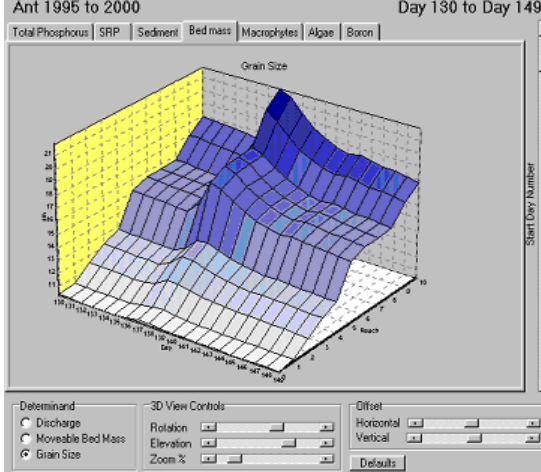
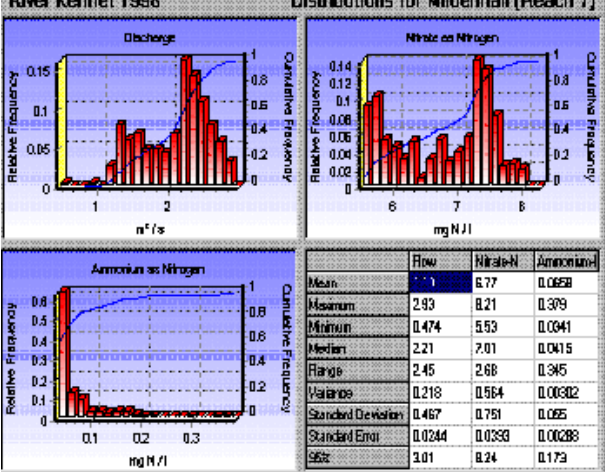


# Water Resource Associates

*A network of consultants in hydraulics, hydrology, groundwater & environmental issues*

**Project title:** Review of the INCA model for the EA Decision Support Tool.

**Summary:** Assessing the utility of the INCA suite of models for use in a new decision support tool being developed for the EA.

<b>Client:</b> Environment Agency	<b>Financed by:</b> Environment Agency																																								
<b>Period of assignment:</b> 2004	<b>Location:</b> United Kingdom																																								
<b>Project Value:</b> £8,260	<b>WRA services:</b> £8,260																																								
 <p>Ant 1995 to 2000 Day 130 to Day 149</p> <p>Grain Size</p> <p>Start Day Number</p> <p>3D View Controls: Rotation, Elevation, Zoom %</p> <p>Offset: Horizontal, Vertical</p> <p>☛ Grain size changes during a storm event</p>	 <p>River Kennet 1998 Distributions for Mildenhall (Reach 7)</p> <p>Discharge</p> <p>Nitrate as Nitrogen</p> <p>Ammonium as Nitrogen</p> <table border="1"> <thead> <tr> <th></th> <th>Flow</th> <th>Nitrate-N</th> <th>Ammonium-N</th> </tr> </thead> <tbody> <tr> <td>Mean</td> <td>1</td> <td>6.77</td> <td>0.0658</td> </tr> <tr> <td>Maximum</td> <td>2.93</td> <td>8.21</td> <td>0.379</td> </tr> <tr> <td>Minimum</td> <td>0.474</td> <td>5.93</td> <td>0.0415</td> </tr> <tr> <td>Median</td> <td>2.21</td> <td>7.01</td> <td>0.0415</td> </tr> <tr> <td>Range</td> <td>2.45</td> <td>2.68</td> <td>0.345</td> </tr> <tr> <td>Variance</td> <td>0.218</td> <td>0.564</td> <td>0.00302</td> </tr> <tr> <td>Standard Deviation</td> <td>0.467</td> <td>0.751</td> <td>0.055</td> </tr> <tr> <td>Standard Error</td> <td>0.0244</td> <td>0.0339</td> <td>0.00288</td> </tr> <tr> <td>SE%</td> <td>3.01</td> <td>0.24</td> <td>0.173</td> </tr> </tbody> </table> <p>☛ Simulated Distributions of flow and water quality at Mildenhall on the Kennet for 1998</p>		Flow	Nitrate-N	Ammonium-N	Mean	1	6.77	0.0658	Maximum	2.93	8.21	0.379	Minimum	0.474	5.93	0.0415	Median	2.21	7.01	0.0415	Range	2.45	2.68	0.345	Variance	0.218	0.564	0.00302	Standard Deviation	0.467	0.751	0.055	Standard Error	0.0244	0.0339	0.00288	SE%	3.01	0.24	0.173
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<p><b>Background</b></p> <p>The EA is setting up a decision support system to assist with the making of environmental impact decisions as well as helping with the Water Framework Directive. As part of the process a review of available models was commissioned with a thorough review of the INCA model, in the first instance. This model is being developed for flow, nitrate, ammonia, organic and inorganic phosphorus, sediments, carbon and ecology (macrophytes, epiphytes and phytoplankton).</p> <p><b>Results</b></p> <p>In the review the model components are described and their utility evaluated for answering Environment Agency type policy questions. The issue of integrating the model into the Environment Agency Decision Support Tool (DST) is considered and a model range of options evaluated. Details of model calibration, validation, uncertainty analysis and model application are discussed and reviewed in the report. A large number of application results are presented to demonstrate the utility of the mode</p>	<p><b>Scope of work by Water Resource Associates Ltd</b></p> <p>The INCA suite of programmes have been developed over the past 5 years to simulate both terrestrial and aquatic systems and to model a wide range of catchments. The basic structure of INCA has been tested on 8 UK catchments and 10 catchments across Europe. The model is process-based and therefore designed to cope with environmental change such as changes in land-use, pollution levels and climate. The model seeks to incorporate the dominant mechanisms and processes operating and therefore does not include over-complicated structures. However, because the model is process-based, it does require user skill in applying the model and in interpreting model results. The software is written in C++ and utilises a menu-driven interface as well as an output graphics and statistics package. INCA provides the following outputs:</p> <ul style="list-style-type: none"> <li>daily time series of flow and water quality, at selected sites and times along the river</li> <li>cumulative frequency distributions of flow and water quality</li> <li>table of statistics for all sites</li> <li>daily and annual water quality loads for all land uses and processes</li> <li>3D pictorial representations of flow and water quality</li> <li>time series plots of the soil and groundwater responses</li> <li>output times series for transfer to other analysis packages [Excel]</li> <li>procedures for saving modified parameter sets</li> <li>scenario simulation results presented graphically or as output files</li> </ul>																																								

Project Number 000226

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