Drinking Water Audit Report

County:	Mayo	**Date of Audit:**	15th May 2015
Plant(s) visited:	Lough Mask RWSS	**Date of issue of Audit Report:**	20th May 2015
		File Reference:	DW2007/464
		Auditors:	Mr. Darragh Page
Audit Criteria:	• The *European Union (Drinking Water) Regulations 2014 (S.I. 122 of 2014).* • *The EPA Handbook on the Implementation of the Regulations for Water Services Authorities for Public Water Supplies (ISBN: 978-1-84095-349-7)* • The recommendations specified in the EPA *Drinking Water Report*. • The recommendations in any previous audit reports.		

MAIN FINDINGS

i. **Elevated turbidity levels on individual filters were commonly observed due to telemetry alarm control and operational issues which results in poor control over turbidity levels coming through the filters. Irish Water should review the management and operation of the filters and implement the necessary changes to the SCADA to ensure that such incidents are eliminated.**
ii. **The chemical coagulant dosing chamber has operational issues that need to be rectified, in particular the possible shearing of the floc at the weir and the dead zones in the mixing chamber. Irish Water should carry out a full assessment of the chemical dosing chamber to ensure that it suitable for current and future use.**
iii. **The current method of recycling filter backwash water and sludge bleeds presents a risk to the supply and a review should be carried out to minimise the risk from this practice.**

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 in response to the notification by Irish Water dated 12th May 2015 of the detection of *Cryptosporidium* in the Lough Mask RWSS.

The opening meeting commenced at 10:00 am at the Lough Mask Regional Public Water Supply (PWS) Drinking Water Treatment Plant in Tourmakeady, Co Mayo. 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 Lough Mask Regional PWS supplies approximately 33-34,000 m^3/day. The design capacity of the plant was reported as 39,000 m^3/d. Treatment at the plant consists of coagulation with ferric and poly, clarification, rapid gravity filtration, chlorination and fluoridation.

The following were in attendance during the audit.

Representing Irish Water: (* indicates that person was also present for the closing meeting) Anne Bonner, Compliance Specialist, Irish Water* Anthony Skeffington, Regional SLA Lead Engineer, Irish Water* Pat O'Sullivan, Compliance, Irish Water* Kieran Shally, Senior Executive Engineer, Mayo Co Co;* Martin Lardner, Plant Manager, Mayo Co Co* Conor O'Toole; Plant Caretaker, Mayo Co Co. Representing the Environmental Protection Agency: Darragh Page, Inspector Representing the Health Service Executive Diarmuid O'Donovan, Regina Kieran, Denise Roddy and Catherine Cosgrave

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.	**Source Protection** a. The source of the supply was not examined as part of this audit.
2.	**Coagulation, Flocculation and Clarification** a. During the previous audit Irish Water (IW) advised that there were issues with the chemical dosing and coagulation stage. IW has since then installed a static mixer and put in place a bar in the mixing chamber (see Photo 1) which appears to have improved chemical coagulant mixing in the first stage of the chemical mixing chamber. b. The poly dosing point was moved and now doses immediately before a weir. There is a sharp drop from the weir close to the wall of the chamber (see Photo 2). The drop appears to cause the water to be more turbulent than is necessary for floc formation and may be shearing the floc apart. There is also a "dead zone" in the mixing chamber (see Photo 3) which has a build up of sludge due to the quiescent conditions. c. There was evidence of pin floc carryover on one of the clarifiers (see Photo 4).
3.	**Filtration** a. The clarified water is distributed to 8 no. rapid gravity filters. These consist of 4 older filters and 4 new ones installed as part of the recent upgrade completed in 2014. b. An extensive examination of the performance of the filters was carried out during the audit looking at the results from the turbidity monitor for each filter from 1st March 2015 to the 15th May 2015. c. Significant issues in the performance of some of the filters were observed, in particular filter no. 7 as detailed below. d. There is inadequate control over the turbidity alarms at present. With the current set up of

	the SCADA the backwash process can only trigger on an instantaneous result. MCC explained that an instantaneous high result could be anomalous and could occur regularly if the level was set at the normal operational level of concern (i.e. 0.2 NTU). To overcome this SCADA set up gap, the backwash trigger was set to activate if the turbidity levels rise above 2 NTU on an instantaneous result. There is also a warning alarm which activates if the turbidity levels go above 0.2 NTU for more than 30 mins, however, this cannot, at present, be set up to trigger a backwash. It means that if levels rise above 0.2 NTU but remain below 2.0 NTU poor quality filtered water could enter supply for a period of time (this is a particular risk when the plant is unoccupied at night). e. There is also inadequate control over filter levels resulting in incidents where individual filters (particularly no. 7) run dry or are flooded. Where such incidents occurred the levels of turbidity on the affected filter rose significantly. This problem is particularly acute when another filter has to be taken out of service for a period. For example, an incident with the penstock on filter no.8 on 20th March 2015 could not be properly repaired until 26th March 2015. During this period turbidity levels on the other filters was poor due to the effect of taking filter no.8 out of service (see Photo 5 for turbidity readings during this period). This led to levels of >1.0 NTU coming through some of the filters on occasion and particularly filter no.7. A repeat of a related incident occurred on 27th, 29th (see Photo 6) and 31st March 2015, 2nd, 11th and 12th April 2015. f. Other incidents of elevated levels of turbidity include (but were not limited to) 3rd March 2015 (due to cold weather and floc carryover), 15th-16th March 2015 (filter flooded), 13th April 2015 (filter no. 7 ran dry) and 7th May 2015 (filter ran dry). g. IW stated that the scope of the necessary improvement works for filter control had been drawn up and a quote obtained to carry out these works. IW stated that these works could be completed in the next 4-6 weeks. h. A backwash of filter no.8 was carried out and no issues with the backwash were observed.
4.	**Chlorination and Disinfection** a. Filtered water from filters no.1-4 enters contact tank no.1 while filters no. 5-8 enter contact tank no.2. b. There is a chlorine monitor on both flows but they are located at different points and therefore not directly comparable (e.g. to determine whether water from filters 1-4 has a different chlorine demand to filters no.5-8). c. IW stated that the contact time before the monitor after contact tank no.2 is insufficient to give a suitable reading as disinfection is not complete. d. IW stated that they have scheduled to carry out improvement works to the control of the chlorine monitoring system in the next 6 weeks.
5.	**Treated Water Storage and Distribution Network** a. Treated water is stored in 2 no. clear water tanks at the plant which have approx. 12 hours storage.
6.	**Monitoring and Sampling Programme for treated water** a. The final water at the Lough Mask Water Treatment Plant has been tested weekly for *Cryptosporidium*. Results up to 10th May 2015 were all free of oocysts, however a sample of 1215 L on 10th May 2015 contained 2 oocysts (0.016 oocsyts/10L). b. Sampling of the raw water, in addition to the final water, for *Cryptosporidium* commenced on the day of the audit.
7.	**Sludge and Backwash Water Management** a. Filter backwash water and supernatant from the sludge bleeds are recycled to the head of the works as discharge from the plant is not permitted. b. The original design of the plant was that all the filter backwash water and the sludge bleeds

	were to enter the picket fence thickener. The sludge was to be pressed and the supernatant returned to the balancing tanks at the head of the works. c. The filter backwash water is now discharged into a balancing tank from where it is returned to the head of the works via the balancing tanks. There is no treatment of this other than basic settlement. d. The filter backwash water and the picket fence thickener supernatant are pumped intermittently to the balancing tanks. The quality of the recycled water is inferior to the raw water. This has the potential to cause variable quality raw water going into the clarifier as well as increasing the possibility of concentrating any *Cryptosporidium* oocysts. Irish Water has not assessed the impact of managing the recycled water in this manner is having on the water being presented for clarification.

3. AUDITORS COMMENTS

There are significant operational issues at the Lough Mask Water Treatment Plant that present a risk of filter breakthrough which could result in *Cryptosporidium* entering the supply if present in the raw water. Specifically, SCADA controls and operation of the filters requires urgent attention as it is clear that there are regular occurrences of elevated turbidity breakthrough on various filters (but most notably filter no.7).

The chemical mixing chamber is not suitable and requires improvement. While improvements have been made further improvements in the immediate to short term, such as preventing possible shearing of the floc from the weir, are necessary to optimise floc formation and reduce the challenges to the filters. A full assessment of the chemical dosing chamber is required to ensure that it suitable for current and future use.

4. RECOMMENDATIONS

Source Protection

1. Irish Water should ensure that daily monitoring of the raw and treated water for *Cryptosporidium* is continued for the duration of the outbreak (as determined by the HSE). Following this Irish Water should continue with weekly monitoring of the raw and treated water, unless a case can be made by Irish Water based on site specific risk assessment for less frequent monitoring.

Coagulation, Flocculation and Clarification

2. Irish Water should carry out a full review of the chemical coagulation stage of the plant and outline what actions are to be taken to address the issues identified. In particular, the report should include what actions are to be taken to:
    a. Prevent shearing of the floc at the weir.
    b. Eliminating the dead end in the mixing chamber.
    c. Ensure that the chemical dosing and mixing stage is optimised and appropriate for the throughput of the plant.

3. Irish Water should carry out an investigation to identify the cause of pin floc formation. In this regard Irish Water shall consult Table 2 on Page 41 of the EPA publication "*Water Treatment Manual: Coagulation, Flocculation and Clarification*" and investigate the use of polyelectrolyte and pH correction in line with the designed plant's operating procedures.

Filtration (General)

4. Irish Water should carry out the necessary remedial works to the filter controls to ensure that incidents of breakthrough on the filter are minimised. These works should include a review of

alarms and control of alarms, filter levels and loads. Irish Water should outline what actions are to be taken to address the issues identified during the audit.

5. Following the remedial works to the filter controls Irish Water should implement revised procedures for the management of the filters including details of when filters should run to waste or are backwashed to prevent a risk of *Cryptosporidium* breakthrough.

Disinfection

6. Irish Water should review disinfection system controls and ensure that the chlorine monitors can be used to adequately control the chlorine dose.

Sludge Management

7. Irish Water should review current methods of recycling the filter backwash water and sludge bleeds. Irish Water should submit a report to the EPA outlining what actions are to be taken including timeframes to reduce the risk of *Cryptosporidium.* This report should include as a minimum a review of the quality of the recycled water, flows into the balancing tanks and the impact this has on the coagulation stage.

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 Mr. Brendan Wall, Manager, Environmental Enforcement.

Irish Water should submit a report to the Agency within one week 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:  **Date:** 22nd May 2015

Darragh Page

Inspector

Photo 1. Bar Installed in Chemical Mixing Chamber to Improve Mixing.

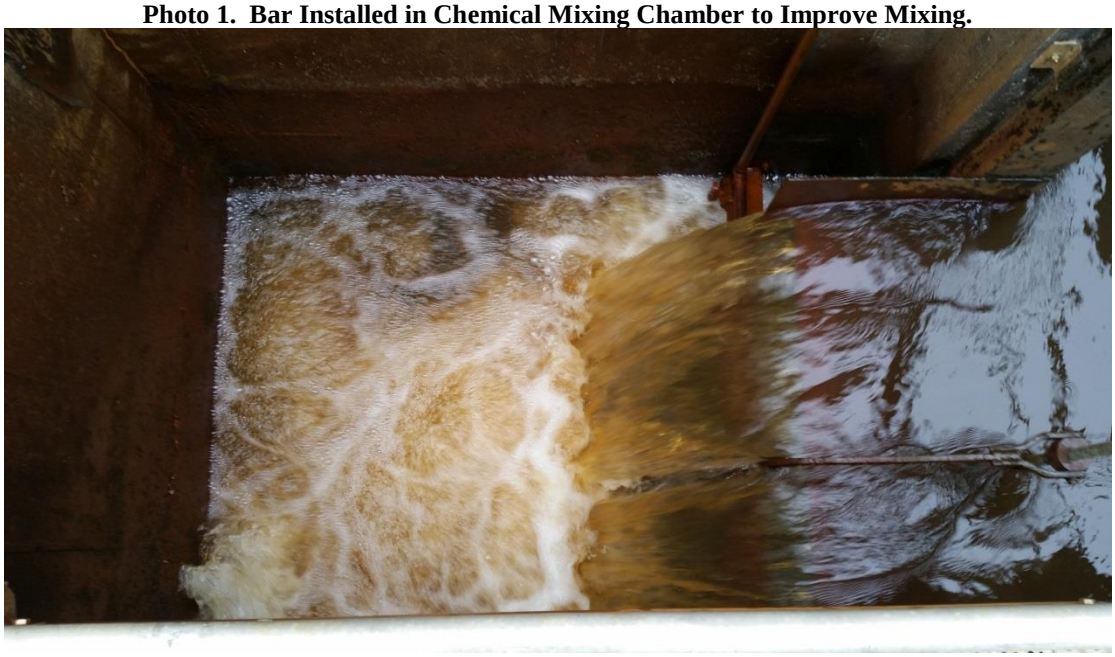

Photo 2. Weir following ferric and poly dosing.

Photo 3. "Dead Zone" in mixing chamber (note sludge build up).

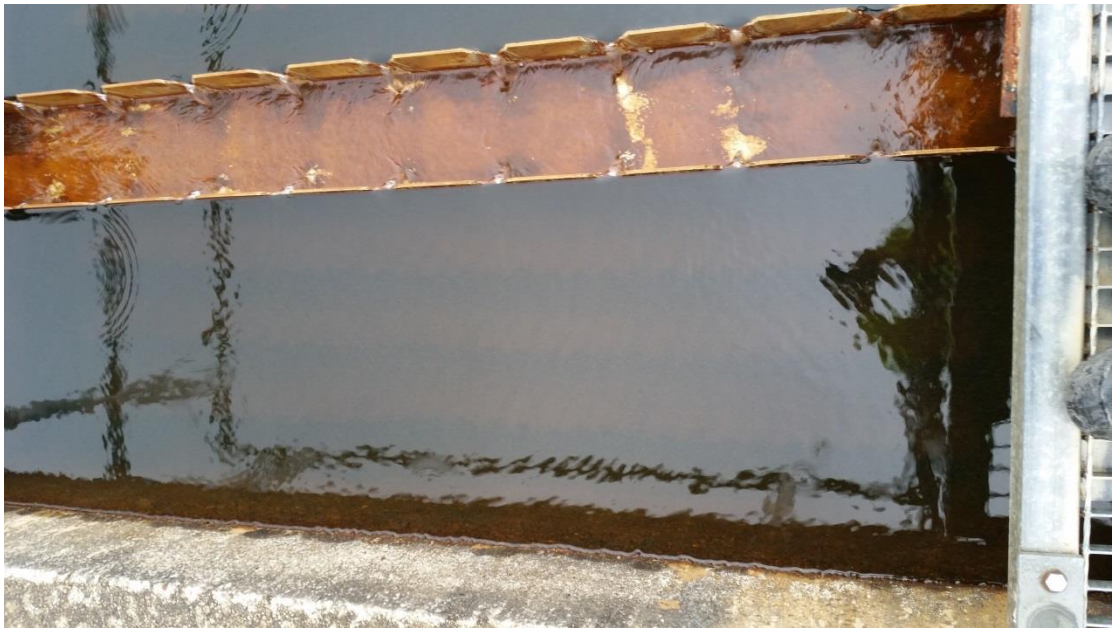

Photo 4. Pin Floc Carryover in Clarifier.

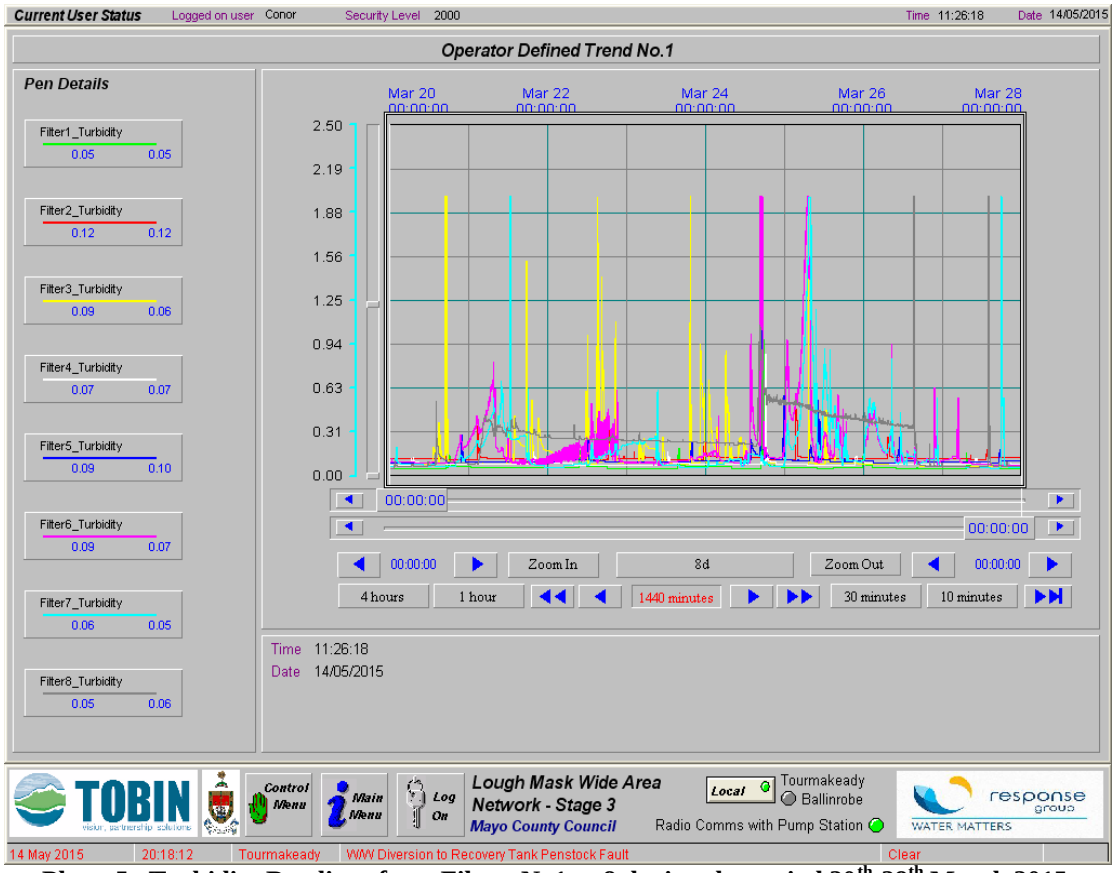

Photo 5. Turbidity Readings from Filters No1 to 8 during the period 20th-28th March 2015.

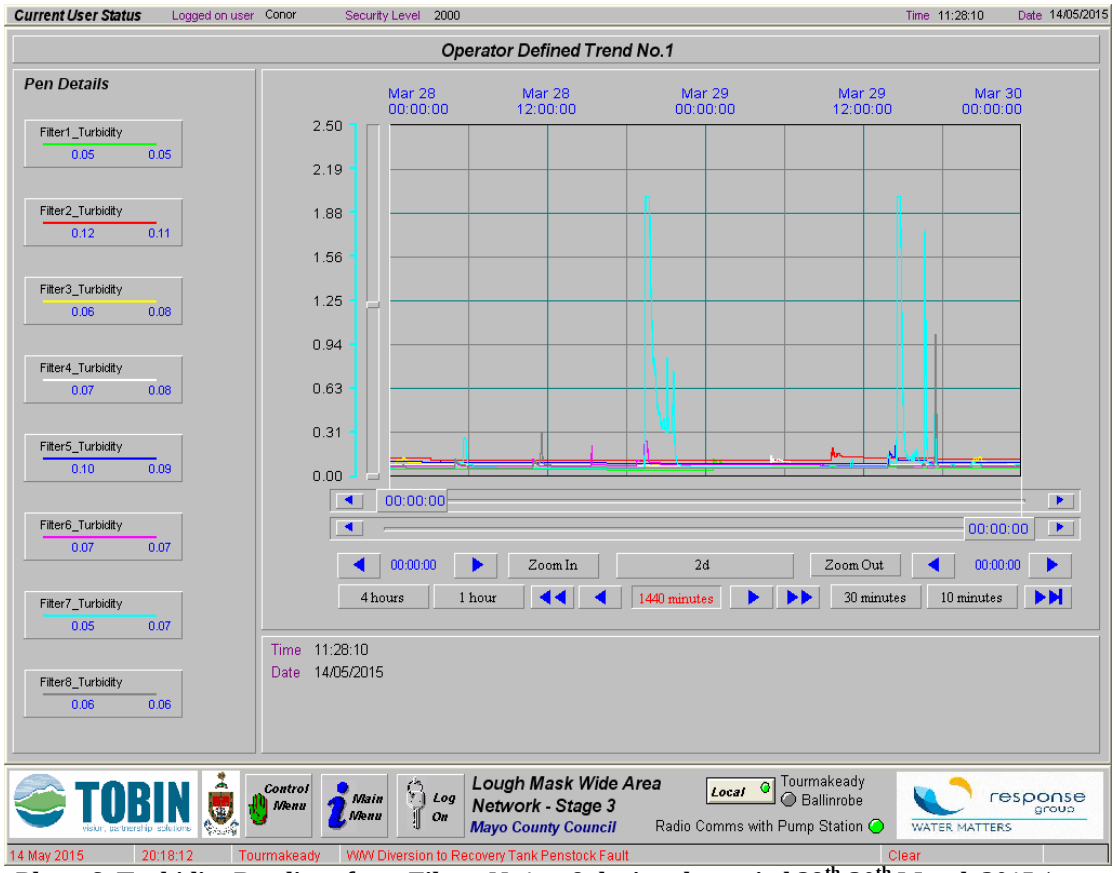

Photo 6. Turbidity Readings from Filters No1 to 8 during the period 28th-30th March 2015 (note the poor performance of filter no. 7).