

RESEARCH SUB-PROGRAM

MAINTENANCE PROGRAM FOR THREE SOUTHWESTERN ONTARIO WATERSHEDS, 1994 - 95

May 1995

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Disclaimer: *The views contained herein do not necessarily reflect the view of the Government of Canada, nor the Green Plan Research Sub-Program Management Committee*

FORWARD

This report summarizes the continuation of agronomic and water quality/quantity monitoring activities from three Southwestern Ontario watersheds which were initiated in the mid-eighties under previous environmental programs, such as SWEEP (Soil and Water Environmental Enhancement Program). These activities have been continued in support of research projects sited on these watersheds under the **COESA** (Canada-Ontario Environmental Sustainability Accord) Research Sub-Program of the Canada-Ontario Green Plan. The **GREEN PLAN** agreement, signed Sept. 21, 1992, is an equally-shared Canada-Ontario program totalling \$64.2 M, to be delivered over a five-year period starting April 1, 1992 and ending March 31, 1997. It is designed to encourage and assist farmers with the implementation of appropriate farm management practices within the framework of environmentally sustainable agriculture. The Federal component will be delivered by Agriculture and Agri-Food Canada and the Ontario component will be delivered by the Ontario Ministry of Agriculture and Food and Rural Assistance.

From the 30 recommendations crafted at the Kempenfelt Stakeholders conference (Barrie, October 1991), the Agreement Management Committee (AMC) identified nine program areas for Green Plan activities of which the three comprising research activities are (with Team Leaders):

1. **Manure/Nutrient Management and Utilization of Biodegradable Organic Wastes** through land application, with emphasis on water quality implications
 - A. Animal Manure Management (nutrients and bacteria)
 - B. Biodegradable organic urban waste application on agricultural lands (closed loop recycling)
(Dr. Bruce T. Bowman, Pest Management Research Centre, London, ONT)
2. **On-Farm Research:** Tillage and crop management in a sustainable agriculture system. (Dr. Al Hamill, Harrow Research Station, Harrow, ONT)
3. **Development of an integrated monitoring capability** to track and diagnose aspects of resource quality and sustainability. (Dr. Bruce MacDonald, Centre for Land and Biological Resource Research, Guelph, ONT)

The original level of funding for the research component was \$9,700,000 through Mar. 31, 1997. Projects will be carried out by Agriculture and Agri-Food Canada, universities, colleges or private sector agencies including farm groups.

This Research Sub-Program is being managed by the Pest Management Research Centre, Agriculture and Agri-Food Canada, 1391 Sandford St., London, ONT. N5V 4T3.

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Prepared on: September 8, 1999

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Maintenance Program for Three Southwestern Ontario Watersheds

June 1, 1994 - May 31, 1995

1 Background

The Soil and Water Environmental Enhancement Program was initiated in 1986 with an overall mandate to:

- reduce Ontario's Non-Point Source loadings of phosphorus to Lake Erie from agricultural sources by 200 tonnes; and
- maintain or improve the productivity of the primary agricultural sector in Southwestern Ontario by reducing or correcting soil erosion and degradation.

The Paired Watershed Study was a major Soil and Water Environmental Enhancement Program sub-program aimed at evaluating and showing the benefits of established conservation farming systems at the watershed and smaller levels. The cooperating agencies in Soil and Water Environmental Enhancement Program are: Environment Canada, Agriculture and Agri-Food Canada and the Ontario Ministry of the Environment and Energy. Beak Consultants Limited was the prime contractor responsible to Agriculture and Agri-Food Canada and Ontario Ministry of the Environment and Energy. Ecologistics Limited was a subcontractor to Beak and was responsible for site selection and the agronomic program of the Paired Watershed Study.

The Paired Watershed Study started in 1987 with detailed study design, staffing, training, cooperator enlistment, and watershed selection. Farm plans were initiated in August 1988 and environmental monitoring began the same year.

Monitoring and evaluation was conducted from late 1988 until mid 1992.

Initially, three paired watersheds were selected for study. Figure 1 shows the locations of the three study watersheds within the Lake Erie watershed. Also, shown is the location of a fourth study area known as the Kintore Creek watershed. The Kintore paired watershed study has been ongoing since 1984. This study has mirrored many objectives of the Soil and Water Environmental Enhancement Program Paired Watershed Study. The study was initiated by the Upper Thames River Conservation Authority, Ontario Ministry of Environment and Energy, and Environment Canada.

2 Purpose

With the completion of the Soil and Water Environmental Enhancement Program in 1993, a need was recognized for an inter-agency presence in the pilot watersheds to help sustain a level of conservation practices by the agricultural community. It was also recognized that upcoming research programs will require well-characterized sites, both agronomically and environmentally. Research projects started to date on these subwatersheds include:

Essex:

- i) Effect of Controlled Drainage/Subirrigation on Tile Drainage Water Quality and Crop Yields at the Field Scale. Dr. Ian van Wesenbeeck, AAFC, Harrow.

Kettle:

- i) Transport and Dissipation Pathways of Pesticides in Upland Watersheds Employing Conventional and Conservation Tillage in Ontario. Great Lakes Water Quality Program (5th Year) Drs. Bowman and Wall, AAFC, London & Guelph.
- ii) State of Resources: Monitoring Soil Loss and Redistribution Using ¹³⁷Cs. Dr. Gary Kachanoski, Environmental Soil Services, Guelph.

Kintore:

- i) Impact of Manure Application Methods on Water Quality, Focusing on Nitrogen and Bacteria Transport in Soil. Dr. Greg Wall, AAFC, Guelph.
- ii) Partitioning of Solutes from Agricultural Fields within the Hydrologic System at Two Sites in Southern Ontario and the Subsequent Impact on Adjacent Aquatic Ecosystems. Dr. David Rudolph, University of Waterloo.

To satisfy these requirements, a maintenance program was adopted for the Kintore, Essex and Kettle watersheds. This program was initiated to maintain a level of cooperation with the landowner to sustain the adoption of the conservation tillage practices. Monitoring of the water quality from the outflow of these sites were continued.

3 Objectives

The objectives of the Maintenance Program for the three Southwestern Ontario Subwatersheds are:

- 1) To encourage continued adoption of conservation tillage/cropping practices on the three subwatersheds through dialogue with the landowners, and
- 2) To monitor selected agronomic and environmental (water quality and quantity) parameters in the three watersheds using existing monitoring equipment from previous programs, in support of other environmental research programs sited on the three watersheds.

4 Project Summaries

4.1 Essex Watershed

Three Conservation Authorities (Essex, Kettle and Upper Thames) are participating in the paired watershed study (PWS) by maintaining streamflow monitoring, collection of water quality data, meteorological and agricultural data. Mr. Jim Eddie, Science and Technology Branch, Toronto, has provided technical support for the water quality and meteorological data collection.

4.1.1 Location

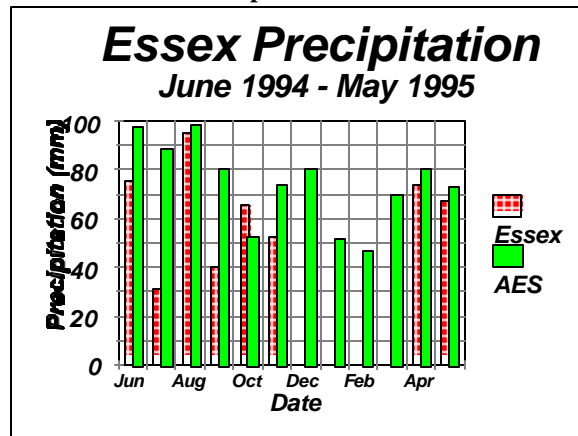
The Essex Paired Watershed Study is found within two distinct watersheds in Essex County. The West Subwatershed is located in the Puce River Watershed while the East Subwatershed is located in the Belle River Watershed. Both subwatersheds drain north to Lake St. Clair, which is connected to the Great Lakes via the Detroit River. Cash crop farming operations predominate with grain corn, soybeans and winter wheat being the major crops produced. The total area comprises 911.5 acres (369 hectares) in the western subwatershed and 672.5 acres (272 hectares) in the eastern subwatershed. This represents 38 total parcels operated by 26 different landowners. Poorly drained, extensively sub-surface tiled Brooskston clay soils predominate the area. The landscape in the region is gently undulating, with less than 1% slope. Erosion rates are not as high in the Essex subwatersheds as compared with Kintore or Kettle Creek. However, due to limited retention areas (such as wetlands, forests, buffers) and the extensive drainage network, the delivery ratio to area streams is very high.

4.1.2 Climate Data

4.1.2.1 Rainfall

Precipitation amounts were below normal for every month except October in 1994. This is displayed in the below figure (Figure 2) and is also tabulated in Appendix A. However, the rain fell at ideal times for farmers. The 30 year normal Rainfall data are from the Woodslee Research Station and have a period of record from 1961 - 1990.

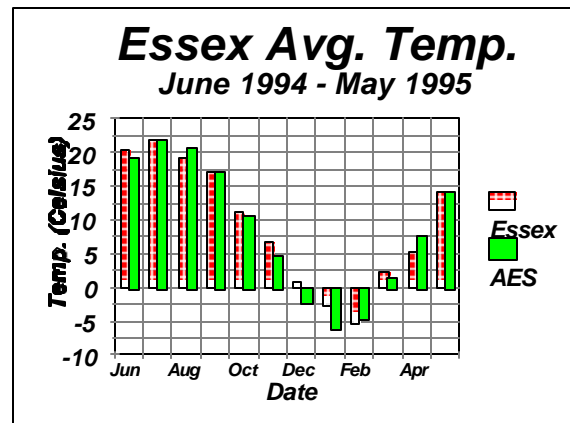
**Figure 2: Precipitation vs 30yr Normal
Precipitation - Essex Watershed**



4.1.2.2 Temperature

Temperatures were above normal for most of the year (Figure 3). Only the month of August 1994 showed below normal average temperatures. These 30 year normals are from the Woodslee Research Station and have a period of record from 1961 - 1990.

**Figure 3: Temperature vs 30yr Normal
Temperature Essex Watershed**



4.1.3 Observations

The fifth concession drain was cleaned out during the fall of 1993. It has taken a few years for the subwatershed to stabilize itself. As such, water quality results could be skewed in the fifth concession subwatershed because of sediment being displaced. As time goes on, one could assume the results will follow normal patterns.

4.1.4 Water Quality Data

A routine grab and storm event sampling program was conducted from June 1, 1994 until May 31, 1995. A complete table summarizing the results for these events is found in Appendix A.

A total of 8 storm events was sampled with 5 sampled during spring run-off, two during a winter thaw period and one during a summer storm event. Twelve base flows were sampled throughout the year when conditions warranted sampling.

Rainfall for the fall of 1994 was below average. At certain times there was no flow over the monitoring stations. The accumulated total from April 1, 1994- November 1, 1994 was 430.4 mm of rain. This represents 68% of the average rainfall for this given period as recorded over a 30 year period at the Woodslee Research Station. Please refer to Appendix A for a summary of the 1993/1994 precipitation and average temperatures.

Water quality analysis was provided by the Ontario Ministry of the Environment and Energy, Southwestern Ontario Laboratory in London. Samples were taken and shipped following provincial guidelines established by OMOEE.

4.1.5 Water Quantity Data

Leopold Stevens chart recorders were used to collect water level data. Price 1210 AA and Gurley 625 Mini flow metres were used to calculate flow velocities for both subwatersheds. A summary of the recorded flows is found in Appendix A.

4.1.6 Agricultural Practices Data

Agronomic survey forms were distributed to all landowners to obtain information about their farm management practices. Data collected included information on tillage practices, crops grown, fertilizers used, crop rotation patterns and general conservation

practices.

In the Western subwatershed, no-till farming accounted for a total of 44.4% of the land management practices as compared with 15.2% in the Eastern subwatershed. Please refer to 1994 field activity summary in Appendix A. Soybean and winter wheat crops are still the highest percentage of crops grown under no-till management. This is comparable to the Essex County Averages, where 50-60% of the soybeans and winter wheat planted in 1993 used no-till equipment while only 5-10% of the corn crop was planted in no-till (Personal Communications, Essex, OMAFRA).

Tillage practices were largely influenced by equipment availability and past practices used under the SWEEP Program. Through Agriculture and Agri-Food Canada, the following pieces of equipment were made available on loan to watershed landowners.

- ! Corn Planter
- ! Grain Drill
- ! Soil Saver
- ! Weigh Wagon

This equipment was also used by Agriculture and Agri-Food Canada off site. Combined with this and the fact that the project agreement was only short term, farmers were unable to plan crop rotations and equipment options for the future. This resulted in fewer farmers using the conservation equipment in the subwatersheds.

With assistance from the Ontario Ministry of Agriculture, Food and Rural Affairs, the ERCA offered soil sampling to paired watershed participants. ERCA staff field sampled and submitted samples to Ridgetown College of Agricultural Technology on behalf of the landowners. Bill Stevens from the Essex OMAFRA office provided crop recommendations when requested.

As part of the 1994-1995 agreement, participants in the paired watershed received a \$ 50 grant for filling out survey forms. ERCA approached all landowners and offered tree planting service to further promote conservation practices in the watershed.

4.1.7 Other Projects

! The paired watershed area is situated close to Agriculture and Agri-Food Canada's sub-research station, the Eugene Whelan Research station in Woodslee. As such, it gives researchers a great opportunity to take experimental plot trials to a field scale. Dr. Chin Tan from The Harrow Research Centre is currently assessing the impacts of controlled drainage on both tile water quality and crop yields within the paired watershed study area. On a no-till site, two plots compare controlled and

conventional tile drainage. Plot studies have shown that controlled drainage reduces nitrates in surface water by as much as 40% while having the potential to increase crop yields. This work will be conducted until 1997.

! The Essex Conservation Club, founded by the Essex Region Conservation Authority and the Essex Soil and Crop Improvement Association is currently assessing the difference in earthworm populations under no-till and conventional tillage cropping management systems. Two out of the eleven co-operators are within the paired watershed. Data will be collected at these sites until March 1997.

! Essex Region Conservation Authority, through its soil and water conservation staff, completed a Conservation Farm Planning Technical Guide for Essex County farmers. It contains information on no-till farming, conservation farming practices and demonstration sites found in the county. Technical data are given on a host of ideas that farmers can incorporate. All farmers were given these manuals to further promote Best Management Practices within the watershed boundaries.

! A newsletter was sent out to all participating landowners, highlighting events in the paired watershed and providing information on issues happening around the county as well.

4.2 Kintore Watershed

4.2.1 Location

The Kintore Creek watershed is formed by the headwaters of the Arther-Vannatter and Logan Municipal Drains. The two branches join to form Kintore Creek, which flows south and outlets into the Middle branch of the Thames River at the Village of Thamesford in Oxford County (Figure 1).

Each subwatershed drains 600 hectares of rolling cropland with well drained silt loam soils and pockets of poorly drained soil. Both branches of the creek originate in swampy headlands with strong spring sources that provide continuous year round base flows between 0.05 and 0.07m³/s in midsummer.

Thirty landowners carry out a range of agricultural activities, including dairy, beef, swine and cash crop. The primary crop grown was corn, soybeans, alfalfa and grain. The field slopes range from 1 to 6% and have been classified by Environment Canada's sediment delivery maps as having a high potential for soil loss and a high potential for delivery of sediment out of the watercourse.

4.2.2 Climate Data

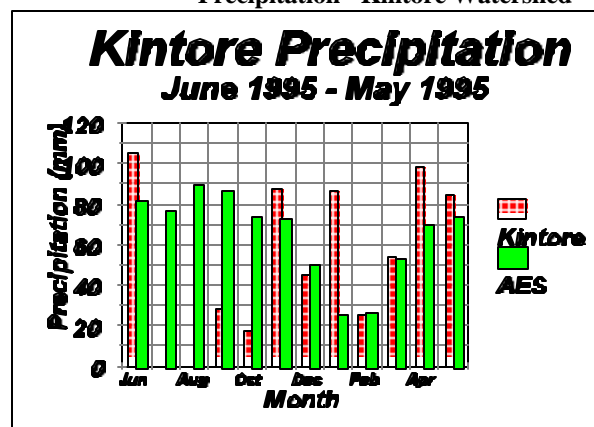
Rainfall and temperature data were collected from the Kintore site from June 1994 to the end of May 1995. Data is not included for the months of July and August of 1994 since the data set was incomplete due to equipment malfunctions at the site. As a result, there is insufficient data to compute a monthly mean temperature or total rainfall summary.

4.2.2.1 Rainfall

Rainfall volumes for the study year were generally lower than the 30 year AES normal when compared with Atmospheric Environment Service rainfall Data (Figure 4). During the winter months however, rainfall was consistently higher than normal. However, the normal winter precipitation volumes from Atmospheric Environment Service have distinguished between rainfall and snowmelt. Snow collection in the gauges would prevent rainfall from entering the tipping bucket. Inaccuracy could also be caused by the bucket being frozen.

Rainfall volumes were similar for most of the year, when compared with Atmospheric Environment Service measured data for the study period. There was however a significant difference in volume for the months of October 1994 and February 1995. The higher volume recorded at the study site in February could be a result of snow accumulation in the rain gauge.

Figure 4: Precipitation vs 30yr Normal
Precipitation - Kintore Watershed

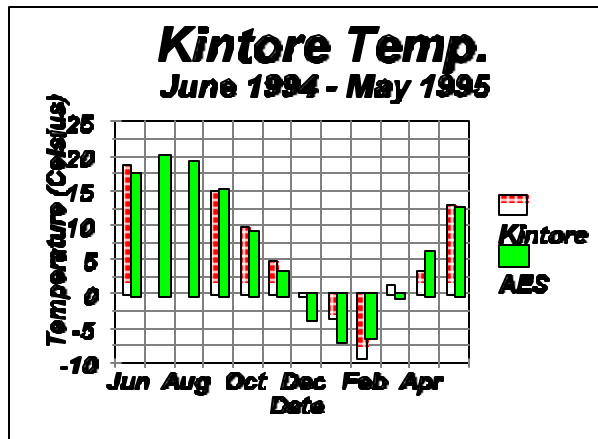


4.2.2.2 Temperature

The average mean temperatures from June 1994 to May 1995 was higher than the 30 year normal mean temperature from the London Airport's Atmospheric Environment Services records (Figure 5). The monthly mean

temperatures were not consistently over or under the normal temperatures for their respective months. There also was not any correlation when compared with the season. The data collected from the study site corresponded closely with the 30 year normal temperatures recorded at the London Airport.

Figure 5: Average Temperature vs. 30yr Normal Temperature - Kintore Watershed



4.2.3 Observations

There were no unusual occurrences in the Kintore watershed during the 1994 growing season. Cool weather caused a late start to the growing season, but good fall weather allowed crops to mature and the harvest proceeded rapidly. Good crop yields were again recorded in the watershed.

A June heat wave was followed by severe thunderstorms and pounding rain. The crop canopy protected soil from serious erosion damage, which most certainly would have happened had the rains occurred a few weeks earlier.

Following a normal month of precipitation in July, rainfall dropped to half of the normal amount by September and October. Warm dry conditions continued throughout the fall helping create ideal field working conditions. Some areas did not record a true killing frost until November, which is unusual for this part of Ontario.

Warmer than normal temperatures in January 1995 helped produce a major runoff event. During the period between January 12, 1994 and January 20, 1994, 80mm of rain was recorded at the London Airport weather office. The removal of the snow cap during this event meant that the spring melt, measured from March 12, 1994 to March 17, 1994 was not as extreme as observed in previous years.

4.2.4 Water Quality Data

Routine grab and storm event sample data from the Kintore watershed is presented in Appendix C. These tables include the data collected for the period from June 1, 1994 to May 31, 1995. Routine grab water samples were collected from the two outlet stations (1 and 5) and the five upstream stations (2, 3, 6, 7, 8).

Storm event data was collected for 13 events in the study period. Spring melt was monitored from March 11 to March 15, 1995. This event was a snowmelt event and did not include any rainfall.

Again, water quality analysis was beyond the scope of this contract. However, a statistical summary has been included for suspended solids and total phosphorus concentrations for this study period, at the two outlets of the Kintore subwatersheds. This data summary included the median, maximum, minimum and the 75th and 25th quartile. Results have been presented in a boxplot format in Appendix C. The central portion of each bar represents the median, the solid bar the inter quartile range and the top and bottom of the vertical line the station's maximum and minimum concentrations.

4.2.5 Water Quantity Data

A rating curve was developed for the two subwatershed outlets and the 5 sampling stations upstream. Regular flow measurements and event monitoring during higher flow events were taken throughout the year. Water level data was collected using a Stevens recorder and digitized by the Science and Technology Branch, Ontario Ministry of the Environment and Energy.

Streamflow information for the Logan and Vannatter drains is available for June 1, 1994 to December 31, 1994. The data for the first five months of 1995 are not available at this time and are not included in this report. Flow information is continuous for the above period of record for the Logan drain but the Vannatter Drain record is missing 5 days in August.

Flow from the Vannatter Drain was consistently higher than the Logan Drain. During the late summer months and early fall, the Vannatter flows were at least twice the Logans flows. However, the flows for the winter months, were similar for each drain. In the winter, the ground is frozen and agricultural coverage tends to be low. This results in similar conditions for each branch of the Kintore Watershed. As a result, flows are similar due to the nearly identical size of the watersheds.

4.2.5.1 Runoff Coefficient

Runoff coefficient (Appendix C-9) is the ratio of runoff volume compared with the volume of rainfall. Since runoff volumes are only available from June 1, 1994 to December 31, 1994, runoff coefficients are only provided for that period.

Rainfall volumes from the site were used for most calculations. Some rainfall volumes were changed from the local values to the rainfall volumes measured at the London Airport by the Atmospheric Environment Service. It appears that some rainfall volumes are incorrect at the Kintore site and result in rainfall amounts much lower than actually occurred resulting in unusually large runoff coefficients. This could be a result of mechanical problems at the gauges or the gauge being dirty.

Runoff coefficients are lowest during the summer months. At the beginning and end of the year, the runoff coefficient value gets larger. During the hot summer months when most of the fields were cropped, the runoff coefficient was very low at 0.16. This value was much higher in December at 0.66. This is a result of a lack of any ground cover during this month and reduced evaporation rates. Since there was not a long period of below 0°C weather in December, it is unlikely that frozen ground played a role in increased runoff.

The summer months showed a low runoff coefficient, most likely due to the coverage of agricultural fields and a higher evapotranspiration rate. Plants intercept a larger portion of the rainfall and retain this water, preventing it from entering the river system.

4.2.6 Agricultural Practices Data

The 1994 field activities of landowners in the western and eastern subwatersheds are summarized in Appendix E. Individual farm and field locations can be referred to with the map in Appendix D. As the below tillage summary indicates, 12% of the west and 22% of the eastern subwatershed were protected with a cover crop. The eastern subwatershed is higher than last year's, while the western subwatershed is lower than previous years.

**Table 1: 1994 Primary Tillage Practices
Kintore Watershed**

Field Activity	Western		Eastern	
	Subwatershed		Subwatershed	
	Area (Acres)	% of Total	Area (Acres)	% of Total
Fall Mould Board	546	44	173	21
Spring Mouldboard	301	24	313	37
Fall Chisel	87	7	59	7
Spring Chisel	68	5	27	3
No-till	94	8	83	10
Cover Crop	153	12	182	22
Total	1249	100	837	100

4.2.7 Other Projects

! Due to the excellent landowner cooperation and interest, coupled with the historical water quality database, Kintore has long been a favourite location for multi-agency research and demonstration projects. Some previous and current projects include:

- University of Guelph: GAMES Model development
- Environment Canada: sediment/transport studies
- Environment Canada: atrazine monitoring
- Environment Canada: invertebrate monitoring techniques
- Agriculture Canada: Green Plan manure application studies
- University of Waterloo: groundwater investigations
- Agriculture Canada: National Soils Program Demonstration
- University of Waterloo: dynamics of sediment transport

! These projects are all in addition to the ongoing soil conservation work initiated by the Ontario Ministry of the Environment and Energy and the Upper Thames River Conservation Authority.

! The watershed has also been selected as the location for two agricultural research projects funded under Canada's Green Plan. The Kintore Creek Research Site is being considered as a monitoring node for the Mixed Wood Plain Ecozone established by Environment Canada. All of the research and data collected would form the basis of the State of the Environment reporting for this region of Canada.

! Dr. Gregory Wall, Agriculture and Agri-Food Canada, is investigating the impact of manure application methods on water quality, focusing on nitrogen and bacteria transport in soils. The field scale study of liquid manure application

is being undertaken to identify the pathways and process in nutrient and bacteria transport to tile drains and ground water with emphasis on preferential flow. This study is in conjunction with other manure studies and represents test fields with a loam type soil.

! Dr. Dave Rudolph, Waterloo Centre for Groundwater Research, and Dr. Gary Kachanoski, University of Guelph, are conducting research into partitioning of solutes from agricultural fields within the hydrologic cycle. The combination of water balance and nitrogen balance measurements will provide a detailed view of contaminant flux partitioning between soil water, shallow groundwater, tile drainage, deep groundwater and surface water.

4.3 Kettle Watershed

4.3.1 Location

The Kettle Creek paired watersheds are within the southern boundaries of the City of London. Soils are a combination of Brant and Muriel Soils with slopes of 2 to 5% throughout. Soils can generally be considered as a series of moraine deposits of silt loams to silty clay loams throughout.

Both the East and the West subwatersheds drain in a southerly direction by open municipal drains to Kettle Creek which drains into Lake Erie. The watersheds' headwaters form the Lake Erie boundary of the Lake Erie - Lake St. Clair divide. Surface flows run across open fields and grassed waterways to the open drains. Drainage is generally considered fair to good. Tile drainage exists only as random tile drainage in depression areas and broad swales. Farm systems in the Kettle Creek Watershed consist of row crops (predominately grain corn, soybeans and winter wheat) and some mixed systems with dairy, beef and hogs.

The west subwatershed is drained by the Madter drain and is about 940 acres (380 ha) in size. The east subwatershed is about 880 acres (355 ha) in size. The east subwatershed is drained by the Holtby Drain. Of the 940 acres in the western subwatershed and 880 in the eastern subwatershed, 62 and 19 acres for the western and eastern subwatersheds respectively, consist of pavement and other non cropped land usage. Both subwatersheds are in the Former Town of Westminster (now within the City of London), Lots 6 - 10, Concessions V - VII.

There are 17 farmers participating in the study. One farm has changed ownership in the past year and no longer produces canning vegetables but has become a cash crop. One farmer has a combination vegetables for canning

purposes/cash crop operation (sites 6, 18 and 23 on attached map); 2 farmers are 40 head dairy/cash crop (sites 22 and 1 on attached map); 3 hog/ cash crop operations (sites 7, 9, and 10 on the attached map); 1 broiler chicken (4000 birds)/cash crop operation (site 11) and 10 farmers are straight cash crop operations (remaining sites on attached map in Appendix E). There are no other land uses, other than agricultural lands, within either subwatershed.

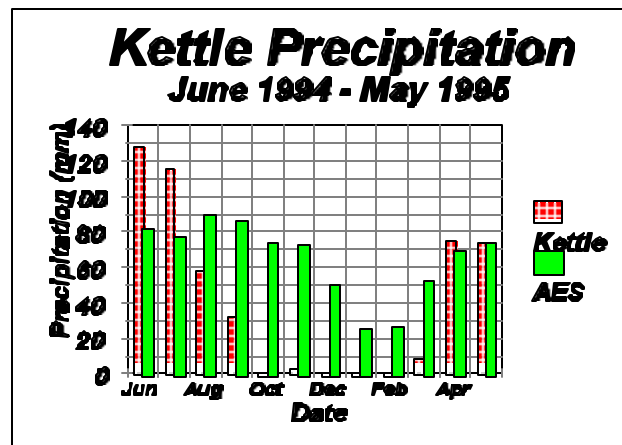
4.3.2 Climate Data

Climate data in the form of rainfall and temperature were collected at the Kettle Creek Sites from June 1, 1994 to May 31, 1995. The data collected is complete for the period of collection.

4.3.2.1 Rainfall

During the study period, the precipitation in the Kettle sub-basis was below the yearly average (Figure 6). During the fall, winter of 1994 and spring of 1995, rainfall volumes were much lower than normal. During April and May of 1995, however, rainfall amounts were slightly above normal. June and July of 1994 were considerably above the long term average (30yr normal). The long term data used for comparison purposes was recorded by Atmospheric Environment Service at the London Airport.

**Figure 6: Precipitation vs 30yr Normal
Precipitation - Kettle Watershed**



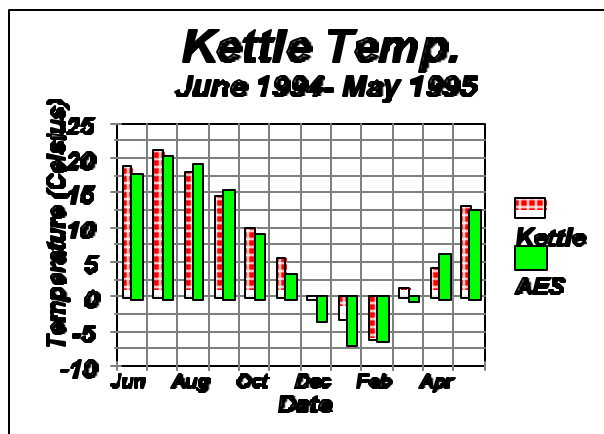
4.3.2.2 Temperature

During the summer months, temperature within the Kettle watershed reflected the precipitation amounts (Figure 7). Warmer than normal temperatures were encountered in the summer months of 1994. This would indicate the presence

of higher than normal thunderstorm activity resulting in more frequent heavy rains. However, during the remaining months, there is not any correlation between precipitation and temperature.

Temperatures during the winter and early spring were generally warmer than the long term. However, temperatures during the later spring of 1995 and the early fall of 1994 were generally cooler than normal. The 30 year normal temperatures are those recorded by Atmospheric Environment Service at the London Airport.

Figure 7: Temperature vs 30yr Normal Temperature - Kettle Watershed



4.3.3 Observations

No work was done on either drain that disrupted flow patterns.

4.3.4 Water Quality Data

Bi weekly monitoring of the drains commenced in November of 1994 when both drains produced streamflows. The last bi weekly measurement was taken June 5, 1995 and was halted after that because of insufficient flow. Bi-weekly recorded data are provided in Appendix E. Four storm events were collected for this project year..

4.3.5 Water Quantity Data

Water depth has been monitored from June 1, 1994 to May 31, 1995. The rating curves have also been developed. However, since the water depth is recorded on chart paper the flows have yet to be calculated.

4.3.6 Agricultural Practices Data

The 1994 field activities are summarized in Appendix I, for each subwatershed. Field locations can be referenced by using the map in Appendix F.

As the table below indicates, there is a difference in cropping practices between the two subwatersheds. The western subwatershed has almost double the area in no-till of the eastern subwatershed, while the eastern subwatershed has more area in conventional tillage practices. There are only minor differences between the other landuses.

Table 2: 1994 Cropping Practices Kettle Watershed

Land use	Western Subwatershed		Eastern Subwatershed	
	Area (Acres)	% of Total	Area (Acres)	% of Total
Homesteads	21.0	2.4	18.0	2.1
Woodlot	98.0	11.2	30.0	3.5
Hay	61.5	7.0	96.5	11.2
Pasture	14.5	1.6	8.7	1.0
Fallow	27.2	3.1	na	na
No-till Corn	194.0	22.1	5.9	0.8
No-till Grains	64.5	7.3	60.0	6.9
No-till Soybeans	175.5	20.0	206.2	23.9
Conventional Corn	96.9	11.0	100.8	11.7
Conventional Grains	18.1	2.1	0.0	0.0
Conventional Soybeans	51.1	5.8	182.0	21.1
Conventional Peas	na	na	68.1	7.9
Reduced Till Corn	28.9	3.2	33.8	3.9
Reduced Till Soybeans	31.0	3.3	16.8	2.0
Reduced Till Wheat	0.0	0.0	34.3	4.0
Total	878.4	100.0	861.1	100.0

No-till continues to become more accepted and utilized within the paired watersheds. No-till remains the primary tillage strategy for wheat and soybeans and is more broadly accepted with corn crops. No-till continues to show increased profit from a cost-benefit analysis and frees up more time for the farmers to work additional acreage in the springtime, but is still subject to some restrictions. Drawbacks to no-till cropping have included later planting dates, high cost of purchasing soil saving equipment and no-till planters, some increased weed problems (although none of the farmers interviewed found any considerable weed problems), and limited use of incorporated fertilizers and pesticides.

The 17 farmers in the watersheds were surveyed for general comments on no-till cropping practices versus conventional tillage practices. Generally, most participating landowners have been satisfied with the results of no-till cropping practices when used in cropping rotations. Overall, no-till offers more benefits than costs, especially in soybeans and wheat. Remarks on No-Till

Soybeans have been very favourable with reduced inputs yet comparable yields. Results on No-till Wheat have been generally good. Reduced yields have been noted, yet overall profit margins remain comparable to conventional practices. No-Till Corn has had variable results with good to poor results as far as profit margins.

Of the 17 farmers:

! Seven farmers are completely no-till (as compared to just two for the 1993-1994 study) and intend to stay no-till for the future.

! Six farmers are completely no-till for their soybeans and wheat but have not committed fully to no-till corn. Two of the farmers have been unsatisfied with the results of no-till corn and have returned to ploughing prior to planting corn. The remaining four have had mixed results with no-till corn and continue to experiment with no-till corn versus plots of conventional tilled corn. Concerns with no-till corn are restrictions with later planting dates in heavier soils and reduced yields.

! Four farmers remain in conventional tillage for the most part. Two of the farmers experimented with reduced till and no-till. Reasons given for not going to no-till include: too small a land base for the cost of purchasing no-till; high cost of purchasing no-till when already owning good conventional equipment; in the canned vegetable business and will continue to use conventional tillage to ensure warm spring soils and broader planting dates and just not interested.

Although the Holtby drain is moving toward no-till, over half the cropped land remains in conventional tillage practices. This allows for some level of continued comparison of the original SWEEP control subwatershed (Holtby) to the test (Madter) which remains 67% no-till or better throughout the past two years.

The most popular rotations used are A) a three year corn-soybean-wheat rotation; B) a four year corn-soybean-soybean-wheat rotation; and C) a five year corn-soybean-corn-soybean-wheat rotation

Each landowner was offered 350 seedling trees to be planted on their property in appreciation for their cooperation in this study. All the landowners in the study watersheds participated in the offer. Trees were planted mostly as windbreaks, shelterbelts and streambank plantings. In all, 4,500 trees were planted in the paired watershed study area for 1995.

5 Summary

Water quality, quantity and agricultural practices' data have been collected and summarized for the periods between June 1, 1994 and May 31, 1995. The 1994/95 data will add to the previously collected data and enhance the overall historical record. As the database grows, agricultural research in Ontario will benefit from the existence of historical agronomic and environmental watershed data for reference.

As outlined in this report, the preservation of these watershed sites has already proved extremely useful in helping agricultural field research and demonstration. With maintenance support, they will continue to pay dividends.

Appendices

Essex Climate Data: Datalogger Summary

Comparison of 1989 to 1994 Monthly Total Precipitation with the Normal from Atmospheric Environment Services London Airport Station						
	Essex Pilot Watershed				Atmospheric Environment Service - Woodslee Research Center	
	Total Rainfall		Avg. Temp. (°C)		Total Rainfall	Average Temperature
Month	1994	1995	1994	1995	Normal	Normal
Jan		na		-2.84	51.2	-5.8
Feb		na		-5.21	46.7	-4.4
Mar		na		2.25	70.1	1.3
Apr		73.8		5.23	80.4	7.7
May		66.8		14.13	72.7	14.1
Jun	75.4		20.5		97.4	19.2
Jul	31.1		21.8		88.6	21.7
Aug	94.8		19.03		98.3	20.6
Sep	40.1		17.23		80.7	17
Oct	65.4		11.24		52.7	10.7
Nov	52.6		6.84		74.1	4.8
Dec	na		0.88		80.3	-2.2
Annual Total					544.9	8.7

**Paired Watershed Study
Essex Region Water Sampling Data**

**Station: Fifth Concession, (West)
Routine Grab Samples**

Date of Sample	Julian Date	Staff Gauge	Suspended Solids (Mg/L)	Nitrogen				Phosphorus		pH	Conductivity (Mg/L)	Potassium (Mg/L)	Sodium (Mg/L)	Calcium (Mg/L)	Magnesium (Mg/L)	Calculated Hardness (Mg/L)
				Free Ammonia (Mg/L)	Total Kjeldahl (Mg/L)	Nitrite (Mg/L)	Nitrate (Mg/L)	Total Mg/L	Reactive (Mg/L)							
Jun-01-94	152	2.094	16.5	0.007	1.17	0.03	0.9	0.084	0.004	8.83	613	1.4	12.9	65.4	30.2	288
Jun-10-94	161	2.077	125	0.031	3	0.01	0.1	0.2	0.002	7.66	1340	2.2	70.2	109	52	488
Jun-20-94	171	2.097	21.4	0.063	1.29	0.1	1.7	0.099	0.023	8.49	673	1.6	10.8	61.7	26.3	263
Jul-06-94	187	2.09	6.5	0.035	1.05	0.01	0.1	0.04	0.007	8.44	778	1.6	31.1	85.5	32.7	348
Aug-15-94	227	2.109	29.6	0.129	0.66	0.02	1.8	0.142	0.024	8.11	901	3.7	54.1	93.3	20.3	317
Nov-02-94	306	2.063	13.8	0.058	1.3	0.1	1.5	0.146	0.055	8.23	1360	8.2	103	125	33.1	451
Nov-19-94	323	2.068							0.04							
Dec-14-94	348	2.127	10.3	0.19	0.98	0.03	8.8	0.079	0.008	8.29	758	2.27	19.6	90.9	25.6	333
Feb-21-95	52	2.143	18.2	0.23	1.12	0.02	1.5	0.17	0.01	7.61	412	2.46	14.2	45	11.3	159
Mar-29-95	88	2.116	5.8	0.05	1.38	0.02	2.3	0.2	0.01	8.98	732	2.48	34.5	61.1	27.6	266
May-3-95	123	2.113	5	0.05	0.65	0.06	4.6	0.04	0.01			1.66	18.5	65.6	30.8	291
May-29-95	149	2.156	19.5	0.11	1.46	0.43	12.8	0.26	0.09	7.86	645	4.34	13.8	86.7	24.8	319
Average			24.69	0.08	1.17	0.08	3.28	0.13	0.02	7.50	746.55	2.90	34.79	80.84	28.61	320.27
Sum			271.60	0.95	14.06	0.83	36.10	1.46	0.28	82.50	8212.00	31.91	382.70	889.20	314.70	3523.00
Count			11.00	11.00	11.00	11.00	11.00	11.00	12.00	10.00	10.00	11.00	11.00	11.00	11.00	11.00

Paired Watershed Study
Essex Region Water Sampling Data
Station: Second Concession, (East)
Routine Grab Samples

Date of Sample	Julian Date	Staff Gauge	Nitrogen				Phosphorus		pH	Conductivity (Mg/L)	Potassium (Mg/L)	Sodium (Mg/L)	Calcium (Mg/L)	Magnesium (Mg/L)	Calculated Hardness (Mg/L)	
			Suspended Solids (Mg/L)	Free Ammonia (Mg/L)	Total Kjeldahl (Mg/L)	Nitrite (Mg/L)	Nitrate (Mg/L)	Total (Mg/L)								Dissolved Reactive (Mg/L)
Jun-01-94	152		0.7	0.023	0.83	0.01	0.1	0.016	0.004	8.07	792	1.4	22.8	97.8	39.1	406
Jun-10-94	161		19	0.007	1.26	0.01	0.2	0.05	0.002	8.04	792	2.1	30.9	74.1	42.5	360
Jun-20-94	171		10.5	0.092	0.95	0.02	0.4	0.065	0.019	8.56	779	0.9	11.5	75.4	28.5	306
Jul-6-94	187															
Aug-15-94	227		9	0.23	0.66	0.01	0.2	0.124	0.004	7.79	887	3.3	43	97.6	19.6	325
Nov-02-94	306		57.8	0.045	1.25	0.04	0.5	0.24		7.72	1630	10.8	112	159	37.1	551
Nov-19-94	323								0.001							
Dec-19-94	353		20.1	0.08	0.8	0.03	18	0.088	0.023	7.91	922	2.52	27.5	108	28.2	388
Feb-21-95	52		7.4	0.21	1.08	0.02	1.2	0.18	0.04	7.8	416	3.31	11.7	45.5	11.9	163
Mar-29-95	88		2.5	0.05	1.34	0.02	2	0.15	0.01	8.95	744	3.25	25.6	75.1	30.3	313
May-3-95	123		5	0.05	0.64	0.03	3.6	0.05	0.01			2.42	14.9	91.1	30.4	353
May-29-94	149		24.2	0.25	2.75	2.3	19	2.75	0.02	7.66	694	3.61	12.4	83.5	20.4	293
Average			14.20	0.09	0.96	0.23	4.11	0.37	0.01	7.25	765.60	3.36	31.23	90.71	28.80	345.80
Sum			156.20	1.04	11.56	2.49	45.20	3.71	0.13	72.50	7656.00	33.61	312.30	907.10	288.00	3458.00
Count			10.00	10.00	10.00	10.00	10.00	10.00	10.00	9.00	9.00	10.00	10.00	10.00	10.00	10.00

**Paired Watershed Study
Essex Region Water Sampling Data
Station: Fifth Concession, (West)
ISCO Samples**

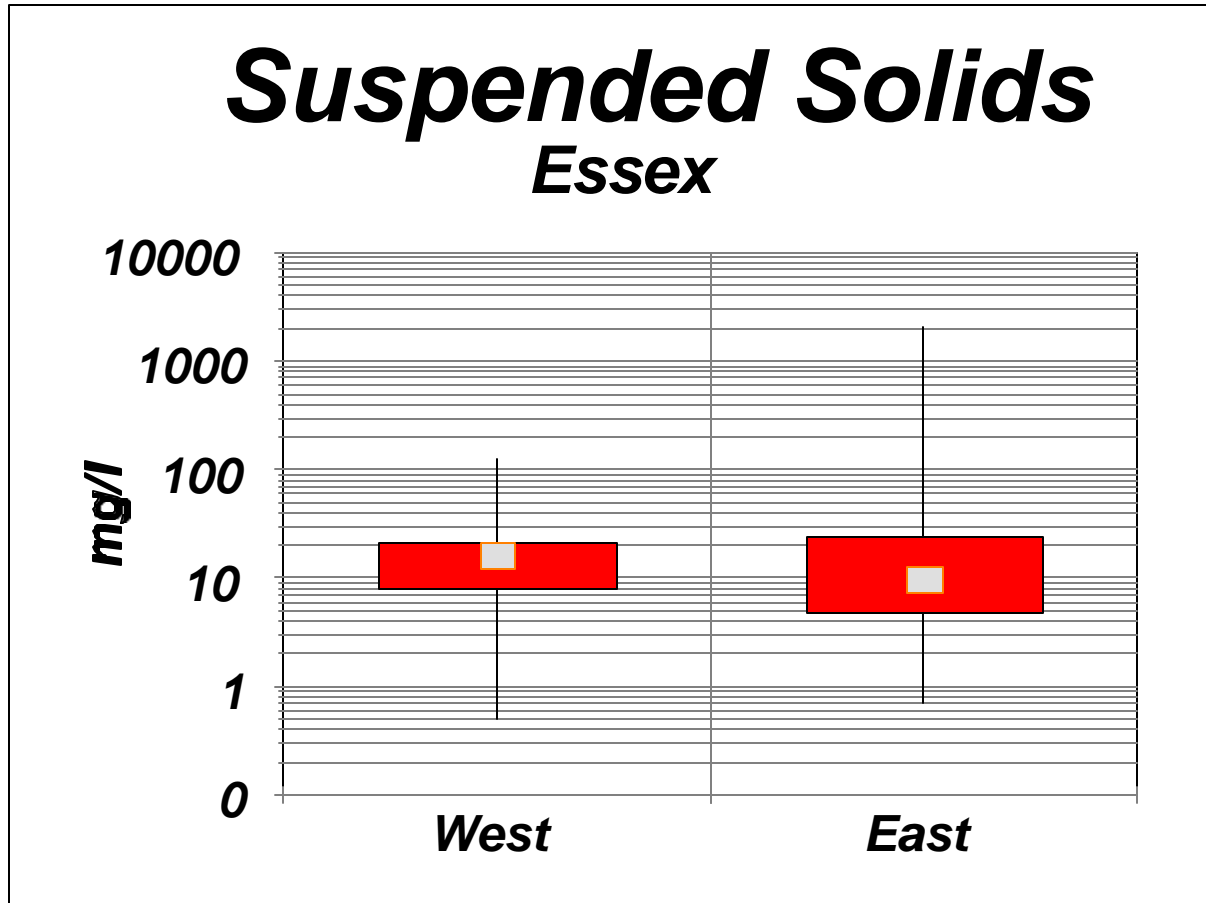
Date of Sample	Julian Date	Time	Staff Gauge (metres)	Suspended Solids (Mg/L)	Nitrogen				Pohosphorus		pH	Conductivity (uhmo/ml)	Chloride (Mg/L)	Potassium (Mg/L)	Sodium (Mg/L)	Calcium (Mg/L)	Magnesium (Mg/L)	Calculated Hardness (Mg/L)
					Free Ammonia (Mg/L)	Total Kjeldahl (Mg/L)	Nitrite (Mg/L)	Nitrate (Mg/L)	Total (Mg/L)	Dissolved Reactive (Mg/L)								
Jun-13-94	164	17:30	2.064	717	0.1	3.78	0.06	1.1	0.8	0.01	7.63	1370	276	4.2	159	72.6	24.6	283
Jun-13-94	164	19:30	2.1	284	0.27	4.22	0.14	2.3	0.68	0.05	6.6	885	126	6.6	66.8	75.6	24.5	290
Jun-13-94	164	21:30	2.209	1724	0.76	10	0.13	8	2.08	0.01	7.54	338	17.9	2.7	6.6	34.8	7.2	117
Jun-13-94	164	23:30	2.643	2285	0.69	0.7	0.14	12.8	2.48	1	7.39	409	17.9	3.1	6.1	50.2	9.8	166
Jun-14-94	165	01:30	2.574	1191	0.8	8.14	0.15	13.3	1.56	0.01	7.3	384	12.2	3.9	4.5	50.5	10.5	170
Jun-14-94	165	05:30	2.358	417	0.74	5.47	0.21	16.8	0.73	0.01	7.23	489	18.9	3.4	5.7	55.2	13	192
Jun-14-94	165	15:30	2.198	44.5	0.53	2.72	0.34	22.1	0.16	0.01	7.75	667	29.8	2.5	9.5	74.2	18.6	262
Jan-14-95	14	11:00	2.191	16.4	0.1	1.99	0.03	9.5	0.13	0.01	7.7	504	29.9	2.16	9.8	62	16.7	224
Jan-14-95	14	19:00	2.279	8.2	0.1	1.98	0.03	9.9	0.18	0.01	7.61	504	29.4	1.95	9.3	59.2	15.7	213
Jan-15-95	15	01:00	2.689	191	0.07	3.52	0.03	8.6	0.63	0.01	7.46	352	18.3	2.81	4.9	42.1	9.6	145
Jan-15-95	15	03:00	2.673	111	0.1	3.43	0.03	7.9	0.57	0.01	7.41	345	19.2	3.23	5.2	40.2	9.4	139
Jan-15-95	15	07:00	2.712	72.9	0.16	3.25	0.04	6.9	0.55	0.01	7.36	332	18.9	3.16	5	36.4	8.6	126
Jan-15-95	15	11:00	2.658	39.2	0.1	2.91	0.04	6.9	0.51	0.01	7.41	332	19.5	3.14	5.3	36.4	8.8	127
Jan-15-95	15	17:00	2.452	28.5	0.08	2.76	0.04	7.8	0.39	0.01	7.44	379	22.3	2.98	6.3	41.4	11.1	149
Jan-16-95	16	01:00	2.221	21.6	0.09	2.45	0.06	8.6	0.32	0.01	7.53	439	26	2.87	7.2	51.8	13.4	185
Jan-20-95	20	06:00	2.468	169	0.26	2.8	0.03	7.7	0.57	0.01	7.44	396	20.9	2.73	6.1	44.6	12.2	162
Jan-20-95	20	15:00	2.776	211	0.11	2.89	0.02	4.8	0.64	0.01	7.26	271	14.9	3.09	5	30.1	7.6	107
Jan-20-95	20	18:00	2.869	211	0.07	2.94	0.02	3.9	0.7	0.01	7.3	235	13.4	3.08	4.5	26.4	6.4	92
Jan-20-95	20	21:00	2.885	168	0.21	2.67	0.02	3.4	0.65	0.01	7.27	216	11.8	1.28	11.5	69.6	24.9	277
Jan-21-95	21	00:00	2.862	124	0.31	2.48	0.02	3.2	0.57	0.01	7.25	207	11	2.9	3.8	22.9	5.7	81
Jan-21-95	21	03:00	2.764	89.9	0.38	2.34	0.02	3.4	0.5	0.01	7.35	216	10.6	2.82	3.7	24.3	5.8	85
Jan-21-95	21	09:00	2.634	60	0.37	2.25	0.02	4.5	0.49	0.01	7.46	267	14	2.75	4.8	31.1	7.8	110
Jan-21-95	21	21:00	2.375	45	0.16	2	0.03	4.8	0.36	0.07	7.52	324	17.3	2.56	6	37.2	9.9	134
Mar-11-95	70	10:00	2.178	32.8	0.15	1.57	0.02	4.7	0.15	0.09	7.86	527	43.7	2.1	14.3	58.5	16.5	214
Mar-11-95	70	13:00	2.18	88.2	0.14	1.91	0.02	3.9	0.32	0.07	7.77	503	50.4	2.59	17.2	52	14.2	189
Mar-11-95	70	16:00	2.323	162	0.12	2.31	0.02	3.5	0.48	0.06	7.6	323	23.3	2.1	5.8	32.4	8.2	115
Mar-11-95	70	19:00	2.432	147	0.11	2.43	0.02	4.2	0.48	0.06	7.49	261	18.8	2.28	3.8	28.3	6.9	99
Mar-11-95	70	22:00	2.406	77.8	0.09	2.4	0.03	5	0.4	0.06	7.46	269	18.8	2.52	3.9	30.2	7.6	107
Mar-12-95	71	04:00	2.173	45.4	0.11	2.27	0.02	5.9	0.34	0.05	7.53	324	21.1	2.04	4.7	36.2	9.2	128
Apr-09-95	99	03:00	2.134	6	0.05	1.09	0.02	6.6	0.07	0.1	7.91	786	70.2	1.79	21.6	92.3	27.9	346
Apr-09-95	99	12:00	2.142	5	0.05	1.03	0.02	6.4	0.08	0.1	7.98	791	67.5	1.61	20.4	92.1	27.2	342
Apr-09-95	99	17:00	2.838	66.2	0.05	1.98	0.01	8.7	0.3	0.1	7.7	519	45.2	1.77	13.1	58.5	15.3	209
Apr-10-95	100	03:00	2.257	14.5	0.08	1.73	0.01	9.2	0.2	0.1	7.76	542	45.2	1.76	13.8	62.3	16.4	223
Apr-10-95	100	12:00	2.19	8.1	0.05	1.22	0.01	9.5	0.15	0.1	7.95	640	47.6	1.67	16.2	79.1	21.5	286
Apr-10-95	100	15:00	2.184	9.6	0.05	1.23	0.01	8.6	0.14	0.1	8.14	652	49.5	1.63	15.8	74.1	21.3	273

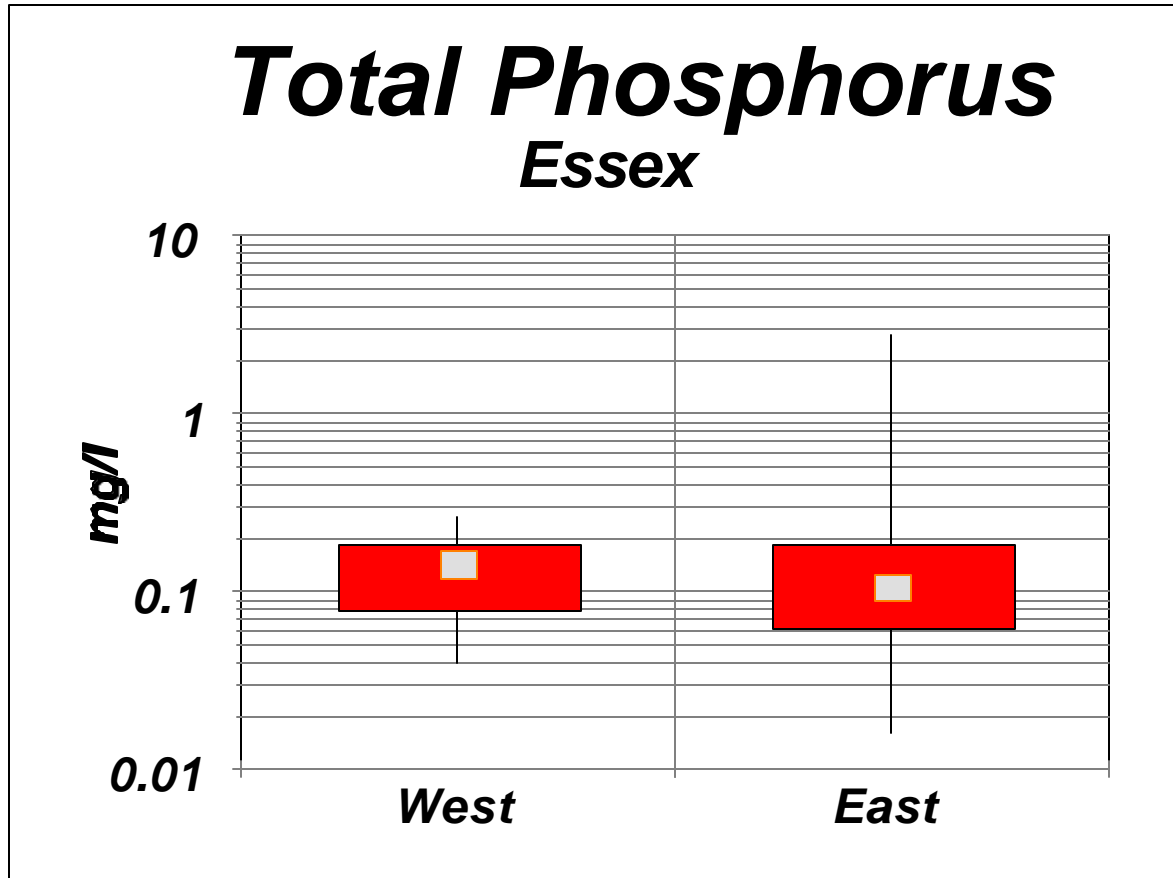
Apr-10-95	100	18:00	2.281	10.2	0.05	1.52	0.01	9.5	0.21	0.01	7.78	506	29.2	1.47	8.7	58.1	16.2	212
Apr-11-95	101	15:00	2.205	23.1	0.13	1.63	0.03	2.1	0.1	0.01	8.08	564	28.1	1.87	11	73.2	20.7	268
Apr-11-95	101	21:00	2.218	95.2	0.11	1.73	0.03	7.9	0.28	0.01	7.66	580	32.3	1.96	12.3	63.1	17.8	231
Apr-12-95	102	03:00	2.291	37.5	0.07	1.99	0.03	9.2	0.31	0.01	7.6	483	22.6	2.02	8.4	55.9	14.7	200
Apr-12-95	102	07:00	2.357	90	0.07	2.22	0.03	10.4	0.46	0.01	7.46	442	22.1	2.64	8.4	56.1	14.5	200
Apr-12-95	102	11:00	2.483	118	0.06	2.1	0.03	9.2	0.43	0.01	7.51	384	16	2.34	6.2	43	11.1	153
Apr-12-95	102	15:00	2.358	44.9	0.08	2.09	0.03	9.5	0.32	0.01	7.54	422	21.1	2.55	8.1	53.2	13.4	188
Apr-12-95	102	19:00	2.281	2308	0.08	1.81	0.02	8.4	0.23	0.01	7.62	479	22.5	2.1	8.8	56.5	14.6	201
Apr-13-95	103	07:00	2.204	13.1	0.02	1.68	0.02	9	0.16	0.01	7.76	562	28.5	1.92	10.6	67	18.3	243
Apr-18-95	108	12:00	2.144	92.7	0.19	2.46	0.03	4.9	0.25	0.01	7.91	797	773	2.8	29.2	77.2	24.8	295
Apr-18-95	108	16:00	2.219	124	0.06	1.96	0.02	5.6	0.31	0.01	7.9	611	37.2	1.71	13.7	65	20.4	247
Apr-18-95	108	18:00	2.218	102	0.05	1.84	0.02	5.7	0.28	0.01	7.84	583	33.9	1.68	12.5	62.6	18.3	232
Apr-18-95	108	22:00	2.275	410	0.18	3.35	0.03	6	0.81	0.06	7.67	525	31	2.13	11.6	57.6	15.7	209
Apr-19-95	109	04:00	2.233	115	0.11	2.4	0.04	7.1	0.4	0.03	7.77	519	27.2	2.15	9.9	59.5	16.3	216
Apr-19-95	109	10:00	2.191	33.2	0.07	1.81	0.03	7.3	0.24	0.02	7.93	576	30.4	1.93	11.5	67	18.4	243
Apr-21-95	111	02:00	2.141	10.2	0.06	0.94	0.03	7.4	0.06	0.01	8.16	722	37.6	1.37	14.7	85.9	27.3	327
Apr-21-95	111	08:00	2.345	867	0.11	5.23	0.03	4.3	1.33	0.01	7.61	444	26.1	2.41	11.2	45.6	12.4	165
Apr-21-95	111	11:00	3.035	867	0.06	4.96	0.02	3.4	1.32	0.02	7.63	236	9.5	2.12	4.1	25	5.4	85
Apr-21-95	111	14:00	2.926	447	0.06	4.01	0.03	3.8	0.98	0.02	7.54	200	6.9	2.52	3	23.1	4.8	78
Apr-21-95	111	17:00	2.667	253	0.05	3.86	0.02	4.4	0.82	0.01	7.5	238	8.9	2.57	3.7	26.2	5.7	89
Apr-21-95	111	23:00	2.389	125	0.07	2.79	0.03	4.7	0.58	0.01	7.58	305	11.3	2.55	4.6	32.1	7.8	112

Paired Watershed Study
Essex Region Water Sampling Data
Station: Second Concession, (East)
ISCO Samples

Date of Sample	Julian Date	Time	Staff Gauge (meters)	Suspended Solids (Mg/L)	Nitrogen				Phosphorus		pH	Conductivity (uhmo/ml)	Chloride (Mg/L)	Potassium (Mg/L)	Sodium (Mg/L)	Calcium (Mg/L)	Magnesium (Mg/L)	Calculated Hardness (Mg/L)
					Free Ammonia (Mg/L)	Total Kjeldahl (Mg/L)	Nitrite (Mg/L)	Nitrate (Mg/L)	Total Dissolved (Mg/L)	Reactive (Mg/L)								
Jun-13-94	164	17:30		192	0.12	2.52	0.01	0.1	0.34	0.1	7.74	657	78.1	5.1	31.5	59.6	27.8	264
Jun-13-94	164	19:30		56.6	0.06	1.52	0.02	0.1	0.17	0.01	8.04	759	116	5.7	40.9	69.7	27.5	288
Jun-13-94	164	21:30		2417	0.7	9.96	0.14	5.2	3.2	0.15	7.23	342	37.9	3.3	8.8	33.2	7.9	116
Jun-13-94	164	23:30		1293	1.58	9.16	0.29	8.7	1.96	0.01	7.16	402	29.8	3.7	7.5	40.5	9.2	139
Jun-14-94	165	01:30		1210	1.83	8.36	0.31	10.2	1.74	0.01	6.95	365	27	3.4	5	37	8.3	127
Jun-14-94	165	05:30		529	2.23	6.5	0.43	15.6	0.94	0.01	7.06	457	33.1	3.4	6.1	46.3	10.4	159
Jun-14-94	165	15:30		127	1.72	4.58	0.46	21.6	0.35	0.01	7.41	611	36.1	4.7	8.6	73.5	18.4	260
Jan-14-95	14	11:00		14.1	0.05	1.38	0.03	8.6	0.14	0.01	7.62	513	35.7	2.56	9.2	57.2	15.3	206
Jan-14-95	14	19:00		107	0.1	2.64	0.03	9.6	0.47	0.01	7.48	500	43.9	3.11	10.4	60.9	16	218
Jan-15-95	15	01:00		194	0.08	3.5	0.03	9	0.82	0.01	7.28	363	29.3	3.59	5.9	39.8	9.2	137
Jan-15-95	15	03:00		131	0.08	3.47	0.03	8.7	0.74	0.02	7.18	342	25.99	3.32	4.8	36.9	8.6	128
Jan-15-95	15	07:00		69.6	0.07	3.1	0.03	8.5	0.62	0.01	7.13	350	31.5	3.83	7	38.3	8.8	132
Jan-15-95	15	11:00		58.4	0.06	3.05	0.05	8.3	0.54	0.01	7.19	364	32.5	3.89	7.7	37.1	8.7	129
Jan-15-95	15	17:00		41	0.007	3.01	0.03	9.4	0.5	0.01	7.17	388	38.9	2.75	9.1	52.7	14.2	193
Jan-16-95	16	01:00		23.3	0.09	2.67	0.09	9.1	0.42	0.01	7.23	404	28.5	3.39	5.5	45.2	11.1	159
Mar-11-95	70	10:00	1.892	35	0.11	1.73	0.02	5.4	0.19	0.05	7.79	474	31.9	2.64	8.1	54.9	15.9	203
Mar-11-95	70	13:00		39.5	0.11	1.54	0.02	5.2	0.2	0.04	7.74	459	31.1	2.41	7.4	54.4	15.5	200
Mar-11-95	70	16:00		94.6	0.11	2.09	0.02	5.3	0.38	0.04	7.58	337	25.2	2.19	5.1	38.6	10.5	140
Mar-11-95	70	19:00		77.5	0.11	2.13	0.02	5.5	0.4	0.05	7.46	281	22.3	2.23	3.9	31.8	8	112
Mar-11-95	70	22:00	1.95	60.8	0.12	2.09	0.02	5.9	0.38	0.04	7.38	269	20.7	2.59	4.1	32.3	8.2	115
Mar-12-95	71	04:00		36.6	0.1	2.04	0.02	6	0.37	0.04	7.4	291	22.5	2.39	3.7	31.9	8.1	113
Apr-07-95	97	00:00		5	0.06	0.76	0.01	0.6	0.09	0.01	7.99	872	90.9	2.96	26.6	90.8	32.4	360
Apr-08-95	98	21:00		5	0.09	0.95	0.03	2	0.07	0.01	8.01	895	95.4	2.7	28.2	97	29.5	364
Apr-09-95	99	18:00		6.2	0.1	1.22	0.03	4.5	0.13	0.01	7.95	704	73.8	2.13	20.9	76.8	21.4	280
Apr-09-95	99	21:00		24.1	0.15	1.91	0.03	6.4	0.21	0.01	7.74	606	56.6	2.09	15.8	68.7	18.9	250
Apr-10-95	100	00:00		14.5	0.22	2.03	0.04	8.1	0.21	0.01	7.72	585	54.3	2.1	14.4	65	18	237
Apr-10-95	100	18:00		12.3	0.15	1.81	0.04	7.9	0.71	0.01	7.77	555	40.2	2.09	10.6	65.8	18.3	240
Apr-11-95	101	15:00	1.94	15	0.09	1.56	0.03	7.6	0.1	0.01	7.97	571	32.3	2.44	10.2	68.2	18.6	247
Apr-11-95	101	23:00		44.1	0.11	1.88	0.03	7.4	0.3	0.01	7.59	533	32.5	2.28	10.3	64.4	17.2	232
Apr-12-95	102	07:00		39.2	0.21	2.24	0.03	9.6	0.34	0.01	7.46	463	24.3	2.73	7.6	55.5	14.3	198
Apr-12-95	102	11:00		38.4	0.29	2.81	0.04	9.6	0.36	0.01	7.41	414	20.5	2.83	6.1	46.5	11.6	164
Apr-12-95	102	15:00		30.3	0.33	2.44	0.04	9.5	0.33	0.01	7.4	415	21.4	2.97	5.9	47.9	12.3	170
Apr-12-95	102	19:00		23.2	0.33	2.59	0.05	9	0.28	0.01	7.46	449	26.4	3.03	7.7	53.3	13.3	188
Apr-13-95	103	07:00		12.2	0.27	1.91	0.03	8.2	0.16	0.01	7.53	526	30.3	2.75	9.1	63.1	16.8	227

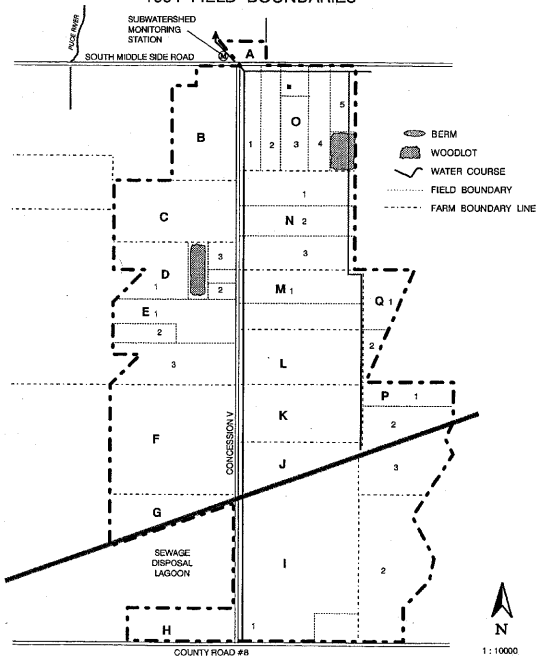
Apr-18-95	108	12:00		44.5	0.14	1.47	0.08	4.6	0.1	0.05	7.93	769	65.5	2.31	18.6	89	26.8	333
Apr-18-95	108	16:00		45.1	0.08	1.7	0.02	4.9	0.24	0.05	7.91	654	45.1	2.01	14.5	73.3	21.5	272
Apr-18-95	108	18:00		60	0.07	1.44	0.04	5.4	0.17	0.02	7.91	620	39.2	2.22	11.8	70.3	20	258
Apr-18-95	108	22:00		56.6	0.08	1.65	0.04	6	0.2	0.01	7.82	632	45.9	2.37	13.5	71.7	20.8	265
Apr-19-95	109	04:00		37.5	0.06	1.68	0.04	6.6	0.19	0.01	7.82	584	34.4	2.37	10.7	67.3	18.8	246
Apr-19-95	109	10:00		18.3	0.07	1.6	0.03	6.3	0.16	0.01	7.92	592	34.1	2.3	10.3	68.4	19.4	251
Apr-21-95	111	02:00	2.338	5.6	0.05	0.99	0.02	5.8	0.005	0.01	8.11	731	39.4	2.13	12	87.5	25.8	325
Apr-21-95	111	08:00		650	0.07	4.01	0.02	5.3	1.09	0.01	7.74	533	31	1.99	10.3	61.2	17	223
Apr-21-95	111	11:00		956	0.11	6.04	0.04	4.6	1.52	0.01	7.61	327	17.7	2.46	6.5	36.2	8.8	127
Apr-21-95	111	14:00		418	0.13	4.7	0.04	5.5	1.13	0.01	7.35	221	10.8	2.78	3.7	26.2	6.2	91
Apr-21-95	111	17:00		255	0.13	3.77	0.05	5.4	0.93	0.01	7.32	238	11.4	2.78	4.4	24.6	5.8	85
Apr-21-95	111	23:00		167	0.1	3.26	0.06	6.5	0.76	0.01	7.37	279	11.9	3.21	3.8	31.6	7.5	110





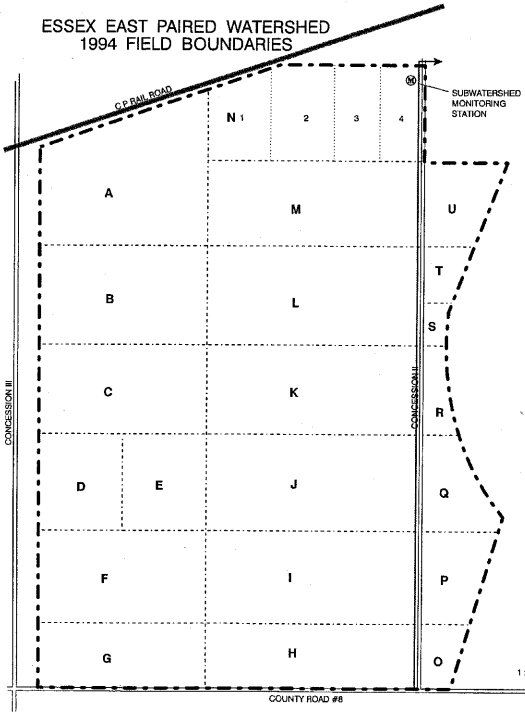
ESSEX PAIRED WATERSHEDS

ESSEX WEST PAIRED WATERSHED 1994 FIELD BOUNDARIES



ESSEX PAIRED WATERSHEDS

ESSEX EAST PAIRED WATERSHED 1994 FIELD BOUNDARIES



Essex -

**1994 Field Activities
Western Sub-basin (5th. Conc. Drain)**

Landowner	Field #	Acres	1993/1994 Tillage	1994 Crop
Farm A	1	4	No-Till	Corn
Farm B	1	49	No-Till	Soybeans
Farm C	1	40	Fall-Chisel Plow Spring- Triple K 2X	Soybeans
Farm D	1	10	Spring - Disc 2X - Cultivate 2X Fall- Cultivate 2X	Spring -Fallow Fall-Winter Wheat
	2	16.5	Fall-Disc 2 X	Winter Wheat
	3	17	Spring- Disc 2 X Fall- Chisel Plow	Soybeans
Farm E	1	24	Spring-Cultivate 2X	Soybeans
	2-3	47	No-Till	Winter Wheat
Farm F	1+3	84	Spring-Disc 2X	Soybeans
	2	15	No-Till	Winter Wheat
Farm G	1	18	Spring-Cultivator 2X	Soybeans
Farm H	1	23	Spring- Triple K 2X Fall- Mouldboard Plow	Corn
Farm I	1	60	No-Till	Corn
	2	50	No-Till	Soybeans
	3	103	Spring-No-till Fall-Chisel Plow	Soybeans
Farm J	1	29	Spring-S-Tine Cultivate 2X Fall-Mouldboard Plow	Soybeans
Farm K	1	42	Spring-Cultivate 1X Fall- Mouldboard Plow	Corn
Farm L	1	47	No-Till	Soybeans
Farm M	1	48	Spring-S-Tine 1X Fall- Mouldboard Plow	Corn
Farm N	1	25	No-Till	Soybeans
	2	16	Spring-S-Tine 2X	Oats
	3	32	Spring-S-Tine	Corn
Farm O	1	10	No-Till	Soybeans
	2	16	No-Till	Soybeans
	3	15	No-Till	Winter Wheat
	4	20	No-Till	Corn
	5	9	No-Till	Soybeans
Farm P	1	10	No-Till	Winter Wheat
	2	20	No-Till	Soybeans
Farm Q	1	8	No-Till	Soybeans
	2	4	Spring -Plow -3K- 2X	Soybeans

ESSEX

1994 Field Activities
Eastern Sub-basin (2nd. Conc. Drain)

Landowner	Field #	Acres	1993/1994 Tillage	1994 Crop
Farm A	1	68	Fall-3K-2X	Winter Wheat
Farm B	1	50	Spring- 3K-2X Fall-Mouldboard Plow	Soybeans
Farm C	1	50	Fall-3K-2X	Winter Wheat
Farm D	1	23	Spring- 3K-2X	Soybeans
Farm E	1	40	Spring- 3K-2X	Soybeans
Farm F	1	50	Spring- 3K-2X	Soybeans
Farm G	1	28	No-Till	Winter Wheat
Farm H	1	30	Spring-3K-2X	Corn
Farm I	1	49	Spring- Disc 1X Fall- Plow	Corn
Farm J	1	40	No-Till	Soybeans
Farm K	1	46	Spring- 3K-2X Fall- 3K, Levelled	Soybeans
Farm L	1	35	Spring- 3K-2X Fall- Mouldboard Plow	Soybeans
Farm M	1	47.5	Spring- 3K-2X Fall- Mouldboard Plow	Corn
Farm N	1 2 3 4	12 12 10 11	Spring Disc 2X " " "	Soybeans " " "
Farm O	1	12	No-Till	Soybeans
Farm P	1	10	Spring-3K-2X	Soybeans
Farm Q	1	7	Spring- 3K-2X Fall- Mouldboard Plow	Soybeans
Farm R	1	5	Spring- Cultivate 2X Fall- Soil Saver	Soybeans
Farm S	1	10	No-Till	Winter Wheat
Farm T	1	12	No-Till	Soybeans
Farm U	1	15	Spring 3K-2X Fall-Mouldboard	Soybeans

Kintore Climate Data: Datalogger Summary

Comparison of 1989 to 1994 Monthly Total Precipitation with the Normal from Atmospheric Environment Services London Airport Station																				
	Green Plan Manure Study Data								AES Data											
Month	Total Rainfall		Avg. Temp. (°C)		Avg. Max. Temp.		Avg. Min. Temp.		Total Rainfall (mm)			Avg. Temp. (°C)			Avg. Max Temp. (°C)			Avg. Min. Temp. (°C)		
	1994	1995	1994	1995	1994	1995	1994	1995	1994	1995	Normal	1994	1995	Normal	1994	1995	Normal	1994	1995	Normal
Jan		86.20		-3.45		-0.38		-6.91		70.5	25.3		-3.3	-6.7		-0.1	-2.8		-6.4	-10.7
Feb		24.90		-9.39		-5.22		-		9.0	26.7		-7.6	-6.2		-3.1	-2.0		-12.0	-10.5
Mar		54.10		1.17		6.55		-3.57		54.0	52.8		1.3	-0.5		6.7	3.8		-4.2	-5.0
Apr		98.20		3.40		8.46		-1.04		96.4	69.5		4.5	6.2		9.4	11.7		-0.4	0.7
May		85.00		12.79		18.28		7.25		104.4	73.6		13.0	12.6		18.5	18.7		7.5	6.4
Jun	105.56		18.62		24.52		12.69		120.8		81.9	24.4		17.7	24.4		23.8	12.8		11.6
Jul	na		na		na		na		90.6		76.7	25.7		20.3	25.7		26.4	15.5		14.2
Aug	na		na		na		na		70.2		89.6	23.4		19.3	23.4		25.2	12.8		13.3
Sep	27.84		15.03		21.44		9.15		37.8		86.2	21.3		15.3	21.3		20.9	9.7		9.6
Oct	17.17		9.59		15.50		4.73		48.6		73.8	15.2		9.1	15.2		14.2	4.9		3.9
Nov	87.17		4.92		8.97		0.99		62.6		72.8	7.1		3.3	7.1		7.1	-0.6		-0.6
Dec	44.90		-0.48		2.84		-3.40		30.3		49.9	3.3		-3.4	3.3		0.1	-3.7		-7.1
Annual Total									873.6		955.1			6.9			12.2			2.1

Paired Watershed Study
Kintore Creek Water Sampling Data
Station 1, (West)
Routine Grab Samples

Date of Sample	Julian Date	Time	Staff Gauge	Temp (C)	Suspended Solids	Nitrogen			Phosphorus		pH	Conductivity	Chloride	Potassium	Sodium	
						Free Ammonia	Total Kjeldahl	Nitrite	Nitrate	Total						Dissolved Reactive
Jun-13-94	164	11:45	0.225		18	0.078	0.5	0.02	5.1	0.019	0.003	8.35	626	19.2	1.4	5.4
Jun-21-94	172				15.4	0.027	0.57	0.04	5.1	0.027	0.001	8.34	608	19.8	1.5	5.4
Jun-29-94	180	14:50	0.832	20	750	0.41	5.65	0.18	11	1.5	0.53	7.16	619	23.2	5.1	9
Jul-14-94	195	15:05	0.2	22	7.5	0.009	0.36	0.01	5.1	0.015	0.001					
Jul-22-94	203	12:30	0.262		21.1	0.59	3.36	0.12	3.8	0.262	0.01	7.62	677	29.1	6.8	12.5
Aug-10-94	222	03:15	0.2		18.2	0.005	0.39	0.01	4.4	0.011	0.015					
Aug-19-94	231		0.2	16	2.4	0.005	0.38	0.03	4.1	0.016	0.001	8.22	633	18.4	1.4	7
Aug-29-94	241				3.2	0.008	0.37	0.02	4.5	0.027	0.001					
Sep-08-94	249	07:51	0.19	11	2.4	0.005	0.39	0.02	4.8	0.017	0.001					
Sep-26-94	269	08:05	0.19	14	4.1	0.005	0.46	0.01	3.9	0.032	0.004	8.15	602	13.3	2.5	4.9
Oct-07-94	280	11:00	0.195		27.9	0.005	0.35	0.01	5	0.02	0.002					
Oct-17-94	290	14:20	0.195	12	28.6	0.005	0.42	0.01	3.7	0.021	0.001					
Oct-31-94	304	14:35	0.205	9	6.8	0.005	0.46	0.02	4	0.022	0.001	8.27	609	16.9	2.17	6.5
Nov-09-94	313	15:55	0.268	9.5	9.7	0.023	0.65	0.03	5.1	0.041	0.009					
Nov-15-94	319	08:10	0.218	8	17.9	0.05	0.45	0.02	4.1	0.023	0.001	8.28	641	24.2	1.51	8.2
Nov-28-94	332	14:00	0.275	4	16.1	0.02	0.85	0.02	5.6	0.073	0.01	8.1	693	39.4	4.15	15.1
13-Jan-95	13	15:00			47.6	0.1	1.06	0.04	8	0.147	0.051	7.8	568	32	3.35	12.6
16-Jan-95	16	11:55		4	30.8	0.178	1.22	0.03	14.9	0.225	0.079	7.78	562	28.5	3.64	7.8
07-Mar-95	66	10:00	0.51		283	0.38	3.33	0.23	9.5	0.54	0.01	7.67	500	31.1	2.86	12.5
07-Mar-95	66	14:40	0.78		308	0.36	3.24	0.15	9.3	0.6	0.01	7.6	415	24.7	3.15	10.5
08-Mar-95	67	13:15	0.655		48	0.42	1.57	0.03	9.3	0.22	0.1	7.71	474	25.1	3.13	8.6
12-Mar-95	71	13:20	0.6	3	125	0.18	1.71	0.04	9.8	0.36	0.07	7.72	476	24	2.54	8.4
13-Mar-95	72	11:55			68.9	0.05	1.31	0.03	10.2	0.22	0.05	7.63	493	22.2	2.73	7.4
26-May-95	146	15:10	0.25		3	0.04	0.64	0.03	5	0.05	0.01	8.36	599	20.1	1.1	6.3

Paired Watershed Study
Kintore Creek Water Sampling Data
Station 2, (West)
Routine Grab Samples

Date of Sample	Julian Date	Time	Staff Gauge	Temp (C)	Suspended Solids	Nitrogen			Phosphorus		pH	Conductivity	Chloride	Potassium	Sodium	
						Free Ammonia	Total Kjeldahl	Nitrite	Nitrate	Total						Dissolved Reactive
Jun-13-94	164	14:15	0.122		10.2	0.032	0.46	0.01	1.4	0.026	0.003	8.41	586	19.4	1.4	5.5
Jun-21-94	172	13:30		22	17.2	0.008	0.37	0.02	3.2	0.017	0.001	8.4	570	19.1	1.4	6.2
Jun-29-94	180	15:35	0.466	18.5	395	0.28	2.62	0.13	9	0.82	0.28	7.67	7.67	20.6	5.3	5.2
Jul-14-94	195	15:55	0.1	19	2.6	0.005	0.37	0.01	3.3	0.021	0.007					
Jul-22-94	203	13:30	0.14		21.7	0.1	3.46	0.01	5.5	0.282	0.19	7.61	629	21.7	7.3	8.6
Aug-10-94	222	14:20			2.9	0.005	0.36	0.01	2.9	0.014						
Aug-19-94	231			16.5	2.7	0.005	0.4	0.03	2.8	0.02	0.004	8.28	585	16.4	1.2	6.5
Aug-29-94	241				2.6	0.007	0.31	0.01	2.3	0.014	0.005					
Sep-08-94	251	08:50	0.118	11.5	2.8	0.005	0.37	0.04	0.1	0.018	0.001					
Sep-26-94	269	08:55	0.12	13	1.9	0.005	0.38	0.01	1.8	0.021	0.001	8.27	571	15.5	1.9	6.5
Oct-07-94	280	13:15			15.8	0.009	1.04	0.01	2.1	0.015	0.002					
Oct-17-94	290	15:20	0.125	11	33.3	0.005	0.35	0.01	2	0.01	0.001					
Oct-31-94	304	16:15	0.245	9	53.4	0.005	0.38	0.01	1.7	0.018	0.001	8.29	576	15.8	1.81	5.3
Nov-09-94	313	13:40	0.182	9.5	9.2	0.032	0.89	0.01	4.7	0.069	0.018					
Nov-15-94	319	09:05	0.13	8	2.3	0.07	0.38	0.01	2.9	0.015	0.001	8.22	599	18.3	1.24	5.6
Nov-28-94	332	15:20	0.18	4.5	13.8	0.05	1.14	0.02	4.7	0.101	0.049	8.09	645	25.2	4.18	8.4
13-Jan-95	13	14:40			66	0.19	0.83	0.04	9.3	0.29	0.073	7.75	553	21.5	4.29	6.9
16-Jan-95	16	11:35		4	48.1	0.005	1.52	0.03	14.9	0.285	0.078	7.73	563	25.7	3.92	6.2
08-Mar-95	67	13:40	0.33		112	0.43	2.49	0.03	8.2	0.36	0.05	7.75	446	19.5	5.7	3.52
12-Mar-95	71	13:48	0.39	2	235	0.15	3.47	0.04	8.7	0.6	0.08	7.67	403	15.5	3.04	4.6
13-Mar-95	72	15:40			116	0.17	1.65	0.02	6.8	0.35	0.1	7.72	363	13	3.73	4.8
26-May-95	146	14:20	0.18		2.9	0.04	0.54	0.01	3.4	0.06	0.01	8.4	564	16.9	0.92	5.2

Paired Watershed Study
Kintore Creek Water Sampling Data
Station 3, (West)
Routine Grab Samples

Date of Sample	Julian Date	Time	Staff Gauge	Temp (C)	Suspended Solids	Nitrogen			Phosphorus		pH	Conductivity	Chloride	Potassium	Sodium	
						Free Ammonia	Total Kjeldahl	Nitrite	Nitrate	Total						Dissolved Reactive
Jun-13-94	164	14:00	0.55	16	20.9	0.063	0.5	0.01	5.4	0.025	0.003	8.32	613	10.7	0.9	4.7
Jun-21-94	172				51.3	0.005	0.7	0.02	7	0.056	0.001	8.31	606	12.1	1.2	4.6
Jun-29-94	180	15:40	0.51	19	33.7	0.17	1.68	0.06	4.9	0.17	0.16	8	430	67.6	3.9	34.8
Jul-14-94	195	13:50			24	0.014	0.54	0.01	6.8	0.042	0.009					
Jul-22-94	203	13:20	0.55		21	0.036	0.86	0.01	4.8	0.056	0.017	8.43	636	28.1	2.7	14.7
Aug-10-94	222	14:15	0.51		31.4	0.006	0.47	0.01	7.1	0.029						
Aug-19-94	231		0.53	16	37.2	0.005	0.41	0.02	6.2	0.032	0.001	8.3	617	13.2	1.3	5.3
Aug-29-94	241				13.7	0.005	0.4	0.02	7.3	0.022	0.002					
Sep-08-94	251	08:45	0.54	10.5	17	0.005	0.38	0.01	0.1	0.017	0.001					
Sep-26-94	269	08:50	0.55	12	6.1	0.005	0.42	0.01	5.8	0.014	0.001	8.26	625	11.9	1.9	5.3
Oct-07-94	280	13:05	0.55		20.1	0.019	0.3	0.01	6	0.009	0.002					
Oct-17-94	290	15:15	0.55	11	24.5	0.005	0.37	0.01	5.4	0.036	0.001					
Oct-31-94	304	16:10	0.59	8.5	70.2	0.005	0.58	0.01	6	0.021	0.001	8.22	648	19	2.34	7.8
Nov-09-94	313	15:35	0.61	9	7.5	0.005	0.65	0.01	5.3	0.035	0.005					
Nov-15-94	319	09:00	0.56	7.5	22.7	0.1	0.51	0.01	6	0.031	0.001	8.23	646	22.1	1.42	8.4
Nov-28-94	332	15:15	0.6	4	7	0.05	0.55	0.01	5.6	0.042	0.001	8.14	740	54.4	2.99	26.8
13-Jan-95	13	14:30			19.9	0.101	0.83	0.02	4.7	0.11	0.055	7.99	655	62.7	3.57	31.8
16-Jan-95	16	11:30		4	12.7	0.012	1.01	0.01	6.5	0.088	0.033	7.9	561	42.2	2.84	22.1
08-Mar-95	67	13:45	0.79		10	0.23	0.8	0.01	6.1	0.06	0.03	8.06	620	55.5	2.1	24
12-Mar-95	71	14:00	1.14	3.5	142	0.1	2.4	0.02	3.6	0.32	0.03	7.85	451	45.3	3.4	24.5
13-Mar-95	72	15:35			33.1	0.07	0.95	0.01	3.6	0.14	0.01	7.91	417	29.6	3.29	17.2
26-May-95	146	14:10	0.55		10.1	0.05	0.6	0.01	5.8	0.07	0.01	8.41	597	15.3	0.59	6.1

Paired Watershed Study
Kintore Creek Water Sampling Data
Station 5, (East)
Routine Grab Samples

Date of Sample	Julian Date	Time	Staff Gauge	Temp (C)	Suspended Solids	Nitrogen				Phosphorus		pH	Conductivity	Chloride	Potassium	Sodium
						Free Ammonia	Total Kjeldahl	Nitrite	Nitrate	Total	Dissolved Reactive					
Jun-13-94	164				5.5	0.095	0.58	0.02	2.6	0.023	0.003	8.33	553	10.6	1.4	3
Jun-21-94	172				10.2	0.023	0.35	0.04	3.8	0.037	0.02	8.28	592	10.4	1.7	4.1
Jun-29-94	180				1188	0.45	5.7	0.18	8.8	2	0.49	7.57	457	11.5	4.1	2.2
Jul-14-94	195				12.3	0.005	0.5	0.01	3.2	0.046	0.001					
Jul-22-94	203				26	0.055	0.76	0.02	1.7	0.085	0.05	8.14	508	12	3.6	3
Aug-10-94	222				12.1	0.05	0.48	0.02	2.7	0.049	0.026					
Aug-19-94	231				2.9	0.005	0.42	0.03	2.4	0.033	0.004	8.16	608	10.9	1.6	4.7
Aug-29-94	241				3	0.009	0.31	0.02	2.7	0.044	0.017					
Sep-08-94	251				4.3	0.032	0.21	0.01	2.4	0.028	0.001					
Sep-26-94	269				3.7	0.005	0.41	0.02	1.8	0.055	0.025	8.15	575	8.9	3	3.6
Oct-07-94	280				28.9	0.005	0.31	0.01	2	0.022	0.001					
Oct-17-94	290				24.7	0.022	0.37	0.02	1.6	0.018	0.004					
Oct-31-94	304				1.6	0.005	0.4	0.02	1.6	0.043	0.025	8.17	589	9.7	2.09	3.5
Nov-09-94	313				4.2	0.005	0.7	0.01	2.2	0.032	0.007					
Nov-15-94	319				3.2	0.06	0.49	0.01	1.9	0.018	0.002	8.1	575	11.9	1.25	3.6
Nov-28-94	332				12.3	0.05	0.8	0.01	2.1	0.053	0.007	7.97	547	14.5	2.03	3.3
13-Jan-95	13	14:00			44.3	0.1	0.98	0.02	2.9	0.147	0.056	7.81	443	9.8	3.2	2.7
16-Jan-95	16	10:40		3	27.7	0.05	1.03	0.01	5.5	0.121	0.033	7.85	394	8.3	2.9	2.3
07-Mar-95	66	10:40	0.64		145	0.35	2.44	0.18	3.8	0.32	0.01	7.65	410	9.5	3.12	3.1
08-Mar-95	67	11:45	0.55		27.3	0.28	1.25	0.42	4.2	0.17	0.1	7.75	351	7.4	2.52	2.1
12-Mar-95	71	15:00	0.695	1.5	166	0.32	2.34	0.03	3.1	0.41	0.08	7.64	294	6	3.67	2.1
13-Mar-95	72	12:52			29.9	0.07	0.98	0.02	4	0.1	0.01	7.75	393	8.1	2.33	2.4
26-May-95	146	12:45	0.175		4	0.04	0.64	0.01	2	0.05	0.01	8.53	503	7.8	0.97	3.2

Paired Watershed Study
Kintore Creek Water Sampling Data
Station 6, (East)
Routine Grab Samples

Date of Sample	Julian Date	Time	Staff Gauge	Temp (C)	Suspended Solids	Nitrogen				Phosphorus		pH	Conductivity	Chloride	Potassium	Sodium
						Free Ammonia	Total Kjeldahl	Nitrite	Nitrate	Total	Dissolved Reactive					
Jun-13-94	164	13:25	0.218	17	5.7	0.056	0.58	0.02	2.4	0.013	0.006	8.4	534	10.1	1.3	2.7
Jun-21-94	172				22.3	0.026	0.35	0.02	3.8	0.015	0.005	8.33	584	9.4	1.2	3.7
Jun-29-94	180	15:20	0.49	19.5	211	0.17	1.87	0.07	5.7	0.038	0.3	7.65	405	9.7	3.9	2.3
Jul-14-94	195	15:35	0.19	21	8.9	0.012	0.44	0.02	3.3	0.016	0.003					
Jul-22-94	203	13:00	0.27		25.9	0.008	0.78	0.02	1.1	0.08	0.052	8.2	481	11.1	3.4	2.7
Aug-10-94	222	13:50	0.185		22.3	0.009	0.37	0.01	2.7	0.014	0.006					
Aug-19-94	231		0.185	17.5	2.7	0.005	0.37	0.02	2.5	0.016	0.003	8.34	591	9.8	1.3	3.7
Aug-29-94	241				5.9	0.006	0.28	0.01	2.8	0.016	0.006					
Sep-08-94	251	08:10	0.172	11	5.4	0.005	0.28	0.01	2.7	0.013	0.001					
Sep-26-94	269	08:30	0.17	14	1.6	0.005	0.31	0.01	2.3	0.017	0.002	8.2	567	7.9	1.9	3.4
Oct-07-94	280	12:30	0.185		11.3	0.005	0.24	0.01	2.4	0.009	0.001					
Oct-17-94	290	14:40	0.188	10.5	28.9	0.005	0.32	0.01	1.9	0.026	0.002					
Oct-31-94	304	15:20	0.205	8.5	23.5	0.005	0.39	0.01	1.6	0.013	0.001	8.19	597	10.4	2.09	3.2
Nov-09-94	313	15:00	0.285	9.5	2.7	0.005	0.61	0.01	1.5	0.015	0.002					
Nov-15-94	319	08:40	0.225	8	1.9	0.07	0.47	0.01	1.6	0.011	0.001	8.24	567	12	1.2	3.5
Nov-28-94	332	14:00	0.31	3.5	7.1	0.05	0.59	0.01	1.3	0.028	0.001	8.02	527	14.2	1.62	3.2
13-Jan-95	13	13:40			50.8	0.111	1.17	0.02	2.4	0.126	0.037	7.88	431	9.8	2.52	2.7
16-Jan-95	16	10:20		3	39.4	0.01	1.19	1	5.9	0.124	0.019	7.85	377	8.3	2.25	2.3
07-Mar-95	66	15:34			218	0.65	3.7	0.32	3.2	0.76	0.27	7.62	281	6.3	5.29	2.1
08-Mar-95	67	14:25	0.42		30.2	0.27	1.3	0.06	4.2	0.16		7.82	368	8.2	2.22	2
12-Mar-95	71	14:36	0.475	1.5	212	0.22	2.56	0.03	3.2	0.41	0.07	7.71	333	7	3.18	2.1
12-Mar-95	72	15:10			144	0.07	1.33	0.02	3	0.24	0.01	7.7	327	6.9	2.21	2.1
26-May-95	146	13:30	0.24		3	0.04	0.55	0.01	1.9	0.05	0.01	8.44	501	7.6	1.06	3.9

Paired Watershed Study
Kintore Creek Water Sampling Data
Station 7, (East)
Routine Grab Samples

Date of Sample	Julian Date	Time	Staff Gauge	Temp (C)	Suspended Solids	Nitrogen				Phosphorus		pH	Conductivity	Chloride	Potassium	Sodium
						Free Ammonia	Total Kjeldahl	Nitrite	Nitrate	Total	Dissolved Reactive					
Jun-13-94	164	13:40	0.05	15	4.3	0.058	0.45	0.06	1.3	0.021	0.009	8.15	564	15.1	2.1	2.6
Jun-21-94	172				21.5	0.02	0.44	0.01	0.6	0.046	0.005	8.22	587	9.1	1.6	3.5
Jun-29-94	180	15:25	0.85	19	36.3	0.12	1.13	0.05	1.1	0.2	0.01	7.84	407	22.3	5.5	2.1
Jul-14-94	195	15:40	0.02	17	9.1	0.005	0.31	0.01	0.8	0.046	0.016					
Jul-22-94	203	13:00	0.15		12.9	0.029	0.66	0.01	0.5	0.056	0.028	8.13	511	17.1	3.9	2.9
Aug-10-94	222	14:00	0		2.7	0.005	0.2	0.01	0.4	0.021	0.009					
Aug-19-94	231		-0.02	15.5	25.9	0.005	0.42	0.02	0.4	0.069	0.003	8.14	606	11.6	1.6	3.6
Aug-29-94	241		-0.05		5	0.005	0.2	0.01	0.2	0.028	0.011					
Sep-08-94	251	08:30	-0.05	10.5	2.4	0.005	0.13	0.01	7.4	0.021	0.001					
Sep-26-94	269	08:40	-0.05	12	5.7	0.005	0.23	0.01	0.4	0.037	0.005	8.08	583	7	2.1	4.3
Oct-07-94	280	12:45	0		3.7	0.005	0.18	0.01	0.2	0.016	0.003					
Oct-17-94	290	14:55	0	10.5	3.1	0.005	0.19	0.01	0.2	0.007	0.005					
Oct-31-94	304	15:55	0.05	8	32.6	0.005	0.35	0.01	0.2	0.052	0.001	7.97	597	11.5	1.91	3.7
Nov-09-94	313	14:55	0.12	9	4.7	0.021	0.4	0.01	0.3	0.022	0.002					
Nov-15-94	319	08:50	0.04	7.5	6	0.15	0.27	0.01	0.4	0.02	0.002	8.25	593	17.9	1.69	3.4
Nov-28-94	332	15:00	0.14	3	22.5	0.05	0.61	0.01	0.6	0.062	0.002	7.95	587	25.7	2.51	3.6
13-Jan-95	13	14:20			39	0.106	0.81	0.02	1.5	0.125	0.034	7.79	419	14.5	4.16	2.4
16-Jan-95	16	11:00		3	25.8	0.107	1.09	0.01	2.4	0.129	0.029	7.92	352	11.5	4.72	2
08-Mar-95	167	14:25	0.8		26.2	0.32	1.21	0.01	1.6	0.15	0.05	7.89	328	10.3	3.05	1.8
12-Mar-95	71	14:17		1	115	0.12	1.77	0.01	1.5	0.24	0.03	7.74	344	8.6	2.76	2.1
13-Mar-95	72	15:15			91	0.07	0.82	0.01	1.6	0.13	0.01	7.76	295	8.4	2.75	1.7
26-May-95	146	13:20	0.1		5.4	0.04	0.39	0.01	1	0.05	0.01	8.15	546	10.1	1.45	3.3

Paired Watershed Study
Kintore Creek Water Sampling Data
Station 8, (East)
Routine Grab Samples

Date of Sample	Julian Date	Time	Staff Gauge	Temp (C)	Suspended Solids	Nitrogen				Phosphorus		pH	Conductivity	Chloride	Potassium	Sodium
						Free Ammonia	Total Kjeldahl	Nitrite	Nitrate	Total	Dissolved Reactive					
Jun-13-94	164	13:50	0.14	15	5.2	0.063	0.41	0.01	2.7	0.014	0.006	8.12	590	8.4	0.4	2.4
Jun-21-94	172				27.8	0.005	0.35	0.01	3.4	0.015	0.004	8.21	603	8.6	0.7	3
Jun-29-94	180	15:45	0.51	18	35.3	0.11	1.16	0.03	5.8	0.11	0.01	7.91	366	9.3	2.1	2.1
Jul-14-94	195	15:45	0.13	16	4.4	0.015	0.31	0.01	3.2	0.018	0.012					
Jul-22-94	203	13:15	0.19		5.5	0.005	0.52	0.01	2.2	0.009	0.001	8.11	561	7.6	0.9	2.8
Aug-10-94	222	14:05	0.14		3.4	0.005	0.33	0.01	2.7	0.09	0.003					
Aug-19-94	231		0.14	15.5	4	0.005	0.33	0.02	2.5	0.017	0.002	8.18	595	10.9	0.6	3
Aug-29-94	241				1.7	0.007	0.23	0.01	2.8	0.014	0.009					
Sep-08-94	251	08:40	0.14	11		0.005	0.34	0.01	2.5	0.016	0.001					
Sep-26-94	269	08:45	0.17	13	40.6	0.005	1.19	0.01	2.3	0.11	0.002	8.07	606	9	1.7	3.9
Oct-07-94	280	12:55	0.16		42.6	0.02	0.35	0.01	2.3	0.012	0.004					
Oct-17-94	290	15:10	0.19	10	26.3	0.005	0.68	0.01	2.2	0.012	0.002					
Oct-31-94	304	16:05	0.23	8.5	17.7	0.005	0.66	0.01	1.7	0.042	0.001	8.03	598	8.5	1.16	2.9
Nov-09-94	313	15:30	0.21	9	4.6	0.005	0.53	0.01	2.4	0.016	0.001					
Nov-15-94	319	08:55	0.14	8	2.6	0.1	0.37	0.01	2.4	0.012	0.001	8.12	581	8.7	0.52	2.9
Nov-28-94	332	15:10	0.2	4.5	15.8	0.05	0.72	0.01	2.1	0.037	0.001	8.05	592	9.1	0.19	2.8
13-Jan-95	13	14:20			39	0.106	0.81	0.02	1.5	0.125	0.034	7.79	419	14.5	4.16	2.4
16-Jan-95	16	11:00		3	25.8	0.107	1.09	0.01	2.4	0.129	0.029	7.92	352	11.5	4.72	2
08-Mar-95	167	14:25	0.8		26.2	0.32	1.21	0.01	1.6	0.15	0.05	7.89	328	10.3	3.05	1.8
12-Mar-95	71	14:17		1	115	0.12	1.77	0.01	1.5	0.24	0.03	7.74	344	8.6	2.76	2.1
13-Mar-95	72	15:15			91	0.07	0.82	0.01	1.6	0.13	0.01	7.76	295	8.4	2.75	1.7
26-May-95	146	13:20	0.1		5.4	0.04	0.39	0.01	1	0.05	0.01	8.15	546	10.1	1.45	3.3

**Paired Watershed Study
Kintore Creek Water Sampling Data
Station 1, (West)
ISCO Samples**

Date	Julian Date	Time	Suspended Solids	Total Phosphorus	TKN	Date	Julian Date	Time	Suspended Solids	Total Phosphorus	TKN
24-Jun-94	175	08:10	119	0.26	2.6	14-Mar-95	73	12:00	12.8	0.1	1.03
24-Jun-94	175	09:10	94	0.26	2.15	14-Mar-95	73	14:00	37	0.12	1.04
24-Jun-94	175	10:10		0.138	1.3	14-Mar-95	73	16:00	45	0.15	1.24
24-Jun-94	175	11:10		0.083	1.13	14-Mar-95	73	18:00	35.8	0.14	1.17
24-Jun-94	175	12:10		0.072	1.06	14-Mar-95	73	20:00	25.2	0.11	1.14
24-Jun-94	175	13:10		0.068	1.03	14-Mar-95	73	22:00	21.5	0.11	1.14
29-Jun-94	180	15:00	502	0.96	3.74	15-Mar-95	74	00:00	18.9	0.09	1.02
29-Jun-94	180	16:00	246	0.59	2.24	15-Mar-95	74	02:00	15.8	0.08	0.95
29-Jun-94	180	17:00	152	0.44	2.38	21-Apr-95	111	08:30	21.1	0.22	1.6
29-Jun-94	180	18:00	97.1	0.33	1.98	21-Apr-95	111	09:30	45.2	0.13	1.08
29-Jun-94	180	19:00	102	0.34	1.8	21-Apr-95	111	10:30	199	0.64	3.26
29-Jun-94	180	20:00	68.6	0.26	1.6	21-Apr-95	111	11:30	325	0.77	4.49
29-Jun-94	180	21:00	54	0.22	1.59	21-Apr-95	111	12:30	657	1.17	6.24
29-Jun-94	180	22:00	44	0.19	1.43	21-Apr-95	111	13:30	428	0.99	4.52
29-Jun-94	180	23:00	33.9	0.16	1.31	21-Apr-95	111	14:30	285	0.79	3.41
29-Jun-94	180	24:00	32.3	0.14	1.17	21-Apr-95	111	15:30	192	0.62	2.75
28-Nov-94	332	0:00		0.63	3	21-Apr-95	111	16:30	124	0.44	2.25
28-Nov-94	332	02:00	205	0.385	2.35	21-Apr-95	111	17:30	91.5	0.33	1.77
28-Nov-94	332	04:00	106	0.225	1.6	21-Apr-95	111	18:30	85.6	0.33	1.98
28-Nov-94	332	06:00	104	0.2	1.8	21-Apr-95	111	19:30	257	0.58	2.78
28-Nov-94	332	08:00	102	0.725	3.65	21-Apr-95	111	20:30	492	1.43	4.25
28-Nov-94	332	10:00	41.8	0.206	1.78	21-Apr-95	111	21:30	339	0.88	3.42
						21-Apr-95	111	22:30	200	0.62	2.46
11-Mar-95	70	12:00	13	0.08	0.86	21-Apr-95	111	23:30	125	0.46	1.98
11-Mar-95	70	14:00	10	0.05	0.85	22-Apr-95	112	00:30	105	0.4	2
11-Mar-95	70	16:00	89.5	0.27	1.69	22-Apr-95	112	01:30	79.6	0.33	1.57
11-Mar-95	70	18:00	110	0.31	1.75	22-Apr-95	112	02:30	60.9	0.27	1.61
11-Mar-95	70	20:00	49.1	0.22	1.39	22-Apr-95	112	03:30	42.1	0.23	1.41
11-Mar-95	70	21:00	40.6	0.18	1.27	22-Apr-95	112	04:30	35.6	0.21	1.5
12-Mar-95	71	00:00	35.5	0.13	1.15	22-Apr-95	112	05:30	32.1	0.19	1.23
12-Mar-95	71	02:00	28.1	0.12	1.03	22-Apr-95	112	6:30	23.5	0.19	1.21
12-Mar-95	71	04:00	24.3	0.1	1.14	22-Apr-95	112	07:30	18.7	0.17	1.27
12-Mar-95	71	10:00	16.2	0.08	1	26-Apr-95	116	15:15	51.4	0.16	1.25
12-Mar-95	71	12:00	24.9	0.97	0.1	26-Apr-95	116	17:15	128	0.31	2.02
12-Mar-95	71	14:00	186	0.43	2.25	26-Apr-95	116	18:15	107	0.31	2.06
12-Mar-95	71	16:00	258	0.6	2.75	26-Apr-95	116	19:15	101	0.29	1.91
12-Mar-95	71	18:00	238	0.53	2.5	26-Apr-95	116	20:15	72.3	0.24	1.71
12-Mar-95	71	19:00	123	0.37	1.9	26-Apr-95	116	21:15	53.5	0.1	0.58
12-Mar-95	71	22:00	70.9	0.29	1.53	26-Apr-95	116	22:15	65.5	0.24	1.58
13-Mar-95	72	00:00	55.8	0.23	1.48	26-Apr-95	116	23:15	73.5	0.25	1.45
13-Mar-95	72	02:00	51.1	0.22	1.35	27-Apr-95	117	00:15	85.8	1.73	0.29
13-Mar-95	72	04:00	43.8	0.21	1.32	27-Apr-95	117	01:15	77.2	0.25	1.75
13-Mar-95	72	10:00	29.5	1.18	0.19	27-Apr-95	117	02:15	56.1	0.23	1.45
13-Mar-95	72	12:00	42.4	0.19	1.2	27-Apr-95	117	03:15	41.6	0.21	1.42
13-Mar-95	72	14:00	161	0.39	2.04	27-Apr-95	117	04:15	36.3	0.18	1.37
13-Mar-95	72	16:00	136	0.37	1.85	27-Apr-95	117	05:15	33.1	0.17	1.38

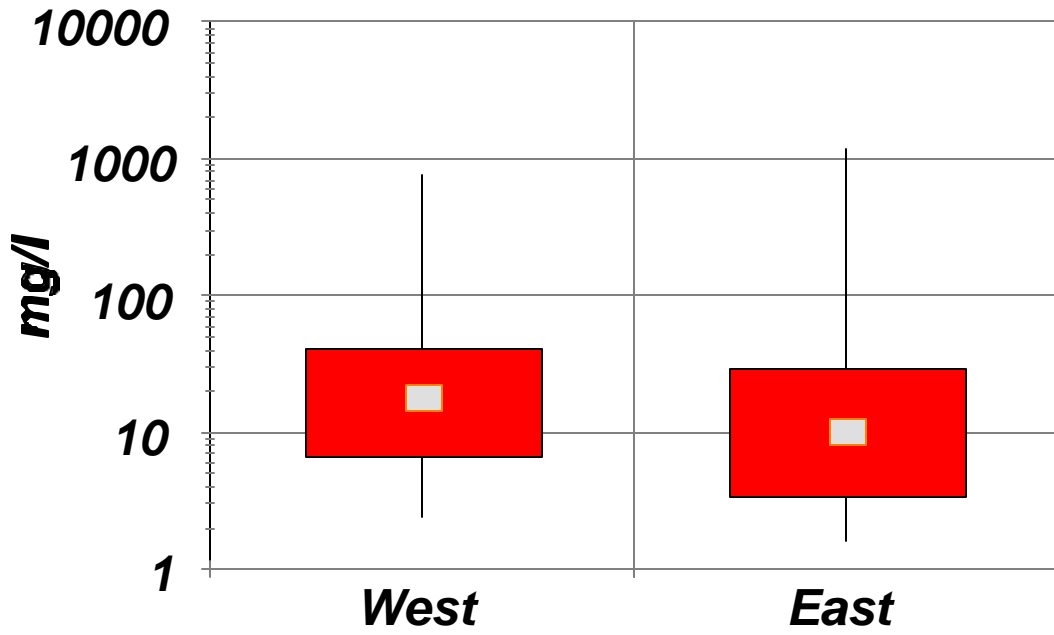
13-Mar-95	72	18:00	72.6	0.29	1.63	10-May-95	130	16:00	8.2	0.05	0.61
13-Mar-95	72	20:00	55.8	0.25	1.46	10-May-95	130	18:00	147	0.48	3.38
13-Mar-95	72	22:00	40	0.21	1.37	10-May-95	130	20:00	80.5	0.22	1.81
14-Mar-95	73	00:00	35.8	0.18	1.29	10-May95	130	22:00	35.9	0.13	1.18
14-Mar-95	73	02:00	30.6	0.16	1.19	11-May-95	131	00:00	17.4	0.1	0.99
14-Mar-95	73	04:00	25.6	0.14	1.13	11-May-95	131	02:00	14.1	0.07	0.89
14-Mar-95	73	06:00	24.2	0.14	1.17						
14-Mar-95	73	08:00	18.8	0.12	1.14						
14-Mar-95	73	10:00	13.1	0.11	1.07						

Paired Watershed Study
Kintore Creek Water Sample Data
Station 5, (East) ISCO Samples

Date	Julian Date	Time	Suspended Solids	Total Phosphorus	TKN	Date	Julian Date	Time	Suspended Solids	Total Phosphorus	TKN
24-Jun-94	175	08:30	87.7	0.166	1.96	14-Mar-95	73	21:00	14.3	0.06	0.82
24-Jun-94	175	09:30	55.7	0.151	1.45	14-Mar-95	73	23:00	10.3	0.05	0.88
24-Jun-94	175	10:30	34.7	0.126	1.28	15-Mar-95	74	01:00	11.2	0.05	0.76
24-Jun-94	175	11:30	27.3	0.103	1.21	15-Mar-95	74	03:00	9.1	0.07	0.83
24-Jun-94	175	12:30	21.4	0.087	1.05	21-Apr-95	111	00:35	45.8	0.19	1.26
24-Jun-94	175	13:30	119	0.275	1.03	21-Apr-95	111	01:35	42.5	0.16	1.2
29-Jun-94	180	14:15	1056	0.16	1.31	21-Apr-95	111	02:35	36.7	0.15	1.11
29-Jun-94	180	15:15	218	0.48	2.6	21-Apr-95	111	03:35	47.6	0.14	1.11
29-Jun-94	180	16:15	93	0.22	1.56	21-Apr-95	111	05:35	28.6	0.11	0.99
29-Jun-94	180	17:15	69.7	0.17	1.46	21-Apr-95	111	06:35	42.5	0.1	0.95
29-Jun-94	180	18:15	67.1	0.16	1.46	21-Apr-95	111	08:35	314	0.6	3.51
29-Jun-94	180	19:15	58.7	0.15	1.5	21-Apr-95	111	09:35	482	0.89	4.72
29-Jun-94	180	20:15	52.6	0.14	1.41	21-Apr-95	111	10:35	401	0.79	3.73
29-Jun-94	180	21:15	43.2	0.12	1.26	21-Apr-95	111	11:35	396	0.67	3.08
29-Jun-94	180	22:15	41.9	0.11	1.35	21-Apr-95	111	12:35	1300	2.33	7.25
29-Jun-94	180	23:15	37.9	0.1	1.23	21-Apr-95	111	13:35	327	0.73	2.99
28-Nov-94	332	0:00	149	0.22	1.7	21-Apr-95	111	14:35	163	0.45	2.09
28-Nov-94	332	02:00	267	0.41	2.1	21-Apr-95	111	15:35	83.2	0.28	1.55
28-Nov-94	332	04:00	283	0.53	2.3	21-Apr-95	111	16:35	77.9	0.25	1.42
28-Nov-94	332	06:00	319	0.465	2.4	21-Apr-95	111	17:35	51.8	0.2	1.23
28-Nov-94	332	08:00	108	0.49	3.3	21-Apr-95	111	18:35	57.6	0.19	1.41
28-Nov-94	332	10:00	126	0.126	0.76	21-Apr-95	111	19:35	44.5	0.79	3.12
						21-Apr-95	111	20:35	318	0.76	2.91
12-Mar-95	71	12:30	156	0.41	2.62	21-Apr-95	111	21:35	97.4	0.4	1.92
12-Mar-95	71	14:30	134	0.35	2.29	21-Apr-95	111	22:35	77.3	0.29	1.58
12-Mar-95	71	16:30	85.3	0.25	1.79	21-Apr-95	111	23:35	64.4	0.24	1.48
12-Mar-95	71	18:30	64.9	0.27	2.53	26-Apr-95	116	14:55	130	0.25	1.85
12-Mar-95	71	20:30	54.7	0.24	2.61	26-Apr-95	116	15:55	152	0.36	1.96
12-Mar-95	71	22:30	45	0.2	1.83	26-Apr-95	116	17:55	99.3	0.3	1.61
13-Mar-95	72	00:30	51.7	0.6	2.26	26-Apr-95	116	19:55	51.1	0.24	1.71
13-Mar-95	72	08:30	51.3	0.21	2.03	26-Apr-95	116	21:55	60.9	0.22	1.45
13-Mar-95	72	13:00	41.5	0.11	0.89	26-Apr-95	116	23:55	70.3	0.25	1.4
13-Mar-95	72	15:00	83.3	0.19	1.37	27-Apr-95	117	00:35	54	0.23	1.25
13-Mar-95	72	17:00	83	0.18	1.24	27-Apr-95	117	01:55	41.8	0.22	1.32
13-Mar-95	72	19:00	47.1	0.13	0.98	27-Apr-95	117	02:55	35.4	0.19	1.1
13-Mar-95	72	21:00	33	0.11	1.01	27-Apr-95	117	03:55	25.8	0.16	1.16
13-Mar-95	72	23:00	22.8	0.1	0.7	27-Apr-95	117	04:55	26.3	0.15	1.22
14-Mar-95	73	01:00	18.7	0.09	0.84	27-Apr-95	117	05:55	27.3	0.14	0.88
14-Mar-95	73	03:00	17.4	0.07	0.63						
14-Mar-95	73	05:00	13.5	0.06	0.6	27-Apr-95	117	07:55	20.6	0.11	1.04
14-Mar-95	73	07:00	8.4	0.06	0.78	27-Apr-95	117	09:55	17.6	0.09	0.97
14-Mar-95	73	09:00	9.9	0.06	0.56	10-May-95	130	20:00	199	0.45	2.2
14-Mar-95	73	11:00	21.4	0.07	0.71	10-May-95	130	22:00	65.4	0.26	1.57
14-Mar-95	73	13:00	40.2	0.1	0.89	11-May-95	131	00:00	33.3	0.12	0.94
14-Mar-95	73	15:00	36.2	0.11	1.02	11-May-95	131	02:00	20.4	0.09	0.88
14-Mar-95	73	17:00	24.5	0.09	0.96	11-May-95	131	04:00	13.7	0.07	0.82
14-Mar-95	73	19:00	20	0.07	0.8	11-May-95	131	06:00	10.8	0.06	0.74

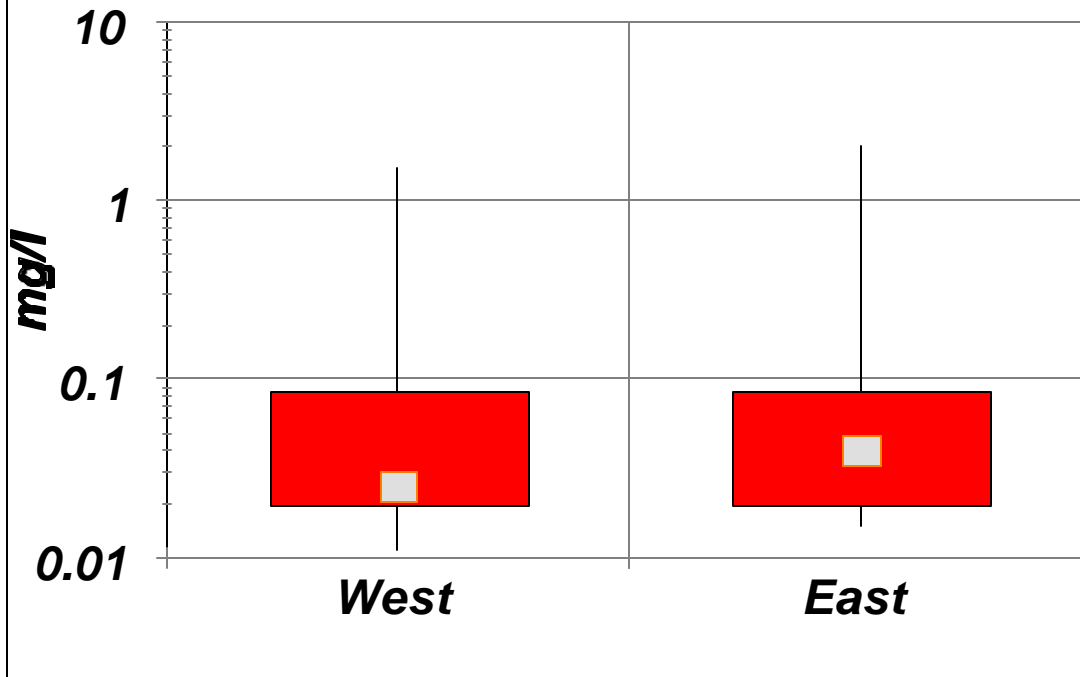
Suspended Solids

Kintore Creek 1994



Total Phosphorus

Kintore Creek 1994

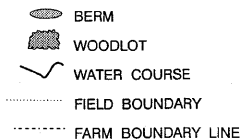
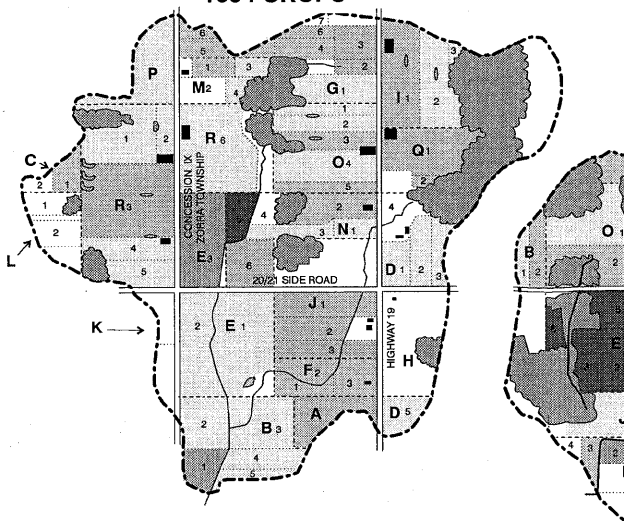


Kintore Runoff Coefficients

Month	Vannatter Drain near Kintore		Logan Drain near Kintore		Watershed
	Runoff (mm)	Runoff Coefficient	Runoff (mm)	Runoff Coefficient	Runoff Coefficient
Jun	40	0.36	39	0.40	0.38
Jul	30	0.33	26	0.28	0.30
Aug	16	0.19	7.8	0.11	0.16
Sep	13	0.46	2.8	0.10	0.28
Oct	17	0.96 (0.34)	7.7	0.46 (0.16)	0.71 (0.25)
Nov	31	0.33	58	0.39	0.36
Dec	57	1.25 [0.75]	42	0.95 [0.57]	1.10 [0.66]
<p>() represents runoff coefficient calculated using Atmospheric Environment Service Rainfall [] represents rainfall + snowfall from Atmospheric Environment Service</p>					

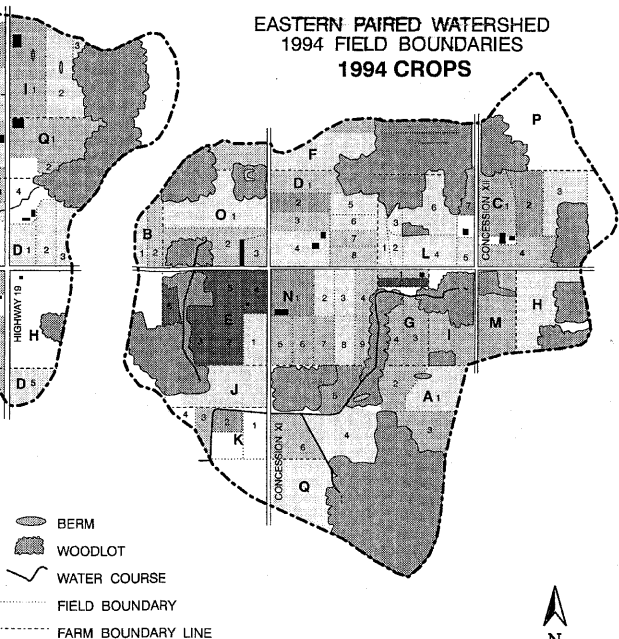
KINTORE PAIRED WATERSHEDS

WESTERN PAIRED WATERSHED
1994 FIELD BOUNDARIES
1994 CROPS



KINTORE PAIRED WATERSHEDS

EASTERN PAIRED WATERSHED 1994 FIELD BOUNDARIES 1994 CROPS



Kintore

1994 Field Activities
Western Sub-basin

Landowner	Field #	Acres	Primary Tillage	1994 Crop
Farm A	1	24	spring mouldboard	s. beans
Farm B	1	20	fall mouldboard	spring grain
	2	24	fall mouldboard	corn
	3	36	fall mouldboard	corn
	4	15	spring mouldboard	corn
	5	15	fall mouldboard	corn
Farm C	1	10	---	alfalfa
	2	7	fall mouldboard	corn
Farm D	1	20	fall mouldboard	corn
	2	26	fall mouldboard	corn
	3	10	fall mouldboard	corn
	4	10	---	idle
	5	21	fall mouldboard	corn
Farm E	1	49	spring chisel	corn
	2	40	fall chisel	corn
	3	47	fall chisel	spring grain
Farm F	1	14	---	alfalfa
	2	6	---	alfalfa
	3	8	---	alfalfa
Farm G	1	20	f./sp. mouldboard	s.corn
	2	6	spring mouldboard	s.beans
	3	16	spring mouldboard	s.beans
	4	13	---	alfalfa
	5	13	fall mouldboard	alfalfa
	6	23	fall mouldboard	alfalfa
Farm H	1	10	---	tree nursery
Farm I	1	50	spring mouldboard	w.beans
	2	20	spring mouldboard	corn
	3	7	spring mouldboard	alfalfa
Farm J	1	20	spring mouldboard	s.beans
	2	22	spring mouldboard	s.beans
	3	20	spring mouldboard	co.beans
Farm K	1	12	fall mouldboard	corn
Farm L	1	15	fall mouldboard	spring grain
	2	15	fall mouldboard	corn
Farm M	1	10	---	alfalfa
	2	13	---	alfalfa
	3	10	spring mouldboard	corn
	4	7	spring mouldboard	corn

Farm N	1	8	spring cultivate	corn
	2	22	---	alfalfa
	3	10	no-till	corn
	4	6	---	alfalfa
	5	12	no-till	wheat
	6	30	no-till	s.beans
Farm O	1	11	spring chisel	corn
	2	14	---	corn
	3	18	---	alfalfa
	4	31	spring mouldboard	corn
	5	14	---	alfalfa
Farm P	1	47	fall mouldboard	corn
Farm Q	1	42	no-till	s.beans
	2	5	---	alfalfa
Farm R	1,2	61	fall mouldboard	corn
	3	80	fall mouldboard	s.beans
	4	15	fall mouldboard	corn
	5	43	spring mouldboard	corn
	6,7	76	fall mouldboard	corn

Kintore

1994 Field Activities
Eastern Sub-basin

Landowner	Field #	Acres	Primary Tillage	1994 Crop
Farm A	1	30	spring mouldboard	corn
	2	15	spring mouldboard	s.beans
	3	25	spring mouldboard	s.beans
	4	34	spring mouldboard	corn
	5	14	spring mouldboard	spring grain
	6	18	spring mouldboard	s.beans
Farm B	1	8	fall mouldboard	corn
	2	10	---	alfalfa
Farm C	1	26	no-till	s.beans
	2	15	spring chisel	spring grain
	3	20	spring mouldboard	corn
	4	21	---	alfalfa
Farm D	1	14	---	alfalfa
	2	13	fall mouldboard	spring grain
	3	12	---	alfalfa
	4	20	spring mouldboard	corn
	5	12	spring mouldboard	corn
	6	7	spring mouldboard	corn
	7	7	---	alfalfa
	8	13	---	alfalfa
Farm E	1	14	spring mouldboard	corn
	2	24	no-till	wheat
	3	11	no-till	wheat
	4	2	no-till	wheat
	5	14	no-till	wheat
	6	5	no-till	wheat
Farm F	1	23	spring mouldboard	s.beans
Farm G	1	3	fall mouldboard	s.beans
	2	7	---	w.wheat
	3	18	spring mouldboard	s.beans
	4	7	---	s.beans
Farm H	1	25	spring mouldboard	corn
Farm I	1	17	---	alfalfa
Farm J	1	42	fall mouldboard	corn
Farm K	1	4	fall mouldboard	alfalfa
	2	4	fall mouldboard	spring grain
	3	3	---	alfalfa
	4	2	---	

Farm L	1	9	fall mouldboard	corn
	2	3	fall mouldboard	corn
	3	3	fall mouldboard	corn
	4	20	fall mouldboard	corn
	5	4	fall mouldboard	corn
	6	20	fall mouldboard	corn
	7	4	fall mouldboard	spring grain
Farm M	1	28	f./sp. mouldboard	s.beans
Farm N	1	16	fall chisel	spring grain
	2	11	fall chisel	corn
	3	10	f./sp. chisel	corn
	4	10	---	alfalfa
	5	11	---	alfalfa
	6	11	---	alfalfa
	7	8	---	alfalfa
	8	9	sp. chisel	corn
	9	9	---	alfalfa
Farm O	1	49	spring mouldboard	corn
	2	15	---	alfalfa
	3	8	---	alfalfa
Farm P	1	18	fall mouldboard	corn

Kettle Climate Data: Datalogger Summary

Comparison of 1989 to 1994 Monthly Total Precipitation with the Normal from Atmospheric Environment Services London Airport Station																					
Kettle Creek Paired Watershed Data									Atmospheric Environment Service - London Airport												
Month	Total Rainfall		Avg. Temp. (°C)		Avg. Max. Temp.		Avg. Min. Temp.		Total Rainfall (mm)			Avg. Temp. (°C)			Avg. Max Temp. (°C)			Avg. Min. Temp. (°C)			
	'94	'95	'94	'95	'94	'95	'94	'95	'94	'95	Norm.	'94	'95	Norm.	'94	'95	Norm.	'94	'95	Norm.	
Jan		0		-3.26		0.33		-7.10		70.5	25.3		-3.3	-6.7		-0.1	-2.8		-6.4	-10.7	
Feb		0		-6.21		-2.36		-10.33		9.0	26.7		-7.6	-6.2		-3.1	-2.0		-12.0	-10.5	
Mar		8.4		1.33		6.80		-4.1		54.0	52.8		1.3	-0.5		6.7	3.8		-4.2	-5.0	
Apr		75.3		4.16		8.62		0.353		96.4	69.5		4.5	6.2		9.4	11.7		-0.4	0.7	
May		74		13.21		18.59		7.54		104.4	73.6		13.0	12.6		18.5	18.7		7.5	6.4	
Jun	128.4		18.75		24.89		12.67		120.8		81.9	24.4		17.7	24.4		23.8	12.8		11.6	
Jul	115.8		21.18		27.01		15.52		90.6		76.7	25.7		20.3	25.7		26.4	15.5		14.2	
Aug	57.6		17.93		23.77		12.02		70.2		89.6	23.4		19.3	23.4		25.2	12.8		13.3	
Sep	31.9		14.49		21.41		8.72		37.8		86.2	21.3		15.3	21.3		20.9	9.7		9.6	
Oct	0.1		9.97		15.86		3.90		48.6		73.8	15.2		9.1	15.2		14.2	4.9		3.9	
Nov	2.7		5.63		9.83		1.02		62.6		72.8	7.1		3.3	7.1		7.1	-0.6		-0.6	
Dec	0		0.04		3.41		-3.64		30.3		49.9	3.3		-3.4	3.3		0.1	-3.7		-7.1	
Ann. Total									873.6	955.1			6.9			12.2			2.1		

Paired Watershed Study
Kettle Creek. C.A. Water Sampling Data
Statio: Madter Drain, (West)
Routing Grab Samples

Date of Sample	Julian Date	TIME	Staff Gauge	Temp °C	Suspednded Solids	Nitrogen				Phosphorus		pH	Conductivity	Chloride	Potassium	Sodium
						Free Ammonia	Total Kjeldahl	Nitrite NO3	Nitrite NO2	Total	Dissolved Reactive					
Nov 14, 1994	318	14:00	0.0025		2.7	0.07	0.48	14.7	0.03	0.066	0.022	8.11	769	37.6	4.01	13.5
Dec 02, 1994	336	09:30	0.0037		5.7	0.76	0.49	11.3	0.03	0.056	0.013	8.01	770	36.0	3.36	12.2
Dec 16, 1994	350	17:30	0.0037		3.3	0.08	0.60	11.4	0.02	0.05	0.026	8.20	718	37.9	3.06	12.4
Jan 05, 1995	5	14:00	0.0019		8.4	0.09	0.67	10.0	0.02	0.08	L0.01	7.74	837	39.8	3.09	15.7
Jan 17, 1995	17	13:30	0.0306		24.2	0.17	1.20	10.7	0.07	0.36	0.280	7.84	505	23.6	6.36	8.3
Feb 02, 1995	33	13:30	0.0013		7.0	0.23	0.51	8.3	0.02	0.06	0.050	7.97	673	38.2	3.83	15.2
Feb 18, 1995	49	16:30	0.0026		47.6	0.22	0.94	3.1	0.03	0.19	0.180	7.65	529	60.7	3.23	29.5
Mar 06, 1995	65	13:30	0.0334		74.2	0.86	1.48	3.8	0.04	0.33	L0.01	7.68	342	26.7	4.59	14.1
Mar 17, 1995	76	09:30	0.0102		10.7	L0.05	0.75	8.0	0.01	0.08	L0.01	8.07	581	30.7	2.81	11.5
Mar 31, 1995	90	13:45	0.0011		4.3	0.23	0.50	6.5	0.01	0.04	0.010	8.24	638	35.1	2.47	13.0
Apr 18, 1995	108	09:30	0.0015		1.5	0.12	0.56	7.3	0.03	0.04	L0.01	8.06	651	34.2	2.49	13.6
May 03, 1995	123	14:00	0.0006		L5.0	0.14	0.46	7.0	0.02	0.04	L0.01	NA	NA	29.3	2.41	11.9
May 15, 1995	135	15:00	0.0005		L5.0	0.08	0.69	7.5	0.05	0.03	L0.01	7.53	560	31.8	2.45	11.0
Jun 05, 1995	156	14:00	0.0002		L5.0	0.35	0.72	10.3	0.04	0.06	L0.01	8.37	625	33.8	2.51	12.3

Paired Watershed Study
Kettle Creek C.A. Water Sampling Data
Station: Holtby Drain, (East)
Routing Grab Samples

Date of Sample	Julian Date	Time	Staff Gauge	Temp Celsius	Suspended Solids	Nitrogen				Phosphorus		pH	Conductivity	Chloride	Potassium	Sodium
						Free Ammonia	Total Kjeldahl	Nitrite NO3	Nitrite NO2	Total	Dissolved Reactive					
Nov 14, 1994	318	14:00	0.0012		1.5	0.11	0.65	5.8	0.02	0.037	0.017	7.94	735	48.9	5.02	8.5
Dec 02, 1994	336	09:30	0.0018		2.1	0.29	0.58	6.2	0.03	0.032	0.005	7.86	733	46.9	4.48	9.0
Dec 16, 1994	350	17:30	0.0027		0.4	0.20	0.78	6.2	0.01	0.06	0.039	8.10	673	43.8	4.47	8.4
Jan 05, 1995	5	14:00	0.0009		1.3	0.13	0.70	0.7	0.02	0.08	0.01	7.59	804	47.2	3.61	10.1
Jan 17, 1995	17	13:30	0.0286		8.8	0.18	1.15	7.8	0.03	0.12	0.03	7.77	485	27.8	4.85	5.9
Feb 02, 1995	33	14:00	0.006		6.2	0.19	0.66	5.1	0.02	0.06	0.03	7.70	651	34.3	3.67	7.5
Feb 18, 1995	49	16:30	0.003		19.8	3.43	6.89	1.7	0.04	0.35	0.13	7.33	480	25.0	12.9	6.7
Mar 06, 1995	65	13:30	0.0304		27.7	0.81	1.86	2.9	0.06	0.36	0.04	7.69	298	18.7	5.07	7.3
Mar 17, 1995	76	10:30	0.008		15.0	0.26	1.12	5.1	0.04	0.08	0.01	7.94	565	33.4	4.25	7.5
Mar 31, 1995	90	14:15	0.0013		8.0	0.89	2.19	3.2	0.01	0.15	0.02	8.04	620	35.9	6.82	8.1
Apr 18, 1995	108	09:45	0.0009		2.1	0.36	1.08	3.9	0.03	0.07	0.01	7.78	617	36.5	4.42	8.8
May 03, 1995	123	14:00	0.0009		15.0	0.17	0.50	3.5	0.02	0.08	0.01	NA	NA	30.7	3.61	7.9
May 15, 1995	135	15:15	0.0009		15.0	0.08	0.73	2.9	0.04	0.03	0.01	8.42	553	32.1	3.21	7.9
Jun 05, 1995	156	14:00	0.0004		15.0	0.17	0.88	1.7	0.05	0.06	0.020	8.25	581	35.8	2.74	7.9

Paired Watershed Study
Kettle Creek C.A. Water Sampling Data
Station: Madter Drain, (West)
ISCO Samples

Date of Sample	Julian Date	Time	Staff Gauge	Suspended Solids	Nitrogen				Phosphorus		pH	Conductivity	Chloride	Potassium	Sodium
					Free Ammonia	Total Kjeldahl	Nitrate NO3	Nitrate NO2	Total	Dissolved					
Nov 27, 1994	331	06:30	0.0025	13.4	0.19	0.78	10.6	0.01	0.093	0.010	8.02	756	38.7	3.97	14.4
Nov 27, 1994	331	22:30	0.0135	122.0	0.21	2.1	9.0	0.02	0.385	0.079	7.89	636	36.1	5.76	11.4
Nov 28, 1994	332	04:30	0.0438	132.0	0.30	2.65	6.0	0.02	0.68	0.140	7.60	431	37.7	7.68	13.3
Nov 28, 1994	332	10:30	0.0502	45.8	0.32	2.2	8.2	0.03	0.445	0.125	7.69	464	31.3	10.00	9.7
Nov 28, 1994	332	16:30	0.0264	23.2	0.41	1.42	10.1	0.02	0.27	0.074	7.84	576	36.7	5.83	12.1
Nov 29, 1994	333	01:30	0.0135	22.8	0.19	1.01	11.5	0.02	0.169	0.038	7.94	660	37.6	4.49	12.4
Nov 29, 1994	333	07:30	0.0073	17.2	0.23	0.72	11.7	0.02	0.13	0.034	7.98	690	39.0	4.37	12.2
Dec 16, 1994	350	16:30	0.0091	25.7	0.06	0.85	10.1	0.11	0.073	0.001	8.05	691	35.1	3.25	12.2
Dec 17, 1994	351	01:30	0.1034	317.0	0.05	2.16	6.1	0.02	0.69	0.113	7.72	390	30.0	6.28	12.1
Dec 17, 1994	351	07:30	0.3	124.0	0.07	1.50	4.5	0.02	0.43	0.149	7.52	242	14.2	6.55	5.6
Dec 17, 1994	351	13:30	0.253	59.9	0.07	1.43	6.7	0.02	0.38	0.140	7.68	321	23.7	6.80	7.7
Dec 18, 1994	352	01:30	0.0658	26.1	0.09	1.22	10.5	0.03	0.37	0.190	7.68	457	25.5	6.73	7.9
Dec 18, 1994	352	16:30	0.0438	31.1	0.05	1.01	10.5	0.03	0.23	0.099	7.81	499	23.7	4.40	7.2
Dec 19, 1994	353	04:30	0.032	22.8	0.10	0.96	10.8	0.03	0.15	0.070	7.86	577	26.5	3.91	8.4
Apr 20, 1995	110	15:00	4.5	5	0.14	0.64	6.4	0.02	0.05	0.01	8.41	601	35.4	2.44	14
Apr 21, 1995	111	09:00	41	879	0.16	4.65	4.7	0.04	1.25	0.01	7.73	447	22.5	3.08	8.7
Apr 21, 1995	111	12:00	120	841	0.35	8.03	3.1	0.05	3.05	0.01	7.57	229	8.4	4.32	3.7
Apr 21, 1995	111	15:00	89	341	0.28	6.4	3	0.05	2.48	0.05	7.58	215	6.8	4.84	3
Apr 21, 1995	111	18:00	35	490	0.27	4.35	4.7	0.04	1.45	0.05	7.66	300	11.7	5.37	5.2
Apr 21, 1995	111	ERR	18	307	0.13	2.52	6.1	0.03	0.84	0.07	7.74	383	18.5	5.21	8.2
Apr 22, 1995	112	09:00	13.5	135	0.09	1.75	8.3	0.02	0.54	0.08	7.89	469	21.9	4.39	8.5
Apr 23, 1995	113	09:00	8	17.4	0.06	0.9	8.6	0.02	0.11	0.03	8.15	581	24.1	2.78	9.1
May 10, 1995	130	16:00	0.0001	131.0	0.08	1.75	3.9	0.13	0.39	0.01	7.54	595	32.0	3.42	14.1
May 10, 1995	130	19:00	0.0052	758.0	0.10	4.66	3.4	0.11	1.45	0.01	7.47	377	14.3	2.90	7.3
May 10, 1995	130	22:00	0.0124	373.0	0.62	5.94	3.9	0.13	1.09	0.10	7.43	342	16.7	4.41	8.7
May 11, 1995	131	01:00	0.0073	181.0	0.48	2.08	5.3	0.21	0.60	0.11	7.44	410	19.7	4.60	8.8
May 11, 1995	131	07:00	0.0052	55.9	0.37	1.41	6.9	0.11	0.30	0.08	7.64	509	25.4	4.00	10.0
May 11, 1995	131	22:00	0.0025	26.9	0.20	0.89	8.3	0.07	0.12	0.04	7.86	605	26.6	2.98	10.6

Paired Watershed Study
Kettle Creek C.A. Water Sampling Data
Station: Holtby Drain, (East)
ISCO Samples

Date of Sample	Julian Date	Time	Staff Gauge	Suspended Solids	Nitrogen				Phosphorus		pH	Conductivity	Chloride	Potassium	Sodium
					Free Ammonia	Total Kjeldahl	Nitrate NO3	Nitrate NO2	Total	Dissolved					
Nov 27, 1994	331	16:30	0.0013	12.4	0.35	0.84	3.1	0.02	0.084	0.002	7.78	803	73.4	5.22	13.2
Nov 27, 1994	331	22:30	0.0232	18.8	1.14	+	3.0	0.04	0.336	0.022	7.60	739	52.0	14.30	11.3
Nov 28, 1994	332	04:03	0.0268	52.3	0.74	3.10	2.5	0.04	0.425	0.088	7.53	582	51.5	15.10	9.3
Nov 28, 1994	332	10:30	0.0205	23.6	0.40	2.16	4.4	0.02	0.280	0.104	7.73	547	47.0	12.30	9.1
Nov 28, 1994	332	16:30	0.0142	8.4	0.27	1.38	6.3	0.02	0.185	0.084	7.79	598	52.1	9.62	9.9
Nov 29, 1994	333	01:30	0.008	5.6	0.25	1.06	6.9	0.02	0.127	0.061	7.81	660	53.8	7.16	10.1
Nov 29, 1994	333	07:30	0.006	6.9	0.23	0.88	7.2	0.02	0.117	0.053	7.82	669	47.6	6.50	9.4
Dec 16, 1994	350	16:30	0.0178	3.7	0.15	0.90	5.5	0.03	0.053	0.007	7.94	674	44.1	5.06	8.4
Dec 17, 1994	351	01:30	0.255	102.0	0.92	3.20	5.0	0.04	0.364	0.068	7.70	514	35.6	10.20	7.4
Dec 17, 1994	351	07:30	0.184	209.0	0.51	3.04	4.8	0.04	0.580	0.119	7.61	304	20.8	9.13	4.5
Dec 17, 1994	351	03:30	0.112	51.2	0.59	1.20	6.9	0.03	0.240	0.089	7.64	329	24.2	6.57	4.4
Dec 18, 1994	352	01:30	0.0482	20.8	0.46	1.12	8.7	0.03	0.165	0.065	7.77	415	29.4	5.35	4.6
Dec 18, 1994	352	16:30	0.0394	9.1	0.32	1.27	8.9	0.03	0.126	0.048	7.82	487	32.4	5.50	5.2
Dec 19, 1994	353	04:30	0.0268	8.6	0.15	1.06	9.3	0.01	0.099	0.042	7.81	516	34.9	4.59	5.7
Apr 20, 1995	110	15:00	2.7	6.1	0.46	1.51	3.2	0.02	0.13	0.02	8.21	647	40	5.3	8.6
Apr 21, 1995	111	09:00	110	257	0.73	3.8	2.1	0.04	0.71	0.03	7.72	498	32.3	7.95	8.3
Apr 21, 1995	111	12:00	180	1530	0.3	9.04	2.4	0.04	3.6	0.01	7.61	291	16.6	5.45	4.9
Apr 21, 1995	111	15:00	116	852	0.22	5.37	4.1	0.04	2	0.02	7.59	268	13	5.25	3.9
Apr 21, 1995	111	18:00	56	213	0.27	3.91	6	0.05	1.23	0.02	7.59	325	16.2	5.31	4.4
Apr 21, 1995	111	ERR	32	151	0.27	2.03	7.3	0.04	0.56	3	7.74	410	20.2	4.34	5
Apr 22, 1995	112	09:00	20	105	0.21	1.76	7.6	0.04	0.42	0.03	7.8	462	21.7	4.01	5.4
Apr 23, 1995	113	09:00	7	13.7	0.36	1.26	7.5	0.02	0.15	0.02	7.98	568	28.3	4.3	6.7
May 10, 1995	130	16:00	0.0006	24.8	0.08	1.56	1.2	0.07	0.16	0.01	7.23	597	34.0	6.07	8.9
May 10, 1995	130	19:00	0.0128	90.2	1.22	7.15	0.2	0.27	0.93	0.05	7.26	584	38.8	23.60	11.7
May 10, 1995	130	22:00	0.025	135.0	0.30	2.19	1.4	0.07	0.48	0.05	7.28	447	30.6	9.21	9.2
May 11, 1995	131	01:00	0.0169	66.2	0.20	1.67	2.7	0.08	0.32	0.04	7.38	474	36.0	5.92	13.1
May 11, 1995	131	07:00	0.0112	51.5	0.15	1.21	4.8	0.10	0.24	0.03	7.59	524	32.1	4.98	10.6
May 11, 1995	131	22:00	0.004	20.6	0.08	0.84	5.5	0.08	0.12	0.02	7.74	598	31.6	3.82	8.9

Suspended Solids

Kettle Creek 1994



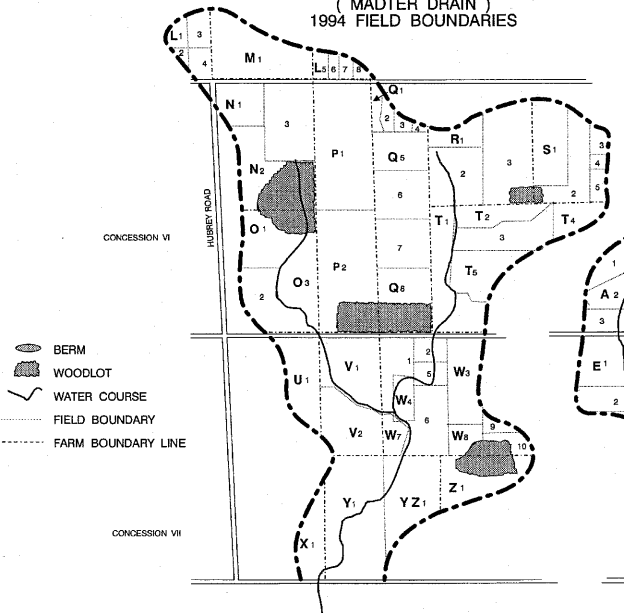
Total Phosphorus

Kettle Creek 1994



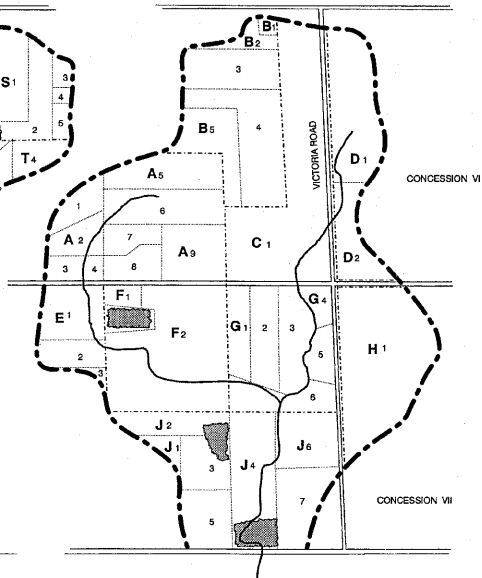
KETTLE CREEK PAIRED WATERSHEDS

WEST PAIRED WATERSHED (MADTER DRAIN) 1994 FIELD BOUNDARIES



KETTLE CREEK PAIRED WATERSHEDS

EAST PAIRED WATERSHED
(HOLTBY DRAIN)
1994 FIELD BOUNDARIES



KETTLE

1994 Field Activities

Western Sub-Basin (Madter Drain)

Land owner	Field #	SIZE (ACRES)	FALL 1993 TILLAGE	SPRING 1994 TILLAGE	CROP
L	1	1.8	No-till	No-till	Corn
	2	3.2	Nothing	Nothing	Hay
	3	14.5	Nothing	Nothing	Pasture
	4	7.0	Nothing	Nothing	Hay
	5	2.8	1 pass soil saved	2 pass cultivate	Corn
	6	2.2	No-till into wheat	Nothing	Winter wheat
	7	3.9	1 pass soil saved	2 pass cultivate	Hay
	8	1.7	Nothing	Nothing	Hay
M	1	40.5	No-till	No-till	Corn
N	1	12.3	Fall mouldboard	3 Pass cultivate	Soybeans
	2	30.8	No-till	No-till	Corn
	3	19.0	No-till	No-till	Soybean
O	1	17.3	No-till	No-till	Soybeans
	2	18.1	Chisel plough into wheat	Nothing	Winter wheat
	3	27.2	Nothing	Nothing	Fallow No crop
P	1	50.9	Fall chisel plough	2 pass cultivate	Sweet corn
	2	44.7	No-till	No-till	Corn
Q	1	3.3	Fall mouldboard	3 pass cultivate	Corn
	2	3.2	Nothing	Nothing	Hay
	3	2.8	N/a	N/a	Non production
	4	1.1	No-till into wheat	Nothing	Winter wheat
	5	17.3	Fall mouldboard	3 pass cultivate	Corn
	6	17.5	No-till	No-till	Soybeans
	7	14.3	No-till into wheat	Nothing	Winter wheat
	8	18.5	No-till	No-till	Corn
R	1	5.1	Fall mouldboard	3 Pass cultivate	Corn
	2	23.2	Nothing	Nothing	Hay
	3	29.7	No-till into wheat	Nothing	Winter wheat
S	1	26.7	No-till	No-till	Soybeans
	2	15.2	No-till	No-till	Corn
	3	3.2	No-till	No-till	Soybeans
	4	1.5	No-till into wheat	Nothing	Winter wheat
	5	.28	Fall mouldboard	2 pass cultivate	Corn
T	1	24.2	No-till	No-till	Corn
	2	12.0	No-till	No-till	Soybeans
	3	15.7	No-till into wheat	No-till	Winter wheat
	4	2.8	No-till	No-till	Soybeans
	5	9.6	No-till	No-till	Soybeans
U	1	15.4	Fall mouldboard	3 pass cultivate	Soybeans

V	1	19.3	Nothing	Nothing	Hay
	2	15.8	No-till	1 pass discs 1 pass packers	Soybeans
W	1	7.7	No-till	No-till	Soybeans
	2	3.6	N/a	N/a	Non production
	3	18.6	No-till	No-till	Soybeans
	4	3.1	No-till	No-till	Soybeans
	5	4.1	No-till	No-till	Corn
	6	14.2	No-till	No-till	Corn
	7	7.2	No-till	No-till	Soybeans
	8	16.3	1 pass soil saved	2 pass cultivate	Corn
	9	5.2	1 pass soil saved	No-till	Soybeans
	10	10.3	1 pass soil saved	2 pass cultivate	Soybeans
X	1	20.0	Fall moldboard	4 pass cultivate	Corn
Y	1	30.8	No-till	No-till	Soybeans
	2	23.4	Fall mouldboard	2 pass cultivate	Soybeans
Z	1	9.8	1 pass soil saved	2 pass cultivate	Corn

KETTLE

1994 Field Boundaries
 Eastern Sub-Basin (Holtby Drain)

Land Owner	Field #	SIZE (ACRES)	FALL 1993 TILLAGE	SPRING 1994 TILLAGE	CROP
A	1	4.9	No-till	No-till	Soybeans
	2	5.9	No-till	No-till	Corn
	3	4.1	No-till	No-till	Soybeans
	4	3.1	No-till	No-till	Soybeans
	5	32.9	No-till	No-till	Soybeans
	6	27.4	No-till into wheat	Nothing	Winter wheat
	7	9.8	No-till	3 pass cultivate	Corn
	8	7.0	Nothing	Nothing	Hay
	9	16.5	No-till	3 pass cultivate	Corn
B	1	3.1	Nothing	Nothing	Hay
	2	7.5	1 pass discs	No-till	Corn
	3	20.2	No-till	No-till	Soybeans
	4	32.6	No-till into wheat	Nothing	Winter wheat
	5	36.1	Fall mouldboard	2 pass cultivate	Corn
C	1	139.0	Fall mouldboard	3 pass cultivate	Soybeans
D	1	43.0	Fall mouldboard	3 pass cultivate	Soybeans
	2	34.3	1 pass cultivate Into wheat	Nothing	Winter wheat
E	1	13.87	No-till	No-till	Soybeans
	2	11.3	1 Pass soil saver	No-till	Soybeans
	3	5.5	1 pass soil saver	2 pass cultivate	Soybeans
F	1	7.8	Nothing	Nothing	Hay
	2	79.3	No-till	No-till	Soybeans
G	1	13.4	Fall mouldboard	2 pass cultivate	Corn
	2	15.7	No-till	No-till	Soybeans
	3	24.1	No-till	No-till	Soybeans
	4	5.6	Fall mouldboard	2 pass cultivate	Corn
	5	8.1	No-till	No-till	Soybeans
	6	8.9	Fall mouldboard	2 pass cultivate	Corn
	7	9.0	Fall mouldboard	2 pass cultivate	Corn
H	1	68.1	Fall mouldboard	2 pass cultivate	Peas
J	1	4.5	Nothing	Nothing	Pasture
	2	11.6	Fall mouldboard	2 pass cultivate	Corn
	3	16.2	Fall mouldboard	2 pass cultivate	Corn
	4	29.7	Nothing	Nothing	Hay
	5	4.2	Nothing	Nothing	Pasture
	6	16.6	Nothing	Nothing	Hay
	7	32.3	Nothing	Nothing	Hay