Webinar Q&A - Wednesday 30th April 2025

Whole of system simulation of catchment water quality treatment devices

#	Question	Answer
Γ		Simulations can cover short duration (single event, hours) through to multi-month and even
		annual and multi-annual Vacuus uld want to consider the length of simulation in the design
		annual and multi-annual. Tou would want to consider the tength of simulation in the design
1		of the underlying hydraulic model to optimise the run times. Multiannual simulations have
1		been undertaken in the past, for example:
		https://scionco.dosi.gld.gov.au/data/assate/ndf_file/0021/275762/gwmp_modli_SEO
		Interserventer interse
	What would be the length of simulation?	new-catchment-models.pdf
		TUFLOW CATCH uses TUFLOW HPC for the catchment runoff component. The combination
		of GPU hardware simulation speed and TUELOW HPC sub-grid sampling and the linkage of
		or or or and ware simulation speed and for Eow rin o sub gird sampling, and the ankage of
		surface and subsurface dynamics mean that we can accurately run multiple year
		simulations using todays technology. This has been done before - TUFLOW CATCH is
		designed to run for up to multiannual periods so that it can simulate environmental
		near and a similar duration. Here's a useful evenue that discusses these things
		processes of a similar duration. Here's a userul example that discusses these things.
		https://www.tuflow.com/library/webinars/#oct2023_integrated_water_modelling
		Here is a report describing a multiannual execution of TUFLOW CATCH:
		https://science.desi.gld.gov.au/data/assets/ndf_file/0031/375763/gwmn-medli-SEO-
	It seems that the hydraulic simulation would be for limited period to reduce run time.	new-catchment-models.pdf
		It would typically be of the order of seconds. The timestep is computed dynamically and is
2		such as to support solution of the equations of motion - i.e. solver for water velocity and
	What is the simulation time stop in receiving waters $(2D \text{ domain})^2$	dopth (rather than using conceptual lumped models)
	יווייניס איז	
		TUFLOW CATCH uses TUFLOW HPC's direct rainfall hydrology. Here is a past webinar of
		ours that describes the modelling approach:
		https://www.tuflow.com/library/webinars/#feb2021_direct rainfall
3		THELOW CATCH does not use lumped or bucket bydrology models. It solves the surface and
		aukauteaa arustiana of motion are a mid ant thur mid anthu in a thur in the internet of the in
		subsurrace equations of motion on a grid cell by grid cell basis, with grids typically being in
	Which conceptual hydrology model is used?	the order of metres or 10's of meters in size
		Second question first: TUFLOW CATCH uses TUFLOW HPC for the catchment runoff
1		component. It solves the equations of fluid motion directly, so does not make lumped
		assumptions with regard to hydrology. It predicts water velocity and depth on a grid cell by
		grid call basis (typically matros or 10's of mators in dimension) and can be used, on a
		giù cell basis (typically metres of 10 5 of meters in unifersion) and call be used, on a
		whole of catchment basis, to examine any type of rainfall event, design or otherwise. It can
		also be used to undertake multiannual simulations and this has done already, for example:
		https://science.desi.gld.gov.au/data/assets/pdf_file/0031/375763/gwmp-medli-SEO-
		new-catchment-models.pdf
		First question: TUFLOW CATCH predictions have indeed been directly compared with those
		of other catchment wide modelling platforms. The report URL above presents one such
		comparison and provides a detailed assessment of relative performance (especially with
		comparison and provides a detailed assessment of relative performance (especially with
		regard to hydraulic performance, although water quality pollutant export was also
		compared). It was found that TUFLOW CATCH was able to reproduce measured
4		hydrographs with a high degree of accuracy, especially with regard to falling limbs, and that
		this repreduction was absorb in the predictions of the lumned model. It uses found that this
		uns reproduction was absent in the predictions of the tumped model. It was found that this
		ability to predict falling limbs correctly had a major impact on overall predictive capability
		of the catchment and receiving waterway models, right through to prediction of
		nbytonlankton dynamics in the receiving waterway. More comparison work is ongoing
		In terms of tractment. THELOW OATON has been dealers data interfere with a
		In terms of treatment - TUFLOW CATCH has been designed to interface with any other
		model predictions via the lookup table presented in the webinar. This means that, for
		example, if detailed modelling of pollutant removal has been undertaken in a different
		package for a particular wetland (or other device) then this performance/hohevieur con ho
		package for a particular welland (or other device) then this performance/bendviour can be
		plugged into TUFLOW CATCH and used 'as is' to look at overall catchment wide impacts in
		the context of a model that explicitly simulates catchment hydraulics and pollutant export.
	You touched on this slightly, but have you compared the Catch results to other water	This interfacing ability has been a deliberate design choice for TUFLOW CATCH and if other
	quality modelling software (e.g. MUSIC). What are areas where Catch would perform	means of doing so are needed then we would be yony happy to discuse how this might ensure
	quadity modelling software (e.g. mosto), what are dreas where Catch would perform	incans or doing so are needed then we would be very happy to discuss now this might occur
	better? Can you simulate design raintall like in a hydraulic model?	- our tocus is user needs
		TUFLOW CATCH does not simulate a prescribed suite of 'treatment devices' as such.
		Rather, it allows the user to flexibly specify how a given treatment device behaves in terms
		of pollutant removal. This is therefore a more holistic and general approach to catchment
6		wide water quality analysis and gives the user complete freedom to eversion their
		muc watch quality analysis and gives the user complete needoni to exercise their
		knowledge and experience in setting how devices perform, whether those devices be
	What types of treatment process are used wetlands and bioretention systems etc.?	wetlands, swales, bioretention systems etc.
		Yes, TUFLOW CATCH can estimate suspended sediment loads from the catchment. It can
		also denocit (and report on the denociting) of addiment within the estebation This secure
7		also deposit (and report on the depositing) of sediment within the catchment. This occurs
		where previously eroded sediment enters low flow areas and settles out (at a user specified
		rate). TUFLOW FV, which is linked for the receiving water modelling can discretely model
	Just wondering if you can do sedimentation process using your tool	the sediment erosion and deposition characteristics as well, using advanced techniques
		It has The Oueensland Water Modelling Network (OW/MN) and Healthy Land and Water
		(11) While commission and a milet study to toot THELOW (ATOLIC-study Land did Water
		(HLW) commissioned a pilot study to test TUFLOW CATCH last year. Here is a link to the
8		peer reviewed pilot study report:
		https://science.desi.gld.gov.au/ data/assets/pdf file/0031/375763/gwmn-medli-SEO-
	Has Catch modelling results been tested against field data?	new-catchment-models.pdf

		Yes it does. Build up rates are user specifiable and TUFLOW CATCH reports associated dry
9	Does the water quality model consider build up and wash off processes and interevent	stores as a function of time for each computational cell. See the CATCH manual for details:
	times between events for pollutant loading prediction?	https://docs.tuflow.com/catch/manual/2025.0/
		TUFLOW can simulate user defined urban pits and pipes and associated blockages. You can
10		specify how the blockage characteristics change for different event magnitudes. The
10		software doesn't automatically predict the blockage values based on catchment runoff
	Is this model can predict blockage on the urban pits and pipes?	details (e.g. associated with sediment).
	From a water quality perspective where we might be designing treatment trains for	
	pollution management based around a % reduction in TN / TP, etc, is a "lumped" model	Every model has its advantages and limitations and so cross comparing is therefore often
	inappropriate for evaluation of treatment strategies when we *can* be reasonably sure	difficult. It is suggested that numerical models be selected that are capable of robustly
11	that our flows travel through our treatment train? Would an appropriately designed lumped	answering the questions being asked. This is why we discussed lumped models, for
	model (e.g. including high / low flow cutoffs for better representation of treatment train	example, having their place in very long term broadscale land use change impact
	hydraulics) with a reduced timestep (e.g. by using BoM 6 min pluvio data) in software such	assessments, and TUFLOW CATCH having a place in cases where high temporal and spatial
	as MUSIC still provide results inferior to TUFLOW CATCH?	resolution is required across catchment larger than a single treatment train
12		Inere are tutorials on the TUFLOW WIKI:
	Could we have the data set for reference as a practice tutorial? Inankyou	nttps://wiki.tutlow.com/TUFLOW_CATCH_Tutorial_Introduction
		THELOW CATCH allows for the simulation of dynamic erosion and settling of pollutants (not
		iust sediment) in the catchment. This explained in the TLIELOW CATCH manual here:
		https://docs.tuflow.com/catch/manual/2025.0/ProcessDescriptions-
13		1.html#ProcessDescriptionsSS-3
10		
	It seems that the model can simulate only sediment load as a conservative pollutant. Does	In the receiving waters, TUFLOW FV simulates a range of more advanced sediment
	the model consider bed load and moving load of sediments, and suspension and	processes and water quality processes. It can be used as a component in CATCH. See here
	deposition patterns?	for details: https://www.tuflow.com/products/modules/#sediment_transport
		Mechanistic models - accumulation/wash off and erosion models are available. See the
		TUFLOW CATCH manual:
14		https://docs.tuflow.com/catch/manual/2025.0/ProcessDescriptions-
		1.html#ProcessDescriptionsMats-3
	Are the pollutant liberation rates based on empirical equations or mechanistic models?	
15	What is the basis for the look up table – using the outputs from a water quality model?	Literature review
16	Is it possible to see the results as concentrations of pollutants? the environment generally	Yes. TUFLOW CATCH outputs maps of concentrations in the surface and subsurface water
	reacts to concentrations of pollutants rather than % reductions of same.	flows
	Thanks for showing the pollutant liberation experiment - very cool! Have additional	
17	experiments been done? It would seem to me that although a real-world experiment has	Michael is just presenting an example. You can parametrise the pollutant load details to
	been undertaken, applying pollutant load results to all roads in the TUFLOW Catch is still	whatever resolution you desire. If you wish to characterise the roads with 100 (or more)
	an averaged approach - similar to MUSIC. Thanks!	different load rates accounting for different road characteristics, you can.
	How do you account for build up and wach off characteristics?	and each land use/area individually
		Ves dissolved pollutants can be modelled. They are advected and dispersed with the flow
		i co, alcoottoa pottatanto can bo modottoa moj alcoato da coporcoa manano potota manano potota
1		and can be in the surface or subsurface water. The Advection and Dispersion (AD) module is
18	Can the model also deal with dissolved pollutants other than undissolved pollutants that	and can be in the surface or subsurface water. The Advection and Dispersion (AD) module is coupled with the TUFLOW HPC hydraulics engine and TUFLOW CATCH module for that
18	Can the model also deal with dissolved pollutants other than undissolved pollutants that stuck with sediments and sediment concentration?	and can be in the surface or subsurface water. The Advection and Dispersion (AD) module is coupled with the TUFLOW HPC hydraulics engine and TUFLOW CATCH module for that purpose.
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18 19 20 21 22 23 24 25 26 27	Can the model also deal with dissolved pollutants other than undissolved pollutants that stuck with sediments and sediment concentration? Road sediment pollutant load will vary due to a number of parameters (eg. road age and degradation rate of road, vehicle usage, road materials and constituents, times since last rainfall and intensity of that rainfall, pot holes, any developments in the area eg. muddy tyres, seasonality, etc). It's not static even on the same road. Is there any continuous field studies to assess the change in concentration and composition of pollutant compared to 2003? The natural treatment of pollutants depends on their resting or travel time within the system. Does the CATCH model account for resting time attributes in its analysis? Do we need eWater MUSIC any more? Is there the capability to simulate different kinds of pollutants (e.g. TN / TP / GPs) along with custom curves for pollutant load by land use (e.g. a natural environment will have a very different TN concentration in runoff vs a farm) Do the treatment device set-ups in Tuflow Catch allow for high-flow bypass of flows around the treatment device? Are there standard "liberation rates" of different pollutants that have been developed for different land uses within the catchment? Pollutant load is generating using daily time step and hydraulic runs are smaller time step? Pollutant load transport along the waterway may be distorted due to different time steps.	and can be in the surface or subsurface water. The Advection and Dispersion (AD) module is coupled with the TUFLOW HPC hydraulics engine and TUFLOW CATCH module for that purpose. Noted Not as far as I am aware Yes, the pollutants are transported in the hydrodynamic field (TUFLOW HPC and /or FV) so will experience any travel time and residence times that the hydraulics show. Yes. I believe MUSIC will still be used by industry. MUSIC and TUFLOW CATCH will actually be complimentary in some regards for the specification of the intervention inputs. It is suggested that numerical models be selected that are capable of robustly answering the questions being asked. This is why we discussed lumped models, for example, having their place in very long term broadscale land use change impact assessments, and TUFLOW CATCH having a place in cases where high temporal and spatial resolution is required across catchment larger than a single treatment train Yes. Any pollutants can be simulated if their pollutant generation properties can be specified, and these specifications can be varied on a spatial basis (i.e. Roads deliver different pollutants at different rates to grassed ovals etc) Yes. TUFLOW HPC / FV, which make of the engines within the TUFLOW CATCH framework, can simulate these directly Some are presented in the TUFLOW CATCH manual: https://docs.tuflow.com/catch/manual/2025.0/SimulationConstruction-1.html#tab:tab-PollAccRates no, the pollutant oad is generated using the same timestep as the rainfall inputs, which is typically G minutes. 6 minutes is at a fine enough resolution that the behaviours are not distorted. Yes, and that is a great example of using the simulation models to support operational practices. Given the inherent uncertainty is the actual build up of sediments and pollutants in the treatment diveces, the models can be used for a range of like weather conditions over

20 Control Model Control model and product in the product of the control MLCW Control model and product in the control model	28	Could we factor in air collution contribution concretely in this type of modelling 2	We could add a background pollutant concentration to rainfall in TUFLOW CATCH if
29 Can ULD/W CADT invoked person polarization thereafter an end of the set of the		Could we factor in air pollution contribution separately in this type of modelling ?	Gross pollutants are probably best simulated as particles rather than dissolved
grass pollutativity as a direct which the version as assessment in the set of a sessment is set of the set of a unrealistic set of the	29	Can TUFLOW CATCH model gross pollutant liberation? Can TUFLOW CATCH simulate a	constituents. TUFLOW CATCH cannot do this yet, although the receiving water component
1ULCOVE statistics pair of the reposture assessment in the refusessment in the refuse assessment in the refuse asse		gross pollutant trap as a 'device' rather than a wetland/bio?	TUFLOW FV can
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31 Instrumentalistic methods in previous probability and a probability of probability and a probability of probabili		A significant complexity with determining the type and extent of WSUD intervention	
90 what is the max much is a statute to a statute the statute and international internatinternational internatenational international internatin		required is establishing ecologically-relevant (ecotoxicological) threshold intervention	
30 online understand exclusionity is assess that and therefore VSUD Discretification. This is complexes in uncomplexe fields the receiving aquate exclusionity is and there of exclusionic addition of the receiving aquate exclusionity is assessed to an integrate addition of the receiving aquate exclusionity is assessed built the can have a direct entiticationic and the receiving aquate exclusionity is assessed built the can have a direct entitication of the receiving aquate exclusionity is assessed built the can have a direct entitication of the receiving aquate exclusionity is assessed built the exclusionity is assessed built the exclusionity is and the properties of the receiving aquate exclusionity is assessed built the exclusionity is additional to the properties of the receiving aquate exclusionity is additional to the properties of the receiving aquate exclusionity is additional to the properties of the receiving aquate exclusionity is additional to the properties of the receiving aquate exclusionity is additional to the properties of the receiving aquate exclusionity in the distributionity and exclusionity and the additional to the properties of the receiving aquate exclusionity in the original properties of the receiving aquate exclusionity in the original properties of the receiving aquate exclusionity in the original properties of the receiving aquate exclusionity in the original construction exclusion exclusion exclusion exclusion exclusion exclusion exclusionity in the receiving aquate exclusion exclu		levels (remediation criteria) for sediments, nutrients and pollutants (individually and cumulative). This is the 'toxicity assessment' side of the risk assessment framework. It's	
conjustor in rutanto is (a, N, Pi (b) table solutions: how much solutions is a first membrality again (c) experimentations (b) mit (a) how a different electroscolution is a first membrality (c) experimentations (b) mit (c) how and where first is the second solutions (c) experimentations (b) mit (c) how and where first is the second solutions (c) experimentations (b) mit (c) how and where first is the second solutions (c) experimentations (b) mit (c) how and mit (c) experimentation (c) mit (c) how and (c) experimentations (c) mit (c) how and (c) h	30	vital to understand ecotoxicity to assess risk and therefore WSUD intervention. This is very	
bad and integration concentration posts an unacceptable risk to the scondary detects an algebraic. Mathemis data to the site of the activity is the scondary detects and gebraic tables. The set of the scondary detects and gebraic tables are complex. Name 31 Association to the set of the scondary detects and gebraic tables. The set of the scondary detects are gebraic tables. The set of th		complex for nutrients (e.g. N, P) but also sediments. For example, how much sediment	
ecosystem. Numerical don't have a fine't ecological affect (ecopt at unestitution) by encounterinsticity, but not a make an give management (ex) who an execondary diffest on algor biomest and multitots are complex. 31 And at the and an encounter the secondary diffest on algor biomest and multitots are complex. And at the and are encounted to but indements and multitots are complex. 31 A comparison against other models can be significant to a dorward in a standar encounted to lead, the encounted backs tables, by then comparison against other water quality modelling results of TUR.OV CATCH compare to these of pollutants? A comparison against other models can be subject to adapt and encounted back adapt and encounted by dorward in a standar encounted by dore forma useare encounted by dorward in a standar encounted by and		load and nitrogen concentration poses an unacceptable risk to the receiving aquatic	
and gap blocms. There are published water quality publishes by some road run-off chemicals but addiments and nutritents are complex. At a ganual information level, treatment efficiencies from other models can be plugged water quality gates addiments and nutritents are complex. 31 At a ganual information level, treatment efficiencies from other models can be plugged water quality gates addiment to the comparison against on such common you of lumpo by dorology water quality modeling equity gates addiment to the comparison against on such common you of lumpo by dorology water quality modeling equity gates addiment to the comparison against on such common you of lumpo by dorology water quality modeling equity gates addiment to the comparison against on such common you of lumpo by dorology water quality modeling equity addiment to the comparison against on such common you of lumpo by dorology water quality modeling equity addiment to the comparison against on such common you of lumpo by dorology water quality modeling equity addiment to the comparison against on such common you of lumpo by dorology water quality modeling equity addiment to the comparison against on such common you of lumpo by dorology water quality modeling equity addiment to the comparison against on such common you of lumpo by dorology addiment include goes pollutant to emove addiment addiment addiment addiment of lumpo equity integrated in the common water and and the assess equity integrated in the comparison against addiment addiment addiment equity addiment addiment addiment addiment addiment addiment equity integrated in the lumpo addiment addiment addiment equity integrated in the lumpo addiment addiment addiment equity integrated in the lumpo addiment addiment addiment equity addiment addiment addiment addiment equity addiment addiment addiment addiment addiment equity addiment addiment addiment addiment addiment equity addiment addiment addiment		ecosystem. Nutrients don't have a direct ecotoxicological effect (except at unrealistically high concentrations) but they can have a long term advere effect via the secondary effects.	
chemicals but sediments and nutrients are complex. Need 31 A a ganual rescention level, treatment efficiences from other models can be plugged into TUEUX CATCH via the emosal toop labels. System comparisons against other water quality packages in ongoing. A comparison against and excention level, treatment efficiences from other models can be plugged into TUEUX CATCH via the emosal toop labels. System comparisons against other water quality packages in ongoing. 4 A comparison against one such commonly used lunge by biology water quality modeling results of TUEUX CATCH compare to those of publicants? A comparison against one such commonly used lunge by biology water quality modeling results of TUEUX CATCH water MURIC? 3 1. Is it possible to assess pollutant removal, efficiency for nitrogen, phosphorus, and gross 1. Yes. Pollutant removal is specified per treatment device and per pollutant. This could include gross pollutants if they were simplers (and in a spatially and temporary) essives approximate on if they can be annot a spatially and temporary essives approximate on the spatial temporary essives approximate on the spatial temporary essives approximate on the spatial spatial temporary essives approximate on the spatial spatial temporary essives approximate and the spatial spatial temporary essives approximate on the spatial spatial temporary essives approximate and the spatial spatial temporary essives approximate and the spatial spatial temporary essive approximate and the spatial spatial temporary essive approximate and the spatial spatial temporary essive approximate app		on algae blooms. There are published water quality guidelines for some road run-off	
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3. what duration events and multi events should be run to assess performance of an asset initiality. Toulow CATCH as such that was a deliberate design intention of TUFLOW CATCH as such that was a deliberate design intention of TUFLOW CATCH. 3. It depends, but we suggest multianual simulations to allow assessment of seasonality. 3. It depends, but we suggest multianual simulations to allow assessment of seasonality. 33 Am I understanding correctly that TUFLOW CATCh is doing only what you tell it to do? You said, you made up numbers for the simulation. In practice i would have to use numbers (removal relationships: it allows them to be seamlessly applied in a whole of catchment setting under arage of explicitly simulated hydraulic and pollutant conditions (removal relationships: it allows them to be seamlessly applied in a whole of catchment setting under arage of explicitly simulated hydraulic and pollutant conditions (removal rates) that are evidence based. Also, what about dissolved pollutants, e.g., Any pollutants can be simulated (included N) - sediments was just as example 34 Nitrogen? TUFLOW CATCH does not simulate a prescribed suite of treatment devices as such. 34 Nitrogen? Tust. Not we can be included in the model? 35 Thanks Michael on the beautiful presentation. Can you shine some light on potential wasy to cabinate the pollutant size as a device. Pleasure. Limited beautiful may be and give to reatment devices be wetlands, swales, bioretention systems etc. 36 So, Treatment Efficiency will change for short and long duration rainfall. How do you tack diverse of their storduration rainfall will have higher device inflow rates,	02	2. How can this be linked to and integrated with the sizing of treatment assets in MUSIC?	performance within detailed hydraulic regimes (and in a spatially and temporally resolved
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		Does TUFLOW Catch factor in sediment relocated downstream in the hydraulics?	the sediment erosion and deposition characteristics as well, using advanced techniques

40	Would it be fair to say that TUFLOW Catch is better suited to Detailed Design/As-built assessment of treatment systems; whereas MUSIC is more targeted towards conceptual	Every model has its advantages and limitations and so cross comparing is therefore often difficult. It is suggested that numerical models be selected that are capable of robustly answering the questions being asked. This is why we discussed lumped models, for example, having their place in very long term broadscale land use change impact assessments, and TUFLOW CATCH having a place in cases where high temporal and spatial
	design?	resolution is required across catchment larger than a single treatment train
41	At source treatment would be bard to simulate with the searce grid recolution?	We typically use 5-20m grid cells size with Subgrid Sampling turned on, and this is ample
	Ac-source treatment would be hard to simulate with the coarse gnu resolution?	TO RESOLVING THE RECESSION INVERTIGATION OF THE ADVISION OF THE PROVIDENT
		THELOW EV. This means that THELOW CATCH can simulated pollutant export and
		catchment transport then deliver predicted flows and loads to automatically written
		houndary condition files for THELOW THELOW EV then uses it fully dynamic water quality
		BGC model to simulate transformation from oxygen up to phytoplankton dynamics. This is
42		explained in more detail in the TUFLOW CATCH manual here:
		https://docs.tuflow.com/catch/manual/2025.0/Overview-1.html#Overview-1
		and
		https://docs.tuflow.com/catch/manual/2025.0/Architecture-1.html#Architecture-1
	Does TUFLOW Catch integrate with BGC models with reactions for ecodynamic modelling?	
		Yes, TUFLOW CATCH simulates both surface and subsurface flows (and surface land
43	Can this be extended to quantify the benefit of healthy soils and infiltration. I.e. what is the	use/perviousness) so these sorts of scenarios are possible. TUFLOW CATCH also reports
	benefit of shifting land use towards conditions that reduce overland flow and promote	groundwater efflux and surface water efflux at bottom of catchment and these flows and
	subsurface flow?	pollutant loads can be compared under different land use/infiltration scenarios
44	Are there examples in using TUFLOW Catch in the development of sediment and erosion	
	control plans? It would seem that the capability is there to develop detailed plans, but	
	requires some industry acceptance.	Not specifically for SECP but this is an excellent application for TUFLOW CATCH.