



Drinking Water Audit Report

County:	Cork	Date of Audit:	18/05/17
Plant(s) visited:	Macroom Public Water Supply (Scheme Code 0500PUB2307)	Date of issue of Audit Report:	08/06/17
		File Reference:	DW2016/145
		Auditors:	Ms. Criona Doyle Ms. Regina Campbell
Audit Criteria:	<ul style="list-style-type: none"> • The <i>European Union (Drinking Water) Regulations 2014 (S.I. 122 of 2014)</i>. • <i>The EPA Handbook on the Implementation of the Regulations for Water Services Authorities for Public Water Supplies (ISBN: 978-1-84095-349-7)</i> • The recommendations specified in the <i>EPA Drinking Water Report</i>. • EPA Drinking Water Advice Notes No.s 1 to 15. • The recommendations in any previous audit reports. 		

MAIN FINDINGS

- i. **Irish Water should undertake improvements on the current disinfection system including the installation of a flow proportional or automatic chlorine dosing system linked to the residual chlorine alarm.**
- ii. **Irish Water should undertake a review of the current turbidity alarm setting of 1 NTU, on the filtered water, as this does not provide sufficient advance warning of filtration issues.**
- iii. **The figures reported on EDEN for population served and volume supplied are incorrect and should be updated.**

1. INTRODUCTION

Under the *European Union (Drinking Water) Regulations 2014* the Environmental Protection Agency is the supervisory authority in relation to Irish Water and its role in the provision of public water supplies. This audit was carried out to assess the performance of Irish Water in providing clean and wholesome drinking water.

The Macroom Water Treatment Plant (WTP) has been in operation since the 1960's. The source water is abstracted from the Sullane River. The original design capacity of the plant was 3,840m³/d. The plant currently produces between 1,200 and 1,500m³/d at a maximum hourly production rate of 80m³/hr. The population served was reported as 3,995 on the date of the audit.

Treatment at the plant includes coagulation, flocculation, clarification, filtration, disinfection and fluoridation. Clarification is undertaken in 2 no. dissolved air flotation chambers which were installed 22 years ago. Rapid gravity filters are located in the base of each of the dissolved air flotation chambers.

Photographs taken by Criona Doyle during the audit are attached to this report and are referred to in the text where relevant.

The opening meeting commenced at 10:40am at the Macroom Water Treatment Plant in the Castle Grounds. The scope and purpose of the audit were outlined at the opening meeting. The audit process consisted of interviews with staff, review of records and observations made during an inspection of the treatment plant. The audit observations and recommendations are listed in Section 2 and 4 of this report. The following were in attendance during the audit.

Representing Irish Water:

Deirdre O’Loughlin, Compliance Monitoring Liaison Specialist, Irish Water.

Siobhan Clifford, Compliance Analyst, Irish Water.

Jim Fitzgerald, SLA Lead, Irish Water.

Alison Foran, Executive Engineer, Cork County Council.

Padraig Thornton, Acting Senior Executive Engineer, Cork County Council.

Mary Hickey, Executive Scientist, Cork County Council.

Patrick Kelly, Water Liaison Engineer, Cork County Council.

Niall Cronin, Water Treatment Plant Curator, Cork County Council.

Representing the Environmental Protection Agency:

Regina Campbell, Inspector.

Criona Doyle Inspector.

2. AUDIT OBSERVATIONS

The audit process is a random sample on a particular day of a facility's operation. Where an observation or recommendation against a particular issue has not been reported, this should not be construed to mean that this issue is fully addressed.

1.	<p>Source Protection</p> <ul style="list-style-type: none"> a. The source for the Macroom Supply is the Sullane River. The water treatment plant and intake are located in the Castle Grounds. b. Landuse in the immediate vicinity of the intake includes the Macroom Golf Club and the public amenity walkways within the Castle Grounds. c. Cork County Council confirmed that inspections were last undertaken within the buffer zones in 2008. No farm inspections have been undertaken in the buffer zones or the remainder of the catchment since 2008. d. A copy of the <i>Cryptosporidium</i> Risk Assessment was provided and indicated an overall final weighted risk assessment score of 85 (high Risk).The risk score on EDEN is reported as 99. e. The raw and treated water is tested twice per annum for <i>Cryptosporidium</i> and Giardia. There were no detections during 2016 or 2017 in the treated water. f. The caretaker reports that the river has a fast response to rainfall. Works have been carried out on site to raise the pumps above historic flood levels. All tanks involved in the treatment process are located above ground level. g. Online monitoring at the WTP includes monitoring of dissolved oxygen and temperature. h. No details were available on site in relation to the status of the Drinking Water Safety Plan for the supply.
2.	<p>Coagulation, Flocculation and Clarification</p> <ul style="list-style-type: none"> a. Raw water from the River Sullane undergoes coagulation, flocculation and clarification. b. pH correction is no longer required. The equipment for soda ash dosing is still present but has not been required in the last 8 to 9 years.

	<ul style="list-style-type: none"> c. 17% liquid Poly Aluminium Chloride (PAC) is used as the coagulant. PAC replaced aluminium sulphate as the main coagulant approximately 16 years ago. d. A streaming current monitor is used for automatic coagulant dosing. The monitor was within the date range for both calibration and servicing. e. Duty and standby PAC dosing pumps are present with automatic switchover in the event of a pump breakdown. Both pumps were within the date range for service and calibration. Weekly rotation of pumps is undertaken. f. The PAC dose rate is determined based on the daily jar tests and streaming current monitor. More frequent jar testing is undertaken as required for example in the event of rapidly changing raw water conditions during flood conditions. Records were checked and a dose chart was on display adjacent to the PAC pumps. On the day of the audit the dose rate was 2.2 l/hr to achieve dose of 45 mg/l. All adjustments are recorded on the Daily Flocc and Test Sheets which are kept onsite. g. PAC dosing takes place in a covered manhole chamber located between the surface water inlet and the treatment plant building. There are duty and standby dosing points. Inline mixing takes place. There was a build-up of water visible in the base of the dosing chamber (Photo No.1). h. Polyelectrolyte (0.2%) coagulant aid is dosed at a rate of 0.12mg/l. The polyelectrolyte dosing is flow proportional. The polyelectrolyte powder is weighed adjacent to the dose pumps, mixed and is added in the flocculation tank (volume 17.6m³). i. The original plant throughput was 155m³/hr but this was reduced to 80m³/hr to achieve the 13 minutes retention time required for flocculation. The raw water flow meter indicated a flow rate of 73.6m³/hr on the date of the audit. j. Two Dissolved Air Flotation (DAF) units are provided for clarification. Each DAF unit has a surface area of 18.2m². The units are drained down once a week allowing the walls and sludge channel to be washed. k. Sludge scrapers skim the sludge off the top of the DAF unit from where it is discharged to the sludge channel and gravity fed to the sludge holding tank.
<p>3. Filtration</p>	<ul style="list-style-type: none"> a. Both DAF units contain an inbuilt rapid gravity filter. The filter media was renewed in DAF Unit No. 2 in November 2016 and in DAF Unit No. 1 in January 2017. The air nozzles were also replaced in DAF Unit No. 2. The filter media total depth 1,350mm is composed of the following gradings: 800mm of 16-30mm sand; 150mm of 2.5 – 6mm; 100mm of 6-12mm; 100mm of 12-25 mm and 200mm of 25-38mm. b. Filtration occurs at a rate of 2.2m³/m²/hr. Backwashing is normally triggered automatically when the head loss across filter media is > 70% for > 5 minutes. Normally backwashing takes place every 2 to 3 days. The frequency can increase during flood conditions to twice per day. Automatic backwashing is not linked to the post filter turbidity monitors. c. The filter media is not visible during filter backwashing. The unit is fully drained down once per month and the media depth and condition is checked. A filter log book is maintained on site which contains records of all inspections and works carried out on the filters. There are documented procedures in place for backwashing. d. A delayed start is in place following backwashing which involves a 30 minute delay to allow time for the filter media to settle before filtration recommences. e. Backwashing involves 5 minutes of air flow, followed by 10 minutes water flow. f. A backwash of DAF Unit no. 1 was observed and backwashing looked evenly distributed across the filter. g. The backwash water is discharged to the backwash water tank and the supernatant is discharged to the River Sullane. h. Turbidity of the filtered water is continuously monitored on the individual filters. At the time of the audit the turbidity was 0.050 NTU on DAF Unit No. 1 and 0.013 NTU on DAF Unit No. 2. The turbidity alarm set points are currently set at 1 NTU which is too high to provide advance warning of filtration issues.
<p>4. Disinfection</p>	<ul style="list-style-type: none"> a. Sodium hypochlorite (14-15%) is used for chlorination. A 1,300 litre bulk storage is

	<p>maintained on site which provides 1 months storage.</p> <p>b. Chlorine dosing is not flow proportional. The caretaker manually sets the dosing rate. A dose chart with the pump settings and corresponding chlorine levels is displayed on site. The residual chlorine monitor is not linked to the dosing pumps. The disinfection system should meet the EPA criteria set out in Drinking Water Advice Note No. 3, E. Coli in Drinking Water.</p> <p>c. The contact time calculation was not available on site.</p> <p>d. Duty and standby dosing pumps are installed on site. The pumps normally switch over on a 3 hour rotation. On the date of the audit only one sodium hypochlorite dosing pump was operational and the fitter was due on site to carry out repairs.</p> <p>e. The target chlorine dose is 1.2 mg/l at the plant to achieve a chlorine residual of 0.10mg/l at the end of the line.</p> <p>f. Monitoring of chlorine residual at the end of the network is undertaken daily. The records to date for 2017 were provided in hard copy. The chlorine residual was less than the 0.1 mg/l level on one sampling date (23/02/17 level 0.031 mg/l) at IDA Coolcower.</p>
5.	<p>Treated Water Storage and Distribution Network</p> <p>a. There is one reservoir, Sleaveen Reservoir, on the distribution system. There are no service connections prior to the reservoir.</p> <p>b. The twin celled storage reservoir provides approximately 1.5 days storage (each cell storage volume 1,098m³). The reservoir is 22 years old and has not been cleaned since it was constructed. There is a bypass in place but it has never been used. The cells can be individually isolated to facilitate works on either cell. Insect proof mesh has recently been installed on all of the reservoir vents.</p> <p>c. There is no insect proof mesh in place on the vents on the clear water tank at the treatment plant site.</p> <p>d. The caretaker reported that the presence of branching in the network creates difficulties in undertaking unidirectional flushing. A programme is in place for flushing of dead ends once a month.</p> <p>e. There was evidence of damage (cracking) on the roof of the clear water tank (Photo No. 2).</p>
6.	<p>Exceedances of the Parametric Values</p> <p>a. There were 2 no. aluminium exceedances notified to the EPA in 2016 on 08/08/16 (263ug/l) and 20/09/16 (433 ug/l) and a further 2 no. samples in 2017 on the 17/01/17 (258 ug/l) and 02/02/17 (226 ug/l). Since the replacement of the filter media in the DAF units and the flushing of the network the daily operational aluminium monitoring in the DAF units, clear water tank and network has remained below the parametric value of 200 ug/l.</p> <p>b. Since the audit pesticide exceedances have been notified to the EPA including MCPA (0.456ug/l) and Total Pesticides (0.58 ug/l) from an audit sample taken on 16/05/17.</p>
7.	<p>Chemical Storage and Bunds</p> <p>a. Bulk storage tanks are present on site for hydrofluorosilic acid, sodium hypochlorite and PAC. All bulk storage tanks, day tanks and fill lines were labelled and adequately banded. MSDS sheets were located adjacent to each storage tank in addition to copies kept in the chemicals folder in the office. Spill kits are kept on site.</p> <p>b. The caretaker is on site during all chemical deliveries.</p> <p>c. The caretaker maintains records of the volume of all chemicals used for stock management purposes and to warn of unusual usage patterns signifying potential plant issues.</p>
8.	<p>Hygiene and Housekeeping</p> <p>a. The caretaker provides cover on wastewater treatment plants as required and duties may involve works on both sites on the same day.</p>
9.	<p>Management and Control</p> <p>a. The supply volume indicated on EDEN at the time of the audit was 1,581m³/d serving a population of 5,075. This does not correspond with the figures quoted in the Irish Water</p>

	<p>2017 Sampling Plan which indicate a population of 1,529 and an average volume of 1,496m³/d. On the day of the audit the plant log figures indicated daily production volume generally ranges between 1,200 to 1,500m³/d and a figure of 3,995 was quoted for the population served.</p> <p>b. Irish Water outlined at the audit that they would confirm the population served following an internal Irish Water meeting between Compliance and Asset Strategy scheduled to take place week ending the 26/05/17. The population has not been confirmed to date.</p> <p>c. Alarms are generated for low chlorine, high turbidity and high reservoir outflow. Plant shutdowns are in place for low chlorine and high turbidity. Plant shutdown is triggered when the filtered water turbidity exceeds 1 NTU for greater than 5 minutes or when the residual chlorine concentration falls below 0.35 mg/l for greater than 5 minutes. In both cases a text alarm is automatically sent to caretaker and the plant automatically shuts down.</p> <p>d. There are health and safety issues with access to the fluoride dosing points which limit access to the dosing lines.</p>
10.	<p>Sludge Management</p> <p>a. Sludge removal (60m³/annum) is via gravity to a sludge holding tank and is pumped to the town sewer.</p>

3. AUDITORS COMMENTS

The audit found that the Macroom Water Treatment Plant is well operated by dedicated caretaking staff. Detailed records and well documented procedures were observed on site. There have been no aluminium non compliances since the completion of the replacement of the filter media in the DAF units in January 2017 and the flushing of the network.

Issues were identified with the disinfection system which requires manual settings of the chlorine dosing pumps. Irish Water should take action to improve the disinfection system including the installation of a flow proportional system or automatic dosing system linked to the residual chlorine monitor. A residual chlorine monitor is provided on site but is not linked to the dosing pumps. On the date of the audit one of the disinfection dosing pumps had broken down and was awaiting repair.

Irish Water should undertake a review of the current turbidity alarm settings on the filtered water. The current alarm setting of 1 NTU is considered too high as it does not provide sufficient advance warning of filtration issues. Automatic filter backwashing is currently linked to the measured head loss across the filter. Irish Water should investigate the feasibility of also linking automatic backwashing of the filters to the continuously monitored post filter turbidity levels.

The figures on EDEN should be updated to reflect the current population being served and daily production volume.

Since the audit it should be noted that there has been some notifications of pesticide exceedances and these should be considered in the Drinking Water Safety Plan for the supply.

4. RECOMMENDATIONS

Disinfection

- Irish Water should: (i) ensure that dosing of chlorine is flow proportional or is linked to the residual chlorine monitor; (ii) submit the effective contact time calculation to the Agency; (iii) submit 1 months trend data (SCADA printout) for the residual chlorine monitor to include the period prior to the audit when only 1 no. pump was operational; (iv) confirm that both the duty and standby dosing pump are operational since the audit; (v) ensure that the free residual chlorine levels at the end of the distribution network are maintained at 0.1 mg/l.

Filtration (General)

2. Irish Water should review the current alarm settings on the continuous turbidity monitors taking into account Section 3.2 of the EPA Advice Notes No. 5 Turbidity in Drinking Water in relation to the setting of appropriate alarm levels. The current alarm setting of 1 NTU is considered too high as it does not provide sufficient warning of filtration issues. The alarm settings should take into account the *Cryptosporidium* Risk Score for the supply. If the plant is a high risk *Cryptosporidium* plant then the turbidity of the filtered water should not exceed 0.2 NTU. Irish Water should investigate the feasibility of linking automatic backwashing of the filters to the monitoring of turbidity.

Source Protection

3. Irish Water should update EDEN to reflect the most recent *Cryptosporidium* Risk score.
4. Irish Water should provide an update on the status of the Drinking Water Safety Plan (WSP) for the Macroom Water Supply. In the response confirm the following information: (i) is there a documented WSP for the supply and what organisational experts are involved; (ii) are all the major steps in the WSP chain described; (iii) what are the major hazards/ threats that are identified in the catchment and (iv) what stakeholder engagement has been carried out in the catchment.

Coagulation, Flocculation and Clarification

5. Irish Water should ensure that the manhole containing the injection points for the coagulant is drained and regularly inspected to ensure there is no ingress of water collecting in the chamber.

Treated Water Storage and Distribution Network

6. Irish Water should ensure that the service reservoir is inspected and cleaned out on a regular basis and any maintenance and repairs completed as soon as possible after the need has been identified in accordance with EPA Drinking Water Advice Note No. 10: Service Reservoir Inspection, Cleaning and Maintenance.
7. Irish Water should undertake an inspection of the clear water tank to ensure that any necessary repair works are undertaken. Adequate insect proof mesh should be installed on all vents on the clear water tank.

Hygiene and Housekeeping

8. Irish Water should ensure that procedures are in place to minimise the risk of cross contamination from staff working on both water and wastewater treatment systems.

Management and Control

9. Irish Water should confirm the population served and volume supplied by the Macroom supply and update EDEN and the Irish Water 2017 Sampling Plan based on the revised figures.
10. Irish Water should examine the options for improving access to the fluoride dosing points.

FOLLOW-UP ACTIONS REQUIRED BY IRISH WATER

During the audit Irish Water representatives were advised of the audit findings and that action must be taken as a priority by Irish Water to address the issues raised. This report has been reviewed and approved by Ms Regina Campbell, Drinking Water Team Leader.

Irish Water should submit a report to the Agency within one month of the date of this audit report detailing how it has dealt with the issues of concern identified during this audit. The report should include details on the action taken and planned to address the various recommendations, including timeframe for commencement and completion of any planned work.

The EPA also advises that the findings and recommendations from this audit report should, where relevant, be addressed at all other treatment plants operated and managed by Irish Water.

Please quote the File Reference Number in any future correspondence in relation to this Report.

Report prepared by: Criona Doyle **Date:** 08/06/17

Inspector

Photo No. 1 – Visible Water on Floor of Manhole Chamber Housing PAC Dosing Injection Points



Photo No. 2 – Visible Damage on Roof of Clear Water Tank

