NCDENR
North Carolina Department of Environment and Natural Resources
Division of Water Quality

Beverly Eaves Perdue
Governor

Coleen H. Sullins
Director

Dee Freeman
Secretary

Memorandum

To: Jeff Poupart
Through: Tom Belnick TB
From: Julie Grzyb
Date: 10/14/2009
Re: **Changes to Water Treatment Plant Strategy (October 2009)**

I. Flow Limit and Monitoring

- **Remove Flow Limit on all WTPs**
  Unlike Wastewater treatment plants, flow data has not been used as much in the design of backwashing treatment units. Also, flow data from Discharge Monitoring Reports will be available to perform Reasonable Potential Analyses. Finally, WTP strategy still precludes new or expanding RO/IE plants to freshwater streams.

- **Require Continuous flow monitoring for Conventional and RO facilities discharging 50,000 gallons per day.** (previous policy $\geq$10,000 gpd)

  Facilities discharging less than 50,000 gpd and intermittent dischargers require instantaneous flow measurements along with the duration. Many facilities with wastewaters less than 50,000 gpd discharge to POTWs or are considering discharging to a POTW. The WTP strategy which includes additional testing by the Permittees is facilitating such decisions and removing the necessity for smaller facilities to purchase recording equipment seems prudent at this time.
  Note: Ion Exchange and Green Sand WTPs require instantaneous flow measurements along with the duration. The monitoring frequency for flow should be as frequent as the minimum frequency of monitoring for any parameter listed.

II. Calcium and Magnesium (Conventional WTPs, not parameters of concern in other WTPs)

- **Remove monitoring for calcium and magnesium from the Conventional WTP effluent page.**
  There is no Water Quality Standard for Calcium or Magnesium. As a result, there is no limit to compare the data obtained from monitoring these parameters.

III. Changes to toxics monitoring:

- **Conventional WTP Effluent page: To make permitting less complicated, monitoring for fluoride, zinc, copper and iron were changed to quarterly sampling to align with quarterly sampling of aluminum, manganese and toxicity testing.** Previously it was monthly if discharge < 0.5 MGD and 2/month if discharge $\geq$ 0.5 MGD.

- **Green Sand WTP Effluent page: To make permitting less complicated, monitoring for fluoride, zinc, manganese and iron were changed to quarterly sampling.** Previously it was monthly if discharge < 0.5 MGD and 2/month if discharge $\geq$ 0.5 MGD.

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- **Ion Exchange WTP Effluent page: To make permitting less complicated, monitoring for copper, chloride, iron, manganese, lead, zinc, ammonia nitrogen and fluoride were changed to monthly sampling.** Previously it was monthly if discharge < 0.5 MGD and 2/month if discharge ≥ 0.5 MGD.

- **Membrane WTP Effluent page: To make permitting less complicated, monitoring for arsenic, copper, chloride, iron, fluoride, zinc, and ammonia nitrogen were changed to monthly sampling.** Previously it was monthly if discharge < 0.5 MGD and 2/month if discharge ≥ 0.5 MGD.

Quarterly and Monthly samples will supply adequate data to evaluate toxicity test results and to perform RPAs.

IV. Turbidity

- **Added turbidity monitoring to all WTP permits to address US EPA Region IV memo dated 2-25-09. Permittees discharging to impaired streams for turbidity will receive a turbidity limitation.**

NPDES PERMITTING STRATEGIES FOR POTABLE WATER TREATMENT PLANTS

October 2009

Background

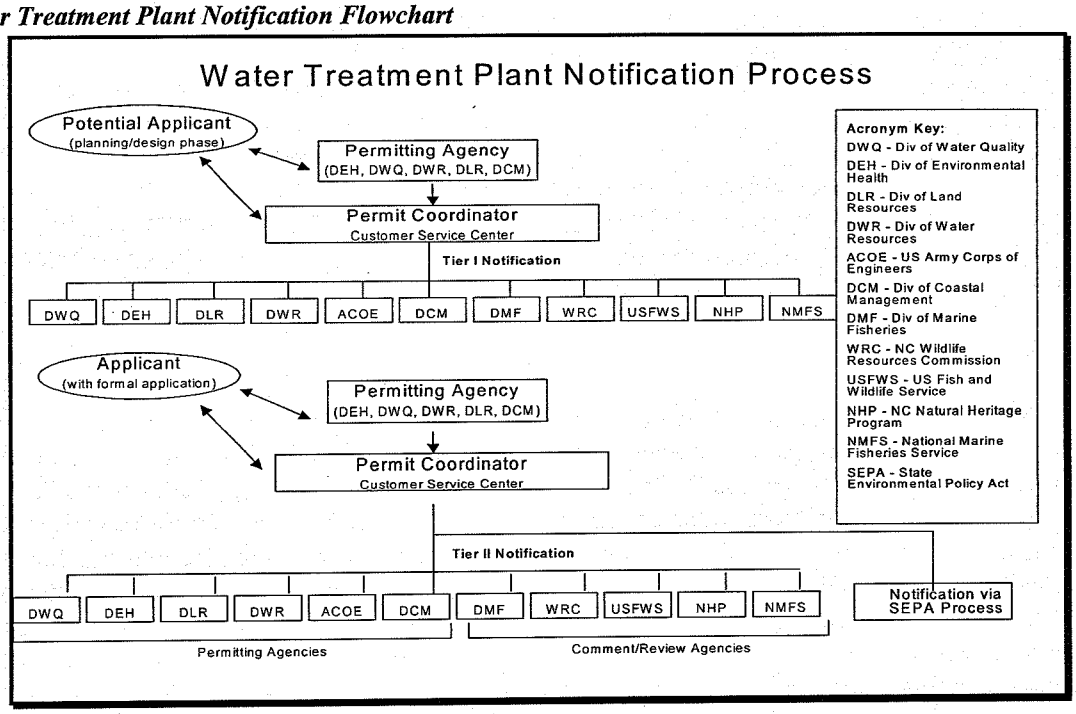
In 1992, the Division of Water Quality (Division) implemented a general water treatment plant (WTP) permitting strategy that was intended to apply to all types of WTPs. However, after further research and discussion, it was agreed that different technologies in water treatment yield very different pollutants of concern and impacts on the environment. As a result, four permitting strategies were developed specifically geared towards certain water treatment processes. This document summarizes the permit application and permit development procedure for WTPs and serves as a reference tool for permit writers and permittees. Other available resources include *Assessment and Recommendations for Water Treatment Plant Permitting: Findings of the Water Treatment Plant Workgroup*, and the *Conventional WTP Report*, both of which further explain the collaborative interdepartmental effort and data study that went into the development of these permitting approaches.

I. PERMIT APPLICATION PROCESS

An NPDES permit application is available on the NPDES website. The application is titled *Standard Form C-WTP* and can be used for all WTPs, regardless of technology. This application differs from those used in the past in that new applicants are required to submit a complete source water analysis and an engineering alternatives analysis that fully explores all feasible alternatives to a surface water discharge. New facilities using ion exchange (IE) or reverse osmosis (RO) technology are also required to perform a water quality model. New IE (includes water softeners) and RO discharges will not be permitted in freshwater unless it is demonstrated that the environmental impact would be minimal.

Based on their potential impacts to aquatic life *all new IE and RO facilities, and conventional WTPs with a discharge of over 0.5 MGD, must also initiate a tiered notification process* that will serve to alert other divisions and agencies through the Customer Service Center (CSC). The notification process, as illustrated in Figure 1, is initiated when a new or expanding WTP project is first presented to a permitting agency or the CSC. When an agency is first contacted, it becomes that agency's responsibility to direct the applicant to the CSC and notify a CSC permit coordinator.

Figure 1 – Water Treatment Plant Notification Flowchart



Once the CSC has been contacted they will distribute a notice, via email, summarizing the proposed project to the appropriate agency contacts. Tier I notification should begin for new or expanding WTPs upon initial contact by the applicant, regardless of project stage. Following Tier I notification, each agency will determine its level of involvement (i.e. requests for additional details, participation in meeting, etc.). Tier II notification should begin when a significant development in the process has occurred, such as when a permit application has been filed or an environmental document has been submitted. Throughout the process, CSC will coordinate communication with the agencies and the applicant. Additional notifications may be necessary to update agency representatives of important developments or to coordinate meetings. Again, these various tiers of notification will only include a summary of developments. Agency involvement is discretionary. The notification process concludes once all applicable permits are issued.

As previously mentioned, this process should only apply to new IE/RO facilities and conventional plants with a predicted discharge of greater than or equal to 0.5 MGD. Copies of proposed draft permits for these facilities should also be forwarded to the US Fish and Wildlife Service and the Wildlife Resource Commission.

No inter-agency notification will be required for greensand filter systems.

II. PERMIT DEVELOPMENT FOR MEMBRANE AND ION EXCHANGE WATER TREATMENT PLANTS

2.1 Background

In 2002, the Division established an inter-departmental Workgroup, which then led to the development of a technical subcommittee tasked to study the impacts of membrane and sodium cycle cationic ion exchange WTPs on receiving waters. The subcommittee first identified potential environmental concerns and then conducted an analytical study, data review, and analysis of several existing WTPs in North Carolina. Foremost amongst water quality concerns were the total residual chlorine (TRC) and chloride levels present in discharges and the potential toxicity of these pollutants on the receiving stream. Based on the results of the analytical study, the following permitting strategy has been adopted for all WTPs using membrane and ion exchange technologies.

Portions of this strategy pertaining to the use of "membrane" technologies will primarily involve reverse osmosis (RO), nanofiltration (NF), microfiltration (MF), and ultrafiltration (UF) processes for the treatment of groundwater. Though less common, electrodialysis/electrodialysis reversal (ED/EDR) processes also use membrane technology and should be guided by the membrane permitting strategy. Other portions of this document pertain to WTPs using ion exchange (IE) as a primary *or* secondary component of the treatment system. It is important to determine whether any part of the permittee's water treatment process uses an ion exchange system. If so, their permit may incorporate relevant components of this strategy, however the permit writer should use discretion when considering relative volumes of wastewater components. These technologies (both membrane and IE) are of particular concern because they concentrate dissolved solids, generating highly concentrated wastestreams. The wastes can have a toxic effect on the receiving water, particularly if the system is freshwater in nature. For this reason, new discharges from membrane and IE WTPs should not be permitted into freshwaters unless it can be demonstrated that the environmental impacts would be minimal. All new IE/RO dischargers must perform dilution modeling.

2.2 Pollutants of Concern

Based on a review of actual data from existing IE and RO facilities, iron, copper, chloride and zinc showed reasonable potential to exist in concentrations that may exceed water quality standards. In addition, arsenic and fluoride seem to pose a particular concern for membrane WTPs, while manganese and lead were typically found in significant concentrations in IE process effluent. Chlorine was determined to be a parameter of concern for IE's in general, however it is important to note that TRC could potentially be problematic for any facility that chlorinates its finished water. Any treatment prior to discharge (i.e. feed disinfection, pH adjustment, antiscalant additives) should be considered when determining permit limits. The only additives that should be introduced prior to separation of product water and reject stream are acids (to reduce deposits) and corrosion inhibitors. Any other additives might introduce additional pollutants of concern. Facilities must obtain approval and request a permit modification for any significant change that would alter the characteristics or nature of the discharge. Tables 1 and 2 provide sample effluent limits and summarize the minimum recommended monitoring requirements for membrane and IE WTPs.

Table 2.1: ***Monitoring Requirements for Membrane WTPs***

The monitoring requirements included below identify various pollutants of concern including conventional parameters, nutrients, and toxicants. A brief rationale for the inclusion of these contaminants can be found in Appendix A. Other toxicants were not included because they were either not detected or rarely detected in the effluent data surveyed. However, if a pollutant specific problem is detected in the receiving stream, effluent, or source water then a monitoring requirement may be added for that parameter. Likewise, if data indicate that a pollutant is not present in the facility's discharge, that parameter may be dropped from the requirements. Limits should be added if the facility shows reasonable potential to exceed water quality standards for toxicants. New facilities should monitor for pollutants of concerns regardless of whether or not there is a water quality standard. Monitoring requirements can be re-evaluated during subsequent renewals.

EFFLUENT CHARACTERISTICS	LIMITS			MONITORING REQUIREMENTS		
	Monthly Average	Weekly Average	Daily Maximum	Measurement Frequency	Sample Type	Sample Location[1]
Flow[2]				Continuous	Recording	E
Temperature[3]				See Table 5.1	Grab	E,U,D
Dissolved Oxygen[3]				See Table 5.1	Grab	E,U,D
Salinity				See Table 5.1	Grab	E,U,D
Conductivity				See Table 5.1	Grab	E,U,D
pH	Saltwater: 6.8 – 8.5 Freshwater: 6.0 – 9.0			See Table 5.1	Grab	E,U,D
Total Residual Chlorine[4]	Freshwater: 17-28 µg/L Saltwater: 13 µg/L			See Table 5.1	Grab	E
Total Dissolved Solids				See Table 5.1	Grab	E
Turbidity[5]				See Table 5.1	Grab	E
Total Arsenic	Limit based on potential			Monthly	Grab	E
Total Copper	Limit based on potential			Monthly	Grab	E
Total Chloride	Limit based on potential			Monthly	Grab	E
Total Iron	Limit based on potential			Monthly	Grab	E
Total Fluoride	Limit based on potential			Monthly	Grab	E
Total Zinc	Limit based on potential			Monthly	Grab	E
Ammonia Nitrogen	Limit based on potential			Monthly	Grab	E
Total Nitrogen (TN)[6]				Quarterly	Grab	E
Total Phosphorus (TP)[6]				Quarterly	Grab	E
Whole Effluent Toxicity Monitoring[7]				Quarterly	Grab	E

Notes to permit writers:

1. Sampling locations: E= Effluent, U= Upstream of discharge location, D= Downstream of discharge location.
2. Continuous monitoring is required for facilities discharging $\geq$ 50,000 gpd. Instantaneous measurement or estimates are allowed if the permitted flow is less than 50,000 gpd. Duration of discharge should be noted in log books.
3. The facility may petition to have DO and temperature monitoring removed from the permit after monitoring for 1 permit cycle.
4. **Footnote for permit:** Limit and monitor only if the facility adds chlorine or chlorine derivatives to water that is eventually discharged. The Division shall consider all effluent TRC values reported below 50 ug/l to be in compliance with the permit. However, the Permittee shall continue to record and submit all values reported by a North Carolina certified laboratory (including field certified), even if these values fall below 50 ug/l.
5. If the receiving stream is impaired for turbidity a daily maximum limit should be given. See Appendix A for limit and footnote.
6. Facilities under 0.05 MGD should only monitor for nutrients if discharging into a NSW.
7. See Table 5.2 for WET Test Requirements and Appendix B for monitoring language.

Table 2.2: ***Monitoring Requirements for Ion Exchange WTPs***

The monitoring requirements included below identify various pollutants of concern including conventional parameters, nutrients, and toxicants. A brief rationale for the inclusion of these contaminants can be found in Appendix A. Other toxicants were not included because they were either not detected or rarely detected in the effluent data surveyed. However, if a pollutant specific problem is detected in the receiving stream, effluent, or source water then a monitoring requirement may be added for that parameter. Likewise, if data indicate that a pollutant is not present in the facility's discharge, that parameter may be dropped from the requirements. Limits should be added if the facility shows reasonable potential to exceed water quality standards for toxicants. New facilities should monitor for pollutants of concerns regardless of whether or not there is a water quality standard. Monitoring requirements can be re-evaluated during subsequent renewals.

EFFLUENT CHARACTERISTICS	LIMITS			MONITORING REQUIREMENTS		
	Monthly Average	Weekly Average	Daily Maximum	Measurement Frequency	Sample Type[1]	Sample Location[2]
Flow				See footnote [3]	Instantaneous or Estimate	E
Temperature[4]				See Table 5.1	Grab	E,U,D
Salinity				See Table 5.1	Composite	E,U,D
Conductivity				See Table 5.1	Composite	E,U,D
pH	Saltwater: 6.8 – 8.5 Freshwater: 6.0 – 9.0			See Table 5.1	Grab	E,U,D
Dissolved Oxygen[4]				See Table 5.1	Grab	E,U,D
Total Dissolved Solids				See Table 5.1	Composite	E
Total Suspended Solids[5]	30 mg/L		45 mg/L	See Table 5.1	Composite	E
Total Residual Chlorine[6]	Freshwater: 17 -28 µg/L Saltwater: 13 µg/L			See Table 5.1	Grab	E
Turbidity[7]				See Table 5.1	Grab	E
Total Copper	Limit based on potential			Monthly	Composite	E
Total Chloride	Limit based on potential			Monthly	Composite	E
Total Iron	Limit based on potential			Monthly	Composite	E
Total Manganese	Limit based on potential			Monthly	Composite	E
Total Lead	Limit based on potential			Monthly	Composite	E
Total Zinc	Limit based on potential			Monthly	Composite	E
Ammonia Nitrogen	Limit based on potential			Monthly	Composite	E
Fluoride[8]	Limit based on potential			Monthly	Composite	E
Total Nitrogen (TN)[9]				Quarterly	Composite	E
Total Phosphorus (TP)[9]				Quarterly	Composite	E
Whole Effluent Toxicity Monitoring[10]				Quarterly	Composite	E

Notes to permit writers:

1. An exception to the composite sampling is provided by 15A NCAC 2B.0505 (C), which states that facilities with design flows under 30,000 gallons per day may use grab samples to characterize their effluent.
2. Sampling locations: E = Effluent, U = Upstream of discharge location, D = Downstream of discharge location.
3. For intermittent discharges, instantaneous flow monitoring is required and the duration of the discharge must be reported. The monitoring frequency for flow should be as frequent as the minimum frequency of monitoring for any parameter listed.
4. The facility may petition to have DO and temperature monitoring removed from the permit after monitoring for 1 permit cycle.
5. For existing plants, TSS limits may need to be phased in over a period of time to allow for the construction of new treatment facilities.
6. **Footnote for permit:** Limit and monitor only if the facility adds chlorine or chlorine derivatives to water that is eventually discharged. The Division shall consider all effluent TRC values reported below 50 ug/l to be in compliance with the permit. However, the Permittee shall continue to record and submit all values reported by a North Carolina certified laboratory (including field certified), even if these values fall below 50 ug/l.
7. If the receiving stream is impaired for turbidity a daily maximum limit should be given. See Appendix A for limit and footnote.
8. Fluoride monitoring should apply only if the facility backwashes with fluoridated, finished water.
9. Facilities under 0.05 MGD should only monitor for nutrients if discharging into a NSW. Monitoring frequency should align with basin-specific requirements if those are more stringent.
10. See section on WET testing for details (Table 5.2).

2.3 Instream Monitoring

Both RO and IE WTPs will require instream monitoring. **This requirement may be waived for facilities discharging to zero flow streams.** For discharges where no water quality model was performed, the facility should monitor 50 feet upstream and at least 100 feet downstream of the outfall. For discharges where a model was performed, locations should be determined on a case-by-case basis, but should take in consideration the size and shape of the effluent plume.

III. PERMIT DEVELOPMENT FOR CONVENTIONAL WATER TREATMENT PLANTS

3.1 Background

Following the completion of the IE/RO report, a second workgroup was formed whose objectives dealt exclusively with concerns associated with the discharge of filter backwash from conventional treatment processes. This report summarizes NPDES permitting strategy recommendations for conventional water treatment plants based upon chemical and physical data from various facilities around North Carolina. The assessment and strategy detailed here applies only to those facilities using surface water sources and the referenced technologies.

Most of the state of North Carolina (west of I-95) uses surface water as a drinking water source. It is generally recognized that the water quality issues associated with surface water are those relating to particulate matter, microbiological content, color, taste and odor. Conventional treatment processes are designed to address these water quality issues. A conventional treatment process is described by the American Water Works Association as including coagulation, flocculation and sedimentation, usually followed by filtration and disinfection.

3.2 Pollutants of Concern

Aluminum, calcium, magnesium, and manganese were detected effluent data from the five conventional WTPs used to supply data for this report. All five facilities had high maximum predicted concentrations for these parameters, therefore they are considered to be pollutants of concern and should be monitored. However, after further consideration monitoring for calcium and magnesium was removed since there are currently no water quality standards for these parameters in North Carolina. Zinc should be monitored if a permittee uses zinc orthophosphate as a corrosion inhibitor.

In addition to pH, flow, and total residual chlorine, which will be limited, the permit writer may need to determine the necessity of a limit for some other parameter of concern that may have been identified in the application. DWQ will perform a reasonable potential analysis (RPA) on any available data to determine the need for monitoring or limits. For existing facilities collecting toxicant data, the RPA would employ these data. The reasonable potential procedure may also be used as a tool for analyzing the source water of proposed water treatment plants. Table 3 provides sample effluent limits and summarizes the minimum recommended monitoring requirements for conventional WTPs.

Table 3.1: ***Monitoring Requirements For Conventional WTPs***

The monitoring requirements included below identify various pollutants of concern including conventional parameters, nutrients, and toxicants. A brief rationale for the inclusion of these contaminants can be found in Appendix A. Other toxicants were not included because they were either not detected or rarely detected in the effluent data surveyed. However, if a pollutant specific problem is detected in the receiving stream, effluent, or source water then a monitoring requirement may be added for that parameter. Likewise, if data indicate that a pollutant is not present in the facility's discharge, that parameter may be dropped from the requirements. Limits should be added if the facility shows reasonable potential to exceed water quality standards for toxicants. New facilities should monitor for pollutants of concerns regardless of whether or not there is a water quality standard. Monitoring requirements can be re-evaluated during subsequent renewals.

EFFLUENT CHARACTERISTICS	LIMITS			MONITORING REQUIREMENTS		
	Monthly Average	Weekly Average	Daily Maximum	Measurement Frequency	Sample Type	Sample Location
Flow[1]				Continuous [1]	Recording [1]	Effluent
TSS	30 mg/L		45 mg/L	See footnote[3]	Grab	Effluent
pH	Freshwater: 6.0 – 9.0			See footnote[3]	Grab	Effluent
Total Residual Chlorine [2]			17-28 µg/L	See footnote[3]	Grab	Effluent
Turbidity[4]				See footnote[3]	Grab	Effluent
Aluminum	Limit based on potential			Quarterly[10]	Grab	Effluent
Total Iron	Limit based on potential			Quarterly[10]	Grab	Effluent
Total Copper	Limit based on potential			Quarterly[10]	Grab	Effluent
Manganese	Limit based on potential			Quarterly[10]	Grab	Effluent
Fluoride [5]	Limit based on potential			Quarterly[10]	Grab	Effluent
Total Zinc [6]	Limit based on potential			Quarterly[10]	Grab	Effluent
Ammonia Nitrogen[7]				Quarterly	Grab	Effluent
Total Phosphorus (TP)[8]				Quarterly	Grab	Effluent
Total Nitrogen (TN)[8]				Quarterly	Grab	Effluent
Whole Effluent Toxicity Monitoring[9]				Quarterly	Grab	Effluent

Notes to permit writers:

1. Continuous discharges ≥ 50,000 gpd are required to perform continuous (frequency), recording (sample type) flow measurements. For intermittent discharges, instantaneous flow monitoring is required and the duration of the discharge must be reported. The monitoring frequency for flow should be the same as the most frequently monitored parameter listed. Instantaneous measurement or estimates are allowed if the permitted flow is less than 50,000 gpd.
2. **Footnote for permit:** Limit and monitor only if the facility adds chlorine or chlorine derivatives to water that is eventually discharged. The Division shall consider all effluent TRC values reported below 50 ug/l to be in compliance with the permit. However, the Permittee shall continue to record and submit all values reported by a North Carolina certified laboratory (including field certified), even if these values fall below 50 ug/l.
3. Monitor 2/month if discharge is < 0.5 MGD and monitor weekly if discharge is ≥0.5 MGD.
4. If the receiving stream is impaired for turbidity a daily maximum limit should be given. See Appendix A for limit and footnote.
5. Fluoride should be monitored if the permittee backwashes with fluoridated finished water.
6. Zinc should be monitored if the Permittee adds zinc orthophosphate as a corrosion inhibitor prior to backwashing.
7. Ammonia Nitrogen should be monitored if the Permittee uses choramines (adds ammonia to chlorinated water) for secondary disinfection prior to backwashing.
8. Facilities under 0.05 MGD should only monitor for nutrients if discharging into a NSW.
9. See Table 5.2 for WET Test Requirements and Appendix B for monitoring language.
10. Parameter should be monitored in conjunction with toxicity test.

IV. PERMIT DEVELOPMENT FOR GREENSAND WATER TREATMENT PLANTS

4.1 Background

The following permitting strategy applies to new and existing water treatment plants using greensand filtration to generate potable water from groundwater. This categorization would also include many community well systems, "iron filters", and "manganese filters" as long as they do not backwash filters with a sodium solution. **The permit writer should contact the facility to verify that there is not a briny discharge.** This permitting strategy *does not* apply to any other kind of cationic exchange unit used in water treatment. If any portion of the water treatment process includes an ion exchange/water softener unit, then the RO-IE Permitting Strategy will apply as well.

Typically, a greensand filtration unit is preceded by the use of an aeration tower along with potassium permanganate to oxidize dissolved iron in the ground water. The particulate ferric hydroxide (and some minor quantities of soluble ferrous material) is then removed via filtration through a manganese based greensand media. Greensand is a proprietary material that does not require sodium cycle regeneration, only backwash with finished (potable) water. Since the discharge from such a facility is not as saline as that from a sodium cycle cationic exchange unit, this may be considered a more environmentally friendly technology for the treatment of groundwater. For that reason, unlike other types of ion exchange systems, non-discharge options are sometimes an alternative and should be explored for new permits. Filter backwash water is usually collected in a settling basin, and the supernatant is then discharged to surface waters or a regional treatment works.

4.2 Pollutants of Concern

Typical chemical additives to such treatment systems are an anti-scalant (such as zinc orthophosphate), fluoride, chlorine and potassium permanganate.

Table 4.1: ***Monitoring Requirements For Greensand WTPs***

The monitoring requirements included below identify various pollutants of concern including conventional parameters, nutrients, and toxicants. A brief rationale for the inclusion of these contaminants can be found in Appendix A. Other toxicants were not included because they were either not detected or rarely detected in the effluent data surveyed. However, if a pollutant specific problem is detected in the receiving stream, effluent, or source water then a monitoring requirement may be added for that parameter. Likewise, if data indicate that a pollutant is not present in the facility's discharge, that parameter may be dropped from the requirements. Limits should be added if the facility shows reasonable potential to exceed water quality standards for toxicants. New facilities should monitor for pollutants of concerns regardless of whether or not there is a water quality standard. Monitoring requirements can be re-evaluated during subsequent renewals.

EFFLUENT CHARACTERISTICS	LIMITS		*MONITORING REQUIREMENTS*		
	Monthly Average	Daily Maximum	Measurement Frequency	Sample Type	Sample Location
Flow			See footnote[1]	Instantaneous or Estimate	Effluent
Total Suspended Solids	30.0 mg/L	45.0 mg/L	See footnote[3]	Grab	Effluent
pH	Freshwater: 6.0 – 9.0 Saltwater: 6.8 – 8.5 s.u.		See footnote[3]	Grab	Effluent
Total Residual Chlorine[2]	Freshwaters: 17- 28 µg/L Saltwater: 13 µg/L		See footnote[3]	Grab	Effluent
Turbidity[4]			See footnote[3]	Grab	Effluent
Fluoride[5]	Limit based on potential		Quarterly	Grab	Effluent
Total Iron	Limit based on potential		Quarterly	Grab	Effluent
Total Zinc[6]	Limit based on potential		Quarterly	Grab	Effluent
Total Manganese	Limit based on potential		Quarterly	Grab	Effluent

Notes to permit writers:

1. For instantaneous flow monitoring, the duration of the discharge must be reported in addition to the total flow. The monitoring frequency for flow should be as frequent as the minimum frequency of monitoring for any parameter listed.
2. **Footnote for permit:** Limit and monitor only if the facility adds chlorine or chlorine derivatives to water that is eventually discharged. The Division shall consider all effluent TRC values reported below 50 ug/l to be in compliance with the permit. However, the Permittee shall continue to record and submit all values reported by a North Carolina certified laboratory (including field certified), even if these values fall below 50 ug/l.
3. Monitor 2/month if discharge is < 0.5 MGD and monitor weekly if discharge is ≥0.5 MGD.
4. If the receiving stream is impaired for turbidity a daily maximum limit should be given. See Appendix A for limit and footnote.
5. Fluoride should be monitored if the permittee backwashes with fluoridated finished water.
6. Zinc should be monitored if the Permittee adds zinc orthophosphate as a corrosion inhibitor prior to backwashing.

V. IMPLEMENTATION

5.1. Monitoring Frequency

In order to be consistent with the monitoring guidance employed for other permits across the state, monitoring frequencies will be based on the flow divisions used to define facility class in the 15A NCAC 08C .0302 regulations. Requirements described in 15A NCAC 2B .0508(d) for water supply plants were used as guidance. Table 5 summarizes the monitoring requirements. After sufficient data have been collected (eight to 12 data points over at least one year) the permittee may petition for a reduction in monitoring.

Table 5.1: ***WTP Monitoring Requirements***

If a parameter is not currently limited but requires a limitation based on reasonable potential, increase sampling frequency by one degree. (Quarterly → Monthly, Monthly→ 2 Month, 2 Month→ Weekly)

Facility Class	Conventional Parameters (except flow) and Toxicants (Effluent and Instream)
Permitted Flow < 0.5 MGD	If limited - 2/Month
	Not limited - Monthly
Permitted Flow ≥ 0.5 MGD	If limited - Weekly
	Not limited - 2/Month

5.2. Whole Effluent Toxicity Testing

Membrane, ion exchange, and conventional WTPs should be required to conduct quarterly WET tests *for monitoring purposes*. Eventually, the Division may choose to use this data to develop additional policy. The type of WET test conducted will vary depending on receiving stream characteristics. In addition, the level of available dilution and tidal effects will determine whether the facility should perform an acute or chronic test, while the type of water (freshwater or saltwater) will determine which organism should be used. Table 1 summarizes WET-testing requirements. Appendix A includes sample WET language.

Greensand filter systems will not be required to monitor whole effluent toxicity.

Table 5.2: ***WET Test Requirements- Monitor Only***

Discharge Condition		Test
Dilution	IWC < 0.25%	Acute 24-hour Pass/Fail at 90%
	IWC ≥ 0.25%	Chronic test at IWC (maximum 90%)
Tidal Effects	Modeled Tidal discharge	Chronic test at chronic mixing zone characteristics
	Tidal Discharge- not modeled[1]	Acute 24-hour Pass/Fail at 90%
Water Type	Freshwater	Acute test organism: *Fathead minnow* Chronic test organism: *Ceriodaphnia dubia*
	Saltwater	Acute test organism: *Fathead Minnow* OR *Mysid Shrimp* OR *Silverside Minnow* (permittee's choice) Chronic test organism: *Mysid shrimp* [2]

Notes:
1. Applies to existing dischargers only.
2. Permittee may choose to conduct comparison studies showing *Ceriodaphnia dubia* to be greater than or equal to *Mysid Shrimp* in degree of sensitivity to the facility's effluent.

5.3. Peer Agency Review

At a minimum, the permit writer should consider providing a copy of draft permits for all membrane and ion exchange facilities and major permits for conventional water treatment plants to the following agencies:

- Division of Marine Fisheries (for saltwater discharges),
- US Fish and Wildlife Service,
- Wildlife Resources Commission
- Division of Environmental Health.

Draft permits proposing a discharge to shellfish waters (SA) must also be sent to the Shellfish Sanitation for review.

Permits for greensand filter systems will not require inter-agency notification.

5.4. Special Considerations – SA Waters

SA waters are, by default, classified as High Quality Waters. Therefore, limits should be calculated using ½ the water quality standard. Draft permits proposing a discharge to SA waters should be sent to the Shellfish Sanitation for review.

APPENDIX A. RATIONALE FOR PARAMETER INCLUSION

I. *CONVENTIONAL PARAMETERS*

Conductivity (IE and RO facilities)
Conductivity provides information on the inorganic nature of a wastewater by tracking the relative concentration of ions. By requiring effluent and instream monitoring of conductivity, it may be possible to assess some of the ionic impacts of the discharge on the receiving stream.

Dissolved Oxygen (IE and RO facilities)
Low dissolved oxygen concentrations were observed in the effluent of the facilities evaluated. **A facility may petition DWQ to reduce/eliminate DO monitoring requirements if they can demonstrate that the discharge has no significant impact on DO levels in the receiving stream.**

Flow
Flow is an important consideration for dilution modeling and mixing zone calculations. **Continuous flow monitoring is required for all but intermittent discharges, Green Sand and Ion Exchange WTPs.** Flows will not be limited but more accurate flow data will be gathered as continuous flow monitors are installed. The maximum monthly average flow in the most recent three-year period (in which there was a representative discharge) will be used as the facility's flow when performing an RPA.

Permittee's are generally allowed 6 months to purchase and install a recorder after it is budgeted by the City. This means allowing 6 to18 months to install a recorder depending on City's budget cycle.

Temperature (IE and RO facilities)
Literature reviews indicate that temperature is a potential cause for concern. **If a permittee can demonstrate that its discharge is not significantly impacting temperature in the receiving stream, the permittee may petition DWQ to reduce/eliminate the temperature monitoring requirements.**

Total Suspended Solids (all types except RO)
Total suspended solids can be a good general indicator of potential toxicity and may be present in elevated concentrations in the wastestream. Since some existing WTPs only have minimal treatment prior to discharge, TSS limits may need to be phased in over a period of time to allow for the construction of new treatment facilities.

pH
Some of the chemicals used in water treatment can depress or raise pH, and as such, it should be monitored and limited. For discharges to fresh waters, pH will be limited in the range of 6.0-9.0 standard units. For salt waters, pH should be limited between 6.8 and 8.5 standard units.

Salinity (IE and RO facilities only)
If effluent salinity is much higher than the salinity of the receiving stream, there may be localized acute toxic effects.

Turbidity
Turbidity in water is caused by suspended matter such as clay, silt, and organic matter and by plankton and other microscopic organisms that interfere with the passage of light through the water (American Public Health Association, 1998). Turbidity is closely related to total suspended solids (TSS), but also includes plankton and other organisms. Turbidity itself is not a major health concern, but high turbidity can interfere with disinfection and provide a medium for microbial growth. It also may indicate the presence of microbes (U.S. EPA Office of Water, Current Drinking Water Standards).

Turbidity will not be limited except for facilities that discharge to a receiving stream which is impaired for turbidity. (10 NTU for trout waters, 25 NTU for lakes and reservoirs not designated as trout waters, 50 NTU freshwaters)
The Permittee can choose either limit as follows:
1) Upstream and downstream sampling.
Footnote:
The discharge from this facility shall not cause turbidity in the receiving stream to exceed 50 NTU. If the instream turbidity exceeds 50 NTU due to natural background conditions, the discharge cannot cause turbidity to increase in the receiving stream. or
2) Sample the effluent and put a turbidity limit of 50 NTUs as a daily maximum. (use if zero low-flow)

II. TOXICANTS

Arsenic (RO facilities only)
For membrane systems, average values of arsenic were slightly below the aquatic life standard and the maximum values observed exceeded standards.

Chloride (IE and RO facilities)
Foremost among the water quality concerns for ion exchange and membrane plants are the levels of chlorides present and the effect of these discharges on the receiving stream.

Copper (IE, RO, and conventional systems)
A data survey indicated the potential for copper to be present in concentrations exceeding NC water quality standards (WQS). While average values were slightly below the aquatic life standard, maximum detected levels exceeded the standards. Since this is an action level parameter, it will be monitored but not limited unless toxicity can be linked to the presence of this parameter in the potable water byproduct.

Fluoride
Fluoride can be a pollutant of concern for conventional, IE and greensand systems if potable, fluoridated water is used for backwash water.

In membrane plants, fluoride levels can be quite high if the source water contains fluoride. In many of the facilities sampled, fluoride levels in membrane WTP discharges showed reasonable potential to exceed water quality standards.

Iron
Iron is typically a primary pollutant of concern for all types of water treatment processes. This parameter should be monitored (with no limit) since no WQ standard currently exists.

Lead (IE systems only)
Lead values present in the IE discharges studied demonstrated the potential to exceed NC water quality standards.

Manganese (all facilities except RO)
Similar to Iron, manganese is a frequently occurring parameter of concern. *The Water Quality standard for Manganese discharged to WS class waters is 200 ug/L.*

Total Residual Chlorine
Chlorine is introduced through the use of finished water in the filter backwash process, and adds a toxic component to backwash effluent. Note that it's also possible for chlorine to mask toxicity from other sources. Using non-chlorinated or dechlorinated water sources during the backwash process can reduce TRC toxicity, however if a WTP discharges filter backwash water and uses chlorinated water in the backwash process, the discharge will receive a TRC limit from 17-28 µg/L as a daily maximum (for freshwaters). All Saltwater dischargers should receive a daily maximum limit of 13 µg/L. Most plants will need to build dechlorination facilities to achieve this level in their discharge. All permits with a TRC limit shall include the following footnote on the Effluent and Monitoring page:

> The Division shall consider all effluent TRC values reported below 50 ug/l to be in compliance with the permit. However, the Permittee shall continue to record and submit all values reported by a North Carolina certified laboratory (including field certified), even if these values fall below 50 ug/l.

Zinc
Zinc is a pollutant of concern for all types of facilities. This is an action level parameter and should be monitored without a limit.

III. NUTRIENTS

Ammonia
The ammonia nitrogen results at conventional water treatment plants indicated very low levels in the potable water by-product. It is important to note, however, that none of the facilities surveyed use chloramination to disinfect the source water. DEH regional office staff has suggested that facilities using chloramines for disinfection should have finished

water ammonia levels between 0.2-0.5 mg/L but may have levels higher than this. For this reason, those conventional treatment facilities using chloramination will be required to monitor ammonia nitrogen on a quarterly basis.

A review of data for IE and RO plants indicated that levels of ammonia nitrogen were considerably higher than background. In addition, a number of WTPs discharge to nutrient sensitive waters, making the need to monitor effluent nutrient levels necessary. Therefore, TN and TP will be monitored quarterly. When sufficient effluent data have been collected, the need for nutrient limits will be assessed on a case-by-case basis.

Nitrogen and Phosphorus
Nutrient monitoring will be added for all facilities except greensand filters. Monitoring should be added according to basin specific requirements, in order to be consistent with other dischargers throughout the state

IV. WET TESTING

Because of the potential toxic effects of WTP discharges, all WTPs (except greensand filters) will be required to monitor for toxicity. Limits will not be implemented at this time.

Example footnotes for Effluent and Moniting page:

Chronic Pass/ Fail test, *Ceriodaphnia dubia* at 90% conducted January, April, July, October. See Special Condition A.(4).

See Special Condition A. (3.) for Whole Effluent Toxicity monitoring and reporting requirements. Permittee may choose to conduct comparison studies showing *Ceriodaphnia dubia* to be greater than or equal to *Mysid Shrimp* in degree of sensitivity to the facility's effluent.

V. SAMPLE TYPE

Membrane and Conventional WTPs
Although variability may occur between plants and within a particular facility, the Workgroup felt that grab samples were adequate to characterize the effluent. After reviewing existing data, the consistency in the individual source water and the treatment process over time suggests that grab samples are appropriate.

Ion Exchange WTPs
Over the course of the regeneration cycle, the effluent characteristics can experience significant variability. Composite samples should be collected for all parameters except flow, total residual chlorine, temperature, dissolved oxygen, and pH. These parameters can only be measured properly using grab samples. An exception to the composite sampling is provided by 15A NCAC 2B.0505 (C), which states that facilities with design flows under 30,000 gallons per day may use grab samples to characterize their effluent.

IV. ADDITIONAL PARAMETERS OF CONCERN
Additional parameters of concern, most notably metals, may be identified in the application package and source water data. Source water data should be entered into a Reasonable Potential Analysis (RPA) in order to assess the need for limits. Such determinations are to be made on a case-by-case basis.

APPENDIX B – SAMPLE WET MONITORING LANGUAGE

CHRONIC TOXICITY MONITORING (QRTRLY)

The permittee shall conduct quarterly chronic toxicity tests using test procedures outlined in the "North Carolina *Ceriodaphnia* Chronic Effluent Bioassay Procedure," Revised February 1998, or subsequent versions.

The effluent concentration defined as treatment two in the procedure document is XX%. The permit holder shall perform *quarterly* monitoring using this procedure to establish compliance with the permit condition. The tests will be performed **during the months of _____, _____, _____ and _____**. Effluent sampling for this testing shall be performed at the NPDES permitted final effluent discharge below all treatment processes.

All toxicity testing results required as part of this permit condition will be entered on the Effluent Discharge Monitoring Form (MR-1) for the month in which it was performed, using the parameter code TGP3B. Additionally, DWQ Form AT-1 (original) is to be sent to the following address:

Attention: North Carolina Division of Water Quality
Environmental Sciences Section
1621 Mail Service Center
Raleigh, N.C. 27699-1621

Completed Aquatic Toxicity Test Forms shall be filed with the Environmental Sciences Section no later than 30 days after the end of the reporting period for which the report is made.

Test data shall be complete and accurate and include all supporting chemical/physical measurements performed in association with the toxicity tests, as well as all dose/response data. Total residual chlorine of the effluent toxicity sample must be measured and reported if chlorine is employed for disinfection of the waste stream.

Should there be no discharge of flow from the facility during a month in which toxicity monitoring is required, the permittee will complete the information located at the top of the aquatic toxicity (AT) test form indicating the facility name, permit number, pipe number, county, and the month/year of the report with the notation of "No Flow" in the comment area of the form. The report shall be submitted to the Environmental Sciences Section at the address cited above.

Should the permittee fail to monitor during a month in which toxicity monitoring is required, then monthly monitoring will begin immediately. Upon submission of a valid test, this monthly test requirement will revert to quarterly in the months specified above.

Should any test data from this monitoring requirement or tests performed by the North Carolina Division of Water Quality indicate potential impacts to the receiving stream, this permit may be re-opened and modified to include alternate monitoring requirements or limits.

NOTE: Failure to achieve test conditions as specified in the cited document, such as minimum control organism survival, minimum control organism reproduction, and appropriate environmental controls, shall constitute an invalid test and will require immediate follow-up testing to be completed no later than the last day of the month following the month of the initial monitoring.

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