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Certificate Number FM29298

Produced for the Whittlesey Drainage Board
Telemetry Report - Remote Monitoring of Pump Stations

1. Site Survey

1.1 Survey Key sites

On 17th May 2016, Lee-Dickens visited the following Whittlesey Drainage Board Pump Stations and Water Level Control sites.

- Wype Pump Station
- Iron Side Pump Station
- Ramsey Mereside Pump Station
- Dryside Pump Station
- Marriots Drove Water Control

The visit enabled Lee-Dickens to gain sufficient information to specify a suitable Remote Monitoring solution and provide a budget quotation.

There are a total of 14 pump stations and 20 control sites that will require remote monitoring. WDB are looking to break the project into two phases.

Phase 1 will be the installation of Telemetry at the pump station sites followed by phase 2, the Water Level Control sites.

Pump Station Sites:

Site Name	Pumps	Weed Screen
Goosetree Corner	1	No
Goosetree Estate	1	Yes
Beggars Bridge Pump Station	1	Yes
Wype Pump Station	1	Yes
Lords Pump Station	1	No
Conquest Pump Station	1	No
Tebbitts Bridge Pump Station	2	Yes
Manor Farm Pump Station	3	Yes
Underwoods Pump Station	2	Yes
Ramsey Mereside Pump Station	2	Yes
New Plantation Pump Station	1	No
Glassmoor Ban Pump Station	2	Yes
Ironside Pump Station	2	Yes
Dryside Pump Station	1	Yes

1.2 Intimate Site Survey

Due to the absence of any previous telemetry there will be some site work needed, to identify signals, survey buildings for the installation of external cellular antennas, ultrasonic sensors, Micro solar panel assemblies, identifying cable routes, etc.

It was agreed, should Whittlesey Drainage Board maintain interest in the Lee-Dicken Sitewatch solution following the release of the report and budget quotation, that a second, more intimate survey should be undertaken.

The Lee-Dickens Project Manager and electrical engineer would survey each of the pump station sites along with a third party supplied by WDB who are familiar with the pump and weed screen control switchgear.

The survey will allow WDB/Lee-Dickens to identify the location of each monitored point. We could decide upon the location of the Midi8 RTU enabling us to cost the installation materials and sundries. It will also give Lee-Dickens the opportunity to determine the location of level sensors and agree a suitable mounting arrangement and location.

At this intimate level, we would estimate being able to survey 2 to 3 sites a day. The survey would be a chargeable activity. We would ask WDB to note that from our experience, undertaking this level of survey is a necessary activity that will save many £1000s throughout the duration of the project. It will enable us to identify any potential problems in advance, to quote accurately for all our material costs and the man days required at each site. The knowledge gained from the survey will enable our configuration engineers to build the WDB Sitewatch Telemetry application.

1.3 Phase 1 Trial Installation

Lee-Dickens has agreed to undertake a free trial installation of the Midi8 Remote Terminal Unit at DRYSIDE PUMP STATION. The aim of the trial will be to prove the reliability of cellular communications and to identify the relevant digital and analogue signals required to mimic the pump station status. We would expect a third party, familiar with the service/maintenance of the existing pump and weed screen control panels to assist during the trial.

1.4 Phase 2 Trial Installation

Lee-Dickens has agreed to undertake a free trial installation of the Micro Remote Terminal Unit at BLACKBUSH Water Level Control site. This site has been chosen as it already has a water level bench mark installed. The aim of the trial will be to prove the solar powered solution and the reliability of cellular communications.

2. Observations

2.1 Pump Stations

There has been no Telemetry installed at any of the pump stations sites before and so there is no old or obsolete communication infrastructure for Lee-Dickens to inherit (such as Radio or BT phone lines)

The pump station sites contain between 1 to 3 pumps and in most cases (but not all) an automated weed screen.



Figure 1 Pump and Weed Screen

Most pump stations do not have an ultrasonic level sensor installed. The pumps are currently automatically started/stopped via capacitance style level switches. The automated operation of the weed screen is triggered by the starting of a pump.

There will need to be some consideration given to the location of the ultrasonic sensors at each pump station sites, the mechanics of mounting and supporting the sensor head as it spans the water channel along with any future maintenance/service work needed on the sensor head.

Signal cable from the ultrasonic sensor head will need to be run back to the Remote Terminal Unit located within the pump station building.



Figure 2 Typical environment where level sensor will need to be installed



Figure 3 Capacitance Level Switches used to automatically start/stop pumps

Each site has a 3 phase electrical control panel for the pumps and where there is a weed screen, a separate 3 phase weed screen control panel.

Most of the electrical control panels have been supplied by electrical contractors A J Speechley, Son and Partner.

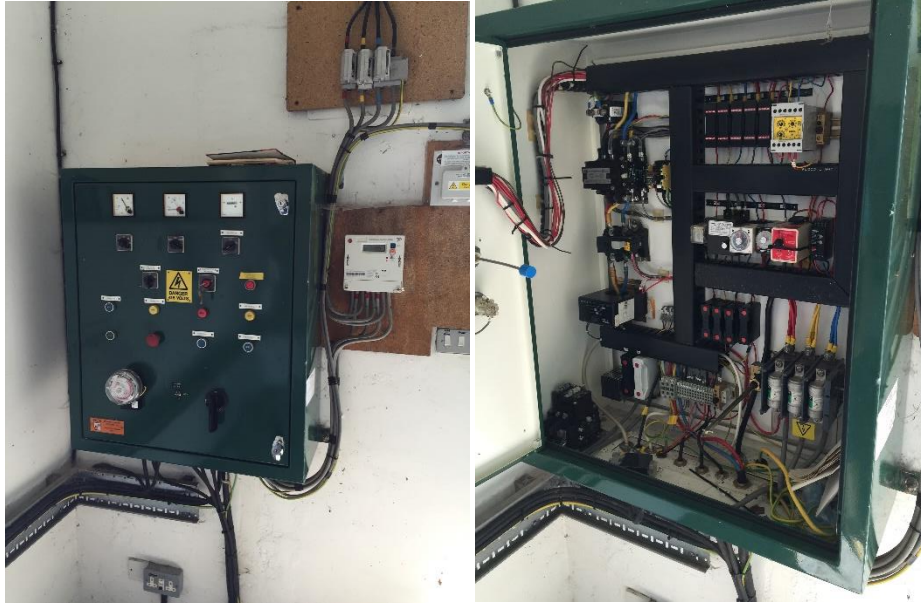


Figure 4 Pump Control Panel

The Remote Monitoring will need to be achieved via physical connection to analogue and digital circuits. The pump stations are controlled via hardwired logic via relays and contactors. There are no PLCs installed within the pump control panels.

The weed screen electrical panel has a PLC for local operation and control. The PLC has no serial port for connection to our Remote Terminal Unit.



Figure 5 Weed Screen Control Panel

There are currently no monitored points marshalled to terminals dedicated for remote monitoring. The analogue and digital signals that need to be remotely monitored will need to be identified from relays, contactors and instrumentation located within each of the two electrical panels.

There is AC power at the pump stations so a 230VAC circuit can be made available for the Telemetry Remote Terminal Unit.

It was noted that there are currently no rain gauges or temperature sensors

currently installed at any of the sites. WDB plan on installing a rain gauge and temperature sensor at 3 key sites, geographically dispersed across the drainage network.



A cellular survey was carried out at each of the 5 sites visited. Using a cellular analyser with the standard stub antenna it was identified that the 2G cellular signal was poor from within the pump station buildings. A cellular based Telemetry system will require externally fitted whip or directional antenna to ensure access to the mobile service provider's strongest signal.

CCTV is wanted to monitor the new WDB offices being built alongside the pump station at the Ironside Pump Station.



Mobile offices are being located to the left of pump station building. This is the only site that will require CCTV.

2.2 Water Level Control Sites

The Water Level control sites are in remote locations without power.



Wooden boards are manually added or removed from the gates to control the water levels on the control side (not the pump side).
A walkway with handrails supported on metal piles spans the water channel. It would appear that most of the water control sites will need water level bench markers installed, this to give the Telemetry a datum level and point of calibration.

3.0 Whittlesey Drainage Board Telemetry Specification

WDB are looking for Lee-Dickens to provide a Telemetry solution with a generic design so that all pump stations utilise the same hardware and software. They are looking to remotely monitor the operational status of the pumps and weed screens as well as monitoring upstream and downstream water levels.

The weed screen can sustain damage if operated at very low temperature or in high winds. WDB want the ability to remotely disable the automated operation of the weed screen from the Telemetry top end.

WDB Monitored Points List

Digital Inputs

Item	Description	Notes
01	PUMP STATUS (Run/Stop)	
02	PUMP FAULT (Tripped/Healthy)	
03	PUMP (Auto/Hand)	
04	WEED SCREEN STATUS (Run/Stop)	
05	WEED SCREEN FAULT (Tripped/Healthy)	
06	WEED SCREEN (Auto/Hand)	
xx	PUMP HOURS RUN	Derived from din status

Analogue Inputs

Item	Description	Notes
01	PUMP CURRENT	
02	UPSTREAM WATER LEVEL	
03	DOWMSTREAM WATER LEVEL	
04	AMBIENT TEMPERATURE	At 3 sites only

Pulsed Inputs

Item	Description	Notes
01	RAIN GAUGE	At 3 sites only

Digital Outputs

Item	Description	Notes
01	WEED SCREEN AUTOMATED	Manual control
02	WEED SCREEN MANUAL	Manual control

4.0 Telemetry Proposal

4.1 Sitewatch Servers Hosted by Lee-Dickens Ltd

Lee-Dickens will host the Whittlesey Drainage Board Sitewatch Remote Control and Monitoring application on servers located at their offices. UPS supported Main and Standby servers will provide dual operation/redundancy, with any one server being able to support the WDB application.

Whittlesey Drainage Board will be able to access the system from any Windows based PC or laptop computer with internet access using internet explorer (user name and password protected).

Lee-Dickens will quote a 5 licence agreement, enabling WDB to make 5 concurrent connections to their Sitewatch application at any one time.

Each pump station and water control level site will have an individual screen configured with animated graphics that mimic the status of equipment at site. Live and historical trends (plotted graphs) will be available for each monitored point.

A main overview screen will display all the sites on a map of the drainage network. Each site will be represented as a single icon displaying the sites health with an active point to enable you to navigate directly to the pump station site.

All system activity will be recorded in the Sitewatch alarm manager, providing and unalterable archive of events. To highlight specific events and alarms, the text is coloured coded, with different visual and audible characteristics based upon the priority level configured.

Email and Text Message (SMS) alerts are offered as standard with the Sitewatch Hosted solution. Alarms can be sent to one or more recipients.

4.2 Remote Terminal Units

4.2.1 Midi8 Remote Terminal Unit

Each pump station will have a Midi8 Remote Terminal Unit installed.

The Midi8 RTU has an LCD/keypad for local interaction and is IP65 rated so can be installed indoors or outdoors.

The Midi8 RTU requires a 110/230VAC supply and is battery backed, powered via its own internal UPS.

As standard, the Midi8 RTU offers 16 digital inputs (dins), 8 analogue inputs (ains) and 4 digital outputs (douts).

The Midi8 has an expansion port that supports a selection of digital and analogue modules, including pulsed inputs.

The Midi8 RTU will be supplied with a cellular modem and a multi-network

roaming SIM card. The RTU will include a bulk head mount antenna base providing a connection to an external 5db whip antenna.

4.2.2 Micro Remote Terminal Unit

The Control Water Level sites will have the water level monitored using the Micro1A Remote Terminal Unit and an ultrasonic level sensor. There is no power at this location and so a solar powered Micro1A assembly will be quoted.

The kit comprises of a plinth mounted pole, a pole mount solar panel, pole mount IP rated polycarbonate enclosure containing; Micro RTU; solar controller; battery pack; fuses and low power relay module. Water level will be measured using an ultrasonic level sensor and bespoke mounting assembly.

We have investigated utilising the remote communication links supplied by the ultrasonic manufacturers to get the downstream water level signal wired back for direct connection to the Midi8 RTU located within the pump station building. We have concluded that it will be cheaper than and just as effective to utilise the solar powered Micro assembly as with the Control Water Level sites.

4.3 Ultrasonic Level Sensors

Lee-Dickens will quote to supply, configure and commission ultrasonic level sensors to monitor (1) upstream, (2) downstream and (3) control site water levels. The quote will include the supply and installation of suitable bespoke mounting bracket to support the ultrasonic sensor head and manage the signal cabling.

4.4 Temperature Sensors

Lee-Dickens will quote to supply, install and commission qty.3 HP5xx wall mount temperature sensors.

4.5 Pulse Input Expansion Modules

Lee-Dickens will quote to supply qty.3 pulse input expansion modules to monitor pulses from a Rain Gauge. The pulse input sub board will be installed within the three appropriate Midi8 RTUs.

4.6 CCTV

Lee-Dickens to quote to supply, install and commission a closed HD colour CCTV system at the Ironside Pump Station. The CCTV will be used to monitor the entrance to the compound and the new WDB office building(s). The system will comprise of two HD colour CCTV cameras with night vision wired back to a local hidden DVR. There will be no need to integrate the CCTV with the Telemetry package.

4.7 Installation Work

Lee-Dickens will quote to undertake all the electrical and mechanical installation work.

The quote will include all power/signal/communications cabling, cable management, installation sundries and any other material costs.

4.8 Commissioning and Site Acceptance Testing

Lee-Dickens will quote to site acceptance test the Telemetry at each pump station site. Commission the Midi8 RTU onto the Sitewatch servers and undertake a point to point test of each monitored point. The tests will be a milestone for payment, witnessed by Whittlesey Drainage Board.

4.9 Sitewatch Operator Training

Lee-Dickens will provide WDB staff with operator training.

Staff will be shown how to establish a remote (thin client) connection with the Sitewatch server and how to use the Sitewatch tools available to view and manipulate your pump station data.