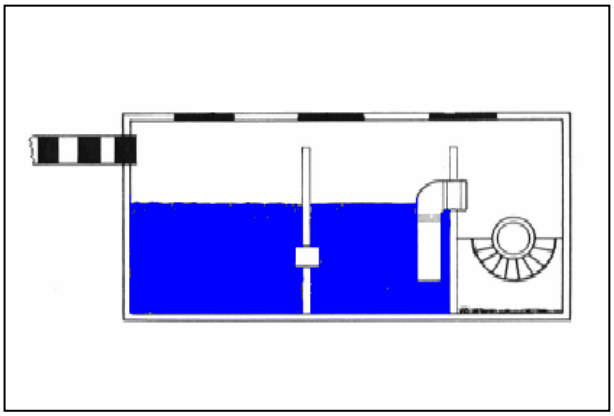
Gravity (Oil-Grit) Separator



Description: Hydrodynamic separation device designed to remove settleable solids, oil and grease, debris and floatables from stormwater runoff through gravitational settling and trapping of pollutants. Facilities with fueling and parking lots containing over 400 spaces require a more advanced separator with coalescing tubes/plates designed to provide a surface that minute oil globules are attracted to and can agglomerate upon. The coalesced oil then rises to the surface to be skimmed.

Components:

- Inlet chamber
- Separation and oil storage chamber
- Enhanced components such as swirl concentrator chamber and Coalescing filter (in high-risk areas)
- Outlet chamber

Advantages/Benefits:

- Good for land uses that are hotspots for hydrocarbons
- Pretreatment for water quality
- Coalescing systems can remove oil particles down to the 20 micron range, while conventional device removes down to the 150 micron level.

Disadvantages/Limitations:

- Cannot alone achieve the 80% TSS removal target
- Intended for hotspot, space-limited or pretreatment applications
- Limited performance data
- Dissolved pollutants are not removed
- Frequent maintenance required

Design considerations:

- Intended for the removal of settleable solids (grit and sediment) and floatable matter, including oil and grease
- Access point for maintenance required
- Performance dependent on design and frequency of inspection and cleanout of unit
- Openings to device must be 1/16 inch or less to prevent mosquito intrusion and breeding.
- Install as an off-line device unless size of separator can be matched to smaller drainage area
- Install inspection/collection manhole on downstream side to provide easy access for sampling of effluent.

Selection Criteria:

☐	**Water Quality 80 % TSS Removal**
✓	**Accepts Hotspot Runoff**
☐	**Residential Subdivision**
✓	**High Density / Ultra Urban Use**

Maintenance:

- Inspect the gravity separator unit
- Clean out sediment, oil and grease, and floatables, using catch basin cleaning equipment (vacuum pumps). Manual removal may be necessary

H **Maintenance Burden**

L = Low M = Moderate H = High

ACTIVITY: Gravity (Oil-Grit) Separator

General Description

Gravity separators (also known as oil-grit separators) are hydrodynamic separation devices that are designed to remove grit and heavy sediments, oil and grease, debris and floatable matter from stormwater runoff through gravitational settling and trapping. Gravity separator units contain a permanent pool of water and typically consist of an inlet chamber, separation/storage chamber, and an access port for maintenance purposes. Runoff enters the inlet chamber where heavy sediments and solids drop out. The flow moves into the main gravity separation chamber, where further settling of suspended solids takes place. Oil and grease are skimmed and stored in a waste oil storage compartment for future removal. After moving into the outlet chamber, the clarified runoff is then discharged.

In "hot-spot" areas (fueling areas and large parking lots with over 400 spaces), separators are required to be equipped with coalescing tubes/plates. These tubes/plates provide a media in which minute oil globules can agglomerate to aid in the separation process. Oil that agglomerates around the coalescing tubes/plates can easily be skimmed through the gravity process.

When used for oil removal, the performance of these systems is based primarily on the relatively low solubility of petroleum products in water and the difference between the specific gravity of water and the specific gravities of petroleum compounds. Gravity separators are not designed to separate other products such as solvents, detergents, or dissolved pollutants. The typical gravity separator unit may be enhanced with a pretreatment swirl concentrator chamber, coalescing tubes/plates, oil draw-off devices that continuously remove the accumulated light liquids, and flow control valves regulating the flow rate into the unit.

Gravity separators are best used in commercial, industrial and transportation land uses and are intended primarily as a pretreatment measure for high-density or ultra urban sites or for use in hydrocarbon hotspots such as gas stations and areas with high vehicular traffic. However, gravity separators cannot be used for the removal of dissolved or emulsified oils and pollutants such as coolants, soluble lubricants, glycols and alcohols, or in waste streams that contain detergents or other chemical-laden wastes.

Site and Design Considerations

Since resuspension of accumulated sediments is possible during heavy storm events, gravity separator units are typically installed off-line. Gravity separators are available as prefabricated proprietary systems from a number of commercial vendors.

1. The use of gravity (oil-grit) separators should be limited to the following applications:
   - Pretreatment for other structural stormwater controls

Site and Design Considerations (Continued)

- High-density, ultra urban or other space-limited development sites
- Hotspot areas where the control of grit, floatables, and/or oil and grease are required

2. Gravity separators are typically used for areas less than 5 acres. It is recommended that the contributing area to any individual gravity separator be limited to 1 acre or less of impervious cover.
3. Gravity separator systems can be installed in almost any soil or terrain. Since these devices are underground, appearance is not an issue and public safety risks are low.
4. Gravity separators are flowrate-based devices. This contrasts with most other stormwater structural controls, which are sized based on capturing and treating a specific volume.
5. Gravity separator units are typically designed to bypass runoff flows in excess of the design flow rate. Some designs have built-in high flow bypass mechanisms. Other designs require a diversion structure or flow splitter ahead of the device in the drainage system. An adequate outfall must be provided.
6. The separation chamber should provide for three separate storage volumes:

   (1) A volume for separated oil storage

   (2) A volume for settleable solids accumulation at the bottom of the chamber

   (3) A volume required to give adequate flow-through detention time for separation of oil and sediment from the stormwater flow
7. The total wet storage of the gravity separator unit should be at least 400 cubic feet per contributing impervious acre.
8. The minimum depth of the permanent pools should be 4 feet.
9. Horizontal velocity through the separation chamber should be 1 to 3 ft/min or less. No velocities in the device should exceed the entrance velocity.
10. A trash rack should be included in the design to capture floating debris, preferably near the inlet chamber to prevent debris from becoming oil impregnated.
11. Ideally, a gravity separator design will provide an oil draw-off mechanism to a separate chamber or storage area.
12. Adequate maintenance access to each chamber must be provided for inspection and cleanout of a gravity separator unit.
13. Gravity separator units should be watertight to prevent possible groundwater contamination.
14. The design criteria and specifications of a proprietary gravity separator unit should be obtained from the manufacturer.

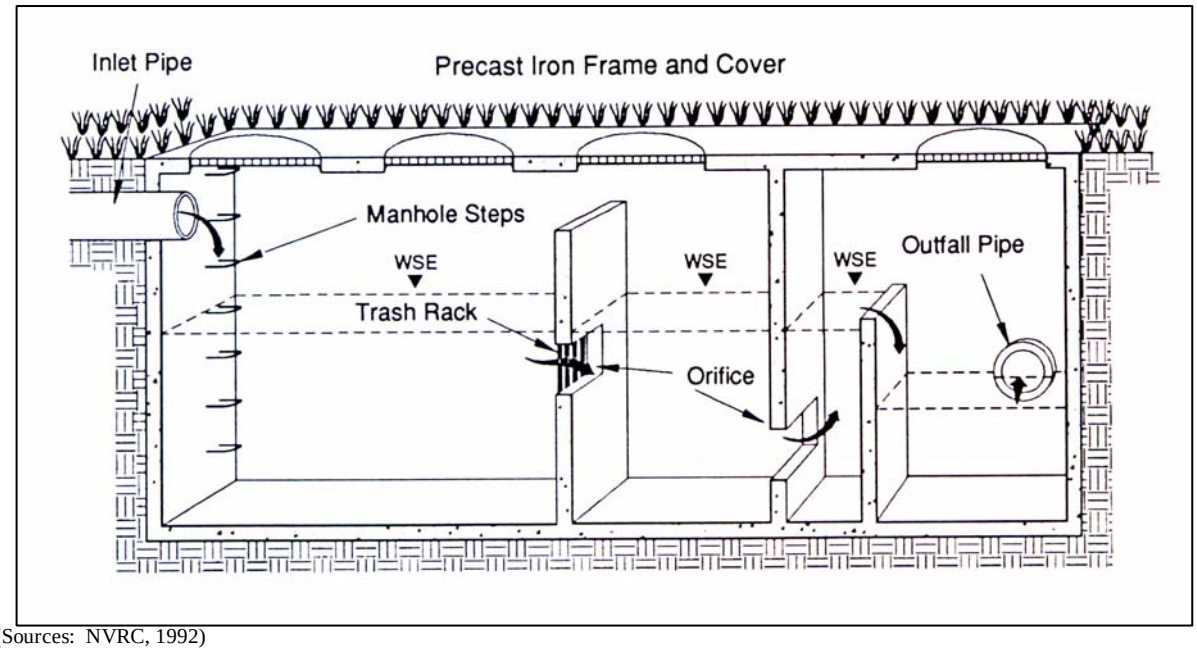
As-Built Certification Considerations

After the hydrodynamic device has been constructed, an as-built certification must be performed by a registered Professional Engineer and submitted to Metro. The as-built certification verifies that the BMP was installed as designed and approved.

Maintenance

Each BMP must have an Operations and Maintenance (O&M) Agreement which is submitted to Metro for approval and is maintained and updated by the BMP owner. Refer to Volume 1 Appendix C for the O&M Agreement for separators, as well as an inspection checklist. The O&M Agreement must be completed and submitted to Metro with grading permit application. The O&M agreement is for the use of the BMP owner in performing routine inspections. The developer/owner is responsible for the cost of maintenance and annual inspections. The BMP owner must maintain and update the BMP operations and maintenance plan. At a minimum, the operations and maintenance plan must address:

1. Additional maintenance requirements for a proprietary system should be obtained from the manufacturer.
2. Proper disposal of oil, solids and floatables removed from the gravity separator must be ensured.



(Sources: NVRC, 1992)

Figure 13.1 Schematics of Gravity (Oil-Grit) Separator

References

ARC, 2001. Georgia Stormwater Management Manual Volume 2 Technical Handbook.

CDM, 2000. Metropolitan Nashville and Davidson County Stormwater Management Manual Volume 4 Best Management Practices.

Suggested Reading

California Storm Water Quality Task Force, 1993. California Storm Water Best Management Practice Handbooks.