

Attachment P

DRAFT

Process for Determining Non-Residential Wastewater Loadings to Drain Fields in Moderate and High CARA Susceptibility Areas

1. Introduction

This document describes the process for evaluating non-residential wastewater loadings in moderate and high susceptibility critical aquifer recharge areas (CARA, Spokane County Code Chapter 11.20.075) in Spokane County. The process includes three levels of site-specific evaluation:

Level 1 evaluation is a simple spreadsheet model (CARA Spreadsheet, Appendix A) based on a nitrogen-to-groundwater analysis. The spreadsheet requires the user to provide basic information about the site and project;

Level 2 evaluation is similar to Level 1 except that the user may provide limited additional site and project-specific information;

The Level 3 evaluation is a detailed, site-specific study utilizing the Large On-Site Systems (LOSS) spreadsheet model, a groundwater nitrogen mixing analysis developed by the Washington State Department of Health. The evaluation involves more complicated sites where the Level 1 or Level 2 analyses are not applicable. Level 3 analyses include development and approval of a Level 3 Work Plan and Hydrogeologic Report; it is strongly advised the applicant notify and meet with Spokane County Division of Utilities before initiating a Level 3 evaluation.

The Level 1 and Level 2 evaluations are soil-nitrogen mixing analyses where the spreadsheet calculates specific nitrate concentration in the drain field leachate at the soil/groundwater interface. A calculated value of 10 milligrams/liter (mg/L) nitrate-N is considered acceptable.

The Level 3 spreadsheet calculates specific nitrate concentrations in the drain field leachate. For Level 3 evaluations, acceptable loadings are based on a maximum of 5 mg/L nitrate-N in groundwater at the edge of the drain field, which is considered the critical trigger value (USEPA 2012a and b).

All levels of evaluation include an evaluation of phosphorus and the potential impacts to nearby surface water. The evaluation is based on an adaptation of the *Phosphorus Breakthrough Analysis Spreadsheet* developed by the Montana Department of Environmental Quality. The model calculates the phosphorus breakthrough rate in the soil beneath the drain field and in the aquifer. Acceptable loadings are based on a breakthrough time of no less than 20 years to the nearest surface water.

The application form (CARA Non-residential on-site sanitary wastewater treatment and disposal application) and the Level 1, Level 2, and Level 3 spreadsheets are located at:

www.spokanecounty/xxxxxxx.org and are available from Spokane County Utilities by request.

To determine whether your project is subject to the CARA evaluation process, refer to Box 1, below:

Box 1: Does Spokane County Code (SCC) 11.20.075.L-3 apply to my development project?

If your new project includes all of the following conditions:

1. Project is for non-residential development¹;
2. Sanitary wastewater would discharge to an on-site septic tank and drain field;
3. Project is located outside the urban growth area (UGA)² within Spokane County; and,
4. Project is located within a moderate or high susceptibility critical aquifer recharge area (CARA)²

Then you must:

1. Complete a *CARA Non-Residential On-Site Sanitary Wastewater Treatment and Disposal Application* form and submit the form and supporting documentation (including spreadsheet results) to Spokane County for review and approval; and,
2. Complete a *CARA Non-Residential On-Site Sanitary Wastewater Treatment and Disposal Analysis* spreadsheet (referred to as a Level 1 or Level 2 analysis) or, under some conditions conduct a “detailed study” (referred to as a Level 3 study) to demonstrate that CARA requirements for wastewater discharge are met.

Please refer to the guidance below for completing the spreadsheet (Levels 1 or 2) or detailed study (Level 3).

¹ Non-residential uses and activities are considered to be those that do not meet the definition of residential use, where residential use is defined as single-family, two-family, multi-family, manufactured and mobile home, community residential facility, community treatment facility, dormitory, fraternity, and sorority (SCC 11.20.010).

² Maps of the UGA and CARA are available on the Spokane County website <http://www.spokanecounty.org/WQMP/content.aspx?c=2919>, or contact Spokane County for assistance (509) 477-3604.

For those who meet the requirements of SCC 11.20.075.L-3 (see Box 1), you must complete an application form (*CARA Non-Residential On-Site Sanitary Wastewater Treatment and Disposal Application*) and conduct a technical evaluation. The application form is located at: www.spokanecounty/xxxxxxx.org and is available from Spokane County Utilities by request.

2. Overview of Application and Evaluation Process

Step 1: If SCC 11.20.075.L-3 applies to your non-residential development (see Box 1), then complete a *CARA Non-Residential On-Site Sanitary Wastewater Treatment and Disposal Application* form. The application form is located at: www.spokanecounty/xxxxxxx.org and is available from Spokane County Utilities by request. The application must include the required supporting documentation.

Step 2: Complete a Level 1 analysis by completing the *CARA Non-Residential On-Site Sanitary Wastewater Treatment and Disposal Analysis* spreadsheet (described in Section 3). Outcomes:

- a. Spreadsheet indicates that hydraulic, nitrate, and phosphorus loadings are “acceptable”. **Go to Step 5.**

- b. Spreadsheet assessment indicates that hydraulic, nitrate, and/or phosphorus loadings have “Further analysis/restrictions” (see Box 2 for explanation of assessments). Options are to proceed with a Level 2 analysis (**Go to Step 3**) or implement alternative disposal options for sanitary wastewater discharge as identified in the CARA regulations.

Step 3: For sites not meeting Level 1 criteria, site specific information can be entered into the spreadsheet (see Section 4). Outcomes:

- a. Spreadsheet indicates that hydraulic, nitrate, and phosphorus loadings are “acceptable”. **Go to Step 5.**
- b. Spreadsheet indicates that hydraulic, nitrate, and/or phosphorus loadings have “Further analysis/restrictions.” Options are to proceed with a Level 3 analysis (**Go to Step 4**) or implement alternative disposal options for sanitary wastewater discharge as identified in the CARA regulations.

Step 4: For sites not meeting Levels 1 and 2 analyses, a Level 3 analysis may be conducted. Before initiating a Level 3 analysis, consult with Spokane County and develop a work plan that outlines the study for approval by Spokane County. See Section 5 for description of Level 3 analysis. Outcomes:

- a. Level 3 analysis indicates that nitrate and phosphorus loadings are “acceptable”. **Go to Step 5.**
- b. Level 3 analysis indicates that nitrate and/or phosphorus loadings have “restrictions” therefore implement alternative disposal options for sanitary wastewater discharge as identified in the CARA regulations.

Step 5: Submit *CARA Non-Residential On-Site Sanitary Wastewater Treatment and Disposal Application* form and analysis spreadsheet (Levels 1 and 2), and/or detailed study (Level 3) to Spokane County.

3. Directions for Completing Level 1 CARA Non-Residential On-Site Sanitary Wastewater Treatment and Disposal Analysis Spreadsheet

The spreadsheet, *CARA Non-Residential On-Site Sanitary Wastewater Treatment and Disposal Analysis* (Microsoft Excel), must be completed as part of the application process. This spreadsheet is available from Spokane County’s website at: www.spokanecounty/xxxxxxx.org and is available from Spokane County Utilities by request.

An example spreadsheet is included as Appendix A to this document.

Input Information for Level 1 Analysis

Required information to complete the Level 1 analysis spreadsheet includes (example spreadsheet is attached; line number below corresponds to line number in spreadsheet):

1. Project name – provide name of non-residential project.
2. Completed by and date – provide name of person (engineer of record or responsible person) completing the application and date of application.
3. Facility type – provide a description of facility type (e.g. church, restaurant, fueling station and convenience store, etc.).
4. Address and tax parcel number - provide address of parcel (if available) and/or the tax parcel number (available from Spokane County’s website).

5. Attach a map of parcel - see Section 2.1.3 in application instruction for description of map requirements.
6. Name of nearest water body – describe the nearest surface water body to the parcel (see Section 3.2.4 in application for instructions on determining nearest water body).
7. Parcel lot size – Input parcel size in acres to 1/10 of an acre (e.g., 10.4 acres).
8. Depth to groundwater – Express in feet below ground surface. See application instruction (section 3.2.1).
9. Distance to shoreline – provide, in feet, the distance between the parcel and the nearest shoreline (water body). See 3.2.4 in application for instructions).
10. Recharge – precipitation recharge value. Select the recharge value (inches per year) based on the Spokane County Recharge map. The Spokane County Recharge map is located at <http://www.spokanecounty.org/xxxxxxx>. If necessary, contact Spokane County for assistance with this map. Use the lowest recharge value for the project parcel. Recharge is rain water that moves downward from the surface through the soil and into the groundwater. The recharge rate should be between 0 and 20 inches per year. A typical value for Spokane County is approximately 4 inches per year.
11. Wastewater volume – see Section 2.2.1 in application for instructions on how to estimate volume.
12. Drain field area - the drain field area (square feet, ft²) is the area the wastewater is spread over before discharge to the ground. Drain field sizing is based on design criteria outlined in On-Site Sewage Systems Chapter 246-272A WAC.
13. Soil type - soil type is classified by one of seven categories. Select the soil type (based on soil texture) from the dropdown menu in the spreadsheet. See application section 3.1.1 for instructions.

Level 1: CARA Spreadsheet Output

Following the input of data (described above), the spreadsheet provides an assessment for hydraulic loading (line 26), nitrate (line 27), and phosphorus (line 28) (see Box 2 for explanation of assessment).

If the assessment reveals “Loading rate acceptable” for hydraulic, nitrate, and phosphorus, then provide a completed application form, a copy of the spreadsheet, and supporting documentation to Spokane County. If Spokane County does not concur with the Level 1 analysis, then the county may request additional information or request a Level 2 or Level 3 analysis be performed.

If the criteria are not met in the Level 1 analysis (assessment portion of spreadsheet shows “Further analysis/restrictions”), then:

- Accept the results and implement alternative disposal options per SCC 11.20.075.L-3;
- Modify the input parameters described above (e.g. change wastewater volumes, note that input values need to be justified), or
- Conduct a Level 2 or Level 3 analysis to further assess site suitability.

4. Level 2: CARA Spreadsheet Plus Modifications

The Spokane County default values (lines 14 through 19 in the spreadsheet) may be changed if the value is justified. Modifications to Spokane County default values may include the following:

- Total nitrogen (TN) concentration in effluent wastewater (line 14).
- Soil denitrification (line 15).
- Nitrate concentration in precipitation (line 16).
- Total phosphorus (P) concentration in wastewater (line 17).
- P adsorption capacity in soil – vadose zone (line 18).
- P adsorption capacity in soil – groundwater layer (line 19).

If the criteria are not met in the Level 2 analysis, then implement alternative wastewater treatment and disposal options per SCC 11.20.075.L-3, or conduct a Level 3 analysis to further assess site suitability. If the Level 2 analysis reveals “Loading rate acceptable” for hydraulic, nitrate, and phosphorus, then provide a completed application, a copy of the spreadsheet, and supporting documentation to Spokane County. If Spokane County does not concur with the Level 2 analysis, the county may request additional information or request a Level 3 analysis based on site-specific conditions.

Box 2: Level 1 and Level 2 Assessment Results

At the bottom of the spreadsheet, an assessment is provided that is either “Loading rate acceptable” or “Further analysis/restrictions” for hydraulic loading, nitrate, and phosphorus:

Hydraulic loading - The hydraulic loading checks that the drain field area is greater than the required minimum drain field area based on sizing criteria established in WAC 246-272A.

Nitrate - This is a check that the total nitrogen concentration from the drain field and the parcel is less than 10 mg/L nitrate-N. This is the value in soil water at the soil/groundwater interface (this value does not include groundwater mixing). The value 10 mg/L is the groundwater quality standard for Washington.

Phosphorus - This is a check that there is phosphorus sorptive capacity for 20 years or greater in the soil column and groundwater prior to reaching surface water. A 20-year breakthrough is based on the assumption that the non-residential parcel would likely be incorporated into the UGA over the 20-year period (would be sewered into a centralized treatment system) and/or that the typical drain field life is 20 years requiring the drain field to be moved to a different location on the parcel (moving the drain field results in new soil sorptive capacity).

5. Level 3: Detailed Study

If Levels 1 and 2 do not provide an acceptable assessment, the applicant can either implement alternative wastewater treatment and disposal options per SCC 11.20.075.L-3 or conduct a Level 3 detailed study to assess if proposed non-residential uses are protective of groundwater and surface water. Level 3 analyses would be nitrate and/or phosphorus.

Nitrate Evaluations

For nitrates, the detailed study must demonstrate aquifer protection, using the Washington State Department of Health method for large on-site sewage systems (LOSS) (WDOH 2011). This method involves the *Level 1 Nitrate Balance for Large On-Site Sewage System* spreadsheet and related instructions. The use of the spreadsheet is required for all CARA Level 3 evaluations regardless of the size of the on-site treatment system. This spreadsheet requires groundwater parameter input and uses a groundwater mixing zone analysis to estimate

groundwater nitrate concentration at the downgradient edge of the drain field. The spreadsheet and instructions can be found at the Washington State Department of Health website under Environmental Review Forms & Guidance:

<http://www.doh.wa.gov/CommunityandEnvironment/WastewaterManagement/LOSSProgram/LOSSGuidance.aspx#Environmental>

A work plan for a proposed study must be provided to Spokane County for review prior to undertaking the study. The work plan should include sufficient detail on approach, including any field monitoring activities. The objective of the work plan review is to minimize the risk of investing in a detailed study without Spokane County input on approach. An example outline for a work plan is presented in Appendix B.

For groundwater nitrate evaluations, potential impacts should be based on not exceeding concentrations above 5 mg/L nitrate-N in groundwater at the edge of the drain field or an alternative point of compliance. Nitrate-N of 5 mg/L is considered the critical trigger value to protect human health especially infants and sensitive populations (USEPA 2012a and b). Example scenarios for interpreting allowable increased in groundwater include:

- When background groundwater concentration is less than or equal to 3.0 mg/L, then the sanitary wastewater discharge must result in a groundwater nitrate concentration increase of less than 2.0 mg/L.
- When the groundwater concentration is between 3.0 and 5.0 mg/L, then the sanitary wastewater discharge must result in a groundwater nitrate concentration increase of 0 to 2.0 mg/L such that the resulting groundwater concentration is no more than 5.0 mg/L.
- When the upgradient groundwater concentration is greater than 5.0 mg/L, then no net increase in groundwater nitrate is allowed. For modeling purposes, a calculated nitrate-N increase of 0.1 mg/L or less is considered acceptable for demonstrating no net increase in concentration.

Phosphorus Evaluations

For Level 3 phosphorus evaluations, the *CARA Non-Residential On-Site Sanitary Wastewater Treatment and Disposal Analysis* spreadsheet must be used. The spreadsheet input parameters specific to phosphorus include:

- Total phosphorus concentration in wastewater
- Phosphorus sorption capacity in soils and groundwater

Generally Level 2 is used for applicants that rely on readily available information (e.g. soil texture information) and literature references. In cases where the applicant will conduct site specific studies (e.g. sorption isotherm determination, phosphorus samples for wastewater), or at the request of the county (e.g. if the county does not accept the justification made in the level 2 analysis), a Level 3 analysis would be conducted. The Level 3 analysis requires a work plan for submittal to Spokane County for review and comment prior to initiating the study. Having the work plan reviewed prior to initiating the work minimizes the risk of investing in a detailed study without Spokane County input on approach.

Level 3 analysis for phosphorus may include:

- Proposed change in phosphorus concentration default value of 10.6 mg/L. If the applicant feels that the proposed non-residential development has a lower average phosphorus concentration than the default value, the applicant may submit data from a similar site. The work plan should address the rationale for assuming a lower

phosphorus concentration and the steps to be taken to ensure there are sufficient samples collected from the similar site to justify the lower value. Generally, more than one sample over a period of time may be required to get a representative value for phosphorus concentration.

- Determination of site specific phosphorus sorption capacity. The default phosphorus sorption capacities are 150 ppm for soil and 50 ppm for groundwater. The applicant may choose to measure the actual sorption capacity of soil and/or groundwater sediment by laboratory methods. The work plan should provide information on field sampling methods (including number of samples to be collected), laboratory methods, and how the sorption capacity will be calculated. Typically to measure phosphorus sorption capacity, the laboratory runs tests on materials finer than 2 millimeters (coarse sand and finer sized material). Thus, gravel and larger fragments are removed from the sample prior to testing. Removing these coarser materials results in an overestimation of bulk sorption capacity. The laboratory adsorption value calculations shall be adjusted to account for the percentage of gravel and larger materials. For example, if the field and laboratory sampling process resulted in removal of 30 percent coarse material and the laboratory conducts its test on the remaining 70 percent (finer textured material), then the estimate sorption capacity should be reduced by 30 percent to account for the bulk sorption capacity of the native soil or groundwater material. Typically, the laboratory generates a graph (sorption isotherm) where the sorption capacity is read where the graph crosses the phosphorus concentration at 10.6 mg/L. The University of Idaho Analytical Sciences Laboratory can perform phosphorus sorption isotherms as well as several soil testing private laboratories.

6. References

- USEPA. 2012a. Estimated Nitrate Concentrations in Groundwater Used for Drinking. http://water.epa.gov/scitech/swguidance/standards/criteria/nutrients/dataset_groundwater.cfm
- USEPA. 2012b. Technical Factsheet on: NITRATE/NITRITE, National Primary Drinking Water Regulations. www.epa.gov/oqwdw/pdfs/factsheets/ioc/tech/nitrates.pdf
- WDOH. 2011. Level 1 Nitrate Balance Instructions for Large On-site Sewage Systems. DOH Publication #337-069. Olympia, WA.

Appendix A
Example Spreadsheet

(Spreadsheet to be added, including calculations)

Appendix B

Level 3 Work Plan Outline

For Nitrate

Project Information

- Date of application
- Name and address of the property owner and the applicant at the head of each page of submission
- Name, signature and stamp of the designer
- Provide information of Level 1 and 2 analyses is why the site was not acceptable under that analysis. Include a copy of the application and spreadsheet as an attachment to the work plan.

Parcel Information

- Parcel number and if available, the address of the site
- Size of the parcel
- A dimensioned site plan
- General topography and/or slope
- Drainage characteristics
- Designated areas for the proposed initial system and the reserve area

Effluent Information

- System operating capacity and design flow;
- Source of sewage, for example, residence, restaurant, or other type of business
 - Characteristics of sewage: flow, concentration of nitrate, and concentration of phosphorus

Soils Information

- Soil type
- The soil and site evaluation as specified under WAC 246-272A-0220
- The location of all soil logs and other soil tests for the OSS
- The depth of the soil dispersal component, the vertical separation, and depth of cover material

Groundwater Information (to support LOSS model)

- Hydraulic conductivity source
- Hydraulic gradient
- Depth to groundwater
- Background nitrate-N concentrations and source of data