NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

GROUNDWATER TESTING

(No.)

CODE 355

DEFINITION

Testing the physical, biological, and chemical quality of groundwater from a water well or spring.

PURPOSE

This practice is applied to determine the quality of a groundwater supply with respect to its intended use.

CONDITIONS WHERE PRACTICE APPLIES

This standard applies to groundwater from a production well or spring used for agricultural or wildlife purposes.

This practice does not apply to monitoring wells installed to sample, monitor, or test groundwater quality parameters related to contamination associated with waste management systems.

New wells constructed using Oklahoma Conservation Practice Standard 642 – Water Well, require testing after disinfection.

CRITERIA

Select the parameters for testing consistent with the intended use or concerns identified with the well or spring.

Use sampling and testing procedures that comply with the Environmental Protection Agency's "Manual of Methods for Chemical Analysis of Water and Wastes."

The specific use of the water and the water quality concerns shall be identified.

The required tests and applicable standards shall be determined based on the planned use of the water.

Testing shall be conducted by a laboratory certified under the Oklahoma Department of Environmental Quality (DEQ) Drinking Water Laboratory Certification Program or through the Oklahoma Cooperative Extension Service via a County Extension Service Office. Other testing facilities which are geographically more accessible may be approved as requested.

Water samples shall be collected and analyzed in accordance with established procedures. Specific parameters, sampling procedures, and laboratory analyses may be specifically required by local, State, Tribal, or Federal laws and regulations. Contact the testing entity for specific guidance.

Interpretation of test results and recommendations for remedial actions shall be obtained from a source knowledgeable of the testing procedures and objectives.

Interpreting Test Results

Irrigation Water. Chemical analysis of water planned for irrigation use, especially for micro-irrigation systems or any system where chemigation or fertigation is planned, is critical. Certain chemicals or fertilizers can react with elements in the irrigation water causing precipitates to form which can clog emitters, nozzles, and/or pipelines. Make sure testing facilities know the proposed use of the water sampled and report the concentrations that may cause plugging, e.g., hardness, iron, manganese, and hydrogen sulfide.

Contaminated Water. Any constituent concentration above the ranges given below which would be harmful to livestock shall be considered contaminated. If determined to be contaminated, a second test shall be run. If the second test confirms contamination, consult with the testing laboratory or a water quality specialist for further guidance. Water shall not be used unless the laboratory or water quality

specialist provides recommendations for treatment.

Contaminated wells shall be properly plugged or decommissioned.

pH. Waters with a pH less than 7.0 are considered suitable for micro-irrigation, those between 7.0 and 7.5 pose a moderate emitter plugging risk, those greater than 7.5 create a severe emitter plugging risk.

The preferred range for pH of livestock water is 6.0 to 8.5 standard units depending on the alkalinity and other factors. Animals can tolerate water outside of this range but use is not recommended.

Total Soluble Salts (TSS) or Electrical Conductivity (EC). Total soluble salts refer to the salt particles that are dissolved in a water sample. TSS can impact animal health. Levels below 3000 ppm are considered very satisfactory for most animals. Levels above 7000 ppm shall not be used for livestock.

High levels of TSS can also impact crop growth and yield. When testing water for irrigation, seek guidance on specific crop tolerances.

Nitrate-Nitrogen. Nitrates are a salt that can be particularly harmful to livestock. Nitrate levels below 89 ppm NO_3 or 20 ppm NO_3-N are generally considered safe. Those nearing the upper limit may need a diet of low nitrate feed. Levels between 90-177 ppm NO_3 or 20-40 ppm NO_3-N could be harmful over long periods of time. Levels over 177 ppm NO_3 or 40 ppm NO_3-N put animals at risk and shall not be used for livestock.

CONSIDERATIONS

Consider using a computerized total farm record keeping system for ease of data input, analysis, and retrieval of testing results.

The following items should be considered in planning water supply testing:

- Location and depth of supply, aquifer characteristics, geology, and history of site in relationship to sources of potential contamination, such as surface water, septic systems, chemical storage facilities, landfills, roads, animal waste storage or treatment facilities, or naturally occurring sources of contamination
- Water supply construction practices used such as dug, drilled, or cased well, or spring development.

Additional Testing

Total Dissolved Solids. The recommended upper limit for total dissolved solids (TDS) is 500 mg/l (ppm) for livestock. If TDS exceeds the recommended limit, additional testing to determine the individual constituents may be necessary to determine treatment options.

Total Coliform Bacteria. Testing for fecal coliform shall be conducted if the presence of total coliform is indicated.

Hardness. Waters with a total hardness less than 75 mg/l (ppm) are considered to be soft, those between 75 and 150 mg/l (ppm) are moderately hard, those between 150 and 300 mg/l (ppm) are hard, and those greater than 300 mg/l (ppm) are very hard. Hardness is generally derived from contact of the water with natural accumulations of salts in soil and geological formations. If water tests hard or extremely hard, additional tests for total alkalinity, calcium, and magnesium, may be necessary to determine treatment options.

Waters with a hardness less than 150 mg/l (ppm) are considered suitable for micro-irrigation, those between 150 and 300 mg/l (ppm) pose a moderate emitter plugging risk, those greater than 300 mg/l (ppm) create a severe emitter plugging risk.

Manganese. Waters with a manganese concentration less than 0.1 mg/l (ppm) are considered suitable for micro-irrigation, those between 0.1 and 1.5 mg/l (ppm) pose a moderate emitter plugging risk, those greater than 1.5 mg/l (ppm) create a severe emitter plugging risk.

Iron. Waters with an iron concentration less than 0.1 mg/l (ppm) are considered suitable for micro-irrigation, those between 0.1 and 1.5 mg/l (ppm) pose a moderate emitter plugging risk, those greater than 1.5 mg/l (ppm) create a severe emitter plugging risk.

Hydrogen Sulfide. Waters with a hydrogen sulfide concentration less than 0.5 mg/l (ppm) are considered suitable for micro-irrigation, those between 0.5 and 2.0 mg/l (ppm) pose a moderate emitter plugging risk, those greater than 2.0 mg/l (ppm) create a severe emitter plugging risk.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for groundwater testing that describe the requirements for applying the practice to achieve the intended purpose. Include the following:

1. Document the location and depth of supply.

2. Document aquifer characteristics, geology, and history of site relative to sources of potential contamination, such as surface water, septic systems, chemical storage facilities, landfills, roads, animal waste storage or treatment facilities, or naturally-occurring sources of contamination.

3. Document the construction method used to install the well or develop the spring.

4. Include a description of sample: 1) collection process, 2) storage, 3) transportation, 4) testing; and 5) test result reporting.

Test laboratories may have specific criteria and forms that must be completed before they will perform water well tests. It is recommended that a laboratory be contacted for this information before a sample is obtained.

OPERATION AND MAINTENANCE

Maintain the water test records for the design life of the well or spring. Include the following items as part of the water test records:

- Sample site location by ground coordinates, such as by Global Positioning System (GPS), or other suitable method
- Name and title of person who collected sample(s)
- Planned use of the water
- Depth interval where sample was taken
- Date and time of water sampling
- Type of sampler and volume of sample
- Standard collection procedure used
- Date of water quality analyses
- Name and address of laboratory that performed analyses
- Parameters tested
- Schedule of additional testing, if required by the applicable water quality standard
- Records to evaluate trends and the effects of any remedial actions to produce water of quality suitable for the intended purpose
- Observations of well or spring condition at time of sampling
- Installation date of well or spring development
- Other records as required by regulations
- A record of any incidents such as spills, leaks, changes in use, or other, involving pesticides, fertilizers, herbicides, degreasers, fuels, and other pollutants near the well or developed spring between scheduled testing.
- If conditions exist that could have an impact on water quality, list actions taken to correct the potential problem. Include records of any wells or developed spring maintenance, such as disinfection or sediment removal, that requires the use of chemicals.
- Other records as required

REFERENCES

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