

## 2.0 AGRICULTURE



**Agriculture is the practice of cultivating soil and producing crops, and raising livestock**  
(Source: CDW 2001)

Collectively these activities are generally referred to as farming. Because large areas of land are typically required for farming, agricultural activities can have a significant impact on water quality and water resources. The effects of agriculture on water resources include both water quality and water quantity considerations. For the purposes of this manual, only water quality concerns will be addressed. Generally, farming practices can be associated with several types of potential pollutants: 1) Nutrients, 2) Pesticides, 3) Pathogens, and 4) Sediments. Each of these categories, and methods for farmers to manage them, is described in this chapter.

### Sediment

Soil loss is not only an undesirable event from a farming perspective, it also transports contaminants off site to surface water resources and can cause sedimentation in lakes, ponds, streams and rivers. Erosion and sediment control methods thus serve two purposes: reducing turbidity in surface waters, and minimizing loss of chemicals applied to crops. Source control is the best approach to minimize sediment transport. Sediment in agricultural runoff can come from cropland, pastureland and rangeland. Animal feedlots may also contribute sediment. Since sediment transports other contaminants such as nutrients, pesticides, organic matter and pathogens, it is important to first reduce sediment transport and then trap soils from erosion that cannot be prevented.

### Nutrients

Nutrients are essential to the raising of crops. Soils are amended in different ways, including application of commercial fertilizers, animal manure, and composts. However, excess nutrients, specifically nitrates and phosphates, can run off fertilized areas and enter surface waters, or

migrate into the subsurface environment and affect ground water<sup>1</sup>. Effective management of nutrients not only benefits water resources, it also reduces fertilizer costs. Nutrient management reduces the potential for loss and waste of nutrients by ensuring proper plant uptake or storage in the soil.

Farmers who employ a nutrient management plan can maximize the benefit of the soil amendments they apply while also protecting water resources. It is important to recognize that while a farm may not be in direct proximity to a water resource, it may well lie within the watershed to a stream, river, reservoir or lake, or within a contributing area to an underground source of public drinking water. See Appendix A for a description of nutrient management plan components.

### Pesticides

Management of pests, including insects, weeds, fungi, nematodes and rodents, is a significant concern to crop farmers. The use of petro-chemically based pesticides is common throughout the country, and has given rise to concerns about impacts to water quality, which have been documented in numerous localities across the country. Migration of pesticide chemicals to water resources depends on six factors:

- application practices;
- pesticide characteristics;
- soil and subsurface characteristics;
- site characteristics;
- climate; and
- agricultural management practices.

To minimize the potential for pesticides to reach important ground and surface water resources, a pest management plan is very effective. Such plans allow use of pesticides to be minimized while maximizing the effectiveness of pest control techniques. Non-chemical controls should be employed whenever possible. Integrated Pest Management (IPM) is an approach that minimizes the use of chemical pesticides while meeting crop production objectives. High yielding crops and minimal impact to the environment can both be attained with a good pest management plan, particularly one that incorporates an IPM component. (For a description of a complete Pest Management Plan, see Appendix B).

### Pathogens

Migration of bacteria and viruses associated with animal wastes is another area of concern for protection of water resources. The recent trend in consolidation of animals in smaller confined facilities has led to a concentration of the pollutants associated with them, originating mainly from animal waste. Pathogens reach water resources through overland movement of runoff waters and sediments, or through infiltration of contaminated water into the subsurface

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<sup>1</sup> Both nitrates and phosphates affect the quality of surface water, while only nitrates impair ground water resources as phosphates are typically adsorbed onto soil particles in the subsurface environment.

environment. One of the worst outbreaks of E. Coli on record took place in Ontario in 2000, and apparently involved the movement of barnyard runoff down the outside casing of a nearby public drinking water well (Canadian Broadcasting Corporation, 2000). Migration of pathogens off site can be minimized through the use of a waste management plan, which prescribes methods for limiting the movement of discharges off barnyards, grazing areas and other facilities, particularly by containing wastes. Improved manure handling and storage, applying manure according to specified nutrient management parameters, and keeping records of manure testing, usage and disposal are all important components of such a plan. EPA's publication "Management Measures for Agricultural Sources" provided the concept for the following diagram of control measures for wastewater and runoff from animal facilities.