Appendix C: Model Type Definition Tables

This section provides an alternative view of the model types defined by Table 3-4 in Section 3.

Static/simple models

Table C-1: Static/simple model examples

Example	Application	Details	Model component included?				
			Pipe network	2D surface	Open channels	Hydrological parameters	Upstream catchments
Rational method, small-scale	Hand calculation / spreadsheet estimates of peak runoff for single, small property.	Direct calculations based on standard engineering approaches. Used for small-scale infrastructure design with no backwater effects.	×	×	×	✓	×
Rational method, medium scale	Hand calculation / spreadsheet estimates of peak runoff for multiple lot development with low known risk.	As above, but including a larger catchment and slightly more complex calculations. Requires experience to ensure that calculations are appropriate and that the system can be described sufficiently with a minimum of effort.	×	×	×	✓	×

Table C-2: Static/simple model components

Example application	Assessment criteria (Tables 3-13 to 3-16)	Model component (Table 3-4)				
		Pipe network	2D surface	Open channels	Hydrological parameters	Upstream catchments
Rational method, small-scale	Methodology	Excluded	Excluded	Excluded	Simple	Excluded
	Level of detail	-	-	-	Averaged, low-resolution	-
	Rigour	-	-	-	Literature	-
	Data maturity	-	-	-	Conceptual	-
Rational method, medium scale	Methodology	Simple	Excluded	Excluded	Simple	Excluded
	Level of detail	-	-	-	Grouped, low-resolution	-
	Rigour	-	-	-	Literature	-
	Data maturity	-	-	-	Conceptual	-

Static/complex models

Table C-3: Static/complex model examples

Example	Application	Details	Model component included?				
			Pipe network	2D surface	Open channels	Hydrological parameters	Upstream catchments
Regression of timeseries data	Flood flow frequency analysis for gauged stream	Statistical or GIS-based model that does not incorporate explicit descriptions of physics	×	×	×	✓	×
Steady-state gutter, inlet, and culvert design	Design software for isolated drainage systems with short times of concentration.	Computerised calculations based on complicated engineering approaches	✓	×	✓	✓	×
Rolling ball with depression analysis	Overland flow path and depression area mapping	Topographic analysis to identify flow paths, catchment sizes, potential ponding areas, and areas of deepest / fastest / most frequent flooding. Not associated with rainfall event probability.	×	✓	✓	×	×

Table C-4: Static/complex model components

Example application	Assessment criteria (Tables 3-13 to 3-16)	Model component (Table 3-4)				
		Pipe network	2D surface	Open channels	Hydrological parameters	Upstream catchments
Regression of timeseries data	Methodology	Excluded	Excluded	Excluded	Data-driven	Excluded
	Level of detail	-	-	-	Averaged, high-resolution	-
	Rigour	-	-	-	Calibrated	-
	Data maturity	-	-	-	Mature	-
Steady-state gutter, inlet, and culvert design	Methodology	1D hydraulics	-	1D hydraulics	Simple	-
	Level of detail	Grouped, low-resolution	-	Grouped, low-resolution	Averaged, low-resolution	-
	Rigour	Literature	-	Literature	Literature	-
	Data maturity	Conceptual	-	Conceptual	Conceptual	-
Rolling ball with depression analysis	Methodology	-	-	Simple (large channels) – small channels excluded	Simple	-
	Level of detail	-	-	Discrete, medium-resolution	Discrete, medium-resolution	-
	Rigour	-	-	Theoretical	Theoretical	-
	Data maturity	-	-	Detailed / mature	Mature	-

Dynamic/simple models

Table C-5: Dynamic/simple model examples

Example	Applications	Details	Model component included?				
			Pipe network	2D surface	Open channels	Hydrological parameters	Upstream catchments
High-level 2D	• Evacuation planning • Lifeline planning	2D domain model with direct rainfall, excluding hydrological losses or pipe network. No editing of DEM to represent channel conveyance.	×	✓	×	✓	✓
Medium detail 2D	• Strategic planning • Programme prioritisation	2D domain model with direct rainfall and hydrological losses, but no pipe network. DEM modified at significant structures on large open channels (culverts, bridges, etc.) to ensure flow continuity, if not accurate afflux.	×	✓	✓	✓	✓
Detailed 2D	• Spatial planning • District Plan development • Regional or District Plan changes • Long Term Plan development • Multiple lot stormwater design with known existing risk (to site or downstream)	2D domain model with direct rainfall and hydrological losses, but no pipe network. Detail is added at significant structures on large open channels to determine accurate afflux. Soakage losses are incorporated into infiltration loss.	×	✓	✓	✓	✓

Table C-6: Dynamic/simple model components

Example application	Assessment criteria (Tables 3-13 to 3-16)	Model component (Table 3-4)					
		Pipe network	2D surface	Open channels		Hydrological parameters	Upstream catchments
				Large	Small		
High-level 2D	Methodology	Excluded	2D hydraulics	2D hydraulics		Excluded	Hydrological
	Level of detail	-	Discrete, low-resolution	Averaged, low-resolution		-	Grouped, low-resolution
	Rigour	-	Theoretical	Literature	Theoretical	-	Verified
	Data maturity	-	Mature	Unconsidered		-	Mature
Medium detail 2D	Methodology	Excluded	2D hydraulics	2D hydraulics		Hydrological	Hydrological
	Level of detail	-	Discrete, low-resolution	Grouped, low-resolution		Grouped, low-resolution	Grouped, low-resolution
	Rigour	-	Theoretical	Literature	Theoretical	Literature	Verified
	Data maturity	-	Mature	Simple	Unconsidered	Unconsidered	Mature
Detailed 2D	Methodology	Excluded	2D hydraulics	1D hydraulics*	2D hydraulics*	Hydrological	Hydrological
	Level of detail	-	Discrete, high-resolution	Grouped, high-resolution	Grouped, low-resolution	Discrete, low-resolution	Grouped, low-resolution
	Rigour	-	Literature	Literature	Theoretical	Literature	Validated
	Data maturity	-	Mature	Mature	Conceptual	Detailed/mature	Mature

* For detailed 2D models, it is often more efficient to model smaller channels in 2D if a sufficiently high-resolution 2D grid is used. This reduces modelling effort in coupling 1D cross-sections with the 2D surface. Large channels may be modelled in 1D to better represent flow through them.

Dynamic/complex models

Table C-7: Dynamic/complex model examples

Example	Applications	Details	Model component included?				
			Pipe network	2D surface	Open channels	Hydrological parameters	Upstream catchments
1D models	River system modelling	Models of large waterways, smaller contributing channels, and possibly overland flow paths where flow remains in-channel or where optimisation, testing of operational control, or many simulations are required. Detailed lumped subcatchment hydrology.	✓	×	✓	✓	✓
Integrated	• Stormwater catchment management planning • Infrastructure design and upgrades • Level of service assessment, renewal and maintenance • Large lot land development planning	Commonly built by Councils. Comprehensive representation of overland flow with representation of significant flood plain obstacles and major primary pipe networks. Significant topographic and primary stormwater features that influence flows outside the study area are explicitly represented (such as significant culverts and open channels). Direct rainfall or detailed lumped hydrology with allowances for infiltration and drainage systems.	✓	✓	✓	✓	✓

Example	Applications	Details	Model component included?				
			Pipe network	2D surface	Open channels	Hydrological parameters	Upstream catchments
Detailed	• Pipe and structure performance • Identify flood extent, depth, approximate velocity & hazard rating • Overland Flow Paths • Assessment of effects for land development • Detailed design	Urban catchment scale models with detailed representation of the stormwater pipe network as well as key surface flow features. These models are suitable to use for most catchment management activities and assessment of impacts from smaller developments. Major and minor primary drainage and secondary stormwater systems including public and private soakage devices.	✓	✓	✓	✓	✓
Highly detailed	• Complex network or drainage infrastructure sizing, design and performance testing • Designing significant private stormwater infrastructure • Development / individual lot scale in high-risk areas • Detailed design of complex stormwater interventions.	All public / private primary drainage systems including all pipe networks, catchpits with leads, open channels, culverts, and soakage and storage devices; and secondary drainage systems including significant topographic features represented in the model DEM and detailed representation of roads, buildings, driveway crossings, retaining walls and fences.	✓	✓	✓	✓	✓

Table C-8: Dynamic/complex model components

Example application	Assessment criteria (Tables 3-13 to 3-16)	Model component (Table 3-4)					
		Pipe network	2D surface	Open channels		Hydrological parameters	Upstream catchments
				Large	Small		
1D models	Methodology	1D hydraulics	Excluded	1D hydraulics		Hydrological	Hydrological
	Level of detail	Grouped, low-resolution	-	Grouped, high-resolution	Grouped, low resolution	Grouped, high-resolution	Grouped, high-resolution
	Rigour	Literature	-	Verified	Literature	Literature	Validated
	Data maturity	Detailed / mature	-	Mature	Detailed	Detailed / mature	Mature
Integrated	Methodology	1D hydraulics	2D hydraulics	1D hydraulics	1D hydraulics	Hydrological	Hydrological
	Level of detail	Discrete, medium-resolution	Discrete, medium-resolution	Grouped, high-resolution	Grouped, low resolution	Grouped, high-resolution	Grouped, low-resolution
	Rigour	Theoretical	Verified	Literature	Theoretical	Validated	Validated
	Data maturity	Mature	Mature	Mature	Conceptual	Detailed / mature	Mature
Detailed	Methodology	1D hydraulics	2D hydraulics	2D hydraulics	2D hydraulics	Hydrological	Hydrological
	Level of detail	Discrete, medium-resolution	Discrete, medium-resolution	Grouped, medium-resolution	Grouped, low-resolution	Grouped, high-resolution	Grouped, low-resolution
	Rigour	Theoretical	Validated	Literature	Theoretical	Validated	Validated
	Data maturity	Mature	Mature	Conceptual	Unconsidered	Detailed / mature	Mature
Highly detailed	Methodology	1D hydraulics	2D hydraulics	2D hydraulics	1D hydraulics	Hydrological	Hydrological
	Level of detail	Discrete, high-resolution	Discrete, high-resolution	Grouped, high-resolution	Grouped, low resolution	Grouped, high-resolution	Grouped, high-resolution
	Rigour	Literature	Validated	Verified	Literature	Validated	Calibrated
	Data maturity	Mature	Mature	Mature	Simple	Detailed / mature	Mature