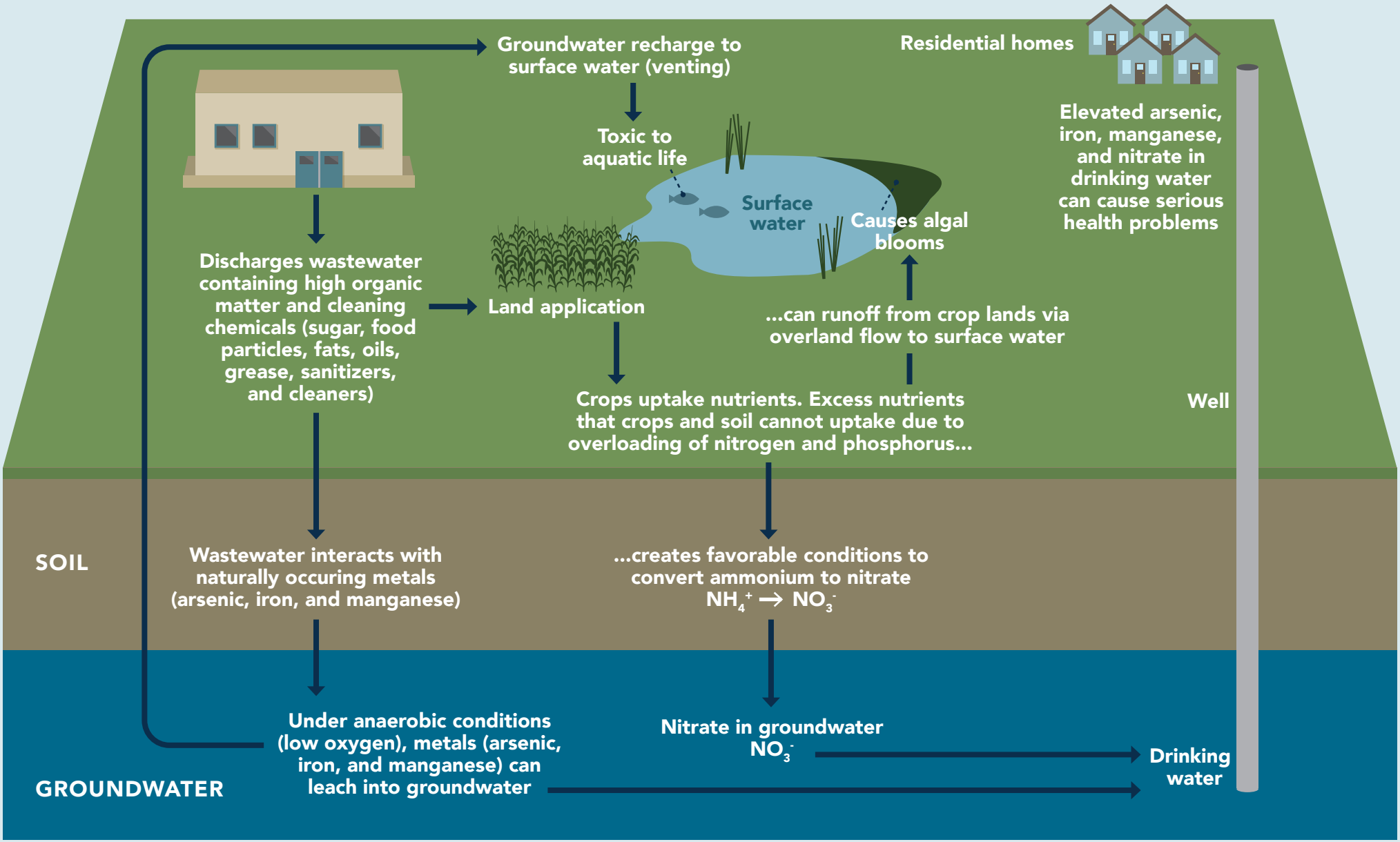
HIGH-STRENGTH WASTEWATER IN MICHIGAN



MICHIGAN DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY

HIGH-STRENGTH WASTEWATER

One of the common methods for disposing of wastewater containing high organic matter (such as sugar, food particles, fats, oils, and greases) and/or cleaning chemicals is to spray irrigate the wastewater to a vegetated area. This process is often referred to as land application. Spray irrigation of wastewater to a cropped field is an example of this method of wastewater disposal; the soil and the crop will absorb the nutrients from the wastewater and some of the nutrients will be removed from the area when the crop is harvested.

When too much wastewater is land applied, some of the wastewater bypasses the crop and soaks into the soil. Once in the soil, the wastewater is consumed by microbes that have the ability to decrease the amount of available oxygen in the subsurface environment and create anaerobic (i.e., low oxygen) conditions. Without enough oxygen available, the microbes will utilize the oxygen molecule from an oxide present in the soil (such as Iron Oxide, Manganese Oxide, and Arsenic Oxide) and release the naturally occurring metals from the soil particles. These naturally occurring metals are thereby dissolved in the groundwater (a process known as leaching) and can then move freely with the groundwater. If the groundwater is then pumped up a drinking water well, the elevated levels of arsenic, iron and manganese can exceed health-based drinking water criteria.

An additional concern with land application of wastewater is the loading of the subsurface environment with excessive nutrients. Although the crops can absorb some of the nutrients carried in the water, they are often not able to utilize all of them. Phosphorus and nitrogen are two nutrients common in wastewater that are readily absorbed by plants and soil. However, if an excess of either nutrient is applied or if the soil has already absorbed as much of the nutrients as it can hold, then the nutrients may move past the plant roots and deeper into the subsurface. Once in the subsurface environment, conditions are right for ammonium (a type of nitrogen) to react geochemically in the subsurface and convert over to nitrate (a different type of nitrogen). Nitrate readily dissolves in water and can easily move further down to the groundwater. Like the process described above for naturally occurring metals, if groundwater with an excess of nitrate in it is pumped up a drinking water well, it can constitute a significant health risk.

In addition to being used as a drinking water source, groundwater also helps recharge Michigan's rivers, lakes, and streams (i.e., bodies of water often referred to collectively as surface water). This recharge process (known as venting) is usually not visible – the groundwater enters the surface water from below the soil – but it is a critical source of water for many surface waters. If the groundwater that is recharging the surface waters contains elevated amounts of arsenic, iron, manganese, ammonia, or nitrate then it may be detrimental to aquatic or human life (if the surface water serves as a drinking water source).

Michigan.gov/GroundwaterDischarge