Storm Water Injection Well Best Management Practices (BMPs)

SITING

Proper siting can minimize the impact of contaminants reaching a storm water injection well. As a general guideline, the greater the distance between a storm water injection well and ground water, the less the threat of contamination. Siting considerations include soil and water table conditions which must be suitable for infiltration of storm water runoff and capture of contaminants. The geology, topography, and climate of an area greatly impact the effectiveness of a BMP in controlling contamination; therefore, siting BMPs are generally site-specific. Siting BMPs can include:

Minimum Setback Distance from Surface Waters - Separation of injection wells from surface waters provides filtration by soil and vegetation prior to entering surface water downgradient from a storm water injection system.

Minimum Setback Distance from Drinking Water Wells - Because of the dependence of contaminant transport on local climate, geology and land-use, no one value can be given to define separation distances for the entire country. Many states and counties develop guidance on separation distances based on local factors.

Minimum Separation from Water Table - Contaminants that are readily removed from water by attraction to soil particles are less likely to contaminate ground water when the injection well does not directly discharge into ground water. For this reason, several design recommendations include a minimum separation between the bottom of a storm water injection well and the seasonal high ground water table.

Prohibition from Some Areas of Critical Concern - A state or local agency or Indian tribe may find it desirable to prohibit storm water injection wells from certain critical areas, for example, within drinking water well protection zones (e.g., source water protection areas), near waters of exceptional high quality such as Outstanding National Resource Waters, or adjacent to wetlands. Other areas where storm water injection wells may be banned include: brownfields, contaminated site clean-ups, and areas prone to landslides or slope instability. Several states actively discourage or prohibit dry wells, depending on site conditions.

DESIGN

Storm water injection well design features can minimize the risk of contaminating drinking water sources and are often less expensive to install during construction than to retrofit later. The well designs and pretreatment systems discussed below provide a brief overview of the types of systems in use that can reduce the potential for contamination of ground water by storm water injection wells.

Sediment Removal

Sediment carried in storm water runoff will enter a storm water injection well unless the well includes devices for removing it. Sediment poses three problems: (1) it can clog the infiltration system causing it to fail; (2) contaminants including metals, pesticides, and phosphorus, can attach to sediments and be carried into ground water systems, leading to possible contamination; and (3) wells that directly inject into underground sources of drinking water (USDWs) may have sediment levels that, for hours or days, render the water unfit for human consumption in nearby wells.

One of the chief difficulties with many storm water injection wells lacking pretreatment devices is that they tend to clog with fine sediment, slowing the rate of infiltration into the soil. In many cases, the sediment enters the basin or dry well during construction of the facility. Measures to

prevent sediment from entering the infiltration device include temporary diversions such as sediment traps, roping off the well area to prevent construction equipment or other traffic from compacting soil, and stabilizing the area around the well by planting vegetation. After the site is fully stabilized, the site operator can remove the sediment and excavate the remainder of the well. Pretreatment methods used for preventing sediment from entering storm water infiltration devices include oil/grit separators, settling basins (catch basins or detention or retention basins), and filter strips and swales.

Oil/Grit Separators

Oil/grit separators, also called water quality inlets, consist of one or more chambers designed to allow sediments to settle out before storm water enters the well. Many separator designs also contain baffles so that the uppermost layer of water in each of the separator chambers is retained. Material such as oil floating on top of the trapped water is retained and can be removed when the separator is cleaned. Sediment that is heavier than water will settle out at a rate determined by the density and size of the sediment particles and the time allowed for settling.

OPERATION AND MAINTENANCE

Proper operational BMPs are often effective and inexpensive ways of preventing contamination by storm water. Source separation and operational BMPs for some common site activities are presented below.

Source Separation

Separating potential contaminants from contact with storm water is a necessary means of minimizing contamination of storm water and ground water. This can be accomplished by moving activities indoors, installing spill containment devices, and covering materials stored outdoors. Basic containment methods include *curbing*, *containment dikes*, *sumps*, and *covering*.

Curbing is a type of barrier, usually made of concrete, metal, or other impermeable substance, that can be used to separate potential spill areas from storm water runoff. Curbing is usually used on a small-scale to prevent spills in areas where liquids are stored or used.

Containment dikes are designed to hold larger spills. They are earth or concrete retaining walls, and are often sited in loading and unloading areas as well as areas where liquids are stored above ground. Dikes are typically designed to hold a volume at least equal to the largest storage tank present plus expected rainfall.

Sumps are holes or low areas graded so that liquid spills or leaks flow toward a particular part of a containment area. Pumps are often placed in the sump to transfer liquids away from the sump as it fills. Sumps are most often constructed of impermeable materials to avoid leaks into the surrounding subsoil; they are positioned at the lowest point in a containment area for maximum efficiency. Sumps are a practical means of collecting storm water in a containment area, but pumps require periodic maintenance to avoid clogging.

Covering materials stored outside is an effective way to prevent rainfall and storm water runoff from contacting potential contaminants. High-risk areas can be covered by tarpaulins, plastic sheeting, roofs, or awnings, and are most effective when routinely inspected for holes.

Operational BMPs for Common Site Activities

Vehicle and Equipment Fueling - BMPs for these problem areas include installing spill and overfill prevention equipment on storage tanks, discouraging "topping off" of vehicle fuel tanks, and covering refueling areas with a roof to prevent direct contact with rainfall. Refueling areas

paved with concrete instead of asphalt help avoid infiltration of spilled fuel and oil into the pavement and underlying soil. If necessary, the refueling area can be graded and dikes or curbs installed to prevent storm water from flowing across the area. Best practices include directing storm water runoff from roof downspouts away from refueling areas, avoiding washing or hosing of refueling areas with large amounts of water where adjacent to storm water wells, and using cloths or specialized dry absorbent materials to clean spills in the refueling area.

Vehicle and Equipment Maintenance - Routine maintenance of vehicles and outdoor equipment can release harmful contaminants such as oil and grease, automotive fluids, and battery acid, which can enter storm drains. Other potential problems include leaks from vehicles and equipment in storage areas and improper disposal of maintenance materials such as greasy rags and used oil filters. Best practices include checking vehicles and equipment for leaking fluids such as oil, using drip pans under leaking vehicles, disposing of drip pan contents properly, and separating work areas from areas contacted by rain water.

Equipment Washing - Wash water can contain many harmful contaminants including solvents, oil and grease. These contaminants can migrate to storm water drains after rainfall if vehicles and equipment are washed outside. BMPs for washing vehicles and equipment include using detergents that are biodegradable and contain no phosphates, washing vehicles in designated diked and graded areas where the wash water will flow to a treatment facility, recycling wash water, and preventing underbody washing in areas where runoff enters a storm water injection well.

Material Loading/Unloading - Materials that are spilled or that leak from vehicles during loading and unloading of materials at terminals or loading docks may enter storm water drains. Specific loading and unloading activities that may cause storm water contamination include transferring material by truck, forklift, or conveyor belt; transferring liquids or gases between a truck or railroad car and a storage facility; and transferring dry chemicals between vehicles. BMPs for loading areas include checking loading and unloading vehicles for leaks and performing loading/unloading activities in specially designed areas. Limiting exposure to rainfall can be achieved by covering loading areas with a building overhang or awning. Constructing dikes around loading and unloading areas can greatly reduce the risk of spilled materials reaching storm water drains, as does directing runoff away from loading areas.

Maintenance BMPs

Maintenance of the storm water injection well is critical to the effectiveness of the system. Routine, thorough evaluations should include: inspections for accumulated debris, rodents, or other obstacles to flow at inlets and outlets; system checks for roots, mineral deposits, trash, or silt build-up; ground surface inspections for signs of subsurface drainage leaks; area inspections for evidence of erosion, which can impede structural and hydraulic performance; and inspections of upstream drainage systems for backups or ponding of surface water that could indicate reduced injectate flows.

Dry wells can be cleaned by a process called jetting, in which wells are partially filled with water, compressed air is injected at the bottom of the well, and the sediment is forced out the top. The frequency with which dry wells should be cleaned will vary greatly depending on the sediment load from the site and the depth of the dry well. Operators of dry wells may have a jet-pump available as standard maintenance equipment to perform jetting on an as-needed basis. Chemical cleaning of drainage wells using biodegradable solutions or neutralizing an acid solution used to dissolve mineral deposits may also be used when there is no access for mechanical cleaning.

EDUCATION AND OUTREACH TO PREVENT MISUSE

Education and outreach to the general public, owners and operators of storm water wells, and state, tribal, and local officials is an important element in storm water pollution prevention. An effective education and outreach program can: (1) disseminate information about the effects of pollution from diffuse sources on ground water, including the loss of drinking water sources; and (2) promote positive environmental results, including the reduction of pollutant loadings from urban and industrial areas.

The goal of a storm water education and outreach program is to (1) promote voluntary compliance with regulations designed to protect ground waters from pollution and (2) deter intentional misuse of storm water wells that introduces contaminants into storm water injection wells.

PROPER CLOSURE, PLUGGING, AND ABANDONMENT

Proper closure, plugging and abandonment of storm water injection wells that either no longer serve their original purpose or are a threat to USDWs is important. Appropriate measures for plugging and abandoning storm water injection wells may include complete removal of any surface structures such as settling basins, piping, etc.; complete removal of all casing, gravel, and other filter and/or annular sealing materials; collection of environmental samples; and backfill and sealing of the resulting borehole. Primacy states may have specific abandonment requirements for properly closing storm water injection wells. Owners and/or operators should contact their permitting authority to learn about site-specific requirements.