3.2 Infiltration rates over time

3.2.1 Summary of outcomes

Following the initial testing immediately after cleaning (0 months Sept 2018), 3 further tests were conducted at four month intervals to observe the decline in infiltration rates over time.

Table 7 below includes the median infiltration rate recorded for each location across one year at 4 month intervals. The Eades Place and Harris St data is graphed in Figure 16 and Figure 17 respectively. Median rates were selected to limit the influence of outliers. Infiltration tests exceeding 45 mins with more than 25% of the test remaining were ceased and given a default infiltration rate of 68 mm/hr. Sites that recorded infiltration rates below 100 mm/hr were deemed effectively clogged (coloured in red).

Table 7. Infiltration test results (mm/hr)

			Median Infiltration Rates (mm/hr) (2018-2019)			
Location	**Cleaning Method**	**Site**	**0 month Sept**	**4 month Jan**	**8 month May**	**12 month Sept**
Eades Place	Pressure washing (sweeping x2)	1	955	68	68	68
		2	447	126	68	68
		3	580	139	68	68
	Dry vacuuming	4	68	*	*	*
		5	68	68	*	*
		6	68	*	*	*
	Dry vacuuming and pressure washing (sweeping)	7	289	68	*	*
		8	1222	68	*	*
		9	336	68	*	*
Harris St	Pressure washing (thorough x1)	10	2910	**	189	137
		11	6548	3667	3048	2332
		12	3667	845	321	949
		13	8731	110	75	68
		14	8334	3056	1457	324
		15	3742	68	68	68
		16	1291	89	68	68
		17	7052	4167	1891	313
		18	7334	2957	1274	360

*Test not conducted. Site deemed clogged at a previous period of testing.

**Test not conducted. Site could not be accessed.

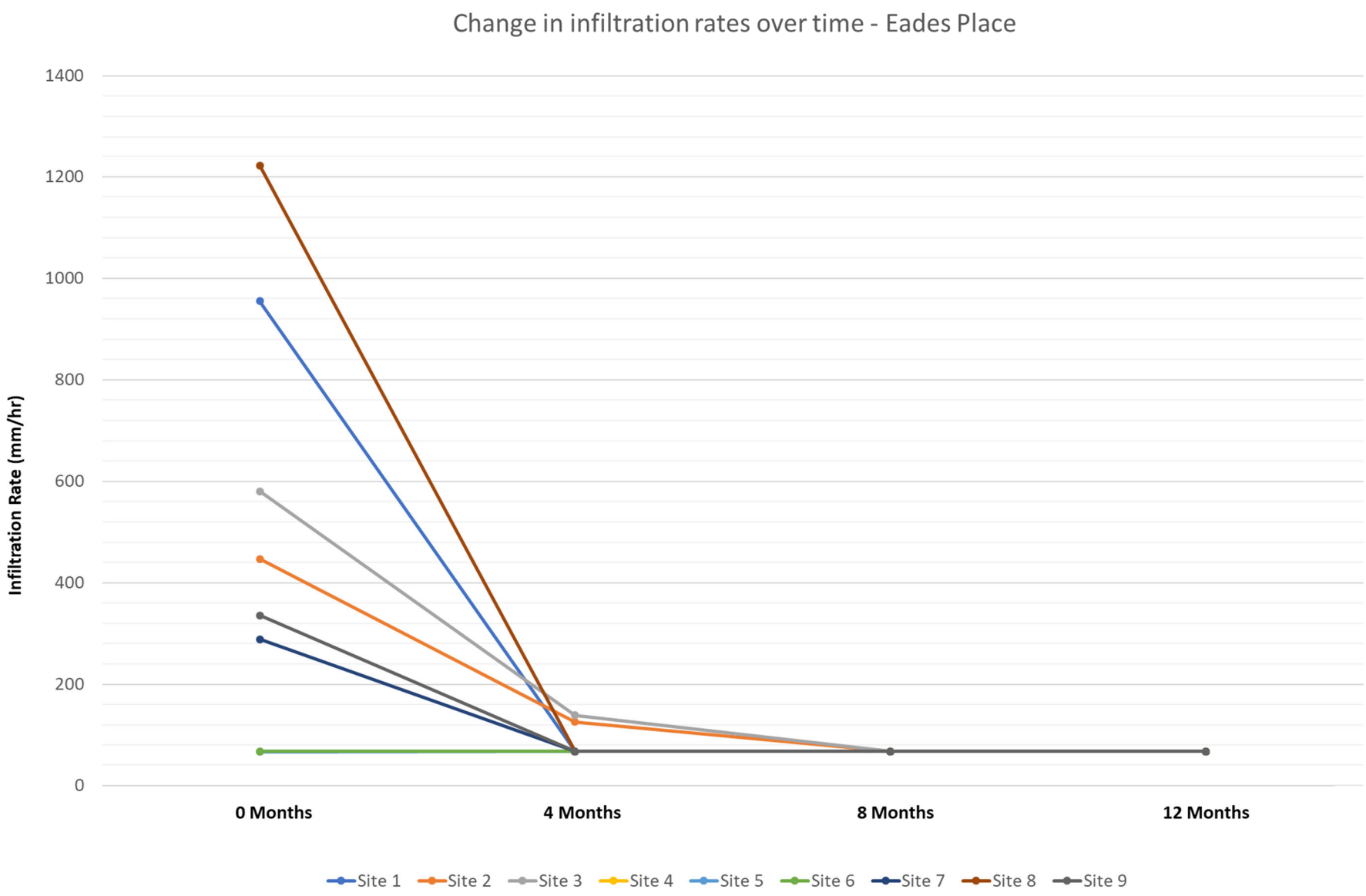

Figure 16. Eades Place infiltration testing results

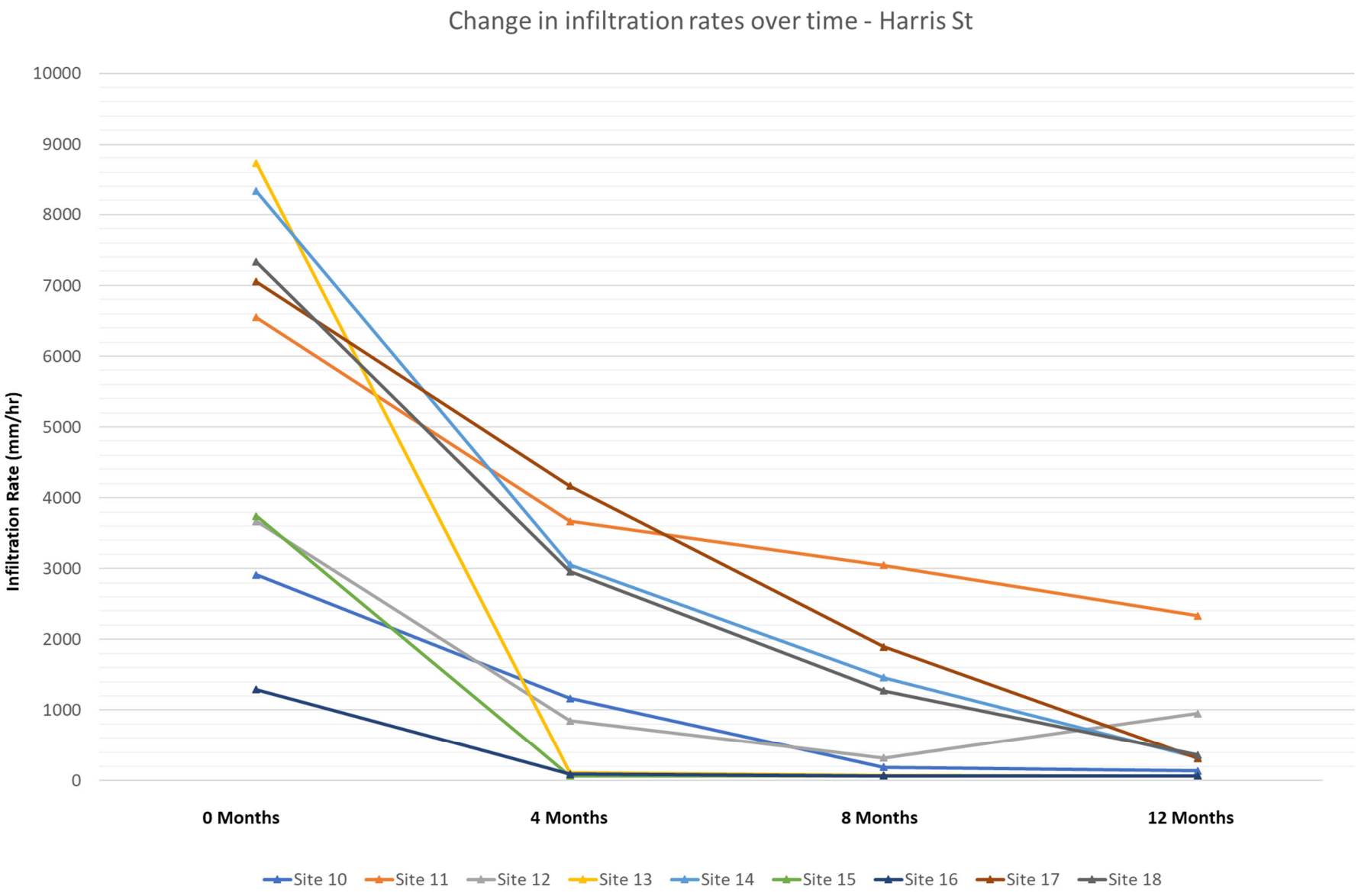

Figure 17. Harris St infiltration testing results

Cleaning Methods

- The dry vacuuming cleaning method was ineffective in restoring permeable pavement infiltration rates as demonstrated by the initial testing after cleaning. A test was conducted at Site 5 at the 4 month period to confirm this outcome. Further testing across Sites 4, 5 and 6 were therefore not conducted.
- The dry vacuuming and pressure washing (sweeping approach) was effective in restoring permeable pavement infiltration rates for less than 4 months. Tests at Sites 7, 8 and 9 at the 4 month period concluded the area to be effectively clogged. Further testing across Sites 4, 5 and 6 beyond the 4 month period were therefore not conducted. It is assumed the restored functionality of the pavement was likely solely due to pressure washing.
- Pressure washing, via two rounds of the sweeping approach, was able to restore infiltration rates for less than 8 months. Tests at Sites 1, 2 and 3 at the 8 month period concluded the area to be effectively clogged. Further testing beyond the 8 month period confirmed this.
- Pressure washing, via the thorough approach, was able to restore infiltration rates beyond 12 months, with over 55% of the Sites are Harris St providing greater than 300mm/hr.

Rate of Degradation

- The very high infiltration rates observed immediately following cleaning (at 0 month period) were short-lived with moderate to low infiltration rates being the normal mode of operation. A moderate to low infiltration rate can still effectively infiltrate a 10% annual exceedance probability (AEP) event, assuming the treatment area equals the catchment area.
- The evidence suggests that there are different types of clogging occurring, one is incremental reductions of infiltration capacity due to sedimentation. The second is the development of patches that are quite clogged with adjacent areas retaining high infiltration rates. This is likely due to organic and inorganic matter deposition in some places and not in others as well as preferential flow paths and low points concentrating inflows and, hence clogging. The first mode was primarily observed at Eades Place which is likely due to its largely uniform surface. Both modes of clogging appear to be present at Harris St, with several sites becoming clearly clogged (Sites 13, 15, 16) amongst other well performing Sites. Interestingly, sites that reside within the centre of each of the cleaned areas (Sites 11, 14, 17, Figure 27), retained high infiltration rates. This could be due to several factors:
    - Lower proximity to sources of pollution (i.e. adjacent runoff, tree pit toppings)
    - Limited exposure due to parked cars.
    - Limited accumulation and settling of debris due to a slight high point and high wind exposure from no adjacent kerb/edging.
    - High exposure to street cleaning activities.

Pollution Types

- **Tree pit toppings**: Both sites are exposed to fine granitic sand as a pollution source from the street tree podiums. This pollutant is transported by wind and settles into the permeable asphalt matrix with rain.

- **Pollen**: The fast rate of degradation at Sites 13, 15 and 16 in Harris St is likely due to an accumulation of tree pollen and granitic sand. The pollen falls from the above London Plane trees and settles into the permeable asphalt matrix with rain. This breaks down and can result in biological clogging Eades Place is planted with Eucalyptus trees which do not drop significant volumes of pollen.
- **Sediment:** The permeable asphalt at Eades Place collects runoff from 50% of the adjacent road. This runoff transports sediments to the permeable asphalt and contributes to clogging Sites adjacent to the road (Sites 1, 4 and 7). The permeable asphalt areas at Harris St do not collect runoff from other surfaces so the permeable surface is 100% of the catchment.

Table 8. Pollutant types

Pollutant		
Tree pit toppings (granitic sand)		
Pollen		
Sediment