MOE / UTRCA Agriculture Waste Management Program

1989 Final Report

April, 1990

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Executive Summary

Objectives and Findings

1.1 Continue to monitor background and runoff event conditions in the Kintore Creek east and west sub-basins.

- routine sampling of the east and west sub-basins took place from March 13 through to February 22.
- a total of 42 sample runs were carried out at the 7 sampling stations.
- 14 storm event days were sampled at intervals throughout the day using the ISCO automatic samplers.
- samples were analysed at the MOE Regional laboratory in London.

1.2 Provide an interim report on the effects of soil conservation practices on sub-watershed water quality.

- a report was prepared entitled "A Water Quality Assessment of the Demonstration and Control Sub watersheds of the Kintore Creek Study Area 1985-1988."
- Due to the lack of average runoff conditions since 1987, it has not been possible to assess the impact of conservation tillage measures during average conditions.
- among the recommendations is a call for continued funding of the project for at least two, average precipitation years.

1.3 Provide laboratory support costs for water sample analysis.

- the Regional laboratory was provided with a person to assist with sample analysis.
- a total of 14,000 samples were analysed.

1.4 Initiate a study in cooperation with the Oxford County Health Unit to determine the extent and impact of unacceptable private septic systems within a rural geographical area of the Pittock Reservoir watershed.

(a) 1989 septic surveys:

- 196 residences in Hickson and surrounding area were surveyed.
- approximately 25% of the homes have improper grey waste disposal methods.
- older systems had a greater tendency to be impaired.

(b) Havelock Drain Study:

- bacteria levels at Pittock Lake's main beach were found to reflect bacteria levels in the adjacent Havelock Drain.
- septic surveys completed in 1984 and 1987 identified a number of faulty systems, most of which are now corrected.
- water quality at the main beach has been improving and further remedial work along the Havelock Drain should continue this trend.
- it is recommended that further septic studies be carried out in the area upstream of Havelock Corners.

1.5 Research, develop and install an alternate, low cost milkhouse washwater treatment method in the Pittock Reservoir, Sub-basin #2 study area.

- authority staff have researched and designed an above ground filtering method of treatment based on a switch-back waterway design.
- plans for a 1989 installation had to be postponed as the participating dairy operator chose to store his milkhouse washwater in a newly enlarged runoff tank.
- steps will be taken in the spring of 1990 to have the system installed and monitored at one of several interested dairy operations.

1.6 Undertake a literature review on the effects of livestock access to streams on herd health and/ or production.

- the literature available cites many isolated cases of illness in livestock caused by disease organisms in stream water.
- waterborne diseases caused by bacteria, viruses, toxic algae, funguses, parasites, and various chemicals are all identified.
- further research is required to quantify the cost of this problem for both the cattle industry and the environment.

1.0 Kintore Creek Monitoring

Routine sampling of the Kintore Creek east and west sub-basins took place from March 13 through to February 22 (Figure 1). 42 background sample runs were carried out. The total number of water samples collected at the 7 sampling stations was 294. At the MOE laboratory, these samples were analysed for Total Phosphorus, Suspended Solids, four forms of Nitrogen, pH, Conductivity, and Soluble Reactive Phosphorus. The SRP samples were field filtered before being analysed at the laboratory. Results of the routine sampling program are presented in Tables 1 to 7.

In addition to the background samples collected, nine runoff events were monitored by the ISCO automatic samplers located at the two sub-watershed outlets. The samplers were activated by depth level actuators to collect water throughout the storm hydrograph. These samples were analysed for Total Phosphorus and Suspended Solids. The data is summarized in Tables 8 and 9.

2.0 Summary and Recommendations from "A Water Quality Assessment of the Demonstration and Control Subwatersheds of the Kintore Greek Study Area : 1985 - 1988

Summary

Since 1984, Kintore Creek has been monitored for flow, sediment and phosphorus concentrations. The two large western and eastern sub-basins were established as respectively demonstration and control subwatersheds to measure conservation tillage impacts.

In 1985, prior to implementation, the demonstration and control subwatersheds delivered respectively 4.9 tonnes/ha/yr and 7.9 tonnes/ha/yr of sediment to the outlets. These estimates were almost identical to the predictions made with the Lands Directorate land management targeting methodology.

For the remaining years of the study, timing, intensity, and amount of precipitation produced sediment load ranges of only 0.4 tonnes/ha/yr to 1.7 tonnes/ha/yr at the two outlets. Due to the reduced erosion and delivery, it is difficult to assess the impact of the conservation tillage measures implemented since the fall of 1987 until average runoff conditions are again encountered.

Recommendations

For both study subwatersheds, runoff responses to events are rapid. One half hour can result in significant changes in flow and/or sediment concentrations. In addition, crop canopy cover can also influence these responses.

1) Complete sample sets rather than subsets from the automatic samplers should be submitted for several storms with and without crop canopy cover.
2) The Beale ratio estimate, designed for much larger tributaries, could be refined based on a better understanding of event responses in these smaller 'flashy' subwatersheds.
3) Funding should continue until at least two average precipitation years are experienced, particularly in the spring.

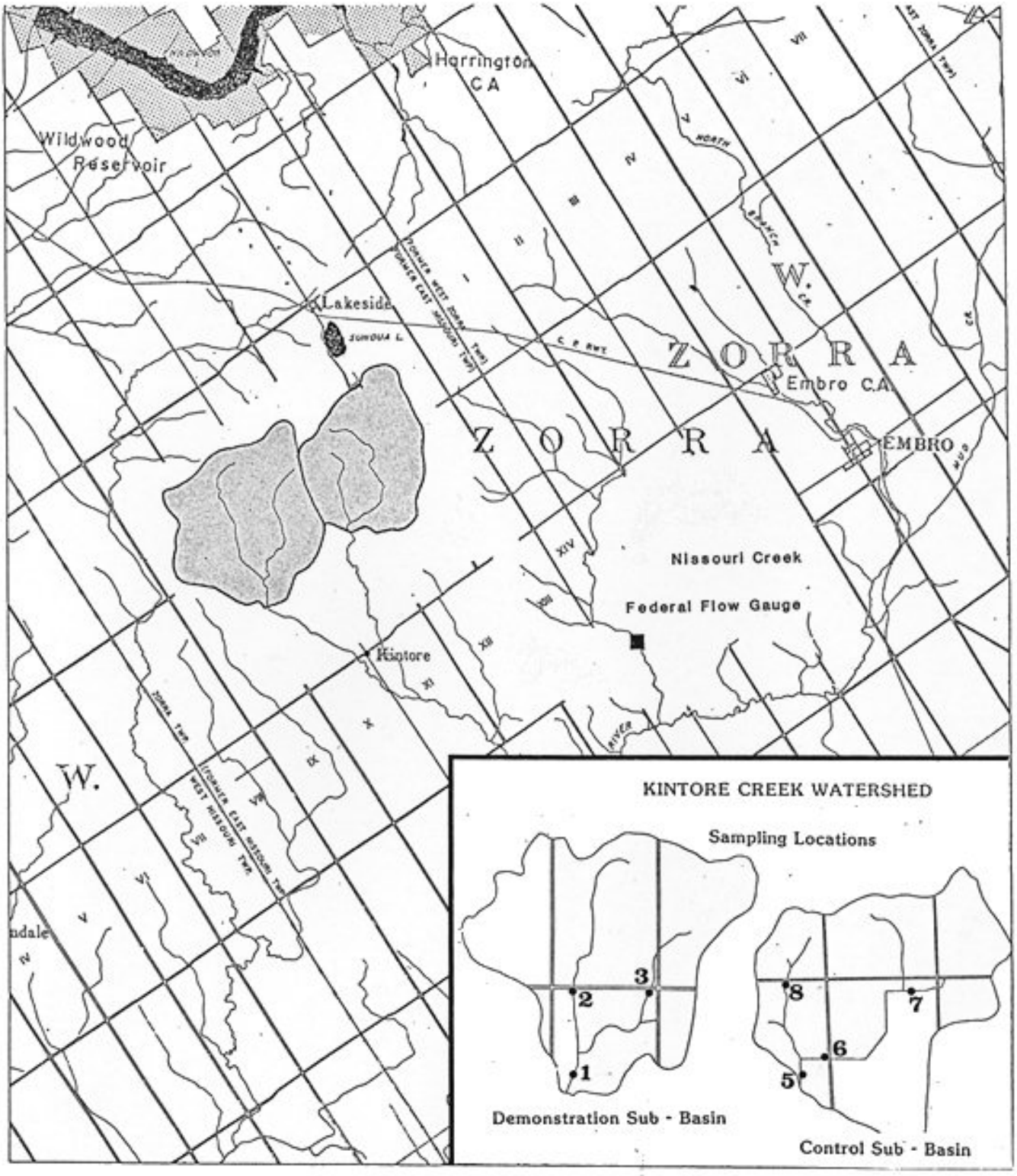

Figure 1: Location of the Kintore Creek Study Area and sampling Locations.

Table 1: KINTORE CREEK WATER QUALITY DATA 1989 Sample Station 1

Date	Time	Staff G meters	F Ammonia	TKN	Nitrite	Nitrate	Total P	SRP	Susp. Sol	pH	Cond.
MAR1389		0.514	1.9	2.81	0.04	5.7	0.29	0.179	22.9		
MAR3089	1500	0.617	0.665	1.55	0.04	8.5	0.12	0.074	5		
APR0389	1200	0.782	0.605	1.92	0.03	7.2	0.24	0.053	103		
APR1389	1200	.607	0.376	0.95	0.02	9.4	0.063	0.029	5		
APR2789	1030	0.51	0.963	1.89	0.1	5.9	0.108	0.056	5.8		
MAY0989	1040	0.495	0.471	1.03	0.05	5.4	0.072	0.033	5.9		
MAY1589	1400	.495	0.204	0.88	0.08	4.8	0.059	0.007	6		
MAY2389	930	0.48	2.7	ND	0.13	5.5	0.21	0.158	5.5		
MAY2989	1000	0.482	0.27	0.72	0.13	5.6	0.21	0.114	6		
JUN0289	935	.732	1.1	2.98	.15	8.4	.48	.124	153		
JUN0589	1130	.508	0.276	0.81	0.08	7	0.071	0.029	8.8		
JUN1289	945	.475	0.372	0.98	0.12	6.2	0.065	0.056	6.8		
JUN1989	1010	0.47	0.001	0.59	0.13	6.1	0.046	ND	8.4		
JUN2689	1130	0.47	1.18	1.88	0.14	6.1	0.151	0.084	11		
JUL0489	1010	0.461	0.107	0.43	0.09	5.3	0.06	0.036	5	8.02	618
JUL1089	1130	0.458	0.956	1.92	0.13	4.9	0.13	0.065	5	8.3	605
JUL1789	1100	0.46	0.014	0.41	0.04	5.2	0.025	0.015	5	8.22	592
JUL2689	945	0.472	0.024	0.42	0.04	4.3	0.028	0.022	5	8.14	600
JUL3189	945	0.471	0.009	0.45	0.04	4.6	0.056	0.024	5	8.2	594
AUG0889	945	0.466	0.005	0.4	0.04	4.3	0.025	0.022	5	8.23	590
AUG1589	1350	0.463	0.003	0.44	0.02	3.7	0.025	0.001	5	8.32	560
AUG2189	1200	0.492	0.014	0.51	0.03	5.4	0.034	ND	10.1	8.29	602
AUG2889	930	.475	0.413	0.97	0.06	4.3	0.077	0.039	5	8.09	602
SEPT0689	1100	.475	0.013	0.49	0.05	4.2	0.057	0.015	5	8.11	593
SEPT1289	1030	0.471	0.005	0.41	0.03	4.3	0.039	0.017	5	8.19	600
SEPT1889	1010	0.481	0.009	0.51	0.03	4.3	0.055	ND	22.2	8.2	596
SEPT2589	1115	0.482	0.001	0.39	0.01	4.2	0.027	0.009	5	8.17	592
OCT0289	1135	0.487	0.003	0.55	0.01	3.9	0.054	0.005	12.6	8.07	603
OCT1189	1200	0.53	0.002	0.9	0.53	4.7	0.185	ND	14.7	8.05	89
OCT2389	1110	0.498	2.31	ND	0.09	4.2	0.215	0.156	8	8.14	675
OCT3089	1420	0.478	2.53	ND	0.23	4.2	0.205	0.184	5	8.23	636
NOV0789	1537	0.65	0.003	3	0.22	0.3	0.59	ND	294	7.94	588
NOV1489	1040	0.49	0.011	0.72	0.03	2.3	0.031	0.003	5	8.25	582
NOV1689	1345	0.738	0.191	1.95	0.05	13.8	0.39	0.057	106	7.77	701
NOV2089	1000	0.567	0.148	0.86	0.05	7.9	0.091	0.025	32.4	7.97	701
NOV2789	1115	0.499	0.064	0.5	0.01	6.1	0.028	0.001	5	8.11	683
NOV2889	950	0.642	0.215	3.4	0.07	10.9	2.1	ND	422	7.76	654
DEC0489	1400	0.495	0.002	0.4	0.12	7	0.04	0.006	19.7	8.09	671
JAN1790	10.4	1.02	ND	ND	ND	ND	0.5	ND	ND	ND	513
FEB0190	1030	0.535	0.975	1.68	0.03	10.2	0.134	0.082	5	7.87	659
FEB0990	1130	0.979	0.203	2	0.02	8.9	0.35	0.055	146	7.68	439
FEB2290	1550	1.175	0.243	2.5	0.01	3.5	0.685	0.06	312	7.56	279

ND = no data

Table 2: KINTORE CREEK WATER QUALITY DATA 1989 Sample Station 2

Date	Time	Staff G meters	F Ammonia	TKN	Nitrite	Nitrate	Total P	SRP	Susp. Sol	pH	Cond.
MAR1389		0.65	0.208	0.89	0.03	3.4	0.14	0.024	38.1		
MAR3089	1445	0.77	0.029	0.71	0.02	7.1	0.04	0.013	5		
APR0389		0.98	0.16	1.83	0.01	6.7	0.153	0.001	54.7		
APR1389		0.77	0.011	0.48	0.01	7.4	0.024	0.002	10.1		
APR2789	1400	0.64	0.025	0.51	0.02	3.5	0.013	0.012	3.2		
MAY0989	1110	0.63	0.011	0.4	0.03	3.5	0.011	0.004	5		
MAY1589	1255	0.62	0.026	0.34	0.02	2.9	0.012	0.002	5		
MAY2389	1040	0.6	0.026	0.47	0.02	3.3	0.016	0.001	7.1		
MAY2989	1110	0.6	0.004	0.46	0.03	3	0.018	ND	5		
JUN0289	1025	.890	.032	1.66	.15	7.1	.238	.036	104		
JUN0589	1300	0.63	0.012	0.52	0.03	4.3	0.018	0.001	5		
JUN1289	1050	0.59									
JUN1989	1045	0.59	0.065	0.58	0.03	3	0.033	0.008	7.5		
JUN2689	1040	0.58	0.406	0.97	0.02	3.5	0.061	0.032	5		
JUL0489	1315	0.55	0.021	0.41	0.02	2.9	0.032	0.01	7.3	8.13	551
JUL1089	1440	0.53	0.053	0.49	0.02	2.9	0.042	0.013	5	8.36	539
JUL1789	1215	0.53	0.014	0.39	0.02	2.7	0.03	0.011	5	8.27	538
JUL2689	1042	0.55	0.014	0.39	0.02	2.3	0.033	0.029	5	8.18	547
JUL3189	1015	0.55	0.01	0.43	0.02	2.3	0.03	0.001	5	8.29	541
AUG0889	1055	0.54	0.006	0.35	0.03	2.3	0.019	0.002	5	8.33	533
AUG1589	1315	0.55	0.003	0.36	0.02	2.1	0.021	0.013	5	8.34	529
AUG2189	1120	0.57	0.019	0.4	0.01	2	0.027	ND	5	8.28	546
AUG2889	1000	0.55	0.003	0.37	0.02	2.1	0.024	ND	5	8.19	540
SEPT0689	1140		0.01	0.36	0.04	2	0.028	0.014	5	8.17	543
SEPT1289	1120	0.56	0.004	0.4	0.02	1.9	0.032	0.02	5.8	8.3	548
SEPT1889	1035	0.57	0.004	0.38	0.02	2.1	0.024	0.009	5	8.28	544
SEPT2589	1255	0.57	0.001	0.35	0.01	1.9	0.021	0.014	5	8.27	542
OCT0289	1055	0.58	0.003	0.41	0.01	1.8	0.035	ND	8.6	8.15	559
OCT1189	1340	0.66	0.022	0.75	0.05	3.3	0.049	ND	15.7	8.6	605
OCT2389	1140	0.62	0.036	0.42	0.02	2.6	0.02	0.006	5	8.21	590
OCT3089	1435	0.59	0.005	0.34	0.02	2.3	0.016	0.015	5	8.29	556
NOV0789	1525	0.94	0.056	3.3	0.23	3.9	0.875	ND	352	7.6	580
NOV1489	1120	0.64	0.017	0.44	0.01	2.8	0.033	0.01	12	8.23	563
NOV1689	1400	0.95	0.058	2.3	0.05	12.3	0.66	0.04	200	7.78	602
NOV2089	1045		0.021	0.73	0.04	6.5	0.056	0.048	14	7.96	611
NOV2789	1132	0.64	0.018	0.43	0.01	4.7	0.016	0.001	5	8.18	603
NOV2889	930	0.86	0.158	6.3	0.1	9.4	3.02	ND	915	7.76	530
DEC0489	1420	0.63	0.1	0.39	0.03	5.6	0.027	0.007	5	8.13	539
JAN1790	1455	bent	ND	ND	ND	ND	0.66	ND	ND	ND	513
FEB0190	1245	bent	0.101	0.57	0.02	7.5	0.027	0.02	5	7.93	550
FEB0990	1053	1.35	0.167	2.4	0.02	8.5	0.44	0.078	186	7.62	417
FEB2290	1515	1.7	0.108	2.8	0.01	3.4	0.59	0.104	287	7.57	256

ND = no data

Table 3: KINTORE CREEK WATER QUALITY DATA, 1989 Sample Station 3

Date	Time	Staff G meters	F Ammonia	TKN	Nitrite	Nitrate	Total P	SRP	Susp. Sol	pH	Cond.
MAR1389		0.48	0.274	1.13	0.02	5	0.3	0.175	35.4		
MAR3089	1430	0.58	0.005	0.74	0.02	3.9	0.05	0.013	5		
APR0389		0.67	0.072	1.3	0.02	3.6	0.25	0.015	62.8		
APR1389		0.57	0.023	0.73	0.01	4	0.042	0.001	15.7		
APR2789			0.001	0.47	0.02	4.4	0.019	0.007	5.1		
MAY0989	1115	0.495	0.008	0.44	0.02	4.9	0.02	0.002	21.2		
MAY1589	1320	0.49	0.007	0.49	0.01	4.2	0.026	0.002	14.1		
MAY2389	1050	0.42	0.012	0.52	0.01	4.8	0.026	0.001	21.5		
MAY2989	1435	0.47	0.005	0.43	0.02	4.7	0.019	0.004	5		
JUN0289	1020	0.635	0.016	0.82	0.09	2.1	0.077	0.026	18.2		
JUN0589	1335	0.5	0.088	0.66	0.03	4.2	0.036	0.01	8.1		
JUN1289	1100	0.48	0.05	0.45	0.25	4.9	0.028	0.01	19.3		
JUN1989	1109	0.49	0.007	0.37	0.03	4.8	0.019	0.002	12.3		
JUN2689	1050	0.49	0.017	1.88	0.14	6.1	0.034	0.002	5		
JUL0489	1340	0.51	0.023	0.37	0.02	5.2	0.018	0.014	10.2	8.16	583
JUL1089	1500	0.2	0.027	0.4	0.02	5	0.03	0.021	9.4	8.14	568
JUL1789		0.5	0.015	0.33	0.02	5.7	0.014	0.001	9.8	8.06	558
JUL2689	1052	0.5	0.022	0.35	0.22	4.6	0.02	0.024	5	8.24	590
JUL3189	1030	0.49	0.029	0.32	0.01	5	0.015	0.001	3.3	8.29	588
AUG0889	1105	0.48	0.007	0.35	0.02	5.1	0.012	0.001	5.9	8.33	584
AUG1589	1320	0.48	0.011	0.35	0.01	5.3	0.019	0.001	5	8.19	578
AUG2189	1130	0.49	0.04	0.42	0.02	5.1	0.021	ND	6.9	8.28	602
AUG2889	1005	0.48	0.004	0.32	0.02	5	0.012	0.008	5	8.2	595
SEPT0689	1150	0.48	0.006	0.34	0.03	5.1	0.017	0.011	5	8.2	594
SEPT1289	1130	0.49	0.003	0.37	0.02	4.9	0.023	0.001	5	8.29	591
SEPT1889	1040	0.51	0.009	0.33	0.02	5.3	0.019	0.003	7.4	8.29	596
SEPT2589	1310	0.51	0.001	0.36	0.01	5.1	0.024	ND	7.7	8.26	597
OCT0289	1045	0.52	0.015	0.43	0.01	5	0.037	0.01	9.6	8.17	601
OCT1189	1355	0.57	0.021	0.53	0.02	4.4	0.042	ND	7.2	8.17	65
OCT2389	1145	0.55	0.003	0.39	0.01	4.8	0.023	0.004	12.2	8.22	654
OCT3089	1442	0.54	0.023	0.43	0.02	5.2	0.029	0.009	5	8.26	609
NOV0789	1522	0.86	0.009	3.2	0.02	3	0.54	ND	233	7.9	761
NOV1489	1130	0.63	0.024	0.78	0.01	4.5	0.077	0.013	35.7	8.22	706
NOV1689	1405	0.8	0.03	0.91	0.04	4.5	0.107	0.052	18.7	7.99	690
NOV2089	1050	0.68	0.045	0.65	0.04	4.1	0.053	0.013	14.5	8.06	729
NOV2789	1150	0.61	0.001	0.39	0.01	5.1	0.025	0.001	14.2	8.18	649
NOV2889	1010	0.63	0.053	0.78	0.01	4.4	0.083	ND	19	8.05	722
DEC0489	1425	0.59	0.025	0.53	0.01	5.5	0.061	0.002	39.1	8.18	617
JAN1790	1450	snow	ND	ND	ND	ND	0.36	ND	ND	ND	574
FEB0190	1255	0.59	0.034	0.95	0.02	4.7	0.078	0.02	40	8.06	612
FEB0990	1044	0.94	0.098	1.74	0.01	3.7	0.31	0.111	114	7.81	493
FEB2290	1455	ice	0.092	2.6	0.01	1	0.565	0.113	214	7.63	327

ND = no data

Table 4: KINTORE CREEK WATER QUALITY DATA, 1989 Sample Station 5

Date	Time	Staff G meters	F Ammonia	TKN	Nitrite	Nitrate	Total P	SRP	Susp. Sol	pH	Cond.
MAR1389	1045	0.24	0.178	0.77	0.02	1.9	0.11	0.014	22.9		
MAR3089	1300	0.334	0.027	0.72	0.02	4.4	0.05	0.018	11.1		
APR0389	1100	0.522	0.065	1.19	0.01	3.1	0.18	0.007	92.9		
APR1389	1100	0.288	0.039	0.62	0.01	3.9	0.043	0.007	16.2		
APR2789			0.001	0.47	0.02	1.9	0.025	0.006	8.1		
MAY0989	1230	0.205	0.003	0.41	0.02	1.8	0.029	0.006	6		
MAY1589	930	0.2	0.021	0.56	0.01	1.7	0.018	0.009	8.6		
MAY2389	1130	0.22	0.019	0.45	0.01	1.9	0.028	0.009	4.5		
MAY2989	1330	0.18	0.132	0.74	0.02	2	0.071	0.061	5		
JUN0289	955	.432	.041	1.28	.11	5	.129	.042	41.8		
JUN0589	1500	0.202	0.025	0.77	0.04	3	0.049	ND	16.9		
JUN1289	1215	0.169	0.048	0.56	0.06	3.1	0.041	0.028	4.5		
JUN1989	1310	0.18	0.085	0.69	0.04	2.6	0.07	0.036	11.7		
JUN2689	950	0.16	0.082	0.5	0.04	3.1	0.072	0.055	5		
JUL0489	1450	0.15	0.079	0.41	0.07	2.7	0.075	0.043	7.3	8.07	568
JUL1089	1540	0.149	0.051	0.58	0.06	2.3	0.096	0.045	22.2	8.26	543
JUL1789	1415	0.15	0.022	0.48	0.03	1.8	0.065	0.034	16.9	8.34	532
JUL2689	1125	0.14	0.026	0.34	0.03	1.6	0.073	0.145	5	8.21	554
JUL3189	1055	0.16	0.01	0.39	0.02	1.6	0.085	0.04	5	8.22	554
AUG0889	1420	0.16	0.004	0.24	0.03	1.4	0.043	0.015	5	8.32	532
AUG1589	1110	0.16	0.007	0.33	0.03	1.2	0.047	0.011	5	8.08	552
AUG2189	1015	0.175	0.031	0.35	0.03	1.5	0.057	ND	5	8.11	569
AUG2889	1050	0.15	0.005	0.26	0.04	1.4	0.051	0.021	5	8.1	553
SEPT0689	1250	0.17	0.003	0.26	0.04	1.2	0.062	0.041	5	8.11	551
SEPT1289	1245	0.161	0.004	0.35	0.03	1.3	0.063	0.027	5	8.22	549
SEPT1889	1245	0.17	0.004	0.27	0.03	1.6	0.042	0.023	5	8.23	559
SEPT2589	1420	0.167	0.001	0.27	0.02	1.5	0.039	ND	5	8.21	549
OCT0289	940	0.17	0.005	0.34	0.02	1.5	0.062	ND	5.2	7.98	568
OCT1189	1525	0.212	0.01	0.65	0.06	2.2	0.088	ND	25.8	8.0	636
OCT2389	1240	0.202	0.1	0.39	0.01	1.6	0.022	0.007	5		
OCT3089	1520	0.179	0.018	0.41	0.03	1.6	0.046	0.044	5	8.13	594
NOV0789	1503	0.342	0.005	2	0.12	3.2	0.4	ND	170	7.74	592
NOV1489	1220	0.21	0.023	0.48	0.01	1.7	0.038	0.025	5	8.1	585
NOV1689	1445	0.462	0.03	1.04	0.05	5.5	0.072	0.031	10	7.8	563
NOV2089	1125	0.279	0.023	0.8	0.04	3.7	0.058	0.018	7.5	7.88	587
NOV2789	945	0.23	0.012	0.51	0.01	2.3	0.024	0.001	5	8	583
NOV2889	1110	0.35	0.032	0.83	0.02	5.3	0.073	ND	20.9	7.83	562
DEC0489	1445	0.211	0.006	0.5	0.04	3.2	0.036	0.03	5	8.05	583
JAN1790	1315	0.525	ND	ND	ND	ND	0.32	ND	ND	ND	494
FEB0190	1400	0.25	0.008	0.45	0.01	1.8	0.026	0.004	5	7.79	481
FEB0990	950	0.642	0.037	1.54	0.02	7	0.31	0.039	126	7.91	386
FEB2290	1420	0.825	0.182	2.3	0.01	3.5	0.48	0.056	236	7.56	267

ND = no data

Table 5: KINTORE CREEK WATER QUALITY DATA, 1989 Sample Station 6

Date	Time	Staff G meters	F Ammonia	TKN	Nitrite	Nitrate	Total P	SRP	Susp. Sol	pH	Cond.
MAR1389		0.53	0.192	0.88	0.01	2.1	0.1	0.013	32.6		
MAR3089		0.843	0.002	0.65	0.02	4.3			5		
APR0389		1.05	0.035	1.31	0.01	3.7	0.2	0.005	75.9		
APR1389		0.8	0.011	0.61	0.01	0.1	0.027	0.001	11.2		
APR2789			0.001	0.5	0.02	2	0.013	0.008	3.3		
MAY0989	1150	0.6	0.011	0.39	0.02	1.9	0.013	0.002	5		
MAY1589	1100	0.53	0.001	0.51	0.01	1.7	0.029	0.003	8.5		
MAY2389	1120	0.55	0.019	0.45	0.01	2.2	0.019	0.001	4.4		
MAY2989	1400	0.52	0.025	0.71	0.02	2.2	0.037	0.01	10		
JUN0289	1005	0.975	0.033	1.23	0.1	4.8	0.109	0.02	44.5		
JUN0589	1420	0.58	0.001	0.78	0.03	3	0.036	0.003	12		
JUN1289	1133	0.47	0.043	0.59	0.05	3.1	0.019	0.01	5.8		
JUN1989	1320	0.455	0.001	0.52	0.03	2.5	0.023	0.005	4.8		
JUN2689	1000	0.43	0.032	0.44	0.03	3.4	0.032	0.012	5		
JUL0489	1410	0.35	0.03	0.36	0.03	3.5	0.034	0.017	5.2	8.09	565
JUL1089	1530	0.32	0.01	0.37	0.03	3	0.036	0.015	5	8.23	550
JUL1789	1500	0.3	0.014	0.33	0.02	2.8	0.31	0.023	5	8.29	549
JUL2689	1110	0.3	0.011	0.29	0.02	2.4	0.022	0.005	5	8.17	564
JUL3189	1135	0.33	0.014	0.28	0.02	2.4	0.038	0.006	5	8.26	557
AUG0889	1325	0.33	0.005	0.23	0.02	2.1	0.015	0.001	5	8.27	552
AUG1589	1135	0.33	0.001	0.26	0.02	1.8	0.023	0.001	5	8.09	566
AUG2189	1040	0.375	0.014	0.28	0.01	2.2	0.031	ND	5	8.16	582
AUG2889	1040	0.36	0.002	0.23	0.02	2.2	0.026	0.004	5	8.14	564
SEPT0689	1225	0.39	0.006	0.34	0.03	5.1	0.017	0.011	5	8.2	594
SEPT1289	1230	0.37	0.004	0.3	0.02	2.1	0.031	0.005	5	8.23	567
SEPT1889	1110	0.38	0.002	0.27	0.02	2.1	0.026	0.006	5	8.22	570
SEPT2589	1405	0.41	0.001	0.23	0.01	2	0.017	ND	5	8.19	560
OCT0289	1015	0.43	0.026	0.37	0.01	2	0.05	0.022	5	8.12	577
OCT1189	1430	0.56	0.018	0.46	0.01	2.7	0.035	ND	5	8.14	634
OCT2389	1210	0.38	0.004	0.4	0.01	2.1	0.001	8.17	5	8.17	611
OCT3089	1500	0.34	0.001	0.24	0.02	2.2	0.01	0.001	5	8.23	594
NOV0789	1518	0.77	0.056	3.3	0.23	3.9	0.875	ND	352	7.6	539
NOV1489	1210	0.4	0.018	0.38	0.01	1.8	0.019	0.008	5	8.12	580
NOV1689	1430	0.93	0.018	1.04	0.06	4.2	0.079	0.033	16.4	7.75	532
NOV2089	1110	0.63	0.001	0.72	0.04	2.9	0.037	0.008	5	7.89	550
NOV2789	1430	0.47	0.001	0.51	0.01	2.3	0.014	0.001	5	8.05	561
NOV2889	1050	0.77	0.02	0.83	0.02	4.9	0.063	ND	23.4	7.83	553
DEC0489	1440	0.43	0.009	0.35	0.01	3.3	0.015	0.004	5	7.96	564
JAN1790	1350	1	ND	ND	ND	ND	0.365	ND	ND	ND	480
FEB0190	1335	0.47	0.222	0.93	0.02	5.3	0.045	ND	5	7.88	522
FEB0990	1003	1.07	0.001	1.78	0.01	7.4	0.37	0.02	199	7.62	388
FEB2290	1405	1.37	0.239	2.4	0.01	3.5	0.54	0.07	321	7.6	275

ND = no data

Table 6: KINTORE CREEK WATER QUALITY DATA, 1989 Sample Station 7

Date	Time	Staff G meters	F Ammonia	TKN	Nitrite	Nitrate	Total P	SRP	Susp. Sol	pH	Cond.
MAR1389		0.08	0.203	0.73	0.01	1.4	0.07	0.011	8.8		
MAR3089	1350	0.14	0.017	0.45	0.01	1.5	0.04	0.022	5		
APR0389		0.34	0.031	0.67	0.01	1	0.076	0.001	23.9		
APR1389		0.14	0.02	0.37	0.01	3.4	0.022	0.001	5		
MAY0989	1135	0.05	0.007	0.21	0.02	0.6	0.011	0.003	5		
MAY1589	1130	0.02	0.025	0.29	0.01	0.4	0.016	0.004	4.4		
MAY2389	1110	0.03	0.017	0.4	0.01	0.3	0.04	0.001	22.9		
MAY2989	1420	0.001	0.008	0.47	0.01	0.3	0.056	0.014	7.5		
JUN0289	1010	0.245	0.018	0.67	0.09	0.7	0.071	0.007	15.3		
JUN0589	1405	0.04	0.011	0.33	0.02	0.6	0.027	0.003	5		
JUN1289	1115	0.001	0.034	0.27	0.04	0.5	0.026	0.012	8.8		
JUN1989	1405	0.001	0.004	0.23	0.02	0.3	0.022	0.009	5		
JUN2689	1014	0	0.008	0.22	0.01	0.3	0.034	0.008	5		
JUL0489	1405	-0.03	0.014	0.2	0.01	0	0.037	0.024	11.3	8.06	556
JUL1089	1520	-0.075	0.009	0.16	0.21	0.3	0.026	0.009	5	8.22	552
JUL1789	1350	-0.075	0.012	0.12	0.02	0.2	0.033	0.024	5	8.17	559
JUL2689	1100	-0.075	0.001	0.13	0.01	0.1	0.025	0.014	5	8.1	562
JUL3189	1145	0	0.008	0.29	0.02	0.1	0.066	0.001	29.6	8.17	561
AUG0889	1300	-0.03	0.007	0.17	0.02	0.2	0.024	ND	5	8.16	562
AUG1589	1240	-0.03	0.023	0.16	0.01	0.2	0.021	0.001	5	8.13	566
AUG2189	1050	0.025	0.012	0.33	0.01	0.1	0.53	ND	23.6	8.03	588
AUG2889	1025	0	0.005	0.12	0.02	0.3	0.016	0.001	5	8.06	565
SEPT0689	1210	0	0.002	0.2	0.03	0.3	0.034	0.012	11.6	8.05	571
SEPT1289	1220	0	0.03	0.21	0.01	0.2	0.031	0.022	6.4	8.16	570
SEPT1889	1100	0.001	0.004	0.16	0.02	0.4	0.018	ND	5	8.11	573
SEPT2589	1345	0.001	0.001	0.15	0.01	0.2	0.016	0.006	3.4	8.02	569
OCT0289	1030	0.001	0.001	0.21	0.01	0.1	0.038	0.008	9.2	7.97	576
OCT1189	1315	0.05	0.017	0.33	0.01	0.4	0.021	ND	5	7.95	636
OCT2389	1200	0	0.004	0.22	0.01	0.2	0.018	0.002	11.8	8.02	620
OCT3089	1455	0.04	0.001	0.21	0.01	0.2	0.016	0.002	5	7.95	602
NOV0789	1520	0.27	0.005	1	0.01	0.4	0.15	ND	58.1	7.7	580
NOV1489	1200	0.09	0.01	0.27	0.01	0.2	0.022	0.01	4.9	7.99	599
NOV1689	1415	0.24	0.017	0.59	0.23	2.1	0.057	0.04	6.7	7.75	540
NOV2089	1100	0.16	0.001	0.47	0.04	1.9	0.031	0.056	5	7.8	557
NOV2789	1205	0.08	0.001	0.33	0.01	1.4	0.016	0.001	2.6	7.95	576
NOV2889	1030	0.18	0.009	0.39	0.01	1.7	0.04	ND	7.7	7.79	547
DEC0489	1435	0.06	0.021	0.22	0.01	1.7	0.014	0.002	5	7.93	566
JAN1790	1400	0.52	ND	ND	ND	ND	0.19	ND	ND	ND	385
FEB0190	1320	0.18	0.001	0.6	0.01	4.8	0.016	0.012	5	7.89	502
FEB0990	1020	0.61	0.002	0.94	0.01	2.6	0.152	0.073	60.4	7.67	343
FEB2290	1355	0.8	0.029	0.86	0.01	0.5	0.145	0.018	59.9	7.53	262

ND = no data

Table 7: KINTORE CREEK WATER QUALITY DATA, 1989 Sample Station 8

Date	Time	Staff G meters	F Ammonia	TKN	Nitrite	Nitrate	Total P	SRP	Susp. Sol	pH	Cond.
MAR1389		0.35	0.023	2.18	0.01	3.8	0.21	0.004	110		
MAR3089	1400	0.57	0.017	1.21	0.01	8.5	0.09	0.011	34.5		
APR0389		0.73	0.035	2.29	0.01	6.5	0.22	0.001	98.8		
APR1389		0.56	0.038	1.46	0.01	6	0.105	0.001	66.8		
APR2789			0.001	0.41	0.02	3.3	0.014	0.006	6.9		
MAY0989	1130	0.398	0.005	0.34	0.02	3.3	0.016	0.002	10.3		
MAY1589	1150	0.38	0.015	0.34	0.01	2.9	0.012	0.001	13.7		
MAY2389	1100	0.38	0.012	0.27	0.01	3.3	0.01	0.001	4.2		
MAY2989	1430	0.35	0.005	0.25	0.01	3.3	0.018	ND	5		
JUN0289	1015	0.47	0.023	0.89	0.18	6.8	0.059	0.014	26		
JUN0589	1400	0.25	0.006	0.4	0.02	4.5	0.015	0.003	5		
JUN1289	1105	0.24	0.028	0.33	0.04	3.3	0.011	0.006	5		
JUN1989	1400	0.18	0.001	0.31	0.02	3.1	0.028	ND	5		
JUN2689	1025	0.25	0.003	0.32	0.01	3.1	0.013	0.003	5		
JUL0489	1400	0.18	0.023	0.24	0.01	2.8	0.014	0.012	5	8.02	574
JUL1089	1510	0.15	0.012	0.28	0.01	2.9	0.015	0.004	5	8.2	575
JUL1789	1341	0.14	0.017	0.25	0.02	3.1	0.012	ND	5	8.16	579
JUL2689	1055	0.14	0.001	0.29	0.01	2.1	0.014	0.006	5	8.07	581
JUL3189	1200	0.11	0.01	0.29	0.01	2.6	0.03	0.001	5	8.16	581
AUG0889	1315	0.1	0.006	0.31	0.02	2.4	0.011	0.001	5	8.14	581
AUG1589	1255	0.11	0.001	0.34	0.01	2.4	0.015	0.001	5	8.13	588
AUG2189	1100	0.14	0.014	0.29	0.01	2	0.056	ND	5	8.04	585
AUG2889	1015	0.125	0.004	0.27	0.02	2.4	0.012	0.001	5	8.04	586
SEPT0689	1200	0.13	0.001	0.3	0.03	0.2	0.013	0.01	5	8.06	587
SEPT1289	1205	0.14	0.01	0.35	0.02	2.2	0.014	0.001	5	8.12	586
SEPT1889	1050	0.15	0.002	0.3	0.01	2	0.012	0.007	5	8.12	583
SEPT2589	1330	0.16	0.001	0.25	0.01	2.1	0.01	0.009	5	8.04	577
OCT0289	1040	0.19	0.003	0.38	0.01	1.7	0.022	0.006	6.9	8	588
OCT1189	1405	0.33	0.015	0.48	0.01	3.8	0.014	ND	5	8	585
OCT2389	1150	0.29	0.004	0.35	0.01	2.5	0.01	0.002	5	8.06	581
OCT3089	1445	0.23	0.002	0.36	0.02	2.3	0.016	0.002	5	8.03	578
NOV0789	1321	0.72	0.011	1.7	0.01	1.4	0.12	ND	55.1	7.88	507
NOV1489	1140	0.27	0.009	0.4	0.01	2	0.022	0.005	8	8.05	553
NOV1689	1410	0.0089	0.007	0.71	0.04	14	0.028	0.018	7.7	7.93	584
NOV2089	1055	0.35	0.001	0.48	0.04	5.4	0.021	0.023	6.9	7.95	571
NOV2789	1200	0.29	0.007	0.41	0.01	3.4	0.023	0.09	11	7.99	571
NOV2889	1012	0.47	0.011	0.61	0.01	8.8	0.043	ND	19.3	7.94	566
DEC0489	1430	0.31	0.011	0.34	0.01	4	0.021	0.006	11.6	8.02	566
JAN1790	1414	0.84	ND	ND	ND	ND	0.3	ND	ND	ND	412
FEB0190	1305	0.36	0.001	1.61	0.01	6	0.108	0.019	70.3	7.99	538
FEB0990	1023	0.87	0.017	2.6	0.01	7.2	0.3	0.003	195	7.75	360
FEB2290	1450	1.15	0.013	2.2	0.01	2.2	0.45	ND	260	7.61	214

ND = no data

Table 8: Kintore Station 1 Rain Event Data

Date	Time	Total P	Susp. Sol.
APR0389	1300	1.17	612
	1700	0.28	101
	2100	0.178	50.5
APR0489	100	0.157	38.7
	500	0.19	59.6
	800	0.39	169
APR1389	1600	0.9	408
	2000	0.32	181
APR1589	0	0.18	94.4
	400	0.18	91.7
	800	0.74	441
MAY2989	500	0.81	469
	600 Peak	1.44	570
	700	0.74	165
	800	0.59	60.7
	900	0.46	35.5
	1000	0.46	26.8
MAY3089	2140 Peak	0.58	156
MAY3189	40	3.45	1320
	140	1.69	551
	240	0.93	268
	340	0.72	172
	440	0.58	106
JUN0289	1530	0.215	15.9
	1630	0.21	18.4
	1730	0.205	21.2
	1830	0.115	5
	1930	0.131	14.6
	2030	0.145	17.3
	2130	0.15	17.8
	2230	0.154	17.5
	2330	0.15	17.5
JUN0389	30	0.154	19.1
JUN2289	400	1	408
	500	0.615	269
	600	4.6	1949
	700	1.45	564
	800	2.52	910
	900	0.835	308
	1000	0.38	116
	1100	0.264	75.3
	1200	0.192	47.2
AUG1589	1930	0.172	59.1
	2030	1.12	695
	2130	0.655	370
	2230	0.348	168
	2330	0.218	84.6
	30	0.164	60.4
0CT1089		0.175	13.7
		0.28	151
		0.215	82.7
		0.21	39.1
		0.42	174
		0.675	286
		0.57	131
		0.395	85
		1.1	603
		0.31	87.9
		0.235	50.5
		0.19	22

KINTORE STORM EVENT DATA 1989 Sample Station 1 (cont'd)

Date	Time	Total P	Susp. Sol
NOV0789	1430	0.16	63.4
	1530	0.58	312
	1630 Peak	0.75	295
	1730	2.28	308
	1930	0.52	124
	2130	0.47	95.5
NOV2889	100	2.08	968
	200	0.87	408
	300	3.12	1174
	400	3.7	1379
	500	3.23	1191
	600	2.8	996
	800	1.6	634
	1000	1.34	433
	1200	1.06	332
	1400	0.81	240
	1600	0.63	182
	1800	0.53	167

Table 9: Kintore Rain Storm Event Station 5 Data, 1989

Date	Time	Total P	Susp. Sol
APR0389	1430	0.17	74.6
	1830	0.177	47.1
	2230	0.074	37.9
APR0489	230	0.057	27.3
	630	0.151	66.9
	1030	0.95	36.8
APR1389	1600	0.62	167
	2000	0.44	202
APR1589	400	0.38	194
	800	0.18	88.8
MAY3089	2030	1.27	552
MAY3189	2130 Peak	8.78	6278
	2230 Peak	4.42	2373
	2330 Peak	1.9	774
	30	0.84	387
	530	0.145	53.9
JUN0289	730	0.34	172
	830	0.266	100
	930	0.131	49.2
	1030	0.09	30.8
	1130	0.075	20.7
	1230	0.072	21.9
	1330	0.074	19.5
	1430	0.057	14.7
	1530	0.053	15.4
	1630	0.167	108
	1730	0.053	19.2
	1830	0.055	17.5
	1930	0.056	17.2
	2030	0.056	13.4
	2130	0.074	18.9
	2230	0.055	21.5
	2330	0.051	17.6
JUN0389	30	0.055	20.1
JUN2289	230	0.525	269
	330	2.55	1261
	430	1.2	621
	530	0.8	334
	630	0.346	155
	730	0.218	87.4
	830	0.14	44
	930	0.14	41.5
	1030	0.118	37.2
AUG1589	2115	2.18	1192
	2215	0.795	383
	2315	0.365	148
	15	0.194	59.9
	115	0.148	51
	315	0.14	60.3
N0V0789	1500	0.48	153
	1600 Peak	0.51	112
	1700	0.42	86.4
	1900	0.185	32.1
	2300	0.093	31
	400	0.11	57.7
N0V2889	ND	ND	ND

ND = no data

3.0 Laboratory Support

The Regional laboratory was provided with a person to assist with sample analysis. The lab assistant was responsible for analysing water samples for Total Phosphorus. According to supervisory staff, a total of 14,000 samples were analysed.

4.0 Septic Investigation.

A septic study was initiated in an area within the Pittock Reservoir watershed. As well, further work was done on the on-going Havelock Drain study.

4.1 1989 Pittock Watershed Septic Study

Summary

In 1989, a septic system survey was conducted in a portion of the Pittock watershed. Survey results revealed that approximately one quarter of the residences in Hickson and surrounding area do not discharge their grey wastes through a septic system. Older systems showed a greater tendency to have improper grey waste disposal methods.

Introduction

Water quality within the Pittock reservoir has long been affected by high bacterial and phosphorus inputs from the surrounding watershed. In 1989 a septic system study was conducted by the Oxford County Board of Health and the Upper Thames River Conservation Authority to identify the extent of faulty septic systems in a portion of the watershed. The study area is located in the township of East-Zorra Tavistock and covers concessions XII to XVI, lots sixteen to thirty (Figure 2).

Methods

One hundred and ninety-six residences in the study area were surveyed. The septic system questionnaires examined the type and age of sewage disposal systems, the method of grey waste disposal, the proximity to field tiles, the record of health unit inspections, and the history of system failures. For comparative purposes, the study area was divided into two groups - the town of Hickson and the surrounding rural area.

Results

Improper grey waste disposal in the survey area (excluding the town of Hickson) was found to occur at 25% of the surveyed homes (Table 10). The average age of faulty septic systems was 24 years whereas the proper systems were found to have an average age of 15 years (Table 11).

The percentage of faulty grey water disposal systems is higher in the town of Hickson than the surrounding rural area. 28% of the homes have grey wastes by-passing the septic system (Table 10). The average age of the faulty septic systems was 25 years whereas the proper systems had an average age of 18 years (Table 11).

Thirty-six percent of the homeowners surveyed reported that their septic systems had been inspected at one time. However, Health Unit records indicate that 22% of the systems had been inspected by the Health Unit (Table 10).

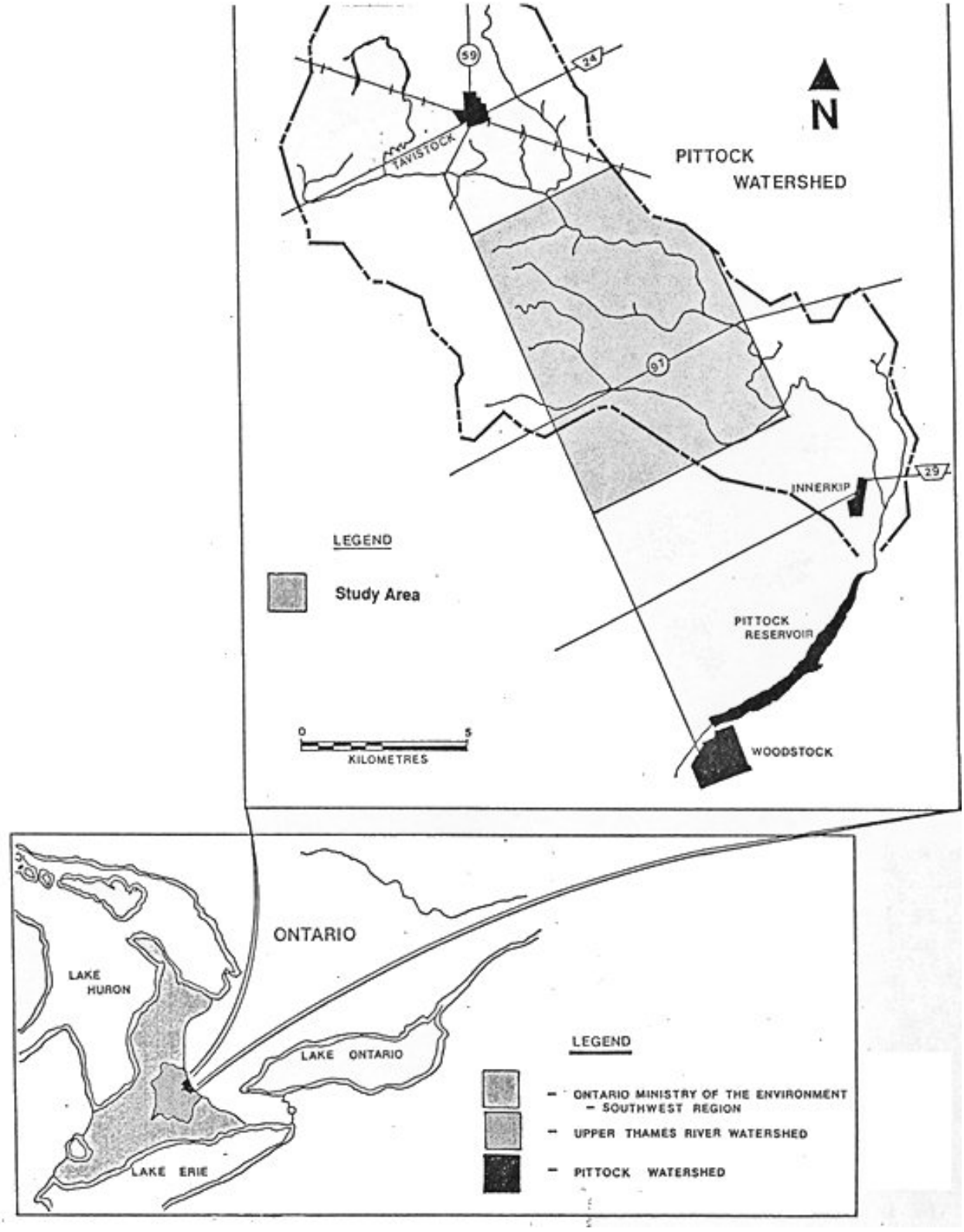

Figure 2: Septic investigations study area; located between Lots 16 to 30 and Conc. 12 to 16.

Table 10: 1989 Septic Survey Results

Area	Number of Surveys	Improper grey waste disposal	% with grey waste problem	Reported inspections	Inspections on record
Hickson	39	11	28	15	8
Other	157	40	25	55	35
Total	196	51	26	70	43

Table 11: Number of septic systems and problem systems per age group.

	Age of Septic System (Years)								
Area	0-5	6-10	11-15	16-20	21-30	31-40	40+	unknown	total
Hickson	1	4	9	2	11	2	4	6	39
Other	26	28	27	20	23	7	6	19	157
Total	27	32	37	22	34	9	10	25	196
Improper grey waste disposal	1	2	12	7	10	6	6	7	51
% faulty systems per age group	4	6	32	32	29	67	60	28	26

Discussion

The study area has a large amount of river coverage with the east branch of the Thames river as well as several other creeks crossing through it (Figure 3). The high percentage of homes in this area with grey waste disposal to field tiles or directly to open water poses a significant water quality risk for the receiving Pittock reservoir.

The older systems in the surveys were much more likely to have an incorrect grey waste discharge (Table 11). This could be a result of old septic systems lacking the capacity for current day water use.

The discrepancy between Health Unit inspection records and reported inspections by homeowners can be attributed to a lack of Health Unit records on file for older systems. Since 1975, accurate records of inspections have been maintained by the Health Unit.

The survey information could not be used to give an accurate assessment of where grey waste was being discharged. Most homeowners were aware of whether or not grey water was going through their septic systems. However, in the cases where it was not, many homeowners were uncertain as to where the grey water went after it went down the drain.

Recommendations

1. The septic surveys should continue in an expanded study area within the Pittock reservoir. The rural area upstream of the Havelock Drain would be an area of high priority for a study as this drain directly affects the water quality of the Pittock Reservoir's main beach (refer to 4.2 Havelock Drain Study).

2. Dye testing of old or potentially impaired septic systems should be done to identify sewage or grey waste bypassing a system.

3. Further work to promote public awareness on the contaminating effects and proper disposal of grey water should be done.

4.2 Havelock Drain Study

Summary

A water sampling program and septic surveys carried out in the area of the Havelock Drain identified problem septic systems which were contaminating the drain. Corrections were made to most faulty systems. Main beach bacteria levels were found to reflect levels in the Havelock Drain. In relation to the rest of the reservoir, main beach bacteria levels have shown a definite reduction over the past few years. Further improvements to the Havelock Drain should continue this trend. More investigative work is required upstream of the Havelock Drain.

Introduction

The Havelock Drain is located within the Pittock watershed and drains directly into the reservoir at the west end of the main beach (Figure 4). This drain is formed by three contributing drains - the Hart-Smith Drain, the Powell-Palmer Drain, and the Benfield Drain. The Havelock Drain runs through Havelock Corners, an area populated by homes which use private septic systems. Due to the history of contamination of this drain as well as its close proximity to the main beach, a Havelock Drain investigative study was initiated by the Oxford County Board of Health.

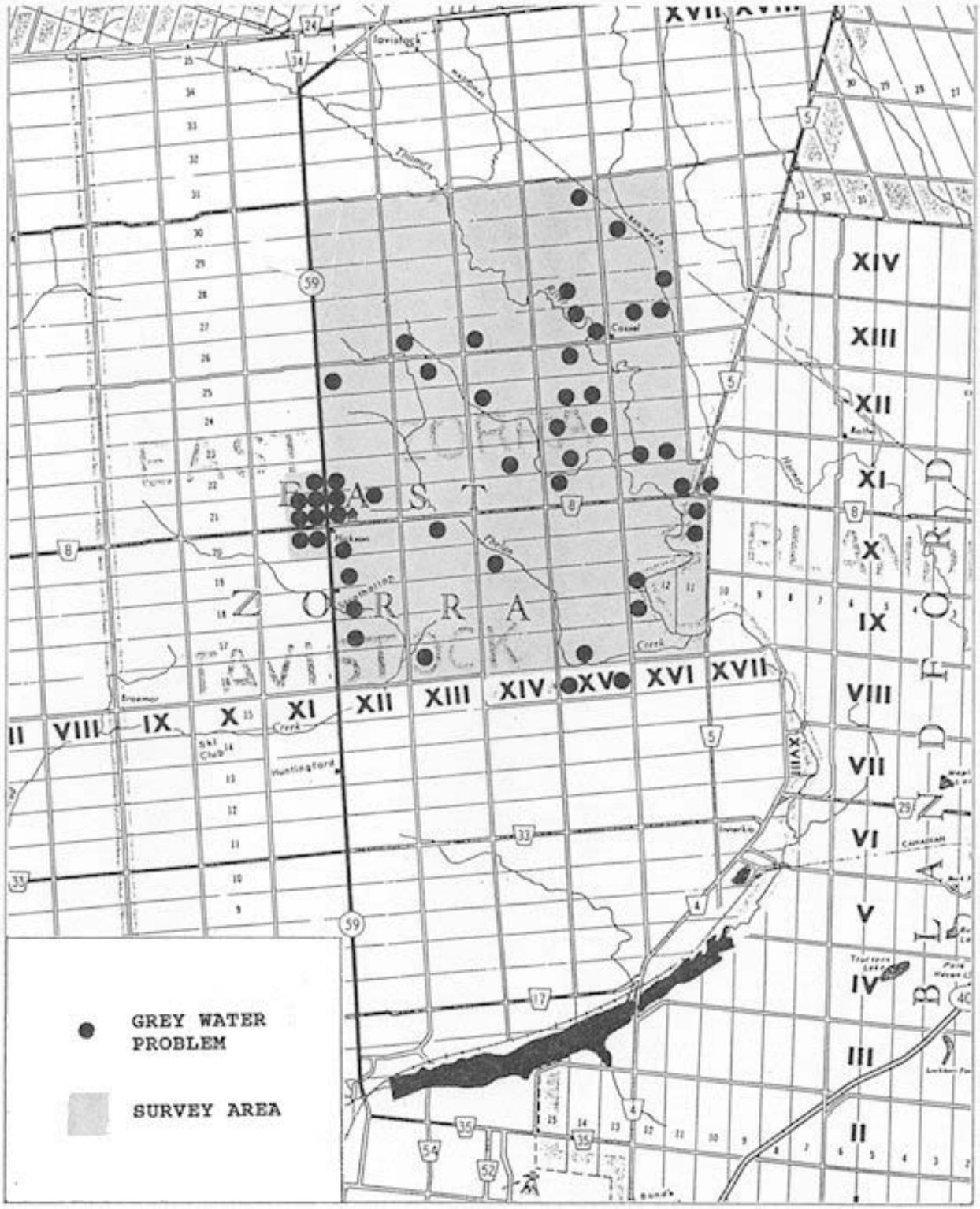

Figure 3: Locations of Improper Grey Waste Disposal Sites As Identified By the Septic Surveys.

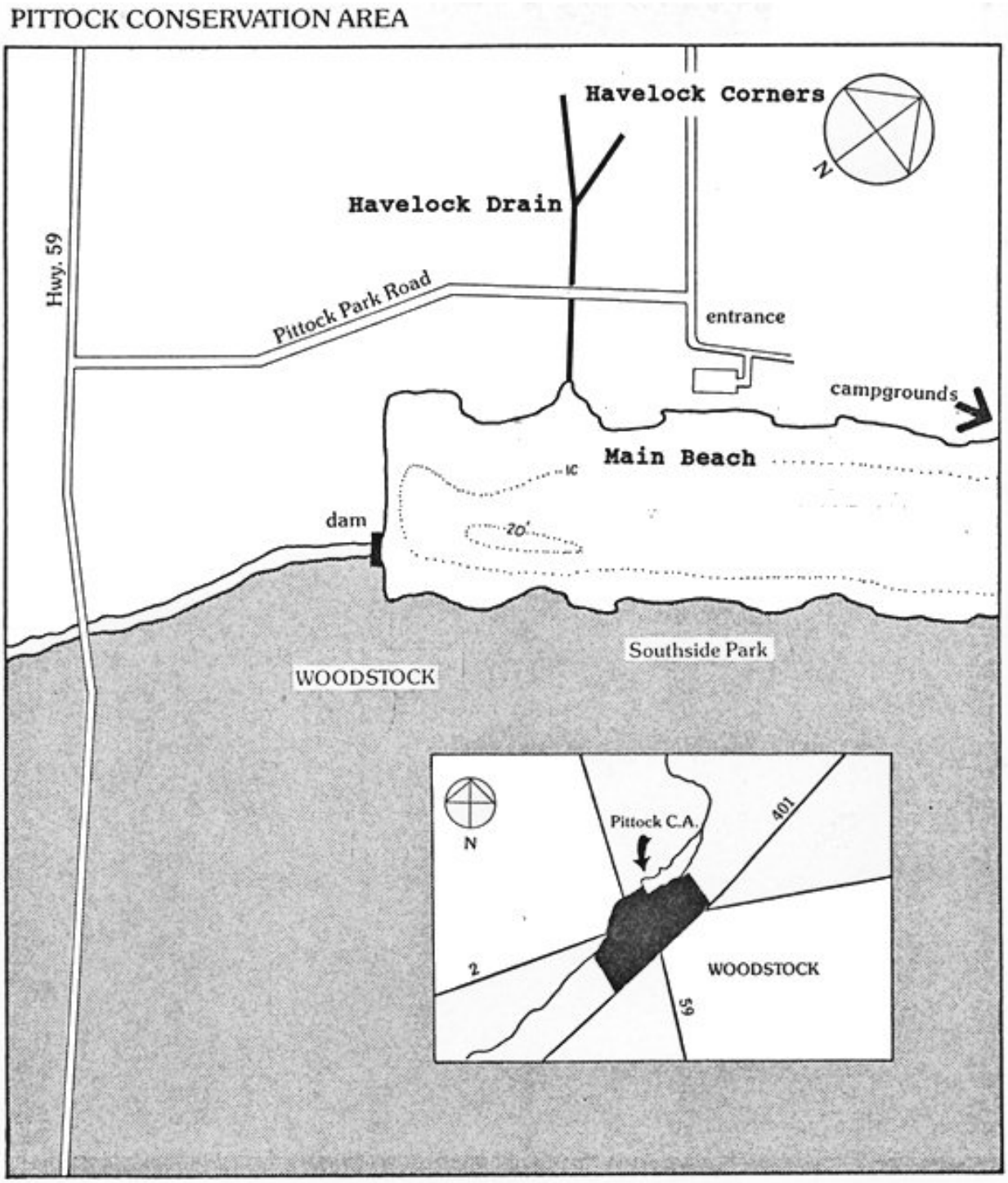

Figure 4: Havelock Drain, Main Beach, and Camp Locations.

Background

In 1974 fecal bacterial contamination of the Havelock Drain was first identified as a result of water sampling in the area. Since 1983, water samples have been taken regularly at various points throughout the area. In 1984, water samples taken at five locations in the Havelock area indicated the source of the contamination was of human origin. This prompted a septic survey to be done on 31 homes in the area. One faulty septic system was identified by a positive dye test and the necessary corrections were made. Also, two other homes in the area replaced their old septic systems that same year (Figure 5).

Water sampling continued through 1985 and 1986 with results continuing to indicate fecal contamination of human origin. In 1987, a more extensive sampling program was carried out at the 12 sampling points. Dye testing was done at seven homes which were suspected of problem systems. Results showed no positive dye tests but one home was found to have a grey waste discharge which bypassed the septic system. This problem has not yet been corrected (Figure 5).

In 1988 and 1989, an extensive water sampling program was continued. No further surveying was done. Sampling of the Havelock Drain has been done concurrently with the Pittock Reservoir sampling program. This has allowed for an observation of how the Havelock Drain impacts the water quality of the reservoir. Of particular interest was the relationship between main beach closings and the levels of bacteria in the Havelock Drain.

Sampling Procedure and Guidelines

Both on and offshore samples (0 - 0.5 meters and 1 - 1.5 meters) were collected in the reservoir. Guidelines for closing the beach for swimming are 3 consecutive days where the offshore samples have a geometric mean greater than 100 fecal coliforms per 100 milliliters (Guidelines for Canadian Recreational Water Quality, 1983). Another criterion for closing the beach is the presence of excessive amounts of algae at such a level that it is aesthetically unappealing.

Results

The locations of problem septic systems and corrections made as identified through the septic surveys are shown in figure 5.

1984 water quality data indicates that fecal coliform levels at the main beach increase following elevated fecal coliform levels at sample station 10 in the Havelock Drain (Figure 6). Concentrations at the main beach are almost always higher than those at camps 1,2, and 3 (Figure 7).

In 1985, the Havelock Drain was found to have a particularly high concentration of fecal coliforms on June 11 (approximately 70000/100 ml). Following this, the concentrations at the main beach showed a substantial increase as compared to the concentrations at the three camps (Figures 8 and 9).

In 1986, water samples taken at station 10 had fairly low levels of fecal coliforms

(Figure 10, 11). A manure spill in the Innerkip road area on July 7 contributed high levels of fecal coliforms to the waters upstream of the reservoir.

The main beach was closed on August 7, 1987 as a result of excessive bacteria levels. Three days previous to this an extremely high concentration of fecal coliforms was recorded at station 10 of the Havelock Drain (Figure 12). In 1987 and 1986, the bacterial contamination at the main beach was no longer consistently higher than the 3 camps. By August of these two years, the water within the reservoir was quite contaminated (Figures 11 and 13).

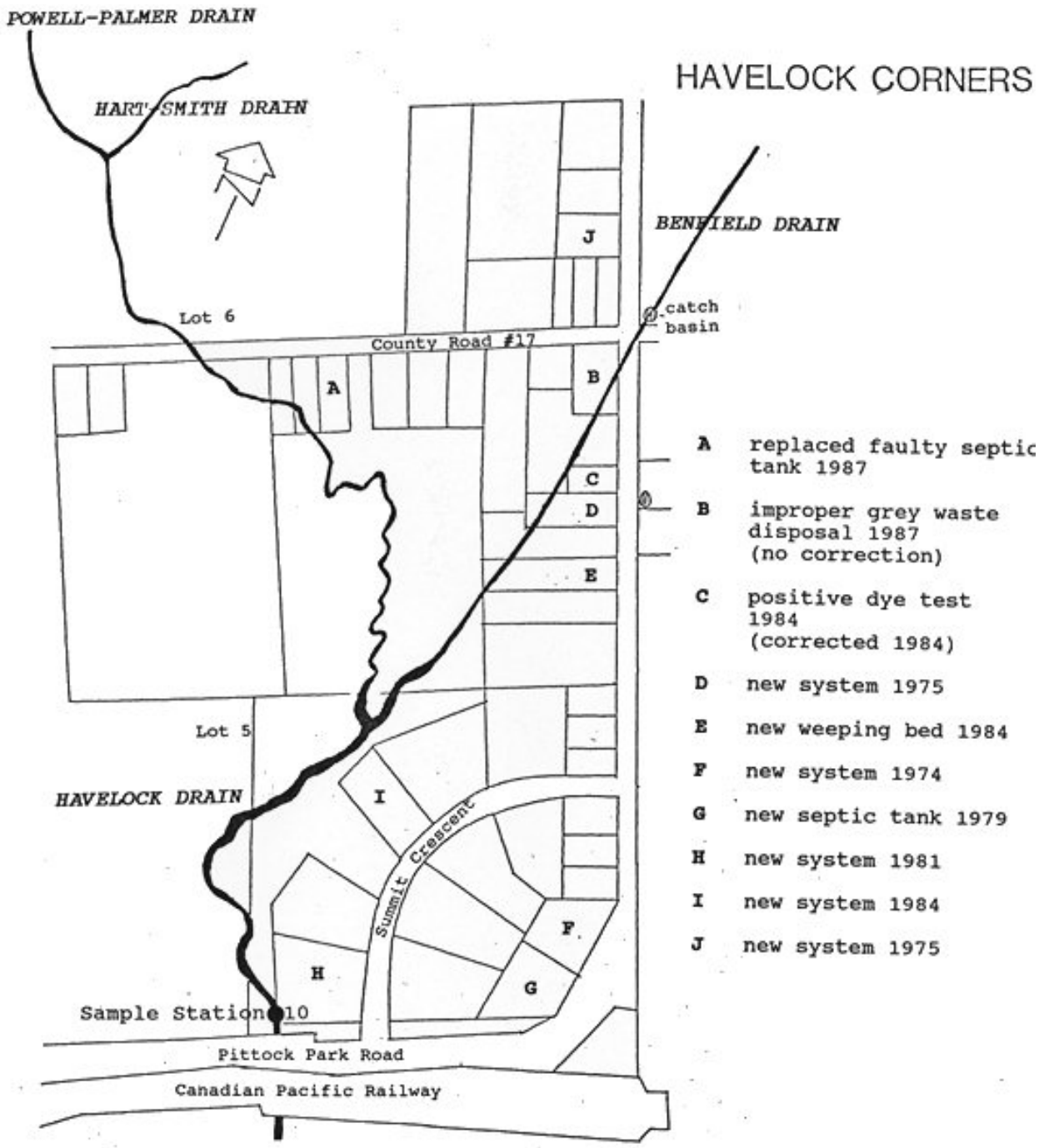

Figure 5: Locations of Problem Septic Systems and Corrections Made as Identified by the Septic Surveys.

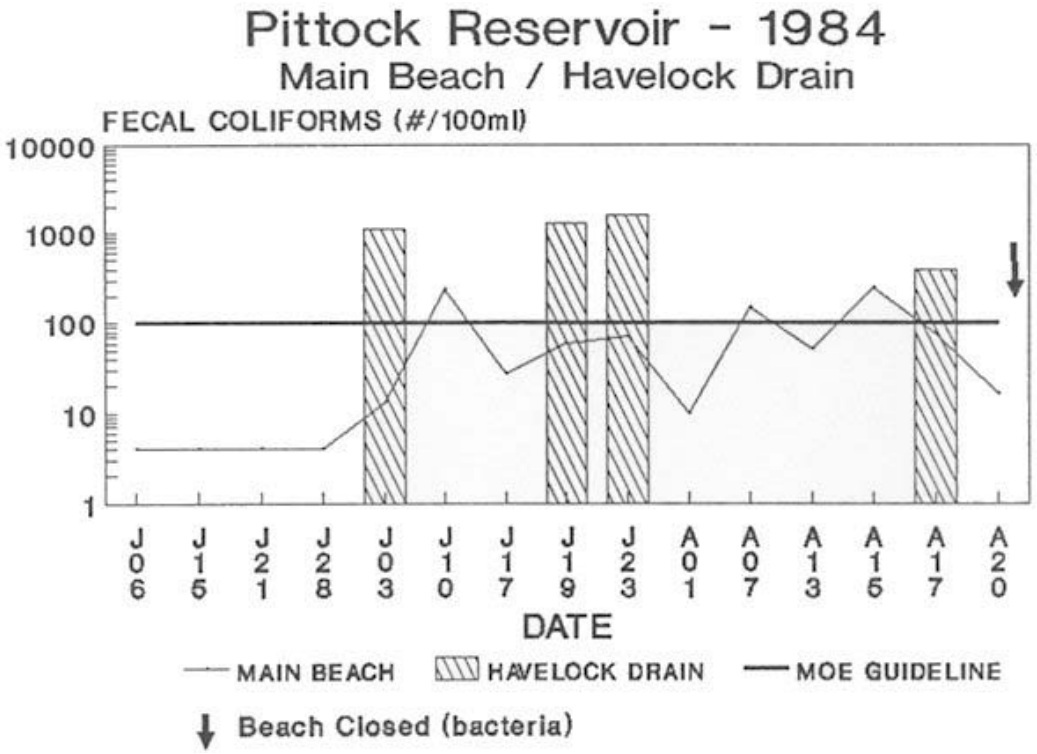

Figure 6: Bacteria Levels at the Havelock Drain (Station 10) and the Main Beach for 1984.

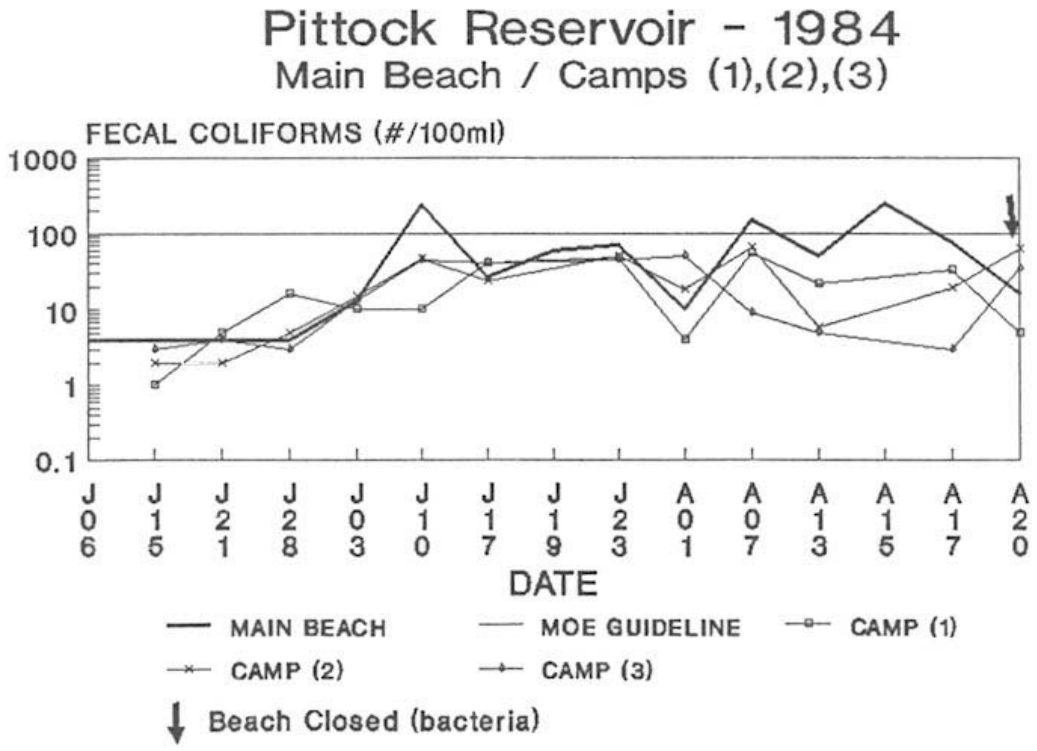

Figure 7: A Comparison of Bacteria Levels at the Main Beach with Camps 1, 2, and 3 for 1984.

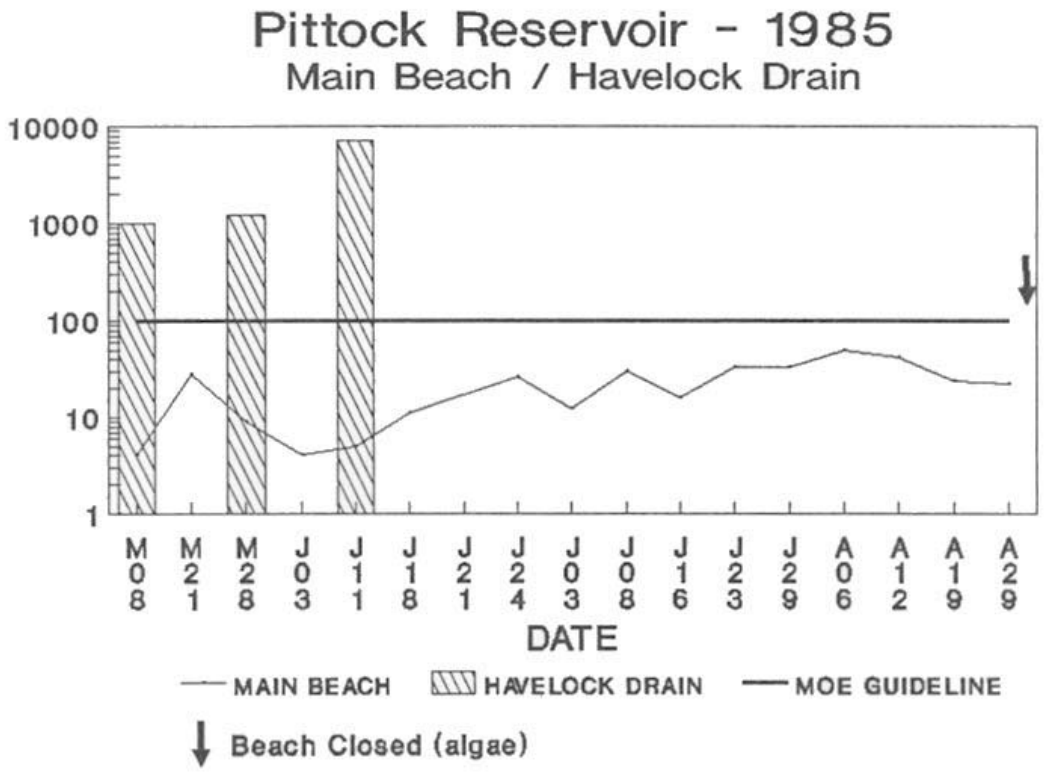

Figure 8: Bacteria Levels at the Havelock Drain (Station 10) and the Main Beach for 1985.

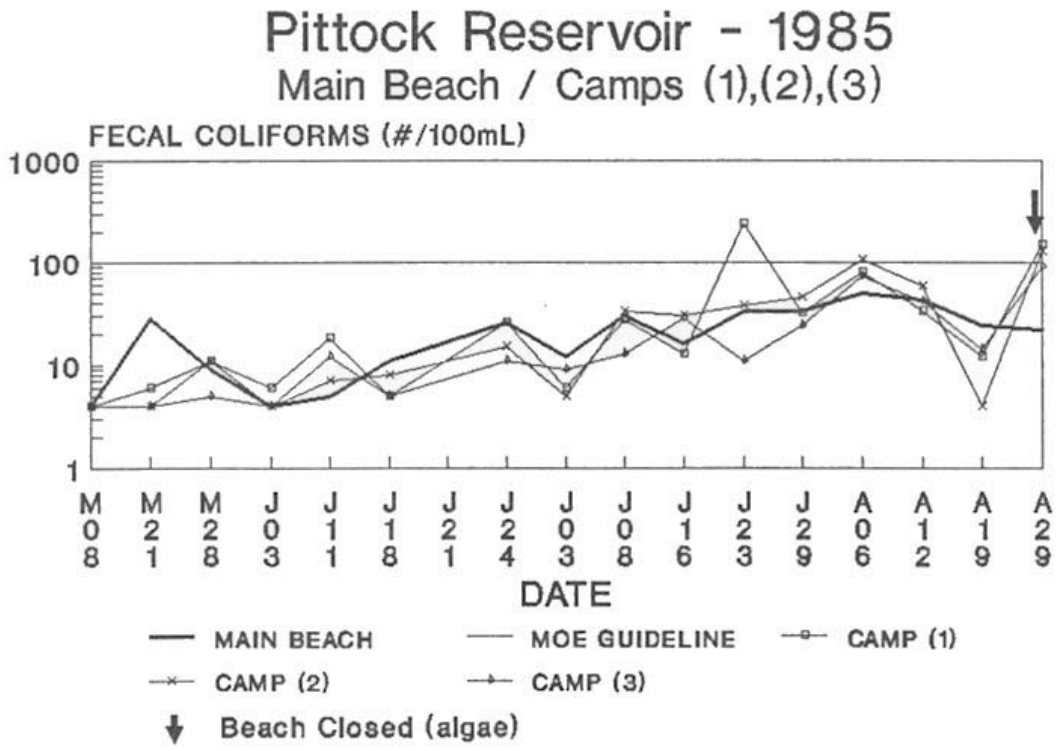

Figure 9: A Comparison of Bacteria Levels at the Main Beach with Camps 1, 2, and 3 for 1985.

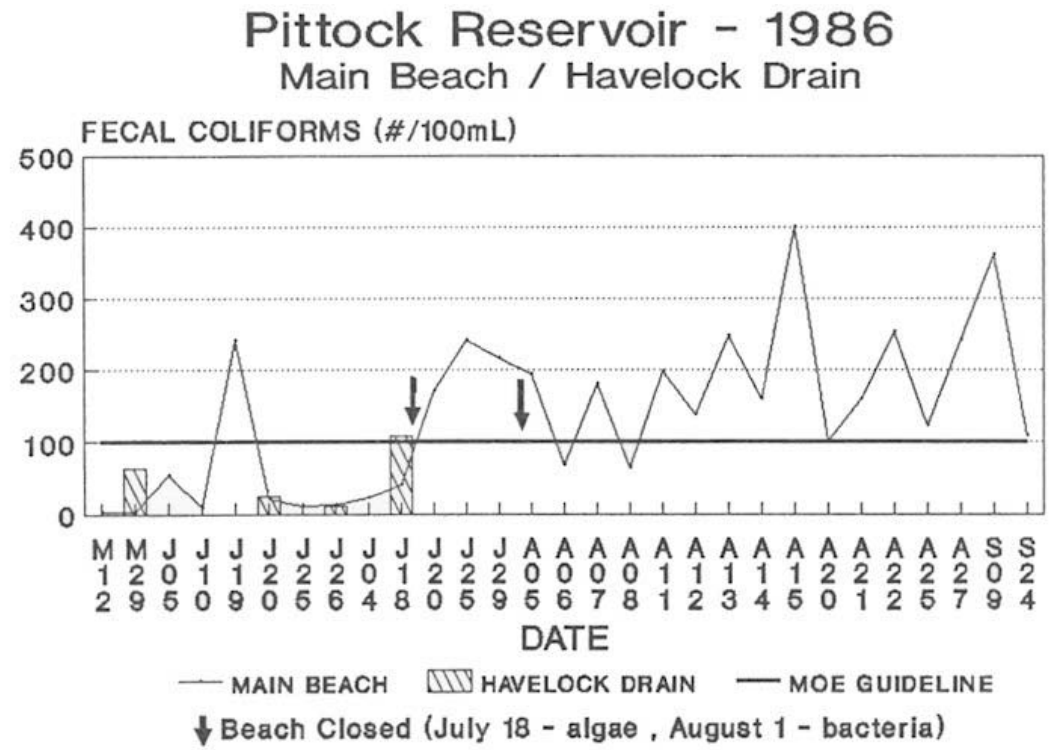

Figure 10: Bacteria Levels at the Havelock Drain (Station 10) and the Main Beach for 1986.

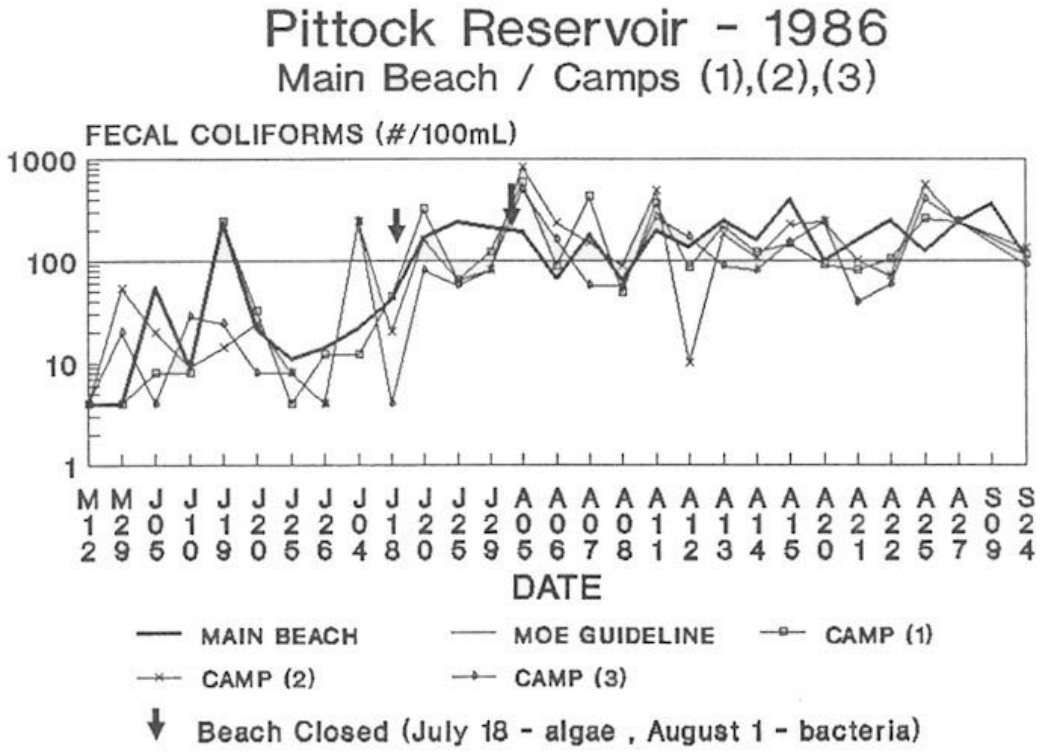

Figure 11: A Comparison of Bacteria Levels at the Main Beach with Camps 1, 2, and 3 for 1986.

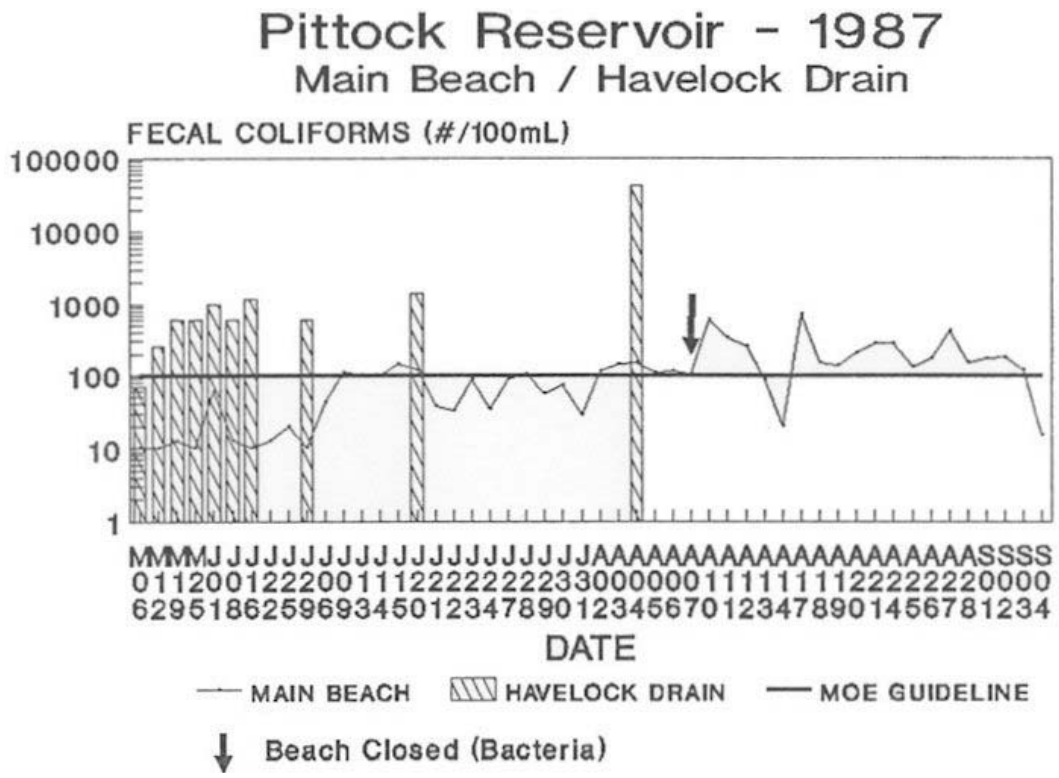

Figure 12: Bacteria Levels at the Havelock Drain (Station 10) and the Main Beach for 1987.

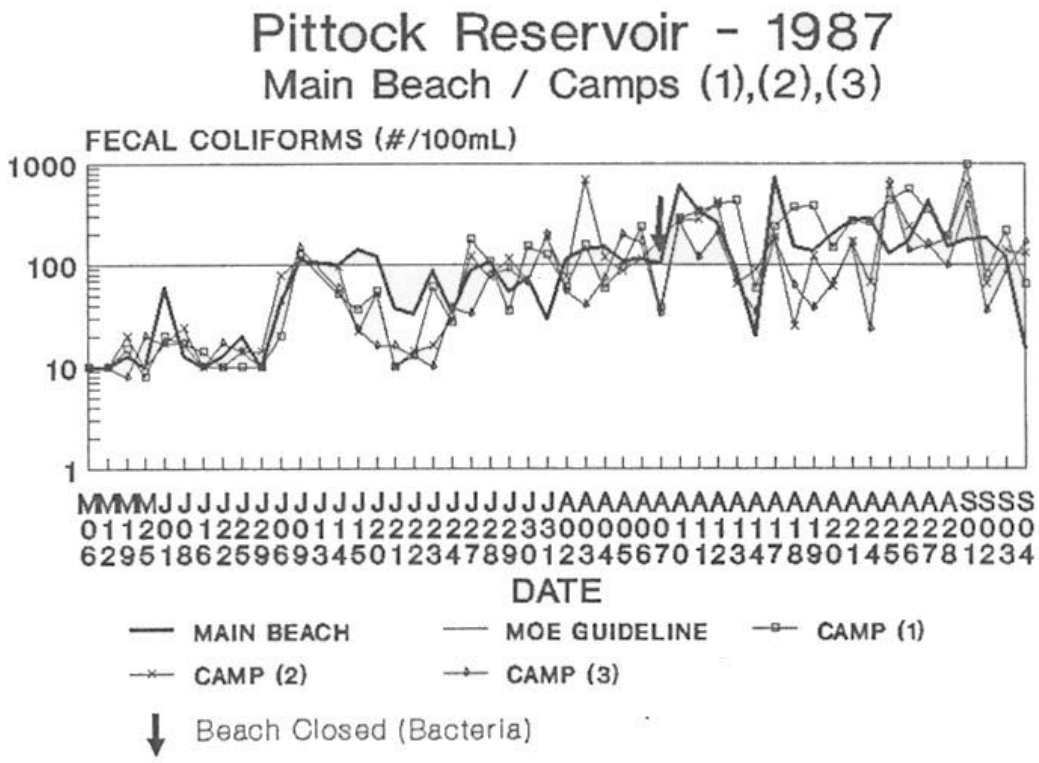

Figure 13: A Comparison of Bacteria Levels at the Main Beach with Camps 1, 2, and 3 for 1987.

Through 1988 and 1989, the water quality at the main beach improved and became less contaminated than the water at the 3 camps (Figures 14, 15, 16 and 17).

Discussion

Over the years 1984 to 1989 there has been a gradual change in the bacteria concentrations at the main beach from being higher than the camps to being generally lower. Improvements to septic systems along the Havelock Drain could be contributing to improvements in the drain itself and ultimately benefitting the reservoir.

Although the water quality at the main beach appears to be affected by the condition of the Havelock Drain, the rest of the reservoir also has a major influence. For example, the manure spill in the Innerkip area in 1986 brought main beach bacteria levels way up while levels in the Havelock Drain remained low.

The fecal coliform levels at sample station 10 (Figure 5) continue to be well above the MOE guideline of 100/ 100 ml. However, it is likely that homes in the Havelock Corners are not the main contributors of bacteria to the drain. In 1987 all the houses in the Havelock area backing the drain were dye tested. Corrections were made to all but one system found to be faulty. Therefore, it is assumed that there are sources of contamination further upstream.

The bacteria levels at the main beach have been decreasing over the past few years. Even with some improvements, Pittock Lake has been closed at some point every summer since 1982 as a result of poor water quality. By decreasing bacterial inputs at the main beach, through improvements to the Havelock Drain, this beach could remain safe for swimming for the entire summer.

Recommendations

1. A sampling program in the Havelock area should continue as inputs from this area have a direct impact on the main beach.

2. An extensive septic survey should be carried out upstream of the Havelock Drain. Farm operations and rural residences along the Hart-Smith, Powell-Palmer, and Benfield Drains should be examined.

5.0 Milkhouse Waste Treatment System

Currently only two viable methods to handle milkhouse washwater are promoted to a dairy farmer. The first method involves pumping the washwater to a holding tank or liquid manure storage containment, then spreading it on the land at the appropriate time of year. The second method is to treat the washwater in a treatment trench system. With proper maintenance, the system has proven itself reliable if installed in medium or coarse soil types. However, the jury is still out on the long-term reliability of the treatment trench system installed in heavy soils. Current research in the Pittock sub-basin #2 study area and at the University of Guelph will help answer this question.

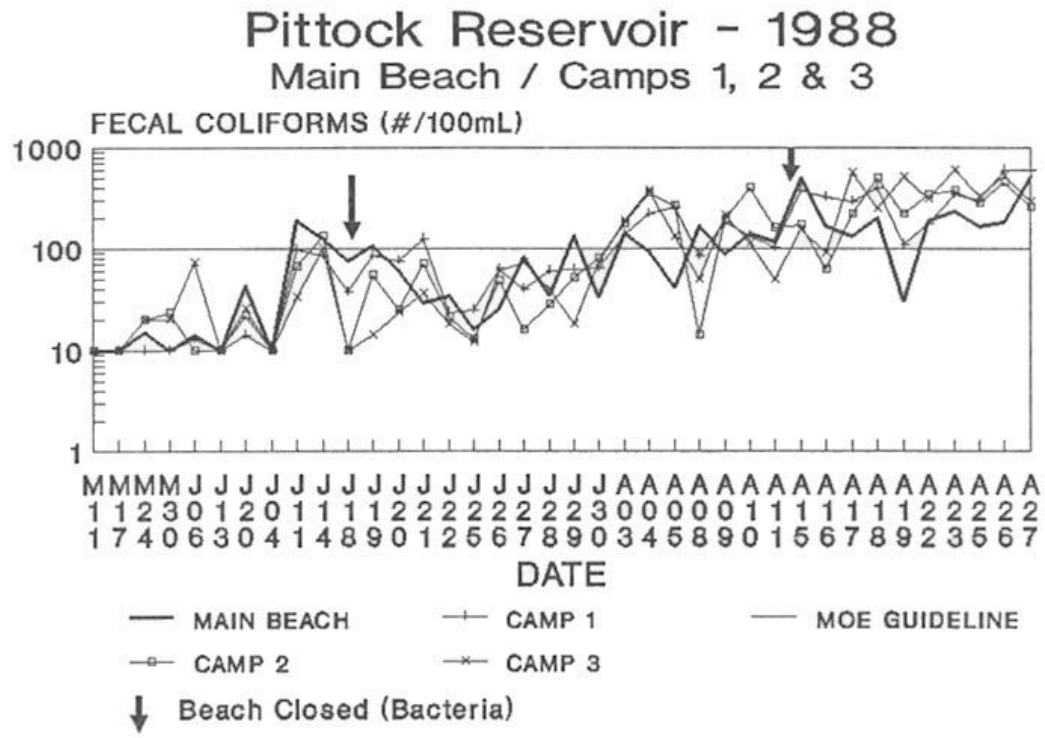

Figure 14: A Comparison of Bacteria Levels at the Main Beach with Camps 1, 2, and 3 for 1988.

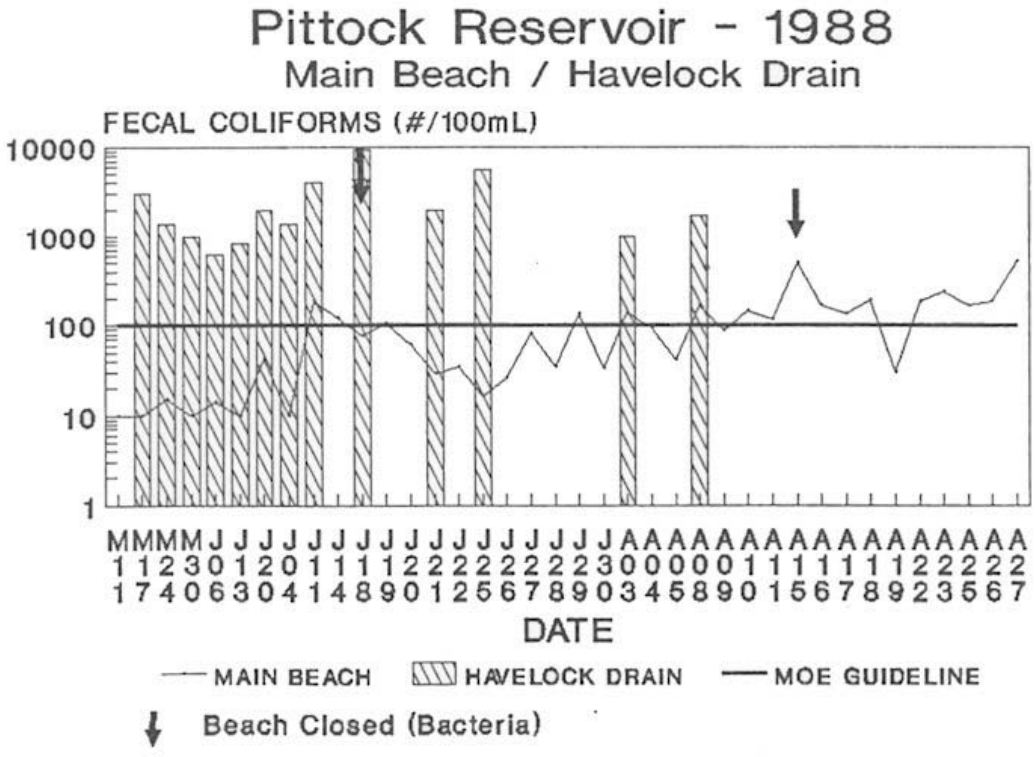

Figure 15: Bacteria Levels at the Havelock Drain (Station 10) and the Main Beach for 1988.

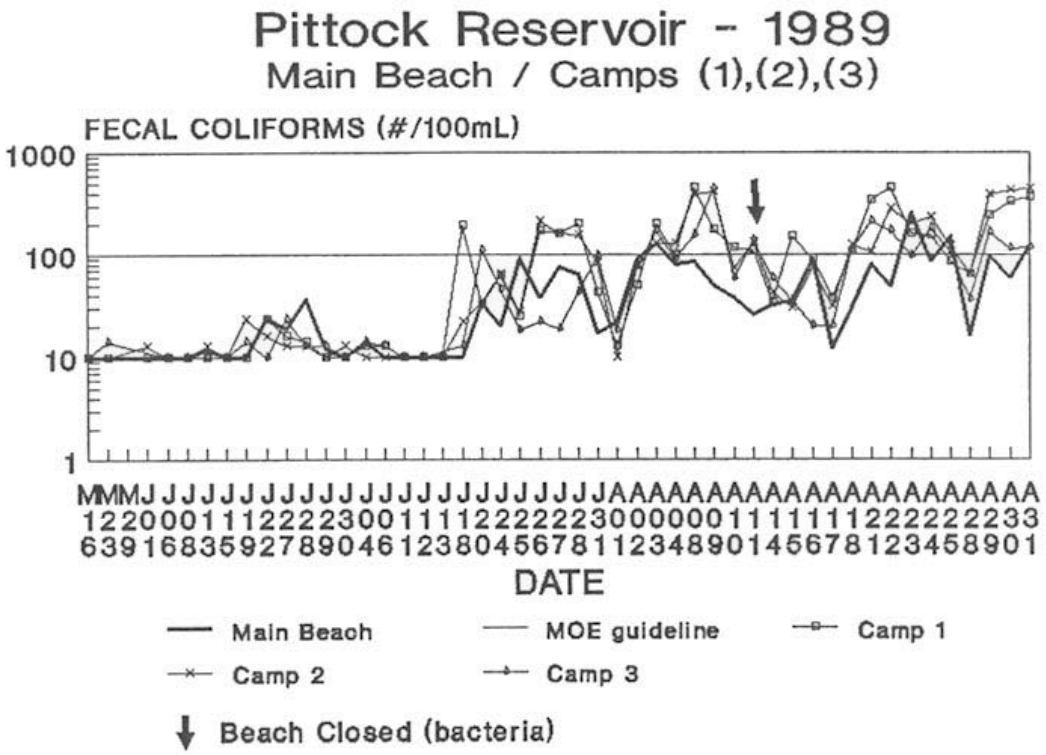

Figure 16: A Comparison of Bacteria Levels at the Main Beach with Camps 1, 2, and 3 for 1989.

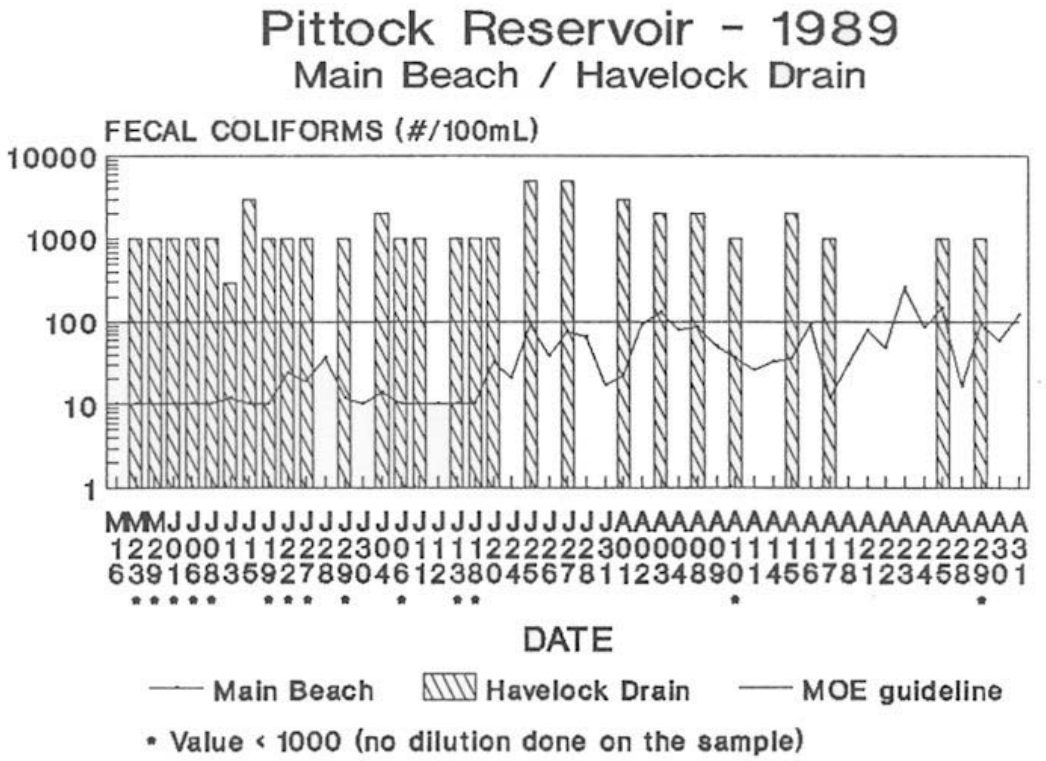

Figure 17: Bacteria Levels at the Havelock Drain (Station 10) and the Main Beach for 1989.

Dairy farmers located on these heavier soil types need inexpensive alternatives to the treatment trench system. For this reason, Authority staff have researched and designed an above ground filtering method of treatment. The system is based on a switch-back waterway design. Waste water is pumped from the milkhouse to the top of the waterway. The waste water soaks into the ground as it flows by gravity down the waterway. The length of the waterway is based on the amount of wash water in the milking operation.

Because this system relies on gravity flow to transport the waste water down the filter strip, the installation site must have some natural gradient. An appropriate location was found in Zorra Township on the John McKay farm. At the time, McKay outletted this waste water through a field tile, which emptied on a flat area close to a stream. McKay was receptive to the switch-back waterway method of treatment, and agreed to having a set of plans drawn up.

During the second visit to his farm, Authority staff raised the question of up-grading his current manure storage system. With his existing uncontained solid manure system, runoff from the area would flow towards the stream.

After considering various options presented to him by Authority staff, McKay made a decision to upgrade his entire method of storing and handling manure. He opted for a walled solid manure storage area with a runoff containment tank.

Once he had made the commitment to the system, it made sense to simply enlarge the capacity of the runoff tank to contain his milkhouse washwater. It was therefore decided not to proceed with the installation of the switch-back waterway system on this farm.

Several other dairy operators have expressed an interest in the system. Steps will be taken in the spring of 1990 to have the system installed and monitored on one of these alternate locations.
(from January, 1990 Progress Report)

6.0 Cattle Access Literature Review

A review of the literature available indicates many disease organisms which are transmitted by way of water. Many isolated cases have been identified in which livestock have become diseased as a result of drinking from contaminated streams or ponds. However, little research has been done on the extent of illnesses associated with watering cattle in a stream and therefore it would not yet be possible to quantify the problem. Further research would be required to identify the cost impacting the cattle industry as well as the environment.

6.1 Cattle Access Reference List

Boardman, G. D., and Evans, S. M. 1986. Detection and Occurrence of Waterborne Viruses. Fate and Effects of Pollutants. June: 717-721.

This paper covers the occurrence and distribution of viruses, virus detection, persistence and transport in soils and groundwater systems, and the fate of viruses in wastewater treatment. This review of studies done worldwide suggests that viral infections can be acquired through contact

with recreational waters. Studies from the U.S. indicate that properly treated drinking waters do not contain viruses. Other studies found viral aggregates in urban wastewater effluents and fecally contaminated open water.

Bonaduce, A. 1980. Water Pollution and Infectious Diseases of Domestic Animals. Acta Medicina Veterinaria. 26: 11-109.

This work refers to the problem of water pollution through time and the multiple factors which cause serious ecological damage with repercussions on the hygiene and, consequently, the health. In particular the survival and/or pollution of bacteria and viruses in polluted water are considered.

As regards bacteria the following pathogenic forms are described*: Leptospira, Vibio, Pseudomonas, Brucella, Francisella, Escherichia, Salmonella, Staphilococcus, Yersinia, Streptococcus, Bacillus,* and *Listeria*.

For viruses the presence of Enterovirus, Adenovirus, and agents of Foot and mouth disease, Hog-cholera, African swine-fever, Duck virus hepatitis, Newcastle disease, Infectious bronchitis of chickens, Pseudorabies, Infectious canine hepatitis, Vaccinia, Blue tongue and Enterophages are described. It is concluded that the domestic and industrial waste production will undoubtedly increase and so also pollution of superficial waters creating bigger problems for hygiene and health.

Carmichael, W. W., Gorham, P.R., and Biggs, D.F. 1977. Two Laboratory Case Studies On The Oral Toxicity To Calves Of The Freshwater Cyanophyte (Blue-green Algae) Anabaena Flos-Aquae NRC-44-1. Canadian Veterinary Journal. 18 (3): 71-75.

Poisonings by toxic waterblooms of freshwater cyanophytes (blue-green algae) often cause considerable economic loss when livestock are involved. Three toxic genera, Microcystis, Aphanizomenon and Anabaena, have been implicated in these poisonings. Of these genera, the species Anabaena flos-aquae has received the most thorough investigation. This cyanophyte often forms thick wind-concentrated surface blooms in eutrophic lakes and sloughs in Western Canada during the summer months. Some of these blooms are toxic and when a critical dose is ingested by livestock deaths occur from 10 to 20 minutes, up to several hours.

Davidson, K. 1987. Cool, Clear Water. Cattlemen. July: 14-15.

This article reviews two case studies which identify fecal contamination of rivers as a result of cattle access situations.

The first involves the high pollution levels in the Humber River, north of Toronto. The large cattle population, some of which use the river as a watering source, is the suspected cause of high fecal bacteria levels. The second case study involves a beef operation near Harmony, Ontario. The owner found an alternate watering source for his cattle after a salmonella poisoning was linked to contaminated creek water.

Diesch, S.L. Disease Transmission of Water-borne Organisms of Animal Origin. Animal Wastes As Water Pollutants. 4: 265- 281.

There is a growing public concern for the environment and the need for a reevaluation of water's role as a vehicle in transmission of animal diseases associated with agriculture.

Documented cases of infectious disease of animal origin in man and animals have been associated

with water transmission. Following a literature review, it is apparent that adequate consideration of water transmission has not been made. This article examines the epidemiological significance of various pathogenic organisms based on their potential for water transmission. Included in the discussion are bacterial diseases, viral diseases, rickettsia! diseases, fungal diseases and parasitic diseases.

Rodenburg, J. 1989. Practical Water Evaluation For Dairy Cattle. The Bovine Proceedings. 21: 72-78.

This article examines the fact that poor bacterial or mineral water quality or factors which restrict intake can cause health problems and reduce milk production in dairy cattle. The following substances are discussed with respect to their effect on a cattle watering source; total dissolved solids, sulfate, magnesium, sodium, calcium, iron, nitrates, trace elements, and toxins produced by certain algae species. It was found that an excessive intake of water by cattle was more likely to reflect a problem with water quality than a low intake.

Bacterial contamination of dairy cattle water supplies was analysed by way of a study in which 75 water samples were taken in 3 regions of the province. Young calves appeared to be the most susceptible to polluted water. Chlorination systems are effective in eliminating bacteria without affecting milk production.

Rodenburg, J. 1987. Effect of Mineral Content of Water on Production and Health of Ruminants. Symposium Paper presented to the Canadian Society of Animal Science, August 26.

Content is similar to the previous article by Rodenburg.

Rodenburg, J. 1987. Water Quality Can Affect Production And Health. Ministry of Agriculture and Food, P.O. Box 666, Woodstock.

Content is similar to the previous article by Rodenburg.

Schilthuis, B. 1985. Water Testing and Water Quality. Goderich Veterinary Clinic Newsletter. November.

Water quality directly affects water consumption; the first effect of water restriction, whether voluntary or involuntary, is to reduce feed consumption and thus to reduce feed efficiency. This article covers several conditions and toxic substances which reduce the palatability of water for livestock. Saline salts, soft water, hard water, nitrates, pH, and bacteria all have maximum safe levels and exceeding these levels results in herd health problems.

Schilthuis, B. 1984. Goderich Veterinary Clinic Newsletter. June.

Content is similar to the previous article but slightly more detailed.

Singer, R.H. 1983. Pollution of Drinking Water and Livestock Poisoning. Proceedings of the United States Animal Health Association. 87: 462-467.

An examination is made of the major changes that influence the chemical contamination of waters utilized as drinking water for livestock. These include the urbanization of rural communities, improperly located municipal garbage dumps, the great expansion of various industries to small towns and rural communities, the farm use of many chemicals classified as agricultural chemicals, and the great increase in gasoline powered vehicles traveling on rural highways as well as for

farm use.

Stephenson, G.R., and Rychert, R.C. 1982. Bottom Sediment: A Reservoir of Escherichia coli in Rangeland Streams. Journal of Range Management. 35 (1): 119-123.

Escherichia coli concentrations of bottom sediment and overlying water were determined from a variety of streams in southwestern Idaho. Results show E. coli concentrations to be from 2 to 760 times greater than from the overlying water. E. coli concentrations of bottom sediment were found to be resuspended following disturbance and a rainstorm event, contributing to pollution of the overlying waters. It is, therefore, suggested that microbial analysis of bottom sediments be considered a part of water-quality evaluations for rangeland streams.

Young, L.G. 1986. Water Quality and Pig Performance. Department of Animal and Poultry Science, University of Guelph, Guelph, Ontario.

A trial was conducted on three farms suspected of water quality problems, with bacteria levels unsafe for human consumption. It appears the pigs can tolerate hard water high in magnesium, calcium and sulphate.

However, the incidence of scours increases slightly as a result of fecal bacteria contamination in the water.