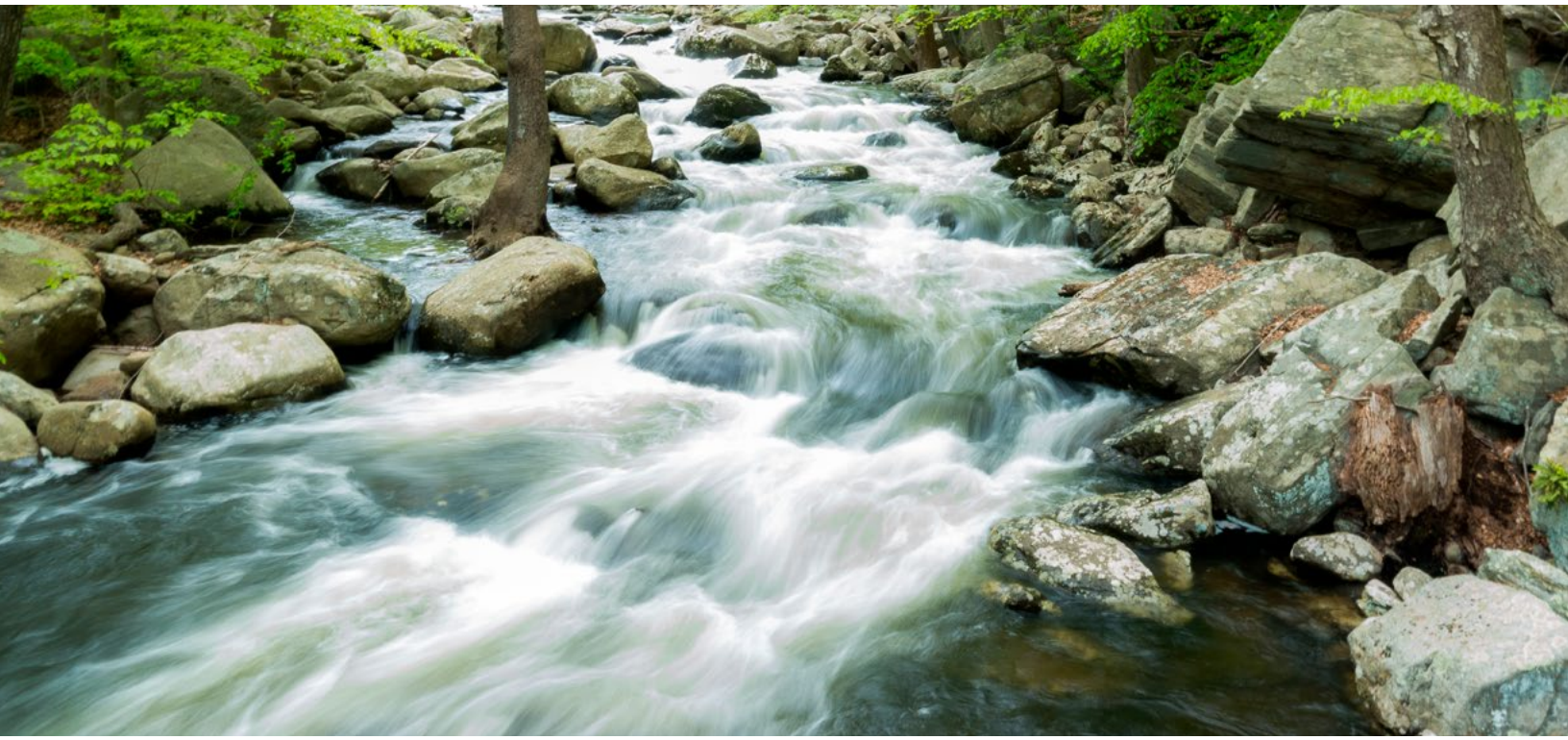
HOBBY FARMING WITH WATER QUALITY IN MIND:

A GUIDE TO SUCCESSFUL BACKYARD FARMING WHILE PROTECTING OUR WATER RESOURCES



Comprehensive Environmental Inc.

MassDEP
Massachusetts Department of Environmental Protection

United States Environmental Protection Agency

OCTOBER 2017

THIS PAGE INTENTIONALLY LEFT BLANK

HOBBY FARMING WITH WATER QUALITY IN MIND:

A Guide to Successful Backyard Farming While Protecting Our Water Resources

OCTOBER 2017

Written and Produced by:

Comprehensive Environmental Inc.

ACKNOWLEDGMENTS

Written and Produced by:

Comprehensive Environmental Inc.

Editorial Support / Special Thanks:

- Massachusetts Department of Conservation and Recreation - Division of Water Supply Protection
- Massachusetts Association of Conservation Districts

This project has been financed with Federal Funds from the Environmental Protection Agency (EPA) to the Massachusetts Department of Environmental Protection (the Department) under an s. 319 competitive grant. The contents do not necessarily reflect the views and policies of EPA or of the Department, nor does the mention of trade names or commercial products constitute endorsement or recommendation for use.

TABLE OF CONTENTS

SECTION	TITLE
SECTION ONE	INTRODUCTION TO HOBBY FARMING AND WATER QUALITY
SECTION TWO	GETTING STARTED: UNDERSTANDING YOUR HOBBY FARM SITE • FACT SHEET 2.1: How Can Hobby Farms be Sources of Stormwater Pollution? • FACT SHEET 2.2: How Can Hobby Farmers Protect Water Resources? • FACT SHEET 2.3: Planning Your Hobby Farm • CHECKLIST 2A: Planning Your Hobby Farm Activities • FACT SHEET 2.4: State Regulatory Protection of Water Resources on or Near Your Hobby Farm • FACT SHEET 2.5: How Do Local Regulations Affect your Hobby Farm? • CHECKLIST 2B: What Regulations Affect My Farm?
SECTION THREE	CREATING A STORMWATER MANAGEMENT PLAN FOR YOUR HOBBY FARM • FACT SHEET 3.1: Mapping Your Hobby Farm • CHECKLIST 3A: Map of Existing Site • FACT SHEET 3.2: Mapping your Hobby Farm Stormwater Plan • CHECKLIST 3B: Map of Hobby Farm Activities
SECTION FOUR	NUTRIENT MANAGEMENT FOR WATER QUALITY • FACT SHEET 4.1: Understanding Your Soil • FACT SHEET 4.2: The Importance of Annual Soil Testing • FACT SHEET 4.3: Essential Plant Nutrients • FACT SHEET 4.4: Understanding Fertilizer and Soil Amendment Types • FACT SHEET 4.5: Fertilizer: What's in the Bag • FACT SHEET 4.6: Keeping Nutrients in Your Soil: Alternative Planning Methods • FACT SHEET 4.7: Plant Material Composting • FACT SHEET 4.8: Nutrient and Soil Amendment Application • CHECKLIST 4A: Nutrient Management for Water Quality
SECTION FIVE	ANIMAL MANAGEMENT FOR WATER QUALITY • FACT SHEET 5.1: Animal Space Needs • FACT SHEET 5.2: Grazing and Grass Management • FACT SHEET 5.3: Mud Management • FACT SHEET 5.4: Manure Management • FACT SHEET 5.5: Animal Manure Composting • FACT SHEET 5.6: Controlling Animal Access to Waterways: Fencing • FACT SHEET 5.7: Controlling Animal Access to Waterways: Crossings • FACT SHEET 5.8: Controlling Animal Access to Waterways: Alternative Water Sources • CHECKLIST 5A: Animal Management for Water Quality
SECTION SIX	STORMWATER RUNOFF SITE MANAGEMENT • FACT SHEET 6.1: Vegetated Buffers • FACT SHEET 6.2: Vegetated Filter Strips • FACT SHEET 6.3: Vegetated Swales • FACT SHEET 6.4: Infiltration Trenches and Dry Wells • FACT SHEET 6.5: Rain Gardens • FACT SHEET 6.6: Rain Barrels and Cisterns • FACT SHEET 6.7: Tree Planting for Water Quality • CHECKLIST 6A: Stormwater Runoff Site Management

SECTION SEVEN	HOBBY FARM MANAGEMENT AND SAFETY

- FACT SHEET 7.1: Integrated Pest Management
- FACT SHEET 7.2: Pesticide Use and Water Quality
- FACT SHEET 7.3: Reading a Pesticide Label
- FACT SHEET 7.4: Pesticide Storage and Disposal
- FACT SHEET 7.5: Equipment Safety and Maintenance Basics
- FACT SHEET 7.6: Reading Hazardous Material Labels and Safety Data Sheets (SDS)
- FACT SHEET 7.7: Hazardous Material Use, Storage and Disposal
- FACT SHEET 7.8: Solid Waste Management
- FACT SHEET 7.9: Neighbor Relations: Communication
- FACT SHEET 7.10: Neighbor Relations: Odor, Dust and Noise Control
- FACT SHEET 7.11: Neighbor Relations: Fly, Mosquito and Rodent Control
- FACT SHEET 7.12: Food Safety
- FACT SHEET 7.13: Emergency Management Plan
- CHECKLIST 7A: Hobby Farm Emergency Contact Form
- CHECKLIST 7B: Emergency Response Procedures
- CHECKLIST 7C: Hobby Farm Inventory
- CHECKLIST 7D: Emergency Supplies Form
- CHECKLIST 7E: Hobby Farm Management and Safety

SECTION ONE

INTRODUCTION TO HOBBY FARMING AND WATER QUALITY

This is a handbook for owners of “Hobby Farms” - small scale farms operated primarily as a residential lifestyle - to provide their owners with the tools to develop and operate an environmentally friendly farm and promote responsible stewardship of both land and the environment.

Agricultural activities on hobby farms can result in the generation of materials that are potentially harmful to the environment. Since hobby farm activities occur largely outdoors, many activities can be exposed to rainfall. When sufficient rainfall occurs, materials associated with hobby farming can be picked up by stormwater runoff and become “pollutants” that eventually reach other lands and water bodies nearby. Pollutants can include excess nutrients from fertilizer, chemicals from pesticides, bacteria from manure, sediment from unvegetated areas, and many more.

YOU MIGHT BE A HOBBY FARMER IF YOU:

- **Plant a backyard vegetable garden**
- **Keep chickens**
- **Have a horse or two**
- **Care for one or more farm animals**
- **Maintain a small fruit orchard**
- **And many more...**

There are a number of common-sense activities and well-established Best Management Practices (BMPs) and good housekeeping techniques that hobby farmers can use to make sure their farming activities have a minimum of impact on the environment, particularly water quality of nearby surface waters. In addition to helping to ensure nearby wetlands and water resources are protected, these practices can often result in better farm management, save money and help keep your animals and crops healthy and safe.

The purpose of this handbook is to guide and serve as a reference for the hobby farmer about activities that can generate pollution and how to protect nearby surface waters. This manual will help hobby farmers develop a practical farm management plan to minimize water quality impacts and result in a successful hobby farm, no matter how big or small.

WHAT IS A HOBBY FARM?

A hobby farm is a small-scale farm operated as a residential life-style, involving the raising of produce or care of livestock for personal use and enjoyment, but not typically generating $1,000 or more of annual sales of agricultural products. A hobby farm can be small or large and located in an urban, rural or suburban area.

According to the United States Department of Agriculture (USDA) Economic Research Service:

"A farm is defined as any place from which $1,000 or more of agricultural products were produced and sold, or normally would have been sold, during the year."

ALTHOUGH THIS IS A CLEAR DEFINITION FOR WHAT DEFINES A "FARM" (BASED ON SALES OF AGRICULTURAL PRODUCTS), THERE ARE VERY FEW REFERENCES THAT DEFINE THE "HOBBY FARM."

The common view of the hobby farm is that it consists of a small-scale farm operated for pleasure or as a residential life-style, rather than as a business. The owner of a hobby farm typically depends on a primary income from some other source than farming – your "day job". Although a hobby farm may generate some income from the sale of products raised on-site, its owners do not generally need to make a profit from their farming activities.

A hobby farmer may be your neighbor who raises chickens in the backyard for fresh organic eggs, the person down the street who provides you with a year's worth of tomatoes and zucchini from their gardens in July or August, your friend across town who raises a few alpacas for their distinctive wool, or a relative who has one horse for the occasional leisure ride. These examples encompass the millions of Americans, thousands residing in Massachusetts, who like to garden or farm, but do not meet the USDA's definition of farming.

According to the USDA 2012 Census of Agriculture, there are 7,755 farms in Massachusetts totaling over 500,000 acres in associated land. About 31% of these farms produced less than $1,000 in agricultural sales in 2012, meaning that roughly a third of the state's farms are very small. It is not clear that these census figures encompass the numerous households that raise sizable plots of vegetables in their backyards or maintain a few livestock animals or horses for personal use and enjoyment, but it's clear that there are lots of small-scale properties, both rural and urban, distributed across Massachusetts that could be considered "hobby farms".

WHAT IS STORMWATER RUNOFF?

Among Massachusetts' most valuable resources are its many wetlands, streams, rivers, lakes, ponds, and coastal areas. These water bodies are highly susceptible to damage from substances that can impact water quality, harm wildlife, and affect human health and well-being.

Pollution of these water bodies includes both point sources (often piped discharges of industrial and sewage treatment systems) and nonpoint sources (pollution that comes from many different sources across the landscape). Nonpoint Source (NPS) pollution occurs through stormwater runoff associated with precipitation and snow melt.

Whenever rain falls (or snow and ice melts) on the surface of the land, it can follow various routes in the water cycle including:

- Be intercepted by trees, plants and leaves where it will either evaporate or soak into the ground and be taken up and used by the root system. This combined process is called evapotranspiration.
- Infiltrate or soak deeper into the ground and recharge groundwater aquifers.
- Land on impervious surfaces such as pavement and bare ground where it may evaporate.
- Flow over the surface of the ground, particularly where there are a lot of impervious or hard surfaces – this is called stormwater runoff. Stormwater runoff can enter catch basin structures designed to collect and discharge stormwater directly to water bodies such as streams, wetlands, ponds, lakes, and coastal waters or can enter these water bodies directly.

As stormwater runoff travels over the surface of the ground, it picks up material along the way such as loose particles of soil, debris, fertilizer, animal waste, chemicals and other pollutants. These materials can be carried by stormwater runoff into nearby water bodies. This water can damage natural habitats, the plants and creatures living in those areas, and the living organisms (including people) that drink or come into contact with polluted water. In some cases, the runoff flows into the ground where some contaminants can also affect groundwater quality - including groundwater sources of drinking water.

HOW IS STORMWATER RUNOFF GENERATED?

Stormwater runnoff is generated from rain and snow melt events that flow over land or impervious surfaces, such as paved streets, parking lots, and building rooftops, and does not soak into the ground. The runoff picks up pollutants like trash, chemicals, oils, and dirt/sediment that can harm our rivers, streams, lakes, and coastal waters - EPA.

As part of a broad spectrum of actions to reduce the NPS pollution finding its way into Massachusetts' (and the nation's) waterways, the Massachusetts Department of Environmental Protection (MassDEP), the U.S. Environmental Protection Agency (EPA), and other partner agencies are reaching out to the owners of hobby farms to engage them in sound, "stormwater-friendly" management practices.

HOW CAN A HOBBY FARM IMPACT STORMWATER?

FARM ACTIVITIES CAN INTRODUCE POTENTIALLY HARMFUL MATERIALS SUCH AS FERTILIZERS, PESTICIDES AND MANURE ONTO THE LANDSCAPE, AS WELL AS EXPOSE NATURAL SOILS, MAKING THEM SUSCEPTIBLE TO EROSION WHEN IT RAINS.

When it rains or when snow melts on a hobby farm, it produces stormwater runoff that can pick up and carry these materials and sediments across the ground surface. Eventually, the runoff deposits these contaminants on other properties or in nearby wetlands, streams, ponds, lakes, and coastal waters where it can degrade natural habitat and severely impact water quality.

Decreased water quality can:

- Have negative health effects on humans and wildlife that come into contact with it
- Help support invasive aquatic species
- Cause harmful algal blooms
- Result in beach closures and impact recreational activities
- Cause fish kills
- Reduce species diversity

Hobby farm activities that can generate substances harmful to habitat and water quality include:

- Land disturbance from land tilling and livestock grazing
- Excessive irrigation
- Application of fertilizers
- Application of other agricultural chemicals, including pesticides and herbicides
- Accidental spills of other potentially toxic materials used around the farm such as cleaning compounds, paints and thinners, and petroleum products used to operate hobby farm equipment
- Management and storage of animal waste, whether animal manure remains where it falls, is collected and disposed of, or is collected and re-applied to the land as a fertilizer
- Management of other waste, such as debris and plant clippings from gardening, left over materials from maintenance and construction activity, and other hobby farm waste material

HOW CAN THE HOBBY FARMER MANAGE STORMWATER IMPACT TO WATER QUALITY?

The hobby farmer can manage farm activities to prevent stormwater impacts often by following some combination of BMPs and good housekeeping practices. Many hobby farms are able to effectively manage stormwater impacts using common-sense management and maintenance practices, some of which you may already be doing. For example, applying fertilizers based on the soils' needs can prevent excess nutrients from reaching water resources, and keeping livestock away from streams can prevent bacteria from entering the water. In some cases, hobby farm owners may need to consider additional BMPs, such as landscape features designed to direct the flow of stormwater away from surface water, promote stormwater infiltration into underlying soils, prevent the contamination of stormwater altogether, or treat stormwater that comes into contact with potentially harmful substances.

This handbook is intended to describe a number of BMPs and good housekeeping practices that are suitable for managing stormwater impacts of hobby farming. We offer a "tool box" of management practices organized by the type of hobby farm (e.g., growing crops or raising livestock), followed by general site management and good housekeeping practices that can be applied to any hobby farm, no matter the size, to prevent, minimize and/or treat pollutants in stormwater runoff.

Much of the remainder of this handbook is devoted to describing these practices and assisting the hobby farmer in placing them into operation to maintain a healthy, stormwater-friendly farmstead.

A ROAD MAP TO THE MANUAL:

The hobby farm owner will find the following information in this handbook to help minimize pollution sources to nearby wetlands and waterbodies:

SECTION TWO	Getting Started: Understanding Your Hobby Farm Site	A guide to understanding the physical conditions on your farm, state and local regulations and how those affect the selection and siting of farming activities.
SECTION THREE	Creating a Stormwater Management Plan for Your Hobby Farm	A guide to planning for a new hobby farm or improving an existing one to avoid, minimize, and address stormwater impacts.
SECTION FOUR	Nutrient Management for Water Quality	A guide to understanding soil, plant and nutrient needs to produce a healthy crop and prevent over-application that can result in contamination of water resources.
SECTION FIVE	Animal Management for Water Quality	A guide to managing animals to increase forage yield and quality, provide a healthy place for livestock and horses and minimize negative impacts to the environment.
SECTION SIX	Stormwater Runoff Site Management	BMPs for erosion and sediment control, rainwater harvesting, and reducing stormwater runoff from hobby farms.
SECTION SEVEN	Hobby Farm Management and Safety	Common sense practices for taking care of the farm including pest management, hazardous material safety and storage, food safety and emergency planning.

In each of the sections, basic information about the topic is provided, followed by a series of Fact Sheets that explain details about each topic. Along the way, we provide links to more information for the hobby farmer who seeks greater detail, a deeper understanding, or additional help in operating the hobby farm with a minimum of impact on stormwater and nearby water resources.

WE INVITE THE HOBBY FARMER TO ENGAGE IN STORMWATER-FRIENDLY FARMING PRACTICES AND PROTECT THE LAND AND WATER RESOURCES ON WHICH WE ALL DEPEND.

SECTION TWO

GETTING STARTED: UNDERSTANDING YOUR HOBBY FARM SITE

Sections 2 and 3 provide tools to plan a new hobby farm or improve an existing one, so your farm's activities will have a minimum impact on nearby water resources. Here we provide information to help you understand your existing site. In the next section, we will discuss forming a Hobby Farm Plan.

"Stormwater-friendly" farming requires you to identify the water resources that might be affected by your farm and how stormwater drains from your particular hobby farm site. It also requires you to understand some municipal and state requirements that apply to the farming activities you propose. The Fact Sheets in this section will assist you to understand your farm site and its environment so that you can plan your activities to result in little or no impact on the water resources to which your hobby farm drains.

The following Fact Sheets are intended to assist you in answering the following questions:

- How hobby farms generate pollution, why they are a concern, and offer ideas for addressing pollution.
- What farm activities are you planning and what do you need to make sure they work with your site?
- What features of your farm site affect how you use it, while managing stormwater runoff?
- Are there important water resources on or near your hobby farm?
- What local and state regulations do you need to consider in planning your farm activities?

THE DEVELOPMENT OF A NEW HOBBY FARM OR IMPROVEMENT OF AN EXISTING ONE CAN RANGE FROM BEING VERY SIMPLE TO COMPLEX, SIMILAR TO THE DIFFERENCE BETWEEN USING A SHOVEL OR A SMALL TRACTOR.

THIS HANDBOOK FOCUSES ON HOW TO INCORPORATE IDEAS AND PRACTICES TO MANAGE STORMWATER RUNOFF AND MINIMIZE POLLUTANTS FROM YOUR HOBBY FARM. YOU SHOULD USE INFORMATION IN THIS HANDBOOK WITH OTHER HELPFUL RESOURCES YOU RELY ON TO PLAN YOUR HOBBY FARMING ACTIVITIES.

If you are just converting part of your lawn to vegetable garden and you are not too close to a wetland, stream, or pond, the planning and implementation of stormwater protection measures will be relatively simple. Your "stormwater management plan" may consist of some basic measures to control erosion, avoid excessive irrigation runoff, and carefully apply fertilizers and other agricultural compounds needed to cultivate a healthy crop. You may be able to undertake this conversion to hobby farming by consulting your local Conservation Commission or searching a few online resources on raising the vegetables you select and implementing some simple measures from this handbook.

On the other hand, if you own several acres and will engage in a variety of farming activities ranging from cultivating vegetables, to raising animals, to growing forage crops for your livestock, your site evaluation, site planning, and hobby farm operations planning will become more complicated and require additional effort. Also, if your property has wetlands or surface water within or near it, your activities may be subject to regulation and will require a greater planning effort.

With this range of hobby farming activity in mind, we provide the following Fact Sheets to guide you to the information you need to start a new environmentally friendly hobby farm or improve an existing one.

The remainder of this handbook provides tools and practices that the hobby farmer can use to ensure that hobby farm operations have a minimum of impact on nearby water resources.

HELPFUL LINKS

U.S. Environmental Protection Agency: www.epa.gov/nps/what-nonpoint-source
Massachusetts Department of Environmental Protection: www.mass.gov/eea/agencies/massdep/water/watersheds/nonpoint-source-pollution.html
University of Massachusetts Amherst - The Center for Agriculture, Food and The Environment: www.ag.umass.edu
University of New Hampshire Cooperative Extension: www.extension.unh.edu

FACT SHEET 2.1

HOW CAN HOBBY FARMS BE SOURCES OF STORMWATER POLLUTION?

You may be surprised to learn that hobby farming is a potential source of water pollution. It is easy to assume that stormwater pollution is more likely associated with highly developed urban and industrialized areas, where extensive roof and pavement result in more stormwater runoff than in rural landscapes.

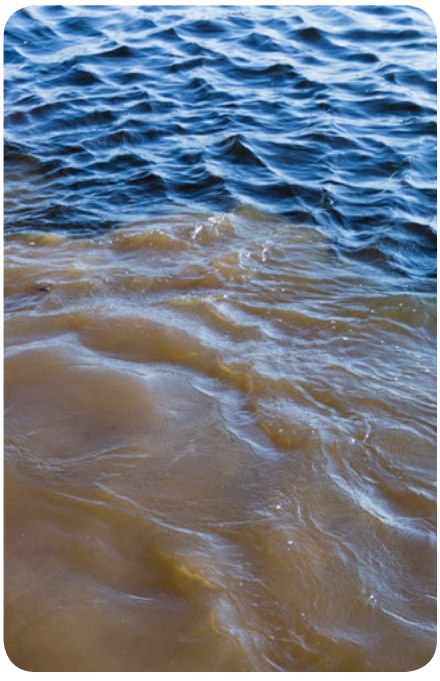
However, human activities including agriculture (sometimes no matter how small) can generate pollutants and create conditions that allow these pollutants to come into contact with stormwater. Because of this, the hobby farm can become a significant source of nonpoint source pollution. In this section, we will take a look at some of the farming activities that can result in the generation of pollutants, and why these pollutants are a concern.

FARMING ACTIVITIES AND THE GENERATION OF "POLLUTANTS"

FARMING ACTIVITY	POLLUTANTS	HOW IT GENERATES POLLUTANTS
LAND DISTURBANCE SUCH AS TILLING AND LIVESTOCK GRAZING	Sediments	Land disturbance activities expose soils to erosion by both water and wind. These exposed soils can be carried by water flowing over the surface of the ground or by the wind and deposited into waterways as sediments.
EXCESSIVE IRRIGATION	Sediments	Excessive irrigation can result in increased erosion by simulating similar conditions to heavy rainfall events.
APPLICATION OF FERTILIZERS	Nutrients	When nutrients applied through fertilizers, manure, soil amendments and composted materials, exceed plant needs or when applied just before significant rainfall, the nutrients can be carried away by stormwater and discharged into nearby water bodies.
APPLICATION OF OTHER AGRICULTURAL CHEMICALS	Toxic Chemicals	When pesticides, fungicides, and herbicides, containing toxic chemicals, are applied, they can adhere to soil particles or readily be dissolved by stormwater runoff and carried into waterways.
INCIDENTAL AND ACCIDENTAL SPILLS	Toxic Chemicals	Equipment operation may require the use of fuel, lubricants and hydraulic fluids. Other activities, such as the application of paints and stains, or the use of cleaning compounds can generate solvents and other chemicals. These substances can drip or spill onto the ground surface in the course of normal operation. When exposed to rain or snow melt, they can be carried by stormwater runoff into nearby water bodies.
MANAGEMENT OF ANIMAL WASTE	Nutrients, Bacteria, Viruses	Animal manure contains bacteria and viruses that when left or spread on the ground in excess amounts, can be carried to nearby water resources.
MANAGEMENT OF OTHER WASTE	Debris	Wastes such as plant clippings from gardening, maintenance and construction waste, trash, and other solid waste from hobby farming activities, can be washed into waterways if not properly managed and disposed of.

WHY ARE THESE POLLUTANTS A CONCERN?

POLLUTANT	CONCERNS	AGRICULTURAL SOURCES
SEDIMENTS	• Clouds surface water • Smothers fish larvae and benthic organisms that live in the aquatic environment, can also clog the gills of fish • Carries pollutants such as nutrients and toxic chemicals attached to the sediments from fertilizer and pesticide applications	Tilling, livestock grazing, excessive irrigation
NUTRIENTS	• Nutrients, such as phosphorus and nitrogen, are a food source for plants and algae. Excess amounts in a surface water can result in algae blooms that can degrade water quality, result in fish kills, make waters unfit for swimming or fishing, and create foul odor and taste in water used for drinking • High concentrations of nitrate (a compound of nitrogen) in drinking water can cause methemoglobinemia, a potentially fatal disease in infants – nitrates are very soluble and can easily travel to groundwater as stormwater runoff infiltrates through soils	Application of fertilizers, manure and composted materials to enhance the nutrient content of soils or animal manure left on the ground surface
TOXIC CHEMICALS	• Poison fish and other wildlife (as well as people), contaminate food sources, destroy habitat, and render potential surface water and groundwater supplies unfit for consumption • Some toxic chemicals have an immediate adverse effect on living organisms, others have effects that manifest over time as the chemicals accumulate in the tissues of living organisms and in their habitats	Application of pesticides and herbicides and incidental spills from operation and maintenance of farm equipment or infrastructure
PATHOGENS, BACTERIA	• Make swimming areas unusable • Render drinking water unfit for consumption • In coastal areas, prohibit the harvesting of shellfish	Animal manure
DEBRIS	• Plastic bags and other packaging materials, bottles, construction waste, and other debris can degrade habitat and choke, suffocate, or disable aquatic wildlife, such as waterfowl, fish, and amphibians • Leaves/brush/grass clippings can lead to low dissolved oxygen levels as the materials break down, affecting fish and other aquatic organisms	Organic wastes, such as plant clippings from gardening, maintenance and construction debris and trash, from farming activities



FACT SHEET 2.2

HOW CAN HOBBY FARMERS PROTECT WATER RESOURCES?

Hobby farmers can plan how they use their property and then conduct their farming activities in ways that protect water resources. This involves preventing the release of the pollutants, as well as capturing and treating contaminants that may find their way into stormwater.

Protecting water resources from stormwater pollution on a hobby farm should follow this three-step process common to all forms of environmental protection:

Step 1: Avoid Impacts

The best way to address pollution is to avoid it in the first place. If the hobby farmer can avoid generating a pollutant or keep it from coming into contact with stormwater, then there is no need to do anything further.

An example of "avoidance" is to store all fertilizers in a secure, enclosed area to avoid contact with rainfall or stormwater and contain any spills. Another would be to use compost or planting techniques that may not require the use of traditional fertilizers. Both of these methods would help avoid impacts to nearby surface waters.

Step 2: Minimize Impacts

If potential impacts cannot be completely avoided, the second step is to keep the potential impacts to a minimum.

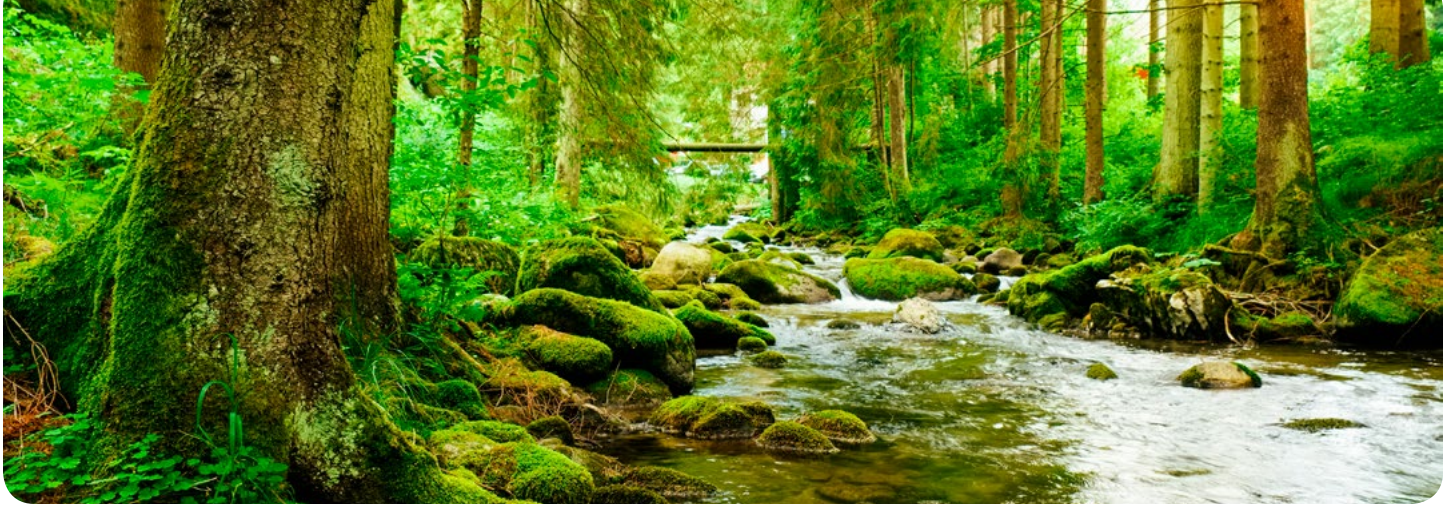
An example of "minimization" is to complete a soil test to determine exactly what nutrients your soil and crops need and to tightly control the type, method, rate, and timing of fertilizer application. This will help avoid overfertilization and reduce the amount of chemicals conveyed in stormwater.

Step 3: Mitigate Remaining Impacts

Some impacts might still be expected after taking Steps 1 and 2. In this case, the hobby farmer can correct for (or mitigate) stormwater pollution that results from farm activities. This generally requires a specific management practice to treat stormwater or otherwise address the potential impact.

An example of "mitigation" is to intercept stormwater runoff from a disturbed area, such as a garden, using a vegetated buffer strip. This measure involves planting and maintaining a permanent strip of vegetation next to the garden to help filter out sediment and contaminants and intercept erosion before ultimately discharging into a nearby stream.

DID YOU KNOW?
Agricultural activities that cause Nonpoint Source Pollution most generally occur in the absence of a conservation plan - EPA



THIS HANDBOOK PROVIDES GUIDANCE TO YOU, THE HOBBY FARMER, ON HOW TO INCORPORATE THESE THREE STEPS INTO THE PLANNING AND MANAGEMENT OF YOUR FARM IN A WAY THAT AVOIDS, MINIMIZES, AND CORRECTS STORMWATER IMPACTS. TO DO THIS, WE RECOMMEND DOING THE FOLLOWING STEPS:

Understand your site and how to work with it

This includes deciding which hobby farm activities you wish to pursue, learning about any local and state regulations that may affect your plan, and compiling some information about existing conditions on your farm property.

Plan your "Stormwater Friendly" Hobby Farm

In Section 3, we offer a series of Fact Sheets for planning your farm. Using the information you learn in this section, we offer guidance on developing a site plan for your hobby farm, including how you operate your farm to minimize stormwater and surface water impacts. This farming plan will depend on practices you choose from the "tool box" included in subsequent sections and will be comprised of the associated fact sheets and worksheets.

Employ Best Management Practices (BMPs) to minimize impacts

The remainder of the handbook describes "Best Management Practices" that Hobby Farmers will use to "avoid-minimize-mitigate" potential stormwater impacts depending on the type of activity you are performing, as well as practices that can be applied to any site to minimize stormwater runoff and prevent pollutants from entering nearby surface waters.

FACT SHEET 2.3

PLANNING YOUR HOBBY FARM

Whether you are developing a new hobby farm or improving an existing one, we recommend you seek as much information as possible to help you plan successful and rewarding farm activities.

Depending on the type and scale of hobby farm activities, the development or improvement of a hobby farm requires you to collect information to judge whether you have enough time and space. Once you do, develop a site plan, and identify the Best Management Practices needed to control impacts to stormwater runoff and nearby water resources.

For example, if you want to keep animals, you will need specific information on the types of animals you intend to keep so you can determine how large an area is required for grazing and manure management without impacting nearby surface water.

You will also need information on sheltering the animals, confining them on your property, water supply and feed requirements and any other factors that would affect how you organize your hobby farm activities.

Checklist 2A contains a series of questions designed to help you gather and document information about your current and/or proposed hobby farming activities. Bear in mind that you may need to revisit each of these questions as you learn about the water resources on or near your property, regulations affecting your activities, and the physical constraints of your property. For example, you may change your mind about the type of animals you will keep when you learn more about your town's zoning requirements.

HELPFUL LINKS

www.ag.umass.edu/umass-extension-your-community
www.usda.gov/topics/rural/cooperative-research-and-extension-services

CHECKLIST 2A

PLANNING YOUR HOBBY FARM ACTIVITIES

If you plan on GROWING CROPS (see Section 4)

What crops do you plan to grow?

What are the space requirements of your selected crops?

What type of soils do you have?

What is the nutrient content of the soil? Have you completed a soil test?

What types and quantities of fertilizers are required for this crop? Where will you store it?

What types of pests are a problem for this crop, and how will you control them?

How will you irrigate the crops? Where will you obtain water and how much will you need?

If you plan on KEEPING ANIMALS (see Section 5)

What types of animals do you want to have on your hobby farm and how many of each animal will you raise?

How much space is needed for grazing? Will you supplement with feed?

How much water is needed to support the animals?

How much manure are they expected to produce? Where will you store it?

What do they need for shelter? Exercise?

How do you plan to confine them? Fencing or other methods?

Other OPERATIONS AND MAINTENANCE (see Sections 6 and 7)

What equipment will you need for your hobby farm?

What products and tools will you need to maintain equipment?

What facilities will you need to store and provide maintenance of this equipment?

What wastes (including animal manure and crop residues) will you need to manage within the farm or dispose off-site?

FACT SHEET 2.4

STATE REGULATORY PROTECTION OF WATER RESOURCES ON OR NEAR YOUR HOBBY FARM

As a Hobby Farm owner, you need to know what water resources are on or near your property, and what your responsibilities are to protect them. You need to know this not only to be a good steward of natural resources, but also to comply with the law.

Massachusetts has strict regulations to prevent disturbance or damage to its water resources. Whenever a property is developed or altered near a wetland or surface water, it may require review and permitting under the Massachusetts Wetlands Protection Act (WPA) regulations and also under local town bylaws or city ordinances. The Massachusetts Department of Environmental Protection (MassDEP) and town or city Conservation Commissions are responsible for enforcing these regulations.

Other state regulations protective of water resources include the Massachusetts Watershed Protection Act, which regulates land use and activities including agricultural, within critical areas of the Quabbin Reservoir, Ware River and Wachusett Reservoir watershed; and MassDEP's Drinking Water Regulations, which includes restrictions on agricultural activities near surface water used as a source of drinking water.

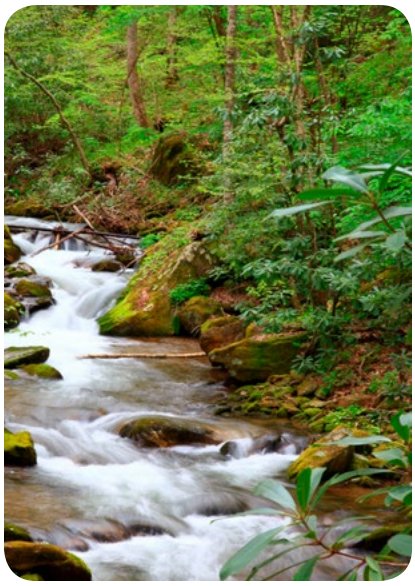
A brief summary of these regulations is provided in the table below:

REGULATION	HOW IT MAY AFFECT YOUR FARM?	WHERE TO GET MORE INFORMATION
MASSACHUSETTS WETLANDS PROTECTION ACT (WPA) **310 CMR 10.00**	If your hobby farm is located within 100 feet of a wetland or certain other water resources (distance may be greater in some communities) you may need to apply for a permit through your local Conservation Commission. You should contact the Conservation Agent or Conservation Commission before you do any work.	• MassDEP • Conservation Commission
MASSACHUSETTS WATERSHED PROTECTION ACT **313 CMR 11.00**	This only applies to communities within the Quabbin Reservoir, Ware River and Wachusett Reservoir watersheds. It prohibits certain activities such as storage of hazardous materials and manure within 400 feet of tributaries and surface waters. Visit this link to see if your hobby farm is within one of the regulated watershed areas: www.mass.gov/eea/agencies/dcr/water-res-protection/watershed-mgmt/the-watershed-protection-act.html	• Department of Conservation and Recreation
MASSACHUSETTS DRINKING WATER REGULATIONS **310 CMR 22.00**	If you're located within 100 feet of a surface water supply or tributary to one, stabling, hitching, feeding, grazing, or other similar activities of livestock or other domestic animals are prohibited. Sites within a Zone II groundwater drinking source protection area should not store fertilizers or manure unless stored in a structure that prevents contaminated runoff from escaping.	• MassDEP

DID YOU KNOW?
Water resource areas include wetlands, rivers, streams, lakes, ponds, coastal features, and their buffers (a protective zone around them). Hobby Farm activities within water resource areas are regulated in Massachusetts. You may need to apply for approval through your local Conservation Commission for certain activities.

START WITH A VISIT TO YOUR LOCAL CONSERVATION COMMISSION OFFICE

While it may seem relatively straightforward to identify a stream or wetland on your property, experts in wetlands science are sometimes needed to identify the limits of these and other water resources as defined in the regulations.



Types of soil, hydrology and vegetation are some of the parameters that must be considered when delineating the extents of these water resources under the regulations. For this reason, we recommend you first consult with your local Conservation Commission or Agent who can assist you.

In some cases, the Conservation Agent may visit your site to help you identify the water resources that you should consider and provide recommendations on how to move forward before you develop or make improvements to your hobby farm. In other cases, they may recommend you hire a professional to identify where protected resources are located on and near your property and to assist you with an application, if necessary, for your proposed activities.

If needed, contact MassDEP

After discussing your project with the local Conservation Commission, you may need to contact MassDEP for additional consultation. This may occur if you're located within certain watersheds in the state or located within a Zone II area around a drinking water well (essentially the area that supplies most of the drinking water to the well). Note that Zone II areas may be irregular in shape and can extend thousands of feet around the location of a well, so it is important to check the mapping of these areas with your Conservation Commission or MassDEP.

You will need the following information to know which of your hobby farming activities are permissible:

- ✓ Location of protected water resources on or near your property
- ✓ Distances that hobby farm activities must be kept from existing wetlands, streams, and other waterbodies
- ✓ Other local and state requirements that affect the layout of your hobby farm
- ✓ How you manage stormwater runoff

See Checklist 2B to document how regulations may impact your hobby farm.

PLAN AHEAD
Know your resource areas and regulations that protect them prior to doing any work near them.

FACT SHEET 2.5

HOW DO LOCAL REGULATIONS AFFECT YOUR HOBBY FARM?

Most communities have zoning bylaws and other regulations that specify allowed and prohibited land uses, and requirements that may apply to activities you plan for your Hobby Farm.

Whether you are starting a new hobby farm, adding activities or improving an existing hobby farm to make it "stormwater friendly," you should learn about your community's regulatory requirements. The following is a brief summary of local regulations that may affect your farm and where you can usually obtain more information.

REGULATION	HOW IT MAY AFFECT YOUR FARM?	WHERE TO GET MORE INFORMATION
PLANNING OR ZONING BYLAW	Planning or zoning bylaws may affect the number and type of animals you own, farming activities you can conduct, and whether you can carry on any commercial activities (e.g., operating a vegetable stand). Some zoning regulations may have specific restrictions and requirements on how you manage your site, especially if you are within a 'water resources protection' district or 'water supply protection' district.	Start with the Code Enforcement Office (sometimes known as the Office of the Building Inspector), or municipal Planning Department
STORMWATER MANAGEMENT REGULATIONS	Many communities have regulations for the management of stormwater that apply to disturbance of land above a certain threshold.	Jurisdiction varies by community - inquire at your Municipal Offices
BOARD OF HEALTH	Many communities have a Board of Health (BOH) and/or Health Agent that administers a variety of regulations that may affect your farm and how you manage stormwater and wastewater on your property, including: • Keeping and Care of Animals – If regulated, your selection of livestock will need to meet local health regulations, which may govern the type, number, and minimum standards of care for the animals. • On-site Sewage Disposal (Septic Systems) – If you have an on-site sewage disposal system, the Health Agent may have records showing its location so you can take measures to protect it from damage by any proposed farm activities. Activities near your system may be restricted and there may be setback requirements for certain stormwater management facilities, such as dry wells and ditches.	Local Board of Health Office
LOCAL WETLAND AND WATER RESOURCES BYLAW	Many communities have adopted local wetland and water resource bylaws that are more stringent than the State Wetlands Protection Act. Activities within a certain distance require approval.	Local Conservation Agent

OTHER REGULATIONS

Other local regulations may affect your farming activities and the use of your property. This handbook highlights several regulations that relate to managing stormwater runoff from your farm. For additional information on local rules and regulations that apply to Hobby Farms, please contact your local municipal departments.

See Checklist 2B to document how regulations may impact your hobby farm.

REGULATORY CHECK

Important things to learn from local rules:

- Do the rules allow the farming activities you want on your Hobby Farm?
- Are there special rules that apply to your farm because it is near a drinking water supply or other critical resource?
- Are there protected wetlands or water resources near your hobby farm (even if they are not on your property) that are regulated?

CHECKLIST 2B

WHAT REGULATIONS AFFECT MY HOBBY FARM?

Use the following questions to guide your conversations with Municipal and in some cases State Offices:

1. Do local Planning or Zoning regulations have provisions that affect the farming activities I propose?

☐ YES ☐ NO if YES, list the provisions: _____

2. Are there restrictions on the number or type of animals I propose to keep?

☐ YES ☐ NO ☐ N/A If YES, list type of animal(s) proposed/limits on number: _____

3. Is my farm within a wetland or water resource buffer, typically 100' (200' for perennial streams), depending on local regulations?

☐ YES ☐ NO If YES, document conversation with local Conservation Commission or Agent: _____

4. Is my farm within the watershed of a surface water or groundwater well drinking water supply?

☐ YES ☐ NO If YES, are there special regulations governing activities within the watersheds of drinking water supplies? _____

☐ YES ☐ NO If YES, check those that apply and provide a brief description, list any other provisions:

- ☐ restrictions on storage tanks
- ☐ restrictions on storage of materials such as fertilizers, chemicals, animal manure and waste materials
- ☐ restrictions on stabling, hitching, standing, feeding or grazing of animals
- ☐ controls on the application of fertilizers, pesticides, and herbicides
- ☐ controls on the management of irrigation
- ☐ other applicable provisions: _____

5. Are there setback requirements for my hobby farm?

☐ YES ☐ NO If YES, list activity and setback: _____

6. Are there any other applicable local regulations that apply to my Hobby Farm?

_____

7. Are there any other applicable state regulations that apply to my Hobby Farm?

_____

SECTION THREE

CREATING A STORMWATER MANAGEMENT PLAN FOR YOUR HOBBY FARM

Section 3 provides you with tools to plan a new hobby farm or improvements to an existing one, so your farm's activities will minimize impacts on our state's valuable water resources.

Now let's make use of the information you gathered following the guidelines in Section 2 to help you understand your site. The Fact Sheets in this Section will help you develop a "Stormwater-Friendly" Hobby Farm Plan.

This handbook deals with the stormwater-related aspects of your hobby farm. The information in this section focuses on elements of planning or improving your farm that relate to stormwater. You may need to seek assistance elsewhere for other aspects of planning your farm (for example, choosing the crops you want to raise and identifying the best methods for cultivating them, selecting the animals you will keep and learning the requirements for their care, and other important planning decisions). Part of your planning effort should be to organize your property and farming activities to properly control stormwater impacts.

The following Fact Sheets are intended to assist you in answering the following questions:

- How will you arrange your hobby farming activities, along with Best Management Practices, so that you can enjoy hobby farming while avoiding stormwater impacts?
- How will you operate your farm to avoid impacts from land disturbance, excessive irrigation, use of fertilizers and agricultural chemicals, incidental and accidental spills, management of animal waste, and management of other wastes?

FACT SHEET 3.1

MAPPING YOUR HOBBY FARM

As you plan or make improvements to your Hobby Farm, you will want to develop a rough map or sketch showing existing site characteristics.

Your goal is to develop a good working description of your farm site, noting all of the features that will help you meet your farming goals, while managing your hobby farm to avoid, minimize, or address stormwater impacts.

A working base map of your existing site is a good way to document these features. It will help you navigate through any applicable local and/or state regulations or restrictions that may apply to your site due to the location of water resources or other features. Finally, it will serve as a template for planning your hobby farm and be critical should an emergency arise. Use Checklist 3A to develop your base map.

WHAT INFORMATION SHOULD YOU SHOW ON YOUR MAP?

The map of your property (also referred to as an "existing conditions site plan") should show the following features:

PRIMARY FEATURES	DESCRIPTION	WHERE TO OBTAIN
SITE BOUNDARIES	Depending on the area of your property dedicated to your hobby farm, this might consist of your entire property, or just the portion of the property where your farming activities will be located.	• Local Assessor's Office • Deed description • Lot survey • OLIVER* database
ROADS AND DRIVEWAYS	Roads in front of and nearby your property, including the name of the roads, and driveways on your property.	• Google Maps/Earth • Local Assessor's Office • OLIVER* database
BUILDINGS AND STRUCTURES	Location and outline of buildings and structures on your property, along with general description (e.g. house, horse barn, livestock pen).	• Google Maps/Earth • Local Assessor's Office • Lot survey • OLIVER* database
SURFACE WATER RESOURCES, BUFFERS AND SETBACKS	Locations of wetlands, streams, rivers, lakes, ponds, and coastal resources on or near your property. Note that some water resources have legally defined "Buffer Zones" where proposed activities are subject to review by the local Conservation Commission. Others may have setbacks regulated under the Watershed Protection Act by the Department of Conservation and Recreation.	• Google Maps/Earth • OLIVER* database • Local Conservation Commission • Watershed Protection Act Map: www.mass.gov/eea/agencies/dcr/water-res-protection/watershed-mgmt/the-watershed-protection-act.html

NATURAL VEGETATED AREAS	One of the practices used to help minimize stormwater is the use of a vegetated buffer between your farming activity and a water resource. If your property has existing wooded areas or areas with native grasses and shrubs, you should show them on your map – especially where they border an existing stream, wetland, or other water resource.	• Google Maps/Earth • OLIVER* database
GROUNDWATER RESOURCES	Some pollutants such as nitrates from fertilizer are not easily filtered and can easily reach groundwater sources if allowed to infiltrate through soils. Public groundwater drinking water sources have a delineated "Zone II" protection area, which may have certain restriction. These should be mapped.	• Google Maps/Earth • OLIVER* database • Local Conservation Commission
SLOPES	The slopes on your hobby farm play an important role in the management of erosion and stormwater. Knowing where these slopes are and where they lead to should be noted on your map.	• Site visit
SOILS	Locate any unique features associated with your site soil conditions such as areas with rock outcrops and areas that are too soft to drive your mower or tractor across.	• Site visit

* OLIVER is an interactive online data viewer for Massachusetts that can help identify various features on and around your hobby farm.

Depending on the size and activities of your hobby farm, supplemental information may be required, including:

SECONDARY FEATURES	DESCRIPTION	WHERE TO OBTAIN
WILDLIFE HABITAT	Identify locations mapped by the Massachusetts Department of Fish and Game under the Natural Heritage and Endangered Species Program (NHESP) to locate on your map.	• Local Conservation Commission • Massachusetts Department of Fish and Game • NHESP Habitat Maps: www.mass.gov/service-details/regulatory-maps-priority-estimated-habitats
EXISTING DRAINAGE FEATURES AND PATTERNS	To plan your hobby farm for stormwater management, you will need to understand how runoff finds its way across your property. Add the following features to your map: • Roof drains and where they discharge (e.g., to ground surface, dry well, storage barrel, garden area) • Swales or shallow ditches that convey stormwater from one location to another • Culvert crossings beneath driveways, roads and trails • General flow patterns across the site (e.g., high ground to low ground) • On-site low areas where stormwater soaks into the ground • Storm drains and/or catch basins	• Most features can be observed on-site – it may be helpful to observe flow patterns when it rains

SERVICE UTILITIES	There are a variety of utility services that could be located within your property. If the services are located underground and you know where they are, plot them on your map. If you know you have a particular service, but do not know its location, note this on your plan. Include the following: • Private water supply well(s) • Service lines for public water and sewer if available • Septic systems and connections to house • Gas service pipelines • Above-ground electrical, telephone, and cable lines, including pole locations; or underground electrical, telephone, and cable lines • Easements – your property could have easements to allow another party access for any number of reasons (e.g., if a utility runs through your property, an easement may exist to allow the utility company access for repairs)	• Board of Health (private wells and septic) • Municipal water and sewer department (public water and sewer) • Gas company (gas service pipelines) • Electric company (underground electrical) • Deed (description of any easements on property)

CONDUCT A "PROBLEMS AND OPPORTUNITIES" TOUR OF YOUR SITE

Once you have completed a draft of your working map, take a tour of your site with map in hand, and look for features that have problems to be addressed or that might have features you want to take advantage of.

The following is a partial list of features to consider:

Potential problems

- Areas on your site showing evidence of erosion, look especially for areas where gullies are present or appear to be forming
- Areas that appear to be deposits of sediment left by past runoff events
- Areas with exposed soils that are not going to be used for crops or groundcover
- Farming activities located in close proximity to surface waters or wetlands
- Areas where animals have destroyed the groundcover by overgrazing or trampling
- Banks of streams, ponds, or other water resources that have been damaged by past grazing, construction activities, vehicle traffic, or foot traffic
- Areas damaged by use of all-terrain vehicles, mountain bikes, or other vehicles
- Existing springs or low wet areas, not otherwise shown as water resources on plan

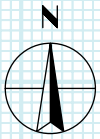
Potential opportunities

- Existing trees, wind breaks, wooded stands, and other vegetation that might be preserved to enhance your landscape, serve as a buffer, or serve as a friendly fence between you and your neighbors
- Existing views you want to keep to enhance your property
- Existing connections to public trails that you might want to preserve so that you can use them as part of your hobby farm activities (for example, if you keep horses to ride for pleasure)
- Existing orchards, berry patches, individual fruit bearing trees, or other plantings that you might want to maintain as part of your farming operation

CHECKLIST 3A

MAP OF EXISTING SITE

- ☐ Draw the approximate property boundaries.
- ☐ Draw the road(s) that run(s) in front or adjacent to your property. Include the name(s) of road(s).
- ☐ Draw buildings as they exist on the property and their approximate shapes.
- ☐ Draw and label surface waters, including locations of wetlands, streams, rivers, lakes, ponds, coastal waterways, and their buffers (as discussed with local Conservation Commission), on or near your property. Remember, even offsite wetland and water resource areas can impact what you are allowed to do on your property.
- ☐ Draw existing wooded areas or areas with native grasses and shrubs.
- ☐ Draw groundwater protection areas (as known).
- ☐ Indicate service utilities such as private water supply wells and septic systems, public water and sewer connections, gas lines, electrical, telephone, and cable lines, including pole locations, and any easements on property (as known).
- ☐ Draw existing drainage features and patterns, including roof drains, swales/ditches, low areas, culvert crossings, roads and trails, storm drains and catch basins with general flow arrows.



FACT SHEET 3.2

MAPPING YOUR HOBBY FARM STORMWATER PLAN

The Hobby Farm Stormwater Plan has two major components: a map showing how hobby farm activities are arranged on your property, and an operational plan that tells how you plan to manage the farm to prevent stormwater impacts.

We recommend that you prepare a plan using a base map of your property. This map will be helpful to you if you need to apply for any permits under state and local regulations. More importantly, it will help you think about how to arrange farming activities on your property to minimize and manage stormwater impacts and even deal with emergencies. You will want to use this mapped plan of your hobby farm to help you locate farm activities away from streams, ponds, wetlands, and other water resources and identify where you need vegetated buffers or other barriers or best management practices to prevent unwanted impacts to those water resources.

To complete this plan, you will need to have reviewed Section 2 of this handbook, to have an understanding of important issues related to stormwater, the regulations that might affect your farm, and the characteristics of your farm. Once you have reviewed those and prepared a map of your farm's existing conditions (see Checklist 3A), you should add information to the map to develop your Hobby Farm Stormwater Plan as described below.

Required regulatory buffers and setbacks

You should review the "base map" of existing conditions you prepared as described in Fact Sheet 3.1 and Checklist 3A and make sure you have shown all regulated water resources on or near your property and related buffer zones and setbacks. Please make sure you understand what activities may occur within the buffer zones and setbacks - if you are not sure, please re-visit the municipal offices and staff described in Fact Sheets 2.4 and 2.5 to make sure you understand how state and local regulations affect your Hobby Farm.

Preliminary layout of farming activities and supporting facilities

Use your base map, together with your knowledge of the buffer zone and setback requirements, to designate locations and the general layout of the activities you want to include in your Hobby Farm. You should sketch proposed features on your map to answer the following questions.

Keep in mind that your initial sketch may need to be modified as you consider other mapping steps outlined below - so this first plan is a preliminary sketch of how your hobby farm will be organized or improved.

Cultivated Areas

- What areas will you plant (row crops, vineyards, orchards, etc.)?
- How do you plan to provide water for growing crops? If you plan an irrigation system, where is the water supply?
- How will water be conveyed from the supply to your crops?

Animal and Livestock Facilities

- What areas will you use as pastures for livestock or other animals?
- Where will you provide shelter?
- How will you provide water?
- Where will you store or compost manure?

Buildings

- Will you use existing buildings to support your farming activities? Will this use require changes to the building to make it suitable for this purpose?
- Do you propose new buildings, and where should they be located?

Storage and Service Areas

- Where will you store and service equipment used for your farm?
- Where will you store and prepare general supplies, fertilizers, other agricultural chemicals (herbicides, pesticides, etc.)?

Utilities

- How will you supply water?
- How will you collect and treat wastewater?
- Where will you need electrical power and other cable utilities (e.g., telephone, TV cable, internet)?
- Will you need a natural gas pipeline extension or other gas supply?

Solid Waste

- How will you collect, store, and dispose of solid waste (e.g. trash) from your hobby farm?
- Will you compost material on your hobby farm?
- How will you manage manure on your site?

Access

- How will you provide access for all of the facilities and activities that you have mapped?
- Which of your access ways will be paved?
- For access ways that are not paved, how will they be surfaced to adequately support proposed equipment and to prevent erosion?

NEXT STEPS

Once you have a preliminary layout of your farm activities and facilities, the next step in planning a Stormwater-Friendly Hobby Farm involves the selection of Best Management and good housekeeping practices to help you prevent stormwater impacts from your farm activities. As you select these practices and add them to your plan, you may need to refine the location and the space occupied by your farm activities so that farming and stormwater management fit together on your site. Doing this will help you become a hobby farmer with water quality in mind.

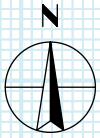
CHECKLIST 3B

MAP OF HOBBY FARM ACTIVITIES

AFTER REVIEWING APPLICABLE REGULATIONS AND REQUIREMENTS FOR THE TYPE OF HOBBY FARMING YOU WOULD LIKE TO DO, ADD THE FOLLOWING COMPONENTS TO YOUR EXISTING SITE MAP:

Draw the approximate property boundaries.

- ☐ Indicate where you will plant crops.
- ☐ Indicate the source of water for crops.
- ☐ Indicate where chemicals, fertilizers, and fuel are/will be located.
- ☐ Indicate where livestock are/will be housed.
- ☐ Show manure storage areas.
- ☐ Indicate areas to be used as pasture for livestock and number of paddocks for rotational grazing.
- ☐ Indicate where composting will occur.
- ☐ Show proposed access ways to all farm areas.
- ☐ Indicate where machinery is/will be located.



SECTION FOUR

NUTRIENT MANAGEMENT FOR WATER QUALITY

Many hobby farmers measure success by the abundance of their harvest of fruits and vegetables or their forage crops. This achievement can often be traced back to healthy soil and nutrient management practices.

SOME HOBBY FARMERS ARE FORTUNATE TO HAVE SITES WITH A THICK LAYER OF FERTILE SOIL RICH IN MICROORGANISMS. HOWEVER, EVEN GOOD SOILS CAN BECOME NUTRIENT DEPLETED OR ERODE OVER TIME. REGARDLESS OF WHAT YOU ARE GROWING, SOILS WILL GENERALLY NEED TO BE MANAGED TO RETURN NUTRIENTS INTO THE SOIL TO SUPPORT HEALTHY PLANT GROWTH.

THE HOBBY FARMER SHOULD CONSIDER THE FOLLOWING QUESTIONS IN DEVELOPING A HEALTHY SOILS MANAGEMENT PLAN:

- Why does annual soil testing help save time and money?
- What nutrients are needed for plant health? (Hint: It's not just about nitrogen, phosphorus, and potassium)
- What's the difference between fertilizers and soil amendments? Organic and synthetic?
- How can you improve nutrient retention in your soil through crop rotation, succession planting, intercropping, and companion planting?
- What are the best techniques to compost and to recycle and reuse materials you likely already have?
- How should you apply fertilizers, manure, and soil amendments for best results?

While nutrients are an essential component of many natural environments, an overabundance in our surface water can cause a reduction in water quality.

Phosphorus and nitrogen from fertilizers can result in:

- excessive aquatic plant growth choking waterways and making them impassable;
- depletion of dissolved oxygen which is essential for fish; and
- creating an ideal environment for toxic algal blooms that can be a health threat to people and pets, often causing recreational areas to close.

Section 4 contains the following Fact Sheets on how to manage nutrients on your hobby farm and how to keep them out of nearby waterways to protect surface water quality.

- FACT SHEET 4-1 Understanding Your Soil
- FACT SHEET 4-2 The Importance of Annual Soil Testing
- FACT SHEET 4-3 Essential Plant Nutrients
- FACT SHEET 4-4 Understanding Fertilizer Types
- FACT SHEET 4-5 Fertilizer: What's in the Bag
- FACT SHEET 4-6 Keeping Nutrients in Your Soil
- FACT SHEET 4-7 Plant Material Composting
- FACT SHEET 4-8 Nutrient and Soil Application
- CHECKLIST 4A Nutrient Management for Water Quality

By following the above fact sheet recommendations, not only can you improve your soil and overall harvest, but you'll be helping to prevent stormwater runoff containing fertilizer, nutrients, and bacteria from entering nearby water resources.

FACT SHEET 4.1

UNDERSTANDING YOUR SOIL

The soils that help support your hobby farm serve as more than just the physical medium needed to grow healthy crops. The most productive soils are alive with microbial activity that work together with the soil structure, nutrients and your plants to provide the balanced environment needed for a successful garden.

Your soil is an ecosystem that cycles nutrients between the organisms in your soil and your plants to ensure a healthy garden and a high-quality harvest. Soil is composed of:

- Minerals
- Water
- Gases
- Organic matter
- Microorganisms

Healthy soils that support good microbial activity need the right amount of:

- Dark organic matter
- Microbial life
- Aeration
- Drainage
- Water retention

GET TO KNOW YOUR SOIL

COLOR	Soils dark in color are generally rich in organic matter that support microbial activity; light and grey soils often lack organic material and proper drainage.
TEXTURE	Soil texture regulates how water, air, nutrients, microorganisms and plants interact in the soil and is determined by the amounts of sand, silt, clay and organic matter. Healthy soils have an ideal texture of 30-50% sand, 30-50% silt, 20-30% clay and 5-10% organic material.
STRUCTURE	Soil structure impacts the movement of air and water through soil. Healthy soil structure is generally loose and crumbly. Overly compacted soils can inhibit root growth and prevent infiltration of water, limiting water available for plant growth and potentially causing erosion.
SMELL	Healthy soils should have an earthy smell while soil with an offensive odor can indicate a disruption in its microbial balance.
PH	Soil pH on a scale of 1-14 measures the acidity and alkalinity of the soil with 7 being neutral, less than 7 being acidic, and greater than 7 being alkaline. Most home garden plants prefer soil that is neutral or slightly acidic, however, there are exceptions and it's best to research the individual plant's preference to ensure the soil pH is correct for optimal health.

WATER QUALITY BENEFIT
Healthy soils have good water retention capabilities and improve drainage resulting in reduced erosion and stormwater impacts to nearby surface waters.

Microorganisms are the primary decomposers of organic material in soil. Decomposers generally include:

- Bacteria
- Algae
- Fungi
- Earthworms
- Nematodes

Healthy balanced soils are more likely to:

- Be less susceptible to erosion and stormwater runoff that can impact nearby waterways.
- Contain the water retention capabilities needed to support plants, particularly during dry conditions.
- Have the ability to adapt to changes in environmental conditions.
- Be able to adjust to changes in nutrient availability as plants grow.
- Defend against the threat of disease and pests.

BY EVALUATING AND UNDERSTANDING THE PHYSICAL AND BIOLOGICAL COMPONENTS OF YOUR SOIL YOU SHOULD BE ABLE TO MORE ACTIVELY AND EFFECTIVELY IMPLEMENT YOUR NUTRIENT MANAGEMENT PROGRAM TO PRODUCE A HIGH-QUALITY HARVEST.

DID YOU KNOW?
One teaspoon of healthy soil can contain 100 million to 1 billion healthy bacteria.

HELPFUL LINKS
www.ag.umass.edu/crops-dairy-livestock-equine/fact-sheets/healthy-soils
www.nrcs.usda.gov/wps/portal/nrcs/main/national/soils/health

FACT SHEET 4.2

THE IMPORTANCE OF ANNUAL SOIL TESTING

Periodic soil testing is critical in determining what nutrients your soil may need to grow healthy plants. No matter what size your garden is or what you are growing, annual soil testing is recommended as the basis for a successful crop and nutrient management program.

DID YOU KNOW?
Adding material to your soil based on annual soil test results may: Save money · Save time
Produce higher crop yields · Produce healthier crops · Protect nearby waterbodies

In most cases, a routine soil analysis or standard fertility test is all you need and can be analyzed by your local Natural Resources Conservation Service (NRCS) Cooperative Extension laboratory, typically for under $20. With the results, you will receive recommendations for nutrient and pH adjustments specific to your soils and type of crop you wish to grow.

WHY DO A SOIL TEST?

- Nutrient needs of gardens can differ depending on what you grow. A soil test can help determine exactly what nutrients your soil already has and what it needs for the specific crop(s) you wish to grow. Test results are provided with fertilizer and pH adjustment recommendations.
- Soil needs can change from year to year as different plants and crops consume different nutrients in varying amounts. Soil test results can help quantify how much of each nutrient should be applied each year.
- Adding too much fertilizer to your garden can result in the transport of those nutrients to the nearest waterbody via stormwater runoff, resulting in water quality impacts. Soil testing can play a role in reducing pollution from stormwater runoff by providing you with a detailed report of the soil's specific needs, reducing the over-application of fertilizer, manure and soil amendments.
- Knowing what you need to add each year and in what quantities can significantly reduce the over-application of products, saving you time and money.
- Too much or too little of a nutrient can harm plants.
- Crops receiving the right type and quantity of fertilizer can result in higher quality plants and yields.
- Healthy plants can better defend against pests, disease, and also environmental stressors such as flooding, drought and sudden temperature changes.

CAUTION!
Retail soil tests kits that provide immediate results are often unreliable. It is recommended that soil samples be sent to your nearest NRCS Cooperative Extension for a more accurate analysis, plus they can often provide follow-up support should you have any questions.

WATER QUALITY BENEFIT
Soil testing is one of the most important steps to help ovoid over-application of nutrients which can be a major surface water contaminant resulting from hobby farm stormwater runoff.

HOW DO I COMPLETE A SOIL TEST?

Soil samples are relatively easy to collect and can be analyzed by your nearby NRCS Cooperative Extension. Directions for soil collection and preparation prior to testing can vary so be sure to obtain specific collection directions prior to submittal to help ensure accurate results. The following are general steps:

Step 1

Determine the area you want to test – soil sample collection locations should be representative of the typical garden or field conditions (avoid atypical areas).

Step 2

With a clean bucket and spade, collect 6 or more subsamples to a depth of six to eight inches and mix together in the bucket.

Step 3

Break up any lumps and remove any stones, roots, and debris.

Step 4

Spread the required sample amount (usually about 1 cup) on a clean piece of paper to dry.

Step 5

Submit the air-dried sample along with any other specific directions provided by your NRCS Cooperative Extension. Be sure to include information on the crop you will be growing (usually called the Crop Code) so the lab can provide site specific recommendations for you.

CONTACT

The NRCS has partnered with the University of Massachusetts Amherst Soil and Plant Tissue Testing Lab to offer soil testing in Massachusetts. Routine soil analysis typically takes 5 to 10 business days.

UMASS-AMHERST SOIL LAB • West Experiment Station
203 Paige Laboratory • 161 Holdsworth Way • Amherst, MA 01003
Phone: 413-545-2311 • soiltest@umass.edu • http://soiltest.umass.edu

HELPFUL LINKS
www.ag.umass.edu/services/soil-plant-nutrient-testing-laboratory/ordering-information-forms
www.ag.umass.edu/soil-plant-tissue-testing-lab/fact-sheets/interpreting-your-soil-test-results

FACT SHEET 4.3

ESSENTIAL PLANT NUTRIENTS

Believe it or not, there are 17 elements or nutrients essential for plant life. Nutrients required in greater quantities are referred to as macronutrients, while those required in smaller quantities are referred to as micronutrients. No one nutrient is more important than another, they are just required in different quantities and concentrations.

Optimal yields can only be produced when all of the nutrients are in proper supply. If one or more nutrient is lacking in the soil, crop yields will be reduced, even though an adequate amount of other nutrients are available. This can also occur if there is too much of a particular nutrient. Any nutrients not used by the plant are considered excess and can travel through stormwater runoff to nearby surface waters. Here they can reduce the quality of water and habitats through excessive aquatic plant growth and algal blooms. Nutrient balance is needed for healthy plants and successful yields.

NUTRIENT CONTENT

The nutrient content of fertilizers and other soil additives are often presented using the nutrient's elemental symbol. For example, fertilizers display Nitrogen-Phosphorus-Potassium ratios as N-P-K ratios.

WHAT ARE THE 17 NUTRIENTS ESSENTIAL FOR PLANT HEALTH?

DEVELOPING AND FOLLOWING AN ENVIRONMENTALLY SOUND NUTRIENT MANAGEMENT PROGRAM THAT CONSIDERS THE ACTUAL NEEDS OF YOUR SOILS AND PLANTS THROUGH SOIL TESTING WILL NOT ONLY RESULT IN A HEALTHY, BOUNTIFUL HARVEST, BUT WILL HELP TO MINIMIZE EXCESS NUTRIENTS FROM CONTAMINATING NEARBY SURFACE WATERS.

The 17 nutrients essential for plant health, along with their elemental symbol (e.g., the elemental symbol for nitrogen is N), are provided below:

NON MINERAL ELEMENTS	Hydrogen (H), carbon (C) and oxygen (O) are the three primary elements that plants use in the largest amounts. Plants can obtain these elements from water, air or both. As such, the soil does not need to provide these nutrients, so they are not sold as fertilizers.
PRIMARY MACRONUTRIENTS	The following three nutrients are considered primary nutrients because they are needed in larger quantities and they are most often limiting from a crop production standpoint. Generally, they are managed by the addition of fertilizers, compost or manures to soils. • Nitrogen (N) is responsible for the growth of leaves. • Phosphorous (P) promotes root development. • Potassium (K) promotes flower and fruit development.
SECONDARY MACRONUTRIENTS	Secondary macronutrients are also needed in larger quantities, but are considered secondary nutrients because they are rarely limiting, and more rarely added to soils as fertilizers compared to nitrogen, phosphorus and potassium. These include: • Calcium (Ca) improves general plant vigor and promotes growth of young roots and shoots. • Magnesium (Mg) helps regulate the uptake of other plant foods and aids in seed-making. • Sulfur (S) helps encourage vigorous plant growth.
MICRONUTRIENTS	Micronutrients are nutrients used by plants in very small amounts in proportion to macronutrients, but are still essential to plant health. These include: boron (B), chlorine (Cl), manganese (Mn), iron (Fe), nickel (Ni), copper (Cu), zinc (Zn) and molybdenum (Mo).

WATER QUALITY BENEFIT

Understanding and identifying the specific nutrients that are needed by your crops will result in healthier plants while helping to protect surface water quality from nutrient contamination.

HELPFUL LINKS

www.ag.umass.edu/vegetable/fact-sheets/vegetable-crops
www.worldcrops.org

FACT SHEET 4.4

UNDERSTANDING FERTILIZER AND SOIL AMENDMENT TYPES

Most plants require 17 essential elements or nutrients for growth and overall plant health. Three of these (carbon, hydrogen and oxygen) can be obtained from air and water through the process of photosynthesis, however, the remaining 14 elements are derived from soils. Of these, Nitrogen (N), Phosphorus (P), and Potassium (K) are most often limiting from a crop production standpoint and require management through the addition of fertilizers, compost or other amendments to soil. The best way to determine your soil's nutrient needs is to test your soil annually.

If your test reveals that your soil needs additional nutrients, recommendations are usually provided on the quantity of nutrients to add. There are different types of soil amendments and fertilizers that can be considered, and while the nutrients will generally be processed the same way, there are several other factors that should be considered. Here we provide a description of the two most common categories of fertilizers to help you understand why fertilizers are not created equal and how your selection may provide additional benefits to your plants while reducing impacts to the environment.

FERTILIZERS VS. SOIL AMENDMENTS

We often hear the words fertilizer and soil amendment used interchangeably. Throw in the terms compost and manure and you have yourself a confusing mix of gardening terms. Fertilizers and soil amendments have two different jobs. Fertilizer is meant to feed plants – generally with one or more of the 17 essential plant nutrients. A soil amendment is used to improve the condition or structure of soil. This might be increased water retention, aeration or drainage – all making a better environment for plant roots and for soil microorganisms to thrive. Examples include compost, animal manures, worm castings, fall leaves, gypsum, straw and grass clippings. Keep in mind that some organic soil amendments such as compost and animal manure can also add nutrients to your soil and are considered to be both a fertilizer and a soil amendment.

ORGANIC OR NATURAL FERTILIZER

Organic or natural fertilizers are typically derived from plant or animal waste or powdered minerals, with minimal processing and are more likely to originate from renewable and sustainable resources. These types of fertilizers are naturally broken down over time by microorganisms found in your soil, making nutrients available over a longer period of time as opposed to all at once. Since organic or natural fertilizers need to be broken down, they can also improve the overall structure of your soil and help support microorganisms. The 'slow release' of nutrients provided with organic fertilizers can help eliminate the need for multiple applications and reduce the chances of overfertilizing plants. Compost and manure can contain a wide variety of other beneficial microbes that can also help to control plant pathogens, resulting in hardier plants.

Pros

- Environmentally friendly since often originating from renewable and sustainable sources
- Improves soil structure by promoting microorganism growth
- Slow release, less likely to "burn" grass and to runoff into waterbodies
- Often fewer applications are needed due to 'slow release' quality

Cons

- Due to slow release, may not "release" fertilizers when you want
- Generally tied to soil temperature, so effectiveness may be limited during cooler months
- Can be more expensive

CAUTION!
Just because a product is natural or organic doesn't mean it can't become a source of water pollution. Correct application techniques are essential in helping to ensure the protection of nearby surface waters.

CHEMICAL OR SYNTHETIC FERTILIZERS

Chemical or synthetic fertilizers are typically manufactured or man-made compounds, such as from by-products of the petroleum industry. Examples include ammonium nitrate, ammonium phosphate, superphosphate, and potassium sulfate. Although they are occasionally made from organic sources, they are generally water soluble, releasing nutrients to plants very quickly rather than over time. Unlike organic fertilizers, chemical or synthetic fertilizers don't support microbiological life in the soil and can actually kill off beneficial microorganisms. These types of fertilizers generally don't provide any benefit to the soil structure or overall soil health, and typically don't contain trace elements needed by plants that can become depleted after repeated plantings. While there are some synthetic slow-release fertilizers on the market, some research has found that synthetic fertilizers can contribute to a soil chemistry that discourages the natural microorganisms important to healthy soil and plant health.

Pros

- Immediate release of fertilizer, become effective quickly
- Relatively inexpensive
- Exact and consistent makeup since chemically manufactured

Cons

- Non-environmentally friendly
- Generally does not improve soil structure and can cause toxic buildup of chemicals
- Can harm microorganisms
- Don't always contain necessary soil micronutrients

QUICK RELEASE VS. SLOW RELEASE FERTILIZERS

Quick release or fast acting fertilizers are often water soluble chemicals that provide plants with immediate access to nutrients. Quick release fertilizers are usually made from synthetic material, and because they are water soluble, can easily leach into groundwater and surface runoff. Because of this they require repeated applications and as a result, become a threat to water quality. Slow release fertilizers are water insoluble and release nutrients over time making only small amounts of nutrients available at a time but over a longer period of time. Slow release fertilizers are often made from natural products and some can also contain synthetic materials.

Hobby farming with water quality in mind requires you to select and apply fertilizers and soil amendments with care. You will need to take into consideration a number of factors based on your specific site, soil and plant needs. The recommended choice is to use natural products for fertilizers and soil amendments. Overall, natural products tend to support healthy soil microorganisms while releasing nutrients a little at a time. These often can be produced right on your hobby farm in the case of compost and/or animal manure and should be considered a long-term investment in the health of your plants, soil and water resources.

WATER QUALITY BENEFIT
Natural fertilizers and soil amendments tend to pose fewer threats to water quality as long as they are applied correctly. However, even natural products can become a water quality problem if applied incorrectly or too much is used.

FACT SHEET 4.5

FERTILIZER: WHAT'S IN THE BAG

Once you have your soil test results and identify what nutrients your soil needs (if any) it is time to select a source for these nutrients. Both organic and synthetic fertilizers can supply your nutrient needs; however, many soil amendments, including compost and manure, offer several additional benefits that can make them a better choice.

CAUTION!
Whether you choose to use an organic or synthetic fertilizer – never exceed the application rate recommended in your soil test results or on the product label.

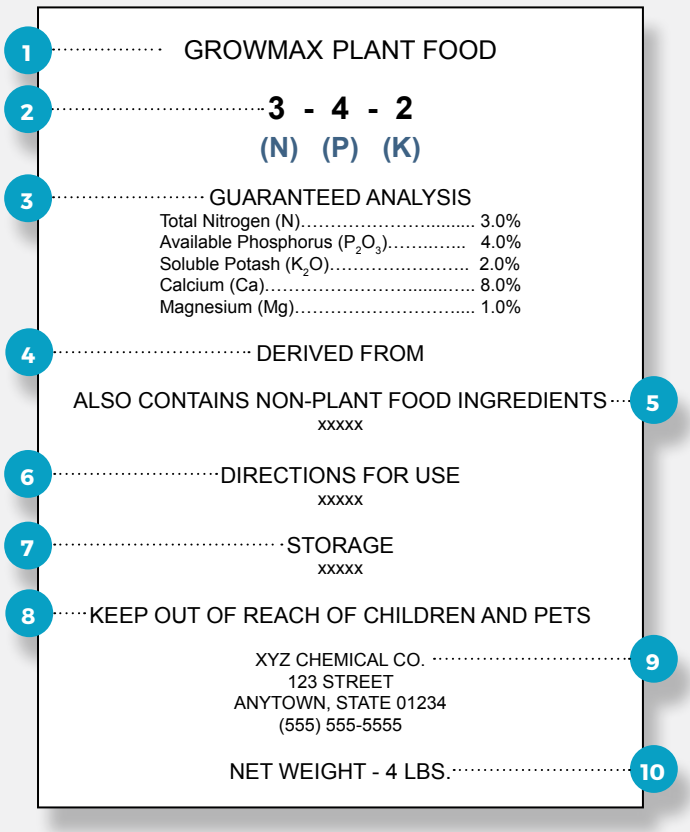
Since organic fertilizers need to be broken down by microorganisms in the soil, they are slowly released into the environment. This 'slow release' process naturally protects plants from overfertilization. It also supplies the nutrients plants need over a longer period of time compared to chemical or synthetic products that often lack this 'slow release' mechanism.

- This slow release process helps reduce the chance of nutrients leaching into groundwater or coming into contact with stormwater runoff, offering greater protection to nearby water resources. It can also decrease the number of applications needed annually, saving time and money.
- As organic fertilizers break down, they can help improve the soil structure by increasing its ability to retain water and promote healthy soil.
- Organic fertilizers are often renewable, biodegradable, sustainable, and environmentally friendly.

The following sample provides guidance on how to read fertilizer labels.

DID YOU KNOW?
Just one pound of phosphorus reaching a surface water can produce 10,000 pounds of algae and aquatic plants.

1. **BRAND NAME** – Lists the name of the product provided by the manufacturer.
2. **N-P-K RATIO OR FERTILIZER GRADE** – Fertilizer labels generally have 3 bold numbers prominently displayed that represent the minimum percentage by weight or proportion of the three primary macronutrients. Also known as the fertilizer grade, these numbers give the percentage of total nitrogen (N), available phosphorus (P) and water-soluble potash (K). Our sample label indicates that the fertilizer contains 3% total nitrogen, 4% available phosphorus and 2% water-soluble potash. Separated by a hyphen, these numbers are always in the same order and are often referred to as the N-P-K Ratio.
3. **GUARANTEED ANALYSIS** – States the minimum percentage by weight of plant nutrients in the fertilizer claimed by the manufacturer. The guaranteed analysis is industry standard information and, by law, is required to be provided on every commercial product. Note that the percentages generally will not add up to 100% since there are often other nutrients and filler products in the fertilizer. Fillers are inactive or inert ingredients that can include material to help prevent the fertilizer from drying out or reduce odor.
4. **DERIVATION STATEMENT** – Lists the sources for the nutrients in the guaranteed analysis. Look for natural organic sources such as manures and meals as well as controlled release ingredients that are often identified as pelletized, coated or called out as 'slow-release'.
5. **NON-PLANT FOOD INGREDIENTS** – Identifies material in the fertilizer that are non-plant food ingredients. For organic fertilizers, this often includes a list of good bacteria. These bacteria are important to soil health and generally are not found in chemical-based fertilizers.
6. **DIRECTIONS FOR USE** – Details how to apply the fertilizer including where, when and how much. If you have completed a soil test you may find that you need less than the recommended rate on the label. Many labels will also say where and when NOT to apply the product. This may include not applying the fertilizer if heavy rain is expected or near water, storm drains or drainage ditches.
7. **STORAGE** – Provides details on fertilizer storage such as store in a dry place.
8. **PRECAUTIONARY STATEMENT** – Includes information related to safety and product warnings.
9. **CONTACT INFORMATION** – Lists the contact information for the manufacturer, registrant or distributor of the product.
10. **NET WEIGHT OR VOLUME** – Gives the net weight or volume of product in the fertilizer container or bag.



Sample Fertilizer Label

BIGGER IS NOT ALWAYS BETTER

Fertilizers with larger numbers are often purchased by consumers with the thought that a higher N-P-K ratio means a better fertilizer. Fertilizers with big N-P-K numbers such as 30-10-15 or 18-24-12 are often synthetic in origin with much of the product wasted since plants cannot completely utilize all of the nutrients. This unused fertilizer can leach unto groundwater or runoff into nearby surface water. Lower N-P-K products that are organic in origin or slow-release can feed plants slowly over time and are less likely to impact groundwater or surface water. Remember that the best fertilizer is one that is selected based on your soil test results so that it can meet all your soil and plant needs.

COMBINATION PRODUCTS

Never use combination products such as those that contain fertilizers with pesticides or fertilizers with herbicides (sometimes called 'Weed and Feed'). Although most often marketed for lawncare, combination products can sometimes be found in the general garden section in stores. If you happen to need a fertilizer along with an herbicide or pesticide, carefully select these products separately. This gives you greater control over the individual product along with how much, when and where you apply it.

SKIP THE BAG

Better yet, skip the fertilizer bag and consider using compost and/or aged animal manure instead of commercially purchased fertilizer to add nutrients to your soil. These types of materials might be available right from your own hobby farm or can often be purchased locally. Using compost or manure can recycle material and provide tremendous boosts to soil health and the living microorganisms within, as well as improve water quality by reducing the potential for erosion of excess nutrients into waterbodies.

NUTRIENT	COMMONLY AVAILABLE ORGANIC SOURCES
NITROGEN (N)	blood meal, composted chicken manure, soybean meal, cottonseed meal, alfalfa meal
PHOSPHORUS (P)	rock phosphate, bone meal, bat guano
POTASSIUM (K)	potash (of muriate or sulfate), greensand, granite dust, seaweed/kelp meal, sul-po-mag

WATER QUALITY BENEFIT
Fertilizers can be a major source of water pollution. Basing fertilizer applications on soil test results and using organic sources helps protect nearby surface waters.

FACT SHEET 4.6

KEEPING NUTRIENTS IN YOUR SOIL: ALTERNATIVE PLANTING METHODS

While fertilizers provide a great source of nutrients to your soil and plants, if used incorrectly, they can have detrimental impacts to both your plants and nearby water resources. The first step in determining your nutrient and fertilizer needs is to perform an annual soil test. This provides you with your soil's nutrient needs based on the types of crops you plan on growing.

A NEW SOIL TEST SHOULD BE CONDUCTED EACH YEAR TO DETERMINE THE APPROPRIATE AMOUNTS AND APPLICATION RATES OF FERTILIZERS TO MEET YOUR GROWING NEEDS. THIS IS IMPORTANT, BECAUSE AS YOUR CROPS GROW, THEY WILL DEPLETE THE SOIL OF CERTAIN NUTRIENTS REQUIRED FOR THAT PLANT TO THRIVE. THESE NUTRIENTS WILL NEED TO BE REPLENISHED FOR FUTURE SUCCESSFUL HARVESTS.

By incorporating some simple cultivation practices into your hobby farm nutrient management plan, you can reduce the depletion of nutrients in your soils. This in turn can reduce the amount of fertilizer you need to add each year, saving you time and money, while helping to protect our environment and water resources. Consider keeping nutrients in the soil by using one or more of the following methods.

CROP ROTATION

Crop rotation is the practice of growing plants in different areas of your garden or field each year. Growing the same types of plants or plant families in the same place each growing season can deplete your soil of the nutrients preferred by that crop on a yearly basis. By rotating where you plant your crops, they are better able to utilize the different types and amounts of nutrients in the soil and have a better chance of interrupting any type of disease or pest cycle. Additionally, some plants routinely leave behind nutrients in the soil which can often be used by other types of crops. For example, it makes sense to plant crops like lettuce that use lots of nitrogen in an area where nitrogen fixing legumes like peas were planted the year before. Similarly, heavy feeders like tomatoes can be followed by light feeders such as herbs and root crops.

DID YOU KNOW?
The 'three sisters' is a Native American companion planting technique where corn, beans and squash are grown together. Each crop or 'sister' contributes to the planting. Corn provides support for the climbing beans; beans add nitrogen to the soil; and the large prickly squash leaves near the ground help keep out predators while shading the soil, keeping it moist and preventing weeds.

ALTERNATIVE PLANTING METHODS SUCH AS THESE CAN:

- **Increase plant health, soil fertility, soil structure and yeilds**
- **Reduce fertilizer use, pests, stormwater runoff and erosion**
- **Maintain a small fruit orchard**
- **And many more...**

SUCCESSION PLANTING

Succession planting works similarly to crop rotation as it introduces several types of plants into one area, using different nutrients and boosting soil structure. Succession planting is the practice of replacing short season crops with a new crop in the same location. For example, quick growing lettuce and radishes can be harvested early in the growing season and immediately replaced with a longer growing crop such as tomatoes. Another way to keep nutrients in your soil is to consider planting a cover crop after you harvest, such as clover or alfalfa. This crop will help prevent soil erosion and add nutrients back into your soil.

INTERCROPPING

Similar to succession planting, intercropping involves planting a short season crop together with a long season crop. Instead of planting them one after another like succession planting, they are grown next to each other with the idea that the short season crop will be harvested prior to the long season crop that requires more space and nutrients for growth. For example, you may want to consider planting quick growing lettuce adjacent to pumpkin plants; the lettuce can be harvested early, freeing up room for pumpkin plants.

COMPANION PLANTING

Companion planting involves the planting of two or more different crops close to each other for their mutual benefit. It is thought that certain plants work well with others with the idea that their specific properties will benefit one another. For example, planting different but carefully selected crops in proximity to one another can assist in nutrient uptake, pest control, pollination, and/or other factors necessary for reducing pest damage and/or increasing crop productivity.

HELPFUL LINKS

www.ag.umass.edu/resources/home-lawn-garden/fact-sheets/vegetable
www.ag.umass.edu/home-lawn-garden/fact-sheets/companion-planting-in-vegetable-garden

FACT SHEET 4.7

PLANT MATERIAL COMPOSTING

As a hobby farmer, you may find yourself with an abundance of organic material throughout the year. Spoiled fruit, vegetable waste, spent garden plants, animal bedding, grass clippings and autumn leaves are just a few of the sources of organic material that can be found on a hobby farm. All of this can add up to a lot of material on a daily, weekly and monthly basis creating a significant amount of work, time, and often money to dispose of. One way to recycle this material is composting.

WHAT IS COMPOSTING?

Composting is the process of decomposing organic material by combining specific ingredients in an ideal environment for microorganisms to break down. As a result, organic material is turned into a nutrient rich soil amendment that you can spread in your garden or farming areas. Composting and decomposition are the same process – both occurring naturally when living materials die, except composting takes place in a controlled environment where material can be collected and reused. Compost is often highly sought after since it is generally organic in nature, builds soil structure and is high in nutrients. Composting organic material can:

- Recycle organic material
- Reduce your overall solid waste volume and disposal costs
- Help keep organic yard waste out of waterways
- Kill disease causing pathogens
- Create a valuable soil amendment
- Enrich soil structure that can increase water retention and reduce soil erosion
- Decrease your fertilizer budget

BUILDING A COMPOST BIN

There are many different ways to compost your organic material. Homemade compost bins can be made of recycled material you might already have around your hobby farm such as discarded wooden pallets, chicken wire, mesh screens or concrete blocks. Compost bins are also available from local garden centers and online catalogs with dozens of different sizes and designs commercially available.

Additionally, many Massachusetts municipalities have compost bin programs, where they sell compost bins to residents at or below retail costs. See the following link to see if your community participates in a compost bin distribution program (www.mass.gov/eea/agencies/massdep/recycle/reduce/get-a-low-cost-rodent-resistant-compost-bin.html).

When deciding on how large of a compost pile you would like to maintain, keep in mind how much time, space and material you will have to dedicate to composting.

LOCATION, LOCATION, LOCATION

It's important to locate your compost bin in an area that is flat, dry and easily accessible so that you can add material and manage your pile easily. If it's not in a convenient location or if you need to carry your organic material long distances to your bin, you'll be less inclined to manage your pile. In any case, make sure your compost area is away from both groundwater wells and surface water and preferably covered.

HOW DO I COMPOST?

Composting is all about creating an environment for good microorganisms to thrive so they can help decompose your organic material. To do this your decomposers need the following:

- **Food** – your compost should be made up of organic material with layers of 'brown' – high carbon organic material and 'green' – high nitrogen organic material. Ideally use approximately three-parts of brown material to one-part green material.
- **Air** – the microorganisms in your compost pile need air. Turn or mix your compost pile often - weekly or even a couple times per week to speed up the process.
- **Moisture** – your compost pile needs moisture to work – it should be damp but not dripping wet. If your compost pile becomes dry – just mix in some water.
- **Heat** – sunlight provides the heat needed to help create that perfect environment for decomposition and to help make sure that any harmful organisms are eliminated. This is why the composting process tends to slow down during the winter months.

WHY COMPOST?

Composting organic material on your hobby farm can significantly reduce the volume of solid waste that may otherwise need to be disposed of while generating a nutrient rich material that you can reuse. It's recycling at its best!

CAUTION!
DO NOT COMPOST diseased plants; food scraps containing meat, fat, oil or butter; hazardous material; pressure treated lumber; inorganic material; weeds or invasive plant species; plants/clippings containing herbicides; or pet waste. It is possible that some of the above materials can be composted however very specific temperatures, intensive compost management and alternative methods are often needed. It is recommended that these materials not be used in a typical hobby farm compost system to help ensure a healthy and safe compost.

Common Compost Material

COMMON 'GREEN' MATERIAL	Spent plants, fruit and vegetable waste, grass clippings, seaweed, blood meal, egg shells, coffee/tea grounds, animal manure* (cow, horse, pig, sheep, chicken, rabbit), hair and feathers, nut shells
COMMON 'BROWN' MATERIAL	Dried leaves, shredded newspaper, animal bedding*, straw/hay, wood chips/ash, cornstalks, saw dust, pine needles

* Note that if you are composting animal manure with bedding, you may need to add an additional source of nitrogen such as grass clippings, blood meal or chicken manure.

Smaller material composts quicker so consider breaking up any larger material in your compost pile if you're looking to speed up the composting process.

Basic Composting Steps

The following are basic composting steps:

Step 1

Select your composting location.

Step 2

Build (or buy) your bin.

Step 3

Add your green and brown organic material.

Step 4

Turn your pile often.

Step 5

Keep it moist and covered.

WATER QUALITY BENEFIT
Composting organic material not only keeps it out of waterways but recycles material into a valuable soil amendment for your garden.

Plan ahead and build a compost bin that has a removable top - this is where you'll add new materials for compost. Have one side of the bin that is open towards the bottom - this is where you'll take your completed compost from. Make sure you can fit a shovel in through the opening!

HOW DO I KNOW WHEN I'M DONE?

Finished compost is generally a crumbly, dark brown soil that is light in weight with an earthy smell. You can screen your compost and return the larger material to start your next batch of compost. The amount of time it takes to create finished compost will vary depending on the volume and type of organic material you use, climate, and how often you turn your pile. Most compost can be ready to use in 3-6 months.

HOW CAN I USE MY FINISHED COMPOST?

Compost is a rich organic material that is high in nutrients which is why it's sought after by gardeners. Compost can be used in all types of gardens throughout the year. Using compost can often reduce or eliminate the need to use certain fertilizers. Completing a yearly soil test can help you determine what nutrients your garden crops need. Adding compost can also help build healthy soil structure that can support soil microorganisms that are important in keeping pests and disease away.

BE INNOVATIVE

Did you know that one pound of worms can eat up to ½ pound of organic material per day? Ideal for those looking to compost in small areas or even indoors, vermicomposting is the process where worms digest organic material and the products – worm castings – are highly nutritious compost. For more info on vermicomposting, visit: http://www.mass.gov/eea/agencies/massdep/recycle/reduce/vermicomposting-indoor-composting-with-worms.html#Wherecanlgetawormbin.

HELPFUL LINKS

www.ag.umass.edu/crops-dairy-livestock-equine/fact-sheets/waste-management-composting
www.howtocompost.org
www.mass.gov/eea/agencies/massdep/recycle/reduce/composting-and-organics.html

FACT SHEET 4.8

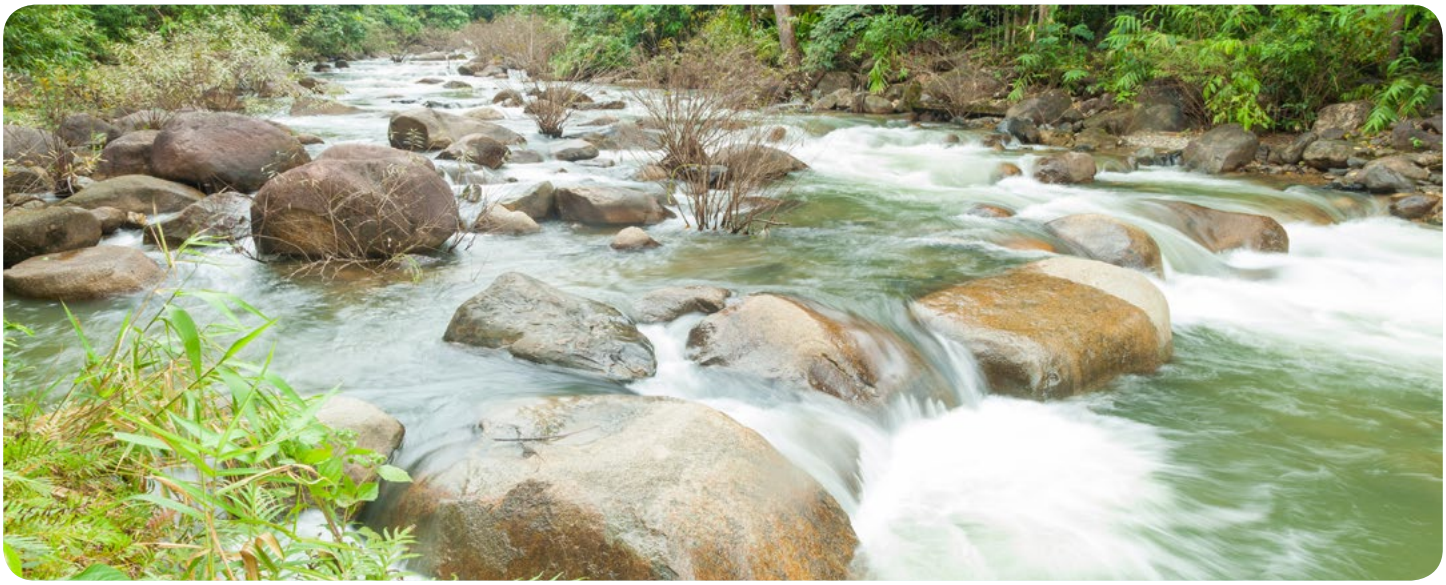
NUTRIENT AND SOIL AMENDMENT APPLICATION

Hobby farmers growing crops may find the need to add nutrients and amendments to the soil. Fertilizers directly affect plant growth by adding nutrients to the soil, while soil amendments improve the physical condition of soil.

Fertilizers and soil amendments are available in both organic and synthetic varieties and include manure and composted garden material. Depending on the source, some of these materials can provide both nutrients and improved soil structure when applied. No matter what type of crops you are growing, the addition of fertilizers and soil amendments may be necessary for healthy plants and a successful harvest.

SURFACE WATER PROTECTION

Fertilizers and soil amendments are valuable to your plants and soil, but if applied improperly can become a source of significant water pollution. If transported to nearby wetlands and waterways, these materials can become a source of water contamination.



REGULATORY CHECK

Many communities and some state agencies now have regulations limiting nutrient application near surface waters. Contact your local Conservation Commission for additional information.

STAY ON TRACK
Annual soil testing is essential in determining what your soil and crops need for a successful harvest.

Consider the following when applying a nutrient source or soil amendment to your garden or fields:

Quantity

Hobby farmers are encouraged to complete a soil test prior to the application of any nutrient source or soil amendment regardless if it's for your vegetable garden or forage crops. Soil test results will specify what type of nutrient or soil amendment is needed for your crop or field and how much you need. Over-application of these products can harm plants, reduce good microorganisms in the soil that help fight pests and disease, and lead to nutrient and pathogen transport into nearby water bodies. Read product labels and carefully apply quantities according to recommended amounts in your soils testing report.

Weather Conditions

Timing your application is important since current and future weather conditions can dramatically influence the chances of erosion and runoff. Do not apply fertilizer or soil amendments prior to or during significant rain events. Similarly, avoid heavy winds where odor and material can be blown off-site.

Time of Year

The application of nutrients and soil amendments should not be done during the winter months when the ground is frozen or snow covered. These conditions can increase the risk of contamination in stormwater runoff and prevent the incorporation of applied material into the soil.

Slopes

Steeply sloping areas are particularly vulnerable to erosion and runoff, so be sensitive to the quantity of fertilizers and soil amendments you're applying to these areas. Consider planting vegetative buffers between slopes and water resources.

Buffers

Vegetated land between your area of nutrient application and surface water can help intercept stormwater runoff. These buffers become particularly important in sloped areas. The closer fertilizer and soil amendments are applied to water resources, the higher the risk of contamination. Maintaining vegetated buffers between these areas is essential to protecting nearby water quality.

Avoid nutrient and soil amendment over-application by following these tips:

- Conduct an annual soil test and follow the recommendations
- Carefully read fertilizer and soil amendment labels
- Calibrate and test application equipment settings
- Discard excess fertilizers and soil amendments according to label instructions – avoid the temptation to use what's leftover unless needed
- Develop a comprehensive and realistic management plan for manure (if you have animals)

NEVER DUMP EXTRA FERTILIZER OR SOIL AMENDMENTS ON YOUR FIELDS, IN A STORM DRAIN OR WATERBODY!

DID YOU KNOW?
Fertilizers add nutrients to the soil while soil amendments improve the physical condition of the soil.

COMPOSTED VS. UNCOMPOSTED (FRESH AND AGED) MANURE

Using manure as a fertilizer source is a great way to recycle nutrients back into the earth and improve soil structure. Composted, fresh, and aged manure can achieve this and all are often readily available to hobby farmers. There are a number of advantages and disadvantages that should be considered when deciding which is right for your hobby farm. Notably, most composted manure has been through the carefully controlled process of decomposing fresh manure at high enough temperatures to kill harmful pathogens. Since fresh and aged manure typically have not been brought to temperatures high enough to eliminate harmful pathogens, it is not recommended that they be applied to areas in edible plant gardens. In contrast, the above forms of manure in most cases can be safely used on hayfields as long as the recommendations regarding quantity, weather, time of year, buffers and slopes are considered.

FRESH OR AGED (UNCOMPOSTED) MANURES SHOULD NOT BE USED NEAR EDIBLE CROPS.

HELPFUL LINKS
www.extension.unh.edu/resources/representation/Resource002114_Rep3119.pdf
www.ag.umass.edu/crops-dairy-livestock-equine/fact-sheets/prioritizing-fields-for-manure-application

CHECKLIST 4A

NUTRIENT MANAGEMENT FOR WATER QUALITY

Use the following questions to help guide your hobby farm nutrient management decisions:

1. Do you test your soil annually through the UMass Amherst Soil Lab (or similar NRCS Extension lab)?

☐ YES ☐ NO If NO, see Fact Sheet 4.2 for sampling method and lab contact information.

2. Do you base your use of fertilizers and/or soil amendments on the results of a recent soil test?

☐ YES ☐ NO If YES, what are the soil test recommendations for fertilization?

_____

If NO, this is highly recommended to ensure an ideal soil nutrient balance and avoid over-fertilization.

3. If fertilizer is recommended by a soil test, do you use organic or natural fertilizers or a soil amendment such as compost or composted manure?

☐ YES ☐ NO If YES, have you selected your organic/natural fertilizer based on the specific nutrient needs of your soil? (See Fact Sheet 4.5 organic fertilizer sources that are best for addressing deficiencies in soil).

_____

If NO, which organic fertilizers would be appropriate for your soil?

_____

4. Which of the following cultivation practices are, or could be, applied to your hobby farm to reduce fertilizer use and better manage soil nutrients? Describe as applicable.

☐ CROP ROTATION ☐ SUCCESSION PLANTING ☐ INTERCROPPING ☐ COMPANION PLANTING

_____

_____

5. Do you produce your own compost?

☐ YES ☐ NO If NO, see Fact Sheet 4.7 for tips on getting started!

6. Do municipal or state regulations restrict the application of fertilizer on your hobby farm?

☐ YES ☐ NO If YES, list the applicable restrictions.

_____

_____

_____

SECTION FIVE

ANIMAL MANAGEMENT FOR WATER QUALITY

Proper pasture and animal yard management is an important component to a successful hobby farm to support healthy animals and sustainable land management practices.

The use of pastures and animal yards by livestock, horses and other farm animals can cause significant land disturbance resulting in soil erosion, stormwater runoff and the pollution of nearby water resources. Good animal management includes taking measures to address the following:

- **Space** – adequate space for animals is essential, both outdoors and indoors
- **Grass and Grazing** – manage grass and grazing to prevent overgrazing and erosion
- **Manure** – develop a successful manure management plan
- **Mud** – properly implement mud management practices
- **Water Resource Areas** – manage shoreline areas for water quality protection
- **Fencing** – develop techniques to keep animals where you want them
- **Water Supply** – provide suitable water sources, other than streams and ponds

Section 5 contains the following Fact Sheets:

- FACT SHEET 5-1 Animal Space Needs
- FACT SHEET 5-2 Grazing and Grass Management
- FACT SHEET 5-3 Mud Management
- FACT SHEET 5-4 Manure Management
- FACT SHEET 5-5 Manure Composting
- FACT SHEET 5-6 Controlling Animal Access to Waterways: Fencing
- FACT SHEET 5-7 Controlling Animal Access to Waterways: Waterway Crossings
- FACT SHEET 5-8 Controlling Animal Access to Waterways: Alternative Water Sources
- CHECKLIST 5A Animal Management for Water Quality

Many of the hobby farm management techniques in these fact sheets are aimed at reducing soil erosion and sediment transport that may make its way to nearby water resources. Hobby farm erosion and sedimentation controls should be based on reducing the amount of precipitation, snow melt and stormwater runoff that reach erodible areas and potential contamination sources. Simple disconnection practices, buffers and barriers can help eliminate runoff from coming into contact with transportable materials such as bare soil, manure, mud, fertilizers and other chemical compounds found on hobby farms.

FACT SHEET 5.1

ANIMAL SPACE NEEDS

Small acreage hobby farms are often located in higher density areas with residential neighbors rather than in rural, less populated areas. Lacking the wide protective buffers that larger and more rural farms often have, hobby farms can be located not only close to neighbors but close to surface waters such as ponds, streams, and coastal waters.

Despite the smaller land area, a wide range of animals can be found on hobby farms. Proper land management is essential to ensuring that farming activities are sustainable and compatible with surrounding land uses to protect water quality, as well as to provide for the health and well-being of your animals.

WHAT IS MY STOCKING RATE?

Your hobby farm 'stocking rate' is how many animals your property can support and reasonably sustain. The number of animals that your hobby farm can safely support is based partially on your (and your land's) ability to:

- Provide feed and water
- Manage manure
- Provide access to pasture and exercise areas
- Provide shelter
- Manage your land

One of the largest sources of surface water pollution originating from hobby farms comes from those farms that cannot support the number of animals on them. Too many animals living in too small an area can produce more manure than can be properly managed and cause pastures to be overgrazed and eroded. Both of these problems can increase the chances of sediment, nutrients and harmful bacteria being carried by stormwater runoff and polluting nearby waterbodies.

Keep in mind that not every hobby farm utilizes pasture. However, if your hobby farm does not contain pasture, then supplemental feed must be purchased (and stored). Also, your animals will still require an adequately sized exercise yard and you will need a realistic manure management plan to support your animals.

REGULATORY CHECK
Some communities have local bylaws or regulations that limit the number of animals per acre or require a certain acreage per animal. Visit your Town or City Hall for more information on specific rules that might apply.

HOW MUCH PASTURE IS NEEDED?

If you are utilizing pasture for feed then you need to ensure that you have adequate managed area for this purpose. Pasture areas differ from livestock yards, paddocks and turnout areas in that pastures provide some or all of the food (forage crops) during the growing season for grazing animals. While these other areas are generally smaller in size without substantial vegetation, a well maintained, well vegetated pasture is important to long-term pasture use, the protection of nearby surface water quality and overall animal health.

The general consensus is that one to two well managed acres of quality land is recommended for each 1,000 pounds of livestock or animal. Based on average weights, this translates into approximately:

- 1 horse or cow per 1-2 acres
- 2 small ponies per 1-2 acres
- 4-6 sheep or goats per acre
- 2-3 llamas per acre
- 4-6 alpacas per acre
- 2-5 pigs per acre

The above stocking rates are only an approximation, as every location is unique and animal needs differ. The number of animals your hobby farm is able to support will depend on various factors. For instance, pastures that have bare ground, weeds, areas that animals won't graze, slow plant growth, soil compaction, erodible sloped land and other problem areas will support fewer animals. High quality and fast-growing pastures, rotational grazing and supplemental feeding can help increase the number of animals your hobby farm can sustain in an environmentally friendly manner.

WHAT ABOUT SHELTER?

Your animals will also need shelter from adverse weather, especially during the cold and snowy winter months, but also to protect them from the hot summer sun and during windy days. This could be in the form of a barn or a 3-sided lean-to structure. Shelter should ideally be located on top of a slight rise so that stormwater does not run into the structure, and if open sided, should face south to avoid facing prevailing wind directions.

THE RESPONSIBLE HOBBY FARMER SHOULD KNOW ABOUT THE SPACE NEEDS OF EACH TYPE OF ANIMAL KEPT ON THE HOBBY FARM, INCLUDING SPACE NEEDED FOR MANURE MANAGEMENT AND THE STORAGE OF FEED, BEDDING AND EQUIPMENT.

HELPFUL LINKS
www.extension.unh.edu/resources/files/Resource000471_Rep493.pdf
www.ag.umass.edu/crops-dairy-livestock-equine/fact-sheets/basics-of-pasture-management
www.ag.umass.edu/crops-dairy-livestock-equine/fact-sheets/livestock-grazing-stocking-rates
www.ag.umass.edu/crops-dairy-livestock-equine/fact-sheets/livestock

FACT SHEET 5.2

GRAZING AND GRASS MANAGEMENT

Many hobby farmers see themselves as “grass farmers” when approaching grass and grazing management. It is important to manage pasture grass and grazing activities to meet the nutritional needs of your foraging animals while maintaining pasture health for long-term viability.

Maintaining proper grass height and resting pastures long enough for grass regrowth contribute to a healthy and lush pasture. Paying particular attention to grass height and grass regrowth, using techniques such as rotational grazing, can ensure a well vegetated pasture and can help keep soil stabilized, reduce soil erosion and protect nearby surface water quality.

GRASS GROWTH

Proper grass growth and care can provide a sustainable source of forage for your hobby farm livestock. Unlike most trees and shrubs that grow from the outer tip of their branches, grass generally grows from the crown, or base of the plant. If grass is grazed too close of the ground, its roots lose the ability to store energy, the crown can be permanently damaged and grass may not regrow. Remember that you need grass to make grass.

Adapted from Managing Small Acreage Pastures During and After Drought. Natural Resources Series, Fact Sheet No. 6.112, Colorado State University, December 2014. Comprehensive Environmental, Inc. © 2017

GRAZING HEIGHT

Optimal grazing height will vary based on the type of grass and how selective the grazer, but in general, pasture vegetation should be grazed at a height of 6 to 8 inches and stopped at a height of around 3 to 4 inches. This can be thought of as ‘take half the grass height and leave half the grass height’ concept. Although this can be difficult with grazers that are selective, grasses grazed down to the crown can decimate a pasture leaving little grass for regrowth.

DID YOU KNOW?
Many farm animals eat approximately 2% to 3% of their body weight every day. This means that a 1,000-pound cow or horse could eat as much as 30 pounds of food or more every day.

MOWING

Selective grazers will consume their preferred grass while leaving others. Periodically mowing your pasture as needed to a height of 6 to 8 inches will help maintain vegetative growth. Mowing can help thwart weed growth by preventing weeds from going to seed.

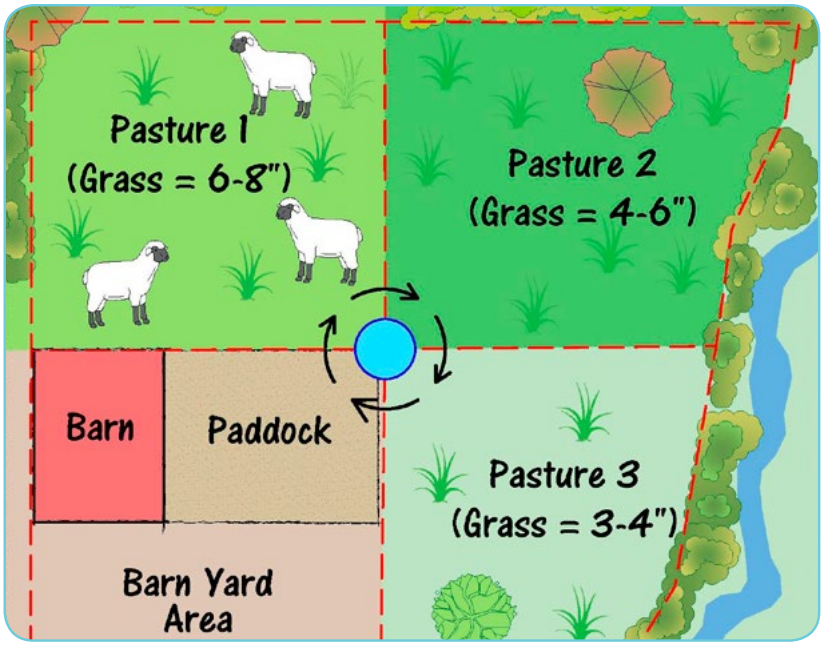
OVERGRAZING

Overgrazed pastures most often occur when they are overstocked (too many animals are being supported by too little land) and pastures are not given the rest period needed for grasses to properly regrow. The quantity and quality of poor grass regrowth will not meet the nutritional needs of the animal. Grass that is consistently grazed too low will eventually die, causing bare spots. The heavy hoofs of horses and livestock on these unvegetated areas will lead to soil compaction and erosion. Consider rotational grazing practices that give pastures a rest period between grazing.

ROTATIONAL GRAZING

Rotational grazing or pasture rotation is when animals are rotated through several pastures or segregated areas rather than being allowed to continuously graze on one large pasture. Dividing your pasture into two or more smaller pastures gives you better control over how long your animals forage each area.

Start them in a pasture that has a grass height of 6-8 inches. When that height is reduced to 3-4 inches, rotate them into another pasture. Depending on the season, amount of rain, and number of animals you need to support, the grass in your starting pasture may or may not be at grazing height (6-8") when you complete the rotation. If not, then animals should be fed supplemental feed and kept in alternative areas (paddock, livestock yard, exercise area) until pasture grass has grown to an appropriate height to begin grazing again.



Periodically inspect your hobby farm pasture(s). Look for bare areas that need seeding, weed species (and those that might be poisonous) that should be removed and erodible areas that could be addressed with stormwater management techniques (see Section 6).

WATER QUALITY BENEFIT

Good grazing and grass management practices not only help sustain strong pastures to support healthy animals but will help to maintain a solid vegetative cover. This cover can help minimize soil erosion and runoff while acting as a filter to help keep nutrients onsite and slow pollutants from reaching nearby waterways, and protecting water quality.

FACT SHEET 5.3

MUD MANAGEMENT

At one time or another almost every hobby farm with animals has had to deal with mud. Soil mixed with water, and in many cases manure, creates mud. Similar to manure, mud can harbor pathogens and become breeding grounds for pests.

Mud can create unsanitary conditions for both animals and humans while becoming a significant threat to water quality. Mud management is a must and requires a solid commitment to managing your pasture, livestock yard, animal manure, erosion control and water supply activities.

In addition to small pastures, hobby farms that support livestock often have a livestock yard (sometimes also referred to as an exercise area, riding ring, feedlot, pen, corral or paddock although there are sometimes slight differences among each of these terms). Unlike pastures, these smaller areas do not provide forage for animals but instead are often spaces used daily for feeding, handling, exercising and loafing. Generally located near the barn or covered animal shelter, these high-traffic areas tend to have bare ground making them a source of mud and concentrated animal waste that can pose a risk to animal health and water quality.

Mud can be a persistent problem for a hobby farmer, but it doesn't have to be with proper planning and management. Mud is not just an annoyance, it can create a number of serious problems for the hobby farmer including:

- Creating unsafe footing for animals and humans
- Harboring disease causing pathogens
- Producing a breeding ground for insects
- Damaging animal hooves and harm digestive systems
- Being a source of concentrated manure
- Compromising nearby water resources through stormwater runoff

REGULATORY CHECK

Massachusetts drinking water regulations (310 CMR 22.00) prohibit the stabling, hitching, standing, feeding or grazing of livestock or other domestic animals within 100 feet of the bank of a surface water source or tributary and prohibit people from allowing or causing any animal to go into, or upon, any surface water source or tributary thereto.

HOW TO MANAGE MUD

REMOVE MANURE	Areas should be cleaned of manure every 1-3 days depending on weather and accumulation rates to maintain a healthy environment. Manure holds moisture, a key component to mud. Removing it regularly can help reduce the production of mud.
APPLY FOOTING MATERIAL	Problem areas should be cleared of mud and replaced with suitable footing material such as gravel, chipped wood products or a combination of both.
DIVERT RAINWATER	Runoff from nearby slopes, roofs, driveways or other impervious areas should be directed away from pastures, animal yards and anywhere else manure accumulates. Easy to install solutions such as gutters and downspouts with flexible extensions from roofs, or strategically located ditches and berms located up-slope from animal yards can help redirect water away from mud prone areas.
PROVIDE COVER	Portions of small livestock areas can often be covered and water diverted away from problem areas. Covering these areas can help prevent rainwater from mixing with manure and soil.
PLANT A TREE	Trees require a lot of water and since water is a major ingredient of mud, then adding trees near your problem area can help alleviate mud concerns. Trees are able to not only take in water through root systems, they can actually intercept rainwater on leaves and stems during a storm. Both of these actions can help reduce the amount of water that reaches pastures and livestock yards.
RESTRICT RESOURCE AREA ACCESS	Animals with direct access to wetlands, streams, ponds, floodplains and other resource areas can damage natural vegetated buffers and create bare areas. Combine these naturally wet areas with the addition of manure and disturbed soils and the making of mud is inevitable. Measures should be taken to prevent animals from gaining access to water resources.

CONSIDER ASSESSING YOUR HOBBY FARM FOR VULNERABLE AREAS SUSCEPTIBLE TO MUD AND DEVELOP A MUD MANAGEMENT PLAN. REMEMBER THAT YOUR MUD MANAGEMENT PLAN MAY VARY DEPENDING ON THE TIME OF YEAR.

WATER QUALITY BENEFIT

Managing mud significantly reduces the chances of runoff contamination from reaching nearby waterways and helps to maintain a healthy environment for both humans and animals.

FACT SHEET 5.4

MANURE MANAGEMENT

All animals produce manure, so manure management is a large part of caring for animals on a hobby farm. Animal manure contains pathogens and nutrients that, if mixed with stormwater runoff, can pollute nearby surface waters.

Poor manure management not only puts waterways and drinking water at risk but exposes animals and humans to harmful pathogens. Pathogens include bacteria, viruses and parasites, all of which can cause significant short and long-term health impacts.

CLEAN UP

Manure should be removed about every 1-3 days from all animal areas to minimize health risks depending on weather and accumulation rates. Frequent manure removal helps to prevent mud and breeding grounds for pests while reducing pollutants that can mix with stormwater runoff. Animal areas free of manure make for a sanitary and healthy environment for everyone.

REDUCTION

Although it's unlikely you'll reduce the total amount of manure your hobby farm produces without reducing the number of animals, you can reduce your overall stall waste by using less bedding or a more absorbent bedding.

STORAGE

Manure storage areas should be located carefully to prevent material from washing into nearby waterways or storm drain systems.

- **Find a dry, level spot** – manure storage should be located away from floodways, slopes, and waterbodies to reduce runoff and potential contact with surface water. A dry, level spot on an impermeable surface such as poured concrete or a liner can work well.

WATER QUALITY BENEFIT

Timely cleanup of animal manure, suitable storage, and proper disposal are three effective ways to help prevent manure from mixing with precipitation and runoff that can contaminate nearby surface waters.

- **Slope** – locate storage areas downslope of drinking water wells, catch basins, storm drains, animal watering areas, edible plants or gardens, and waterbodies (if possible), making it less likely for stormwater to wash manure into nearby surface waters.
- **Cover it up** – manure should be covered to prevent mixing with precipitation. A roof, weighted tarp or even a covered dumpster can achieve this.
- **Divert water** – help keep water from mixing with your manure storage by diverting roof and surface runoff to areas that can help infiltrate the water back into the ground. Redirecting runoff to well vegetated or crushed stone areas can help slow and infiltrate this excess water.
- **Buffer** – creating a vegetated buffer around your manure storage area will help infiltrate drainage and reduce stormwater runoff entering and exiting your storage area.
- **Maintain access** – if you plan on eventually disposing of manure using equipment such as a small front loader, bobcat, or similar vehicle, then make sure your storage area is easily accessible by the size of equipment you plan on using. Also, select a material such as crushed stone to place in heavily traveled areas leading up to your storage area. This along with a suitable cover can help prevent erosion and reduce mud.

DISPOSAL

A reliable manure disposal system can help eliminate overflow and keep it from becoming a threat to you, your animals and nearby surface waters. Depending on the amount of manure your hobby farm produces, disposal generally involves one or more of the following methods:

- Compost it
- Apply it to pastures
- Give it away
- Hire a manure hauler/disposer to remove it
- Find an off-site disposal or compost facility to bring it to

Since each of the above disposal methods has its advantages and disadvantages with varying financial costs, you may want to consider implementing several at various levels.

Remember that a successful manure management plan includes manure clean-up, reduction, storage and disposal and a plan lacking one of these individual elements can lead to failure. Although keeping up with manure management can be tedious at times, the cost of not implementing a proper program can put the long-term health of your animals and viability of your hobby farm at risk.

PLAN AHEAD

Manure can pile up quickly! A 1,000-pound animal can produce well over 50 lbs. of manure per day, exceeding 18,000 lbs. of manure each year. Plan ahead and create an area large enough to store manure, bedding and feed waste for a year or more. This pile may be bigger than you think!

REGULATORY CHECK

According to the MA Watershed Protection Act (313 CMR 11.00), uncovered outdoor storage of manure is not allowed if your hobby farm is located within certain areas of the Quabbin, Ware River or Wachusett watersheds. To determine if you are located in this area or for more information on specific restrictions see the following link: www.mass.gov/eea/agencies/dcr/water-res-protection/watershed-mgmt/the-watershed-protection-act.html#ForFurtherInformation

FACT SHEET 5.5

ANIMAL MANURE COMPOSTING

Hobby farms that support animals find that efficient manure management is essential to upholding a healthy farm environment, protecting water quality and maintaining good neighbor relations. One of the most challenging steps to manure management can be disposal. Many hobby farmers find that composting is a good way to safely and efficiently reduce and recycle animal manure.

WHY COMPOST MANURE?

Composting animal manure can save money and time and generate a nutrient rich material that you may be able to use in other areas of your farm such as your pastures or in your vegetable gardens.

WHAT IS COMPOSTING?

Most organic matter, including manure, will naturally decompose. The process of composting speeds up this decomposition process by providing an ideal environment for microorganisms to break down manure and create a nutrient rich soil mixture. Compost can be a highly sought-after nutrient source and soil amendment for gardens and pastures since it generally is organic in nature and can build soil structure for plant growth.

Composting manure can:

- Reduce and recycle animal manure
- Reduce animal manure disposal costs
- Decrease your manure pile size and storage area
- Help keep nutrients out of waterways
- Kill disease causing pathogens
- Create a valuable soil fertilizer/amendment
- Enrich soil structure that can increase water retention and reduce soil erosion
- Decrease fertilizer amounts and costs

WHAT TYPE OF MANURE CAN I COMPOST?

Many types of animal manure are suitable for composting on a hobby farm, but not all. Manure from farm animals such as horses, cows, poultry, and llamas/alpacas along with bedding material such as straw, sawdust, wood shavings, and hay are all good composting material. Do not compost dog, cat or human waste as this material requires very high temperatures for a sustained amount of time to rid the material of harmful pathogens.

CAUTION!
DO NOT COMPOST dog/cat manure or human waste; manure from diseased animals; or meat or animal products.

WHERE CAN I PUT MY COMPOSTING OPERATION AND DO I NEED A SPECIAL COMPOST CONTAINER?

Although there are many commercial compost containers on the market, these are often more suitable to compost kitchen scraps and small amounts of yard waste. If your hobby farm has one or more larger animals you will need a space big enough to handle multiple compost piles. Your compost pile should be on an impervious surface such as a concrete pad or tarp and located away from edible gardens, groundwater wells, surface waters, storm drains and any place that may flood. A flat, well-drained, covered area with easy access is an ideal location. A grassed buffer around your compost area is recommended so that any runoff can filter through this vegetated area, reducing the potential for containments to reach surface waters.

Compost systems should be sized to meet your specific hobby farm needs. The kind of system you choose will depend on the type and number of animals you have and how much space you can dedicate to manure composting. It is recommended that a multi-bin system be used so that when one bin fills another one can be started. If, for example, a 3-bin system is used, the goal is to have finished compost in the first bin before the third bin is filled with fresh manure. The finished compost can be removed and the first bin becomes available when the third bin is full. Compost bins can be any size or shape and easily be made out of new or recycled materials such as wooden pallets, cinder blocks, wire mesh, chicken wire, fence sections, window screens or any other material that will enclose your manure. If your design doesn't have a roof, a secured tarp can be used to cover your compost.

IDEALLY, YOUR COMPOST AREA SHOULD BE LARGE ENOUGH TO HOLD 6-MONTHS OF MANURE. HOWEVER, MANY HOBBY FARMERS HAVE LIMITED SPACE, SO CONSIDER ANY AMOUNT OF MANURE COMPOSTING, NO MATTER HOW SMALL, TO BE A BENEFIT TO YOUR HOBBY FARM.

PLAN AHEAD
One large animal can generate as much as 50 pounds of manure every day! This requires a storage area of about 12 feet on each side, with a depth of about 5 feet for one year, per animal.

WATER QUALITY BENEFIT
Composting manure not only helps to prevent it from potentially reaching nearby waterways, but creates a valuable soil amendment and organic nutrient source that when applied to crops and fields is recycled back into the earth.

A RECIPE FOR COMPOSTING SUCCESS

Microorganisms that assist in the composting of manure need what many living organisms require: food, water and air.

- **Food (Nitrogen and Carbon)** – How fast your manure decomposes relies heavily on the carbon to nitrogen (C:N) nutrient ratio in your pile. Most animal manure alone generally has an ideal C:N ratio. However, if you have bedding mixed in you may need to add an additional source of nitrogen such as grass clippings, blood meal or chicken manure.
- **Air** – Microorganisms need oxygen to survive and break down manure. Periodically turning your compost to introduce air or incorporating simple perforated PVC pipes into your compost pile can provide the oxygen needed to support these microorganisms.
- **Temperature** – Decomposition creates heat which is important to support the microorganisms you want in your compost and in your finished soil structure. Heat created in your compost pile is also needed to kill any pathogens, weed seeds and/or fly larvae you may have in your manure. Compost piles generally should be turned periodically to maintain an internal temperature of 140-150˚F. This can be measured with a compost thermometer (similar to a meat thermometer but with a longer probe).
- **Water** – Compost piles need moisture to support the decomposition process. Your compost pile should be wet but not soaked. Since heat plays a major role in the process it can quickly evaporate moisture, so plan to add water to your compost pile on a regular basis to keep it moist but not to the point where you are creating runoff.

COLLECT WATER FROM THE ROOF OR COVER OF YOUR COMPOST BIN SYSTEM WITH A RAINBARREL AND USE THIS RECYCLED WATER TO ADD MOISTURE TO YOUR COMPOST WHEN NEEDED.

The length of time it will take to make any type of compost will depend on the size of your compost pile, time of year, contents, and how you manage it. Typically, it will take approximately 3 to 6 months to complete a batch of compost.

HELPFUL LINKS
www.mass.gov/eea/agencies/massdep/water/watersheds/horsekeeping-and-water-quality.html
www.ag.umass.edu/crops-dairy-livestock-equine/fact-sheets/composting-horse-manure
www.ag.umass.edu/sites/ag.umass.edu/files/fact-sheets/pdf/manure_composting_for_small_livestock_operation_17_03.pdf

FACT SHEET 5.6

CONTROLLING ANIMAL ACCESS TO WATERWAYS: FENCING

Many hobby farms rely on nearby waterways to provide animals with freshwater access. Although convenient, direct animal access to nearby streams and ponds can be detrimental to water quality and may eventually render that water source unusable in the future due to pollution.

When farm animals are allowed to congregate near surface waters such as lakes, streams, ponds, rivers, and coastal areas significant environmental damage can occur resulting from hoof traffic, grazing and manure including loss of vegetation and protective buffers, soil compaction, bank erosion, sediment and nutrient deposition and accumulation of harmful pathogens.

ANIMALS SHOULD NOT HAVE DIRECT ACCESS TO WATERWAYS AND BE PROVIDED ALTERNATE WATER SOURCES FOR THEIR DAILY, FRESHWATER NEEDS.

EFFECTS ON WATERWAYS

Waterways have historically been economically important to farmers with animals, as forage quantity and quality at times tend to be greater, not to mention the ease of access to a reliable water source on demand. However, allowing livestock unrestricted access can promote overgrazing along the shore of a waterbody, while grasses in undergrazed areas become unpalatable to the animals. As grasses preferred by horses and livestock continue to produce new growth, the animals will stay in the area longer, which prevents recovery of the area and reduces the ability for vegetation to treat runoff from adjacent grazing areas.

Negative impacts of farm animals on waterbodies and surrounding areas can be prevented or minimized by eliminating access. There are many opportunities for hobby farmers to improve farming practices while protecting the functionality of waterways and adjacent buffers through proper land and grazing management practices.

Hobby farms that raise animals need to consider options to protect waterways through the use of fencing, properly constructed stream crossings and alternative water sources that promote good grazing management.

REGULATORY CHECK

Massachusetts drinking water regulations (310 CMR 22.00) prohibit the stabling, hitching, standing, feeding or grazing of livestock or other domestic animals within 100 feet of the bank of a surface water source or tributary and prohibit people from allowing or causing any animal to go into, or upon, any surface water source or tributary thereto.

PLAN AHEAD
Hobby farmers need to be aware of any local regulations or bylaws that pertain to fencing requirements and also know the exact location of property boundaries when installing fence near neighboring properties.

FENCING

Fencing is a common practice used to prevent access of animals to waterways. Fencing farm animals out has many benefits, including preventing destabilization of streambanks, preventing erosion and improving runoff filtration and nutrient uptake, while allowing control of productive rotational grazing systems.

There are many types of fencing. The best fencing option will depend on the purpose, topography, size of the area, soil type, flood risk, animal type, material availability and cost. Before purchasing fence materials, consider all options to decide which is best for your hobby farm.

Common Types of Fencing

WOOD	• Traditional material commonly used and easily found • May require upkeep every few years, including painting or staining • Expect that pressure-treated lumber will last for about seven years without painting or staining, but has a higher initial cost than untreated lumber • Pressure-treated wood is used for posts with any fencing system for its rot resistant properties
WOVEN WIRE	• Often made with galvanized wire and is often used for sheep, goats, and poultry • Horse owners also use woven wire fencing because of its rigid property and keeps predators out of corral areas • Woven wire fence can last for 20 years with moderate maintenance
HIGH TENSILE WIRE	• Stronger alternative to galvanized woven wire • Requires specialized equipment to install • Wire is heavy duty grade which has a higher initial cost • Requires little maintenance and has a 50-year life expectancy
BARBED WIRE	• Developed for use in areas where wood was scarce and large areas of land were needed to raise livestock • Difficult to work with due to the barbs • Requires special equipment to install • Can cause serious injuries to horses, livestock and wildlife animals if tangled in barbs • Local regulations may prohibit the use of barbed wire fencing
ELECTRIC FENCES	• Easy to install in any configuration that is needed • Flexible wire is an inexpensive option for fencing horses and larger livestock • Woven wire version is available for use with smaller livestock • Has fairly low maintenance requirements

Unfortunately, fences can also pose a risk to wildlife if they cannot cross over or under the fence. Consideration should be made to maintain free travel for wildlife and reduce adverse impacts when choosing a safe barrier method for your farm animals.

REGULATORY CHECK
Since most hobby farms are not exempt from the MA Wetlands Protection Act (WPA 310 CMR 10.00), most fencing within 100 feet (in some cases 200 feet) of a wetland or waterway will likely require approval. See your local Conservation Commission for assistance in complying with the WPA and for information on other approvals that may be required.

FACT SHEET 5.7

CONTROLLING ANIMAL ACCESS TO WATERWAYS: WATERWAY CROSSINGS

A waterway or stream crossing may be necessary for animals to access a hobby farm pasture or trail system that is separated by water from other areas of the hobby farm. Direct animal access to wetlands and waterways can significantly impact the water quality and long-term viability of the freshwater resource. In addition to the physical damage that can occur to the banks and nearby vegetation from hoof traffic and grazing, manure deposited directly into the water can have an immediate impact on water quality and animal health.

A well-built crossing can provide farm animals with a safe and stable surface to reduce the risk of injury when crossing the stream channel or waterway. A designated crossing can reduce land disturbance, minimize muddy conditions and prevent impacts to the stream bed and water quality.

Stream crossings can be built with a variety of materials, however choosing the right location is essential. A crossing should be installed where the stream is straight, narrow if possible and where the channel alignment is less likely to change, as it would at a meander. Channel alignment at a meander often shifts because of the scouring affect the stream has on the outside edge of a meander.

REGULATORY CHECK

Since most hobby farms are not exempt from the MA Wetlands Protection Act (WPA 310 CMR 10.00), the crossing of any wetland or waterway generally requires approval. See your local Conservation Commission for assistance in complying with the WPA and for information on other approvals that may be required. Additionally, Federal, state and local regulations may govern the sizing of any culvert or bridge.

WATER QUALITY BENEFIT
Keeping livestock, horses and other animals away from and out of waterways is essential to water quality protection.

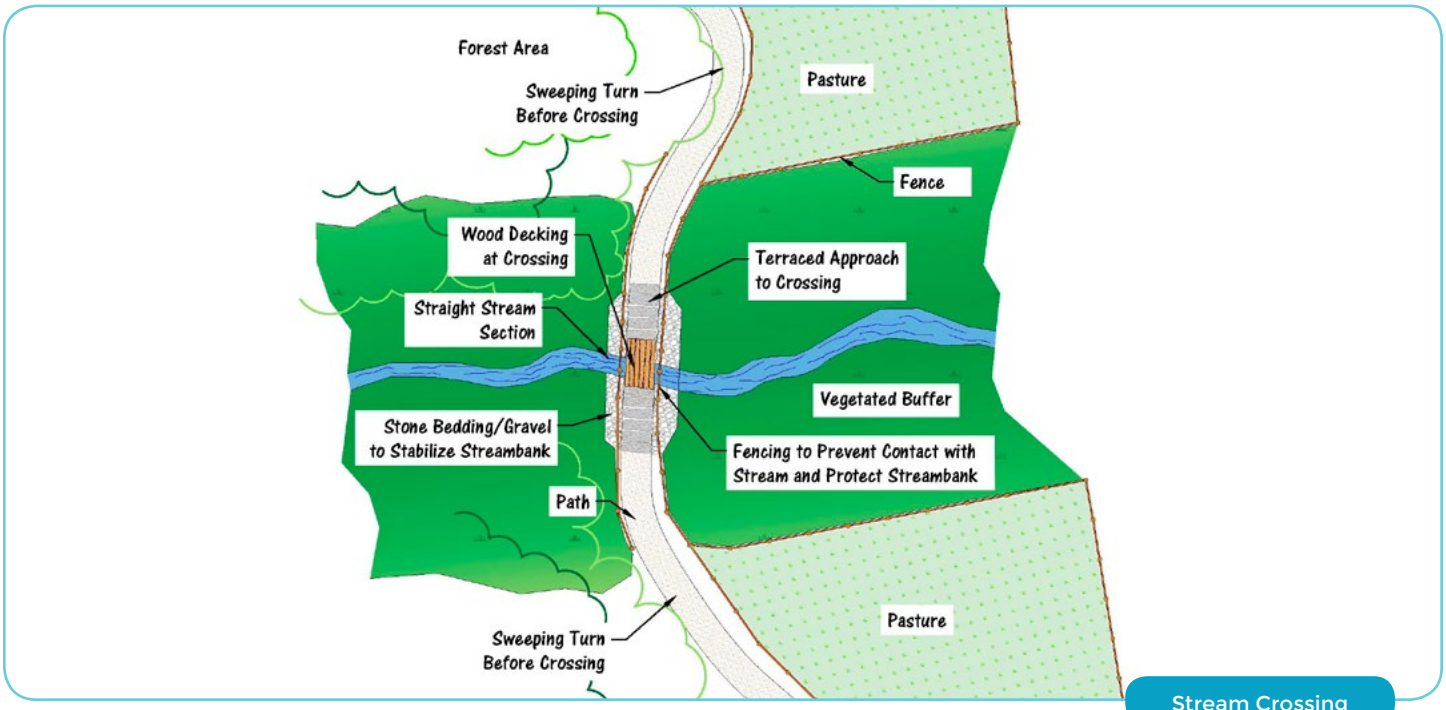
BUILDING A STREAM CROSSING

- Contact the local Conservation Commission for information on local and state regulations that apply to work being completed in a stream channel or waterway. Most work within or adjacent to a waterway will require one or more approvals.
- Build the crossing during the dry part of the year.
- Grade the banks with gentle slopes to make it easier for farm animals to approach the crossing.
- Stabilize stream banks with landscaping fabric beneath a layer of crushed stone and gravel.
- Install a culvert (e.g. pipe, granite blocks, large field stones) parallel to the stream bank to convey flow below the crossing and allow for wildlife passage.
- Various stream crossing materials can be used (e.g. wood timbers, large flat stones, concrete slabs, etc.) to span the stream.
- Install fencing on either side of the crossing to prevent farm animals from accessing the waterway.

The above is simply a guide in developing a stream crossing strategy – each individual location and community will have different concerns and standards that will need to be addressed. Never construct a crossing without first consulting with your local Conservation Commission.

STREAM CROSSING MAINTENANCE

As with most structures, maintenance is critical to ensure your crossing remains safe for you and your animals and that it is achieving the goal of protecting your riparian area while allowing your animals access to other parts of your property. Make sure you routinely inspect your stream crossing, particularly after a rain event, and make the necessary repairs (with Conservation Commission approval if needed).



Stream Crossing

FACT SHEET 5.8

CONTROLLING ANIMAL ACCESS TO WATERWAYS: ALTERNATIVE WATER SOURCES

Allowing farm animals unrestricted access to surface water has generally been the most common and easiest way to meet the water needs of horses, livestock and other farm animals. However, this method often results in impacts to surface water quality and to that of the adjacent land area.

Streambank erosion, depleted buffer zones and pathogens from manure are a few of the long-term impacts from direct waterway access. To avoid direct water quality impacts, hobby farmers need to find a dependable alternative water source for animals.

Benefits of providing an alternative water source include:

- stream bank and waterway protection
- aquatic and wildlife habitat protection
- improved animal health
- better pasture management
- improved relationship with neighbors

A water trough or similar device can be permanent or portable. When installing a trough, you should place it at a location that reduces the risk of contamination to waterbodies and water supply sources and encourages farm animals to drink. Remember, Massachusetts drinking water regulations (310 CMR 22.00) prohibit the stabling, hitching, standing, feeding or grazing of livestock or other domestic animals within 100 feet of the bank of a surface water source or tributary and prohibit people from allowing or causing any animal to go into, or upon, any surface water source or tributary thereto.

DID YOU KNOW?
If your water trough is large, deep, covered, and won't be knocked over - you can add fish! Fish can have the added benefit of eating algae, reducing the need to clean the trough as often.

WATER QUALITY BENEFIT
Alternate water sources eliminate the need for farm animals to access waterways, helping to protect water quality and adjacent habitat.

WHEN INSTALLING AN ALTERNATIVE WATER SOURCE

- Locate it away from waterbodies and water supply sources
- Provide a flat and stable surface area around the trough to protect the area from erosion
- Centrally locate it so that it's accessible from all pastures and paddock areas at all times
- Provide adequate capacity to meet the requirements of all animals
- Ideally, construct a structure over the trough to provide animals with shade and reduce the amount of alga growth and maintenance required
- If the water source is also used for human consumption, install check valves or similar devices to prevent contamination of the water source (check local codes for requirements)

MAINTENANCE REQUIREMENTS

- Always ensure animals have adequate water in the trough
- If automated, regularly check the flow of water to the trough
- Look for leaks and fix them right away
- If you have a float valve check it regularly to make sure it's working
- Areas around the trough can get wet and muddy - stop any leaks and fix eroded areas right away
- Consider a mud management plan
- Drain and cleanout troughs at least once a year

HOW TO CLEAN YOUR TROUGH

- Dump out the existing water and use a pressure washer to hose off the sides and bottom
- Pour in a small amount of dish washing soap and use a stiff bristle brush to scrub the inside of the trough
- Dump out the trough again and thoroughly rinse out any remaining soap and debris
- Refill the trough

CHECKLIST 5A

ANIMAL MANAGEMENT FOR WATER QUALITY

Use the following questions to help guide your hobby farm animal management decisions:

1. Does your municipality have local bylaws or regulations that limit the number of animals per acre or require a certain acreage per animal?

☐ YES ☐ NO If YES, list the applicable restrictions,

2. Does your farm utilize pasture for feed?

☐ YES ☐ NO If YES, is the size of your pasture within the recommended guideline of one to two acres for each 1,000 pounds of livestock? Use the guide below.

Recommended Pasture Size (by Animal Type)	Your Pasture Size
1 horse or cow per 1-2 acres	
2 small ponies per 1-2 acres	
4-6 sheep or goats per acre	
2-3 llamas per acre	
4-6 alpacas per acre	
2-5 pigs per acre	

3. If you answered YES to question #2, do you follow these recommended practices? (check selections that apply)

☐ Practice rotational grazing to give pastures a rest and avoid over-grazing (e.g., avoid grazing beyond a minimum grass height of 3-4 inches)?

☐ Periodically mow your pasture to a height of 6-10 inches to maintain healthy vegetation and limit weeds?

4. Do you use a properly installed fence (and crossing, if necessary) to keep animals out of surface water? ☐ YES ☐ NO

5. As required by the Massachusetts Drinking Water Regulations, do you avoid stabling, feeding, hitching, standing, feeding, or grazing of livestock within 100 feet of surface water sources and their tributaries? ☐ YES ☐ NO

6. Is an alternative water source needed to prevent animal access to surface waters? ☐ YES ☐ NO

7. Do you have sufficient area to store manure, animal bedding and feed waste for a year or more? ☐ YES ☐ NO

8. Do you compost livestock manure as part of your manure management strategy? ☐ YES ☐ NO

9. Do you follow recommended mud management practices? (check selections that apply)

☐ Remove accumulated manure every 1-3 days (depending on weather and accumulation rates)?

☐ Restrict livestock access to sensitive areas such as wetlands, streams and ponds (e.g., with fencing)?

☐ Divert stormwater away from areas where manure accumulates?

☐ Plant trees and/or use materials such as gravel and wood chips in problem areas?

SECTION SIX

STORMWATER RUNOFF SITE MANAGEMENT

Protecting water resources from stormwater runoff is often a multi-step process for hobby farmers, where avoiding and minimizing potential problems is generally the first step. Proper planning can save time and money as opposed to dealing with a larger problem later on.

Previous sections have stressed the importance of selecting the right location for your hobby farm activities; developing a stormwater management strategy; and planning out your nutrient, crop and animal management activities. In those sections, planning strategies were introduced to help the hobby farmer develop successful farming activities while minimizing impacts to water quality.

However, even after careful planning some environmental impacts might remain, which can readily be addressed through further actions. This section focuses on site management measures after following the tips and recommendations in previous sections. Each management technique has been developed so that most hobby farmers can undertake the project in a relatively short amount of time, with commonly found and easily available materials, and in most cases without the need for professional assistance or expensive equipment.

Section 6 offers a "tool box" of Best Management Practices (BMPs) geared towards addressing remaining impacts from your hobby farm through the management and treatment of stormwater runoff. These BMPs include a mix of techniques that focus on:

- Stormwater disconnection/reduction - stormwater is returned to the ground so less water needs to be managed
- Rerouting water - precipitation is kept away from potential pollutants
- Stormwater treatment and natural filtration - help clean polluted runoff before it reaches nearby surface water.

The following Stormwater Runoff Site Management Fact Sheets are included in Section 6:

- FACT SHEET 6-1 Vegetated Buffers
- FACT SHEET 6-2 Grassed Filter Strips
- FACT SHEET 6-3 Vegetated Swales
- FACT SHEET 6-4 Infiltration Trenches and Dry Wells
- FACT SHEET 6-5 Rain Gardens
- FACT SHEET 6-6 Rain Barrels and Cisterns
- FACT SHEET 6-7 Tree Planting for Water Quality
- CHECKLIST 6A Stormwater Runoff Site Management

IMPORTANT STORMWATER TERMS

- **Berm or Check Dam** – Small barrier often used in constructed stormwater BMPs and made out of natural material to slow stormwater flow.
- **Groundwater Recharge** – Occurs when water moves downward through the ground and replenishes groundwater.
- **Infiltration** – Occurs when water on the land surface moves downward through the soil.
- **Level Spreader** – Used in constructed stormwater BMPs to slow and spread out the flow of water as sheet flow.
- **Sheet Flow** – A slow moving, shallow flow of water over land that is not concentrated into channels.
- **Stormwater Best Management Practice or BMP** – A method or action used to prevent, treat or manage stormwater quality and quantity to help protect surface water. BMPs can include structural methods that are constructed to help control, filter, infiltrate and store stormwater. BMPs can also be non-structural methods that rely on education, good housekeeping and maintenance.
- **Stormwater Runoff** - Water from precipitation or snow-melt that runs off impervious surfaces such as rooftops, paved streets and parking lots. Stormwater can also come from hard grassy surfaces like lawns and fields and from compacted surfaces such as unpaved driveways, parking lots and roads. Stormwater runoff can pick-up pollutants along these surfaces and carry contaminants to nearby surface waters.

FACT SHEET 6.1

VEGETATED BUFFERS

A vegetated buffer is a planted or naturally vegetated area of land that can slow down, spread out and infiltrate stormwater flow to help filter out pollutants such as sediment, nutrients and bacteria before reaching a waterbody. They should be located between your hobby farm and a surface water or wetland, generally running the length of the waterbody.

WHAT IS INFILTRATION?

Infiltration is when water or stormwater soaks into the ground.

WITH MOST VEGETATED BUFFERS, WIDER IS OFTEN BETTER, BUT EVEN A NARROW STRIP OF VEGETATION BETWEEN YOUR HOBBY FARM AND SURFACE WATER CAN OFFER WATER QUALITY BENEFITS.

The size of your buffer will be largely dependent on the area of land you have to work with and the area you are able to dedicate as a buffer. Farm activities should always be placed as far away from wetlands and surface water as possible.

BENEFITS

- ✓ Interception, infiltration and absorption of precipitation and stormwater runoff
- ✓ Filtration of suspended and water soluble pollutants like sediment, fertilizers and pesticides
- ✓ Bank stabilization and erosion control for slopes and disturbed areas
- ✓ Flood control during heavy rain and high-water levels
- ✓ Trees and shrubs provide shade and shelter for aquatic organisms
- ✓ Enhanced habitat for wildlife and pollinators
- ✓ Helps contain animals and prevent direct contact with surface water
- ✓ May help reduce nuisance complaints from adjacent neighbors from odor, dust and noise
- ✓ Can act as a fence line to keep unwanted wildlife such as Canada geese off of your property

DID YOU KNOW?

Although vegetated buffers are typically used along waterways, they can also be used to buffer your hobby farm activities from other areas such as adjacent properties, road shoulders and stormwater drainage systems.

DESIGN CONSIDERATIONS

Consider the following when planning your vegetated buffer:

Length

Your vegetated buffer should extend the length of the waterbody or shoreline on your property. If you need access to the water, consider meandering paths rather than straight paths through the buffer. Winding routes can help slow polluted runoff and reduce erosion. Remember that farm animals should never have a direct route or access to waterways. Fencing, protected waterway crossings and alternative water sources should be used so that animals are kept out of waterways.

Width

Wider is better, preferably 50-feet or more. Recognizing this is not always possible, particularly in more urban settings, any size buffer can be beneficial. Even a narrow buffer with healthy vegetation can provide benefits and is a worthwhile endeavor. Generally, steeper slopes warrant wider buffers to provide enough time to slow the flow of water and remove pollutants.

Slope

Slope is how flat or steep your land is. Since water flows faster going downhill, steep slopes are more susceptible to erosion and cannot filter as effectively as flat lands. If possible, make vegetated buffers wider in sloped areas.

Vegetation

All types of native plants can create an effective buffer. Keep in mind that different types of plants provide different benefits. Ideally, the most effective buffers will include a mix of trees, shrubs and plants that are native to the area. Buffer trees, shrubs, grasses and even the leaf litter or the ground layer each provide a unique function.

Trees

A tree leaf canopy can intercept thousands of gallons of precipitation per year; trap airborne pollutants; provide noise and odor control; protect against damaging winds; and provide temperature control. Fallen limbs can help create topographic features that can slow and detain runoff, filtering pollutants. Tree roots improve soil porosity encouraging infiltration of runoff; aid in flood management; provide streambank stabilization and erosion control; and help filter pollutants.

Shrubs

Shrubs intercept water that passes through the tree canopy. They provide streambank stability and erosion control. Shrub roots and leaf litter can slow runoff and improve soil infiltration, help filter sediment and attached pollutants; and be a physical barrier to some larger animals preventing access to waterways (no farm animals should have direct access to waterways due to water quality impacts).

Grasses

The high stem density of herbaceous plants can slow water and disperse runoff helping to remove sediment and water soluble pollutants like fertilizers and pesticides.

Ground Layer

The ground or leaf layer made up of accumulated plant material like leaves, pine needles and seeds such as acorns help protect the soil against erosion and keep it in place. It also helps slow down runoff, encouraging infiltration into the ground and the filtration of pollutants.

REGULATORY CHECK
In most communities, any activity within 100' of a surface water (or within 200' of a perennial stream) may require approval - see your local Conservation Commission for assistance.

STRATEGIES

Buffers can be created naturally or through the planting and seeding of new areas. The most effective buffers are not only wide but contain a mix of different species of trees, shrubs and grasses. You can establish your buffer using one of three basic approaches: 1) stop maintaining an area to allow for natural revegetation; 2) create a landscaped buffer through planting; 3) enhancing the natural growth process through planting select vegetation (a combination of 1 and 2).

NATURAL REVEGETATION	Natural revegetation allows the existing plants and seeds in the area to grow naturally. This is ideal for areas that have been mowed or disturbed. Simply leave the area alone and it will progress through its natural succession of plant growth. Monitor the area periodically to remove any invasive or non-native plant species. Any bare areas that appear can always be seeded or planted. This approach is the easiest and least costly but will take some time for everything to grow in and mature.
ACTIVE REVEGETATION	Active revegetation is ideal if you don't want to wait for your buffer to grow in naturally or if you would like to select the specific types of vegetation to grow. This approach involves: 1) staking out your proposed buffer area and measuring the space – maybe sketch out a simple plan; 2) selecting your plant species and determining how many you need based on the total area and how much space each plant will require; 3) preparing your planting area; and 4) planting, mulching and watering your plants. Remember that you may need temporary sediment controls until the area has been stabilized by plant growth. This approach is more labor intensive and costly, but the advantage is that your buffer will fill in quicker and with native species you personally selected. Proper species selection, coupled with an early maintenance effort, can also help prevent invasive species growth.
BUFFER ENHANCEMENT	Can't decide if you should do natural or active revegetation? Do a little of both! This approach will allow you to select and plant species in certain areas while letting other spaces revegetate naturally. This method gives you flexibility when it comes to labor, budget, plant type and growing time.

MAINTENANCE AND MANAGEMENT

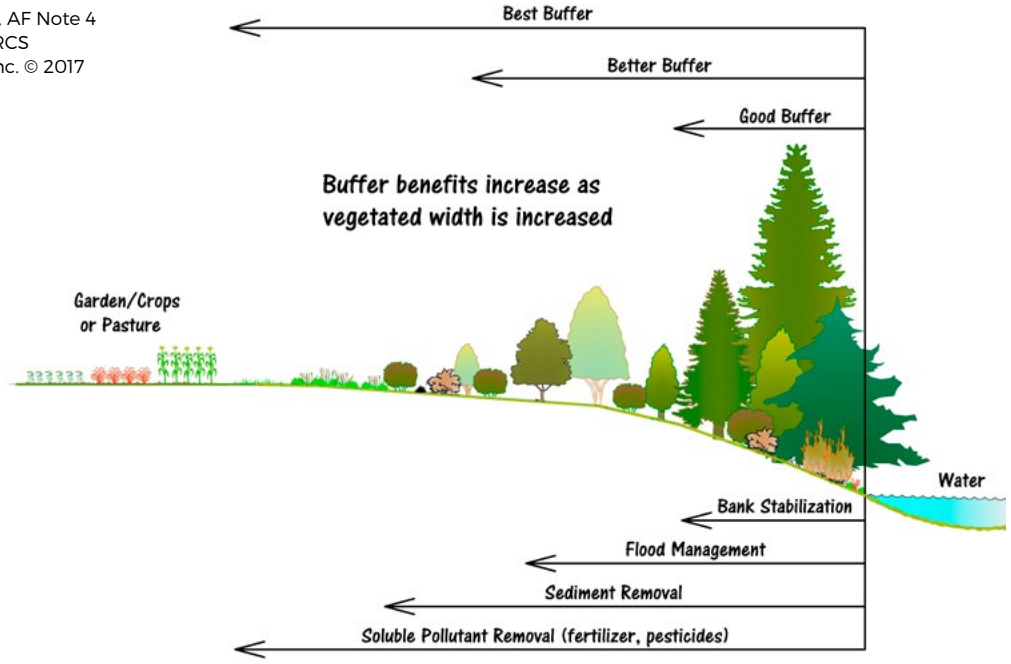
Some of the best buffer management strategies are to simply leave them alone. Undisturbed buffers generally work the best; however, periodic inspections should take place to identify any problems or corrective actions. The following is a simple inspection checklist and a few reminders to help you get the most out of your vegetated buffer.

- ✓ Seed or plant any bare spots and ensure new plantings are growing and existing plants are healthy
- ✓ Remove invasive species and any hazard trees that pose a safety risk
- ✓ Do not use fertilizer or pesticides within your buffer
- ✓ Keep farm animals out of your buffer
- ✓ Do not store heavy equipment or anything else in your buffer
- ✓ Avoid tracking through your buffer with your vehicles and equipment

DID YOU KNOW?
Massachusetts has a Prohibited Plant List. Never purchase, plant or propagate any plants on the prohibited plant list: www.mass.gov/eea/agencies/agr/farm-products/plants/massachusetts-prohibited-plant-list.html

CAUTION!
if you plan on purchasing or transplanting your plants to create your vegetated buffer, make sure you are planting species that are non-invasive and native to your area.

Adapted from Agroforestry Notes, AF Note 4
Jan 1997, USDA Forest Service/ NRCS
Comprehensive Environmental, Inc. © 2017



Vegetated Buffers

VEGETATED BUFFER BENEFITS	VEGETATION TYPE		
	Grass	Shrubs	Trees
STREAMBANK STABILIZATION AND EROSION CONTROL	💧	💧💧💧	💧💧💧
FILTER SEDIMENT CONTAINING NUTRIENTS, PESTICIDES AND PATHOGENS	💧💧💧	💧💧	💧💧💧
FILTER WATER SOLUBLE FERTILIZER AND PESTICIDES	💧💧	💧	💧💧
IMPROVE AQUATIC HABITAT	💧	💧💧	💧💧💧
IMPROVE WILDLIFE HABITAT FOR FOREST ANIMALS	💧	💧💧	💧💧💧
FLOOD PROTECTION	💧	💧💧	💧💧💧

NOTES : Good Benefit 💧 Better Benefit 💧💧 Best Benefit 💧💧💧

HELPFUL LINKS
www.soaknh.org/wp-content/uploads/2016/06/Vegetated-Buffer.pdf
www.mass.gov/eea/docs/dep/water/bufman.pdf

FACT SHEET 6.2

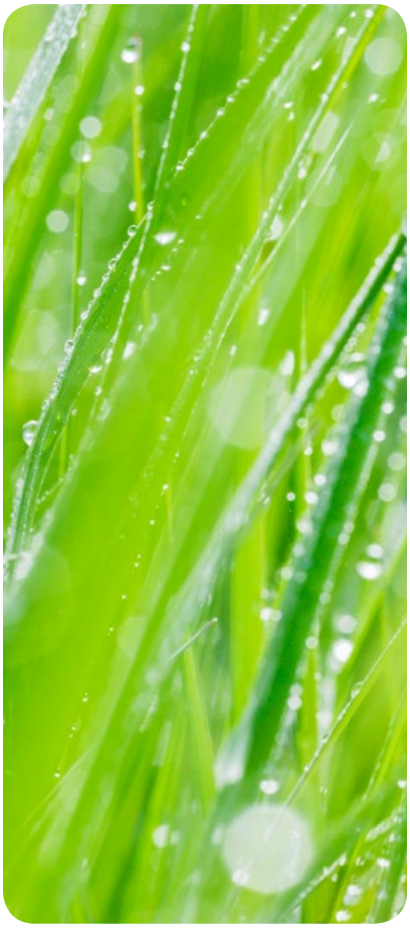
VEGETATED FILTER STRIPS

A vegetated or grass filter strip (sometimes referred to as a grass strip) is an area used to help slow down, filter and infiltrate stormwater runoff. Unlike a vegetated buffer, which is used to provide an undisturbed natural protective area between your hobby farm and waterbody, filter strips are installed in specific locations around your hobby farm to help treat stormwater runoff.

Filter strips are more effective in treating sheet flow (a more even, slow moving, shallow flow that can occur on relatively flat, gently sloping land) compared to channelized flows (fast moving, narrow flow that can occur with natural swales, man-made ditches, or eroded gullies) and can be used in combination with other treatment techniques or as a stand-alone practice.

BENEFITS

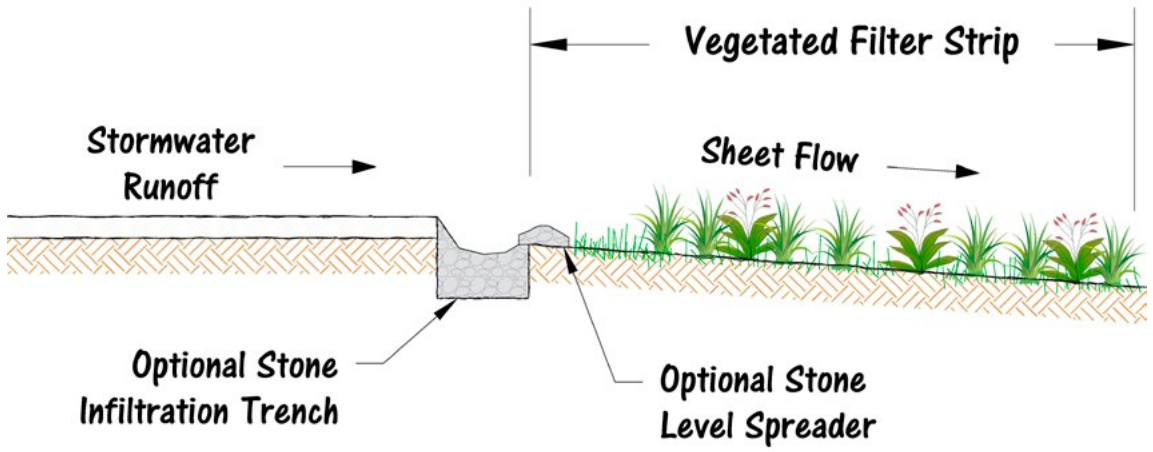
- Trap and filter out sediment and attached pollutants
- Slow down stormwater runoff helping to control erosion
- Promote infiltration of runoff into the soil
- Do not require a lot of space



Where Can Filter Strips be Used on Hobby Farms?

Filter strips can be used wherever precipitation, snow melt or stormwater runoff occur to help intercept and treat it. They are ideally used in areas that receive sheet flow, or water that is spread out (i.e., runoff from a small area of land). Vegetated filter strips are extremely useful on hobby farms where they can be constructed between a wetland or waterway and the following areas:

- Fields used to grow crops
- Pastures used for grazing
- Animal yards
- Barns and other structures
- Manure storage
- Compost areas
- Upland side of vegetated buffers
- Driveways and roadways
- Storm drainage systems



DESIGN CONSIDERATIONS

LOCATION IS KEY WITH VEGETATED OR GRASS FILTER STRIPS AND SIMILAR TO VEGETATED BUFFERS, BIGGER IS OFTEN BETTER, BUT ANY SIZE FILTER STRIP CAN MAKE A WATER QUALITY IMPROVEMENT.

Length

The filter strip should extend the crop length of the area where stormwater runoff occurs. For example – if you are looking to filter stormwater runoff from crop fields, then the length of the filter strip should follow adjacent to as much of the field's downslope perimeter as possible.

Width

The width of your filter strip is largely going to depend on the amount of area you can dedicate to it. Filter strips 25-feet in width and more have been proven to provide substantial water quality benefits, however in many situations this is not always possible. It is recommended that hobby farmers assess the areas they would like to protect, determine the amount of area they are able to use and focus on maintaining a healthy, vegetated strip for maximum potential. Something is better than nothing, therefore any amount should be considered a worthwhile endeavor.

Vegetation

Grasses that can withstand periodic mowing and thrive in both wet and dry conditions should be used for vegetated filter strips. If seeding the area, be sure to protect it from any significant flow until the seed has germinated and grown to a point where it has filled in the strip and the risk of erosion has passed.

Slopes

Vegetated filter strips are more effective on gentle slopes where stormwater runoff can flow across the strip as sheet flow. At steeper slopes, stormwater runoff starts to concentrate, creating small rivulets or channels, and may either erode the filter strip or simply bypass it entirely. One way to help eliminate channelized flow and promote a slower, more continuous sheet flow across the filter strip is to install a level spreader. A level spreader can be anything (stone, gravel) that will slow and fan out the water before it reaches the filter strip.

INSTALLATION

The following are basic installation steps for vegetated filter strips:

Step 1

Mark your filter strip boundary with stakes, flags or paint.

Step 2

Clear any existing weeds, invasive species or other unwanted vegetation or obstructions.

Step 3

Ensure the existing soil is level, stable and suitable to plant or seed your selected plant species.

Step 4

The inlet or area where runoff enters your filter strip should be stabilized with plants or stone to both help avoid erosion from incoming water and ensure the flow is spread out to produce sheet flow as opposed to a channel of water.

Step 5

Plant your selected vegetation and be sure to water during the early weeks.

MANAGEMENT AND MAINTENANCE

- ✓ Inspect seasonally and after heavy rains to remove sediment and debris and to stabilize any eroded areas
- ✓ Ensure new plantings are growing and existing plants are healthy
- ✓ Seed or plant any bare spots
- ✓ Remove invasive species
- ✓ Mow at your highest height setting several times per year
- ✓ Do not use fertilizer or pesticides
- ✓ Keep farm animals and heavy equipment out

CAUTION!
Never use or store heavy equipment on vegetated filter strips or swales to avoid soil compaction. Compacted or tightly packed soil can severely limit runoff infiltration (your soil's ability to soak up water), eliminating one of the main functions of vegetated runoff practices.

HELPFUL LINKS
www.mapc.org/resources/low-impact-dev-toolkit/grass-filter-strips
www.mda.state.mn.us/protecting/conservation/practices/buffergrass.aspx
www.elibrary.dep.state.pa.us/dsweb/Get/Document-67997/6.4.9%20BMP%20Vegetated%20Filter%20Strip.pdf

FACT SHEET 6.3

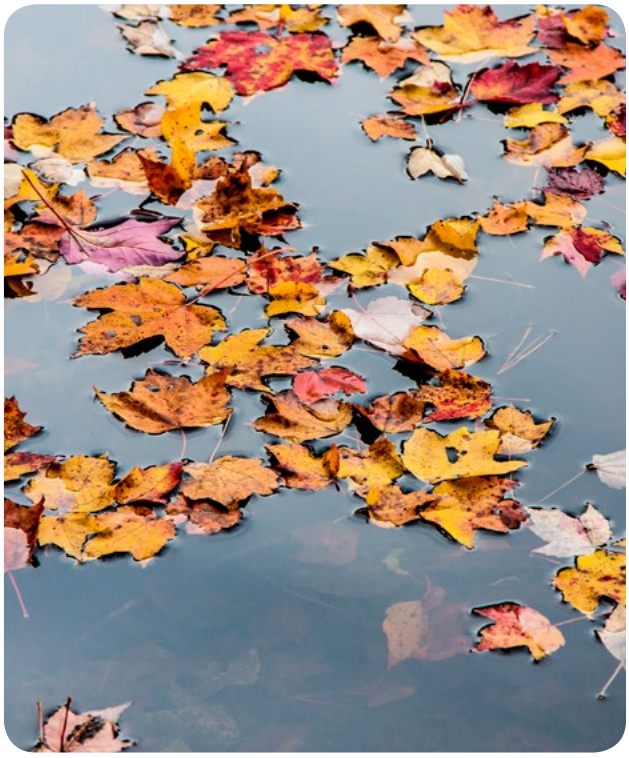
VEGETATED SWALES

A vegetated swale is an open, shallow, vegetated channel or ditch that collects and moves stormwater runoff, preferably to an area better suited for treatment and infiltration, like a rain garden or dry well. The swale itself can also slow down, filter and infiltrate stormwater.

DID YOU KNOW?
Volume vs. Velocity – Stormwater volume refers to the overall amount of water while stormwater velocity is the speed of the water as it moves or flows. Many stormwater Best Management Practices (BMPs) aim to reduce the overall amount of stormwater AND slow it down. Achieving both of these goals helps to control erosion, increase infiltration and reduce pollutants entering nearby surface water.

BENEFITS

- Directs runoff away from areas where pollutants may be more concentrated like animal yards
- Carries stormwater to an area where it can be better managed
- Traps and filters out sediment and attached pollutants
- Slows down stormwater runoff helping to control erosion
- Promotes infiltration of stormwater into the soil



Where can vegetated swales be used on Hobby Farms?

Vegetated swales can generally be used anywhere stormwater runoff collects including water from the roofs of houses, barns, and storage areas; covered compost areas; driveways and roadways; animal yards; the bottom of steep slopes; and near any other areas that generate stormwater runoff.

CAUTION!
Do not use vegetated swales to direct water off of your property, into the street or catch basin, or directly into surface water. Vegetated swales should be used to move stormwater to another, more suitable location on your property where it can further soak or infiltrate into the ground.

CAUTION!
Always call Dig Safe (811) before any type of digging or excavation to help ensure you do not come into contact with utilities, pipes or wires. This must be done at least 72-hours prior to the start of work. See www.digsafe.com for more information.

DESIGN CONSIDERATIONS

Location

A vegetated swale should be located downhill from areas that produce stormwater runoff or at a location to intercept and redirect runoff away from higher pollutant areas. Remember to always check with your local Conservation Commission if you are working within 100' of a wetland of water resource area, or within 200' of a perennial stream.

Size

The length of your vegetated swale will be based on the distance between the source of your stormwater runoff (roof, driveway, roadway etc.) and the discharge location (raingarden, dry well, etc.). The width and depth of a vegetated swale can vary and is often determined by available space and the volume of water you are moving. A rule of thumb is to make the width of each of the sides of the swale three times the depth of the swale.

Slopes

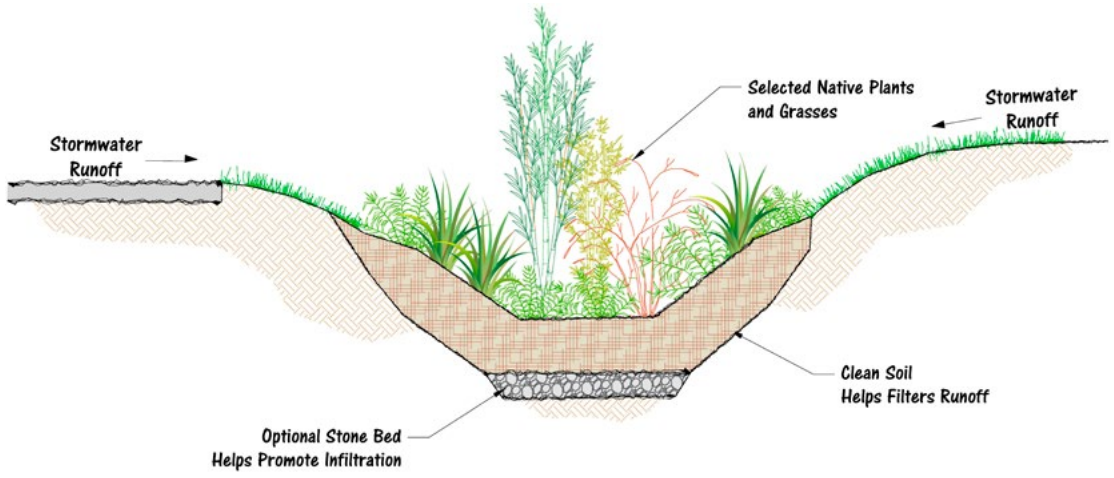
Swales are typically constructed in naturally sloping areas to move water from one location to another through gravity. Consider constructing periodic check dams or berms across the width of the swale. Check dams or berms can be easily constructed out of rocks, silt socks or even haybales and act as a speed bump to slow down stormwater. You can also slow flow by creating a meandering or winding swale (as opposed to straight) to create more time for sediment to settle out. Vegetated swales should not be constructed on steep slopes.

Discharge

Swales should preferably discharge to a vegetated area to allow the runoff to soak into the ground. If a vegetated area does not exist, consider constructing a dry well or raingarden for the swale to flow into.

Plants

Small shrubs and grasses that can tolerate both dry and wet conditions will do well in most swales. Stagger larger plants to either side of the deepest part of the swale, while grasses can be planted full width.



Vegetated Swale

INSTALLATION

STEP 1

Mark your swale boundary with stakes, flags or paint and contact Dig Safe (811) at least 72-hours prior to digging. If Dig Safe identifies obstructions in or around your marked area you will need to relocate your swale.

STEP 2

Dig the swale, creating your channel and gently sloping sides along the entire length of the swale.

STEP 3

Install your check dams or berms along the bottom of the swale if needed.

STEP 4

The inlet to your swale where stormwater runoff enters may need to be stabilized with either plants or stone to help avoid erosion from incoming water.

STEP 5

Plant your selected vegetation and be sure to water during the early weeks.

MAINTENANCE AND MANAGEMENT

- ✓ Inspect seasonally and after heavy rains to remove sediment and debris
- ✓ Ensure new plantings are growing and existing plants are healthy
- ✓ Seed or plant any bare spots
- ✓ Remove invasive species
- ✓ Remove any hazard trees that pose a safety risk
- ✓ Do not use fertilizer or pesticides
- ✓ Keep farm animals out
- ✓ Keep heavy equipment out and avoid crossing or traveling through the swale to access your farming activities

HELPFUL LINKS

www.soaknh.org/wp-content/uploads/2016/06/Vegetated-Swale.pdf
http://www.maine.gov/dep/land/stormwater/stormwaterbmps/vol3/chapter8_1.pdf

FACT SHEET 6.4

INFILTRATION TRENCHES AND DRY WELLS

It is common for hobby farms to have one or more covered structures such as a storage shed, barn, compost area or animal shelter in addition to the main residence. Paved driveways, roads or compacted travel ways may also be present on a hobby farm.

Roofs and roadways can significantly contribute stormwater runoff to the overall volume of water that requires management on your hobby farm. If this water can be captured and infiltrated near its source, then the overall amount of stormwater runoff that has to be managed elsewhere can be significantly reduced. One way to do this is to install infiltration trenches or dry wells adjacent to these areas.

An infiltration trench is a shallow, horizontal excavation filled with crushed stone, which stores stormwater runoff in the spaces between the stone and allows for a gradual infiltration of runoff into the ground. Similarly, a dry well is a deeper vertical excavation that serves the same purpose. Both of these techniques are used to treat runoff that has had minimal contact with contaminants such as bacteria and nutrients that are less likely to be found in roof runoff or runoff generated from driveways and private roadways.

WATER QUALITY BENEFIT

Stormwater practices that promote infiltration return stormwater runoff to the ground. This not only benefits groundwater resources, but reduces the amount of runoff that can potentially pick up pollutants from the hobby farm and flow into nearby surface water.

BENEFITS

- Promotes infiltration of stormwater runoff
- Reduces overall stormwater runoff volume
- Helps remove sediment
- Supports groundwater recharge

ARE YOUR SOILS SUITABLE?

The primary function of infiltration trenches and dry wells is to return water to the ground. To achieve this, the soils have to be porous enough to accept the water at the rate it is received. Different soils do this at different rates. A simple percolation 'Perc' test can help determine if your soil can do this at a rate sufficient to support an infiltration trench or dry well. A rule of thumb is that the soils should infiltrate water you've collected within 24-hours. Soils that take longer are not suitable for these types of techniques and often result in flooding and erosion.

How to do a Perc Test:

Note: The following method is for a small system. Large non-residential systems serving extensive impervious areas will require a more in-depth soil investigation and engineering design.

Step 1

Dig a 12" x 12" x12" hole where you want to install your dry well or infiltration trench.

Step 2

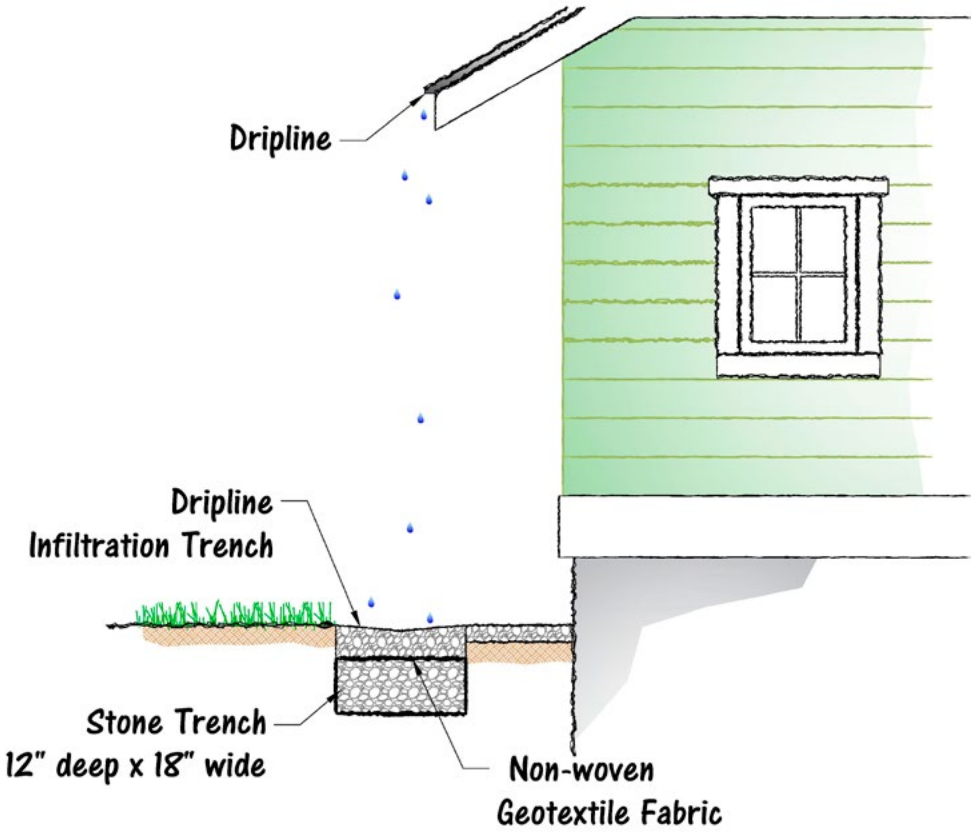
Fill it with water.

Step 3

If it drains within 24-hours, your soils will likely support an infiltration trench or dry well. If it doesn't drain completely or fills with water, then a new location is needed.

CAUTION!
Always call Dig Safe (811) before any type of digging or excavation to help ensure you do not come into contact with utilities, pipes or wires. This must be done at least 72-hours prior to the start of work. See www.digsafe.com for more information.

REGULATORY CHECK
Contact your local Conservation Commission before doing any work within 100' of a wetland or water resource or within 200' of a perennial stream



Dripline Infiltration Trench

SIZING AND INFILTRATION

Once you have determined where to construct your infiltration trench or dry well and confirmed that your soils are suitable to infiltrate runoff, you are ready to size and construct your stormwater element. Below are links to detailed instructions on how to both size and construct your project.

BEFORE CONSTRUCTING YOUR INFILTRATION TRENCH OR DRY WELL, BE SURE TO REFER TO THE FOLLOWING ONLINE RESOURCES:

- **Infiltration Trench for Driveway Runoff**: http://soaknh.org/wp-content/uploads/2016/06/Driveway-Infiltration-Trench.pdf
- **Infiltration Trench for Roof Runoff**: http://soaknh.org/wp-content/uploads/2016/06/Dripline-Infiltration-Trench.pdf
- **Dry Well:** http://soaknh.org/wp-content/uploads/2017/01/Dry-Well.pdf

INNOVATIVE IDEAS

Pervious Walkways and Patios

Pavers used to promote stormwater infiltration along walkways and sitting areas.
http://soaknh.org/wp-content/uploads/2016/06/Pervious-Walkways-and-Patios.pdf

Water Bars

Used to intercept stormwater along sloping walkways, paths or gravel driveways, water bars divert runoff into vegetated areas for treatment and infiltration, reducing erosion.
http://soaknh.org/wp-content/uploads/2016/06/Water-Bar.pdf

Infiltration Steps

Steps along a sloped walking path to slow down and infiltrate runoff and reduce erosion.
http://soaknh.org/wp-content/uploads/2016/06/Infiltration-Steps.pdf

MAINTENANCE AND MANAGEMENT

- ✓ Inspect seasonally and after heavy rains to remove visible sediment and debris.
- ✓ Check often for ponding and slow draining water as this can be an indicator of clogging. If this occurs, the stone and landscape fabric should be removed, washed free of accumulated sediment causing the clog and replaced.
- ✓ Protect the area from compaction by foot traffic, vehicles and equipment.

REGULATORY CHECK

Some dry wells may be regulated as a Class V well (UIC or Underground Injection Control). Visit the following link to determine if your dry well will require state registration: www.mass.gov/eea/agencies/massdep/water/drinking/underground-injection-control.html. Dry wells draining higher pollutant areas may not be allowed so always check first.

HELPFUL LINKS

www.maine.gov/dep/land/stormwater/stormwaterbmps/vol3/chapter6.pdf
www.dec.vermont.gov/sites/dec/files/wsm/lakes/docs/Shoreland/Infiltration%20Trenches_04162015.pdf
www.extension.unh.edu/resources/files/resource001799_Rep2518.pdf

FACT SHEET 6.5

RAIN GARDENS

A rain garden is a garden that is planted in a shallow depression with soil and plants that help capture, treat and infiltrate stormwater runoff. Now being used in all types of settings including urban, commercial and residential locations, rain gardens have recently become a popular landscape feature because of their ease of installation, low cost, significant stormwater management benefits and aesthetic qualities.

Sometimes used interchangeably with the term 'bioretention', rain gardens are used to collect and infiltrate stormwater runoff from impervious surfaces such as rooftops, driveways and roads. Hobby farms can often benefit from one or more strategically placed rain gardens. Rain gardens can be constructed alone or at the end of filter strips and vegetated swales to treat and infiltrate overflow from these stormwater management techniques.

BENEFITS

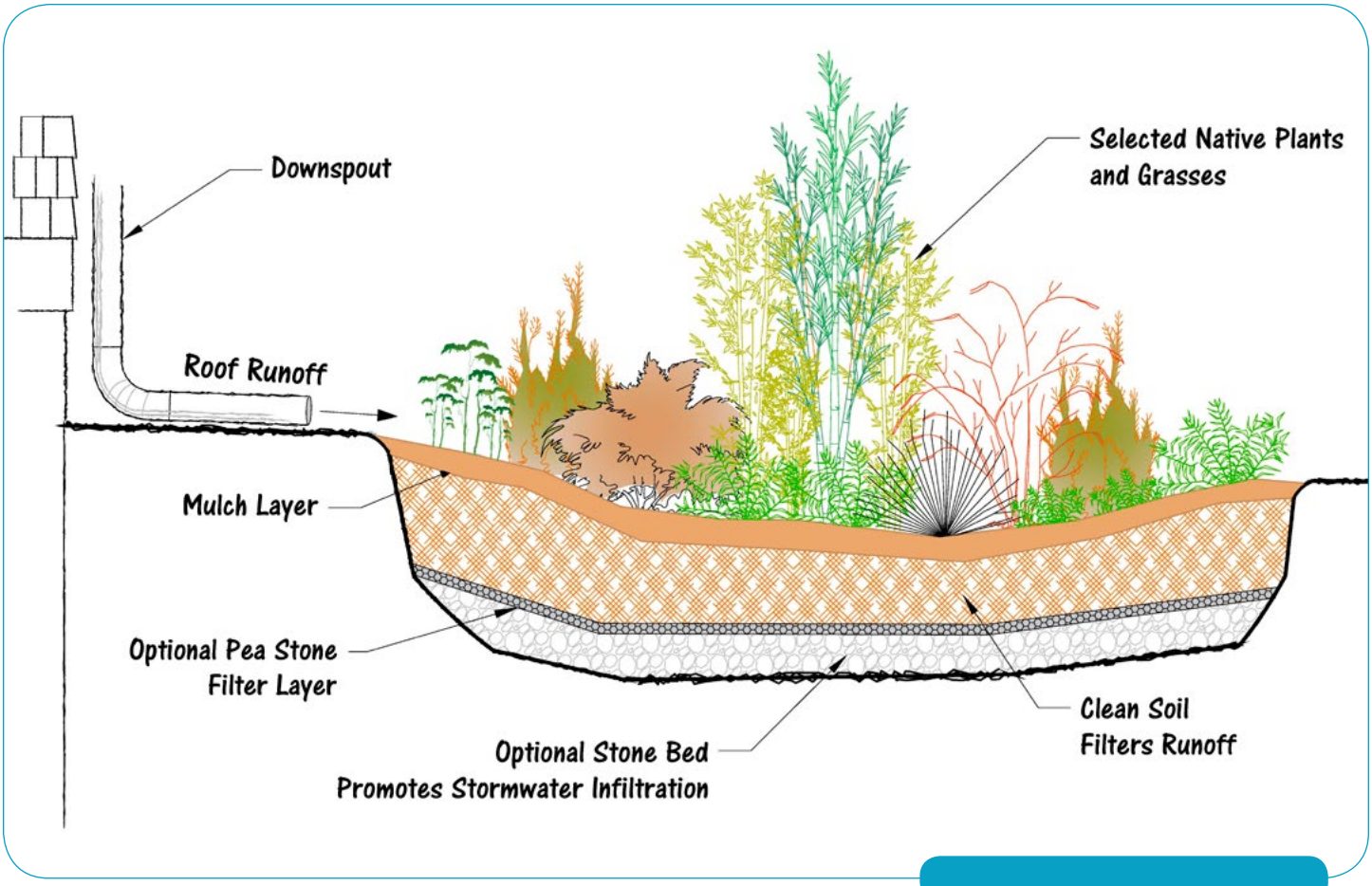
- Promotes groundwater recharge
- Infiltrates stormwater runoff
- Traps and filters sediment associated pollutants
- Plants provide nutrient removal
- Helps reduce overall runoff
- Attractive landscape feature

Rain gardens can be constructed wherever stormwater runoff can be collected including along:

- Driveways/roadways
- Roof gutter and downspouts
- Animal shelter overhangs
- Sidewalks and other impervious or compacted travel ways

DID YOU KNOW?

Massachusetts has a list of prohibited plants and invasive plant species. Never plant or cultivate species on either of these lists:
www.mass.gov/eea/agencies/agr/farm-products/plants/massachusetts-prohibited-plant-list.html
www.massnrc.org/mipag/invasive.htm



DESIGN AND INSTALLATION

- Make yourself aware of underground service lines or utilities before you dig. Always call Dig Safe (811) for information about underground utilities.
- Do not construct a rain garden in areas where water already ponds or drains poorly. Consider doing a percolation (or 'Perc') test to determine soil suitability. See link for instructions on how to complete a simple perc test: https://extension.unh.edu/resources/files/Resource005890_Rep8255.pdf.
- Rain gardens should be a minimum of 10 feet from building foundations to avoid water damage.
- Never construct a rain garden over or near the drainage field for a septic system, near drinking water wells or around large trees.
- Beneath your garden bed, include a layer of crushed stone or small rocks collected from around your hobby farm to provide additional water storage capacity.
- Look for native plant species to put in your rain garden. Never plant invasive or prohibited plant species in your rain garden (or anywhere else!).
- Select plant species that are perennial (come back every year). The plants selected for the bottom of the rain garden should be able to tolerate water. Select plants for drier sites as you move up in elevation along the sides. Be sure to include salt tolerant plants if you plan on collecting runoff from travel ways where salt is used during the winter months.

SEE THE FOLLOWING LINKS FOR SPECIFIC RAIN GARDEN SIZING, DESIGN AND INSTALLATION GUIDANCE:

- http://soaknh.org/wp-content/uploads/2016/06/Rain-Garden.pdf
- www.ag.umass.edu/landscape/fact-sheets/rain-gardens-way-to-improve-water-quality

BE SURE TO SELECT NATIVE PLANTS FOR YOUR RAIN GARDEN!

Native plants generally offer longevity, diversity, and hardiness. The following link provides a list of native New England plants suitable for rain gardens with information on sun exposure, USDA hardiness zone, soil moisture preference, bloom time, color, suggested rain garden location (base, slope or berm), size and growth pattern: www.extension.unh.edu/resources/files/Resource005899_Rep8265.pdf.

RAIN GARDENS TYPES – THE POSSIBILITIES ARE ENDLESS!

Rain gardens can be designed to accommodate almost any type of garden preference including:

- Formal landscape rain garden
- Daylily rain garden
- Wildflower rain garden
- Shrub rain garden
- Shade rain garden
- Sunny rain garden
- Butterfly rain garden
- Wildlife habitat rain garden
- And many more!

USE THE FOLLOWING ONLINE TOOL TO HELP SELECT PLANTS FOR YOUR NEXT RAIN GARDEN:

- www.nemo.uconn.edu/raingardens/plants.php

MAINTAINING AND MANAGING YOUR RAIN GARDEN

Rain gardens are maintained similar to regular gardens.

- ✓ Weed your garden and remove any invasive species on a regular basis.
- ✓ Replace dead, unhealthy or diseased plants as needed.
- ✓ Clean out any sediment or debris that may accumulate, this includes spring and fall cleanup.
- ✓ Avoid crossing your raingarden with equipment used on your hobby farm.

HELPFUL LINKS
www.epa.gov/soakuptherain/soak-rain-rain-gardens#ma
www.uvm.edu/seagrant/sites/default/files/uploads/publication/VTRainGardenManual_Full.pdf

FACT SHEET 6.6

RAIN BARRELS AND CISTERNS

Structures on hobby farms can generate a large amount of stormwater runoff that if not managed can cause erosion and collect and carry pollutants into nearby waters. Management efforts should first focus on minimizing the runoff from these sources.

One way is to infiltrate runoff back into the ground by directing it into a dry well, infiltration trench or raingarden. If infiltration is not an option or if you prefer to store and reuse water, then rain barrels and cisterns, simple devices that collect and store roof runoff through gutters and downspouts, could be your answer.

Water stored in rain barrels and cisterns can be used for:

- Irrigation of flower gardens, lawns and indoor plants
- Wash water for vehicles and farm equipment
- Moisten compost piles

RAIN BARRELS VS. CISTERNS

A rain barrel is a large barrel typically ranging from 60-100 gallons in capacity that captures rainwater from your roof to reduce stormwater runoff and store water for future use.

Cisterns serve the same purpose but are typically larger, permanently installed tanks that range in size from 100-10,000 gallons in capacity. Unlike rain barrels that sit aboveground, cisterns can be installed partially or fully underground if desired.

DID YOU KNOW?
The roof of a small shed could generate 15 gallons of water during a small rain event (1/4" of rain) and up to 60 gallons during a larger 1" rain event. A larger barn or garage could generate 2-4 times that amount – 30-60 gallons of water for a smaller storm and 120-240 gallons of water for a larger storm. That's a lot of water!

HOW LARGE SHOULD MY RAIN BARREL OR CISTERN BE?

Even small roof areas can generate an amazing amount of stormwater runoff and you'll find that unless you empty your collection system often, you'll need multiple rain barrels or a large cistern to collect everything. The following calculations (using a 10'x10' roof example) can be used to determine how large a system you would need to collect a 1" storm.

Determine Area of Roof

Roof Length (ft) x Roof Width (ft) = Drainage Area (ft^2)
Example: 10 ft x 10 ft = 100 ft^2 Drainage Area

Determine Volume of Stormwater Generated by Roof

Drainage Area (ft^2) determined above x 1 inch storm ÷ 12 inches per foot = Stormwater Volume (ft^3)
Example: 100 ft^2 x 1 in ÷ 12 in/ft = 8.33 ft^3 stormwater volume

Convert to Gallons (Measurement for Most Rain Barrels/Cisterns)

Stormwater Volume (ft^3) determined above x 7.48 gallons = Stormwater Volume (gallons)
Example: 8.33 ft^3 x 7.48 gal. = 62.3 gal. stormwater volume

In this example, one 60-gallon rain barrel can almost hold the runoff volume of a one-inch rain event.

AS YOU CAN SEE IT ADDS UP FAST! ALTHOUGH IT WOULD BE NICE TO COLLECT AND REUSE ALL OF YOUR ROOF AREA RUNOFF, YOU DON'T HAVE TO. ANY AMOUNT OF RUNOFF REUSED WILL HELP REDUCE THE CHANCES OF STORMWATER RUNOFF IMPACTING NEARBY SURFACE WATER QUALITY. START SMALL AND STAY SMALL OR START SMALL AND ADD TO YOUR COLLECTION SYSTEM LATER ON. EITHER WAY, YOUR EFFORTS ARE HELPING TO PROTECT NEARBY SURFACE WATER QUALITY AND REDUCING YOUR WATER COSTS.

RECYCLE
Even though most rain barrels do not provide the pressurized flow of a regular hose, if slightly elevated they can produce enough pressure to work a soaker hose irrigation system.

CAUTION!
Roof runoff collected by rain barrels and cisterns is non-potable (not safe for consumption) and can contain pollutants. Humans and animals should not consume it, nor should it be applied to edible crops.

RAIN BARREL INSTALLATION TIPS:

- Install your rain barrel on level ground. Consider raising it slightly on blocks to allow space for a watering can beneath the spigot if needed.
- Make sure your gutter downspout is aligned with the rain barrel intake. Flow diverters can be used to accomplish this.
- Be sure your rain barrel intake area is covered with a screen to catch leaves, twigs and any other debris that might collect in your gutters. This screen will also help prevent mosquitoes from breeding in your collected water.
- Direct any overflow away from the building foundation and into another rain barrel or a vegetated area where it can infiltrate into the ground.

MAINTAINING AND MANAGING YOUR RAIN BARREL

- ✓ Use it often! Emptying your rain barrel creates storage space for the next storm and keeps your rain barrel water supply fresh.
- ✓ Check the structure periodically for leaks.
- ✓ Make sure your gutter downspout is aligned with the inlet and screen.
- ✓ Clean the screen of leaves and other debris to avoid clogging.
- ✓ Inspect your overflow area for erosion and stabilize if necessary.
- ✓ Empty your rain barrel and store it inside during the winter months so water doesn't freeze inside it. If stored outside be sure it's empty and stored upside down to keep it clean and free of ice, snow, water and animals! Be sure to return your gutter downspout to its regular position.

CONSIDER LINKING YOUR RAIN BARRELS TOGETHER. A 1" RAIN EVENT WILL FILL A TYPICAL 60-GALLON RAIN BARREL COLLECTING WATER FROM A SMALL 10'X10' SHED. CONSIDER LINKING SEVERAL RAIN BARRELS TOGETHER TO FORM A CHAIN OR USE SEVERAL RAIN BARRELS AT DIFFERENT DOWNSPOUTS TO STORE MORE WATER FOR FUTURE USE.

CISTERNS

Similar but generally larger than rain barrels, cisterns can be installed above or below ground. Some models even contain a water pump. It is recommended that the manufacturers' instructions for installation be carefully followed for your specific cistern design. The following is a link listing various water cistern manufacturers: www.rainharvest.com/by-manufacturer.asp.

HELPFUL LINKS
www.mass.gov/eea/agencies/massdep/water/watersheds/rain-barrels-and-other-water-conservation-tools.html#Whatarerainbarrels
http://soaknh.org/wp-content/uploads/2016/06/Rain-Barrel.pdf

FACT SHEET 6.7

TREE PLANTING FOR WATER QUALITY

There are many runoff site management measures that can be used to help control stormwater runoff on hobby farms. These include vegetated buffers, treatment swales, filter strips and rain gardens to help both reduce stormwater volume and filter out potential pollutants such as excess fertilizer, sediment and manure.

Many of these techniques utilize natural materials and processes where vegetation is used to help in the retention and infiltration (or absorption) of precipitation and snowmelt into the soil or be taken up by plant roots. Trees are a large part of many of these stormwater management measures.

BUT WHAT IF THERE WAS A WAY TO SAFELY REDUCE WATER VOLUME EVEN BEFORE IT REACHES THE GROUND?

Recent studies have shown that tree roots are not the only part of the tree that assists with runoff reduction efforts. A leafy tree canopy itself can help intercept and retain precipitation, thereby reducing the overall volume of stormwater. Tree canopies located in Massachusetts have been shown to intercept on average about 15% of the precipitation that falls on them. When hobby farmers plant trees, they are directly reducing the amount of runoff they need to manage on their farms.

MATURE TREE BENEFITS:

- Erosion control
- Reduce heating and air conditioning costs
- Absorbption of carbon dioxide
- Oxygen production
- Stormwater management
- Increased property values
- Source of nutritious food (fruit trees)

While the benefits of trees are clear, and programs nationwide are being implemented to encourage tree planting, even in the most urban of areas, the addition of trees to hobby farms can have far greater long-lasting impacts.

DID YOU KNOW?
One large tree can reduce erosion and help manage stormwater by capturing, using or filtering up to 36,500 gallons of water per year.

In addition to the above benefits, trees planted on hobby farms can:

- **Shade livestock** – keeping them cool in the summer
- **Create windbreaks** – protecting both animals and crops from damaging winds
- **Humidify the air** – helping to maintain moisture for crops during dry periods
- **Improve air quality** – in addition to producing oxygen, trees can trap airborne particulates and other pollutants
- **Provide habitat for pollinators** – trees provide the shelter and thoroughfare for pollinating insects to move about
- **Odor control** – help dissipate and control odor that may reach your neighbors

Consider planting trees throughout your hobby farm to take advantage of one or more of the above tree benefits by following these easy steps:

Step 1

Consider how trees can work for you – which of the above benefits would you like to achieve and how can trees help? Need help with erosion control and shading your farm animals? Plant trees in and around your pasture to improve your buffer and increase animal shelter areas. Are your crops too exposed during inclement weather? Plant trees next to fields where they can provide protection from wind and serve as habitat for pollinators. Barn too hot during the summer? Plant trees around it to provide shade that helps lower summer temperatures, provides a windbreak to reduce heating needs in the winter, and to enhance the infiltration of roof runoff.

Step 2

Evaluate your site and location – trees come in all shapes, sizes, colors and hardiness. Make sure you consider the following to help in your tree selection process:

- Space constraints
- Climate/hardiness zone
- Proximity to structures and overhead utilities
- Maintenance and care needs
- Insect/disease susceptibility

Step 3

Utilize available resources for tree selection, installation and care

- Visit www.itreetools.org to customize your search and find the tree that's just right for you, AND see the benefits existing trees provide.
- Visit www.treesaregood.org for in depth information on tree benefits and values, selecting and purchasing a tree, how to plant a tree, and tree maintenance/care.
- Visit www.treecanopybmp.org for helpful resources on tree canopy use and stormwater management along with resources for tree selection, installation and care.

CHECK WITH YOUR LOCAL LANDSCAPE AND GARDEN CENTER FOR HELPFUL INFORMATION ON TREES AVAILABLE IN YOUR AREA, AS WELL AS TIPS FOR INSTALLATION AND ROUTINE TREE CARE.

CHECKLIST 6A

STORMWATER RUNOFF SITE MANAGEMENT

Use the following questions to help guide your hobby farm stormwater runoff site management decisions:

CHECKLIST TIPS

- **Keep in mind that some of the BMP's listed in Section 6 can be used to achieve more than one of the site management goals listed below.**
- **When considering potential BMP locations, it is often helpful to walk your hobby farm during or immediately following rain to observe stormwater runoff patterns.**

Which Best Management Practices (BMPs) are either currently used or could be applied to your hobby farm to achieve the following (list specific BMPs and potential locations):

☐ DISCONNECT stormwater flows, allowing precipitation to soak into the ground closer to where it lands

DISCONNECTION PRACTICE	EXISTING LOCATION	OTHER POTENTIAL LOCATIONS

☐ REROUTE stormwater flows, to prevent or minimize stormwater contact with potential pollutants (e.g., manure storage areas)

REROUTING PRACTICE	EXISTING LOCATION	OTHER POTENTIAL LOCATIONS

☐ PROVIDE TREATMENT AND NATURAL FILTRATION of stormwater before it can reach nearby wetlands and surface waters

TREATMENT/FILTRATION PRACTICE	EXISTING LOCATION	OTHER POTENTIAL LOCATIONS

SECTION SEVEN

HOBBY FARM MANAGEMENT AND SAFETY

The operation, organization, maintenance and management of every hobby farm varies based on its size and primary farming activities. The responsibilities that go into tending a small vegetable garden will often differ from those that have multiple farm animals, pastures and a larger field of crops.

Previous sections have provided an overview of many of the main activities a hobby farmer may be involved with based on the type of hobby farm. However, with this comes a number of important good housekeeping, operations and maintenance, and safety measures that should be in place to help ensure a safe and healthy hobby farm environment for everyone.

MAINTAINING AN ORGANIZED AND HAZARD FREE HOBBY FARM WITH PROPER EMERGENCY PLANNING CAN HELP AVOID SMALL PROBLEMS THAT CAN GROW INTO VERY LARGE HEADACHES AND EVEN LEAD TO UNSAFE SITUATIONS.

This section focuses on good management practices such as pest management and neighbor relations; overall farm safety measures like hazardous material use and storage; equipment maintenance; and emergency planning. The fact sheets provided in Section 7 also have a connection to water quality protection.

By planning ahead and following the 'avoid, minimize, mitigate' concepts woven throughout this section, you should be able to help protect nearby wetlands and water resources by:

- minimizing your use of potentially hazardous materials
- choosing products knowing that you have the knowledge to make a well informed choice
- using and maintaining equipment and storage areas to avoid hazardous spills
- knowing that time spent preparing for an emergency can help protect you, your hobby farm and nearby water resources

Section 7 contains the following:

- FACT SHEET 7-1 Integrated Pest Management
- FACT SHEET 7-2 Pesticide Use and Water Quality
- FACT SHEET 7-3 Pesticide Label Reading
- FACT SHEET 7-4 Pesticide Storage and Disposal
- FACT SHEET 7-5 Equipment Safety and Maintenance Basics
- FACT SHEET 7-6 Reading Hazardous Material Labels and Safety Data Sheets (SDS)
- FACT SHEET 7-7 Hazardous Material Use, Storage and Disposal
- FACT SHEET 7-8 Solid Waste Management
- FACT SHEET 7-9 Neighbor Relations: Communication
- FACT SHEET 7-10 Neighbor Relations: Odor, Dust and Noise Control
- FACT SHEET 7-11 Neighbor Relations: Fly, Mosquito and Rodent Control
- FACT SHEET 7-12 Food Safety
- FACT SHEET 7-13 Emergency Management Planning
- CHECKLIST 7A Hobby Farm Emergency Contact Form
- CHECKLIST 7B Emergency Response Procedures
- CHECKLIST 7C Hobby Farm Inventory
- CHECKLIST 7D Emergency Supplies Form
- CHECKLIST 7E Hobby Farm Management and Safety

FACT SHEET 7.1

INTEGRATED PEST MANAGEMENT

Along with the many benefits of hobby farming can come challenges, including the control of pests and disease. Integrated Pest Management (IPM) is an ecologically based approach for preventing, monitoring, and controlling pests, while eliminating or reducing the use of pesticides.

PESTICIDE USE CAN BE HARMFUL TO PLANTS, ANIMALS, PEOPLE AND THE ENVIRONMENT, PARTICULARLY SURFACE AND GROUNDWATER RESOURCES. USING AN IPM APPROACH TO CONTROL PESTS, WEEDS, AND DISEASE CAN HELP MINIMIZE PESTICIDE USE.

IPM TECHNIQUES

Prevention

Prevention is the first line of defense for pest control. It often includes modifications in cultural practices to prevent or reduce pest populations by making their environment less favorable. Changes may include rotating crops, planting pest-resistant varieties, improving soil structure for better microbial activity or implementing good housekeeping measures. Prevention can also include creating suitable habitat for the natural enemies of pests to thrive – a form of biological control to better manage pest populations.

Monitor and Identify

Monitor your hobby farm area for pests, weeds, and/or disease and be sure to identify specific problem areas. Population levels should be noted along with those of any natural enemies. Remember that not all insects, weeds, or other pests require control and some can be beneficial.

Set Action Levels

The presence of a single pest (or two) does not necessarily mean that there is a problem requiring control. Setting an action level or threshold for applying pest controls helps to determine at what point action to reduce the population should be taken. This limit will be different for each hobby farm and is based on the level at which the pest becomes a threat or surpasses the point tolerable.

CAUTION!

Pesticide use should be limited since these chemicals can:

- Pose a threat to human and animal health
- Pollute groundwater and surface water
- Disrupt biological activity in healthy soil
- Eliminate non-target species including pollinators
- Persist in crops and enter food supplies

Control

Once action levels have been met and it is clear that prevention methods are no longer effective then pest control may be necessary. Evaluating the proper controls should begin with mechanical options including trapping, weeding or barrier methods. If these are not effective then chemical controls can be considered starting with those that are target specific as opposed to those that broadcast spray non-specific pesticides.

Evaluate and Record

Once control methods have been implemented, an evaluation of the effectiveness of your efforts should be completed and recorded. Since pest problems can often exhibit trends and patterns, it is recommended that your monitoring, outbreak, and treatment method information be recorded. This will help next season to select more effective prevention and control methods if needed.

IPM IS NOT A SINGLE CONTROL METHOD, BUT A DECISION-MAKING PROCESS THAT REVOLVES AROUND MONITORING, PREVENTION, CONTROL AND EVALUATION. IPM CAN SUCCESSFULLY BE USED FOR ANY SIZE HOBBY FARM.

WATER QUALITY BENEFIT

IPM aims to help naturally regulate pest populations to a level where they have no impact on your hobby farm activities. Creating an undesirable environment for disease, certain insects, rodents and other unwanted pests can help eliminate the need for pesticide use that could otherwise have lasting environmental and water quality impacts.

HELPFUL LINKS

www.ag.umass.edu/greenhouse-floriculture/fact-sheets/integrated-pest-management
www.extension.unh.edu/Integrated-Pest-Management/IPM-Publications
www.nrcs.usda.gov/wps/portal/nrcs/detail/national/home/?cid=nrcs143_023552
www.npic.orst.edu/pest/ipm.html

FACT SHEET 7.2

PESTICIDE USE AND WATER QUALITY

Hobby farmers are encouraged to implement an Integrated Pest Management (IPM) approach to help control pests. If it is determined that a pesticide is warranted to control a pest population, disease or weed that cannot be managed through prevention, mechanical control, or other non-chemical IPM methods, there are several safety steps that should be taken to protect your hobby farm and nearby surface waters.

DID YOU KNOW?

A pesticide is a substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest. Pesticides can include:

- Herbicides
- Insecticides
- Larvicides
- Rodenticides
- Fungicides
- Disinfectants
- Repellents
- Natural/biological agents

PESTICIDES ARE AVAILABLE IN MANY FORMS INCLUDING LIQUID CONCENTRATES, READY-TO-USE FORMULATIONS, GRANULES/PELLETS, BAITS AND DUSTS/WETTABLE POWDERS.

Any of these products can reach nearby surface water sources through water and wind movement. Contamination of nearby waterbodies can occur when:

- Too much pesticide is applied
- Broadcast methods are used to apply pesticides
- Pesticide is applied before heavy rains or during windy conditions
- Pesticide is leaked or spilled onto a surface then carried off with stormwater runoff
- Heavy irrigation causing runoff takes place too soon after an application
- Pesticide storage or discarded pesticide containers are exposed to precipitation

CAUTION!

Even organic pesticide products can be harmful if applied improperly. Always follow the label instructions for both organic and non-organic products and start with the lowest toxicity product first.

REGULATORY CHECK
It is illegal to apply more than the labeled application rate of a pesticide. Also, check with your local Conservation Commission prior to applying pesticides within 100-feet of wetlands and water resources and within 200-feet of perennial (flowing most of the year) rivers and streams. Finally, remember to check with your city or town before applying pesticides or herbicides within a public right-of-way.

WHEN USING PESTICIDES, CONSIDER THE FOLLOWING:

Step 1 - Choose Carefully

Select a product that is labeled for your pest and location. A product cannot be legally used unless both your treatment area and pest are mentioned on the label.

Step 2 - Get Knowledgeable Advice

Contact your local or state cooperative extension to help determine appropriate pesticide use and application practices.

Step 3 - What's Your Signal Word?

Federal regulation requires that a signal word be prominently printed on the label of most pesticide products. Signal words are based on exposure effects if eaten, absorbed through the skin, inhaled or comes into contact with eyes and skin. Signal words include:

- **CAUTION** – slightly toxic
- **WARNING** – moderately toxic
- **DANGER/POISON** – highly toxic

Step 4 - How Much Do You Really Need

Read the label to determine how much product you are really purchasing. Concentrates may come in small containers but can make a lot of product. Read the label before you purchase – it will tell you how much of the product to apply and how to apply it. Buying in bulk may be economical but not if you consider the hassle of storing and disposing of the leftover product. Remember that more is not better. Applying more than the labeled application rate is not only illegal, but can be a health risk to yourself and your family in addition to risking damage to your plants, livestock, pets, and nearby water resources.

WATER QUALITY BENEFIT
Minimizing the use of pesticides can help prevent them from reaching nearby surface water through stormwater runoff or accidental spills.

HELPFUL LINKS
www.ag.umass.edu/greenhouse-floriculture/greenhouse-best-management-practices-bmp-manual/pesticides-groundwater
www.npic.orst.edu/ingred/products.html

FACT SHEET 7.3

READING A PESTICIDE LABEL

Hobby farmers may find the need to use a pesticide or herbicide as part of an overall management program, particularly if non-chemical integrated pest management measures are not working. Reading and understanding the information provided on a pesticide label is essential for the product's safe and effective use. Most of the information on a pesticide label is required to be provided to you by Federal Law. It is against the law to use a pesticide inconsistent with its label.

WHAT THE PESTICIDE LABEL WILL TELL YOU

- What the pesticide is approved to control (e.g. type of pest or weed)
- Ingredients in the pesticide
- Pesticide toxicity
- Health hazards and first aid information
- Physical, chemical and environmental hazards
- Directions for use: how, where, when and how often to apply
- Directions for storage and disposal
- Manufacturer contact information

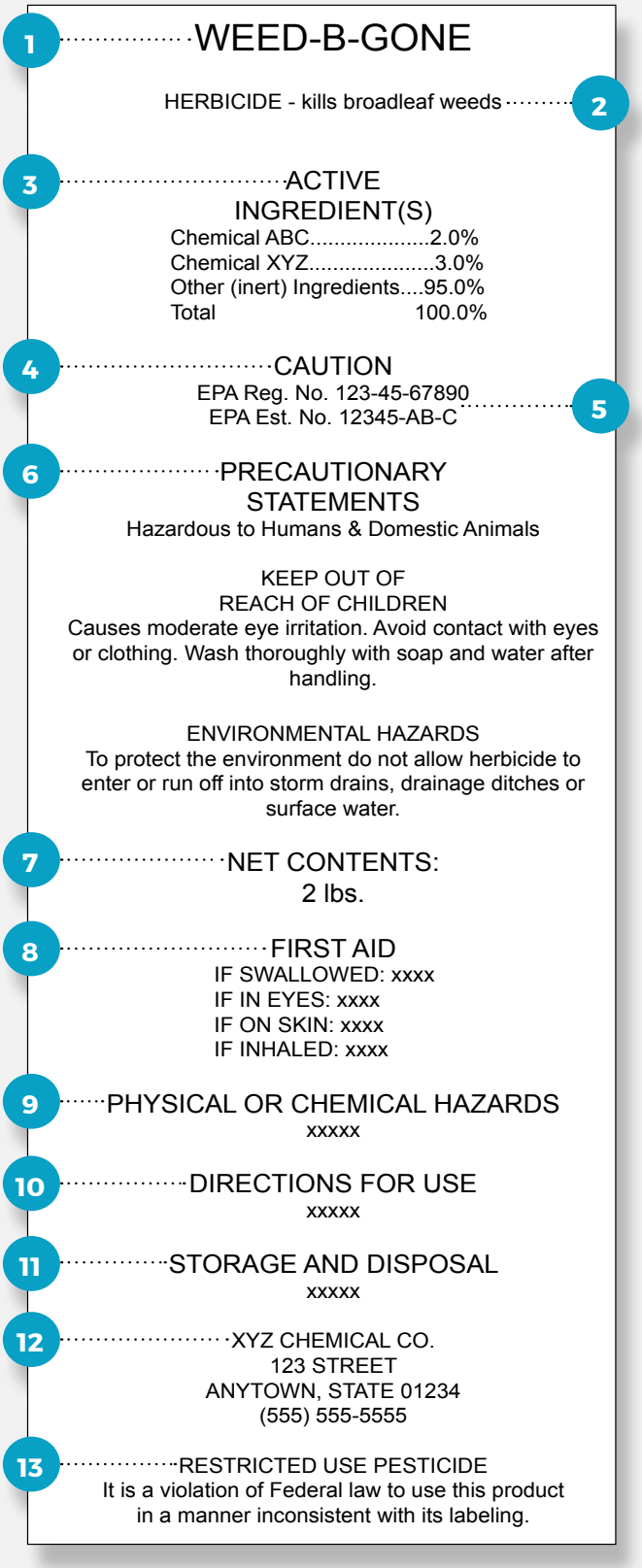
POLLINATOR PROTECTION ADVISORY ON PESTICIDE LABELS

Pesticides have long been known to impact important pollinators, including bees. A recent pesticide label change now requires the addition of a bee advisory box on certain pesticides to help protect pollinator populations. Identified by a bee icon, this advisory box alerts applicators to the potential hazard the pesticide poses to bees and other insect pollinator populations. This bee advisory box provides specific instructions and separate label restrictions to help minimize pollinator exposure during foraging (when plants and trees flower, shed pollen, or produce nectar).

REMEMBER, MANY CROPS RELY ON POLLINATORS TO BE SUCCESSFUL. ALTHOUGH WIND PLAYS AN IMPORTANT ROLE IN PLANT POLLINATION, BEES AND OTHER INSECTS ARE ALSO ESSENTIAL TO THIS PROCESS AND CAN BE NEGATIVELY IMPACTED BY PESTICIDE USE.

WATER QUALITY BENEFIT
Following pesticide label instructions can help reduce the chances of harmful chemicals reaching nearby water resources.

Sample Pesticide Label



1. **BRAND NAME -** The name used by the manufacturer. A particular active ingredient may be sold under several different brand names.
2. **PRODUCT DESCRIPTION -** Describes the type of pesticide and what it will control.
3. **ACTIVE INGREDIENT(S) -** The chemical that controls the pest. Inert or other Ingredient(s) do not directly impact the pest but help the active ingredient work.
4. **SIGNAL WORD -** Will be one of the following: CAUTION, WARNING, DANGER or DANGER/POISON with CAUTION being least toxic and DANGER/POISON being highly toxic. Signal words indicate the relative acute (short-term) toxicity of the product to humans and animals. If you are choosing between two products that will control the same pest, the signal word can be used to help choose the least toxic product.
5. **REGISTRATION AND ESTABLISHMENT NO. -** The registration # is proof that the product and label were reviewed by the U.S. EPA. The establishment # identifies the facility where the product was manufactured.
6. **PRECAUTIONARY STATEMENT -** Details of the potential hazards to people, pets and the environment. Most pesticide labels are required to say 'Keep Out of Reach of Children'. This area may also include the main route of entry (how a pesticide may enter the body), how to prevent exposure and required personal protective equipment.
7. **NET WEIGHT -** The total volume or weight in the pesticide container.
8. **FIRST AID SECTION -** Outlines what to do in case of exposure to the pesticide.
9. **PHYSICAL OR CHEMICAL HAZARDS -** Describes potential fire, chemical, or explosion hazards specific to the pesticide.
10. **DIRECTIONS FOR USE** - Details how to properly apply the pesticide safely. Information may include: what type of pest it can be used to control, where it can be used, how to apply it, how much to apply (rate of application, dilution rate), frequency (how often), when to apply it, how soon after application people and animals can come into contact with a treated area, and how soon a crop can be harvested or consumed after treatment.
11. **STORAGE AND DISPOSAL** - Details how the product should be stored and how to dispose of unused product and empty containers.
12. **MANUFACTURER** - Gives the name and contact information for the product manufacturer.
13. **RESTRICTED USE PESTICIDE** - Pesticides are either General Use Pesticides (GUP) or Restricted Use Pesticides (RUP). RUPs are generally more toxic and require the applicator to be trained and certified to purchase and apply it.

FACT SHEET 7.4

PESTICIDE STORAGE AND DISPOSAL

Proper pesticide storage and disposal is an important part of good housekeeping on a hobby farm. Poor storage and disposal practices can result in harmful chemicals reaching nearby surface and groundwater, severely impacting water quality. Pesticide storage and disposal practices should start with limiting the amount and type of pesticide stored. Purchase only the minimum of what you need for the current season.

CAUTION!
Pesticides should never be stored outdoors or on pervious surfaces where they can come into contact with soils and stormwater runoff.

PESTICIDE STORAGE AREAS SHOULD:

- ✓ Be located inside a dry secure structure or cabinet that can be locked.
- ✓ Not be in basements, locations containing open floor drains or where there is a potential for flooding.
- ✓ Be kept away from children and pets. Avoid storing pesticides in your general living area.
- ✓ Be located away from both surface and groundwater sources.
- ✓ Be stored away from direct sunlight, freezing temperatures and extreme heat.
- ✓ Be stored separately from food, feed, seeds, animals and animal supplies, fertilizers, petroleum products, lubricants, cleaners and other chemicals to avoid cross-contamination.

When storing pesticides remember to:

- ✓ Store wet and dry pesticides separately if possible.
- ✓ Keep them closed in their original labeled containers unless the container is broken and/or at risk of leaking or spilling. In this case, the material should either be used or disposed of according to the label
- ✓ Consider storing pesticide containers inside a plastic bin. This bin can provide secondary storage if a spill or leak were to occur while in storage.
- ✓ Immediately clean up pesticides, spills and follow proper disposal practices.
- ✓ Always read the pesticide label prior to storage to ensure you are storing it according to any special labeled storage instructions.
- ✓ Flammable and non-flammable pesticides should be stored separately.

WATER QUALITY BENEFIT
Good pesticide storage and disposal practices combined with efforts to reduce product use can help keep nearby surface and groundwater protected from pesticide contamination.

ACTIVE INGREDIENTS VS. INERT INGREDIENTS

Active ingredients are the chemicals in a pesticide product that control the pest. Inert ingredients are the materials in a pesticide that are added to make the product safer; more effective; and easier to measure, mix, apply, and handle. The pesticide formulation is the mixture of the active and inert ingredients.

For emergency preparedness be sure to:

- Keep Safety Data Sheets (SDS) nearby. SDSs contain more detailed information on the contents, hazards, and proper handling, storage and disposal of a product than may be on a label. You can obtain copies of SDSs from the product manufacturer and in most cases, these are freely available on the Internet. These should be stored in a nearby accessible area.
- Keep emergency clean-up material nearby such as pet litter or other absorbent material along with a shovel and waste container.
- Never hose down pesticide leaks or spills. Contaminated washwater can be highly concentrated and contaminate nearby surface and groundwater resources.
- Keep personal protective equipment such as protective clothing, helmets, goggles, or other garments or equipment designed to protect an individual using the product near the storage area. Types of protective equipment needed are typically specified on the product label or in the SDS.
- An emergency response plan should be developed to include procedures in case of a spill or accident along with emergency contact information.

REMEMBER, THE ABOVE STORAGE AND DISPOSAL PRACTICES ARE SUGGESTED. PESTICIDE LABEL INSTRUCTIONS FOR STORAGE AND DISPOSAL SHOULD BE CLOSELY FOLLOWED.

For pesticide disposal be sure to:

- Read the pesticide label to make sure you are following proper disposal practices. Using, storing or discarding pesticides and their containers in a manner inconsistent with its label is against the law.
- Empty liquid pesticide containers should be triple rinsed with the washwater collected and added to the next dilution.
- Liquid containers that have been triple rinsed and empty dry pesticide containers and bags should be discarded according to the label directions. Generally, this material can be discarded with your regular trash and solid waste.
- Do not recycle or reuse pesticide containers.
- Never pour leftover or unwanted pesticides into a sink, toilet, sewer, dry well or storm drain.
- Most communities hold household hazardous waste days where pesticides can be brought for proper disposal.

HELPFUL LINKS

www.ag.umass.edu/greenhouse-floriculture/fact-sheets/pesticide-storage
www.ag.umass.edu/greenhouse-floriculture/greenhouse-best-management-practices-bmp-manual/pesticide-storage-handling
www.mass.gov/eea/agencies/massdep/recycle/hazardous/pesticides.html
www.epa.gov/pesticide-labels/keep-safe-read-label-first

FACT SHEET 7.5

EQUIPMENT SAFETY AND MAINTENANCE BASICS

Hobby farm equipment will vary from one farm to another often based on the size of the hobby farm and the types of activities. Typical equipment includes: garden tools, wheelbarrow or hand cart, rototiller, lawn mower and small electric or gas power equipment.

Some hobby farms might even have a small tractor, utility vehicle and/or livestock trailer. Whether it's a large piece of complex equipment or a simple hand tool, safety and maintenance is important to prevent injuries and protect nearby water resources.

STAY ON TRACK
Read and Follow the Owner's Manual - Before using any equipment, read the manual to be familiar with its operation, maintenance, and any warnings.

EQUIPMENT STORAGE, FUELING, AND MAINTENANCE

All hobby farm equipment should be stored, fueled and maintained in a manner that reduces the potential for injury and the likelihood of chemicals to be released into the environment. One way is to store equipment indoors, on a hard, impermeable surface to prevent any potential leaks from coming into contact with soils. Be sure to fuel and maintain equipment on an impermeable surface and under cover, but not indoors, if possible.

Follow these safety tips for hobby farm equipment storage, fueling, and maintenance:

Storage

- When parking vehicles, use the 'Safe Stop' method where you: stop in a safe place, apply the handbrake, disengage, lower any attachments, turn off the engine and remove the key.
- Immediately clean up spills and leaks of fuel or maintenance fluids which can occur under and around stored power equipment. Be sure to keep a spill cleanup kit nearby.
- Do not wash areas containing spills – use dry methods such as absorbent pads and socks or even clean kitty litter whenever possible.

CAUTION!
If a petroleum spill of more than 10 gallons occurs, or if any size spill reaches a waterbody or storm drain, you should call the fire department (911), then the Massachusetts Department of Environmental Protection at their 24-hour spill reporting hotline (1-888-304-1133)

CAUTION!
Many hobby farms have portable generators for use during a power loss. There are inherent hazards associated with generator use and if operated incorrectly could lead to electrocution, carbon monoxide poisoning, or fire to name a few. The following link provides basic generator safety tips to help ensure safe use of your portable generator - www.osha.gov/OshDoc/data_Hurricane_Facts/portable_generator_safety.pdf

Fueling

- When filling gas canisters, always place the canister on the ground before filling.
- Do not refuel equipment near a wetland or water resource area.
- Do not top off fuel tanks.
- Never leave equipment unattended while fueling.

Maintenance

- Follow maintenance procedures and schedules found in the equipment manual – regular maintenance can prevent equipment failure and fuel spills during operation.
- Collect and recycle oil, transmission fluid, and hydraulic fluid whenever possible. Recycling often removes this material from your hobby farm as well as the potential for accidental spills.
- Leaks can occur after maintenance so placing a clean piece of cardboard or drip pan (if outside) underneath the equipment can help detect leaks.
- Check the fluids regularly (engine oil, transmission fluid, coolant level, etc.) – low levels may indicate a leak.

Enforce the "No Riders" Rule

Most tractors are not equipped to accommodate extra riders or passengers, especially children. Unless your tractor has an 'instructor seat', extra riders are at risk of severe injury or death due to being crushed by the tractor or trailing equipment in the event of an accident. Sudden stops, sharp turns or holes can easily cause a rider to be thrown from the tractor – even tractors with enclosed cabs. No matter how slow you are driving, you cannot stop a tractor before it rolls over a thrown rider. A "NO RIDERS" rule for all tractors at all times may be the single best way you can assure the safety of others.

THOUSANDS OF ACCIDENTS INVOLVING CHILDREN OCCUR EVERY YEAR IN FARM ENVIRONMENTS, INVOLVING FARM MACHINERY, EQUIPMENT AND ANIMALS.

The following links include useful information on how to keep children safe in a farm environment:

- www.farmsafety4kids.net
- www.uvm.edu/extension/youth/youthfarmsafety/?Page=resources.html

WATER QUALITY BENEFIT
Store, fuel and maintain all farm equipment properly and away from wetlands, streams, rivers, lakes, ponds and storm drains. Doing this can help eliminate leaks and spills and keep hazardous materials out of nearby surface waters.

FACT SHEET 7.6

READING HAZARDOUS MATERIAL LABELS AND SAFETY DATA SHEETS (SDS)

Hobby farms commonly use small amounts of hazardous materials. Hazardous materials are defined as chemical, biological or physical substances that can cause harm to people, animals, and/or the environment. This may include: fuel and lubricants for equipment, fertilizers, pesticides, herbicides, medications and cleaning solutions.

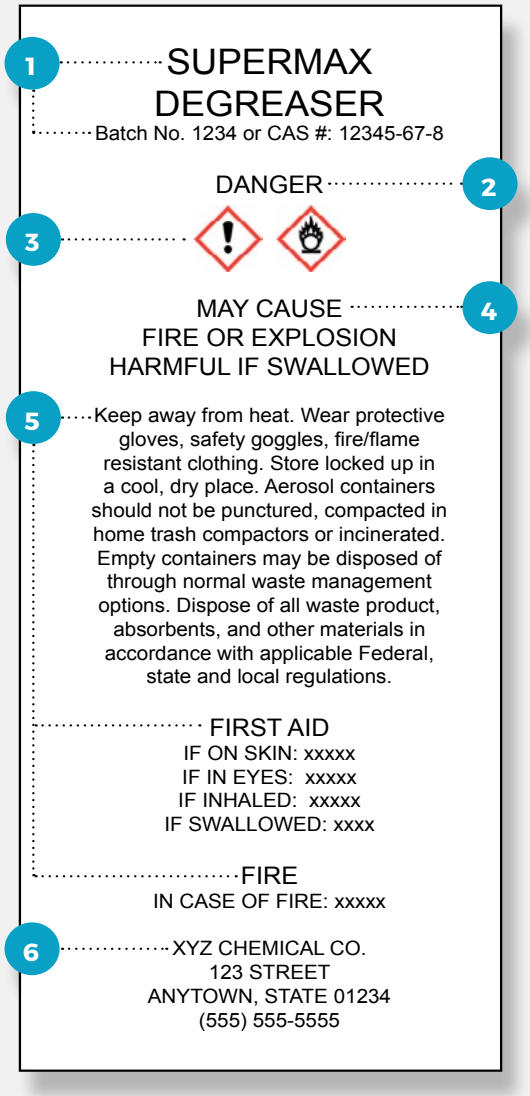
If incorrectly used or mishandled, hazardous materials can be a source of surface water pollution. Reading and understanding the information provided on product labels is essential for the safe and effective use of these materials and to help prevent unwanted health and water quality impacts.

The following provides guidance on how to read hazardous material product labels and how to identify their hazards*.

1. **PRODUCT IDENTIFIER** - Includes the chemical name to identify the product.
2. **SIGNAL WORD** - Indicates the relative level of severity of the hazard the chemical presents, "Warning" is used for less severe hazards and "Danger" is used for more severe hazards.
3. **PICTOGRAM OR HAZARD WARNING SYMBOL** - Standard symbols used to quickly convey specific information about chemical hazards. Hazard warning symbols found on labels provide a quick reference to the dangers of a product, and precautions to be taken when storing and handling it.
4. **HAZARD STATEMENT** - Describes the nature of the hazard.
5. **PRECAUTIONARY STATEMENT** - Describes measures to prevent adverse effects from exposure, or improper handling of the chemical. The four types of precautionary statements include chemical information related to prevention, response procedures, storage and disposal.
6. **CONTACT INFORMATION**- Name, address and telephone number of the chemical manufacturer, importer or other responsible party.

*Note that pesticides have their own labeling system and are often labeled differently than hazardous materials.

Sample Hazardous Materials Label

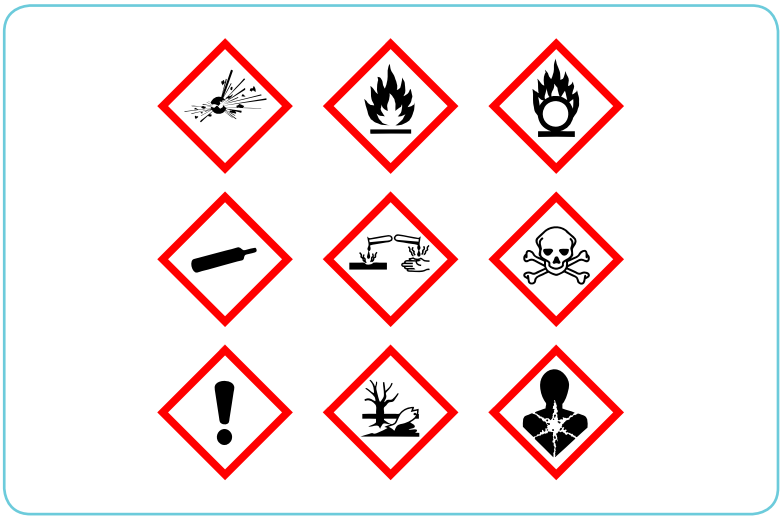


DID YOU KNOW?
A hazardous material is a chemical, biological or physical substance that has the ability to cause harm to people, animals and/or the environment. A hazardous material that can no longer be used for its intended purpose is called a hazardous waste. It is a material that has been spent, used up or contaminated beyond its ability to be used.

SAFETY DATA SHEETS (SDS)

For more detailed information on a chemical, you can refer to the Safety Data Sheet (SDS). It's a good idea to have a SDS for all hazardous chemicals you use and store on your hobby farm. SDSs contain similar, but more detailed information about a product than the label and includes:

- product identification
- hazard identification
- composition/information on ingredients
- first-aid measures
- fire-fighting measures
- accidental release measures
- handling and storage information
- exposure controls/personal protection
- physical and chemical properties
- stability and reactivity
- toxicological information
- ecological information
- disposal considerations
- transport information
- regulatory information



BEFORE BUYING

Always read the label of a product before purchasing. Consider using the safest option that will get the job done and look for products that are non-toxic, biodegradable, and contain no hazardous ingredients, if available. However, remember that even these products can impact water quality if not handled properly. Always purchase the least amount necessary to get the job done. Storing and disposing of unused chemicals increases the risk of exposure and leaks.

READING YOUR CHEMICAL LABEL AND UNDERSTANDING ITS RISKS AND WARNINGS IS AN IMPORTANT STEP IN PROPER HAZARDOUS MATERIAL MANAGEMENT. THE MORE YOU KNOW ABOUT THE PRODUCTS YOU USE, THE BETTER EQUIPPED YOU ARE FOR NOT ONLY PREVENTING SPILLS TO PROTECT WATER QUALITY, BUT FOR EFFICIENTLY AND EFFECTIVELY DEALING WITH AN EMERGENCY SHOULD ONE OCCUR.

CAUTION!
A Safety Data Sheet (SDS) should be kept for all chemicals utilized on your hobby farm and be easily available in the event of an emergency such as a spill or fire.

FACT SHEET 7.7

HAZARDOUS MATERIAL USE, STORAGE AND DISPOSAL

Hazardous materials and waste can be used and generated as a result of a number of common hobby farm activities. Fuel, lubricants, antifreeze, fertilizers, pesticides, herbicides, paints, cleaners, and medicine are a few of the hazardous products that may be used on hobby farms. The proper use, storage, and disposal of these materials is an important part of good housekeeping and water quality protection.

A hazardous material may occur as a solid, liquid or gas and is defined as any item or agent (biological, chemical, radiological, and/or physical) which has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors.

If a material exhibits one or more of the characteristics listed below or contains a number of toxic constituents that have been shown to be harmful to human health and/or the environment, it is hazardous.

- **Ignitable** — capable of being burned or causing a fire.
- **Corrosive** — capable of dissolving metals and/or other materials and destroying living tissue on contact.
- **Reactive or Explosive** — unstable or undergoes a rapid or violent chemical reaction when exposed to air, water or other chemicals.
- **Toxic** — poisonous, either immediately or over a long period of time to plants and/or animals.

START WITH THE 3 R'S

- **Reduce** the amount of waste generated by purchasing only what you need. Consider a less hazardous or non-hazardous alternative.
- **Reuse** by giving unused or unwanted products to others who could use them.
- **Recycle** whenever possible by working with your community recycling center.

CAUTION!
If a petroleum spill of more than 10 gallons occurs, or if any size spill reaches a waterbody or storm drain, you should call the fire department (911), then the Massachusetts Department of Environmental Protection at their 24-hour spill reporting hotline (1-888-304-1133)

HAZARDOUS MATERIALS STORAGE

- Make an Emergency Management Plan, including what to do in case of a spill.
- Always keep a spill cleanup kit nearby in case of spills.
- Keep Safety Data Sheets for each chemical in a separate but nearby location from your storage area.
- Keep hazardous materials inside a secure structure or cabinet that can be locked, keeping them safe from spills and accidents and inaccessible to children and animals.
- Always store material in the original container with the original label. If the container is at risk of leaking, place it in a secondary container and promptly use or dispose of it.
- Consider placing the material in a secondary container, such as a plastic storage bin, to catch potential leaks or spills (but only if the storage bin material and the method of storage is consistent with the SDS instructions).
- Keep in a location away from surface water and groundwater resources.
- Do not store materials in basements, areas prone to flooding, or in areas with floor drains.
- Store in a dry area, away from sunlight, freezing temperatures, and extreme heat.
- Keep materials away from general living areas and always store away from food, animal feed and seeds.
- Separately store chemicals by hazard class such as flammables in one area and poisons in another. Similarly, separate acids and bases from each other and other incompatibles. Visit the following link for helpful information on chemical storage: www.bu.edu/ehs/files/2011/03/Chemical-Segregation-and-Storage-Chart.pdf.
- If keeping hazardous materials in a secure storage cabinet is not possible, store them off of the ground in a dry location to prevent corrosion or washing away of chemicals or in secondary containment such as a plastic tub (consult the SDS to make sure the chemical is not reactive with the plastic).
- Rags used to clean up liquid spills may be a fire hazard. Store them in a covered, combustion-proof container.

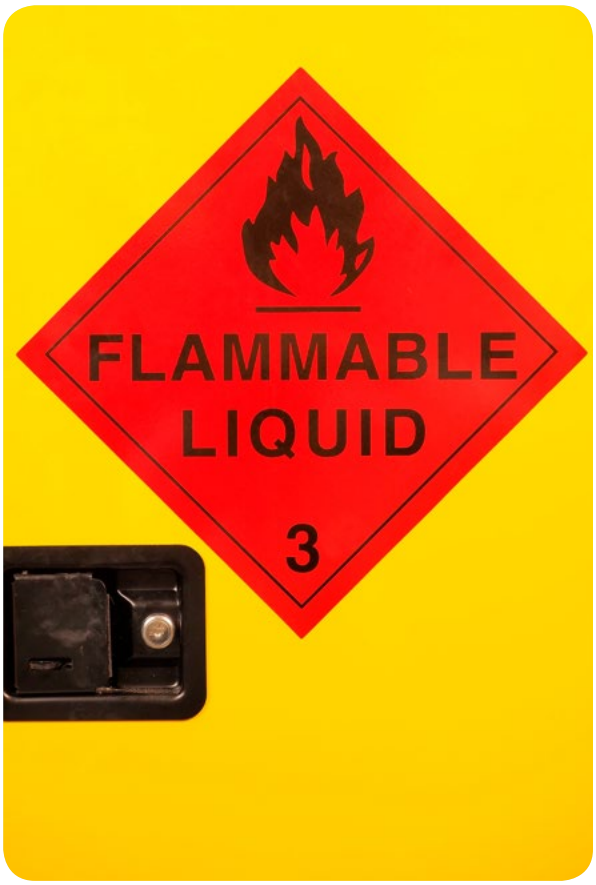
REMEMBER: REDUCE THE AMOUNT OF WASTE THAT MUST BE DISPOSED OF BY BUYING ONLY THE AMOUNTS NEEDED TO COMPLETE THE JOB OR GIVING THE REMAINING PRODUCT TO SOMEONE WHO CAN USE IT. THIS ALSO PREVENTS ACCIDENTS OR CONTAMINATION THAT COULD RESULT FROM IMPROPER STORAGE.

CAUTION!
Never dispose of hazardous materials or waste directly onto the ground, into surface waters or into storm drains or catch basins. Also, never dispose of hazardous materials or waste in household trash, unless the product label or SDS indicates this is okay.

HAZARDOUS MATERIAL USE

- Prepare for accidents – know what you will do if you have a spill or an emergency. Always have a spill kit nearby.
- Don't eat, drink, or smoke while handling hazardous products.
- Wear appropriate clothing and protective equipment for working with the chemicals – goggles, gloves, long sleeve shirt, respirator, or a dust mask may be just a few of the necessary protective measures to take.
- Never mix hazardous materials together unless specified by the manufacturer's instructions.
- Use the correct amount for the job as specified on the product label – twice as much is rarely twice as effective.
- If working indoors, make sure the space is well ventilated.
- Always wash your hands after handling hazardous materials.

HAZARDOUS MATERIAL DISPOSAL



- Find where you can dispose of household hazardous waste by visiting the MassDEP's Municipal Household Hazardous Waste Collection Facilities website: www.mass.gov/eea/agencies/massdep/recycle/hazardous/household-hazardous-waste-collection-facilities.html. If your city or town is not listed, there are several facilities available to residents of all municipalities.
- Contact your city or town to learn what hazardous material and waste collection programs are available.
- Used oil can be returned to the store where you bought it. Retailers are required to accept up to 2 gallons per person, per day if you have the purchase receipt.
- Oil filters can contain up to 12 ounces of oil. To recycle, puncture the domed part of the oil filter with a sharp tool. Drain filters on a rack while they are hot for 12 hours, then bring to the auto supply store for recycling.
- Never pour hazardous materials down drains, especially those connected to a septic system where materials may kill organisms needed to break down waste. This could also be a pathway for hazardous materials to contaminate groundwater.
- For help on recycling a specific type of hazardous material, visit the MassDEP's Hazardous Household Products: Handling and Management webpage: www.mass.gov/eea/agencies/massdep/recycle/hazardous/hazardous-household-products-handling-and-management.html.

IF YOU ARE GENERATING LARGE AMOUNTS OF HAZARDOUS WASTE, YOU MAY NEED TO REGISTER AS A HAZARDOUS WASTE GENERATOR.

Visit the following link for registration thresholds and additional information: www.mass.gov/eea/agencies/massdep/recycle/hazardous/the-very-small-quantity-generator-of-hazardous-waste.html.

FACT SHEET 7.8

SOLID WASTE MANAGEMENT

Depending on your specific hobby farm activities, you could produce a variety of solid wastes that will require disposal or recycling. Solid waste is often comprised of discarded materials including household trash, building debris, paper, plastic, glass, food waste, yard waste, animal waste and scrap material but does not include hazardous materials waste that require special disposal. The proper storage, handling and recycling of solid waste is important to prevent the transport of contaminants to water resources.

DID YOU KNOW?
Many communities have free recycling programs. Check with your community to see what waste materials you can recycle such as paper and cardboard, building materials, scrap metal, plastic, glass and appliances. Many recycling centers also accept certain universal waste such as batteries, fluorescent bulbs, and mercury containing items like thermometers.

SOLID WASTE MANAGEMENT SHOULD ALWAYS BEGIN WITH THE THREE R'S – REDUCE, REUSE AND RECYCLE.

By reducing, reusing and recycling you can significantly lower the volume of solid waste you need to manage on your hobby farm.

There are several types of solid waste including:

- **Organic Waste** – any waste that will decompose naturally. Organic waste often may be composted or reused, such as animal manure or yard and garden waste.
- **Recyclables** – any materials that can be separated and recycled like metal, paper and plastic.
- **Municipal Solid Waste** – includes household trash and other non-hazardous waste that is not organic and cannot be recycled.

RECYCLE
Consider composting your yard and garden waste along with manure generated from farm animals. This compost can be highly sought after by gardeners as a soil amendment since it can be high in nutrients and organic matter. Visit www.howtocompost.org for more information on composting or see Fact Sheets 4.7 and 5.5.

MANAGING SOLID WASTE

Consider the following steps when managing solid waste:

- All waste management areas, including dumpsters, should be located on a flat, paved surface and away from storm drains and water resources.
- Dumpster and waste receptacles should be leak-tight with lids to keep precipitation out.
- Consider using animal proof receptacles to prevent animals such as raccoons, squirrels, dogs and other critters from entering your trash and making a mess.
- If there is unavoidable leakage, either place the container in an enclosed area or construct a berm around it to contain the leakage. Leaking material from dumpsters and waste receptacles may contain pollutants that should be prevented from reaching soils and surface waters.
- Solid waste not in containers should be covered. Acceptable coverage includes plastic tarps and building overhangs.
- Prevent stormwater runoff from other parts of the hobby farm from entering your solid waste management area by enclosing the area or building a berm.
- Take special care when loading or unloading solid waste to minimize spills. Clean up spills immediately when they occur.
- Ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, batteries, etc. may not be disposed of in solid waste containers. Always check with your municipality or solid waste disposal company.

INSPECTION AND MAINTENANCE

Regularly perform the following to ensure proper solid waste management:

- Sweep and clean your solid waste storage area regularly.
- Inspect solid waste containers for structural damage or leaks regularly. Repair or replace damaged containers as necessary.
- Regularly recycle or dispose of unused scrap/junk materials.

WATER QUALITY BENEFIT
A sound solid waste management plan can help you maintain good storage practices, minimize disposal costs and maximize recycling opportunities, while preventing waste material from entering nearby storm drain systems and surface waters.

FACT SHEET 7.9

NEIGHBOR RELATIONS: COMMUNICATION

Hobby farms can be found in all areas of the country with their small size making them ideal to be located in suburban and rural neighborhoods. Even though hobby farmers tend to manage less land and fewer animals, they still have to deal with some of the challenges that larger agricultural operations face, just on a smaller scale and often with less time and assistance.

These challenges can include manure management, noise and odor control, pest management, and erosion. However, along with these challenges comes the task of learning to co-exist with non-farming neighbors (and vice-versa!). Being a good neighbor becomes even more crucial in higher density areas where there is little buffer between you and your neighbor, which can sometimes lead to your struggles becoming that of your neighbors' as well.

KNOW YOUR LOCAL RULES AND REGULATIONS

Every community has different rules when it comes to what you can and can't do with your property. It helps to be familiar with the land use regulations specific to your city or town since they often differ from one community to another. Know what permits you need and be knowledgeable about the rules and regulations that apply to you.

These may include:

- minimum property line setbacks
- nuisance (noise/odor/dust) ordinances
- fencing requirements/restrictions
- minimum required area for specific animals
- animal-specific rules such as a limit on roosters

WATER QUALITY BENEFIT

Adhering to good hobby farm practices not only make your activities more conducive to happy neighbors but the protection you provide to nearby surface waters will benefit your entire community as a valued resource.

HOBBY FARM LAYOUT

Choosing a hobby farm layout can have an immediate impact on neighbor relationships. Hobby farmers should be mindful of the sounds and smells that will be generated from hobby farming activities and how they may be offensive to non-farming neighbors. The relationship between a hobby farmer and neighbor can often lead to conflicts when a layout does not take into consideration potential impacts to neighbors.

Precautions to locate activities away from neighboring properties and to provide visual, odor and noise barriers can help to avoid possible complaints.

- Choose the right fencing to prevent animals from entering neighboring properties.
- Provide adequate screening to protect neighbor privacy.
- Consider a vegetated buffer or windbreak to help prevent the drift of odor, dust and noise from your property to your neighbors.
- Locate compost and manure piles downwind and as far as possible from neighboring houses and yards, keeping in mind surface water resources and storm drain locations.

COMMUNICATING CAN BE KEY TO COEXISTING

The best way to communicate with a neighbor is to get out and meet them. Meeting your neighbor is a great way to gage their point of view when it comes to your hobby farm plans and activities. A farmer's communication skills may be as important as minimizing odors, noise or pests to maintain a good relationship with your neighbor.

Know your neighbor

- Be neighborly and a good listener.
- People are often more open to individual discussion and will become an ally once a personal connection is made.
- Resolve conflicts through compromise and by adjusting farming practices that are the source of the problem.
- Neighbors are a great resource for information. Discussions may lead to information that could be helpful in managing your hobby farm.
- Invite neighbors over to show them the farm, talk about your activities and how you have taken actions to mitigate potential nuisances caused by your hobby farm.
- Invite neighbors over to observe or participate in the harvest or other milestones.

Most hobby farmers are very good at raising animals and growing food. You may find that you end up with excess food during the year. Bringing your neighbor fresh eggs and vegetables or hosting a neighborhood barbecue is a great way to show your appreciation for being a good neighbor and build positive relationships.

GOOD HOUSEKEEPING

The appearance of your hobby farm plays a big role when developing neighbor relationships and can be a direct reflection on you and your willingness to be considerate of your non-farming surroundings. Hobby farming is a commitment that requires a lot of time. Make sure you can handle the daily and weekly schedule required to complete your farming activities and maintenance so your property won't become a neighborhood eyesore. Investing time to maintain an eye-pleasing farm will help gain the support of your neighbors.

FACT SHEET 7.10

NEIGHBOR RELATIONS: ODOR, DUST AND NOISE CONTROL

Hobby farms are located in all sizes and types of communities and neighborhoods. As a result, neighbor considerations should always become part of your farm management plan. A common but often challenging issue is odor, dust and noise control.

ODOR CONTROL

A common complaint from non-farming neighbors can be odor. Complaints associated with odor typically occur in the spring and summer when work on a hobby farm is at its peak and neighbors begin spending more time outdoors. Hobby farms with animals tend to have more complaints due to the accumulation of manure. When manure breaks down, hydrogen sulfide, ammonia and methane are released into the air and together cause an unpleasant odor. Hobby farms growing crops can also receive odor complaints if they have compost piles or apply manure to gardens and crops.

There are three basic strategies to control agricultural related odor:

1. Prevent the creation of odors.
2. Reduce existing odors.
3. Disperse odor before it leaves your hobby farm boundaries.

For more information on the above steps, visit: https://ag.umass.edu/crops-dairy-livestock-equine/fact-sheets/odor-control.

Consider the following odor control tips:

- Determine the direction of prevailing winds and locate animal yards, manure storage and compost areas downwind of neighbors to minimize odors and dust blowing in the direction of neighbors.
- Evaluate your available space to support healthy animals. Determine your 'stocking rate' or amount of space each animal requires to be properly cared for. Uncontrollable odor may be an indication that you have exceeded the number of animals you have room for or that you need to readjust your animal management practices such as your manure management plan.

REGULATORY CHECK

Many communities have local air pollution or nuisance regulations that address noise, odor and dust issues. Ranging from specific standards such as limiting noise decibel ranges during daytime hours to determining if odor or dust is a nuisance that is causing harm or impeding one's use of property, these issues are most often addressed on a local level. Contact your city or town hall for more information.

WINDBREAKS

Vegetated buffers, filters and strips can serve as windbreaks if placed around the perimeter of the area causing odor, dust and noise. Planting a variety of native shrub and tree species can disrupt these nuisance conditions and help control impacts to neighbors.

- Reduce application rates of surface-applied manure or switch to composted or aged manure.
- Avoid applying manure, fertilizers or other soil amendments on weekends, holidays, or when social events are taking place.
- Follow good housekeeping practices for routine care of barns, animal yards and other animal enclosures. Employ proper stormwater management practices and good ventilation and air distribution near these animal areas to keep them dry.
- Follow proper composting procedures and consider adding a layer of wood chips on top of compost or manure piles to help reduce odor.

DUST CONTROL

Dust control can be a problem for hobby farmers and quickly become a neighbor complaint, particularly during drier times of year. The most effective means of dust control is prevention.

Consider the following dust control tips:

- Do not plant or disturb soil during high winds.
- Plant soon after soil is turned or plowed to quickly stabilize the ground.
- Cover compost, manure piles and any other earthen piles.
- Stabilize unvegetated areas and locations susceptible to erosion.
- Use cover crops to minimize wind erosion.
- Seed bare or sparsely vegetated pasture areas.
- Promote water retention in garden soils by maintaining a high organic content through the use of compost and other organic soil amendments.
- Apply gravel to locations where frequent dust problems occur such as on unpaved roads, pathways and in animal yards.

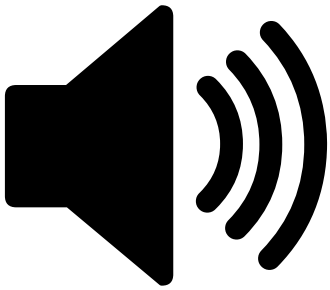
AIRBORNE DUST PARTICLES CAN CAUSE RESPIRATORY PROBLEMS FOR HUMANS AND ANIMALS RESULTING IN BOTH SHORT AND LONG-TERM HEALTH EFFECTS. DUST IS NOT ONLY A NUISANCE, BUT CAN BE A HEALTH HAZARD.

CAUTION!
Check the weather and avoid activities during high winds that can stir up dust and other particulates and create excessive odor.

NOISE CONTROL

Many sounds are generated on a farm. You may love the sounds of farm animals and the tractor running in a nearby field, but the noise may be annoying to some neighbors. Sound generated by animals and farm equipment may be perceived as noisy and intrusive if the sound levels are higher than typical background levels. Many communities have a noise ordinance in place to limit the allowable noise levels at different times of the day. Maximum allowable noise levels are typically higher during daytime hours and lower during nighttime hours.

Noise generated from hobby farms will vary, based on the number and types of animals being raised, the range of farming activities, types of equipment, landscape, and location relative to adjacent properties.



Animal noises become more noticeable when large numbers of animals are present. Sheep, goats and roosters will typically generate more noise than other farm animals which should be a consideration when choosing which animals to raise on your farm. Farm animals and farming activities should be located as far as possible from neighbors to minimize noise intrusion.

Hobby farmers should be aware that the time of day farm equipment is used will generate a noticeable difference in the noise level. Operating equipment in the late evening and early morning may be perceived as noisier and more intrusive than daytime operation.

HOBBY FARM NOISE CAN BE SIGNIFICANTLY REDUCED WITH THE USE OF SCREENING SUCH AS EARTHEN BERMS, FENCES, VEGETATION AND STRUCTURES. WHEN TRYING TO REDUCE NOISE LEVELS IT IS BETTER TO INCLUDE MULTIPLE TECHNIQUES TO ABSORB, DEFLECT, AND MUFFLE INTRUSIVE SOUND. LOCATING A SCREEN AS CLOSE TO THE SOURCE AS POSSIBLE WILL BE MOST EFFECTIVE AT REDUCING NOISE.

WATER QUALITY BENEFIT
Controlling the drift of materials offsite can help prevent windborne particles from reaching nearby waterbodies and impacting water quality.

HELPFUL LINKS
www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1167383.pdf
www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1049502.pdf
www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/mdpmctn7166.pdf

FACT SHEET 7.11

NEIGHBOR RELATIONS: FLY, MOSQUITO AND RODENT CONTROL

Hobby farms have numerous areas that could attract and promote the breeding of pests. Compost piles, crop residue, manure and animal feed can encourage the presence of flies, mosquitoes, and rodents if not managed properly.

Consequently, because of the close proximity of neighboring properties, an increase in pest populations will create a nuisance for your neighbors. Hobby farmers can prevent infestations from occurring with good farm management practices that include an Integrated Pest Management (IPM) program beginning with prevention.

RODENT CONTROL

Rodents can affect hobby farms in several ways. They can carry disease and contribute to the spread of other diseases caused by the parasites that infect them. Physical damage to structures can occur as a result of rodents chewing on materials such as wood, plastic, rubber and electrical wiring. Finally, rodents can cause crop damage, eat animal feed and even consume young chicks.

Techniques for controlling rodents:

- Introduce a predator such as a barn cat.
- Keep your barn, storage and animal areas clean by using good housekeeping practices.
- Keep all extra feed in sturdy, closed, rodent proof metal containers.
- Always clean up spilled feed and dispose of empty feed bags.
- Immediately dispose of or compost food waste.
- Don't leave food or water out at night.
- Fix leaky taps, hoses and pipes; and empty all water holding containers when not in use.
- Keep grass cut short and do not pile brush near structures.
- Remove old building materials and eliminate any other potential hiding spots.
- Remove and dispose of rodent nests as soon as they are found.
- Use proper compost and waste management techniques.

CAUTION!
Rodents are not only a nuisance and health hazard but with their inclination to chew on electrical wires, can be the cause of structural fires. Encase wires in metal conduit pipe to help prevent rodent access and use the above management techniques to help control rodent populations.

MOSQUITO CONTROL

Mosquitoes can be more than just an annoyance on and around a hobby farm; they can carry disease that may impact human and animal health. Horses, livestock and pets can be susceptible to diseases and parasites that mosquitoes carry and transmit. Hobby farms often offer a perfect environment where mosquitoes can thrive. Any standing water sources such as ditches, troughs, feed bowls and old tires can provide a breeding ground for mosquitoes if not regularly flushed or emptied. Maintaining proper drainage and taking measures to reduce mosquito populations around the farm will help protect you, your neighbors, and animals by lowering the risk of exposure to mosquito-borne disease.

Techniques for controlling mosquitoes:

- Provide proper drainage and infiltrate stormwater runoff where possible to prevent standing water.
- Flush or empty troughs and water bowls regularly.
- Prevent and eliminate standing water in old tires, clogged gutters, wheelbarrows, bird baths, buckets, and any other areas that can hold stagnant water.
- Inspect and fill puddles that may develop along roadways and in barnyards, animal yards and fields.
- Use yellow incandescent or fluorescent lights which are less attractive to mosquitoes.
- Increase air circulation in barn and stables to make it difficult for mosquitoes to navigate.
- Attract natural predators by installing bird and bat houses.
- Prevent untreated runoff from washing fertilizer and manure into waterbodies. This can promote weed and algae growth that can result in stagnant water – key mosquito habitat.

CAUTION!
The use of pesticides is always an option to control pests. However, consider the benefits vs. risks since many pesticides can be toxic to farm animals, crops, house pets and humans. Certain pesticides can also impact beneficial soil microorganisms, natural predators and pollinators. Always read the pesticide label first and follow instructions for both application and disposal.

FLY CONTROLS

House flies and stable flies are common pests found on hobby farms and can become a complaint among neighbors. Fly populations can peak during summer months as they reproduce in warm and damp environments that are often found around hobby farms. The Horn Fly and Face Fly are most common among pastures while the House Fly and Stable Fly are more often a problem around barns and stable areas. Having a small population of flies is common but an infestation usually indicates a failure in one or several key areas:

- Poor management of manure and compost piles.
- Inadequate drainage around the barnyard, allowing excessive moisture.
- Lack of daily good housekeeping practices and maintenance.
- Failure to clean up spilled feed or soiled straw bedding.

Eliminating favorable conditions for fly breeding is the first step toward controlling the population; however, a combination of control methods is often needed to reduce populations to an acceptable level.

Techniques for controlling flies

- Introduce biological controls to interrupt the reproductive cycles of flies. There are many beneficial insects (parasitic wasps, predatory beetles) that can provide natural and very effective fly management. The population of flies and their predators will reach a natural balance such that flies do not reach pest levels.
- Mound compost and manure in a large enough pile to maximize heat and make it less desirable for flies to lay eggs.
- Spread manure in a thin layer in fields and pastures to allow it to dry out.
- Routinely remove spilled feed and straw bedding to prevent moist areas in the barn and stalls.
- Clean feed tubs and buckets to avoid accumulating moist, decaying feed waste.
- Remove piles of rotting leaves, grass clippings, decaying fruit or vegetables from gardens where flies will lay eggs.
- Install pest strips, sticky traps and insect baits inside buildings.
- Attract natural predators by installing bird and bat houses.
- Install fans in buildings to make it difficult for flies to navigate.

WATER QUALITY BENEFIT

Be sure to prevent untreated stormwater runoff from your hobby farm that can carry nutrients and bacteria into nearby waterways. Protecting the water quality of nearby water resources can help promote habitat appealing to natural mosquito predators such as dragonflies, fish, birds, bats and amphibians.

HELPFUL LINKS

www.ag.umass.edu/crops-dairy-livestock-equine/fact-sheets/rodent-control
www.ag.umass.edu/crops-dairy-livestock-equine/fact-sheets/fly-control-measures

FACT SHEET 7.12

FOOD SAFETY

One of the many reasons hobby farming is so appealing is the reduced risk of foodborne illnesses since you know exactly where your food has come from and how it was handled. Foods produced at small hobby farms often have less processing than most mass-produced food that will often go through many distributors and locations before reaching your table.

ALTHOUGH HOBBY FARMING CAN SIGNIFICANTLY HELP MINIMIZE THE RISK OF FOODBORNE ILLNESS, THERE ARE STILL SEVERAL STEPS THAT SHOULD BE TAKEN TO REDUCE THIS RISK AND HELP ENSURE YOUR HOME GROWN FOOD IS SAFE TO CONSUME.

ANIMALS

Never let pets or farm animals enter areas where food is grown including vegetable gardens and fruit orchards. Waste left behind can contain disease causing pathogens that can easily mix with crops. Similarly, do not feed wild animals, including birds, near these areas.

WATER

Make sure the water you use to irrigate crops is from a safe source. Water from a municipal or public water system is generally safe to use as public water suppliers perform regular water quality testing. If you use a potable groundwater well for your water source, it is recommended that a standard water test be conducted periodically to help ensure you are using a safe water supply. It is not recommended that surface water be used on crops.

GARDEN LOCATION

Locate your edible garden away from manure storage, compost bins, septic systems, solid waste, dumpsters, animals, pets and storage areas where hazardous materials, fertilizers or pesticides are stored. Runoff, spills, or cross-contamination from any of these areas could create an unsafe food source.

COMPOST AND MANURE

Aged manure is not the same as composted manure. Although pathogens are known to die over time, it is not safe to assume that all pathogens in aged manure have been eliminated. Therefore, aged manure should be treated and handled similarly to fresh or uncomposted manures and be kept away from edible crops.

Make sure compost used in your garden has been heated to a temperature above 140˚F which is the temperature needed to destroy harmful pathogens. Do not apply fresh or aged (uncomposted) manure to edible gardens. Also, avoid using compost that contains diseased plants or plant material that has been treated with herbicides or pesticides. For more information on Composting, see Fact Sheets 4.7 and 5.5.

LEAD IN SOILS

Lead is a heavy metal that naturally occurs in soils. However, elevated levels can present a health risk, with young children being especially vulnerable. The most common form of lead exposure is through inhalation or ingestion of dust and chips from old paint containing lead, but lead can also accumulate in plants. Roots and leafy green vegetables are particularly at risk which is why soil testing is recommended. It's always a good idea to complete annual soil testing for nutrient management and most county extension soil tests include a total lead level or lead screening. Although low levels of lead in soil generally won't present a health risk, higher levels may require special precautions such as peeling root crops before consumption, removing leafy vegetables from your garden and in some cases, selecting a different area altogether for your edible garden. Contact your local NRCS extension office for assistance.

FOOD HARVEST AND STORAGE TIPS

- Always wash your hands before handling food
- Use clean, food-grade containers to place and store your harvest in
- Never harvest or handle food when you are sick
- Produce that needs refrigeration should be stored at 40˚F or lower
- Produce stored at room temperature should be stored in a cool, dry, pest-free area
- Always wash fruits and vegetables with clean water prior to preparation and consumption

BACKFLOW PREVENTION

Backflow is the reversal of the flow of water into the drinking water system. It occurs when there is a drop-in pressure, allowing for anything connected to the water system to flow back into it. For example, pesticide and fertilizer sprayers that are attached to garden faucets or hoses can release these chemicals into your clean water supply if a pressure drop were to occur (e.g., from a broken water line, or large water use nearby). This can be prevented with the use of a backflow prevention device. These are widely available at most hardware stores and should be installed on all outside faucets and hose connections to prevent water supply contamination. You may actually be obligated to have such devices under your local plumbing code. Contact your city or town hall for more information.

WATER QUALITY BENEFIT
Food safety starts with good housekeeping practices and sanitation throughout your hobby farm. Keeping a clean and well-organized hobby farm can go a long way in your overall success and help ensure that potentially harmful materials are kept out of nearby water resources.

FACT SHEET 7.13

EMERGENCY MANAGEMENT PLAN

Unexpected emergencies and disasters can impact any property, including hobby farms. These can include natural and man-made disasters such as flooding, blizzard/severe winter storm, hurricane/ severe thunderstorm, fire/lightening strike, drought, power failures, and chemical releases or spills.

DISASTERS AND EMERGENCIES SUCH AS THESE CAN HAVE DETRIMENTAL IMPACTS ON YOUR HOBBY FARM AND THE ENVIRONMENT IF NOT MANAGED PROPERLY.

The best way to prepare for such emergencies is to have an established emergency preparedness plan with response procedures in place prior to any emergency situation. Before a disaster or emergency be sure to:

- ✓ Know the warning signals in your area
- ✓ Be informed by following emergency alerts through radio, tv, internet or cell phone
- ✓ Have an emergency supply kit in place
- ✓ Know where vulnerable areas are, such as low lying areas subject to flooding, material storage areas, etc.
- ✓ Make a list of farm inventory including animals, equipment, and hazardous materials
- ✓ Keep an updated list of emergency phone numbers
- ✓ Keep a copy of your insurance coverage
- ✓ Stockpile supplies such as food for humans, feed for animals, water, fuel, lumber, sandbags, plastic sheeting, fire extinguishers and first aid kits
- ✓ Have an evacuation plan that includes an escape route and plan for moving animals if needed
- ✓ Identify areas to relocate animals, equipment, feed, fuel, generators and hazardous materials
- ✓ Identify an alternate water and power source if available and source of fire water if needed by the fire department if you are in a rural area and no fire hydrants are accessible
- ✓ Consider developing an informal mutual aid agreement with your neighbors to lend support to each other in the event of an emergency

At a minimum, your emergency management plan should be written down and stored in several accessible areas throughout your home and hobby farm, should there be an emergency. All members of your family should be familiar with the contents and practices contained in it.

Simple worksheets have been provided at the end of this section with several adapted from www.mass.gov/eea/agencies/agr/animal-health/farm-emergency-plan for your convenience. Consider using them to help develop your Emergency Management Plan.

CAUTION!
Portable generators are commonly used to provide electricity during emergencies that result in a power failure. However, operating a generator incorrectly can create a carbon monoxide, fire and/or electrical hazard that can be deadly to you or a repairman working on the lines. Visit the following link for tips on portable generator safety: www.osha.gov/OshDoc/data_Hurricane_Facts/portable_generator_safety.pdf

CLEARLY POST AN EMERGENCY CONTACT INFORMATION IN A READILY ACCESSIBLE LOCATION. THIS SHOULD INCLUDE EMERGENCY CONTACT INFORMATION FOR FIRST RESPONDERS, UTILITIES AND PEOPLE WHO MAY BE ABLE TO HELP YOU IN THE EVENT OF AN EMERGENCY.

HOBBY FARM MAP

If you haven't already done so as part of Section 3, create a map of your hobby farm. On a piece of blank paper (or graph paper if you have it) draw a simple map of your property that includes the relative location of structures, animal yards/pens, storage areas, access routes, barriers/fences, crops, pastures, nearby surface waters, drinking water well, utilities (if known), main electrical and gas shutoffs, fuel tanks including liquid propane, catch basins and the location of emergency supplies. Keep an evacuation route map with your hobby farm map.

TYPES OF EMERGENCIES AND RESPONSE PROCEDURES

List potential emergency situations that could occur in your area and the steps you will take to address the emergency. Proper emergency preparedness and response can help reduce and/or prevent harm to your family, animals, crops, and nearby water resources.

HOBBY FARM INVENTORY

Depending on the size of your hobby farm, be sure to keep an updated inventory of animals, feed locations, hazardous materials, equipment and crops. Keep in mind that you may not be present when an emergency occurs on your property, or may have a lot on your mind making it difficult to recall the details of your hobby farm. Having a list will also make it easier for a neighbor or other friend to check on things while you're not around.

EMERGENCY SUPPLIES AND SPILL KIT

Gather supplies to address a variety of emergency situations and develop a checklist/inventory of these materials and their locations. Additionally, keep a stocked spill response kit near your hazardous material storage and readily accessible in case of spills. Spill response materials should include several bags of sand, kitty litter, or other absorbent material, along with access to shovels and large containers such as trash barrels.

KEEP SPILL RESPONSE MATERIALS IN A CLOSED, STURDY PLASTIC STORAGE CONTAINER LABELED "SPILL KIT". STORE IN A READILY ACCESSIBLE LOCATION NEAR CHEMICAL STORAGE.

Recommended Supplies:

- ✓ Safety splash goggles or face shield
- ✓ Chemical-resistant coveralls
- ✓ Unlined, chemical-resistant gloves
- ✓ Chemical-resistant boots
- ✓ Broom and dustpan
- ✓ Hazardous material storage bags
- ✓ Absorbent material such as oil absorbent, cat litter, activated charcoal or sawdust
- ✓ Absorbent pads for water, oil or solvent based chemicals
- ✓ Absorbent boom
- ✓ Drums/bucket/trashcan

HELPFUL LINK

The following link provides some very useful information for emergency preparedness and even though it is for larger farms in rural communities, the information provided can easily be adapted for even the smallest urban hobby farm: www.prep4agthreats.org/All-Hazard-Preparedness/farm-emergency-preparedness-plan

CHECKLIST 7A

HOBBY FARM EMERGENCY CONTACT FORM

POLICE	911
AMBULANCE	911
FIRE	911
LOCAL / FARM VETERINARIAN	
MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION (MassDEP)	Petroleum spills over 10 gallons or any petroleum or chemical spill to a surface water or catch basin/storm drain 1-888-304-1133
POISON CONTROL CENTER (NATIONAL)	1-800-222-1222
HOSPITAL	
ASPCA ANIMAL POISON CONTROL CENTER	1-800-426-4435
EMERGENCY MANAGEMENT OFFICE	
ANIMAL FEED SUPPLIER	
NEIGHBORS	
COOPERATIVE EXTENSION SERVICE	
OUT OF STATE CONTACT	
FUEL SUPPLIER	
AMERICAN RED CROSS	
WATER COMPANY	
POWER COMPANY	
DISASTER HOTLINE	
GAS COMPANY	
PUBLIC HEALTH DEPARTMENT	
ANIMAL CONTROL OFFICER	
COMMUNICATION COMPANY (PHONE/CABLE/INTERNET)	
INSURANCE POLICY CONTACTS AND POLICY NUMBERS	
OTHER	

CHECKLIST 7B

EMERGENCY RESPONSE PROCEDURES

TYPE OF EMERGENCY	RESPONSE	EMERGENCY CONTACT
CHEMICAL OR OIL SPILL (NON EMERGENCY SMALL SPILL)	Prior to spill, prepare a spill kit (Fact Sheet 7.13). 1. Remove unnecessary people and animals from the hazard area 2. Assess the spill area for safety concerns 3. Put on at least the following: safety glasses or goggles, gloves, apron, rubber boots 4. Stop the spill • Approach the spill with the wind at your back • Turn off all sources of ignition • Remove all surrounding materials that could interfere with cleanup or could be contaminated by the spill without placing yourself or others at risk of injury • Cover any nearby floor drains and catch basins • Stop the flow by up-righting containers or plugging holes using non-sparking tools • If necessary, place leaking containers into larger containers 5. Clean up the spill: • Obtain absorbent material from the nearest spill kit and place a berm of absorbent material around the edge of the spill to keep it from spreading • Confine the spilled material into the smallest area possible • Soak up the remainder of the spill with additional absorbent material 6. Collect, label, store and properly dispose of used absorbent	911
CHEMICAL OR OIL SPILL (EMERGENCY LARGE SPILL)	Prior to spill, prepare a spill kit (Fact Sheet 7.13). 1. Evacuate the area 2. Immediately notify the Fire Department by calling 911 3. Notify MassDEP	911
FIRE	• Identify the source of water provided to the property which may be used by the fire department	911
DISEASE	• Stay on property until instructed or authorized to leave • Where appropriate, take action to limit harm to people, animals, and crops • Wear protective gear (gloves, respirators, etc.) and be careful to not expose yourself to any biological hazards • Take care not to cross-contaminate and spread biological hazards to people or animals that appear not to be exposed	911 MDAR–Division of Animal Health: 617-626-1764
FLOOD	• Ensure that chemicals, manure, and other substances that may be potentially harmful to water resources are safely transported to higher ground • Consider relocating animals to a designated evacuation area	
OTHER		

CHECKLIST 7C

HOBBY FARM INVENTORY

ANIMAL/LIVESTOCK TYPE	# OF ANIMALS	HOBBY FARM LOCATION

CROP TYPE	# OF ACRES	HOBBY FARM LOCATION

FEED TYPE	# OF BARRELS/BINS	HOBBY FARM LOCATION

ANIMAL/LIVESTOCK TYPE	# OF UNITS	HOBBY FARM LOCATION

HAZARDOUS SUBSTANCE TYPE*	AMOUNT	HOBBY FARM LOCATION

*pesticides, fertilizers, fuels, medicines, chemicals, etc.

CHECKLIST 7D

EMERGENCY SUPPLIES FORM

RESOURCE	HOBBY FARM LOCATION
NON PERISHABLE FOOD AND DRINKING WATER	
NEAREST WATER SOURCE FOR FIRE USE	
SHOVELS	
FIRE EXTINGUISHERS	
EXCAVATION EQUIPMENT	
SPILL KITS	
FIRST AID KITS	
WATER AND FEED FOR ANIMALS	
PERSONAL PROTECTIVE EQUIPMENT (E.G. CHEMICAL RESISTANT SUITS, GOGGLES, GLOVES, AND BOOTS)	
EMPTY TANKS OR CONTAINERS (TO HOLD LEAKING MATERIAL AND USED ABSORBENT CLEAN UP MATERIALS)	
SAFETY DATA SHEETS DETAILED INFORMATION REQUIRED FOR EACH HAZARDOUS CHEMICAL STORED OR USED	
BATTERY POWERED RADIO, FLASHLIGHTS AND EXTRA BATTERIES	
EMERGENCY PREPAREDNESS WRITTEN PLAN AND CONTACT INFORMATION ALONG WITH HOBBY FARM MAP, EVACUATION ROUTE AND INVENTORY	
OTHER:	

CHECKLIST 7E

HOBBY FARM MANAGEMENT AND SAFETY

Use the following questions to help guide your hobby farm's good housekeeping, operations and maintenance, safety, and emergency preparedness step:

1. Do you conduct pest management on your hobby farm?

☐ YES ☐ NO

If NO, see Fact Sheet 7.1. If YES, do you:

☐ incorporate Integrated Pest Management (IPM) into your pest control strategy?

2. Do you use pesticides or herbicides on your hobby farm?

☐ YES ☐ NO

If YES, do you:

☐ read the product labels(s) to determine the appropriate application rate(s)?

☐ contact your local Conservation Commission before applying pesticides within 100 feet of a wetland or surface water or within 200 feet of perennial rivers and streams?

☐ store material in a dry, secure location? (see Fact Sheet 7-4 for tips on storage and emergency preparedness)?

☐ follow disposal practices as directed on the product label?

3. Do you practice safe fueling and regular maintenance schedules for hobby farm equipment and tools?

☐ YES ☐ NO

If a petroleum spill of over 10 gallons occurs, or if any spill reaches a water body, catch basin or storm drain, call the fire department (911) and then call the MassDEP 24-hour spill hotline (1-888-304-1133).

4. Do you have a spill kit to quickly address small spills of hazardous materials?

☐ YES ☐ NO

If NO, see Fact Sheet 7.13 for Emergency Spill Kit Supply Checklist.

5. Do you know where you can dispose of hazardous household chemicals?

☐ YES ☐ NO

If NO, visit MassDEP's Hazardous Household Products webpage: http://www.mass.gov/eea/agencies/massdep/recycle/hazardous/hazardous household-products-handling-and-management.html. If YES, list location:

_____

6. Are all solid waste management areas:

Located on flat paved surfaces, away from storm drains and water resources?

Enclosed or in areas away from stormwater flow patterns?

☐ YES ☐ NO

If NO, list problem locations and steps that can be taken to address these areas:

_____

CHECKLIST 7E

HOBBY FARM MANAGEMENT AND SAFETY

CONTINUED

7. Does your municipality have specific regulations related to control of dust, odor, and noise?

☐ YES ☐ NO

If YES, list problem locations and steps that can be taken to address these areas:

_____

_____

_____

8. Does your hobby farm layout take precautions to minimize and avoid conflicts with neighbors?

☐ YES ☐ NO

If YES, check applicable selections:

- ☐ proper fencing installed to prevent animals from entering neighboring properties
- ☐ vegetated buffer or windbreak installed to minimize migration dust, odors, and noise
- ☐ compost and manure storage areas located downwind as far as possible from neighboring houses and yards.
- ☐ proper steps have been taken for control of rodents and other pests (see Fact Sheet 7-11).

9. Have you taken appropriate steps to ensure food safety (if applicable)?

☐ YES ☐ NO

If YES, check applicable selections:

- ☐ prevent pets and farm animals from entering garden or crop growing areas.
- ☐ locate crops away from manure, compost bins, solid waste, hazardous materials storage, etc.

REFERENCES & RESOURCES

American Community Gardening Association. www.communitygarden.org.

Arbor Day Foundation. *Benefits of Trees.* 2017, www.arborday.org/trees/benefits.cfm.

Arbor Day Foundation. *How to Plant Conservation Buffers for Streams.* 2017, www.arborday.org/programs/graphics/conservation-trees/conservation-buffers.pdf.

Association of American Plant Food Control Officials. *AAPFCO Product Label Guide.* 2017, www.aapfco.org/pdf/product_label_guide.pdf.

ATTRA Sustainable Agriculture & National Center for Appropriate Technology. *Start a Farm in the City.* 2009, www.attra.ncat.org/attra-pub/summaries/summary.php?pub=21.

Bellinger, Robert. *Organic Pesticides and Biopesticides. Clemson Cooperative Extension,* March 1999, www.clemson.edu/extension/hgic/pests/pesticide/hgic2756.html.

Bellows, Barbara. *Protecting Riparian Areas: Farmland Management Strategies. Appropriate Technology Transfer for Rural Areas*, March 2003, attra.ncat.org/attra-pub/download.php?id=115.

Blickle, Alayne & Jessica Paige. *Healthy Horses, Clean Water. Horses for Clean Water,* Wild Horse Multimedia, 2003, www.whatcomcd.org/sites/default/files/publications/info_sheets/whatcom_manual.pdf.

Bonanno, Richard & Kline, Wesley. *Good Agricultural Practices (GAPs) & Food Safety Manual*. The Center for Agriculture, Food, and the Environment, UMass Amherst, 2000, ag.umass.edu/resources/food-safety/for-farmers/good-agricultural-practices-gap/good-agricultural-practices-gap.

British Columbia Ministry of Agriculture. *Guide to Edge Planning: Promoting Compatibility along Agricultural -Urban Edges* . 2015, www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/agriculture-and-seafood/agricultural-land-and-environment/strengthening-farming/800-series/823100-3_edge_guide_2015.pdf.

Burdett, Holly & Michael Sullivan. *Clean Water Starts at Home. Healthy Landscapes Program,* April 2005.

Cappiella, Karen, et al. *Urban Watershed Forestry Manual.* United States Department of Agriculture Forest Service- Northeastern Area, July 2005.

City of Bellingham, Washington. *Farm Practices that Protect Waterways*. www.cob.org/services/environment/stormwater/Pages/hobby-farms.aspx.

City of Santa Barbara. *Stormwater Runoff BMP Options. Storm Water BMP Guidance Manual*, Chapter 6, July 2013, www.santabarbaraca.gov/civicax/filebank/blobdload.aspx?BlobID=168701.

REFERENCES & RESOURCES

Commonwealth of Massachusetts, et al. *Farming in Wetland Resource Areas: A Guide to Agriculture and the Massachusetts Wetlands Protection Act*. January 1994, www.mass.gov/eea/docs/dep/water/laws/a-thru-h/farman.doc.

Commonwealth of Massachusetts. Environmental Laws and Regulations. www.mass.gov/eea/agencies/massdep/water/regulations/.

Connecticut Department of Environmental Protection. *Environmental Best Management Practices Guide for Small Businesses*. August 2009, www.ct.gov/deep/lib/deep/compliance_assistance/manuals_guidelines/bmpforsmallbsiness.pdf.

Connecticut River Joint Commissions, et al. *Buffers for Agriculture. Riparian Buffers for the Connecticut River Watershed*, No. 5, September 2000, www.crjc.org/buffers/Buffers%20for%20Agriculture.pdf.

Consumer Reports. *Maintaining your Lawn and Garden Equipment: These simple steps boost savings and safety*. July 2013, www.consumerreports.org/cro/2013/07/maintaining-your-lawn-and-garden-equipment/index.htm.

D'Ambrosio, Jessica, et al. *A Basic Primer on Nonpoint Source Pollution and Impervious Surface*. The Ohio State University Extension Factsheet, August 2014, www.researchgate.net/publication/255625956_A_Basic_Primer_on_Nonpoint_Source_Pollution_and_Impervious_Surface.

Darby, Brien. *6 Ways to Maximize Rainwater in Your Garden*. Hobby Farms, March 2016.

Day, Julie. T*he Debate over Organic vs. Chemical Fertilizers*. Today's Homeowner, August 2008, www.todayshomeowner.com/debate-over-organic-chemical-fertilizers/.

DeAngelis, Jack. *Pesticides. Living with Bugs*, www.livingwithbugs.com/organic.html.

Dosskey, Michael, et al. *How to Design a Riparian Buffer for Agricultural Land*. National Agroforestry Center, University of Nebraska – Lincoln, U.S. Department of Agriculture: Forest Service, January 1997, digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1002&context=agroforestnotes.

Drip Depot. *Drip Irrigation Systems for Gravity Feed*. www.dripdepot.com/article/gravity-feed-irrigation.

Elmendorf, William. *Planting Trees in Your Community Forest.* PennState Extension, 2006.

Flinn Scientific, Inc. *How to Read a Safety Data Sheet (SDS)*. Eastern Washington University, 2014, sites.ewu.edu/ehs/files/2017/06/Flin-Scientific-How-to-Read-an-SDS.pdf.

Gach, Jerry. *Synthetic vs. Organic Fertilizers*. EnviroIngenuity, 2009-2012, www.enviroingenuity.com/articles/synthetic-vs-organic-fertilizers.html.

REFERENCES & RESOURCES

Georgia Soil and Water Conservation Commission. *Best Management Practices for Georgia Agriculture: Conservation Practices to Protect Surface Water Quality*. Second Edition, 2013, www.gaswcc.georgia.gov/sites/gaswcc.georgia.gov/files/2013AgManualINTERACTIVE2%20%281%29.pdf.

Goodwin, D. & J.A. Moore. *Manure Management in Small Farm Livestock Operations: Protecting Surface and Groundwater*. Oregon State University Extension Service, May 1997, ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/14863/em8649.pdf?sequen%20ce=3.

Hashley, Jennifer, et al. *An Entrepreneur's Guide to Farming in Massachusetts*. New Entry Sustainable Farming Project, February 2014, nesfp.org/sites/default/files/resources/an_entrepreneurs_guide_to_farming_ma_0.pdf.

Helmers, Matthew, et al. *Buffers and Vegetative Filter Strips*. Iowa State University, 2008, lib.dr.iastate.edu/cgi/viewcontent.cgi?article=1580&context=abe_eng_pubs.

Hobby Farm Magazine. www.hobbyfarms.com/.

HSENI Controlling Risk Together. *Equipment- working safely with farm equipment and vehicles*. 2015.

International Society of Arboriculture (ISA). *Tree Selection and Placement*. 2011, www.treesaregood.org/portals/0/docs/treecare/TreeSelection.pdf.

Iowa State University, the Center for Food Security and Public Health. *All-Hazards Preparedness for Rural Communities*. Edited by Dvorak, Glenda & Williamson, Brittany, 1st edition, 2010.

Johnson, Jill, et al. *Tree Owner's Manual for the Northeastern Midwestern United States*. United Stated Department of Agriculture, U.S. Forest Service, 2008, www.fs.usda.gov/treesearch/pubs/19712.

Kammel, David, et al. *Designing Facilities for Pesticide and Fertilizer Containment*. Iowa State University, 1991.

Little, Sarah. *Introduction to Organic Lawns and Yard plus a Checklist for an Eco-Friendly Property*. Northeast Organic Farming Association (NOFA) Organic Land Care Program (OLC), June 2016, www.organiclandcare.net/sites/default/files/2016iolyfinalsingle_page_opt.pdf.

Livestock and Poultry Environmental Stewardship (LPES), et al. LPES *Curriculum Small Farm Fact Sheets*. 2005, articles.extension.org/pages/8890/lpes-curriculum-small-farm-fact-sheets.

Loehr, Raymond. Hazardous Solid Waste from Agriculture. *Environmental Health Perspectives*, Cornell University, Vol. 27, pp. 261-273, December 1978, www.ncbi.nlm.nih.gov/pmc/articles/PMC1637284/pdf/envhper00484-0250.pdf.

REFERENCES & RESOURCES

Lynn, Karen. *Hobby Farming: Sustainable Home Food Production from Small Scale to Large.* August 2015.

Mader, Eric & Nancy Lee Adamson. *Organic-Approved Pesticides: Minimizing Risks to Bees. Invertebrate Conservation Fact Sheet*, 2012, xerces.org/wpcontent/uploads/2009/12/xerces-organic-approved-pesticides-factsheet.pdf.

Massachusetts Department of Agricultural Resources. www.mass.gov/eea/agencies/agr/.

Massachusetts Department of Conservation & Recreation. www.mass.gov/orgs/department-of-conservation-recreation.

Massachusetts Department of Conservation and Recreation, et al. *Horse Ownership and Massachusetts Watershed Protection Act.* February 2017, www.mass.gov/eea/docs/dcr/watersupply/watershed/wspahorse.pdf.

Massachusetts Departments of Environmental Protection. www.mass.gov/orgs/massachusetts-department-of-environmental-protection.

Massachusetts Department of Environmental Protection. *Horsekeeping and Water Quality. Fact Sheet Series*, www.mass.gov/eea/agencies/massdep/water/watersheds/horsekeeping-and-water-quality.html.

McCarthy, Jillian. New Hampshire *Homeowner's Guide to Stormwater Management: Do-It Yourself Stormwater Solutions for Your Home*. New Hampshire Department of Environmental Services, edited by Lisa Loosigian photography by Soak Up the Rain NH Program, March 2016, www.des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-11-11.pdf.

Metropolitan Council & Barr Engineering Co. *Infiltration Systems, Infiltration Trenches. Minnesota Urban Small Sites* BMP Manual, Minnesota Pollution Control Agency, pp. 3-169 – 3-180, www.sccd.org/wp-content/uploads/2015/07/Infiltration-Trenches.pdf.

Michigan Agriculture Environmental Assurance Program. *Emergency Farm Plan Electronic Template*. www.maeap.org/uploads/files/EMERGENCY_PLANNING_fillable_Form_E2575-ET_AA.pdf.

Minnesota Department of Natural Resources. *Vegetation Buffer Stripes in Agricultural Areas.* November 2007, files.dnr.state.mn.us/publications/waters/buffer_strips.pdf.

Minnesota Pollution Control Agency & USDA Natural Resources Conservation Service. A*pplying Manure in Sensitive Areas:* State Requirements and Recommended Practices to Protect Water Quality. May 2005, www.pca.state.mn.us/sites/default/files/feedlots-manureapplication.pdf.

Missouri Botanical Garden. *Rainscaping Guide: Creek Corridor Vegetative Buffers*. www.missouribotanicalgarden.org/sustainability/sustainability/sustainable-living/at-home/rainscaping-guide/creek-buffer.aspx.

REFERENCES & RESOURCES

National Pesticide Information Center (NPIC). npic.orst.edu/.

Natural Resource Conservation Services. *Small Scale Solutions for your Farm. Series*, www.nrcs.usda.gov/wps/portal/nrcs/detail/national/home/?cid=stelprdb1167242.

New Hampshire Department of Agriculture, Markets, and Food. *Manual of Best Management Practices (BMPs) For Agriculture in New Hampshire*. 2014, www.agriculture.nh.gov/publications-forms/documents/bmp-manual.pdf.

New Hampshire Department of Environmental Services. www.des.nh.gov/.

Northeast Recycling Council, Inc. (NERC). *Guide to Providing Manure Management Education to Small Farm and Livestock Operations*. United States Department of Agriculture, March 2009, nerc.org/documents/manure_management/guide_to_providing_manure_management_ed.pdf.

Oregon State University Extension Service. extension.oregonstate.edu/.

PennState Extension. www.extension.psu.edu/what-you-need-to-know-about-reading-a-pesticide-label.

Pinto & Associates, Inc. *OSHA Training: Labels – Fewer Signal Words & New Pictograms*. Techletter, July 2013, www.techletter.com/assets/Files,%20misc/TL-7-7-13%20OSHA.pdf.

Plastic Tanks. Cistern Tank Installation Procedures. www.plastictanks.ca/content.php?contentid=23.

Portland Water District. *Vegetated Phosphorus Buffer Strips.* www.pwd.org/sites/default/files/veg-phos.pdf.

Rangarajan, Anusuya, et al. *Food Safety Begins on the Farm: A Grower's Guide*. Cornell Good Agricultural Practices Program, 2000, ecommons.cornell.edu/handle/1813/2209.

Santa Barbara County Air Pollution Control District. *Best Practices to Control Dust on Farmland.*

SavaTree. *Interesting Facts about Trees*. www.savatree.com/tree-facts.html.

Sideman, Eric. *Composting in the Back Yard or on a Small Farm*. Main Organic Farmers and Gardeners Association, November 2007, www.mofga.org/Portals/2/Fact%20Sheets/FS%2005%20Composting%20web.pdf.

Siel, Emilee, et al. *Understanding the Pesticide Label*. University of Nebraska – Lincoln Extension, Institute of Agriculture and Matural Resources, May 2015, extensionpublications.unl.edu/assets/pdf/g1955.pdf.

REFERENCES & RESOURCES

Stormwater PA. *Pennsylvania Stormwater Best Management Practices Manual*. www.stormwaterpa.org/assets/media/BMPmanual/.

Tenth Acre Farm. www.tenthacrefarm.com/.

The Federation of Vermont Lakes and Ponds – FOVLAP, et al. *A Guide to Healthy Lakes Using Lakeshore Landscaping*. Designed and Illustrated by Greenleaf, Holly & Zeitz, Gavin, 2015, www.vermontlakes.org/wp-content/uploads/VTLakescapingBooklet.9.9.15.pdf.

The Woodland Trust. *Benefits of Trees on Livestock Farms*. Research Report, August 2012, www.woodlandtrust.org.uk/publications/2012/08/benefits-of-tree-on-livestock-farms/.

Tree People. *Top 22 Benefits of Trees*. January 2015, www.treepeople.org/resources/tree-benefits.

United States Department of Agricultural Services. www.usda.gov/.

United States Department of Agriculture – National Agricultural Library. *List of Alternative Crops and Enterprises for Small Farm Diversification*. 2017, www.nal.usda.gov/afsic/list-alternative-crops-and-enterprises-small-farm-diversification.

United States Department of Agriculture Census of Agriculture. www.agcensus.usda.gov/.

United States Department of Agriculture Natural Resources Conservation Service. *Missouri Pasture Management Guide for Horse Owners*. September 2008, www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_022712.pdf.

United States Department of Agriculture Natural Resources Conservation Service. www.nrcs.usda.gov/wps/portal/nrcs/site/national/home/.

United States Department of Agriculture Farm Service Agency. *Conservation Programs*. www.fsa.usda.gov/programs-and-services/conservation-programs/index.

United States Environmental Protection Agency. *Agriculture*: Ag 101. July 2015, www.epa.gov/agriculture/agriculture-ag-101.

United States Environmental Protection Agency. T*he New EPA Bee Advisory Box*. https://www.epa.gov/sites/production/files/2013-11/documents/bee-label-info-graphic.pdf.

United States Environmental Protection Agency. *Polluted Runoff: Nonpoint Source Pollution*. www.epa.gov/nps.

REFERENCES & RESOURCES

United Sates Environmental Protection Agency. *Requirements for Pesticide Storage*. 2015, www.epa.gov/pesticide-worker-safety/requirements-pesticide-storage.

United States Environmental Protection Agency. *Stormwater Trees-Technical Memorandum*. September 2016.

University of Amherst Massachusetts Extension. ag.umass.edu/.

University of Illinois Extension. extension.illinois.edu/.

University of Missouri Extension. extension.missouri.edu/.

University of New Hampshire Cooperative Extension. extension.unh.edu/resources/.

University of Rhode Island Cooperative Extension. web.uri.edu/coopext/.

Utah State University Extension. *How to Protect Your Water from Hazardous Waste. Utah Farmstead Assessment for Ground Water and Surface Water Protection, Fact Sheet 5,* March 2012, extension.usu.edu/waterquality/filesou/Publications/how_to_protect_your_water_from_hazardous_waste.pdf.

Vermont Agency of Agricultural Food and Markets. agriculture.vermont.gov/.

Vermont Department of Environmental Conservation. Dripline *Trenches: Controlling Water Runoff.* dec.vermont.gov/sites/dec/files/wsm/lakes/Lakewise/docs/LP_BMPSHOREDriplineTrenches.pdf.

Warren, L.K. & P. Aravis. *Managing Small Acreage Pastures During and After Drought. Natural Resources Series,* revised by Jennifer Cook, Fact Sheet No. 6.112, Colorado State University, December 2014, www.extension.colostate.edu/docs/pubs/natres/06112.pdf.

Whatcom Conservation District. *Pasture Management*. 2015.

Wyatt, Leslie. *How No-Till Farming Will Help You Save Water*. Hobby Farms, May 2016.

Zuromski, Kathryn & Elizabeth Berg. *Rhode Island Resource Management Guide: Designing a Resource Management and Conservation Strategy for Your Farm*. United States Division of Agriculture – Natural Resources Conservation Service (USDA-NRCS), Rhode Island Resource Conservation and Development Council (RIRC&D), Rhode Island Department of Environmental Management (RIDEM), Rhode Island State Conservation Committee (RI SCC), theartofservicelab.s3.amazonaws.com/All%20Toolkits/The%20Resource%20Management%20Toolkit/Check/Printing%20Of%20Rhode%20Island%20Resource%20Management%20Guide%20Provided%20By%20The%20Rinrcs%20And%20Ridem.pdf