BRISBANE CITY COUNCIL
BRISBANE WATER

Australia Trade Coast Sewer Project

SP300

Serpentine Rd Pump Station

Operation & Maintenance Manual

Contract No. BW30137-02/03

Volume No. 4

BRISBANE CITY COUNCIL
Brisbane Water
Serpentine Road P/S SP300 Australia Trade Coast Sewer Project

BW30137-02/03

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4.1

Australia Trade Coast Sewer Project Contract No.: BW 30137-02/03
BW Site Based Training.
Lytton Rd P/S SP298 & Serpentine Rd P/S SP300
Attendance Record

Name	Section	Date	Signature
GARRON LUMLEY	BRIS/Water	6/10/05	
KEITH DAVIS	Bris Water	6/10/05	
ALBERT BORLAND	BRIS WATER	6.10.05	
PAUL YOUNG.	BRIS-WATER	6/10/05.	
Peter Ham	B/W	6/10/05	
LUKE LAKE	B/W	6/10/05	
JON BURTON	BW	6/10/05	
Gregg Buckley	BW	6/10/05	
JAMIE SCHEIWE	B.W.	6/10/05.	
Harish Prakash	B.W	6/10/05	
PETER SHERRIFF	B.W.	6/10/05	
IAN DIXON	BW	6/10/05	
DAVID WILLIAMS	B.W.	6/10/05	
Karen Burst	BW	6/10/05	

Australia Trade Coast Sewer Project Contract No.: BW 30137-02/03
BW Site Based Training
Lytton Rd P/S SP298 & Serpentine Rd P/S SP300
Attendance Record

Name	Section	Date	Signature
W. Collie	BW - Projects	29-09-05	[signature]
T. Power	BW Mtc Plan	29/09/05	[signature]
P. Carpendale	BW - Field	29/09/05	P. Carpendale
J Kirkland	" WS Field	29/9/05	[signature]
A. MASON	BW - FIELD	29/9/05	[signature]
G. KAMCEV	BW FIELD	29/9/05	[signature]
J. Klauss	BW NCS	29/9/05	[signature]
G. Anderson	BW NCS	29/9/05	[signature]
L Doherty	BW MTC Plan	29/9/05	[signature]
S. MORRISON	BW NCS	29/9/05	[signature]
M. McPHEAT	BW M+E	29/9/05	[signature]
N. STANTON	BW M+E	29-9-05	[signature]
L. COMBER	B.W. M+E	29-9-05	[signature]
M. Cowper	B.W M+E	29/9/05	M. Cowper
R SEHMISH	B W M+E	29-9-05	[signature]
F. SAMAL	B.W Maint. Planning	29/9/05	[signature]
L. BREWER	B.W	29/9/05	[signature]
N. GLIDDON	BW	29.9.05	[signature]
P. KAVANAGH	BW	27306	[signature]
P. Martini	BW	39292	Paul Martini
S. PEEL	BW	29266	[signature]

From: Reg McGirr
To: Colston, Jason; Harrison, Shane; Ralph, Noel
Date: Thu, Sep 22, 2005 8:23 am
Subject: Fwd: Re: AUSTRALIAN TRADE COAST SEWER PROJECT. Contract No. BW30137-02/03 On Site Pump Station Traning

Shane/Noel/Jason,

Operational personal site based training at the following two (2) pumping stations.

Lytton Road Pumping Station SP298
Serpentine Road Pumping Station SP300

When: Thursday 29 September 05 Time 9am to 11am.
Where: Lytton Road Pumping Station SP298.
Points to be covered in training:

Handout: Australia Trade Coast **Keyplan Drg** 486/5/7-TR201/001: Overview of Pumping System.

1) Reg McGirr Walkaround site:
Incoming rising mains from Prichard St SP85 & Kianwanah Rd SP49.
Bypass piping arrangement to Gibson Island WWTP.
Inlet valve pit. (Knife Valve Actuated) (Sump Pump).
Grit Collector pit. (Vactor piping).
Pump Wetwell. (Hidrostal Pumps 71Kw) (Vactor piping).
Overflow piping.
Discharge valve pit. (Pressure Transmitter) (Sump Pump).
Flow meter.
Rising Main to Serpentine Rd SP300.

Alex Witthoft - Control System Overview
Standard MITS MD3311 site with GE Fanuc PLC controlling pumps
Pump Control
PID Control
Valve Control - Failure Modes.
a - Normal Mode - Both Open
b - Surcharge Mode - Kianawah Diverted (1 Closed, 2 Open)
c - Failure Mode - (1 Open, 2 Closed).
Peer 2 Peer Comms. - Systemic Control

When: Thursday 29 September 05 Time 12 to 2pm.
Where: Serpentine Road Pumping Station SP300
Points to be covered in training:

2)Reg McGirr Walkaround site:
Incoming rising mains from Lytton Rd SP298 & Kingsford Smith Drive SP146.
Wetwell . (Knife Valves) (Overflow to rising main) (Odour pipework) (Vactor Piping).
Pump Drywell . (Hidrostal Pumps 234Kw) (Sump Pump) (Valving Actuated)(Pressure Transmitter) (Sump Pump).
Drain valve pit.
Flow meters.
Rising Mains to. (1370 Main) (1840 Main) (Isolation Valves).

Alex Witthoft - Control System Overview Standard MITS MD3311 site with GE Fanuc PLC controlling pumps
Pump Control
PID Control
Valve Control - Rising Main Selection
a - DN1370 (1 Closed, 2 Open)
b - DN1840 (1 Open, 2 Closed)

In remote - selected from Control Room, Local - Push buttons - Close before Open
Peer 2 Peer Comms. - Systemic Control.

Regards,
Reg McGirr
Commissioning Manager
Tel: 07 34033349
E-mail: Reg.McGirr@brisbane.qld.gov.au

Regards,
Reg McGirr
Commissioning Manager
Tel: 07 34033349
E-mail: Reg.McGirr@brisbane.qld.gov.au

CC: Bannink, Andrew; Witthoft, Alexander

4.2

System Integration Testing Procedure
SP 298 Lytton Rd Pump Station & SP 300 Serpentine Rd Pump Station

Australian Trade Coast Sewer Project Contract No.: BW 30137-02/03
Project/System Background

1. Lytton Rd Pump Station

1.1 Incoming sewage is pumped through two separate mains one from Pritchard Street PS (SP85) and the other from Kianawah Road PS (SP49). To reference the incoming sewage mains refer to BW drawing numbers 486/5/8-SM20/021 & 486/5/8-SM21/021.
Above section of the mains has been commissioned and Pritchard Street PS (SP85) has been redirected to Gibson Island WWTP.

1.2 Note Pritchard Street PS (SP85) and Kianawah Road PS (SP49) incoming mains into Lytton Rd PS are interconnected by valving at two section within the mains.
Reference drawing 486/5/7-WR101/022 note the three manual valves in the road at the entrance to Lytton Rd PS.
Reference drawing 486/5/7-WR101/030 note Mark No. 34 actuated valve and Mark No. 33 manual valve.
The mains are interconnected for the following reasons.
High flow conditions into Lytton Rd PS: SP49 will be diverted to Gibson Island WWTP.
Failure Condition at Lytton Rd PS: All flow is diverted to Gibson Island WWTP.
For a more detailed description of the bypass system on the incoming mains into Lytton Rd PS refer to Functional Specification page 8.

1.3 To understand the layout of Lytton Rd PS refers to drawings numbers 486/5/7-WR101/030 and 486/5/7-WR101/031.

1.4 The discharge main from Lytton Rd PS refers to drawing number 486/5/8-SM18/021.
The main has been pre-commissioned by pumping water from Lytton Rd PS to Serpentine Road PS.

1.5 Lytton Rd PS has been separately pre-commissioned on clear water using a bypass piping system.
All equipment has been tested according to the functional specification.

System Integration Testing Procedure
SP 298 Lytton Rd Pump Station & SP 300 Serpentine Rd Pump Station

2. Serpentine Road Pump Station

2.1 Incoming sewage is pumped through two separate mains one from Lytton Rd PS (drawing No. 486/5/8-SM18/021) and the other from Kingsford Smith Drive PS SP146 (drawing No. 486/5/8-SM17/021).
Note: The Kingsford Smith Drive main into Serpentine Road PS will not be part of this system integration testing.

2.2 To understand the layout of Serpentine Road PS refer to drawings numbers 486/5/7-TR201/031 and 486/5/7-TR201/030.

2.3 The discharge main from Serpentine Road PS refers to drawing number 486/5/7-TR201/021. Note one main has been pre-commissioned by pumping water from Serpentine Road PS into the DN1370 rising main.

2.4 Serpentine Road PS has been separately pre-commissioned on clear water using a bypass piping system. All equipment has been tested according to the functional specification.

System Integration Testing Procedure
SP 298 Lytton Rd Pump Station & SP 300 Serpentine Rd Pump Station

3. Responsibility Codes

The Responsibility Codes used on the ITP and Inspection Check Lists are as followers:

Name	Code	Branch/Section	Required Dates
Andrew Bannink	AB	Project Manager (BW)	Nil
Alex Witthoft	AW	Networks Control Systems (BW)	30/31 May 05 and1 June 05
Geoffrey Timms	GT	Networks Control Systems (BW)	30/31 May 05 and1 June 05
Kerry McGovern	KM	Co-Ordinator Electrical (BW)	31 May 05
Sidney Wain	SW	Hydrotechnic Operation (BW)	30/31 May 05 and1 June 05
Henri Lai	HL	Engineering Manager (BW)	Nil
Ralph Berry	RB	Contracts Manager Electrical (BW)	30/31 May 05
Peter Hague	PH	Construction Manager Electrical (BW)	30/31 May 05
Brian McMahon	BM	Construction Manager (BW)	30/31May 05 and 1 June 05
Reg McGirr	RM	Commissioning Manager (BW)	30/31 May 05 and1 June 05
George Henry	GH	Water & Sewerage Operations Manager (BW)	Nil

4. **Attachments:**

Inspection & Test Plan No.: 001 Rev.0 Separable Portion 1.
Inspection & Test Plan No.: 002 Rev.0 Separable Portion 2 Lytton Rd PS SP298.
Inspection & Test Plan No.: 003 Rev.0 Separable Portion 2 Serpentine Road PS SP300.
Inspection Check List No 1. Lytton Rd
Inspection Check List No 2. Serpentine Rd
Functional Specification Lytton Rd PS SP298.
Functional Specification Serpentine Road PS SP300.
KEYPLAN Drg No. 486/5/7-TR201/001 Overview of Pumping System.

5. Inspection & Test Plans and Inspection Check Lists

To be signed before proceeding with system integration testing

6. Staff Responsibilities

Commissioning Manager	Reg McGirr/ Henri Lai	To provide direction as required and to insure that all ITP,s and check sheets have been signed before proceeding with system integration testing
Networks Control Systems	Alex Witthoft/ Geoffrey Timms	Responsible for starting/monitoring and controlling the two pumping systems.
Electrical Manager	Ralph Berry/ Peter Hague	Ensure that all electrical equipment is ready for automatic operation.
Field Commissioning Monitoring	Sidney Wain/ Brian McMahon,	Ensure all valving is in the correct position for automatic operation. Once the pumps are started all rising mains to be bleed of air. The above in accordance with Inspection Check Lists 1 & 2. **All Air Valve Manholes to be emptied of water/sewage by 27 May 05.**

System Integration Testing Procedure
SP 298 Lytton Rd Pump Station & SP 300 Serpentine Rd Pump Station

7. System Pre-commissioning Procedure

7.1 Everyone involved in the system integration testing to assemble at Serpentine Road Pumping Station on 30 May 2005 Time 8am.

7.2 **Workplace Health & Safety**

Tool Box talk (8:15am) before the start of the System Integration Testing to cover the following:

- Everyone has a copy and understands the System Integration Testing Procedure/Documentation.
- In case of a emergency (during normal working hours) regarding the System Integration Testing:

First point of contact	**Reg McGirr :**	**Mobile Tel No. 0415293772**
Second point of contact	**Alex Witthoft :**	**Mobile Tel No. 0414236300**
Third point of contact	**Andrew Bannink :**	**Mobile Tel No. 0412178551**

- **Confined Space Entry Permit** will be the responsibility of **Sidney Wain.**
  Note: No entry into a confined space without Authority Card.

7.3 All ITP,s and Inspection Check Lists signed and handed in before automatic operation.

! Inspection & Test Plan No.: 001 Rev.0 Separable Portion 1.
! Inspection & Test Plan No.: 002 Rev.0 Separable Portion 2 Lytton Rd PS SP298.
! Inspection & Test Plan No.: 003 Rev.0 Separable Portion 2 Serpentine Road PS SP300.
! Inspection Check List No 1. Lytton Rd
! Inspection Check List No 2. Serpentine Rd

System Integration Testing Procedure
SP 298 Lytton Rd Pump Station & SP 300 Serpentine Rd Pump Station

8. System Integration Testing – Day 1 (Monday 30 May 2005 Time 8am. Everyone involved in the system integration testing to assemble at Serpentine Road Pumping Station).

8.1 Serpentine Road PS placed in Remote and Lytton Rd PS placed in Remote

! Inlet Valve to SP298 opens allowing flow from SP049 and SP085 to enter SP298 wet well.

8.2 Monitor the operation of the pump systems according to the Functional Specifications SP298 and SP300.

! Monitor the wet well at SP298 and confirm that the duty pump starts at the start level and stops at the stop level.

! Once SP298 has started to cycle, SP300 wet well will start to fill. Monitor the wet well at SP300 and confirm that the duty pump starts at the start level and stops at the stop level.

! Monitor at least 2 cycles for each wet well (each pump has started once).

8.3 Manual Inhibit of SP298 by the control room operator.

! Once the operator has inhibited both pumps at SP298, ensure that the inlet valve (vlv2) to SP298 closes, diverting all inflow to the station to Gibson Island WWTP.

! Once confirmed, un-inhibit all pumps and ensure the inlet valve (vlv2) opens.

8.4 Systemic Control – Power Failure

! Simulate complete power outage at Serpentine Rd SP300 (Both energex and generator failure) and ensure the systemic control from SP300 Serpentine Rd to SP298 Lytton Rd automatically, via peer to peer communications over the Trio radio network, "inhibits" all pumps at Lytton Rd. This will occur once the wet well level rises above the start level.

! Once the systemic control has inhibited both pumps at SP298, ensure that the inlet valve (vlv2) to SP298 closes, diverting all inflow to the station to Gibson Island WWTP.

! Once confirmed, re-establish the power at SP300, enabling both pumps to become available. Ensure that both pumps at SP298 are subsequently un-inhibited and ensure the inlet valve (vlv2) opens. This will occur once the wet well level falls below the start level.

8.5 Systemic Control – Pump Failure

! Repeat the above test, replacing a site power failure with both pump failing (by pressing Emergency Stop on both pumps).

8.6 **The pumping system will be left in the automatic position overnight.** Site Instruction will be left at both SP298 and SP300 that if there is a system failure, SP298 should immediately have both pumps inhibited (if the systemic control has not done so already) to divert all flow to Gibson Island.

8.7 **Pumping trends** of Lytton Rd PS and Serpentine Rd PS to be captured at the end of the day.

! Trends required of Wet Well Levels.

! Trends required of Delivery Flow.

! Trends required of Delivery Pressure.

! Trends required of Pump Power, Speed and Running Signal.

9. System Integration Testing – Day 2

9.1 **Day 2 Tuesday 31 May 2005 Time 8am**. Everyone involved in the system integration testing to assemble at Serpentine Road Pumping Station.

! Review of previous days work and work to be carried out.
! Signage of Inspection Check Lists and ITP,s.

9.2 **System Integration Testing** – To ensure that the introduction of SP300 does not have a detrimental impact on the operation of Eagle Farm pumping station during high flow conditions, the following flow conditions will be simulated. The performance of both Eagle Farm SP010 and Serpentine Rd SP300 compared at the different flow and pressure conditions. The readings will be provided by either Alex Witthoft (AW) stationed at SP300 or Kerry McGovern (KM) stationed at SP010 and will be recorded by Reg McGirr.

SP300 pumping into the DN1370 steel rising main. (High Pressure)

Eagle Farm at Maximum Flow – SP300 under normal operation.

! Ramp up Eagle Farm pumping to maximum flow rate down the DN1370. (4200 l/s) Time: _______
! Record the Delivery Flow and Pressure at SP300 _______ mAHD _________ l/s (AW)
! Record the Delivery Flow and Pressure at SP010 _______ mAHD _________ l/s (KM)
! Start SP300 under surcharge pumping mode (one pump at 25 Hz).
! Record the Delivery Flow and Pressure at SP300 _______ mAHD _________ l/s (AW)
! Record the Delivery Flow and Pressure at SP010 _______ mAHD _________ l/s (KM)

Eagle Farm at Maximum Flow – SP300 under high flow operation.

! Ramp up Eagle Farm pumping to maximum flow rate down the DN1370. (4200 l/s) Time: _______
! Record the Delivery Flow and Pressure at SP300 _______ mAHD _________ l/s (AW)
! Record the Delivery Flow and Pressure at SP010 _______ mAHD _________ l/s (KM)
! Start SP300 under surcharge pumping mode (one pump at 50 Hz).
! Record the Delivery Flow and Pressure at SP300 _______ mAHD _________ l/s (AW)
! Record the Delivery Flow and Pressure at SP010 _______ mAHD _________ l/s (KM)

Eagle Farm at Maximum Flow – SP300 under surcharge pumping mode.

! Ramp up Eagle Farm pumping to maximum flow rate down the DN1370. (4200 l/s) Time: _______
! Record the Delivery Flow and Pressure at SP300 _______ mAHD _________ l/s (AW)
! Record the Delivery Flow and Pressure at SP010 _______ mAHD _________ l/s (KM)
! Start SP300 under surcharge pumping mode (both pumps at 50 Hz).
! Record the Delivery Flow and Pressure at SP300 _______ mAHD _________ l/s (AW)
! Record the Delivery Flow and Pressure at SP010 _______ mAHD _________ l/s (KM)

System Integration Testing Procedure
SP 298 Lytton Rd Pump Station & SP 300 Serpentine Rd Pump Station

SP300 pumping into the DN1840 concrete rising main. (Low Pressure)

Eagle Farm at Maximum Flow – SP300 under normal operation.

! Ramp up Eagle Farm pumping to maximum flow rate down the DN1840. (4200 l/s) Time: _______
! Record the Delivery Flow and Pressure at SP300 _______ mAHD ________ l/s (AW)
! Record the Delivery Flow and Pressure at SP010 _______ mAHD ________ l/s (KM)
! Start SP300 under surcharge pumping mode (one pump at 25 Hz).
! Record the Delivery Flow and Pressure at SP300 _______ mAHD ________ l/s (AW)
! Record the Delivery Flow and Pressure at SP010 _______ mAHD ________ l/s (KM)

Eagle Farm at Maximum Flow – SP300 under surcharge pumping mode.

! Ramp up Eagle Farm pumping to maximum flow rate down the DN1840. (4200 l/s) Time: _______
! Record the Delivery Flow and Pressure at SP300 _______ mAHD ________ l/s (AW)
! Record the Delivery Flow and Pressure at SP010 _______ mAHD ________ l/s (KM)
! Start SP300 under surcharge pumping mode (one pump at 33 Hz).
! Record the Delivery Flow and Pressure at SP300 _______ mAHD ________ l/s (AW)
! Record the Delivery Flow and Pressure at SP010 _______ mAHD ________ l/s (KM)

9.3 **All items on Inspection Check Lists 1 & 2 to be re-checked dated and signed.**

! Inspection & Test Plan No.: 001 Rev.0 Separable Portion 1.
! Inspection & Test Plan No.: 002 Rev.0 Separable Portion 2 Lytton Rd PS SP298.
! Inspection & Test Plan No.: 003 Rev.0 Separable Portion 2 Serpentine Road PS SP300.
! Inspection Check List No 1. Lytton Rd
! Inspection Check List No 2. Serpentine Rd

9.4 **Pumping trends** of Lytton Rd PS and Serpentine Rd PS to be captured at the end of the day.

! Trends required of Wet Well Levels.
! Trends required of Delivery Flow.
! Trends required of Delivery Pressure.
! Trends required of Pump Power, Speed and Running Signal.

9.5 **The pumping system will be left in the automatic position overnight.** Site Instruction will be left at both SP298 and SP300 that if there is a system failure, SP298 should immediately have both pumps inhibited (if the systemic control has not done so already) to divert all flow to Gibson Island.

9.6 If required day three system testing.

9.7 System Integration Testing Report – A System Integration Testing report will be produced and distributed to all parties detailed in the responsibilities section (6) for review and acceptance.

Brisbane Water

INSPECTION & TEST PLAN

PAGE 1
Date 26/04/05
ITP: 001 Rev. 0

CUSTOMER/PROJECT: Australia Trade Coast Sewer Project (Separable Portion 1)
EQUIPMENT: Sewer RM Pritchard St PS to Lytton Rd PS.
Sewer RM from connection to Kiawanah Rd PS SP49 RM at Lindum Rd to Lytton Rd PS.

ATCSP CONTRACT REF: BW30137-02/03

ITEM NO: 1 Drawing no: 486/5/8-SM20/021 & 486/5/8-SM21/021 S/C: LEIGHTON
COMPONENT: Mechanical System Commissioning
MATERIAL:

KEY TO INSPECTION ACTIVITIES
H-Hold Point W- Witness S-Surveillance R-Review N-Notification DR-Document Reqd

NO	PROCESS DESCRIPTION/ACTIVITY	LOC	PROCEDURE	ACCEPTANCE STANDARD	Certifying Verifying Document	Inspection: LEIGHTON Key	LEIGHTON Date	LEIGHTON Sgn	BW Key	BW Date	BW Sgn	Code
1	Review of Installation and Test Documentation for: Sewer Rising Main Pritchard Street Pumping Station to Lytton Road No.4 Pump Station. Drg No: 486/5/8-SM20/021	E	Visual Inspection	Contract Document BW30137-02/03	Leighton ITP Check Sheets/Records Sheets/Test Procedure/O&MM	DR			R	18/5/05	B.J. Mc	BM
2	Review of As Constructed Drawings for: Sewer Rising Main Pritchard Street Pumping Station to Lytton Road No.4 Pump Station. Drg No: 486/5/8-SM20/021	E	Visual Inspection	Contract Document BW30137-02/03	BW/Leighton/Cardon MBK Drawings	DR			R	18/5/05	B.J. Mc	BM
3	Review of Installation and Test Documentation for: Sewer Rising Main From Connection To Kiawanah Road P/S SP49 Rising Main at Lindum Road To Lytton Road No.4 Pump Station. Drg No: 486/5/8-SM21/021	E	Visual Inspection	Contract Document BW30137-02/04	Leighton ITP Check Sheets/Records Sheets/Test Procedure/O&MM	DR			R	18/5/05	B.J. Mc	BM
4	Review of As Constructed Drawings for: Sewer Rising Main From Connection To Kiawanah Road P/S SP49 Rising Main at Lindum Road To Lytton Road No.4 Pump Station. Drg No: 486/5/8-SM21/022	E	Visual Inspection	Contract Document BW30137-02/05	BW/Leighton/Cardon MBK Drawings	DR			R	18/5/05	B.J. Mc	BM
5	Commissioning of Rising Main by rediverting Pritchard Street PS through to Lindum Road/Gibson Island WWTP.	E	Visual Inspection	Contract Document BW30137-02/03	BW Report Document				DR	18/5/05	[illegible]	RM
6	Networks Operation Final Acceptance		Visual Inspection	Contract Document BW30137-02/04	BW Procedure				DR			GH

ORIGINAL ISSUE	RELEASED BY: ATCSP	KEY TO LOCATION ACTIVITIES	BRISBANE WATER
PREPARED BY: Reg McGirr APPROVED BY: Andrew Bannink		A-ATCSP S-Supplier C-Sub Contractor E-Site	T.C. Burnie Building 315 Brunswick St. Mall, Fortitude Valley, Brisbane Qld 4000

Brisbane Water

INSPECTION & TEST PLAN

PAGE: 1
Date 20/04/05
ITP: 002 Rev. 0

CUSTOMER/PROJECT: Australia Trade Coast Sewer Project (Separable Portion 2 SP298 Lytton Rd Pump Station)
EQUIPMENT: Pumping Station Site System Commissioning

ATCSP CONTRACT REF: BW30137-02/03

ITEM NO: 1 Drawing no: 486/5/7-WR101/031 S/C: LEIGHTON
COMPONENT: Mechanical/Electrical System Commissioning
MATERIAL:

KEY TO INSPECTION ACTIVITIES H-Hold Point W- Witness S-Surveillance R-Review N-Notification DR-Document Reqd

NO	PROCESS DESCRIPTION/ACTIVITY	LOC	PROCEDURE	ACCEPTANCE STANDARD	Certifying Verifying Document	Inspection: LEIGHTON Key	LEIGHTON Date	LEIGHTON Sgn	BW Key	BW Date	BW Sgn	BW Code
1	Site Induction/Confined Space Training	E	Visual Inspection	Contract Document BW30137-02/03	BW PROCEDURE Doc Id: 002728				DR/R			
2	Review Factory Inspection & Test Documentation Pump	E	Visual Inspection	Contract Document BW30137-02/03	Leighton ITP Check Sheets/Records Sheets/Test Procedure/O&MM	DR			R	25/5/05	[signature]	HL
3	Review Factory Inspection & Test Documentation Switchboards	E	Visual Inspection	Contract Document BW30137-02/03	Leighton ITP Check Sheets/Records Sheets/Test Procedure & BW Check SheetsO&MM	DR			R	8/6/05	[signature]	AW/RB
4	Review Factory Inspection & Test Documentation Diesel Generating Unit	E	Visual Inspection	Contract Document BW30137-02/03	Leighton ITP Check Sheets/Records Sheets/Test Procedure & BW Check Sheets O&MM	DR			R	13/5/05	[signature]	RB
5	Review Mechanical Installation Documentation	E	Visual Inspection	Contract Document BW30137-02/03	Leighton ITP Check Sheets/Records Sheets O&MM	DR			R	18/5/05	[signature]	RM
6	Review Electrical Installation Documentation	E	Visual Inspection	Contract Document BW30137-02/03	Leighton ITP Check Sheets/Records Sheets O&MM	DR			R	18/5/05	[signature]	RB
7	Review Functional Specification	E	Visual Inspection	Contract Document BW30137-02/04	LEIGHTON/BW	DR			R DR			AW
8	Review of Pre-Commissioning Test Documentation	E	Visual Inspection	Contract Document BW30137-02/03	Leighton ITP & Check Sheets/Records Sheets/Test Procedure & BW Check Sheets O&MM	DR			R	25/5/05 19/5/05	[signature] [signature]	HL/RM
9	Review of As Constructed Drawings or Marked-up As Installed Drawings: Civil/Mechanical and Electrical	E	Visual Inspection	Contract Document BW30137-02/04	BW/Leighton/PB/Cardno MBK Drawings	DR			R	18/5/05	[signature]	RB/ BM/ RM/ AW
10	Review Operating & Maintenance Manuals	E	Visual Inspection	Contract Document BW30137-02/04	Leighton ITP & Check Sheets/Records Sheets/Test Procedure	DR			R	3/4/05	[signature]	RM
11	Fill Grit Collector Pit & Pump with water up to the overflow pipe. Record level of water in both pits and hold for 7 days then record level level of water in both pits.	E	Visual Inspection	Contract Document BW30137-02/04	Leighton ITP & Check Sheets/Records Sheets/Test Procedure & BW Check Sheets O&MM	DR			R	18/5/05	B.J. McMah.	BM
12	Review of System Integration Testing Procedure	E	Visual Inspection	Contract Document BW30137-02/03	BW ITP & Check Sheets/Records Sheets/Test Procedure O&MM				R DR		[signature] 17/08/05	AB/HL/AW
13	Clearance for use of incoming & discharge sewage mains	E	Visual Inspection	BW	BW PROCEDURE					30/5/05	BJ. McMahon	BM/SW
14	System Integration Testing	E	Visual Inspection	BW	BW PROCEDURE System Integration Testing Report				R DR			AW
15	Networks Operation Final Acceptance		Visual Inspection	Contract Document BW30137-02/03	BW PROCEDURE				R DR			GH

ORIGINAL ISSUE
PREPARED BY: Reg McGirr
APPROVED BY: Andrew Barwink

RELEASED BY: ATCSP

KEY TO LOCATION ACTIVITIES
A-ATCSP S-Supplier C-Sub Contractor E-Site

BRISBANE WATER
T.C. Burnie Building 315 Brunswick St. Mall, Fortitude Valley, Brisbane Qld 4000

Brisbane Water

INSPECTION & TEST PLAN

PAGE: 1
Date 26/04/05
ITP: 003 Rev. 0

CUSTOMER/PROJECT: Australia Trade Coast Sewer Project (Separable Portion 2 SP300 Serpentine Rd Pump Station)
EQUIPMENT: Pumping Station Site System Commissioning

ATCSP CONTRACT REF: BW30137-02/03

ITEM NO: 1 Drawing no: 486/5/7-TR201/030 S/C: LEIGHTON
COMPONENT: Mechanical/Electrical System Commissioning
MATERIAL:

KEY TO INSPECTION ACTIVITIES
H-Hold Point W- Witness S-Surveillance R-Review N-Notification DR-Document Reqd

NO	PROCESS DESCRIPTION/ACTIVITY	LOC	PROCEDURE	ACCEPTANCE STANDARD	Certifying Verifying Document	Inspection: LEIGHTON Key	Inspection: LEIGHTON Date	Inspection: LEIGHTON Sgn	Inspection: BW Key	Inspection: BW Date	Inspection: BW Sgn	Code
1	Site Induction/Confined Space Training	E	Visual Inspection	Contract Document BW30137-02/03	BW PROCEDURE Doc Id: 002728				DR/R			
2	Review Factory Inspection & Test Documentation Pump	E	Visual Inspection	Contract Document BW30137-02/03	Leighton ITP Check Sheets/Records Sheets/Test Procedure/O&MM	DR			R	27/7/05	[illegible]	HL
3	Review Factory Inspection & Test Documentation Switchboards	E	Visual Inspection	Contract Document BW30137-02/03	Leighton ITP Check Sheets/Records Sheets/Test Procedure & BW Check SheetsO&MM	DR			R	8/6/05	[illegible]	AW/RB
4	Review Factory Inspection & Test Documentation Diesel Generating Unit	E	Visual Inspection	Contract Document BW30137-02/03	Leighton ITP Check Sheets/Records Sheets/Test Procedure & BW Check Sheets O&MM	DR			R	18/5/05	[illegible]	RB
5	Review Mechanical Installation Documentation	E	Visual Inspection	Contract Document BW30137-02/03	Leighton ITP Check Sheets/Records Sheets O&MM	DR			R	18/5/05	[illegible]	RM
6	Review Electrical Installation Documentation	E	Visual Inspection	Contract Document BW30137-02/03	Leighton ITP Check Sheets/Records Sheets O&MM	DR			R	18/5/05	[illegible]	RB
7	Review Functional Specification	E	Visual Inspection	Contract Document BW30137-02/04	LEIGHTON/BW	DR			R DR			AW
8	Review of Pre-Commissioning Test Documentation	E	Visual Inspection	Contract Document BW30137-02/03	Leighton ITP & Check Sheets/Records Sheets/Test Procedure & BW Check Sheets O&MM	DR			R	27/7/05 19/5/05	[illegible] [illegible]	HL/RM
9	Review of As Constructed Drawings or Marked-up As Installed Drawings: Civil/Mechanical and Electrical	E	Visual Inspection	Contract Document BW30137-02/04	BW/Leighton/Cardno MBK Drawings	DR			R	18/5/05	[illegible]	RB/ BM/ RM/ AW
10	Review Operating & Maintenance Manuals	E	Visual Inspection	Contract Document BW30137-02/04	Leighton ITP & Check Sheets/Records Sheets/Test Procedure	DR			R	3/11/05	[illegible]	RM
11	Fill Grit Collector Pit & Pump with water up to the overflow pipe. Record level of water in both pits and hold for 7 days then record level level of water in both pits.	E	Visual Inspection	Contract Document BW30137-02/04	Leighton ITP & Check Sheets/Records Sheets/Test Procedure & BW Check Sheets O&MM	DR			R	18/5/05	B.J. McM.	BM
12	Review of Site System Integration Testing Procedure	E	Visual Inspection	Contract Document BW30137-02/03	BW ITP & Check Sheets/Records Sheets/Test Procedure O&MM				R DR		[illegible] 17/05/05	AB/HL/AW
13	Clearance for use of incoming & discharge sewage mains	E	Visual Inspection	BW	BW PROCEDURE					30/5/05	B.J. McMah	BM/SW
14	System Integration Testing	E	Visual Inspection	BW	BW PROCEDURE System Integration Testing Report				R DR			AW
15	Networks Operation Final Acceptance	E	Visual Inspection	Contract Document BW30137-02/03	BW PROCEDURE				R DR			GH

ORIGINAL ISSUE PREPARED BY: Reg McGirr APPROVED BY: Andrew Bannink	RELEASED BY: ATCSP	KEY TO LOCATION ACTIVITIES A-ATCSP S-Supplier C-Sub Contractor E-Site	BRISBANE WATER T.C. Burnie Building 315 Brunswick St. Mall, Fortitude Valley, Brisbane Qld 4000

System Integration Testing Procedure
SP 298 Lytton Rd Pump Station & SP 300 Serpentine Rd Pump Station

Inspection Check List No1 Lytton Rd

The following manual and actuated operated Valving to be inspected and checked for correct position open/closed. To be signed and dated in the following check list.

Item No	Item Description	BW Drawing No.	Valve Position	Date Checked	Code	Sgn
1	Pritchard Street P/S SP85 VI Flanged sluice valve manual operated. V2 Socketed sluice valve manual operated.	486/5/8-SM20/027	V2 Closed V1 Open	30-5-05	BM/ SW	B.J. McMahon
1.1	DN300 SV Lindum Road Connection to Kianawah Road Pump Station-Gibson Island Rising Main. Manual operated valve	486/5/8-SM21/025	Opened	30-5-05	BM/ SW	B.J. McM
1.2	Lytton RD to PS SP298 Connection Detail Valve Position manual operated	486/5/8-SM21/025 486/5/7-WR101/022	Open Closed Open	30-5-05	BM/ SW	B.J. McM.
1.3	Lytton RD PS Inlet Valve Chamber. RM from Pritchard Street. V3 manual operated	486/5/7-WR101/030	Mark No. 33 (1off) V3 Open	30-5-05	BM/ SW	B.J. McM.
1.4	Lytton RD PS Inlet Valve Chamber. RM from Kianawah Road Valve (V1) and Valve (V2) into Grit Collector	486/5/7-WR101/030 **Actuated Valves**	Mark No. 34 (2off) V1 Open V2 Close	30-5-05	AW	B.J. McM
1.5	Lytton RD PS Inlet Valve Chamber. Valve manual operated for Lowpressure Connection Main	486/5/7-WR101/030	Mark No. 33 (1off) Closed	30-5-05	BM/ SW	B.J. McM.
1.6	Lytton RD PS Discharge Valve Chamber. Valves manual operated	486/5/7-WR101/030	Mark No. 8 (2off) Open	30-5-05	BM/ SW	B.J. McM.
1.7	Sewer Rising Main Pritchard Street Pumping Station To Lytton Road No. 4 Pump Station **Air Released from Main**	486/5/8-SM20/021	Bleed	31-5-05	BM/ SW	B.J. McMahon.
1.8	Sewer Rising Main From Connection To Kiawanah Road P/S SP49 Rising Main at Lindum Road To Lytton Road No. 4 Pump Station **Air Released from Main**	486/5/8-SM21/021	Bleed	31-5-05	BM/ SW	B.J. McMahon.
1.9	Sewer Rising Main Lytton Road Pump Station (SP298) to Serpentine Road Pump Station (SP300) **Air Released from Main**	486/5/8-SM18/021	Bleed	31-5-05	BM/ SW	B.J. McMahon

Page 1 of 1

Issue Date: 29/4/05
Rev No: 0

SITE SYSTEM COMMISSIONING
LYTTON Road Pump Station SP298
&
SERPENTINE Road Pump Station SP300

Inspection Check List No2 Serpentine Rd

The following manual operated Valving to be inspected and checked for correct position open/closed.
To be signed and dated in the following check list.

Item No	Item Description	BW Drawing No.	Valve Position	Date Checked	Code	Sgn
2	Serpentine Road Overflow DN450 Gate Valve	486/5/7-TR201/043	Open	30-5-05	BM/ SW	AGW B.J. McM.
2.1	DN450 Lugged Kinfe Gate Valve in Serpentine Road Wet Well. Incoming Main from Lytton Road PS	486/5/7-TR201/030 486/5/7-TR201/031	Mark No. 21 Open	30-5-05	BM/ SW	AGW B.J. McM.
2.2	DN315 Lugged Kinfe Gate Valve in Serpentine Road Wet Well. Incoming Main from Kingsford Smith Drive SP146	486/5/7-TR201/030 486/5/7-TR201/031	Mark No. 19 Close	30-5-05	BM/ SW	AGW B.J. McM.
2.3	DN500 Sluice Valves on discharge main from Serpentine Road PS connecting into 1840 Rising Main	486/5/7-TR201/021 486/5/7-TR201/042 Section B	Open	30-5-05	BM/ SW	AGW B.J. M.M.
2.4	DN500 Sluice Valves on discharge main from Serpentine Road PS Connecting into 1370 Rising Main	486/5/7-TR201/021 486/5/7-TR201/042 Section A	Open	30-5-05	BM/ SW	AGW B.J. McM.
2.5	DN450 Metal Wedge Sluice Valves Dry Well Pump Pit Serpentine Road PS	486/5/7-TR201/031 486/5/7-TR201/030	Mark No. 6 (4off) Open	30-5-05	BM/ SW	AGW B.J. McM.
2.6	DN450 Lugged Knife Gate Vave Dry Well Pump Pit Serpentine Road PS	486/5/7-TR201/031 486/5/7-TR201/030	Mark No. 41 Open	30-5-05	BM/ SW	AGW B.J. McM.
2.7	DN450 Lugged Actuated Knife Gate Valve V1. Dry Well Pump Pit Serpentine Road PS (RM 1840)	486/5/7-TR201/031 486/5/7-TR201/030	Mark No. 8 V1 Closed	30/5/5	AW	[illegible]
2.8	DN450 Lugged Actuated Knife Gate Valve V2. Dry Well Pump Pit Serpentine Road PS (RM1370)	486/5/7-TR201/031 486/5/7-TR201/030	Mark No. 8 V2 Open	30/5/5	AW	[illegible]
2.9	Serpentine Road PS Sewer Discharge Main to 1370/1840 rising mains **Air Released from Main**	486/5/7-TR201/042	Bleed	30/5/05	BM/ SW	B.J. McMahon

Page 1 of 1

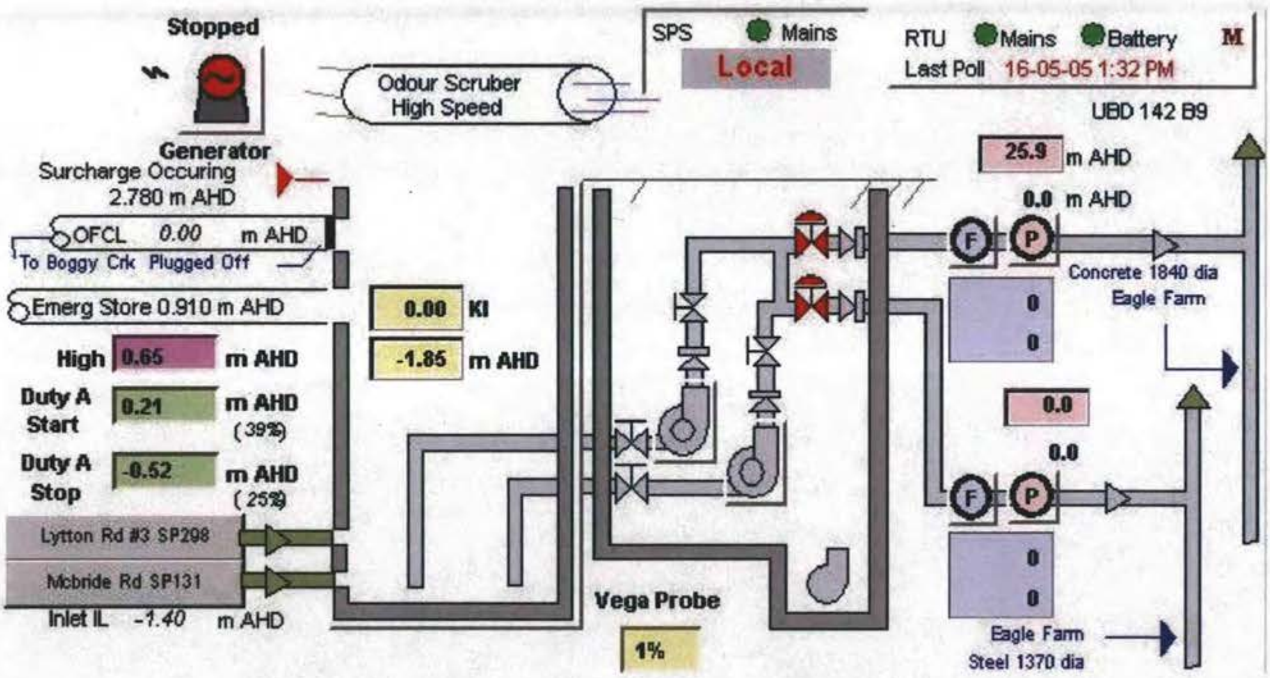
Issue Date: 29/4/05
Rev No: 0

Brisbane City

Brisbane Water

BRISBANE WATER

Network Control Systems



FUNTIONAL SPECIFICATION

SP300 Serpentine Rd

Sewage Pumping Station

Conventional 2 Pumps With VSD and 2 Valves

Document Signoff

Approval

	Name	Role	Signature	Date
Supervising Elec. Eng *Engineering Design Services*	Alan Mooney	Recommend	[signature]	26/5/05
Supervising Elec. Eng *Engineering Design Services*	Henri Lai	Concur	[signature]	25/5/05
Team Leader *Network Control Systems*	Peter Sherriff	Concur		
Manager *System Planning*	Peter Casey	Concur		
Manager *Water & Sewerage Operations*	George Henry	Concur		
Manager *Mechanical And Electrical Services*	Michael Greene	Concur		
Project Manager	Andrew Bannik	Approve	[signature]	17/05/05

Distribution

Name	Role	Section

Revision Control

Revision Number	Date	Amendment Details	Responsible Officer
Version 0.00	11/11/2004	Original Draft – Developed from Leightons SP300 Revised Functional Spec – Version 3	Alex Witthoft
Version 0.03	26/11/2004	Issued for comment	Alex Witthoft
Version 0.04	29/11/2004	Added Comments by Malcolm Barrett	Alex Witthoft
Version 0.05	08/03/2005	Revised the Valve Control Section	Alex Witthoft
Version 0.06	09/03/2005	Finished 3.2.1 Valve Control	Alex Witthoft
Version 0.10	22/03/2005	Added Comments by Reg McGirr Issued to Reg for distribution to Leightons.	Alex Witthoft
Version 0.20	06/04/2005	Modified wet well levels (section 3) Added emergency storage (section 3.2.3 & 3.3.2) Added systemic control (section 3.3.3) Added Non standard picture sections (3.4.3 & 3.4.4)	Alex Witthoft
Version 1.00	16/05/2005	Minor modification from Reg McGirr	Alex Witthoft
Version 1.10	21/11/2005	Levels modified after official NSM surveying	Alex Witthoft

Document Consultation

Please review the attached document and add your comments where necessary. To ensure that the process is kept within reasonable timeframes, it would be appreciated if you could return this document by the **Requested Return Date** listed below.

Project Sponsor:	Andrew Bannik	Officer Code: PM13BW	Location: T.C.B. Level 2
Author:	Alex Witthoft	Officer Code: CTAMP12	Location: Cullen Ave
Document Administrator:	Alan Mooney	Officer Code: SEEPSBW	Location: T.C.B. Level 2

Version Number (1,2,3 etc)	Forwarded To: (Name / Officer Code)	Location (eg,TCB, Cullen Ave)	Date Sent	**Requested Return Date**	Date Returned	Comments Received (Y / N)	Comments Incorporated (Y / N)
0.03	Malcolm Barrett	Cullen Ave	26/11/04	03/12/04	03/12/04	Y	Y
0.04	Peter Sherriff	Cullen Ave	29/11/04	06/12/04	06/12/04	Y	Y
0.04	George Henry	Cullen Ave	29/11/04	06/12/04	06/12/04	Y	Y
0.04	Alan Mooney	TCB	29/11/04	06/12/04	06/12/04	Y	Y
0.04	Peter Casey	TCB	29/11/04	06/12/04	06/12/04	Y	Y
0.04	Henri Lai	TCB	29/11/04	06/12/04	06/12/04	Y	Y
0.06	Henri Lai	Cullen Ave	09/03/05	14/03/05	-	N	N
0.06	Kerry McGovern	Cullen Ave	09/03/05	14/03/05	-	N	N

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Definitions

IDTS	Integrated Departmental Telemetry System
RTU	Remote Telemetry Unit
SCADA	Supervisory Control And Data Acquisition
MAHD	Metres above Australia Height Datum

1 INTRODUCTION

This document contains the site specific details and describes the non standard functional requirements for control, monitoring and telemetry at sewage pump station SP300 at Serpentine Road Pinkenba. The functional requirements described in the document are in addition to the standard functionality detailed in "SPSV3 SEWAGE PUMPING STATION SUBMERSIBLE 3 PUMPS WITH VFD" [1].

The standard specification was written for a 3 pump station, of which only 2 pumps are allowed to run at any given time. The functionality for SP300 Serpentine Road is identical, except that SP300 only has 2 pumps, both of which can run simultaneously into the DN1370 main and single pump into the DN1840 main.

The site specific details and the non standard functional requirements in this document were derived from the functional specification written by Leighton Contractors Pty Ltd "SP300 FUNCTIONAL SPECIFICATION REV 3" [2].

SP300 is a sewage pump station incorporating two variable speed driven 216 kW dry mounted submersible pumps operating in a duty/standby arrangement. SP300 is located in a Brisbane Water pipeline easement at the western end of Serpentine Road Pinkenba.

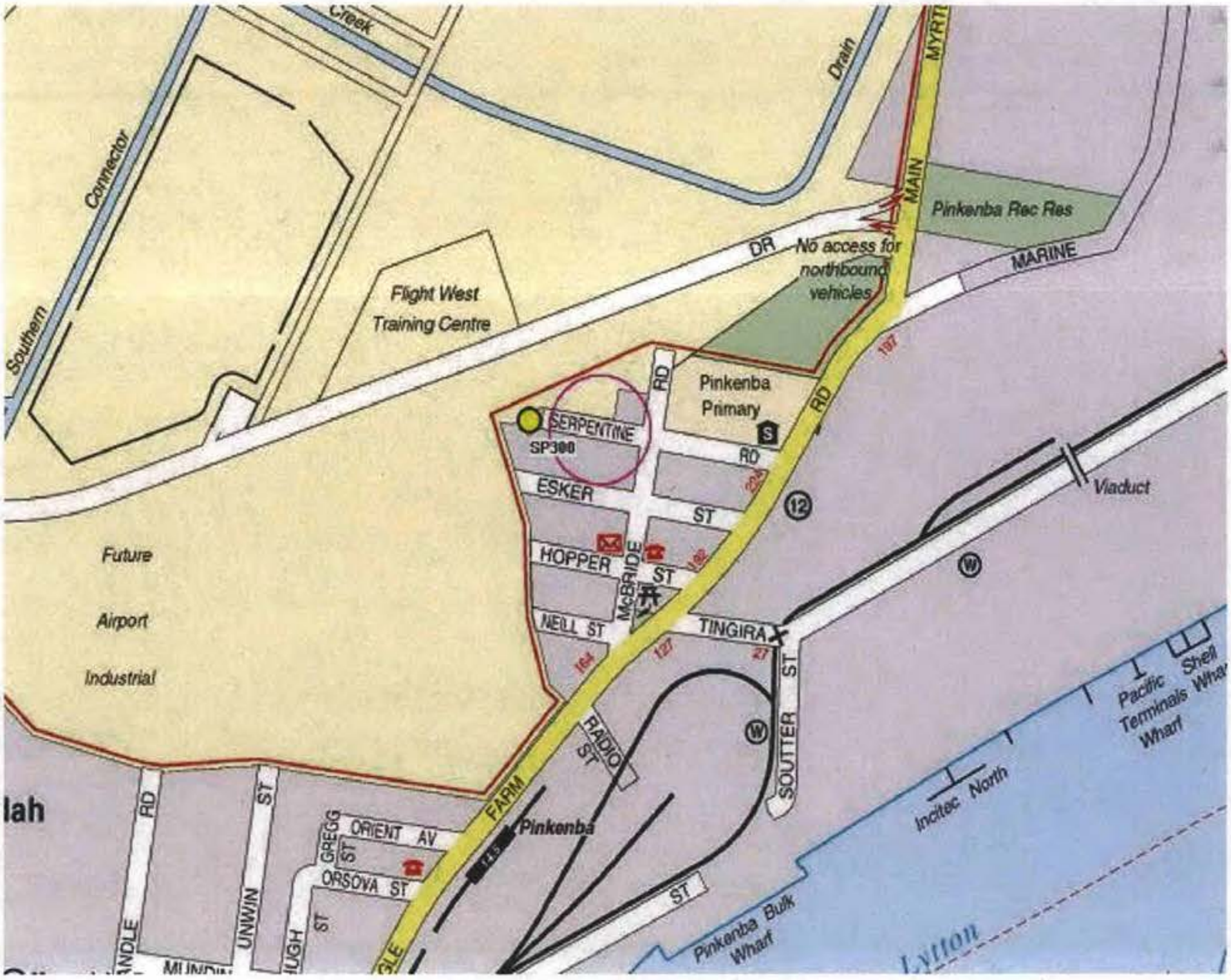

Figure 1: SP300 Location Map

1.1 General Process Description

The incoming flow to SP300 comes from SP298 at Lytton Rd Lytton (South side) and a number of other pumping stations on the north side of the Brisbane River. Sewage is pumped from all locations into the submerged inlet chamber at SP300. From the inlet chamber, the sewage flows directly into the wet well.

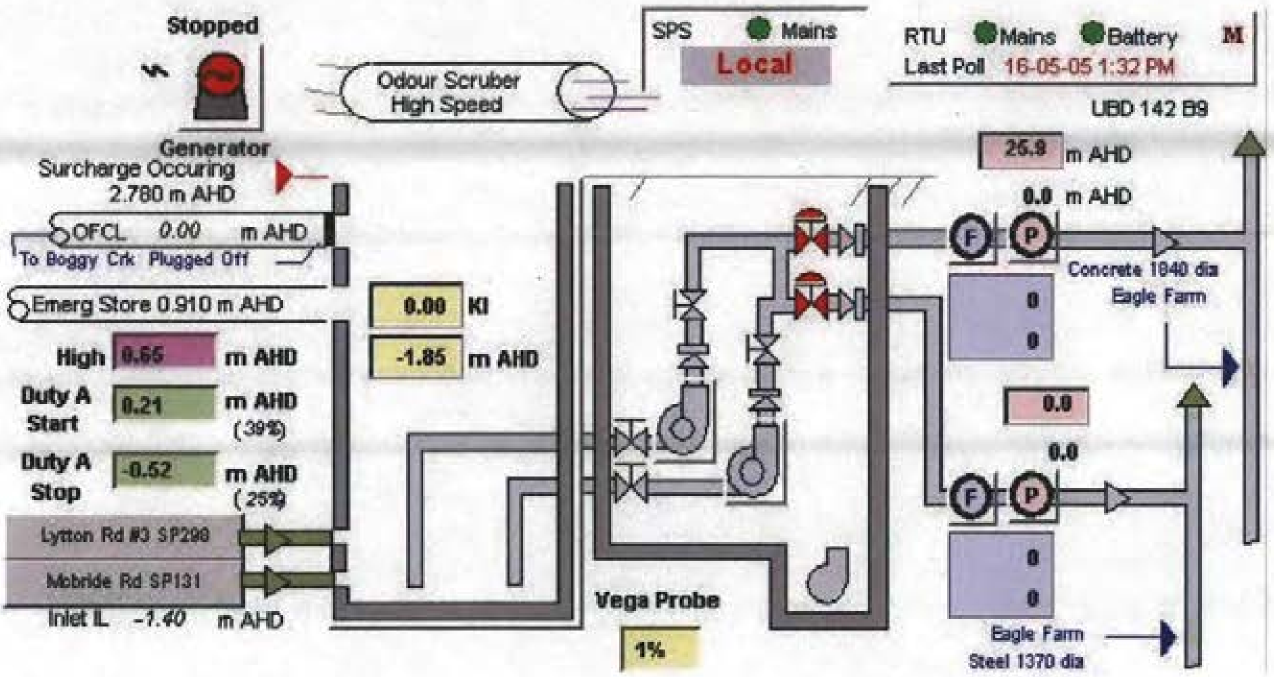

Figure 2: SP300 Process and Instrumentation Overview

SP300 is designed to discharge into one of two 'Eagle Farm to Luggage Point' rising mains

1. Low pressure DN1840 concrete rising main
2. High pressure DN1370 steel rising main.

The Eagle Farm Pump Station (EFPS) actually consists of two pump stations:

1. EFPS#1, which has three 2000 kW pumps in a two duty/one standby arrangement; and
2. EFPS#2, which has two 1850 kW pumps in a duty/standby arrangement.

Both EFPS#1 and EFPS#2 use variable speed pumps and hence the sewage flow in each rising main is variable.

During dry weather, EFPS#1 is normally used in conjunction with the DN1370 main. Under this operating arrangement, EFPS#1 can deliver a maximum of around 4200 L/s through the DN1370 main to the Luggage Point WWTP.

During wet weather events, EFPS#1 is normally used in conjunction with the DN1370 main, and EFPS#2 is brought online to assist, in conjunction with the DN1840 main. Under this operating arrangement, the EFPS can deliver a maximum of around 8000 L/s through both mains to the WWTP.

If the steel rising main DN1370 is offline (for maintenance) then EFPS#2 is operated in conjunction with the DN1840 main. Under this operating arrangement, the operator at Eagle Farm runs EFPS#2 in manual mode to ensure that the pressure remains within acceptable limits.

As SP300 is required to deliver sewage directly into the existing rising mains, its duty head is a strong function of the residual head in the selected discharge main. The maximum and minimum pump duties for SP300 are presented in the table below.

Main in Use	EFPS Flow (L/s)	SP300 Flow (L/s)	SP300 Head (m)
DN1370	4200	348	40.8
	0	348	8.9
DN1840	3800	348	19.2
	0	348	8.9

SP300 Serpentine Road has been designed to operate predominantly with the steel rising main and the pumps and drives have been sized accordingly. If this steel rising main is not in service (as determined by the Eagle Farm pump station operators), then SP300 can utilise the concrete rising main provided that certain limitations are adhered to.

The main two limitations are limiting the station to only run one pump and to restrict the pump running to a maximum speed of 33Hz (to be confirmed after commissioning when pumps run on 1840mm main). Limiting the speed of the drive limits the flow and head pressure to the figures shown in the table below. The limiting of the speed will limit the flow and the head pressure to the limits listed below. These limits will have alarms configured to alert both the Eagle Farm control room and IDTS master station. The max speed of 52 hz will need to be confirmed after commissioning when pumps run on 1370mm main

Main in Use	Maximum Pumps to Run	Maximum Speed (Hz)	Maximum Flow (l/s)	Maximum Head Pressure (m)
DN1370	2	52.0	Unlimited	Unlimited
DN1840	1	33.0	348	10.0

2 EQUIPMENT INSTALLED

2.1 Standard Equipment

SP300 Serpentine Rd pump station has the following standard equipment installed. The functionality for the control, monitoring and alarming for these items is fully described in the standard functional specification.

Pumps	Two Hidrostal I10K submersible pumps with 216 kW four pole electric motors are installed in the dry well. Each pump is fitted with moisture probes in the oil chamber and thermistors in the stator windings.
Pump Starters	Two Danfoss VLT8000 Variable Frequency Drives (VFDs) are installed in the pump station switchboard. The VFDs will also provide soft starting functionality.
Flow meters	Two direct buried DN500 ABB Magmaster electromagnetic flow meters are installed in the DN500 PE100 discharge mains downstream of the valve chamber. The flowmeter will be used in the flow control algorithm (PID Loop) to control the speed of the pumps.
Level Sensors	One Vega hydrostatic level transmitter and one Multitrode level probe are installed in the wet well.
Pressure Transmitters	Two Vega D84 pressure transmitters are installed on the discharge pipe work in the valve chamber.

2.2 Non Standard Equipment

SP300 Serpentine Rd pump station has the following non standard equipment installed. The functionality for the control, monitoring and telemetry for is described in the following sections as these items are NOT described in the standard specification.

Emergency Generator	One SE Power 500 kVA diesel powered backup generator is installed on a slab adjacent to the valve chamber. The generator includes its own GE FANUC PLC mounted in a dedicated control panel inside the generator housing.
Actuated Valves	Two DN450 Keystone Figure 951 knife gate valves with 415 V Rotork actuators are installed in the discharge pipe work in the valve chamber.
Activated Carbon Scrubber	One activated carbon odour scrubber (nominally RKR Engineering Airclenz) to be installed adjacent to the wet well. Provision was made for the starter and controls for the activated carbon unit to be installed in a dedicated control panel adjacent to the scrubber.

2.2.1 Emergency Generator

The emergency generator is designed to the standard functionality as described by "DIESEL STANDBY GENERATOR LOCAL CONTROL PANEL FUNCTIONAL DESCRIPTION". [3] The generator is supplied with the PLC fully configured and loaded with the standard program. The RTU (Logica MD3311) will programmed with the standard interface program that will provide the monitoring, control and telemetry to the IDTS master station.

2.2.2 Activated Carbon Scrubber

SP300 will have an activated carbon scrubber unit installed to eliminate odours. The functional specification for this equipment has not been finalised and will be provided in a separate document.

2.2.3 Actuated Valves

The two actuated knife gate valves are used to control which rising main the station will pump into. The functionality of these valves is detailed in the Control Philosophy section.

2.3 Provision for Future Non-Standard Equipment

Although the project has made civil provision for the following future equipment, no PLC or RTU code has been developed

- Dosing Pump

Any future project to install the above equipment will provide funding for the functional specification and programming of the control, monitoring and telemetry.

2.3.1 Dosing Pumps

Provision was made for two chemical dosing pumps (nominally Alldos 0.18 kW) to be installed adjacent to the dosing slab. Provision was made for VFDs for these pumps to be installed in a dedicated control panel adjacent to the pumps.

3 CONTROL PHILOSOPHY

The station will operate according to the control philosophy detailed in the standard functional specification (SPSV3). The only modification is to the duty rotation algorithm, which will now control only two pumps instead of three. The number of pumps allowed to run remains the same (2) and the initialisation block will be configured with the site specific set points listed in the tables in the next sections.

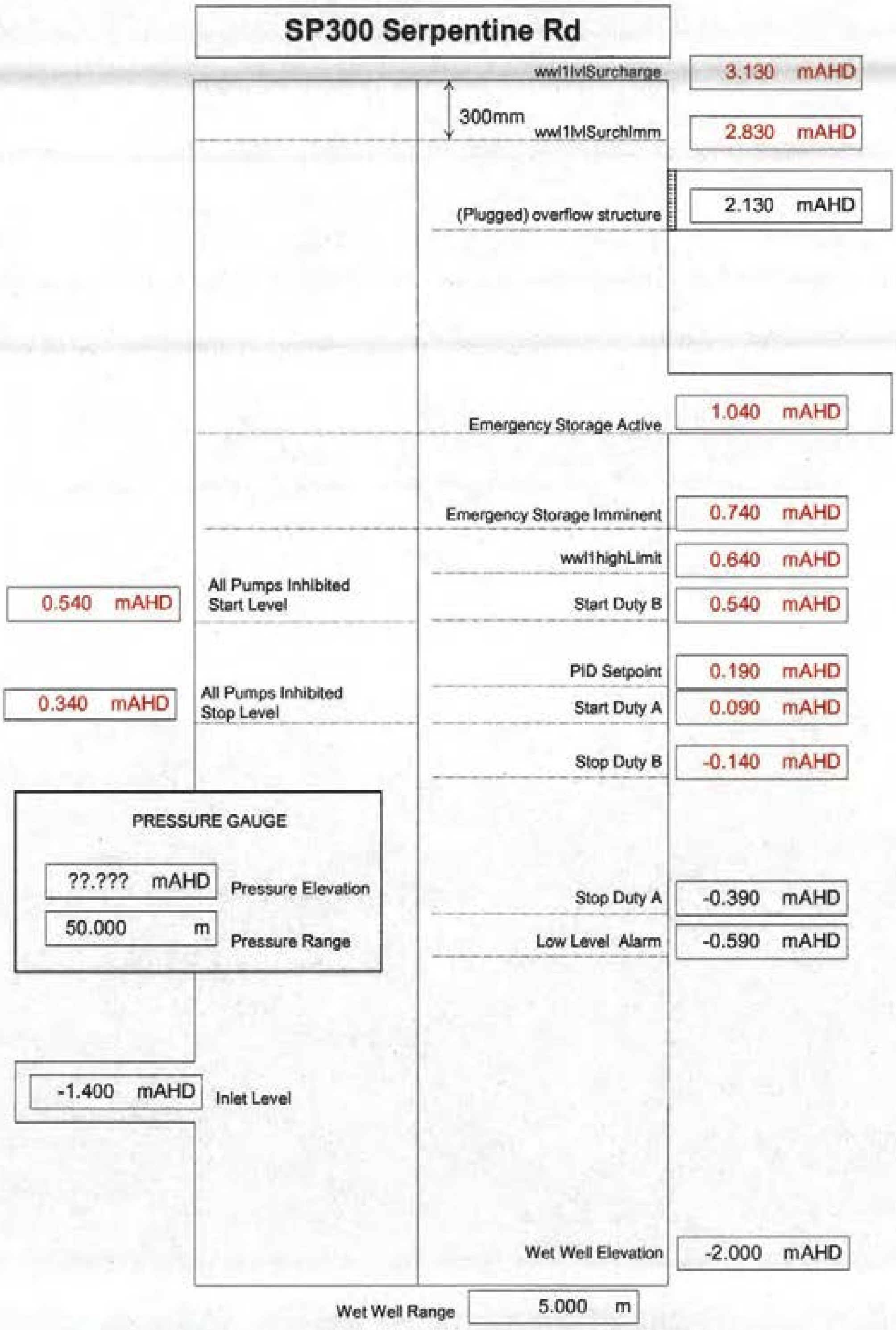

Figure 3: SP300 Station Level Set Points

SOME LEVELS MAY CHANGE ACCORDING TO COMMISSIONING FIGURES

3.1 Site Specific Values

Table 1: Site Specific Constants defined in the PLC

Tag Name	Description	Type	Value	Units
Sewerage Pumping Station				
Stn01grSurchPumpingTime	Surcharge pumping duration [3]	Integer	600	Sec
Delivery flow				
Flw0[x]txRange	Delivery flow – Range	Real	7500	l/s
Stn01grMinFlow1Pmp	Delivery flow – Minimum flow	Real	100	l/s
Stn01grMaxFlow1Pmp	Delivery flow – Maximum flow – 1 Pump	Real	348	l/s
Stn01grMaxFlow2Pmp	Delivery flow – Maximum flow – 2 Pumps	Real	700	l/s
Delivery pressure				
Pre01txRange	Delivery pressure - Range	Real	5000	mmAHD
Pre01txZero	Delivery pressure – Elevation of the transducer	Real	T.B.A	mmAHD
Pump Blockage				
Stn01grPmpBlockFlowKneeSP	Flow blocked limit for flow/level PID control (knee)	Integer	T.B.A	l/s x 100
Stn01grPmpBlockSpeedKneeSP	VFD speed blocked limit for flow/level PID control (knee)	Integer	T.B.A	Hz x 100
Stn01grPmpBlockSpeedMinSP	VFD speed blocked limit for minimum flow PID control	Integer	T.B.A	Hz x 100
Wet well level				
Wwl01txRange	Wet well level range	Integer	5500	mmAHD
Wwl01txSurchImmLevelSP	Wet well surcharge imminent level	Integer	2830	mmAHD
Wwl01txEStorImmLevelSP	Wet well surcharge imminent level	Integer	640	mmAHD
Wwl01grInhStartLevelSP	Wet well inhibit mode start level	Integer	540	mmAHD
Wwl01grInhStopLevelSP	Wet well inhibit mode stop level	Integer	340	mmAHD
Wwl01grRunatMaxLvlSP	Wet well run at maximum speed level	Integer		mmAHD
Wwl01txDtyBStartLevelSP	Wet well duty B pump start level	Integer		mmAHD
Wwl01txPIDLevelSP	Wet well PID set point	Integer		mmAHD
Wwl01txDtyAStartLevelSP	Wet well duty A pump start level	Integer		mmAHD
Wwl01txDtyBStopLevelSP	Wet well duty B pump stop level	Integer		mmAHD
Wwl01txDtyAStopLevelSP	Wet well duty A pump stop level	Integer		mmAHD
Wwl01txZero	Wet well empty level (4mA of Probe)	Integer	-1920	mmAHD
Variable Frequency Drive				
Stn01grMinSpeed	Variable Frequency Drive – Minimum Speed (either mode)	Integer	250	Hz x 100
Stn01grMaxSpeed1	Variable Frequency Drive – Maximum Speed (Mode 1)	Integer	500	Hz x 100
Stn01grMaxSpeed2	Variable Frequency Drive – Maximum Speed (Mode 2)	Integer	330	Hz x 100

Table 2: Site Specific Constants defined in the RTU

Tag Name	Description	Type	Value	Units
flw1almInhibitTm	Delivery flow - Alarm inhibit timer	Integer	15	sec
pre1almInhibitTm	Delivery pressure - Alarm inhibit timer	Integer	15	sec
wwl1surchLvlVol	Wet well volume at surcharge level	Real	46.30	kl
wwl1lvlSurcharge	Wet well surcharge occurring level	Real	1.880	mAHD
Pumps 1 & 2				
Pmp[x]almInhPwrTm	Pump [x] - Motor power alarm inhibit timer.	Integer	15	sec
pmp[x]almInhCrntTm	Pump [x] - Motor current alarm inhibit timer.	Integer	15	sec
pmp[x]currRange	Pump [x] - Motor current range	Real		Amps

Table 3: Site Specific Variable defined in the RTU

Wet well level				
wwl1highLimit	Wet well level - High alarm set point	Integer	510	mmAHD
wwl1lowLimit	Wet well level - Low alarm set point	Integer	-970	mmAHD
Delivery flow				
flw1highLimit	Delivery flow - High alarm set point	Integer	7000	ml/s x 10
flw1lowLimit	Delivery flow - Low alarm set point	Integer	700	ml/s x 10
flw2highLimit	Delivery flow - High alarm set point	Integer	7000	ml/s x 10
flw2lowLimit	Delivery flow - Low alarm set point	Integer	700	ml/s x 10
Delivery pressure				
pre1highLimit	Delivery pressure DN1370 – High alarm set point	Integer		mmAHD
pre1lowLimit	Delivery pressure DN1370 – Low alarm set point	Integer		mmAHD
pre2highLimit	Delivery pressure DN1840 – High alarm set point	Integer		mmAHD
pre2lowLimit	Delivery pressure DN1840 - Low alarm set point	Integer		mmAHD
Pumps 1 & 2				
pmp[x]currHiLimit	Pump [x] - Motor current high alarm set point [4]	Integer		mAmps
pmp[x]currLoLimit	Pump [x] - Motor current low alarm set point [5]	Integer		mAmps
pmp[x]powHiLimit	Pump [x] - Motor power high alarm set point	Integer		Watts
pmp[x]powLoLimit	Pump [x] - Motor power low alarm set point	Integer		Watts

Table 4: Wet Well Level vs Volume Data

	Height (mAHD)	Volume m^3	Remaining Storage m^3	% Level	% Volume
1	-0.720	0.000	60.430	22%	0%
2	-0.270	7.300	53.130	30%	12%
3	-0.120	9.800	50.630	33%	16%
4	0.210	15.100	45.330	39%	25%
5	0.510	20.000	40.430	44%	33%
6	0.660	22.400	38.030	47%	37%
7	0.760	24.000	36.430	49%	40%
8	1.250	32.000	28.430	58%	53%
9	1.450	35.300	25.130	61%	58%
10	1.650	38.500	21.930	65%	64%
11	2.110	46.000	14.430	73%	76%
12	2.130	46.300	14.130	74%	77%
	3.000	60.430	0.000	89%	100%

THESE FIGURES WILL NEED TO BE UPDATED TO INCLUDE THE EMERGENCY STORAGE VOLUME

(TO BE PROVIDED BY SYSTEM PLANNING)

3.2 Non Standard Control

3.2.1 Valve Control

The two knife gate valve which determine which rising main the station is discharging into are not standard equipment and their functionality are not covered by the standard specification. These valves also effect the pump control functionality however this section only covers the valve control functionality.

The two knife gate valves are the mechanism in which the station switches between 2 modes of operation, controlled by the open and close status of valve 1 and valve 2. These modes are:

Rising Main	Valve 1	Valve 2	Description
1 – DN1370	OPEN	CLOSED	SP300 is discharging into the high pressure steel rising main.
2 – DN1840	CLOSED	OPEN	SP300 is discharging into the low pressure concrete rising main.

The rising main can be selected under the following modes of operation

1. Local
2. Remote – Manual
3. Remote – Auto (FUTURE)

Control Modes

Local

The valves can also be controlled locally via hard wiring (independent of the PLC). While in local control, it is the responsibility of the on site technician to ensure the correct rising main is in operation.

Remote – Manual

Under remote-manual mode the valves are controlled by the control room operator via the IDTS master station. The selection of the valve position is done via a selection popup screen in which the operator can choose to select either the DN1370 or the DN1840. The PLC will then operate the valves in the sequence outlined in the following section.

Remote – Auto (FUTURE)

The mode which is selected is governed by which rising main(s) is being used by Eagle Farm. The following table details the active mode depending on the status of the two Eagle Farm pumping stations.

The default mode is mode 1 – DN1370. This has SP300 discharging into the high pressure rising main. This is the safest mode as there are no pressure restriction. Eagle Farm pumping station will communicate, via peer to peer communication over the Trio radio network, the status of both of the Eagle Farm pump stations. If the peer to peer communications fail, then SP300 will revert back to remote-manual mode.

Sequencing

The valves can change position while the pumps are off or while they are running. As the wet well has a very small volume compared with the flow rates, there is minimal retention time in the system while the pumps are off. The most likely change over will therefore occur while the pumps are running. At no stage should both valves be open, as this could lead to the high pressure steel main over pressurising the low pressure concrete main. The change over sequence will be as follows.

Mode 1 → Mode 2

1. Starting conditions are valve 1 open, valve 2 closed, 0 to 2 pumps running at up to 52 Hz.
2. Limit the station to only 1 pump.
3. Clamp the speed of the pump to minimum speed (25 Hz).
4. Close Valve 1.
5. When valve 1 is closed, open valve 2.
6. When valve 2 is open, unclamp the speed of the pump (to a maximum of 33Hz)

Mode 2 → Mode 1

1. Starting conditions are valve 1 closed, valve 2 open, 0 or 1 pump running at up to 33 Hz.
2. Clamp the speed of the pump to minimum speed (25 Hz).
3. Close valve 2.
4. When valve 2 is closed, open valve 1.
5. When valve 1 is open, unclamp the speed of the pump and allow 2 pumps to run (if needed).

Failure States

There are three failure modes that will prevent a successful mode change. These failure modes and their respective recovery procedures are as follows.

Failure Mode	Recovery Process for Failed Valve	Recovery Process for Other (Healthy) Valve
Fail to Close	Command to Open. Can not close until failed to close alarm has been reset.	Stays closed
Fail to Open	Command to Close. Can not open until failed to open alarm has been reset.	Once failed valve has re-closed, then healthy valve is commanded to open.
Failed in Transit (Both Failed to Open and Failed to Close are active)	Stays in current (failed position) until faults have been reset.	The healthy valve will stay in its current position.

3.2.2 Pump Controls

The pump control will be based upon the standard pump control philosophy outlined in the standard specification. This included the wet well to flow to speed cascaded P.I.D. which will be tuned maintain the wet well level yet still provide control over the flow rate. The following sections highlight the specific differences between this site and standard functionality.

Number of Pumps

SP300 is designed to normally operate with the DN1370 steel rising main. In this mode, the station acts as per the functionality outlined in the standard Functional Specification. The duty block is modified to only consider 2 pumps (the standard has 3 pumps).

Interlocking and Speed Limiting

As mentioned in the Valve Control section, if the station is operating with the DN1840 concrete rising main, the station will become interlocked, allowing only one pump to operate at any given time. This interlock is both in the hard wiring as well as in the PLC code. Not only is the station interlocked, the variable speed drives are limited to run at a much lower speed (33Hz). All these limitations are imposed to ensure that the low pressure rising main operates acceptable pressures. These limitations are in effect during both local and remote control modes.

3.2.3 Emergency Storage

Instead of the standard overflow structure, this site will 'overflow' into an emergency storage facility (abandoned eagle farm rising main). This inclusion of this extra storage will significantly increase the time to overflow, in the case of complete station failure.

The system was modelled at ultimate PWWF with a total inflow to Serpentine Rd of 252 l/s. Time to full storage has been calculated to be:

With the rising main shut at Eagle Farm	5 hrs 13 minutes.
With a 100mm Scour Valve (46 l/s)	5 hrs 31 minutes.
With a 150mm Scour Valve (97 l/s)	5 hrs 59 minutes.
With a 225mm Scour Valve (187 l/s)	7 hrs 42 minutes.

The Maximum hydraulic gradient line (HGL) in Serpentine Rd pump station wet well is 2.45 mAHD.

NOTE: Once this level is reached if the inflow is not diverted, higher HGL's will occur in the wet well resulting in an overlfow.

The emergency storage will be connected to the wet well at 0.910 mAHD. This is 1.22 meters below the original overflow structure that has been constructed.

Modelling of the emergency storage has been performed and it was found that the maximum hydraulic gradient of the emergency storage when it is draining into Eagle Farm pumping station SP010) is **higher** (2.45 mAHD) than the overflow structure (2.13 mAHD) that has been constructed. To avoid unnecessary overflow into the environment (Boggy Creek) the existing overflow structure will be 'sealed'.

NOTE: In the unlikely event that the wet well reaches the sealed overflow structure (because the emergency storage is either shut at the Eagle Farm pump station or is blocked) then the level will rise past the sealed overflow structure. The site will then overflow through the wet well lids, over the site and then into the Boggy Creek. The resultant overflow will be uncontrolled. (As opposed to a controlled overflow through the overflow structure.)

To incorporate this emergency storage into the control philosophy the following changes were made to the standard alarms and controls.

- The surcharge imminent electrode will be utilised as the emergency storage imminent electrode, the surcharge imminent alarm will now be only raised by the wet well level sensor (instead of a level sensor AND an electrode).
- The surcharge occurring alarm will be set at the height of the wet well lids instead of the overflow structure (now sealed) as this is the level at which the sewerage will overflow into the environment.
- The 'new' emergency storage imminent probe will be used to active the emergency sewerage imminent alarm (identical functionality to the surcharge imminent alarm detailed in the standard functional specification (Ref1).
- Instead of the surcharge pumping mode, the site will have a emergency storage pumping mode (identical to the surcharge pumping mode detailed in the standard functional specification (Ref1)).

3.2.4 Peer to Peer Comms

To SP298 Lytton Rd #4 - Systemic Control

The majority of the inflow to Serpentine Rd comes from Lytton Rd #4. Lytton Rd #4 has the capability to divert all inflow coming to it, from SP049 Kianawah Rd and SP085 Prichard St, to Gibson Island.

Systemic control from SP300 Serpentine Rd to SP298 Lytton Rd #4 will automatically, via peer to peer communications over the Trio radio network, 'inhibit' all pumps at Lytton Rd #4 if any of the following occurs.

- Emergency Storage Imminent
- Both pump unavailable (for any reason including power outage)

In this mode, Lytton Rd will divert all inflow (from Prichard and Kianawah) to Gibson Island, instead of pumping it to Serpentine Rd. According to figures provided by Brisbane Water Projects Branch, this will alleviate up to 90% of the flow to Serpentine Rd.

In addiction to the Emergency storage imminent (or pumps available) alarm the IDTS master stations will also receive the Pump inhibited alarms for both pumps at Lytton Rd #4. Once the Lytton Rd has been inhibited, it will stay inhibited until the operator manually 'uninhibited' at least one pump at Lytton Rd. The operator will NOT be able to uninhibited the pumps while the conditions at Serpentine Rd that caused the automatic inhibit are still active.

Systemic control can be deactivated by the control room operators via a control button on the IDTS details page for SP300 Serpentine Rd.

An addition alarm will be configured to monitor the status of the communication link between the two RTU's. No systemic control will be possible if the communication link has failed. The control room operator will still be able to manually inhibit both pumps at Lytton Rd #4 at any stage (assuming communications to Lytton Rd #4 are healthy).

From SP010 Eagle Farm ((FUTURE))

To achieve remote-auto mode for the valve control, this site will have to communicate to the Eagle Farm pumping station, to receive the operational status of both the EFPS#1 and EFPS#2. To achieve this, a Logica MD3311 RTU has to be installed at Eagle Farm pumping station to communicate directly via the Trio radio network.

3.3 Non Standard Monitoring and Alarms

3.3.1 Additional Valve Monitoring and Alarms

The following alarms and events are associated with both valves

Plant	Quantity	Priority
Valve	Available	1
Valve	Available_remote	0
Valve	Open	0
Valve	Closed	0
Valve	Fail_open_alarm	1
Valve	Fail_close_alarm	1
Valve_station	Auto_manual	Control
Valve_station	Auto_manual_Fbk	0
Sewage_pumping_station	Mode_control	Control
Sewage_pumping_station	Mode_selected	0

Available

The valve is considered available only when all of the following conditions are present:

- Available for Remote
- Not "Failed to Open"
- Not "Failed to Close"

Available for Remote

The digital input status for "valve available for remote" is transferred directly to the IDTS master station.

Open

The digital input status for "valve open" is transferred directly to the IDTS master station. This is used to animate the valve status on the main IDTS page.

Closed

The digital input status for "valve closed" is transferred directly to the IDTS master station. This is used to animate the valve status on the main IDTS page.

Fail to Open

If the valve is commanded to open and does not reach the open limit within the pre determined time period (set at two times the normal travel time) then the failed to open alarm will be activated. The valve will then revert back to the last heatlhy position (ie pen). This alarm can be reset locally by pressing either of the pump (1 & 2) reset push buttons or remotely by the IDTS master station.

Fail to Close

If the valve is commanded to close and does not reach the close limit within the pre determined time period (set at two times the normal travel time) then the failed to close alarm will be activated. . The valve will then revert back to the last heatlhy position (ie closed). This alarm can be reset locally by pressing either of the pump (1 & 2) reset push buttons or remotely by the IDTS master station.

Valve Station Auto / Manual Control and Feedback

When the sewage pumping station is in remote mode, the valve station (both valve 1 and 2) can be selected to be in either manual or auto mode. The current mode selected is returned back to the IDTS master station via the feedback variable.

Sewage Pumping Station Mode Control / Selected

If the valve station is selected to be in auto mode, then the control room operator is able to select which rising main is to be operational via the 'mode control' control variable. The current mode selection will be returned back to the IDTS master station via the feedback variable.

3.3.2 Additional Wet Well Monitoring and Alarms

Plant	Quantity	Priority
Sewage_pumping_station	Emergency_storage	1
Sewage_pumping_station	Emergency_storage_imminent	1

Emergency Storage Imminent Alarm

The emergency storage imminent alarm is a final warning to the control room operator that the site is at immediate risk of overflowing into the emergency storage. This serves as a reminder to the control room operator in implementing the contingency plans.

As the emergency storage imminent electrode triggers this alarm, it also provides a redundancy to the wet well high alarm that the Vega probe should activate. The emergency storage imminent alarm is the first alarm that the control room operator receives if the wet well level Vega probe is not functioning correctly.

The emergency storage imminent alarm is primarily activated by the emergency storage imminent electrode input. When this signal is active for 10 seconds then the emergency storage imminent alarm is activated. To prevent repetitious alarms due to wave action the signal is kept active for 1 minute after the emergency storage imminent electrode deactivates.

As a backup, a valid wet well level signal exceeding the emergency storage imminent level by 100mm, for 10 seconds, will also trigger the emergency storage imminent alarm while the station is in remote mode. This 100mm is ignored during power outages. The emergency storage imminent electrode is 24VDC and is backed up by the battery system.

Emergency Storage Active Alarm

This alarm is the final alarm that the control room operator will receive as the wet well level rises to the emergency storage level.

When the wet well level is greater than or equal to the surcharge level the surcharge occurring signal is activated. To prevent repetitious alarms due to wave action the signal is kept active for 1 minute after the wet well level falls below the surcharge occurring level.

3.3.3 Systemic Control

Plant	Quantity	Priority
Sewerage_pumping_station	Systemic_control_enable	Control
Sewerage_pumping_station	Systemic_control_enable_Fbk	0
Sewerage_pumping_station	Systemic_control	0

Systemic Control Enable and Feedback

This control point will enable and disable the systemic control of SP298 Lytton Rd #4. The feedback point will be configured to display the current status of the control point.

Systemic Control Active

This event will be configured to indicate to the control room operator whether the systemic control has been activated. The same point will also be configured on the SP298 Lytton Rd #4 site indicate weather that site has currently reveived a request from SP300 to activate the systemic control (inhibit both of its pumps). This will be displayed on the SP298 Lytton Rd #4 details page to indicate the inhibit function has been activated by SP300 Serpentine Rd (rather than by an operator).

3.3.4 Additional RTU Monitoring and Alarms

Plant	Quantity	Priority
Remote_rtu	Comms_fault	1

Remote RTU Comms Fault

The station will monitor the peer communications to all the RTU's that it is configure to communicate with. The alarm will activate if the site has not received a peer communication within the specified time period (site specific peer timeout value set in the initial block).

3.4 Non Standard IDTS Picture

3.4.1 Additional Valves

The two valves will be displayed and will be animated to indicate open, closed and faulted conditions. Double clicking on the valve will bring up the valve control page, on which the following operator controls will be available:

- Individual valve remote resets
- Mode selection (manual/auto)
- Rising Main selection (DN1370 / DN1840)

3.4.2 Additional Pipe Animation

The two rising main pipes (which are connected to the DN1370 and the DN1840) will be animated to show a "filled" condition if their respective valve is open.

3.4.3 Systemic Control

To allow the control room operator to enable and disable the systemic control of SP298 Lytton Rd #4, a control pushbutton will be displayed on a popup screen which can be opened form the SP300 Serpentine Rd details page.

The current status of the systemic control will be displayed next to the control button in the form of a text field with 'On' or 'Off'

3.4.4 Emergency Storage

The emergency storage pipe will be displayed and will have the hydraulic gradient level marked to indicate the level at which the sewerage will start to flow into Eagle Farm.

4 REFERENCES

1

TITLE	SPSV3 Sewage Pumping Station Submersible 3 Pumps With VFD – Functional Specification
DOCUMENT ID	003589
VERSION	0.30
AUTHOR	Alex Witthoft , Brisbane Water – Network Control Systems
DOCUMENT OWNER	Peter Sherriff, Brisbane Water – Network Control Systems

2

TITLE	SP300 Functional Specification
DOCUMENT ID	N/A
VERSION	REVISION 3
AUTHOR	M. BRAND
DOCUMENT OWNER	Leighton Contractors Pty Ltd

3

TITLE	Diesel Standby Generator - Local Control Panel - Functional Description
DOCUMENT ID	N/A
VERSION	02
AUTHOR	SOUTH EAST POWER GENERATION
DOCUMENT OWNER	

PB PARSONS BRINCKERHOFF

BRISBANE CITY

LEIGHTON

SEWAGE PUMP STATION
SP 300
SERPENTINE ROAD PINKENBA

REVISED FUNCTIONAL SPECIFICATION

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		Signature	Date
Author	M. Brand		
Design Verifiers	I. Cameron		
Projects Engineering Manager			
Project Manager	I. Cameron		
Team Leader – Projects Systems & Information Management			
Principal Process Operations Engineer			

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ATTACHMENTS:
SP300 Design Calculations
SP300 Electrical Drawings

1. INTRODUCTION

1.1 Scope of Document

This document outlines the functional requirements for control, monitoring and telemetry at sewage pump station SP300 at Serpentine Road Pinkenba.

1.2 Organisations Involved

The design, construction and commissioning of SP300 were components of Brisbane Water's Australia Trade Coast Sewer Project. The project was awarded to Leighton Contractors Pty Ltd (LCPL) in late 2003.

SP300 was designed by Parsons Brinckerhoff — LCPL's design consultant — and was constructed by LCPL in the second half of 2004.

1.3 General Description of SP300

SP300 is a 13 m x 5.5 m reinforced concrete pump station incorporating two variable speed driven 216 kW dry mounted submersible pumps operating in a duty/standby arrangement. SP300 is located in a Brisbane Water pipeline easement at the western end of Serpentine Road Pinkenba.

SP300 discharges a maximum of 348 L/s of raw sewage through one of two OD500 PE100 rising mains into the existing Eagle Farm to Luggage Point sewage rising mains. The system operators can remotely select either the high pressure DN1370 MSCL rising main or the low pressure DN1840 MSCL rising main to take the flow from SP300.

2. FUNCTIONAL REQUIREMENTS

2.1 Pump Station Duties

SP300 is required to deliver a maximum of 348 L/s into either the high pressure DN1370 Eagle Farm to Luggage Point rising main, or the low pressure DN1840 Eagle Farm to Luggage Point rising main. Both the large diameter rising mains are connected to variable speed pumps at the Eagle Farm Pump Station (EFPS) and hence the sewage flows in each main are variable.

The EFPS actually consists of two pump stations:

- EFPS#1, which has three 2000 kW pumps in a two duty/one standby arrangement; and
- EFPS#2, which has two 1850 kW pumps in a duty/standby arrangement.

During dry weather, EFPS#1 is normally used in conjunction with the DN1370 main. Under the current operating arrangements, EFPS#1 can deliver a maximum of around 4200 L/s through the DN1370 main to the Luggage Point WWTP.

During wet weather events, EFPS#1 is normally used in conjunction with the DN1370 main, and EFPS#2 is brought online to assist, in conjunction with the DN1840 main. Under the current operating arrangements, the EFPS can deliver a maximum of around 8000 L/s through both mains to the WWTP.

As SP300 is required to deliver sewage directly into the existing rising mains, its duty head is a strong function of the residual head in the selected discharge main. The maximum and minimum pump duties for SP300 are presented in the table below.

Main in Use	EFPS Flow (L/s)	**SP300 Flow (L/s)**	**SP300 Head (m)**
DN1370	4200	**348**	**40.8**
	0	**348**	**8.9**
DN1840	3800	**348**	**19.2**
	0	**348**	**8.9**

It should be noted that BW has concerns about the allowable pressures in the DN1295 concrete mains downstream of the SP300 rising main connection to the DN1840 rising main. We understand a 12 m operating head has been nominated (to be confirmed).

System curves, pump performance curves and duty calculations for SP300 are presented in the Attachments.

2.2 Equipment Installed

2.2.1 Pumps

Two Hidrostal I10K submersible pumps with 216 kW four pole electric motors are installed in the dry well.

2.2.2 Pump Protection Equipment

Each pump is fitted with moisture probes in the oil chamber and thermistors in the stator windings.

2.2.3 Starters

Two Danfoss VLT8000 Variable Frequency Drives (VFDs) are installed in the pump station switchboard.

2.2.4 Flowmeters

Two direct buried DN500 ABB Magmaster electromagnetic flowmeters are installed in the DN500 PE100 discharge mains downstream of the valve chamber.

2.2.5 Level Sensors

One Vega hydrostatic level transmitter and one Multitrode level probe are installed in the wet well.

2.2.6 Pressure Transmitters

Two Vega D84 pressure transmitters are installed on the discharge pipework in the valve chamber.

2.2.7 Actuated Valves

Two DN450 Keystone Figure 951 knifegate valves with 415 V Rotork actuators are installed in the discharge pipework in the valve chamber.

2.2.8 Dosing Pumps

Provision was made for two chemical dosing pumps (nominally Alldos 0.18 kW) to be installed adjacent to the dosing slab. Provision was made for VFDs for these pumps to be installed in a dedicated control panel adjacent to the pumps.

2.2.9 Activated Carbon Scrubber

Provision was made for one activated carbon odour scrubber (nominally RKR Engineering Airclenz) to be installed adjacent to the wet well. Provision was made for the starter and controls for the activated carbon unit to be installed in a dedicated control panel adjacent to the scrubber.

2.2.10 Emergency Generator

One SE Power 500 kVA diesel powered backup generator is installed on a slab adjacent to the valve chamber. The generator includes its own GE FANUC PLC mounted in a dedicated control panel inside the generator housing.

2.2.11 Pump Station PLC

One GE FANUC PLC is installed in the pump station switchboard.

2.2.12 Telemetry Equipment

One MITS RTU is installed in the pump station switchboard.

2.2.13 Pump Controls

It is recommended that the PLC for pump controls is programmed and interlocked to ensure that when the pumps are pumping into the DN1840 rising main that operational pressure limitations are not exceeded for the DN1295 concrete mains.

2.3 Pump Station Operating States

SP300 has two operating states:

- Remote
- Local

The Local/Remote selector switch dictates the mode of operation. This switch is located in the door of the main switchboard.

2.3.1 Remote State

This is the normal operating state. Pump functionality is directed by the PLC based on automatic feedback control of the wet well level. The PLC calculates the deviation between the measured well level (from the hydrostatic transmitter) and the level setpoint (in the PLC software) and manipulates the speed of the operating pump(s) through the VFDs.

2.3.2 Local State

In Local mode, no automatic control is performed. The PLC controls the pumps based on the manual initiation of the pumps individual start and stop pushbuttons. Once started in manual, the pumps will run until they are requested to stop manually. The operator or electrician is fully responsible for the consequences of running the station in this mode.

THE VFD KEYPADS WILL BE DISABLED AFTER COMMISSIONING TO AVOID OPERATION BY UNTRAINED PERSONNEL.

Electricians with proper training will be able to enable the keypad and allow the pumps to be operational in an emergency situation.

2.4 Pump Start/Stop Sequence

A pump will start if both the following conditions are true.

1) the pump is available for PLC control; and

2) the pump is requested to run.

A pump will stop if either of the following conditions are true:

1) the pump is no longer available for PLC control; or

2) the pump is requested to stop.

Once a start request is accepted by the PLC, the pump is started using the following sequence:

- VFD run/stop relay output shall close;
- VFD speed control shall be set to the required speed depending on control being Local or Remote;
- a low flow inhibit timer set to 60 seconds inhibits the low flow cut-out (based on the magnetic flowmeter signal) while the pump starts;
- if the magnetic flowmeter has not registered a flow of at least 20 L/s after the time delay has expired, then the run/stop relay remains energised;
- the status indicator lights turns on.

Upon a stop request being reset, the pump is stopped using the following sequence:

- VFD run pump relay output shall open;
- VFD frequency reaches 0 Hz, the drive running light on the panel is de-energised; and
- the status indicator light turns off.

The emergency stop sequence for a pump will be executed in the following manner:

- main switchboard or VFD panel emergency stop pushbutton is pressed;
- the isolating contactor opens;
- VFD run/stop relay is de-energised; and
- run light on VFD panel is de-energised.

2.5 Pump Availability

A pump must be available before it can be started. Any one of the following onsite fault conditions will make the pump unavailable:

Fault Condition	Description	Set Criteria	Reset Criteria
Pump Control Power NOT on	Pump or Control Circuit breaker switched to the "OFF" or "Tripped" position	Physical input inactive	Physical input active
Pump Emergency Stop	Pump Emergency Stop pushbutton pressed	Physical input inactive	Physical input active
Pump VFD NOT Ready	VFD faulted due to any of the conditions listed in 2.5.1	Physical input active	Physical input inactive

Pump VFD Not Ready Count Exceeded	More than 3 VFD Not Ready faults in eight hours	Counter > 2	Local or Remote Reset
Pump Contactor fail to operate (open or close)	Any pump contactor fails to operate. Fail to open or fail to close)	Output command ≠ Input Feedback for two seconds	Local or Remote Reset

In Remote mode, under normal operating conditions (not surcharge pumping), a pump motor restart request is locked out for ten minutes to protect the motor starting equipment from thermal failure. This lockout is bypassed by the remote start command from the MITS SCADA system.

A pump cannot be stopped (except emergency stop) once the wet well level is above surcharge imminent.

The emergency stop button is a latched button. The physical button has to be reset before the emergency stop condition is reset.

Local mode prevents the CRO from controlling the site and the pump unavailable alarm is suppressed in this mode. Critical alarms as surcharge imminent and surcharge occurring are sent back to the CRO regardless of his control status.

2.5.1 Pump VFD Ready and in Auto Mode

The local control keypad for the VFD is mounted in the door of the pump compartment. The following control functions are available on the keypad.

"VFD Ready" PLC digital input signal. This signal will be on when the VFD is powered up and the following conditions are not present:

- one of the VFD essential faults has not been detected. The VFD essential faults are:

  < earth fault;

  < switch mode fault;

  < short circuit;

  < auto-optimisation not OK;

  < heat sink temperature too high;

  < motor phase failure; and

  < inverter fault.

If any of these essential faults is detected, the VFD will stop the pump and the "VFD Ready" PLC input signal will be off.

- "VFD Auto Mode selected" this signal will be on , if the drive is selected to Auto on the keypad and is ready for remote control.

- "VFD Running" this signal will be on when the drive is running.
- "VFD Running Speed" PLC analogue input signal will provide 4–20 mA VFD running Hz to the PLC.
- When selected to Auto mode with the pump station mode selector switch in Remote, each VFD speed will be controlled via an analogue output from the PLC. The pump operating speed will be set by the PLC.
- When the VFD is in Auto mode with the pump station mode selector switch in Local, each VFD speed will be controlled via a potentiometer mounted on the pump starter panel part of the main switchboard.

The pumps will be available for PLC control if the "VFD Ready" and "VFD Auto Selected" signals are on.

The pump "VFD Not Ready" fault will be unlatched and the pump will become available for PLC control if any of the following conditions are true.

1. The pump VFD Not Ready fault condition is reset (VFD Ready PLC input signal active) and the local reset pushbutton is pressed.
2. The pump VFD Not Ready fault condition is reset (VFD Ready PLC input signal active) and a reset is issued from the operator workstation.
3. The pump VFD Not Ready reset delay timer times out. This will be indicated by the pump VFD Ready auto reset flag being active.

When the pump VFD faults, the VFD Auto reset timer will start. The VFD Ready delay reset timer is used to allow a preset time to pass before unlatching the fault.

2.6 Running Philosophy

2.6.1 Normal Operation

The incoming flow to SP300 comes from SP298 at Lytton Rd Lytton and a number of other pumping stations on the north side of the Brisbane River. Sewage is pumped from all locations into the submerged inlet chamber at SP300. From the inlet chamber, the sewage flows directly into the wet well.

SP300 is designed to discharge into one of two Eagle Farm to Luggage Point rising mains — a low pressure DN1840 steel rising main and a higher pressure DN1370 steel rising main. Pressure transmitters are installed in the discharge pipework leading to each main to advise the control system which main is in use.

Motorised knifegate valves with proximity switches are installed in the discharge pipework to allow automatic switching between the discharge mains. SP300 is not designed to discharge to both mains simultaneously.

During normal operation, SP300 operates on level control. The electromagnetic flowmeters on the discharge lines are for monitoring only, and flow setpoints are not used to control the station. The proposed level control philosophy is described below.

Level control is used in order to operate the pump station as a "flow-in/flow-out" transfer station as opposed to a "fill and drain" station. SP300 will, however, operate in "fill and drain" mode if the inflow is less than the minimum flow from the station (ranging from 0 L/s to 200 L/s, depending on the rising main in use and the residual pressure in the main).

The control system attempts to maintain a steady level in the pump station by adjusting the output of the operating pump(s). The control loop uses an analogue level signal (from the hydrostatic level transmitter) as the measured variable and manipulate the pump speed through the VFDs.

The PID control loop should be configured at commissioning to provide Proportional-only control action. That is, the integral time constant should be set to a very large number and the derivative constant should be set to zero.

Proportional Control (PC) manipulates the pump speed in response to the deviation between the measured level and a nominal level setpoint. PC will not maintain the level exactly at the setpoint but will allow it to vary around the nominal setpoint within a range called the Proportional Band (PB). The amplitude of the PB can be set arbitrarily by changing the Proportional Gain (Kp) of the feedback controller. **The Proportional Gain should be set to a value of 90** at commissioning to give a PB of +/- 0.15 m around the nominal setpoint, allowing for a pump speed range of 25 Hz to 52 Hz. **The nominal setpoint should be RL0.41 mAHD.**

At the start of an operating cycle, the level in the wet well will be at Cut Out and all pumps will be off. As sewage enters the station the level will rise.

When the level reaches Bottom of PB (Cut In) the Duty A pump will start at the minimum speed of 25 Hz. If the inflow is less than the pump output at minimum speed, the level will fall and the pump will cut out at Cut Out. The operating volume between Cut In and Cut Out is sized for a maximum of 10 starts per hour with one pump producing a nominal flow of 200 L/s.

If the inflow is greater than the minimum discharge rate, the level in the wet well will continue to rise after the pump starts. Within the PB, the controller will modulate the speed of the pump in proportion to the level until the pump can stabilise the level. The VFD will ramp the pump supply frequency within a range from a minimum of 25 Hz (at the bottom of the PB) to a maximum of 52 Hz (at the top of the PB) with a linear distribution between the two limits. At 52 Hz a single pump will discharge approximately 348 L/s into the high pressure main when the EFPS is delivering its peak flow of 4200 L/s.

If the well level continues to rise above the Top of PB, the Duty B pump will start. The feedback level control loop will continue to operate as normal and both pumps will operate at the same speed. The Duty B pump will cut out when the level is drawn down to the Stop Duty B level.

During Level Control operation, the discharge flowrate from the pump station will be monitored by the PLC through the magnetic flowmeters. If the discharge flowrate reaches the upper flow limit of 348 L/s, the PLC will not command any further frequency modulation that will drive the flow above this limit. The speed that corresponds to this flowrate will depend on the main in use (DN1370 or DN1840) and the residual pressure in the main at the time. The pump speed required to deliver 348 L/s could be as low at 33 Hz (with the minimum residual in the DN1840 main), or as high as 52 Hz (with the maximum residual in the DN1370 main).

The PLC will also monitor the discharge rate to ensure it does not drop below 75 L/s during steady operation. This flow corresponds to the intersection between the peak DN1370 system curve and the nominal operating region of the pump. This part of the control logic is designed to prevent the pump station operating continuously at low speed against a high residual head and delivering no flow.

Under normal circumstances, all control functions will be initiated in response to an analogue signal from the hydrostatic level transmitter. The Multitrode level switches will be used to indicate Surcharge Imminent.

In the event of a failure of the hydrostatic level transmitter, all pumps will immediately stop and control of the pump station will be based on the surcharge imminent digital input alarm. When this alarm is received, the Duty A pump will start at maximum speed and run for a predefined time.

When the level reaches the surcharge imminent level, as per the physical surcharge imminent electrode, the station will initiate the surcharge pumping mode. In surcharge pumping mode, all starting interlocks, pump inhibits and wet well level duty setpoints are ignored. All available pumps will be commanded to run.

Surcharge pumping mode is active while surcharge pumping conditions are true and for a set period of time (site specific) after the level falls below the surcharge imminent condition.

Once surcharge-pumping mode is deactivated, the station will revert to normal level of operation.

The MITS operator can inhibit one or all station pumps. A single pump can be inhibited if it is not operating in the pump curve. This will remove it from the duty cycle allowing the other pumps to operate as duty pumps until the inhibit is removed.

When the whole pump station is inhibited, it is desirable to minimise the volume pumped. This is achieved by utilising the wet well storage capacity to a safe maximum level. The duty start levels are raised to 200 mm below surcharge imminent. At this level, the pumps will run for a minimum of five minutes until the pump lockout time expires. After this period, the pumps will stop at 400 mm below surcharge imminent. While both pumps are inhibited, the wet well high alarm will be suppressed.

In the event of a failure of the wet well probe, all pumps will immediately stop and control of the pump station will be based on the surcharge imminent digital input alarm.

When this alarm is received, both pumps start at maximum speed.

SP300 may communicate by telemetry with the EFPS, SP298, SP299, SP146, SP136 and SP131 through BW's Cullen Avenue Control Centre. This would enable the system to be controlled as a whole, thus minimising the chance of sewage overflows in the event of a breakdown or malfunction. The nature of this system control interconnectivity is to be determined by Brisbane Water.

2.6.2 Daily Cleaning Cycle

Hydrotec Consultants Ltd who completed the physical modelling of the SP300 wet well recommended that a daily cleaning cycle be included in the operating philosophy for the pump station, as detailed below.

On initiation of the cleaning cycle the duty pump will run up from base speed until the inflow is beaten (up to a maximum flow of 348 L/s). If the inflow is below the pumped outflow, and the sump level reduces, the cleaning cycle will start. The cycle time for the cleaning period will depend on the inflow to the pumping station and the available sump volume. At the end of the cleaning cycle the duty pump will stop to allow the sump to fill and revert back to normal operation.

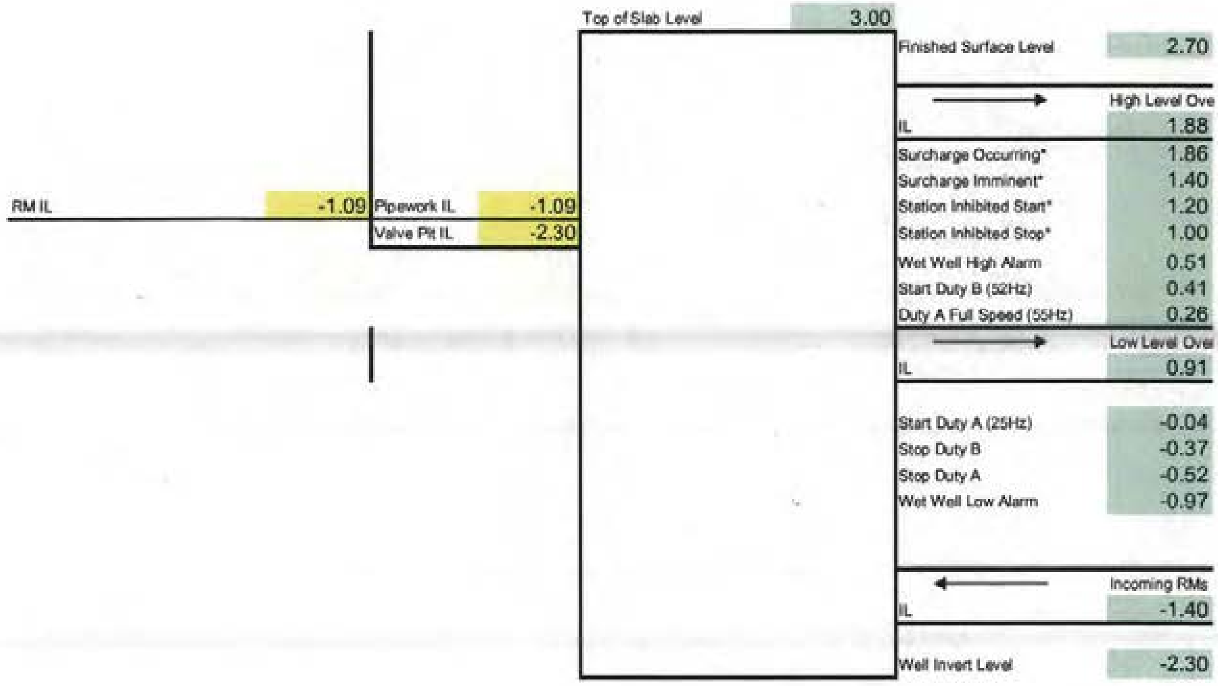
If the inflow to the sump is at or above the pumped outflow at the start of the cleaning cycle, and no reduction in sump level is recorded, the cleaning cycle will be overridden and normal operation will resume.

The duty or lead pump selection should be alternated to minimise accumulation of grit debris around the non-operative or standby pump. To help minimise blockages within the pump it is recommended that the lead pump is alternated after running for a set period of say, one hour. However, we would recommend that further advice on running times is sought from the pump supplier.

It is recommended that the minimum drawdown level for the daily cleaning cycle be set during commissioning. Hydrotec have determined a minimum drawdown level of -1.30 m for one pump operating at full or base speed (200 to 348 L/s).

Operational Diagram

The following diagram shows the station structure levels and operating levels.



Note: *Based upon DN1295 concrete pipe being isolated.

2.7 Site Alarms

2.7.1 Alarm Definition

When alarms are triggered, the PLC immediately transmits them to the MITS master station. These are unsolicited transmissions and, to preserve radio network capacity, these transmissions are kept to a minimum.

The alarm definitions are:

Priority 1: Immediate action

Priority 2: Action next calendar day

Priority 3: Action next working day

Priority 4: No action required, not an "alarm", log as an event for future reference

Priority 1 alarms need immediate action and are therefore placed in the PLC trigger queue.

The alarm priority class is shown by colour in the CRO's alarm picture on the MITS. The MITS SCADA allows alarm filtering of alarms.

2.7.2 Pump Station Alarms

The following alarms are labelled Pump Station Alarms and cause the PLC to send and immediate alarm to the control room.

MITS SCADA Details		
Plant	**Quantity**	**Alarm Description**
Sewage_pumping_station	Local_Remote	Station in Local mode
Sewer_pump	Available	Sewer pump unavailable
PLC	Isagraph_stopped	PLC software stopped
PLC	Isagraph_failed	PLC software faulted
Sewage_pumping_station	Mains_fail	Site Main Power Fails
PLC	Battery	PLC power failure battery
PLC	Mains_fail	PLC power failure (mains)
Wet_well	Level_invalid	Wet well measuring instrument faulted
Wet_well	Surcharge_imminent	Wet well level reaches the surcharge imminent level
Wet_well	Surcharge_occurring	Wet well level reaches the surcharge occurring level
Wet_well	High	Wet well level rises above a high alarm level
PLC	Abnormal_operation	Abnormal operation of PLC – PLC has restarted
Wet_well	Low	Wet well level is low
Sewer_pump	Pump_hours_excessive	Pump run hours are excessive
Sewer_pump	Low_run_hours	Pump station run hours are below normal
Pressure_gauge	High	RM Pressure is high
Pressure_gauge	Low	RM Pressure is low
Pressure_gauge	Invalid	RM Pressure is invalid
Sewer_pump	Motor_power_high	Pump motor power high
Sewer_pump	Motor_power_low	Pump motor power low
Sewer_pump	Motor_power_invalid	Pump motor power invalid
Sewer_pump	Motor_current_high	Pump motor current high
Sewer_pump	Motor_current_low	Pump motor current low
Sewer_pump	Motor_current_invalid	Pump motor current invalid
Sewer_pump	VFD_Fault	Pump VFD Faulted, signal provided by VFD Not Ready
Sewer_pump	VFD_count_check	Pump VFD has faulted more than 3 times in 8 hrs period

MITS SCADA Details		
Plant	**Quantity**	**Alarm Description**
Sewer_pump	Mains_power	Pump has lost mains power
Sewer_pump	Running	Pump running indication
Sewer_pump	Contactor_Fail_to_Close	Pump contactor fail to close
Sewer_pump	Emergency_stop_fault	Pump emergency stop button is active
Sewer_pump	Moisture_In_Oil Chamber	Pump Oil Chamber - Moisture detected
Attention	Automatic_reset	Site attention indication has automatically reset

The pump performance degradation and pump blockage variables have the following values.

Index	DPBkSP (mAHD)	VSDDSP (Hz)	FlwDSP (L/s)	VSDBSP (Hz)	FlwBSP (L/s)
0		Set in code	Set in code	Set in code	Set in code
1	0	TBA	TBA	TBA	TBA
2	TBA	TBA	TBA	TBA	TBA
3	TBA	TBA	TBA	TBA	TBA

The PID loop variables have the following values.

Index	PidIN	PidSP	PidK	pidKd	PidKi	pidInt	pidDb	pidOUT
0	Set in code	Set in code	TBA	0	TBA	0	0.2	Set in code
1	Set in code	Set in code	TBA	0	TBA	0	0.2	Set in code
2	Set in code	Set in code	TBA	0	TBA	0	0.2	Set in code

Pump Performance Degradation (Monitoring Only)

The pump performance degradation alarm flag will be latched if the pump has been running, the VFD speed is valid, the flow rate is valid, the delivery pressure is valid and either of these following alarm conditions becomes active.

- During PID minimum flow control, the VFD speed is above the performance degradation minimum flow rate VFD speed setpoint for that delivery pressure for longer than the time period determined by the performance degradation minimum flow rate VFD speed timer; and
- Flow rate less than the performance degradation flow rate setpoint for that delivery pressure and the VFD speed is above the performance degradation flow rate VFD speed setpoint for that delivery pressure for longer than the time period determined by the performance degradation flow rate VFD speed timer.

The alarm flag will be reset when the pump performance degradation conditions no longer exist and either of the following conditions occur:

- local reset (PnLRst) via the pump local reset pushbutton being pressed; and
- remote reset via an operator.

Pump Blockage

The pump blockage flag, which inhibits the pump from being available if another pump is available to run, will be latched if the pump station doesn't have a surcharge imminent alarm active, the pump has been running, the VFD speed is valid, the flow rate is valid and either of these following alarm conditions becomes active.

- While being in PID minimum flow control, the VFD speed is above pump blockage minimum flow rate VFD speed setpoint for that delivery pressure for longer than the time period determined by the pump blockage minimum flow rate VFD speed timer.
- Flow rate less than the pump blockage flow rate setpoint for that delivery pressure and the VFD speed is above the pump blockage flow rate VFD speed setpoint for that delivery pressure for longer than the time period determined by the pump blockage flow rate VFD speed timer.

The alarm flag will be reset when the pump blockage conditions no longer exist and any of the following conditions occur:

- local reset (PnLRst) via the pump local reset pushbutton being pressed;
- remote reset via an operator; and
- surcharge imminent alarm becomes active.

Pump Availability

The pump available flag will only be set when all of the available conditions occur and either of the following conditions occur:

- NOT pump no.n blockage;
- pump no.n blockage and another pump is NOT available to run; and
- pump no.n blockage and surcharge imminent alarm becomes active.

If any of the available conditions are not met then the pump is unavailable for PLC control and will not be able to be run automatically or locally via the local start pushbutton.

2.7.3 Priority 2 Alarms

Priority 2 alarms are stored in the PLC buffer and transmitted when the buffer is full or when the MITS master station polls the PLC. The CRO will be notified of these alarms once they are transmitted.

Since these alarms are non-critical, this delay is acceptable.

No Priority 2 alarms are used for this site.

2.7.4 Alarm Suppression

To avoid consequential alarming that is one fault condition triggering multiple alarms at the MITS SCADA system, alarm suppression is used on secondary alarms.

The main consequential alarm condition is Site Power Fail.

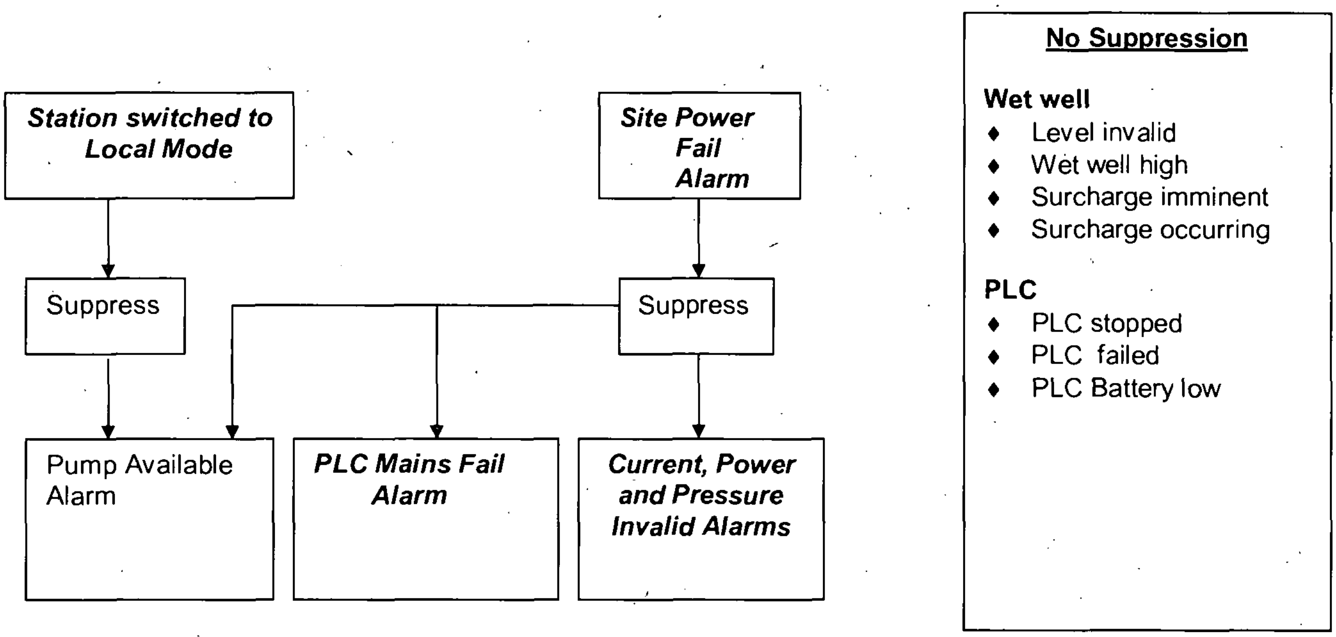
If site power fails, the following secondary alarms are suppressed:

- pump unavailable;
- PLC power fail;
- motor current invalid;
- motor power invalid; and
- site pressure invalid.

When the station is switched to Local mode, the site is under the control of the on site technician. An alarm is triggered at the SCADA system to indicate the station is in local control. All pump alarms are suppressed as the on site technician has assumed responsibility for the station.

Note: Wet well and PLC alarms are not suppressed.

Alarm Suppression Tree



2.8 PLC Functionality

2.8.1 PLC Calculations

The following calculations are performed by the pump station PLC:

1. Wet Well Level Calculations
2. Wet Well Volume
3. Station Inflow
4. Station Volume Pumped
5. Station Surcharge Duration
6. Station Pressure mAHD
7. Pump Hour Run per day
8. Pump Flow (kL) per day
9. Pump Starts per day
10. Pump kW hours per day

A brief description of the listed items are given below:

2.8.1.1 Wet Well Level Calculations

The onsite wet well level indicator mounted on the switchboard shows well level in percentage (%) of full range. This value is transmitted to control room for ease of comparison with the on site technician.

The operator requires the wet well level in mAHD to be able to do a meaningful comparison between different sites.

The following formulas are used to calculate these values.

WWL (mAHD) = WWL (metres) + WWLZero Level (mAHD)

$$\text{WWL \%} = \frac{WWL(mAHD) - WWLZero(mAHD)}{WWLRange(m)}$$

2.8.1.2 Wet Well Volume

The wet well level is calculated using a wet well level versus volume look up table. The look up table has a maximum of 32 point specification of the non-linear relationship of the wells "Level versus Volume". Volume in wet well is an interpolation of the well versus volume look up table values.

Note: The wet well volumes are calculated on the basis that DN1295 concrete overflow pipe is isolated. Once BW commissions the DN1295 concrete pipe overflow system, the set points will need to be adjusted.

		Water Height (mAHD)	Stored Volume (m^3)	Remaining Storage Capacity [m^3]	Comments	% Level	% Volume
1	Wet Well Low	-0.97	0.0	46.3	BWL	0%	0%
2	Stop Duty A	-0.52	7.3	39.0		16%	16%
3	Stop Duty B	-0.37	9.8	36.5		21%	21%
4	Start Duty A	-0.04	15.1	31.2		33%	33%
5	Duty A Full Speed	0.26	20.0	26.3		43%	43%
6	Start Duty B	0.41	22.4	23.9		48%	48%
7	High Level Alarm	0.51	24.0	22.3	TWL	52%	52%
8	Station Inhibited Stop	1.00	32.0	14.3		69%	69%
9	Station Inhibited Start	1.20	35.3	11.0		76%	76%
10	Surcharge Imminent Alarm	1.40	38.5	7.8		77%	77%
11	Surcharge Occurring Alarm	1.86	46.0	0.3		99%	99%
12	Overflow Level	1.88	46.3	0.0		100%	100%

2.8.1.3 Total Inflow

The total volume pumped in kilolitres since the start of the year is updated in two seconds increment calculated by integrating the inflow, if the wet well level and flow are valid, using the following calculation algorithm:

Total Inflow = (Inflow x 2)/1000 + Total Inflow

The Inflow rate is the change in volume plus the volume pumped out of the well and is updated in two second increments calculated, if the wet well level and flow are valid, using the following calculation algorithm.

Inflow = ((Volume Now – Volume Old) + (Flow x 2)) / 2

Volume now = Current wet well level volume

Volume old = Previous (2 seconds ago) wet well level volume

Flow = Flow in engineering units

The wet well volume is calculated, if the wet well level is valid, using the wet well level as a reference and interpolation of a level vs. volume vs. surcharge flow lookup table.

2.8.1.4 Total Volume Pumped

The total volume pumped in Kilolitres since the start of the year is updated in two second increments calculated by integrating the inflow if the wet well level and flow are valid.

2.8.1.5 Station Surcharge Duration

While the surcharge occurring alarm is active, a timer is accumulated to measure the duration of the surcharge event. This figure is stored until a new surcharge occurring alarm is triggered, at which time the timer is reset to zero.

2.8.1.6 Station Pressure (mAHD)

The pressure probe measures the pressure in kPA. This allows the CRO to compare different sewerage sites. The pressure, in mAHD, is calculated and sent back to the MITS SCADA system.

Pressure (mAHD) = Pressure $\frac{kPA}{k}$ + Pressure Elevation (mAHD)

k = 9.803 (Pressure constant to convert from kPA to metres)

Pressure Elevation = Site Specific Pressure Elevation of Pressure Gauge

2.8.1.7 Pump Hrs Run/day

The VFD of each pump has a Modbus communication card connected to the PLC.

This card provides the PLC with information regarding Current, Speed, kW hours per day and Hours run per day.

2.8.1.8 Pump kL/day

The station magnetic flowmeter will provide flow readings via an analogue 4–20 mA signal connected to the PLC.

2.8.1.9 Pump Starts/day

The number for starts per day counter is incremented every time a pump starts. This counter is reset at midnight.

2.8.1.10 Pump kW hrs/day

The VFD of each pump has a Modbus communication card connected to the PLC.

This card provides the PLC with information regarding Current, Speed, kW hours per day and hours run per day.

2.8.2 Site Attention Indicator

The operator will be able to initiate and cancel the site attention indicator. When a site attention indication is generated, officers on site will be required to acknowledge the attention indicator and then contact the operator.

The site attention indicator digital output is latched by an operator generating a site attention indicator flag.

The output is unlatched if any of the following occurs:

- site attention indicator reset by the operator;
- site attention indicator reset pushbutton digital input being pressed; and
- site attention alarm timer expires.

The site attention alarm timer is enabled by the site attention alarm indicator digital output.

The site attention alarm flag is latched if the site attention alarm expires. The alarm is unlatched when the next site attention indicator output is set.

2.8.3 Local Indication Lamp

The local indication lamp output displays the status of the pump.

Lamp Off	Pump stopped but available
Lamp On	Pump running
Lamp Flashing	Pump Fault

2.8.4 Pump Hours Run

An hours run counter shall be kept for all pumps in the PLC.

A cyclometer type hours run meter has also been mounted on the front door of each pump starter Panel.

An electronic hours run meter also exists in the VFD for the Pumps, these totalise the pump hours run time during its operation.

3. MITS SCADA SYSTEM — OPERATOR INTERFACE

The SCADA Screen shall follow the format and standards of the existing Screens.

Live points from PLC fed back to picture

- Wet well level in metres AHD and % full.
- Pump duty A start level (in metres AHD and % full), pump duty A stop level, and wet well high level.
- Status of each pump (available, running).
- Delivery pressure in metres AHD.
- Delivery Flow.
- Site power status.
- Local/ Remote control status.
- Station inflow (when pumps are not running).
- Wet well volume.
- Time (in minutes) to surcharge (when pumps are unavailable).

MITS database points in the picture

The Inlet level (metres AHD), Overflow Control Level (metres AHD) and the Site Level (metres AHD) are stored in the MITS database and not in the PLC. These values are displayed in the main station picture.

3.1 PLC Input/Output Listing

Refer to electrical drawings.

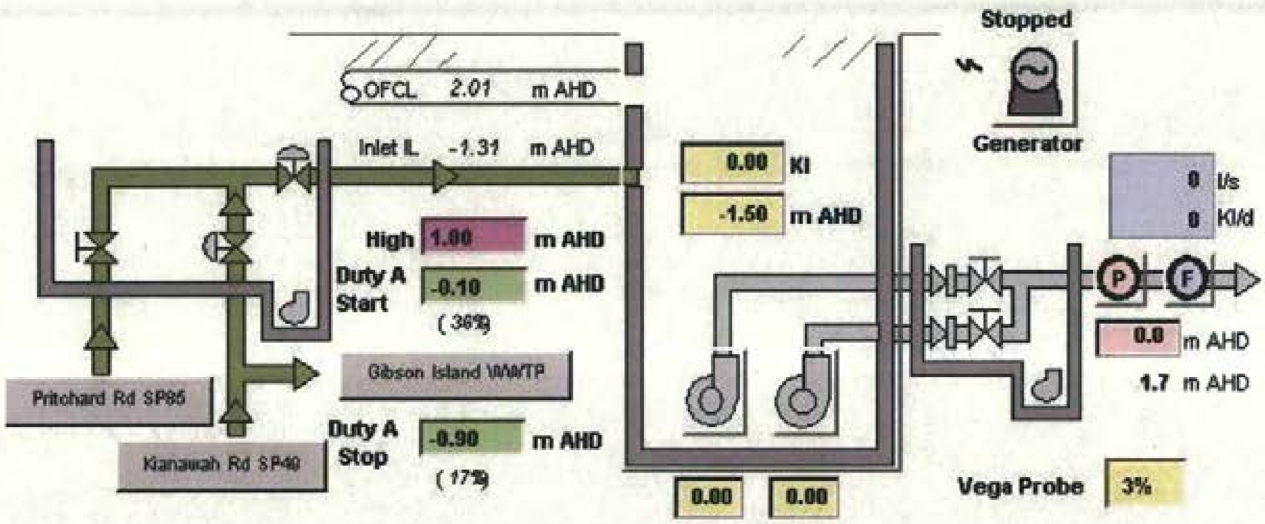
ATTACHMENTS

Brisbane City

Brisbane Water

BRISBANE WATER

Network Control Systems



FUNCTIONAL SPECIFICATION

SP298 Lytton Rd #4

Sewage Pumping Station

Submersible 2 Pumps With VSD

Document Signoff

Approval

	Name	Role	Signature	Date
Supervising Elec. Eng *Engineering Design Services*	Alan Mooney	Recommend	A Mooney	26/5/05
Supervising Elec. Eng *Engineering Design Services*	Henri Lai	Concur	HLai	28/5/05
Team Leader *Network Control Systems*	Peter Sherriff	Concur		
Manager *M & E Planning*	Peter Casey	Concur		
Manager *Water & Sewerage Operations*	George Henry	Concur		
Project Manager	Andrew Bannik	Approve	AB	17/05/05

Distribution

Name	Role	Section

Revision Control

Revision Number	Date	Amendment Details	Responsible Officer
Version 0.00	11/11/2004	Original Draft – Developed from Leightons Revised Functional Spec – Version 4	Alex Witthoft
Version 0.03	26/11/2004	Issued for Comment	Alex Witthoft
Version 0.04	29/11/2004	Added Comments by Malcolm Barrett	Alex Witthoft
Version 1.00	15/02/2005	Added Comments by Leightons and PB	Alex Witthoft
Version 1.01	16/02/2005	Added Comments by Reg McGirr	Alex Witthoft
Version 1.02	16/02/2005	Minor spelling corrections	Alex Witthoft
Version 1.03	08/03/2005	Set points changed after commissioning	Alex Witthoft
Version 1.04	09/05/2005	Changed Lytton Rd #3 to Lytton Rd #4	Alex Witthoft
Version 1.05	13/05/2005	Minor Modifications requested by Reg McGirr	Alex Witthoft
Version 1.10	21/11/2005	Levels modified after official NSM surveying	Alex Witthoft

Document Consultation

Please review the attached document and add your comments where necessary. To ensure that the process is kept within reasonable timeframes, it would be appreciated if you could return this document by the **Requested Return Date** listed below.

Project Sponsor:	Andrew Bannik	Officer Code: PM13BW	Location: T.C.B. Level 2
Author:	Alex Witthoft	Officer Code: CTAMP12	Location: Cullen Ave
Document Administrator:	Alan Mooney	Officer Code: SEEPSBW	Location: T.C.B. Level 2

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0.04	Peter Sherriff	Cullen Ave	29/11/04	06/12/04	06/12/04	Y	Y
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0.04	Henri Lai	TCB	29/11/04	06/12/04	06/12/04	N	N
0.04	Frank Mitchell	Leightons	29/11/04	21/12/04	21/12/04	Y	Y
0.04	Dean Maguire	Parsons Brinckerhoff	29/11/04	21/12/04	21/12/04	Y	Y

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Definitions

IDTS	Integrated Departmental Telemetry System
RTU	Remote Telemetry Unit
SCADA	Supervisory Control And Data Acquisition
mAHD	Metres above Australia Height Datum

1 INTRODUCTION

This document contains the site specific details and describes the non standard functional requirements for control, monitoring and telemetry at sewage pump station SP298 at Lytton Road Lytton. The functional requirements described in the document are in addition to the standard functionality detailed in "SPSV3 SEWAGE PUMPING STATION SUBMERSIBLE 3 PUMPS WITH VFD" 1.

The standard specification was written for a 3 pump station, of which only 2 pumps are allowed to run at any given time. The functionality for SP298 Lytton Road #4 is identical, except that SP298 only has 2 pumps, both of which can run simultaneously.

This site specific details and the non standard functional requirements in this document was derived from the functional specification written by Leighton Contractors Pty Ltd "SP298 FUNCTIONAL SPECIFICATION REV 4" [2].

SP298 Lytton Rd #4 is a sewerage pumping station with two variable speed 68 kW (nominal) submersible pumps operating in a duty/standby arrangement. This station is located on the northwest side of Lytton Road Lytton, approximately 300 m southwest of Freight Street.

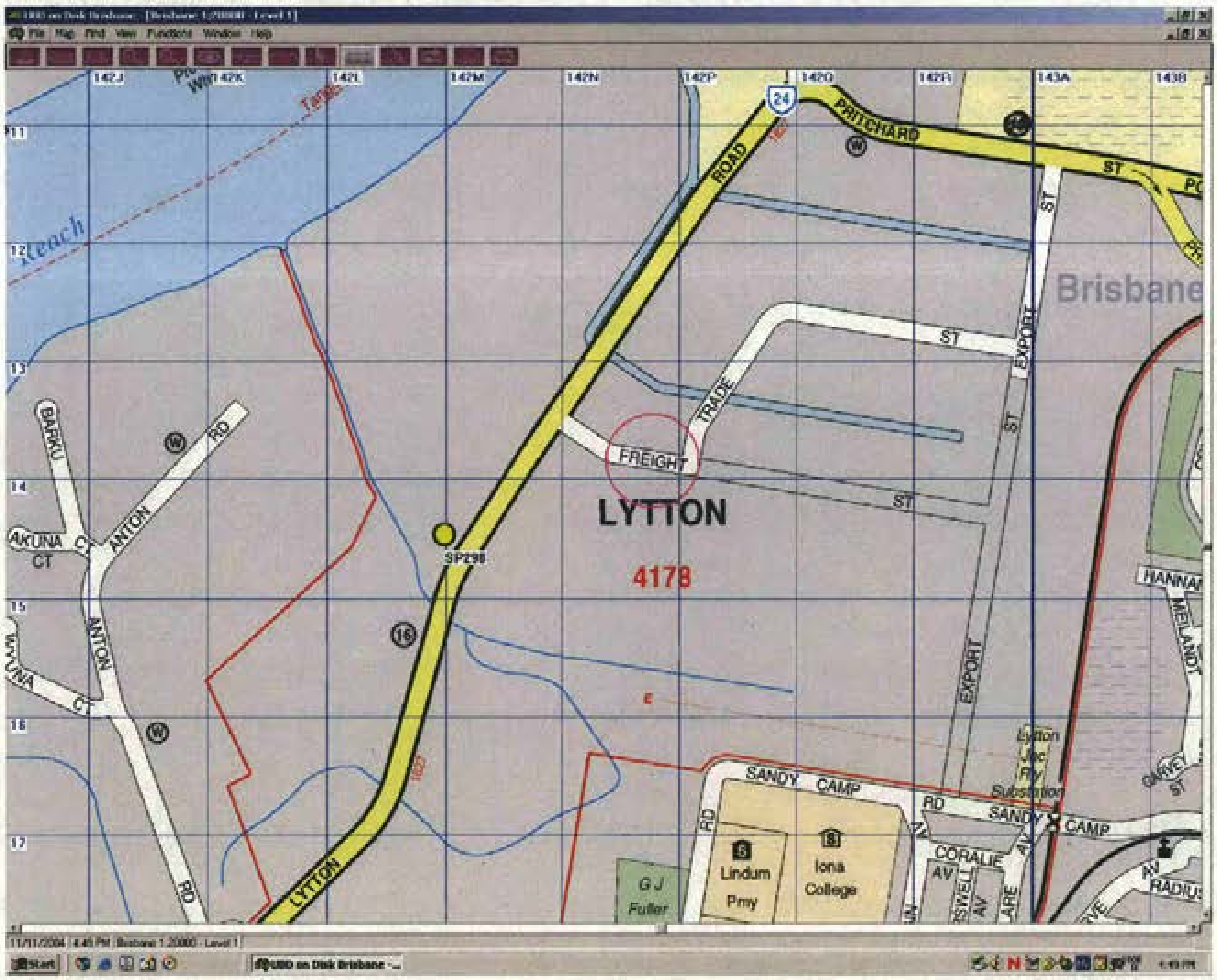


Figure 1: SP298 Location Map

1.1 General Process Description

The incoming sewage at SP298 is pumped from SP049 Kianawah Rd and SP085 Pritchard St. A branch was constructed on the SP049 rising main to allow flow into SP298 from the existing SP049, which originally pumped to Gibson Island WWTP. SP049 is still capable of pumping directly to Gibson Island WWTP when the new branch is isolated at the inlet to SP298. An actuated knife gate valve is installed at the end of the branch to allow this diversion to be triggered remotely. Refer to drawing 486/5/7-WR101/030.

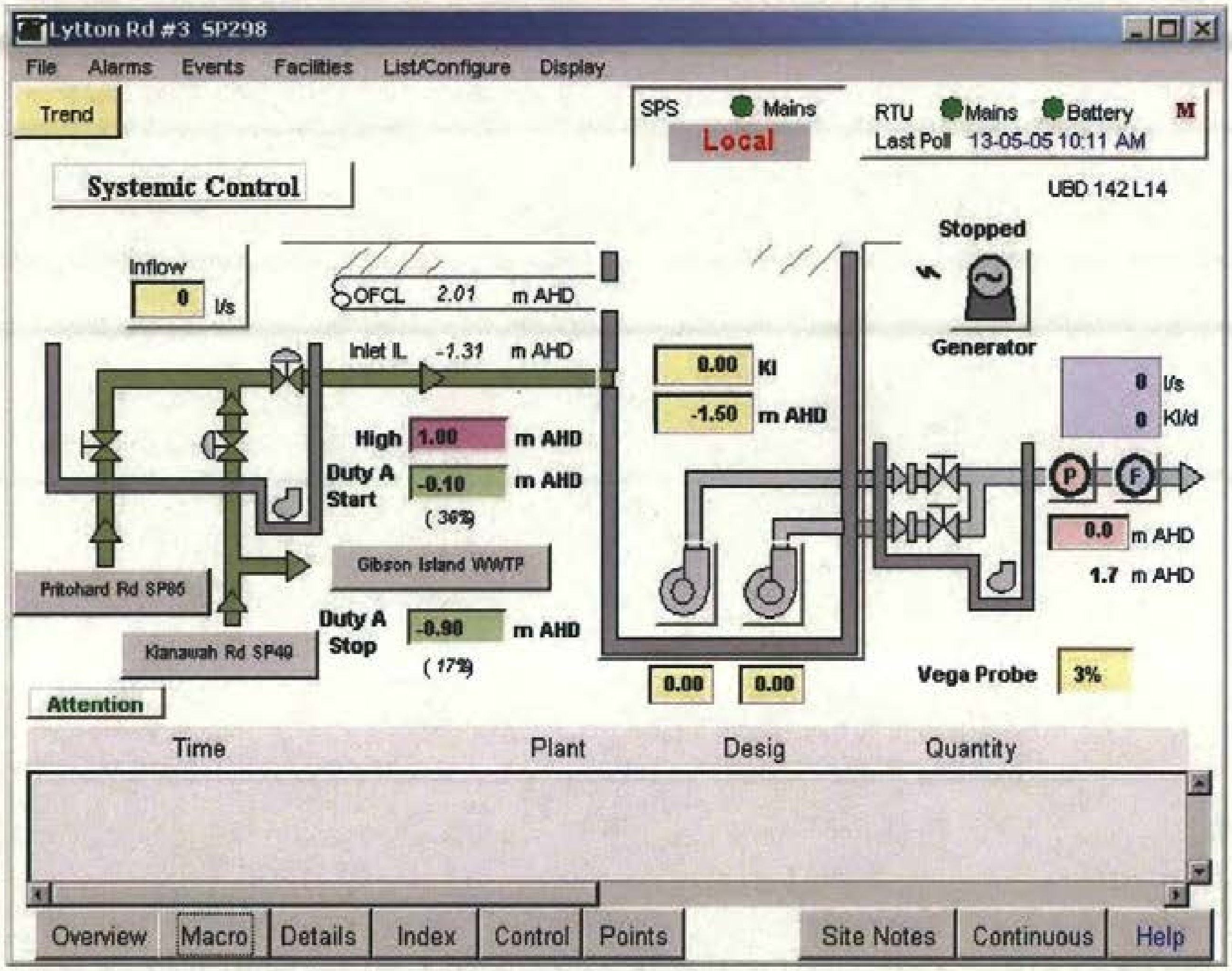


Figure 2: SP298 Process and Instrumentation Overview

The Kianawah Road branch and Pritchard Street rising main are connected in a valve chamber upstream of SP298 and discharge through a common pipe into the SP298 grit collector maintenance hole (GCMH). From the GCMH, the sewage flows directly into the wet well through a submerged pipe.

With one pump running, SP298 discharges a maximum of 160 L/s of raw sewage through an OD450 PE100 and OD400 PE100 rising main to the inlet structure at SP300 at Serpentine Road Pinkenba, approximately 2.6 km to the northwest. This figure increases to 210 l/s when both pumps are running at maximum speed. The rising main includes a Horizontal Directional Drilled (HDD) section under the Brisbane River at approximately RL-50mAHD which is OD400 PE100. A pressure transmitter and flow transmitter are installed in the discharge pipe work.

2 EQUIPMENT INSTALLED

2.1 Standard Equipment

SP298 Lytton Rd #4#4 pump station has the following standard equipment installed. The functionality for the control, monitoring and alarming for these items is fully described in the standard functional specification.

Pumps	Two Hidrostal H08K submersible pumps with 68 kW (nominal) four pole electric motors are installed in the wet well. Each pump is fitted with moisture probes in the oil chamber and thermistors in the stator windings.
Pump Starters	Two Danfoss VLT8000 Variable Frequency Drives (VFDs) are installed in the pump station switchboard. The VFDs will also provide soft starting functionality.
Flowmeters	One direct buried DN450 ABB Magmaster electromagnetic flowmeter is installed in the DN450 PE100 discharge main downstream of the valve chamber. The flowmeter will be used in the flow control algorithm (PID Loop) to control the speed of the pumps.
Level Sensors	One Vega hydrostatic level transmitter and one Multitrode level probe are installed in the wet well.
Pressure Transmitters	One Vegabar 64 pressure transmitter is installed on the discharge pipework in the valve chamber.

2.2 Non Standard Equipment

SP298 Lytton Rd #4#4 pump station has the following non standard equipment installed. The functionality for the control, monitoring and telemetry for is described in the following sections as these items is NOT described in the standard specification. (ref 1: Document ID 003589)

Emergency Generator	One 133kVA diesel powered backup generator is installed on a slab adjacent to the valve chamber. The generator includes its own GE FANUC PLC mounted in a dedicated control panel inside the generator housing.
Manual Valves	A manually operated DN300 Keystone Figure 951 knifegate valve would be installed on the rising main from SP085 (V3). and from future new developments at Lytton Rd
Actuated Valves	Two actuated DN300 Keystone Figure 951 knifegate valves shall be installed at the inlet valve pit. These valves will be located on the rising main from SP049 (V1) and on the common main to SP298 (V2).

2.2.1 Emergency Generator

The emergency generator is designed to the standard functionality as described by "DIESEL STANDBY GENERATOR LOCAL CONTROL PANEL FUNCTIONAL DESCRIPTION". [3] The generator is supplied with the PLC fully configured and programmed with the standard program. The RTU (Logica MD3311) is programmed with the standard interface program that will provide the monitoring, control and telemetry to the IDTS master station.

2.2.2 Manual Valve

A manually operated valve is installed on the rising main from SP085 Prichard Rd to allow the rising main to be isolated in the event of a burst in the rising main.

2.2.3 Actuated Valves

SP298 Lytton Road #4 has two actuated valves (V1 and V2 – refer to Figure 2: SP298 Process and Instrumentation Overview~~Figure 2: SP298 Process and Instrumentation Overview~~~~Figure 2: SP298 Process and Instrumentation Overview~~) installed to allow the inflow to the station to be controlled under high flow and failure conditions.

Normal Flow Conditions

Under normal conditions both of the actuated valves (V1 and V2) will be open and both SP085 Prichard Street and SP048 Kianawah Road will deliver flow to the SP298 Lytton Road #4.

High Inflow Conditions

If SP298 Lytton Road #4 can not keep up with the inflow to the station, the wet well level will rise. Once the surcharge imminent level is reached, the station is deemed to be under high inflow condition. To reduce flow into the station, the flow from SP049 will be diverted to Gibson Island WWTP by closing the actuated valve (V1) fitted to the rising main.

Failure Conditons

IF both pumps are unavailable to run, the site will be deemed to be under failure condition. All flow is diverted to Gibson Island WWTP by closing the actuated valve before the inlet to the wet well (V2) while the actuated valve on the rising main from SP049 Kianawah (V1) is open.

NOTE: Both actuated valves will NOT be able operate during an electrical outage (ie both Energex and generator power is unavailable) under the control of the PLC. It can be only operated manually by an on site operator.

2.3 Provision for Future Non-Standard Equipment

Although the project has made civil provision for the following future equipment, no PLC or RTU code has been developed

- Dosing Pump
- Activated Carbon Scrubber

Any future project to install the above equipment will provide funding for the functional specification and programming of the control, monitoring and telemetry.

2.3.1 Dosing Pumps

Provision was made for two chemical dosing pumps (nominally Alldos 0.09 kW) to be installed adjacent to the dosing slab. Provision was made for VFDs for these pumps to be installed in a dedicated control panel adjacent to the pumps. These will need to be flow paced to allow for the two flow duties. Provision for a 3-phase power supply has been made in the pump station switchboard.

2.3.2 Activated Carbon Scrubber

Provision was made for one activated carbon odour scrubber (nominally RKR Engineering Airclenz) to be installed adjacent to the wet well. Provision was made for the starter and controls for the activated carbon unit to be installed in a dedicated control panel adjacent to the scrubber Provision for a 3-phase power supply has been made in the pump station switchboard.

3 CONTROL PHILOSOPHY

The station will operate according to the control philosophy detailed in the standard functional specification (SPSV3) with the following modifications.

3.1 Normal Operation

In the event of a sudden failure of the SP298 pumps (eg power failure, emergency stop etc), there is some risk of the momentum of the water column to drain the SP298 pump well. Water hammer modelling was undertaken by Parsons Brinckerhoff to identify a solution to this problem.

From these investigations, it was found that the momentum issue would be controlled by ensuring that the volume in the well is sufficient for the current flow rate of the station.

To achieve this the pump station will run a single pump at minimum flow rate of 90 l/s while it is under 0.000mAHD. Above this level a single pump will be controlled to gradually increase the flow rate, via a proportional only control loop, to 160/s at 0.500mAHD. A single pump will be limited to 160 l/s. The second pump will be started at 0.600mAHD and both pumps will be contolled to produce 160 l/s. Above 0.600mAHD the two pumps will be controlled to gradually increase the flow rate, via a proportional only control loop, to 210 l/s at 0.800mAHD. The same proportional loops will reduce the flow rate of the station as the wet well level decreases.

All the above levels and flow rates are displayed graphically in Figure 3: SP298 Station Level Set Points~~Figure 3: SP298 Station Level Set Points~~~~Figure 3: SP298 Station Level Set Points~~

To achieve this change in control philosophy, the PID Loops detailed in the standard specification (ref 1: Document ID 003589) will have an integral coefficient of 0 and a proportional coefficient to provide the necessary flow increase as the wet well level increases.

If the flow meter is invalid, the proportional loop will provide a VFD speed set point equivalent to the desired flow.

Number of pumps running	Flow Rate	Equivalent Speed
1 pump	90 l/s	25 Hz
1 pump	160 l/s	50 Hz
2 pumps	160 l/s	?? Hz ?????????????
2 pumps	210 l/s	50 Hz

3.2 Duty Rotation Algorithm

The duty rotation algorithm will now control only two pumps instead of three. The number of pumps allowed to run remains the same (2) and the initialisation block will be configured with the site specific set points listed in the tables in the next section.

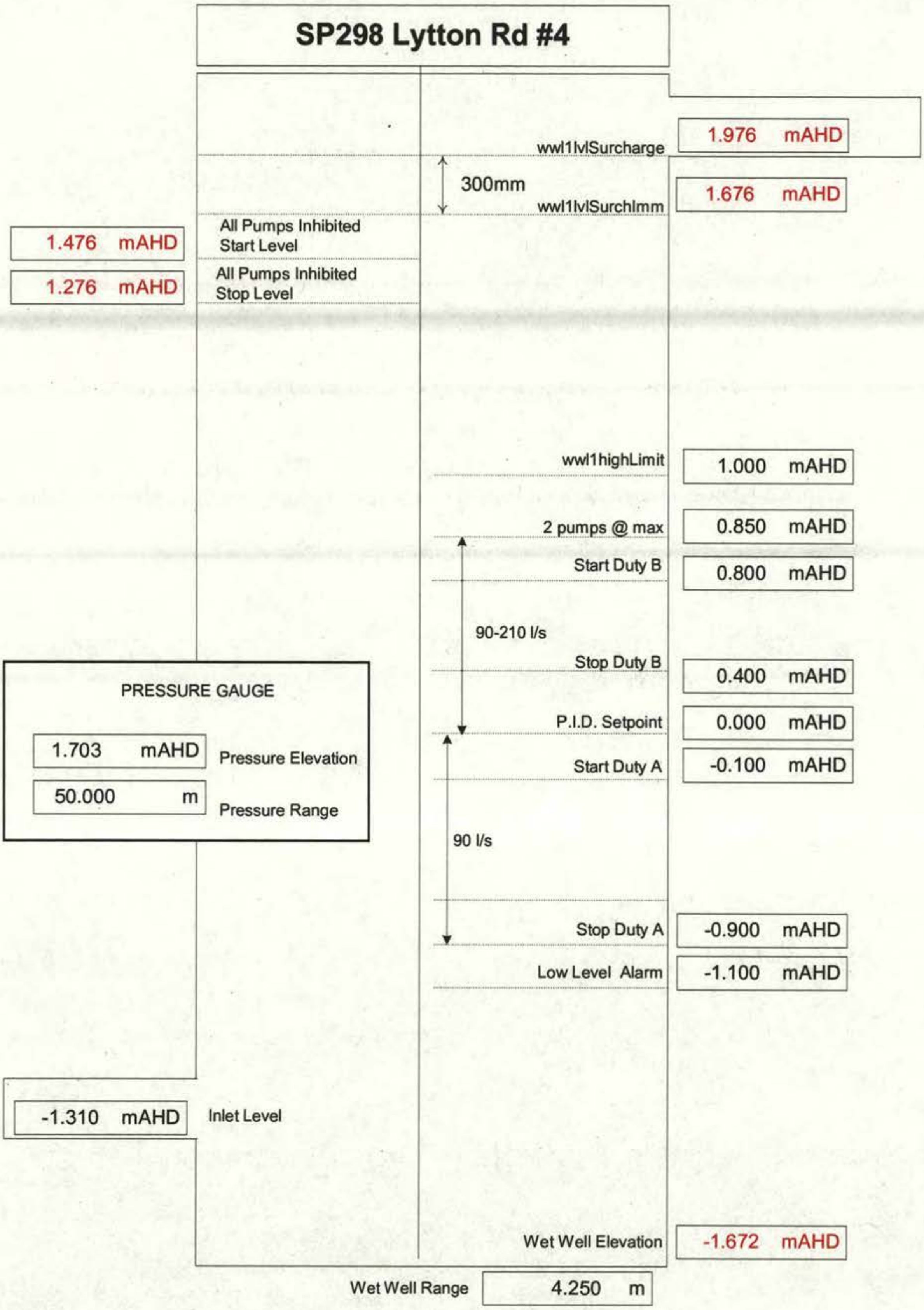


Figure 3: SP298 Station Level Set Points

3.3 Site Specific Values

Table 1: Site Specific Constants defined in the PLC

Tag Name	Description	Type	Value	Units
Sewerage Pumping Station				
Stn01grSurchPumpingTime	Surcharge pumping duration [3]	Integer	45	Sec
Delivery flow				
Flw01txRange	Delivery flow – Range	Real	250.0	l/s
Stn01grMinFlow1Pmp	Delivery flow – Minimum flow	Real	90.0	l/s
Stn01grMaxFlow1Pmp	Delivery flow – Maximum flow – 1 Pump	Real	160.0	l/s
Stn01grMaxFlow2Pmp	Delivery flow – Maximum flow – 2 Pumps	Real	210.0	l/s
Delivery pressure				
Pre01txRange	Delivery pressure - Range	Real	50000	mmAHD
Pre01txZero	Delivery pressure – Elevation of the transducer	Real	1703	mmAHD
Pump Blockage				
Stn01grPmpBlockFlowKneeSP	Flow blocked limit for flow/level PID control (knee)	Integer	1000	l/s x 10
Stn01grPmpBlockSpeedKneeSP	VFD speed blocked limit for flow/level PID control (knee)	Integer	800	Hz x 10
Stn01grPmpBlockSpeedMinSP	VFD speed blocked limit for minimum flow PID control	Integer	900	Hz x 10
Wet well level				
Wwl01txRange	Wet well level range	Integer	4250	mmAHD
Wwl01txSurchImmLevelSP	Wet well surcharge imminent level	Integer	1676	mmAHD
Wwl01grInhStartLevelSP	Wet well inhibit mode start level	Integer	1476	mmAHD
Wwl01grInhStopLevelSP	Wet well inhibit mode stop level	Integer	1276	mmAHD
Wwl01grRunatMaxLvlSP	Wet well run at maximum speed level	Integer	850	mmAHD
Wwl01txDtyBStartLevelSP	Wet well duty B pump start level	Integer	800	mmAHD
Wwl01txPIDLevelSP	Wet well PID set point	Integer	0	mmAHD
Wwl01txDtyBStopLevelSP	Wet well duty B pump stop level	Integer	400	mmAHD
Wwl01txDtyAStartLevelSP	Wet well duty A pump start level	Integer	-100	mmAHD
Wwl01txDtyAStopLevelSP	Wet well duty A pump stop level	Integer	-900	mmAHD
Wwl01txZero	Wet well empty level (4mA of Probe)	Integer	-1672	mmAHD
Variable Frequency Drive				
Stn01grMinSpeed	Variable Frequency Drive – Minimum Speed	Integer	2500	Hz x 100
	Variable Frequency Drive – Maximum Speed (DN1840)	Integer	3300	Hz x 100
Stn01grMaxSpeed	Variable Frequency Drive – Maximum Speed (DN1370)	Integer	5000	Hz x 100

Table 2: Site Specific Constants defined in the RTU

Tag Name	Description	Type	Value	Units
Delivery flow				
flw1almInhibitTm	Delivery flow - Alarm inhibit timer	Integer	15	sec
Delivery pressure				
pre1almInhibitTm	Delivery pressure - Alarm inhibit timer	Integer	15	sec
Wet well level				
wwl1surchLvlVol	Wet well volume at surcharge level	Real	30.50	kl
wwl1lvlSurcharge	Wet well surcharge occurring level	Real	2.014	mAHD
Pumps 1 - 3				
Pmp[x]almInhPwrTm	Pump [x] - Motor power alarm inhibit timer.	Integer	15	sec
pmp[x]almInhCrntTm	Pump [x] - Motor current alarm inhibit timer.	Integer	15	sec
pmp[x]currRange	Pump [x] - Motor current range	Real	115.0	Amps

Table 3: Site specific Variable defined in the RTU

Tag Name	Description	Type	Value	Units
Wet well level				
wwl1highLimit	Wet well level - High alarm set point	Integer	850	mmAHD
wwl1lowLimit	Wet well level - Low alarm set point	Integer	-1100	mmAHD
Delivery flow				
flw1highLimit	Delivery flow - High alarm set point	Integer	250000	ml/s
flw1lowLimit	Delivery flow - Low alarm set point	Integer	0	ml/s
Delivery pressure				
pre1highLimit	Delivery pressure - High alarm set point	Integer	51703	mmAHD
pre1lowLimit	Delivery pressure - Low alarm set point	Integer	1703	mmAHD
Pumps 1 - 2				
pmp[x]currHiLimit	Pump [x] - Motor current high alarm set point	Integer	115000	mAmps
pmp[x]currLoLimit	Pump [x] - Motor current low alarm set point	Integer	0	mAmps
pmp[x]powHiLimit	Pump [x] - Motor power high alarm set point	Integer	68000	Watts
pmp[x]powLoLimit	Pump [x] - Motor power low alarm set point	Integer	0	Watts

Table 4: Wet Well Level vs Volume Data

	Height (mAHD)	Volume m³	Remaining Storage m³	% Level	% Volume
1	-0.72	0.0	46.3	0%	0%
2	-0.27	7.3	39.0	16%	16%
3	-0.12	9.8	36.5	21%	21%
4	0.21	15.1	31.2	33%	33%
5	0.51	20.0	26.3	43%	43%
6	0.66	22.4	23.9	48%	48%
7	0.76	24.0	22.3	52%	52%
8	1.25	32.0	14.3	69%	69%
9	1.45	35.3	11.0	76%	76%
10	1.65	38.5	7.8	77%	77%
11	2.11	46.0	0.3	99%	99%
12	2.13	46.3	0.0	100%	100%

Figures in red need to be adjusted for storage in BW overflow pipe.

3.4 Non Standard Control

3.4.1 Valve Control

There are 3 valid modes of operation, controlled by the open and close status of valve 1 and valve 2. These modes are:

Mode	Valve 1	Valve 2	Description
1 – Normal	OPEN	OPEN	Both SP049 and SP085 pump into SP298
2 – Surcharge Pumping	CLOSED	OPEN	Only flow from SP085 will inflow to SP298 Flow from SP049 directed to GI to reduce inflow to SP298
3 – Failure	OPEN	CLOSED	Flow from SP085 directed to GI through valve 1. No flow to SP298 Flow from SP049 also directed to Gibson Island as the pressure from SP085 will be greater than the pressure from SP049.
4 – Invalid	CLOSED	CLOSED	NOT VALID – Flow from SP085 has no destination.

Mode 1 – Normal

In this mode both SP085 and SP049 will contribute flow to SP298. The station will be in this mode unless one of the other modes is activated.

Mode 2 – Surcharge

The flow from Kianawah is to be diverted to Gibson Island when the surcharge pumping mode is active. Surcharge pumping mode is fully explained in the standard specification. By closing valve 1 flow coming from SP049 is stopped which reduces the total inflow to SP298. Once surcharge pumping mode is deactivated, the valves will revert back to Mode 1 – Normal (ie Valve 1 will open).

Mode 3 – Failure

When this mode is active the valves are configure to divert all flow into the station (from Prichard and Kianawah) to Gibson Island. This mode will be active when either of the following conditions are true:

- Both pumps are unavailable and the well has filled to the wet well high level.
- Both pumps are inhibited. (ie all pumps inhibited mode should not start the pumps).

If a pump becomes available (or not inhibited), then once that pump has started and pumped the wet well down below the duty A start level valve 2 will open.

Local Control

The valves can also be controlled locally via hard wiring (independent of the PLC). While in local control, it is the responsibility of the on site technician to ensure the correct position of the valve.

3.4.2 Pump Control

Number of Pumps

The station acts as per the functionality outlined in the standard Functional Specification. The duty block is modified to only consider 2 pumps (the standard has 3 pumps).

All Pumps Inhibit Mode

As mentioned in the Valve Control section, this stations 'All Pumps Inhibit Mode' not only modifies the start and stop level, it also prevents all inflow to the station by diverting the flow to Gibson Island. This mode will be activated, by the control room officer, as part of the SP300 Serpentine Rd contingency plan to reduce the inflow to SP300 Serpentine Rd.

3.5 Non Standard Monitoring and Alarms

3.5.1 Additional Valve Monitoring and Alarms

The following alarms and events are associated with both valves

Plant	Quantity	Priority
Valve	Available	1
Valve	Available_remote	0
Valve	Open	0
Valve	Closed	0
Valve	Fail_open_alarm	1
Valve	Fail_close_alarm	1

Available

The valve is considered available only when all of the following conditions are present:

- Available for Remote
- Not "Failed to Open"
- Not "Failed to Close"

Available for Remote

The digital input status for "valve available for remote" is transferred directly to the IDTS master station.

Open

The digital input status for "valve open" is transferred directly to the IDTS master station. This is used to animate the valve status on the main IDTS page.

Closed

The digital input status for "valve closed" is transferred directly to the IDTS master station. This is used to animate the valve status on the main IDTS page.

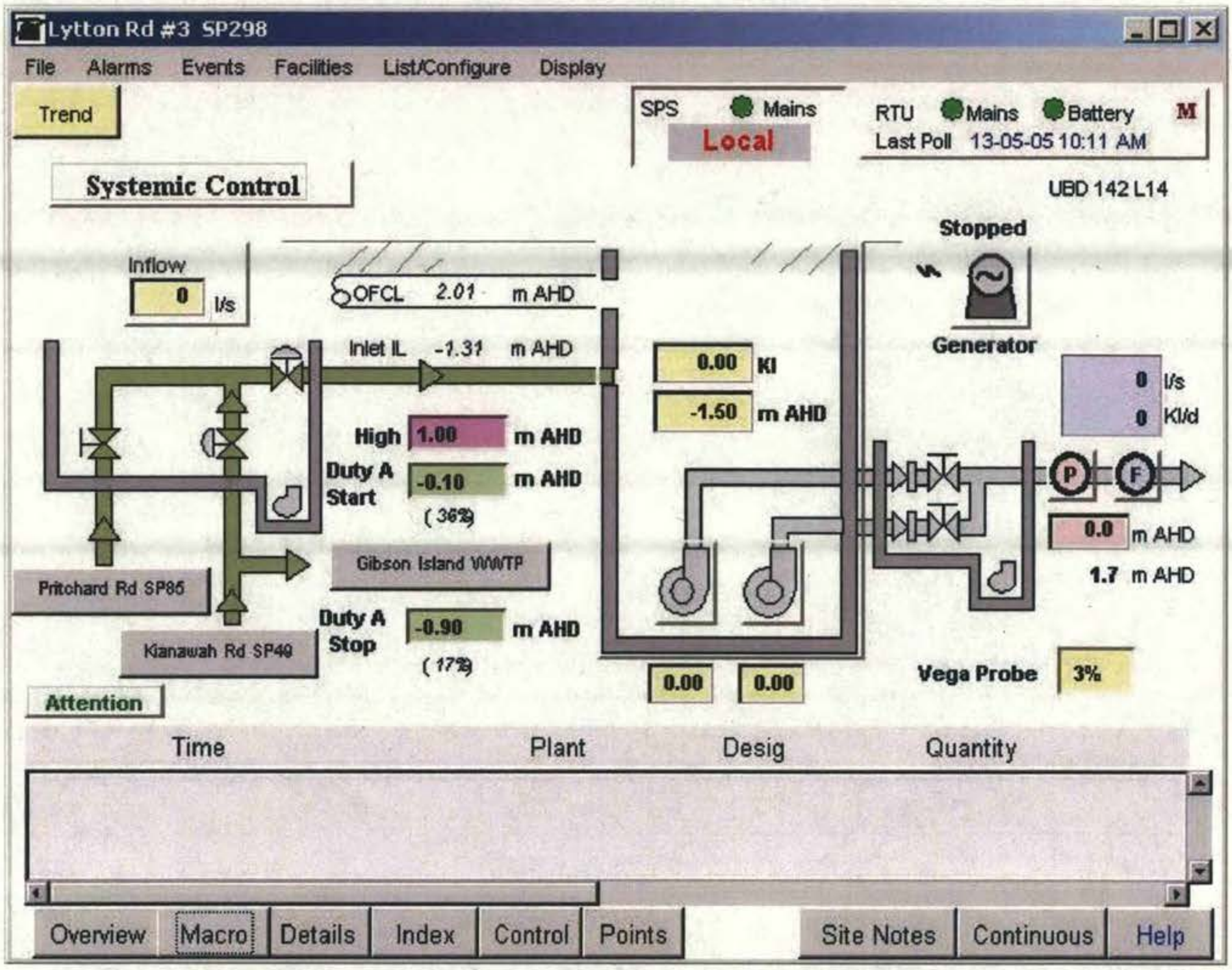
Fail to Open

If the valve is commanded to open and does not reach the open limit within the pre determined time period (set at two times the normal travel time) then the failed to open alarm will be activated. This alarm can be reset locally by pressing either of the pump (1 & 2) reset push buttons or remotely by the IDTS master station.

Fail to Close

If the valve is commanded to close and does not reach the close limit within the pre determined time period (set at two times the normal travel time) then the failed to close alarm will be activated. This alarm can be reset locally by pressing either of the pump (1 & 2) reset push buttons or remotely by the IDTS master station.

3.6 Non Standard IDTS Picture



3.6.1 Additional Valves

The two valves will be displayed and will be animated to indicated open, closed and faulted conditions. Double clicking on the valve will bring up the valve control page, on which the operator will be able to send a remote reset.

3.6.2 Additional Pipe Animation

The two inlet pipes will be animated to show a "filled" condition if their respective valve is open. An arrow on the inlet pipe from SP049 Kianawah will indicate the direction of flow (ie into SP298 or back to Gibson Island).

4 REFERENCES

1

TITLE	SPSV3 Sewage Pumping Station Submersible 3 Pumps With VFD – Functional Specification
DOCUMENT ID	003589
VERSION	0.30
AUTHOR	Alex Witthoft , Brisbane Water – Network Control Systems
DOCUMENT OWNER	Peter Sherriff, Brisbane Water – Network Control Systems

2

TITLE	SP298 Functional Specification
DOCUMENT ID	N/A
VERSION	REVISION 4
AUTHOR	M. BRAND
DOCUMENT OWNER	Leighton Contractors Pty Ltd

3

TITLE	Diesel Standby Generator - Local Control Panel - Functional Description
DOCUMENT ID	N/A
VERSION	02
AUTHOR	SOUTH EAST POWER GENERATION
DOCUMENT OWNER	

SEWAGE PUMP STATION
SP 298
LYTTON ROAD LYTTON

REVISED FUNCTIONAL SPECIFICATION

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		Signature	Date
Author	M. Brand		
Design Verifiers			
Projects Engineering Manager			
Project Manager			
Team Leader – Projects Systems & Information Management			
Principal Process Operations Engineer			

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ATTACHMENTS:
SP298 Design Calculations
SP298 Electrical Drawings

1. INTRODUCTION

1.1 Scope of Document

This document outlines the functional requirements for control, monitoring and telemetry at sewage pump station SP298 at Lytton Road Lytton.

1.2 Organisations Involved

The design, construction and commissioning of SP298 were components of Brisbane Water's *Australia Trade Coast Sewer Project*. The project was awarded to Leighton Contractors Pty Ltd (LCPL) in late 2003.

SP298 was designed by Parsons Brinckerhoff — LCPL's design consultant — and was constructed by LCPL in the second half of 2004.

1.3 General Description of SP298

SP298 is a 3.6 m diameter reinforced concrete pump station incorporating two variable speed 68 kW submersible pumps operating in a duty/standby arrangement. SP298 is located on the northwest side of Lytton Road Lytton, approximately 300 m southwest of Freight Street.

SP300 discharges a maximum of 160 L/s of raw sewage through an OD450 PE100 and OD400 PE100 rising main to the inlet structure at SP300 at Serpentine Road Pinkenba, approximately 2.6 km to the northwest. The rising main includes a horizontal directional drilled (HDD) section under the Brisbane River at approximately RL-50mAHD.

2. FUNCTIONAL REQUIREMENTS

2.1 Pump Station Duty

SP298 is required to deliver a maximum of 160 L/s into SP300 at Serpentine Road Pinkenba. The rising main consists of approximately 2700 m of OD450 PN12.5 PE100 pipe installed by "cut and cover" and around 750 m of OD400 PN20 PE100 pipe installed by HDD under the river.

Immediately upstream of SP300 is an elevated valve pit at RL2.25 m AHD on the southern side of the existing rising mains. It has been included in the design to reduce the impact of the momentum associated with pump stop and pump trip events and to prevent the rising main from draining on shutdown.

The pumping station has two duties, 90 L/s and 160 L/s. The duty will be selected depending on water level in the wet well.

System curves, pump performance curves and duty calculations for SP298 are presented in the Attachments.

2.2 Equipment Installed

2.2.1 Pumps

Two Hidrostal H08K submersible pumps with 68 kW four pole electric motors are installed in the wet well.

2.2.2 Pump Protection Equipment

Each pump is fitted with moisture probes in the oil chamber and thermistors in the stator windings.

2.2.3 Starters

Two Danfoss VLT8000 Variable Frequency Drives (VFDs) are installed in the pump station switchboard. VFDs were installed to allow two duty points and for flexibility of operations in the future. The VFDs will also provide soft starting functionality.

2.2.4 Flowmeters

One direct buried DN450 ABB Magmaster electromagnetic flowmeter is installed in the DN450 PE100 discharge main downstream of the valve chamber. The flowmeter will be used to control the flow set points of 90 L/s and 160 L/s.

2.2.5 Level Sensors

One Vega hydrostatic level transmitter and one Multitrode level probe are installed in the wet well.

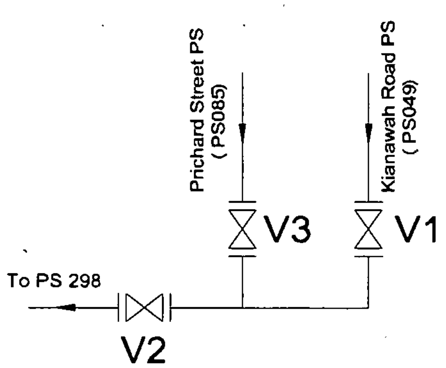
2.2.6 Pressure Transmitters

One Vega D84 pressure transmitter is installed on the discharge pipework in the valve chamber.

2.2.7 Actuated Valves

Normally flow from Prichard Street Pumping Station (PS085) and Kianawah Road Pumping Station (PS049) will deliver flow to the Lytton Road Pumping Station (PS 298). The incoming rising mains to PS 298 shall be fitted with actuated valves to allow flow from PS085 and PS049 to bypass PS 298 (flows from PS085 will be diverted to the PS049 rising main) or to allow each incoming pipeline to be isolated in the event of a pressure main burst.

Two actuated DN300 Keystone Figure 951 knifegate valves shall be installed at the inlet valve pit. These valves will be located on the rising main from PS 049 (V1) and on the common main to PS298 (V2). The actuated valve will be required to operate during an electrical outage. To ensure reliable operation the valves shall be fitted with a 24 VDC electric actuator connected to the grid/ generator and backed by a battery power supply. A manually operated DN300 Keystone Figure 951 knifegate valve would be installed on the rising main from PS 085 (V3). The sketch below shows the proposed arrangement.



The above valve arrangement will have the following modes of operation:

1. Normal Operation Mode 1 – V1, V2 and V3 Open.
   Allows Flow from PS085 and PS049 to discharge to PS298.

2. Normal Operation Mode 2 – V1 Closed, V2 and V3 Open.
   Allows only flow from PS PS085 to discharge to PS298.

3. Failure Mode 1 – V1 Open, V2 Closed and V3 Open.
   Allows from PS 085 to be diverted to Gibson Island WWTP.

4. Failure Mode 2 – V1 and V2 Open, V3 Closed.
   Isolates PS 085 rising main in the event of the PS085 main failing.

5. Failure Mode 3 – V1 Closed, V2 and V3 Open.
   Isolates PS 049 rising main in the event of the PS049 main failing.

2.2.8 Dosing Pumps

Provision was made for two chemical dosing pumps (nominally Alldos 0.09 kW) to be installed adjacent to the dosing slab. Provision was made for VFDs for these pumps to be installed in a dedicated control panel adjacent to the pumps. These will need to be flow paced to allow for the two flow duties.

2.2.9 Activated Carbon Scrubber

Provision was made for one activated carbon odour scrubber (nominally RKR Engineering Airclenz) to be installed adjacent to the wet well. Provision was made for the starter and controls for the activated carbon unit to be installed in a dedicated control panel adjacent to the scrubber.

2.2.10 Emergency Generator

One 150 kVA diesel powered backup generator is installed on a slab adjacent to the valve chamber. The generator includes its own GE FANUC PLC mounted in a dedicated control panel inside the generator housing.

2.2.11 Pump Station PLC

One GE FANUC PLC is installed in the pump station switchboard.

2.2.12 Telemetry Equipment

One MITS RTU is installed in the pump station switchboard.

2.3 Pump Station Operating States

SP298 has two operating states:

- Remote
- Local

The Local/Remote selector switch dictates the mode of operation. This switch is located in the door of the main switchboard.

2.3.1 Remote State

This is the normal operating state. Pump functionality is directed by the PLC based on automatic stop/start control of the wet well level.

2.3.2 Local State

In Local mode, no automatic control is performed. The PLC controls the pumps based on the manual initiation of the pumps individual start and stop pushbuttons. Once started in manual, the pumps will run until they are requested to stop manually. The operator or electrician is fully responsible for the consequences of running the station in this mode.

THE VFD KEYPADS WILL BE DISABLED AFTER COMMISSIONING TO AVOID OPERATION BY UNTRAINED PERSONNEL.

Electricians with proper training will be able to enable the keypad and allow the pumps to be operational in an emergency situation.

2.4 Pump Start/Stop Sequence

A pump will start if both the following conditions are true:

1. the pump is available for PLC control; and
2. the pump is requested to run.

A pump will stop if either of the following conditions are true:

1. the pump is no longer available for PLC control; or
2. the pump is requested to stop.

Once a start request is accepted by the PLC, the pump is started using the following sequence:

- VFD run/stop relay output shall close;
- a low flow inhibit timer set to 60 seconds inhibits the low flow cut-out (based on the magnetic flowmeter signal) while the pump starts;
- if the magnetic flowmeter has registered a flow of at least 20 L/s after the time delay has expired, then the run/stop relay remains energised; and
- the status indicator lights turns on.

If the pump is unable to match the duty flow with the motor frequency within a set band, then the pump will stop, an alarm will be activated and the standby pump will become the duty pump. (These acceptable frequency bands will be set during commissioning.)

Upon a stop request being reset, the pump is stopped using the following sequence:

- VFD run pump relay output shall open;
- VFD frequency reaches 0 Hz, the drive running light on the panel is de-energised; and
- the status indicator light turns off.

The emergency stop sequence for a pump will be executed in the following manner:

- main switchboard or VFD panel emergency stop pushbutton is pressed;
- the isolating contactor opens;
- VFD run/stop relay is de-energised; and
- run light on VFD panel is de-energised.

2.5 Pump Availability

A pump must be available before it can be started. Any one of the following onsite fault conditions will make the pump unavailable:

Fault Condition	Description	Set Criteria	Reset Criteria
Pump Control Power NOT on	Pump or Control Circuit breaker switched to the "OFF" or "Tripped" position	Physical input inactive	Physical input active
Pump Emergency Stop	Pump Emergency Stop pushbutton pressed	Physical input inactive	Physical input active
Pump VFD NOT Ready	VFD faulted due to any of the conditions listed in 2.5.1	Physical input active	Physical input inactive
Pump VFD Not Ready Count Exceeded	More than 3 VFD Not Ready faults in eight hours	Counter > 2	Local or Remote Reset
Pump Contactor fail to operate (open or close)	Any pump contactor fails to operate. Fail to open or fail to close)	Output command ≠ Input Feedback for two seconds	Local or Remote Reset

In Remote mode, under normal operating conditions (not surcharge pumping), a pump motor restart request is locked out for six minutes to protect the motor starting equipment from thermal failure. This lockout is bypassed by the remote start command from the MITS SCADA system.

A pump cannot be stopped (except emergency stop) once the wet well level is above surcharge imminent.

The emergency stop button is a latched button. The physical button has to be reset before the emergency stop condition is reset.

Local mode prevents the CRO from controlling the site and the pump unavailable alarm is suppressed in this mode. Critical alarms as surcharge imminent and surcharge occurring are sent back to the CRO regardless of his control status.

2.5.1 Pump VFD Ready and in Auto Mode

The local control keypad for the VFD is mounted in the door of the pump compartment. The following control functions are available on the keypad:

"VFD Ready" PLC digital input signal. This signal will be on when the VFD is powered up and the following conditions are not present:

- one of the VFD essential faults has not been detected. The VFD essential faults are:
  - earth fault;
  - switch mode fault;
  - short circuit;
  - auto-optimisation not OK;

< heat sink temperature too high;

< motor phase failure; and

< inverter fault.

If any of these essential faults is detected, the VFD will stop the pump and the "VFD Ready" PLC input signal will be off.

- "VFD Auto Mode selected" this signal will be on , if the drive is selected to Auto on the keypad and is ready for remote control.
- "VFD Running" this signal will be on when the drive is running.
- "VFD Running Speed" PLC analogue input signal will provide 4–20 mA VFD running Hz to the PLC.
- When selected to Auto mode with the pump station mode selector switch in Remote, each VFD speed will be controlled via an analogue output from the PLC. The pump operating speed will be set by the PLC.
- When the VFD is in Auto mode with the pump station mode selector switch in Local, each VFD speed will be controlled via a potentiometer mounted on the pump starter panel part of the main switchboard.

The pumps will be available for PLC control if the "VFD Ready" and "VFD Auto Selected" signals are on.

The pump "VFD Not Ready" fault will be unlatched and the pump will become available for PLC control if any of the following conditions are true:

1. The pump VFD Not Ready fault condition is reset (VFD Ready PLC input signal active) and the local reset pushbutton is pressed.

2. The pump VFD Not Ready fault condition is reset (VFD Ready PLC input signal active) and a reset is issued from the operator workstation.

3. The pump VFD Not Ready reset delay timer times out. This will be indicated by the pump VFD Ready auto reset flag being active.

When the pump VFD faults, the VFD Auto reset timer will start. The VFD Ready delay reset timer is used to allow a preset time to pass before unlatching the fault.

2.6 Running Philosophy

The incoming sewage at SP298 is pumped from SP049 at Kianawah Rd Lindum and SP085 at Pritchard St Lytton. A branch was constructed on the SP049 rising main to allow flow into SP298 from the existing SP049, which originally pumped to Gibson Island WWTP. SP049 is still capable of pumping directly to Gibson Island WWTP when the new branch is isolated at the inlet to SP298. An actuated knifegate valve is installed at the end of the branch to allow this diversion to be triggered remotely.

The Kianawah Road branch and Pritchard Street rising main are connected in a valve chamber upstream of SP298 and discharge through a common pipe into the SP298 grit collector maintenance hole (GCMH). From the GCMH, the sewage flows directly into the wet well through a submerged pipe.

SP298 is designed to discharge through its own dedicated rising main to the inlet structure at SP300. A pressure transmitter and flow transmitter are installed in the discharge pipework. Only the flow setpoints will be used to control the station.

During normal operation, SP298 operates in "fill and drain" mode based on the measurement from the hydrostatic level transmitter. The proposed level control philosophy is described below.

Two flow "banded" set points are proposed for 90 L/s and 160 L/s in the lower and upper well respectively. The Duty A pump will ramp up the ramp down using the two set points.

At the start of an operating cycle, the level in the wet well will be at *Stop Duty A* and the pumps will be off. As sewage enters the station, the level will rise. When the level reaches the *Duty A* to 90 L/s level, the duty pump will start at 90 L/s. Once the pump starts, the level will fall and the pump will stop at the *Stop Duty A* level. The operating volume between *Duty A* to 90 L/s and *Stop Duty A* is sized for a maximum of ten starts per hour.

If the inflow is greater than the maximum pump discharge rate, the level in the wet well will continue to rise after the *Duty A* pump starts. If the level reaches *Duty A* to 160 L/s, the pump will increase in speed to achieve that required flow. If the level reaches *Start Duty B*, the second pump will start to assist the first pump. The *Duty B* pump will cut out when the level is drawn down to the *Stop Duty B* level.

Under normal circumstances, all control functions will be initiated in response to an analogue signal from the hydrostatic level transmitter. The Multitrode level switches will be used to indicate Surcharge Imminent.

In the event of a failure of the hydrostatic level transmitter, all pumps will immediately stop and control of the pump station will be based on the surcharge imminent digital input alarm. When this alarm is received, the *Duty A* pump will start and run for a predefined time (120 seconds).

When the level reaches the surcharge imminent level, as per the physical surcharge imminent electrode, the station will initiate the surcharge pumping mode. In surcharge pumping mode, all starting interlocks, pump inhibits and wet well level duty setpoints are ignored. All available pumps will be commanded to run.

Surcharge pumping mode is active while surcharge pumping conditions are true and for a set period of time (site specific) after the level falls below the surcharge imminent condition. Once surcharge-pumping mode is deactivated, the station will revert to normal level of operation.

The MITS operator can inhibit one or both station pumps. A single pump can be inhibited if it is not operating in the pump curve. This will remove it from the duty cycle allowing the other pumps to operate as duty pumps until the inhibit is removed.

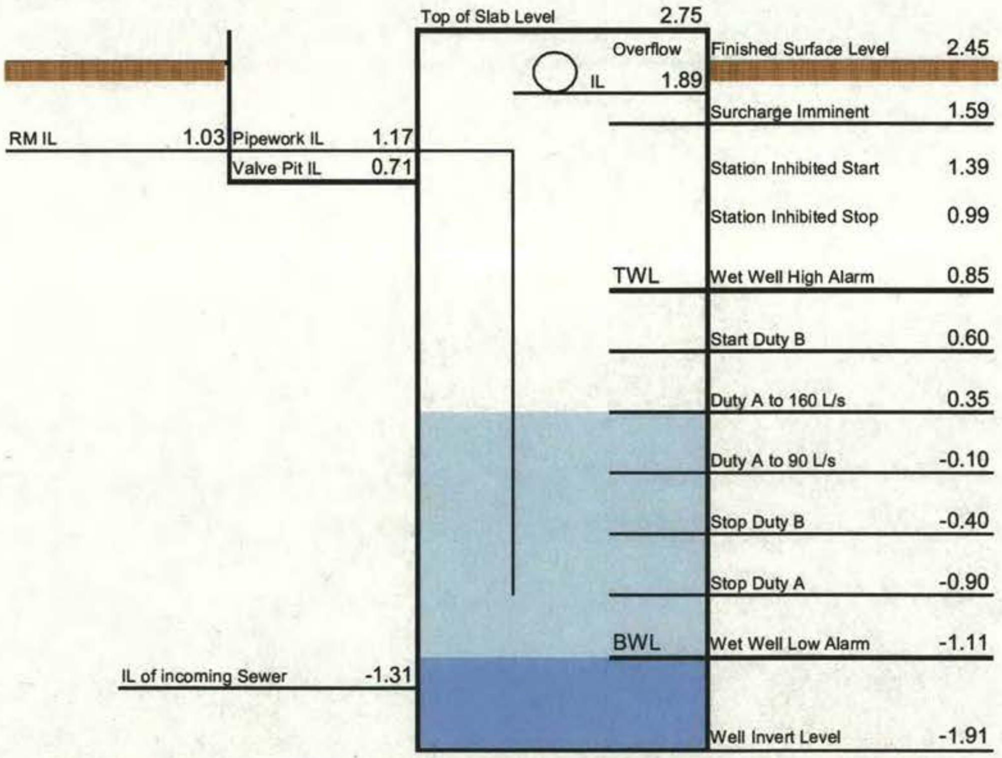
When the whole pump station is inhibited, it is desirable to minimise the volume pumped. This is achieved by utilising the wet well storage capacity to a safe maximum level. The duty start levels are raised to 200 mm below surcharge imminent. At this level, the pumps will run for a minimum of two minutes until the pump lockout time expires. After this period, the pumps will stop at 400 mm below surcharge imminent. While both pumps are inhibited, the wet well high alarm will be suppressed.

SP298 may communicate by telemetry with SP049, SP085 and SP300 through BW's Cullen Avenue Control Centre. This would enable the system to be controlled as a whole, thus minimising the chance of sewage overflows in the event of a breakdown or malfunction. The nature of this system control interconnectivity is to be determined by Brisbane Water.

Operational Diagram

The following diagram shows the station structure levels and operating levels.

Station Levels (NTS)



Note: BW may alter settings during commissioning to provide the best performance for the pump station.

2.7 Site Alarms

2.7.1 Alarm Definition

When alarms are triggered, the PLC immediately transmits them to the MITS master station. These are unsolicited transmissions and, to preserve radio network capacity, these transmissions are kept to a minimum.

The alarm definitions are:

Priority 1: Immediate action

Priority 2: Action next calendar day

Priority 3: Action next working day

Priority 4: No action required, not an "alarm", log as an event for future reference.

Priority 1 alarms need immediate action and are therefore placed in the PLC trigger queue.

The alarm priority class is shown by colour in the CRO's alarm picture on the MITS. The MITS SCADA allows alarm filtering of alarms.

2.7.2 Pump Station Alarms

The following alarms are labelled Pump Station Alarms and cause the PLC to send and immediate alarm to the control room.

MITS SCADA Details		
Plant	**Quantity**	**Alarm Description**
Sewage_pumping_station	Local_Remote	Station in Local mode
Sewer_pump	Available	Sewer pump unavailable
PLC	Isagraph_stopped	PLC software stopped
PLC	Isagraph_failed	PLC software faulted
Sewage_pumping_station	Mains_fail	Site Main Power Fails
PLC	Battery	PLC power failure battery
PLC	Mains_fail	PLC power failure (mains)
Wet_well	Level_invalid	Wet well measuring instrument faulted
Wet_well	Surcharge_imminent	Wet well level reaches the surcharge imminent level
Wet_well	Surcharge_occurring	Wet well level reaches the surcharge occurring level
Wet_well	High	Wet well level rises above a high alarm level

MITS SCADA Details		
Plant	**Quantity**	**Alarm Description**
PLC	Abnormal_operation	Abnormal operation of PLC – PLC has restarted
Wet_well	Low	Wet well level is low
Sewer_pump	Pump_hours_excessive	Pump run hours are excessive
Sewer_pump	Low_run_hours	Pump station run hours are below normal
Pressure_gauge	High	RM Pressure is high
Pressure_gauge	Low	RM Pressure is low
Pressure_gauge	Invalid	RM Pressure is invalid
Sewer_pump	VFD frequency low	Main burst
Sewer_pump	VFD frequency high	Pump or pipe blockage or excessive pump wear
Sewer_pump	Motor_power_high	Pump motor power high
Sewer_pump	Motor_power_low	Pump motor power low
Sewer_pump	Motor_power_invalid	Pump motor power invalid
Sewer_pump	Motor_current_high	Pump motor current high
Sewer_pump	Motor_current_low	Pump motor current low
Sewer_pump	Motor_current_invalid	Pump motor current invalid
Sewer_pump	VFD_Fault	Pump VFD Faulted, signal provided by VFD Not Ready.
Sewer_pump	VFD_count_check	Pump VFD has faulted more than 3 times in 8 hrs period
Sewer_pump	Mains_power	Pump has lost mains power
Sewer_pump	Running	Pump running indication
Sewer_pump	Contactor_Fail_to_Close	Pump contactor fail to close
Sewer_pump	Emergency_stop_fault	Pump emergency stop button is active
Sewer_pump	Moisture_In_Oil Chamber	Pump Oil Chamber - Moisture detected
Attention	Automatic_reset	Site attention indication has automatically reset

The pump performance degradation and pump blockage variables have the following values.

Index	DPBkSP (mAHD)	VSDDSP (Hz)	FlwDSP (L/s)	VSDBSP (Hz)	FlwBSP (L/s)
0		Set in code	Set in code	Set in code	Set in code
1	0	TBA	TBA	TBA	TBA
2	TBA	TBA	TBA	TBA	TBA
3	TBA	TBA	TBA	TBA	TBA

The PID loop variables have the following values.

Index	PidIN	PidSP	PidK	pidKd	PidKi	pidInt	pidDb	pidOUT
0	Set in code	Set in code	TBA	0	TBA	0	0.2	Set in code
1	Set in code	Set in code	TBA	0	TBA	0	0.2	Set in code
2	Set in code	Set in code	TBA	0	TBA	0	0.2	Set in code

Pump Performance Degradation (Monitoring Only)

The pump performance degradation alarm flag will be latched if the pump has been running, the VFD speed is valid, the flow rate is valid, the delivery pressure is valid and either of these following alarm conditions becomes active.

- During PID minimum flow control, the VFD speed is above the performance degradation minimum flow rate VFD speed setpoint for that delivery pressure for longer than the time period determined by the performance degradation minimum flow rate VFD speed timer.
- Flow rate less than the performance degradation flow rate setpoint for that delivery pressure and the VFD speed is above the performance degradation flow rate VFD speed setpoint for that delivery pressure for longer than the time period determined by the performance degradation flow rate VFD speed timer.

The alarm flag will be reset when the pump performance degradation conditions no longer exist and either of the following conditions occur:

- local reset (PnLRst) via the pump local reset pushbutton being pressed; and
- remote reset via an operator.

2.7.2.1 Pump Blockage

The pump blockage flag, which inhibits the pump from being available if another pump is available to run, will be latched if the pump station doesn't have a surcharge imminent alarm active, the pump has been running, the VFD speed is valid, the flow rate is valid and either of these following alarm condition becomes active.

While being in PID flow control, the VFD speed is above the upper speed setpoint for the requested duty flow for longer than the time period determined by the pump blockage minimum flow rate VFD speed timer.

The alarm flag will be reset when the pump blockage conditions no longer exist and any of the following conditions occur:

- local reset (PnLRst) via the pump local reset pushbutton being pressed;
- remote reset via an operator; and
- surcharge imminent alarm becomes active.

2.7.2.2 Pump Availability

The pump available flag will only be set when all of the "available" conditions occur and any of the following conditions occur:

- NOT Pump no.n blockage;
- pump no.n blockage and another pump is NOT available to run; and
- pump no.n blockage and surcharge imminent alarm becomes active.

If any of the available conditions are not met then the pump is unavailable for PLC control and will not be able to be run automatically or locally via the local start pushbutton.

2.7.3 Priority 2 Alarms

Priority 2 alarms are stored in the PLC buffer and transmitted when the buffer is full or when the MITS master station polls the PLC. The CRO will be notified of these alarms once they are transmitted.

Since these alarms are non-critical, this delay is acceptable.

No priority 2 alarms are used for this site.

2.7.4 Alarm Suppression

To avoid consequential alarming that is one fault condition triggering multiple alarms at the MITS SCADA system, alarm suppression is used on secondary alarms.

The main consequential alarm condition is Site Power Fail.

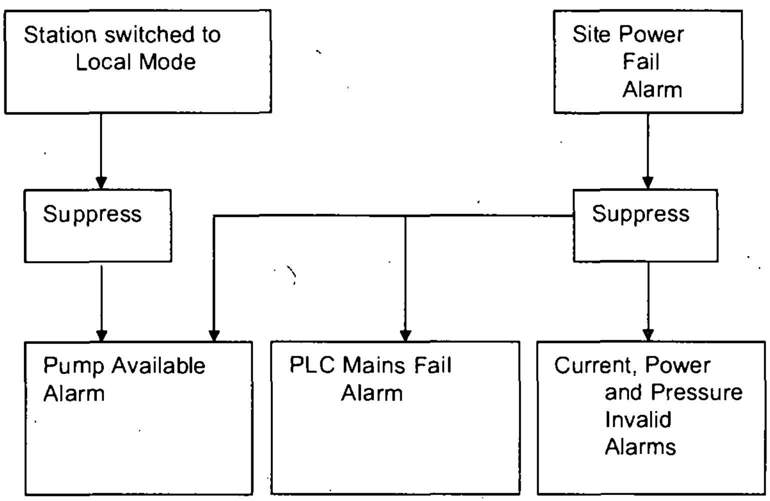
If site power fails, the following secondary alarms are suppressed:

- pump unavailable;
- PLC power fail;
- motor current invalid;
- motor power invalid;
- site pressure invalid; and
- motor speed out of allowable operating bands.

When the station is switched to Local mode, the site is under the control of the on site technician. An alarm is triggered at the SCADA system to indicate the station is in local control. All pump alarms are suppressed as the on site technician has assumed responsibility for the station.

Note: Wet well and PLC alarms are not suppressed.

Alarm Suppression Tree



No Suppression

Wet well
- Level invalid
- Wet well high
- Surcharge imminent
- Surcharge occurring

PLC
- PLC stopped
- PLC failed
- PLC Battery low

2.8 PLC Functionality

2.8.1 PLC Calculations

The following calculations are performed by the pump station PLC:

1. Wet Well Level Calculations
2. Wet Well Volume
3. Station Inflow
4. Station Volume Pumped
5. Station Surcharge Duration
6. Station Pressure mAHD

7. Pump Hour Run per day

8. Pump Flow (kL) per day

9. Pump Starts per day

10. Pump kW hours per day

A brief description of the listed items are given below.

2.8.1.1 Wet Well Level Calculations

The onsite wet well level indicator mounted on the switchboard shows well level in percentage (%) of full range. This value is transmitted to control room for ease of comparison with the on site technician.

The operator requires the wet well level in mAHD to be able to do a meaningful comparison between different sites.

The following formulas are used to calculate these values.

WWL (mAHD) = WWL (meters) + WWLZero Level (mAHD)

$$\text{WWL (\%)} = \frac{[WWL(mAHD) - WWLZero(mAHD)]}{WWLRange(m)}$$

2.8.1.2 Wet Well Volume

The wet well level is calculated using a wet well levels versus volume look up table. The look up table has a maximum of 32 point specification of the non-linear relationship of the wells "Level versus Volume". Volume in wet well is an interpolation of the well versus volume look up table values.

		Water Height (mAHD)	Stored Volume (m^3)	Remaining Storage Capacity [m^3]	Comments	% Level	% Volume
1	Wet Well Low	-1.11	0.0	30.5	BWL	0%	0%
3	Stop *Duty A*	-0.90	2.1	28.4		7%	7%
4	Stop *Duty B*	-0.40	7.2	23.3		24%	24%
5	*Duty A* to 90 L/s	-0.10	10.3	20.2		34%	34%
6	*Duty A* to 160 L/s	0.35	14.8	1537		49%	49%
7	Start *Duty B*	0.60	17.4	13.1		57%	57%
8	High Level Alarm	0.85	19.9	10.6	TWL	65%	65%

		Water Height (mAHD)	Stored Volume (m^3)	Remaining Storage Capacity [m^3]	Comments	% Level	% Volume
9	Station Inhibited Stop	0.99	21.4	9.1		70%	70%
10	Station Inhibited Start	1.39	25.5	5.0		84%	84%
11	Surcharge Imminent Alarm	1.59	27.5	3.0		90%	90%
12	Surcharge Occurring Alarm	1.87	30.3	0.2		99%	99%
13	Overflow Level	1.89	30.5	0.0		100%	100%

2.8.1.3 Total Inflow

The total volume pumped in kilolitres since the start of the year is updated in two seconds increment calculated by integrating the inflow, if the wet well level and flow are valid, using the following calculation algorithm:

Total Inflow = (Inflow x 2) /1000 + Total Inflow

The Inflow rate is the change in volume plus the volume pumped out of the well and is updated in two second increments calculated, if the wet well level and flow are valid, using the following calculation algorithm.

Inflow = ((Volume Now – Volume Old) + (Flow x 2)) / 2

Volume now = Current wet well level volume

Volume old = Previous (2 seconds ago) wet well level volume

Flow = Flow in engineering units

The wet well volume is calculated, if the wet well level is valid, using the wet well level as a reference and interpolation of a level vs. volume vs. surcharge flow lookup table.

2.8.1.4 Total Volume Pumped

The total volume pumped in Kilolitres since the start of the year is updated in two second increments calculated by integrating the inflow if the wet well level and flow are valid.

2.8.1.5 Station Surcharge Duration

While the surcharge occurring alarm is active, a timer is accumulated to measure the duration of the surcharge event. This figure is stored until a new surcharge occurring alarm is triggered, at which time the timer is reset to zero.

2.8.1.6 Station Pressure (mAHD)

The pressure probe measures the pressure in kPA. This allows the CRO to compare different sewerage sites. The pressure, in mAHD, is calculated and sent back to the MITS SCADA system.

$$\text{Pressure (mAHD)} = \text{Pressure}\ \frac{(kPA)}{k} + \text{Pressure Elevation (mAHD)}$$

k = 9.803 (Pressure constant to convert from kPA to metres)

Pressure Elevation = Site Specific Pressure Elevation of Pressure Gauge

2.8.1.7 Pump Hrs Run/day

The VFD of each pump has a Modbus communication card connected to the PLC.

This card provides the PLC with information regarding Current, Speed, kW hours per day and Hours run per day.

2.8.1.8 Pump kL/day

The station magnetic flowmeter will provide flow readings via an analogue 4–20 mA signal connected to the PLC.

2.8.1.9 Pump Starts/day

The number for starts per day counter is incremented every time a pump starts. This counter is reset at midnight.

2.8.1.10 Pump kW hrs/day

The VFD of each pump has a Modbus communication card connected to the PLC.

This card provides the PLC with information regarding Current, Speed, kW hours per day and Hours run per day.

2.8.2 Site Attention Indicator

The operator will be able to initiate and cancel the site attention indicator. When a site attention indication is generated, officers on site will be required to acknowledge the attention indicator and then contact the operator.

The site attention indicator digital output is latched by an operator generating a site attention indicator flag.

The output is unlatched if any of the following occurs:

- site attention indicator reset by the operator;
- site attention indicator reset pushbutton digital input being pressed; and
- site attention alarm timer expires.

The site attention alarm timer is enabled by the site attention alarm indicator digital output.

The site attention alarm flag is latched if the site attention alarm expires. The alarm is unlatched when the next site attention indicator output is set.

2.8.3 Local Indication Lamp

The local indication lamp output displays the status of the pump.

Lamp Off	Pump stopped but available
Lamp On	Pump running
Lamp Flashing	Pump Fault

2.8.4 Pump Hours Run

An hours run counter shall be kept for all pumps in the PLC.

A cyclometer type hours run meter has also been mounted on the front door of each pump starter Panel.

An electronic hours run meter also exists in the VFD for the Pumps, these totalise the pump hours run time during its operation.

3. MITS SCADA SYSTEM – OPERATOR INTERFACE

The SCADA Screen shall follow the format and standards of the existing Screens.

Live points from PLC fed back to picture

- Wet well level in metres AHD and % full.
- Pump duty A start level (in metres AHD and % full), pump duty A stop level, and wet well high level
- Status of each pump (available, running)
- Delivery pressure in metres AHD
- Delivery Flow
- Site power status
- Local/ Remote control status
- Station inflow (when pumps are not running)
- Wet well volume
- Time (in minutes) to surcharge (when pumps are unavailable)

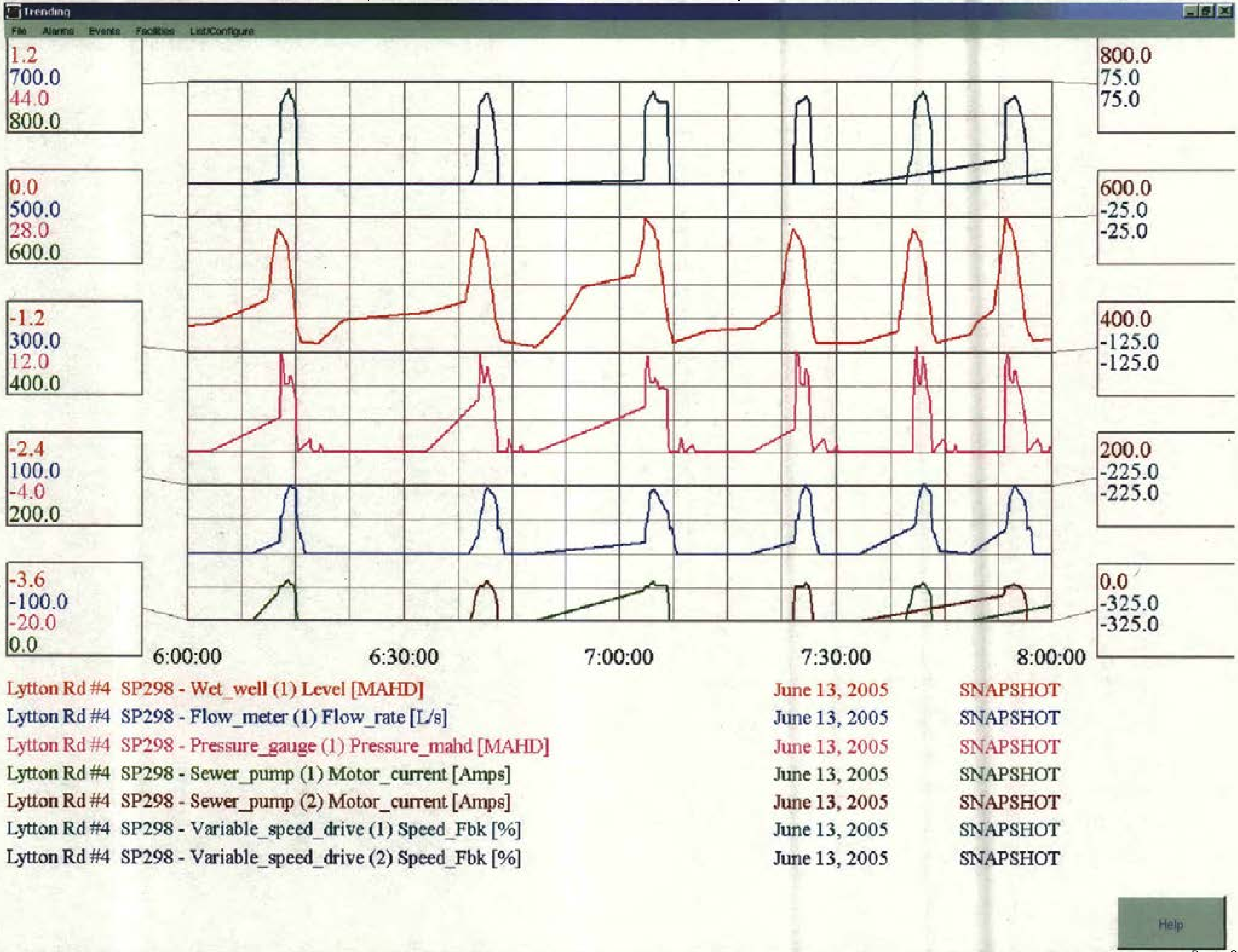
MITS database points in the picture

The Inlet level (metres AHD), Overflow Control Level (metres AHD) and the Site Level (metres AHD) are stored in the MITS database and not in the PLC. These values are displayed in the main station picture.

3.1 PLC Input/Output Listing

Refer to electrical drawings.

ATTACHMENTS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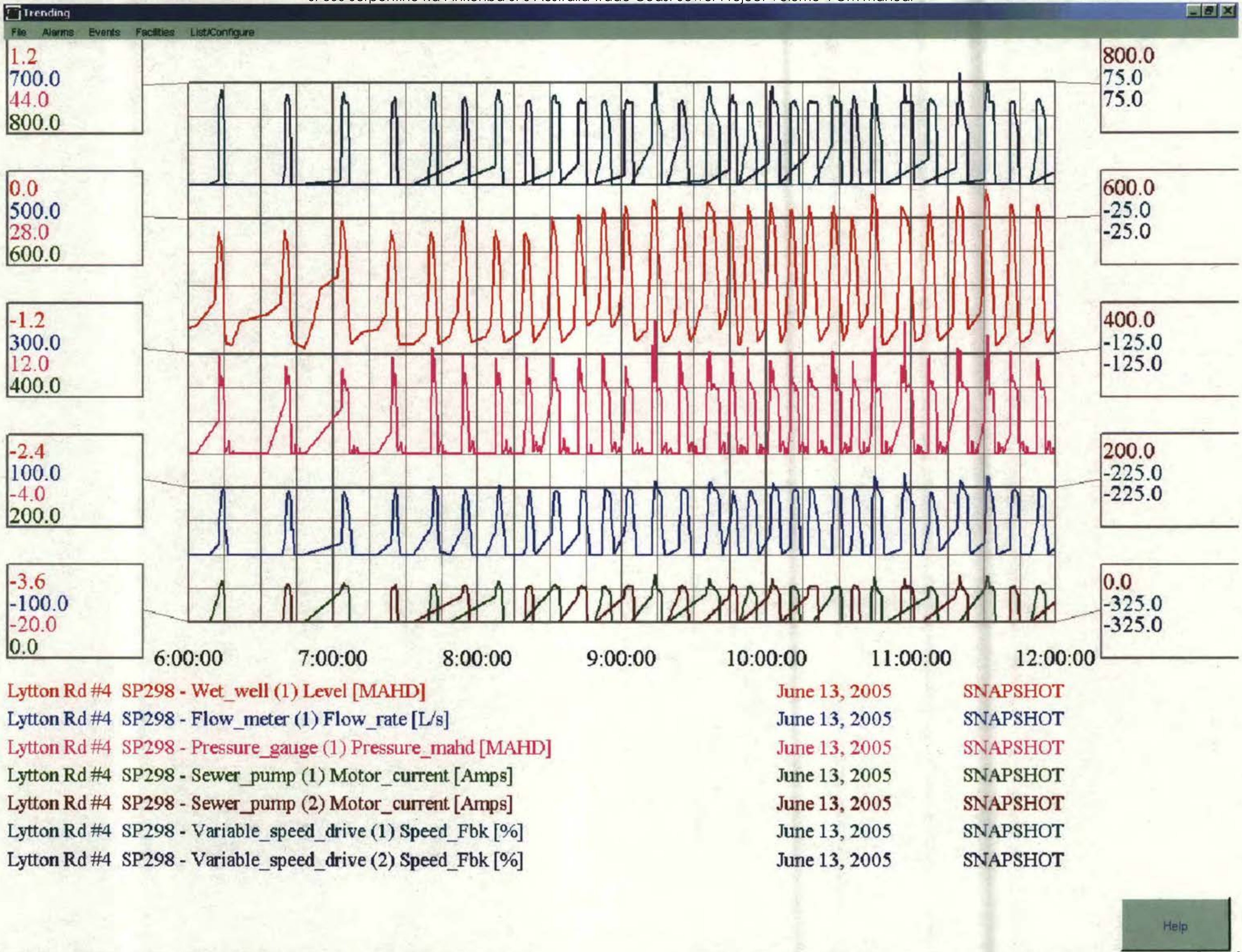
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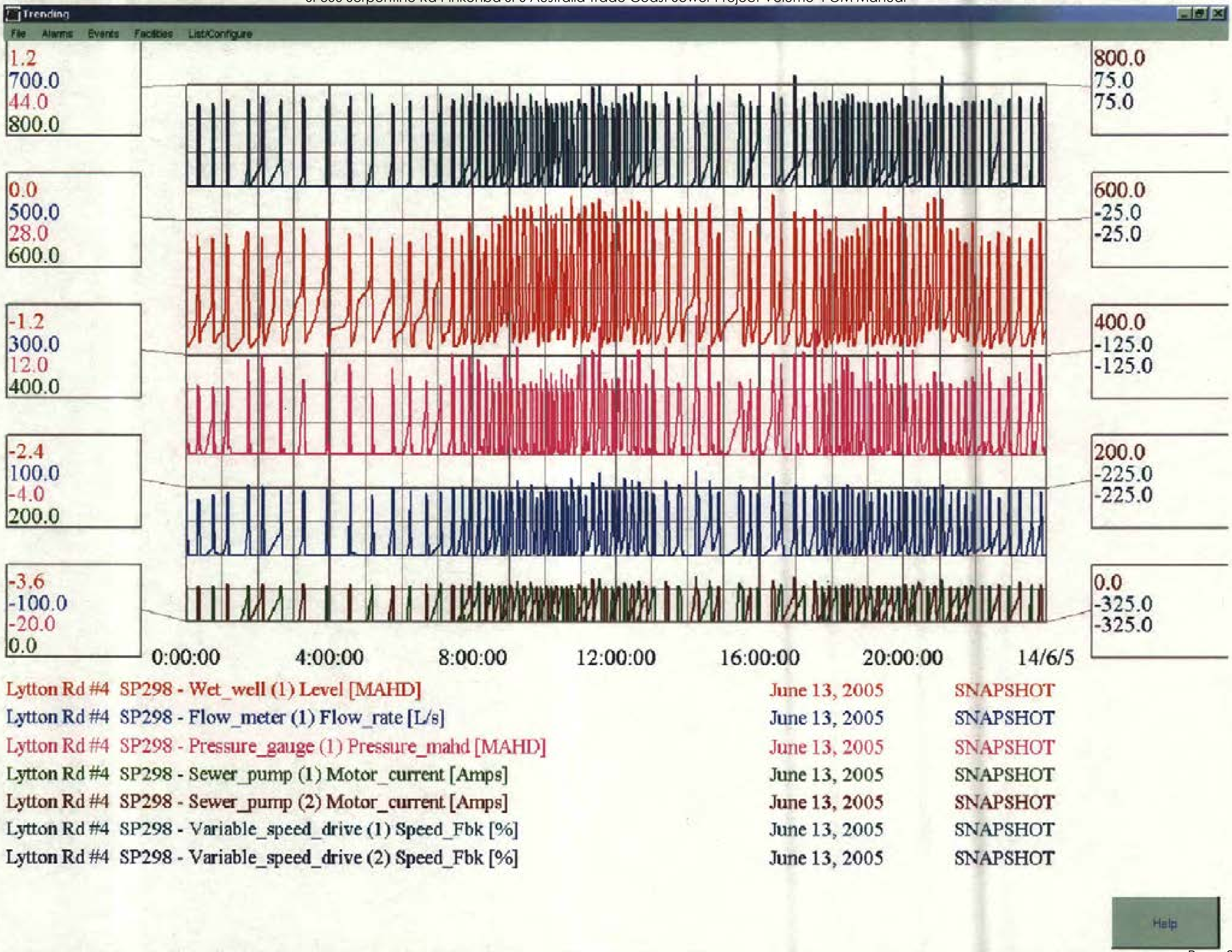
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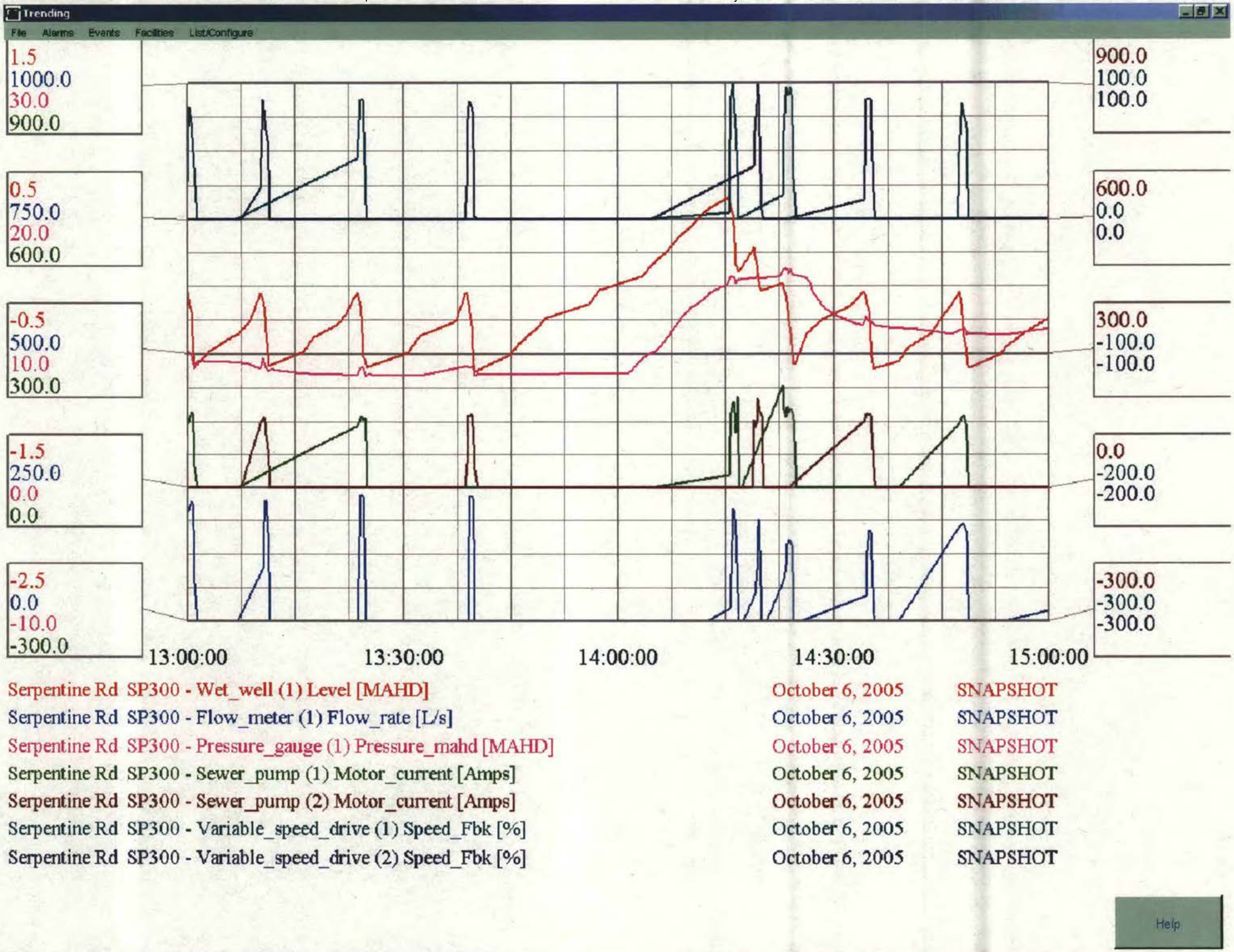
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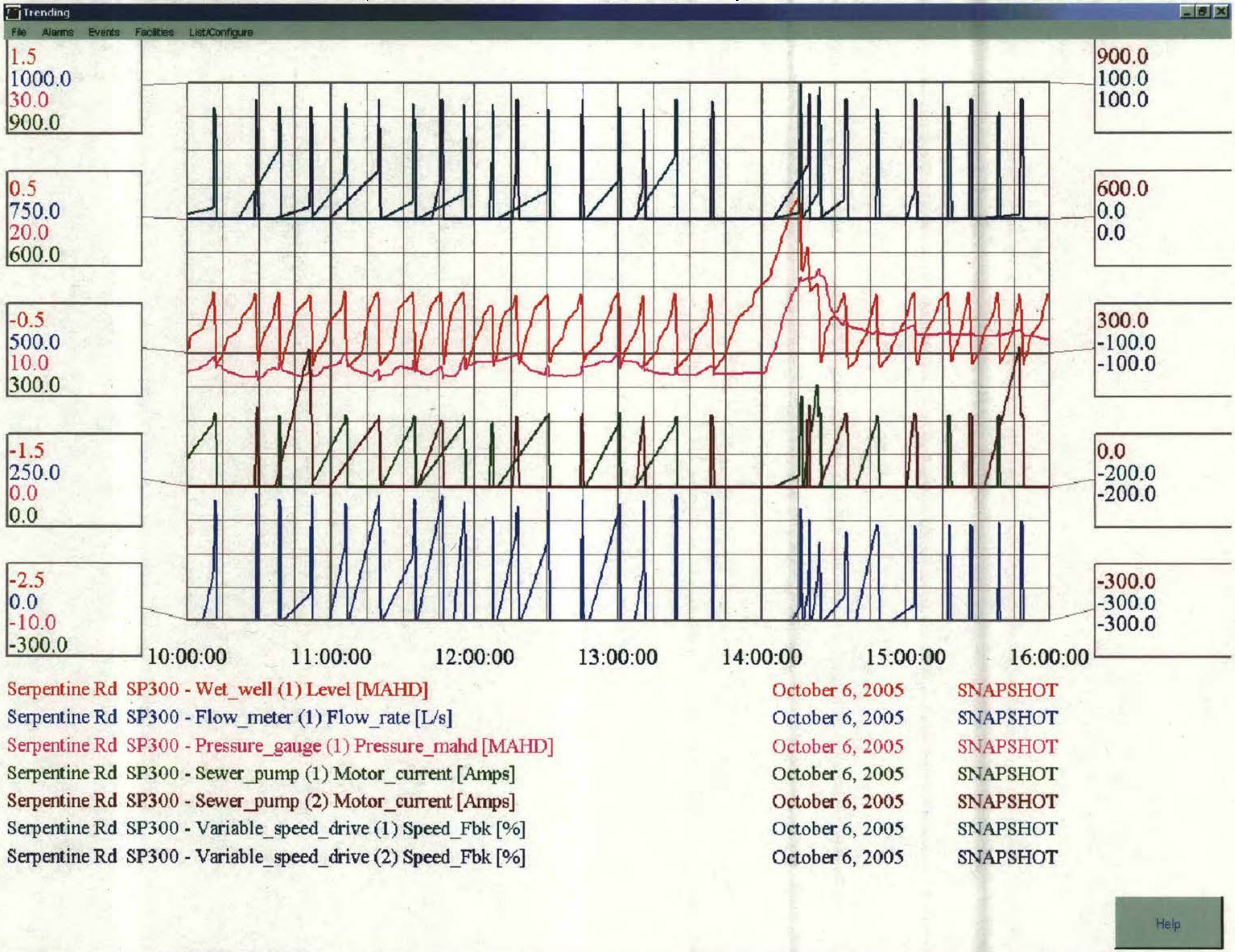
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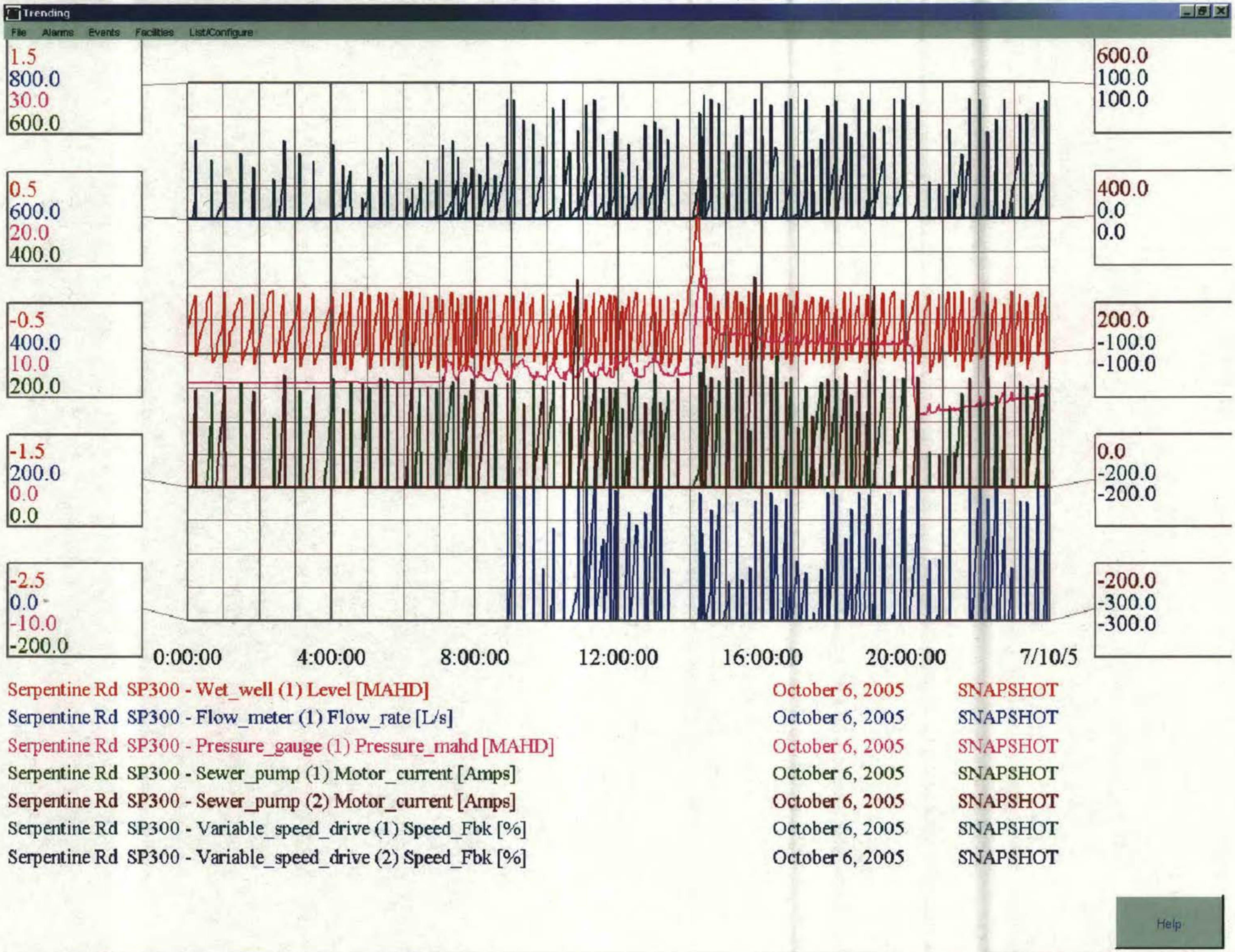
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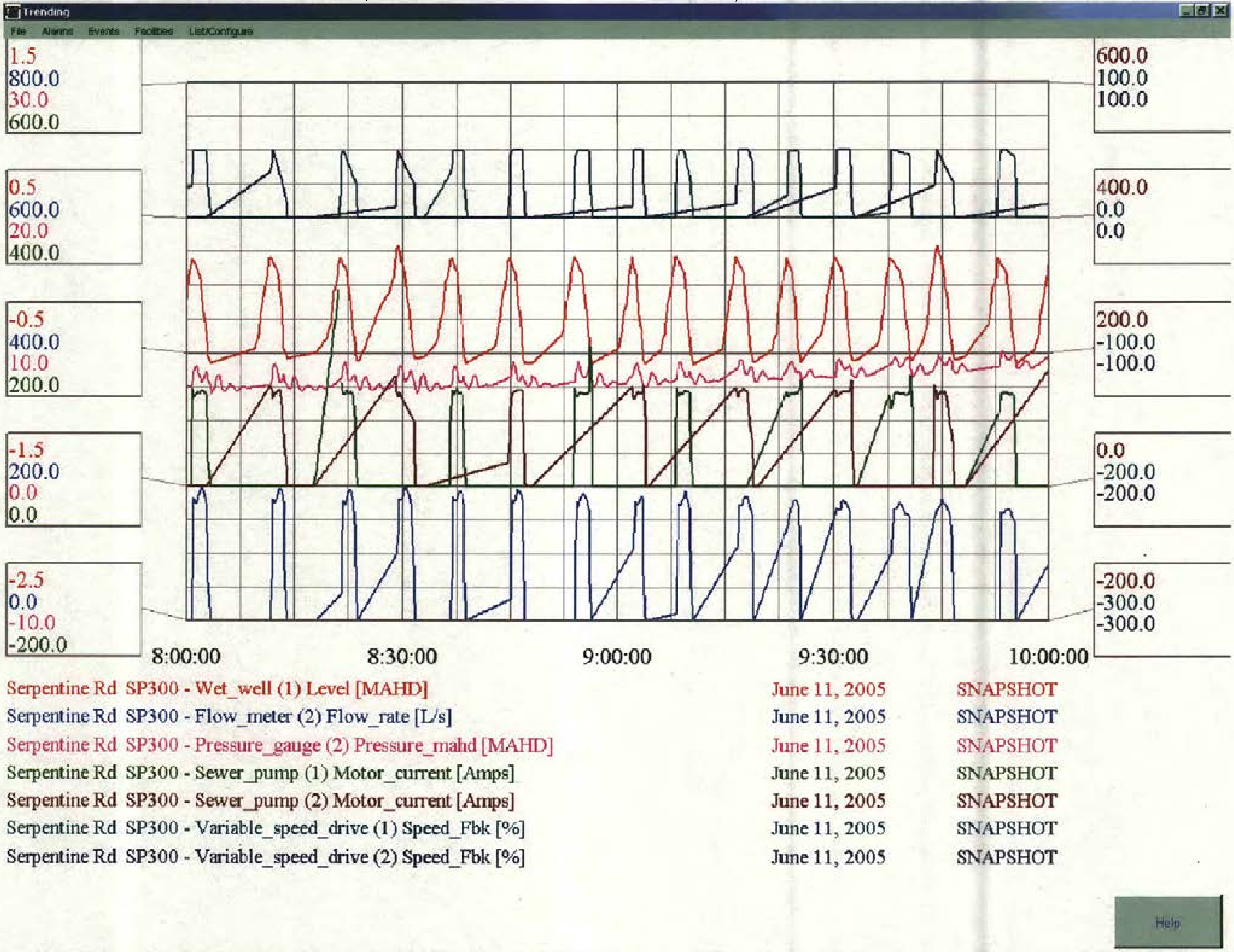
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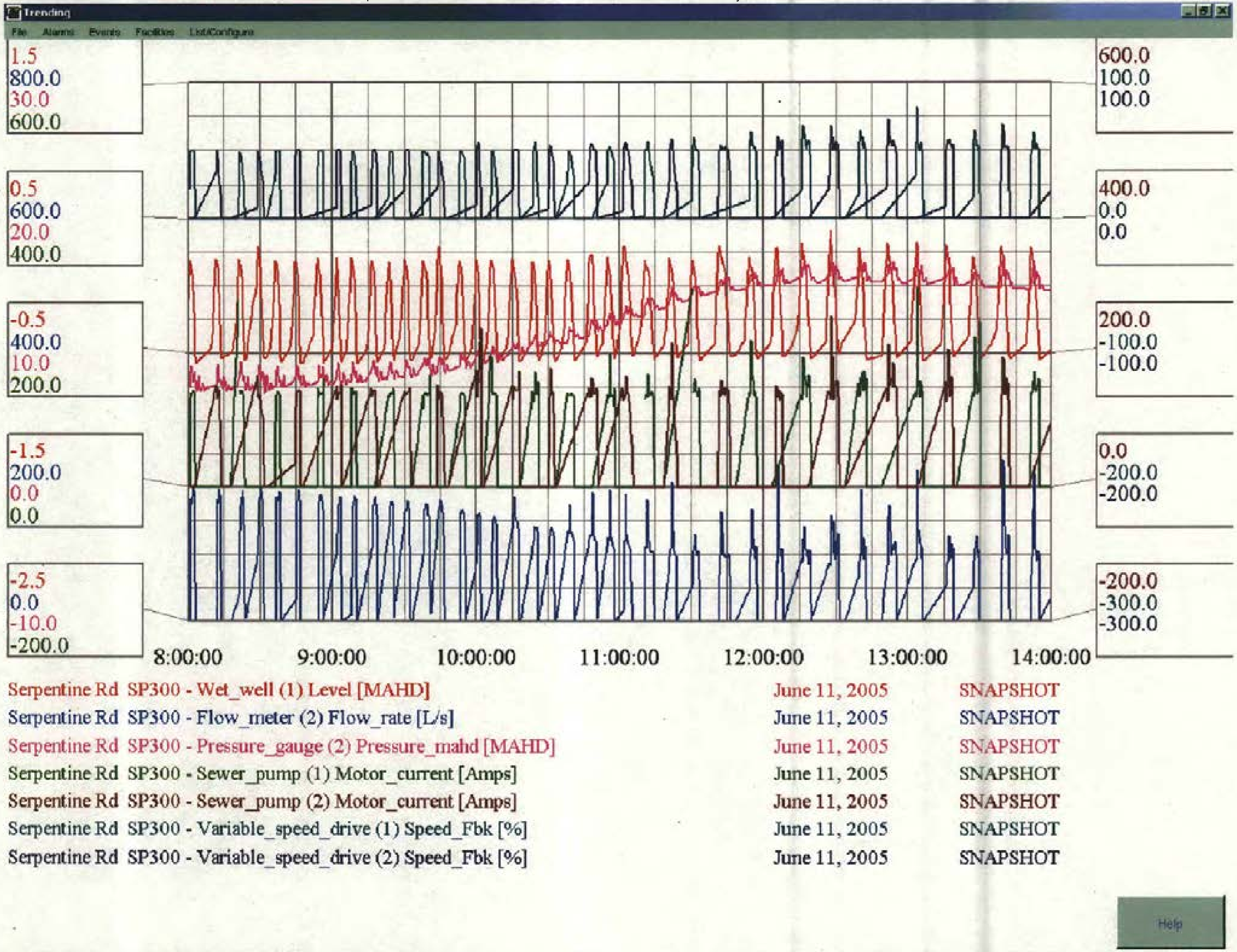
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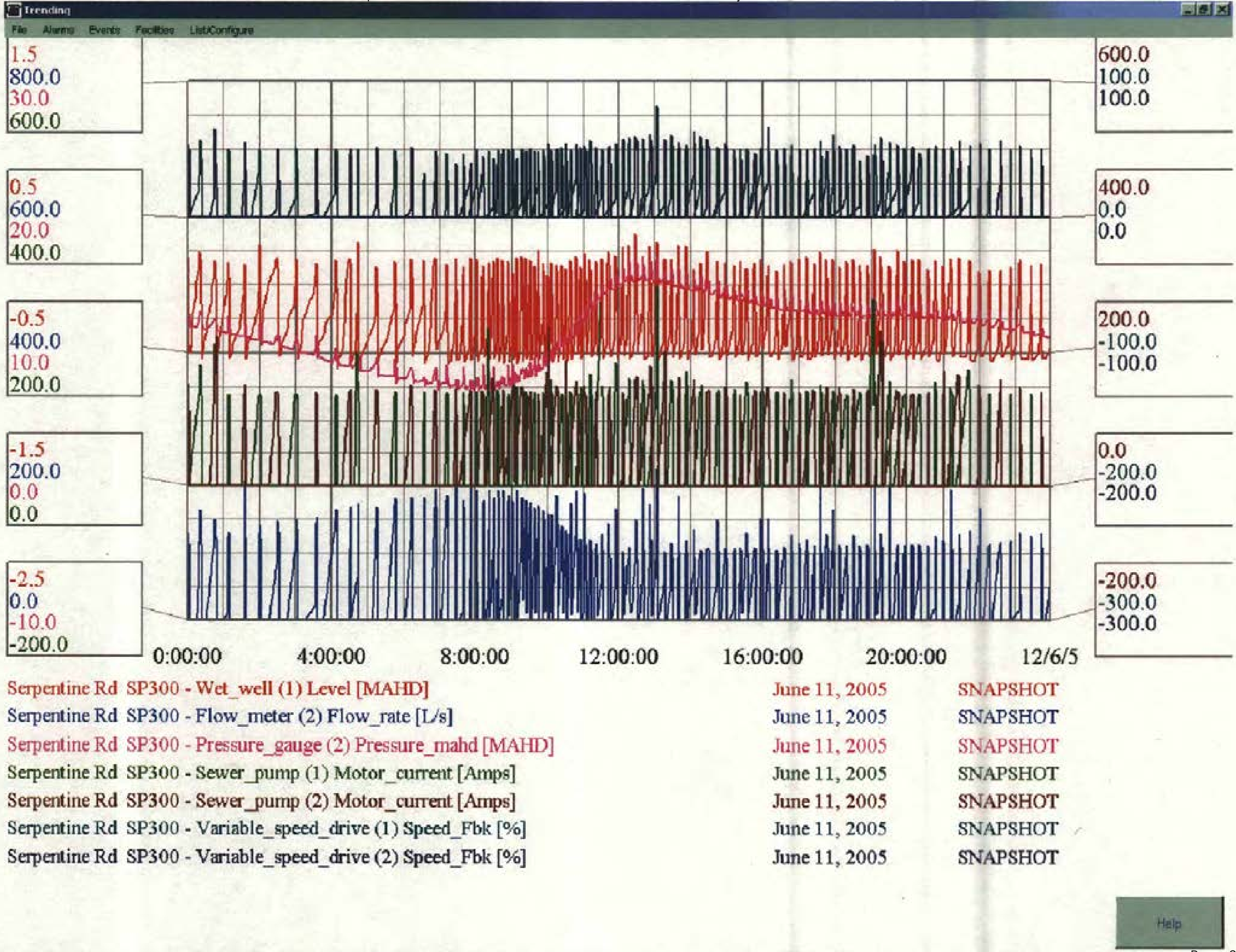
11:00:00
12:00:00
13:00:00
14:00:00
Serpentine Rd SP300 - Wet_well (1) Level [MAHD] June 11, 2005 SNAPSHOT
Serpentine Rd SP300 - Flow_meter (2) Flow_rate [L/s] June 11, 2005 SNAPSHOT
Serpentine Rd SP300 - Pressure_gauge (2) Pressure_mahd [MAHD] June 11, 2005 SNAPSHOT
Serpentine Rd SP300 - Sewer_pump (1) Motor_current [Amps] June 11, 2005 SNAPSHOT
Serpentine Rd SP300 - Sewer_pump (2) Motor_current [Amps] June 11, 2005 SNAPSHOT
Serpentine Rd SP300 - Variable_speed_drive (1) Speed_Fbk [%] June 11, 2005 SNAPSHOT
Serpentine Rd SP300 - Variable_speed_drive (2) Speed_Fbk [%] June 11, 2005 SNAPSHOT
Help


Trending
File Alarms Events Facilities List/Configure
1.5
800.0
30.0
600.0
0.5
600.0
20.0
400.0
-0.5
400.0
10.0
200.0
-1.5
200.0
0.0
0.0
-2.5
0.0
-10.0
-200.0
600.0
100.0
100.0
400.0
0.0
0.0
200.0
-100.0
-100.0
0.0
-200.0
-200.0
-200.0
-300.0
-300.0
0:00:00
4:00:00
8:00:00
12:00:00
16:00:00
20:00:00
12/6/5
Serpentine Rd SP300 - Wet_well (1) Level [MAHD] June 11, 2005 SNAPSHOT
Serpentine Rd SP300 - Flow_meter (2) Flow_rate [L/s] June 11, 2005 SNAPSHOT
Serpentine Rd SP300 - Pressure_gauge (2) Pressure_mahd [MAHD] June 11, 2005 SNAPSHOT
Serpentine Rd SP300 - Sewer_pump (1) Motor_current [Amps] June 11, 2005 SNAPSHOT
Serpentine Rd SP300 - Sewer_pump (2) Motor_current [Amps] June 11, 2005 SNAPSHOT
Serpentine Rd SP300 - Variable_speed_drive (1) Speed_Fbk [%] June 11, 2005 SNAPSHOT
Serpentine Rd SP300 - Variable_speed_drive (2) Speed_Fbk [%] June 11, 2005 SNAPSHOT
Help

Brisbane City

Brisbane Water

BRISBANE WATER

Network Control Systems

PRE-COMMISSIONING ACCEPTANCE TEST DOCUMENT

SP300 Serpentine Road
Conventional 2 Sewage Pumping Station
Pumps With VSD,
2 Valves (Outlet) and Generator

Project & Commissioning Details

Date Commissioned	
Project Manager	Andrew Bannik
Construction Manager	Reg McGirr
Electrical Inspector	Ralph.
RTU Programmer (NCS)	Alex Witthoft,
Electricians	Dave (Leightons)

PRE-COMMISSIONING CHECK LIST (RTU PROGRAMMER)

SP298 LYTTON RD #3

ANTENNA

Task	Outcome
Check that the antenna mast (pole) has adequate clearance from overhead power lines. ▪ 1.8 metres for LV line ▪ 3 metres for HV line ▪ Antenna should NOT be mounted vertically beneath a power line.	OK ☑
Check that antenna is pointing in the correct direction. (Bearing the same as the Radio Survey result)	OK ☑

SURCHARGE IMMINENT PROBE

Task	Outcome
Check that the surcharge imminent probe is fixed at the correct height and is operational. (Actually ground the electrode to ensure full ponit to point)	OK ☑

WET WELL PROBE

Task	Outcome
Calibrate the Vega probe.	OK ☑
Check that the "deragging" tube is fitted over the Vega and covers the pump start and stop range.	OK ☑

RTU

Task	Outcome
Check that the RTU has the correct IP address set	IP Address 192 . 168 . 39/34 . 94. Subnet mask 255 . 255 . 255 . 0
Check that the RTU has the correct program code loaded	Code Name SP300_X6
Check CPU Firmware Version and Serial Number	Serial Number 1004-3444 Firmware Ver 1.0.4.
Check that the .main file has been downloaded from the IDTS	OK ☒ (DO During SAT)

FLOWMETER

Task	Outcome
Check that the range of the F/M is the same as the value in the INIT block	OK ☒ Same as Test Rig
Check that the flow reading on the flow meter is the same as the RTU/PLC	OK ☒ Same as test Rig

Site pre-commissioned by (RTU Programmer)

Name: Alex Witthoft

Signature: [signature]

Date: 20-04-05

Pre-commissioning Test Sheet checked by NCS Project Officer

Name: ....

Signature: ....

Date: ....

RADIO

Task	Outcome
Check that the antenna mast (pole) has adequate clearance from overhead power lines. ▪ 1.8 metres for LV line ▪ 3 metres for HV line ▪ Antenna should NOT be mounted vertically beneath a power line.	OK ☑
Check that antenna is pointing in the correct direction. (Bearing the same as the Radio Survey result)	OK ☐ Bearing 248°
Check the VSWR of the cable with the antenna connected.	1.39 VSWR
Check that the correct radio type has been installed - high or low (transmit frequency)	High ☐ Low ☑
Check that radio is set on the correct frequency for the desired base station.	Tx Yes MHz Rx MHz
Check that the RSSI is similar to the signal strength obtained in the Radio Survey results. Check that the (BER) packet test is similar to the Radio Survey.	-64 RSSI ____ % loss with 10 dB attenuation
Check that the antenna is mounted with the drain hole in the dipole facing towards the ground.	OK ☑
Check that the antenna cable joints are wrapped with weather proof tape.	OK ☑

WET WELL PROBE

Task	Outcome
Check that the range of the Vega is the same as the value in the RTU initialisation block.	Range 55 m
Check that the suspended length of the Vega matches the "zero" value (4mA) in the RTU initialisation block.	Zero T.B.A. m

PRESSURE GAUGE

Task	Outcome
Check that the range of the PG is the same as the value in the INIT block	OK ☑ 50.00 m

Site pre-commissioned by (RTU Programmer)		Pre-commissioning Test Sheet checked by NCS Project Officer	
Name:	Alex Witthoft	Name:	
Signature:	[signature]	Signature:	
Date:	20-04-05	Date:	

Brisbane City

Brisbane Water

BRISBANE WATER

Network Control Systems

SITE ACCEPTANCE TEST (SAT)
TEST DOCUMENT (On Site)

SP300 Serpentine Road
Conventional 2 Sewage Pumping Station
Pumps With VSD,
2 Valves (Outlet) and Generator

Project & Commissioning Details

Date Commissioned	
Project Manager	Andrew Bannik
Construction Manager	Reg McGirr
Electrical Inspector	Ralph
RTU Programmer	Alex Lithoft
Electricians	Dave (Leightons)

IDTS Commissioning Test Sheet

SP300 SERPENTINE RD

The purpose of these tests is to confirm that the new RTU is running and responding to inputs and sending data back to the IDTS master station.

- Notify Control Room that site is being commissioned - ph 340 78414
- Contact IDTS Test Room ph 3407 8477 to confirm receipt of alarms

Action	Observation	Result
Site in remote mode Switch on RTU power	Confirm that RTU ABNORMAL OPERATION alarm is received by IDTS Confirm that operator ajustable alarm setpoints are downloaded on RTU restart.	☑ Yes ☑ Yes
Cycle the Energex power	Confirm that Energex Power Alarm is received by IDTS and no other alarms [alarm suppression] are sent. Ensure that the Generator Starts and transfers before the site mains fail alarm activates	☑ Yes
Switch off RTU mains power	Confirm that RTU MAINS FAIL alarm is received by IDTS.	☑ Yes
Test operation of all pumps in REMOTE mode (Manual)	Each pump starts and stops when commanded by the IDTS picture controls	☑ OK
Activate the probe itself to produce the ~~surcharge~~ imminent alarm. E/storage	Confirm that 2 pumps start	☑ Yes
	Confirm that ~~SURCHARGE~~ IMMINENT alarm is received by IDTS E/storage	☑ Yes
Switch site to LOCAL and STOP pumps Wait until surcharge pumping timer expires (Record Time). Open Valve 1 via the push buttons.	Confirm that LOCAL mode alarm is received by IDTS	☑ Yes
Test operation of all pumps in LOCAL mode.	Each pump starts and stops when commanded by the site pushbuttons.	☑ OK
Site in Remote mode, RTU operating Test operation of the pump inhibit.	Apply pump inhibit to each pump and confirm that "station inhibit" is active	☑ OK
Fault Pump 1 *Note: not every point that causes an availability alarm is tested, as this linkage is proved by SPSS2 standard code and FAT of switchboard*	Confirm Availability alarm is received by IDTS. Look at the points page and confirm the reason for the fault. Send a remote reset to clear the fault	☑ OK ☑ OK ☑ OK
Fault Pump 2	Confirm Availability alarm is received by IDTS. Look at the points page and confirm the reason for the fault. Send a remte reset to clear the fault	☑ OK ☑ OK ☑ OK
Trigger Wet Well Surcharge Occurring Alarm	Confirm alarm is received by IDTS	☑ OK
Trigger Wet Well High alarm	Confirm alarm is received by IDTS	☑ OK
Trigger Wet Well Invalid Alarm	Confirm alarm is received by IDTS	☑ OK
Allow well to fill.	Observe that the duty pump starts and stops. Only need to test for 1 pump on a slow filling site.	☑ Yes
	Confirm that IDTS is receiving the correct wet well level (%).	☑ Yes
Pump start and stop values shown on the wet well label match the IDTS picture	Duty A start ....% Duty A stop ....%	

Site FAT by (RTU Programmer)

Name: Alex Wittkopf

Signature: AWittkopf

Date: ....

Pre-commissioning Test Sheet checked by NCS Project Officer

Name: ....

Signature: ....

Date: ....

VALVES

Action	Observation	Result
Local Mode	Ensure that the valves can be opened and closed fully in local mode. Leave the Valves in the "Steel Rising Main" Position	☐ V1 ☐ V2
Remote – Manual Mode Select Steel Rising Main to Concrete Rising Main	Select the Steel Rising Main as the current "Mode from IDTS From IDTS select Manual Mode for the Valve Station Turn the station to Remote Mode. Now Select the Concrete Rising Main as the current Mode Ensure that the Valves transition one rising main to the other 1. Starting conditions are valve 1 open, valve 2 closed, 0 to 2 pumps running at up to 52 Hz. 2. Limit the station to only 1 pump. 3. Clamp the speed of the pump to minimum speed (25 Hz). 4. Close Valve 1. 5. When valve 1 is closed, open valve 2. 6. When valve 2 is open, unclamp the speed of the pump (to a maximum of 33Hz)	☐
Remote – Manual Mode Concrete Rising Main to Select Steel Rising Main	Now Select the Steel Rising Main as the current Mode Ensure that the Valves transition one rising main to the other. 1. Starting conditions are valve 1 closed, valve 2 open, 0 or 1 pump running at up to 33 Hz. 2. Clamp the speed of the pump to minimum speed (25 Hz). 3. Close valve 2. 4. When valve 2 is closed, open valve 1. 5. When valve 1 is open, unclamp the speed of the pump and allow 2 pumps to run (if needed).	☐
Remote – Manual Mode Failure Modes	Now Select the Steel Rising Main as the current Mode. But force the valve position limit switches so that the valve does not make its desired position. (Only do ONE at a time and check failure recovery). 1. Steel Rising Main does not close 2. Concrete Rising main does not open. Ensure that the when the rising main does NOT make the desired position, that the failed to close/open flag is raised the the valve moves back to the original position.	☑ ☐
Remote – Auto Mode	**FUTURE (Funtionality to be determined)**	
IDTS POINTS	Close	☑ V1 ☐ V2
	Open	☑ V1 ☐ V2
	Available	☑ V1 ☐ V2
	Available in Remote	☑ V1 ☐ V2
	Fail to Open	☑ V1 ☐ V2
	Fail to Close	☑ V1 ☐ V2
	Valve Reset Command	☑ V1 ☐ V2

NEEDS TO BE DONE !!!

Done AW.

☑ Valve 1 – Concrete – Description wrong
☑ Valve 2 – steele. – Description wrong.

Site FAT by (RTU Programmer)

Name: Alex Wittzof

Signature: ....

Date: ....

Pre-commissioning Test Sheet checked by NCS Project Officer

Name: ....

Signature: ....

Date: ....

SUMP PUMP

Action	Observation	Result
Fill the sump until the start level is reached.	Ensure Sump Pump Starts	✓
Before the stop electrode is reached press the stop button.	Ensure the Sump Pump stops Ensure IDTS has the sump running indication off	✓
Press the start button	Ensure the Sump Pump Starts and runs until the stop level is reached after which it stops	X Fail to stop – Sump not deep enough
Sump Running Signal	Start the sump pump and ensure that the IDTS receives the sump running signal and the Picture shows the sump running	✓
Sump Fault	Turn the Sump pump power off and ensure that IDTS gets the sump fault flag and the picture shows the sump.	✓
Sump High Alarm	With the sump pump off - fill the sump to the high level and ensure that the IDTS receives the sump high alarm and that the picture indicates a full sump pit.	✓
Sump Pump Trip	With the sump pump off – and the sewer pumps runnimg, fill the sump to the trip level and ensure that the IDTS receives the sump trip alarm and that the picture indicates a trip level sump pit and that the sewer pump stops. (Sewer pump are interlocked) (Then turn sump pump back on and drain well).	✓
Sump Excessice Run	Make the sump pump The excessive run and ensure that the IDTS get the alarm	✓
Sump Excessive Cycling	Excessicve cycling should be active.	✓
Sump Reset	Get the IDTS to reset the excessivce alarm remoteley	✓

IDTS POINTS

Emergency Storage

Emergency Storage Imminent Alarm ☑
Surcharge Imminent Alarm ☑

Carbon Scrubber

Running ☑
Available ☑
Speed ☑

Site FAT by (RTU Programmer)

Name: Alan Wittkopf

Signature: [signature]

Date: ....

Pre-commissioning Test Sheet checked by NCS Project Officer

Name: ....

Signature: ....

Date: ....

PID TUNING

SP300 SERPENTINE RD #3

This test can only be carried out if the inflow to the station is greater than the flow that one pump produces at minimum speed. The tuning of the loops should be rechecked after a 24 hour period (on trending) to ensure the station operates correctly over the varying flows during the day.

LOOP 3 – WET WELL LEVEL → PUMP SPEED

Action	Observation	Result
Level reaches the Duty A start level	• Pump runs at minimum speed • Wet well will continue to rise	☑ Yes ☑ Yes
Level reaches the PID set point level and continues to rise	• Pump speed will increase in a controlled manner until the level starts to fall. • Over time the should drop to the PID set point.	☑ Yes
Level falls below the PID set point level	• Pump speed will reduce in an attempt to maintain the PID set point level.	☑ Yes
Check the trending of the site.	• Overall the pump speed should change in a controlled maner. • The wet well level should be fairly constant, around the PID set point. • Unless the inflow to the site is greater than the flow of one pump running at max speed, the station should only run one pump – the speed should change quickly enough to avoid the starting of the second pump.	☑ Yes
PID CONSTANTS RECORDED IN INIT BLOCK	• Once the PID loop has been tuned, all constants in the INIT block must be recorded (ie the init value should equal the current value) so that the loop is tuned on the code as well as the running program.	☑ Yes

Site FAT by (RTU Programmer)		Pre-commissioning Test Sheet checked by NCS Project Officer	
Name:	Alex Withoff	Name:	
Signature:	[signature]	Signature:	
Date:		Date:	

LOOP 1 & 2 – CASCADED - WET WELL LEVEL → FLOW → PUMP SPEED

Action	Observation	Result
Level reaches the Duty A start level	• PID Loop 1 will request the minimum flow. • PID Loop 2 will run the pump at minimum speed and will increase the speed if the minimum flow is not achieved. (It should be close tho). • Wet well will continue to rise	☑ Yes ☑ Yes ☑ Yes
Level reaches the PID set point level and continues to rise	• PID Loop 1 will increase the flow set point. • PID Loop 2 will increase the pump speed to achieve the new flow SP. • The pump speed increases in a controlled manner, the level will eventually start to fall. • Over time the well level should drop to the PID set point.	☑ Yes ☑ Yes ☑ Yes ☑ Yes
Level falls below the PID set point level	• PID Loop 1 will decrease the flow set point. • PID Loop 2 will decrease the pump speed to achieve the new flow SP	☑ Yes ☑ Yes
Check the trending of the site.	• Overall the flow SP and the pump speed should change in a controlled maner. • The flow should be stable, with no large variations over a small time period. A steady increase/decrease is what is desired. • The wet well level should be fairly constant, around the PID set point. • Unless the inflow to the site is greater than the flow of one pump running at max speed, the station should only run one pump – the flow SP, and thus the speed, should change quickly enough to avoid the starting of the second pump. (Must be balanced with the previous condition)	☑ Yes ☑ Yes ☑ Yes ☑ Yes
PID CONSTANTS RECORDED IN INIT BLOCK	• Once the PID loop has been tuned, all constants in the INIT block must be recorded (ie the init value should equal the current value) so that the loop is tuned on the code as well as the running program.	☑ Yes

Site FAT by (RTU Programmer)

Name: Alex Witthoft

Signature: ....

Date: ....

Pre-commissioning Test Sheet checked by NCS Project Officer

Name: ....

Signature: ....

Date: ....

Brisbane City

Brisbane Water

BRISBANE WATER

Network Control Systems

IDTS POINT COMMISSIONING SHEET AND GENERATOR SUPPLY OPERATIONAL CHECKS

Pump Station Generator Connection Project (STTX-I910)

SITE TYPE & NO. SP300

Site Name. Serpentine Rd.

***NOTE:** Some (or all) of the Generator associated IDTS points may be Scan Inhibited in the IDTS system. Remove the Scan Inhibit from these points before proceeding with these tests*

IDTS Point : Generator Offsite

Action	Observation	Result
Connect the Control interface lead to the station	Confirm that GENERATOR OFFSITE alarm return to normal is received by IDTS	☑ Yes
Disconnect the Control interface lead to the station	Confirm that GENERATOR OFFSITE alarm is received by IDTS	☑ Yes
Reconnect the Control interface lead to the station		☑ OK

IDTS Point : Security Door_limit_switch

Action	Observation	Result
Open a canopy door on the Generator	Confirm that SECURITY DOOR_LIMIT_SWITCH alarm is received by IDTS	☑ Yes
Close the canopy door	Confirm that SECURITY DOOR_LIMIT_SWITCH alarm return to normal is received by IDTS	☑ Yes

IDTS Point : Generator Low_fuel

Action	Observation	Result
Make the Generator low fuel warning alarm active	Confirm that GENERATOR LOW_FUEL alarm is received by IDTS	~~Yes~~
Deactivate the Generator low fuel warning alarm	Confirm that GENERATOR LOW_FUEL alarm return to normal is received by IDTS	~~Yes~~

Could not test. (Fuel was Full)

IDTS Point : Generator Warning

Action	Observation	Result
Make the Generator warning alarm active (except by low fuel)	Confirm that GENERATOR WARNING alarm is received by IDTS	☑ Yes
Deactivate the Generator warning alarm	Confirm that GENERATOR WARNING alarm return to normal is received by IDTS	☑ Yes

IDTS Point : Generator Common_fault

Action	Observation	Result
Make the Generator common fault alarm active	Confirm that GENERATOR COMMON_FAULT alarm is received by IDTS	☑ Yes
Deactivate the Generator common fault alarm	Confirm that GENERATOR COMMON_FAULT alarm return to normal is received by IDTS	☑ Yes

IDTS Point : Generator Automatic

Action	Observation	Result
Turn the generator to ~~local~~ manual. mode	Confirm that GENERATOR AUTOMATIC alarm is received by IDTS	☑ Yes
Return the generator to automatic mode	Confirm that GENERATOR AUTOMATIC alarm return to normal is received by IDTS	☑ Yes

IDTS Point : Generator CB_tripped

Action	Observation	Result
Trip the Generator circuit breaker	Confirm that GENERATOR CB_TRIPPED alarm is received by IDTS	☑ Yes
Reset the Generator circuit breaker	Confirm that GENERATOR CB_TRIPPED alarm return to normal is received by IDTS	☑ Yes

IDTS Point : Generator Running

Action	Observation	Result
Start the Generator (off line only)	Confirm that GENERATOR RUNNING alarm is received by IDTS	☑ Yes
Stop the Generator	Confirm that GENERATOR RUNNING alarm return to normal is received by IDTS	☑ Yes

IDTS Control Points : Generator Remote_run_request
& Generator Remote_stop_request

Action	Observation	Result
Confirm the Generator is available to run, but not running		☑ OK
Set the IDTS control point GENERATOR REMOTE_RUN_REQUEST and send to the site	Confirm that the Generator starts and runs off-line	☑ Yes
	Confirm that GENERATOR RUNNING alarm is received by IDTS	☑ Yes
Set the IDTS control point GENERATOR REMOTE_STOP_REQUEST and send to the site	Confirm that the Generator stops	☑ Yes
	Confirm that GENERATOR RUNNING alarm return to normal is received by IDTS	☑ Yes

IDTS Point : Power_supply Energex_power

Action	Observation	Result
Turn the generator to ~~local~~ manual. mode		☑ OK
Fail the Energex power	Confirm that POWER_SUPPLY ENERGEX POWER alarm is received by IDTS	☑ Yes
Restore the Energex power	Confirm that POWER_SUPPLY ENERGEX POWER alarm return to normal is received by IDTS	☑ Yes

IDTS Point : Generator Connected, and

Generator supply operational checks

NOTE: The purpose of these operational checks is;

- *to confirm Generator is capable of starting all available pumps on site "simultaneously" (each pump start separated only by the RTU / PLC minimum pump start separation time), and running all pumps continuously for at least one minute.*
- *to confirm the pumps are interlocked under Generator supply (where required)*
- *to confirm the code changes have not interfered with the operation of the Surcharge Imminent probe.*

Action	Observation	Result
Ensure the Generator is in Automatic mode		☑ OK
Ensure the pumps are selected for local mode		☑ OK
Ensure there is enough sewage in the well for the pumps to run continuously for one minute		☑ OK
Fail the Energex power to the Generator	Confirm that the Generator starts and supplies power to the station	☑ Yes
	Confirm that GENERATOR CONNECTED alarm is received by IDTS	☑ Yes
~~Press all pumps local start buttons together~~	~~Confirm that all pumps (available under Generator supply) start~~	☒ Yes
Sites: Billan St, Musgrave Rd, Centenary Hwy / Kooringal Dr, Manet St, Sanananda St and Sinnamon Rd. Serpentine	Confirm the RTU will run a maximum of one pump under generator supply.	☑ Yes
~~Site: Creek Rd~~	~~Confirm the RTU will run a maximum of two pumps under generator supply.~~	☒ Yes
Restore Energex power and record the time taken for the Generator controller to return the station power to Energex supply	Time for station power to return to Energex supply	60 .... Secs
	Confirm that GENERATOR CONNECTED alarm return to normal is received by IDTS	☑ Yes
Record time taken for the Generator to stop after station power to returns to Energex supply	Time for Generator to stop after station power to returns to Energex supply	300 .... Secs

Test completed during Leighton Pre-Commissioning

Pump Automatic operation, and
Surcharge Imminent operation under Generator supply

Action	Observation	Result
Fail the Energex power to the Generator	Confirm that the Generator starts and supplies power to the station	☑ Yes
Ensure the pumps are selected for remote mode	Fixed speed pump sites: Confirm that the duty pump lowers the well to the Duty A stop level and stops	☑ Yes
	Variable speed pump sites: Confirm that the duty pump operates on variable speed control satisfactorily	☑ Yes
Ensure the well level is below the Duty A start level using pump local control as required		☑ OK
Ensure the pumps are selected for remote mode and are stopped		☑ OK
Activate the surcharge imminent probe for at least 10 sec	Confirm that WET_WELL SURCHARGE_IMMINENT alarm is received by IDTS one	☑ Yes
	Confirm that ~~all~~ pump~~s~~ (available under Generator supply) start	☑ Yes
Ensure the well does not fall below the Duty A stop level by selecting local mode for the pumps as required		☑ OK
Return the surcharge imminent probe to normal	Confirm that WET_WELL SURCHARGE_IMMINENT alarm return to normal is received by IDTS	☑ Yes
Restore Energex power indication to the Generator and allow the Generator controller to return the station power to Energex supply		☑ OK

IDTS Points and Generator Supply

Operational Checks commissioned by ....[signature]....... Date 20/04/05

SIR001
SITE INSPECTION REPORT - SWITCHBOARDS

PROJECT: ATC SERPENTINE RD

PROJECT No: SQT9 6226

Inspector: PETER HAGUE

Legend: Acc=Accept Rej=Reject N/A= Not Applicable

Item No.	Activity Description	Comments	Inspection Results			Date Accepted
			Acc	Rej	N/A	
1	Location Correct as per Contract Drawing		✔			11/05/2005
2	Orientation Correct		✔			11/05/2005
3	Material/Finish as per Specification		✔			11/05/2005
4	Unauthorised Modifications				-	11/05/2005
5	Anchor Bolts Fitted / Tight		✔			11/05/2005
6	IP Rating as per Specifications		✔			11/05/2005
7	Panel Layout as per Drawings		✔			11/05/2005
8	Labelling - Wording, Size, Fixing, Material, Level	Incomplete *1		×		
9	Enclosure Free of Debris			×		
10	Components Fitted are as Specified		✔			11/05/2005
11	Main Switches/Circuit Breakers/Fuses Sizes OK		✔			11/05/2005
12	Thermal Overloads Appropriately Set		✔			11/05/2005
13	CT Ratios are as Specified	Energex 800/5A	✔			11/05/2005
14	Metering Fuses Fed off Line Side Main Sw & CT's		✔			11/05/2005
15	Equip Fed from Line Side is Appropriately Labelled				-	11/05/2005
16	Neutral & Earth Connections not in CT Section		✔			11/05/2005
17	All Neutral Connections are Accessible		✔			11/05/2005
18	MEN Connections Provided		✔			11/05/2005
19	Earth Bar/Earth Connections Fitted & OK		✔			11/05/2005
20	Check Phasing of Circuits		✔			11/05/2005
21	Cores Ferruled & Numbered	3Ph outlet cores		×		
22	Colour Coding of Wiring as per Spec.		✔			11/05/2005
23	Terminals Identified per Dwg. and Spares Provided		✔			11/05/2005
24	Indicators Fitted with Correct Coloured Bezels		✔			11/05/2005
25	Selector Switches Engraved Correctly		✔			11/05/2005
26	Main Switches Lockable/Defeatable as per Spec.	Not Main Isolator	✔			11/05/2005
27	Terminals & Busbar Connections Tight		✔			11/05/2005
28	Busbars appropriately shielded		✔			11/05/2005
29	Check internal access & routes for field cabling		✔			11/05/2005
30	Check Operation of Mech & Key Interlocks		✔			11/05/2005
31	Check Operation and Orientation of Door Handles		✔			11/05/2005
32	Circuit Breakers Isolate Stated Circuits		✔			11/05/2005
33	ELCB's Tested		✔			11/05/2005
34	Test Sheets Provided for Insulation Tests	Provided to BCC	✔			11/05/2005
35	Test Sheets Provided for Earth Continuity Tests	Provided to BCC	✔			11/05/2005
36	"As Built" Drawings Marked Up	Provided to BCC	✔			11/05/2005
37	Legend & Drawings Secured in Enclosure	Not 'As Built' *2		×		
38	Laytop Support Tray Provided		✔			11/05/2005
39	Sunshields Fitted with IP56 Maintained	Sunshield loose - aerial side	✔			11/05/2005
40	Door Locks as Required	BCC locks not fitted		×		
41	Manual Functions Tested		✔			11/05/2005
42	Outlets fitted to Sw/Bd as required		✔			11/05/2005
43	Surge Diverter earthed to adjacent stud.		✔			11/05/2005
44	Switchboard Lights Operate OK	Pump1 VSD light faulty		×		
45	Adequate access to RTU comms plugs		✔			11/05/2005

Special Notes:

1 Label over Drywell fan selector

2 As Built Dwgs not included, Legend Card Incorrect

Signature Date

SIR002
SITE INSPECTION REPORT - CABLES

PROJECT: ATC SERPENTINE RD

PROJECT No: SQT9 6226

Inspector: PETER HAGUE Legend: Acc=Accept Rej=Reject N/A= Not Applicable

Item No.	Activity Description	Comments	Inspection Results Acc	Rej	N/A	Date Accepted
1	Cables Sized as per Cable Schedule	Changes as per schedule	✔			11/05/2005
2	Correct Cable Types Installed	Pump cables extended	✔			11/05/2005
3	Cables Glanded/Bushed Satisfactorily		✔			11/05/2005
4	Cables Terminated Satisfactorily	IP67 J-Box used OK	✔			11/05/2005
5	Sheathes/Insulation not Damaged		✔			11/05/2005
6	Bending Radius not Exceeded		✔			11/05/2005
7	Mechanical Protection Provided as Required	See Note *2		×		
8	Cables Adequately Supported	See Note *3, 4, 5		×		
9	Power & Signal Cable Clearances Adequate		✔			11/05/2005
10	All Cables Identified as per Cable Schedule	See Note *1		×		
11	Overall Appearance Satisfactory	See Note *6	✔			11/05/2005
12	Insulation Tests Carried out on all Cables		✔			11/05/2005
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23	Cable Tests:					

Cable No.	Insulation Voltage	Insulation Resistance	Continuity Test

Special Notes:

1 Cable No and make safe all spare cables, Gen cables at Gen end, Sump pump cables
2 Provide bushing to protect cable at odour scrubber
3 Pump cables to be secured off drywell floor
4 Upgrade conduit supports at motorised valves
5 Conduits for reflux valves prox. Switches to be supported from floor
6 Reflux Prox. Switch cable coils to be secured. Reflux 2 Valve 1 cable to be rerun under cabble ladder.

Signature Date

SIR003

SITE INSPECTION REPORT - CABLE LADDER/TRAY/DUCT

PROJECT: ATC SERPENTINE RD

PROJECT No: SQT9 6226

Inspector: PETER HAGUE

Legend: Acc=Accept Rej=Reject N/A= Not Applicable

Item No.	Activity Description	Comments	Inspection Results			Date Accepted
			Acc	Rej	N/A	
1	Ladder/Tray/Duct Correct Size/Type as per Spec.		✔			11/05/2005
2	Correct Routing as per Specification/Drawings		✔			11/05/2005
3	Sufficient Brackets/Fixings to Suit Span		✔			11/05/2005
4	Brackets/Fixings Secure		✔			11/05/2005
5	Ladder/Tray/Duct Earthed/Bonded Correctly		✔			11/05/2005
6	Covers Fitted & Secured Correctly	See Note *1		×		
7	Protrusions & Sharp Edges Removed	See Note *2		×		
8	Dissimilar Metals Not in Contact		✔			11/05/2005
9	Segregation Barriers Fitted Correctly				-	11/05/2005
10	Adequate Mechanical Protection Provided		✔			11/05/2005
11	Integrity of Finish/Coating Maintained		✔			11/05/2005
12	Penetrations Sealed Correctly	See Note *3		×		
13	Clearance from Other Trades Satisfactory		✔			11/05/2005
14	"As Built" Drawings Marked Up		✔			11/05/2005
15						
16						
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30						

Special Notes:

1 Tread plate at end of switchboard to be secured
2 Provide bushing to protect odour control motor cable
3 Seal all conduit entries

Signature

Date

SIR004

SITE INSPECTION REPORT - INSTRUMENTS

PROJECT: ATC SERPENTINE RD

PROJECT No: SQT9 6226

Inspector: PETER HAGUE

Legend: Acc=Accept Rej=Reject N/A= Not Applicable

Item No.	Activity Description	Comments	Inspection Results			Date Accepted
			Acc	Rej	N/A	
1	Instrument Types/Models as per Specification	See Note *1	✔			11/05/2005
2	Model Range as per Specification	See Note *1	✔			11/05/2005
3	Suitably Mounted & Orientation Correct	See Note *2	✔			11/05/2005
4	Clearances Adequate for Correct Operation		✔			11/05/2005
5	Adequate Mechanical Protection Provided		✔			11/05/2005
6	IP Ratings Suitable for Location		✔			11/05/2005
7	Earthing Provided as per Instrument Manual	Checked by ABB	✔			11/05/2005
8	Identification Tags Fitted		✔			11/05/2005
9	Termination Covers & Seals Securely Fitted		✔			11/05/2005
10	Data Plate Fitted & Legible		✔			11/05/2005
11						
12						
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29						
30						

Special Notes:

1 Pressure TX = -100 to 1000kPa bar 64
Motorised valve = Rotork IQ20 2.23A
Reflux Prox. = IFM 115436 11-2015-FRKG

2 Pressure TX mounted vertically on top of pipe

Signature

Date

SIR005

SITE INSPECTION REPORT - FIELD EQUIPMENT

PROJECT: ATC SERPENTINE RD

PROJECT No: SQT9 6226

Inspector: PETER HAGUE

Legend: Acc=Accept Rej=Reject N/A= Not Applicable

Item No.	Activity Description	Comments	Inspection Results			Date Accepted
			Acc	Rej	N/A	
1	Equipment Types/Models as per Specification	See Note *1 on SIR004	✔			11/05/2005
2	Suitably Mounted for Correct Operation	See Note *2		×		
3	Adequate Mechanical Protection Provided		✔			11/05/2005
4	IP Ratings Suitable for Location		✔			11/05/2005
5	Identification Tags Fitted	See Note *3		×		
6	Termination Covers & Seals Securely Fitted		✔			11/05/2005
7	Limit/Float Arms Adjusted Correctly				-	11/05/2005
8	Multitrode probe adjustment		✔			11/05/2005
9						
10						
11						
12						
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Special Notes:

1 See Note 1 on SIR004
2 Brackets for prox. Sw. need to be secured to allow accurate adjustment of senor.
3 Labels for reflux switches to be renamed

Signature

Date

SIR006

SITE INSPECTION REPORT - ELECTRIC MOTORS

PROJECT: ATC SERPENTINE RD

PROJECT No: SQT9 6226

Inspector: PETER HAGUE   Legend: Acc=Accept Rej=Reject N/A= Not Applicable

Item No.	Activity Description	Comments	Inspection Results			Date Accepted
			Acc	Rej	N/A	
1	Motors Correct Size/Type as per Drawings		✔			11/05/2005
2	Star/Delta Connections Correct				-	11/05/2005
3	Mountings Adequate & Secured		✔			11/05/2005
4	IP Ratings Suitable for Location (eg. Hosing)		✔			11/05/2005
5	Termination Covers & Seals Securely Fitted		✔			11/05/2005
6	Isolators Positioned & Sized Correctly	Provided by Sw/Bd			-	11/05/2005
7	Isolators Accessable & Labelled	Provided by Sw/Bd			-	11/05/2005
8	Isolators Function Correctly	Provided by Sw/Bd			-	11/05/2005
9	Overloads Adjusted Correctly		✔			11/05/2005
10	Circuit Breaker Sized Correctly		✔			11/05/2005
11	No Obstructions at Coupling or Fan				-	11/05/2005
12	Motor Test Sheets Completed	Check with Reg McGirr	✔			11/05/2005
13	Identification Tags Fitted		✔			11/05/2005
14	Data Plate Fitted & Legible	200kW 420A 400V	✔			11/05/2005
15						
16						
17						
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19						
20						
21						
22						
23						

Special Notes:

Signature   Date

SITE INSPECTION & TEST SHEET - ELECTRIC MOTORS

PROJECT: ATC SERPENTINE RD

PROJECT No:

Drive Name ____________ **Equipment No.** ____________

NAME PLATE DETAILS

Make:	____________	Serial No:	____________
Type:	____________	Frame Size:	____________
Rating:	____________	Speed:	____________
Freq:	____________	No. of Poles:	____________
FLC:	____________	Insulation Class:	____________
Connection:	____________	IP Rating:	____________
Voltage:	____________	Power Factor:	____________

Heater	Continuity:	____________	Resistance:	____________
Thermister	Continuity:	____________		____________
RTD	Continuity:	____________		____________

COMMISSIONING CHECKS

Free Rotation:	____________	Mounting:	____________
Shaft Rotation:	____________	Transport Damage:	____________

Insulation Test

R-W	____________	M.Ohms	at	____________	Volts
R-B	____________	M.Ohms	at	____________	Volts
W-B	____________	M.Ohms	at	____________	Volts
R-E	____________	M.Ohms	at	____________	Volts
W-E	____________	M.Ohms	at	____________	Volts
B-E	____________	M.Ohms	at	____________	Volts

Resistance Test

R-W	____________	Ohms
R-B	____________	Ohms
W-B	____________	Ohms

	Unloaded	Loaded
Starting Current:	____________	____________
Running Current:	____________	____________
Bearing Temperature:	____________	____________

Tested by: ____________ ____________

Signature Date

4.3

REDILEC

27 Long Street
CLONTARF QLD 4109
Phone 0419 784 770
Fax 07 3283 4421
mcdonalddca@optusnet.com.au

31 August 2005

Re: ***Australia Trade Coast Sewer Project***
SP300 Serpentine Road Pump Station

This is to certify that the electrical works have been carried out and tested in accordance with AS3000 and the Electrical Safety Act 2002.

David McDonald
Redilec (Queensland Electrical Contractors Licence No 58331)

Australia TradeCoast Sewer Project
Contract No. BW 30137-02.03

Pre-commissioning Report Serpentine Road Pump Station SP300

June, 2005

Brisbane Water

Winner
Engineering
Excellence Award 2003
Category: Project Management

Highly Commended
Engineering
Excellence Award 2003
Category: Project Management

Winner
National and Queensland
Case Earth Award 2003
Category 3: Environmental
Excellence - projects over
$10 million

Highly Commended
Queensland Stormwater
Industry Association
State Award 2003
Category: Major WSUD Project
>$1.0 million

Minister's Grand Prize
Healthy Waterways Awards 2003
Category: Industry Award

Finalist
Healthy Waterways Awards 2003
Category: Industry Award

Commendation
Public Domain Awards 2003
Category: Bridges

2138110B-RPT021Bvb

PARSONS BRINCKERHOFF

Parsons Brinckerhoff Australia Pty Limited ACN 078 004 798 and Parsons Brinckerhoff International (Australia) Pty Limited ACN 006 475 056 trading as Parsons Brinckerhoff ABN 84 797 323 433

12th floor, IBM Centre
348 Edward Street
Brisbane Qld 4000
GPO Box 2907
Brisbane Qld 4001
Australia
Telephone +61 7 3218 2222
Facsimile +61 7 3831 4223
Email brisbane@pb.com.au

ABN 84 797 323 433
NCSI Certified Quality System ISO 9001

Author: Vic Bowyer, Senior Water Engineer

Signed: ....

Reviewer: Ian Cameron, Water Executive

Signed: ....

Approved by: Ian Cameron, Water Executive

Signed: ....

Date: 21 June 2005, Revision B (2138110B)..

Distribution: Brisbane Water ....

PARSONS BRINCKERHOFF

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Appendix D Pre-commissioning test data
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PB PARSONS BRINCKERHOFF

1. Introduction

On 13 and 14 April 2005 pre-commission was undertaken at the new Serpentine Road Pumping Station (SPS300) under the supervision of PB Commissioning Engineer, Vic Bowyer and Leightons Mechanical and Electrical Manager, Frank Mitchell. Pre-commissioning was undertaken generally in accordance with the Construction Method Statement prepared by Leightons entitled "Commissioning of Serpentine Road Pumping Station SPS 300, Revision 5". The method statement is included in Appendix A. During pre-commissioning it was necessary to depart slightly from the methodology provided in the method statement in order to produce suitable results. In all cases departure from the method statement were agreed on site by all parties.

2. Temporary pre-commissioning system

A temporary OD315 PE pipeline was installed from the 250 mm by-pass valve on the discharge pipe work cross connection and recycled water back to the wet well. The temporary pipeline discharged to below the pump stop level to avoid unnecessary turbulence. The temporary main was fitted with the 300mm flowmeter that is ultimately intended to be fitted at the Viola Place Pumping Station (SPS299) and a 300 mm Fig 694 John valve to be used to throttle the flow. The flowmeter was calibrated by the manufacturer (ABB) for a maximum flow of 550 L/s. Appendix B contains a sketch and site photos of the temporary pipework arrangement.

Testing water on Day 1 was supplied via water trucks however on Day 2; water was pumped from Lytton Road Pumping Station (SPS298) to SPS300.

3. Pre-commissioning tests

3.1 Day 1 testing

3.1.1 Pump performance

During Day 1 the wet well was filled to RL 0.72 mAHD and the pumps operated at 25, 33, 50 and 53 Hz with various amounts of throttling imposed by the throttling valve. The pumps were operated manually in local mode for each pump test. Flow, pressure and pump motor performance data were recorded and the results compared to the manufacturers pump test data. The manufacturers test data is included in Appendix C while the results of the Day 1 pre-commissioning testing are included in Appendix D. Comparison graphs comparing the manufactures test data to the Day 1 pre-commissioning results are include in Appendix E.

No testing was performed with both pump 1 and 2 operating simultaneously.

3.1.2 Automatic pump changeover

The station was set to local mode with pump 1 manually started at 52 Hz with the pump delivering about 340 L/s. The duty pump isolator was opened and it was observed that the standby pump automatically started.

3.1.3 Automatic generator start

The station was set to local mode with pump 1 manually started at 52 Hz with the pump delivering about 340 L/s. The main incomer isolator was open to simulate a power cut. It was noted that after the mains power had been off for about 30 seconds the generator automatically started. It was noted that after the mains power had been off for about 60 seconds the generator started and after a further 30 seconds the automatic power transfer switches on the switchboard operated thus providing generator power throughout the switchboard. When the mains power was restored by re-closing the main incomer isolator the transfer switches again operated after a time delay of approx 30 seconds thus restoring mains power throughout the switchboard. The generator then ran-on for five minutes before shutting down.

3.2 Day 2 testing

3.2.1 PLC functionality

The test for pumping from SPS298 to SPS300 was successfully completed. This testing was undertaken with SPS300 set in remote mode while SPS298 was operated manually. The following observations were made;

- The pumps at SPS298 were manually started at 25 Hz and were run for approximately five minutes. The SPS298 flowmeter recorded the flow delivered to SPS300 varying between 55 L/s and 75 L/s. The pumps where then stopped for 15 minutes until the inflow at SP300 was observed to stop. SPS298 was then restarted at 50 Hz delivering about 200 L/s to SPS300. It was observed that inflow into SPS300 continued for 45 minutes when SPS298 was stopped. The water level in SPS300 was raised up to the overflow level to test the operation of the surcharge imminent probe.

  The long period that water continued to fill the SPS300 wet well after SPS298 was stopped suggest that the system was siphoning flows from SPS298. Pump station and pipe work levels are such that with high water levels at SPS298 the system will tend to siphon flows. The potential for siphoning was identified during design and is undesirable; hence a high-level manual air vent was installed adjacent to SPS300. The high-level manual air vent is intended to remain open at all times; this ensures that the siphoning will not occur. It is likely the high-level manual air vent is closed causing the system to siphon.

  It is recommended that the high-level manual air vent valve is checked and set in the open position.

- The next test involved opening the valves to the Luggage Point high pressure main and pumping the volume of water in the SPS300 wet well into the main. This was successfully done by throttling the recycling main valve to induce a greater head in the recycling system than that in the Luggage Point high pressure main. Once it was verified that flow into the main had been achieved, the recycling main valve was closed and the full pumping effort of the pumps where used to delivering into the main. Pumping into the Luggage Point high pressure main was undertaken with one pump operating at 25 Hz delivering approximately 120 L/s at 15 m head. During the test the PID loop/level where verified.

3.2.2 Vortices inspection

A visual inspection of he wet well was undertaken. The wet well lave was drawn down to the low water alarm level and the duty pump operated in local mode at 25 Hz. No vortices were observed.

3.3 Pre-commissioning problems

3.3.1 Flow by-pass

During initial testing it was observed that each pump delivered much less flow that expected. It was quickly identified that the reason for the reduced flows was due to testing being undertaken with the station reflux valve held open. This caused some of the flow from the duty pump to 'short circuit' the temporary recycle main by flowing backwards through the standby pump. Once the reflux valves were allowed to operate freely, as designed, expected flows were achieved.

3.3.2 Pressure transducer calibration

During initial testing it was observed that each pump appeared to deliver flows at very low pressures — much lower than expected. It was identified that the isolation valve on the pressure transducer was closed causing the pressure transducer to be effectively isolated from the flow. Opening the isolation valve dramatically improved the pressure readings however the transducer required recalibration which was subsequently undertaken by the Vega representative utilising Vega proprietary software.

3.3.3 VSD over current warning

During testing it was observed that when the pumps were run at speeds above 50 Hz, against a partially closed throttling valve, the VSD issued an over current waming. The VSD had been programmed with motor parameters as specified on the motor specification plate and as recommended by the VSD manufacturer. However, when run at speeds above 50 Hz, VSD current reading often spiked above the motor specification plate value. Interestingly the VSD can calculate the maximum current rating for the motor based on the other motor parameters; however these calculated values are higher than those on the motor.

It is suspected that the VSD over current threshold value needs to be set slightly higher than the motor specifications to take into account how the VSD measures this value. The VSD parameter number 222 "Warning Current High" was originally set to the motor nameplate of 420A however after experiencing the warning during the test this parameter was increased on both pumps by 10% to 462A. During subsequent operation of the pumps the warning was not observed. Parameter 107 "Automatic Motor Adaptation" was also operated to allow the VSD to measures critical parameters at motor standstill and ensure best possible motor torque performance.

3.3.4 VSD trip out on over temperature

During testing it was noted that pump 1 tripped out on over temperature after operating at high speed. Further investigation identified that the cooling fans for both pump 1 and 2 were incorrectly installed and were not operating when the VSD was operating. It is suspected that the reason why pump 2 did not trip when operating under similar conditions was because the VSD cabinet doors were open and provided adequate ventilation.

4. Pump data comparison

4.1 H/Q curve

The head and flow data was recorded for individual pump operation at a number of different pump speeds. This data is summarised in Appendix D. The collected data points were then compared to the factory test data supplied by the manufacturer. The comparison has been graphed and is included in Appendix E. From the graph it is apparent that there is very good correlation between the measured pump data and the previous factory test data.

4.2 Power curve

The power consumption, voltage and current of each pump were also measure for the various pump tests. These readings were read off the VSD controller. It was observed that the current and power readings tended to be unsteady and varied by about 10% even though other parameter remained relatively stable. The recorded values included in Appendix D are roughly the average values observed. The collected data points were then compared to the factory test data supplied by the manufacturer. The comparison has been graphed and is included in Appendix E. From the graph it is apparent that the observed pump power readings were slightly higher than expected however they still show good correlation to the manufacturers test data.

There are two reasons that contribute to the observed power reading being higher than those provided by the manufacturer. These include;

- The Hydrostal factory tests were undertaken without a VFD in the circuit while the permanent installation utilises a VSD. The inclusion of a VSD in the permanent installation introduces an efficiency loss not accounted for in the factory tests. The Danfoss VSD manual indicates that the VDS has a nominal efficiency of about 95% however this efficiency will reduce as motor load increases. The factory test power readings would therefore be at least 5% smaller than the observed readings.
- During site testing it was observed that the power readings fluctuated as the pumps were operating even though the load on the pumps remained the same. These fluctuations suggest that the on site power measuring equipment may be of a lower accuracy introducing error into power readings.

5. Conclusion

Based on the pre-commissioning tests and subsequent analysis PB is of the opinion the pumps meet the nominated requirements of the contract and are capable of achieving the design duties.

Appendix A

Pre-commissioning plan

LEIGHTON	Leighton Contractors Pty Limited ACN 000 893 667 Level 3 143 Coronation Drive MILTON Qld 4064 PO Box 288 Toowong Qld 4066	FORM **CONSTRUCTION METHOD STATEMENT**		
		Project: Australia Trade Coast Sewer	**No.:**	**Q1112**

CMS TITLE: **Commissioning of Serpentine Road Pump Station SP300**

CMS No.: **Q1112-CS-802**

START DATE: **13th April 2005**

DURATION: **2 days**

Submit to Client / Nominate for review where specified in contract

- ❑ Rejected, resubmit ____________ / /
- ❑ Accepted, with comments ____________ / /
- ❑ Accepted ____________ / /

Approved: ____________________ **Date:** ________

James Whybrow

IDM Search:	Q1112-CS-802 Rev 5
	Page 1 of 12

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1 SCOPE OF WORK

The following is a method statement for the commissioning of Serpentine Road Pump Station, located in Pinkenba.

This statement includes the construction sequencing, associated risks and hazards and identifies critical activities. Supplementary to this will be risk assessments and toolbox talks itemising all safety and environmental hazards and control measures.

2 CONSTRAINTS

Constraints on the project include the following:

- Completion of mechanical and electrical works
- Completion of BW programming of the PLC "Program Control Logic
- Completion of the Lytton Road Pump Station

3 REFERENCES

3.1 Specifications and Approvals

- BW functional specification Version 0.20 dated 06/04/2005
- SP300 design report.
- Attachment 5 of the contract – Mechanical Works
- All associated Brisbane City Council drawings and specifications

3.2 Management Plans & Documents

- Project Management Plan
- Safety and Health Management Plan
- Environmental Management Plan
- Construction Management Plan

4 STAFF RESPONSIBILITIES

Commissioning Manager – Vic Bowyer, to provide direction as required, record readings and provide technical support for the Pre-commissioning

Mechanical and Electrical Manager – Frank Mitchell, to insurer that ITP's are complete and pre-check done prior to Precommissioning.

Commissioning Forman – Dave Manson, to coordinate the works and do most of the work.

BW Commissioning Manager – Reg McGirr/Henry Lai to observe and verify as required

BW PLC Manager – Alex Witthoft/Geoffrey Timms, to program, operate and monitor the PLC to insurer pump station operates correctly.

5 PERMITS / APPROVALS

N/A

6 CONSTRUCTION SEQUENCE

6.1 Previous Works

The previous works to be completed prior to this work commencing is listed below.

a) ITP complete for mechanical installation (Style)

b) ITP complete for electrical installation (Reidlec)

c) BW complete programming of PLC

d) Overflow pipe to be plugged to allow filling of wet well

e) Ref Drg 486/5/7-TR201/030, valves No's 6, 8 & 41 to be OPEN

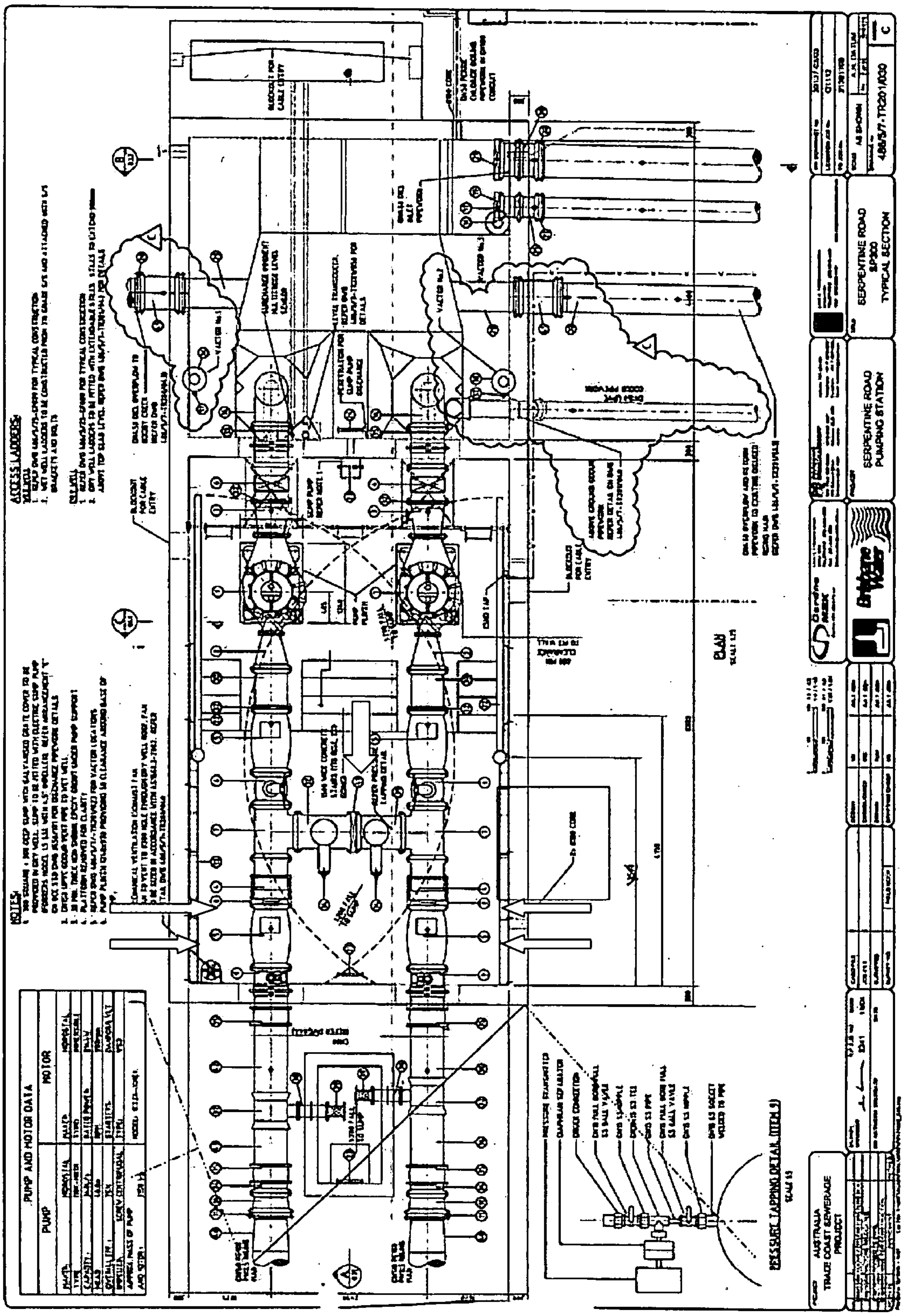
f) Ref Drg 486/5/7-TR201/030, Swing check valves to be held OPEN (Manually)

g) Water supply from hydrant to be set up each day

h) Wet wells to be filled each day prior to testing.

6.2 Completion of Works

Completion of the Serpentine Road Pump Station is April 2005.


SERPENTINE ROAD
SP300
TYPICAL SECTION
SERPENTINE ROAD
PUMPING STATION
AUSTRALIA
TRADE COAST SEWERAGE
PROJECT
PUMP AND MOTOR DATA
PUMP
MOTOR
PRESSURE TAPPING DETAIL (ITEM 9)
PLAN
NOTES:
ACCESS LADDERS:

7 PRE-COMMISSIONING TESTING

The purpose of the testing is to determine operational points (head vs. flow) for each pump and compare these points to the pump curves supplied by the manufacturer. Each pump will be tested operating at 25Hz, 33Hz, 50Hz and 55Hz. The test needs to be undertaken with the pump station in Manual mode. This will allow the pumps to be run at a set speed as the system resistance is increased (i.e. discharge valve closed). If the test were undertaken in Auto the pump speed would automatically increase to cater for the higher resistance.

Note – Generally a minimum time to allow the system to stabilise, (approximately 10minutes), should be allowed before readings are taken.

7.1 Visual Inspection of Station

A. Monday 14th March visually inspect both dry and wet wells

7.2 Electrical Checklist (14th March to the 1st April)

A. Materials to Site
B. Cable Tray Ladders
C. Surface Conduits
D. Underground Conduits and Pits
E. Earthing
F. Power and Control Cables
G. Main switchboard and meters
H. Motors
I. Marshalling and junction box's
J. Pressure Transmitters
K. Flow Meter
L. Instrumentation
M. Energise switchboard and Generator

7.3 Low Wet Well Level Testing

7.3.1 Pump A & B Q/H 25Hz.

A. Set wet well to **0.22** mAHD, just above "*Start Duty A*" to test pump station at low levels. This level is higher than target to allow for system to stabilise.

B. Set discharge-throttling valve to near closed.

C. With the station in "Manual Mode" start Pump A at 25Hz

D. Test Pump A against near closed valve and take readings. (Approx 100l/s)
Note do not run the pump at near closed valve for too long.

E. Set "Q" @ 200 L/s by throttling control valve until flow is reached. Run for 10 minutes and observe operation and take readings.

F. With the discharge throttling valve fully open record readings for Q (max ≅ 250L/s) & H.

G. Shut down Pump A, near close throttling valve and repeat for Pump B

7.4 PLC Functionality – VSD verification

This test is required to assess operation of flow banding of the station while filling. Pump trip test and power failure tests are also tested when the station is delivering at approximately its duty flow.

A. Fully open the throttling valve.

B. Set the station to operate on Auto.

C. Fill the well from hydrant

D. Observe that the duty pump shall start (at low speed) when the water level is at RL **0.21** mAHD.

E. When the duty pump starts record delivery pressure, discharge flow, pump speed and measure water level in wet well.

F. Observe that the duty pump's speed increases as the well level increases. Take readings fro every 5Hz increase. I.e. 25, 30, 35, 40, 45, 50.

G. When the wet well level reaches RL **0.41** mAHD record delivery pressure, discharge flow, pump speed and measure water level in wet well in tape measure.

7.5 High Level Testing

7.5.1 Pump A & B— Q/H @ 50Hz.

A. With the station in "Manual Mode" start Pump A.

B. The VSD should increase to **50Hz.**

C. Test Pump A against near closed valve and take readings. (Approx. 200l/s)

D. Set throttling valve to a flow of **320l/s** and record readings. (Duty point).

E. Continue to take reading at 10 minutes interval at the duty point flow for ½ hour.

F. With the discharge throttling valve fully open record readings for Q (max ≅ 450L/s) & H and pumps speed.

G. Set discharge-throttling valve open 100%.

H. Shut down Pump A, open throttling valve and repeat for Pump B

7.5.2 Pump A & B — Q/H @ 55Hz

A. With the station in "Manual Mode" start Pump A.

B. Check that wet well level to between RL (0.41 – 0.51) mAHD.

C. The VSD should increase to **55Hz.**

D. Test Pump A against near closed valve and take readings. (Approx. 250 l/s)

E. Set throttling valve to a flow of **348l/s** and record readings. (Duty point).

F. Continue to take reading at 10 minutes interval at the duty point flow for ½ hour.

G. With the discharge throttling valve fully open record readings for Q (max ≅ 470L/s) & H and pumps speed.

H. Shut down Pump A, open throttling valve and repeat for Pump B

7.5.3 Pump A & B Q/H 33Hz.

A. With the station in "Manual Mode" start Pump A at 33Hz

B. Fill level in wet well to **RL 0.51** mAHD to test pump.

C. Test Pump A against near closed valve and take readings. (Approx 100l/s)
Note do not run the pump at near closed valve for too long.

D. Set "Q" @ 250 L/s by throttling control valve until flow is reached. Run for 10 minutes and observe operation and take readings.

E. With the discharge throttling valve fully open record readings for Q (max ≅ 350L/s) & H. *Note the head from pipework may restrict the Q to 300L/s @12m head.*

F. Shut down Pump A, open throttling valve and repeat for Pump B

7.6 PLC Functionality – Final fill and Emptying (Day 2)

This test is required to assess operation of flow banding of the station while the station fills and empties.

A. Fill SP298 overnight with 25m3 of water.

B. Set the station to operate on Auto. Run Pump A for 10min.

C. **Trip the duty pump**. Pump to be tripped by simulating fault, using software.

D. Observe that the standby pump starts.

E. Reset the tripped pump.

F. Trip the standby pump. Pump to be tripped by simulating fault, using software.

G. Observe the duty pump starts.

H. Reset the tripped pump.

I. Trip power supply to switchboard by opening main isolator.

J. Observe start up of **generator** and continued operation of station.

K. Restore power to the switchboard by closing main isolator.

L. Observe shutdown of generator and continued operation of station.

M. Commence fill SP300 from SP298.

N. When the wet well level reaches RL0.71 record delivery pressure, discharge flow, and pump speed for both pumps and measure water level in wet well.

O. Continue fill until wet well reaches the point that Brisbane Water need to check for the sensor probes.

P. Once Probe have been check commence lowering water in wet well by opening main shut off valve to Luggage Point main. **NOTE BEFORE THIS IS DONE THE REFLEX VALVES NEED TO BE RELEASED TO OPERATE NORMALLY**.

Q. At RL0.41 record delivery pressure, discharge flow, pump speed and measure water level in wet well. Stop the pumps and reset so that one pump is running.

R. Empty level in wet well to **RL –0.52** mAHD to test pump station at low levels and observe for any vortices in wet well. (If **vortices** are observed the water level will need to be raised until these disappear. These levels will need to be recorded.)

S. Stop pump station

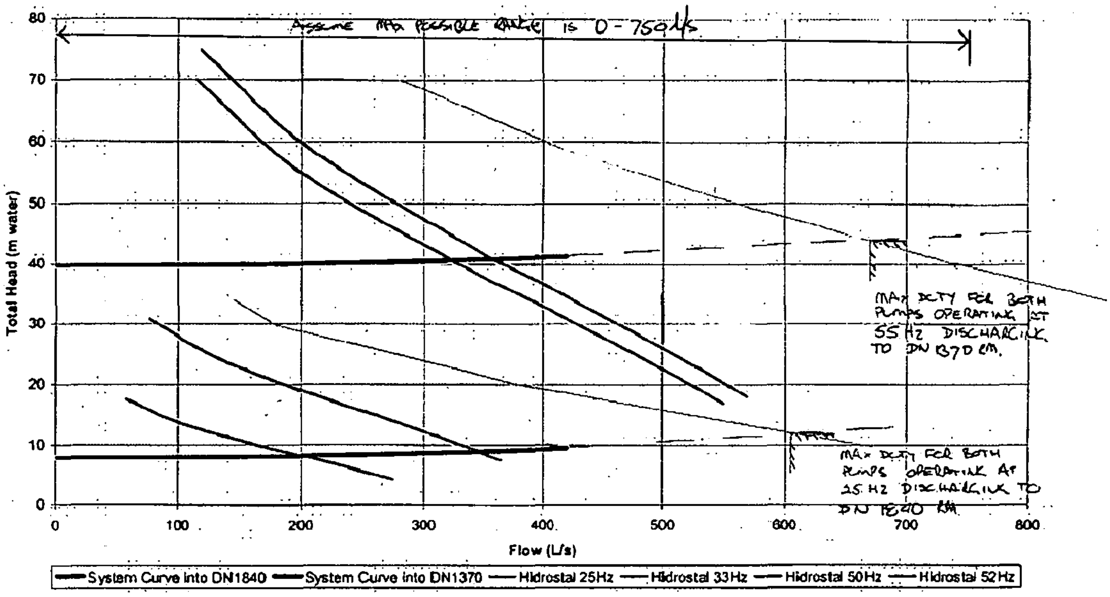
7.7 Reinstatement of system

Once the testing is complete the recycle pipe will be removed. Target 22nd April.

7.8 System/Pump Curve

Once the testing is complete the recycle pipe will be removed and site backfilled and fencing completed

SP 300 (Serpentine Rd) - Performance Curves - One Hidrostal I10K-M / 216kW

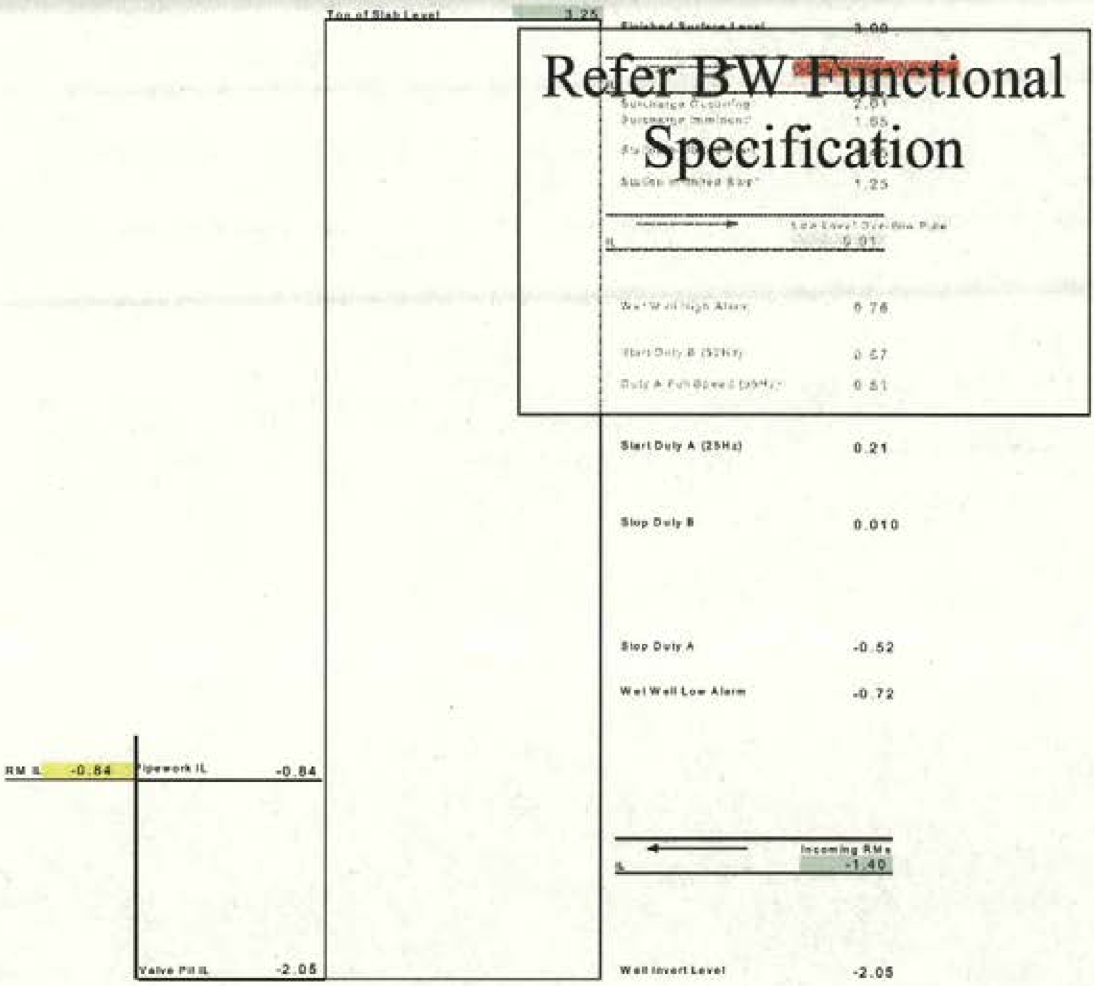


SP 300 Design Rev 1.12 | Performance Curves | Page 1 of 1

IDM Search:	Q1112-CS-802 Rev 5
	Page 10 of 12

7.9 Operational Diagram

The following diagram shows the station structure levels and operating levels.



8 PLANT, EQUIPMENT AND MATERIALS

8.1 Plant

- Backhoe
- Water Truck

8.2 Equipment

- Flex drive pumps and motors
- Small tools
- Plugs for overflow

8.3 Materials

9 PARTICULAR HAZARDS / RISKS

9.1 Safety & Health

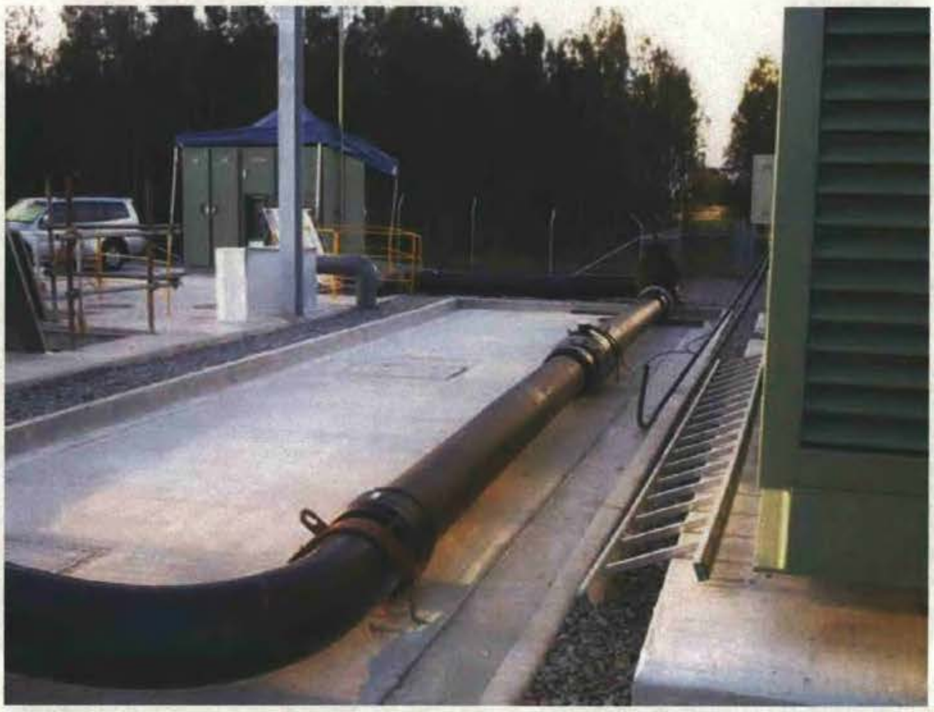
9.2 Environment

Please refer to each individual Safe work method Statement and risk assessment to show associated risks and hazards. This includes all environmental risks as well. This statement must be completed and have a tool box talk completed for each activity.

PB PARSONS BRINCKERHOFF

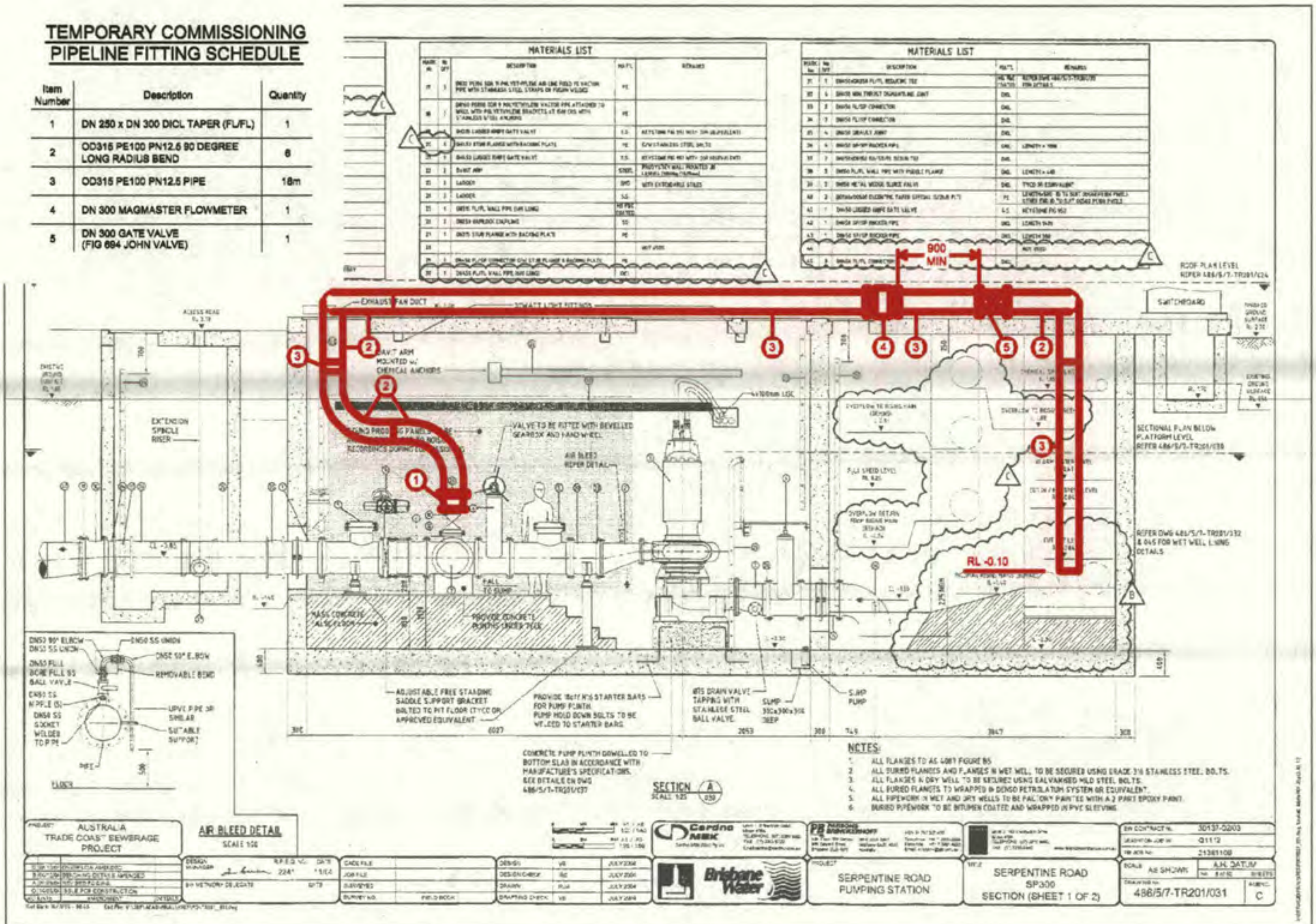
Appendix B

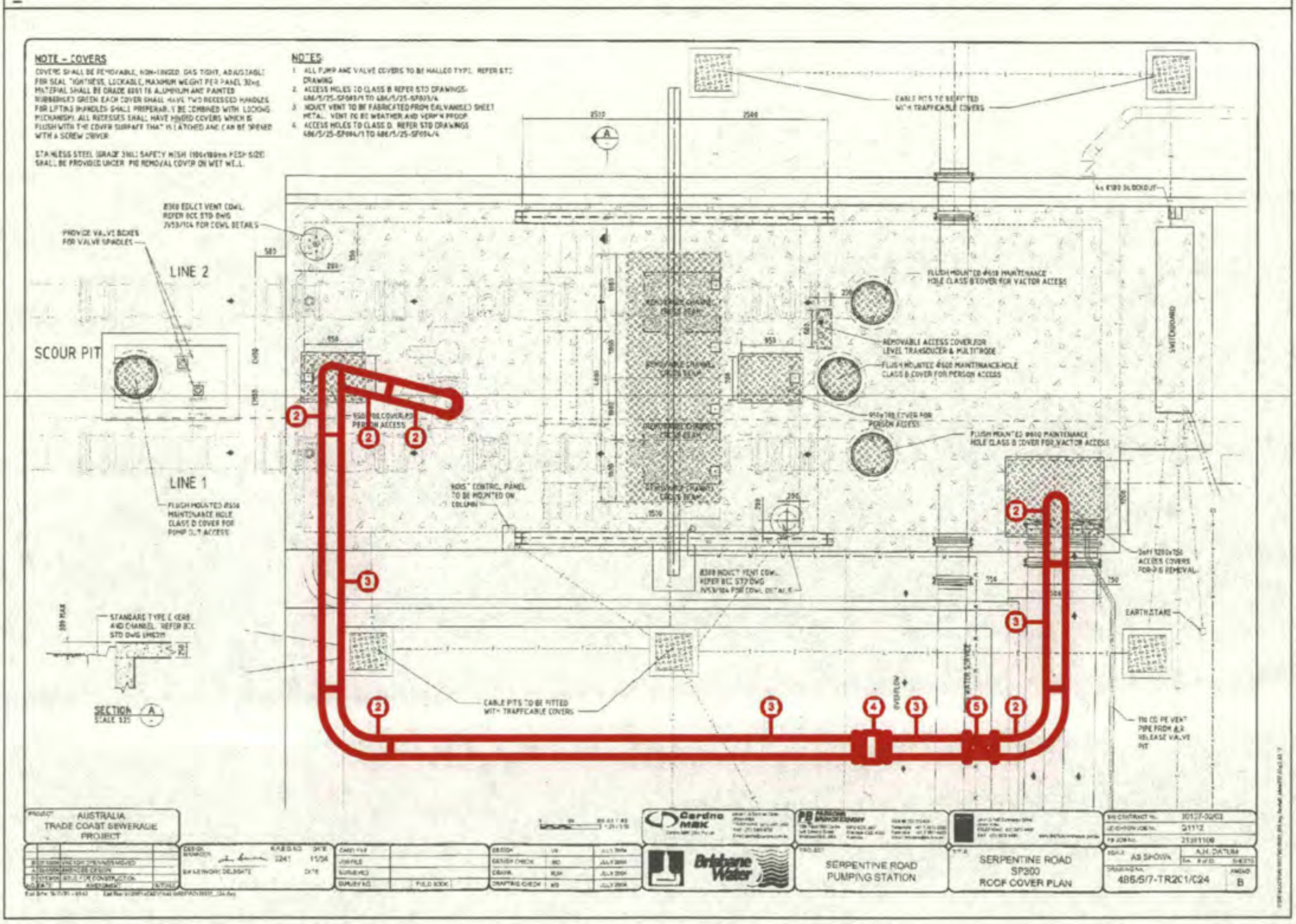
Temporary pre-commissioning pipework arrangement



TEMPORARY COMMISSIONING PIPELINE FITTING SCHEDULE

Item Number	Description	Quantity
1	DN 250 x DN 300 DICL TAPER (FL/FL)	1
2	OD315 PE100 PN12.5 90 DEGREE LONG RADIUS BEND	6
3	OD315 PE100 PN12.5 PIPE	18m
4	DN 300 MAGMASTER FLOWMETER	1
5	DN 300 GATE VALVE (FIG 694 JOHN VALVE)	1





Appendix C

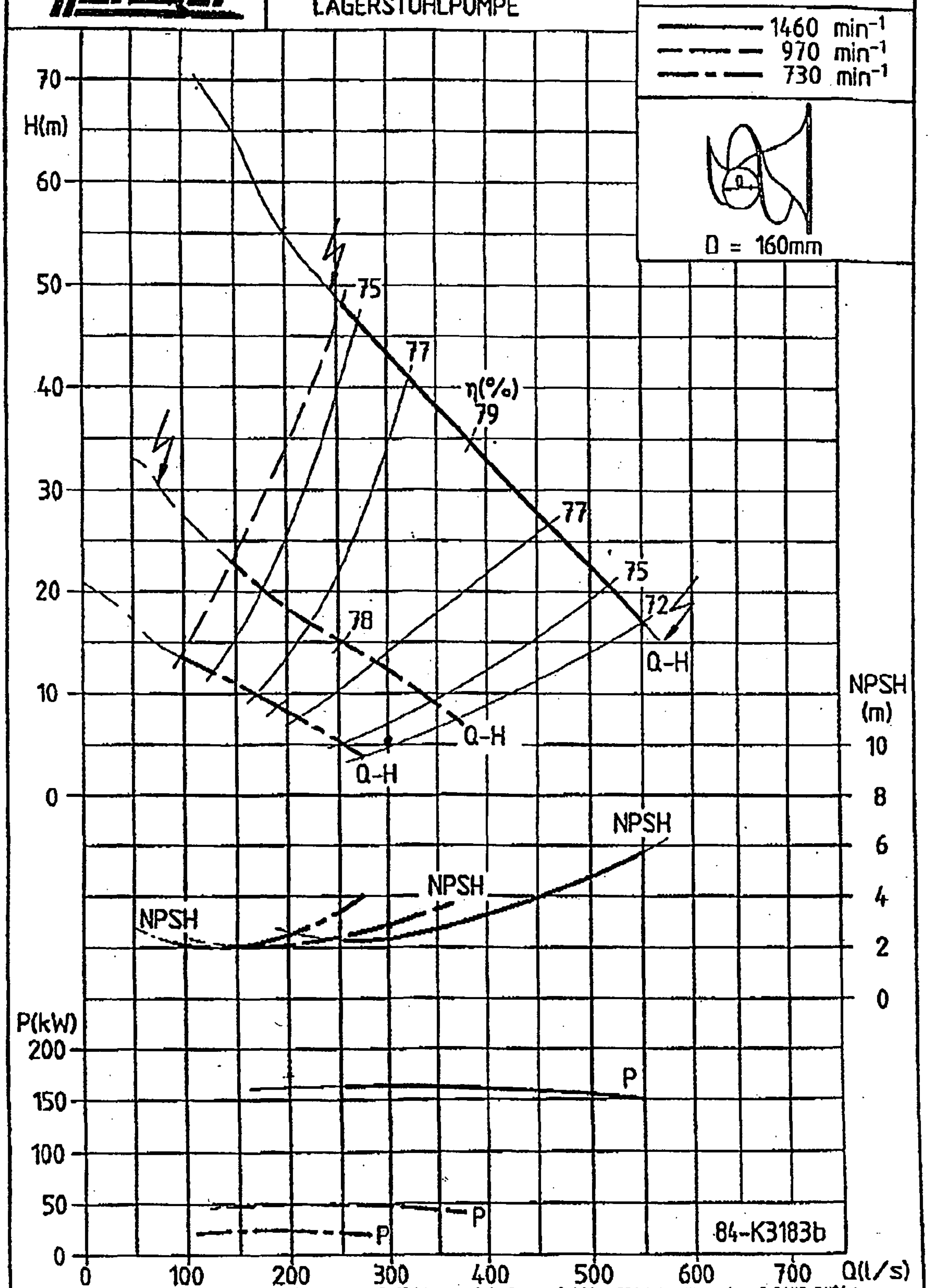
Manufacturers test data

17-MAR-2004 07:58 FROM WEIR SERVICES TO 0-0738314223 P.07

Hidrostal

BEARING FRAME PUMP
LAGERSTUHLPUMPE

I10K-M



NOTE: PUMP POWER P. INCLUDE MECH.SEAL FRICTION AND BEARING FRAME LOSS, FROM A RUN-IN BEARING RAME TYPE L
VERMERK: LEISTUNG P. MIT REIBVERLUSTE DER LAGERUNG UND DICHTUNG EINES EINGELAUFENEN LAGERSTUHL TYP -L

Aend. SERPENTINE RD	Drawn. by/Bearb. Dat.Vis.: 03.12.96 PK Approved by/Genr. Dat.Vis. : 03.12.96 HF	No : 84-K3183b

TOTAL P.07

Australia Trade Coast Sewerage Project
SPS 300 - Serpentine Road Pumping Station
Manufacturers Test Data

Serpentine Road - Pump 1?

Pump :- I10K-M02R+IETZ4-XMEK
Fab-No. 138077

Hz	50	
RPM	1493	
Flow (l/s)	Head (m)	P (kW)
250.5	49.8	184
297	44.5	189
351.1	38.3	186
400	33.5	186
429.9	31.4	183
508.3	24.8	174
550.8	19.9	165

Hz	33	
RPM	985	
Flow (l/s)	Head (m)	P (kW)
165.3	21.7	52.9
196.0	19.4	54.3
231.7	16.7	53.5
264.0	14.6	53.5
283.7	13.7	52.6
335.5	10.8	50.0
363.5	8.7	47.4

Hz	25	
RPM	747	
Flow (l/s)	Head (m)	P (kW)
125.3	12.5	23.0
148.5	11.1	23.6
175.6	9.6	23.3
200.0	8.4	23.3
215.0	7.9	22.9
254.2	6.2	21.8
275.4	5.0	20.6

Hz	53	
RPM	1583	
Flow (l/s)	Head (m)	P (kW)
265.5	56.0	219.1
314.8	50.0	225.1
372.2	43.0	221.5
424.0	37.6	221.5
455.7	35.3	218.0
538.8	27.9	207.2
583.8	22.4	196.5

Serpentine Road - Pump 2?

Pump :- I10K-M02R+IETZ4-XMEK
Fab-No. 138078

Hz	50	
RPM	1493	
Flow (l/s)	Head (m)	P (kW)
250.5	49.7	183
318.7	41.4	187
363.9	36.2	184
400.4	33.1	182
421.8	31	181
488.3	25.6	174
550.8	18.7	162

Hz	33	
RPM	985	
Flow (l/s)	Head (m)	P (kW)
165.3	21.6	52.6
210.3	18.0	53.8
240.2	15.8	52.9
264.3	14.4	52.3
278.4	13.5	52.0
322.3	11.2	50.0
363.5	8.1	46.6

Hz	25	
RPM	747	
Flow (l/s)	Head (m)	P (kW)
125.3	12.4	22.9
159.4	10.4	23.4
182.0	9.1	23.0
200.2	8.3	22.8
210.9	7.8	22.6
244.2	6.4	21.8
275.4	4.7	20.3

Hz	53	
RPM	1583	
Flow (l/s)	Head (m)	P (kW)
265.5	55.8	218.0
337.8	46.5	222.7
385.7	40.7	219.1
424.4	37.2	216.8
447.1	34.8	215.6
517.6	28.8	207.2
583.8	21.0	192.9

Appendix D

Pre-commissioning test data

Australia Trade Coast Sewerage Project
SPS 300 - Serpentine Road Pumping Station
Pre-Commissioning Test Data Summary

Serpentine Road - Pump 1?

Pump :- I10K-M02R+IETZ4-XMEK
Fab-No. 138077

Hz	25					
RPM	747					
Pressure Gauge Level (mAHD)	Pump Level (mAHD)	Wet Well Level (mAHD)	Pressure Gauge Reading (m)	Pump Discharge Head (m)	Pump Discharge Flow (l/s)	Pump Power (kW)
-0.55	-0.745	0.72	12.65	11.38	135	24
-0.55	-0.745	0.72	9.4	8.13	189.3	24.5
-0.55	-0.745	0.72	8.05	6.78	222	23.5

Hz	33	p;				
RPM	985					
Pressure Gauge Level (mAHD)	Pump Level (mAHD)	Wet Well Level (mAHD)	Pressure Gauge Reading (m)	Pump Discharge Head (m)	Pump Discharge Flow (l/s)	Pump Power (kW)
-0.55	-0.745	0.72	21.5	20.23	176.5	53.5
-0.55	-0.745	0.72	16	14.73	248	53.5
-0.55	-0.745	0.72	12.8	11.53	297	56.5

Hz	50					
RPM	1493					
Pressure Gauge Level (mAHD)	Pump Level (mAHD)	Wet Well Level (mAHD)	Pressure Gauge Reading (m)	Pump Discharge Head (m)	Pump Discharge Flow (l/s)	Pump Power (kW)
-0.55	-0.745	0.72	35.6	34.33	369	198
-0.55	-0.745	0.72	27.8	26.53	440	190

Hz	53					
RPM	1583					
Pressure Gauge Level (mAHD)	Pump Level (mAHD)	Wet Well Level (mAHD)	Pressure Gauge Reading (m)	Pump Discharge Head (m)	Pump Discharge Flow (l/s)	Pump Power (kW)
-0.55	-0.745	0.72	40.5	39.23	395	
-0.55	-0.745	0.72	31.5	30.23	468	234
-0.55	-0.745	0.72	22.2	20.93	581	210

Serpentine Road - Pump 2?

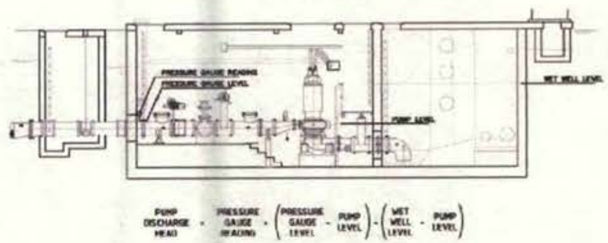
Pump :- I10K-M02R+IETZ4-XMEK
Fab-No. 138078

Hz	25					
RPM	747					
Pressure Gauge Level (mAHD)	Pump Level (mAHD)	Wet Well Level (mAHD)	Pressure Gauge Reading (m)	Pump Discharge Head (m)	Pump Discharge Flow (l/s)	Pump Power (kW)
-0.55	-0.745	0.72	11	9.73	166.5	25.3
-0.55	-0.745	0.72	8.77	7.5	208	24.6
-0.55	-0.745	0.72	6.4	5.13	266	23.5

Hz	33					
RPM	985					
Pressure Gauge Level (mAHD)	Pump Level (mAHD)	Wet Well Level (mAHD)	Pressure Gauge Reading (m)	Pump Discharge Head (m)	Pump Discharge Flow (l/s)	Pump Power (kW)
-0.55	-0.745	0.72	18.4	17.13	218	56.4
-0.55	-0.745	0.72	14.6	13.23	275	55
-0.56	-0.745	0.72	10.2	8.93	354	53

Hz	50					
RPM	1493					
Pressure Gauge Level (mAHD)	Pump Level (mAHD)	Wet Well Level (mAHD)	Pressure Gauge Reading (m)	Pump Discharge Head (m)	Pump Discharge Flow (l/s)	Pump Power (kW)
-0.55	-0.745	0.72	40.3	39.63	322	196
-0.55	-0.745	0.72	32.2	30.93	410	199
-0.55	-0.745	0.72	21.6	20.33	533	185

Hz	53					
RPM	1583					
Pressure Gauge Level (mAHD)	Pump Level (mAHD)	Wet Well Level (mAHD)	Pressure Gauge Reading (m)	Pump Discharge Head (m)	Pump Discharge Flow (l/s)	Pump Power (kW)
-0.55	-0.745	0.72	35.7	34.43	427	235
-0.55	-0.745	0.72	39.4	38.13	395	235
-0.55	-0.745	0.72	24	22.73	569	226



CALCULATION DIAGRAM

PUMP TEST SHEET

Brisbane Water

Australia Trade Coast Sewer Project
CONTRACT NO: BW30137-02/03
Pump Station: Serpentine Road SP300
Test Date: 13/4/05 & 14/4/05

Mode	Running Local Remote	Pump Serial No: Type: H0K-M02R+ETZ4-XMEK+NEE8-16 Make: Hidrostal	Time	Incomming Mains SP298 Lytton Road P/S	Incomming Mains SP131 McBride Road P/S	Wet Well Level Set Points (m AHD) Low Alarm	Stop Duty A	Stop Duty B	Start Duty A	PID Setpoint	Start Duty B.	High Level Alarm	Emergency Storage Imminent	Emergency Storage Active	Overflow Level	Wet Well Level Vega Probe	Pump Delivery Head	Flow Rate	Motor Speed	Motor Current	Motor Power	Discharge Valve Position Open	Water Temp	Generator Running	~~Pump~~ MOTOR ~~Hours Run~~ VOLTAGE
No	Mode	No	Hr/Min	Open/Close		-0.72	-0.52	0.01	0.21	0.28	0.41	0.61	0.71	0.91		%/mAHD	m AHD	l/s	RPM/Hz	A	Kw	%	Deg.C	Yes/No	~~Hrs~~ V
1	Local	PUMP 1		Close	Close											48%/0.72	12.65	135	25	130	24	10%		No	140
1	Local	"		Close	Close											46%/0.72	21.5	176.5	33	179.5	53.5	10%		No	226.7
	Local Remote			Open Close	Open Close																			Yes No	
1	Local	PUMP 1		Close	Close											48%/0.72	9.4	189.3	25	131	24.5	15%		No	141
1	Local	"		Close	Close											48%/0.72	16.0	246.0	33	184	53.5	15%		No	226
1	Local	"		Close	Close											48%/0.72	35.6	369.0	50	338	198	15%		No	433
1	Local	"		Close	Close											48%/0.72	40.5	395.0	53	WARNING	12	15%		No	—
	Local Remote			Open Close	Open Close																			Yes No	
1	Local	PUMP 1		Close	Close											48%/0.72	8.05	222.0	25	129	23.5	20%		No	142.5
1	Local	"		Close	Close											48%/0.72	12.8	297.0	33	179	56.5	20%		No	229
1	Local	"		Close	Close											48%/0.72	27.8	440	50	337	190	20%		No	433
1	Local	"		Close	Close											48%/0.72	31.5	466.0	53	382	234	20%		No	433
	Local Remote			Open Close	Open Close																			Yes No	
1	Local	PUMP 1		Close	Close											48%/0.72	22.2	581	53	335 WARNING	210 12	100%		No	435
	Local Remote			Open Close	Open Close																			Yes No	
	Local Remote			Open Close	Open Close																			Yes No	
	Local Remote			Open Close	Open Close																			Yes No	
	Local Remote			Open Close	Open Close																			Yes No	
	Local Remote			Open Close	Open Close																			Yes No	
	Local Remote			Open Close	Open Close																			Yes No	
	Local Remote			Open Close	Open Close																			Yes No	
	Local Remote			Open Close	Open Close																			Yes No	

Mode 1 One or Two Pump running into 1370 Rising Main

Mode 2 One Pump running into 1840 Rising Main

Pump Serial No: 138077 Pump 1—2

Pump Serial No: 138078 Pump 1—2

Entered By: Vic Bowyer (PB)

Witnessed By: Reg McGirr (BW)

Comments:

Wet well probe:
0%= -1.92 mAHD
100%= 3.58 mAHD

Discharge:
Gauge RL -0.55 mAHD

Site Form 001 Rev 0

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PUMP TEST SHEET

Brisbane Water

Australia Trade Coast Sewer Project
CONTRACT NO: BW30137-02/03
Pump Station: Serpentine Road SP300

Test Date: 13/4/05 + 14/4/05

Mode	Running Local Remote	Pump Serial No: Type: H0K-M02R+ETZ4-XMEK+NEE8-16 Make: Hidrostal	Time	Incomming Mains		Wet Well Level Set Points (m AHD)										Wet Well Level	Pump Delivery	Flow	Motor			Discharge Valve	Water	Generator	~~Pump~~ MOTOR
				SP298 Lytton Road P/S	SP131 McBride Road P/S	Low Alarm	Stop Duty A	Stop Duty B	Start Duty A	PID Setpoint	Start Duty B.	High Level Alarm	Emergency Storage Imminent	Emergency Storage Active	Overflow Level	Vega Probe	Head	Rate	Speed	Current	Power	Position Open	Temp	Running	~~Hours Run~~ VOLTAGE
No	Mode	No	Hr/Min	Open/Close		-0.72	-0.52	0.01	0.21	0.28	0.41	0.51	0.71	0.91		%/mAHD	m AHD	l/s	RPM/Hz	A	Kw	%	Deg.C	Yes/No	~~Hrs~~ ✓
1	Local Remote	Pump 2		Open Close	Open Close											48% / 0.72	11.0	166.5	25	135	25.3	10%		Yes No	140.7
1	Local Remote	"		Open Close	Open Close											48% / 0.72	18.4	218.0	33	184	56.4	10%		Yes No	226.
1	Local Remote	"		Open Close	Open Close											48% / 0.72	40.9	322	50	349	196	10%		Yes No	424
	Local Remote			Open Close	Open Close																			Yes No	
1	Local Remote	Pump 2		Open Close	Open Close											48% / 0.72	8.77	208	25	133	24.6	15%		Yes No	141.4
1	Local Remote	"		Open Close	Open Close											48% / 0.72	14.5	275	33	186	55	15%		Yes No	228
1	Local Remote	"		Open Close	Open Close											48% / 0.72	32.2	410	50	355	199	15%		Yes No	423
1	Local Remote	"		Open Close	Open Close											48% / 0.72	35.7	427	53	382	235	15%		Yes No	435
	Local Remote			Open Close	Open Close																			Yes No	
1	Local Remote	Pump 2		Open Close	Open Close											48% / 0.72	39.4	395	53	385 WARNI	235 NG 12	12%		Yes No	435
	Local Remote			Open Close	Open Close																			Yes No	
1	Local Remote	Pump 2		Open Close	Open Close											48% / 0.72	6.4	266	25	130	23.5	100%		Yes No	139
1	Local Remote	"		Open Close	Open Close											48% / 0.72	10.2	354	33	180	53	100%		Yes No	225
1	Local Remote	"		Open Close	Open Close											48% / 0.72	21.6	533	50	343	185	100%		Yes No	419
1	Local Remote	"		Open Close	Open Close											48% / 0.72	24.0	569	53	375	226	100%		Yes No	435
	Local Remote			Open Close	Open Close																			Yes No	
	Local Remote			Open Close	Open Close																			Yes No	
	Local Remote			Open Close	Open Close																			Yes No	
	Local Remote			Open Close	Open Close																			Yes No	
	Local Remote			Open Close	Open Close																			Yes No	
	Local Remote			Open Close	Open Close																			Yes No	
	Local Remote			Open Close	Open Close																			Yes No	

Mode 1 One or Two Pump running into 1370 Rising Main

Entered By: Vic Bowyer (PB)

Comments:

Mode 2 One Pump running into 1840 Rising Main

Pump Serial No: 138077 Pump 1—2

Witnessed By: Reg McGirr (BW)

Pump Serial No: 138078 Pump 1—2

Wet well probe:
0%= -1.92 mAHD
100%= 3.58 mAHD

Discharge:
Gauge RL -0.55 mAHD

Site Form 001 Rev 0

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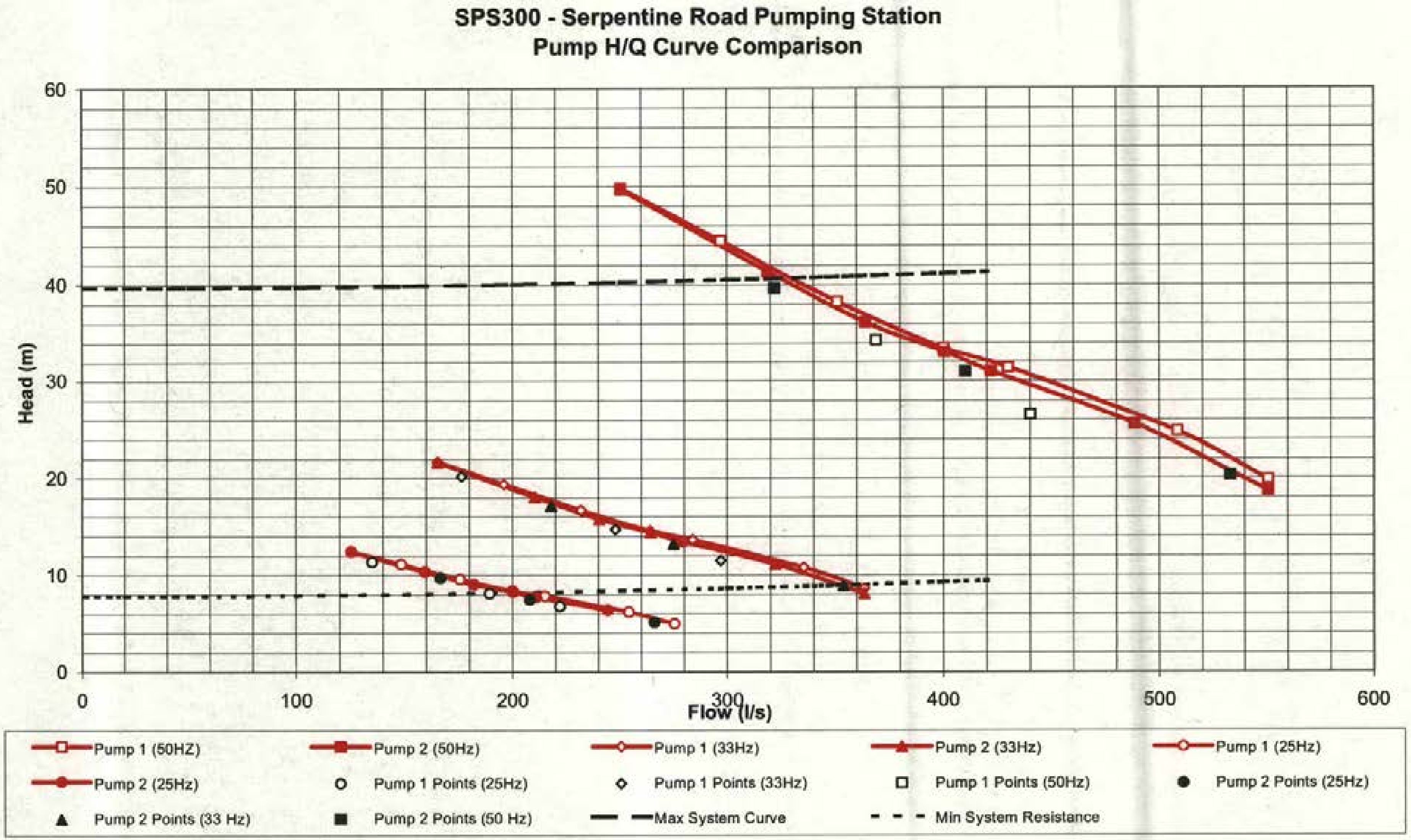
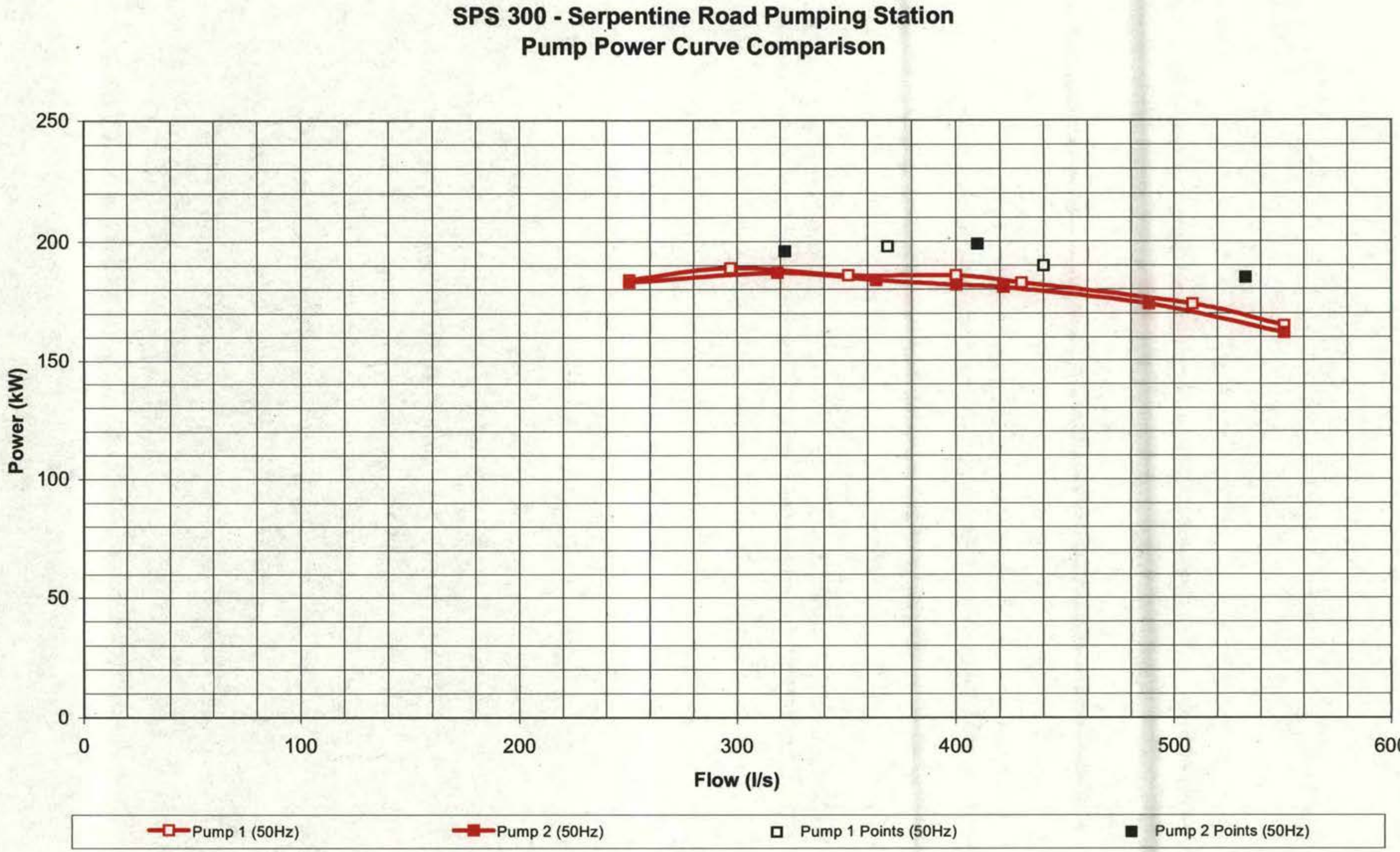
Appendix E

Pump data comparison graphs


SPS300 - Serpentine Road Pumping Station
Pump H/Q Curve Comparison
Head (m)
60
50
40
30
20
10
0
0
100
200
300
400
500
600
Flow (l/s)
Pump 1 (50HZ)
Pump 2 (50Hz)
Pump 1 (33Hz)
Pump 2 (33Hz)
Pump 1 (25Hz)
Pump 2 (25Hz)
Pump 1 Points (25Hz)
Pump 1 Points (33Hz)
Pump 1 Points (50Hz)
Pump 2 Points (25Hz)
Pump 2 Points (33 Hz)
Pump 2 Points (50 Hz)
Max System Curve
Min System Resistance


SPS 300 - Serpentine Road Pumping Station
Pump Power Curve Comparison
Power (kW)
250
200
150
100
50
0
0
100
200
300
400
500
600
Flow (l/s)
Pump 1 (50Hz)
Pump 2 (50Hz)
Pump 1 Points (50Hz)
Pump 2 Points (50Hz)

4.4

LEIGHTON

Leighton Contractors Pty Limited
ACN 000 893 667

Level 3
143 Coronation Drive
MILTON Qld 4064
PO Box 288
Toowong Qld 4066

FORM

CONSTRUCTION METHOD STATEMENT

Project:	Australia Trade Coast Sewer	No.:	Q1112

CMS TITLE: **Construction of Separable Portion 2**

CMS No.: **Q1112-CS-703**

START DATE: **28 June 2004**

DURATION: **6 months**

Submit to Client / Nominate for review where specified in contract

- ❑ Rejected, resubmit ____________ / /
- ❑ Accepted, with comments ____________ / /
- ❑ Accepted ____________ / /

Approved: ____________________ **Date:** __________

Project Manager

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1. SCOPE OF WORK

The following is a method statement for the construction of the pipeline from Lytton Road pump station (South Side of river) to Serpentine Pump Station (North Side of River). There are multiple sections this can be split into which are as follows:

- 700m of 450-diameter pipe from the Lytton Road pump station to the river crossing.
- River crossing using 400 diameter pipe (separate Construction method statement)
- 1,050m of 450 diameter pipe being placed in open areas.
- 950m of 450 diameter pipe adjacent and in road reserves.

This statement includes the construction sequencing, associated risks and hazards and identifies critical activities. Supplementary to this will be risk assessments and toolbox talks itemising all safety and environmental hazards and control measures.

2. CONSTRAINTS

Constraints on the project include the following:

- Alignment approvals.
- Traffic control permits.
- Permits including CMP (coastal marine permit).
- Interaction with major stakeholders and the community.
- Indigenous community
- "For construction" drawings

3. REFERENCES

3.1 Specifications

- Attachment 4 of the contract – Civil Works Construction Specification
- Brisbane City Council specifications
- Manual of Uniform Traffic Control Devices 2003 edition Part 3 (MUTCD)

3.2 Drawings

- 486/5/8-SM18/021 to 039 – Drawings of trenching works Separable portion 2

3.3 Management Plans & Documents

- Project Management Plan
- Safety and Health Management Plan
- Environmental Management Plan
- Acid Sulphate management plan

4. STAFF RESPONSIBILITIES

Staff will be responsible for all associated work according to their project descriptions, which can be found in the Project Management Plan. The Project Engineer will coordinate with the Site Engineer and Foreman the supervision of all direct labour and subcontractors to ensure that all work is completed in a professional manner with no class 1 or 2 safety and environmental incidents. All costs and production rates will be reviewed on a daily basis to ensure the work is completed on time and to budget.

5. PERMITS / APPROVALS

Prior to commencing construction all relevant permits and approvals are required to be signed and approved for construction. This includes coastal marine permits and also Main Roads alignment approvals. Other approvals that are to be completed are "for construction' drawing approvals from Brisbane City Council, Community consultation to ensure the public are aware of the works and any Traffic Control permits to complete works on or near the road alignment. All of these approvals will be required to be signed off on a works pre-commencement checklist by all associated people looking after each particular area. Construction on site will not commence until this checklist is completely signed off and reviewed and approved by the Project Manager. A dilapidation report and baseline monitoring will be required to be completed prior to and during the construction phase

6. CONSTRUCTION SEQUENCE

6.1 Previous Works

Previous work to be completed is the trenching and pits for Separable portion 1. Practical completion on this section of works is required prior to commencing on this section.

6.2 Works to be Completed

All associated work with this section is to be completed by December 2004.

7. DETAILED CONSTRUCTION METHODS

Works will be carried out in the following stages:

7.1 Clearing, Grubbing and Topsoil Removal

Once the approvals form has been completed and approved, construction can take place. Were required the traffic control plan will reduce the traffic down to 40km/hr with a lane closure. This will mean stop / go in certain sections of the works. This will be completed in accordance with the MUTCD 2003 Part 3.

The approved clearance zone as specified in the appropriate permits and approvals will be pegged out using survey and any trees, shrubs or grass that needs to remain will be clearly marked. A 20 Tonne excavator will use a straight edge batter bucket to remove all vegetation and topsoil. This material will be stockpiled along the edge of the cleared zone. Where drains are present silt fences will be erected between the drain and the stockpile of material to ensure no runoff will take place. Where required the silt fence will have 20mm aggregate or ballast placed at the base to ensure stability problems are overcome. The couch grass will be removed with care so it can be used to reinstate the area.

The areas that have "trapped" water will be pumped out using sump holes and flex drive pumps into grassland so it can be filtered prior to entering any waterways. The water will be tested for pH prior to pumping and neutralised if required. No untreated water will be entering directly into the waterways.

7.2 Deliveries and Welding

There will be strategic points along the alignment that will be delivery areas and welding bays. The pipe will be delivered in quantities nominated by the Project Engineer and unloaded into the delivery area. All deliveries and unloading will be completed under traffic control where required as explained in section 7.1. The working platform will be free draining and free of rocks, sticks and other foreign material. Once stockpiled a backhoe will move the pipes into position for welding and then once the pipe has been welded into strings the backhoe will move the pipe into position. This will be completed using a skid or roller system if required so the pipe does not get any defects.

The pipe will be welded into approximately 60m lengths including fittings where required and left in a storage area next to the welding bay. A 60m length of pipe will consist of 3 welds and each one will be completed according to attachment 4 of the contract (Civil Works Construction Specification). This will ensure each weld is consistent and completed free of contamination. Welding will continue in 60m lengths until the delivery has been completed.

7.3 Under boring

Prior to the under boring subcontractor starting on site an entry and exit pit will be excavated using the 12T Excavator or backhoe by Leighton Contractors. To complete the excavation an excavation permit is required to be completed and approved. This will locate any services in the area. The pits will be made safe with battering or benching if required. The bottom of the pits will be 500mm below the survey invert of the pipe. Once the excavation is complete the subcontractor will be inducted and will commence on site. A permit to excavate will be filled in showing all services in the area. Each service that the subcontractor will cross or come near will be located in detail using survey. The permit to excavate will be signed off by the subcontractor ensuring that it has been fully understood. Survey will set out the entry and exit locations and hand over any information required by the subcontractor.

The subcontractor's equipment will be inspected and approved for use prior to commencing works. The machine will be set up in the entry pit and will commence drilling. The drill will be monitored to ensure the correct trajectory under the road or creek is maintained at all times. The under bore under the rail line will be pipe jacked using a steel sleeve. The under bore at the road and creek locations will be directionally drilled. Both the entry and exit pit will be dewatered and maintained by the Subcontractor. Quality control will be monitored throughout the entire process. Once the under bore has been completed the pipe will be pulled through and any voids filled with Bentonite. The void between the steel liner and the pipe under the rail crossings will be fully grouted. Once the grouting has been completed the subcontractor will demobilise the equipment or move onto the next bore location. The entry and exit pits will be partially filled leaving a trench width to enable the connection onto the trenched pipe on either side.

7.4 Excavation, placement and backfill

Where required works will be completed using traffic control utilising a lane closure. The closure will be delineated using traffic cones or barriers. No one will be allowed to work outside the delineation.

An excavation permit will be completed and approved and all service locations will be marked on the ground to ensure nothing is cut. Service providers will be present if required when trenching is in close proximity.

A 20 Tonne excavator will be used to excavate the trench. This will be reduced to a 12T excavator where tight areas occur. The trench will be a nominal 2m in depth and will be benched, battered or shored accordingly. The trench will be excavated until a certain point in the day. As the trench is excavated to level a backhoe will place bedding material into the trench at a nominal 200mm thick layer. The bedding will then be compacted to specified standards. The bedding layer will be checked with survey to ensure the pipe will be placed in the correct position and level. If required the trench will now be dusted with lime to ensure that no acid sulphate can be produced. The PE pipe will then be moved into position using the backhoe or excavator. Once into position beside the trench the excavator and backhoe will lift the pipe using certified lifting slings. Both the backhoe and excavator will be checked for lifting capacities to ensure that they are in lifting range. The pipe will then be placed onto the bedding material. Both machines will straighten the pipe in the trench and start to place the haunch material. This will be compacted to the required compaction standard and tested. Survey will ensure that the pipe is in the correct location and complete an as built. The general excavation material will be used, as the backfill material above the haunch zone for the pipe is not in the road reserve. Areas that are in the road reserve will be backfilled with material that has been approved and is in accordance to the drawings. This material will be placed in layers and compacted using a trench roller. These layers will be tested for compaction.

The general material that comes from the trench consists of about 1m of good fill material and then the rest is potential acid sulphate clay soil. This potential acid sulphate soil that will not be placed as backfill back into the trench will be treated according to the management plan and spread over the work area. The clean fill will be used to cap the top of the trench so no acid sulphate can be produced.

In areas that are wet there will be a geofabric membrane placed around the bedding and haunch to stop ingress of water into the pipe location. There will also be pits excavated along the trench to allow dewatering. The water will be tested for pH and neutralised prior to any pumping.

The cycle above will be completed on a daily basis. At the end of each day a small pit will be left at the end of the trench with shoring so at the beginning of the following day the cycle can commence at that location. Each joint will be connected using an electro-fusion coupler. This pit will be larger to ensure a safe and clean working area. The electro-fusion coupler will be placed onto one side, the other pipe will be moved into position and clamped into place to secure the pipe. Both ends will be cleaned as per the Brisbane specification, the coupler moved into position and welded on. Once the weld has been completed and cooled down, the position of the coupler will be surveyed as a joint and then backfilled as the same procedure above.

7.5 Reinstatement

Once the pipe has been placed and backfilled the stripped material will be reinstated. The 12T or 20T excavator will pick up the grass and topsoil from the stockpile and spread it over the cleared area. A good mixture of grass and topsoil will be spread to ensure that the grass can regerminate. A water truck will occasionally water the area to promote the grass to bring the area back close to its original state. The salt cooch that has been cleared will be replanted to help with restoration.

7.6 Air and Scour Pits

Air and scour pits will be completed once the pipe has been installed in the particular area. There will be a Tee section along the main pipe at each location that has been blanked off. Each of these sections will be surveyed so an accurate location can be determined when the pits are to be constructed. Each location will be excavated and benched if applicable to ensure a safe working area. All pits have been precast and will be placed onto sand bedding. The associated pipes and fitting will then be installed and the opening will be grouted. All joints of the precast pit will be made watertight. Once in position the pit will be backfilled same as the main pipe. Backfilling around the pits will be completed in layers with material that has no large clumps, sticks or rocks. All backfilling will be tested as required. The pipework, fittings and valves inside each pit will then be installed.

8. PLANT, EQUIPMENT AND MATERIALS

8.1 Plant

- 12 Tonne Excavator
- 20 Tonne Excavator
- Backhoe
- Trench roller
- 10m Truck / water Truck combination

8.2 Equipment

- Flex drive pumps and motors
- Wacker Packer
- Vibratory plate
- Small tools
- Welding machines
- Environmental silt fencing

8.3 Materials

- Bedding material – sand or crusher dust
- Lime
- Road base
- 10mm aggregate

9. PARTICULAR HAZARDS / RISKS

9.1 Safety & Health

9.2 Environment

9.3 Community

Please refer to each individual Safe work method Statement and risk assessment to show associated risks and hazards. This includes all environmental risks as well. This statement must be completed and have a tool box talk completed for each activity.

LEIGHTON

Leighton Contractors Pty Limited
ACN 000 893 667

Level 3
143 Coronation Drive
MILTON Qld 4064
PO Box 288
Toowong Qld 4066

FORM

CONSTRUCTION METHOD STATEMENT

Project:	Australia Trade Coast Sewer	No.:	Q1112

CMS TITLE: **Construction of Serpentine Road Pump Station**

CMS No.: **Q1112-CS-705**

START DATE: **25 October 2004**

DURATION: **3 months**

Submit to Client / Nominate for review where specified in contract

- ❑ Rejected, resubmit ______________ / /
- ❑ Accepted, with comments ______________ / /
- ❑ Accepted ______________ / /

Approved: ______________________ **Date:** __________
Project Manager

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1. SCOPE OF WORK

The following is a method statement for the construction of Serpentine Road Pump Station in separable portion 2 and details the construction sequence for civil and concrete works. Mechanical and electrical works will be completed in a separate method statement.

This statement includes the construction sequencing, associated risks and hazards and identifies critical activities. Supplementary to this will be risk assessments and toolbox talks itemising all safety and environmental hazards and control measures.

2. CONSTRAINTS

Constraints on the project include the following:

- Alignment approvals.
- BACL development application approval
- Interaction with major stakeholders and the community.
- Indigenous community
- "For construction" drawings

3. REFERENCES

3.1 Specifications and Approvals

- Attachment 4 of the contract – Civil Works Construction Specification
- Attachment 5 of the contract – Mechanical Works
- All associated Brisbane City Council drawings and specifications
- Manual of Uniform Traffic Control Devices 2003 edition Part 3 (MUTCD)
- BACL permit to commence works

3.2 Drawings

Serpentine Drawings CS705.pdf

- 486/5/7-TR201/000 to 073 – Serpentine Road SP300 pump station
- Associated Brisbane City Council standard drawings
- Associated IPWEAQ standard drawings

3.3 Management Plans & Documents

- Project Management Plan
- Safety and Health Management Plan
- Environmental Management Plan
- Construction Management Plan

4. STAFF RESPONSIBILITIES

Staff will be responsible for all associated work according to their project descriptions, which can be found in the Project Management Plan. The Project Engineer will coordinate with the Site Engineer and Foreman the supervision of all direct labour and subcontractors to ensure that all work is completed in a professional manner with no class 1 or 2 safety and environmental incidents. All costs and production will be reviewed on a daily basis to ensure the work is completed on time and to budget.

5. PERMITS / APPROVALS

Prior to commencing construction all relevant permits and approvals are required to be signed and approved for construction. This includes Brisbane Airport Corporation Limited (BACL) development application approvals and the permit to commence work approval. Other approvals that are to be completed are "for construction' drawing approvals from Brisbane City Council, Community consultation to ensure the public are aware of the works and any Traffic Control permits to complete works on or near the road alignment. All of these approvals will be required to be signed off on a works pre-commencement checklist by all associated people looking after each particular area.

6. CONSTRUCTION SEQUENCE

6.1 Previous Works

No previous work is to be completed prior to this work commencing but the workforce will have almost completed the Lytton Road Pump Station before starting on this one.

6.2 Completion of Works

Completion of the Serpentine Road Pump Station is currently targeted for December 2004 for the civil works and March 2005 for the Mechanical and Electrical works.

7. DETAILED CONSTRUCTION METHODS

Works will be carried out in the following stages:

7.1 Clearing, Grubbing and Topsoil Removal

Once the pre-commencement checklist (this includes all external permits and approvals required) has been completed and approved, construction can take place.

The approved clearance zone as specified in the BACL permits and approvals will be pegged out using survey and any trees, shrubs or grass that needs to remain will be clearly marked. A 20 Tonne excavator will use a straight edge batter bucket to remove all vegetation and topsoil. This material will be taken to a dumping area on site. Where drains are present silt fences will be erected between the drain and the work area to ensure no runoff will take place. Where required the silt fence will have 20mm aggregate or ballast placed at the base to ensure stability problems are overcome.

The areas that have "trapped" water will be pumped out using a dewatering system that will be described in more detail later. The water will be pumped into a rock pit and then into a rock drain leading out to nearby grassland and eventually to the adjacent creek. The water will be tested for pH prior to pumping and neutralised if required. No untreated water will be entering directly into the waterways.

7.2 Sheet Piling and Dewatering

Sheet piling will be completed around the pump station and will also include an extra area for the scour pit to be constructed and also around the inlet pipes so they can be connected (refer drawing 1). Piling will consist of 8m box piles driven using a 30T Excavator. The box piling will have one row of bracing 1m from the top of the sheet pile. MacDonald Sheetpiling will complete this work and a letter will be issued once completed stating that the geotechnical conditions are acceptable for the current design of the box piles and is safe to excavate.

Once this is completed a dewatering system will be put into place. This will consist of approximately 50 spears located behind the sheet piling and attached to 2 pumps (refer drawing 2). This water will be pumped as described above and will lower the water table to an acceptable working height. The spears will be constructed by using a jet tubing method, which is driving a steel tube down 8m using a water jet and a 12T Excavator. Once it is at the correct level the spear will be placed and then backfilled using medium grade river sand. The steel tube is then removed and relocated to the next hole.

`

7.3 Excavation

Once the water table is at an acceptable height a 30T Excavator will remove the material from inside the box piles. This will be completed in sections and excavated 1-2m in depth at a time (refer drawing 3). The box piles will be monitored using survey to ensure that they are not moving as we excavated to the required level. If movement does occur no one will enter the excavated area until it is deemed to be safe. This has not been looked at yet as there should not be a problem.

If possible, the middle section of the excavation will be trimmed to level and then a blinding layer of concrete, 100-200mm in depth will be poured. The remaining excavation will then be trimmed and also blinded with a layer of concrete. Depending on the water ingress the plastic layer will be placed prior to pouring the blinding layer so when reinforcement is being fixed the plastic will not get damaged and the work area will not be as hot.

7.4 Underboring

Once the excavation has been completed and the area is safe to work in, a hole will be cut through the box piling for the 2 incoming sewer lines from Serpentine Road. Once this has been completed the under boring machine will be set-up at the end of Serpentine Road and will bore through to the box piling. The under boring will be completed with an excavation permit as previously done to ensure all existing services are missed.

The under bore will go through the cut box pile and into the excavated pit. Extra precautions will be taken to ensure there is nobody in the pit when the under bore comes through as there will be some material and possibly water enter. Minor cutting of the box pile may need to take place if the under bore has not quite found the original hole. The box piling on the opposite side to the under boring will have a small section at the top removed and rollers placed so the pipe can be pulled through the under bore without getting damaged. Once the first under bore is cleaned out the pipe will be pulled through. Once this one is completed then the other line will follow the same procedure.

Once both pipes are in place the adjacent area of box piling that is still open will be concreted to ensure the box piling is resealed to prevent excess water entering (refer drawing 4).

7.5 Base slab

The base slab will now be poured. This will include fixing the reinforcement in the excavation and then pouring.

7.6 Walls stage 1

The first stage of the walls will be completed next. First the incoming sewer lines will be secured into position through the wall and blockouts will be placed for all other penetrations. The box piling will be utilised for the external formwork except for the incoming sewer line location and then other end of the pit (refer drawing 5). These 2 sections will have external formwork and bracing completed. The reinforcement will then be completed for the first lift of the walls. All of the walls including the internal wall will be poured to a height of RL0.4 (2.7m in height). This allows 600mm to the underside of the bracing. The internal formwork system is now installed and will be the Boral pan formwork system. They will provide a certified drawing to ensure the formwork is suitable for this activity. The internal wall and end wall will require PE lining to be placed as shown on drawing 5. Once all of the formwork has been completed and Boral have checked to make sure it has been placed correctly the walls will be poured.

7.7 Walls stage 2

Once the fist stage of the walls has cured for 2 days, the formwork system will be stripped. Once this has been completed the bracing for the sheet piling can be removed. The reinforcement will then be completed up to the roof level and the Boral formwork placed. A small external form will be required for approximately 1m as this is above the current ground level. PE lining will again be placed and once Boral are happy with the formwork the second lift will be completed. Once the walls have adequately cured (approximately 5 days) the formwork will be stripped (refer drawing 6)

7.8 External pipework

Once the second lift of the walls have been poured the external pipework and scour pit can be completed. This is still inside the box pile area and will be completed using conventional formwork and trenching techniques. Once the pipework is in place and the pit has been completed the area will be completely backfilled with sand. This includes the area of the incoming sewer lines (refer drawing 7). A section of the box piling will require cutting near the scour valve so that the pipework can be placed and continued outside of the box piling. This section that is cut will be oversized so that any movement in the pipes will not cause them to rest on the box pile possibly cutting them.

The pipework will then be continued and connected onto the 1370 and 1840 steel mains. This will be done as per the standard trenching techniques we current use.

7.9 Benching

While the scour pit and pipework is being completed benching will be done in the wet well section. The walls will be completed first and will be formed full height with the PE lining attached. Once the formwork has been approved the benching will be poured using standard 20Mpa concrete (refer drawing 8). The next section of benching poured will be from the baffle as shown on the drawing. The remaining benching as shown will follow this. The 2 "bowls" for the pump intake will be manufactured out of PE material and will be glued onto the external walls and poured into the other benching. These may require a stainless steel strap with bolts to secure it to the external walls.

Once all of the wet well benching is complete, the PE lining will be welded together and all connection will be patched and welded. The entire area of the wet well will be filled with sand so that scaffolding for the roof can be constructed. There will be long timber planks placed underneath the scaffolding for stabilisation. All of the timber and scaffolding will be sized accordingly so they can be easily removed from the pit through the covers.

7.10 Roof

While the scaffolding is being completed in the wet well for the roof the concrete floor will be formed and poured in the valve pit area. Once this has cured then the scaffolding will be completed. Fist item to be placed will be the PE lining in the wet well section. Once this has been secured all of the reinforcement will be fixed. The lids and covers will then be installed and once all of this has been inspected and approved the roof will be poured.

Once adequate curing has taken place everything will be stripped.

7.11 Completion civil, concrete works

The entire area will be backfilled using structural fill and sand. The overflow pits and pipework will be installed and all conduits will be placed. The concrete and asphalt pavement will be completed using conventional techniques and the area will be tidied up.

Once all of this is done the internal Mechanical work will be completed using a subcontractor. The Electrical work will also be completed using a subcontractor.

8. PLANT, EQUIPMENT AND MATERIALS

8.1 Plant

- 12 and 30 Tonne Excavator
- Backhoe
- Trench roller
- 10m Tip trucks
- Water Truck
- 12 or 20T Franna
- 25T Rough terrain crane
- Underbore machine

8.2 Equipment

- Flex drive pumps and motors
- pumps
- Wacker Packer
- Small tools
- Concreting tools
- Welding machines
- Environmental silt fencing

8.3 Materials

- Box piling
- Bedding material – sand or crusher dust
- Lime
- Road base
- 10mm aggregate
- asphalt
- PE Liner
- Concrete
- Reinforcement
- Formwork

9. PARTICULAR HAZARDS / RISKS

9.1 Safety & Health

9.2 Environment

9.3 Community

Please refer to each individual Safe work method Statement and risk assessment to show associated risks and hazards. This includes all environmental risks as well. This statement must be completed and have a tool box talk completed for each activity.

DRAWING 1

PUMP AND MOTOR DATA			
PUMP		**MOTOR**	
MAKER:	HIDROSTAL	MAKER:	HIDROSTAL
TYPE:	110K-M02R	TYPE:	IMMERSIBLE
CAPACITY:	348L/s	RATED POWER:	214kW
HEAD:	40.8m	RPM	990rpm
OVERALL EFF.:	75%	STARTERS:	DANFOSS VLT
IMPELLER:	SCREW CENTRIFUGAL	TYPE:	VSD
APPROX. MASS OF PUMP AND MOTOR:	3150 kg	MODEL: IETZ4-XMEK	

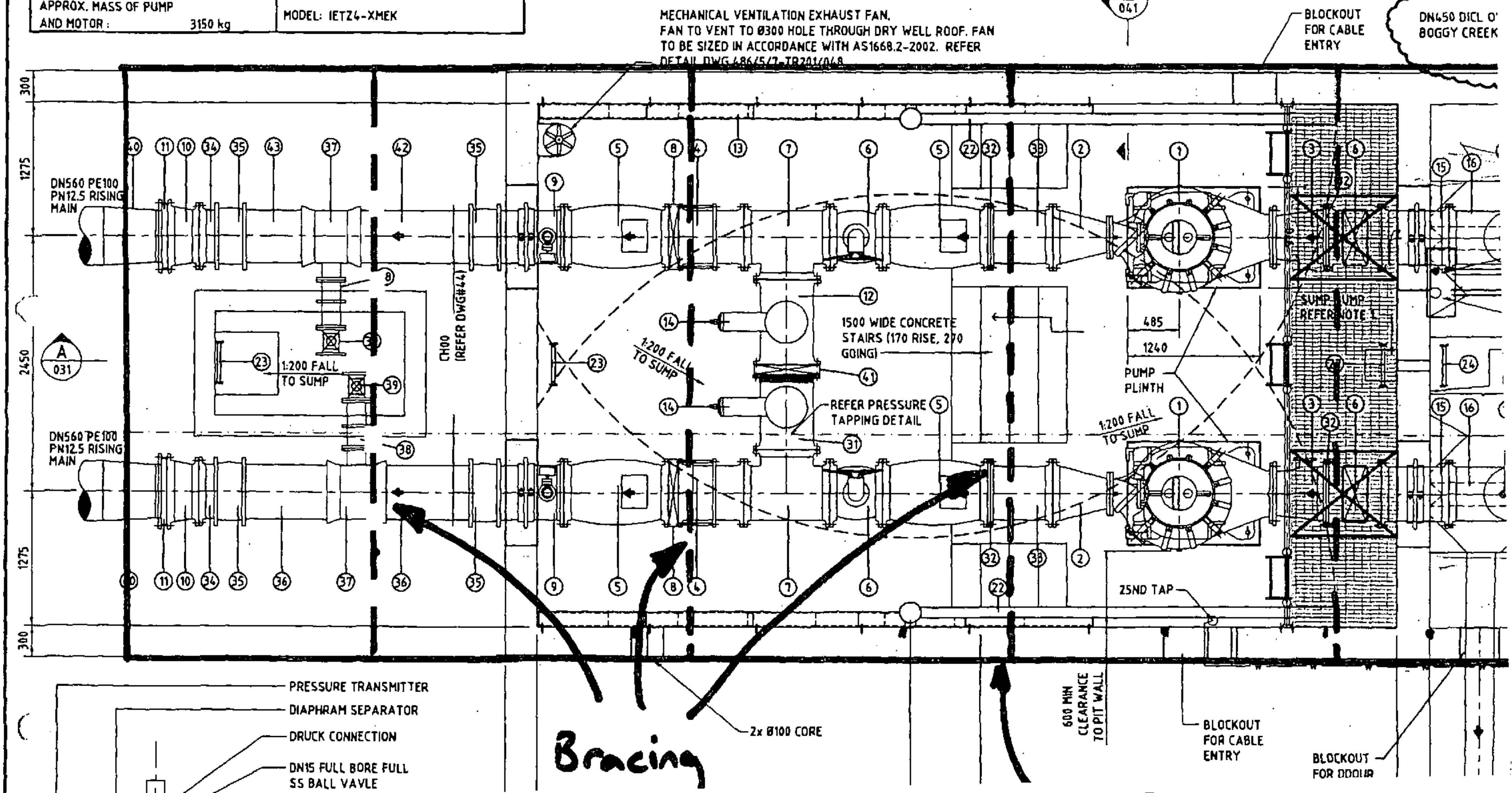
NOTES:

1. 300 SQUARE x 300 DEEP SUMP WITH GALVANISED GRATE COVER TO BE PROVIDED IN DRY WELL. SUMP TO BE FITTED WITH ELECTRIC SUMP PUMP (FORRERS MODEL 1.5 SSL WITH 4.5" IMPELLER). REFER ARRANGEMENT "C" ON BCC STD DWG JS56/101 FOR DISCHARGE PIPEWORK DETAILS.
2. DN150 UPVC ODOUR VENT PIPE TO WET WELL
3. 30 MIN. THICK NON SHRINK EPOXY GROUT UNDER PUMP SUPPORT
4. PLATFORM REMOVED FOR CLARITY
5. REFER DWG 486/5/7/-TR201/023 FOR VACTOR LOCATIONS
6. PUMP PLINTH 1240x970 PROVIDING 50 CLEARANCE AROUND BASE OF PUMP.

ACCESS LADDERS:

WET WELL
1. REFER DWG 486/5/25-SF0(
2. WET WELL LADDERS TO BE BRACKETS AND BOLTS

DRY WELL
1. REFER DWG 486/5/25-SF00
2. DRY WELL LADDERS TO BE ABOVE TOP SLAB LEVEL. RE



DRAWING 2

PUMP AND MOTOR DATA

PUMP		MOTOR	
MAKER:	HIDROSTAL	MAKER:	HIDROSTAL
TYPE:	110K-M02R	TYPE:	IMMERSIBLE
CAPACITY :	348L/s	RATED POWER:	214kW
HEAD:	40.8m	RPM	990rpm
OVERALL EFF. :	75%	STARTERS:	DANFOSS VLT
IMPELLER:	SCREW CENTRIFUGAL	TYPE:	VSD
APPROX. MASS OF PUMP AND MOTOR :	[illegible]	MODEL:	IETZ4-XME[illegible]

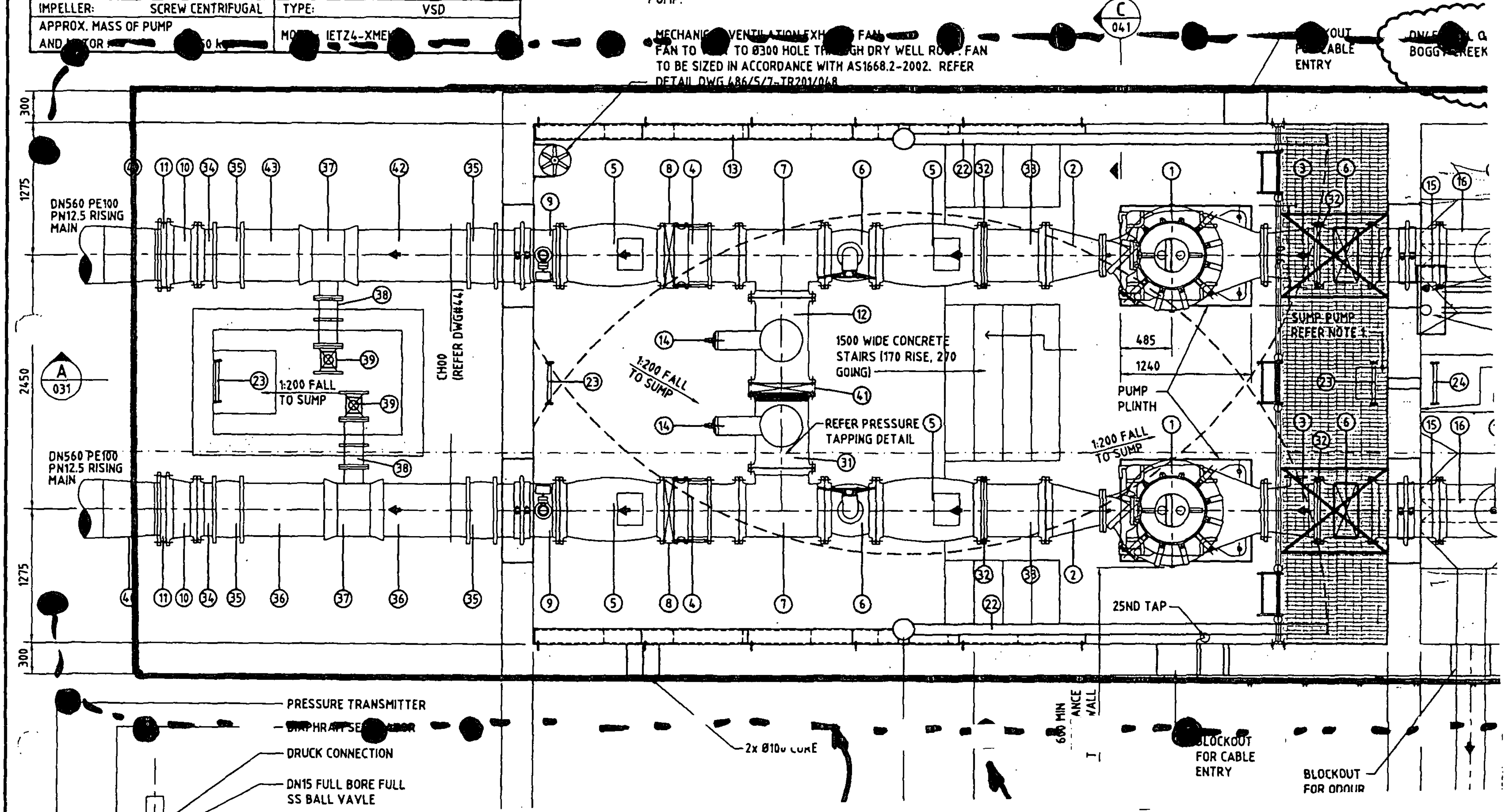
NOTES:

1. 300 SQUARE x 300 DEEP SUMP WITH GALVANISED GRATE COVER TO BE PROVIDED IN DRY WELL. SUMP TO BE FITTED WITH ELECTRIC SUMP PUMP (FORRERS MODEL 1.5 SSL WITH 4.5" IMPELLER). REFER ARRANGEMENT "C" ON BCC STD DWG JS56/101 FOR DISCHARGE PIPEWORK DETAILS.
2. DN150 UPVC ODOUR VENT PIPE TO WET WELL
3. 30 MIN. THICK NON SHRINK EPOXY GROUT UNDER PUMP SUPPORT
4. PLATFORM REMOVED FOR CLARITY
5. REFER DWG 486/5/7/-TR201/023 FOR VACTOR LOCATIONS
6. PUMP PLINTH 1240x970 PROVIDING 50 CLEARANCE AROUND BASE OF PUMP.
7. MECHANI[illegible] VENTILATION EXH[illegible] FAN [illegible] FAN TO [illegible] TO Ø300 HOLE T[illegible]GH DRY WELL RO[illegible]. FAN TO BE SIZED IN ACCORDANCE WITH AS1668.2-2002. REFER DETAIL DWG 486/5/7-TR201/048

ACCESS LADDERS:

WET WELL
1. REFER DWG 486/5/25-SF0[illegible]
2. WET WELL LADDERS TO BE BRACKETS AND BOLTS

DRY WELL
1. REFER DWG 486/5/25-SF0[illegible]
2. DRY WELL LADDERS TO BE ABOVE TOP SLAB LEVEL. R[illegible]



DRAWIN_ 3

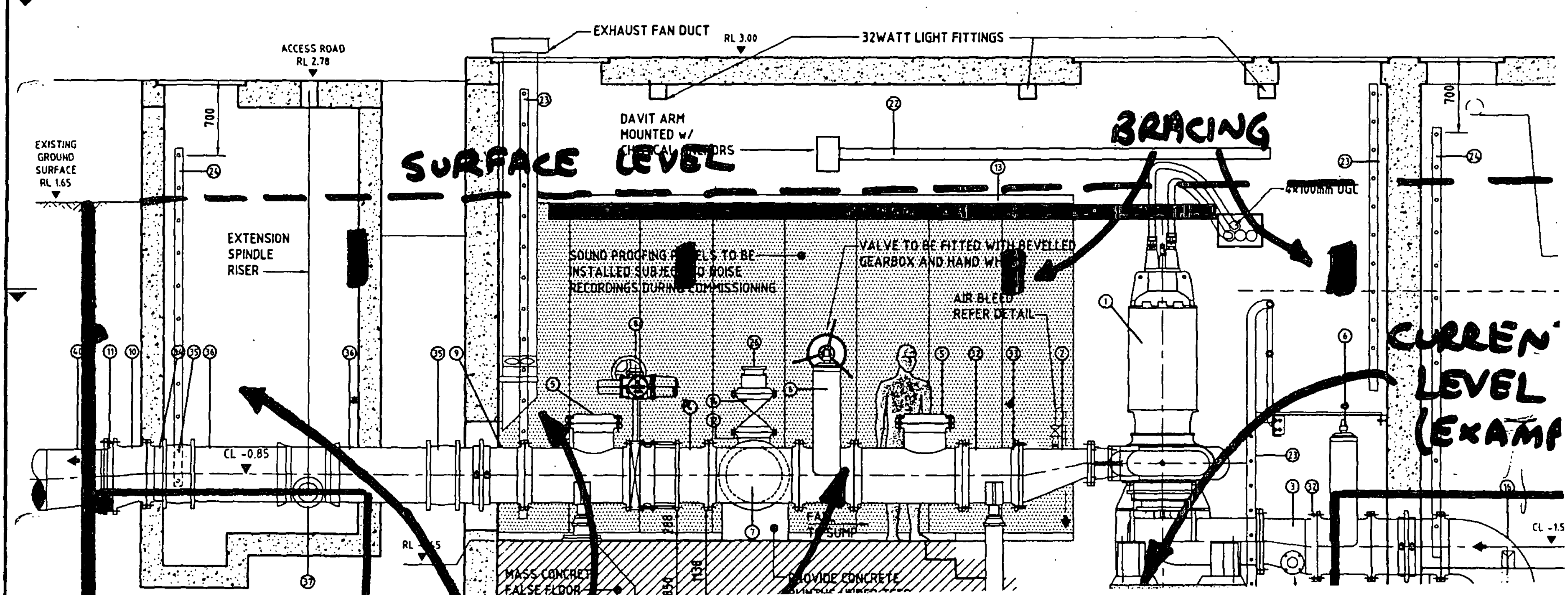
MATERIALS LIST

MARK No	No OFF	DESCRIPTION	MAT'L	REMARKS
1	2	250kW DRY MOUNTED SUBMERSIBLE PUMP	CI	HIDROSTAL I10K-M02R
2	2	DN250 x DN450 ECCENTRIC REDUCER (SPECIAL) 660mm LONG	MS FBE COATED	REFER DWG 486/5/7-TR201/032 FOR DETAILS
3	2	DN300 x DN450 ECCENTRIC REDUCER (SPECIAL) 520mm LONG	MS FBE COATED	REFER DWG 486/5/7-TR201/032 FOR DETAILS
4	2	DN450 THRUST TYPE DISMANTLING JOINT	DICL	
5	4	DN450 SWING CHECK VALVE	CI	DOBBIE DICO (OR EQUIVALENT)
6	4	DN450 METAL WEDGE SLUICE VALVE	DICL	TYCO (OR EQUIVALENT)
7	2	DN450 FL/FL/FL TEE	DICL	
8	2	DN450 LUGGED ACTUATED KNIFE GATE VALVE	S.S.	KEYSTONE FIG 952 WITH AUMA ACTUATOR (OR EQUIVALENT)
9	2	DN450 FL/SP WALL PIPE WITH THRUST FLANGE	DICL	L= 720mm , CLASS K12 C/W TAPPING FOR PRESSURE PROBE
10	2	DN500xDN450 FL/FL REDUCER (ECC.)	DICL	
11	2	DN500 STUB FLANGE WITH BACKING PLATE	PE	C/W STAINLESS STEEL BOLTS
12	1	DN450xDN250 FL/FL REDUCING TEE	DICL	
13	1	ABSORPTIVE NOISE BARRIER SYSTEM		FENCO OR EQUIVALENT
14	2	DN250 METAL WEDGE SLUICE VALVE	DICL	
15	2	DN450 FL/FL WALL PIPE WITH THRUST FLANGE	DICL	L= 600mm

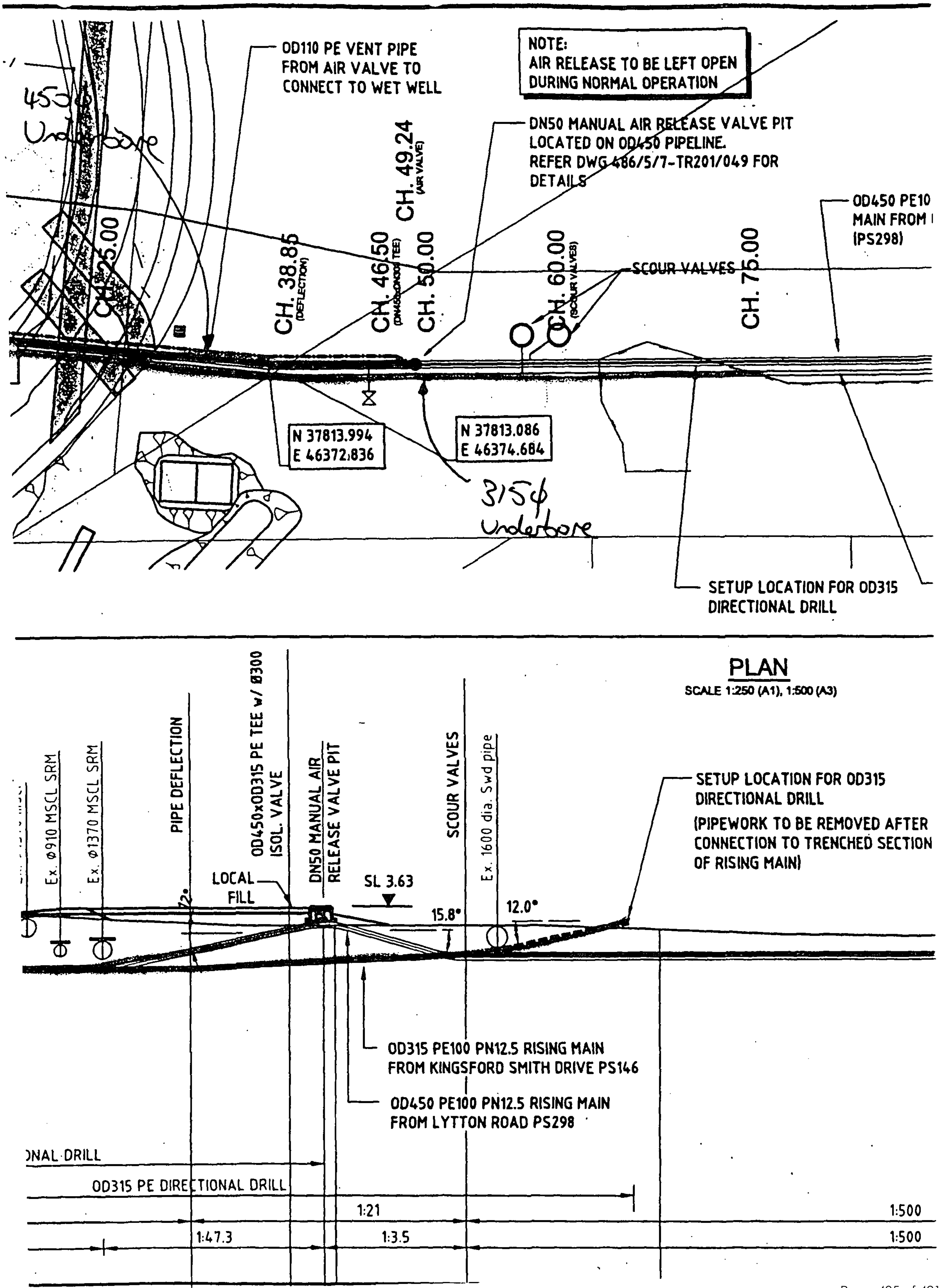
MATERIALS LIST

MARK No	No OFF	DESCRIPTION	MAT'L	REMARKS
16	2	DN450 90° FL/FL BEND	DICL	ONE FLANGE TO BE REMOVED IN FACTORY PRIOR TO DELIVERY
17	3	DN32 PE100 SDR 11 POLYETHYLENE AIR LINE FIXED TO VACTOR PIPE WITH STAINLESS STEEL STRAPS OR FUSION WELDED	PE	
18	3	DN160 PE80B SDR 9 POLYETHYLENE VACTOR PIPE ATTACHED TO WALL WITH POLYETHYLENE BRACKETS AT 1500 CRS. WITH STAINLESS STEEL ANCHORS	PE	
19	1	DN315 LUGGED KNIFE GATE VALVE	S.S.	KEYSTONE FIG 952 WITH (OR EQUIVALENT)
20	1	DN450 STUB FLANGE WITH BACKING PLATE	PE	C/W STAINLESS STEEL BOLTS
21	1	DN450 LUGGED KNIFE GATE VALVE	S.S.	KEYSTONE FIG 952 WITH (OR EQUIVALENT)
22	2	DAVIT ARM	STEEL	PROSYSTEM WALL MOUNTED JIB L610104 (1000kg/3935mm)
23	2	LADDER	GMS	WITH EXTENDABLE STILES
24	2	LADDER	S.S.	
25	1	DN315 FL/FL WALL PIPE (600 LONG)	MS FBE COATED	
26	2	DN250 KAMLOCK COUPLING	SS	
27	1	DN315 STUB FLANGE WITH BACKING PLATE	PE	
28	3	DN450 FL/SP WALL PIPE (400 LONG)	DICL	

MARK No	No OFF	DES
29	3	DN450 FL/SP CONNECTOR
30	1	DN450 FL/FL WALL PIPE (
31	1	DN450xDN250 FL/FL REDU
32	4	DN450 NON THRUST DISMA
33	2	DN450 FL/SP CONNECTOR
34	2	DN450 FL/SP CONNECTOR
35	4	DN450 GIBAULT JOINT
36	4	DN450 SP/SP ROCKER PIPE
37	2	DN450xDN150 SO/SO/FL S
38	2	DN150 FL/FL WALL PIPE W
39	2	DN150 METAL WEDGE SLUIC
40	2	OD560xOD500 ECCENTRIC T
41	1	DN450 LUGGED KNIFE GATE
42	1	DN450 SP/SP ROCKER PIPE
43	1	DN450 SP/SP ROCKER PIPE
44	3	DN450 SO/SO CONNECTOR



DRAWING 4



NOTE:
AIR RELEASE TO BE LEFT OPEN DURING NORMAL OPERATION
OD110 PE VENT PIPE FROM AIR VALVE TO CONNECT TO WET WELL
450φ Underbore
DN50 MANUAL AIR RELEASE VALVE PIT LOCATED ON OD450 PIPELINE. REFER DWG 486/5/7-TR201/049 FOR DETAILS
OD450 PE10 MAIN FROM (PS298)
CH. 25.00
CH. 38.85 (DEFLECTION)
CH. 46.50
CH. 49.24 (AIR VALVE)
CH. 50.00
CH. 60.00 (SCOUR VALVES)
CH. 75.00
SCOUR VALVES
N 37813.994
E 46372.836
N 37813.086
E 46374.684
315φ Underbore
SETUP LOCATION FOR OD315 DIRECTIONAL DRILL
PLAN
SCALE 1:250 (A1), 1:500 (A3)
Ex. Ø910 MSCL SRM
Ex. Ø1370 MSCL SRM
PIPE DEFLECTION
OD450xOD315 PE TEE w/ Ø300 ISOL. VALVE
DN50 MANUAL AIR RELEASE VALVE PIT
SCOUR VALVES
Ex. 1600 dia. Swd pipe
LOCAL FILL
SL 3.63
15.8°
12.0°
SETUP LOCATION FOR OD315 DIRECTIONAL DRILL
(PIPEWORK TO BE REMOVED AFTER CONNECTION TO TRENCHED SECTION OF RISING MAIN)
OD315 PE100 PN12.5 RISING MAIN FROM KINGSFORD SMITH DRIVE PS146
OD450 PE100 PN12.5 RISING MAIN FROM LYTTON ROAD PS298
ONAL DRILL
OD315 PE DIRECTIONAL DRILL
1:21
1:500
1:47.3
1:3.5
1:500

DRAWING (A)

PUMP AND MOTOR DATA			
PUMP		MOTOR	
MAKER:	HIDROSTAL	MAKER:	HIDROSTAL
TYPE:	I10K-M02R	TYPE:	IMMERSIBLE
CAPACITY :	348L/s	RATED POWER:	214kW
HEAD:	40.8m	RPM	990rpm
OVERALL EFF. :	75%	STARTERS:	DANFOSS VLT
IMPELLER:	SCREW CENTRIFUGAL	TYPE:	VSD
APPROX. MASS OF PUMP AND MOTOR :	3150 kg	MODEL: IETZ4-XMEK	

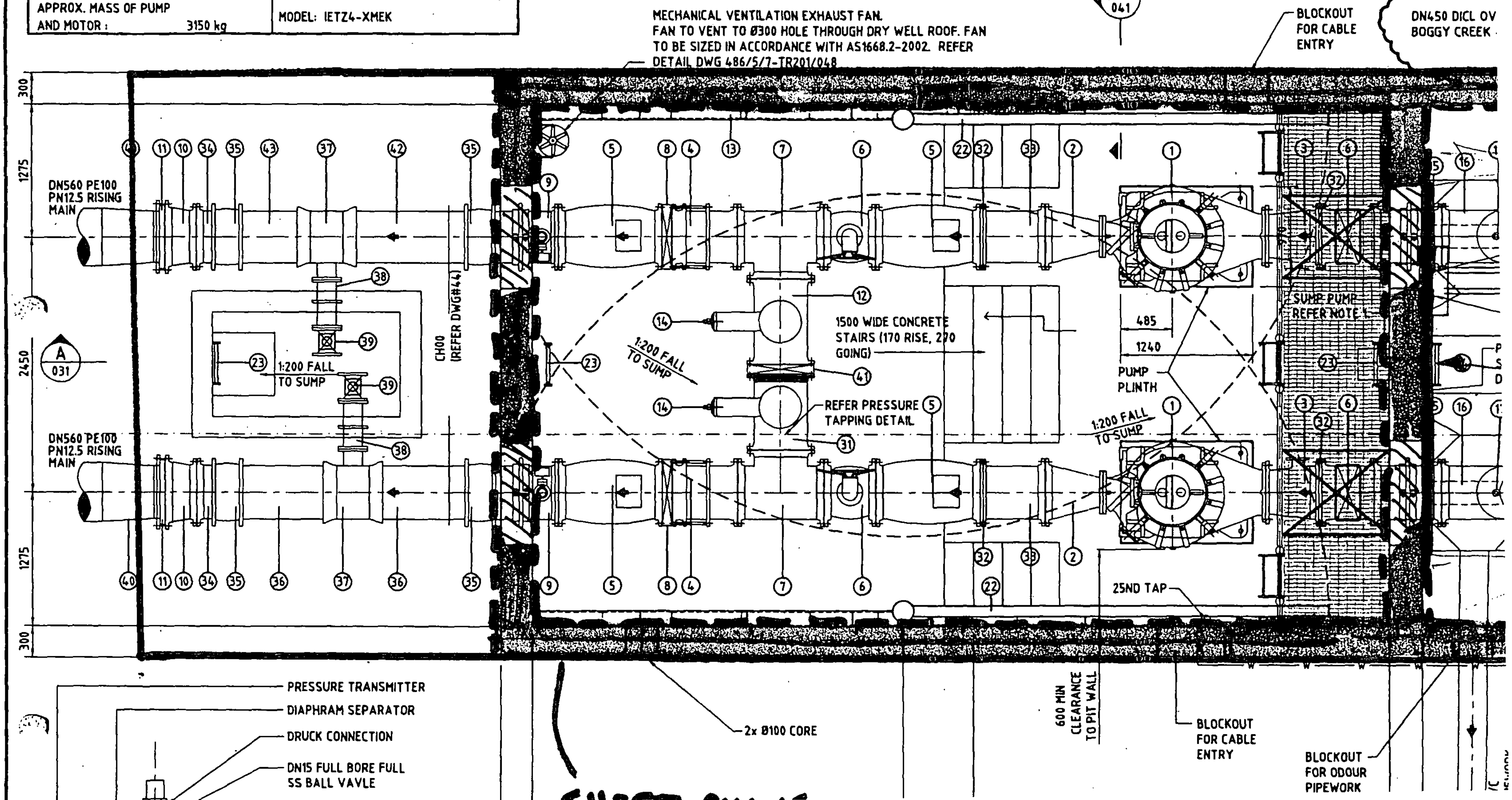
NOTES:

1. 300 SQUARE x 300 DEEP SUMP WITH GALVANISED GRATE COVER TO BE PROVIDED IN DRY WELL. SUMP TO BE FITTED WITH ELECTRIC SUMP PUMP (FORRERS MODEL 1.5 SSL WITH 4.5" IMPELLER). REFER ARRANGEMENT "C" ON BCC STD DWG JS56/101 FOR DISCHARGE PIPEWORK DETAILS.
2. DN150 UPVC ODOUR VENT PIPE TO WET WELL
3. 30 MIN. THICK NON SHRINK EPOXY GROUT UNDER PUMP SUPPORT
4. PLATFORM REMOVED FOR CLARITY
5. REFER DWG 486/5/7/-TR201/023 FOR VACTOR LOCATIONS
6. PUMP PLINTH 1240x970 PROVIDING 50 CLEARANCE AROUND BASE OF PUMP.

ACCESS LADDERS:

WET WELL
1. REFER DWG 486/5/25-SF00
2. WET WELL LADDERS TO BE C BRACKETS AND BOLTS

DRY WELL
1. REFER DWG 486/5/25-SF00
2. DRY WELL LADDERS TO BE F ABOVE TOP SLAB LEVEL. REF



DRAWING 5(B)

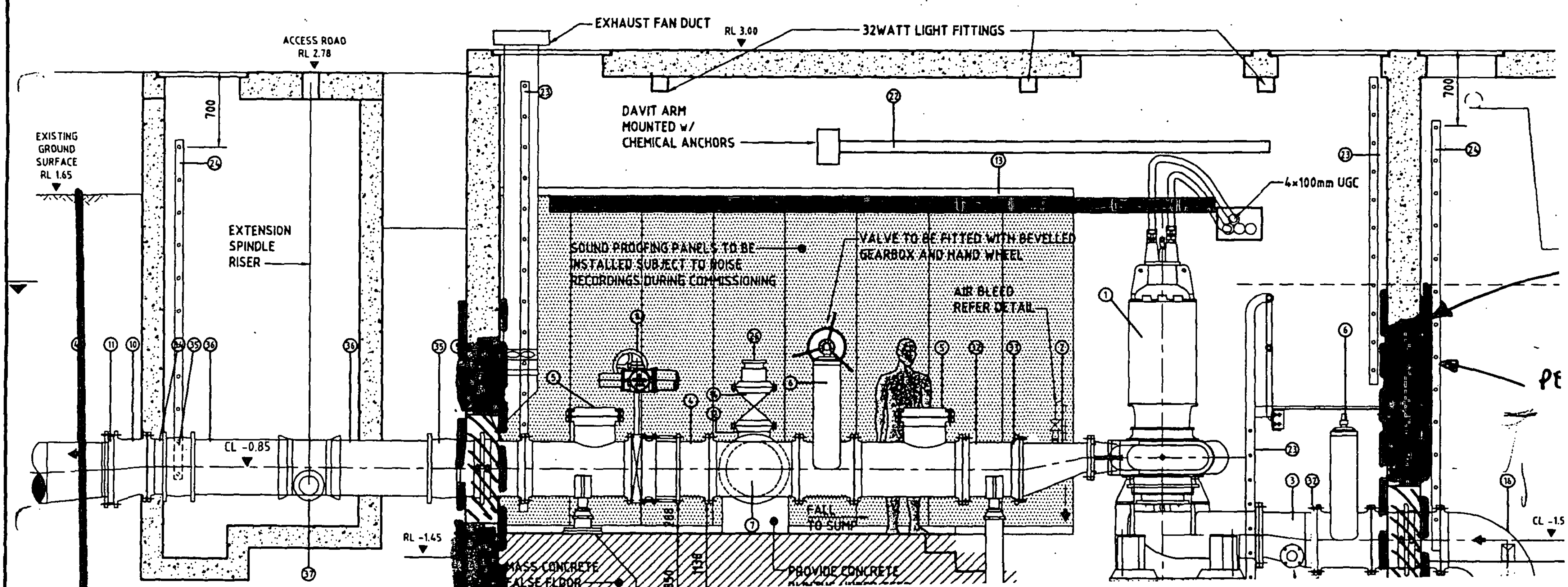
MATERIALS LIST

MARK No	No OFF	DESCRIPTION	MAT'L	REMARKS
1	2	250kW DRY MOUNTED SUBMERSIBLE PUMP	CI	HIDROSTAL M0K-M02R
2	2	DN250 x DN450 ECCENTRIC REDUCER (SPECIAL) 660mm LONG	MS FBE COATED	REFER DWG 406/S/7-TR201/032 FOR DETAILS
3	2	DN300 x DN450 ECCENTRIC REDUCER (SPECIAL) 520mm LONG	MS FBE COATED	REFER DWG 406/S/7-TR201/032 FOR DETAILS
4	2	DN450 THRUST TYPE DISMANTLING JOINT	DICL	
5	4	DN450 SWING CHECK VALVE	CI	DOBBIE DICO (OR EQUIVALENT)
6	4	DN450 METAL WEDGE SLUICE VALVE	DICL	TYCO (OR EQUIVALENT)
7	2	DN450 FL/FL/FL TEE	DICL	
8	2	DN450 LUGGED ACTUATED KNIFE GATE VALVE	S.S.	KEYSTONE FIG 952 WITH AUMA ACTUATOR (OR EQUIVALENT)
9	2	DN450 FL/SP WALL PIPE WITH THRUST FLANGE	DICL	L= 720mm , CLASS K12 C/W TAPPING FOR PRESSURE PROBE
10	2	DN500xDN450 FL/FL REDUCER (ECC)	DICL	
11	2	DN500 STUB FLANGE WITH BACKING PLATE	PE	C/W STAINLESS STEEL BOLTS
12	1	DN450xDN250 FL/FL REDUCING TEE	DICL	
13	1	ABSORPTIVE NOISE BARRIER SYSTEM		FENCO OR EQUIVALENT
14	2	DN250 METAL WEDGE SLUICE VALVE	DICL	
15	2	DN450 FL/FL WALL PIPE WITH THRUST FLANGE	DICL	L= 600mm

MATERIALS LIST

MARK No	No OFF	DESCRIPTION	MAT'L	REMARKS
16	2	DN450 90° FL/FL BEND	DICL	ONE FLANGE TO BE REMOVED IN FACTORY PRIOR TO DELIVERY
17	3	DN32 PE100 SDR 11 POLYETHYLENE AIR LINE FIXED TO VACTOR PIPE WITH STAINLESS STEEL STRAPS OR FUSION WELDED	PE	
18	3	DN160 PE80B SDR 9 POLYETHYLENE VACTOR PIPE ATTACHED TO WALL WITH POLYETHYLENE BRACKETS AT 1500 CRS. WITH STAINLESS STEEL ANCHORS	PE	
19	1	DN315 LUGGED KNIFE GATE VALVE	S.S.	KEYSTONE FIG 952 WITH (OR EQUIVALENT)
20	1	DN450 STUB FLANGE WITH BACKING PLATE	PE	C/W STAINLESS STEEL BOLTS
21	1	DN450 LUGGED KNIFE GATE VALVE	S.S.	KEYSTONE FIG 952 WITH (OR EQUIVALENT)
22	2	DAVIT ARM	STEEL	PROSYSTEM WALL MOUNTED JIB L610104 (1000kg/3935mm)
23	2	LADDER	GMS	WITH EXTENDABLE STILES
24	2	LADDER	S.S.	
25	1	DN315 FL/FL WALL PIPE (600 LONG)	MS FBE COATED	
26	2	DN250 KAMLOCK COUPLING	SS	
27	1	DN315 STUB FLANGE WITH BACKING PLATE	PE	
28	3	DN450 FL/SP WALL PIPE (400 LONG)	DICL	

MARK No	No OFF	DESC
29	3	DN450 FL/SP CONNECTOR (
30	1	DN450 FL/FL WALL PIPE (
31	1	DN450xDN250 FL/FL REDU
32	6	DN450 NON THRUST DISMA
33	2	DN450 FL/SP CONNECTOR
34	2	DN450 FL/SP CONNECTOR
35	6	DN450 GIBAULT JOINT
36	6	DN450 SP/SP ROCKER PIPE
37	2	DN450xDN150 SO/SO/FL SC
38	2	DN150 FL/FL WALL PIPE WI
39	2	DN150 METAL WEDGE SLUIC
40	2	OD560xOD500 ECCENTRIC T
41	1	DN450 LUGGED KNIFE GATE
42	1	DN450 SP/SP ROCKER PIPE
43	1	DN450 SP/SP ROCKER PIPE
44	3	DN450 SO/SO CONNECTOR



DRAWING

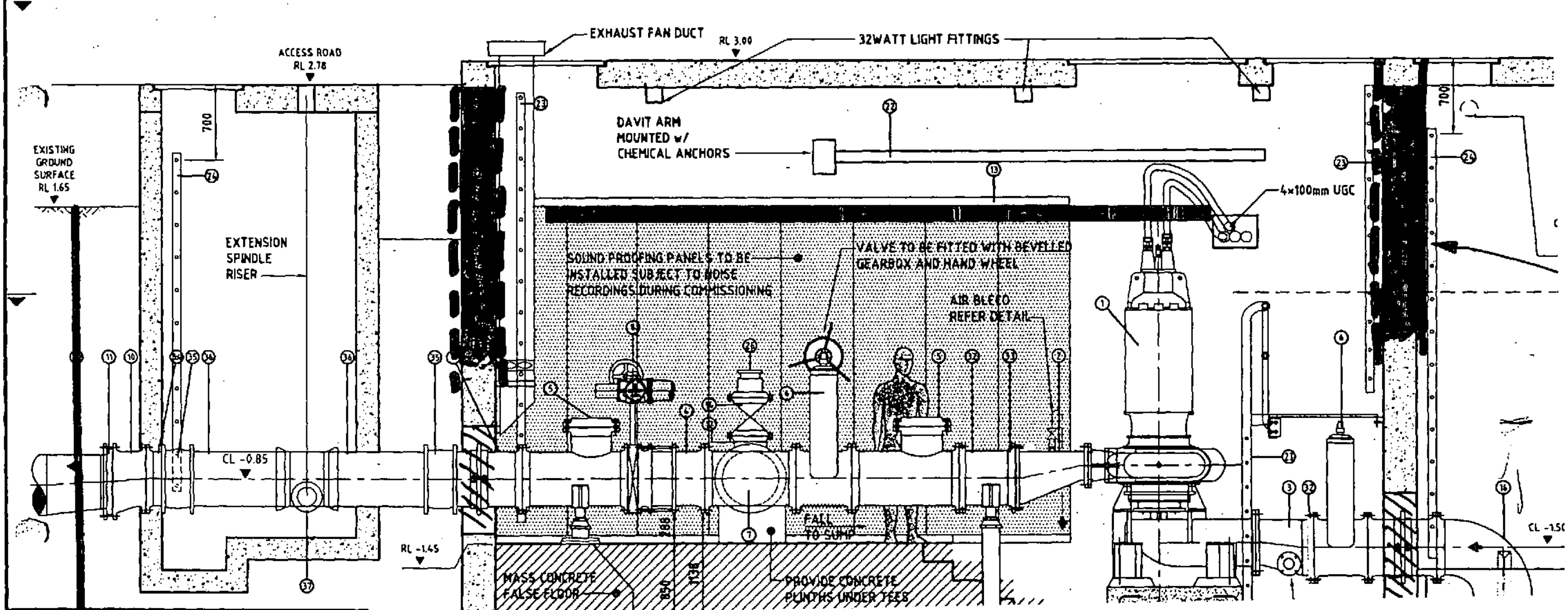
MATERIALS LIST

MARK No	No OFF	DESCRIPTION	MAT'L	REMARKS
1	2	250kW DRY MOUNTED SUBMERSIBLE PUMP	CI	HIDROSTAL H0K-H02R
2	2	DN250 x DN450 ECCENTRIC REDUCER (SPECIAL) 660mm LONG	MS FBE COATED	REFER DWG 606/5/7-TR201/032 FOR DETAILS
3	2	DN300 x DN450 ECCENTRIC REDUCER (SPECIAL) 520mm LONG	MS FBE COATED	REFER DWG 606/5/7-TR201/032 FOR DETAILS
4	2	DN450 THRUST TYPE DISMANTLING JOINT	DICL	
5	4	DN450 SWING CHECK VALVE	CI	DOBBIE DICO (OR EQUIVALENT)
6	4	DN450 METAL WEDGE SLUICE VALVE	DICL	TYCO (OR EQUIVALENT)
7	2	DN450 FL/FL/FL TEE	DICL	
8	2	DN450 LUGGED ACTUATED KNIFE GATE VALVE	S.S.	KEYSTONE FIG 952 WITH AUMA ACTUATOR (OR EQUIVALENT)
9	2	DN450 FL/SP WALL PIPE WITH THRUST FLANGE	DICL	L= 720mm , CLASS K12 C/W TAPPING FOR PRESSURE PROBE
10	2	DN500xDN450 FL/FL REDUCER (ECC)	DICL	
11	2	DN500 STUB FLANGE WITH BACKING PLATE	PE	C/W STAINLESS STEEL BOLTS
12	1	DN450xDN250 FL/FL REDUCING TEE	DICL	
13	1	ABSORPTIVE NOISE BARRIER SYSTEM		FENCO OR EQUIVALENT
14	2	DN250 METAL WEDGE SLUICE VALVE	DICL	
15	2	DN450 FL/FL WALL PIPE WITH THRUST FLANGE	DICL	L= 600mm

MATERIALS LIST

MARK No	No OFF	DESCRIPTION	MAT'L	REMARKS
16	2	DN450 90° FL/FL BEND	DICL	ONE FLANGE TO BE REMOVED IN FACTORY PRIOR TO DELIVERY
17	3	DN32 PE100 SDR 11 POLYETHYLENE AIR LINE FIXED TO VACTOR PIPE WITH STAINLESS STEEL STRAPS OR FUSION WELDED	PE	
18	3	DN180 PE100 SDR 9 POLYETHYLENE VACTOR PIPE ATTACHED TO WALL WITH POLYETHYLENE BRACKETS AT 1500 CRS. WITH STAINLESS STEEL ANCHORS	PE	
19	1	DN315 LUGGED KNIFE GATE VALVE	S.S.	KEYSTONE FIG 952 WITH (OR EQUIVALENT)
20	1	DN450 STUB FLANGE WITH BACKING PLATE	PE	C/W STAINLESS STEEL BOLTS
21	1	DN450 LUGGED KNIFE GATE VALVE	S.S.	KEYSTONE FIG 952 WITH (OR EQUIVALENT)
22	2	DAVIT ARM	STEEL	PROSYSTEM WALL MOUNTED JIB L610104 (1000kg/3935mm)
23	2	LADDER	GMS	WITH EXTENDABLE STILES
24	2	LADDER	S.S.	
25	1	DN315 FL/FL WALL PIPE (600 LONG)	MS FBE COATED	
26	2	DN250 KAMLOCK COUPLING	SS	
27	1	DN315 STUB FLANGE WITH BACKING PLATE	PE	
28	3	DN450 FL/SP WALL PIPE (400 LONG)	DICL	

MARK No	No OFF	DESC
29	3	DN450 FL/SP CONNECTOR (
30	1	DN450 FL/FL WALL PIPE (6
31	1	DN450xDN250 FL/FL REDUC
32	4	DN450 NON THRUST DISMA
33	2	DN450 FL/SP CONNECTOR
34	2	DN450 FL/SP CONNECTOR
35	4	DN450 GIBAULT JOINT
36	4	DN450 SP/SP ROCKER PIPE
37	2	DN450xDN150 SO/SO/FL SO
38	2	DN150 FL/FL WALL PIPE WI
39	2	DN150 METAL WEDGE SLUIC
40	2	OD560xOD500 ECCENTRIC TA
41	1	DN450 LUGGED KNIFE GATE
42	1	DN450 SP/SP ROCKER PIPE
43	1	DN450 SP/SP ROCKER PIPE
44	3	DN450 SO/SO CONNECTOR



PUMP AND MOTOR DATA

PUMP		MOTOR	
MAKER:	HIDROSTAL	MAKER:	HIDROSTAL
TYPE:	I10K-M02R	TYPE:	IMMERSIBLE
CAPACITY :	348L/s	RATED POWER:	214kW
HEAD:	40.8m	RPM	990rpm
OVERALL EFF. :	75%	STARTERS:	DANFOSS VLT
IMPELLER:	SCREW CENTRIFUGAL	TYPE:	VSD
APPROX. MASS OF PUMP AND MOTOR :	3150 kg	MODEL: IETZ4-XMEK	

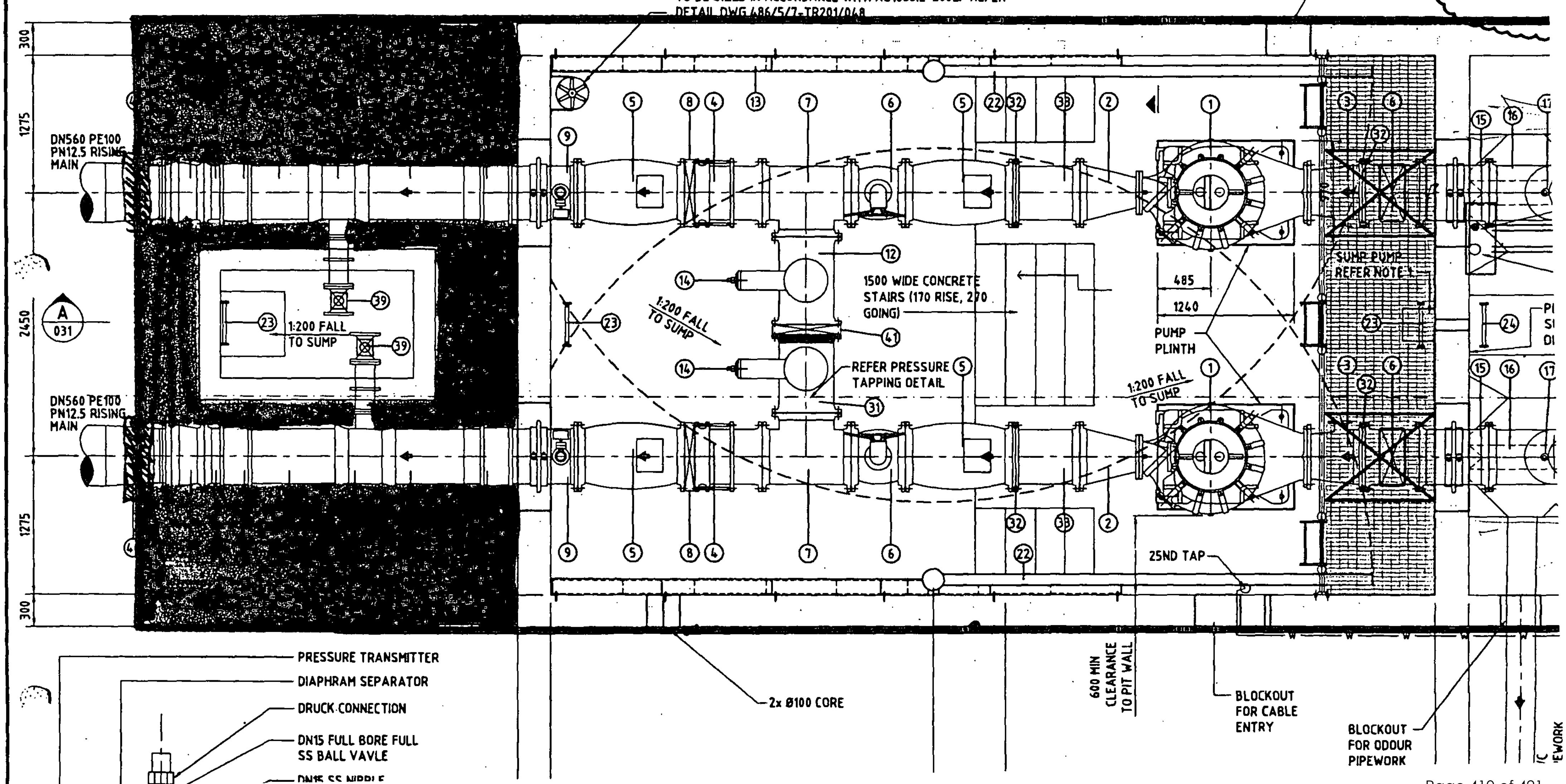
NOTES:

1. 300 SQUARE x 300 DEEP SUMP WITH GALVANISED GRATE COVER TO BE PROVIDED IN DRY WELL. SUMP TO BE FITTED WITH ELECTRIC SUMP PUMP (FORRERS MODEL 1.5 SSL WITH 4.5" IMPELLER). REFER ARRANGEMENT "C" ON BCC STD DWG JS56/101 FOR DISCHARGE PIPEWORK DETAILS.
2. DN150 UPVC ODOUR VENT PIPE TO WET WELL
3. 30 MIN. THICK NON SHRINK EPOXY GROUT UNDER PUMP SUPPORT
4. PLATFORM REMOVED FOR CLARITY
5. REFER DWG 486/5/7/-TR201/023 FOR VACTOR LOCATIONS
6. PUMP PLINTH 1240x970 PROVIDING 50 CLEARANCE AROUND BASE OF PUMP.

ACCESS LADDERS:

WET WELL
1. REFER DWG 486/5/25-SF009
2. WET WELL LADDERS TO BE C BRACKETS AND BOLTS

DRY WELL
1. REFER DWG 486/5/25-SF009
2. DRY WELL LADDERS TO BE FI ABOVE TOP SLAB LEVEL. REF



DRAWING 8

PUMP AND MOTOR DATA			
PUMP		**MOTOR**	
MAKER:	HIDROSTAL	MAKER:	HIDROSTAL
TYPE:	110K-M02R	TYPE:	IMMERSIBLE
CAPACITY :	348L/s	RATED POWER:	214kW
HEAD:	40.8m	RPM	990rpm
OVERALL EFF. :	75%	STARTERS:	DANFOSS VLT
IMPELLER:	SCREW CENTRIFUGAL	TYPE:	VSD
APPROX. MASS OF PUMP AND MOTOR :	3150 kg	MODEL: IETZ4-XMEK	

NOTES:

1. 300 SQUARE x 300 DEEP SUMP WITH GALVANISED GRATE COVER TO BE PROVIDED IN DRY WELL. SUMP TO BE FITTED WITH ELECTRIC SUMP PUMP (FORRERS MODEL 1.5 SSL WITH 4.5" IMPELLER). REFER ARRANGEMENT "C" ON BCC STD DWG JS56/101 FOR DISCHARGE PIPEWORK DETAILS.
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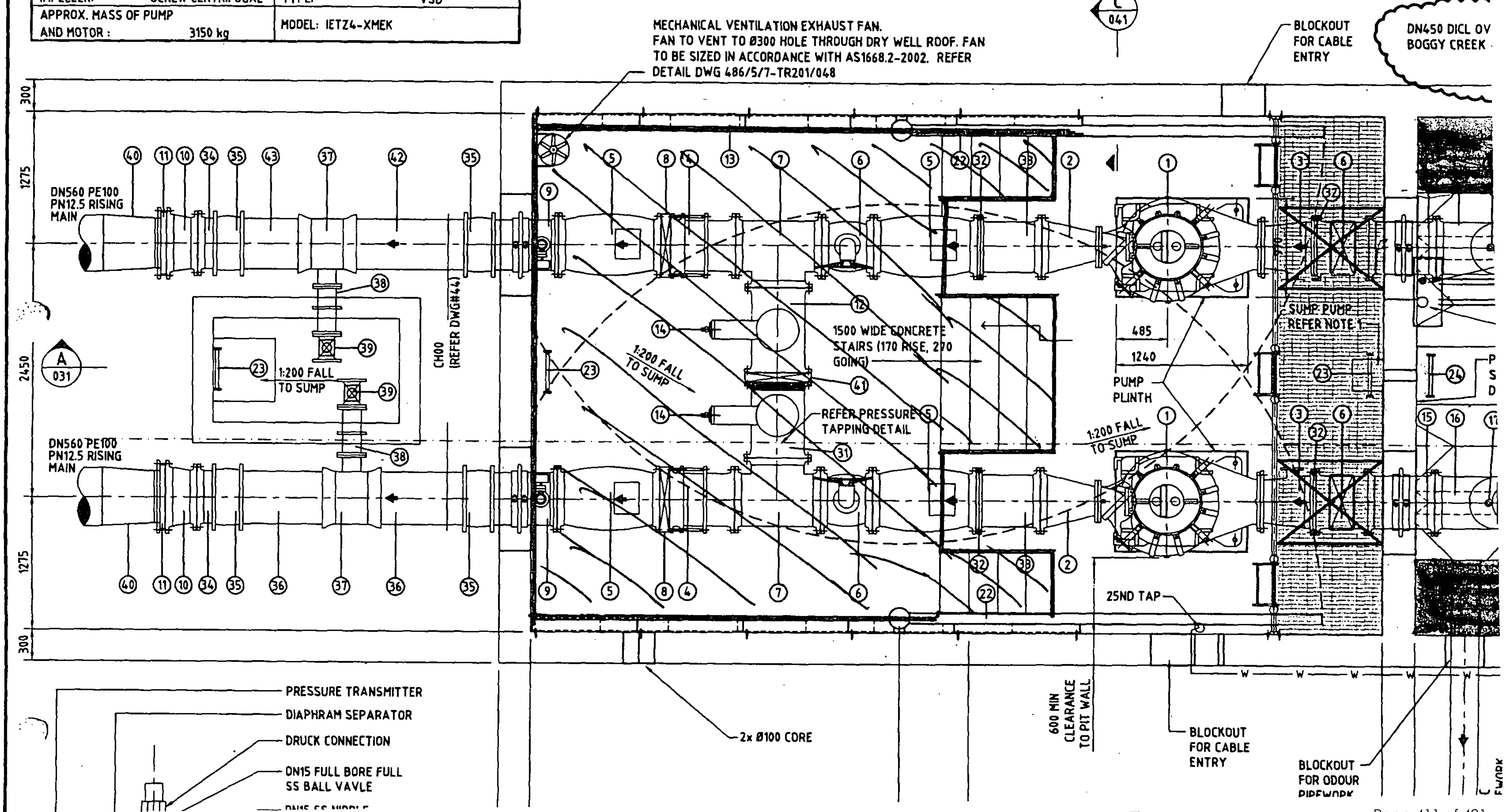
ACCESS LADDERS:

WET WELL
1. REFER DWG 486/5/25-SF00
2. WET WELL LADDERS TO BE (BRACKETS AND BOLTS

DRY WELL
1. REFER DWG 486/5/25-SF00
2. DRY WELL LADDERS TO BE F ABOVE TOP SLAB LEVEL. REF



4.5

BRISBANE CITY COUNCIL
Brisbane Water
Australia Trade Coast Sewer Project

BW30137-02/03

QA Register Serpentine Road SP300

Lot No.	Description	Chainage From	Chainage To	Date Opened	Date Closed
AS01	Asphalt placement McBride Road	1325	1317	5/10/2004	22/10/2004
AS03	Asphalt placement Serpentine Pump Station			14/02/2005	16/03/2005
AV08	Air Valve Pit Installation SM18 Ch 500, 1400, 1982, 2217, 2700, 3103, Serpentine PS			13/07/2004	4/03/2005
AV09	Air Valve Pit Installation SM17 Ch 0, 169, 463, 702, 750, 1199, 1467, 1717			30/07/2004	14/03/2005
BW06	Butt Welding SM18 Ch 0 - 650 Sewer	0	650	26/05/2004	28/08/2004
BW07	Butt Welding SM18 Ch 620 - 1372			4/06/2004	20/08/2004
BW08	Butt Welding SM18 Ch 1372 - 3427			15/06/2004	30/09/2004
BW09	Butt Welding SM17 Ch 0 - 1360 Sewer			13/07/2004	25/08/2004
BW10	Butt Welding SM17 Ch 1360 - 1988 315dia			19/07/2004	20/08/2004
BW12	Butt Welding 560dia Serpentine PS to Mains			13/12/2004	9/03/2005
CG07	SM16, SM17, SM18 clearing and grubbing			4/06/2004	23/12/2004
CP02	SP300 Serpentine Rd Pump Station			24/11/2004	24/11/2004
CW12	SP300 Transformer Slab Serpentine Rd PS			19/11/2004	23/11/2004
CW13	SP300 Base Slab Serpentine Rd PS			24/11/2004	11/01/2005
CW15	SP300 Serpentine Rd PS Wall pour 1			3/12/2004	11/01/2005
CW16	SP300 Serpentine Rd PS Wall pour 2			20/12/2004	3/02/2005
CW19	SP300 Benching in Wet well Walls			12/01/2005	8/03/2005
CW20	SP300 False Floor in dry well			13/01/2005	15/01/2005
CW21	SP300 Benching between sumps in wet well			14/01/2005	8/03/2005
CW22	SP300 Stairs, Scour pit base, switch board base and benching wet well			15/01/2005	18/01/2005
CW23	SP300 Switch board trench walls			17/01/2005	18/01/2005
CW24	SP300 Scour Pit Walls			19/01/2005	8/03/2005
CW25	SP300 Kerb around turning bay			4/02/2005	6/02/2005
CW26	SP300 Turning Bay Pour 1			8/02/2005	15/03/2005
CW27	SP300 Turning Bay Pour 2			9/02/2005	20/04/2005
CW28	SP300 Turning Bay Pour 3			10/02/2005	11/02/2005
CW29	SP300 Turning Bay Pour 4			11/02/2005	12/02/2005
CW31	SP300 Foot paths to valve and Generator slab			25/02/2005	26/02/2005
CW32	SP300 Kerb in parking bay			28/02/2005	29/05/2005
CW40	SP300 Overflow Pit walls			4/04/2005	28/04/2005
CW41	SP300 Overflow pit roof			5/04/2005	28/04/2005
EC44	Electrofusion Coupling SM18 Ch410	410	410	7/06/2004	27/07/2004
EC45	Electrofusion Coupling SM18 Ch319	319	319	8/06/2004	27/07/2004
EC46	Electrofusion Coupling SM18 Ch228	228	228	9/06/2004	27/07/2004
EC50	Electrofusion Coupling SM18 Ch61	60	60	19/06/2004	27/07/2004
EC52	Electrofusion Coupling SM18 Ch153	153	153	23/06/2004	27/07/2004
EC53	Electrofusion Coupling SM18 Ch61	61	61	24/06/2004	27/07/2004
EC54	Electrofusion Coupling SM18 Ch2367	2367	2367	30/06/2004	27/07/2004
EC55	Electrofusion Coupling SM18 Ch2307	2307	2307	1/07/2004	27/07/2004
EC56	Electrofusion Coupling SM18 Ch2457	2457	2457	3/07/2004	27/07/2004
EC57	Electrofusion Coupling SM18 Ch2247	2247	2247	5/07/2004	27/07/2004
EC58	Electrofusion Coupling SM18 Ch2186	2186	2186	6/07/2004	27/07/2004
EC59	Electrofusion Coupling SM18 Ch2095 & 2024	2095	2024	7/07/2004	27/07/2004
EC60	Electrofusion Coupling SM18 Ch2533 & 2570	2533	2570	8/07/2004	27/07/2004
EC61	Electrofusion Coupling SM18 Ch2609	2609	2609	13/07/2004	27/07/2004
EC62	Electrofusion Coupling SM18 Ch2669	2669	2669	14/07/2004	27/07/2004
EC63	Electrofusion Coupling SM18 Ch2730	2730	2730	15/07/2004	27/07/2004

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EC64	Electrofusion Coupling SM18 Ch2789 & 2800			16/07/2004	27/07/2004
EC65	Electrofusion Coupling SM18 Ch1983	1983	1983	19/07/2004	27/07/2004
EC66	Electrofusion Coupling SM18 Ch1920	1920	1920	20/07/2004	27/07/2004
EC67	Electrofusion Coupling SM18 Ch1830	1830	1830	21/07/2004	27/07/2004
EC68	Electrofusion Coupling SM17 Ch283	283	283	26/07/2004	17/08/2004
EC69	Electrofusion Coupling SM17 Ch350 & 351	350	351	28/07/2004	17/08/2004
EC70	Electrofusion Coupling SM17 Ch223, 168, 120, 105	105	223	30/07/2004	17/08/2004
EC71	Electrofusion Coupling SM17 Ch412 & 464	412	464	3/08/2004	17/08/2004
EC72	Electrofusion Coupling SM17 Ch509 & 570	509	570	5/08/2004	17/08/2004
EC73	Electrofusion Coupling SM17 remainder (refer to TW076 - TW100)	TW076	TW100	12/09/2004	24/11/2004
EC74	Electrofusion Coupling SM18 Remainder (refer to TW101 - TW115)	TW101	TW115	17/08/2004	14/11/2004
EL02	Electrcial Works Serpentine Pump Station SP300			16/02/2005	17/05/2005
ME02	Mechanical Works Serpentine Pump Station SP300			16/02/2005	7/04/2005
PJ03	Pipe Jacking SM17 Ch 119 - 167	119	167	19/07/2004	2/08/2004
PT03	Pipe testing SM18 chainage 0 to 1370	0	1370	1/10/2004	8/10/2004
PT04	Pipe testing SM18 chainage 1370 to 2830	1370	2830	15/10/2004	20/10/2004
PT05	Pipe testing SM17 chainage 0 to 1360	0	1360	2/11/2004	5/11/2004
PT06	Pipe testing SM18 chainage 2860 to 3425	2860	3425	17/12/2004	19/01/2005
PT07	Pipe testing SM17 chainage 1360 to 1990	1360	1990	17/12/2004	23/12/2004
SG02	Subgrade in Serpentine Rd driveway			5/02/2005	16/02/2005
ST02	PE liner spark testing Serpentine P/S			2/12/2004	16/03/2005
SV06	Scour Valve Pit Installation SM18 Ch95, 617, 1701, 2025, 2503, 2865, 3500 Sewer	95	3500	30/06/2004	1/03/2005
SV07	Scour Valve Pit Installation SM17 Ch351, 600, 902, 1601 Sewer			28/07/2004	26/09/2004
TB05	Tunnel Boring SM18 Ch 2866 - 2900	2866	2900	28/06/2004	1/08/2004
TB06	Tunnel Boring SM18 Ch 1985 - 2025	1985	2025	4/07/2004	1/08/2004
TB07	Tunnel Boring SM18 Ch 1630 - 1700	1630	1700	7/07/2004	1/08/2004
TB08	Tunnel Boring SM17 Ch 63 - 100	63	100	13/07/2004	1/08/2004
TB09	Tunnel Boring SM17 Ch 300 - 350	300	350	15/07/2004	1/08/2004
TB10	Tunnel Boring SM17 Ch704 - 750	704	750	16/07/2004	1/08/2004
TB11	Tunnel Boring SM17 Ch1215 - 1323 Sewer	1215	1323	8/08/2004	19/08/2004
TB12	Tunnel Boring Serpentine incoming rising mains Ch 0 - 50 Sewer	0	50	8/11/2004	25/11/2004
TB13	Tunnel Boring Serpentine incoming rising mains Ch 0 - 60 Sewer	0	60	8/11/2004	25/11/2004
TW043	Trenching SM18 Ch 500 - 410 Sewer	500	410	4/06/2004	17/08/2004
TW044	Trenching SM18 Ch 410 - 319 Sewer	410	319	7/06/2004	17/08/2004
TW045	Trenching SM18 Ch 319 - 228 Sewer	319	228	8/06/2004	17/08/2004
TW046	Trenching SM18 Ch 228 - 153 Sewer	228	153	9/06/2004	17/08/2004
TW047	Trenching SM18 Ch 0 - 60 Sewer &			10/06/2004	17/08/2004
TW048	Trenching SM18 Ch 60 - 85 Sewer &	60	85	18/06/2004	17/08/2004
TW049	Trenching SM18 Ch 155 - 65 Sewer	155	65	23/06/2004	17/08/2004
TW051	Trenching SM18 Ch 61 - 31 Sewer	61	31	24/06/2004	17/08/2004
TW052	Trenching SM18 Ch 2457 - 2367	2457	2367	28/06/2004	17/08/2004
TW053	Trenching SM18 Ch 2367 - 2307	2367	2307	30/06/2004	17/08/2004
TW054	Trenching SM18 Ch 2307 - 2247	2307	2247	1/07/2004	17/08/2004
TW055	Trenching SM18 Ch 2457 - 2534	2457	2534	3/07/2004	17/08/2004
TW056	Trenching SM18 Ch 2247 - 2186	2247	2186	5/07/2004	27/08/2004
TW057	Trenching SM18 Ch 2186 - 2095	2186	2095	6/07/2004	17/08/2004
TW058	Trenching SM18 Ch 2095 - 2024	2095	2024	7/07/2004	17/08/2004
TW059	Trenching SM18 Ch 2534 - 2609	2534	2609	8/07/2004	16/08/2004
TW060	Trenching SM18 Ch 2609 - 2669	2609	2669	13/07/2004	16/08/2004

TW061	Trenching SM18 Ch 2669 - 2730	2669	2730	14/07/2004	4/08/2004
TW062	Trenching SM18 Ch 2730 - 2789	2730		15/07/2004	4/08/2004
TW063	Trenching SM18 Ch 2789 - 2861	2789	2861	16/07/2004	16/03/2005
TW064	Trenching SM18 Ch 1983 - 1920	1983	1920	19/07/2004	4/08/2004
TW065	Trenching SM18 Ch 1920 - 1830	1920	1830	20/07/2004	16/08/2004
TW066	Trenching SM18 Ch 1830 - 1769	1830	1769	21/07/2004	16/08/2004
TW067	Trenching SM17 Ch 223 - 290 Sewer	223	290	26/07/2004	6/09/2004
TW068	Trenching SM17 Ch 350 - 412 Sewer	350	412	28/07/2004	6/09/2004
TW069	Trenching SM17 Ch 223 - 168 Sewer	223	168	29/07/2004	6/09/2004
TW070	Trenching SM17 Ch 120 - 105 Sewer			30/07/2004	6/09/2004
TW071	Trenching SM17 Ch 463 - 508 Sewer	463	508	2/08/2004	6/09/2004
TW072	Trenching SM17 Ch 412 - 463 Sewer	412	463	3/08/2004	6/09/2004
TW073	Trenching SM17 Ch 508 - 568 Sewer	508		4/08/2004	14/09/2004
TW074	Trenching SM17 Ch 568 - 630 Sewer			5/08/2004	14/09/2004
TW075	Trenching SM18 Ch 1367 - 1400			5/08/2004	14/09/2004
TW076	Trenching SM17 Ch 630 - 703 Sewer	630	703	12/08/2004	14/09/2004
TW077	Trenching SM17 Ch 749 - 825 Sewer	749	825	16/08/2004	14/09/2004
TW078	Trenching SM17 Ch 825 - 900 Sewer	825	900	17/08/2004	14/09/2004
TW079	Trenching SM17 Ch 900 - 1022 Sewer	900	1022	18/08/2004	14/09/2004
TW080	Trenching SM17 Ch 1022 - 1108	1022	1108	23/08/2004	14/09/2004
TW081	Trenching SM17 Ch 1108 - 1215	1108	1215	20/08/2004	14/09/2004
TW082	Trenching SM17 Ch 1325 - 1359	1325	1359	25/08/2004	22/11/2004
TW083	Trenching SM17 Ch 1359 - 1390	1359	1390	26/08/2004	22/11/2004
TW084	Trenching SM17 Ch 1390 - 1420	1390	1420	26/08/2004	24/11/2004
TW085	Trenching SM17 Ch 1420 - 1452	1420	1452	27/08/2004	24/11/2004
TW086	Trenching SM17 Ch 1452 - 1481	1452	1481	30/08/2004	24/11/2004
TW087	Trenching SM17 Ch 1480 - 1511	1481	1511	31/08/2004	24/11/2004
TW088	Trenching SM17 Ch 1510 - 1540	1510	1540	2/09/2004	24/11/2004
TW089	Trenching SM17 Ch 1540 - 1571	1540	1571	3/09/2004	24/11/2004
TW090	Trenching SM17 Ch 1570 - 1600	1570	1600	6/09/2004	24/11/2004
TW091	Trenching SM17 Ch 1600 - 1630	1600	1630	7/09/2004	24/11/2004
TW092	Trenching SM17 Ch 1630 - 1662	1630	1662	8/09/2004	24/11/2004
TW093	Trenching SM17 Ch 1662 - 1697	1662	1697	14/09/2004	24/11/2004
TW094	Trenching SM17 Ch 1697 - 1717, SM18 3133 - 3159			30/09/2004	24/11/2004
TW095	Trenching SM17 Ch 1717 - 1747, SM18 Ch 3159 - 3189			1/10/2004	20/12/2004
TW096	Trenching SM17 Ch 1747 - 1777, SM18 Ch 3189 - 3219			5/10/2004	20/12/2004
TW097	Trenching SM17 Ch 1777 - 1807, SM18 Ch 3219 - 3249			6/10/2004	24/11/2004
TW098	Trenching SM17 Ch 1807 - 1838, SM18 Ch 3249 - 3279			7/10/2004	24/11/2004
TW099	Trenching SM17 Ch 1837 - 1868, SM18 Ch 3279 - 3309			12/10/2004	24/11/2004
TW100	Trenching SM17 Ch 1868 - 1900, SM18 Ch 3309 - 3341			13/10/2004	24/11/2004
TW101	Trenching SM18 Ch 2898 - 2920 Sewer	2898	2920	20/09/2004	14/11/2004
TW102	Trenching SM18 Ch 2920 - 2950 Sewer	2920	2950	21/09/2004	14/11/2004
TW103	Trenching SM18 Ch 2950 - 2980 Sewer	2950	2980	22/09/2004	14/11/2004
TW104	Trenching SM18 Ch 2980 - 3011 Sewer	2980	3011	23/09/2004	14/11/2004
TW105	Trenching SM18 Ch 3011 - 3041 Sewer	3011	3041	24/09/2004	14/11/2004
TW106	Trenching SM18 Ch 3041 - 3069 Sewer	3041	3069	27/09/2004	14/11/2004
TW107	Trenching SM18 Ch 3069 - 3103 Sewer	3069	3103	28/09/2004	24/11/2004
TW108	Trenching SM18 Ch 3103 - 3133 Sewer	3103	3133	29/09/2004	24/11/2004
TW109	Trenching SM18 Ch 499 - 591 Sewer	499	591	27/08/2004	14/10/2004
TW110	Trenching SM18 Ch 591 - 638 Sewer	591	638	26/08/2004	14/10/2004
TW111	Trenching SM18 Ch 1700 - 1769 Sewer	1700	1769	16/09/2004	14/11/2004
TW112	Trenching SM18 Ch 1564 - 1624 Sewer	1564	1624	17/09/2004	14/11/2004
TW113	Trenching SM18 Ch 1504 - 1564 Sewer	1504	1564	20/09/2004	14/11/2004
TW114	Trenching SM18 Ch 1444 - 1504 Sewer	1444	1504	21/09/2004	14/11/2004
TW115	Trenching SM18 Ch 1414 - 1444 Sewer	1414	1444	22/09/2004	14/11/2004

TW116	Trenching SM17 Ch 0 - 58 Sewer	0	58	19/10/2004	14/11/2004
TW122	Trenching SM17 Ch 1900 - underbore, SM18 Ch3341 - underbore			29/11/2004	22/12/2004
UB04	Unbound Pavement under turning bay Serpentine PS			3/02/2005	7/02/2005
UB05	Unbound Pavement Lamandra Dr access to PS			10/02/2005	21/02/2005