MKPCONSULTANTS
ENGINEERING EXCELLENCE

Feasibility of Rainwater Harvesting

at

Kidderpore Avenue

for

Mount Anvil

Preliminary Issue P1

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1. Introduction

MKP Consultants were commissioned by Mount Anvil to investigate the feasibility of installing a rainwater harvesting system into the Kidderpore Avenue project assessing both its practical and commercial viability. Availability of water is an ever increasing significant topic and as such water efficiency and general water re-use is reviewed for each development.

The project comprises the development of the existing Kings College London site at Kidderpore Avenue, Hampstead, London. The project includes the conversion of grade II listed and non-listed historic buildings into private dwellings together with the construction of new building dwelling blocks, car parking and other user facilities. A variety of dwelling types are proposed, including flats, town houses, duplex flats, affordable flats and premium houses.

2. Overview

Rainwater Harvesting is the collection & recycling of rainwater for re-use on site rather than allowing it to run-off via surface water drainage systems. Rainwater collection and recycling systems have been developed to reduce the consumption of mains cold water in a development, primarily for financial reasons but also to relieve pressures on surface water drainage & sewerage infrastructure. It should be noted however that recycling rainwater will not reduce a development's carbon emissions as it is not considered a renewable or low-carbon technology and it will actually increase energy consumption due to the need to operate water treatment & pumping equipment.

The concept of rainwater recycling is relatively simple; rainwater is collected from the roof of the building via guttering & downpipes, passing through filtration plant before being diverted to underground storage reservoirs or basement tanks incorporating booster pumps. A rainwater recycling system won't produce potable water for human consumption but it can produce water that can be utilised in other non-potable applications throughout a building such as WC & urinal flushing cisterns, external irrigation & landscape watering, vehicle washing, swimming pools, cooling towers etc.

A disinfection unit is also required, usually installed after filtration plant between the storage tank and reservoir, to eliminate any bacteriological & microbial contamination that may be present in the water entering the reservoir. The system also requires a mains cold water back-up supply to keep the system topped-up during periods of drought, additional drainage pipework to collect surface water from each rainwater downpipe to the reservoir and a duplicate pipework distribution system to serve the selected outlets with treated recycled rainwater.

3. Advantages of Rainwater Harvesting

Reduction in water bills	Any reduction in water consumption costs need to be considered against additional costs for installing, operating & maintaining the additional plant, equipment & pipework systems.
Good for irrigation	Rainwater is usually free from chlorine and is generally considered better for watering plants.
Sustainable Urban Drainage (SUDs)	Can be integrated into surface water attenuation systems if considered during the preliminary design stages of the project.

4. Disadvantages of Rainwater Harvesting

Additional capital expenditure	Significant additional expenditure is required for the large volume reservoirs, filtration equipment, disinfection units, booster pumps and duplicate/additional pipework systems.
Additional maintenance	Reservoirs require regular labour intensive maintenance to prevent them becoming infiltrated by rodents, algae, insects etc. Filters require regular cleaning and disinfection units also need regular maintenance.
Unreliable rainfall	Irrigation is typically required during summer months when periods of low rainfall or drought can render the system inoperative. As such, the reservoirs are usually sized to provide 21 day storage which increases their size/cost.

Chemical roof seepage	Certain roof coverings will seep chemicals into the rainwater which can prove harmful to plant life or damaging to vehicle paint finishes.
Space requirements	It may not be possible to provide sufficient space to store the total volume of water required and system usage may have to be restricted to a reduced reservoir capacity.

5. Technical Viability

Rainwater recycling systems can usually be accommodated within almost any building if sufficient space is provided for the large volume reservoirs, filtration equipment, disinfection units, booster pump sets, control panel and additional drainage pipework can be arranged for the additional rainwater downpipe connections. Therefore, we would consider rainwater recycling to be technically feasible for Kidderpore Avenue but the site constraints and architectural/structural implications will make it practically infeasible.

6. Financial Viability

We have undertaken preliminary assessments to determine the size of storage reservoir required for the Kidderpore Avenue site assuming the recycled rainwater volume is to offset the potable water requirement for flushing WC cisterns and external irrigation, together with assessing the anticipated water savings and the results are tabulated below:-

	Daily Water Demand (litre)	**Rainwater Storage Period** (days)	**Rainwater Storage Capacity** (litre)	**Annual Water Demand** (litre)	**Annual Water saving** (m^3)	**Thames Water Charges** (£/m^3)	**Annual Water Cost** (£)
WC cisterns	2,990	21	62,792	1,091,350	1,091	2.10	2,291
Irrigation	3,240	21	68,040	100,440	100	2.10	210
Total	6,230	21	130,832	1,191,790	1,191	2.10	2,501

NB: The WC flushing volume is based on a total of 325 WC's each having dual flush cisterns of 4/2.6 litres capacity and each being flushed an average of 2 times a day at 2.6 litres and once a day a 4 litres. The irrigation volume is based on 12 irrigation points each delivery a flow rate of 0.3 l/s for 15 mins once a day for 31 days a year. The Thames Water charges are applicable to metered supplies for the year 2016/2017 comprising 128.37p/m^3 for water and 81.60p/m^3 for wastewater.

Budget Cost for Installation	**£**
21 day capacity storage tank in basement (150m^3 nominal volume)	32,000
Filtration equipment in basement Plantroom	2,000
Disinfection unit in basement Plantroom	4,000
Booster pumps in basement Plantroom	3,000
Automatic control system, panel & wiring	6,000
Additional rainwater/drainage pipework	3,000
Additional water distribution pipework	25,000
Total additional expenditure	75,000

Budget Cost for Maintenance	**£/annum**
Annual cleaning & disinfection of storage tank	500
Quarterly maintenance of filtration & disinfection equipment	1,000
Bi-annual maintenance of booster pumps	500
Annual maintenance of controls & wiring	500
Total annual maintenance cost	2,500

The total annual saving provided by the rainwater harvesting system against the Thames Water PLC utility bills amounts to £2,500/year, which when assessed against the additional capital expenditure required for its installation equates to a 30 year payback period excluding maintenance, however the maintenance costs associated with the rainwater harvesting scheme equate to the same figure as the saving against potable water charges, resulting in zero nett saving and the additional capital expenditure associated with installing the rainwater harvesting system never being recouped.

7. Summary

The excessive additional capital expenditure required to install a rainwater harvesting & recycling system in Kidderpore Avenue compared to the comparatively small saving in mains water costs results in it not being financially feasible, coupled with the impracticalities of installing large tanks & additional pipework means we do not recommend Mount Anvil implement it for this project.