Water Quality in the Rat River – St.Malo Watershed:

Current conditions, historical trends, and potential actions.

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Manitoba

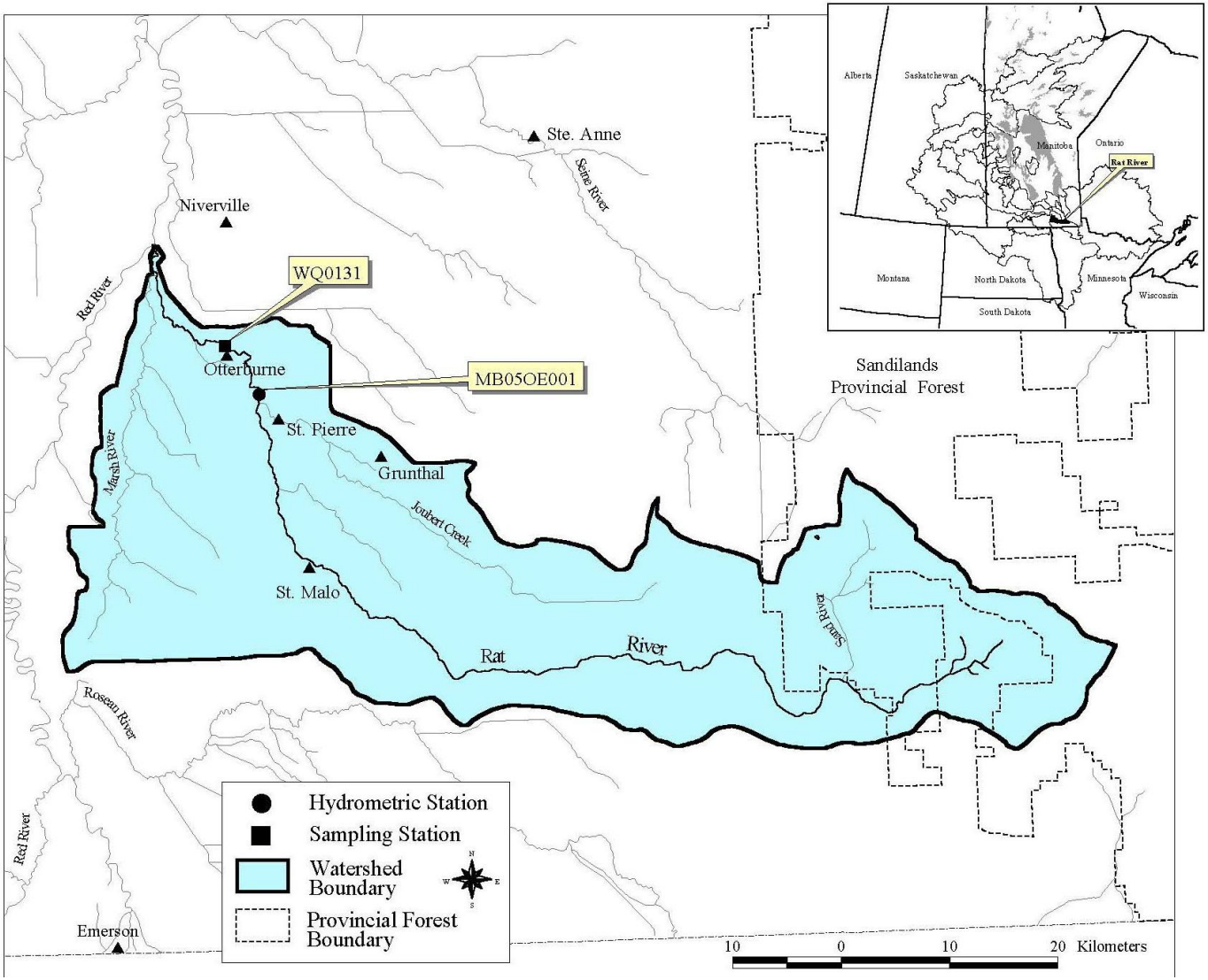
Overview

- Background to Area of Study
- Evaluating Water Quality: The Basics
- Water quality in the Rat River – Joubert Creek
  - Trends in nutrient concentrations
  - Trends in Canadian Water Quality Index (CWQI)
  - Trends in biological condition using benthic macroinvertebrates
  - Current status of water quality → Manitoba Water Quality Standards, Objectives, and Guidelines (MWSOGs)
- Actions to improving water quality

Study Goals

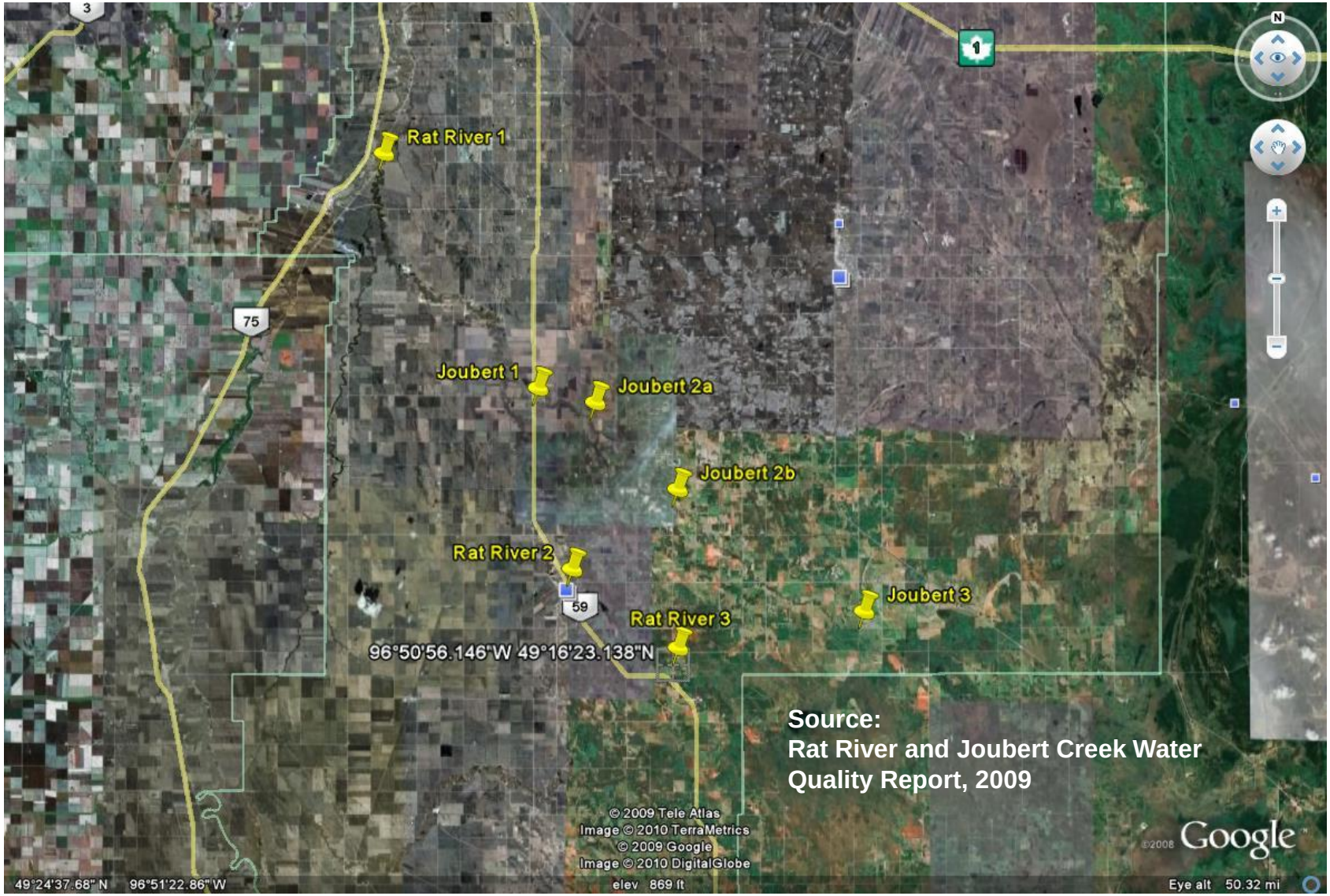
- Measure water quality at several sites – focus on nutrient and bacteria levels.
- Identify water quality concerns, investigate potential pollution sources, and initiate cooperative mitigation work.
- Compare changes in water quality upstream and downstream of agriculture and residential development.
- Compare results to Provincial standards for surface water quality.

Background to Area of Study



Source: Jones and Armstrong, 2001

Background to Area of Study



Source:
Rat River and Joubert Creek Water Quality Report, 2009

Evaluating Water Quality: The Basics

- Questions:
  - Is water quality getting better or worse?
  - Is water quality good or bad?
- What is commonly measured?
  - 100 variables including:
    - Nutrients (phosphorus, nitrogen)
    - Microbiology (*E. coli*, fecal coliforms)
    - Pesticides
    - Metals
- Frequency
  - Dependent on the nature of the study
  - Long term provincial monitoring sites - quarterly

Evaluating Water Quality: The Basics

- Trend analysis – Has there been an increase or decrease in concentrations over time?
- Water Quality Index – Tool for simplifying the reporting of water quality data; much data, one value.
- Biological Condition (macroinvertebrates) – Allows evaluation of integrated set of conditions encountered by aquatic community over time.
- Comparison with objectives, standards, and guidelines – What is the current status of water quality?

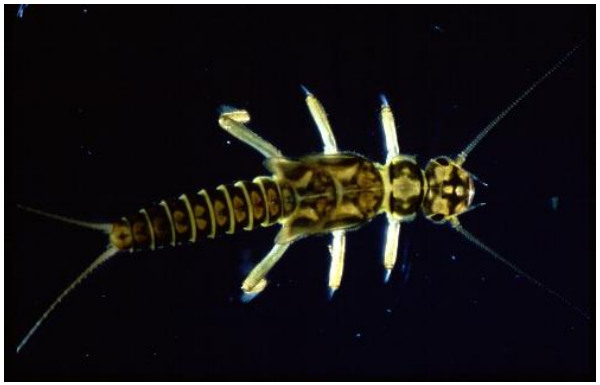
CCME Water Quality Index

- Calculations based on:
  - **F1 (Scope)** - number of variables that are in exceedance
  - **F2 (Frequency)** - percentage of tests that are in exceedance
  - **F3 (Amplitude)** - amount or magnitude of exceedances

- Classifications:
  - **Excellent** - virtual absence of threat; pristine
  - **Good** - minor degree of threat or impairment; rare exceedances
  - **Fair** - occasionally threatened or impaired; sometimes depart from desirable
  - **Marginal** - frequently threatened or impaired; often depart from desirable
  - **Poor** - almost always threatened or impaired; usually depart from desirable

Biological Condition

- Site-specific and time-integrated evaluation of water quality
- Community metrics used to categorize sites as to biological condition
  - Taxa Richness
  - Dominant Taxon
  - EPT Index
  - EPT/Chironomidae Ratio
  - Hilsonhoff Biotic Index
  - Ration of Shredders/Total Count

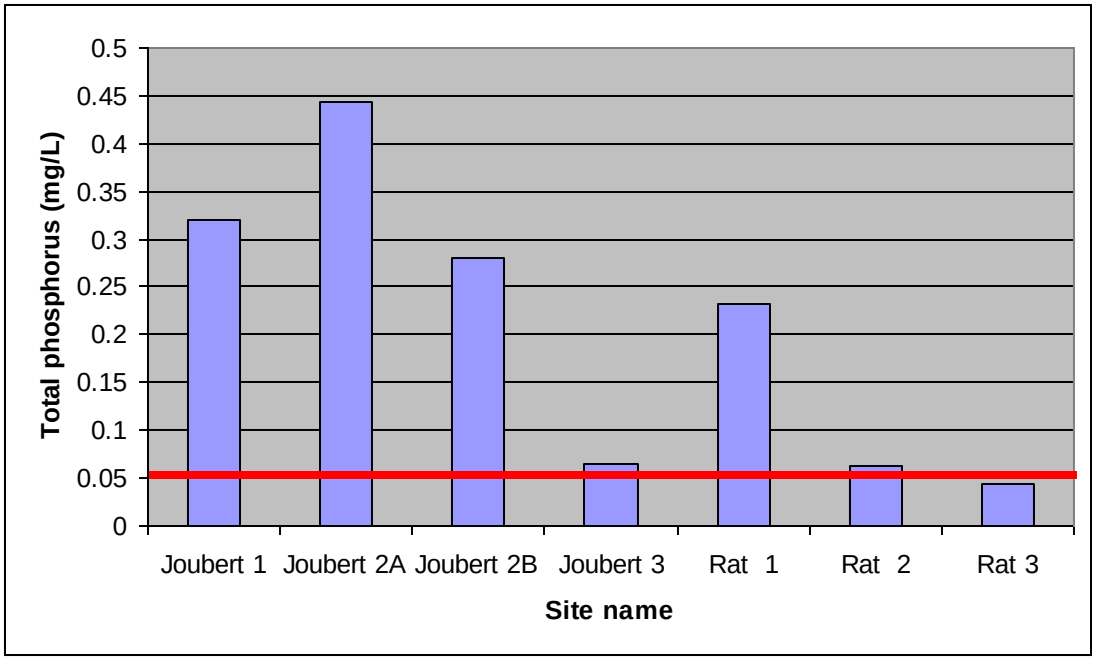


Picture Sources: www.shef.ac.uk
www.aquatax.ca/trichoptera.html
www.ucmp/berkeley.edu/ephemeropter.html

Biological Condition

Nonimpaired	-Balanced trophic structure -Community structure is optimal for stream size and habitat quality
Slightly Impaired	-Community structure less than expected -Absence of some intolerant groups -Percent contribution of tolerant groups increases
Moderately Impaired	-Fewer species are present -Absence of most intolerant groups -Reduction in EPT index
Severely Impaired	- If higher numbers of organisms are present, dominated by one or two species.

Water quality in the Rat River – Joubert Creek watershed, Manitoba



Manitoba Objective = 0.05 mg/L

Figure: Pooled annual averages of total phosphorus concentrations on Joubert Creek and Rat River From 2000 – 2009.

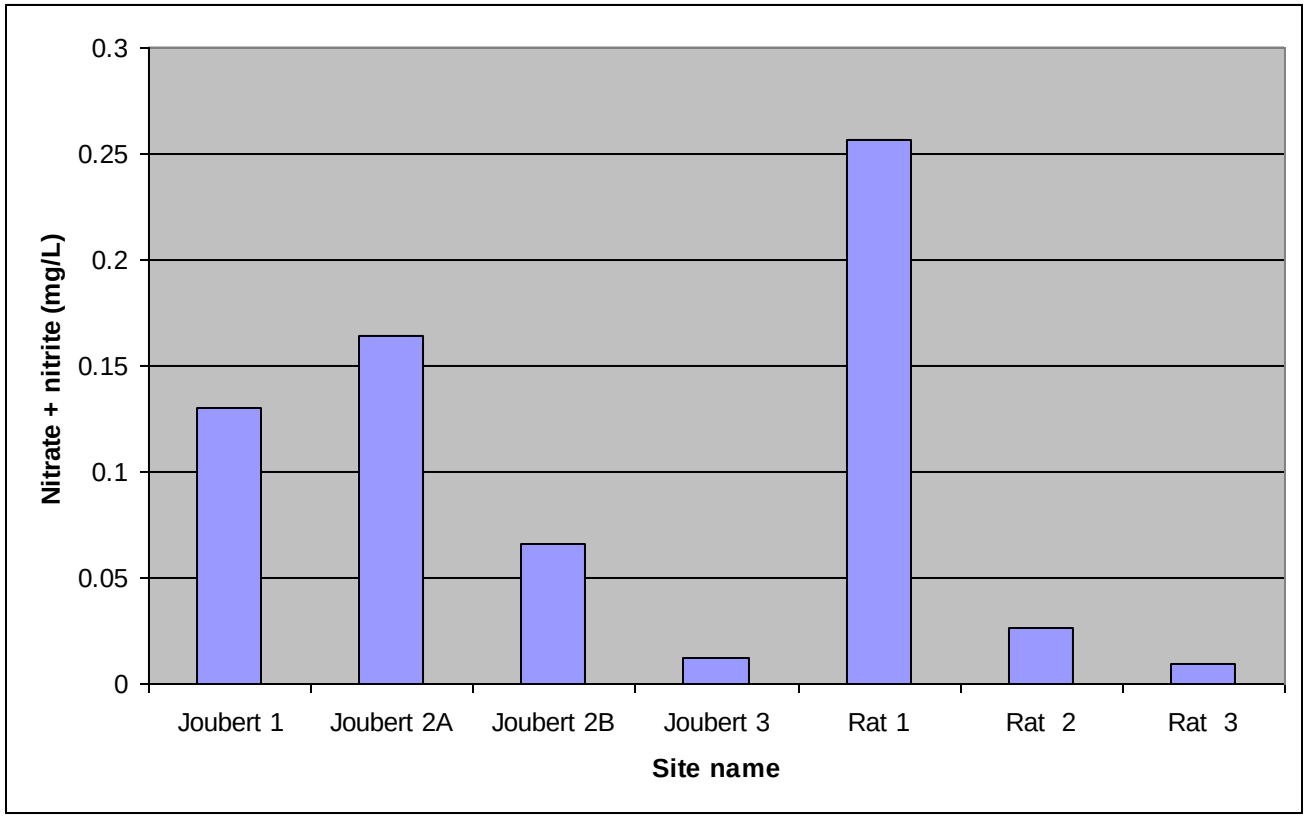
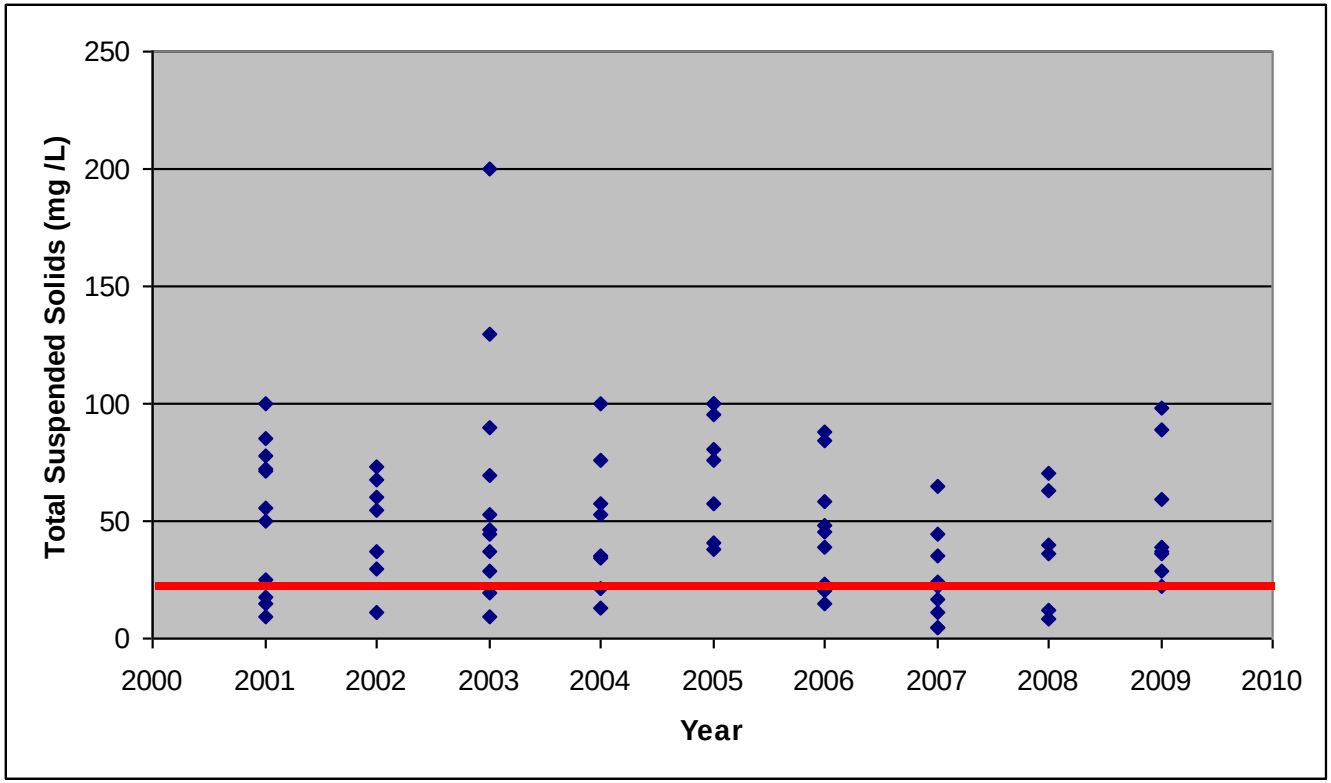


Figure: Pooled annual averages of nitrate + nitrite concentrations on Joubert Creek and Rat River From 2000 – 2009.



Manitoba Objective = 25.0 mg/L

Figure: Total Suspended Solids at Rat River 1, 2000-2009

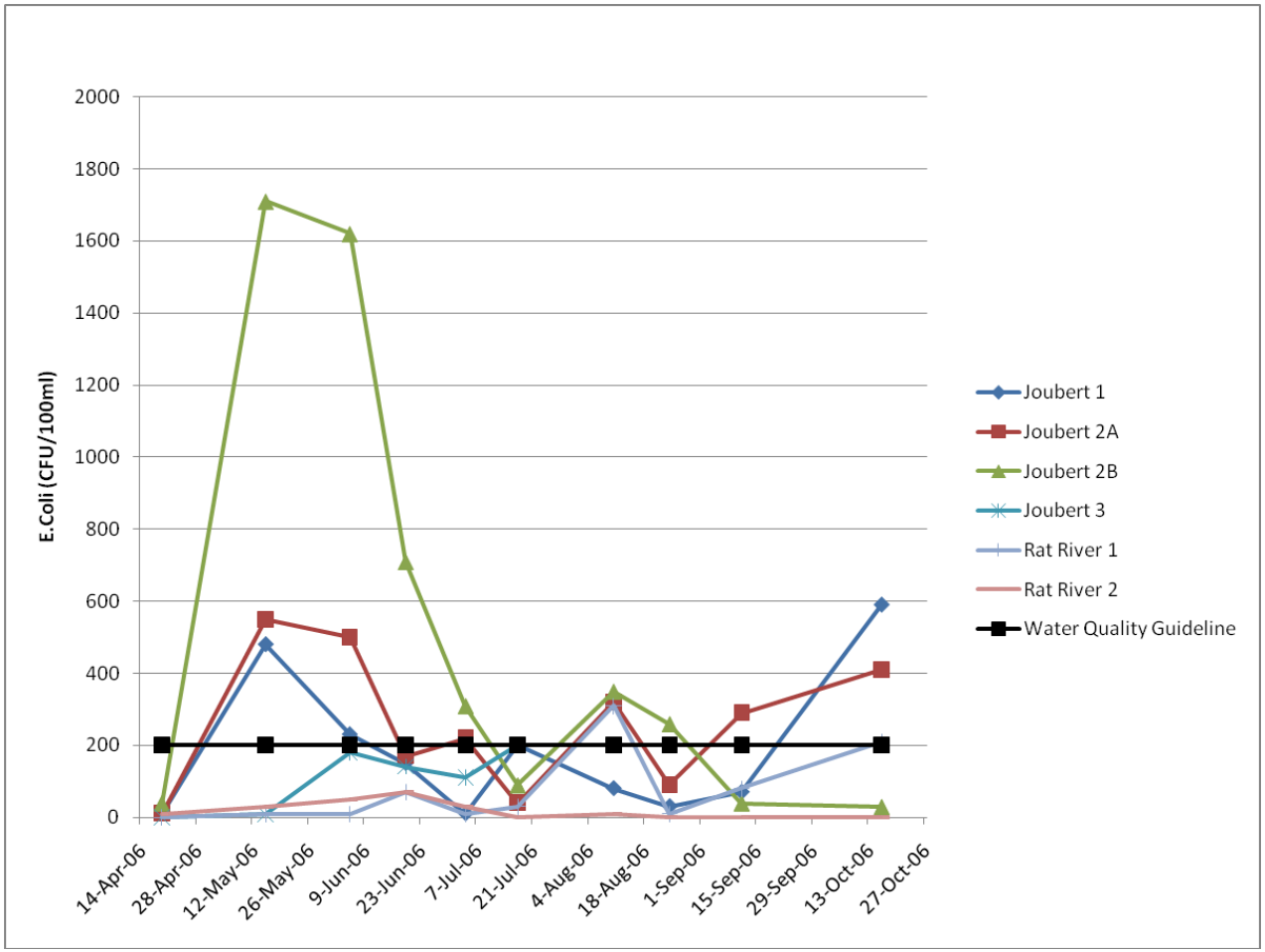


Figure*: E.coli* counts from the Rat River and Joubert Creek, 2006**.**

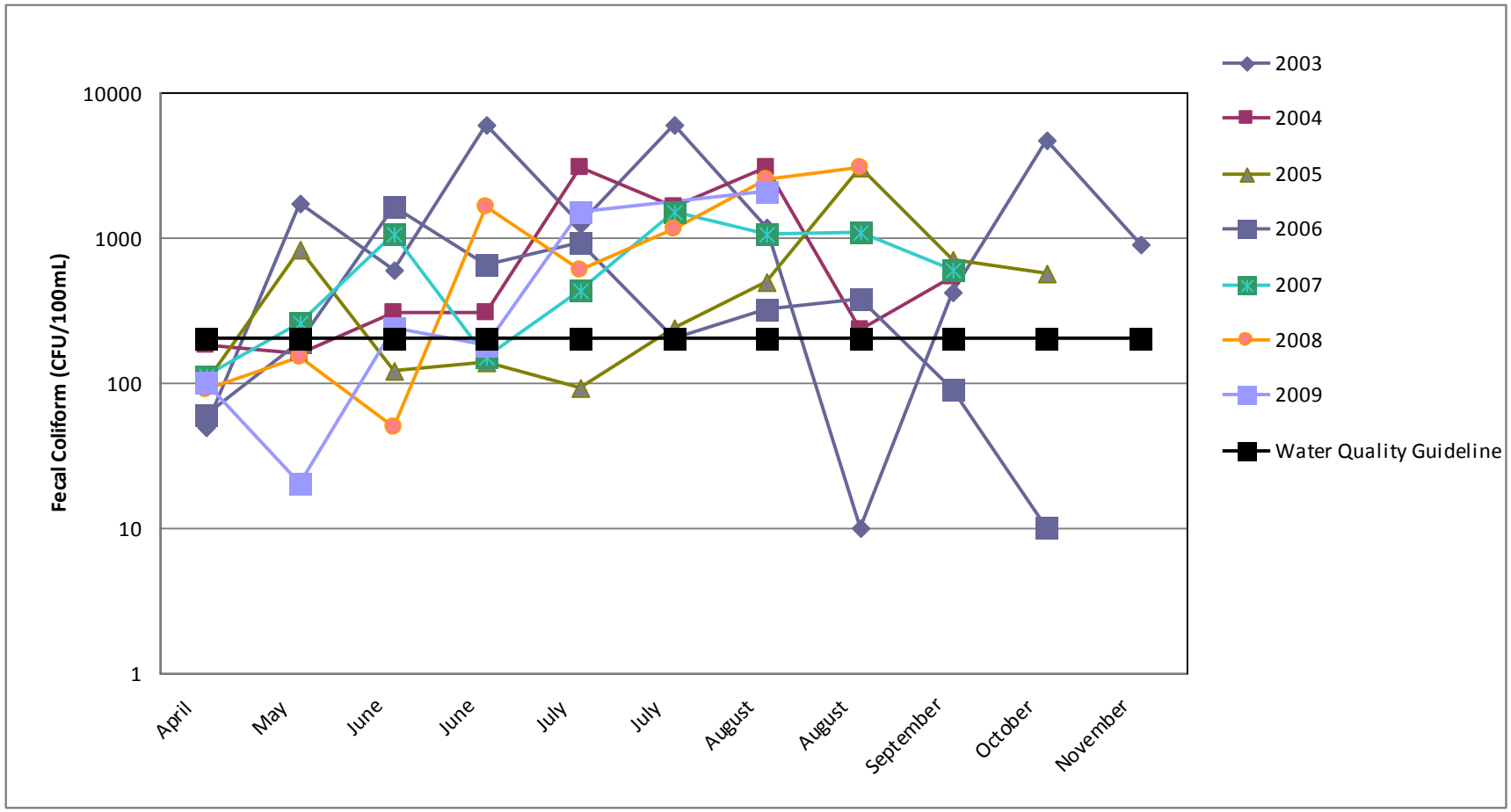
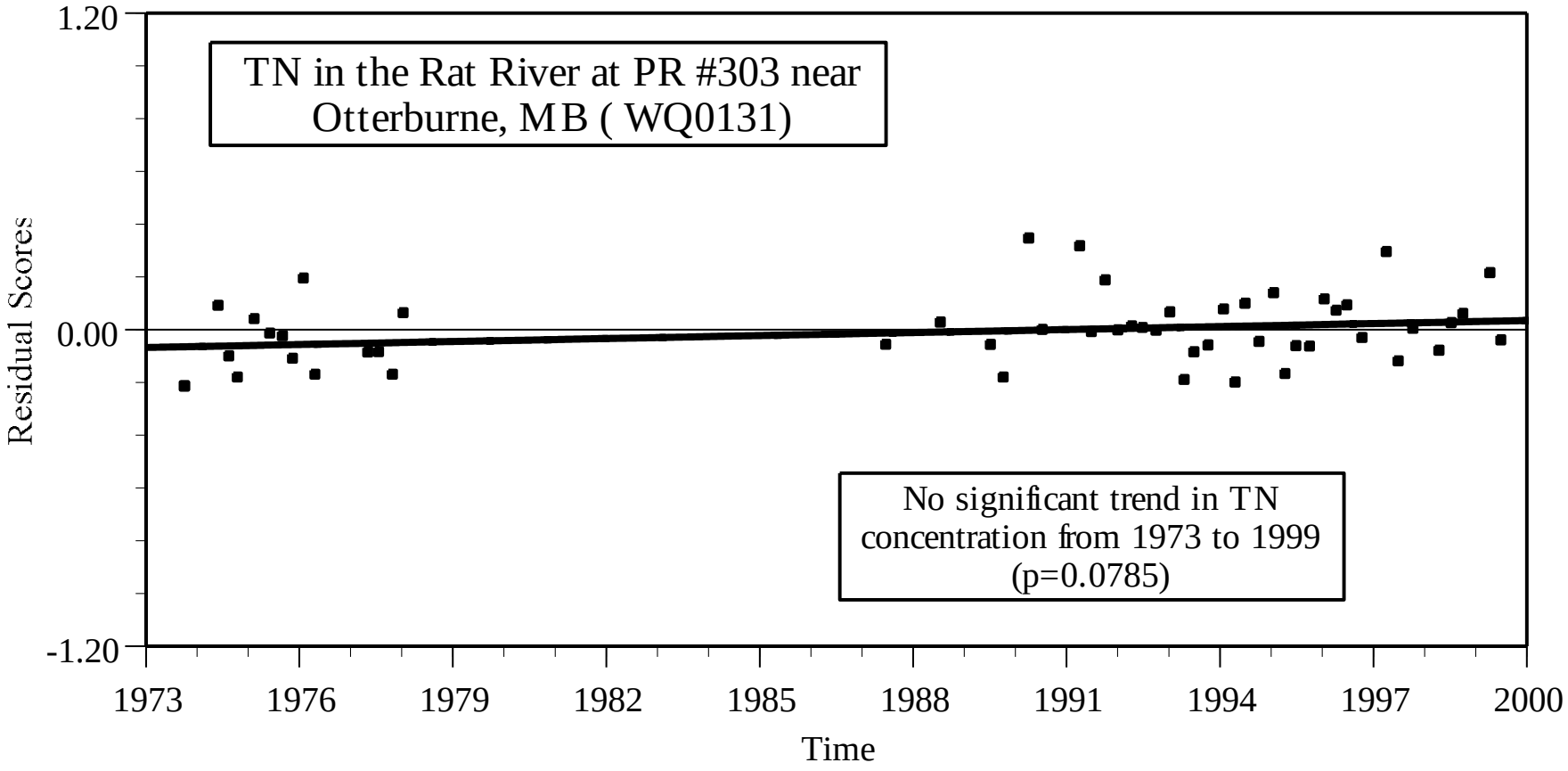


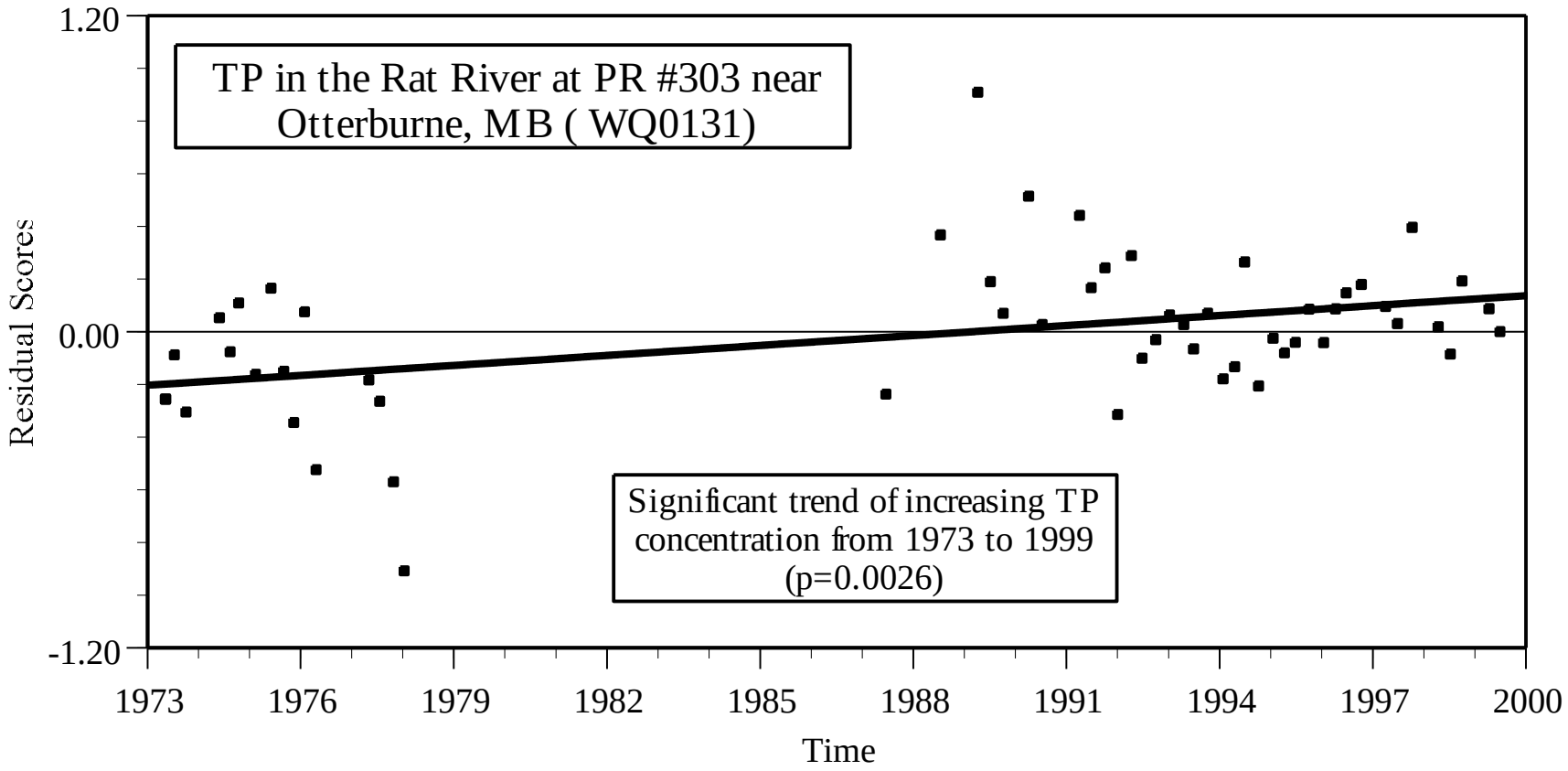
Figure: Fecal coliform counts at Joubert Creek Site 2B, 2003 – 2009.

Trends in Nitrogen – Rat River



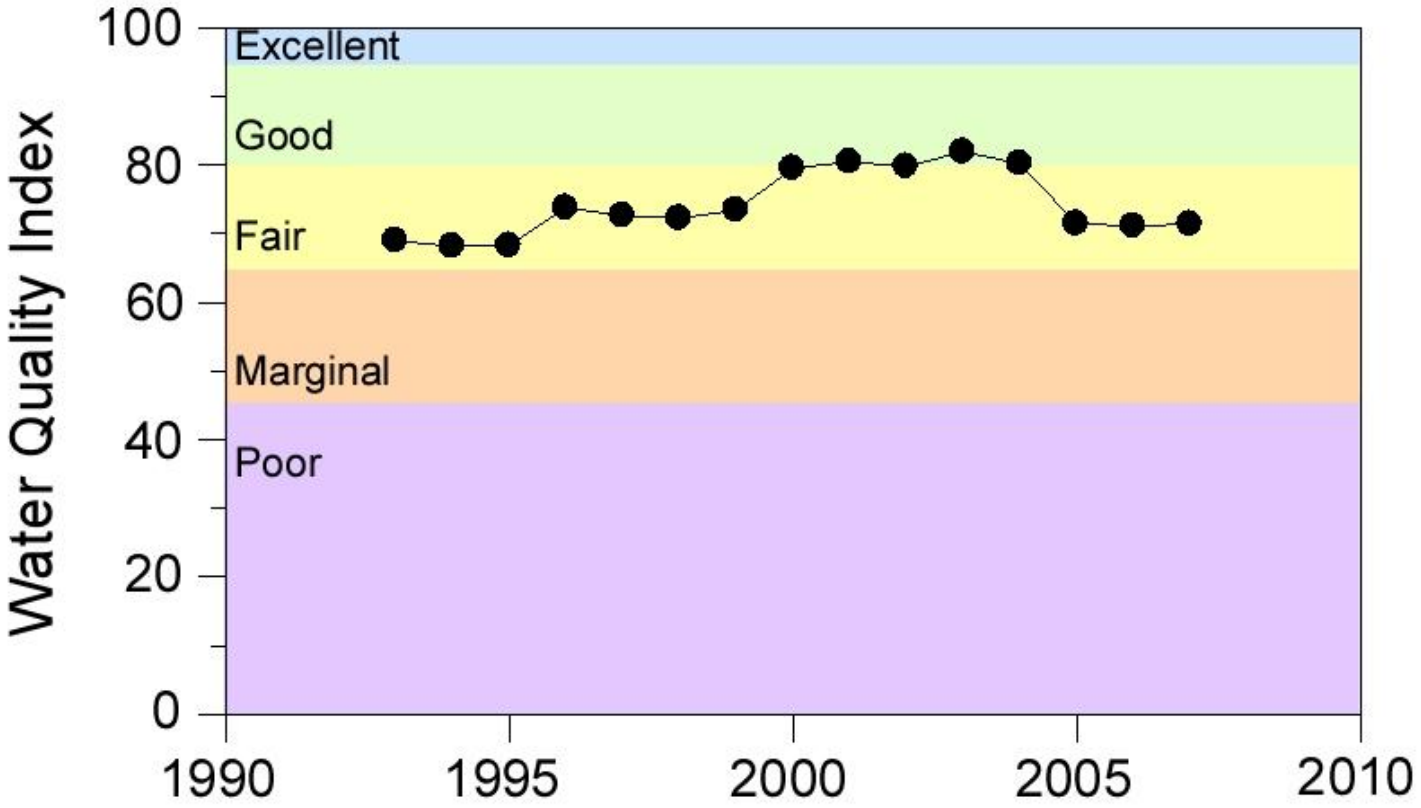
Source: Jones and Armstrong, 2001

Trends in Phosphorus – Rat River

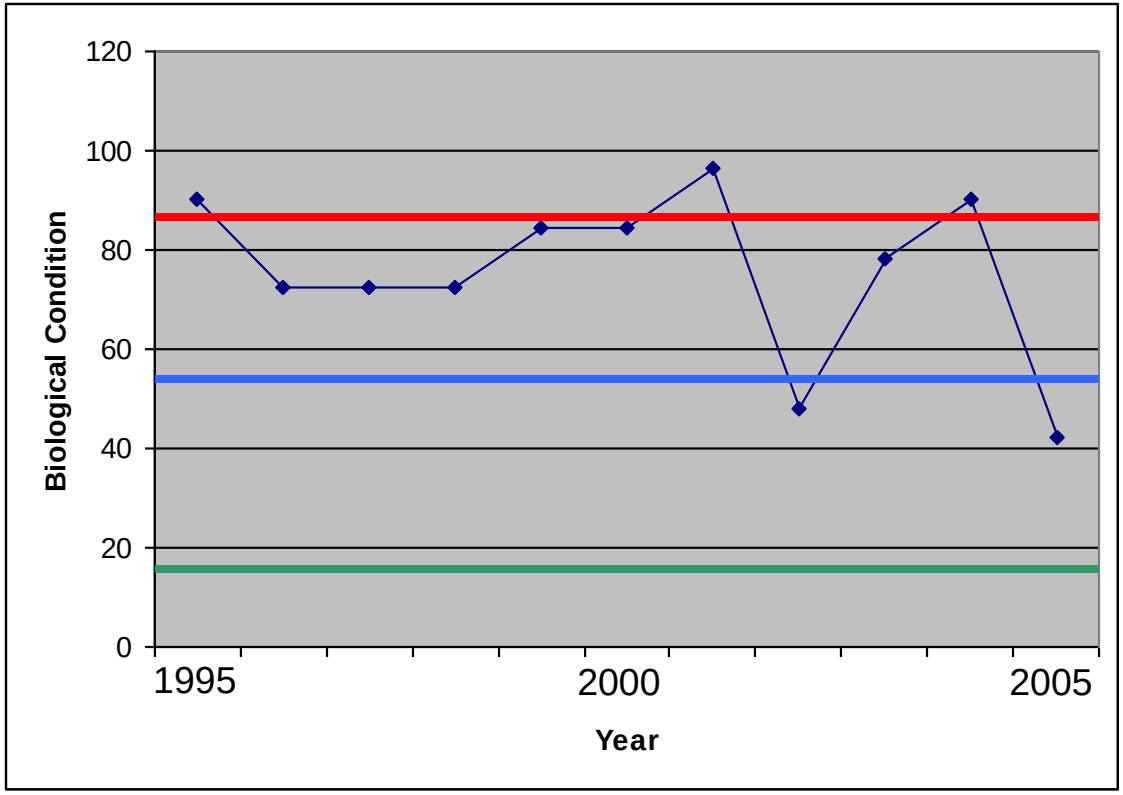


Source: Jones and Armstrong, 2001

Rat River: Trends in CWQI (1993 – 2007)



Rat River – Trend in Biological Condition



Non Impaired (> 83 %)

Slightly Impaired (54 – 79 %)

Moderately Impaired (21 – 50 %)

Severely Impaired (< 17 %)

Rat River / Joubert Creek Water Quality

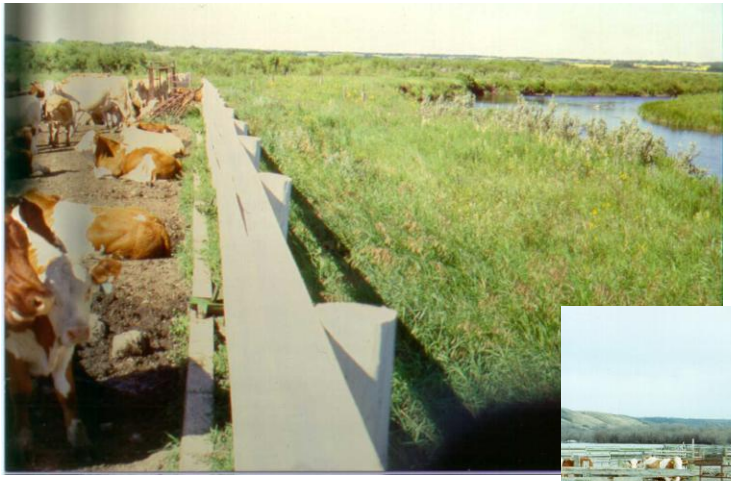
- Downstream sites show generally higher concentrations of nutrients than upstream sites.
- Downstream sites have frequent exceedances of provincial standards for total phosphorus, total suspended solids, and fecal coliforms.

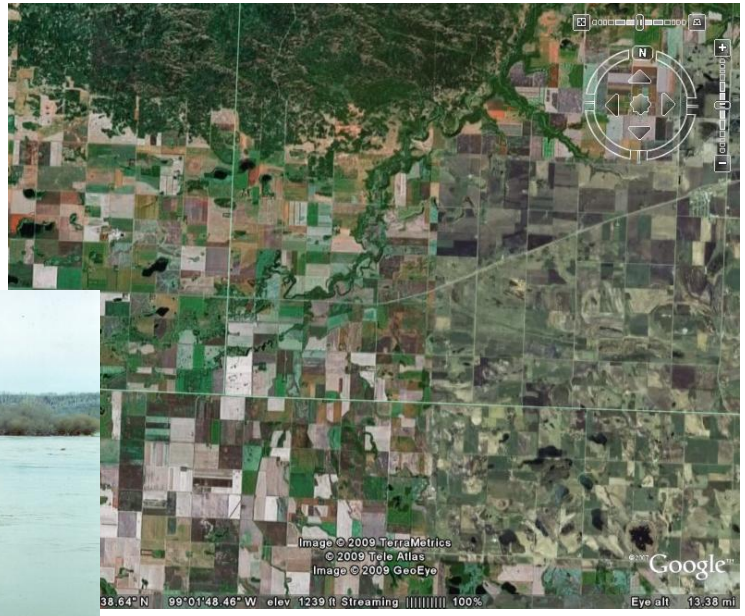
Water quality and relationship to land use

- Artificial addition of nutrients to Manitoba watercourses and waterbodies can be related to land use:
  - Point Source (*e.g.*, industrial discharge, lagoon outflow)
  - Non-point Source (*e.g.*, runoff from fields, flow from damaged septic system)

Actions to Improving Water Quality

- Emphasize land-based initiatives BMP (off-site watering and access, erosion control, riparian vegetative buffers)





- Education/public information

- Address priority land-use issues – improved water quality will be an outcome (off-site livestock watering, erosion, riffles, drainage)

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Thank You