Infiltration vs. Surface Water Discharge: Guidance for Stormwater Managers: Phase 1

Stormwater managers who seek to protect surface and ground waters from the effects of polluted urban runoff will better achieve their goals by selecting the correct options. It is also important that managers understand the appropriate applications and restrictions of the different methods available for use.

Several factors contribute to a decision to infiltrate stormwater and/or route it to surface waters. Those factors include local conditions, policies, opportunities, constraints, and regulatory requirements. Stormwater managers face many potentially conflicting objectives, from flood prevention to protection of downstream habitat. New management plans, which attempt to address goals of water quality and water quantity control, incorporate both infiltration and surface treatment/discharge methods.

Stormwater Infiltration

The desire to incorporate infiltration raises two potential concerns: acceptance of small-scale infiltration devices, especially by regulatory authorities, and the potential for groundwater contamination. The researchers surveyed stormwater managers to determine their interest in and ability to approve infiltration as a stormwater management technique. Although all the states and regional respondents supported the installation of infiltration devices, only two-thirds of the local governments indicated they would approve infiltration. The report addresses limitations to the use of infiltration.

The second concern is that the potential for groundwater contamination from stormwater infiltration is not well known or documented. Advocates of infiltration often have not addressed pollutant removal in the subsurface. A modeling exercise evaluated whether vadose zone natural soils found below infiltration basins could be expected to remove three representative stormwater pollutants effectively—zinc, sodium, and chloride. Models predicted the depth of migration of these pollutants in the subsurface to determine which factors influenced migration. Rainfall was the common driver of pollutant depth in the model. Concentration affected the zinc migration, whereas intrinsic permeability affected the pollutant depth for sodium and chloride. In addition, the modeling exercise identified data gaps that need to be addressed before more accurate modeling could occur.

Management plans which address goals of water quality and water quantity control, incorporate both infiltration and surface treatment/discharge methods.

BMP Review

Infiltration devices allow water to penetrate the surface soil, moving it through the unsaturated zone to the groundwater. During this movement, pollutants may be transported with the water or may be retarded through physiochemical interactions with the soil matrix. The stormwater manager must develop an overall strategy for selecting the most appropriate BMP for existing or projected watershed conditions.

The research team discussed infiltration as a stormwater management prac-

BENEFITS

- Develops an overall strategy for selecting appropriate best management practices (BMPs).
- Recommends appropriate tools to design BMPs.
- Focuses on the appropriateness, sizing, and performance predictions of infiltration devices.

RELATED PRODUCTS

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tice and analyzed the design and performance of infiltration BMPs. The researchers determined that the selection of an appropriate BMP or combination of BMPs depends on four considerations: 1) local site hydrology e.g., amount of runoff to be treated, frequency of runoff; 2) expected pollutant loading from the drainage area; 3) local installation conditions e.g., surface treatment vs. infiltration, availability of suitable locations; and 4) regulatory requirements.

Data Gaps in Stormwater Infiltration

The researchers identified questions and data gaps in the selection and use of stormwater treatment devices.

Pollutants of concern

Microbial and other pollutants must be accounted for when selecting and managing a stormwater infiltration practice. The relationship between wet weather flows and higher concentrations of these microorganisms infers a relationship between urban stormwater runoff and microbiological quality.

Effects of pollutants

Data gaps exist for both the effect of stormwater quality on stream integrity as well as stream restoration. Further research is needed on the ability of BMPs or low impact development techniques to improve the quality of a receiving water.

Design of infiltration facilities

To date, no model can accurately predict pollutant migration depth. Future research should use site-specific information to compare observed and model predicted organic movement in the subsurface. Installed BMPs should be monitored for better prediction of performance.

Groundwater Contamination Potential for Stormwater Pollutants

Compound Class	Compounds	Mobility (worst case: sandy/low organic soils)	Abundance in stormwater	Fraction filterable
Nutrients	nitrates	mobile	low/moderate	high
Pesticides	2,4-D	mobile	low	likely low
	γ-BHC (lindane)dane)	intermediate	moderate	likely low
	malathion	mobile	low	likely low
	atrazine	mobile	low	likely low
	chlordane	intermediate	moderate	very low
	diazinon	mobile	low	likely low
Other organics	VOCs	mobile	low	very high
	1,3-dichloro-benzene	low	high	high
	anthracene	intermediate	low	moderate
	benzo(a) anthracene	intermediate	moderate	very low
	bis (2-ethyl-hexyl) phthalate	intermediate	moderate	likely low
	butyl benzyl phthalate	low	low/moderate	moderate
	fluoranthene	intermediate	high	high
	fluorene	intermediate	low	likely low
	naphthalene	low/intermediate	low	moderate
	Penta-chlorophenol	intermediate	moderate	likely low
	phenanthrene	intermediate	moderate	very low
	pyrene	intermediate	high	high
Pathogens	enteroviruses	mobile	likely present	high
	Shigella	low/intermediate	likely present	moderate
	P. aeruginosa	low/intermediate	very high	moderate
	protozoa	low/intermediate	likely present	moderate
Heavy metals	nickel	low	high	low
	cadmium	low	low	moderate
	chromium	intermediate/very low	moderate	very low
	lead	very low	moderate	very low
	zinc	low/very low	high	high
Salts	chloride	mobile	seasonally high	high

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