Rain Diversion System

Rainwater diversion system must include the following elements:

- Pump Well
- Rain Switch
- Overflow Line

Pump Well

The point where separation of storm runoff from washwater takes place must consist of a pump well. During dry weather, the washwater that discharge into the well must be conveyed by means of a pump to discharge to the sanitary sewer. During rainfall periods, the pump must be automatically deactivated after 0.1 inch of rainfall, and all subsequent rainwater or stormwater that flows into the well must be diverted to the storm drain.

Rain Switch

A device to detect rainfall similar to the detail shown on Figure 1 must be installed in an open area as close as possible to the pump well. The diversion system must contain electronically activated valves to divert the flow and an automatic timer. The rain switch must automatically deactivate the pump or close the valve whenever it detects 0.1 inch of rainfall so that no excess rainwater will be discharged to the sanitary sewer. The switch must not be reset while rain continues to fall. Once the rain has stopped, the switch is to be reset no earlier than two hours after the cessation of rain and the stormwater flows into the diversion system has become negligible. The rain collector must be installed in an area where it will remain directly exposed to rainfall. The collector and switch must also be located in an accessible area, as close as possible to the pump well and at a height not greater than six feet above the adjacent supporting surface (floor, deck or other permanent walkway). This will allow testing of the diversion system safely and without undue difficulty. A “Y” section with cap for the purpose of testing should only be installed when all other means are proven to be impractical.

Overflow Line

The diversion of rainwater or stormwater to the storm drain must be accomplished through the use of gravity overflow. The overflow line must be located in the pump well or slightly upstream and should be at the same elevation as the pumps effluent line. In the event that a gravity overflow is not feasible due to the surrounding grade of the property, the installation of a second pump to divert all rainwater may be allowed. This second pump must be automatically activated by the rain switch at the same time that the pump conveying washwater to the sanitary sewer is deactivated. The rating capacity of the secondary pump must be sufficient to prevent flooding.

Rain Diversion System

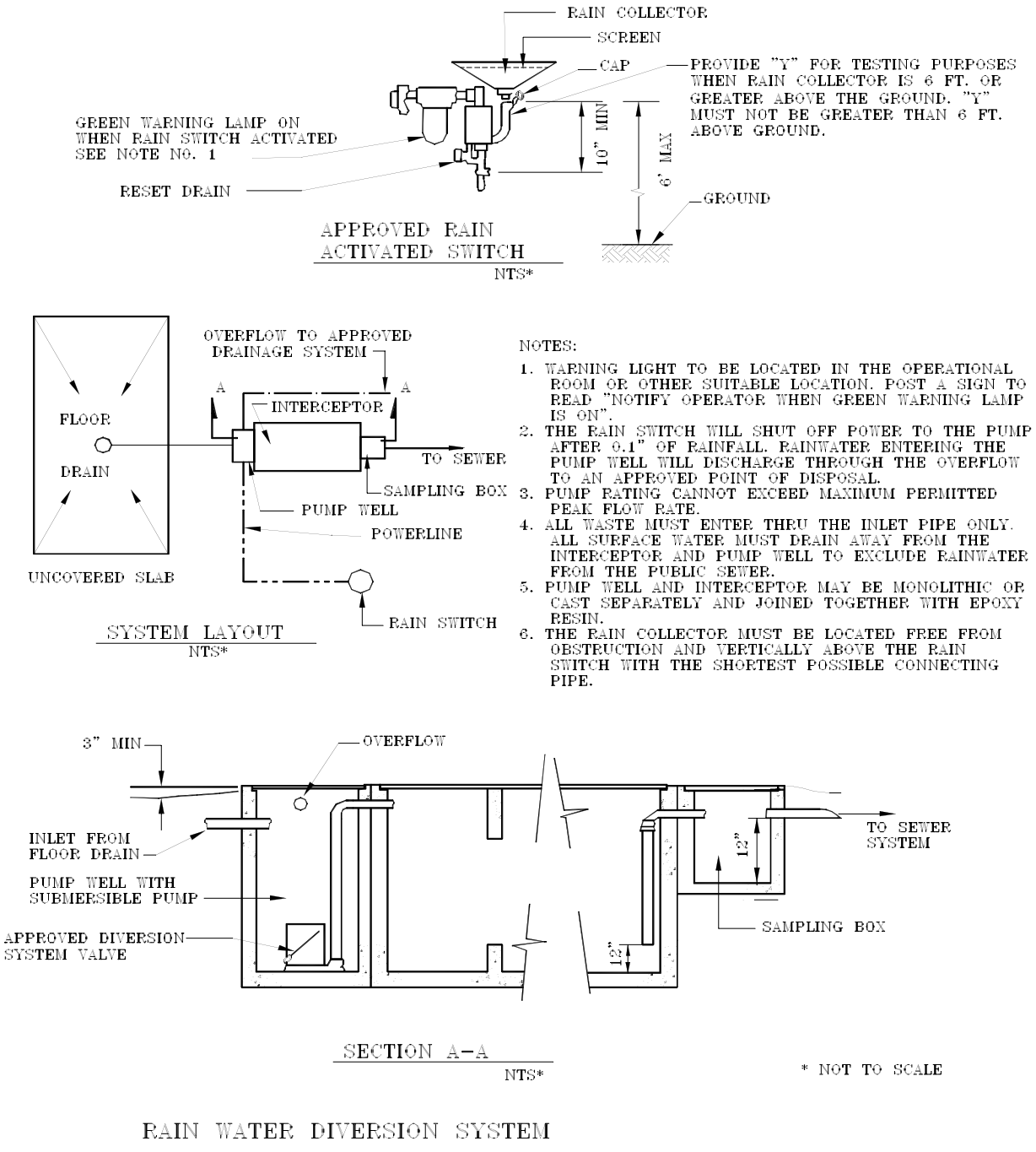


FIGURE 1

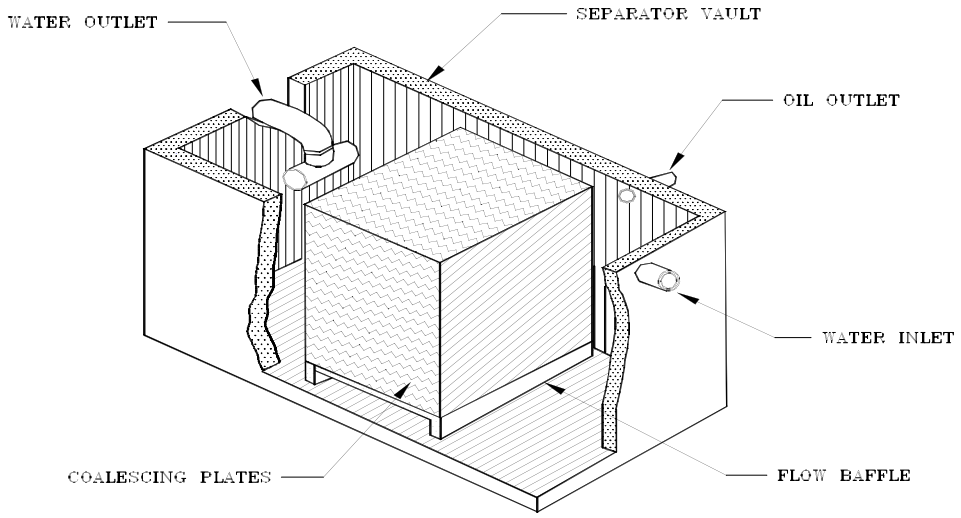
Pretreatment Unit

Pretreatment structure for treating wash water should be a CPI type oil/water separator or any other comparable treatment device. CPI (coalescing plate interceptor) separator contains a bundle of plates made of fiberglass or polypropylene (Figure 2). The plates are closely spaced. The closely spaced plates improve the hydraulic conditions to promote oil removal. Removal of fine suspended solids is also improved. Manufacturers can provide packaged separator units for flows up to several cubic feet per second. For larger flows, the designer must size the plate pack and design the vault. The following procedures can be used to size the facility.

Sizing the separator

Assuming wash water temperature of 60 F and density of oil in it as 0.9 gm/cc, the required total plate area (A) can be calculated as follows:

A (sq.ft.) = Q / 0.0016 Cosine H;
Q is the design flow rate in cu.ft./sec and H is the plate angle in degrees



CPI SEPARATOR

FIGURE 2

CPI separators are not 100% hydraulically efficient; ranging from 0.35 to 0.95 depending on the plate design. Thus efficiency should be incorporated to above equation by dividing the result by the selected efficiency. The design parameters for the plates are as follows:

Select spacing, S, between the plates, usually 0.75 to 1.5 inch.
Identify reasonable plate width, W, and length, L (in feet)
Number of plates, N = A/WL

Calculate plate volume (in cu.ft): Pv = [(N*S/12) + L*Cos H] [W*L*Sine H]

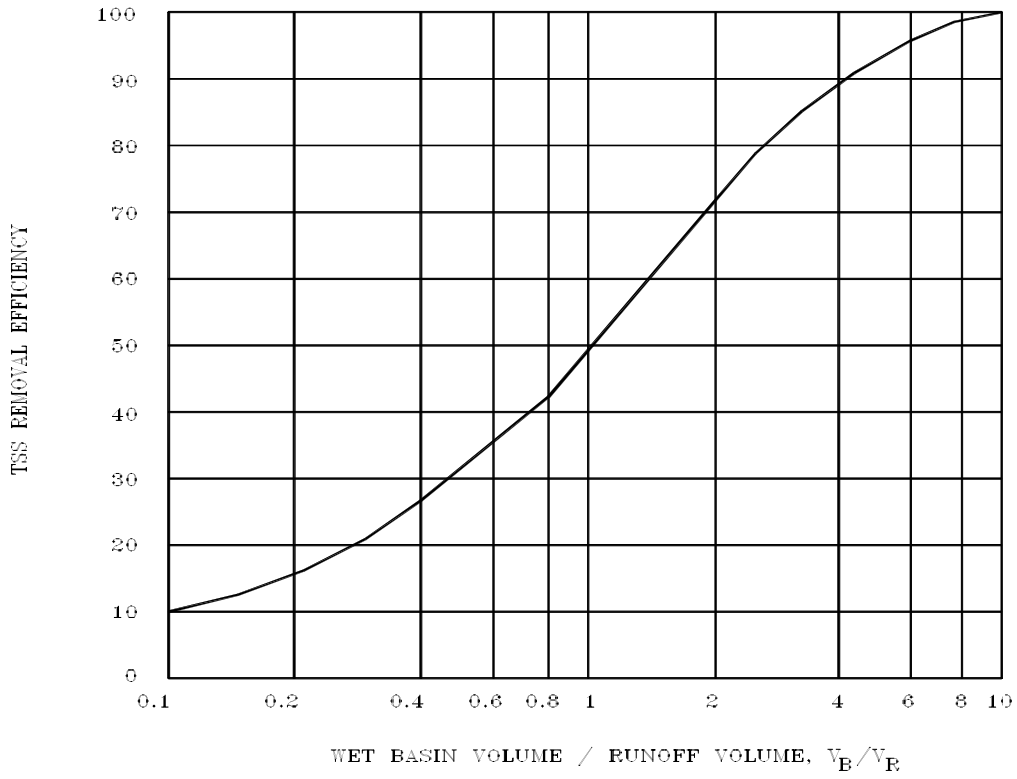
Add one foot beneath the plates for sediment storage. Add 6" to 12" above the plates for water clearance so that the oil accumulates above the plates. Add one foot for freeboard. Add a forebay for floatable and distribution of flow if more than one plate unit is needed. Add afterbay for collection of the effluent from the plate pack area. For larger units include device to remove and store oil from the water surface.

Horizontal plates require the least plate volume to achieve a particular removal efficiency. However, settleable solids will accumulate on the plates complicating maintenance procedures. The plates may be damaged by the weight when removed for cleaning. The plates should be placed at an angle of 45 to 60 degrees so that settleable solids slide to the facility bottom. Experience shows that even with slanted plates some solids will stick to the plates because of the oil and grease. Placing the plates closer together reduces the plate volume. However, if debris is expected such as twigs, plastics, and paper, select a larger plate separation distance. Or install ahead of the plates a trash racks and/or screens with a diameter somewhat smaller than the plate spacing.

Efficiency

Figure 3 shows removal efficiency of total settleable solids by a wet vault based on he ratio of wet basin volume to runoff volume. However, efficiency of CPI separators can be also estimated using the above figure, with recognition that as the figure does not include the effect of plate technology, actual performance of CPI separator should be considerably better than indicated in the figure. To use the Figure 3, take plate volume as the basin volume (Vb) and calculate the ratio with runoff volume (Vr) by assuming runoff volume as equal to the daily total volume of wash water used for cleaning of the vehicles.

Vb = Pv (cu.ft.)
Vr = Daily total water usage for vehicle washing (cu.ft.)



Source: FHWA (1989)

TSS REMOVAL VERSUS V_B / V_R RATIO

Figure 3