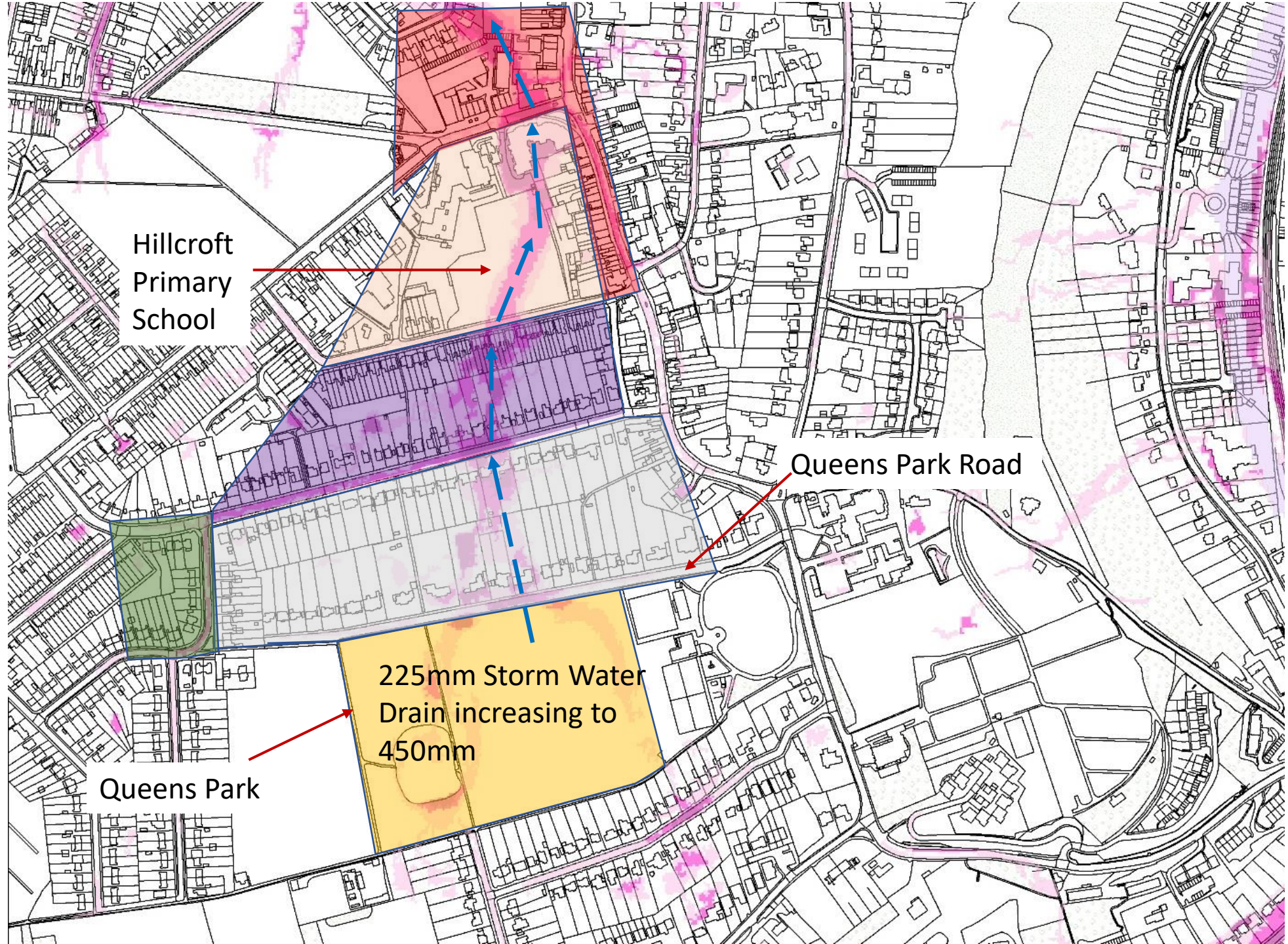
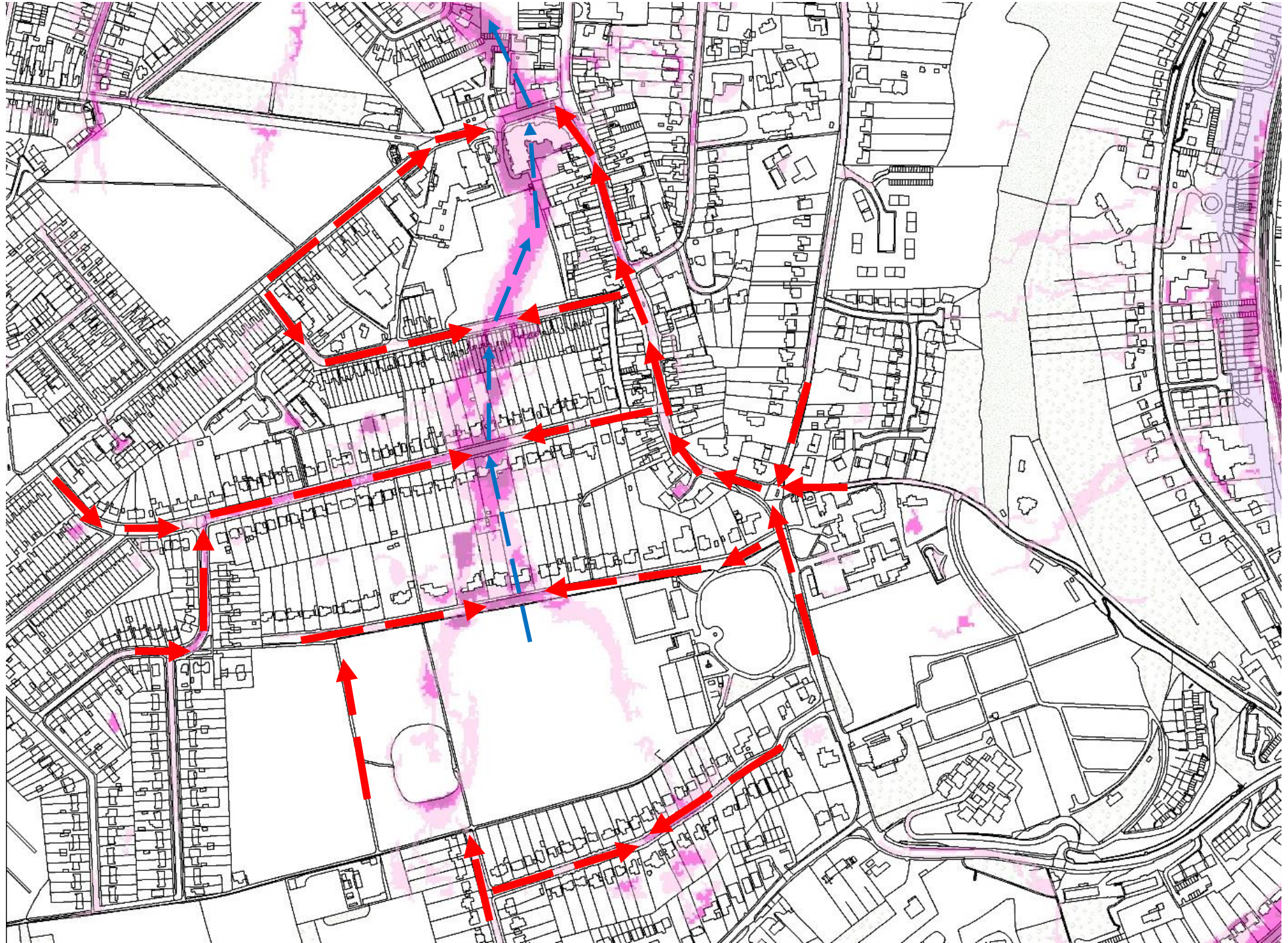


Rain Gardens in Caterham

Highways SuDS Only



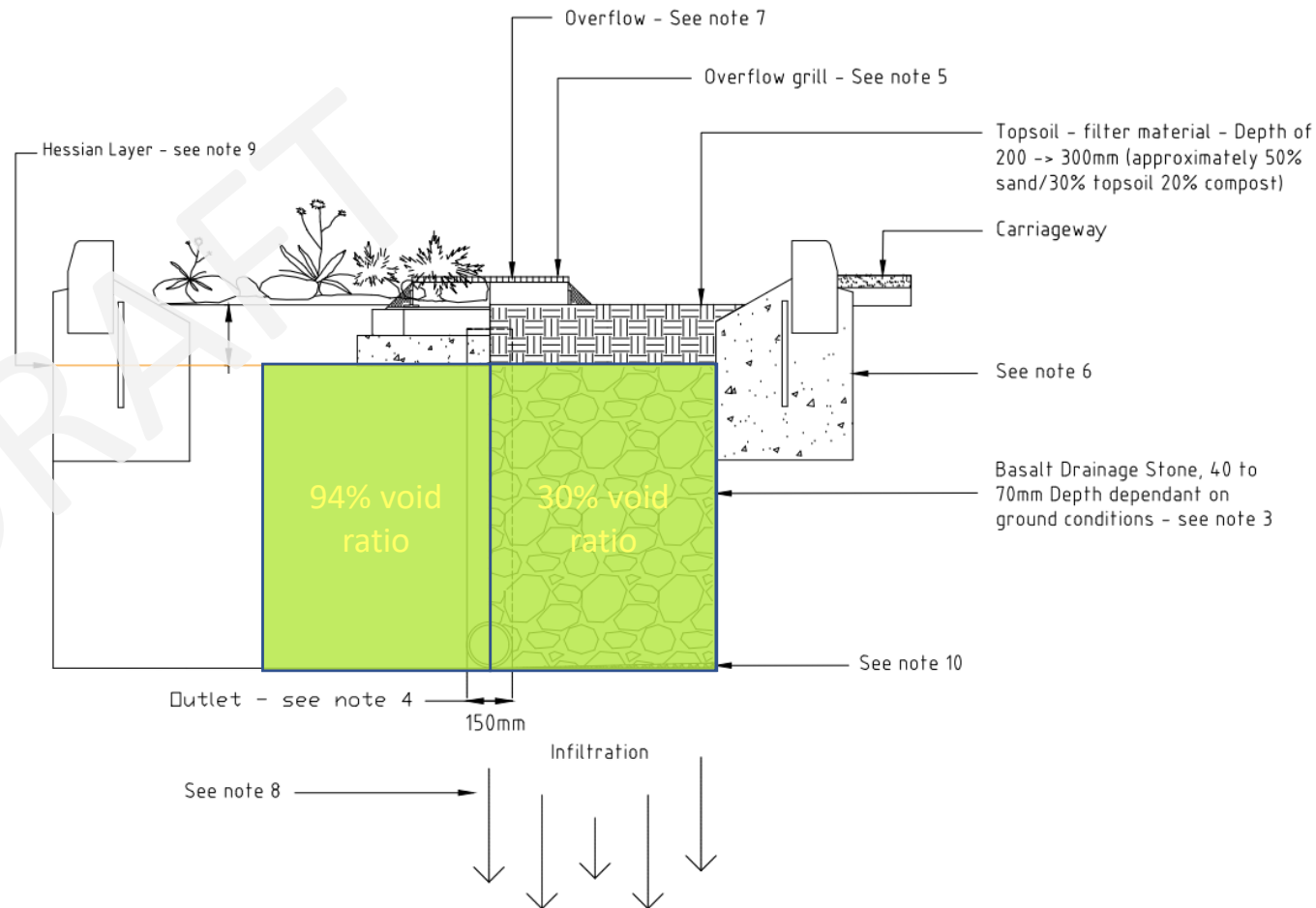




ENFIELD – Using gravel filter medium – approximately 30% void



HydroRock has more storage per 1m³ compared to Basalt Rock due to the void ratio and will take up to three times longer to fill up assuming the conditions are the same



Notes

1. All dimensions are in millimeters
2. 200 for wild flowers, increase to 300 for other planting schemes - if increased to 300 then an extra layer of engineering bricks will be required when constructing an overflow
3. Storage can be increased from 30% to 90%+ if higher storage volumes are required by using alternative technology such as Crates or a Natural Aquifer for SuDS to replace Basalt stone.
4. Outlet depth is restricted to the level of existing drainage system.
5. Overflow to be set no less than 5mm below carriageway but may be increased up to 50mm.
6. Refer to sd1000-348
7. Refer to sd1000-368
8. If there is sufficient infiltration then an overflow is not required
9. Hessian layer to be used as it is biodegradable but gives enough time for planting layer to settle
10. If overflow is required a gradient of no less than 1:40 is to be created with Type 1 infill

Rev.	Description

Drawn by	Date	Checked by	Date	Approved by	Date



Drawn by	Date	Checked by	Date	Approved by	Date

Drawing No. 1000/349

Rev. -

STANDARD DETAIL

SECTION

DRAINAGE

Drawing Title

RAIN GARDEN - TYPICAL CROSS-SECTION





Example area 2200m² – 1:30yr (50mm in 1 Hour) = 110m³ of storage

Traditional gravel filter medium with approx. 30% void ratio = Rain Garden volume of 330m³ required – 8 x Rain Gardens at 40m³

Hydrorock filter medium with approx. 94% void ratio – Rain Garden volume of 120m³ required – 3 x Rain Gardens at 40m³

Queens Park Road, Caterham

Figures are all approximate

Solving Caterham's Flooding: Queens Park Road case study

Objective: use water gardens to buffer 120m^3 of water in 1 hour and infiltrate 60m^3 in 24 hours

Comparison below between gravel vs Hydrorock

<u>Water Garden Dimension</u>	<u>15.6m length x 2.4m width x 1.0m depth (37.5m^3 unfilled void)</u>		<u>ASSUMPTIONS</u>	
	HYDROROCK	GRAVEL		
Water gardens needed to buffer 120m^3 / 1 hr	3	10	Water space in gravel	30%
Total Water Gardens Footprint	110m^2	375m^2	Water space in Hydrorock	94%
Total Volume of soil removed	145m^3	485m^3	Weight of soil m^3	1.3t
Total Weight of soil removed	145t	485t	Soil expansion factor	130%
Total Spoil loads (26t lorry)	6	19	Weight per spoil load	26t
Total Weight of infill	8.4t	630t	Gravel weight m^3	1.68t
Lorry loads for infill (26t lorry)	2 (Containers)	24	Hydrorock weight m^3	0.075t
End of life cleaning / treatment / disposal / recycling of 'hazardous waste'	8.4t (Recycled free by Rockwool)	630t (£100k)	Cost of cleaning gravel	£160 per t



Hydrorock Array buffering 40m^3 in 1 Hr / infiltrating 20m^3 in 24 Hrs

- **Array Comprises: 78 BD440 Blocks** (2 Modules side-by-side of 39 Blocks each @ 3 Blocks wide X 13 Blocks long)
- **Array Dimensions: 15.6m Long x 2.4m Wide x 1.0m High / Footprint: 37m^2**
- **Infiltration Surface Area: 55.4m^2** (Bottom 37.4m^2 + Sides 15.6m^2 + Ends 2.4m^2)
- **Filling Rate: $45.0\text{m}^3 / \text{hr}$** (52 Blocks x 864 L / hr per Block)
- **Static Capacity: 34.3m^3** (Storage capacity of Blocks - 78 Blocks x 440 L)
- **Infiltration Rate: $5.8\text{m}^3 / \text{hr}$** ($104\text{L} / \text{m}^2 / \text{hr}$ x 55.4m^2)
- **Dynamic Capacity: 40.1m^3** (Static Capacity 34.3m^3 + infiltration during 1st hr of filling $5.8\text{m}^3/\text{hr}$)
- **Capability to infiltrate 50% of buffered volume within 24 hours: < 3 hrs** ($17.1\text{m}^3 \div 5.8\text{m}^3 / \text{hr}$) 100% < 6 hrs

[NB. Chalk soil infiltration K Value $2.5 = 104\text{L} / \text{m}^2 / \text{hr}$]



Comparison of Hydrorock and Gravel for Queens Park Road, Caterham

	HR	Gravel	
Number of Gardens	3	10	
Volume of water buffered in first hour	120.3	117.9	m³
Total dimensions of excavations			
Length	46.8	156	m
Width	2.4	2.4	m
Depth	1	1	m
Number of BD440 blocks	234	N/a	
Volume of System	112.3	374.4	m³
"Foot Print"	112.3	374.4	m²
Volume of excavation (expansion 130%)	146.0	486.7	m³
Weight of excavation (1.3T per M3)	146.0	486.7	Tonnes
Weight of infill (1.68T/M3 for gravel)	8.2	629.0	Tonnes
Number of Lorry loads for infill (26t per load)	2	25	Trips
Number of lorries for excavations (26t per load)	6	19	Trips
Total number of vehicle movements	8	44	Trips

	HR	Gravel
Cost of raw materials	43,371	30,192
Drainage Gang - 1 week 4,000	12,000	40,000
Build out cost 15,000	45,000	150,000
Top soil 1,000	3,000	10,000
Waste 2,000	6,000	20,000
Total install costs	<u>111,371</u>	<u>244,192</u>
Cost per m3 of water	945	2071
Maintenance	nil	nil
End of life	<u>nil</u>	<u>201,277</u>
Total project costs	<u>101,207</u>	<u>425,321</u>

1,500 per container from holland Hydrorock, 500 per lorry UK

Hydrorock is approx. 54% cheaper than Gravel

- Intangible benefits of Hydrorock
- Green
 - Less Disturbance
 - Smaller foot print
 - Structural integrity
 - Ease of install
 - Etc

Some of the costs are estimated but conservative but will still show a price comparison to give a 1:30yr protection rate

