



Drinking Water Audit Report

County:	County Cork	Date of Audit:	12/08/2014
Plant(s) visited:	Tibbotstown (0500PUB2408)	Date of issue of Audit Report:	20/08/2014
		File Reference:	DW2014/284
		Auditors:	Ms. Cliona Ní Eidhin
Audit Criteria:	<ul style="list-style-type: none"> • The <i>European Union (Drinking Water) Regulations 2014 (S.I. 122 of 2014)</i>. • 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> • The recommendations specified in the EPA Report on <i>The Provision and Quality of Drinking Water in Ireland</i>. • The recommendations in any previous audit reports. 		

MAIN FINDINGS

- i. *The security of the Tibbotstown public water supply would benefit from investment to modernise and automate a number of aspects and controls of the treatment process.*
- ii. *The chlorine monitor was alarmed but the low level alarm set point was found to be too low to function as a meaningful assurance of adequate chlorine levels in the network.*

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 of failures to meet the parametric values specified in the Regulations for the following parameters on the dates indicated:

- Fluoride – 17/06/2014
- Lead – 20/05/2014
- *Cryptosporidium* – 07/04/2014

The audit was also scheduled due to the lack of response from Irish Water to an EPA request for information regarding the lead exceedance.

Where the text makes reference to ‘the Water Service Authority’ (WSA) this refers to Irish Water in accordance with Section 7 of the Water Services (No. 2) Act 2013.

Supply Information

The Tibbotstown Public Water Supply (PWS) is located in East Cork some 13 km east of Cork City and 3 km north of Carrigtohill village. The supply has two raw water sources. The primary source is an impounded lake located adjacent to the treatment plant. (see Photograph 1) The lake is topped up, if required, by piping raw water a distance of approximately 5 km from its secondary source; the Owenacurra river in Middleton. The plant also has the option of receiving raw water exclusively from the Owenacurra source by direct feed, bypassing the lake.

On the date of the audit, the treatment plant was receiving raw water direct from the Owenacurra River only, due to a recent algal bloom in the lake.

Design treatment capacity is 300 m³/hr and the plant is currently operating at a throughput of 180 m³/hr. The Tibbotstown PWS serves a population of 8718. The population served varies from time to time as the distribution network can be extended if capacity or other issues arise in adjacent supplies.

Treatment at the Tibbotstown plant is as follows:

- Flocculation and coagulation using aluminium sulphate
- Clarification
- Rapid gravity sand filtration
- Disinfection with sodium hypochlorite

There are two reservoirs in the distribution network; Springhill Upper and Killahora.

The Tibbotstown treatment plant operates 24 hours per day and has an assigned Water Curator who attends the plant 39 hours per week including weekends as required.

Irish Water advised that this plant was to be audited on 15/08/2014 within the Process Optimisation programme.

The opening meeting commenced at 10.00am at the Tibbotstown treatment plant. The scope and purpose of the audit were outlined at the opening meeting. The audit process consisted of interviews with staff, reviews of records and observations made during an inspection of the source, treatment plant and reservoir. The audit observations and recommendations are listed in Section 2 and 4 of this report. Photographs taken by Cliona Ní Eidhin during the audit are attached to this report and are referred to in the text where relevant.

The following were in attendance during the audit and closing meeting:

Representing Irish Water:
Conor Foley – Above Ground Water Lead, Irish Water Kevin Murphy – Water Engineer, Irish Water Liam Lynch – Senior Executive Engineer, Cork County Council Tony Sheehan – Water Curator (Relief), Cork County Council
Representing the Environmental Protection Agency:
Cliona Ní Eidhin - 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.

<p>1.</p>	<p>Source Protection</p> <ul style="list-style-type: none"> a. The two raw water sources used for the supply and the configuration of pipework directing raw water to the plant offer flexibility to the Tibbotstown PWS to adapt to changing conditions in the lake. The lake is inspected daily by the curator. The decision to switch to the secondary source in the period prior and up to the audit was taken following Curator observations of an algal bloom at the lake. There are no documented criteria or protocols governing the decision to switch from one source to the other. b. The WSA confirmed to the auditor that a number of landowners within the 250 m buffer zone around the lake had been written to in 2007 to advise them of their obligations under Article 17 of the EC (Good Agricultural Practice for the Protection of Water) Regulations and that a number had been inspected. The lake perimeter was not walked during the audit, however the WSA advised that it is not securely fenced off. c. A <i>Cryptosporidium</i> risk assessment was completed for this supply yielding a result of 137, indicating high risk. The WSA advised that this assessment was now out of date as some instrumentation had been installed since it was completed. d. The auditor noted that there is no online monitoring of raw water at the entry point to the plant nor at either of the intake points. The WSA informed that there is no routine monitoring programme for raw water. This presents a vulnerability to the supply in terms of reacting to pollution events. The only means of running water to waste is via the clarifier sludge bleeds. e. An actuated valve is in place at the entry point for raw water to the treatment plant. This valve is linked to the chlorine monitor; if the chlorine monitor alarm is triggered the valve shuts off the raw water inflow to the plant.
<p>2.</p>	<p>Coagulation, Flocculation and Clarification</p> <ul style="list-style-type: none"> a. Duty and standby coagulant dosing pumps were confirmed to be in place and were dosing flow proportionally. The pumps are calibrated internally. Dose is determined by the completion of jar tests. The frequency of jar testing is based on observation of the clarification process; typically the test is completed daily to every second day. There was no documented procedure prescribing the frequency of jar testing. Historical raw water monitoring results reviewed indicated that pH in both source waters was within the optimal range for coagulation. b. No coagulant aid is used at the treatment plant. c. Two of the 3 clarifier units at the plant were in operation on the day of the audit. It was noted that some of the decanting channels were not level. The WSA advised that this would be addressed under Process Optimisation. d. Downpipes from the treatment plant roof were diverting collected rainwater into the clarifier units. e. The operating clarifiers were observed during the audit. It was noted that there was some carryover of small floc particles into the decanting channels. f. The absence of online monitoring also limits the proactive management of the coagulation process, rather forcing a reactive management based on observation of the clarification process.
<p>3.</p>	<p>Filtration</p> <ul style="list-style-type: none"> a. Three filter units are in use at the Tibbotstown treatment plant. The WSA advised that sand replacement was to be undertaken in the near future. No details of the filter sand characteristics are documented at the treatment plant for reference when ordering replacement sand such as the suitable effective size and uniformity coefficient. b. The WSA advised that sand was to a depth of 800 mm in each filter. One filter appeared to have a lesser depth of sand than the other. No depth markers are in place in the filters and depth measurements using a staff are not routinely undertaken. c. The filtration rate was not known at the time of the audit. d. Turbidity monitors are in place on each filter and were reading 0.05, 0.06 and 0.07 NTU at the time of the audit. The turbidity monitors are calibrated by Council staff every three months. There is no

	<p>turbidity monitor on the combined filtered water.</p> <ul style="list-style-type: none"> e. The backwashing of one of the filters was observed as part of the audit. Control of the backwash cycle was noted to be very manual in nature and subject to run for as long or as short as the duty curator decides is necessary. The water cycle of the backwash is continued until the water appears to be running clear on visual inspection by the curator. No target turbidity is set to govern the duration of the backwash programme. f. A very slight dead zone was observed in one corner (beside the access ladder) of the filter during the backwash air cycle. During the water phase of the backwash programme the weir was noted to be not fully level, with reduced flow in the same area as the dead zone. Both observations were pointed out to the WSA as meriting investigation. g. The protocol for returning a filter to use after a backwash is documented in the Plant Operating Manual but the approach taken was reported to vary from one operator to another. The WSA advised that, after a backwash, the filter takes approximately 45 minutes to fill (with clarified water) and only resumes filtration when 1.8 head is reached. It was unclear whether ensuring this 45 minute 'stand' period allowing the filter to stand is manually controlled. It appeared from information provided by the WSA that, on returning a filter to use after a backwash, the filtered water may or may not be diverted to waste, depending on the operator.
<p>4.</p>	<p>Sludge Management</p> <ul style="list-style-type: none"> a. Sludge bled from the clarifiers and backwash water from the filters is discharged to the sludge settling tank located within the treatment plant site. Supernatant from the sludge settling tank is discharged to a small stream.
<p>5.</p>	<p>Chlorination and Disinfection</p> <ul style="list-style-type: none"> a. Disinfection is achieved by dosing final filtered water with sodium hypochlorite. Duty and standby dosing pumps were confirmed to be in place. Dosing is flow proportionate with the dosing point located in an enclosed culvert/ channel of filtered water underneath the floor of the treatment plant. The small circular entry point of the chlorine injection points to this culvert was open. (See photograph No. 2) b. A chlorine monitor is in place at the outflow from the plant. The chlorine monitor is alarmed with a low level set-point of 0.2 ug/l. The WSA advised that the alarm had never been triggered. The auditor noted that this alarm level was too low to function as a meaningful assurance of adequate chlorine levels in the network. During the audit the WSA committed to undertake a review of this alarm set point. c. Two remote chlorine monitors are in place at the outflow from each of the reservoirs at Springhill Upper and Killahora. Both monitors relay readings to the SCADA at Glashaboy drinking water treatment plant which is staffed 24 hours per day. d. The chlorine alarm is the only parameter governing the actuated valve at the inflow to the plant. Chlorine residuals are measured weekly at the end of the line by a network-based curator. Results for 2014 to-date were reviewed by the auditor and it was noted that levels lower than 0.1 ug/l were frequently recorded in the extremities of the network.
<p>6.</p>	<p>Fluoridation</p> <ul style="list-style-type: none"> a. Fluoride is dosed by a single dosing pump. Dose rate is set based on flow recorded at the inflow point to the plant.
<p>7.</p>	<p>Treated Water Storage</p> <ul style="list-style-type: none"> a. Two reservoirs are in use located in the distribution network of the Tibbotstown public water supply at Springhill Upper and Killahora. The Springhill Upper reservoir was inspected as part of the audit. b. The reservoir was constructed in 1970 and comprises two cells. Inspection hatches were confirmed to be locked and sealed. Immediately after the audit, the WSA informed the auditor that the reservoir was last drained down, washed and integrity assessed in April 2004 with no concerns identified. c. It was noted that, whilst the reservoir vents were secure against vandalism (see Photograph No. 3), there was no mesh in place on the vent openings.

8.	<p>Monitoring and Sampling Programme for treated water</p> <p>a. A dataset of treated water sampling results for 2014 were reviewed during the audit. An iron exceedance (361 µg/l) in the Ballard Hill area of Cobh was noted by the auditor and the presence of cast iron mains in this locality was discussed. No other results of concern were noted.</p>
9.	<p>Exceedances of the Parametric Values</p> <p>a. The WSA notified the EPA on 04/07/2014 of an exceedance (0.92 mg/l) of the fluoride parametric value in a sample taken on 17/06/2014. The cause of this exceedance was discussed. Dosing with fluorosilicic acid at the plant takes place close to the outflow point, but the dose rate is set based on the measured inflow. Typical average daily volumetric losses due to sludge bleeding and filter backwashing are factored into the dose rate required. On the days leading up to the exceedance, a malfunctioning valve in one of the filters lead to the curator backwashing two filters in one day, rather than one. The plant's net throughput was therefore reduced yet fluoride dose was not adjusted accordingly. The WSA have provided some details of actions proposed to replace filter valves and put in place a better flow monitoring arrangement at the outflow to permit more accurate dose control. Submission of a timeframe for completion of this work is pending. The file reference for this exceedance is DW2014/263.</p> <p>b. The WSA notified the EPA on 16/06/2014 of an exceedance (37.5 ug/l) of the lead parametric value in a sample taken on 20/05/2014. On the date of the audit, a response to an EPA request for further information was overdue by 7 weeks. During the audit, the WSA committed to submission of the requested information; this was received the next day. A number of questions asked by the EPA in relation to the initial exceedance were not addressed in Irish Water's response. These will be pursued within the relevant file (Reference DW2014/246).</p> <p>c. A single <i>Cryptosporidium</i> oocyst was detected in final water as part of the County-wide routine <i>Cryptosporidium</i> monitoring programme. As this supply has a high <i>Cryptosporidium</i> risk score, it has been sampled for <i>Cryptosporidium</i> between 5 and 7 times per year. Results for the years 2011 to 2014 (to-date) have been provided to the EPA. Results prior to April 2014 were negative for <i>Cryptosporidium</i>. In accordance with <i>European Union (Drinking Water) Regulations 2014</i> the oocyst detected in April 2014 required notification to the EPA. The advice of the HSE was to retest. Results of retesting are pending.</p>
10.	<p>Chemical storage and bunds</p> <p>a. Bulk and day tank storage facilities for chemicals were observed to be adequately banded and all chemicals were confirmed to be in date. The site is secure and the protocol for delivery of chemicals in bulk was satisfactory.</p>
11.	<p>Hygiene and Housekeeping</p> <p>a. The treatment plant was confirmed to be well maintained and was generally clean and tidy.</p>
12.	<p>Management and Control</p> <p>a. Good labelling of various points in the treatment process was noted throughout the plant.</p> <p>b. A toilet at the plant directs waste to a septic tank located in the far corner of the treatment plant site and did not raise any concerns.</p>

3. AUDITORS COMMENTS

The Tibbotstown drinking water treatment plant is one of strategic importance in the provision of drinking water to consumers in this sub-region of County Cork due to the use of an impounded lake source, the availability of a supplementary and/or alternative river source and as the plant is currently only operating at just over half of its design capacity.

Up to 2014, the treatment plant has operated satisfactorily and has produced water in compliance with the Regulations. The plant, however, shows that there has been minimal investment in the plant over the past decade or so. This is evident throughout the treatment plant with a marked absence of automation and lack of optimised controls over certain processes. The majority of the plant's treatment processes are manually controlled and, therefore, open to inconsistency. The EPA welcomes Irish Water's scheduled Process Optimisation Audit of this plant and seeks that investment to enhance controls at the plant be expedited in order to improve supply security, ensure future compliance and protect human health.

4. RECOMMENDATIONS

Source Protection

1. **Source Protection:** The Water Services Authority should ensure that the *Cryptosporidium* risk assessment is reviewed following the implementation of actions to address these audit recommendations and those of the Process Optimisation audit and appropriate measures implemented to reduce the risk.
2. **Source Protection:** The Water Services Authority should assess the security of the lake, particularly at the southernmost end, closest to the intake. If access by livestock is found to present a risk to the raw water quality, action should be taken to ensure it is made secure and fenced off to prevent livestock access.
3. **Source Protection:** The Water Services Authority should ensure that the sending of letters to landowners within the 250 m buffer zone around the lake to advise them of their obligations under Article 17 of the EC (Good Agricultural Practice for the Protection of Water) Regulations is repeated periodically. Farm inspections should also be repeated periodically and as required on foot of lake perimeter inspections.
4. **Source Protection:** The Water Services Authority should install a continuous, alarmed online monitor to track changes, alert plant operators of any changes in raw water quality and to assist in treatment process optimisation. An ammonia monitor is recommended on the river source and any further parameters that the WSA deems necessary to protect the treatment plant against pollution events should be monitored for also. The WSA should consider linking the online raw water monitor to automatic shut-off of the intake/inflow should key parameters exceed alarm levels.
5. **Source Protection:** The Water Services Authority should prepare and document a procedure setting out the actions to be taken in the event of a serious pollution event in either of the source waters for reference until online raw water monitoring and alarms / shut off are installed.
6. **Source Protection:** The Water Services Authority should develop and document a protocol setting out the criteria for enacting the topping up of the lake using the Owenacurra river source and for changeover to using the river source exclusively, by direct feed.

Coagulation, Flocculation and Clarification

7. **Coagulation:** The Water Services Authority should ensure that the frequency of jar testing to determine optimum coagulant dose is documented as a procedure within the plant operating manual and that this procedure is followed. Results should be recorded at the treatment works

and used for control of the treatment plant.

8. **Clarification:** The Water Services Authority should carry out an investigation to identify the cause of floc carryover from the clarifier onto the filters. In this regard the Water Services Authority shall consult Table 2 on Page 41 of the EPA publication "*Water Treatment Manual: Coagulation, Flocculation and Clarification*" and consider whether a coagulant aid is required or whether dose control requires optimisation or automation in order to respond to variations in raw water quality.
9. **Clarification:** The Water Services Authority should ensure that the settled water outlet or decanting channels are level and that flow into these channels is even.
10. **Clarification:** The Water Services Authority should review the current arrangement whereby rainwater from the roof of the main treatment plant building is directed by down pipes into the clarifier units and undertake to modify this arrangement.

Rapid Gravity Sand Filtration

11. **Filtration:** The Water Services Authority should install a continuous turbidity monitor on the final treated water at the water treatment plant (i.e. on the combined filtered water from all operating filters). These monitors should be linked to a recording device and generate an alarm in the event of a deviation from the acceptable operating range of the filters.
12. **Filtration:** The Water Services Authority should ensure that the air/water backwash is even across the filter and should ensure that air nozzles are fully functional and not blocked or damaged. Any 'dead zones' should be investigated and action taken to address the underlying cause.
13. **Filtration:** The Water Services Authority should ensure that the weir is level in each filter thus ensuring even backwashing.
14. **Filtration:** The Water Services Authority should ensure that the planned replacement of filter media is undertaken.
15. **Filtration:** The Water Services Authority should ensure that a 'filter logbook' is kept for each filter containing the following:
 - i. Details of the media depth and particulars of the sand used in the filter.
 - ii. A procedure for the regular measurement of depth of filter sand.
 - iii. A record of all maintenance work and inspections carried out on the filter;
 - iv. A record of any observations made regarding the condition of the filter when it is drained down;
 - v. Details of the backwashing programme;
16. **Filtration:** The Water Services Authority should follow the guidance as specified in the EPA publication "*Water Treatment Manual on Filtration*" and in particular the following action is required as a priority;
 - i. Ensure that the minimum depth of filter media (excluding the gravel layer) is no less than 800 mm ;
 - ii. Ensure that the filtration rate in the rapid gravity filters does not exceed $7.5 \text{ m}^3/\text{m}^2/\text{hour}$;
 - iii. Review the filter backwash process to ensure that the maximum backwash water flow rate does not exceed $20 \text{ m}^3/\text{m}^2/\text{hour}$;
 - iv. Ensure that, following backwashing, the filters are run to waste for an appropriate period of time, until a target turbidity is reached or that there is a fixed period slow start when the filter is brought back into use and that this is strictly followed each time a filter is backwashed, or both; and
 - v. Review the operation of the filters to ensure that the levels of turbidity in the filtered water are as low as possible. As this is a high risk *Cryptosporidium* plant then the turbidity of the filtered water should not exceed 0.25 NTU.

Disinfection

17. **Disinfection:** The Water Services Authority should place a seal / cover over the small hole at the entry point of the chlorine dosing lines to the underfloor treated water culvert.
18. **Disinfection:** The Water Services Authority should review the low level chlorine alarm set point and reset it to a level which provides assurance of adequate chlorine levels in the network.
19. **Disinfection:** The Water Services Authority should ensure that a chlorine residual of > 0.1 mg/l is maintained in all areas of the network at all times.

Treated Water Storage

20. **Treated Water Storage:** The Water Services Authority should ensure that all vents on the Springhill Upper and Killahora reservoirs are secured against ingress of animals or insects. A photograph should be submitted as an example of the mesh put in place at either reservoir.

Exceedances of the Parametric Values

21. **Exceedances of the parametric values:** The Water Services Authority should submit a timeframe for completion of actions to permit more accurate fluoride dose control.
22. **Exceedances of the parametric values:** The Water Services Authority should submit results of retesting undertaken for *Cryptosporidium* in treated water from the Tibbotstown PWS. If any *Cryptosporidium* oocysts are detected during retesting the Water Services Authority should immediately contact the Health Service Executive and notify the EPA.
23. **Exceedances of the parametric values:** The Water Services Authority should ensure that a response is submitted to all questions asked by the EPA in respect of the 20/05/2014 lead exceedance. These should be submitted without delay within file reference DW2014/246 and not as a response to this audit report.
24. **Exceedances of the parametric values:** The Water Services Authority should include premises in the Ballard Hill, area of Cobh in a sampling programme to ascertain whether there is an issue with persistent iron exceedances in this part of the network. If persistent exceedances are identified, the WSA should consult with the HSE. Iron is an indicator parameter and the EPA should be notified if the criteria as set out in the *EPA Handbook on the Implementation of the Regulations for Water Services Authorities for Public Water Supplies* are met.

Sludge Management

25. **Sludge Management:** The Water Services Authority should analyse samples of the supernatant from the sludge settling tank for aluminium and submit results to the EPA.
26. **Sludge Management:** The Water Services Authority should review current methods of handling and disposal of water treatment sludge to ensure that the practice is not in contravention of the *Waste Management Act, 1996-2003*. The discharge of water treatment sludge to receiving water, where practiced, should cease immediately. Leachate from stored drinking water sludge should not give rise to environmental pollution. The mixing of water treatment sludges for subsequent spreading on land is not permitted under the *Waste Management (Use of Sewage Sludge in Agriculture) Regulations, 1998* and therefore such practices, where they exist, should cease immediately.

FOLLOW-UP ACTIONS REQUIRED BY IRISH WATER

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

The Water Services Authority 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 actions 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 **DW2014/284** in any future correspondence in relation to this report.

Report

prepared by:

Cliona Ní Laidhin

Date:

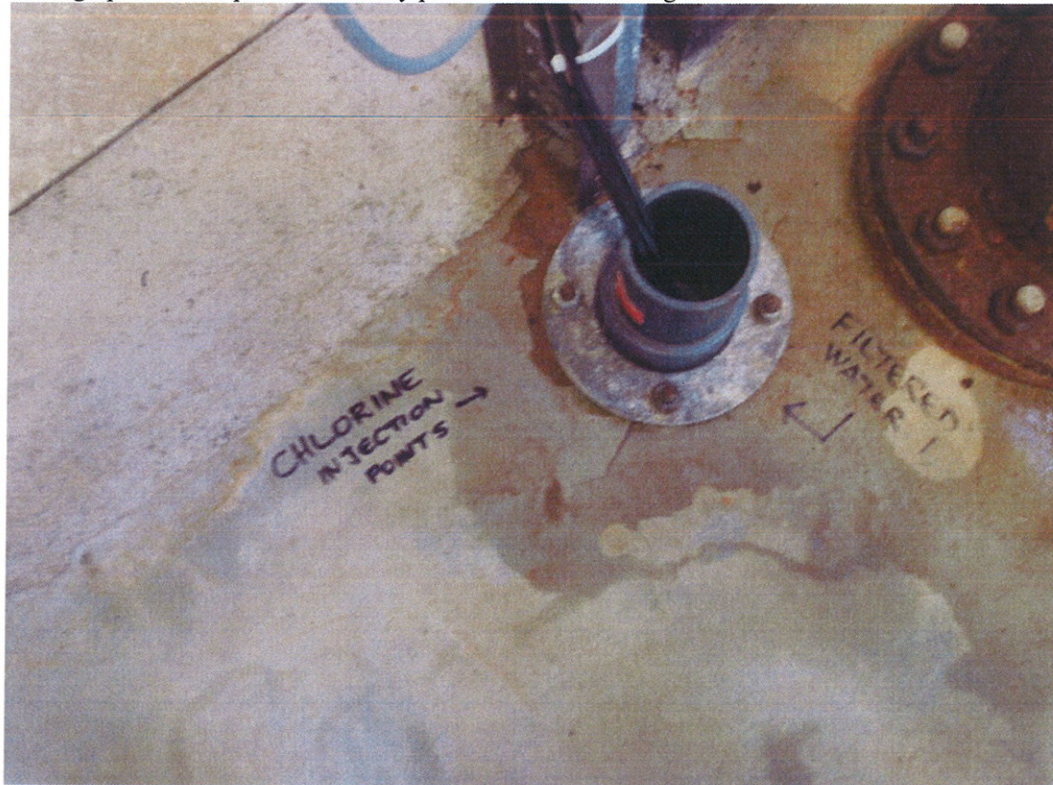
20.08.14

Inspector

Photograph No. 1: The primary raw water source – an impounded lake located adjacent to the plant.



Photograph No. 2: Open hole at entry point of chlorine dosing lines.



Photograph No. 3: Reservoir vents – secure against vandalism but no mesh in place.

