

Report on Events leading to the Water Quality Incident at Creagh Water Treatment Plant, Gorey, County Wexford

15th June 2022

Report commissioned by Wexford County Council



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1. Outline of Brief and Background

Wexford County Council appointed Aengus Consulting Ltd on 30th September 2021 to examine the events leading to the Water Quality Incident at Creagh Water Treatment Plant, Gorey, Co. Wexford, which occurred over the period 19th to 24th August 2021 inclusive.

The Water Quality Incident arose from a power failure at the plant during the late evening of Thursday 19th August 2021. The chlorine dosing pumps failed as a result of the power outage. The impact of this failure was compounded by human error that allowed water, without the appropriate level of disinfection, to enter the public water supply at Gorey for a period of 4 days from 19th to the 23rd August 2021. Subsequently there were reports of 52 local Gorey residents becoming ill, all of whom attended their GPs, and one who was eventually hospitalised. However, on 2nd November, the HSE clarified that the number of people who fell ill solely from the water incident was in fact 46 as some people had more than one infection.

Following the power failure, a further issue was that some of the automatic alarms activated to a 'low priority setting' and therefore did not issue relevant notice by text to Council staff after the pump failure. The poor water quality in supply only came to light on Thursday 26th August after complaints from Gorey residents to Irish Water which were then passed onto Wexford County Council. As soon as senior staff were aware in Wexford, both the EPA and the HSE were immediately notified by Irish Water and Wexford County Council respectively.

Irish Water released a statement to the Elected Members of Wexford County Council and published the same statement on their website on 2nd September confirming that water quality issues had arisen at the Creagh Water Treatment Plant between 19th August and 24th August but that these had been since resolved and that the water in the Gorey network was 'now satisfactory'. Irish Water also promised, and gave, further updates publicly since then.

There were however significant delays in first detecting the issue by Wexford County Council and subsequent notification to Irish Water that resulted in the late notification to the EPA, HSE and the public. Wexford County Council has accepted and apologised for these failings.

Following a meeting with the Minister for the Department of Housing, Heritage and Local Government, Wexford County Council issued a statement that *'Irish Water and Wexford County Council are reviewing their processes and would like to apologise to customers for the delay in communicating the incident and would like to assure the public all steps are being taken to avoid any recurrence.'*



1.2 Community Health Post Water Quality Incident

Irish Water is responsible for producing a safe and secure supply of drinking water. Wexford County Council, under a Service Level Agreement (SLA) with Irish Water, is tasked with operating the water treatment plants in County Wexford.

During the EPA in-person, on-site, audit of the Creagh WTP on 16th September 2021, the HSE gave an update on the health of the local community in relation to this Water Qualify Incident. The HSE described the scale of the gastrointestinal illness outbreak in Gorey as of 16/09/21. At the time of the audit, a total of 52 infections had been identified. A range of age groups from very young to over age 65 were known to have been affected with no other common risk factor than either resident in Gorey or having consumed water from Gorey Regional Creagh Public Water Supply (PWS) at this time. As previously stated, the HSE clarified on 2nd November that the number of people who fell ill from the water incident was in fact 46.

The following details are extracted from EPA Audit of 07/09/21:

'The HSE confirmed during the audit that the following illnesses had been reported up to close of business Monday 6th of September:

- 18 cases of VTEC- eColi (3 of those are co-infected with campylobacter, 1 is co-infected with rotavirus)
- 1 case of Shingella co-infected with Campylobacter
- 6 cases of Campylobacter

On the 7th of September the HSE reported one of those cases has been hospitalised.

The HSE described the level of cases reported as 'unprecedented' and that there was a probable link to the water supply given the size of the outbreak and compiling food histories for the affected population.'

1.3 Drinking Water Quality - 2019, 2020 & 2021

According to information obtained from Irish Water's website (Table 1 overleaf), the Drinking Water Quality in the Gorey Urban Town Water Supply Zone (WSZ) was in compliance on every test carried out in 2019, 2020 and 2021, prior to this incident. This indicates that the quality of the drinking water in Gorey complies with the acceptance limits as set out in the European Union (Drinking Water) Regulations 2014. Up to the major incident on the 19th of August 2021, there was no other incident recorded by Irish Water of the limits being exceeded from 2019-2021.



	2019		20	20	2021*		
Parameter	Tests undertaken	% of tests within exceedance limit	Tests undertaken	% of tests within exceedance limit	Tests undertaken	% of tests within exceedance limit	
Bacteria & Protozoa	46	100	42	100	25	100	
Chemicals	96	100	96	100	48	100	
Metals	52	100	48	100	28	100	
Other	86	100	72	100	49	100	

Table 1 - Irish Water Quality Testing Results 2019-2021 Gorey Urban Town WSZ

*The dates of these tests are not yet available on the Irish Water website.

1.4 Communications to the Public

The first statement on the incident to the Public was issued by Irish Water on Thursday 2nd September. This Statement was posted on Irish Water's website and was emailed to Elected Members of Wexford County Council on the same date.

The Director of Services for Water and Roads with Wexford County Council reported on the Incident to a full meeting of Wexford County Council on Monday 13th September. This was the first meeting of Wexford County Council post the incident.

A Press release was issued by Wexford County Council on Saturday 18th September which included a sincere apology in relation to the incident.

The Director of Services for Water and Roads was interviewed on South East Radio discussing the incident and made an apology on Monday 20th September.

A Meeting of the Gorey-Kilmuckridge Municipal District was held on Tuesday, 21st of September. It was attended by the Chief Executive, the Director of Services for Roads and Water and the Acting Senior Engineer, with the purpose of delivering an update on the incident.

Irish Water issued two further press releases on the 17th and 18th of September which are available, for viewing, on their website.



2. Description of Creagh Water Treatment Plant

2.1 Treatment Processes at Creagh

The portion of the Gorey Public Water Supply (PWS) that is treated at Creagh Water Treatment Plant (WTP) is supplied from one pumped surface water abstraction point and one gravity fed abstraction point at Kilmichael and Pallis, respectively, on the River Bann. Both sources are mixed coming into the treatment plant. The River Bann rises from the foot of Croghan Mountain on the Wexford/Wicklow border and flows in a south westerly direction past Gorey and Camolin to meet the River Slaney just north of Enniscorthy.

The Creagh plant dates from the original Gorey-Courtown Water Supply Scheme which was constructed in 1938.

Gorey WTP is currently operating at between 1,800 and 2,300m³/day for 24 hours/day and the supply serves a population of 6,815 to 7,459 people in Gorey subject to the interaction between district supply boundaries.

The following treatment is currently in place at the plant:

- pH correction with Caustic Soda (Sodium Hydroxide) updated in 2017
- Coagulation and Flocculation with aluminium sulphate and polyelectrolyte upgraded in 2019 when an automatic coagulation system was commissioned.
- Dissolved Air Flotation Filtration (DAFF)
- Slow Sand Filtration
- Chlorination with Sodium hypochlorite dosing, upgraded from Chlorine Gas in 2015
- Fluoridation

For the purposes of this report the disinfection system and associated monitoring systems are described further below.

The DAFF plant has not been fully serviced since its installation and the sand requires replacement. This work has been highlighted by Wexford County Council since 2015 but funding has not been made available. However the budget has now been assigned by Irish Water for this work.

2.1.1 Disinfection Process

The water is disinfected with sodium hypochlorite prior to entry into supply. The disinfection system was upgraded by Irish Water in 2015 from gas to sodium hypochlorite. The chlorine dosing system operates using a Duty- Standby - Assist pump arrangement. The chlorine residual is monitored using three analysers, Control, Validation 1 and Validation 2. The third pump kicks in, dosing at a fixed rate, if the chlorine control monitor located in the dosing chamber falls below a target dose of 0.7mg/l. The third pump is not linked to the Supervisory Control and Data Acquisition



System (SCADA) onsite which records and monitors the other pumps and associated sampling monitors. At all times, a minimum chlorine residual of 0.1mg/l must be maintained at the end of the drinking water networks.

The National Disinfection Programme (Irish Water) was initiated in 2017 in County Wexford but the processes were not actually completely upgraded at Creagh WTP, the upgrades made since 2017 only included pH and not chlorine. There is no automatic shutdown on the plant in the case of water quality exceedance for turbidity or chlorine. The Creagh WTP is currently under review for upgrade by Irish Water though the Irish Water website states that it is completed as part of the national programme.

The plant has online final water quality monitors for chlorine, turbidity and pH. These results are trended and alarmed on SCADA.





Figure 1 - Creagh Intake





Figure 2 - Creagh Clear Water Reservoir





Figure 3 - Creagh DAFF Plant



2.2 Irish Water Service Level Agreement

Wexford County Council has operated the public water supplies and wastewater treatment in County Wexford under a Service Level Agreement (SLA) with Irish Water since 1st January 2014. The Service Level Agreement operates with a headcount of 71.7 Full Time Equivalent (FTE) staff made up of 56.4 operations staff and 15.3 capital assignments. There are an additional 10 staff assigned to Water Services throughout the District Offices paid through Central Management Charge - this includes district engineers and clerical officers. Over the last 3 years the budget assigned to operations has decreased by 2.3% while headcount has remained the same.

The functions covered under the SLA include water operations, wastewater operations, water compliance, wastewater compliance, water conservation, HSQE (Health, Safety, Quality and Environment), new connections, commercial metering support, water capital and administrative.

SLA meetings are held between Irish Water and Wexford County Council throughout the year. In general the SLA works well and again generally, good service delivery is achieved through this partnership.

The following is an extract from the SLA between Irish Water and Wexford County Council relating to the transformation process which seeks to promote a healthy constructive working relationship.

9.2 Shared Responsibilities

Irish Water and the Local Authority will, complying with their respective obligations under this Agreement, work to deliver the transformation initiatives in the Long Term Service Plan and Annual Service Plan, which include but are not limited to:

9.2.1. - identifying opportunities for investment in assets to improve performance, improvement and innovation of Information and Communications Technology (ICT) to support more efficient use of resources and improved operation of assets;

9.2.2. - collaborative working to realise a Continuous Improvement culture that drives incremental benefits;

9.2.3. - identify and implement opportunities for restructuring and reorganization that may be required to achieve objectives;

9.2.4. - optimise efficiency on a regional basis by sharing services and cross-boundary work;

9.2.5. - procurement related changes;

9.2.6. - customer services initiatives;

9.2.7. - standard operating procedures;

9.2.8. - using peer and international benchmarking to identify areas of potential improvement;

and

9.2.9 - initiatives to maximise regulatory compliance.



2.3 Standard Operating Procedures, issued by Irish Water

Irish Water issued a number of Standard Operating Procedures (SOP's) to Wexford County Council through a general issue of SOPs. However, these were not developed on a site specific basis.

Irish Water's Primary Disinfection SOP is dated August 2019. The SOP should be *'implemented by Plant Operational Staff to ensure that water is wholesome and safe to drink by achieving the Pathogen Compliance Standard, as defined in the Irish Water's Disinfection Strategy and IW-TEC-900-05, Design Specification: Disinfection.' - extracted from the Primary Disinfection SOP. Guidance on the rollout of SOPs was issued by Irish Water in 2020. However, site specific training was impacted by Covid - 19.*

The Roles and Responsibilities of Irish Water and Wexford County Council are set out in the SOP and it is reproduced below in Table 2.

Role	Responsibilities
IW Asset Operations	Ensure the SOP is consistent with IW policy and technical standards
LA Managerial Staff	Ensure the SOP is implemented on site
LA & other Contractual Operational Staff	Carry out the steps in this SOP

Table 2 - Roles and Responsibilities on site as set out in the IW SOP on Disinfection.

The SOP goes on to list the hazards associated with the Disinfection Process, the operational tasks and checks that should be implemented on site, reporting requirements and troubleshooting procedures. Among the checks to be carried out on the disinfection process is the requirement under '6.1 Operational Checks, ID 6.1.4. **Liquid Chlorine** visually check levels in bulk and day tanks and matching SCADA reading if available'.

2.4 Wexford County Council Staffing

Wexford County Council operates 32 public water supply schemes on behalf of Irish Water. This consists of 39 Treatment Plants. In addition to the Irish Water sites, Wexford County Council also operates 49 small public supplies (2-15 house schemes) with no direct funding from Irish Water. The water services for the county are divided into 4 Water Districts as follows:

• Gorey, Enniscorthy, Wexford and New Ross.

Details of the number of outdoor staff, public treatment works, km of water main and the M3 of water produced can be found in Table 3.



District	Drinking Water outdoor staff	No. of public Treatment Plants	Km of Water Main	M ³ Water produced /day (EDEN figures)
Gorey	5	15 (9 plants & 6 borehole schemes)	396	8,834
Enniscorthy	5	13	162	5,534
Wexford	8.5	5	973	19,362
New Ross	6.5	6	384	8,881
Total	25	39	1,915	42,611

Table 3 - Wexford County Council Staffing and Infrastructure

As shown on the attached organogram on Figure 4 there is one duty Caretaker at Water Services Inspector (WSI) level on site, assisted by one to three staff members as required (for cleaning and maintenance duties). The caretaker also has responsibility for the water supply network in Gorey town. The caretaker is trained in Water Treatment Operations to FETAC Level 5 and has operated the Creagh Water Treatment Plant for a number of years.





Figure 4 - Wexford County Council Organogram

*The backfilling process is underway for the vacant SEE position. Interviews are being held in November 2021 and the intention is to have the position filled by the end of 2021.



In light of the complexity of the Creagh Plant in normal times and especially when external factors such as weather extremes and other emergencies occur, we recommend that the permanent staffing level at Creagh now needs review including rostering and relief.

It is our view that a technician with adequate knowledge (Level 6) of the chemical, biological and physical processes is required in a supervisory role (excluding responsibility for the water supply network) to prevent a recurrence of the recent water quality incident at Creagh. Two technicians at this level would be required for the County, one with responsibility for the North of the County and one for the South. Having two staff members at this level would also help with rostering and holiday relief when required.

There is currently one district supervisor at Senior General Services Supervisor (SGSS) level who is responsible for water and wastewater services in both the Enniscorthy and Gorey areas. That particular role, and the skills required to carry it out successfully, also needs to be reviewed in relation to this incident, including rostering and relief.

At the Engineering Level in Wexford County Council, below the Director of Services for Water and Roads, there is an Acting Senior Engineer responsible for both Water Services Capital Projects and Water Services Operations. The Senior Executive Engineer post in Operations is vacant and is in the process of being filled. This has been an issue because instead of two senior engineers at senior or senior executive level, there is in fact only one person fulfilling both roles so the mandated resource is effectively reduced by 50%.

Currently the entire water services in County Wexford is under the technical control of one acting Senior Engineer and one Senior Executive Engineer responsible for capital projects with teams operating below this on various functions. With respect to Gorey and Enniscorthy Municipal District areas, there are two District Engineers and one Senior General Services Supervisor (SGSS) who reports to each of two District Engineers. Each District Engineer has one shared SGSS and a total of 3 Water Services Inspectors (WSI), one each for Gorey, Enniscorthy, Barnadown, Ferns, Bunclody and Vinegar Hill water treatment plants. Three of these plants - Creagh, Bunclody and Vinegar Hill - have full chemical, biological and physical treatment.

Five staff members of Wexford County Council, in the Gorey area, receive the SMS alarms on a cascade system from the SCADA and are required to respond. While there are overtime arrangements in place, an annual average of two alarms per night, 7 nights a week existed prior to August 2021. The system needs to be reviewed in Gorey to ensure that the staff are capable of responding to alarms and that they have clear instructions of when it is their duty.

Having regard to the investigation we have undertaken to determine the events leading up to the water quality incident, it is our professional view that the Creagh site is under-resourced in terms of competent and experienced staff in the complexities of water treatment. On the other hand, it is our view that there is no such competence



deficit with respect to the water pipeline networks all of which appear to be operating with both sufficient knowledge and efficiency. The Employee (WSI) and indeed his Supervisor at Creagh cover both networks and processes and their duties should, in future, be split to take account of the fundamental differing requirements of both.

2.5 Servicing on Site

Both CSL and EMR, two maintenance contractors, have service agreements with Irish Water which were reduced in 2020.

CSL is a service and maintenance provider to the water and wastewater, environmental and industrial sectors. Their services include supply, installation and commissioning, maintenance and routine servicing across all Mechanical, Electrical, Instrumentation and Control and Automation (MEICA) disciplines.

Prior to 2021 CSL were contracted to service the Creagh Water Treatment Plant quarterly and this was reduced by Irish Water to bi-annually during 2020. CSL did however service the plant in April of this year, which was 4.5 months before the water quality incident commencing on 19th August 2021. In line with the previous quarterly maintenance contract, there would have been a scheduled service within the previous two months of the incident. However, this did not happen since the servicing contract was reduced.

Quote (CSL) from February 24th 2021 call out report - 'It is strongly recommended to increase the frequency of service visits per year as minor issues can evolve to more serious during the 6 month service intervals, the condition of the chlorine and caustic dosing pumps serves as a clear example of same.'

EMR Integrated Solutions is a provider of communications, SCADA and instrumentation solutions. They work in industrial sectors as diverse as water, power, utilities, corporate business, broadcasting and public safety organisations.

The contract with SCADA service operators, EMR, was also reduced in the last 2 years by Irish Water. The following were removed from the contract:

- 1st Line Help Desk with 2nd line field support
- Out of Hours Support 24x7x365
- Weekly trend signal validations
- PMI and onsite signal validations
- Service Review Meetings Quarterly

The reduction in maintenance frequency was a contributing factor at the Creagh Plant as the pressure sensors and suctions were damaged on all three chlorine pumps and left staff unaware that the pumps were not pumping chlorine into the water until the sensors were replaced on a maintenance call out on 24th August 2021.



2.6 SCADA Alarm System

The SCADA system alarms at four different levels when particular conditions are not met and sends this information to the WSI Employee and other Council Staff in differing formats, depending on the severity of the event occurring.

The alarm levels are -

- Diagnostic no information sent. Display on SCADA only.
- Low turns red on the alarm screen on the SCADA system and an email issued.
- Medium turns red on the alarm screen on the SCADA system and an email issued. If an alarm occurs between 8am and 5pm an SMS is also sent.
- High turns red on the alarm screen on the SCADA system and an email issued. Irrespective of the hour of the day or night an SMS is also sent.

All high level alarms are issued through SMS messages. If there is a high priority alarm, staff should attend without the need for prior approval. There is a requirement that the WSI Employee responds to alarms out-of-hours or organises his own cover.

Between the 1st of January 2021 and the 30th of September 2021, there were 2,449 SMS alarm events related to Creagh, 469 of which occurred out of hours, which is on average almost 2 alarms per night (from 5.00pm to 8.00am, 7 days per week).

At the time of the incident SCADA alarms were set up to issue to the WSI Employee first, then after 10 minutes to another local WSI, 10 mins later to a 3rd local WSI, then after another 10 mins to the SGSS and then to the District Engineer. The District Engineer and the WSI Employee received the 4th alarm together. The alarm for the same incident was sent 20 times in total over a period of 2 hrs and 40 mins before timing out.

During the incident the District Engineer was on annual leave and while another District Engineer was to oversee his general duties, the alarms were not transferred, nor did the District Engineer have access to read the SCADA system at Creagh remotely.

Since the water quality incident, the alarm levels for the SCADA at Creagh have been reviewed, the staff receiving the alarms have received additional training, and the alarm system reset to appropriate settings.

The following table details the priority settings for all of the alarms on site at the Creagh WTP before the Water Quality Incident and to what values, since the incident, they were reset to.



Settings Prior to the 26th August			Current Settings				
Alarm	Priority	OnDelay	Setpoint	Alarm	Priority	OnDelay	Setpoint
Creagh WTP Chlorine Lo Lo Alarm	2	60	1.00	Creagh WTP Chlorine Lo Lo Alarm	3	60	1.00
Creagh WTP Clear Water Tank Low Alarm	2	1200	2.40	Creagh WTP Clear Water Tank Low Alarm	3	120	2.00
Creagh WTP Clear Water Tank Turbidity High	3	12	0.25	Creagh WTP Clear Water Tank Turbidity High	3	120	0.25
Creagh WTP DAF Plant Turbidity Alarm	3	9900	0.40	Creagh WTP DAFF plant outlet turbidity high	3	900	0.20
-	-	-	-	Creagh WTP DAFF plant outlet turbidity High High	3	900	0.25
Creagh WTP Filter 1 Turbidity High	2	1800	0.25	Creagh WTP Filter 1 Turbidity High	3	900	0.25
Creagh WTP Filter 1 Turbidity High High	3	900	0.80	Creagh WTP Filter 1 Turbidity High High	3	120	0.50
Creagh WTP Filter 2 Turbidity High	2	1800	0.25	Creagh WTP Filter 2 Turbidity High	3	900	0.25
Creagh WTP Filter 2 Turbidity High High	3	900	0.80	Creagh WTP Filter 2 Turbidity High High	3	120	0.50
Creagh WTP Filter 3 Turbidity High	2	1800	0.25	Creagh WTP Filter 3 Turbidity High	3	900	0.25
Creagh WTP Filter 3 Turbidity High High	3	900	0.80	Creagh WTP Filter 3 Turbidity High High	3	120	0.50
Creagh WTP Filter 4 Turbidity High	2	1800	0.25	Creagh WTP Filter 4 Turbidity High	3	900	0.25
Creagh WTP Filter 4 Turbidity High High	3	900	0.80	Creagh WTP Filter 4 Turbidity High High	3	120	0.50
Creagh WTP Filter 5 Turbidity High	2	1800	0.25	Creagh WTP Filter 5 Turbidity High	3	900	0.25
Creagh WTP Filter 5 Turbidity High High	3	900	0.80	Creagh WTP Filter 5 Turbidity High High	3	120	0.50
Creagh WTP Filter 6 Turbidity High	0	1800	0.25	Creagh WTP Filter 6 Turbidity High	3	900	0.25
Creagh WTP Filter 6 Turbidity High High	0	900	0.80	Creagh WTP Filter 6 Turbidity High High	3	120	0.50
Creagh WTP Filter 7 Turbidity High	2	1800	0.25	Creagh WTP Filter 7 Turbidity High	3	900	0.25
Creagh WTP Filter 7 Turbidity High High	3	900	0.80	Creagh WTP Filter 7 Turbidity High High	3	120	0.50
Creagh WTP Filter 8 Turbidity High	2	1800	0.25	Creagh WTP Filter 8 Turbidity High	3	900	0.25
Creagh WTP Filter 8 Turbidity High High	2	900	0.80	Creagh WTP Filter 8 Turbidity High High	3	120	0.50
Creagh WTP Filter 9 Turbidity High	2	1800	0.25	Creagh WTP Filter 9 Turbidity High	3	900	0.25
Creagh WTP Filter 9 Turbidity High High	3	900	0.80	Creagh WTP Filter 9 Turbidity High High	3	120	0.50
-	-	-	-	Creagh WTP Low Chlorine Residual Alarm	3	120	0.70
Creagh WTP Validation 1 Chlorine Residual High	3	1200	1.00	Creagh WTP Validation 1 Chlorine Residual High	3	1200	1.40
Creagh WTP Validation 1 Chlorine Residual High High	3	1200	1.30	Creagh WTP Validation 1 Chlorine Residual High High	3	1200	1.50
Creagh WTP Validation 1 Chlorine Residual Low	1	1200	0.40	Creagh WTP Validation 1 Chlorine Residual Low	3	120	1.05
Creagh WTP Validation 1 Chlorine Residual Low Low	1	1200	0.30	Creagh WTP Validation 1 Chlorine Residual Low Low	3	120	1.00
Creagh WTP Validation 2 Chlorine Residual High	2	1200	1.00	Creagh WTP Validation 2 Chlorine Residual High	3	1200	1.40
Creagh WTP Validation 2 Chlorine Residual High High	3	1200	1.30	Creagh WTP Validation 2 Chlorine Residual High High	3	1200	1.50
Creagh WTP Validation 2 Chlorine Residual Low	1	300	0.40	Creagh WTP Validation 2 Chlorine Residual Low	3	120	1.05
Creagh WTP Validation 2 Chlorine Residual Low Low	1	1200	0.30	Creagh WTP Validation 2 Chlorine Residual Low Low	3	120	1.00

Table 4 - Alarm settings before the Incident and currently

Any instrument reading in alarm mode would have shown up flashing red on the SCADA alarm page.

Filter by Site	Creagh	Date Range	۹ 🔍			18/08/21 - 23/08	/21	۹, ۱
		Selection	4 Aug 9 Aug	14 Aug 19 Aug	24 Aug 29 Aug	3 Sep 8 Sep	13 Sep 18 Sep 23 Sep	28 Sep 3 Oct 8 Oct
Event Time	Name	Display Path	Priority	Event State	Ack'ed By	Event Value	Current State	Label
22/08/21 01:00	Creagh WTP Filter 6 Turbidity High High	Creagh	Diagnostic	Active		0.8044	Active, Unacknowledged	Creagh WTP Filter 6 Tur
21/08/21 22:32	Creagh WTP Filter 6 Turbidity High	Creagh	Diagnostic	Active		0.2543	Active, Unacknowledged	Creagh WTP Filter 6 Tur
21/08/21 18:38	Creagh WTP DAF Plant Turbidity Alarm	Creagh	High	Active		0.4331	Active, Unacknowledged	Creagh WTP DAF Plant T
21/08/21 10:09	Creagh WTP Filter 6 Turbidity High	Creagh	Diagnostic	Clear	Auto-Ack	0.2225	Cleared, Acknowledged	Creagh WTP Filter 6 Turbi
21/08/21 10:03	Creagh WTP Filter 6 Turbidity High	Creagh	Diagnostic	Active		0.2567	Active, Unacknowledged	Creagh WTP Filter 6 Tur
21/08/21 06:32	Creagh WTP Clear Water Tank Low Alarm	Creagh	Medium	Clear	Auto-Ack	2.4021	Cleared, Acknowledged	Creagh WTP Clear Water
20/08/21 22:36	Creagh WTP Clear Water Tank Low Low Alarm	Creagh	High	Clear	Auto-Ack	2.003	Cleared, Acknowledged	Creagh WTP Clear Water
20/08/21 20:29	Creagh WTP Filter 6 Turbidity High	Creagh	Diagnostic	Clear	Auto-Ack	0.2396	Cleared, Acknowledged	Creagh WTP Filter 6 Turbi
20/08/21 20:28	Creagh WTP Filter 6 Turbidity High	Creagh	Diagnostic	Active		0.2616	Active, Unacknowledged	Creagh WTP Filter 6 Tur
20/08/21 17:57	Creagh WTP Filter 6 Turbidity High	Creagh	Diagnostic	Clear	Auto-Ack	0.2421	Cleared, Acknowledged	Creagh WTP Filter 6 Turbi
20/08/21 17:46	Creagh WTP Filter 6 Turbidity High	Creagh	Diagnostic	Active		0.2567	Active, Unacknowledged	Creagh WTP Filter 6 Tur
20/08/21 12:30	Creagh WTP Clear Water Tank Low Low Alarm	Creagh	High	Active		1.991	Active, Unacknowledged	Creagh WTP Clear Wate
19/08/21 22:26	Creagh WTP Validation 1 Chlorine Residual Low	Creagh	Low	Active		0.001	Active, Unacknowledged	Creagh WTP Validation
23/08/21 23:31	Creagh Kilmichael PS Outflow Low Flow Alarm	Creagh	Medium	Clear		30.0781	Cleared, Unacknowledged	Creagh Kilmichael PS Outf
23/08/21 23:01	Creagh Kilmichael PS Outflow Low Flow Alarm	Creagh	Medium	Active		29.7031	Active, Unacknowledged	Creagh Kilmichael PS O
23/08/21 23:01	Creagh Kilmichael PS Outflow Low Flow Alarm	Creagh	Medium	Ack	Live Event Limit		Cleared, Acknowledged	Creagh Kilmichael PS Outf
23/08/21 22:04	Creagh Kilmichael PS Outflow Low Flow Alarm	Creagh	Medium	Clear		30.5469	Cleared, Unacknowledged	Creagh Kilmichael PS Outf
23/08/21 22:02	Creagh Kilmichael PS Outflow Low Flow Alarm	Creagh	Medium	Active		29.6875	Active, Unacknowledged	Creagh Kilmichael PS O
23/08/21 22:02	Creagh Kilmichael PS Outflow Low Flow Alarm	Creagh	Medium	Ack	Live Event Limit		Cleared, Acknowledged	Creagh Kilmichael PS Outf.
23/08/21 21:37	Creagh Kilmichael PS Outflow Low Flow Alarm	Creagh	Medium	Clear		30.3047	Cleared, Unacknowledged	Creagh Kilmichael PS Outf.
23/08/21 20:43	Creagh Kilmichael PS Outflow Low Flow Alarm	Creagh	Medium	Active		29.4844	Active, Unacknowledged	Creagh Kilmichael PS O
23/08/21 20:43	Creagh Kilmichael PS Outflow Low Flow Alarm	Creagh	Medium	Ack	Live Event Limit		Cleared, Acknowledged	Creagh Kilmichael PS Outf
23/08/21 18:44	Creagh Kilmichael PS Outflow Low Flow Alarm	Creagh	Medium	Clear		30.0625	Cleared, Unacknowledged	Creagh Kilmichael PS Outf.
23/08/21 18:43	Creagh Kilmichael PS Outflow Low Flow Alarm	Creagh	Medium	Active		29.8906	Active, Unacknowledged	Creagh Kilmichael PS O
23/08/21 18:43	Creagh Kilmichael PS Outflow Low Flow Alarm	Creagh	Medium	Ack	Live Event Limit		Cleared, Acknowledged	Creagh Kilmichael PS Outf
23/08/21 18:12	Creagh Kilmichael PS Outflow Low Flow Alarm	Creagh	Medium	Clear		30.4375	Cleared, Unacknowledged	Creagh Kilmichael PS Outf.
23/08/21 18:09	Creagh Kilmichael PS Outflow Low Flow Alarm	Creagh	Medium	Active		29.6094	Active, Unacknowledged	Creagh Kilmichael PS O
23/08/21 18:09	Creagh Kilmichael PS Outflow Low Flow Alarm	Creagh	Medium	Ack	Live Event Limit		Cleared, Acknowledged	Creagh Kilmichael PS Outf
23/08/21 17:42	Creagh WTP Filter 9 Turbidity High High	Creagh	High	Clear	Auto-Ack	0.7971	Cleared, Acknowledged	Creagh WTP Filter 9 Turbi
23/08/21 17:42	Creagh WTP Filter 8 Turbidity High High	Creagh	Medium	Clear	Auto-Ack	0.7946	Cleared, Acknowledged	Creagh WTP Filter 8 Turbi
22/09/21 17:25	Creach WTP Filter 6 Turbidity High	Creach	Diagnostic	Clear	Auto-Ack	0 2372	Cleared Acknowledged	Creach WTP Filter 6 Turbi

Figure 5 - SCADA alarm page example



3. Incident Outline and Sequence of Events

3.1 Thursday - 19th August 2021

3.1.1 Thursday 19th August, Daily Records & Actions on Site

The WSI Employee was on site at the Creagh Plant.

The Daily Record sheet was completed by the Employee at 9.00am on Thursday, 19th of August. The final water quality results were all within the relevant acceptable ranges.

Parameter	Required Values at Plant	Actual Values on 19/8/21
рН	>6.2, <6.5	6.5
Turbidity	<0.4	0.02
Total Residual Chlorine Monitor	>0.7mg/l	0.72
Free Residual Chlorine monitor	>0.85 mg/l (Irish Water calculation)	1.14

Table 5 - Daily Records 19/8/21

At this time there were no water quality issues detected at the plant.

3.1.2 Thursday 19th August, SCADA Readout

The readout from the SCADA system displays a 48hr period from 00.01 on the 19th of August through to 23.59 on 20th of August. It shows that a significant event occurred between 20.00 and 20.30 on the evening of Thursday 19th August. In addition to a number of 'Battery faults' and 'Mains Fails' registered in the SCADA system from associated offsite locations at approximately this time, and the monitors for turbidity and chlorine drop to zero for a period of approximately 30 mins, it can be concluded that there was a power failure at Creagh WTP on that evening.

Later that evening, from approximately 22.30 to midnight, chlorine was detected by the residual analyser, albeit at a very low level of approximately 0.05mg/l which may reflect an analyser problem. To ensure adequate disinfection, this value should not fall below 0.7mg/l at the plant. Chlorine Validation 1 and Chlorine Validation 2 monitors, which sit at the outlet of Clear Water Tank 1 were reading zero, indicating that they were not recording any chlorine being present in the water passing through to supply. The low level reading of Chlorine in the dosing chamber, could be attributed to the third chlorine pump kicking in but its pumping activity is not recorded on the SCADA system.



3.1.3 Thursday 19th August, SCADA Alarms

As detailed in section 2.6, High Level Alarms are issued by SMS to the WSI Employee, plus four additional individuals if not acknowledged by the WSI Employee. Medium Level alarms are issued by SMS if they occur between the hours of 08.00am and 17.00pm and are not issued outside of these normal working hours, the alarm is sent by email. Low level alarms can only be read by email or on the SCADA system, no SMS is issued.

On Thursday, 19th of August, after 17.51pm, when the first indication of a power outage was detected in the SCADA (Mains Fails in Brooklyn Court, Ballymoney, and Kilmichael), a number of important alarms were issued. These are detailed in Table 6.

It should be noted again here that many of the alarms were set at inappropriate levels on the 19th of August, 2021. These alarm levels for each parameter have since been examined and where required, rectified in conjunction with Irish Water. A list of these changes is located within section 2.6.

There were seven high level alarms at locations other than Creagh issued by SMS on Thursday evening, 19th August, in relation to mains fails and battery backups, at a number of locations routed through the Creagh SCADA system. At the same time there was no SCADA alarm set up to report a Mains Fail specifically at the Creagh WTP and no backup generator was installed on site. Therefore the loss of power on site on the evening of the 19th of August went unnoticed.

In addition to the failure to notice the loss of power, the majority of the alarms listed in Table 6 should have been set to 'High' and therefore issue an SMS message to the WSI Employee. The alarms that would have been particularly important were in relation to the residual chlorine levels in the Clear Water Tank which would have informed him immediately that the water entering the supply network contained insufficient chlorine, to which he should have responded immediately. One alarm was issued by SMS at 20:26 in relation to a high residual chlorine.

There is no automatic shutdown on the Creagh WTP for such incidents.





Figure 6 - SCADA readout 19/8/21



Date - time of Event	Alarm	Priority
8/19/21 22:26	Creagh WTP Validation 1 Chlorine Residual Low Low	Low
8/19/21 22:26	Creagh WTP Validation 1 Chlorine Residual Low	Low
8/19/21 22:21	Creagh WTP Validation 2 Chlorine Residual Low Low	Low
8/19/21 22:06	Creagh WTP Validation 2 Chlorine Residual Low	Low
8/19/21 21:50	Creagh WTP Validation 1 Chlorine Residual Low Low	Low
8/19/21 21:50	Creagh WTP Validation 1 Chlorine Residual Low	Low
8/19/21 21:50	Creagh WTP Validation 2 Chlorine Residual Low Low	Low
8/19/21 21:50	Creagh WTP Validation 2 Chlorine Residual Low	Low
8/19/21 21:38	Creagh WTP Filter 7 Turbidity High	Medium
8/19/21 21:36	Creagh WTP Filter 7 Turbidity High	Medium
8/19/21 21:28	Creagh WTP Clear Water Tank Low Alarm	Medium
8/19/21 21:03	Creagh Kilmichael Intake Mains Fail	High*
8/19/21 21:03	Creagh Kilmichael PS Outflow Low Flow Alarm	Medium*
8/19/21 21:02	Creagh WTP RTU Battery Supply Mode	Medium
8/19/21 21:02	Creagh WTP Chlorine PLC Alarm	Medium
8/19/21 20:46	Creagh WTP Validation 1 Chlorine Residual Low Low	Low
8/19/21 20:46	Creagh WTP Validation 1 Chlorine Residual Low	Low
8/19/21 20:46	Creagh WTP Validation 2 Chlorine Residual Low Low	Low
8/19/21 20:31	Creagh WTP Validation 2 Chlorine Residual Low	Low
8/19/21 20:27	Creagh WTP Chlorine PLC Alarm	Medium
8/19/21 20:26	Creagh WTP Validation 1 Chlorine Residual High	High
8/19/21 20:26	Creagh WTP Validation 2 Chlorine Residual High	Medium
8/19/21 20:26	Creagh Kilmichael Intake Mains Fail	High*
8/19/21 20:26	Creagh WTP RTU Battery Supply Mode	Medium

Table 6 - Alarms issued on 19/08/21

* Located at Kilmichael Lower, not at the Creagh WTP



3.2 Friday - 20th August, 2021

There was heavy and consistent rainfall from approximately 1.00pm on Friday, 20th August through the late evening. This would be expected to affect water quality of the intake from the River Bann, especially with regard to turbidity (suspended solids).

3.2.1 Friday 20th August, Daily Records & Actions on Site

The WSI Employee was on site at the Creagh plant.

The Daily Record sheet was completed by the WSI Employee at 11.00am on the 20th of August. The Final Water Quality results that were recorded on the sheet were within the acceptable range, however a number of important boxes on the sheet were left blank, including:

- Total Residual Chlorine Monitor
- Free Residual Chlorine Monitor
- Chlorine dosing rate on pump
- Pump in use

The WSI Employee was asked why these values were not recorded. The WSI Employee was unable to explain why.

Parameter	Required Values at Plant	Actual Values on 20/8/21
рН	>6.2, <6.5	6.35
Turbidity	<0.4	0.02
Total Residual Chlorine Monitor	>0.7mg/l	Left blank on daily log sheet
Free Residual Chlorine monitor	>0.85 mg/l (Irish Water calculation)	Left blank on daily log sheet



3.2.2 Friday 20th August, SCADA Readout

According to the SCADA records (contained within Section 3.1.2), the Chlorine dosing continued to be insufficient throughout the 20th with the residual value being maintained at 0.05mg/l approximately. Again this may reflect a problem with the analyser as on the previous day. Turbidity can be noted as increasing during the day.



3.2.3 Friday 20th August, SCADA Alarms

The following relevant alarms were issued on Friday the 20th.

Date - time of Event	Alarm	Priority
8/20/21 22:36	Creagh WTP Clear Water Tank Low Low Alarm	High
8/20/21 12:30	Creagh WTP Clear Water Tank Low Low Alarm	High

Table 8 - Alarms issued on 20/08/21

It is evident on the SCADA readout that throughout Friday 20th, the residual chlorine levels of the water entering the distribution system contains insufficient chlorine, however no alarms were issued by the SCADA system on the 20th because the alarms issued on the 19th were not acknowledged and subsequently timed out. It is noted that these alarms were set at a low priority level and thus no SMS issued.

3.3 Saturday - 21st August

There was heavy and consistent rainfall from approximately 1.00pm on Friday 20th, until approximately 22.30pm on Saturday 21st. The following records are from a weather station in Clonganny (17km to the south east of Creagh ETP).

Heavy rainfall over the weekend of the 21st August resulted in a deterioration of the water quality of the River Bann, which supplies the Gorey Regional Creagh PWS.



Figure 7 - Rainfall accumulation for Clonganny weather station



3.3.1 Saturday 21st August, Daily Records & Actions on Site

The WSI Employee was on site at Creagh Water Treatment Plant.

No daily record was completed at the site on Saturday 21st by the WSI Employee. The WSI Employee visited, and is required to visit the site for 2hrs on Saturdays and Sundays and it is requisite planned overtime. The WSI Employee was there, did walk around the site, and did not notice anything unusual. In addition to acknowledging the alarms and reading the SCADA output, the WSI Employee should have noticed that the day storage tank should be visibly dropping if the chlorine dosing was being injected into the clear water tank, while a full day tank would indicate that there was no chlorine liquid being added to the water leaving the plant.

This failure to notice that the chlorine day tank was not dropping day to day is in contravention of the Irish Water Standard Operating Procedure (SOP) which requires the WSI Employee to carry out visible checks on day tanks as it provides a fail safe especially when the monitoring equipment is not functioning properly. This good practice would also be addressed by operator FETAC training.

3.3.2 Saturday 21st August, SCADA Readout

From the SCADA display, reproduced on Figure 8 overleaf, it can be seen that the DAFF Turbidity readings increased and topped out at 2 NTU during the late evening of Saturday, the 21st August. During this time SMS alarms were sent to five staff members of WCC as detailed in Section 3.3.3. The alarms were not acknowledged nor attended to.

The alarm limit for DAFF Plant Turbidity was set at 0.4 NTU and has been reset to 0.3 NTU since the incident. From the SCADA the 0.4 NTU level would have been exceeded during Saturday afternoon, 21st August, which would be consistent with the almost continuous rainfall over the previous 24hrs. The coagulation system does not appear to have adjusted correctly to deal with the change in raw water turbidity measured at the intake. The rising turbidity within the DAFF ultimately resulted in the turbidity measurements in the filtered water rising above 1 NTU which issued further alarms that evening. However these were set at 'Medium' level or lower and thus no SMS text messages were sent.

It should be noted that water produced by the DAFF is further filtered by the slow sand filters before entering the clear water tank and into water supply distribution.





Figure 8 - SCADA readout for 21/08/21



3.3.3 Saturday 21st August, SCADA Alarms

The following alarms were issued by the SCADA system on Saturday, 21st.

Date - time of Event	Alarm	Priority
8/21/21 18:38	Creagh WTP DAF Plant Turbidity Alarm	High
8/21/21 6:32	Creagh WTP Clear Water Tank Low Alarm	Medium

Table 9 - Alarms issued on the 21/08/21

It can be seen from the SCADA readout that the time when the DAFF Turbidity trend went over the set value of 0.4NTU corresponds to the time of the alarm. There was heavy and continuous rainfall since the previous evening and the resulting turbidity in the river intake is assumed to be the main cause of this steep rise in turbidity.

This alarm was issued by SMS to five staff members of Wexford County Council but was not acknowledged or responded to and thus timed out.

3.4 Sunday - 22nd August

There was insignificant rainfall on Sunday the 22nd August but the intake would have still recorded increased turbidity because of the previous day's rainfall. See SCADA output, Section 3.4.2.

3.4.1 Sunday 22nd August, Daily Records & Actions on Site

THe WSI Employee was on site at the Creagh plant.

The Daily Record sheet was completed by the WSI Employee at 12.00 noon on the 22nd of August. They were as follows:

Parameter	Required Values at Plant	Actual Values on 22/8/21
рН	>6.2, <6.5	6.4
Turbidity (NTU)	<0.4	0.05
Total Residual Chlorine Monitor (mg/l)	>0.7mg/l	0.06
Free Residual Chlorine monitor (mg/l)	>0.85 mg/l (Irish Water calculation)	0.05

Table 10 - Daily records 21/8/21

The WSI Employee realised Chlorine was low but assumed it was an issue with the sampling pump because it did not appear to be working. The WSI Employee activated the sampling pump, which brings a sample to the chlorine analyser (CL17) but it kept



losing its prime and observed that pump 3 was working and assumed that it was dosing sufficient chlorine. However, it was subsequently noticed on the 24th (during a visit by CSL) that the suction line on pump 3 was cracked and therefore unlikely to have been dosing chlorine correctly.

It can be seen from a SCADA trend that just after 11.00am on the morning of Sunday, the 22nd August, chlorine pumps 1 and 2 were reactivated. However they could not operate as intended, and could not raise the chlorine level sufficiently because of damaged parts. The pressure sensors on the sample pumps were also subsequently discovered to be damaged on the 24th, so pump 1 and 2 cycled on and off repeatedly without dosing sufficient chlorine.



Figure 9 - Pump activity - 19th - 24th August

3.4.2 Sunday 22nd August, SCADA Readout

The SCADA readout for the 22nd shows that the Chlorine Residual control monitor did register a change after the WSI Employee made a change to the sample pump. The residual level of Chlorine rose from 0.05mg/l to 0.1mg/l and maintained this approximate new level for another 24 hours. The residual level of Chlorine should be 0.7mg/l at a minimum to ensure proper disinfection occurs.

Best practice would suggest and the Irish Water Standard Operating Procedures (SOP) on Disinfection specifically require that, for example, in the event of low chlorine residual readings from an analyser, that an in situ sample of treated water should be taken from the clean water tank and tested to ensure that the finished water had sufficient chlorine residual. This was not done by the WSI Employee nor was the chlorine dosing pump failure 'escalated to Supervisor' as required by the Irish Water SOP ID 6.3.3. Corrective Action.



Turbidity readings topped out at 2 NTU on the DAFF for almost the entire 24 hours of Sunday 22nd and increased above 1 NTU on some filters so therefore were not in compliance as turbidity should not exceed 1NTU for water going into supply.

3.4.3 Sunday 22nd August, SCADA Alarms

These are the relevant alarms that issued on Sunday 22nd of August. They would have been issued by SMS, apart from the 4.09am alarm, to five staff members of Wexford County Council.

Date - time of Event	Alarm	Priority
8/22/21 20:42	Creagh WTP Clear Water Tank Low Low Alarm	High
8/22/21 15:14	Creagh WTP Clear Water Tank Low Alarm	Medium
8/22/21 12:05	Creagh WTP Filter 9 Turbidity High High	High
8/22/21 10:15	Creagh WTP Filter 7 Turbidity High	Medium
8/22/21 9:50	Creagh WTP Filter 8 Turbidity High High	Medium
8/22/21 8:55	Creagh WTP Filter 9 Turbidity High	Medium
8/22/21 4:09	Creagh WTP Filter 8 Turbidity High	Medium

Table 11 - Alarms issued by SCADA 22/08/21

Since the Water Quality Incident, all of the above alarms are set at 'high priority'.

The rise in turbidity through the plant is evident in the SCADA trend and in the alarms. The turbidity levels in the DAFF plant activated an alarm on the 21st August followed by the turbidity levels in the filter beds on the 22nd August.

These alarms were not acknowledged and timed out. The WSI Employee advised that the high turbidity on the DAFF was interpreted as a backwash matter and thus was not an issue.





Figure 10 - SCADA readout for 22/8/21



3.5 Monday - August 23rd

3.5.1 Monday 23rd, Daily Records & Actions on Site

The WSI Employee was on site at the Creagh Water Treatment Plant.

The Daily Record sheet was completed by the WSI Employee at 8.00am on Monday, 23rd August. The results recorded were as follows:

Parameter	Required Values at Plant	Actual Values on 23/8/21
рН	>6.2, <6.5	6.5
Turbidity (NTU)	<0.4	0.05
Total Residual Chlorine Monitor (mg/l)	>0.7mg/l	0.08
Free Residual Chlorine monitor (mg/l)	>0.85 mg/l	0.00

Table 12 - Daily Records for 23/8/21

According to the WSI Employee, he realised that his assumption, made the previous day, that the sampling pump was not working correctly, was misguided. It was working correctly and furthermore had to be assumed to be recording real values. Chlorine pump 3 was put into manual to raise the residual chlorine level to >0.5mg/l. The WSI Employee also noticed that an outlet valve on the DAFF was stuck open.

The WSI Employee has stated that the issue with the DAFF valve and the chlorine pumps was escalated by him to the Area Supervisor (SGSS). The WSI Employee also requested CSL to visit which did not happen until the following day. CSL has advised that they were contacted in relation to the DAFF valve issue.

This was also the date when the first illness complaint from Gorey was made to Irish Water from a resident in Ardmore Estate. This was then passed to Wexford County Council who visited the resident and scoured the water main outside the property to a nearby road gully and took a water sample which registered 0.34mg/l residual chlorine which was considered adequate. Two days later on the 25th August, another sample was taken at the same property which registered 0.57mg/l which was also satisfactory. In addition, a bacteriological sample was also taken and tested for compliance at this location which confirmed that the water leaving the plant was safe to drink. During this time also, planned pipe repairs were ongoing in Gorey town which was a further draw on resources and led to non-illness water quality complaints from some residents, which required investigation.



3.5.2 Monday 23rd August, SCADA Readout

The SCADA readout for the 23rd August shows that the Turbidity readings begin to drop from approximately 10.30am that morning and return to near, or nearly within, acceptable limits of 0.4 NTU. Residual and free chlorine begin to come into compliance during the day also.

From the SCADA trend in Figure 9 it can be seen that at approximately 3pm on Monday the 23rd, chlorine pumps 1 and 2 (though in need of more regular maintenance) are switched to operate manually and the chlorine level begins to rise and reach acceptable levels.





Figure 11 - SCADA readout from August 19th to August 25th



3.5.3 Monday 23rd August, Alarms by SCADA

The following alarms were activated on Monday 23rd, these would have all been issued by SMS, apart from the 'Filter 8 Turbidity High High Alarm'.

Date - time of Event	Alarm	Priority
8/23/21 17:42	Creagh WTP Filter 9 Turbidity High High	High
8/23/21 17:42	Creagh WTP Filter 8 Turbidity High High	Medium
8/23/21 11:35	Creagh WTP DAF Plant Turbidity Alarm	High
8/23/21 6:57	Creagh WTP Filter 7 Turbidity High High	High
8/23/21 5:59	Creagh WTP Filter 7 Turbidity High High	High
8/23/21 5:24	Creagh WTP Clear Water Tank Low Low Alarm	High
8/23/21 3:59	Creagh WTP Clear Water Tank Low Low Alarm	High

Table 13 - Scada alarms for 23/08/21

The WSI Employee and Supervisor were both onsite on Monday and it is assumed they adjusted the plant manually to get it back into compliance. It is unclear at this time exactly what was adjusted to achieve this.

3.6 Tuesday, August 24th

CSL had received a call on Monday the 23rd August and were requested to visit the Creagh site. They arrived on site on Tuesday morning at approximately 9.30am. The reason for the call-out was that the 'DAFF plant was not maintaining a correct level'. CSL found the following issues on site:

- power failed during DAFF backwash
- Chlorine residual on sample pump was being affected by corrosion on steel socket
- Sample pump had lost its prime
- Found crack in suction hose on chlorine pump no.3
- Found cracked compression cones on both chlorine pumps 1 &2
- Pressure sensors were damaged on all three pumps and flow control was deactivated
- Liquid ends and multi function valves need to be replaced

For whatever reason, these issues were not escalated to the senior management of Wexford County Council.



3.7 Wednesday, August 25th

Another water sample was taken in Ardmore Estate on this date together with a microbiological sample for analysis. This confirmed that residual chlorine which was 0.34mg/l on August 23th, had now risen to 0.57mg/l and the sample was also clear of eColi.

3.8 Thursday, August 26th

This was the date when the second complaint of illness in Gorey was reported to Irish Water and Wexford County Council which prompted further investigation by Wexford County Council confirming that there had been a serious incident in the Gorey Water Supply. This led to an immediate conference call between Wexford County Council and Irish Water on that date.

There followed a review of plant operations by Wexford County Council which fully confirmed that the disinfection process had failed from the night of 19th August to the 24th August.

There then followed an assessment by Irish Water and Wexford County Council who both concluded that there was no requirement at that stage for the imposition of Boil Water Notices as the immediate incident had passed and the water was now safe to drink. The HSE were notified of the incident and agreed with this conclusion. Irish Water notified the EPA of the incident.

3.9 Ongoing Testing

Overleaf on Figure 12 is the location of recorded residual chlorine levels across a number of locations in areas in Gorey whose residents complained of illness to Irish Water. Also shown are recorded residual chlorine levels checked and tested from 23rd August to 16th September 2021. These were all monitored and recorded by the Wexford County Council Drinking Water Quality Engineer and district staff at the request of the Acting Senior Engineer. All values tested were within acceptable limits for Drinking Water.

The estates were Ardmore, Woodbury, Newborough, Creagh Demense, Hunters Hillgreen, Ashwood Grove, Willow Park, Sean Doire, Baile Eoghain, Twin Oaks, Hazelwood, Naomh Eanna Clubhouse, Fox Hill, Doire Fea, Raithinn Cuilinn, Cois Linne, Ramsfort Avenue, Oak Ridge, The Lask, Gorey Hill, Charlotte Grove, Charlotte Row, The Lodge Charlotte Row, Oakwood, Clonattin, Hillcrest Drive, Clonattin Lodge and Clonattin Village.





Figure 12 - Residual Chlorine Levels for Gorey Town Water Supply Scheme



4. Report Conclusions

Aengus Consulting Ltd have examined all relevant material and interviewed all relevant people in connection with Water Quality Incident at Creagh Water Treatment Plant over the period 19th August to 24th August 2021 and have concluded as follows:-

- 1. **The primary cause of the Water Quality Incident**, which led to 46 confirmed local illnesses and one known hospitalisation, was the failure of the disinfection system. This happened following a power failure on the evening of 19th August 2021. The disinfection system, consisting of sodium hypochlorite pumped into the treated water, ceased to operate due to mechanical failure but human error in not detecting and escalating the problems extended the timeline of the incident by approximately 4 days. The plant is equipped with automatic alarms alerting caretaking and supervisory staff but these alarms proved ineffective in alerting Wexford County Council staff that a serious situation had occurred at the plant. Also, critically the chlorine alarms were set at too low alarm priorities resulting in no SMS messages issuing.
- 2. The duty assist standby chlorine pumps were not operating as a result of the power failure and defective sensors over the 19th to 23rd August 2021 weekend. However, it is believed that the WSI Employee on Sunday 22nd August, attempted to restart the pumps and created a small chlorine residual but this was possibly overwhelmed by high incoming turbidity. SCADA records showed that chlorine pump no. 1 and no. 2 were manually activated on Sunday the 22nd August but damaged suctions due to lack of adequate maintenance disabled adequate chlorine delivery. Pump 3 is not trended on SCADA.
- 3. The first complaint of illness in Gorey came to Irish Water on Monday 23rd August. This was passed to Wexford County Council who noted the address of the reported illness and, as a precautionary measure, visited the house in Ardmore Estate and decided to scour the water mains from a fire hydrant outside on the road to an adjacent road gully in accordance with good practice. The sample was then tested and found to have a residual chlorine of 0.34mg/l in the drinking water. Two days later on 25th August, a microbiological sample was taken together with a further sample at Ardmore Estate where a chlorine residual of 0.57mg/l was recorded which was also satisfactory.
- 4. **Second illness detected in Gorey and confirmed on Thursday 26th August**. On Thursday 26th August, there was a second illness complaint to Irish Water from another Gorey resident again in Ardmore Estate which prompted a review of plant operations leading to the incident being detected. A conference meeting



was then held on that afternoon between the operational staff in Wexford County Council and Irish Water. Wexford County Council also notified the HSE. The necessity for a 'boil water notice' was discussed and agreed by all present that the immediate incident had passed at that stage and that the water supply was safe to drink.

- 5. Lack of Supervisory Oversight. Based on what we now know about the events that led to the water quality incident on the 19th August 2021, the delay in recognising the problem that occurred resulting in inadequate dosing of chlorine for a period of 3 to 4 days was entirely unacceptable in public health terms. It is now certain that there was human failure and a lack of supervisory oversight on the Creagh plant from 19th August to the 24th August. Organisational and operational changes are required at Creagh Water Treatment Plant by Wexford County Council, in consultation with Irish Water, to address these deficiencies to avoid a future recurrence.
- 6. Lack of Staff Refresher Training. Whilst all plant operators are trained to FETAC Level 5, it is obvious that further ongoing training is required to take account of changes in treatment processes. Refresher training in 2020/21 has been delayed by the Covid-19 pandemic. There was also a significant lack of incident reporting from site operational staff to management in Wexford County Council. In addition, water treatment training needs to be site specific as is the current practice in Creagh since the August incident. While the SLA remains in place, adequate support is required from Irish Water to all local authority staff and this extends to all staff levels to include individual Plant Caretakers and all outdoor water staff.
- 7. Limited compliance with Irish Water Standard Operational Procedures (SOP). There has been limited compliance with the Irish Water Standard Operational Procedures drawn up by Irish Water for implementation by Wexford County Council staff. Roll out of these procedures has been impacted by Covid-19. Furthermore, under the Irish Water/Local Authority Service Level Agreements, these procedures are necessary for all water personnel to understand and implement. This too needs to be a shared responsibility between Irish Water and Wexford County Council. Significant improvement is required in the organisation of staff workshops to engender a shared responsibility which is a duty of care towards water customers.



5. Report Recommendations

To ensure that there is no recurrence of this Water Quality Incident at Creagh Water Treatment Plant, the following recommendations are made to Wexford County Council:

Recommendation No 1

SCADA alarms to be installed for power failure at Creagh Water Treatment Plant (WTP).

There was no alarm system on the plant in the event of power failure. This has now been installed by Wexford County Council to create a functional alarm system in future and throughout the plant to prevent a recurrence.

WCC Response: A review of the SCADA alarms for Creagh has been carried out and a new alarm for power failure at the plant has been put in place.

Recommendation No 2

Provision of a standby generator on this site is urgently required.

WCC Response: An emergency generator was purchased in December 2021 and is now on site in Creagh WTP to provide an emergency power supply in the event of future power failure.

Recommendation No 3

Wexford County Council needs to review the current staffing and oversight at Creagh Water Treatment Plant and discuss with Irish Water as the current staffing arrangements in the light of recent events are now deemed to be inadequate for the responsibility involved. This plant is quite complex for its relative size in terms of process and chemical dosing arrangements including pH correction prior to alum and polyelectrolyte dosing in turn prior to slow sand filtration followed by pH correction a second time, disinfection and fluoridation before going into supply. It is recommended that a plant of this nature requires a Chemical or Civil/Environmental minimum Level 6 Technician in a supervisory role who would concentrate on the North of the County. A second similar technician would be needed in the South of the County. This individual with either a science or engineering background needs to be employed either by Wexford County Council or by Irish Water on secondment to Wexford County Council. Pending the appointment of such an individual, temporary plant management of equivalent scientific or engineering competence need to be assigned by the Council to the plant operation and maintenance.

WCC Response: Staffing levels in the water services department are constrained by Irish Water's set headcount. This is a national matter which is being reviewed through



Irish Water's Transformation Plan and move to the Single Public Utility. Notwithstanding any constraints, WCC has appointed a caretaker for the Creagh plant who no longer has any network duties and is fully assigned to the water treatment plant operation. Wexford County Council has strengthened the role of process technicians in the county by appointment of Executive Technician and redistribution of Executive Technician duties. Irish Water has initiated Project Connect to strengthen their oversight of water treatment facilities throughout the country, and the Creagh site is included in the initial 26 treatment plants for this project.

Recommendation No 4

Creagh WTP needs to revert to quarterly maintenance because of its age and complexity. The recent reduction of quarterly maintenance to half yearly maintenance by Irish Water was a likely contributory factor in not recovering the chlorine residual levels sooner prior to entering supply. This was due to lack of pump suction maintenance on all three pumps and sensor equipment failure requiring the immediate purchase and installation of new equipment for the sampling and automated dosing of sodium hypochlorite on 24th August.

WCC Response: Wexford County Council has already advised Irish Water that Creagh WTP and all major water treatment plants in County Wexford have reverted to quarterly mechanical maintenance.

Recommendation No 5

The plant SCADA alarm system at Creagh needs a substantial revision to prevent the current overload of various levels of alarms which because of their unnecessary multiplicity can lead to an inadequate response and alarms being ignored. Since the incident, it is acknowledged that Wexford County Council and Irish Water have agreed to new alarm settings. Manpower cover should be adequate to allow for plant operational and supervisory staff to respond appropriately.

WCC Response: A review of the SCADA alarms throughout the county has been carried out and changes made where necessary. The system has been monitored extensively to remove false alarms and improve the system. Toolbox talks have been held with all relevant staff regarding alarm response requirements.

Recommendation No 6

We recommend the upgrade of the chlorine dosing system in line with Irish Water disinfection requirements and with the provision of baffles to improve mixing and chlorine contact time and the inclusion of UV treatment to provide resilience to the supply.

WCC Response: Irish Water has carried out improvement works to the disinfection monitoring system. The disinfection upgrade has been included as part of a larger plant upgrade to be undertaken by Irish Water. These works include provision of UV, upgrades to the existing Dissolve Air Flotation Filtration (DAFF) as well as modifications



to existing intake and filter beds. The disinfection works cannot be upgraded to the Irish Water specification without this larger upgrade as it would not be possible to fully implement all of the required shutdowns and controls. Irish Water has invested approximately ≤ 200 k in Creagh in the past 6 months to improve the supply. In addition to this, a further ≤ 2 m has been secured for the upgrading of the plant over this year and next year. As part of these works, Irish Water has been in discussions with statutory authorities regarding the proposed upgrades, has appointed a consultant and will be in a position to appoint a contractor in Q3 of this year.

Recommendation No 7

We recommend that Irish Water progress the implementation of automatic plant shutdown procedures in response to water quality issues.

WCC Response: Changes were made to the operation of the Dissolve Air Flotation Filtration (DAFF) plant which will now shut down on a turbidity quality failure.

Recommendation No. 8

We recommend that Irish Water approve provision for a plant caretaker at Creagh without the additional responsibility for the water network systems.

WCC Response: The caretaker at Creagh WTP no longer has the additional responsibility of the water network.

Recommendation No. 9

We recommend replacement of the sand and full servicing for the DAFF plant is now urgently required.

WCC Response: A refurbishment of the DAFF plant sand and services was carried out in 2021. A further upgrade of the DAFF plant will be carried out at part of the overall plant upgrade.

<u>Recommendation No. 10</u> (Wexford County Council have already raised with Irish Water)

We recommend that Irish Water reinstate the Service Level Agreement with the SCADA service provider to allow for planned maintenance of the system.

WCC Response: Wexford County Council has recommended that the Service level Agreement (SLA) with the SCADA provider be reinstated. At present this has not yet been funded by Irish Water and is under review.

<u>Recommendation No. 11</u> (Already implemented at Creagh Water Treatment Plant and at other WTPs in Wexford).



It is recommended that Irish Water and Wexford County Council fully implement Irish Water Standard Operations Procedures (SOP) at Creagh and all other plants in County Wexford.

WCC Response: SOPs have been put in place at Creagh WTP and are being rolled out at all plants throughout County Wexford by Irish Water with cooperation from Wexford County Council.

Recommendation No. 12

Wexford County Council to arrange an audit of all treatment plants in the county. (In fact, we understand that this has already commenced).

WCC Response: An internal audit of all water treatment plants in Wexford is well underway and is expected to be completed by the end of June 2022. Irish Water is also carrying out an alarm and inhibit review of all plants throughout the county as part of a national programme of inspection.

Recommendation No.13

A review of the Incident Management Protocol is recommended particularly around the area of communications internally and with Irish Water, EPA and HSE.

WCC Response: Internal detection and notification of incidents has been strengthened so that early reporting to the relevant agencies takes place. Both the HSE and the EPA were critical of the lack of communication with the public in relation to this incident. While reports to the media and the public are a matter for Irish Water during incident management, Wexford County Council has strengthened internal incident management procedures to ensure that all nursing homes, schools, creches and hospitals on the supply are phoned to notify them directly when a boil water notice is issued.

Wexford County Council has made recommendations to Irish Water around the updating of their incident management protocol to allow for changes in procedures over recent years around responsibilities for communications with the different agencies. The incident management protocol is being continuously reviewed in this regard. There is ongoing communication with the HSE in relation to any drinking water incident through the agreed protocol channels.

