

 <p><b>WATER</b> CORPORATION ABN 28 003 434 917</p>	<p align="center"><b>Disposal of Highly Chlorinated / Alkaline Disinfection Water Guideline</b></p>
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*For assistance with this guideline please call the Manager Operations Section, Environment & Aboriginal Affairs Branch.*

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**1. Purpose**

To identify the steps that must be taken to minimise the environmental and asset related impacts of the disposal of hyper chlorinated water (usually that has been used to disinfect water supply assets) or alkaline water (usually associated with the commissioning of new assets).

To provide a decision-making hierarchy of the options to be followed in the disposal of disinfection water is included.

To provide a Disposal Plan and Record Form (Appendix 2 of this document) for completion and submission by the Project Manager for approval prior to commencing the work.

## 2. Scope

This document covers the disposal of both hyper chlorinated water and alkaline water to the environment by Water Corporation employees and contractors working on Water Corporation assets.

## 3. Definitions

For the purpose of this guideline, the following definitions apply:

- **Disinfection water:** Highly chlorinated (usually >20mg/L chlorine concentration) water used to disinfect water supply assets following maintenance and construction activities. It may contain other materials that were present in the asset e.g. soil, particles of pipe (lining)
- **Alkaline water:** Water that has a pH >9 (Typically associated with the commissioning of new cement lined assets that contain or store water e.g. pipelines and storage tanks)
- **Receiving environments:** Any ecosystem and its constituent parts that the disinfection water is released into. They may be natural or manmade e.g. water bodies, land, stormwater systems.
- **Receiving waters:** Any water body, or its dry bed e.g. creek, river, lake, channel or gutter used to, or designed to, receive and convey rainwater;
- **Sensitive areas:** Locations that are considered significant from an environmental, cultural or heritage perspective which may be negatively impacted upon. For example wetlands and culturally important sites.
- **Disposal Plan:** A documented process to determine the most effective way of disposing of disinfection water or alkaline water, ensuring minimal impact upon the receiving environment. The Disposal Plan is an integral part of the Commissioning Plan (which is finalised in the Delivery Phase of a project) and is the responsibility of the Project Manager.

## 4. References

Corporate Incident Management Standard S110

Drinking Water Sampling Procedures

Disinfection of Water Mains

CEMS Environmental Aspects and Impacts Guideline

## 5. Guideline

### *Use of highly chlorinated water for disinfection*

The Water Corporation uses highly chlorinated water for the disinfection of water mains, tanks and reservoirs. Disinfection is carried out to ensure that the asset is free of bacteria (Refer to Guideline: Disinfection of Water Mains). Initial

concentrations of chlorine in the disinfection water vary from 20mg/L (24 hours contact time) up to 100mg/L. (three hours or more contact time). The concentration of disinfectant will depend on the time available and the activities and type of contamination that has occurred during construction or maintenance. The pH should not be higher than 8.5. However, in relation to drinking water quality, 9.2 is acceptable if the bacteriological results are satisfactory and the main is to be put into service immediately.

### *Environmental Impacts*

Care must be taken to minimise the impacts of chlorinated water disposal on the environment and Water Corporation assets. The discharging of disinfection water to the wrong environment or in the wrong manner can result in

- Harm to living organisms in receiving environments
- Erosion of soil and increased turbidity in water bodies
- Non-compliance with relevant legislation e.g. environmental harm offences and associated penalties
- Increased cost due to the need for remediation works.

### *Monitoring*

The disinfection water must be analysed for total chlorine, and where appropriate, turbidity, pH and temperature to gain information to be used in the disposal hierarchy evaluation.

The receiving environment where the disinfection water is discharged must be monitored before, during and after the disposal process. This includes visual inspection as well as collection and analysis of soil and/or water samples.

## **6. Types of Discharge/Disposal**

### *Disposal of Potable Water from Water Main Flushing*

Potable water from water main flushing (or used for disinfection of mains), which typically has a chlorine concentration of about 1mg/L (but can have up to 5 mg/L and can also contain chloramines), may be disposed directly to the environment. Disposal of this water needs to consider erosion, pH and suspended solid issues, and should be undertaken in a manner to minimise these issues.

### *Disposal of Disinfection Water*

Disinfection water with a total chlorine concentration less than 1mg/L can be disposed of directly to the environment. Disinfection water with a total chlorine concentration greater than 1mg/L should not be disposed of directly to streams or rivers, or to storm water systems that are within 150 metres of a stream or river.

### *Disposal of Alkaline Water*

Alkaline water with a pH greater than 10 should not be discharged to the environment. Typically new concrete lined assets associated with the storage or transfer of water (tanks or pipelines) has the potential to promote alkalinity when water has been into contact with these assets for extended periods. Typically new concrete lined assets have a significant amount of calcium oxide residue, a common by-product of concrete production. The calcium oxide reacts with water to form soluble calcium hydroxide with a pH generally above 11.

Any water to be discharged from newly commissioned concrete assets should be tested prior to discharge to ensure the pH is below 10. If the pH is above 10, then treatment will be required to neutralise the pH. Water Corporation use Hydrochloric acid to neutralise the pH of alkaline water prior to discharge. (Refer to Appendix 5 for details of the chemical reaction).

Because the buffering capacity can vary depending on the source of alkalinity water samples should be jar tested for total alkalinity prior to treatment to ensure correct dosages are used.

The work methodology flowchart, disposal plan and guidelines used for the disposal of highly chlorinated disinfection water can also be used when neutralising and discharging alkaline water.

## **7. Methods of Disposal**

### *Hierarchy of disposal*

In determining the best option for the disposal of disinfection water, the following disposal options hierarchy is to be followed. Each subsequent option is only to be evaluated for use if its immediate predecessor has been found to be unsuitable.

1. Reuse of water elsewhere, possibly through tankering or pumping to a reuse or storage site, such as a water storage reservoir (subject to the approval of the asset owner).
2. Discharge to a sewerage system where sewer is reasonably available and discharge will not adversely affect integrity of the sewerage system or wastewater treatment plant.
3. Discharge to land, where contact with natural organic matter will dechlorinate the discharge.
4. Discharge to the stormwater system via street drains or drainage sumps (except near potentially sensitive stormwater receiving environments), where contact with natural organic matter may dechlorinate the discharge.
5. Disposal to a sensitive area, usually combined with chemical or physical dechlorination to a target of <1mg/L.

### *Sewerage system*

The disposal of disinfection water to the Water Corporation's sewerage system requires initial evaluation of:

- The proximity of the disinfection water release point to a sewerage system access point
- The capacity of the sewerage conveyancing system and wastewater treatment plant to handle the additional water load (more relevant to regional areas where smaller plants are used).
- The impact of the disinfection water quality and quantity on wastewater treatment plant treatment processes and maintenance activities.
- The impact upon operations and maintenance activities in the sewerage collection and transfer system.

Before any disposals into the sewerage system take place the disinfection water characteristics and the Disposal Plan must be submitted to and approved by the Manager Assets for the WWTP and conveyancing system.

### *Local Authority Drainage System*

Generally, Local Authority drainage systems have a high ability to absorb chlorine, thus providing an effective means of reducing chlorine levels. The Local Authority drainage system should be assessed to determine whether there is enough organic matter to allow for effective dechlorination to minimise the potential for detrimental impacts on sensitive organisms in receiving waters.

Where a Local Authority sump and/or storm water system is going to be used as the discharge point, the disinfection water characteristics and Disposal Plan must be discussed with and approved/endorsed by the Local Authority before any disposal begins.

## **8. Management of Disposal**

Consideration should be given by the project team to the need for the disposal of highly chlorinated disinfection and alkaline water during the early stages of the asset acquisition process. More specifically the need for disposal should be included in the project risk assessment that starts in the activation phase and continues through scoping into delivery. The risk should be completed for the highest feasible disposal option(s) being considered. Significant environmental risks must be managed in the Disposal Plan.

The Disposal Plan is an integral part of the Commissioning Plan (which is finalised in the Delivery Phase of a project) and is the responsibility of the Project Manager.

### *Disposal plan*

A Work Methodology Flowchart for Preparation of a Disposal Plan is contained in Appendix 1.

In a Disposal Plan for the disposal of chlorinated water the following issues need to be documented:

1. The type of asset that is being disinfected e.g. main, tank, reservoir.
2. The reason for disinfection.
3. The type of disinfectant used.
4. The method of disinfection.
5. The monitored characteristics of the disinfection water e.g. pH, Chlorine residual, Temperature, Turbidity.
6. The disposal options available, including neutralisation.
7. The risk assessment and management for each option assessed.
8. The proximity of sensitive areas to the discharge point (as appropriate).
9. The proposed site monitoring program (as appropriate).

## **9. Process for Obtaining Approval for Planned Disposal**

The process for obtaining approval for disposal has three parts:

- **Prior to disposal:**

- Disposal Plan and record form completed by Project Manager.
- Disposal plan signed by Project Manager and Project Environmental Officer and submitted to Manager Environmental Operations, EAAB for approval.

**During disposal:**

1. Project Manager or delegate completes Section 2 of the form “Measured characteristics” and Appendix 3 “Monitoring Results Form”.

**After Disposal:**

2. Project Environmental Officer completes Section 3 of the form and updates “Register of Disposed Disinfection Water”.

A **Disposal Plan and Record Form** can be found in Appendix 2 of this document. Please complete this **Disposal Plan** and **submit for approval prior to commencing the work**.

The “Monitoring Results” form in Appendix 3 is used in conjunction with the Disposal Plan and Record Form.

Manager Environment & Aboriginal Affairs

24 December 2014

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17 Mar 2009	G Watson and J Jansen edits
13 Nov 2009	G Watson and S Brown edits
25 May 2010	Added hyperlink to dechlorination trailer in CWS manual.
31 May 2011	Added information on Alkaline Water
4 Feb 2013	EB changed to EAAB
17 May 2013	Update to reflect input from PMB – identification of need, approval
30 Jun 2014	Added disposal of alkaline disinfection water. Changed title. Added section numbers, added TOC and expanded Section 2 Purpose. Added new Section 10 Process for Obtaining Approval for Planned Disposal.
24 Dec 2014	Corrected roles and responsibilities.
28 Jan 2015	Corrected responsibilities to Project Manager on pages 2 and 5

## Appendix 1: Work Methodology Flowchart for Preparation of a Disposal Plan

The Disposal Plan is an integral part of the Commissioning Plan (finalised in the Delivery Phase of a project) and is the responsibility of the Project Manager.

The following flowchart outlines the work methodology behind the development of a Disposal Plan and the persons responsible for each stage.

The Doer consults with the Advisor/Responsible Officer for each stage of the process before “doing” that stage.

Activity	Responsibility				Guidance Notes
	EAAB Environmental Officer	Line Manager EAAB Compliance	Site Super/Super's Rep	Project Manager/ Project Env Off	
1. Assess the site conditions around the asset being disinfected.	Advise		Advise	DO	<p>All overriding principles and issues requiring consideration must be acknowledged. Begin to complete Disposal Plan and Record Form (Appendix 2)</p> <p>Examine the possible discharge options and select the one that is the highest in the Hierarchy of Disposal.</p> <p>Refer to Disposal Plan and Record Form (Appendix 2)</p> <p>Undertake the initial monitoring of the receiving environment. This enables its environmental condition to be assessed prior to and following the disposal of the disinfection water. Record all results in the Disposal Plan and Record Form (Appendix 2) or Monitoring results.(Appendix 3)</p> <p>Review the risk assessment commenced in Activation phase. Attach details of the risk assessments to the Disposal Plan and Record Form – Appendix 2 Section 9</p> <p>This stage is only required when significant environmental issues (see CEMS Environmental Aspects and Impacts Guideline) are raised from the risk assessment.</p> <p>Refer to the Disposal Plan and Record Form (Appendix 2)</p> <p>For disposals to Local Authority drainage systems, advice and approval must be obtained from the Local Authority.</p> <p>For disposals to the sewerage system, additional approvals must be</p>
2. Develop a disposal strategy	Advise	Advise	Advise	DO	
3. Prepare the Disposal Plan			Advise	DO	
a) Assess the background conditions of the proposed disposal site.	Advise		Advise	DO	
b) Perform and report a risk assessment of the Disposal Plan.	Advise	Advise	Advise	DO	
c) Review the disposal plan.	Advise	Advise	Advise	DO	
d) Prepare and submit the disposal plan for approval.			Advise	DO	
e) Approve the proposed disposal plan.				DO	



## Disposal of Highly Chlorinated / Alkaline Disinfection Water Guideline

Activity	Responsibility				Guidance Notes
	EAAB Environmental Officer	Line Manager EAAB Compliance	Site Super/Super's Rep	Project Manager/ Project Env Off	
f) Endorse disposal plan.					obtained from relevant asset Manager Operations and relevant asset owner.
4. Initiate disposal of the disinfection water.			DO	DO	Ensure a signed copy of the Disposal Plan and Record Form (Appendix 2) is available onsite at all times. Dispose of the disinfection water in accordance with the Plan.
5. Conduct monitoring during disposal of the disinfection water.	Advise		Advise	DO	Record all results on the Disposal Plan and Record Form (Appendix 2)
6. Closeout on completion of works and debrief as necessary.	Consult		Advise	DO	Ensure the Disposal Plan and Record Form (Appendix 2) is completed and all necessary documents are attached.
7. Approve the completed works.		DO	DO		
8. Record and register the completed form and attachments.			Advise	DO	Complete the checklist in the Disposal Plan and Record Form. File the Record Form. Enter details of the Form and attachments into your Register of Disposed Disinfection Water.
9. Audit.	DO				Audits will be conducted as part of Water Distribution audits and audits of the Corporate Environmental Management System.

## Appendix 2: Disposal Plan and Record Form

The following table sets out when work in Sections 1 to 3 should be completed.

Section of Disposal Plan	Asset Acquisition Phase	Pre-approval to Delivery	On Site
Section 1: Prior to Disposal	SCOPING	Yes	No
Section 2: During Disposal	DELIVERY	No	Yes
Section 3: Following Disposal	PRE PPC	No	Yes

### Section 1: Prior to Disposal (SCOPING)

**1. Type of asset being disinfected:**

Reticulation main     Distribution main     Tank     Reservoir

**2. Title of asset:** \_\_\_\_\_

**3. Location of asset:** \_\_\_\_\_

**4. Reason for disinfection:**

Cleaning of existing assets     Maintenance of existing assets  
 Construction and cleaning of new assets  
 Other (please specify): \_\_\_\_\_

**5. Type of disinfectant used:**

Sodium hypochlorite     Calcium hypochlorite  
 Other (please specify): \_\_\_\_\_

**6. Method of disinfection used**

Continuous feed     Slug  
 Other (please specify): \_\_\_\_\_

**7. Characteristics of the disinfection water to be measured:**

Parameter	Unit	Frequency	Proposed frequency
Total Chlorine	mg/L	Always	
pH		As required	
Turbidity	NTU	As required	
Temperature	°C	As required	

**8. Characteristics of the receiving environment to be monitored:  
(If options 3-5 in Section 7 are used)**

Parameter	Unit	Frequency	Proposed frequency
Total Chlorine	mg/L	Always	
pH		As required	
Turbidity	NTU	As required	
Temperature	°C	As required	

**Note: Ensure photograph(s) of receiving environment is attached  
Ensure the Monitoring Results Form (Appendix 3) is attached.**

**9. Decision making hierarchy and checklist for disposal plan:**

Options for Disposal	Assessment Criteria			
		Yes	No	
Reuse disinfection water.	Is a viable reuse option available? Details: _____	<input type="checkbox"/>	<input type="checkbox"/>	
	Is tankering viable?	<input type="checkbox"/>	<input type="checkbox"/>	
	Is pumping viable?	<input type="checkbox"/>	<input type="checkbox"/>	
2. Discharge to the sewerage system	Sewers readily available and of adequate capacity for discharge rate.	<input type="checkbox"/>	<input type="checkbox"/>	
	Wastewater Treatment Plant: Can handle the additional volumetric load; No adverse effect on maintenance operations and processes.	<input type="checkbox"/>	<input type="checkbox"/>	
	No adverse effect on treatment processes or staff	<input type="checkbox"/>	<input type="checkbox"/>	
	All necessary approvals obtained.	<input type="checkbox"/>	<input type="checkbox"/>	
Discharge to land.	Land owner (e.g. Local Authority or private) approvals obtained (where required).	<input type="checkbox"/>	<input type="checkbox"/>	
	Land exhibits high chlorine demand (as evidence of a high level of vegetation on the ground).	<input type="checkbox"/>	<input type="checkbox"/>	
	Land exhibits low chlorine demand, but additional chemical and/or physical dechlorination measures will be applied.	<input type="checkbox"/>	<input type="checkbox"/>	
	Details: _____ _____			
	Potential for erosion.	<input type="checkbox"/>	<input type="checkbox"/>	
	Natural drying cycle of receiving environment.	<input type="checkbox"/>	<input type="checkbox"/>	
	Natural wetting cycle of receiving environment.	<input type="checkbox"/>	<input type="checkbox"/>	
All drainage paths tracked and monitored	<input type="checkbox"/>	<input type="checkbox"/>		

## Disposal of Highly Chlorinated / Alkaline Disinfection Water Guideline

	Greater than 150m from a stream and not within close proximity to a sensitive area.	<input type="checkbox"/>	<input type="checkbox"/>
	Within 150m from a stream or in close proximity to a sensitive area. If yes, what control measures will be applied?	<input type="checkbox"/>	<input type="checkbox"/>
	Details: _____ _____ _____		

Options for Disposal	Assessment Criteria	Yes	No
Discharge to the storm water system via a street drain or drainage sump.	Local Authority approval obtained (where required)	<input type="checkbox"/>	<input type="checkbox"/>
	All drainage paths tracked and monitored	<input type="checkbox"/>	<input type="checkbox"/>
	Greater than 150m from a stream and not in close proximity to a sensitive area.	<input type="checkbox"/>	<input type="checkbox"/>
	Within 150m of a stream or in close proximity to a sensitive area. If yes, what control measures will be undertaken?	<input type="checkbox"/>	<input type="checkbox"/>
	Details: _____ _____ _____		
Disposal to a sensitive receiving site after chemical or physical dechlorination.	Close proximity of site to receiving waters and sensitive areas	<input type="checkbox"/>	<input type="checkbox"/>
	Chlorine concentration of disinfection water within agreed limits	<input type="checkbox"/>	<input type="checkbox"/>
	Other characteristics of the disinfection water (e.g. pH, turbidity) are within agreed limits	<input type="checkbox"/>	<input type="checkbox"/>
	Details: _____ _____ _____		

**10. Proposed method of disposal of disinfection water (tick one or more box):**

- a) Reuse (**approvals necessary**)
- b) Sewerage system (**approvals necessary**)
- c) Discharge to land
- d) Stormwater system/street drain/drainage sump
- e) Chemical dechlorination prior to disposal (**refer to Appendix 4**)
- f) Chemical pH Neutralisation prior to disposal (**refer to Appendix 5**)
- Other (please specify): \_\_\_\_\_

**11. Planned date of disinfection water disposal:** \_\_\_\_\_

**12. Location of proposed disposal site:** \_\_\_\_\_

**13. Estimated Quantity of disinfection water to be discharged (litres):**

Time Frame	Approximate Minimum	Approximate Maximum
Per hour		
Per day		
Per week		

**14. Estimate of Planned Duration of disposal:** \_\_\_\_\_

**15. Disposal plan prepared and submitted for approval by:**

Name: \_\_\_\_\_ Position: \_\_\_\_\_  
Signature: \_\_\_\_\_ Date: \_\_\_\_\_

**16. Approvals/Endorsement:**

a) Project Manager:

Name: \_\_\_\_\_ Position: \_\_\_\_\_  
Signature: \_\_\_\_\_ Date: \_\_\_\_\_

b) Project Environmental Officer:

Name: \_\_\_\_\_ Position: \_\_\_\_\_  
Signature: \_\_\_\_\_ Date: \_\_\_\_\_

c) Manager Operations Section, Environment & Aboriginal Affairs Branch:

Name: \_\_\_\_\_  
Signature: \_\_\_\_\_ Date: \_\_\_\_\_

d) Disposal to sewer (where required):

(i) Metropolitan area:

Name: \_\_\_\_\_ *Manager, Asset Management (Sewerage), Perth Region*  
Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Name: \_\_\_\_\_ *Supervising Engineer (\_\_\_\_\_ WWTP)*  
Signature: \_\_\_\_\_ Date: \_\_\_\_\_

(ii) Regional area:

Name: \_\_\_\_\_ *Regional Asset Manager (\_\_\_\_\_ Region)*  
Signature: \_\_\_\_\_ Date: \_\_\_\_\_

### Section 2: DURING DISPOSAL (DELIVERY)

#### 17. Measured characteristics of the disinfection water:

Parameter	Unit	Frequency	Result
Total Chlorine	mg/L	Always	
pH		As required	
Turbidity	NTU	As required	
Temperature	°C	As required	

#### 18. Measured characteristics of the receiving environment:

Parameter	Unit	Frequency	Result
Total Chlorine	mg/L	Always	
pH		As required	
Turbidity	NTU	As required	
Temperature	°C	As required	

**Note: Ensure photograph(s) of receiving environment is attached  
Ensure the Monitoring Results Form (Appendix 3) is attached.**

**Section 3: FOLLOWING DISPOSAL (DELIVERY – PRE PPC)**

**19. Estimated quantity of disinfection water discharged (litres):** \_\_\_\_\_

**20. Closeout:**

a) Monitoring collected and submitted for approval by:

Name: \_\_\_\_\_ Position: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

b) **Check** (tick box on completion):

Disposal Plan and Record Form completed and photographs and all supporting documents attached

Approvals obtained

b) Project Environmental Officer:

Name: \_\_\_\_\_ Position: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

c) Project Manager:

Name: \_\_\_\_\_ Position: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Add Disposal Plan and Record Form and attachments to file

Updated 'Register of Disposed Disinfection Water'

Advised Environmental Coordinator

Date: \_\_\_\_\_

**NOTE:**

- **Ensure all approvals are obtained;**
- **Ensure form and attachments are recorded to file; and**
- **Enter into Register of Disposed Disinfection Water.**

### Appendix 3: Monitoring Results

Title of asset and monitoring location: \_\_\_\_\_

Stage of works (prior to, during disposal of disinfection water): \_\_\_\_\_

Date & Time	Disinfection / Alkaline Water					Receiving Environment				
	Total Chlorine (mg/L)	pH	Turbidity (NTU)	Temp. (°C)	Other	Total Chlorine (mg/L)	pH	Turbidity (NTU)	Temp. (°C)	Other

**\*Ensure photograph(s) attached**

Results completed by: \_\_\_\_\_ Name: \_\_\_\_\_ Position: \_\_\_\_\_  
 Signature: \_\_\_\_\_ Date: \_\_\_\_\_



#### **Appendix 4: Chemical Dechlorination – highly chlorinated water**

The typical residual chlorine level for pipeline disinfection is 20mg/L.  
Water Corporation uses Sodium Thiosulphate,  $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$  for dechlorination.

The chemical reaction is:  $\text{Na}_2\text{S}_2\text{O}_3 + 4\text{HOCl} + \text{H}_2\text{O} \rightarrow 2\text{NaHSO}_4 + 4\text{HCl}$

The required dose of sodium thiosulphate to neutralise a chlorine residual of 20 mg/L is 17.5mg/L of sodium thiosulphate. To calculate the dechlorination dosages for different chlorine residuals refer to the Chlorine Neutralisation Calculation Sheet.

#### Trunk Main Dechlorination Trailer

Refer to CWS Pipeline Chlorination Trailer Operations & Maintenance Manual – Section 7.6 Trunk Main Dechlorination using Sodium Thiosulphate

## Appendix 5: Chemical pH Neutralisation – alkaline water

Typically new concrete lined assets have a significant amount of calcium oxide residue which is a standard by-product of concrete production. The calcium oxide reacts with water to form soluble calcium hydroxide with a pH generally around 11 to 12.

The chemical reaction is:  $\text{CaO (s)} + \text{H}_2\text{O (l)} \rightleftharpoons \text{Ca(OH)}_2 \text{ (aq)}$

Water Corporation use Hydrochloric Acid to neutralise alkaline water prior to discharge. This is typically done using the Trunk Main Dechlorination Trailer.

The chemical reaction is:  $\text{Ca(OH)}_2 \text{ (aq)} + 2\text{HCl} = \text{CaCl}_2 + 2\text{H}_2\text{O}$