



British Water

How To Guide Performance Summary
and
SIA Mitigation Indices (MI) for
StormTech Isolator Row Plus
in Accordance with
NJDEP Filtration Protocol

Prepared by
Advanced Drainage Systems, Inc.

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1. Description of Technology

The Isolator® Row PLUS (shown in **Figures 1 and 2**) is the first row of StormTech chambers, and is surrounded with filter fabric and connected to a closely located manhole for easy access. The Isolator Row PLUS provides for settling and filtration of sediment as stormwater rises in the chamber and ultimately passes through the filter fabric. The open-bottom chambers allow stormwater to flow out, while particulate matter is captured in the Isolator Row PLUS.

The Isolator Row PLUS is designed to capture the “first flush” runoff and offers the versatility to be sized on a volume basis or a flow basis. An upstream manhole not only provides access to the Isolator Row PLUS but includes a high/low concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row PLUS bypass through a manifold to the other chambers. This is achieved with either an elevated bypass manifold or a high-flow weir. This creates a differential between the Isolator Row PLUS row of chambers and the manifold to the rest of the system, thus allowing for settlement time in the Isolator Row PLUS. After stormwater flows through the Isolator Row PLUS and into the rest of the StormTech chamber system, it either infiltrates into the soil below or flows at a controlled rate through an outlet manifold and outlet control structure.

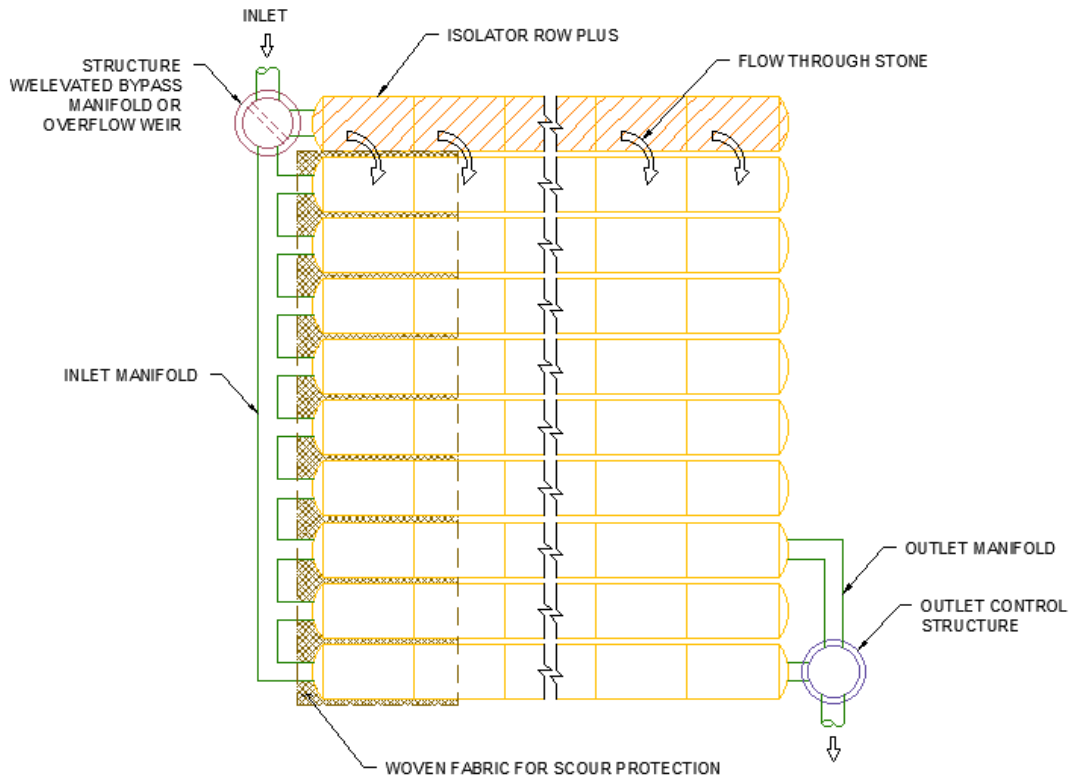


Figure 1. Schematic of the StormTech Isolator Row PLUS System

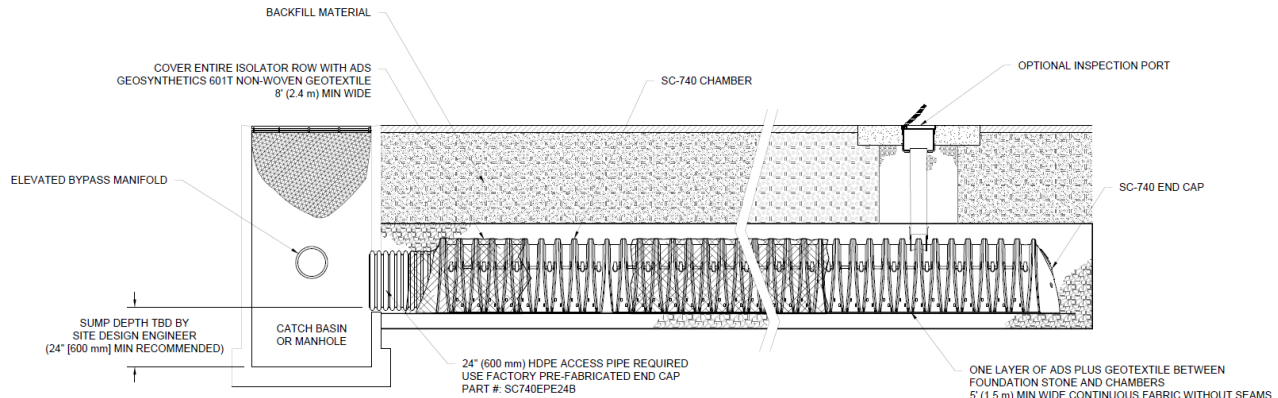


Figure 2. Isolator Row PLUS Detail

2. Isolator Row Plus Laboratory Testing

In January 2020, two overlapping StormTech SC-740 Isolator Row PLUS commercial size chambers were installed at the BaySaver Laboratory in Mount Airy, Maryland, to evaluate the performance of Isolator Row PLUS on Total Suspended Solids (TSS) removal. Boggs Environmental Consultants, Inc. (BEC) provided third-party review and oversight of all testing and data collection procedures, in accordance with the “New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device” (January 2013). All sediment concentration samples were analyzed by Fredericktowne Labs (FTL) using ASTM D3977-97 (2019). All sediment particle size distribution (PSD) analysis was performed by Environmental Consulting Services (ECS), using the methodology of ASTM D422- 63 (2007). Prior to the start of testing, a Quality Assurance Project Plan (QAPP), revision dated January 9, 2020, was submitted to, and approved by the New Jersey Corporation for Advanced Technology (NJCAT).

The Isolator Row PLUS used in this test, constructed from two (2) overlapping StormTech SC-740 chambers and one layer of ADS PLUS fabric, demonstrated a cumulative mass TSS removal efficiency of 81.2% and a sediment mass loading capacity of 17.48 kg/m² (mass capture capacity of 14.21 kg/m²) of geotextile fabric filtration area when operated with a driving head < 50.8 cm at a hydraulic loading rate of 2.80 l/s/m² of geotextile fabric filtration area. The StormTech Isolator Row PLUS tested has a maximum treatment flow rate (MTR) of 14.3 l/s and an effective filtration treatment area (EFTA) of 5.1 m² (loading rate 2.80 l/s/m²).

3. Isolator Row Plus Mitigation Index (MI)

Isolator Row PLUS was assessed according to “New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device,” January 14, 2022. The particle retention efficiency at 100% MTR will be used for assessments 1 through 4 of the “British Water How To Guide: Applying The CIRIA SuDS Manual (C753) Simple Index Approach To Proprietary/Manufactured

Stormwater Treatment Devices” (“How To Guide”) to derive the Simple Index Approach (SIA) value. This is done with the assumption that there is no detrimental effect on particle removal rate below 100% MTRF, and that the removal rate will be relatively constant across the operating range. Isolator Row PLUS is a treatment device integral to the ADS StormTech below-ground Sustainable Drainage System (SuDS) attenuation system. The system is designed such that the MTRF through Isolator Row PLUS is also the design first-flush flow rate. The system is designed to eliminate scour within Isolator Row PLUS, whereby exceedance flows greater than the MTRF/first-flush flow rate will bypass Isolator Row PLUS. On this basis, a scour test for StormTech Isolator Row PLUS is not relevant.

The British Water “How To Guide” performance data and SIA Mitigation Indices (MI) are calculated by correlating the NJCAT MTRF to the UK peak annual rainfall and interpolating the performance values required for the “How To Guide” calculation.

Removal efficiency for Isolator Row PLUS was measured at 100% MTRF in accordance with NJDEP protocol. Removal efficiency percentages at flow rates lower than the NJCAT tested flow rate are expected to be at least equal to or greater than that at 100% MTRF; thus, the derived values at less than 100% MTRF are considered conservative. The Isolator Row PLUS tested has a design flow rate (100%) of 0.505 cfs (14.3 l/s) and provides 81.2% sediment removal through settling and filtration. This removal rate is used as a basis for the SIA MI derivation. The derived performance values that correlate to the British Water “How To Guide” flow rates from the NJCAT test data are listed in **Table 1**.

Table 1. SIA Mitigation Index Derivation From NJCAT

NJCAT MTRF	RAINFALL (mm/h)	NJCAT MEASURED REMOVAL EFFICIENCY (%)	DERIVED British Water “How To Guide” REMOVAL EFFICIENCY (%)	DATA SOURCE
25%	6.75	81.2	81.2	British Water How To Guide FAQ
50%	13.5	81.2	81.2	British Water How To Guide FAQ
75%	20.25	81.2	81.2	British Water How To Guide FAQ
100%	27	81.2	81.2	NJCAT 100% MTRF
125%	33.75	<i>Isolator Row is not tested for scour as the MTRF is not exceeded through the unit. Flow exceeding the MTRF is bypassed at the inlet structure.</i>		

Measured removal efficiencies from the NJCAT testing are linearly interpolated to match the British Water “How To Guide” rainfall intensities as shown in **Table 2**. Where performance data is not available and cannot be linearly interpolated (i.e., at the lower flow rate range), the 25%

MTFR performance value is used. The 25% MTFR performance is selected for lower flow rates as a conservative measure, so as not to overestimate device performance.

Table 2. SIA Mitigation Index Derivation From NJCAT (Align with UK Rainfall Distribution)

NJCAT MTFR	RAINFALL (mm/h)	NJCAT MEASURED REMOVAL EFFICIENCY (%)	DERIVED British Water "How To Guide" REMOVAL EFFICIENCY (%)	DATA SOURCE
	1.7*	-	≥ 81.2	25% MTFR
	3.6*	-	≥ 81.2	25% MTFR
	5.3*	-	≥ 81.2	25% MTFR
25%	6.75	81.2	-	
	11.3*	-	81.2	Interpolated
50%	13.5	81.2	-	
75%	20.25	81.2	-	
100%	27	81.2	80	NJCAT 100% MTFR
125%	33.75	<i>Isolator Row is not tested for scour as the MTFR is not exceeded through the unit. Flow exceeding the MTFR is bypassed at the inlet structure.</i>		

*British Water "How To Guide" test flow rates

Based on CIRIA C753 The SuDS Manual Table 26.2 – Isolator Row PLUS provides MIs for TSS, metals and hydrocarbons that meet or exceed Medium Pollution Hazard Index applications and meet High Pollution Hazard Index applications for TSS, as shown in **Table 3**.

The metal Mitigation Index for a filtration device is calculated as follows:

$$\text{Particulate fraction reduction} = 81.2\% \times 75\% = 0.61$$

$$\text{Dissolved fraction reduction} = 0\% \times 25\% = 0$$

$$\text{Total Metals Mitigation Index} = 0.61 + 0 = 0.61$$

The composite hydrocarbon MI for a filtration device in an urban area is calculated as follows:

$$\text{Particulate fraction reduction} = 81.2\% \times 90\% = 0.73$$

$$\text{Free phase fraction reduction} = 0\% \times 10\% = 0$$

$$\text{Composite Hydrocarbons Mitigation Index} = 0.73 + 0 = 0.73$$

Table 3. Isolator Row PLUS Mitigation Index Check

POLLUTANT	SuDS Manual HAZARD INDEX (Table 26.2) Very Low	SuDS Manual HAZARD INDEX (Table 26.2) Low ¹	SuDS Manual HAZARD INDEX (Table 26.2) Low ²	SuDS Manual HAZARD INDEX (Table 26.2) Medium	SuDS Manual HAZARD INDEX (Table 26.2) High	Isolator Row MITIGATION INDEX	DESIGN CHECK (Medium Hazard Index)
TSS	0.2	0.3	0.5	0.7	0.8	0.8	OK
Metals	0.2	0.2(0.8)*	0.4	0.6	0.8	0.6	OK
Hydrocarbons	0.05	0.05	0.4	0.7	0.9	0.7	OK

1. Application areas include non-residential roofs (residential roofs = Very Low), typically commercial/industrial roofs.

*up to 0.8 where there is potential for metals to leach from the roof

2. Application areas include individual property driveways, residential car parks, low traffic roads, i.e. <300 traffic movements/day

4. Isolator Row PLUS Scaling

The scaling of the Isolator Row PLUS is based on the hydraulic surface loading rate (2.80 l/s/m²), and details of the dimensions for scaled models are listed in **Table 4**. The device head values at maximum flow for scaled models are shown in **Table 5**. The sediment storage capacity is shown in **Table 6**.

Table 4. Isolator Row Plus Treatment Capacity for Scaled Models

Model (SINGLE CHAMBER)	UNIT SIZE (M)	TREATMENT CAPACITY (L/S)	DRAINABLE AREA (HA)
StormTech SC-160	2.2 x 0.64 x 0.31	3.0	0.040
StormTech SC-310	2.3 x 0.86 x 0.41	4.6	0.061
StormTech SC-740	2.3 x 1.3 x 0.76	7.2	0.096
StormTech DC-780	2.3 x 1.3 x 0.76	7.2	0.096
StormTech SC-800	2.3 x 1.3 x 0.84	7.2	0.096
StormTech MC-3500	2.3 x 1.96 x 1.14	11.2	0.149
StormTech MC-4500/MC-7200	1.32/2.11 x 2.54 x 1.52	7.8/12.5	0.104/0.166

Table 5. Isolator Row Plus Device Head at Maximum Flow for Scaled Models

Model (SINGLE CHAMBER)	UNIT SIZE (M)	CHAMBER HEIGHT (M)	STONE FOUNDATION (M)	DEVICE HEAD AT MAXIMUM FLOW (M)
StormTech SC-160	2.2 x 0.64 x 0.31	0.305	0.101	0.406
StormTech SC-310	2.3 x 0.86 x 0.41	0.406	0.153	0.559
StormTech SC-740	2.3 x 1.3 x 0.76	0.762	0.152	0.914
StormTech DC-780	2.3 x 1.3 x 0.76	0.762	0.229	0.991
StormTech SC-800	2.3 x 1.3 x 0.84	0.838	0.152	0.991
StormTech MC-3500	2.3 x 1.96 x 1.14	1.143	0.229	1.372
StormTech MC-4500/MC-7200	1.32/2.11 x 2.54 x 1.52	1.524	0.229	1.753

The data in this table is in metric units converted from original data in US imperial units. In some cases, due to rounding, the figures may not align mathematically but have been checked and verified. For example, the SC-800 chamber requires foundation stone 6 inch (152.4 mm; 152mm in the table) + chamber height 33 inch (838.2 mm; 838mm in the table) = max head 39 inch (990.6 mm; 991mm in the table)

Table 6. Isolator Row Plus Sediment Storage Capacity for Scaled Models

Model (SINGLE CHAMBER)	TREATMENT CAPACITY (L/S)	CAPTURED SEDIMENT (Kg)	CAPTURED SEDIMENT (L)
StormTech SC-160	3.0	14.98	9.8
StormTech SC-310	4.6	22.97	15.0
StormTech SC-740	7.2	35.95*	23.6
StormTech DC-780	7.2	35.95	23.6
StormTech SC-800	7.2	35.95	23.6
StormTech MC-3500	11.2	55.92	36.8
StormTech MC-4500/MC-7200	7.8/12.5	38.95/62.41	25.4/40.8

* Accumulative mass of captured sediment by StormTech SC-740 (single chamber) from NJCAT testing

5. Conclusion

The StormTech Isolator Row PLUS shows an NJCAT TSS removal rating of 81.2% and similarly, the derived British Water “How To Guide” TSS performance rating is 81.2%. This is a more conservative performance value than the NJCAT testing. Isolator Row PLUS is expected to have higher removal ratings, due to the lower rainfall intensity distributions in the UK.

The tested Isolator Row PLUS (two StormTech SC-740 chamber system) has a treatment flow-rate of 14.3 l/s, resulting in an allowable connected area of 0.193 ha (14.3 l/s / 73.96 l/s/ha). The British Water “How To Guide” translates into a SIA MI for TSS = 0.80; Total Metals = 0.6; Composite Hydrocarbons = 0.7.