

Regulation 85 Nutrient Sampling and Analysis Plan

Insert Organization's Name

Insert Organization's Address

CDPS Permit No. _____

Insert Date

**FOR A MICROSOFT WORD VERSION OF THIS
TEMPLATE, PLEASE CONTACT:**

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Instructions: This SAP is set up such that it can be customized by individual agencies or watershed groups. Instructions and notes are in red italics (like these instructions) and should be deleted once the SAP is complete. Exhibits are also provided for your information and should be deleted once the SAP is complete. Appendices are expected to remain with the SAP during implementation.

Regulation 85 Sampling and Analysis Plan

Prepared by: _____

Organization: _____

Address: _____

Phone: _____

Approved by (Agency/Entity): _____

Signed By (Printed Name): _____

Title: _____

Signature: _____

Date: _____

Table of Contents

List of Figures	iv
List of Tables	1-iv
List of Abbreviations	1-v
1.1 Background	1-1
1.2 Description	1-1
1.3 Time Line	1-1
1.4 Monitoring Requirements.....	1-1
1.4.1 Effluent Monitoring	1-1
1.4.1.1 Locations	1-1
1.4.1.2 Parameters.....	1-1
1.4.1.3 Frequency.....	1-2
1.4.1.4 Sample Types.....	1-2
1.4.2 Stream Monitoring.....	1-2
1.4.2.1 Locations	1-2
1.4.2.2 Parameters.....	1-2
1.4.2.3 Frequency.....	1-2
1.4.2.4 Sample Types.....	1-3
1. Analytical Methods	2-1
2.1 Analytical Method Detection Limits	2-1
2.2 Analytical Methods.....	2-1
2. Data Reporting.....	3-1
3.1 Reporting Procedures	3-1
3. Sampling Protocol	4-1
4.1 Sampling Locations.....	4-1
4.2 Sampling Parameters	4-2
4.3 Sampling Techniques	4-2
4.3.1 Field Notes, Sample Labeling, and Chain of Custody.....	4-2
4.3.2 Sampling Containers.....	4-3
4.3.3 General Sampling Recommendations.....	4-3
4.3.3.1 Stream Grab Sample Technique.....	4-3
4.3.3.2 Effluent Composite Sample Technique	4-4
4.3.3.3 Flow Determination.....	4-4
4.4 QA/QC	4-4
4.5 Data Review.....	4-4
Appendix A: SAP Certification	A
Certification of Sampling and Analysis Plan for Nutrients	A
Certification of Sampling and Analysis Plan for Nutrients	A

Additional Information Requested Regarding Sampling Locations.....A

Appendix B: 40 CFR Part 136 Excerpt..... B

 Analytical Methods, Sample Holding Times, Sample Bottles, and Preservatives B

Appendix C: Electronic Data Format C

Appendix D: Example Chain of Custody D

Exhibit A: Division Policy WQP-20.....A

 Baseline Monitoring Frequencies.....A

Exhibit B: Stream Flow Measurement B

List of Figures

Figure 1-1. Sampling Location Map..... **Error! Bookmark not defined.**

List of Tables

Table 4-1. Sampling Parameters 4-2

List of Abbreviations

AWQMS	Ambient Water Quality Monitoring System
CDPS	Colorado Discharge Permit System
CDSN	Colorado Data Sharing Network
CDWR	Colorado Division of Water Resources
Commission	Colorado Department of Public Health and Environment, Water Quality Control Commission
Division	Colorado Department of Public Health and Environment, Water Quality Control Division
EPA	Environmental Protection Agency
GPS	Global Positioning System
Major Discharge	≥1 MGD
MDL	Method Detection Limit
MGD	Million Gallons per Day
Minor Discharge	<1 MGD
PQL	Practical Quantification Limit
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RL	Reporting Limit
SAP	Sampling and Analysis Plan
TIN	Total Inorganic Nitrogen
TKN	Total Kjeldahl Nitrogen
TN	Total Nitrogen
TP	Total Phosphorus
USGS	United States Geological Survey

Section 1

SAP OVERVIEW

1.1 Background

This Sampling and Analysis Plan (SAP) was developed to meet the requirements of Colorado Department of Public Health and Environment Water Quality Control Commission (Commission) Regulation 85, Nutrients Management Control Regulation 5 CCR 1002-85. The monitoring, as required in Regulation 85, is to evaluate the effectiveness of the control regulation and to determine the sources and load of nutrients at selected locations, and eventual implementation of appropriate and necessary source controls. The Colorado Department of Public Health and Environment, Water Quality Control Division (Division) will be analyzing all monitoring information to determine the sources and load of nutrients at selected locations. As the sampling effort required under Regulation 85 is mainly intended to characterize point source dischargers, there will be gaps in the data with regard to characterization of other sources of nutrients. This limitation should be kept in mind when analyzing the data that are submitted to the Division as Regulation 85 is implemented.

1.2 Description

Regulation 85 requires domestic wastewater treatment facilities to develop, implement, and document a routine water monitoring program. The monitoring program is designed to characterize the load (coincident flow and concentration) of nutrients in the discharge, the concentrations in the receiving water above the discharge, and the load of nutrients in the river or stream below the discharge.

1.3 Time Line

The certification, see Appendix A, was submitted to the Division and data collection began no later than March 1, 2013. For cooling towers, data collection began in November 2012 will continue no longer than two years after the first sample was collected (through October 2014).

1.4 Monitoring Requirements

1.4.1 Effluent Monitoring

1.4.1.1 Locations

Sampling for nutrients is required in the effluent before it is discharged into the receiving water body at the location where monitoring is performed to satisfy other Colorado Discharge Permit System (CDPS) permit requirements.

1.4.1.2 Parameters

At minimum, sufficient data are collected to calculate:

- Total Nitrogen (TN) - Test for Total Kjeldahl Nitrogen (TKN) and Nitrate+Nitrite Nitrogen
- Total Inorganic Nitrogen (TIN) - Test for Ammonia and Nitrate+Nitrite Nitrogen
- Total Phosphorus (TP)
- Flow - The total daily effluent discharge flows (in gallons or million gallons per day) are collected at the same time as the nutrient concentrations are measured.

1.4.1.3 Frequency

(Choose one)

- Samples are collected a minimum of six times a year (every two months) *(if you are a minor discharger discharging less than 1 MGD).*
- Samples are collected a minimum of monthly *(if you are a major discharger discharging ≥ 1 MGD).*

1.4.1.4 Sample Types

Effluent samples are taken where monitoring is performed to satisfy other CDPS requirements for Industrial or Domestic *(choose those that apply to your facility)* Wastewater Facilities as is reflected in the permit. *(See Exhibit A for more information on effluent sampling taken from the Division's Policy WQP-20 Baseline Monitoring Frequency, Sample Type, and Reduced Monitoring Frequency Policy for Industrial and Domestic Wastewater Facilities.)*

1.4.2 Stream Monitoring

(Ambient stream monitoring is not required for Domestic Wastewater Facilities that have a design capacity less than or equal to 1 MGD or are owned by a disadvantaged community. If this exclusion applies, delete Section 1.4.2.)

1.4.2.1 Locations

Sampling for nutrients is required in the receiving water body at the following locations:

- Upstream of the discharge.
- At the closest active Colorado Division of Water Resources (CDWR) or United State Geological Survey (USGS) gaging station with daily flow available throughout the year downstream of the discharge's mixing zone.

(Note: If an upstream or downstream gage is not available, the flow can be calculated by an approved method from the Division. In lieu of the closest downstream CDWR or USGS gaging station, facilities may take part in collaborative watershed-based monitoring efforts if the parameters and frequency follow sections below.)

1.4.2.2 Parameters

At a minimum, samples are analyzed for:

- Total Nitrogen (TN) - Test for Total Kjeldahl Nitrogen (TKN) and Nitrate+Nitrite Nitrogen
- Total Phosphorus (TP)
- Flow – Daily average streamflow (cfs) on the day instream samples are collected is obtained where an established gaging station with a datalogger is present. *(Where an established gaging station is not available, an alternative streamflow method could be used with approval from the Division and documented in the plan.)*

1.4.2.3 Frequency

Choose one.

- Samples are collected a minimum of six times a year (every two months) *(for minor dischargers discharging less than or equal to 1 MGD).*
- Samples are collected a minimum of monthly *(for major dischargers discharging greater than 1 MGD).*

1.4.2.4 Sample Types

Ambient stream samples are collected as grab samples.

Section 2

Analytical Methods

2.1 Analytical Method Detection Limits

The analytical methods for ambient monitoring are capable of reporting results at or below the following method detection limits (MDL):

Total Phosphorus	0.01 mg/L
Nitrate + Nitrite Nitrogen	0.02 mg N /L
Nitrate Nitrogen	0.02 mg N/L
Nitrite Nitrogen	0.02 mg N/L
Total Kjeldahl Nitrogen	0.1 mg N /L
Total Nitrogen	0.1 mg/L

All results above the MDL are reported for ambient data. Data measured between the MDL and the lab practical quantitation limit (PQL) are reported and flagged with “J” as qualified data.

The analytical method for all effluent monitoring shall be capable of reporting at or below the following PQLs:

Total Phosphorus	0.01 mg/L
Nitrate + Nitrite Nitrogen	0.5 mg N /L
Nitrate Nitrogen	0.05 mg N/L
Nitrite Nitrogen	0.01 mg N/L
Total Kjeldahl Nitrogen	0.5 mg N /L
Total Nitrogen	0.5 mg/L
Ammonia Nitrogen	0.05 mg N/L

All results above the PQL are reported for effluent data.

2.2 Analytical Methods

All samples are collected using standard sampling procedures, sample bottles, and preservatives as prescribed by the method. Samples are delivered to the lab and are analyzed within analysis holding times as specified in Table 1A in 40 CFR Part 136 (see Appendix B). All methods used for analysis of samples are listed in the most current version of 40 CFR Part 136 or are approved by the Division (see Appendix B). The lab follows and meets method and general lab quality control procedures including the use of method blanks, sample spikes, known value standards, and duplicate sample analysis.



Section 3

Data Reporting

3.1 Reporting Procedures

All data collected are maintained in an electronic form and will be submitted to the Division by April 15, 2014 and then each April 15th thereafter. The submission will include geographic locations of sampling points, CDPS permit number, method of sample collection, method detection limit, practical quantitation limit, sample results, and name and identification of the stream flow gage used in ambient flow calculation. The data can be submitted using one of the following two methods below:

- In electronic data deliverable in a format specified by the Division (see Appendix C) for receipt by the Division.
- Electronic submission in a format specified by the Division (see Appendix C) to an alternative publicly available data repository (example – Colorado Data Sharing Network - www.coloradowaterdata.org). If this option is selected, the Division will be notified by April 15th of each year and all relevant data will be accessible to the public.

Section 4

Sampling Protocol

4.1 Sampling Locations

The sampling locations below were selected to comply with the requirements of Regulation 85. *(Remove the upstream and downstream sampling locations if exempt – less than or equal to 1 MGD or owned by a disadvantaged community.)* Figure 4-1 is a map of the three sampling locations *(attach a map for your Figure 4-1 –only include the effluent location if exempt)*. Descriptions and GPS coordinates for each sampling location are:

Upstream:

Location ID: _____

Location name: _____

GPS Latitude: _____

GPS Longitude: _____

Gage ID for flow: _____

Or

Calculation Method: _____

Frequency: _____

Downstream:

Location ID: _____

Location name: _____

GPS Latitude: _____

GPS Longitude: _____

Gage ID for flow: _____

Or

Calculation Method: _____

Frequency: _____

Effluent:

Location ID: _____

Permit number: _____

GPS Latitude: _____

GPS Longitude: _____

Frequency: _____

4.2 Sampling Parameters

The sampling parameters are provided in Table 4-1. *(If exempt, enter NA in the ambient sampling column.)* When a calculation method is used to determine the TN or TIN, the fractions as well as the calculated total will be reported.

Table 4-1. Sampling Parameters			
Parameter	Effluent Sampling Method (Composite or Grab)	Ambient Sampling Method (Composite or Grab)	Method # (Insert NA if using a different method)
Total Phosphorus			
Total Nitrogen			
Total Kjeldahl Nitrogen			
Nitrate+Nitrite Nitrogen			
Total Inorganic Nitrogen		NA	
Ammonia		NA	
Nitrate+Nitrite Nitrogen		NA	

4.3 Sampling Techniques

The sampling is conducted by _____ (agency/entity) using the following protocols. Samples are collected in containers provided by _____ (name of laboratory) and _____ (shipped or delivered) for analysis per laboratory recommendations.

The following analytical laboratories are used for each analysis:

Total Phosphorus	Name of Laboratory _____
Nitrate+Nitrite Nitrogen	Name of Laboratory _____
Total Kjeldahl Nitrogen	Name of Laboratory _____
Ammonia	Name of Laboratory _____

Careful precision in the laboratory cannot compensate for improperly collected samples. Inadequate field techniques, poor equipment, and improper sample preservation will have a greater effect on the testing outcome than errors from variation in laboratory analyses.

4.3.1 Field Notes, Sample Labeling, and Chain of Custody

Field notes are taken for all sample sites and recorded in a bound field notebook. Information recorded includes: identification of the monitoring site; date and time of sampling, identity of the sampler(s); description of the type of samples taken; method of sampling; results of any field analyses; description of the weather, including percent cloud cover and air temperature; description of the site appearance; and any unusual conditions observed.

Collected samples are designated by sample location using the location ID identified above. Each sample container is individually labeled, with the label affixed directly to the bottle or bag itself with the preservative and analysis to be performed printed on the label. Additional sampling information, date, time, location, and sampler initials, is also written on the label with indelible waterproof ink.

Chain of custody (COC) documentation identifies sample containers and provides a complete inventory of all containers in a sample set, and will provide an audit trail identifying the persons who have custody

of a sample in order and the exact date and time when custody was relinquished from one person to the next. A COC will be filled out for each sampling event (See Appendix D for sample). *(See Appendix D for a Chain of Custody that can be used or modified for your needs).*

4.3.2 Sampling Containers

The lab provides the containers and any shipping materials necessary to maintain sample integrity from the time of collection through analysis. Table II of 40 CFR section 136.3 defines specific materials, preservation techniques, and holding times (see Appendix B)

4.3.3 General Sampling Recommendations

Following are general recommendations for water quality sampling.

- Since sampling is taking place year round, it is possible that instream sampling may not be safe at certain times. If alternative methods of sample collection are not possible, it is up to the discretion of the individual sampling personnel whether sampling will take place during high flows. The turbidity of the stream, visual flow, and previous rain events may also affect sampling schedule.
- When wading, collect samples upstream from the body and avoid disturbing sediments in the immediate area of sample collection.
- Sampling at or near structures (e.g., dams, weirs, or bridges) may not provide representative data because of unnatural flow patterns. If you have to collect from a bridge, sample on the upstream side in the center of the main flow.
- Collect grab samples within the top 12 inches of the water column, but avoid skimming the surface of the water during collection.
- Where practical, use the actual sample container as the collection device (direct grab). If a direct grab sample cannot be collected, ensure that the intermediate sample container is well rinsed with site water before sample collection.

4.3.3.1 Stream Grab Sample Technique

Grab samples will be collected for analysis of ambient and effluent water quality. *(Remove “and effluent” from the previous sentence if your permit requires that you take composite samples of constituents like ammonia or TIN.)* Grab sample technique is summarized as follows:

- Use an unpreserved sample container to collect the sample. Rinse with sample site water.
- If using prepreserved sample bottles, collect sample water (in same manner described below) in a clean carboy/sample collection container that is rinsed with sample site water. Fill the bottles from that carboy.
- Take sample from area representative of the flow conditions at that site.
- Remove the container cap and slowly submerge the container, opening first, into the water.
- Invert the bottle so the opening is facing toward the water and parallel to water flow. Allow water to run slowly into the container until filled.
- Return the filled container quickly to the surface.
- Pour out a small volume of sample away from and downstream of the sampling location. This procedure allows for addition of preservatives (if using) and sample expansion.
- Add preservatives (provided by the analytical laboratory), if required, securely cap container, label, and complete field notes and COC.
- If preservatives have been added, invert the container several times to ensure sufficient mixing of sample and preservatives.

4.3.3.2 Effluent Composite Sample Technique

Composite samples will be collected for effluent samples. *(Delete this Section 4.3.3.2 if your permit requires grab samples of constituents like ammonia or TIN.)*

- Use an aliquot of well mixed effluent composite and place in appropriate container.
- Add preservatives (provided by the analytical laboratory), if required, securely cap container, label, and complete field notes and COC.
- If preservatives have been added, invert the container several times to ensure sufficient mixing of sample and preservatives.

4.3.3.3 Flow Determination

Flow is an important tool in assessing water quality. Measurements will be recorded to help understand flow regimes within the watershed and to determine constituent loading. Daily average flow in cubic feet per second (cfs) from either a United States Geological Survey (USGS) or Colorado Division of Water Resources (CDWR) gage station will be determined on the day samples are collected. Prior to each field visit, the USGS/CDWR website will be checked to confirm that the gage is active and flow data are available. Flow will be reported based the stream gage flow or will be calculated based on the methods provided in Section 4.1.

For effluent sampling, total outfall flow will be reported in gallons or million gallons per day (gpd or MGD) on the day the sample is collected.

Where USGS flow data are not available, alternative flow calculations may be required. Methods for stream flow monitoring provided in Exhibit B may be useful, but this alternative stream flow calculation strategy must be reviewed and approved by the Division.

4.4 QA/QC

(The following Quality Assurance/Quality Control (QA/QC) recommendations and protocols are provided for reference and for use as a supplement to your existing Quality Assurance Project Plan (QAPP) protocols. Revise to reflect your QAPP.)

All information produced must be of reliable and documented quality. The primary means for ensuring data quality is through implementation of QAPPs.

Field QA/QC includes thorough cleaning of sampling equipment, use of appropriate sample containers, and maintaining COC procedures. Analytical QA/QC measures are also followed by the laboratories and include equipment blanks and spikes. Analytical QA/QC results are provided by the laboratory.

Field duplicates and field blanks should be collected, one for every 20 samples collected. The field duplicate is collected immediately after the primary sample is collected at the site. Field blanks are taken by pouring reagent water from the laboratory into sample bottles at the site. Reagent water would need to be requested from the laboratory. Field duplicates/blanks are labeled as separate samples to avoid confusion and to provide an unbiased blind evaluation.

Laboratory QC meets the requirements specified by each analytical method.

4.5 Data Review

Data review consists of reviewing the data package received from the contracted laboratories to ensure the package is complete and consistent. The following data review procedures are performed following receipt of each data package *(revise to reflect your QAPP)*:

Step 1

1. Review the data set for completeness. Confirm that all sample sites and constituents are reported or that there is an explanation for each missing data point.
2. Review the data report. Confirm that all titles, labels, column headings, and footnotes are accurate and complete. Confirm that all constituents are reported in proper units.
3. Review the date and time documentation. Confirm that the sample dates and times are consistent with the date and time received in the laboratory. Confirm that the dates and time for analysis are consistent with the dates and times of the analysis. Confirm that the holding times were not violated, based on a comparison of sampling and analysis date and times.

Step 2

1. Review all values that are reported as “None Detected.” Confirm that the analytical detection limits are low enough to accomplish project goals. Confirm that all values are either reported as values or less than the detection limit. Confirm that the detection limit is used consistently on all samples.

Step 3

1. Review data for internal consistency. Confirm that values have a logical relationship to one another. Confirm that values are within the historical range of data for a given site and constituent. Confirm that values vary logically according to known conditions, such as seasonal temperature and presence or absence of dilution flows.
2. Review the internal and external quality control results. Confirm that spike recovery percentages on matrix spikes, relative percent difference on laboratory duplicates, and percent error on known laboratory standards were within acceptance limits. Confirm that digestion blanks, reagent blanks, and method blanks do not contain concentrations of analyte that interfere with interpretation of data.

Appendix A: SAP Certification

Certification of Sampling and Analysis Plan for Nutrients

Certification of Sampling and Analysis Plan for Nutrients

As Required by Regulation 85

Facility Name: _____

Permittee: Organization Formal Name: _____

Permit Number(s): _____

Permitted Discharge Flow: _____

This certifies that the facility named above has current Sampling and Analysis Plan ("SAP") in place for the monitoring of nutrients as required by Regulation #85. The SAP includes, but is not limited to: plant effluent monitoring location (latitude/longitude) where monitoring is performed; effluent parameters sampled (at a minimum, sufficient data, including flows, shall be collected to calculate TN, TIN, and TP load); daily average effluent discharge; date and time of sample collection; stream nutrient monitoring locations (latitude/longitude) upstream and downstream of the discharge; latitude/longitude coordinates for the closest active Colorado Division of Water Resources or United States Geological Survey (USGS) gaging station with daily flow available throughout the year downstream of the discharge's mixing zone or in lieu of the closest downstream Division of Water Resources or USGS gaging station, facilities may take part in collaborative watershed-based monitoring; parameters sampled (at a minimum, sufficient data shall be collected to calculate TN, TIN, and TP load); and date and time of sample collection.

This SAP is available upon request by the Water Quality Control Division or other interested parties.

Signature of Legally Responsible Party_____
Date_____
Name (Printed) and Title

Additional Information Requested on the Back.

Additional Information Requested Regarding Sampling Locations

Location of Discharge:

Waterbody _____

Latitude/Longitude _____

Upstream monitoring location (if applicable):

Waterbody/Station Number _____

Latitude/Longitude _____

Downstream monitoring location (if applicable):

Waterbody/Station Number _____

Latitude/Longitude _____

Collection Agency of downstream gaging station (if applicable): _____

The SAP to meet the Regulation # 85 monitoring requirement for this facility is part of a collaborative watershed-based monitoring program.

Group/Watershed Name: _____

Contact Person for SAP (if needed): _____

Contact Telephone # and/or e-mail address: _____

Appendix B: 40 CFR Part 136 Excerpt

Analytical Methods, Sample Holding Times, Sample Bottles, and Preservatives

Parameter	Methodology	EPA	Standard methods	ASTM	USGS/AOAC/ Other
4. Ammonia (as N), mg/L	Manual distillation or gas diffusion (pH > 11), followed by any of the following:	350.1, Rev. 2.0 (1993)	4500-NH ₃ B-1997		973.49 ³ .
Add H ₂ SO ₄ to pH < 2, store at 4°C for up to 28 days	Nesslerization			D1426-08 (A)	973.49 ³ , I-3520- 85. ²
	Titration		4500-NH ₃ C-1997		
<i>500-mL; plastic or glass</i>	Electrode		4500-NH ₃ D-1997 or E- 1997	D1426-08 (B)	
	Manual phenate, salicylate, or other substituted phenols in Berthelot reaction based methods		4500-NH ₃ F-1997		See footnote. ⁶⁰
	Automated phenate, salicylate, or other substituted phenols in Berthelot reaction based methods	350.1 ³⁰ , Rev. 2.0 (1993)	4500-NH ₃ G-1997		I-4523-85. ²
			4500-NH ₃ H-1997.		
	Automated electrode	Ion Chromatography		D6919-09	See footnote. ⁷
31. Kjeldahl Nitrogen ⁵ - Total, (as N), mg/L	Manual digestion ²⁰ and distillation or gas diffusion, followed by any of the following:		4500-N _{org} B-1997 or C- 1997 and 4500-NH ₃ B- 1997	D3590-02(06) (A)	
Add 2mL/L H ₂ SO ₄ , analyse ASAP or store at 4°C for up to 28 days	Titration		4500-NH ₃ C-1997		973.48. ³
	Nesslerization			D1426-08 (A)	
<i>500-mL; plastic or glass</i>	Electrode		4500-NH ₃ D-1997 or E- 1997	D1426-08 (B)	
	Semi-automated phenate	350.1 Rev 2.0 1993	4500-NH ₃ G-1997.		
			4500-NH ₃ H-1997		
	Manual phenate, salicylate, or other substituted phenols in Berthelot reaction based methods		4500-NH ₃ F-1997		See footnote. ⁶⁰

Parameter	Methodology	EPA	Standard methods	ASTM	USGS/AOAC/ Other
	Automated Methods for TKN that do not require manual distillation				
	Automated phenate, salicylate, or other substituted phenols in Berthelot reaction based methods colorimetric (auto digestion and distillation)	351.1 (Rev. 1978) ¹			I-4551-78. ⁸
	Semi-automated block digester colorimetric (distillation not required)	351.2, Rev. 2.0 (1993)	4500-N _{org} D-1997	D3590-02(06) (B)	I-4515-91. ⁴⁵
	Block digester, followed by Auto distillation and Titration				See footnote. ³⁹
	Block digester, followed by Auto distillation and Nesslerization				See footnote. ⁴⁰
	Block Digester, followed by Flow injection gas diffusion (distillation not required)				See footnote. ⁴¹
38. Nitrate (as N), mg/L Store at 4°C for up to 48 hours	Ion Chromatography	300.0, Rev 2.1 (1993) and 300.1-1, Rev 1.0 (1997)	4110 B-2000 or C-2000	D4327-03	993.30. ³
<i>100-mL; plastic or glass</i>	CIE/UV		4140 B-1997	D6508-00(05)	D6508, Rev. 2. ⁵⁴
	Ion Selective Electrode		4500-NO ₃ ⁻ D-2000		
	Colorimetric (Brucine sulfate)	352.1 (Issued 1971) ¹			973.50, ³ 419D ^{1,7} , p. 28. ⁹
	Nitrate-nitrite N minus Nitrite N (See parameters 39 and 40)				See footnote. ⁶²
39. Nitrate-nitrite (as N), mg/L	Cadmium reduction, Manual		4500-NO ₃ ⁻ E-2000	D3867-04 (B)	
Add H ₂ SO ₄ to pH < 2, store at 4°C for up to 28 days	Cadmium reduction, Automated	353.2, Rev. 2.0 (1993)	4500-NO ₃ ⁻ F-2000	D3867-04 (A)	I-2545-90. ⁵¹
	Automated hydrazine		4500-NO ₃ ⁻ H-2000		

Parameter	Methodology	EPA	Standard methods	ASTM	USGS/AOAC/ Other
<i>200-mL; plastic or glass</i>	Reduction/Colorimetric				See footnote. ⁶²
	Ion Chromatography	300.0, Rev 2.1 (1993) and 300.1-1, Rev 1.0 (1997)	4110 B-2000 or C-2000	D4327-03	993.30. ³
	CIE/UV		4140 B-1997	D6508-00(05)	D6508, Rev. 2. ⁵⁴
40. Nitrite (as N), mg/L	Spectrophotometric: Manual		4500-NO ₂ ⁻ B-2000		See footnote. ²⁵
Store at 4°C for up to 48 hours	Automated (Diazotization)				I-4540-85 ² , See footnote. ⁶²
<i>100-mL; plastic or glass</i>	Automated (*bypass cadmium reduction)	353.2, Rev. 2.0 (1993)	4500-NO ₃ ⁻ F-2000	D3867-04 (A)	I-4545-85. ²
	Manual (*bypass cadmium reduction)		4500-NO ₃ ⁻ E-2000	D3867-04 (B)	
	Ion Chromatography	300.0, Rev 2.1 (1993) and 300.1-1, Rev 1.0 (1997)	4110 B-2000 or C-2000	D4327-03	993.30. ³
	CIE/UV		4140 B-1997	D6508-00(05)	D6508, Rev. 2. ⁵⁴
43. Organic nitrogen (as N), mg/L Add H ₂ SO ₄ to pH < 2, store at 4°C for up to 28 days	Total Kjeldahl N (Parameter 31) minus ammonia N (Parameter 4)				
50. Phosphorus—Total, mg/L	Digestion ²⁰ , followed by any of the following:		4500-P B(5)-1999		973.55. ³
Add H ₂ SO ₄ to pH < 2, analyse ASAP or store at 4°C for up to 28 days	Manual	365.3 ¹ (Issued 1978)	4500-P E-1999	D515-88 (A)	
	Automated ascorbic acid reduction	365.1 Rev. 2.0 (1993)	4500-P F-1999, G-1999, H-1999		973.56 ³ , I-4600-85. ²
<i>100-mL; plastic or glass</i>	ICP/AES ^{4, 36}	200.7, Rev. 4.4 (1994)	3120 B-1999		I-4471-97. ⁵⁰
	Semi-automated block digester (TKP digestion)	365.4 ¹ (Issued 1974)		D515-88 (B)	I-4610-91. ⁴⁸
Total Nitrogen, (as N), mg/l	Lachat 10-107-04-4 ^A				

Parameter	Methodology	EPA	Standard methods	ASTM	USGS/AOAC/ Other
Add H ₂ SO ₄ to pH < 2, store at 4°C. If frozen it can be stored for up to 30 days					
<i>100-mL; plastic or glass</i>					

Notes/Footnotes

^A Approved for use by the Colorado Water Quality Control Division

¹ Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020. Revised March 1983 and 1979, where applicable. U.S. EPA.

² Methods for Analysis of Inorganic Substances in Water and Fluvial Sediments, Techniques of Water-Resource Investigations of the U.S. Geological Survey, Book 5, Chapter A1., unless otherwise stated. 1989. USGS.

³ Official Methods of Analysis of the Association of Official Analytical Chemists, Methods Manual, Sixteenth Edition, 4th Revision, 1998. AOAC International.

⁴ For the determination of total metals (which are equivalent to total recoverable metals) the sample is not filtered before processing. A digestion procedure is required to solubilize analytes in suspended material and to break down organic-metal complexes (to convert the analyte to a detectable form for colorimetric analysis). For non-platform graphite furnace atomic absorption determinations a digestion using nitric acid (as specified in Section 4.1.3 of Methods for the Chemical Analysis of Water and Wastes) is required prior to analysis. The procedure used should subject the sample to gentle, acid refluxing and at no time should the sample be taken to dryness. For direct aspiration flame atomic absorption determinations (FLAA) a combination acid (nitric and hydrochloric acids) digestion is preferred prior to analysis. The approved total recoverable digestion is described as Method 200.2 in Supplement I of “Methods for the Determination of Metals in Environmental Samples” EPA/600R-94/111, May, 1994, and is reproduced in EPA Methods 200.7, 200.8, and 200.9 from the same Supplement. However, when using the gaseous hydride technique or for the determination of certain elements such as antimony, arsenic, selenium, silver, and tin by non-EPA graphite furnace atomic absorption methods, mercury by cold vapor atomic absorption, the noble metals and titanium by FLAA, a specific or modified sample digestion procedure may be required and in all cases the referenced method write-up should be consulted for specific instruction and/or cautions. For analyses using inductively coupled plasma-atomic emission spectrometry (ICP-AES), the direct current plasma (DCP) technique or the EPA spectrochemical techniques (platform furnace AA, ICP-AES, and ICP-MS) use EPA Method 200.2 or an approved alternate procedure (e.g., CEM microwave digestion, which may be used with certain analytes as indicated in Table IB); the total recoverable digestion procedures in EPA Methods 200.7, 200.8, and 200.9 may be used for those respective methods. Regardless of the digestion procedure, the results of the analysis after digestion procedure are reported as “total” metals.

⁵ Copper sulfate or other catalysts that have been found suitable may be used in place of mercuric sulfate.

- ⁷ Industrial Method Number 379-75 WE Ammonia, Automated Electrode Method, Technicon Auto Analyzer II. February 19, 1976. Bran & Luebbe Analyzing Technologies Inc.
- ⁸ The approved method is that cited in *Methods for Determination of Inorganic Substances in Water and Fluvial Sediments, Techniques of Water-Resources Investigations of the U.S. Geological Survey, Book 5, Chapter A1*. 1979. USGS.
- ⁹ American National Standard on Photographic Processing Effluents. April 2, 1975. American National Standards Institute.
- ²⁰ When using a method with block digestion, this treatment is not required.
- ²⁵ Method 8507, Nitrogen, Nitrite-Low Range, Diazotization Method for Water and Wastewater. 1979. Hach Company.
- ³⁰ The use of EDTA decreases method sensitivity. Analysts may omit EDTA or replace with another suitable complexing reagent provided that all method specified quality control acceptance criteria are met.
- ³⁶ Microwave-assisted digestion may be employed for this metal, when analyzed by this methodology. *Closed Vessel Microwave Digestion of Wastewater Samples for Determination of Metals*. April 16, 1992. CEM Corporation
- ³⁹ Method PAI-DK01, Nitrogen, Total Kjeldahl, Block Digestion, Steam Distillation, Titrimetric Detection. Revised December 22, 1994. OI Analytical.
- ⁴⁰ Method PAI-DK02, Nitrogen, Total Kjeldahl, Block Digestion, Steam Distillation, Colorimetric Detection. Revised December 22, 1994. OI Analytical.
- ⁴¹ Method PAI-DK03, Nitrogen, Total Kjeldahl, Block Digestion, Automated FIA Gas Diffusion. Revised December 22, 1994. OI Analytical.
- ⁴⁵ Open File Report 00-170, *Methods of Analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of Ammonium Plus Organic Nitrogen by a Kjeldahl Digestion Method and an Automated Photometric Finish that Includes Digest Cleanup by Gas Diffusion*. 2000. USGS.
- ⁴⁸ Open File Report 92-146, *Methods of Analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of Total Phosphorus by Kjeldahl Digestion Method and an Automated Colorimetric Finish That Includes Dialysis*. 1992. USGS.
- ⁵⁰ Open File Report 98-165, *Methods of Analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of Elements in Whole-water Digests Using Inductively Coupled Plasma-Optical Emission Spectrometry and Inductively Coupled Plasma-Mass Spectrometry*. 1998. USGS.
- ⁵¹ Open File Report 93-125, *Methods of Analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of Inorganic and Organic Constituents in Water and Fluvial Sediments*. 1993. USGS.
- ⁵⁴ Method D6508, *Test Method for Determination of Dissolved Inorganic Anions in Aqueous Matrices Using Capillary Ion Electrophoresis and Chromate Electrolyte*. December 2000. Waters Corp.
- ⁶⁰ Analysts should be aware that pH optima and chromophore absorption maxima might differ when phenol is replaced by a substituted phenol as the color reagent in Berthelot Reaction (“phenol-hypochlorite reaction”) colorimetric ammonium determination methods. For example when phenol is used as the color reagent, pH optimum and wavelength of maximum absorbance are about 11.5 and 635 nm, respectively—see, Patton, C.J. and S.R. Crouch. March 1977. *Anal. Chem.* 49:464-469. These reaction parameters increase to pH > 12.6 and 665 nm when salicylate is used as the color reagent—see, Krom, M.D. April 1980. *The Analyst* 105:305-316.
- ⁶² Easy (1-Reagent) Nitrate Method, Revision November 12, 2011. Craig Chinchilla.

Appendix C: Electronic Data Format

Format for Submission to Division or Other Publically Available Database

INSERT DIVISION'S ELECTRONIC FORMAT AS SOON AS AVAILABLE

Appendix D: Example Chain of Custody

Agency: _____

Agency Address: _____

CHAIN OF CUSTODY RECORD

CDPS PERMIT #			SAMPLERS (SIGNATURE)			
LOCATION	DATE	TIME	SAMPLE TYPE (Wastewater/ Surface Water)	SAMPLE TIME	# OF CONTAINERS	ANALYSIS REQUESTED
RELINQUISHED BY: (SIGNATURE)			RECEIVED BY: (SIGNATURE)			DATE/TIME
RELINQUISHED BY: (SIGNATURE)			RECEIVED BY: (SIGNATURE)			DATE/TIME
RELINQUISHED BY: (SIGNATURE)			RECEIVED BY: (SIGNATURE)			DATE/TIME

DISPATCHED BY: (SIGNATURE)	DATE/TIME	RECEIVED FOR LABORATORY BY:	DATE/TIME
METHOD OF SHIPMENT:			
RELINQUISHED BY: (SIGNATURE)		RECEIVED BY: (SIGNATURE)	DATE/TIME
RELINQUISHED BY: (SIGNATURE)		RECEIVED BY: (SIGNATURE)	DATE/TIME
DISTRIBUTION: ORIGINAL-ACCOMPANY SHIPMENT 1 COPY-COORDINATOR			

Exhibit A: Division Policy WQP-20

Baseline Monitoring Frequencies

**Baseline Monitoring Frequencies for Domestic Mechanical Wastewater Facilities
Discharging to Surface Waters**

Parameter	Frequency of Measurement Based on the Expected Flow (mgd) During the Permit Period						Type of Sample
	0 – 0.25	Over 0.25 – 1.0	Over 1.0 – 2.5	Over 2.5 – 5.0	Over 5.0 – 10.0	Over 10.0	
Influent and Effluent BOD ₅	Monthly	Weekly	2x / week	3x / week	5x / week	Daily	Composite 1/
Influent and Effluent TSS	Monthly	Weekly	2x / week	3x / week	5x / week	Daily	Composite 1/
Influent and Effluent Flow 2/	Daily	Daily	Daily	Daily	Daily	Daily	Continuous 3/
Ammonia, Nitrite, Nitrate or other N	Monthly	Weekly	2x / week	3x / week	5x / week	Daily	Composite 1/
E. Coli / Fecal Coliform	Monthly	Weekly	2x / week	3x / week	5x / week	Daily	Grab
pH, DO	Weekly	Daily	Daily	Daily	Daily	Daily	Grab or Continuous
Oil and Grease	Weekly	Daily	Daily	Daily	Daily	Daily	Visual 4/
Total Residual Chlorine	Weekly	3x / week	5x / week	Daily	3x / day	5x / day	Grab or Continuous
Metals, Cyanide, Sulfide, Boron	Monthly	Monthly	Monthly	2x / Month	Weekly	Weekly	Composite 1/
Phosphorus	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Composite 1/
TDS (narrative standard based)	Monthly	Monthly	Monthly	2x / Month	Weekly	Weekly	Composite 1/
TDS (Control Reg based)	Quarterly	Quarterly	Monthly	Monthly	Weekly	Weekly	Composite 1/
WET	WET testing frequency and reduced monitoring as described in the WET Guidance Document						
Organics 5/, or Temperature 6/	Case by Case Basis						Composite 1/

1/ An effluent grab sample may be allowed where the mechanical facility is followed by a non-aerated pond with a detention time of two days or more. For facilities discharging < 1 mgd, a grab sample may be substituted.

Exhibit B: Stream Flow Measurement

Stream Channel Measurements. Stream channel flow is calculated by velocity and area measurements taken at instream sample locations. Stream width is determined with a tape measure across a sample transect perpendicular to the channel. Streams are generally waded to collect measurements of depth (staff gauge) and velocity (current velocity meter). Current velocity measurements may be obtained using an electromagnetic flow instrument (e.g., Global Flow Probe, Marsh McBurney). Where streams can not be accessed by wading, flow can be measured from a bridge using a weighted line marked in feet for the depth with the flow meter attached.

Measurements of depth and velocity are taken on the same vertical line at even distances across the stream at the center of equally spaced intervals. Interval width is determined by how even and consistent the flow is across the channel, as well as the width of the channel. A stream strewn with boulders without a uniform channel would demand closer intervals than an even channel with a sandy bottom. Generally, velocity readings will be recorded at the center of intervals that are ten percent of the width of the stream along the cross-section transect at each sample site.

Flow for each section of the sample transect is calculated by multiplying the velocity by the area of the individual transect section. Flows for each transect section are then summed to determine an overall transect flow rate. This flow rate calculation method is shown schematically on Figure 3.

How to Calculate Flow

Calculating discharge from each of the width intervals:

$$q_2 = v_2 d_2 (w_3 - w_1) / 2$$

where: q_2 = discharge at width interval 2 (cfs)

v_2 = velocity measure at width interval 2 (ft./sec.)

d_2 = depth at interval 2 (feet)

w_3 = distance from the bank or initial measuring point to the point following interval 2 (feet)

w_1 = distance from the bank or initial measuring point to the point preceding interval 2 (feet)

Calculate the total discharge (flow) as the sum of each of the partial discharges.

$$Q = q_1 + q_2 + q_3 + q_4 \dots q_n$$

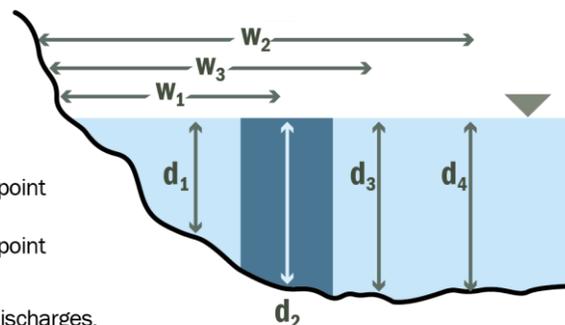


Figure 3. Stream Channel Flow Calculation

Another flow measurement option, the sixth tenths depth method (0.6 method) is summarized below. The 0.6 method consists of measuring the velocity at 0.6 of the depth from the bottom of the stream, and is generally used for shallow flows where the water depth is less than 2 feet. A single velocity measurement is taken at each interval, at 0.6 of the depth from the bottom. It is essential that portable flow meter be in place long enough to get a reliable average of the velocity. Electromagnetic velocity meters are counted or observed for a minimum of 20 seconds. This standard operating procedure describes general use of an electromagnetic velocity meter. Instructions for steps 1, 5, and 9 may vary based on the specific manufacturer and model.

1. Adjust the time averaging interval with the up/down arrows until 20 seconds is displayed on the screen.
2. Measure the width of the stream leaving the tape suspended several feet above the water.
3. Beginning 6 inches from either bank, measure the depth.
4. Adjust the wading rod to the 0.6 tenth position.
5. Holding the rod in a steady upright position, push the START button on the meter. The movement screen will begin moving left to right measuring velocity for 20 seconds. At the end of 20 seconds,

the average velocity will appear on the screen and the display will again begin another 20-second period.

6. Record the first velocity reading, ignoring the second displayed velocity.
7. Move the wading rod 1 foot into the stream and record the depth.
8. Adjust the wading rod to the 0.6 tenth position.
9. Push the START button on the display. A new 20-second interval period will begin. At the end of the 20-second period, the average velocity will again appear on the screen.
10. Record the second velocity reading, ignoring the display counting the third display period.
11. Repeat step 7-10 until you reach 6 inches from the far bank. The 6 inch reading will be your last reading.
12. Add all the velocities and divide by the number of readings to get the average.
13. Add all the depths and divide by the number of readings to get the average depth.
14. Multiply the width by the average depth and the average velocity to determine flow in cubic feet per second (cfs).

Estimating Flow Volumes. Excessive flow velocities and flow depth may impede the measurement of flow at some sample locations. In this case, flow will be estimated using an approximate velocity, water depth, and the known cross-sectional geometry from previous sampling events. It is critical that the field sheet is marked “estimated” using this method.