

# THE USE OF MODELLING IN DESIGN OF WASTEWATER SUBSURFACE DRIP IRRIGATION

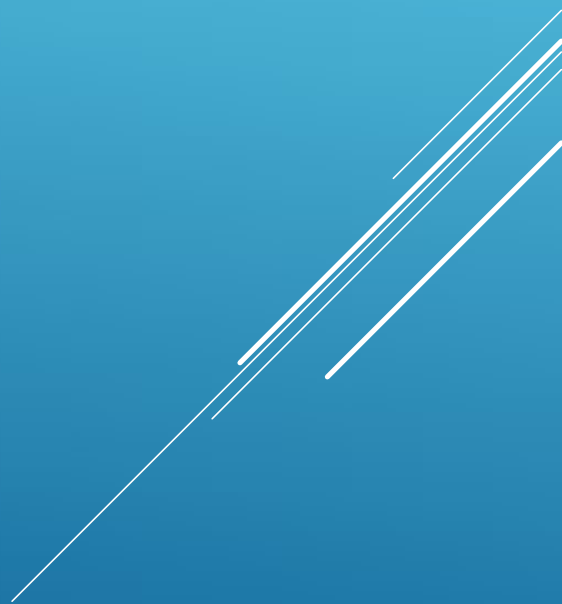
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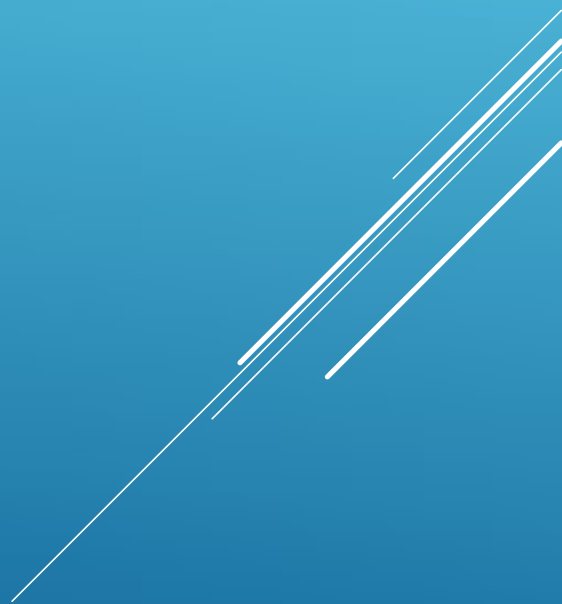
<sup>b</sup>NexGen Water Ltd

<sup>c</sup>Stantec New Zealand Ltd

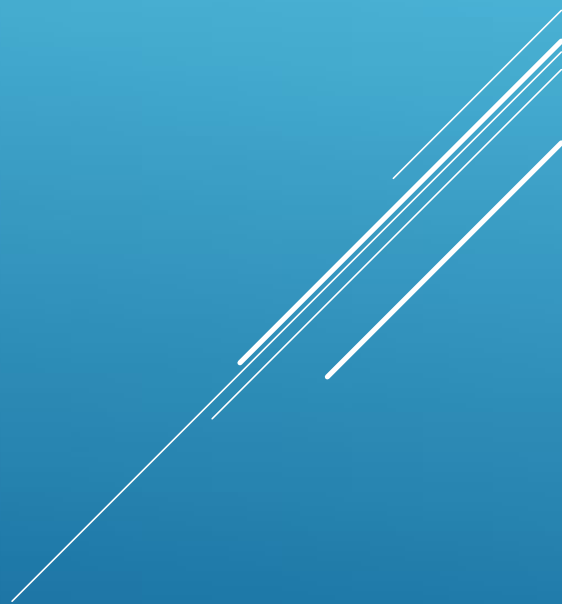
# LAND TREATMENT OF WASTEWATER CAN:

- ▶ Reduction in pollution of surface water
  - ▶ Irrigation water shortage
  - ▶ Recycle nutrients
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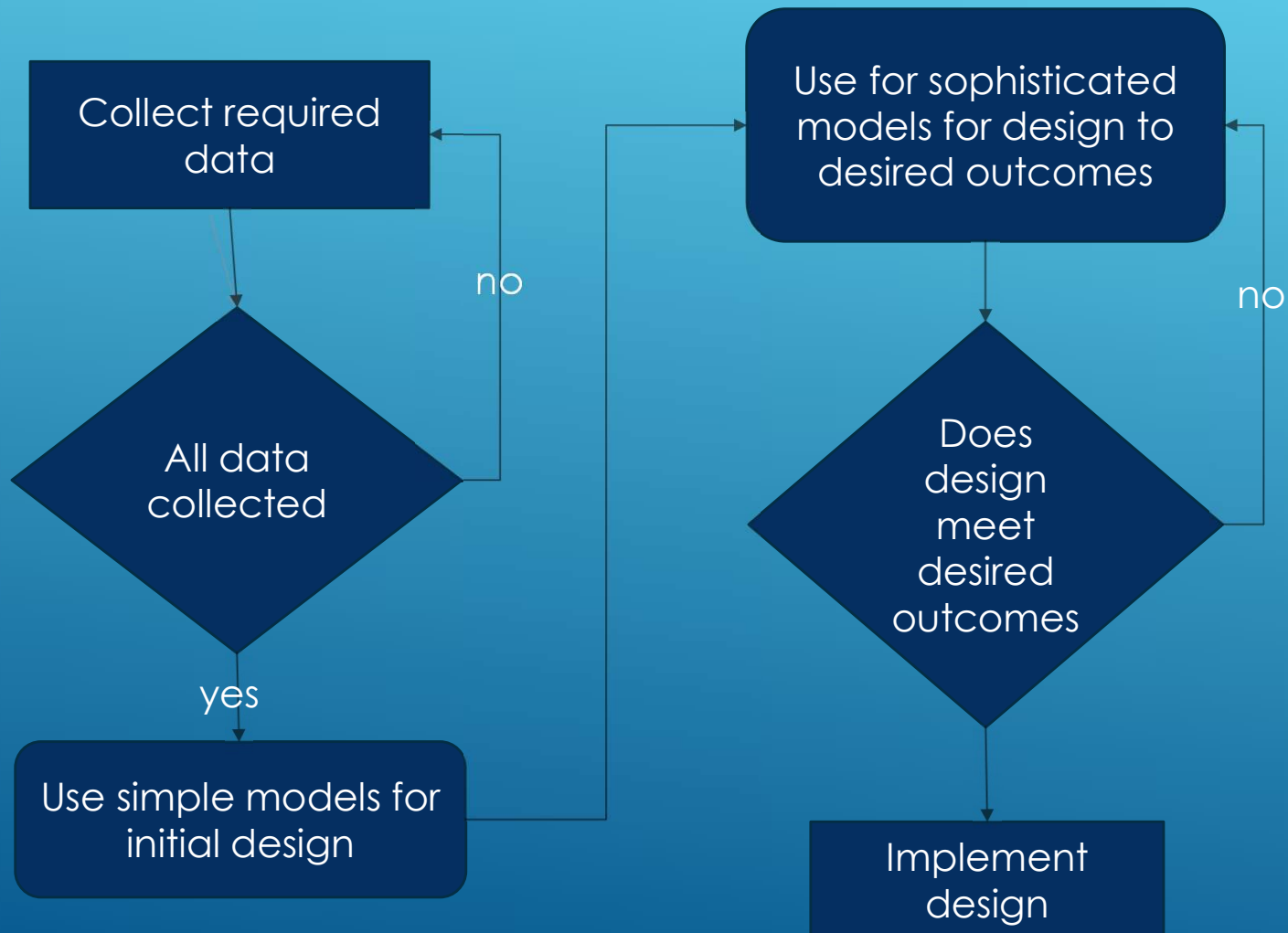
# SUBSURFACE DRIP IRRIGATION

- ▶ Reduces risk of bacteria and virus contamination of vegetation and runoff
  - ▶ Reduces off-site issues such as spray drift and odour
  - ▶ If soil permeable enough can operate during rainfall
  - ▶ Lends itself to automated system control
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# A MODELLING FRAMEWORK: HOW DOES THIS HELP

- ▶ Collection of the right data: summary data are not the best
  - ▶ Measuring the right parameters: often soil databases are inadequate
  - ▶ Time series allow for better understanding of storage requirements
  - ▶ Results in more cost effective and better design
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# MODELLING FRAMEWORK

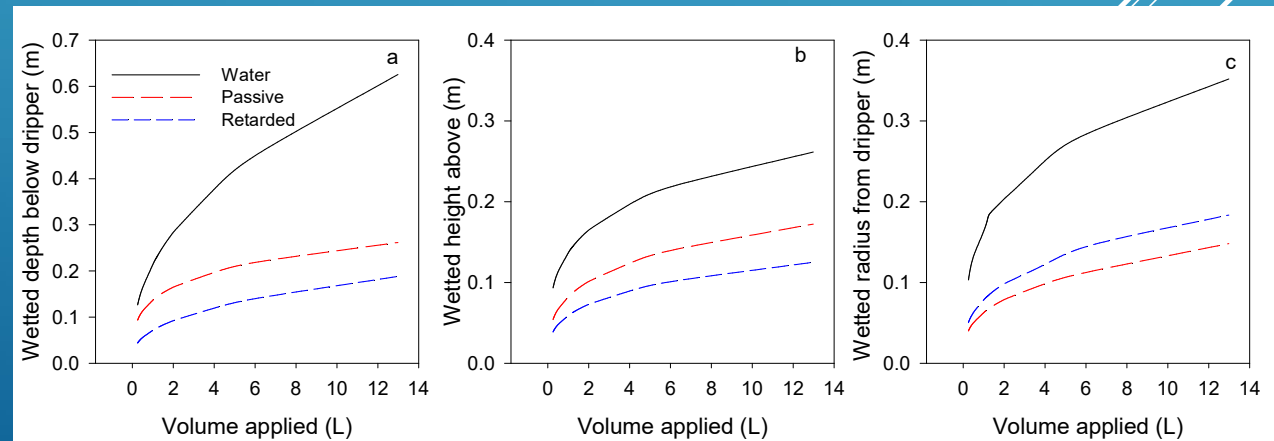


# SIMPLE MODELS: INITIAL ASSESSMENT/DESIGN

- ▶ Simple spreadsheet models can be used for determining land area, storage, nutrient loading etc

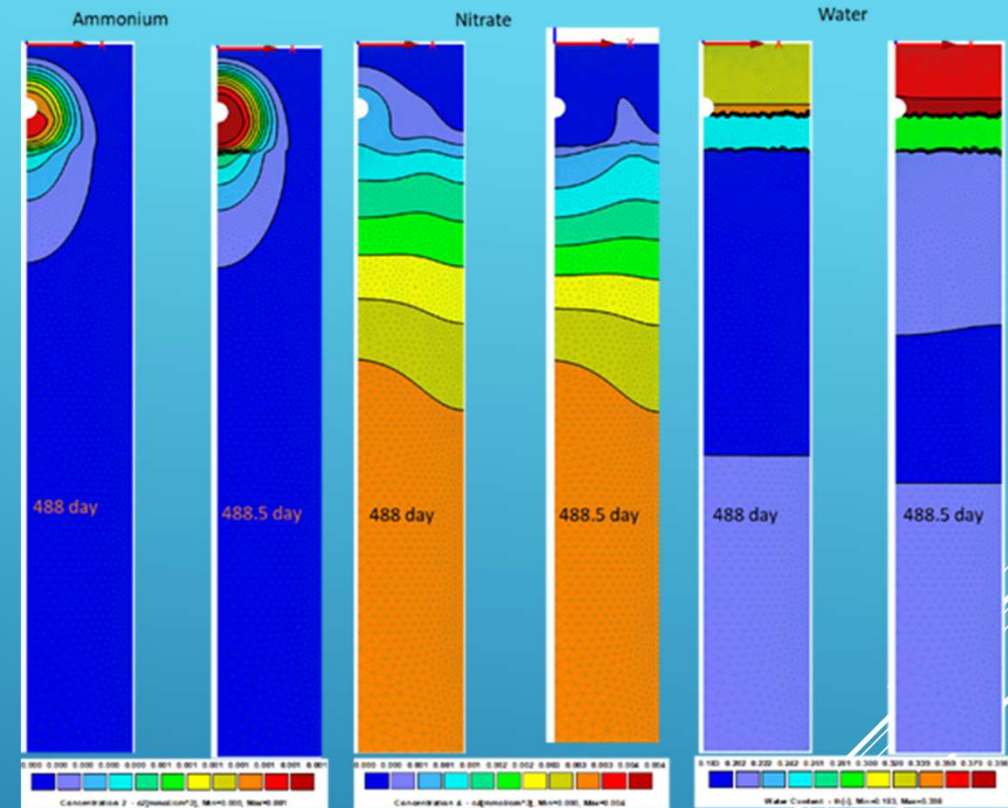
	High Flow rate		Standard Flow rate		Low Flow rate	
	2020	2050	2020	2050	2020	2050
Flow (year)	2020	2050	2020	2050	2020	2050
N conc (gm/m3)	18	18	18	18	18	18
	MaxW		Max N		Max N	
Days of flow total	844	1482	2100	2100	0	1758
% time high rate area used	0.401905	0.705714				
Area (ha)	4.14502	7	16	19.44448	0	9
volume applied m3	357265	1006849	2034870	2750055	0	268382.8
volume per day average m3	423.2997	679.3852	968.9859	1309.55	NA	152.6637
Average application (mm/day)	10.21225	9.705503	6.056162	6.734817	NA	1.696264
Maximum application (mm/day)	57.99996	28.62575				
Maximum application/Maximum infiltration (%)	100.00%	49.35%				
Largest number of sequential days	49	348				
Largest number of sequential days at maximum rate	2	348				
Mass N concentration (g/m3)	18	18	18	18	18	18
Mass N (kg/ha)	1551.445	2589.04	2289.229	2545.761	NA	536.7657
Mass N (kg/ha/day)	1.838205	1.746991	1.090109	1.212267	NA	0.305327
Mass N (kg/ha/yr)	269.6559	449.9998	397.8898	442.4775	NA	111.4445
Mass N/Maximum N loading (%)	60%	100%	88%	98%	NA	93%

- ▶ The WetUp model can be used to assess the wetting and solute patterns with flow volume
- ▶ Preliminary design

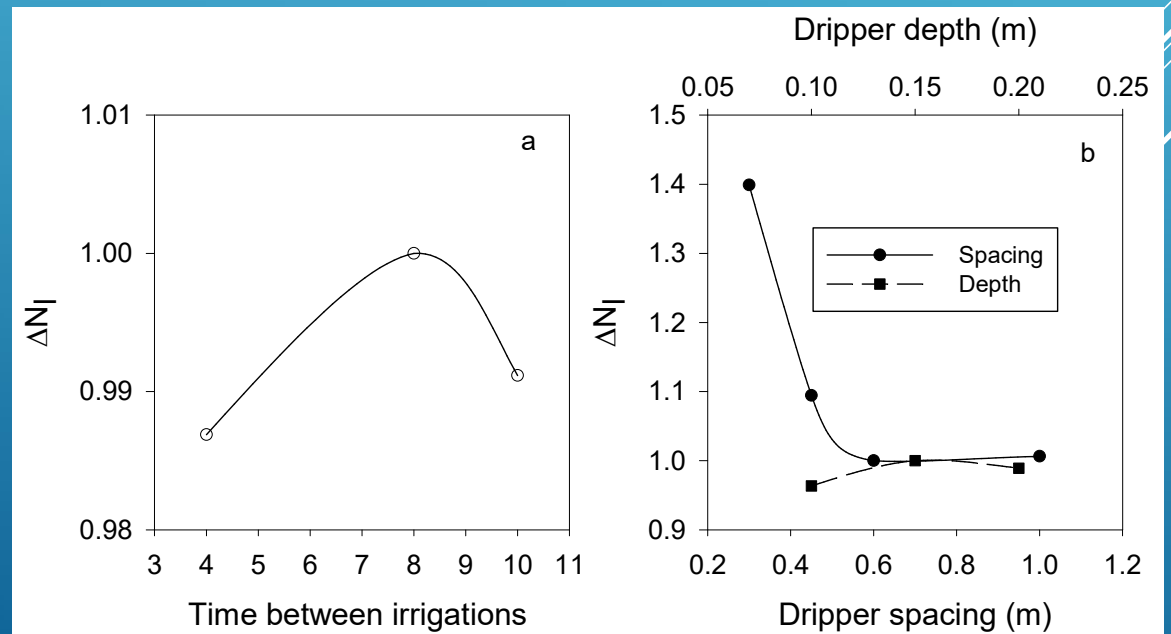
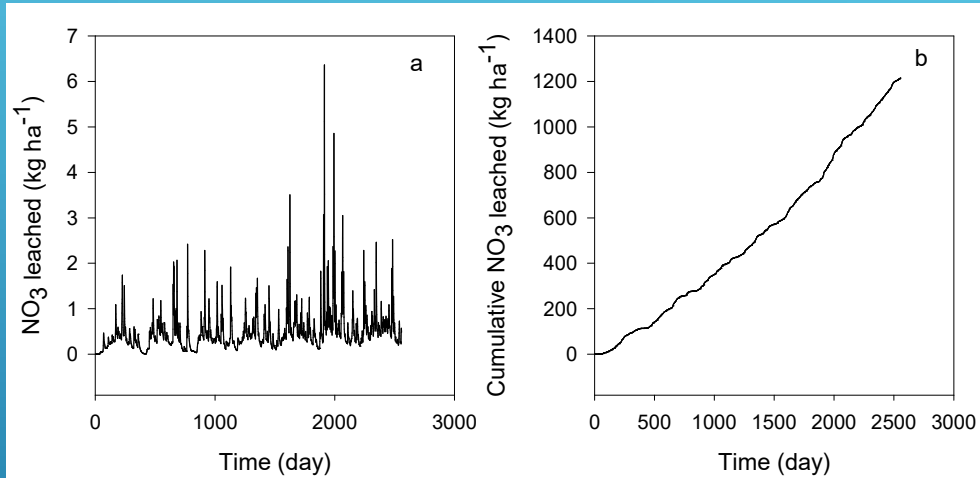


# NUMERICAL MODELLING

- ▶ For subsurface drip we need a model that can handle axisymmetric flow, nitrogen chain reactions and active uptake of solutes. HYDRUS2D can do this but requires care and skill to setup.
- ▶ Need at least 10 years of climate data. Again, care require to include wet and dry periods,

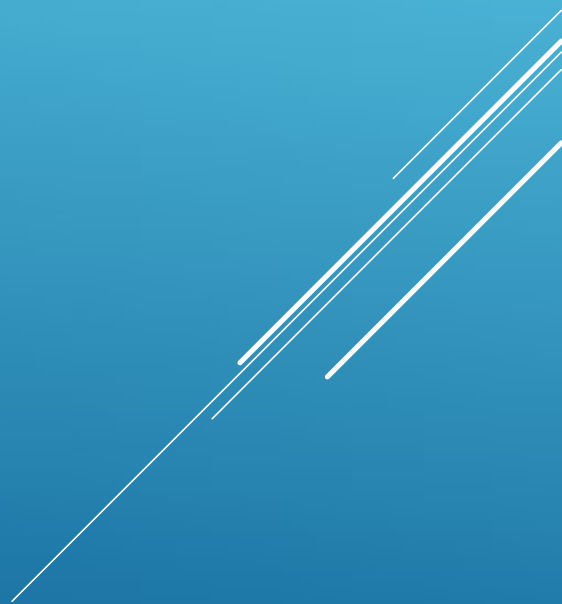


# NITROGEN LOSES





# CONCLUSION

- ▶ **MODELLING ASSISTS with Design of Land treatment of Wastewater**
    - ▶ Collection of the right data: summary data are not the best
    - ▶ Measuring the right parameters
    - ▶ Time series allow for better understanding of storage requirements
    - ▶ Results in more cost effective, environmental sensitive design
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