SOUTH TIPPERARY COUNTY COUNCIL

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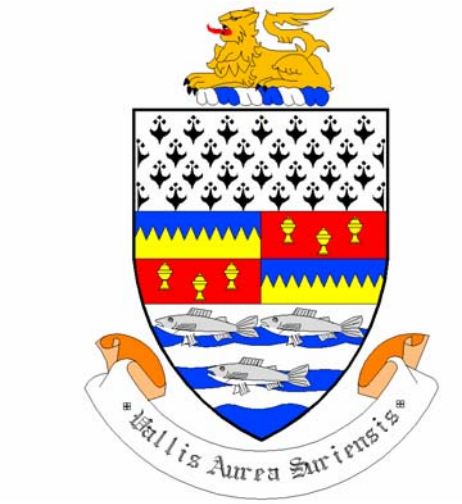

WATER SERVICES SECTION

POTABLE WATER, FOUL AND SURFACE WATER REQUIREMENTS

A Design and Construction Guide for Significant Developments

DATE: July 2009 **Revision 1.3**

The following document has been developed to assist Developers in completing both a planning application and taking in charge applications for significant developments in regard to South Tipperary County Councils (STCC) Potable Water, Foul and Surface Water requirements. The statutory requirements to complete a valid planning application are outlined in the "Planning and Development Regulations, 2001" (S.I. No. 600 of 2001).

These guidelines are subject to change without notification. Prior to submitting a planning application it is recommended that applicants consult with the Water Services Section to confirm their requirements.

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1. GENERAL REQUIREMENTS

1.1. The Developer must consult with the Water Services Section as early as possible prior to submission of any planning application, in order to ascertain both the drainage and potable water requirements, including points of connection.

1.2. The landscape design must take cognisance of the drainage layout in order to protect the structural integrity of the drainage pipes from damage from plant roots. All existing and proposed trees within 10m of any water network is to be shown on the layout plan.

1.3. The developer shall provide for wayleave for services across private property. The width of the wayleave shall be appropriate to the size and depth of the service pipe and shall be agreed in writing with South Tipperary County Council prior to commencement. This shall protect and preserve all future access to service pipes and outlet for surface water discharge to the receiving waters.

1.4. The developer must make provision to service adjoining lands if those lands may be deemed landlocked by the construction of the proposed development.

1.5. All significant developments to submit, prior to commencement of developments, details of a Sediment and Water Pollution Control Plan, for the agreement of the Water Services Section.

1.6. The Local Sanitary Authority must be notified at least 10 working days in advance of the commencement of any proposed drainage works.

1.7. Abandoned sewers and watermains shall be grubbed up or filled with concrete and disused connections properly seal.

1.8. All manhole covers in roads and footpaths shall be heavy-duty covers, Class B 125 product in accordance with IS EN 124 Gully tops and Manhole tops foe vehicular and pedestrian areas. All road gullies shall be lockable type road gullies.

1.9. All works to comply with the following publications:

- Greater Dublin Strategic Drainage Study (GDSDS) - 2005
- Dublin City Council's *"Code of Practice for Drainage Works V6.0"* .
- Department of Environment & Local Government's *"Recommendations for site Development Works for Housing Areas"*, November 1998
- Waste Water Treatment Plants shall be designed, constructed and located in accordance with: "*Treatment Systems for Small Communities, Business, Leisure Centres and Hotels*" as published by the EPA
- "*Sewers for adoption – A Design and Construction Guide for Developers"* 6th Edition as published by Water UK
- *"Standard Specification for Waste Water Treatment Plants – Civil, Mechanical and Electrical "*as published by South Tipperary County Council
- *"Specification for the laying of distribution watermains"* as published by South Tipperary County Council

Where conflicts arise between the above publications, clarification should be sought from the Water Services Section. Where it is intended to deviate from layouts, terms and conditions of governing grant of permission, written agreement is to be sought from the planning section prior to commencement. Where written agreement is not reached a separate grant of permission may be required.

2. DESIGN CALCULATIONS

2.1. South Tipperary County Council have implemented the Greater Dublin Strategic Drainage Study(GDSDS) in its own administrative area. The Councils requirements for all new drainage works in the County are contained in the GDSDS Regional Drainage Policies – Technical Documents. Volume 2, New Developments, chapters 4 to 5 are particularly relevant to developers:

Volume 2 – New Developments

Chapter 4	Sustainable Drainage Systems
Chapter 5	Foul Drainage Design
Chapter 6	Stormwater Drainage Design

2.2. On foot of the GDSDS the "Regional Code of Practice for Drainage works" has been published and is based on best management practice derived from international experience. This document sets out the Councils requirements in a concise format for day-to-day use.

2.3. Design calculations for both the foul and surface water systems are to be in accordance with the design criteria set our in Section 5 & 6 of the GDSDS.

2.4. Submit summary report on all calculations, outlining the conclusions made.

2.5. Where assumptions are made in relation to design calculations you are required to submit details of how, where and why these assumptions were made. It is not sufficient merely to submit design calculations independent of this.

2.6. The applicant shall provide details of both the proposed biological and volumetric loading on the WWTP from the development.

2.7. In relation to potable water the applicant shall submit detailed calculations for the following:

2.7.1. Average daily demand
2.7.2. Peak daily demand.
2.7.3. Location(s) in development where head loss is at a maximum
2.7.4. Estimated maximum and minimum pressures at the developments highest and lowest service points assuming a supply pressure at the point of connection to the public main to be 2bar.

3. DRAWINGS

3.1. Submit drawings in accordance with section 23 of the "Planning and Development Regulations,2001" Plans should clearly show water mains, sewer lines, manholes, invert & cover levels, hydrants, sluice valves etc. Where more than one service is shown on a drawing both colour coding and line type coding should be used.

3.2. Submit proposed longitudinal sections of the Water mains, Foul & Surface Water sewers to include; the chainage, pipe type, pipe strength, pipe diameter, pipe gradient, the invert and cover levels of the manholes, and to include the invert level of the existing manhole at the outfall.

3.3. Plans of proposed Waste Water Treatment Plants shall clearly show the plant layout and compliance with the buffeing zones as detailed in Table 4 of the EPA's "Treatment Systems for Small Communities, Business, Leisure Centres and Hotels".

4. WATER MAIN NETWORK (WN)

4.1. The minimum pipe size shall be 100mm in housing developments of up to 50 houses. Developments of 50 to 100 houses shall have a 150mm diameter trunk main with 100mm spurs.

4.2. The minimum pipe size shall be 150mm in industrial or commercial developments.

4.3. All watermains shall be pressure rated to a minimum of 10bar.

4.4. Water mains shall preferably be laid under footpaths.

4.5. Water mains up to and including 150mm in diameter shall not be laid within 3m of any building or structure, nor shall it be laid within 1m of the boundary of a private property. For water mains greater than 150mm the applicant shall seek the advice of the Water Section.

4.6. Dead ends will not be permitted, and water mains shall be looped. The loop shall contain a minimum of 4 No. houses and 1No. hydrant. This will not only minimise the risk of stagnant or turbid water, but will also allow for back feeding during future maintenance work.

4.7. Dual mains are not acceptable within any site unless prior agreement. Mains should generally remain on the same side of the carriageway/service strip throughout its length and should be sited

on the side where the density of housing is greatest to minimise the number of service connections crossing the road.

4.8. Sluice valves should be sited at each junction to enable the isolation of individual streets and should take account of the need for future maintenance.

4.9. A hydrant shall be provided on the main at its lowest point to facilitate scouring. Double orifice air valves shall be installed at the highest points on the main to release any air that might build up in the main.

4.10. All watermains to be overlaid with a marker tape containing a trace wire.

4.11. Hydrants shall be provide so that no house or part of house is more than 46m from the hydrant, and shall be subject to the approval of the Fire Service. Hydrants should be located such that they can be accessed in an emergency and should not be located in roads or parking areas.

4.12. All service pipes shall include the installation of a Water Control Unit with integral stopcock (note that the use of the traditional stopcock has been discontinued) and meter. Contractors shall consult with STCC Water section in relation to approved types of boundary box.

4.13. Where the flows to a residential development / estate exceed 5,000 litres per day (the equivalent of 10 domestic houses) the Contractor shall supply, install and fully commission at locations specified, electronic bulk flow Water Meters with Readout and Pressure Sensing equipment with Kiosk. All commercial and industrial developments will require electronic bulk flow Water Meters.

4.14. All pipes shall have a minimum depth of cover of 750mm and maximum depth of 900mm.Horizontal distance of 300mm between the distribution water main and other utilities, cabinets, poles, junction boxes or chambers shall be maintained. No other service shall be laid above the line of the watermain. There shall be a minimum vertical clearance of 100mm where other services cross over the watermain. Pipes/ducts, cabinets, poles, junction boxes or chambers shall not be constructed on top of a watermain.

4.15. A surface water or foul sewer may not cross over a watermain.

4.16. Where electric showers are provided in dwellings they shall not be connected directly to the public mains. They must be fed from a storage tank located within the dwelling.

4.17. Fire Water Retention Facilities shall be agreed with the Fire Section and in general shall be in accordance with the EPA “Draft Guidance note to industry on the requirement for Fire –Water Retention Facilities".

4.18. All car wash facilities will be required to recycle

5. BOREHOLE SUPPLY

5.1. The Council’s preferred option is to supply all water needs, both potable and non-potable via the Council’s existing supply network. It is the Councils policy only to develop or allow development of borehole supplies in areas which will augment existing schemes only.

5.2. Bore holes shall be tested for yield and quality, and results submitted as part of the planning submission together with full details of proposed treatment. An estimate of the annual running cost of the production borehole shall be included.

5.3. The bore hole shall comply with the Institute of Geologists of Ireland Guidelines for Water Well Construction and Best International Practice.

5.4. A hydro geologist report outlining the following shall be submitted:
- the principal hydrological characteristics of the area
- delineate source protection zones for production borehole

6. FOUL SEWER NETWORK

6.1. The Council's preferred option is to only permit gravity foul sewers, and all reasonable effort must be made by the Developer to facilitate this. Only in exceptional circumstances will pumping stations be acceptable. Please provide details of the various options that have been explored to connect to the public sewer via gravity, indicating why a pumping station has been preferred over same. If necessary the developer shall be expected to relay existing sewers if doing so would negate the requirement for a pumping station.

6.2. If the Developer proposes to connect to a private sewer not yet taken in charge, and which may or may not be on the public road, the Developer should note the following:

Section 4.1.8 of Dublin City Council's "Code of Practice for Drainage Works V6.0 states"

"The Developer is responsible for establishing the adequacy of any existing private drainage to which they propose to connect their development. The Developers attention is drawn to the fact that it is their responsibility to obtain all necessary permission from the owners of the private drainage system to which it is intended to connect to."

This written permission should accompany the application.

6.3. The Council requires that any site greater than 1ha shall make provision for the monitoring of discharges from the development in line with Section 5.3 of the GDSDS. Submit details with regard to same.

6.4. The use of under sink macerators/food grinders for processing and discharging waste food to the drainage system is not permitted.

6.5. In areas where material is stored, such as bins, waste compactors, etc that can cause pollution: the immediate area must be contained, covered and drained to the foul sewer.

6.6. Prior to the publication of the GDSDS foul sewer design was based on the Department of Environment & Local Government's "Recommendations for site Development Works for Housing Areas", November 1998. While this document still remains in place, it has effectively been superseded by the GDSDS, and Dublin City Council's "Code of Practice for Drainage Works V6.0", which is based on the GDSDS.

Some of the principal design requirements for a foul sewer are shown below:

- All new drainage systems shall be designed and constructed on the basis of a separate system, even where draining into a combined system.
- Sewers and manholes shall be located in public pavements, roads or in public open spaces.
- The length of pipe-work from manhole to manhole should not exceed 90m.
- Gully pots must be provided for every 200m^2 of paved area but low points on a roadway will require additional gullies.
- The minimum depth of cover over a main pipeline shall be 1.2m. If that cannot be achieved, the pipes shall be fully surrounded in 150mm thick concrete with an absolute minimum depth of cover of 750mm.
- Foul sewers shall be by gravity where possible.
- The GDSDS reduces design flows to 3900 l/dwelling/day.
- Gradients to be selected so as to maintain self cleaning velocities.
- When flowing half full velocities should be in the range 0.75m/s to 3m/s.
- Gravity mains to be a minimum 225mm diameter. Where self cleansing velocities cannot be achieved with a 225mm diameter sewer, the Council will consider alternative proposals.

- Monitoring facilities for foul discharges shall be included for those developments exceeding 1ha in area

- A minimum clear distance of 3m between the outside diameter of the pipe and all structures shall be maintained to allow for future access and maintenance of the pipeline. This distance shall increase in accordance with Table 2.1 of "Sewers for Adoption".

- Swimming pools shall be discharged to the foul sewer at a maximum flow rate of 5l/s for an agreed time period.

- Manholes shall be constructed in accordance with Appendix I – Standard Manhole details of the Dublin City Council's "Code of Practice for Drainage Works V6.0"

7. FOUL PUMPING STATIONS (FPS)

7.1. Foul Pumping Stations shall be designed, constructed and located in accordance with "Sewers for adoption – A Design and Construction Guide for Developers" 6th Edition, and in general they should be of a Wet Well/Dry Well Design.

7.2. Appropriate design calculation shall be submitted with the application and should include full details of proposed pumping station.

7.3. A plan layout and typical arrangement drawing of pumping station and valve chamber shall be submitted. A typical pumping station layout is shown in Figures 2.11 and 2.12 of Sewers for Adoption.

7.4. The station should be located no closer than 15m to habitable buildings.

7.5. It shall be located as near as possible to the point of discharge to the public sewer. The rising main shall be laid along the shortest route to the public sewer.

7.6. Estimated annual running costs shall be submitted.

7.7. Where it is proposed to discharge effluent to sewers prone to surcharge the applicant may be required to discharge at off-peak periods. These periods shall be agreed with Water Services prior to commencement and the pumping station designed accordingly.

7.8. Pumped Mains:

- Discharge velocity in range 0.75m/s to 1.8m/s. Max 3m/s

- Diameters below 100mm will generally not be accepted.

- Mains >500m may require chemical dosing or a reduced main size. Design calculation shall be provided.

8. WASTE WATER TREATMENT PLANTS (WWTP)

8.1. The South Tipperary Draft County Council Development Plan 2009-2015 has divided its towns and villages into 5 distinct groups:

Primary Service Centre	Secondary Service Centre	District Service Centres	Local service Centres	Settlement Nodes	
Clonmel	Cahir	Ardfinnan	Anacarthy	Ahenny	Knocklofty
	Carrick on Suir	Ballingarry	Ballypatrick	Ardmayle	Lisronagh
	Cashel	BallyClerihan	Ballysloe	Ballagh	Marlfield
	Tipperary	Ballyporeen	Boherlahan	Ballinure	Monard
		Bansha	Burncourt	Ballylooby	Moyglass
		Cappawhite	Cloneen	Ballyneill	Nine-Mile-House
		Clogheen	Clonoulty	Ballynonty	Rossadrehid
		Dundrum	Donohill	Coalbrook	Rossmore
		Emly	Drangan	Cullen	Sologhead
		Fethard	Dualla	Donaskeagh	Commons
		Golden	Glengoole	Faugheen	Thomastown
		Holycross	Gortnahoe	Goatenbridge	Toem
		Limerick Junction	Grangemockler	Gouldscross	
		Killenaule	Hollyford	Grange (Clonmel)	
		Kilsheelan	Kilfeackle	Grange	
		Lisvarrinane	Lattin	Kilcash	
		Mullinahone	Rosegreen	Killusty	
		Newcastle		Kilross	
		Newinn		Knockavilla	

8.2. To avoid the situation where there could be a multitude of sewerage treatment systems of different technologies in one village or community to cater for each development as it arises, it is proposed to have only one central WWTP for any village or community. This plant would have a 20year design period and a population equivalent of 350 would be the very minimum that any village or community would rise to over a 20 year period. The Council have adopt the following policy in regard to District and Local Service Centres and Settlement Nodes

District Service Centres
The Council will prioritise investment in the upgrading of waste water treatment facilities in District Services Centres. Where development is proposed prior to the implementation of upgrading works, the council will require developers to comply with Option 1 or 2 set out below

Option 1*: The developer will pay 100% of the cost of the upgrade of the existing facility where this is possible for use by the development. Option 1(b) would provide the opportunity for a developer to finance the upgrade of the facility but the Council would cover the marginal cost of that aspect which was over and above the developer's requirements. However, the developer is required to frontload and carry the full 100% cost initially and be reimbursed through development contributions as and when subsequent development occurs.*

Option 2*: This option will be appropriate where option 1 is considered impractical by the Council and where the size of the development will not cause any detrimental effects on the operation of the municipal waste water treatment plant or on the quality of receiving waters. A temporary treatment facility would be considered for development where the effluent was treated on site to an agreed standard and then disposed of through the networks to the Council's system. The temporary waste water treatment plant would be decommissioned by the developer and removed from the site once the new upgraded municipal facility was provided. There will also be a limit placed on the number of temporary treatment plants in any one settlement and the developer must also provide for eventual connection to the municipal facility. The developer will pay the full standard development contribution. The developer would maintain the treatment facility until decommissioning takes place and may be subject to licence or legal agreement.*

Local Service Centres/Settlement Nodes

Within Local service Centres/settlement Nodes the Council will facilitate appropriate sustainable development by requiring developers to provide enabling waste water treatment infrastructure for a proposed development subject to the agreement of the Council. The provision of waste water treatment plants (wwtp) shall be as follows

(i) Where there is an existing facility, the developer will upgrade and consolidate this facility where possible or cover the cost of same: or,

(Iii) Where no existing facility exists and/or where the existing facility is not at the optimum location (not operating satisfactorily and not reasonably possible to make it so) the developer will locate the wwtp on a site identified and/or purchased by the council or on a site which meets the necessary standards as set out by the Council where no site is purchased.

In all casse the wwtp shall be capable of servicing the proposed development and the existing and future requirements of the settlement and of being upgraded in the future by the Council where required. The developer is advised to have proposals agreed with the Water Services, Environment and Planning Sections of the Council prior to making any planning application and submit evidence of same with the planning application. The Council will also require the developer to enter a contract providing ownership of the wwtp site to the Council, along with necessary wayleaves and other rights of way required to operate the facility. (Page79 STDDP 2009-2015)

8.3. A suitable watercourse with sufficient dilution should be available to accept the treated effluent discharge. The Developer must satisfy the Water Services Section that the receiving water is capable of accepting the discharge prior to the granting of any permission.

8.4. In general WWTP's shall be designed, constructed and located in accordance with:

- "Treatment Systems for Small Communities, Business, Leisure Centers and Hotels" as published by the EPA.
- "Standard Specification for Waste Water Treatment Plants – Civil, Mechanical and Electrical "as published by South Tipperary County Council.
- Treatment system and proposed level of treatment – to include
    - Storm water holding tanks.
    - Mechanically operated Inlet Screen.
    - Grit removal where there is an existing combined foul and surface water network.
    - The Council's preferred treatment process is Activated Sludge.
    - Nutrient removal e.g. Nitrigen, Phosphorous.
    - An emergency overflow pipe to local watercourse.
    - A telemetry system.
    - Flow measurement of both the influent and effluent.
    - Automatic recording of the principal operating parameters of the particular process.
    - Duty and standby units for all equipment essential to the correct functioning of the process.
    - Control building to include Office and toilet.
    - Chemical Storage building.
    - All structural elements shall be constructed in reinforced concrete or precast concrete units. No GRP or uPVC chambers will be permitted.
    - Sludge holding tanks, sealed and suitable for connection to a sludge tanker, capable of holding 3 months sludge output from the plant. It must also be fitted with the means to filter the gases given off from the sludge holding tank before releasing them into the environment.
    - Three phase power supply.
    - Sampling chambers for both the influent and effluent.
    - The WWTP can be of modular design.
    - All hard standing areas to be concreted.
    - Access and turning facilities for HGV's within the site.
    - A certificate for the supplier/ installer of the WWTP indicating that the plant has been installed and commissioned in accordance with the planning permission.
    - A copy of the maintenance agreement shall to forwarded to the Water Services Section annually.

- The plant will operate under Licence from the Environment Section, South Tipperary County Council until taken in charge. This License will determine the quality of the effluent discharge.

8.5. Appropriate design calculation shall be submitted with the application and should include all details of the proposed plant including :

- Population projections, Development Potential of surrounding lands and existing Waste waters flows.
- Hydraulic and Biological Loads
- Assimilative capacity of the receiving waters or, where none exist, the geology of the soils to allow discharge to groundwater.
- Site suitability test.
- Effluent Quality analysis.
- Existing sewage system and any other waste water treatment systems.
- Proposed suppliers and manufactures.
- A plan layout showing location of settlement tanks, sand filters etc.

9. SURFACE WATER SEWER (SWS)

9.1. The pumping of Surface Water is not permitted.

9.2. The Council require that surface water must be accommodated where possible on-site.

9.3. The developer shall make provision to incorporate the surface water from public roads where possible.

9.4. All surface water runoff from roofs, driveways and paved areas within the site shall be collected and shall be disposed of within the site boundaries where possible. Surface Water shall not discharge onto the public road or to adjoining properties.

9.5. In general watercourses are not to be culverted or piped. They should remain open in their natural valley, which should be incorporated into the public open space.

9.6. Provide details of petrol/oil separators and silt traps in accordance with Section 20 of the Greater Dublin Regional Code of Practice for Drainage Works. In general petrol/oil separators shall be installed:

- In all industrial and manufacturing developments.
- Commercial Developments with greater than 20 car parking spaces.
- All Petrol service Stations.
- All residential development where surface water attenuation is required.

9.7. All home heating oil tanks shall be sited within bunds capable of retailing 110% of the tank capacity. The bund shall be rendered impervious to home heating oil. All inlets and outlets to the tank shall be contained within the bund. No pipe work shall pass through the bund structure.

9.8. If a Developer's proposed development interferes with the natural drainage pattern/route of the catchment's area, he must submit proposals to accommodate this within his sewer network.

9.9. SWS shall be designed in accordance with the publications outlined previously. Some of the principal design requirements for a Surface Water Sewers are shown below :

- Area to be considered for design of the piped sewer is the total Impermeable area – total area of roofs together with the total area of paving contributing to be system

- Paving from which the runoff flows onto permeable surfaces should not be included

- Run off calculated by means of Modified Rational Method

  - $Q = A_p \times i \times C_r \times C_v \times 2.78$
  - Q Rate of runoff l/s
  - A_p Impermeable area
  - I Rainfall intensity mm/hr *Based on* 1yr return if site gradient >1%

2yr return if site gradient <1%

- o C_r Routing Coefficient (1.3)
- o C_v Volumetric run-off coefficient (0.6 – 0.9)

- Velocities should be in the range 0.8m/s to 3m.s when flowing half full
- Time of entry lies in range 4 to 8 min.
- Computer modelling is not required for sites less than 24ha
- The length of pipe work from manhole to manhole should not exceed 90m.
- Minimum recommended diameter of pipe acceptable for a public sewer is 225mm.
- Sewer and manholes shall be locate in public open spaces, vehicular access shall be maintained, shall not be located in flood attenuation waters.
- Min pipe cover 1.2mm or 750mm with concrete surround.
- All new developments must allow for climate change as set out in the GDSDS.

10. SUSTAINABLE URBAN DRAINAGE SYSTEMS (SUDS)

10.1. South Tipperary County Council Development Plan 2009-2015 states

INF 6 Surface Water
The Council will seek the implementation of rainwater harvesting, SUDS and best practice guidance for the collection and reuse or disposal and treatment of surface water. Such systems will be required to conserve water, protect water quality and regulate the rate of surface water runoff so as not to cause or exacerbate flooding on the relevant site or elsewhere

10.2. Sustainable Urban Drainage Systems (SuDs) are mandatory for all new developments, with the onus on the developer to demonstrate that he cannot incorporate SuDS facilities.

10.3. The applicant shall be required to install a system to provide for the collection, recycling and reuse of surface water to meet non-potable water needs in each dwelling/commercial unit.

10.4. The overall objective when addressing the surface water drainage system for any new development is to mimic the pre-development situation insofar as possible. There are two general methods available:

- Minimise the amount of water entering the piped drainage system.
- If the amount cannot be reduced adequately, provide attenuation measures, which will at least slow the rate of entry into the watercourse. Storage volumes should then be provided to meet the various design criteria.

Minimise Surface Water Entering Drainage System
When planning the overall development, the amount of impervious surfaces should be minimised as they prevent infiltration and increase runoff and pollutant loadings. Suggested approaches to limiting impermeable surface areas include:-

- Reducing road lengths and widths.
- Minimising building footprints.
- Locating buildings close to the main road network to minimise lengths of impervious access.
- Using grass swales for roadway drainage to encourage infiltration.
- Using porous pavements for driveways and parking areas.

Within individual properties, source control systems should be provided to further cut down on the area being positively drained. Examples are soak ways and water butts and these should be designed in accordance with the latest SuDS Manuals. These measures (within private properties) will not be taken in charge by South Tipperary County Council.

Outside the individual properties, pervious pavements, grass swales and infiltration blankets with failsafe mechanisms should be provided to cater for the first 5mm of rainfall as a minimum and in general promote infiltration on the site.

There will be some instances where infiltration will not be possible either due to ground conditions (e.g., low permeability clay) or due to groundwater considerations such as:

- Where poor runoff water quality may pose a pollution threat to groundwater resources, particularly where water supply could be affected.
- Where groundwater levels are high (known to come within 1m of ground surface).

In these instances, minimising of hard standing areas is critical and all runoff should pass through a Class 1 bypass petrol interceptor, which will intercept first flush discharges.

10.5. Intercept Volume

Where possible, an "Interception Volume" should be provided for the first 5mm of rainfall runoff for the development area to ensure zero discharge from this rainfall depth. For calculating the Interception Volume to be provided, the following assumptions should be made:-

- 80% runoff from hardstand surfaces.
- 0% runoff from pervious surfaces.

The most effective way of providing this is by the use of:-

(i) Permeable pavements
(ii) Infiltration Blanket (with overflow).
(iii) Grass swales with raised outlet levels. [See Appendix 2 for worked examples]

- The soil infiltration rate shall be tested in accordance with the method detailed in Appendix 1.
- A factor of Safety of 5 shall apply to all infiltration rates.

10.6. Attenuation Measures (To Slow Down Rate of Flow)

In addition to minimising the area that is positively drained by the surface water system, attenuation measures should be provided to slow the rate of surface water flow off the site during storm conditions. To provide this, the following infrastructure is required:-

- A flow control device - a valve that limits the flow from the system to a pre-determined rate (Vortex flow control devices are common). It should be noted that limiting flows to much less than 7 – 8l/sec is difficult to achieve as throttle pipes should not be smaller than 150mm in diameter and orifice plates and vortex flow control devices should not be less than 100mm in diameter.
- A storage medium - typical alternatives include large diameter pipes, underground storage tanks or "geocellular systems".

The preferred option is to provide oversized gravity sewers, which can be easily flushed clean and will require minimal maintenance for South Tipperary County Council. The oversized network should be designed to ensure no surface flooding during the critical 30-year return period storm event.An acceptable alternative (but less preferred) option is to provide off line tanks or geocellular storage systems:-

- **Attenuation tanks** must be designed for safe operation and maintenance and minimise the need for entry by inclusion of self-cleansing arrangements. Attenuation tanks would be considered confined spaces, would require venting and would need to have a minimum height of 2m for safe man entry.
- High quality, low maintenance **geocellular systems** can provide a more suitable solution in situations where available head is limited and the minimum internal height cannot be provided (There will be no requirement for man-entry).

10.7. The minimum design life for all storm water management structures shall be 50 years. Table 1 provides a comparison of the range of SUDS techniques together with the benefits they provide

	SUDS Techniques	Flow attenuation	Flow reduction	Water quality treatment	High visual amenity	Low maintenance required	Proven long-term reliability	Established design criteria
1	Water butts					√	√	
2	Sub-pavement storage	√	√ 1	√		(√)		
3	Swales	√	√ 2	√	√		√	√
4	Tank sewer storage	√				√		
5	Roof storage (flat)	√				(√)	√	
6	Infiltration basin	√	√	√	(√)			
7	Paved surface flooding	√					√	√
8	Detention basin	√	√ 2	√	√		√	(√)
9	Retention pond	√	√ 2	√	√		√	(√)
10	Permeable pavements	√	√ 1		(√)			
11	Soakaways	√	√	√		(√)	(√)	√
12	Infiltration trench	√	√	√		(√)	(√)	(√)
13	Filter strip	√	√ 2	√	√			(√)
14	Wetlands	√	√ 2	√	√			

Notes:
(√) it can be argred that it does fit this criterion
√ 1 small reduction in volule if lined, high reduction in volume with infiltration
√ 2 flow reduction only significant in smaller events

Table 1

10.8. All new developments that have > 1,500m2 impervious area or discharge to overloaded sewers must have attenuation measures.

10.9. The Developer shall design his storm water attenuation system in accordance with the principals outlined in Section 6.0 of the GDSDS. **A worked example in shown in Appendix 3.**

10.10. The Developer shall submit full detail of proposed attenuation tanks. Tanks must have the capacity to be cleaned and de-silted.

10.11. For all methods of attenuation within a drainage system a Health and Safety Statement must, prior to commissioning of works, to STCC. A full risk assessment must be completed identifying all hazards likely to affect the general public and STCC operations staff and/or their subcontractors. All work from the design stage through to construction and maintenance should be carried out in accordance with the current Safety, Health and Welfare at Work regulations.

10.12. If the developer proposes to use the attenuation tank to discharge to groundwater, he must:

- Carry out a soil infiltration test in accordance with Appendix 1.
- Provide an emergency overflow pipe to a suitable water course. It is not acceptable to use the foul sewer as an overflow.

10.13. The rate of discharge to the receiving water shall be restrained to that of Greenfield runoff for the site. Method of calculation shall be the Institute of Hydrology Report No. 124 “flood estimation for small catchments “, 1994. This may require attenuation

$$QBAR_{rural} = 0.00108\ AREA^{0.89}\ SAAR^{1.17}\ SOIL^{2.17}$$

$QBAR_{rural}$	Mean Annual Flood flow from a rural catchment in m3/s	
AREA	Area of catchment in km2	
SAAR	Standard average rainfall	Available from Met Eireann
SOIL	Soil index	Map available from the Flood Studies Report

For sites less than 50ha, QBAR should be calculated for 50Ha and the corresponding flow rate for smaller sites should then be linearly interpolated.

10.14. Attenuate the 30 year critical storm event.

10.15. Contain the 100 year critical storm event on site. It is recommended that floor levels of all houses are at least 500mm above the predicted maximum 100yr flood level.

10.16. Intercept at least 5mm and preferably 10mm rainfall event runoff to storage and infiltration.

10.17. Maximum permissible outflow from site shall be as calculated abpve or 2 l/s/ha, whichever is greater.

10.18. Design calculations must take account of Climate change:

1. Adjust rainfall intensities by factor of 1.1
2. Adjust river flows by factor of 1.2.

11. SOAKPITS

11.1. Although soakways have been applied to road drainage, their use for anything other than roof water is not advised, as the high sediment loads from road runoff usually causes blockage problems within 20 years. In light of this STCC require the following

Where developers proposed to discharge all runoff to infiltration ditches or soakways, these shall be designed in accordance with BRE Digest 365, with the following adjustments:

- The soakway shall be designed for both the 30year and 100 year storm event as per the attenuation tanks.
- Stone filled soakways will only be permitted for the disposal of roof water
- For the disposal of road runoff an approved system with a void ratio in excess of 90% with associated silt traps must be used. An emergency overflow pipe to a suitable watercourse must be provided.

12. TAKING IN CHARGE

12.1. If a developer wishes to apply to have his services to be taken in charge by the Local authority he shall comply with the Council's "Policy for Taking in Charge Residential Estates". Application forms are available from the Planning Section.

12.2. All sewers, drains pumping stations etc shall be constructed in accordance with this document. These elements shall be taken in charge in conjunction with roads/footpaths and open spaces.

12.3. The Water Services Section will require the following specific information to be submitted:

12.3.1. **MAPPING**

Two copies of "as constructed" drawings of the development shall be submitted to the Council in both hard copy and soft copy, in DXF format. The drawings shall indicate the following information:

a) The site location
b) The Scheme which is to be taken in charge outlined in colour: Red
c) The layout and levels of roads, footpaths, watermains and sewers (foul and surface water). Indicating invert/cover level at manholes, pipe size and gradient, upstream and downstream pipe diameter, material, direction of flow etc.
d) Easting and Northing co-ordinates for all water services elements (valves, meters, manholes etc)
e) All levels must be related to Ordance Survey Datum, Malin Head, to an accuracy of +/- 25mm and stating which benchmark was used.
f) A list of the National Grid Co-ordinates (accuracy to +/- 300mm) for the elements should be supplied.
g) The position of road gullies and their connection points to the main surface water network;
h) The position of service ducts crossing carriageways clearly identified by dimensioning from clearly visible surface feature, e.g. road gully or manhole and also details of the services for electrical, telephone and television or other services underground;
i) Any open space (to be coloured green) and details of its finished levels and landscaping;

j) Clear identification of surface water discharge points.
k) Location of Surface Water Attenuation Systems
l) Location and details of Pumping Stations and rising mains
m) Where Waste Water Treatment plants are involved, the applicant shall consult with the Local Authority regarding the details required.
n) The drawing scales shall be such that information can be easily read.

12.3.2. **CCTV SURVEY**

a) A CCTV survey/manhole survey of the collection systems will be submitted to the Council prior to lodging an application form for taking in charge. The survey shall be completed at the Applicants expense.
b) The sewers to be surveyed shall be thoroughly cleaned out first.
c) The CCTV Survey shall be carried out using a camera, which is capable of measuring distances from one manhole to another.
d) The CCTV survey report shall conform to the standards set out in the WRC Manual on Sewer Condition Classification. The report shall include a summary of any defects in the systems. Any defects in the systems shall be corrected by the Applicant at his own expense, prior to taking in charge. High-resolution photographs and quality DVD recordings shall supplement the printed report.

12.3.3. **TESTING**

12.3.3.1. *Sewers*
All sewers shall be tested in accordance with Section 3 of Department of Environment & Local Government's *"Recommendations for site Development Works for Housing Areas"*, November 1998.

12.3.3.2. *Water Mains*
All water mains shall be tested in accordance with South Tipperary County Council "Specification for the laying of distribution water mains".

12.3.3.3. *Surface Water Attenuation System*
A commissioning report from the system supplier or from an agreed third party shall be prepared to the satisfaction of the local authority before the system is brought into operation

12.3.3.4. *Pumping Stations*
All pumping stations shall be tested in accordance with "Sewers for adoption – A Design and Construction Guide for Developers" 6th Edition as published by Water UK.

12.3.3.5. *Waste Water Treatment Plants*
A commissioning report from the plant supplier or from an agreed third party shall be prepared to the satisfaction of the local authority before the plant is brought into operation. The applicant will be required to obtain the necessary feed source for the plant in order to enable its performance to be measured.

Certification for the above will be required from a suitably qualified person with professional indemnity insurance and tax clearance certificates.

APPENDIX 1
INFILTRATION TEST PROCEDURE

INFILTRATION TEST PROCEDURE

General
The hydraulic properties of a soil are site-specific. The infiltration coefficient for a soil is an important element of the hydraulic design of an infiltration system. At present, the only reliable method of determining the infiltration coefficient for a particular site is to carry out an infiltration test on site based on the procedure below and a factor of safety will be applied to take account of the following possible design issues:-

- The test pit may not be representative of the full size system.
- The infiltration coefficient may differ for different antecedent soil moisture conditions.
- The infiltration coefficient may reduce in time due to clogging of the system by fine sediments.

Number of Test Pits

If preliminary calculations indicate that one of the dimensions of the infiltration system will be larger than 25m then a second test pit should be used. For larger systems, further test pits should be required every 25m. If the soil is fissured or there is reason to suspect that the soil characteristics may vary across the proposed system location, then the distance between test pits should be reduced to 10m.
If more than one test pit is used, the mean value of the infiltration coefficients determined in the different test pits should be used in the design calculations.

Size of Test Pit

The test pit should be at the same approximate depth as the elevation of the proposed infiltration surface. This implies that for a plane infiltration system, such as an infiltration pavement, a relatively shallow test pit will normally be required while for a large soakaway a deeper test pit is likely to be more appropriate. The size of the test pit should be related to the size of the area to be drained to the infiltration system as follows:-

- If the area to be drained is less than 100m^2, the pit should be at least 0.5m^3.
- If the area to be drained is greater than 100m^2 then the pit should be at least 2m^3.

Ideally, the pit should be 0.3 to 1 m wide and 1 to 3 m long with vertical sides trimmed square. Any smearing to the sides or base of the test pit caused by excavation machinery should, if possible, be removed by hand, as smearing could significantly reduce the recorded infiltration coefficient.

Test Procedure

1. Excavate a trial pit of the appropriate size.
2. Record the wetted area of the internal surface of the pit including both the sides and base when the pit would be half full of water.
3. Fill the pit with water.
4. Record the water level and time at frequent intervals as the pit empties of water.
5. Repeat the test twice more, preferably on the same day.

Testing to full depth may not be appropriate if:-

- The trial pit is very deep and it would be difficult to supply sufficient water for a full depth soakage test.
- In the completed infiltration system, infiltration will only take place from the lower layers.

In these cases, the test may be conducted at less than full depth. The calculation of the soil infiltration coefficient should then be based upon the actual maximum water depth achieved. If necessary for stability, the pit should be filled with granular material and a full-height perforated, vertical observation tube should be positioned in the pit so that water levels can be monitored. In this case, the volume used to calculate the infiltration coefficient (V_{p75-25}) should be multiplied by the porosity of fill material.

Analysis of Test Results

The time taken for the pit to empty from 75 per cent to 25 per cent of the depth of the pit should be determined, t_{p75-25}.

The storage volume of the pit between 75 per cent and 25 per cent of the depth should be determined, V_{p75-25}.

The area of the base and sides of the pit at 50 per cent of the depth should be determined,a_{p50}.

The soil infiltration coefficient, q is given by:

$$q = V_{p75-25} / (a_{p50} \times t_{p75-25})$$

The smallest value of q obtained from all the tests carried out in the pit should be used. Where multiple test pits are used, the mean value of the infiltration coefficients determined in the different test pits should be used in the design calculations.

APPENDIX 2
DESIGN EXAMPLES FOR INTERCEPTION STORAGE

(Pervious Pavements, Infiltration Blankets & Grass Swales)

PERVIOUS PAVEMENT

Conventional pavements allow all rainwater to run across the surface to gullies which collect it and direct it into pipes. Permeable pavements offer an alternative to this whereby traffic loads are still supported, but water is allowed pass through the surface and into the underlying subbase where it is released slowly into the ground. Permeable pavements are therefore recommended and should be provided to cater for the first 5mm of rainfall (interception storage) as a minimum.

Design Calculations
The design criteria for interception storage are an intensity of 30mm/h (0.03m/hr) and a duration of 10minutes (total rainfall depth = 5mm).

Assuming no short term storage is provided under the surface (e.g. open lattice blockwork), storage occurs on open ground above the infiltration surface. The maximum buildup of water on the surface in this case can be calculated by

$$\mathbf{h_{max} = D\,(Ri - q_a)}$$

Where: i = intensity (30mm/hr)
D = duration (10 minutes)
q_a = applicable infiltration coefficient
R = ratio of area to be drained/infiltration area (normally = 1)

Therefore for the minimum interception storage, assuming infiltration was negligible, the maximum depth of water would be 5mm (= Di). Therefore in general, permeable pavements can be considered to provide interception storage.

Design for Wider Applications
For wider applications (whereby pervious pavements are being provided to cater for large storm conditions) the required short term storage can be provided in the subgrade material below the infiltration surface.

This subgrade material can be in the form of a depth of clean stone or geocellular system. The porosity of the relevant materials should be divided into the value of h_{max} to give the total depth of storage material required. Typical porosity values for fill materials are given in the table below:-

Material	**Porosity, n**
Geocellular Systems	0.9 – 0.95
Clean Stone	0.4 – 0.5
Uniform Gravel	0.3 – 0.4
Graded Sand or Gravel	0.2 – 0.3

INFILTRATION BLANKET

The construction of an infiltration blanket involves the laying of slotted pipes through a granular filled blanket, which allows the water to infiltrate into the underlying soil. The system is effectively buried and allows alterative use of the ground surface. An overflow pipe should be provided which allows surface water in excess of the design rainfall depth (5mm in this case) to bypass the system and pass to the drainage system downstream. A schematic layout is shown below.

Design Calculations
Determine the area to be drained to the infiltration blanket, A_d

Calculate the applicable infiltration coefficient for the site, q_a (from site tests - see Appendix 1) Estimate the required infiltration blanket area, A_b:

Calculate $h_{max} = D/n \times (iR - q_a)$

Where I = Intensity
D = Duration
N = porosity of infiltration blanket material
R = drainage ratio = A_d / A_b
A_b = Area of Infiltration Blanket
q_a = applicable infiltration coefficient for the site

For first 5mm of rainfall, there should be no overflow discharge to the downstream piped system from the blanket. Therefore either

- h_{max} should be zero or
- For hmax > 0, the blanket should be designed such that adequate storage is provided

Worked Example

Inputs
Assume from site tests, infiltration coefficient for the site, q = 50mm/h (0.05m/hr)
Factor of safety = 5, therefore applicable coefficient, q_a = 10mm/h (0.01m/hr)

Equivalent Area to be drained = 4,000m^2
Intensity = 30mm/hr for 10 minutes, giving 5mm of rainfall
Duration = 10minutes = 0.167hours
Infiltration Blanket is to be filled with uniform gravel with a porosity value, n = 0.3

Calculate Blanket Dimensions

A_b = 200m^2
R = 4,000/200
= 20
H_{max} = 0.167/0.3 x [(0.03 x 20) – 0.01]
= 0.328m

Therefore, set the blanket dimensions whereby say 0.350m of storage across the area is provided. This gives a total of 70m^3 blanket volume storage.

GRASS SWALE WITH RAISED OUTLET

Swales are grass-lined channels with shallow side slopes, which can be used to both convey and infiltrate stormwater. To increase the infiltration and detention capacity, they can be provided with low check dams across their width.

The swale channel dimensions should be sized using Manning's equation based on maximum velocity of 0.3m/sec. The required design flow for interception storage will be 30mm/hr for 10 minutes for area to be drained. The maximum depth of flow should be restricted to 100mm. The slope of the channel should be between 1 and 3%. If slopes greater than 4% are used, small check dams should be provided. Trapezoidal cross sections should be provided with side slopes sloped at 3:1 or less.

Interception Storage should be provided within the swale channel as required by raising the outlet.

Design Calculations

Determine the area to be drained to the swale, A_d and the associated max flow. Using this flow, determine the swale cross-sectional dimensions using Mannings Equation:

$Q = V \times A = [1/n \times (m)^{2/3} \times slope^{1/2}] \times A$
V = Velocity.
m = A/P where: A = cross-sectional area of flow; P = wetted perimeter.
n = Mannings Number and should be taken as 0.15 for flow depth up to 100mm.

The velocity and flow capacity should be checked for 100mm flow depth to ensure the design criteria are met Once the channel cross-sectional dimensions are decided, check the infiltration capacity to determine the volume of interception storage volume (if any) required.

Worked Example

Inputs
Assume from site tests, infiltration coefficient for the site, q = 50mm/h (0.05m/hr)
Factor of safety = 5, therefore applicable coefficient, q_a = 10mm/h (0.01m/hr)

Equivalent Area to be drained = 2,000m^2
Intensity = 30mm/hr for 10 minutes, giving 5mm of rainfall
Duration = 10minutes = 0.167hours

Therefore design flow = 2000 x 0.03m^3/hr
= 60m^3/hr
= 16.7l/sec

Select Swale Cross Section
Following trapezoidal cross section is chosen:
2m wide flat section
3:1 side slopes
Longitudinal slope of swale channel = 1/100

For 100mm depth of flow, calculate velocity and capacity

A = 2m x 0.1m + 0.1m x (3 x 0.1m) = 0.23m^2
$P = 2m + 2 \times (0.1^3 + 0.3^2)^{1/2} = 2.63m$
m = 0.087
$V = 1/0.15 \times (0.087)^{2/3} \times 0.01^{1/2} = 0.131m/sec$
Q = V x A = 0.030m^3/sec = 30l/sec

Q > 16.7l/sec and V< 0.3m/sec

Therefore cross sectional dimensions acceptable.

Calculate Storage Volume Requirement

Infiltration capacity of soil	=	10mm/h (0.01m/hr)
Flow into swale	=	$60m^3$/hr for 10 minutes = $6m^3$

Assuming 100m long swale and infiltration only occurs through the flat base of the swale, infiltration area = $200m^2$. Therefore infiltration volume in 10 minutes = 0.01m/hr x 1/6hours x $200m^2$ = $0.33m^3$

Therefore storage volume required = $5.67m^3$.

It is recommended that in general the outlet pipe be set a minimum of 100mm above the base of the swale to ensure some infiltration will take place. For a 100mm step in this example, the storage provided (as shown below over 2m width) would be calculated as approximately $10m^3$.

It should be noted that in general swales are better suited to non-point discharges (sheet flow) such as 'over the edge' road drainage. However point discharges can be permitted if adequate anti-erosion measures (such as riprap) are put in place.

APPENDIX 3
DESIGN EXAMPLE FOR STORMWATER ATTENUATION

It is assumed that, in this case, the outlet from the site will be a free discharge and will not be subject to backing up.

The design example has been divided into 12 steps as follows:

1. When planning the overall development, minimise the amount of hardstanding areas thus promoting infiltration.

2. When addressing the hardstanding areas that are being provided, minimise the area to be positively drained by the system by providing source control systems within individual properties. Examples are soakaways, water butts, etc and these should be designed in accordance with the latest SuDS Manual. These measures within private properties will not be taken in charge by South Tipperary County Council

3. Separate the total site area into the following and calculate the total area for each:-

    - Hardstand surfaces (whether positively drained to the system or partially drained to infiltration).
    - Pervious/landscaped areas not connected to the drainage system

    Once the developer has carried out steps 1-3, the following figures are relevant to the site.

    Total site area = 5 Hectares
    Soil Category = S2
    SAAR = 820mm
    Total site area converted to hardstanding = 3 Hectares

4. Calculate runoff from 5mm of rainfall on the development area. For this calculation, hardstand areas should be assumed to provide 80% runoff, non-hardstand areas should be assumed to provide 0% runoff. An equivalent volume of "Interception Storage" should be provided on the site whereby no discharge from the site occurs for this depth of rainfall.

    Examples are grass swales and infiltration trenches for piped runoff and pervious pavements for car park areas. Carry out design checks for infiltration systems proposed which will be based on the infiltration coefficient, q for the site. The procedure for working out the infiltration coefficient, q is included in Appendix 1.

    Ensure that all runoff passes through some infiltration measure unless infiltration is specifically not permitted on the site.

    Hardstand area = 3 hectares = 30,000m^2
    Total volume from 5mm rainfall = 5mm x 80% x 30,000
    = **120m^3**

    Therefore, a minimum interception volume of 120m^3 should be provided. This will prevent discharge from the site during rainfall events of up to 5mm rainfall. The depth and vulnerability of the groundwater in the area should be established before infiltration measures are provided.

    Assuming infiltration is possible, design checks should be carried out at this stage for the various infiltration measures being proposed. The designs will be based on the infiltration coefficient, q for the site, which will be determined from site tests as outlined in Appendix 1.

    This volume can be provided at different locations around the site, but runoff from all individual areas must pass through some infiltration measure designed for a minimum of 5mm rainfall. Worked examples for the design of pervious pavements, infiltration blankets and grass swales are included in Appendix 2.

5. The calculation to be used to predict the existing Greenfield Runoff rate is shown below. This equation was developed by the Institute of Hydrology in their report 124 "Flood estimation for small catchments", 1994 and is based on 71 small rural catchments weighted sum of individual soil class fractions as detailed below:-

    $$\mathbf{QBAR_{rural} = 0.00108 \times AREA^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}}$$

    where:

    - QBARrural is the mean annual flood flow from a rural catchment in m^3/s.

- AREA is the area of the catchment in km^2.
- SAAR is the standard average annual rainfall in mm.
- SOIL is the soil index (from Flood Studies or Wallingford Procedure maps). It is a

As area < 50 Hectares, QBAR for 50 Hectares is first calculated

$QBAR = 0.00108 \times (AREA)^{0.89} \times (SAAR)^{1.17} \times (SOIL)^{2.17}$
$QBAR = 0.00108 \times (0.5)^{0.89} \times (820)^{1.17} \times (0.3)^{2.17}$
$= 0.1100\ m^3/sec$
$= 2.2l/sec/ha$

Calculate QBAR for smaller area

QBAR = 2.2l/sec/ha x 5ha
= **11.0 l/sec**

6. QBAR can be factored using the Flood Studies Report regional growth curve for Ireland to produce peak flood flows for a number of return periods. Information on growth curves for UK and Ireland is available in Flood Studies Supplementary Report (FSSR) 14, 1987 produced by the Institute of Hydrology

T (Years)	QT/QBAR
1	0.87
2	0.95
5	1.2
20	1.54
30	1.64
100	1.96

Tale1 : Peak Flow Rate for Various Return Periods

The table above gives values for a number of return periods, which are based on the following calculation:-

$$\mathbf{Q_T / QBAR = -3.33 + 4.20\ e^{Y/20}, \qquad Y = -ln\ [-ln\ (T - 1)/T]}$$

where T = return period in years.

Factor QBAR to calculate Q2 (The peak flood flow for the 2-year return period) and Q30 (ditto for 30-year return period) using the growth curves.

Calculate the peak flood flows for various return periods

QBAR = 11.0l/sec
Q2 = 11.0 x 0.95 = **10.5lsec**
Q30 = 11.0 x 1.64 = **18.0lsec**

7. Set the allowable discharge from the site to Q2, as calculated above. Using the rainfall return period table (including additional 10% for climate change), calculate the volume of attenuation storage required for the critical 30-year return period storm event.

Factor this volume by 1.25 to allow for the head-discharge relationship, as the full Q2 flow will not be mobilised for the entire storm duration.

For this calculation, 80% runoff should be assumed for hardstand areas. (The remaining 20% takes account of obstructions, depression storage, evaporation, etc).

For the pervious surfaces, it is unreasonable to assume that there will be no runoff from these areas as the argument can be made that the area will continue to contribute in the same way as it did prior to the development. It can also be argued however that the runoff will have been seriously restricted due to urbanization effects impeding runoff from these areas.

The percentage runoff for pervious areas should therefore be taken to be equal to the SPR value (Standard Percentage Runoff) for the soil type on the site. The table below summarises the SPR value for the five soil types used in the Flood Studies Report procedure.

Soil Type	Standard Percentage Runoff (SPR)
1	0.1
2	0.3
3	0.37
4	0.47
5	0.53

Table 1.2 SPR Values for Various Soil Types

Summary of Run-off Factors

Impervious areas 80% Runoff
Pervious areas 10 – 53% Runoff

Allowable discharge set at 10.5l/sec. 30-year return period storm events checked.

80% of hardstand areas assumed to contribute.

Soil SPR Value = 0.3, therefore 30% of non-hardstand areas assumed to contribute

Equivalent runoff area = (80% x 3Ha) + (30% x 2) Ha
= 30,000m2

For the 30-year storm events, use rainfall depths for the various durations. A table is generated below, which identifies the 12-hour duration event as the critical event. The rainfall depths used include a 10% allowance for climate change.

A		B	C	D	E	F	G
Duration		Runoff Area (m2)	Total Rainfall Depth (mm)	Revised Depth for climate Change (mm)	Total Surface Water (m3)	Total Permitted Discharge (m3)	Storage Volume Required (m3)
hr	min			(C x 1.1)	(BxD)	(Q2 xA)	(E-F)
0.25	15	30,000	14.9	16.39	492	9	483
0.5	30	30,000	18.3	20.13	604	19.00	585
1	60	30,000	22.5	24.75	743	38.00	705
2	120	30,000	27.6	30.36	911	76.00	835
4	240	30,000	34.0	37.4	1122	151.00	971
6	360	30,000	38.3	42.13	1264	227.00	1037
12	720	30,000	47.1	51.81	1554	454.00	1100
24	1440	30,000	53.1	58.41	1752	907.00	845
48	2880	30,000	57.9	63.69	1911	1814.00	97
96	5760	30,000	75.6	83.16	2495	3629.00	-1134

The critical storm event is the 12-hour duration, which gives a volume of 1100m3. An allowance to account for the simplifying assumption of head – discharge relationship of 1.25 is applied. This is because the simple calculations above assume the maximum flow rate can be mobilized immediately for each design return period.

Revised Critical Volume = 1,100 x 1.25 = 1,375m3

8. It is noted that many of the urban drainage software packages are capable of carrying out optimized storage volume designs. If modeling the drainage system, the rainfall depth should be distributed throughout the storm duration by using the summer profile from the Flood Studies report. Acceptable modeling packages would be Infoworks, Microdrainage, or equivalent

   Ideally, the system should be modeled using the summer rainfall profile to distribute the rainfall depth over the storm duration. This will lead to an optimization of the storage volume required. Most drainage

software packages also allow the control mechanism to be modeled, thereby avoiding the requirement to multiply the volume by 1.25. If no modeling is carried out, the calculation in Step 7 should stand.

It is assumed that following modeling, the optimized critical storage volume required is 1,150m3.

Note: A printout of the results from the software package should be provided to South Tipperary County Council backing up the modeling output. All assumptions and inputs must be clearly shown and the model layout should correspond with the drainage layout drawing for the site.

9. Subtract the volume of "Interception storage" (if provided) for maximum of first 5mm of rainfall to calculate attenuation volume required. If infiltration potential is considered marginal, do not subtract this volume

   Subtract interception storage already provided under Step 4 above. Note that if the infiltration capacity of the site is deemed to be marginal, this volume should not be subtracted from the attenuation volume. The interception storage infiltration measures should still be put in place however. In this case it is assumed that the infiltration capacity is adequate. Therefore:

   Required Attenuation Volume = 1,150 – 120 = **1,030m3**

10. The preferred method for providing this storage volume is in the form of oversized sewers, which will be allowed to fill and surcharge during storm events. If the system has been modeled, the sewers sizes can be changed as required on a trial and error basis so as to meet the design criteria. Care should be taken to ensure that no surface flooding will occur (in low lying areas) when this storage volume is being used for the 30-year storm events.

11. If a storm event of return period greater than 30-years occurs, the calculated attenuation storage volume will be used up. At this stage an over flow should occur to a second discharge point whereby the combined discharge from the site should be equal to Q30 (The peak Greenfield flood flow for the 30-year return period).

    If a storm event of return period greater than 30-years occurs, the calculated attenuation storage volume will be used up. At this stage an overflow should occur to a second discharge point whereby the combined discharge from the site should be equal to Q30 (The peak Greenfield flood flow for the 30-year return period)

    It is important that this overflow setting should be such that it is only mobilized once the attenuation storage volume has been used up first.

12. Once the allowable discharge from the site has been set at Q30, the critical 100-year storm event should be run to identify what areas of the development site will flood. These areas should be public open space, car parks, playing pitches, etc and be capable of draining away (either through drainage system or infiltration) once the storm abates. No internal property flooding and no flooding of adjacent urban areas should occur.

    The six-hour duration 100-year return period storm should be run to assess the additional temporary flood storage required for the site. This temporary flood storage should take place in a designated public area (e.g. playing pitch, green area or car park) and should be able to drain away (either to the system of via infiltration) once the storm has abated. This can be readily assessed when the drainage system is modeled.
    If no modeling is carried out, the following simplistic calculation should be used:-

    - 100-year, 6 hour event: Rainfall depth = 47.4mm.
    - Factor up for Climate Change = 52.1mm.

Step	Details	Calculation	Volume (m3)
A	Total volume of Runoff	52.1mm x 30,000m2	1563
B	Deduct discharge at Q2 for 5 hours	10.5 l/sec x 5 hours	189
C	Deduct discharge at Q30 for last hour	18.0 l/sec x 1 hour	65
D	Storage volume required A - (B + C)	A - (B+C)	1309
E	Factor up for head relationship factor D x 1.25	D x 1.25	1636
F	Deduct Interception Storage	(From Step 4)	120
G	Deduct Attenuation Storage	(Not modeled - see step 7)	1375
H	Temporary Flood Storage Required	E - (F + G)	141

This flooding will occur at the low points on the site where water can escape from the drainage system. Care should be taken to ensure that this will not result in property flooding. Ideally this flooding should take place in public open space, car parks, playing pitches, etc and be capable of draining away (either back through the drainage system or via infiltration) once the storm abates.

Water Butts: The use of water butts while recommended is not mandatory

Wetlands:

Wetlands shall be designed in accordance with CIRIA C522, and shall meet the following basic sizing criteria

- Minimum treatment volume to capture and treat an amount equal to 15mm of rainfall
- Surface area required defined as the minimum wetland surface area in proportion to the area being drained is as follows
    - Shallow marsh wetland 2%
    - Pond/wetlands 1%
- The dry weather flow path length should be at least twice the width of the wetland
- The inflow and ground water inputs should be greater than infiltration and evaporation water losses for all designs

Filter Strips:

Filter strips shall be designed in accordance with CIRIA C522, and shall meet the following basic sizing criteria

- They should be between 6m and 15m wide
- Velocities should not be less than 0.3m/s to settle out sediments