
# Guidance for UIC Wells that Manage Stormwater

**December 2006**
**Publication Number 05-10-067**

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- Local or state authorities may prohibit the use of UIC wells subject to frequent spills or illegal dumping.

These may be areas where incidents have occurred or where there is sufficient evidence that a UIC well would be attractive to illegal dumping. For example, UIC wells at many auto parts shops, restaurants, and food processing facilities have been subject to frequent illicit discharges by customers or employees.

Designers should discuss potential problems with their clients and take care to locate UIC wells to minimize easy, unobtrusive access for illegal dumping.

### 5.1.2 Spill containment structures

The type of land use will determine if a spill control containment structure is required. See the stormwater manual chapter on source control for more information on spill containment structures and when they are required.

High vehicle traffic areas (see definition below), fueling stations, and other facilities where fueling activities take place, and areas where petroleum products are stored and/or transferred in amounts greater than 1,500 gallons per year, must include:

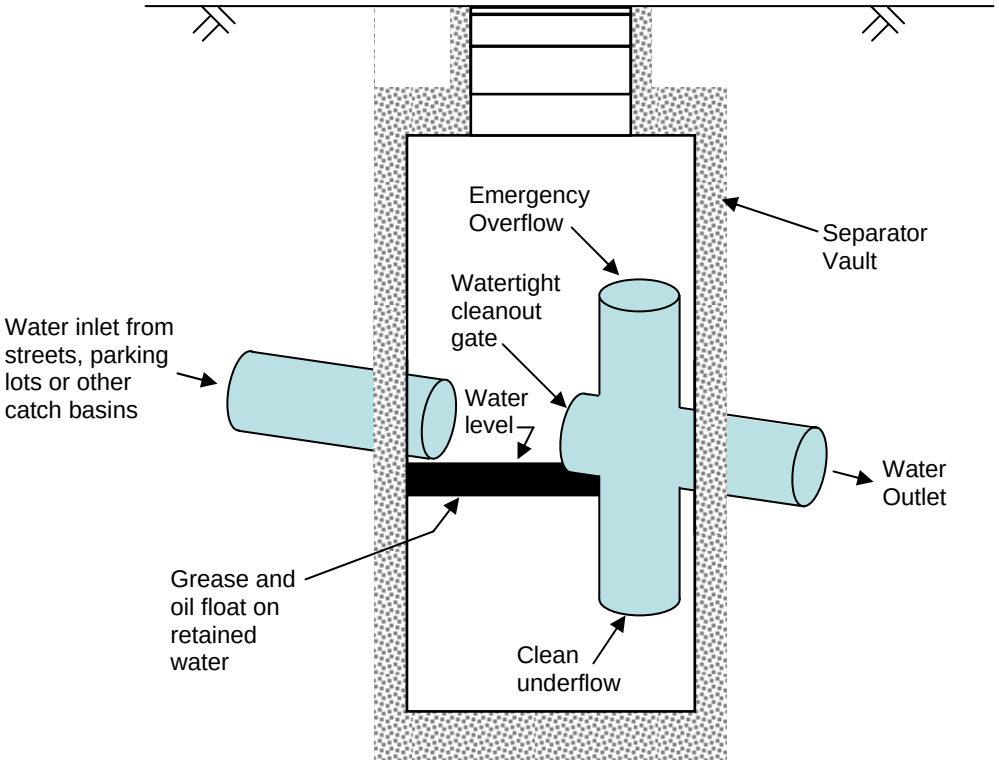
- A spill containment structure.
- A spill prevention control and containment plan (see stormwater management manual).

*High vehicle traffic areas are:*

- *Commercial or industrial sites subject to an expected average daily traffic count (ADT) ≥ 100 vehicles/1000 ft² gross building area (trip generation).*
- *Road intersections with an ADT of ≥ 25,000 on the main roadway, and ≥ 15,000 on any intersecting roadway*.

### 5.1.3 Spill control devices

Examples of a *spill control device* are a tee section or turn down elbow designed to retain a limited volume of pollutant that floats on water, such as oil or antifreeze. Spill control devices are passive and must be cleaned out to remove the spilled pollutant




Source: 1992 Ecology Stormwater Manual.

**Figure 5.1: A spill control (SC) separator**. A catchbasin with a T-inlet for temporarily trapping small volumes. Source: 1992 Ecology Stormwater Manual**.**

At high-use sites except for those listed in the previous section (high traffic areas), the UIC well must include a spill control device.

These high-use sites include:

- Parking areas with trip end count equal to or greater than 300 vehicles or 100 trip ends per 1000 square feet of gross building area.
- A commercial or industrial site subject to use, storage, or maintenance of a fleet of 25 or more diesel vehicles that are over 10 tons gross weight (trucks, buses, trains, heavy equipment, etc.). See Chapter 2.2 for prohibitions.
- A commercial or industrial site subject to petroleum storage and transfer in excess of 1,500 gallons per year (does not include locations where heating fuel is routinely delivered to end users and the annual amount of heating oil used at the site is the sole basis for the site meeting this definition; except for heating fuel handling and storage facilities).
- Maintenance and repair facilities for vehicles, aircraft, construction equipment, railroad equipment, or industrial machinery and equipment. See Chapter 2.2 for prohibitions.
- Fueling stations and facilities.
- Outdoor areas where hydraulic equipment is stored.

- Log storage and sorting yards and other sites subject to frequent use of forklifts and (or) other hydraulic equipment.
- Railroad yards.

In eastern Washington only: the following are also high use sites:

- All roads with ADT equal to or greater than 30,000 vehicles per day.
- Commercial on-street parking areas on streets with an expected total ADT count equal to or greater than 7,500.

A spill response plan and employee training are required to reduce the risk of stormwater contamination.

### 5.1.4 Evaluating the need for spill containment structures or control devices for other situations

A spill containment structure or spill control device should also be used if in the designer's judgment spills are likely during the life of the project (see stormwater management manual).

Impervious surfaces contributing stormwater to UIC structures should be evaluated for risk of exposure to potential spills.

For *traffic surfaces*, the designer should consider whether any of the following conditions are present.

- Locations where traffic accidents are likely to occur, such as the bottom of a steep hill, a dangerous intersection, or a sharp turn in a road.
- Roads in industrial areas or with frequent daily travel by tanker trucks.
- Other situations that increase the risk for accidental spills.

For *commercial and industrial sites*, the designer should consider:

- The types of materials that will be handled and stored at the site.
- Site layout and spill response plans.
- Probable employee training and preparation for responding to a spill
- Protecting the UIC well from receiving spilled material.

## *5.2 Pre-treatment*

The best management practices chosen for the site must remove or reduce the target pollutants to levels that will comply with state ground water quality standards when the discharge reaches the water table or first comes into contact with an aquifer (see WAC 173-200). Each best management practice is designed to reduce or eliminate certain pollutants. See Ecology's stormwater management manuals, to determine the required best management practices that apply to the pollutants at your site, see Chapter 5 of the *Stormwater Management Manual for Eastern Washington* or Volume V of the *Stormwater Management Manual for Western Washington* for best management practices applicable to your site.

These best management practices include filtration and bio-infiltration, water quality vaults and wetpools, oil/water separators, manufactured devices (such as catch basin inserts, media filters, and other emerging technology), and other approved facilities that provide treatment of expected pollutants (using filtration, adsorption, or sedimentation processes) for flows up to the water quality design storm.

Alternatively, project proponents may request conditional approval from Ecology for a new or experimental treatment method following the protocol described in Ecology stormwater management manuals, see *Stormwater Management Manual for Western Washington* (SMMWW), chapter 12 Emerging technologies, or *Stormwater Management Manual for Eastern Washington* (SMMEW) chapter 5.

### *Pretreatment when space is limited*

The Ecology stormwater manuals list treatment technologies that have a relatively small footprint. These include filter systems, such as the Contech Stormfilter, the CDS Media filter, the Contech Vortfilter, the Ecology Embankment, the Aquashield Aquafilter, and the HydroInternational Downstream Defender. More information on the technologies can be found at: http://www.ecy.wa.gov/programs/wq/stormwater/newtech/index.html.

Example: A jurisdiction needs to install a UIC well to prevent flooding of the road. The right-of-way is too narrow to allow a basic treatment structure such as a swale. One solution is to use basic treatment that has a small footprint, including some that fit inside the UIC well.

Alternatively, the demonstrative approach (see Chapter 2) may be used.

### 5.2.1 Preserving infiltration rates

Removing solids from stormwater runoff before it is discharged to a UIC well helps preserve infiltration rates over the long term. UIC wells used for flow control are required to have solids removed prior to discharge. Pre-treatment for solids removal must be designed, constructed, operated and maintained in accordance with an Ecology stormwater manual or an equivalent department approved local manual.

Coliform bacteria and other pathogens in stormwater come from many sources. Examples are manure fertilizers, pet waste, and confined animal feeding operations.

The NPDES Phase II stormwater permit requires subject municipalities to control sources of pathogens to prevent stormwater contamination. Under the permit, they must address illicit discharges to sewers and educate target audiences about preventing pet wastes from contaminating stormwater. These measures help prevent pathogens from contaminating stormwater. Similar measures can be applied to discharges to UIC wells.

Private well owners must ensure that their UIC wells are appropriately protected from sources of bacterial contamination.

The following conditions increase the risk for contamination and require additional precautions:

- The UIC well is less than 100 feet from a drinking water supply well and the seasonal high water table is less than 15 feet below the bottom of the UIC well.

Pre-treatment for solids removal is required. This is called *basic treatment* in Ecology's stormwater management manuals.

- The UIC well is less than 1000 feet from a drinking water supply well or less than 100 feet from a surface water body that is impaired due to coliform bacteria, and the vadose zone treatment capacity is categorized as "low" or "none." See Table 5.2 at the end of this chapter.

Pre-treatment for solids removal is required. This is called *basic treatment* in Ecology's stormwater management manuals.

- The UIC well is located where it could receive runoff from areas or sites that generate high coliform bacteria loadings.

Stormwater treatment facilities are unreliable in removing coliform bacteria and other pathogens from runoff. Because of this, UIC wells shall not receive direct stormwater discharges from areas or sites that generate high coliform bacteria loadings, such as concentrated animal feeding operations.

Alternatively, this type of runoff may be:

- Discharged to the sanitary sewer, if this is allowed by the local jurisdiction.
- Used for crop irrigation, as long as other applicable requirements are met.
- Directed to a biofiltration or bioinfiltration system.
- Diverted through constructed wetlands prior to discharge to a UIC well.

### 5.2.3 Soluble pollutants

Many soluble pollutants that are commonly found in stormwater (including pesticides, fertilizers, road salts, and other chemical pollutants) are very difficult to remove from stormwater. Source controls applicable to the land use and activities at the site are required to reduce the contamination of stormwater from these chemicals.

See Chapter 8 of the *Stormwater Management Manual for Eastern Washington* (Department of Ecology Publication # 04-10-076) or Volume IV of the *Stormwater Management Manual for Western Washington* (Department of Ecology Publication # 99-14) for best management practices applicable to your site.

#### 5.2.3.1 Special requirements

The following land uses, conditions, and activities have special requirements. However, UIC wells located in parking lots or other impervious areas would follow the source control and treatment requirements for solids, metals, and oils.

##### *A. Sites with pesticides, fertilizer, and nutrients in runoff*

Areas such as golf courses, public ball fields, and cemeteries typically use pesticides and fertilizers for landscape management. Examples of other activities that generate high nutrient loads include commercial composting, commercial animal handling areas, and nurseries.

Runoff that would violate ground water quality standards because it is contaminated by pesticides or fertilizers and other nutrients should ***not*** be discharged directly to UIC wells.

Non-biological treatment systems, such as catch basins, are ineffective at removing these pollutants from runoff. Instead, runoff from these types of landscaped areas should be directed to biofiltration or bioinfiltration systems or to constructed wetlands prior to discharge to UIC wells. Stormwater with fertilizer or nutrients may be used to irrigate crops in accordance with other applicable requirements.

The following practices are encouraged:

- Limit use of applied chemicals.
- Design the site to minimize runoff from the landscaped surface.

*The term "pesticides" includes a host of chemicals with varying chemical fate and transport characteristics. Some pesticides travel to ground water more readily because they are more water soluble and less likely to "stick" or sorb to particles of earth. These pesticides need to be treated by a biological treatment method, such as a bioswale or constructed wetland. UIC wells that receive stormwater with pesticides that use one of these biological treatment methods are rule-authorized when they are registered, providing this technical guidance is followed.*

*If UIC owners wish to use a different treatment method for pesticides, they may apply to the department for rule-authorization using the demonstrative approach outlined in this guidance.*

#### *B. Industrial activities*

The Environmental Protection Agency has listed industrial activities that have monitoring requirements for nitrate, nitrite, ammonia, or phosphorus. This list is reproduced in Appendix A. Runoff from these sites must be directed to one of the following:

- Biofiltration or bioinfiltration systems.
- Constructed wetlands prior to discharge.
- Sanitary sewer if allowed by the local jurisdiction.
- Municipal storm sewer, if allowed by the local jurisdiction and following pre-treatment for removal of solids.

Facilities may complete a *no exposure* certification as part of Ecology's UIC well registration process to be exempted from these requirements. In order to qualify, no outdoor processing, handling, or storage of raw solid materials or finished products may take place at the facility. Industrial facilities that qualify for no-exposure certification may use the Tables 5.2 – 5.4 at the end of this section to determine pre-treatment requirements.

## 5.2.4 Solids, metals, and oil

### 5.2.4.1 Tables to determine treatment requirements

Table 5.2, Table 5.3 and Table 5.4 at the end of this chapter are intended for use in meeting the requirements of the presumptive approach. Project proponents and local jurisdictions following the demonstrative approach may define other treatment capacity categories and pollutant loading requirements (see section 2.5.2).

Where adequate geologic and groundwater depth information are available, Table 5.2, Table 5.3, and Table 5.4 at the end of this chapter can be used to evaluate whether a stormwater discharge from a road, commercial site, or residential site to a UIC well is presumed to meet the non-endangerment standard for solids, metals, oil, grease, and PAHs.

Used together, the tables identify the extent to which the vadose zone is presumed to provide sufficient treatment for a given pollutant loading classification and whether additional pretreatment is necessary to meet the groundwater quality standards for these pollutants.

At sites where the vadose zone is presumed to provide sufficient treatment to protect groundwater quality, pretreatment is not required prior to discharge to the UIC well.

Industrial sites with no outdoor processing, storage, or handling of raw or finished products may also use these tables.

### 5.2.4.2 Treatment requirements

#### *Commercial roofs*

Roof runoff from commercial businesses with ventilation systems specifically designed to remove commercial indoor pollutants must be evaluated on a case-by-case basis to identify the pollutants of concern and the appropriate pre-treatment requirements.

In general, this runoff may be classified as a "medium" pollutant loading source (see Table 5.3 at the end of this chapter), and the requirements of this section may be applied to discharges from these areas to UIC wells.

#### *Industrial roofs*

Roof runoff from industrial facilities must be evaluated on a case-by-case basis and should be treated according to the other best management practice requirements for the facility. See the previous page for special requirements for industrial facilities (section 5.4.3.1).

### 5.2.4.3 Oil control

Treatment to remove oil means to apply one of the separation or adsorption technologies identified in an Ecology stormwater manual.

Stormwater with pollutant loadings in the "high" category, as described in Table 5.4, must be pre-treated for removal of oil.

An oil-water separator should be used at high-density intersections and at commercial or industrial sites subject to an expected average daily traffic count (ADT) ≥100 vehicles/1000 $ft^2$ gross building area. These areas are expected to generate sufficient quantities of oil to justify the operation of a separator.

Basic treatment that also provides adsorptive capacity may be used at:

- Other sites where oil control is required except for the ones listed above.
- Commercial parking and streets with ADT > 7500. Alternatively, a simple passive oil control device, such as a turned down elbow, may be used.
- In eastern Washington, roads with ADT > 30,000. See table 5.4, footnote 3.

Examples of basic treatment that provide adsorptive capacity include biofiltration swales, bioinfiltration swales, filters, and catch basin inserts. See Ecology's stormwater management

manuals or other equivalent department approved manuals for more examples and information on these BMPs.

#### 5.2.4.4 Solids removal

Pre-treatment for solids removal is required:

- At commercial sites with outdoor handling or storage of raw solid materials. Examples include gravel, sands, logs, salts and compost.
- At industrial sites listed in Appendix A where outdoor processing, handling, or storage of raw solid materials or finished products, including outdoor loading areas for these materials or products, takes place. These are sites defined by EPA (40 CFR 122.26(b)(14)).

Stormwater associated with construction activities classified under the federal rules, 40 CFR 122.26(b)(14)(x) are exempt from this requirement.

- When an evaluation of storm runoff from roofs subject to ventilation systems that are specifically designed to remove commercial indoor pollutants identifies the need for pre-treatment for solids removal.

## *5.3 Vadose zone treatment capacity*

Studies of stormwater pollutant concentrations in water through and below infiltration systems show mixed results in the effectiveness of vadose zone filtration in protecting ground water quality (USEPA 1999; Pitt *et al*.1999; Mason *et al.* 1999; and Appleyard 1993).

Many of the problems documented in these studies can be corrected by proper siting, design and use of the facilities, enhanced source control, additional pre-treatment prior to discharge to the facilities, or prohibition of the discharge.

Studies of sub-surface infiltration systems also indicate that filtered and adsorbed pollutants accumulate in the vadose zone at depths of less than a few feet below the facilities at concentrations that may require soil cleanup activities upon decommissioning of a UIC well (Mikkelsen *et al.* 1996 #1 and #2; Appleyard 199.).

Because contaminated soil removal and disposal costs can be considerable, project proponents may wish to consider including pre-treatment facilities to remove solids from stormwater runoff and avoid potential cleanup requirements following long-term use of the UIC well. This caution is addressed to UIC wells receiving runoff from commercial and industrial areas and from traffic areas with moderate to high use. For examples of traffic areas with moderate and high use, see Table 5.3.

In general, the vadose zone may provide adequate filtration, adsorption, and other pollutant reduction capacity to meet the non-endangerment standard for solids, metals, oil, grease, and PAHs. The tables at the end of this section may be used to evaluate the use of the vadose zone for treatment and to determine pre-treatment requirements for these pollutants.

### 5.3.1 Classification of vadose zone treatment capacity

Table 5.2 classifies the treatment capacity of the vadose zone as high, medium, low, and none. These classifications are based on minimum thickness and the geologic materials that make up the treatment layer.

Several different ways of describing the geologic materials are used, including grain-size distribution, sand-to-fines ration, well log lithology, and geologic names. Examples of these are given in Table 5.1.

**Table 5.1: Examples of Geologic Material Descriptions**

| Geologic Material Description Method | Example |
|---|---|
| Grain size distribution | Materials with median grain size <0.125mm |
| Sand-to-fines ratio | Having a sand to silt/clay ratio of less than 1:1 and sand plus gravel less than 50% |
| Well log lithology | Sandy or silty clay<br>Silt<br>Clayey or sandy silt<br>Sandy loam or loamy sand<br>Silt/clay with inter-bedded sand |
| Geologic name | This category generally includes till, hardpan, caliche, and loess |

The ability of geologic materials to filter or adsorb pollutants such as solids, oils, and metals is related to grain size, the amount of organic matter, and the presence of clays, among other factors. Native organic matter improves adsorption and filtration (Ingloria et. al., 1997) but is rarely found at depths below UIC wells.

## High Treatment Capacity

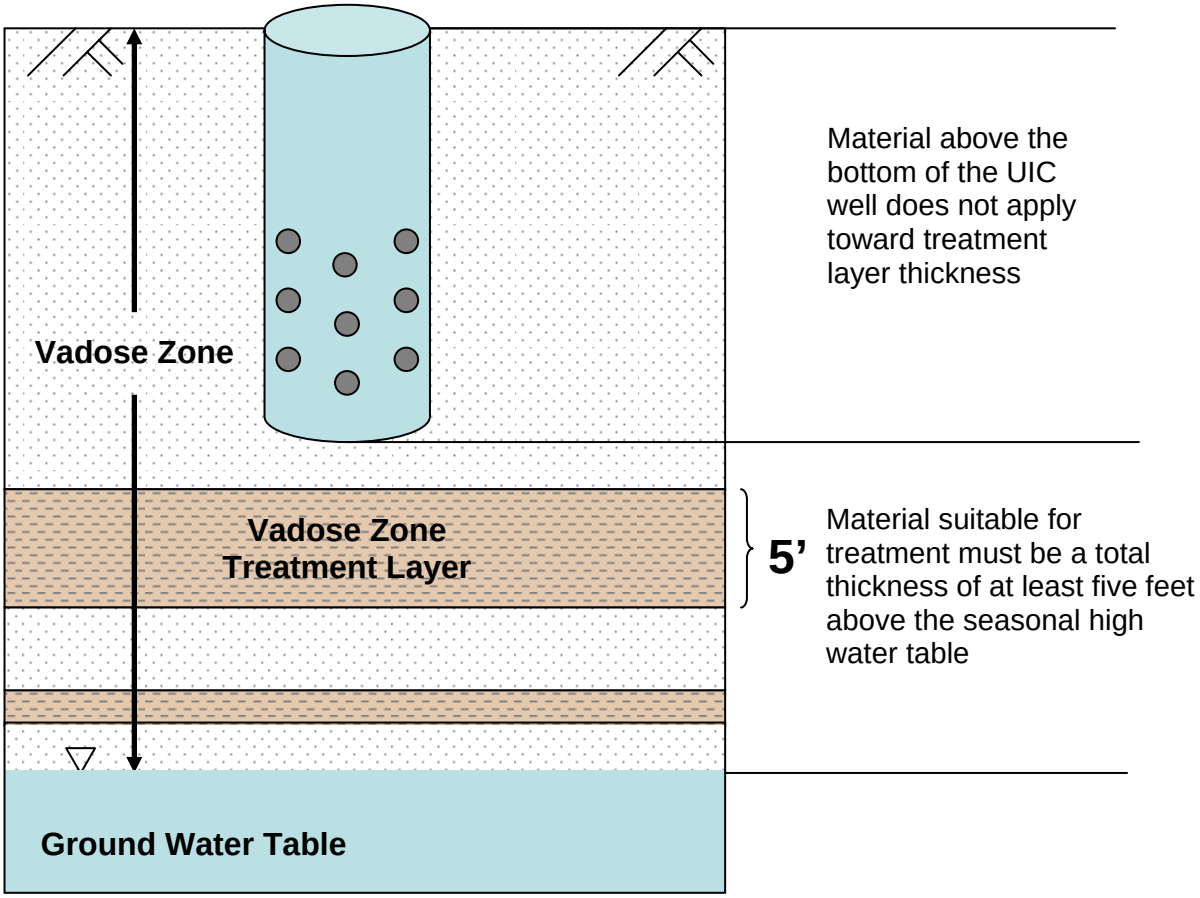



**Figure 5.2: Schematic Vadose Zone Treatment Layer Example**

Geologic materials that are classified as having a *high treatment capacity* are fine-grained with a greater capacity to filter discharges. These materials also tend to remove pollutants by chemical reactions such as cation exchange capacity and sorption. These may be mixtures of materials where silt and clay fill the void spaces in the matrix of the coarser materials. More compaction results in better filtration. High treatment capacity layers must total a minimum of five feet between the bottom of the UIC well and the seasonal high water table.

Geologic materials that are classified as having a *medium treatment capacity* provide moderate to high filtration and have minor or no chemically reactive characteristics. Medium treatment capacity layers must total a minimum of ten feet.

Geologic materials that are classified as having a *low treatment capacity* provide some minimal filtration. Although the sand and gravel mixtures in this category may provide moderate filtration when the UIC well is initially installed, preferential flow paths develop that reduce this capacity. Low treatment capacity layers must total a minimum of 25 feet between the bottom of the UIC well and the seasonal high water table.

### Table 5.2: Vadose Zone Treatment Capacity

The treatment capacity classifications describe the vadose zone between the bottom of the UIC well and the top of the highest known seasonal water table. This table will be used to determine pre-treatment requirements when using Table 5.4. If vadose zone conditions are unknown, use *None* for treatment capacity. If thicknesses are less than those listed, use *None* for treatment capacity or you may consider using the demonstrative approach, see section 2.5.2. Separation between the bottom of the UIC well and the top of the water table is still required, see WAC 173-218-090(1) (b).

| Treatment Capacity Classification and Required Minimum Thickness | Description of Vadose Zone Layer |
|---|---|
| **HIGH**<br><br>A minimum thickness of five feet | Materials with median grain size < 0.125 mm<br>Having a sand to silt/clay ratio of less than 1:1 and sand plus gravel < 50%<br>Lean, fat, or elastic clay<br>Sandy or silty clay<br>Silt<br>Clayey or sandy silt<br>Sandy loam or loamy sand<br>Silt/clay with inter-bedded sand<br>Well-compacted, poorly-sorted materials<br>This category generally includes till, hardpan, caliche, and loess |
| **MEDIUM**<br><br>A minimum thickness of ten feet | Materials with median grain size 0.125mm to 4mm<br>Sand to silt/clay ratio from 1:1 to 9:1 and percent sand > percent gravel<br>Fine, medium or coarse sand<br>Sand with interbedded clay and/or silt<br>Poorly-compacted, poorly-sorted materials<br>This category includes some alluvium and outwash deposits |
| **LOW**<br><br>A minimum thickness of twenty-five feet | Materials with median grain size > 4mm to 64mm<br>Having a sand to silt/clay ratio greater than 9:1 and percent sand less than percent gravel<br>Poorly-sorted, silty or muddy gravel<br>Sandy gravel, gravelly sand, or sand and gravel<br>This category includes some alluvium and outwash deposits |
| **NONE**<br><br>Minimum thickness not applicable | Materials with median grain size >64mm<br>Having total fines (sand and mud) less than 5%<br>Well-sorted or clean gravel<br>Boulders and/or cobbles<br>Fractured rock<br>This category generally includes fractured basalt, other fractured bedrock, and cavernous limestone |

### Table 5.3: Pollutant Loading Classifications for Solids, Metals, and Oil in Stormwater Runoff Directed to UIC Wells

These are the categories of pollutant loadings used to determine whether the facility is exempt from the pre-treatment requirement when using Table 5.4.

| Classification | Areas Contributing Runoff to the UIC Well<br>(ADT = Average Daily Traffic) |
|---|---|
| **Insignificant** | Impervious surfaces not subject to motorized vehicle traffic or application of sand or deicing compounds<br>Un-maintained open space |
| **Low** | Parking areas with <40 trip ends per 1000 SF of gross building area or <100 total trip ends<br>Other land uses with similar traffic/use characteristics (e.g. most residential parking and employee-only parking areas for small office parks or other commercial buildings)<br>**Inside Urban Growth Management Areas**<br>Fully controlled and partially controlled limited access highways with ADT less than 15000<br>Other roads with ADT less than 7500 vehicles per day<br>**Outside Urban Growth Management Areas**<br>All roads with ADT less than 15000 vehicles per day |
| **Medium** | Parking areas with between 40 and 100 trip ends per 1000 SF of gross building area or between 100 and 300 total trip ends<br>Primary access points for high-density residential apartments<br>Intersections controlled by traffic signals that do not meet the definition of a high-density intersection (see Glossary)<br>Transit center bus stops<br>Other land uses with similar traffic/use characteristics (e.g. visitor parking for small to medium commercial buildings with a limited number of daily customers)<br>**Inside Urban Growth Management Areas**<br>Fully controlled and partially controlled limited access highways with ADT between 15000 and 30000 vehicles per day<br>Other roads with ADT between 7500 and 30000 vehicles per day<br>**Outside Urban Growth Management Areas**<br>All roads with ADT between 15,000 and 30,000 vehicles per day |
| **High** | High Use Sites<br>In eastern Washington, all roads with ADT >30000 vehicles per day<br>High-density intersections<br>Parking areas with >100 trip ends per 1000 SF of gross building area or >300 total trip ends<br>On-street parking areas of municipal streets in commercial and industrial areas<br>Highway rest areas<br>Other land uses with similar traffic/use characteristics (e.g., commercial buildings with a frequent turnover of visitors, such as grocery stores, shopping malls, restaurants, drive-through services, etc. |

## Table 5.4: Pre-treatment Required for Solids, Oil and Metals

Find the *Treatment Capacity Classification* from Table 5.2 and the *Pollutant Loading Classification* from Table 5.3. Use Table 5.4 to determine the pre-treatment requirements for solids, oil, and metals based on these classifications. Pre-treatment technologies for solids, oil, and metals removal are provided by the Department of Ecology stormwater manuals.

| **Treatment capacity** / **Pollutant loading** | *High* | *Medium* | *Low* | *None* |
|---|---|---|---|---|
| *Insignificant* | None | None | None | None |
| *Low* | None | None | None | Remove solids[2] |
| *Medium* | Two-stage drywells[1] | Two-stage drywells[1] | Remove solids[2] | Remove solids[2] |
| *High* | Remove oil[3] | Remove oil[3] | Remove oil and solids[2,3] | Remove oil and solids[2,3] |

[1] A **two-stage drywell** is a catch basin or other pre-settling/spill control structure that traps small quantities of oils and solids. The catch basin or other pre-settling/spill control device must be inspected and cleaned regularly (see the operation and maintenance requirements in Ecology stormwater management manuals).

[2] **Treatment to remove solids** means basic treatment. See the definition for basic treatment in the glossary. Removal of solids should remove a large portion of the metals in most stormwater runoff. Any special treatment requirements in this chapter still apply. For **low** pollutant loading sites, implementation of appropriate source control BMPs may be employed in lieu of structural treatment BMPs (see Ecology stormwater management manuals).

[3] **Treatment to remove oil** is to be accomplished by applying one of the technologies identified in the Ecology stormwater management manuals.

At high-density intersections and at commercial or industrial sites subject to an expected average daily traffic count (ADT) of 100 vehicles/1000 ft² gross building area, sufficient quantities of oil will be generated to justify operation of a separator BMP.

At other high-use sites, project proponents may select a basic runoff treatment BMP that also provides adsorptive capacity, such as a biofiltration or bioinfiltration swale, a filter or catch basin insert, or other adsorptive technology, in lieu of a separator BMP.

The requirement to remove oil for all roads with ADT> 30,000 applies only in eastern Washington. For these roads in eastern Washington, an oil control facility is not required; instead a basic treatment facility with sorptive characteristics (i.e., swale or sand filter) is required.

This requirement to apply a basic treatment facility with adsorptive characteristics also applies to commercial parking and to streets with ADT > 7500; alternatively a simple passive oil control device such as a turned down elbow may be used.