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Soil Testing Following Flooding, Overland Flow of Waste Waters and other Freshwater Related Disasters

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The impact of flooding rivers, overflowing sewage and septic systems and other freshwater flooding scenarios has an immediate and dramatic effect on the lives of area residents, agricultural enterprises and the overall environment. After the water has receded, evaluation of damages typically is centered on homes and businesses, roads, utility services and other often life essentials. However, flood water also can have a pronounced influence on soil fertility and its physical and chemical properties, as well as creating potentially serious environmental issues.

The impacts of seawater flooding and tidal surge on soils and plants are addressed in a sister publication: Soil Testing and Landscape Recovery Issues Following Tidal Surge Flooding.

Specific Soil Concerns

Agronomic

The flooding of yards, gardens, pastures, and other agricultural lands can have significant short and long-term effects on the soil. The long-term impact is largely dependent on the source of the flood waters and the materials carried in the water. Immediate agronomic concerns include:

1. Death of plant vegetation due to oxygen depletion in the rooting zone. Adequate drainage or removal of floodwater is essential before any recovery effort can be initiated. If the rooting zone remains saturated, seeds will not germinate and most plants will not grow. Allow floodwaters to drain and/or percolate into the soil, where possible remove any limitations to natural surface drainage (e.g., debris), and monitor soil conditions prior to beginning recovery efforts. Following drainage of the floodwaters, air exchange into the soil will occur again provided the soil surface is not covered with significant levels of plant debris, thus restoring the ability of the soil to support plant growth.

2. Loss of plant available soil nitrogen due to leaching or volatilization (biological conversion to nitrogen gas by soil microbes). A soil test should be conducted prior to adding any supplemental nutrients to determine the appropriate rate of application.

3. The decay of vegetation may result in short-term immobilization of existing soil nitrogen or added fertilizer nitrogen. If water deposited plant debris is greater than 1 inch deep, some level of tillage/incorporation of the debris into the soil may be needed to allow for re-vegetation. If debris is greater than 4 inches deep, consider burning or mechanical removal.

Whenever burning is considered, insure strict adherence to all local, county and state regulations. Police the debris areas to insure no potential explosive or other regulated materials exist, including propane tanks, pressurized gas containing cylinders, refrigerators, air conditioners, petroleum containers, tires, significant plastic percentages, or other materials from which toxic vapors or black smoke would result. Advise local fire protection officials of your intentions to burn and use extreme caution to prevent off-site fires.

When mechanical removal is used, insure that both underground and aboveground utilities and pipelines are not impacted. During flooding events, erosion may occur resulting in buried utilities being at or near the surface. The toll-free number to call prior to any digging or dirt work is 800-DIG-TESS (800-344-8377). This service will locate all electrical, gas (natural), communications, telephone, etc., lines. It may or may not locate water/sewer lines and oil/gas pipelines. At the time the service is logged, the customer should be notified whether or not they will have to contact those utilities separately.

4. Deposits of significant amounts of soil-sediment materials on top of the original soil surface. This issue is generally most pronounced along rivers or other areas where water flow was abruptly restricted. When sandy materials are deposited on top of finer textured soils (clay loams and clays), the abrupt change in soil texture (defined as the % sand, % silt, and % clay) can result in a substantial reduction in subsoil water infiltration. Deep tillage generally can reduce or correct this problem if the deposit is less than 8 inches deep. If the layer is thicker, contact your local county Extension agent for other management options.

Soil testing for agronomic concerns

1. Upon drying of the soil surface, the soil should be tested as usual for normal agronomic management. Specific sampling instructions are listed on Texas AgriLife Extension Service Soil, Water and Forage Testing Laboratory submittal forms. These forms can be downloaded from http://soiltesting.tamu.edu/webpages/forms.html or obtained at any Texas County Extension office. Additionally, the publication, Testing Your Soil (L-1793) provides additional information on soil sampling and selecting the best test for your specific needs.

2. Selecting the appropriate parameters to measure by soil testing will depend on the characteristics of the flooding event. If no salt water was associated with the flooding event, the Soil, Water and Forage Testing Laboratory's routine test will generally provide adequate information for managing the soil in the near future. If the floodwater contained significant salt levels, a detailed salinity test will allow the laboratory to provide additional information to clientele on management and treatment of the salt affected soil.

Environmental

From an environmental and health standpoint, potential soil contamination caused by the flooding or inundation of containment systems, residential storage sheds and garages, chemical storage warehouses, industrial complexes, various machinery service centers, industrial areas, sewage handling and treatment systems, and livestock feeding operations is normally due to microbiological, pesticide, hydrocarbon or heavy metal releases and movement.

Soil testing for environmental concerns:

1. Microbiological

The flooding of livestock facilities, sewage treatment plants, septic tanks, as well as, overland discharges from sewers, can be a significant source of pathogenic microbes. Concern over these pathogens decreases upon drying of the soil/sediment deposits, while pathogen contamination in wells, ponds and stagnant water may persist for extended periods of time. Contact your local health department for advice on sampling and/or testing for microbial contaminants.

2. Pesticides

Many currently manufactured pesticides are typically highly soluble and have relatively short life in soil. This high solubility results in quick dissolution and movement of the pesticide in the flooded area. In most cases, sediments containing properly applied pesticides will not pose a long-term threat, however short-term plant losses may occur if a given pesticide was recently applied. Greater concerns for pesticide contamination result from flooding of locations storing significant amounts of undiluted pesticides. Warehouses and other large inventory centers are under the jurisdiction of both the Texas Commission on Environmental Quality (TCEQ) and the United States Environmental Protection Agency (EPA). Localized contamination, including homeowners, pest control services and agricultural producers, is normally the responsibility of the land owner. In either event, knowing which pesticides were potentially released and their toxicity is the first step in dealing with this type of contamination. The National Pesticide Information Center (NPIC) (1-800-858-7378) is a clearinghouse of information on pesticide and chemical safety. Soil testing for pesticide residues can be extremely expensive, particularly if there is no understanding of which pesticide has been released. A limited number of laboratories provide pesticide analysis services. Additionally, certain types of pesticides require specific antibody sensitive analysis kits. Prior to collecting soil samples for pesticide analysis, contact the laboratory which will be conducting the analysis for specific sampling, storage and shipping instructions.

3. Hydrocarbons

Contamination of soils by hydrocarbons can occur due to oil and manufactured product spills at petrochemical, retail and wholesale, and equipment and automotive service industries, as well as from automobiles, off-road equipment, and industrial machines and equipment. While the potential for soil contamination does exist, many of the lighter hydrocarbons (gasoline and similar) and processing solutions (benzene) will rapidly volatize. The heavier oils and greases may persist; however, unless the soil is in very close proximity to the spill, the overall concentration of oil and grease is often under the 10,000 ppm level typically used to define a soil as contaminated with hydrocarbons. Testing for oil and grease in soil is a common test offered by many environmental laboratories with costs ranging from $25 to over $150 depending on the laboratory and methodology used. Typically, contaminated soil will have an oil soaked appearance and water placed on the soil will bead and not absorb into the soil for prolonged periods of time. Sampling for hydrocarbons is similar to those techniques used for agronomic testing. However, individuals should contact the laboratory that will conduct the testing for sampling and shipping instructions.

4. Heavy metals

Heavy metals typically tested in soil include the elements arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc. These metals are typically associated with metal plating companies, electronics manufacturing, and other similar manufacturing industries. Testing is commonly performed by environmental laboratories with costs ranging from $125 to over $500 per sample. The probability of flood induced heavy metal contamination of soil declines significantly with distance from the initial contaminant source. Sampling for heavy metals is similar to those techniques used for agronomic testing. The publication Testing Your Soil (L-1793) can be downloaded as a sampling guide; however, the testing laboratory should be contacted for specific sample collection, handling and shipping instructions.

References:

Texas AgriLife Extension Service Soil, Water and Forage Testing Laboratory http://soiltesting.tamu.edu

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National Pesticide Information Center (NPIC) (1-800-858-7378) http://npic.orst.edu/tech.htm

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http://soilcrop.tamu.edu