

**RIDEAU VALLEY
CONSERVATION AUTHORITY**

**CLEAN UP RURAL BEACHES PROGRAM
1995 ANNUAL REPORT**

(April 1, 1995 - March 31, 1996)

YEAR IV

Prepared By: Terry K. Davidson, P.Eng
Peter Van Adrichem

Prepared For: Ontario Ministry of Environment and Energy

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Committee Members:

Bruce Reid, Rideau Valley Conservation Authority

Kirk Hansen, Ministry of Environment and Energy, Ottawa

Steve Clark, Ontario Ministry of Agriculture, Food & Rural Affairs

Michael Payne, Ontario Ministry of Agriculture, Food & Rural Affairs

Jim Craig, Lanark, Leeds and Grenville District Health Unit

Alex Bell, OSCIA, Lanark

Gordon Hill, OSCIA, Carleton

Barry Thompson, OSCIA, Grenville

Terry K. Davidson, Rideau Valley Conservation Authority

Peter Van Adrichem, Rideau Valley Conservation Authority

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EXECUTIVE SUMMARY

The Clean Up Rural Beaches (CURB) Implementation Program is funded by the Ontario Ministry of Environment and Energy, and administered by the Rideau Valley Conservation Authority.

The CURB Program provides financial assistance to farmers to build structures that reduce the potential for livestock wastes to contaminate surface waters. The program also provides financial assistance to rural landowners who repair or rebuild private sewage systems that are impacting local surface water quality. Accordingly, CURB's primary objective is to improve surface water quality and therefore, to clean up rural beaches for recreational purposes.

For the 1995/96 program year, RVCA was allocated \$240,000 for grant assistance. With the assistance of the CURB Review Committee, RVCA approved 100 percent of this allocation for remedial projects.

An intensive promotional campaign was used to advertise the program throughout the watershed, as well as, to educate farmers on the impact livestock operations can have on surface water quality.

Two demonstration sites on local farms were monitored this past year to promote new approaches for agricultural waste management.

The RVCA's water quality monitoring program is continued to measure the results of implementing remedial action projects which reduce bacterial contamination and nutrient loading of surface waters.

The CURB Implementation Program was terminated by MOEE as of March 31, 1996.

RECOMMENDATIONS

The following recommendations will be conveyed to MOEE:

1. RVCA Staff will endeavour to seek out the latest technology used for livestock waste management, and to demonstrate this technology on local farms.
2. RVCA Staff will work with area farmers to develop manure management plans to ensure proper land application.
3. The RVCA will continue to educate landowners to improve their knowledge of how their activities may affect the environment.

INTRODUCTION

The Ontario Ministry of Environment and Energy's CURB Program was delivered in Ontario by Conservation Authorities that have completed a CURB Plan, which outlines the remedial measures required to reduce non-point sources of pollution affecting local surface waters.

The CURB Plans submitted by the Conservation Authorities were developed under the Rural Beaches Program which was funded under the Ontario Ministry of Environment and Energy's Provincial Beaches Management Strategy.

The CURB Implementation Program was delivered by the RVCA over a four year period. Funding was established by the Ministry of Environment and Energy on a year by year basis using the government fiscal year of April 1 to March 31. The delivery of the Clean Up Rural Beaches (CURB) Program in the Rideau Watershed commenced April 1st, 1992, and continued until March 31st, 1996.

The Program focused on the following aspects:

- Emphasis on local surface water quality improvement through improved rural land management practices.
- Extension, Education and Technology Transfer.
- Grants to farmers who build structures which eliminate livestock waste from entering surface waters.
- Grants to rural residents who repair or rebuild a private sewage system which is impacting on surface water quality.
- All proposed projects were reviewed by a CURB Review Committee which was represented by the Conservation Authority, Ontario Ministry of Environment and Energy, Ontario Ministry of Agriculture, Food and Rural Affairs, local Health Units and the Ontario Soil and Crop Improvement Association.

STUDY AREA

The grant assistance was available to rural residents of the Rideau Valley Watershed who are located within the CURB Study Area. (Refer to Figure #1).

The Curb Study Area encompassed the Rideau River from Smiths Falls to Mooney's Bay (Ottawa) and included all tributaries and creeks that discharge into the Rideau within this area. The Tay River, from the outlet of Christie Lake to where it discharges into the Rideau above Smiths Falls, along with its tributaries were also eligible for grant assistance.

GRANT ASSISTANCE

The following grants are available to rural residents who build structures that address non-point sources of surface water pollution.

Section	Eligible items	Grant Rate	Grant Ceiling
A	Private Sewage Systems	50%	\$ 2,000.00
B	Livestock Access Restriction	75%	\$10,000.00
C	Milkhouse Washwater Disposal System	50%	\$ 5,000.00
D	Manure Management	50%	\$12,000.00

1995 CURB PROGRAM

The RVCA was allocated \$240,000 for grant assistance in its fourth year of delivering the CURB Program (April 1/95 - March 31/96).

The RVCA's CURB Review Committee made a concerted attempt to invoke the priority rating system. The number of applications presented at the first local CURB Review Committee dictated that applications be assessed on a priority bases. The rating system is designed to ensure that provincial funds are being spent in accordance with the goals and targets of the program. In other words, projects that have the greatest potential to impact on surface water quality will be funded before low priority projects.

The RVCA's CURB Review Committee approved over 50 projects in the fourth year of the program. Unfortunately, not all 50 projects were completed after receiving approval.

To summarize the 1995/96 CURB Program, the following table has been provided. It is a brief financial breakdown of the total monetary cost involved in the completion of projects, and the related CURB grants that were received by owners.

TABLE #2: CURB PROJECTS '95-'96

Project Description	# Completed	Grant \$	Project \$
Private Sewage Systems	29	55,122.58	188,561.90
Livestock Restrict Access	11	48,731.37	66,758.43
Milkhouse Wash Water Disp.	3	9,226.25	28,100.28
Manure / Barnyard Runoff Storage	4	40,193.84	154,415.60
Total	47	153,274.04	283,575.02

The average cost for projects in each section were then determined from the above table:

Section	Eligible Items	Average Project Cost
A	Private Sewage System	\$6,502
B	Livestock Fencing	\$6,068
C	Milkhouse Washwater	\$9,366
D	Manure Storage	\$38,603

TABLE #3: CURB PROJECTS '94-'95

Section	Number	Project Cost To Owner	Grant To Owner
A	37	\$205,414.85	\$71,719.00
B	14	\$ 68,200.81	\$60,453.30
C	4	\$ 24,925.63	\$15,744.76
D	4	\$ 45,980.38	\$37,060.55
TOTAL	59	\$344,521.67	\$183,977.61

TABLE #4: CURB PROJECTS '93-'94

Section	Number	Project Cost To Owner	Grant To Owner
A	21	\$101,494.15	\$32,394.68
B	20	\$ 85,179.25	\$62,690.38
C	9	\$ 68,105.49	\$27,582.48
D	10	\$205,493.33	\$69,497.39
TOTAL	60	\$336,660.81	\$192,164.93

TABLE #5: CURB PROJECTS '92-'93

Section	Number	Project Cost To Owner	Grant To Owner
A	14	\$ 58,550.00	\$15,901.98
B	17	\$ 47,739.20	\$35,804.41
C	3	\$ 4,067.30	\$ 2,033.65
D	6	\$ 90,732.08	\$36,000.00
TOTAL	49	\$201,088.58	\$89,740.04

TOTAL GRANTS PAID OUT UNDER CURB 1992 TO MARCH 31, 1995 \$543,630.94

Uncertainty in the agricultural industry discourages farmers from participating in the CURB Program. Manure storage facilities and milk house milk house washwater disposal systems are often updated as farmers expand or renovate barn structures. Further program promotion was carried out in order to increase interest and participation. Several fencing and manure storage projects were supported this year. One of the fencing projects is on a creek which has been sampled for water quality for the past 2 years. It will be interesting to monitor improvements in water quality.

Due to high density of residences in the RVCA watershed and water front, private sewage system projects were most common.

DEMONSTRATION PROJECTS

Under CURB demonstration projects, the Rideau Valley Conservation Authority continued to monitor demonstration sites in the 1995/96 program year. One project involved treating barn yard runoff using a constructed wetland. The other involved using a synthetic clay liner in an earthen liquid manure storage pit. The CURB Program provided up to 75 percent funding in the first two years of the Program for demonstration/research projects. Although, these 2 projects were initiated in the second year, they were not completed until the third year. For specific information on these projects they are examined in greater detail in the enclosed appendices. Two fencing projects were installed using solar cells for power source.

EDUCATIONAL AND PROMOTIONAL ACTIVITIES

Promotion and education play an integral role in ensuring the success of a program. As a result, this year's RVCA CURB Program staff embarked on a comprehensive promotional and educational strategy.

Throughout the operation of the 1995 CURB Program, the local media remained an important instrument in ensuring rural residents were aware of the program. A variety of press releases were circulated to a number of prominent newspapers throughout the CURB Study Area.

A concerted effort was made to educate rural residents about the problems associated with leachate produced from septic systems and the availability of grant assistance. Summer students were employed to promote the grant for the septic system upgrade or replacement along the Rideau River between Manotick and Kemptville. Waterfront residents were approached by staff in an effort to make them more aware of the program and problems associated with faulty septic systems. This approach to advertising yielded a number of responses. Promotion for grants pertaining to septic system upgrade and replacement will be continued in 1995.

The Perth and Richmond fairs also served as an important tool in the promotion of the CURB Program. The setting for these events provided an ideal environment for establishing contacts in the rural community. The Authority will continue to attend these events and promote the CURB Program.

The Ottawa Valley Farm Show is another important promotion opportunity for the CURB Program. It provides access to farmers who are interested in new ideas or approaches to agriculture.

In August of 1994, RVCA Staff organized a tour of CURB projects within the watershed. The all day tour had over 70 participants who were interested in new initiatives in agricultural waste management.

WATER QUALITY MONITORING

INTRODUCTION

To monitor the effectiveness of remedial measures undertaken by the implementation of the CURB Program, RVCA is continuing to conduct a water quality sampling program.

The water quality monitoring program consists of sampling for bacteriological concentrations and nutrient loading. Bacteria are microorganisms that are used to determine the safety of water for recreational use in terms of disease prevention. Nutrient concentrations are examined as they cause excessive aquatic plant growth and algae blooms, which results in attendant aesthetic problems, and once this vegetation dies, it contributes to the oxygen depletion of a water.

The following discussion is based on the results of the two initial years of sampling under the Rural Beaches Program and the first three years of sampling under the CURB Program. In summary, samples were taken from the Rideau River, the Jock River, Kemptville Creek, the Tay River, and many other tributaries of the Rideau. In many instances, there were several sampling locations along a creek or tributary, however, the data reported is accounting for the outflow sites ie. the point closest to or furthest downstream where the creek or tributary meets the Rideau River. This is true for both the bacteriological data and nutrient loading analysis.

BACTERIAL ANALYSIS

Evidence of feces from human or animal origin in a water is determined by sampling and testing for pollution indicator bacteria. For the years 1990, 1991, and 1992, fecal coliform was the most common indicator organism used to assess bacterial pollution. The MOEE's recreational water quality guideline was 100 fecal coliform per 100 mL of water. However, in 1993 and 1994, the indicator organism used to evaluate bacterial contamination was switched to *Escherichia coli*, as it was determined that fecal coliform may give a false indication of fecal or sewage present in a water containing cellulose or plant material. The MOEE's Provincial Water Quality guideline for recreational purposes is 100 *E. coli* per 100 mL, based on a geometric mean of at least 5 samples.

In order to compare and evaluate fecal coliform and *E. coli* levels contributing to the Rideau from its tributaries and creeks, refer to Table 2. To review bacteria levels in the Rideau River, a profile from Smiths Falls to Mooney's Bay (Ottawa) has been provided in Figure 2.

TABLE #2: Tabulated geometric means for fecal conform in Rideau River tributaries and creeks

TRIBUTARY NAME	Fecal Coliform Per 100 ml			E. Coli Per 100 ml	
	1990	1991	1992	1993	1994
Jock River	50	310	128	103.1	35.4
Tay River	N/A	513	125	90.0	140.7
Kemptville Creek	76	417	74	62.9	69.5
Mosquito Creek	106	128	67	61.0	66.7
Mud Creek	127	174	178	183.0	74.3
Doyle Creek	460	206	653	84.0	138.8
Steven Creek	35	84	35	30.0	46.0
Cranberry Creek	137	106	26	30.0	NA
Hudson Drain	406	441	251	29.0	160.0
Arcand Drain	95	130	73	31.0	43.8
Murphy Drain	32	83	21	47.0	49.1
Brassils Creek	77	290	97	150.0	93.4
Dales Creek	79	101	55	63.0	132.8
Rideau Creek	50	107	68	59.0	30.9
Barbers Creek	476	336	142	180.0	298.3
Rosedale Creek	316	231	268	230.0	156.5
Irish Creek	14	66	13	31.0	30.0
Otter Creek	28	N/A	N/A	285.0	56.3

Table 2 indicates that the majority of the tributaries have at some point over the sampling years had elevated bacterial levels that exceed the guideline.

In summary figure 2 illustrates that the Rideau River is safe for water-based recreation along the entire study area, however, bacteria levels close to the river's banks and near the confluence of its tributaries may be greater than the MOEE guideline.

NUTRIENT ANALYSIS

Although nitrogen and potassium are required plant nutrients, phosphorus is considered the limiting reagent causing excess plant growth, and consequently eutrophication. As a result, total phosphorus concentrations are reported for the Rideau River (see figure #3) and a yearly comparison of total phosphorus levels found in the tributaries and creeks (refer to table #3).

Although current scientific evidence is insufficient to develop a firm Water Quality Objective for total phosphorus concentrations, the MOEE states that the general guideline for the elimination of excessive plant growth in rivers and streams should be below 0.03 mg/L. However, this value should be supplemented by site-specific studies.

TABLE #3: Calculated arithmetic means for total phosphorus concentrations in Rideau River tributaries and creeks.

Tributary Name	Arithmetic Mean Total Phosphorus Per 100 ml				
	1990	1991	1992	1993	1994
Jock River	0.048	0.053	0.046	0.042	0.05
Tay River	N/A	0.025	0.022	0.022	0.022
Kemptville Creek	0.021	0.106	0.018	0.018	0.021
Mosquito Creek	0.092	0.105	0.111	0.083	0.12
Mud Creek	0.063	0.043	0.052	0.058	0.08
Doyle Creek	0.348	0.915	0.197	0.098	N/A
Steven Creek	0.038	0.059	0.049	0.043	N/A
Cranberry Creek	0.056	0.062	0.057	0.055	N/A
Hudson Drain	0.826	0.239	0.074	0.022	18.22
Arcand Drain	0.471	0.359	N/A	0.724	N/A
Murphy Drain	0.050	0.066	0.057	0.030	N/A
Brassils Creek	0.062	0.014	N/A	0.015	0.014
Dales Creek	0.030	0.059	0.025	0.024	N/A
Rideau Creek	0.027	0.081	0.026	0.023	N/A
Barbers Creek	0.083	0.130	0.042	0.121	0.066
Rosedale Creek	0.036	0.068	N/A	0.035	0.028
Irish Creek	0.018	0.013	0.013	0.019	0.019
Otter Creek	0.057	N/A	N/A	0.071	N/A

In short, both Table 3 and Figure 3, indicate that total phosphorus concentrations in the Rideau River and many of its tributaries have exceeded the MOEE guideline. This sampling data supports the idea that the Rideau River may be classified as eutrophic due to excessive nutrient loading.

CONCLUSIONS

The third year of delivering the CURB Implementation Program in the Rideau Valley was considered very successful.

With the delivery and promotion of the program, along with the continued water quality monitoring, the following results are presented.

1. The Rideau River from Kilmarnock to Mooney's Bay in the centre channel only had geometric mean *E. coli* concentrations below the MOEE recreational guidelines of 100 FC/100 ml. There are numerous tributary mixing zones and isolated sources of pollution along this reach causing elevated fecal coliform bacteria levels which exceed the recreational guideline.
2. The majority of the tributaries within the study area have fecal coliform levels above the MOEE guideline.
3. The Rideau River within the study area in most cases exceeds the total phosphorus objective of 0.03mg/L, accounting for large algae blooms and excessive aquatic weed growth.
4. The majority of tributaries within the study area have total phosphorus levels exceeding the MOEE objective.
5. Economic restraints in the agricultural community/environment is reflected upon the CURB demand for funding of manure storages. This may be attributed to the large capital costs associated with such structures.
6. Due to an increased awareness of the CURB program, Section A - septic system has seen a greater utilization of the program.

References

1. Michael Michalski Associates and Anthony Usher Planning Consultant. Rideau Lakes Basin Carrying Capacities and Proposed Shoreland Development Policies February 1992, Prepared for Rideau Valley Conservation Authority.
2. Rideau Valley Conservation Authority 1990 Water Quality Study. Manotick, Ontario.
3. Rideau Valley Conservation Authority. CURB PLAN - Rideau River. 1991. Manotick, Ontario.
4. Rideau Valley Conservation Authority CURB - 1992 ANNUAL REPORT. Manotick, Ontario.
5. Rideau Valley Conservation Authority CURB - 1993 ANNUAL REPORT. Manotick, Ontario.
6. Rideau Valley Conservation Authority Rideau Inquirer. July 1992, Manotick, Ontario

APPENDIX

CONSTRUCTED WETLAND FOR MANURE RUNOFF TREATMENT	A1 -A3
MANURE STORAGE USING A GEOSYNTHETIC CLAY LINER (GCL)	B 1

CONSTRUCTED WETLAND FOR MANURE RUNOFF TREATMENT

INTRODUCTION

The impact of agricultural runoff from barnyards and manure stacks on surface water quality is an important waste management issue for farmers. In today's society environmental degradation is no longer being tolerated and the protection and enhancement of water quality is on everyone's agenda.

To achieve an environmentally acceptable solution for livestock waste management, farmers must assess the best management practice available to them that would be suitable for their operation. An acceptable livestock waste management plan will take into consideration the storage and land application of manure, how liquid runoff from barnyards generated by precipitation is handled, and the disposal of milkhouse wastewater.

In recent years in Ontario, acceptable manure storage systems have been designed for either solid, semi-solid or liquid manure.

Solid systems have consisted of concrete pads with runoff containment pits. Recently, solid manure storage systems have incorporated a roof structure that excludes precipitation from falling on the manure stack, however separate runoff pits are required for the barnyard runoff. Semi-solid and liquid storages have consisted of earthen lagoons, concrete tanks or above ground prefabricated steel tanks that are capable of containing the manure and all contaminated runoff from barnyards and milkhouse wastewater.

A constructed wetland may be used to replace a runoff containment pit on a livestock farm using a solid manure system and at the same time eliminate the need for land application.

This report provides a detailed description of the design and the proposed monitoring strategy for the constructed wetland for manure runoff treatment located on the Rideau Angus Farm.

BACKGROUND INFORMATION

Constructed Wetlands are man-made systems that are designed, built and operated to emulate natural wetlands or functions of natural wetlands for human desires and needs (Hammer).

Constructed Wetlands consist of sites that have been modified to create poorly drained soils and wetland flora and fauna for the primary purpose of contaminant or pollutant removal from wastewater (Hammer).

Constructed Wetlands have been used in the United States to treat wastewater from urban, industrial and agricultural sites for the past 20 years (Hammer).

The major components of wetlands that influence the treatment of wastewater are; vegetation, soil/substrate, microbial populations and water depth. The role of vegetation in the purification process is to assist in nutrient uptake, provide additional environments for microbial populations, obstruct flow to facilitate sedimentation, provide reactive surface area for microbes and to transfer oxygen from the atmosphere to the root zone creating an aerobic environment in the saturated soil zone.

Wetlands can reduce the concentration of nitrogen and phosphorus, reduce the pathogens, suspended solids, and the high level of biochemical oxygen demand. The functions that accomplish the removal of the above mentioned constituents are present in Table #1.

CONSTITUENTS REMOVAL MECHANISMS

Suspended Solids	Sedimentation/filtration
BOD _s	Microbial degradation (aerobic and Anaerobic)
	Sedimentation (accumulation of organic matter/sludge on the sediment surface)
Nitrogen	Ammonification followed by microbial nitrification and denitrification
	Plant uptake
	Ammonia volatilization
Phosphorous	Soil sorption (adsorption-precipitation reactions with aluminum, iron, calcium, and clay minerals in the soil)
	Plant uptake
	(Phosphine production)
Pathogens	Sedimentation/filtration
	Natural die-off
	UV radiation
	Excretion of antibiotics from roots of macrophytes

From Watson, J.T., S.C. Reed, R.H. Kadlec, R.L. Knight, and A.E. Whitehouse. *Constructed Wetlands for Wastewater Treatment*. D.A. Hammer, Ed. 319, 1989. With modifications

Constructed Wetlands therefore, may provide a low-cost control for manure runoff treatment for livestock farmers.

SITE DESCRIPTION

The Constructed Wetland designed and monitored by the Rideau Valley Conservation Authority is located in Rideau Township in the Regional Municipality of Ottawa-Carleton. This wetland is located on a cow-calf operation adjacent to the Rideau River. The "Rideau Angus Farm" is owned and operated by Jim and Gwen Peaker & Family. The Peakers maintain approximately 30 head of registered Angus cows for breeding purposes.

The farmstead previously consisted of a concrete barnyard for feeding and preparing cattle for showing purposes and breeding. Manure was scrapped to one corner of the concrete yard until an appropriate spreading time. The farm operation also consisted of an exercise area or loafing area for feeding and calving in the late winter. All runoff generated from precipitation flowed towards the Rideau River.

WETLAND DESIGN

A Constructed Wetland can provide substantial improvements in water quality and quantity. The water purification process is a function of vegetation, water column, substrate, and microbial populations (Hammer).

The wetland design/system consists of the following components:

- First: A Sediment Basin which allows removal of large sediments and acts as storage facility during the winter. The Sediment Basin protects the other components from sediment overload and thus reduces their maintenance requirement. The Sediment Basin was constructed with gentle slopes to facilitate sediment removal on a routine basis with a farm tractor equipped with a front-end loader.
- Second: A Marsh Cell designed to remove organic material, suspended solids and pathogens. The Marsh is design to be shallow and vegetated with cattails (*Typha*), bulrushes (*Scirpus validus*), and reeds (*Phragmites*).
- Third: A Pond designed to further reduce BOD and for nitrification and denitrification. The Pond has depths ranging from 0.3 metres to 2.5 metres. Vegetation will vary from duckweed (*Lemna*) on the surface of the pond to submerged pondweeds.

The outlet of the Sediment Basin consists of a submersible pump located in a concrete catchbasin. This pump is controlled by a 1 hour timer which allows the operator to choose a minimum pump run time of 30 seconds and allows increases in 30 second intervals. Also, there is an emergency overflow spillway from the Sediment Basin to the Marsh Cell.

The outlet control structure to maintain water levels in the marsh cell consists of a water level control structure which allows adjustments by 5 inches or 7 inches.

To prevent the Marsh Cell from drying up in the summer a submersible pump was installed in the Pond to transfer water from the Pond to the inlet of the Marsh Cell. This water pump will also assist in evaporation by recirculating the water from the Pond to the Marsh Cell. A Pond aerator will be used to encourage evaporation and to promote bacterial die-off by exposing more bacteria to sunlight.

MANURE STORAGE USING A GEOSYNTHETIC CLAY LINER

The Geosynthetic Clay Lined Manure Storage illustrates a viable alternative to the use of concrete if the native soils do not meet the following provincial guidelines for an earthen manure storage:

- the natural clay content of the soil must be greater than 15 %; (infiltration rate should not be greater than 10^{-9} m/s)
- the normal water table should be below the floor elevation of the storage;
- the floor of the storage should be at least 3 feet above bedrock.

DESIGN INFORMATION

This system included the installation of a manure transfer pump and a Geosynthetic Clay Lined Manure Storage.

The Geosynthetic Clay Lined Manure Storage is required because the native soils do not meet the provincial guidelines. (Refer to the above.)

The Rideau Valley Conservation Authority in consultation with the engineering firm Water And Earth Science Associates LTD. has determined that "CLAYMAX 200R" (GCL) will meet the CURB guidelines. The product was purchased from ARMTEC CONSTRUCTION PRODUCTS.

CLAYMAX LINER INFORMATION

The CLAYMAX liner is composed of sodium bentonite clay laminated between two geotextiles. This product and similar products are designed for fast, easy installation with minimal manpower, equipment and site preparation requirements.

After the CLAYMAX is installed and the protective cover material is in place, hydration with fresh water causes the liner to swell, forming tight seams at the lap joints, and filling voids

and irregularities in the installation. This hydration process results in a strong barrier system which is highly impermeable to liquids.

ECONOMIC ADVANTAGES

It has not been determined if a Geosynthetic Clay Lined Manure Storage possesses any economic advantages over a concrete manure storage. It was anticipated that there may be a cost savings due to the fact that the liner can be installed by the farmer with limited supervision.

PROVINCIAL WATER QUALITY MONITORING NETWORK ANALYSIS RESULTS FOR 1985 TO 1994 AT KILMARNOCK AND NICHOLSONS LOCKS

SOURCES OF POLLUTION

There are numerous potential sources of bacterial pollution and nutrient loading, most of which exist within the study area. A brief description of sources is provided:

Urban Stormwater Runoff

Stormwater runoff from urban/residential areas containing bacteria from domestic pets and urban wildlife; nutrients from lawn fertilizers; road de-icing sand/salt mixtures; and a variety of other pollutants eventually find their way into watercourses.

Livestock Access

When livestock defecate into the watercourse, bacteria and nutrients are input directly into the river system.

Manure Storage Facilities

Inadequate livestock manure storage allows runoff to transport bacteria and nutrients to the watercourse.

Manure Management

Spreading manure at the wrong time of the year, along with excessive application rates, allow runoff to transport bacteria and nutrients to the watercourse.

Milkhouse Wastewater Disposal

The detergents used for cleaning pipeline milking systems contain large concentrations of phosphorus, that, if not properly disposed of, enter the watercourse.

Private Septic Systems

Improperly designed or faulty septic systems, located within 300 - 400 in of the watercourse, can allow leakage of bacteria and nutrients into the river system.

Agricultural Runoff

Agricultural runoff carries nutrients, bacteria, pesticides, and soil particles from agricultural operations.

Pets and Wildlife

Animals in urban areas, including seagulls, pigeons, dogs and raccoons, can cause bacterial problems at local beaches.

OTHER

- Municipal Sewage Treatment Plants
- Industrial Effluent
- Illegal Dumping/Spills
- Atmospheric Fallout

BACTERIAL INDICATORS

Pathogenic (harmful) and non-pathogenic "indicator" bacteria, commonly found in the presence of other disease-causing bacteria from animal and human feces, are analyzed for their concentrations in water samples. Fecal coliforms and *Escherichia coli* are examples of indicator bacteria.

For the past in Ontario, the Provincial Water Quality Guideline for bacterial concentrations has been 100 fecal coliforms per 100 mL of water, for recreational water use. During the summer

of 1992, the Provincial Guideline was changed to 100 *E. coli* per 100 mL. *E. coli* was selected for the guideline because studies have determined that, among bacteria of the coliform group, *E. coli* is the most suitable and specific indicator of fecal contamination (Ontario Ministry of Environment and Energy, 1994). *E. coli* represents a subset of fecal coliforms; it is used to indicate feces, since its primary natural environment is the gastro-intestinal tract of humans and other mammals, and can survive in watercourses for a period of time. **The contamination must be from a combination of failed septic systems, poor manure storage facilities or poor manure spreading and management practices in the watershed.** See graph of Fecal Coliform for contamination levels between 1985 and 1994.

CHEMICAL VARIABLES

Perhaps one of the greatest threats to the natural aging process of a water body is an increase in the supply of nutrients, particularly phosphorus and nitrogen (phosphorus is considered the primary limiting nutrient to plant growth). In nature, rivers age from a young, nutrient-poor and unproductive state to an old, nutrient-rich and highly productive state. This process is referred to as eutrophication. Without human input this process takes many thousands of years. Human-based development of any kind causes rivers and lakes to age much faster than pristine watersheds. Excessive levels of phosphorus and nitrogen cause drastically increased populations of aquatic plants and algae during the summer. The algae form floating mats, also called "blooms". When the algae die, their decomposition places a greatly increased biological oxygen demand (BOD) on the river, and the attendant reduction in dissolved oxygen content may compromise other aquatic life. At the same time, the accumulation of organic matter accelerates the natural aging of the river through depositional filling.

A Water Quality Objective is defined as a numerical concentration or narrative statement which has been established to support and protect the designated uses of water at a specified site (MOEE, 1994).

TOTAL PHOSPHORUS

Total phosphorus measures both soluble and particulate forms of phosphorous. Excessive concentrations of this nutrient encourages overabundant algal and plant growth, leading to eutrophication. Some of the most common sources of phosphorus include manure runoff, treated sewage, milkhouse wastewater, industrial cleaners and household detergents, and fertilizers from direct runoff or soil erosion. Although the MOEE has no firm objectives for total phosphorus, a general guideline for the prevention of excessive plant growth in rivers and streams is a total phosphorus concentration below 0.030 mg/L.

Concentrations below 0.03 mg/L should reduce excessive plant and algae growth. Greater reduction in plant growth can be achieved at levels below 0.02 mg/L.

Common sources of phosphorous include manure runoff, treated sewage from municipal sewage treatment plants, milkhouse wash water, detergents, fertilizers and soil erosion. Water sample results indicate heavy loadings of phosphorous at most locations. See graph for phosphorus loadings 1985 to 1994.

TOTAL KJELDAHL NITROGEN

TKN is used as a water quality indicator, it may contribute to the overall abundance of nutrients in water and thus eutrophication. MOEE has no guidelines for Total Kjeldahl Nitrogen but some samples were exhibiting high rates. TKN can enter streams from sources as fertilizers, pesticides and fecal material. See graph for total nitrogen loadings, 1985 to 1994.

BIOCHEMICAL OXYGEN DEMAND

BOD₅ is the amount of oxygen required over a 5 day period to oxidize the organic matter in a water sample by aerobic microbial decomposition to a stable inorganic form. This is a sensitive test to determine loadings of nitrogenous organic matter such as sewage, farm drainage, dairy wastes, and food processing wastes. BOD loadings can depress dissolved oxygen to levels which affect aquatic organisms, thus the food chain. See graph for total biochemical oxygen demand from 1985 to 1994.

**RIDEAU VALLEY CONSERVATION AUTHORITY
CLEAN UP RURAL BEACHES (CURB)
PROGRAM ACTIVITY 1992 TO 1995**

	Number of Projects	Grant \$	Land Owner Contribution
Lower Board Projects	110	273,756.90	476,116.44
Mid Board Projects	34	167,048.59	214,401.79
Upper Board Projects	29	66,709.39	165,174.21
TOTAL RVCA	173	507,514.88	855,692.44
TOTAL COST OF ENVIRONMENTAL PROJECTS:		\$1,363,207.30	
			Total costs

**RIDEAU VALLEY CONSERVATION AUTHORITY
CLEAN UP RURAL BEACHES (CURB)
PROGRAM ACTIVITY 1992 TO 1995**

REGIONAL MUNICIPALITY OF OTTAWA-CARLETON
TOWNSHIPS OF RIDEAU, GOULBOURN, OSGOODE, NEPEAN, AND GLOUCESTER

1992 #App --Approved # Com = Completed Projects

Project Description	# App	# Com	Grant \$	Project \$
Private Sewage Systems	7	7	14,000.00	62,908.53
Livestock Restrict Access	3	2	9,455.94	12,606.58
Milkhouse Wash Water Disp.	2	2	6,402.53	10,567.30
Manure / Barnyard Runoff Storage	2	1	12,000.00	32,096.00
Total	14	12	41,858.47	118,178.41

1993

Project Description	# App	# Com	Grant \$	Project \$
Private Sewage Systems	7	7	13,748.91	37,219.18
Livestock Restrict Access	7	5	10,047.25	13,396.33
Milkhouse Wash Water Disp.	2	0		
Manure / Barnyard Runoff Storage	3	2	15,226.74	40,109.52
Total	19	14	39,022.90	90,725.03

1994

Project Description	# App	# Com	Grant \$	Project \$
Private Sewage Systems	33	29	55,853.00	157,641.10
Livestock Restrict Access	8	4	10,689.03	14,222.03
Milkhouse Wash Water Disp.	2	2	7,000.00	15,490.95
Manure / Barnyard Runoff Storage	2	3	12,503.50	29,904.32
Total	45	38	86,045.53	217,258.40

**LOWER BOARD
1995 ESTIMATED**

Project Description	# App	# Com	Grant \$	Project \$
Private Sewage Systems	19		36,200	154,311
Livestock Restrict Access	6		22,130	29,513
Milkhouse Wash Water Disp.	4		12,500	27,887
Manure / Barnyard Runoff Storage	3		36,000	112,000
Total	32		106,830	323,711

CURB PROJECTS'92-'95	110		273,756.90	749,873.34
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MID BOARD 1992 # App = Approved # Com = Completed Projects

Project Description	# App	# Com	Grant \$	Project \$
Private Sewage Systems	2	2	4,000.00	8,579.26
Livestock Restrict Access	3	3	9,062.87	12,083.82
Milkhouse Wash Water Disp.	1	1	4,836.00	9,672.00
Manure / Barnyard Runoff Storage	2	2	24,000.00	58,636.08
Total	8	8	37,898.87	88,971.16

1993

Project Description	# App	# Com	Grant \$	Project \$
Private Sewage Systems	2	2	3,645.09	9,246.43
Livestock Restrict Access	1	1	2,419.46	3,225.95
Milkhouse Wash Water Disp.	3	3	13,377.60	34,377.64
Manure / Barnyard Runoff Storage	2	2	24,000.00	82,867.29
Total	8	8	43,442.15	129,717.31

1994

Project Description	# App	# Com	Grant \$	Project \$
Private Sewage Systems	2	2	4,000.00	9,127.85
Livestock Restrict Access	5	5	29,444.31	39,866.33
Milkhouse Wash Water Disp.	1	1	4,456.26	5,941.68
Manure / Barnyard Runoff Storage	1	1	12,057.00	16,076.06
Total	9	9	49,957.57	71,011.92

MID BOARD**1995 - ESTIMATED**

Project Description	# App	# Com	Grant \$	Project \$
Private Sewage Systems	6		12,000	41,925
Livestock Restrict Access	3		23,750	49,825
Milkhouse Wash Water Disp.	0			
Manure / Barnyard Runoff Storage	0			
Total	9		35,750	91,750

CURB PROJECTS'92-'95	34		167,048.59	381,450.38
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UPPER BOARD 1992

App = Approved # Com = Completed Projects

Project Description	# App	# Com	Grant \$	Project \$
Private Sewage Systems	3	3	5,910.21	12,873.67
Livestock Restrict Access	3	3	13,461.47	17,948.63
Milkhouse Wash Water Disp.	0	0		
Manure / Barnyard Runoff Storage	0	0		
Total	6	6	19,371.68	30,822.30

1993

Project Description	# App	# Com	Grant \$	Project \$
Private Sewage Systems	3	3	5,000.68	10,397.34
Livestock Restrict Access	5	5	32,994.13	44,546.93
Milkhouse Wash Water Disp.	1	1	5,000.00	15,318.55
Manure / Barnyard Runoff Storage	1	1	12,000.00	45,955.65
Total	10	10	54,994.81	116,218.47

1994

Project Description	# App	# Com	Grant \$	Project \$
Private Sewage Systems	4	4	7,887.50	26,806.00
Livestock Restrict Access	4	4	16,330.40	22,305.83
Milkhouse Wash Water Disp.	0			
Manure / Barnyard Runoff Storage	0			
Total	8	8	24,217.90	49,111.83

UPPER BOARD 1995 ESTIMATED

Project Description	# App	#Com	Grant\$	Project\$
Private Sewage Systems	2		4,000	10,231
Livestock Restrict Access	3		19,125	25,500
Milkhouse Wash Water Disp. Manure / Barnyard Runoff Storage				
Total	5		23,125	35,731
CURB PROJECTS'92-'95	29		66,709.39	231,883.60

**RIDEAU VALLEY CONSERVATION AUTHORITY
CLEAN UP RURAL BEACHES PROGRAM
1992 - 1995
TOWNSHIP SUMMARY**

TOWNSHIP	SECTION	NUMBER	PROJECT COST	GRANT PAID
Nepean	Septic	9	76,045.53	18,000.00
	Fencing	4	10,119.68	5,901.55
	Milkhouse	0		
	Manure	2	34,663.04	12,503.50
	Total	15	120,828.25	36,405.05

TOWNSHIP	SECTION	NUMBER	PROJECT COST	GRANT PAID
Rideau	Septic	38	181,967.57	50,503.00
	Fencing	6	15,244.85	9,536.89
	Milkhouse	4	22,584.00	11,251.00
	Manure	2	14,814.35	9,497.39
	Total	49	234,610.77	80,788.28

TOWNSHIP	SECTION	NUMBER	PROJECT COST	GRANT PAID
Goulbourn Milkhouse	Septic	1	4,979.00	2,000.00
	Fencing	5	13,769.88	10,327.42
		2	30,054.73	10,000.00
	Manure	2	84,817.91	24,000.00
	Total	10	133,621.52	46,327.42

TOWNSHIP	SECTION	NUMBER	PROJECT COST	GRANT PAID
Osgoode	Septic	10	51,164.70	19,098.91
	Fencing	0		
	Milkhouse	1	4,067.30	2,033.65
	Manure	2	74,522.93	24,000.00
	Total	13	129,754.93	45,132.56

TOWNSHIP	SECTION	NUMBER	PROJECT COST	GRANT PAID
Wolford	Septic	0		
	Fencing	5	58,690.58	42,375.00
	Milkhouse	2	21,279.78	9,456.26
	Manure	3	88,076.05	36,057.00
	Total	10	168,046.41	87,888.26

TOWNSHIP	SECTION	NUMBER	PROJECT COST	GRANT PAID
N. Elmsley	Septic	1	4,441.08	2,000.00
	Fencing	4	37,922.43	28,434.73
	Milkhouse	1	15,318.55	5,000.00
	Manure	1	45,955.65	12,000.00
	Total	7	103,637.71	47,434.73

TOWNSHIP	SECTION	NUMBER	PROJECT COST	GRANT PAID
Bathurst	Septic	9	36,165.94	16,798.39
	Fencing	7	33,143.18	24,482.90
	Milkhouse	0		
	Manure	1	8,387.68	4,193.84
	Total	17	77,696.80	45,475.13

TOWNSHIP	SECTION	NUMBER	PROJECT COST	GRANT PAID
Gloucester	Septic	5	37,440.00	10,000.00
	Fencing	1	11,783.58	8,837.69
	Milkhouse	1	8,577.00	4,288.50
	Manure	0		
	Total	7	57,800.58	23,126.19

TOWNSHIP	SECTION	NUMBER	PROJECT COST	GRANT PAID
S. Gower	Septic	3	11,233.54	5,616.77
	Fencing	0		
	Milkhouse	0		
	Manure	0		
	Total	3	11,233.54	5,616.77

TOWNSHIP	SECTION	NUMBER	PROJECT COST	GRANT PAID
Elizabethtown	Septic	0		
	Fencing	0		
	Milkhouse	1	12,284.34	5,000.00
	Manure	1	36,852.99	12,000.00
	Total	2	49,137.33	17,000.00

TOWNSHIP	SECTION	NUMBER	PROJECT COST	GRANT PAID
Kitley	Septic	0		
	Fencing	2	7,492.60	5,619.45
	Milkhouse	1	9,672.00	4,836.00
	Manure	0		
	Total	3	17,164.60	10,455.45

TOWNSHIP	SECTION	NUMBER	PROJECT COST	GRANT PAID
Montague	Septic	4	19,084.10	8,000.00
	Fencing	1	3,225.95	2,419.46
	Milkhouse	0		
	Manure	0		
	Total	5	22,310.05	10,419.46

TOWNSHIP	SECTION	NUMBER	PROJECT COST	GRANT PAID
Beckwith	Septic	1	4,173.00	2,000.00
	Fencing	1	9,058.15	6,793.61
	Milkhouse	1	6,755.20	3,377.60
	Manure	0		
	Total	3	19,953.35	12,171.21

TOWNSHIP	SECTION	NUMBER	PROJECT COST	GRANT PAID
S. Elmsley	Septic	1	14,531.00	2,000.00
	Fencing	4	33,222.05	24,483.13
	Milkhouse	0		
	Manure	1	47,680.40	12,000.00
	Total	6	95,433.45	38,483.13

TOWNSHIP	SECTION	NUMBER	PROJECT COST	GRANT PAID
N. Burgess	Septic	1	4,197.64	2,000.00
	Fencing	1	3,500.00	2,625.00
	Milkhouse	0		
	Manure	0		
	Total	2	7,697.64	4,625.00

Augusta, Drummond, Mountain, Bastard = no projects

Cattle Restriction From Watercourses:

# Livestock Access Projects Approved:	1992 = 8	\$42,637
	1993 = 11	\$61,396
	1994 = 13	\$76,393
	1995 = 12	\$104,838

75% are on creeks/ natural streams and remainder on municipal drains.

60% fences are permanent page wire fences, 20% are high tensile and 20% are electric depending upon the situation of flooding or straightness of fence. More difficult to build winding high tensile and page wire because of corner posts and brace posts, plus added labour.

Current grant amount is probably adequate since each property is eligible for a grant rather than on a land owner basis. 75% grant is good since a lower rate would probably not be sufficient to encourage fence installations. Reliable water source is the greatest concern for the land owner - in dry summers, a small stream may go low and nearly dry and the farmer's pumping system may not work then. Thus well drilling should still be an eligible item in the need can be shown.

Buffer strips are recommended to be 8 to 20 feet from stream or ditch, but a few farmers prefer building somewhat closer in fear of losing too much land. Buffer strip should also enhance the appearance of the property to increase participation by landowners.

Two projects we installed a solar panel to collect energy to run the pump from a remote lake and a remote river up to the pasture.

Cattle Watering Behaviour Study

The project was to develop a low cost solution for watering cattle and to minimize environmental impact from cattle access to the Rideau River.

The water pumping station was installed in mid summer. The water tank and water level switch was situated on the river bank about 25 feet above the water level; the pump was placed mid-way down the bank and a foot valve was installed. Pumping problems ensued which resulted in moving the pump about 1.5 m above water level but yet not below the flood line. The pump was powered by 2 solar cells and a back-up 12 volt battery. By late summer a fence had been installed for the most of the length of waterfront. Data was collected by metering and sensory equipment and downloaded onto a portable computer.

We hypothesized that cattle would prefer to drink out of the water tank rather than wading

into mud and water to drink directly from the river. Water quality of the later would be degraded by "the early arrivals" stirring up mud from the bottom and defecating and urinating directly into the water.

It was observed that cattle tend to roam and pasture across the field as a group.

Preliminary data indicate that the dairy heifers did not have a strong preference for drinking water from the water tank rather than drinking directly from the river. Unfortunately, a complete data set could not be collected but it seems that the cattle drank water from the nearest site depending upon their location. The cattle did not seem to have preference according to immediate environment such as footing nor water quality.

If the cattle had shown a very strong preference to drinking from the water tank, then the necessity of a fence would be greatly reduced and water quality issue would have been reduced.