Technical Specification - Commissioning

TRANSITIONING ASSETS INTO OPERATION

Document Change Summary

Version No.	Clause	Changes in this revision
2	Whole document	Commissioning and Acceptance (CA) changed to Operational Acceptance (OA), Contractor changed to Service Provider
	2	Mechanical equipment FAT added. Minor amendments
	3	Minor amendments to clarify responsibilities. When commissioning plan to be finalised and submission of documentation prior to pre-commissioning changed
	5.1	Finalisation of the Commissioning Plan and subsequent review during construction phase included. Minor amendments related to generic ITPs
	7	Minor amendments.
	7.3.3	Clause number added. Duration and applicable standards of test changed. Clause 7.3.3.2 Use of Applicable standards changed
	7.4	FAT Testing of instruments and monitoring systems added
	9	Not used. Amended content included in Clause10
	10.1	Commissioning phases amended and reference to Appendices changed,
	10.2	Minor amendments including references to appendices
	12.1	Reference to interim operation ITP added
	13.2	Reference to start of process proving added
	14.3	Document upload requirements prior to handover added
	16.2.1	Reference to sampling and testing amended
	19.6.3	Minor amendments and from the test pressure pump unit is subjected to" minimum" removed
	19.5	Not used. Amended content included in Clause 19.8.3
	19.6	Clause number changed to Clause 19.8.2
	19.7.3	Heading amended, testing requirements changed, and applicable appendices added
	19.8	Clause 19.8.2, 19.8.4 added
	20	Not used. Amended content included in Clause 1
	22	Table listing the appendices removed and the relevant amended appendices included in the document

1. Introduction

1.1 Purpose

Commissioning is the process of managing all activities required to verify and document the compliance, performance, functionality and transitioning to operation of new, renewed, or modified assets.

This document defines, outlines, and details the commissioning process and includes inspections, testing, configuration, performance optimisation, defect management and document requirements through to operation.

1.2 General

This Commissioning specification sets out the minimum requirements for the management and implementation of commissioning services to be provided across Sydney Water Corporation (SWC) portfolio by the internal and external Service Provider.

The commissioning process and responsibilities are introduced in the early sections of the document, with detailed requirements for each step then presented chronological throughout the following sections.

1.3 Applicability

This document is applicable to:

New assets delivered via internal resources

New assets delivered by external Service Providers including Developers

Renewal of existing assets

Major overhauls of assets

Modified or replacement of assets as part of maintenance activities

Temporary operating arrangements required for upgrade works.

1.4 Acronyms

The following terms are used throughout this document.

Term / Acronym	Meaning as used in this Document
ADWG	Australian Drinking Water Guidelines
BOD	Biochemical Oxygen Demand
CCTV	Closed Circuit TV
CDU	Chemical Dosing Unit
CT	Current Transformer
dB	Decibel
dB(A)	Decibel A-weighted

Term / Acronym	Meaning as used in this Document
DICL	Ductile Iron Cement Lined
DN	Nominal Diameter of a pipe
dpi	Dots per square inch
EDMS	Engineering Drawing Management System
EEHA	Electrical Equipment in Hazardous Areas
FAT	Factory Acceptance Test
FDS	Functional Design Specification
FIFM	Flow Isolation and / or Flow Management
FMECA	Failure Mode, Effects, and Criticality Analysis
FST	Final System Test
GPO	General Power Outlet
HIDRA	Hazard Identification and Risk Assessment
HMI	Human Machine Interface
HSL	House Service Line
HT	Hydrostatic Testing
HV	High Voltage
Hz	Hertz
IICATS	Integrated Instrumentation Control Automation & Telemetry System
I/O	Control Signal Inputs and Outputs
IFC	Issued For Construction
IFR	Issued For Review
ITC	Inspection and Test Checklist
IOP	Interim Operating Procedures
ITP	Installation and Test Plan
LOTO	Lock Out Tag Out
MCC	Motor Control Cubicle or Cabinet
MDF	Main Distribution Frame

Term / Acronym	Meaning as used in this Document
MDR	Manufacturer data report
MMD	Monitoring and Measuring Devices
MPM	Major Periodic Maintenance
MTBF	Mean Time Between Failure
MTBR	Mean Time Between Repair
MTTR	Mean Time To Recovery
NCR	Non-Conformance
NOE	Notice of Energisation
OCR	Operational Change Request
OCU	Odour Control Units
O&M	Operation and Maintenance
OEM	Original Equipment Manufacturer
OTDR	Optical Time Domain Reflectometer
OT	Operational Technology
PE	Polyethylene
PEFD	Plain English Functional Description / Process Control Philosophy
PCV	Pressure Control Valve
PFD	Process Flow Diagram
P&ID	Process and Instrumentation Diagram
PLC	Programmable Logic Controller
PLF	Process Limiting Factors
PRV	Pressure Reducing Valve
PSAT	Pre-Site Acceptance Test
QC	Quality Control
RL	Reduced Level
RTU	Remote Telemetry Unit
SAT	Site Acceptance Test

Term / Acronym	Meaning as used in this Document
SCADA	Supervisory Control and Data Acquisition
SDP	Software Download Plan
SDS	Safety Data Sheets
SFAT	Software Factory Acceptance Test
SiD	Safety in Design
SME	Subject Matter Expert
SOC	SW Telemetry System, Systems Operation Centre
SOP	Standard Operating Procedure
SPL	Sound Pressure Levels
SPS	Strategic Product Specification
SUSN	Site Update Status Notification
SWL	Sound Power Levels
SWMS	Safe Work Method Statement
TAR	Technical Asset Register (Hydra/Maximo)
TOM	Temporary Operating Mode
UPG	Unit Process Guideline
VSD	Variable Speed Drive
WAC	Work As Constructed
WPS	Welding Procedure Specification

1.5 Definitions

The following terms are defined as they are applicable to SWC:

Term / Acronym	Definition
Facility	A system of infrastructure components designed to work together and controlled as a single entity. Facilities generally have all components located on the same site.
Enterprise Asset Management System (EAMS)	SWC's current enterprise asset management system
OA Team	Operational Acceptance Team (SWC Customer Delivery) who is responsible for the compliance verifications, approval of HOLD

	POINTS, sign off and transitioning of network assets into operation and endorsement of treatment assets transitioning to operation
HOLD POINT	An activity requiring verification and approval from SWC to proceed to the next stage of work

1.6 Asset types

SWC has many different water and wastewater asset types, requiring varying commissioning approaches. Table 1.6.1 presents the asset types and terminology across all asset types.

Table 1.6.1: SWC Asset Types

Facility code	Description	Facility code	Description
CP	Cathodic Protection	**SS**	Wastewater Storage Reservoir / Surge Tank
DB	Stormwater Bridges or Aqueducts	**ST**	Wastewater Treatment Plant
DP	Stormwater Pumping Station	**SU**	Wastewater Overflow Storage Facility
DR	Stormwater Silt / Pollutant traps	**SV**	Wastewater Syphons
FM	Facility Maintenance	**SW**	Wastewater Not Used
GE	General Not Used	**SX**	Wastewater Chemical Dosing Unit
GG	General Gauging site	**SY**	Wastewater Odour Control Unit
RF	Recycled Flow meters	**TD**	Corrosion Control System
RK	Recycled Valve Site (IICATS Monitored)	**TP**	Electrolysis Test Point
RM	Recycled Major Main or Carrier	**WC**	Water Channels / Canals / Conduits
RN	Recycled Distribution or Reticulation Main	**WD**	Water Dams / Weirs / Detention Basins
RP	Recycled Pumping Station	**WF**	Water Flow meters
RQ	Recycled Product Monitoring Point - Quality	**WG**	Water Gauging site
RS	Recycled Storage Reservoir / Surge Tank	**WH**	Water Hydro Stations
RT	Recycled Treatment Plant	**WK**	Water Valve Site (IICATS Monitored)
RX	Recycled Chemical Dosing Unit	**WM**	Water Major Main or Carrier
SC	Wastewater Channels / Canals / Conduits	**WN**	Water Distribution or Reticulation Main

Facility code	Description	Facility code	Description
SF	Wastewater Flow meters	**WP**	Water Pumping Station
SG	Wastewater Gauging site	**WQ**	Water Product Monitoring Point - Quality
SK	Wastewater Valve Site (IICATS Monitored)	**WS**	Water Storage Reservoir / Surge Tank
SL	Wastewater Low Pressure House Pump	**WT**	Water Treatment Plant
SM	Wastewater Major Main or Carrier	**WU**	Water Overflow Storage Facility
SN	Wastewater Distribution or Reticulation Main	**WX**	Water Chemical Dosing Unit
SO	Wastewater Overflow Monitor / Floodway	**WZ**	Water Unclassified Facilities
SP	Wastewater Pumping Station	**DG**	Stormwater Gauging site
SQ	Wastewater Product Monitoring Point - Quality		
SR	Wastewater Silt / Pollutant traps		

1.7 Control and monitoring system classifications

SWC sites are classified as Monitored or Unmonitored sites, defined as follows:

Monitored sites: Sites that require remote monitoring for operations

Unmonitored sites: Sites with no remote monitoring.

There are two distinct groups in SWC for development and application of control and monitoring systems for operating assets. Both these groups are within SWC's Operational Technology Services (OT) group within Digital Business.

Supervisory Control and Data Acquisition (SCADA) is the monitoring and control protocol used throughout treatment facilities

Integrated Instrumentation, Control, Automation and Telemetry System (IICATS) is a remote monitoring and control system, used on network assets, and remote monitoring of unmanned treatment facilities.

There are significant differences between the two systems, and as such it is critical that the Service Providers understands the interface requirements and obligations relating to a specific project or asset type, and clearly articulate these in management plans. The respective responsibilities are detailed in Section 0.

Monitored sites (IICATS)

SWC will undertake software development, review, testing and integration for any site using IICATS. This is a specific differentiator between IICATS sites and other controlled sites using SCADA systems.

The following requirements are specific to IICATS monitored site commissioning:

The RTU will be supplied by OT, unless otherwise stated in the Contract. If the RTU supplied by SWC is found to be faulty the Service Provider must record the nature of the failure and notify SWC. The Service Provider must return the RTU to SWC. SWC will then provide a new RTU. Tests must be repeated when a replacement RTU is installed.

SWC will carry out IICATS Telemetry and picture testing. The IICATS site-commissioning engineer will communicate with a remote IICATS workstation operator (IICATS Commissioning Technical Support Officer) during these tests. The Service Provider must assist and make allowance for this time in his schedule and necessary modifications to the RTU/PLC hardware.

The Service Provider is required to produce a PEFD for all water and wastewater, CDUs and PRV/PCV as a result of the site-specific requirements for these asset types. For other asset types the Service Provider will confirm with IICATS if a PEFD is required, or if an existing site template can be applied.

Monitored sites (SCADA)

The commissioning of SCADA sites may require modifications to existing plant process and hydraulics and is almost always undertaken on brownfield assets.

All SCADA control system development, testing and commissioning will be undertaken by OT's designated Software Service Provider, based on the design provided by the Principal Service Provider and under the direction and management of The Principal Service Provider. Integration of the physical assets with the appropriate control system and final commissioning requires coordination and planning by The Service Provider between the relevant stakeholders, including OT and OT's designated Service Provider.

Un-Monitored sites (No remote control)

Unmonitored sites have no control or remote monitoring requirements. These sites still require commissioning as per the process defined in Section 0, with any control or monitoring system commissioning activities omitted.

1.8 Application of commissioning to maintenance activities

Commissioning is required on any asset that is replaced, upgraded, or returned to service after significant downtime, failure, or Major Periodic Maintenance (MPM) works.

The extent of commissioning required will depend on the complexity of the works, process and the equipment being placed into service.

Unless otherwise stated in the Contract or other documentation, the applicable commissioning process defined in Section 0 must be followed.

When returning assets to service, consideration must be given to recommissioning and testing back to the control system of assets that were also offline for extended periods as works were undertaken (e.g. if an entire system is offline for works on a small portion of the system). This testing should include as a minimum, confirmation of calibration of field devices against the control system.

2. Commissioning process

2.1 Commissioning methodology

The methodology for commissioning and transitioning assets into operation will be consistent with

. This process may vary or be simplified depending on the extent and complexity of the systems or assets being commissioned, and in consultation with SWC's stakeholders.

The following sections of this document provide the detail for each of the phases.

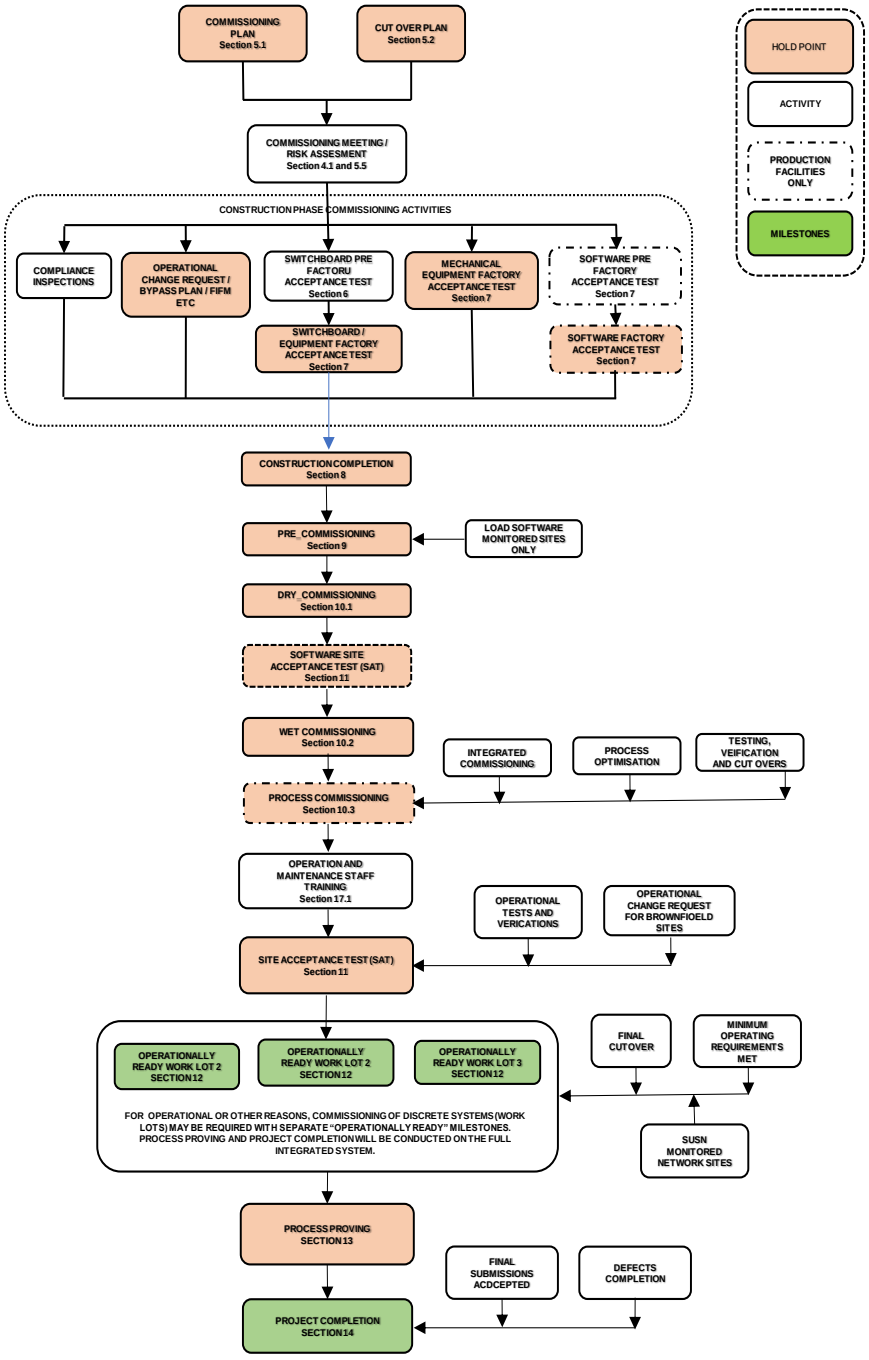


Figure 0.1-1: General commissioning methodology

3. Roles and responsibilities

There are two primary groups responsible for commissioning SWC assets. This includes.

The Service Provider Commissioning Team

SWC Operational Acceptance (OA) Team.

The key responsibilities of the commissioning representative from each team are summarised below:

The Service Provider Commissioning Lead is responsible for coordinating all commissioning activities and overseeing delivery of commissioning (inclusive of process proving and optimisation) in accordance with the commissioning plan, and in compliance with the project scope and technical specifications.

The Operational Acceptance (OA) Team representative from SWC will ensure the correct application of the commissioning process, operation of the asset is not adversely affected by the commissioning work, verify compliance to standards and specifications and will accept Network assets on behalf of SWC and recommend acceptance to Production staff for Treatment Facilities.

The Service provider must ensure that experienced and qualified personnel are present during testing, commissioning, and proving. They will provide technical expertise, supervision, adjustment/optimisation, remedial work, liaison with the OA Team Representative and training. The Service Provider is responsible for the coordination of all commissioning activities, and provision of a Commissioning Lead to manage and oversee the commissioning process.

The Service Provider is responsible for facilitating all inspections, carrying out all required testing, commissioning (i.e. set up of process parameters), process proving and process optimisation (optimising based on field data) of the plant, including the provision of all labour, materials, testing and any specific arrangements that may be deemed by SWC to be necessary to achieve the testing required.

The OA Team reserves the right to halt the commissioning process at any time here documentation, installation or other aspects of the project do not meet the requirements of this, or other specifications nominated. The Service Provider will be held responsible for delays caused by incomplete works, documentation, or a lack of preparedness.

3.1 Networks facilities responsibility matrix

OA	Operational acceptance		**SP**	Service Provider	
OP	Operations		**OT**	Operational Technology (IICATS or SMART/SCADA)	
PD	Project Delivery		**DESIGN**	Designer (may be SW Internal, or Service Provider /Consultant)	
R	**Responsible**	The party who carries out the activity and holds responsibility for completing it.	**C**	**Consulted**	Not directly involved with carrying out the activity but are consulted. Generally, a stakeholder or subject matter expert for endorsement / sign off eg. Hold points, FAT, ITPs
A	**Accountable**	The party who is ultimately accountable for process or task being completed appropriately. Responsible party is accountable to this party.	**I**	**Informed**	Those who receive output from the process or task or have a need to stay informed.

	Activity		SP	DESIGN[1]	PD	OP	OA	OT (IICATS)	Comments
1.0	**Concept design phase (as applicable)**								
	1	Inform IICATs and Customer Delivery of Project	-	R	A	I	I	I	
	2	Issue Preliminary I/O List & Advice Concerning I&C Standards	I	I	A	-	I	R	
	3	Request Drawing Templates (as Applicable)	I	R	A	-	C	C	
	4	Draft Design	*	R	A	C	C	C	*Responsibility will depend on Design &Construct (D &C) or Construct Only, including need specification or design basis.
	5	Design Review Meeting / SiD Meetings	*	R	A	C	C	C	*10 business days' notice required for attendance at reviews.* *Responsibility will depend on D&C or C Only
	6	Provide revised I/O List (if Required)	I	C	A	I	I	R	
	7	Review Finalised Design	C	C	R	I	C	I	*Min. 10 business days required for review of documentation* SW-PM to determine FIFM / OCR / bypass requirements during Conceptual Design
2.0	**Detail design phase (as applicable)**								
	1	Notify IICATS and Customer Delivery of Contract Award	-	-	R/A	I	I	I	
	2	Project Kick Off Meeting	C	C	R/A	C	C	C	*5 business days' notice required for attendance at meetings*
	3	Request Facility and Functional Location Numbers (TAR) / Distribute	*	R	A	-	-	I	*Responsibility will depend on D&C or C Only
	4	Detailed Design	*	R	A	C	C	C	*Responsibility will depend on D&C or C Only, including equipment schedules, draft O&M
	5	Design Review Meeting / SiD Meetings	*	R	A	C	C	C	*10 business days' notice required for attendance at reviews.* *Responsibility will depend on D&C or C Only
	6	Critical Spares Assessment	C	*R	A	C	C	C	* Supply Chain Operations & Reliability Engineers to participate in assessment
	7	Provide revised I/O List (if Required)	I	I	A	-	I	R	
	8	Plain English Function Description	C	*R	A	C	C	C	*Required if control system does not adhere to a standard template. Confirm with IICATS
	9	Prepare Construction Methodology	R	C	A	C	C	C	

[1] Design activities relevant to commissioning shown here for clarity, particularly where the designer and Service Provider may be different parties.

	Activity		SP	DESIGN[1]	PD	OP	OA	OT (IICATS)	Comments
	10	Prepare Draft Commissioning Plan	R	C	A	C	C	C	*Min. 10 business days required for review of documentation*
	11	Prepare Cut-Over Plan	R	C	A	C	C	C	*Min. 10 business days required for review of documentation*
	12	Review Finalised Design	C	C	A/R	I	C	C	SW-PM to determine FIFM / OCR / bypass requirements during Conceptual Design
	13	Provide Operational Acceptance Team list of project specific Test, Hold and Witness Points for inclusion in Plan	I	I	A	-	R	-	Example provided in Appendix C
	14	Review Finalise Cut Over Plan	R	C	A	C	*C	C	**HOLD POINT** *OA endorsement Required.
	14	Review Finalise Commissioning Plan	R	C	A	C	*C	C	**HOLD POINT** *OA endorsement Required.
	15	Develop FDS, Config and Picture, Control Sequence for PLC and RTU, Integration tests and Alarm Help.	I	I	A	C	I	R	Designer is responsible for design calculations, cut-in/out levels, control setpoints and other process parameters for renewed assets.
3.0	**Pre-construction**								
3.1	**Brownfield (existing) assets**								
	1	Provide Info for Operational Change Request (OCR)	R	C	A	I	I	I	
	2	Review, Approve & Issue OCR	I	-	I	R	C	I	*Min. 7 business days required* Once issued, SOC will manage the OCR
	3	Finalise Bypass Plan and FIFM (As Applicable)	R	-	A	C	C	C	Follow the appropriate FIFM Process.
	4	Inform Stakeholders of Commissioning Date	R	-	A	I	I	I	*10 business days' notice required*
	5	Commission Bypass System	R	-	A	C	*C	C	**HOLD POINT** *OA endorsement Required.
3.2	**Greenfield (new) assets**								
	1	Inform Stakeholders of Commissioning Date	R	-	A	-	I	I	*10 business days' notice required*
4.0	**During construction**								
	1	Commissioning Meetings / Risk Workshops	R	C	A	C	C	C	*5 business days' notice required for attendance at meetings.*
	2	Update Commissioning Plan, ITPs & ITCs	R	-	A	C	*C	C	**HOLD POINT** *OA endorsement Required.
	3	Provide Asset Data	R	-	A	I	I	I	**HOLD POINT**
	4	Pre-FAT on Manufactured Equipment	R	C	A	-	C	I	

	Activity		SP	DESIGN[1]	PD	OP	OA	OT (IICATS)	Comments
	5	FAT on Manufactured Equipment	R	C	A	-	*C	C	*10 business days' notice required for attendance at meetings.* *ITPs for FAT to be provided 10 business days prior to FAT for review.* **HOLD POINT** SW to Witness tests as per ITP Requirements. *OA endorsement required.
	6	Prepare Technical Spec Spreadsheet and Contingency Schematic	C	C	A/*R	C	C	-	*SWC Project Engineer
	7	Issue Contingency and Facility Information file to TAR	-	-	A	R	C	*C	*TAR Data uploaded to IICATS (Automated nightly process)
	8	Trial FIFM (As applicable)	R	-	A	C	I	C	As per approved FIFM process
	9	Construction Compliance Inspection(s)	R	-	A	C	C	-	May occur multiple times throughout construction.
	10	Construction ITP and ITC Finalisation	R	-	A	-	C	-	
	11	Construction Defects Site Walk	R	-	A	C	C	C	*10 business days' notice required for attendance at meetings.*
	12	Obtain Verification Certificate (TAR)	R	-	A	-	I	-	**HOLD POINT**
	13	Submit Training Plan /Docs	R	-	A	C	C	C	*To be submitted for review 20 business days prior to the start of training.*
	14	Submit Draft O&M	R	C	A	C	C	C	
	15	Submit Red Pen Marked up drawings	R	C	A	I	C	C	
	16	Installation Completion Report	R	-	A	C	C	C	**HOLD POINT, including submission of fabrication MDRs**
5.0	**Commissioning (section 10)**								
5.1	***Dry-commissioning***								
	1	Successfully Complete Dry-Commissioning Tests as per ITPs, ITCs. (Un-energised)	R	-	A	-	C	C	**HOLD POINT** SW to Witness tests as per ITP Requirements.
	2	Submit all deliverables after Dry-Commissioning	R	-	A	-	C	I	
	3	Update Defects Register	R	-	A	I	C	I	
	4	Notice Of Energisation	R	-	A	I	C	C	
5.2	***Pre-commissioning***								
	1	Energise Relevant Electrical / Controls	R	-	A	I	C	C	**HOLD POINT** *OA endorsement required.
	2	Load Software, Check Asset Visible on SOC	C	I	A	-	C	R	
	3	Check Signals to Site Picture	C	I	A	-	C	R	

	Activity		SP	DESIGN[1]	PD	OP	OA	OT (IICATS)	Comments
	4	Water Quality Testing (Water / Recycled Water Assets Only)	R	-	A	C	*C	-	**HOLD POINT** *OA endorsement required.
	5	Successfully Complete Pre-Commissioning Tests as per ITPs, ITCs.	R	-	A	-	C	C	**HOLD POINT** SW to Witness tests as per ITP Requirements.
	6	Complete Pre-Commissioning Checklist	R	-	A	I	*C	I	**HOLD POINT** *OA endorsement required.
	7	Submit all deliverables after Pre-Commissioning	R	-	A	-	C	C	**HOLD POINT**
	8	Update Defects Register	R	-	A	I	C	I	
5.3	***Wet-commissioning***		**SYSTEM POWERED UP AND TEST FLUID AVAILABLE**						
	1*	Provide Info for Operational Change Request (OCR)	R	C	A	I	C	I	*Only applies to Brownfield sites
	2*	Review, Approve & Issue OCR	I	-	I	R	I	I	*Min. 7 business days required* *Only applies to Brownfield sites Once issued, SOC will manage the OCR
	3	Approve Operational Test	-	-	A	I	R	I	**HOLD POINT**
	4	Successfully Complete Wet-Commissioning Tests as per ITPs, ITCs.	R	-	A	C	*C	C	SW to Witness tests as per ITP Requirements. *OA endorsement required.
	5	Submit all deliverables after Wet-Commissioning	R	-	A	-	C	C	**HOLD POINT**
	6	Update Defects Register	R	-	A	I	C	I	
6.0	**O&M training (section 0)**		R	C	A	C	C	C	
7.0	**Site acceptance testing (section 0)**		**SYSTEM POWERED UP AND PROCESS FLUID AVAILABLE**						
	1	Approve Operational Test	-	-	A	I	R	I	**HOLD POINT**
	2	Implement Cutover Plan*	R	-	A	C	C	C	SW to Witness tests as per ITP Requirements. *Not applicable to greenfield sites.
	3	Successfully Complete SAT as per ITPs, ITCs.	R	-	C	-	C	C	SW to Witness tests as per ITP Requirements. **HOLD POINT**
	4	Operational Test Period	R	-	A	C	*C	C	Duration as stated in Project Specification *OA endorsement required.
8.0	**Operationally ready (section 0)**								
	1	Defects walk and updated defects list.	R	-	A	C	C	C	*10 business days' notice required for attendance at meetings*
	2	Operational Minimum Deliverables provided (As per section 0).	R	-	A	I	C	C	

	Activity		SP	DESIGN[1]	PD	OP	OA	OT (IICATS)	Comments
	3	Place Asset into Normal Operation	-	-	-	C	A/R	C	
	4	Site Update Status Notification (SUSN)	-	-	-	I	A	R	After this point site will be monitored by SOC
9.0	**Process proving (section 0)**		**SITE OPERATES IN AUTO. SERVICE PROVIDER MONITORS PLANT AND RECTIFIES FAULTS AS ADVISED BY SOC.**						
	1	Process Proving Period	R	I	A	C	C	C	Duration as stated in Project Specification
	2	Successful Completion of Proving Period	-	-	A	I	R	I	**HOLD POINT**
	3	Finalise FDS and Store Online	-	-	-	-	C	A/R	
10	**Project completion (section 0)**								
	1	Submit Final Project Deliverables incl Commissioning Report (As per section 0)	R	C	A	C	C	C	
	2	Final Defect Walks	R	-	A	C	C	C	*10 business days' notice required for attendance at meetings*
	3	Defects Addressed and Closed out	R	-	A	I	C	C	
	4	Complete Commissioning Handover Checklist/workflow	R	-	A	C	C	C	**HOLD POINT**
	5	Asset Handover	C	C	A	C	R	C	

3.2 Treatment facilities responsibility matrix

OA	Operational acceptance		**SP**	Service Provider	
OP	Operations (Customer Delivery)		**OT**	Operational Technology (IICATS or SMART/SCADA)	
PD	Project Delivery		**DESIGN**	Designer (may be SW Internal, or Service Provider /Consultant)	
R	**Responsible**	The party who carries out the activity and holds responsibility for completing it.	**C**	**Consulted**	Not directly involved with carrying out the activity but are consulted. Generally, a stakeholder or subject matter expert for endorsement / sign off eg. Hold points, FAT, ITPs
A	**Accountable**	The party who is ultimately accountable for process or task being completed appropriately. Responsible party is accountable to this party.	**I**	**Informed**	Those who receive output from the process or task or have a need to stay informed.

	Activity		SP	DESIGN[2]	PD	OP	OA	OT (SCADA)	Comments
1.0	**Concept design phase (as applicable)**								
	1	Inform OT and Customer Delivery of Project	-	R	A	I	-	I	
	2	Request Drawing Templates (as Applicable)	I	R	A	-	C	C	
	3	Draft Design	*	R	A	C	C	C	*Responsibility will depend on Design &Construct (D &C) or Construct (C) Only,
	4	Design Review Meeting / SiD Meetings	*	R	A	C	C	C	*10 business days' notice required for attendance at meetings* *Responsibility will depend on D&C or C Only
	5	Confirm if any "Black Box" controllers proposed for use and provide details.	*	R	A	I	C	C	*Responsibility will depend on D&C or C Only
	6	Approve "Black Box" controllers	C	C	A	I	C	R	Required prior to procurement of equipment.
	7	Implement any requirements for "Black Box" Controller	*	R	A	I	C	C	*Responsibility will depend on D&C or C Only
	8	Review Finalised Design & Issue	R	C	A	I	C	I	*Min. 10 business days required for review of documentation* SW-PM to determine FIFM / OCR / bypass requirements during Conceptual Design
2.0	**Detail design phase (as applicable)**								
	1	Notify OT and Customer Delivery of Contract Award	-	-	R/A	I	I	I	
	2	Project Kick Off Meeting	C	C	R/A	C	C	C	*10 business days' notice required for attendance at meetings*
	3	Request Facility and Functional Location Numbers (TAR) / Distribute	*	R	A	I	-	I	*Responsibility will depend on D&C or C Only
	4	Detailed Design	*	R	A	C	C	C	*Responsibility will depend on D&C or C Only, including equipment schedules, draft O&M
	5	Design Review Meeting / SiD Meetings	*	R	A	C	C	C	*10 business days' notice required for attendance at meetings* *Responsibility will depend on D&C or C Only
	6	Critical Spares Assessment	C	R	A	C	C	C	*Include Supply Chain Operations
	7	Plain English Function Description	C	R	A	C	C	C	*Min. 10 business days required for review of documentation*
	8	Prepare Construction Methodology	R	C	A	C	C	C	

[2] Design activities relevant to commissioning shown here for clarity, particularly where the designer and Service Provider may be different parties.

	Activity		SP	DESIGN[2]	PD	OP	OA	OT (SCADA)	Comments
	9	Prepare Draft Commissioning Plan	R	C	A	C	C	C	*Min. 10 business days required for review of documentation*
	10	Prepare Cut-Over Plan	R	C	A	C	C	C	*Min. 10 business days required for review of documentation*
	11	Review Finalised Design	C	C	R/A	C	C	C	SW-PM to determine FIFM / OCR / bypass requirements during Conceptual Design
	12	Provide Operational Acceptance Team list of specific Test, Hold and Witness Points for Inclusion in Commissioning Plan	I	C	A	-	R	-	Example provided in Appendix F
	12	Control System Design Kick-off	*	R	A	C	C	C	*Responsibility will depend on D&C or C Only
	13	Develop FDS	*	*	A	C	C	R	*Responsibility will depend on D&C or C Only
	14	FDS Workshop / CHAZOP	C	C	A	C	C	R	
	15	SCADA/PLC Programming, Finalise FDS.	*	C	A	C	I	R	*Responsibility will depend on D&C or C Only
	16	Draft Software Download Plan	*	C	A	C	C	R	*Responsibility will depend on D&C or C Only
	17	E-Stop / Handstation Review Meeting	*	R	A	C	I	R	*Responsibility will depend on D&C or C Only
3.0	**Pre-construction**								
3.1	**Brownfield (existing) assets**								
	1	Provide Info for Production Change Management (IMS0038)	R	C	A	I	I	I	
	2	Review, Approve Change	I	-	I	R/A	C	I	
	3	Finalise Cutover Plan and FIFM (As Applicable)	R	-	A	C	C	C	Follow the appropriate FIFM Process.
	4	Inform Stakeholders of Commissioning Date	R	-	A	C	I	C	*10 business days' notice required*
	5	Commissioning Temporary Arrangements	R	-	A	C	C	C	
3.2	**Greenfield (new) assets**								
	1	Inform Stakeholders of Commissioning Date	R	-	A	C	I	C	*10 business days' notice required*
4.0	**During construction**								
	1	Commissioning Meeting / Risk Workshop	R	C	A	C	C	C	*10 business days' notice required for attendance at meetings*
	2	Provide Acceptance Team list of Test, Hold and Witness Points for Inclusion in Commissioning Plan	I	-	A	I	R	-	Example provided in Appendix E

	Activity		SP	DESIGN[2]	PD	OP	OA	OT (SCADA)	Comments
	3	Update /Finalise Commissioning Plan, ITPs & ITCs	R	-	A	C	C	C	*Finalised 20 business days prior to the start of commissioning.* **HOLD POINT**
	4	Provide Asset Data	R	-	A	I	I	I	**HOLD POINT**
	5	Pre-FAT on Manufactured Equipment	R	C	A	I	C	I	
	6	FAT on Manufactured Equipment	R	C	A	I	C	C	*10 business days' notice required for attendance at meetings.* *ITPs for FAT to be provided 10 business days prior to FAT for review.* **HOLD POINT**
	7	Pre-FAT on Software	I	C	A	I	I	R	
	8	FAT on Software	C	-	A	C	C	R	*10 business days' notice required for attendance at meetings.* **HOLD POINT**
	9	Trial FIFM (As applicable)	R		A	C	I	C	As per approved FIFM process
	10	Finalise Software Download Plan	*	C	A	C	C	R	*Finalised 5 business days prior to the download.* *Responsibility will depend on D&C or C Only
	11	Construction Compliance Inspection(s)	R	-	A	C	C	C	May occur multiple times through construction.
	12	Construction ITP and ITC Finalisation	R	-	A	C	I	-	
	13	Construction Defects Site Walk	R	-	A	C	C	C	*10 business days' notice required for attendance at meetings.*
	14	Installation Completion Report	R	-	A	C	C	I	**HOLD POINT, including submission of fabrication MDRs**
	15	Submit Training Plan /Docs	R	-	A	C	C	C	*To be submitted for review 20 business days prior to the start of training.*
	16	Submit Red Pen Marked up drawings	R	C	A	C	C	C	
	17	Submit Draft O&M	R	C	A	C	C	C	
	18	Obtain Verification Certificate (TAR)	R	-	A	I	I	I	SW to Witness tests as per ITP Requirements.
5.0	**Commissioning (section 0)**								
5.1	**Dry-commissioning (section 10)**		**PRELIMINARY ELECTRICAL & MECHANICAL**						
	1	Successfully Complete Dry-Commissioning Tests as per ITPs, ITCs. (Unenergised)	R	-	A	C	C	C	SW to Witness tests as per ITP Requirements.
	2	Submit all deliverables after Dry-Commissioning	R	-	A	I	*C	I	**HOLD POINT** *OA endorsement required.
	3	Notice of Energisation	R	-	A	I	C	C	

	Activity		SP	DESIGN[2]	PD	OP	OA	OT (SCADA)	Comments
	4	Update Defects Register	R	-	A	C	C	I	
5.2	***Pre-commissioning***		**SYSTEM POWERED UP**						
	1	Energise Relevant Electrical / Controls	R	-	A	I	*C	C	**HOLD POINT** *OA endorsement required.
	2	Download Software, Check Signals to PLC and SCADA	C	I	A	C	I	R	
		Water Quality Testing (Water Assets Only)	R	-	A	C	C	-	Water Treatment & Recycled Water Facilities.
	1	Successfully Complete Pre-Commissioning Tests as per ITPs, ITCs.	R	-	A	C	C	C	SW to Witness tests as per ITP Requirements.
		Complete Pre-Commissioning Checklist	R	-	A	C	*C	I	**HOLD POINT** *OA endorsement required.
	2	Submit all deliverables after Pre-Commissioning	R	-	A	I	C	I	**HOLD POINT**
	3	Update Defects Register	R	-	A	C	C	I	
5.3	***Wet-Commissioning***		**SYSTEM POWERED UP AND TEST FLUID AVAILABLE**						
	1	Successfully Complete Wet-Commissioning Tests as per ITPs, ITCs.	R	-	A	C	C	C	SW to Witness tests as per ITP Requirements.
	2	Submit all deliverables after Wet-Commissioning	R	-	A	I	C	I	**HOLD POINT**
	4	Update Defects Register	R	-	A	C	C	C	
6.0	**Software site acceptance testing**		**SYSTEM POWERED UP AND TEST FLUID AVAILABLE**						
	1	Successfully Complete SSAT as per ITPs, ITCs.	C	-	A	C	C	R	SW to Witness tests as per ITP Requirements. **HOLD POINT**
7.0	**Process commissioning (section** Error! R eference source not found.**)**								
7.1	**Testing cutover(s)**								
	1	Implement Testing Cutovers as per Plan	R	-	A	C	C	C	SW to Witness tests as per ITP Requirements.
7.2	**Integrated commissioning**		**SYSTEM POWERED UP AND PROCESS FLUID AVAILABLE**						
	1	Successfully Complete Integrated Commissioning Tests as per ITPs, ITCs.	R	-	A	C	C	C	SW to Witness tests as per ITP Requirements.
7.3	**Process optimisation**		**SYSTEM POWERED UP AND PROCESS FLUID AVAILABLE**						
	1	Successfully Complete Process Optimisation as per ITPs, ITCs.	R	-	A	C	C	C	SW to Witness tests as per ITP Requirements.
	2	Update Defects Register	R	-	A	C	C	I	
8.0	**O&M training (section 0)**		R	C	A	C	I	C	

	Activity		SP	DESIGN[2]	PD	OP	OA	OT (SCADA)	Comments
9.0	**Site acceptance testing (sat) (section 0)**								
	1	Successfully Complete SAT as per ITPs and ITCs	R	C	A	C	C	C	*10 business days' notice required for attendance at meetings.* SW to Witness tests as per ITP Requirements. **HOLD POINT**
	2	Operational Test Period	R	C	A	C	C	C	Duration as stated in Project Specification
	3	Approve Operational Test	-	-	A	I	R	I	**HOLD POINT**
10	**Operationally ready (section 0)**								
	1	Defects Walk and Updated Defects register	R	-	A	C	C	C	*10 business days' notice required for attendance at meetings.*
	2	Operational Minimum Deliverables provided (as per section 0)	R	C	A	C	C	C	
	3	Place Asset into Normal operation	-	-	A	R	C	C	
11	**Process proving (section 0)**		**SITE OPERATES IN AUTO.** Service Provider **MONITORS PLANT AND RECTIFIES FAULTS AS ADVISED BY SW.**						
	1	Full System Test	C	-	A	C	C	R	In accordance with Treatment SCADA Standards.
	2	Process Proving Period	R	C	A	C	C	C	
	3	Successful Completion of Proving Period	-	-	A	R	C	I	**HOLD POINT**
12	**Project completion (section 0)**								
	1	Submit Final Project Deliverables incl Commissioning Report (as per section 0)	R	C	A	C		C	
	2	SCADA Standards Compliance Checklist	C	-	A	C	C	R	In accordance with Treatment SCADA Standards.
	3	Final Defect Walks	R	-	C	C	C	I	*10 business days' notice required for attendance at meetings.*
	4	Defects Addressed and Closed Out	R	-	A	C		C	
	5	Complete commissioning Handover Checklist / Workflow	R	-	A	C	C	C	**HOLD POINT**
	6	Asset Handover	C	C	A	C	R	C	

4. General requirements

Tests and inspections, unless otherwise specified or accepted, must be in accordance with the latest relevant standards of the Standards Association of Australia, SWC's standards, WSAA Codes, or in their absence, those of the British Standards Institution or ASCE standards. The Service Provider must arrange and obtain the necessary permits, notification, inspections, testing,

and certificates required by State and Local Government regulatory authorities such as Work Cover Authority, Electrical Supply Authority and Local Council.

SWC reserves the right to witness any and/or perform any test for the purposes of observation, result verification, obtaining technical information or operator training.

All data taken during each stage of testing and commissioning must be recorded and used in the assessment of performance. This data must be stored in a safe place. All test measurements and recordings are to be handed to SWC at Project Completion.

The Service Provider must have available a complete set of spare parts for minor items, such as, relays, lamps, contactor coils, etc. so that the testing process is not delayed due to the failure of such items.

4.1 Commissioning safety and risk assessment

All commissioning activities must be carried out in accordance with the requirements of Project Management Plans that may include:

a) Project WHS Management Plan
b) Environmental Management Plan
c) Incident Management Plan
d) Any Safety in Design requirements
e) Commissioning Risk, HIDRA workshop involving key stakeholders

A risk assessment must be undertaken with commissioning stakeholders prior to commencing commissioning; risks must be identified, assessed, and managed using an appropriate risk assessment process and task specific Safe Work Method Statements (SWMS) must be developed and reviewed by all relevant personnel.

All commissioning plans and procedures must include emergency / contingency procedures to address perceived risk including:

Threat to human life

Injury to personnel

Threat to the environment

Breach of law / licence provision

Emergency external to site

Equipment breakdown

Contingencies related to biological and mechanical commissioning

Threat to equipment / plant

Interaction with other operations at the SWC Plant

Exclusion zones around assets being commissioned.

4.2 Control of monitoring and measuring devices (MMD)

Monitoring and measurements are undertaken during the delivery of the project in order to:

Check and validate conformance to specified requirements (e.g. tolerance to design requirements)

Monitoring compliance to standards and regulations (e.g. noise measurements)

Demonstrate conformance of products to specifications (e.g. pump & motor capacities).

Devices used for the purposes such as observation, indicator only or fault diagnosis need not be treated as MMDs.

Due consideration must be given to the level of accuracy of the MMDs to ensure valid results. The OA Team must be consulted where any clarification is required.

The Commissioning Lead must ensure that the MMDs used on the project are:

Suitable for the purpose

Uniquely identified

Have valid and current calibration status

Calibrated against recognised standards or manufacturer's recommendations

Calibrated by a qualified person or an accredited laboratory

Are calibrated for reliable operation with the process fluid and in normal operating conditions.

The Commissioning Lead must ensure that the MMDs used are registered as per The Service Provider's management system.

The Commissioning Lead undertaking surveillance must ensure that MMDs are used only by qualified persons who are familiar with the controlled environment in which the MMDs are to be used (e.g. Temperature, vibration, electromagnetic interference) and competent to maintain and protect the accuracy of the MMDs.

The Commissioning Lead must check that the unique identification of the MMD is recorded on the ITP.

In the event that the accuracy of an MMD used on the project is found to be outside the permitted limits, the Commissioning Lead must review the measurements or tests done with the MMD and check the validity of the results obtained. The Commissioning Lead must ensure that additional measurements as necessary are taken to validate the results.

4.3 Non-conformance, defects, and corrective actions

During commissioning non-compliances with performance requirements, specification, the Contract, or other documents may be raised. These will be separated into Non-Conformances and Defects as is defined below:

- **Non-conformance (NCR)** - A failure to meet a requirement, either from the Contract, specifications and codes, process and procedures, product quality / performance, incorrect or inadequate documentation, deviation from testing and inspections.
- **Defect** - Works that does not achieve the standard required by the Contract, either due to workmanship, defective product / systems, or damage to work.

4.3.1 Non-conformance

Testing and commissioning non-conformances will be defined as Major or Minor. Guidelines for the classification of these non-conformances and the required corrective actions are identified below.

In the case of ambiguity or uncertainty as to the classification of non-conformances during the testing and commissioning process, SWC will classify the non-conformance.

A Non-Conformance Schedule must be prepared by the Service Provider, identifying all non-conformances, all planned/completed corrective actions, target dates for completion and responsible personnel. This Schedule will be submitted to SWC and updated by the Service Provider on a weekly basis throughout the testing and commissioning process.

1. **Non-conformance report category "A" - Major omissions/non-conformance by the Service Provider**

This category includes all safety issues, failure of individual assets or tests which prevents successful testing of the asset/system/facility and therefore unable to prove capability of safe and normal operation of the equipment / facility.

All NCRs under this category must be completed and equipment / systems successfully re-tested prior to take over of the equipment/system/facility.

2. **Non-conformance report category "B" - Major omissions/ non-conformance by SWC**

This category like Category "A" above includes all safety issues, failure of individual assets or tests which prevents successful testing of the asset/system/facility and therefore unable to prove capability of safe and normal operation of the equipment /system/ facility.

It is expected all NCRs under this category are to be completed by SWC and the equipment /systems successfully re-tested prior to handover of the asset/system/facility.

However, if any of the items are unable to be completed prior to completion of part or the entire project as in the Approved Project Management Plan (PMP) the issue must be brought to the attention of:

a. Operational Programs Leader / Facility Program Manager - Customer Delivery
b. Head of Program Delivery / Head of Major Project delivery – Asset Lifecycle

It is the responsibility of those listed above to develop SWC's position on each issue and advise the OA Team Representative responsible for the handover of the facility. Timely resolution is essential to avoid Contractual issues related to completion of the project.

The equipment / facility will not be taken over without a documented plan to resolve each outstanding issue.

3. **Non-Conformance report category "C" - Minor omissions/non-conformance by the Service Provider**

This category includes work that has no impact on successful testing of the asset/system/facility that is essential to prove capability of safe and normal operation of the equipment / facility.

All NCRs under this category must be listed with a written confirmation from the Service Provider of acceptable completion times and any agreed penalties of subsequent non-conformances.

If the facility/equipment is part of a developer activity process All NCRs must be cleared prior to SW handover of the asset/ system / facility.

4. **Non-conformance report category "D" - Minor omissions/non-conformance by SWC**

This category includes work that has no impact on successful testing of the asset/system / facility that is essential to prove capability of safe and normal operation of the equipment / facility.

All incomplete NCRs under this category must be listed and forwarded to:

c. Operational Programs Leader / Facility Program Manager - Customer Delivery
d. Head of Program Delivery / Head of Major Project delivery – Asset Lifecycle

It is the responsibility of those listed above to develop SWC's position on each issue and advise the OA Team Representative responsible for the handover of the facility. Timely resolution is essential to avoid Contractual issues related to completion of the project.

4.3.2 Defects

Testing and commissioning defects will be defined as Major or Minor. Guidelines for the classification of these defects and the required corrective actions are identified below.

In the case of ambiguity or uncertainty as to the classification of defects during the testing and commissioning process, SWC will classify the defects.

A defects register must be prepared by the Service Provider, identifying all defects, all planned/completed corrective actions, target dates for completion and responsible personnel. This Register will be submitted to SWC and updated by the Service Provider at the end of each phase of the testing and commissioning process.

1. **Defect Category "A" - Major defects by The Service Provider**

   This category includes all safety issues, failure of individual assets or tests and design or construction issues which prevents progress to the next project phase.

   All defects under this category must be completed and/or equipment / systems successfully re-tested prior to proceeding with the next commissioning phase.

   Examples of major defects may include:

incorrect equipment (non-compliant to specification).

construction issues (poor compaction, structural failures, and leaks).

safety issues (non-complying access, unguarded equipment etc.).

2. **Defect Category "B" - Minor defects by The Service Provider**

   This category includes work that has no impact on the works progressing to the next stage but must completed prior to Project Completion.

   Examples of major defects may include:

minor coating defects (touch-up etc).

minor wiring non-compliances (incorrect colour, labelling etc.).

5. Planning for commissioning

5.1 Commissioning plan

The Service Provider must prepare a detailed Commissioning Plan to cover all aspects of the project delivery phase including civil, mechanical and electrical construction, factory acceptance testing (FAT), pre-commissioning, dry-commissioning, wet-commissioning, process commissioning, site acceptance testing (SAT), proving and training. The Commissioning Plan is to be considered as a live document, to be updated to accommodate changes during the delivery of the project and inclusion of new information as applicable.

A draft plan is to be produced prior to completion of detailed design, providing high level details of the commissioning process, a register of inspection and test plans (ITPs) and check sheets and preliminary program details for review by the stakeholders.

Where applicable the generic ITPs included in the appendix of this document are to be considered in the preparation of site or equipment specific ITPs.

The proposed Commissioning Plan is to be finalised and endorsed by OA team representative at the end of detail design and prior to commencement of construction activities.

During construction phase, either due to amendment to the design, equipment, material or the method of construction requires changes to timing, methods of inspection, testing and verification the Commissioning Plan is to be updated, reviewed and endorsed by stakeholders as part of finalising the proposed changes to the design, equipment, material or the construction.

As a minimum the Commissioning Plan must include the following:

1. Overview of Commissioning methodology and stages as per Section 0
2. Details of risk assessments that have been undertaken to facilitate the development of the plan and methodologies stated
3. Details of the construction stage procedures inclusive of test plan for the construction stage covering all items of process, civil, mechanical, software and electrical construction and FAT of equipment and systems
4. Details of the pre-commissioning stage procedures inclusive of test plan covering all items of plant and equipment
5. Details of the dry commissioning stage procedures inclusive of a software download plan, commissioning procedures and test methodologies for all key testing and commissioning activities
6. Details of the wet commissioning stage procedures inclusive of commissioning procedures and test methodologies for all key testing and commissioning activities
7. Details of the SAT/integrated commissioning stage procedures inclusive of cutover, test methodologies for all key testing, commissioning, and O&M training activities
8. Details of the operational test / reliability period stage monitoring and testing methodologies activities
9. Details of the process proving stage monitoring and testing methodology
10. Software Download Plan, software FAT (SFAT), software SAT (SSAT) and required operational change requests for IICATS sites
11. Detailed ITPs and inspection and test check sheets (ITCs), incorporating identification, recording and verification of:
    a) all relevant asset information required for entry into the SWC technical asset register (TAR)
    b) all civil, structural, mechanical, electrical, process and control (software) checks necessary for testing, commissioning, and operation of the facility
    c) all key testing and commissioning activities as identified in the prepared procedures and methodologies
    d) all performance targets and project objectives as per the requirements of the Contract
    e) all equipment supplier recommended checks and tests
    f) the corresponding acceptance criteria that the Service Provider must use for establishing the conformance of the Works with the requirements of the Contract
    g) all hold, witness, or surveillance points as per the requirements of the Contract, nominated by the OA Team or otherwise nominated by the Service Provider.
12. A testing and commissioning program or schedule, defining:
    a) the work breakdown structure (WBS) adopted in order to detail Lot Management of the Asset(s)
    b) hold point dates
    c) all dates and periods for each stage of the commissioning process
    d) all required periods for notifications and submissions to SWC.

13. A roles and responsibilities matrix, identifying all personnel, stakeholders, and Service Providers (including sub-contractors) who will be involved with all key testing and commissioning activities
14. Decision-making process to determine whether a system is operating satisfactorily
15. Procedure for recording, managing, and rectifying any non-conformances.

5.2 Cutover plan and procedures

All cutovers must be planned and executed so as not to adversely impact the continued operation of existing systems. It is critical that any licence obligations are met throughout the Contract. Therefore, the Service Provider must plan cutovers in co-operation with all relevant stakeholders. If a cutover must be delayed due to operational needs, the Service Provider will be notified by SWC.

Cutover procedures must be developed for each commissioning sub-system as well as for individual equipment, systems, and facilities once construction and pre-commissioning activities have progressed to a sufficient degree as to warrant the progression to Commissioning.

Cutover procedures must detail the management of activities and risks involved with the energisation and operation of new and upgraded equipment, systems, and facilities in order to minimise downtime and prevent the occurrence of foreseeable issues associated with the commissioning works.

Cutover procedures must include the following:

a) Prerequisites
b) Risk and contingency plan including HIDRA
c) Communication protocols and contacts
d) Energisation and loading procedures (electrical, fluid, chemicals, etc)
e) Marked up process and instrumentation diagrams (P&IDs) and electrical drawings with lock out tag out (LOTO) requirements / blank flanges
f) Sequence of cutover and hold points
g) Process requirements including power, flows and volumes required
h) Temporary works and bypass requirements
i) Control System / SCADA / IICATS requirements including disabled alarms and interlocks.

5.2.1 Equipment energisation

Cutover procedures must be prepared when energisation of new equipment requires modification of existing operating arrangements. The need for emergency asset operation must be considered and be formulated to provide redundancy during the cutover or minimise downtime if the cutover process needs to be reversed. Following cutover, the impacted equipment, systems and facilities must be deemed to be energised works.

Energisation procedures must be developed to plan and detail the steps for the energisation and de-energisation of equipment, systems and facilities, inclusive of connection to permanent electrical supply and the introduction of process fluids into the systems, as applicable, and must be submitted together with a Notice of Energisation to SWC.

Access to and subsequent work activities being conducted on energised works will be controlled using Permits to Work and LOTO plans that have been developed to include the specific conditions, risks and controls associated with the energised works.

The requirements for new Permits to Work and LOTO procedures will be communicated to all project personnel by means of pre-start meetings, toolbox meetings and appropriate signage in the area of the energised works.

All personnel carrying out work activities on any works deemed as energised must only do so after signing onto a relevant Permit to Work, reviewed, and authorised by a member of the Commissioning Team.

The distinction of energised works requiring new or updated Permits to Work and LOTO plans is made to ensure that:

Access of personnel to the affected area is controlled

Safety and process risks associated with the work to be carried out are assessed and eliminated

Work is carried out in a controlled manner so as not to pose a risk to personnel

Commissioning activities are controlled so as not to pose a risk to the personnel carrying out the work.

5.3 Asset data information

The Service Provider is responsible for collation and compilation of necessary information in the required format for inclusion in TAR. The Service Provider is responsible for requesting location numbers, entry of asset details in TAR and advising of decommissioned assets and their location number. Details of spare parts and decommissioned assets need to be provided by the Service Provider via spreadsheet specified by SWC. The Service Provider must liaise with SWC before data entry is commenced to ensure that data entry standards and SWC's requirements are fully understood. A specialist from SWC will be available for consultation on matters involving data entry.

Requirements for data capture are constantly evolving to facilitate improvements in maintenance strategy and operational decision-making.

To prevent delays to handover, it is critical that asset data be entered as early as reasonably practicable in the project development and delivery. Provision of asset data updates in TAR are a pre-requisite to pre-commissioning commencement.

5.3.1 General

For all types of facilities and assets the Service Provider must refer to the Data Dictionaries, which can be obtained from SWC.

In TAR each facility or asset location is identified with a unique number, which is termed a "Location Number". SWC is responsible for allocation of Facility Number and Location Number. The Service Provider is responsible for requesting Facility Number(s) (if not already requested) and Location Number(s) for new Assets at design stage.

5.3.2 Facility number or location number

SWC will issue Facility Numbers or Location Numbers to the Service Provider for all new locations to be provided under the Contract.

The Service Provider must request Facility or Location numbers using standard templates which are available from SWC. The information supplied in each request spreadsheet must relate to only one Project. A Service Provider working on multiple projects for SWC must, where required to supply information, do so using a separate spreadsheet for each project. Service Provider requests must be provided to SWC via SWC Project Manager.

Service Provider requests for location numbers must be accompanied by P&IDs or relevant drawings (i.e. for electrical assets).

Upon receipt of a Facility number request form, SWC will issue Facility Numbers from TAR. SWC may seek additional information on the location of the Facility, where required. SWC will return the Facility number request spreadsheet containing the allocated Facility number to the Service Provider

Upon receipt of a Location number request form, SWC will issue Location Numbers and enter these numbers in TAR. SWC will return Location number request spreadsheet containing the allocated location numbers and relevant external reference number to the Service Provider. The Service Provider must then amend the P&IDs and other relevant documentation, by replacing the provisional Location Numbers with the allocated Location Numbers.

If SWC identifies from the Service Provider's P&IDs and location layout drawings that there are location(s) not included in their Location number request spreadsheet, which require Location Numbers, SWC will allocate these additional Location Numbers. The Service Provider must include the additional Location Numbers (and their corresponding locations) in the P&IDs and other relevant documentation.

The Service Provider is responsible for providing information on existing locations and assets made redundant (decommissioned) or replaced by the project, using standard templates available from SWC. The information must be provided to the SWC's Project Manager, most appropriately at the same time the Service Provider is requesting new location codes.

5.4 Asset information

The Service Provider must liaise with SWC before asset information submission is commenced to ensure that data entry requirements and processes are fully understood. The Service Provider must collate and compile necessary data for timely inclusion in TAR. and submit for 'Validation' by SWC prior to the commencement of pre-commissioning. Asset information submission will require access to SWC's TAR for data entry personnel. SWC will arrange access to TAR for the Service Provider's data entry personnel.

The Service Provider must comply with the Asset Data standards when entering asset data. SWC has guides available to assist in entering asset information.

SWC will validate asset data supplied by Service Provider and notify the Service Provider via the Project Manager of any issues that need to be resolved.

Additional time may be required if the information provided by the Service Provider is incomplete and requires clarification.

5.4.1 Data verification

The Service Provider must request a Verification Certificate from Asset Data Management to ensure the required asset information has been provided by the project. The request must include a list of locations requested along with final P&IDs and associated drawings, a list of redundant or replaced assets.

A representative of SWC will issue a Verification Certificate after satisfactory verification of asset information provided by the project. Any issues or concerns identified during verification must to be resolved prior of issuing of the Verification Certificate. Verification Certificate is a prerequisite for the start of Pre-commissioning activities.

5.5 Commissioning meetings

Regular commissioning liaison meetings are to be conducted with SWC during the construction, testing and commissioning periods. Alternatively, Commissioning should be included in regular progress meetings. Commissioning must be planned to coordinate with the activities of other Service Provider's at the site and with the operational activities of SWC.

It is recommended that a Commissioning and Cutover Plan review meeting be held during the development of construction methodology, commissioning, cutover and handover documents to enable the documents to articulate any site-specific requirements and complexities.

6. Pre-factory acceptance testing (Pre-FAT)

Pre-FAT is required on critical factory built equipment or system components prior to Factory Acceptance Testing (FAT) to confirm the scope of work and minimise the amount of time required to complete the FAT by eliminating wiring, labelling, workmanship and equipment functionality problems.

Testing at the factory for materials and major items of equipment, including all electrical components supplied by the Service Provider, must be carried out and include the following as a minimum:

pumps

blowers and diffusers

Chemical Dosing Units (CDUs)

Odour Control Units (OCUs)

valves and valve actuators

electrical equipment

instrumentation, including flow meters, etc

computer systems and software including Human-Machine Interface (HMI) (where applicable)

any other relevant equipment.

A Pre-FAT must be carried out when:

a) manufacturing is complete
b) the system or sub-system is fully assembled
c) the assembly is ready for transportation to site
d) calibration sheets are complete and available and
e) Manufacturer's data report (MDR) available.

SWC will not normally witness the Pre-FAT, but has the right to do so.

Copies of Pre-FAT Test Results Record Sheets must be submitted prior to commencement of the FAT for approval. Each test must be dated and signed off by two representatives of the Service Provider.

The Pre-FATs itemise and cover all tests associated with the following:

a) completeness of work
b) labelling and wiring
c) compliance with standards and specifications
d) correctness of drawing/equipment
e) equipment rating, e.g. Circuit breakers, etc
f) firmness of equipment

g) set overloads, MAS/CAS Relays, soft starter / variable speed parameters; note the Service Provider must supply a full set of variable speed parameters in a spreadsheet including a listing of all those that have been left untouched and left as factory set, (for future reference, also any software and tools required to alter the Variable speed drives (VSDs)

h) functional operations of switches, circuit breakers, push buttons, drives, PLC/RTU inputs and outputs etc.

7. Factory acceptance testing (FAT)

As a minimum, all prefabricated mechanical systems, pumping units, electrical panels, cabinets, and kiosks must be factory inspected and tested (FAT). Other equipment that requires factory acceptance testing along with the type of test may be specified in the contract, needs specification, design documents or other asset specifications.

SWC will nominate hold and inspection points during FAT activities. These will be provided by SWC's Operational Acceptance Team (See Appendix C).

The FAT requirements for specific equipment are detailed in SWC's Technical Specification - Civil, Technical Specification - Mechanical, Technical Specification - Electrical, Technical Specification - SCADA - Technical Specification – IICATS and the Technical Specifications – High Voltage.

The Service Provider must submit ITPs and ITCs for FAT testing to SWC for review prior to the commencement of testing. FAT must be of enough length to allow for testing, correction of defects and retesting (this may be 2 - 3 days).

7.1 Scope of factory acceptance testing and inspection

The scope of FAT and inspection includes but not limited to:

a) inspection, examination, and certification of materials of manufacture

b) inspection of welding and castings, testing for defects

c) hydrostatic pressure testing of all parts, which may be subject to internal pressure during normal or abnormal working conditions

d) performance tests of key equipment. Type tests may be acceptable on pumps, blowers, and other mass-produced commodities.

e) performance tests on pumping units. Type tests are acceptable on pumps <3 kW. Specific performance tests must be carried out on equipment with drives greater than 3 kW and evidence of the testing provided to SWC. Where drives are >100 kW, replacements aren't readily available, or for high risk facilities, SWC reserves the right to witness performance testing. Refer to Section 7.3 for more information.

f) for software orientated systems, particularly for treatment facilities, functional testing of the control system is to be conducted during the Software Factory Acceptance Test. (SFAT). Simulated I/O is acceptable during this test.

g) specific tests in other sections of the Contract.

Testing of equipment at the manufacturer's works will not relieve the Service Provider of responsibilities to conduct site testing. Performance tests must be in accordance with an Australian or International Standard or to a method approved by SWC.

7.2 Software specific requirements

7.2.1 Plain English functional description (PEFD)

The PEFD is to be developed by the responsible stakeholder as indicated in the Contract and approved by SWC during Detailed Design, prior to commencement of the Functional Design Specification (FDS).

7.2.2 Functional design specification (FDS)

The FDS is to be developed by the responsible stakeholder as indicated in The Contract, and approved by SWC during Detailed Design, with formal testing conducted as a Software FAT.

7.2.3 Software FAT (SFAT)

Under the overall responsibility of the Service Provider, the software FAT is to be organised by the Service Provider and conducted by OT or OT's designated service provider and witnessed by SWC operations staff, to ensure the operation is in accordance with the PEFD and FDS.

7.2.4 Software download plan (SDP) (Not normally applicable to IICATS)

Under the overall responsibility of the Service Provider a Software Download Plan (SDP) is to be developed by OT or OT's designated service provider, detailing the exact processes to be followed for the downloads and any risk to the operation of existing plant operation. This is a requirement for any change or modification of operational control systems (including defects rectification).

This plan must be prepared in consultation with SWC's Operations team and the Service Provider must ensure that it is approved by SWC prior to download.

Changes to operational control systems on Treatment Plants are to be undertaken in accordance with IMS0038 - Treatment Plant Operational Change Management.

7.3 Equipment specific FAT requirements

The following specific FATs are required for the equipment as noted. The tests carried out at the manufacturer's workshop must form the basis of the FATs for assets / equipment supplied under the Contract. Test certificates and performance curves must be provided for each test.

7.3.1 Electrical equipment, instrumentation, control, and switchboards

FAT testing will be in accordance with the requirements detailed in the following relevant specifications where applicable:

Technical Specification - Electrical

Technical Specification - IICATS

Technical Specification - SCADA

SW Standard HV Specifications.

7.3.2 Rotating/moving equipment

7.3.2.1 Bearing tests

In conjunction with the performance tests, the Service Provider must continuously record bearing housings temperatures while operating at the most adversely loading conditions. The test should be conducted for a minimum of four hours and until the temperatures have peaked and stabilised relative to the ambient temperature for a period of at least one hour. The bearing housings temperatures, after adjustment for an ambient temperature of 45^{o}C, must not exceed the maximum

bearing temperature stated by the equipment manufacturers. These tests must be repeated on site for final acceptance.

7.3.2.2 Vibration tests

Preliminary vibration tests are to be undertaken at the manufacturer's works during performance tests and repeated on site for final acceptance. The vibration tests must be conducted and evaluated in accordance with SWC Technical Specification - Mechanical**.**

7.3.2.3 Noise tests

Preliminary noise tests must also be undertaken at the manufacturer's works during performance tests and repeated on site for final acceptance. Preliminary noise tests must identify any obvious noisy operating condition within the asset / equipment operating range. The obtained data are to be evaluated and translated to defined site noise performance conditions. The equipment must only be delivered to site if the above evaluation indicates that the specified site noise levels will be achieved.

7.3.3 Specific testing for pumps

7.3.3.1 Hydrostatic testing of pumps

All pump casings, after machining, must be subject to a hydrostatic test at the manufacturer's works by the Service Provider. Alternatively, the hydrostatic tests may be carried out after the pump has been assembled.

The total test pressure must be 1.5 times the sum of pump maximum shut off head and maximum suction head. The use of long bolts or other similar apparatus extending through the pump casing to seal off the suction, discharge, shaft, or other openings during the test must not be permitted.

The pressure must be sustained for at least 10 minutes to ANSI/11.6 for rotodynamic pumps / ANSI/ 6.6 for reciprocating pumps. During the hydrostatic test, there must be no visible leakage through the shaft seals or any other part of the casing. The exterior of the casing must remain completely dry and there must be no visible deformation or distortion of the casing or other pump components.

The Service Provider must replace all casing or parts found defective or unsound in any respect under this test at no cost to SWC.

7.3.3.2 Performance testing of pumps

Pumps must be witness works performance tested with their respective motors and starters (or variable speed drives, if supplied) at the manufacturers' works by the Service Provider in accordance with AS/ISO 9906:2018 "Rotodynamic pumps - Hydraulic performance acceptance tests - Grades 1, 2 and 3". Grade 1 tolerance factors must be adopted for pumps driven by motors 50 kW or larger and Grade 2 for pumps with motors smaller than 50 kW. The Service Provider must provide all materials, equipment (including test starters if not supplied with the pumps) and labour for the works tests.

Unless stated otherwise, the performance tests must include the following:

- Pump capacity (Q)
- Head (H)
- Net positive suction head required (NPSHr)
- Overall efficiency (ηO/A).

The overall efficiency guarantee must include pump, motor, and starter or, if supplied, variable speed drives losses. Acceptance of NPSHr tests must be based on satisfying the stated NPSHr at

3% head drop, i.e. “NPSH3”, at the pump minimum head / maximum flow duty point. The NPSHr tests will include a minimum of three tests, i.e. one at this duty point and one on either side of it, to confirm the trending of the NPSHr curve.

7.3.3.3 Valves, pipes, and fittings

All valves, pipes and fittings must be subject to hydrostatic and leakage acceptance tests and all other production and batch release tests at the manufacturer’s works. The valves must also be supplied with Type Test Certificates.

The tests must be carried out in accordance with relevant Australian Standards. If no relevant Australian Standard exist, the test must be carried out in accordance with relevant International Standards. Written approval must be obtained from SWC prior to the use of International Standards.

System components for specific applications, such as chemical dosing, are subject to stringent requirements in regard to material selection, fabrication, installation, and training of personnel. The requirements are specifically outlined in the relevant SWC specifications for those asset types.

7.4 FAT and inspection report

The Service Provider must submit a FAT and Inspection Report to SWC.

SWC will may witness the FAT. Any defects or non-conformances identified during the test are to be identified, documented, and dealt with in accordance with Section 0.

The Service Provider must not deliver or install any part of the system until such approval has been granted by SWC in writing.

Tests and inspections performed by suppliers/manufacturers at their factory or on site must be recorded and reviewed as part of the pre-commissioning verification process.

Testing of major items must include, but not be limited to:

a) Material tests
b) Manufacturing tests
c) Electro-mechanical and mechanical equipment tests
d) Electrical equipment tests,
e) Instrumens and monitoring sensors included in equipment (pumps, motors, blowers etc).
f) Control and monitoring equipment tests
g) All ITPs, ITCs, material certificates, Original Equipment Manufacturer (OEM) test and certificates, performance curves and all other relevant documentation must be included in the FATs and Inspection Report.

8. Construction completion

Construction Completion is required prior to commencement of Pre-Commissioning**.**

The following activities will be captured within the Construction Verification Checklists. Construction Verification will include, but not be limited to:

a) confirmation that plant hardware is installed in accordance with the P&IDs and relevant drawings and meets the Specification
b) hydrostatic pressure testing of piping and tank systems including certificate of compliance for any plumbing or drainage works
c) valves checked for “clean” travel and correct sealing when closed

d) lubrication of pumps and assemblies
e) electrical test certification including certificate of compliance
f) checking tanks and pipelines have been installed and cleaned to ensure that all construction debris has been removed
g) compaction tests
h) concrete testing
i) CCTV inspections
j) inspections on buried pipeline or components prior to backfilling
k) delivery of construction mechanical and electrical ITPs, PEFD, FDS and SFAT documentation to WAC status
l) delivery of vendor manuals
m) check electrical integrity, including point to point testing, electrical tests for insulation, earth leakage, resistance to high voltage (HV)
n) instrument configuration in accordance with the IO list, units, ranges etc
o) valve, actuator, and limit switch configuration
p) leak and pressure test water retaining structures
q) undertaking all pre-start-up activities as recommended in O&M manuals.

The above activities will be captured on construction ITPs and will be signed off by the SWC prior to commissioning activities commencing.

It is the responsibility of the Service Provider to engage OA Team Representative at the relevant stage of the construction programme.

The Service Provider must not pre-commission any part of the system until a punch list/defects walk has been completed and approval has been granted by the OA Team Representative in writing.

9. Not Used

10. Commissioning

Commissioning will be performed on components and sub-systems, once pre-commissioning is complete. The Commissioning Team will also undertake testing activities in conjunction with suppliers or vendors where applicable.

Commissioning will be conducted in 3 stages as follows:

a) **Dry Commissioning** includes dry tests on equipment and systems to confirm initial configurations, fail safes and operation
b) **Wet-Commissioning** is the process used to determine the control system operates in accordance with the FDS and involves the initial setting of control loops. This process should determine that all process controls and safety interlocks are fully operational.
c) **Process Commissioning** (*Only required on assets with a process component*) relates to the demonstration that the upgraded asset and all associated components integrate and operate as intended. The plant must be brought on-line with product and all the systems necessary to operate the asset must be fully tested and commissioned.

10.1 Dry-commissioning

This phase will typically consist of inspections of all installed components including Civil, Mechanical, electrical, and testing, verification of electrical equipment, protection settings, to ensure the installation complies with the detail design and is safe and ready for energisation of

power supplies. These activities will be captured on dry-commissioning ITPs and ITCs and will be signed off prior to Wet-Commissioning by the relevant Commissioning Representative.

Example of testing requirements for Water and Sewer pumping stations are detailed in a series of standardised testing sheets (PSATs), which are included in Appendix H & J.

10.1.1 Dry-commissioning activities

Dry-Commissioning activities will include, but it is not limited to:

a) where applicable, inspection of civil installation
a) inspection of mechanical installation
b) inspection of electrical installation
c) verification of satisfactory completion of construction ITPs
d) dry-run functional tests, where possible

10.1.1.1 Dry-commissioning electrical activities

Electrical equipment checks and testing will include but not limited to the following, where applicable:

a) inspection of electrical installation
b) electrical integrity tests, including electrical tests for insulation, earth leakage
c) electrical continuity and electrical earthing tests
d) inspection of cable pits
e) inspection of electrical wiring on cable trays
f) inspection of labelling and terminations of electrical wiring
g) check type, number and locations of light switches and GPOs
h) testing and verification of electrical installation to enable energisation
i) verification of protection settings of all protective circuits
j) inspection of switchboards

10.1.1.2 Dry-commissioning HV electrical activities

HV Electrical equipment checks and testing will include but not limited to the following, where applicable:

a) insulation resistance tests
b) voltage withstand tests
c) Ductor tests
d) phase rotation tests
e) polarity checks
f) primary injection testing of CTs
g) secondary injection testing of protection relays

10.1.1.3 Dry-commissioning mechanical activities

Mechanical equipment checks and testing will include but not limited to the following, where applicable:

a) pipework installations
b) valve operations, opening / closing directions

c) pump installations
d) lifting chains and cable supports
e) anchor points
f) ventilation system installations
g) reservoir mixer installations
h) Air valves, PRV installations
i) protective coatings
j) access ladders
k) access hatches and gratings

10.1.2 Prerequisites for dry-commissioning

The Service Provider must ensure the following are prepared and submitted to SWC in advance of dry-commissioning any component, system, or sub-system. The requirements may vary depending on asset type and complexity of the project. Some of these items may form part of the Commissioning Plan submitted at the first stage of commissioning:

a) updated Commissioning Plan
b) dry-commissioning kick-off meeting and risk assessment completed
c) construction completion reports including satisfactory leak and pressure testing of civil structures and mechanical pipework, accepted, and endorsed by SWC's subject matter experts (SMEs)
d) design reports including HZOP / CHAZOP and safety in design
e) updated defect register
f) no category 'A' defects
g) FAT and Inspection Report(s)
h) ITPs and procedures for the dry-commissioning stage covering all items of plant and equipment
i) all regulatory certificates and approvals required for the installation and the equipment obtained by the service Provider on SWC's behalf
j) calibration certificates for equipment or instruments used for testing
k) where applicable, MDRs for prefabricated equipment
l) all drawings including P&IDs marked-up to a Work As Constructed (WAC) condition
m) where applicable, Asset Isolation Plans and Permit to Work
n) Updated Operating Procedures and Plant Process Specifications
o) Updated O & M Manuals
p) Draft training package
q) where applicable, the asset Hazardous Area Dossier needs to be completed/updated as applicable to EEHA requirements and submitted for review completed (to be signed off before power can be applied to any electrical equipment or cables in a hazardous area during Pre-commissioning stage)

Example of a Dry-Commissioning Prerequisites Checklist available in appendix G

10.1.3 Dry-commissioning completion requirements

a) civil installation is satisfactory to proceed to Pre-Commissioning
b) mechanical installation is satisfactory to proceed to Pre-Commissioning
c) electrical installation is satisfactory for energisation and proceed to Pre-Commissioning

d) asset labelling, including Open / Close directions of valves is satisfactory
e) no category 'A' defects
f) updated defects register
g) updated drawings marked-up to a Work As Constructed (WAC) condition
h) completed dry-commissioning ITPs
i) notice of energisation (NOE)
j) correct installation of guards, trip wires and other personnel safety equipment
k) ensure the pipework system has been cleaned and flushed
l) ensure equipment storage plugs, locks etc. are removed
m) registration of key equipment, (pressure vessels, bulk chemical storage tanks etc.), or update of existing details with WorkSafe NSW.
n) on water assets, the asset must be appropriately washed / cleaned / disinfected and followed up with appropriate sampling to demonstrate cleanliness before proceeding to pre commissioning
o) all delivery blocks and oils have been removed and equipment is ready for commissioning

10.2 Pre-commissioning

Pre-commissioning is the checking/verification of individual components of sub-systems for correct installation, configuration, and operation to ensure it will meet the operational and functional specifications as set out in the Needs Specifications and design documentations. Pre-Commissioning is performed on all new plant components after the satisfactory completion of Dry-Commissioning phase.

The Service Provider will undertake the pre-commissioning activities in conjunction with the commissioning team and vendors where applicable. These activities will be captured within the pre-commissioning ITPs and ITCs.

Pre-commissioning completion is required prior to commencement of commissioning**.**

Pre-Commissioning may include but not limited to the following activities:

10.2.1 Pre-commissioning activities

10.2.1.1 Pre-commissioning Electrical activities

a) Delivery of mechanical, electrical ITPs, FDS and SFAT documentation to IFC status
b) Electrical energisation of motor control centres (MCCs) and field instrumentation
c) voltage tests
d) trip tests
e) functional tests
f) testing and adjustment of safety devices
g) check of ranges/settings of equipment
h) Control power redundancy testing.
i) Alternative mains power supply testing
j) Generator power supply testing
k) confirmation of 'Fail Safe' mechanisms
l) check maintained emergency and exit lights
m) check two way switching operation

n) check operation of photo-electric cell and override switch
o) correct operation of all field connected items
p) electrical point to point checks
q) Motor starter configuration and tuning
r) Motor rotation checks
s) Confirmation of 'Fail Safe' mechanisms
t) correct functionality of all site connected items on each motor drive, including Local Control Station (LCS), Latch/Emergency Stop push button, thermistor, motor anti-condensation heaters, etc.
u) set up and programming of VSDs and soft starters
v) power redundancy testing

10.2.1.2 Pre-commissioning controls and instrumentation activities

Controls and instrumentation equipment checks and testing will include not limited to the following, where applicable:

a) download RTU/PLC and SCADA/IICATS software
b) network communications verification
c) Setting up of flowmeters
d) initial configuration and calibration of Field Instrumentation
e) instrument configuration in accordance with the IO list, units, ranges etc
f) initial configuration of operator set points and alarm values
g) checking the electrical instrumentation and control systems input and output signals in conjunction with the RTU/PLC and SCADA/IICATS system
h) SCADA/IICATS picture testing and screen navigation
i) checking equipment operation and remote lockout from LCS
j) calibrate and test all instruments and analysers
k) simulate fault condition tests
l) check interlocks, RTU/PLC and SCADA/IICATS logic
m) alarm handling, including local and SOC Alarms
n) Profibus network testing
o) Network redundancy testing
p) Fibre Optic testing (OTDR)

10.2.1.3 Pre-commissioning mechanical activities

Mechanical equipment checks and testing will include not limited to the following, where applicable:

a) Air compressor configuration - Setting of Load/Unload setpoints
b) rotation checks (bump test) of all pumps and motors
c) Pump configuration
d) Pump performance tests
e) System storage test
f) Vibration measurements
g) Noise measurements

h) Water hammer tests
i) Ventilation system performance tests
j) Mixer operational testing
k) Blower performance testing
l) setting of pressure control/pressure sustaining and pulsation dampers
m) Anchor points

10.2.1.4 Pre-commissioning electrical-mechanical activities

Electro-mechanical and mechanical equipment checks and testing will include but not limited to the following, where applicable:

a) runs of rotating equipment, rotating direction, and performance of electric motors
b) Valve, actuator, and limit switch configuration
c) Initial configuration of PRVs, PCVs and associated hardware
d) functional tests of equipment
e) testing and adjustment of safety devices
f) recording of key test / set points in TAR, (specifically PRVs and pressure vessels)
g) check that equipment is correctly lubricated and lubrication reservoirs charged with suitable lubricant
h) clearance, end play and operation of major bearings
i) level control of pumps
j) valve positions and operation
k) check of lifting facilities
l) control valve operational tests
m) Testing of asset including but not limited to all mechanical and electrical equipment, instrumentation, control and SCADA systems, alarm annunciators, set points.

Example of a Pre-Commissioning Prerequisites Checklist available in appendix G

NOTE: The setup is limited to motor nameplate details, motor protection settings and other parameters to enable “bump” testing of the motors.

Records of parameters are to be recorded and supplied prior to testing of any motors.

10.2.2 Prerequisites for pre-commissioning

The Service Provider must ensure the following are prepared and submitted to SWC in advance of pre-commissioning. The requirements may vary depending on asset type and complexity of the project. Some of these items may form part of the Commissioning Plan submitted at the first stage of commissioning:

a) Commissioning and Cutover Plan Review meeting held
b) Kick-off meeting held and risk assessment completed
c) Dry-commissioning ITPs & ITC satisfactorily completed and signed off
d) Notice of power supply energisation available and signed off

e) where applicable, completed Software FAT (SFAT) (SCADA sites)
f) where applicable, approved Software Download Plan (SDP) (SCADA sites)
g) IFC copies of the SSAT, FDS and PEFD
h) updated defects register
i) updated Non-Conformance register
j) all drawings including P&IDs marked-up to a WAC condition
k) ITPs and procedures for the Pre-Commissioning stage covering all items of plant and equipment
l) where applicable, Asset Isolation Plans and Permit to Work
m) for existing IICATS sites, an Operational Change Request (OCR) may be required by Network Operations. The OCR will be submitted by Network Operations to SOC
n) calibration certificates for equipment or instruments used for testing
o) where applicable, SOC notified Pre-Commissioning is in progress (IICATS sites)
p) where applicable, the asset Hazardous Area Dossier needs to be completed/updated and signed off as applicable to EEHA
q) data loaded into TAR
r) temporary bypass systems in place (if applicable)

completion of any required preliminary training programs (vendor training, for example)

10.2.3 Pre-commissioning completion requirements

When pre-commissioning is completed the Service Provider must ensure the following requirements are fulfilled before wet-commissioning commences:

a) Asset Isolation Plans - if required
b) copies of WAC drawings available including P&IDs (redline mark-ups are permissible.) and stored on site. A current copy of electrical drawings must be kept in the switch room or kiosk at all times once switchboards are live
c) manufacturer's trial run records/ test certificates of equipment available including performance tests
d) decommissioned and disposed assets list
e) supplier/vendor Instrument calibration records
f) updated Commissioning Plan
g) Project Safety Plan covering the commissioning work including the required SWMS for the commissioning tasks
h) Environmental Management Plan (EMP) covering the commissioning work of the project
i) where applicable, draft Plant Operations Manuals for the asset (treatment facilities)
j) where applicable, draft Process Equipment Asset Specifications for the asset (treatment facilities)
k) where applicable, draft Plant Operations Manual, Plant Process Specification and Plant Asset Specifications (treatment facilities)
l) where applicable, up to date FDS and PEFD
m) where applicable, a completed SFAT has been conducted for the Asset(s)
n) commissioning team and other critical personnel have sufficient training to enable asset to be commissioned

o) if the Works change the hydraulics of the asset and network or impact flow monitoring equipment, then notify Hydrographic Services to recalibrate flow instrumentation
p) where applicable, Software SAT (SSAT) scripts are available
q) updated Project Risk Register
r) proof of compliance with statutory and regulatory requirements
s) defects/punchlist walk with key stakeholders completed
t) updated defects register
u) no category 'A' defects
v) a completed Pre-commissioning ITP

The Service Provider must pre-commission all components, together with their ancillaries, and

10.3 Wet-commissioning

Wet-commissioning will be performed on plant components and sub-systems, once pre-commissioning is completed. Where available wet-commissioning will be carried out using potable/recycled water or process fluid as specified in the commissioning plan.

Wet-Commissioning is the process used to determine the performance of equipment and systems whilst operating in the specified normal / abnormal operating environment. This will also include the performance testing of control system in accordance with the FDS and involves the initial setting of control loops. This process should determine that all equipment and systems including safety interlocks are functioning as specified in the needs specification and relevant applicable standards and specifications.

Facilities may be broken down into sub-systems composed of interrelated equipment and other components for which functional testing has been completed. Each system will then be tested to demonstrate that it operates in the manner designed. Individual commissioning ITP's will be developed for each sub-system that is to be tested and signed off.

For Water and Sewer pumping stations, example testing requirements are detailed in a series of standardised testing sheets (PSATs), which are included in Appendix H & J.

Wet-Commissioning will include, but it is not limited to:

a) any Statutory approvals have been obtained before wet testing (e.g. approval to discharge)
b) initial priming of pumps and process pipework
c) initial setting and confirmation of process control loops
d) initial calibration of process instruments
e) vibration and Noise testing of mechanical equipment identified in Technical Specification - Mechanical
f) all instruments have been calibrated and test/calibration sheets have been completed. These must include any internal setting/set points and a hard copy output detailing the parameters set (particularly applicable to drives or instruments with internal ranges and parameters)
g) check performance of equipment to the requirements of the Contract
h) check integration of controls systems particularly with off-site equipment
i) wet-run performance tests with one of the scenarios on the most critical operating condition
j) submission of power factor correction report as applicable
k) submission of harmonic analysis and correction report as applicable

Not all equipment or controls may be able to be tested before wastewater or process fluid is introduced. The Commissioning Plan must clearly state if this is so and must include steps to manage the associated risk.

The Service Provider must carry out all the necessary adjustments until the Components are ready and suitable for starting and running under all operating conditions. Tests must be carried out to verify that the Components will meet operational requirements of the Contract under conditions replicating the operational range as much as possible. The scope must include any specific tests nominated in this Contract for particular items of plant and equipment. The Service Provider is required to simulate the conditions necessary for the proper operation of all Components including stoppages due to simulated power failure.

During the wet tests, the Service Provider must ensure the following work has been completed:

a) any Statutory approvals have been obtained before wet testing (e.g. approval to discharge)
b) all instruments have been calibrated and test/calibration sheets have been completed. These must include any internal setting/set points and a hard copy output detailing the parameters set (particularly applicable to drives or instruments with internal ranges and parameters)
c) check completeness of entire installation paying particular attention to integration of sub-systems
d) check performance of equipment to the requirements of the contract
e) check integration of controls systems particularly with off-site equipment
f) wet-run performance tests based on various operating scenarios including worst case conditions and other conditions as required for reliable operation (i.e. high, low flow, emergency PLC settings and so on)
g) submission of power factor correction report as applicable
h) submission of harmonic analysis and correction report
i) operations and maintenance training completed, prior to cutover and TOM, as applicable.
j) software Pre-SAT (PSAT) including functional testing of all phases of operation in accordance with the FDS.
k) software Site Acceptance Testing (SSAT) - NB: Timing of Software SAT can be project dependent. On sites where testing on water is not possible, this will be undertaken concurrently with the overall asset SAT.
l) updated defects register
m) where progressive systems commissioning is required, provision of warranty period preventative maintenance job plans to TAR.
n) no category ‘A’ defects
o) a completed wet-commissioning ITP (with details of requirements (a) to (m) above.

The Service Provider must update all data in the TAR on a weekly basis during the wet testing period of the asset(s) until completion of the works.

Wet testing must be completed before process fluid is admitted to the Component.

10.4 Process commissioning

The Process Commissioning phase relates to the demonstration that the upgraded asset and all associated components integrate and operate as intended. The plant must be brought on-line with process fluid/product and all the systems necessary to operate the asset must be fully tested and commissioned. The process commissioning may happen altogether or by sub-system, according to the natural flow of the asset’s processes.

The Service Provider must prepare and submit a Cutover plan to detail the implementation of these operations safely and effectively. A draft of the Cutover Plan should be included with the commissioning plan and updated prior to its execution as necessary. For treatment facilities, the cutover plan should be developed in accordance with IMS0038 'Treatment Plant Operational Change Management'.

a) final tuning of process control loops
b) final calibration of process instruments
c) confirmation of process flows
d) confirmation of effluent quality
e) update of all project documentation to WAC status
f) delivery of Commissioning ITPs.

Process commissioning must include the following:

a) Integrated Asset Commissioning is the phase in which all newly commissioned and existing systems are integrated together to be tested and operated in their final process arrangement.
b) Process Optimisation is the period of operation with process fluids immediately following cut-over or seeding in which equipment and control setting are adjusted and tests conducted for a period to ensure the Components operate as intended.

The Service Provider must commission all Components with process fluid to prove the components operate reliably in actual flow conditions with fully automatic operation including correct start up, shutdown and emergency shutdown sequences, and stoppages due to simulated power failure.

Each component must be tested over its full range of operating conditions which can be reasonably simulated / achieved at the time of the tests. The tests must be designed to demonstrate the component's compliance with design hydraulic, mechanical, electrical control and occupational noise criteria.

10.4.1 Integrated asset commissioning

After successful commissioning of all assets, the Service Provider must commission the integrated asset/plant, comprising new and existing Works.

The Integrated Asset must be operated continuously over its full range of operating conditions, which can be reasonably simulated/ achieved during a process proving period.

10.4.2 Process optimisation

During this time the Service Provider must conduct various relevant tests, carry out all necessary adjustments, and optimise the Component until it performs reliably and as intended under a range of service conditions in automatic mode to demonstrate performance compliance. It is likely process optimisation will be ongoing from Process commissioning through to the end of the proving period.

Any process control modifications are to be recorded within the FDS.

11. Site acceptance testing (SAT)

Site Acceptance Testing is formalised testing prior to final cutover and putting assets into ongoing operation. There are three key stages to SAT.

a) **Pre-SAT** is an internal SAT conducted by the Service Provider to ensure all systems are performing as intended prior to the formal SAT

b) **SAT** is the formal test conducted prior to the introduction of process fluids and will be witnessed by the OA Team

c) **Operational Test** is the period of a number of continuous days, as specified (refer to Project Specification) during which the assets must operate reliably in the intended manner. For operational test, the asset must be selected in automatic sequence mode (all modes should be tested as applicable) and in automatic equipment control mode at the SCADA interface. Plant Operations Manuals must be adjusted as applicable based on actual asset operation.

11.1 Pre-site acceptance testing (PRE-SAT)

The Service Provider is to conduct a Pre-SAT on all process or sub-systems prior to the formal SAT, to eliminate any wiring, software, or equipment functionality issues.

A Pre-SAT must be carried out once:

the system or sub-system has been dry and wet commissioned

the system or sub-system post FAT software has been downloaded.

SWC will not normally witness the Pre-SAT but must have the right to do so.

The signed copies of the Pre-SAT ITP must be available for review on the day of the SAT.

The Pre-SATs must itemise and cover all tests associated with the relevant section of the FDS.

11.2 Site acceptance test (SAT)

SATs will include, but are not limited to:

Functional Testing of all phases of operation

PLC/SCADA system operation and Alarm Handling

All alarms and control functions are operable (electrical simulation not acceptable)

Functional check on interlocks and control systems for the entire plant

Integration of the asset with existing operations

Local, Remote testing of devices

Duty/Standby/Assist testing of process units

Functional testing of components and sub-systems

Initial PID Loop tuning

Flow, temperature, and pressure control

Other process performance testing and monitoring as required by the specification.

During FAT or SAT, if equipment is subjected to considerable wear and tear, it must be replaced by the same specification of new equipment at the Service Provider’s expense.

11.3 Operational test

Operational Tests must be carried out by the Service Provider to prove compliance with the hydraulic, mechanical, electrical control and occupational noise requirements set out in the Project Specification and other parts of this Contract. During the Operational Test, Components or part thereof must be tested under the worst operating hydraulic and/or all loading conditions for a sufficient period of time to validate the performance of the Component.

All documentation including SOPs, O&M manuals, WAC drawings and Asset Management Maintenance Systems Data must be adjusted as required to reflect any modifications and the actual operation following Operational Testing.

The acceptance criteria for the Operational Test is that the Component must operate continuously for a specified period of days, 24 hours a day (unless agreed otherwise by SWC) meeting all hydraulic, mechanical, electrical control and occupational noise requirements as stated in the Contract and other parts of this Contract, under automatic mode of operation without any category 'A' defects.

12. Operationally ready

After successful commissioning, SAT and Operational Test, activities may commence to transition the asset into ongoing operation.

Once an asset is accepted as being Operationally Ready, from that point forward it will be operating for its intended purpose, monitored by SWC. At this stage the assets will be cutover to for ongoing monitoring, with defined contacts for the Service Provider for failures and call outs. On IICATS sites an OCR will be required to define where SOC directs contact in the event of a failure.

Making an asset and associated system(s) operational will generally require the following to take place:

(a) Minimum Operation Deliverables are to be submitted to and accepted by SWC

(b) Interim Operating Modes occur when discrete systems or part of a system may be in an operational state, however SWC will commence and continue to operate the system in conjunction with the existing equipment, systems, and facilities to maintain asset capacity and performance

(c) Final Cutover is the removal of all temporary isolation or the connection to allow the process flow (water, chemical, wastewater or air) into the asset for ongoing operation. These may occur progressively.

12.1 Minimum operation deliverables

To enable assets to be placed into ongoing operations, specific activities and documentation must be completed. The items below are the minimum requirements; and must be met. Other site-specific requirements to accelerate transitioning assets to ongoing operation are to be agreed with SWC as required. Additional requirements for specific works will be specified in the Contract:

a) All assets labelled
b) All relevant assets in TAR (and verified)
c) Clear operational instructions, call out contacts etc.
d) Alarm help information available (IICATS)
e) Draft Contingency Plans, uploaded to TAR
f) Red Line markups of WAC Drawings
g) Completed Site Acceptance Tests (SATs), including automation and control test results
h) Asset Inspection and Defects walk conducted
i) Defects Register (e.g. non-conformances, defects) updated, including any items identified during Pre-Commissioning and Commissioning
j) No "A" Category defects
k) Draft O&M manuals
l) Draft Plant Operations Manuals and Process Equipment Asset Specifications
m) HYDRA updated to reflect upgrades (for Linear Assets e.g. Rising Mains)
n) Draft maintenance plans
o) Site must be safe for ongoing operation and maintenance activities

An ITP detailing the requirements and sign off prior to interim operation is available in Appendix 22.3.4 - C4

12.2 Interim operating modes

Interim Operating Modes may be required for operational reasons or due to complicated constructability issues or for staged cutover of assets. The use of interim operating modes is subject to agreement by all operations, maintenance, and commissioning stakeholders.

After successful Commissioning of discrete systems (Commissioning Work Lots), SWC will commence and continue to operate the System in conjunction with the existing equipment, systems, and facilities to maintain asset capacity and performance. Systems may be required to operate in an Interim Operating Mode, either in an Automatic or a clearly defined Manual control sequence, under the instructions of the OA Team in consultation with operations.

The Service Provider must remain fully responsible for the performance of the Works. Systems will not be able to be operated in Interim Operating Modes unless the requirements of section 0 have been achieved. SWC will maintain the works in accordance with preventative maintenance plans from TAR, or as agreed by SWC prior to accepting assets for interim operation.

Operations personnel and the Commissioning Team must co-ordinate and work together to monitor all new plant SCADA alarms as part of on the job training for the upgraded asset operation. SWC will advise The Service Provider of any system failure of breakdowns for the purpose of defects liability periods.

In Network Facilities, Temporary Operating Modes, (TOM), are known as Interim Operating Procedures, (IOP).

12.3 Final cutover

Following successful SATs the Service Provider must cutover and allow process fluids to enter the component. All activities and tests that were performed during the wet testing stage must be re-tested following the cut-over to ensure that there is no abnormal operational performance difference following the introduction of process fluids. The Service Provider must install the control system works or modifications for the relevant component and have them fully functional and ready for use by the operators before the cutover is implemented.

The Service Provider must be responsible for the dewatering, sludge and debris removal and cleaning of existing or new structures/equipment to a condition necessary to facilitate each cutover.

13. Process proving

The process proving period is the nominated duration that the asset must demonstrate that it meets or exceeds the performance requirements, specified in the Contract. During the process proving period the asset must operate as a complete unit and all new equipment will run under conditions as close as practicable to specified load conditions. The asset will be operated in accordance with the process manuals as applicable and consistent with specified automation.

Process proving will be conducted as soon as practicable following the integrated commissioning and/or SAT of the asset.

At treatment plants and manned assets, SWC operators must be fully trained prior to the commencement of the process proving period and will operate the plant during the process proving period under the technical control and instruction of the Service Provider.

Where assets under test operate outside of normal working hours, the Service Provider must put into place a suitable system of notification with SWC to enable SWC Operations to advise the Service Provider of urgent issues.

Any modifications to the plant, control systems, set-points, circuitry, and the like must be carefully recorded, communicated to operations staff and all relevant documents updated.

During the process proving period, the collected data will be compared to the performance requirements, which are specified in the Contract. The process proving must continue until such a time that the specified performance requirements are met continuously for the nominated period. If, during the process proving period, the plant fails to meet the specified performance requirements, then the provisions of Section 0 must apply. The process proving must continue until there is an uninterrupted specified period meeting all the specified performance requirements.

During the process proving period, the Service Provider will provide weekly test reports (in Microsoft Excel or Microsoft Word) to SWC. The weekly test reports must include test results, a log of alarms and any equipment failures and details of any operator attendance at the plant outside the normal attendance times. If any results which do not meet the requirements or operators are required to attend the plant outside normal attendance hours, the Service Provider must notify SWC immediately.

The Commissioning Report will be revised at the end of the process proving and provided to SWC for review.

13.1 Process proving tests

Where required, Process proving tests must be carried out by the Service Provider to prove compliance or otherwise with the specified performance requirement using sampling and test methods specified in Section 19.2**.** The Service Provider must take into account the turnaround time for sampling and testing. The recording, sampling and analyses parameters and frequency will be in accordance with specific performance requirements in the Contract.

During the process proving, assets or part thereof will be tested under the worst operating hydraulic and/or all loading conditions for a sufficient period of time to validate the performance of the asset.

The Service Provider must monitor and record the consumption of all consumables such as power and chemicals during the process proving period. The levels in chemical storage tanks will be recorded at the start of the process proving period, at the completion and before and after any delivery. Here instruments monitor the levels, the level will be verified by physical measurement.

SWC may elect to take samples for analysis and to record an independent set of test results for evaluation.

13.2 Staffing during process proving

Unless it is essential, process proving not to be commenced on Fridays.

SWC will provide to the, normal operating staff for operating the plant under the technical control and instruction of the Service Provider during the process proving period.

The Service Provider must make allowance for suitable 24-hour on-call support during the performance testing and proving period. Depending on the nature of the project this will include but not be limited to the following:

a) Engineering Support - Commissioning and Control System Integration
b) Mechanical Support - Fitters etc
c) Electrical Support - Electricians and instrumentation specialists.

This support must be able to respond to site within 1-hour of the call out made by the relevant SWC staff.

13.3 Quality testing

Where applicable, the Service Provider must prepare an interim report for each week during which sampling is carried out. The weekly report must include an analysis of data for that week plus that from the preceding week(s). Both reports must be issued within 24-hours of all analyses being completed and must be transmitted by email to SWC. SWC may require the frequency of reporting to be increased depending on the nature of the results.

The Service Provider must ensure no results are missing in the weekly reports. Duplicate samples suitably preserved for analysis must be retained, should SWC require substantiation of the results or results do not meet the quality assurance requirements.

The Service Provider must analyse duplicates on any samples, which do not conform to the limits specified in this Contract. The repeat analyses must be carried out at the Service Provider's expense. Should the result remain outside the limits, SWC must be notified immediately during working hours, or the next working day if analyses are performed out of hours or on a weekend or public holiday. SWC will approve the format and content of the reports.

14. Project completion

Project completion will normally occur after commissioning is complete, and all final documentation has been accepted by SWC. Site works remain the responsibility of the Service Provider until the Completion of Contract.

14.1 Prerequisites to project completion

The conditions for project completion include but are not limited to the following:

a) successful completion of Pre-FAT, FAT, Pre-SAT and SAT and approval of all test sheets
b) successful completion of commissioning, including reviewed and approved Commissioning Report
c) all NCRs resulting from FAT and SAT have been rectified and signed off by SWC
d) removal of redundant equipment and restoration of the site
e) all redundant cables be removed. Where it can be demonstrated as impractical, cost prohibitive or unsafe to remove all or a part of the cable, the cable needs to be made safe in accordance with Technical Specification - Electrical
f) closure of all items in omissions and major defects list
g) Preventative Maintenance Schedules completed
h) Signed off Commissioning Handover checklist (or completion of document submission workflow on SWC's project management system).

14.2 Document submissions

Typical document submissions for acceptance are presented in Table 0.2-1 below, for specific project requirements refer to the project Scope of Works document.

Table 0.2-1: Document Submissions

Document descriptions
Construction ITPs & ITCs

Commissioning ITPs & ITCs
Test & Calibration Certificates
FAT, SAT Test Records
WAC Drawings
WAC Needs Specification (where applicable)
WAC Design Report (where applicable)
WAC FMECA and Reliability Block Diagram for the assets
Verification Certificate issued by SWC advising Asset Information is complete
WAC Approved Operations and Maintenance Manuals
HYDRA data sheets (where applicable)
Environmental Records
Community Relations Records
Software Programs
WAC FDS, PEFD
Updated Plant Operations Manuals and Process Equipment Asset Specifications
Warranties transferred to SWC
Operation and Maintenance Training Records and Training Material
Recommended List of Critical Spares (Based on Critical Spares Assessment)
Decommissioned Assets Register
Other handover docs as required in I&C and SCADA standards

14.2.1 Work as constructed drawing submissions

WAC drawings require a review and approval process with SWC prior to acceptance. All drawings will be submitted via SWC's Engineering Drawing Management System (EDMS). This process needs to be completed prior to handover, and timeframes for review and approval should be considered when submitting.

14.2.2 Operation and maintenance manual submissions

O&M manuals require a single hard copy submission (in addition to electronic submission), provided as detailed in section 0, and to be kept at the facility.

14.3 Handover of documents

All documents, including O & M Manuals, UPGS, SOPs etc are to be submitted in electronic format to SWC via USB, File Transfer or other agreed method to enable SWC to upload the files to SWC's controlled electronic filing system (currently SWIM). This process needs to be completed prior to handover, and timeframes for review and approval should be considered when submitting.

All documents must be uploaded to SWIM prior to asset hand over.

All documents supplied in electronic formats must conform to the following:

each document must be supplied as a single file. Where documents are made of several files, they are to be made into a single consolidated file.

documents must not contain links to other documents. References to other documents are permitted.

all electronic files provided to SWC must not be password protected, locked, or read only

electronic copies of all documents must be supplied in their native formats as well as in PDF format.

14.3.1 File naming convention

File names must consist of the following components:

Facility Number - Asset Number File Name - date as per following example

SP1234PMP02 Operation & Maintenance Manual 04-05-09.

Where there are documents common to several assets, only one document is required and including all identified asset numbers associated followed by an electronic file names must be kept to a minimum character length (maximum of 128 characters).

14.4 Critical spares and special tools

The Service Provider must consult with Supply Chain Operations to conduct a spares assessment on all OEM and non-OEM spare part and rotable equipment requirements. This is to ensure SWC maintains the right and adequate spare parts into inventory within the SWC Supply Chain network, which supports forward maintenance activities once assets are operational.

The following clauses are applicable to all new installations:

The Service Provider must complete a critical spares assessment in consultation with Supply Chain Operations

The Service Provider will recommend a list of spare parts and stock levels inclusive of description, part numbers, supplier details, price, recommended minimum stock level and re-order level

Following consultation with SWC, the initial stock of spares must be procured by the Service Provider and must be delivered to SWC prior to handover

The Service Provider must provide a recommended list of special tools and software for maintenance purposes (e.g. program loader and proprietary software etc.). All recommended special tools should be supplied prior to hand-over.

14.5 Warranties

The Service Provider must obtain warranties as specified in the Contract and must ensure that SWC will have the benefit of the warranties. The Service Provider must ensure that SWC will have the benefit of any warranties specified in the Contract that are obtained by subcontractors.

14.6 Maintenance plans and maintenance handover

Preventive maintenance “Job Plans” need to be produced by the Service Provider against each asset number and provided to the asset data management team for inclusion into TAR prior to handover. The Service Provider must allow for a meeting with the Responsible Engineer (Treatment) or Operations Representative (Networks) to discuss if standard SWC Job Plans are applicable or if new Job Plans need to be created. The Service Provider should also consider if normal ongoing Job Plans are sufficient or if there are specific warranty or defect liability period Job Plans required.

15. Decommissioning and disposal of assets

Any assets that are redundant, being decommissioned or replaced as part of the works, or as specified in the Contract must be either disposed of or made safe, decommissioned correctly and associated site documentation updated to reflect its state.

The following key considerations must be made when decommissioning assets:

a) List of decommissioned assets to be provided
b) TAR must be updated with all decommissioned asset details
c) Redundant cabling removed back to the switchboard
d) Cells in switchboards decommissioned, blanked off etc as necessary
e) Consult with SWC to confirm items that may be maintained for spares and returned to the warehouse for storage. This includes consultation with OT for Instrument and Control related equipment.
f) Update and revision of site labelling, including labelling of spare conduits to identify location and status
g) Revision of current site drawings to reflect all decommissioned or redundant components and superseding of redundant drawings.

15.1 Decommissioning of redundant mains

Where linear assets are being left in ground, they are to be grout filled using a product complying with SWC standard EPS504 or approved equivalent.

15.2 Update of spares inventory for decommissioned items

The Service Provider will consult with Supply Chain Operations to assist with revising spares inventory for decommissioned equipment.

16. Asset specific requirements

SWC has many different assets, requiring varying commissioning approaches. This section details the general methodology and terminology to the different stages of commissioning, applicable across all asset types.

16.1 Linear assets

16.1.1 Water main specific

The following requirements are specific to water linear assets:

a) Testing will be in accordance with SWC's Technical Specification - Civil, section C4.22
b) The Service Provider will ensure that all installation, cleaning, inspection, testing, and commissioning activities comply with the relevant pipe manufacture's technical guidelines
c) The Service Provider must allow for all necessary equipment and labour to carry out all filling, testing and disinfection works and to allow for planning and coordination with SWC and SWC's nominated departments and personnel
d) All drinking water mains must be disinfected in accordance with SWC's latest procedure for disinfecting new water mains available ((SOP) WPIMS 5027 - Disinfecting New Water Mains)
e) The Service Provider will submit a filling, testing and chlorination program to SWC to enable SWC to coordinate resources, schedule timing of works with SWC's assets, and

ensure sufficient supply of testing water (where appropriate). The Service Provider must make all due allowances to accommodate SWC's resourcing and timing for the supply of testing water.

f) If the results of any inspection or testing as specified above fail to meet the requirement of the Contract, the Service Provider must carry out all necessary remedial works to satisfy SWC that the finished pipeline complies with all requirements. SWC may, at their discretion, request additional inspections or testing as necessary to demonstrate that the remedial works are satisfactory.

16.1.2 Pressure mains

The Service Provider must test the pressure main in accordance with WSA04 and must ensure that all closing joints (i.e. PE to DICL or PE to PE) are tested to ensure these joints are adequate.

16.1.3 Relining works - testing and acceptance

The Service Provider will conduct hydrostatic tests on SWC's sewers and maintenance holes/access chambers, and house/property service lines as specified in this document and/or by SWC's Authorised Person. The intent of such test is to:

either

identify leakage and establish leakage rates in SWC's sewers HSLs and maintenance holes/access chambers prior to rehabilitation,

or

assess seal achieved through rehabilitation.

Testing method(s), alternative to those specified here will be given consideration provided the Service Provider at tendering stage negotiates for such alternative(s), after providing specifications, advantages, and cost of alternatives.

The Service Provider is to demonstrate the quality of work through hydrostatically testing a minimum sample of sealed sewer assets (SWC's sewers, maintenance holes, house service lines, etc) plus additional samples if excessive failures occur.

16.1.3.1 Extent/coverage of each test

Following are the extent or physical coverage of each test, to be performed independent of each other.

For SWC's sewers, maintenance hole to maintenance hole will be considered as one complete testing. SWC's Authorised Person, however, may allow the test to be carried out in parts to satisfy other criteria e.g. hydrostatic head requirement, over-pressurisation of old pipes, water escaping through branch lines/HSLs, etc.

For HSLs the test must be carried out from the junction at SWC's sewer (including the junction) up to the top of vertical at the boundary trap.

Junction test must cover lengths on up and down stream of the junction opening, up to but excluding the joints, in the main sewer; and including the length of lateral up to and including the first joint.

The maintenance hole test must exclude any conduit length but must include the first joint between conduit and maintenance hole. Full height of maintenance hole must be included in the test unless the rehabilitation was specifically restricted to lesser height or the height is prohibitive endangering the structure. In such cases SWC's Authorised Person will provide guidance.

16.1.3.2 Equipment

The Service Provider will have all equipment(s) required for conducting hydrostatic tests. The equipment must include such items by which a line between two maintenance holes can be sectionalized into at least three sections and hydrostatically tested. The equipment and arrangement should be such that length and hydrostatic head (pressure gauges) at both ends of each section under test (especially middle section) can be precisely measured from ground level. Mechanical or pneumatic plugs can be used.

For testing of junctions up to first joint in the laterals will require lateral packers.

To conduct tests quickly and save water, the Service Provider may have to use mobile water tankers with attached pump sets.

16.1.4 Test procedures for sewers

In both SWC's sewers and HSLs, junctions and connections in the line may have to be isolated to restrict hydrostatic tests within intended segments only.

The hydrostatic head requirement for the tests must be as follows:

a) The hydrostatic head for testing HSLs will be up to ground level at the vertical pipe. The pipe connection to vertical pipe, leading towards the building/lowest gully, must be plugged during this test.
b) The hydrostatic head for testing SWC sewers must be 1,000 mm above soffit of the pipe at the highest point and must not exceed 2000 mm at the lowest point.
c) Hydrostatic tests must be carried out after appropriate flow control and diversion measure. This includes notification to the residents regarding their use of water during the duration of tests.
d) The test must be started by first filling up the pipeline segment (or its section, as appropriate) under test with water up to the desired level and allow 10 minutes. Refill line up to the specified level and start the clock. Replenishing water continuously, if necessary, for next 5 minutes and maintain the hydrostatic head at the same level. Note: Volume of water added in the 5-minute period. This is referred to as replenishment volume.
e) Repeat the exercise one more time, by topping-up, and replenishing water for 5 minutes. Therefore, each test would yield two 5-minute replenishment volumes.

In case a pipe cannot be filled up to the desired level, despite consuming water three (3) times the volume that is being filled, then SWC's Authorised Person may decide to abandon the test and declare the seal to be defective.

The leakage rate from each test will be calculated by the following formula:

$$lps\ post\ grouting = \frac{(Second\ Replenishment\ Volume\ in\ mL)}{(Pipe\ diameter\ in\ mm \times length\ in\ m)} \times 12$$

The Service Provider must measure test lengths of sewers for calculating the above rate.

16.1.4.1 Test procedures for junctions up to first joint

The hydrostatic test must be carried out by using lateral packers. The packer lengths must be such that it will be able to isolate the junction and first joint from rest of the main or lateral connection.

The test must be carried at a pressure of 5 PSI and held for 60 seconds.

16.1.4.2 Test procedures for maintenance holes

The procedure for hydrostatic testing must be as follows:

a) Plug all pipe connections at the maintenance hole, arrange flow control and diversion
b) Fill maintenance hole to rim with water
c) Wait 10 minutes
d) Refill with water
e) Measure water loss at the end of 10 minutes

The Leakage rate must be calculated by the following formula:

$$Elm\ Post\ Grouting = \frac{(Second\ Replenishment\ Volume\ in\ Litres)}{(Diameter\ of\ Pipe\ in\ mm \times Length\ of\ Pipe\ in\ m)} \times 100$$

16.1.4.3 Test procedures for grouted liner end sealing

The procedure for hydrostatic testing must be as follows:

a) Plug all pipe connections at the maintenance hole with plug at least one meter from the outlet/inlet(s), arrange flow control and diversion
b) Fill maintenance hole to a minimum of 1-meter head above pipe soffit
c) Wait 10 minutes
d) Measure refill volume with water to initial test level mark

16.1.4.4 Acceptance testing of rehabilitated works

Acceptance test for leakage seal must be carried out on the following rehabilitated items:

Maintenance hole
House service line (grouted)
Main line (grouted)
Main line (grouted/lined) to junction seal
Main line liner to end seal.

SWC's Authorised Person will nominate batches of items for testing approximately one month after completion of rehabilitation of the sewer asset.

The minimum number of compliance tests for each item of work is set out in the following table.

Table 0.1.4.4-2: Rehab compliance tests

Sewer asset item	Service Provider testing	Independent auditor testing
Maintenance hole	10%	Variable
House service line (grouted)	10%	Variable
Main line (grouted)	10%	Variable
Main line (grouted) to Junction Seal	10%	Variable

Main line liner to junction seal	10%	Variable
Main line liner to end seal	10%	Variable

The Service Provider will undertake hydrostatic testing on each batch within three weeks of advice from SWC's Authorised Person. The first round of each batch test must be completed within two weeks.

The round testing of each batch must be at least10 samples or multiples of 10. If more than one out of 10 tested from any batch fails against the acceptance criteria, then an additional round of testing of equivalent sample size must be undertaken.

Failure of any round of testing will lead to further rounds being tested up to the total number of samples within that batch.

If at any stage of the testing, the total pass rate (i.e. sum of the individual pass tests (excluding re-tests for reworked items) / total number of tests carried out (excluding re-tests for reworked items)) is less than 80% then the Service Provider has to demonstrate the quality of remaining completed work. Individual Acceptance Testing as referred to in the following Acceptance Testing Flowchart must be carried out.

There are two stages in the progress of work when reconciliation of the overall acceptable pass rate to actual performance is made. One at approximately 80% of the item's progress completion and another at total completion of the work. In both cases, if the pass rate is less than 90% then the Service Provider will carry out Individual Acceptance Testing to demonstrate quality of the remaining untested items and to raise the overall pass rate to 90% or above.

The Service Provider will advise SWC's Authorised Person of the time and location of testing to enable the witnessing of the tests if desired.

The Service Provider will undertake approved testing method is required to demonstrate the quality of work for each item of work being tested. If un-rehabilitated HSLs cannot be isolated from main lines, then segmented or joint to joint testing method must be used.

The Service Provider may propose alternative but proven methods of hydrostatic or vacuum testing that achieves the same objective as specified methods. SWC's Authorised Person may accept or reject the proposed alternatives.

The Service Provider will undertake the rectification work on items that fail the acceptance criteria and demonstrate sealing as per the criteria by subsequent hydrostatic testing. The Service Provider will meet all costs for rectification work and re-testing.

16.1.5 Acceptance criteria for rehabilitated works

Acceptance of rehabilitation work will be at three levels:

a) Acceptance of individual work items tested:

   If any work item tested fails to meet the acceptable criteria, then it is considered to be defective and must be reworked and re-tested at the Service Provider's expense.

b) Acceptance of a batch:

   If more than 10% of the sample items tested within the batch fail, an additional batch of equivalent size must be tested. Failure of additional batches will lead to further batches being tested up to the total amount of work being undertaken under the contract.

c) Acceptance of the project (completion or at any stage of the work):

If the progressive total failure rate of items during any stage of the work exceeds 20%, or if the progressive total failure rate of items at the reconciliation stage (approximately 80% of the work progress or when nominated by SWC's Authorised Person) and at project completion exceeds 10%, individual tests on remaining untested items must take place until the total failure rate is 10% or less.

Table 0.1.5-1: Acceptable leakage of individual sealed items

Item	Max allowable leakage	or
Full line hydrostatic test of grouted main line	5 mL/mm dia/m length/hr	10 L/test
Segmental hydrostatic test of grouted main line	5 mL/mm dia/m length/hr	
Joint test of grouted main line (using packers)	1 joint/line (i.e. All other joints in the main line should be fully sealed)	
Hydrostatic test of grouted HSL	5 mL/mm/m/hr	
Hydrostatic test of grouted maintenance hole	.5% of theoretical volume/10 mins	
Hydrostatic test of grouted end seal	7 L/10 mins	
Hydrostatic lateral packer test of junction seal	No pressure loss over 60 seconds	10 L/10 mins

Note: For sewers in water charged ground:

MH leakage estimated from volume in invert after 10 minutes prior to HT test

Grouted lines and junction leakage - nonvisible from CCTV examination.

Maintenance hole theoretical volume of conical MH π x 0.225 x depth.

Acceptable leakage of multiple tested sealed items:

When SWC's Authorised Person has nominated a batch of items for testing, the Service Provider may propose changes to facilitate testing of multiple items in a single test, e.g. one or more liner end seals per maintenance hole, or a full line test with one or more rehabilitated HSLs.

The maximum allowable leakage must be the maximum allowable leakage of any individual item.

16.2 Reservoirs

16.2.1 General requirements

Reservoir filling and operational tests must be programmed and executed so as not to adversely impact the continued operation of SWC's assets.

The Service Provider must design and undertake tests to demonstrate the performance of each reservoir bypass, scour and overflow systems against the requirements of the specification.

The Service Provider must undertake the test in a manner that minimises the volume of water discharged to the environment. Water from the scour and overflow test must be discharged in accordance with SWC's discharge protocols for water supply assets.

A reservoir will only be emptied when absolutely necessary (i.e. especially during times of drought). A reservoir will not be emptied without the prior written approval of SWC.

All sampling and testing will be undertaken in accordance with Section 16.2.3.

16.2.2 Reservoir filling

During the filling of each reservoir, the Service Provider must:

a) Demonstrate the air expulsion performance of the drinking water inlet main
b) Test the rechlorination dosing system

Filling of reservoirs will be undertaken as follows;

a) Each reservoir must be filled in increments of 20% of its total depth until each reservoir is full. Determination and application of suitable and appropriate rates for filling and emptying of the reservoirs must be the responsibility of the Service Provider.
b) At each depth increment, the level will be maintained for a minimum of 24 hours
c) Following each 24-hour period, the Service Provider must measure and record the level of each of the control survey marks on the ring beam of each reservoir to identify any settlement that may have occurred during that period and must inspect each reservoir for any evidence of leaks including visible wet patches, or defects which may cause leakage.
d) Each record of survey and inspection must be reviewed and certified by a structural engineer and submitted to SWC prior to commencing the next increment of reservoir filling. The Service Provider must not proceed with filling if the survey identifies that any settlement at any control location has occurred or if there is any evidence of leaks. The Service Provider must notify SWC of any settlement immediately along with advice from the Service Provider's structural and/or geotechnical engineer of the cause of the settlement, the likelihood of further settlement and the possible consequences on the reservoirs or connecting pipework. Any leaks including visible wet patches, or defects which may cause leakage, must be rectified prior to continuing the filling procedure.

16.2.3 Sampling and testing

Specific sampling and testing requirements in the commissioning of reservoirs.

Should any sample fail to meet the acceptance criteria defined in the Contract, the Service Provider must resample and test for each of the failed parameters. If the sample fails again, the Service Provider must investigate the cause of the failed test and submit a recommendation of its proposed corrective action to SWC for approval. In the event that the Service Provider's corrective action is unacceptable to SWC, SWC may instruct the Service Provider of a more appropriate action or actions. The Service Provider must implement the agreed corrective action and repeat sampling and testing for the failed parameter or as otherwise directed by SWC.

The Service Provider must submit the test results, along with any data collated to SWC. SWC will review the data and the Delivery recommendation and advise the Service Provider in writing of its acceptance or otherwise of the test results, the Service Provider's recommendation or any other information submitted with the test results. SWC shall advise the Service Provider whether the reservoirs can be put into service or whether further sampling, testing or other action is necessary. The Service Provider must be responsible for all additional sampling, testing, consumables or works necessary to achieve water quality acceptance and allow the reservoirs to be put into service.

Testing and sampling will include but not be limited to:

a) With each reservoir at maximum level, the Service Provider must record the chlorine residual. Boost chlorine to 3 mg/L (free). Let water stand for 24 hours. The Service Provider must investigate if chlorine is lost rapidly in each reservoir by developing a depth profile of chlorine residual over the full depth of the reservoir.

b) Metals scan using method number TM64TML. The results of the metals scan must be within the range level typically expected as provided in Table 13 Australian Drinking Water Guidelines (ADWG).
c) An organics scan using method number TC015. Due to the vast number of organic compounds that could be found within the drinking water supply and the limited information that can be available on acceptable levels in drinking water supplies, each organic compound with a positive result will have to be considered individually together with its toxicity level.

In the event of a positive result for organics, for each positive result the Service Provider must:

i. Check any results for blanks and / or controls if applicable
ii. Identify if the compound is listed in the ADWG and if so at what acceptable levels
iii. Identify if there is any information in the ADWG Fact Sheets on the compound
iv. Identify if there is any information in the ChemWatch database or Safety Data Sheets (SDS) on the compound
v. Identify any other credible source of information regarding the compound and its likely impact on drinking water supplies
vi. Record toxicity levels if available
vii. Collate and review all the above available data and formulate a recommendation.

16.2.4 Reservoir operational test

Each Reservoir should be placed into service and commence the operational test when chlorine residual has reached target residual and all tests (including odour/taste) are satisfactory. If chlorine levels fall below 0.5 mg/L (total) prior to a reservoir being put into service, boost levels to 3 mg/L (free) for 24 hours, prior to putting into service.

The reservoirs must commence operational testing no later than one week after the completion and passing of all relevant tests. If for any reason this does not happen, the water quality testing must be repeated prior to commencement of the Operational Test.

17. Commissioning documentation

17.1 Training plan and training requirements

17.1.1 Training plan

The Service Provider must train SWC's nominated staff in the operation and maintenance of the works. The purpose of training is to teach SWC's Operation and Maintenance personnel all aspects of operating and maintaining the works, ensuring reliable, safe, and effective operation and maintenance under all conditions without supervision, direction, or assistance of the Service Provider. This will include operation of any HMIs, SCADA, and software configurations for the various operational modes of the asset (auto, manual, field) as applicable.

The training must be conducted in a series of programmed half-day sessions attended by up to 10 persons per session, and include a mix of hands on and presentation-based training. A training plan must be submitted and agreed with SWC prior to the commencement of training, unless agreed otherwise. The plan must include:

Detailed agenda for the training session(s)

Details of any supporting materials to be used to assist the session (e.g. O&M manuals, Plant Operations Manuals, Process Equipment Asset Specifications)

Proposed date and times for the training.

The Service Provider will issue to each of the nominated attendees a set of training handouts containing information that the Service Provider considers as necessary to properly train SWC personnel. For treatment facilities, at least one training session must be recorded (video and/or sound) to facilitate future training of staff.

On manned sites, the Service Provider must be prepared to vary the hours of training and run multiple sessions to fit in with the availability of staff and rolling roster operations. Unless noted otherwise, a minimum of one training session per operations/shift team is to be allowed for on treatment assets.

The Service Provider will be responsible to confirm, in writing, the attendees of the training and evidence that the attendees have demonstrated the required degree of competence.

17.1.2 Training requirements

Training must cover all aspects of operation and maintenance of new equipment. This must include but not be limited to the following (these may not be all applicable to networks assets):

Overview of the upgraded assets and processes, boundaries of the upgraded equipment and respective impacts on the existing equipment or process

Process Equipment Asset Specification Training including process theory, operation principles, limitations, and target performance criteria

Plant Operations Manual Training to walk through updates that have been developed, demonstrate their application (including hands on training) and review the manual in the operating environment

Software/Operation Training to be delivered by the Service Provider and software integrator or their nominated representative who is knowledgeable of the FDS and control system. This training will explain detailed operation and background of the control system.

Maintenance Training with asset maintainers to demonstrate key maintenance items, review lifting, and access issued etc

Site Walk of the upgraded equipment, to show physically the arrangements for operations and maintenance

Troubleshooting information to assist O&M with ongoing issues that may arise with the new assets. This should focus on:

What do I need to look at?

What are the parameters it should be within?

What is the action if it is outside these parameters?

Supplier Training for key equipment, covering maintenance and operations of the equipment. This may include hands-on maintenance training for replacement of maintainable items.

The personnel to be trained will have a range of backgrounds including plant operator, electrical trade, instrumentation trade, mechanical trade and professional engineer. The training may include one or more specialist sessions which provide more detail on those areas specific to a particular work discipline of the individual trainees.

17.2 Commissioning inspection and test plan (ITP) register

The Commissioning ITP Register is a high-level document breaking down and identifying individual work elements within the overall commissioning works.

The Commissioning ITP Register will identify the commissioning work lots to be developed and their associated Commissioning ITPs and ITCs.

17.3 Commissioning ITPs

Specific Commissioning ITP's will be prepared for each commissioning sub-system on a sequential basis.

ITPs define system elements that are to be tested, inspection and test routines that will be employed, acceptance criteria, and verification records to be produced or provided.

Hold and witness points will be defined in the ITP to satisfy the requirements in the specifications.

Once all specified test routines have been successfully completed and documentary evidence approved, then the associated commissioning activity can be approved by the Commissioning Manager.

A guideline and checklist for ITP development is available from SWC (refer to Section 22).

17.4 Commissioning inspection and test checklists (ITCs)

ITC checklists are produced which define specific inspection and test routines and which are used to record test results for each commissioning procedure.

Each asset must be accompanied by ITCs which define set points, checks and other verification records as required to ensure reliable operation. Relevant ITCs will be referenced from the ITP.

17.5 Commissioning /process proving report

The Service Provider must submit a Commissioning Report prior to an asset being deemed Operationally Ready. The report and its appendices are to be issued to SWC in native file format including any data on Microsoft Excel. The report will include but not be limited to:

a) completed ITPs, check sheets and test sheets for all commissioning stages
b) summary of asset performance clearly showing required performance and actual performance
c) check sheets
d) test sheets
e) flows, pollution loads, chemical and power consumption
f) noise and vibration testing as applicable
g) all recorded data taken
h) a history of all testing and proving periods - i.e. chronological diary of findings and incidents including:
    i. Service Provider's workmanship
    ii. logs of alarms and operator attendance
    iii. plant operating peculiarities and observations
    iv. any measurement and checks that may be required by operating and maintenance personnel
    v. results of any statutory testing and inspection
i) modifications to the process operation
j) list of control and instrument set points and alarm signal settings which have been determined during the successful operation of the plant and include these in the O&M Manuals
k) records of any modifications to the plant, control systems, set-points, circuitry, and the like
l) other information as applicable

m) completed SAT documentation
n) WAC SSAT documentation
o) WAC FDS and PEFD
p) a completed Handover Checklist - with details of requirements (a) to (n) above.

Comments should be included on any observed deficiencies in plant equipment design and performance. Any observations that would be helpful to operating and maintenance staff can be summarised at the end of the report.

Where commissioning is staged, a commissioning report must be provided for the completion of each stage (or a single report that is revised for each stage).

A Draft report must be submitted to SWC for review. The Service Provider will incorporate final comments in the final report.

17.6 O&M manuals

The requirements for the Production Facilities are different from that of the network facilities like pumping stations and reservoirs. Detailed requirements are specified in Sections 0 & 0 below.

O & M Manual template and a copy of an O & M Manual for a SPS are given in appendix 22.2 3 – B3.

17.6.1 Type of O&M manuals

O&M Manuals can be prepared at Process Level, Area Level or Equipment / Asset Level. Depending on the Contract, the Service Provider must discuss and agree with SWC on the type/s of O&M Manuals required. Each manual must have a content page indicating the chapters and corresponding page numbers.

O&M Manuals (Applicable to WWTPs, WFPs & WRPs only)

These PDF documents will then be consolidated into one PDF file, with PDF bookmarks (destination set) for each section and headings in the content page to create one O&M Manual.

The typing must be prepared using MS Word. The collection of documents that make up the manual must be converted to PDF format.

a) The Manuals must contain sufficient information on the specification, installation and maintenance of the equipment supplied, installed, or modified under the Contract. The Manuals must be supplied to SWC prior to handover of the assets. Delivery of the assets under the Contract will not be considered complete until all Manuals and required copies are supplied by the Service Provider and accepted by SWC.
b) Each copy of the Manual must be adequately bound or contained in a three-ring, hard cover binder, with the equipment and plant identification permanently marked on the outside cover. Each page must be numbered. The page format must be A4 (or A3/A4 for drawings as approved by SWC) and printed in a clear typeface with a 35 mm margin for binding. Alternative methods of binding and page size format may be submitted, but acceptance of these will be subject to the approval of SWC.
c) The contents must be presented as follows (alternative compilation will be subject to approval):

   Title Sheet - containing:

   i. Name of the Plant

   ii. Contract Details

iii. Name of Supplier

iv. Address and Telephone Numbers for Service Calls

d) The information to be supplied in each Chapter must be as follows (where applicable):

Contents

Chapter 1: Description - A full description of the equipment type (engineering description for example centrifugal pump), with a tabulation of dimensions and performance ratings.

Chapter 2: Technical Data - A copy of the Technical Data Sheet including make, model, size & serial number supplied by the manufacturer; reliability data (MTBF, MTTR, Reliability Block Diagram and MTBR - for replaceable assets) must be provided for each equipment type supplied by the Service Provider. Attach a copy of FMECA if carried out by the.

Chapter 3: Principles of Operation - A basic working description, including novel features and any automatic control including print screens of SCADA, IICATs and HMI as applicable.

Chapter 4: Operating Instructions - A step-by-step procedure organised into sections entitled including photos for each step as applicable:

1) Checks before Starting
2) Starting
3) Continuous Operation
4) Stopping
5) Emergency Stopping
6) Abnormal Operation as applicable

Chapter 5: Installation and Commissioning Instructions - Details of standards and procedures for mounting or erecting, wiring, and lubricating the equipment. The commissioning instructions must include step-by-step procedures for checks before the first start, first start, after starting and operational tests. They should be co-ordinated with Chapters 3 and 8 and may refer to both.

Chapter 6 Maintenance Plans (Preventive Maintenance) Step-by-step procedure for preventative maintenance work to be carried out at various intervals, supported by FMECA, if available (e.g. two weeks, four weeks, six weeks etc) Procedure should also clearly indicate replacements of consumables where necessary and the labour-hours required for each activity. These will be the basis of the preventative maintenance schedules which are to be developed by the Service Provider in consultation with SWC

Chapter 7: Maintenance Plans (Overhaul / MPM) Step-by-step procedures for fault finding and correction and for overhauling (major periodic maintenance) involving parts other than consumables. A list of necessary special tools should be included. Indicate Design Life.

Chapter 8: Test Data, Inspection Results (e.g. Test Sheets, FAT, SAT etc) and Troubleshooting - Instructions to qualified tradesman for assessing the operational performance of the equipment and system.

Chapter 9: Parts List and Recommended Spares - Illustrations and schedules for identification and specifications for all items in the equipment. Exploded

	diagrams are required, if available. The recommended spare parts stock must be indicated.
Appendices	(Including; complete vendor manual, software documentation (if software required to configure equipment)

Notes:

The information in Chapters 1 to 5 must be included for each item supplied, while the extent of information in Chapters 6 to 9 may vary with the complexity of the equipment. The text must be in English and easily understood by plant operators and fitters. Information irrelevant to the equipment supplied in the Contract must not be included in the Manual.

The PDF Version of the manual must have bookmarks for each chapter with major headings. The bookmark must include the reference number and description. Documents that are locked and cannot be included into a single PDF document must be scanned at 250dpi, saved as jpeg with maximum compression. This document must then be included into the single PDF document. When converting documents to PDF use the print command and select the PDF printer. This will automatically create the “Bookmarks” while converting other formatted documents to PDF. When collating various documents into a single PDF document use the Acrobat “Combine Files into PDF Command”.

Advertising brochures and catalogues are not acceptable. Remove all pages not associated with the equipment installed.

All electronic files should be in “Vector” format (not scanned) if possible. Some signed documents will need to be in “Raster”. Documents in “Raster” that are available in “vector” format are not locked for collating and will be rejected.

Equipment such as cable connectors, lamp holders, non-repairable equipment or items that are readily available at the local electrical equipment supplier, are not required in the O&M Manual.

17.6.2 O&M Manuals for unmanned sites (applicable to all facilities other than WWTPs, WFPs & WRPs)

When a combination of different software is used or where there are several components / pages of PDF documents forming one O&M Manual, the document must be consolidated into one PDF file, with bookmarks for each section in the content page. PDF Version of the manual must have bookmarks for each chapter and each major heading. The bookmark must include the reference number and description. All electronic files should be in “Vector” format (not scanned) if possible. O&M instructions that are of a general nature are not acceptable.

Documents that are locked and cannot be included into a single PDF document must be scanned at 250dpi, saved as jpeg with maximum compression. This document must then be included into the single PDF document.

Advertising brochures and catalogues are not acceptable. All pages not associated with the equipment installed will be removed.

O&M information for each of the following asset types must be included in the O&M Manual. O&M Manuals must also be supplied for any additional asset, if it is specified.

Operation and maintenance of the pumping station

Pump and motor

Control equipment

Specialised equipment

Odour Control Unit

Chemical Dosing Unit

Power Generating Equipment

Cranes and Hoists

Ventilation systems

Reservoirs

Valve stations.

Ensure that the O&M Manual specifies the assets that are installed and used within the facility ONLY, do not include manufactures specifications for all equipment's with the company's product list as this will be rejected by SWC.

Chemical Dosing and Odour Control units must be treated as standalone and the O&M manual for them will be separate to the one supplied for the pumping station.

The contents of the O&M Manual must be in accordance with Section 0 a), b) and c) above.

17.6.3 Manufacturer's instructions manuals

The Service Provider must supply manufacturer's instruction manuals if available for each asset installed or key component of an asset. Examples of key components include PLCs, motors, gearboxes etc. Items such as connectors, lamp holders and contactors are not regarded as key assets or key components.

The manufacturer's instruction manuals must be included as appendices to the relevant O&M manual.

17.7 Plant operations manual, process specification, asset specification, UPGs, SOPs and work instructions

Where modifications or changes are being made to a facility process or a change in operational methodology is required, new or updates to UPGs, SOPs, Plant Operations Manual, Plant Process Specification and Plant Asset Specifications may be required. The development of new documents is to incorporate information from existing documents available for the asset in consultation with the operations team and utilise standard templates.

17.7.1 Plant operations manual

Plant Operations Manuals are being developed for each production facility to consolidate existing SOPs and Work Instructions. These documents define the steps for operating the production facilities process-by-process in Automatic, Manual and Field modes.

The Service Provider is to request the active manual from the relevant production hub, and update with changes relevant to upgrades. This is to be carried out in accordance with the IMS0038 Production Change Management Process.

17.7.2 Process equipment asset specifications

Process Equipment Asset Specification and common UPGs are being developed by Customer Delivery Process Engineers to consolidate existing plant based UPGs. Any updates to these documents are to be handled through the nominated Process Engineer for the relevant Production Hub.

17.7.3 Unit process guidelines

The purpose of a UPG is to provide a process management framework for the operations staff to manage the unit process effectively.

Each UPG will have several Standard Operating Procedures (SOPs) to support the operation of the unit process.

In general, a UPG will:

a) define the objectives and functions of the process unit, and its relationship with other process units
b) describe the components/equipment of the process unit
c) describe the theoretical basis for the operation of the process unit
d) describe the validation criteria and process limiting factors of the process unit
e) describe the process control strategy and how it can be used by the operations staff to achieve the desired objectives
f) provide a trouble-shooting guide for the process unit.

The format of the UPG will typically be as shown below:

Heading of section		**Content requirement**
1.0	Introduction	Identify the Process Unit
1.1	Structure of UPG	Describe the structure/format of the UPG preferably with a summary of the sections in the Unit Process Guidelines**.**
1.2	Responsibilities	Define responsibilities of the operating staff in relation to approval, implementation, and validation of the UPG.
2.0	Process Description	Plant Specific Description of the Process Unit
2.1	Process Flow Diagram	Schematic description of the process unit covering the main process streams, side streams and recycled streams. Identify sub-units of the process unit. Attach P&ID.
2.2	Process Sub-Unit	Describe each process sub-unit.
2.2.1	Function of Sub-Unit	Describe the function of the process sub-unit.
2.2.2	Components of Sub-Unit	Describe major components/equipment of the sub-unit. The description should include configuration and SWC dimensions of physical structure, capacity, pump size (kW), motor rpm, type, etc, related to its function. Refer to relevant drawings of the plant.
2.3	Instrumentation and Control	Describe the overall instrumentation and control system for the process units. Describe the control logic. Refer to relevant process and instrumentation diagrams. The information used here must normally be extracted from the FDS.
3.0	Process Theory	Describe the theoretical basis of the process design and operation of the process unit.
4.0	Process Monitoring	Describe the process monitoring requirements.
4.1	Process Validation Criteria	Identify criteria to be used for assessing and validating the performance of the process unit. Define each criterion. Provide formula for converting monitoring data into values to be assessed against the criterion. Provide the relevant mean, low and high values for each criterion.
4.2	Process Limiting Factors (PLF)	Identify the factors that can limit or inhibit the performance of the process unit. Identify the suitable location for monitoring these factors. Provide the mean (target value), low and high values for each limiting factor.

Heading of section		Content requirement
		Explain how the process can be brought under control if the PLFs are above or below the target values.
4.3	Other monitoring requirements	Identify the monitoring data related to the validation criteria or process limiting factors that are used to monitor.
5.0	Process Control Strategy	Describe the process control strategy to ensure the performance of the process unit.
5.1	Ranking of Process Limiting Factors	Rank the priority for control of the process limiting factors.
5.2	Key Process Control Actions	Describe actions that production officers can perform directly to control the process limiting factors.
6.0	Process Run and Control Charts	Describe the type of run and control charts to be used to monitor and assess trends of relevant process parameters. Provide the relevant mean, low and high limits on these charts. Simple tools for the preparation of these charts such as forms, templates, calculation sheets etc should be included as appendix to the UPG. More complex tools should be developed into Standards Operating Procedures. (SOPs).
7.0	Process Trouble Shooting Guide	Identify the potential problems and provide guides to overcome the problems and bring the process back under control. This section uses four column format with the following headings: Observation: Visible sign of the process problem Probable Cause: Probable cause of the process problem Necessary Check: Check to be carried out to validate/check the process problem Corrective Action: Action to be taken overcome the process problem.
8.0	References	List of reference documents used for the preparation of the UPG and/or those that should be referred to for the optimisation and improvements of the process performance.
9.0	Appendices	Provide additional information, tools, etc, referred to in the UPG

a) Preparation of UPGs

Where the process provided is in common use, SWC will provide generic UPGs for each of the unit processes supplied under this Contract. The Service Provider will customise the generic UPGs by adjusting, modifying, and developing them to accommodate any specific site requirements. The customising must be carried out in consultation with the SWC's operation and other expert staff.

Where the process is not in common use, the Service Provider must develop the UPGs in consultation with the SWC's operation and other expert staff.

17.7.4 Standard operating procedures

The Service Provider must prepare Standard Operating Procedures (SOPs) for each unit process covered by this Contract.

The purpose of the SOPs is to provide step-by-step instructions to the operations staff to operate the associated process unit process effectively and safely, for the plant to achieve its required outcomes.

The SOPs will be organised into four groups, namely:

a) Sampling SOPs: Procedures for taking samples at various locations of the process unit.

b) Analysis SOPs: Procedures for the type of analysis to be carried out on the samples collected for assessing the performance of the process unit.
c) Monitoring SOPs: Procedures for gathering process information required for making process decisions.
d) Equipment SOPs: Procedures for operating the process equipment including start-up and shut down in automatic and manual modes.

In general, a SOP will:

a) state why the procedure is required
b) define the scope of the procedure
c) define the responsibilities of operations staff
d) specify conditions and standards to be applied to the procedures
e) specify the tasks to be carried out to complete the procedure
f) identify the hazards associated with the procedure and the control measures to be taken
g) contain a routine risk assessment.

The format of a SOP will be as follows:

Heading of section		Content required
1.0	**Introduction**	Describe the purpose of the SOP. Outline briefly the tasks of the SOP and its importance to the plant
2.0	**Responsibility**	Define who is responsible for performing the SOP, who is responsible for evaluating the performance and evaluation frequency.
3.0	**Conditions**	Define the factors that must be present or satisfied to carry out the SOP safely and correctly.
4.0	**Standards**	Define the accuracy/precision required of the SOP.
5.0	**Safety**	State the hazards and the safety measures to be taken.
6.0	**Environment**	Describe the environmental impacts of not following or inappropriately following the Procedure. State the environmental safeguards to be put in place.
7.0	**Procedure**	Describe the procedure in a three-column format with the following headings: Location: Identify the physical location where a specific task is performed. Task: Describe what is to be done.
8.0	**Troubleshooting guide**	This section is applicable on a need basis only. This section uses a four-column format with the following headings: Observation: Visible sign of the problem related to the SOP Probable Cause: Probable cause of the problem. Necessary Check: Action to be carried out to validate/confirm the problem. Corrective Action: Action to overcome the problem.
9.0	**References**	List of other SOPs that refer to this SOP or are referred to by this SOP.

18. Signage, labelling and identification

18.1 General requirements

The Service Provider must supply and install labels to identify locations in accordance with the location numbers issued by SWC.

Labels are used to provide a description of the assets as well as to display the unique identification linking to TAR.

The Service Provider must supply a full list of labels and signage for endorsement prior to the 90% detailed design milestone.

Signage for SWC sites is detailed in SDIMS0026 Customer Delivery Facility Safety Signage Specification. Proofs of signage to be provided to SWC for review prior to manufacture.

In cases where there are two Service Providers working within one facility, e.g.: Vacuum systems or CDUs the Service Provider working inside the building for all electrical and mechanical assets must provide SWC approved labelling. The Service Provider working outside the building including civil, mechanical and site within the facility grounds must provide all SWC approved labelling.

18.2 Label descriptions

The description of the asset on labels is to be succinct and needs to describe the asset's function, for example:

Valve – Pump 1 Inlet Isolation ✓ Inlet Gate Valve ✗

Appendix G includes a list of common descriptions for SPS and WPS.

18.3 Label dimensions

The size of the label must be determined by the number of letters, size of letters, space available to install the label and the text must be understood without ambiguity. The location number must remain on a single line.

18.4 Label materials

Materials will be as follows:

Internal Labels (Low Impact Areas or Switchboards) - Traffolyte or similar material with black lettering engraved on a white background, unless specifically nominated otherwise. Edges of labels must be bevelled on all sides. Shutdown system labels (example emergency stop buttons) and warning labels will be white lettering engraved on a red background.

Exposed Labels (e.g. installed on outdoor enclosures such as kiosks, cubicles, buildings etc., or high wear locations) - are to be 1.2 mm thick, 316 Stainless Steel, 0.75 mm engraved and in-filled with black paint. Labels in chemical contact process areas must be treated similarly. Edges of labels must be bevelled on all sides and corners rounded to prevent injury. Etched labels will not be accepted.

Corrosive Environments (wet wells maintenance holes) - stainless steel and fixed with a minimum of two stainless steel screws.

Labels identifying physical assets i.e. wet wells, motors, instruments must be visible without the removal of a cover or access lid. The manufacturer's nameplate, attached to the assets installed under the Contract, must be in addition to the Location Number label described above and must be visible from the access position.

If Service Provider is in doubt, communication between SWC and the Service Provider must take place for confirmation on label details including installation location

18.5 Label font sizes

All label lettering must be in “CAPITAL” and “ARIAL” font. The wording on the labels must be horizontal.

Unless otherwise stated elsewhere in the Contract documents, the following font sizes are applicable.

a) Facility Numbers such as SP1140 on kiosks or equipment enclosures should be 12 mm and on superstructures (e.g. SP1139) 100 mm high.
b) Where permissible (except for physically small assets) font size 10 mm must be used for location labels. For very small assets, the font size may be reduced to fit. The exceptions to this rule are listed below.
c) Location number labels for electrical components must be 4 mm.
d) In certain facilities such as SPSs, and WPSs, a pump unit number may be specified in the drawings. In such cases, the Pump Unit Number label must have a font size of 50 mm.
e) The labels that describe operating procedures must have headings of 6 mm and the content must be of 4 mm.

18.6 Installation of labels

All stainless-steel labels must be secured using stainless steel fixtures.

The Traffolyte labels on front panels of switchgear and control assemblies must be secured using stainless steel fixtures. Gluing is not acceptable.

Self-adhesive Traffolyte labels, where the adhesive covers the complete back plane of the labels, are acceptable for use inside enclosures, buildings and switchgear and control assemblies only.

To prevent re-doing the labels after maintenance/replacement of the equipment, the location labels must not be directly secured to replaceable components. For such assets, the labels must be installed on a permanent structure as close as possible to the equipment. For example, the valve label must not be fixed to the valve body but could be mounted on a suitable bracket on the valve flange or valve-supporting plinth, except in the case of small valves where a hanging label fixed with stainless steel wire is acceptable. The stainless-steel wire and fixings must be installed so that there are no sharp objects that may injure personnel during operation or maintenance.

When labels are fitted close to access covers, they must visible with the cover in both open and closed positions.

The labels for electrical equipment within cubicles must be on the mounting plate. Attaching labels to cable trays and other removable parts is not acceptable.

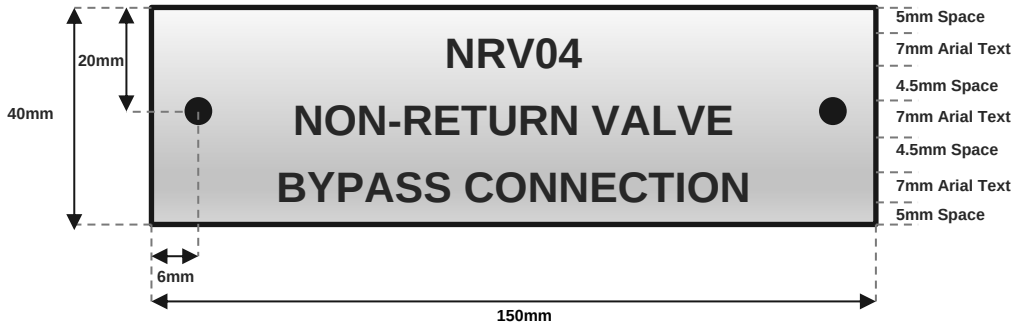
All inscriptions on the labels must be visible from the ground or a level platform.

If Service Provider is in doubt on location of an asset label, communication between SWC and the Service Provider must take place for a confirmation on exact location before printing.

18.7 Examples of labelling

Figure 0.7-1 provides an example of a typical asset label, including dimensions.

Figure 0.7-1:Labelling Example



18.8 Exemptions to labelling rules

a) Where labelling requirements are specifically stated in SWC approved drawing/s, Service Provider must comply with such instructions instead of the labelling requirements under this clause.

b) Under special circumstances, for example, where locations belonging to two facilities are physically in close proximity to each other or where a location is remote from the parent facility, SWC may request the Service Provider to include the facility number in the labels e.g. SP1139PEN01 instead of PEN01.

c) For specific assets including High Voltage (HV) assets, sewer gauges and vacuum sewage systems, reference to these rules will be referred to the Asset Data Dictionaries.

d) Small, non-maintainable assets (DN15 valves, camlocks, minsups etc.) do not require labels.

e) If the Service Provider is uncertain of labelling requirements, clarifications should be sought from SWC.

18.9 Survey datum marks

During construction of wet wells one Survey Datum reference marks with labels must be installed. Labels identifying RL in m AHD must be provided on the wet well roof slab, on the top of the inlet maintenance hole, on top of emergency storage tank and wherever else level measuring instruments and/or switches are installed.

Sitting of survey reference marks and labels must be as close as possible to the instruments as follow:

Wet Well - on the roof slab adjacent to the instrument access hatch

IMH - on the rim of the MH above the instruments

Storage Chambers - on the roof slab adjacent to the instrument access hatch

The reference mark label must clearly indicate the reduced level and datum e.g. RL 123.45m AHD.

19. Testing, sampling & analysis

Where sampling and testing is required, it will be undertaken in accordance with this section. Project specific sampling requirements will be detailed in the Contract.

Prior to commencing any sampling, a Sampling Plan should be provided by the Service Provider.

19.1 Sampling

The Service Provider must use refrigerated automatic samplers for sampling raw wastewater, intermediate and final effluent. All sampling for chemical analysis will be flow weighted composite unless otherwise specified.

The automatic samplers will be programmed to collect maximum volume over the sampling day, i.e. 9.5 litres.

A duplicate sample will be collected for all samples, which are to be analysed for Faecal Coliforms.

Where the Service Provider intends to use preservatives for certain analyses, the types of preservatives must conform to:

AS 2031.1 - Chemical

AS 2031.2 - Microbiological

The Service Provider must supply a list of the analyses, which will be performed immediately upon receipt at the laboratory. For those that cannot be, the type of preservation techniques which will be used should be provided.

Sample containers for microbiological tests must be suitably prepared to AS 2031.2.

Sampling for process unit cleanouts must be in accordance with SWC Process Unit cleanout guidelines.

19.1.1 Sampling failure

The samplers are required to function correctly and collect the correct amount of sample in the correct manner throughout the testing period. Failure of the sampling renders the results invalid and is a Major non-conformance requiring the testing to be restarted after the sampling failure is rectified.

If a sample has not been collected in the correct manner, then the following must be undertaken:

Sampler failure

Where there are eight or more hours remaining in the sampling day, and a replacement sampler can be in place before 1500 hours, then the Service Provider will replace the sampler and reset the replacement to sample a uniform frequency and volume such that the necessary sample volume is acquired during the remainder of the sampling day.

Where there are less than eight hours remaining in the sampling day or it will be later than 1500 hrs on that day before the sampler can be replaced (or sample failure is only discovered when the supplier arrives to collect the samples) then that day's sampling will be aborted and reason noted in the weekly report.

Insufficient sample in sample bottles

If the Service Provider, when collecting the samples, discovers that insufficient volume has been collected by the sampler then:

For minor shortfalls of volume (less than 15% of the programmed volume) a grab sample at the time of pickup will be used to top up the volume only if this is required to perform the necessary analysis. This must be noted on the weekly report.

For large shortfalls of volume (greater than 15% of programmed volume) the composite will be rejected if there is insufficient volume to perform the analysis and that day's sampling will be aborted and the reason noted on the weekly report.

19.1.2 Collection, transportation, and receipt of samples

The Service Provider must complete a chain of custody form for all samples taken, at the time of carrying out the work. Sample containers must be suitably labelled to identify the time, date etc. They should be easily paired with their respective chain of custody form.

Samples will be transported in a manner such that a temperature between 1°C and 6°C is maintained always. The Service Provider will provide details of proposed transportation methods, which will minimise the possibility of sample breakage in transit, and guarantee sample temperature remains between 1°C and 6°C.

Except as provided otherwise herein, the Service Provider must ensure that each particular sample will be at the Service Provider's laboratory within eight hours of the completion of sampling. Should the sampling end between midnight and 7 am, the Service Provider must ensure that the samples are at the Service Provider's laboratory by 11 am after each sampling event. This is to ensure that for those analyses requiring immediate analyses, that the analyses can be commenced, and preservation of the others can be undertaken.

Enough samples will be sub sampled on receipt so that a duplicate can be preserved and kept at the Service Provider's laboratory until the results have been reported and have been demonstrated to meet the Quality Assurance requirements.

The requirements of this clause will apply to samples taken or collected on a weekend or public holiday.

19.2 Analysis

19.2.1 General

The analytical work must comply with the procedures specified in "Standard Methods for the Examination of Water and Wastewater" (APHA/AWWA/WEF). The analytical technique to be used for the measurement of faecal coliform levels will be the membrane filtration method.

Upon arrival of the sample at the Service Provider's laboratory, the following analyses must be commenced immediately: BOD_5, Faecal Coliform and other analyses that SWC considers necessary to ensure the integrity of the sample is not compromised. Samples for other analyses must be preserved until the next working day, if not analysed in the same working day.

It is expected that the maximum turnaround time for any one sample will not exceed ten working days, except for BOD_5 duplicates.

a) Laboratory analysis

The Service Provider must ensure that a NATA approved laboratory (approved by SWC and paid for by the Service Provider) performs all sampling and testing. The sampling and analysis will be executed as specified in:

"Standard Methods for the Examination of Water and Wastewater" (APHA/AWWA/WEF)

The requirements stipulated in separate sections of the Contract

b) Laboratory quality manual

The Service Provider must supply, as part of the Test Plan & Procedures, an uncontrolled copy of the Quality Manual prepared by the Laboratory that will conduct sampling and analysis for the Contract and other relevant manuals.

19.2.2 Sampling

Provide a flow chart for procedures that detail how sample results are received, checked, and accepted, including quality control checks.

Provide sub-sampling procedures that guarantee no contamination.

Provide chain of custody forms to be used.

For each analysis group provide preparation and cleaning procedures for the acceptable sample containers, indicate the type of container suitable.

Maintenance schedule program for auto samplers. This should include, but not be limited to, a description of the cleaning procedure for the sampler, pump tubing, sampling lines etc.

Communication protocols for broken or missed samples etc.

Collection, transportation, and receipt

Sample collection.

Sample transportation and receipt, including details of the proposed transportation methods, which will minimise the possibility of sample breakage in transit, and guarantee samples are stored between 1 and 6°C.

Sub-sampling for analysis and duplicates (with any preservatives).

19.2.3 Analyses

Supply a list of the analyses to be performed immediately upon receipt at the laboratory. For those which cannot be performed immediately, the type of preservation techniques to be used must be documented.

A schedule of Methods, Quality Control & Limits, including for each analysis, the method and matrix, standard or modified method, accreditation, volume to be used (in the case of BOD, minimum number of dilutions which will be used per sample), limit of quantitation, method detection limit, method range, quality control to be used, acceptance limits for each quality control procedure, turn-around time.

Details of the Quality Control (QC) Procedures for analyses must include but not necessarily be limited to:

minimum of one replicate every 10 samples (can be a replicate on <10)

blanks

spikes

standards

surrogates

use of validated Internal Reference Material

use of Certified Reference Material

sampling Blanks

provide the acceptance criteria for the QC items outlined above.

A list of personnel who will perform each analysis together with each person's qualifications and experience must be submitted to SWC. SWC reserves the right to reject personnel considered not suitably qualified or experienced. The list should include the names of backup personnel who will perform the analysis.

19.2.4 Reporting

Provide the laboratory's statistical procedures for rounding and interpretation of limiting values (i.e. AS 2706). Be sure to address situations when one of the results from a duplicate is a 'less than' (<) result.

The three-day geometric mean must be calculated using the formula: = $\sqrt[3]{}$(a1*a2*a3), where a1,a 2,a 3 are the results for each day, over any three consecutive days.

Provide suggested reporting and database formats.

19.3 Screenings samples

There is no “Standard Method” for measurement of the BOD content of washed and dewatered screenings.

The following test method will be used to measure the BOD content of washed and dewatered screenings.

The BOD content in the washed and dewatered screenings will be measured by the BOD_5 and expressed as a cleanliness factor or concentration, as described below.

The cleanliness of the washed and dewatered screenings will be measured to give either:

1. A cleanliness factor determined by the equation below:

Cleanliness Factor = BOD_5 (g/ litre) / Density (tones/m^3) x Dry Solids Fraction.

The Service Provider will guarantee that 8 out of 10 samples must have a cleanliness factor of less than 50. The cleanliness factor will be obtained by measuring leachate BOD_5, the density and dry solids content of the screenings and inserting the figures obtained in the formula above.

The BOD_5 must be analysed in accordance to Standard Method - 5-day biochemical oxygen demand (BOD_5).

Or

2. The maximum BOD_5 of the washed and dewatered screenings must be not more than 50 mg/g of dry solids.

The method for determining the BOD_5 will be:

A 2 to 3 kg sample of the discharged screenings (free of any external source of moisture) will be taken and stored in a sealed plastic bag for transport to the laboratory. Analysis will be taken as soon as possible. The sample bag is opened in the laboratory and the contents quickly shredded without loss of water or other sample material. The whole sample is then well mixed. Sub-samples of 150 to 200 g are then taken, one for dry solids determination, the other for washing with five successive litres of clean water. Between each wash the sample is drained through a 30 micron mesh sieve. The combined washings are analysed for total BOD_5, according to the Standard Method for 5-day biochemical oxygen demand (BOD_5)**.**

19.4 Grit samples

The moisture content and the organic content of the washed and dewatered grit will be measured in accordance with “Standard Methods for the Examination of Water and Wastewater” (standardmethods.org).

19.5 Not used

19.6 Odour assessment

19.6.1 General

The Service Provider will carry out odour assessment during the following conditions:

Dry weather

When the sewer flows are not influenced by rainfall

In the months January through April.

The Service Provider will sample each odour source at least twice on different days and at a time of day where worst case conditions are most probable. Samples must not be collected within 5 days of any significant rain event in the catchment of the wastewater system.

19.6.2 Sampling for odour testing

The Service Provider will collect the odorous air samples in accordance with the Technical Notes: Assessment and Management of Odour from Stationary Sources In NSW November 2006 (epa.nsw.gov.au/air/odour.htm). The Service Provider will submit a duplicate set of samples to SWC for independent testing if necessary. The Service Provider will provide a minimum of 2 days' notice to SWC prior to sampling so that SWC may witness the collection of samples.

19.6.3 Testing for odour concentration

The analysis of the collected odorous air samples will be performed in accordance with the Australian and New Zealand Standard: Air Quality Determination of Odour Concentration by Dynamic Olfactometry' (AS/NZS 4323.3:2001 (R2014)).

19.6.4 Modelling of odour impacts

The odour impact will be assessed by use of the most recent version of the AUSPLUME gaussian plume dispersion modelling software and is to be performed over the nose response time of 1 second (Assessment and Management of Odour from Stationary Sources In NSW November 2006 (epa.nsw.gov.au/air/odour.htm) for 99% of the modelled time.

The largest available site specific, or if not available site representative, meteorological data file is to be used for these assessments. The meteorological data file noted previously, and a local terrain file are to be used as inputs to this process. The outcome of this modelling must produce a situation which conforms to the NSW EPA requirements.

19.7 Hydraulic testing

19.7.1 Structures

No work can be backfilled, covered, or concealed until it has been inspected and tested. Testing must be in accordance with - SW Technical Specification - Civil.

19.7.2 Pipework hydrostatic tests

No work can be backfilled, covered, or concealed until it has been inspected and tested. Pipe joints and structures must be exposed to enable observation during hydrostatic tests.

Pipelines must be tested for leakage and defects in the pipes, joints, fittings, valves and thrust blocks. The test must be carried out in sections as soon as practicable after each section has been laid, jointed and cleaned and not earlier than seven days after the last concrete thrust block in the section has been cast unless suitable strutting and bracing is installed to take the thrust. Solvent cement joints must be cured for at least 24 hours before testing.

In order to achieve stable testing conditions, the pipe section to be tested must be filled slowly with water, ensuring all air is expelled and allowing for absorption. The section must be kept full of water for 24 hours prior to the commencement of the pressure testing. During pressure testing of a pipeline each isolation valve must sustain the full pressure on one side of the valve with no pressure on the other side.

The Service Provider must ensure that all pipe components under test (including thrust blocks) have rated pressure or manufacturers recommended maximum test pressure above the hydrostatic test pressure. The test report must be supplied to SWC.

Pipework must be tested in accordance with relevant Australian Standards. The test pressure for all pipework must be the design pressure plus 25%. The design pressure for pumping station discharge pipework and pressure mains must be the larger of the pump shut-off head plus the maximum head at pump suction, and the maximum pressure determined by water hammer analysis. For all other pipework the design pressure must be the larger of the maximum head and the maximum pressure determined by water hammer analysis.

The pipe work must be deemed tested when the test pressure has been maintained for two hours without topping up and there is no visible leakage or sweating or pressure drop. Test certificates are to be supplied by the Service Provider.

When conducting hydrostatic testing, all tests will be measured using a minimum of two calibrated pressure gauges, and the relevant calibration certificates and numbers included with relevant quality documentation.

19.7.3 Site specific hydrostatic tests

10 For Sewage Pumping Stations in Network, hydrostatic testing of emergency bypass pipework the procedure as outlined in appendix F1 to be followed.

For Sewage Pumping Stations in Network and Treatment, hydrostatic testing of inlet stop valve the procedure as outlined in appendix F2 to be followed.

For Network and Treatment, hydrostatic testing of penstocks in a chamber / maintenance hole / channel / wet well the procedure as outlined in appendix F3 to be followed.

For Sewage Pumping Stations in Network and Treatment, hydrostatic testing of pump riser pipes and not including joints with pump the procedure as outlined in appendix F4 to be followed.

For Sewage Pumping Stations and Water Pumping Stations in Network and Sewage Pumping Stations in Treatment, hydrostatic testing of pipework including joints with pump the procedure as outlined in appendix F5 to be followed.

Notwithstanding the above, the Service Provider must consult the pump supplier to confirm if their equipment, component that will be subjected to the test pressure is rated (preferably 10% to 15% above) for the test pressures mentioned in this clause.

19.7.4 Hydraulic capacity

The Service Provider will carry out all tests necessary to determine compliance with the Contract for the hydraulic capacity of process units and systems including flow splitting and bypasses, under simulation of the most severe loading conditions. The Service Provider will provide, calibrate, and maintain all flow measuring devices, which are necessary for these tests. The flow measuring devices must be installed in a manner to ensure accurate measurement. Flow splitting between process units and overflow weir settings will be within ± 5% of that required by the design inclusive of the accuracy of the flow measuring devices.

If peak instantaneous hydraulic conditions are not achievable during commissioning, the Service Provider will test hydraulic capacity at the maximum flows achievable, as agreed with SWC, and submit calculations, which predict the performance at the maximum design flows by calibration of the design calculations and/or extrapolation of the results obtained for the flows used in the hydraulic capacity tests to the peak instantaneous hydraulic conditions.

19.8 Other specific testing

19.8.1 Crane and lifting equipment testing

Cranes must be tested and commissioned in accordance with AS 1418.3. Prior to the testing, the crane must be inspected in accordance with AS 1418.1. Following testing a Work Cover Certificate will have to be obtained for the lifting device and provided to SWC.

19.8.2 Pump performance testing

Pump performance must be tested on site with their respective motors and starters (or variable speed drives, if supplied) in accordance with AS/ISO 9906:2018 “Rotodynamic pumps - Hydraulic performance acceptance tests - Grades 1, 2 and 3”. Grade 1 tolerance factors must be adopted for pumps driven by motors 50 kW or larger and Grade 2 for pumps with motors smaller than 50 kW. The Service Provider must provide all materials, equipment (including test starters if not supplied with the pumps) and labour for the works tests. Refer appendices C1 and C2 for tests to be done by the Service Provider.

Unless stated otherwise, the performance tests must include the following:

Pump capacity (Q)

Head (H)

Overall efficiency (ηO/A)

Needs specification curve (where prepared and available)

19.8.3 Noise testing

The installed equipment, plant and systems must comply with the Environmental and Occupational noise levels and remedial measures as specified in the SWC Mechanical Specification.

Preliminary noise tests to be undertaken at the manufacturer’s works during performance tests and repeated on site for final acceptance. The preliminary noise tests will identify any obvious noisy operating condition within the asset / equipment operating range. The obtained data are to be evaluated and translated to defined site noise performance conditions. The equipment can only be delivered to site if the above evaluation indicates that the specified site noise levels will be achieved.

The Service Provider must conduct noise tests on all individual equipment installed and the complete plant carried out under full operational load. The noise tests will be conducted under the noisiest loading conditions within the defined operating range. All measurements to be carried out and certified by trained personnel with currently NATA calibrated equipment and must conform to the requirements of the Contract. The measured data will be supplied in Sound Pressure Levels (SPL) and Sound Power Levels (SWL) - refer to table below - Noise Analysis Data sheet.

The Service Provider must supply full details of the test procedure, conditions and standards used.

The Service Provider must enter the results of the above tests in a “NOISE ANALYSIS, Data Sheet” which must be included in the commissioning records.

Noise analysis - data sheet

Description	dB(A) L_{Aeq}	63 Hz	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz	8k Hz
Sound Pressure Levels (SPL) at 1 m (or other - specify)*									
Sound Power Levels (SWL)									
Standard by which noise measured									
Ambient Noise Levels (dB(A))									
Directivity Index (dB)									
Test Description									
Test Location Condition									
Other Information									

The test results will be used to verify compliance with both WHS and environmental noise regulations.

Assets / equipment tested to meet the environmental noise requirements should have an allowance for noise increase with age and wear. This means the maximum acceptable noise level must be at least 2 dBA below the legal limit.

Assets will not be accepted unless they meet the specified noise levels. When assets fail to meet the required noise levels, the Service Provider must take necessary actions to remedy the problems to the satisfaction of SWC, at no extra cost to SWC.

19.8.4 Vibration testing

The Service Provider must carry out vibration testing as part of the performance testing of all installed equipment in compliance to SWC technical Specification – Mechanical.

20. Not used

21. References

Document Ref.	Document title
QA-PRO-027	Inspection and Test Plan Guideline
QA-F-022	ITP Review Checklist
	WAC Drawing Checklist
IMS0038	Treatment Plant Operational Change Management SAP

Document Ref.	Document title
SDIMS0008.01	Procedure Template
SDIMS0008.02	Detailed Work Instruction Template
SDIMS0008.03	Simple Work Instruction Template Portrait
SDIMS0008.04	Simple Work Instruction Template Landscape
SDIMS0008.05	Manual or Specification Template
SDIMS0026	Customer Delivery Facility Safety Signage Specification
D0000256	Asset Creation Operational Readiness Standard
Multiple	SWC Technical Specifications
Multiple	Maintenance Excellence Standards (Specific Asset Types)
Multiple	Standard Type Unit Process Guide (UPG) Templates
Multiple	Standard Operating Procedure (SOP) Templates
MGT-STD-005	Instrumentation and Control Standards
	Water Specific I&C Standards
	SPS Specific I&C Standards
TOG_TS04	Potable Water Pressure Monitoring Station Standards
TOG_TS05	Flow Monitoring Station Standards
TOG_TS08	Sewer Odour & Corrosion Control Standards
MGT-STD-006	Treatment Plant SCADA Standards
HSSC0005	SCADA Standards Compliance Checklist
(SOP) WPIMS 5027	Disinfecting New Water Mains

22. Appendices

The following appendices are guidance material only. They may be continuously revised or improved and are provided to assist in the development of project specific commissioning documentation.

22.1 Appendix A – Labelling and signage

22.1.1 Appendix A1- Label descriptions – sewage pumping station

Label Asset	Label Description	Location Description (by SWC)	
ACT01	ACTUATOR - WELL 1 INLET PENSTOCK	Actuator - Penstock 01, inlet pipe 1	
ACT02	ACTUATOR - WELL 2 INLET PENSTOCK	Actuator - Penstock 02, inlet pipe 2	
ACT03	ACTUATOR - WELL 1 DIVIDING PENSTOCK	Actuator - Penstock 03, wet well dividing wall	
ACT04	ACTUATOR - WELL 2 DIVIDING PENSTOCK	Actuator - Penstock 04, wet well dividing wall	
ACV01	AIR VALVE - PUMP 1 DISCHARGE	Air Release Valve - Pump 01 Discharge	
ACV02	AIR VALVE - PUMP 2 DISCHARGE	Air Release Valve - Pump 02 Discharge	
ACV03	AIR VALVE - PUMP 3 DISCHARGE	Air Release Valve - Pump 03 Discharge	
ACV04	AIR VALVE - PUMP 4 DISCHARGE	Air Release Valve - Pump 04 Discharge	
ACV05	AIR VALVE - PRESSURE MAIN 1	Air Release Valve - Pressure main 1	
ACV06	AIR VALVE - PRESSURE MAIN 2	Air Release Valve - Pressure main 2	
CHB01	EMERGENCY RELIEF CHAMBER	Chamber - Emergency Relief Chamber (Overflow Manhole)	
CRA01	ANCHOR POINT - FALL RESTRAINT	Lifting Equipment - Anchor Point - Fall Restraint	
CRA02	ANCHOR POINT - FALL RESTRAINT	Lifting Equipment - Anchor Point - Fall Restraint	
CRA03	ANCHOR POINT - FALL RESTRAINT	Lifting Equipment - Anchor Point - Fall Restraint	
CRA04	ANCHOR POINT - FALL RESTRAINT	Lifting Equipment - Anchor Point - Fall Restraint	
CRA05	ANCHOR POINT - FALL RESTRAINT	Lifting Equipment - Anchor Point - Fall Restraint	
CRA06	ANCHOR POINT - FALL RESTRAINT	Lifting Equipment - Anchor Point - Fall Restraint	
CRA07	ANCHOR POINT - FALL RESTRAINT	Lifting Equipment - Anchor Point - Fall Restraint	
CRA08	ANCHOR POINT - FALL RESTRAINT	Lifting Equipment - Anchor Point - Fall Restraint	
CRA09	ANCHOR POINT - FALL RESTRAINT	Lifting Equipment - Anchor Point - Fall Restraint	
FAN01	INDUCT VENT - WET WELL 1	Fan - Induct Vent Wet Well 1 DN100	
FAN02	INDUCT VENT - WET WELL 2	Fan - Induct Vent Wet Well 2 DN100	
FAN03	EDUCT VENT	Fan - Educt Vent DN300	
HYV01	HYDRANT TO WET WELL	Hydrant - Flushing, water service to wet well	The hydrants to have standard covers with "H" and therefore additional label not required.
HYV02	HYDRANT TO WET WELL	Hydrant - Flushing, water service to wet well	
HYV03	HYDRANT TO IMH	Hydrant - Flushing, water service to Inlet Maintenance Hole	
LSA02	LEVEL SWITCH - DEWATERING PUMP 5 CUT-IN	Level Switch - Dewatering pump 05 level Wet Well 2	

Label Asset	Label Description	Location Description (by SWC)	
LSH01	LEVEL SWITCH - ATWL ALARM	Level Switch - Wet well 1 Level High ATWL Alarm	
LSH02	LEVEL SWICH - WELL 2 HIGH LEVEL ALARM	Level Switch - High Level Alarm for dewatering pump 05 Wet Well 2	
LSH03	LEVEL SWICH - OVERFLOW IMPENDING ALARM	Level Switch - Inlet Maintenance Hole Level High Overflow alarm	
LSL02	LEVEL SWICH - DEWATERING PUMP 05 CUT OUT	Level Switch - Dewatering pump 05 cut out	
LTX01	LEVEL Tx - WET WELL 1	Level Transmitter - Wet well 1 Level	
LTX03	LEVEL Tx - IMH LEVEL	Level Transmitter - Inlet Maintenance Hole Level	
MHL01	INLET MAINTENANCE MANHOLE	Manhole - Inlet Maintenance Manhole	
NRV01	NON RETURN VALVE- PUMP 1	Non Return Valve - Pump 1 discharge	
NRV02	NON RETURN VALVE - PUMP 2	Non Return Valve - Pump 2 discharge	
NRV03	NON RETURN VALVE - PUMP 3	Non Return Valve - Pump 3 discharge	
NRV04	NON RETURN VALVE - PUMP 4	Non Return Valve - Pump 4 discharge	
NRV05	NON RETURN VALVE - ERC	Non Return Valve - Emergency overflow Emergency relief chamber	
NRV06	NON RETURN VALVE - VALVE CHAMBER DRAIN	Non Return Valve - Valve chamber drain to wet well 2	Not Required
PEN01	PENTSTOCK - WET WEL 2 INLET	Penstock - Isolation, inlet pipe 1	
PEN02	PENTSTOCK - WET WEL 1 INLET	Penstock - Isolation, inlet pipe 2	
PEN03	PENTSTOCK - WET WELL 2 DIVIDING	Penstock - Isolation , wetwell dividing Wall	
PEN04	PENTSTOCK - WET WELL 1 DIVIDING	Penstock - Isolation, wetwell dividing Wall	
PIX01	PRESSURE GAUGE - PUMP 1 DISCHARGE	Pressure gauge - Discharge Pressure Upstream Non retuen valve 01 PMP01	
PIX02	PRESSURE GAUGE - PUMP 2 DISCHARGE	Pressure gauge - Discharge Pressure Upstream Non retuen valve 02 PMP02	
PIX03	PRESSURE GAUGE - PUMP 3 DISCHARGE	Pressure gauge - Discharge Pressure Upstream Non retuen valve 03 PMP03	
PIX04	PRESSURE GAUGE - PUMP 4 DISCHARGE	Pressure gauge - Discharge Pressure Upstream Non retuen valve 04 PMP04	
PIX05	PRESSURE GAUGE - PRESSURE MAIN 1	Pressure gauge - Pressure Main 1 Pressure	
PIX06	PRESSURE GAUGE - PRESSURE MAIN 2	Pressure gauge - Pressure Main 2 Pressure	
PIX07	PRESSURE GAUGE - PUMP DISCHARGE MANIFOLD	Pressure gauge - Pump 01 & Pump 2 outlet pressure	
PIX08	PRESSURE GAUGE - PUMP DISCHARGE MANIFOLD	Pressure gauge - Pump 03 & Pump 4 outlet pressure	
PMP01	PUMP UNIT 1	Pump - Submersible pump 1	
PMP02	PUMP UNIT 2	Pump - Submersible pump 2	
PMP03	PUMP UNIT 3	Pump - Submersible pump 3 (install in future)	
PMP04	PUMP UNIT 4	Pump - Submersible pump 4 (install in future)	
PMP11	PUMP UNIT 11 DEWATERING PUMP	Pump - Dwatering No 5	
RPZ01	VALVE - REDUCE PRESSURE ZONE	Valve - RPZ (Backflow Preventer) SP1154	
RPZ02	VALVE - REDUCE PRESSURE ZONE	Valve - RPZ (Backflow Preventer) SP1154	
RTU01	IICATS CONTROL PANEL	RTU - IICATS RTU for Vineyard SP1154	
SBD01	STOP BOARD - WET WELL 2 INLET	Stop Board - Stop Board to Wet Well 1	
SBD02	STOP BOARD - WET WELL 1 INLET	Stop Board - Stop Board to Wet Well 2	
SCB01	LV SWITCH BOARD	Switch Control Assembly - Switch Control Assembly SP1154	
SCV01	SCOUR VALVE - PUMP 3 & 4 DISCHARGE	Scour Valve - Isolation, Pumps 1 & 2 Discharge	
SCV02	SCOUR VALVE - PUMP 1 & 2 DISCHARGE	Scour Valve - Isolation, Pumps 3 & 4 Discharge	
SCV03	SCOUR VALVE - PRESSURE MAIN 1	Scour Valve - Isolation, Pressure main 1 low point scour	

Label Asset	Label Description	Location Description (by SWC)	
SCV04	SCOUR VALVE - PRESSURE MAIN 1	Scour Valve - Isolation, Pressure main 1 low point scour	
SCV05	SCOUR VALVE - PRESSURE MAIN 2	Scour Valve - Isolation, Pressure main 2 low point scour	
SCV06	SCOUR VALVE - PRESSURE MAIN 2	Scour Valve - Isolation, Pressure main 2 low point scour	
STN01	STRAINER - REDUCE PRESSURE ZONE 1	Strainer - RPZ 01 device to water service for wet well SP1154	
STN02	STRAINER - REDUCE PRESSURE ZONE 2	Strainer - RPZ device to water service for safety shower at CDU	
VLV01	VALVE - PUMP 1 INLET ISOLATION	Valve - Isolation, Pump 1 discharge	
VLV02	VALVE - PUMP 2 INLET ISOLATION	Valve - Isolation, Pump 2 discharge	
VLV03	VALVE - PUMP 3 INLET ISOLATION	Valve - Isolation, Pump 3 discharge	
VLV04	VALVE - PUMP 4 INLET ISOLATION	Valve - Isolation, Pump 4 discharge	
VLV05	VALVE - PRESSURE MAIN 2 ISOLATION	Valve - Isolation, Pressure Main 1	
VLV06	VALVE - PRESSURE MAIN 1 ISOLATION	Valve - Isolation, Pressure Main 2	
VLV07	VALVE - DISCHARGE MANIFOLD CROSS CONNECTION	Valve - Isolation, Pumps 1, 2, 3 & 4 Discharge manifold	
VLV08	VALVE - AIR VALVE INLET ISOLATION	Valve - Isolation, Upstream Pump 01 air valve 01	
VLV09	VALVE - AIR VALVE OUTLET ISOLATION	Valve - Isolation, Downstream Pump 01 air valve 01	
VLV10	VALVE - AIR VALVE INLET ISOLATION	Valve - Isolation, Upstream Pump 02 air valve 02	
VLV11	VALVE - AIR VALVE OUTLET ISOLATION	Valve - Isolation, Downstream Pump 02 air valve 02	
VLV12	VALVE - AIR VALVE INLET ISOLATION	Valve - Isolation, Upstream Pump 03 air valve 03	
VLV13	VALVE - AIR VALVE OUTLET ISOLATION	Valve - Isolation, Downstream Pump 03 air valve 03	
VLV14	VALVE - AIR VALVE INLET ISOLATION	Valve - Isolation, Upstream Pump 04 air valve 04	
VLV15	VALVE - AIR VALVE OUTLET ISOLATION	Valve - Isolation, Downstream Pump 04 air valve 04	
VLV16	VALVE - AIR VALVE INLET ISOLATION	Valve - Isolation, Upstream Air valve 05, Pressure main 1	
VLV17	VALVE - AIR VALVE OUTLET ISOLATION	Valve - Isolation, Downstream Air valve 05, Pressure main 1	
VLV18	VALVE - AIR VALVE INLET ISOLATION	Valve - Isolation, Upstream Air valve 06, Pressure main 2	
VLV19	VALVE - AIR VALVE OUTLET ISOLATION	Valve - Isolation, Downstream Air valve 06, Pressure main 2	
VLV20	VALVE - RPZ 1 INLET ISOLATION	Valve - Isolation, Upstream RPZ 01	
VLV21	VALVE - RPZ 1 OUTLET ISOLATION	Valve - Isolation, Downstream RPZ 01	
VLV22	VALVE - HYDRANT 1 INLET ISOLATION	Valve - Isolation, water service for hydrant 01	
VLV23	VALVE - HYDRANT 2 INLET ISOLATION	Valve - Isolation, water service for hydrant 02	
VLV24	ISOLATION VALVE - WATER TO WET WELL	Valve - Isolation, water service to wet well	Asset label not Required but must have a warning sign
VLV25	ISOLATION VALVE - WATER TO WET WELL	Valve - Isolation, water service to wet well	to the effect " NOT FOR DRINKING NON POTABLE WATER "
VLV26	VALVE - WATERMAIN ISOLATION TO AMENITIES	Valve - Isolation, water service to toilet amenities	
VLV27	VALVE - RPZ 2 INLET ISOLATION	Valve - Isolation, Upstream RPZ02	
VLV28	VALVE - RPZ 2 OUTLET ISOLATION	Valve - Isolation, Downstream RPZ02	
VLV29	ISOLATION VALVE - WATER TO IMH	Valve - Isolation, water service to Inlet Maintenance Hole	Asset label not Required but must have a warning sign to the
VLV30	VALVE - PUMP 1 DISCHARGE DRAIN	Valve - Isolation, Pump 01 Discharge pipe flushing line	effect " NOT FOR DRINKING NON POTABLE WATER "
VLV31	VALVE - PUMP 2 DISCHARGE DRAIN	Valve - Isolation, Pump 02 Discharge pipe flushing line	
VLV32	VALVE - PUMP 3 DISCHARGE DRAIN	Valve - Isolation, Pump 03 Discharge pipe flushing line	

Label Asset	Label Description	Location Description (by SWC)	
ACT01	ACTUATOR - WELL 1 INLET PENSTOCK	Actuator - Penstock 01, inlet pipe 1	
ACT02	ACTUATOR - WELL 2 INLET PENSTOCK	Actuator - Penstock 02, inlet pipe 2	
ACT03	ACTUATOR - WELL 1 DIVIDING PENSTOCK	Actuator - Penstock 03, wet well dividing wall	
ACT04	ACTUATOR - WELL 2 DIVIDING PENSTOCK	Actuator - Penstock 04, wet well dividing wall	
ACV01	AIR VALVE - PUMP 1 DISCHARGE	Air Release Valve - Pump 01 Discharge	
ACV02	AIR VALVE - PUMP 2 DISCHARGE	Air Release Valve - Pump 02 Discharge	
ACV03	AIR VALVE - PUMP 3 DISCHARGE	Air Release Valve - Pump 03 Discharge	
ACV04	AIR VALVE - PUMP 4 DISCHARGE	Air Release Valve - Pump 04 Discharge	
ACV05	AIR VALVE - PRESSURE MAIN 1	Air Release Valve - Pressure main 1	
ACV06	AIR VALVE - PRESSURE MAIN 2	Air Release Valve - Pressure main 2	
CHB01	EMERGENCY RELIEF CHAMBER	Chamber - Emergency Relief Chamber (Overflow Manhole)	
CRA01	ANCHOR POINT - FALL RESTRAINT	Lifting Equipment - Anchor Point - Fall Restraint	
CRA02	ANCHOR POINT - FALL RESTRAINT	Lifting Equipment - Anchor Point - Fall Restraint	
CRA03	ANCHOR POINT - FALL RESTRAINT	Lifting Equipment - Anchor Point - Fall Restraint	
CRA04	ANCHOR POINT - FALL RESTRAINT	Lifting Equipment - Anchor Point - Fall Restraint	
CRA05	ANCHOR POINT - FALL RESTRAINT	Lifting Equipment - Anchor Point - Fall Restraint	
CRA06	ANCHOR POINT - FALL RESTRAINT	Lifting Equipment - Anchor Point - Fall Restraint	
CRA07	ANCHOR POINT - FALL RESTRAINT	Lifting Equipment - Anchor Point - Fall Restraint	
CRA08	ANCHOR POINT - FALL RESTRAINT	Lifting Equipment - Anchor Point - Fall Restraint	
CRA09	ANCHOR POINT - FALL RESTRAINT	Lifting Equipment - Anchor Point - Fall Restraint	
FAN01	INDUCT VENT - WET WELL 1	Fan - Induct Vent Wet Well 1 DN100	
FAN02	INDUCT VENT - WET WELL 2	Fan - Induct Vent Wet Well 2 DN100	
FAN03	EDUCT VENT	Fan - Educt Vent DN300	
HYV01	HYDRANT TO WET WELL	Hydrant - Flushing, water service to wet well	The hydrants to have standard covers with "H"
HYV02	HYDRANT TO WET WELL	Hydrant - Flushing, water service to wet well	and therefore additional label not required.
HYV03	HYDRANT TO IMH	Hydrant - Flushing, water service to Inlet Maintenance Hole	
LSA02	LEVEL SWITCH - DEWATERING PUMP 5 CUT-IN	Level Switch - Dewatering pump 05 level Wet Well 2	
Label Asset	**Label Description**	**Location Description (by SWC)**	
LSH01	LEVEL SWITCH - ATWL ALARM	Level Switch - Wet well 1 Level High ATWL Alarm	
LSH02	LEVEL SWICH - WELL 2 HIGH LEVEL ALARM	Level Switch - High Level Alarm for dewatering pump 05 Wet Well 2	
LSH03	LEVEL SWICH - OVERFLOW IMPENDING ALARM	Level Switch - Inlet Maintenance Hole Level High Overflow alarm	
LSL02	LEVEL SWICH - DEWATERING PUMP 05 CUT OUT	Level Switch - Dewatering pump 05 cut out	
LTX01	LEVEL Tx - WET WELL 1	Level Transmitter - Wet well 1 Level	
LTX03	LEVEL Tx - IMH LEVEL	Level Transmitter - Inlet Maintenance Hole Level	
MHL01	INLET MAINTENANCE MANHOLE	Manhole - Inlet Maintenance Manhole	

22.1.2 Appendix A2 - Label layout – sewage pumping station

NRV04 NON RETURN VALVE EMERGENCY RELIEF STRUCTURE	VLV14 INLET ISOLATION VALVE AIR VALVE ACV03	LSA02 LEVEL SWITCH IMH OVERFLOW ALARM	NRV07 NON RETURN VALVE INDUCT VENT EST
VLV16 ISOLATION VALVE CDU SUMP DRAIN	VLV11 OUTLET ISOLATION VALVE AIR VALVE ACV03	LSA01 LEVEL SWITCH WET WELL ATWL ALARM	NRV08 NON RETURN VALVE INDUCT VENT WET WELL
VLV15 ISOLATION VALVE CDU BUND-DRAIN	VLV13 OUTLET ISOLATION VALVE AIR VALVE ACV02	LSA03 LEVEL SWITCH EST HIGH LEVEL ALARM	WEL01 WET WELL (WW)
RPZ01 REDUCED PRESSURE ZONE VALVE SPS-WATER SUPPLY	VLV12 INLET ISOLATION VALVE AIR VALVE ACV02	PMP01 SUBMERSIBLE PUMP 01 WET WELL	IMH 01 INLET MAINTENANCE HOLE (IMH)
RPZ02 REDUCED PRESSURE ZONE VALVE CDU WATER SUPPLY	VLV02 ISOLATION VALVE PUMP 1 DISCHARGE	PMP02 SUBMERSIBLE PUMP 02 WET WELL	SMP01 SUMP CDU DRAIN
VLV22 INLET ISOLATION VALVE SPS WATER SUPPLY	VLV03 ISOLATION VALVE PUMP DISCHARGE	VLV17 ISOLATION VALVE RPZ01 WATER SUPPLY	TNK01 EMERGENCY STORAGE TANK (EST)
HYV01 HYDRANT	VLV04 ISOLATION VALVE PRESSURE MAIN	VLV18 ISOLATION VALVE SPS WATER SUPPLY	CHB01 VALVE CHAMBER

NRV04 NON RETURN VALVE EMERGENCY RELIEF STRUCTURE	VLV14 INLET ISOLATION VALVE AIR VALVE ACV03	LSA02 LEVEL SWITCH IMH OVERFLOW ALARM	NRV07 NON RETURN VALVE INDUCT VENT EST
VLV16 ISOLATION VALVE CDU SUMP DRAIN	VLV11 OUTLET ISOLATION VALVE AIR VALVE ACV03	LSA01 LEVEL SWITCH WET WELL ATWL ALARM	NRV08 NON RETURN VALVE INDUCT VENT WET WELL
VLV15 ISOLATION VALVE CDU BUND-DRAIN	VLV13 OUTLET ISOLATION VALVE AIR VALVE ACV02	LSA03 LEVEL SWITCH EST HIGH LEVEL ALARM	WEL01 WET WELL (WW)
RPZ01 REDUCED PRESSURE ZONE VALVE SPS-WATER SUPPLY	VLV12 INLET ISOLATION VALVE AIR VALVE ACV02	PMP01 SUBMERSIBLE PUMP 01 WET WELL	IMH 01 INLET MAINTENANCE HOLE (IMH)
RPZ02 REDUCED PRESSURE ZONE VALVE CDU WATER SUPPLY	VLV02 ISOLATION VALVE PUMP 1 DISCHARGE	PMP02 SUBMERSIBLE PUMP 02 WET WELL	SMP01 SUMP CDU DRAIN
VLV22 INLET ISOLATION VALVE SPS WATER SUPPLY	VLV03 ISOLATION VALVE PUMP DISCHARGE	VLV17 ISOLATION VALVE RPZ01 WATER SUPPLY	TNK01 EMERGENCY STORAGE TANK (EST)
HYV01 HYDRANT	VLV04 ISOLATION VALVE PRESSURE MAIN	VLV18 ISOLATION VALVE SPS WATER SUPPLY	CHB01 VALVE CHAMBER
CRA01 ANCHOR POINT FAULT RESTRAINT PUMP UNIT 1 ACCESS HATCH	CRA02 ANCHOR POINT FAULT RESTRAINT PUMP UNIT 2 ACCESS HATCH		

22.2 Appendix B - Templates

22.2.1 Appendix B1- Commissioning plan

Introduction

1.1 Project description

[**Do not type here.** This is instructional text.

Mandatory. Explain briefly the background of the project/activity/upgrade. Keep to a very key and simple description]

[**Note.** Do not delete green boxes, [Delete all instructional boxes by clicking the 'Finalise Document' button (far left of the 'Home' tab). When instructional text no longer required.]

[Enter text]

1.2 Project critical data

[**Do not type here.** This is instructional text.

Mandatory. Using the table below summarise the key critical system design criteria, and the source of the information. For larger systems keep to system level performance, rather than individual asset (this will be covered later. Delete example text in yellow.]

Work Lot	Description	Design Criteria	Relevant Design Document
1.1	WAS Thickening System	4% DS @ 25 KL/hr	Design Report
[Enter Text]	[Enter Text]	[Enter Text]	[Enter Text]

1.3 Document objectives

[**Do not type here.** This is instructional text.

Mandatory. Summarise the key objectives of the document. Text in yellow is example text only.

This plan describes the approach to undertaking commissioning activities for this project. Detail activities, tests and witness/hold points will be contained within the commissioning ITPs and ITCs.

This is intended to be a live document that will be revised and updated to align with site conditions, and operational needs.

The objectives of this document are to:

Describe the commissioning procedure and methodology
Define criteria required and the documents required to have the equipment systems successfully placed into operation.
Define commissioning pre-requisites.
Provide standard commissioning procedures.
Define the inspections and tests required at each stage
Complete and sign off all required commissioning and handover deliverables.

2. Commissioning team

2.1 Roles and responsibilities

[**Do not type here.** This is instructional text.

Mandatory. Update the highlighted text as required to reflect the commissioning R&R for the specific project.

The Commissioning Team will be a multi-skilled team utilising a range of resources from Suppliers, Customer Delivery, Maintenance, Design and Construction. The team structure is presented in 0 below.

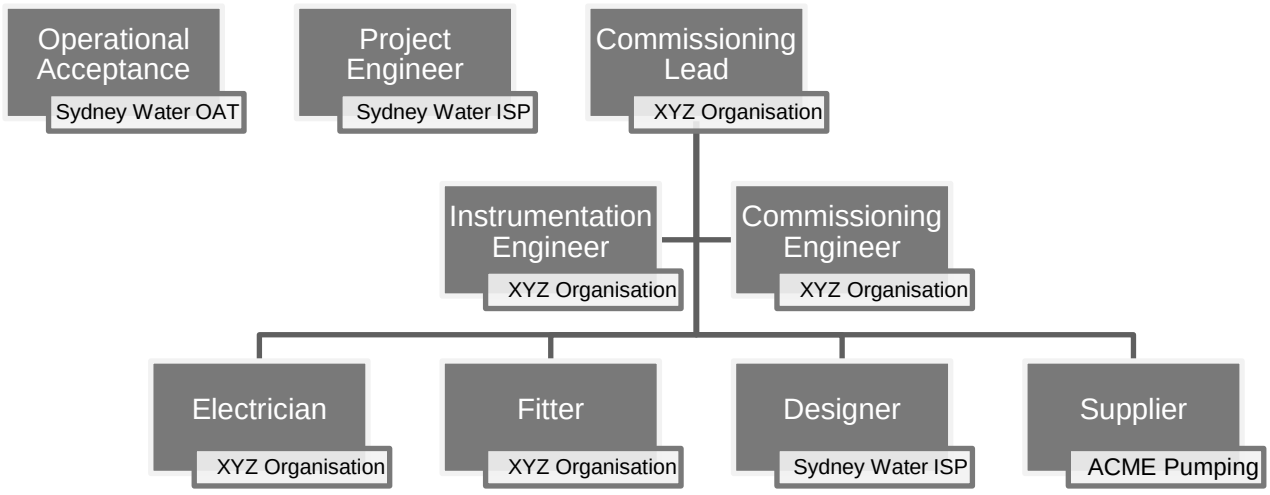
The Service Provider Commissioning Lead is responsible for coordinating all commissioning activities and overseeing delivery of commissioning (inclusive of process proving and optimisation) in accordance with this commissioning plan, and in compliance with the project scope and technical specifications.

Specific roles and responsibilities between different parties in commissioning will be as per the RACI in section 3.1.2 of the “Commissioning – Transitioning Assets into Operation” specification.

2.2 Team structure

[**Do not type here.** This is instructional text.

Mandatory. Provide a team structure diagram for the Commissioning Team. This should include key stakeholders, and 3rd parties involved in the commissioning process.]



2.3 Communication protocols

[**Do not type here.** This is instructional text.

Mandatory. Populate the table below with the intended communication protocols for the commissioning. This may include kick offs, progress meetings, weekly email updates to operations, cutover/shutdown meetings, daily site level meetings and pre-starts.

The following communication frequency and protocols will be followed for the commissioning phase;

Item	Description	Format	Frequency
1	Commissioning Kick Off & Risk Assessment	Meeting	Prior to Pre-Commissioning
2	[Enter Text]	[Enter Text]	[Enter Text]
3	[Enter Text]	[Enter Text]	[Enter Text]
4	[Enter Text]	[Enter Text]	[Enter Text]
5	[Enter Text]	[Enter Text]	[Enter Text]

2.4 Managing safety during commissioning

[**Do not type here.** This is instructional text.

Mandatory. Explain how safety will be managed throughout commissioning activities. This may include risk assessments, communication, specific training requirements for team members, permits to work, exclusion zones etc.

[Enter text]

3. Commissioning approach

[**Do not type here.** This is instructional text.

Mandatory. This section is to summarise the high-level approach to how commissioning will be conducted. The detail for specific commissioning work Lots and packages will be covered in later sections of the document. No text required under this heading, only under the sub headings.]

3.1 Commissioning process

[**Do not type here.** This is instructional text.

Mandatory. Update the highlighted text as required to reflect the commissioning process being adopted.]

Commissioning will be undertaken in accordance with the standard process contained within the “Commissioning – Transitioning Assets into Operation” specification.

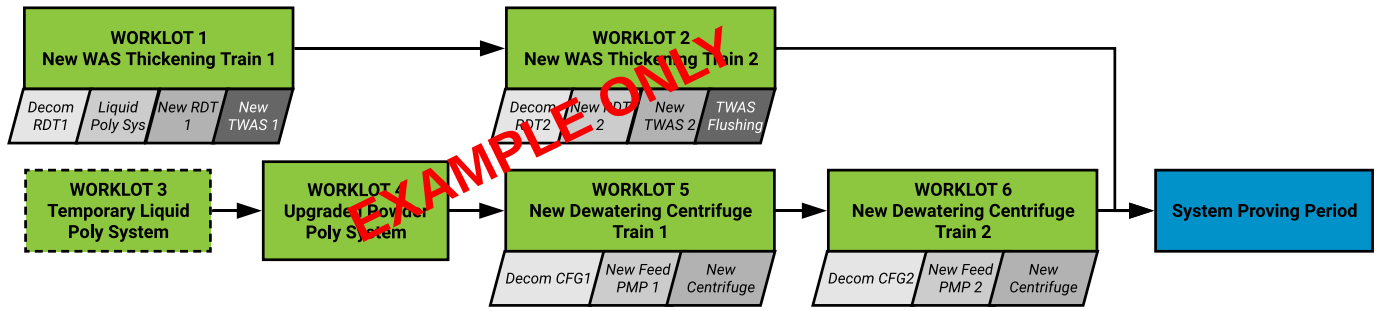
3.2 Commissioning work lots & staging

[**Do not type here.** This is instructional text.

Mandatory. This section should clearly articulate how commissioning will be approached for the works. It is recommended to use a diagram, or table to define the breakdown and interface between work lots and temporary works as required. See example text and diagram below.]

The System Commissioning process will be structured around a Commissioning Sub-System approach. Each Sub-System will be defined as a Commissioning Work Lot. The Commissioning Work Lots will be defined in a logical manner, based around the operational requirements of the site and the Construction Schedule. Defining the Commissioning Work Lots can also assist in defining the Construction schedule. Commissioning ITPs include PIDs and details of the specific individual assets to be commissioned within each work lot.

The diagram below identifies the commissioning work lot packages and their respective dependencies. Each green box represents an **‘Operationally Ready”** milestone.



4. Work lot methodologies

4.1 Work lot XX – Work lot name

4.1.1 Work lot description & boundaries

[**Do not type here.** This is instructional text.

Mandatory. Provide a brief (one paragraph) description of the work lot, and its boundaries]

[This entire Section will be repeated for each respective worklot]

[Enter text]

4.1.2 Work lot references

[**Do not type here.** This is instructional text.

Mandatory. In the table below list the key references to this work lot. This does not have to be exhaustive and be realistic about the actual documents that will influence the commissioning activities (P&IDs, ITPs, FDS, PEFD etc)].

Item	Document No.	Description
1	ITP-001	Switchboard FAT ITP
2	[Enter Doc. No.]	[Enter Text]
3	[Enter Doc. No.]	[Enter Text]
4	[Enter Doc. No.]	[Enter Text]

4.1.3 Work lot pre-requisites and input requirements

[**Do not type here.** This is instructional text.

Mandatory. State the inputs and/or pre-requisites required for commissioning of this work lot to begin. It may include cutovers, other construction stages, construction signoffs, or other commissioning work lot completion.]

Item	Description	Requirement
1	FAT Completed	ITP-001 Signed Off.
2	Defects walk conducted	No 'Major' Defects.
3	[Enter Text]	[Enter Text]
4	[Enter Text]	[Enter Text]
5	[Enter Text]	[Enter Text]

4.1.4 Work lot third party inputs

[**Do not type here.** This is instructional text.

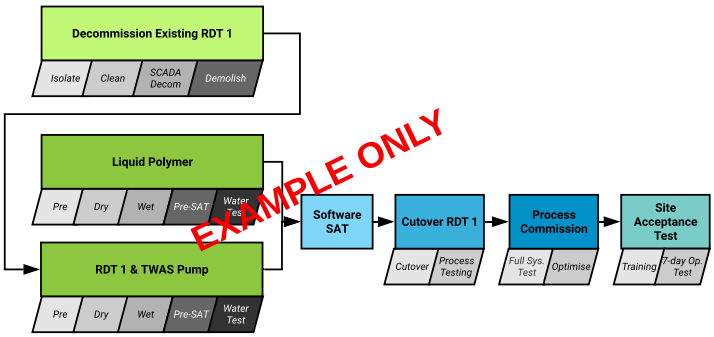
Optional. As applicable – delete sub heading if not relevant. This section is for the listing of any specific requirements or involvement by 3rd Parties – Suppliers, certifiers, approvers etc.]

Item	Provider	Activties
1	XYZ Supplier	Commissioning Assistance Installation inspection.
2	[Enter Text]	[Enter Text]
3	[Enter Text]	[Enter Text]
4	[Enter Text]	[Enter Text]

4.1.5 Work lot commissioning methodology

[**Do not type here.** This is instructional text.

Mandatory. Explain clearly (preferably with a diagram) the methodology and process for the commissioning activities for this work lot. Dependent on complexity this may be at an asset or sub system level.]



Item	Activity	Comments
1	Factory Acceptance Test Switchboard	
2	Complete Un-energised Pre-Commissioning Tests	ITP-123
3	Notice of energisation	

4	[Enter Text]	[Enter Text]
5	[Enter Text]	[Enter Text]
6	[Enter Text]	[Enter Text]

4.1.6 Work lot testing and monitoring requirements

[**Do not type here.** This is instructional text.

Mandatory. In the table below, detail key test/monitoring parameters specific to the work lot performance testing. Often these details will be found in the design report or needs specification.]

Item	Parameter	Unit	Performance Requirement	Test Method	Frequency
1	Feed Concentration	% DS	0.4 to 0.8	Sample	3 per RDT train, per day
2	Outlet Sludge TSR	% DS	4.0	Sample	3 per RDT train, per day
3	Feed Rate (Peak)	kL/Hr	88	Online	Continuous
4	[Enter Text]	[Enter Text]	[Enter Text]	[Enter Text]	[Enter Text]

4.1.7 Work lot acceptance criteria

[**Do not type here.** This is instructional text.

Mandatory. In the table below, summarise the key criteria for acceptance of the work lot. This includes length of operational testing, tolerances on performance tests, ITP completion requirements.]

Item	Description	Requirement	Comments
1	Pass Operational Test	48 hours	Submit DataPortal Workflow
2	ITPs Signed Off	ITP-000, 001, 002	Signed Off.
3	Interim Operating Procedure Training	Training and call outs provided	
4	[Enter Text]	[Enter Text]	[Enter Text]

5. Process proving

5.1 Pre-requisites and input requirements

[**Do not type here.** This is instructional text.

Mandatory. In the table below, summarise the key pre-requisites to commencing the proving period for the full system.]

Item	Description	Requirement
1	Work Lots Operationally Ready	
2	Training Completed	
3	Defects Walks Conducted	No 'Major' Defects.
4	Proving Kick-Off Meeting Held,	Operations approve Commencement.
5	Operations Monitoring Log Provided	
6	Operations Daily Checklist Provided	
7	Updated Call Out Contacts	
8	[Enter Text]	[Enter Text]
9	[Enter Text]	[Enter Text]
1	[Enter Text]	[Enter Text]

5.2 Contacts and call outs

Description	Requirement
Engineering Support and coordination	[Enter Name] [Enter Mobile Number]
Construction Project Manager	[Enter Name] [Enter Mobile Number]
Mechanical Support	[Enter Name] [Enter Mobile Number]
Electrical Support	[Enter Name] [Enter Mobile Number]
[Enter Text]	[Enter Name] [Enter Mobile Number]

5.3 Monitoring during process proving

[**Do not type here.** This is instructional text.

Mandatory. In this section, summarise what monitoring will be undertaken during the proving period. Detailed sampling and testing will be summarised in the next section.]

The following information will be recorded during proving to ensure performance may be fully analysed and understood.

Alarm Logs from SCADA
Daily checklists and comments log from operations (including call outs)
Consumption of consumables including power, chemicals, and water.

Sampling and testing results from online instrumentation
Sampling and testing results from accredited lab services.

The information will be consolidated into a single report that will provided to project stakeholders weekly.

5.4 Testing and sampling during process proving

[**Do not type here.** This is instructional text.

Mandatory. All required sampling and testing requirements should be included here, to make it clear to the reader what has been considered, this may include process parameters, chemical / water / power consumption. If this is large, or a detailed sampling plan is required, consider including as an appendix.]

Item	Parameter	Unit	Performance Requirement	Test Method	Frequency
1	Outlet Sludge TSR	% DS	4.0	Sample	3 per RDT train, per day
2	Feed Rate (Peak)	kL/Hr	88	Online	Continuous
3	[Enter Text]	[Enter Text]	[Enter Text]	[Enter Text]	[Enter Text]

5.5 Process proving completion & acceptance criteria

[**Do not type here.** This is instructional text.

Mandatory. In the table below, summarise the key criteria for acceptance of the proving period. This includes length of proving, tolerances on performance tests, ITP completion requirements.]

Item	Description	Requirement	Comments
1	Pass Proving Period	14 Calendar Days	
2	ITPs Signed Off	ITP-000, 001, 002	Signed Off.
3	Commissioning Report Endorsed		
4	[Enter Text]	[Enter Text]	[Enter Text]

5.6 Process completion and handover

Project Completion and final handover will be undertaken using Sydney Water's DataPortal handover process, and completion checklist.

Completion is subject to the requirements of section 14 of the "Commissioning – Transitioning Assets into Operation" specification being met.

6. Contingency plan

[**Do not type here.** This is instructional text.

Optional. Define any critical contingency that may be required in the delivery of commissioning. This must be covered either in this document, or in the Cutover Plan.]

[Enter text]

7. Operations and maintenance training

[**Do not type here.** This is instructional text.

Mandatory. Define at a high level all the training to be conducted as part of the commissioning. Details of each individual]

Item	Description	Led By	Sessions	Attendee Groups	Length
1	Overview Training	Commissioning Lead	1 per Team	Operators OM Controller	2 hours
2	Software Operations	SCADA Engineer	2	Reliability Engineers Operators	2 hours
3	Process Training	Process Designer	1 per Team	M&E Leading Hand Reliability Engineers	4 hours
4	[Enter Text]	[Enter Text]	[Enter Text]	[Enter Text]	[Enter Text]

8. Definitions

[**Do not type here.** This is instructional text.

Mandatory. Define all key terms and acronyms that are particular to the plan. Do not include terms that are not mentioned in the document.]

Term	Definition	Source
[Enter term]	[Enter definition]	[Enter source]
[Enter term]	[Enter definition (and further rows as needed)]	[Enter source]

8.1 Attachments

[**Do not type here.** This is instructional text.

If relevant, list any attachments to support this procedure. This should Include:

-ITP Register

-Commissioning Schedule

-MMD Register

-Commissioning Risk Assessment (but after performing it with stakeholders)]

Attachment	Title
1	[Enter text]
2	[Enter text (and further rows as needed)]

9. Ownership

[**Do not type here**. This is instructional text.

Mandatory. Insert details of the Group that owns the procedure as well as the as the position title of owner and author.]

Role	Title
Group	[Enter text]
Owner	[Enter position title]
Author	[Enter name and position title]

9.1 Change history

[**Do not type here**. This is instructional text.

Mandatory. Insert details of the latest review or changes made to the document. Every time a plan is updated, it must be reissued. **Documents will not be accepted without internal review.**

List the latest version at the top of the table. Add a new version row by clicking the 'Add Version' button (far left of the 'Home' tab). To record previous versions type in the oldest version first and click 'Add Version' to add each subsequent version.]

Version	Issue Date	Approved by	Brief description of change and consultation
2	1/10/2021	[Enter name and position title]	New document

[Delete all instructional boxes by clicking the 'Finalise Document' button (far left of the 'Home' tab).]

22.2.2 Appendix B2- Cutover plan

Introduction

Examples have been added and highlighted in yellow – these will need to be removed or updated to suit requirements.

1.1 Project description

[**Do not type here.** This is instructional text.

Mandatory. Explain briefly the background of the project/activity/upgrade. Keep to a very key and simple description – include the document purpose (is this cutover methodology for a specific phase or full project etc.

Note: Do not delete green boxes, [Delete all instructional boxes by clicking the 'Finalise Document' button (far left of the 'Home' tab). When instructional text no longer required.]

[Enter text]

1. Cutover strategy

[**Do not type here.** This is instructional text.

Mandatory. This section is to detail the staging of cutovers and/or cut-ins. Consider providing a high-level diagram in this header section to articulate how different staging may fit together]

[Enter text]

a. Sequencing of cutovers

[**Do not type here.** This is instructional text.

Mandatory. List the sequence or stages and approximate duration here. The detail of the phases will be contained in later sections**]**

Stage/Step	Work Description	Duration	Comments
1	Temporary Pumping Trial	4 hours	Req
2	[Activity or Step Description]	[Duration and Units]	[Enter Text]
3	[Activity or Step Description]	[Duration and Units]	[Enter Text]
4	[Activity or Step Description]	[Duration and Units]	[Enter Text]

b. Pre inspections and pre work

[**Do not type here.** This is instructional text.

Mandatory. Include any inspections, prework that are required to confirm the methodology or prior to proceeding.]

Item	Work Description	Comments
1	Cutover Plan/Methodology Meeting	
2	Review of Risk and Contingency Plan	Including HIDRA
3	[Activity Description]	[Enter Text]
4	[Activity Description]	[Enter Text]

2. Detailed methodology

a. Stage 1 – insert stage name

i. Stage description & boundaries

[**Do not type here.** This is instructional text.

Mandatory – Provide a brief (one paragraph) description of the stage, and its boundaries. **This entire section will be repeated for each respective worklot**]

[Enter text]

ii. Stage pre-requisites and input requirements

[**Do not type here.** This is instructional text.

Mandatory. States the inputs and/or pre-requisites required for this stage. May include Factory Acceptance testing, completion of previous works or stages etc.

This section must also include any key control system (IICATS/SCADA) Inputs, such as alarm or interlock disabling.

Include details of process requirements including power, flow rates, volumes required.]

Item	Description	Comments
1	OCR submitted	Submit to xyz.
2	FIFM	[Enter Text]
3	[Enter Text]	[Enter Text]
4	[Enter Text]	[Enter Text]

iii. Sequencing

[**Do not type here.** This is instructional text.

Mandatory. Provide a diagram here for the stage – this could be a diagram/sketch of the flow path/power supply/etc arrangement used.]

[Insert Diagram Here]

[**Do not type here.** This is instructional text.

Mandatory. Detail the sequence of activities that need to occur. This should include any temporary systems, shutdowns, submissions to other authorities (Ausgrid etc.), or hold points.]

Item	Activity	Relevant assets	Comments
1	Establish Temp Generator	Generator Panel	
2	[Enter text]		[Enter text]
3	[Enter text]		[Enter text]
4	[Enter text]		[Enter text]

iv. Operating arrangement at end of stage

[**Do not type here.** This is instructional text.

Mandatory Use this section to be clear about what the operating arrangement is for assets at the end of this stage of cutover. Examples are included below]

Item	Assets	Operating status	Contingency/comments
1	Power Supply-Feeder 1	Unavailable	Offline
2	Power Supply-Feeder 2	Available	Generator Dry Hired for period
3	Pump 1	Available - Manual	Requires Operator via Call Out
4	Pump 2	Available - Auto	Pump 1 in manual – requires call out
5	Pump 3	Unavailable	Offline
6	[Enter Text]	[Enter Text]	[Enter Text]

v. Stage supporting deliverables

[**Do not type here.** This is instructional text.

Mandatory. This table should summarise deliverables for the stage, including any documentation for Interim Operations.]

Item	Document/deliverable	Comments
1	OCR	Submit to xyz.
2	Interim Operating Procedure	Submit to Ops, Copy onsite.
3	Marked up Single Line Diagram	Copy onsite
4	Marked up P&ID	Copy onsite
5	[Enter Text]	[Enter Text]

3. Communication

a. Communication protocols

Event type	Responsibility
Operation Failure	ACME Constructions
Maintenance – Existing Assets	Sydney Water
Maintenance – Upgraded Assets	ACME Constructions
Complaints	Sydney Water Project Manager
[Enter Text]	[Enter Text]
[Enter Text]	[Enter Text]

b. Contact details

Description	Contact Details
Engineering Support and coordination	[Enter Name] [Enter Mobile Number]
Construction Project Manager	[Enter Name] [Enter Mobile Number]
Mechanical Support	[Enter Name] [Enter Mobile Number]
Electrical Support	[Enter Name] [Enter Mobile Number]
[Enter Text]	[Enter Name] [Enter Mobile Number]

4. Definitions

[**Do not type here**. This is instructional text.

Mandatory. Define all key terms and acronyms that are particular to the plan. Do not include terms that are not mentioned in the document.]

Term	Definition	Source
2	1/10/2021	[Enter source]
[Enter term]	[Enter definition (and further rows as needed)]	Enter source]

a. Attachments

[**Do not type here.** This is instructional text.

If relevant, list any attachments to support this plan. This should Include:

-ITP Register

-Commissioning Schedule

-MMD Register

-Commissioning Risk Assessment (but after performing it with stakeholders).]

Attachment	Title
1	[Enter text]
2	[Enter text (and further rows as needed)]

5. Ownership

[**Do not type here**. This is instructional text.

Mandatory. Insert details of the Group that owns the plan as well as the as the position title of owner and author.]

Role	Title
Group	[Enter text]
Owner	[Enter position title]
Author	[Enter name and position title]

a. Change history

[**Do not type here**. This is instructional text.

Mandatory. Insert details of the latest review or changes made to the document. Every time a plan is updated, it must be reissued. **Documents will not be accepted without internal review**.

List the latest version at the top of the table. Add a new version row by clicking the 'Add Version' button (far left of the 'Home' tab). To record previous versions type in the oldest version first and click 'Add Version' to add each subsequent version.]

Version	Issue Date	Approved by	Brief description of change and consultation
2	1/10/2021	[Enter name and position title]	New document

[Delete all instructional boxes by clicking the 'Finalise Document' button (far left of the 'Home' tab).]

22.2.3 Appendix B3- Operation and maintenance manual

[Site Street Address]

SUPPLIER	[Enter Supplier/Contractor Name]
SUPPLIER CONTRACT NO.	[Enter Supplier's Contract Reference number]
CONTRACT NO. (SYD WATER)	[Enter Sydney Water Contract No. / Specific Task Order No.]
ADDRESS	[Enter Supplier Address]
PHONE	[Enter Supplier Contact Phone – For Support/ Parts etc.]
EMAIL	[Enter Supplier Contact Email – For Support/Parts etc.]

Table of contents

Description

Document purpose

[Enter text]

This manual should be studied carefully and understood prior to the operation of any systems or equipment related to this installation. Incorrect operation can cause personal injury or damage to property and equipment. It is important that this manual be reviewed in conjunction with the relevant Sydney Water safety plans and procedures associated with the operation and maintenance of this installation.

Site / works overall description

[Enter text]

Asset No.	Description (Maximo)	Existing / New
[Enter Asset No.]	[Maximo Description]	Choose an item.
[Enter Asset No.]	[Maximo Description]	Choose an item.
[Enter Asset No.]	[Maximo Description]	Choose an item.

Sub-system description

[Enter text]

Technical data

[Enter text]

[FACILITY NO.] Description

Characteristic	Detail/Information
Constructor	Acme Constructions Pty Ltd
Relevant General Arrangements	ST00XXX-4090[A]
Operation Duty	
Storage Capacity	
Discharge Location	
[Enter Descriptor]	[Item Information]
[Enter Descriptor]	[Item Information]
[Enter Descriptor]	[Item Information]
[Enter Descriptor]	[Item Information]
[Enter Descriptor]	[Item Information]

[ASSET NO.] Description pump

Characteristic	Detail/Information
Serial No.	
-[**Enter Asset Tag**]	[Item Information]
-[**Enter Asset Tag**]	[Item Information]
Manufacturer	[Item Information]
Address and Contact No.	[Item Information]
Type	[Item Information]
Model No.	[Item Information]
Lead Time	[Item Information]
Unit Mass (Kg)	[Item Information]
Impellor Diameter (mm)	[Item Information]
Impellor Type	[Item Information]
Duty Flow Rate (L/s)	[Item Information]
Duty Pump Speed (rpm)	[Item Information]
Duty Head (m)	[Item Information]
Duty NPSHR (m abs)	[Item Information]
Duty Pump Efficiency (%)	[Item Information]
Duty Power Input (kW)	[Item Information]
Duty Noise Level (dBA @ 1m)	[Item Information]
Upper Bound Flow Rate (L/s)	[Item Information]
Upper Bound Pump Speed (rpm)	[Item Information]
Upper Bound Head (m)	[Item Information]
Upper Bound NPSHR (m abs)	[Item Information]
Upper Bound Pump Efficiency (%)	[Item Information]
Upper Bound Power Input (kW)	[Item Information]
Upper Bound Noise Level (dBA @ 1m)	[Item Information]
Lower Bound Flow Rate (L/s)	[Item Information]
Lower Bound Pump Speed (rpm)	[Item Information]
Lower Bound Head (m)	[Item Information]
Lower Bound NPSHR (m abs)	[Item Information]
Lower Bound Pump Efficiency (%)	[Item Information]
Lower Bound Power Input (kW)	[Item Information]
Lower Bound Noise Level (dBA @ 1m)	[Item Information]
[Enter Descriptor]	[Item Information]
[Enter Descriptor]	[Item Information]
[Enter Descriptor]	[Item Information]

[ASSET NO.] Sump pump

Characteristic	Detail/Information
Serial No.	
-[**Enter Asset Tag**]	[Item Information]
Manufacturer	[Item Information]
Address and Contact No.	[Item Information]
Type	[Item Information]
Model No.	[Item Information]
Lead Time	[Item Information]
Unit Mass (kg)	[Item Information]
Flowrate (L/s)	[Item Information]
Head (m)	[Item Information]
Pump Speed (rpm)	[Item Information]

[ASSET NO.] Description instrument

Characteristic	Detail/Information
Serial No.	
-[**Enter Asset Tag**]	[Item Information]
-[**Enter Asset Tag**]	[Item Information]
Manufacturer	[Item Information]
Address and Contact No.	[Item Information]
Type	[Item Information]
Model No.	[Item Information]
Lead Time	[Item Information]
Measuring Range	[Item Information]
Power Supply	[Item Information]
Output Signal	[Item Information]
Connection size	[Item Information]
Ingress Protection (IP)	[Item Information]
Sensor Material	[Item Information]
Sensor Housing Material	[Item Information]
Seal (Type, Material, Size)	[Item Information]
Cable Length	[Item Information]

[ASSET NO.] Description lifting equipment

Characteristic	Detail/Information
Serial No.	

-[**Enter Asset Tag**]	[Item Information]
Manufacturer	[Item Information]
Address and Contact No.	[Item Information]
Type	[Item Information]
Model No.	[Item Information]
Lead Time	[Item Information]
Safe Working Load (SWL)	[Item Information]
Operating Speed Bridge (m/min)	[Item Information]
Operating Speed Hoist (m/min)	[Item Information]
Motor / Current	[Item Information]

[ASSET NO.] Penstocks / Wet well isolation

Characteristic	**Detail/Information**
Manufacturer	[Item Information]
Address and Contact No.	[Item Information]
Type	[Item Information]
Model No.	[Item Information]

Asset No.	**Size**	**Material**	**Seat/Seal**	**Description**
PEN01	*DN450*	*316SS*	*Resilient*	*Wet Well 1 Inlet Isolation*
[Item Information]	[Item Information]	[Item Information]	[Item Information]	[Item Information]

[ASSET NO.] Fan

Characteristic	**Detail/Information**
Serial No.	
-[**Enter Asset Tag**]	[Item Information]
Manufacturer	[Item Information]
Address and Contact No.	[Item Information]
Type	[Item Information]
Model No.	[Item Information]
Lead Time	[Item Information]
Unit Mass (kg)	[Item Information]
Flowrate (L/s)	[Item Information]
Pressure (Pa)	[Item Information]
Fan Speed (rpm)	[Item Information]

[ASSET NO.] Add others as relevant (RCDs, other equipment etc.)

Principles of operation

[Enter text]

This site contains specific risks and hazards including;
Trade waste
Noise levels in excess of xxxx

Example subsection – pumping units

Operating instructions

[Enter text]

Example subsection – Manual SPS operation

Flushing pump 1

Installation and commissioning instructions

[Enter text]

Installation checks

[CHECKLIST PURPOSE]			
1	[Enter text]	☐	☐
2	[Enter text]	☐	☐
3	[Enter text]	☐	☐
4	[Enter text]	☐	☐

Checks before first start

[CHECKLIST PURPOSE]			
1	[Enter text]	☐	☐
2	[Enter text]	☐	☐
3	[Enter text]	☐	☐
4	[Enter text]	☐	☐

Checks after first start

[CHECKLIST PURPOSE]			
ITEM	**DESCRIPTION OF CHECK**	**PASS**	**N/A**
1	[Enter text]	☐	☐
2	[Enter text]	☐	☐
3	[Enter text]	☐	☐
4	[Enter text]	☐	☐

Ongoing operational checks

[CHECKLIST PURPOSE]			
ITEM	**DESCRIPTION OF CHECK**	**PASS**	**N/A**
1	[Enter text]	☐	☐
2	[Enter text]	☐	☐
3	[Enter text]	☐	☐
4	[Enter text]	☐	☐

Preventative maintenance

Qualification of maintenance personnel and warnings

Only qualified personnel should work on electrical, plumbing, and mechanical equipment.

Before commencing any maintenance work the pump should be completely disconnected from the mains by a qualified person.

Under continuous running conditions the pump motor housing can become very hot. To prevent burn injury allow to cool down before handling.

Electrical equipment should not be subjected to direct water hose pressure; and indirect splashing should be minimized during plant wash-down and clean up.

When carrying out maintenance activities, personnel should follow the site safety requirements. This should include following FIFM and Lock Out Tag Out procedures and closing of isolation valves. Where possible rain sewage out of the pump volute. Check that the equipment item & surrounding pipework is depressurised before disconnecting it.

Ensure that the appropriate PPE is worn for the task, e.g. goggles/face shield, chemical resistant gloves, etc. Personnel should also ensure that maintenance activities will not adversely affect plant operations.

Maintenance schedule

[ASSET NO.] Description

[ITEM DESCRIPTION]				
ACTIVITY	**TASK DESCRIPTION**	**FREQUENCY**	**CONSUMABLES**	**LABOUR HRS**
[Enter text]	[Enter text]	[Enter text]	[Enter text]	[Enter text]
[Enter text]	[Enter text]	[Enter text]	[Enter text]	[Enter text]
[Enter text]	[Enter text]	[Enter text]	[Enter text]	[Enter text]
[Enter text]	[Enter text]	[Enter text]	[Enter text]	[Enter text]

Overhaul and major periodic maintenance

[ASSET NO.] Description

[ITEM DESCRIPTION]			[DESIGN LIFE YRS]	
ACTIVITY	**TASK DESCRIPTION**	**FREQUENCY**	**CONSUMABLES**	**LABOUR HRS**
[Enter text]	[Enter text]	[Enter text]	[Enter text]	[Enter text]
[Enter text]	[Enter text]	[Enter text]	[Enter text]	[Enter text]
[Enter text]	[Enter text]	[Enter text]	[Enter text]	[Enter text]

Test data, inspection results and troubleshooting

Test data & inspection results

Asset / Device	Available data	Location stored / Appendix no.
[Enter text]	[Enter text]	[Enter text]
[Enter text]	[Enter text]	[Enter text]

Troubleshooting

Problem	Possible causes	Action
[Enter text]	[Enter text]	[Enter text]
	[Enter text]	[Enter text]
[Enter text]	[Enter text]	[Enter text]
	[Enter text]	[Enter text]
[Enter text]	[Enter text]	[Enter text]
	[Enter text]	[Enter text]

Parts list and recommended spares

Parent Asset	Equipment Item	Part No.	Supplier	Lead Time (wks)
[Enter text]	[Enter text]	[Enter text]	[Enter text]	[Enter text]
[Enter text]	[Enter text]	[Enter text]	[Enter text]	[Enter text]
[Enter text]	[Enter text]	[Enter text]	[Enter text]	[Enter text]

Appendices

[Enter text]

Appendix	Title
1	[Enter text]
2	[Enter text (and further rows as needed)]

22.2.4 Appendix B4- Operation and maintenance manual (example for networks)

76 Barton Street Kogarah 2217

SUPPLIER	Monadelphous
SUPPLIER CONTRACT NO.	58121
CONTRACT NO. (SYD WATER)	26763
ADDRESS	Suite 2, Level 2, 22 George St North Strathfield
PHONE	(02) 8790 1215
EMAIL	reception@monadel.com.au

Table of contents

Description

Document purpose

The purpose of this manual is to provide important information necessary for the proper operation and maintenance of Monterey Sewage Pump Station (SPS0148).

It is intended that the user of this manual gain an understanding of:

How the sewage pump station operates

Best practices and required operational tasks for pump station operation

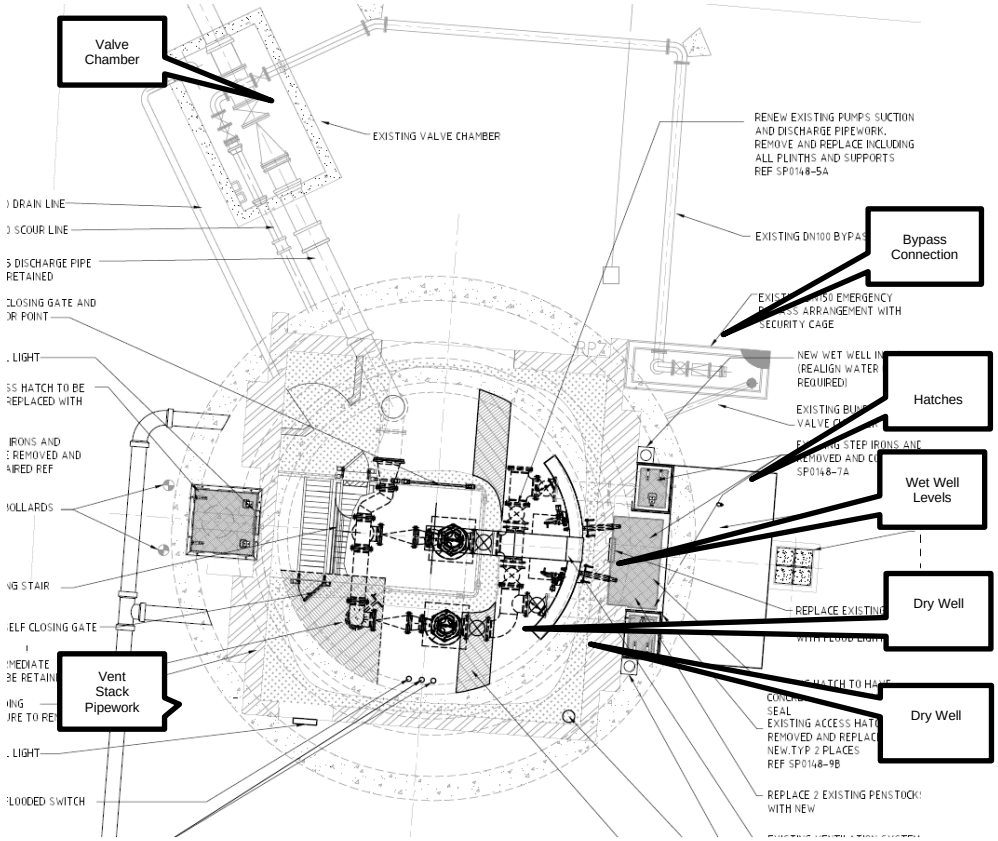
This manual should be studied carefully and understood prior to the operation of any systems or equipment related to this installation. Incorrect operation can cause personal injury or damage to property and equipment. It is important that this manual be reviewed in conjunction with the relevant Sydney Water safety plans and procedures associated with the operation and maintenance of this installation.

Site / works overall description

Monterey Sewage Pump Station (SPS) is used to collect and transfer sewage from low laying surrounding areas to Malabar Sewage Treatment before discharging to the ocean.

Monterey Sewage Pump Station also known as SPS0148 is located on 76 Barton St Kogarah, 2217 NSW, and Scarborough Park. This pump station is made up of a superstructure with two distinct parts, above ground and underground structures.

The above ground structure is comprised of a small rectangular single storey load bearing brick building. Also, above ground and visible from the street is a valve chamber & emergency bypass arrangement.



The substructure (below ground) is constructed of concrete and portioned into chambers; a dry well where pumps and pipelines are mounted, and wet wells. The dry well houses two centrifugal pumps, valves and instrumentation. Adjacent are two sewage wet wells and inlet wet well.

Example Note: The list below should include asset tags for structures (IMH, Wet Wells etc) as well as key maintainable electrical items also in maximo (RCDs etc).

Asset No.	Description (Maximo)	Existing / New
SP0148CRA01	Anchor Point - Machinery Well - Fall Restraint	New/Upgraded
SP0148CRA02	Anchor Point - Inlet Man Hole Access - Fall Restraint	New/Upgraded
SP0148DIS01	Distribution Board - LV	New/Upgraded
SP0148ELP01	Electrical Panel - Fan Control Panel	New/Upgraded
SP0148FAN01	Fan - Inline Centrifugal Fan - Dry Well	New/Upgraded
SP0148LCP01	Local Control Panel - SP0148	New/Upgraded
SP0148LCP02	Local Control Panel - Starter Panel	New/Upgraded
SP0148LSH01	Level Switch High - Dry Well Flood Alarm Switch	New/Upgraded
SP0148LSA01	Wet well 1 high level switch	Existing
SP0148LSA02	Wet well 2 high level switch	Existing
SP0148LSH02	Level Switch High - Dry Well Flood Sump Pump Fail Alarm Switch	New/Upgraded
SP0148LTX01	Level Tx - Wet Well 1	New/Upgraded

Asset No.	Description (Maximo)	Existing / New
SP0148LTX02	Level Tx - Wet Well 2	New/Upgraded
SP0148NRV01	Non Return Valve - Pump 1 Discharge Isolation	Existing
SP0148NRV02	Non Return Valve - Pump 2 Discharge Isolation	Existing
SP0148NRV03	Valve - Pump 1 Inlet Double Isolation	Existing
SP0148NRV06	Reflex Valve - Sump Pump Discharge	New/Upgraded
SP0148PEN01	Penstock - Wet Well 1 Inlet	New/Upgraded
SP0148PEN02	Penstock - Wet Well 2 Inlet	New/Upgraded
SP0148PMP01	Pump - Unit 1	Existing
SP0148PMP02	Pump - Unit 2	Existing
SP0148PMP11	Pump - Unit 11 Dewatering Pump	New/Upgraded
SP0148VLV01	Valve - Pump 1 Discharge Isolation	Existing
SP0148VLV04	Valve - Suction Cross Connection Isolation	Existing
SP0148VLV05	Valve - Suction Cross Connection Isolation	Existing
SP0148VLV08	Valve - Discharge Isolation	Existing
SP0148VLV10	Valve - Pump 1 Inlet Isolation	Existing
SP0148VLV11	Valve - Pump 2 Inlet Isolation	Existing
SP0148VLV12	Valve - Pump 2 Inlet Double Isolation	Existing
SP0148VLV13	Valve - Ball - Isolation, Sump Pump Discharge	New/Upgraded
SP0148VLV19	Valve - Ball - Isolation, Wet Well 1 Level Sensor	New/Upgraded
SP0148VLV20	Valve - Ball - Isolation, Valve Wet Well 1 Level Sensor Drain	New/Upgraded
SP0148VLV21	Valve - Ball - Isolation, Valve Wet Well 1 Level Sensor Test Cock 1	New/Upgraded
SP0148VLV22	Valve - Ball - Isolation, Valve Wet Well 1 Level Sensor Test Cock 2	New/Upgraded
SP0148VLV23	Valve - Ball - Isolation, Wet Well 2 Level Sensor	New/Upgraded
SP0148VLV24	Valve - Ball - Isolation, Valve Wet Well 2 Level Sensor Drain	New/Upgraded
SP0148VLV25	Valve - Ball - Isolation, Valve Wet Well 2 Level Sensor Test Cock 1	New/Upgraded
SP0148VLV26	Valve - Ball - Isolation, Valve Wet Well 2 Level Sensor Test Cock 2	New/Upgraded
SP0148VLV27	Valve - Ball - Isolation, PMP01 Suction Elbow Drain Line	New/Upgraded
SP0148VLV28	Valve - Ball - Isolation, PMP02 Suction Elbow Drain Line	New/Upgraded
SP0148VLV29	Valve - Ball - Isolation, PMP01 Suction Test Port	New/Upgraded
SP0148VLV30	Valve - Ball - Isolation, PMP02 Suction Test Port	New/Upgraded
SP0148VLV31	Valve - Ball - Isolation, PMP01 Discharge Drain Line	New/Upgraded
SP0148VLV32	Valve - Ball - Isolation, PMP02 Discharge Drain Line	New/Upgraded
SP0148VLV33	Valve - Ball - Isolation, PMP01 Discharge Test Port	New/Upgraded
SP0148VLV34	Valve - Ball - Isolation, PMP02 Discharge Test Port	New/Upgraded
SP0148VLV35	Valve - Ball - Isolation, Sump Pump Discharge Drain Line 1	New/Upgraded
SP0148VLV36	Valve - Ball - Isolation, Sump Pump Discharge Test Port	New/Upgraded

Asset No.	Description (Maximo)	Existing / New
SP0148VLV41	Valve- Ball - Isolation, Sump Pump Discharge Drain Line 2	New/Upgraded

Inlet well and incoming sewers

SP0148 substructure is constructed 9.9m deep below ground (RL - 8.478 m ref SP0148|8A) to allow sewage from surrounding low laying area to flow and collect at the pump station inlet wet well. There is one sewer line connected to the inlet wet well, a 450mm cement lined pipe. This inlet wet well can only be isolated from a collecting manhole located few meters north of the pump station (outside SP0148 compound).

Sewage wet wells

Sewage from the inlet wet well flows evenly to the adjacent sewage wet wells. Flow from the inlet wet well into sewage wet wells can be independently isolated via sewage wet wells inlet isolation valves VLV03 and VLV12. Each of the sewage wet wells is equipped with a high level switch LSH01 and LSH02. High level in these wells will raise a SOC alarm in the event the wet well liquid level rises above a pre-set level. For operating levels, refer to the IICATS Site Setup information stored onsite.

Dry well and pumps

The dry well houses two Sulzer centrifugal pumps and operate in a duty standby cycle to pump the sewage up a DN250 to DN375 rising main. Upon completion of a cycle, the duty pump will switch from duty to standby. The pumps suction manifold can be manually crossed over allowing both pumps to draw from the same sewage wet well. Non-return valves on the pumps discharge manifold and prevent the sewage from draining back into the wet wells and keep the pumps primed. Isolation valves are provided on the pump suction and discharge to allow for these pumps to be isolated as required. A dismantling joint on the suction side to allow maintenance access.

Two hydrostatic pressure transmitters, LTX001 & LTX002 measure the wet well hydraulic head. On cut-in level, the duty pump will be activated. At cut-out level, the operating pump will be powered down.

A sump equipped with an automated sump pump located at the dry well low point collects any run-off and pump it back into the sewage wet well.

Dry well and pumps

The rising main is of DN250 to DN375, running from bottom of the dry well to the valve chamber. In the valve chamber there is an isolation valve VLV02 and non-return valve NRV03. The non-return valve prevents the raising main and transfer main from being drained. Drain from the valve chamber runs back into sewage wet well 1.

Scour line and valve chamber

SPS0148 is also equipped with a DN100 scour line which is used to scour the wet wells. The scour line is discharged into sewage wet well 2 and isolated via valve VLV15 & SCV01.

Emergency bypass

An emergency bypass line located within an enclosed cage is provided in the event the raising main need to be drained/emptied or the pump station to be bypassed. When bypassing the pump station, the rising main should be emptied and bypass set up.

Gantry crane

The existing hoist was replaced with a 2-tonne electric hoist, which has re-rated and labelled to “1.2 tonne SWL”.

Platform and railings

There are two level platforms, upper and intermediate level with handrail, kick plate and swing gate to access the step ladders between each floor.

On the upper level platform, there is an access gate to move equipment and plant up and down the dry well which is normally locked closed. To access this gate, the operator/personnel must utilise a fall arrestor and hook onto one of two 1.5 tonne restraint points located on the upper floor platform around the access gate (refer SP0148|7 rev A).

The intermediate level platform is used to access the lower dry well via a covered ladder. A second uncovered ladder gives access from the intermediate platform to the lower dry well (RL-8.005) (refer SP0148|7 rev A).

Ventilation system

The SP0148 has a two-part ventilation strategy. Fresh air is sucked with a fan from the roof of the pump station, foul air is ducted from the wet wells and sent out a 14m high flue.

A fresh air fan draws air from the roof of the pump station via a duct continuously. Four air is exhausted to the environment via the DN225 duct and into a 14m high flue.

Lighting system

The lighting system is configured into upper and lower level lights and are of different circuits. The lights draw its power from the main low voltage switchboard located at the electrical kiosk above ground.

Electrical kiosk and switchgear

The electrical kiosk and switchgear is located on the right side of the pump station compound and is of existing. The kiosk contains all the circuit boards, manual control for the pumps and communication devices to SOC for offline monitoring and controls.

Technical data

Below are the details for the equipment installed as part of the Mechanical Refurbishment at Sewage Pump Station SP0148 Monterey.

SP0148 Monterey pump station (overall)

Characteristic	Detail/Information
Constructor	New South Wales Public Works Department
Relevant General Arrangements	ST0148|5A, ST0148|5B, ST0148|5C
Operation Duty	
Storage Capacity	144 kL (4h at PDWF, 40 L/s, tested 2009)
Discharge Location	Malabar Sewage Treatment Plant

PMP01 & PMP02 Dry well pumps

Characteristic	Detail/Information
Serial No.	
-PMP01	XXX1234
-PMP02	XXX4321
Manufacturer	Sulzer
Address and Contact No.	14-16 Clyde St, Rydalmere, NSW, 2116
Type	Dry Mounted Submersible
Model No.	XFP 205J-CB2 PE550/4
Unit Mass (Kg)	1060
Impellor Diameter (mm)	330mm
Impellor Type	CB Open
Duty Flow Rate (L/s)	135
Duty Pump Speed (rpm)	1480
Duty Head (m)	23.3
Duty NPSHR (m abs)	[Item Information]
Duty Pump Efficiency (%)	[Item Information]
Duty Power Input (kW)	55
Duty Noise Level (dBA @ 1m)	[Item Information]
Upper Bound Flow Rate (L/s)	[Item Information]
Upper Bound Pump Speed (rpm)	[Item Information]
Upper Bound Head (m)	[Item Information]
Upper Bound NPSHR (m abs)	[Item Information]
Upper Bound Pump Efficiency (%)	[Item Information]
Upper Bound Power Input (kW)	[Item Information]
Upper Bound Noise Level (dBA @ 1m)	[Item Information]
Lower Bound Flow Rate (L/s)	[Item Information]
Lower Bound Pump Speed (rpm)	[Item Information]
Lower Bound Head (m)	[Item Information]
Lower Bound NPSHR (m abs)	[Item Information]
Lower Bound Pump Efficiency (%)	[Item Information]
Lower Bound Power Input (kW)	[Item Information]
Lower Bound Noise Level (dBA @ 1m)	[Item Information]

PMP11 Sump pump

Characteristic	Detail/Information
Serial No.	
-PMP11	XYZ6543
Manufacturer	Lowara
Address and Contact No.	2/2 Capricure Dr, Eastern Creek NSW 2766
Type	DOMO
Model No.	DOMO 15GT
Unit Mass (kg)	15.3
Flowrate (L/s)	4.17
Head (m)	8.7
Pump Speed (rpm)	2850

LTX01 & LTX02 Pressure transmitters

Characteristic	Detail/Information
Serial No.	
-LTX01	35158103
-LTX02	35158104
Manufacturer	Vega
Address and Contact No.	398 the Boulevard, Kirrawee - 02 9542 6662
Type	VEGABAR 82 (4-20mA/HART)
Model No.	B82.IXESDBGESHXANDXX w\ Ceramic Measuring Cell
Measuring Range	0– 10 bar
Power Supply	10-30V DC, two wire system
Output Signal	4-20 mA
Connection size	G1 1/2
Ingress Protection (IP)	IP68 (120m H2O)
Sensor Material	Ceramic
Sensor Housing Material	316 stainless steel
Seal (Type, Material, Size)	EPDM; config: O-ring; Size: 40x5mm
Cable Length	20m

CRN01 Lifting equipment

Characteristic	Detail/Information
Serial No.	
-CRN01	[Item Information]
Manufacturer	Kito

Address and Contact No.	98 Forrester rd, St Mary's NSW 2760 02 8886 5200
Type	Under running single crane
Model No.	ER2-020IS
Safe Working Load (SWL)	2 tonne. De-rated to 1.2 tonne.
Operating Speed Bridge (m/min)	24 – 4 m/min
Operating Speed Hoist (m/min)	8.2 – 1.4 m/min
Motor / Current	3 Phase, 415V, 50Hz

PEN01 & PEN02 Penstocks / Wet well Isol

Characteristic	Detail/Information
Manufacturer	AWMA
Address and Contact No.	18 Roviras Rd, Cohuna Vic 3568 – 03 5456 3331
Type	Penstock
Model No.	AWMA WLF "Rnd Bottom" 316 SS Manufactured Penstock

Asset No.	Size	Material	Seat/Seal	Description
PEN01	*DN450*	*316SS*	*Resilient*	*Wet Well 1 Inlet Isolation*
PEN02	*DN450*	*316SS*	*Resilient*	*Wet Well 1 Inlet Isolation*

Level switches

Characteristic	Detail/Information	
Manufacturer	Flygt	
Address and Contact No.	2/2 Capricure Dr, Eastern Creek NSW 2766	
Type	Ball Float	
Model No.	Flygt ENM-10	
Measuring Range		
Power Supply	10-30V DC 5A, three wire system	
Output Signal	DC Normally closed / not closed, wire selectable	
Ingress Protection (IP)	IP68 (20m H_2O)	
Sensor Material	polypropylene	
Medium Temperature (deg C)	0^oC to 60^oC	
Medium Density	1 g/cm^3	
Cable Length	20m	
Equipment	Asset No.	Description
	LSH135	Collecting manhole
	LSH01	Wet well 1
	LSH02	Wet well 2
	LSH01	(duplicate tag) main dry well level sensor.
	LSHxxxx	Dry well sump
	LSH01	Wet well 1 level switch high
	LSH02	Wet well 2 level switch high

Manual and miscellaneous valving

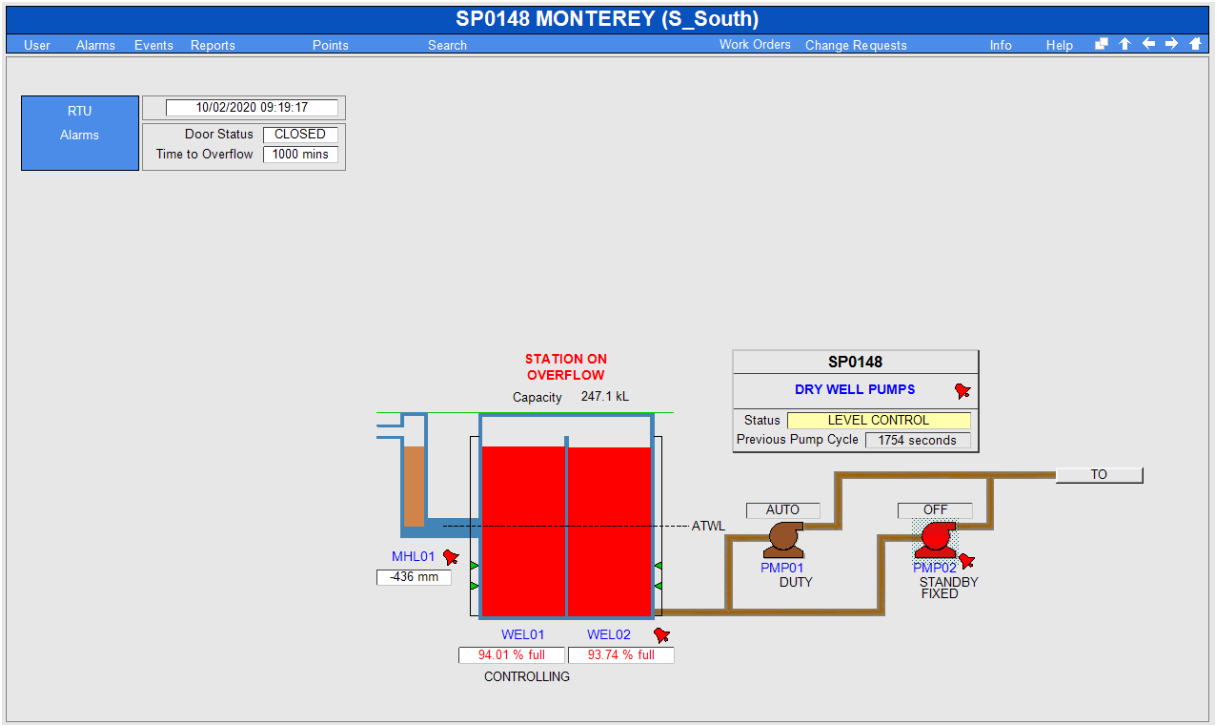
Characteristic		Detail/Information	
Manufacturer		Pentair	
Address and Contact No.		9 George St, Parramatta NSW 2150 – 02 9895 1500	
Size		Various size, see below	
Type		3 Piece Ball Valve	
Body		Stainless Steel 316	
Cap		Stainless Steel 316	
Ball / Blade / Internals		Stainless Steel 316	
Seat		PTFE	
Seals		p PTFE	
Max Operating Pressure (kPa)		1600 kPa	
End Connections		Threaded Female BSP	
Asset No.	Size	Connection	Application
NRV06	DN50	Ball Check	Reflex Valve - Sump Pump Discharge
VLV19	DN50	Ball valve	Valve - Ball - Isolation, Wet Well 1 Level Sensor
VLV20	DN25	Ball valve	Valve - Ball - Isolation, Valve Wet Well 1 Level Sensor Drain
VLV21	DN10	Ball valve	Valve - Ball - Isolation, Valve Wet Well 1 Level Sensor Test Cock 1
VLV22	DN10	Ball valve	Valve - Ball - Isolation, Valve Wet Well 1 Level Sensor Test Cock 2
VLV23	DN50	Ball valve	Valve - Ball - Isolation, Wet Well 2 Level Sensor
VLV24	DN25	Ball valve	Valve - Ball - Isolation, Valve Wet Well 2 Level Sensor Drain
VLV25	DN10	Ball valve	Valve - Ball - Isolation, Valve Wet Well 2 Level Sensor Test Cock 1
VLV26	DN10	Ball valve	Valve - Ball - Isolation, Valve Wet Well 2 Level Sensor Test Cock 2
VLV27	DN50	Ball valve	Valve - Ball - Isolation, PMP01 Suction Elbow Drain Line
VLV28	DN50	Ball valve	Valve - Ball - Isolation, PMP02 Suction Elbow Drain Line
VLV29	DN10	Ball valve	Valve - Ball - Isolation, PMP01 Suction Test Port
VLV30	DN10	Ball valve	Valve - Ball - Isolation, PMP02 Suction Test Port
VLV31	DN25	Ball valve	Valve - Ball - Isolation, PMP01 Discharge Drain Line

Characteristic		Detail/Information	
VLV32	DN25	Ball valve	Valve - Ball - Isolation, PMP02 Discharge Drain Line
VLV33	DN10	Ball valve	Valve - Ball - Isolation, PMP01 Discharge Test Port
VLV34	DN10	Ball valve	Valve - Ball - Isolation, PMP02 Discharge Test Port
VLV35	DN20	Ball valve	Valve - Ball - Isolation, Sump Pump Discharge Drain Line 1
VLV36	DN20	Ball valve	Valve- Ball - Isolation, Sump Pump Discharge Drain Line 2

Principles of operation

At SP0148 sewage enters collection chamber through the DN450 inlet, after which it flows through the Penstocks and into Wet Well 1 and 2. When the level within the wet well reaches the nominated cut in level (see site setup information), Pump 1 cuts in and pumps the sewage until the level within the wet well drops to hit the nominated cut-out level.

A typical submersible sewage pumping station consists of a wet well, valve chamber, inlet maintenance hole, electrical kiosk or switch room and supporting systems.



The wet well is a circular or sometimes rectangular in ground concrete structure that accommodates pumps, their discharge riser pipes, incoming sewer line with isolating valve and level sensing equipment.

The wet well floor is benched to provide adequate hydraulic flow to the pumps and achieve self-cleansing. Its control volume between pump cut-in and cut-out levels should be sufficient to limit the number of pump starts per hour to no more than that recommended by the manufacturer.

Wet well roof provides suitably sized openings for pumps, level sensors and personnel access. All the openings are fitted with water and gas tight covers.

A typical submersible pumping unit consists of a single stage centrifugal pump driven by an electric motor via a common rotor/impeller shaft, forming a compact and completely watertight vertical pumping unit. The motor is cooled by the pumped liquid so that no external cooling is required.

Telecommunication system facilitates remote monitoring and control (SCADA or IICATS) of the asset.

This site contains specific risks and hazards including;

Trade waste

Working at Heights

Pumping units

SP0148 is designed to maximise the use of gravity to convey the sewage. By using gravity, the pumps at SP0148 only have to pump the sewage to the highest point it the line (head); from that point onwards gravity transfers the sewage to the either the next SPS or onto the STP. It also means that the pumps do not have to work as hard thereby using less energy and less maintenance required.

Within the dry well sits 2 x Sulzer dry mount submersible pumps, with high efficiency motors. The pumps can be accessed via stairs leading down to the base of the dry well.

In addition to the pumps there are a number of ancillary equipment:

Sump Pump: used for when the suction and discharge lines need to be drained or if there are leaks in the line or from the pumps.

Valves: on the suction and discharge side of the Pumps.

Pressure Transmitters: for each wet well, when read from the site control panel shows the percentage of the level within the wet well.

Drain and vent valves

Ventilation: this allows fresh air to be transferred to the base of the dry well.

Lighting: approx. 400 Lux of light to allow workers perform inspections and or maintenance work at the base of the dry well. Proper lighting also allows for the safe entry and exit of the dry well.

Local control panel: providing local distribution and isolation of the pumps.

Operating instructions

This section describes the manual operation of the pumps only, but for further details on the pumps, sump pumps and pressure/level sensors refer to the original manufacturer's manual. This description includes the steps that must be followed when on site.

All personnel operating this SPS should follow the site requirements for safety, including wearing the appropriate PPE for the task.

Automatic SPS operation

No operator intervention is required for automatic operation. Automatic operation is monitored and managed remotely by SOC using IICATS and would normally not require intervention. If communications with SOC are lost, the site RUT will continue to control the station. In case of RTU failure, the emergency PLC will take over automatic control after a pre-set time.

Manual SPS operation

Notification of SOC

When conducting any works onsite that may alter or affect the automatic operation, such as opening up the kiosk and manually controlling the pumps, entering wet well and or collection chamber, resetting of pressure transmitters, operating valves wither within the dry well and or valve chamber, placing the SPS on bypass; SOC must be advised on 8849 5113.

Advise SOC on the work to be carried out on site and if pumps need to be manually controlled have SOC place the pumps into "Maintenance Mode". Also advise the length of time you intend on being on site for and to ignore any alarms until such time you call SOC back to take the pumps off maintenance mode.

Checks before starting

1) Perform all checks as required by the WHS procedures: general workplace inspection, site environmental inspection, workplace safety inspection
2) Check that there are no alarms on the local control panel and the kiosk
3) Check that there is enough space in and around your proposed area of work within the SPS
4) Check that all manual valves are in the correct position.

Manual operation pump 1

1) Within the external kiosk there are 3 sections, moving from right to left these sections are:
    a. Wet well monitoring and isolation (panel 1)
    b. Pump Controls: Auto, Off, Manual, Flush (pendant must be used for flushing of wet well) (Panel 2) and emergency stop.
    c. Pump isolation and 2 x GPO's: used whenever maintenance is being conducted on pumps (LOTO) (Panel 3)
    d. Panel 1: Start moving the "Site Attendance Manned / Unmanned" to "Manned".
    e. Panel 2: Move Pump 1 dial to manual and Pump 2 dial to off and isolated (red button).

Before switching the pumps into manual and off mode respectively ensure the pumps aren't about the cut in by looking at Panel 1 and the level being displayed.

If the pump 1 is in operation, wait until cut out. Only one (1) pump must be in operation at any one time. Even in "Auto" Pump 1 is duty and Pump 1 is standby.

Placing the pump into manual mode allows the operator to not only control pump 1 but allow the level within the wet wells to build up beyond cut in, even above top water level (ATWL).

Flushing pump 1

Flushing allows the operator to drain the wet well below the suction pipe/ bell mouth. The purpose of this allows on site plant operators to maintain or replace pumps, valves or pipe spools.

If pump, valve or pipe replacements are to take place, ensure a FIFM has been produced and approved by SWC.

Once FIFM has been approved and work is to commence, the bypass arrangement needs to have been commissioned and signed off by site supervisor.

Follow the isolation procedure spelt out within the FIFM that ensures that Pump 1 is completely isolated from incoming flow, flow from wet well 2 by the interconnecting pipework within the dry well and back flow from the rising main.

1) Keeping Pump 2 off, move the dial under Pump 1 from "Manual" to "Flush".
2) Connect the pendant to socket halfway down Panel 2
3) Observe the level indicator on wet well. It will only drop to 10%, and is therefore not below the suction pipe / bell mouth.
4) Visual indication will be required and or listening to the sound of the pump in operation, it will be sucking air which indicates level is below suction pipe / bell mouth.
5) Monitor the level in wet wells to ensure the levels are not rising and the isolation valves are properly closed.

The pressure transmitter located at the base of the dry well will need to be recalibrated after the wet well has been flushed and refilled with sewage. The reason for this is due to the air that has entered the tubing after the wet well was flushed and trapped after the wet well is refilled.

Slowly open the valve closest to the pressure transmitter until liquid begins to pour out then close.

Stopping pump 1

As stated above in point 3 of Manual operation, move the dial of the pump that you wish to stop to "off" and press the "isolate" button.

Emergency stopping pump 1

If there is an emergency situation in the pump operation process, press the "isolation/ emergency stop" button above the respective pumps in Panel 2.

Abnormal operation or pump faults on pump 1

If there is a fault with pump 1 (or to a lesser extent pressure/ level sensor), or if the levels within the wet well gets above 50%, isolate Pump 1 at the control panel, open wet well 2 isolation and take Pump 2 off isolation, turn dial to manual or auto. MANUAL allows one to control the cut in at any level but one will have to stand at the Panel 2 to start and stop the pump, alternatively AUTO pump 2 will cut in at its cut-in set point. If Pump 2 fails or fails to bring the levels within the wet wells under control contact SOC immediately on 8849 5113.

Installation and commissioning instructions

This description covers the equipment and instruments installed at SP0148 as a whole, but for details on the pumps, sump pumps and pressure/ level sensors refer to the original manufacturer's manual.

All personnel operating this system should follow the site requirements for safety, including wearing the appropriate PPE for the task.

Installation checks

Equipment checks			
ITEM	**DESCRIPTION OF CHECK**	**PASS**	**N/A**
1	Visual inspection on delivery (surface coating damage, impact damage etc.)	☐	☐
2	Equipment location is appropriate for purpose and located in line with drawings	☐	☐
3	Equipment is mounted securely and well supported.	☐	☐
4	Process connections are correctly connected and sealed from leaks.	☐	☐
5	Equipment is correctly labelled and asset tags attached.	☐	☐
6	Equipment enclosure seals, gaskets and fixings are fitted correctly.	☐	☐
7	Correct power supply and control cables connected and terminated.	☐	☐
8	Enclosure internals and components are clean.	☐	☐

Pump installation sequence checks			
ITEM	**DESCRIPTION OF CHECK**	**PASS**	**N/A**
1	Refer to Sulzer MSD Installation, Operations & Maintenance Manual Document No.: MSD-5.04-IOM	☐	☐
2	Foundation Construction	☐	☐
3	Prepare Foundation	☐	☐
4	Place Spacer Blocks	☐	☐
5	Set Baseplate over Foundation Blocks	☐	☐
6	Level Baseplate using Jack Screws and Shim Pack	☐	☐
7	Snug-up Foundation Bolt Nut	☐	☐
8	Check Levelling of Baseplate	☐	☐
9	Mount Driver (IF field mounted)	☐	☐
10	Check for soft feet, pump and driver	☐	☐
11	Align driver to pump	☐	☐

Pump installation sequence checks			
ITEM	**DESCRIPTION OF CHECK**	**PASS**	**N/A**
12	Grout baseplate	☐	☐
13	Final torque foundation bolts after grout cures	☐	☐
14	Install Main Piping	☐	☐
15	Check for Pipe Strain	☐	☐
16	Fill System	☐	☐
17	Final Alignment	☐	☐

Pump unit checks			
ITEM	**DESCRIPTION OF CHECK**	**PASS**	**N/A**
1	Pump Unit as per design drawings/specifications	☐	☐
2	Installed in correct location with correct orientation and mounting	☐	☐
3	Pump and motor alignment is completed	☐	☐
4	Coupling guards and other protective barriers are installed	☐	☐
5	Cooling water piping work for shaft seals are installed	☐	☐
6	Drainage pipework for the shaft seals, air release etc are installed	☐	☐
7	Suction and delivery pressure measurement test points for pump tests are installed	☐	☐
8	Impeller direction of rotation	☐	☐
9	Suction and delivery pipework vibration dampeners installed	☐	☐
10	Protective coatings applied and not damaged	☐	☐
11	Tags/Labels installed	☐	☐

Electrical checks			
ITEM	**DESCRIPTION OF CHECK**	**PASS**	**N/A**
1	Lights installed in location as per drawings	☐	☐
2	Cables connected and terminated as per cable check list	☐	☐
3	Lux level measured at 1 metre from AFFL. Lux Level: _____ *Note: Minimum 400 Lux required for "Maintenance" activities as per AS/NZS 1680*	☐	☐
4	FAT Testing Completed	☐	☐
5	Circuit Breakers fitted and appropriately rated.	☐	☐

Checks before first start

Commissioning checks			
ITEM	**DESCRIPTION OF CHECK**	**PASS**	**N/A**
1	Installation Inspection This will be a general inspection to confirm the installation is complete and has been carried out in a proper manner. Using the check sheet (refer clause **Error! Reference source not found.**), work through each item checking for t ightness of bolts and fittings etc.	☐	☐
2	Does the pump sit correctly on the pedestal	☐	☐
3	Have the electrical connections been carried out in accordance with regulations?	☐	☐
4	Is the direction of rotation of the pump correct?	☐	☐
5	Are the switching ON and switching OFF levels set correctly?	☐	☐
6	Are the level control switches functioning correctly?	☐	☐
7	Are the required gate valves (where fitted) open?	☐	☐
8	Do the non-return valves (where fitted) function easily?	☐	☐
9	If any electrical changes have been made (e.g. replacing instruments/pumps) test that the signals to/from the SCADA are working correctly. Test carried out by SWC IICATS personal.	☐	☐
10	Have the thermal sensors been connected.	☐	☐
11	Is the seal monitoring device correctly installed	☐	☐
12	Is the motor overload switch correctly set	☐	☐
13	Install hydrant and lay-flat hose for filling of collection for commissioning if flows into SPS are low	☐	☐
14	Check that all connections (e.g. flanges, vents and drains) are tight and leak-free.	☐	☐
15	Once Calibrations test completed, empty the bulk of the remaining water from the storage tanks by opening the drain valves then close or run pumps until tank is empty.	☐	☐

Ongoing operational checks

Operational checks			
ITEM	**DESCRIPTION OF CHECK**	**PASS**	**N/A**
1	Check that the performance of the pumps (SAT) close matches the FAT, to within +/- 5% comparing them to the flowmeter and the maximum rated flow on the pump nameplate.	☐	☐
2	Record amperage readings and compare readings with FAT results.	☐	☐
3	Monitor levels of wet wells through display shown in Panel 1	☐	☐
4	When the pump performance tests are done, ensure all gate valves open.	☐	☐

Preventative maintenance

Qualification of maintenance personnel and warnings

Only qualified personnel should work on electrical, plumbing and mechanical equipment.

Before commencing any maintenance work the pump should be completely disconnected from the mains by a qualified person.

Under continuous running conditions the pump motor housing can become very hot. To prevent burn injury allow to cool down before handling.

Electrical equipment should not be subjected to direct water hose pressure; and indirect splashing should be minimized during plant wash-down and clean up.

When carrying out maintenance activities, personnel should follow the site safety requirements. This should include following Lock Out Tag Out procedures and closing of isolation valves. Where possible drain sewage out of the pump volute. Check that the equipment item & surrounding pipework is depressurised before disconnecting it.

Ensure that the appropriate PPE is worn for the task, e.g. goggles/face shield, chemical resistant gloves, etc. Personnel should also ensure that maintenance activities will not adversely affect plant operations.

Maintenance schedule

Refer to the original manufacturer's manuals in the Appendix for details of maintenance activities. Note that equipment not provided by Monadelphous is not covered in this manual.

This includes any and all existing equipment. Refer to the manuals provided by the equipment supplier for details on these items.

PMP01 & PMP02 – Sulzer pumps

PMP01 & PMP02				
ACTIVITY	**TASK DESCRIPTION**	**FREQUENCY**	**CONSUMABLES**	**LABOUR HRS**
Functional Examination		Weekly	Nil	2
Process Performance Test		Monthly		4
Inspection		Quarterly		1
Service & Paint		Annually		8
Lubrication	A glycol change is only necessary: • At specified service intervals (for details contact your local Sulzer Service Centre). • If the DI moisture sensor detects an ingress of water into the seal chamber or dry chamber. • After repair work that requires draining of the glycol. • If the pump is being taken out of service the glycol should be changed before storage. • In the case of extreme ambient temperatures below -15 °C / 5 °F (e.g. during transport, storage, or if the pump is out of duty) the cooling liquid must be drained. Otherwise the pump may be damaged Refer to Section 10.4 in Equipment IOM.			

PMP11 Sump pump

PMP11				
ACTIVITY	**TASK DESCRIPTION**	**FREQUENCY**	**CONSUMABLES**	**LABOUR HRS**
Functional Examination	Check for leaks or other deterioration If sump is dry and sump has not been used fill up sump to ensure pump turns on at right level and drains sump until float switch has settled.	1-Monthly	Nil	2

Hoist

HOS50				
ACTIVITY	**TASK DESCRIPTION**	**FREQUENCY**	**CONSUMABLES**	**LABOUR HRS**
Functional Examination	Inspect Hook for cracks and wear. Chain Inspection Brake Inspection Push Button Inspection	Every Use	Nil	0.25

Non-return and gate valves

NRV & VLV				
ACTIVITY	**TASK DESCRIPTION**	**FREQUENCY**	**CONSUMABLES**	**LABOUR HRS**
NRV Functional Examination	Check for leaks or other deterioration Repair or replace as necessary. *Refer to Section 3.3 in RSSC Swing Check IOM*	6-monthly	Nil	0.25
Gate Valve Functional Examination	*Refer to section 1.3.4 in the RSGV IOM (Appendix XX)*	Annually	Nil	0.25

Pressure transmitters (Vegabar 52)

NRV & VLV				
ACTIVITY	**TASK DESCRIPTION**	**FREQUENCY**	**CONSUMABLES**	**LABOUR HRS**
Functional Examination	*Refer to Section 7 in Operating Instructions PLICSCOM (Appendix XX)*	Annually	Nil	1

Overhaul & major periodic maintenance

PMP01 & PMP02 Dry well pumps

Sulzer submersible pumps are reliable quality products, each being subjected to careful final inspection. Lubricated-for-life ball bearings, together with monitoring devices, ensure optimum pump reliability provided that the pump has been connected and operated in accordance with the operating instructions. However, should a malfunction occur, do not improvise, but ask your Sulzer Customer Service Department for assistance. This applies particularly if the pump is continually switched off by the current overload in the control panel, by the thermal sensors of the thermo-control system, or by the seal monitoring system (DI).

Regular inspection and care is recommended to ensure a long service life. Service intervals vary for XFP pumps depending on installation and application. For recommended service interval details contact your local Sulzer Service Centre. A maintenance contract with our Service Department will guarantee the best technical service.

When carrying out repairs, only original spare parts supplied by the manufacturer should be used.

Sulzer warranty conditions are only valid provided that any repair work has been carried out in a Sulzer approved workshop and where original Sulzer spare parts have been used.

PMP11 Sump Pump

For any and all major maintenance Grundfos recommends that the pump be brought back to their workshop in Newington.

Before carrying out maintenance and service, it must be ensured that the pump has been thoroughly flushed with clean water. Rinse the pump parts in water after dismantling.

Check the pump replace and replace the oil once a year. If the pump is used for pumping liquids containing abrasive particles or it is operating continuously, the pump must be checked at shorter intervals.

Test data, inspection results and troubleshooting

Test data and inspection results

Asset / Device	Available Data	Location Stored / Appendix No.
Ventilation System	Test Record	Included Below.
SPS Site Setup	IICATS Site Setup Information	Included Below

Site setup sheet

Sydney WATER

COMMISSIONING RECORD SHEET

21-Feb-17 **SCF- S3.2.1** **Site Set up Information**

Site Information: **SP0148** **Monterey**

Level Information	Wet Well 1	Wet Well 2	Collecting Manhole	Emerg Storage
Top of (mAHD):	1.930	1.930	1.870	N/A
Overflow Weircrest (mAHD):	1.100	1.100	1.100	
Invert / **Obvert** of Incomer (mAHD) :	-3.590	-3.590	**-3.080**	
Bottom of (mAHD):	-8.040	-8.040	-3.530	
Range of Instrument:	9040 mm	9040 mm	4950 mm	
Survey Marker RL (nm AHD):	1.930	Survey Marker No:	BM	
RTU Operational Parameters	Metres (AHD)	%	From Top of Wet Well1	IICATS Parameters
Overflow RL	1.100	100.0%	0.830	100%
ATWL Back Up Level	-3.590	48.12%	5.520	4H
ATWL Switch Position	-3.690	47.01%	5.620	4H-100mm
Maximum Upper Window	-5.290	29.31%	7.220	3H
				2H
A Duty Pump Cut in	-5.390	28.21%	7.320	1H
				1L
A Duty Pump Cut Out	-6.415	16.87%	8.345	2L
Maximum Lower Window	-6.515	15.76%	8.445	3L
Suction Safety Level	-6.715	13.55%	8.645	4L
Bottom of Probe	-7.940	0.00%	9.870	0%
Emergency PLC Parameters	PLC Override Delay Time :	120 secs	ATWL Pump Run Time	120 Secs
	Metres (AHD)	%	From Top of Wet Well 1	
A Duty Pump Cut in	-5.228	30%	7.158	
A Duty Pump Cut Out	-6.494	16%	8.424	
Collecting Manhole	Metres (AHD)	IICATS (mm)	From Top of CMH	
Top of Collecting Manhole	1.870			
Probe 100%	1.870	770		
Overflow (& Switch)	1.100	0	0.770	4H
Inflow Alarm	-2.880	-3980	4.750	1H
Bottom of Probe	-3.080	-4180	4.950	0%

Set up Note : WWL1 Transmitter Range : -640mm to +8400mm (7.07% = Atmosphere)

Set up Note : WWL2 Transmitter Range : -640mm to +8400mm (7.07% = Atmosphere)

Vent system test record

Sydney WATER

SW Commissioning and Acceptance Team (SW Customer Delivery) – Tests and inspections

Ventilation tests

SP	148	Monterey		Conventional station		
Rajiv Madhok	Commissioning and Acceptance Team - Customer Del			Test date	14/08/2017	
Test done at	Dry well floor	Instrument used		HMA Thermal anemometer		
Fan - type, make, power	Axial	Fantech	0.37 kW			
Test points	4	branch duct outlets				
Total num of air outlets	4					
Outlet dia without diffuser	195 mm			Area	0.02986 m2	
Cross sectional duct dims (WxH) - m	0.25	x	0.21	Area	0.0525 m2	
Flow rate test						
Outlet identifier (hand marked on site)	1	2	3	4		
Velocity measured (m/s)	4.6	6.1	7.5	8.0	Acceptable limit is 6.0	
Flow (L/s)	138.0	182.2	222.8	240.0		
Total flow (L/s)					782.9	
Required flow (L/s)					400	
Result (flow rate)					PASS	
Diffusion and vel test	**Without diffusers (Jet distribution)**			**Diffusers in place (diffuse distribution)**		
Dis from outlets (m)	2			2		
Dis above floor (m)	2			2		
Test location	left of pumps	bet pumps	right of pumps	left of pumps	bet pumps	right of pumps
Measured vel (m/s)	0.10	1.24	0.21	0.56	0.65	0.60
Requirement (m/s)	1.5 - 2.0			0.5 - 0.75		
Each branch vel (m/s)	7.5	requirement is 8 m/s			PASS	
Result (dry well diffusion)					PASS	
Air changes test						
Dia of dry well (m)	5.8					
Height to CL of air diffuser (m)	2.5					
Dry well height for vol calcs (m)	3					
Vol of bottom 3m (L)	79262.38					
Flow (L/h)	2818603.96					
Changes per hour	36					
Required changers per hr	20					
Result (air changes)					PASS	
Overall result					PASS	

Troubleshooting

Dry well pumps

Problem	Possible Causes	Action
Pump does not run	Moisture sensor shutdown	Check for loose or damaged oil plug, or locate and replace faulty mechanical seal / damaged O-rings. Change oil( )
	Level control override	Check for float switch that is faulty or tangled and held in OFF position in sump
	Impeller jammed	Inspect and remove jammed object. Check gap between impeller and bottom plate and adjust if necessary
	Gate valve closed, non-return valve blocked.	Open gate valve, clean blockage from non-return valve.
Pump is not pumping	Pump and/or pipeline are not completely vented or primed	Vent - by lifting the pump off the duckfoot bend and lowering it back again
	Pump suction is blocked by deposits	Clean suction pipework, pump parts and non return valve
	Damage column pipe (pipe and seal)	Replace defective column pipe and renew seals
	Motor not running due to no voltage supply	Check electrical installation Inform electrical company
	Motor running on two phases only	Replace defective fuses Check electric cable connections
	Motor winding or electric cable defective	Replace by new original cabling or contact your nearest pump dealer or agent
	Temperature monitor for winding control has ceased to operate due to excessively high winding temperature	The motor will switch on automatically after cooling down
	Moisture protection relay has been released due to moisture within the motor	Check the pump
Pump switching on/off intermittently	Temperature sensor shutdown	Motor will restart automatically when pump cools down. Check thermal relay settings in control panel. Check for impeller blockage. If none of above, a service inspection is required(2)
Low head or flow	Wrong direction of rotation	Change rotation by interchanging two phases of the power supply cable
	Gap too wide between impeller and bottom plate	Reduce gap
	Gate valve partially open.	Open valve fully.
	Pump delivers against excessively high discharge pressure	Open discharge valve further until duty point is reached

Problem	Possible Causes	Action
	Suction pipe or impeller blocked - rotor running sluggishly	Remove deposits from within the pump and/or pipeline
	Wear of internal pump parts	Replace worn parts
	Damage column pipe (pipe and seal)	Replace defective column pipe and renew seals
	Unacceptable air or gas content within the pumped media	Check the wet well operating level hasn't been changed or suction of air through vortex. Increase wet well operating level.
Excessive noise or vibration	Defective bearing.	Replace bearing
	Clogged impeller.	Remove and clean hydraulics.
	Wrong direction of rotation.	Change rotation by interchanging two phases of the power supply cable
	Wear of internal pump parts	Replace worn parts
	Unacceptable air or gas content within the pumped media	Check the wet well operating level hasn't been changed or suction of air through vortex. Increase wet well operating level.
	Oscillations caused by plant	Contact your nearest authorised pump dealer or agent
	Radial bearing in the motor defective	Contact your nearest authorised pump dealer or agent
Current / Power Consumption too High	Pump not running within operating limits	Check operating data of the pump
	Dirt / fibres in impeller chambers	Check impeller ensuring that it rotates slightly - if necessary clean hydraulic
	Pump chocked	Clean the pump impeller
	Wear of internal pump parts	Replace worn parts
	Motor winding or electric cable defective	Replace by new original cabling or contact your nearest pump dealer or agent
	Radial bearing in the motor defective	Contact your nearest authorised pump dealer or agent
High voltage test failure	Water inside motor. Stator insulation damaged	Replace stator.
	Power cable or lead damaged	Repair/replace stator.

Sump pump

Problem	Possible Causes	Action
Motor does not run	No Electricity supply	Connect the electricity supply
	Motor switched off by level switch	Adjust/replace the level switch
	Fuses are blown	Replace fuses
	Motor protection/ thermal relay has tripped out	Wait until the motor protection trips in again/ reset the relay
	Impeller blocked by impurities	Clean the impeller

Problem	Possible Causes	Action
	Short-circuit in cable or motor	Replace the defective part
Motor protection/ thermal relay trips out after short time or operation	Temp of pump liquid is too high	Use another pump type
	Impeller blocked or partially blocked by impurities	Clean the pump
	Phase failure	Call an electrician
	Voltage too high	Call an electrician
	Overload setting of the motor starter too low	Adjust the setting
	Incorrect direction of rotation	Reverse the direction of rotation
Pump runs constantly or gives insufficient water	Pump partly blocked by impurities	Clean the pump
	Discharge pipe or valve partly blocked by impurities	Clean the discharge pipe
	Impeller not properly fixed to the shaft	Tighten the shaft
	Incorrect direction of rotation	Reverse the direction of rotation
	Incorrect setting of level switch	Adjust the level switch
	Pump too small for application	Replace the pump
Pump runs but gives no water	Pump blocked by impurities	Clean the pump
	Discharge pipe or non-return valve blocked by impurities	Clean the discharge pipe
	Impeller not properly fixed to the shaft	Tighten the impeller
	Air in pump	Vent the pump and the discharge pipe
	Liquid level too low. Pump inlet not completely submerged in the pumped liquid	Submerged the pump in the liquid or adjust the level switch
	Level switch does not move freely	Make level switch move freely

Lifting equipment / hoist

Problem	Possible Causes	Action
Gears sound louder than usual.	Damaged gears or bearings due to use over long periods or overload despite insufficient or depleted lubricant.	Disassemble and inspect. Replace parts where necessary.
Electric shock imparted when touching the trolley or motor block.	Grounding line of power source is erroneously connected.	Eliminate the causes (on the left). If the malfunction or trouble continues, check the trolley electrical part.
Runway beam is tilted.	Runway beam is constantly subjected to sideways pulling. Immethodical force is acting on runway beam	Repair runway beam and restrict sideways force.
Trolley wheel idles.	Trolley wheel is liable to idle when runway beam is stained with paint, oil, or grime.	Thoroughly clean the runway beam. If unavoidable, sprinkle sand over runway beam.

Parts list and recommended spares

Parent asset	Equipment item	Part No.	Supplier	Lead Time (wks)
PMP01 & 02 Dry Well Pumps	Repair Kit	61705087	Sulzer	Off Shelf
	Seal Kit	61195134		Off Shelf
	Hydraulic Kit	61705858		Off Shelf
	Screw Kit	62615063		Off Shelf
	Impeller	35075663		8 Weeks
	Volute	31055134		8 Weeks
	Wear Plate	31065105		4 Weeks
	Stator	65004088		4 Weeks
	Cable	43025167		4 Weeks
	Cable Assembly	61025027		4 Weeks
PMP11 Sump Pump	Shaft Seal, standard	96429307	Grundfos	Off Shelf
	Oil	96010646		Off Shelf

Appendices

Appendix	Title
1	Test Data and Commissioning Check Sheets
2	PMP01 & PMP02 Dry Well Pumps Supplier Manual
3	PMP11 Sump Pump Supplier Manual
4	Hoist Supplier Manual
5	Pressure Transmitter Supplier Manual
6	Valve Supplier Manuals

22.3 Appendix C - Witness and hold points

22.3.1 Appendix C1- Witness and hold points nominations – tests and inspections of sewage pumping stations

Asset number:	Address:					
Test/Inspection		**SW OA involvement (✓/×)**	**Reference docs/method**	**Hold / witness by SW OA**	**Performed by**	**Status and date**
1. Compliance checks						
1.1	Compliance to WSA Codes, SW specifications and IFC design drawings		On-going inspection – from construction to completion		SW OA	
2. Installation checks						
2.1	Pump pedestal / stand installation		Visual checks, follow SW ITP		SW OA	
3. Hydrostatic tests						
3.1	Hydro testing of all water retaining structures; 1. WW 2. IMH 3. EST 4. ERS 5. Surge tank(s)		Civil spec clause C3.20.2		Service Provider- provide procedure, pics and report	
3.2	Hydro test of pressure pipes: 1. from WW to PM double isolation SV in VC 2. bypass(es) 3. Pigging arrangement if installed		1. Clause Hydraulic Testing 2. Individual procedures 3. Clause Hydraulic testing		Service Provider	
3.3	Hydro testing of pressure main		Relevant standards, codes, SW spec D-0001440		NATA certified, provide report	
3.4	Leak test of inlet valve(s)/penstocks to WW		SW specs, and clause Hydraulic testing		Service Provider	
3.5	Leak test of dividing valve		AS2638		Service Provider	
3.6	Leak test of isolating plate installed in IMH, where installed		SW Mech spec		Service Provider	

Asset number:	Address:					
Test/Inspection		**SW OA involvement (✓/×)**	**Reference docs/method**	**Hold / witness by SW OA**	**Performed by**	**Status and date**
3.7	Stop boards		SW Mech spec		Service Provider	
4. Operational tests						
4.1	Noise		SW specs		Part of PSAT – by DC	
4.2	Vibrations		SW Mech spec		SW OA	
4.3	Flow test		Duty point flow		SW OA	
4.4	Pump performance tests		ISO9906/Duty point and supplier FAT		SW OA-	
4.5	Water hammer mitigation		FDS		SW OA	
4.6	Crane performance		SW Mech spec		SW OA	
4.7	Crane load test		AS1418		Provide report	
4.8	Mech ventilation of: 1. Dry/wet well 2. Switch-room 3. VSD panels		SW specs		SW OA	
4.9	RPZ testing		Relevant AS		Accredited plumber	
4.10	Supervisory relays		SW specs		SW OA	
4.11	Wet well/IMH washing		FDS		SW OA	
4.12	Flow control valves to pressure mains		FDS/design docs		SW OA	
5. Factory Acceptance Tests (FAT)						
5.1	Pumps		AS/ISO9906		Supplier	
5.2	Kiosk/Switchboard		AS, SW specs		Supplier	
5.3	Permanent generator / gas or diesel pump		SW Specs		Supplier	
6. Miscellaneous						
6.2	Sump pump		Duty requirements		SW OA	
6.3	Coating/lining checks		SW coating specialist		SW coating specialist	

Asset number:	Address:					
Test/Inspection		**SW OA involvement (✓/×)**	**Reference docs/method**	**Hold / witness by SW OA**	**Performed by**	**Status and date**
6.4	Drains		Operate freely		SW OA	
7. Process Proving						
7.1	To cover complete operation of the station. <u>Conditions to meet prior to process proving</u>**:** 1. Satisfactory completion of items 1 to 4 (4.4 may be done later with agreement from SW OA engineer) 2. Maximo labels in place 3. Pressure main shown in HYDRA 4. IICATS work complete 5. All safety and public heath related defects closed out 6. All defects within water retaining structures resolved		Station to operate without any issues during proving period. Service Provider to fix any defects, including their causes, all alarms, emergency events such as choked pumps, sewage overflows, public health issues that come up from the failure of equipment under process proving.		SW OA	

11

22.3.2 Appendix C2 - Witness and hold points nominations – tests and inspections of water pumping stations

Asset number:	Address:					
Test/Inspection		**SW OA involvement (✓/×)**	**Reference docs/method**	**Hold / witness by SW OA**	**Performed by**	**Status and date**
4. Compliance checks						
1.1	Compliance to WSA Codes, SW specifications and IFC design drawings		On-going inspection – from construction to completion		SW OA	
5. Installation checks						
2.1	Pump pedestal / stand installation		Visual check, follow SW ITP		SW OA	
6. Hydrostatic tests						
3.1	Hydro testing of all water retaining structures 6. Surge tanks 7. Accumulator (boosters)		AS1210 and SW Mech spec		Service Provider - provide procedure, pics and report	
3.2	Hydro test of pressure pipes		Clause Hydraulic Testing		Service Provider	
3.3	Hydro testing of pressure main		Relevant standards, codes, SW spec D-0001440		NATA certified, provide report	
3.4	Leak test of valves		SW PSATs, Hydraulic testing clause		Service Provider	
7. Operational tests						
4.1	Noise		SW specs		Part of PSAT – by DC	
4.2	Vibrations		SW Mech spec		SW OA	
4.3	Bearing temp		SW Mech spec		DC/SW	
4.3	Delivery Control Valve		Project FDS		SW OA	
4.4	Flow test		Duty flow		SW OA	
4.5	Pump performance tests		ISO9906/Duty point and supplier FAT		SW OA	

Asset number:	Address:					
Test/Inspection		**SW OA involvement (✓/×)**	**Reference docs/method**	**Hold / witness by SW OA**	**Performed by**	**Status and date**
4.6	Crane performance		SW Mech spec		SW OA	
4.7	Crane load test		AS1418		DC	
4.8	Mech ventilation of: 4. Pump house 5. Switch-room 6. VSD panels		SW specs		SW OA	
4.9	Water Hammer		SW PSATs		SW OA	
4.10	Water Hammer mitigation		WH report		SW OA	
5. Factory Acceptance Tests (FAT)						
5.1	Pumps		AS/ISO9906		Supplier	
5.2	Kiosk/Switchboard		AS, SW specs		Supplier	
5.3	Permanent generator / gas or diesel pump		SW Specs		Supplier	
6. Sensors and miscellaneous						
6.1	Pressure boards		SW standard drawing		SW OA	
6.2	Pressure switches and Transmitters		Pump cut out to design value		SW OA	
6.3	Flowmeter		Operational/compare to calibrated unit		SW OA	
6.4	Ventilation system op on thermostat		FDS/design docs		DC	
6.5	Pump house flooded switch(s)		Cut outs to design values		SW OA	
6.6	Reed switches: 1. IICATS 2. Security		Elec spec		DC	
6.7	Security system		SW specs		DC	
6.8	Lighting		SW elec spec		DC	
7. Process Proving						
7.1	To cover complete operation of the station. <u>Conditions to meet prior to process proving</u>**:**		Station to operate without any issues during proving		SW OA	

Asset number:	Address:					
Test/Inspection		**SW OA involvement (✓/×)**	**Reference docs/method**	**Hold / witness by SW OA**	**Performed by**	**Status and date**
	7. Satisfactory completion of items 1 to 4 (4.5 may be done later with agreement from SW OA engineer) 8. Maximo labels in place 9. Pressure main shown in HYDRA 10. IICATS work complete 11. All safety and public heath related defects closed out 12. All defects within water retaining structures resolved		period. Service Provider to fix any defects, including their causes, all alarms, emergency events such as choked pumps, sewage overflows, public health issues that come up from the failure of equipment under process proving.			

22.3.3 Appendix C3- Witness and hold points nominations – pump pedestal / pump stand / pump skid installation sewage pumping stations

Pump pedestal / pump stand / pump skid installation

Asset number	**Address**	**Status**	**by**		
		HOLD point	DC/RDC and Sydney Water Operational Acceptance		
Item / activity description		**Requirements** (SW Mech spec clause M43)		**Result (✓/✗) and initials**	
				RDC	**SW**
Concrete surface for packers and grout placement		Rough scabbed to approx. 3-5mm, clear of loose dust, debris, oil, grease and water			
SS packers		1-piece construction from grade 316			
Number of SS shims		Max 2 per packer			
Shim size		Same as packer			
Packers size		**Pump stand/skid in dry well / pump house** • Packer length - to be same as the width of the base stand • Packer width – min 40mm • Packer height – min 32mm, max 50mm inclusive of shims where fitted **Wet well pedestal:** • Packer length – same as the length of the pedestal feet, if no feet then min 50mm • Packer width - same dimension as the distance between the inner edge of the slot (for anchor bolt) to the nearest outer edge of the pedestal (parallel to slot) • Packer height – min 32mm, max 50mm (inclusive of shims where fitted)			
Packers location and number - wet well		1 along each side of slot in pump pedestal for anchor bolts (2 per anchor bolt)			
Packers location and number– dry well/pump house/booster skid		1 at either side of each anchor bolt spanning the width of pump stand/skid base (2 per anchor bolt)			

Packer spacing at anchor bolt	Within 5mm from jacking nut on either side		
Jacking nuts	Under the stand / skid / pedestal.		
Jacking nut final position	Backed off to floor after alignment		
Anchor bolts and nuts	SS 316		
Washers at anchor bolts (only on top)	50 x 50 x 3mm SS grade 316. Under anchor bolt hold down nuts, on top surface of base frame / skid / pedestal. Note: Do not provide washers at jacking nuts		
Chemical anchor	Hilti HVU		
Anchor bolts depth	To pump manufacturer requirements, min 200mm		
Anchors extension above washer and nuts	No more than 10mm		
Anchor bolts if cut	Pickle and passivate cut surfaces. Deburr all sharp edges		
Pump pedestal flange face (wet well)	Plumb – check with spirit level		
Pump discharge flange face (dry well / pump house)	Plumb – check with spirit level		
Pedestal / pump stand top face	Straight – check with spirit level		
Corrosion, if any	Repair to WSA0201		
Formwork	1. Leakproof 2. Pump base frame / skid– extend min 50mm all around (inside and out) 3. Pump pedestal (for wet well) – extend min 50mm outside all around) 4. Facilities to achieve 5 x 45 deg bevelled surface at all edges		

Stage 1 – DC/RDC self-assessment sign off:

DC/ RDC company:	Name:	Signature	Date:

Note: Submit the above completed form to SW Operational Acceptance team before proceeding to the following activities.

Stage 2 works

Item/activity description	**Requirement**	**Result (✓/✗) and initials**

		(Sydney Water)
Grout (Parchem Conbextra EP65 plus)	Use parchem Conbextra EP65 plus. 1. Wet well - to be placed fully under the whole pump pedestal. 2. Dry well – to be placed under the bearing faces of the base frame / skid plus extension of 50mm inside and out.	
Grout (Conbextra EP65 plus) placement	Ensure no air pockets within grout	
Finish level of grout Conbextra EP65 plus grout:	1. Wet well - Min half way to pump pedestal thickness. 2. Dry well (pump stand/skid base)– As a min extend past the radius of SHS frame plus 5mm	
Grout (Conbextra EP65 plus) finish	Smooth with no sharp edges / corners	
Grout inside the pump stand (dry well SPS)	1. Apply a suitable bonding agent on cured conbextra EP65 Plus 2. Grout the insides from top of pump base stand in a dome shape such that water disperses to the dry well floor drain. Permissible grouts are Conbextra GP or Patchroc both by Parchem or equivalent	

Stage 2 –Sydney Water (Operational Acceptance) sign off:

SW Operational Acceptance	Name:	Signature	Date:

22.3.4 Appendix C4- Putting assets into interim operation

INSPECTION AND TESTING PROCEDURE
INTERIM OPERATION ACCEPTANCE TESTS SHEET No:

PROJECT: ……
SITE:
TEST: Completion of essential work and delivery of documents
TEST PURPOSE: Ensure equipment/system/facility operation is satisfactory to take over by SWC

Test Condition / Configuration :	Installation work including field mechanical and electrical equipment complete. The Service Provider ITPs (including pressure testing etc.) are completed and approved. The electrical and mechanical equipment PSAT ITPs & SAT ITPs completed and approved to proceed.
Description of Test:	Check and ensure that all work and services required enabling safe and normal operation of the equipment/system/facility has been completed. The SWC staff is trained / familiar with the equipment /system/ facility
Expected Test Results;	The equipment /system/ facility is ready to be taken over and place into interim operation by SWC.
Measurements and Readings:	
	Test equipment Used: **Serial No:** **Calibrated Valid to** …… …… …….. …… …… …….. …… …… ……..
Comments:	…… …… …… …… …… ……

Test Completion and Sign-off:

Re-Test required: *YES / NO*

Tests: *PASS / FAIL* Re-Test Sheet No: ....……..

Testing Officer: ….……	First Witness: ……..	Second Witness: ……..
Date: ..……	Date: ..……..	Date: ……..
Company: ……..	Company: ……..	Company: ……..
Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*
Non Conformance Required: *YES / NO*		NCR No.

INSPECTION AND TESTING PROCEDURE

PROJECT:…… **SITE:**……..…… **TEST:**

REF	EQUIPMENT/ITEM		PASS	FAIL	MEASUREMENTS/COMMENTS
1	**Non Conformance Reports**				
1.1		Category "A" NCRs are cleared (refer note 1)			
1.2		Category "B" NCRs are cleared (refer note 2)			
1.3		Category "C" NCRs are cleared (refer note 3)			
1.4		Category "D" NCRs are cleared (refer note 4)			
2	**Operation and Maintenance Manuals, Including Specific SOPs & UPGs.**	Operation and maintenance manuals, SOIPs & UPGs (where applicable) are delivered and accepted (refer note 5)			
3	**Equipment Manuals**	Two sets of complete equipment manuals are delivered and accepted (refer note 6)			
4	**Work - As - Constructed drawings**	2 Complete set of (mech/elec/civil) Work - As-Constructed Drawings are delivered and accepted (refer note 7)			
5	**Facility & Equipment Technical Data**	MAXIMO database update delivered and accepted (refer Note 8)			
6	**Warranty Transfer**	Transfer of Warranties of all equipment/material/services are documented and delivered (refer note 9)			
7	**Spare Parts**	All spare parts are delivered and accepted (refer note 10)			
8	**Training**	Operational and maintenance staff training completed (refer note 11)			
9	**Energy Supply Accounts**	Energy supply accounts (Electricity/Gas) are transferred to SWC and accepted (refer note 12)			
10	**Land Ownership**	The ownership of land and easements are transferred			

		to SWC and are registered (refer note 13)			
11	**Driveway and Crane Truck Access**	The construction of driveway is complete and suitable for crane truck access			
12	**Landscaping**	The landscaping work including security fence completed and accepted (refer note 14)			
13	**Change Management**	Where applicable, Change Management Check sheet and Plant Modification Request Form submitted approved. Refer to Change Management SAP (IMS0038) (refer note 15)			

Notes:

1. Non Conformance Report Category "A" - Major omissions/defects by the Service Provider

This category includes all safety issues, failure of PSAT or SAT which prevents successful testing of the asset/system/facility and therefore unable to prove capability of safe and normal operation of the equipment / facility.
All NCRs under this category must be completed and equipment / systems successfully re-tested prior to take over of the equipment/system/facility.

2. Non Conformance Report Category "B" - Major omissions/defects by SWC

This category similar to Category "A" above includes all safety issues, failure of PSAT or SAT which prevents successful testing of the asset/system/facility and therefore unable to prove capability of safe and normal operation of the equipment /system/ facility.

It is expected all NCRs under this category is to be completed by SWC and the equipment /systems successfully re-tested prior to handover of the asset/system/facility

However, if any of the items are unable to be completed prior to Practical Completion of part or the entire project as in Approved Project Management Plan the issue must be brought to the attention of:

e. Area Manager / Asset Program Manager – Service Delivery Division
f. DM Program Manager – Liveable City Solution Division
g. Urban Development Manager (for Developer activity issues only) - Customer Services Division

It is the responsibility of those listed above to develop SWC position on each issue and advise SWC Representative responsible for the handover of the facility. Timely resolution is essential to avoid Contractual issues related to Practical Completion of the project.

The equipment / facility must not be taken over without a documented plan to resolve each outstanding issue.

3. Non Conformance Report Category "C" - Minor omissions/defects by the Service Provider

This category includes work that has no impact on successful testing of the asset/system/facility that is essential to prove capability of safe and normal operation of the equipment / facility.

All NCRs under this category must be listed with a written confirmation from the Service Provider of acceptable completion times and any agreed penalties of subsequent non conformances.

If the facility/equipment is part of a developer activity process All NCRs must be cleared prior to SWC handover of the asset/ system / facility.

4. Non Conformance Report Category "D" - Minor omissions/defects by the SWC

This category includes work that has no impact on successful testing of the asset/system / facility that is essential to prove capability of safe and normal operation of the equipment / facility.

All incomplete NCRs under this category must be listed and forwarded to:

h. Area Manager / Asset Program Manager – Service Delivery Division
i. DM Program Manager– Liveable City Solution Division
j. Urban Development Manager (for Developer activity issues only) - Customer Services Division

It is the responsibility of those listed above to develop SWC position on each issue.

5. Operation And Maintenance Manuals (Include Equipment/System Specific SOPs & UPGs)

As agreed by the SWC stakeholders either a draft O & M manuals or an specific interim operation plan sufficiently detailed to provide the necessary operational & maintenance information for safe operation of the equipment/system/facility must be delivered to SWC prior to take over of the equipment / facility. Where necessary draft SOPs & UPGs shall be developed, reviewed, accepted by SWC as adequate shall be provided.

One copy of the O & M Manual shall be A4 size hard copy in three ring folder/s.

One electronic copy on CDs/DVDs shall be in PDF format and shall be of direct conversion to PDF from original documents. Scanned versions will not be accepted.

6. Equipment Manuals

Equipment manuals required for safe operation and effective maintenance of the equipment shall be provided.

The equipment manuals shall contain the documents related only to the equipment supplied under the contract. If a manual common to a number of models or types are included, the relevant model or type shall be highlighted.

One copy of the manuals shall be A4 size hard copy in three ring folder/s.

One electronic copy on CDs/DVDs shall be in PDF format and shall be of direct conversion to PDF from original documents. Scanned versions will not be accepted.

7. Work - As - Constructed Drawings

The WACs shall include all related to Civil/ Mechanical, Electrical and general Arrangement drawings required for the safe operation and effective maintenance of the equipment/system/facility.

Marked up drawings representing the work as constructed, and can be used with confidence to be correct are acceptable for the short duration of the interim operation.

Too copies of WAC drawings shall be delivered prior to take over of the equipment / system / facility and shall include:

- **One (1) electronic Copy of drawings in AutoCAD format and PDF on CDs/DVDs**
- **One (1) A3 size hard copy (replacement for the documents at the facility)**

If the facility/equipment is part of a developer activity process the finalised WAC drawings must be delivered to SWC prior to SWC handover of the equipment / facility.

8. Facility & Equipment Asset List & Technical Data

The asset list and the technical data for supplied equipment shall be delivered to SWC in the format given in MAXIMO database provided by SWC.

The asset numbers shall be finalised and validated and the asset labels shall be installed at the equipment / system prior to commencement of the commissioning of the equipment.

The Validation certificate received at the completion of asset data entries into Maximo shall be sighted by the Project Manager.

9. Warranty Transfer

The management of the delivery of warranty services including call out and response protocols shall be finalised, documented and signed off prior to placing assets into operation

If SWC is to provide part or in full the warranty services, the warranties associated with all equipment / materials (including spare parts) and services supplied under the Contract for that part of the work shall be transferred to SWC. Documentary evidence of this transfer as well as expiry

dates of warranties must be provided (details shall be included in equipment manuals) prior to handover of the asset/system/facility.
.

10. Spare Parts

The delivery of spare parts shall be as identified in the management of the warranty services in item 9 above, the spares shall be entered into MAXIMO and shall be in its original condition and packages and shall be clearly labelled with:

- Facility Number
- Equipment Description
- Part Number

11. Training

The training requirements shall be as per the Contract Specification and shall be completed prior to handover of the asset/system/facility.

Where there is no training requirement specified in the Contract, an appropriate familiarisation session for the nominated SWC staff must be provided. The familiarisation session shall contain:

- Site visit and inspection of equipment and facility
- Demonstration of the operation of major equipment

12. Energy Supply Accounts

The ownership of energy supply accounts for the equipment / facility, such as electricity and gas supplies shall be transferred to SWC.
Documentary evidence of completion of all work to the satisfaction of the supply authority shall be provided prior to take over of equipment asset/system/facility.

13. Land Ownership

The ownership of land and easements shall be transferred to SWC and shall be registered accordingly in the Land Registry.
Documentary evidence shall be provided prior to take over of equipment / facility.

14. Landscaping Work

The landscaping work including security fences, barriers, drainage etc. shall be completed as per the approved design to facilitate safe operation of the asset/system / facility.

If local authority inspection and acceptance is required they shall also be completed and documentary evidence shall be provided

If the facility/equipment is part of a developer activity process all work must be completed prior to SWC handover of the equipment / facility.

15. Change Management

All changes to Treatment Plants must also be carried out in accordance with IMS0038 Treatment Plant Operational Change Management SAP.

22.4 Appendix D- Compliance inspections

22.4.1 Appendix D1- Compliance inspections – typical defects on sewage pumping stations

Scope

Submersible SPS

Exclusions

Acceptance testing

1. Ladder - inclined - top rung not meeting SWC and AS 1657 requirements
2. Ladder - rungs not equi-spaced especially the bottom one to floor
3. Ladder - feet without grout
4. Ladder - rungs not from deformed bars
5. Ladder - loose nuts at bracket to wall
6. Ladder - sharp edges on stiles
7. Step irons - plastic encapsulated ones used instead of SS
8. Step irons - single 400 wide from deformed SS bar not used
9. Step irons - not 150 away from concrete ring joint
10. Step irons - not equally spaced from TOC to floor (dis to floor measured from middle of step iron)
11. Step irons / ladder steps protrusion from access point into the IMH < 125
12. Step iron / vertical ladder - first rung not 400 from TOC
13. Hand stanchions - not painted yellow
14. Hand stanchions - fixed - too far from step irons/ladder
15. Hand stanchions - fixed - too wide (> 650)
16. Hand stanchions - fixed - grout missing under holding down plate
17. Al chequer plate hatches - no insulation between SS hinges and other hardware
18. Al chequer plate hatches - nylocs used under the hatch as hinge fasteners
19. Al chequer plate hatches - hinge nuts not tack welded to bolt
20. Al chequer plate hatches - bowed covers
21. Al chequer plate hatches - tesa foam broken or pushed out
22. Safety grilles - not lying flat when fully open
23. Safety grilles - 125 clear spacing not provided at the edge strip on three sides except hinge side
24. Safety grilles - movement too tight
25. Safety grilles - lock nut missing at hinge instead tack welded
26. Safety grilles - 2 person lift sign applied on single person lift grilles
27. Safety grilles - cut out missing for pump cable
28. Safety grilles - 2nd cut out missing where the pump has two cables
29. Safety grille - radar - missing under radar hatch
30. Hatch frame - stitch welding done instead of seam welding
31. Hatch frame - not 150 x 150
32. Hatch frame - counter sunk screws loose or sticking out
33. Hooks - not aligned to conduits
34. Hooks - insufficient

35. Hooks - SWL plate missing
36. SS welding - pickling and passivation not done. Residue not washed out. Brown marks visible
37. SS anchor rods cut to size - rust at cut sections, pickling and passivation not done
38. Grates - deflection exceeds 5 mm
39. Grates - wobbly, unstable
40. Grates - rust showing at cut out ring for extension spindle
41. Grates - plates for U shaped handles have sharp edges
42. Grates - locking loop in the walking area through hand stanchions
43. Grates - above access ladder to open away from entry/egress point
44. Grates - distance behind to beam less than AS 1657 requirements
45. Grates - plain tops instead of serrated slip resistance profile
46. Grates - label missing showing one-person or two- person lift
47. Valves - isolating valves operating direction arrow missing, or label not laser cut throughout the thickness
48. Valves - PN rating lower than required
49. Valves - missing support
50. Valves - inlet valve SV - extension spindle squeaks
51. Valves - inlet valve SV - anchor bolts to concrete pedestal underneath are inclined not straight
52. Valves - SV - with gearbox/torque saver in wet well
53. Valves - SV - with gearbox/torque saver in buried installation
54. Valves - NRV - swing arm and counter weight if not required not hung inside the valve chamber wall
55. Valves - NRV - swing arm can move without any movement of disc
56. Valves - NRV - without facilities to install proximity switch
57. Valves - NRV - movement of disc not visible
58. Valves - NRV - guards not provided where counter weight is staying
59. Valves - chipped coatings showing rust
60. Valves - buried - extension spindle missing
61. Valves - buried - extension spindles too high, touching the underside of surface box
62. Valves – buried - cheese boxes loose
63. Valves - buried - cheese boxes - concrete surround or small plinth for Maximo label missing
64. Valves - air - exhaust with plastic fittings
65. Valves - air - exhaust missing isolating valves (ball valve)
66. Valves - air - exhaust missing dismantling features such as 3-way union
67. Valves - air - exhaust pipe connected to vent lines not wet well
68. Valves - air - exhaust pipe extends to far into wet well. It should end flush with wet well wall
69. Valves - pump flush valve – timing not set
70. Valves - pump flush valve - not on pump number 1
71. Valves - pump flush valve - not pointed correctly
72. Penstocks - standard SWC valve key (to AS 2638.1) wouldn’t fit to spindle cap
73. Pipework - DJ - loose nuts
74. Pipework - DJ - propriety bolts hitting the body causing rust
75. Pipework - DJ - to NRV with loose ring to SV instead of NRV
76. Pipework - above ground pipework non-metallic

77. Pipework - remove concrete spatter
78. Wet well - pump pedestal installation - packers - not SS, not rectangular, not single piece
79. Wet well - pump pedestal installation - packers - surface under not prepared no scabbling (3 -5 mm) or too deep scabbling
80. Wet well - pump pedestal installation - packers - placed too far on either side of anchor bolt whereby force from nut torqueing not transferred to packers
81. Wet well - pump pedestal installation - packers - placed not along the slot for anchor bolt
82. Wet well - pump pedestal installation - packers - too many shims (max 2 allowed), metallic shims not used
83. Wet well - pump pedestal installation - packers - square washer 50 x 50 x 3 not provide under the top nut
84. Wet well - pump pedestal installation - packers - square washer 50 x 50 x3 provided at jacking nuts
85. Wet well - pump pedestal installation - packers - jacking nuts not backed off to floor below
86. Wet well - pump pedestal installation - packers - conbextra 65 plus grout not extending pedestal in all directions
87. Wet well - pump pedestal installation - packers - conbextra 65 plus grout not extended to min half the pedestal height or more
88. Wet well - pump pedestal installation - packers - conbextra 65 plus grout with sharp edges not bevelled
89. Wet well - pump pedestal installation - pedestal - chipped coating, rust evident
90. Wet well - pump pedestal installation - pedestal - not plumb
91. Wet well - pipework - insulating washers - not installed
92. Wet well - pipework - insulating washers - cracked, flared out
93. Wet well - pump installation - leaks at pedestal
94. Wet well - pump guide bar - not secure at joints, jiggly when pushed causing rattling
95. Wet well - pump guide bar - welded to top bracket not bolted
96. Wet well - pump guide bar - top rubber ring installed inside out
97. Wet well - pump guide bar - guide bar top bracket too low causing pump to pull out and difficulty in inserting into guide bar
98. Wet well - pump guide bar - bent
99. Wet well - pump risers - loose support bracket
100. Wet well - uni-struts ends not capped
101. Wet well - sump - dirty, full of construction rubbish
102. Wet well - 900 clear opening for workbox not provided all the way to floor
103. Wet well - workbox landing not provided up to wet well wall
104. Wet well - workbox landing area not directly below personnel access hatch causing workbox to unstable when sitting on floor
105. Wet well - pump cables too long not wound around hooks
106. Wet well - floor - too steep up to end of bench
107. Wet well - scour pipe comes too far into
108. wet well roof - State Survey Mark (SSM) missing
109. Liner - HDPE - pipe penetrations - sealing not to SWC requirements
110. Liner - HDPE - brackets - sealing not to SWC requirements
111. Liner - HDPE - not made free draining at the bottom
112. Liner - HDPE - holes in liner

113. Liner - epoxy - chipped, scratched coating
114. Wet well - drains - flap valves not sealing
115. Wet well - drains - duck bill not sealing, debris stuck at duck bill
116. Wet well - P-trap not aligned to wall curvature
117. Wet well - not all pipe openings in the wet well
118. Wet well - roof slab - rodding point for duck bill valve without proper hinged surface box. Please note screwed plates are not allowed
119. IMH - 900 cylindrical clearance not kept throughout to the floor
120. IMH - High level pipe flange - gap behind to wall curve at min is < 125
121. IMH - ladder steps protrusion from access point into the IMH < 125
122. IMH - ladder not facing long side of the opening
123. IMH - pressure transmitter incorrectly installed
124. IMH - ladder landing into the channel
125. IMH - chem dosing line - to be secured to wall
126. IMH - chem dosing line - pipe in pipe with a break for 90 degree transition
127. Valve chamber - landing height < 2000
128. Valve chamber - concrete valve supports - shrinkage evident requiring non-shrink grout which cracks at concrete and metal surfaces
129. Valve chamber - concrete valve supports - 3 thick neoprene missing
130. Valve chamber - concrete valve supports - neoprene not trimmed and sealed to support
131. Valve chamber - concrete valve supports - sharp edges not bevelled
132. Valve chamber - NRV swing arms not facing wall
133. Valve chamber - bolts into wall missing to hang NRV swing arms and counter weights
134. Valve chamber - Floor fall not to drain
135. Valve chamber - drain not in wall but in floor
136. Valve chamber - drain blocked
137. Valve chamber - grates sloping to middle
138. Valve chamber - removable beam not set in weak sand cement mix
139. Valve chamber - walls - nails from earlier formwork remaining
140. Valve chamber - grate above ladder opening on to personnel access hatch of wet well
141. Valve chamber/pit - air valve - no drain provided
142. Valve chamber pipework - space for clamp-on flowmeter sensors not provided.
143. Air valve chamber - gate valves cannot be accessed safely from top i.e. centreline of valve spindle exceeding 300 from the edge of the valve operating surface
144. Air valve chamber with flushing facility - safety grille not provided
145. Air valve chamber with flushing facility - facility to be provided for safe operation of camlock i.e. grille in grille or adequate cut out based on camlock size
146. ERS - gas check MH - hand stanchions missing
147. ERS - gas check MH - step irons missing
148. ERS - gas check MH - gas check valve (Tide flex) hitting wall when fully open
149. ERS - gas check MH - cover not hinged aluminium chequer plate
150. ERS - discharge - head wall - not to SWC standard / Code requirements
151. ERS - discharge head wall - grille - not to SWC standard / code requirements
152. ERS - discharge head wall - loose / unstable soil around
153. ERS - discharge head wall - rip rap missing or insufficient
154. Bypass arrangement - NRV incorrectly installed

155. Bypass arrangement - dust cap missing
156. Bypass arrangement - dust cap not chained to pipework
157. Bypass arrangement - floor not sloped to drain
158. Bypass arrangement - swing arm and counter weight not removed and hung in valve chamber
159. Bypass arrangement - camlock/bauer connection missing
160. Bypass arrangement - ball valve not provided in 90 deg elbow in cases where the main SV to bypass is buried
161. RPZ - earth connection missing
162. RPZ - valve not to SWC specs i.e. hazard rating not High, flexible rubber hoses with SS sheath used
163. RPZ - valve leaking
164. RPZ - floor drain missing
165. RPZ - floor drain not to a structure where it is possible to
166. Turrets - wet well - not centrally aligned to pumps (3 o'clock and 9 o'clock orientation with flow in 6 o'clock and 12 o'clock orientation)
167. Turrets - wet well - spare pump cable wound in lower compartment
168. Turrets - wet well instrument hatch - not central to hatch
169. Turrets - IMH - not central to the opening
170. Turrets - EST - not central to the instrument hatch
171. Turrets - all - less than 2000 behind inner edge of nearest hatch frame
172. Turret - pump cables wound in turret lower compartment
173. Turrets - too close to anchorage points
174. Conduits - obvert > 600 below TOC
175. Conduits - not in one plane i.e. some below others
176. Conduits - terminate more than 100 behind the inner edge of the frame
177. Conduits - bellmouths not provided or cracked bellmouths or bellmouths fouling each other because they are too close to each other
178. Conduits - incorrect fall, fall should be towards the structure not away
179. EST - instruments - pressure transmitter not installed
180. EST - hinged aluminium covers not provided, gattics provided
181. EST - formwork nails in the walls
182. EST - instruments located in wrong place
183. EST - personnel access hatch too small
184. EST - hatches oriented such that each hatch cannot be provided with an in-ground anchor point in optimum location
185. Electrical kiosk - outgoing conduit pit not provided
186. Electrical kiosk - drain in the plinth without grille
187. Electrical kiosk - communication conduits uncovered
188. Electrical kiosk - pump nameplates missing at starter panel
189. Electric pit cover not greased and set in properly
190. Electric pit - floor not graded to drain
191. Pressure tapping points - not block and bleed style
192. Pressure tapping points - if block and bleed then horizontal ball valve not on top
193. Pressure tapping points - too close to wall, hinders access
194. Pressure tapping points - rust at nipple threaded to pipe

195. Pressure tapping points - missing under the bypass line in valve chamber
196. Pressure tapping points - SS end caps missing
197. Natural ventilation - induct - too close to pump turret (min 300 apart required)
198. Natural ventilation - induct - enclosure less than 600 high
199. Natural ventilation - induct - enclosure with air louvers / holes adjacent to turret
200. Natural ventilation - induct - flap does not operate in low or med winds
201. Natural ventilation - educt ventstack - sways in air
202. Natural ventilation - induct - not provided at EST
203. Natural ventilation - educt ventstack - anchor bolts - lock nuts missing
204. In-ground anchor points - less than 1500 from the opening of their hatch
205. In-ground anchor points - to lift grille from its outside edge strip near wet well wall - not in line with hinges (some offset is okay)
206. In-ground anchor points - to lift grille from its inner edge strip towards wet well centre - not provided
207. In-ground anchor points - incorrect locations
208. In-ground anchor points - loose nuts
209. In-ground anchor points - out of date tag at the anchor point
210. Concrete works - cracks propagating from corners of penetrations in concrete
211. Concrete works - cracks greater than 0.2 mm
212. Fence - chain wire - post overhang outside SWC property
213. Fence - height less than SWC required height
214. Fence - gate post installed on kerb not road
215. Fence - gate posts missing diagonal braces
216. Fence - holes in road surface for gate bolts not provided
217. Fence - palisade - individual members not welded all around but tack welded
218. Fence - palisade - gate leaves sagging
219. Fence - timber insulation missing at supply authority demarcation zone
220. Labels - paint coming off
221. Labels Maximo - description not to SWC requirements
222. Labels Maximo - anchor points - missing description of their relevant penetration
223. Labels Maximo - missing wet well, IMH and EST roof slab RL to AHD
224. Labels Maximo - missing wet well ATWL RL to AHD
225. Labels Maximo - missing IMH overflow weir crest level RL to AHD
226. Labels Maximo - missing valve chamber TOC
227. Labels Maximo - instrument hatch - RL label not close by
228. Labels - missing for instruments
229. Labels - wet well roof slab RL not next to SSM
230. Labels - missing for all maintainable equipment
231. Labels - missing for earth stake, IMH, electric pole, educt ventstack
232. Signage - ‘Do not drink’ missing at hose cock
233. Signage - No trespassing missing or not at every fourth or so panel
234. Bollards - concrete footed - not concrete footed
235. Bollards - concrete filled - not filled with concrete
236. Bollards - paint - peeling and rust showing
237. Bollards - incorrect reflective tape and number of tapes

238. Signage - missing confined spaces signs at relevant penetrations e.g. pump hatches, personnel entry hatch in wet well, IMH hatch, EST hatch
239. Signage - station - not provided at nearest main public road
240. Signage - station - not provided on posts approx. 1000 inside the fence and approx. 2000 high. Instead tied to the station perimeter fence
241. Signage - road - at public road - 'No Parking signs SWC vehicles excepted' - not provided
242. Landscaping - stones smaller than 40 mm
243. Miscellaneous - Gattic covers - missing concrete apron in the direction of opening
244. Miscellaneous - Earth stake - missing yellow paint
245. Miscellaneous - documentation - missing Contingency plan (in electrical kiosk - RTU panel)
246. Miscellaneous - documentation - missing WACs (in electrical kiosk - RTU panel)
247. Miscellaneous - documentation - missing O&Ms (in electrical kiosk - RTU panel)
248. Miscellaneous - documentation - missing IICATS commissioning sheet pasted at RTU panel
249. Miscellaneous - documentation - missing A4 laminated map of anchor points and their hatches
250. Miscellaneous - documentation - missing anchor points test certificates.

22.5 Appendix E- Test reports

22.5.1 Appendix E1- Vibration test data record sheet

Vibrations test record sheet

Asset number	Suburb	Address	Performed by	Date
Instrument used		**Measurement**	**Acceptable limit**	**Reference**
Hand held accelerometer		Velocity in mm/s	ANSI/HI 11.6	D-0001440 and SW Mech spec

Vibrations of Pump unit num: **KW:** **Make** **SNo.**

Ref number (write on pump)	Notation	Motor freq (hz)	Value Condition 1:	Value Condition 2:	Value Condition 3:
1	X1				
2	X2				
3	X3				
4	Y1				
5	Y2				
6	Y3				
7	Z1				
8	Z2				
9	Z3				

Colour coding: Black = acceptable, **Yellow** = on the margin, Red = Not acceptable

X (Measurement direction)	Y (Measurement direction)	Z 1,2 (Measurement direction) Z3 - 45 deg to top bearing
Perpendicular to the water flow direction (x-axis)	In the direction of water flow	Perpendicular to x-axis, on stand or top of cable head

Ref num 1 and 4	Ref num 2 and 5	Ref num 3 and 6	Ref num 7, 8 – top of pump base plate, cable head
Top end of pump casing	Approx. upper bearing	Middle of volute	7 on stand, 8 on cable head 9 at 45 deg to top bearing

Conditions

Condition 1: Dry run	Condition 2: Water run	Condition 3: pump bolts loosened	Condition 4:

Further actions/remarks:

1	
2	

22.5.2 Appendix E2- Ventilation test data record sheet

Sydney WATER

Ventilation tests

Asset number and address				Type:		
Done by:	Operational Acceptance Team				Date:	
Test done at		Instrument used		HMA Thermal anemometer		
Fan - type, make, power				kW		
Test points		branch duct outlets				
Total num of air outlets						
Outlet dia without diffuser		mm		Area:	m2	
Cross sec duct dims (WxH) m				Area	m2	
Flow rate test						
Outlet identifier (hand marked on site)	1	2	3	4	5	
Velocity measured (m/s)						
Flow (L/s)						
Total flow (L/s)						
Required flow (L/s)						
Result (flow rate)						
Diffusion and vel test	**Without diffusers (Jet distribution)**			**Diffusers in place (diffuse distribution)**		
Dis from outlets (m)						
Dis above floor (m)						
Test location	left of pumps	bet pumps	right of pumps	left of pumps	bet pumps	right of pumps
Measured vel (m/s)						
Requirement (m/s)						
Each branch vel (m/s)		requirement is 8m/s				
Result (dry well diffusion)						
Air changes test						
Dia of dry well (m)						
Ht to CL of air diffuser (m)						
Dry well ht for vol calcs (m)						
Vol of bottom 3m (L)						
Flow (L/h)						
Changes per hour						
Required changers per hr						
Result (air changes)				PASS		
Overall result				FAIL		

22.6 Appendix F - Test procedures (mechanical)

22.6.1 Appendix F1- Hydrostatic testing of emergency bypass system in sewage pumping station

Note: Follow the sequence of testing from A to E.

Test pressure	Test duration	Test media	Asset number	Date
1200kPa (120m)	**Refer to procedure**	**Potable water / RE if available**		

A. Hydrostatic pressure test

1. On a hot day consider to do the test early in the morning (before 8am) or keep the pipework in shade to avoid pipe expansion due to temperature when under test.
2. Close SV in bypass line downstream of the bypass arrangement. This SV could be in the valve chamber or it might be buried.
3. Remove dust cap from the camlock/Bauer fitting
4. Remove camlock/Bauer fitting
5. Lift up the non-return valve (NRV) disc and chock it in open position (eg tie off securely with a sling or secure in open position with timber support underneath)
6. Open SV downstream of the NRV in the bypass arrangement
7. Close ball valve at the invert of spool piece.
8. Fit blank flange (with 3mm thick neoprene gasket) to the spool piece upstream of NRV.
9. Crack open the seal of NRV bonnet to allow air to escape OR open manual ball valve if fitted on top of NRV bonnet.
10. Start filling from fill point in valve chamber if bypass SV is in valve chamber otherwise fill it from the pressure tapping point in the side of the vertical section of pipe coming up from ground.
11. Ensure all air has escaped from the top of non-return valve. This is typically confirmed by full uninterrupted steady stream of water spilling out of the top of non-return valve or the ball valve in the bonnet (where fitted).
12. For cement lined pipes, ensure pipes have been kept full with water for 24 hours prior to the test to allow for absorption.
13. Close the seal in NRV bonnet or ball valve if fitted
14. Pressurise to test pressure
15. Crack open the NRV bonnet or open ball valve in the bonnet (where fitted) if pressure is not increasing to allow any trapped/induced air to escape
16. Pressure will rise steadily when all air has been expelled
17. Pressurise in three steps of 400kPa each. Hold at each step and check for pressure drop and leakage
18. Re-pressurise until pressure stabilises to test pressure
19. Check for leakage at all visible flanges. No leakage allowed.
20. Check for pressure drop at gauge. No pressure drop allowed.
21. Test duration: 15 minutes
22. RESULT:

B. SV (downstream of NRV) leak test

1. Depressurise the pipework

2. Close SV
3. Keep the NRV disc up and locked in open position
4. Open ball valve underneath the spool piece upstream of NRV to release pressure between the NRV and the blank flange. Allow water to drain out as much as possible. Close ball valve.
5. Remove the blank flange from spool piece.
6. Wipe clean water from spool piece and inside of NRV ensuring all water is removed.
7. Close the open end of the spool piece upstream of NRV with a blank flange
8. Open the ball valve at the invert of the spool piece
9. Re-pressurise until pressure stabilises to test pressure to compensate for pressure drop due to thermal and pipe expansion.
10. Hold pressure for min 10 minutes.
11. Check for pressure drop. No pressure drop allowed.
12. Check for water dripping from ball valve under the spool piece. Zero leakage/drip allowed.
13. Depressurise the pipework
14. Remove the blank flange at the spool piece
15. Visually check for leakage past the SV disc. No leakage allowed.
16. RESULT:

C. NRV leak test

1. Close SV downstream of NRV
2. Drop the NRV disc to close position (some water will come out)
3. Wipe clean water from spool piece ensuring all water is removed.
4. Open SV
5. Close the open end of the spool piece upstream of NRV with a blank flange
6. Open the ball valve at the invert of the spool piece
7. Pressurise to test pressure from ball valve inside the valve chamber or from the ball valve in the side of the vertical pipe (if installed) from the ground.
8. Crack NRV top seal to release air or open manual air relief valve (where fitted) in the bonnet to release air trapped in the pipework.
9. Re-pressurise if required to compensate for pressure drop due to thermal and pipe expansion.
10. Hold pressure for min 10 minutes.
11. Check for pressure drop. No pressure drop allowed.
12. Check for water dripping from ball valve under the spool piece. Zero leakage/drip allowed.
13. Depressurise the pipework
14. Remove the blank flange at the spool piece
15. Visually check for leakage past the NRV disc. No leakage allowed.
16. Test duration: 10 minutes
17. RESULT:

D. Pressure test contd…

1. If any flange or fitting had to be loosened to release pressure, re-fasten the flanges, recharge the complete main to the test pressure as done for Bypass pressure test
2. Keep pressurised for the test duration of this activity
3. Check for pressure drop
4. Check for leakage through flanges
5. Test duration: 15 minutes
6. RESULT:

E. Floor drain

1. Check floor drain operation from the water discharged during the above tests.

RESULT

22.6.2 Appendix F2- Hydrostatic testing of inlet stop valve to sewage pumping station wet well – network and treatment plants

Note: Prior to this test, overflow drain line (ERS) must have been constructed**)**

1. Close SV under test in wet well by hand. Use of longer bar to create a good seal at the valve is allowed.
2. Install plug (inflatable or Pockydela) into the immediate upstream incoming pipe(s) and any other pipe through which the test water can escape.

New SPS

1. Other side of the valve under test to be at atmospheric pressure.
2. Fill wet well to about 100mm with potable water while ensuring it is well below the lowest tip of drop tube (where installed) or the valve invert level.
3. Fill water to the Inlet chamber / Inlet Maintenance Hole (IMH) to overflow RL plus a minimum of 0.3m. This height to be increased to such level that will allow design flow to pass over the overflow weir crest level. Consult Sydney Water in such cases.
4. Hold pressure for a minimum of 10 minutes.
3. Check for leaks from top of wet well. Any leaks should be visible by torch light at the drop tube (where installed) or the valve. Ripples on the water surface in the wet well will also assist in the evidence of leakage through the valve.
4. Where the inlet valve is not visible from top e.g. deep wet well, or other structures are in the way inhibiting direct line of sight, entry into the wet well will need to be made.
    a. Service Provider to advise means of entry/exit into the wet well. Note, use of tripod and manually lowering/lifting workers into the wet well is not acceptable for Sydney Water staff due to the risk of suspension trauma.
    b. Physically check for leaks at the drop tube / inlet valve from inside the wet well
5. If leak is to be measured such as for a metal seated valve or for any other reason, place a graduated container underneath the drop tube/valve such that all leaks howsoever small would go into this container.
    a. Remove container under the valve in a safe manner
    b. Measure the leak
6. Alternative method to measure the leak is to prepare a coffer dam using wetted sand bags and sealed to the floor. Suck the leaked water using wet vacuum and measure.

Upgrades (existing wastewater pumping station being upgraded)

7. Test to be done only on a dry day and with no heavy rain for two days preceding the test day.
8. Test to be done with sewage or reclaimed effluent where available
9. Test must be done in the presence of Sydney Water Operational Acceptance team representative or Operating staff representative.
10. If access is available in the inlet chamber / IMH then mark out 100% and test head on the inlet chamber / IMH walls with paint or similar prior to the test. Ensure marks are easily visible from top of IMH.
11. Consult Sydney Water (Operational Acceptance team) for test head. This is likely to be 75-80% of the system overflow level.
12. Flush the valve momentarily with incoming water to maximise the chances of no material getting between the valve disc/gate and its invert. Consult Sydney Water Operational Acceptance team representative if the material coming through is sludge, screenings etc. which is applicable to Treatment assets.

13. Fill structure behind the inlet valve (SV) to test head.
14. Hold pressure for about 10 minutes, reduce time if the rate of rise of sewage in inlet chamber / IMH appears too high. Sewage/process water must not go over 80% of system overflow level at any time during the test.
15. Check for leakage through the valve disc:
    a. If access available to the stop valve, go down if approved by Sydney Water Flow management/isolation procedures to physically check the leakage. Follow dot points 5 and 6 above.
    b. No access available. Qualitative approach - fill the wet well with about 100mm of water and look for ripples from top of the chamber / IMH on water surface due to leak
16. No leak is allowed for resilient seated valves.
17. Leakage rate for metal seated gate valves - follow AS2638.1

Asset number	**Asset address**	**New installation**	**Existing installation**	**Date**	**Performed by**

Overflow (RL m)	**Distance above Overflow for DWWF (RL m)**	**Test head (RL m)**	**IL of inlet valve (RL m)**	**Test head (m)**	**Volume of Leakage observed (L)**	**Leakage rate observed (L/m/min)**	**Result**

22.6.3 Appendix F3 - Hydrostatic testing of penstock in a chamber / maintenance hole / channel / wet well - network and treatment Plants

Preliminaries:

a) Test head is 1.2 x design head. Design head is measured from invert level of the penstock gate to the overflow weir crest Reduced Level (RL) plus head required at the weir crest to achieve the design wet weather flow (Design flow). For existing operational structures, test pressure may be lowered to ensure water doesn't get inside the electrical conduits or cause a sewage overflow, subject to approval from Sydney Water Customer Delivery Operations Acceptance representative.
b) Service Provider to confirm prior to the test that the penstock can handle the test head without any damage i.e. test head is within the design pressure rating of the penstock.
c) Test head and design head to be confirmed with Sydney Water Operational Acceptance representative prior to the commencement of the test
d) Penstocks to be tested for both on-seating and off-seating conditions
e) Duration of test: minimum 5 minutes.
f) Test media:
    a. Potable water for new wastewater pumping stations in Networks.
    b. Sewage for existing wastewater pumping stations in Networks.
    c. Potable water for water treatment plants.
    d. Reclaimed Effluent (RE) for wastewater treatment plants
g) Acceptance criteria: SW Mechanical specification clause Penstocks – leak rate

Procedure:

1. Block all incoming and outcoming pipes connecting the maintenance hole (MH)/wet well (WW)chamber/channel with penstock to other structures. This will include any high level (HL) and low level pipes typically connecting the chamber/MH/channel to other structures. Where the pipe ends have flanges, ideal way to isolate against inflow/outflow is using blind flange or blind plate. Alternatively, a plug (inflatable or Pockadyla type) can also be used. If plugs are used, these need to be tested prior to commencement of test to confirm they will hold the required pressure/head.
2. Thoroughly wipe clean penstock's all sealing surfaces to remove lubricating material and impurities such as dirt, grime, construction material.
3. Remove all water from the side of the penstock gate not under test. This may be done using a submersible pump. Remaining water may be removed by wet vacuum cleaner or by manual means.
4. Operate the penstock to fully open position and then to fully close position at least twice prior to start of the test.
5. Close the penstock
6. Subject one side of the penstock to test head with test media while keeping the other end of the penstock at atmospheric pressure.
7. If leaks are found between the penstock frame and the surface it is attached to, abandon the test till this leakage is positively fixed.

8. This procedure provides three options to collect and measure the leaked water. Any of the three can be used to prove compliance to this procedure.
9. Option 1 - If there is room under the penstock frame and the bottom of the structure, place a suitable sized receptacle there to collect all leaked water for 5 minutes.
10. Option 2 - A coffer dam arrangement using wetted sand bags sealed to the floor may be prepared around the penstock gate exposed to atmospheric pressure to collect leaked water.
    a. Ensure size of coffer dam is such that water within it does not rise more than its height and does not touch the invert of the penstock under test.
    b. Wait for 5 minutes
    c. Suck up the leaked water using wet vacuum and measure.
11. Option 3 - Manually place a hydrostatic probe into the chamber/channel/MH/WW.
    a. For off-seating test, the probe will be immersed in test media.
    b. For on-seating, the probe will need to be placed at the lowest point on the floor of the MH/chamber/channel. It can be the sump area. Fill the MH/WW/channel/chamber to a level such that volume of escaped water can be easily measured.
        i. Ensure 100mm submergence of the hydrostatic probe
        ii. Ensure water level does not rise above the penstock invert as it would affect the test head
        iii. Log the water level rise in a data logger for minimum 5 minutes and calculate the volume of leaked water

    Note:

        i. If water level rises quickly i.e. the dedicated sump fills up before the test duration, the calculation for leaked water volume may become quite difficult as the floor may have benching all around and also floor will have a fall on it.
        ii. If so, wait till the water level rises above the benching of the wall but below the invert of pen 02. This will be a visual check from top as man entry is to be avoided (only one means of isolation that too is leaking). Start recording the rise in water height from this water level.
        iii. The leaked water must not reach up to the invert of the penstock under test

22.6.4 Appendix F4 - Hydrostatic testing of pump riser pipes not including joints with pump in sewage pumping station – network and treatment plants

Scope:

Pressure pipework downstream of the pump up to the most downstream isolation valve within the pumping station. This procedure does not include joint between the pipework and the pump pedestal or with the pump.

This procedure does not apply to pressure mains for which other procedures apply.

This procedure includes additional requirements to those documented in clause Hydraulic Testing in the main body of the document.

Scope

1. Pressure pipes and appurtenances downstream of pump pedestal/stool up to the pressure main double isolation valve which may be in a valve chamber
2. Pressure pipes and appurtenances related to air release valves
3. Pressure pipes and appurtenances related to agitation/stirring of the contents within the wet well (stand-alone flushing or mixing function).

Preliminary activities

Prior to the test, Service Provider is to:

1. Send test methodology clearly marked on the IFC drawings to Sydney Water for our review and endorsement
2. Ensure all parts under the test including any blank flanges/spades used for the test have pressure rating more than 1.15 times the test pressure. Consult Sydney Water's Operational Acceptance team if this cannot be achieved.
3. Safe access is to be provided to Sydney Water into and out of any structures for the purpose of this test. Access by tripod is not considered safe due to the risk of suspension trauma. Scaffolding is the preferred method followed by workbox with a mobile crane.

It is recommended that Service Provider perform hydrostatic pressure test first themselves and once satisfied with the results, organise date/time with Sydney Water to witness the test.

Test pressure:

Test pressure is 1.25 x Design Pressure.

Design Pressure is maximum of:

a. Max water hammer (obtained by computer modelling),
b. Pump No Discharge Head plus suction head
c. 96m (960kPa)

Test pressure (to be recorded)	Test duration	Test media	Asset number	Date
	2 hours	**Potable water / Reclaimed Effluent (RE)**		

A. Hydrostatic pressure test methodology

Service Provider to satisfy themselves that all activities mentioned in this procedure are safe for people and equipment. If Service Provider wishes to make changes to this procedure, they must advise Sydney Water of the changes at least 10 working days prior to conducting the test and obtain Sydney Water Operational Acceptance team's endorsement prior to the test.

Refer clause Hydraulic Testing in the main body of the document.

1. It is recommended to keep all test pipes under shade to avoid pressure drop/rise due to pipe expansion/contraction.
2. Prior to start of the test ensure grout under pump pedestal has not been installed.
3. Wipe off dirt and grime from the all pipework and valves under test
4. Ensure all pipework and valve joints under test are completely dry from outside and in particular between the flanges at the gaskets.
5. Remove SS packers from under the pump pedestal. Lower the pump pedestal. Install a blind flange at the lowest pipe joint with pedestal such that blank flange is sandwiched between pipe flange and the pedestal. Tighten the jacking nuts such that pedestal is not loose.
6. Lift the non-return valve disc from the swing arm and tie it off securely in the open position or chock it securely in open position such as with a timber support from underneath or similar.
7. Bleed out air from the pipework to be tested using pressure tapping points/air bleed points. Close air bleed valves.
8. Close all those isolating valves which are required to facilitate pipework and appurtenances to be tested ensuring there is atmospheric pressure on the sides of the valves that are not under test.
9. Some sections of the pipes may have to be tested separately if all pipework and appurtenances to be tested cannot be isolated in one go or where any part under test has pressure rating below 1.15 times the test pressure. Consult Sydney Water's Operational Acceptance team if this is the case.
10. Slowly fill pipework with potable water/reclaimed effluent (RE) if available ensuring air is completely expelled.
11. Raise the pressure in steps up to the test pressure.
12. For example for a 1200kPa test pressure, incremental pressure steps could be 500 and 850kPa. Hold pressure for a few minutes (say 2 minutes) at each step and check for pressure drop. Raise pressure only if no drop in pressure or leak is found.
13. Pressure measurements to be made with a minimum of two pressure gauges both with current calibration. Range of pressure gauges must be suitable for the pressure being checked. Provide calibration certificates and instrument numbers with quality documentation.

Test acceptance criteria

Refer clause Hydraulic Testing in the main body of the document.

RESULT:

22.6.5 Appendix F5 – Hydrostatic testing of pipework-joints including joints with pump in a pumping system – water pumping stations, sewage pumping stations in Networks and Treatment plants

Scope:

Includes suction pipework immediately upstream of the pump, and downstream of the pump up to the most downstream pumping station isolation valve. This procedure does not apply to pressure mains for which other procedures apply.

This procedure includes additional requirements to those documented in clause Hydraulic Testing in the main body of the document.

Preliminary activities

Prior to the test, Service Provider is to:

1. Send test methodology clearly marked on the IFC drawings to Sydney Water for review and endorsement
2. Confirm that all parts under test including any blank flanges/spades used for the test have pressure rating more than 1.15 times the test pressure. Consult Sydney Water's Operational Acceptance team if this cannot be achieved.
3. Safe access to be provided to Sydney Water into and out of any structures for the purpose of this test.

It is recommended that Service Provider perform hydrostatic pressure test first by themselves and once satisfied with the results, organise date/time with Sydney Water to witness the test.

Test pressure:

Test pressure is:

1. 85m (850kPa) where any part under test has a maximum pressure rating of 100m (1000 kPa). This could be an internal part of the pump such as the seal mechanism.

2. If max pressure rating of any part under test is greater than 100m then consult Sydney Water's Operational Acceptance team to determine the test pressure.

Test pressure	Test duration	Test media	Asset number	Date
	2 hours	**Potable water / Reclaimed effluent (RE)**		

A. Site hydrostatic pressure test methodology

Service Provider to satisfy themselves that all activities mentioned in this procedure are safe for people and equipment. If Service Provider wishes to make changes to this procedure, they must advise Sydney Water of the changes at least 10 working days prior to conducting the test and obtain Sydney Water endorsement prior to the test.

Refer clause Hydraulic Testing in the main body of the document.

14. It is recommended to keep all test pipes under shade to avoid pressure drop/rise due to pipe expansion/contraction.
15. Make sure all pipework under test is completely dry from outside and between flanges at the gaskets.
16. Lift the non- return valve disc from the swing arm and tie it off securely in the open position or chock it securely in open position such as with a timber support from underneath or similar.
17. Bleed out air from the pipework to be tested using pressure tapping points/air bleed points. Close air bleed valves.
18. Close all those isolating valves which are required to facilitate pipework and appurtenances to be tested ensuring there is atmospheric pressure on the sides of the valves that are not under test.
19. Some sections of the pipes may have to be tested separately if all pipework and appurtenances to be tested cannot be isolated in one go or where any part under test has pressure rating below 1.15 times the test pressure. Consult Sydney Water's Operational Acceptance team if this is the case.
20. Sections of the pipes may have to be tested separately if all pipework and appurtenances to be tested cannot be isolated in one go or where pressure rating of any part is less than 1.15 times the test pressure. Consult Sydney Water's Operational Acceptance team if this is the case.
21. Slowly fill pipework with potable water or reclaimed effluent (RE) if available, ensuring air is fully expelled.
22. Raise the pressure in steps up to the test pressure.
23. For example for a 850kPa test pressure, incremental pressure steps could be 350 and 500kPa. Hold pressure for a few minutes (approx. 2 minutes) at each step and check for pressure drop and leakage. Raise pressure only if no drop in pressure or leak is found.
24. Pressure measurements to be made with a minimum of two pressure gauges both with current calibration. Range of pressure gauges must be suitable for the pressure being checked. Provide calibration certificates and instrument numbers with quality documentation.

Test acceptance criteria

Refer clause Hydraulic Testing in the main body of the document.

RESULT:

22.7 Appendix G - Commissioning prerequisites checklists

22.7.1 Appendix G1 – Dry-commissioning prerequisites checklist

Project No:		**Site No.**	
Delivery Team:		**Date:**	
Project Name:		***Work Lot / PID:**	

**Where multiple commissioning work lots are required, this checklist shall be repeated for each respective worklot.*

All deliverable documents required are to be uploaded to the relevant project management system being used for the works (SW Delivery Portal etc.) prior to completion of this checklist.

*Where **"NA"** is provided as an option, comments must be provided. **"Draft"** refers to documents being in the order of 70-80% of the standard of the final submission.*

NOTE: Pre-Commissioning Checklist must be signed off a minimum 5 Business days prior to Commissioning works commencing.

No.	Requirements	Compliance	Reference *Delivery Portal or Document Ref*	Comments
1.	Updated Commissioning Plan available ***Provide Document / Reference #***	Yes☐ NO☐		
2.	Dry-Commissioning kick-Off meeting held and Risk Assessment available. The controls identified in the Commissioning Risk Assessment are in place. ***Provide Document / Reference # for relevant SWMS or Other***	Yes☐ NO☐		
3.	Relevant Construction Inspection and Test Plans (ITP's) and Checklists (ITC's) **completed/signed.** ***(Includes civil, electrical and mechanical works. Full ITPs may not be complete, however activities relevant to the commissioning activities should be completed, including any Hold Points). **Any accepted incomplete items should be noted in the comments.***	Yes☐ NO☐ NA☐		
4.	Copy of Design Report provided (including HAZOP / CHAZOP and Safety in Design report etc.) ***Provide Document / Reference #***	Yes☐ NO☐ NA☐		
5.	Updated Defects / Punchlist register available for the works. ***Provide Document / Reference #***	Yes☐ NO☐		
6.	Updated Non-Conformance register available No category 'A" defects relevant to the commissioning activities ***Provide Document / Reference #***	Yes☐ NO☐ NA☐		
7.	All Factory Acceptance Test (PFAT's and FAT's) documentation available and accepted for all prefabricated units. ***(Chemical Dosing Skids/Units, Odour Control Skids/Units, Pump Skids/Units, Switchboards, tanks, OEM records / test***	Yes☐ NO☐ NA☐		

	certs/ performance tests/ curves of equipment. SW Technical specification state when FAT is required)			
8.	Dry-Commissioning Plan including copy of **all ITP's** and **ITC's** for assets being commissioned in this worklot. ***Provide Document / Reference #***	Yes☐ NO☐		
9.	Regulatory certificates and approvals obtained. **(E.G. WorkSafe approvals, Energy Authority approvals or chemical supplier approvals)** ***Provide Document / Reference #***	Yes☐ NO☐ NA☐		
10.	Calibration certificates for testing and measuring equipment / instruments provided and satisfactory ***Provide Document / Reference***	Yes☐ NO☐ NA☐		
11.	MDRs for pre-fabricated equipment is available. ***Provide Document / Reference #***	Yes☐ NO☐ NA☐		
12.	**Current** redline WAC Mark-up drawings available onsite and a copy uploaded to the Project Management System. ***(On network sites, hard copies to be kept in the Kiosk / switch room)***	Yes☐ NO☐		
13.	Asset Isolation Plan (mechanical and electrical) and to follow SWC LOTO ***Provide Document / Reference #***	Yes☐ NO☐ NA☐		
14.	Updated Operating Procedures and updated Plant Process Specifications available (Treatment) ***Applicable to treatment facilities, and network sites with abnormal operations.***	Yes☐ NO☐ NA☐		
15.	Updated Operations and Maintenance Manual uploaded to Project Management System. ***Provide Document / Reference #. Draft should be reviewed against the O&M Checklist.***	Yes☐ NO☐		
16.	Draft Training Package ***To be provided if training scheduled within one month of Pre-Comm commencing. Provide Document / Reference #***	Yes☐ NO☐ NA☐		
17.	Hazardous Area Dossier completed / updated, reviewe completed. ***Provide Document / Reference #***	Yes☐ NO☐ NA☐		

Agreement to proceed to Commissioning

Role	Name	Signature	Date
Service Provider r Commissioning Engineer			
Sydney Water Commissioning Engineer			
Sydney Water Operational Acceptance			

22.7.2 Appendix G2 – Pre-commissioning prerequisites checklist

Project No:		**Site No.**	
Delivery Team:		**Date:**	
Project Name:		***Work Lot / PID:**	

**Where multiple commissioning work lots are required, this checklist shall be repeated for each respective worklot.*

All deliverable documents required are to be uploaded to the relevant project management system being used for the works (SW Delivery Portal etc.) prior to completion of this checklist.

*Where **"NA"** is provided as an option, comments must be provided. **"Draft"** refers to documents being in the order of 70-80% of the standard of the final submission.*

NOTE: Pre-Commissioning Checklist must be signed off a minimum 5 Business days prior to Commissioning works commencing.

No.	Requirements	Compliance	Reference *Delivery Portal or Document Ref*	Comments
1.	Cutover Plan available detailing relevant cutovers and their methodology. ***(Applicable for any cutover – mech/elec/process) Provide Document / Reference #***	Yes☐ NO☐ NA☐		
2.	Pre-Commissioning kick-Off meeting held and Risk Assessment available. The controls identified in the Commissioning Risk Assessment are in place. ***Provide Document / Reference # for relevant SWMS or Other***	Yes☐ NO☐		
3.	Dry-Commissioning **ITP's** and **ITC's** completed and signed off for assets being commissioned in this worklot. ***Provide Document / Reference #***	Yes☐ NO☐		
4.	Hazardous Area Dossier completed / updated and accepted by SWC. ***Provide Document / Reference #***	Yes☐ NO☐ NA☐		
5.	Notice of Energisation process documented and available. ***Provide evidence of a process / procedure or other for ensuring impacted stakeholders are aware of energising of previously unenergized equipment. This may be electrical, hydraulic sources of energy.***	Yes☐ NO☐		
6.	Software FAT completed for system/(s) being commissioned. SAT and FAT script(s) uploaded to the Project Management System. ***Provide Document / Reference #***	Yes☐ NO☐ NA☐		
7.	Software Download Plan uploaded to the Project Management System ***Relevant to Treatment Facilities - Provide Doc. / Reference #***	Yes☐ NO☐ NA☐		
8.	Copy of Process Control Philosophy provided ***(Where Applicable) Provide Document / Reference #***	Yes☐ NO☐ NA☐		

9.	Function Description Specification (FDS) provided ***(Where Applicable) Provide Document / Reference #***	Yes☐ NO☐ NA☐		
10.	MAXIMO entry is completed and validation certificate uploaded to project management system. ***Provide Document / Reference #***	Yes☐ NO☐ NA☐		
11.	Updated Defects / Punchlist register available for the works. ***Provide Document / Reference #***	Yes☐ NO☐		
12.	Updated Non-Conformance register available.. ***Provide Document / Reference #***	Yes☐ NO☐ NA☐		
13.	**Current** redline WAC Mark-up drawings available onsite and a copy uploaded to the Project Management System. ***(On network sites, hard copies to be kept in the Kiosk / switch room)***	Yes☐ NO☐		
14.	Pre-Commissioning Plan including copy of **all ITP's** and **ITC's** for assets being commissioned in this worklot.available ***Provide Document / Reference #***	Yes☐ NO☐		
15.	Asset Isolation Plan (mechanical and electrical) and to follow SWC LOTO ***Provide Document / Reference #***	Yes☐ NO☐ NA☐		
16.	For existing IICATs sites OCR registered in SOC ***Provide Document / Reference***	Yes☐ NO☐ NA☐		
17.	Calibration certificates for testing and measuring equipment / instruments provided and satisfactory ***Provide Document / Reference***	Yes☐ NO☐ NA☐		

Agreement to proceed to Commissioning

Role	Name	Signature	Date
Service Provider Commissioning Engineer			
Sydney Water Commissioning Engineer			
Sydney Water Operational Acceptance			

22.8 Appendix H -Test procedures

22.8.1 Appendix H1 – Electrical equipment - sewage pumping stations

ACCEPTANCE TEST SHEET No: **PSAT- S01**

PROJECT: …….
SITE: Sewage pumping station (SPS)
TEST: Electrical equipment checks
TEST PURPOSE: Confirm equipment used, equipment condition and location, wiring and labelling

Test Condition / Configuration:	Installation work complete. The Service Provider's ITPs are completed and approved. Equipment ready for energisation. The checks are to be done prior to energisation of equipment.
Description of Test:	Check and confirm installed equipment is as per the approved equipment data sheets Check and confirm mounting arrangements (location, orientation, spacing, protective covering on terminals and busbars,) are as per the approved design Check and confirm wiring (colour coding, labelling etc) are as per the approved design Check and confirm physical condition of equipment (damage, corrosion etc) is satisfactory
Expected Test Results;	All equipment and installation work conform to specification and design All equipment is in a satisfactory condition
Measurements and Readings:	Record observations below and opposite page under relevant equipment. The observations shall not be limited to conformance to specification and designs but all aspects including safety, operational difficulties, deficiencies of equipment or installation arrangements etc which may need rectification at this facility and / or considered for possible future improvements.
	Test equipment Used: Serial No: Calibrated Valid to …… …… …… …… …… …… …… ……
Comments:	…… …… …… …… …… …… ……

Test Completion and Sign-off:

Re-Test required: *YES / NO*

Tests: *PASS / FAIL* Re-Test Sheet No: .....……..

Testing Officer: ……..…… First Witness: ……..…… Second Witness: ……..

Date: ..……Date: ……... Date: ……..

Company: ……Company: …… SWC: ……...

Test Status: *PASS / FAIL* Test Status: *PASS / FAIL* Test Status: *PASS / FAIL*

Non Conformance Required: *YES / NO* NCR No.

PROJECT:…… **SITE:**……..…… **TEST:** Electrical equipment checks

REF	EQUIPMENT		PASS	FAIL	MEASUREMENTS/COMMENTS
1	Motor Starter Pump Unit 1	As Per Specification			
1.1		Orientation & mounting location are acceptable			
1.2		Wiring complete, neat and tidy			
1.3		All Equipment/components and starter are labelled			
1.4		No damage, corrosion or deterioration and protective coatings intact			
1.5		All fuse holders have fuses as per the design			
1.6		Indication lamps functioning			
1.7		Indicating instruments are calibrated and functioning			
1.8		Cubicle, doors and equipment earthing is satisfactory			
1.9		Submersible Pump Unit name plates attached			
1.10		Starter data plate attached (refer note. 8)			
1.11		Cubicle lighting acceptable			
2	Motor Starter Pump Unit 2	As Per Specification			
2.1		Orientation & mounting location are acceptable			
2.2		Wiring complete, neat and tidy			
2.3		All Equipment/components and starter are labelled			
2.4		No damage, corrosion or deterioration and protective coatings intact			

2.5		All fuse holders have fuses as per the design			
2.6		Indication lamps functioning			
2.7		Indicating instruments are calibrated and functioning			
2.8		Cubicle, doors and equipment earthing is satisfactory			
2.9		Name plates (Submersible Pump Unit Only) attached			
2.10		Starter data plate attached (refer note. 8)			
2.11		Cubicle lighting acceptable			
3	Motor Starter Pump Unit 3 (refer note 9)	As Per Specification			
3.1		Orientation & mounting location are acceptable			
3.2		Wiring complete, neat and tidy			
3.3		All Equipment/components and starter are labelled			
3.4		No damage, corrosion or deterioration and protective coatings intact			
3.5		All fuse holders have fuses as per the design			
3.6		Indication lamps functioning			
3.7		Indicating instruments are calibrated and functioning			
3.8		Cubicle, doors and equipment earthing is satisfactory			
3.9		Name plates (Submersible Pump Unit Only) attached			
3.10		Starter data plate attached (refer note. 8)			
3.11		Cubicle lighting acceptable			
4	Motor Starter Pump Unit 4 (refer note 9)	As Per Specification			
4.1		Orientation & mounting location are acceptable			
4.2		Wiring complete, neat and tidy			
4.3		All Equipment/components and starter are labelled			
4.4		No damage, corrosion or deterioration and protective coatings intact			
4.5		All fuse holders have fuses as per the design			

4.6		Indication lamps functioning			
4.7		Indicating instruments are calibrated and functioning			
4.8		Cubicle, doors and equipment earthing is satisfactory			
4.9		Name plates (Submersible Pump Unit Only) attached			
4.10		Cubicle lighting acceptable			
4.11		Starter data plate attached (refer note. 8)			
5	LV Supply Equipment	As Per Specification			
5.1		Orientation & mounting location are acceptable			
5.2		Wiring complete, neat and tidy			
5.3		All Equipment/components and cubicles are labelled			
5.4		No damage, corrosion or deterioration and protective coatings intact			
5.5		All fuse holders have fuses as per the design			
5.6		All circuit breaker protection values are set as per the design			
5.7		Indication lamps functioning			
5.8		Indicating instruments are calibrated and functioning			
5.9		Cubicle, doors and equipment earthing is satisfactory			
5.10		Cubicle lighting acceptable			
5.11		Supply Phase Sequence is correct			
6	LV Distribution	As Per Specification			
6.1		Orientation & mounting location are acceptable			
6.2		Wiring complete, neat and tidy			
6.3		All Equipment/components and cubicles are labelled			
6.4		No damage, corrosion or deterioration and protective coatings intact			
6.5		All fuse holders have fuses as per the design			
6.6		Indication lamps functioning			
6.7		Indicating instruments are calibrated and functioning			

6.8		Cubicle, doors and equipment earthing is satisfactory			
6.9		Cubicle lighting acceptable			
7	Generator Supply	As Per Specification			
7.1		Orientation & mounting location are acceptable			
7.2		Terminal separation and cable access adequate			
7.3		Wiring complete, neat and tidy			
7.4		All Equipment/components and cubicles are labelled			
7.5		No damage, corrosion or deterioration and protective coatings intact			
7.6		Indication lamps functioning			
7.7		Indicating instruments are calibrated and functioning			
7.8		Cubicle, doors and equipment earthing is satisfactory			
8	Control Equipment	As Per Specification			
8.1		Orientation & mounting location are acceptable			
8.2		Wiring complete, neat and tidy			
8.3		All Equipment/components and cubicles are labelled			
8.4		No damage, corrosion or deterioration and protective coatings intact			
8.5		All fuse holders have fuses as per the design			
8.6		Indication lamps functioning			
8.7		Indicating instruments are calibrated and functioning			
8.8		Cubicle, doors and equipment earthing is satisfactory			
8.9		Cubicle lighting acceptable			
8.10		Cubicle anti condensation heaters installed			
9	Level Sensors Wet Well	As Per Specification			
9.1		Orientation & mounting location are acceptable			
9.2		Stilling tube (120mm) extends full length of well			

9.3		Level sensor protrude app. 10mm below the bottom of stilling tube			
9.4		Cables anchored properly (refer note 1& 11)			
9.5		Wiring complete, neat and tidy			
9.6		All Equipment/components labelled (refer note 10)			
9.7		No damage, corrosion or deterioration and protective coatings intact			
9.8		Indicating instruments are calibrated and functioning			
10	Level Sensor Collecting Maintenance Hole	As Per Specification			
10.1		Orientation & mounting location are acceptable			
10.2		Stilling tube (120mm) extends full length of well			
10.3		Level sensor protrude app. 10mm below the bottom of stilling tube			
10.4		Cables anchored properly (refer note 1& 11)			
10.5		Wiring complete, neat and tidy			
10.6		All Equipment/components labelled (refer note 10)			
10.7		No damage, corrosion or deterioration and protective coatings intact			
10.8		Indicating instruments are calibrated and functioning			
11	Level Sensor Emergency Storage Chamber	As Per Specification			
11.1		Orientation & mounting location are acceptable			
11.2		Stilling tube (120mm) extends full length of well			
11.3		Level sensor protrude app. 10mm below the bottom of stilling tube			
11.4		Cables anchored properly (refer note 1& 11)			
11.5		Wiring complete, neat and tidy			

11.6		All Equipment/components labelled (refer note 10)			
11.7		No damage, corrosion or deterioration and protective coatings intact			
11.8		Indicating instruments are calibrated and functioning			
12	ATWL Level Switch	As Per Specification			
12.1		Orientation & mounting location are acceptable (refer note			
12.2		Cables anchored properly (refer note 1& 11)			
12.3		Wiring complete, neat and tidy			
12.4		All Equipment/components labelled (refer note 10)			
12.5		No damage, corrosion or deterioration and protective coatings intact			
13	Overflow Level Switch	As Per Specification			
13.1		Orientation & mounting location are acceptable			
13.2		Cables anchored properly (refer note 1& 11)			
13.3		Wiring complete, neat and tidy			
13.4		All Equipment/components labelled (refer note 10)			
13.5		No damage, corrosion or deterioration and protective coatings intact			
14	Inflow Emergency Level Switch	As Per Specification			
14.1		Orientation & mounting location are acceptable			
14.2		Cables anchored properly (refer note 1& 11)			
14.3		Wiring complete, neat and tidy			
14.4		All Equipment/components labelled (refer note 10)			
14.5		No damage, corrosion or deterioration and protective coatings intact			
15	Level Switch Emergency Storage Chamber	As Per Specification			

15.1		Orientation & mounting location are acceptable			
15.2		Cables anchored properly (refer note 1& 11)			
15.3		Wiring complete, neat and tidy			
15.4		All Equipment/components labelled (refer note 10)			
15.5		No damage, corrosion or deterioration and protective coatings intact			
16	External Lighting	As Per Specification			
16.1		Orientation & mounting location are acceptable			
16.2		Wiring complete, neat and tidy			
16.3		All Equipment/components labelled			
16.4		No damage, corrosion or deterioration and protective coatings intact			
17	Kiosk	Orientation & mounting location are acceptable			
17.1		Concrete plinth, drainage, vermin proofing acceptable			
17.2		Access and work space for operational and maintenance adequate			
17.3		No damage, corrosion or deterioration and protective coatings intact			
17.4		Weather shields, doors & locking mechanisms operate properly			
17.5		All door seals are adequate			
17.6		Wiring complete, neat and tidy			
17.7		Wet Well cable entry points are sealed with removable sealant			
17.8		The facility name plate is installed			
17.9		Cubicle anti condensation heaters & thermostat installed			
18	Survey Marks	Survey Mark with RL fitted on the wet well as close as possible to level sensors			
18.1		Survey Mark with RL fitted on the collecting maintenance hole			

18.2		Survey Mark with RL fitted on the emergency storage chamber			
19	HV Equipment				

Notes:

1. Level sensors and float switches shall be anchored utilising suitable cable anchoring device. Cable wrapped around the hook is not acceptable.
2. The level sensor shall protrude below the bottom of stilling tube by about 10 mm
3. The stilling tube (120 mm ф) shall extend full length of the wet well and shall not be mounted directly in line with the incoming flow (shall preferably be in a non-turbulent area)
4. Pump electrical cables shall be anchored using stainless steel cable socks and the cable shall not interfere with the withdrawal and installation of pump units
5. All panel meter terminals shall be shrouded to prevent accidental contact with live terminals
6. All non-insulated bus-busbars shall be shrouded with a suitable removable insulating barrier
7. Removal of an earth wire (or earth bar) of an equipment shall not affect the integrity of earthing of other equipment in service
8. Motor starter name plate shall include:
    i. Makers name
    ii. Type of motor starter
    iii. Year of manufacture
    iv. Complying Australian Standard
    v. Incoming supply voltage
    vi. Control supply voltage
    vii. Maximum operating motor kW
    viii. Duty rating
9. For series pumping stations use Motor Starters Pump Unit 3 and Motor Starter Pump Unit 4 information for the downstream (dry well) pumps
10. All equipment shall be labelled according to its function. The labels provided in open areas could be subjected to vandalism shall be engraved on either stainless or brass sheets. The labels shall be attached using SS screws or bolts. The labels in secure areas could be engraved on trafolite sheet.
11. The cable anchoring point for level sensors, float switches and submersible pumps shall be near the access opening so that the cable can be removed or re-installed safely from outside the well or chamber. Installations where person entry to category 1 and 2 confined space to access the cables is not acceptable.

22.8.2 Appendix H2 – Mechanical equipment - sewage pumping stations

ACCEPTANCE TEST SHEET No: **PSAT-S02**

PROJECT: ……..
SITE: Submersible sewage pumping station SPS……
TEST: Mechanical equipment checks
TEST PURPOSE: Confirm equipment used, equipment condition, location and labelling

Test Condition / Configuration:	Installation work complete. The Service Provider's ITPs are completed and approved. The checks are to be done prior to pressure testing/ running pumps.
Description of Test:	Check and confirm installed equipment is as per the approved equipment data sheets Check and confirm mounting arrangements (location, orientation, spacing, operating spindles etc) are as per the approved design Check and confirm labelling are as per the approved design Check and confirm condition of equipment (damage, corrosion, paint work etc.) is satisfactory
Expected Test Results;	All equipment and installation work conform to specification and approved design. All equipment is in a satisfactory condition.
Measurements and Readings:	Record observations below and opposite page under relevant equipment. The observations shall not be limited to conformance to specification and designs but all aspects including safety, operational difficulties, deficiencies of equipment or installation arrangements etc which may need rectification at this facility and / or considered for possible future improvements.
Comments:	…… …… …… …… …… ……

Test Completion and Sign-off:

Re-Test required: *YES / NO*

Tests: *PASS / FAIL* Re-Test Sheet No: ....……..

Testing Officer:	First Witness:	Witness:
Date:	Date:	Date:
Company:	Company:	SWC:
Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*

Non Conformance Required: *YES / NO* NCR No.

INSPECTION AND TEST PLAN

PROJECT:…… **SITE:……..…… TEST**: Mechanical Equipment Checks

REF	EQUIPMENT		PASS	FAIL	COMMENTS
1	Pump Unit 1	As Per Specification			
1.1		Security of foot bend mountings			
1.2		Guide rails installation			
1.3		Lifting chain (refer note: 6)			
1.4		Lifting chain & Cables are suspended properly and clear of pump (refer note: 7)			
1.5		Electrical cables are not sharply bent or pinched			
1.6		Impeller direction of rotation			
1.7		Pump seating on footbend			
1.8		Protective coatings			
1.9		Flush valve fitted			
1.10		Tagged / label installed			
2	Pump Unit 2	As Per Specification			
2.1		Security of foot bend mountings			
2.2		Guide rails installation			
2.3		Lifting chain (refer note: 6)			
2.4		Lifting chain & Cables are suspended properly and clear of pump (refer note: 7)			
2.5		Electrical cables are not sharply bent or pinched			
2.6		Impeller direction of rotation			
2.7		Pump seating on footbend			
2.8		Protective coatings			
2.9		Flush valve fitted			
2.10		Tagged / label installed			
3	Pump Unit 3 (refer note 11)	As Per Specification			
3.1		Security of bedplate mountings			
3.2		Electrical cables are anchored properly and are not sharply bent or pinched			
3.3		Impeller direction of rotation			
3.4		Protective coatings			
3.5		Tagged / label installed			
4	Pump Unit 4 (refer note 11)	As Per Specification			
4.1		Security of bedplate mountings			
4.2		Electrical cables are anchored properly and are not sharply bent or pinched			

4.3		Impeller direction of rotation			
4.4		Protective coatings			
4.5		Tagged / label installed			
5	Isolating Valve Pump Unit 1 Discharge	As Per Specification			
5.1		Orientation			
5.2		Installation (bolts & gaskets)			
5.3		Extension Spindle installed, supported & lined up with access opening			
5.4		Valve Open/Close freely			
5.5		Direction of Open/Close marked at the hand wheel or on chamber cover at spindle opening			
5.6		Valve anchoring and supporting arrangement is satisfactory			
5.7		Protective coatings			
5.8		Tagged / label installed			
5.9		Operating wheel is secured to the driven shaft as per the manufacturers instructions and SWC guide lines (Refer Note 12)			
6	Isolating Valve Pump Unit 2 Discharge	As Per Specification			
6.1		Orientation			
6.2		Installation (bolts & gaskets)			
6.3		Extension Spindle installed, supported & lined up with access opening			
6.4		Valve Open/Close freely			
6.5		Direction of Open/Close marked at the hand wheel or on chamber cover at spindle opening			
6.6		Valve anchoring and supporting arrangement is satisfactory			
6.7		Protective coatings			
6.8		Tagged / label installed			
6.9		Operating wheel is secured to the driven shaft as per the manufacturers instructions and SWC guide lines (Refer Note 12)			
7	Reflux Valve Pump Unit 1	As Per Specification			
7.1		Orientation			

7.2		Installation (bolts tight & gaskets)			
7.3		Tapping point installed			
7.4		Valve Open/Close freely			
7.5		Valve anchoring and supporting arrangement is satisfactory			
7.6		Counter weight installation acceptable			
7.7		Protective coatings			
7.8		Tagged / label installed			
7.9		Operating wheel is secured to the driven shaft as per the manufacturers instructions and SWC guide lines (Refer Note 12)			
8	Reflux Valve Pump Unit 2	As Per Specification			
8.1		Orientation			
8.2		Installation (bolts tight & gaskets)			
8.3		Tapping point installed			
8.4		Valve Open/Close freely			
8.5		Valve anchoring and supporting arrangement is satisfactory			
8.6		Counter weight installation acceptable			
8.7		Protective coatings			
8.8		Tagged / label installed			
8.9		Operating wheel is secured to the driven shaft as per the manufacturers instructions and SWC guide lines (Refer Note 12)			
9	Isolating Valve Wet Well Inlet	As Per Specification			
9.1		Orientation			
9.2		Installation (bolts & gaskets)			
9.3		Extension Spindle installed, supported & lined up with access opening			
9.4		Valve Open/Close freely			
9.5		Direction of Open/Close marked at the hand wheel or on chamber cover at spindle opening			
9.6		Surface box installation at spindle opening acceptable			
9.7		Valve anchoring and supporting arrangement is satisfactory			

9.8		Protective coatings			
9.9		Tagged / label installed			
9.10		Operating wheel is secured to the driven shaft as per the manufacturers instructions and SWC guide lines (Refer Note 12)			
10	Isolating Valve Scour Line	As Per Specification			
10.1		Orientation			
10.2		Installation (bolts & gaskets)			
10.3		Extension Spindle installed, supported & lined up with access opening			
10.4		Valve Open/Close freely			
10.4		Direction of Open/Close marked at the hand wheel or on chamber cover at spindle opening			
10.5		Valve anchoring and supporting arrangement is satisfactory			
10.6		Protective coatings			
10.7		Tagged / label installed			
10.8		Operating wheel is secured to the driven shaft as per the manufacturers instructions and SWC guide lines (Refer Note 12)			
11	Isolating Valve By-Pass Connection	As Per Specification			
11.1		Orientation			
11.2		Installation (bolts & gaskets)			
11.3		Extension Spindle installed, supported & lined up with access opening			
11.4		Valve Open/Close freely			
11.5		Valve anchoring and supporting arrangement is satisfactory			
11.6		Protective coatings			
11.7		Tagged / label installed			
11.8		Operating wheel is secured to the driven shaft as per the manufacturers instructions and SWC guide lines (Refer Note 12)			
12	Reflux Valve By-Pass Connection	As Per Specification			
12.1		Orientation			

12.2		Installation (bolts tight & gaskets)			
12.3		Tapping point installed			
12.4		Valve anchoring and supporting arrangement is satisfactory			
12.5		Counter weight installation acceptable			
12.6		Valve Open/Close freely			
12.7		Protective coatings			
12.8		Tagged / label installed			
12.9		Operating wheel is secured to the driven shaft as per the manufacturers instructions and SWC guide lines (Refer Note 12)			
13	Isolating Valve Rising Main Gas Relief	As Per Specification			
13.1		Orientation			
13.2		Installation (bolts & gaskets)			
13.3		Extension Spindle installed, supported & lined up with access opening			
13.4		Valve Open/Close freely			
13.5		Direction of Open/Close marked at the hand wheel or on chamber cover at spindle opening			
13.6		Protective coatings			
13.7		Tagged / label installed			
13.8		Operating wheel is secured to the driven shaft as per the manufacturers instructions and SWC guide lines (Refer Note 12)			
14	Isolating valve Rising Main	As Per Specification			
14.1		Orientation			
14.2		Installation (bolts & gaskets)			
12.3		Extension Spindle installed, supported & lined up with surface box opening			
14.4		Surface box installation satisfactory			
14.5		Direction of Open/Close marked at surface box on the wet well cover			
14.6		Valve anchoring and supporting arrangement is satisfactory			
14.7		Valve Open/Close freely			

14.8		Protective coatings			
14.9		Tagged / label installed			
14.10		Operating wheel is secured to the driven shaft as per the manufacturers instructions and SWC guide lines (Refer Note 12)			
15	Isolating valve Emergency Storage	As Per Specification			
15.1		Orientation			
15.2		Installation (bolts & gaskets)			
15.3		Extension Spindle installed, supported & lined up with surface box opening			
15.4		Surface box installation satisfactory			
15.5		Direction of Open/Close marked at surface box			
15.6		Valve anchoring and supporting arrangement is satisfactory			
15.7		Valve Open/Close freely			
15.8		Protective coatings			
15.9		Tagged / label installed			
15.10		Operating wheel is secured to the driven shaft as per the manufacturers instructions and SWC guide lines (Refer Note 12)			
16	Water Supply And Backflow Prevention Device Assembly	As Per Specification (Refer Note: 8)			
16.1		Isolating valves installed			
16.2		Water meter installed			
16.3		Apply to SWC for approval for installation			
16.4		Test certificate and certificate of compliance received & accepted by SWC			
16.5		Hydrant installation is acceptable (Refer Note 9)			

1. Notes:
2. All isolating valves shall have Opening and Closing directions clearly labelled
3. Extension spindles shall if necessary be provided with intermediate support to ensure alignment with openings provided on safety grills and chamber covers

4. Isolating valves of gas relief valves must be provided with operating capability without entering the chamber
5. Some valves (including reflux valves) are uni-directional and orientation of valve must satisfy the marking on valve
6. Ensure the installation has been registered in the SWC database. If necessary arrange inspection by SWC Plumbing and Drainage Inspector to ensure installation satisfy SWC requirements.
7. Pump Unit lifting chains shall be heavy duty galvanised or stainless steel and have at 3 m intervals, lifting eyes capable of accommodating commercially available shackle of size suitable for lifting the pump unit. Alternatively the chain shall be a long link type capable of accommodating the shackle.
8. Pump electrical cables shall be anchored using stainless steel cable socks and the cable shall not interfere with the withdrawal and installation of pump units. The stainless hooks used to anchor the cables and lifting chains shall be mounted close to the access cover to allow safe removal and installation of cables and chains without having to enter the wet well.
9. Ensure the installation has been registered in the SWC database. If necessary arrange inspection by SWC Plumbing and Drainage Officer designated to backflow prevention to ensure installation satisfy SWC requirements.
10. A spring type hydrant as per the SWC Standard Drawing shall be installed on the downstream side of backflow prevention device at a location near the wet well. The access cover shall be marked "H".
11. The guide rails shall be installed in accordance with supplier guidelines.
12. For series pumping stations use Pump Unit 3 and Pump Unit 4 information for the downstream (dry well) pumps.
13. The operating wheel must be attached to the driven shaft as per the manufacturers' instructions and for chain operated wheels as a minimum to the SWC guidelines. The SWC guide lines include installation of split pin or axial bolt with appropriate spring washers.

22.8.3 Appendix H3 – Mechanical auxiliary equipment – sewage pumping stations

ACCEPTANCE TEST SHEET No: **PSAT-S03**

PROJECT: ……
SITE: Sewage Pumping Station SPS……
TEST: Mechanical Auxiliary Equipment Checks
TEST PURPOSE: Confirm equipment used, equipment condition, location and labelling

Test Condition/ Configuration:	Installation work complete. The Service Provider's ITPs are completed and approved.
Description of Test:	Check and confirm installed equipment is as per the approved design Check and confirm mounting arrangements (location, orientation, spacing, fixtures, locking devices, etc) are as per the approved design Check and confirm labelling are as per the approved design Check and confirm condition of equipment (damage, corrosion, paint work etc.) is satisfactory See Notes:
Expected Test Results;	All equipment and installation work conform to specification and approved design. All equipment is in a satisfactory condition.
	Test equipment Used: **Serial No:** **Calibrated Valid to** …… …… …… …… …… ……
Measurements and Readings:	Record observations below and opposite page under relevant equipment. **The observations shall not be limited to conformance to specification and designs but all aspects including safety, operational difficulties, deficiencies of equipment or installation arrangements etc which may need rectification at this facility and / or considered for possible future improvements.**
Comments:	…… …… …… …… …… ……

Test Completion and Sign-off:

Re-Test required: *YES / NO*

Tests: *PASS / FAIL* Re-Test Sheet No: ……

Testing	First		
Officer: ……	Witness: ……	Witness: ……	
Date: ……	Date: ……	Date: ……	
Company: ……	Company: ……	SWC: ……	
Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*	

Non Conformance Required: *YES / NO* NCR No.

INSPECTION AND TEST PLAN

PROJECT:…… **SITE:**……..…… **TEST:** Mechanical auxiliary equipment checks

REF	EQUIPMENT		PASS	FAIL	COMMENTS
1	Pipework Wet Well	As Per Specification (refer note 1)			
1.1		Installation as per design			
1.2		Bolted connections are tight			
1.3		Pipe supports complete and adequate			
1.4		Dismantling joints are correct type and adequately supported			
1.5		Protective coatings			
2	Access Covers Wet Well	Gas seal installed			
2.1		The access openings shall be of sufficient dimension and fit for the purpose (refer note 4)			
2.2		The access covers and safety grils can be lifted safely by one person.			
2.3		Hinged safety grill installed			
2.3		Cover & grill laid flat when fully open			
2.3		Cover hinge bolts & nuts tack welded (refer note 2)			
3	Pipework valve Chamber	As Per Specification			
3.1		Installation as per design			
3.2		Bolted connections are tight			
3.3		Dismantling joints installed correctly			
3.4		Support plinths complete			
3.5		Puddle flanges installed correctly			
3.6		Delivery Tapping points Pump Unit 1, either side of isolating and reflux valves installed			
3.7		Delivery Tapping points Pump Unit 2, either side of isolating and reflux valves installed			
3.8		Protective coatings			

3.9		Air valve discharge pipework complete			
3.10		Tagged / label installed			
4	Access Covers & Ladders Valve Chamber	Normal entry covers are hinged and padlockable			
4.1		Hinged safety grills installed (chamber depth >1.5m)			
4.2		Cover hinge bolts & nuts tack welded			
4.3		Cover & grill laid flat when fully open			
4.4		Opening with cover plate to gain access to valve operating extension spindle is provided, check access for all valves.			
4.5		Open/close directions are marked at the valve spindle access opening (refer note: 3)			
4.6		Step irons/ladders acceptable			
4.7		Retractable handgrip stanchions provided			
5	Pipework Emergency Relief Structures	As Per Specification			
5.1		Installation as per design			
5.2		Bolted connections are tight			
5.3		Trash rack & screenings tray			
5.4		Protective coatings			
5.5		Gas check valve and its operation acceptable			
6	Access Covers & Ladders Emergency Structures	Normal entry covers are hinged and padlockable			
6.1		Hinged safety grills installed (chamber depth >1.5m)			
6.2		Cover hinge bolts & nuts tack welded			
6.3		Cover & grill laid flat when fully open			

6.4		Valve extension spindle access openings with covers are provided			
6.5		Step irons/ladders acceptable			
6.6		The hand grips are non slip type			
6.7		Retractable handgrip stanchions provided			
7	Vent Shaft Educt	As Per Specification			
7.1		Installation as per design			
7.2		Guy wires are adequately tensioned			
7.3		Guy wire eye bracket bolt and nut are tack welded			
7.4		Protective coatings			
8.	By-Pass Pipework	As Per Specification			
8.1		Installation as per design			
8.2		Bolted connections are tight			
8.3		Camlok fitting aligns with the access opening.			
8.4		The distance between camlok fitting and access cover is acceptable			
8.5		Support plinths complete			
8.6		Bleed valve below the camlok fitting and isolating valve installed			
8.7		Bleed valve can be operated via the access opening provided for camlok fitting			

Notes:

1. The installation of pipework and equipment shall be as per the approved design drawings and specification. Any deviation to that during construction caused either due to workmanship, materials or deficiencies in the design shall be noted and appropriate NCRs shall be issued.
2. The valve chambers, wet well and other hinged cover plates hall have the hinge bolts and nuts tack welded to deter removal by unauthorised personnel.
3. All isolating valves shall have Opening and Closing directions clearly labelled.
4. When the access cover and safety grill are fully opened the effective opening for person entry shall be of sufficient dimensions for safe entry and rescue of personnel. The openings for equipment withdrawal shall be of sufficient dimensions and aligned with supporting structures.

22.8.4 Appendix H4 – Motor starter (autotransformer type) – sewage pumping stations

ACCEPTANCE TEST SHEET No: **PSAT-S04**

PROJECT: ……
SITE: Submersible sewage pumping station SPS ……
TEST: Motor Starter (Autotransformer type) operational checks
TEST PURPOSE: Prove motor starter operation without pump unit running

Test Condition / Configuration:	Installation work including field equipment complete. The Service Provider's ITPs (including primary injection tests) are completed and approved. The electrical equipment PSAT ITP (PSAT-001) completed and approved to proceed. The equipment is ready to energise and the motor cables are disconnected at the starter.
Description of Test:	Check and confirm Manual operation of the starter Check and Confirm Automatic operation by simulation of RTU start/stop signals
Expected Test Results;	Successful operation of the starter equipment on all modes of operation.
Measurements and Readings:	Record observations below and opposite page under relevant equipment.
	Test equipment Used: **Serial No:** **Calibrated Valid to** …… …… …… …… …… …… …… ……
Comments:	…… …… …… …… …… …… …… ……

Test Completion and Sign-off:

Re-Test required: *YES / NO*

Tests: *PASS / FAIL* Re-Test Sheet No: ……

Testing Officer: ……	First Witness: ……	Witness: ……
Date: ……	Date: ……	Date: ……
Company: ……	Company: ……	SWC: ……
Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*

Non Conformance Required: *YES / NO* NCR No.

INSPECTION AND TEST PLAN

PROJECT:…… **SITE:**…….…… **TEST:** Motor Starter (Autotransformer type) Operational Checks

REF	EQUIPMENT		PASS	FAIL	COMMENTS
0	Facility	Series Pump Installation			Yes/No
1	Motor Starter Pump Unit 1	Manual Start/Stop Operation (refer. Note 1)			Starter motor end terminal voltages Between Phases Phase & Neutral R & Y ……V R & N ……V Y & B ……V Y & N ……V B & R ……V B & N ……V
1.1		Simulated Automatic Start/Stop Operation (refer. Note 2)			
1.2		Emergency Stop Operation (refer. Note 3)			
1.3		Interlock Operation between pump sets(refer. Note 4)			
1.4		Interlock Operation between pump units(refer. Note 4)			
1.5		Selector Switch Off Position (refer. Note 5)			
2	Motor Starter Pump Unit 2	Manual Start/Stop Operation (refer. Note 1)			Starter motor end terminal voltages Between Phases Phase & Neutral R & Y ……V R & N ……V Y & B ……V Y & N ……V B & R ……V B & N ……V
2.1		Simulated Automatic Start/Stop Operation (refer. Note 2)			
2.2		Emergency Stop Operation (refer. Note 3)			
2.3		Interlock Operation between pump sets(refer. Note 4)			
2.4		Interlock Operation between pump units(refer. Note 4)			
2.5		Selector Switch Off Position (refer. Note 5)			
3	Motor Starter Pump Unit 3	Manual Start/Stop Operation (refer. Note 1)			Starter motor end terminal voltages

					Between Phases Phase & Neutral R & Y ……V R & N ……V Y & B …….. …V Y & N ……V B & R ……V B & N ……V Start time delay:……seconds
3.1		Simulated Automatic Start/Stop Operation (refer. Note 2)			
3.2		Emergency Stop Operation (refer. Note 3)			
3.3		Interlock Operation between pump sets(refer. Note 4)			
3.4		Interlock Operation between pump units(refer. Note 4)			
3.5		Selector Switch Off Position (refer. Note 5)			
4	Motor Starter Pump Unit 4	Manual Start/Stop Operation (refer. Note 1)			Starter motor end terminal voltages Between Phases Phase & Neutral R & Y ……V R & N ……V Y & B ……V Y & N ……V B & R ……V B & N ……V Start time delay:……seconds
4.1		Simulated Automatic Start/Stop Operation (refer. Note 2)			
4.2		Emergency Stop Operation (refer. Note 3)			
4.3		Interlock Operation between pump sets(refer. Note 4)			
4.4		Interlock Operation between pump units(refer. Note 4)			
4.5		Selector Switch Off Position (refer. Note 5)			

Notes:

1. Manual Start/Stop:

   Select manual operating mode. Operate the Pump Unit from the local start/stop pushbuttons. Check and confirm the operation of the equipment. Measure and record motor terminal voltages.

   In case of a series pump installations, confirm that the downstream pump unit starts after a set time delay. Measure and record motor terminal voltages and the start time delay.

   When stop pushbutton is activated confirm that both pumps stop simultaneously.

2. Simulated Automatic Start/Stop:

   Select automatic operating mode. Operate the Pump Unit by simulating the automatic start/stop signals at the RTU field terminals. Check and confirm the operation of the equipment.

   In case of a series pump installation the operation of the downstream pump unit will be similar to manual operation.

3. Emergency Stop:

   Check operation on both manual and automatic operating modes. Push button shall remain latched and shall be padlockable in active position.

   In case of a series pump installations, confirm that the downstream pump unit stops simultaneously with upstream pump unit. If dedicated emergency stops are provided confirm that initiation of any one them will trip both pump units.

4. Interlock Operation:

   On manual operating mode start Pump Unit and try to start the second Pump Unit. Check and confirm that the second Pump Unit does not start.

   Repeat test for automatic operating mode and confirm the interlock operation.

   In case of a series pump installation the operation of interlocks between pump sets as well as interlocks between upstream and downstream pump units shall be confirmed.

5. Selector Switch "OFF" Position:

   Check and confirm that the pump Unit cannot be started either manually or automatically.

22.8.5 Appendix H5 – Motor starter (autotransformer type) – sewage pumping stations

ACCEPTANCE TEST SHEET No: **PSAT-S05**

PROJECT: ……
SITE: Sewage pumping station SPS ……
TEST: Motor Starter (Autotransformer Type) protection and instruments
TEST PURPOSE: Prove motor starter operation with pump unit running

Test Condition / Configuration:	Installation work including field mechanical and electrical equipment complete. The Service Provider's ITPs (including pressure testing of rising main) are completed and approved. The electrical and mechanical equipment PSAT ITPs completed and approved to proceed. The wet well is sufficiently full to operate the pump.
Description of Test:	Set protection settings (thermal overload, suction safety, over temperature, etc) Check and confirm adequacy of Insulation Resistance of motor Check and confirm direction of rotation of pump Run pump unit on manual mode and confirm its operation within acceptable limits (running current, discharge pressure, etc) . Check tripping out of the starter on all protections
Expected Test Results;	IR > 10 MOhms, Phase Voltages = 415V ± 6%, Starting Current < 3.5X Full Load Current Running Current < 90% Full Load current Thermal Overload trip at Full Load current or approximately 10% above Running current which ever is the lowest. Suction Safety trip setting is above the no-load current by approximately 30% of the difference in current from no-load to full-load and time delay of 10 seconds to trip Successful operation of the pump unit protection and starter equipment.
Measurements and Readings:	Record observations on opposite page under relevant items.
	Test equipment Used: Serial No: Calibrated Valid to …… …… …… ……
Comments:	…… …… …… …… ……

Test Completion and Sign-off:

Re-Test required: *YES / NO*

Tests: *PASS / FAIL* Re-Test Sheet No: .....……..

Testing	First	Second
Officer: …..……	Witness: ……	Witness: ……
Date: ..……	Date: ……	Date: ……
Company: ……	Company: ……	SWC: ……
Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*

Non Conformance Required: *YES / NO* NCR No.

INSPECTION AND TEST PLAN

PROJECT:…… **SITE:**……..…… **TEST:** Motor Starter (Autotransformer Type)

REF	EQUIPMENT		PASS	FAIL	MEASUREMENTS/COMMENTS
0	Facility	Series Pump Installation			**Yes/No**
1	Motor Starter Pump Unit 1 (refer note 12)				
1.1		Motor Insulation Resistance (refer note 1)			R – E……MΩ Y – E……MΩ B – E……MΩ
1.2		Pump Impeller direction of rotation (refer note 2)			Rotation reference to Drive End: Clockwise/Counter Clockwise
1.3		Motor supply voltage at the starter terminals (refer note 3)			Between Phases Phase & Neutral R & Y ……V R & N ..……V Y & B ……...…V Y & N ..……V B & R ……..…V B & N ...……..…V
1.4		Motor running current (refer note 3)			R ……A, Y …A, B ……A
1.5		Motor starting current (refer note 5)			R ……A, Y …A, B…….…A
1.6		Motor current indicator (ammeter) operation (refer note 6)			
1.7		Motor Overload trip & alarm indications operation (refer note 7)			Current Setting: ……..…..……..Amp. Time to Trip at 1st run: ……seconds Time to Trip at 2nd run: ……seconds
1.8		Suction safety trip and alarm indication operation (refer note 8)			No Load Current: ……..Amp Suction Safety Trip Current:……..…Amp Time Delay Set At: …….seconds
1.9		Autotransformer over temperature trip and alarm indication operation (refer note 9)			
1.10		Motor over temperature trip and alarm indication operation (refer note 10)			

1.11		Pump seal failure alarm indication operation (refer note 11)			
2	Motor Starter Pump Unit 2				
2.1		Motor Insulation Resistance (refer note 1)			R – E……MΩ Y – E……MΩ B – E……MΩ
2.2		Pump Impeller direction of rotation (refer note 2)			Rotation reference to Drive End: Clockwise/Counter Clockwise
2.3		Motor supply voltage at the starter terminals (refer note 3)			Between Phases Phase & Neutral R & Y ……..….V R & N ……V Y & B ……..…V Y & N ……V B & R ..,,……...V B & N ……V
2.4		Motor running current (refer note 3)			R ……A, Y…….A, B…….A
2.5		Motor starting current (refer note 5)			R ……A, Y..,.…A, B……A
2.6		Motor current indicator (ammeter) operation (refer note 6)			
2.7		Motor Overload trip & alarm indications operation (refer note 7)			Current Setting: ……..…Amp . Time to Trip at 1st run: ……...seconds Time to Trip at 2nd run: ...…….seconds
2.8		Suction safety trip and alarm indication operation (refer note 8)			No Load Current: ……..……Amp Suction Safety Trip Current: ……Amp Time Delay Set At: ……...seconds
2.9		Autotransformer over temperature trip and alarm indication operation (refer note 9)			
2.10		Motor over temperature trip and alarm indication operation (refer note 10)			

2.11		Pump seal failure alarm indication operation (refer note 11)			

1. Motor insulation resistance to earth shall be measured at the starter terminals. The insulation resistance shall be >10 MOhms. Record the results.
2. Suspend the pump utilising a suitable lifting device and start pump unit and stop immediately after the pump has commenced rotation.
3. Start Pump Unit and observe that the unit started and operating within its limits and no excessive vibration or unusual noise which may need shutdown of Pump Unit. If the operation of unit is satisfactory measure and record the motor terminal voltages and running current, observe ammeter operation.
4. Motor running current shall be measured at steady state operation.
5.
6. Ammeter reading shall read correctly including zero reading and the full load current records at about 70% full scale and marked with red line (refer calibration FAT ITP…….)
7. Assumed the protection equipment has been tested by primary injection under FAT ITP. Reduce the operating current to 50% of the running current and run the Pump Unit. Record the time to trip, observe initiation of alarm indications and reset operation. Run the Pump Unit without delay and observe the reduce time to trip and record results.
8. Run Pump Unit and close delivery valve fully. Measure and record the no-load current. Set the Suction Safety to desired current. Run the Pump Unit again and close the delivery valve slowly and observe tripping of the Pump Unit, initiation of alarm indications and reset operation.
9. Assumed the protection equipment has been tested by simulation under FAT ITP. Run Pump Unit and open one of the thermistor wires at the protection equipment terminal and observe the tripping of the Pump Unit, initiation of alarm indications and reset operation.
10. Assumed the protection equipment has been tested by simulation under FAT ITP. Run Pump Unit and open one of the thermistor wires at the protection equipment terminal and observe the tripping of the Pump Unit, initiation of alarm indications and reset operation.
11. Short circuit the electrode wires from the pump at the termination points (if wires are terminated at marshalling terminals they must be shorted at that point) and observe alarm initiation and reset operation. There is no unit trip function designed for this circuit.
12. For series pumping stations use another sheet and change the pump unit numbers to Motor Starters Pump Unit 3 and Motor Starter Pump Unit 4 for the downstream (dry well) pumps.

22.8.6 Appendix H6 – Storage capacity of the facility – sewage pumping stations

ACCEPTANCE TEST SHEET No: **PSAT-S06**

PROJECT: ……

SITE: Sewage pumping station SP ……

TEST: Storage capacity of the facility

TEST PURPOSE: Prove available storage capacity of the facility satisfy needs specification

Test Condition / Configuration:	Installation work including field mechanical and electrical equipment complete. The Service Provider's ITPs (including pressure testing of rising main) are completed and approved. The electrical and mechanical equipment PSAT ITPs completed and approved to proceed. The ITP for wet well level sensor is calibration completed and approved A suitable Data Logger with sufficient storage capacity has been configured to log wet well level at one second interval. A standpipe with calibrated water meter is fitted to hydrant. Wet well dimensions have been checked and confirmed during construction, ITP……..
Description of Test:	Configure the wet well and storage chamber valves to normal. Fill up the system with fresh water from the hydrant. Record the water meter readings when wet well level reaches two known RLs and calculate volume and confirm with the water meter reading. Continue filling of the wet well and note the water meter readings at every 10% increment in wet well level and also when level reaches ATWL level and then at Overflow level. If needed close inlet isolating valve and pump out the wet well and perform item 3 of PSAT -S08.
Expected Test Results;	Confirm available storage capacity satisfy Needs Specification. Obtain storage volume profile, ie Volume vs RL.
Measurements and Readings:	Record observations on opposite page under relevant items.
	Test equipment Used: **Serial No:** **Calibrated Valid to** …… …… …… …… …… …… …… …… ……
Comments:	…… …… …… …… …… …… …… …… …… …… ……

Test Completion and Sign-off:

Re-Test required: *YES / NO*

Tests: *PASS / FAIL* Re-Test Sheet No: .....……..

Testing Officer: …..	First Witness: …….	Witness: ……..
Date: ..……	Date: …….	Date: ……..
Company: …….	Company: …….	SWC: ……...
Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*

Non Conformance Required: *YES / NO* NCR No.

INSPECTION AND TEST PLAN

PROJECT:…… …. **SITE:**……..…… **TEST:** Storage capacity of the facility

REF	EQUIPMENT	PASS	FAIL	MEASUREMENTS/COMMENTS	
1	Hydrant Water Meter Check			Point 1: RL …. Corresponding level sensor value: ….. ……mA Point 2: RL… . Corresponding level sensor value: …….mA Calculated storage Volume (v) …….litres Point 1: Water Meter reading . …….litres Point 2: Water Meter reading . …….litres Volume Delivered: . …….litres	
2	Storage Volume			Water Meter reading at ATWL , …….litres Water Meter reading at Over Flow Level ,,……litres Volume Delivered: …….litres	
3	Profile			% Wet Well Level	Storage Volume (liters)
				0	
				10	
				20	
				30	
				40	
				50	
				60	
				70	
				80	
				90	
				100	

22.8.7 Appendix H7 – Performance of pump units – sewage pumping stations

ACCEPTANCE TEST SHEET No: **PSAT-S07**

PROJECT: …….
SITE: Sewage Pumping Station SPS……
TEST: Performance of Pump Units
TEST PURPOSE: Prove capability of pump units to satisfy requirements specified in needs spec
Prove Storage Capacity of the facility to satisfy Needs Specification

Test Condition / Configuration:	Installation work including field mechanical and electrical equipment complete. The Service Provider's ITPs (including pressure testing of rising main) are completed and approved. The electrical and mechanical equipment PSAT ITPs completed and approved to proceed. The ITP for wet well level sensor is calibration completed and approved The wet well is filled with water above ATWL and the rising main has also been filled. A suitable Data Logger with sufficient storage capacity has been configured to log wet well level at one second interval. Calibrated pressure gauges installed to read pump discharge pressure and rising main pressure. Wet well dimensions have been checked and confirmed during construction, ITP……..
Description of Test:	Tests should be carried out with no wet well inflow. Test 1. Open the discharge isolation valve partially. Start the pump on manual mode. Wait for at least 20 seconds and then close the discharge valve fully. Record discharge and rising main pressures and stop the pump. Test 2. Open discharge isolation valve fully and restart the pump on manual. Record wet well levels while the pump is operating. After steady flow has been established, measure and record discharge and rising main pressures for test flow conditions at Cut-in and Cut-Out levels. Note the height of the pressure gauges above mean operating wet well level. Plot zero and normal flowrate test points onto a copy of the pump works test curve and system curve.
Expected Test Results;	Prove pump performance and static head satisfy specified requirements of Needs Specification
Measurements and Readings:	Record observations on opposite page under relevant items.
	Test equipment Used: **Serial No:** **Calibrated Valid to** …… …… …… …… …… ……

Comments:	…… …… …… …… …… …… …… …… ……

Test Completion and Sign-off:

Re-Test required: *YES / NO*

Tests: *PASS / FAIL* Re-Test Sheet No: .....……..

Testing Officer:	First Witness:	Witness:
Date:	Date:	Date:
Company:	Company:	SWC:
Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*

Non Conformance Required: *YES / NO* NCR No.

INSPECTION AND TEST PLAN

PROJECT:…… **SITE:**……..…… **TEST:** Performance Pump Units

REF	EQUIPMENT		PASS	FAIL	MEASUREMENTS/COMMENTS
1	Pump Unit1	Configuration Data			
1.1		Wet well level “A” Duty Cut-In level (RL) & Level sensor Out-Put (mA) (Note 4)			RL……metres Out Put……..….mA
1.2		Wet well level “A” Duty Cut-Out level (RL) & Level sensor Out-Put (mA) (Note 4)			RL……metres Out-Put……..….mA
1.3		Height difference between pressure gauges & mean operating wet well level : (Note 1)			Discharge……metres Rising Main…….…….metres
1.4		Pump discharge pressure at zero flowrate (Note 2 & 3)			Gauge reading:…….metres/kPa Pump Discharge Pressure:…..m
1.5		Rising Main pressure at zero flowrate (Notes 2, 3, 5 & 6)			Gauge reading:…….metres/kPa Rising Main Pressure:……...m
1.6		Pump discharge pressure at normal flowrate (Notes 2, 3 & 6)			Gauge reading:…….metres/kPa Pump Discharge Pressure:……m

1.7		Rising Main pressure at normal flowrate (Note 2, 3 & 6)			Gauge reading:…….metres/kPa Rising Main Pressure:……...m
1.8		Pump discharge flowrate			Selected point 1: RL……metres Corresponding level sensor value:……..mA Selected point 2: RL……metres Corresponding level sensor value:……..mA Pump down time between the two points: (t):……..…..seconds Calculated pump down Volume: (v): …….litres Pump flow rate (Q=v/t): ..……l/s
2	Pump Unit2	Configuration Data			
2.1		Wet well level “A” Duty Cut-In level (RL) & Level sensor Out-Put (mA) (Note 4)			RL…….... …metres Out-Put……..….mA
2.2		Wet well level “A” Duty Cut-Out level (RL) & Level sensor Out-Put (mA) (Note 4)			RL…….... …metres Out-Put…….mA
2.3		Height difference between pressure gauges & mean operating wet well level : (Note 1)			Discharge……metres Rising Main……,metres
2.4		Pump discharge pressure at zero flowrate (Note 2 & 3)			Gauge reading:…….metres/kPa Pump Discharge Pressure:…….m
2.5		Rising Main pressure at zero flowrate (Notes 2, 3, 5 & 6)			Gauge reading:…….metres/kPa Pump Discharge Pressure:…….m
2.6		Pump discharge pressure at normal flowrate (Notes 2, 3 & 6)			Gauge reading:…….metres/kPa Pump Discharge Pressure:…….m
2.7		Rising Main pressure at normal flowrate (Note 2, 3 & 6)			Gauge reading:…….metres/kPa Pump Discharge Pressure:…….m
2.8		Pump discharge Flowrate			Selected point 1: RL……metres Corresponding level sensor value: ……..…mA Selected point 2: RL……metres Corresponding level sensor value: ……...…mA Pump down time between the two points: (t): ……..seconds Calculated pump down Volume: (v): ……litres Pump flow rate (Q=v/t): ……...l/s

Notes:

1. During test the wet well level should be as close as possible to the normal operating level but within the parallel section.
2. The discharge pressure gauge is to be connected upstream (before) the pump reflux valve and the rising main gauge connected downstream (after) the pump discharge isolation valve and rising main reflux valve (if installed).
3. The ranges of the pressure gauges should not be more than two times the operating pressure.
4. Select two vertical points and calculate pump-down volume between the points (use points sufficiently apart, e.g. >500 mm if possible and wet well wall parallel for accuracy of the results). From the logged data obtain the pump-down time between the two points and derive the pump flow rate.
5. The rising main pressure (plus height correction) under zero flow conditions should equal the system static head.
6. The rising main pressure (plus height correction) under normal flow conditions should approximately be the same as the pump discharge pressure (plus height correction) ignoring the corrections for velocity and minor losses.

22.8.8 Appendix H8 – Operation of mechanical equipment – sewage pumping stations

ACCEPTANCE TEST SHEET No: **PSAT- S08**

PROJECT: ……
SITE: Sewage pumping station SPS ……
TEST: Operation of mechanical equipment
TEST PURPOSE: Prove operation of mechanical equipment

Test Condition / Configuration:	Installation work including field mechanical and electrical equipment complete. The Service Provider's ITPs (including pressure testing of rising main) are completed and approved. The electrical and mechanical equipment PSAT ITPs completed and approved to proceed. Wet well is filed with water (above ATWL) to operate the pump. Wet well is capable of filling via collecting manhole.
Description of Test:	Start Pump Unit 1 on manual mode. Check and confirm operation of all listed items. Check and confirm acceptability of pipe work, vibration, water tightness, anchorage, etc.
Expected Test Results;	Successful operation of all mechanical equipment as per the design intent. Any leakage from pipe work including pump discharge connection and valves is not acceptable.
Measurements and Readings:	Record observations on opposite page under relevant items.
	Test equipment Used: **Serial No:** **Calibrated Valid to** …… …… …… …… …… ……
Comments:	…… …… …… …… …… ……

Test Completion and Sign-off:

Re-Test required: *YES / NO*

Tests: *PASS / FAIL* Re-Test Sheet No: ……

Testing Officer: ……	First Witness: ……	Witness: ……
Date: ……	Date: ……	Date: ……
Company: ……	Company: ……	SWC: ……
Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*

Non Conformance Required: *YES / NO* NCR No.

INSPECTION AND TEST PLAN

PROJECT:…… **SITE:**……..…… **TEST:** Operation of mechanical equipment

REF	EQUIPMENT		PASS	FAIL	COMMENTS
1	Pump Unit 1	Flush valve operation (refer note 1)			
1.2		Seating of discharge connection (refer note2)			
1.3		Isolating valve assembly pump discharge operation (refer note 3)			
1.4		Reflux valve operation (refer note4)			
1.5		Isolating valve assembly rising main gas relief			
1.6		Pipe work			
2	Pump Unit 2	Flush valve operation (refer note 1)			
2.1		Seating of discharge connection (refer note2)			
2.2		Isolating valve assembly pump discharge operation (refer note 3)			
2.3		Reflux valve operation (refer note4)			
2.4		Isolating valve assembly rising main gas relief			
2.5		Pipe work			
3	Input /Output Process Equipment	Isolating valve wet well inlet (refer note 5)			
3.1		Isolating valve rising main (refer note 3)			
3.2		Isolating Valve by-pass connection (refer note)			
3.3		Reflux valve by-pass connection (refer note)			
3.4		Isolating valve scour line (refer note)			

Notes:

1. During start-up and first 30 seconds of operation observe the agitation of water due to opening of flush valve. After the time lag the agitation should stop indicating the closure of flush valve.
2. After initial agitation of water due to opening of flush valve has subsided observe signs for leakage at the pump discharge connection.

3. Isolating valve should be checked for smooth and easy operation, positive shutoff and no leakage from glands. The closing of the valve should be checked whilst the pump is in operation and observe the closing of reflux valve fully, rising main pressure stabilise at previous no flow pressure and lack of flow noise.
4. The reflux valves should open and close smoothly with flow and shall not slam shut due to excessive water hammer. The closing of the valve should be checked under normal pump shutdown condition as well as simulated electrical power supply failure condition.
5. Apply maximum water pressure in the system by filling up the collecting manhole to overflow level. Open and close valve and check operation and positive shutoff of the valve (this test could be done whilst carrying out PSAT -S06).

22.8.9 Appendix H9 – Operation of generator supply – sewage pumping stations

ACCEPTANCE TEST SHEET No: **PSAT-S09**

PROJECT: ……
SITE: Sewage Pumping Station SPS ……
TEST: Operation of Generator Supply Engagement
TEST PURPOSE: Prove operation of Facility on Generator Supply

Test Condition / Configuration:	Installation work including field mechanical and electrical equipment complete. The Service Provider's ITPs (including pressure testing of rising main) are completed and approved. The electrical and mechanical equipment PSAT ITPs completed and approved to proceed. Wet well is filed with water (above ATWL) to operate the pump. The mechanical and electrical equipment operational checks ITPs completed and approved Suitably sized generating set available Equipment operating on normal supply
Description of Test:	Check and confirm operation of generator supply changeover equipment Check and confirm operation of facility on generator supply.
Expected Test Results;	Successful operation of facility on generator supply.
Measurements and Readings:	Record observations on opposite page under relevant items.
	Test equipment Used: **Serial No:** **Calibrated Valid to** …… …… …… …… …… …… …… …… …… …… …… …… …… …… …… …… …… ……
Comments:	…… …… …… …… ……

Test Completion and Sign-off:

Re-Test required: *YES / NO*

Tests: *PASS / FAIL* Re-Test Sheet No: ……..

Testing Officer:	First Witness:	Witness:
Date:	Date:	Date:
Company:	Company:	SWC:
Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*

Non Conformance Required: *YES / NO* NCR No.

INSPECTION AND TEST PLAN

PROJECT:…… **SITE:**……..…… **TEST:** Operation of generator supply equipment

REF	EQUIPMENT		PASS	FAIL	MEASUREMENTS/COMMENTS
1	**Change over equipment**				
1.1		Confirm generator terminal isolation (refer note 1)			R–Y…….. Volts R-B ……..,……Volts Y–B …….. Volts R–N……..Volts Y–N ……..Volts B–N……..Volts
1.2		Confirm switchboard isolation (refer note 1.2)			R–Y……Volts R-B ……..,…….Volts Y–B ……Volts R–N……Volts Y–N ……Volts B–N……Volts
2	**Change over supply**				
2.1		Generator terminal Voltages (refer note 2.1)			R–Y……Volts R-B ……..,……..Volts Y–B ……Volts R–N……Volts Y–N ……Volts B–N……Volts
2.2		All systems reset to normal after change over of supply to generator supply (refer note 2.2)			
4	**Pump Unit 1**	Operation on generator supply (refer note 2.3)			Motor terminals: R–Y……Volts R-B …….. Volts Y–B ……..… Volts Generator Terminals: R–Y…….. Volts R-B …….. Volts Y–B …….... Volts
5	**Pump Unit 1 & 2 (If system is designed to do so only)**	Operation on generator supply (refer note 3)			Motor terminals: R–Y……,…Volts R-B ……..Volts Y–B …….. Volts Generator Terminals: R–Y…….. Volts R-B …….. Volts Y–B …….. Volts

Notes:

1. Changeover Equipment Checks:
    a. Whilst facility on normal supply and generator disconnected check and confirm no voltages at generator terminals.
    b. Operate the changeover switch to generator supply (generator disconnected) check and confirm no voltage at the power supply distribution board.
2. One Pump Unit Operation on Generator Supply:
    a. Changeover to normal supply. Connect generator to generator terminals. Start generator and record voltages at generator terminals.
    b. Changeover the power supply to generator supply. Observe all systems reset to normal (alarm indications generated due to loss of supply have reset, control system and pump units are available for normal operation)
    c. Start pump unit 1 on manual, observe operation of pump unit and other auxiliary items and record motor terminals and generator supply terminal voltages. On completion of tests switch off pump unit and changeover the power supply back to mains supply. Observe all systems reset to normal.
3. Two Pump Unit Operation on Generator Supply: (ONLY IF SYSTEM IS DESIGNED)

Parallel operation of pumps should not be carried out unless the system is designed to run multiple units. Whilst first pump is running start pump unit 2 on manual and record motor terminals and generator supply terminal voltages

22.8.10 Appendix H10 – Operation of alternative supply - sewage pumping stations

ACCEPTANCE TEST SHEET No: **PSAT-S10**

PROJECT: ……
SITE: Sewage pumping station SPS ……
TEST: Operation of alternative supply equipment
TEST PURPOSE: Prove operation of facility on generator supply

Test Condition / Configuration:	Installation work including field mechanical and electrical equipment complete. The Service Provider's ITPs (including pressure testing of rising main) are completed and approved. The electrical and mechanical equipment PSAT ITPs completed and approved to proceed. The mechanical and electrical equipment operational checks ITPs completed and approved. Equipment operating on normal supply. If alternative supply not available a suitably sized generating set is made available. Switching on/off capability of supply available monitoring signals to the control system.
Description of Test:	Check and confirm operation of alternative supply changeover equipment. Check and confirm operation of facility on alternative supply.
Expected Test Results;	Successful operation of changeover equipment. If alternative mains supply available successful operation of facility on alternative supply.
Measurements and Readings:	Record observations on opposite page under relevant items.
	Test equipment Used: **Serial No:** **Calibrated Valid to** …… …… …… …… …… ……
Comments:	…… …… …… ……

Test Completion and Sign-off:

Re-Test required: *YES / NO*

Tests: *PASS / FAIL* Re-Test Sheet No: ……..

Testing Officer: …….	First Witness: ……	Witness: ……
Date: ……	Date: ……	Date: ……
Company: ……	Company: ……	SWC: ……
Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*

Non Conformance Required: *YES / NO* NCR No.

INSPECTION AND TEST PLAN

PROJECT:…… **SITE:**……..…… **TEST:** Operation of alternative supply equipment

REF	EQUIPMENT		PASS	FAIL	MEASUREMENTS/COMMENTS
1	**Change over equipment**				
1.1		Mechanical interlock operation (refer note 1)			
1.2		Change over of supply from normal supply to alternative supply (refer note 2)			Time Delay: … seconds
1.3		Change over of supply from alternative supply to normal supply (refer note 3)			Time Delay: … seconds
1.4		Retention of facility on normal supply during loss of both supplies (refer note 4.1)			
1.5		Retention of facility on alternative supply when both supplies fail (refer note 4.2)			
1.6		Restoration of normal supply from alternative supply (refer note 4.3)			
1.7					
2	**Change over supply**	All systems reset to normal after change over of supply to alternative supply (refer note)			
3	**Pump Unit 1**	Operation on alternative supply (refer note 5)			Motor terminals: R–Y……. Volts R-B ……..… Volts Y–B ……..….. Volts Alternative supply: R–Y……..... Volts R-B ……..….. Volts Y–B ……..……. Volts
4	**Pump Unit 1 & 2 (If system is designed to do so only)**	Operation on alternative supply (refer note 6)			Motor 1 terminals: R–Y……..….. Volts R-B …… Volts Y–B ……... Volts Motor 2 terminals: R–Y……. Volts R-B …… Volts Y–B ……..…. Volts Alternative terminals: R–Y……. Volts R-B …… Volts Y–B ……..…. Volts

Notes:

If alternative supply is not available at the time of commissioning and only the provision is provided a suitable generating set shall be used to simulate the alternative supply.

1. Mechanical Interlock
   If available disconnect alternative power supplies from respective circuit breaker. Disable electrical interlocks from the changeover control circuit.
   Whilst the normal power supply circuit breaker (Q……) is ON try manually to close the alternative supply circuit breaker (Q….). and observe circuit breaker (Q……) cannot be closed.

2. Switch off normal power supply circuit breaker (Q…..) and try manually to close the normal power supply circuit breaker (Q….). and observe circuit breaker (Q……) cannot be closed.
3. Automatic Changeover of Power Supplies
   Restore control circuits to normal (enable electrical interlocks). If alternative power supply available connect the power supply back to circuit breaker (Q…..).
   Whilst the facility on normal power supply (Q…..Closed and Q……Opened), disable the normal supply available signal to changeover control unit. Observe after a set time delay changeover of facility power supply to alternative power supply (Q……Opened & Q……Closed).

4. Whilst the facility on alternative power supply (Q…..Opened and Q……Closed), enable the normal supply available signal to changeover control unit. Observe after a set time delay changeover of facility power supply to normal power supply (Q……Closed & Q……Opened).

4. {Check design to confirm this functionality is available and shall be enabled or not}

4.1 Whilst the facility on normal power supply (Q…..Closed and Q……Opened), disable both the alternative supply and the normal supply available signals to changeover control unit. Observe facility remains supplied by the normal supply (Q…….Closed & Q……Opened), i.e. control system retains current supply arrangement due to loss of both supplies.

After sufficient time delay to prove above operation, enable both the supply available signals to changeover control unit. Observe no change in status.

4.2 Whilst the facility on normal power supply (Q…..Closed and Q……Opened), disable the normal supply available signal to changeover control unit. Observe after a set time delay changeover of facility power supply to alternative power supply (Q……Opened & Q……Closed). Disable the alternative supply available signal to changeover control unit. Observe facility remains supplied by the alternative supply (Q…….Opened & Q……Closed), i.e. control system retains current supply arrangement due to loss of both supplies.

After sufficient time delay to prove above operation, enable the alternative supply available signal to changeover control unit. Observe no change in status.

4.3 Whilst the facility on alternative power supply (Q…..Opened and Q……Closed), disable both the alternative and normal supply available signals to changeover control unit. Observe no change in status. Enable simultaneously both normal and alternative supply available signals to changeover control unit. Observe facility remains supplied by the alternative supply (Q…….Opened & Q……Closed) for a set time and then changed-over to normal supply(Q…….Closed & Q…….Opened).

5 One Pump Unit Operation on Alternative Power Supply:

Changeover the supply to alternative supply. Observe all systems reset to normal. Start pump unit 1 on manual and record the following.

6 Parallel operation of pumps should not be carried out unless the system is designed to run multiple units. Whilst first pump is running start pump unit 2 on manual and record motor terminals and generator supply terminal voltages.

22.8.11 Appendix H11 – Full functional test of the facility – sewage pumping stations

ACCEPTANCE TEST SHEET No: **PSAT- S11**

PROJECT: ……

SITE: Sewage Pumping Station SP……

TEST: Full Functional Tests Of The Facility (Two Pump Operation Only)

TEST PURPOSE: Prove operation of facility as per the FDS for the facility

Test Condition / Configuration:	All installation work completed. All relevant ITPs completed and approved. The facility is confirmed as operational for the purpose of executing this ITP. The latest version of RTU / PLC Programs are loaded. The ITP corresponding to Operator Graphics completed and approved. PARAMETERS: Prior to executing the ITP a number of parameters are to be set as given below. If subsequent changes are required they will be stated at the beginning of relevant items. Pump Unit number of starts per hour = 10 (Pump Unit Re-start Delay =6 minutes) Choke Offset = [Normal Pump Duty Cut-In Level – Pump Duty Cut-Out Level] x $^{1}/_{20}$ Pump down delay time = 90% of time to pump down well from ATWL level to Suction Safety level with no inflow. ATWL alarm delay time = 90 seconds
Description of Test:	Fill wet well via collecting manhole and control flow using Inlet isolating Valve. Operate facility on Automatic mode. Check and confirm all local and remote operating functions, operator graphics test at SOC, local and remote status & alarms indications.
Expected Test Results;	Facility and operator graphics functions as per the Functional design Specification for the facility.
Measurements and Readings:	Record results on the opposite page under relevant Item.
	Test equipment Used: **Serial No:** **Calibrated Valid to** …… …… …… …… …… …… …… …… …… …… …… …… …… …… ……
Comments:	…… …… …… …… …… …… ……
Test Completion and Sign-off:	Re-Test required: *YES / NO*

Tests: *PASS / FAIL* Re-Test Sheet No: .....……..
Testing First
Officer: …..……Witness: …… Witness: ……..
Date: ..…… Date: …… Date: ……..
Company: ……Company: …… SWC: ……...
Test Status: *PASS / FAIL* Test Status: *PASS / FAIL* Test Status: *PASS / FAIL*
Non Conformance Required: *YES / NO* NCR No.

INSPECTION AND TESTING PROCEDURE

PROJECT:…… **SITE:**……..…… **TEST:** Full functional tests of facility (two pump operation only)

REF	EQUIPMENT		PASS	FAIL	MEASUREMENTS/COMMENTS
1	**Pump Units**	Pump Units unavailable operation (refer note 1)			
2		Pump Unit 1 manual operation			
3		Pump Unit 2 manual operation			
4	**Flushing Operation**				
4.1		Automatic and manual operation whilst selected on FLUSH mode			
4.2		Pump Unit 1 operation			
4.3		Pump Unit 2 operation			
5	**Automatic Operation**				
5.1		Automatic duty changeover			
5.2		Re-start delay			
5.3		Stand-by unit operation			
5.4	**Choke control operation Pump Unit 1**				
5.4.1		First choke test			
5.4.2		Second choke test			
5.4.3		Stand-by operation and duty changeover			
5.4.4		Third (final) choke test and lock-out of choked pump			
5.4.5		Single Pump Unit operation			
5.5	**Choke control operation Pump Unit 2**				
5.5.1		First choke test			
5.5.2		Second choke test			
5.5.3		Stand-by operation and duty changeover			

5.5.4		Third (final) choke test and lock-out of choked pump			
5.5.5		Single Pump Unit operation			
5.6	**Emergency Controller Operation**				
5.6.1		Pump operation by the Emergency PLC			Pump Stop time Delay:……sec
5.6.2		ATWL alarm initiation			
5.7	**High Level Pump Mode Operation**				
5.7.1		High level pump operation by the RTU			Pump Stop time Delay: ……..……sec
5.7.2		ATWL alarm initiation			

Notes:

1. PUMP UNITS UNAVAILABLE FOR OPERATION

Select both Pump Unit Control Selector Switch to OFF mode:

Gradually raise wet well level to pump Cut-In and then above ATWL Alarm Float Switch level and observe that Pump Units do not operate Automatically, Manually or via Flush Pendant .

4.1 LOCAL MANUAL OPERATION OF PUMP UNIT 1

Select Pump Unit 1 Control Selector Switch to Manual mode and observe that Pump Unit does not start automatically or via Flush Pendant.

Operate Pump Unit 1 on Manual Mode. Check and confirm the Operator Graphics including display of analogue values. Allow Pump Unit to Trip on Suction Safety and no alarms displays on Operator Graphics.

4.2 LOCAL MANUAL OPERATION OF PUMP UNIT 2

Select Pump Unit 2 Control Selector Switch to MANUAL mode and observe that Pump Unit does not start automatically when Wet Well Level is raised above operating points and also via Flush Pendant.

Operate Pump Unit 2 on MANUAL Mode. Check and confirm the Operator Graphics including display of analogue values. Allow Pump Unit to Trip on Suction Safety and no alarms displays on Operator Graphics.

4.3 FLUSHING OPERATION OF PUMP UNITS

Select Pump Units Selector Switches to AUTO.

4.4 Raise Wet Well Level above Cut-In level and observe designated next to run Pump Unit start and stop
Automatically.

Select Pump Unit 1Control Selector Switch to FLUSH mode and observe that none of the Pump Units start automatically when Wet Well Level is raised above operating points and also via Manual start/stop push buttons.

4.5 Operate Pump Unit 1 utilising Flush Pendant. Check and confirm the Operator Graphics including display of analogue values. Allow Pump Unit to run dry only for 11 seconds and observe the Pump Unit does not trip on Suction Safety.

4.6 Select Pump Unit 1Control Selector Switch to AUTO mode and Pump Unit 2 Control Selector Switch to FLUSH mode observe that none of the Pump Units start automatically when Wet Well Level is raised above operating points and also via Manual start/stop push buttons.

Operate Pump Unit 2 utilising Flush Pendant. Check and confirm the Operator Graphics including display of analogue values. Allow Pump Unit to run dry only for 11 seconds and observe the Pump Unit does not trip on Suction Safety.

5. AUTOMATIC OPERATION

Select Pump Units Selector Switches to AUTO.

5.1 Automatic Duty Changeover

Raise Wet Well Level above Cut-In level and observe designated next to run (Duty) Pump Unit start and stop Automatically and pump “Next to Run” selection changes to remaining Pump Unit.

Complete the cycle by raising Wet Well Level above Cut-In level and observe Duty Pump Unit start and stop Automatically and pump “Next to Run” selection changes to previous Pump Unit.

5.2 Re-start delay

After 10 minutes delay on completion of item 5.1 above, complete one pump down cycle with shortest possible time. {This could be achieved by having the incoming sewer filled with water and controlling the flow via Wet Well Inlet Isolating valve. When the level has reached Cut-In level shut the Inlet Isolating Valve to facilitate a fast pump down. Also commence filling immediately after the pump stops} Note Pump start and stop times.

Commence 2nd pump down cycle immediately after completion of the first. Check and confirm that the Duty Pump Unit starts after elapse of re-start delay time (6 minutes from the previous start).

Commence 3nd pump down cycle immediately after completion of the 2nd. Check and confirm that the Duty Pump Unit starts after elapse of re-start delay time (6 minutes from the previous start).

5.3 Stand-By Unit Operation

Raise Wet Well Level above Cut-In level and observe designated next to run Pump Unit start Automatically (may experience re-start delay).

Trip the unit by operating the Emergency Stop. Check and confirm the start-up without delay and operation of the second Pump Unit (stand-by). Also confirm the pump “Next to Run” (Duty) selection changes to stand-by Pump Unit, alarm indications and Operator Graphics.

Retain the status of Pump Unit which was tripped before. Raise Wet Well Level above Cut-In level and confirm that designated Duty Pump Unit start Automatically (may experience re-start delay) and the same Pump Unit remains the Duty Pump Unit.

Reset and put previously tripped Pump Unit into operation. Repeat the above test by tripping the second Pump Unit and confirm the operation of stand-by Pump Unit, operation of facility with single Pump Unit, alarm indications and Operator Graphics.

5.4 Choke Control Operation

5.4.1 Reset all Pump Units and restore control system to normal automatic operation. Fill the incoming sewer
sufficiently to maintain inflow for a long period.

Raise the Wet Well level at a reasonably high flowrate and check and confirm the start-up of Duty Pump Unit at Cut-In level. Whilst maintaining the inflow throttle the Pump Unit discharge Isolating Valve to restrict the discharge flow to a minimum (just enough to prevent overheating of pump) to simulate a choked pump. Allow the Wet Well level to rise above choke level.

Check and confirm the shutdown of duty pump and start-up of stand-by Pump Unit and also after the stand-by Pump Unit has stopped the Duty Pump Unit remains the same as before (no change of duty Pump Unit). Shut off the inflow after stand-by Pump Unit has started to conserve water.

Check and confirm the Operator graphics.

5.4.2 Raise the Wet Well level to choke level as before. Check and confirm that duty Pump Unit starts at the normal Cut-In level and stops when Wet Well level reaches choke level. Also check and confirm stand-by Pump Unit operation and also no change of Duty Pump Unit.

5.4.3 Whilst the stand-by Pump Unit is running trip the unit by operating Emergency pushbutton. Check and
confirm the start-up of choked pump Unit. Reset stand-by Pump Unit. Check and confirm the shutdown of choked Pump Unit and re-starting of stand-by Pump Unit.

5.4.4 Repeat the same as above and confirm the Duty and Stand-by operation as before and also the change of
Duty to Stand-by pump Unit. Check and confirm that when the Duty Pump Unit trips the choked Pump Unit does not start and when reset the Duty Pump Unit operate as normal. Check and confirm the Operator graphics and alarm indications

5.4.5 Reset stand-by Pump Unit. Check and confirm the shutdown of choked Pump Unit and re-starting of stand-by Pump Unit.

5.4.6 Reset the choked Pump Unit and restore automatic operation. Repeat the above test by simulating a choke on the second Pump Unit. Check and confirm the operation of facility under choke condition.

5.5 Emergency Controller Operation

Disable the Wet Well Level sensor (short circuit the 4 - 20 mA analogue signal Input at the RTU field terminals) to simulate a “Failed” level sensor.
Remove RTU pump start out-put signal wires at the RTU field terminals to stop RTU starting the pump Unit.
Check and confirm the Operator graphics and alarm indications

5.6.1 Raise the Wet Well level at a reasonable rate and when a pump starts shut off the inflow. Check and confirm that the Duty Pump Unit does not start at the normal Cut-In Level or at the Emergency Cut-In level. Check and confirm that the Duty Pump Unit starts by the Emergency PLC at the ATWL Switch Cut-In level. Note the time delay in starting the pump. Check and confirm that the Duty Pump Unit stops after a set time delay. Note the stop delay time. Check and confirm the Operator graphics and alarm indications.

5.6.2 Repeat the above but do not shut off the inflow. Throttle the Pump Discharge Isolating Valve to maintain the well level above ATWL Cut-In level for a period of about two minutes to allow initiation of ATWL alarm. Open Pump Discharge Isolating Valve and Close Inlet Isolating Valve. Confirm High Level Pump operation by the Emergency Controller and Duty rotation of Pump Units. Check and confirm the Operator graphics and the initiation of ATWL alarm indication.

5.7 High Level Pump Mode Operation

5.7.1 Reconnect the RTU Out-Put wires which were disconnected before and restore RTU controls. Raise the Wet Well level at a reasonable rate and when a pump starts shut off the inflow. Check and confirm that the Duty Pump Unit does not start at the normal Cut-In Level or at the Emergency Cut-In level. Check and confirm that the Duty Pump Unit starts without delay by the RTU at the ATWL Switch Cut-In level. Check and confirm that the Duty Pump Unit stops after a set time delay. Note the stop delay time. Check and confirm the Operator graphics and alarm indications.

5.7.2 Repeat the above but do not shut off the inflow. Throttle the Pump Discharge Isolating Valve to maintain the well level above ATWL Cut-In level for a period of about two (2) minutes to allow initiation of ATWL alarm. Open Pump Discharge Isolating Valve & Close Inlet Isolating Valve. Confirm High Level Pump operation by the RTU and Duty rotation of Pump Units. Check and confirm the Operator graphics and the initiation of ATWL alarm indication.

22.8.12 Appendix H12 – Water hammer, vibration and noise – sewage pumping stations

ACCEPTANCE TEST SHEET No: **PSAT- S12**

PROJECT: ……
SITE: Submersible Sewage Pumping Station SP……
TEST: Water Hammer, Vibration and Noise
TEST PURPOSE: Prove Water hammer, vibration and noise levels of Equipment/system within specified limits

Test Condition / Configuration :	Installation work including field mechanical and electrical equipment complete. The Service Provider ITPs (including pressure testing of rising main) are completed and approved. The electrical and mechanical equipment PSAT ITPs completed and approved to proceed. The mechanical and electrical equipment operational checks ITPs completed and approved.
Description of Test:	Check and confirm vibration levels of equipment and pipework within specified limits. Check and confirm noise levels generated by operation of facility within specified limits.
Expected Test Results;	Water hammer, vibration levels are within acceptable limits. Noise levels inside and outside the facility are within specified limits and conform to Sydney Water's Corporate Instruction No. 831.
Measurements and Readings:	Record observations on opposite page under relevant items or attach relevant certified reports
	Test equipment Used: **Serial No:** **Calibrated Valid to** ....
Comments:	…… …… …… …… …… ……

Test Completion and Sign-off:

Re-Test required: *YES / NO*

Tests: *PASS / FAIL* Re-Test Sheet No: .....……..

Testing Officer: …….	First Witness: ……	Witness: ……..
Date: …….	Date: ……	Date: ……..
Company: ……	Company: ……	SWC: ……..
Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*

Non Conformance Required: *YES / NO* NCR No.

INSPECTION AND TESTING PROCEDURE

PROJECT:…… . **SITE:**……..…… **TEST: Water Hammer, Vibration and Noise levels**

REF	EQUIPMENT	PASS	FAIL	MEASUREMENTS/COMMENTS
1	Water hammer pressure levels under all operating conditions are within acceptable limits			
2.	Vibration levels of equipment, pipework and structures are within acceptable limits			
	Occupational noise levels are within acceptable limits (refer note 3)			Pump Unit 1 Operating: Covers Open……..…...….dB(A); Covers Closed……dB(A) Pump Unit 2 Operating: Covers Open……..…dB(A); Covers Closed……...dB(A) Pump Unit 1 & 2 Operating: Covers Open……..….dB(A) Covers Closed……dB(A) {this measurement applicable only if operation of equipment in this configuration }
3	Environmental noise levels are within acceptable limits (refer note 3)			Background Noise Level;……dB(A) Point 1 ……dB(A) Point 2 ……dB(A) Point 3 ……dB(A) Point 4 ……dB(A)

Notes:

1. Water hammer measurements:

2. Vibration measurements:

3. Noise Measurements:

3.1 Occupational Noise:

Overall A-weighted sound pressure – $L_{Aeq,\ 1\ minute\ (SPL)}$. The measurements shall be taken if not specified otherwise in the Technical specifications, at the wet well with and without hatch covers open.
The parallel operation of pumps shall be carried out if facility is designed to do so only.

3.2 Environmental Noise

The measurements shall be taken at the boundary of residential or any other properties of concern when background noise levels are at the lowest (eg. mid night). Attached a site layout drawing showing the noise measuring points.

22.8.13 Appendix H13 – Calibration of level measuring devices – sewage pumping stations

ACCEPTANCE TEST SHEET No:
PROJECT: ……
SITE: Submersible Sewage Pumping Station SP……..…
TEST: Calibration of level measuring devices
TEST PURPOSE: Set operating spans/levels and prove operation of level measuring device instrument loop

PSAT- S13

Test Condition / Configuration:	Installation work including field mechanical and electrical equipment complete. The Service Provider's ITPs (including pressure testing of rising main) are completed and approved. All analogue instrument loops are installed and ready for calibration.
Description of Test:	Set operating span of the level sensor/s to corresponding design specification Check and confirm calibration of level sensor equipment. Complete relevant sections of ITP RTU/PLC Input checks PSAT – …...
Expected Test Results;	All analogue instrument loops are calibrated functioning as per the design specification
Measurements and Readings:	Record results on the opposite page under relevant Input.
	Test equipment Used: **Serial No:** **Calibrated Valid to** …… …… …… …… …… ……
Comments:	…… …… …… …… …… …… ……

Test Completion and Sign-off:

Re-Test required: *YES / NO*

Tests: *PASS / FAIL* Re-Test Sheet No: ....……..

Testing Officer:	First Witness:	Witness:
Date: ..……	Date: ……	Date: ……
Company: ……	Company: ……	SWC: ……
Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*

Non Conformance Required: *YES / NO* NCR No.

		COLLECTING MAINTENANCE HOLE LEVEL SENSOR		STORAGE CHAMBER LEVEL SENSOR		WET WELL LEVEL SENSOR 1		WET WELL LEVEL SENSOR 2	
% OF SPAN		**APPLIED PRESSURE OR MEASURED DEPTH (mH_2O)**	**INSTRUMENT OUTPUT(mA)**	**APPLIED PRESSURE OR MEASURED DEPTH (mH_2O)**	**INSTRUMENT OUTPUT(mA)**	**APPLIED PRESSURE OR MEASURED DEPTH (mH_2O)**	**INSTRUMENT OUTPUT(mA)**	**APPLIED PRESSURE OR MEASURED DEPTH (mH_2O)**	**INSTRUMENT OUTPUT(mA)**
100%									
75%									
50%									
25%									

OPERATING PARAMETERS	**IICATS LEVEL SETTINGS**	**RL**	**INSTRUMENT OUTPUT**		**RL**	**INSTRUMENT OUTPUT**		**RL**	**INSTRUMENT OUTPUT**		**RL**	**INSTRUMENT OUTPUT**	
			mA	%		mA	%		mA	%		mA	%
Station on Overflow	**4H**												
Inflow Emergency level Switch													
Inflow emergency Level Reach	**1H**												
Bottom of Manhole Sensor													
Top of Collecting Manhole Survey Mark													
Station on Overflow	**4H**												
Storage Filling Backup													
Storage Filling	**1H**												
Emergency duty Cut-Out													
Overflow Level													
ATWL Backup Alarm	**4H**												
ATWL Switch Cut In													
Emergency duty Cut-In	**3H**												
“B” Duty Cut-In	**2H**												
“A” Duty Cut-In	**1H**												
“B” Duty Cut-Out	**1L**												
“A” Duty Cut-Out	**2L**												
Emergency duty Cut-Out	**3L**												
Suction Safety Trip Imminent	**4L**												
Suction Safety cut-Out													
Minimum Storage													
Top of Wet Well Survey Mark													

22.8.14 Appendix H14 – Motor starter (soft starer type) – sewage pumping stations

ACCEPTANCE TEST SHEET No: **PSAT- S14**

PROJECT: …….
SITE: Sewage Pumping Station SP……
TEST: Motor Starter (Soft starter Type) Protection & Instruments
TEST PURPOSE: Prove motor starter operation with Pump Unit running

Test Condition / Configuration:	Installation work including field mechanical and electrical equipment complete. The Service Provider ITPs (including pressure testing of rising main) are completed and approved. The electrical and mechanical equipment PSAT ITPs completed and approved to proceed. The wet well is sufficiently full to operate the pump.
Description of Test:	Set protection settings (thermal overload, suction safety, over temperature, etc) Check and confirm adequacy of Insulation Resistance of motor Check and confirm direction of rotation of pump Run pump unit on manual mode and confirm its operation within acceptable limits (running current, discharge pressure, etc) . Check tripping out of the starter on all protections
Expected Test Results;	IR > 10 Mohms, Phase Voltages = 415V ± 6%, Starting Current < 3.5X Full Load Current Running Current < 90% Full Load current Thermal Overload trip at Full Load current or approximately 10% above Running current which ever is the lowest. Suction Safety trip setting is above the no-load current by approximately 30% of the difference in current from no-load to full-load and time delay of 10 seconds to trip Successful operation of the pump unit protection and starter equipment.
Measurements and Readings:	Record observations on opposite page under relevant items.
	Test equipment Used: **Serial No:** **Calibrated Valid to** …… …… …… …… …… ……
Comments:	…… …… …… …… …… ……

Test Completion and Sign-off:

Re-Test required: *YES / NO*

Tests: *PASS / FAIL* Re-Test Sheet No: ....……..

Testing Officer: ….……	First Witness: ……	Witness: ……..
Date: ..……	Date: ……	Date: ……..
Company: …….	Company: ……	SWC: ……...
Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*

Non Conformance Required: *YES / NO* NCR No.

INSPECTION AND TESTING PROCEDURE

PROJECT:…… **SITE:**……..…… **TEST:** Motor Starter (Soft starter Type)
Protections & Instruments

REF	EQUIPMENT		PASS	FAIL	MEASUREMENTS/COMMENTS
0	**Facility**	Series Pump Installation			Yes/No
1	**Motor Starter Pump Unit 1 (refer note 11)**				
1.1		Motor Insulation Resistance (refer note 1)			R – E……MΩ Y – E……MΩ B – E……MΩ
1.2		Set programmable parameters to suit the designed application and record the values (refer note…)			Refer Table 1
1.3		Pump Impeller direction of rotation (refer note 2)			Rotation reference to Drive End: Clockwise/Counter Clockwise
1.4		Motor starting current (refer note 3)			R …… ….A, Y…..… ……..….A, B…… ……A
1.5		Motor supply voltage at the starter terminals (refer note 4)			Between Phases and Phase & Neutral R & Y …… ……..……V R & N ……..……V Y & B ……. ……..……V Y & N ……V B & R …… ……...…V B & N ……V
1.6		Motor running current is acceptable and (refer note 4)			R…… ……. …A, Y …… A B … ……..……A
1.7		Motor current indicator (ammeter) operation (refer note 5.)			
1.8		Motor Overload trip & alarm indications operation (refer note 6)			Current Setting: ..…..…Amps Time to Trip at 1st run: ……..seconds Time to Trip at 2nd run: ……..seconds
1.9		Motor over temperature trip and alarm indication operation (refer note 7)			
1.10		Suction safety trip and alarm indication operation (refer note 8)			No Load Current: ……..Amp Suction Safety Trip Current: ……Amp Time Delay Set At: ……..seconds
1.11		Pump seal failure alarm indication operation (refer note 9)			

1.12		Under voltage trip and alarm indication operation (refer note 10)			
1.13		Over voltage trip and alarm indication operation (refer note 10)			
2	**Motor Starter Pump Unit 2**				
2.1		Motor Insulation Resistance (refer note 1)			R – E……MΩ Y – E……MΩ B – E……MΩ
2.2		Set programable parameters to suit the designed application and record the values (refer note…)			Refer Table 1
2.3		Pump Impeller direction of rotation (refer note 2)			Rotation reference to Drive End: Clockwise/Counter Clockwise
2.4		Motor starting current (refer note 3)			R…… …… ….A Y ……..…. A B … ……..….A
2.5		Motor supply voltage at the starter terminals (refer note 4)			Between Phases Phase & Neutral R & Y …,,,,,,,,,,,,,,,,,,,,,… ……V R & N ……,,,,,,,,,,,,,,,,,,,,,,,……V Y & B ……,,,,,,,,,,,,,,,,,,,, ……V Y & N …,,,,,,,,,,,,,,,,,,,,,,,……V B & R ……,,,,,,,,,,,,,,,,,,,, ……V B & N ,,,,,,,,,,,,,,,,,,,,,,……V
2.6		Motor running current is acceptable and (refer note 4)			R ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,…… …A Y …… ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,…A B … ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,……A
2.7		Motor current indicator (ammeter) operation (refer note 5.)			
2.8		Motor Overload trip & alarm indications operation (refer note 6)			Current Setting: ……..……..…Amps Time to Trip at 1st run: …….seconds Time to Trip at 2nd run: ……..……seconds
2.9		Motor over temperature trip and alarm indication operation (refer note 7)			
2.10		Suction safety trip and alarm indication operation (refer note 8)			No Load Current: ……..Amp Suction Safety Trip Current: ……..Amp Time Delay Set At: ……...seconds

2.11		Pump seal failure alarm indication operation (refer note 9)			
2.12		Under voltage trip and alarm indication operation (refer note 10)			
2.13		Over voltage trip and alarm indication operation (refer note 10)			

Notes:

1. Motor insulation resistance to earth shall be measured at the starter terminals. The insulation resistance shall be >10 MOhms. Record the results.

2. Suspend the pump utilising a suitable lifting device and start pump unit and stop immediately after the pump has commenced rotation.

3. Calculate the expected starting current from the parameters programmed into the softstarter (Current Limit {%} x Motor Full Load current).
   Start the pump unit and monitor the starting current. If the measured starting current does not match the calculated start current the pump unit must be stopped, identify and eliminated the cause prior to proceeding further as this could affect the correct functioning of the softstarter. The cause may be the parameters loaded into softstarter, if external CTs (or converters) are provided the CT wiring or the incorrect ratio selected or loaded into softstarter .

4. Start Pump Unit and observe that the unit started and operating within its limits and no excessive vibration or unusual noise which may need shutdown of Pump Unit. If the operation of unit is satisfactory measure and record the motor terminal voltages and running current.

   Compare the measured current reading with the panel ammeter reading and the display on the softstarter unit. The readings should be within reasonable limits (½% of measured value). If the readings differ it should be investigated and rectified. If external CTs (converters) are provided with the softstarter check the parameter settings to ensure correct ratio has been loaded and calibrate if required.

5. Ammeter reading correctly including zero reading, full load current records at about 70% full scale and marked with red line (refer calibration FAT ITP…….).

6. Raise the wet well level to sufficient depth which will allow pump unit to operate for a longer period.
   Set the motor kW rating/motor current, whichever the primary parameter required in the softstarter to 60% of the motor rating.
   Set the starting current limit to 4.5 X Full Load current to allow the motor to run up to speed.
   Observe the activation of overload indication on softstarter whilst starting and normal running at full speed. Note the higher running current (30% to 50% above FLC).
   Allow the pump to continue to run and observe the time to trip (between 3 to 5 minutes).
   Reset the parameters to operating values.

7. Assumed the protection equipment has been tested by simulation under FAT ITP…….
   Run Pump Unit and open one of the thermistor wires at the protection equipment terminal and observe the tripping of the Pump Unit, initiation of alarm indications and reset operation.

8. NOTE: The Energy Saving / Load Matching functionality of the softstarter MUST be disabled to enable proper functioning of the protection circuit.

   Run Pump Unit and close delivery valve fully. Measure and record the no-load current. Set the Suction Safety

to desired current. Run the Pump Unit again and close the delivery valve slowly and observe tripping of the
Pump Unit, initiation of alarm indications and reset operation..

9.

10. Short circuit the electrode wires from the pump at the termination points (if wires are terminated at marshalling terminals they must be shorted at that point) and observe alarm initiation and reset operation.
Note that there is no unit trip function built into the circuit.

11. For series pumping stations use another sheet and change the pump unit numbers to Motor Starters Pump Unit 3 & Motor Starter Pump Unit 4 for the down stream (dry well) pumps.

12. Record final set up of the soft starter parameters and made available as part of the site setup sheet.

22.8.15 Appendix H15– Pump unit operation – sewage pumping stations

ACCEPTANCE TEST SHEET No: **SAT- S01**

PROJECT: …….
SITE: Sewage Pumping Station SP……
TEST: Pump unit operation under normal operating conditions
TEST PURPOSE: Ensure facility operation is satisfactory to take over by SWC

Test Condition / Configuration:	Installation work including field mechanical and electrical equipment complete. The Service Provider's ITPs (including pressure testing of rising main) are completed and approved. The electrical and mechanical equipment PSAT ITPs completed and approved to proceed. **THE COMMISSIONING PLAN SHOULD SCHEDULE THE CARRYING OUT OF THIS ITP AS PART OF SWC STAFF TRAING/FAMILIARISATION SESSIONS.**
Description of Test:	Check and ensure that all work and services required to enable safe and normal operation of the facility has been completed. Check the operation of equipment for two operating cycles and flushing operation
Expected Test Results;	The equipment / facility is ready to put into service.
Measurements and Readings:	
	Test equipment Used: **Serial No:** **Calibrated Valid to** …… …… …… …… …… …… …… …… ……
Comments:	…… …… …… …… …… …… …… ……

Test Completion and Sign-off:

Re-Test required: *YES / NO*

Tests: *PASS / FAIL* Re-Test Sheet No: ……..

Testing Officer: …….	First Witness: ……	Witness: ……..
Date: ……	Date: ……	Date: ……..
Company: ……	Company: ……	SWC: ……...
Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*

Non Conformance Required: *YES / NO* NCR No.

INSPECTION AND TESTING PROCEDURE

PROJECT:…… **SITE:**……..…… **TEST: Pump unit normal operation**

REF	EQUIPMENT/ITEM		PASS	FAIL	MEASUREMENTS/COMMENTS
1	**Facility**	Configuration (refer note 1)			Refer note 1
2	**Pump Unit 1 Selector switch in "OFF" position**	Manual operation disable (refer note 2)			
2.1		Flushing operation disable (refer note 3)			
2.2		Automatic Operation disable (refer note 4)			
3	**Pump Unit 1 Selector switch in "MANUAL" position**	Manual operation functioning (refer note 5)			
3.1		Flushing operation disable (refer note 3)			
3.2		Automatic Operation disable (refer note 4)			
4	**Pump Unit 1 Selector switch in "FLUSH" position**	Manual operation disable (refer note 2)			
4.1		Flushing operation functioning (refer note 6)			
4.2		Automatic Operation disable (refer note 4)			
5	**Pump Unit 1 Selector switch in "AUTO" position**	Manual operation disable (refer note 2)			
5.1.		Flushing operation disable (refer note 3)			
5.2		Automatic Operation functioning (refer note 7)			
	Pump Unit 1 Selector switch in "OFF" position				
6	**Pump Unit 2 Selector switch in "OFF" position**	Manual operation disable (refer note 2)			
6.1		Flushing operation disable (refer note 3)			
6.2		Automatic Operation disable (refer note 4)			
7	**Pump Unit 2 Selector switch in "MANUAL" position**	Manual operation functioning (refer note 5)			

7.1		Flushing operation disable (refer note 3)			
7.2		Automatic Operation disable (refer note 4)			
8	**Pump Unit 2 Selector switch in "FLUSH" position**	Manual operation disable (refer note 2)			
8.1		Flushing operation functioning (refer note 6)			
8.2		Automatic Operation disable (refer note 4)			
9	**Pump Unit 2 Selector switch in "AUTO" position**	Manual operation disable (refer note 2)			
9.1.		Flushing operation disable (refer note 3)			
9.2		Automatic Operation functioning (refer note 7)			
10	**Pump Unit 1 & 2 Selector switches in "MANUAL" position**	Whilst Pump Unit 1 operating Pump Unit 2 disabled (refer note 8)			
10.1		Whilst Pump Unit 2 operating Pump Unit 1 disabled (refer note 8)			
11	**Pump Unit 1 & 2 Selector switches in "AUTO" position**	Pump Unit assigned for "Next to Run" start and stop at operating levels (refer note 9)			
11.1		Duty change over (refer note 10)			
11.2		Pump Unit assigned for "Next to Run" start and stop at operating levels (refer note 9)			
11.3		Stand-by unit operation (refer note 11)			
		Reset operation (refer note 12)			

Notes:

1. Cofiguration: Select pump unit starter selector switches to "OFF" position
Fill wet well to just below normal pump Cut-In level
Wet Well level measuring equipment tested and operational
Control equipment tested and operational
Wet well level filling is possible via inlet isolating valve

c) Try to operate pump unit using manual pushbutton and observe that the pump unit does not start.

d) Connect the flush pendant and try to flushing operation and observe that the pump unit does not start.

4. Raise wet well level above pump Cut-In level and observe that the pump unit does not start.

5. When started manually observe that the pump unit ramp up within set time period and the motor current
does remains within limit. If flush valve fitted observe the agitation in water and the set time period and
also no excessive vibration or noise from equipment or pipework. Allow the pump unit to run until well level drops below suction safety limits and observe tripping of the unit.

6. The pump unit should be able to be started and stopped using flush pendant similar to manual operation of pump unit. Also note that the pump unit does not trip out on suction safety.

7. Select AUTO and allow wet well level to rise gradually and observe that the pump unit start at the set operating (cut-in) level. Stop inflow and observe the pump unit stops at the set operating (cut-out) level. Note the time and gradually raise the wet well to pump operating level and observe that the pump does not start immediately. Stop inflow and observe that the pump unit will start after a time delay of about six (6) minutes.

8. Start one of the pump units and whilst it is running try to start the second pump unit and observe that the second unit does not start.

9. Raise wet well level gradually and observe the pump unit that has been selected by the control system as Unit Next Run" start and stop at the set operating levels

10. Observe that the duty, "Unit Next Run" has changed to second pump unit.

11. Raise wet well level gradually and observe the pump unit that has been selected by the control system as Unit Next Run" start op at the set operating level. Trip the unit by actuation of emergency pushbutton. Observe the second pump unit start and stop at set operating level.

12. Reset tripped pump unit and observe that the duty selection remains the same. Raise wet well level gradually and observe the pump unit that has been selected by the control system as Unit Next Run" start and stop at the set operating levels and also observe the change of duty to previously reset pump unit.

22.8.16 Appendix H16 – Completion of all essential work – for hand over of facility – sewage pumping stations

ACCEPTANCE TEST SHEET No:
PROJECT: ……
SITE: Sewage Pumping Station SP……
TEST: Completion of all essential work and delivery of documents
TEST PURPOSE: Ensure facility operation is satisfactory to take over by SWC

SAT- S02

Test Condition / Configuration:	Installation work including field mechanical and electrical equipment complete. The Service Provider's ITPs (including pressure testing of rising main) are completed and approved. The electrical and mechanical equipment PSAT ITPs & SAT ITP SAT-S01completed and approved to proceed.
Description of Test:	Check and ensure that all work and services required to enable safe and normal operation of the facility has been completed. The SWC staff is trained / familiar with the equipment / facility
Expected Test Results;	The equipment / facility is ready to be taken over by SWC.
Measurements and Readings:	
	Test equipment Used: **Serial No:** **Calibrated Valid to** **……** **……** **……..** **……** **……** **……..** …… …… ……..
Comments:	…… …… …… …… …… …… …… …… ……

Test Completion and Sign-off:

Re-Test required: *YES / NO*

Tests: *PASS / FAIL* Re-Test Sheet No: .....……..

Testing Officer: ….……	First Witness: ……	Witness: ……..
Date: ..……	Date: ……	Date: ……..
Company: …….	Company: ……	SWC: ……...
Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*

Non Conformance Required: *YES / NO* NCR No.

11.2.1 INSPECTION AND TESTING PROCEDURE

PROJECT:…… **SITE:**……..…… **TEST:**

REF	EQUIPMENT/ITEM		PASS	FAIL	MEASUREMENTS/COMMENTS
1	**Non Conformance Reports**				
1.1		Category "A" NCRs are cleared (refer note 1)			
1.2		Category "B" NCRs are cleared (refer note 2)			
1.3		Category "C" NCRs are cleared (refer note 3)			
1.4		Category "D" NCRs are cleared (refer note 4)			
2	**Operation and Maintenance Manuals**	Two sets of operation and maintenance manuals are delivered and accepted (refer note 5)			
3	**Equipment Manuals**	Two sets of complete equipment manuals are delivered and accepted (refer note 6)			
4	**Work - As - Executed drawings**	Two Complete set of (mech/elec/civil) Work - As-Executed Drawings are delivered and accepted (refer note 7)			
5	**Facility & Equipment Technical Data**	Update of MAXIMO database completed and accepted (refer Note 8)			
6	**Warranty Transfer**	Transfer of Warranties of all equipment/material/services are documented and delivered (refer note 9)			
7	**Spare Parts**	All spare parts are delivered and accepted (refer note 10)			
8	**Training**	Operational and maintenance staff training completed (refer note 11)			
9	**Energy Supply Accounts**	Energy supply accounts (Electricity/Gas) are transferred to SWC and accepted (refer note 12)			
10	**Land Ownership**	The ownership of land and easements are transferred to SWC and are registered (refer note 13)			
11	**Driveway and Crane Truck Access**	The construction of driveway is complete and suitable for crane truck access			
12	**Landscaping**	The landscaping work including security fence completed and accepted (refer note 14)			

Notes:

5. Non Conformance Report Category "A" - Major omissions/defects by the Service Provider

This category includes all safety issues, failure of PSAT or SAT which prevents successful testing of the equipment / facility and therefore unable to prove capability of safe and normal operation of the equipment / facility.
All NCRs under this category must be completed and equipment / systems successfully re-tested prior to take over of the facility.

6. Non Conformance Report Category "B" - Major omissions/defects by the SWC

This category similar to Category "D" above includes all safety issues, failure of PSAT or SAT which prevents successful testing of the equipment / facility and therefore unable to prove capability of safe and normal operation of the equipment / facility.

It is expected all NCRs under this category to be completed by SWC and equipment /systems successfully re-tested prior to take over of the facility

However, if any of the items is unable to be completed prior to Practical Completeion of the project the issue must be brought to the attention of:

k. Planning Manager Mech/Elech Maintenance, Managing Maintenance - Asset Management Division
l. SPS Program manager, Product And Asset Planning - Asset Management Division
m. Urban development Manager (for Developer activity issues only) - Customer Services Division

It is the responsibility of those listed above to develop SWC position on each issue and advice SWC Representative responsible for the take over of the facility. Timely resolution is essential to avoid Contractual issues related to Practical completion of the Project.

The equipment / facility must not be taken over without a documented plan to resolve each outstanding issue.

3. Non Conformance Report Category "C" - Minor omissions/defects by the Service Provider

This category includes work that has no impact on successful testing of the equipment / facility that is essential to prove capability of safe and normal operation of the equipment / facility.

All NCRs under this category must be listed with a written confirmation from the Service Provider of acceptable completion times and any agreed penalties of subsequent non conformances.

If the facility/equipment is part of a developer activity process All NCRs must be cleared prior to SWC take over of the equipment / facility.

4. Non Conformance Report Category "D" - Minor omissions/defects by the SWC

This category includes work that has no impact on successful testing of the equipment / facility that is essential to prove capability of safe and normal operation of the equipment / facility.

All incomplete NCRs under this category must be listed and forwarded to:

a. Planning Manager Mech/Elech Maintenance, Managing Maintenance - Asset Management Division
b. SPS Program manager, Product And Asset Planning - Asset Management Division
c. Urban development Manager (for Developer activity issues only) - Customer Services Division

It is the responsibility of those listed above to develop SWC position on each issue.

5. Operation And Maintenance Manuals

If specified in Contract as deliverables, finalised O & M manuals must be delivered to SWC prior to take over of the equipment / facility. Total of three copies shall be provided.

One copy of the O & M Manual shall be A4 size hard copy in three ring folder/s to be kept at facilty

One electronic copy shall be in PDF format (Scanned versions will not be accepted) and shall be uploaded to SWIM as per the document upload procedure for facilities.

6. Equipment Manuals

The equipment manuals shall contain the documents related only to the equipment supplied under the contract. If a manual common to a number of models or types are included the relevant model or type shall be highlighted.

One copy of the O & M Manual shall be A4 size hard copy in three ring folder/s to be kept at facility

One electronic copy shall be in PDF format (Scanned versions will not be accepted) and shall be uploaded to SWIM as per the document upload procedure for facilities.

7. Work _ As _ Constructed Drawings

The WACs shall include all related to Civil/ Mechanical, Electrical and general Arrangement drawings of the facility. All drawings become the property of SWC and therefore shall not include copyright clauses/statements referred to other organisation.

One (1) set of A3 size hard copies bound in A3 size three ring folder of SWC approved drawings must be delivered to SWC prior to take over of the equipment / facility. The drawing folder shall be kept in a secure place at the facility.

The finalised WAC drawings shall be uploaded to EDMS for review and approval. The drawings shall be approved and in EDMS prior to take over of the equipment / facility.

8. Facility & Equipment Technical Data Sheet

Upload of all relevant asset data including Contingency Plans shall be completed and accepted by SWC.

This information shall be delivered prior to take over and putting the assets into operation.

9. Warranty Transfer

The warranties associated with all equipment / materials (including spare parts) and services supplied under the Contract shall be transferred to SWC. Documentary evidence of this transfer as well as expiry dates of warranties must be provided (details shall be included in equipment manuals) prior to take over of the equipment / facility.

.

10. Spare Parts

The specified spare parts must be delivered to SWC prior to take over of the equipment / facility. The spare parts shall be in its original condition and packages and shall be clearly labelled with:

- Facility Number
- Equipment Description

- Part Number

11. Training

The training requirements shall be as per the Contract Specification and shall be completed prior to take over of equipment / facility.

Where there is no training requirement specified in the Contract an appropriate familiarisation session for the nominated SWC staff must be provided. The familiarisation session shall contain:

- Site visit and inspection of equipment and facility
- Demonstration of the operation of major equipment

12. Energy Supply Accounts

The ownership of energy supply accounts for the equipment / facility, such as electricity and gas supplies shall be transferred to SWC.
Documentary evidence of completion of all work to the satisfaction of the supply authority shall be provided prior to take over of equipment / facility.

13. Land Ownership

The ownership of land and easements shall be transferred to SWC and shall be registered accordingly in the Land Registry.
Documentary evidence shall be provided prior to take over of equipment / facility.

14. Landscaping Work

The landscaping work including security fences, drainage etc shall be completed as per the approved design. If local authority inspection and acceptance is required they shall also be completed and documentary evidence shall be provided

If the facility/equipment is part of a developer activity process all work must be completed prior to SWC take over of the equipment / facility.

22.9 Appendix J - Test procedures (water pumping stations)

22.9.1 Appendix J1 – Electrical equipment - water pumping stations

ACCEPTANCE TEST SHEET No: **PSAT- W01**

PROJECT: ……

SITE: Water Pumping Station WP……

TEST: Electrical Equipment Checks

TEST PURPOSE: Confirm equipment used, equipment condition & location, wiring and labelling

Test Condition / Configuration:	Installation work complete. The Service Providers ITPs are completed and approved. Equipment ready for energisation. The checks are to be done prior to energisation of equipment.
Description of Test:	Check and confirm installed equipment is as per the approved equipment data sheets Check and confirm mounting arrangements (location, orientation, spacing, protective covering on terminals and busbars,) are as per the approved design Check and confirm wiring (colour coding, labelling etc) are as per the approved design Check and confirm physical condition of equipment (damage, corrosion etc) is satisfactory Check and confirm all Inputs & Outputs to RTU
Expected Test Results;	IR > 10 Mohms, Phase Voltages = 415V ± 6%, Starting Current < 3.5X Full Load Current Running Current < 90% Full Load current Thermal Overload trip at Full Load current or approximately 10% above Running current which ever is the lowest. All equipment and installation work conform to specification and design All equipment is in a satisfactory condition
Measurements and Readings:	Record observations below and opposite page under relevant equipment. The observations shall not be limited to conformance to specification and designs but all aspects including safety, operational difficulties, deficiencies of equipment or installation arrangements etc which may need rectification at this facility and / or considered for possible future improvements.
	Test equipment Used: Serial No: Calibrated Valid to …… …… …… …… …… …… …… ……
Comments:	…… …… …… …… ……

Test Completion and Sign-off:

Re-Test required: *YES / NO*

Tests: *PASS / FAIL* Re-Test Sheet No: ……..

Testing Officer: ……. First Witness: …… Witness: ……..

Date: …… Date: …… Date: ……..

Company: …… Company: …… SWC: ……..

Test Status: *PASS / FAIL* Test Status: *PASS / FAIL* Test Status: *PASS / FAIL*

Non Conformance Required: *YES / NO* NCR No.

PROJECT:…… **SITE:**…….…… **TEST:** Electrical Equipment Checks

REF	EQUIPMENT		PASS	FAIL	MEASUREMENTS/COMMENTS
1	Motor Starter Pump Unit 1	As Per Specification			
1.1		Orientation & mounting location are acceptable (refer note 1)			
1.2		Wiring complete, neat and tidy (refer note 2)			
1.3		All Equipment/components and starter are labelled (refer note 3)			
1.4		No damage, corrosion or deterioration and protective coatings intact			
1.5		All fuse holders have fuses as per the design (refer note 4)			
1.6		Indication lamps are functioning			
1.7		Indicating instruments (Voltmeters, Ammeters, etc) are calibrated and functioning			
1.8		Cubicle, doors and equipment earthing is satisfactory (refer note 5)			
1.9		All busbars & terminals are either insulated, shrouded or provided with readily removable protective barriers to prevent accidental contacts.			
1.10		Starter data plate attached (refer note. 6)			
1.11		Cubicle lighting acceptable			
1.12		Check and confirm the motor starter manual selected RTU input			
1.13		Check and confirm the motor starter auto selected RTU input			
1.14		Check and confirm the motor starter off selected RTU input			
2	Motor Starter Pump Unit 2	As Per Specification			
2.1		Orientation & mounting location are acceptable (refer note 1)			
2.2		Wiring complete, neat and tidy (refer note 2)			
2.3		All Equipment/components and starter are labelled (refer note 3)			
2.4		No damage, corrosion or deterioration and protective coatings intact			
2.5		All fuse holders have fuses as per the design (refer note 4)			
2.6		Indication lamps are functioning			

2.7		Indicating instruments (Voltmeters, Ammeters, etc) are calibrated and functioning			
2.8		Cubicle, doors and equipment earthing is satisfactory (refer note 5)			
2.9		All busbars & terminals are either insulated, shrouded or provided with readily removable protective barriers to prevent accidental contacts.			
2.10		Starter data plate attached (refer note. 6)			
2.11		Cubicle lighting acceptable			
2.12		Check and confirm the motor starter manual selected RTU input			
2.13		Check and confirm the motor starter auto selected RTU input			
2.14		Check and confirm the motor starter off selected RTU input			
3	Motor Starter Pump Unit 3 (refer note 9)	As Per Specification			
3.1		Orientation & mounting location are acceptable (refer note 1)			
3.2		Wiring complete, neat and tidy (refer note 2)			
3.3		All Equipment/components and starter are labelled (refer note 3)			
3.4		No damage, corrosion or deterioration and protective coatings intact			
3.5		All fuse holders have fuses as per the design (refer note 4)			
3.6		Indication lamps are functioning			
3.7		Indicating instruments (Voltmeters, Ammeters, etc) are calibrated and functioning			
3.8		Cubicle, doors and equipment earthing is satisfactory (refer note 5)			
3.9		All busbars & terminals are either insulated, shrouded or provided with readily removable protective barriers to prevent accidental contacts.			
3.10		Starter data plate attached (refer note. 6)			
3.11		Cubicle lighting acceptable			
3.12		Check and confirm the motor starter manual selected RTU input			
3.13		Check and confirm the motor starter auto selected RTU input			
3.14		Check and confirm the motor starter off selected RTU input			

5	LV Supply Equipment	As Per Specification			
5.1		Orientation & mounting location are acceptable (refer note 1)			
5.2		Wiring complete, neat and tidy (refer note 2)			
5.3		All Equipment/components and cubicles are labelled (refer note 3)			
5.4		No damage, corrosion or deterioration and protective coatings intact			
5.5		All fuse holders have fuses as per the design (refer note 4)			
5.6		All circuit breaker protection values are set as per the design (refer note 4)			
5.7		Indication lamps functioning			
5.8		Indicating instruments (Voltmeters, Ammeters, etc) are calibrated and functioning			
5.9		Cubicle, doors and equipment earthing is satisfactory (refer note 5)			
5.10		Cubicle lighting acceptable			
5.11		Power supply phase sequence is correct (refer note 7)			
5.12		The phase failure relay on supply side of the busbar is wired & operating correctly (refer note 8) Confirm the status at relevant RTU input			
5.13		All busbars & terminals are either insulated, shrouded or provided with readily removable protective barriers to prevent accidental contacts.			
5.14		The facility main earth stake is accessible and the terminal is within confines of clearly identified surface box , the main earth cable is of suitable size (check design) and terminated correctly.			
5.15		The earth link is terminated at the facility water main as per the design.			
6	LV Distribution	As Per Specification			
6.1		Orientation & mounting location are acceptable (refer note 1)			
6.2		Wiring complete, neat and tidy (refer note 2)			
6.3		All Equipment/components and cubicles are labelled (refer note 3)			

6.4		No damage, corrosion or deterioration and protective coatings intact			
6.5		All fuse holders have fuses as per the design (refer note 4)			
6.6		Indication lamps functioning			
6.7		Indicating instruments are calibrated and functioning			
6.8		The phase failure relay on auxiliary bus is wired correctly. Confirm the status at relevant RTU input (refer Note 8)			
6.9		Cubicle, doors and equipment earthing is satisfactory (refer note 5)			
6.10		Cubicle lighting acceptable			
6.11		All busbars & terminals are either insulated, shrouded or provided with readily removable protective barriers to prevent accidental contacts.			
7	Generator Supply Connection	As Per Specification			
7.1		Orientation & mounting location are acceptable			
7.2		Terminal separation and cable access adequate			
7.3		Wiring complete, neat and tidy			
7.4		All Equipment/components and cubicles are labelled			
7.5		No damage, corrosion or deterioration and protective coatings intact			
7.6		Indication lamps functioning			
7.7		Indicating instruments are calibrated and functioning			
7.8		Cubicle, doors and equipment earthing is satisfactory			
8	Control Equipment	As Per Specification			
8.1		Orientation & mounting location are acceptable			
8.2		Wiring complete, neat and tidy			
8.3		All Equipment/components and cubicles are labelled			
8.4		No damage, corrosion or deterioration and protective coatings intact			
8.5		All fuse holders have fuses as per the design			
8.6		Indication lamps functioning			
8.7		Indicating instruments are calibrated and functioning			
8.8		Cubicle, doors and equipment earthing is satisfactory			
8.9		Cubicle lighting acceptable			

8.10		Cubicle anti condensation heaters installed			
		24V dc power supply to control equipment is functioning. Confirm the status of site PSU power failed & battery volts low RTU inputs (refer Note 10)			
9	Suction Pressure Transmitter	As Per Specification			
9.1		Orientation & mounting location are acceptable (refer note 18)			
9.5		Wiring complete, neat and tidy			
9.6		All Equipment/components labelled (refer note 3)			
9.7		No damage, corrosion or deterioration and protective coatings intact			
9.8		Calibrate pressure transmitter & Indicating instruments and are functioning Confirm the status at relevant RTU input (refer Note 11)			
10	Delivery Pressure Transmitter	As Per Specification			
10.1		Orientation & mounting location are acceptable (refer note …)			
10.5		Wiring complete, neat and tidy			
10.6		All Equipment/components labelled (refer note 10)			
10.7		No damage, corrosion or deterioration and protective coatings intact			
10.8		Calibrate pressure transmitter & Indicating instruments and are functioning. Confirm the status at relevant RTU input (refer Note 11)			
11	Machinery Well Flooded Switch	As Per Specification			
11.1		Orientation & mounting location are acceptable (refer note 9)			
11.2		Wiring complete, neat and tidy			
11.3		All Equipment/components labelled (refer note 10)			
11.4		Check the operation of the switch. Confirm the machinery well flooded alarm RTU input			
12	Sump Pump & starter	As Per Specification			
12.1		Orientation & mounting location are acceptable			

12.2		Wiring complete, neat and tidy			
12.3		All Equipment/components and cubicles are labelled			
12.4		No damage, corrosion or deterioration and protective coatings intact			
12.5		All fuse holders have fuses as per the design			
12.6		Indication lamps functioning			
12.7		Indicating instruments are calibrated and functioning			
12.8		Cubicle, doors and equipment earthing is satisfactory			
12.9		Cubicle lighting is acceptable			
12.10		Cubicle anti condensation heaters installed			
12.11		Thermal overload setting and operation are satisfactory (refer note 13) Confirm the sump pump failed alarm RTU input			
12.12		Sump pump operation satisfactory (refer note 12)			
13	Sump Pump Failed Alarm Float switch	As Per Specification			
13.1		Orientation & mounting location are acceptable			
13.2		Wiring complete, neat and tidy			
13.3		All Equipment/components labelled (refer note 10)			
13.4		Check the operation of the switch. Confirm the sump pump failed alarm RTU input			
14	Ventilation Fan 1	As Per Specification			
14.1		Orientation & mounting location are acceptable			
14.2		Wiring complete, neat and tidy			
14.3		All Equipment/components and cubicles are labelled			
14.4		No damage, corrosion or deterioration and protective coatings intact			
14.5		All fuse holders have fuses as per the design			
14.6		Indication lamps functioning			
14.7		Indicating instruments are calibrated and functioning			
14.8		Cubicle, doors and equipment earthing is satisfactory			
14.9		Cubicle lighting is acceptable			
14.10		Thermal overload setting and operation are satisfactory (refer note 13)			

		Confirm the vent fan failed alarm RTU input			
14.11		Vent fan operation satisfactory (refer note 13)			
15	Ventilation Fan 2	As Per Specification			
15.1		Orientation & mounting location are acceptable			
15.2		Wiring complete, neat and tidy			
15.3		All Equipment/components and cubicles are labelled			
15.4		No damage, corrosion or deterioration and protective coatings intact			
15.5		All fuse holders have fuses as per the design			
15.6		Indication lamps functioning			
15.7		Indicating instruments are calibrated and functioning			
15.8		Cubicle, doors and equipment earthing is satisfactory			
15.9		Cubicle lighting is acceptable			
15.10		Thermal overload setting and operation are satisfactory (refer note 13) Confirm the vent fan failed alarm RTU input			
15.11		Vent fan operation satisfactory (refer note 13)			
16	Ventilation Fan 3	As Per Specification			
16.1		Orientation & mounting location are acceptable			
16.2		Wiring complete, neat and tidy			
16.3		All Equipment/components and cubicles are labelled			
16.4		No damage, corrosion or deterioration and protective coatings intact			
16.5		All fuse holders have fuses as per the design			
16.6		Indication lamps functioning			
16.7		Indicating instruments are calibrated and functioning			
16.8		Cubicle, doors and equipment earthing is satisfactory			
16.9		Cubicle lighting is acceptable			
16.10		Thermal overload setting and operation are satisfactory (refer note 13) Confirm the vent fan failed alarm RTU input			

16.11		Vent fan operation satisfactory (refer note 13)			
17	Lighting	As Per Specification			
17.1		Orientation & mounting location are acceptable (refer note 14)			
17.2		Wiring complete, neat and tidy			
17.3		All Equipment/components labelled			
18	Site Entry Alarm	All access doors are connected to the alarm Confirm the site entry access RTU input (refer note 15)			
19	Site Facility Manned Switch	Site man/unmanned switch is installed near the main door Confirm the status RTU input			
20	Delivery Flowmeter	As Per Specification			
20.1		Orientation & mounting location are acceptable (refer note 16)			
20.2		Wiring complete, neat and tidy			
20.3		All Equipment/components labelled			
20.4		Check the calibration operation of the flowmeter (refer note 17) Confirm the flowmeter RTU input			
21	Overhead Crane	Carry out commissioning as per the AS1418.3 (refer note 19)			
22	Suction Pressure Switch Pump Unit 1	As Per Specification			
		Orientation & mounting location are acceptable (refer note 18)			
		Wiring complete, neat and tidy			
		All Equipment/components labelled (refer note 3)			
		No damage, corrosion or deterioration and protective coatings intact			
		Calibrate pressure transmitter & Indicating instruments and are functioning Confirm the status at relevant RTU input (refer Note 11)			
23	Suction Pressure Switch Pump Unit 2	As Per Specification			
		Orientation & mounting location are acceptable (refer note 18)			
		Wiring complete, neat and tidy			
		All Equipment/components labelled (refer note 3)			

		No damage, corrosion or deterioration and protective coatings intact			
		Calibrate pressure transmitter & Indicating instruments and are functioning Confirm the status at relevant RTU input (refer Note 11)			
23	Suction Pressure Switch Pump Unit 3	As Per Specification			
		Orientation & mounting location are acceptable (refer note 18)			
		Wiring complete, neat and tidy			
		All Equipment/components labelled (refer note 3)			
		No damage, corrosion or deterioration and protective coatings intact			
		Calibrate pressure transmitter & Indicating instruments and are functioning Confirm the status at relevant RTU input (refer Note 11)			

Notes:

1. The cubicle shall be installed as per the design. The access doors shall be able to be opened fully and when fully opened there shall be at least 600mm unrestricted access corridor available for emergency exit.

2. All wiring shall comply with the colour coding as per the I&C manual and shall be enclosed in suitable cable ducts. All cables entering or leaving the cubicle shall have cable glands. Door mounted equipment terminals shall be shrouded to prevent accidental contact with live terminals. All non insulated bus-busbars shall be shrouded with a suitable removable insulating barrier.

3. All equipment shall be labelled according to its function. The labels provided in open areas could be subjected to vandalism shall be engraved on either stainless or brass sheets. The labels shall be attached using SS screws or bolts. The labels in secure areas could be engraved on trafolite sheet.

4. The fuses and circuit breakers should be rated to suite the down stream circuit as well as graded appropriately with the upstream protection equipment. It may be necessary to review the design to ensure the ratings and the protection settings are suitable for the application (eg. rating & characteristics matches the starting current & time of the drive unit).

5. All doors and removable panels shall be connected to the earth bar. Removal of an earth wire (or earth bar) of an equipment shall not affect the integrity of earthing of other equipment in service.

6. Motor starter name plate shall include:

   Makers name
   Type of motor starter
   Year of manufacture
   Complying Australian Standard
   Incoming supply voltage
   Control supply voltage
   Maximum operating motor kW

Duty rating

8. The phase failure relay shall be set at 7% with a time delay of 10 sec. The time delay shall be adjusted if necessary to suite the motor start-up conditions.

9. The float switch should be mounted at the sump or as close as feasible to the lowest point on the floor to allow the alarm to be activated as early as possible.

10 Check and ensure the PSU output voltage is within specification. After allowing the batteries to fully charge check that the battery terminal voltage is within specification. Switch off mains power to the PSU and confirm the PSU power failed alarm RTU input. Remove the battery terminal and battery volts low alarm RTU input

11 Both the suction and delivery pressure transmitters shall be calibrated against a known pressure. Check that the corresponding analogue input to the RTU is satisfactory. The RTU requires a voltage 0-10V signal and therefore ensure that 250ohm resistor as specified is connected to convert current signal to voltage signal.

12. Check the operation of the sump pump by filling the sump. Whilst the pump running trip the thermal overload using test button and check tripping of the unit, alarm activation. Confirm the sump pump failed RTU input.

13. Check the start and stop operation of vent fan. Operate emergency switches and check that the unit trips out. Check that the air flow direction is as per the specification. Whilst the fan running trip the thermal overload using test button and check tripping of the unit, alarm activation. Confirm the vent fan failed RTU input.

14. The lighting fixtures should be installed where they can be accessed safely for maintenance work.

15. Switches are connected in series and close all doors and check the RTU input is ON. Open one door and check the RTU input is OFF and then close the door. Try each door one at a time.

16. The installation shall ensure that the flowmeter detector is oriented correctly (if the detector is uni-directional an identification mark for flow direction will be stamped on the detector). The detector shall be earthed as per the specification. If the detector head is buried in the ground or in a chamber, after successfully completing the commissioning the terminal box shall be sealed with recommended flexible sealant.

17. A volumetric calibration check of the flowmeter shall be made to confirm the installation. Check that the corresponding flow rate analogue input to the RTU is satisfactory. The RTU requires a voltage 0-10V signal and therefore ensure that 250ohm resistor as specified is connected to convert current signal to voltage signal.

18. All pressure transmitters and pressure switches (include suction and delivery) shall be installed as per the
standard with necessary isolation & pressure relief valves and calibration ports. The equipment shall be mounted on a separate SS board installed close to the tapping point. The mounting arrangement shall be sufficiently strong and rigid to ensure operation of valves do not move or disturb any part of the installation.The instrument pipework shall be a minimum of 12mm (1/2inch) either copper or SS.

22.9.2 Appendix J2 – Mechanical equipment - water pumping stations

ACCEPTANCE TEST SHEET No: **PSAT- W02**

PROJECT: ……

SITE: Water Pumping Station WP……..

TEST: Mechanical Equipment Checks

TEST PURPOSE: Confirm equipment used, equipment condition, location and labelling

Test Condition / Configuration:	Installation work complete. The Service Providers ITPs are completed and approved. The checks are to be done prior to pressure testing/ running pumps.
Description of Test:	Check and confirm installed equipment is as per the approved equipment data sheets Check and confirm mounting arrangements (location, orientation, spacing, operating spindles etc) are as per the approved design Check and confirm labelling are as per the approved design Check and confirm condition of equipment (damage, corrosion, paint work etc.) is satisfactory
Expected Test Results;	All equipment and installation work conform to specification and approved design. All equipment is in a satisfactory condition.
Measurements and Readings:	Record observations below and opposite page under relevant equipment. **The observations shall not be limited to conformance to specification and designs but all aspects including safety, operational difficulties, deficiencies of equipment or installation arrangements etc which may need rectification at this facility and / or considered for possible future improvements.**
Comments:	…… …… …… …… …… …… …… …… …… …… ……

Test Completion and Sign-off:

Re-Test required: *YES / NO*

Tests: *PASS / FAIL* Re-Test Sheet No: .....……..

Testing Officer:	First Witness:	Witness:
Date:	Date:	Date:
Company:	Company:	SWC:
Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*

Non Conformance Required: *YES / NO* NCR No.

PROJECT:…… **SITE:**…….…… **TEST:** Mechanical Equipment Checks

REF	EQUIPMENT		PASS	FAIL	COMMENTS
1	Pump Unit 1	As Per Specification			
1.1		Orientation & Mounting arrangement (refer note 6)			
1.2		Pump and motor alignment is competed (refer note 7)			
1.3		Coupling guards and other protective barriers are installed			
1.4		Cooling water piping work for shaft seals are installed (refer note 9)			
1.5		Drainage pipework for the shaft seals, air release etc are installed (refer note 8)			
1.6		Suction and delivery pressure measurement test points for pump tests are installed (refer note 10)			
1.7		Impeller direction of rotation			
1.8		Suction and delivery pipework vibration dampners installed			
1.9		Protective coatings satisfactory			
1.10		Tagged / label installed			
2	Pump Unit 2	As Per Specification			
2.1		Orientation & Mounting arrangement (refer note 6)			
2.2		Pump and motor alignment is competed (refer note 7)			
2.3		Coupling guards and other protective barriers are installed			
2.4		Cooling water piping work for shaft seals are installed (refer note 9)			
2.5		Drainage pipework for the shaft seals, air release etc are installed (refer note 8)			
2.6		Suction and delivery pressure measurement test points for pump tests are installed (refer note 10)			
2.7		Impeller direction of rotation			
2.8		Suction and delivery pipework vibration dampners installed			

2.9		Protective coatings satisfactory			
2.10		Tagged / label installed			
3	Pump Unit 3	As Per Specification			
3.1		Orientation & Mounting arrangement (refer note 6)			
3.2		Pump and motor alignment is competed (refer note 7)			
3.3		Coupling guards and other protective barriers are installed			
3.4		Cooling water piping work for shaft seals are installed (refer note 9)			
3.5		Drainage pipework for the shaft seals, air release etc are installed (refer note 8)			
3.6		Suction and delivery pressure measurement test points for pump tests are installed (refer note 10)			
3.7		Impeller direction of rotation			
3.8		Suction and delivery pipework vibration dampners installed			
3.9		Protective coatings satisfactory			
3.10		Tagged / label installed			
4	Pump Unit 4	Orientation & Mounting arrangement (refer note 6)			
4.1		Pump and motor alignment is competed (refer note 7)			
4.2		Coupling guards and other protective barriers are installed			
4.3		Cooling water piping work for shaft seals are installed (refer note 9)			
4.4		Drainage pipework for the shaft seals, air release etc are installed (refer note 8)			
4.5		Suction and delivery pressure measurement test points for pump tests are installed (refer note 10)			
4.6		Impeller direction of rotation			
4.7		Suction and delivery pipework vibration dampners installed			
4.8		Protective coatings satisfactory			
4.9		Tagged / label installed			

4.10					
5	Isolating Valve Pump Unit 1 Discharge	As Per Specification			
5.1		Orientation			
5.2		Installation (bolts & gaskets)			
5.3		Extension Spindle installed, supported & lined up with access opening			
5.4		Valve Open/Close freely			
5.5		Direction of Open/Close marked at the hand wheel or at the valve spindle access opening to insert valve key.			
5.6		Valve anchoring and supporting arrangement is satisfactory			
5.7		Protective coatings			
5.8		Tagged / label installed			
6	Isolating Valve Pump Unit 2 Discharge	As Per Specification			
6.1		Orientation			
6.2		Installation (bolts & gaskets)			
6.3		Extension Spindle installed, supported & lined up with access opening			
6.4		Valve Open/Close freely			
6.5		Direction of Open/Close marked at the hand wheel or at the valve spindle access opening to insert valve key.			
6.6		Valve anchoring and supporting arrangement is satisfactory			
6.7		Protective coatings			
6.8		Tagged / label installed			
7	Isolating Valve Pump Unit 3 Discharge	As Per Specification			
7.1		Orientation			
7.2		Installation (bolts & gaskets)			
7.3		Extension Spindle installed, supported & lined up with access opening			
7.4		Valve Open/Close freely			
7.5		Direction of Open/Close marked at the hand wheel or at the valve spindle			

		access opening to insert valve key.			
7.6		Valve anchoring and supporting arrangement is satisfactory			
7.7		Protective coatings			
7.8		Tagged / label installed			
8	Isolating Valve Pump Unit 4 Discharge	As Per Specification			
8.1		Orientation			
8.2		Installation (bolts & gaskets)			
8.3		Extension Spindle installed, supported & lined up with access opening			
8.4		Valve Open/Close freely			
8.5		Direction of Open/Close marked at the hand wheel or at the valve spindle access opening to insert valve key.			
8.6		Valve anchoring and supporting arrangement is satisfactory			
8.7		Protective coatings			
8.8		Tagged / label installed			
9	Reflux Valve Pump Unit 1	As Per Specification			
9.1		Orientation			
9.2		Installation (bolts tight & gaskets)			
9.3		Tapping point installed			
9.4		Valve Open/Close freely			
9.5		Valve anchoring and supporting arrangement is satisfactory			
9.6		Counter weight installation acceptable			
9.9		Protective coatings			
9.8		Tagged / label installed			
10	Reflux Valve Pump Unit 2	As Per Specification			
10.1		Orientation			
10.2		Installation (bolts tight & gaskets)			
10.3		Tapping point installed			
10.4		Valve Open/Close freely			
10.5		Valve anchoring and supporting arrangement is satisfactory			

10.6		Counter weight installation acceptable			
10.9		Protective coatings			
10.8		Tagged / label installed			
11	Reflux Valve Pump Unit 3	As Per Specification			
11.1		Orientation			
11.2		Installation (bolts tight & gaskets)			
11.3		Tapping point installed			
11.4		Valve Open/Close freely			
11.5		Valve anchoring and supporting arrangement is satisfactory			
11.6		Counter weight installation acceptable			
11.9		Protective coatings			
11.8		Tagged / label installed			
12	Reflux Valve Pump Unit 4	As Per Specification			
12.1		Orientation			
12.2		Installation (bolts tight & gaskets)			
12.3		Tapping point installed			
12.4		Valve Open/Close freely			
12.5		Valve anchoring and supporting arrangement is satisfactory			
12.6		Counter weight installation acceptable			
12.9		Protective coatings			
12.8		Tagged / label installed			
13	Pump Unit 1 Discharge Control Valve	As Per Specification			
13.1		Orientation			
13.2		Installation (bolts & gaskets)			
13.3		Actuator mounted with hand wheel, teriminal box and position indicators accessible for manual operation			
13.4		Valve manually Open/Close freely			
13.5		Direction of Open/Close marked at the hand wheel.			
13.6		Valve anchoring and supporting arrangement is satisfactory			
13.7		Protective coatings			
13.8		Tagged / label installed			

14	Pump Unit 2 Discharge Control Valve	As Per Specification			
14.1		Orientation			
14.2		Installation (bolts & gaskets)			
14.3		Actuator mounted with hand wheel, teriminal box and position indicators accessible for manual operation			
14.4		Valve manually Open/Close freely			
14.5		Direction of Open/Close marked at the hand wheel.			
14.6		Valve anchoring and supporting arrangement is satisfactory			
14.7		Protective coatings			
14.8		Tagged / label installed			
15	Pump Unit 3 Discharge Control Valve	As Per Specification			
15.1		Orientation			
15.2		Installation (bolts & gaskets)			
15.3		Actuator mounted with hand wheel, teriminal box and position indicators accessible for manual operation			
15.4		Valve manually Open/Close freely			
15.5		Direction of Open/Close marked at the hand wheel.			
15.6		Valve anchoring and supporting arrangement is satisfactory			
15.7		Protective coatings			
15.8		Tagged / label installed			
16	Pump Unit 4 Discharge Control Valve	As Per Specification			
16.1		Orientation			
16.2		Installation (bolts & gaskets)			
16.3		Actuator mounted with hand wheel, teriminal box and position indicators accessible for manual operation			

16.4		Valve manually Open/Close freely			
16.5		Direction of Open/Close marked at the hand wheel.			
16.6		Valve anchoring and supporting arrangement is satisfactory			
16.7		Protective coatings			
16.8		Tagged / label installed			
17	Isolating Valve Pump Unit 1 Suction	As Per Specification			
17.1		Orientation			
17.2		Installation (bolts & gaskets)			
17.3		Extension Spindle installed, supported & lined up with access opening			
17.4		Valve Open/Close freely			
17.5		Direction of Open/Close marked at the hand wheel or at the valve spindle access opening to insert valve key.			
17.6		Valve anchoring and supporting arrangement is satisfactory			
17.7		Protective coatings			
17.8		Tagged / label installed			
18	Isolating Valve Pump Unit 2 Suction	As Per Specification			
18.1		Orientation			
18.2		Installation (bolts & gaskets)			
18.3		Extension Spindle installed, supported & lined up with access opening			
18.4		Valve Open/Close freely			
18.5		Direction of Open/Close marked at the hand wheel or at the valve spindle access opening to insert valve key.			
18.6		Valve anchoring and supporting arrangement is satisfactory			
18.7		Protective coatings			
18.8		Tagged / label installed			

19	Isolating Valve Pump Unit 3 Suction	As Per Specification			
19.1		Orientation			
19.2		Installation (bolts & gaskets)			
19.3		Extension Spindle installed, supported & lined up with access opening			
19.4		Valve Open/Close freely			
19.5		Direction of Open/Close marked at the hand wheel or at the valve spindle access opening to insert valve key.			
19.6		Valve anchoring and supporting arrangement is satisfactory			
19.7		Protective coatings			
19.8		Tagged / label installed			
20	Isolating Valve Pump Unit 4 Suction	As Per Specification			
20.1		Orientation			
20.2		Installation (bolts & gaskets)			
20.3		Extension Spindle installed, supported & lined up with access opening			
20.4		Valve Open/Close freely			
20.5		Direction of Open/Close marked at the hand wheel or at the valve spindle access opening to insert valve key.			
20.6		Valve anchoring and supporting arrangement is satisfactory			
20.7		Protective coatings			
20.8		Tagged / label installed			
21	Isolating Valve Suction Main Scour Line	As Per Specification			
21.1		Orientation			
21.2		Installation (bolts & gaskets)			
21.3		Extension Spindle installed, supported & lined up with access opening			
21.4		Valve Open/Close freely			
21.4		Direction of Open/Close marked at the hand wheel or at the valve spindle			

		access opening to insert valve key.			
21.5		Valve anchoring and supporting arrangement is satisfactory			
21.6		Protective coatings			
21.9		Tagged / label installed			
22	Isolating Valve Discharge Main Scour Line	As Per Specification			
22.1		Orientation			
22.2		Installation (bolts & gaskets)			
22.3		Extension Spindle installed, supported & lined up with access opening			
22.4		Valve Open/Close freely			
22.4		Direction of Open/Close marked at the hand wheel or at the valve spindle access opening to insert valve key.			
22.5		Valve anchoring and supporting arrangement is satisfactory			
22.6		Protective coatings			
22.9		Tagged / label installed			
23	Isolating Valve Pump Unit 1 Suction Pipework Drainage (Refer note	As Per Specification			
23.1		Orientation			
23.2		Installation (bolts & gaskets)			
23.3		Valve Open/Close freely			
23.4		Valve anchoring and supporting arrangement is satisfactory			
23.5		Protective coatings			
23.6		Tagged / label installed			
24	Isolating Valve Pump Unit 2 Suction Pipework Drainage (Refer note	As Per Specification			
24.1		Orientation			
24.2		Installation (bolts & gaskets)			
24.3		Valve Open/Close freely			
24.4		Valve anchoring and supporting arrangement is satisfactory			
24.5		Protective coatings			

24.6		Tagged / label installed			
25	Isolating Valve Pump Unit 3 Suction Pipework Drainage (Refer note	As Per Specification			
25.1		Orientation			
25.2		Installation (bolts & gaskets)			
25.3		Valve Open/Close freely			
25.4		Valve anchoring and supporting arrangement is satisfactory			
25.5		Protective coatings			
25.6		Tagged / label installed			
26	Isolating Valve Pump Unit 4 Suction Pipework Drainage (Refer note	As Per Specification			
26.1		Orientation			
26.2		Installation (bolts & gaskets)			
26.3		Valve Open/Close freely			
26.4		Valve anchoring and supporting arrangement is satisfactory			
26.5		Protective coatings			
26.6		Tagged / label installed			
27	Isolating Valve Pump Unit 1 Discharge Pipework Drainage (Refer note	As Per Specification			
27.1		Orientation			
27.2		Installation (bolts & gaskets)			
27.3		Valve Open/Close freely			
27.4		Valve anchoring and supporting arrangement is satisfactory			
27.5		Protective coatings			
27.6		Tagged / label installed			
28	Isolating Valve Pump Unit 2 Discharge Pipework Drainage (Refer note	As Per Specification			
28.1		Orientation			
28.2		Installation (bolts & gaskets)			
28.3		Valve Open/Close freely			
28.4		Valve anchoring and supporting arrangement is satisfactory			

28.5		Protective coatings			
28.6		Tagged / label installed			
29	Isolating Valve Pump Unit 3 Discharge Pipework Drainage (Refer note	As Per Specification			
29.1		Orientation			
29.2		Installation (bolts & gaskets)			
29.3		Valve Open/Close freely			
29.4		Valve anchoring and supporting arrangement is satisfactory			
29.5		Protective coatings			
29.6		Tagged / label installed			
30	Isolating Valve Pump Unit 4 Discharge Pipework Drainage (Refer note	As Per Specification			
30.1		Orientation			
30.2		Installation (bolts & gaskets)			
30.3		Valve Open/Close freely			
30.4		Valve anchoring and supporting arrangement is satisfactory			
30.5		Protective coatings			
30.6		Tagged / label installed			
31	Suction Pipework	As per specification			
31.1		Alignment and supporting is acceptable			
31.2 31.3		Flange fixtures are as per specification			
		Protective coatings			
32	Delivery Pipework	As per specification			
32.1		Alignment and supporting is acceptable			
32.2		Flange fixtures are as per specification			
32.3		Protective coatings			
33	Platforms, Ladders & Stairways	As per the specification			
		Mounting fixtures are adequate and the footings are grouted where necessary			

		Hand rails & Kick plates are installed and are per the standard			
		Protective coatings are as the specification and satisfactory			
		Stairs and Ladders comply with the Standards (refer note 11)			
34	Cranes	As per the specification (refer note 12)			

Notes:

1. All isolating valves shall have Opening & Closing directions clearly labelled

2. Extension spindles shall if necessary be provided with intermediate support to ensure alignment with openings provided on safety grills and chamber covers.

3. Isolating valves of gas relief valves must be provided with operating capability without entering the chamber.

4. Some valves (including reflux valves) are uni-directional and orientation of valve must satisfy the marking on valve.

5.

6. The adequacy of the mounting plinth, frame and holding down bolts, nuts, washers must be as per the specification, The grouting & drainage of cavities within the mounting fame must be adequate and the drainage must be directed to the nearest drain without allowing to disperse on the floor.

7. All components (pump, motor gear boxes etc) of the pump assembly must be aligned using laser alignment methods and documentary evidence must be sited before accepting this item.

8. The drainage pipework must be directed to a collection chamber (tundish) which discharge to the nearest drain or discharge to the nearest drain. If directly discharge to the drain the discharge from each drainpipe must be able to be observed at the point of discharge. The drainage pipework must be either copper or SS, must be adequately sized (not be less than ½ inch diameter) for the expected flow, must be anchored to prevent movement and where necessary must be mechanically protected.

9. The cooling water pipework for shaft seals are installed as per the manufacturer's specifications. All pipework must be SS.

10. DN11 M/F SS plug cock must be provided at the pump suction and delivery to enable installation of pressure measurement instruments for pump performance tests. The pug cocks must be installed either directly at the pump suction and delivery or on pipework before any control valve.

11. Installation of Ladders & Stairs must comply with the latest relevant Australian Standards (As1657 – 1992)

12. The installation of the crane, inspection and testing must comply with latest relevant Australian Standards- (AS 1418)

22.9.3 Appendix J3 – Mechanical auxiliary equipment - water pumping stations

ACCEPTANCE TEST SHEET No: **PSAT- W03**

PROJECT: ……

SITE: Water Pumping Station WP……

TEST: Mechanical Auxiliary Equipment Checks

TEST PURPOSE: Confirm equipment used, equipment condition, location and labelling

Test Condition/ Configuration:	Installation work complete. The Service Providers ITPs are completed and approved.
Description of Test:	Check and confirm installed equipment is as per the approved design Check and confirm mounting arrangements (location, orientation, spacing, fixtures, locking devices, etc) are as per the approved design Check and confirm labelling are as per the approved design Check and confirm condition of equipment (damage, corrosion, paint work etc.) is satisfactory See Notes:
Expected Test Results;	All equipment and installation work conform to specification and approved design. All equipment is in a satisfactory condition.
	Test equipment Used: **Serial No:** **Calibrated Valid to** …… …… …… …… …… …… …… ……
Measurements and Readings:	Record observations below and opposite page under relevant equipment. **The observations shall not be limited to conformance to specification and designs but all aspects including safety, operational difficulties, deficiencies of equipment or installation arrangements etc which may need rectification at this facility and / or considered for possible future improvements.**
Comments:	…… …… …… …… …… …… …… ……

Test Completion and Sign-off:

Re-Test required: *YES / NO*

Tests: *PASS / FAIL* Re-Test Sheet No: ……..

Testing Officer: …….	First Witness: ……	Witness: ……
Date: …….	Date: ……	Date: ……
Company: ……	Company: ……	SWC: ……
Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*	Test Status: *PASS / FAIL*

Non Conformance Required: *YES / NO* NCR No.

PROJECT:…… **SITE:**……..…… **TEST:** Mechanical Auxiliary Equipment Checks

REF	EQUIPMENT		PASS	FAIL	COMMENTS
1	Pipework valve Chamber	As Per Specification			
1.1		Installation as per design			
1.2		Bolted connections are tight			
1.3		Dismantling joints installed correctly			
1.4		Support plinths complete			
1.4		Puddle flanges installed correctly			
1.6		Protective coatings			
1.7		Tagged / label installed			
2	Access Covers & Ladders Valve Chamber	Normal entry covers are hinged and padlockable			
2.1		Hinged safety grills installed (chamber depth >1.4m)			
2.2		Cover hinge bolts & nuts tack welded			
2.3		Cover & grill laid flat when fully open			
2.4		Opening with cover plate to gain access to valve operating extension spindle is provided, check access for all valves.			
2.4		Open/close directions are marked at the valve spindle access opening (refer note: 3)			
2.6		Step irons/ladders acceptable			
2.7		Retractable handgrip stanchions provided			
2.8		Hard landing for Gatic covers are provided.			
2.9		Gatic covers are oriented so that they can be removed safely on to the hard stand.			
3	Isolating Valve	As Per Specification			
3.1		Orientation			
3.2		Installation (bolts & gaskets)			
3.3		Extension Spindle installed, supported & lined up with access opening			
3.4		Valve Open/Close freely			

3.4		Direction of Open/Close marked at the hand wheel or at the valve spindle access opening to insert valve key.			
3.6		Valve anchoring and supporting arrangement is satisfactory			
3.7		Protective coatings			
3.8		Tagged / label installed			
4	Isolating Valve Scour	As Per Specification			
4.1		Orientation			
4.2		Installation (bolts & gaskets)			
4.3		Extension Spindle installed, supported & lined up with access opening			
4.4		Valve Open/Close freely			
4.5		Direction of Open/Close marked at the hand wheel or at the valve spindle access opening to insert valve key.			
4.6		Valve anchoring and supporting arrangement is satisfactory			
4.7		Protective coatings			
4.8		Tagged / label installed			

Notes:

13. The installation of pipework and equipment shall be as per the approved design drawings and specification. Any deviation to that during construction caused either due to workmanship, materials or deficiencies in the design shall be noted and appropriate NCRs shall be issued.

14. The valve chambers, wet well and other hinged cover plates hall have the hinge bolts and nuts tack welded to deter removal by unauthorised personnel.

15. All isolating valves shall have Opening & Closing directions clearly labelled.

16. When the access cover and safety grill are fully opened the effective opening for person entry shall be of sufficient dimensions for safe entry and rescue of personnel. The openings for equipment withdrawal shall be of sufficient dimensions and aligned with supporting structures.

23. Ownership

Role	Title
Group	Customer Delivery – Work program & Optimisation
Owner	Manager – Facility Programs
Author	Senior Commissioning Specialist – Facility Programs
BMS Number	D0001440

24. Revision Log

Version	Prepared by	Date	Approved for Use	Issue Date
1	Peter Haylock /Milton Pathirana / Rajiv Madhok	12 September 2019	Nalayini Janakan	24October 2019
2	Milton Pathirana / Rajiv Madhok / Malik Hassan / Chirag B Patel	16 August 2021	Nalayini Janakan	06 Oct 2021