

## Maintenance

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# 1. Maintenance services

## 1.1 General

The Maintenance specification sets out the minimum requirements for the management and implementation of maintenance services to be provided across Sydney Water Corporation (SWC) portfolio by the Contractor.

The objective of the maintenance specification is compliance with the SWC AMQ0002 Asset Management Policy document and optimising the reliability, availability and effectiveness of all the assets and processes.

The services to be provided include activities necessary to:

- minimise the life cycle cost of plant and equipment
- decrease operational and maintenance costs
- ensure design performance and process objectives of Plant and Equipment is/are consistently met or exceeded
- maintain asset on-line availability (plant and equipment up time)
- maintain plant reliability and performance
- avoid catastrophic failures
- minimise frequency and duration of breakdowns, bypasses, planned and unplanned shutdowns.

Maintenance Services must be consistent with the above objectives and the intention is to keep the frequency and duration of breakdowns, reduced plant output quality or capacity, bypasses and planned or unplanned shutdowns to a minimum.

The Contractor must:

- provide consistent high quality and cost-effective maintenance services in accordance with SWC's maintenance schedules and job plans and in response to specific requests
- plan and execute maintenance services in close co-ordination and co-operation with SWC stakeholders
- implement and refine the maintenance management strategy and maintenance improvement program in conjunction with the SWC stakeholders.

The Contractor must arrange all labour, plant, tools, materials, spare parts, transport, management, supervision, technical support services, etc., necessary to provide all specified Maintenance Services, including:

- preventive maintenance, including condition assessment
- breakdown maintenance
- corrective maintenance
- major periodic maintenance
- general maintenance
- technical support
- Support the implementation and ongoing refinement of maintenance management strategy and maintenance improvement program.

After completion of work the Contractor must clear the site by removing all scrap material and return unused materials to SWC warehouse, tools, waste etc to make sure site is clean and safe. The Contractor must ensure that the Systems Operation Centre (SOC), Resource Coordinator and/or Plant Operator are notified of the date and time on the commencement and completion of the maintenance services.

## 1.2 Maintenance strategy

SWC has developed six (6) types of maintenance approaches which are applied to all the operating assets.

These include:

### **Plan to Repair Assets:**

- S1 Failure based maintenance (run to fail) (RFM)

### **Avoid Fail Assets:**

- S2 Periodic Scheduled Inspection (PSI)
- S3 Periodic Basic Maintenance (PBM)
- S4 Periodic Scheduled Maintenance (PSM)
- S5 Usage Based Maintenance (UBM)
- S6 Predictive Maintenance (PDM)

For further details, please also refer to D0000654 Maintenance Strategy Definition and the SWC Collaborative Framework Agreement Annexure C, Section 4.5.6 Maintenance Strategy.

SWC has developed a range of Maintenance Excellence Standards which detail the maintenance strategy and maintenance requirements for high priority assets with the objective of the standards being to optimise the remaining life cycle cost of the assets.

The Contractor can access available maintenance excellence standards from SWC in relation to:

- Submersible pumps
- Conventional pumps
- Lifting gear
- Valves
- Platforms and walkways
- Bridges
- Aqueducts
- Retaining walls
- Stormwater channels and
- Stormwater quality improvement devices (SQIDS).

## **1.3 Scope of work extent of maintenance contract**

### **1.3.1 Facilities to be maintained**

The Facilities to be maintained generally comprises SWC's water, wastewater, recycled water and storm water infrastructure.

The pipework and mains include all above and belowground pipework and mains in vacuum systems nominated, low-pressure systems nominated and inside boundary fence of treatment facilities nominated.

The Contractor must determine the area of coverage and Facilities to be maintained by reference to Facilities nominated in the SWC Asset Register.

Some of the tasks required and facilities to be maintained include the following:

- maintenance of water filtration plants, waste water treatment plants, water recycling plants, water pumping stations, sewage pumping stations, stormwater pumping stations, reservoirs, sewage vacuum systems, low pressure sewage systems, re-chlorination plants, odour control plants, automatic control valves and flowmeters
- maintenance of IICATS/SCADA related Equipment (please refer to the SWC Technical Specifications - IICATS and SCADA)
- cathodic protection/electrolysis systems

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- maintenance of high voltage electrical apparatus and distribution lines
- inspection of wet wells, channels, tanks and water pressure monitoring sites
- repair of above and below ground pipework and mains
- regulatory and statutory maintenance i.e. lifts, cranes, pressure vessels
- maintenance of materials handling Equipment, excluding mobile plant and equipment
- maintenance of onsite chemical dosing systems
- undertaking of Equipment commissioning
- performance of technical support services
- provision of periodic and specific reports including daily outage report.

The Scope of Work under the Contract includes the clearance, collection storage and disposal, by the Contractor, of all waste material, in accordance with statutory and WHS requirements as per SWC waste disposal standard.

### 1.3.2 Excluded equipment

The Contractor is responsible for the maintenance of all Plant and Equipment in a Facility covered by the Contract unless it is specified by SWC as belonging to others, in which case it is deemed as excluded Equipment.

If the Contractor becomes aware of a fault in any excluded Equipment that may have impacts on the operation of the Facility, it is the responsibility of the Contractor to immediately report the fault to SWC.

### 1.3.3 Equipment and facility additions or deletions

SWC reserves the right to add or delete Equipment to or from the Facilities and add or delete a Facility covered by the Contract during the Contract Period. The additions or deletions of Equipment and Facility may be due to commissioning or decommissioning of Equipment or any other reasons. For additional Equipment or Facilities, the Contractor must provide all maintenance services in accordance with the Contract.

## 2. Preventive maintenance

Preventive Maintenance is a type of maintenance service carried out at predetermined intervals or corresponding to prescribed criteria and intended to reduce the probability of failure or degradation of performance of an asset/item.

Preventive Maintenance Work is pre-planned and programmed in the SWC TAR. Preventive Maintenance Services should be in accordance with the Preventive Maintenance program and Job Plan. Preventive Maintenance also includes, manufacturer or supplier maintenance recommendations and planned condition monitoring tasks.

The timing and frequency of delivery of Preventive Maintenance Services will generally be in accordance with that shown in the Job Plans and may not match past frequencies. The Contractor may exercise some day-to-day flexibility in the timing of delivery of Preventive Maintenance for the optimisation of resource planning and cost minimisation, however modification to the timing and frequency of Maintenance Services should not proceed without prior approval of SWC.

The following are the Contractor requirements which must be adhered to for the appropriate delivery of Preventive Maintenance services:

- Preventive Maintenance services of the required level must be performed, irrespective of the level of Breakdown and Corrective Maintenance services workload
- Resource for Breakdown and Corrective Maintenance should be over and above the base load required for Preventive Maintenance. The Contractor must ensure that maintenance backlogs do not occur. Should backlog occur, they must be cleared expeditiously.

- Unless otherwise approved by the SWC, Preventive Maintenance must be carried out during normal working hours
- All statutory maintenance must be completed by the due date
- All spare parts and/or rotatable equipment required for Preventive Maintenance Work must be requested at minimum one month in advance to Supply Chain Operations to ensure supply is available
- If the Contractor determines that work instructions are not appropriate or insufficient to maintain an asset, the Contractor should notify SWC to amend the work instruction by filling out IMS0038 Treatment Plant Operational Change Management Request Form
- While Providing the Service, if the Contractor becomes aware of an existing defect, the Contractor is to notify SWC. Where no additional resources are required, the Contractor is to rectify the defect and record the findings on a Work Order. In the instance where rectification of the defect will require additional resources, the Contractor will notify SWC and raise a subsequent Corrective Work Order.
- When contractor raised a corrective Work Order, it needs to be raised at lowest possible asset level or next level of asset hierarchy. The contractor will also need to check that any Work Order carried out is at lowest possible asset level and if not, they need to organise change to the correct level in co-ordination with the SWC.
- For any PM Work Orders requiring cancelling, the Contractor will seek approval from SWC, have a valid reason for cancellation.

### 3. Breakdown maintenance

Breakdown Maintenance is carried out as a result of a failure of an asset and is intended to restore the asset to a state in which it can perform its intended function.

The Contractor must provide a Call-Out Service for Breakdown Maintenance on a 24 hour, 7 days per week basis. When making use of the Call-Out Service, SWC will allocate a Work Order Priority.

The Contractor must respond in accordance with the Work Order Priority. The response time required for each priority is specified below:

Priority	Required response time
Priority 6	within 1 hour
Priority 5	within 3 hours
Priority 4	maximum 24 hours
Priority 3	within next working day
Priority 2	maximum 2 weeks
Priority 1	maximum 1 month

For Priority 6 and 5 call-outs, the Contractor must make every effort to reduce the response time to less than 1 hour and 3 hours, respectively.

The following points are the minimum requirement which the Contractor must adhere to for the delivery of Breakdown Maintenance services:

- Tradespersons responding to call-cut services must be familiar with the maintenance and repair of the assets and its function within the operating system
- Tradespersons responding to call-out services must be already inducted, be qualified and have all the required level of training to carry out work on concerned asset as per required standard including any specific requirement by SWC
- Any opportunity maintenance work carried out during this period must be recorded separately as Corrective Maintenance

- The Contractor must advise the SOC, Resource Coordinator and/or Plant Operator of the Asset's status.
- Breakdown Maintenance with low Work Order Priority responses must normally be carried out during normal working hours within the Priority response time given
- Based on asset condition and repair cost, the Contractor must follow asset Like for Like replacement process as specified in DOC0328 - Mechanical and Electrical Like for Like filed based decision framework if a decision is made to replace an asset to restore its function
- All spare part and/or rotatable equipment requirements are to be requested to SWC Supply Chain Operations
- The Contractor must follow required level of commissioning steps as per the Commissioning Specification when asset replacement decision is being made during a 'Like for Like' replacement process.

### 3.1 Bypass pumping

Depending upon the length of the outage, the degree of redundancy available at the Affected Facility, as well as the nature of the Maintenance Services to be undertaken, SWC may direct the Contractor as to whether, and the extent to which, bypass pumping is to be provided.

If the Affected Facility is anticipated to be out of action for longer than four hours, and there is provision for bypass pumping, the service provider must provide bypassing in consultation with SWC Operators. If the outage is anticipated to be longer than four hours and there is no provision for bypass pumping, the Contractor must obtain SWC's direction.

Where Plant and Equipment exists for a particular pumping station to enable bypass pumping to occur, the Contractor must arrange to obtain the Plant and Equipment from SWC's central warehouse. The Contractor must install the bypass Plant and Equipment and return the bypass Plant and Equipment to the warehouse upon completion of the bypass.

## 4. Corrective maintenance

Corrective Maintenance is Planned Maintenance carried out on an asset to correct an unacceptable condition and restore an asset to an operational condition within the tolerances or limits established for in-service operations. e.g. adjustment, replacement of worn or damaged components.

Corrective Maintenance must be programmed and undertaken at the earliest opportunity, having regard to the condition of the Equipment or Facility and the likely impact of failure.

Where work such as Corrective Maintenance arises from a Breakdown or Preventive Maintenance Work Order, then a "Follow-Up" Work Order must be created that automatically links the Work Orders.

For Corrective Maintenance, the Contractor must record the actual hours and material costs expended or, in the case of an external fixed price, the quoted labour hours and costs and materials costs. For SWC issued Inventory, costs and quantities will be recorded in the individual Work Order when issued by Supply Chain Operations.

The Contractor must carry out required planning and scheduling of resources, services and material to get equipment/machine back into operation as quickly as possible in order to minimise the interruption to production.

## 5. Major periodic maintenance (MPM)

Major periodic maintenance (MPM) is work carried out periodically to restore an asset to an acceptable condition to enable the asset to achieve its full-service life. MPM of an asset including overhauls requires significant technical and engineering knowledge. These are specialist activities and will generally require the Affected Facility to be taken out of service for a longer duration. These tasks can be classified as extremely



highly complex tasks that would be delivered by technical specialists with suitable advanced training and competencies.

The requirements which must be followed for the delivery of MPM services are:

- The Contractor to undertake a detailed condition assessment to determine the scope of the MPM. The scope must be approved by SWC prior to commencement of the Services.
- The Contractor will undertake a detailed commissioning plan for the MPM in accordance with the SWC Specification - Commissioning.

## 6. General maintenance

General Maintenance is a process for undertaking miscellaneous services similar to the Maintenance services that are not carried out from any of the Preventive, Corrective or Breakdown categories. SWC may identify work to be performed as General Maintenance services to be carried out by the Contractor.

The Work Order for this nature of work will normally be initiated by SWC and will be treated in the same way as Corrective Maintenance.

The nature and scope of services to be similar to the examples shown below:

- minor Plant and Equipment modification and upgrades
- minor installations - GPO, flowmeter, exhaust fan, handrail
- installation of safety guard
- re-routing of pipework, cabling etc
- relocation of lock stops
- installation of additional lighting
- fabrication of platforms, ladders
- facilitating access for electricity authority outage e.g. generator connection at SPS.

The Contractor must carry out General Maintenance services as and when requested by SWC.

## 7. Technical support

To provide the quality of maintenance services required by SWC, the Contractor must provide experienced technical support personnel within their field staff team.

The technical support personnel should provide required technical and/or engineering advice to carry out maintenance services effectively to achieve the following objectives:

- scheduling and managing all the maintenance services so that they are undertaken efficiently, effectively and on time
- supporting field staff in more complicated tasks of problem solving, root cause analysis, and any other similar services
- co-operate and participate with SWC in the investigation of high cost or frequent asset failures, identifying performance trends and developing preventive or corrective actions.

## 8. Documentation / data quality

Any documentation produced by SWC must be compatible with existing documentation, consistent in format and level of detail as appropriate and to the satisfaction of SWC.

The Contractor must also ensure that:

- any Job Plan which are prepared by the Contractor must ensure that all maintenance work can be carried out in a safe manner for its safe return to service.



- where appropriate, Job Plans indicate relevant settings, parameters to be recorded and consequent action required at predetermined status levels.
- the Job Plans that are prepared by the Contractor are in accordance with maintenance requirements specified in Equipment manuals, suitably modified to take account of relevant experience and the particular operating environment. Also, it will be in accordance with the MEPR0074.01 Job plan Data standard and MEPR0075.01 PM data Standard as defined in the SWC website <https://eloin.ads.swc/sites/iConnect/SubContent/1504672800458> Asset Knowledge - Data Standards.

### 8.1 Work order data

Following completion of any maintenance services, the Contractor must record appropriate details verifying that the required services have been carried out satisfactorily.

The documentation must be accurate and sufficiently detailed to allow both the asset maintained and the work carried out to be clearly identified.

The Contractor must ensure the minimum data required in relation to Work Order data is collected and updated as per D0000373 Work order Data standard - Maintenance and capture required information in to work order as per Asset Core Data attributes for asset maintenance and operation document - D0000468 Asset Core Data Attributes for Asset Maintenance and Operation.

### 8.2 Facilities and equipment information

The Contractor must check for discrepancies between records of assets and its related information and the actual asset onsite on a day-to-day basis. The Contractor must notify SWC of any discrepancies by following the change management process as specified in IMS0038 'Treatment Plant Operational Change Management'.

### 8.3 Drawings

The Contractor must familiarise itself with all drawings necessary to provide essential corrective and breakdown maintenance services.

The Contractor must identify any inaccuracy in the drawings and temporary mark-up all SWC drawings of assets and provide to SWC.

For any further requirements, please refer to the SWC Design Management specification - Section 10 and CPDMS0021 Computer Aided Drafting (CAD) Standard and Specification. For assistance on how to access and use the SWC EDMS Contractor Portal, contact SWC. The Contractor is responsible for uploading all drawings, in the correct format, to the EDMS system at the completion of the project.

### 8.4 Operations and maintenance manuals

The Contractor must familiarise itself with all manuals necessary to provide essential Corrective and Breakdown Maintenance services. The Contractor must identify any inaccuracy in the manuals and must temporary mark up of all manuals prior to providing to SWC.

For any further requirements, please refer to the SWC Specification - Commissioning - Section 17.6.

### 8.5 Test certificates

As and where applicable, the Contractor must prepare and submit Plant and Equipment for statutory inspections by the respective Authorities for the obtaining of the required Test Certificates. The Contractor must hold a copy of each Test Certificate for the duration of the Contract. The Contractor must provide SWC with the original Certificates and attach a laminated copy of the Certificate close to the Plant and Equipment to which it refers.

## 9. Materials

SWC will provide the Contractor access to its inventory of managed goods and equipment. The goods and equipment are requested to Supply Chain Operations who will then source and manage centrally within the existing Supply Chain Operations Warehouse and Distribution Network for both replacement and repairs. Supply Chain Operations coordinate and manage the full replacement of spare parts and rotatable equipment (including some consumable types) as well as the repair process, which includes onsite or offsite condition assessment and final induction back into SWC's inventory to ensure 'Fit for Service'.

## 10. Spare parts and rotatable equipment

SWC Supply Chain has an established Inventory Management function which manages the planning, purchasing, safe storage and distribution of inventory (for both uninstalled and installed fixed assets required for replacement or repairs) in support of all maintenance works. Inventory is managed and maintained in a network of Supply Chain stores which are located within key areas based on criticality to operations. The Contractor will ensure any requirements for spare parts and rotatable equipment is requested to the Supply Chain Operations team who will coordinate supply. The Contractor can access the Supply Chain stores onsite at Production Plants and Network locations following Supply Chain processes. The Contractor is responsible to record and advise Supply Chain following use of parts and requesting all spare parts and rotatable equipment.

The Contractor needs to ensure the following requirements are met in relation to the management of critical spares:

- Notify SWC Supply Chain Operations if spare parts or rotatables have been utilised from onsite store locations and/or requires return
- Request all spare parts and rotatable equipment (including replacement or repair) which is managed by SWC directly to Supply Chain Operations when planning material requirements for all maintenance work order types
- Notify SWC Supply Chain Operations and site representatives if an inventory item is not 'fit for service' providing adequate supporting information.

### 10.1 Consumables

The Contractor must supply all consumable items required to carry out all the Maintenance services in a timely manner. The Contractor can hold required level of consumable stock at sites (not within SWC's Supply Chain storerooms) provided by SWC for Maintenance Services.

### 10.2 Tools and equipment

The Contractor must provide a constant supply of tools and Equipment for regular use to carry out maintenance work safely including:

- slings
- other lifting tackle such as chains blocks when not installed at site; and hoists for sites where there is no lifting provision
- hand tools
- vehicles
- measuring instruments
- test and calibration Equipment
- brush tension measuring devices
- electrically driven hand-held tools with core balance safety devices when applicable
- lead-lights and flexible leads with core balance safety devices or transformers

- Backflow Prevention Devices (to prevent backflow and/or eliminate the potential for the contamination of potable water supply).

## 11. Chlorine system maintenance

SWC has recognised the risk to work health and safety, the environment and to public safety associated with the installation and operation of chlorination plants and processes. Chlorine (gas or liquefied gas) is one of a number of disinfection agents used by SWC.

Chlorine is a powerful anti-bacterial agent. It presents a hazard as it is toxic and highly corrosive. Chlorine is a dangerous chemical due to both its corrosive and toxic properties. Chlorine will corrode most materials and burn skin and mucous membranes. Chlorine is governed under legislation as both a hazardous substance and a dangerous good.

SWC has developed a Chlorine Gas Safety Guideline TG 501 - Disinfection Safety Guideline for Liquefied Gaseous Chlorine which applies to all of SWC's operations, services or assets, which are involved in the use of chlorine for disinfection of drinking water or wastewater. The guideline specifies the requirements and standards for the use of liquefied chlorine gas in all aspects of a chlorination facility and the transportation of chlorine, including supply of chlorine and ongoing operation and maintenance of the asset.

Maintenance is one of the fundamental risk control measures at chlorination facilities in order to minimise the extent and effect of equipment failures and the degree of their subsequent impacts. All maintenance carried out on chlorine system are required to meet the performance and testing requirements as outlined in AS 2927, as a minimum.

The Contractor must meet all the requirement set out in the Technical Guidelines document TG 501 related to chlorine gas safety (refer Section 4 References below).

Further maintenance requirements which must be followed but not specified in AS 2927 include:

- Lubricants suitable for use with chlorine must be used, such as silicone grease (i.e. no organic based oils or greases)
- Spare parts compatible for use with chlorine are used
- Pipe work must be purged before welded or heating
- Steps are taken to prevent accidental opening (e.g. 'reflex' actions) of gas isolation points without first forcing a conscious safety check, e.g. double isolation or lock out of operation devices
- Moisture from atmospheric air and other sources is prevented from entering gas pipe work when connections are broken
- Gas pipe work system is dried using compressed nitrogen or dry air for a minimum of 24 - 48 hours if new pipe work is installed or where the existing pipe work has been left open to the atmosphere for a period of time
- Silicone grease is used where ever threaded plastic parts are assembled, to prevent the joint from seizing
- All flexible pipelines and hoses under gas pressure within a chlorination facility must be replaced at least every twelve months, or more frequently, if they are subject to frequent movement. All flexible lines must be tagged with the date they were put into service, the name of the person who changed them, and the date on which the next change is required.
- Any flexible pipelines and hoses that are bent, kinked, or damaged must be replaced immediately. Discolouration or dulling of the flexible connection normally indicates a leak which must be located and fixed immediately. The requirement for annual replacement includes any flexible plastic connectors on remote vacuum systems as these also become brittle with service.

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- It is the responsibility of the persons conducting maintenance activities to remove all their equipment, materials and wastes from site. Storage of any other chemicals, or items not specifically related to the chlorination systems are NOT permitted in any room containing chlorine cylinders, drums or equipment. Items used for maintenance must be kept in such a manner that access/egress is not obstructed at any time.
- Any person carrying out Maintenance services on Major Hazardous Facility (MHF) site must be qualified in relation to knowledge and training required as per MHF Guidelines and TG 501 requirements.
- The Contractor should make sure that only trained and qualified person will be send to MHF site to carry out any repair work during working hours and for after-hours call outs as well
- The Contractor must participate and support the implementation of Safety Management System for MHF site.

### 11.1 Training

- The Contractor must ensure that maintenance personnel must undertake training and maintain any competency specified in TG501
- Maintenance personnel must undertake training in the relevant national recognised training qualification (or equivalent) and be assessed as competent by a Qualified Independent Assessor as per D0000859 Competency training process for WT16 Authorised Maintenance Providers.
- Maintenance personnel must undertake re-training and assessment at least every two years.

### 11.2 Competencies/authorisations

- Maintenance personnel must be authorised by the SWC Western Water Hub Authorised Operator and Production or Interface Manager.
- Maintenance personnel must complete work at WT0016 Warragamba Pipeline Chlorination Plant within a 6-month period to maintain familiarity and status as an authorised maintainer.

## 12. Flammable gas hazardous area maintenance

A hazardous area is defined as an area in which an explosive atmosphere is present, or may be expected to be present, in quantities such as to require special precautions for the construction, installation, and use of potential ignition sources.

SWC has developed technical guidance document for the classification and management of flammable gas hazardous area. Any maintenance work carried out in the gas hazardous area must follow all the requirement specified in the relevant AS/NZS standard as well as requirement set out in TG 502. - Classification and Management of Flammable Gas Hazardous Areas.

Some of the maintenance requirements which must be followed while working in gas hazardous area are:

- All personnel who perform maintenance work on a plant with hazardous areas must be trained in this procedure.
- Testing and faults finding must be carried out by a qualified person using certified testing instruments.
- Asset repairs/overhauls must be carried out in an accredited/certified workshop, supervised by a competent person, as per the guidelines detailed in AS/NZS 3800.
- Repairs of gas detection system and instrument must be carried out by the manufacturer or an authorised agent, who must provide certification to verify that the repair work fully complies with the manufacturer's original standard and specification.
- Electricians working in gas hazardous area must have in-depth knowledge of wiring rules specified in AS/NZS 3000. Also, they must have in-depth knowledge of installation of explosion-protection apparatus and systems as per AS/NZS 60079.17.

### 13. Water system asset maintenance

SWC delivers the highest quality of drinking water to its customers. To do so, SWC has adopted a Drinking Water Management Policy (BMIS 0213.13) which states a commitment to provide safe and reliable drinking water to customers by having water management system consistent with the Australian Drinking Water Guidelines. The Australian Drinking Water Guidelines encourages the protection of drinking water from catchment to customer. One of the important factors influencing the quality of drinking water provided to the customer is the effect of various materials and substances that may come into contact with the drinking water as it is collected and supplied throughout the distribution system.

Maintenance plays a big role in making sure water quality is not compromised and there are controls and measures in place to avoid contamination of water. The following are some of the requirements which must be followed while carrying out Maintenance Services on assets in SWC's water system network:

- All the materials which has potential to come in to contact with water and used for maintenance should comply with Australian Standard AS/NZS 4020 Products for use in contact with drinking water
- All the personnel carrying out maintenance of water system asset should have required level of knowledge, awareness and training specified in Australian Drinking Water Guidelines
- Lubricants used for the maintenance of water system assets should be of food grade quality. All lubricants and associated equipment used for lubrication must be stored and transported in such a way that it does not create risk of cross contamination.
- There should be a system in place to avoid any cross contamination from the use of tools and equipment for the maintenance of water system assets.

### 14. High voltage electrical apparatus operation and maintenance

This section details High Voltage (HV) electrical apparatus Operation and Maintenance for overhead transmission lines, substations, transformer yards, motors, starters, power factor correction and combined HV / Low Voltage (LV) installations in pumping stations. The following [Table 14-1](#) illustrates the definitions in relation to HV activities.

**Table 14-1 HV definitions**

Item	Definition
<b>Approved</b>	<p>An employee who is approved in writing to be a member of a HV Work Team or a HV Testing Team.</p> <p>The employee may be:</p> <ol style="list-style-type: none"> <li>an apprentice electrician in HV training</li> <li>an electrician in HV training</li> <li>an employee assisting in carrying out work or testing on electrical apparatus and/or electrical overhead lines or</li> <li>an employee carrying out non-Electrical Apparatus work in HV areas and/or HV and LV combined areas.</li> </ol>
<b>Authorised</b>	<p>Authorised in writing by SWC.</p> <p>Employees may be Authorised as:</p> <ol style="list-style-type: none"> <li>Authorised HV operator; and/or</li> <li>Authorised HV recipient for access permit for work and/or</li> <li>Authorised HV recipient for access permit for test and/or</li> <li>Authorised to work.</li> </ol> <p>SWC, subject to qualifications and training may further authorise an employee as:</p> <ol style="list-style-type: none"> <li>Authorised HV switching instruction writing officer and/or</li> </ol>

Item	Definition
	b) Authorised switching instruction verifying officer.

## 14.1 Scope of work

The scope of work is to meet the following objectives:

- a) To maintain a safe and reliable operation of HV power supplies and HV electrical apparatus:
  - (i) by detecting any failed, damaged or deficient asset of SWC, which may be reasonably discerned by competent staff
  - (ii) by anticipating during inspection, situations where there is reasonable likelihood of subsequent failure or damage to SWC's asset or interruption to supply
  - (iii) by anticipating during inspection, situations where there is reasonable likelihood of fire or risk of electric shock or other injury to persons involving SWC's asset and
  - (iv) by providing planned maintenance to ensure HV apparatus is kept in a serviceable safe condition.
- b) To comply with NSW legislative requirements or their latest equivalent, including:
  - (i) The Gas & Electricity (Consumer Safety) Act 2018
  - (ii) The Gas & Electricity (Consumer Safety) Regulation 2018
  - (iii) Electricity Supply (Safety and Network Management) Regulation 2014
  - (iv) Electricity Supply Act 1995; current version 1st June 2019; (v) Service & Installation Rules 2018 - Energy NSW
  - (v) WorkSafe NSW Code of Practice - Managing electrical Risks in the workplace.
- c) To comply with the requirements of the Electrical Distributing Authorities, including:
  - (i) Network Management Plans
  - (ii) Bushfire Risk Management
  - (iii) Customer Installation Safety Plans
  - (iv) Public Electrical Safety Awareness Plans.
- d) To comply with the latest requirements of the relevant 'Codes of Practice', Regulations, Acts and Australian Standards. Some current examples are:
  - (v) AS/NZS 3000:2008 Wiring rules
  - (vi) AS2067-2008 Substations and HV Installations
  - (vii) Electricity Distributing Authority Network Standards
  - (viii) New South Wales Service and Installation Rules
  - (ix) Electricity Distributing Authority 'High Voltage Safe Working Practices Training Course' or equivalent.



- e) To comply with the SWC's 'High Voltage Operating Procedures' 3rd Edition 2013 (known as the Black Book) or their latest updates
- f) To fulfil a 'duty of care' to SWC and the community.

## 14.2 Application

The Contractor must carry out inspections and maintenance on all HV electrical apparatus included in the Contract in accordance with the Preventive Maintenance Schedule and Job Plans. Any additional and/or modifications to Schedules and Job Plans submitted by the Contractor and/or SWC in the Contract and any future Maintenance improvement plans must be incorporated into the inspection and Maintenance program subject to the approval of SWC.

All work must be carried out in accordance with all relevant 'Codes of Practice', Regulations, Australian Standards and Electrical Distributing Authorities documents, examples detailed above.

## 14.3 High voltage switching operations

### 14.3.1 Scope

In performing HV switching operations, the Contractor must conform to the Electricity (Consumer Safety) Act 2018 (NSW) or its latest equivalent.

### 14.3.2 Scope of work

The Contractor is responsible for:

- a) Nomination of staff to operate HV electrical apparatus and obtain authorisation from SWC's HV Authorising Officer
- b) Provision of all relevant training to the Contractor's employees
- c) Co-ordination of safety and operating procedure with the Electricity Network Operator's staff where necessary
- d) Compliance with the SWC's High Voltage Operating Procedures
- e) Ensuring all the Contractor's employees working on HV electrical apparatus in HV sub-stations/areas are either Authorised or Approved as defined in Section 14.4.1 (below) and have received a copy of SWC's 'High Voltage Operating Procedures'
- f) Availability of Safety Signs, Danger Tags and necessary forms at each HV sub-stations/switch rooms
- g) Provision of marked-up HV System Diagrams if any modification is carried out on the HV Equipment by the Contractor and forward a copy of diagram to SWC's HV Authorising Officer
- h) Preparation and submission of 'Request for Switching and/or Access Permit' Forms for all work to be carried out by the Contractor's HV employees
- i) Provision of live-line testing Equipment, with self-testing Facilities for proving de-energised the electrical apparatus installed.

#### Note:

- a) SWC will provide a security keying system including the supply of keys and re-keying where necessary of existing HV locks.
- b) The Contractor will maintain a register of keys for HV switchgear, transformer yards and switch rooms. Keys will be issued on a personal basis, signed for and it is agreed, that they will not be copied and will be returned to the Contractor at the end of the Contract or on the termination of employment of the employee.



## 14.4 High voltage approval or authorisation

### 14.4.1 Qualifications and experience for approval or authorisation

The following provides a general overview of the qualifications, experience and training required by an employee to be Approved or Authorised.

#### QUALIFICATIONS

The following outlines the level of qualifications required for HV Approval or Authorisation.

##### Mandatory requirements

- a) Distributing Authority High Voltage Safe Working Practices Training: four days for Access Permit Issuers and Receivers (to be currently valid by completing the one day revalidation each year)
- b) Confined Space Training: (Complete Course if Authorisation to enter Confined Spaces is required)
- c) HIDRA Training: (Hazard Identification and Risk Assessment (can be part of another accepted training course))
- d) SWC's 'High Voltage Operating Procedures' (Third Edition Black Book) Training
- e) HV Authorisation requires the applicant to be the holder of an Electrical 'Qualified Supervisor Certificate' or equivalent
- f) To be Authorised to work on overhead lines or carry out cable jointing and splicing work the employee must provide evidence of appropriate training and experience.

#### EXPERIENCE/TRAINING

For Authorisation an employee must have a minimum of two years' experience, excluding apprenticeship in HV (exceeding 1000 volts (V) alternating current (AC) or exceeding 1500 V direct current (DC) up to 33,000 V) electrical apparatus: e.g.:

- a) Air circuit breakers
- b) Oil circuit breakers
- c) Minimum oil circuit breakers
- d) Ring Main Units
- e) SF6 Circuit Breakers
- f) Vacuum Circuit Breakers
- g) Cable/cable jointing and terminating (overhead and underground)
- h) HV Protection Equipment
- i) HV Motors and Starters
- j) Power Transformers and Appropriate Protection Equipment
- k) HV Switchboards and Bus Sections
- l) HV Links and Drop Out Fuses
- m) Overhead Lines
- n) HV Earthing Requirements
- o) Laying, joining and/or splicing of underground HV cables
- p) Overhead HV electrical distribution lines.

The standards for Approval and/or Authorisation may be updated throughout the term of the Contract based on changes to any of the relevant 'Codes of Practice', Regulations, Australian Standards, Electrical Distributing Authorities Documents and SWC's 'High Voltage Operating Procedures'.

**Note:** Approval or Authorisation in writing (Issue of SWC's High Voltage Operating Procedures Third Edition Black Book) will not be validated until after employees have completed Familiarisation training at all relevant HV Sites. Authorisation for 'High Voltage Operator' will not be validated until an employee has completed the Familiarisation training and can demonstrate operating skills and Maintenance expertise in relation to all the different types of HV switchgear employed at SWC's HV Sites.

### 14.4.2 Electrical testing and instruments

The Contractor must provide adequate testing instruments to carry out all required HV Testing procedures as appropriate to field Maintenance services without the support of specialist subcontractors.

Some of the required tests are detailed below:

- a) HV measurements (1000 to 33,000 V)
- b) Circuit Breaker Contacts Resistance Tests (Micro ohms)
- c) Earth Electrode Earth Resistance Test
- d) Earthing System Resistance Test
- e) Insulation Resistance (Various Types) Tests
- f) Fault Loop Impedance Test
- g) Continuity of Earthing System Test
- h) Temperature Readings
- i) Thermography Testing
- j) Transformer Oil-Breakdown Voltage (Electrical Dielectric) Tests
- k) Power Frequency Voltage Withstand Test
- l) Performance of Protection Relays Tests
- m) Diagnostic (Circuit Breakers) Testing
- n) Secondary Cell Batteries Testing.

## 15. Telemetry and plant SCADA system maintenance

SWC uses computerised controls and monitoring systems (SCADA & IICATS) for the operation of Treatment plants and water and wastewater network assets such as water pumping stations, reservoirs, valves, gauges, sewage pumping stations and the like, that SWC has classified these control systems as mission critical and security of control systems and their interconnection is increasingly becoming an issue. SWC has developed a policy and standards to mitigate this security risk. All personnel who carry out services within any of SWC's control system must meet all the requirements of following documents:

- Must comply with SCADA security Policy
- Must follow all the requirements identified in the relevant specifications and standards. For any further requirements, please refer to the SWC TOGS-TS01 IICATS and D0000724 Treatment plant SCADA technical specifications.

## 16. Civil maintenance

The following Operating Protocols and Maintenance Specifications (OPAMS) provide details on SWC's requirements for all civil-related works. The Contractor must comply with the following requirements as specified in:

- BMIS0047 Operating Protocols And Maintenance Specifications (OPAMS) - Storm Water
- BMIS0057 Operating Protocols And Maintenance Specifications (OPAMS) - Water and Recycle Water
- BMIS0100 Operating Protocols And Maintenance Specifications (OPAMS) - Wastewater

## 17. Glossary of terms - abbreviations

The purpose of the Terms and Definitions tables (below) is to ensure consistency in the use of language by general audience for asset maintenance information standards across SWC assets.

Maintenance related Terms and Definitions are available in the document D0000646 Maintenance Terms and Definitions Standard v3. The same information and additional definitions can be accessed from Collibra.

Abbreviation are often used to facilitate and shorten written narratives. SWC has an extensive list of abbreviations that are used in various documentation. All acronyms used by SWC are available on Collibra.

Item	Definition
GPO	General Power Outlet
MHF	Major Hazardous Facility
MPM	Major Periodic Maintenance
OPAMS	Operating Protocols and Maintenance Specifications
PBM	S3 Periodic Basic Maintenance
PDM	S6 Predictive Maintenance
PM	Preventive Maintenance
PSI	S2 Periodic Scheduled Inspection
PSM	S4 Periodic Scheduled Maintenance
RFM	S1 Failure based maintenance - run to fail
SOC	Systems Operation Centre
SPS	Sewer Pumping Stations
TAR	Technical Asset Register
UBM	S5 Usage Based Maintenance
WHS	Work Health and Safety

## 18. Glossary of terms - definitions

Item	Definition
<b>Asset</b>	A structure or an item of plant or equipment that provides service potential e.g.: An individual piece of Equipment within an assembly such as a pump, motor, valve etc
<b>Consumables</b>	Miscellaneous items, which are consumed or replaced on an ongoing basis because of Maintenance work e.g. top up grease, top up oil, cleaning fluids, abrasive sheets, stationary and other disposable items of a like nature.
<b>Employee</b>	For this purpose, an Employee means any person in the employment of SWC and employees of the Contractor and its approved subcontractors, who are engaged in the design, construction, operation and Maintenance of the Electrical Equipment owned and operated by SWC.
<b>Equipment</b>	Apparatus consisting of interrelated parts with separate functions used in the performance of work e.g.: electric motor pump, air conditioner air blower
<b>Facilities</b>	An aggregation of assets located within a designated geographical area that are associated to provide a function or service. For example, pumping station, reservoir, treatment plant, etc
<b>Materials</b>	Items used to carry out work activity on an asset. All materials used in the work activity need to be recorded to manage inventory and future maintenance planning.
<b>Property, Plant and Equipment</b>	A set of tangible assets held by an entity for use in the production or supply of goods or services, for rental to others, or for administrative purposes that are expected to be used for more than one period.
<b>Site</b>	A group of SW real estate and facilities within a common ground with a common entry access (usually with a common address).
<b>Tools</b>	Are the plant and equipment hired to carry out the activity

## 19. References

The document templates relevant to maintenance are tabled below:

Document type	Title
Specification	BMIS0209 Technical Specification - Mechanical
Specification	CPDMS0022 Technical Specification - Electrical
Specification	CPDMS0023 Technical Specification - Civil
Specification	HSS0009 Technical Specification - IICATS
Specification	Technical Specification - SCADA
Specification	Technical Specification - Commissioning
Specification	Technical Specification - Facilities Management
Specification	Management Specification
Form	Request for Switching and/or Access Permit Form
Policy	Asset Management Policy - AMQ0002
Policy	Drinking Water Management Policy -- BMIS 0213.13
Policy	SCADA Security Policy - ICONN_UD_605181
Procedure	Mechanical and Electrical Like for Like filed based decision framework - DOC0328

Document type	Title
Procedure	Australian Drinking Water Guidelines (Updated May 2019) - <a href="https://www.nhmrc.gov.au/about-us/publications/australian-drinking-water-guidelines#block-views-block-file-attachments-content-block-1">https://www.nhmrc.gov.au/about-us/publications/australian-drinking-water-guidelines#block-views-block-file-attachments-content-block-1</a>
Procedure	High Voltage Operating Procedures 3rd Edition , 2013
Process	Asset Core Data attributes for asset maintenance and operation document - D0000468
Process	Treatment Plant Operational Change Management - IMS0038
Process	Disinfection Safety Guideline for Liquefied Gaseous Chlorine - TG 501
Process	Competency training process for WT16 Authorised Maintenance Providers - D0000859
Standard	Treatment plant SCADA standard - D0000724
Standard	Job plan Data standard - MEPR0074.01
Standard	PM data Standard - MEPR0075.01
Standard	Work Order Data Standard – Maintenance - D0000373
Standard	Classification & Management Of Flammable Gas Hazardous Areas -- TG -502
Standard	Treatment plant SCADA standard - D0000724
Standard	Maintenance Terms and Definitions Standard v3 - D0000646
Standard	Operating Protocols And Maintenance Specifications (OPAMS) - Storm Water -- BMIS 0047
Standard	Operating Protocols And Maintenance Specifications (OPAMS) - Water and Recycle Water -- BMIS 0057
Standard	Operating Protocols And Maintenance Specifications (OPAMS) - Wastewater - BMIS0100
Strategy	Maintenance Strategy Definition - D0000654

## 20. Ownership

Role	Title
<b>Group</b>	Liveable City Solutions, Service Planning & Asset strategy
<b>Owner</b>	Norbert Schaeper, Service Planning Manager, Asset Reliability Planning
<b>Author</b>	Mahen Mahendrarvarman, Service Planning Lead

### 20.1 Change history

Version	Issue Date	Approved by	Brief description of change and consultation
1	24/09/2019	Norbert Schaeper, Service Planning Manager, Asset Reliability Planning	New document