

## The Conception and Development of a Dynamic Dissolved Oxygen Model for the Grand River

Grand River Conservation Authority

## Ontario Treasury Board Report ~ 1971 ~

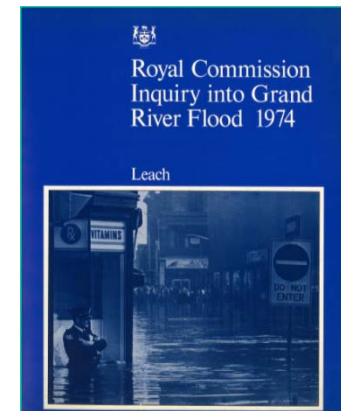
*“Review of Planning for the Grand River Watershed “*



## Conception of GRSM ~ 1971 ~

*We recommend that water quality standards and further planning evaluations related to river quality and effluent loading guidelines **should employ a computer simulation; to take account of the probabilistic nature of the processes and to incorporate mathematical stream flow models to describe the significant water quality characteristics, such as dissolved oxygen, in the stream.** In addition, we recommend that further field work on river quality characteristics adequate to allow for the evaluation of planning alternatives and the calibration of stream models be carried out. Such studies would include, among other things, a quantitative study of biomass and its major determining factors, rates of photosynthesis and respiration, benthic deposits, re-aeration rates, the sources and rates of assimilation of BOD and the hydraulic characteristics of the river. Furthermore, such data should be collected so as to represent the probabilistic behavior of pollution sources and stream responses. - RECOMMENDATION NO. 6*

## Royal Commission ~ 1974 ~



## Thames River Basin Water Management Study ~ 1975 ~

- Steady state & dynamic water quality modeling

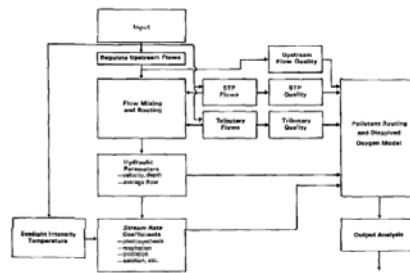
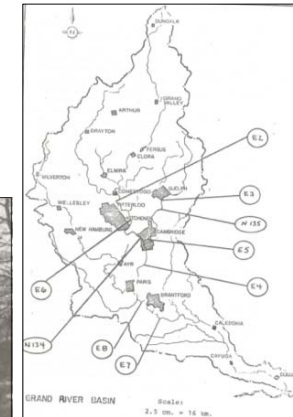


Figure A1. Thames River dynamic water quality simulation model.

## Continuous Monitoring of Dissolved Oxygen ~ 1975-1979 ~



## Grand River Basin Study ~ 1977 - 1979 ~

- Grand River Study Team
- Grand River Implementation Committee

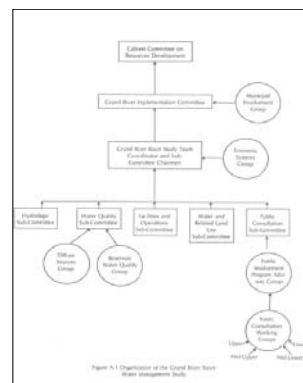


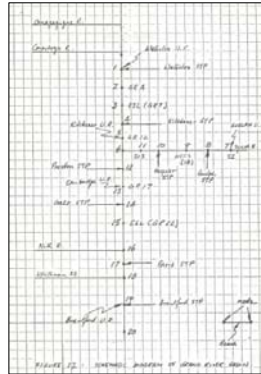
Figure A1. Organization of the Grand River Basin Water Management Study.

## GRIC Technical Report Series

- Weatherbe *et al.* 1976. Central Grand River Basin Waste Assimilation Study. Tech Report No. 4
- Kwong, Weatherbe *et al.* 1978. Water Quality Assessment for the Grand River Basin.
- Willson, *et al.* Draft 1982 (edited and published 1996) Water Quality Simulation Models and Modeling Strategy for the Grand River Basin. Technical Report No. 30.

## Model Development ~ 1978-1979 ~

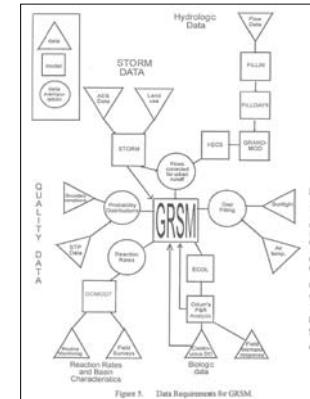
- 19 reaches; 20 nodes
- 8 STP's
- Simulated parameters: BOD, NOD, DO, SS, TP
- May to October simulation period (i.e. critical periods)



From: Kwong, Weatherbe *et al.* 1978. Water Quality Assessment for the Grand River Basin.

## Grand River Simulation Model ~ 1979-1980 ~

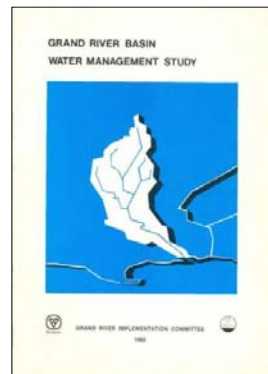
- Capable of long-term simulation
- ECOL1 & DOMOD7
- HEC-5; STORM models for hydrologic conditions & stormwater runoff



Willson *et al.* 1982 Draft. Data Requirements

## Integrated Water Management Study ~ 1982 ~

- Flooding
- Water Quality
- Water Supply



## Intermission ~ 1982 – early 1990's ~

## GRSM Revival ~ Early 1990's ~

- Revival of the Water Managers working-group
  - Partnership: GRCA, MOE, Watershed Municipalities & Universities
- ROW WWMP (1994)



The 'VAX' 8300

## GRSM Revival ~ mid-to-late 1990's ~

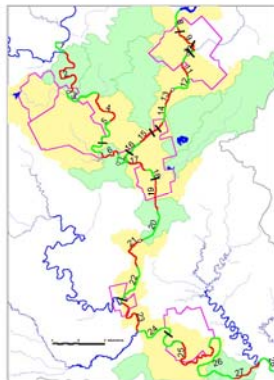
- Migrated program from the VAX to the PC
- Updated FORTRAN
- Substantive field data collection



Mark's 'PC'

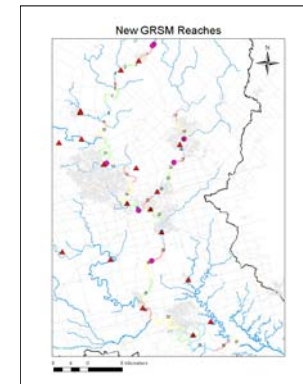
## Decision Support Tool ~ 2003 - 2004 ~

- GRCA staff provided support to municipal partners
  - City of Guelph,
  - ROW WWTMP
- Expanded model to 28 reaches



## Decision Support Tool ~ 2005 - 2006 ~

- Expanded GRSM to the Shand Dam to include Fergus and Elora STP's
- Elora WWTP Expansion EA
- 37 Reaches



## Decision Support Tool ~ 2006 - 2007 ~

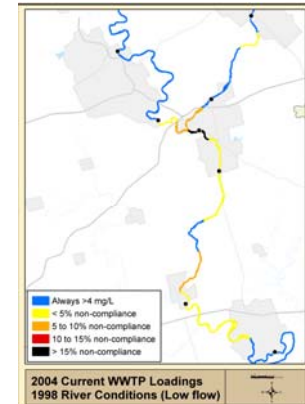
- Evaluate water management scenarios:
  - Increased population growth
  - Climate change
  - Cumulative effects



Ontario's Places To Grow Act

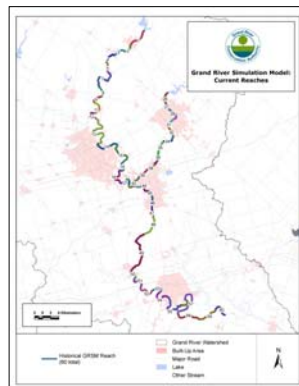
## Decision Support Tool ~ 2006 - 2007 ~

- Evaluate water management scenarios:
  - Increased population growth
  - Climate change
  - Cumulative effects
- Water Managers Working Group



## Decision Support Tool ~ 2008 - 2009 ~

- Model expanded to 60 reaches
- Support for the Kitchener Assimilative Capacity Study



## Commitment to Monitoring / Modeling

- 9 monitoring stations
- Enhanced nutrient monitoring/studies
  - GRCA / MOE
  - ROW
  - City of Guelph
  - Centre Wellington
- Integration of applied research



Continuous Dissolved Oxygen Monitoring Station

## Looking to the Future

- Continuous improvement
- 2010-2012 Water Management Plan
  - Population growth
  - Climate change
  - Sensitivities & vulnerabilities (i.e. temperature, flows)
  - Model integration (surface/ground/quantity/quality; landscape/in-river)
- Municipal Water Managers Working Group

Thank-you!