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FAWCETT
PERCOLATION SERVICES LTD.

Surface Water Drainage. Study and Recommendations.

Our ref; J1664 Castle Quay



Table of Contents

Item	Page(s)
1. Introduction	1
2. Findings	2
3. Proposals	3 - 4
4. Appendix Contents Table	5
5. Appendices	6 – 7
6. Reference	8

1. INTRODUCTION

- 1.1. The property has had historic Surface Water (SW) drainage issues. Additions and re-routes to existing roof water drainage points have been carried out.
- 1.2. With the building being detached, and adjustment limited due to listing restrictions, drainage calculations are required to improve the current system.
- 1.3. FPS Ltd was tasked with the above and the work was structured as follows:
 - 1.3.1. Site visit to identify existing surface water drainage pipework.
 - 1.3.2. Calculate current flow from and destinations for all roof areas, tying these up with existing gutters and drains. Allowing capacity calculations and flow rates, highlighting any insufficiencies and/or head room where appropriate.
 - 1.3.3. Carry out resizing recommendations with listed building requirements in mind.

2. FINDINGS

- 2.1. The site was visited on the 15th of July and with the use of existing drawings, existing surface water pipework was identified and inspected where possible.
- 2.2. Volumes and flow routes have been identified and capacities assessed.
- 2.3. The existing surface water discharge points is shown in the **Appendix. A** with downspouts labelled A through to H and with catchment zones marked.
- 2.4. Varying pitches are factored to represent increased rainfall catchment. These calculations are shown in Appendix B, along with the current capacities of the discharge routes, their current loading, and any headroom available. The figures are open to interpretation as bends and angles of certain routes reduce flow capacity and although no allowances have been made for this, these changes of direction will slow the flow and reduce the loading to downspouts. As is clear in the head room figures, none are over their capacity although C and G are extremely close with D and H close to their limit during a 1:100 year storm.
- 2.5. **Appendix C** focuses on the current capacities of the guttering, their discharge routes, current loading and any headroom available. Here we see evidence of severe deficiencies within the system.
- 2.6. The guttering discharging to downspouts C, D, G and H could be overcome, however, as the gutters are level the excess load to a specific outlet can easily transfer to neighbouring downspouts, the issue being where positive discharge from the upper middle sections on the north and south of the building kickout to the gutter and inhibit cross flow potentially causing eaves fall.

3. PROPOSALS

- 3.1. The downspouts have sufficient capacity, however it would be beneficial for the flow to C and G to be shared among the neighbouring downspouts. This is easily achieved by specifying a larger replacement gutter profile. The increase in volume would allow the queueing water to back up and overflow to neighbouring downspouts removing the need to increase the current number of outlets.
- 3.2. The current square profile gutter is 110mm wide. Most manufacture's, although offering a 160 -170mm width of gutter, only allow 110mm running outlets which are not adequate for this required flow rate. A 200mm guttering laid level and with 150mm running outlets, will allow for attachment to the existing 150mm downpipes and achieve a suitable flow rate for all downpipes with their existing loading.
- 3.3. Suppliers of this larger 200mm profile guttering with the essential 150mm outlets are scarce. One manufacturer of the guttering would be KALSI who produce a range called aquaflow where a 200mm wide half pipe guttering with 150mm running outlets is possible. **Appendix D** shows the flow rates which would be possible with this replacement. The following link is from one of their suppliers: (other suppliers are available).
[Aqua flow 200mm with 150mm running outlet.](#)
- 3.4. On the south elevation of the building, there are three separate instances where 2x 90° corners allow the guttering to flow closer to the balcony railings. Twice on the south west side, shown circled in blue in Fig 1, and once on the south east side, shown circled in blue in Fig 2. It would be beneficial if these gutter diversions where altered to be uniform across the building and allowed to be straight gutter runs.

Fig 1



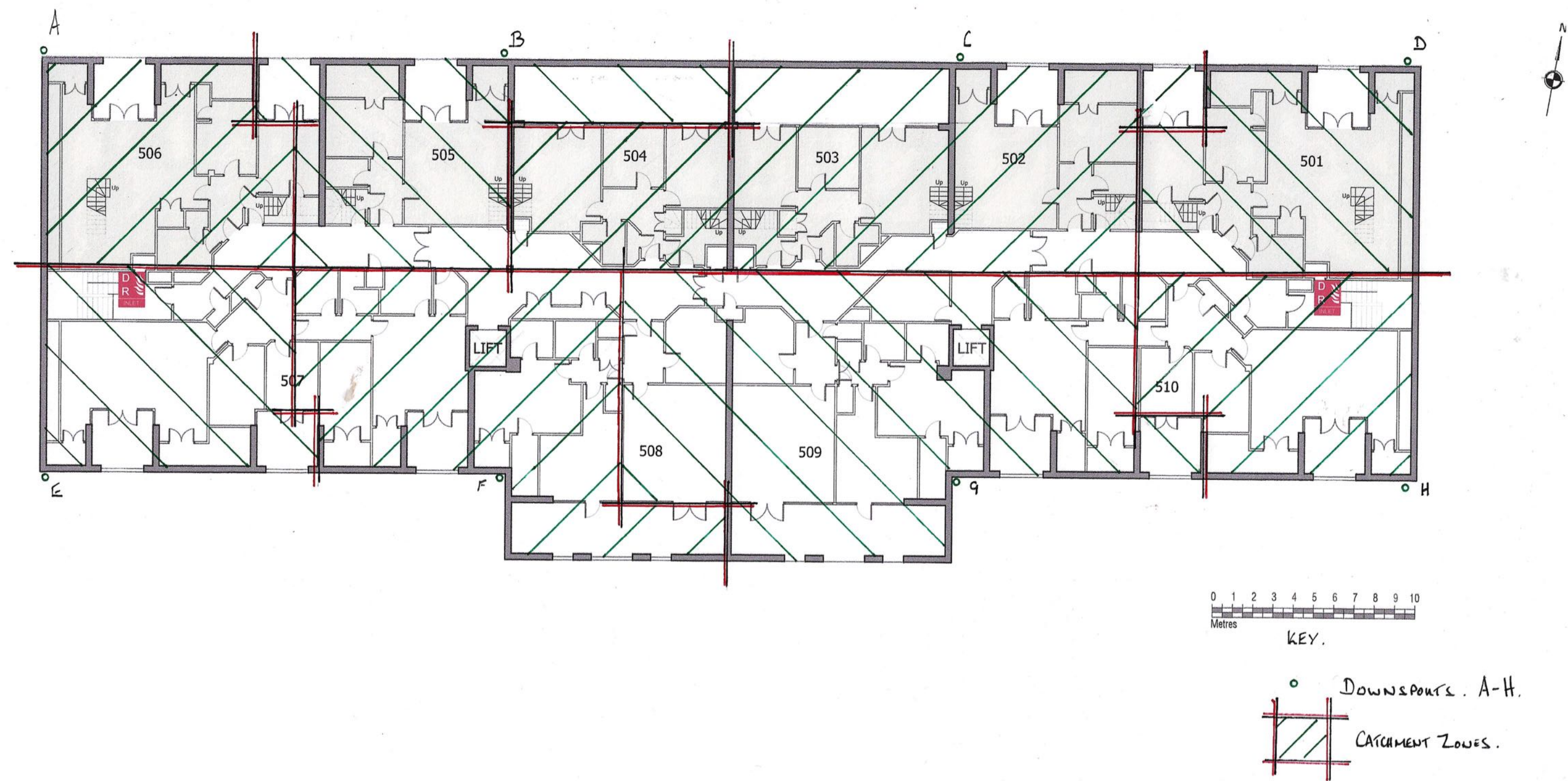
Fig 2.



4. APPENDICES CONTENTS TABLE

A. Existing overview of current SW discharge points.	Appendix A
B. Current capacities of discharge routes.	Appendix B
C. Current capacities of existing gutters.	Appendix C
D. Potential capacities after alteration works.	Appendix D.

Appendix A. Existing overview of current SW discharge points.



Appendix B. Current capacities of discharge routes.

Final receiving downspout	Plan view area in m2 of flat roof.	Plan view area in m2 of ca. 30 Degree pitch roof.	Drained area in m2 of 30 Degree roof with pitch considered.	Plan view area in m2 of ca. 60Degree pitch roof.	Drained area in m2 of 60 Degree roof with pitch considered.	Total drained area in m2 with pitch considered	Potential flow from 1:100 year storm event in l/s	Approximate Max capacity of discharge point. l/s	Current head room of flow capacity. l/s	% of capacity in use during 1:100 rainfall event
A	9	98	126.42	15	28.05	163.47	3.27	8.2	4.93	40
B	13.5	98.7	127.32	0	0.0	140.82	2.82	8.2	5.38	34
C	73.8	242.4	312.70	0	0.0	386.50	7.73	8.2	0.47	94
D	18	109.5	141.26	15.3	28.61	187.87	3.76	4.3	0.54	87
E	13.5	91.14	117.57	15.3	28.61	159.68	3.19	8.2	5.01	39
F	46.5	215.4	277.87	0	0	324.37	6.49	8.2	1.71	79
G	76	254.5	328.31	0	0	404.31	8.09	8.2	0.11	99
H	9	109.5	141.26	15.3	28.61	178.87	3.58	4.3	0.72	83

Appendix C. Current capacities of existing gutters.

Outer roof gutters serving downspout	Total drained area in m2 with pitch considered	Potential flow from 1:100 year storm event in l/s	Approximate Max capacity prior to discharge point. l/s	Current head room of flow capacity. l/s	% of capacity in use during 1:100 rainfall event
A	163.47	3.27	2.4	-0.87	136
B	140.82	2.82	2.4	-0.42	117
C	386.50	7.73	2.4	-5.33	322
D	187.87	3.76	2.4	-1.36	157
E	159.68	3.19	2.4	-0.79	133
F	324.37	6.49	2.4	-4.09	270
G	404.31	8.09	2.4	-5.69	337
H	178.87	3.58	2.4	-1.18	149

Appendix D. Potential capacities after proposed works.

Outer roof gutters serving downspout	Total drained area in m2 with pitch considered	Potential flow from 1:100 year storm event in l/s	Approximate Max capacity prior to discharge point after gutter alterations. l/s	Current head room of flow capacity. l/s	% of capacity in use during 1:100 rainfall event
A	163.47	3.27	7.56	4.29	43
B	140.82	2.82	9.87	7.05	29
C	386.50	7.73	9.87	2.14	78
D	187.87	3.76	7.56	3.80	50
E	159.68	3.19	7.56	4.37	42
F	324.37	6.49	9.87	3.38	66
G	404.31	8.09	9.87	1.78	82
H	178.87	3.58	7.56	3.98	47

5. REFERENCE

BS EN 607: 2004 Eaves gutters & fittings - PVCu. Definitions, requirements and testing.

BS EN 12200-1: 2000 Plastics rainwater piping systems for above ground external use - PVCu.

BS 4576-1: 1989 Specification for PVCu half round gutters and circular pipe.

Approved Document H of the Building Regulations 2015.