

3. Specification

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Specification

1. WORKING INSTRUCTIONS

1.1 GENERAL

Refer to the Contract Conditions issued by the Principal accompanying this Specification. Conditions on any other basis are not acceptable.

Tenders shall be lump sum fixed prices not subject to rise and fall.

1.2 DEFINITIONS OF TERMS

The following definitions apply to this specification.

Principal	Means 'Port Phillip City Council'
Contractor	Means the Tenderer who shall have submitted a tender for the supply and installation of the works detailed herein and whose tender has been accepted by the Principal.
Superintendent	Means the appointed representative of the Principal responsible for contract administration of the Works.
Approved	Means approved or selected by the Superintendent. Approved is not to be deemed to be approved of defective workmanship and/or materials or to be a variation to the Contract.
Works	Means and includes the supply and installation of the whole systems described in this specification and the accompanying Drawings.

1.3 GOODS AND SERVICES TAX

This project shall include Goods and Services Tax in accordance the applicable regulations.

1.4 DRAWINGS

The following Drawings shall form part of the Contract:

Drawing No.	Title
CPP105-E01	Garden City Reserve – Public Lighting Layout Part 1
CPP105-E02	Garden City Reserve – Public Lighting Layout Part 2
CPP105-E03	Garden City Reserve – Public Lighting Diagrammatics & Details

1.5 SCHEDULES

Tenderers shall complete and provide all schedules to be submitted with his tender. Please note that the schedule of rates for variation shall apply to any additions or deletions to the work as specified and shown on the Drawings. The prices shall include the supply, installation, commissioning, making good, defects liability etc., as specified for similar items.

1.6 OPERATING AND MAINTENANCE INSTRUCTIONS AND MANUALS

Provide Operating and Maintenance Instructions and Manuals, three (3) copies.

The data to be provided in the manuals shall include manufacturer's literature, diagrams, illustrations and drawing and test reports covering commissioning and works tests.

A draft of the proposed manual shall be provided for the approval of the Superintendent not later than one week prior to the due date for physical completion of the Works.

Manuals shall be of International A4 size, with stiff plastic covers. The binding shall be of the loose leaf type with all pages machine punched and shall permit pages to lie flat and enable easy insertion and removal of pages. A minimum of 3 split rings shall be used.

Good quality, durable printing paper shall be used for text, printed on one side only.

Drawings shall be folded in their length to fit covers. Photo-reducing may be necessary to comply with these requirements.

Each section shall be started on a new page, separated from other sections by a stiff divider.

Each paragraph shall be numbered or otherwise identified, for quick and easy reference.

Each manual shall contain the information shown below, set out in logically divided sections including the following:

- a) scope and contents;
- b) detailed description of the lighting installation;
- c) maintenance and repair instructions;
- d) equipment supplier's schedule;
- e) technical data sheets;
- f) commissioning details;
- g) as installed drawings and CAD CD-ROM; and
- h) other information.

1.7 AS INSTALLED DRAWINGS

On completion of the Works, provide as-installed drawings detailing the complete works.

Supply a set of prints in each manual, and one (1) set of CAD CD-Rom

All drawings shall be prepared using the computer aided drafting system AUTOCAD latest release, Application CAD software and the .DWG files provided. All computer drawings shall be compiled and saved on CD-ROM.

1.8 REGULATIONS & FEES

Obtain all necessary permits, consents, approvals and certificates from all authorities having jurisdiction over any part of the work of this contract. Pay all royalties and costs relating to patent rights, trade marks or other protected rights. Comply with all statutory requirements including local laws and by-laws of the authorities and fully indemnify the Principal against any claims arising therefrom.

1.9 MATERIALS, WORKMANSHIP AND SUNDRIES

All materials, fittings, accessories and apparatus shall be new and unused of first grade design and manufacture, and shall comply with the relevant S.A.A. document. The workmanship shall be of a high standard throughout.

The Contractor must submit to the Superintendent prior to commencing installation, samples of all accessories, fittings and apparatus which it is proposed to employ in the work, and only such times as have been approved may be installed. Failure to comply with this provision may result in the unconditional rejection of such items when inspected on site.

Any rejected materials, accessories or apparatus shall be removed from the site within twenty-four (24) hours.

1.10 SETTING OUT, CUTTING AWAY AND MAKING GOOD

Thoroughly check the relevant dimensions on the drawings and confirm by site measurements which will take precedence over other figures.

The setting out shall be confirmed on-site with the Superintendent at the commencement of the contract and prior to any on-site works being performed.

The Contractor shall set out, at the earliest opportunity the position and sizes of all penetrations, recesses, etc, necessary for the accommodation of the work included in this Contract, and shall arrange to cut away for and make good after, such work.

1.11 CO-ORDINATION

The Contractor shall be responsible for checking and co-ordination of work under the Lighting and Electrical Services Works package.

1.12 SCAFFOLDING, HOISTING & LIFTING

Provide all crantage, lifting, hoisting, protection, hoarding, scaffolding and the like associated with the works of the Contract to the requirements of the Victorian Workcover Authority and any other relevant authority.

1.13 TESTS

Carry out complete commissioning and testing. All testing and commissioning work shall be carried out by qualified persons.

1.14 PLINTHS AND SUPPORTS

Provide all necessary concrete fill.

Provide all necessary galvanised steel brackets and supports required for the correct operation of the lighting as specified.

Details of all proposed supplementary supports shall be submitted for approval to the Superintendent prior to fabrication.

1.15 WELDING, CUTTING OR GRINDING INSITU

All operations shall be carried out in accordance with A.S. 1674 Cutting and Welding Safety Code. Never use equipment damaged in any way. Regular inspection is necessary. Replacement of hoses at least annually is highly desirable.

1.16 SITE NOISE CONTROL & DISRUPTION

The site is a public area and will continue to offer access to the public throughout the Works.

Comply with all statutory requirements relating to noise levels on site. Take all necessary precautions to prevent nuisance from noise and vibration. Permission shall be obtained before carrying out work involving high level noise. Blasting will not be permitted.

Cutting, drilling, digging, demolition and like activities shall be planned and conducted in such a way as to cause as little inconvenience as possible to the public.

All compressors and other stationary engines shall be of the silenced type and silence jackhammers shall be used where such breaking equipment is necessary or called for. Operation of equipment shall be closely supervised to ensure that silencers are always in place.

Existing services shall only be interrupted after obtaining permission via the Superintendent for the work to proceed.

1.17 PROTECTIVE MEASURES

Provide all measures to protect and safeguard personnel and property with regard to the works it is proposed to carry out under this Contract.

Make good damage arising to property, goods and services consequent to any failure with the protection and safeguarding measures.

It shall be the Contractor's responsibility to provide for all on-site storage required to secure contract goods and materials.

1.18 ENVIRONMENTAL CONTROLS

Environmental Management

All contractors have some impact on the environment. These impacts can occur during all phases of the product lifecycle, from raw materials extraction, through processing, production, finishing, packing, transport, operation and disposal. Similar considerations apply in the purchase of services from organisations as their operation interfaces with the environment. Minimising the environmental impacts of these processes and quantifying the results are key government priorities.

Tenderers are required to provide details on how they identify and minimise the impact of their relevant products/services and activities on the environment including:

- a) copies of environmental policy (including environmental purchasing policy where available). If no environmental policy, indicate if one is being developed;
- b) details of environmental management system (if any) and level of accreditation (e.g. ISO14001). Provide copy of accreditation or if not certified the scope of the EMS;
- c) a project specific Environmental Management Plan, including as a minimum a waste management plan, stormwater management plan and vegetation management plan; and
- d) an outline of environmental/sustainability related procedures, targets, objectives, auditing regimes and progress towards meeting/implementing these goals and systems as they relate to the company's operations.

Waste management

The Contractor's responsibilities will include, but not necessarily be limited to, the following:

- a) store, physically deliver, unpack all items of equipment and remove and dispose of all packaging in an environmentally acceptable manner; and
- b) fluorescent lamps and electronic ballasts, being hazardous waste, will be recycled in reputable electronics schemes including a chain of custody of equipment through the recycling process.

Protection of vegetation

The Contractor will comply with the requirements as laid out in Section 9.14

Sustainable Innovation

Where environmental initiatives are identified that maintain or improve the outcome of the service for the community and environment, Council will negotiate additional costs with the Contractor.

1.19 INSPECTION OF SITE

The Contractor warrants that before tendering, the Contractor inspected the site and is conversant with all visible existing conditions in and surrounding the site and with conditions of access to and use of the site for building purposes and has noted anything likely to affect the performance of the contract which such an inspection should have reasonably disclosed.

1.20 SUB-CONTRACTING

No work under this contract shall be sub-contracted without the written approval of the Superintendent to the Contractor. No sub-contractor other than a registered electrical contractor shall be used to conduct these works. Luminaire suppliers shall be deemed unacceptable as contractors for electrical services projects.

1.21 CODES AND STANDARDS

Notwithstanding that stated herein, the entire electrical services installation shall fully comply with the regulation of the following Authorities having jurisdiction over such works:

- a) the *Building Regulations* 2006 incorporating the Building Code of Australia;
- b) Metropolitan Fire Brigade (MFB);
- c) Insurance Council of Australia (ICA);
- d) electricity distribution company ('Citipower'); and
- e) the Victorian Workcover Authority.

together with all relevant Australian Standards and all amendments to those Standards.

1.22 ALTERNATIVES

The manufacturer and model numbers specified herein or on the Drawings indicate the preferred type of equipment and the design intent. The Contractor may propose alternatives where noted with proof that they are "equal". Acceptable "equal" proposal shall include submission of proof for:

- a) identical construction details;
- b) identical materials specification; and
- c) identical technical performance

Submit proof to Superintendent for approval if alternative is proposed. The submission shall include:

- a) appropriate technical literature;

- b) any initial and running cost savings; and
- c) technical calculations

Where an item of equipment other than that specified or detailed in the drawing, which requires any redesign of the system, drawings showing the layout of the equipment and such redesign as required therefore shall be prepared to the satisfaction of the Superintendent at the Contractor's expense. Where such approved deviation necessitates a different quantity and arrangement of materials and equipment from that originally specified or indicated on the Drawings, additional materials and equipment required by the system shall be provided at no additional cost.

Proposals for the submission of alternatives after the acceptance of tenders will only be considered where:

- a) the original offer is not available, or delivery cannot meet the required project timetable, or
- b) the alternative offers a cost saving to the project

The Superintendent reserves the right to deduct the cost of considering post tender alternatives from the contract sum.

1.23 TEMPORARY PROVISIONS

Allow for and provide temporary provisions to assist in construction and hand over of the site.

These shall include maintaining existing utility fed public lighting intact and in a fully operational condition until such time as the new works as shown and specified are completed and commissioned.

2. SCOPE OF WORK - ELECTRICAL CONTRACT

2.1 PROJECT DESCRIPTION

The scope of the work comprises the supply, installation, commissioning and testing of the Public Lighting Services at Garden City Reserve, Port Melbourne.

2.2 SCOPE OF WORKS

The scope of work covered by the Lighting and Associated Electrical Services documents and to be performed by the Contractor includes the manufacture, supply, installation, testing, commissioning and subsequent maintenance during the defects liability period of the work specified herein and shown on the Drawings.

The Contractor shall be responsible for the provision of all manufactured items, materials, labour, cartage, tools, plant, appliances and fixings necessary for the proper execution of the works, including Citipower charges and all minor and incidental works as follows:

- a) alterations and addition to existing service pillar (located outside the Sandridge Centre);
- b) cable location prior to commencement including 1100 Melbourne One Call System (MOCS) application to verify location of known utility services;
- c) formal 'NO GO ZONE' Assessment in vicinity of existing utility underground services per Authority's safe working practices;
- d) new luminaires supply and installation for types P1 (Pathway) & P2 (Playground) light poles;
- e) new light poles, type P1 Pedestrian (Pathway), Type P2 (Playground) - supply, delivery, installation and wiring. Works include ragbolts and foundation cage for each pole;
- f) new pole foundations including structural certification;
- g) coordination, ragbolt, cage and conduit installation into new pole foundations to ensure best configuration for cable loop in and loop out connection and tru-ing of poles;
- h) new final sub-circuits supply and installation;
- i) trenching, backfilling, laying of marker tapes and surface reinstatement for new underground services including compliance with the Principal's Tree Protection Guidelines;
- j) underground boring below all pathway crossings;
- k) surface reinstatement by a Principal approved civil works contractor of asphalt cut surface;
- l) underground type 'EP' Pits and Lighting Service Pits type 'LP' numbered as per plan layout;
- m) Category A Underground Rigid PVC Orange Conduit System - supply and installation to enclose final sub circuits supplying new lighting including supply and installation of draw wires, marker tape and surface markers. Galvanised steel conduit at small pedestrian bridge crossing;
- n) samples and shop drawings for approval. Samples and swatches to confirm: Light Pole General Arrangement for Type P1 and P2 Light Poles;

- o) service location detailing of all underground services laid or discovered to include precise distance triangulated measurement from permanent site features such as kerbing. Works by a specialist detailing company for compliance with 1100 Melbourne One Call Recording requirements of Citipower for entry of the Contractor's electrical installation information on behalf of the Principal;
- p) testing and commissioning including functional check of public lighting controls and programming of time clocks;
- q) liaison with Citipower for disconnection and removal of the existing redundant park lights, poles and service lines made redundant by the new pathway lights once commissioned. Obtain written consent from the Principal prior to having any poles removed. Note payment of charges levied by Citipower will be by the Principal;
- r) provision of Operating and Maintenance Manuals (3 sets) including an as-built drawing and CAD disk; and
- s) removal of all rubbish and debris from the site associated with the works on a daily basis.

2.3 WORKS BY OTHERS

The following work will be provided at no cost to the Contractor for the installation of the electrical services, and also details the interface with the Contractor and other trade contractors.

All necessary co-ordination, provision of shop drawings and other information necessary for the satisfactory interface and execution of works to be carried out by other trades shall be furnished at the correct time and in the prescribed manner by the Contractor.

Principal

1. Payment of any charges levied by Citipower to disconnect and remove the redundant aerial cable supplies and light poles at completion of the works.

Citipower

2. Disconnection and removal of services made redundant by the proposed new works. These include utility unmetered lighting fed light poles, luminaires and public lighting supply cables.

2.4 SUBMISSIONS

Shop Drawings

Carry out site measurement and prepare and submit detailed working and shop drawings for review and approval prior to manufacture and installation. Shop drawings shall comprise three (3) sets of prints for each submission. Drawings of inadequate standard will not be accepted.

Such drawings will be examined by the Superintendent to verify only that they represent the Lighting Consultant's design intent. The endorsement of such drawings by the Superintendent does not relieve the Contractor of his responsibility for detailed checking.

Make any necessary adjustments in conjunction with the Superintendent before manufacture.

Check all layouts before and after erection, and be fully responsible for the accuracy of the contract works.

Shop drawings shall fully describe the proposed appearance, materials, construction, thicknesses, corrosion prevention, paint treatments, fixing details and foundation layout. Provide a pole access panel detail and baseplate detail typical pole foundation detail for structural engineering review and adaptation to suit specific site geotechnical data.

The structural computations for all pole structural elements shall accompany the submitted shop drawings.

3. GENERAL ELECTRICAL REQUIREMENTS

3.1 GENERAL

Execute all work in accordance with the attached specification and drawings, current rules and regulations and Australian Standards, the following in particular:

- a) Building Code of Australia including Victorian amendments;
- b) AS3000 SAA Wiring Rules;
- c) Service and Installation Rules - Code of Practice for the Connection of Electrical Installations to Supply Mains;
- d) AS3008 - Selection of Cables for A.C. Voltages up to 0.6/1kV; and
- e) AS3439.1 - Low Voltage Switchgear and Control gear Assemblies.

New materials shall be supplied.

The words supply and install shall be deemed to also include wiring.

4. 1100 CALL, SERVICES LOCATION

The Contractor shall independently ascertain full details from the MOCS 1100 Call Service concerning the assets on site and carry out a site services location survey using services detection equipment to ensure assets are correctly pinpointed along all proposed excavation routes.

Upon award of contract and prior to any site works commencing, directly arrange to have a 'NO GO ZONE ASSESSMENT' carried out on proposed works procedures and comply with all required provisions of the responsible service authorities without variation to the contract.

5. 'NO GO ZONE' ASSESSMENT

The site of the proposed works contains major utility assets.

Upon award of contract and prior to any site works commencing, eg excavation, directly arrange to have a NO GO ZONE ASSESSMENT carried out on proposed works procedures and comply with all required provisions of the responsible service authorities without variation to the contract

6. REMOVAL OF REDUNDANT SERVICES

Arrange with the Citipower to disconnect and remove the existing external overhead supply, pole lights and wiring following commissioning of the new lighting supply.

At the end of this project there shall be no remnant Citipower lighting assets within the Reserve.

7. ELECTRICITY SUPPLY & METERING

7.1 ELECTRICITY SUPPLY

Existing electricity supply is to remain at MSB-P.

Nominal prospective fault level shall be taken as 10kA (1 sec) rms symmetrical at the Pillar

7.2 METERING (BASE TENDER)

The meter is within the existing switchboard pillar MSB-P.

7.3 METERING (TENDER OPTION 1 – RENEWABLE ENEREGY POWER SYSTEM)

In the event the Principal instructs works are to proceed inclusive of Option 1, the Contractor shall arrange for the metering suitable for co-generation metering.

In this event, advise the Principal's energy retailer and request a change of metering application information from Citipower at the commencement of works.

Make application on behalf of the Principal to Citipower for a cogeneration meter that suits both the mains and generation system equipment of this contract.

Prepare and lodge at commencement all specific applications notifying of Grid-Tie Connection.

Obtain and submit the specific connection agreement to the Principal for agreement and signature. Obtain both signed copies of the Customer Agreement from the Principal and submit back to Citipower..

At completion of the Renewable Energy Power System (“REPS”) installation works, provide to Citipower:

- a) a copy of the Certificate of Electrical Safety; and
- b) evidence of Inspection of the Installation by an Electrical Inspector (S class).

The Contractor shall ensure the above steps and any other further requirements of Citipower are completed to enable connection and metering of the installation.

8. MAIN SWITCHBOARD PILLAR (MSB-P)

8.1 GENERAL REQUIREMENTS

The existing main switchboard pillar is to remain.

Carry out alterations and additions as shown.

8.2 SHOP DRAWINGS

Shop drawings shall include plan, elevation and section to detail alterations made to the existing MSB-P pillar for inclusion as part of the project as-built records.

8.3 DISTRIBUTION BOARD ADDITIONS

Supply a new metalclad load centre to supplement the existing provisions.

The new load centre shall provide a minimum capacity 12 poles.

Supply and install new RCD circuit breakers as shown to suit the proposed new works.

Miniature circuit breakers shall comply with AS3111 of DIN-T design.

MCBs shall not be less than 6kA (1 sec) rms symmetrical fault rated as a minimum.

Circuit labelling and schedule shall be affixed to the inside of the distribution board. Labels shall be manufactured and be of engraved laminated plastic, screw fixed traffolyte or equal. Adhesive or self-tapper fixed labels will not be accepted. Identification labels shall be 10mm high letters.

Electrical equipment and accessories shall not be connected to the distribution board circuit breakers until they have been tested to be in safe operational order. All temporary connections for construction use on site tests shall be provided with earth leakage protection. Electrical loading shall be balanced as evenly as possible across the three phases during commissioning.

8.4 RESIDUAL CURRENT CIRCUIT BREAKERS

Residual current devices (“RCDs”) shall be current operated circuit breaker type in compliance with AS3190 and be fitted to all new public circuits as individual circuit breakers. The RCDs and MCBs for final sub-circuit protection shall be one integral unit. The sensitivity shall be 30 mA. Each circuit breaker for single phase circuits shall occupy a single pole space only.

8.5 PUBLIC LIGHTING CONTROL

Provide a daylight sensor and timeclock switch control circuit complete with manual bypass switch for routine testing to operate a contactor for control of the public lighting circuit and any future circuits. Works comprise:

- a) PE Cell (behind a windowed polycarbonate cutout in the side of the New MSB-P Pillar);
- b) timeclocks x 2, one for feature lighting and one for security lighting;
- c) Contactor control of each lighting circuit;
- d) auto-off-manual bypass selector style switch (not circuit breaker) to allow testing of public lighting;
- e) din rail mount componentry;
- f) permanently fixed written instruction next to each timeclock on how to adjust; and
- g) each component clearly and permanently labelled with a traffolyte label.

Details shall be as shown.

Lighting designated as ‘Security Lighting’ shall be controlled on at dusk via Photocell (PE Cell) and off via time clock and PE Cell combination such that the lighting is set to turn off in any case at dawn under PE Cell control but permits the Principal to elect to turn lighting off at a preset night time by means of the time clock setting.

It is envisaged that each pathway will have lighting arranged across two circuits alternating along the path. Each circuit shall be supplied from a different supply phase and each circuit controlled off a different time clock. Early ‘lights out’ will occur under time clock control to one circuit resulting in half lighting. This will be followed after a delay time, as nominated in the time clock setting instructed by Principal, of full lights off by shutdown of the 2nd circuit.

In this way ‘lights-out’ is signalled to members of the public prior to complete switch off.

The lights may be turned back on at a pre-dawn time as nominated by the Principal.

Set up of time clocks shall be on an individual day basis so that running hours can be equally shared across all lights as equitably as possible to avoid overrunning one group of lamps.

The following are nominal times to be confirmed with the Principal at time of commissioning:

Time Zone 1 Paths	‘Off’ 10pm ‘On’ 4am Mon then every 2nd day
Time Zone 2 Paths	‘Off’ 11pm ‘On’ 5am Tues the every 2nd day

Feature lighting will connect to circuits on Time Zone 3.

Each component clearly and permanently labelled with a traffolyte label.

Control and monitoring cables shall be multi-stranded minimum 2.5mm² 0.6/1KV V75 grade. Colour code wiring in accordance with AS2067 and identify them by moulded ferrules at both ends. Terminate incoming and outgoing cables on insertion or tunnel type rail-mounted terminal blocks.

Lace and loom cables and wires using ties, cleats, trays and ducts as appropriate. Provide bushes to prevent chafing of cables.

Label all new pillar apparatus and controls. Labels shall be polycarbonate, engraved black lettering on white.

Electrical equipment shall not be connected to the pillar until the equipment has been tested to be safe for connections. Temporary final circuit connections shall be provided with earth leakage protection.

Refer Drawings for diagrammatic details.

8.6 DAYLIGHT SENSORS

The daylight sensor shall be a photoelectric device contained within a weatherproof and vandal-resistant enclosure, designed for outdoor operation and rated for 10 Amp, 240 volt minimum. The relay shall switch lighting ON in diminished lighting levels, and OFF in increased lighting levels. The switching threshold value shall be of good stability, with built-in ON-OFF time delay of approximately 30 seconds.

8.7 CONTACTORS

Contactors shall comply with AS1029 for mechanical duty Class 0.3 and making and breaking Category AC3. They shall be double break, non-sticking, chatter-free and shall operate without audible hums. They shall close satisfactorily at 80% and hold in satisfactorily at 65% of nominal voltage. Auxiliary contacts shall be rated at minimum 10 Amps, 240V.

8.8 RELAYS

Relays shall be electro-mechanical plug-in type complying with AS1431. They shall have self-cleaning silver contacts and shall be enclosed in dust-proof clear plastic cases. The rating of the relay contacts shall match that of circuit breaker device. The relays shall close satisfactorily at 80% and hold in satisfactorily at 65% of nominal voltage.

8.9 CONTROL SWITCHES

Control switches shall be rotary type providing a positive wiping action when operated, and designed for panel mounting. They shall be double break and rated at a minimum of 16 Amp inductive at 0.8pf. Do not use circuit breakers for switches. A manual bypass switch shall be provided for the public lighting circuit per specification requirements listed above.

9. CABLING AND WIRING SYSTEMS

9.1 PVC / PVC CABLING

The cabling installation shall comply with AS3008 and AS3000 and the requirements of Citipower.

PVC insulated and PVC sheathed (PVC/PVC) cables shall comply with AS3147, of 0.6/1KV, V75 grade.

XLPE insulated and PVC sheathed (XLPE/PVC) cables where applicable shall comply with AS3198, of 0.6/1kV R90 grade.

Use multi-core cables with copper conductors and colour code, each core using standard approved colours.

Preserve the uniformity of phase colours throughout the installation.

Run cables straight and true, parallel with, or perpendicular to the main axes of buildings and features of the site.

Rate the cable to match the rating of the circuit protective device and equipment. Each circuit shall incorporate an insulated earthing conductor of appropriate size in accordance with AS3000.

Space circuits in accordance with AS3008 so that derating factors need not be applied.

Through joints in cables will not be acceptable. Clip or saddle cables to approved supporting systems.

9.2 PVC WIRING

Use TPI (PVC insulated) cables where wiring is enclosed within either steel or PVC conduits, otherwise use TPS cables. TPS and TPI cables shall comply with AS3147. The cabling installation shall comply with AS3008 and AS3000. Joints in cables will not be permitted.

Run cables straight and true, parallel with, or perpendicular to the main axes of buildings and features of the site.

Apply derating in accordance with AS3008 as appropriate. Rate the cable to match the rating of the circuit protective device and equipment.

Power cable sizes shall have a minimum size as follows:

Lighting sub-circuits	6 sq mm
Power sub-circuits	2.5 sq mm
Single earthing conductor	2.5 sq mm

9.3 WIRING METHODS

External underground wiring: TPS in UPVC conduits with 600mm minimum cover to top of conduits or as permitted by AS3000 and approved by Citipower.

Exposed in Park TPS in Galv Steel Conduits / Duct to 2400mm affl and in rigid grey PVC conduit above this.

9.4 CONDUITS

General

Install conduits truly vertical or horizontal and parallel to the main axes of built construction.

The minimum diameter of conduit used for external underground public Lighting shall be 32 Dia UPVC Heavy Duty Category A, Electrical Orange to AS 2053. Sharp edges shall be smoothed prior to drawing-in wires.

Install draw-in boxes in accessible positions. Terminate conduits in switch and outlet boxes of the same material as the conduits. Sharp edges shall be smoothed prior to drawing-in wires.

P.V.C. Conduit

PVC conduit shall be rigid, high impact, heavy or light duty as specified, complying with AS2053. Form sets using an internal bending spring of approved type and size. Use approved jointing cement to all conduit connections.

Steel Conduit

Steel conduit using screwed fittings shall be used. Treat threaded joints on metal conduits with aluminium paint or other rust preventative to ensure good electrical continuity.

Make sets using a standard proprietary bender of proportional size to the conduit being used. Any sets which do not retain substantially circular section or which open seams, joints or welds will not be accepted.

9.5 CONCEALMENT OF WIRING AND CONDUITS

All wiring and conduits shall be generally be run concealed underground.

If the Contractor considers that a section of the wiring cannot be concealed, advise the Superintendent, who will issue a direction as to the installation of that particular section of the wiring.

There shall be no chasing of walls or marring of constructed finishes without express approval of the Superintendent.

9.6 PENETRATIONS

Penetrations through walls and floors shall be sealed after cables and wires are insitu. Fire seals shall be in accordance with tested fire stopping methods in accordance with AS1530 Part 4, and to the approval of the Building Surveyor and Occupational Health and Safety Authority.

9.7 ALIGNMENT OF EQUIPMENT

Generally equipment shall be aligned with the axis site elements and site features. Install vertically, horizontally, parallel to walls and in line with similar units to present a pleasing appearance.

The location of equipment shown on the electrical layout drawings is diagrammatic only. Confirm on site with the Superintendent the actual position required, prior to installation of any work.

9.8 GENERAL SAFETY PRECAUTIONS

All exposed or loose cable ends shall be protected with tape to prevent potential risk to causing eye damage. During installation all cables shall be rolled up to above head height to prevent potential risk to causing eye damage.

Do not terminate cables onto circuit breakers of live switchboards until load end of cable is permanently terminated and until the electrical equipment has been insulation tested. Do not connect cables to circuit breakers and tape the breaker in the OFF position. Ensure that cables are not positioned to enable them to come into contact with sharp edges of building elements.

9.9 UNDERGROUND CABLING INSTALLATION

The underground cabling installation shall include:

- a) liaison with the services utilities, Citipower and telecommunications carriers;
- b) co-ordination with other in-ground services such as gas, sewer, stormwater, fire mains, water supply, irrigation lines and telephone services, prior to digging, trenching or coring,
- c) trenching, backfilling and reinstatement for underground electrical services;
- d) boring below all pathways and hard standing surfaces;
- e) laying of sand-beds for all underground conduiting;
- f) provision of pits shown
- g) supply and installation of Electrical Category A Rigid Underground PVC conduits to accommodate the underground cabling. PVC conduits are to be sealed to prevent water seepage and vermin entry into conduits;
- h) supply and installation of electricity marker tapes continuously above the centre line of electrical conduits;
- i) supply and installation of surface cable markers; and
- j) service recording of position of underground services and input to 1100 call system records using a specialist company approved by Citipower to conduct works to the Citipower's recording standards.

Provide temporary fencing, barriers and night lighting as appropriate to prevent accidents. Generally trenching and backfill should be completed as quickly as possible to ensure trench integrity, personnel safety and to prevent obstruction to other activities on site.

Take necessary precautions with due regard to the terrain and weather forecasts shall be taken to prevent flooding and cave-in of exposed trenches.

Backfill over conduits using clean existing material, free of organic matter and rocks.

Apply in maximum 200mm layers and compact to approval.

Complete backfill using approved top soil. All excess spoil shall be removed from site.

Install underground cables in unbroken lengths between termination points. Exposed underground conduits shall be protected with metal or concrete cover slabs.

In each underground conduit, new and used, a draw wire shall be provided.

Where conduits enter the base of the light poles they shall be sealed at ground level with an expanding foam or weak concrete slurry to prevent moisture and vermin entry.

9.10 UNDERGROUND CABLE TRENCHES AND CONDUITS

The Contractor shall be fully responsible for the provision including laying and marking of all conduits associated with the public lighting services.

Supply and install underground cable conduits for the enclosure of subcircuit cables.

Cable conduits shall be laid 600mm (to top of conduits) below pavements and final finished ground levels. Cable conduits shall be PVC for Category A underground system. Liaise with the Superintendent for exact routes and locations of cable conduit runs. Lay continuous heavy duty orange polyethylene marker tapes 150mm above and aligned with conduits on centre of run.

The Contractor's civil works sub-contractor shall:

- a) carry out the trenching, backfilling and surface reinstatement to the standard required by the Principal for the proposed surface works; and
- b) ensure that all trenching conforms with the minimum requirements of the specification section as set out herein as well as the specific requirements of the authorities concerned where trenches accommodate or disturb assets of the authorities.

Trenches should be provided with a grade away from buildings. Ensure that the underground cable and conduit installation does not interfere with other services including existing services on the site. Make good any damage to other services during the cable conduit installation to the original conditions to approval without variation to the contract price.

Trenches shall be constructed in straight runs and sides, with a smooth and even bottom free from stones and other projections.

Trenching in existing continuous hard surfaces eg: concrete, asphalt, bitumen, etc., shall be avoided in favour of boring.

Where boring is not a suitable option surfaces shall be neatly saw-cut and reinstated to provide a stable compacted base suitable for reinstatement back to the existing condition.

Liaise with the Principal and the utility authorities, Citipower and telecommunications carriers in trenching works.

Arrange for and pay costs associated with inspections of the cable and conduit installation while trenches are open.

Backfilling over conduits shall use clean existing material free of organic matter and rocks. Complete backfill using approved top soil. All excess spoil shall be removed from site.

Do not backfill excavations of the cable and conduit installation until the relevant construction or services installation works have been inspected, tested where appropriate, and approved by the Superintendent or Superintendent's appointed representative and the local network provider.

Materials to be used for backfilling shall conform to one of the following types:

- a) selected material excavated from site being free from organic matter, topsoil, rubbish, debris, lumps or balls of clay and from rock with a maximum dimension in excess of 100mm;
- b) approved imported, granular material such as salamander, clean quarry waste, granitic sand or clean road-making gravel, any such material to be free of particles with a maximum dimension of 100mm, and
- c) first class backfilling consisting of material of quality not lower than Class 2A crushed rock.

Filling materials shall be placed in horizontal layers of not more than 200mm loose thickness and each layer tamped and/or watered then compacted as appropriate to the required density before the following layer is placed.

The compacted density of the material when tested shall not be less than:

- a) for non-spanning slab on ground areas of building:
100% standard maximum dry density;
- b) for areas covered by pavements:
95% standard maximum dry density; and
- c) for all other areas:
90% standard maximum dry density.

The standard maximum dry density for the material shall be that obtained in accordance with AS1289.

When services pipes are not required to be encased in concrete, initial filling of the same material as specified for pipe bedding, or 7mm nominal size fine crushed rock, shall be carefully packed around all pipes and fittings by placing and compacting in 150mm layers until the filling material reaches at least 150mm above the tops of the pipes.

The materials shall be carefully packed by manual ramming only, to a level at least 300mm above tops of pipes taking particular care to avoid damage and displacement of services components and jointing seals. Mechanical rammers may be used in all other locations.

In order to avoid displacement of and damage to services components, the material shall not be dropped into place from a height of more than 1 metre unrestricted fall before the surface of compacted filling has reached a level of at least 150mm above the tops of the pipes.

After initial backfilling trench excavations shall be backfilled as follows:

a) BACKFILLING UNDER PAVEMENT

First class backfilling shall be used under pavements and any future pavements. The trench shall be backfilled and compacted until level with the underside of pavements and to the surface level for future construction. Approved imported granular material may be used as an alternative material subject to specific authorisation of the Superintendent.

b) BACKFILLING FOR OTHER AREAS

Selected material won from site shall be used for backfilling in areas other than under buildings, pavements and surface drains. Filling material shall be placed in layers not exceeding 200mm loose thickness and each layer compacted before the following layer is placed.

In unpaved areas eg: grassed areas excluding garden beds, topsoils shall be placed and packed to fill the excavation and finished with a slight crowned surface mound to allow for settlement.

In grassed areas, the turf sods which were removed and stored during excavation works shall be set firmly in position with tops married to the side of excavation turf surfaces each side and using good quality topsoil or sandy loam as bedding and filling around all sides of sods.

In garden beds, the top of the excavations shall be filled with topsoil and mulch to match existing strata and intending finished ground level.

9.11 CABLE LOCATION RECORDS

The Contractor shall engage a specialist company approved by Citipowerto carry out all service records of installed underground services in public areas to ensure the records are prepared to a standard suitable for entry onto the MOCS system for 1100 Call location by the Citipower.

Mark the location of all electrical services conduits installed under this contract through the installation of electrical marker tapes in durable polyethylene inscribed "Electricity". Lay above the centre line of each service conduit run in accordance with the trench detail shown on the Drawings.

Cable marker tapes shall be high quality acid and alkali resistant polyethylene film 250mm wide in accordance with AS 2645 with inscriptions facing up.

Record the location of all underground services laid or discovered to include precise offset from permanent site features such as kerbing.

Lay surface cable markers at intervals not exceeding 30m of straight run, at each change of direction, at each road crossing marking on kerb of road/path edge each side and at point of entry to each building and/or structure. Cable markers shall be submitted for approved.

9.12 UNDERGROUND CABLE PITS

The Contractor shall supply and install all cable pits and shall confirm the exact set out of all cable pits.

Electrical (EP) cable pits shall be heavy duty equal to 'Gatic' manufacture or approved equal to withstand the traffic load and of minimum 600 sq x 750mm deep size with inlay metal lid to accept matching paving surface. All electrical pits shall have a minimum depth of 750mm to ensure maintenance of 600mm cover when 2 rows of conduits are installed.

Type EP cable pits shall be concrete type complete with formed conduit entries.

Citipower pits where provided as part of the Contract shall strictly adhere to Citipower's pit specification and construction requirements.

Polymer concrete (Polycrete) pits and / or lids are unacceptable for use with any pit.

Pits constructed or finished with in-situ concrete shall be finished to a suitable high quality exposed aggregate finish to approval.

All pit lids shall be either purchased complete with the wording "Electricity" prominently inscribed in the lid or alternatively labelled with non-trip cable markers displaying the same wording securely fixed to the pit lid in an approved manner.

At electrical turning pits offset install conduits to maximise bending radius for draw-in operations.

Provide a gravel base and drainage hole in each pit. Seal all conduit openings around and internally at each pit to ensure water barrier and vermin proof construction.

9.13 REINSTATEMENT

Engage an experienced civil works contractor to conduct reinstatement of all surfaces back to a condition consistent with the immediate surrounding untouched conditions.

Works procedure shall be confirmed with the Superintendent prior to site commencement to ensure minimal disruption to site operations.

9.14 TREE PROTECTION GUIDELINES

All contractors working on site shall comply with the Principal's tree protection guidelines

a) TREE PROTECTION ZONES

All trees shall be protected from damage during the works.

A tree protection zone shall be established a minimum of 5m from tree trunks. Install temporary fencing (star picket with para-webbing or similar approved) to clearly mark tree protection zones.

In tree protection zones:

- a) no fuel, oil or chemicals shall be allowed or stored;
- b) servicing and re-fuelling of equipment and vehicles is prohibited; and
- c) no storage of any materials, equipment or temporary buildings should take place

b) TRENCHING, EXCAVATION & BORING WORKS

Prior to commencement of any excavation or boring works, the locations of all conduit routes and poles shall be marked on site for confirmation by the Superintendent.

No trenching shall occur with 5m of any tree trunk unless otherwise approved in writing by the superintendent. For all required underground cabling within the drip line of tree trunks, directional boring shall be utilised.

Extreme care shall be taken when excavating footings for light poles. For footings within the drip line of any tree trunk, hand digging only will be allowed, unless otherwise approved in writing by the superintendent.

For footings outside drip lines, augers may be utilised, however Council's arborist must be in attendance to monitor the works.

Where any roots greater than 40mm diameter are encountered, Contact the Superintendent for instruction and direction.

10. GENERAL INSTALLATION REQUIREMENTS

10.1 CUTTING AWAY, CHASING AND MAKING GOOD

Advise the Superintendent with drawings where necessary, the locations and sizes of all openings, conduits, inserts, etc. required for the installation of electrical services.

Supply and install conduits, inserts and fittings required.

10.2 FIXINGS AND ANCHORS

Wooden plugs shall not be used for fixing anywhere on this site. Fixings into masonry or concrete for lightweight items may use at least two plastic plugs.

Items heavier than one kilogram shall be fixed on to masonry or concrete with two or more metal expansion devices of the "Loxin" or similar type of adequate size. The expansion anchor shall be properly set before attempting to hold the item with the anchor.

Equipment suspended from structures shall be by means of mild steel rods or angle irons.

10.3 CORROSION PROTECTION

All small metallic parts shall be plated or of non-corroding material. Where small parts are visible, such as switchboard hinges, they shall be chrome plated. Other small items shall be galvanised, cadmium plated or passivated. All external ferrous items exposed to weather shall be galvanised.

Ferrous brackets or steelwork located out of doors shall be hot dip galvanised. Where used internally they may be painted. The metal shall be properly cleaned and prepared, then as a minimum shall be primed and painted with two finishing coats. Aluminium brackets, cable ladders and other items shall be anodised.

10.4 EARTHING

The earthing system shall be to the requirements of Citipower and as specified in AS3000 SAA Wiring Rules.

Earth all metal enclosures, including light poles.

Bonding conductors shall terminate as a common link block thence to the main switchboard main earth bar. Conduct an earth impedance test to verify effectiveness of earthing.

Bond also, sheathing of cables, metal conduits, where applicable, and all parts of a metallic system forming part of a wiring system, using earth clips, conductors or other approved means.

Comply strictly with AS3000 relating to types, sizes, installation and connection of all earth conductors.

10.5 GENERAL SAFETY REQUIREMENTS

Means of personnel access and equipment hoisting shall be secure to prevent falling. Bolted connections are preferred to site welding.

Provide firm and adequate supports and means of fixing for the light fittings and conduits to prevent support structure failure.

11. LIGHTING

11.1 LUMINAIRES – GENERAL

Luminaires and light poles of the same type shall be identical and shall be complete with lamps, starters, ballasts, diffusers, suspensions and fixing brackets.

Ballasts shall be quiet in operation. Power factor correction capacitors shall be provided to maintain a minimum value of 0.92 lagging. Internal wiring shall use 105oC PVC insulated conductors.

Lamp holders shall be manufactured from high temperature polycarbonate, porcelain for high intensity discharge lamps.

Provide an approved earth stud complete with washers and lock nuts on each luminaire. Luminaires shall be bushed where wiring enters.

Metalware shall generally be powder coated. Seams where exposed to view shall be welded, filled and rubbed smooth prior to painting. Luminaires shall be delivered to site suitably packaged in sealed cases or cartons.

The procedure for cleaning and routine inspection of each Luminaire shall be as recommended by the suppliers. As a minimum include for a 12 Monthly Visual inspection to ensure all lamps are operating correctly and physically check connections for tightness of all components. Provide inspection report to the Principal.

11.2 IN-GROUND LUMINAIRES (TYPE A)

Engage a civil works sub-contractor to neatly cut and form openings in the existing paving for new in-ground luminaires and to also form a concrete niche into which the new luminaires shall be securely located.

In-ground uprights shall have a non-slip surface and safe contact temperature glass supplied.

In-ground luminaires shall be fully glanded where wiring enters and installed strictly accordance with the manufacturers written installation instructions which shall be explicitly sought and strictly adhered to.

An installation blockout shall be used and mounted into concrete niches as shown. Install such that the cable loop feed to each light is sealed within an underground joint kit designed specifically to ensure reliable termination integrity and exclude water. The joint kit shall be accessible below the in-ground light when removed from installation blockout.

Leave enough cable loop to ensure retermination is possible in future where a unit needs to be replaced.

Ensure lamp is supplied only by the luminaire supplier not an intermediary such as a wholesaler.

Confirm the exact set out of position each pit at a lighting night trial.

11.3 LIGHTING PIT LUMINAIRES (TYPE B)

Supply luminaires as shown within custom fabricated lighting pits set into the ground for semi-flush mounting.

Pits shall be fabricated as shown.

Pits shall be provided with an anti-glare grille across top of which shall be set a flat polycarbonate clear diffuser.

Both the grille and the diffusers shall be contained within a hinged frame locked via hasp and padlock at 2 points each side of pit.

Submit shop drawings for approval prior to fabrication.

Incorporate an internal mounting support to permit full adjustment positioning of the luminaire within each pit.

Each lighting pit shall have a drainage outlet at bottom and be set onto a gravel base to assist drainage of any water.

Gland and seal all cable entries into the pit and provide fully sealed IP68 junction connection box and glanding to connect luminaires.

Confirm the exact setout of position each pit at a lighting night trial.

11.4 NIGHT TRIAL AND FINAL COMMISSIONING AIMING ADJUSTMENT

Include to carry out works in two stages:

- a) during construction position installation blockouts to suit proposed luminaire set out locations, temporarily connect all luminaires using flex and plug at proposed installation locations and demonstrate operation to verify the exact locational set outs prior to casting in of the blockouts to the paving works; and
- b) at commissioning make aiming adjustments as directed and clean all luminaires to ensure performance is optimised.

Both sets of adjustments shall be carried out at night in the presence of the Superintendent and lighting design consultant.

12. LIGHT POLES

Supply and install new light poles as shown complete with poles, ragbolts and foundation cages.

All poles shall be erected true and on alignment with other poles. Make arrangements to supply a suitable ragbolt assembly and install onto the concrete foundation taking care to ensure correct luminaire orientation is achieved.

Utilise levelling nuts to maintain all poles in true vertical alignment. Ensure the base plate setup is done correctly to ensure installation as shown on the typical pole base detail and that anti-corrosion measures are incorporated to suit below surface baseplate installation.

12.1 LIGHT POLE FOUNDATIONS

The Contractor shall be responsible for providing concrete pole foundations suited to installation at the project site and shall include all costs associated with their correct provision.

Pole foundations shall be designed and certified by a structurally qualified certified practising engineer (CP Eng)

The Contractor shall review the proposed foundations ragbolts and foundation cages to ensure adequate construction provisions are made.

The Contractor shall include to co-ordinate the provision of ragbolts, foundation cages, conduit entries and orientation of foundation bolts to ensure that poles are erected vertically true, in alignment with other poles and with the correct orientation of pole mounted luminaires perpendicular to footpaths.

12.2 SPECIFIC STANDARDS

New light poles shall be provided in full compliance with:

AS 1170 – Regional Basic Design Wind Velocity
AS 1650 – Hot Dipped Galvanised Coatings on Ferrous Metals
AS 1798 - Lighting Pole and Bracket Arms – Preferred Dimensions

12.3 AUSTRALIAN MANUFACTURE

Poles shall be manufactured in Australia and be of an approved Australian design only. Manufacturer shall be nominated with the submission.

12.4 POLE CONSTRUCTION

The pole design shall be of a duty applicable to the environment of site and of high quality construction.

Poles shall be fully welded hot dip galvanized mild steel to AS 1650 and be provided complete with levelling and fixing ragbolts, cage assembly, template, cable and gear access opening at pole base, fixing straps for future gear trays, earth lug, luminaire adaption plate, asset labels and all componentry to effect a complete installation.

Pole top shall be closed off with a flat capping plate square set to sides of pole to prevent water entry.

Design to suit the luminaire arrangements shown and provide adaptors and brackets to match the luminaire mounting fixing and cable entries.

Bracketing and fixing shall be mechanically strong to maintain the luminaire in the mounted horizontal position.

12.5 ACCESS PANELS

Provide access panels at the base of each pole. Access panel size shall be nominated on the shop drawings.

The access panels shall be fully lockable as shown.

Welded internal straps shall be provided to suit mounting of circuit protective devices and loop-in terminals all as fixed mounted equipment.

12.6 DELIVERY & OFF LOADING

Works shall include freight and off-loading.

Provide all crange, lifting and off loading into the Principal's Depot or other designated delivery address within the municipality.

12.7 POLE ERECTION EQUIPMENT

The pole supplier shall provide details regarding pole erection equipment required to suit each size and type of pole offered as part of the pole installation procedure.

12.8 REPAIRS TO GALVANISING & PAINT FINISHES

Poles shall be supplied fully intact without damage.

Provide a repair instruction to treat galvanizing and paint finishes should repair is subsequently required for galvanising treatment marred during handling, erection or in service.

12.9 PAINT FINISH

Paint each pole using a selected external powder coated finish as shown and to be confirmed at time of shop drawing submission.

12.10 POLE FOUNDATIONS

The pole supplier shall provide a typical foundation design for each size and type of pole offered.

The Contractor shall conduct a geotechnical report and then use this to have a suitable pole foundation designed to suit site conditions for each pole type and will use the pole suppliers 'typical' foundation design for general reference only when doing so.

Note also the foundation arrangements shown on the drawings show general pole arrangements only and do not purport to document size and depth of foundations or any other aspect of the structural adequacy requirements.

The top of the foundations will be installed below ground level. Foundations will only be installed by an approved civil works sub-contractor engaged by the Contractor.

The Contractor will make reference back to the pole supplier to ensure that the proposed foundation designs are compatible with the pole supplier's pole design. The pole supplier shall make due allowance in this Contract for providing a coordination service role.

The pole supplier shall provide a template suitable for installation of the foundation bolt arrangement for each size and type of pole. Verify the size and type of pole proposed and transmit via the Superintendent the applicable foundation bolt template to ensure bolt set out is correct.

The Contractor or sub-contractor installing the light poles shall ensure installation of the foundation bolts such that the headframe orientation is correct when the pole is erected onto the foundation.

12.11 POLE ASSET LABELS

Install an asset label onto each pole of stainless steel suitably engraved and fixed with stainless steel band to the circumference of pole each side of luminaire junction.

The asset tag shall contain the following information:

- a) Principal's pole asset reference number;
- b) name of manufacturer;
- c) date of pole manufacture;
- d) manufacturer's pole catalogue number and serial code for later identification; and
- e) height of pole (m).

Submit details of the asset label with the pole shop drawings submitted for approval.

Asset tags shall be mounted at luminaire height above ground level or as otherwise approved on submitted shop drawings.

A duplicate tag for each pole shall be provided inside the base of pole electrical access compartment fixed to rear of access door and tag details recorded on the as-built drawings.

12.12 SHOP DRAWINGS

The shop drawings shall as a minimum include drawing detail of each light pole including luminaire in proposed assembled condition.

13. RENEWABLE ENERGY POWER SYSTEM (Tender Option 1)

13.1 GENERAL

Provide an option with the tender for the supply and installation of a REPS in the form of a solar array mounted to the roof of the Sandridge Centre (Trugo Centre) as shown.

The intent of the proposed installation is to provide a highly visible solar PV installation to promote the benefits of solar energy within the precinct to demonstrate Council's commitment to greenhouse gas emissions reduction through the application of renewable energy technology. The capacity of the solar PV installation should be demonstrated to have a capacity equal to the total energy requirements imposed by the proposed new lighting development as set out below.

Luminare	Unit Incl Load control Gear	Qty	Total	Duration	Daily Avg Load (kwh)
P1 Pedestrian	35W	20	700W	5 hrs (6-10 & 5-6)	3.5
P2 Feature Playground	35W	2	86W	3.5 hrs Feature Ltg	0.3
A Tower Uplights	70W	3	86W	3.5 hrs Feature Ltg	0.3
B Tree Uplights	70W	8	86W	3.5 hrs Feature Ltg	0.3
				Total Lighting Load	4.4kwh/day

(Note: Time of running limitation is specified under public lighting controls via the time clock provisions of the specification)

13.2 SPECIFIC STANDARDS

All systems, components and equipment must comply with, and be designed and installed in accordance with all relevant Australian Standards or, where such does not exist, with the relevant international standard. Australian Standards include, but are not limited to:

- a) AS/NZS 3000 – Electrical installations;
- b) AS 4509 – Stand-alone power systems;
- c) AS 4086 – Secondary batteries for use with standalone power systems;
- d) AS 4777 – Grid connection of energy systems via inverters;
- e) AS/NZS 5033 – Installation of photovoltaic (PV) arrays (currently under review);
- f) AS/NZS 1170 – Structural design actions; and
- g) any other standard called upon by the above or other relevant standards.

Photovoltaic modules must be tested and certified to IEC61215 or IEC61646 by a laboratory registered under the International Electrotechnical Commission's (IEC) CB scheme to test these standards.

13.3 SCOPE

This REPS comprises the following:

- a) grid connection application to Citipower;
- b) supply and installation of Monocrystalline PV Solar Modules to form a Photovoltaic (PV) Array with 1.36Kw nominal output nominally 8 x 170W as shown based on 3.5 hrs per day of average generating time ($3.5 \times 1.36 = 4.76$ Kwh per day avg) complete with final adjustment to ensure no shadowing of cells;
- c) solar modules support framework and fixing to the roof of the Sandridge Centre (Trugo Centre) with micro-siting to ensure maximum solar access and minimum shading of the array;
- d) weatherproof terminal housing and DC rated isolator mounted on roof for isolation of PV array to Citipower's requirements and to provide an inconspicuous viewing from the front elevation of building;
- e) grid Interactive inverter, sinewave output type rated at 1.6Kw nominal and ESAA certified with approval number. Note the rating of the inverter shall be greater than the output power (1.36kW) of the solar array;
- f) provision of inverter free standing powder coated metalclad enclosure for location in the building to approval;
- g) metering provisions to incorporate new single phase bi-directional electronic interval meter approved by Citipower;
- h) a remote meter monitoring module to be included monitoring module that allows occupants and visitors to readily see the impact on electricity consumption of the photovoltaic system and the appliances being used;
- i) all cabling, connectors and associated hardware;

- j) provision of labels including all labels to be mounted on the main switchboard;
- k) shop drawing of the PV Array General Arrangement set out and Electrical Schematic Diagram showing the cable connections. Drawings required to co-ordinate roof penetrations and support works. Reflect general requirements of E13.7 and Submittal requirements of E13.10;
- l) verification of roof system structure adequate to support the Photovoltaic Panels shown;
- m) flashing of roof bracket supports and required cable penetrations to ensure watertight roof installation of the PV array system;
- n) commissioning and instructing Principal;
- o) applications and follow up to obtain PV system rebates; and
- p) 12 months defects liability and maintenance.

13.4 ASSOCIATED WORKS

The following work will be provided at no cost to the Contractor for the installation of the REPS system.

Principal

1. Physical accommodation provision within building for the PV Inverter.
2. Meter connection fee levied by Citipower for the provision of the cogeneration meter at the Garden City Reserve main switchboard

13.5 SPECIALIST INSTALLATION COMPANY

Accredited installers only shall be used for the purpose of seeking installation quotations for the REPS. The system shall be installed by an approved specialist company experienced in the supply and installation of REPSs.

The specialist company shall be accredited (full or provisional) for design and installation of photovoltaic systems by the Australian Business Council for Sustainable Energy that is also a registered electrical contractor and also comply with the requirements of the local network provider Energy Australia. The installation shall be checked by a licensed electrical inspector (S Class) as listed with the Office of Chief Electrical Inspector prior to connection to the main switchboard.

Supply and install a photovoltaic grid connect generator system to the Sandridge Centre in strict accordance with the manufacturer's recommendations.

13.6 REBATE APPLICATION

The installer shall make application on behalf of the Principal for all rebates available and prepare all necessary documentation.

Obtain and complete the application in favour of the Principal for photovoltaic rebate and such other rebates as may become available to the Principal via Sustainability Victoria (SV), or the Department of Environment, Water, Heritage and the Arts (Federal).

The rebate application shall be prepared and forwarded at the earliest time from which system equipment and capacity is confirmed with the Principal.

13.7 GENERAL REQUIREMENTS

Equipment shall be arranged in accordance with manufacturer's recommendations.

All maintenance parts shall be easily accessible, removable and replaceable.

The earthing of the grid connected inverter, frames and all other metallic equipment and components shall be in conformance to the requirements of AS3000 and the local network provider.

The inverter shall be located in a vented metal enclosure to ensure noise levels are kept to a minimum.

13.8 GENERAL REQUIREMENTS

The following shop drawings shall be submitted as a minimum:

- a) inverter metalclad enclosure;
- b) PV Array General Arrangement Drawing detailing the support arrangements for Builder Interface; and
- c) REPS Electrical Schematic Drawing.

13.9 PHOTOVOLTAIC (SOLAR) ARRAY

Supply and install the solar array with a peak rated output of 1.92kW on the roof as shown. Panels shall not be wired in a single string. Maximum system DC Voltage shall be 48V dc.

Solar panels shall be high efficiency monocrystalline solar modules with toughened 'high transmission' glass and anodised aluminium frame. For space limitations the preferred panels shall have a minimum rating of 170W with a nominal total of twelve panels. The panels shall be orientated to the north with optimised inclination generally 30 deg with 20% variation from this angle. Panels shall be of a quality standard equal to BP Solar manufacture.

13.10 INVERTER

The grid-connected inverter shall be a distribution business approved model which complies with AS 4777, approved for use by the ESAA with certification number. Arrange for a suitably qualified and registered electrical inspector to provide a "Certificate of Electrical Safety" for the photovoltaic generator system installation.

The inverter shall be designed to prevent back-feeding of the Citipower network if the grid supply is de-energised. It shall also be capable of restarting within a short period after the external grid supply is restored.

The inverter shall also be fitted with surge protection to prevent external network surges from damaging the REPS equipment. The Inverter shall be of a quality standard equal to Power Solutions Australia manufacture.

Output shall be sine wave output specifically designed for use in Grid Connect REPS System Design.

The inverter shall be suitable for indoor location within the Sandridge Centre.

Confirm the sizing with the inverter manufacturer to ensure adequate ventilation when operating at full rated output and design overload conditions. It shall be sized such that it's capacity is no greater than 20% of the capacity of the solar PV system.

13.11 SUBMITTALS

Submit shop drawing details as specified herein. Details to include:

- a) physical dimensions of cabinets and proposed equipment general arrangements;
- b) electrical schematic showing equipment details and equipment ratings;
- c) descriptive literature for the various components proposed for inclusion; and
- d) details of mounting and fixing of PV panels.

13.12 COMMISSIONING

The REPS shall be fully commissioned and three copies of the test report submitted to the Principal. A full set of as-installed drawings and maintenance manuals (3 copies) shall be provided at completion.

Include the following specific measures:

Metering & Main Switchboard - Vacuum out the metering enclosure and refit removed covers. Verify the correct operation of the reversing power meter.

Inverter Enclosure - Vacuum out the inverter enclosure. Inspect and check locking.

PV Array - Clean down all panels and inspect tightness of all connections.

Wiring - At the completion of the installation, remove any temporary cable bridges, secure all cables, check all earth connections and check the security of all terminations. Tidy up cabling and secure with wire ties.

Labelling - Clear and professionally sign written or printed labels shall be provided on all line equipment in areas if energised prior to practical completion. Check that all labels required have been provided.

Keys - Hand over keys and any specified spare items to the Superintendent.

13.13 WARRANTIES

In addition to the main contract warranty provisions, the following warranty provisions apply to the componentry and installation of the grid connected solar PV system:

- a) a product manufacture warranty of 5 years minimum is to be provided for all manufactured components, including panels, inverter and mounting. A guarantee should be provided on the power output of the panels, at a minimum of 75% of the stated nominal output after 20 years; and
- b) a 12 month defects liability period applies to the installation and operation of the system.

14. TESTING & COMMISSIONING

14.1 SCOPE

This section sets out the testing and commissioning requirements of the lighting and electrical services systems installed. Test all systems and equipment as required by this specification.

Carry out preliminary testing, checking, control setting, etc. prior to notification that the work has reached the state of practical completion. Provide during this period a skilled operator to operate the system.

Give forty-eight (48) hours notice in writing prior to any sectional or complete tests on any tests called for by this specification being executed. Provide all necessary testing apparatus and be responsible for all costs associated with the testing.

Test and demonstrate operational readiness of the following systems:

- a) public lighting; and
- b) public lighting controls.

Each system shall be tested as specified in the respective section for the system herein and the associated Standards. All electrical Installation testing shall be carried out in accordance with AS3017.

Include copy of all testing notes and reports in the operating and maintenance manuals.

14.2 ELECTRICAL INSPECTION

Provide for the electrical services installation prescribed and non-prescribed works to be inspected by registered Electrical Inspector 'Electrical Inspection & Certification Pty Ltd' contact Mr Michael Maher phone number 9431 3148 mobile 0418 339 820. A full report shall be prepared and provided to the lighting consultant.

The Contractor shall make all applications and pay all fees as required. There shall include but not limited to prescribed and non prescribed inspections, truck appointments etc.

14.3 CERTIFICATION

Perform at appropriate times during the currency of site work, all tests required by Authorities who may from time to time have jurisdiction over the work, and obtain the necessary certificates of approval. Lodge all these certificates of approval.

At the time of practical completion, and as a condition thereof, provide Certificates of Compliance for all works carried out under this contract and the Electrical Inspection Report.

Carry out all tests and obtain the necessary certificates of approval for the following:

- a) the Certificate of Electrical Safety;
- b) independent electrical inspection as set out herein; and
- c) certification of entry to MOCS 1100 System of Citipower.

All certificates shall be included in the Maintenance Manual.

14.4 EARTHING

Check that all earthing provided is installed and tested to the requirements of AS3000 and AS3017.

14.5 LIGHTING

Check and clean all luminaires.

Replace lamps which have been used during the construction period with new lamps.

Refit diffusers.

14.6 MAIN SWITCHBOARD PILLAR

Test as specified in AS 3439. In any case carry out insulation tests. Check that all circuit breakers function correctly and RCD devices are fully operational. Vacuum out and refit any removed covers.

14.7 WIRING

At the completion of the installation, remove any temporary cable bridges, secure all cables, check all earth connections and check the security of all terminations. Tidy up cabling and secure with wire ties.

14.8 LABELLING, PADLOCKS & KEYS

Clear and professionally sign written or printed labels shall be provided on all line equipment in areas if energised prior to practical completion. Check that all labels required have been provided. All labels shall be traffolyte.

Hand over keys (2 sets) and any specified spare items to the Superintendent.

15. DEMONSTRATION AND TRAINING

The Contractor shall, prior to the issue of the notice of completion, spend sufficient time with the Principal or his appointed representative to show the location of all items which require maintenance and/or adjustment during the life of the installation. The Contractor shall also explain the operation of each item and system to the Principal and show where that item and system reference information is located in the Maintenance Manual.

Allow for demonstration and training of the following systems:

System	Hours
Public Lighting	2
REPS System	1

16. SERVICE AND MAINTENANCE

16.1 SCOPE

This section sets out the maintenance requirements for the electrical services installed under the contract. Supply the specified number of sets of the Maintenance Manual.

16.2 LIMITS OF RESPONSIBILITY

Be responsible for 4 No. 3-monthly maintenance and servicing visits during the warranty period as a minimum, in addition to visits as required.

Within seven (7) days of written notice make good all defects which are due to faulty material, apparatus, equipment or workmanship. Should the Contractor fail, within seven (7) days of written notice to make good defects, the Principal reserves the right to have such defects rectified by others at the Contractor's expense and responsibility. Should any such defect be of such a nature that it endangers or prevents operation of the installation, it shall be rectified immediately, on telephoned or other advice.

During the term of the Defects Liability Period the Principal may:

- a) shut down any item of equipment, if, in his opinion, a major breakdown would occur if such a system continues to run;
- b) immediately notify the Contractor of such a shut down; and
- c) notify the Contractor if any equipment requires replacement prior to the next scheduled visit.

16.3 MAINTENANCE SCHEDULE

Carry out servicing in strict accordance with the maintenance schedule included in the Operation and Maintenance Manual.

16.4 MAINTENANCE VISITS

After completing each maintenance visit, prepare a report and obtain the Principal's signature on the report. The report shall include as a minimum:

- a) date of inspection;
- b) company name and name of inspecting person;
- c) list of items / equipment inspected;
- d) status of inspected items;
- e) action taken, ie, any repairs carried out and date completed;
- f) signature of inspecting person and date;
- g) Principal's signature and date.

Provide a duplicate copy for forwarding to the Superintendent.

The final payment at the end of the Defects Liability Period will be withheld until preventative maintenance as scheduled has been carried out and sufficient maintenance reports, signed by the Principal, have been submitted.

16.5 EMERGENCY CALL-OUTS

Provide an emergency call-out service during the whole 24 hours of every day during the Defects Liability Period for attending to breakdowns and lamp replacement within 24 hours of notification.

17. WARRANTIES

17.1 GENERAL

Make good any defects caused by faulty workmanship and/or materials during the Defects Liability Period upon notice to do so.

17.2 TIME WARRANTIES FOR WORKMANSHIP AND MATERIALS

The time warranties for the work commence at the agreed Date of Practical Completion given to the Contractor for the completion of each phase of the works. Warrant the respective portion of the works completed in each phase for a period of 52 weeks from the Date of Practical Completion.

In the event of inclusion of equipment normally covered by a lesser time warranty, allow for and include the cost of extending such warranty.

17.3 EQUIPMENT WARRANTIES

Warrant that the performance of all items of equipment used in the Works are not less than those specified when operating under the specified conditions and that such equipment can be installed with adequate clearances for operation and maintenance.

Replace any items of equipment, not meeting the requirements, at the sole cost of the Contractor.

Note: Replacement and/or repair of equipment during the Defects Liability Period may result in the Defects Liability Period being extended for the respective items.