City of Vader

Lewis County, Washington

Biosolids Sampling and Analysis Plan

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1. Introduction

This document describes the methods of collection, preservation, and analysis for biosolids produced at the City of Vader Wastewater Treatment Plant (WWTP). Analyzing biosolids quality is required to remove and beneficially reuse biosolids in compliance with State and Federal rules and regulations. It is assumed that biosolids removed from the treatment lagoons at the City of Vader WWTP will meet the requirements for Class B biosolids; however, this assumption must be verified prior to the removal and land application of the biosolids. This document presents the information necessary to implement standard practices for the collection and analysis of biosolids to comply with those rules and regulations.

A copy of this document will be retained at the City of Vader WWTP for reference whenever biosolids are removed from the facility. This document should be periodically reviewed and revised, and any changes should be reviewed and approved by the Department of Ecology prior to implementation.

Objective

Three elements define the quality of biosolids: pollutant concentration, pathogen reduction, and vector attraction reduction. This sampling and analysis plan is intended to provide reasonable assurance that the standards for these elements are met. Additional standards are required of the beneficial use facilities (BUFs) where the biosolids will be land applied. This document does not address those elements. The City intends to use contract haulers and BUFs to accomplish beneficial reuse of WWTP biosolids and responsibility for compliance with land applications requirements (including soil sampling) rests with the BUF.

Pollutant Concentrations

Biosolid pollutant concentration limits are established by Washington Administrative Code (WAC) 173-308-160 and summarized in the table below. Given that most wastewater received at the WWTP is domestic sewage, it is expected that pollutant concentrations in biosolids from the facility will be below the regulatory limits.

Pollutant	Ceiling Concentration in Milligrams per Kilogram (dry wt. basis)[1]
Arsenic	75
Cadmium	85
Copper	4,300
Lead	840
Mercury	57
Molybdenum	75
Nickel	420
Selenium	100
Zinc	7,500

1 Ceiling Concentrations reported in Table 1 of WAC 173-308-160.

The State has determined that if biosolids have pollutant concentrations that are sufficiently low, biosolids preparers and land appliers are relieved of some recordkeeping, reporting, and labeling requirements. Those threshold concentrations are presented in the table below. The biosolids preparer should assume that the biosolids will exceed these threshold concentrations for relaxed documentation requirements until confirmed by analytical testing.

Pollutant	Limit Monthly Average Concentration in Milligrams per Kilogram (dry wt. basis)[1]
Arsenic	41
Cadmium	39
Copper	1,500
Lead	300
Mercury	17
Nickel	420
Selenium	100
Zinc	2,800

2 Ceiling Concentrations reported in Table 3 of WAC 173-308-160.

Pathogen Reduction

Adequate pathogen reduction is required prior to land application of biosolids. Pathogen reduction requirements for Class A and B biosolids are described in WAC 173-308-170. The WAC provides three alternative approaches to demonstrate that pathogen reduction has occurred. The City of Vader intends to show pathogen reduction via Alternative 1 (testing). This alternative method requires that the biosolids be tested for fecal coliform and not exceed the following limits:

- Geometric mean of the density of fecal coliform of the samples must be less than 2,000,000 Most Probably Number (MPN) per gram of total solids (dry wt. basis), or
- Geometric mean of the density of fecal coliform of the samples must be less than 2,000,000 Colony Forming Units (CFU) per gram of total solids (dry wt. basis).

This method requires the analysis of at least seven (7) samples per basin.

Vector Attraction Reduction

Vector attraction reduction is important for limiting the potential for animals or insects to spread pathogens that may be present in biosolids. WAC 173-308-180 establishes requirements for vector attraction reduction and outlines six alternative approaches for achieving adequate vector attraction reduction. Given the wastewater treatment process used at the City of Vader WWTP, Alternative 1a will be used to demonstrate vector attraction reduction compliance.

Alternative 1a uses bench-scale testing of anaerobically digested sludge to show that sufficient reduction in volatile solids has occurred. Under this method, a sample of anaerobically digested sludge undergoes additionally anaerobic digestion in a laboratory for 40 days at a temperature of 30 to 37°C. The sludge is deemed to have undergone adequate vector attraction reduction if volatile solids reduction in the laboratory digestion test is less than 17 percent over the duration of the 40-day test period.

If biosolids exhibit a volatile solids reduction greater than 17 percent during the above-described laboratory test, the City will pursue incorporation or injection of the biosolids at a BUF. The incorporation or injection of biosolids will meet the VAR requirement as outlined in WAC 173-308-210.

2. Sample Collection and Handling

Sampling and Analysis Frequency

WAC 173-308-150 establishes minimum biosolids monitoring frequencies based on the dry weight tonnage of biosolids land applied each year. The wastewater treatment system used at the City of Vader WWTP is such that wastewater solids can accumulate for long periods of time in the treatment basins (on the order of several years) before removal and beneficial use may be necessary. As a result, implementation of this Sampling and Analysis Plan is only required when biosolid removal and beneficial reuse is planned. Sampling and characterization of the accumulated biosolids should occur immediately prior to planned removal events, and staff should begin coordinating sampling work with the Department of Ecology Regional Biosolids Coordinator approximately 4-6 months prior to an anticipated removal event. Monitoring results will only need to be submitted to the Department of Ecology in years when land application occurs.

Sample Collection Locations

Biosolids must be characterized in each treatment basin from which they will be removed during a removal event. The City is currently undertaking upgrades to its WWTP. Prior to completion of the project, the WWTP consists of three distinct treatment basins, each of which have measurable solids that will be removed and beneficially reused as part of the construction process. The biosolids in each of those basins should be separately sampled and characterized as described in this document.

When these upgrades to the WWTP are complete, the facility will include two treatment basins each of which is divided into two distinct cells. When removal events occur following the completion of this current facility upgrade project, each cell from which solids will be removed should be characterized according to this document.

Sample Collection Tools

Prior to collecting samples, collect the following equipment and tools:

- Protective gloves
- Eye protection
- Sample containers with labels – contact analytical lab to obtain; verify that an adequate number are obtained with particular attention to confirming that eight (8) fecal coliform sample containers are provided for each basin being sampled.
- Custody seals and Chain of Custody paperwork
- Sixteen (16) sample buckets per basin being sampled (at least 2-gallon volume)
- Five (5) bucket for composite sample preparation (at least 5-gallon volume)
- Twenty (20) sample scoops per basin being sampled
- Ice chest(s) large enough to hold all sampling containers
- Ice or ice packs
- Pens and permanent markers

- Field notebook
- Sludge sampling tube (Sludge Judge®)
- Boat with life jackets, oars, tethering rope
- Twenty-five (25) clean stirrers per basin being sampled (paint stirrers are recommended)

Sample Collection Preparation

The following tasks should be completed to prepare for sample collection:

1. Notify the Department of Ecology Regional Biosolids Coordinator of the anticipated dates of biosolids sample collection and removal.
2. Contact the laboratory conducting the analyses to schedule the sampling event.
3. Assemble and clean sampling tools and equipment.
4. Assemble and prepare (if necessary) sample collection containers and preservatives. These materials are likely to be provided by the analytical laboratory in a precleaned state, but this should be confirmed prior to the sampling date.

Sample Collection Procedures

The following section describe sample collection procedures for pollutant concentration, pathogen reduction, and vector attraction reduction testing. Sampling maps included in this document indicate sampling locations prior to construction of planned upgrades to the WWTP and should be updated once construction is completed. These procedures are written for sampling an individual basin.

1. Label and date laboratory sample containers.
2. Prepare necessary data collection sheets.
3. Place markings around the edge of the basins to establish the sample collection grid. Stakes with bright-colored flagging or paint at the top are recommended.
4. Put on protective gloves and eyewear.
5. Load the boat with the sludge judge, sample buckets (one per subquadrant being sampled), and other necessary supplies.
6. Launch the boat with two people on board and a third person on shore. The person on shore is responsible for holding a tether line to the boat and recording information relayed from the boat. The individuals in the boat should always wear life jackets.
7. Maneuver the boat to the first sampling location.
8. Use the sludge judge to collect a sample by smoothly lowering it all the way to the bottom of the basin and then withdrawing the sludge judge from the basin. The sludge judge is designed such that a valve opens to allow liquid into the sludge judge while it is being lowered and closes as the sludge judge is being raised. Have the person on shore record the time, location, and depth of sludge in the sludge judge.
9. Deposit the solids portion from the bottom of the sludge judge tube into the sample bucket labelled for this subquadrant of the basin. The clear liquid in the top of the sludge judge should be returned into the basin.

10. If necessary, repeat steps 8 and 9 until approximately 1.0 gallon of sludge has been collected in the sample bucket for this subquadrant.
11. Repeat steps 7 through 10 for each of the remaining subquadrants in the basin (16 total). Use a different sample bucket for each subquadrant. The subquadrant map and approximate sample locations are shown on the attached diagram.

Sample Processing Procedures

The following steps should occur once samples from all subquadrants in a basin have been collected.

1. Return to shore with all sample collection buckets from the basin.

Pathogen Reduction Sample Processing

2. Randomly select eight (8) of the subquadrant sample buckets.
3. For a given selected subquadrant sample use a clean stirrer to homogenize the contents of the bucket. Try to avoid aerating the contents of the bucket while mixing.
4. Once homogenized, use a clean sample scoop to fill one of the fecal coliform sample containers with contents from the sample bucket. Sample should be collected immediately after mixing so that settling does not occur.
5. Place lids on the fecal coliform sample containers and seal each sample container in a separate plastic bag. Place the sealed sample containers in the ice chest filled with ice.
6. Set aside the remaining contents of the sample bucket.
7. Repeat steps 3 through 6 with the remaining sample buckets. Use different stirrers and scoops for each sample bucket to avoid cross contamination. This should result in a total of eight (8) fecal coliform samples being collected from each basin.
8. Complete all chain of custody paperwork for these samples.

Pollutant Concentrations, Nutrient Concentrations, and Volatile Solids Reduction Sample Processing

9. To collect samples for pollutant concentrations, nutrient concentrations, and volatile solids reduction testing, the subquadrant samples will be combined to produce a single composite sample for the basin.
10. Locate the four subquadrant samples for a specific basin quadrant and obtain a composite sample bucket. Label the bucket with the identification tag for the quadrant from which the subquadrant samples were obtained.
11. Select one sample bucket and homogenize the sample by thoroughly mixing with a clean stirring device. Mix the sample thoroughly, being mindful not to aerate it.
12. Once mixed, measure 0.5 gallons of the sample and transfer it to the composite sample bucket for the quadrant.
13. Repeat steps 11 and 12 for the three remaining sample buckets in the quadrant.
14. Repeat steps 10 through 13 for the three remaining quadrants in the basin.
15. Develop a basin composite sample from the quadrant composite samples. Homogenize each quadrant composite sample and transfer approximately 1

gallon from each into a container labelled for the quadrant composite sample. The resulting basin composite sample should have a total volume of approximately 4 gallons.

16. Once the basin composite sample bucket has approximately 4 gallons of sample, stir the sample with a clean stir stick to homogenize the contents.
17. Fill the sample container(s) labelled for pollutant concentration and nutrient concentration analyses using a clean sample scoop.
18. Once full, place lids on the sample containers and seal the sample containers in plastic bags. Place the plastic bag in the ice chest with the samples collected for fecal coliform analyses.
19. Place a lid on the composite sample bucket and seal the bucket in plastic. Label the bucket to indicate that its contents are to be used for the volatile solids reduction analysis.
20. Complete all chain of custody paperwork for these samples.

Additional Actions

21. If samples are being collected from multiple basins, repeat the procedures for Sample Collection and Sample Processing. Samples for a specific basin should be collected and processed before collecting samples from additional basins. All equipment should be cleaned before using in a different basin.
22. Transport all samples to the laboratory. Note: due to short sample hold times for fecal coliform samples, intermediate trips to the laboratory may be required if multiple basins are being sampled.
23. After delivery of the samples to the laboratory, thoroughly clean and store all equipment.

Chain of Custody and Sample Transportation Procedures

Chain of custody procedures must be followed so that laboratory results can be used to demonstrate regulatory compliance. A chain of custody form documents a sample's security from the time it is collected until it is received by the laboratory for testing. The laboratory should provide chain of custody forms for each sample they are contracted to analyze. All elements of the chain of custody form should be completed to the time is collected and prior to submitting the sample to the lab. The chain of custody form must contain the following elements:

1. The project name and assigned number.
2. The sampler(s) signature from the time of sample collection.
3. The name of the laboratory performing the analyses.
4. The sample location.
5. The date and time of sample collection.
6. Whether the sample was a grab sample or composite sample.
7. The description and quantity of sample containers.
8. The analyses being performed on the sample.
9. The total number of sample containers per location and any other remarks about the sample.

10. The signatures and dates of both parties when custody is transferred from one person to another. This includes transfers from the person collecting the sample to the person transporting the sample to the laboratory.

Proper handling and transportation are required for samples to remain viable for analysis. There are two aspects to handling and transportation that must be considered for each sampling event: handling conditions and time from sample collection to delivery at the laboratory.

In most cases, samples must be held at a temperature no warmer than 4°C until analysis. This means that samples should be stored and transported in insulated containers with ice, dry ice, or ice packs from the time the sample is collected until it is delivered at the laboratory.

Sample holding times- the time after sampling when the sample remains viable for laboratory analyses- vary based on the analyte. For example, samples being tested for pollutant concentrations can be held for up to 6 months while samples used for fecal coliform analyses must be tested within 8 hours. The timing of sample collection and timing and method of delivery must consider these holding times. The table below summarizes sample storage temperatures and holding times based on the analyte and test method.

Constituent	Analysis Method	Temperatures	Hold-Time
Arsenic	SW-846 Method 6010, 6020, 7010, 7061	Cool to 39° F or 4° C	6 months
Cadmium	SW-846 Method 6010, 6020, 7000B, 7010	Cool to 39° F or 4° C	6 months
Copper	SW-846 Method 6010, 6020, 7000B, 7010	Cool to 39° F or 4° C	6 months
Lead	SW-846 Method 6010, 6020, 7000B, 7010	Cool to 39° F or 4° C	6 months
Molybdenum	SW-846 Method 6010, 6020, 7000B, 7010	Cool to 39° F or 4° C	6 months
Nickel	SW-846 Method 6010, 6020, 7000B, 7010	Cool to 39° F or 4° C	6 months
Selenium	SW-846 Method 6010, 6020, 7010, 7741	Cool to 39° F or 4° C	6 months
Zinc	SW-846 Method 6010, 6020, 7000B, 7010	Cool to 39° F or 4° C	6 months
Mercury	SW-846 Method 7470, 7471	Cool to 39° F or 4° C	6 months
Total Kjeldahl Nitrogen	SM 4500- N_{org} B or C	Cool to 39° F or 4° C	28 days
Nitrate – N	EPA 300.0 or 353.2	Cool to 39° F or 4° C	28 days
Ammonia – N	SM4500-NH_3 B+C, D,E, or G	Cool to 39° F or 4° C	28 days
Fecal Coliform	SM 9221 C or E	Cool to 39° F or 4° C	Analysis in 8 hours from time of collection.*
Fecal Coliform	EPA 1680 or 1681	Cool to 39° F or 4° C	Analysis within 24 hours.**
Salmonella	SM 9260 D	Cool to 39° F or 4° C	Analysis within 24 hours.
Total Solids	SM 2540 G	Cool to 39° F or 4° C	7 days

[1] Maxiumum of 6 hours for transport, 2 hours for lab processing.
[2] 24 hour hold times for Class A composted, Class B aerobically or anaerobically digested only. All others: Analysis within 8 hours. 6 hours maximum for transport, 2 hours for lab processing.

Though not required, the City may wish to collect and analyze samples for potassium and total phosphorus content. If these analytes are to be measured, the City should contact the contracted BUF prior to sample collection to determine the BUF's preferred analytical method.

3. Documentation and Reporting

Properly documenting and reporting each sample collection event is important, particularly if the sample collection event is used to show compliance with regulatory requirements. The following sections describe the actions that should be taken to comprehensively document sample collection events.

Establish Field Records

A field notebook or logbook should be used to document each sampling event. If possible, a single notebook or logbook should be used to record all sampling events so that information is retained in a centralized location. For each sampling event, the following information (at a minimum), should be recorded:

1. Date and time of the sampling event and the personnel participating.
2. Weather conditions at the time of sample collection.
3. Sample locations (include a sketch of the sample locations within each basin if possible).
4. Sample identification.
5. Type and quantity of samples.
6. Summary of equipment and procedure used to collect samples.
7. Analyses performed on the samples.
8. Any unusual or abnormal events that occurred during sample collection. Note any points at which sample collection deviated from the standard procedure.
9. Any general observations from the sample collection event.

Data Interpretation

Once results are received from the laboratory, the results should be reviewed both for compliance with regulatory requirements and to identify potential improvements in biosolids preparation, sampling, and characterization methods. The following items should be considered to evaluate the effectiveness of the sampling program:

1. Were any “non-detects” reported?
2. Are detection/reporting limits above standard?
3. Are there any data qualifiers?
4. Is QA/QC data included by the lab and does it comply with current best practices?
5. Are analytical methods cited?
6. Are the results reported in the proper units?
7. Does the analytical data show compliance with the applicable regulations?

Note: If the data indicated regulatory noncompliance, this information must be reported to the Department of Ecology Regional Biosolids Coordinator within five (5) days. Results which are close (but not exceeding) regulatory limits should also be discussed with the Department of Ecology. The Department of Ecology Regional Biosolids Coordinator can be contacted at: 360-763-2871.

Reporting and Record Keeping

Per WAC 173-308-295, an annual report must be completed and submitted to the Department of Ecology by March 1 of each year. Staff should contact the Department of Ecology to obtain the annual report form each year.

WAC 173-308-290 describes the records that must be retained by the individual responsible for preparing biosolids. Records must include the following:

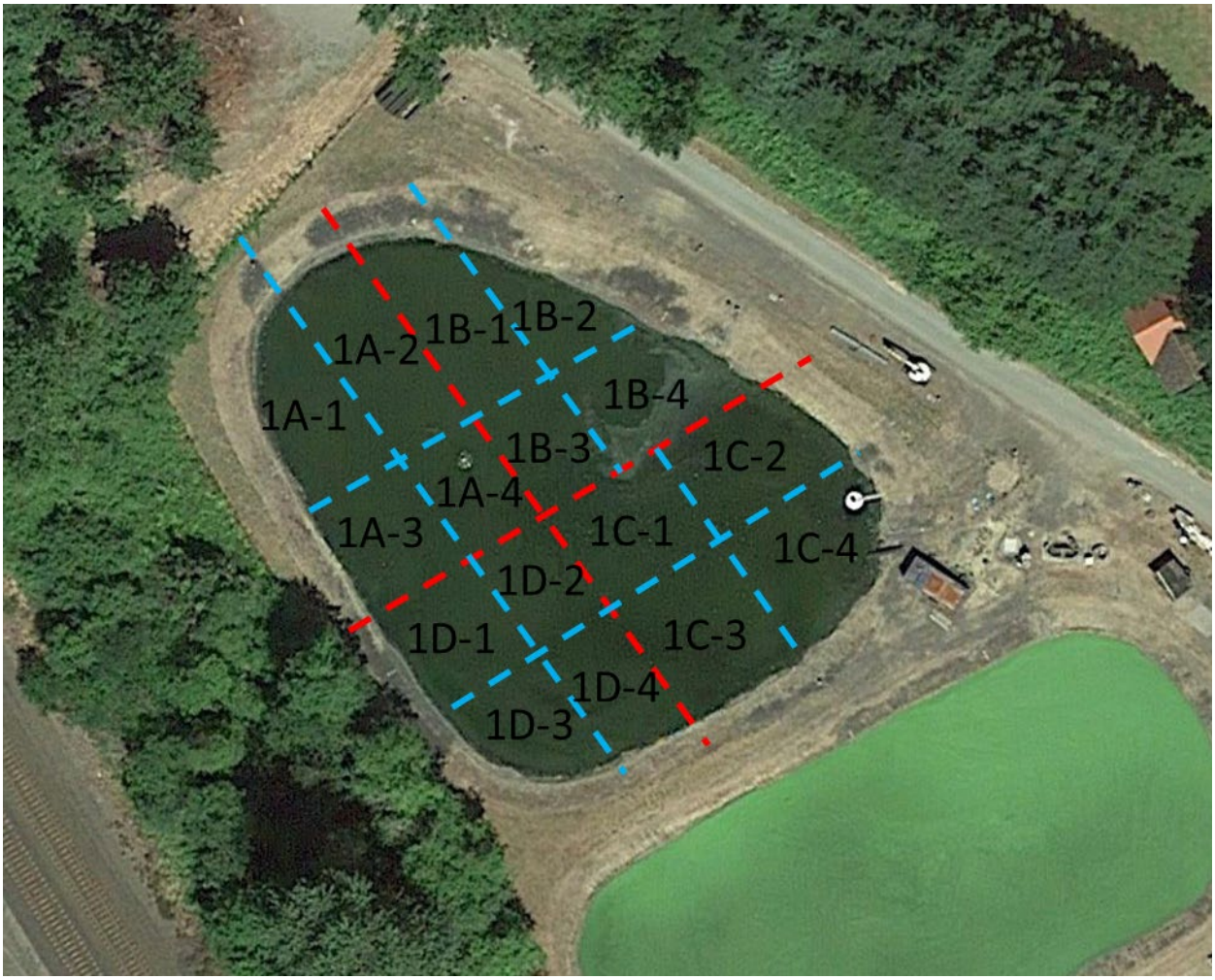
1. The amount applied by the preparer/preparer's agent to agricultural lands.
2. The amount applied by the preparer/preparer's agent to forest land.
3. The amount applied by the preparer/preparer's agent to a public contact site.
4. The amount applied by the preparer/preparer's agent to a land reclamation site.
5. The amount applied by the preparer/preparer's agent to a lawn or home garden.
6. The amount sold or given away by the preparer in a bag or other container.
7. The amount sold or given away by the preparer in bulk form (does not include that provided to the preparer's agent).
8. The amount in a compost or blended biosolids product sold or given away by the preparer.
9. The amount sent to a municipal solid waste landfill for disposal and the name of the landfill.
10. The amount stored on-site.
11. The amount transferred to another facility for further treatment and the name of the other treatment facility.
12. The amount received from another treatment facility and the name of the other facility.
13. The amount transferred for incineration and the name of the incineration facility.
14. Laboratory analysis data showing that the pollutant ceiling concentrations in WAC 173-308-160 Table 1 were met.
15. Laboratory analysis data showing that the pollutant concentrations in WAC 173-308-160 Table 3 were met.
16. Process monitoring and/or laboratory analysis data showing that pathogen reduction requirements in WAC 173-308-170 were met and a description of how the requirements were met.
17. If the vector attraction reduction requirements in WAC 173-308-180 were met, process monitoring and/or laboratory analysis data and a description of how the requirements were met.
18. Laboratory analysis data showing the nitrogen concentration.

In addition to the records above, a certifying statement must be prepared and signed as described in WAC 173-308-290.

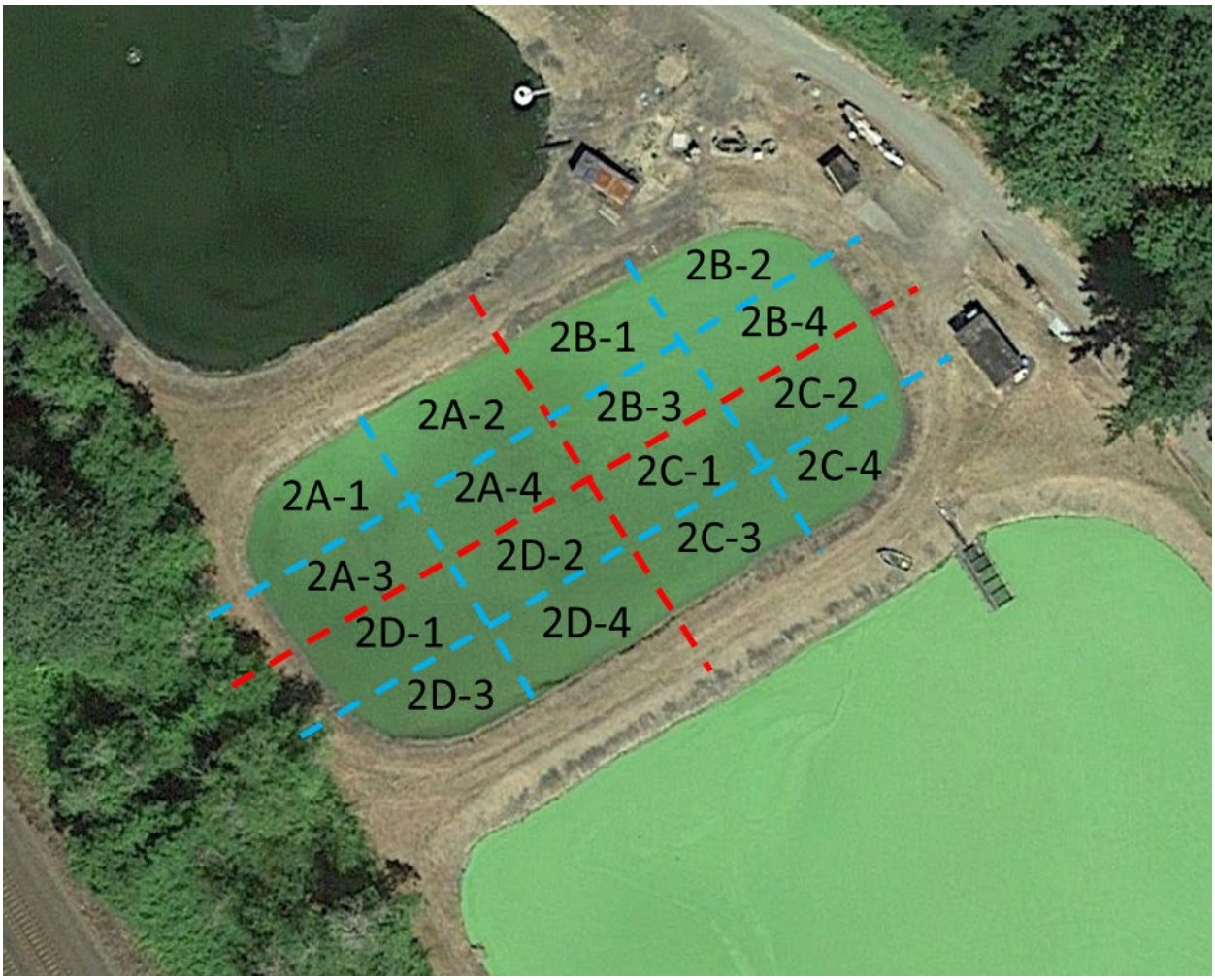
Both the records and the signed certifying statement must be retained for a minimum of five years.

Basin Sampling Maps

Basin 1



Basin 2



Basin 3