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Natural Resources Conservation Service

Resource Concerns

WATER

Ponding, Flooding, Other Excess

Excess Water - Ponding, Flooding, Other Excess

Surface water or poor subsurface drainage restricts land use and management goals. Wind-blown snow accumulates around and over surface structures, restricting access to humans and animals.

What is it?

Water can flood or pond and restrict plant growth and land use. Water may flow into or around buildings if they are constructed over or near a spring or seep. If the soil has a dense layer, especially a layer of clay, flow of water through the soil may be restricted and water may pond.

Why is it important?

Flooding and ponding impacts plant grow and land use. Plant growth is essential for improving soil quality and increasing soil organic matter. Saturated soils increase the likelihood of diseases, significant losses of soil nitrogen due to denitrification and leaching of nitrate N, and soil damage due to heavy equipment. Seeps and high water tables must be taken into account for conservation plantings and when evaluating sites for construction. Excess water can affect structures and slope stability while drifting snow may prevent access to livestock or farmsteads. Drifting snow can block access.

What can be done about it?

Using a systems approach can help address excess water. Strategies include managing for drainage, conveyance, and multiple uses for crops and wildlife. Drainage systems must be compatible with crops grown, field layouts, and cultural practices such as crop rotation and cultivation. System choices include open ditches, tile drains, mole drains, and land forming for increased surface runoff. Planned systems can include diverting excess water and infiltration basins combined with roof runoff management systems. Restored and enhanced wetlands can also be key components in water management.

Ponding, Flooding, Other Excess at a Glance

Problems / Indicators - Little to no established vegetation due to excess water, wet areas due to restrictive soil layers, flood prone buildings and structures	
Causes	**Solutions**
• Ponding and seeps • Stormwater runoff • Flood prone areas	• Drainage management and structures for water control • Roof runoff structures and capture for reuse methods • Floodplain management • Wetland restoration or enhancement • Windbreak placement for protection and to provide access

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Resource Concerns

WATER

Inefficient Moisture Management

Insufficient Water - Inefficient Moisture Management

Natural precipitation is not optimally managed to support desired land use goals or ecological processes.

What is it?

In dryland conditions, management of available water is critical to production and to maintain natural systems.

Why is it important?

Water is important to farming and natural systems. In cropland, poor yields may be related to an insufficiency of soil moisture rather than an insufficiency of rainfall. Inefficient moisture management can result in increased runoff and reduced soil moisture. In some grassland systems, available water can be tied up by brush.

What can be done about it?

Managing residue and cover will aid in utilizing available soil moisture. Establish mulch and residue management systems to conserve soil moisture. New weed control techniques and tools, along with cover crops can help manage available water for crops. Minimize soil compaction to maintain water movement through the soil by reducing soil hydraulic properties such as infiltration. In some grassland systems, brush management can help restore a natural water regime. Using plants that are more tolerant of drought conditions is an effective measure in optimize existing soil moisture.

Inefficient Moisture Management at a Glance

Problems / Indicators - Dryland farming in low rainfall areas	
Causes	**Solutions**
• No soil cover in the winter to prevent moisture loss • Excess soil tillage and disturbance destroys soil organic matter and structure • Unchecked brush growth creating potential for less available moisture for desired plants	• Cover crops • Conservation tillage • Brush management

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Resource Concerns

WATER

Inefficient Use of Irrigation Water

Insufficient Water - Inefficient Use of Irrigation Water

Irrigation water is not stored, delivered, scheduled and/or applied efficiently. Aquifer or surface water withdrawals threaten sustained availability of ground or surface water. Available irrigation water supplies have been reduced due to aquifer depletion, competition, regulation and/or drought.

What is it?

Inefficient use of irrigation water impacts on- and off-site water quantity and quality. Irrigation systems and water management practices can waste water and negatively affect farm profitability.

Why is it important?

Irrigated agriculture is essential in meeting the nation's food and fiber production needs. Agriculture is the nation's largest water user, accounting for more than 85% of the nation's annual water consumption. Emerging problems that further complicate resource protection and water allocation include: serious long-term drought conditions, critical ground water declines occurring in agricultural production areas, saltwater intrusion into ground water supplies, and competition for water among a multitude of water users, including power generation, drinking water supplies, minimum stream flows, etc.

What can be done about it?

Solutions are available to address many of the competing water resource needs. Choices generally include conservation of the water used, conversion to other crops that utilize less water, and conversion to other sources of water. Conserving water could include improvements in irrigation water use efficiencies, off stream storage of water during periods of excess runoff, water re-use and water recycling, and ground water recharge.

Inefficient Use of Irrigation Water at a Glance

Problems / Indicators - Irrigated crops, plant stress, insufficient water supply	
Causes	**Solutions**
• Open earthen ditches • Irrigation water allowed to run off of fields • Losses due to improper system design, installation, or maintenance	• Line ditches or install pipe; improve water transport systems • Manage applications to reduce runoff; tailwater return systems • Audit system and retrofit or replace where warranted

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Resource Concerns

WATER

Nutrients

Water Quality Degradation - Nutrients

Nutrients (organics and inorganics) are transported to receiving waters through surface runoff and/or leaching into shallow ground waters in quantities that degrade water quality and limit use for intended purposes.

What is it?

Water bodies require nutrients, such as nitrogen and phosphorus, to be healthy, but too many nutrients can be harmful. Many of our nation's waters, including streams, rivers, wetlands, estuaries, and coastal waters, are affected by excess nutrients. The effect of nutrients for a given water body depends on its ecoregion and the source of nutrients.

Why is it important?

Increased nitrogen and phosphorus levels in water can produce excessive aquatic vegetation and algal blooms resulting in reduced dissolved oxygen, harmful toxins, and increased water temperature. In extreme cases dissolved oxygen may be so low that dead zones, known as hypoxia, exist where most aquatic life cannot survive. Algal blooms can also impart an undesirable taste to potable water that is difficult to remove by water treatment. High ammonia levels are toxic to some freshwater fish species.

What can be done about it?

Management is the key to protecting water quality from excess nutrients. Nutrient management shall specify the source, amount, timing and method of application of nutrients on each field to achieve realistic production goals, while minimizing movement of nutrients and other potential contaminants to surface and/or ground waters. Realistic yield goals shall be established based on soil productivity information, historical yield data, climatic conditions, level of management and/or local research on similar soil, cropping systems, and soil and manure/organic by-products tests. Areas contained within established minimum application setbacks (e.g., sinkholes, wells, or rapidly permeable soil areas) should not receive direct application of nutrients. Nutrients may also be lost due to erosion, runoff, irrigation and drainage, so applicable practices should be installed to address these concerns.

Nutrients at a Glance

Problems / Indicators - Algae blooms, mass death of fish or aquatic organisms, dissolved oxygen concentrations, hypoxia	
Causes	**Solutions**
• Overusing fertilizer (both residential and agricultural usage) • Soluble nutrients • Erosion of nutrient-laden soil • Rainfall flowing over cropland, animal feeding operations and pastures, picking up animal waste and depositing it in water bodies • Low organic matter	• Nutrient management to address the form, rate, placement and timing of nutrient application • Cover crops • Crop rotations • Increased crop diversity • Conservation buffers • Residue management

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Resource Concerns

WATER
Pesticides

Water Quality Degradation - Pesticides

Pest control chemicals are transported to receiving waters in quantities that degrade water quality and limit use for intended purposes.

What is it?

The term "pesticide" is a composite term that includes all chemicals that are used to kill or control pests. Pesticides can be harmful to people and the environment. Part of the problem is the toxicity of some pesticides, but even more important is the sheer volume of pesticides used in this country every year. Some of this pesticide finds its way to our water, air, and soil.

Why is it important?

Protecting ground and surface water from chemical pollutants is a national initiative. Water is an exceptionally valuable natural asset. The health and livelihood of Americans depends on the availability of a safe drinking water supply. Equally important is the role of water quality on fish and aquatic ecosystems. Indirect benefits of water quality are provided by recreational boating, sport fishing, swimming, relaxation, and natural beauty.

What can be done about it?

The ecological impacts of pesticides in water are determined by their toxicity, persistence, degradates, and environmental fate. The use of Integrated Pest Management strategies and techniques involving prevention, avoidance, monitoring, and suppression are effective means to reduce the risks associated with pesticide use. A risk assessment tool can be used to identify risks and guide the mitigation of off-site pesticide hazards. Mitigating practices include residue management, cover crops, conservation crop rotation, and Integrated Pest Management.

Pesticides at a Glance

Problems / Indicators - Pesticide use in the farm/ranch operation	
Causes	**Solutions**
• Pesticide use in sensitive watersheds • Use of pesticides with intermediate or higher hazard risk	• Residue management • Cover crops • Conservation crop rotation • Integrated pest management strategies • Alternative pest suppression strategies • Conservation buffers • Proper use and storage • Drainage water management

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Resource Concerns

WATER

Pathogens

Water Quality Degradation - Pathogens

Pathogens, pharmaceuticals, and other chemicals are carried by soil amendments that are applied to the land and are subsequently transported to receiving waters in quantities that degrade water quality and limit use for intended purposes. This resource concern also includes the off-site transport of leachate and runoff from compost or other organic materials of animal origin.

What is it?

Many potential pathogens (disease-causing microorganisms) can be found in manure. These pathogens include bacteria, protozoa, and viruses. If effected soil amendments are not adequately treated and contained, pathogens may enter ground or surface water posing a potential risk to human and animal health.

Why is it important?

Pathogens can be transmitted to humans directly through contact with animals and animal waste or indirectly through contaminated water or food. Human illness and death has resulted from exposure to pathogens from livestock and poultry manure. Pathogens can also be transmitted to domestic and wild animals with similar results.

What can be done about it?

The most effective tool in eliminating pathogens from manure, from both practical and economic standpoints, is time. If manure is allowed to sit undisturbed in storage or in soil, the concentration of pathogens will decrease with time as they die off or are overgrown by native microbes. Managing manure for pathogens is approached in two phases: 1) collection and storage and 2) land treatment. In the collection and storage of manure, pathogens can be addressed by biological control (composting, anaerobic digesters, etc.), chemical methods, and control of runoff and leaching. It is also important to manage livestock access to streams, rivers and water bodies. Land application is commonly a critical process in manure management. Pathogens from manure can threaten humans who are exposed to runoff, have direct contact with manure, or consume food or water contaminated with manure. Application rate and seasonal conditions are important factors contributing to the transfer of pathogens from lands where manure has recently been applied to nearby surface water. Managing the rate, timing and method of application of manure are critical elements in managing for pathogens. Keeping a buffer zone or setback distance between manure application areas and water bodies is a common practice that greatly decreases the transport of pathogens to those water bodies.

Pathogens at a Glance

Problems / Indicators - Storage, handling, and application of manure, bio-solids, or compost	
Causes	**Solutions**
• Collection, handling and storage of manure • Land application of manure	• Biological treatment (anaerobic storage, composting, anaerobic digesters) • Vegetative filter strips, setbacks and buffer zones • Managing livestock access to water • Managing the rate, timing, and method of application of manure

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Resource Concerns

WATER

Salts

Water Quality Degradation - Salts

Irrigation or rainfall runoff transports salts to receiving waters in quantities that degrade water quality and limit use for intended purposes.

What is it?

Salinity is a process by which water-soluble salts accumulate in the soil and water. Nearly all waters contain dissolved salts and trace elements, many of which result from the natural weathering of the earth's surface. In addition, drainage waters from irrigated lands and effluent from city sewage and industrial waste water can impact water quality. In most irrigation situations, the primary water quality concern is salinity levels since salts can affect both the soil structure and crop yield. Most salinity problems in agriculture result directly from the salts carried in irrigation water.

Why is it important?

Salinity increases the cost of treating water for drinking, reduces the availability of water for irrigation, and renders farmland useless, costing the economy millions each year. Salinity is an ecological factor, influencing the types of organisms that live in a body of water. It influences the kinds of plants that will grow either in a water body, or on land fed by irrigation water or groundwater. If water containing too much salt is applied during irrigation, salt tends to build up in the soil, reducing the amount of water available to plants. Salts in the soil increase the efforts by plant roots to take in water and can make water unavailable to plants at higher salt levels. Few plants grow well on saline soils; often restricting options for cropping in a given land area.

What can be done about it?

Salinity as a water quality issue is addressed through soil management activities. Reducing the severity and extent of salinity is accomplished primarily with recharge and discharge water management. Recharge management is used on areas that contribute excess water to the soil and includes decreasing infiltration of excess saline water and irrigation to maintain salts at a level below the root zone. Discharge management is used on areas where excess water comes to the soil surface and includes growing salt tolerant crops, reducing deep tillage and eliminating seepage.

Salts at a Glance

Problems / Indicators - White crusting of soil, irregular crop growth, and lack of plant vigor	
Causes	**Solutions**
• Naturally occurring in soils with concentrations of soluble salts, such as sulfates of sodium, calcium, and magnesium in the soil • Inadequate drainage to leach salt from the soil • Upward migration of salt from shallow ground water • Application of saline water	• Proper use of irrigation water • Salt-tolerant crops • Removal of excess water from recharge areas • Maintain water table at a safe levels • Cropping and tillage systems that promote adequate infiltration and permeability • Reducing deep tillage

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Resource Concerns

WATER

Petroleum and Heavy Metals

Water Quality Degradation - Petroleum and Heavy Metals

Heavy metals, petroleum and other pollutants are transported to receiving water sources in quantities that degrade water quality and limit use for intended purposes.

What is it?

Petroleum is generally thought of in terms of crude oil products but also includes all liquid, gaseous, and solid hydrocarbons. Petroleum contamination in agriculture typically occurs through point source spills and from nonpoint sources, where small amounts of petroleum are collected through runoff from asphalt-covered roads and parking areas, and over a long period of time add up to large-scale effects. A heavy metal can be defined as a chemical element with a specific gravity that is at least five times that of water. Examples of heavy metals include arsenic, cadmium, iron, lead, chromium, copper, zinc, nickel, and mercury. Heavy metal contamination is typically through the use and application of biosludge, contaminated animal manure, and artificial fertilizers.

Why is it important?

Protecting ground and surface water from chemical pollutants is a national initiative. Water is an exceptionally valuable natural asset. The health and livelihood of Americans depends on the availability of a safe drinking water supply. Equally important is the role of water quality on fish and aquatic ecosystems. Indirect benefits of water quality are provided by recreational boating, sport fishing, swimming, relaxation, and natural beauty. In large concentrations, the hydrocarbon molecules that make up crude oil and petroleum products are highly toxic to many organisms, including humans. Petroleum products can have a detrimental effect on oxygen demand and transfer in surface water, and it can restrict the penetration of sunlight to aquatic plants. Heavy metals are also toxic, and they can build up in the soil and plant tissue. Most of the ingestion of heavy metals occurs from consumption of plants.

What can be done about it?

The key to addressing petroleum and heavy metal contamination is prevention. The proper handling and storage of petroleum and chemical products can prevent contamination of the soil and water. Containment systems are very effective in containing spills. Heavy metals build up can be addressed through the proper use and application of biosludge, animal manure and artificial fertilizers. The use of soil testing and managing the rate and application of soil amendments are effective preventive measures.

Petroleum and Heavy Metals at a Glance

Problems / Indicators - Storage and handling of petroleum; use of biosludge, contaminated animal manure, and artificial fertilizers	
Causes	**Solutions**
• Inadequate storage and handling • Application of biosludge, contaminated animal manure, and artificial fertilizers • Unprotected surface and groundwater sources	• Proper storage and handling • Petroleum and chemical containment systems • Proper application and use of animal manure biosludge and artificial fertilizer • Protection of surface and groundwater sources • Conservation buffers and application setbacks

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Resource Concerns

WATER

Sediment

Water Quality Degradation - Sediment

Off-site transport of sediment from sheet, rill, gully, and wind erosion into surface water that threatens to degrade surface water quality and limit use for intended purposes.

What is it?

Wind or water erosion is the physical and chemical wearing of the earth's surface and is a natural ecosystem process. Problems arise when excess fine sediment enters surface water at rates and volumes greater than under natural conditions, resulting in turbidity and sedimentation. Typically, erosion related to human activities generates excessive sediment and should be controlled to acceptable levels.

Why is it important?

Sediment can have a significant impact on water quality and aquatic habitat. Not only does sediment carry nutrients and pesticides that can negatively impact water quality, but the physical characteristics of sediment can clog stream channels, silt in reservoirs, cover fish spawning grounds, and reduce downstream water quality. Sediment makes the water more turbid and restricts light penetration into the water, which impacts the ability of aquatic plants to perform photosynthesis. Suspended sediments can clog the gills of aquatic organisms and cause death. Sediment build up on the stream bottom can lead to the suffocation of fish eggs and macro invertebrates and impact natural spawning. Additionally, with an increased amount of particles in the water, dissolved oxygen levels may be reduced due to elevated water temperatures. Excessive sediment also impacts coastal area water quality as it can smother and kill coral tissue and reduces light levels and food supplied to the coral by symbiotic algae.

What can be done about it?

The issue of excessive sediments for water quality is managed by addressing the source and/or transport of soil. Controlling the source of soil erosion involves maintaining a protective cover on the soil and modifying the landscape to control runoff amounts and rates. Specific practices include growing perennial crops in rotation or as permanent cover, growing cover crops, managing crop residue, shortening the length and steepness of slopes, and increasing water infiltration rates. Controlling the transport of soil into water bodies involves buffers and edge of field treatments. Specific practices include grassed waterways, field borders, filter strips, and riparian forest/herbaceous buffers.

Sediment at a Glance

Problems / Indicators - Cloudy or muddy water, stream/water body soil deposition	
Causes	**Solutions**
• Bare or unprotected soil • Long and steep slopes, • Intense rainfall or irrigation events when residue cover is at a minimum, • Decreased infiltration by compaction	• Residue management • Crop rotations with high biomass crops • Cover crops • Terraces • Strip cropping • Windbreaks • Buffers and filter strips to address the transport of sediment

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Resource Concerns

WATER

Elevated Water Temperature

Water Quality Degradation - Elevated Water Temperature

Surface water temperatures exceed State/Federal standards and/or limit use for intended purposes.

What is it?

Temperature has an important influence on water chemistry. As water temperature rises, there is a corresponding decrease in the availability of oxygen, carbon dioxide, and other gases important to aquatic life. Elevated water temperature also results in increases of dissolved minerals that can further degrade water quality. In some areas, Federal and/or State law regulate the temperature of surface water.

Why is it important?

Water temperature has extremely important ecological consequences. The metabolic rate of organisms rises with increasing water temperatures, resulting in increased oxygen demand. This is coupled with the reduced amount of oxygen that is available as the water temperature increases. During extended periods of warming, water may lose its potential to support healthy populations of fish and other aquatic organisms and may even kill desired species or lead to a change in species diversity. Warm water also has the potential to increase the presence of dissolved toxic substances that may restrict the suitability of water for human use.

What can be done about it?

There is actually very little an individual landowner can do to cool surface waters. Most conservation actions designed to address water temperature issues reduce additions of heat energy. Heat can enter surface water through direct sunlight and by the air directly above the water. Reestablishing or protecting riparian vegetation is often the first step to address water temperature issues. While riparian vegetation does not cool the water, on small water bodies it can block much of the sun and keep the air in direct contact with the water surface cooler. Groundwater inflow and outflow, precipitation, runoff, and evaporation are also responsible for heat energy exchange. Water entering a water body from below ground flows tends to be much cooler than the surface water. Actions that conserve or increase shallow groundwater may increase the amount of cool water entering a water body. The sediment load of a water body also plays a role in water temperature. When the sediment load increases, water tends to spread out over a larger area. Shallow, wide channels provide more surface area for solar energy to enter the stream, potentially increasing water temperature. In addition, turbidity raises water temperature because the suspended particles absorb the sun's heat. Actions to reduce sediment reaching a water body will help reduce warming of surface water.

Elevated Water Temperature at a Glance

Problems / Indicators - Water temperature exceeds legal standard, threatens the health of aquatic organisms, or limits the intended use by the client	
Causes	**Solutions**
• Surface water unprotected from direct sunlight • Little or no groundwater contribution to water body • Sediment laden runoff reaching water body	• Reestablish riparian vegetation • Brush management, residue management, terraces to reduce transpiration, evaporation and/or increase infiltration of upland water • Buffers and filter strips to intercept sediment

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