4.4.12.1.1 Porous Baffles

Source: City of Franklin

Definition and Purpose

Porous baffles are flow-distributing structures made from highly permeable materials, installed perpendicular to flow within sediment basins or traps. Their primary function is to reduce water velocity and turbulence, to minimize short-circuiting (phenomena in which influent water bypasses the intended flow path) by promoting uniform flow across the full width of the basin. This improved hydraulic performance enhances the settling of sediments by increasing residence time (Schussler et al., 2022).

Appropriate Applications

Baffles can be installed in any sediment trap or sediment basin. Porous baffles are often used when excessive short-circuiting or dead zones are observed. Furthermore, porous baffles establish an ideal location to place flocculants and polymers (Section 4.4.12.5) when chemical treatment is necessary.

Limitations and Maintenance

Ensure porous baffles are properly secured along the cross-section of the basin and extend the full width of the basin. The material should be taught. Porous baffles may increase the frequency with which accumulated sediment needs to be removed from the basin, particularly within the first chamber. Inspect for scour along the sides of the baffle and replace baffle material if it is damaged or degraded.

Planning and Design Considerations

Various types of materials can be used for porous baffles, including coir erosion blankets, wood excelsior, other RECPs (Section 4.2.6.6), coir mesh, or jute fabric (Iowa SUDAS, 2019);

however, coir is most often recommended due to its strength and biodegradable composition (ALSWCC, 2018; NCDEQ, 2013). Ensure the baffle material is durable enough to last the length of the project, as repair as replacement will likely require basin dewatering. Porous baffles should be installed similarly to a silt fence (Section 4.4.10) using posts and wire backing, if necessary. Proper installation requires securing the baffle at the bottom and sides using staples, stakes, trenching, or other anchoring methods to prevent flow from bypassing underneath, over, or around the structure. Staples should be made of 0.125-inch diameter new steel wire formed into a 'U' shape, not less than 12 inches in length, with a throat of one inch in width. Steel posts should be approximately 1-3/8" wide, measured parallel to the fence, and have a minimum weight of 1.25 pounds per linear ft. The posts should be equipped with an anchor plate having a minimum area of 14 square inches. To prevent sagging, a support wire or rope may be tied along the top of the baffle, or use a sawhorse type of support with the legs stabilized with rebar inserted into the basin floor. A nine-gauge high-tension wire is recommended in the former scenario. A porous baffle height of three feet has proven effective, though in some cases, site conditions may warrant taller baffles (ALSWCC, 2018). Baffles should extend the full depth of the basin, including any freeboard and auxiliary spillway depth. Overlap baffles six inches where necessary. Because most sediment settles in the first bay, this area should remain accessible for routine maintenance.

Research has shown that nearly all porous baffles improve the hydraulic performance of basins through flow dispersion and turbulence reduction (Figure 4.4.12.1.1-A, and as shown by the flow path of the green dye in the above picture) and thereby promote sediment trapping (Farjood et al., 2015; Schussler et al., 2022). Based on the findings of Farjood et al. (2015), the hydraulic performance of basins is significantly influenced by the number, spacing, and mesh characteristics of porous baffles. In the experimental design, the optimal configuration for five baffles included a mesh aperture of one millimeter and 42% open area, evenly spaced throughout the basin. For installations with fewer than four baffles, the best performance was achieved with three baffles having a finer mesh aperture of 0.415 millimeters and 40% open area, placed in the first half of the pond near the inlet. Positioning the first baffle at approximately 17% of the pond length from the inlet enhanced energy dissipation and improved residence time. While finer meshes may improve performance in low-baffle configurations, overly fine meshes combined with high baffle counts can increase velocity and short-circuiting, ultimately reducing effectiveness (Farjood et al., 2015). Therefore, selecting mesh aperture size and open area should be carefully balanced based on the number and placement of baffles.

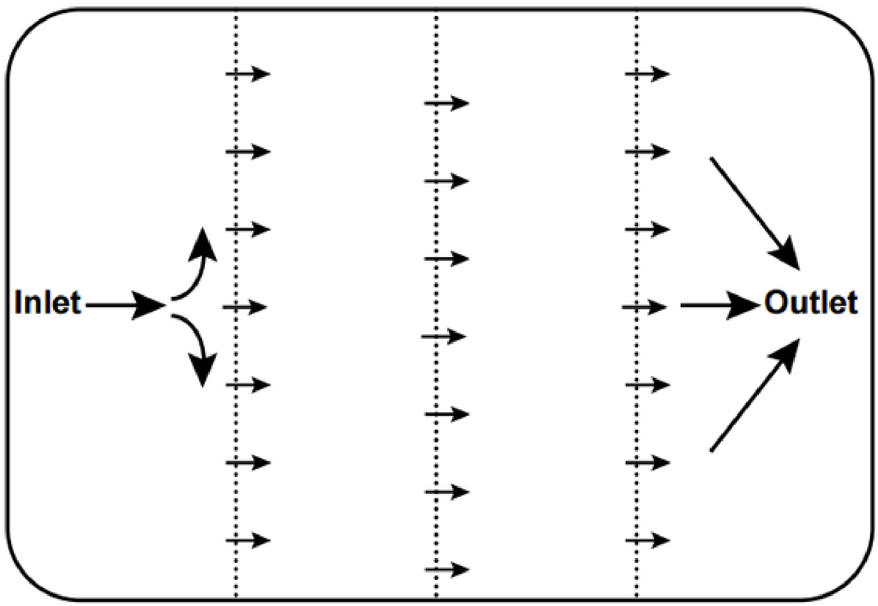

Figure 4.4.12.1.1-A: Flow dispersion and turbulence reduction of porous baffles in a sediment basin. Source: Rivers & McLaughlin (2015).

Example Application

No formal design or quantities are required for this measure and therefore are not presented here.

References

ALSWCC. (2018). *Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas*.

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