

IoT Devices / Sensors Installation & Support

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Revision History

Issue Number	Changes made by	Date Revised	Description of Change
01	Ovais Aziz	29 Oct 21	Initial issue
02	Chris Harris	01 Nov 21	Summarised & formatted for external distribution

1. Background

Monitoring has traditionally been undertaken using SCADA systems which provide very high levels of reliability and redundancy and have been used for many years on the water and sewer trunk systems. Even with the use of mobile networks and battery powered RTUs this technology has remained too expensive to extend down into the reticulation systems in great depth. Consequently, the customer has been relied on to report issues in the network such as low water pressure and sewer overflow or surcharge events once they have already created an impact for them.

The introduction of low power wide area networks coupled with battery powered IoT devices promises to provide a means of pushing monitoring down into the reticulation network with devices up to the customer premises.

Since 2017 Sydney Water has been undertaking IoT trials of which the deployment of monitoring devices in the sewer has been a key use case. The first stage of the trial demonstrated a device network operating on LPWAN technology could provide a means to monitor our networks more closely and respond to faults prior to customer impact.

As a first step this sensor network enabled an immediate response before or as soon as there is an issue which will impact a customer and the environment. The vision is for these device networks to utilize machine learning and analytics to provide predictive fault diagnosis capabilities so that targeted maintenance activities can entirely avoid an event which may impact a customer.

Now, in September 2021, with over 3,300 sewer blockage detection devices deployed in the field, this project has detected and prevented more than 190 blockages at environmentally high-risk sites and is now avoiding on average 15 overflows/month. Moving to productionise this project as part of Sydney Water's Environmental Improvement Program, and considering the lessons learned from the IoT Extended Trial, the device and sensor requirements have been refined to sustain mass deployment of devices commencing July 2022.

This document outlines the scope for IoT device & sensor installation services to fulfil the requirements of sewer monitoring.

2. Scope & Requirements Outline

2.1 Installation and Life Cycle

The total life cycle cost considerations are critical for the success of IoT devices. With relatively low equipment cost, the installation, ongoing maintenance and network operating costs contribute significantly to the overall cost of ownership.

It is important that devices are easy to install, reliable, have long battery life and stable firmware to reduce re-work and site visits. Total life cycle cost rather than initial cost will be the key driver for device selection.

In regard to installation, devices should have appropriate mounting brackets and/or attachment points to reduce installation time, improve accuracy/quality of the install and reliability of any attached instrument. Devices, sensors, and any associated mounting brackets should be designed such that entry into manholes is not required as this is highly undesirable from a safety perspective

The project needs to install and commission NB-IoT data logger devices (with external antenna) to be attached with the level switches or level sensors for sewer level & overflow monitoring.

The company would need to be able to install approx. 250 devices per week per year. The devices need to be installed in the manholes within a model reticulation sewer network spread over 4600 Km area across NSW within the Sydney Water's area of operations. The cumulative indicative rollout volumes for the project are 23,000 devices over 2 years.

Some planning assumptions at this stage are;

1. 80% NB IoT devices will be integrated with float switches (80%) and 20% with analogue level sensors (20%)
2. 80% devices with external antenna and 20% with internal antenna
3. 30 % of the sites will need traffic control plans and 10 % will be within customer backyards.

The company would need to have staff with vehicles, traffic control signs, PPE & tools who are able to install devices anywhere within Sydney Water's area of operations.

The installers would be required to:

- Interpret maps
- Read and follow work instructions and safety documentation
- Good communication skills
- Able to use hand and power tools
- Able to report site specific details via a field based app.

The installers would require:

- White Card
- First Aid training
- Confined spaces qualifications
- Implement traffic Control Plans qualifications (yellow card)

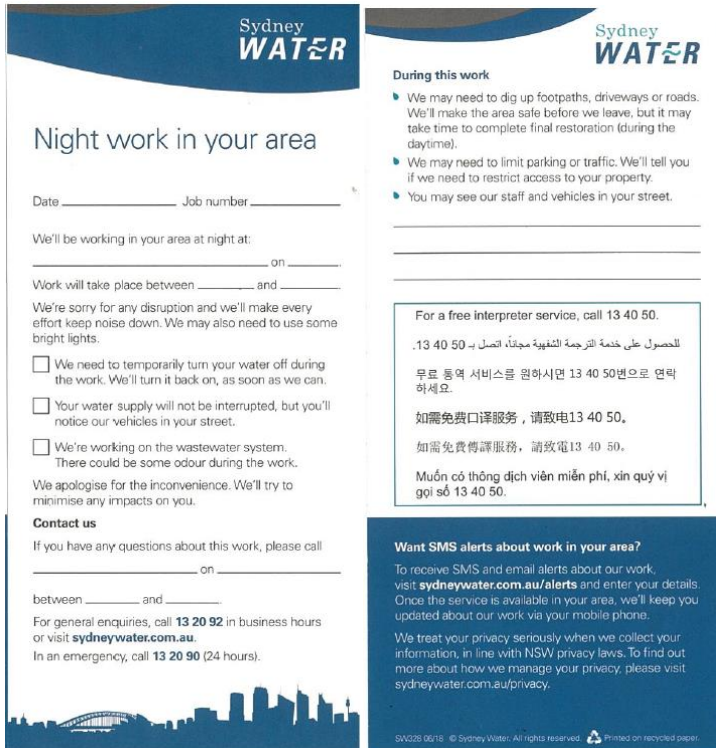
3) Indicative IoT Device Installation Work Instructions

1. Purpose

This work instruction provides a step-by-step guide for the installation of IoT Sewer Blockage Detection Devices. This includes assessing a site, installing a device and reporting all necessary information.

2. Work instruction

Task no.	Work instruction details	Visual Guide																			
1.	Site Assessment																				
A	Using the map generated from the IoT Control Plan, determine a site's location and details	<table><tr><th>Location Details</th><th>Colour Code</th></tr><tr><td>Footpaths/Nature Strips/Front yards/Parks/Reserves</td><td></td></tr><tr><td>Roadways</td><td></td></tr><tr><td>National Parks</td><td></td></tr><tr><td>Backyards</td><td></td></tr><tr><td>Unique Location (Hospitals/Golf Courses/etc.)</td><td></td></tr><tr><td>On Hold</td><td></td></tr><tr><td>Unable to Install (NA)</td><td></td></tr><tr><td>Installed</td><td></td></tr></table>	Location Details	Colour Code	Footpaths/Nature Strips/Front yards/Parks/Reserves		Roadways		National Parks		Backyards		Unique Location (Hospitals/Golf Courses/etc.)		On Hold		Unable to Install (NA)		Installed		
Location Details	Colour Code																				
Footpaths/Nature Strips/Front yards/Parks/Reserves																					
Roadways																					
National Parks																					
Backyards																					
Unique Location (Hospitals/Golf Courses/etc.)																					
On Hold																					
Unable to Install (NA)																					
Installed																					
B	Find the site/manhole (MH) and follow the access procedures required for the specific location details. See 1.c for footpaths, nature strips, front yards, parks and reserves. See 1.d for roadways. See 1.f for National Parks. See 1.h for backyards. See 1.g for unique locations.																				
C	MH's that are located on footpaths and nature strips, in certain front yards, and specific parks																				

Task no.	Work instruction details	Visual Guide
	and reserves can be accessed immediately if deemed safe. See <i>Task No. 2</i> for further details.	
d	Prior to working on/or near a roadway a Traffic Control Plan (TCP) is required to be completed. The TCP will display whether external Traffic Control is required for the access to the MH. If external Traffic Control is required, it will need to be scheduled prior to installation. Note: If Traffic Control is required to be conducted prior to 7am, a night works letter is required to be dropped to all residents that may be affected by noise.	 The visual guide displays two versions of a 'Night work in your area' letter from Sydney Water. The left version is a standard letter with fields for date, job number, and work times, and checkboxes for water interruption or wastewater work. The right version includes additional information about interpreter services and SMS alerts in multiple languages.
e	If external Traffic Control is not required, the site must be assessed to determine if the TCP can be carried out safely. Set up safety signage and equipment as outlined, See <i>Task No. 2</i> for further details.	

Task no. Work instruction details Visual Guide

- f Prior to entering a National Park, read and sign the environmental report for the catchment area. The National Parks and Wildlife Service (NPWS) require notification before any Sydney Water team is to conduct work. Using the National Park office locations, provided in the below hyperlink, an email to the relevant NPWS office is required.
- [Guide for working in National Parks](#)

NPWS Contact Details current as at 1 June 2020

See next section for Parks and Reserves by NPWS Area/Branch

For Type A and B Notifications

NPWS Area Mailboxes and office phone numbers (please address correspondence to Area Manager) – monitored approximately between 9am and 4pm (Monday to Friday)

Branch	NPWS Area	Mailbox	Office Phone Number
Blue Mountains	Upper Mountains	npws.uppermountains@environment.nsw.gov.au	(02) 47873100
	Hawkesbury-NPSA	npws.hawkesbury@environment.nsw.gov.au	(02) 4720 8200
Greater Sydney	Sydney North	npws.sydneynorth@environment.nsw.gov.au	(02) 9451 3479
	North Western Sydney	npws.northwesternsydney@environment.nsw.gov.au	(02) 8448 0400
	Cumberland	npws.cumberland@environment.nsw.gov.au	(02) 4572 3100
	Sydney South	npws.sydneyouth@environment.nsw.gov.au	(02) 9337 5511
	Royal	npws.royal@environment.nsw.gov.au	(02) 9542 0632
South Coast	Illawarra Highlands	npws.illawarrahighlands@environment.nsw.gov.au	(02) 4224 4188

In addition to the table above, contact details for the NPWS Local Area Office for each national park or reserve are available at: <https://www.nationalparks.nsw.gov.au/visit-a-park>

For Emergency Notifications

Contact the relevant emergency service first (call 000) if required, and then:

For 'material harm' emergencies contact:

1. Environment Line (EPA) on 131 655, followed by
2. Relevant NPWS Branch Duty Officer.

For 'non-material harm' emergencies contact:

1. Relevant NPWS Branch Duty Officer.

Branch Duty Officer Contact Details (24hrs)

Branch	Email	Phone Number
Blue Mountains	npwsBMB.dutyofficer@environment.nsw.gov.au	(02) 8275 1748
Greater Sydney	npwsGSB.dutyofficer@environment.nsw.gov.au	1300 056 284
South Coast	npwsSCB.dutyofficer@environment.nsw.gov.au	(02) 8275 1752

For general queries regarding the Protocol, Consent or if there are issues that cannot be resolved with the local NPWS Area

Contact the NPWS Senior Project Officer – Utilities

• NPWS.Utilities@environment.nsw.gov.au

p: 02 6450 5641

- g The NPWS Notification Proforma for proposed work ([BMIS0128.01](#)) will need to be updated to include the park name, date of proposed work, as well as a screenshot of Spatial Hub with the relevant Sewer Manholes highlighted for the reference of NPWS staff.
- The activity type (Type A), Sydney Water Reference Number (IoT Project Number 20036146) and description of works (Installing IoT overflow devices) should remain the same.

This will be attached to the email to the relevant NPWS office 2 days prior to entering the National Park. If alerted by the NPWS that no work is to be conducted proceed to a new site.

NPWS NOTIFICATION PROFORMA - PROPOSED WORK

Please use one form per proposal

Activity Type: Type A

Sydney Water Reference Number: IoT Project Number 20036146

Park name: ~~Garagal~~ National Park Choose an item.

Dates of proposed work: 09/12/2020

Description of works: Installing IoT overflow devices

Mode of access: by foot

Any notes, include any prior discussions

Click or tap here to enter text.

Type B works only

Likely environmental impacts and mitigations:

Click or tap here to enter text.

Type B must also attach

Duration information ☐ Map showing the location of the activity and access route ☐

AHIMS Map ☐ Threatened Species Map ☐

Map of any sensitive environment, such as EECs, in close proximity ☐

Details of any excavation or vegetation management required to undertake the activity ☐

SW rep name: Adam Wadex Position: Hydrometric Team Leader

Phone: 0417080750 Email: adam.wadex@sydneywater.com.au

National Parks and Wildlife Section

TYPE B or Type A Drone Operations

ENDORSED ☐ NOT ENDORSED ☐ FURTHER INFORMATION REQUIRED ☐

SPECIAL REQUIREMENTS ☐ Notify NPWS Area when entering and exiting the park ☐

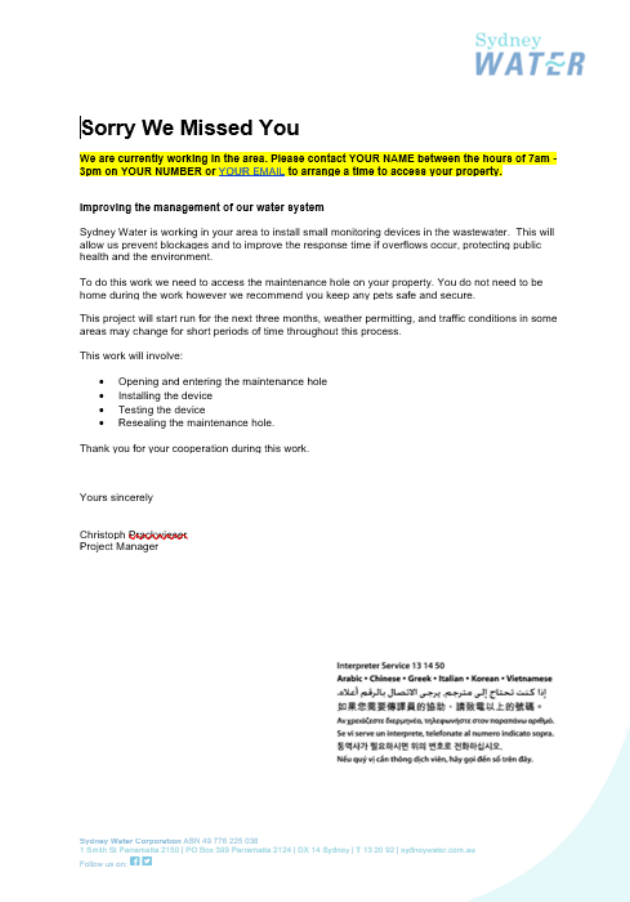
NPWS requirements are:

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NPWS Area Manager (or delegate) (Type B or Type A Drone Operations):

Date: Phone: E-mail:

Task no.	Work instruction details	Visual Guide
	If there is no response or an okay is given, proceed to <i>Task No. 2</i>. Note: After sending the Notification Proforma, save the document in the environmental folder in the catchment database.	
h	Upon arrival at a site that requires customer contact to access a MH, this includes backyards and certain front yards; leave a “<i>We are Working in Your Area</i>” letter in their mailbox. See document LTR 7 day notice - We are working in your area. Note: The letter must be dropped 7 days prior to attempting to install, if the owner offers to install within that time see Task No. 2.	
i	After ~7 days have passed, attempt to contact the property owner via a door knock. If the door is answered and permission to enter the property is granted proceed to <i>Task No. 2</i>. If access to the MH is denied, See <i>Task No. 4</i>. If there is no response proceed to <i>1.j</i>.	

Task no.	Work instruction details	Visual Guide
j	After an unsuccessful attempt contacting the property owner via knocking, drop a “<i>Sorry we Missed You</i>” letter into their mailbox. See document LTR 7 day notice - Sorry we missed you. If the property owner contacts Sydney Water, set a time and date for install; See <i>Task No. 2</i>. If no contact has been received within 7 days, proceed to 1.k. Note: The contact details must be updated and unhighlighted prior to the letter drop.	
k	If no contact has been received from the property owner, contact the customers using the information provided by the Customer Hub. If they respond, set a date for install (See <i>Task No. 2</i>) If there is no response, continue to attempt to contact each customer a total of 3 times before the catchment is closed. Note: If access to the MH is denied or there is no response from multiple attempts at contact, see <i>Task No. 4</i>.	
l	Upon arrival at a site labelled ‘Unique Location’ an onsite assessment needs to be conducted to	

Task no.	Work instruction details	Visual Guide
	determine the specific site procedure and location details. For example, at golf courses, you must speak to the pro shop, and at a hospital it is important to seek consent from reception for certain areas. After deciding the site requirements determine which Task No. (1.c, 1.d, 1.e or 1.f) needs to be followed.	
2.	Device Installation	
a	Upon arrival, a safety assessment (see IoT SWMS) and SHOOTs conversation with all present staff should be conducted to identify risks and implement controls, including gas testing of the MH. Everyone must be aware of possible Total Fire Bans (TOBANS), Environmental Assessments and Traffic Control Plans.	See it? Say it! W Where are we? W What are we doing? W What's the weather like?  STOP S The site is... H The hazards we can see are... O Other people could hurt us by... O Our people could hurt us by... T The tools we need are... S The safety gear we need is...  STOP com What's our communication plan?

Task no.	Work instruction details	Visual Guide
b	Conduct a network coverage test using the Telstra NB-IoT Network test device. The signal strength (RSRP) is measured in decibels per milliwatt (dBm) and is a negative number. If the signal tester connects outside the MH, record the results in the IoT Install Report Form and continue with the installation. If the Telstra NB-IoT Network test device is unable to get a signal, see Task No. 4	
c	Open the MH and gas test. Drill an 8mm hole in solid concrete/brick at a minimum of 100mm from the base of the manhole rim. The location of the 8mm hole will be determined by several factors: - Upstream side of the MH to prevent the float being pulled downstream during surcharge, if possible. - Not in front of a drop-junction or overflow window as this will cause the float to be damaged and potential fouling to occur leading to the alarm being triggered - Not be directly adjacent to the	

Task no.	Work instruction details	Visual Guide
	step irons as this can lead to the float becoming tangled and stuck in the 'alarm' position during internal surcharge events.	
d	Insert an eyebolt into the hole and screw it in the rest of the way using a screwdriver. Best practise is to rotate the eyebolt until tight but also with the eye piece in the horizontal position to allow for ease of attachment of the thimble and device. If required, a hammer can be used to begin to insert the eyebolt and enable the thread to catch once it is turned with the screwdriver.	
e	Hang the NB-IoT Network test device from the eye bolt and then connect to the MQTTTool phone application (See <i>Appendix</i>). Close the MH lid and wait for the signal strength reading to stabilise. Record the Internal signal strength 3 times. If the signal strength inside the MH is higher than -100dBm, install an internal antenna IoT device. If signal is lower than -100dBm install an external antenna IoT device. Note: Internal antennas are also used if the MH is on a driveway, or in	

Task no.	Work instruction details	Visual Guide
	similar area of conflict on a customer's property.	
f	Measure the MH depth with a tape measure, in line with the eyebolt, from the MH rim to the invert of the pipe. Using the known pipe diameter, calculate 100mm above the pipe inlet and determine which float switch will be required for installation (e.g. 2m, 4m, 6m, 10m float lengths). Note: Conduct a test to determine whether the float has the potential to become caught on benches, overflow windows and/or drop junctions.	
g	After confirming the length of float switch, wrap the chosen cable around a thimble, and cable tie tightly to create an anchor point.	
h	Cable tie the float switch to the eyebolt using the thimble and loop any excess lead. If the float switch is not at the right height, remove and redo.	

Task no.	Work instruction details	Visual Guide
i	Prior to placing the device into the MH, plug the float switch into the side of the selected device (internal or external). The connection point will click and lock. If the chosen device is external see <i>Task No. 1.j</i>. Use amalgamation tape to seal the connection point between the float and the device. Note: Avoid placing weight on the anchor point as the spring system can break under pressure. The device can then be secured to the eyebolt.	
j	To install an external antenna, dig out a section of ground next to the MH rim. Using a long 500mm drill bit, aim to avoid the metal rim of MH and drill through the outside of the MH wall through to the inside. Pull antenna lead through the hole and connect it to the device, loop any excess antenna lead and cable tie it to the eyebolt. Use amalgamation tape to seal the connection point between the antenna and the device. Reseal the antenna hole with silicon, mastic or clay and ensure the cable and antenna are reburied. You can now reseal the MH and return it to its previous condition.	

Task no.	Work instruction details	Visual Guide
k	Complete an <i>IoT Install Report</i>, requiring the following information and photos: - Site - Signal Test Results - Technicians Names - Location Co-Ordinates and description - MH Lid type - Device Serial Number - External or Internal - Device, Install, MH and Site Photos - Any other photo that may help with location or special requirements of that site. See <i>Task No. 5.</i> on how and where to save this information.	
3. Device Roadway Installation		
a	Installing an IOT device on a roadway follows the same steps as Device Installation <i>Task No. 2 a. to h.</i> The primary difference begins with the external antenna installation. Using the long 500mm drill bit, drill through the road into the MH. Once a hole has been cleared, a small cavity, slightly larger than the antenna is drilled using a chisel bit.	

Task no.	Work instruction details	Visual Guide
b	Pull antenna lead through the hole and connect it to the device. The antenna should sit snugly in the cavity with enough room to cover with road base.	
c	Cover the antenna and remaining cavity with road base. Using a mallet, compact the road base and smoothen. The surface should be returned to the original condition. Sweep up any remaining debris	
4.	Unable to Install	
a	The site can be identified as 'Unable to Install' if it is: - Inaccessible (go to 4.b), - Unlocatable (go to 4.c), - Requires Civil Work (go to 4.d); or, The Customer is Uncontactable (go to 4.f).	

Task no.	Work instruction details	Visual Guide	
b	A site can be deemed Inaccessible if the Manhole (MH) is: – Too shallow to install (top left image), – Raised (top right image), – Covered (bottom left image), – Buried (bottom right image), – Unable to be opened – Deemed unsafe. If Inaccessible, record details in the <i>IoT Unable to Install Form</i> and see <i>Task No. 5.</i> for further details.	   	
c	A site can be deemed unlocatable if the MH cannot be found or is not in the location specified in the IoT Control Plan. If Unlocatable record details in the IoT Unable to install form and see <i>Task No. 5.</i> for further details.		

Task no.	Work instruction details	Visual Guide
d	If there are issues with the pipe or flow, a site can be deemed to require civil work. This includes – Excessive tree roots (top left image), – Blockages or flowing drop junction (top right image), – Blocked pipe (bottom left image) – Issues with the MH cover (bottom right image) If site Requires Civil Work call 13 20 90 while at the site. You will need to provide fault details, location/address, manhole asset number and your contact details.	
e	After placing the call, record the work order number and await contact on whether the issue is resolved and whether the IoT device can be installed. Record details form and go to <i>Task No. 5</i>.	
f	If a site requires customer contact and contact has not been made after multiple visits, including letter drops, phone calls or if the customer denies entry. Then label the site as 'Unable to Install – Customer Uncontactable' and record the details in the IoT Unable to Install form and go to <i>Task No. 5</i>.	

5. Reporting

Task no. Work instruction details Visual Guide

- a The IoT Control Masterlist, located in the Hydrometrics SharePoint, is required to be updated with any new information gained from visiting the site after an installation. This includes address, directions, location description, depth to invert, etc.

Status	Site #	Date	Commissioning Status	MH asset number	Latitude	Longitude	Address	Suburb	Location Description	Access Instructions
Installed	502433	Commissioned 15/10/20		1031857	-34.0944	151.1124	30 Bruce Ave, Carlingbah South		Frontyard	Located on driveway 8m from the house
Installed	502434	Commissioned 5/2/2021		1026129	-34.0947	151.1172	28 Bruce Ave, Carlingbah South		Backyard	Nth western side of backyard along fence line in line with
Installed	502435	Commissioned 15/10/20		1031861	-34.0912	151.1138	228 Bruce Ave, Carlingbah South		Backyard	Backyard of 228 on the 4th 12m from house under pad
Installed	502436	Commissioned 15/10/20		1031885	-34.0987	151.1143	14 Bruce Ave, Carlingbah South		Backyard	Backyard of 14, Manhole is 40m from house along the r
Installed	502437	Commissioned 5/2/2021		1032005	-34.0578	151.1144	4 Bruce Ave, Carlingbah South		Backyard	Midline of backyard near rear boundary fence
Installed	502438	Commissioned 5/2/2021		1131775	-34.0710	151.1147	52 Crescent Rd, Carlingbah South		On Road	On roadside gutterline in front of 52 Crescent Rd
Not installed	502439			1031737	-34.0673	151.1121	208 Beckton Pl, LRB PBI		Backyard	Midline of backyard approx. 7m from house
Installed	502440	Commissioned 15/10/20		1026109	-34.0626	151.1121	20 24 Beckton Pl, LRB PBI		Backyard	West of backyard along boundary fence
Installed	502441	Commissioned 15/10/20		1026105	-34.0603	151.1124	18 Beckton St, LRB PBI		Backyard	West of backyard right near the rear left corner of the ho
Installed	502442	Commissioned 15/10/20		1031709	-34.0736	151.1125	8 Barrens St, LRB PBI		On Road	Located in middle of road. Requires clear gutter line fo
Not installed	502443			1025941	-34.0717	151.1129	8 Barrens St, LRB PBI		Frontyard	On driveway half way down towards house on 145, Prop
Installed	502444	Wells to be commissioned		1031773	-34.0736	151.1132	7 Barrens St, LRB PBI		Frontyard	Wells in at the rear of 302 LRB Point Rd Located and
Installed	502445	Wells to be commissioned		1031871	-34.0738	151.1133	94 LRB Point Rd, LRB PBI		Backyard	In this section of backyard of 92 LRB Point Rd in gar
Installed	502446	Commissioned 5/2/2021		1026050	-34.0703	151.1135	Koonkan Rd, LRB PBI		Backyard	Nth located in LRB PBI Point Reserve along bottom walk
Installed	502447	Commissioned 5/2/2021		1026050	-34.0703	151.1135	Koonkan Rd, LRB PBI		Backyard	Nth located in LRB PBI Point Reserve along bottom walk
Installed	502448	Commissioned 5/2/2021		1030504	-34.0703	151.1133	Koonkan Rd, LRB PBI		Backyard	Nth located in LRB PBI Point Reserve along bottom walk
Installed	502449	Commissioned 5/2/2021		1030504	-34.0703	151.1133	Koonkan Rd, LRB PBI		Backyard	Nth located in LRB PBI Point Reserve along bottom walk
Installed	502450	Commissioned 15/10/20		8924540	-34.0644	151.1189	154 North East Cres, LRB PBI		Backyard	Down driveway and manhole is in the far rear left hand
Installed	502451	Commissioned 15/10/20		1032531	-34.0877	151.1198	10 North East Cres, LRB PBI		Frontyard	Frontyard of 10 N E Cres near large tree
Installed	502452	Commissioned 15/10/20		1035082	-34.0877	151.1194	10 North East Cres, LRB PBI		Backyard	In steep bushland easement between the houses at 33
Installed	502453	Commissioned 15/10/20		1035086	-34.0877	151.1187	10 North East Cres, LRB PBI		Backyard	Down along gutter line between houses, across throug
Installed	502454	Commissioned 15/10/20		1035288	-34.08574	151.1188	79 Turnell Point Rd, Port Hacking		Nature Strip	Naturestrip in front yard

Note: Access instructions description needs to be less than 90 characters

- b Using individual IoT Install Reports or IoT Unable to Install reports, transfer relevant information to the IoT Control Masterlist. This includes status (Installed, Not Installed, or On Hold) date attended, device type, antenna type, device serial number, signal test results, install/rework status and customer details.

Status	Site #	Date	Device Type	Device No.	Antenna Type	NB-IoT Signal Outside	NB-IoT Signal Inside	CapEx Internal Signal	CapEx Internal Signal	Signal Range/Status	Install/Network Status
Installed	502433	Carlingbah South	15/10/2020	CapEx	746543.74	External					
Installed	502434	Carlingbah South	15/10/2020	CapEx	748980.20	External					
Installed	502435	Carlingbah South	15/10/2020	CapEx	748980.20	External					
Installed	502436	Carlingbah South	23/09/2020	CapEx	748950.52	External					
Installed	502437	Carlingbah South	23/09/2020	CapEx	746188.41	External					
Installed	502438	Carlingbah South	23/09/2020	CapEx	746187.20	External					
Not installed	502439	Carlingbah South		CapEx		External					
Installed	502440	Carlingbah South	15/10/2020	CapEx	748980.20	External					
Installed	502441	Carlingbah South	24/09/2020	CapEx	748981.30	External					
Installed	502442	Carlingbah South	23/09/2020	CapEx	748980.30	External					
Not installed	502443	Carlingbah South	24/09/2020	CapEx		External					
Installed	502444	Carlingbah South	15/10/2020	CapEx	748136.96	External					
Installed	502445	Carlingbah South	15/10/2020	CapEx	748975.20	External					
Installed	502446	Carlingbah South	15/10/2020	CapEx	748171.52	External					
Installed	502447	Carlingbah South	23/09/2020	CapEx	748035.30	External					
Installed	502448	Carlingbah South	23/09/2020	CapEx	764761.18	External					
Installed	502449	Carlingbah South	15/10/2020	CapEx	746347.43	External					
Installed	502450	Carlingbah South	23/09/2020	CapEx	748884.41	External					
Installed	502451	Carlingbah South	15/10/2020	CapEx	748551.74	External					
Installed	502452	Carlingbah South	15/10/2020	CapEx	748975.30	External					
Installed	502453	Carlingbah South	15/10/2020	CapEx	748980.52	External					
Installed	502454	Carlingbah South	14/09/2020	CapEx	748928.18	External					

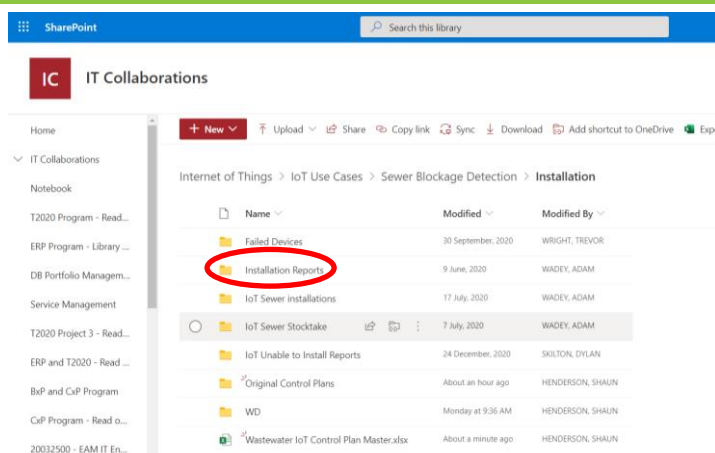
Note: When entering the device number add an apostrophe before the start of the number to ensure the data stays as text in the excel spreadsheet.

- c Save the *IoT Install Reports*, as a pdf, in the 'Install' folder in their specified catchment. The folder can be found in the Dry Weather Surcharge sites catchment directory under Canvas > Install.

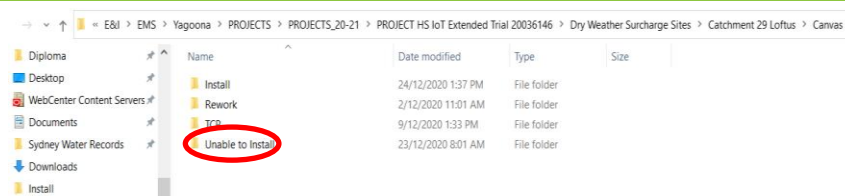
Name	Date modified	Type	Size
Install	24/12/2020 1:37 PM	File folder	
Rework	2/12/2020 11:01 AM	File folder	
TCP	9/12/2020 1:33 PM	File folder	
Unable to Install	23/12/2020 8:01 AM	File folder	

Task no.	Work instruction details	Visual Guide
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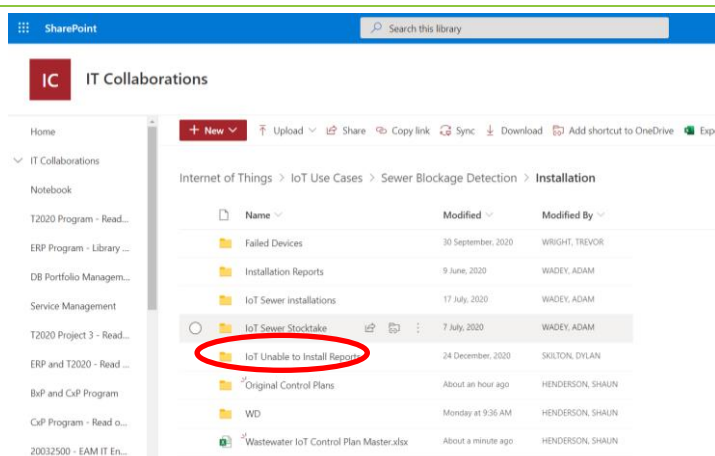
- d Copy the *IoT Install Report* pdf files and save in the IoT SharePoint Installation Reports folder.



- e Save the *IoT Unable to Install Reports*, as a pdf, in the relevant folder labelled 'Unable to Install'. The folder can be found in the Dry Weather Surcharge sites catchment directory under Canvas > Unable to Install.



- f Copy the *IoT Unable to Install Forms* pdf file and save in the IoT SharePoint Unable to Install Reports folder.



3. References

[Enter text]

Document type	Title
Policies	Nil
Procedures	Nil
Forms and checklists	Nil
Other documents or references	BMIS0128.01 NPWS Notification Proforma BMIS0128 NPWS Access Consent and Protocol LTR 7day notice - We are working in your area LTR 7day notice - Sorry we missed you

3.1 Change history

Version	Issue Date	Approved by	Brief description of change and consultation
1	[Choose date]	Chris Harris Hydrometric Services Manager	New document

Task no.	Work Instruction Details	Visual Guide
1	NB-IoT Testing	
a	Connect the device to its battery to view results displayed on an LED screen. The signal strength (RSRP) is measured in decibels per milliwatt (dBm) and is a negative number, if the outside MH test is less than -120 dBm (e.g. -122) then <i>See IoT Unable to Install Work Instruction</i>. If it is greater than or equal to -120 dBm (e.g. -87) record the results in the IoT Install Report Form and continue with the testing.	
b	On the internal LED screen observe the connection of the device to the NB-IoT network following the steps below: 1. Init Modem 2. Activating APN 3. Registered 4. Server Login 5. Getting RSRP 6. RSRP: -xxxdBm Notes: • If the device appears to power off at any step, check battery, unplug and restart. • If there is no signal the device will read as either 'No Network' or it will not get past the 'Activating APN' stage. • The signal device will rarely connect and produce a signal strength reading less than -125dBm • The attached battery can be charged with a mini USB port adjacent to the larger USB port. • A phone application can be used to record the signal strengths detected by the device.	
c	<u>App Setup</u> - For Apple iOS the free application is called MQTTool - The following details must be entered correctly on first use (these details will be saved for future uses): ○ On the 'Connect' tab (bottom), the following details must be filled: • Host: solo-fame.bnr.la • Port: 1883 Clean Session: [On] • Client Id: [leave blank]	

-
- **Username:** simple
 - **Password:** 5ZiwSWeNDnv7 Save
Password: [On]
 - On the 'Subscribe' tab, the following details must also be filled:
 - **Topic:** s/simple/nb_iot_tester2/RSRP
 - **QOS:** [1]

- To begin signal strength recording, First start the signal strength device using above steps.
- In the MQTTTool App, On the 'Connect' tab, underneath where the password is entered, click [Connect]. Ensure the last line shows:
'Status: Connected to solo-fame.bnr.la: 1883'
- On the 'Subscribe' tab. Click [Subscribe] underneath the QOS selection. Ensure the last line shows:
*'Status: Subscribed to:
s/simple/nb_iot_tester2/RSRP'*
- As the signal strength device continuously receives a signal strength it will report this to the app at the top of the Subscribe list

d Record at least 3 signal strength recording when testing after the signal has stabilised

Work Activity: Installation of IoT devices in the Wastewater Network (Sewer Manhole)

SAFE WORK METHOD STATEMENT (SWMS)

Outcome: To ensure that working can be safely carried out whilst investigating/installing IoT devices in the Wastewater Network (sewer manholes).

Purpose: The purpose of this SWMS is to provide staff with controls to ensure that work can be carried out safely when installing and/or investigating an IoT Device.

Document number: D0001913

Date completed: 07/06/2021

Review date: 07/06/2022

Address or catchment of where work is being carried out: _____

- *Trained in Confined Spaces work and current certification in Confined Spaces including current Fitness for Work certification*
- *Current Confined Spaces Evacuation drill*
- *Completed the Electrical Awareness training*
- *Sydney Water General and Customer Delivery Inductions and any other site-specific inductions*
- *A site-specific risk assessment (SHOOTS) is to be performed prior to the commencement of any work, including an emergency evacuation plan discussion*
- *Induction in appropriate documentation e.g. Critical Control Standard (Hazardous Atmosphere Management), D0001771, D0000729 and any other Confined Spaces related documentation*
- *Current Provide First Aid certification*
- *Current FLAG Testing certification*
- *Ensure that Confined Spaces Safety Equipment has been maintained to manufacturers specification and is in date*
- *Prevent contact with contaminated material by wearing required PPE*

Potential High Risks Associated with Task	Equipment Required	Training/Competency Required
Work: ☐ fall from heights ☐ contact with sewage ☐ working in contaminated atmospheres ☐ potential engulfment ☐ manual handling ☐ public interference ☐ vehicles/traffic working on, in or adjacent to a roadway ☐ electrical hazards (If an electrical hazard is present then a separate SWMS for electrical hazards is required) ☐ environmental conditions	<i>Equipment required to complete the activity safely i.e.</i> • Appropriate PPE • Safety cones, fencing/barriers & signage • Gas meter & calibration gases • Mechanical manhole lifter • Confined Spaces entry permit • Site access keys / passes <i>Equipment that maybe required if Risk assessment identifies hazards that require controls i.e.</i> • Tripod, RPD, T-bar, harness, rope bag, lanyard, SSR unit • Boots, waders &/or gum boots as appropriate • Safety manhole grate • Canvas bucket with lid • Blower, fan, fan sock, generator • Helmet	<i>Training/competency required to complete the activity safely i.e.</i> • Sydney Water General & Customer Delivery General Inductions • Any site-specific inductions • Trained in this SWMS, D00001771, D0000729 and Critical Control Standard (Hazardous Atmosphere Management) • Provide First Aid / CPR • FLAG testing • SafeWork NSW (Working on or near roadways) • Current Confined Spaces certification including Fitness for Work health check • Risk Assessment SHOOTS process & Emergency Response Planning
Personal Protective Equipment Required ☐  ☒  ☒  ☒  ☐  ☒  ☒  ☐  ☒  ☐  Other/specific details: —		

WHS or Environmental Legislation

- *Work Health and Safety Act 2011*
- *Work Health and Safety Regulation 2017*

- *Code of Practice: Confined Spaces*
- *Code of Practice: Managing the risk of falls at workplaces*
- *Code of Practice: First Aid in the Workplace*
- *Critical Control Standard (Hazardous Atmosphere Management)*
- *Code of Practice: Hazardous Manual Tasks*

		Rare	Very unlikely	Unlikely	Possible	Likely	Very Likely
		A very distant chance of occurring under exceptional circumstances or <0.4% (less than 1 in 250 chance)	Not expected to occur or 0.4% to 2% (1 in 250 to 1 in 50 chance)	More likely to not occur, surprised if it happens or 2% to 10% (1 in 50 to 1 in 10 chance)	Might occur in some circumstances or 10% to 50% (1 in 10 to 1 in 2 chance)	Will occur in most circumstances or 50% to 90% (1 in 2 to 9/10 chance)	Expected to occur frequently or >90% (greater than 9/10 chance)
Extreme	Multiple Fatalities	Medium 4	High 3	High 2	Very High 1	Very High 1	Very High 1
Critical	Single Fatality	Medium 5	Medium 4	High 3	High 2	Very High 1	Very High 1
Major	Permanent Total Disability/Loss of Capacity	Low 6	Medium 5	Medium 4	High 3	High 2	Very High 1
Moderate	Immediate admission to hospital as an inpatient and/or permanent partial disability/loss of capacity	Low 6	Low 6	Medium 5	Medium 4	High 3	High 2
Minor	Treatment by a registered medical practitioner requiring ongoing treatment with no permanent disability/loss of capacity	Low 6	Low 6	Low 6	Medium 5	Medium 4	High 3
Minimal	Recoverable injury or illness requiring first aid or medical treatment with no follow up required	Low 6	Low 6	Low 6	Low 6	Medium 5	Medium 4

Person/s responsible for ensuring the implementation, monitoring & compliance with the SWMS

Name, Position Title, Date

Signature

Staff acknowledge & understand this SWMS and it controls and will implement these controls

Name:

Signature:

Date:

Name:

Signature:

Date:

Name:

Signature:

Date:

Name:

Signature:

Date:

Work Activity: Installation of IoT devices in the Wastewater Network (Sewer Manhole)

Activity	Hazard	Risk/Consequence	Risk Rating	Controls	Revised Rank
What are the tasks involved?	Identify the hazards that may cause harm to workers or the public.	What can happen? How can it happen?	1-6	Describe what will be done to control the risk. What will you do to make the activity as safe as possible?	1-6
Setting up & packing up equipment Site access	Remote locations	No communications	4	- Carry out a Risk Assessment (SHOOTS) & have an Emergency Response discussion - Have a plan for locating site - Carry TWIG and/or call the Sydney Water 3rd Party Check In Check Out Service (1800 686 565) - Check mobile reception before walking into site - Ensure that there is a method of communication in the event of an emergency/injury - Ensure the Emergency + app is on mobile phone for use in an emergency - Wear appropriate footwear to prevent ankle injury	6
	Manual handling	Sprains & strains	4	- Carry out a Risk Assessment (SHOOTS) & have an Emergency Response discussion - Trained in Manual Handling - Utilise two person lifts, carry small loads or utilise a mechanical device when lifting heavy objects when able - Utilise backpacks for carrying equipment / share loads / rotate tasks - Manage fatigue throughout day	6
	Biological Contamination	Infection/ sickness	4	- Carry out Risk Assessment (SHOOTS) & have an Emergency Response discussion - Staff must follow proper hygiene practices, including washing of hands with approved antiseptic or disinfectant wash after contact with sewage - Wash/clean off equipment that has been in contact with sewage or sludge. Use the pressure cleaner if appropriate - Wear appropriate PPE for the task as a minimum (gloves & eye protection) - All staff required to work with sewage or sewage contaminated equipment must have current inoculation against Hep A & B and Tetanus - Staff must carry or have access to the Safety Data Sheet (SDS) for sewage	6
	UV exposure	Dehydration, fatigue, burns	4	- Carry out Risk Assessment (SHOOTS) & have an Emergency Response discussion - Wear appropriate UV protection (long sleeves and long pants, headwear, sunglasses, sunscreen)	6
	Public	Public safety/Unauthorised access to work area	4	- Carry out a Risk Assessment (SHOOTS) & have an Emergency Response discussion - Erect barriers & signage around work area / access point if required - Utilise variation of hours if work site has high public traffic - Ensure that all visitors to work site are inducted into the work site/task including this SWMS - Consult with asset owner for permission to access site if required - Ensure that the access point is secured whilst carrying out work in the confined space to prevent unauthorised access - Secure access point after completion of work e.g. lock doors, replace manhole covers including bolts etc.	6

Opening manhole lid	Private property	Customer complaints, property damage, hostile pets	4	- Carry out a Risk Assessment (SHOOTS) & have an Emergency Response discussion DO NOT try to enter the property without previously trying to contact the owner DO NOT enter the property if there are pets and the owner is not present to control their pet/pets or make them safe - Perform animal checks by calling out/light rattling of a fence or gate - Handle private property with care and under the guidance of the owner if they are home - Leave work area in the condition you found it	6
	Uneven surfaces / ground	Slip, Trip, Falls	4	- Carry out a Risk Assessment (SHOOTS) & have an Emergency Response discussion - Where possible always access via designated walkways, stairs and bridges. Where it is not possible to use the designated walkways, plan route and identify safe access. - Wear appropriate footwear that is in good condition. - Avoid attending remote sites in wet weather conditions - Use adequate lighting (e.g. Portable flood lights, head lamps) - Maintain good housekeeping around work site	6
	Insects/Spiders/ Snakes	Bites & Stings	4	- Carry out a Risk Assessment (SHOOTS) & have an Emergency Response discussion - Ensure staff have a current "Provide First Aid" certification - Carry a first aid kit and a snake bite kit - Refer to Bites and Stings Australia app for information on appropriate first aid treatment - Apply bug spray (Bushman's with 40% DEET) and wear appropriate PPE (gloves, boots, long pants and long sleeves) - Tuck shirt into pants and pants into socks when accessing sites in bushland - Utilise a tool to remove spider webs & not hands	6
	Manual handling	Sprains & strains	4	- Carry out a Risk Assessment (SHOOTS) & have an Emergency Response discussion - Trained in Manual Handling - Utilise two person lifts or utilise a mechanical device when lifting heavy objects when able - Manage fatigue throughout day	6
	Hazardous/Toxic atmosphere	Explosion, inhalation of toxic gas or oxygen deficient atmosphere	3	- Carry out a Risk Assessment (SHOOTS) & have an Emergency Response discussion - Trained in FLAG gas testing and Confined Spaces gas testing - Staff have a current Confined Spaces Statement of Attainment and Fit for Work health assessment - Ensure gas monitor has passed the daily response check & calibration dates are current prior to use, note bump test results in table attached to this SWMS - Ensure No smoking near access chamber - Gas test around access point prior to opening manhole - Gas test while cracking access entry point, do not open more than 2cm -3cm & sweep/monitor around the access opening - Gas test the full air column/workspace, note results on table attached to this SWMS - Continue constant gas monitoring of the atmosphere while work is being carried out - Don't disturb any rotting organic material/sludge etc. - Respond to any alarm, by closing the manhole, after 5 minutes retest the atmosphere - Follow procedure D0000729 when alarms are encountered - contact your Team Leader/Manager immediately to decide if an incident should be declared and emergency services are needed. Ensure area is kept safe and that you and the public are not at risk of harm	5
	Moving traffic	Collision & injury	3	- Carry out a Risk Assessment (SHOOTS) & have an Emergency Response discussion - Ensure Site has a current Traffic Control Plan (TCP) & that the TCP has been issued for that day if required - Ensure staff have a current "Traffic Controller & "Implement Traffic Control Plans"" certification - Identify an escape route in the event of a vehicle entering your work area - Where appropriate utilise Traffic Control Contractors - Ensure appropriate high visibility reflective PPE is worn - Never work with your back to oncoming traffic - Access tools & equipment from the back or pedestrian side of the vehicle	5

	Fall from Height	Cuts, sprain, strains, bruising or loss of consciousness	3	- Carry out a Risk Assessment (SHOOTS) & have an Emergency Response discussion - Training in Confined Spaces &/or Working at Heights - If accessing a manhole, ensure manhole grate is placed over opening - Utilise Tripods, harnesses, Lanyards etc. as per your Confined Spaces training if appropriate	5
Installation of IoT devices	Fall from Height	Back injuries, cuts, sprain, strains, bruising or loss of consciousness	3	- Carry out a Risk Assessment (SHOOTS) & have an Emergency Response discussion - Training in Confined Spaces &/or Working at Heights - Ensure manhole grate is placed over any opening - Utilise Tripods, harnesses, Lanyards etc. as per your Confined Spaces training if appropriate	5
	Hazardous/Toxic atmosphere	Explosion, inhalation of toxic gas or oxygen deficient atmosphere	3	- Carry out a Risk Assessment (SHOOTS) & have an Emergency Response discussion - Trained in FLAG gas testing and Confined Spaces gas testing - Staff have a current Confined Spaces Statement of Attainment and Fit for Work health assessment - Ensure gas monitor has passed the daily response check & calibration dates are current prior to use. Results noted on table attached to this SWMS - Ensure No smoking near access chamber - Gas test around access point prior to opening manhole - Gas test while cracking access entry point, do not open more than 2cm -3cm & sweep/monitor around the access opening - Gas test the full air column/workspace, note bump test results and Confined Spaces readings on table attached top this SWMS - Continue constant gas monitoring of the atmosphere while work is being carried out - Don't disturb any rotting organic material/sludge etc. - Respond to any alarm, by closing the manhole, after 5 minutes retest the atmosphere - Follow procedure D0000729 when alarms are encountered - contact your Team Leader/Manager immediately to decide if an incident should be declared and emergency services are needed. Ensure area is kept safe and that you and the public are not at risk of harm	5
	Power Tools	Lacerations/cuts bruises/eye injury/strains/sprains	3	- Carry out a Risk Assessment (SHOOTS) & have an Emergency Response discussion - Ensure you have familiarisation with the power tool utilised, only use tools in accordance with the manufacture's manual - Utilise the correct tool for the job at hand - Inspect power tools / tools for damage prior to each uses. Do not use damaged power tools / tools, tag out damaged tools - Ensure the correct PPE is utilised whilst using power tools / tools e.g. goggles, hearing muffs, gloves - Ensure that you maintain a firm grip of tool being used to prevent kick back, dropping tool etc. - Clean all tools after uses & that they are stored correctly in the back of vehicles - Ensure drill bits are sharp & not damaged - Avoid over stretching whilst operating a power tool - Ensure that nothing can catch in moving parts of power tools e.g. clothing, hair, fingers etc. - Only charge batteries in vehicles that have an approved inverter installed	5
	Noise	Hearing loss	3	- Carry out a Risk Assessment (SHOOTS) & have an Emergency Response discussion - Wear hearing protection when operating power tools - Ensure all power tools have not been modified & that all guards etc are in place	5
	Contact with wastewater/sewage	Infection/sickness	4	- Carry out a Risk Assessment (SHOOTS) & have an Emergency Response discussion - Staff must follow proper hygiene practices, including washing of hands with approved antiseptic or disinfectant wash after contact with sewage - Wash/clean off equipment that has been in contact with sewage or sludge. Use the pressure cleaner if appropriate - Wear appropriate PPE for the task as a minimum (gloves & eye protection) - All staff required to work with sewage or sewage contaminated equipment must have current inoculation against Hep A & B and Tetanus	5

				- Staff must carry or have access to the Safety Data Sheet (SDS) for sewage - Sewer contaminated clothing/overalls to be laundered separately to regular clothing when washed	
	Contact with sharps	Needle stick injury	3	- Carry out a Risk Assessment (SHOOTS) & have an Emergency Response discussion - Do not use hands for cleaning tasks such as sensor or debris removal - Wear appropriate gloves whilst working in wastewater systems, do not pick up sharps by hand but utilise an appropriate tool & place any sharp found in "Sharps container"	5
	Hazardous substances or chemicals	Contact with chemical reagents, sewage containing industrial trade waste, or hazardous substances at work sites	3	- Carry out a Risk Assessment (SHOOTS) & have an Emergency Response discussion - Consult Site Risk Assessment if available - Ensure appropriate PPE is utilised	5
	Public	Public safety/Unauthorised access to work area	4	- Carry out a Risk Assessment (SHOOTS) & have an Emergency Response discussion - Erect barriers & signage around work area / access point - Utilise variation of hours if work site has high public traffic - Ensure that all visitors to work site are inducted into the work site/task including this SWMS - Consult with asset owner for permission to access site if required - Ensure that the manhole is secured whilst carrying out work in the confined space to prevent unauthorised access - Secure manhole cover after completion of work including bolts	6
Entry/Exit of Confined Spaces	If entry is required, then utilise Confined Spaces SWMS (D0001824) and Permit (D0001771)				

Add in any notes that are relevant to the SWMS including who has been consulted with to develop this SWMS i.e.

- This SWMS has been developed in consultation with Managers, Team Leaders, Safety & QA Officer, Hydrometric Staff*
- Staff undertaking work on this project are responsible for implementing controls as described and have the required and current competencies and qualifications to undertake this activity*
- Work must be performed in accordance with this SWMS.*
- Staff have access to a copy of this SWMS*
- If new hazards or changes to the above activities/hazards along with controls described in this SWMS are identified, crew must stop work and advise their Manager/Team Leader, they would then decide if the hazard can be controlled or if the job/task is stopped*
- Team Leaders will notify Document Owner to update this SWMS as per comments above*
- This SWMS will be reviewed at regular intervals to ensure information and controls described are current*

Response/Bump Test		Gas Tester Name:			Date:
	Test 1	Test 2	Test 3	Test 4	Test 5
Gas meter serial number:					
O ₂ , CO, H ₂ S, LEL gas bottle serial number:					
VOC gas bottle serial number:					
NH ₃ gas bottle serial number:					
Time of test:					
O ₂	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐
CO	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐
H ₂ S	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐
LEL	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐
VOC	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐
NH ₃ (FLAG, if applicable)	Pass ☐ Fail ☐ NA ☐	Pass ☐ Fail ☐ NA ☐	Pass ☐ Fail ☐ NA ☐	Pass ☐ Fail ☐ NA ☐	Pass ☐ Fail ☐ NA ☐

This SWMS is to be used in conjunction with the Confined Spaces Permit (D0001771) and Hazardous Gas Response Procedure (D0000729)