Technical Specification

Wastewater Pump Stations

PS001

SOUTH GIPPSLAND WATER CORPORATION

Amendment, Distribution & Authorisation Record

Amendment Record

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A	Draft Document for Discussion	16/02/2015
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Approval Record

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DEFINITIONS

The following definitions apply in the document:

BWL	Bottom Water Level
FAT	Factory Acceptance Testing
ITP	Inspection and Test Plan
NPSH	Net Positive Suction Head
SAT	Site Acceptance Testing
SGW	South Gippsland Water Corporation
TWL	Top Water Level
WSAA	Water Services Association Australia

1 OBJECTIVE

This document describes South Gippsland Water's (SGW) requirements for the design, construction and installation of sewerage pumping stations. The document is to be used as a guide for developers and designers when undertaking pump station design and construction for any new SGW wastewater pumping station. This specification shall be read in conjunction with all relevant WSAA standards.

2 INTRODUCTION

This specification describes the requirements for wastewater pumping stations constructed within SGW's service region.

These standards are to provide consultants, contractors and customers with a standard specification outlining requirements for the type and features of a wastewater pumping station to be owned and operated by SGW.

The document covers South Gippsland Water's requirements and standards for traditional gravity scheme collection Pump Stations

The exact type and features of a new pumping station will be determined by the location, function and operational environment of the pumping station.

2.1 Cost Effective Design

Developments in pumping technologies and control systems are providing SGW and designers of sewerage systems the opportunity to evaluate and select various combinations of pump stations, rising mains and sewers to provide an optimal whole of life outcome (construction, operations, maintenance and disposal).

SGW will seek to facilitate the design and installation of sewerage pump station infrastructure which meets the following requirements;

- Provides reliable, robust and efficient sewer collection and pumping capability;
- Meet SGW's design and functionality requirements;
- Ensure that whole of life costs are considered and incorporated;
- Protect public health and the environment;

3 DESIGN CONCEPTS

3.1 Design Report

Submission of an appropriate pump station design report to SGW for review and approval is required prior to any procurement or construction activity occurring. The design report shall be a succinct report summarising key design elements of the proposed pump station including any supporting information and calculations. The design report allows SGW to assess and sign off on key design elements, assumptions and supporting information and to ensure the proposed pump station meets our requirements.

When developing the design for a new or upgraded sewerage collection pump station, there are many interrelated design criteria to consider. SGW and WSAA have developed many standards which should be used as guidelines to assess, conceive, design and deliver any new pump station asset.

Design work shall include but not be limited to the following;

- Site Considerations;
    - Geotechnical Investigation;
    - Site layout including all weather vehicle access, turning circles for larger trucks etc.;
    - Site drainage including access road drainage;
    - Flood protection considerations
    - Retaining wall and embankments
    - Local groundwater/seawater and possible intrusion
- Hydraulic Design
    - Catchment Inflows
    - Wet Well Design
    - Rising Main Design
    - Emergency flow relief provisions and locations
    - Surge assessment and mitigation
- Electrical Design
    - Electrical conduits, cable trays and power supply
    - Electrical Design
    - Control Philosophy
- Mechanical design including pump selection
- Environmental Considerations
- Planning approvals
- Water Supply, including suitable backflow protection
- Supporting Drawings
- Supporting Calculations

The design report, review and sign off is a hold point and required **prior** to moving to procurement or construction phases of development.

This hold point ensures developers, designers, constructors and SGW have common understanding of the project and reduces the potential for errors during construction and handover which can be costly and time consuming for all stakeholders involved.

3.2 Accredited Design Consultants

Sewerage pumping stations become long term critical assets and infrastructure for Water Corporations and therefore require design in accordance with strict design and construction standards. As such, SGW has a list of accredited design consultants that have demonstrated competency and experience to design a pump station in accordance with this Specification and WSAA standards. Developers and land development consultants will need to utilise one of these consultants to undertake standard SGW pump station design in accordance with SGW and WSAA requirements.

Consultant Name	Scope of Services/Competency	Contact
Kellogg Brown & Root (KBR)	Pump Station Design • Electrical • Mechanical • Civil • Project Management	Don McRae donald.mcrae@kbr.com 03 9820 5299
GHD	Pump Station Design • Electrical • Mechanical • Civil • Project Management	Darren Shrives darrenshrives@ghd.com 03 8687 8479
SMEC	Pump Station Design • Electrical • Mechanical • Civil • Project Management	Stephen Howe Stephen.Howe@smec.com +61 3 5173 0110
Jacobs	Pump Station Design • Electrical • Mechanical • Civil • Project Management	Melbourne Office (03) 8668 3000
SJ Progressive Consulting	Pump Station Design • Hydraulics/Hydrology • Manuals, Drawings • Project Management	Shelaan Mathes smathes@sjpc.com.au +61 412 021 534
Optimum Drafting	Pump Station Design • Electrical Switchboard drafting	Ray Just ray.just@optimumdrafting.com.au 03 5195 5549
Safe Group	Pump Station Design • Control Philosophy • SCADA Control • Electrical Design	Cliff Pancutt cliff.pancutt@safegroup.com.au 0439 383 540

Alternative consultants proposed by a proponent will need to be considered and approved by SGW prior to commencing any design work. Alternate consultants will need to have sufficient skills and expertise to design a pump station in accordance with the requirements of this Standard Specification and also have demonstrated industry experience in similar works.

3.3 Siting and Layout

The following factors should be considered when selecting the location of a proposed pumping station;

- Proximity to rising main discharge point should be minimised where possible. SGW can advise on discharge location;
- Depth of incoming gravity sewer will impact the depth of the wet well of pump station;
- Sites should be as unobtrusive and minimalist as possible and kept away from houses and built up areas if possible;
- Sites require available access for future operations and maintenance activities.
- The order of preference for land siting choice is as follows;
    - Reserve or Land provided with the subdivision by the developer;
    - Council Land
    - Vacant Crown Land
    - Established Crown Land

Designers need to evaluate and discuss siting options and present to SGW within the design report phase to ensure alignment to the Corporation's requirements.

3.4 Access for Maintenance Vehicles

All pumping stations require adequate access and turning area for maintenance vehicles. Therefore it will be necessary to provide or obtain suitable and adequate land. Pump stations are to be designed and landscaped in a manner that blends in with local development and surrounding environment. Access roads are discussed further in Section 3.7 and 3.10.

3.5 Emergency Flow Relief

As pumping stations are subject to mechanical or electrical failure, provision may be required to allow continuing sewage flows to be relieved from the sewer. This will be in the form of a flow relief structure and should be considered together with the pumping station when determining location and layout of the station.

An emergency flow relief or overflow structure shall not be designed or constructed without SGW approval. SGW shall assess whether an overflow structure may be required based on an assessment of whether it is essential for the proper and efficient operation of a wastewater system. To facilitate this the design report must address options, risks and mitigations as a minimum.

3.6 Flooding

Where a pumping station is sited in a flood prone area, the switchgear must in all cases be located above the 1 in 10 year flood level. For small to medium pump stations, the finished surface of the top of the wet well roof slab should be placed 0.3m minimum above a 1 in 100 year flood level. The base of the electrical switchboard cabinet shall be mounted a minimum of 0.6m above a 1 in 100 year flood level.

3.7 Easements

Where necessary, easements are to be obtained for access roads, rising mains, water service and power supply. Site layout shall be arranged to minimise the number and size of easements. If possible, underground power supply should not cross other services.

Minimum clear easement width for an access road shall be 4 metres. Minimum clear easement width for a rising main shall be 3 metres.

3.8 Fencing

Small pumping stations with only minor features do not normally require fencing, however the following guidelines should be considered;

a) Fencing of stations will be to the requirements of SGW. Areas subject to vandalism/public access may require security fencing
b) Sites adjacent to developed residential property may require fencing of the welded mesh type or timber paling type with galvanised posts
c) As fencing itself can have an adverse visual impact, developers and designers should consider how to best mitigate visual impact and blend the station in with local residents, landscape and environment.

3.9 Emergency Storage

Pump Station failure may occur for a number of reasons including failure of power supply, switchboards, pumps and rising mains. Emergency storage needs to be provided for SGW to have sufficient time to respond to such failures and mitigate the possibility of any spills or overflows. Emergency storage is considered to include both wet well storage and storage in upstream gravity sewers.

For any new or upgraded pump station, SGW requires a minimum of 8 hours storage at Average Dry Weather Flows (ADWF) for ultimate development of the subdivision.

Options to be considered for emergency storage in order of preference include;

1. Use of larger diameter wet wells;
2. Online storage in larger diameter gravity sewers
3. Use of larger diameter manholes
4. Emergency Storage Structure interconnected to system

Final emergency storage solution shall be discussed and agreed to with SGW through the design report any preceding discussions.

3.10 Operational Requirements

The following features shall be provided within any new pump station facility to ensure operability and minimise potential for wastewater spills or overflows;

- A bypass pumping connection point on the rising main
- A generator connection point to allow the connection of a portable generator.
- Access for tankering and eduction trucks

4 PUMP WELL REQUIREMENTS

4.1 General

Wet wells should be designed to have minimal "dead" space where solids can accumulate and provide smooth even flow to the pump entrances adequately accommodating all pipework and pump equipment. Flow should not travel past one pump inlet to reach another inlet.

Inlet design must ensure that swirling doesn't occur in the wet well. In addition, the incoming flow should not affect the pumps through excessive aeration. Excessive aeration and entrained air may cause pumps to lose prime or lead to build up of entrained air within the rising main.

In small stations with incoming design flows of less than 5L/sec a plain inlet without a drop tube will generally be sufficient. For pumps stations with design flows of >5L/sec a suitably designed drop tube will be required as per Figure 1 below.

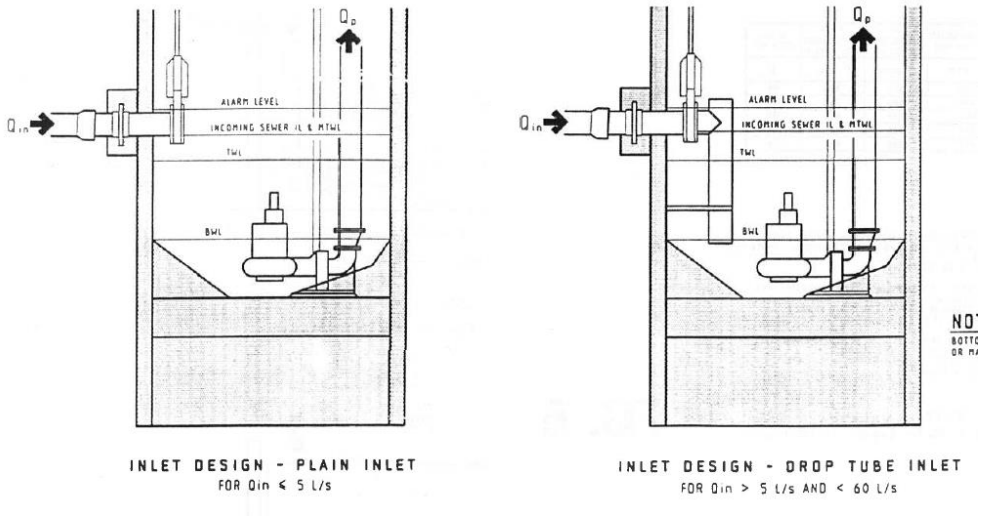

Figure 1: Wet Well Inlet Arrangements

4.2 Clearances for Pump Suction

The designer shall allow sufficient pump clearance below the proposed pump as per manufacturer's specifications. There will be minimal distance requirements below and to the sides of the pump to allow the pump to operate as per its design and achieve the required pump rates and operability. The distances are dependent on the pump and therefore are a key consideration when designing a pumping station.

4.3 Determination of Wet Well Control Levels

The well size and control levels will generally comply with the following;

a) **Bottom Water Level (BWL)** should be set as low as possible to minimise "dead" storage but ensuring sufficient submergence to prevent vortexing and to provide appropriate Net Positive Suction Head (NPSH) at the pump inlet. Designers should follow the pump manufacturer's recommendations to calculate BWL.

b) **Top Water Level (TWL)** is set such that there is sufficient volume between TWL and BWL to limit the number of pump starts per hour to an acceptable number (generally 10 per hour or as per manufacturer's recommendations). The TWL for ultimate flow condition is to be set 150mm below the invert of the incoming gravity sewer to avoid the possibility of surcharging the sewer network.

   Maximum control depth (i.e. depth between TWL and BWL) is normally limited to approximately 1000mm. Absolute maximum control depth for small to medium stations is 1500mm. Minimum control depth is 300mm.

   Control depth should be rounded to nearest multiple of 100 or 150mm to suit the level sensor probe.

c) **Maximum Top Water Level (MTWL)** is set at the invert of the incoming sewer and this level is usually only reached when the duty pump is unable to cope with incoming flow. The standby pump is switched on at this level in a duty-assist mode.
d) **Flood Alarm Level** (High Level) is set 150mm above MTWL.
e) **Switching Arrangement** for smaller sized pump stations with design flows less than 5L/sec is shown in Figure 2 below.

Figure 3 shows the required switching arrangements for medium sized pumping stations. For pump stations larger than 60L/sec SGW should be consulted on switching and control arrangements.

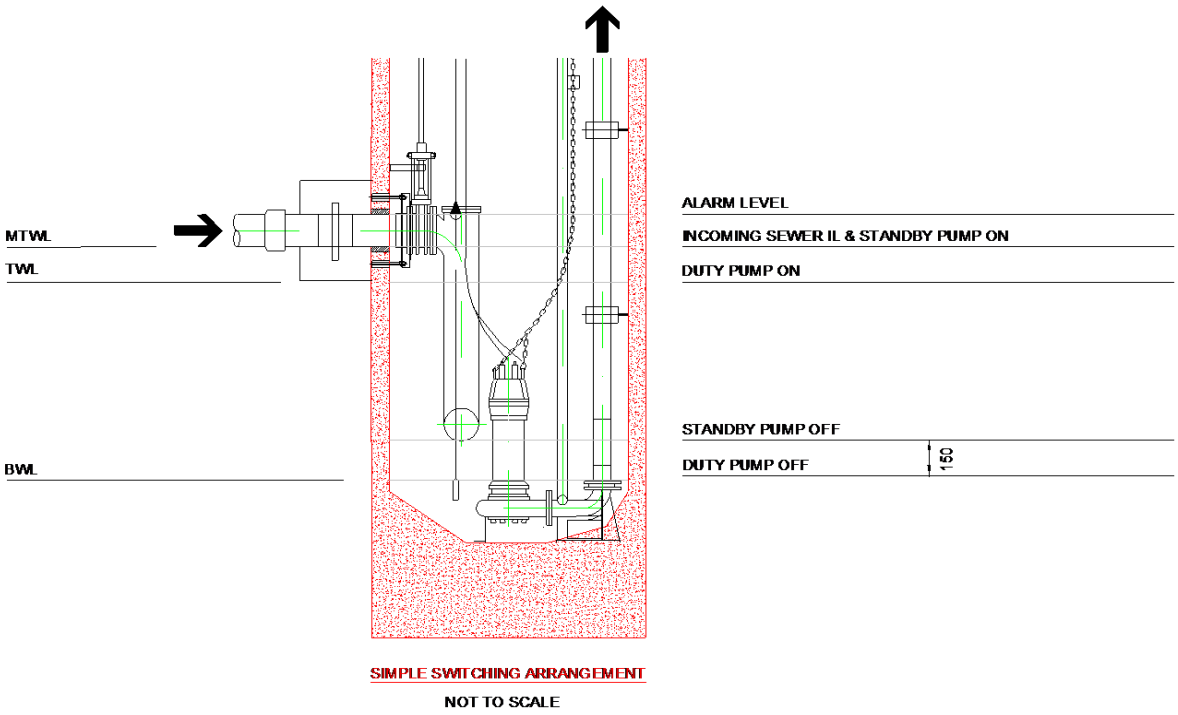

Figure 2: Small Pump Station Switching Arrangement (<5L/sec)

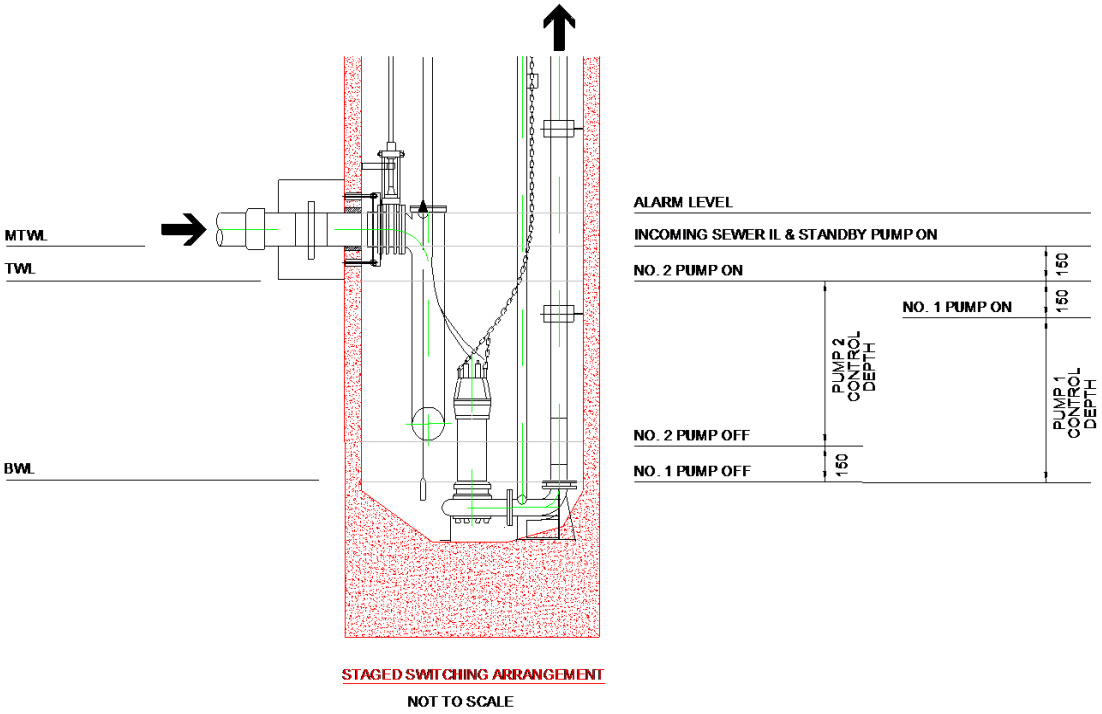

Figure 3: Medium Sized Pump Station Switching Arrangement (>5L/sec)

4.4 Catchment Inflow Calculations

The catchment flow contributions during dry and wet weather events need to be calculated to determine appropriate sizing for the following pump station elements including;

- Wet well depth and diameter;
- Pump duty points;
- Rising main diameters.

Designers will need to undertake catchment flow calculations in accordance with WSAA 02-2002. Incorporation of the following key parameters are required when calculating catchment inflows;

- Number of customer connections;
- Total area of wastewater catchment including future development of surrounding areas that are likely to drain into the proposed wastewater pumping station;
- Calculation of Average Dry Weather Flow, Peak Dry Weather Flow and Design Flow (Peak Dry Weather Flow plus groundwater and rainfall infiltration).

4.5 Pump Station Wet Well

Designers are required to size a new pump station with storage facility to contain 8 hours of average dry weather flow wastewater volume, for ultimate development of the subdivision. SGW will not accept storage facility of less than 8 hours of dry weather flow unless consulted and express permission is attained. SGW minimum wet well diameters are specified below. Consultation and approval is to be attained from SGW if designers are proposing to vary wet well diameters from the standards set out in Table 1 below.

Table 1: SGW Wet Well Diameter Requirements

Pump Station Size	Minimum Wet Well Diameter
<10kW	1.8m
10-30kW	2.2m
>30kW	>2.2m (based on design calculations

The basement of the wet well requires 45° angle slopes in the base of the wet well to ensure minimal sludge settlement occurs within the pump station as shown in Figure 4.

4.6 Groundwater and Flotation

Designers are to investigate site conditions and the presence and levels of groundwater to the proposed pump station. Groundwater and particularly saline conditions may have ramifications for the material type, depth and diameter of the wet well.

Designers are to complete full flotation calculations of the wet well to ensure that there is sufficient "dead" loading and skin friction to offset any flotation forces due to perched groundwater/flooding etc.

Soil bearing capacities are also to be investigated and calculated to ensure settlement of the pump station is not an issue.

4.7 Valve Chamber Requirements

Valve chambers should be constructed separately to the pump station wet well to accommodate differential ground settlement.

The valve chamber should house the following;

- 1 sluice valve per pump mounted horizontally in the pump set outlet pipework and arranged to enable isolation of the pump sets from the rising main;
- 1 check valve per pump mounted horizontally in the pump set outlet pipework upstream of the gate valves and arranged to prevent mass flow reversal under normal operating conditions;
- A gate valve and 100mm diameter female Bauer coupling, mounted vertically in a Tee piece in the rising main downstream of the gate valve and check valves and suitable for connecting to a flexible hose for pumping out the wet well by mobile pump/tanker during plant maintenance or failure.

The valve chamber should be provided with a gravity drain into the wet well. The discharge from the drain should be protected by a duckbill drainage valve, flap valve, disc/plug valve, penstock or other suitable device which may project sufficiently into the wet well to permit hosing off of rags etc. from ground level.

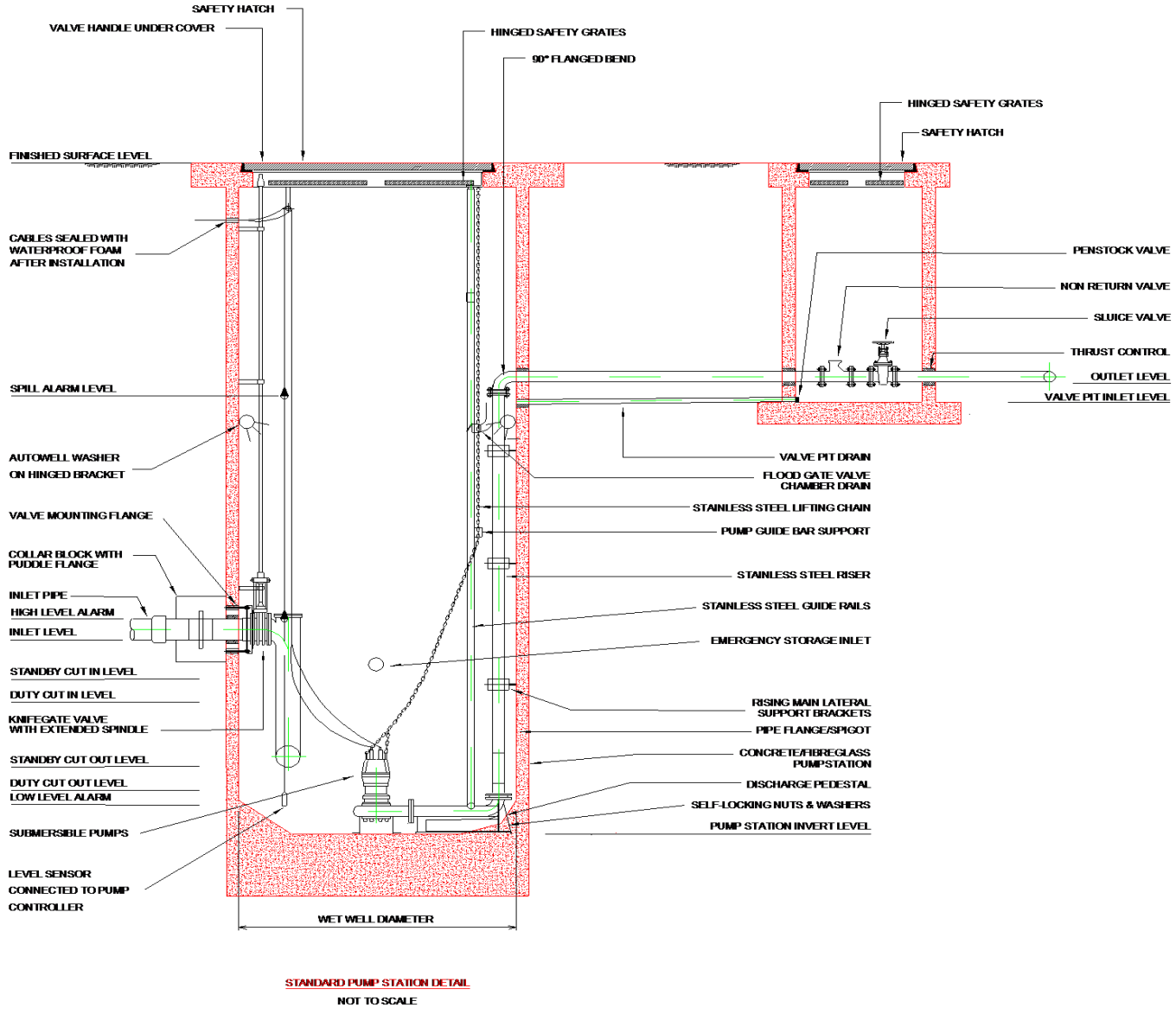

Figure 4: Typical Pump Station Layout

4.8 Fall Prevention /Well Lid Requirements

To ensure the safety of all future SGW operations and maintenance personnel when working around sewer pump stations, the Corporation has standard fall prevention system requirements.

All new and upgraded sewer pump stations shall install fall prevention systems in accordance with SGW Preferred Equipment Manufacturers List.

5 RISING MAINS

When undertaking the design of rising mains for a pump station the designer needs to consider various technical aspects including but not limited to;

- Survey and alignment of rising mains (including access and easements);
- Velocities within and diameters of rising mains;
- Detention time and septicity control in rising mains;
- Hydraulics and Water hammer in rising mains including Pipe Material Selection;
- Air Valves, Scour Points and Isolation Valves on Rising Mains;
- Pipe Material Type

5.1 Rising Main Location

Rising mains should be located and aligned to keep maximum pumping head to a minimum thereby minimising pump size and operating costs.

Where possible rising mains should be located within public thoroughfares to ensure ease of access for future maintenance and negate the need for easements.

Rising mains shall be kept as short as possible to reduce the residence time of sewage in the main therefore reducing septicity and associated problems.

Pegs or other suitable marker posts shall be placed at all proposed structures, start and end of the proposed mains and changes in direction and at 50 metre intervals. These marks shall be tied into property boundaries

5.2 Crossings

Crossings of roads and railways shall be completed in accordance with statutory body requirements. Perpendicular intersection of such assets is desirable for future access and maintenance requirements.

Rising mains should ideally be located above stormwater pipes unless unavoidable and crossing of stormwater/drainage systems should also occur at a perpendicular angle where possible.

5.3 Velocity Requirements

Rising main pipework is to be sized appropriately so that pumped velocities of wastewater are between **0.75 – 1.5m/sec** velocities. These velocities are required to provide a minimum self-cleansing velocity within the rising main and to also avoid unnecessary friction related head losses.

SGW will not accept rising main pipelines less than 80mm internal diameter unless by permission. This is to provide sufficient space for high pressure jetting equipment to be deployed to clear blockages and solids build up.

Designers are to select appropriate pipe size, class and pressure rating based on the system hydraulics, surge and rising main locations in accordance with WSAA standards.

6 PUMP SELECTION

The pump unit shall be suitable for handling unscreened wastewater, containing suspended solids, rags, fats and stringy material.

The pumps shall be selected to cater for the calculated design flows and shall be in accordance with Design Flow calculation within Section 4.4 of this document.

The pumps shall be fitted within the well that has suitable access requirements for cleaning and maintenance.

The Specification for Preferred Equipment Suppliers lists SGW's preference for submersible wastewater pumps with anti-clogging control features within the pump and control system. Any variation to these brand pumps requires approval from SGW. Energy efficiency is a key consideration in pump selection and needs to be demonstrated by the designer to ensure optimal whole of life outcomes are achieved.

Table 2: Pump Solids Handling Performance

Nominal Bore of Outlet (mm)	Diameter of solid sphere able to be passed (mm)
<=100	75
>100 but <125	90
>125 but <175	120

6.1 Pump Performance Requirements

Designers are to select a suitable wastewater pump to achieve the following operational requirements;

- Maximum operating speed of the pump sets shall be 1500rpm;
- Each pump set shall be capable of pumping the design flow;
- The pump sets shall be capable of continuous operation within the design operating envelope, including being run on a regular basis for short periods/cycles be capable of running 'on snore' to keep the wet well free from silt and debris;
- The pump sets shall have stable head versus flow characteristics against the system curve(s) (i.e. each pump set's head versus flow rate curve shall slope upwards towards closed valve with reducing flow rate in one continuous curve, with no points of inflection capable of causing hunting when considered against the system curve(s).
- The pump sets shall be selected such that the design flow rate is between 80% and 105% of the pump set's best efficiency point (BEP) flowrate.
- The pump sets shall be capable of discharging into an empty main (i.e. the pump sets shall have a non-overloading head versus flow rate characteristics).

- The pump sets shall be capable of operating against a closed valve for short periods of time.

Pump choice, wet well volumes and pump start and stop levels should be designed so that wastewater pumps starts per hour are between 1 to 8 starts per hour. This requirement aims to protect the motor and minimise unnecessary wear and deterioration as well as avoid septicity and solids accumulation.

6.2 Condition Monitoring

Detectors/switches shall be fitted to the pump sets as follows:

Table 3: Pump Condition Monitoring Requirements

Pump set size	Detector/switch
Less than 7.5 kW	Stator Temperature
7.5 kW to 22kW	Stator Temperature Seal Leakage in Stator
22kW to 55kW	Stator Temperature Seal Leakage in Stator Lower Bearing Temperature Vibration.
Above 55 kW	Stator Temperature Seal Leakage in Stator Lower Bearing Temperature Upper Bearing Temperature Vibration

6.3 Pump Impeller

The impeller shall be suitable, in all respects, for the process media being pumped.

The selection of the impeller type and size shall offer best efficiency, whilst taking into account: reliability, process media and potential for blockage. Generally SGW's preference for impellers, in order of precedence, is as follows, but it shall remain the Contractor's responsibility to ensure this selection is suitable:

Table 4: Pump Impellor Selection

Impeller Type	Process Media
Semi open *(semi shrouded)* - multiblade impeller with close fitting wear plate with integral self-cleaning groove.	Sewage Raw water Sludge Media containing solids
Closed (shrouded/channel)	Media with little or no solids, i.e. wash water Media with solids, where semi open impeller described above cannot be utilised
Screw impeller	Waste water and sludge with high rag/solids content
Vortex impeller	Grit
Semi open impeller *(semi shrouded)* with cutter	Waste water and sludge with very high rag/solids content

6.4 Pump Guide Rails

Pumps shall be located by means of a standard guide rail system complying with the following:

- Allow for the installation and removal of submersible pumps from the wet well without the need for man entry and leaning into/over the well.
- Consist of a set of stainless steel grade 316 twin circular rails of NB 50mm or 80mm, positioned on 100mm or 142mm centres respectively.
- Positioned vertically parallel to each other and have the provision to be secured onto pump stool at one end and an adjustable upper guide rail holder at surface level on the other. The upper guide rail holder shall utilise a method of locking the rails in position with adjustable expanding rubber inserts. These inserts shall allow for adjustment and locking from the top of the bracket at surface

level. On wet wells of sufficient depth the guide rails shall utilise intermediate support brackets every 3 m and be tied back to the vertical pipework or the wet well wall. The design of the brackets shall not interrupt lifting of the pump.

6.5 Pump Stool

The pump stool and bracket shall comply with the following:

- Manufactured from cast iron coated with a material suitable for full time immersion in aggressive wastewater conditions.
- Discharge connection flange to PN16.
- Provide positive location for the pump discharge to ensure a leak free connection, without the need for any non metallic seals.
- Incorporate provision for locating and fixing the guide rails.
- Include suitable fixing holes for bolting to the structure. Pumps over 55kw shall have a bed frame support, which shall be cast into the floor of the sump during well construction.

6.6 Pump Handle

Pump Handles shall comply with the following:

- Compatible with SGW's 2 tonne lifting hook.
- Handle and securing device manufactured from 316 stainless steel with suitable galvanic corrosion isolations.
- Suitable profile to ensure the nose of the lifting hook does not sit on the underside of the handle, such as 'round', 'V' or 'bevelled'.
- Suitable clearance from top of pump to underside of handle to allow easy and effective location of SGW's lifting hook.

7 ELECTRICAL AND CONTROL SPECIFICATION

Electrical, Control and SCADA standards required for a new or upgraded sewerage pumping station need to be designed, procured and deployed in accordance with SGW's existing standards including;

- Electrical switchboards used in new or upgraded sewer pump stations will be constructed to SGW's Standard SPS Electrical Designs. Modifications of drawings to be performed by Optimum Drafting to suit each site.
- All pump station electrical work, will comply with SGW's Electrical Standards Specification, STE-013.
- All equipment and components used in the electrical scope of work shall comply with SGW's Specification for Preferred Equipment Manufacturers List.
- Control Philosophy shall utilise existing SGW standards written using SGW's existing Control Philosophy Template – Sewer Pump Stations.
- SCADA platform shall be designed and deployed in accordance with existing ClearSCADA standards

All standard documents and templates can be obtained either through SGW's website http://www.sgwater.com.au/development/technical-publications/ or by contacting the relevant member of staff.

7.1 Control Strategy

The contractor responsible for setting up the site instruction, controls and automation shall document the site's control strategy within SGW's standard Control Strategy Template. The document is located on SGW's Technical Publications section on Internet site.

The control strategy document contains a summary of key site controls including;

- Pumping Station Control Overview
- Site Operation
- Start-up/Shutdown
- Alarms
- Controls & Indications

7.2 Level Control

SGW's level monitoring and control within wastewater pumping stations are to utilise hydrostatic level sensors to detect wastewater levels within the wet well.

The level detector will be mounted in a suitable location to attain clean and un-interrupted level signal of the wastewater level.

Pump controllers and SCADA equipment shall meet SGW's Preferred Equipment Manufacturer's List.

In addition to the hydrostatic level sensor, a high level float sensor is to be installed within the wet well to sense and trigger a high level alarm in the wet well. This sensor is to activate prior to any spill at the pump station and operate in the event that the level sensor fails.

7.3 Pump Station Control

The following pump stations controllers are required by SGW for all new pumping stations;

Table 5: Pump Controller Requirements

Pump Station Rating	HMI & Pump Controller
<10kW	Broderson RTU Pump Controller
>10kW and <20kw	Broderson RTU Pump Controller 2 x Danfoss Soft Starters
>20kw	Broderson RTU Pump Controller 2 x Danfoss Soft Starters or 2 x Danfoss Variable Speed Drives (SGW determination)

The use of Broderson pump controllers eliminate the need for hours run and ammeters within the panel as this information is collected and stored within these pump control units.

Pump station control operations shall be provided as follows:

- Duty/standby arrangement of pumps, with alternating rotation of pump duty.
- Automatic start of standby pump in the event of a fault with the duty pump.
- A duty/assist arrangement during high flows.
- Pump/motor fault detection, including overload & blockage.
- Pump dry-running protection.
- High Well level detection.
- Level detector failure.
- Mains phase-failure detection.

7.4 Pump Station Alarms

Pump station alarming and control shall be provided in accordance with SGW standard “Process Control Functional Description” for a standard SPS. This document has been written by our preferred SCADA vendor. The designer is to utilise these standards to ensure alignment of the proposed pump station control and alarming philosophy with SGW existing standards.

Pump stations will be fitted with an alarm dialler with connection to the local telephone network. Where the Purchaser requires Telemetry this shall be as per SGW telemetry requirements set out in SGW’s Preferred Equipment Manufacturers List.

8 INSPECTION TESTING & COMMISSIONING

8.1 General

To ensure all new pump station infrastructure meets SGW design, construction and operational requirements, commissioning and testing processes shall be undertaken. The contractor and consultant shall prepare and undertake suitable inspection, testing and commissioning processes to ensure the new pump station is built to design and functional specifications.

Inspection, Testing and Commissioning shall comprise, but not be limited to:

- Development of an Inspection & Test Plan for Pump Station
- Factory Acceptance Tests (where required)
- Dry (& Clean Water) Tests
- Site Acceptance Testing
- Performance Tests (where required)
- Submission of testing information and Asset Manual for the site.

8.2 Inspection & Test Plan

The contractor shall develop an Inspection and Test Plan (ITP) during the design process which details all tests and procedures to be completed and includes plans for Factory Acceptance Testing, Site Acceptance Testing and Performance Testing as a minimum.

Testing of new pump stations shall include but not limited to the following key areas;

- Mechanical Testing
- Electrical, Instrumentation and Power Supply Testing
- Control Testing
- Hydraulic Testing
- Access, Egress & Site Safety Assessment

The ITP shall be submitted to SGW during the design process with no testing to commence until the ITP is approved in writing by SGW.

8.3 Factory Acceptance Testing (FAT)

The Contractor shall be responsible for undertaking the following Factory Acceptance Testing Processes in line with relevant SGW specification;

Acceptance Item	Factory Acceptance Testing requirements	Standard Specification	Notification for FAT
Switchboards	Factory testing meets SGW's Electrical & Control Specification requirements	SGW Electrical Standards	5 Business Days
Package Pump Station Components	Factory acceptance testing of key package pump station components including; • Pre-fabricated Concrete Components • Isolation Valve Chamber • Ancillary package items (pumps, pedestals etc.)	Wastewater Pumping Stations Standard Specification	5 Business Days

8.4 Site Acceptance Testing (SAT)

Site Acceptance Testing (SAT) will involve the contractor, consultant and SGW representative/s undertaking all relevant site inspection and performance testing in accordance with the approved ITP.

SAT testing will comprise but not limited to;

- Visual inspection for installation, finish, and standard of work
- Inspection for consistency with designs and specifications
- Site Layout, features and access
- Access, Egress and Safety assessment
- Full electrical, control and operational assessment in accordance with electrical standards
- Full system operational to check hydraulics, capacity and overall performance
- Submission of all as-constructed and commissioning documentation in accordance with Section 9

Following completion of the SAT processes, a defects register will be populated with the contractor. This register will itemise all defects that require addressing prior to SGW acceptance and handover.

Upon completion of the defects register and signoff from SGW responsible staff, the pump station will commence a 12 month defect liability period.

9 AS-CONSTRUCTED INFORMATION

The main purposes of the preparation and submission of accurate As-Constructed Information are as follows.

- To provide a source of information consistent with ensuring the full integration of all new assets into SGW.
- To identify personnel directly involved with the design, construction and testing of the Pump Station.
- To provide a repository for documents which are or will be of significant importance to the satisfactory hand over and subsequent completion and acceptance of the pump station and which would not otherwise be readily available either now or in the future.
- To maintain a current and up to date record of the Pump Station and its equipment throughout construction, installation, commissioning, testing and optimisation up to Final Acceptance
- To maintain a record of new assets and their commissioning and testing.
- To provide a record of failures and defects that occur throughout construction, installation, commissioning, testing and the project defects liability period.
- To provide a repository for supplier's documents that are received directly on site e.g. installation instructions and calibration certificates.
- To provide a repository for documents that are generated on site e.g. commissioning & testing records.
- To maintain a record of training of SGW Staff.

The As-Constructed Asset Information Manual shall divided into three key areas as follows;

Volume 1 – Design & Construction

Volume 2 – Testing

Volume 3 – Training Record

The detailed documents, drawings, manuals and other supporting information required within each Volume of the As-Constructed Asset Information Manual is listed in Table 6 below.

Each Volume shall be divided into sections and sub-sections. The Contractor and Consultant shall collate and develop this documentation throughout the design, construction and commissioning phase to meet SGW's information requirements for the acceptance/handover phase of project.

Table 6: As-Constructed Asset Information Submission Requirements

Information Type	Document Submission	Requirements	Document Reference	Checklist (Yes/No)
DESIGN & CONSTRUCTION	**Design Documentation**	• Design Calculations • Design Report • Control Philosophy • SGW Signoff		
	As Constructed Drawings	• Site Layout Drawings • Civil Construction Drawings • Electrical Drawings • Process & Instrument Diagrams (P&ID) • I/O Schedule • Telemetry Alarm List		
	Compliance Certificates (where applicable);	• Certificate of Electrical Safety • Lifting Certificates • Calibration Certificates • Other		
	Equipment List	• List of installed equipment as per SGW Asset Creation & Disposal Form	2014/02734	
TESTING	**Inspection & Test Plan**	• Completed Inspection & Test Plan • Completed Factory Acceptance Test Documentation • Completed Site Acceptance Test Documentation		
	Operations & Maintenance Manual	• Completed and endorsed Operations & Maintenance Manual		
	SCADA	• Copy of the SCADA/PLC/RTU Code • Copy of any site settings/set points • Listing of site alarms		
TRAINING	**Training & Handover Register**	• Attendance Record Sheets • Site Handover Record Sheets		

SGW will not accept the pump station site or commence the pump station defect liability period until the contractor/consultant has completed, submitted and attained approval from SGW on submitted as-constructed information.

10 PRESSURE SEWER SYSTEMS

Land development and connections into SGW's established pressure sewer networks need to incorporate requirements contained in SGW's Pressure Sewer System Guidelines.

A copy of the Guideline can be found on our website at the following location;

http://www.sgwater.com.au/wp-content/uploads/2014/03/Pressure-Sewer-System-Guidelines.pdf

11 REFERENCES

Document Name	Author	Location
South Gippsland Water Preferred Equipment Manufacturers List	SGW	http://www.sgwater.com.au/wp-content/uploads/2014/04/Preferred-Equipment-Manufacturers-List-Information.pdf
South Gippsland Water Electrical Standard Specification	SGW	http://www.sgwater.com.au/wp-content/uploads/2014/03/STE-013-SGW-Electrical-Standards.pdf
South Gippsland Water Developer Manual	SGW	http://www.sgwater.com.au/wp-content/uploads/2014/03/Land-Development-Manual-Final.pdf
List of Accredited Design Consultants	SGW	http://www.sgwater.com.au/wp-content/uploads/2014/03/SGW-Approved-Consultants-List.pdf
Pressure Sewer Guidelines	SGW	http://www.sgwater.com.au/wp-content/uploads/2014/03/Pressure-Sewer-System-Guidelines.pdf
Standard Electrical Drawings – Pump Station	SGW	
Asset Creation & Disposal Form	SGW	TRIM 2014/02734
Control Philosophy Template – Standard Sewer Pump Station (Draft)	SGW	Supplied as required until finalised
Sewer Pump Station Inspection & Test Plan	SGW	Supplied as required until finalised

12 APPENDIX A – SITE ACCEPTANCE TEST & HANDOVER – GUIDANCE CHECKLIST

Date: ……

Site Name: ……

Address: ……

ASSET INSTALLATION CHECK

SITE	Meets PC Y/N
1. Area around wet well and switchboard/control box has been concreted.	
2. Fencing has been erected (if required).	
3. Bollards installed (if required).	
4. Lighting has been installed over wet well and switchboard	
5. Area is level, no subsidence, pipes back filled, topsoil and grassed.	
6. All weather access / driveway is suitable for truck/heavy vehicle access.	
7. SGW standard locks on all doors, covers and/or gates.	
8. Unrestricted access for removal of pumps by truck mounted crane.	
9. Reticulated water available.	
10. Backflow prevention device installed and includes meter and external tap.	
11. Backflow device caged or secure from damage.	

WET WELL	Meets PC Y/N
12. Wet well is constructed of concrete materials with a minimum diameter of 2.0m.	
13. Wet well has a minimum of 60 minutes storage volume, at peak wet weather flows, above pump start level.	
14. Wet well covers are lightweight with secondary fall arrest safety grills.	
15. Wet well covers have been fitted with SGW standard locks.	
16. Wet well covers have been installed at ground level with no tripping hazards.	
17. MultiTrode wet well washers are installed, function correctly and adequately clean entire well.	
18. All materials used are non-corrosive.	

19. Two rail mounted submersible pumps operating as duty/standby.	
20. Pumps operate at a minimum noise and vibration level (dba to be checked) in accordance with manufacturer's specification	
21. Benching of wet well to 300 mm high and 300 mm from pump and sloped upward from pump at slope of 1:2.	
22. 2 Grade 316 stainless steel pump lifting chains installed as required.	
23. 2 Grade 316 stainless steel pump guide rails installed as required.	
24. Wet well washer lifting chains Grade 316 stainless steel as required.	
25. Washer easily removable from well.	
26. Pumps are correctly labelled at top of well. The labels are to be permanent, legible and securely installed.	
27. Instruments and floats correctly labelled on cables near top of well.	

Valves	**Meets PC Y/N**
28. Incoming Isolation Valve seals when closed & open fully	
29. Pump Discharge Valves seals when closed & open fully	
30. Pump Non Return Valves seals when closed & open fully	

Duck foot Bends	**Meets PC Y/N**
31. Pumps seal okay against duck foot (no water circulation in well)	
32. Pumps secured to well floor (no vibration)	

VALVE PIT	**Meets PC Y/N**
33. All valves to be to SGW standards.	
34. All valves operational at ground level.	
35. All valves are in a separate pit no deeper than 1.5 m. unless otherwise approved.	
36. Valve pit is self-draining to wet well.	
37. Rising main scour valve discharges to the wet well.	
38. Non-return/flap valve on rising main.	
39. Isolating valve on each delivery line.	

40. Discharge pressure tapping point fitted (as required).	
41. All valves correctly labelled (as required).	

EMERGENCY STORAGE	**Meets PC Y/N**
42. Emergency storage is generally to be provided within the wet well, unless site conditions require storage to be provided externally.	
43. Overflow into emergency storage operational	
44. Non return valve operational	
45. ERS self-draining	

PERFORMANCE TESTING	**Meets PC Y/N**
46. Pump Discharge Tests in Accordance with Hydraulics/Pump Curve; a. Check Flow/Pressure Head against pump curve b. Ability for pump to snore (empty well for short duration) c. High head cut-off d. Self-Priming/Discharge to empty main	
47. All alarms and level set points checked and passed a. Pump start/stop b. Duty start/stop c. Pump set alternating d. Duty /Assist functional if larger pump station e. All alarms dial out and display on SCADA	
48. Pump Station Operates on Backup Generator (SGW to provide)	

SWITCHBOARD	Meets PC Y/N
49. The switchboard is constructed to South Gippsland Water drawings and specifications.	
50. Switchboard is installed close to the wet well with the doors opening so that the wet well can be seen when operating the pump station at the switchboard. The switchboard does not obstruct access to the wet well.	
51. The switchboard has been fitted with SGW standard locks	
52. The external surfaces of the switchboard are painted Bronze Olive or approved similar colour; the internal surfaces of the switchboard are painted gloss White (or other colour acceptable to the Corporation).	
53. There are no scratches, marks or damage to the painted surfaces.	
54. The workmanship of the switchboard and equipment is acceptable.	
55. The doors on the switchboard have stays fitted to hold them in the open position.	
56. The switchboard is to be provided with vents and forced ventilation fans to prevent build-up of heat. Vents are to be sealed with termite mesh.	
57. The switchboard is weatherproof and vermin proof (door seals are installed; doors close fully against door seals; and, insect screens and dust proofing are installed on the switchboard vents), constructed of Grade 316 stainless steel or aluminium.	
58. The switchboard is fully sealed against the entry of corrosive gases from the wet well (including the conduits between the wet well and the switchboard).	
59. There is no damage or deterioration to the switchboard or any equipment installed within the switchboard.	
60. The hot dipped galvanised plinth is securely installed and the switchboard is secured to the plinth.	
61. Separate socket outlets are provided for the alarm dialler and the RTU.	

ELECTRICAL	Meets PC Y/N
62. The underground electricity supply is connected to the switchboard.	
63. There are labels identifying the switchboard, components and functions. The labels are permanent, legible, understandable, and securely installed.	
64. The pump controller Brodersen RTU or MultiTrode - MultiSmart (with built in motor protection module and Sun Smart Display) is commissioned and tested.	
65. The radio telemetry unit (RTU) (Elpro 105U-G-ET1, 5 watt Wireless Gateway telemetry unit) is commissioned and tested.	
66. The RTU antenna pole is securely mounted to the switchboard.	
67. The alarm dialler (EDAC 400 GSM voice dialler) is commissioned and tested. Note – SGW to provide Sim Card.	

ELECTRICAL	Meets PC Y/N
68. The alarm dialler antenna is securely mounted to the switchboard.	
69. Inspection Test Plans for electrical, mechanical and control tests are performed in accordance with SGW's Sewer Pump Station Inspection and Test Plan document.	
70. The analogue level sensor is installed in the wet well (Vegawell hydrostatic) has calibration certificate and provides an accurate reading of the wet well level on the control panel & SCADA system (end to end)	
71. The High Level Alarm is from a separate float switch in the wet well and is connected directly to the alarm dialler and RTU, independent of other monitoring and control equipment, from the backup battery. A MultiTrode or Brodersen High Level Alarm (Digital Output) is connected in parallel with the float switch.	
72. The power status (alarm/fail) signal to the alarm dialler and telemetry is supplied from a 3 Phase Fail Relay (PFR). An adjustable timer for a delay of up to 4 hours is to be wired in close proximity to the Alarm Dialler for this input and clearly labelled.	
73. The Alarm Dialler Pump Fault (both pumps 1 & 2 fail) will trigger in the event that both pumps fail or become unavailable, not for individual pump faults.	
74. The mounting location of the monitoring and control equipment on the switchboard is between 1.1 and 1.6 m high and is in accordance with the design layout in the switchboard drawings.	
75. There is at least 20% free space on the back panel within the switchboard for the installation of equipment in the future.	
76. There is a generator socket and a changeover switch installed (if required). Marechal 90A DS6 3pm N & E for applications greater than 30A or Clipsal 32A N & E for Applications less than 30A	
77. Variable speed drives are installed and function correctly (if required).	
78. Pumps fitted with screened cables where VSD installed.	
79. Alarm dialler and SCADA Battery Backup installed	

AS CONSTRUCTED INFORMATIION	Meets PC Y/N
80. As constructed electrical drawings provided and a copy of the electrical drawings to be placed in the holder behind one of the switchboard doors.	
81. 2 hardcopies of pump station information are to be provided to the Foster Office. Refer Section 9 for required details.	

WARRANTY

Defects Liability/Maintenance Period of 52 weeks period on entire pump station and all items commences as of ____/____/____ (date of acceptance by SGW).

DEFECTS

The following defects were identified and require to be rectified before acceptance by South Gippsland Water:

Item No.	Defect

Handover to South Gippsland Water IS / IS NOT accepted.

Name: ……

Signed …… (On behalf of South Gippsland Water)

Date: ……/……/……