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Hydraulic Services Specification

Jordan Springs Village Oval

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SECTION 1 PRELIMINARIES

1.1 GENERALLY

This part of the specification is to be read in conjunction with the general conditions of contract, Specification/Project Brief preliminary clauses and technical clauses.

1.2 SCOPE OF WORKS

Contractor shall furnish all labour, materials, equipment and services for the complete design, installation, testing and perfect operation of the systems and works in this section of the specification, to the satisfaction of the Principal.

The extent of the plumbing works covered by the contract consists of the following:-

- Sanitary plumbing system
- Sanitary drainage system
- Gas services
- Roofwater plumbing only in-ground drainage by Civil contractor
- Domestic cold water services
- Domestic hot & warm water services
- Automatic Irrigation system
- Oval sub-soil drainage

WORKS BY ASSOCIATED TRADES

The following associated work shall be completed by trades other than that of the hydraulic services contractor.

ROOFING TRADE

- Gutters and downpipes
- Roofing and waterproofing / sheet metal flashings

BUILDING TRADE

- Filling of formed penetrations
- Water proofing wet areas
- Concrete pads/plinths
- Access panels

CIVIL STORMWATER

- In ground stormwater drainage including connection of building roof water downpipes to existing stormwater system.

ELECTRICAL TRADE

- Wiring of hot water units
- Wiring to pump control panel.
- Wiring to all hydraulic equipment's and components

1.3 AUTHORITIES

The whole of the work shall be carried out by or under the full supervision of a fully licensed contractor in accordance with the drawings and specification, and to the satisfaction of the Principal and to the Standards/Regulations of any authority having jurisdiction over the works and in particular those listed below:

- Environmental Protection Authority
- Sydney Water Corporation
- Local Council
- Building Code of Australia (Current edition)
- Work Cover NSW
- Department of Fair Trading NSW

Obtain certificates from the above authorities indicating satisfactory completion of service and hand over to the Principal before application for certificates of practical completion.

1.4 STANDARDS

Materials and workmanship are to conform to Australian Standards and Codes where not in conflict with the provisions of this Specification, including the standards listed below:

AS/NZS 5601.1 (2010)	Gas installation code
AS 1012.1 (1995)	Method of testing concrete
AS 1221 (1997)	Fire hose reels
AS 1302 (2005)	Steel reinforcing bars for concrete
AS 1345 (1995)	Identification of the contents of pipes, conduits and ducts
AS 1379 (2001)	Specification and supply of concrete
AS 1432 (2004)	Copper tubes for water, gas and sanitation
AS 1478.1 (2000)	Chemical admixtures for concrete
AS 1488 (2007)	Cast grey iron fittings for pressure pipes (excluding bolted gland joints)

AS 1585 (2001)	Capillary and brazing fittings of copper and copper alloy
AS 1588 (1999)	Filler rods for welding
AS 1590 (2001)	Copper alloy screwed pipe fittings for use in water supply and hot water services
AS 1628 (1999)	Copper alloy gate valves and non-return valves for use in water supply and hot water services
AS 1645 (2001)	Copper and copper alloy compression fittings for use in water supply and hot water services
AS 1657 (1992)	Access stairways and platforms
AS 1718 (2005)	Copper alloy draw off taps, stop taps, and ferrule or main taps for use in water supply and hot water services
AS 1722.2 (1992)	Pipe threads of whitworth form
AS 1851 (2005)	Maintenance of fire protection equipment
AS 1940 (2004)	The storage and handling of flammable and combustible liquids
AS 2032 (2006)	Installation of PVC-u pipes
AS 2129 (2000)	Flanges and bolting for pipes, valves and fittings
AS 2280 (2004)	Centrifugally cast ductile iron pressure pipes
AS 2419 (2005)	Fire hydrants
AS.2441 (2005)	Fire hose reel installation
AS 2444 (2001)	Fire extinguishers
AS 3000 (2007)	Wiring rules
AS 3500 (2003)	National plumbing code
AS 3582.1 (1998)	Supplementary cementitious materials for use with Portland cement
AS 3600 (2001)	SAA concrete structures code
AS 3610 (1995)	SAA formwork code
AS 3972 (2010)	Portland and blended cements
NCC	National Construction Code (2012)
WSA 02	Sewerage Code Of Australia

Works are to be executed wholly to comply with the requirements and recommendations of the pipe work manufacturers.

Where some doubts exist as to the appropriate standard, the decision shall be made by the Principal before commencement of any work on or off the site. If a doubt exists as to whether a section of the design is able to comply with the relevant authorities regulations the Principal shall be notified prior to the commencement of any work. No consideration of claim for redundant work shall be given if the Principal is not notified.

1.5 STATUTORY FEES

The sub-contractor shall make payment of all costs for fees and attendances by Government and other authorities having jurisdiction over the works and who are entitled to charge fee for service.

1.6 EXISTING SERVICES

Prior to undertaking ANY form of excavation or disturbing of soil, the sub-contractor(s) undertaking the works must complete and submit to the Principal a "Buried & Overhead Services Permit". The Works can commence when part 1 and part 2 of the 'Buried & Overhead Services Permit" has been reviewed and formal sign off has been provided by the Principal.

1.7 DRAWINGS

Drawings show the approximate route of the various services, they are to be read in conjunction with all construction drawings for this project. Make due allowance for all necessary diversions from the straight line, rise and fall, positions of equipment and co-ordination with new and existing services as may be required for the proper execution of the works.

The sub-contractor is to demonstrate that compliant spatial allocations have been incorporated into the design and is to co-ordinate installations in accordance with the compliant spatial allocations and with site construction sequencing.

Tenderers are to advise the Principal of ambiguities &/or contradictions &/or errors identified within the design/tender documentation during the tender period. If contradictions &/or errors are identified post tender submission &/or contract award, the tenderer is deemed to have allowed for the higher value, the higher quality &/or the higher standard.

Workshop Drawings

Workshop drawings have been produced in accordance with Principal requirements.

The following are the minimum requirements to be detailed:

- Pipe inverts, sizes and materials fixing / support details;
- Coordination with building structures and other services;
- Valve types including manufacture and model numbers;
- Penetration details;
- Items of plant and equipment and supports; and
- Details as necessary.

Work as Executed Drawings

Drawings are to be prepared by a competent draftsperson in both DWG AutoCAD format and PDF format. The minimum size scale is to be at least equivalent to those used on the contract document. The invert depths and location of all pipes and valves are to be accurately plotted and indicated by measurements.

Record drawings

The Sub-Contractor is to keep available at all times on site, two (2) copies of scale prints marked up in colour and dated to indicate the extent and chronological order of all work tested and approved the relevant authority.

1.8 QUALITY ASSURANCE

The Sub-contractor is to undertake the works under the contract within a Quality Management System as per Principal requirements.

1.9 OPERATION AND MAINTENANCE MANUALS

General:

Three hard copy sets of the FINAL Operation and Maintenance Manuals shall be submitted prior to practical completion. The Managing Contractor may withhold monies if the manuals are not submitted on time and as per the requirements nominated below, and in accordance with the sub-contract agreement.

Provide a full set of as built drawings (original size) with each set of manuals.

Provide a draft copy for review at least 6 weeks before project completion (this draft copy of the manual must be provided in hard copy and should include the complete manual except for final commissioning data & reports). Incorporate all comments arising from review into final copies.

Each manual shall be A4 size, bound in stiff covered, blue coloured, plastic folders with 3 ring binders (as built drawings shall be folded in a proper and neat manner consistent with the drawings list). The cover and spine sheets of the folder will be provided by the Managing Contractor (for standardisation and consistency across the project).

Provide 3 electronic copies of the manual on Compact Disks (text to be submitted in PDF and Microsoft Word Format, drawings must be submitted in PDF & DWG Format; any scanned material such as manufacturers' literature MUST be scanned in an orderly manner).

Contents:

In general the O&M manuals shall be comprehensive and inclusive of all the information required to safely operate and maintain the building plant & equipment; below is a list of the minimum requirements for the O&M manuals for this project; the O&M manual shall include but not limited to:

- Index & sub-indexes
- Project overview
- Contact details(Managing contractor, consultant, sub-contractor, manufacturers, suppliers, installers, emergency contact details, etc)
- Certificates & Warranties
- Systems description
- Systems operation
- Detailed maintenance procedures (must be comprehensive and inclusive of all statutory requirements)
- Equipment schedules
- Final commissioning data / reports
- Manufacturers manuals
- List of As-Built drawings
- As-Built drawings (Accurate and reflective of the as constructed systems)

Where the sub-contractor has relied on a sub-sub-contractor to procure, supply, install or commission a particular system (or part of system); it is the sub-contractors responsibility to obtain ALL the required information, drawings and commissioning results for inclusion in the manual. O&M manuals will be rejected if not complete or if missing information.

As Built documentation shall be progressively maintained for submission on completion. This includes the requirement for sub-contractors to progressively provide hand marked up as built at weekly intervals for the Managing contractor to review and approve.

1.10 MAINTENANCE SCHEDULE

From the date on which the fire and hydraulic services systems are placed in regular service, the Sub-contractor is to fully maintain them (within this contract) in proper working order for a period of twelve (12) calendar months, including all recommended scheduled routine maintenance.

All testing and tagging shall be done on time and reports to be submitted to Principal.

The contract maintenance of the hydraulic services systems is to commence on the date on which all of the equipment and associated pipework, and electrical components are placed in regular service following the satisfactory completion of the tests and final painting. This date will be agreed upon by Principal and the sub-contractor but not earlier than completion of the works. It should be noted that partial completion will not be related to the commencement of the maintenance period.

In the event of maintenance being delayed or proving unsatisfactory, breakage or a serious defect occurring in any part of the equipment, or the unsatisfactory operation of the systems, Principal has the right to engage the services of an appropriate Sub-contractor to undertake the work in question. The cost associated with such is to be directed to the Sub-contractor for payment within the terms of this contract. The maintenance period is to be extended until such time as the hydraulic services have operated to the satisfaction of Principal for a period of one calendar month.

Labour, Materials and Services Covered by Contract Maintenance

Shall include:

Answering of breakdown calls and supervisory inspections, as specified hereinafter;

The replacement of damaged or defective parts, materials or equipment or parts showing signs of undue wear;

The provision of all necessary lubricating oils and greases, cleaning liquids, materials and accessories required for pump and driving unit;

General routine maintenance in accordance with manufacturers' instructions; and

Records of maintenance activities to be to progressively submitted to Principal.

Answering of Breakdown Calls

In the event of a defect occurring at any time (i.e. at any hour of any day or night) during the maintenance period the Sub-contractor is to, when notified, send a competent tradesman to the site by the quickest means of transport available to restore the system to proper working order with a minimum of delay.

Work to be Carried Out during final Maintenance Inspection

During the final supervisory maintenance inspection on hydraulic services systems at the end of the contract maintenance period, the Sub-contractor is to carry out any work as directed to ensure that the whole of the installation and equipment is left in satisfactory working condition and in a clean condition at the end of the maintenance period. The Sub-contractor is to replace or recommission any systems to meet design criteria.

1.11 WARRANTIES

From the sub-contractor will begin from the time of Practical Completion Certification issued by Principal.

1.12 CO-ORDINATION

The sub-contractor is to coordinate his work with other trades on the buildings in such a manner as not to interfere with other work being carried out on the building.

In locations where piping and equipment must be installed along with other work being installed under other contracts, the sub-contractor is to cooperate with the other sub-contractor concerned and see that all equipment is installed to the best advantage.

Any cutting, patching, etc., required to the building structure as a result of this sub-contractor's failing to coordinate with the program are to be arranged at the sub-contractor's expense.

1.13 SETTING OUT

The set out of pipework to all groups of fixtures is to be so arranged in conjunction with the Principal and separate trades concerned. All pipework is to be made and positioned in a neat, workmanlike manner and a first class finish obtained.

1.14 PLACING OR ORDERS

The Sub-contractor is to ensure that orders for materials, sanitary fixtures, pumps, etc., are to be placed with the Manufacturer and/or Supplier as soon as possible to ensure delivery of the items specified and to obviate any delay or change of specified articles due to this neglect.

1.15 PROVISON OF MATERIALS

Except where otherwise noted, the Sub-contractor is to provide all necessary fixtures and appliances, piping fittings, tools, pumps and all other incidental materials and accessories necessary for the satisfactory installation, testing and completion of the works, all to the satisfaction of Principal

All materials are to be new and the best of their respective kinds and generally the whole of the work are to be carried out in a tradesman like manner and a first class finish obtained.

Allow for building in such other fittings and accessories as required or supplied with the fixtures.

1.16 SERVICES PITS

The sub-contractor will be deemed to have made due allowance for all pits, whether shown or not on Drawings, required for installation of straight runs pit-to-pit to avoid clashes with existing trees, services or other obstructions.

1.17 SPECIFICATION

The intent of this specification is to provide for the work set out and described herein to be completed. Where an item is usual or necessary and is reasonable or properly to be inferred in the type of work generalised in this specification but not specifically mentioned, it is to be deemed to be included in the scope of works. Should there be any discrepancy between the drawings and specification the contract is to be deemed to cover the alternative which involves the greater cost.

1.18 COMMISSIONING, TESTING & HANDOVER REQUIREMENTS

The sub-contractor shall supply all apparatus and materials necessary for, and carry out the tests and equipment commissioning required by, the Conditions of Contract, Principal, Specification and Authorities and ensure that such tests are appropriately witnessed by the relevant local Authority.

Records of all such testing and commissioning, which evidence compliance with the requirements of the documents, are to be duly signed by the sub-contractor and the relevant local Authority, as appropriate, and shall be provided to the Principal.

General

The sub-contractor must adhere to the requirements outlined in the Principal Commissioning and Handover Plan for each of the project elements. The commissioning process undertaken for this project shall be thorough and comprehensive including but not limited to:

- Prepare commissioning program as applicable to the discipline outlining all tasks and activities to be undertaken as part of the commissioning process.
- Prepare and submit project and discipline specific commissioning plan to include inspection & test plans, check sheets, test reports, procedures, inspections, etc... for all systems and components.
- Attend all commissioning meetings.
- Coordinate commissioning with other disciplines as applicable.
- Prepare and implement pre-commissioning procedures for all systems and components.

- Prepare and implement start-up procedures for all systems and components.
- Commission ALL plant and equipment; Sub-contractor to engage qualified specialist technicians as required in order to commission all systems in full.
- Test all plant and equipment prior to organising witness testing.
- Submit detailed and comprehensive commissioning reports – no later than 3 days after commissioning is conducted.
- Attend all witness testing activities.
- Prepare training material and conduct training as necessary to the discipline.
- Prepare and submit all handover materials and documents (O&M Manuals, as built Drawings, etc.).

1.19 FIXING AND SUPPORTING OF PIPES

All service pipes are to be positioned in locations as approved by Principal before installation commences. Pipework must not come into contact with any other service pipes or part of the building structure unless insulated with 25mm thick sectional mineral wool and/or closed seal foam lagging. All pipework is to be free to move without causing stresses in the pipework or in the pipe joints.

Support is to be galvanised mild steel "Unistrut" P1000 channel or equal complete with purpose made galvanised spring nuts, framings, fittings and pipe clamps for each pipe. 'U' clamps are to not be used with PVC-U pipes. Fixings for PVC-U are to completely circumvent the pipe without distorting the cross sectional profile of the pipe. Alternative methods of fixings may be used provided the proposed method is detailed, discussed and approved by Principal prior to the commencement of any work dependent upon such an approval. Approved fabricated mild steel brackets are to have ground off neat square ends drilled holes.

Mild steel brackets must be hot dipped galvanised after fabrication. Vertical frames where used to support suspended horizontal runs are to allow for complete adjustment of clamp support to suit pipe grade as required.

Channels are to be galvanised steel bolt fixed direct or with purpose made clips to walls or underside slab. On completion of work remove all cement droppings, dirt etc. from pipe supports, pipework and fittings.

All copper pipes are to be separated from supports by 4mm thick PVC strip of similar approved material equal to “unisrut incursion”. Where pipes are insulated for thermal integrity, the pipes are to be supported inside the insulation with timber ferrules.

Fastening of Supports

Where the structure is of masonry or concrete, the support is to be fastened either by bolts firmly grouted in or by expanding type bolt device equal to "Ramset Dynabolt".

Explosive power fastening tools are to only be used where specifically approved beforehand by Principal.

Appropriate zinc plated screws are to be used for fastening supports to timber. Where pipes are supported directly off purlins support rods are to not be hooked off the bottom flange of the purlins without prior approval of the structural engineer but are to be connected by bolts/self-tapping screws to the web of the purlin.

All bolts and screws are to be sized to suit the load but in no case is the diameter to be less than 8mm for fastening to timber, steel, masonry or concrete. Smaller bolt sizes may be approved by Principal.

Span of Supports for Steel and Copper Pipes

Unless otherwise specified or required by the regulatory authority, the distance between pipe supports is to not exceed the following:

Nominal Size of Piping (mm)	Steel Piping (metres)	Copper Piping (metres) to AS 1432			
		Type A	Type B	Type C	Type D
10	..	..	1.5	1.2	..
15	2.0	2.0	2.0	1.2	..
20	2.5	2.5	2.0	2.0	..
25	2.5	2.5	2.0	2.0	..
32	3.0	2.5	2.5	..	2.5
40	3.0	2.5	2.5	..	2.5
50	3.0	3.0	3.0	..	3.0
80	4.0	..	3.0	..	3.0
90	4.0	..	3.0	..	3.0
100	4.0	..	3.0	..	3.0
125 to 225	5.0	..	4.5	..	..

Where vertical pipes are exposed in rooms, they are to be secured at floor and ceiling and are to have at least one intermediate support. Valves and mechanical joints are to be independently supported.

Span of Supports for Metallic Rigid Pipes

The distance between both horizontal and vertical cast iron pipe supports is to not exceed 2.0 metres. In the case of spigot and socketed pipes such as cast iron, there is to be at least one fixing behind each collar or pipe fitting or coupling.

1.20 NOISE AND VIBRATION

The Sub-contractor is to take suitable precautions to prevent any noise or vibration from his equipment, transmitting to the building structure, in the occupied areas of the building. The equipment is to initially be designed and selected for a minimum of noise and is to be fully statically and dynamically balanced to prevent vibration.

All pumps are to be fitted with stainless steel braided vibration elimination connections and where applicable mounted on spring mounts.

1.21 CLEANING OF SERVICES

After installation and prior to testing the piping and storage vessels, each service is to be thoroughly cleaned and flushed out. All valves, seats, tap washer and strainers are to be checked for any foreign matter and cleaned. Damaged seats and washers are to be replaced. Chipped paint is to be sanded and reapplied to achieve smooth finish.

1.22 SPARE PARTS AND SPECIAL TOOLS

The Sub-contractor is to supply any special tools necessary for the regular maintenance of new and/or existing refurbished equipment as required under the maintenance schedule and one complete set of spare parts (i.e. washers etc.) which are normally required when carrying out the maintenance schedule. Spare parts and tools to be supplied are to be enumerated and described within the tender.

1.23 SERVICES FINISHES AND IDENTIFICATION AND MARKING/LABELING

Generally water services pipework within concealed spaces is to be left unpainted unless noted otherwise. All exposed pipework in wet areas including fixture connection, waste traps and vents etc. is to be chrome plated.

All gas services pipework is to be painted with two (2) coats of gloss almond.

Provide identification markers on services pipework at not greater than 3m centres. Markers are to be of vinyl, pressure sensitive, self-adhesive type consisting of name of service and direction of flow. Markers are to be on all pipework in ducts, ceilings or exposed in plant rooms. Gas markers are to indicate gas pressures.

Construct permanent 200mm x 200mm brass service indicator markers to indicate the location, size and direction of all infrastructure water and gas mains. Where located in soft landscaped areas markers are to be permanently fixed to concrete blocks.

1.24 SAMPLES

The sub-contractor is to a schedule of all required samples within 2 weeks of contract award. A schedule template and sample naming convention will be provided by the Principal upon request;

All samples are to be issued by subcontractors on a 'Sample Submission and Approval' form which will be provided by the PRINCIPAL upon request;

Samples are to be tagged, given a unique number and description as detailed on the register provided by the subcontractor;

Documented approval must be obtained from the Principal prior to procurement of materials;

Samples to be stored in a location nominated by the Principal; and

Costs of sample supplies are to be borne by the subcontractor.

The following items are to be submitted as samples / technical data including supplier certification to the Principal for approval prior to installation:

- Pipework technical data
- All valves technical data
- Support and bracketing details sample

- Domestic hot water heaters technical data
- Sanitary fixtures samples and technical data
- Tap ware samples
- Water filters technical data
- Pumps and ancillaries technical data
- Automatic irrigation sprinkler

1.25 DESIGN AND EQUIPMENT SELECTION

The following demarcation of responsibility is intended to ensure that all necessary design and checking is done by those best placed to do so, to avoid needless rework resulting from duplication of responsibility and to encourage co-operative participation to the benefit of the project.

The Sub-contractor will not be required to accept design responsibility for the following:

- Overall system concept;
- Specification of main plant equipment items; and
- Specification of piping and plumbing materials

The sub-contractor is required to be responsible for the following items within the Contract:

- Detailed layout of the installation including dimensioned drawings based upon actual equipment offered and final co-ordinated layout;
- Selection and sizing of incidental material and components including pressure calculations and pipe and pump sizes, etc.;
- Selection of equipment which meets the specified requirements; and
- Checking the suitability of equipment and materials for the application prior to ordering including compatibility of equipment to achieve design criteria and requirements of the specification.

This requirement is intended to ensure that the Sub-contractor arranges for the Manufacturer, who should know the product best, to check its suitability for the application and to be contractually bound to warrant that suitability.

In the course of carrying out the work, review the system design and draw any perceived problems to the Consultant's attention. Additional responsibilities will not be incurred by the Sub-contractor as a result of this review. The Consultant will, in reviewing shop drawings, draw any perceived problems to the Sub-contractor's attention but will not incur any additional responsibilities as a result of the review.

Construction Supervision and Inspection.

Supervise and inspect all work under this contract. Assign a competent Supervisor to do at least the following tasks:

- Attend meetings as requested by Principal;
- Coordinate with other trades;
- Liaise with Authorities;
- Check all shop drawings and technical data;
- Supervise installation of work under this contract;
- Check the installed work in detail;
- Supervise commissioning, coordinate commissioning with other trades
- Check the function of all equipment and systems in detail;
- Do not transfer the Supervisor from the project without Principals' approval or replace with a new Supervisor deemed unsuitable by Principal; and

- Submit for approval prior to signing the contract a proposed organisation chart including sub-trades showing names of key personnel and the allocation of responsibility and authority.

Consultant's Inspection Role.

The Consultant will at the request of Principal inspect the work during construction. The purpose of such inspections is to check the general progress and to minimise the likelihood of inconvenience to the Principal or Principal from rejection of unsatisfactory work following completion of the installation. Following any such inspections the consultant will generally notify Principal of any observed defects but this will in no way transfer any responsibility for superintendence and inspection from the Sub-contractor to the consultant.

1.26 TEMPORARY SERVICES

Design, supply and install temporary water and sewerage for construction purposes and site amenities as per Principal requirements.

1.27 PENETRATIONS

The sub-contractor shall refer and be compliant with the Acoustic Specifications and Principal requirements.

- Set-out of penetration by hydraulic sub-contractor.

1.28 ENVIRONMENTAL

The sub-contractor that construction performed is compliant with Principal requirements.

1.29 LIGHTING (TASK & ACCESS)

The sub-contractor shall provide all necessary task and access lighting to safely complete construction works in accordance with Principal requirements.

1.30 FINALLY

On completion of all work all tools, supplies, unused materials and waste materials are to be removed and the work left in a clean including all hydraulic plant system & equipment tidy condition in a timely manner to meet Principal s program.

SECTION 2 EXCAVATIONS, BACKFILLING AND REINSTATEMENT

2.1 GENERALLY

Excavation work backfilling and surface reinstatement are to be undertaken by the Civil Sub-contractor under strict supervision, instruction and approval by the head hydraulic contractor to the satisfaction of the principal

2.2 CLEARING AND GRUBBING

Remove all trees, roots, debris and all dumped material and items in the width of clearing and grubbing, unless directed otherwise by the Principal. The width of clearing and grubbing shall be defined as the trench width plus 1 metre either side of the trench for hydraulic services infrastructure pipework.

All stumps and roots over 75mm shall be grubbed out to a minimum depth of 500mm below subgrade levels in and road formations or below finished surface in unpaved areas. All grub holes shall be backfilled with suitable spoil from excavations compacted in layers to the density of the surrounding soil.

Where trees are directed to be retained and protected, they shall be in accordance with the requirements of the Landscape Specification and as directed by the Principal. The extent of protection shall be no closer to the tree than the edge of the canopy, unless directed otherwise by the Principal.

Parking, refuelling and storage of vehicles and plant under existing tree canopies shall not be permitted. Work within 2.5 metres of trees to be protected shall be carried out by hard to avoid damage by equipment.

If plant operation close to trees to remain is unavoidable, timber palings shall be lashed upright around the trunks. The protective material shall be 1.5m high and spaced at no more than 100mm around trunks. Lower ends shall touch the ground. A flat face shall be outermost and painted white. The Principal may direct that levels be adjusted in the vicinity of trees to minimise the effects of excavation or filling.

Roots that are greater than 30mm diameter measured at a distance of 2.5 metres from the tree trunk shall not be cut without prior approval from the Principal. Where permitted, cut roots neatly in the line of the work before commencing machine excavation. All cut surfaces shall be coated with suitable bitumen based paint. Any tree damaged during the course of the work will be repaired, removed or replaced, as directed by the Principal at the Subcontractor's expense.

All intruding branches on the working area shall be trimmed by a tree surgeon approved by the Principal. Unless otherwise directed or permitted by the Principal, all trees, shrubs and similar material cleared from the works shall be disposed off-site.

All non-organic waste and debris shall be disposed of offsite to an approved Landfill Facility at the Subcontractor's cost.

2.3 EXCAVATION

Before commencing excavation, the Subcontractor must complete, submit and have approved by the Principal a permit for excavation. The Subcontractor shall strip for the width of the trench within the limits of clearing. The depth of stripping shall be to the bottom of the grassroots zone, and shall avoid contamination by any other material.

All material found in the excavation of trenches (including topsoil) shall be removed off site to an approved EPA Landfill Facility in accordance with the Environmental (Contamination) reports, the Hazardous Substances Management Plan and the direction of the Principal and the Subcontractor's cost.

Unless otherwise specified, soils shall not be stripped from around existing trees closer than a distance equal to twice the radius of the tree's crown measured from the trunk.

Excavate trenches to the depths and widths necessary to allow installation of the respective services to the levels, grades or covers specified. Allow for the depth of bedding material as necessary and for the widening or deepening of trenches at valves or structures.

Before commencing excavation the Subcontractor shall expose crossings and connection points on existing services.

The length of trench opened up ahead of pipe laying shall be as short as the approved construction programme permits.

Backfilling of trenches shall be as specified in Clause 6.14.10 of this Specification.

Where directed by the Principal the Subcontractor shall backfill with a temporary layer of asphaltic concrete (Cold Mix) over the road or pathway opening surface.

Unless otherwise permitted do not excavate by machine within 1 metre of existing services or within 2.5 metres of trees marked to remain. Hand excavation will be required in these locations in accordance with the Principal s requirements.

Requirements for the protection of trees are specified in Clause 6.14.1 Clearing and Grubbing.

Support and protect all trees, shrubs, pipes and structures in or adjacent to trenches.

Advise Principal when non rippable rock has been reached in trench bottom.

Remove or cut back exposed boulders in trench bottoms .Where areas of soft material occurs in trench bottoms the Principal may require the use of alternative bedding materials.

2.4 RESTORATIONS OF GRASSED AND PREPARED AREAS

Where relatively short trenches cross existing lawns and when these trenches will be backfilled within two (2) days, cut out turf and stack neatly to one side. Water turf as necessary. On completion of backfilling, replace turf and restore lawn to its original condition as specified.

Where trenches cross areas which have been prepared for sowing, separate topsoil and place to one side of trench. Place excavated material on the opposite side of the trench. On completion of backfilling replace topsoil and restore surface to original condition.

2.5 EXCAVATIONS AND RESTORATION OF PAVEMENT

Trenches through existing pavements are only to be excavated with the approval of the Principal: In general, under-road boring will be used under concrete pavements and existing flexible pavements which are to remain.

Where trenches are permitted to be excavated in pavements, the pavement shall first be saw cut along each side of the trench to the full depth of any surfacing and bound courses (e.g. concrete).

Pavements shall be restored to a standard of construction at least equal to the existing adjoining pavement or to a similar new pavement in the work at the discretion of the Principal. Where trenching has been permitted through concrete pavements, the restoration shall include the installation of galvanized steel dowels to the directions of the Principal along each side of the trench.

2.6 TRENCH DIMENSIONS

Width

Trench excavation generally shall comply with the principles laid down in Clause 6.1.2 Standards and Codes of Practice for the type, material and class of pipe required.

Maximum trench widths for hydraulic services infrastructure and conduits shall generally be the external pipe diameter plus 300mm each side measured at the level of the crown of the pipe. The standard minimum trench width is 750mm.

Maximum trench widths for individual electrical, communication and security trenches are shown on the respective services drawings and specification.

Details of common/ shared hydraulic and other services trenches are shown on the drawings.

In trenches where timbering is necessary, increase width sufficiently to maintain clearances specified above between face of timbering and pipes. The width of curved trenches shall be adequate to allow correct jointing of rubber ring jointed pipes.

If a trench is excavated to excess width or caves in due to inadequate support, the Principal may require the use of a higher standard of bedding or a pipe of higher strength class, or both, without additional payment.

Cover

Where levels are not detailed, excavate trenches to provide the minimum covers itemised in Table 6.3 Where pipes are socketed, cover is measured over sockets.

Table 6.3		
Minimum Cover (mm) as per AS3500 & AS5601		
Item	**General**	**Under Pavements**
Stormwater (Including roofwater)	450	600
Water	450	600
Sewer	450	600
Gas	450	600

Where the nominated cover cannot be achieved seek direction from the Principal for treatments or alternative pipe materials or encasement requiring less cover.

2.7 DRAINAGE OF WORKS AND DEWATERING

Unless details are provided on the drawings for the diversion and control of stormwater during construction of underground services, the Subcontractor shall provide details of his proposed method and gain the approval of the Principal prior to commencement of excavation. Where trenches cannot be drained by gravity, provide pumping equipment to keep excavations dewatered. Water from excavations shall not be drained to any sewer. Where necessary provide secure and proper temporary fluming for conducting storm and subsoil water across and beyond the works.

All equipment including well-point pumping plant shall be driven by electric motor to minimise noise levels. The equipment shall be attended to 24 hours per day and shall be equipped with diesel backup motors in case of power or motor failure.

The cost of drainage and dewatering works is included in the Subcontractors contract sum.

2.8 COMMON/SHARED TRENCHING AND SERVICES CO-ORDINATION

The Subcontractor shall liaise and co-ordinate the alignment, levels, protection, jointing bedding,, backfill and sequencing of all underground services (hydraulic, electrical, communications and security) by the respective trade Subcontractors in common/shared trenches .

2.9 BACKFILLING

General

Backfilling of service excavations is to be carried out under this contract, promptly after laying of pipelines but not before inspection by the Principal and written approval of the as constructed level.

Backfill below pavements and areas outside pavements.

Backfilling of services is to be completed using approved sand or granular material as specified below to subgrade level or underside of topsoil as required.

Backfill is to be placed in layers not exceeding 200mm loose thickness, and compacted to a density of at least 98% SMDD (Minimum Relative Density Index of 60) as per AS 1289 in pavement areas and 95% SMDD (Minimum Relative Density Index of 50) as per AS1289 in other areas.

Immediately after the pipeline has been tested to the satisfaction of the Principal the trench is to be backfilled in the following manner:

- The fill material is to then be carefully and continuously placed, rammed and watered around and over the pipe until the firmly compacted filling completely covers the pipe for the full width of the trench.
- Approved compaction and water sprinkling equipment are to be employed where necessary to produce the required compaction. If it is necessary to increase the moisture content the layers are to be watered by sprinkling which gives a uniform distribution of water over the whole area.
- If the material is too wet to permit proper compaction the work with such material is to be delayed until it has dried to the required moister content.
- Connection branches and fittings are to be left exposed until their positions have been measured and recorded by the Subcontractor and verified by the Subcontractor as a practical check of the installation and record drawing.

2.10 SUPPORT TO EXISTING PIPES AND STRUCTURE

Where an existing pipe or other structure crosses a trench it shall be supported by a plug of compacted granular material extending from the trench floor to the springing line of pipe or underside of structure and for a distance of 1m along the trench on both sides. Where it is impracticable to compact material under the structure the Subcontractor may use concrete of minimum strength 15 MPa placed on one side only and vibrated until it flows under the structure and appears on the other side. No additional payment will be made for the support of pipes or structures where their existence is indicated on the drawings.

2.11 SURPLUS SOIL

Surplus spoil is to mean such excavated material that is not required or suitable for the purposes of this contract and is to be waste classified and removed off-site as directed by the Principal. At the Subcontractor's cost.

2.12 CONNECTION

Leave connection branches exposed in the trench until their positions have been recorded on the work-as-executed drawings to the approval of the Principal.

2.13 ACCEPTANCE

Compaction Requirements

Compaction requirements for work carried out under this Clause of the Specification are laid down under the various categories of backfill described above.

Acceptance of each layer of backfill material is conditional upon that layer achieving the specified compaction requirements.

Sampling and Testing

All laboratories testing of work carried out under this Clause of the Specification is to be performed in accordance with procedures prescribed in current Australian Standards.

Sampling is to be carried out in locations selected by the Principal.

Compaction testing for the services trench backfill will be undertaken at a frequency of 1 test per 30m per layer with a minimum of 1 test per layer for a trench width less than 1200mm. Where the trench width exceeds 1200mm and up to 4000mm the frequency shall be 3 tests per 30 metres per layer with a minimum of 3 tests per layer.

The compaction requirements specified are minimum requirements, when density tests are carried out on a section of work. Test results not achieving the specified requirements will require recompaction at the Subcontractor's expense to achieve the required compaction requirements.

Compaction test results for each layer must be issued and approved by the Principal before proceeding to the next layer.

Final Inspection

All pipe work shall be flushed out and cleaned of all debris silt etc. before final inspection. Water for flushing shall not be drawn from hydrants but from the Subcontractor's temporary water supply.

Liaise with the Principal who will arrange for a final inspection when all lines have been checked and backfilled, all chambers and pits complete and flushed out.

Attendance is drawn to the need for compliance with the relevant Environmental Legislation.

Final acceptance is that stage when the Principal is satisfied that the work meets all Contract requirements including those of the Relevant Acts.

The Subcontractor is to provide a minimum 7 days' notice to the Principal to allow for inspections to be arranged with the respective consultants.

At Practical Completion the Subcontractor is to inspect, flush out and clean out all debris, silt from the pipe systems and remove from site.

SECTION 3 MATERIALS

3.1 GENERALLY

All materials are to be of the best quality and type of their kind. They are to conform to the requirements of the latest relevant specification of the Standards Association of Australia, or if no Australian Standards exist, to the requirements of the relevant British Standard Specification in conjunction with principal's requirements

All materials delivered to the site must be protected in a manner suitable for storage on a building site. Materials are to be stored away from all damp and the ends of pipes are to be sealed.

Obtain pipes and pipe fittings from approved manufacturers.

The word 'piping' is to mean all pipes, fittings and accessories connected there to.

Piping is to be of the diameter as shown on the drawings.

3.2 MEASUREMENT OF MATERIALS

Make available appropriate and approved metric gauges and/or scales for measuring and/or weighting all materials supplied.

3.3 REJECTION OF UNSATISFACTORY MATERIALS

In the event of materials being of a mixed description and quality, the Principal is to have power to order to have those portions of the materials which in his opinion are unsuitable for the works, picked out, marked and stacked where directed and all defective or unsuitable materials removed from the site?

3.4 WORKMANSHIP GENERALLY

Coordinate installation of pipework with other types of trade pipe runs or duct runs so that all services can be installed and maintained without hindrance. Lay pipes in continuous lengths wherever practicable and bend in order to minimise joints.

Make all connections to valves, taps, tanks, etc., pipes of other materials and dismantling points. For pipes 65 bore and over, connections are to be made with flanged joints, and for pipes 50 bore and under, connections are to be made with threaded union joints.

Brazing is to be carried out by first class tradesmen experienced in work being carried out.

Open ends in pipework being erected are to be properly protected by metal caps at end of each day's work or at the end of each section of work.

Valves and inspection panels and all items which require access at any time are to be placed in a position that is fully accessible for maintenance and operation.

Where pipes are led up or along walls and then through fixtures, pipes are to not be bent but are to be fitted with gunmetal elbows to allow for correct fitting of cover plates. Mitred elbows will not be permitted. Except where specifically mentioned in conjunction with a particular item of work, cast bends are to not be used.

Care must be taken that sufficient unions or flanged joints are installed to allow satisfactory removal of fittings for inspection or repair, all as approved on site by Principal.

Pipes are to be spaced clear of all services. A minimum of 150 horizontally and 150 vertically is to be maintained from any electrical conduit cable or fitting.

All piping is to be cut square with the run and all cutting burrs removed with a proper pipe reamer. Pipework generally is to be concealed in false ceiling spaces or in the ducts provided. Joints will not be permitted within the thickness of walls or floors unless it can be demonstrated that no other option is practicable or possible.

Only hexagonal nipples are to be used on screwed pipework; barrel nipples or running joints will not be permitted.

Pipework concealed in pipe ducts or plinths is to be provided with easy access to cleaning eye.

Pipe work passing through fire rated building elements is to have appropriate fire stop collars installed so as to maintain that building elements required fire resistance level. Provide certification of fire collars complying with authority testing requirements.

Pipe Schedule

Pipeline	Location	Material	Remarks	Finish
Gas	In ground	Copper Type B with polyethylene sleeve	To AS1432	N/A
Gas	Above ground	Copper Type B with polyethylene sleeve	To AS1432	N/A
Domestic Cold Water	In ground	Copper Type B with polyethylene sleeve	To AS1432	N/A
Domestic Cold Water	Above ground	Copper Type B	To AS1432 Copper tube to be utilised for all main runs and for pipes 25mm diameter and greater	Concealed = N/A Exposed = Chrome Plated
Domestic Hot Water	Above ground dead legs	Copper Type B with thermal insulation complying with the current NCC.	Kemlag insulation or equal approved	Concealed = N/A Exposed = Chrome Plated

Pipeline	Location	Material	Remarks	Finish
Domestic Hot Water	Above ground rough in	Copper type B with thermal insulation complying with the current NCC.	Used for rough in sizes Ø20- Ø15 mm only in concealed spaces	Concealed = N/A Exposed = Chrome Plated
Sanitary Drainage	Below ground	uPVC - DWV – SN6 (50-100) HDPE (65-150)	Max depth 3m	N/A
Sanitary Drainage	Below ground	uPVC - DWV SCJ-SN10 with RRJ fittings	Greater than 3m	N/A
Sanitary Plumbing	Above ground	uPVC - DWV – SN6		N/A
Stormwater plumbing	Charged in ground systems	PVC pressure pipe below ground only		N/A
Stormwater plumbing	Gravity systems	PVC-U sewer grade up to and equal to 225 NB		N/A
Stormwater plumbing	Gravity systems	RCP '2' above 225 NB	RRJ	N/A

3.5 COPPER TUBES AND FITTINGS

Copper tubes are to be solid drawn conforming to AS 1432 Type B. Fittings for copper tubes conforming to AS 1585 are to be copper or gunmetal and Watermark stamped.

3.6 UNPLASTICISED POLYVINYL CHLORIDE PIPES (PVC-U)

PVC-U pipes and fittings are to be approved for use and are to be to the appropriate Australian Standard and are to where applicable, be installed in accordance with the current requirements of AS 3500 and AS2032.

PVC-U pipes and fittings are to be so positioned that identifying marks are readily visible for inspection when installed.

PVC-U pipes are to be of approved manufacture and are to conform to the following Australian Standards as appropriate:

3.7 FLANGES

Flanges are to conform to Australian Standards and be Class 16 unless specified otherwise. Use brass flanges for copper tube, galvanised mild steel flanges for galvanised mild steel pipes, and cast iron flanges for cast iron pipes.

3.8 VALVES

Valves are to be placed in easily accessible position for operation and repairs.
Approved type of valves only is to be used.

All valves are to be "AVK/CIM" or equal and are to be approved by Principal.
Control valves are to be of the loose jumper valve pattern unless indicated otherwise.
All valves 65mm and over are to be flanged. All other valves are to be screwed.

Screwed valves are to be provided with unions to facilitate maintenance removal. Valves up to 65 mm are to be all bronze. Valves 80 mm and over may be cast iron with DR bronze trim. The spindles for gate valves are to be non-rising type and must not project into the bore of the valve when the valve is in full open position. The bore must be clear and unobstructed in this position.

The internal seats and washers of valves must be cleaned of all foreign material during installation. Any valve faces or seats found damaged on completion of the installation are to be replaced.

Loose valve stop valves are to be used generally for domestic cold water services, gate valves for hot services. Valves with the exception of built in recess taps, are to not be directly silver soldered in to pipe lines. All valves are to be suitable for the system pressure or test pressure together with shock loadings imposed by check valve closure.

Valve and Ancillary Schedule

Type	Size	Manufacture	Model	Connection	Remarks
Gate	Up to Ø50	CIM	Fullway Kite 70BCSR	Screwed BSP	Construct with downstream union
Gate/Sluice	Ø80-Ø250	AVK	PN16 57/40	Flanged Class 16	Socket & Spigot valves are acceptable with approval from CA in

Type	Size	Manufacture	Model	Connection	Remarks
					appropriate circumstances
Check	Up to Ø50	CIM	80A	Screwed BSP	DRR – Model
Check	Ø80-Ø250	AVK	PN16 41/8x	-	End construction to suit pipe application
Gas Ball	Ø20-Ø80	CIM	406	Screwed BSP	AGA approved
Duo	Up to Ø32	RMC/Watts	Duo check	Screwed BSP	
Stop	Up to Ø50	RMC/Watts	Stop tap	Screwed BSP	Rough brass valve stem is strictly to be constructed upright
RPZD	Up to Ø50	RMC/Watts	909 (fitted with stainless steel seats)	Screwed BSP	Constructed complete with inlet strainer resilient seated ball valves and test nipples
RPZD	Ø65-Ø150	RMC/Watts	909 (fitted with stainless steel seats)	Flanged Class 16	Constructed complete with resilient seated ball valves inlet strainer and R/A test nipples.
Double Check	Up to Ø50	RMC/Watts	709 (fitted with stainless steel seats)	Screwed BSP	Constructed complete with resilient seated ball valves inlet strainer and R/A test nipples.
Strainers	Up to Ø50	Spirax Sarco	Y type in line strainer	Screwed BSP	Generally 60 micron unless noted otherwise
Strainers	Ø65 and over	Spirax Sarco	Y type in line strainer	Flanged Class 16	Generally 60 micron unless noted otherwise
Pressure Reducing	Up to Ø50	Caleffi	With self – contained replaceable cartridge	Screwed BSP and pressured gauge Ø50mm	
Filter	Up to 50mm inlet	BWT	Infinity AP	Screwed BSP	RAAD docking model complete with pressure regulator.
High Pressure Gauges	75mm	WIKA	Superfine filled	Screwed BSP	Gauge to be complete with gauge cock. Range 0-1500 KPa
Knife Valve	Ø150	AK	Epoxy coated		Electric actuated
Butterfly valves	Ø65-Ø200	AVK	PN16	Flanged inserted Class 16	Lever actuated

3.9 JOINTING MATERIALS

Bolts and nuts are to conform to Australian Standards AS 1110 and AS 1112 and are to be 304 stainless steel where pipes are buried, or hot dipped galvanised where above ground. Where buried below ground all flange bolts are to be "Denso" tape wrapped.

Where flanged joints are to be made between copper pipes and cast iron pipes or fittings, high tensile brass bolts and nuts conforming dimensionally to the above standards are to be used. The high tensile brass is to have an ultimate tensile strength of at least 460 MPa. Rubber insertion for flanged joints is to be of approved quality and sufficiently durable to last the life of the pipe without leaking.

Cement mortar for pipe jointing is to be proportioned accurately by volume and mixed thoroughly with water as directed by Principal. Mortar is to be used fresh and in proportion of one (1) part cement to two (2) parts sand.

Bitumen paint is to be of approved quality and suitable for painting over mortar which is still damp.

Flanges are to be Class 16 unless noted otherwise.

PTFE tape may be used for pipe threads ≤ Ø25mm. Pipe threads ≥ Ø32mm are to be home and pipe sealant jointed.

3.10 SILVER BRAZING OF COPPER AND BRASS TUBES

Joints in copper tubes and brass pipe are to be made with copper phosphorous brazing alloy complying with the requirements of Australian Standard 1167 Table 2 Copper Phosphorous brazing alloy, alloy designation B4 having a silver content between not less than 14.5% and 15.5% and the remainder being phosphorous between 4.5% and 5.5% with a melting range of 645 deg. C Solidus and 700 deg. C Liquids.

The tip colour identification is to be AS K185 (or BS 381 C) Brown.

Soft solder jointing is NOT acceptable.

3.11 GALVANISING

All galvanising of steel work is to be using the hot dip process to AS 1650 - 1989 give a coating minimum thickness of 0.1mm. Galvanising is to be done after all fabrication and drilling of the metalwork has been completed.

3.12 SAND FOR BEDDING

Is to be approved and conform to the following:

- Loss of weight after thoroughly washing with water is to not exceed 10%.
- Not less than 25% by weight is to be retained on Tyler 28 mesh sieve.

3.13 USE OF CONCRETE

Provide 20 MPa concrete not less than 100 mm thick with exposed surfaces cement rendered as follows:

- Around pipes and fittings wherever required by appropriate authority.

- Around and under disconnect or traps, gullies, gully risers and sink stones.
- Around pipes and fittings pass under footing beams to the invert of the footing beam.
- Under and around bases of inclined junction and bends.
- Under Bases of traps.
- Under roadways and footpaths / stabilised sand 10 MPa only.

Where regulation cover cannot be provided over drains, surround pipes with 150 mm of 20 MPa concrete.
Provide 150mm thick pads under all vertical bends and on the outside of all changes in direction.

SECTION 4 SANITARY DRAINAGE SYSTEM

4.1 SCOPE OF WORKS

Drainage for the project is to include the following:

- Sanitary Drainage
- Roof water Drainage

This is to include the provision and construction of all maintenance holes, inspection chambers, pits, sumps, gratings, covers etc.

Refer also to drainage sections noted within Infrastructure section of this specification.

4.2 DESCRIPTION OF WORK

Drainage is to include the supply and installation of complete sanitary systems as shown on drawings connecting all fixtures and fittings as required.

4.3 BEDDING MATERIAL SCHEDULE

Description	Size	Material
Sanitary Drainage	12mm – 15mm	Blue Metal / Quarter minus
Roofwater drainage	15mm - 20mm	Blue Metal / Quarter minus
Sub surface drainage	20mm	Single sized aggregate

4.4 PIPELAYING GENERALLY

Sewer drainage pipes are to be laid, lined and boned in to an even grade to levels shown on the Drawings or supplied by Principal.

Pipes are to be laid in such a manner that their barrels bear firmly and evenly on the bedding material, the sockets being entirely free from bearing. The spigots are to be pushed home in the sockets so that an even line will occur at the invert, any lip due to eccentricity being at the soffit.

4.5 MINIMUM DRAINAGE GRADIENTS

The minimum recommended drainage gradients are:

1.65% Grade for Sewer
1.00% Grade Roofwater drainage.

Any drainage laid at less than the recommended minimum gradients other than those shown on design drawings will require special permission from Principal or the Authority unless otherwise noted on the drawings.

4.6 TESTING OF DRAINAGE

Carry out all tests as set out in Principal specification or as required by the Authorities and or Principal At least 48 hours' notice is to be given for inspection of works under test. Supply all plugs and other materials necessary for the tests.

Underground or enclosed work is to not be covered or concealed from view until it has been inspected and approved by Principal, and the governing authorities. Sewer lines are to be subject to a hydrostatic test for a minimum of 15 minutes. The line must be free of air pockets whilst under test.

All testing shall be in accordance with AS.3500.

4.7 DRAINAGE PITS & STRUCTURE

Construct as documented on drawings all site drainage pits and structures.

Precast drainage pits for sewer and stormwater applications are permitted only within soft landscape areas. All precast pits are to be bedded on minimum of 150mm clean fill sand with minimum 100mm fill sand side surround.

Drainage pits that occur below vehicular traffic pavements are to be reinforced concrete formed in situ.

All pits are to be constructed with a minimum of 50mm 3:1 sand cement mix benching in the direction of flow unless otherwise noted on the drawings. Pits greater than 1.2m in depth is to be constructed with step irons @ 300mm CTS. All penetrations to pits are to be made good with 2 pack epoxy.

Pipes greater than Ø150mm diameter are to have a flexible rubber ring joint both upstream and downstream within 600mm of the external pit wall adjacent. All pits are to be cleaned of debris prior to completion.

Formwork is to comply with the requirements of the ACSE Concrete Specification. Both internal and external surfaces of walls are to be formed. However, where the depth of the structure and nature of the ground permit, Principal will allow the casting of walls without external forms provided the ground is undisturbed, that it is trimmed to an even vertical surface and that wall thickness is increased by at least 50mm over that detailed. No additional payment will be allowed for this alternative procedure.

External formwork is to be used for the top 300mm of manholes and sumps in all cases. Formwork is to be used for both faces of end walls.

Construct maintenance holes and sumps with block outs for connection of future pipelines as detailed.

Finish maintenance hole covers 25mm above nominated pavement levels and locally feather pavement finish to maintain smooth transition in paved areas, 25mm above finished surface in landscaped areas and 75mm above natural surface elsewhere (U.N.O.).

Where existing structures are to be raised or lowered, break out sufficient of the walls to expose reinforcement and to allow at least 150mm of new concrete below the new cover or frame. Splice new reinforcement to old as necessary, form and place concrete as specified for new structures.

Where shown on the drawings, mild steel fixtures including grates, frames, step irons, ladders, etc., are to be hot dip galvanised. Galvanising is to comply with the requirements of AS 1214 or AS 1650, as appropriate.

The average coating to items other than threaded fasteners is to be 600 g/m². Threaded fasteners are to have an average coating of 375 g/m². Surplus material is to be removed from threads of bolts so that no recutting is required.

4.8 GRATES AND COVERS

All drainage grates are to be fitted within purpose cast or manufactured "T" frames.

All blind covers are to be minimum class D unless noted otherwise.

All blind covers are to be such that the surrounding pavement may be in filled so as to minimise visual impact of pits within pavement areas.

All pits are to be constructed such that the base remains level. Adjust grates and covers to suit surrounding pavement grade.

Small Grate / Floor Waste / Drainage Feature Schedule or Equal Approved.

FW	Floor Wastes	Diamond Pattern Chrome plated brass on copper tail pipe
BTFW	Bucket Trap Floor Wastes	SPS or Equal in pipe stainless steel floor drain with square hinged grate and removable stainless steel basket
PDFW	Plant drain floor wastes	SPS or equal heavy duty cast iron floor drain push in fitting
ORG	Overflow Relief Gully	100mm riser shaft and pop top gully grate with preformed concrete surround. 150mm below FFL to top of grate. Fit gully 75mm above surrounding FSL
CO	Clear out	Chrome plated brass in PVC-U fitting
ISLC	Inspection Shaft light cover	PVC-U bolted trap screw
ISHC	Inspection shaft heavy cover	Cast iron 300mm round cover supported independently of sewer shaft

4.9 CONDUITS, ELECTRICAL PITS AND INTERFACE WITH ELECTRICAL SERVICES

The hydraulic sub-contractor will arrange for and be responsible for the laying of all new electrical and conduit sleeves and pits as shown on the drawings in association with the hydraulic services scope of works.

The Sub-contractor will arrange and construct all control panels required for the operation of hydraulic services equipment and provide a point of connection for electrical services power supply.

All conduit details are to be as specified by the relevant services sub-contractor and supplied and installed in accordance with the requirements of AS 2053 and AS 3000.

Installation is to comply with the requirements of this specification for stormwater drainage where not contra

Lay conduits at a minimum grade of 0.5% and with a minimum cover as specified by the relevant services sub-contractor. Conduits under roads and other construction are to project at least 500mm beyond the kerb, roadway edge, or other construction. Install a 2.5mm diameter high tensile draw wire in each conduit and seal both ends. Draw wires are to be at least 1m longer than the conduit in which they are installed. Leave ends of conduits exposed until their locations have been recorded, unless directed otherwise by Principal.

Electrical pits are to be precast concrete with class D solid covers with 'T' frames unless noted otherwise. Conduits are to be heavy duty PVC-U (orange). Lay electrical warning tape and brickwork as required complying with the requirements of AS 3000.

4.10 LAYING AND JOINTING OF PIPES

Unless otherwise permitted, commence laying pipes at the outlet end and proceed upstream.

Remove all foreign matter from inside and outside of pipes before laying. Lay and joint pipes to the lines, grades and levels shown on the drawings. Ensure that pipe barrels bear uniformly on the prepared bedding over their full length. Keep pipelines clear of debris and obstructions as laying and jointing proceeds.

Pipes up to and including 225mm dia. are to have the first joint 150mm from the wall of structures, followed by a 600mm length of flexible jointed pipe. Pipes 300mm diameter inclusive are to project a maximum of 150mm from structures to the first joint.

Plug lifting holes in pipes with cement mortar before commencing backfilling.

When using a rubber ring jointing system, form joints by placing ring evenly over the pipe spigot without twist and rolling it into the socket. Spigots are to always be inserted squarely into sockets. If line is to be curved, deflect pipe after making joint.

Concrete encasement, if required, are to extend for the full width of trench and for 150mm above and below the pipe.

Where pipe cutting is required, the cut end is to be treated to prevent deterioration of the exposed reinforcement (steel or cellulose fibre) in accordance with the manufacturer's recommendations.

Connection to Existing Facilities

Where required connect drains to existing maintenance holes, sumps or pipes. Break out existing structures to the minimum extent necessary and reinstate on completion of the connection.

Connection of stormwater pipes to downstream outlets is not be made until all pipes within the contract for that particular catchment have been cleaned, inspected and passed.

4.11 TOLERANCE

Pipelines are be within 20mm of design line and level at all points where design grade exceeds 1% and within 10mm of line and level for grades flatter than 1%.

No adverse grades will be permitted on any section of the pipeline.

4.12 FINAL INSPECTION

Pipes and structures are to be flushed out and cleaned of debris, silt etc. before final inspection. Water for flushing may be obtained from the Sub-contractor's temporary tapping on site. Attention is drawn to the need for compliance with Environmental Legislation.

Final acceptance is that stage when Principal is satisfied that the work meets all of the requirements of the Contract including the requirements of the relevant Acts.

Liaise with Principal who will arrange for a final inspection when the sewer lines have been checked and backfilled, maintenance holes and sumps are complete and lines have been flushed clean.

SECTION 5 SANITARY PLUMBING SYSTEM

5.1 SCOPE OF WORKS

Sanitary plumbing works above ground are to include all those works generally considered by authorities and trade practice to be soil, waste, vent above ground as distinct from drainer's work.

Plumbing is to be the connection of waste fixtures, condensate and vents to the drainage system.

The Sub-contractor is to provide for protection of all fittings and pipework after installation and secure them against damage and is to be completely responsible for the replacement of any damaged or disfigured fitting, pipe or fixture at his own cost.

5.2 MATERIAL SCHEDULE

Description	Size	Material
Sanitary Plumbing	40 - 100	PVC-u DWV SN6 /Copper/chrome-plated copper where exposed
Sanitary Vents	50 - 100	PVC-u DWV SN6

5.3 SUPPORTING AND FIXTURES PIPES

All pipes are to be adequately supported and securely fixed in accordance with the drawings and to the satisfaction of Principal. Such supporting and fixing to be carried out without causing any distortion, damage or stress on the pipes or pipe joints. Pipes are to be supported at each collar and at spacing ABS.

5.4 FIXTURE TRAPS AND WET AREA SANITARY PIPES

75mm water seal traps are to be provided for the following fixtures:

- Sinks — 50 mm two part universal pattern (NOTE: CP copper traps are to be used where exposed)
- Basin — 40 mm CP copper two part S or P trap with 40 mm CP extension riser
- Basin Plug & Wastes: — 40mm CP Brass Plug & Waste.
- Exposed Flush Pipes: — CP Copper Tube
- Exposed vent pipes within wet areas: — CP Copper Tube
- CP = Chrome Plated.

5.5 VENT PIPES

Terminate all vents through roof with a cowl, "Dektite" or equal flashing and weather apron. Finish vents minimum of 3 metres above ground level, clear of openings as required by the local authority and as indicated on the drawings. Flashing of vents which penetrate the roof is to be carried out within the hydraulics scope of works. Vents are to be offset a minimum of 4m within buildings from edge of eaves. Terminate vents no closer than 6 m to air intake ducts.

5.6 COVERPLATES

Construct chrome plated cover plates within wet areas and cover plates to match surrounding finish at all penetrations through finished surface levels including walls, floors, ceilings, joinery.Chrome plated cover plates are generally to have 10mm raised dome.

SECTION 6 WATER SERVICES

6.1 SCOPE OF WORKS

Domestic cold water incoming main is extended from existing 100mm DICL authority water main to all draw-off points within the building. Building domestic water supply system will comprise the following:

- Domestic cold water system
- Domestic hot water system

6.2 MATERIAL SCHEDULE

Description	Size	Materials
Domestic Cold Water (above ground)	15 - 65	Copper Type B
Domestic Hot Water	15 – 65	Copper Type B (Lagged Armaflex)

6.3 BACKFLOW

Backflow prevention devices are to be installed in locations as shown on drawings and are to be RMC/Watts manufacture or equal. All backflow preventers are to be installed in accordance with manufacturer's recommendations and AS/NZS 3500 Part 1. All RPZDs are to be fitted with stainless steel valve seats.

Sub-contractor is to submit all documentation and pay all fees to regulatory authorities and commission all backflow devices prior to completion.

6.4 FLOW CONTROL

Flow control valves manufactured in accordance with AS 3715 are to be fitted to all water outlets within the project.

6.5 HOSE TAPS

Provide and install hose taps extended from the rainwater re-used system in the positions shown on the drawings. Construct all external hose taps as detailed on hydraulic services drawings.

Internal hose taps are to be "Enware" Ø15mm with cover plate or as nominated of fixture and tapware schedules. External hose taps are to be Ø20mm rough brass. Each external tap is to have separate isolation valve and hose tap vacuum breaker mounted within independently support galvanised mild steel support post.

6.6 DOMESTIC HOT AND WARM WATER SYSTEM

Supply and install hot water heaters where nominated on the drawings in accordance with AS.3500.4. Sanitary hot water fixtures used primarily for personal hygiene purposes are to be set at a temperature not exceeding the following by means of thermostatic mixing valves.

- 43.5 degree Celsius accessible uses
- 50.0 degree Celsius elsewhere except where higher temperatures are required

6.7 THERMOSTATIC MIXING VALVE

Supply and install TMVs as shown on the hydraulic services drawings to accessible amenities provisions and other amenities where warm water supply is required.

Thermostatic mixing valves complete with lockable stainless steel enclosure/box are to be recessed into the wall in a location that is inaccessible to students. All in accordance with the manufacturers printed technical manual for installation, commissioning and maintenance for thermostatic mixing valves.

All TMV's and other water service isolation valves to be located not more than 1.5m above finished surface level to allow inspection and maintenance without the use of step ladders.

Valves are to be equal to "Enware" Aquablend and be complete with cold water by-pass, isolation valves, strainers and provisions for temperature and pressure gauges all incorporated with vandal proof wall recessed stainless steel housing with identification signage at each TMV.

6.8 PIPEWORK EXPANSION

Take care in planning hot water pipe routes to ensure that sufficient offsetting is achieved to compensate for length increases from pipe expansion. Pipe brackets on the hot water pipework systems are to be guide type and are not to restrain the pipe from longitudinal movement.

Ensure that branch pipes are of maximum lengths from main pipe circuits before being restrained by entering vertical built in positions. Construct hot water loops as indicated on drawings.

6.9 THERMAL INSULATION

Supply and install thermal insulation to pipework as per the following table:

Type of Service	**Type of Insulation**
Hot Water	
15 - 25 diameter	25 mm closed-cell foam with aluminium foil vapour barrier
32 - 50 diameter	25 mm closed-cell foam with aluminium foil vapour barrier
15 – 20 diameter dead legs	Kemlag or equal
Cold Water	
Chased in walls	Kemlag or equal
Exposed externally	Armaflex or equal

6.10 BEDDING AND PIPE COVER

All copper water services are to be bedded on a minimum of 150 mm of clean fill sand approved bedding material. DICL water services are to be backfilled and bedded on cement stabilised clean fill sand and carefully compacted and watered in place. The minimum cover water services are to be 600 mm. All below ground water services are to be wrapped in PVC sleeve and taped firmly to pipe.

6.11 COVER PLATES

Construct chrome plated cover plates within wet areas and cover plates to match surrounding finish at all penetrations through finished surface levels including walls, floors, ceilings, and joinery.

Chrome plated cover plates are generally to have 10mm raised dome.

6.12 WATER METERS

Construct pulse capable water meters as shown on hydraulic services drawings. All water meters are to be equal to Kent / RMC Watts and are to be fitted with pulse connection for remote readout and interconnection with BMS systems. Standard rated pressure 1000kpa.

6.13 TESTING

All metallic water services are to be tested hydraulically in accordance with relevant Standard.

Cold water	-	AS/NZS 3500.1.
Hot water	-	AS/NZS 3500.4.

SECTION 7 GAS SERVICES

7.1 SCOPE OF WORKS

Supply and install all gas service pipes from the authorities main within to meter assembly then to the hot water plant, and equipment provisions as documented. Include for all pipework, bends, offsets, brackets, valves and sundry equipment required for the installation.

7.2 PIPEWORK

All gas service materials shall conform to the specifications detailed under the Materials section of this Hydraulic Services Technical Specification.

7.3 VALVES

Provide control service valves for each appliance and/or branch as indicated on the drawings.

Meter inlet control valve and appliance control valves shall be approved type Spherical ball, stainless steel body type only. Branch control valves may be brass or copper of sizes as indicated on the drawings, and of type approved by AS5601

Path Box valves - Provide cast-iron valve boxes with removable covers for access to underground valves. Identification: Mark the box covers with the word "GAS".

7.4 MASTER GAS METER AND REGULATOR

Determine the exact location of gas meter and regulator and items of equipment required for the installation. Allow for all valves, fittings, pipework, regulators, fees, meters associated with the supply and installation of the gas meter and its associated equipment.

7.5 CONNECTION TO APPLIANCE

Before connecting gas to each appliance the Contractor shall ensure that the appliance is approved in accordance with the requirements of the local supply authority and is correctly installed and that all supports, connection etc., meet with the regulations.

Connection to appliances shall be with stainless steel hoses as approved by AS5601. Hoses shall be of an appropriate length. Appliances shall be chained to the wall in accordance with AS5601.

7.6 PURGING

Contractor to allow for purging of pipework in accordance with Gas Company regulations and in the presence of the Superintendent's Representative and Gas Company inspector.

7.7 TESTING

All gas services shall be tested to the satisfaction of Jemena Gas fitting Rules and AS5601. All defects disclosed during testing shall be immediately rectified and fresh tests carried out as required by the Project Manager.

7.8 JOINTING

Copper tubing shall be slipped and silver soldered using 15% silver brazing alloy, capillary fittings may be used joined in accordance with 1585 and AS1167.

7.9 ACCESSIBILITY

Locate pipe fittings requiring maintenance or servicing, including control valves, joints designed to enable removal of pipes, and the like, in accessible positions with adequate clearance. As far as practicable install components of the installation, such as pipe-work fittings, so that they are removable without damage either to themselves or to the building structure or finishes.

7.10 LABELS

Label gas services every 3 metres. Label shall indicate Natural Gas pressure.

7.11 GAS FLUES

Flue materials shall be spiral wound 316 stainless steel in accordance to AAS5601-2010.

7.12 APPLIANCE

Before connecting gas to each appliance, the Contractor shall ensure that the appliance is approved in accordance with the requirements of the Jemena Gas fitting Rules and AS5601, and is correctly installed and that all supports, connections meet with the regulations. All appliances shall be suitable for natural gas.

The Contractor shall allow in his tender price for the complete testing of the operation of all connected appliances.

Flue materials shall be spiral wound 316 stainless steel in accordance to AAS5601-2010.

SECTION 8 AUTOMATIC IRRIGATION AND INTENSIVE SUBSURFACE DRAINAGE

8.1 REFERENCED DOCUMENTS

All relevant and civil works, landscape and other services plans, sections and specifications and other details which may be available from the client of other trades and or service utilities..

8.2 FINAL LOCATION

The irrigation Contractor is responsible to mark out the entire system or in stages and is to seek approval of all final locations of, mainlines, laterals, controllers solenoid valves, isolation valves, sprinklers, valve pits, cabinets etc prior to installation. All irrigation stakes or markers are to be timber and clearly identified with written letters IRR and any required detail (e.g. valve pit) and shall also incorporate BLUE paint, marking or tape to the top of the peg. 2 Pegs minimum 900mm above ground are to be placed adjacent to each valve pit during construction and remain until final levels/finishes are approved. Manufacturer marker flags are suggested and may be used only for location and identification of sprinkler locations and should also remain until final finishes are completed and final sprinkler levels approved.A minimum 400 x 400 x 400 concrete support slab at ground level is to be provided with 100mm of the slab extending above the ground.

8.3 DESIGN

The equipment symbols shown on the plans are diagrammatic in scale. Both the drainage and the Irrigation Contractors shall generally follow the design as shown and shall not alter the general layout without prior written application and approval.

Check on site, all measurements and final location of equipment and notify the Irrigation Consultant and the Client by written notice and any alternate option on any variations to the design should it be required due to site conditions. The contractor shall be responsible for the final working and performance of all installed items, and any alterations made to the specified irrigation equipment and design.

8.4 EXCLUSIONS

The head contractor will provide for water and power to be laid to the tank site. The irrigation Contractor shall be responsible for all other final connections. Power to be connected to the pump panel cabinet by the site electrician and the irrigation contractor shall arrange for a sub-contractor to carry out all other required electrical work from the panel to all irrigation and pump components.

The Irrigation Controller is also to be located in the pump panel cabinet and operate as a standalone controller adjusted by the contractor until handed over to Council at which time Council will supply a sim card to enable the controller to be connected to their Central Maxicom system.

All other work required to furnish a complete and fully functioning drainage and irrigation system is to be by the contractor including for the backflow prevention device and connection of potable water supply to the tank.

8.5 EXCLUSIONS

Hold points may be requested from time to time for formal independent inspections. The contractor is to provide experienced personnel for any and all such inspections upon request with reasonable notification.

All work is to be carried out under the direct supervision of suitably qualified and licensed personnel and shall conform to this document and any relevant Australian Standards, including any authority requirements.

Hold points may be requested from time to time for formal independent inspections. The contractor is to provide experienced personnel for any and all such inspections upon request with reasonable notification.

All work is to be carried out under the direct supervision of suitably qualified and licensed personnel and shall conform to this document and any relevant Australian Standards, including any authority requirements.

The contractor shall, implement and ensure the daily record keeping and maintenance of an approved work-cover WHSE, manual and practices including MWS, MSD and any other relevant information during the course of the works and until such time and completion of the defects and liability period following approved practical completion. Defects period shall be minimum 12 months from PC.

8.6 BARRICADES, EXCAVATION, BEDDING AND BACKFILL

During construction, all pipework when left unattended shall be securely capped, taped or plugged to prevent the entry of foreign matter and barricaded or covered. No open trenches are to be left unattended or overnight without being suitably barricaded and identified even where they may be within secured work areas.

Mainlines for this project are to be laid on a levelled trench base, free of sharp objects and protrusions. Allowance is to be made to incorporate imported screened and graded filling sand for bedding and initial backfilling to all irrigation mainline pipes and to potable water line extensions. Imported approved fill shall then be used for the topping up of irrigation trench lines.

All irrigation pipework shall be coordinated with and be clear of critical drainage pipe levels. Allow to closely coordinate at all stages of the project for where pipes cross over and maybe in conflict with drainage pipe levels. Damage to irrigation pipes by the drainage works is to be repaired by the irrigation specialist at the contractor's cost.

All mainline and lateral trenches are to be backfilled and compacted with a minimum two passes with mechanical Wacker Packer machine or as otherwise necessary to prevent the subsidence and erosion of trench lines. Minimum of three passes required on slopes of greater than 5°. Suitable soil moisture content is to be available to ensure suitable compaction. Settlement or erosion of trenches greater than 20mm shall be considered a defect and unsuitable. The contractor shall be required to return within 48hrs to rectify to the approval of the client with an approved imported top-dress soil.

All trenching shall be by open trench method, hand, chain type trenching machines and or bucket type machines, unless written approval is granted by the client or his agent for other methods.

All pipework, trenching and backfilling is to be closely co-ordinated between all trades and or services and utilities on the site.

All trenches shall finish flush with the surrounding soil levels.

All excavated spoil is to be retained on site and is to be moved to a stockpile area as nominated by the client on site.

8.7 PIPE AND FITTINGS

All piping shall conform to Australian Standards and be of the type and size of that indicated on the drawings. Pipelines shall be installed using the longest practical length to eliminate unnecessary jointing and shall follow the manufacturers recommended installation practise.

Main Line Pipework:

Mainline pipe for irrigation services are to be as indicated on the drawings

- Generally mainlines shall be plain BLACK MDPE PE100 PN 12.5 with blue "IRRIGATION MAIN BELOW" ID tape which is to be laid in the final 200-150mm of backfill.

- Irrigation main lines are to be Butt weld, or electro fusion fittings are to be used on mains pipework 90mm and above. Mechanical fittings to a rating of PN16 may be used on pipework less than 90mm.

- NOTE: Blue Striped Poly will not be acceptable on any irrigation service lines as there may be blue striped poly potable supplies on the site.

- Mainlines shall be the class and size as shown on the plans.

Lateral Pipework:

Lateral pipe for irrigation services are to be:

- PE100 minimum PN10 plain black

- Fittings shall be mechanical compression type or PN16 rated saddles with 316 stainless steel bolts used

Fittings General:

All fittings used are to be approved by the manufacturer of the pipework to be used and shall be fully compatible and the best of their kind.

Tapping saddles rated to PN16 may be used on mains to solenoid valves equal to "Stock brands" and may also be used on lateral lines to sprinkler offtakes. Where tapping saddles or flanges are used, ONLY stainless steel bolts are to be used. No joints, are to be made under roads, pavement, concrete or other such areas without approval.

Cover over pipework general allowances shall be between:

	Minimum	Maximum
Mainlines cover	**600mm**	**800mm**
Laterals general cover	**450mm**	**600mm**

Failure to meet required depths, without express written approval due to a specific site condition, at random check points, may render rejection of or the request to replace, the entire section of work.

Note: I.D Tape is required in final 200-150mm backfill over all irrigation mainlines from both town supplies or pumped irrigation supplies.

Note: All irrigation pipes are to avoid conflict with drainage lines. Gradients of drainage lines will take priority over irrigation lines. Where the above minimum cover cannot be maintained due to drainage gradients the irrigation pipes shall be installed first and deeper.

Note: Where cover cannot be met due to ground restrictions, conditions or existing structures or services, the available cover is to be noted on the as built drawings and brought to the notice of the project supervisor for approval prior to laying or backfilling.

8.8 ISOLATION VALVES

All small bore isolation valves (up to 80mm) shall be of stainless steel and where necessary shall be lockable type. Isolation valves to be placed before all solenoid valves are to be full stainless steel.

All valves are to be installed as specified and as indicated on the plans. Open and close positions shall be clearly identified on the top of all valves.

Large bore valves; over 80mm shall be cast iron, flanged resilient seated sluice valves.

Butterfly valves are NOT considered suitable for this project and are not to be used.

8.9 MINOR ITEMS – QUICK COUPLING VALVES

Quick Coupling Valves. All QCV's shall be:

Rain spray 25mm 2 piece brass type with rubber cover. Final location to be approved by the project superintendent.

QCV's shall be fitted with double o-ring swing arm joints of equal size or larger than the QCV. The swing arm joint shall be a minimum of 300mm in length and will in any case allow for future height adjustment. No swing arm joint riser, pipe shall be at a greater angle than 30° degrees when measured against the lateral feeder pipe. The swing arm joint shall be connected to the side of the submain pipe using either, a mechanical jointing threaded branch fitting, tapping saddle, solvent weld or electro fusion threaded branch fitting which ever is most suitable and appropriate and as approved by the pipe manufacturer.

QCV's shall be reset to final height at the end of the maintenance period or as requested, to the approval of the Project Superintendent or his agent.

All QCV's are to have an isolation ball valve preceding each valve and the QCV shall incorporate a stabilizing device, The isolation valve and QCV shall each be located in a separate 9" round Valve box.

8.10 SPRINKLERS

Sprinkler type: The design has been based on Rainbird 8005 stainless steel riser #14 nozzle at 480kPa on a grid of 15m x 16.25m. This selection has been made due to site specific parameters and water efficiency as modeled by WinSpace. Generally this spacing is to fall between the North South Drainage alignments and is to be maintained around the centreline of the fields.

Pressure regulators are required on the solenoid valves and are to be set to ensure the last sprinkler of each line has a minimum pressure of 480kPa as registered by a pitot tube in the last sprinkler of each line.

Average suggested application is nominal 11mm per hour with a DU of 90% on average and a SC of 1.2.* (*Based on Space data of average spacing's at 480 kPa and 5% critical window. 10% critical window shall be SC of 1.1)

Other sprinklers may be offered such that they do not exceed the flow of the nominated sprinklers (57lt/min) and their respective performance is equal to or exceeds the nominated sprinklers at equal to or less pressure. The contractor shall provide all evidence of performance data should they wish to offer an alternative. Any such alternative shall not be installed without prior written approval by the Client or the system designer on behalf of the Client, in writing.

Sprinklers General ALL.

NOTE: Every effort has been made to accurately locate sprinklers on the plan however final nozzle, arc and location is to be determined by the contractor on site as the site conditions may dictate and alter in minor cases. If there is any discrepancy as to the design intent the Client or designer is to be contacted for clarification.

All sprinklers shall be fitted to a "swing arm joint" of equal size or greater than the inlet of the sprinkler. The swing arm joint shall be a minimum of 200mm in length and will in any case allow for future height adjustment. No swing arm joint riser pipe shall be at a greater angle than 30 degrees when measured against the lateral feeder pipe. The swing arm joint shall be connected to the side of the lateral pipe using either a tapping saddle or a mechanical joint fitting whichever is most suitable and appropriate and as approved by the manufacturer. Teflon tape to be used on all threaded joints to ensure a good seal and smooth adjustment.

Alternative to standard swing arm joints with Teflon tape, a double o-ring swing arm may be used.

All Sprinklers shall be neat and straight, installed in a true vertical position and consistent height within a tolerance of 10mm but not higher than finished soil level to the underside of the rubber cover. Allowance is to be made within the tendered price to reset to final height as necessary or as requested, to the approval of the Client or agent.

All sprinklers are to be installed in accordance with manufacturer recommendations.

8.11 CONTROL SYSTEM

A new Rainbird ESP Site Satellite for Maxicom in 24 stations with GSM communications modem kit including power supply antenna and modem is to be the only acceptable controller. The Council shall supply a suitable sim card when the system reaches the end of DLP and is handed over to Council. Until then the controller shall operate as a stand-alone controller and the contractor shall make monthly or more frequent if required adjustments until the end of the DLP. The contractor shall allow to install all necessary wiring from the controller to all solenoid valves including the master valve, and flow/ sensor and shall wire valves individually into the controller but shall program the controller to operate valves in pairs as nominated on the drawings.

Final operation run times shall be worked out in-conjunction with the Council for minimal irrigation needs and should generally not to exceed an average irrigation of 25mm per week. Calculated irrigation rate of the system design is 4 nights watering per week of up to 35mins per station or 17mins for the part circle stations.

All cable joins are to be completed with particular care using correctly installed DBY type cable joins

Allowance shall be made to adjust and program the Controller as may be necessary, for final commissioning and to monitor and make necessary adjustments during the initial installation period in conjunction with the whole of the project works.

Allow for Three (3) formal training sessions to be conducted with the nominated operators of the system in the use and programming of the controller and the maintenance and operation of all other equipment installed.

Allowance is to be made to run heavy duty conduit to carry cables where they deviate to the controller away from pipework. Conduits up walls to be either steel or heavy duty uPVC with a steel protective shroud/cover plate over. Preference is for cables to run through conduits into the base of cabinets through the concrete plinth or base. Steel painted shrouds are to be used for all conduits from 1.2m above ground to 100mm below ground level.

The control system is also to be wired to the flow sensor or meter on the irrigation mainline after the pump and the controller programmed to register the flow and record and monitor flow rates for each station so as to log and in the future report any flow faults to Councils central system. Refer to Rainbird for assistance in controller set up and programming and registering of flow sensor/meter in/outputs and type etc.

8.12 SOLENOID VALVES

Solenoid valves generally shall be of 50mm or as noted on the plan. They shall each be preceded by an isolation ball valve of at least the same size and housed in a protective valve box as specified in 3.9.

Solenoid valves shall be Irritrol Century, Rainbird PEB Series or Hunter ICV series and shall be fitted with pressure regulating devices. A master valve is to be fitted and does not require pressure regulation. The VFD on the pump will regulate main line pressure.

Regulators to be set as nominated under 3.5 Sprinklers and or as required to enable optimum performance from the sprinklers on each zone. Allow to adjust setting as requested if required upon commissioning.

8.13 EXTRA LOW VOLTAGE CABLING AND CONDUIT

All valves shall be individually wired with individual active wire between the controller and the valve.

All active cables from the controller to each valve shall be multi-core, multi-strand, double insulated and shall be a continuous run with no cable joins outside of valves boxes. Common cables shall be a separate twin core multi-strand, double insulated cable.

Common and active cables to each of the valve pits from shall be in a continuous run between with no joins.

Cables sizes are to be:

- active minimum **1.5mm** and
- common minimum **2.5mm.**

Refer also to the wiring chart on the drawings. Allow a minimum of a 1m loop in each valve pit.

All cable paths are to be installed in a light duty pvc or poly conduit between valve boxes.

All cables conduits are to be laid in the shadow of the mainline pipework. Where cables deviate from the pipework, and are above ground or running through or under concrete structures they are to be laid in an orange poly electrical conduit of a suitable size. All conduits shall be installed in a neat, straight workmanship like manner and fixed or bracketed as required. Conduits fixed to external walls shall firstly be to the approval of the client, shall be metal and painted to the same or similar colour of the surface affixed to.

All cables shall be joined or terminated using an approved waterproof 3M DBY type cable joiner. A plastic zip cable tie shall be used at the base of each set of joints to bundle cables neatly together and provide extra mechanical strength.

Cables are not to be joined in the "field" without permission and being recorded and highlighted on the as built plans.

All active cable looms shall retain the black cable as a spare and it is not to be cut anywhere.

Common cable looms shall be twin core and the Black is to be used and the white retained as a spare and is not to be cut anywhere.

8.14 VALVE BOXES

Valve boxes shall be of, commercial grade complete with "lip over" and a bolt or other type of lockable lid. They shall be minimum model 1419-12 or larger as required for isolation valves and all solenoid valves. In all cases the valve box shall be of sufficient size to provide sufficient room to enable the adjustment, minor servicing and control of all items housed within the valve box. The contractor may be asked to replace and make good at his expense if a valve pit is deemed to be insufficient in the opinion of the superintendent.

Each Valve box shall be clear of all pipework. Bidium or other geofabric, plastic sheeting or other material shall be used to line the exterior and base of the valve pit to prevent the ingress of dirt and sand into the valve box. A pre-cast concrete or ploy slab shall form the base of the valve pit. Where bricks are used to build up the base of the valve pit, mortar is also to be used to prevent movement of the bricks. Alternative is to use a precast concrete base riser or treated timber drilled and pinned together.

Valve boxes shall be located square with adjoining valve boxes and or nearby kerbs, cabinets, fences buildings etc etc and flush and level with the proposed finished ground level. Final locations should be first approved by the superintendent. They are to be accurately recorded on the as built drawings for future location.

8.15 TANK, PUMP, TOWN WATER, CABINETS, POWER & SPECIAL PROVISION

Tank

A new minimum 165kl concrete tank with a purpose constructed "pump sump" in the base floor of minimum 2.5m x 2.0m x 1m deep is to be supplied and installed equal to Panthers Concrete tanks with two manhole covers and internal tread poly steps and or hot dipped galvanized fixed ladder under each manhole.

A 20mm aluminum lip is to be included surrounding the sump to prevent silt and debris flowing into the pump sump. The pump sump is to be designed to ensure maximum draw down potential within the tank.

The tank is to be located in the location near to that shown on the plans and is expected to be a minimum 0.3m high proud of ground on the north or eastern side and maximum of 0.6m above ground to the southern and or western sides. The contractor shall be responsible for confirming with the client for final location and for tank access.

The new tank is to be fitted up by the irrigation contractor including but not limited to appropriate overflows, inlets and outlets with painted covered steel shrouds etc.

The tank should be fitted with two secure, and approved by the client, lockable or concrete infill gatic manhole covers, one over the pump sump and pump discharge and the other opposite and over the town water inlet.

The irrigation contractor shall provide a minimum 110mm outlet for pump discharge at the appropriate level with isolation valve, sealed core holes for float switches, town water inlet and suitable overflow. The man hole is to be over the level switches. All level to be adjustable and accessible from under the manhole covers of the tank. All town water connections to the tank are to meet AS3500.The tank, shrouds and enclosures are all to be painted to the colour nominated by the client, by the contractor.

Spoil from excavation may with the client's approval be used to reshape around the tank and excess is to be moved stockpiled at a location on site to be nominated.

The tank overflow is to be fitted and piped to a location approved by the client. The overflow shall be protected by a painted steel shroud or shall be piped in gal steel pipe and securely attached to the tank wall so as to prevent any damage by act of vandalism.

The tank is currently to be painted 'colourbond bushland' or other nominated colour. The client shall nominate or approve the final colour in writing.

Irrigation Pump, Enclosure, Meters, Power etc.

The system is to be fitted with a new irrigation pump system which is to be pressure activated. The pump is to be a Lowara Z631—07 L6w 9.3kw and fitted with a VFD control. Pump duty to be 2-10lt/sec at 600kPa. A small pressure vessel and pressure transducer is to be located in the base of the pump enclosure or a separate pit in a secure and positively drained pit. Equivalent Grundfos pump may be offered and used.

Low pressure **and** low level protection to be included. Low pressure conditions to automatically retest minimum 5 times and low level to automatically reset upon level replenishment minimum 200mm above low level cut out.

The pump panel shall be located in a secure, two section (upper and lower) double or triple locking; strong powder coated, and ventilated "dead front", vandal proof cabinet adjacent to the tank. The pump panel shall provide pump on/off/auto indication, hour meter, signal indicator lights, for pump run, low level and or fault/alarm.

Pump duty shall be capable of minimum 2-10lt/sec @ 600kPa.

Allow for a flow sensor or meter with master valve to be fitted at the tank with minimum 10x pipe diameters before and 5x pipe diameters after before the installation of a master valve. See typical layout on plan. The flow sensor shall also include connection to the Irrigation controller which is to register and log flow data. Check with manufacturer regarding cable type and size give the distance back to the controller.

Allowance is to be made to work in with the site appointed electrician for the supply of power to the tank site and into the cabinet to facilitate power supply for the pump, irrigation controller and other power needs of the irrigation system.

Town Water

Allowance to be made to connect a new town water supply to the tank. Allowance to be made to connect to a 40mm isolation valve within 15m of the proposed tank site and to extend to the tank fitting a new 40mm testable double check backflow prevention device in a cage to AS3500 before connecting the supply to the tank and fitting internally a Philmac 40mm high pressure servo float valve. The inlet to be located opposite side of the tank to the pump and directly under the second manhole.

8.16 MATERIALS AND COMPONENTS – DRAINAGE

Incorporated with the irrigation system is to be installed an intensive subsurface drainage system

An intensive subsurface gravel and sand slit drainage system is to be installed in the oval. Refer to the drawings for details and layout. The drainage levels shall take priority over pressurised irrigation lines and close coordination will be required at various points to ensure critical drainage falls and levels are adhered to.

The drainage system is to be installed by a specialist drainage contractor with laser guided trenching equipment and which will provide minimum disturbance and damage to the oval surface. The drainage system shall provide 50mm wide sand slit "collectors" at no more than 3m centres to be run as set out on the drawings and main 70mm wide with 50mm ag line, gravel and sand"carriers" at 5m centres to be run generally North and South with fall to the north and fall to the south from a centre point. Carriers are to interconnect to 160mm main drain lines to the north and south, which are to then extend and connect to pits as shown. Pits and overall main site drainage works by Civil or other contractors and does not form part of this intensive drainage contract work.

Note: The location of irrigation sprinklers shall generally fall between 5m carrier lines. Carrier lines collector lines to be adjusted to maintain 2.5m in the carrier and minimum 1m in the collector drainage lines from sprinklers. In essence the drainage is to be set out around the irrigation sprinklers to avoid minimal conflict on the field.

All excavated soil is to be removed from the field and stockpiled as directed by the client on site for removal by others.. All imported gravel and sand is to be premium washed, graded, tested and approved drainage media which will meet and pass Sportsturf Research Institute (STRI)- UK recommendations and standards. All connections from pipe to be made using specialised connections and inspection and flushing points on the main drains are to be installed as necessary.

8.17 INSPECTION AND TESTING

The irrigation and drainage systems are to be inspected at several stages during the construction at random. The contractors are to provide an experienced representative as may be required for inspections. Any work found not to be to the satisfaction of this specification or the client is to be repaired or replaced as directed in a professional and workmanship like manner to the satisfaction of the client. The cost of repairing and or replacement of any unsatisfactory work shall be totally borne by the contractor.

The main line is to be pressure tested and witnessed as stages are completed. The contractor shall be responsible to contact co-ordinate and schedule such tests when sections of the irrigation main is completed. The irrigation main pressure test shall be to 1.5 times the working pressure or to the pressure rating of the pipe, whichever is lesser for a period of a minimum 30 minutes. Flush the pipe work of all foreign objects prior to the test and expel all air from the system.

All costs associated with any tests or re-tests are to be included by the contractor in the tendered price.

Allow to fully commission the operation of the entire section of work and shall provide to make all necessary adjustments to fine tune the completed system to the satisfaction of the client.

8.18 WORK AS EXECUTED DRAWINGS AND MANUALS – IRRIGATION

Keep on site at all times and update daily a set of drawings showing final locations of all equipment as detailed below.

GPS data logging is to be used to locate main lines, solenoid valves, isolation valves sprinklers etc during or at the end the construction of the system or each stage. Field data must be collected and formatted by the contractor using minimum sub meter GPS. Total Irrigation Designers can supply a base plan or may be engaged at cost by the contractor to provide such survey of works on the contractor's behalf.

Submit draft set of as built drawings for approval by the client. The drawings shall be of equivalent scale as that which where originally supplied for tender. They shall show as a minimum:

- Position of all sprinklers and solenoid valves, size, brand, station number
- Position of any Mainline isolation valves, solenoid valves etc
- Location of main lines, (indicate depth to the invert of the pipe where required cover is not met.)
- Location of all low voltage cables.

Upon approval, make any adjustments/ add any additional information requested and submit with application for practical completion along with irrigation manuals as detailed below:

- 1 set of prints in A1, plus 2 sets in A3
- 1 set drawings in AutoCAD .dwg format on disc (base drawing can be made available
- 1 reduced plan laminated and affixed beside the controller and also 1 laminated plan of full size to be located on Velcro tabs inside the pump cabinet door.

Manuals shall contain the following information and to be bound in a hard cover minimum A4 size ring binder:

- Brief description of the system and operation of major components
- An additional folded set of plans showing all information, to be individually folded and contained each in a separate clear plasticised sleeve.
- Details of each item of equipment including manufacturer, spare parts, and warranty details.
- Items of equipment to be included but not limited to:
- Irrigation control system (Include full service details and or contacts)
- Pipework Details
- Popup sprinkler details
- Cable details
- Mainline isolation details
- Pump
- Flow meters
- Recommended service schedule for all components of the system.

- Completion date and any compliance certificates from any authority having jurisdiction over the works.

8.19 PRACTICAL COMPLETION

Allow to seek Practical Approval on completed stages as approved by the superintendent to achieve a recognized date for commencement of warranty and maintenance period. The contractor is to promptly rectify any determined defects within the specified time following each inspection.

8.20 WARRANTY

The contractor shall supply in writing all manufacturers warranties and shall also be responsible for a 52 week defect and warranty period from the date of practical completion of any stage as advised. Any extended Manufacturer's warranty beyond this time shall be handed onto the client.

SECTION 9 FIXTURES & FITTINGS

9.1 SCOPE OF WORKS

The work specified in this section comprises procurement and installation of sanitary ware, taps and outlet fittings as detailed below, scheduled, shown on drawings and/or specified, principal's requirements and necessary for complete installation. The submission of alternate equally manufactured items will be considered.

All items are to be new and of first quality, free of chips, cracks and crazing and defects and are to be subject to inspection prior to installation.

Prior to placing orders, obtain guarantees from the manufacturer that any items which craze or show any other defects within twelve months of issue of certificate of completion will be replaced providing that such crazing or other defects are not caused by abuse.

9.2 GENERALLY

Fixtures
Fix and support fixtures strictly to manufacturer's recommendations. All fixtures including all exposed water closet cisterns are to be 3 /4.5 litre dual flush china. All exposed flush pipes are to be chrome plated copper tube or stainless steel.

Fittings
Supply and install all taps and outlet fittings and be responsible for fixing of same to the fixtures and appliances nominated and connect same to the water service.

Tapware Indication Colours
- Cold water taps - Blue
- Hot water taps - Red
- Warm water taps - Yellow

Supply, install and commission all sanitary fixtures, fittings and tapware and connect to the hydraulic services.

Allow to take delivery, store as necessary and install. Provide all fixings, necessary cutting, securing of brackets to walls, levelling and connection to various services required for satisfactory operation.

- Fix and support fixtures strictly to the manufacturer's recommendations.
- All exposed brackets shall be white enamelled.
- All exposed connections shall be chrome plated unless specified.
- Supply and install the following or equivalent fixtures, fittings and tapware.

9.3 FIXTURES SCHEDULE

Refer to Architectural tapware and sanitary ware schedule.

SECTION 10 TENDER SCHEDULE

I/we, the undersigned, conform our willingness to enter into a Contract agreement to carry out the complete works as described in the documents to the standards and requirements expressed throughout the Specification and Contract documents subject to acceptance of our tender price as detailed below.

Fixed Lump Sum Price $.....

Amount is words .....

Name of Tenderer:.....

.....

Address:.....

.....

Telephone No. ..... Fax No. .....

The amounts indicated in the total tender price including totals cost and margins of the work are as follows

		Fixed Price
1.	Sewer In ground Drainage System	$ .....
2.	Oval Sub-Soil Drainage System	$ .....
3	Roof Drainage System	$ .....
4.	Sanitary Plumbing and Vents System	$ .....
5.	Automatic Irrigation System Including Tanks & Equipment	$ .....
6.	Potable Hot and Cold Water System	$ .....
7.	Hot Water Plant	$.....
8.	Sanitary Fixtures and Tapware	$ .....
9.	Gas Services	$ .....
10.	Sub-soil drainage	$ .....
11.	12 Month Defect Liability and Routine Maintenance	$ .....
12.	Workshop and as Installed Documentation	$ .....

Sub Total Price (Excluding GST)	$.....
Goods and Services Tax	$.....
Total Fixed Lump Sum Price (including GST)	$.....

Tenderer: .....
Signed by: ..... Title: .....
Witness: ..... Title: .....
Date: .....

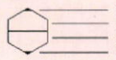
JORDAN SPRINGS VILLAGE OVAL

JORDAN SPRINGS, NSW

HYDRAULIC SERVICES

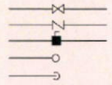
HYDRAULIC SERVICES LEGEND

PIPELINES



EX	EXISTING SERVICE
X X X	EXISTING SERVICE TO BE ABANDONED
PCW	DOMESTIC COLD WATER
PHW	DOMESTIC HOT WATER
S	SANITARY DRAINAGE/PLUMBING
VP	VENT PIPE
SW	STORMWATER PIPE
SSD	SUBSOIL DRAINAGE
IR	IRRIGATION SUPPLY
-g-	GAS SUPPLY

PIPELINE ACCESSORIES



	STOP VALVE
	CHECK VALVE/REFLUX VALVE
	GAS BALL VALVE
	PIPE RISER FROM BEND
	PIPE DROPPER FROM BEND
	PIPE RISER FROM TEE
	PIPE DROPPER FROM TEE
C/O	CLEAROUT
FW	FLOOR WASTE
BT	BOUNDARY TRAP
TD	TUNDISH
IPMF	INDUCT PIPE MICA FALP
RPZD	BACKFLOW DEVICE
HT	HOSE TAP

ABBREVIATIONS

LEVEL

FFL	FINISH FLOOR LEVEL
FSL	FINISH SURFACE LEVEL
IL	INVERT LEVEL
RL	REDUCED LEVEL
H/L	HIGH LEVEL
L/L	LOW LEVEL
G/L	GROUND LEVEL

FIXTURES

(REFER ALSO FIXTURE SCHEDULE ON ARCHITECTURALS)

HT	HOSE TAP
SHR	SHOWER
BSN	BASIN
SK	KITCHEN SINK
FW	FLOOR WASTE
WC	WATER CLOSET
ORG	OVERFLOW RELIEF GULLY
TD	TUNDISH

GENERAL HYDRAULIC NOTES

GN1 ALL WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH SYDNEY WATER REGULATIONS AND SUPERINTENDENT'S APPROVAL.

GN2 THIS PLAN SHALL BE READ IN CONJUNCTION WITH APPROVED ARCHITECTURAL, STRUCTURAL AND MECHANICAL PLANS AND SPECIFICATIONS.

GN3 DRAINS TO BE SUPPORTED ON OR FROM SOLID GROUND. LOCATION AND DEPTH / INVERT LEVEL OF BRANCH SHALL BE VERIFIED ON SITE PRIOR TO COMMENCEMENT OF WORK.

GN4 DRAINS UNDER BUILDINGS SHALL BE RE-TESTED WHERE DIRECTED SUPERINTENDENT.

GN5 EXISTING SERVICES HAVE BEEN PLOTTED FROM SUPPLIED DATA. THE SUPERINTENDENT DOES NOT GUARANTEE THEIR ACCURACY AND IT IS THE CONTRACTOR'S RESPONSIBILITY TO ESTABLISH THE LOCATION OF ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF ANY WORK. CLEARANCES SHALL BE OBTAINED FROM THE RELEVANT AUTHORITY.

GN6 THE CONTRACTOR SHALL ARRANGE ALL SURVEY SETOUT BY A REGISTERED SURVEYOR.

GN7 ALL SERVICES THAT CROSS PAVEMENTS, FOOTINGS ETC. SHALL BE BACKFILLED WITH GRANULAR MATERIAL TO SUBGRADE LEVEL AND COMPACTED TO 95% M.M.D.D.

GN8 ON COMPLETION OF PIPE INSTALLATION, ALL DISTURBED AREAS MUST BE RESTORED TO ORIGINAL CONDITION INCLUDING KERBS, FOOTPATHS, CONCRETE AREAS, GRAVEL AREAS, GRASSED AREAS AND ROAD PAVEMENTS.

GN9 TRENCHES THROUGH EXISTING ROAD AND CONCRETE AREAS SHALL BE SAWCUT TO FULL DEPTH OF CONCRETE AND A MIN. OF 50mm IN BITUMINOUS PAVING. REINSTATE WITH ADDITIONAL REINFORCEMENT & DOWELING AS REQUIRED BY STRUCTURAL ENGINEERS.

GN10 WHERE NEW WORK ABUTS EXISTING THE CONTRACTOR SHALL ENSURE THAT A SMOOTH EVEN PROFILE, FREE FROM ABRUPT CHANGE IS OBTAINED.

GN11 CARE SHALL BE TAKEN WHEN EXCAVATING NEAR EXISTING SERVICES. NO MECHANICAL EXCAVATION SHALL BE TAKEN OVER TELECOM OR ELECTRICAL SERVICES. EXCAVATE BY HAND IN THESE AREAS.

GN12 PROVIDE 12mm WIDE CORK EXPANSION JOINTS BETWEEN BUILDING AND ALL CONCRETE PAVEMENTS.

GN13 WHERE SANDSTONE BASECOURSE IS USED, IT IS TO BE TESTED FOR COMPLIANCE WITH SPECIFICATION BEFORE BEING IMPORTED.

GN14 SANDSTONE BASECOURSE UNDER PAVEMENT SHALL BE COMPACTED TO NOT LESS THAN 98% MODIFIED MAXIMUM DRY DENSITY IN ACCORDANCE WITH AS 1289 E2.1.

GN15 CONTRACTOR SHALL PROVIDE ALL TIMBERING, SHORING AND SHUTTERING AS NECESSARY TO CONSTRUCT PIPEWORK INCLUDING THE REMOVAL OF SAME UPON COMPLETION OF PIPEWORK.

GN16 PROVIDE 80mm COMPRESSIBLE MATERIAL OVER PIPEWORK WHERE CLEARANCE TO UNDERSIDE OF FOOTING IS LESS THAN 150mm U.N.O.

GN17 CONTRACTOR SHALL OBTAIN ALL AUTHORITY APPROVALS AND PAY ALL FEES.

GN18 FOR DETAILS ON BELOW GROUND STORMWATER DRAINAGE REFER TO CIVIL DRAWINGS

GN19 ALL ROOF PENETRATIONS TO DETAIL AND PAINTED COLOUR TO BE ADVISED. ALL VENTS SHALL BE OFFSET IN ROOF SPACE MINIMUM 600 FROM EAVES AND AS SHOWN ON ARCHITECTURAL DRAWINGS.

SANITARY DRAINAGE NOTES

SD1 PRECISE LOCATION OF SEALED FLOOR TRAPS AND STACKS PROVISIONS TO BE APPROVED BY SUPERINTENDENT.

SD2 CONTRACTOR TO PROVIDE ANY ADDITIONAL EXCAVATION, BACKFILL OF PIPES, FITTINGS AND ALL JUMP UPS TO AS3500 AND COUNCIL REQUIREMENTS INCLUDING THOSE TO BRANCH DRAINS.

SD3 ALL SEWER ACCESS CHAMBERS GREATER THAN 1.2m DEEP SHALL BE CONSTRUCTED WITH STEP IRONS TO AS3500 REQUIREMENTS.

SD4 ALL SANITARY DRAINAGE PIPEWORK SHALL BE IN PVC-U UNLESS NOTED OTHERWISE.

SD5 SANITARY DRAINAGE LINES TO BE LOCATED MINIMUM 1.4m FROM FOOTINGS U.N.O.

SD6 INSPECTION OPENINGS SHALL BE PROVIDED AT:
- THE PROPERTY BOUNDARY
- ON EACH WC OR BRANCH
- AT MAX. 30m INTERVALS SPREAD EQUIDISTANT WHERE POSSIBLE
- IMMEDIATELY UPSTREAM AND DOWNSTREAM OF ALL JUMP-UPS
- AS REQUIRED BY THE AUTHORITY FOR INSPECTION AND MAINTENANCE

GAS SERVICES NOTES

GS1 CONTRACTOR TO PAY ALL FEES AND LIAISE WITH THE NATURAL GAS COMPANY FOR GAS UTILITY SERVICE TO BE SUPPLIED OUTSIDE BOUNDARY. CUSTOMER SERVICE METER SET AND CUSTOMER PIPING SYSTEM BY CONTRACTOR.

GS2 CONTRACTOR TO CONFIRM ALL EXISTING GAS PRESSURE AND LOCATION AND REPORT TO SUPERINTENDENT.

GS3 ALIGNMENT OF GAS SERVICE TO BE APPROVED BY SUPERINTENDENT PRIOR TO COMMENCEMENT.

GS4 ALL WORK SHALL BE IN DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH AS 5601 AND GAS FITTING RULES.

MATERIAL SCHEDULE

SEWER DRAINAGE	(AS.3500)
SANITARY PLUMBING	(AS.3500)
STORM WATER DRAINAGE	(AS.3500)
SUB-SOIL DRAINAGE	(AS.3500)
DOMESTIC COLD WATER	(AS.3500)
DOMESTIC HOT / WARM WATER	(AS.3500)
NATURAL GAS	(AS.5601)

WATER SERVICES NOTES

WS1 MINIMUM SIZE INGROUND PIPEWORK SHALL BE Ø20 O.D.

WS2 LAY FOIL BACKED MARKER TAPE 300mm ABOVE ALL WATER NON METALLIC SERVICES.

WS3 FLUSH ALL WATER SERVICE PIPES PRIOR TO CONNECTION TO FIXTURES/VALVES ETC.

WS4 MINIMUM PIPE DEPTH SHALL BE 450mm U.N.O.

WS5 ALL EXPOSED WATER PIPES IN ABLUTION AREAS/WET AREAS SHALL BE BRIGHT CHROME PLATED PIPE.

WS6 CONSTRUCT ISOLATION VALVES TO ALL WET AREAS. CO-ORDINATE ACCESS COVERS, PIPES ETC. AS REQUIRED.

WS7 INGROUND STOP VALVES SHALL BE CONSTRUCTED COMPLETE WITH CAST IRON VALVE BOX AND uPVC RISER.

DRAWINGS LIST

H0.01	COVER & LEGEND SHEET
H1.01	SITE PLAN - PART - A
H1.02	SITE PLAN - PART -B
H2.01	AMENITIES DRAINAGE PLAN
H3.01	AMENITIES WATER & GAS PLAN
H4.01	OVAL SUB-SOIL DRAINAGE PLAN
H5.01	OVAL IRRIGATION PLAN
H5.02	IRRIGATION DETAIL SHEET

This drawing has been assigned an electronic code that signifies the drawing has been checked and approved by: -insert

Issue	Description	Date	Drawn	Approved
D	RE-ISSUE FOR CC	18.06.15	DM	BA
C	RE-ISSUE FOR CC	12.06.15	DM	BA
B	RE-ISSUE FOR CC	29.10.14	DM	BA
A	ISSUE FOR CC	14.10.14	DM	BA

North

Client: LEND LEASE

Architect: DWP SUTERS

Landscape Architect: CLOUSTON

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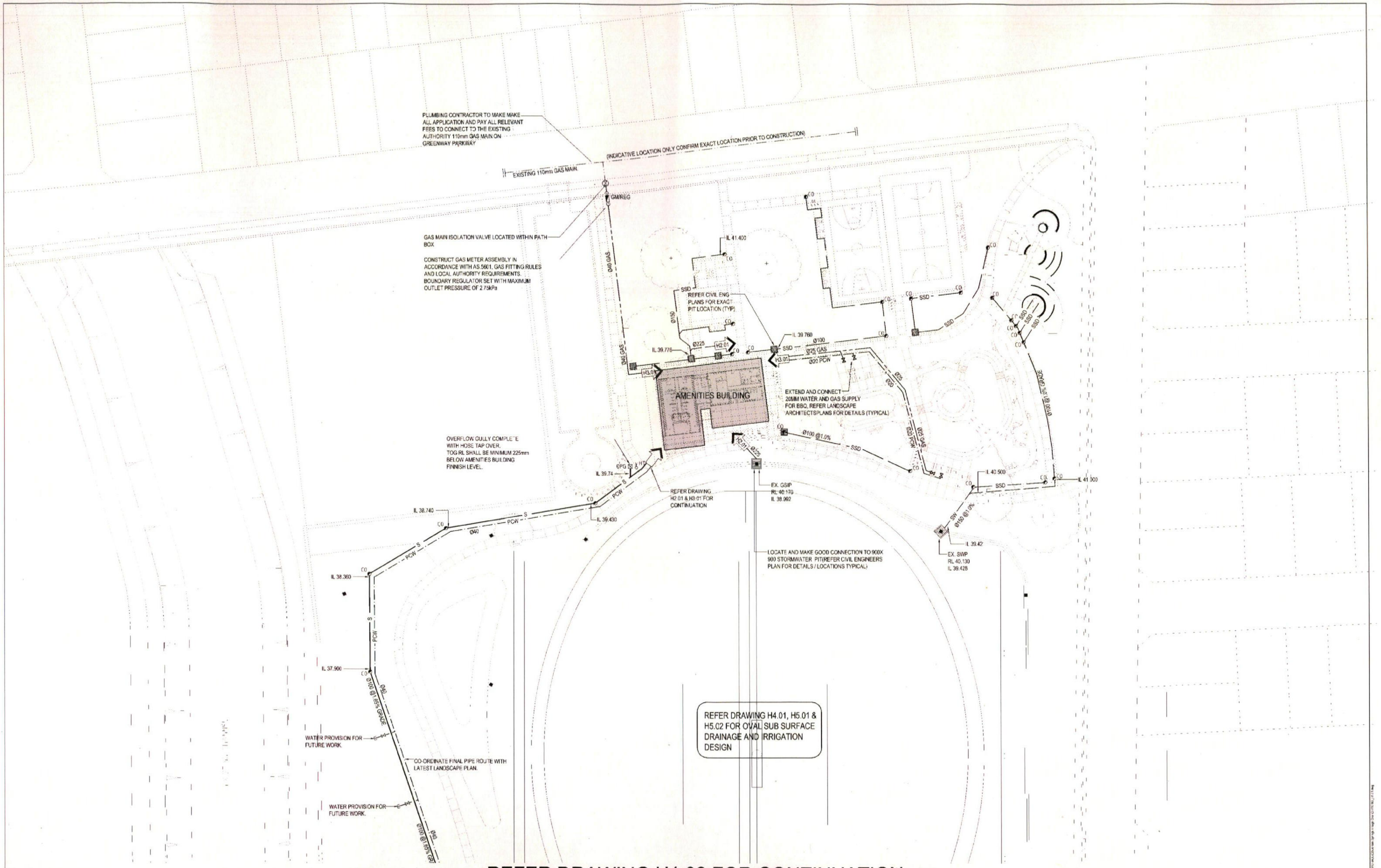
Project: JORDAN SPRINGS VILLAGE OVAL
JORDAN SPRINGS
NSW

Drawing Title: COVER & LEGEND SHEET

Drawn: D.M.	Date: SEPT 2013	Scale: N.T.S.	A1	Q.A. Check	Date
Designed: K.A.	Project No.: CH110163	Dwg. No.: H1.01		Issue: D	


PLUMBING CONTRACTOR TO MAKE MAKE ALL APPLICATION AND PAY ALL RELEVANT FEES TO CONNECT TO THE EXISTING AUTHORITY 110mm GAS MAIN ON GREENWAY PARKWAY
(INDICATIVE LOCATION ONLY CONFIRM EXACT LOCATION PRIOR TO CONSTRUCTION)
EXISTING 110mm GAS MAIN
GM/REG
GAS MAIN ISOLATION VALVE LOCATED WITHIN PATH BOX
CONSTRUCT GAS METER ASSEMBLY IN ACCORDANCE WITH AS.5601, GAS FITTING RULES AND LOCAL AUTHORITY REQUIREMENTS. BOUNDARY REGULATOR SET WITH MAXIMUM OUTLET PRESSURE OF 2.75kPa
Ø40 GAS
IL 41.400
SSD
REFER CIVIL ENG PLANS FOR EXACT PIT LOCATION (TYP)
Ø150
IL 39.776
Ø225
H2.01
IL 39.760
Ø100
Ø25 GAS
Ø20 PCW
H3.01
AMENITIES BUILDING
EXTEND AND CONNECT 20MM WATER AND GAS SUPPLY FOR BBQ, REFER LANDSCAPE ARCHITECTSPLANS FOR DETAILS (TYPICAL)
Ø100 @1.0%
Ø20 PCW
Ø100 @1.0% GRADE
IL 40.500
IL 41.300
OVERFLOW GULLY COMPLETE WITH HOSE TAP OVER. TOG RL SHALL BE MINIMUM 225mm BELOW AMENITIES BUILDING FINNISH LEVEL.
IL 39.74
REFER DRAWING H2.01 & H3.01 FOR CONTINUATION
EX. GSIP
RL 40.170
IL 38.992
IL 38.740
IL 39.430
Ø150 @1.0%
IL 39.42
EX. SWP
RL 40.130
IL 39.428
LOCATE AND MAKE GOOD CONNECTION TO 900X 900 STORMWATER PIT(REFER CIVIL ENGINEERS PLAN FOR DETAILS / LOCATIONS TYPICAL)
IL 38.360
IL 37.900
Ø100 @1.65% GRADE
WATER PROVISION FOR FUTURE WORK.
CO-ORDINATE FINAL PIPE ROUTE WITH LATEST LANDSCAPE PLAN.
REFER DRAWING H4.01, H5.01 & H5.02 FOR OVAL SUB SURFACE DRAINAGE AND IRRIGATION DESIGN

REFER DRAWING H1.02 FOR CONTINUATION

This drawing has been assigned an electronic code that signifies the drawing has been checked and approved by:

Issue	Description	Date	Drawn	Approved
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C	REISSUE FOR CC	12.06.15	DM	BA
B	REISSUE FOR CC	29.10.14	DM	BA
A	ISSUE FOR CC	14.10.14	DM	BA

North

Client: LEND LEASE

Architect: DWP SUTERS

Landscape Architect: CLOUSTON

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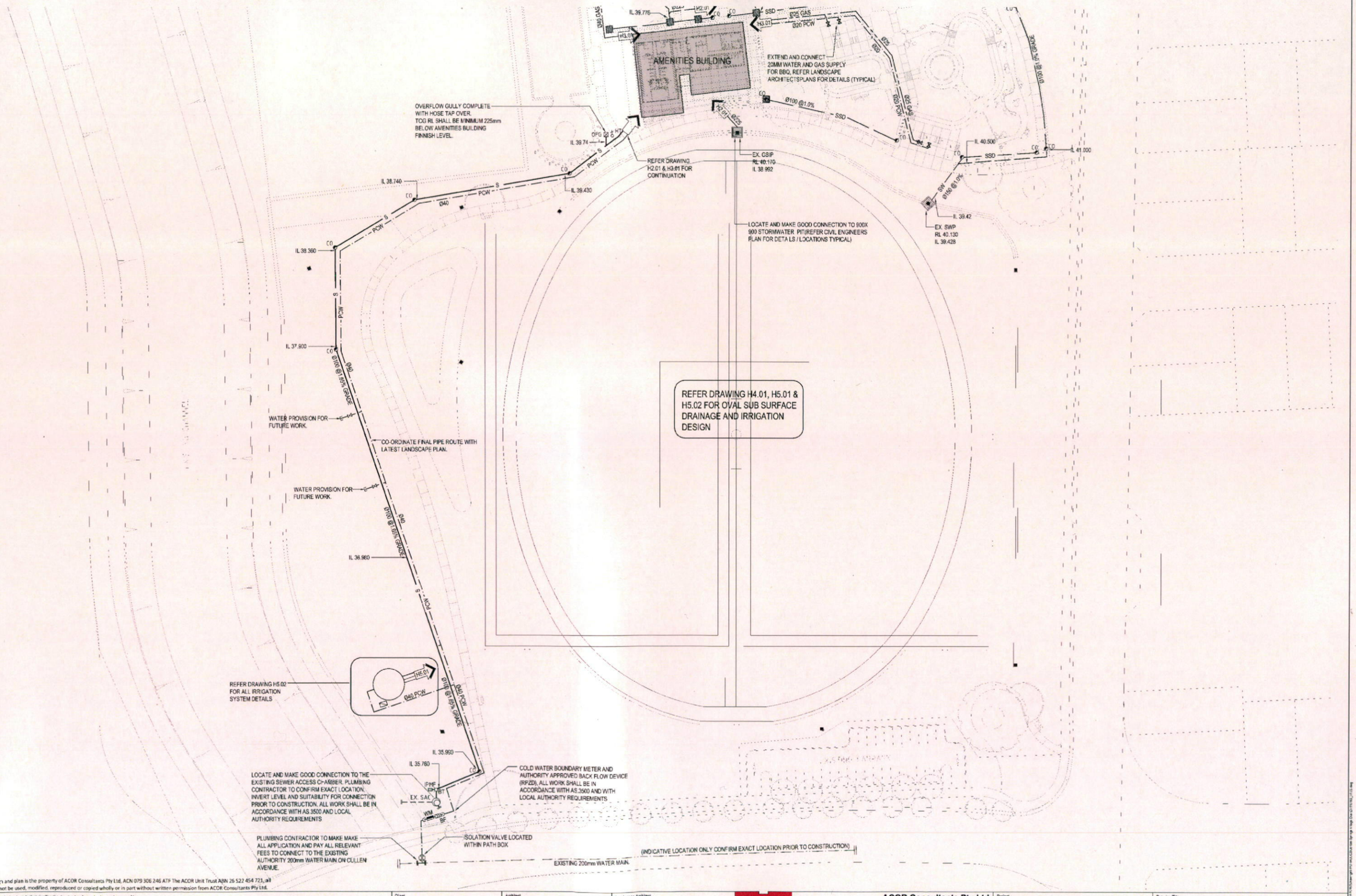
Project: JORDAN SPRINGS VILLAGE OVAL
JORDAN SPRINGS
NSW

Drawing Title: HYDRAULIC SERVICES SITE PLAN PART - A

Drawn	Date	Scale A1	Q.A. Check	Date
D.M.	SEPT 2013	1:500		

Designed	Project No.	Dwg. No.	Issue
B.A	CH110163	H1.01	D

REFER DRAWING H1.01FOR CONTINUATION



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Issue	Description	Date	Drawn	Approved
D	REISSUE FOR CC	18.06.15	DM	BA
C	REISSUE FOR CC	12.06.15	DM	BA
B	REISSUE FOR CC	29.10.14	DM	BA
A	ISSUE FOR CC	14.10.14	DM	BA

North

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Landscape Architect: CLOUSTON

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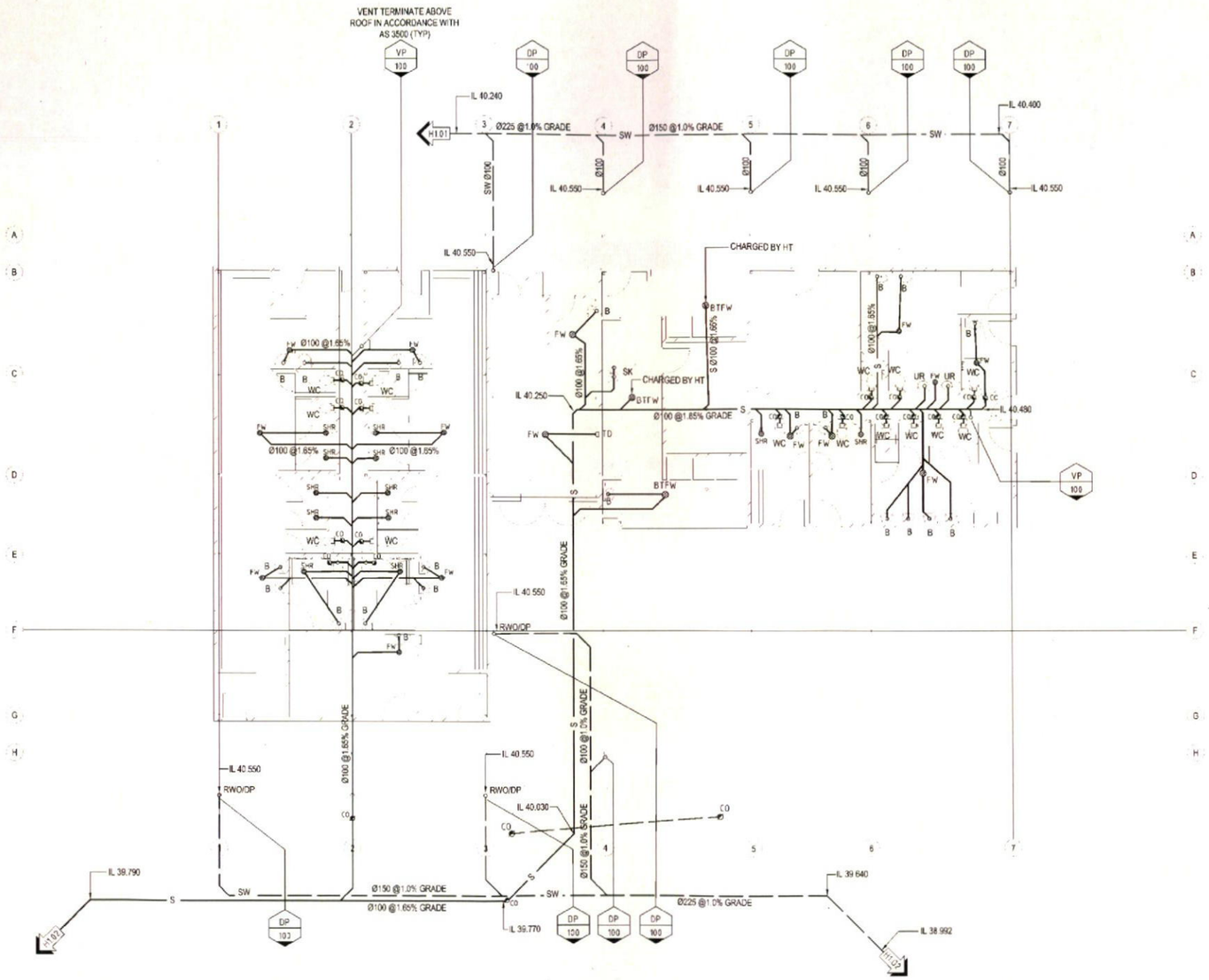
Project: JORDAN SPRINGS VILLAGE OVAL
JORDAN SPRINGS NSW

Drawing Title: HYDRAULIC SERVICES SITE PLAN PART - B

Drawn	Date	Scale A1	Q.A. Check	Date
D.M.	SEPT 2013	1:500		
Designed	Project No.	Dwg. No.	Issue
B.A	CH110163	H1.02	D



This drawing has been assigned an electronic code that signifies this drawing has been checked and approved by

Issue	Description	Date	Drawn	Approved
E	REISSUE FOR CC	18.06.15	DM	BA
D	REISSUE FOR CC	12.06.15	DM	BA
C	REISSUE FOR CC	04.06.15	DM	BA
B	REISSUE FOR CC	29.10.14	DM	BA

North

Client: LEND LEASE

Architect: DWP SUTERS

Landscape Architect: CLOUSTON

ACOR CONSULTANTS
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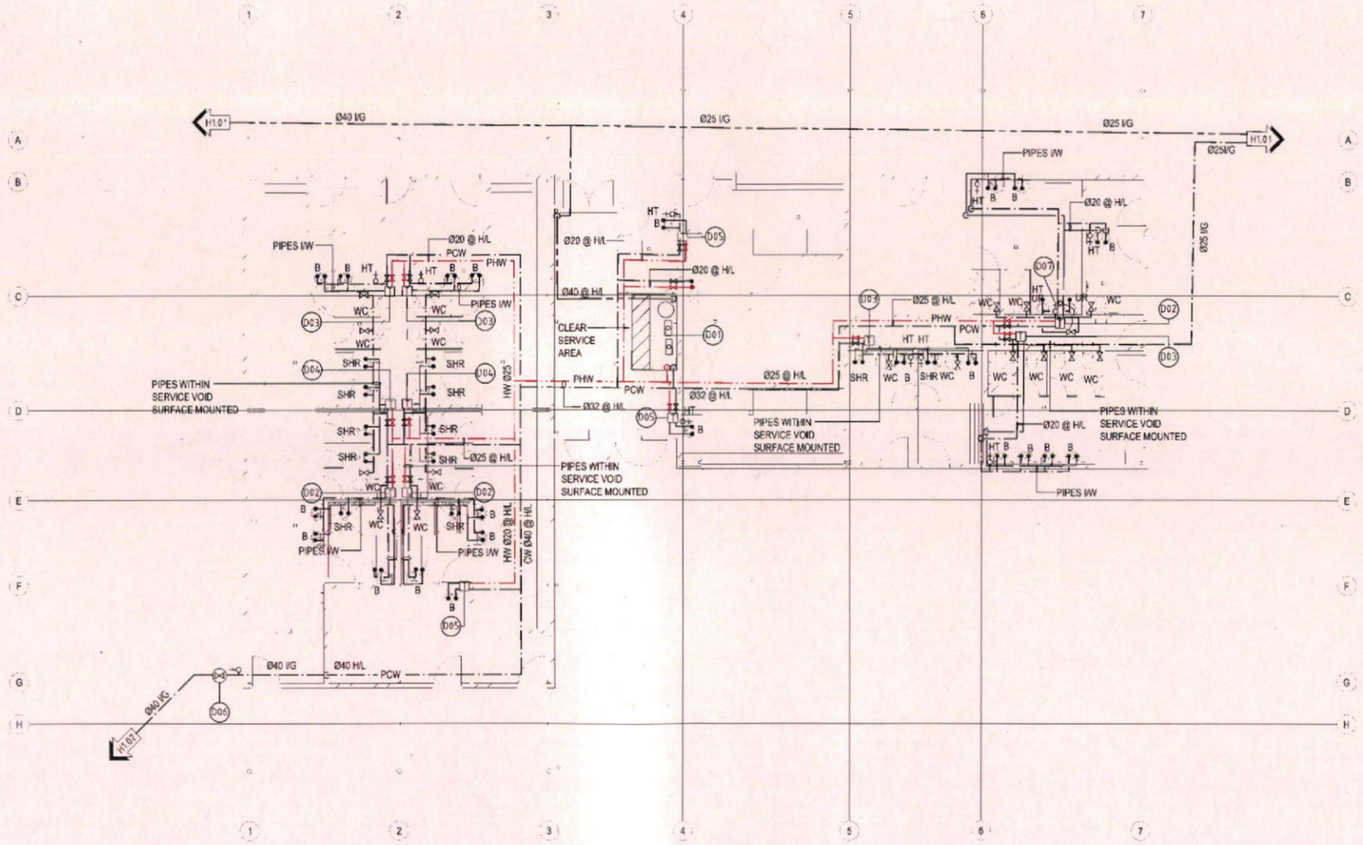
Project: JORDAN SPRINGS VILLAGE OVAL
JORDAN SPRINGS NSW

Drawing Title: HYDRAULIC SERVICES AMENITIES DRAINAGE PLAN

Drawn	Date	Scale	A1	Q.A. Check	Date
D.M.	SEPT 2013	1:100			
Designed	Project No.	Dwg. No.	Issue
B.A	CH110163	H2.01	E



DESIGN NOTES:

D00 HOT WATER SYSTEM SHALL BE OR EQUAL TO RHEEM TANK PACK MODEL: TP02ND1340 INCLUSIVE OF:
- 2X RHEEM 6.1 STAR COMMERCIAL CONTINUOUS FLOW WATER HEATERS FACTORY MANIFOLD ON A FREE STANDING FRAME.
- 1X 610340 COMMERCIAL STORAGE CYLINDER.
- 1X PRIMARY CIRCULATOR CM 3-2.
- 1X DIGITAL CONTROLLER.

D07 THERMOSTATIC MIXING VALVE LOCATED WITHIN SERVICE DUCT SHALL BE OR EQUAL TO ENWARE AQUA BLEND 1500 WITH MAXIMUM TEMPERATURE SET AT 45°C.

D03 THERMOSTATIC MIXING VALVE LOCATED WITHIN SERVICE DUCT SHALL BE OR EQUAL TO ENWARE AQUA BLEND 1500 WITH MAXIMUM TEMPERATURE SET AT 50°C.

D02 THERMOSTATIC MIXING VALVE LOCATED WITHIN SERVICE DUCT SHALL BE OR EQUAL TO ENWARE AQUA BLEND 2500 WITH MAXIMUM TEMPERATURE SET AT 45°C

D05 THERMOSTATIC MIXING VALVE LOCATED RECESSED IN WALL SHALL BE OR EQUAL TO ENWARE AQUA BLEND 1500 WITH MAXIMUM TEMPERATURE SET AT 50°C.

D04 HOSE TAP OVER GULLY.

D07 URINAL FLUSH SYSTEM SHALL BE OR EQUAL TO ZIP DIRECT INJECTION SYSTEM COMPLETE WITH THE FOLLOWING
- AIR BREAK LOCATED WITHIN SERVICES VOID
- SENSOR, MOUNTED IN CEILING BETWEEN URINAL
- LATCHING VALVE LOCATED WITHIN CEILING SPACE

ALL WORK SHALL BE IN ACCORDANCE WITH THE MANUFACTURERS REQUIREMENTS

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Issue	Description	Date	Drawn	Approved
E	REISSUE FOR CC	18.06.15	DM	BA
D	REISSUE FOR CC	12.06.15	DM	BA
C	REISSUE FOR CC	04.06.15	DM	BA
B	REISSUE FOR CC	29.10.14	DM	BA

North

Client: LEND LEASE

Architect: DWP SUTERS

Landscape Architect: CLOUSTON

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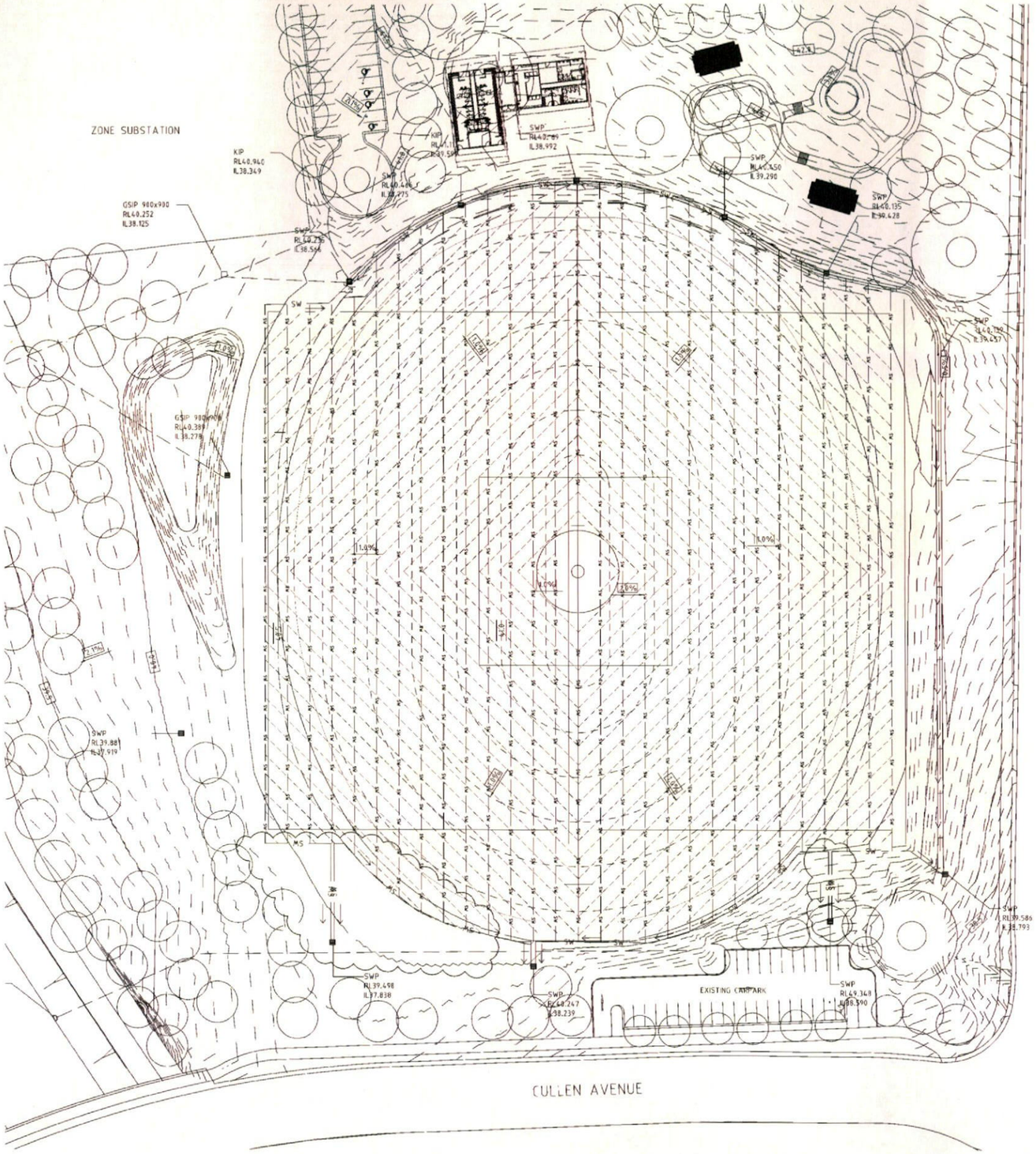
Project: JORDAN SPRINGS VILLAGE OVAL
JORDAN SPRINGS NSW

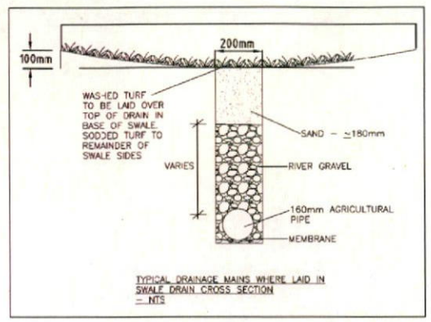
Drawing Title: HYDRAULIC SERVICES AMENITIES WATER & GAS PLAN

Drawn	Date	Scale A1	Q.A. Check	Date
D.M.	SEPT 2013	1:100		
Designed	Project No.	Dwg. No.	Issue	
B.A	CH110163	H3.01	E	

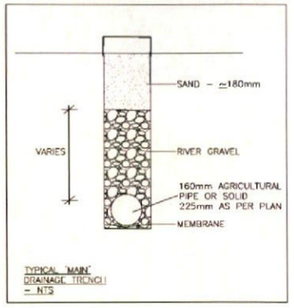


LEGEND:

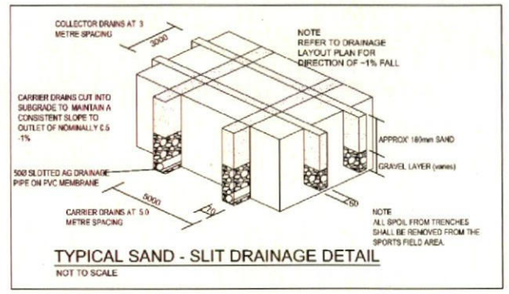
- SW — 225mm SOLID uPVC OR 160mm AG DRAINAGE MAINS (NOTE: ALL MAINS TO HAVE A GRADE NOT LESS THAN 0.5%)
- SW — SW — 70mm WIDE CARRIERS WITH 50mm POLY PIPE AND MEMBRANE – SEE DETAIL (GENERALLY LAID WITH A MINIMUM 1% GRADE TO MAINS)
- 50mm COLLECTORS
- SWALE DRAIN BY CIVIL CONTRACTOR
- 900mmSQ JUNCTION PIT BY CIVIL CONTRACTOR



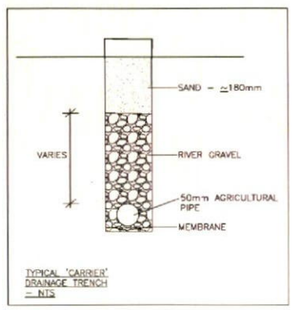
TYPICAL DRAINAGE MAINS WHERE LAID IN SWALE DRAIN CROSS SECTION
– NTS



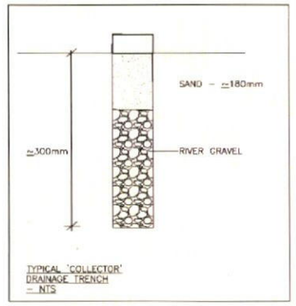
TYPICAL 'MAIN' DRAINAGE TRENCH
– NTS



TYPICAL SAND - SLIT DRAINAGE DETAIL
NOT TO SCALE



TYPICAL 'CARRIER' DRAINAGE TRENCH
– NTS



TYPICAL 'COLLECTOR' DRAINAGE TRENCH
– NTS

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Issue	Description	Date	Drawn	Approved
D	REISSUE FOR CC	18.06.15	DM	BA
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B	REISSUE FOR CC	29.10.14	DM	BA
A	, ISSUE FOR CC	14.10.14	DM	BA

North

Client: LEND LEASE

Architect: DWP SUTERS

Landscape Architect:

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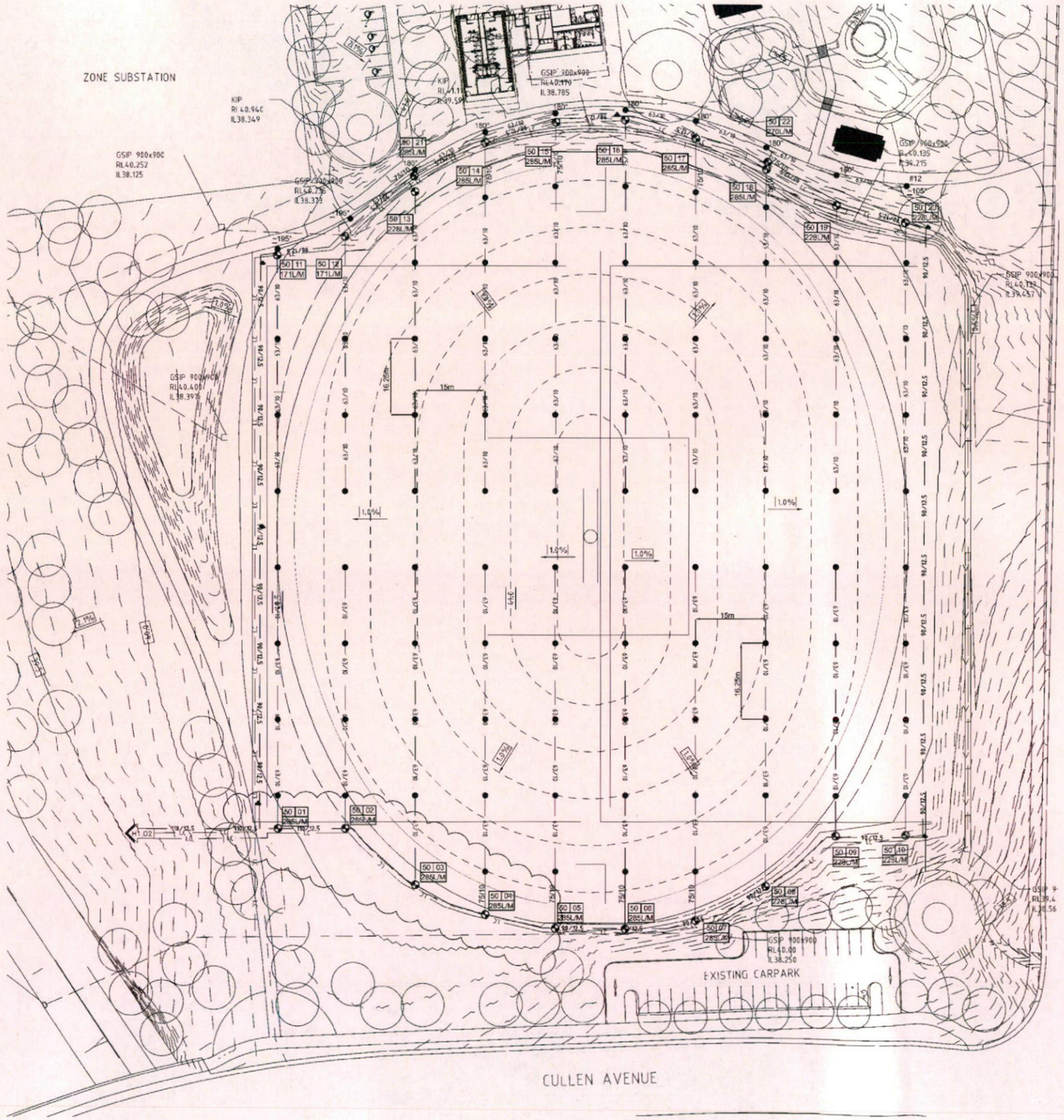
Project: JORDAN SPRINGS VILLAGE OVAL

JORDAN SPRINGS
NSW

Drawing Title: HYDRAULIC SERVICES
OVAL
SUB-SOIL DRAINAGE PLAN

Drawn	Date	Scale A1	Q.A. Check	Date
D.M.	SEPT 2013	1:100		
Designed	Project No.	Dwg. No.	Issue
B.A	CH110163	H4.01	D



SOLENOID WIRING CHART - **Active** MultiCore cable		
CABLE	CABLE SIZING	STATIONS
13 CORE	1.5mm2	1-10
13 CORE	1.5mm2	11-22

Note: IN ACTIVE CABLES the Black to be retained as a continuous spare and not used.

SOLENOID WIRING CHART - **Common** Twin Core cable		
CABLE	CABLE SIZING	STATIONS
2 CORE	2.5mm2	1-10
2 CORE	2.5mm2	11-22

Note: IN THE COMMON CABLES the Black to be used as the common and white retained as a continuous spare and not used.

CONTROLLER WIRING CHART	
STATION CONTROLLER No	VALVE NUMBERS AS PER PLAN
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
14	14
15	15
16	16
17	17
18	18
19	19
20	20
21	21
22	22

NOTE: THE FOLLOWING VALVE/STATION PROGRAM PAIRING IS DESIRABLE
1,11
2,12
3,13
4,14
5,15
6,16
7,17
8,18
9,19
10,20
21,22

GENERAL NOTE:

- CONTRACTOR TO VERIFY ALL DIMENSIONS ON SITE PRIOR TO COMMENCING WORK.
- THE CONTRACTOR SHALL BE FULLY SATISFIED WITH THE NATURE AND INTENT OF ALL WORK TO BE PERFORMED AND SHALL GUARANTEE THE THE FINAL SYSTEM PERFORMANCE AND ALL WORKMANSHIP
- THE CONTRACTOR SHALL NOTIFY THE CLIENT AND/OR THE DESIGNER IN WRITING IMMEDIATELY IF ANY DISCREPENCIES ARE FOUND AND PRIOR TO COMMENCING WORK.
- THIS PLAN IS TO BE READ IN CONJUNCTION WITH OTHER LANDSCAPE, SITE AND SERVICES PLANS AS MAY BE AVAILABLE BY THE CLIENT
- THE CONTRACTOR IS TO ALLOW TO COORDINATE ALL WORK WITH ANY OTHER TRADES REQUIRED
- THE CONTRACTOR IS TO RECEIVE WRITTEN APPROVAL FOR ANY VARIATIONS TO BE PERFORMED.
- ALL ITEMS OF EQUIPMENT ARE INDICATIVE OF LOCATION AND SHALL BE ADJUSTED AS NECESSARY ACCORDING TO FINAL SITE CONDITIONS.
- ANY DRIP LINE ROWS SHOWN ARE FOR DEMONSTRATION ONLY AND ARE INDICATIVE AS TO ROW DIRECTION AND SHALL BE ADJUSTED AS REQUIRED ON SITE
- AS BUILT RECORDS ARE TO BE KEPT AND UPDATED DAILY. FINAL AS BUILT PLANS ARE TO BE SUPPLIED & APPROVED PRIOR TO FINAL COMPLETION.

NOTE:
DRAINAGE DEPTHS AND LEVELS TO TAKE PRECEDENCE OVER IRRIGATION.
ALL IRRIGATION TO GO UNDER DRAINAGE LEVELS, HOWEVER SPRINKLER LOCATION TO TAKE PRECEDENCE OVER DRAINAGE.
CARRIERS TO BE 2.5m OFFSET FROM SPRINKLERS.
COLLECTORS TO VEER AWAY/AROUND SPRINKLERS AND BE NO CLOSER THAN 1M.

LEGEND

- RAINBIRD 8005 POPUP SPRINKLER #14 NOZZLE OR AS SHOWN
- 110/12.5 / 90/12.5 — IRRIGATION MAINLINE POLY PN12.5 PE100 SIZE AS SHOWN
- 75/10 / 63/10 — IRRIGATION LATERAL PIPE POLY PN10 PE100 SIZE AS SHOWN
- LC — IRRIGATION CONTROLLER CABLE REFER TO WIRING CHART ON PLAN
- SOLENOID VALVE 50mm HUNTER ICV OR IRRITROL.
- XX 01 / XXXL/M — VALVE SIZE / VALVE NUMBER / EST VALVE FLOW
- QUICK COUPLING VALVE BRASS RAIN SPRAY 25mm
- IRRIGATION PUMP LOWARA Z631 07-BC 9.3Kw WITH VFD FITTED. DUTY SET POINT 600kPa. PUMP TO BE IN TANK SUMP LAID IN SHROUD AS SIZED BY MANUFACTURER.
- PUMP CONTROL PANEL FREE STANDING "DEAD FRONT" 2 PART VENTILATED VANDAL PROOF POWDER COATED STEEL LOCKED CABINET ON STURDY CONCRETE PLINTH.
  TOP SECTION TO HOUSE SUB CIRCUIT BOARD, PUMP CONTROL PANEL & IRRIGATION CONTROLLER.
  LOWER SECTION TO HOUSE PRESSURE TANK AND PRESSURE TRANSDUCER ETC.
- IRRIGATION CONTROLLER - RAINBIRD 24 STATION COMPATIBLE WITH COUNCIL'S CENTRAL MAXICOM SYSTEM - REFER TO SPEC
- FM — FLOW SENSOR RAINBIRD INSERT SENSOR CONNECTED TO IRRIGATION CONTROLLER AND IN ADDITION STANDARD 80mm LOCAL REFERENCE FLOW METER
- MV — 80mm MASTER VALVE
- BACKFLOW PREVENTION DEVICE TO AS3500

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D	RE-ISSUE FOR CC	18.06.15	DM	BA
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B	RE-ISSUE FOR CC	29.10.14	DM	BA
A	ISSUE FOR CC	14.10.14	DM	BA

North

Client: LEND LEASE

Architect: DWP SUTERS

Landscape Architect:

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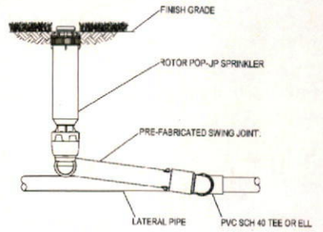
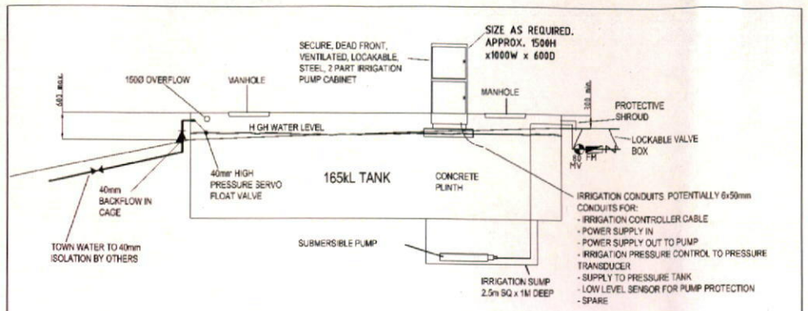
Project: JORDAN SPRINGS VILLAGE OVAL
JORDAN SPRINGS NSW

Drawing Title: HYDRAULIC SERVICES OVAL IRRIGATION PLAN

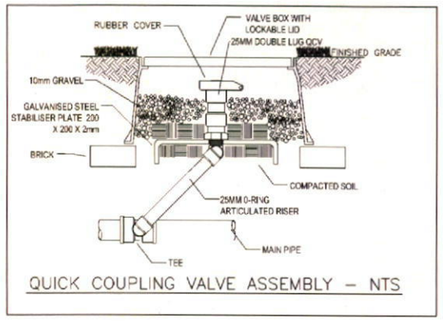
Drawn	Date	Scale A1	C.A. Check	Date
D.M.	SEPT 2013	1:100		
Designed	Project No.	Dwg. No.	Issue	
B.A	CH110163	H5.01	D	



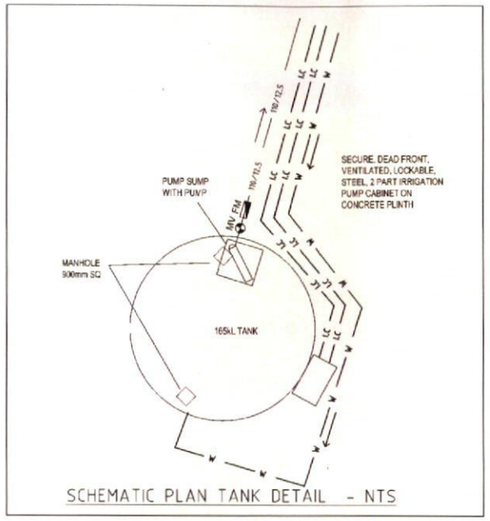
SPRINKLER DETAIL - NTS



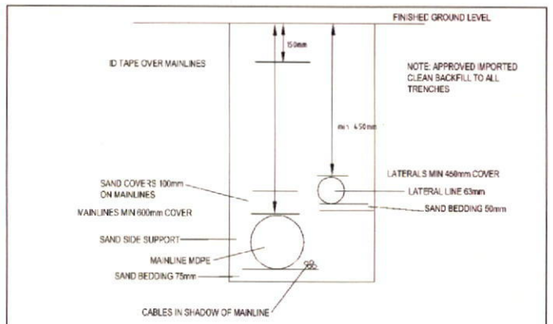
SCHEMATIC ELEVATION TANK DETAIL - NTS



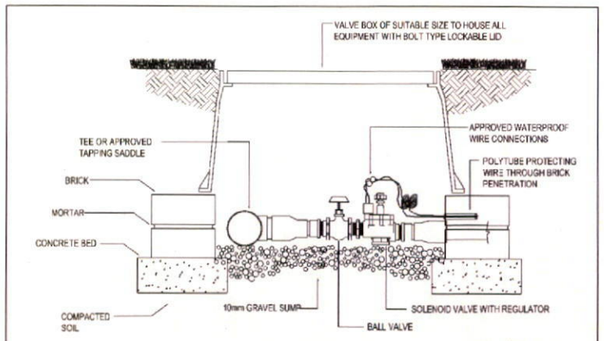
QUICK COUPLING VALVE ASSEMBLY - NTS



SCHEMATIC PLAN TANK DETAIL - NTS



TYPICAL TRENCH REQUIREMENTS - NTS



SOLENOID VALVE DETAIL - NTS

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C	REISSUE FOR CC	12.06.15	DM	BA
B	REISSUE FOR CC	29.10.14	DM	BA
A	ISSUE FOR CC	14.10.14	DM	BA

For A1 Only: 10cm, 20cm

North

Client: LEND LEASE

Architect: DWP SUTERS

Landscape Architect:

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Project: JORDAN SPRINGS VILLAGE OVAL
JORDAN SPRINGS NSW

Drawing Title: HYDRAULIC SERVICES IRRIGATION DETAIL SHEET

Drawn	Date	Scale A1	Q.A. Check	Date
D.M.	SEPT 2013	1:100		
Designed B.A	Project No. CH110163	Dwg. No. H5.02	Issue D	