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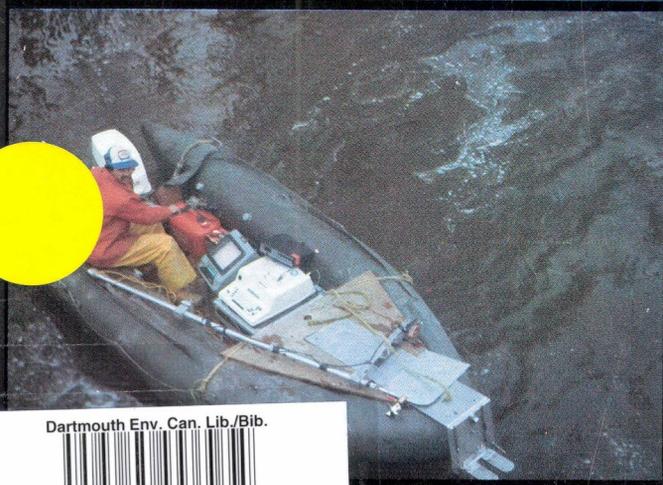
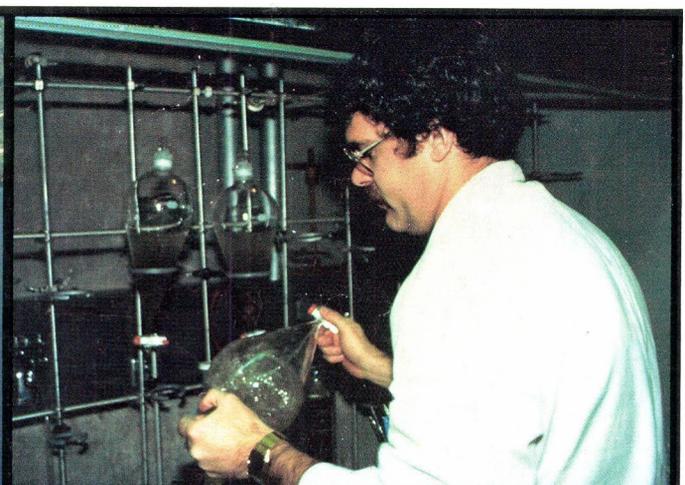
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CHARLOTTETOWN AIRPORT REDEVELOPMENT PROJECT

WATER QUALITY MONITORING PROGRAM

1982 TO 1987

IWD — AR — WQB — 89 — 149



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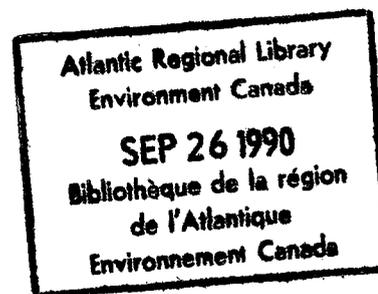
**INLAND WATERS DIRECTORATE
ATLANTIC REGION
WATER QUALITY BRANCH
MONCTON, NEW BRUNSWICK**

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WATER QUALITY MONITORING PROGRAM

1982 TO 1987



IWD-AR-WQB-89-149

HAROLD S. BAILEY

INLAND WATERS DIRECTORATE

WATER QUALITY BRANCH

ATLANTIC REGION

MONCTON, NEW BRUNSWICK

JUNE, 1989

ADDENDUM

Recent observations, subsequent to the period of record discussed in this report, indicate that physical-chemical changes are occurring in the vicinity of the new runway (Runway 28).

An odour of hydrogen sulphide, an indicator of reduction processes, has been observed in Wells E and #14 during surveys in November 1988 and February 1989. Odour ranged from mild in Well #14 in November and Well E in February to strong during the entire pumping of Well #14 in February. Extracted iron concentrations in Well #14 have increased dramatically under the reducing conditions (0.003 to 8.8 mg/L from 1982 to 1987) as discussed in Section 3.3. Iron values have continued to increase with a concentration of 20.0 mg/L reported for the sample collected March 1, 1989.

Although the recent data are not discussed in the report, this information resulted in a more accurate assessment of conditions in Well #14.

The recommendations as proposed would necessitate the collection of 6 additional samples per year for the standard analysis (private wells) and 16 additional samples per year for iron and manganese. These samples would represent an additional yearly cost of approximately \$300 for a total of \$8600. No additional sampling cost would be incurred.

EXECUTIVE SUMMARY

In response to a steady increase in the volume of air traffic, the Ministry of Transport (MOT) announced an expansion to the existing Charlottetown Airport facilities including construction of an air terminal building, combined service building, taxiways and a 2130 metre east-west runway. The construction phase was commenced in 1978.

Water related concerns were identified by the Prince Edward Island Department of Community and Cultural Affairs, with regard to possible detrimental effects construction may have on ground water resources adjacent to the airport, since the facilities are partially situated in the recharge areas of well fields which supply water to the City of Charlottetown. In response to their concerns, the Inland Waters Directorate of Environment Canada implemented a water resource investigation of the Charlottetown Airport Redevelopment Project which was, in part, funded by the Ministry of Transport.

The water quality component of the investigation, initiated in the fall of 1976, was to establish baseline water quality information within and adjacent to the airport redevelopment. Samples were collected from test wells, which were also used to delineate the ground water flow patterns, surface water sites that drained the airport property, and municipal water supplies and some private wells

adjacent to the airport. Additional test wells were drilled to provide links between wells and to provide more effective coverage in the area of the new runway. Sampling stations and parameter schedules varied with the construction phases.

This report discusses the water quality aspects of ground and surface waters sampled between August 1982 and May 1987. Some data collected from 1976 to 1980 have been used to determine long term trends.

The only parameter which has been found at concentrations of environmental concern in some test wells and surface water is nitrate nitrogen. Three wells in the Wrights Creek drainage and one in the Winter River drainage greatly exceed the nitrate levels found in a cross-section of municipal water supplies on the Island, and also exceed the Canadian Drinking Water Guideline of 10 mg/L on many occasions.

The nitrate concentrations in the above wells appear to be cyclic with recharge and fluctuate with yearly conditions such as urea usage (averages 60,000 kilograms annually as a runway de-icer), snowmelt, etc. Wrights Creek and South Branch Winter River have shown upward trends in nitrate concentrations from 1976 to 1987.

Heavy metals such as copper, lead, zinc and cadmium were at or below detection limit values for all sites. For the most part, elevated aluminum, iron and manganese concentrations are the product of well construction and natural events. High iron and manganese concentrations in one well are probably due to reduction processes resulting from construction of the new runway.

Phenolic materials were found in eight samples at near detection limit values but concentrations remained unchanged from those measured in 1976-77. Petroleum products were not detected in two samples from Well #10 downgrade from the fire training area.

To study change with time, a relatively lengthy and preferably continuous data base should be established. It is therefore recommended that the present sampling stations and parameters be retained with a few exceptions. Sampling of three private wells on Norwood Ave. should be recommenced on a twice a year basis noting the elevated nitrate levels in Well #9, which drains toward Norwood Ave.

Well #10 has been retained to monitor downgrade of the new fire training area for petroleum products. However, this well has not been sampled on 8 of the 12 most recent occasions due to the lack of water. It is recommended that a new deeper well adjacent to the present well be established to monitor the fire training area.

Iron and manganese should be analyzed at additional sampling stations to determine the extent of the reduction process and future change.

ABSTRACT

This report presents the results of the Charlottetown Airport Redevelopment Project Water Quality Monitoring Program for the period from 1982 to 1987.

Nitrate concentrations in four test wells greatly exceeded a cross-section of municipal production wells on P.E.I. and also exceeded the Guideline for Canadian Drinking Water Quality of 10 mg/L on most occasions. Wrights Creek and South Branch Winter River also exhibited increases in nitrate concentrations from 1976 to 1987. Urea used at the rate of 60,000 kg annually for airport runway de-icing is the probable source of most nitrate.

Increases in iron and manganese concentrations in Well #14 suggest that reduction processes are present, probably as a result of the compaction of soils under the new runway.

Other metals, phenolic materials, and petroleum product concentrations have not been significant during the study.

RESUME

Un programme de surveillance de la qualité des eaux fut initié à l'aéroport de Charlottetown suite à de nouveaux développements à ce site. Ce rapport présente les résultats recueillis entre 1982 et 1987 sous ce programme.

Les niveaux de nitrates dans quatre puits d'observation dépassaient significativement ceux enregistrés selon un profil des puits de production municipaux de l'Ile-du-Prince-Edouard. Ils dépassaient fréquemment la concentration de 10 mg/L, établie par les Recommandations pour la qualité de l'eau potable au Canada. De 1976 à 1987, il y eut une augmentation des niveaux de nitrates dans le ruisseau Wrights et dans la ramification sud de la rivière Winter. L'urée, utilisé à un taux de 60000 kg par an pour dégivrer les pistes d'atterrissage, est la cause la plus probable de ces résultats.

Dans le puit #14, une augmentation des niveaux de fer et de manganèse a été observée. Ceci suggère la présence de réactions de réduction causée par le compactage du sol situé sous la nouvelle piste d'atterrissage.

Les analyses des autres métaux, des matériaux phénoliques et des produits pétroliers n'ont pas démontré de résultats significatifs lors de l'étude.

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1. INTRODUCTION

In response to a steady increase in the volume of air traffic, the Ministry of Transport (MOT) announced an expansion to the existing Charlottetown Airport facilities including construction of an air terminal building, combined service building, taxiways and a 2134 metre east-west runway (Environment Canada, 1981). A chronological list of construction projects, which began in 1978, is presented in Appendix I.

The water resource concerns and terms of reference have been previously outlined (Environment Canada, 1978) and will only be discussed briefly here.

Water related concerns were identified by the Prince Edward Island Department of Community and Cultural Affairs, Water Resources Branch, with regard to possible detrimental effects construction may have on ground water resources adjacent to the airport, since the facilities are partially situated in the recharge areas of well fields which supply water to the City of Charlottetown.

In response to the concerns of the Department of Community and Cultural Affairs and at their request, the Inland Waters Directorate of Environment Canada implemented a water resource investigation of the Charlottetown Airport Redevelopment Project, which was, in part, funded by the Ministry of Transport. The water quality component has been funded on a cost recovery basis since 1976.

The water quality component of the investigation, initiated in the fall of 1976, was to establish baseline water quality information within and adjacent to the airport redevelopment. This component, from 1976 to 1980, may be divided into three distinct phases. The time frame for each phase and stations sampled during each phase are provided in Table 1.

The initial phase (September 1976 - April 1977) was intensive in that all stations were sampled and analyzed for a wide variety of parameters. Parameter lists for each phase are provided in Table 2.

The second phase (May 1977 - October 1978) was a period of monitoring at a reduced number of wells. Three wells (2, 5 and 8) represented different ground water flow directions from the existing airport whereas two other wells (B and E) were maintained to characterize the ground water prior to and following runway construction. In addition, monitoring of surface water and municipal pumping stations was maintained.

The third phase (January 1979 - March 1980) consisted of only four sampling runs. Four wells were sampled of which three were new. Two (#'s 9 and 10) were located in Wrights Creek drainage and the third in the Winter River drainage at the northerly end of the existing runway (21). Well #8 was retained from the previous phases. These wells were to supplement the test wells established in 1976. The sampling frequency at Wrights Creek was increased to bi-weekly

and major rain event sampling was also initiated to assess the impacts of construction on surface water resources. Like phase 1, a wide variety of parameters were analyzed during the phases 2 and 3.

This report discusses the water quality aspects of ground and surface waters sampled from August 1982 to May 1987. This time period may be divided into two additional phases with respect to stations sampled and parameters analyzed - phase 4 (August 1982 - February 1985) and phase 5 (May 1985 - May 1987).

TABLE 1: CHARLOTTETOWN AIRPORT REDEVELOPMENT PROJECT - SAMPLING PHASES AND WATER QUALITY MONITORING STATIONS

PHASE 1 Sept. 1976-- April 1977	PHASE 2 May 1977-- Dec. 1978	PHASE 3 January 1979-- March 1980	PHASE 4 Aug. 1982-- Feb. 1985	PHASE 5 May 1985-- Present
Well #1				
2	2	8	8	2*
3	5	9	9	7*
4	8	10	10	8*
5	B	11	11	9
7	E		12(Oct'82)	10
8				12
				13
A				14
B				15
C				16
D				
E				A
				B
WC	WC	WC	WC	D
WR	WR		WR	E
MS	MS		UT	
				WC
UPS	UPS			WR
BPS	BPS			UT
MPS	MPS			

* Annual Stations

Key

WC - Wrights Ck
 WR - South Branch Winter R.
 MS - Malpeque Stream
 UT - Unnamed Tributary
 UPS - Union Pumping Station
 BPS - Brackley Pumping Station
 MPS - Malpeque Pumping Station

TABLE 2: CHARLOTTETOWN AIRPORT REDEVELOPMENT PROJECT - WATER QUALITY PARAMETERS

Parameter	PHASES 1 TO 4*		PHASE 5	
	Ground Water	Surface Water	Old Wells & Surface Water	New Well
<u>Field</u>				
Temperature	X	X	X	X
Specific Conductance	X	X	X	X
pH	X	X	X	X
DO		X		
Turbidity	X	X	X	X
Depth of Water Table	X		X	X
Well Pumped or not	X			
<u>Laboratory</u>				
Temperature	X	X		
pH	X	X	X	
Specific Conductance	X	X		
Turbidity	X	X		X
Color	X	X		
Calcium Diss.	X	X	X	X
Magnesium Diss.	X	X	X	X
Potassium, Diss.	X	X		X
Sodium, Diss.	X	X		
Alkalinity, Total	X	X	X	X
Chloride, Diss.	X	X	X	X
Sulphate, Diss.	X	X		X
Sulphate (IC)				
Phosphorus, Total	X	X		
Silica, Diss.*	X	X		
Arsenic*				
Manganese, Ext.	X	X		X
Iron, Ext.	X	X		X
Copper, Ext.	X	X		
Lead, Ext.	X	X		
Zinc, Ext.	X	X		
Cadmium, Ext.*				
Total Organic Carbon	X	X		
Total Inorganic Carbon	X	X		
Nitrate + Nitrite, Diss.	X	X	X	X
Nitrate (IC)				
Ammonia	X	X		
Nitrogen Total	X	X		
Phenols	X			
Urea	X	X	X	X
Hydrocarbons - Kerosene	X			
Hydrocarbons - Jet Fuel	X			
Hydrocarbons - Diesel Fuel	X			
Hydrocarbons - Stove Oil	X			
Hydrocarbons - Furnace Oil	X			
Hydrocarbons - Bunker Oil	X			
Hydrocarbons - Gasoline	X			

* Some parameters were deleted in Phase 4

2. METHODOLOGY

2.1 Stations and Parameters

The fourth and fifth phases of the redevelopment project began August 1982. The fourth phase, which ended February 1985, was very much a continuation of phase 3. One additional well, a three-level piezometer, was established between wells 9 and 10 to provide a link between these wells and to sample deeper portions of the aquifer. Three surface water stations on streams draining the property and a number of private wells in the vicinity of Norwood Road were also sampled.

The parameter suite was similar to the previous monitoring phase. A number of parameters were eliminated (arsenic, silica, cadmium, fluoride) thus reducing analytical costs slightly.

Phase 5 of the project began May 1985 and is ongoing, although this report will only consider data to May 1987.

This fifth phase revives the broad coverage experienced during the first phase with some qualifications. (The sampling stations for phase 5 are presented in Table 1). Wells 2, 7 and 8 become annual stations sampled only in May. Four new wells (#13-16) were constructed to provide more effective coverage in the vicinity of the new runway. The monitoring of well #11 was discontinued.

The parameter list was reduced to approximately one third of those previously analyzed (Table 2) and the sampling frequency of 3 month intervals to correspond to the hydrological cycle (February, May, August, November) has been maintained during the fourth and fifth phases.

A station listing for the 4th and 5th phases and their NAQUADAT (National Water Quality Data Bank) station numbers are provided in Table 3. These stations are also plotted in Figure 1. Station information such as UTM, geodetic level and date installed is provided in Appendix II.

2.2 Field Methodology

A standardized sampling methodology has been used since August, 1982 and differs considerably from that previously reported (Environment Canada, 1981).

(a) Ground Water Collection

Water table measurements are taken at all wells prior to pumping. All wells except the piezometer are pumped with a 7.5 cm submersible pump which is lowered to 0.3 m from the well bottom. The water is pumped via 30 m of reinforced 2.5 cm diameter tygon tubing at a pumping rate approximately equivalent to the recharge rate of the well. The rate, which in the case of the airport wells range from 1 to 40 litres per minute, is controlled by a shut-off valve at

the end of the hose. Pumping continues until the well has recharged several times and has become clear. Wells are pumped a maximum of 1 hour.

Pumping rates, measured using a calibrated vessel and stopwatch in litres/minute, are listed in Appendix III. Although the rates do give a general indication of the recharge ability of the well, it should be noted that high recharge wells were not always pumped at the maximum rate. In some wells, rates were reduced to facilitate quicker clearing of the well or, in other cases, rates were varied to determine the rate which was the best compromise - turnover versus clarification.

A 2.5 cm Middleburg bladder pump which operates on nitrogen gas, is used to pump each piezometer. Tubing for this pump consists of a 30 metre 0.6 cm air line and a 1 cm water line of reinforced tygon. Each piezometer is pumped a maximum of 1.5 hours at the rate of 1 litre/minute.

Samples are collected directly from the hose in both cases. Bottles are rinsed twice with sample water prior to the collection of the sample. The pumping rate and time pumped are recorded for each station.

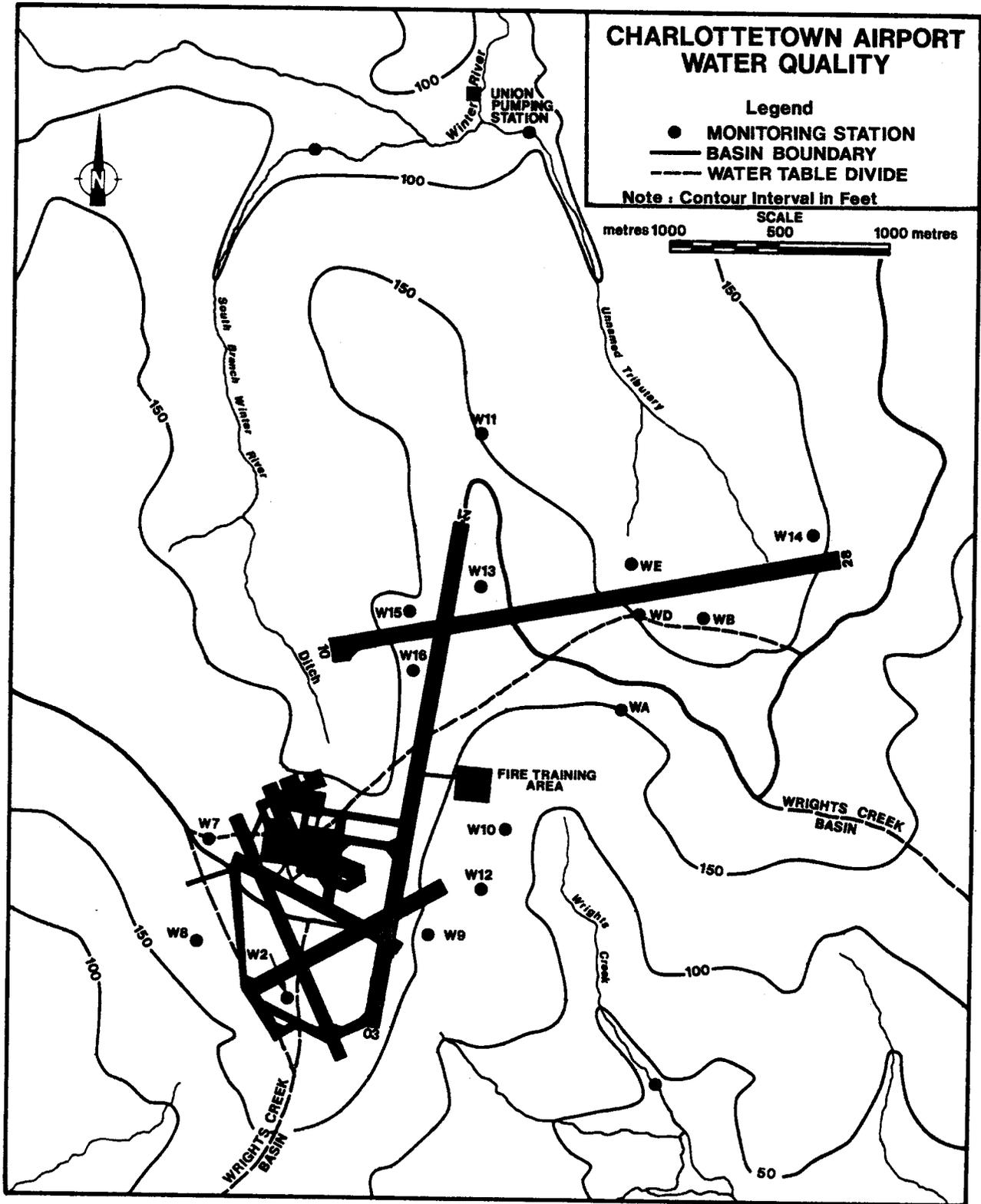
b) Surface Water

Surface water samples are collected directly into the bottle. Bottles are rinsed twice with sample water prior to collection.

TABLE 3: CHARLOTTETOWN AIRPORT REDEVELOPMENT PROJECT - WATER QUALITY MONITORING STATIONS - 1982 TO 1987

#	DESCRIPTION	NAQUADAT Station #
1	Test Well #2 - Off old Terminal Bldg Apron	10PE01CC0032
2	Test Well #7 - East of Brackley Point Road	10PE01CC0037
3	Test Well #8 - West of Brackley Point Road at Stabilizers Ltd.	10PE01CC0028
4	Test Well #9 - Transmissometer Site, near Norwood Ave. Ext.	10PE01CC0027
5	Test Well #10 - At Old Sewage Treatment Ruins, Norwood Ave. Ext.	10PE01CC0029
6	Test Well #11 - On Crash Route at North End of Runway 21	10PE01CC0030
7	Test Well #12B - Multilevel Peizometer Bottom	12PE01CC0001
8	Test Well #12M - Multilevel Peizometer Middle	12PE01CC0002
9	Test Well #12T - Multilevel Peizometer Top	12PE01CC0003
10	Test Well #13 - NE of Intersection of Runways	10PE01CC0049
11	Test Well #14 - N of Easterly End of New Runway	10PE01CC0050
12	Test Well #15 - NW of Intersection of Runways	10PE01CC0051
13	Test Well #16 - SW of Intersection of Runways	10PE01CC0052
14	Test Well #A - Near the Centre and South of New Runway	10PE01CC0039
15	Test Well #B - Near Easterly End and South of New Runway	10PE01CC0040
16	Test Well #D - Near Easterly End and South of New Runway	10PE01CC0042
17	Test Well #E - Near the Centre and just North of New Runway	10PE01CC0043
18	Wrights Creek 500 m above Andrews Pond	00PE01CC0040
19	South Branch Winter River at Union Road Culvert	00PE01CC0042
20	Unnamed Tributary above confluence with Winter River at Union Pumping Station	00PE01CC0044

Figure 1 Charlottetown Airport Monitoring Stations 1982 to 1987



c) Field Parameters

Parameters measured in the field include water temperature, specific conductance, pH, turbidity and water level. Water temperature and specific conductance are measured in-situ at surface water stations and in a vessel such as a wide mouth 2-litre bottle at the time of sampling in the case of ground water. pH and turbidity are measured within 4 to 8 hours after collection from a separate 250 mL bottle which has been warmed to room temperature.

Filtration of samples with high turbidities (>10 JTU) began in May 1986 to prevent changes in water quality due to the sediment load and eliminate possible analytical problems due to turbidity.

Metals (1 mL conc. HNO_3 /500 mL) and phenols (2 g CuSO_4 , 3 mL conc. H_3PO_4 /L) were preserved in the field until 1985. Iron and manganese, the only metals measured since 1985, have been preserved at the Moncton laboratory. Phenols were discontinued in 1985.

2.3 Laboratory Methodology

Water analyses are performed using standard analytical procedures described in the Water Quality Branch Analytical Methods Manual (WQB, 1979). A brief description of the methodology is available from the NAQUADAT Dictionary of Parameter Codes (WQB, 1985).

2.4 Quality Assurance/Quality Control (QA/QC)

Replicate sampling for the Charlottetown Airport Monitoring Program began in August 1984. Water Quality Branch, Atlantic Region quality control procedures recommend that approximately 20% of the samples be collected in triplicate. During the lighter sample load prior to May 1985, two triplicate samples were collected per trip. Three triplicates per trip were collected with the increase of sampling stations in May 1985. The results of these QA/QC procedures are not discussed, however, the data are incorporated in data tables.

3. RESULTS AND DISCUSSION

3.1 Major Ion Data

Water Quality data collected from Aug. 19, 1982 to May 1987 are presented in Appendix IV. Pie-charts illustrating major ion distribution by equivalents, have been prepared for all sampling stations according to basin drainage in Figures 2 to 4. The pie-charts illustrate the strong calcium-magnesium bicarbonate dominance of major ions for the groundwater and surface water sampling sites. Well #8 in the North Creek Drainage, which is down gradient of the Brackley Point Road, has nearly equal concentrations of chloride and bicarbonate probably reflecting the use of road salt.

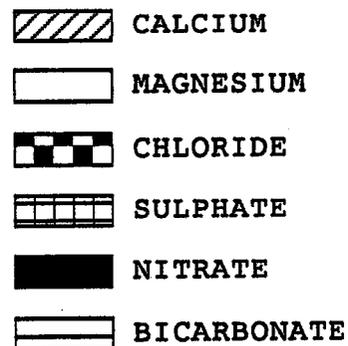
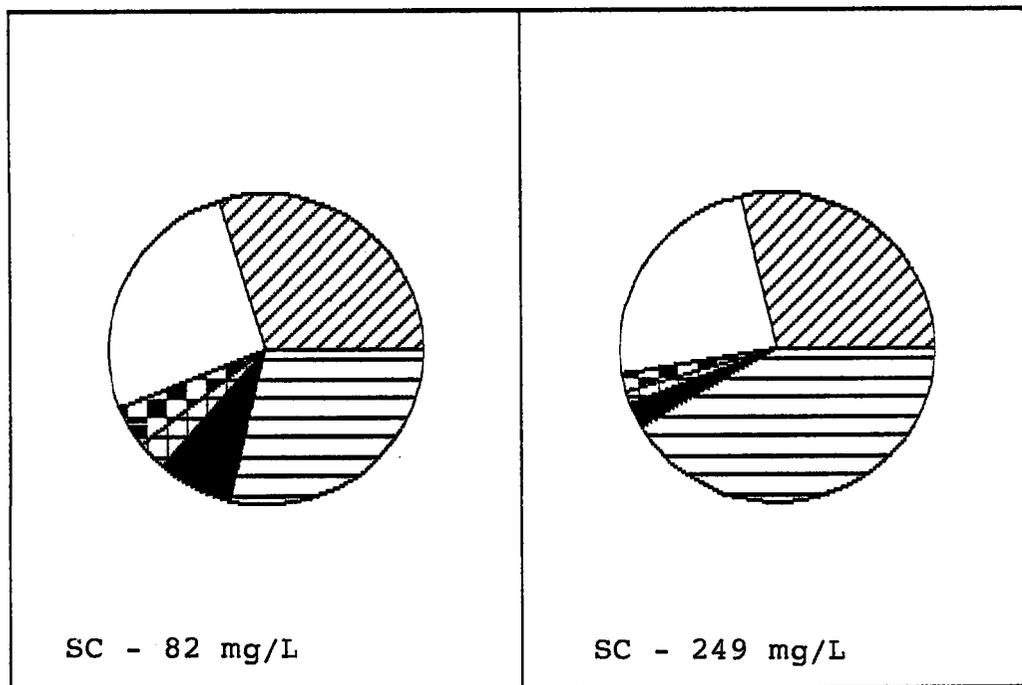
The mean sum of the constituents (total dissolved solids, mg/L) is included with each pie-chart. Although the ion dominance changes very little there is considerable variability in the dissolved material. This may be attributed to the anionic and cationic dissolution of aquifer materials (Environment Canada, 1981).

Most individual wells also showed variability of dissolved major ions with respect to water table. This variability is best illustrated by Well #9. For example, total alkalinity ranged from 7.2 to 181 mg/L and calcium from 9.5 to 48 mg/L, as the water table ranged from 9.258 m to 15.800 m (35.669 to 29.127 m geodetic) respectively. The calcium/water table relationship (Figure 5(a)) indicates a strong increase in calcium as the water table falls. A

FIGURE 2: MAJOR ION COMPOSITION (meq/L) AND SUM OF CONSTITUENTS (SC) AT SAMPLING STATIONS IN THE WRIGHTS CREEK DRAINAGE BASIN

WELL #9 (HIGH TABLE)

WELL #9 (LOW TABLE)



WELL #10

WELL #12M

WRIGHTS CREEK

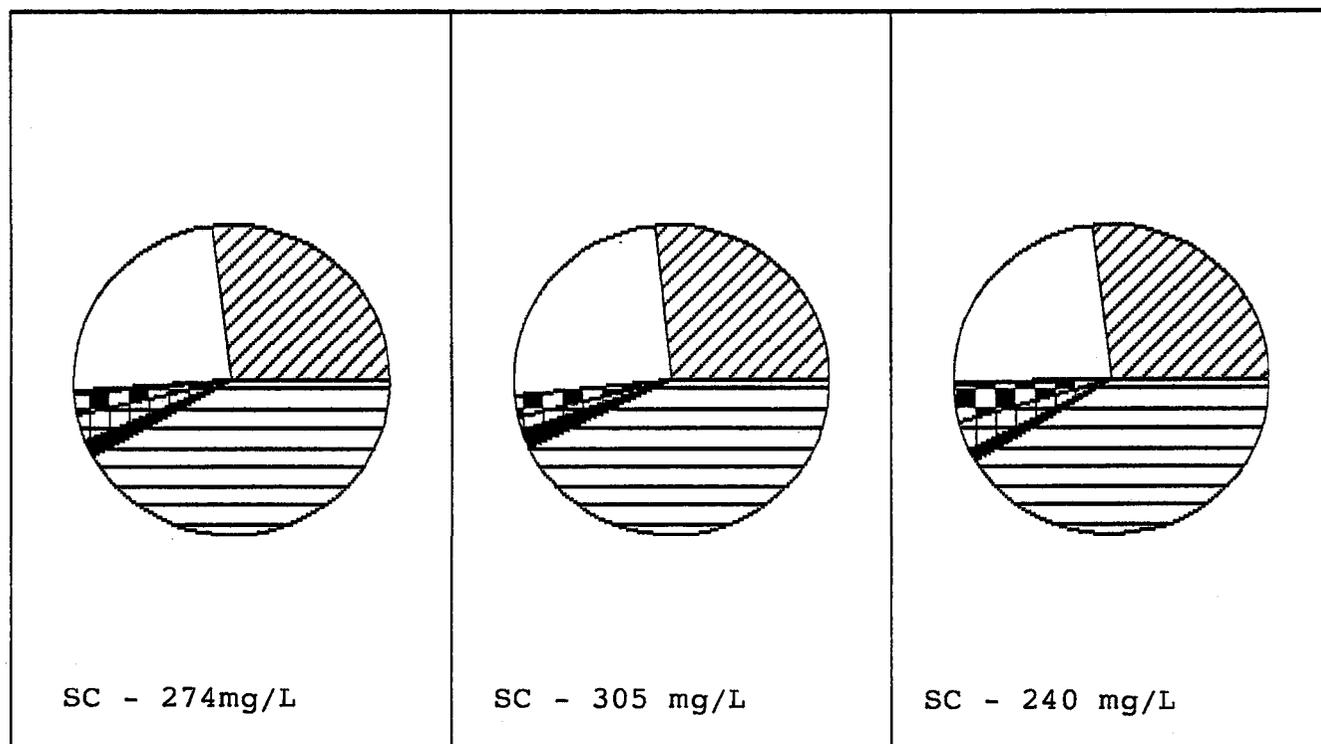


FIGURE 3: MAJOR ION COMPOSITION (meq/L) AND SUM OF CONSTITUENTS (SC) AT SAMPLING STATIONS IN THE WINTER RIVER DRAINAGE BASIN

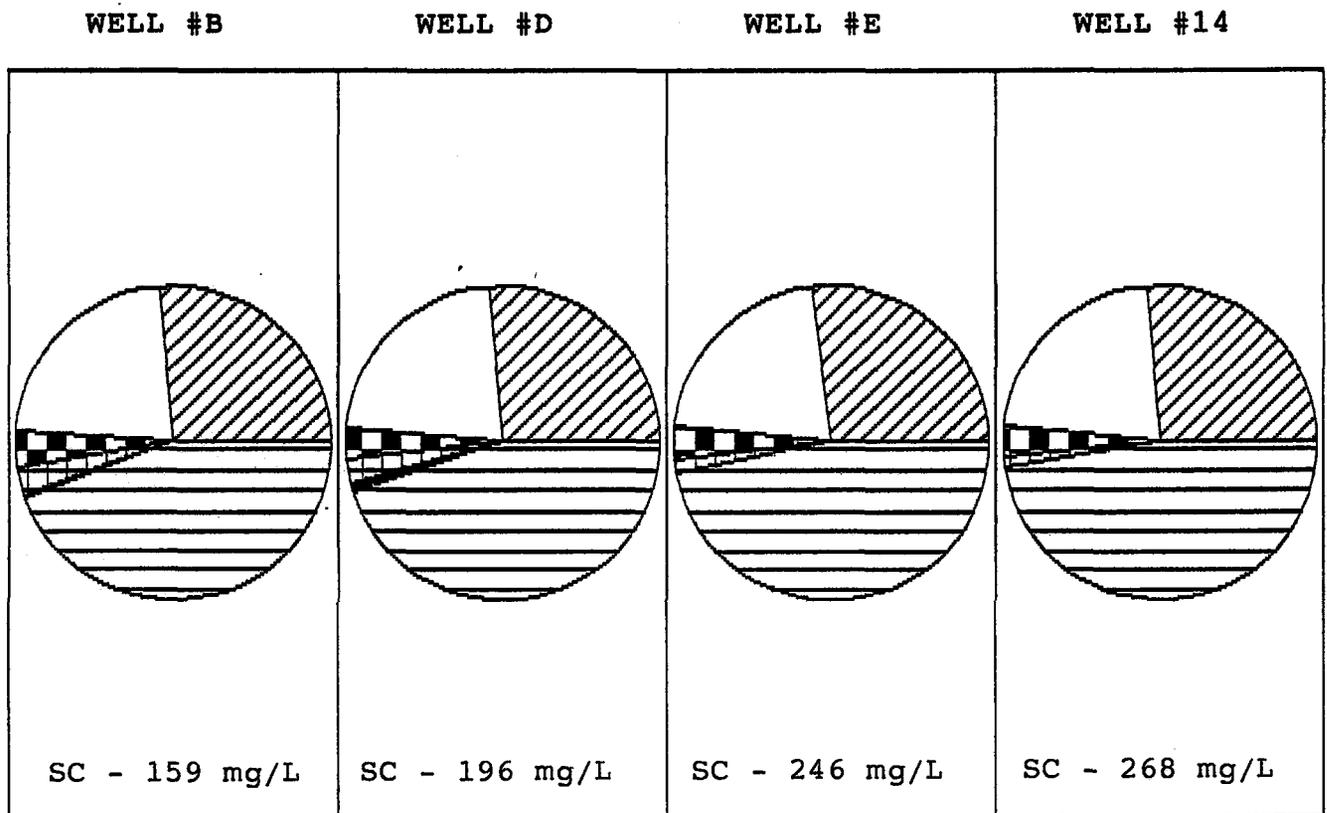
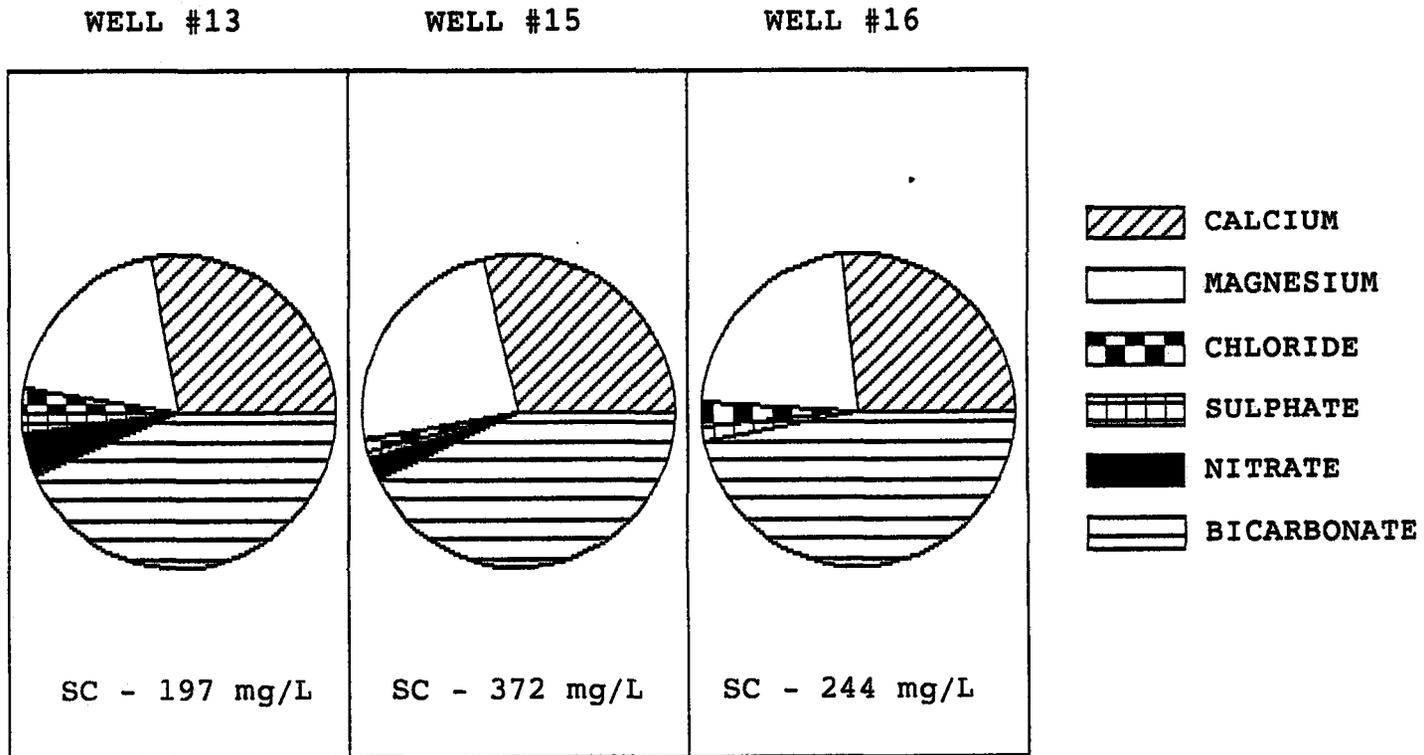
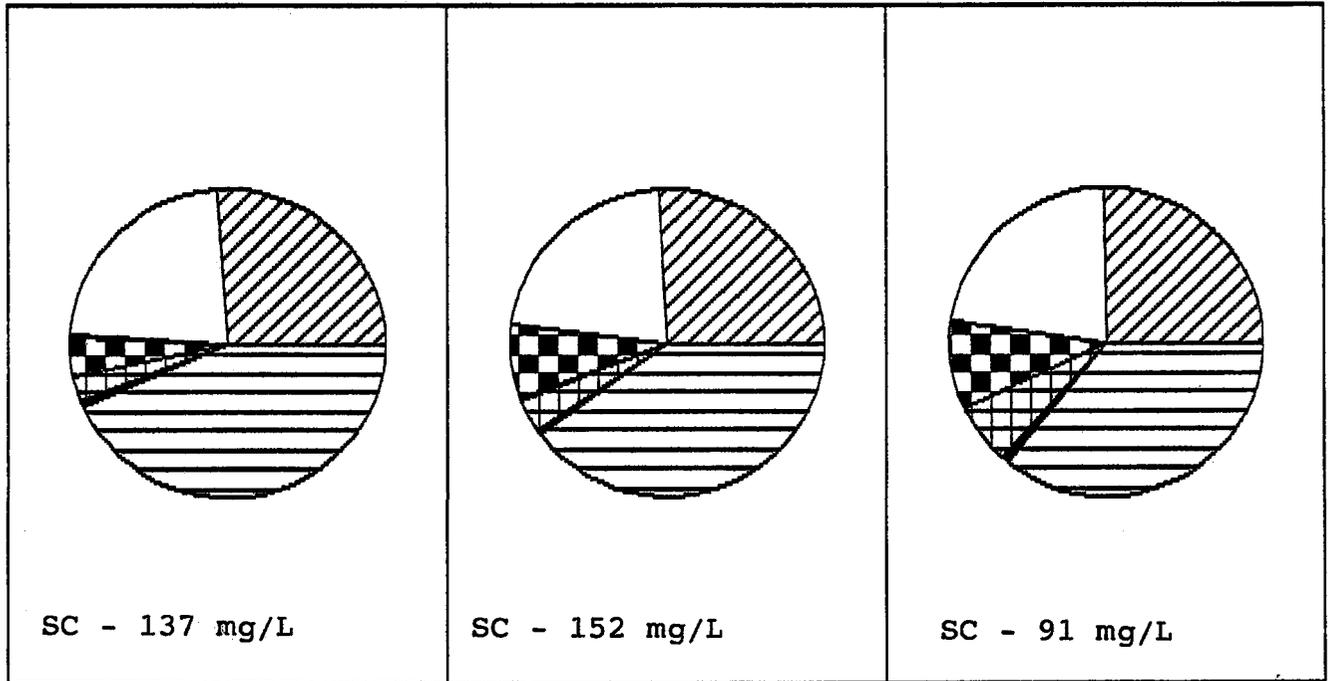


FIGURE 4: MAJOR ION COMPOSITION (meq/L) AND SUM OF CONSTITUENTS (SC) AT SAMPLING STATIONS IN THE WINTER RIVER AND NORTH CREEK DRAINAGE BASINS

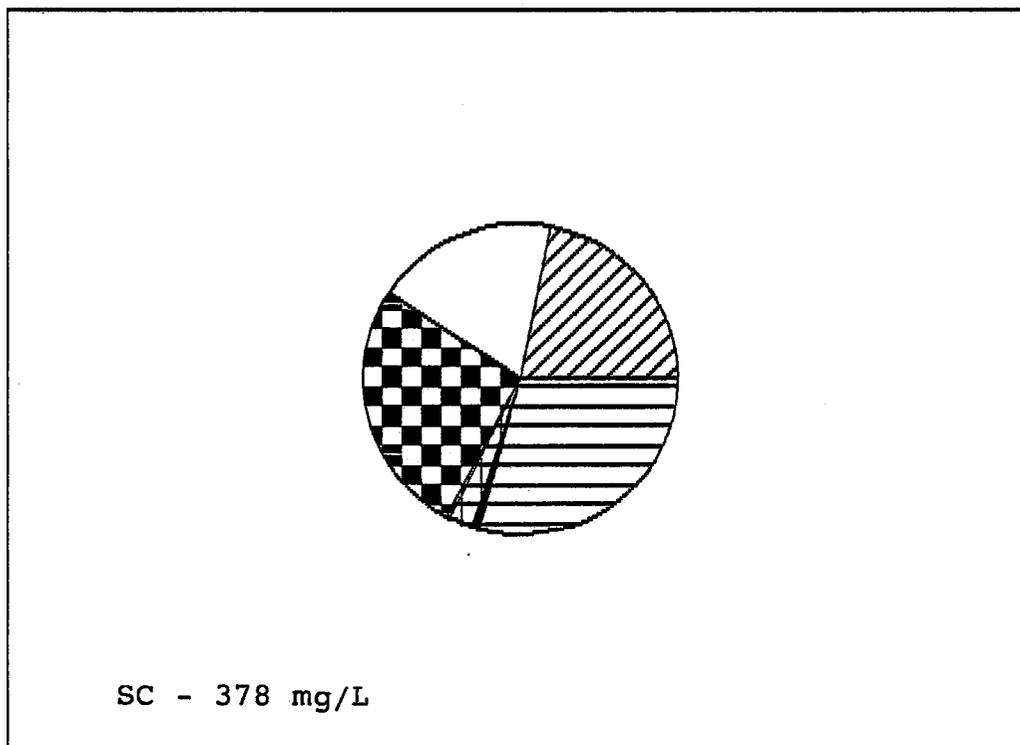
WELL #11

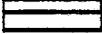
SOUTH BRANCH WINTER R.

UNNAMED TRIBUTARY



WELL #8



-  CALCIUM
-  MAGNESIUM
-  CHLORIDE
-  SULPHATE
-  NITRATE
-  BICARBONATE

SC - 378 mg/L

correlation matrix of major ions and water table also indicated there was a similar but weaker inverse relationship between sodium, chloride, sulphate and the water table. In Figure 2, the pie-charts for Well #9 (Low and High Water Table), indicate higher percentages of chloride, sulphate and nitrate are associated with a high water table or recharge as compared to low water table. Although nitrate is often associated with recharge (Figure 2), the concentrations can be quite independent of the water table (Figure 5(b)).

3.2 Nitrate/Urea

The nitrate nitrogen concentrations measured in test wells and surface water sites are presented in a box and whisker plot in Figure 6. The box and whisker plot provides the minimum, maximum, median as well as 25th and 75th percentiles. An illustrating figure of these plots is provided in Appendix V. The distribution of nitrate (range) is also plotted on a map of the airport in Figure 7.

The box and whisker plot indicates that four wells have elevated levels of nitrate - Well #9, Well #10, Well #12 (middle and top) and Well #15 - with medians ranging from 7 to 18 mg/L. These concentrations are considerably higher than samples analyzed from the P.E.I. water supplies. The sampling sites from Souris to St. Eleanor's, which represent a cross-section of agricultural activities, had nitrate concentrations ranging from a minimum of 0.47

FIGURE 5(a): WELL #9 - VARIATION OF CALCIUM AND GEODETIC WATER LEVEL WITH TIME

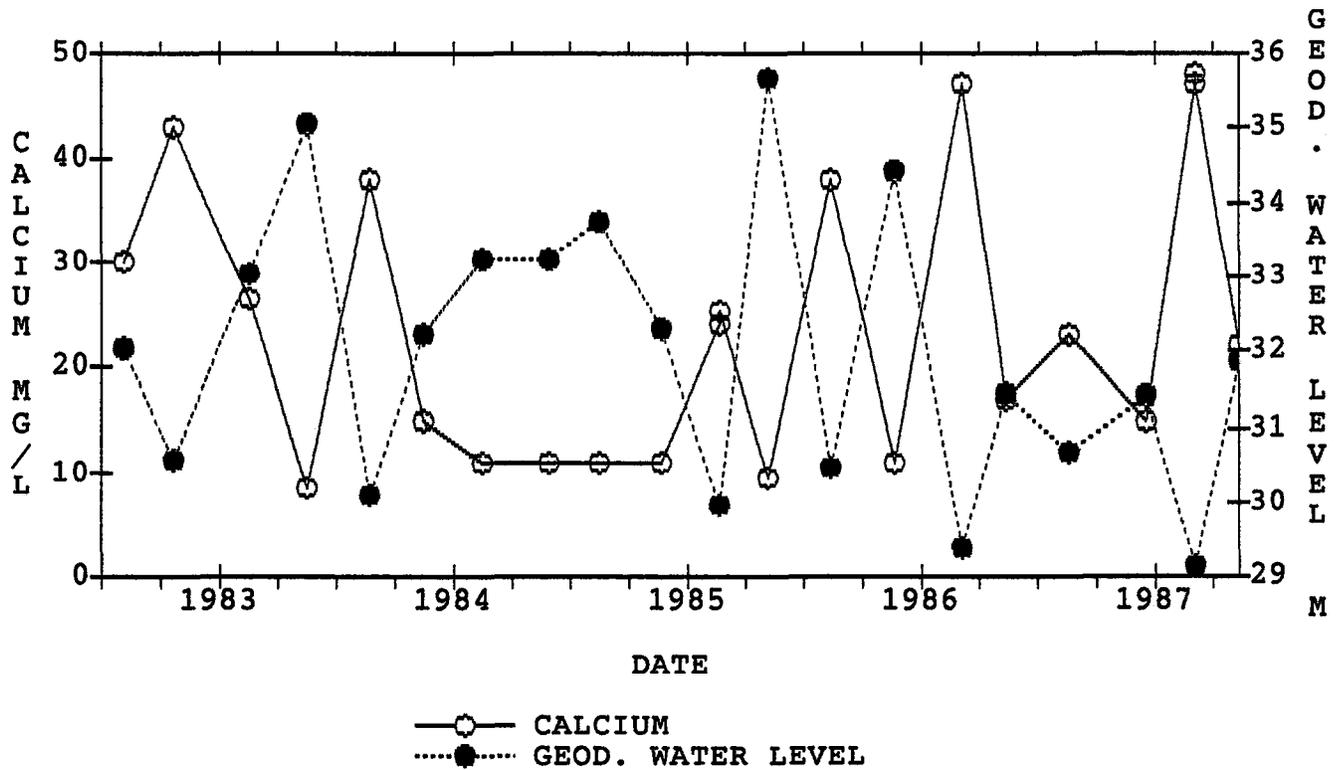


FIGURE 5(b): WELL #9 - VARIATION OF NITRATE AND GEODETIC WATER LEVEL WITH TIME

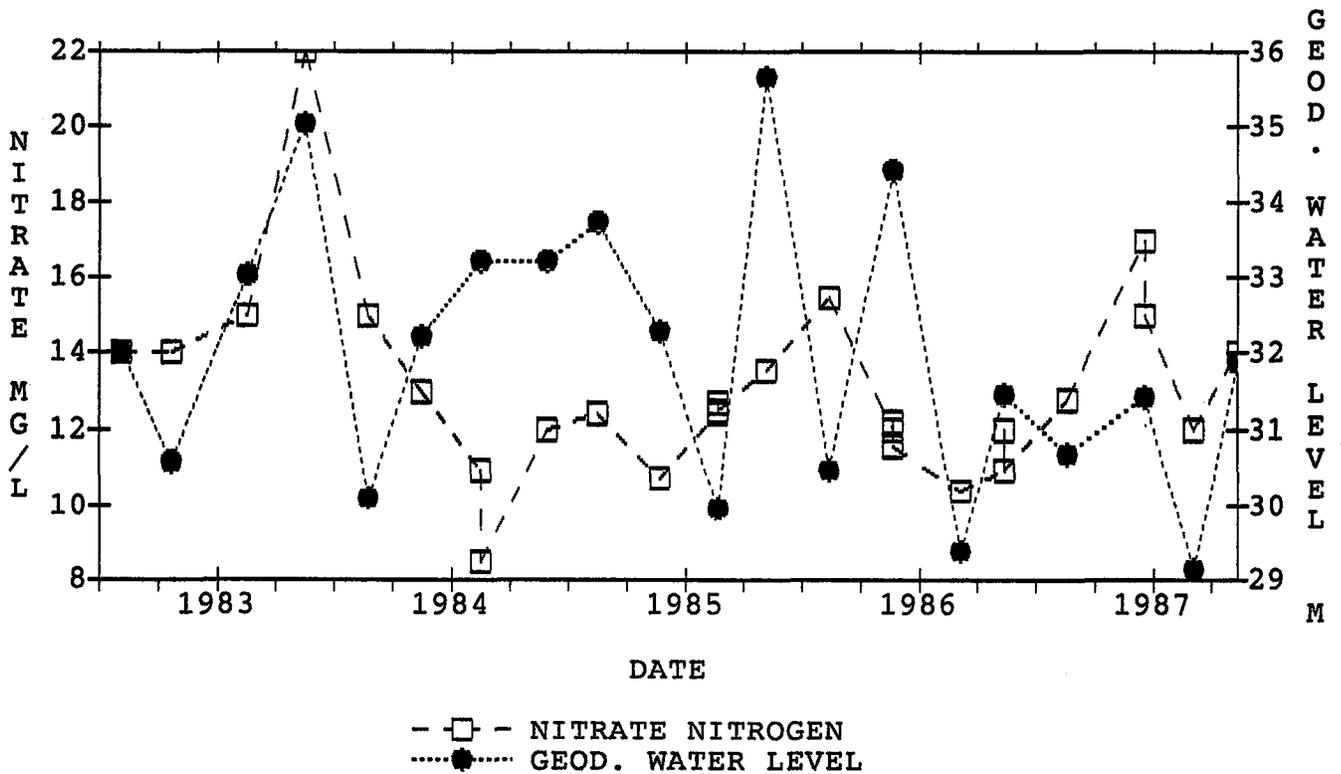
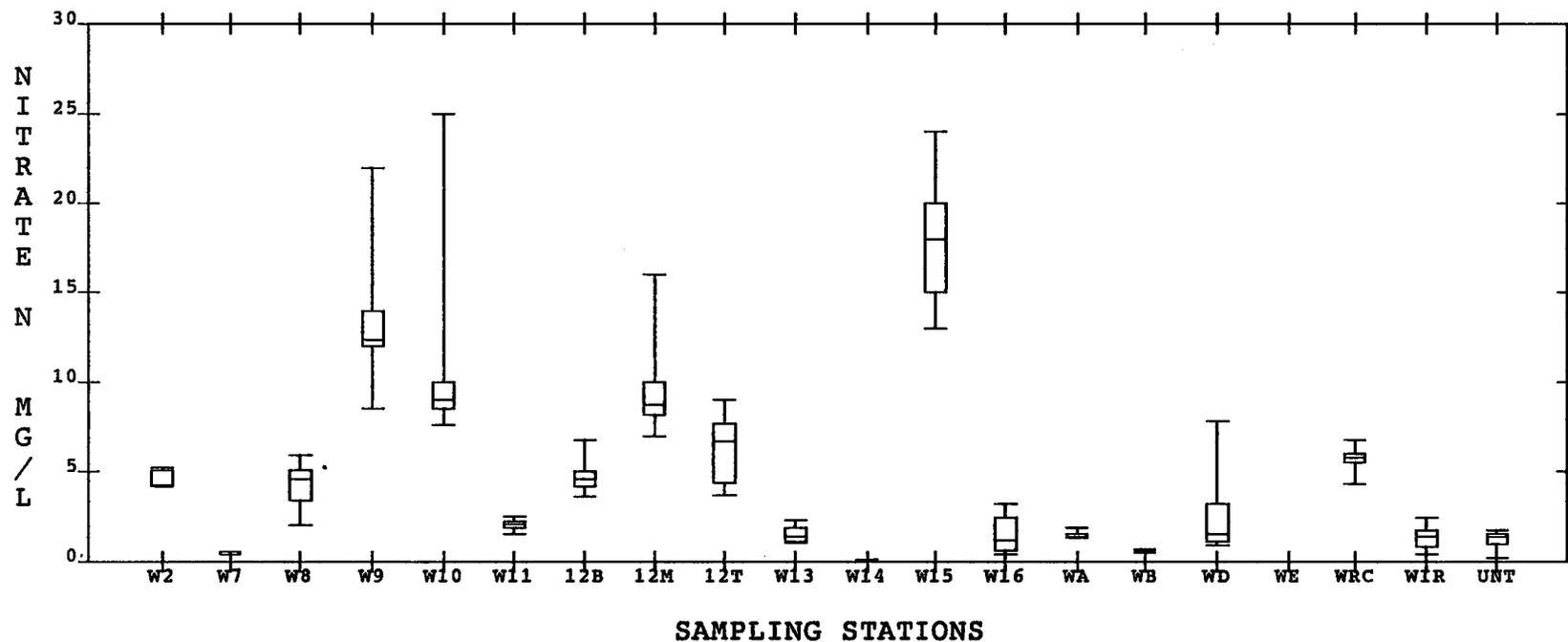
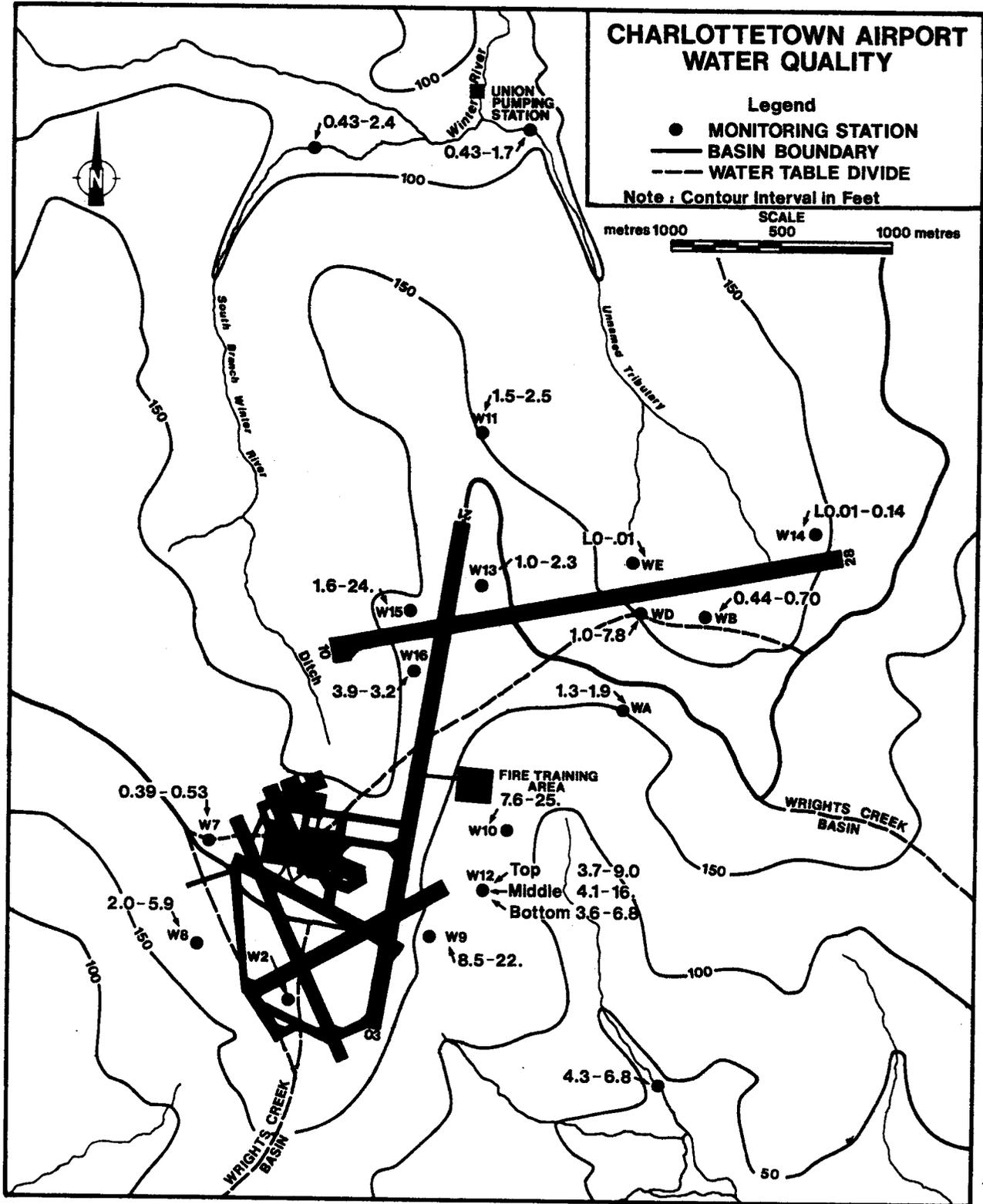


FIGURE 6: NITRATE NITROGEN IN TEST WELLS
AND SURFACE WATER STATIONS FROM 1982 TO 1987



WRC - WRIGHTS CREEK
 WIN - SOUTH BRANCH WINTER RIVER
 UNT - UNNAMED TRIBUTARY

Figure 7 Range of nitrate levels [mg/L] in test wells and surface water stations



mg/L at Georgetown Well #7 to a maximum of 6.4 mg/L at St. Eleanors. The median value was 2.80 mg/L. Charlottetown Municipal Water Supply wells in the vicinity of the airport, Union Well #5 and Main Malpeque dug well, both had nitrate levels below the median value (O'Neill and MacKeigan, 1987).

The same four airport wells also exceed the Canadian Drinking Water Guidelines of 10 mg/L on most occasions (NH&W, 1978).

Nitrate concentrations in Wrights Creek were considerably higher than those found in the Dunk River (Figure 8), an area of intensive agriculture and high nitrate usage from fertilizer. Also in Figure 8 it is shown that the median nitrate concentrations for the South Branch Winter River and the Unnamed Tributary fall approximately halfway between the medians of the Morell River (an area of light agriculture) and the Dunk River.

The high nitrate concentrations result from the use of urea (48%-nitrogen) as a de-icing compound on the airport's runways, taxiways and tarmac. Approximately 60,000 kg of urea are used annually (personal comm. - E. MacDonald) with 40,000 kg on the main runway, taxiway and tarmac and the remaining 20,000 kg used on the new runway. Urea rapidly hydrolyses to ammonia and is then oxidized to nitrate. According to a laboratory study on acid podzolic soil, urea was hydrolyzed within 5 days at temperatures between 9 & 18°C. Subsequent nitrification rates were limited at 4°C, extensive at 9°C, and essentially complete after 48-68 days at 18°C (MacLean and McRae, 1987).

As a result of urea hydrolysis, the parent compound is found only occasionally in the test wells and at low concentrations in relation to nitrate. The majority of the positive urea values were achieved when values greater than 0.01 mg/L were reported (Appendix IV). The reportable detection limit was increased to 0.05 mg/L in May 1985. South Branch Winter River and Unnamed Tributary had a higher proportion of detectable values, probably due to the quicker transit time in relation to ground water. Very high urea values were detected at 4 stations during the August 19 to August 21, 1986 survey - Well #12M, Well #13, South Branch Winter River and the Unnamed Tributary. Considering the hydrolysis and nitrification processes discussed above, it would be highly unlikely to find the parent compound at these concentrations in wells or surface water at this time of year, approximately four months after snowmelt, therefore they are to be treated as anomalous values.

Nitrate data from most monitoring stations have been plotted over time in Figures 9 to 11. In Figure 9, three wells in the area draining the southeasterly section of the airport towards Wrights Creek provide the most interesting relationships. The data from the three wells corroborate the high nitrate concentrations which occurred following the snowmelt in May 1983. The high concentrations may be attributed to heavy urea usage, snow piling practices, timely sample collection with respect to snowmelt, etc., however discussions with airport staff to determine a possible cause were inconclusive. Although the other peaks for Well #9 (Figure 9) are not associated with snowmelt and subsequent recharge in May, the relationship

FIGURE 8: NITRATE NITROGEN CONCENTRATIONS IN THE MORELL AND DUNK RIVERS AND STREAMS DRAINING THE AIRPORT PROPERTY

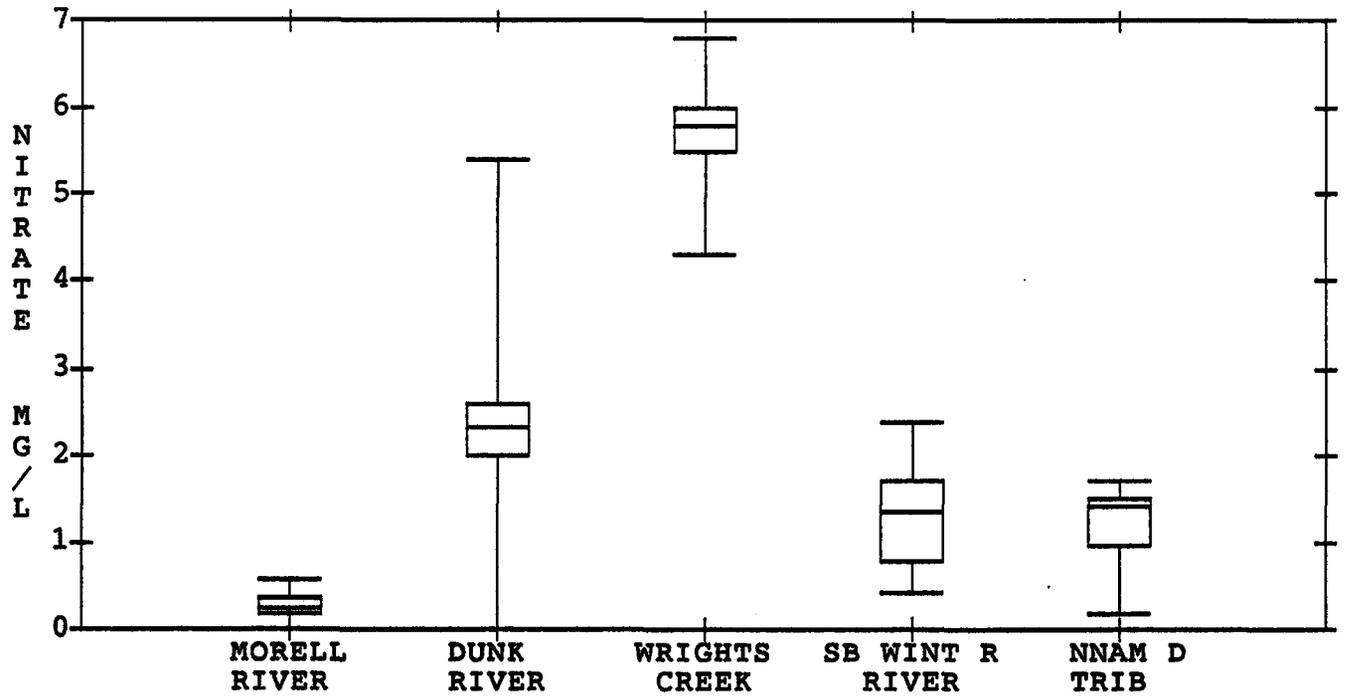
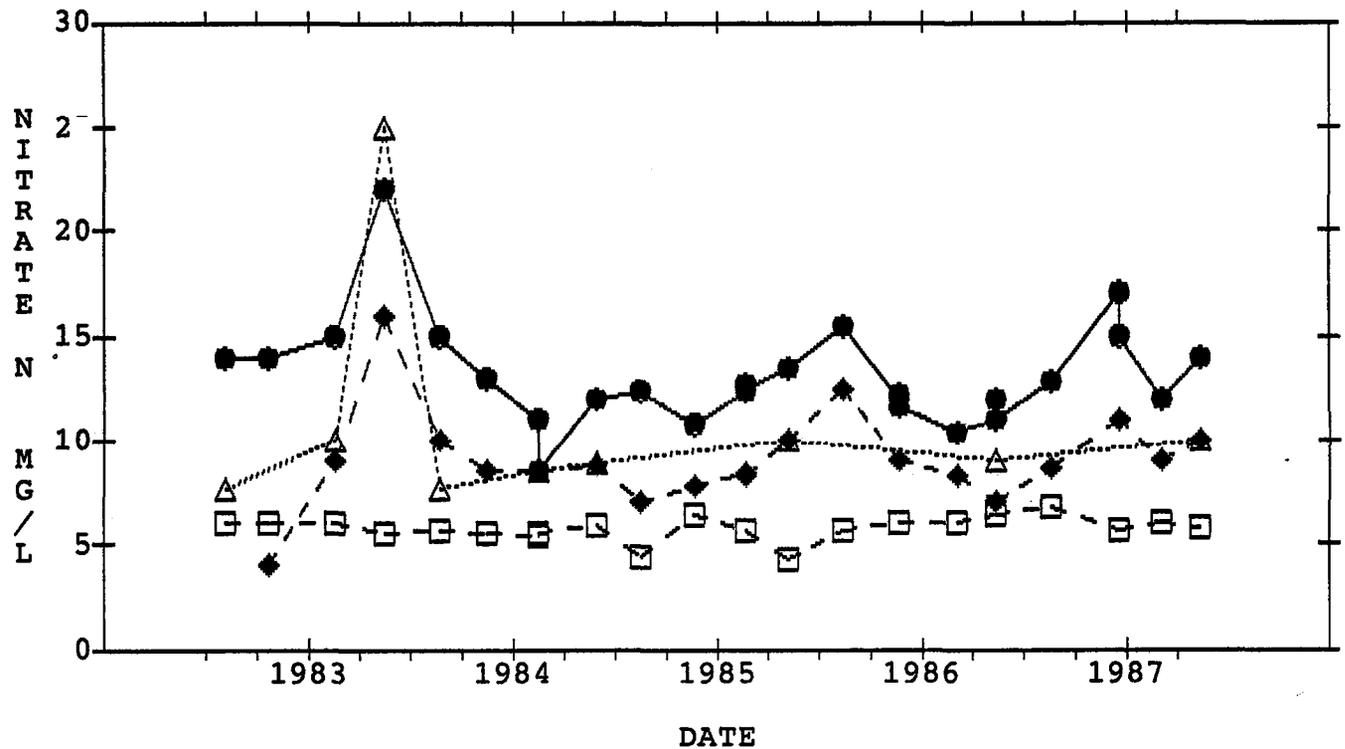


FIGURE 9: NITRATE NITROGEN IN TEST WELLS AND SURFACE WATER DRAINING THE SOUTHEASTERLY SECTION OF THE AIRPORT



- — WELL 9
- △ ····· WELL 10
- ◆ - - - WELL 12M
- - - - WRIGHTS CK

between Wells #9 and #12M remains to a lesser degree. The peaks on August 13, 1985 and December 18, 1986 are more likely associated with rain events on August 8-10 and 12 and December 3, respectively.

Well #10 does not follow a similar pattern probably due to the lack of samples, particularly on the above dates. The nitrate concentrations for Wrights Creek remained relatively stable during this period.

Samples collected from private residence wells on Norwood Avenue and downgradient of Well #9 had nitrate concentrations of 2.9 to 5.3 mg/L, which were considerably lower than the test wells in this drainage basin. The wells were only sampled once in 1983, except for one which was resampled in 1984.

In Figure 10, nitrate concentrations are plotted for the three wells at the intersection of the runways. It should be noted that these wells were constructed in 1985 and the plots only represent 8 data points.

Wells #13 and #16 have nitrate concentrations among the lowest for the test wells (Figure 6). Well #16 which is downgradient of the runway does show 3 to 5-fold increases in nitrate concentrations during the spring recharge in 1986 and 1987. Well #15 has the highest median nitrate values for the study and also has been quite variable during the sample period (Figure 10). The highest values which are shown for August 1986 and 1987, may well be a function of

FIGURE 10: NITRATE NITROGEN IN TEST WELLS AT INTERSECTION OF RUNWAYS

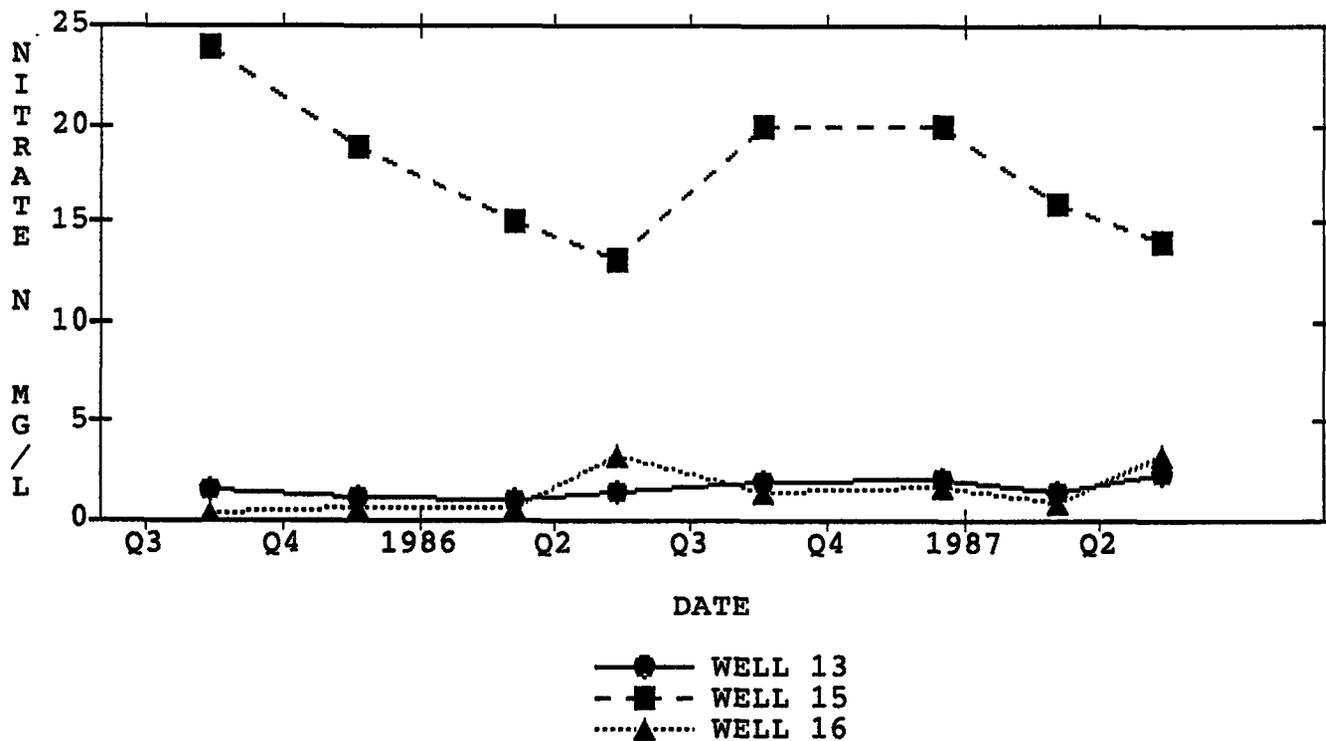
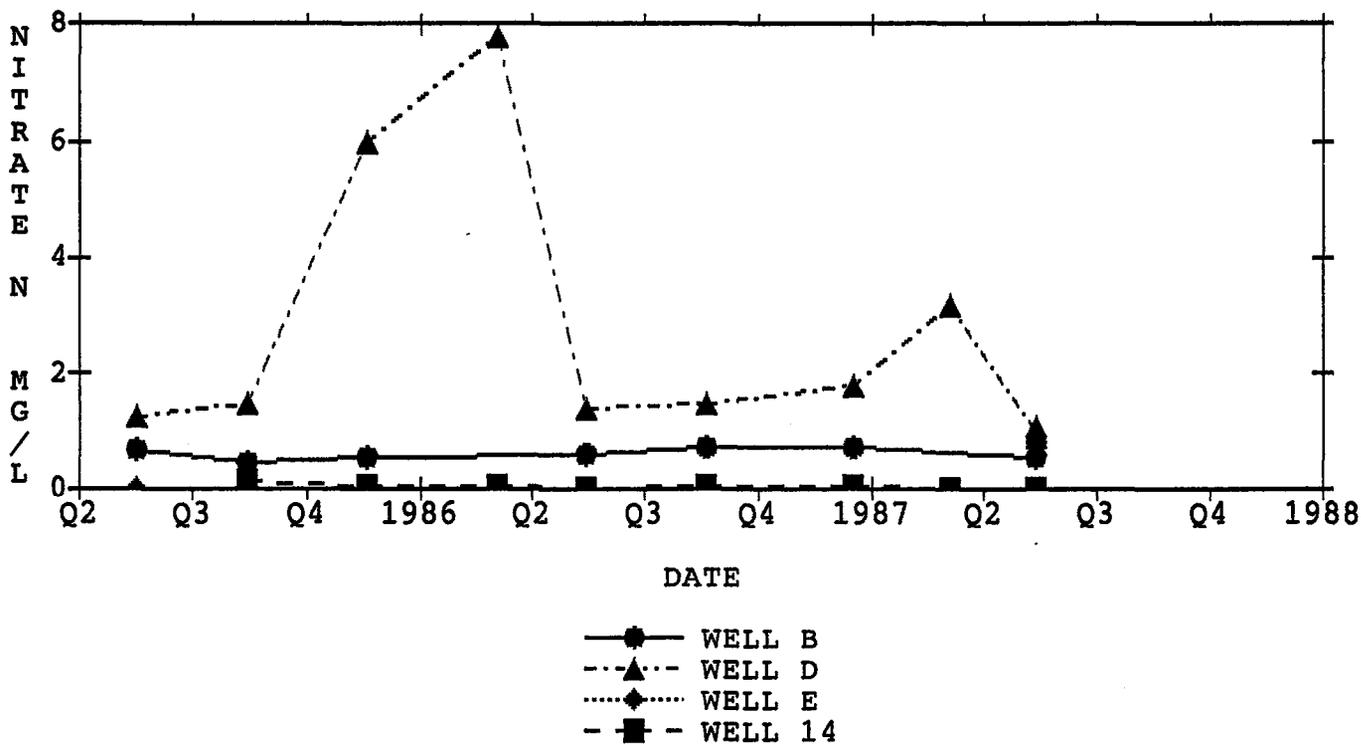


FIGURE 11: NITRATE NITROGEN IN TEST WELLS FLANKING THE EASTERLY END OF THE NEW RUNWAY



the sampling frequency. On both occasions the spring sampling was early (May 13) which perhaps did not allow sufficient time for spring recharge to occur for this well. Well #15, besides being relatively deep, requires a low pumping rate to maintain the water level in the well indicating moderately slow recharge. Also, despite the high nitrate concentrations, urea has never been detected in this well suggesting ample time is available for the hydrolysis and oxidation processes to be completed.

Three of the four wells flanking the easterly end of the new runway have the lowest nitrate concentrations reported during the study - Well #B, Well #E and Well #14 (Figure 11). Nitrate concentrations have never exceeded the detection limit of 0.01 mg/L in Well #E, and have ranged from 0.01 to 0.14 mg/L in Well #14. Nitrate concentrations in Well #D, for the most part, do not exceed 2 mg/L however, large increases were experienced Nov. 19/85, Mar. 4/86 and Mar 5/87. One explanation for these anomalous values is contamination of the well during snow removal, and pumping activities. This well head is located in the casting zone of the snowblower during runway snow removal operations and since it is cut-off 5 cm below ground level, it is much more susceptible to surface water contamination.

The surface water stations, particularly Wrights Creek and South Branch Winter River, may provide the best indication of change prior to and after construction due to the longer period of record and

consistent sampling methodology. In Figures 12, 13 and 14, nitrate concentrations have been plotted against time.

As illustrated in Figure 12, nitrate concentrations in Wrights Creek show an upward trend through the various sampling and corresponding construction phases. In 1976-77, prior to construction, nitrate values ranged from approximately 2.7 to 5.0 mg/L. During the early stages of construction (1979-80), the sampling frequency at Wrights Creek was increased to biweekly and after rain events. The resultant values showed an overall increase and ranged from 1.5 to 6.5 mg/L. From 1982 to 1987, with a sampling frequency of three months and no event sampling, nitrate concentrations have maintained the same range as the previous period. However, there has been an increase in the 1982 to 1987 mean value to approximately 6 mg/L or almost double 1976 concentrations.

It is very difficult to ascertain the cause for the increase in nitrate concentrations in Wrights Creek. The concentrations began to increase in 1979 prior to heavy construction. However, 1979 biweekly and rain event data (Environment Canada, 1981) indicate that nitrate concentrations did not increase with moderate run-off and declined considerably during heavy rain events. The increase in nitrate concentration may be the result of the increased use of urea at the airport due to the increase in the volume of air traffic. The records kept by the airport do not specify actual quantities used, therefore this speculation cannot be confirmed.

FIGURE 12: NITRATE NITROGEN IN WRIGHTS CREEK
FROM 1976 TO 1987

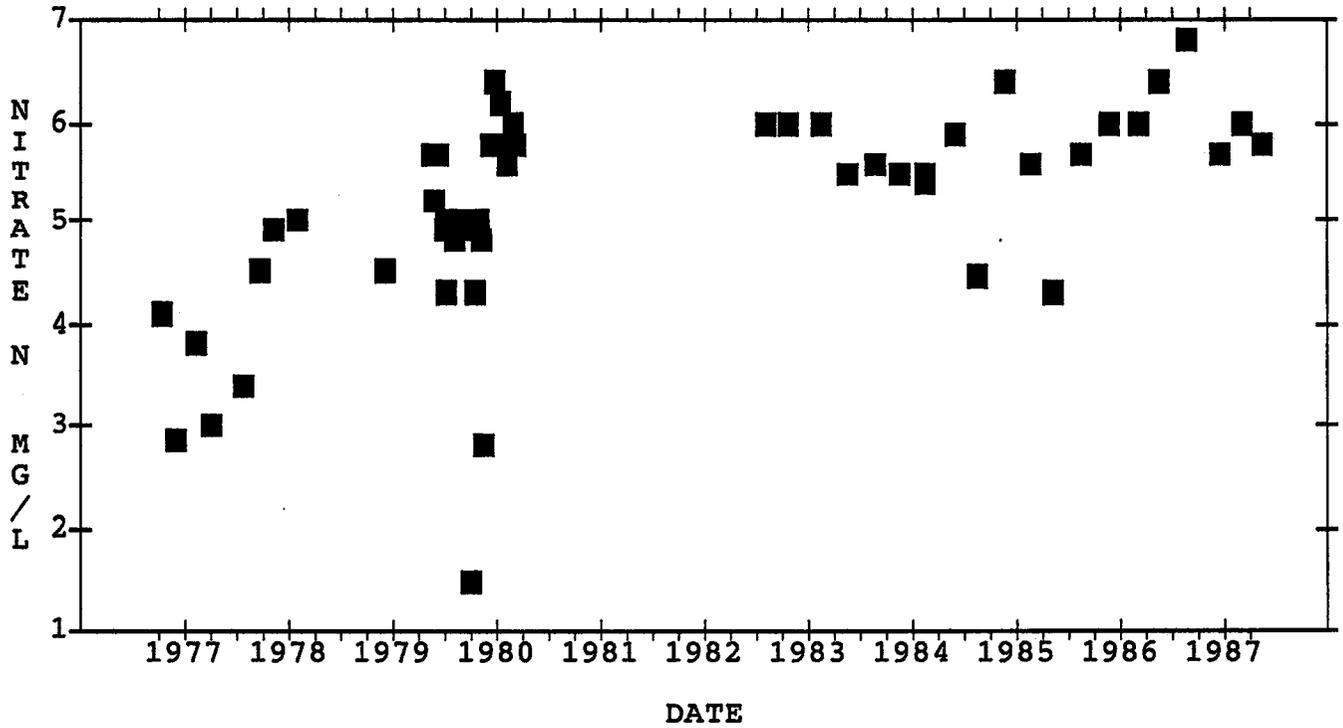
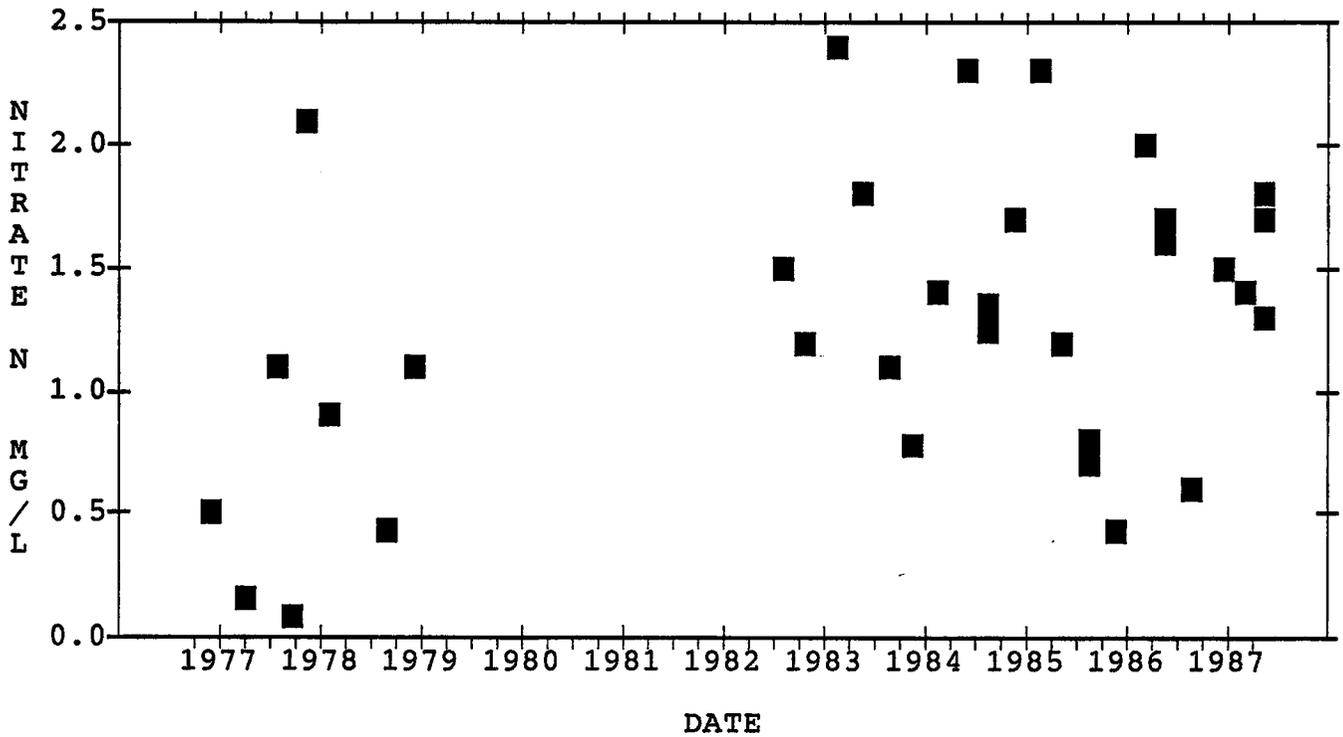


FIGURE 13: NITRATE NITROGEN IN SOUTH BRANCH
WINTER RIVER FROM 1976 TO 1987



A similar increase in nitrate concentrations in the South Branch Winter River has occurred as shown in Figure 13. The Unnamed Tributary was not sampled prior to 1982 and trends at this site are not discernible (Figure 14).

3.3 Metals

Metals including copper, lead, zinc, cadmium, aluminum, iron and manganese were analyzed for most wells and surface water stations from August 1982 to February 1985. Monitoring for iron and manganese was continued but only at new wells established in 1985 (Wells #13 to #16). The metal data are presented in Appendix IV and summarized as ranges in Table 4.

As shown in Table 4, copper, lead, zinc and cadmium values were at or near the detection limit. Aluminum concentrations were elevated in the upper and middle stages of the piezometer (Well #12M and 12T). Bentonite, which is used to seal one piezometer stage from another, is often present as a floc in the water samples from these two levels. This material, a clay mineral comprised of montmorillonite, is a hydrous silicate of aluminum and likely responsible for these values. Elevated concentrations of aluminum (Aug. 15/84) in South Branch Winter River and the Unnamed Tributary were associated with runoff following a rain event on August 14/88.

Iron and manganese concentrations ranged from <.002 to 8.8 mg/L and <.01 to 1.6 mg/L respectively (Table 4). Elevated concentrations

FIGURE 14: NITRATE NITROGEN IN THE UNNAMED TRIBUTARY
FROM 1982 TO 1987

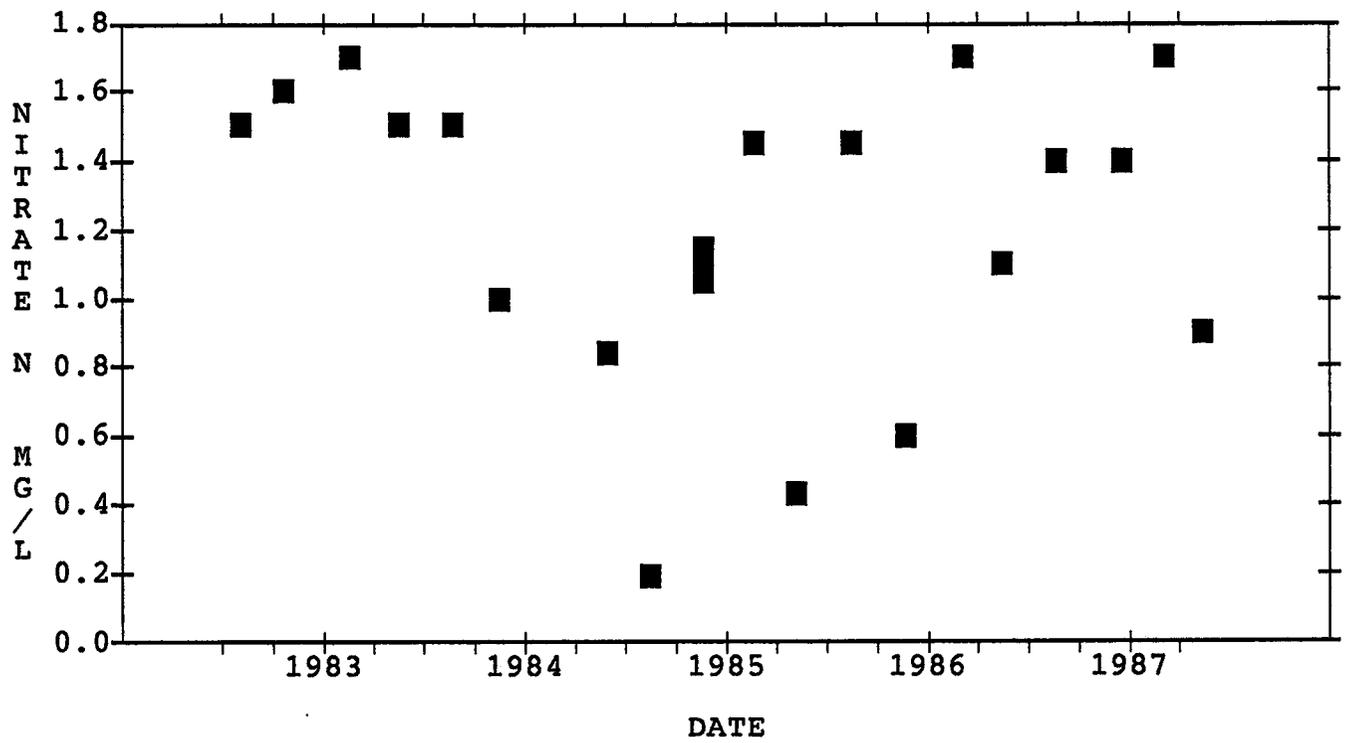


TABLE 4: SUMMARY TABLE - RANGE OF METAL CONCENTRATIONS FOR MONITORING SITES FROM 1982-1985 (mg/L)

Well	Ext. Copper	Ext. Lead	Ext. Zinc	Ext. Cadmium	Ext. Aluminum	Ext. Iron	Ext. Manganese
Well 8	<.002-0.007	<.002-.003	0.009-.020	<.001	<.01-.016	<.002-.09	<.01-.03
Well 9	0.002-0.009	<.002-0.004	0.008-0.04	<.001	0.019-0.086	0.013-0.042	0.30-0.79
Well 10	0.002-0.003	<.002-0.004	0.003-0.03	<.001	<.01-0.01	<.002-0.11	<.01-0.02
Well 12B	<.002	<.002-0.009	<.002-0.01	<.001-0.002	<.010-0.036	0.010-0.10	<.01-0.01
Well 12M	<.002-0.004	0.002-0.020	<.01-0.06	<.001-0.001	0.9-4.0	0.25-3.7	0.02-0.32
Well 12T	<.002	<.002-0.007	0.005-0.01	<.001-0.001	<.01-0.460	<.002-0.65	<.01-0.13
Well 13	-	-	-	-	-	0.024-0.19	<.01-0.02
Well 14	-	-	-	-	-	0.003-8.8	0.12-1.6
Well 15	-	-	-	-	-	0.022-0.21	<.01-0.02
Well 16	-	-	-	-	-	0.086-1.4	0.01-0.10
Wrights Ck	<.002	<.002	<.01	<.001	<0.10-0.070	0.013-0.14	<.01-0.04
Winter R	<.002-0.007	<.002	<.01	<.001	0.050-0.36	0.12-1.26	0.02-0.08
Unnamed Trib.	<.002	<.002	<.01-0.01	<.002	0.028-0.420	0.10-0.79	0.01-0.04

of iron were found in samples from Well #12M and 12T, Well 14, Well 16, South Branch Winter River and the Unnamed Tributary. The iron concentrations in 12M and 12T are probably attributable to the high sediment load and to the bentonite floc discussed previously, which also contains biotite, an iron-bearing mineral. The elevated iron concentrations in the South Branch Winter River and Unnamed Tributary are the result of the runoff following the rain event on August 14/88. High dissolved organic carbon and apparent color values which were also associated with the event have been shown to correlate well with elevated iron concentrations.

The iron concentrations in Wells #14 and #16 ranged from 0.003 to 8.8 mg/L and 0.086 to 1.40 mg/L respectively. The iron concentrations in Well #14 have shown a systematic increase since monitoring began on August 15/85, having increased dramatically from 0.003 to 8.8 mg/L. Turbidity, total alkalinity, magnesium and manganese also have all shown systematic increases. Specific conductance increased 25% between the first and second sampling, however it has been stable since that time. These increases are probably the result of physical-chemical changes as a result of the compaction of the fill used for the new runway construction, on a previously boggy area. With time this compaction can produce reducing conditions (without oxygen) in the aquifer, and under such conditions, iron and other parameters bound to the clay or sandstone are more readily released into solution. Iron, under reducing conditions, is very soluble in the ferrous state, however in contact with oxygen it forms ferric hydroxide, a reddish floc. This would

also explain the high turbidity values, which could not be lowered by additional pumping.

Iron concentrations in Well #16 ranged from 0.086 to 1.4 mg/L. A visual comparison of the data shows that iron increases with an increase in turbidity on all occasions except the first indicating the iron may be related to the sediment load. Field turbidities were less than 10 NTU for all samples.

Manganese concentrations were also elevated in Well #9 with values ranging from 0.30 to 0.79 mg/L. Iron concentrations ranged from 0.013 to 0.042 mg/L. It is rather unusual to have ground water that contains more manganese than iron (Hem, 1971). It is suspected that the manganese source is natural.

The analyses of metals was begun in July 1979 at a limited number of sites. The previous report (Environment Canada, 1981) suggested that the iron and manganese results for this period were excessive however it is probably a function of the sampling methodology. The data collected from October 1982 to February 1985 confirms this suspicion at least for Well #8. Metal data for Well #8 from 1979 to 1985 are presented in Table 5. A comparison of iron concentrations in Well #10 also indicate a reduction in values.

The use of metals as an indicator of trends in ground water is not possible due to the lack of metal analyses and effects of sampling methodology prior to 1982. The surface water station at

TABLE 5: METAL VALUES IN WELL #8 FOR THE PERIODS OF JULY 1979 -
FEBRUARY 1980 AND 1982-1985

Date	Ext. ¹ Copper	Ext. ¹ Lead	Ext. ¹ Zinc	Ext. ¹ Iron	Ext. ¹ Manganese	Turbidity ²
July 5/79	0.027	<0.002	0.030	0.95	0.03	65.
Aug. 22/79	0.037	0.004	0.036	0.60	0.12	62.
Nov. 7/79	0.019	0.002	0.018	0.50	0.06	49.
Feb. 6/80	0.005	0.004	0.009	0.27	0.07	50.
Oct. 20/82	-	<0.002	0.013	0.09	0.03	2.8
Feb. 17/83	-	0.003	0.009	0.08	0.03	6.2
May 17/83	-	<0.002	<0.01	0.013	0.02	0.4
Aug. 23/83	-	0.002	0.01	0.018	<0.01	0.6
Nov. 15/83	0.004	<0.002	0.02	<0.002	<0.01	5.8
Feb. 14/84	-	<0.002	-	0.014	-	-
May 30/84	0.005	<0.002	0.01	0.02	0.01	2.0
Aug. 15/84	0.003	<0.002	0.02	0.02	0.01	2.7
Nov. 20/84	<0.002	<0.002	<0.01	0.011	<0.01	-
Feb. 19/85	0.007	<0.002	0.01	0.06	0.01	7.2

¹ mg/L

² NTU

Wrights Creek does have a good data record for 1979 and 1980 as a result of the increase in sampling frequency to biweekly and after rain events. Metals were also analyzed at this site from 1982 to 1985. Metal data for Wrights Creek, summarized in Table 6, indicate that copper, lead, zinc, manganese and iron show little change and most values are at or near their detection limits. Iron values have increased in association with some rain events, however there are no indications of trends.

3.4 Phenolic Material/Petroleum Products

Phenolic materials were analyzed during Phase IV (August 1982 to February 1985) at Wells 8, 9, 10, 11 and 12 (three levels) as well as the three surface water sites (Appendix IV). All but one of the eight positive readings determined at the above sites fell between the two detection limits of 0.005 and 0.010 mg/L used for this method. The highest concentration reported was 0.07 mg/L at the Winter River station in May 1983. Since the source of this river is on airport property and near maintenance facilities, there may be some relationship between the two. The other sites are well away from the service area and no explanation with respect to anthropogenic input can be offered for their near detection limit values. Detectable phenolic concentrations can occur naturally from the degradation of lignin found in natural soil organic matter, giving background concentrations which can range up to approximately 0.010 mg/L. These concentrations are generally lower than most drinking water guidelines and significantly lower than the

concentrations observed in contaminated ground water at many waste disposal sites (Fernstra, 1987). Phenolic material was also analyzed in Phase 3 (January 1979 - March 1980) with reported values ranging from 0.002 to 0.017 mg/L.

TABLE 6: METAL VALUES AT WRIGHTS CREEK FROM MAY 1979 TO FEBRUARY 1985 (mg/L)

Date	Ext. Copper	Ext. Lead	Ext. Zinc	Ext. Iron	Ext. Manganese
May 16/79	<0.002	<0.002	<0.002	0.008	0.01
May 25/79	<0.002	<0.002	<0.002	0.022	0.02
May 28/79	<0.002	<0.002	<0.002	0.027	0.01
June 11/79	<0.002	<0.002	<0.002	0.034	0.02
Aug. 22/79	0.003	0.002	<0.002	0.069	0.01
Sept. 5/79	<0.002	-	<0.002	0.017	-
Sept. 17/79	0.002	<0.002	0.005	0.10	0.01
Oct. 2/79	<0.002	0.002	0.011	0.70	0.21
Oct. 15/79	<0.002	<0.002	0.055	0.10	0.03
Oct. 29/79	<0.002	<0.002	0.002	0.05	0.02
Nov. 9/79	<0.002	<0.002	0.002	0.10	0.03
Nov. 15/79	0.002	<0.002	0.006	0.30	0.04
Dec. 10/79	<0.002	<0.002	<0.002	0.056	0.02
Dec. 24/79	<0.002	<0.002	<0.002	0.046	0.02
Jan. 14/80	<0.002	<0.002	<0.002	0.047	0.02
Jan. 21/80	<0.002	<0.002	<0.002	0.029	0.01
Feb. 6/80	<0.002	<0.002	<0.002	0.033	0.01
Feb. 26/80	<0.002	<0.002	<0.002	0.015	0.01
Mar. 7/80	<0.002	<0.002	<0.002	0.017	0.01
Aug. 4/82	-	<0.002	<.002	0.015	<0.01
Oct. 20/82	-	<0.002	<.002	0.029	0.01
Feb. 15/83	-	<0.002	0.003	0.013	<0.01
May 17/83	-	<0.002	<0.01	0.10	0.03
Aug. 23/83	-	<0.002	<0.01	0.018	<0.01
Nov. 15/83	<0.002	<0.002	<0.01	0.045	0.02
Feb. 14/84	<0.002	<0.002	<0.01	0.06	0.02
May 29/84	<0.002	<0.002	<0.01	0.14	0.04
Aug. 15/84	<0.002	<0.002	<0.01	0.11	0.03
Nov. 20/84	<0.002	<0.002	<0.01	0.08	0.02
Feb. 19/85	<0.002	<0.002	<0.01	0.06	0.02

Well #10 has been sampled for a cross-section of petroleum products, since it is close to and downgradient of the new fire training area. No positive values were detected, as shown in Table 7, in samples collected May 14/86 and May 12/87. The lack of samples from this site is partially due to the fact that the well has been dry or too low to pump 8 of the last 12 sampling trips. This phenomenon is discussed briefly in the following section.

TABLE 7: Petroleum Products Analysis and Concentration in Well #10 samples

Compounds Analysed	Concentration ($\mu\text{g/L}$)
Benzene	< 0.30
Toluene	< 0.30
Xylenes	< 0.30
Alkyl Benzenes	< 0.30
Naphtalenes	< 0.30
Total Gasoline	< 5.00
Fuel Oil	< 5.00
Pristane	< 0.30
Phytane	< 0.30
Others	0.00
Total Hydrocarbons	< 5.00

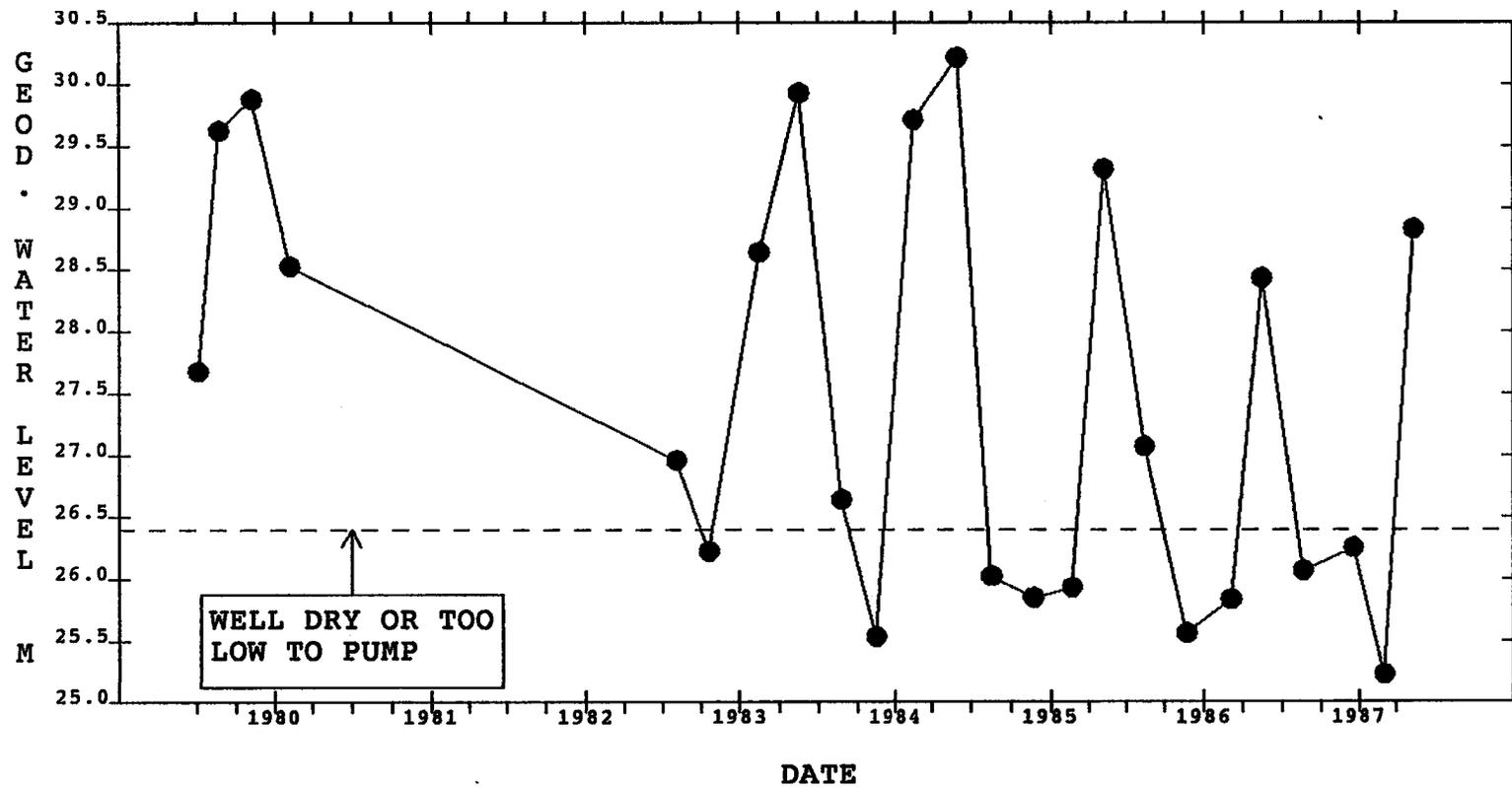
3.5 Well #10 Water Level

As illustrated in Figure 15, Well #10 has been dry or too low to pump in 10 of the last 20 sampling trips since 1982. Although this well, with a depth of only 11.4 metres, is relatively shallow, the water levels were adequate following construction of the well in February 1979. The water table ranged from 6.55 to 8.75 metres (29.877 to 27.676 m geodetic) for the four sampling trips from February 1979 to March 1980. Since the sampling was resumed in 1982

the well has gradually become more unsuitable as a monitoring site with the well being either dry or too low to pump on 8 of the last 12 occasions.

A plot of water table values for Wells #9 and #10 from 1982 to 1987, indicate that the two wells follow an almost identical fluctuation pattern which suggest that changes in the water table in Well #10 are a function of climatic conditions and not to construction of the fire training area or large quantities of fill spread immediately upgradient of Well #10. The natural fluctuation in Well #9 (4 to 6 metres) is greater than normal water levels in Well #10 indicating that Well #10 is too shallow.

FIGURE 15: GEODETIC WATER WATER LEVEL IN WELL #10 INDICATING WHEN WELL COULD NOT BE PUMPED



4. CONCLUSION

The purpose of the Charlottetown Airport Redevelopment Project Study is to determine if construction of the new runway and other infrastructure may have a detrimental effect on ground and surface water resources adjacent to the airport. It is difficult to ascertain if this purpose has been achieved. The lack of continuity of both sampling stations and water quality parameters and problems with sampling methodology during the pre-construction phase from 1976-1980 has limited the scope of the report. This report has discussed the water quality aspects of ground and surface waters sampled between August 1982 and May 1987. The data collected from 1976 to 1980 have been used to determine long term trends where data have been deemed valid.

The only parameter which has been found at levels of environmental concern in some test wells and surface water is nitrate nitrogen. Four wells, three in the Wrights Creek Drainage (Well #9, 10 and 12) and Well #15 in the Winter River Drainage greatly exceed nitrate levels found in a cross-section of municipal water supply wells on the Island, and also exceed the Canadian Drinking Water Guidelines of 10 mg/L on many occasions.

The nitrate concentrations in the above wells appear to be cyclic with recharge and fluctuate with yearly conditions such as urea usage, snowmelt, etc.. Wrights Creek and South Branch Winter River have shown upward trends in the nitrate concentrations from

1976 to 1987. Urea concentrations have been low, with the exception of the anomolous values determined during the August 1986 survey, indicating that hydrolysis and subsequent oxidation processes have taken place.

Heavy metals such as copper, lead, zinc and cadmium were at or below detection limit values for all sites. For the most part, elevated aluminum, iron and manganese concentrations are the product of well construction and natural events. In Well #12, high aluminum values are the direct result of the use of bentonite as a sealing agent, whereas the high iron concentrations in the well are also probably related to the bentonite and the high sediment load of the samples typical in the middle and upper stages of the piezometer. The systematic increase of iron and manganese concentrations in Well #14 can probably be attributed to the reduction processes resulting from runway construction. Other than moderate sediment load in some samples, no explanation is offered for the high iron concentrations in Well #16. In Well #9, manganese concentrations exceeded those for iron which is considered rather unusual. It is suspected that the source is natural. The elevated concentrations of aluminum, iron and manganese in surface water are related to rain events and subsequent runoff.

Phenolic materials were found in eight samples at near detection limit concentrations and are probably the product of natural degradation of soil organic matter. With the exception of one value for the Winter River (0.07 mg/L), phenolic concentrations remained unchanged from those measured in 1976-77. Petroleum products were not detected in 2 samples from Well #10.

5. RECOMMENDATIONS

- (1) To study change with time, a relatively lengthy and preferably continuous data base should be established. This has not been the case with the airport study. The sampling stations and parameter lists have been modified frequently resulting in an extremely fragmented data set.

It is recommended that the longer term planning include the requirement to maintain a consistent package of sampling stations and parameters. (1) It is recommended that the present sampling stations be retained. (2) Sampling of three private wells on Norwood Ave. should be re-commenced on a twice a year basis noting the elevated nitrate concentrations in Well #9 which drains the southeasterly portion of runway 03. (3) The parameter list should remain status quo, with sufficient major ions analyzed to perform the sample validation routine.

- (2) Well #10 has been retained to monitor downgrade of the new fire training area for petroleum products primarily kerosene, however, this well has not been sampled on 8 of the 12 most recent occasions due to the lack of water.

It is recommended it be dug deeper or a new well adjacent to the present well be established to monitor the fire training area.

- (3) The prospect of reduction processes becoming widespread in the aquifer in the area of the new runway (Well #14) and causing water quality changes in the Unnamed Tributary (Winter River) or municipal wells (Union Well Field) for the Charlottetown Water Supply should be addressed.

It is recommended that additional stations be monitored for iron and manganese to assess whether the reducing conditions are confined. Suggested additional stations would be Wells B, D, and E and the Unnamed Tributary. Dissolved iron would also be monitored at Wells 13 to 16 and the additional stations noted above.

6. ACKNOWLEDGEMENTS

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8. APPENDICES

APPENDIX I

CONSTRUCTION LOG

Construction of Combined Services Building - nearly completed
November 22, 1978

Construction Operations Building/Control Tower - tender closing date
March 3, 1983 - Completion date September 9/84

Construction Runway 10-28 and Recap of runway 03-21 - Tender closing
date March 24, 1983 - Charlottetown Airport closed August 15 to
October 15, 1983. Runway 10-28 completed October 1984

Construction of new Air Terminal Building - Tender close August 16,
1984

Construction Paved Access Road & Car Park - Tender close June 6, 1985

- Both opened March 24, 1986

Apron Floodlighting - Tender closing date September 26, 1985

Security Fencing - Tender closing November 28, 1985

Construct Fire Training Area - Tender closing July 17, 1986

Reconstruction of 2000 ft of Runway 03-21 and a portion of Taxi Bravo
- Start date September 8, 1987 - Completion date October 20,
1987

APPENDIX II

TEST WELL COORDINATES, GEODETIC ELEVATIONS AND DATES INSTALLED

Test Well Number	Location		Geodetic Top Casing Elevation	Remarks	Date Installed
	North	East			
A	350 526.66	470 814.65	45.592		Oct 1976
B	351 564.83	472 015.76	42.813		Oct 1976
D	351 866.63	471 060.09	42.294	Relevelled 1986	Oct 1976
E	352 483.12	471 011.22	40.267	Relevelled 1986	Oct 1976
2	346 487.56	466 537.37	51.383		Oct 1976
3	347 755.25	466 697.54	50.868		Oct 1976
6	349 437.90	466 077.22			Oct 1976
7	348 564.28	465 214.94	57.099		Oct 1976
8	347 357.70	465 163.67	55.468		Oct 1976
9	347 549.80	468 334.41	44.927		Feb 1979
10	349 024.14	469 411.11	36.426		Feb 1979
11	354 441.49	469 229.07	44.334	Relevelled 1986	Feb 1979
12	348 200.65	469 101.10	41.139		Aug 1983
13	352 364.86	469 027.54	49.247	Relevelled 1986	Aug 1985
14	352 648.71	472 026.24	41.639	Relevelled 1986	Aug 1985
15	351 877.13	468 056.56	47.314	Relevelled 1986	Aug 1985
16	350 995.66	467 866.04	44.081	Relevelled 1986	Aug 1985

APPENDIX III

PUMPING RATES AND TIME PUMPED

Well	Times Pumped	Pumping Rate Range - L/min	Median L/min.	Length of Time Pumped - min.	Median Min.
2	3	7-8	8	25-45	35
7	3	10-14	12	25-45	30
8	13	3-20	8	30-85	50
9	16	0.5-30	12	25-80	40
10	9	2-26	8	25-45	35
11	9	24-40	40	15-40	20
12B	19	1-2*	1	25-100	70
12M	19	0.75-1	1	90-215	130
12T	16	0.25-1	0.75	45-155	105
13	8	3.5-8	5	40-60	55
14	8	20-30	30	25-55	30
15	7	8-30	25	25-65	40
16	8	12-30	20	30-50	30
A	7	0.6-2.0	2	40-90	55
B	7	2-24	17	40-85	50
D	9	0.7-30	2	20-95	55
E	9	15-40	30	20-35	25

* - Capacity of Middleburg Bladder Pump

APPENDIX IV

WATER QUALITY DATA

CHARLOTTETOWN AIRPORT TEST WELL #2

0	1 STATION	2 SAMPLE DATE	3 SAMPLE TIME	4 SUBID	5 WATER TEMP. DEG C	6 SP COND US/CM	7 FIELD PH	8 LAB PH	9 FIELD TURBIDITY NTU	10 LAB TURBIDITY NTU
1	10PE01CC0032	07-MAY-85	1205	T243	7.0	388	7.6	7.9		
2	10PE01CC0032	07-MAY-85	1210	T243	7.0	389	7.6	7.9		
3	10PE01CC0032	07-MAY-85	1215	T243	7.0	391	7.6	7.9		
4	10PE01CC0032	13-MAY-86	1050	243	9.0	440	6.3	8.2	1.7	
5	10PE01CC0032	12-MAY-87	1045	243	9.0	438	7.3	8.0	8.5	7.1

0	11 WATER TABLE M	12 TOTAL ALKALINITY MG/L	13 CALCIUM MG/L	14 MAGNESIUM MG/L	15 SODIUM MG/L	16 POTASSIUM MG/L	17 CHLORIDE MG/L	18 SULPHATE MG/L	19 SULPHATE IC MG/L
1	19.100	175.4	41.0	22.0			6.4		
2	19.100	175.5	41.0	22.0			6.5		
3	19.100	177.7	41.0	22.0			6.4		
4	12.230	185.7	45.0	24.0			6.1		
5	12.115	195.9	47.0	25.0	5.0	1.3	6.2	5.6	4.6

0	20 NITRATE MG/L	21 NITRATE IC MG/L	22 UREA MG/L
1	4.25	3.75	L.05
2	4.15	4.00	L.05
3	4.15	3.75	L.05
4	5.00	4.40	L.01
5	5.20	5.40	L.05

CHARLOTTETOWN AIRPORT TEST WELL #7

0	1 STATION	2 SAMPLE DATE	3 SAMPLE TIME	4 SUBID	5 WATER TEMP DEG C	6 FIELD SP COND US/CM	7 LAB SP COND US/CM	8 FIELD PH	9 LAB PH	10 FIELD TURBIDITY NTU	11 LAB TURBIDITY NTU
1	10PE01CC0037	08-MAY-85	1510	243	6		721	7.1	7.0		
2	10PE01CC0037	14-MAY-86	1155	243	10	610		7.6	7.6	3.6	
3	10PE01CC0037	14-MAY-87	1410	243	9	406	406	6.8	7.9	3.7	4

0	12 WATER TABLE M	13 GEODETIC ELEVATION M	14 TOTAL ALKALINITY MG/L	15 CALCIUM MG/L	16 MAGNESIUM MG/L	17 SODIUM MG/L	18 POTASSIUM MG/L	19 CHLORIDE MG/L	20 SULPHATE MG/L
1	9.946	47.178	106.3	41	22			160.0	
2	10.960	46.550	125.9	39	21			109.0	
3	10.895	46.204	91.3	26	14	38.3	14	66.3	8.9

0	21 SULPHATE IC MG/L	22 NITRATE MG/L	23 NITRATE IC MG/L	24 UREA MG/L
1		0.39	0.65	L.05
2		0.39	0.25	L.01
3	9.3	0.53	0.60	L.05

CHARLOTTETOWN AIRPORT TEST WELL #8

0	1 STATION	2 SAMPLE	3 SAMPLE DATE	4 SAMPLE TIME	5 SUBID	6 WATER TEMP. DEG C	7 FIELD SP COND US/CM	8 LAB SP COND US/CM	9 FIELD PH	10 LAB PH	11 FIELD TURBIDITY NTU
1	10PE01CC0028	202103	20-OCT-82	1350	243	10.0	620	610		7.8	
2	10PE01CC0028	203077	17-FEB-83	1055	243	9.0	800	754	7.2	7.5	6.2
3	10PE01CC0028	300561	17-MAY-83	1400	243	8.0	740	720	7.1	7.3	0.4
4	10PE01CC0028	301579	23-AUG-83	1520	243	11.0	680	660	7.0	6.9	0.6
5	10PE01CC0028	302843	15-NOV-83	1500	243	10.0	630	610	7.1	6.7	5.8
6	10PE01CC0028	303928	14-FEB-84	1535	243	9.0	830		7.5		
7	10PE01CC0028	400642	30-MAY-84	1120	243	9.5	820	770	7.6	7.6	2.0
8	10PE01CC0028	401783	15-AUG-84	1405	T243	9.0		673	7.0	7.4	2.7
9	10PE01CC0028	401782	15-AUG-84	1400	T243	9.0		693	7.0	7.5	2.7
10	10PE01CC0028	401784	15-AUG-84	1410	T243	9.0		674	7.0	7.4	2.7
11	10PE01CC0028	403154	20-NOV-84	1330	243	7.0		725	6.8	7.7	
12	10PE01CC0028	404142	19-FEB-85	1400	243	7.0	270	688	7.2	7.9	7.2
13	10PE01CC0028	500267	07-MAY-85	1010	243	7.0		886	7.3	7.4	
14	10PE01CC0028	600454	15-MAY-86	1520	243	11.5	930		7.5	7.7	0.7
15	10PE01CC0028	700450	12-MAY-87	1600	243	10.0	972	972	7.3	8.2	0.8

0	12 LAB TURBIDITY NTU	13 FIELD COLOUR REL. U	14 LAB COLOUR REL U	15 WATER TABLE M	16 GEODETIC ELEVATION M	17 TOTAL ALKALINITY MG/L	18 CALCIUM MG/L	19 MAGNESIUM MG/L	20 SODIUM MG/L	
1	2.8		5 L5.	17.970	37.516	168.0	48.0	24	29	
2	2.5		5 L5.	17.140	38.346	141.0	52.0	26	50	
3	0.3	L5.	L5.	16.200	39.286	161.0	54.5	28	45	
4	0.6	L5.0	L5.	18.020	37.466	160.0	44.0	22	41	
5			5	18.370	37.116	184.0	54.0	28	27	
6			L5.	16.490	38.996	149.0	59.0			
7	0.8	L5.	L5.	16.530	38.956	141.0	60.0	29	52	
8	1.4	L5.	L5.	17.800	37.686	154.0	52.0	29	42	
9	1.0	L5.		5	17.800	37.686	151.0	52.0	28	44
10	1.8	L5.		5	17.800	37.686	154.0	52.0	29	47
11	0.3		L5.	17.780	37.706	165.0	54.0	27	42	
12	4.2		15 L5.	18.550	36.936	190.4	53.0	29	35	
13				16.000	39.486	142.0	59.0	30		
14				17.205	38.281	146.7	58.0	31		
15	0.3			17.110	38.376	147.8	62.0	33	73	

CHARLOTTETOWN AIRPORT TEST WELL #8

0	38 EXT LEAD MG/L	39 EXT ZINC MG/L	40 EXT CADMIUM MG/L	41 EXT ALUM MG/L
1	L.002	0.013		
2	0.003	0.009		
3	L.002	L.010		
4	0.002	0.010		
5	L.002	0.020	L.001	L.010
6	L.002		L.001	L.010
7	L.002	0.010	L.001	L.010
8	L.002	0.020	L.001	0.012
9	L.002	0.020	L.001	0.014
10	L.002	0.020	L.001	0.014
11	L.002	L.01	L.001	L.010
12	L.002	0.010	L.001	0.016
13				
14				
15				

CHARLOTTETOWN AIRPORT TEST WELL #9

0	1 STATION	2 SAMPLE DATE	3 SAMPLE TIME	4 SUBID	5 WATER TEMP DEG C	6 FIELD SP COND US/CM	7 LAB SP COND US/CM	8 FIELD PH	9 LAB PH	10 FIELD TURBIDITY NTU	11 LAB TURBIDITY NTU
1	10PE01CC0027	05-AUG-82	1240	243	9.5	320	322	6.6	6.9	3.5	1.7
2	10PE01CC0027	21-OCT-82	1212	243	9.0	430	429	6.8	7.1		0.6
3	10PE01CC0027	16-FEB-83	1640	243	7.5	290	292	6.3	6.6	1.2	0.5
4	10PE01CC0027	17-MAY-83	1520	243	6.5	133	126	5.3	5.5	0.5	0.5
5	10PE01CC0027	23-AUG-83	1615	243	9.5	410	403	6.7	6.7	1.2	1.1
6	10PE01CC0027	15-NOV-83	1550	243	8.5	176	173	5.9	7.2	0.5	
7	10PE01CC0027	15-FEB-84	1205	243	9.0	158	147	6.0	6.4	0.7	0.5
8	10PE01CC0027	15-FEB-84	1210	243	9.0	158		6.0	6.4	0.7	0.7
9	10PE01CC0027	15-FEB-84	1215	243	9.0	158	146	6.0	6.3	0.7	0.6
10	10PE01CC0027	29-MAY-84	1340	243	7.5	162	148	5.9	6.1	0.7	0.6
11	10PE01CC0027	16-AUG-84	1120	243			146	5.7	6.4	1.0	0.4
12	10PE01CC0027	21-NOV-84	1120	243			144	5.7	7.4	3.4	1.4
13	10PE01CC0027	20-FEB-85	1420	T243	7.5	260	261	6.3	6.8	0.5	0.4
14	10PE01CC0027	20-FEB-85	1425	T243	7.5	260	262	6.3	6.8	0.5	0.3
15	10PE01CC0027	20-FEB-85	1430	T243	7.5	260	265	6.3	6.9	0.5	0.4
16	10PE01CC0027	07-MAY-85	1450	243	7.5		138	5.2	6.0		
17	10PE01CC0027	13-AUG-85	1120	243	11.5	260		6.3	6.6	2.0	
18	10PE01CC0027	20-NOV-85	1230	T243	9.0	158		5.7	6.7		
19	10PE01CC0027	20-NOV-85	1225	T243	9.0	158		5.7	6.2		
20	10PE01CC0027	20-NOV-85	1220	T243	9.0	158		5.6	6.9		
21	10PE01CC0027	05-MAR-86	1135	243	10.0	450		6.8	7.1		
22	10PE01CC0027	13-MAY-86	1150	T243	9.2	190		6.4	6.6	1.0	
23	10PE01CC0027	13-MAY-86	1154	T243	9.2	190		6.3	6.6	0.8	
24	10PE01CC0027	13-MAY-86	1155	T243	9.2	190		6.3	6.5	0.8	
25	10PE01CC0027	19-AUG-86	1050	243	10.3	240		6.1	6.3	1.2	
26	10PE01CC0027	18-DEC-86	1025	T243	7.5	194		5.6	6.6	2.0	
27	10PE01CC0027	18-DEC-86	1035	T243	7.5	194		5.7	7.2	3.2	
28	10PE01CC0027	18-DEC-86	1030	T243	7.5	194		5.6	6.5	1.8	
29	10PE01CC0027	04-MAR-87	1110	T243	7.5	480		6.8	7.0	4.9	
30	10PE01CC0027	04-MAR-87	1114	T243	7.5	480		6.8	7.2	4.7	
31	10PE01CC0027	04-MAR-87	1112	T243	7.5	480		6.8	7.1	4.7	
32	10PE01CC0027	12-MAY-87	1300	243	10.0	247	247	6.0	6.6	1.4	0.5

CHARLOTTETOWN AIRPORT TEST WELL #9

0	12 FIELD COLOUR	13 LAB COLOUR	14 WATER TABLE M	15 GEODETIC ELEVATION M	16 TOTAL ALKALINITY MG/L	17 CALCIUM MG/L	18 MAGNESIUM MG/L	19 SODIUM MG/L	20 POTASSIUM MG/L
1	L5.0	L5.	12.910	32.017	88.5	30.0	16.0	4.0	3.00
2		L5.	14.330	30.597	153.0	43.0	22.0	4.5	3.20
3		5 L5.	11.900	33.027	86.3	26.4	13.0	3.9	2.70
4	L5.	L5.	9.880	35.047	8.6	8.7	4.6	2.8	2.90
5	L5.0	L5.	14.830	30.097	147.0	38.0	19.0	4.2	
6	L5.		12.720	32.207	29.0	15.0	7.5	2.9	2.20
7	L5.	L5.	11.700	33.227	19.4	11.0	5.7	2.8	2.50
8		L5.	11.700	33.227	18.6	11.0	6.7	2.8	2.50
9	L5.	L5.	11.700	33.227	18.3	11.0	6.9	2.8	2.50
10		5 L5.	11.700	33.227	17.9	11.0	6.0	2.6	2.50
11	L5.	L5.	11.180	33.747	14.2	11.0	5.6	2.8	2.80
12			5 12.645	32.282	13.8	11.0	5.7	2.8	2.85
13	L5.	L5.	14.970	29.957	69.9	24.0	13.0	3.1	2.70
14	L5.	L5.	14.970	29.957	72.0	24.0	13.0	3.2	2.70
15	L5.	L5.	14.970	29.957	73.3	25.0	14.0	3.2	2.70
16			9.258	35.669	7.2	9.5	5.1		
17			14.430	30.497	103.2	38.0	17.0		
18			10.500	34.427	13.4	11.0	6.0		
19			10.500	34.427	14.2	11.0	5.9		
20			10.500	34.427	14.5	11.0	6.0		
21			15.540	29.387	174.2	47.0	24.0		
22			13.475	31.452	41.9	17.0	9.4		
23			13.475	31.452	39.3	17.0	9.5		
24			13.475	31.452	39.8	17.0	9.5		
25			14.240	30.687	64.2	23.0	12.0	3.3	2.90
26			13.500	31.427	31.3	15.0	8.3	2.9	3.00
27			13.500	31.427	28.7	15.0	8.3	2.9	2.90
28			13.500	31.427	28.7	15.0	8.3	2.9	2.90
29			15.800	29.127	178.1	47.0	25.0	4.3	2.70
30			15.800	29.127	181.0	48.0	25.0	4.3	2.30
31			15.800	29.127	179.8	47.0	25.0	4.3	2.70
32			13.062	31.865	57.9	22.0	12.0	3.0	2.60

CHARLOTTETOWN AIRPORT TEST WELL #9

0	21 CHLORIDE MG/L	22 SULPHATE MG/L	23 SULPHATE IC MG/L	24 SILICA MG/L	25 NITRATE MG/L	26 NITRATE IC MG/L	27 TOTAL NITROGEN MG/L	28 UREA-MG/L	29 PHENOLIC MATERIAL MG/L
1	5.2	4.5			14.0		12	0.030	
2	5.2	4.8			14.0		13	0.010	L.05
3	4.2	3.3			15.0		13	L.01	L.05
4	4.3	4.0	3.7		22.0			0.010	L.05
5	4.6	5.2	4.4		15.0		12	L.01	L.05
6	3.7	4.1	4.1	6.6	13.0		13	0.050	L.05
7	4.1	4.5	3.1	6.5	11.0		12	L.01	L.01
8	4.2							L.01	L.01
9	4.0	4.2	3.3	6.5	8.5		12	L.01	L.01
10	4.0	2.8		6.2	12.0	10.6	11	0.012	L.01
11	4.1	3.1		5.3	12.4	10.4	12	L.01	L.01
12	4.3	4.0		6.6	10.8	10.8	12	L.01	L.01
13	4.2	3.7		6.1	12.4	11.6	14	L.01	L.01
14	4.1	3.7		6.1	12.7	11.6	14	L.01	L.01
15	4.2	3.5		6.2	12.5	11.6	14	L.01	L.01
16	4.1				13.5	9.0		L.05	
17	5.9				15.5	13.0		L.05	
18	3.6				12.0	11.0		L.05	
19	3.5				12.2	12.0			
20	3.3				11.6	12.0			
21	7.3				10.4	10.5		L.05	
22	4.4				11.0	10.4		L.01	
23	4.5				12.0	10.4		L.01	
24	4.5				11.0	10.4		L.01	
25	5.4	4.2	4.5		12.8	12.0		L.05	
26	4.1	3.7	3.4		17.0	12.3		L.05	
27	4.2	3.7	3.4		17.0	12.1		L.05	
28	4.2	3.7	3.4		15.0	16.8		L.05	
29	5.4	4.7	4.1		12.0	11.4		L.05	
30	5.5	4.8	4.0		12.0	11.4		L.05	
31	5.4	4.8	4.1		12.0	11.6		L.05	
32	5.2	4.4	4.1		14.0	14.0		L.05	

CHARLOTTETOWN AIRPORT TEST WELL #9

0 38 EXT CADMIUM 39 EXT ALUM
 MG/L MG/L

1		
2		
3		
4		
5		
6	L.001	0.075
7	L.001	0.085
8		
9	L.001	0.055
10	L.001	0.086
11	L.001	0.150
12	L.001	0.110
13	L.001	0.022
14	L.001	0.019
15	L.001	0.019
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CHARLOTTETOWN AIRPORT TEST WELL #10

0	1 STATION	2 SAMPLE	3 SAMPLE DATE	4 SAMPLE TIME	5 SUBID	6 WATER TEMP DEG C	7 FIELD SP COND US/CM	8 LAB SP COND US/CM	9 FIELD PH	10 LAB PH	11 FIELD TURBIDITY NTU
1	10PE01CC0029		04-JUL-79		243						
2	10PE01CC0029		21-AUG-79		243						
3	10PE01CC0029		07-NOV-79		243						
4	10PE01CC0029		06-FEB-80		243						
5	10PE01CC0029	201263	05-AUG-82	1030	243	9.8	410	421	7.6	7.7	67.0
6			21-OCT-82								
7	10PE01CC0029	203075	16-FEB-83	1500	243	7.5	464	462	7.0	7.3	0.2
8	10PE01CC0029	300566	18-MAY-83	950	243	8.0	410	407	7.0	7.2	0.5
9	10PE01CC0029	301584	24-AUG-83	1150	243	11.0	410	397	7.5	7.6	12.0
10			16-NOV-83								
11	10PE01CC0029	303935	15-FEB-84	1420	243		440	416		7.7	4.5
12	10PE01CC0029	303936	15-FEB-84	1425	243	8.5	440		7.3		
13	10PE01CC0029	303937	15-FEB-84	1430	243	8.5	440	416	7.3	7.7	4.5
14	10PE01CC0029	400599	29-MAY-84	1430	243	9.0	430	400	7.3	7.3	0.7
15			16-AUG-84								
16	10PE01CC0029	403178	21-NOV-84	1100	243						
17			20-FEB-85								
18	10PE01CC0029	500274	07-MAY-85	1545	T243	7.5		440	7.3	7.1	
19	10PE01CC0029	500275	07-MAY-85	1550	T243	7.5		437	7.3	7.1	
20	10PE01CC0029	500276	07-MAY-85	1555	T243	7.5		438	7.3	7.2	
21	10PE01CC0029	501211	13-AUG-85	1100	243						
22	10PE01CC0029	502271	20-NOV-85	1100	243						
23			04-MAR-86								
24	10PE01CC0029	600440	14-MAY-86	1030	T243	13.5	460		7.4	7.7	3.0
25	10PE01CC0029	600441	14-MAY-86	1035	T243	13.5	460		7.4	7.7	2.8
26	10PE01CC0029	600442	14-MAY-86	1040	T243	13.5	460		7.4	8.2	2.3
27	10PE01CC0029	601594	19-AUG-86	1315	243						
28	10PE01CC0029	602716	18-DEC-86	1310	243						
29	10PE01CC0029	603076	04-MAR-87	1500	243						
30	10PE01CC0029	700444	12-MAY-87	1130	T243	12.5	481	481	6.9	7.9	3.6
31	10PE01CC0029	700445	12-MAY-87	1135	T243	12.5	484	484	6.9	8.0	2.9
32	10PE01CC0029	700446	12-MAY-87	1140	T243	12.5	487	487	6.8	7.6	2.9

CHARLOTTETOWN AIRPORT TEST WELL #10

0	12 LAB TURBIDITY NTU	13 FIELD COLOUR	14 LAB COLOUR	15 WATER TABLE M	16 GEODETIC ELEVATION M	17 TOTAL ALKALINITY MG/L	18 CALCIUM MG/L	19 MAGNESIUM MG/L	20 SODIUM MG/L	
1				8.750	27.676					
2				6.800	29.626					
3				6.549	29.877					
4				7.895	28.531					
5	2.8	75	L5.	9.470	26.956	165.0	42.0	9	4.9	
6				10.205	26.221					
7	0.2	L5.0	L5.	7.785	28.641	179.0	48.0	26	5.3	
8	0.4	L5.	L5.	6.500	29.926	157.0	41.0		4.8	
9	16.0		15	20	9.790	26.636	166.0	37.0	4.9	
10				10.895	25.531					
11	3.9		5	5	6.710	29.716	167.0	44.0	23	4.7
12			5	5	6.710	29.716	168.0	45.0		
13	3.8		5	5	6.710	29.716	172.0	45.0	25	4.8
14	0.8	L5.	L5.		6.210	30.216	158.0	43.5	25	5.0
15				10.410	26.016					
16				10.582	25.844					
17				10.500	25.926					
18				7.110	29.316	177.0	46.0	25		
19				7.110	29.316	179.0	46.0	25		
20				7.110	29.316	180.4	44.0	24		
21				9.360	27.066					
22				10.870	25.556					
23				10.600	25.826					
24				7.995	28.431	186.2	50.0	27		
25				7.995	28.431	186.6	47.0	27		
26				7.995	28.431	188.6	48.0	27		
27				10.360	26.066					
28				10.180	26.246					
29				11.200	25.226					
30	2.9			7.600	28.826	195.7	50.0	27	4.8	
31	3.0			7.600	28.826	192.4	50.0	27	4.8	
32	2.5			7.600	28.826	194.2	50.0	27	4.8	

CHARLOTTETOWN AIRPORT TEST WELL #10

0	21 POTASSIUM MG/L	22 CHLORIDE MG/L	23 SULPHATE MG/L	24 SULPHATE IC MG/L	25 SILICA MG/L	26 NITRATE MG/L	27 NITRATE IC MG/L	28 TOTAL NITROGEN MG/L	29 UREA MG/L
1									
2									
3									
4									
5	1.2	6.9	7.5			7.6		8.0	0.080
6									
7	1.4	6.2	13.3			10.0		9.5	L.005
8	1.1	6.7	13.0	12.4		25.0			L.01
9	1.0	6.0	7.3	7.1		7.7		7.2	0.005
10									
11	1.7	7.0	12.5	12.7	7.5	8.5		8.9	L.010
12						8.5			L.010
13	1.8	7.0	12.5	12.7	7.5	8.5		9.6	
14	2.0	7.3	11.0		8.5	8.9	8.25	8.9	0.009
15									
16									
17									
18		7.4				10.0	6.00		L.05
19		7.4				10.0	3.50		L.05
20		7.3				10.0	5.50		L.05
21									
22									
23									
24		5.7				9.0	8.50		L.01
25		5.7				9.0	8.70		L.01
26		6.4				9.0	8.50		L.01
27									
28									
29									
30	1.8	7.6	10.6	10.5		10.0	9.30		L.05
31	1.8	7.6	11.0	10.5		10.0	9.50		L.05
32	1.8	7.6	10.8	10.6		10.0	9.40		L.05

CHARLOTTETOWN AIRPORT TEST WELL #10

0 38 EXT ZINC 39 EXT CADMIUM 40 EXT ALUM
 MG/L MG/L MG/L

1	0.030		
2	0.003		
3	L.010		
4	0.010		
5	L.01	L.001	0.01
6	L.01	L.001	0.01
7	L.01	L.001	0.01
8	0.010	L.001	L.010
9			
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CHARLOTTETOWN AIRPORT TEST WELL #11

0	1 STATION	2 SAMPLE DATE	3 SAMPLE TIME	4 SUBID	5 WATER TEMP DEG C	6 FIELD SP COND US/CM	7 LAB SP COND US/CM	8 FIELD PH	9 LAB PH	10 FIELD TURBIDITY NTU	11 LAB TURBIDITY NTU
1	10PE01CC0030	04-AUG-82	1510	243	8.5	210	231	7.2	7.4	1.5	0.3
2	10PE01CC0030	21-OCT-82	930	243	8.0	240	255	7.4	8.0		1.4
3	10PE01CC0030	15-FEB-83	1520	243	8.0		198	6.9	7.2	0.7	0.8
4	10PE01CC0030	18-MAY-83	1420	243	8.0	168	167	6.9	7.2	1.3	0.9
5	10PE01CC0030	24-AUG-83	1440	243	9.0	230	225	7.2	7.3	0.9	0.8
6	10PE01CC0030	16-NOV-83	1105	243	8.0	260	255	7.5	6.7	1.3	
7	10PE01CC0030	14-FEB-84	1410	243	7.5	168	162	6.9	7.3	0.3	0.3
8	10PE01CC0030	30-MAY-84	1330	243	8.0	182	175	7.0	8.0	1.5	0.8
9	10PE01CC0030	15-AUG-84	1510	243	7.0		230	7.0	7.6	1.0	0.4
10	10PE01CC0030	20-NOV-84	1420	T243	5.5		241	7.1	7.7		0.2
11	10PE01CC0030	20-NOV-84	1425	T243	5.5		242	7.1	7.7		1.4
12	10PE01CC0030	20-NOV-84	1430	T243	5.5		242	7.1	7.8		1.7
13	10PE01CC0030	19-FEB-85	1540	243	9.0	690	259	7.2	7.8	4.0	7.3

0	12 FIELD COLOUR	13 LAB COLOUR	14 WATER TABLE M	15 GEODETIC ELEVATION M	16 TOTAL ALKALINITY MG/L	17 CALCIUM MG/L	18 MAGNESIUM MG/L	19 SODIUM MG/L	20 POTASSIUM MG/L
1	L5.0	L5.	9.519	34.815	88.9	22.0	12.0	4.5	1.10
2	L5.	L5.	9.950	34.384	103.0	26.0	12.8	4.7	1.30
3	L5.0	L5.	7.825	36.509	74.7	19.0	8.5	4.3	0.80
4	L5.	L5.	6.500	37.834	62.5	15.8	8.4	4.0	0.60
5	L5.0	L5.	9.640	34.694	93.4	19.0	10.0	4.4	0.60
6	L5.		10.130	34.204	110.0	27.0	14.6	4.7	0.80
7	L5.	L5.	6.978	37.356	61.9	15.0	8.5	3.8	1.10
8	L5.	L5.	6.830	37.504	64.8	16.3	8.8	3.9	0.70
9	L5.	L5.	9.618	34.716	95.1	24.0	13.0	4.7	1.25
10		L5.	9.542	34.792	102.0	25.0	13.0	4.6	1.20
11		L5.	9.542	34.792	102.0	25.0	14.0	4.7	1.25
12		L5.	9.542	34.792	102.0	24.0	13.0	4.7	1.25
13	5	5	10.095	34.239	109.6	26.0	14.0	4.6	1.22

0	21 CHLORIDE MG/L	22 SULPHATE MG/L	23 SULPHATE IC MG/L	24 FLUORIDE MG/L	25 SILICA MG/L	26 NITRATE MG/L	27 NITRATE IC MG/L	28 TOTAL NITROGEN MG/L	29 UREA MG/L
1	7.3	5.5				2.00		2.3	0.04
2	6.9	6.0				2.20		2.1	L.01
3	5.3	5.5				2.50		2.6	L.005
4	5.4	5.7	5.7			2.40			L.01
5	5.8	6.4	6.0			2.20		2.4	L.005
6	6.5	5.9	5.5	0.06	6.3	2.10		2.2	L.005
7	5.2	5.8	5.3		7.6	1.50		1.5	
8	5.8	5.0			8.0	1.90	2.00	2.2	L.005
9	5.7	5.6			7.3	1.85	1.85	2.0	L.01
10	6.0	5.3			7.5	1.95	1.70	1.9	L.01
11	6.0	5.3			7.5	2.10	1.80	2.1	L.01
12	6.0	5.2			7.5	2.05	1.80	1.9	L.01
13	6.7	5.3			6.5	1.60	1.60	2.1	L.01

CHARLOTTETOWN AIRPORT TEST WELL #11

0	30 PHENOLIC MATERIAL MG/L	31 DISS.ORG. CARBON MG/L	32 DISS.INDRG. CARBON MG/L	33 TOTAL PHOSPHORUS MG/L	34 EXT. IRON MG/L	35 EXT. MANGANESE MG/L	36 EXT COPPER MG/L	37 EXT LEAD MG/L
1		L2.0	23.7	0.110	0.021	L.01		L.002
2	L.005	0.5	24.0	0.100	0.041	L.01		L.002
3	L.005	6.5	18.0	0.130	0.050	L.01		L.002
4	L.01	L.50	21.0	0.090	0.180	L.01		L.002
5	L.005	3.2		0.085	0.013	L.01		L.002
6	0.005	1.0	28.0	0.110	0.018	L.01	L.002	L.002
7		L1.0		0.110	0.052	L.01	L.002	L.002
8	L.005	L1.		0.170	0.200	L.01	L.002	L.002
9	L.01	L1.0			0.014	L.01	L.002	L.002
10	L.005	L1.			0.050	L.01	L.002	L.002
11	L.005	L1.			0.035	L.01	L.002	L.002
12	L.005	L1.			0.029	L.01	L.002	L.002
13	L.005	L1.			0.160	L.01	0.002	L.002

0	38 EXT ZINC MG/L	39 EXT CADMIUM MG/L	40 EXT ALUM MG/L
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1	0.003		
2	0.003		
3	0.005		
4	L.010		
5	L.01		
6	L.01	L.001	0.020
7	L.01	L.001	L.010
8	L.01	L.001	L.010
9	0.010	L.001	L.010
10	L.01	L.001	L.010
11	L.01	L.001	L.010
12	L.01	L.001	L.010
13	L.01	L.001	0.022

CHARLOTTETOWN AIRPORT TEST WELL #12B
PIEZOMETER BOTTOM

0	1 STATION	2 SAMPLE	3 SAMPLE DATE	4 SAMPLE TIME	5 SUBID	6 WATER TEMP. DEG C	7 FIELD SP COND US/CM	8 LAB SP COND US/CM	9 FIELD PH	10 LAB PH	11 FIELD TURBIDITY NTU
1	12PE01CC0001	202106	21-OCT-82	1350	243	9.5	430	419	7.6	7.9	
2	12PE01CC0001	203072	16-FEB-83	1210	243	7.0	490	483	7.5	7.7	1.9
3	12PE01CC0001	300563	18-MAY-83	1000	243	7.5	500	493	7.6	7.7	1.7
4	12PE01CC0001	301581	24-AUG-83	1005	243	7.5	480	472	7.5	7.7	2.6
5	12PE01CC0001	302845	16-NOV-83	1015	243	7.2		475	7.5	8.2	1.0
6	12PE01CC0001	303929	15-FEB-84	1020	243	7.5	520	499	7.5	7.9	2.4
7	12PE01CC0001	400639	30-MAY-84	1010	243	7.0	540	510	7.5	7.8	12.0
8	12PE01CC0001	401800	16-AUG-84	1130	243	8.5		501	7.5	7.8	3.6
9	12PE01CC0001	403171	21-NOV-84	1000	243	7.5		514	7.4	7.9	9.0
10	12PE01CC0001	404147	20-FEB-85	1130	243	6.5	480	481	7.2	8.1	13.0
11	12PE01CC0001	500292	08-MAY-85	1115	243	7.0		514	7.4	7.8	
12	12PE01CC0001	501154	14-AUG-85	1050	243	8.5	410		7.5	7.8	1.3
13	12PE01CC0001	502227	20-NOV-85	1155	243	8.0	480		7.5	7.7	
14	12PE01CC0001	503518	05-MAR-86	1105	T243	7.5	470		7.6	7.9	
15	12PE01CC0001	503519	05-MAR-86	1110	T243	7.5	470		7.7	7.9	
16	12PE01CC0001	503520	05-MAR-86	1115	T243	7.5	470		7.7	7.8	
17	12PE01CC0001	600437	14-MAY-86	1100	243	7.2	480		7.6	7.7	0.4
18	12PE01CC0001	601588	19-AUG-86	1100	T243	8.5	450		7.6	7.7	0.5
19	12PE01CC0001	601589	19-AUG-86	1105	T243	8.5	450		7.6	7.7	0.5
20	12PE01CC0001	601590	19-AUG-86	1110	T243	8.5	450		7.6	7.7	0.5
21	12PE01CC0001	602708	18-DEC-86	1045	243	6.0	470		7.5	7.9	1.2
22	12PE01CC0001	603066	04-MAR-87	1145	T243	6.5	450		7.7	7.9	0.5
23	12PE01CC0001	603068	04-MAR-87	1148	T243	6.5	450		7.7	7.8	0.7
24	12PE01CC0001	603067	04-MAR-87	1147	T243	6.5	450		7.7	7.8	0.5
25	12PE01CC0001	700451	13-MAY-87	1055	243	7.5	464	464	7.2	8.2	1.0

CHARLOTTETOWN AIRPORT TEST WELL #12B
PIEZOMETER BOTTOM

0	12 LAB TURBIDITY NTU	13 FIELD COLOUR REL. U	14 LAB COLOUR REL U	15 WATER TABLE M	16 GEODETIC ELEVATION M	17 TOTAL ALKALINITY MG/L	18 CALCIUM MG/L	19 MAGNESIUM MG/L	20 SODIUM MG/L
1	8.8		5	16.450	24.689	177.0	43.0	22.0	7.0
2	1.7	5	L5.	15.360	25.779	225.0	51.0	26.0	6.1
3	1.4	L5.	L5.	14.100	27.039	227.0	53.5	34.0	6.0
4	1.5	L5.0	L5.	17.080	24.059	219.0	45.0	23.0	5.9
5		L5.		18.300	22.839	222.0	51.0	26.5	2.9
6	1.5	L5.	L5.	14.780	26.359	238.0	55.0	30.0	5.8
7	6.2	15	10	14.070	27.069	244.0	60.0	31.0	6.3
8	1.7	5	L5.	16.700	24.439	234.0	56.0	32.0	6.3
9	3.4		5	16.990	24.149	239.0	56.0	30.0	6.2
10	8.7	15	5	17.710	23.429	224.5	50.0	28.0	5.7
11				14.732	26.407	236.0	57.0	30.0	
12				16.560	24.579	223.0	45.0	20.0	
13				18.125	23.014	223.9	52.0	29.0	
14				17.720	23.419	216.4	52.0	27.0	
15				17.720	23.419	212.3	52.0	27.0	
16				17.720	23.419	216.9	51.0	27.0	
17				15.380	25.759	224.0	56.0	30.0	
18				17.485	23.654	214.3	51.0	26.0	5.6
19				17.485	23.654	212.6	50.0	26.0	5.8
20				17.485	23.654	214.7	51.0	26.0	5.7
21				17.150	23.989	218.0	52.0	28.0	6.0
22				18.395	22.744	202.1	48.0	27.0	5.6
23				18.395	22.744	200.4	47.0	25.0	5.6
24				18.395	22.744	199.7	48.0	28.0	5.6
25	0.3			15.005	26.134	217.5	51.0	28.0	5.6

CHARLOTTETOWN AIRPORT TEST WELL #12B
PIEZOMETER BOTTOM

0	21 POTASSIUM MG/L	22 CHLORIDE MG/L	23 SULPHATE MG/L	24 SULPHATE IC MG/L	25 SILICA MG/L	26 NITRATE MG/L(N)	27 NITRATE IC MG/L(N)	28 TOTAL NITROGEN MG/L	29 UREA MG/L
1	0.80	7.1	8.0			6.8		7.0	L.01
2	1.00	6.9	7.6			4.5		4.8	L.005
3	0.70	6.8	7.5	6.6		5.3		5.9	L.01
4		6.5	7.3	6.7		4.2		4.5	L.005
5	0.80	6.8	7.2	6.6	8.4	4.6		5.1	L.005
6	1.40	6.9	7.2	6.8	8.2	5.9		6.6	L.01
7	1.50	6.7	6.5		9.0	4.6	5.15	5.8	L.005
8	1.50	5.2	7.5		8.0	4.7	4.65	5.0	L.01
9	1.50	5.5	7.2		8.4	5.8	5.40	5.4	L.01
10	1.35	6.7	6.8		7.9	4.3	4.20	5.2	L.01
11		6.5				6.1	4.00		L.05
12		7.2				4.5	3.90		L.05
13		6.2				4.7	4.50		L.05
14		6.1				4.2	3.70		L.05
15		5.9				4.5	3.70		L.05
16		6.3				4.2	3.80		L.05
17		6.0				5.3	4.80		L.01
18	1.34	7.2	6.6	6.7		4.8	4.30		L.05
19	1.40	7.2	6.6	6.7		4.8	4.10		L.05
20	1.30	7.5	6.4	6.7		4.6	4.30		L.05
21	1.50	6.8	7.1	6.5		5.0	4.40		L.05
22	1.30	7.0	7.0	6.4		3.7	3.70		L.05
23	1.30	7.0	7.0	6.4		3.6	3.80		L.05
24	1.30	6.9	7.0	6.4		3.6	3.70		L.05
25	1.20	7.7	7.4	6.9		4.5	4.90		L.05

CHARLOTTETOWN AIRPORT TEST WELL #12B
 PIEZOMETER BOTTOM

0 38 EXT ZINC 39 EXT CADMIUM 40 EXT ALUM
 MG/L MG/L MG/L

1	L.002			
2		0.002		
3	L.010			
4	L.01			
5	L.01	L.001		0.012
6	L.01	L.001	L.010	
7		0.010	0.002	0.031
8		0.010	0.001	0.020
9		0.010	0.001	0.020
10	L.01	L.001		0.036
11				
12				
13				
14				
15				
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21				
22				
23				
24				
25				

CHARLOTTETOWN AIRPORT TEST WELL #12M
PIEZOMETER MIDDLE

0	1 STATION	2 SAMPLE	3 SAMPLE DATE	4 SAMPLE TIME	5 SUBID	6 WATER TEMP. DEG C	7 FIELD SP COND US/CM	8 LAB SP COND US/CM	9 FIELD PH	10 LAB PH	11 FIELD TURBIDITY NTU
1	12PE01CC0002	202105	21-OCT-82	1140	243	8.5	470	476	7.5	7.9	
2	12PE01CC0002	203073	16-FEB-83	1435	243	6.5	470	471	7.3	7.7	125
3	12PE01CC0002	300564	18-MAY-83	1150	243	8.2	420	472	7.4	7.6	35
4	12PE01CC0002	301582	24-AUG-83	1350	243	9.5	480	464	7.4	7.6	26
5	12PE01CC0002	302846	16-NOV-83	1330	243	7.2		463			
6	12PE01CC0002	303930	15-FEB-84	1340	243	7.5	480		7.4	8.0	63
7	12PE01CC0002	400640	30-MAY-84	1245	243	9.5	500	473	7.5	7.7	95
8	12PE01CC0002	401801	16-AUG-84	1330	243	10.0		477	7.5	8.0	100
9	12PE01CC0002	403172	21-NOV-84	1205	243	7.0		476	7.2	8.0	350
10	12PE01CC0002	404148	20-FEB-85	1335	T243	6.5	460	470	7.3	8.0	70
11	12PE01CC0002	404149	20-FEB-85	1340	T243	6.5	460	470	7.3	7.9	70
12	12PE01CC0002	404150	20-FEB-85	1345	T243	6.5	460	473	7.3	8.1	70
13	12PE01CC0002	500293	08-MAY-85	1315	243	6.0		464	7.5	7.8	
14	12PE01CC0002	501155	14-AUG-85	1425	243	9.0	420		7.3	7.7	300
15	12PE01CC0002	502269	20-NOV-85	1410	243	8.0	480		7.4	7.8	
16	12PE01CC0002	503522	05-MAR-86	1340	243	7.3	470		7.6	7.8	
17	12PE01CC0002	600438	14-MAY-86	1340	243	9.5	480		7.6	8.1	1
18	12PE01CC0002	601591	19-AUG-86	1325	243	9.5	470		7.6	8.0	15
19	12PE01CC0002	602709	18-DEC-86	1300	243	5.5	480		7.5	8.2	500
20	12PE01CC0002	603069	04-MAR-87	1355	243	6.0	490		7.6	8.1	370
21	12PE01CC0002	700452	13-MAY-87	1300	243	8.5	480	480	7.4	6.7	100

0	12 LAB TURBIDITY NTU	13 FIELD COLOUR REL. U	14 LAB COLOUR REL U	15 WATER TABLE M	16 GEODETIC ELEVATION M	17 TOTAL ALKALINITY MG/L	18 CALCIUM MG/L	19 MAGNESIUM MG/L	20 SODIUM MG/L
1	4.5		L5	17.530	23.609	218.0	51	26	6.3
2	110.0			13.500	27.639	199.0	52	60	6.3
3	44.0			11.700	29.439	206.0	52	28	6.1
4	33.0	25		15.000	26.139	201.0	45	25	5.8
5				15.080	26.059				
6	67.0			11.962	29.177	200.0	50	27	6.8
7	100.0			11.560	29.579	208.0	56	30	9.0
8	130.0			13.920	27.219	208.0	52	30	7.8
9	390.0			13.985	27.154	206.2	49	27	8.5
10	63.0			13.850	27.289	203.9	48	26	8.4
11	65.0			13.850	27.289	199.1	48	26	8.3
12	93.0			13.850	27.289	201.7	48	26	8.4
13				11.958	29.181	200.2	50	27	
14				14.025	27.114	207.7	49	19	
15				14.440	26.699	199.9	49	26	
16				14.815	26.324	197.3	49	26	
17				12.950	28.189	205.7	52	28	
18				14.400	26.739	198.1	50	25	8.0
19	8.3			14.060	27.079	200.5	50	27	8.2
20	6.7			15.215	25.924	201.7	54	27	6.7
21	2.7			12.660	28.479	210.1	51	28	6.9

CHARLOTTETOWN AIRPORT TEST WELL #12M
PIEZOMETER MIDDLE

0 38 EXT ZINC 39 EXT CADMIUM 40 EXT ALLUM
MG/L MG/L MG/L

1				
2	0.02			
3	L.010			
4	L.01			
5	0.01	L.001		1.20
6	0.01	L.001		0.90
7	0.01	L.001		0.35
8	0.01		0.001	1.70
9	0.06	L.001		4.00
10	0.01	L.001		0.42
11	0.01	L.001		0.47
12	0.01	L.001		0.50
13				
14				
15				
16				
17				
18				
19				
20				
21				

CHARLOTTETOWN AIRPORT TEST WELL #12T
PIEZOMETER TOP

0	1 STATION	2 SAMPLE	3 SAMPLE DATE	4 SAMPLE TIME	5 SUBID	6 WATER TEMP. DEG C	7 FIELD SP COND US/CM	8 LAB SP COND US/CM	9 FIELD PH	10 LAB PH	11 FIELD TURBIDITY NTU
1	12PE01CC0003	203074	16-FEB-83	1700	243	2.0	440	460	7.1	7.3	38.0
2	12PE01CC0003	300565	18-MAY-83	1445	243	10.0	444	423	7.2	7.3	125.0
3	12PE01CC0003	301583	24-AUG-83	1540	243	16.0	360	368	7.3	7.5	84.0
4	12PE01CC0003	302847	16-NOV-83	1425	243	6.5	340		7.3	7.8	42.0
5	12PE01CC0003	303931	15-FEB-84	1500	243			275		7.6	105.0
6	12PE01CC0003	400641	30-MAY-84	1430	243	11.0	260	284	7.1	7.1	120.0
7	12PE01CC0003	401802	16-AUG-84	1500	243	16.0		380	7.3	7.6	63.0
8	12PE01CC0003	403173	21-NOV-84	1430	243	5.0		402	7.4	7.9	12.0
9	12PE01CC0003	404151	20-FEB-85	1515	243	3.5	390	421	6.9	7.3	
10	12PE01CC0003	500294	08-MAY-85	1530	243			259	7.3	7.5	
11	12PE01CC0003	501212	14-AUG-85	1201	243	NO	SAMPLE				
12	12PE01CC0003	502270	20-NOV-85	1550	243	7.5	400		7.4	7.7	
13	12PE01CC0003	503528	05-MAR-86	1615	243		300		7.6	7.8	
14	12PE01CC0003	600439	14-MAY-86	1530	243	14.0	380		7.3	7.9	3.4
15	12PE01CC0003	601592	19-AUG-86	1510	243	14.0	360		7.2	7.7	18.0
16	12PE01CC0003	602710	18-DEC-86	1435	243	2.0	320			8.0	
17	12PE01CC0003	603070	04-MAR-87	1410	243	NO	SAMPLE				
18	12PE01CC0003	700453	13-MAY-87	1420	243		264	264		7.9	170.0

0	12 LAB TURBIDITY NTU	13 FIELD COLOUR REL. U	14 LAB COLOUR REL. U	15 WATER TABLE M	16 GEODETIC ELEVATION M	17 TOTAL ALKALINITY MG/L	18 CALCIUM MG/L	19 MAGNESIUM MG/L	20 SODIUM MG/L
1	41.0			12.290	28.849	183.0	46	26.0	9.5
2	120.0			10.200	30.939	176.0	41	22.0	8.9
3	94.0			13.470	27.669	158.0	30	17.0	9.5
4				13.480	27.659	135.0	35	21.0	5.7
5	100.0			11.250	29.889			14.0	5.8
6	120.0			10.910	30.229	112.0	28	15.7	6.7
7	78.0	80		13.060	28.079	156.0	43	23.0	6.7
8	17.0		20	13.280	27.859	160.7	41	22.0	6.1
9	146.0			13.850	27.289	174.8	42	24.0	5.8
10				11.153	29.986	99.2	25	14.0	
11				14.405	26.734				
12				13.400	27.739	164.0	42	22.0	
13				14.070	27.069	123.9	29	16.0	
14				12.620	28.519	160.4	40	22.0	
15				13.730	27.409	136.7	35	19.0	5.5
16	3.5			13.405	27.734	142.7	36	20.0	5.9
17				14.460	26.679				
18	5.6			12.200	28.939	101.8	26	14.0	5.1

CHARLOTTETOWN AIRPORT TEST WELL #12T
PIEZOMETER TOP

0 38 EXT LEAD 39 EXT ZINC 40 EXT CADMIUM 41 EXT ALUM
 MG/L MG/L MG/L MG/L

1	0.003	0.005			
2	L.002	L.010			
3	0.005	L.01			
4	0.005	L.01	L.001		
5	0.006	L.01	L.001		0.460
6	0.006	0.010	L.001		0.380
7	0.005	0.010		0.001	0.210
8	0.004	L.01	L.001		0.078
9	0.007	0.010	L.001		1.400
10					
11					
12					
13					
14					
15					
16					
17					
18					

CHARLOTTETOWN AIRPORT TEST WELL #13

0	1 STATION	2 SAMPLE	3 SAMPLE DATE	4 SAMPLE TIME	5 SUBID	6 WATER TEMP. DEG C	7 FIELD SP COND US/CM	8 FIELD PH	9 LAB PH	10 FIELD TURBIDITY NTU	11 LAB TURBIDITY NTU
1	10PE01CC0049	501156	14-AUG-85	1030	243	11.0	280	7.7	8.0	9.5	
2	10PE01CC0049	502221	19-NOV-85	1135	243	9.0	296	8.0	8.1		3.2
3	10PE01CC0049	503515	04-MAR-86	1550	T243	7.5	320	7.9	8.1		46.0
4	10PE01CC0049	503516	04-MAR-86	1553	T243	7.5	320	7.9	8.0		47.0
5	10PE01CC0049	503517	04-MAR-86	1556	T243	7.5	320	7.9	8.0		64.0
6	10PE01CC0049	600434	13-MAY-86	1420	243	9.2	270	8.0	8.0	1.5	
7	10PE01CC0049	601595	19-AUG-86	1440	243	10.5	270	7.8	8.1	12.0	2.6
8	10PE01CC0049	602703	17-DEC-86	1445	243	8.5	280	7.8	7.9	6.8	6.2
9	10PE01CC0049	603074	04-MAR-87	1330	243	8.0	290	7.9	8.0	0.5	0.8
10	10PE01CC0049	700454	13-MAY-87	1030	243	9.5	277	7.4	8.1	6.6	6.9

0	12 WATER TABLE M	13 GEDDETTIC ELEVATION M	14 TOTAL ALKALINITY MG/L	15 CALCIUM MG/L	16 MAGNESIUM MG/L	17 SODIUM MG/L	18 POTASSIUM MG/L	19 CHLORIDE MG/L	20 SULPHATE MG/L
1	9.080	40.167	152.0	37	12			6.4	
2	8.830	40.417	134.3	34	15		1.05	6.0	7.31
3	9.810	39.437	147.4	36	17		1.00	5.6	8.00
4	9.810	39.437	145.7	37	18		1.00	5.5	8.00
5	9.810	39.437	147.4	36	17		1.00	5.5	8.00
6	8.365	40.882	118.6	32	13			5.7	
7	8.830	40.417	121.9	32	13	4.1	1.00	6.7	5.70
8	8.300	40.947	124.4	33	13	4.0	1.00	6.8	5.80
9	9.810	39.437	123.6	33	14	4.0	1.00	7.1	6.00
10	8.430	40.817	120.4	32	13	3.7	0.90	7.9	5.70

0	21 SULPHATE IC MG/L	22 NITRATE MG/L (N)	23 NITRATE IC MG/L (N)	24 UREA MG/L	25 EXT. IRON MG/L	26 EXT. MANGANESE MG/L
1		1.5	1.00	L.05		
2	6.7	1.1	L.05	L.05	0.032	L.01
3	7.1	1.0	0.75	0.11	0.080	0.02
4	7.0	1.0	0.75	0.09	0.080	0.02
5	7.1	1.1	0.75	0.06	0.070	0.02
6		1.4	1.50	L.01		
7	6.0	1.9	1.80	2.90	0.150	0.02
8	5.3	2.0	1.40	L.05	0.190	L.01
9	5.5	1.4	1.40	L.05	0.024	L.01
10	5.5	2.3	2.00	L.05	0.090	L.01

CHARLOTTETOWN AIRPORT TEST WELL #14

0	1 STATION	2 SAMPLE NUMBER	3 SAMPLE DATE	4 SAMPLE TIME	5 SUBID	6 WATER TEMP. DEG C	7 FIELD SP COND US/CM	8 FIELD PH	9 LAB PH	10 FIELD TURBIDITY NTU	11 LAB TURBIDITY NTU
1	10PE01CC0050	501197	15-AUG-85	955	T243	8.0	300	7.6	7.8		5.4
2	10PE01CC0050	501198	15-AUG-85	1000	T243	8.0	300	7.6	8.2		6.4
3	10PE01CC0050	501199	15-AUG-85	1005	T243	8.0	300	7.6	8.2		6.4
4	10PE01CC0050	502222	19-NOV-85	1400	T243	7.5	400	7.5	7.7		6.7
5	10PE01CC0050	502223	19-NOV-85	1405	T243	7.5	400	7.6	7.7		6.8
6	10PE01CC0050	502224	19-NOV-85	1410	T243	7.5	400	7.5	7.7		7.1
7	10PE01CC0050	503512	04-MAR-86	1055	243	7.7	396	7.6	7.6		16.0
8	10PE01CC0050	600445	14-MAY-86	1455	243	8.5	420	7.4	8.1	18	6.8
9	10PE01CC0050	601597	20-AUG-86	925	T243	8.7	420	7.4	7.9	26	1.2
10	10PE01CC0050	601598	20-AUG-86	930	T243	8.7	420	7.4	8.0	28	1.2
11	10PE01CC0050	601599	20-AUG-86	935	T243	8.7	420	7.4	8.0	24	0.8
12	10PE01CC0050	602700	17-DEC-86	1050	243	7.5	400	7.4	7.6	30	0.3
13	10PE01CC0050	603079	05-MAR-87	942	T243	6.5	430	7.4	8.1	26	2.7
14	10PE01CC0050	603078	05-MAR-87	940	T243	6.5	430	7.4	8.2	26	1.3
15	10PE01CC0050	603080	05-MAR-87	944	T243	6.5	430	7.4	8.1	31	3.0
16	10PE01CC0050	700448	12-MAY-87	1350	243	8.0	399	7.1	8.1	33	2.0

0	12 WATER TABLE M	13 GEODETIC ELEVATION M	14 TOTAL ALKALINITY MG/L	15 CALCIUM MG/L	16 MAGNESIUM MG/L	17 SODIUM MG/L	18 POTASSIUM MG/L	19 CHLORIDE MG/L	20 SULPHATE MG/L
1	4.800	36.839	168.2	39	14		1.00	9.2	5.60
2	4.800	36.839	170.4	38	18		1.00	9.2	5.60
3	4.800	36.839	167.3	38	18		1.00	9.0	6.00
4	5.540	36.099	191.8	42	21		1.11	8.7	5.22
5	5.540	36.099	192.9	42	22		1.08	8.8	5.22
6	5.540	36.099	191.1	42	22		1.11	8.2	5.22
7	5.335	36.304	181.2	42	21		1.50	8.4	4.70
8	3.345	38.294	198.1	43	23		1.30	7.4	3.70
9	5.360	36.279	196.4	43	23	5.7	1.20	9.2	3.70
10	5.360	36.279	199.3	43	23	5.7	1.20	9.2	3.70
11	5.360	36.279	204.6	44	23	5.7	1.20	9.2	3.70
12	5.075	36.564	201.4	45	24	6.0	1.30	9.0	4.40
13	5.920	35.719	194.7	44	23	5.8	1.20	8.8	5.00
14	5.920	35.719	197.0	44	23	5.8	1.10	8.9	5.00
15	5.920	35.719	193.0	44	23	5.8	1.10	8.8	5.00
16	3.080	38.559	197.9	44	23	5.3	1.20	8.1	2.10

CHARLOTTETOWN AIRPORT TEST WELL #14

0	21 SULPHATE IC MG/L	22 NITRATE MG/L (N)	23 NITRATE IC MG/L (N)	24 UREA MG/L	25 EXT. IRON MG/L	26 EXT. MANGANESE MG/L
1	5.0	0.10	L.5	L.05	0.003	0.23
2	4.8	0.14	L.5	L.05	0.003	0.12
3	4.8	0.12	L.5	L.05	0.005	0.15
4	4.4	0.03	L.05	L.05	0.960	0.54
5	4.4	0.02	L.05	L.05	1.200	0.59
6	4.4	0.04	L.05	L.05	1.200	0.59
7	3.8	0.06		0.04 L.05	2.400	0.92
8	2.6	0.02		0.01 0.01	4.500	1.60
9	3.6	0.06	L.5	L.05	4.500	1.30
10	3.6	0.04	L.5	L.05	4.500	1.30
11	3.6 L.01		L.5	L.05	4.400	1.30
12	3.6	0.04		0.03 L.05		
13	4.2 L.01		L.02	L.05	4.000	1.30
14	4.2	0.02	L.02	L.05	3.900	1.40
15	4.2 L.01		L.02	L.05	4.000	1.40
16	1.5	0.02		0.09 L.05	8.800	1.80

CHARLOTTETOWN AIRPORT TEST WELL #15

0	1 STATION	2 SAMPLE NUMBER	3 SAMPLE DATE	4 SAMPLE TIME	5 SUBID	6 WATER TEMP. DEG C	7 FIELD SP COND US/CM	8 FIELD PH	9 LAB PH	10 FIELD TURBIDITY NTU	11 LAB TURBIDITY NTU
1	10PE01CC0051	501152	13-AUG-85	1420	243	8.5	440	7.1	7.4	33.0	45.0
2	10PE01CC0051	502274	20-NOV-85	1530	243	8.0	600	7.3	8.1		9.3
3	10PE01CC0051	503523	05-MAR-86	1440	243	7.7	630	7.6	7.8		2.2
4	10PE01CC0051	600435	13-MAY-86	1510	243	8.0	590	7.2	7.5	1.2	1.2
5	10PE01CC0051	601596	19-AUG-86	1540	243	9.0	580	7.1	7.6	1.0	1.0
6	10PE01CC0051	602704	17-DEC-86	1525	T243	8.0	620	7.1	7.4	0.8	0.7
7	10PE01CC0051	602706	17-DEC-86	1535	T243	8.0	620	7.0	7.4	0.8	0.6
8	10PE01CC0051	602705	17-DEC-86	1530	T243	8.0	620	7.0	7.8	0.8	0.8
9	10PE01CC0051	603075	04-MAR-87	1450	243	7.5	660	7.3	8.0	1.0	1.3
10	10PE01CC0051	700455	13-MAY-87	1120	243	8.0	561	6.8	7.9	3.7	3.2

0	12 WATER TABLE M	13 GEODETIC ELEVATION M	14 TOTAL ALKALINITY MG/L	15 CALCIUM MG/L	16 MAGNESIUM MG/L	17 SODIUM MG/L	18 POTASSIUM MG/L	19 CHLORIDE MG/L	20 SULPHATE MG/L
1	9.420	37.894	195.6	58	23		1.5	6.1	4.00
2	10.100	37.214	241.8	65	35		1.6	4.8	4.76
3	10.575	36.739	263.5	70	35		1.7	4.8	5.10
4	8.560	38.754	253.2	66	35		1.7	5.8	4.70
5	9.635	37.679	237.2	62	33	4.7	1.6	5.2	4.00
6	9.090	38.224	251.7	67	36	4.7	1.7	5.3	4.40
7	9.090	38.224	252.9	67	36	4.6	1.7	5.2	4.40
8	9.090	38.224	248.3	67	36	4.7	1.7	5.2	4.40
9	11.220	36.094	264.7	73	37	5.0	1.6	5.6	5.00
10	8.350	38.964	237.4	61	33	4.8	1.5	7.4	4.40

0	21 SULPHATE IC MG/L	22 NITRATE MG/L (N)	23 NITRATE IC MG/L (N)	24 UREA MG/L	25 EXT. IRON MG/L	26 EXT. MANGANESE MG/L
1	3.6	24	22.0	L.05	0.057	0.01
2	3.9	19	18.2	L.05	0.043	L.01
3	3.5	15	14.2	L.05	0.023	0.01
4	4.0	13	12.8	L.01	0.210	L.01
5	4.7	20	19.0	L.05	0.050	0.02
6	3.4	20	16.0	L.05	0.030	L.01
7	3.4	17	16.0	L.05	0.025	L.01
8	3.7	20	15.0	L.05	0.022	L.01
9	3.7	16	16.0	L.05	0.060	L.01
10	3.8	14	14.0	L.05	0.190	L.01

CHARLOTTETOWN AIRPORT TEST WELL #16

0	1 STATION	2 SAMPLE NUMBER	3 SAMPLE DATE	4 SAMPLE TIME	5 SUBID	6 WATER TEMP. DEG C	7 FIELD SP COND US/CM	8 FIELD PH	9 LAB PH	10 FIELD TURBIDITY NTU	11 LAB TURBIDITY NTU
1	10PE01CC0052	501153	13-AUG-85	1540	243	8.5	340	7.3	7.7	8.8	14.0
2	10PE01CC0052	502226	20-NOV-85	1000	243	7.0	400	7.4	7.6		0.8
3	10PE01CC0052	503524	05-MAR-86	1535	243	7.7	400	7.6	7.9		3.0
4	10PE01CC0052	600436	13-MAY-86	1600	243	7.5	350	6.8	6.9	1.8	1.8
5	10PE01CC0052	601603	20-AUG-86	1405	243	9.0	360	7.3	7.6	7.0	6.7
6	10PE01CC0052	602707	17-DEC-86	1615	243	7.5	320	7.0	7.4	4.0	3.9
7	10PE01CC0052	603077	04-MAR-87	1550	243	7.0	390	7.5	7.8	1.2	2.1
8	10PE01CC0052	700459	13-MAY-87	1410	243	7.5	310	6.7	7.7	2.7	1.8

0	12 WATER TABLE M	13 GEDDETTIC ELEVATION M	14 TOTAL ALKALINITY MG/L	15 CALCIUM MG/L	16 MAGNESIUM MG/L	17 SODIUM MG/L	18 POTASSIUM MG/L	19 CHLORIDE MG/L	20 SULPHATE MG/L
1	13.785	30.296	194.7	44	16		1.20	7.7	4.40
2	16.150	27.931	192.9	44	23		1.27	7.3	4.91
3	15.680	28.401	195.2	39	22		1.30	6.5	5.00
4	12.520	31.561	160.2	38	21		1.40	6.1	5.20
5	15.420	28.661	172.9	40	20	4.1	1.20	8.1	4.20
6	15.010	29.071	146.5	34	18	5.2	1.90	7.8	4.40
7	16.220	27.861	178.1	42	22	4.4	1.30	7.7	4.70
8	12.625	31.456	132.0	32	17	5.0	1.40	6.9	5.40

0	21 SULPHATE IC MG/L	22 NITRATE MG/L (N)	23 NITRATE IC MG/L (N)	24 UREA MG/L	25 EXT. IRON MG/L	26 EXT. MANGANESE MG/L
1	3.8	0.39	0.80	L.05	0.086	0.10
2	4.4	0.66	0.44	L.05	0.090	0.02
3	4.1	0.60	0.65	L.05	0.710	0.03
4	4.5	3.20	2.90	L.01	0.200	0.03
5	4.5	1.40	1.10	L.05	1.400	0.10
6	4.2	1.70	1.30	L.05	1.200	0.08
7	4.1	0.90	0.95	L.05	0.380	0.02
8	5.1	3.20	3.20	L.05	0.170	0.01

CHARLOTTETOWN AIRPORT TEST WELL #A

0	1 STATION	2 SAMPLE NUMBER	3 SAMPLE DATE	4 SAMPLE TIME	5 SUBID	6 WATER TEMP. DEG C	7 FIELD SP COND US/CM	8 FIELD PH	9 LAB PH	10 FIELD TURBIDITY NTU	11 LAB TURBIDITY NTU
1	10PE01CC0039	500329	16-MAY-85	1130	243				7.9		
2	10PE01CC0039	501201	15-AUG-85	1400	243	14.0	195	8.0	8.2		
3	10PE01CC0039	502279	21-NOV-85	1320	243	12.0	210	8.1	7.9		
4	10PE01CC0039	600449	15-MAY-86	1400	243	12.0	198	8.2	8.1	1.8	
5	10PE01CC0039	601604	21-AUG-86	955	243	12.0	200		7.9	5.3	
6	10PE01CC0039	602714	18-DEC-86	1240	243	7.5	200	8.0	8.0	17.0	0.9
7	10PE01CC0039	700464	14-MAY-87	1000	243	13.0	193	7.8	8.1	22.0	1.4

0	12 WATER TABLE M	13 GEDDETTIC ELEVATION M	14 TOTAL ALKALINITY MG/L	15 CALCIUM MG/L	16 MAGNESIUM MG/L	17 SODIUM MG/L	18 POTASSIUM MG/L	19 CHLORIDE MG/L	20 SULPHATE MG/L
1	9.075	36.517	75.2	19	10			6.4	
2	11.300	34.292	89.3	22	11			6.5	
3	12.820	32.772	82.1	21	11			6.1	
4	10.110	35.482	78.8	20	10			5.6	
5	12.395	33.197	83.0	20	11	3.9	1.0	6.7	6.6
6	12.045	33.547	80.6	20	11	4.6	1.2	6.1	7.8
7	9.945	35.647	75.6	19	10	3.7	1.0	6.0	7.2

0	21 SULPHATE IC MG/L	22 NITRATE MG/L (N)	23 NITRATE IC MG/L (N)	24 UREA MG/L
1		1.4	1.3	
2		1.3	1.1	L.05
3		1.9	1.3	L.05
4		1.4	1.2	0.01
5	7.1	1.5	1.3	L.05
6	6.9	1.3	1.1	L.05
7	6.5	1.3	1.3	L.05

CHARLOTTETOWN AIRPORT TEST WELL #8

0	1 STATION	2 SAMPLE NUMBER	3 SAMPLE DATE	4 SAMPLE TIME	5 SUBID	6 WATER TEMP. DEG C	7 FIELD SP COND US/CM	8 FIELD PH	9 LAB PH	10 FIELD TURBIDITY NTU	11 LAB TURBIDITY NTU
1	10PE01CC0040	500330	16-MAY-85	1350	243			8.0	8.0		
2	10PE01CC0040	501200	15-AUG-85	1130	243	8.5	200	7.9	8.0		
3	10PE01CC0040	502278	21-NOV-85	1130	243	9.0	230	8.0	8.0		
4	10PE01CC0040	600447	15-MAY-86	1115	243	10.7	240	8.2	8.0	1.4	
5	10PE01CC0040	601605	21-AUG-86	1110	243	10.0	240		7.8	1.9	
6	10PE01CC0040	602715	18-DEC-86	1525	243	7.5	260	7.7	8.1	1.5	
7	10PE01CC0040	700466	14-MAY-87	1220	243	8.0	256	7.8	8.1	3.2	3

0	12 WATER TABLE M	13 GEODETIC ELEVATION M	14 TOTAL ALKALINITY MG/L	15 CALCIUM MG/L	16 MAGNESIUM MG/L	17 SODIUM MG/L	18 POTASSIUM MG/L	19 CHLORIDE MG/L	20 SULPHATE MG/L
1	4.116	38.697	98.4	24	13			6.2	
2	5.040	37.773	96.0	24	12			6.5	
3	6.480	36.333	102.5	24	12			5.6	
4	3.870	38.943	104.3	25	13			5.5	
5	6.165	36.648	114.1	26	14	3.4	0.79	6.7	5.9
6	6.060	36.753	120.4	28	14	3.7	0.91	6.3	6.1
7	3.725	39.088	115.7	27	14	3.5	0.73	6.3	6.5

0	21 SULPHATE IC MG/L	22 NITRATE MG/L(N)	23 NITRATE IC MG/L(N)	24 UREA MG/L
1		0.68	0.70	L.05
2		0.44	0.50	L.05
3		0.54	0.40	L.05
4		0.59	0.50	L.01
5	6.2	0.70	0.60	L.05
6	5.6	0.70	0.60	L.05
7	5.8	0.54	0.54	L.05

CHARLOTTETOWN AIRPORT TEST WELL #D

0	1 STATION	2 SAMPLE NUMBER	3 SAMPLE DATE	4 SAMPLE TIME	5 SUBID	6 WATER TEMP. DEG C	7 FIELD SP COND US/CM	8 FIELD PH	9 LAB PH	10 FIELD TURBIDITY NTU	11 LAB TURBIDITY NTU
1	10PE01CC0042	500331	17-MAY-85	1005	243				6.8		
2	10PE01CC0042	501157	14-AUG-85	1445	243	7.5	220	6.8	7.3	3.2	
3	10PE01CC0042	502268	19-NOV-85	1600	243	7.5	230	7.1	6.7		
4	10PE01CC0042	503514	04-MAR-86	1410	243	8.2	370	7.6	7.6		
5	10PE01CC0042	600446	15-MAY-86	955	243	7.0	250	6.6	6.9	1.2	
6	10PE01CC0042	601601	20-AUG-86	1110	243	13.0	360		7.2	5.6	
7	10PE01CC0042	602702	17-DEC-86	1335	243	8.0	440	7.0	7.3	3.4	
8	10PE01CC0042	603082	05-MAR-87	1300	243	11.0	430	7.5	7.9	100.0	1.2
9	10PE01CC0042	700456	13-MAY-87	1315	T243	7.5	251	6.4	7.4	1.2	0.4
10	10PE01CC0042	700458	13-MAY-87	1325	T243	7.5	252	6.4	8.0	1.2	0.4
11	10PE01CC0042	700457	13-MAY-87	1320	T243	7.5	252	6.4	7.2	1.3	0.4

	12 WATER TABLE M	13 GEODETIC ELEVATION M	14 TOTAL ALKALINITY MG/L	15 CALCIUM MG/L	16 MAGNESIUM MG/L	17 SODIUM MG/L	18 POTASSIUM MG/L	19 CHLORIDE MG/L	20 SULPHATE MG/L
1	8.665	34.129	83.0	20	11.0			6.0	
2	10.800	31.994	110.2	26	9.5			6.5	
3	11.700	31.094	69.6	23	11.0			5.3	
4	11.350	31.444	169.4	37	20.0			5.8	
5	9.470	33.324	111.7	27	13.0			5.2	
6	11.360	31.434	169.5	37	20.0	4.6	2.5	6.8	5.0
7	11.015	31.779	226.2	51	26.0	5.5	3.3	6.8	15.5
8	12.880	29.914	188.7	44	23.0	5.3	2.5	6.4	6.0
9	9.305	33.489	112.4	26	14.0	3.7	1.4	6.7	5.5
10	9.305	33.489	111.9	26	14.0	3.6	1.4	6.6	5.5
11	9.305	33.489	112.1	26	14.0	3.7	1.4	6.6	5.4

	21 SULPHATE IC MG/L	22 NITRATE MG/L (N)	23 NITRATE IC MG/L (N)	24 UREA MG/L
1		1.25	1.10	L.05
2		1.50	1.00	L.05
3		6.00	5.80	
4		7.80	5.50	0.2
5		1.40	1.20	L.01
6	5.1	1.50	1.60	L.05
7	5.0	1.80	2.20	L.05
8	5.4	3.20	3.10	L.05
9	5.2	1.00	1.10	L.05
10	5.2	1.10	1.00	L.05
11	5.2	0.90	0.99	L.05

CHARLOTTETOWN AIRPORT TEST WELL #E

0	1 STATION	2 SAMPLE NUMBER	3 SAMPLE DATE	4 SAMPLE TIME	5 SUBID	6 WATER TEMP. DEG C	7 FIELD SP COND US/CM	8 FIELD PH	9 LAB PH	10 FIELD TURBIDITY NTU	11 LAB TURBIDITY NTU
1	10PE01CC0043	500332	16-MAY-85	1530	243			7.6	7.8		
2	10PE01CC0043	501194	14-AUG-85	1530	T243	8.5	300	7.6	7.8	3.4	
3	10PE01CC0043	501195	14-AUG-85	1535	T243	8.5	300	7.6	7.8	3.4	
4	10PE01CC0043	501196	14-AUG-85	1540	T243	8.5	300	7.6	8.2	3.6	
5	10PE01CC0043	502225	19-NOV-85	1450	243	8.0	350	7.6	7.8		
6	10PE01CC0043	503513	04-MAR-86	1150	243	8.3	360	7.7	7.9		
7	10PE01CC0043	600444	14-MAY-86	1415	243	8.5	370	7.7	8.5	1.8	
8	10PE01CC0043	601600	20-AUG-86	1005	243	8.8	370	7.5	7.8	3.1	
9	10PE01CC0043	602701	17-DEC-86	1130	243	7.5	380	7.6	7.7	4.5	
10	10PE01CC0043	603081	05-MAR-87	1035	243	7.0	400	7.7	7.9	3.3	
11	10PE01CC0043	700449	12-MAY-87	1430	243	8.5	382	7.4	8.3	3.8	2.8

0	12 WATER TABLE M	13 GEODETIC ELEVATION M	14 TOTAL ALKALINITY MG/L	15 CALCIUM MG/L	16 MAGNESIUM MG/L	17 SODIUM MG/L	18 POTASSIUM MG/L	19 CHLORIDE MG/L	20 SULPHATE MG/L
1	4.150	36.117	158.8	37	19			8.3	
2	4.000	36.267	159.7	36	13			8.2	
3	4.000	36.267	161.4	37	14			8.3	
4	4.000	36.267	160.7	38	18			8.8	
5	4.790	35.477	165.7	38	20			8.4	
6	4.525	35.742	173.5	40	20			7.9	
7	2.690	37.577	179.9	41	20			7.4	
8	4.520	35.747	179.9	41	21	5.1	0.95	9.2	4.8
9	4.160	36.107	188.0	43	22	5.3	1.00	9.0	5.0
10	5.980	34.287	188.8	44	21	5.4	1.00	8.7	5.1
11	2.510	37.757	188.9	43	22	5.1	0.90	8.4	5.0

0	21 SULPHATE IC MG/L	22 NITRATE MG/L (N)	23 NITRATE IC MG/L (N)	24 UREA MG/L
1		L.01	L.25	L.05
2		L.01	L.5	L.05
3		L.01	L.5	L.05
4		L.01	L.5	L.05
5		L.01	L.05	L.05
6		L.01	L.01	L.05
7		L.01	L.01	L.01
8	4.9	L.01	L.5	L.05
9	5.0	L.01	L.02	L.05
10	4.5	L.01	L.02	L.05
11	4.4	L.01	L.01	L.05

WRIGHTS CREEK 500M ABOVE HWY 2

0	1 STATION	2 SAMPLE NUMBER	3 SAMPLE DATE	4 SAMPLE TIME	5 SUBID	6 WATER TEMP. DEG C	7 FIELD SP COND US/CM	8 LAB SP COND US/CM	9 FIELD PH	10 LAB PH	11 DISS OXYGEN MG/L
1	00PE01CC0040	201261	04-AUG-82	1220	243	10.0	390	402	7.9	8.1	12.0
2	00PE01CC0040	202100	20-OCT-82	925	243	7.5	400	399	7.9	7.9	11.5
3	00PE01CC0040	203069	15-FEB-83	1020	243	6.0	380	387	7.7	7.9	
4	00PE01CC0040	300558	17-MAY-83	940	243	6.7	340	320	7.5	7.8	11.4
5	00PE01CC0040	301576	23-AUG-83	1130	243	10.5	396	394	7.9	7.5	11.3
6	00PE01CC0040	302842	15-NOV-83	1100	243	7.0	410	391	7.8	7.2	12.1
7	00PE01CC0040	303922	14-FEB-84	940	243	5.5	340	337	7.7	7.9	13.4
8	00PE01CC0040	303923	14-FEB-84	945	243	5.5	340	338		7.9	
9	00PE01CC0040	303924	14-FEB-84	950	243	5.5	340		7.7		13.4
10	00PE01CC0040	400595	29-MAY-84	930	243	8.5	320	345	7.6	7.4	
11	00PE01CC0040	401777	15-AUG-84	930	243	10.5		366	7.9	7.9	
12	00PE01CC0040	403149	20-NOV-84	930	243	3.0		409	7.7	8.1	
13	00PE01CC0040	404138	19-FEB-85	950	243	4.0	410	410	7.8	8.2	
14	00PE01CC0040	500295	08-MAY-85	1050	243	6.0		288	7.8	7.9	
15	00PE01CC0040	501202	15-AUG-85	1450	243	11.5	330		8.0	8.1	
16	00PE01CC0040	502275	21-NOV-85	900	243	6.0	360		8.0	7.9	
17	00PE01CC0040	503527	06-MAR-86	1130	243	5.8	420		8.6	8.5	
18	00PE01CC0040	600448	15-MAY-86	1230	243	12.5	380		8.4	8.1	
19	00PE01CC0040	601602	20-AUG-86	1140	243	11.2	270			8.2	
20	00PE01CC0040	602697	16-DEC-86	1500	243	4.5	430		8.1	8.1	
21	00PE01CC0040	603084	05-MAR-87	1400	243	5.5	440		8.3	8.3	
22	00PE01CC0040	700465	14-MAY-87	1030	243	9.0	280	387	7.8	8.6	

0	12 FIELD TURBIDITY NTU	13 LAB TURBIDITY NTU	14 FIELD COLOUR	15 LAB COLOUR REL U	16 TOTAL ALKALINITY MG/L	17 CALCIUM MG/L	18 MAGNESIUM MG/L	19 SODIUM MG/L	20 POTASSIUM MG/L	
1		0.7	0.3	5 L5.	152.0	39.0		22	6.2	1.20
2			0.8 L5.	L5.	161.0	40.0		20	6.4	0.90
3	L.5		0.4	5 L5.	149.0	40.0		20	6.4	1.10
4		1.7	1.1	5 L5.	129.0	31.0		19	5.5	1.00
5		0.6	0.4 L5.0	L5.	154.0	41.0		20	6.5	1.00
6		1.4		10	158.0	42.7		23	6.3	1.20
7		0.6	0.6	L5.	128.0	35.0		17	6.5	1.90
8		0.6	0.5	5				18	6.5	1.90
9		0.6		5						
10		3.7	3.3	10	5	133.0	36.0	19	6.4	1.50
11		3.5	3.6	15	10	142.0	39.0	22	6.0	1.85
12			2.3		5	166.0	42.0	22	6.4	1.70
13		1.5	1.7	5 L5.		169.2	41.0	24	6.1	1.82
14						106.5	28.0	15		
15						165.0	42.0	20		
16						161.8	41.0	22		
17						167.2	43.0	23		
18		0.5				152.0	39.0	21		
19						172.0	42.0	23	6.1	1.40
20		0.7				170.3	44.0	24	6.3	1.50
21		2.0				175.7	46.0	25	6.4	1.60
22		2.0	1.1			148.1	39.0	22	6.6	1.30

WRIGHTS CREEK 500M ABOVE HWY 2

0 38 EXT CADMIUM 39 EXT ALUM
MG/L MG/L

1		
2		
3		
4		
5		
6	L.001	0.037
7	L.001	0.010
8	L.001	
9	L.001	L.010
10	L.001	0.070
11	L.001	0.050
12	L.001	0.036
13	L.001	0.032
14		
15		
16		
17		
18		
19		
20		
21		
22		

SOUTH BRANCH WINTER RIVER AT UNION ROAD

0	1 STATION	2 SAMPLE NUMBER	3 SAMPLE DATE	4 SAMPLE TIME	5 SUBID	6 WATER TEMP. DEG C	7 FIELD SP COND US/CM	8 LAB SP COND US/CM	9 FIELD PH	10 LAB PH	11 DISS OXYGEN MG/L
1	00PE01CC0042	201259	04-AUG-82	1030	243	13.7	240	285	7.9	7.9	9.4
2	00PE01CC0042	202102	20-OCT-82	1100	243	7.5	240	242	7.6	8.0	
3	00PE01CC0042	203070	15-FEB-83	1150	243	3.0	280	295	7.8	8.0	
4	00PE01CC0042	300559	17-MAY-83	1020	243	6.8	198	199	7.3	7.4	11.4
5	00PE01CC0042	301577	23-AUG-83	1210	243	15.0	280	288	7.9	7.6	9.1
6	00PE01CC0042	302841	15-NOV-83	1020	243	2.5	116	118	6.8	6.3	11.6
7	00PE01CC0042	303925	14-FEB-84	1040	243	2.0	250	252	7.4	7.6	13.8
8	00PE01CC0042	400596	29-MAY-84	1000	243	8.5	270	269	7.7	7.4	
9	00PE01CC0042	401778	15-AUG-84	1030	T243	17.5		104	6.8	6.9	
10	00PE01CC0042	401780	15-AUG-84	1040	T243	17.5		104	6.8	6.7	
11	00PE01CC0042	401779	15-AUG-84	1035	T243	17.5		105	6.8	6.7	
12	00PE01CC0042	403150	20-NOV-84	950	243	9.0		211	7.6	7.4	
13	00PE01CC0042	404139	19-FEB-85	1030	243	1.0	330	338	7.4	7.7	
14	00PE01CC0042	500269	07-MAY-85	950	243	5.0		138	7.1	7.3	
15	00PE01CC0042	501203	16-AUG-85	900	243	17.0	194		7.9	8.0	
16	00PE01CC0042	501204	16-AUG-85	905	T243	17.0	194		7.9	8.0	
17	00PE01CC0042	501205	16-AUG-85	910	T243	17.0	194		7.9	8.1	
18	00PE01CC0042	502276	21-NOV-85	930	243	5.5	99		6.8	6.7	
19	00PE01CC0042	503525	06-MAR-86	1015	243	0.0	256		7.8	7.9	
20	00PE01CC0042	600450	15-MAY-86	1450	T243	16.5	330		8.7	8.3	
21	00PE01CC0042	600451	15-MAY-86	1454	T243	16.5	330		8.7	8.2	
22	00PE01CC0042	600452	15-MAY-86	1458	T243	16.5	330		8.7	8.1	
23	00PE01CC0042	601606	21-AUG-86	1150	T243	17.0	290		8.0	8.0	
24	00PE01CC0042	601607	21-AUG-86	1155	T243	17.0	290		8.0	8.0	
25	00PE01CC0042	601608	21-AUG-86	1159	T243	17.0	290		8.1	8.0	
26	00PE01CC0042	602698	16-DEC-86	1530	243	0.0	230		7.7	7.8	
27	00PE01CC0042	603065	03-MAR-87	1600	243	0.0	280		7.9	8.0	
28	00PE01CC0042	700460	13-MAY-87	1515	T243	13.0	260	297	7.6	8.2	
29	00PE01CC0042	700461	13-MAY-87	1520	T243	13.0	260	297	7.6	8.0	
30	00PE01CC0042	700462	13-MAY-87	1525	T243	13.0	260	295	7.8	8.1	

SOUTH BRANCH WINTER RIVER AT UNION ROAD

0	12 FIELD TURBIDITY NTU	13 LAB TURBIDITY NTU	14 FIELD COLOUR	15 LAB COLOUR REL U	16 TOTAL ALKALINITY MG/L	17 CALCIUM MG/L	18 MAGNESIUM MG/L	19 SODIUM MG/L	20 POTASSIUM MG/L
1	5.7	3.3	50	30	112.0	28.0	16.0	5.4	0.80
2		1.8	60	6100.	98.0	26.0	12.8	5.4	1.10
3	1.5	1.3	15	5	117.0	30.0	14.0	6.0	1.00
4	2.0	2.1	120	120	76.3	19.6	12.0	6.2	1.20
5	15.0	8.7	40	25	126.0	29.0	16.0	5.7	1.10
6	7.7		200		19.5	9.0	4.5	6.4	2.30
7	3.3	2.9	80	100	63.3	18.0	10.0	15.2	2.00
8	1.5	1.3	40	30	103.0	25.0	20.0	6.1	1.30
9	6.5	6.0	280	320	21.0	9.0	4.1	5.7	3.65
10	6.5	6.1	280	320	19.1	8.8	4.0	5.7	3.65
11	6.5	5.9	280	320	19.0	8.8	4.2	5.7	3.70
12		2.4		100	71.2	19.0	11.0	5.8	1.95
13	2.7	1.6	70	35	98.5	26.0	14.0	14.6	8.00
14					35.7	10.0	5.6		
15					136.5	31.0	18.0		
16					135.7	31.0	1.1		
17					135.4	31.0	1.5		
18					16.7	7.7	4.0		
19					121.1	28.0	16.0		
20	1.4				133.9	33.0	17.0		
21	1.9				135.2	33.0	18.0		
22	1.7				135.6	33.0	18.0		
23	1.9				127.1	29.0	16.0	5.3	1.20
24	2.2				126.9	29.0	17.0	5.4	1.30
25	2.4				127.9	29.0	17.0	5.4	1.30
26	1.6				109.7	27.0	15.0	6.1	1.50
27	3.8				123.0	31.0	16.0	5.7	1.50
28	6.8	5.6			114.1	29.0	16.0	6.6	1.30
29	7.0	5.8			114.5	29.0	16.0	6.5	1.30
30	6.5	5.5			113.5	29.0	16.0	6.5	1.30

SOUTH BRANCH WINTER RIVER AT UNION ROAD

0	21 CHLORIDE MG/L	22 SULPHATE MG/L	23 SULPHATE IC MG/L	24 SILICA MG/L	25 NITRATE MG/L (N)	26 NITRATE IC MG/L (N)	27 TOTAL NITROGEN MG/L	28 UREA MG/L	29 PHENOLIC MATERIAL MG/L
1	11.0	8.2			1.50		1.50	0.130	
2	8.9	7.5			1.20		1.30	0.050	L.005
3	14.0	7.9			2.40		2.50	L.005	L.005
4	9.9	7.5	5.9		1.80			L.01	0.070
5	9.1	7.3	7.3		1.10		0.97	0.012	0.005
6	11.8	11.2	8.1	5.1	0.78		1.10	0.046	L.005
7	32.0	8.2	7.4	4.9	1.40		1.40	0.013	L.01
8	13.8	7.8		6.4	2.30	2.25	2.50	0.015	L.005
9	6.5	10.7	10.0	5.3	1.25	1.60	1.40		L.01
10	5.9	10.5	10.0	5.5	1.35	1.70	1.50		L.01
11	6.1	10.6	10.0	5.3	1.30	1.70	1.30		L.01
12	10.3	8.7	8.2	7.0	1.70	1.40	2.00	0.010	L.005
13	35.0	8.5	7.6	5.5	2.30	2.40	3.50	L.01	L.005
14	13.1				1.20	0.95		L.05	
15	13.3				0.70	0.80		L.05	
16	13.2				0.80	0.80		L.05	
17	12.0				0.78	0.80		L.05	
18	14.0				0.43	0.32		0.100	
19	10.0				2.00	1.70		0.060	
20	13.8				1.60	1.20		L.01	
21	13.1				1.60	1.20		L.01	
22	13.0				1.70	1.20		L.01	
23	12.3	7.2	6.5		0.60	0.18		0.730	
24	12.3	7.2	6.5		0.60	0.21		0.620	
25	12.3	7.2	6.5		0.60	0.46		0.510	
26	14.0	8.3	6.8		1.50	1.50		L.05	
27	12.3	7.5	6.5		1.40	1.35		L.05	
28	17.4	8.2	7.5		1.30	1.30		L.05	
29	16.8	8.3	7.0		1.70	1.70		L.05	
30	16.8	8.0	7.0		1.80	1.80		L.05	

SOUTH BRANCH WINTER RIVER AT UNION ROAD

0 38 EXT CADMIUM 39 EXT ALUM
MG/L MG/L

1		
2		
3		
4		
5		
6	L.001	0.360
7	L.001	0.140
8	L.001	0.033
9	L.001	0.330
10	L.001	0.350
11	L.001	0.360
12	L.001	0.120
13	L.001	0.051
14		
15		
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30		

UNNAMED TRIBUTARY 50M ABOVE CONFLUENCE WITH
WINTER RIVER (BEHIND UNION PUMPING STATION)

0	1 STATION	2 SAMPLE NUMBER	3 SAMPLE DATE	4 SAMPLE TIME	5 SUBID	6 WATER TEMP. DEG C	7 FIELD SP COND US/CM	8 LAB SP COND US/CM	9 FIELD PH	10 LAB PH	11 DISS OXYGEN MG/L
1	00PE01CC0044	201260	04-AUG-82	1140	243	11.0		165	6.7	7.7	10.5
2	00PE01CC0044	202101	20-OCT-82	1015	243	7.5	166	163	7.5	7.4	
3	00PE01CC0044	203078	17-FEB-83	1035	243	0.0		163	7.3	7.5	
4	00PE01CC0044	300560	17-MAY-83	1105	243	6.0	122	120	7.1	7.2	12.5
5	00PE01CC0044	301578	23-AUG-83	1250	243	15.0	152	170	7.8	7.3	
6	00PE01CC0044	302840	15-NOV-83	1010	243	4.0	134	137	7.2	6.4	12.2
7	00PE01CC0044	303926	14-FEB-84	1100	243			128		7.6	
8	00PE01CC0044	400597	29-MAY-84	1020	243	8.0	116	133	7.5	7.7	
9	00PE01CC0044	401781	15-AUG-84	1100	243	16.5		96	6.8	6.8	
10	00PE01CC0044	403151	20-NOV-84	1030	T243	0.0		138	7.6	7.2	
11	00PE01CC0044	403152	20-NOV-84	1035	T243	0.0		137	7.6	7.2	
12	00PE01CC0044	403153	20-NOV-84	1040	T243	0.0		138	7.6	7.0	
13	00PE01CC0044	404140	19-FEB-85	1050	243	1.5	174	177	7.5	7.5	
14	00PE01CC0044	500268	07-MAY-85	940	243	5.0		97	7.1	7.3	
15	00PE01CC0044	501206	16-AUG-85	915	243	12.0	106		7.5	7.7	
16	00PE01CC0044	502277	21-NOV-85	950	243	5.5	88		7.3	7.2	
17	00PE01CC0044	503526	06-MAR-86	1030	243	0.7	184		7.8	7.8	
18	00PE01CC0044	600453	15-MAY-86	1500	243	15.5	138		8.7	7.5	
19	00PE01CC0044	601609	21-AUG-86	1215	243	14.5	178		7.9	7.9	
20	00PE01CC0044	602699	18-DEC-86	1425	243	0.0	178		7.5	7.5	
21	00PE01CC0044	603083	05-MAR-87	1130	243	0.5	200		7.8	7.8	
22	00PE01CC0044	700463	13-MAY-87	1530	243	13.0	116	136	7.5	7.9	

0	12 FIELD TURBIDITY NTU	13 LAB TURBIDITY NTU	14 FIELD COLOUR	15 LAB COLOUR REL U	16 TOTAL ALKALINITY MG/L	17 CALCIUM MG/L	18 MAGNESIUM MG/L	19 SODIUM MG/L	20 POTASSIUM MG/L
1	1.7	0.7	30	10	49.0	14.0	7.7	4.8	1.00
2		0.7	35	30	51.5	15.0	7.3	5.0	1.00
3	1.2	0.3	10	5	50.5	14.0	7.0	4.9	0.80
4	2.2	2.0	70	80	37.4	11.0	6.0	4.2	0.60
5	2.6	1.7	35	20	57.5	15.5	8.0	4.7	
6	1.8		85		32.5	12.0	6.0	5.6	1.00
7	1.7	1.5	40				6.0	4.2	1.00
8	1.4	0.9	30	30	42.1	12.0	6.0	4.4	1.00
9	70.0	58.0	320	320	17.9	8.4	4.2	4.9	1.35
10		2.8		45	41.1	12.0	6.6	4.8	1.25
11		2.6		50	40.2	12.0	6.6	4.6	1.20
12		3.1		45	41.1	12.0	6.6	4.6	1.20
13	1.6	1.4	20	5	59.0	16.0	9.0	4.7	1.48
14					28.0	7.3	4.3		
15					60.0	16.0	8.2		
16					28.0	9.9	5.4		
17					62.1	16.0	9.3		
18	0.7				45.3	12.0	6.6		
19	2.7				64.9	17.0	9.6	4.3	1.10
20	1.2				62.5	17.0	9.0	4.7	1.30
21	2.3				72.8	19.0	10.0	4.9	1.50
22	3.0	0.7			43.2	12.0	6.6	4.1	1.00

UNNAMED TRIBUTARY 50M ABOVE CONFLUENCE WITH
WINTER RIVER (BEHIND UNION PUMPING STATION)

0 38 EXT CADMIUM 39 EXT ALUM
MG/L MG/L

1		
2		
3		
4		
5		
6	L.001	0.095
7		0.040
8	L.001	0.042
9	L.001	0.420
10	L.001	0.087
11	L.001	0.096
12	L.001	0.080
13	L.001	0.028
14		
15		
16		
17		
18		
19		
20		
21		
22		

PRIVATE RESIDENCE WELLS - NORWOOD AVE.

0	1 STN	2 SAMPLE	3 SDATE	4 STIME	5 SUBID	6 WATER TEMP	7 FIELD SP COND	8 LAB SP COND	9 FIELD PH	10 LAB PH	11 FIELD TURBIDITY
1	10PE01CC0046	300568	18-MAY-83	1040	243	8.2	422	433	7.3	7.6	0.3
2	10PE01CC0047	300569	18-MAY-83	1100	243	6.6	282	298	7.6	7.8	0.3
3	10PE01CC0047	400600	29-MAY-84	1330	243	9.0	330	306	7.6	7.6	0.3
4	10PE01CC0048	300570	18-MAY-83	1120	243	10.0	362	363	7.6	7.7	0.2

0	12 LAB TURBIDITY	13 FIELD COLOUR	14 LAB COLOUR	15 TOTAL ALKALINITY	16 CALCIUM MG/L	17 MAGNESIUM MG/L	18 SODIUM MG/L	19 POTASSIUM MG/L	20 CHLORIDE MG/L	21 SULPHATE MG/L
	0.1	L5.	L5.	171	42.0	23.0	8.3	1.1	12.7	12.3
2	0.1	L5.	L5.	111	27.8	17.0	6.6	1.0	10.5	13.2
	0.1	L5.	L5.	114	29.0	15.7	7.3	1.5	13.4	12.5
	0.1	L5.	L5.	133	31.4	20.0	8.0	1.1	18.0	15.5

0	22 SULPHATE IC MG/L	23 SILICA MG/L	24 NITRATE MG/L	25 NITRATE IC MG/L	26 T NITROGEN MG/L	27 UREA MG/L	28 PHENOLIC MATERIAL	29 DISS.ORG. CARBON	30 DISS.INDRG. CARBON
	12.1		5.3		6.2	L.01	L.01	L.50	50
	13.1		3.1		3.4	L.01	L.01	0.74	36
3		7.8	2.9	3.3	3.5	0.01	L.005	L.1.	
	14.0		4.1		3.9	L.01	L.01	L.5	41

0	31 TOTAL PHOSPHORUS	32 EXT. IRON MG/L	33 EXT. MANGANESE MG/L	34 EXT COPPER MG/L	35 EXT LEAD MG/L	36 EXT ZINC MG/L	37 EXT CADMIUM MG/L	38 EXT ALUM MG/L
1	0.050	0.002	L.01		L.002		0.06	
	0.052	0.005	L.01		L.002		0.06	
	0.073	0.015		0.02	0.004	L.002	0.04	L.001
4	0.050	0.004	L.01		L.002		0.13	L.010

APPENDIX V
SCHEMATIC OF THE BOX AND WHISKER PLOT

