Appendix E

Sewage Impact Assessment

ARUP

Application for Amendment of Plan under Section 12A of the Town Planning Ordinance (Cap. 131) to Rezone the Application Site from "Green Belt" to "Residential (Group C)1" for Proposed House Development at Various Lots in D.D. 244 and Adjoining Government Land, Nam Pin Wai, Sai Kung

Sewerage Impact Assessment

Reference:

1 | 11 October 2023

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 282344

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1. Introduction

1.1 Background

Arup Hong Kong Limited was commissioned to conduct a Sewerage Impact Assessment (SIA) to support the Section 12A Planning Application for Proposed House Development at Various Lots in D.D. 244, Nam Pin Wai, Sai Kung.

The Application Site is located within a "Green Belt" ("GB") zone on the Approved Ho Chung Outline Zoning Plan No. S/SK-HC/11.

1.2 Objective

The objective of this report is to provide an assessment of the impact of wastewater flow generation as a result of the Proposed Development at the Application Site on the connecting the existing public sewerage system and to propose mitigation measures (if any).

1.3 Reference Materials

In evaluating the sewerage impact arising from the Proposed Development, the following sources of information have been specifically referred to:

- Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning (Version 1.0) Report No.: EPD/TP 1/05 issued by Environmental Protection Department (EPD);
- Sewerage Manual Key Planning Issues and Gravity Collection System (Third Edition) issued by Drainage Services Department in May 2013;
- Employment density shall refer to Commercial and Industrial Floor Space Utilization Survey published by PlanD; and
- Drainage Record Plans obtained from the GeoInfo Map services of the Lands Department (<u>https://www.map.gov.hk/gm/?lg=en</u>)

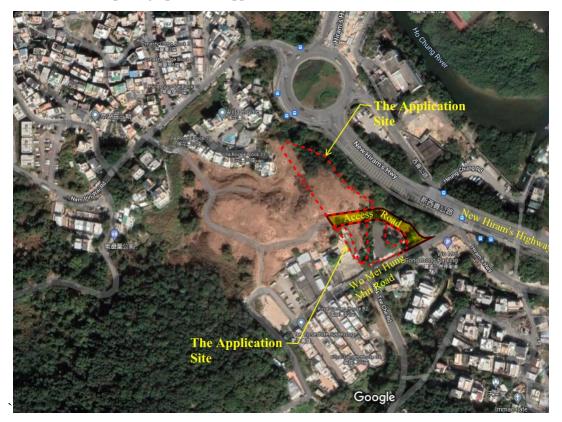
2. The Proposed Development

Master Layout Plan showing the proposed development is attached in **Appendix A – Plan 1**. A table showing the Proposed Development parameters is shown in table below:

Proposed Development	Site Particulars
Project	Application for Amendment of Plan under Section 12A of the Town Planning Ordinance (Cap. 131) to Rezone the Application Site from "Green Belt" to "Residential (Group C)1" for Proposed House Development at Various Lots in D.D. 244 and Adjoining Government Land, Nam Pin Wai, Sai Kung
Location	Nam Pin Wai Sai Kung
Land Use Zoning	"Green Belt" ("GB")
Development Site Area excluding Access Road (About)	5,355m ²
Domestic GFA (About)	4,016m ²

No. of House	17
Clubhouse GFA (About)	151 m ²

Below is an aerial photograph of the Application Site.



3. Sewerage Impact Assessment for the Proposed Development

3.1 Existing Sewerage Network

There is no existing public sewer in the vicinity of the Application Site as per Drainage Record Plan obtained from the GeoInfo Map services of the Lands Department.

3.2 Population of Proposed Development

The prediction for the Proposed Development sewage generation has been based on the information extracted from the development schedule in **Section 2** above. The quantity of sewage generated by the Proposed Development depends on the number of population with unit flow factor of Private R2 development.

For easy reference, a table showing the sewage generation of the Proposed Development is calculated based on the guideline set in EPD Guideline for Estimating Sewage Flows for planning catchment level sewage infrastructure and is shown in **Appendix B** – **Table T1** and summarized in below table.

Proposed Development	Parameters
Domestic GFA (About)	4,016
No. of Houses	17
No. of Residents	51
Unit Flow Factor (m ³ /person/day) for Private R2	0.27
Average Dry Weather Flow for Residents (m ³ /day)	13.77
Clubhouse GFA (m ²) (About)	151
Number of Employee	8
Unit Flow Factor for Restaurant (m ³ /person/day)	1.58
Average Dry Weather Flow for Clubhouse (m ³ /day)	12.14
Total Average Dry Weather Flow (m ³ /day)	25.91
Contributing Population	96
Global Peaking Factor (including stormwater allowance) for Sewage Treatment Works	4.0
Global Peaking Factor (including stormwater allowance) for Sewers	8.0
Peak Flow for Sewage Treatment Works (L/s)	1.20
Peak Flow for Gravity Sewer (L/s)	2.40

3.3 Private Sewage Treatment Plant

In view of the lack of a public sewerage system in the vicinity of the Application Site, it is proposed to provide a private sewage treatment plant with treatment level reaching the secondary level plus disinfection as an alternative option and dispose treated effluent of a standard acceptable to EPD to the proposed drainage system along the access road. Design of the private sewage treatment plant will make reference to the "Guidelines for the Design of Small Sewage Treatment Plants (the Guidelines)" published by the EPD. A tentative location for the private sewage treatment plant is shown on the Master Layout Plan and is subject to detailed site planning. It is considered to be an acceptable alternative option prior to any future improvement to sewage infrastructure in the vicinity of the Application Site. The private sewage treatment plant should be designed in such a way that it is capable of handling the daily and peak sewage flow arising from the proposed development. Should public sewerage be available in future, we would modify the sewerage system to facilitate the sewerage connection.

Adopting the peaking factor of 8 in Table T-5 of EPD Report No. EPD/TP 1/05, the peak flow for sewers from the proposed development is estimated as 2.40 l/s. A 225mm diameter sewer of 1 in 100 minimum gradient is sufficient to convey the sewage from the proposed development to the private sewage treatment plant and the treated effluent from the private treatment plant to the proposed drainage along the future access road. **Appendix B** – **Table T2** shows the capacity checking of the proposed sewer from the proposed development to the private sewage treatment plant with the proposed sewerage plan shown in **Appendix A** – **Plan 2**.

As regards the standard of acceptance of the treated effluent to minimize pollution, Table 7 of the "Technical Memorandum Standards for Effluent Discharged into Drainage and Sewerage Systems, Inland and Coastal

Waters" for Port Shelter Area shall be followed. EPD will be consulted on the treatment proposals during the detailed site planning and the discharged effluent standard required.

4. Conclusion

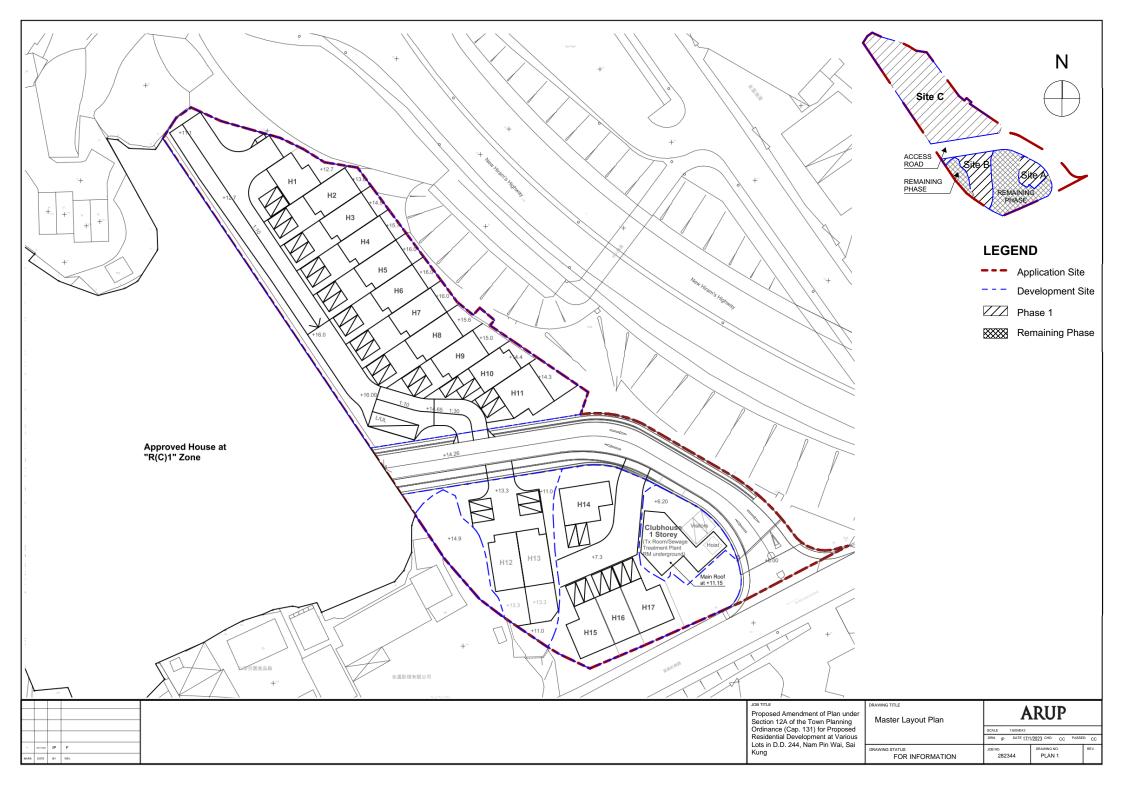
In view of the lack of a public sewerage system in the vicinity of the Application Site, it is proposed to provide a private sewage treatment plant with treatment level reaching the secondary level plus disinfection as an alternative option and dispose treated effluent of a standard acceptable to EPD to the proposed drainage system along the access road.

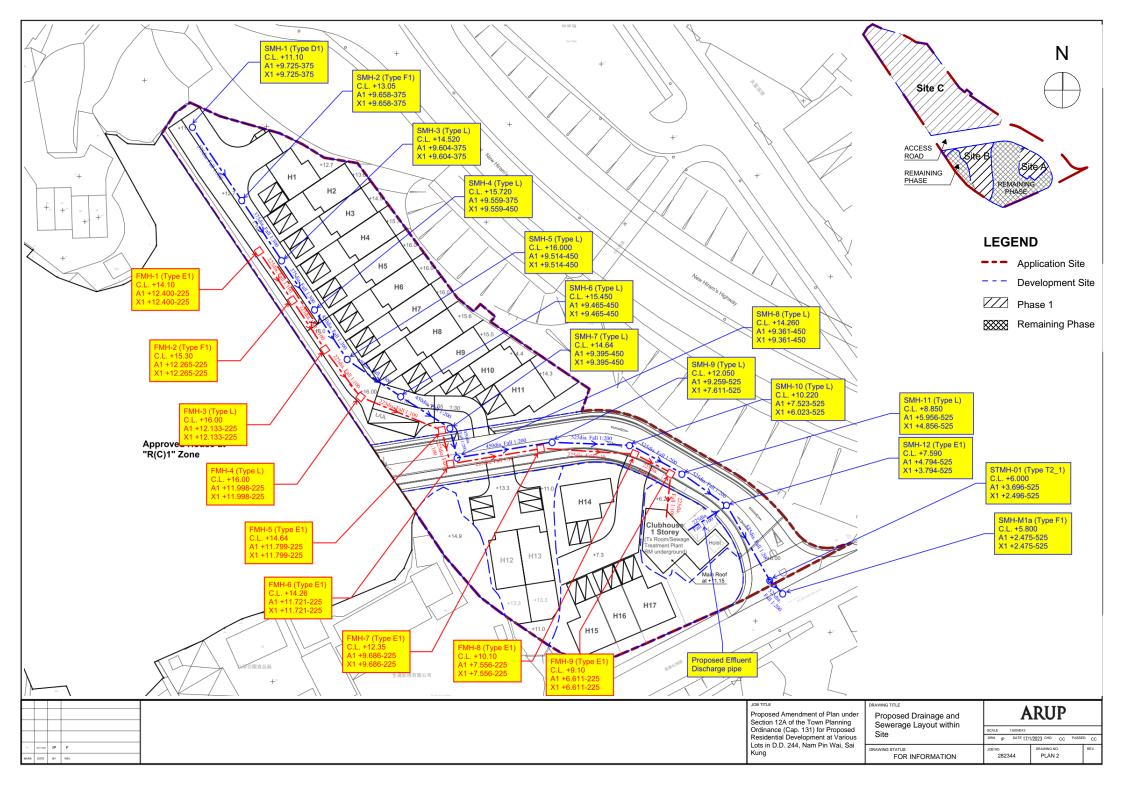
Design of the private sewage treatment plant will make reference to the "Guidelines for the Design of Small Sewage Treatment Plants (the Guidelines)" published by the EPD.

The private sewage treatment plant should be designed in such a way that it is capable of handling the daily and peak sewage flow arising from the proposed development. Should public sewerage be available in future, we would modify the sewerage system to facilitate the sewerage connection.

As regards the standard of acceptance of the treated effluent to minimize pollution, Table 7 of the "Technical Memorandum Standards for Effluent Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters" for Port Shelter Area shall be followed. EPD will be consulted on the treatment proposals during the detailed site planning and the discharged effluent standard required.

Appendix A Plan







ARUP	Ove Arup & Partners Calculation Sheet	Job No.	288253	Sheet No.		Rev.	0
Job Title	Application for Amendment of Plan under Section 12A of the Town Planning Ordinance (Cap. 131) to Rezone the Application Site from "Green Belt" to "Residential (Group C)1" for Proposed House Development at Various Lots in D.D. 244 and Adjoining Government Land, Nam Pin Wai, Sai Kung	Made by	CC	Date	17/10/2023	Checked	CC

<u>TABLE B1</u> Estimation of Sewage Flows Estimation for Proposed Development

Design Code 1. Based on EPD Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning. 2. Plumbing Engineering Services Design Guide by The Institute of Plumbing.

Design Assumption: Global Peaking Factor, P (Including Stormwater Allowance) as per Table T-5 Global Unit Flow Factors as per Tables T-2 and T-3 Catchment Inflow Factor for Sai Kung (PCIF = 1.30) as per Table T-4

ewage Flow Estimates	Estimation	Remark
roposed Development		
Domestic		
Number of Houses	17	Based on Development Schedule
Number of Residents (3-storey @ 3 persons for each storey)	51	
Unit flow factor (m ³ /person/day)	0.27	Table T-1 of GESF - Private R2
ADWF, (m ³ /day)	13.77	
Clubhouse		
GFA (m ²)	151	Based on Development Schedule
Worker Density (Number of Worker per 100m ² GFA)	5.1	Restaurant
Number of Employee	8	
Unit flow factor (m ³ /person/day)	1.58	Table T-2 of GESF - J10 Restaurant and Hotel
ADWF, (m ³ /day)	12.14	
Total ADWF, (m ³ /day)	25.91	
Contributing Population	96	
Global Peaking Factor (including stormwater allowance) for Sewage Treatment Works	4	Table T-5 of GESF
Global Peaking Factor (including stormwater allowance) for Sewers	8	Table T-5 of GESF
Peak Flow (L/s) for Sewage Treatment Works	1.20	
Peak Flow (L/s) for Gravity Sewers	2.40	

Notes: Employment density shall refer to Commercial and Industrial Floor Space Utilization Survey published by PlanD. Restaurant = 5.1 employee per $100m^2$ of GFA

ARUP

Ove Arup & Partners Calculation Sheet

Application for Amendment of Plan under Section 12A of the Town Planning Ordinance (Cap. 131) to Rezone the Application Site from "Green Belt" to "Residential (Group C)1" for Proposed House Development at Various Lots in D.D. 244 and Adjoining Government Land, Nam Pin Wai, Sai Kung

Job Title

Table B2 - Capacity Performance of Proposed Sewer

Notes:

(1) Calculate by Colebrook-White Equation

$$\overline{V} = -\sqrt{32gRS_f} \log \left[\frac{k_s}{14.8R} + \frac{1.255\nu}{R\sqrt{32gRS_f}}\right]$$

where ks is roughness value is 3mm for sewer.

v is kinematic viscosity of fluid = 1.14 x 10-6 m2/s and g is the gravity = 9.81m/s2

V is the velocity, D is the diameter of the sewer and S is the gradient of the sewer.

Abbreviation:

UP_MAN	Upstream Manhole	CON_POP	Contributing Population	DN_GL	Downstream Ground Level	CAP	Peak Pipe Capacity
DN_MAN	Downstream Manhole	DIA	Diameter	UP_INV	Upstream Invert Level	F/C	Peak Flow/Capacity
ADWF	Average Dry Weather Flow	LEN	Length	DN_INV	Downstream Invert Level		
ACC_ADWF	Accumulated Average Dry Weather Flow	UP_GL	Upstream Ground Level	VEL	Peak Pipe Velocity		

Proposed Development

Ма	anhole			PEAKING FACTOR								Proposd Sewe	r				
UP_MAN	DN_MAN	Catchment	CON_POP		ACC_ADWF	Peak Flow	DIA (D)	LEN	UP_GL	DN_GL	UP_INV	DN_INV	Gradient	VEL	CAP	F/C	Adequate
No.	No.				(L/s)	(L/s)	(mm)	(m)	(mPD)	(mPD)	(mPD)	(mPD)	(S)	(m/s)	(L/s)	(%)	Capacity?
FMH-1	FMH-2	Proposed Development	96	8	0.30	2.40	225	13.5	13.90	15.30	12.400	12.265	100	1.02	40.68	5.9%	YES
FMH-2	FMH-3		96	8	0.30	2.40	225	13.2	15.30	16.00	12.265	12.133	100	1.02	40.68	5.9%	YES
FMH-3	FMH-4		96	8	0.30	2.40	225	13.5	16.00	15.60	12.133	11.998	100	1.02	40.68	5.9%	YES
FMH-4	FMH-5		96	8	0.30	2.40	225	19.9	15.60	14.40	11.998	11.799	100	1.02	40.68	5.9%	YES
FMH-5	FMH-6		96	8	0.30	2.40	225	7.8	14.40	14.26	11.799	11.721	100	1.02	40.68	5.9%	YES
FMH-6	FMH-7		96	8	0.30	2.40	225	20.4	14.26	12.35	11.721	9.686	10	3.24	128.90	1.9%	YES
FMH-7	FMH-8		96	8	0.30	2.40	225	21.3	12.35	10.10	9.686	7.556	10	3.24	128.90	1.9%	YES
FMH-8	FMH-9		96	8	0.30	2.40	225	9.5	10.10	9.10	7.556	6.611	10	3.24	128.90	1.9%	YES
FMH-9	On-site Sewage Treatment Plant		96	8	0.30	2.40	225	10.2	9.10	9.10	6.611	6.509	100	1.02	40.68	5.9%	YES

	Job No.	288253	Sheet No.		Rev.	0
Rezone the	Made by	CC	Date	11/10/2023	Checked	CC
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Appendix D

Drainage Impact Assessment

ARUP

Application for Amendment of Plan under Section 12A of the Town Planning Ordinance (Cap. 131) to Rezone the Application Site from "Green Belt" to "Residential (Group C)1" for Proposed House Development at Various Lots in D.D. 244 and Adjoining Government Land, Nam Pin Wai, Sai Kung

Drainage Impact Assessment

Reference:

1 | 13 October 2023

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 282344

Arup Hong Kong Limited Level 5 Festival Walk 80 Tat Chee Avenue Kowloon Tong Kowloon Hong Kong arup.com

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	Assessment Methodology Design Criteria Existing Drainage Existing Drainage Network Drainage Impact Assessment for the Proposed Development Catchment Area Changes Assessment Result Flooding Susceptibility Maintenance Responsibility An Outline of the Changes to the Drainage Characteristics and Potential Drainage Impacts Which Might Arise from the Proposed Project Details of Proposed Temporary Drainage System Details of Monitoring Requirement During Construction Stage

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1. Introduction

1.1 Background

Arup Hong Kong Limited was commissioned to conduct a Drainage Impact Assessment (DIA) to support the Section 12A Planning Application for Proposed House Development at Various Lots in D.D. 244, Nam Pin Wai, Sai Kung. The Application Site is located within a "Green Belt" ("GB") zone on the Approved Ho Chung Outline Zoning Plan No. S/SK-HC/11.

1.2 Objective

The objective of this report is to provide an assessment of the impact of storm water flow generation as a result of the proposed house development at the Application Site on the connecting public drainage system adjacent to the Application Site and to propose mitigation measures as necessary such that the Application Site will not impose any adverse drainage impacts in areas upstream of, adjacent to, and downstream of the Application Site.

1.3 Reference Materials

In evaluating the drainage impact arising from the Proposed Development, the following sources of information have been specifically referred to:

- Stormwater Drainage Manual Fifth Edition, January 2018
- Stormwater Drainage Manual Corrigendum No. 1/2022
- DSD's Advice Note No. 1 Application of the Drainage Impact Assessment Process to Private Sector Projects; and
- Drainage Record Plans obtained from the GeoInfo Map services of the Lands Department (<u>https://www.map.gov.hk/gm/?lg=en</u>)

2. The Project Outlines

2.1 The Proposed Development

Master Layout Plan showing the proposed development is attached in **Appendix A – Plan 1**. **Table 1** showing the Proposed Development parameters is shown in table below:

Proposed Development	Site Particulars								
Project Application for Amendment of Plan under Section 12A of the Town Planning Ordinance (Cap. 131) to Rezone the Application Site from "Green Belt" to "Residential (Group C)1" for Proposed House Development at Various Lots in D.D. 244 and Adjoining Government Land, Nam Pin Wai, Sai Kung									
Location	Nam Pin Wai Sai Kung								
Land Use Zoning	"Green Belt" ("GB")								
Development Site Area excluding Access Road	About 5,355m ²								
•									

Unpaved Area = 100%	Unpaved Area = 0%

Table 1 Recommended Design Return Period

Below is an aerial photograph of the Application Site.



2.2 Project Interface

There is another Drainage Impact Assessment for Residential Development at Lot Nos. 738, 877 (Portion), 878 (Portion), 879 RP (Portion), 887, 931, 932, 1939 sA, 1939 sB (Portion), 1939 sC, 1939 RP (Portion), 1941 sA (Portion), 1942, 1943, 1944 sA, 1945 sI and adjoining Government Land in DD 244 at Nam Pin Wai, Sai Kung, N. T. (New Lot to Be Lot 2189 in DD 244), carried out for the adjoining upstream "R(C)1" Site at the west of the Application Site. This approved DIA report of "R(C)1" should be considered as a separate submission.

3. Assessment Methodology

3.1 Design Criteria

The design criteria for this DIA are based on the Stormwater Drainage Manual (SDM) Table 10 of the SDM. The recommended design return periods for the various drainage system are shown in below **Table 2**.

Description	Design Return Period
Intensively Used Agricultural Land	2 to 5 years
Village Drainage including Internal Drainage System under a polder scheme	10 years
Main Rural Catchment Drainage Channel	50 years

Urban Drainage Trunk System	200 years
Urban Drainage Branch System	50 years

Table 2 Recommended Design Return Period

The proposed drainage system within/outside the development is classified as village (rural) drainage system, hence 10-year flood level return period is adopted as the design criteria.

3.1.1 Determination of Flood Level

The design criteria for flood level depends on the combination of rainstorm event and tidal level under different return period. The flood level is selected referring to SDM Table 11, shown in below **Table 3**:

Flood Level Return Period Scenarios	Rainfall Return Period	Sea Level Return Period
10-years A (10A)	10	2
10-years B (10B)	2	10

Table 3 Determination of Flood Level

3.1.2 Roughness

The Colebrook-White roughness (ks) adopted for concrete pipe is 0.6mm.

3.1.3 Freeboard

Referring to Section 6.5 of SDM, a 300mm minimum freeboard margin of safety is recommended to account for inaccuracies in flood level computations. Therefore, a 300mm freeboard is recommended.

3.1.4 Climate Change

Climate change is taken into account in existing drainage system capacity check calculation. 16.0% Rainfall intensity increase for end 21st century (2081-2100) is included referring to SDM, Table 28.

3.1.5 Sea Level Rise

Climate change is taken into account in existing drainage system back water analysis calculation. 0.20m Sea level rise for end 21st century (2090) is included referring to SDM, Table 29.

3.1.6 Storm Surge Increase

Climate change is taken into account in existing drainage system back water analysis calculation. Storm surge increase for end 21st century (2090) is included referring to SDM, Table 30b.

4. Existing Drainage

4.1 Existing Drainage Network

The Application Site is divided into 5 nos. of individual parcels which are next to the planned access road to be constructed under the residential development in R(C)1 zone. There is a proposed 825ø stormwater drain to be laid along the R(C)1 access road to collect the surface runoff from R(C)1 site and will be connected to an existing triple 1800ø pipe and finally discharge to Pak Sha Wan via an existing twin cell box culvert (2 x 2m x 2m) according to the approved R(C)1 Residential Development DIA.

Surface run-off from the Application Site will be collected by a separate new drainage system to be constructed by the Applicant other than the proposed 825ø stormwater drain to be constructed along

the R(C)1 access road by R(C)1 Residential Development and finally discharges to Ho Chung River directly.

5. Drainage Impact Assessment for the Proposed Development

5.1 Catchment Area Changes

Comparing the existing and the proposed catchment area, it can be found that the proposed house development will be assumed fully paved for conservative analysis.

	Existing Catchme	ent Area	Proposed Catchm	ent Area
	Hard-paved	Unpaved	Hard-paved	Unpaved
Surface run-off discharges to the proposed 825ø	R(C)1 Site and R(C)1 Access Road	0	R(C)1 Site and R(C)1 Access Road	0
Surface run-off discharges to the proposed 525ø	0	Site A, Site B, Site C and the Remaining Phase	Site A, Site B, Site C and the Remaining Phase	0

The catchment area change is summarized in Table 4 and Table 5 below:

Table 4 Summary of Catchment Area Change

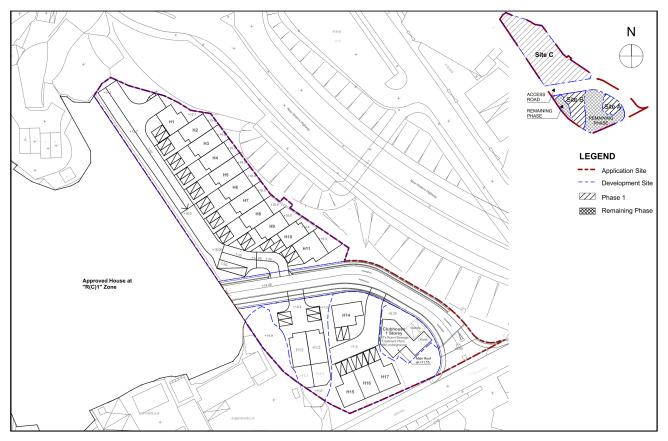


Figure 4-1 Catchment Plan

	Catchment A	rea Distribution	
Catchment		Area (m²)	
Area	paved	natural slope	grassland
Site A+B+C (About)	4,020	0	0
Remaining Site (About)	1,335	0	0
Access Road under Approved Planning Application No. A/SK-HC/223 (About)	1246	0	0

Table 5 Summary of Catchment Area Distribution for Proposed Development and the Adjacent developments

5.2 Assessment Result

The peak runoff generated from the proposed development is $0.292m^3$ /s under 10-year return period. Surface run-off from the Application Site will be collected by a separate new drainage system of 375ø to 525ø to be constructed by the Applicant along the R(C)1 access road and finally discharges to Ho Chung River directly (see **Appendix A – Plan 2** and **3**).

The proposed stormwater drainage system is aligned within a single lane as shown in drawing in **Appendix A** – **Plan 2** and **3** to avoid difficulty in approval and implementation of TTA. It is observed that the existing ground level of the public carpark is too low for catering the design tidal level and therefore the design manhole cover level of the proposed manhole SMH-M4a located at the amenity area in Heung Chung public carpark will be raised to +4.15, around 450mm above the ground. The proposed manhole SMH-M4a is located away from the dripline of the existing tree and will be located at the back of the parking space which will not affect the departure of driver/passenger from the vehicle. Consent from relevant departments regarding the proposed upstand design of manhole SMH-M4a from safety point of view will be seek. To facilitate the future maintenance works at any time and at high tide, installation of stoplog will be provided within manhole in the detailed design of proposed manhole SMH-M4a for submission to DSD for comment prior to the commencement of the works.

The assessment result of adopting a proposed 375ø to 525ø stormwater drain has been appended in **Appendix B**. Referring to the backwater checking, by adopting a proposed 375ø to 525ø stormwater drain along Wo Mei Hung Min Road and Hiram's Road, 300mm freeboard can be achieved.

Considering the assessment result and the conservative approach adopted in estimation of the freeboard, there will be negligible impact on the existing drainage system as a result of the proposed house development.

5.3 Flooding Susceptibility

The proposed site ground level is varying from around +6.0mPD to +16.0mPD which is much higher than the design extreme sea level of 1 in 200 return period which is +4.19mPD referring to DSD Storm Drainage Manual Table 8. On the other hand, there is no record of flood blackspot found for the Application Site or adjacent area. In general, foreseeing there is slim chance of the Application Site been affected by backwater effect under extreme weather.

5.4 Maintenance Responsibility

The management and maintenance responsibilities for the proposed 375ø to 525ø inside the Application site will be maintained by the developer or the management of the development after completion. The proposed drainage system of 525ø outside the Application Site will be handed over to DSD upon completion of the construction works.

5.5 An Outline of the Changes to the Drainage Characteristics and Potential Drainage Impacts Which Might Arise from the Proposed Project

According to the topographical survey included in **Appendix C**, the Application Site is at high point in the central region of the site that grades down in all directions with overland flows towards existing surface channel outside the Application Site. The proposed development will keep all the existing ground levels or drainage or land use adjacent to but outside the project site intact and they will be unaffected by the proposed development.

During construction, the Application Site should be fenced off by hoarding boards with temporary drainage, comprising perimeter channels and catchpits with desilting trap, towards the existing surface channel outside site following the existing catchment overland flow paths. No change to the drainage path during construction but after the completion of the proposed drainage in Wo Mei Hung Min Road, the drainage path of the Application Site after completion will be altered by discharging to the newly proposed drainage system in Wo Mei Hung Min Road.

No potential adverse impact and impact on the land users which might arise as a result of changes to the drainage characteristics caused by the proposed development. As all the existing ground levels or drainage or land use adjacent to but outside the project site will kept intact. The Application Site drainage will be discharge to the new stormwater drainage system in Wo Mei Hung Min Road directly.

5.6 Details of Proposed Temporary Drainage System

The existing catchment of the Application Site and the proposed temporary drainage system during construction period with hydraulic capacity checking is included in **Appendix C**. During construction, the Application Site should be fenced off by hoarding boards with temporary drainage, comprising perimeter channels and catchpits with desilting trap, towards the existing surface channel outside site following the existing catchment overland flow paths.

The temporary drainage should be designed in accordance with standards and recommendations established in DSD Stormwater Drainage Manual (SDM), DSD Technical Circular No. 14/2000 – Temporary Flow Diversions and Temporary Works Affecting Capacity in Stormwater Drainage System, and DSD Practice Note No. 1/2004 – Design Rainfall Depth for Temporary Works within the Dry Season.

Proper measures shall be taken to maintain the existing drainage characteristic of the catchment areas and to minimize drainage impacts associated with the construction works. The principal drainage impacts which are associated with construction of the works have been identified as follows:

- Erosion of ground material;
- Sediment transportation to existing downstream drainage system, and
- Obstruction to drainage systems.

Excavated slopes for the Application Site shall be well-compacted and protected to prevent any loose material being washed out during rainfall. Temporary protection may be in the form of placing layers of granular material and rockfill material or hard surface cover on the sloping faces of channel or tarpaulin covering.

Regular inspection shall be carried out to ensure integrity of the works. These inspections shall cover works under construction as well as the existing area in the vicinity of the Application Site.

No excavated materials should be left on site. If it is not possible to transport away the excavated material within the same day, the material should be covered by tarpaulin/impervious sheets. Measures shall be taken to ensure that runoff from the Application Site is managed so that silts and other pollution are properly intercepted.

In the event of extreme weather including landslip warning, issuance of amber/red/black rainstorm warning signal, Typhoon Signal No. 3 or above and the like, site inspections shall be carried out by the contractor's emergency team as deemed practical and safe before and after the events to ascertain if there has been any siltation or erosion. If it is determined that any unacceptable siltation or erosion has occurred, the contractor shall rectify it immediately.

Silt removal facilities, channels and manholes should be checked and maintained to ensure satisfactory working conditions. The deposited silt and grit should be removed regularly, at the onset of and after each rainstorm to ensure that these facilities are functioning properly at all times.

As the preliminary temporary drainage scheme and monitoring requirements included in this submission are subject to changes based on actual site constraints encountered on site and the method statement for each phase of construction works. As such, a detailed temporary drainage management plan, including but not limited to the proposed temporary drainage plan, associated hydraulic calculation, method statement for each phase of works, and the monitoring requirement and programme which should be endorsed by AP of the project should be submitted to DSD for agreement prior to the commencement of the works.

5.7 Details of Monitoring Requirement During Construction Stage

The contractor should include below drainage monitoring requirements during construction stage for agreement with RSS and DSD:

- Monitoring points should be set at catchpits, inlets to existing channels, manholes etc of the temporary drainage system and the existing drainage system in the vicinity of the Application Site;
- Drainage performance requirement: (i.e. no blockage, no flooding, no damage of drainage system; no mud/silty water discharge to monitoring points);
- General inspection should be carried out by contractor for the temporary drainage system (i.e. sump pit, sedimentation tank, wastewater treatment facilities and surface channel etc.) within the site and the existing drainage facilities in the vicinity of the Application Site;
- Monitoring frequency at monitoring points: Weekly basis & appropriate time after lowering of amber/red/black rainstorm warning signal and typhoon signal no. 3 or above hoisted by Hong Kong Observatory;
- Requirement of Remedial works: Timely complete the remedial works if non-conformity found after inspection, to ensure the drainage performance during construction;
- Provide an inspection checklist and rectification record (certified by the RSS with signature) together with the site photos at the monitoring points; and
- Keep the monitoring record and rectification record properly and submit to DSD upon requested.

6. Conclusion

This DIA has been prepared to assess the potential drainage impact as a result of the proposed house development.

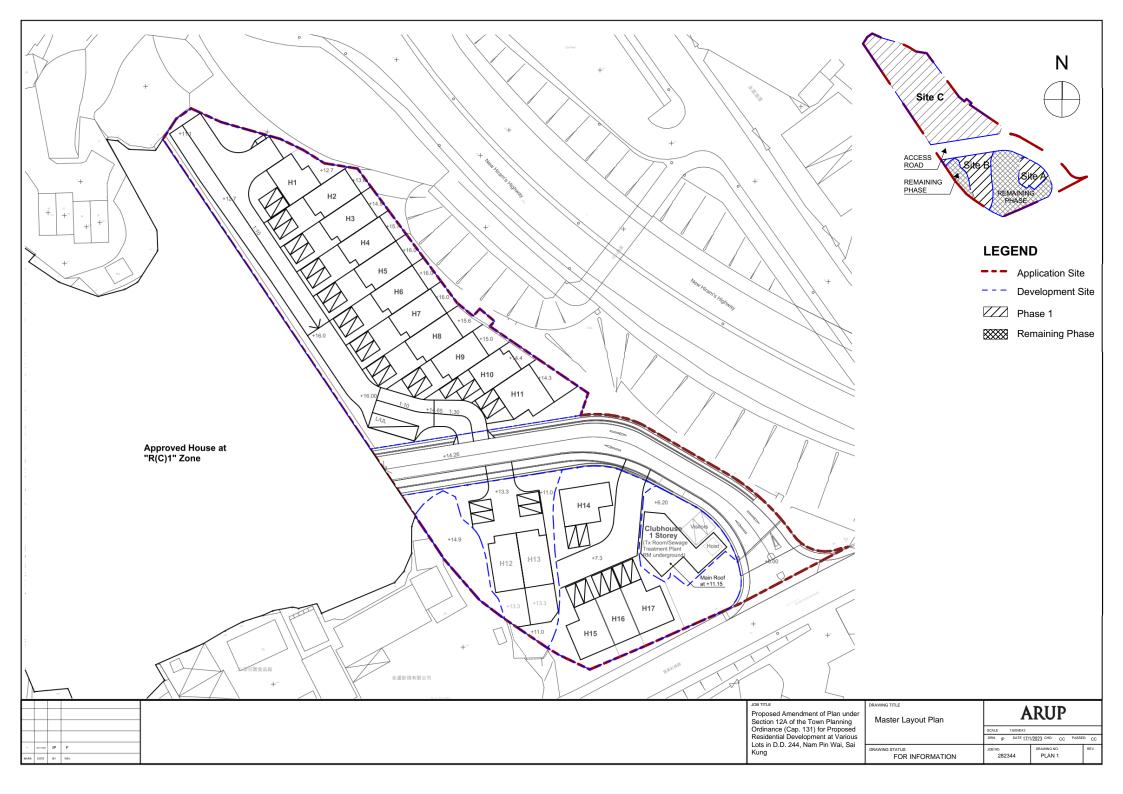
Surface run-off from the Application Site will be collected by a separate new drainage system of 375ϕ to 525ϕ to be constructed by the Applicant along the R(C)1 access road and finally discharges to Ho Chung River directly.

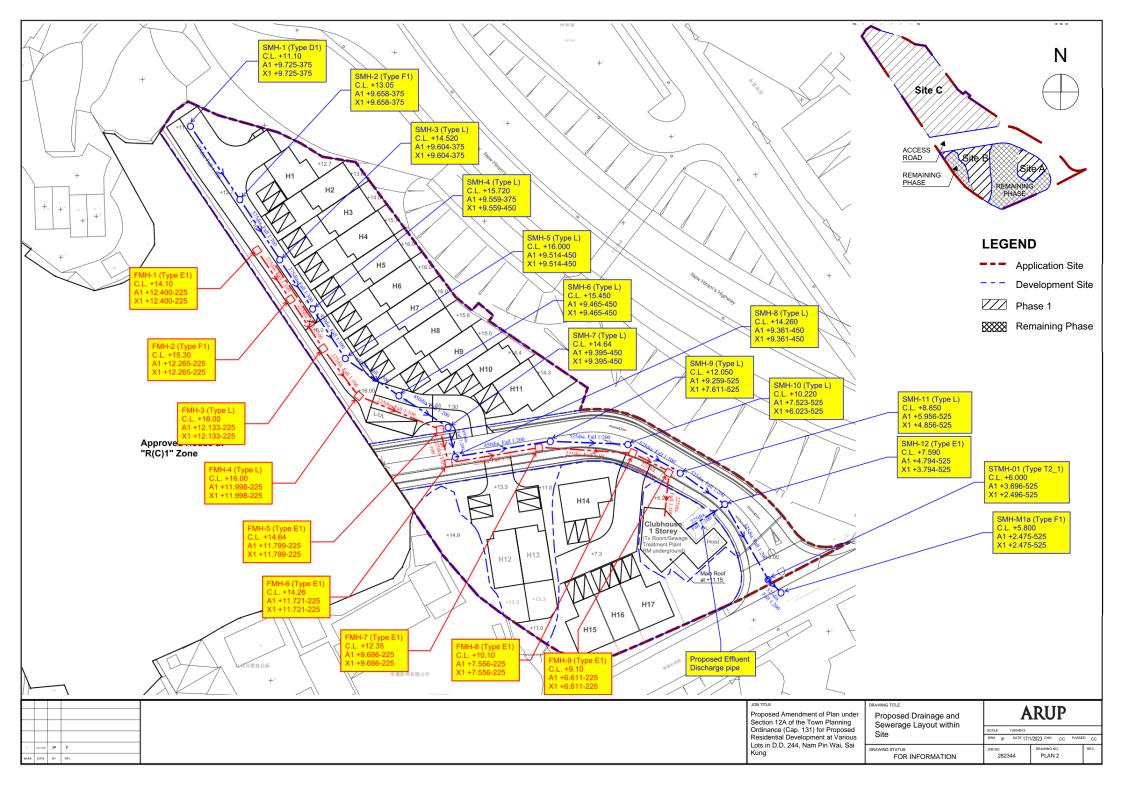
10-year design return period of design criteria is adopted for the impact assessment on the proposed stormwater drain. Based on the hydraulic assessment, the proposed drainage system has sufficient capacity for the proposed house development.

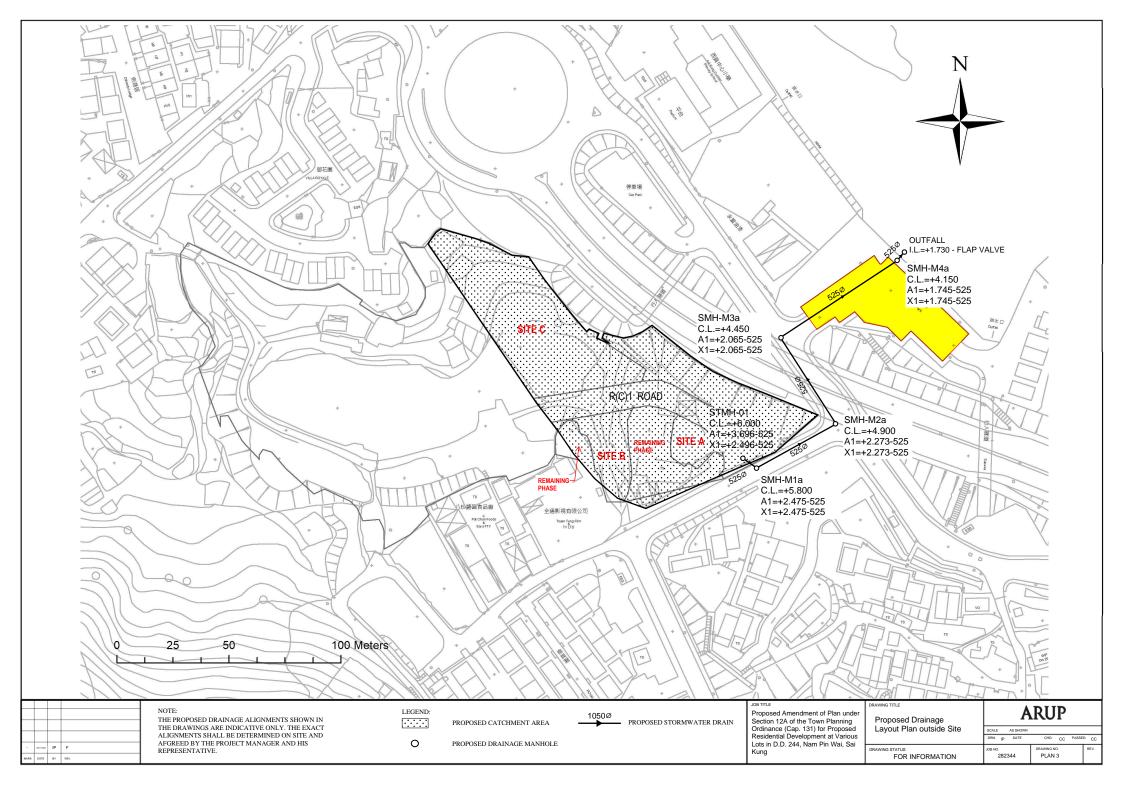
Regarding the proposed upstand design of manhole SMH-M4a located at the amenity area in Heung Chung public carpark, consent from relevant departments from safety point of view will be seek. To facilitate the future maintenance works at any time and at high tide, installation of stoplog will be provided within the proposed manhole SMH-M4a in the detailed design for submission to DSD for comment prior to the commencement of the works. A flap valve is also proposed at the downstream to prevent backwater effect for mitigation measure.

In conclusion, no adverse drainage impact is expected to the surrounding drainage system arising from the proposed development and the proposed drainage system has sufficient capacity to convey the additional surface runoff arising from the proposed development.

Appendix A Plan









ARUP

Job Title

Ove Arup & Partners Hong Kong

Proposed Amendment of Plan under Section 12A of the Town Planning Ordinance (Cap. 131) for Proposed Residential Development at Various Lots in D.D. 244, Nam Pin Wai, Sai Kung

Table A - Backwater Checking of the proposed drainage system after completion of the Proposed Development

Loca	ion	Sub-			Catchment Area						Draina	ge Character					Hydraulic para	meter	Tim	е	(i) Extreme	Peak	Full Bore	Full Bore	Mean	k	k	Н	Н	Re	1/f^(1/2)	f	Н	Total	Water lev	vel
IS	DS	Catchment	Imper	rmeable	Permeable		Total	Drainage		Drainage s	ize	Grou	nd level	Inve	t level	Slope		t _e	t _f	t _c	mean intensi	ty Runoff	Capacity	Velocity	Velocity	(entry)	(exit)	(entry)	(exit)	(Reynold		(friction ceof	(friction)	н		
		Reference	Sub-	Accumula	ative Sub- Accumulati	/e Sub-	Accumulative	Shape	width	height	length	USG	DSG	US	DS		cross area Pi	oe Dia.			10-year									number)						
			Catchment	Area	Catchment Area	Catchmen	t Area		(mm)	(mm)	(m)	(mPD)	(mPD)	(mPD)	(mPD)	(S _f)	(A)	(D)																		
			(m ²)	(m ²)	(m ²) (m ²)	(m ²)	(m ²)										(m ²)	(m) (mir	n) (mir	n) (min)	(mm/h)	(m ³ /s)	(m ³ /s)	(m/s)	(m/s)			(m)	(m)				(m)	(m)	(mPD))
-1	SMH-2		619	619	0 0	619	619	375DIA.	375	375	20.2	11.100	12.720	9.725	9.658	0.003	0.11 (0.375 5.00	0 0.32	2 5.32	235.80	0.036	0.115	1.041	0.330	0.500	1.000	0.003	0.006	1.0E+05	6.430	0.02418	0.0072	0.016	10.047	
-2	SMH-3		446	1,065	0 0	446	1,065	375DIA.	375	375	16.2	12.720	14.360	9.658	9.604	0.003	0.11 (0.375 5.32	2 0.26	5.58	232.96	0.062	0.115	1.041	0.562	0.500	1.000	0.008	0.016	1.8E+05	6.531	0.02345	0.0163	0.040	10.032	
3	SMH-4		459	1,524	0 0	459	1,524	375DIA.	375	375	13.4	14.360	15.680	9.604	9.559	0.003	0.11 (0.375 5.58	8 0.21	5.80	230.69	0.088	0.115	1.041	0.796	0.500	1.000	0.016	0.032	2.5E+05	6.579	0.02310	0.0267	0.075	9.991	
1	SMH-5	SITE C	466	1,990	0 0	466	1,990	450DIA.	450	450	13.5	15.680	16.000	9.559	9.514	0.003	0.16 (0.450 5.80	0 0.19) 5.99	228.72	0.114	0.186	1.169	0.716	0.500	1.000	0.013	0.026	2.7E+05	6.721	0.02214	0.0173	0.056	9.916	
;	SMH-6		516	2,506	0 0	516	2,506	450DIA.	450	450	14.6	16.000	15.000	9.514	9.465	0.003	0.16 (0.450 5.99	9 0.21	6.20	226.65	0.142	0.186	1.169	0.893	0.500	1.000	0.020	0.041	3.3E+05	6.748	0.02196	0.0290	0.090	9.860	
6	SMH-7		570	3,076	0 0	570	3,076	450DIA.	450	450	14.2	15.000	14.400	9.465	9.395	0.005	0.16 (0.450 6.20	0 0.16	6.36	225.06	0.173	0.228	1.434	1.088	0.500	1.000	0.030	0.060	4.1E+05	6.769	0.02182	0.0415	0.132	9.770	
7	SMH-8	-	0	3,076	0 0	0	3,076	450DIA.	450	450	6.8	14.400	14.260	9.395	9.361	0.005	0.16 (0.450 6.30	6 0.08	3 6.44	224.31	0.172	0.228	1.434	1.085	0.500	1.000	0.030	0.060	4.1E+05	6.769	0.02182	0.0197	0.110	9.638	
8	SMH-9	Remaining Area	a 216	3,292	0 0	216	3,292	450DIA.	450	450	20.3	14.260	12.050	9.361	9.259	0.005	0.16 (0.450 6.44	4 0.24	6.68	222.13	0.183	0.228	1.434	1.149	0.500	1.000	0.034	0.067	4.3E+05	6.775	0.02179	0.0663	0.167	9.528	
9	SMH-10	SITE B	637	3,929	0 0	637	3,929	525DIA.	525	525	17.6	12.050	10.220	7.611	7.523	0.005		0.525 6.68			220.47	0.217	0.342	1.580	1.000	0.500	1.000	0.026	0.051	4.4E+05	6.893	0.02105	0.0359	0.112	7.723	
C	SMH-11	Remaining Area	a 1,110	5,039		1,110	5,039	525DIA.	525	525	13.4	10.220	8.850	6.023	5.956	0.005		0.525 6.80			219.23	0.276	0.342	1.580	1.276	0.500	1.000	0.041	0.083	5.6E+05	6.916	0.02091	0.0442	0.169	6.191	
1	SMH-12	SITE A	315	5,354		315	5,354	525DIA.	525	525	12.4	8.850	7.590	4.856	4.794	0.005		0.525 7.00			218.10	0.292	0.342	1.580	1.349	0.500	1.000	0.046	0.093	5.9E+05	6.921	0.02088	0.0458	0.185	5.041	
2	STMH-01	-	0	5,354		0	5,354	525DIA.	525	525	19.5	7.590	6.000	3.794	3.696	0.005		0.525 7.13			216.37	0.290	0.342	1.580	1.338	0.500	1.000	0.046	0.091	5.9E+05	6.920	0.02088	0.0709	0.208	4.704	
	SMH-M1a	-	0	5,354		0	5,354	525DIA.	525	525	4.3	6.000	5.800	2.496	2.475	0.005		0.525 7.34			216.00	0.289	0.342	1.580	1.336	0.500	1.000	0.045	0.091	5.8E+05	6.920	0.02088	0.0154	0.152	4.496	
1	SMH-M2a	_	0	5,354		0	5,354	525DIA.	525	525	40.5	5.800	4.900	2.475	2.273	0.005		0.525 7.39			212.58	0.285	0.342	1.580	1.314	0.500	1.000	0.044	0.088	5.8E+05	6.919	0.02089	0.1419	0.274	4.344	
1	SMH-M3a	_	0	5,354		0	5,354	525DIA.	525	525	41.5	4.900	4.500	2.273	2.065	0.005).525 7.8 ⁻			209.26	0.280	0.342	1.580	1.294	0.500	1.000	0.043	0.085	5.7E+05	6.917	0.02090	0.1410	0.269	4.070	
a	SMH-M4a	_	0	5,354		0	5,354	525DIA.	525	525	64.0	4.500	4.150	2.065	1.745	0.005		0.525 8.2			204.48	0.274	0.342	1.580	1.264	0.500	1.000	0.041	0.081	5.5E+05	6.915	0.02091	0.2077	0.330	3.801	
	OUTFALL	_	0	5,138		0	5,354	525DIA.	525	525	3.0	4.150	4.150	1.745	1.730	0.005		0.525 8.93			204.27	0.262	0.342	1.580	1.212	0.500	1.000	0.037	0.075	5.3E+05	6.912	0.02093	0.0090	0.121	3.471	
to	mwater Drai	n (2 vear rair	n + 10 vea	ır sea lev	vel)																														2.820 3.350	
		n (2 year rair _{Sub-}		ır sea le	/						Draina	ge Character					Hvdraulic para	meter	Tim	e	(i) Extreme	Peak	Full Bore	Full Bore	Mean	k	k	н	н	Re	1/f^(1/2)	f	Гн	Total	3.350	
	ion	Sub-		ar sea le	Vel) Catchment Area Permeable		Total	Drainage		Drainage s		ge Character Grou	nd level	Inve	rt level	Slope	Hydraulic para	meter	Tim			Peak							H (exit)		1/f^(1/2)					
			Imper	rmeable	Catchment Area Permeable		Total Accumulative	Drainage Shape	width	Drainage s	ize	Grou	nd level			Slope		t _e	Tim		mean intensi	Peak ty Runoff						H (entry)		Re (Reynold number)		f (friction ceof			3.350	
	ion	Sub- Catchment	Imper	rmeable Accumula	Catchment Area Permeable ative Sub- Accumulati		Accumulative	Ū.	width (mm)	height	ize length	Grou	DSG	US	DS		cross area Pi	be Dia.												(Reynold					3.350	
	ion	Sub- Catchment	Imper Sub- Catchment	rmeable Accumula Area	Catchment Area Permeable ative Sub- Accumulati Catchment Area	/e Sub- Catchmen	Accumulative	Ū.	width (mm)		ize length	Grou		US	DS		cross area Pi (A)	De Dia. (D)	t _f	t _c	mean intensi 2-year	ty Runoff	Capacity	Velocity	Velocity			(entry)	(exit)	(Reynold				н	3.350 Water lev	vel
	ion	Sub- Catchment	Imper Sub- Catchment (m ²)	rmeable Accumula	Catchment Area Permeable ative Sub- Accumulati Catchment Area (m ²) (m ²)	/e Sub-	Accumulative t Area (m ²)	Ū.	(mm)	height (mm)	ize length (m)	Grou USG (mPD)	DSG (mPD)	US (mPD)	DS (mPD)	(S _f)	cross area Pi (A) (m ²)	De Dia. (D) (m) (min	n) (mir	t _c (min)	mean intensit 2-year	ty Runoff	Capacity (m ³ /s)	Velocity (m/s)	Velocity (m/s)	(entry)	(exit)	(entry) (m)	(exit) (m)	(Reynold number)		(friction ceof) (friction) (m)	H (m)	3.350	vel
Loca	ion DS	Sub- Catchment	Imper Sub- Catchment	rmeable Accumula Area (m²)	Catchment Area Permeable ative Sub- Accumulati Catchment Area (m ²) (m ²) 0 0	ve Sub- Catchmen (m ²)	Accumulative	Shape		height	ize length (m) 20.2	Grou USG (mPD) 11.100	DSG	US (mPD) 9.725	DS (mPD) 9.658		cross area Pi (A) (m ²) 0.11 (De Dia. (D)	n) (mir 0 0.32	t _c 1) (min) 2 5.32	mean intensi 2-year (mm/h)	ty Runoff (m ³ /s)	Capacity	Velocity	Velocity			(entry) (m) 0.002	(exit)	(Reynold	6.378	(friction ceof) (friction) (m) 0.0048	H (m) 0.010	3.350 Water leve (mPD)	vel
	DS SMH-2	Sub- Catchment Reference	Imper Sub- Catchment (m ²) 619	rmeable Accumula Area (m ²) 619	Catchment Area Permeable ative Sub- Catchment Area (m ²) (m ²) 0 0 0 0	ve Sub- Catchmen (m ²) 619	Accumulative Area (m ²) 619	Shape 375DIA.	(mm) 375	height (mm) 375	ize length (m) 20.2 16.2	Grou USG (mPD) 11.100	DSG (mPD) 12.720	US (mPD) 9.725	DS (mPD) 9.658 9.604	(S _f) 0.003	cross area Pi (A) (m ²) 0.11 (0.11 (t _e (D) (m) (min 0.375 5.00	n) (mir 0 0.32 2 0.26	t _c (min) 2 5.32 5 5.58	mean intensit 2-year (mm/h) 189.85	ty Runoff (m ³ /s) 0.029	Capacity (m ³ /s) 0.115	Velocity (m/s) 1.041	Velocity (m/s) 0.266	(entry) 0.500	(exit) 1.000	(entry) (m) 0.002 0.005	(exit) (m) 0.004	(Reynold number) 8.3E+04	6.378 6.494	(friction ceof 0.02458 0.02371) (friction) (m) 0.0048	H (m) 0.010 0.026	3.350 Water lev (mPD) 9.803	vel
Loca	ION DS SMH-2 SMH-3	Sub- Catchment	Imper Sub- Catchment (m ²) 619 446	rmeable Accumula Area (m ²) 619 1,065	Catchment Area Permeable ative Sub- Accumulati Catchment Area (m ²) (m ²) 0 0 0 0 0 0 0 0	ve Sub- Catchmen (m ²) 619 446	Accumulative Area (m ²) 619 1,065	Shape 375DIA. 375DIA.	(mm) 375 375	height (mm) 375 375	ize length (m) 20.2 16.2	Grou USG (mPD) 11.100 12.720	DSG (mPD) 12.720 14.360	US (mPD) 9.725 9.658 9.604	DS (mPD) 9.658 9.604	(S _f) 0.003 0.003	cross area Pi (A) (m²) 0.11 (0) 0.11 (0) 0.11 (0)	te Dia. (D) (m) (min 0.375 5.00 0.375 5.33	n) (mir 0 0.32 2 0.26 8 0.21	t _c (min) (min) 5.32 5.58 5.80	mean intensii 2-year (mm/h) 189.85 187.36	ty Runoff (m ³ /s) 0.029 0.050	Capacity (m ³ /s) 0.115 0.115	Velocity (m/s) 1.041 1.041	Velocity (m/s) 0.266 0.452	(entry) 0.500 0.500	(exit) 1.000 1.000	(entry) (m) 0.002 0.005 0.010	(exit) (m) 0.004 0.010	(Reynold number) 8.3E+04 1.4E+05	6.378 6.494 6.550	(friction ceof 0.02458 0.02371) (friction) (m) 0.0048 0.0106 0.0174	H (m) 0.010 0.026 0.049	3.350 Water leve (mPD) 9.803 9.793	vel
	ION DS SMH-2 SMH-3 SMH-4	Sub- Catchment Reference	Imper Sub- Catchment (m ²) 619 446 459	rmeable Accumula Area (m ²) 619 1,065 1,524	Catchment Area Permeable ative Sub- Accumulati Catchment Area (m ²) (m ²) 0 0 0 0 0 0 0 0 0 0 0 0	/e Sub- Catchmen (m ²) 619 446 459	Accumulative Area (m ²) 619 1,065 1,524	Shape 375DIA. 375DIA. 375DIA. 375DIA.	(mm) 375 375 375	height (mm) 375 375 375 375	ize length (m) 20.2 16.2 13.4	Grou USG (mPD) 11.100 12.720 14.360	DSG (mPD) 12.720 14.360 15.680	US (mPD) 9.725 9.658 9.604	DS (mPD) 9.658 9.604 9.559 9.514	(S _f) 0.003 0.003 0.003	cross area Pi (A) (m²) 0.11 (0) 0.11 (0) 0.11 (0) 0.11 (0) 0.16 (0)	te Dia. (D) (m) (min 0.375 5.00 0.375 5.32 0.375 5.53	n) (mir 0 0.32 2 0.26 8 0.21 0 0.19	t _c (min) 2 5.32 5 5.58 5.80 5.99	mean intensit 2-year (mm/h) 189.85 187.36 185.37	ty Runoff (m ³ /s) 0.029 0.050 0.071	Capacity (m ³ /s) 0.115 0.115 0.115	Velocity (m/s) 1.041 1.041 1.041	Velocity (m/s) 0.266 0.452 0.640	(entry) 0.500 0.500 0.500	(exit) 1.000 1.000 1.000	(entry) (m) 0.002 0.005 0.010	(exit) (m) 0.004 0.010 0.021	(Reynold number) 8.3E+04 1.4E+05 2.0E+05	6.378 6.494 6.550 6.689	(friction ceof 0.02458 0.02371 0.02331 0.02235) (friction) (m) 0.0048 0.0106 0.0174 0.0113	H (m) 0.010 0.026 0.049	3.350 Water lev (mPD) 9.803 9.793 9.767	vel
Loca	ION DS SMH-2 SMH-3 SMH-4 SMH-5	Sub- Catchment Reference	Imper Sub- Catchment (m ²) 619 446 459 466	rmeable Accumula Area (m ²) 619 1,065 1,524 1,990	Catchment Area Permeable ative Sub- Accumulati Catchment Area (m²) (m²) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	/e Sub- Catchmen (m ²) 619 446 459 466	Accumulative Area (m ²) 619 1,065 1,524 1,990	Shape 375DIA. 375DIA. 375DIA. 450DIA.	(mm) 375 375 375 450	height (mm) 375 375 375 375 450	ize length (m) 20.2 16.2 13.4 13.5	Grou USG (mPD) 11.100 12.720 14.360 15.680 16.000	DSG (mPD) 12.720 14.360 15.680 16.000	US (mPD) 9.725 9.658 9.604 9.559	DS (mPD) 9.658 9.604 9.559 9.514 9.465	(S _f) 0.003 0.003 0.003 0.003	cross area Pi (A) (m²) 0.11 0 0.11 0 0.11 0 0.11 0 0.11 0 0.11 0 0.11 0 0.11 0 0.16 0	te Dia. (D) (m) (min 0.375 5.00 0.375 5.32 0.375 5.58 0.450 5.80	n) (mir 0 0.32 2 0.26 8 0.21 0 0.19 9 0.21	t _c (min) 2. 5.32 3. 5.58 5.80 5.99 6.20	mean intensii 2-year (mm/h) 189.85 187.36 185.37 183.64	ty Runoff (m ³ /s) 0.029 0.050 0.071 0.091	Capacity (m ³ /s) 0.115 0.115 0.115 0.186	Velocity (m/s) 1.041 1.041 1.041 1.169	Velocity (m/s) 0.266 0.452 0.640 0.575	(entry) 0.500 0.500 0.500 0.500	(exit) 1.000 1.000 1.000 1.000	(entry) (m) 0.002 0.005 0.010 0.008 0.013	(exit) (m) 0.004 0.010 0.021 0.017	(Reynold number) 8.3E+04 1.4E+05 2.0E+05 2.2E+05	6.378 6.494 6.550 6.689 6.721	(friction ceof 0.02458 0.02371 0.02331 0.02235) (friction) (m) 0.0048 0.0106 0.0174 0.0113 0.0188	H (m) 0.010 0.026 0.049 0.037	3.350 Water leve (mPD) 9.803 9.793 9.767 9.718	vel
	ION DS SMH-2 SMH-3 SMH-4 SMH-5 SMH-6	Sub- Catchment Reference	Imper Sub- Catchment (m ²) 619 446 459 466 516	rmeable Accumula Area (m ²) 619 1,065 1,524 1,990 2,506	Catchment Area Permeable ative Sub- Accumulati Catchment Area (m ²) (m ²) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	 Sub- Catchmen (m²) 619 446 459 466 516 	Accumulative Area (m ²) 619 1,065 1,524 1,990 2,506	Shape 375DIA. 375DIA. 375DIA. 450DIA. 450DIA.	(mm) 375 375 375 450 450	height (mm) 375 375 375 375 450 450	ize length (m) 20.2 16.2 13.4 13.5 14.6	Grou USG (mPD) 11.100 12.720 14.360 15.680 16.000 15.000	DSG (mPD) 12.720 14.360 15.680 16.000 15.000	US (mPD) 9.725 9.658 9.604 9.559 9.514 9.465	DS (mPD) 9.658 9.604 9.559 9.514 9.465 9.395	(S _f) 0.003 0.003 0.003 0.003 0.003	cross area Pi (A) (m²) 0.11 (0 0.11 (0 0.11 (0 0.16 (0 0.16 (0	te Dia. (D) (m) (min 0.375 5.00 0.375 5.32 0.375 5.53 0.375 5.54 0.450 5.89	n) (mir 0 0.32 2 0.26 8 0.21 0 0.19 9 0.21 0 0.16	t _c (min) 2 5.32 5 5.58 5.80 5.99 6.20 6 6.36	mean intensit 2-year (mm/h) 189.85 187.36 185.37 183.64 181.83	ty Runoff (m ³ /s) 0.029 0.050 0.071 0.091 0.114	Capacity (m ³ /s) 0.115 0.115 0.115 0.115 0.186 0.186	Velocity (m/s) 1.041 1.041 1.041 1.169 1.169	Velocity (m/s) 0.266 0.452 0.640 0.575 0.716	(entry) 0.500 0.500 0.500 0.500 0.500	(exit) 1.000 1.000 1.000 1.000 1.000	(entry) (m) 0.002 0.005 0.010 0.008 0.013	(exit) (m) 0.004 0.010 0.021 0.017 0.026	(Reynold number) 8.3E+04 1.4E+05 2.0E+05 2.2E+05 2.7E+05	6.378 6.494 6.550 6.689 6.721 6.746	(friction ceof 0.02458 0.02371 0.02331 0.02235 0.02214	 (friction) (m) 0.0048 0.0106 0.0174 0.0113 0.0188 0.0268 	H (m) 0.010 0.026 0.049 0.037 0.058 0.085	3.350 Water lev (mPD) 9.803 9.793 9.767 9.718 9.682	vel
	ION DS SMH-2 SMH-3 SMH-4 SMH-5 SMH-5 SMH-6 SMH-7	Sub- Catchment Reference	Imper Sub- Catchment (m ²) 619 446 459 466 516 570 0	rmeable Accumula Area (m ²) 619 1,065 1,524 1,990 2,506 3,076	Catchment Area Permeable ative Sub- Accumulati Catchment Area (m²) (m²) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	 Sub- Catchmen (m²) 619 446 459 466 516 	Accumulative (m ²) 619 1,065 1,524 1,990 2,506 3,076	Shape 375DIA. 375DIA. 375DIA. 450DIA. 450DIA. 450DIA.	(mm) 375 375 375 450 450 450	height (mm) 375 375 375 450 450 450	ize length (m) 20.2 16.2 13.4 13.5 14.6 14.2	Grou USG (mPD) 11.100 12.720 14.360 15.680 16.000 15.000	DSG (mPD) 12.720 14.360 15.680 16.000 15.000 14.400	US (mPD) 9.725 9.658 9.604 9.559 9.514 9.465	DS (mPD) 9.658 9.604 9.559 9.514 9.465 9.395 9.361	(S _f) 0.003 0.003 0.003 0.003 0.003 0.005	cross area Pi (A) (m²) 0.11 0 0.11 0 0.11 0 0.11 0 0.11 0 0.11 0 0.16 0 0.16 0 0.16 0	te be Dia. (D) (m) (min 0.375 5.00 0.375 5.33 0.375 5.53 0.450 5.80 0.450 5.80 0.450 5.99	t _f n) (mir 0 0.32 2 0.26 8 0.21 0 0.19 9 0.21 0 0.16 6 0.08	$\begin{array}{c c} t_{c} \\ t_{c} \\ (min) \\ 2 \\ 5.32 \\ 5.58 \\ 5.80 \\ 5.80 \\ 6 \\ 5.99 \\ 6.20 \\ 6 \\ 6.36 \\ 6 \\ 6 \\ 6 \\ 6 \\ 6 \\ 6 \\ 6 \\ 6 \\ 6 \\$	mean intensii 2-year (mm/h) 189.85 187.36 185.37 183.64 181.83 180.43	ty Runoff (m ³ /s) 0.029 0.050 0.071 0.091 0.114 0.139	Capacity (m ³ /s) 0.115 0.115 0.115 0.186 0.186 0.228	Velocity (m/s) 1.041 1.041 1.041 1.169 1.169 1.434	Velocity (m/s) 0.266 0.452 0.640 0.575 0.716 0.872	(entry) 0.500 0.500 0.500 0.500 0.500 0.500	(exit) 1.000 1.000 1.000 1.000 1.000 1.000	(entry) (m) 0.002 0.005 0.010 0.008 0.013 0.019 0.019	(exit) (m) 0.004 0.010 0.021 0.017 0.026 0.039	(Reynold number) 8.3E+04 1.4E+05 2.0E+05 2.2E+05 2.7E+05 3.3E+05	6.378 6.494 6.550 6.689 6.721 6.746 6.745	(friction ceof 0.02458 0.02371 0.02331 0.02235 0.02214 0.02198	 (friction) (m) 0.0048 0.0106 0.0174 0.0113 0.0188 0.0268 0.0128 	H (m) 0.010 0.026 0.049 0.037 0.058 0.085	3.350 Water leve (mPD) 9.803 9.793 9.767 9.718 9.682 9.624)
	ion DS SMH-2 SMH-3 SMH-4 SMH-5 SMH-6 SMH-7 SMH-8	Sub- Catchment Reference SITE C	Imper Sub- Catchment (m ²) 619 446 459 466 516 570 0	rmeable Accumula Area (m ²) 619 1,065 1,524 1,990 2,506 3,076 3,076	Catchment Area Permeable ative Sub- Accumulati Catchment Area (m²) (m²) (m²) (m²) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	 Sub- Catchmen (m²) 619 446 459 466 516 570 0 	Accumulative (m ²) 619 1,065 1,524 1,990 2,506 3,076 3,076	Shape 375DIA. 375DIA. 375DIA. 450DIA. 450DIA. 450DIA. 450DIA. 450DIA.	(mm) 375 375 375 450 450 450 450	height (mm) 375 375 375 450 450 450 450 450	ize length (m) 20.2 16.2 13.4 13.5 14.6 14.2 6.8	Grou USG (mPD) 11.100 12.720 14.360 15.680 16.000 15.000 14.400 14.260	DSG (mPD) 12.720 14.360 15.680 16.000 15.000 14.400 14.260	US (mPD) 9.725 9.658 9.604 9.559 9.514 9.465 9.395 9.361	DS (mPD) 9.658 9.604 9.559 9.514 9.465 9.395 9.361 9.259	(S _f) 0.003 0.003 0.003 0.003 0.003 0.005 0.005	cross area Pi (A) (m²) 0.11 (0 0.11 (0 0.11 (0 0.16 (0 0.16 (0 0.16 (0 0.16 (0 0.16 (0 0.16 (0	te Dia. (D) (m) (min 0.375 5.00 0.375 5.32 0.375 5.32 0.375 5.53 0.450 5.80 0.450 5.99 0.450 6.20 0.450 6.30	n) (mir 0 0.32 2 0.26 8 0.21 0 0.19 9 0.21 0 0.16 6 0.08 4 0.22	t _c (min) 2 5.32 5 5.58 5.80 5.99 6.20 5 6.36 8 6.44 4 6.68	mean intensit 2-year (mm/h) 189.85 187.36 185.37 183.64 181.83 180.43 179.77	ty Runoff (m ³ /s) 0.029 0.050 0.071 0.091 0.114 0.139 0.138	Capacity (m ³ /s) 0.115 0.115 0.115 0.186 0.186 0.228 0.228	Velocity (m/s) 1.041 1.041 1.041 1.169 1.169 1.434 1.434	Velocity (m/s) 0.266 0.452 0.640 0.575 0.716 0.872 0.869	(entry) 0.500 0.500 0.500 0.500 0.500 0.500 0.500	(exit) 1.000 1.000 1.000 1.000 1.000 1.000 1.000	(entry) (m) 0.002 0.005 0.010 0.008 0.013 0.019 0.019 0.022	(exit) (m) 0.004 0.010 0.021 0.017 0.026 0.039 0.039 0.043	(Reynold number) 8.3E+04 1.4E+05 2.0E+05 2.2E+05 2.7E+05 3.3E+05 3.3E+05 3.5E+05	6.378 6.494 6.550 6.689 6.721 6.746 6.745 6.752	(friction ceof 0.02458 0.02371 0.02331 0.02235 0.02214 0.02198 0.02198	 (friction) (m) 0.0048 0.0106 0.0174 0.0113 0.0188 0.0268 0.0128 0.0428 	H (m) 0.010 0.026 0.049 0.037 0.058 0.058 0.085 0.071	3.350 Water lev (mPD) 9.803 9.793 9.767 9.718 9.682 9.682 9.624 9.539	vel
	ion DS SMH-2 SMH-3 SMH-4 SMH-5 SMH-5 SMH-6 SMH-7 SMH-8 SMH-9	Sub- Catchment Reference SITE C	Imper Sub- Catchment (m²) 619 446 459 466 516 570 0 a 216 637	rmeable Accumula Area (m ²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,292	Catchment Area Permeable ative Sub- Accumulati Catchment Area (m²) (m²) (m²) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	/e Sub- Catchmen (m²) 619 446 459 466 516 570 0 216	Accumulative (m ²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,292	Shape 375DIA. 375DIA. 375DIA. 450DIA. 450DIA. 450DIA. 450DIA. 450DIA. 450DIA.	(mm) 375 375 375 450 450 450 450 450	height (mm) 375 375 375 450 450 450 450 450 450	ize length (m) 20.2 16.2 13.4 13.5 14.6 14.2 6.8 20.3	Grou USG (mPD) 11.100 12.720 14.360 15.680 16.000 15.000 14.400 14.260	DSG (mPD) 12.720 14.360 15.680 16.000 15.000 14.400 14.260 12.050	US (mPD) 9.725 9.658 9.604 9.559 9.514 9.465 9.395 9.361	DS (mPD) 9.658 9.604 9.559 9.514 9.465 9.395 9.361 9.259	(S _f) 0.003 0.003 0.003 0.003 0.003 0.005 0.005 0.005	cross area Pi (A) (m²) 0.11 0 0.11 0 0.11 0 0.16 0 0.16 0 0.16 0 0.16 0 0.16 0 0.16 0 0.16 0 0.16 0 0.22 0	te De Dia. (D) (m) (m) (mi)	t _f n) (mir 0 0.32 2 0.26 8 0.21 0 0.19 9 0.21 0 0.16 6 0.08 4 0.22 8 0.19	$\begin{array}{c c} t_c \\ (min) \\ 2 \\ 5.32 \\ 5 \\ 5.58 \\ 5.80 \\ 5.99 \\ 6.20 \\ 6 \\ 6.36 \\ 6 \\ 6 \\ 6 \\ 6 \\ 6 \\ 6 \\ 6 \\ 6 \\ 6 \\$	mean intensii 2-year (mm/h) 189.85 187.36 185.37 183.64 181.83 180.43 179.77 177.84	ty Runoff (m ³ /s) 0.029 0.050 0.071 0.091 0.114 0.139 0.138 0.146	Capacity (m ³ /s) 0.115 0.115 0.115 0.186 0.186 0.228 0.228 0.228	Velocity (m/s) 1.041 1.041 1.041 1.169 1.169 1.434 1.434 1.434	Velocity (m/s) 0.266 0.452 0.640 0.575 0.716 0.872 0.869 0.920	(entry) 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500	(exit) 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000	(entry) (m) 0.002 0.005 0.010 0.008 0.013 0.019 0.019 0.022	(exit) (m) 0.004 0.010 0.021 0.017 0.026 0.039 0.039 0.043	(Reynold number) 8.3E+04 1.4E+05 2.0E+05 2.2E+05 2.7E+05 3.3E+05 3.3E+05 3.5E+05	6.378 6.494 6.550 6.689 6.721 6.746 6.745 6.752 6.867	(friction ceof 0.02458 0.02371 0.02331 0.02235 0.02214 0.02198 0.02198 0.02194 0.02121	 (friction) (m) 0.0048 0.0106 0.0174 0.0113 0.0188 0.0268 0.0128 0.0428 0.0231 	H (m) 0.010 0.026 0.049 0.037 0.058 0.085 0.085 0.071 0.108	3.350 Water leve (mPD) 9.803 9.793 9.767 9.718 9.682 9.624 9.539 9.468	vel
	ion DS SMH-2 SMH-3 SMH-4 SMH-5 SMH-6 SMH-6 SMH-7 SMH-8 SMH-8 SMH-9 SMH-10	Sub- Catchment Reference SITE C - Remaining Area SITE B	Imper Sub- Catchment (m²) 619 446 459 466 516 570 0 a 216 637	rmeable Accumula Area (m ²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,076 3,292 3,929	Catchment Area Permeable ative Sub- Accumulati Catchment Area (m²) (m²) (m²) (m²) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	/e Sub- Catchmen (m²) 619 446 459 466 516 570 0 216 637	Accumulative (m ²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,292 3,929	Shape 375DIA. 375DIA. 375DIA. 375DIA. 450DIA. 450DIA. 450DIA. 450DIA. 450DIA. 525DIA.	(mm) 375 375 375 450 450 450 450 450 450 525	height (mm) 375 375 375 450 450 450 450 450 450 525	ize length (m) 20.2 16.2 13.4 13.5 14.6 14.2 6.8 20.3 17.6	Grou USG (mPD) 11.100 12.720 14.360 15.680 15.000 15.000 14.400 14.260 12.050	DSG (mPD) 12.720 14.360 15.680 16.000 15.000 14.400 14.260 12.050 10.220	US (mPD) 9.725 9.658 9.604 9.559 9.514 9.465 9.395 9.361 7.611 6.023	DS (mPD) 9.658 9.604 9.559 9.514 9.465 9.395 9.361 9.259 7.523	(S _f) 0.003 0.003 0.003 0.003 0.003 0.005 0.005 0.005 0.005	cross area Pi (A) (m²) 0.11 0 0.11 0 0.11 0 0.16 0 0.16 0 0.16 0 0.16 0 0.16 0 0.16 0 0.12 0	te De Dia. (D) (m) 0.375 5.00 0.375 5.32 0.375 5.53 0.375 5.53 0.450 5.80 0.450 5.80 0.450 5.80 0.450 5.99 0.450 6.20 0.450 6.30 0.450 6.31 0.450 6.32 0.450 6.34 0.525 6.66	t _f n) (mir 0 0.32 2 0.26 8 0.21 0 0.19 9 0.21 6 0.08 4 0.22 8 0.19 6 0.14	t _c (min) 2 5.32 5 5.58 5 5.80 5 5.99 6 6.20 5 6.36 8 6.44 4 6.68 9 6.86 4 7.00	mean intensit 2-year (mm/h) 189.85 187.36 185.37 183.64 181.83 180.43 179.77 177.84 176.37	ty Runoff (m ³ /s) 0.029 0.050 0.071 0.091 0.114 0.139 0.138 0.146 0.173	Capacity (m ³ /s) 0.115 0.115 0.115 0.186 0.186 0.228 0.228 0.228 0.228 0.342	Velocity (m/s) 1.041 1.041 1.041 1.169 1.169 1.434 1.434 1.434 1.580	Velocity (m/s) 0.266 0.452 0.640 0.575 0.716 0.872 0.869 0.920 0.800	(entry) 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500	(exit) 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000	(entry) (m) 0.002 0.005 0.010 0.008 0.013 0.019 0.019 0.022 0.016 0.027	(exit) (m) 0.004 0.010 0.021 0.017 0.026 0.039 0.039 0.043 0.033	(Reynold number) 8.3E+04 1.4E+05 2.0E+05 2.2E+05 2.7E+05 3.3E+05 3.3E+05 3.5E+05	6.378 6.494 6.550 6.689 6.721 6.746 6.745 6.752 6.867 6.895	(friction ceof 0.02458 0.02371 0.02331 0.02235 0.02214 0.02198 0.02198 0.02194 0.02121	 (friction) (m) 0.0048 0.0106 0.0174 0.0113 0.0188 0.0268 0.0128 0.0428 0.0231 0.0284 	H (m) 0.010 0.026 0.049 0.037 0.058 0.058 0.085 0.071 0.108 0.072	3.350 Water lev (mPD) 9.803 9.793 9.767 9.718 9.682 9.682 9.624 9.539 9.468 7.683	vel
	ion DS SMH-2 SMH-3 SMH-4 SMH-5 SMH-6 SMH-7 SMH-8 SMH-7 SMH-8 SMH-9 SMH-10 SMH-11	Sub- Catchment Reference SITE C - Remaining Area SITE B Remaining Area	Imper Sub- Catchment (m²) 619 446 459 466 516 570 0 a 1,110	rmeable Accumula Area (m ²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,292 3,929 5,039	Catchment Area Permeable ative Sub- Accumulati Catchment Area (m²) (m²) (m²) (m²) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Ve Sub- Catchmen (m²) 619 446 459 466 516 570 0 216 637 1,110	Accumulative (m ²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,076 3,292 3,929 5,039	Shape 375DIA. 375DIA. 375DIA. 450DIA. 450DIA. 450DIA. 450DIA. 450DIA. 525DIA. 525DIA.	(mm) 375 375 375 450 450 450 450 450 450 525 525	height (mm) 375 375 375 450 450 450 450 450 450 525 525	ize length (m) 20.2 16.2 13.4 13.5 14.6 14.2 6.8 20.3 17.6 13.4 12.4	Grou USG (mPD) 11.100 12.720 14.360 15.680 15.000 15.000 14.400 14.260 12.050 10.220 8.850	DSG (mPD) 12.720 14.360 15.680 16.000 15.000 14.400 14.260 12.050 10.220 8.850	US (mPD) 9.725 9.658 9.604 9.559 9.514 9.395 9.361 7.611 6.023 4.856	DS (mPD) 9.658 9.604 9.559 9.514 9.465 9.395 9.361 9.259 7.523 5.956 4.794	(S _f) 0.003 0.003 0.003 0.003 0.003 0.005 0.005 0.005 0.005	cross area Pi (A) (m²) 0.11 0 0.11 0 0.11 0 0.16 0 0.16 0 0.16 0 0.16 0 0.16 0 0.16 0 0.16 0 0.22 0 0.22 0	te be Dia. (D) (m) (min 0.375 5.00 0.375 5.32 0.375 5.32 0.375 5.53 0.450 5.80 0.450 5.80 0.450 6.20 0.450 6.30 0.450 6.30 0.450 6.44 0.525 6.68	t _f n) (mir 0 0.32 2 0.26 8 0.21 0 0.19 9 0.21 0 0.16 6 0.12 6 0.14 0 0.15	t _c (min) (min) 5.32 5.58 5.58 5.80 5.99 6.20 6.36 6.36 6.36 8 6.44 4 6.68 9 6.86 4 7.00 8 7.13	mean intensit 2-year (mm/h) 189.85 187.36 185.37 183.64 181.83 180.43 179.77 177.84 176.37 175.28	ty Runoff (m ³ /s) 0.029 0.050 0.071 0.091 0.114 0.139 0.138 0.146 0.173 0.221	Capacity (m ³ /s) 0.115 0.115 0.115 0.186 0.186 0.228 0.228 0.228 0.228 0.228 0.342	Velocity (m/s) 1.041 1.041 1.041 1.169 1.169 1.434 1.434 1.434 1.434 1.580 1.580	Velocity (m/s) 0.266 0.452 0.640 0.575 0.716 0.872 0.869 0.920 0.800 1.020	(entry) 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500	(exit) 1.000	(entry) (m) 0.002 0.005 0.010 0.008 0.013 0.019 0.019 0.019 0.022 0.016 0.027 0.030	(exit) (m) 0.004 0.010 0.021 0.017 0.026 0.039 0.039 0.033 0.043 0.033 0.053 0.059	(Reynold number) 8.3E+04 1.4E+05 2.0E+05 2.2E+05 2.7E+05 3.3E+05 3.3E+05 3.5E+05 3.5E+05 4.5E+05	6.378 6.494 6.550 6.689 6.721 6.746 6.745 6.752 6.867 6.900	(friction ceof 0.02458 0.02371 0.02331 0.02235 0.02214 0.02198 0.02198 0.02194 0.02121 0.02104	 (friction) (m) 0.0048 0.0106 0.0174 0.0113 0.0188 0.0268 0.0128 0.0231 0.0284 0.0294 	H (m) 0.010 0.026 0.049 0.037 0.058 0.085 0.071 0.108 0.072 0.108 0.118	3.350 Water leve (mPD) 9.803 9.793 9.767 9.718 9.682 9.624 9.624 9.539 9.468 7.683 6.131	vel
	ion DS SMH-2 SMH-3 SMH-4 SMH-5 SMH-6 SMH-6 SMH-7 SMH-8 SMH-9 SMH-10 SMH-11 SMH-11 SMH-12	Sub- Catchment Reference SITE C - Remaining Area SITE B Remaining Area	Imper Sub- Catchment (m²) 619 446 459 466 516 570 0 a 1,110	rmeable Accumula Area (m ²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,076 3,292 3,929 5,039 5,354	Catchment Area Permeable ative Sub- Catchment Accumulati Catchment Area (m²) (m²) (m²) (m²) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Ve Sub- Catchmen (m²) 619 446 459 466 516 570 0 216 637 1,110	Accumulative (m ²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,292 3,929 5,039 5,039	Shape 375DIA. 375DIA. 375DIA. 375DIA. 450DIA. 450DIA. 450DIA. 450DIA. 525DIA. 525DIA. 525DIA. 525DIA.	(mm) 375 375 450 450 450 450 450 450 525 525 525	height (mm) 375 375 375 450 450 450 450 450 450 525 525 525	ize length (m) 20.2 16.2 13.4 13.5 14.6 14.2 6.8 20.3 17.6 13.4 12.4	Grou USG (mPD) 11.100 12.720 14.360 15.680 16.000 15.000 14.400 14.260 12.050 10.220 8.850	DSG (mPD) 12.720 14.360 15.680 16.000 15.000 14.400 14.260 12.050 10.220 8.850 7.590	US (mPD) 9.725 9.658 9.604 9.559 9.514 9.395 9.361 7.611 6.023 4.856	DS (mPD) 9.658 9.604 9.559 9.514 9.465 9.395 9.361 9.259 7.523 5.956 4.794 3.696	(S _f) 0.003 0.003 0.003 0.003 0.003 0.005 0.005 0.005 0.005 0.005 0.005	cross area Pi (A) (m²) 0.11 0 0.11 0 0.11 0 0.16 0 0.16 0 0.16 0 0.16 0 0.16 0 0.16 0 0.22 0 0.22 0 0.22 0	te De Dia. (D) (m) (mi) 0.375 5.00 0.375 5.32 0.375 5.53 0.375 5.53 0.375 5.53 0.450 5.80 0.450 5.80 0.450 5.80 0.450 6.20 0.450 6.20 0.450 6.21 0.450 6.25 6.60 0.525 6.60 0.525 7.00	t _f n) (mir 0 0.32 2 0.26 8 0.27 0 0.16 9 0.27 0 0.16 6 0.08 4 0.22 8 0.12 6 0.14 0 0.13 3 0.21	t _c (min) 2 5.32 5 5.58 5.80 5.99 6.20 5 6.36 6.36 6.44 6.68 6.68 6.86 4 7.00 3 7.13 7.34	mean intensit 2-year (mm/h) 189.85 187.36 185.37 183.64 181.83 180.43 179.77 177.84 176.37 175.28 174.28	ty Runoff (m ³ /s) 0.029 0.050 0.071 0.091 0.114 0.139 0.138 0.146 0.173 0.221 0.233	Capacity (m ³ /s) 0.115 0.115 0.115 0.186 0.186 0.228 0.228 0.228 0.228 0.228 0.342 0.342	Velocity (m/s) 1.041 1.041 1.041 1.169 1.169 1.434 1.434 1.434 1.434 1.580 1.580	Velocity (m/s) 0.266 0.452 0.640 0.575 0.716 0.872 0.869 0.920 0.800 1.020 1.078	(entry) 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500	(exit) 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000	(entry) (m) 0.002 0.005 0.010 0.008 0.013 0.019 0.019 0.019 0.022 0.016 0.027 0.030	(exit) (m) 0.004 0.010 0.021 0.017 0.026 0.039 0.039 0.033 0.043 0.033 0.053 0.059	(Reynold number) 8.3E+04 1.4E+05 2.0E+05 2.2E+05 2.7E+05 3.3E+05 3.3E+05 3.5E+05 4.5E+05 4.7E+05	6.378 6.494 6.550 6.689 6.721 6.746 6.745 6.752 6.807 6.895 6.900 6.899	(friction ceof 0.02458 0.02371 0.02331 0.02235 0.02214 0.02198 0.02198 0.02194 0.02194 0.02104 0.02100	 (friction) (m) 0.0048 0.0106 0.0174 0.0113 0.0188 0.0268 0.0128 0.0231 0.0284 0.0294 0.0454 	H (m) 0.010 0.026 0.049 0.037 0.058 0.085 0.071 0.108 0.072 0.108 0.118 0.133	3.350 Water lev (mPD) 9.803 9.793 9.767 9.718 9.682 9.682 9.624 9.682 9.624 9.539 9.468 7.683 6.131 4.974	vel
	ion DS SMH-2 SMH-3 SMH-3 SMH-4 SMH-5 SMH-5 SMH-6 SMH-7 SMH-6 SMH-7 SMH-8 SMH-9 SMH-10 SMH-10 SMH-11 SMH-12 STMH-01	Sub- Catchment Reference SITE C - Remaining Area SITE B Remaining Area	Imper Sub- Catchment (m²) 619 446 459 466 516 570 0 a 1,110	rmeable Accumula Area (m ²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,076 3,292 3,929 5,039 5,354 5,354	Catchment Area Permeable ative Sub- Catchment Accumulati Catchment Area (m²) (m²) 0 0	Ve Sub- Catchmen (m²) 619 446 459 466 516 570 0 216 637 1,110	Accumulative (m ²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,076 3,292 3,929 5,039 5,039 5,354 5,354	Shape 375DIA. 375DIA. 375DIA. 375DIA. 450DIA. 450DIA. 450DIA. 450DIA. 450DIA. 525DIA. 525DIA. 525DIA. 525DIA.	(mm) 375 375 375 450 450 450 450 450 450 525 525 525 525	height (mm) 375 375 375 450 450 450 450 450 450 525 525 525 525 525	ize length (m) 20.2 16.2 13.4 13.5 14.6 14.2 6.8 20.3 17.6 13.4 12.4 19.5	Grou USG (mPD) 11.100 12.720 14.360 15.680 16.000 15.000 14.400 14.260 12.050 10.220 8.850 7.590	DSG (mPD) 12.720 14.360 15.680 16.000 15.000 14.400 14.260 12.050 10.220 8.850 7.590 6.000	US (mPD) 9.725 9.658 9.604 9.559 9.514 9.465 9.395 9.361 7.611 6.023 4.856 3.794	DS (mPD) 9.658 9.604 9.559 9.514 9.465 9.395 9.361 9.259 7.523 5.956 4.794 3.696 2.475	(S _f) 0.003 0.003 0.003 0.003 0.003 0.005 0.005 0.005 0.005 0.005 0.005 0.005	cross area Pi (A) (m ²) 0.11 0 0.11 0 0.11 0 0.16 0 0.16 0 0.16 0 0.16 0 0.16 0 0.16 0 0.22 0 0.22 0 0.22 0 0.22 0 0.22 0	te De Dia. (D) (m) (min 0.375 5.00 0.375 5.32 0.375 5.32 0.375 5.32 0.375 5.32 0.450 5.80 0.450 6.20 0.450 6.30 0.450 6.30 0.450 6.44 0.525 6.60 0.525 7.00 0.525 7.13	t _f n) (mir 0 0.32 2 0.26 8 0.21 0 0.19 9 0.21 0 0.16 6 0.12 6 0.11 3 0.21	t_c a) (min) 2 5.32 3 5.58 5 5.80 9 5.99 6 6.20 6 6.36 8 6.44 4 6.68 9 6.20 8 7.13 7.34 7.39	mean intensit 2-year (mm/h) 189.85 187.36 185.37 183.64 181.83 180.43 179.77 177.84 176.37 175.28 172.74	ty Runoff (m ³ /s) 0.029 0.050 0.071 0.091 0.114 0.139 0.138 0.146 0.173 0.221 0.233 0.231	Capacity (m ³ /s) 0.115 0.115 0.115 0.186 0.186 0.228 0.228 0.228 0.228 0.228 0.228 0.342 0.342 0.342 0.342	Velocity (m/s) 1.041 1.041 1.041 1.169 1.169 1.434 1.434 1.434 1.434 1.580 1.580 1.580 1.580	Velocity (m/s) 0.266 0.452 0.640 0.575 0.716 0.872 0.869 0.920 0.800 1.020 1.078 1.068	(entry) 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500	(exit) 1.000	(entry) (m) 0.002 0.005 0.010 0.008 0.013 0.019 0.019 0.022 0.016 0.027 0.030 0.029 0.029	(exit) (m) 0.004 0.010 0.021 0.021 0.026 0.039 0.039 0.043 0.033 0.053 0.059 0.058	(Reynold number) 8.3E+04 1.4E+05 2.0E+05 2.2E+05 2.7E+05 3.3E+05 3.3E+05 3.5E+05 3.5E+05 4.7E+05 4.7E+05 4.7E+05	6.378 6.494 6.550 6.689 6.721 6.746 6.745 6.752 6.867 6.895 6.900 6.899 6.899 6.899	(friction ceof 0.02458 0.02371 0.02331 0.02235 0.02214 0.02198 0.02198 0.02194 0.02194 0.02101 0.02100 0.02101	 (friction) (m) 0.0048 0.0106 0.0174 0.0113 0.0188 0.0268 0.0128 0.0284 0.0294 0.0454 0.0099 	H (m) 0.010 0.026 0.049 0.037 0.058 0.071 0.085 0.071 0.108 0.072 0.108 0.118 0.133 0.097	3.350 Water leve (mPD) 9.803 9.793 9.767 9.718 9.682 9.624 9.624 9.539 9.468 7.683 6.131 4.974 4.629	vel
	ion DS SMH-2 SMH-3 SMH-3 SMH-4 SMH-5 SMH-5 SMH-5 SMH-6 SMH-7 SMH-6 SMH-7 SMH-7 SMH-7 SMH-10 SMH-10 SMH-11 SMH-11 SMH-12 STMH-01 SMH-01	Sub- Catchment Reference SITE C - Remaining Area SITE B Remaining Area	Imper Sub- Catchment (m²) 619 446 459 466 516 570 0 a 1,110	rmeable Accumula Area (m ²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,076 3,076 3,076 3,292 3,929 5,039 5,354 5,354	Catchment Area Permeable ative Sub- Catchment Accumulati Catchment Area (m²) 0 0 0	Ve Sub- Catchmen (m²) 619 446 459 466 516 570 0 216 637 1,110	Accumulative (m ²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,076 3,292 3,929 5,039 5,354 5,354 5,354	Shape 375DIA. 375DIA. 375DIA. 375DIA. 375DIA. 450DIA. 450DIA. 450DIA. 450DIA. 450DIA. 525DIA. 525DIA. 525DIA. 525DIA. 525DIA. 525DIA. 525DIA. 525DIA. 525DIA.	(mm) 375 375 375 450 450 450 450 450 450 525 525 525 525 525 525	height (mm) 375 375 375 450 450 450 450 450 450 450 525 525 525 525 525 525	ize length (m) 20.2 16.2 13.4 13.5 14.6 14.2 6.8 20.3 17.6 13.4 12.4 19.5 4.3	Grou USG (mPD) 11.100 12.720 14.360 15.680 15.680 16.000 14.400 14.260 12.050 10.220 8.850 7.590 6.000	DSG (mPD) 12.720 14.360 15.680 16.000 15.000 14.400 14.260 12.050 10.220 8.850 7.590 6.000 5.800	US (mPD) 9.725 9.658 9.604 9.559 9.514 9.395 9.361 7.611 6.023 4.856 3.794 2.496	DS (mPD) 9.658 9.604 9.559 9.514 9.465 9.395 9.361 9.259 7.523 5.956 4.794 3.696 2.475 2.273	(S _f) 0.003 0.003 0.003 0.003 0.003 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005	cross area Pi (A) (m²) 0.11 0 0.11 0 0.11 0 0.11 0 0.11 0 0.16 0 0.16 0 0.16 0 0.16 0 0.16 0 0.22 0 0.22 0 0.22 0 0.22 0 0.22 0 0.22 0 0.22 0	te De Dia. (D) (m) (m) (min 0.375 5.00 0.375 5.32 0.375 5.32 0.375 5.53 0.450 5.80 0.450 5.80 0.450 5.99 0.450 6.20 0.450 6.20 0.450 6.21 0.450 6.30 0.450 6.25 6.60 0.525 6.60 0.525 7.00 0.525 7.13 0.525 7.34	t _f n) (mir 0 0.32 2 0.26 8 0.27 0 0.16 9 0.27 0 0.16 6 0.08 4 0.22 8 0.12 6 0.14 0 0.13 3 0.21 4 0.02 9 0.43	t _c (min) 2 5.32 5 5.58 5.80 5.99 6.20 5 6.36 6.36 6.44 6.68 6.68 6.86 7.00 8 7.13 7.34 4 7.39 8 7.81	mean intensit 2-year (mm/h) 189.85 187.36 185.37 183.64 181.83 180.43 179.77 177.84 176.37 175.28 172.74 172.41	ty Runoff (m ³ /s) 0.029 0.050 0.071 0.091 0.114 0.139 0.138 0.146 0.173 0.221 0.233 0.231 0.231	Capacity (m ³ /s) 0.115 0.115 0.115 0.186 0.186 0.228 0.228 0.228 0.228 0.228 0.228 0.342 0.342 0.342 0.342 0.342	Velocity (m/s) 1.041 1.041 1.041 1.169 1.169 1.434 1.434 1.434 1.434 1.580 1.580 1.580 1.580 1.580	Velocity (m/s) 0.266 0.452 0.640 0.575 0.716 0.872 0.869 0.920 0.800 1.020 1.078 1.068 1.066	(entry) 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500	(exit) 1.000	(entry) (m) 0.002 0.005 0.010 0.008 0.013 0.019 0.019 0.022 0.016 0.027 0.030 0.029 0.029	(exit) (m) 0.004 0.010 0.021 0.017 0.026 0.039 0.039 0.033 0.043 0.033 0.053 0.059 0.058 0.058	(Reynold number) 8.3E+04 1.4E+05 2.0E+05 2.2E+05 2.7E+05 3.3E+05 3.3E+05 3.5E+05 3.5E+05 4.7E+05 4.7E+05 4.7E+05	6.378 6.494 6.550 6.689 6.721 6.745 6.745 6.752 6.895 6.900 6.899 6.899 6.899 6.899	(friction ceof 0.02458 0.02371 0.02331 0.02235 0.02214 0.02198 0.02198 0.02194 0.02194 0.02104 0.02101 0.02101 0.02101 0.02101 0.02102	 (friction) (m) 0.0048 0.0106 0.0174 0.0113 0.0188 0.0268 0.0128 0.0231 0.0284 0.0294 0.0454 0.0906 	H (m) 0.010 0.026 0.049 0.037 0.058 0.071 0.085 0.071 0.108 0.072 0.108 0.118 0.133 0.097	3.350 Water lev (mPD) 9.803 9.793 9.767 9.718 9.682 9.624 9.682 9.624 9.539 9.468 7.683 6.131 4.974 4.629 4.496	vel
	ion DS SMH-2 SMH-3 SMH-3 SMH-4 SMH-5 SMH-5 SMH-6 SMH-7 SMH-6 SMH-7 SMH-8 SMH-7 SMH-8 SMH-9 SMH-10 SMH-11 SMH-11 SMH-12 SMH-12 STMH-01 SMH-M1a SMH-M2a	Sub- Catchment Reference SITE C - Remaining Area SITE B Remaining Area	Imper Sub- Catchment (m²) 619 446 459 466 516 570 0 a 1,110	rmeable Accumula Area (m ²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,076 3,292 3,929 5,039 5,354 5,354 5,354	Catchment Area Permeable ative Sub- Catchment Accumulati Catchment Area (m²) (m²) 0 0	Ve Sub- Catchmen (m²) 619 446 459 466 516 570 0 216 637 1,110	Accumulative (m ²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,076 3,292 3,929 5,039 5,039 5,354 5,354 5,354	Shape 375DIA. 375DIA. 375DIA. 375DIA. 450DIA. 450DIA. 450DIA. 450DIA. 450DIA. 525DIA. 525DIA. 525DIA. 525DIA. 525DIA. 525DIA. 525DIA.	(mm) 375 375 375 450 450 450 450 450 450 525 525 525 525 525 525 525 525	height (mm) 375 375 375 450 450 450 450 450 450 450 525 525 525 525 525 525 525	ize length (m) 20.2 16.2 13.4 13.5 14.6 14.2 6.8 20.3 17.6 13.4 12.4 19.5 4.3 40.5 41.5	Grou USG (mPD) 11.100 12.720 14.360 15.680 15.680 16.000 14.400 14.260 12.050 10.220 8.850 7.590 6.000 5.800 4.900	DSG (mPD) 12.720 14.360 15.680 16.000 15.000 14.400 14.260 12.050 10.220 8.850 7.590 6.000 5.800 4.900	US (mPD) 9.725 9.658 9.604 9.559 9.514 9.395 9.361 7.611 6.023 4.856 3.794 2.496 2.475 2.273	DS (mPD) 9.658 9.604 9.559 9.514 9.465 9.395 9.361 9.259 7.523 5.956 4.794 3.696 2.475 2.273 2.065	(S _f) 0.003 0.003 0.003 0.003 0.003 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005	cross area Pi (A) (m²) 0.11 0 0.11 0 0.11 0 0.11 0 0.11 0 0.16 0 0.16 0 0.16 0 0.16 0 0.16 0 0.22 0 0.22 0 0.22 0 0.22 0 0.22 0 0.22 0 0.22 0 0.22 0 0.22 0 0.22 0 0.22 0	te De Dia. (D) (m) (min 0.375 5.00 0.375 5.32 0.375 5.32 0.450 6.32 0.450 6.34 0.525 6.64 0.525 7.00 0.525 7.13 0.525 7.33 0.525 7.33	t _f n) (mir 0 0.32 2 0.26 8 0.21 0 0.19 9 0.21 0 0.16 6 0.08 3 0.21 9 0.43 1 0.44	t_c a) (min) 2 5.32 3 5.58 3 5.80 4 6.20 5 6.36 6 6.44 4 6.68 9 6.20 5 6.36 8 6.44 4 6.68 9 7.13 1 7.34 4 7.39 3 7.81 4 8.25	mean intensit 2-year (mm/h) 189.85 187.36 185.37 183.64 181.83 180.43 179.77 177.84 176.37 175.28 172.74 172.74 169.37	ty Runoff (m ³ /s) 0.029 0.050 0.071 0.091 0.114 0.139 0.138 0.146 0.173 0.221 0.233 0.231 0.231 0.227	Capacity (m ³ /s) 0.115 0.115 0.115 0.186 0.186 0.228 0.228 0.228 0.228 0.228 0.228 0.342 0.342 0.342 0.342 0.342 0.342	Velocity (m/s) 1.041 1.041 1.041 1.169 1.169 1.434 1.434 1.434 1.434 1.580 1.580 1.580 1.580 1.580 1.580	Velocity (m/s) 0.266 0.452 0.640 0.575 0.716 0.872 0.869 0.920 0.800 1.020 1.020 1.078 1.068 1.066 1.047	(entry) 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500	(exit) 1.000	(entry) (m) 0.002 0.005 0.010 0.008 0.013 0.019 0.019 0.022 0.016 0.027 0.030 0.029 0.029 0.028 0.027	(exit) (m) 0.004 0.010 0.021 0.017 0.026 0.039 0.039 0.033 0.033 0.043 0.033 0.053 0.059 0.058 0.058 0.056 0.054	(Reynold number) 8.3E+04 1.4E+05 2.0E+05 2.2E+05 2.7E+05 3.3E+05 3.3E+05 3.5E+05 3.5E+05 4.7E+05 4.7E+05 4.7E+05 4.7E+05 4.7E+05 4.5E+05	6.378 6.494 6.550 6.689 6.721 6.746 6.745 6.752 6.807 6.895 6.900 6.899 6.899 6.899 6.899 6.899 6.899 6.898 6.896	(friction ceof 0.02458 0.02371 0.02331 0.02235 0.02214 0.02198 0.02198 0.02194 0.02194 0.02104 0.02101 0.02101 0.02101 0.02101 0.02102	 (friction) (m) 0.0048 0.0106 0.0174 0.0113 0.0188 0.0268 0.0128 0.0284 0.0294 0.0294 0.0454 0.0099 0.0906 0.0897 	H (m) 0.010 0.026 0.049 0.037 0.058 0.071 0.085 0.071 0.108 0.072 0.108 0.118 0.133 0.097 0.174 0.171	3.350 Water leve (mPD) 9.803 9.793 9.767 9.718 9.682 9.624 9.624 9.624 9.539 9.468 7.683 6.131 4.974 4.629 4.496 4.400	vel

Loca	ion	Sub-			Catchn	nent Area						Drainag	e Character					Hydraulic para	ameter	Time		(i) Extreme	Peak	Full Bore	Full Bore	Mean	k	k	Н	Н	Re	1/f^(1/2)	f	н	Total	Water lev
JS	DS	Catchment	Imper	meable	Perr	neable	-	Total	Drainage		Drainage si	ze	Grou	ind level	Inv	ert level	Slope		t _e	, t _f	t _c	mean intensity	Runoff	Capacity	Velocity	Velocity	(entry)	(exit)	(entry)	(exit)	(Reynold		(friction ceof)	(friction)	н	
		Reference	Sub-	Accumulative	Sub-	Accumulative	e Sub-	Accumulative	Shape	width	height	length	USG	DSG	US	DS		cross area Pi	'ipe Dia.			10-year					,	. ,			number)			. ,		
			Catchment	Area	Catchment	Area	Catchment	t Area		(mm)	(mm)	(m)	(mPD)	(mPD)	(mPD)	(mPD)	(S _f)	(A)	(D)																	
			(m ²)	(m ²)	(m ²)	(m ²)	(m ²)	(m ²)		· · ·	. ,	. ,	. ,	· · ·		, ,		(m ²)	(m) (mi	n) (min)	(min)	(mm/h)	(m ³ /s)	(m ³ /s)	(m/s)	(m/s)			(m)	(m)				(m)	(m)	(mPD)
-1	SMH-2		619	619	0	0	619	619	375DIA.	375	375	20.2	11.100	12.720	9.725	9.658	0.003	()	0.375 5.0	, , ,	5.32	235.80	0.036	0.115	1.041	0.330	0.500	1.000	0.003	0.006	1.0E+05	6.430	0.02418	0.0072	0.016	10.047
2	SMH-3	-	446	1,065	0	0	446	1,065	375DIA.	375	375	16.2	12.720	14.360	9.658	9.604	0.003		0.375 5.3		5.58	232.96	0.062	0.115	1.041	0.562	0.500	1.000	0.008	0.016	1.8E+05	6.531	0.02345	0.0163	0.040	10.032
;	SMH-4	-	459	1,524	0	0	459	1,524	375DIA.	375	375	13.4	14.360	15.680	9.604	9.559	0.003		0.375 5.5		5.80	230.69	0.088	0.115	1.041	0.796	0.500	1.000	0.016	0.032	2.5E+05	6.579	0.02310	0.0267	0.075	9.991
	SMH-5	SITE C	466	1,990	0	0	466	1,990	450DIA.	450	450	13.5	15.680	16.000	9.559	9.514	0.003		0.450 5.8		5.99	228.72	0.114	0.186	1.169	0.716	0.500	1.000	0.013	0.026	2.7E+05	6.721	0.02214	0.0173	0.056	9.916
	SMH-6	-	516	2,506	0	0	516	2,506	450DIA.	450	450	14.6	16.000	15.000	9.514	9.465	0.003		0.450 5.9		6.20	226.65	0.142	0.186	1.169	0.893	0.500	1.000	0.020	0.041	3.3E+05	6.748	0.02196	0.0290	0.090	9.860
	SMH-7	-	570	3.076	0	0	570	3,076	450DIA.	450	450	14.2	15.000	14.400	9.465	9.395	0.005		0.450 6.2		6.36	225.06	0.173	0.228	1.434	1.088	0.500	1.000	0.030	0.060	4.1E+05	6.769	0.02182	0.0415	0.132	9.770
	SMH-8		0	3,076	0	0	0	3,076	450DIA.	450	450	6.8	14.400	14.260	9.395	9.361	0.005		0.450 6.3		6.44	224.31	0.170	0.228	1.434	1.085	0.500	1.000	0.030	0.060	4.1E+05		0.02182	0.0197	0.102	9.638
	SMH-9	Remaining Area	216	3,292	0	0	216	3,292	450DIA.	450	450	20.3	14.260	12.050	9.361	9.259	0.005		0.450 6.4		6.68	222.13	0.183	0.228	1.434	1.149	0.500	1.000	0.034	0.067	4.3E+05	6.775	0.02179	0.0663	0.167	9.528
	SMH-10	SITE B	637	3,929	0	0	637	3,929	525DIA.	525	525	17.6	12.050	10.220	7.611	7.523	0.005		0.525 6.6		6.86	220.47	0.217	0.342	1.580	1.000	0.500	1.000	0.034	0.051	4.4E+05	6.893	0.02105	0.0359	0.107	7.723
	SMH-10 SMH-11	Remaining Area		5.039	0	0	1,110	5,039	525DIA.	525	525	13.4	10.220	8.850	6.023	5.956	0.005		0.525 6.8		7.00	219.23	0.276	0.342	1.580	1.276	0.500	1.000	0.020	0.083	5.6E+05	6.916	0.02091	0.0442	0.169	6.191
_	SMH-11 SMH-12	SITE A	315	5,039	0	0	315	5,039	525DIA.	525	525	13.4	8.850	7.590	4.856	4.794	0.005		0.525 0.6		7.00	219.23	0.270	0.342	1.580	1.349	0.500	1.000	0.041	0.083	5.9E+05	6.921	0.02091	0.0442	0.185	5.041
	STMH-01	SILA	0	5,354	0	0	0	5,354	525DIA. 525DIA.	525	525	12.4	7.590	6.000	3.794	3.696	0.005		0.525 7.1		7.13	216.10	0.292	0.342	1.580	1.349	0.500	1.000	0.046	0.093	5.9E+05	6.921	0.02088	0.0458	0.183	4.704
	STMH-01 SMH-M1a	-	0	5,354	0	0	0	5,354	525DIA.	525	525	4.3	6.000	5.800	2.496	2.475	0.005		0.525 7.3		7.34	216.00	0.290	0.342	1.580	1.336	0.500	1.000	0.046	0.091	5.9E+05	6.920	0.02088	0.0709	0.208	4.704
a	SMH-M1a	-	0	5,354	0	0	0	-	525DIA.	525	525	4.3	5.800	4.900	2.490	2.473	0.005				7.81	210.00	0.289	0.342	1.580	1.330	0.500	1.000	0.043	0.091	5.8E+05		0.02088	0.0134	0.132	4.490
a a	SMH-M3a	-	0	5,354	0	0	0	5,354	525DIA.		-											209.26	-								5.7E+05	6.919	0.02089	0.1419		
	SMH-M3a	-	0	5,354	0	0	0	5,354	525DIA.	525	525	41.5	4.900	4.500	2.273	2.065	0.005		0.525 7.8		8.25		0.280	0.342	1.580	1.294	0.500	1.000	0.043	0.085		6.917			0.269	4.070
I		-	0	•	0	0	0	5,354		525 525	525 525	64.0 3.0	4.500 4.150	4.150 4.150	2.065 1.745	1.745 1.730	0.005 0.005		0.525 8.2 0.525 8.9		8.93 8.96	204.48 204.27	0.274	0.342	1.580 1.580	1.264 1.212	0.500 0.500	1.000 1.000	0.041	0.081	5.5E+05 5.3E+05	6.915 6.912	0.02091	0.2077	0.330	3.801 3.471
Sto	OUTFALL	n (2 vear rain	1 0 1 + 10 vea	5,138 r sea level)	0	0	5,354	525DIA.	525	1	-				·		·																		2.820 3.350
Sto	mwater Drai	n (2 year rain	· · ·		,	0	0	5,354	525DIA.	525			e Character			·		Hydraulic para	ameter	Time		(i) Extreme	Peak	Full Bore	Full Bore	Mean	k	k	н	н	Re	1/f^(1/2)	f	н	Total	3.350
Sto	mwater Drai	Sub-		r sea level	Catchn	0 nent Area meable						Drainaç	e Character Grou	ind level	Inv	ert level	Slope	Hydraulic para	ameter	Time	ta	(i) Extreme				Mean Velocity		k (exit)	H (entry)	H (exit)		1/f^(1/2)				
Sto	mwater Drai	Sub- Catchment	Imper	r sea level meable	Catchn Perr	neable		Total	Drainage		Drainage si	Drainaç ze	Grou	Ind level		ert level	Slope		t _e	Time	t _c	mean intensity							H (entry)		(Reynold		f (friction ceof)			3.350
Sto	mwater Drai	Sub-	Imper Sub-	r sea level meable Accumulative	Catchn Perr Sub-	neable Accumulative	e Sub-	Total Accumulative		width	Drainage si height	Drainaç ze length	Grou USG	DSG	US	DS		cross area Pi	lipe Dia.	Time	t _c															3.350
Sto	mwater Drai	Sub- Catchment	Imper Sub- Catchment	r sea level meable Accumulative Area	Catchn Perr Sub- Catchment	neable Accumulative		Total Accumulative t Area	Drainage		Drainage si	Drainaç ze	Grou	DSG	US	DS	Slope (S _f)	cross area Pi (A)	lipe Dia. (D)	, t _f	t _c	mean intensity 2-year	Runoff	Capacity	Velocity	Velocity			(entry)	(exit)	(Reynold				н	3.350 Water lev
Sto	mwater Drai ^{ion} DS	Sub- Catchment	Imper Sub- Catchment (m ²)	r sea level meable Accumulative Area (m ²)	Catchn Perr Sub-	neable Accumulative	e Sub- Catchment (m ²)	Total Accumulative t Area (m ²)	Drainage Shape	width (mm)	Drainage si height (mm)	Drainag ze length (m)	Grou USG (mPD)	DSG (mPD)	US (mPD)	DS (mPD)	(S _f)	cross area Pi (A) (m ²)	lipe Dia. (D) (m) (mi	n) (min)	t _c (min) 5.32	mean intensity 2-year (mm/h)	Runoff (m ³ /s)	Capacity (m ³ /s)	Velocity (m/s)	Velocity (m/s)	(entry)	(exit)	(entry) (m)	(exit) (m)	(Reynold number)		(friction ceof)	(friction) (m)	H (m)	3.350 Water lev (mPD)
Sto	mwater Drai ^{ion} DS SMH-2	Sub- Catchment	Imper Sub- Catchment (m ²) 619	r sea level meable Accumulative Area (m ²) 619	Catchn Perr Sub- Catchment	neable Accumulative Area (m ²)	e Sub- Catchment (m ²) 619	Total Accumulative t Area (m²) 619	Drainage Shape 375DIA.	width (mm) 375	Drainage si height (mm) 375	Drainag ze length (m) 20.2	Grou USG (mPD) 11.100	DSG (mPD) 12.720	US (mPD) 9.725	DS (mPD) 9.658	(S _f)	cross area Pi (A) (m ²) 0.11	t _e tipe Dia. (D) (m) (mi) 0.375 5.0	n) (min) 0 0.32	5.32	mean intensity 2-year (mm/h) 189.85	Runoff (m ³ /s) 0.029	Capacity (m ³ /s) 0.115	Velocity (m/s) 1.041	Velocity (m/s) 0.266	(entry) 0.500	(exit)	(entry) (m) 0.002	(exit) (m) 0.004	(Reynold number) 8.3E+04	6.378	(friction ceof)	(friction) (m) 0.0048	H (m) 0.010	3.350 Water lev (mPD) 9.803
Sto	mwater Drai ion DS SMH-2 SMH-3	Sub- Catchment Reference	Imper Sub- Catchment (m ²) 619 446	r sea level meable Accumulative Area (m ²) 619 1,065	Catchn Perr Sub- Catchment	neable Accumulative Area (m ²)	e Sub- Catchment (m ²) 619 446	Total Accumulative t Area (m ²) 619 1,065	Drainage Shape 375DIA. 375DIA.	width (mm) 375 375	Drainage si height (mm) 375 375	Drainag ze length (m) 20.2 16.2	Grou USG (mPD) 11.100 12.720	DSG (mPD) 12.720 14.360	US (mPD) 9.725 9.658	DS (mPD) 9.658 9.604	(S _f) 0.003 0.003	cross area (A) (m ²) 0.11 0.11	te tipe Dia. (D) (m) (mi) 0.375 5.0 0.375	m) (min) 0 0.32 2 0.26	5.32 5.58	mean intensity 2-year (mm/h) 189.85 187.36	Runoff (m ³ /s) 0.029 0.050	Capacity (m ³ /s) 0.115 0.115	Velocity (m/s) 1.041 1.041	Velocity (m/s) 0.266 0.452	(entry) 0.500 0.500	(exit) 1.000 1.000	(entry) (m) 0.002 0.005	(exit) (m) 0.004 0.010	(Reynold number) 8.3E+04 1.4E+05	6.378 6.494	(friction ceof) 0.02458 0.02371	(friction) (m)	H (m)	3.350 Water lev (mPD) 9.803 9.793
Sto	mwater Drai ^{ion} DS SMH-2	Sub- Catchment	Imper Sub- Catchment (m ²) 619	r sea level meable Accumulative Area (m ²) 619	Catchn Perr Sub- Catchment	neable Accumulative Area (m ²)	e Sub- Catchment (m ²) 619	Total Accumulative t Area (m²) 619 1,065 1,524	Drainage Shape 375DIA.	width (mm) 375 375 375 375	Drainage si height (mm) 375	Drainag ze length (m) 20.2 16.2	Grou USG (mPD) 11.100	DSG (mPD) 12.720	US (mPD) 9.725	DS (mPD) 9.658 9.604 9.559	(S _f) 0.003 0.003 0.003	cross area (A) (M ²) 0.11 0.11 0.11	te tipe Dia. (D) (m) (min 0.375 5.0 0.375 5.3 0.375 5.5	n) (min) 0 0.32 2 0.26 8 0.21	5.32 5.58 5.80	mean intensity 2-year (mm/h) 189.85 187.36 185.37	Runoff (m ³ /s) 0.029 0.050 0.071	Capacity (m ³ /s) 0.115 0.115 0.115	Velocity (m/s) 1.041 1.041 1.041	Velocity (m/s) 0.266 0.452 0.640	(entry) 0.500 0.500 0.500	(exit) 1.000 1.000 1.000	(entry) (m) 0.002 0.005 0.010	(exit) (m) 0.004	(Reynold number) 8.3E+04 1.4E+05 2.0E+05	6.378 6.494 6.550	(friction ceof) 0.02458 0.02371 0.02331	(friction) (m) 0.0048 0.0106	H (m) 0.010 0.026	3.350 Water lev (mPD) 9.803
Sto	mwater Drai	Sub- Catchment Reference	Imper Sub- Catchment (m ²) 619 446 459 466	r sea level meable Accumulative Area (m ²) 619 1,065 1,524	Catchn Perr Sub- Catchment	neable Accumulative Area (m ²)	e Sub- Catchment (m ²) 619 446 459 466	Total Accumulative t Area (m ²) 619 1,065 1,524 1,990	Drainage Shape 375DIA. 375DIA. 375DIA.	width (mm) 375 375 375 375 450	Drainage si height (mm) 375 375 375 450	Drainag ze length (m) 20.2 16.2 13.4	Grou USG (mPD) 11.100 12.720 14.360 15.680	DSG (mPD) 12.720 14.360 15.680 16.000	US (mPD) 9.725 9.658 9.604 9.559	DS (mPD) 9.658 9.604 9.559 9.514	(S _f) 0.003 0.003 0.003 0.003	cross area Pi (A) (m²) 0.11 0.11 0.11 0.11 0.16 0.16	te tipe Dia. (D) (m) (m) 0.375 5.0 0.375 5.3 0.375 5.5 0.450	t _f in) (min) 0 0.32 2 0.26 8 0.21 0 0.19	5.32 5.58 5.80 5.99	mean intensity 2-year (mm/h) 189.85 187.36 185.37 183.64	Runoff (m ³ /s) 0.029 0.050	Capacity (m ³ /s) 0.115 0.115 0.115 0.186	Velocity (m/s) 1.041 1.041	Velocity (m/s) 0.266 0.452 0.640 0.575	(entry) 0.500 0.500 0.500 0.500	(exit) 1.000 1.000 1.000 1.000	(entry) (m) 0.002 0.005	(exit) (m) 0.004 0.010 0.021	(Reynold number) 8.3E+04 1.4E+05 2.0E+05 2.2E+05	6.378 6.494 6.550 6.689	(friction ceof) 0.02458 0.02371 0.02331 0.02235	(friction) (m) 0.0048 0.0106 0.0174	H (m) 0.010 0.026 0.049	3.350 Water lev (mPD) 9.803 9.793 9.767
Sto	mwater Drai ion DS SMH-2 SMH-3 SMH-4 SMH-5	Sub- Catchment Reference	Imper Sub- Catchment (m ²) 619 446 459 466 516	r sea level meable Accumulative Area (m ²) 619 1,065 1,524 1,990	Catchn Perr Sub- Catchment	neable Accumulative Area (m ²)	e Sub- Catchment (m ²) 619 446 459	Total Accumulative t Area (m²) 619 1,065 1,524 1,990 2,506	Drainage Shape 375DIA. 375DIA. 375DIA. 450DIA.	width (mm) 375 375 375 375 450 450	Drainage si height (mm) 375 375 375 450 450	Drainag ze length (m) 20.2 16.2 13.4 13.5 14.6	Grou USG (mPD) 11.100 12.720 14.360 15.680 16.000	DSG (mPD) 12.720 14.360 15.680	US (mPD) 9.725 9.658 9.604 9.559 9.514	DS (mPD) 9.658 9.604 9.559 9.514 9.465	(S _f) 0.003 0.003 0.003 0.003 0.003	cross area (A) (M ²) 0.11 0.11 0.11 0.16 0.16	te tipe Dia. (D) (m) (mi) 0.375 5.0 0.375 5.3 0.375 5.5 0.450 5.8 0.450 5.9	n) (min) 0 0.32 2 0.26 8 0.21 0 0.19 9 0.21	5.32 5.58 5.80 5.99 6.20	mean intensity 2-year (mm/h) 189.85 187.36 185.37 183.64 181.83	Runoff (m ³ /s) 0.029 0.050 0.071 0.091	Capacity (m ³ /s) 0.115 0.115 0.115 0.186 0.186	Velocity (m/s) 1.041 1.041 1.041 1.169	Velocity (m/s) 0.266 0.452 0.640	(entry) 0.500 0.500 0.500 0.500 0.500	(exit) 1.000 1.000 1.000	(entry) (m) 0.002 0.005 0.010 0.008 0.013	(exit) (m) 0.004 0.010 0.021 0.017 0.026	(Reynold number) 8.3E+04 1.4E+05 2.0E+05 2.2E+05 2.7E+05	6.378 6.494 6.550 6.689 6.721	(friction ceof) 0.02458 0.02371 0.02331 0.02235 0.02214	(friction) (m) 0.0048 0.0106 0.0174 0.0113	H (m) 0.010 0.026 0.049 0.037	3.350 Water lev (mPD) 9.803 9.793 9.767 9.718
Sto	mwater Drai ion DS SMH-2 SMH-3 SMH-4 SMH-5 SMH-6	Sub- Catchment Reference	Imper Sub- Catchment (m ²) 619 446 459 466	r sea level meable Accumulative Area (m ²) 619 1,065 1,524 1,990 2,506	Catchn Perr Sub- Catchment	neable Accumulative Area (m ²)	e Sub- Catchment (m ²) 619 446 459 466 516	Total Accumulative t Area (m ²) 619 1,065 1,524 1,990 2,506 3,076	Drainage Shape 375DIA. 375DIA. 375DIA. 450DIA. 450DIA.	width (mm) 375 375 375 375 450	Drainage si height (mm) 375 375 375 450	Drainag ze length (m) 20.2 16.2 13.4 13.5	Grou USG (mPD) 11.100 12.720 14.360 15.680	DSG (mPD) 12.720 14.360 15.680 16.000 15.000	US (mPD) 9.725 9.658 9.604 9.559	DS (mPD) 9.658 9.604 9.559 9.514 9.465 9.395	(S _f) 0.003 0.003 0.003 0.003 0.003 0.003	cross area Pi (A) (m²) 0.11 0.11 0.11 0.11 0.16 0.16	te ripe Dia. (D) (m) (m) 0.375 5.0 0.375 5.5 0.450 5.9 0.450 6.2	t _f in) (min) 0 0.32 2 0.26 8 0.21 9 0.21 00 0.16	5.32 5.58 5.80 5.99	mean intensity 2-year (mm/h) 189.85 187.36 185.37 183.64	Runoff (m ³ /s) 0.029 0.050 0.071 0.091 0.114	Capacity (m ³ /s) 0.115 0.115 0.115 0.186	Velocity (m/s) 1.041 1.041 1.041 1.169 1.169	Velocity (m/s) 0.266 0.452 0.640 0.575 0.716	(entry) 0.500 0.500 0.500 0.500	(exit) 1.000 1.000 1.000 1.000 1.000	(entry) (m) 0.002 0.005 0.010 0.008	(exit) (m) 0.004 0.010 0.021 0.017	(Reynold number) 8.3E+04 1.4E+05 2.0E+05 2.2E+05 2.7E+05 3.3E+05	6.378 6.494 6.550 6.689 6.721 6.746	(friction ceof) 0.02458 0.02371 0.02331 0.02235 0.02214	(friction) (m) 0.0048 0.0106 0.0174 0.0113 0.0188	H (m) 0.010 0.026 0.049 0.037 0.058	3.350 Water lev (mPD) 9.803 9.793 9.767 9.718 9.682
Sto Loca	mwater Drai ion DS SMH-2 SMH-3 SMH-4 SMH-5 SMH-6 SMH-7 SMH-8	Sub- Catchment Reference SITE C	Imper Sub- Catchment (m²) 619 446 459 466 516 570 0	r sea level meable Accumulative Area (m ²) 619 1,065 1,524 1,990 2,506 3,076 3,076	Catchn Perr Sub- Catchment	neable Accumulative Area (m ²)	e Sub- Catchment (m ²) 619 446 459 466 516 570 0	Total Accumulative t Area (m²) 619 1,065 1,524 1,990 2,506 3,076 3,076	Drainage Shape 375DIA. 375DIA. 375DIA. 450DIA. 450DIA. 450DIA. 450DIA.	width (mm) 375 375 375 375 450 450 450 450	Drainage si height (mm) 375 375 375 450 450 450 450	Drainag ze length (m) 20.2 16.2 13.4 13.5 14.6 14.2 6.8	Grou USG (mPD) 11.100 12.720 14.360 15.680 16.000 15.000 14.400	DSG (mPD) 12.720 14.360 15.680 16.000 15.000 14.400 14.260	US (mPD) 9.725 9.658 9.604 9.559 9.514 9.465 9.395	DS (mPD) 9.658 9.604 9.559 9.514 9.465 9.395 9.361	(S _f) 0.003 0.003 0.003 0.003 0.003 0.005 0.005	cross area Pi (A) (m²) 0.11 0.11 0.11 0.11 0.16 0.16 0.16 0.16	te ripe Dia. (D) (m) (mi) 0.375 5.0 0.375 5.3 0.375 5.5 0.450 5.8 0.450 5.9 0.450 6.2 0.450 6.3	n) (min) 0 0.32 2 0.26 8 0.21 0 0.19 9 0.21 0 0.16 6 0.08	5.32 5.58 5.80 5.99 6.20 6.36 6.44	mean intensity 2-year (mm/h) 189.85 187.36 185.37 183.64 181.83 180.43 179.77	Runoff (m ³ /s) 0.029 0.050 0.071 0.091 0.114 0.139 0.138	Capacity (m ³ /s) 0.115 0.115 0.115 0.115 0.186 0.186 0.228 0.228	Velocity (m/s) 1.041 1.041 1.041 1.169 1.169 1.434 1.434	Velocity (m/s) 0.266 0.452 0.640 0.575 0.716 0.872 0.869	(entry) 0.500 0.500 0.500 0.500 0.500 0.500 0.500	(exit) 1.000 1.000 1.000 1.000 1.000 1.000 1.000	(entry) (m) 0.002 0.005 0.010 0.008 0.013 0.019 0.019	(exit) (m) 0.004 0.010 0.021 0.017 0.026 0.039 0.039	(Reynold number) 8.3E+04 1.4E+05 2.0E+05 2.2E+05 2.7E+05 3.3E+05 3.3E+05	6.378 6.494 6.550 6.689 6.721 6.746 6.745	(friction ceof) 0.02458 0.02371 0.02331 0.02235 0.02214 0.02198 0.02198	(friction) (m) 0.0048 0.0106 0.0174 0.0113 0.0188 0.0268 0.0128	H (m) 0.010 0.026 0.049 0.037 0.058 0.085	3.350 Water lev (mPD) 9.803 9.793 9.767 9.718 9.682 9.624
Sto Loca	mwater Drai ion DS SMH-2 SMH-3 SMH-4 SMH-5 SMH-6 SMH-7 SMH-8 SMH-9	Sub- Catchment Reference SITE C	Imper Sub- Catchment (m²) 619 446 459 466 516 570 0	r sea level meable Accumulative Area (m ²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,292	Catchn Perr Sub- Catchment	neable Accumulative Area (m ²)	e Sub- Catchment (m ²) 619 446 459 466 516 570 0 216	Total Accumulative t Area (m ²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,292	Drainage Shape 375DIA. 375DIA. 375DIA. 450DIA. 450DIA. 450DIA. 450DIA. 450DIA. 450DIA.	width (mm) 375 375 375 450 450 450 450 450 450	Drainage si height (mm) 375 375 375 450 450 450 450 450	Drainag ze length (m) 20.2 16.2 13.4 13.5 14.6 14.2 6.8 20.3	Grou USG (mPD) 11.100 12.720 14.360 15.680 16.000 15.000 14.400 14.260	DSG (mPD) 12.720 14.360 15.680 16.000 15.000 14.400 14.260 12.050	US (mPD) 9.725 9.658 9.604 9.559 9.514 9.465 9.395 9.361	DS (mPD) 9.658 9.604 9.559 9.514 9.465 9.395 9.395 9.361 9.259	(S _f) 0.003 0.003 0.003 0.003 0.003 0.005 0.005 0.005	cross area Pi (A) (m²) 0.11 0.11 0.11 0.11 0.16 0.16 0.16 0.16 0.16 0.16	te vipe Dia. (D) (m) (min 0.375 5.0 0.375 5.3 0.375 5.5 0.450 5.8 0.450 5.9 0.450 6.2 0.450 6.3 0.450 6.4	t _f in) (min) 0 0.32 i2 0.26 i8 0.21 i0 0.19 i9 0.21 i0 0.16 i6 0.08 4 0.24	5.32 5.58 5.80 5.99 6.20 6.36 6.44 6.68	mean intensity 2-year (mm/h) 189.85 187.36 185.37 183.64 181.83 180.43 179.77 177.84	Runoff (m ³ /s) 0.029 0.050 0.071 0.091 0.114 0.139 0.138 0.146	Capacity (m ³ /s) 0.115 0.115 0.115 0.186 0.186 0.228 0.228 0.228	Velocity (m/s) 1.041 1.041 1.041 1.169 1.169 1.434 1.434 1.434	Velocity (m/s) 0.266 0.452 0.640 0.575 0.716 0.872 0.869 0.920	(entry) 0.500 0.500 0.500 0.500 0.500 0.500 0.500	(exit) 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000	(entry) (m) 0.002 0.005 0.010 0.008 0.013 0.019 0.019 0.022	(exit) (m) 0.004 0.010 0.021 0.017 0.026 0.039 0.039 0.043	(Reynold number) 8.3E+04 1.4E+05 2.0E+05 2.2E+05 2.7E+05 3.3E+05 3.3E+05 3.5E+05	6.378 6.494 6.550 6.689 6.721 6.746 6.745 6.752	(friction ceof) 0.02458 0.02371 0.02331 0.02235 0.02214 0.02198 0.02194	(friction) (m) 0.0048 0.0106 0.0174 0.0113 0.0188 0.0268 0.0268 0.0128 0.0428	H (m) 0.010 0.026 0.049 0.037 0.058 0.085 0.071 0.108	3.350 Water lev (mPD) 9.803 9.793 9.767 9.718 9.682 9.624 9.539
Sto	mwater Drai ion DS SMH-2 SMH-3 SMH-4 SMH-5 SMH-6 SMH-6 SMH-7 SMH-8 SMH-8 SMH-9 SMH-10	Sub- Catchment Reference SITE C - Remaining Area SITE B	Imper Sub- Catchment (m²) 619 446 459 466 516 570 0 216 637	r sea level meable Accumulative Area (m ²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,076 3,292 3,929	Catchn Perr Sub- Catchment	neable Accumulative Area (m ²)	e Sub- Catchment (m ²) 619 446 459 466 516 570 0 216 637	Total Accumulative t Area (m²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,292 3,929	Drainage Shape 375DIA. 375DIA. 375DIA. 450DIA. 450DIA. 450DIA. 450DIA. 450DIA. 450DIA. 525DIA.	width (mm) 375 375 375 375 450 450 450 450 450 450 450 525	Drainage si height (mm) 375 375 375 450 450 450 450 450 450 450 525	Drainag ze length (m) 20.2 16.2 13.4 13.5 14.6 14.2 6.8	Grou USG (mPD) 11.100 12.720 14.360 15.680 16.000 15.000 14.400 14.260 12.050	DSG (mPD) 12.720 14.360 15.680 16.000 15.000 14.400 14.260 12.050 10.220	US (mPD) 9.725 9.658 9.604 9.559 9.514 9.465 9.395 9.361 7.611	DS (mPD) 9.658 9.604 9.559 9.514 9.465 9.395 9.361 9.259 7.523	(S _f) 0.003 0.003 0.003 0.003 0.003 0.005 0.005 0.005 0.005	cross area Pi (A) (m²) 0.11 0.11 0.11 0.11 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.16	te Pipe Dia. (D) (m) (min 0.375 5.0 0.375 5.3 0.375 5.5 0.450 5.8 0.450 5.9 0.450 6.2 0.450 6.3 0.450 6.4 0.525 6.6	t _f n) (min) 0 0.32 2 0.26 8 0.21 9 0.21 20 0.19 9 0.21 20 0.16 6 0.08 4 0.24 8 0.19	5.32 5.58 5.80 5.99 6.20 6.36 6.44 6.68 6.86	mean intensity 2-year (mm/h) 189.85 187.36 185.37 183.64 181.83 180.43 179.77 177.84 176.37	Runoff (m ³ /s) 0.029 0.050 0.071 0.091 0.114 0.139 0.138 0.146 0.173	Capacity (m ³ /s) 0.115 0.115 0.115 0.115 0.186 0.186 0.228 0.228 0.228 0.228 0.228	Velocity (m/s) 1.041 1.041 1.041 1.169 1.169 1.434 1.434 1.434 1.580	Velocity (m/s) 0.266 0.452 0.640 0.575 0.716 0.872 0.869 0.920 0.800	(entry) 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500	(exit) 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000	(entry) (m) 0.002 0.005 0.010 0.008 0.013 0.019 0.019 0.022 0.016	(exit) (m) 0.004 0.010 0.021 0.017 0.026 0.039 0.039	(Reynold number) 8.3E+04 1.4E+05 2.0E+05 2.2E+05 2.7E+05 3.3E+05 3.3E+05 3.5E+05	6.378 6.494 6.550 6.689 6.721 6.746 6.745 6.752 6.867	(friction ceof) 0.02458 0.02371 0.02331 0.02235 0.02214 0.02198 0.02198 0.02194 0.02121	(friction) (m) 0.0048 0.0106 0.0174 0.0113 0.0188 0.0268 0.0268 0.0128 0.0428	H (m) 0.010 0.026 0.049 0.037 0.058 0.085 0.071	3.350 Water lev (mPD) 9.803 9.793 9.767 9.718 9.682 9.682 9.624 9.539 9.468 7.683
Sto	mwater Drai ion DS SMH-2 SMH-3 SMH-4 SMH-5 SMH-6 SMH-7 SMH-8 SMH-9 SMH-10 SMH-10 SMH-11	Sub- Catchment Reference SITE C Remaining Area SITE B Remaining Area	Imper Sub- Catchment (m²) 619 446 459 466 516 570 0 216 637 1,110	r sea level meable Accumulative Area (m ²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,076 3,292 3,929 5,039	Catchn Perr Sub- Catchment	neable Accumulative Area (m ²)	e Sub- Catchment (m ²) 619 446 459 466 516 570 0 216 637 1,110	Total Accumulative t Area (m ²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,076 3,292 3,929 5,039	Drainage Shape 375DIA. 375DIA. 375DIA. 375DIA. 450DIA. 450DIA. 450DIA. 450DIA. 450DIA. 525DIA. 525DIA.	width (mm) 375 375 375 450 450 450 450 450 450 450 525 525	Drainage si height (mm) 375 375 375 450 450 450 450 450 450 450 525 525	Drainag ze length (m) 20.2 16.2 13.4 13.5 14.6 14.2 6.8 20.3 17.6	Grou USG (mPD) 11.100 12.720 14.360 15.680 16.000 15.000 14.400 14.260 12.050 10.220	DSG (mPD) 12.720 14.360 15.680 16.000 15.000 14.400 14.260 12.050	US (mPD) 9.725 9.658 9.604 9.559 9.514 9.465 9.395 9.361 7.611 6.023	DS (mPD) 9.658 9.604 9.559 9.514 9.465 9.395 9.361 9.259 7.523 5.956	(S _f) 0.003 0.003 0.003 0.003 0.003 0.005 0.005 0.005 0.005 0.005	cross area Pi (A) (m²) 0.11 0.11 0.11 0.11 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.22 0.22 0.22	te ripe Dia. (D) (m) (m) 0.375 5.0 0.375 5.5 0.450 5.9 0.450 6.2 0.450 6.3 0.450 6.450 0.525 6.6 0.525	t _f	5.32 5.58 5.80 5.99 6.20 6.36 6.44 6.68 6.86 7.00	mean intensity 2-year (mm/h) 189.85 187.36 185.37 183.64 181.83 180.43 179.77 177.84 176.37 175.28	Runoff (m ³ /s) 0.029 0.050 0.071 0.091 0.114 0.139 0.138 0.146 0.173 0.221	Capacity (m ³ /s) 0.115 0.115 0.115 0.186 0.186 0.228 0.228 0.228 0.228 0.228 0.342	Velocity (m/s) 1.041 1.041 1.041 1.169 1.169 1.434 1.434 1.434 1.434 1.580 1.580	Velocity (m/s) 0.266 0.452 0.640 0.575 0.716 0.872 0.869 0.920 0.800 1.020	(entry) 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500	(exit) 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000	(entry) (m) 0.002 0.005 0.010 0.008 0.013 0.019 0.019 0.019 0.022 0.016 0.027	(exit) (m) 0.004 0.010 0.021 0.021 0.026 0.039 0.039 0.043 0.033 0.053	(Reynold number) 8.3E+04 1.4E+05 2.0E+05 2.2E+05 2.7E+05 3.3E+05 3.3E+05 3.5E+05 3.5E+05 4.5E+05	6.378 6.494 6.550 6.689 6.721 6.746 6.745 6.752 6.895	(friction ceof) 0.02458 0.02371 0.02331 0.02235 0.02214 0.02198 0.02198 0.02194 0.02194 0.02104	(friction) (m) 0.0048 0.0106 0.0174 0.0113 0.0188 0.0268 0.0128 0.0231	H (m) 0.010 0.026 0.049 0.037 0.058 0.085 0.071 0.108 0.072	3.350 Water lev (mPD) 9.803 9.793 9.767 9.718 9.682 9.624 9.624 9.539 9.468
Sto	SMH-2 SMH-3 SMH-4 SMH-5 SMH-6 SMH-7 SMH-8 SMH-9 SMH-10 SMH-11 SMH-12	Sub- Catchment Reference SITE C - Remaining Area SITE B	Imper Sub- Catchment (m²) 619 446 459 466 516 570 0 216 637	r sea level meable Accumulative Area (m ²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,076 3,292 3,929	Catchn Perr Sub- Catchment	neable Accumulative Area (m ²)	e Sub- Catchment (m ²) 619 446 459 466 516 570 0 216 637	Total Accumulative t Area (m²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,292 3,929 5,039 5,354	Drainage Shape 375DIA. 375DIA. 375DIA. 450DIA. 450DIA. 450DIA. 450DIA. 450DIA. 450DIA. 525DIA.	width (mm) 375 375 375 450 450 450 450 450 450 450 450 525 525 525	Drainage si height (mm) 375 375 375 450 450 450 450 450 450 450 450 450 525 525	Drainag ze length (m) 20.2 16.2 13.4 13.5 14.6 14.2 6.8 20.3 17.6 13.4 12.4	Grou USG (mPD) 11.100 12.720 14.360 15.680 16.000 15.000 14.400 14.260 12.050 10.220 8.850	DSG (mPD) 12.720 14.360 15.680 16.000 15.000 14.400 14.260 12.050 10.220 8.850	US (mPD) 9.725 9.658 9.604 9.559 9.514 9.465 9.395 9.361 7.611 6.023 4.856	DS (mPD) 9.658 9.604 9.559 9.514 9.465 9.395 9.361 9.259 7.523 5.956 4.794	(S _f) 0.003 0.003 0.003 0.003 0.003 0.005 0.005 0.005 0.005 0.005 0.005	cross area Pi (A) (m²) 0.11 0.11 0.11 0.11 0.16 0.16 0.16 0.16 0.16 0.22 0.22 0.22	te Pipe Dia. (D) (m) (mi) 0.375 5.0 0.375 5.3 0.375 5.5 0.450 5.8 0.450 5.9 0.450 6.2 0.450 6.3 0.450 6.4 0.525 6.6 0.525 6.8	t _f n) (min) 0 0.32 2 0.26 8 0.21 9 0.21 9 0.21 9 0.21 9 0.21 9 0.21 9 0.21 9 0.21 9 0.16 6 0.19 6 0.14 0 0.13	5.32 5.58 5.80 5.99 6.20 6.36 6.44 6.68 6.86 7.00 7.13	mean intensity 2-year (mm/h) 189.85 187.36 185.37 183.64 181.83 180.43 179.77 177.84 176.37 175.28 174.28	Runoff (m ³ /s) 0.029 0.050 0.071 0.091 0.114 0.139 0.138 0.146 0.173	Capacity (m ³ /s) 0.115 0.115 0.115 0.115 0.186 0.186 0.228 0.228 0.228 0.228 0.228	Velocity (m/s) 1.041 1.041 1.041 1.169 1.169 1.434 1.434 1.434 1.580 1.580 1.580	Velocity (m/s) 0.266 0.452 0.640 0.575 0.716 0.872 0.869 0.920 0.800	(entry) 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500	(exit) 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000	(entry) (m) 0.002 0.005 0.010 0.008 0.013 0.019 0.019 0.019 0.022 0.016 0.027 0.030	(exit) (m) 0.004 0.010 0.021 0.017 0.026 0.039 0.039 0.039 0.043 0.033	(Reynold number) 8.3E+04 1.4E+05 2.0E+05 2.2E+05 2.7E+05 3.3E+05 3.3E+05 3.5E+05 4.5E+05 4.7E+05	6.378 6.494 6.550 6.689 6.721 6.746 6.745 6.752 6.867 6.900	(friction ceof) 0.02458 0.02371 0.02331 0.02235 0.02214 0.02198 0.02198 0.02194 0.02121 0.02104 0.02100	(friction) (m) 0.0048 0.0106 0.0174 0.0113 0.0188 0.0268 0.0128 0.0284 0.0231 0.0284 0.0294	H (m) 0.010 0.026 0.049 0.037 0.058 0.085 0.071 0.108 0.072 0.108 0.118	3.350 Water lev (mPD) 9.803 9.793 9.767 9.718 9.682 9.624 9.624 9.539 9.468 7.683 6.131
Sto	SMH-2 SMH-3 SMH-4 SMH-5 SMH-6 SMH-7 SMH-8 SMH-9 SMH-10 SMH-12 SMH-12 SMH-10 SMH-12 STMH-01	Sub- Catchment Reference SITE C Remaining Area SITE B Remaining Area	Imper Sub- Catchment (m²) 619 446 459 466 516 570 0 216 637 1,110	r sea level meable Accumulative Area (m ²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,076 3,076 3,076 3,292 3,929 5,039 5,354 5,354	Catchn Perr Sub- Catchment	neable Accumulative Area (m ²)	e Sub- Catchment (m ²) 619 446 459 466 516 570 0 216 637 1,110	Total Accumulative t Area (m ²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,076 3,292 3,929 5,039 5,354 5,354	Drainage Shape 375DIA. 375DIA. 375DIA. 375DIA. 450DIA. 450DIA. 450DIA. 450DIA. 450DIA. 525DIA. 525DIA. 525DIA. 525DIA.	width (mm) 375 375 375 450 450 450 450 450 450 450 450 525 525 525 525 525	Drainage si height (mm) 375 375 450 450 450 450 450 525 525 525 525	Drainag ze length (m) 20.2 16.2 13.4 13.5 14.6 14.2 6.8 20.3 17.6 13.4 12.4 19.5	Grou USG (mPD) 11.100 12.720 14.360 15.680 16.000 15.000 14.400 14.260 12.050 10.220 8.850 7.590	DSG (mPD) 12.720 14.360 15.680 16.000 14.400 14.260 12.050 10.220 8.850 7.590 6.000	US (mPD) 9.725 9.658 9.604 9.559 9.514 9.465 9.395 9.361 7.611 6.023 4.856 3.794	DS (mPD) 9.658 9.604 9.559 9.514 9.465 9.395 9.361 9.259 7.523 5.956 4.794 3.696	(S _f) 0.003 0.003 0.003 0.003 0.003 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005	cross area Pi (A) (m²) 0.11 0.11 0.11 0.11 0.16 0.16 0.16 0.16 0.16 0.22 0.22 0.22 0.22 0.22	te ripe Dia. (D) (m) (m) 0.375 5.0 0.375 5.3 0.375 5.5 0.450 6.2 0.450 6.450 0.450 6.450 0.525 6.6 0.525 7.0 0.525 7.1	t _f	5.32 5.58 5.80 5.99 6.20 6.36 6.44 6.68 6.86 7.00 7.13 7.34	mean intensity 2-year (mm/h) 189.85 187.36 185.37 183.64 181.83 180.43 179.77 177.84 176.37 174.28 172.74	Runoff (m ³ /s) 0.029 0.050 0.071 0.091 0.114 0.139 0.138 0.146 0.173 0.221 0.233 0.231	Capacity (m ³ /s) 0.115 0.115 0.115 0.186 0.186 0.228 0.228 0.228 0.228 0.228 0.228 0.342 0.342 0.342 0.342	Velocity (m/s) 1.041 1.041 1.041 1.169 1.169 1.434 1.434 1.434 1.434 1.580 1.580 1.580 1.580	Velocity (m/s) 0.266 0.452 0.640 0.575 0.716 0.872 0.869 0.920 0.800 1.020 1.078 1.068	(entry) 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500	(exit) 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000	(entry) (m) 0.002 0.005 0.010 0.008 0.013 0.019 0.019 0.019 0.022 0.016 0.027 0.030 0.029	(exit) (m) 0.004 0.010 0.021 0.021 0.026 0.039 0.039 0.043 0.033 0.053 0.059 0.058	(Reynold number) 8.3E+04 1.4E+05 2.0E+05 2.2E+05 2.7E+05 3.3E+05 3.3E+05 3.5E+05 3.5E+05 4.5E+05 4.7E+05 4.7E+05	6.378 6.494 6.550 6.689 6.721 6.745 6.752 6.807 6.895 6.900 6.899	(friction ceof) 0.02458 0.02371 0.02331 0.02235 0.02214 0.02198 0.02198 0.02194 0.02194 0.02104 0.02100 0.02101	(friction) (m) 0.0048 0.0106 0.0174 0.0113 0.0188 0.0268 0.0128 0.0284 0.0231 0.0284 0.0294	H (m) 0.010 0.026 0.049 0.037 0.058 0.085 0.071 0.108 0.072 0.108 0.118	3.350 Water lev (mPD) 9.803 9.793 9.767 9.718 9.682 9.624 9.624 9.624 9.539 9.468 7.683 6.131 4.974 4.629
Sto	mwater Drai ion DS SMH-2 SMH-3 SMH-3 SMH-4 SMH-5 SMH-5 SMH-5 SMH-6 SMH-7 SMH-7 SMH-8 SMH-9 SMH-10 SMH-10 SMH-11 SMH-11 SMH-12 STMH-01 SMH-11a	Sub- Catchment Reference SITE C Remaining Area SITE B Remaining Area	Imper Sub- Catchment (m²) 619 446 459 466 516 570 0 216 637 1,110	r sea level meable Accumulative Area (m ²) 619 1,065 1,524 1,990 2,506 3,076	Catchn Perr Sub- Catchment	Accumulative Area (m²) 0	e Sub- Catchment (m ²) 619 446 459 466 516 570 0 216 637 1,110	Total Accumulative t Area (m²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,292 3,929 5,039 5,354 5,354	Drainage Shape 375DIA. 375DIA. 375DIA. 375DIA. 450DIA. 450DIA. 450DIA. 450DIA. 450DIA. 525DIA. 525DIA. 525DIA. 525DIA. 525DIA.	width (mm) 375 375 375 375 450 450 450 450 450 450 450 450 525 525 525 525 525 525	Drainage si height (mm) 375 375 375 375 450 450 450 450 450 450 450 525 525 525 525 525 525	Drainag ze length (m) 20.2 16.2 13.4 13.5 14.6 14.2 6.8 20.3 17.6 13.4 12.4 19.5 4.3	Grou USG (mPD) 11.100 12.720 14.360 15.680 16.000 14.400 14.260 14.260 12.050 10.220 8.850 7.590 6.000	DSG (mPD) 12.720 14.360 15.680 16.000 15.000 14.400 14.260 12.050 10.220 8.850 7.590 6.000 5.800	US (mPD) 9.725 9.658 9.604 9.559 9.514 9.465 9.395 9.361 7.611 6.023 4.856 3.794 2.496	DS (mPD) 9.658 9.604 9.559 9.514 9.465 9.395 9.361 9.259 7.523 5.956 4.794 3.696 2.475	(S _f) 0.003 0.003 0.003 0.003 0.003 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005	cross area Pi (A) (m²) 0.11 0.11 0.11 0.11 0.16 0.16 0.16 0.16 0.16 0.22 0.22 0.22 0.22 0.22 0.22 0.22 0.22 0.22	te ripe Dia. (D) (m) (0) (0) (0) (0) (0) (0) (0) (0) (0) (0) (0) (0) (1)	t _f n) (min) 0 0.32 2 0.26 8 0.21 9 0.21 9 0.21 9 0.21 9 0.21 9 0.21 9 0.21 9 0.21 9 0.21 9 0.16 6 0.19 9 0.13 3 0.21 4 0.04	5.32 5.58 5.80 5.99 6.20 6.36 6.44 6.68 6.86 7.00 7.13 7.34 7.39	mean intensity 2-year (mm/h) 189.85 187.36 185.37 183.64 181.83 180.43 179.77 177.84 176.37 175.28 172.74 172.41	Runoff (m ³ /s) 0.029 0.050 0.071 0.091 0.114 0.139 0.138 0.146 0.173 0.221 0.233 0.231 0.231	Capacity (m ³ /s) 0.115 0.115 0.115 0.115 0.186 0.186 0.228 0.228 0.228 0.228 0.228 0.228 0.342 0.342 0.342 0.342 0.342	Velocity (m/s) 1.041 1.041 1.041 1.169 1.169 1.434 1.434 1.434 1.580 1.580 1.580 1.580 1.580	Velocity (m/s) 0.266 0.452 0.640 0.575 0.716 0.872 0.869 0.920 0.800 1.020 1.078 1.068 1.066	(entry) 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500	(exit) 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000	(entry) (m) 0.002 0.005 0.010 0.008 0.013 0.019 0.019 0.019 0.022 0.016 0.027 0.030 0.029 0.029	(exit) (m) 0.004 0.010 0.021 0.021 0.026 0.039 0.039 0.039 0.043 0.033 0.053 0.053 0.058 0.058	(Reynold number) 8.3E+04 1.4E+05 2.0E+05 2.2E+05 2.7E+05 3.3E+05 3.3E+05 3.5E+05 3.5E+05 4.5E+05 4.7E+05 4.7E+05	6.378 6.494 6.550 6.689 6.721 6.746 6.745 6.752 6.867 6.895 6.900 6.899 6.899	(friction ceof) 0.02458 0.02371 0.02331 0.02235 0.02214 0.02198 0.02198 0.02194 0.02194 0.02121 0.02104 0.02100 0.02101 0.02101	(friction) (m) 0.0048 0.0106 0.0174 0.0113 0.0188 0.0268 0.0128 0.0231 0.0231 0.0284 0.0294 0.0294 0.0454 0.0099	H (m) 0.010 0.026 0.049 0.037 0.058 0.085 0.071 0.108 0.072 0.108 0.118 0.133 0.097	3.350 Water lev (mPD) 9.803 9.793 9.767 9.718 9.682 9.624 9.624 9.539 9.468 7.683 6.131 4.974 4.629 4.496
Sto Loca	mwater Drai ion DS SMH-2 SMH-3 SMH-3 SMH-4 SMH-5 SMH-5 SMH-6 SMH-7 SMH-6 SMH-7 SMH-8 SMH-9 SMH-10 SMH-10 SMH-11 SMH-12 SMH-12 SMH-12 SMH-11 SMH-12	Sub- Catchment Reference SITE C Remaining Area SITE B Remaining Area	Imper Sub- Catchment (m²) 619 446 459 466 516 570 0 216 637 1,110	r sea level meable Accumulative Area (m ²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,076 3,076 3,076 3,292 3,929 5,039 5,354 5,354 5,354 5,354	Catchn Perr Sub- Catchment	neable Accumulative Area (m ²)	e Sub- Catchment (m ²) 619 446 459 466 516 570 0 216 637 1,110	Total Accumulative Area (m²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,292 3,929 5,354 5,354 5,354 5,354	Drainage Shape 375DIA. 375DIA. 375DIA. 375DIA. 450DIA. 450DIA. 450DIA. 450DIA. 450DIA. 450DIA. 525DIA. 525DIA. 525DIA. 525DIA. 525DIA. 525DIA.	width (mm) 375 375 375 450 450 450 450 450 450 450 450 525 525 525 525 525 525 525 525 525	Drainage si height (mm) 375 375 450 450 450 450 450 525 525 525 525 525 525 525 525 525 525 525 525 525 525	Drainag ze length (m) 20.2 16.2 13.4 13.5 14.6 14.2 6.8 20.3 17.6 13.4 12.4 19.5 4.3 40.5	Grou USG (mPD) 11.100 12.720 14.360 15.680 16.000 15.000 14.400 14.260 12.050 10.220 8.850 7.590 6.000 5.800	DSG (mPD) 12.720 14.360 15.680 16.000 14.400 14.260 12.050 10.220 8.850 7.590 6.000 5.800 4.900	US (mPD) 9.725 9.658 9.604 9.559 9.514 9.465 9.395 9.361 7.611 6.023 4.856 3.794 2.496 2.475	DS (mPD) 9.658 9.604 9.559 9.514 9.465 9.395 9.361 9.259 7.523 5.956 4.794 3.696 2.475 2.273	(S _f) 0.003 0.003 0.003 0.003 0.003 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005	cross area Pi (A) (m²) 0.11 0.11 0.11 0.11 0.11 0.16 0.16 0.16 0.16 0.16 0.16 0.22 0.22 0.22 0.22 0.22 0.22 0.22 0.22 0.22 0.22 0.22	te ripe Dia. (D) (m) 0.375 5.0 0.375 5.3 0.375 5.5 0.450 6.2 0.450 6.450 0.450 6.450 0.450 6.450 0.525 6.6 0.525 7.0 0.525 7.3 0.525 7.3	t _f	5.32 5.58 5.80 5.99 6.20 6.36 6.44 6.68 6.86 7.00 7.13 7.34 7.39 7.81	mean intensity 2-year (mm/h) 189.85 187.36 185.37 183.64 181.83 180.43 179.77 177.84 176.37 175.28 172.74 172.74 169.37	Runoff (m³/s) 0.029 0.050 0.071 0.091 0.114 0.138 0.146 0.173 0.221 0.233 0.231 0.227	Capacity (m ³ /s) 0.115 0.115 0.115 0.186 0.186 0.228 0.228 0.228 0.228 0.228 0.228 0.228 0.342 0.342 0.342 0.342 0.342 0.342	Velocity (m/s) 1.041 1.041 1.041 1.169 1.169 1.434 1.434 1.434 1.434 1.580 1.580 1.580 1.580 1.580 1.580	Velocity (m/s) 0.266 0.452 0.640 0.575 0.716 0.872 0.869 0.920 0.800 1.020 1.078 1.068 1.066 1.047	(entry) 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500	(exit) 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000	(entry) (m) 0.002 0.005 0.010 0.008 0.013 0.019 0.019 0.019 0.022 0.016 0.027 0.030 0.029 0.029 0.028	(exit) (m) 0.004 0.010 0.021 0.021 0.026 0.039 0.039 0.033 0.043 0.033 0.053 0.053 0.058 0.058 0.056	(Reynold number) 8.3E+04 1.4E+05 2.0E+05 2.2E+05 2.7E+05 3.3E+05 3.3E+05 3.5E+05 3.5E+05 4.5E+05 4.7E+05 4.7E+05 4.7E+05 4.6E+05	6.378 6.494 6.550 6.689 6.721 6.745 6.752 6.895 6.900 6.899 6.899 6.899 6.899	(friction ceof) 0.02458 0.02371 0.02331 0.02235 0.02214 0.02198 0.02198 0.02198 0.02194 0.02194 0.02101 0.02101 0.02101 0.02101 0.02102	(friction) (m) 0.0048 0.0106 0.0174 0.0113 0.0188 0.0268 0.0128 0.0284 0.0231 0.0284 0.0294 0.0294 0.0454 0.0099 0.0906	H (m) 0.010 0.026 0.049 0.037 0.058 0.085 0.071 0.108 0.072 0.108 0.118 0.133 0.097 0.174	3.350 Water lev (mPD) 9.803 9.793 9.767 9.718 9.682 9.624 9.624 9.624 9.539 9.468 7.683 6.131 4.974 4.629 4.496 4.400
	mwater Drai ion DS SMH-2 SMH-3 SMH-3 SMH-4 SMH-5 SMH-5 SMH-5 SMH-6 SMH-7 SMH-7 SMH-8 SMH-9 SMH-10 SMH-10 SMH-11 SMH-11 SMH-12 STMH-01 SMH-11a	Sub- Catchment Reference SITE C Remaining Area SITE B Remaining Area	Imper Sub- Catchment (m²) 619 446 459 466 516 570 0 216 637 1,110	r sea level meable Accumulative Area (m ²) 619 1,065 1,524 1,990 2,506 3,076	Catchn Perr Sub- Catchment	Accumulative Area (m²) 0	e Sub- Catchment (m ²) 619 446 459 466 516 570 0 216 637 1,110	Total Accumulative t Area (m²) 619 1,065 1,524 1,990 2,506 3,076 3,076 3,292 3,929 5,039 5,354 5,354	Drainage Shape 375DIA. 375DIA. 375DIA. 375DIA. 450DIA. 450DIA. 450DIA. 450DIA. 450DIA. 525DIA. 525DIA. 525DIA. 525DIA. 525DIA.	width (mm) 375 375 375 375 450 450 450 450 450 450 450 450 525 525 525 525 525 525	Drainage si height (mm) 375 375 375 375 450 450 450 450 450 450 525 525 525 525 525 525	Drainag ze length (m) 20.2 16.2 13.4 13.5 14.6 14.2 6.8 20.3 17.6 13.4 12.4 19.5 4.3 40.5 41.5	Grou USG (mPD) 11.100 12.720 14.360 15.680 16.000 14.400 14.260 14.260 12.050 10.220 8.850 7.590 6.000	DSG (mPD) 12.720 14.360 15.680 16.000 15.000 14.400 14.260 12.050 10.220 8.850 7.590 6.000 5.800	US (mPD) 9.725 9.658 9.604 9.559 9.514 9.465 9.395 9.361 7.611 6.023 4.856 3.794 2.496	DS (mPD) 9.658 9.604 9.559 9.514 9.465 9.395 9.361 9.259 7.523 5.956 4.794 3.696 2.475 2.273 2.065	(S _f) 0.003 0.003 0.003 0.003 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005	cross area Pi (A) (m²) 0.11 0.11 0.11 0.11 0.16 0.16 0.16 0.16 0.16 0.22 0.22 0.22 0.22 0.22 0.22 0.22 0.22 0.22 0.22 0.22 0.22 0.22 0.22 0.22 0.22 0.22	te ripe Dia. (D) (m) (0) (0) (0) (0) (0) (0) (0) (0) (0) (0) (0) (0) (1)	t _f n) (min) 0 0.32 2 0.26 8 0.21 9 0.21 9 0.21 9 0.21 9 0.21 9 0.21 9 0.16 6 0.08 4 0.24 8 0.19 9 0.13 3 0.21 4 0.04 9 0.43 1 0.44	5.32 5.58 5.80 5.99 6.20 6.36 6.44 6.68 6.86 7.00 7.13 7.34 7.39	mean intensity 2-year (mm/h) 189.85 187.36 185.37 183.64 181.83 180.43 179.77 177.84 176.37 175.28 172.74 172.41	Runoff (m ³ /s) 0.029 0.050 0.071 0.091 0.114 0.139 0.138 0.146 0.173 0.221 0.233 0.231 0.231	Capacity (m ³ /s) 0.115 0.115 0.115 0.115 0.186 0.186 0.228 0.228 0.228 0.228 0.228 0.228 0.342 0.342 0.342 0.342 0.342	Velocity (m/s) 1.041 1.041 1.041 1.169 1.169 1.434 1.434 1.434 1.434 1.580 1.580 1.580 1.580 1.580 1.580 1.580	Velocity (m/s) 0.266 0.452 0.640 0.575 0.716 0.872 0.869 0.920 0.800 1.020 1.078 1.068 1.066	(entry) 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500 0.500	(exit) 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000	(entry) (m) 0.002 0.005 0.010 0.008 0.013 0.019 0.019 0.019 0.022 0.016 0.027 0.030 0.029 0.029	(exit) (m) 0.004 0.010 0.021 0.021 0.026 0.039 0.039 0.039 0.043 0.033 0.053 0.053 0.058 0.058	 (Reynold number) 8.3E+04 1.4E+05 2.0E+05 2.2E+05 2.7E+05 3.3E+05 3.3E+05 3.5E+05 4.5E+05 4.7E+05 4.7E+05 4.6E+05 4.5E+05 	6.378 6.494 6.550 6.689 6.721 6.746 6.745 6.752 6.867 6.895 6.900 6.899 6.899 6.899 6.899 6.899 6.899	(friction ceof) 0.02458 0.02371 0.02331 0.02235 0.02214 0.02198 0.02198 0.02194 0.02194 0.02104 0.02104 0.02101 0.02101 0.02101 0.02102	(friction) (m) 0.0048 0.0106 0.0174 0.0113 0.0188 0.0268 0.0128 0.0231 0.0284 0.0231 0.0284 0.0294 0.0294 0.0454 0.0099 0.0906 0.0897	H (m) 0.010 0.026 0.049 0.037 0.058 0.085 0.071 0.108 0.072 0.108 0.118 0.133 0.097	3.350 Water lev (mPD) 9.803 9.793 9.767 9.718 9.682 9.624 9.624 9.539 9.468 7.683 6.131 4.974 4.629 4.496

Notes:

Rational Method is adopted for the peak runoff estimate i.e. Qp = 0.278 C I A.

The time of entry (te) is assumed to be 5.0 minutes.

The Colebrook White's Equation was used for hydraulic analysis of the drainage system.

The roughness value (ks) of 0.6mm has been taken in the hydraulic calculation for concrete pipes. The runoff coefficient of 0.90 for paved area and 0.35 for unpaved area has been adopted.

The inlet and outlet headloss coefficients of 0.5 and 1.0 respectively for the drainage system have been assumed in the hydraulic calculations.

Sea level rise due to Climate Change refers to Table 29 of 0.47m for End 21st Century. Storm surge Increase in End 21st Century refer to Table 30b.

Rainfall increase due to Climate Change refers to Table 28 of 16.0% for End 21st Century.

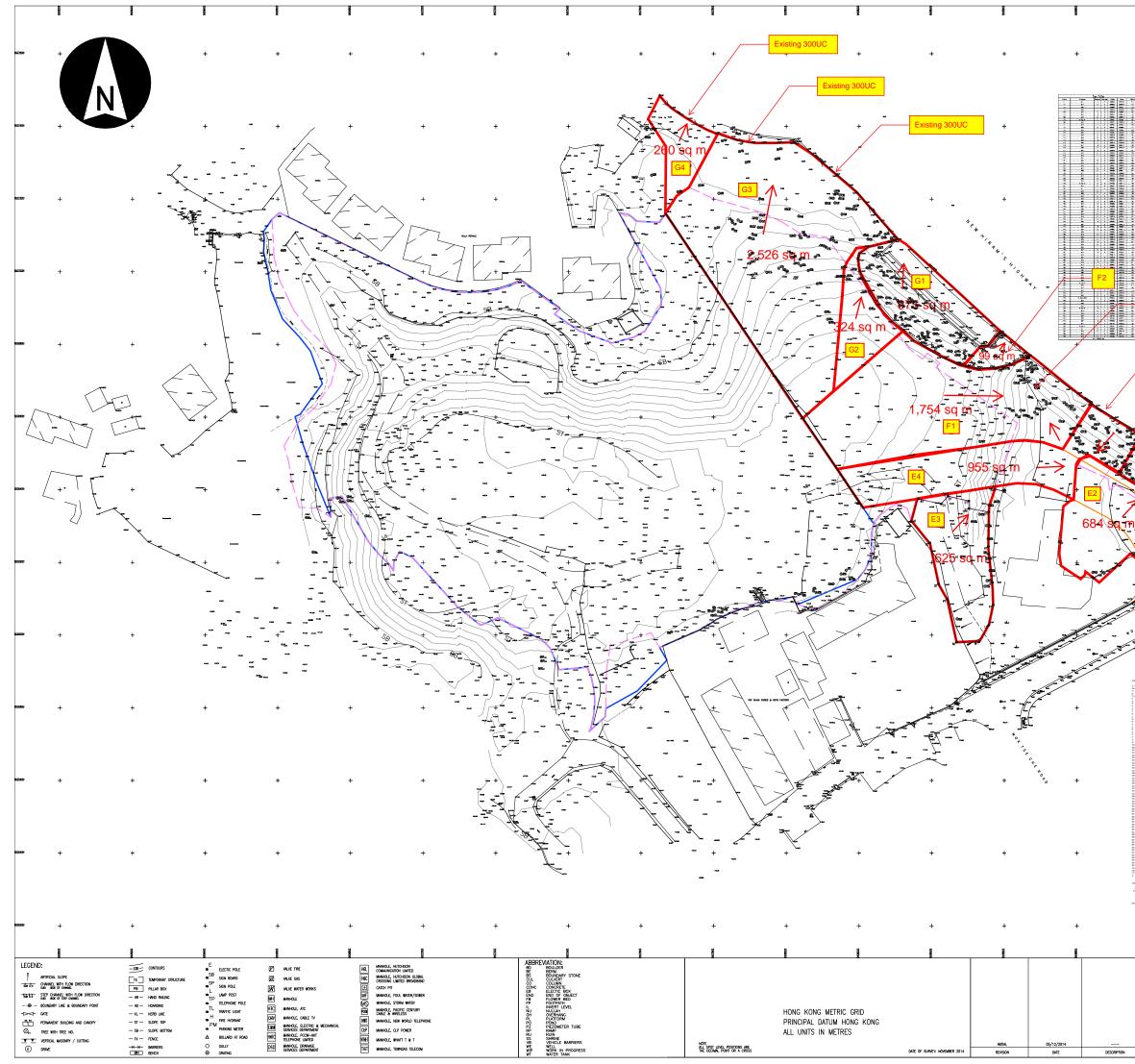
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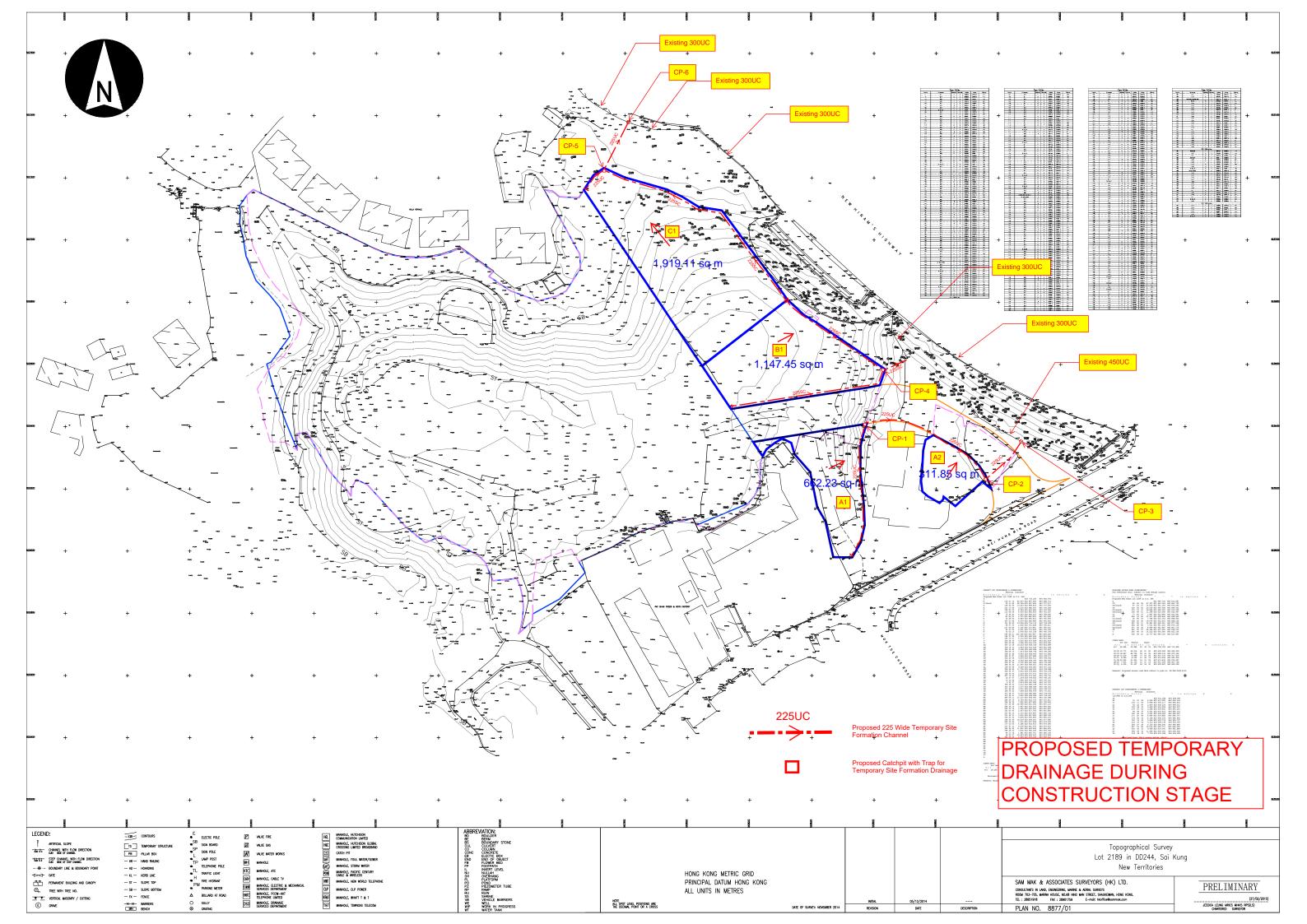
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Appendix C

Temporary Drainage During Construction Stage

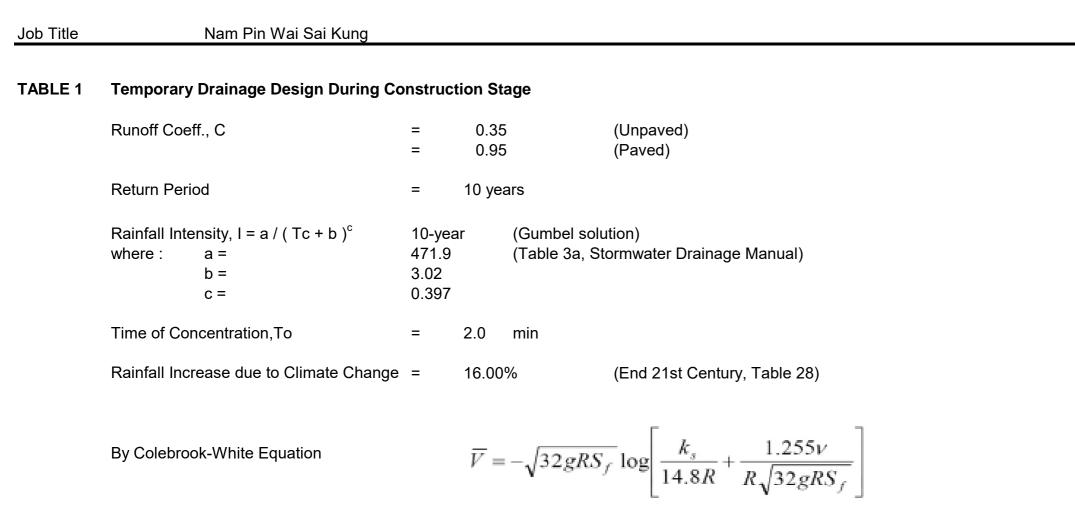


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ARUP

Ove Arup & Partners Calculation Sheet



where ks is equivalent roughness with value equals 1.5mm for channels v is kinematic viscosity of fluid = $1.14 \times 10-6 \text{ m}^2/\text{s}$ and g is the gravity = 9.81 m/s^2 V is the velocity, R is the hydraulic radius of the drain and S is the gradient of the drain

Proposed Temporary Drainage Design

Manhole/0	Catchpit Ref	Contributing	Area	a (m ²)		T _o	T _f	T _c	I	Peak Flow,						Existing / Pro	posed Stepp	oed Channel	and Drain							
Upstream Manhole/ Catchpit	Downstream Manhole/ Catchpit	Catchment Ref.	Unpaved	Paved	Factored Area A, (m ²)	(min.)	(min.)	(min.)	(mm/hr)	Q (m ³ /s)	Channel / Drain	Width (mm)	Depth (mm)	Wetted Area A (m ²)	Wetted Perimeter P (m)	Hydraulic Radius R (m)	Length (m)	UP_GL (mPD)	DN_GL (mPD)	UP_INV (mPD)	DN_INV (mPD)	Gradient (S)	VEL (m/s)	CAP (m ³ /s)	F/C (%)	Ade Cap
U/S U/C	CP-1	A1	662	0	232	1.00	0.23	1.23	308.10	0.020	225UC	225	225	0.045	0.578	0.08	43.1	11.000	9.000	10.775	8.775	0.046	3.07	0.139	14%	
CP-1	CP-2	A1 + A2	974	0	341	1.23	0.19	1.43	302.71	0.029	225UC	225	225	0.045	0.578	0.08	45.8	9.000	5.500	8.775	5.275	0.076	3.95	0.178	16%	
CP-2	CP-3	A1 + A2	974	0	341	1.43	0.09	1.52	300.30	0.028	225UC	225	225	0.045	0.578	0.08	16.1	5.500	4.800	5.275	4.575	0.043	2.98	0.134	21%	
U/S U/C	CP-4	B1	1147	0	402	1.00	0.17	1.17	309.85	0.035	225SC	225	225	0.045	0.578	0.08	52.0	18.000	9.000	17.775	8.775	0.173	5.00	0.226	15%	
U/S U/C	CP-4	B1	1147	0	402	1.00	0.13	1.13	311.24	0.035	225SC	225	225	0.045	0.578	0.08	37.9	16.000	9.000	15.775	8.775	0.185	5.00	0.226	15%	
CP-4	EX OUTFALL	B1	1147	0	402	1.17	0.03	1.20	309.07	0.034	22SUC	225	225	0.045	0.578	0.08	8.0	9.000	7.000	8.775	6.775	0.251	5.00	0.226	15%	
U/S U/C	CP-5	C1	1919	0	672	1.00	0.06	1.06	313.12	0.058	22SUC	225	225	0.045	0.578	0.08	8.4	8.400	8.200	8.175	7.975	0.024	2.20	0.099	59%	
U/S U/C	CP-5	C1	1919	0	672	1.00	0.27	1.27	307.00	0.057	22SUC	225	225	0.045	0.578	0.08	75.1	16.000	8.200	15.775	7.975	0.104	4.60	0.208	28%	
CP-5	CP-6	C1	1919	0	672	1.06	0.10	1.16	310.17	0.058	22SUC	225	225	0.045	0.578	0.08	17.1	8.200	7.500	7.975	7.275	0.041	2.89	0.130	44%	

Existing Drainage Checking

Manhole/C	Catchpit Ref	Contributing	Area	a (m ²)		T _o	T _f	T _c	I	Peak Flow,					E	xisting / Pro	posed Stepp	ed Channel	and Drain						T	T
Upstream Manhole/ Catchpit	Downstream Manhole/ Catchpit	Catchment Ref.	Unpaved	Paved	Factored Area A, (m ²)	(min.)	(min.)	(min.)	(mm/hr)	Q (m³/s)	Channel / Drain	Width (mm)	Depth (mm)	Wetted Area A (m ²)	Wetted Perimeter P (m)	Hydraulic Radius R (m)	Length (m)	UP_GL (mPD)	DN_GL (mPD)	UP_INV (mPD)	DN_INV (mPD)	Gradient (S)	VEL (m/s)	CAP (m ³ /s)	F/C (%)	Ade Cap
Existin	g 450UC	E1, E2, E3, E4	2837	0	993	1.00	0.28	1.28	306.86	0.085	450UC	450	450	0.181	1.157	0.16	38.0	5.400	5.000	4.950	4.550	0.011	2.28	0.413	20%	
Existin	g 300UC	F1, F2	1853	0	649	1.00	0.09	1.09	312.41	0.056	300UC	300	300	0.080	0.771	0.10	9.0	8.000	8.000	7.700	7.610	0.010	1.72	0.138	41%	
Existin	g 300UC	G1, G2, G3, G4	3785	0	1325	1.00	0.20	1.20	309.13	0.114	300UC	300	300	0.080	0.771	0.10	36.2	8.000	4.800	7.300	6.160	0.031	3.05	0.245	46%	

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