



# Drinking Water Audit Report

<b>County:</b>	Cork	<b>Date of Audit:</b>	19/08/16
<b>Plant(s) visited:</b>	Ballineary PWS (Scheme Code 0500PUB2302)	<b>Date of issue of Audit Report:</b>	12/09/16
		<b>File Reference:</b>	DW2016/106
		<b>Auditors:</b>	Ms. Derval Devaney Ms. Criona Doyle
<b>Audit Criteria:</b>	<ul style="list-style-type: none"> <li>• The <i>European Union (Drinking Water) Regulations 2014 (S.I. 122 of 2014)</i>.</li> <li>• The <i>EPA Handbook on the Implementation of the Regulations for Water Services Authorities for Public Water Supplies (ISBN: 978-1-84095-349-7)</i></li> <li>• The recommendations specified in the <i>EPA Drinking Water Report</i>.</li> <li>• EPA Drinking Water Advice Notes No.s 1 to 15.</li> <li>• The recommendations in any previous audit reports.</li> </ul>		

## MAIN FINDINGS

- i. Investigations found slumping of sand on Filter No. 1 which may have led to the presence of *Cryptosporidium* and *Giardia* in the Ballineary Public Water Supply on 8<sup>th</sup> and 22<sup>nd</sup> June 2016.
- ii. Greater source protection measures are required to protect the drinking water abstraction point. The catchment was not inspected since the *Cryptosporidium* and *Giardia* detections and raw water monitoring ceased in March 2014.
- iii. The operation and management of the slow sand filters needs to be improved, including the preparation of documented standard operating procedures and monitoring of filtered water quality prior to bringing the filters back into service.

## 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 following the detection of *Cryptosporidium* and *Giardia* in the Ballineary Public Water Supply on 8<sup>th</sup> and 22<sup>nd</sup> June 2016. The HSE confirmed during the audit that it had not had any reported cases of cryptosporidiosis in the area being served by the supply.

The Ballineary Water Supply was built in the 1960's and serves a population of 450. The source water is abstracted from the Bunsheelin River. Treatment at the plant consists of filtration in 2 no. slow sand filters and disinfection by chlorination. There are no planned upgrades or long term capital works proposed at this time.

The normal daily volume of water provided is 70-80m<sup>3</sup>/d. There is a seasonal peak water demand of 120m<sup>3</sup>/d during the summer months associated with the operation of the Irish College at Ballineary. The design capacity was reported in 2009 as being 172m<sup>3</sup>/d.

The opening meeting commenced at 10:30am at the Ballingeary Water Treatment Plant. 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.

Patrick Duggan, Water Compliance Monitor Analyst, Irish Water.

Kevin Murphy, Engineer, Irish Water.

Martin Duggan, Water Treatment Plant Caretaker, Cork County Council.

Alison Feron, Executive Engineer, Cork County Council.

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

Mary Hickey, Laboratory Services, Cork County Council.

**Representing the HSE:**

Kathleen Clifford, Principal Environmental Health Officer.

**Representing the Environmental Protection Agency:**

Derval Devaney, 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><b>Exceedances of the Parametric Values</b></p> <p>a. On 16/06/16 the EPA was notified under Regulation 9(1) of <i>Giardia</i> (result 0.007 per 10L) in the treated water at Ballingeary WTP on 08/06/16. The notification stated that turbidity was &lt; 1 NTU and chlorination was adequate. The HSE advice on 21/06/16 was to review the sand filtration system and see if any remedial action was required. Resampling undertaken on the 22/06/16 detected <i>Cryptosporidium</i> 0.008 per 10L and <i>Giardia</i> 0.004 per 10L. Due to the low number of oocysts present the genotype could not be determined.</p>
2.	<p><b>Source Protection</b></p> <p>a. One house which is likely to rely on a domestic waste water treatment system (DWWTS, for e.g. a septic tank) was identified in close proximity to the public water supply abstraction point (&lt; 100m north of the Bunsheelin River and approximately 150m from the abstraction point). Cork County Council was unsure if this house was listed on the DWWTS National Inspection Plan for inspection.</p> <p>b. The land in the immediate vicinity of the intake includes scrubby woodland. Pastures and peat bog are located further up the catchment. Sheep wire fencing was present on both sides of the river at the intake to prevent animal access. It was stated that sheep, cattle and deer are present in catchment. While regular checks are undertaken particularly during the autumn period to remove leaves and vegetation in the vicinity of the intake, catchment inspections had been not undertaken. There was no catchment inspection undertaken in response to the detections of <i>Cryptosporidium</i> and <i>Giardia</i> on the 8<sup>th</sup> and 22<sup>nd</sup> June 2016.</p>

	<ul style="list-style-type: none"> <li>c. A <i>Cryptosporidium</i> Risk Assessment was completed in 2016 with a final weighted score of 44 (Low Risk). Previously, a High Risk score of 89 was assigned (based on the 2015 Drinking Water Returns) and Cork County Council indicated changes to process control and monitoring including turbidity shut-off was likely to have reduced this risk score.</li> <li>d. The curator confirmed that the source had a rapid response to rainfall in the catchment with a fast recovery of elevated turbidity level (typically &lt; 6 hours).</li> <li>e. A map of the 100m and 200m set back distances / buffer zones were viewed on site. With respect to the GAP Regulations [<i>European Union (Good Agricultural Practice for the Protection of Waters) Regulations 2014 (SI No.31 of 2014)</i>] the 5 no. farmers inside the 100m buffer zone were notified in 2008 by Cork County Council Environment Section of their GAP requirements. There has been no contact with the other landowners in the catchment outside of the 100m setback distance.</li> <li>f. Raw water flows by gravity from the river to a screening chamber located next to the river bank. These screens were upgraded 2 years ago and the chambers are emptied and cleaned 2-3 times per year.</li> <li>g. There is an online turbidity meter on the raw water at the plant (at the inlet to the inlet tank and prior to entering the slow sand filters). The raw water turbidity was 0.92 NTU on the day of the audit and the auditors witnessed raw water being diverted away from the slow sand filter treatment process.</li> <li>h. Raw water monitoring commenced in 2012, following recommendations of the EPA's last audit in 2009, but ceased in March 2014. Historic raw water monitoring indicates turbidity up to 10.7 NTU and elevated levels of TOC up to 6.5mg/l with high levels of Coliform Bacteria and <i>E. coli</i> on occasion.</li> </ul>
<p><b>3. Filtration</b></p>	<ul style="list-style-type: none"> <li>a. Raw water flows by gravity from the screening chamber to a single sump where the flow is divided between the 2 no. slow sand filters (SSFs). Raw water is automatically diverted away from the filters when turbidity exceeds 1 NTU with the water being discharged to an adjacent stream. The caretaker is not alerted by text or otherwise when this alarm is generated and the diversion occurs. The caretaker however has the facility to dial into the plant to check the turbidity, flow rate through the filters and reservoir levels at any time. The filters are brought back into operation when the turbidity reduces to 0.5 NTU.</li> <li>b. There are turbidity monitors on each individual filter. Skimming of the SSFs is carried out on a 2 to 3 month frequency based on readings from the turbidity monitors which are post each SSF and visual inspections. The most recent SSF's skim was on 21/06/16 on Filter Bed No. 1 and 01/07/16 on Filter Bed No. 2.</li> <li>c. There are no head loss pressure gauges being used to identify when skimming should take place.</li> <li>d. At the time of the audit there was a documented procedure in place on how to undertake skimming and cleaning records were on site but there was no documented SOP detailing the criteria for triggering of skimming or sand replacement or outlining the general checks that are undertaken. Additional information provided by Irish Water on 29/08/16 included SOP detailing "How to recognise that the Slow Sand Filter needs to be cleaned" in addition to "Procedure for Cleaning Slow Sand Filter". The current procedure does specify the need for recording of observations by the caretaker for determining when the SSFs need to be cleaned or the requirement to record observations made during the cleaning process. The requirement for microbiological sampling prior to the SSFs being brought back into service is also omitted.</li> <li>e. At present microbiological samples are not taken to demonstrate that maturation of the schmutzdecke has taken place before the filter is brought back into service.</li> <li>f. Investigations of the incident found that slumping of sand was occurring in one corner of Filter No. 1. This indicates possible preferential flow may have occurred possibly linked to a structural defect. It is thought that this is a recent occurrence as it was not noticed during previous filter cleaning events and it is proposed to remove all of the filter media and examine the base of the tank prior to media replacement to determine the cause of this defect.</li> <li>g. Remedial works were scheduled to take place on the filter beds week commencing 22/08/16. The filter media was last fully replaced in 2013. Due to the sand grading for the replacement media initially being outside of the required grading specification, alternative</li> </ul>

	<p>filter media has had to be sourced which has delayed the media replacement. Filter No. 1 is to be resanded first with the depth of sand to be brought from its current level of 500mm up to 800mm. Following the maturation of the schmutzdecke in Filter No. 1 (anticipated time frame of 1 week) resanding of Filter No. 2 will take place.</p> <p>h. The 2009 EPA audit report indicated the design throughput of slow sand filters of 7.2 m<sup>3</sup>/hr (172 m<sup>3</sup>/d). On the 14/08/16 the filters combined flow was 4.2 m<sup>3</sup>/hr. The caretaker reported that the maximum flow rate for each filter bed is 2.5 m<sup>3</sup>/hr. During the remedial works it is proposed to temporarily increase the rate in the operational filter bed while the other filter is taken out of service. During the audit Filter No. 1's throughput was reduced to 1 m<sup>3</sup>/hr.</p>
<p><b>4.</b></p>	<p><b>Disinfection</b></p> <p>a. Disinfection is undertaken using 10% sodium hypochlorite prior to the water being pumped to the reservoir (3 days storage). There are duty and standby chlorine pumps and dosing is flow proportional. Chlorine boosting takes place at the reservoir outlet and prior to entering the distribution system. There is a duty pump only (no standby pump) at the chlorine booster point.</p> <p>b. The target residual chlorine is 0.80mg/l for the reservoir chlorine monitor and 0.7 mg/l for the booster pump to ensure adequate disinfection and a residual of 0.1 to 0.2 mg/l at end of distribution network. On the day of the audit the online CL17 chlorine monitor sampling treated water post the reservoir (at the booster pump) had a residual chlorine reading of 0.75 mg/l. The flow meter was reading 4 m<sup>3</sup>/hr for the treated water supply serving the village.</p> <p>c. Both continuous chlorine monitors are alarmed. The high level alarm was set at 2.5 mg/l while the low level alarm was set at 0.2 mg/l at the time of the audit. On 29/08/16 Irish Water confirmed that the low level alarm level has been increased to 0.4 mg/l. There is a low, low chlorine residual alarm set at &lt; 0.1 mg/l which triggers an automatic plant shut-down. The high and low alarms are texted to the caretakers phone and it was confirmed that there was a response cascade system in place but there was no schematic or procedure at the plant detailing such cascade.</p> <p>d. All of the monitors are calibrated and within the calibration due dates.</p> <p>e. Chlorine residual samples are taken 3 times per week and compared to the online monitors. Chlorine residual samples are also taken in the network however the samples taken at the end of the distribution network are not recorded in the plant logbook. Those that were recorded in the village were all above 0.1 mg/l.</p>
<p><b>5.</b></p>	<p><b>Treated Water Storage and Distribution Network</b></p> <p>a. There is 45m<sup>3</sup> storage in clear water tank at WTP, 227 m<sup>3</sup> in the reservoir and 5m<sup>3</sup> in the sump this equates to a total of 257m<sup>3</sup> representing 3-4 days storage.</p> <p>b. The plant and network date from the 1960's. The network is composed of cast iron mains and the caretaker reports no issues with pipe bursts or complaints.</p> <p>c. The mesh on the vent pipes on the holding tank was examined and it is recommended that a finer grade mesh be installed. Irish Water was requested to examine the reservoir to determine if the vents there were adequately covered to protect the treated water from contamination.</p>
<p><b>6.</b></p>	<p><b>Monitoring and Sampling Programme for Treated Water</b></p> <p>a. There were previous issues with THMs in this supply in 2012 (relating to a previously closed file DW2012/111). Regular THM monitoring was undertaken at the time with levels being less than but close to the THMs 100 ug/l parametric value (PV) and while the file was closed, monitoring of the situation was recommended. The available raw water monitoring indicates elevated levels TOC (e.g. 6-7 mg/l) could be problematic in meeting the THMs PV.</p> <p>b. It was not clear at the audit that chlorine residual monitoring was taking place at the end of the distribution mains as sampling is reported to be from the village tap. Irish Water confirmed on the 29/08/16 that end of line monitoring is being carried out but not recorded.</p>

	<ul style="list-style-type: none"> <li>c. <i>Cryptosporidium</i> monitoring is undertaken once a year for the last 10 years based on the population and presence of barrier in accordance with Cork County Council sampling criteria. Up to 2014 the raw and treated water were sampled twice a year for <i>Cryptosporidium</i>. For the last 2 years only treated water was tested. <i>Cryptosporidium</i> has not been detected previously. These monitoring results were not available on the day of the audit.</li> <li>d. Treated water monitoring data for 2012 – 2014 was reviewed. Data was not available for 2015. Irish Water since confirmed that the sampling plan in 2015 was for 3 no. check and no audit sample. The EPA is satisfied that the 2016 sampling plan includes 4 no. check and 1 no. audit sample.</li> </ul>
<b>7.</b>	<p><b>Hygiene and Housekeeping</b></p> <ul style="list-style-type: none"> <li>a. The caretaker is responsible for the operation of waste water treatment plants in addition to water treatment plants.</li> </ul>
<b>8.</b>	<p><b>Management and Control</b></p> <ul style="list-style-type: none"> <li>a. There is automatic shutdown at the inlet to the slow sand filters if the turbidity of the raw water exceeds 1 NTU. There is no text alarm system in place to inform the caretaker of the automatic shutdown of the inlet to the filters. The facility exists for the caretaker to access data on a daily basis to observe the turbidity and daily flow data.</li> <li>b. Text alarms are in place for (i) low water level at the reservoir and (ii) high and low residual chlorine levels.</li> <li>c. SCADA is monitored at the Macroom Water Treatment Plant by Cork County Council personnel.</li> <li>d. There is a response cascade system in place with both caretakers getting text message alarms.</li> <li>e. Copies of SOPs, drawings and schematics were available the plant.</li> <li>f. Detail on the water source and treatment in place on the Drinking Water Returns in EDEN for 2015 are incorrect.</li> </ul>

### 3. AUDITORS COMMENTS

The initial investigations by Irish Water following the detection of *Giardia* indicated that the turbidity was < 1 NTU and chlorination was operating at adequate levels. Further investigations were undertaken by Irish Water on 21/06/16 in to the effectiveness of the slow sand filters in conjunction with the cleaning of Filter Bed No. 1. Slumping was observed in Filter No. 1 during dewatering prior to cleaning operations. Resampling on the 22/06/16 confirmed the presence of *Cryptosporidium* and *Giardia*. A decision was made by Irish Water to undertake resanding of both filters. No investigation into activities on the catchment took place following the detections of *Cryptosporidium* and *Giardia* and there is no evidence of any monitoring of potentially polluting activities taking place in the catchment.

Due to difficulties with the sourcing of the required filter media there had been a delay in resanding works commencing. The resanding of the slow sand filters should be progressed without any further delay. Monitoring of the raw and treated water for *Giardia* and *Cryptosporidium* is required following the maturation of the schmutzdecke to demonstrate that the slow sand filters are working correctly post upgrade works. SOP's are in place at the plant but additional detail is required with respect to the standard observations that should be recorded during the skimming operations and the water quality monitoring to be undertaken in the treated water prior to sending water into supply. Based on the high TOC recorded in the raw water, monitoring of THM's is recommended for a period during 2016 to coincide with likely seasonal peaks.

The audit found that the majority of the EPA recommendations of the previous audit in 2009 had been implemented.

## **4. RECOMMENDATIONS**

### **Source Protection**

1. Irish Water should liaise with Cork County Council to ensure that:
  - (i) farm and septic tank inspections are carried out, in particular the domestic wastewater treatment system at houses near the source.
  - (ii) catchment inspections are carried out without delay when an incident arises at the water treatment plant as a result of deterioration of the source water quality.
2. Irish Water should ensure that the source protection and catchment risk assessment score for the *Cryptosporidium* risk assessment is urgently reviewed in detail and appropriate measures implemented to reduce the risk.
3. Irish Water should include Ballingearry PWS under the raw water monitoring programme and provide a timeframe for re-commencing raw water monitoring of the river source.

### **Slow Sand Filtration**

4. Irish Water should undertake the re-sanding of the slow sand filters and any necessary repair works (in particular any structural defects identified in Filter No. 1) without further delay.
5. Irish Water should develop documented Standard Operating Procedures (SOP) for maintenance of the slow sand filters to identify (i) the general checks required, (ii) what scenarios trigger the need for skimming and (iii) the need to record the observations made during the skimming operations and (iv) the requirement for water quality monitoring (including turbidity, coliform bacteria and *E. Coli*, etc.) on the filtered water after skimming. Monitoring is required to demonstrate that the filters have ripened prior to being brought back into service, in accordance with the EPA's *Water Treatment Manual: Filtration*. A copy of all procedures should be available for review at the plant.

### **Disinfection**

6. Irish Water should install a standby pump on the chlorine booster station with automatic switch over.

### **Treated Water Storage**

7. Irish Water should install a finer mesh on the vents on the holding tank at the WTP and at the reservoir to prevent entry of large insects.

### **Monitoring and Sampling Programmes for Treated Water**

8. Irish Water should undertake monitoring for *Cryptosporidium* and *Giardia* in the raw and treated water once the filters have ripened. If any *Cryptosporidium* oocysts are detected during the monitoring programme then Irish Water should immediately contact the Health Service Executive.
9. Irish Water should undertake monitoring of THM's for the next 3 months (August, September and October) on (a) the final water at the WTP pre reservoir, (b) post reservoir and (c) at the end of the network and such results submitted to the EPA.

### **Management and Control**

10. Irish Water should ensure that the Drinking Water returns data in EDEN is updated to reflect that the site is a surface water source rather than a groundwater source and the level of treatment provided.

## **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 Aoife Loughnane, 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:**

Críona Doyle

**Date:**

12<sup>th</sup> September 2016