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IRISH - DUTCH RAISED BOG STUDY

GEOHYDROLOGY AND ECOLOGY

- National Parks and Wildlife Service of the Office of Public Works, Dublin
- Department of Nature Conservation, Environmental Protection and Wildlife Management, The Hague
- Geological Survey of Ireland, Dublin
- National Forest Service, Driebergen

HYDROLOGY OF RAHEENMORE BOG
A WATER BALANCE STUDY

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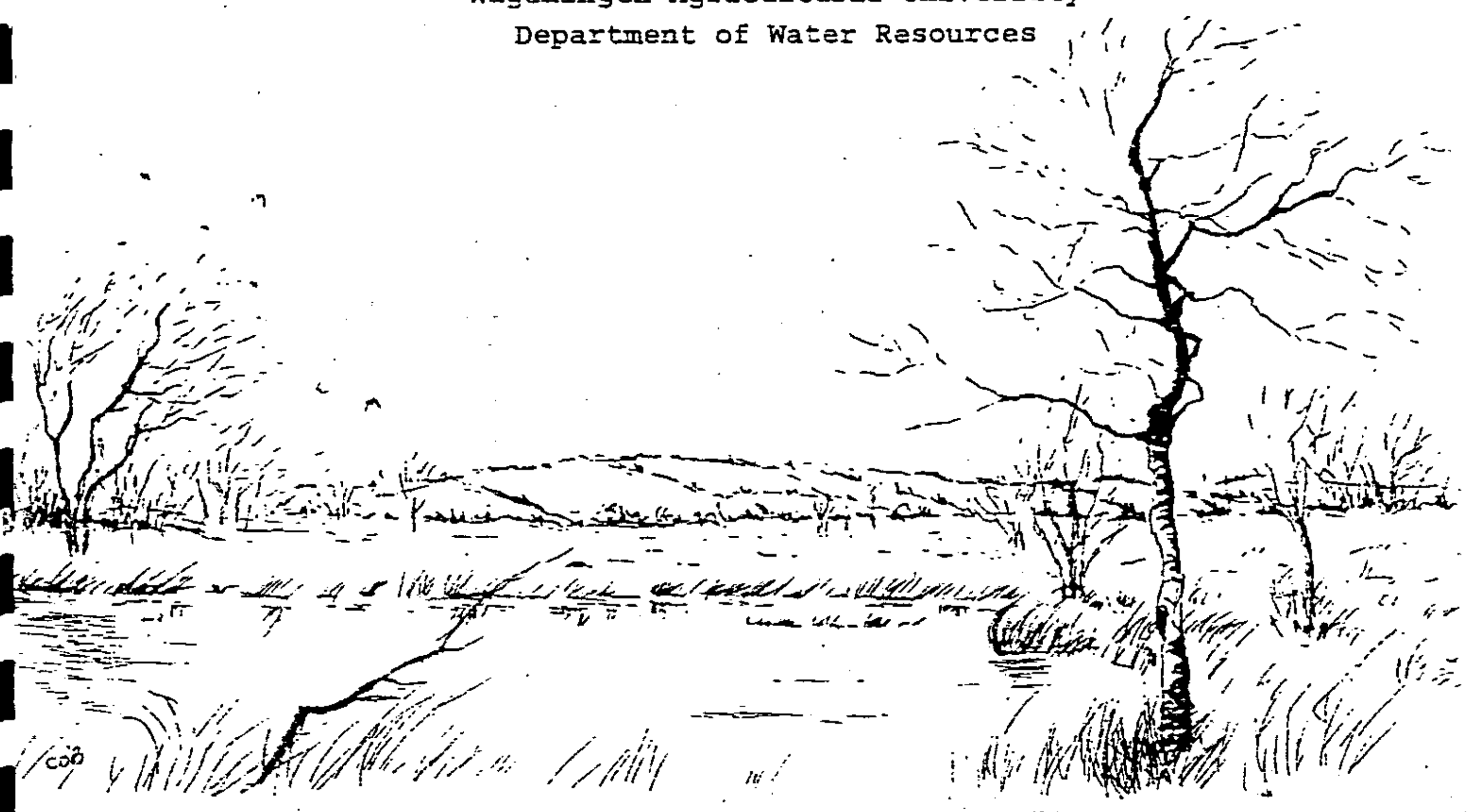

Sketch of Clara Bog by Catherine O' Brien. Clara. County Offaly.

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Preface

The ultimate experience for a hydrologist is to walk on water. During our stay in Clara in the winter of '91/'92, doing fieldwork on Clara Bog and Raheenmore Bog, we probably came as close to walking on water as we will ever get.
This report is the final result of an eight months thesis agrohydrology, part of our study Land and Water Management at the Agricultural University of Wageningen, dealing with the hydrology of Irish raised bogs.
We like to thank Sake van der Schaaf for sharing his knowledge and enthusiasm while supervising our work.
Furthermore our gratitude goes to everyone, whom we have worked, lived and pubbed with in Ireland, fellow students and supervisors involved in the project; friends and relatives who supported us or came over for holidays, but ended up assisting us on the bog under heavy weather conditions; and last but not least all the many friends we made in Clara who made our stay an unforgettable experience and Clara a town worth going back to.
Hopefully this project will make a difference in the way that both Clara and Raheenmore Bog will survive us.

February 1993,

Norbert Veldkamp
Ronald Westein

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List of Symbols

A	area	[L^2]
a	empirical factor	[ ]
B	width	[L]
c	hydraulic resistance	[T]
c_v	coefficient of variation	
D	thickness of an aquifer	[L]
E_a	actual evapotranspiration	[$L.T^{-1}$]
E_p	evapotranspiration according Penman	[$L.T^{-1}$]
h	pressure head	[L]
hm	swelling of the bog	[L]
H	hydraulic head	[L]
i	slope of the groundwater table	[-]
k	hydraulic conductivity	[$L.T^{-1}$]
α	reservoir coefficient	[T]
m	empirical factor	[ ]
μ	storage capacity	[-]
n	number of data	
p	precipitation	[$L^{-2}.M$]
P	precipitation sum	[L^3]
q	discharge	[$L^3.T^{-1}$]
Q	discharge sum	[L^3]
r	distance from the centre	[L]
R	radius	[L]
ρ_w	density of water	[$M.L^{-3}$]
$\hat{s}$	variance	
ΔS	change in storage	[L]
t	time	[T]
T	transmissivity (kD)	[$L^2.T^{-1}$]
U	flow density	[$L.T^{-1}$]
v_d	downward seepage	[$L.T^{-1}$]
V_a	volume of water added/removed	[L^3]
ΔV	volume change of stored water	[L^3]
W	mass	[M]
z	height above reference level	[L]

Summary

In an effort to protect the few last remaining raised bogs in Ireland the Irish and Dutch government have agreed in a co-operation which is known under the name "Irish-Dutch Raised Bog Project". The Department of Water Resources from the Agricultural University Wageningen have been asked by the Dutch National Forest Service (Staatsbosbeheer) to do research on the hydrological system. Part of this study is the water balance for Raheenmore Bog.

Raheenmore Bog is a raised bog which covers an area of 213 ha and is located in the Central Lowland which is part of an undulating drift, floored mainly by limestones. In a depression lacustrine clay has settled after which peat growth began. Local peat depths of 15 meters occur. Raheenmore Bog has all the features of raised bogs in general. The bog is dome shaped with a surface height of more than 4 meters above the surrounding mineral soil surface. A distinction in peat structure is clearly present; the top layer, called acrotelm, of about 40 cm containing the root zone of the living vegetation, which is highly permeable; a layer containing the dead plant remains, called catotelm, which reaches till the mineral subsoil.

The first step to come to a water balance is the assembling of complete data series of all components in this water balance. Gaps in data appeared in measurements that were not under continuous control by the researchers. The extremely wet conditions take a major part in these failures. The continuous measurements (precipitation, discharge and water levels) are checked every week by hand and weekly data is largely available.

The next step is the analysis of the individual flow components. The flow system for raised bogs can be divided in runoff, horizontal outflow, precipitation, evapotranspiration, storage and seepage.

The runoff takes the major part in the discharge. The acrotelm is highly permeable and largely responsible for this runoff. Transmissivity values of more than 500 m^2/day have been measured.

Horizontal groundwater flow has been estimated according to the results of a conductivity test over different depths in the catotelm. The catotelm appears to be a very low permeable aquifer with maximum conductivity values of 0.0056 m/day. The horizontal outflow according to a model of Bakker is less than a millimetre a year and thus negligible.

The precipitation sum over the year (April 1991 - April 1992) is about 850 mm. A precipitation excess of 300 mm exists with little shortage in late spring and summer.

Evapotranspiration has been measured with lysimeters. The lysimeters generally give good results, but in periods of high rainfall intensity some errors occur due to overflow. The evapotranspiration according to the lysimeters has been related to the Penman evapotranspiration figures of two nearest weather stations; Penman highly underestimates in winter periods. Over the year the evapotranspiration reads about 550 mm.

The storage is built up by two components: storage in the effective pore volume (free water) measured by the phreatic level and storage in the peat itself (absorption) measured by the surface levels. The latter is of great influence regarding a fluctuation of the surface level of 7 cm over the year and assuming a water content of 95 % in the acrotelm.

All sets of piezometers indicate downward seepage. For the measuring of seepage no vertical conductivity values are available. Therefore the assumption is made that vertical conductivity is at most equal to the horizontal conductivity. With the hydraulic gradients over the filter depth intervals of the piezometer sets and Darcy's law the maximum vertical seepage can be calculated. The horizontal conductivity is, however, measured at other depths and at less points than the hydraulic gradients. Therefore three methods of averaging have been used. The results of the three methods do not differ essentially and result in a downward seepage of 40 - 50 mm.

Combining all individual flow components the water balance over the lysimeter year, in which the downward seepage is the unknown variable, results in:

Precipitation	: 877 mm
Evapotranspiration	: 557 mm
Discharge	: 263 mm
Change in storage	: -12 mm
Downward seepage	: 69 mm

This result for downward seepage approaches the seepage found with the methods using Darcy's law, regarding an error range of 10-40% for the individual water balance components.

To verify the catchment size estimated by surface contours hydrograph analyses have been carried out. For a single crested floodwave it is relatively simple to derive the area which causes the discharges. If, however, new storms occur while discharge is still recessing, corrections have to be made for storage or recession limbs have to be extrapolated. Measuring storage is very inaccurate and thus an attempt is made to extrapolate the recession limb of discharges. First is tried to fit the recession limb for a linear reservoir, but the reservoir coefficients varied for different values of discharge (increasing for lower discharges). Then a discretion for different discharges was made and the discharges for separate storms have been estimated.

The catchment sizes resulting are about half the size of the catchment based on contour lines. Therefore discharges have been divided in two groups; runoff coming from the area without acrotelm and baseflow. The increase of reservoir coefficients towards decreasing discharges (or phreatic levels) do underbuild the theory of the acrotelm as a non-linear system for runoff.

1 Introduction

History of the project

The Dutch botanic Mathijs Schouten was the first person who attended the Irish government of the great ecological value of raised bogs in the midlands of Ireland. Peatlands in Ireland are still in use for the production of turf, mainly by Bord Na Mona. Because of the political issue of nature conservation the Irish government decided to purchase several of the raised bogs. Two bogs recieve special attention, Clara bog and Raheenmore Bog, because they are little affected by years of turf cutting. The Irish Wildlife Service of the Office of Public Works (OPW), however, don't have the experience for the management and conservation of these bogs. From Dutch side there is great interest in the functioning of raised bog systems, because it is tried to regenerate some bog remnants in the Netherlands. Therefore both governments agreed in a co-operation which is known under the name "Irish Dutch Raised Bog project".

Several universities and institutes from Ireland, the Netherlands and England have been approached by the wildlife services of both countries and they are now working in a joined research project which includes ecological, hydrological and geological aspects (figure 1). The Dutch National Forest Service (Staatsbosbeheer) have asked the Agricultural University of Wageningen, and specific the Department of Water Resources, to do research on the hydrological system. Since September 1989 students from Wageningen have been to Ireland for research. Several reports have been published since and together with reports from the ecological and geological side a management program for raised bogs must follow.

This is a more or less final report in the hydrology study on one of the observed bogs, Raheenmore Bog. In this report a water balance is given for the period September 1990 to April 1992.

Objectives

The hydrological section is mainly interested in the quantitative aspects of bog-hydrology. Water balance study forms the boundary conditions for the later modelling of peatlands. With the help of these models biotopes can be created providing conditions in which peatlands can survive or be regenerated.

The contribution of the students in this project is considerable, because they do most of the fieldwork. This report is the final result of an eight months' case which is divided in five months of practical time and three months of reporting. Although the fieldwork was done at both Raheenmore and Clara Bog, this report is restricted to Raheenmore Bog. The fieldwork gives a better insight in hydrological features and the theories behind them. Besides the fieldwork the students have the responsibility for the presentation of the assembled data and the conclusions drawn from them.

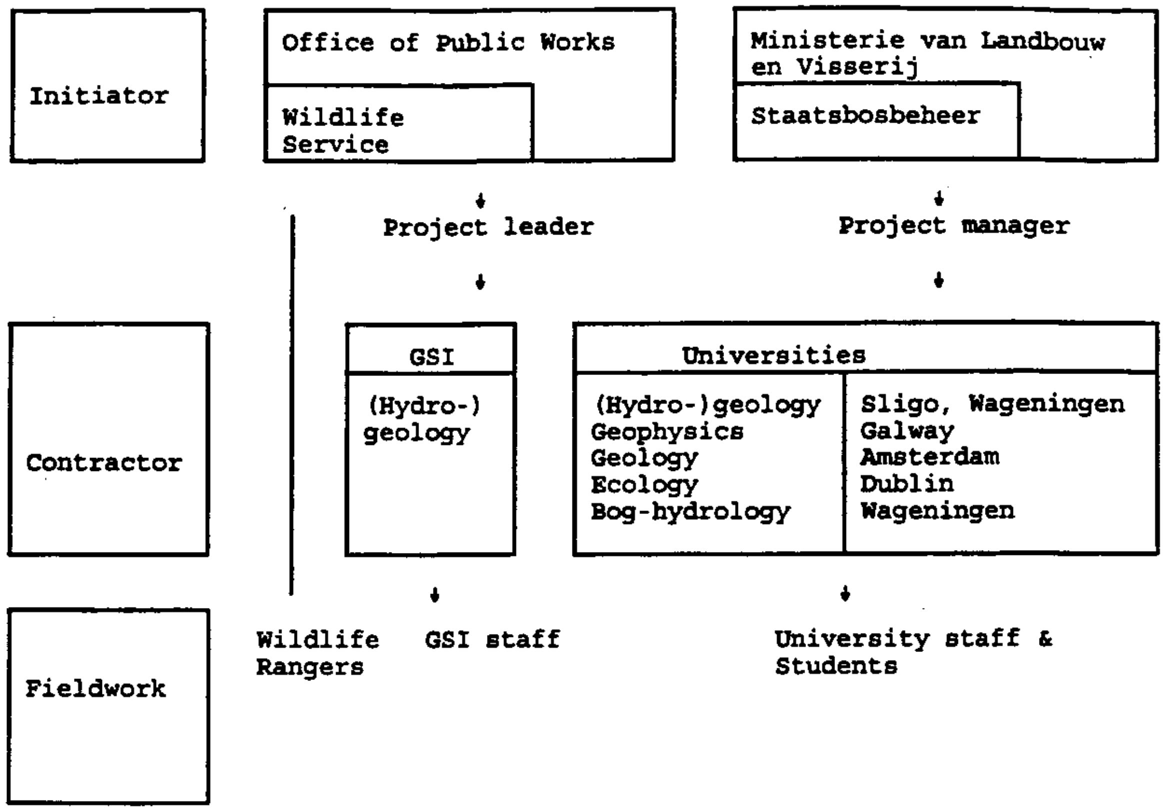
A lot of information about bog-hydrology has been published in the reports of former students in the project. Most of the information, however, refers to the single items of the flow system without relating them to each other. A lot of data has been collected over the years, but time limited the processing and analyzing of this data. Therefore the last two groups of students who went to Ireland have been given more time for data processing and analyzing.
With the allowance of time given for this study the following objectives have been drawn up. A division has been made between assembling & processing and analyzing.

Assembling and processing:
- the processing of a continuous time series of discharge data, precipitation and groundwater levels from the chartpapers by digitising;
- further calculations of the evapotranspiration with the lysimeters;
- a completion of acrotelm transmissivities.

Analyzing:
- a series of storage coefficients over the depth of the acrotelm;
- a measure for the horizontal outflow;
- a measure for the downward seepage;
- the verification of the catchment size derived from surface contour lines;
- the combining of the different flow components in a water balance.

Report structure

In chapter 2 a short introduction is given about the topography and genesis of peatlands and specific for Raheenmore Bog. Chapter 3 gives a list of the instruments which have been used for making the water balance: raingauges, lysimeters, piezometers, a groundwater recorder and a discharge weir. Chapter 4 describes the different components of the flow system: horizontal outflow, runoff, storage, evapotranspiration, precipitation and seepage. In chapter 5 all flow components have been put together and a water balance follows. Furthermore some corrections for seasonal differences in the water balance have been made. In chapter 6 an analysis of hydrographs is given in order to verify the catchment based on contour levels. Chapter 7 gives an idea of the possible error translations in calculations. In chapter 8 the final conclusions are drawn.



GSI : Geological Survey of Ireland

Figure 1 Participants in the Irish-Dutch Raised Bog Project

2 Raheenmore Bog

2.1 Topography

Raheenmore Bog is situated in county Offaly in the midlands of Ireland, located at a latitude of 53.4 degrees and covering a total area of 213 ha. The middle of the bog reaches 107.5 m.O.D. Raheenmore Bog is enclosed by esker ridges, which reach about 25 meters high. The bog is oval shaped and one of the best examples of a raised bog in a basin situation. The swelling of the bog, characteristic for raised bogs, is in order of 4 meters measured from the edge to the middle of the bog. The depth of the peat is more than 15 meters in places.

2.2 Geology

Offaly is part of the Central Lowland of Ireland, which is an undulating drift area floored mainly by limestones. The higher topographic features - Slieve Bloom, Croghan Hill, Bellair Hill, Cor Hill, Endrim Hill and the smoothly sloped hills in east Offaly have rock at or close to the surface. However the bedrock in most of Offaly is covered by the Quaternary deposits - peat, sand, gravel and till - which form many of the lower irregular topographic features. Besides older sandstone rocks Offaly consists of a variety of limestones with a small area of volcanic rocks forming Croghan Hill, only a few miles from Raheenmore Bog. It is the highest hill in east Offaly, an extinct volcano which was active in Carboniferous times. It consists of dark grey or black basalt and dark green volcanic ash. The geological succession for the area in which Raheenmore Bog lies consists of:

Age	**Rock Type**
Holocene	Fen to raised bog peat (*sphagnum*)
Holocene	Blue grey lacustrine clay
Pleistocene	Glacial till
Pleistocene	Boulder to medium sandesker deposits
Carboniferous	Volcanic; Pure, coarse limestone; Calp Limestone; Pure fine cherty Limestone; "Reef" Limestone; Muddy Limestone; Alternating Limestones; Sandstones and Mudstone
Devonian	Basal Sandstone; Red Sandstone, Siltstone and Mudstone
Silurian	Metamorphosed clays, Sandstones and Slates

(Daly, s.a.; Flynn, 1990)

The Applied Geophysics Unit from University College of Galway provided answers regarding the depth and thickness of different layers. The Very Low Frequency-Resistivity (VLF-R) survey of Smyth (1992) concludes that there is relatively shallow bedrock to the south and south eastern margins of the bog, and intruding northwards into the central area of Raheenmore West. Furthermore a large area of deep bedrock is suggested in the north west, and a narrow channel of deep bedrock towards the extreme western margin.

The results of the Vertical Electric Soundings (VES) survey indicate areas where the bedrock is very deep, in excess of 50 m. Interpretations of VES suggest extremely deep bedrock in the central areas of Raheenmore East, but these soundings could equally well be interpreted showing a shallower bedrock, by altering the apparent resistivities. Drilling through the layers to bedrock in an area on the east side of the bog is the only way to give a more secure estimation of bedrock depths. Shallow bedrock is indicated to encircle the bog from the east, around the south east and southern margins, projecting northwards to form an area of shallow bedrock in the west central area of the bog. Extremely deep bedrock is suggested in the north and the greater part of the eastern area of the bog. In the extreme west of the bog, deep bedrock is also implied.

Four boreholes were drilled on Raheenmore Bog, three in the summer of 1990 and the last in the summer of 1991 in the middle of the bog. The exact locations are given in Appendix 1a. Piezometers were installed in different layers below and on the bottom of the peat.

The peat base contours show a depression contained in the central area of the bog. Two deeper areas within this depression exist to the west and to the east, of the central area. Shallowing towards the margins of the bog occurs on all sides, displaying a classical depression for raised bog formation.

In general the peat surface contours indicate the dome shaped raised bog, with a high surface elevation in the central area and decreasing gently towards the margins. A comparison with the surface elevation map of Bord Na Mona of 1948 shows a reduction of the surface elevation in the north east due to drainage in this area. The peat thickness is greatest in the south western area, where peat surface elevation is also greatest. Here peat reaches a maximum of 15 m. Peat thins out gradually towards the margins, mirroring the pattern shown by the peat surface elevation (Smyth, 1992).

2.3 Soil profile

Peat growth started in the early holocene and shows a peak in the Atlanticum because of optimum climatic conditions. The growth started under extreme wet conditions.

Fenpeat

Retreating ice had left standing water in a shallow depression in the underlying limestone, which was sealed with a clay layer, forming a lake fed with mineral-rich alkaline water. Organic matter or gyttja accumulated until the water was shallow enough to allow the growth of reed. Other plant like sedges an mosses took over. These mosses formed a carpet that floated on the surface in times of high water. Eventually the pool is filled up and peat formation continues at or slightly above groundwater level. In times of decreasing annual rainfall trees like birch and alder were able to grow. The reed-, birch- and alderpeat together are called fenpeat or topogenic peat, characterized by the inflow of water which is rich to medium rich in nutrients.

Raised bog

The peat surface kept on rising and became out of reach of water containing nutrients. The development then was only controlled by rainwater (ombrotrophic) and the vegetation changed completely. From this time on we have to do with a raised bog with growth of mainly *Sphagnum*, *Eriophorum* and *Ericaceae*. Figure 2 shows different stages in the development of a raised bog.

Acrotelm and catotelm

In present-day Raheenmore Bog two very different layers, with regard to hydrology, can be distinguished:

- the acrotelm, being the uppermost layer (10-40 cm) where peat is formed;
- the catotelm where peat accumulates.

In former reports (Lensen, 1990; van 't Hullenaar and ten Kate, 1991; Sijtsma and Veldhuizen, 1992) the characteristics of both layers have been discussed thoroughly. For this report is it is important to know the flow capacity of both layers: the acrotelm in regard to discharges and the catotelm in regard to seepage.

The acrotelm is best developed in the central areas of the bog. As a system of living *Sphagna*, including their water supply, it has a relatively high hydraulic conductivity with very large fluctuations from spot to spot, due to existing vegetation types and formed hummocks and hollows.

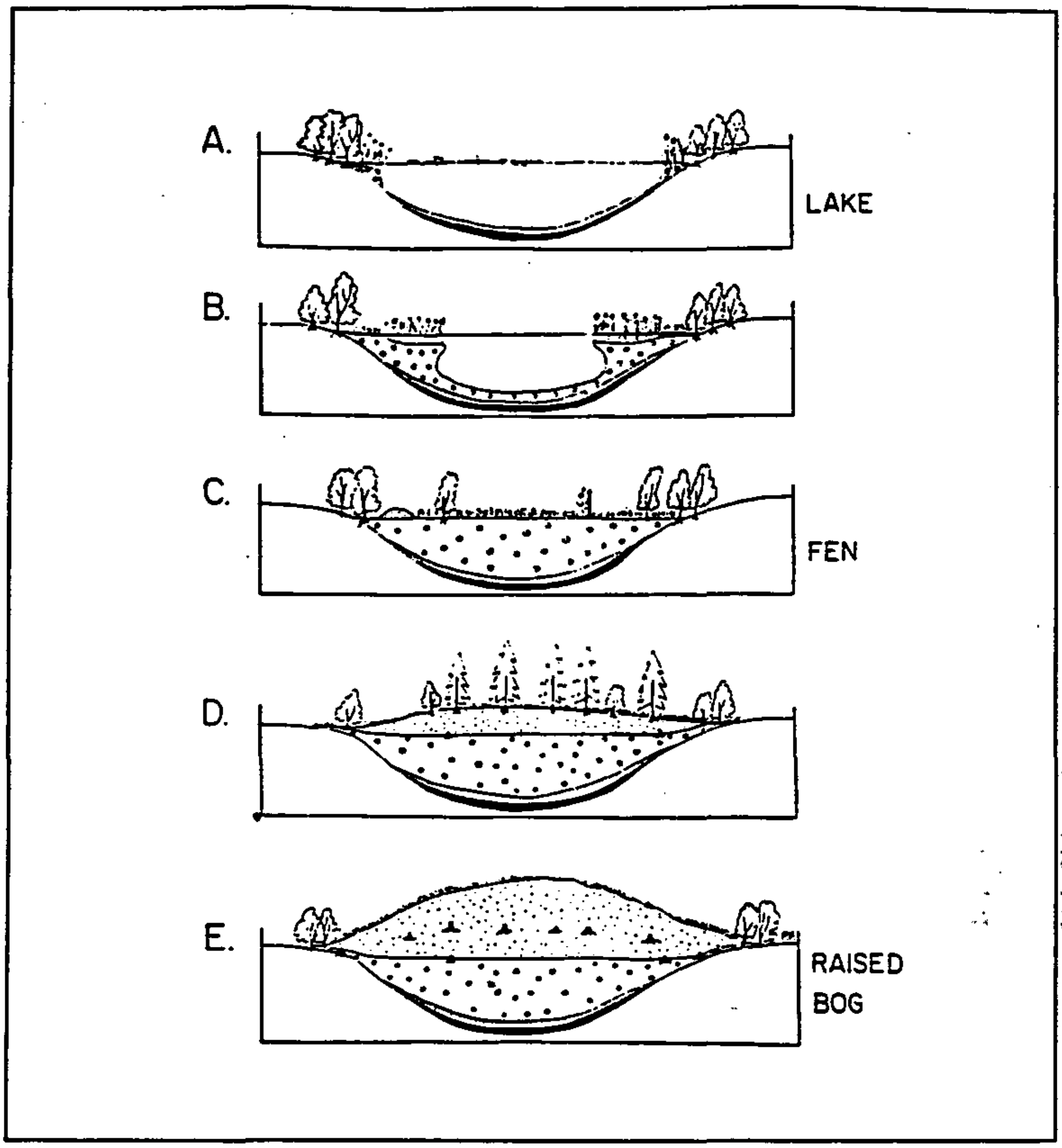


Figure 2 Stages in the development of a raised bog

Furthermore this is the layer in which periodically fluctuating groundwater levels mainly regulated by precipitation and evapotranspiration occur. The capacity of the substratum to swell and shrink influences the storage coefficient. Together these factors determine the rate of storage.

- The catotelm contains much more humified peat and has a higher degree of compaction and therefore smaller hydraulic conductivities, depending on the type of peat contained in different layers and depth. Below the peat mass lacustrine clay is found almost everywhere on the bog as a sealing layer.

2.4 Vegetation

The vegetation of Raheenmore Bog is typical for a raised bog and adapted to ombrogenic habitat circumstances. In the more wet areas, where there is still a fairly good acrotelm, mainly *Sphagnum* species forming hummocks and hollows cover the surface.

Sphagnum species present are : *Sphagnum capillifolium, Sphagnum tenellum, Sphagnum papillosum, Sphagnum cuspidatum* and *Sphagnum magellanicum.*

Other common species covering Raheenmore Bog are : *Calluna Vulgaris, Erica tetralix, Narthecium ossifragum, Eriophorum vaginatum, Eriophorum augustifolium, Hypnum jutlanicum, Scirpus caespitosus, Polytrichum alpestre, Pleurozium schreberi, Leucobryum glacum, Campylopus flexuosa, Cladonia portentosa, Aulacomium palustre* and *Rhynchospora alba.* (Kelly in Sijtsma and Veldhuizen, 1992).

When circumstances are not optimal for a raised bog, meaning badly developed or completely missing acrotelm not able to hold enough water stored (dying bog), *Sphagnum* species are repressed and heather like *Calluna Vulgaris* and for instance *Scirpus caespitosus* are taking over. For Raheenmore Bog the north-eastern side among other sites can be seen as dying bog due to the old drainage system present there. Part of the catchment lies in that area.

3 Methods and Instruments

3.1 Raingauges

The rainfall at Raheenmore Bog is being recorded since October 1989. Two handgauges with a diameter of 5 inch and height of 40 cm are used for week sums. The sites of the two raingauges differ in height. One is situated in a depression near the Rossum weir and the other higher up upon the bog near the groundwater recorder (Appendix 1a).

An analogue raingauge (syphon recorder) is placed which supplies a continuous record of the rainfall with respect to time on a chart. This one is situated at the same spot as the handgauge near the Rossum weir. The water is collected in a funnel which is connected to a pipe. A float inside this pipe is moved up by the water level. A pen, connected to the float, draws a line on chart paper, which is attached to a rotating cylinder that makes one tour a week driven by a clock mechanism. After 10 mm of rainfall, which is also the reach of the chart paper, the float pipe is emptied and the recording pen falls back to zero level. Gaps in rainfall registration were caused by two defects, corrosion in the clock mechanism and frost damage in the float pipe.

Later on, in december 1991, an other type of raingauge was installed. This raingauge, a so called tipping bucket, is less sensitive for the outside climate. The principle is as follows. Two buckets are filled one after the other by rainwater and tip over when a certain amount (0.01 inch) is reached. Each time the bucket tips over, an electric pulse is sent to a recorder. In the first few months after the installation a recorder was used that registered the pulses on chart paper. Unfortunately this instrument was failing and an other recorder was installed that writes the pulses direct to a solid state memory.

The charts with the rainfall registration have been digitised with the program PTM21 (van der Schaaf, 1991). The week sums have been corrected with the readings of the two handgauges.

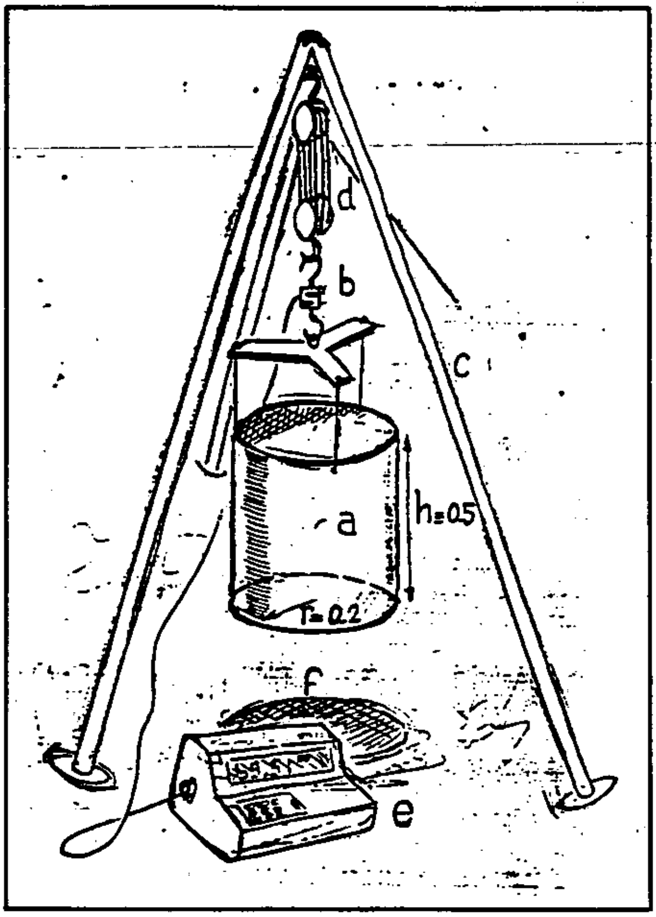
3.2 Lysimeters

3.2.1 Evapotranspiration

The evapotranspiration is a major element in the water balance. Therefore 16 weighable lysimeters were installed on Raheenmore Bog in April 1991. Not only evapotranspiration but also storage coefficients in the upper layer of the bog were to be acquired from the lysimeter results.
The lysimeters are 50 cm deep with a diameter of 40 cm (figure 3.1); they are sealed at the bottom. Each lysimeter is filled with a column of peat taken from different spots (vegetation sites) on the bog itself.

Four types of vegetation are used:

- *Calluna vulgaris* (heather) and some *Erica tetralix* (heather) with *Sphagnum* (peat moss);
- *Eriophorum vaginatum* (Common Cotton Grass) with *Sphagnum*;
- *Narthecium ossifragum* (Bog Asphodel) with *Sphagnum*;
- *Sphagnum* species.



a: lysimeter
b: weighing element
c: tripod
d: pulley
e: weighing recorder
f: acrotelm hole

Figure 3.1 Lysimeter and accompanying equipment

Eight of the lysimeters (nrs. 1 - 8) were filled with peat with a good acrotelm and eight (nrs. 9 - 16) with a poor acrotelm, so there are eight times two lysimeters with the same vegetation and acrotelm circumstances.
The situation in de lysimeter should be the same as the surrounding area, which means that the water levels have to be kept at a level that equals the water level in the immediate surroundings. Therefore water has to be removed or added, regarding the time of the year (Sijtsma and Veldhuizen, 1992).

The lysimeters were weighed once a week, using a tripod, a pulley and a weighing device. The water level before and after weighing is recorded. Twice a month the surface level is measured at two determined spots in each lysimeter to get an idea of the swelling and shrinkage of the peat surface.

By weighing the lysimeters every week the circular form of it tends to become oval and the danger of burst increases. Therefore it was decided to install hoisting rings around them to secure them from further damage.

3.2.2 Storage coefficient

The set of lysimeters was also used to acquire the storage coefficient down to 30 cm below the peat surface and to see if there is a significant difference over depth. In march 1992, when evapotranspiration was still low, during 10 days a test was done. The watertable in each lysimeter was lowered in intervals of circa 5 cm by pumping out water. After that weight and water level were measured. The next day the water levels (now balanced) were measured again and lowered further.

Difficulties started coming at a depth of circa 10 cm. While pumping water out of the tube, the flow of water towards the tube for most of the lysimeters was so slow that an interval of 5 cm a day could no longer be reached, whereas the whole test was not supposed to last longer than 10 days at its maximum to avoid damage to the vegetation and disturbing the evapotranspiration measurements. For most lysimeters a depth just over 20 cm below surface level was reached.

3.3 Piezometers and benchmarks

On Raheenmore Bog two transects of piezometers have been installed. The oldest is the north-south transect across the bog in which tube numbers in the 300 series (301-348), a benchmark and boreholes nrs. 1-3 (edges) are situated. The other transect is in the east-west direction going from the north-eastern edge towards the middle of the bog. On this transect tubes with numbers in the 200 series (201-212), two benchmarks and borehole nr. 4 (middle) is found. In Appendices 1a and 1b the exact locations are given. A denser piezometer network is installed at the edges of the bog, where the higher gradients in hydraulic heads can be expected. Piezometers used for determining the permeability are found on both transects.

The technical aspects of the piezometers are:

material	:	PVC
outside diameter	:	2.5 cm or 1 inch
inside diameter	:	2.1 cm
filter length	:	15 cm
filter material	:	nylon gauze
enclosure	:	rubber ferrule

Capitals are used for different depths:

A : phreatic, filter length 1.0 m
B : 1.5 m
C : 3.0 m
D : 4.5 m
E : 6.0 m
F : clay surface
S : in the mineral substratum

Benchmarks

Three benchmarks are installed (drilled into the clay layer) to have a fixed reference height for levelling. The heights of the tubes are levelled every three or four months. To each benchmark a movable metal plate is connected, which rests on and is able to move freely up and down with the peat surface. By measuring the distance from the top of the benchmark to this metal plate (at four corners) every two weeks an indication for the swelling and shrinkage of the peat surface is acquired.

3.4 Groundwater recorder

Groundwater levels were recorded with an automatic float gauge (type Ott). The principle of the automatic recording float gauge is as follows (figure 3.2). A float inside a pipe, which is perforated at the bottom, is moved up or down by the water level (fluctuations are almost eliminated). The movement of the float is transmitted by a thin wire to a mechanism which records these movements on paper. The paper is attached on a cylinder which is circulating with a rotation time of 32 days. The clock is mechanical and has to be wound every four weeks.

The functional requirements are:

- a float gauge installation should permit measurement of stage to be made at all levels from below the lowest to above the highest level anticipated;
- the float should float properly (without friction) and the tape or wire should be free of twist and links.

Both requirements failed from time to time, but more serious problems occurred when the clock mechanism broke down.

The charts were digitised at OPW, Dublin.

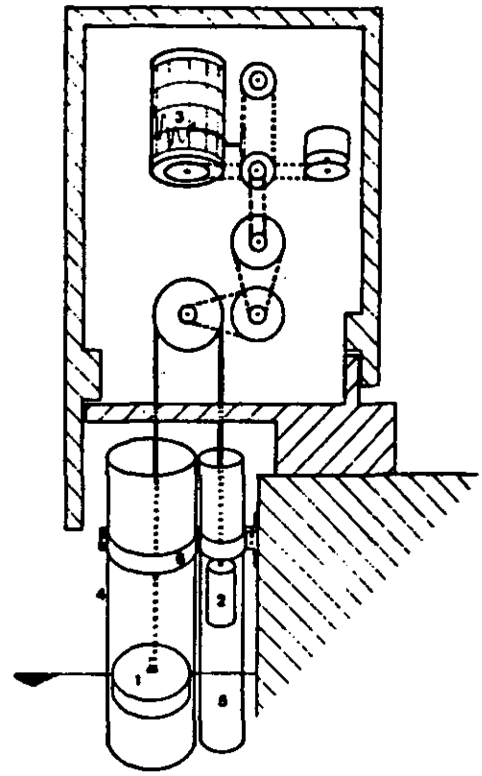


Figure 3.2 Example of a float gauge.

3.5 Rossum V-notch

To measure the discharge from the catchment area at Raheenmore Bog it was necessary to install a flow measuring structure in the ditch that was dug on the east side. Regarding the expected discharge range and available fall a short crested weir, the so called Rossum weir, was chosen. The structure of this weir causes a local narrowing of the cross section, in which a part of the total energy head is taken away to allow critical flow, while another part is lost in friction.

As for all discharge measuring structures a head-discharge relation can be derived. The head (h) is defined as the difference between water level and crest level. The water level needs to be measured at a sufficient distance upstream of the weir to avoid influence of the surface drawdown. The accuracy of the structure depends on the number and the reliability of the calibration and whether the measurements can be reproduced within a limited percentage. Sharp crested weirs are famous for their high accuracy.

To get a reliable water balance over a year it is important to be able to measure both longlasting low discharges and short peak discharges. A Rossum weir can do this, the V-shaped bottom of the structure increases the accuracy when discharges are low (Boiten, 1986).

The head discharge relation for the Rossum V-notch installed at Raheenmore Bog is:

$$\log Q = 0.2466 + 2.5081 \log h - 0.0398 (\log h)^2 \qquad (3.1)$$

in which Q : discharge (m^3/s)
h : water level above crest level (m)

(Gloudemans, 1990)

The water level is recorded a few meters upstream from the V-notch in the same way as described in par. 3.4.

4 Hydrology of Raheenmore Bog

4.1 Groundwater flow

4.1.1 Hydraulic conductivity measurements

Three methods have been developed for measuring the hydraulic conductivity: rising head, falling head and constant head. All methods use piezometers. Sijtsma (1992) has tested these methods for their statistical differences. For her analysis she has done 48 measurements, using all three methods. Some rough idea about differences has been acquired using distribution-free tests. The results of the individual tests are as follows.

Sign-Test: A test which counts the occasions in which one method gives higher or lower values than the other method. In this case the constant head method gives significantly higher values.

Spearman-Test: A rank correlation test for two dependent samples. The test shows a significant rank correlation between the three methods, which means that all three methods follow the same line, giving high or low conductivity values within the same experiment.

More reliable is the analysis of variance, in which all combinations of methods are observed and put in a linear model. The variance of the model differs for the three methods or combinations of methods. The Fisher F-test is sensitive for these differences and tells whether the changes are significant.

The main conclusion of this analysis is that conductivity is significant effected by the used method. This is endorsed by means of the conductivity estimated by the three different methods. The least significant difference for the geometric means is derived from a 97,5 % significant interval of the Student distribution. The results of all three methods differ significantly. The conductivity estimated by the constant head method is a factor 2.3 larger than the falling head method and the falling head is a factor 0.7 larger than the rising head. Though the constant head is supposed to be the best method, the conclusion is that in this case the constant head method gives too high conductivity values and is therefore rejected.

Rising- and falling head

Conductivity measurements have been carried out at various places and depths along the two piezometer transects, north-south and east-west (Appendix 1b) across the bog. For this purpose the same tubing and filter is used as described in Chapter 3.3. A total of sixteen piezometers has been placed. After each measurement the tube is pushed down to a new depth.

Luthin and Kirkham (1949) have derived the following formula for the rising head method,

$$k = \pi \; . \; R^2 \; . \; \frac{\ln(H_1/H_2)}{A\;(t_2 - t_1)} \qquad (4.1)$$

with k	:	hydraulic conductivity	(m/s)
t_1, t_2	:	limits time interval	(s)
H_1, H_2	:	hydraulic head at time 1, 2	(m)
R	:	radius of the tube	(m)
A	:	geometrical constant	(m)

The conductivity according to the falling head method is estimated with the same formula.

An amount of circa 30 cm water was added respectively removed from the piezometer. The falling resp. rising water level was recorded at various time intervals. The initial drop resp. rise of the water level is not reliable for any calculation because of temporary disturbance of the peat enclosing the piezometer. After some time, depending on the peat structure, the falling resp. rising becomes stationary. The logarithm of the water level, $ln(H_0/H_2)$, plotted against time should give a straight line according to formula 4.1. Thus, it is more important to have accurate measurements in the last quarter of the curve than in the first quarter. The results of the conductivity test of which the greater part was done by ten Dam and Spieksma (1992) are given in table 4.1.

***Table 4.1** Horizontal hydraulic conductivity (m/day) in the catotelm aquifer at various depths and locations (Appendix 1b), averaged over the rising and falling head method.*

depth	2 m	3 m	4 m	7 m	10 m	13 m
201	0,0002					
206	0,0012	0,0002	0,0001			
207	0,0002		0,0006	0,0002		
210	0,0006	0,0020	0,0020	0,0016	0,0021	
211	0,0033	0,0019	0,0008	0,0032	0,0009	
330	0,0024	0,0021	0,0045	0,0049	0,0011	0,0010
327	0,0033	0,0055	0,0056	0,0040	0,0004	
324	0,0053	0,0036	0,0026	0,0010		
321	0,0023	0,0036		0,0003		
317	0,0015	0,0015				

The harmonic average over depth of all (n) k-values per piezometer set in the permeability test,

$$harmonic\ avg\ \ k = \left[\frac{(k_1^{-1} + k_2^{-1} + \ldots + k_n^{-1})}{n} \right]^{-1} \qquad (4.2)$$

averaged over all sets results in: k = 0.0011 m/day.

Taking the average for each transect, however, there is a clear distinction between both:

east-west (201-211) : k = 0.0007 m/day
north-south (317-330): k = 0.0015 m/day

A quick look at the results of the permeability test is enough to conclude that the horizontal flow through the catotelm is relatively small to the other inputs of the water balance. Nevertheless a model is introduced, which gives a rough estimation of the height of this flow component.

4.1.2 Model Bakker

A hydrological, mathematical model is presented that simulates the groundwater tables of raised bogs with a homogeneous body of peat. As the surface of bogs and the level of the groundwater are closely related, this model is used to describe the shape of raised bogs.

From a hydrological point of view, the gradual rise of the water table in an expanding raised bog is an interesting phenomenon. The water table rises together with the bog surface and one may use hydrological principles and formula to describe the shape of bogs. Ingram (1982, 1983) was the first to do so by presenting a purely hydrological model to explain the relationship between the height and the width of raised bogs. Here a slightly different model is presented.

Capillary rise

The fact that raised bogs grow in time is not generally seen as a surprising feature. On the other hand, from a hydrological point of view, there is the surprising phenomenon that the water table rises at the same rate as the bog surface. The general opinion is that the rise is due to capillary rise i.e. a raised bog behaves like a sponge. This, however, is very unlikely, because the capillary rise is only of the order of a few decimeters, whereas the elevation of the bog surface - and thus the water table - above the surroundings may be more than 5 metres. When the rate of evapotranspiration of a raised bog in summer is 3 to 5 mm/day and the maximum suction of *Sphagna* is not more than *pF* 2, the maximum capillary rise is only some 300 mm. From this it is obvious that capillary rise can not explain the elevation of the water table in a raised bog.

The flow of groundwater

In a raised bog, precipitation is the only source for the groundwater supply. The outflow of water from a raised bog comprises evapotranspiration, surface runoff and groundwater flow either downward to the mineral subsoil or laterally to the surroundings of the bog. For the moment we will neglect the surface runoff, although, as will be seen later (par. 4.2), this is far from correct.
The equilibrium between the supply, discharge and storage of the water can be described by two basic hydrological principles:

- Darcy's law, which states that the rate of groundwater flow (q) is linearly related to the slope of the groundwater table (i) and the hydrological conductivity of the medium through which the flow takes place (k): $q = k \cdot i$

- the principle of continuity, which implies that the amount of water supplied to an area is equal to the discharge plus the change in water storage.

An equation for the height of the water table in a raised bog can be derived from these two hydrological principles. Ingram (1982, 1983) was the first to use this approach of which the model is shown in figure 4.1.

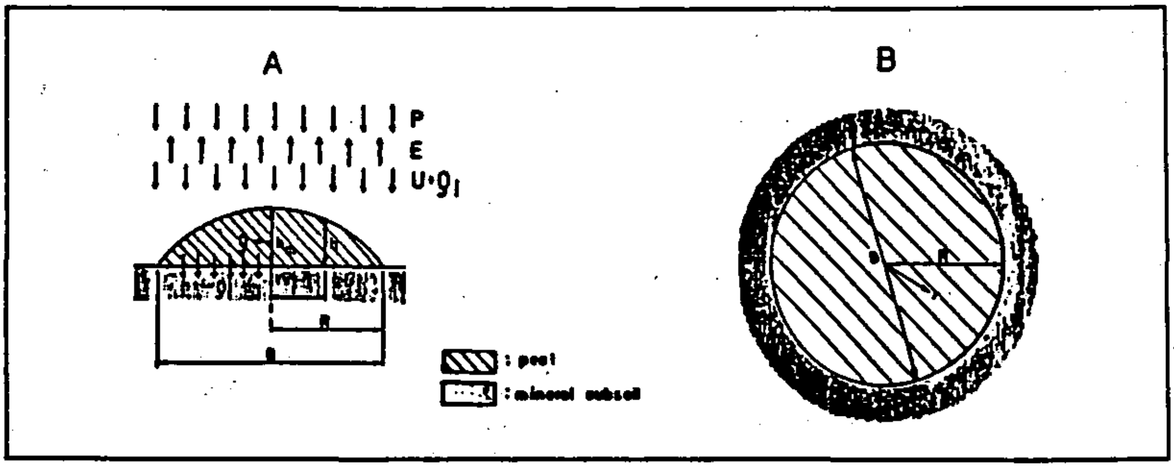


Figure 4.1 Model of a raised bog; A: cross section, B: top view

It is assumed that the hydrological conductivity (k) is the same throughout the whole body of peat and that the surface forms an elips. Another assumption is that the groundwater in the bog is independent of the groundwater in the mineral subsoil. The mineral subsoil is covered with a thick layer of clay with a high resistance to groundwater flow. This layer causes a "perched water table" in the peat body, with a hydraulic head that is often several metres above piezometric level of the groundwater in the underlying bedrock.

Under these conditions the flow of groundwater can be described by:

$$Q = -2\pi r \,.\, D \,.\, k \,.\, \frac{dh}{dr} \qquad \textit{(Darcy's law)} \qquad (4.3)$$

$$dQ = 2\pi r \,.\, U \,.\, dr \qquad \textit{(Continuity)} \qquad (4.4)$$

with Q :	rate of horizontal flow of groundwater through the peat	(m^3/day)
U :	precipitation minus evapotranspiration minus loss of groundwater to mineral subsoil	(m/day)
r :	distance from the centre of the bog	(m)
h :	height of the water table in the bog (As the height of the bog is more or less the same as the height of the groundwater table, h also describes the shape of the bog)	(m)
k :	hydrological conductivity of the peat	(m/day)
also R :	radius of the bog	(m)
B :	width of the bog	(m)

Solving the above two equations using the following boundary conditions:

r=0 than Q=0 and r=R than h=0

yields

$$h^2 = (R^2 - r^2) \,.\, \frac{U}{2k} \qquad (4.5)$$

The relationship between the horizontal flow (U) and the height of the bog in the centre (hm), width of the bog (B = 2R) and hydrological conductivity (k) is :

$$U = 8k \left(\frac{hm}{B}\right)^2 \qquad (4.6)$$

(Bakker, 1992)

With $B \approx 1500$ (m), $k = 0.0011$ (m/day) and $hm \approx 4.5$ (m):
U yields no more than 10^{-7} m/day i.e. less than 0.1 mm/year.

In comparison with the annual precipitation sum of circa 850 mm, evapotranspiration of circa 550 mm, runoff of circa 250 mm and downward seepage of several tens of millimetres, the horizontal groundwater flow is negligibly small and will not be part of further calculations.

4.2 Transmissivity of the acrotelm

Since the catotelm is of small importance in the drainage system of the bog, the major part of the discharge has to be transported through the acrotelm. The acrotelm is not very thick, but high values for the transmissivity can be expected. In reports preceding this one different techniques have been described for measuring the transmissivity. From results of earlier measurements it is concluded that transmissivity and water level are related. Furthermore it is obvious that the transmissivities vary in horizontal direction.

Ivanov (1957) and Romanov (1961) suggest the following relation between the hydraulic conductivity and water level (from Ingram and Bragg, 1984)

$$k(z) = \frac{A}{(z+1)^m} \qquad (4.7)$$

with
- k : hydraulic conductivity (cm/s)
- z : depth from surface (cm)
- A : empirical factor
- m : empirical factor

The transmissivity T ($=kD$) at depth d from the surface can be calculated according to

$$T = \int_d^{\infty} k(z)\, dz = \int_d^{\infty} \frac{A}{(z+1)^m}\, dz \qquad (4.8)$$

Integration yields (m>1)

$$T = kD = \frac{A}{(m-1)\,(d+1)^{m-1}} \qquad (4.9)$$

in which the transmissivity is in cm/s. To get transmissivity values in m^2/day the results have to be multiplied by the factor 8.64. It should be noted that the equations are empirical, so dimensions can be ignored.

The transmissivity is calculated according to:

- Pit Bailing method: < 25 m^2/day
- Guinness method : > 25 m^2/day (Appendix 3)

As stated before, the transmissivities vary both in horizontal and vertical direction. Therefore it is tried to relate the transmissivities to the vegetation cover. For that purpose Larissa Kelly described the vegetation cover around the acrotelm holes. Additionally she distinguished 7 different vegetation types (table 4.2). It is expected that the vegetation cover will indicate differences in acrotelm structure. For each type of vegetation the Ivanov/Romanov formula is fitted (Sijtsma and Veldhuizen, 1992). For this purpose all data that has been assembled during the project, is used. Measurements have proceeded since and new transmissivity values have been added to the old data. A list of transmissivity values is given in Appendix 4.

Table 4.2 *Vegetation types around the acrotelm holes*

Holes	**Description**
L13,L2,L1,L-1,K6	Low *Sphagnum magellanicum* hummocks
L6,O6,P6,N6	*Sphagnum* lawns,probably infilled pools
L11,M6,L12	Variable vegetation on wettest part of the bog
L3,L5	Hollow vegetation
L8,L9	*Eriophorum vaginatum/augustifolium*
Q6	Hollow channel in *Scirpus caespitosus/Calluna vulgaris* zone
L0,L4,L7,J6	*Narthecium ossifragum* hollows, variable *Sphagnum* cover

The standard deviation of the transmissivity values with respect to the Ivanov/Romanov curve is calculated according to

$$s = \sqrt{\frac{\sum_{i=1}^{n} (T_{meas}-T_{calc})^2}{n-1}} \qquad (4.10)$$

and the coefficient of variation, c_v according to

$$c_v = \frac{\hat{s}}{|T_{meas} - T_{calc}|} \qquad (4.11)$$

with $\hat{s}$: standard deviation (m²/day)
c_v : coefficient of variation
n : number of measurements
T_{meas} : measured transmissivity (m²/day)
T_{calc} : calculated transmissivity (m²/day)

The standard deviation and coefficient of variation given by Sijtsma and Veldhuizen (1992) have been compared with the standard deviation and coefficient of variation calculated with the completed data set (table 4.3).

Table 4.3 *Standard deviation $\hat{s}$ and coefficient of variation c_v according to Veldhuizen and Sijtsma (1992) (old) and according to the completed data set (new); new empirical m and A factors*

Holes	$\hat{s}_{old}$	$\hat{s}_{new}$	$c_{v\ old}$	$c_{v\ new}$	m_{new}	A_{new}
L13,L2,L1,L-1,K6	18.4	29.7	1.66	3.15	2.0	9
L6,O6,P6,N6	42.0	46.3	1.38	2.58	2.0	9
L11,M6,L12	38.2	33.2	1.14	1.79	2.4	57
L3,L5	52.6	283.5	1.32	3.41	2.4	50
L8,L9	365.3	540.4	1.47	1.72	2.4	58
Q6	28.9	28.9	1.38	0.96	3.0	192
L0,L4,L7,J6	3.4	12.8	1.37	4.76	1.6	1

4.3 Evapotranspiration and precipitation

4.3.1 Lysimeter results

The evapotranspiration over a period is calculated according to

$$E = P + \frac{V_a - \Delta V}{A} \qquad (4.12)$$

in which E : actual evapotranspiration (mm)
P : precipitation (mm)
V_a : volume of water added (l)
A : surface area of lysimeter (m²)
ΔV : volume change of stored water, determined by difference in weight (l)

Just before or after weighing the lysimeters the rainfall is measured at both handgauges and the automatic gauges. The volume of water added through rainfall is added to the volume added or removed by hand between two weighings. The volume change of stored water is calculated by the difference in weight of the lysimeters in between weighing intervals. The density of water needed in this calculation is assumed to be constant: ρ_w = 1000 kg/m^3

The evapotranspiration results measured with the lysimeters from April 1991 to April 1992 in weekly periods are given in Appendices 8a and 8b.

When a lysimeter was overflown during a period the evapotranspiration was corrected by taking the average of the previous and latter period. Table 4.4 shows the average monthly results of all lysimeters compared with the Penman evapotranspiration measured at the meteorological stations Birr and Mullingar. Figure 4.2 shows that evapotranspiration of the lysimeters highly exceeds the Penman data in the winter months. It is common knowledge that Penman underestimates winter evapotranspirations. At the same time it is known that heather and *Sphagnum* species keep assimilating in the winter; besides that *Sphagnum* species under very wet conditions are able to transpire up to 200% more than open water.

Table 4.4 *Monthly lysimeter evapotranspiration compared to Penman evapotranspiration of the weather stations Birr and Mullingar from April 1991 to April 1992 in mm*

Month	Lysimeters Average	Penman Birr	Penman Mullingar	Penman Average
april 1991	68.3	46.0	58.2	52.1
may	76.9	68.3	76.2	72.2
june	66.5	69.1	73.8	71.5
july	72.5	68.4	80.3	74.3
august	62.4	57.7	61.0	59.4
september	48.4	40.6	47.4	44.0
october	25.0	15.6	15.9	15.7
november	18.6	3.8	2.6	3.2
december	16.7	1.2	0.0	0.6
january 1992	14.6	1.2	6.9	4.1
february	29.6	15.5	12.9	14.2
march	43.7	26.3	28.0	27.2
april	68.3	42.9	43.0	43.0

Over exactly a year (19 April 1991 to 18 April 1992 with leap-year correction) the evapotranspiration sums are:

Lysimeters : E_a = 541 mm
Penman Birr : E_p = 410 mm
Penman Mullingar: E_p = 453 mm

The lysimeters give about 25% higher figures than Penman.

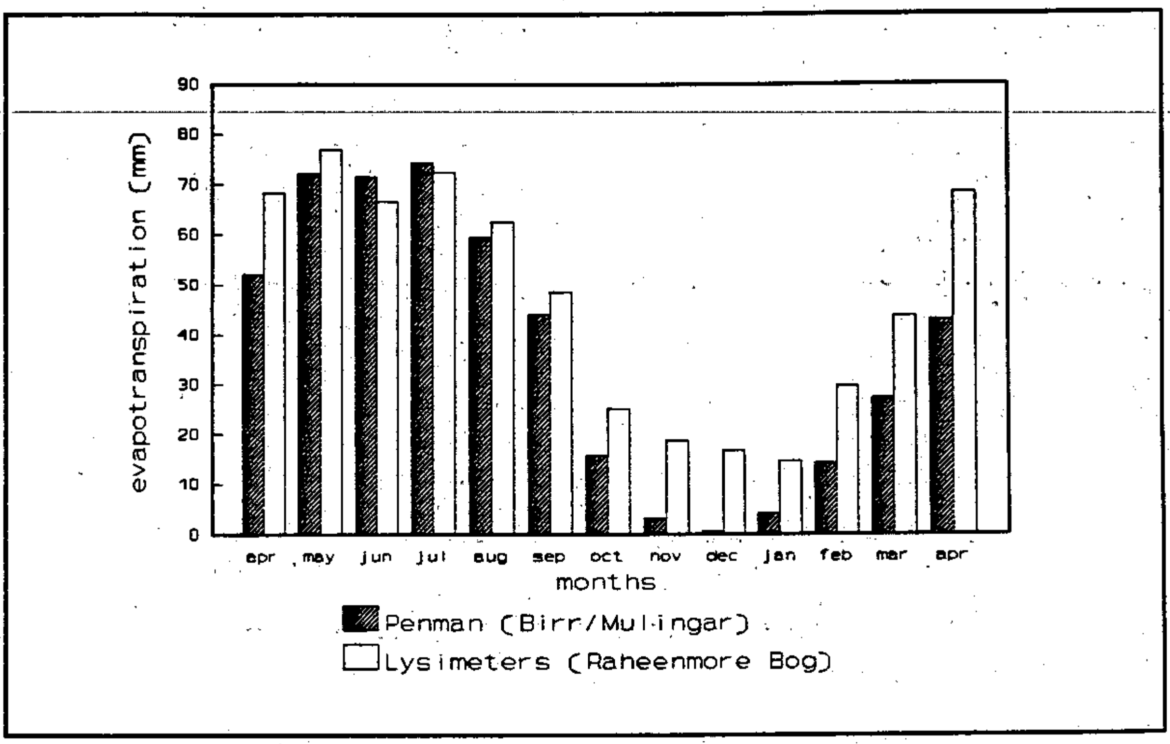


Figure 4.2 Comparison of monthly lysimeter and Penman evapotranspiration in the period April 1991 - April 1992.

To get an idea of the actual evapotranspiration in the two periods of the water balance preceding April 1991 the lysimeter results are related to the average Penman data of Birr and Mullingar. For every month Penman figures are plotted against those of the lysimeters and a regression curve is drawn (figure 4.3). The function to describe the actual evapotranspiration when Penman is known derived from this curve is:

$$E_a = 17 + \frac{8 . E_p}{10} \qquad (4.13)$$

in which E_a : actual evapotranspiration according to regression function (mm)
E_p : Penman evapotranspiration (mm)

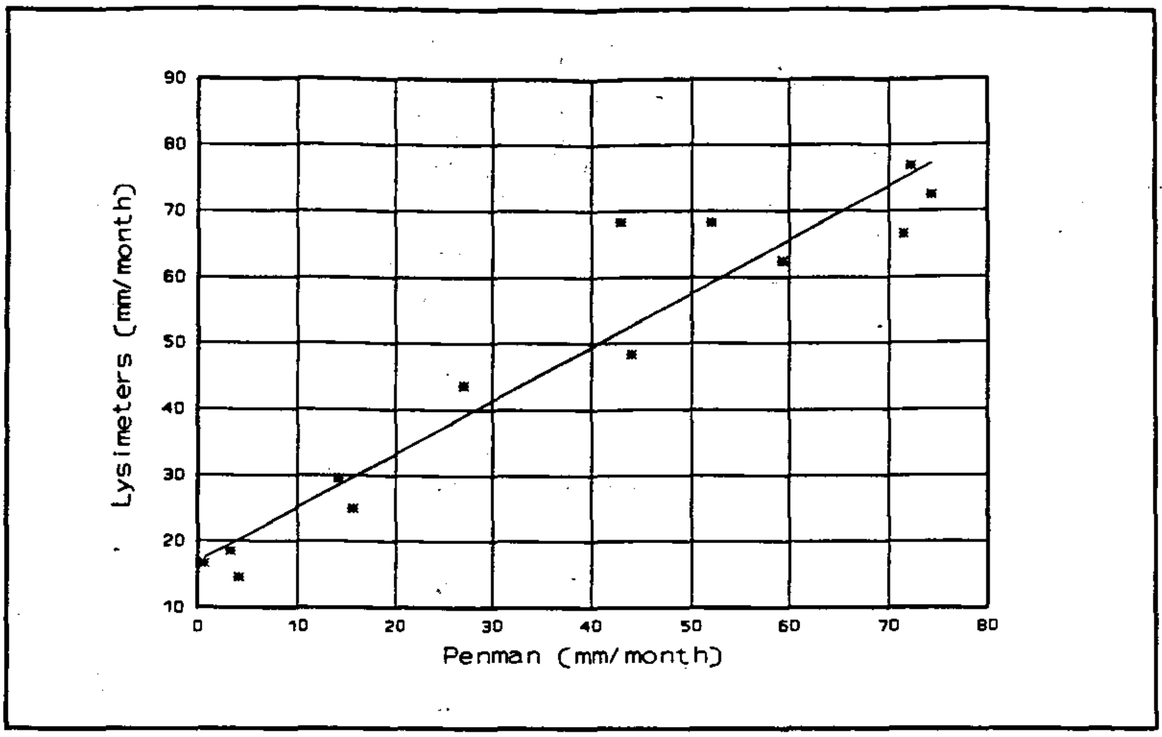


Figure 4.3 Relation between evapotranspiration according to Penman and the lysimeter evapotranspiration

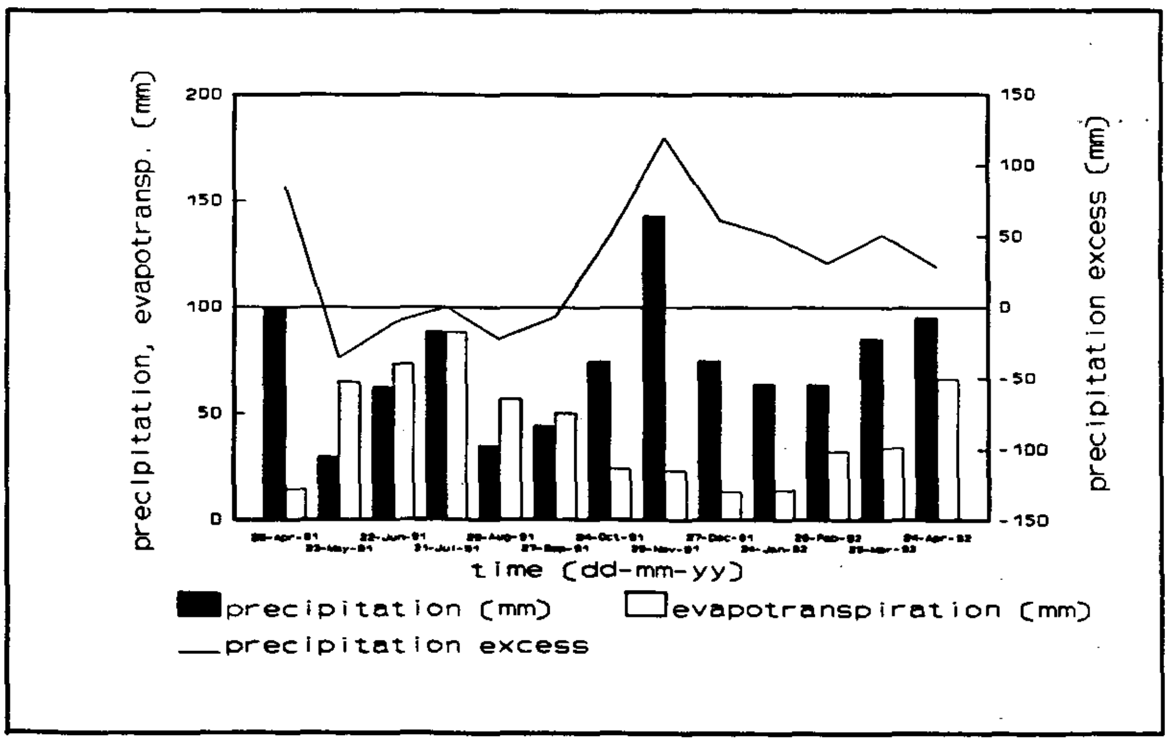


Figure 4.4 Precipitation, evapotranspiration and precipitation excess from April 1991 to April 1992

4.3.2 Precipitation

The average weekly rainfall measurements of both hand raingauges from December 1989 until April 1992 can be found in Appendix 6; daily figures are far from complete.
Figure 4.4 shows that a precipitation excess over the year exists. A shortage of water, however, occurs in late spring and summer of 1991; the exact precipitation excess over the year counts 320 mm. May 29 until June 8 and August 29 until September 21 discharges at the V-notch stopped.

4.4 Storage

4.4.1 Storage coefficient

The storage coefficient is the ratio of the water quantity added (mm) to the resulting change in water table (mm). This coefficient depends on the phreatic water level, the change in level of the peat surface over the year and the acrotelm structure. To get more information of the storage coefficient over depth the test with the lysimeters as described in par. 3.2.2 was done.

The storage coefficient for each interval in the test is calculated using the measured weights and corresponding water tables, which is more accurate than using measured volume changes of removed water and additional rainfall. Therefore the following formula is derived:

$$\mu = \frac{(W_1 - W_2)}{\rho_w \, A(h_1 - h_2)} \qquad (4.14)$$

in which	μ	: storage coefficient	(-)
	W_1	: mass of the lysimeter at time 1	(kg)
	W_2	: mass of the lysimeter at time 2	(kg)
	ρ_w	: density of water	(kg/m^3)
	A	: surface area of the lysimeter	(m^2)
	h_1	: phreatic level at time 1	(m)
	h_2	: phreatic level at time 2	(m)

Though for most lysimeters it was impossible to reach the aimed fall of water table of 30 cm, a sufficient depth was reached to make sure if there is a significant difference between the upper 10 cm and lower. In former calculations with the weekly lysimeter measurements this was found to be the case. The storage coefficient for the first 10 cm was higher than further down and at the same time higher for good acrotelm than for poor acrotelm (Sijtsma and Veldhuizen, 1992); a similar decrease over depth was found by Romanov (1968).

In the lysimeter test however there is no indication that there is difference over depth in the upper 20 cm. The results show significantly higher figures for the good acrotelm than for poor acrotelm. For good acrotelm the average storage coefficient $\mu = 0.35$ and for poor acrotelm $\mu = 0.26$.
The storage coefficient used in the water balance is the average of all lysimeters in the test: $\mu = 0.31$.
In detail the results can be found in Appendix 10. Table 4.5 shows the average storage coefficient for each lysimeter.

Table 4.5 *Storage coefficients of the lysimeters (average weighed for depth) in the lysimeter test*

Lys. nr.	**Poor acrotelm**	**Lys. nr.**	**Good acrotelm**
1	0.25	9	0.28
2	0.33	10	0.32
3	0.27	11	0.31
4	0.17	12	0.34
5	0.10	13	0.35
6	0.31	14	0.29
7	0.32	15	0.50
8	0.35	16	0.42
Average	**0.26**	**Average**	**0.35**

4.4.2 Swelling and shrinkage

Swelling and shrinkage of the peat surface can also add to the rate of storage. To get an idea of the influence of this phenomenon the data from the rise and fall of the metal plates connected to all three benchmarks (BM1, BM2 and BM3) was determined. The metal plates have a maximum fluctuation of 5 - 7 cm over the year (Appendix 11). This could mean a substantial change in storage, because we have to reckon with the water content of 95% for acrotelm (free water in the effective pore volume), determined by Sijtsma (1992). This means that a swelling of 7 cm results in a storage increase of almost 70 mm, what may not be neglected.
It is not said that this storage can just be added to storage due to groundwater fluctuations, because one influences the other, but not instantly, because groundwater fluctuations take place much quicker than swelling or shrinkage. Besides that phreatic tubes can go up and down with the rise and fall of the peat surface, but in what rate is more or less a guess. This will, however, not contribute to the accuracy of the seasonal water balance; taking the storage over a year the inaccuracy will be smaller.

4.5 Downward seepage

The hydraulic gradients for almost every set of piezometers on both transects indicate downward seepage (Appendices 20a and 20b). Making the water balance the seepage is the unknown variable that completes this balance. The seepage found as a result of the water balance is not very accurate due to a certain error range (10-40%) in the other variables and the difficulty of not knowing the exact catchment size.

To be able to check the outcome of the water balance, the downward seepage needs to be calculated in another way. This is done using the results of the permeability test (table 4.1) and the total set of hydraulic heads of all tubes (Appendices 19a and 19b). The results of the permeability test give a horizontal conductivity, that for peatland can be seen as a maximum for vertical groundwater flow.

Downward seepage can then very easily be estimated using Darcy's law,

$$v_d = k \cdot \frac{dH}{dz} \qquad (4.15)$$

in which

v_d	:	downward seepage	(m/day)
k	:	conductivity	(m/day)
dH/dz	:	gradient in hydraulic head	(-)

This is done for both transects using three different methods.

Method 1

First the downward seepage for every interval between piezometer filters towards the bottom of the peat (B-C, C-D, D-E and E-F) for every set of piezometers on both transects (east-west: 8 sets, north-south: 15 sets) is determined. The gradient in hydraulic head between two filters is taken as the average of all available monitoring data. For the conductivity the average of the test (k = 0.0007 m/day for the east-west transect and k = 0.0015 m/day for the north-south transect), as determined in par. 4.1.1, is used for the whole profile, whereas it is known that through compaction k tends to be far less at the bottom of the peat, although that does not appear in the results of the permeability test.

Then the average downward seepage for every set of piezometers and next the average for the whole transect, in which every piezometer set is weighed for distance, is calculated.
The results of this calculation are:

east-west transect : v_d = 6 mm/year
north-south transect : v_d = 65 mm/year

Method 2

In this method the gradient in hydraulic head between phreatic level (A-tubes) and the deepest piezometer (C, D, E, or F) for the same locations is taken. For the rest this method follows the first. The results of this calculation are:

east-west transect : v_d = 7 mm/year
north-south transect : v_d = 86 mm/year

The information for every single set of piezometers can be found in Appendices 13 and 14.

Method 3

The horizontal conductivity values of the permeability test vary over depth in an irregular pattern. It is however generally accepted that conductivity decreases over depth because of humification and compression caused by the overlying peat mass. It is therefore questionable if the determined *k*-values are accurate and specific for the aquifer in which they were measured. To see if an individual *k*-value at a certain depth and location can be used to determine the local downward seepage the following theory has been followed.

The assumption is made that no horizontal groundwater flow occurs in the catotelm. The downward seepage in an aquifer can then be seen as the result of two factors, the vertical resistance and the difference in hydraulic head. Darcy's law can be written as

$$v_d = \frac{dH}{c} \tag{4.16}$$

in which dH : difference in hydraulic head (m)
c : hydraulic resistance (days)

So, for all layers between piezometer depths where *k*-values and *dH*'s are available, the differences in hydraulic heads should be proportional to the hydraulic resistances. This is assumed to be the case in the central area of the bog.
To underbuild this theory the *k*-values for five locations in the central area of the bog (piezometer sets 210, 211, 324, 327 and 330) are transformed into *c*-values, according to

$$c = \int_0^D \frac{1}{k_{(z)}}\, dz \tag{4.17}$$

in which D : thickness of an aquifer (m)

The c-values are plotted against the differences in hydraulic heads of the concerning peat layers. If this plot is more or less chaotic then the conductivity values are inaccurate and averaging, as in the former methods, is the best estimation for the conductivity. Figure 4.5 shows that in the centre of the bog a proportional rise between differences in hydraulic heads and hydraulic resistances is found. Locations more towards the edge of the bog, however, give a scattered pattern.

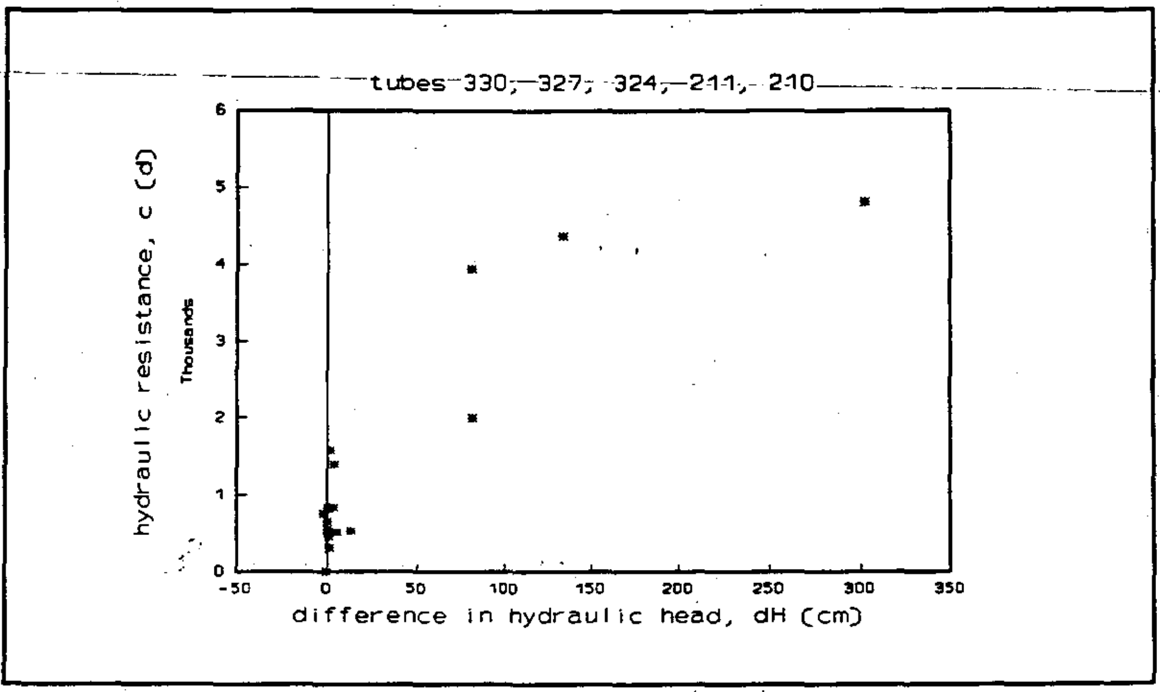


Figure 4.5 Relation between the difference in hydraulic head and the hydraulic resistance for the layers between piezometer depths (B-C, C-D, D-E and E-F) in the centre of the bog

The conclusion drawn from this is that the determined conductivity values at five locations in the middle of the bog are accurate and specific for a certain layer and c-values derived from them can be used in calculating downward seepage.

Using equation 4.16 first the downward seepage for every peat layer between piezometer depths, next the average for every set of piezometers and latest the average for all five sets in the middle of the bog is calculated.
The result of this calculation is:

central area: v_d = 55 mm/year

This is an absolute maximum assuming that downward seepage towards the edges of the bog only decreases and besides that, as mentioned before, the used horizontal conductivities are a maximum for vertical groundwater flow.

The results of this calculation in more detail can be found in Appendix 15. Table 4.6 gives a summary of the three methods discussed. The reliability of these methods depends highly on the amount and accuracy of the conductivity measurements and the way of averaging. Though there is no essential difference in the results of the methods, they must not be regarded as absolute figures, but as a reference for the results of the water balance.

Table 4.6 *Downward seepage in mm/year determined with three different methods*

k = harm. avg transect		***dH/dz*** average	v_d average	v_d weighed	v_d
method 1	east-west	0.048	12	6	
	north-south	0.120	65	65	36
method 2	east-west	0.056	14	7	
	north-south	0.103	56	86	46
k = specific for layer					
method 3	piezometer set 210		3		
	piezometer set 211		36		
	piezometer set 324		74		55
	piezometer set 327		116		
	piezometer set 330		54		

For method 1 and 2 the averages of both transects are added, because they both are assumed to represent the catchment equally. The assumption that downward seepage towards the edges decreases is not confirmed by the figures of the east-west transect; weighing the v_d's for distance means that tubes towards the centre of the bog become relatively more important, so higher downward seepage values can be expected. For the east-west transect the opposite occurs. The north-south transect gives a weighed average that is equal for method 1 and higher for method 2.

Furthermore table 4.6 shows that for the east-west transect the downward seepage is a lot smaller than for the north-south transect, using method 1 and 2; in that perspective also the tubes 210 and 211 of the east-west transect give smaller figures than the other three, using method 3. Looking at the k-values of the permeability test the harmonic average on the east-west transect is 0.0007 m/day, while on the north-south transect an average of 0.0015 m/day is found; on top of that the average gradients in hydraulic head on the east-west transect are about half the magnitude of those on the north-south transect.

Together these aspects explain the differences in downward seepage between the transects figurewise. Differences are most likely caused by higher compaction on the north-eastern part of the bog, which is confirmed by the knowledge that the surface elevation in that part has been reduced since the Bord Na Mona elevation mapping in 1948, due to the drainage system (Appendix 2b) present there.

5 Water balance and catchment size

5.1 Catchment

An intensive surface levelling has been carried out by OPW in 1990. The levelling was done at each gridpoint in a grid with cells of 100 x 100 m. Together with the levelling data from the piezometers and recorders a contour map is created. The graphical program SURFER is used for the interpolation between the data points. Lensen (1991) was the first in this approach and in his report more detailed information is given about different interpolation techniques.

Perpendicular on these contour lines the boundaries of the catchment have been drawn, with both ends of the drain as starting points (Appendix 2a). To acquire the catchment boundaries in this case it is acceptable to use surface levels as if they are water levels, because during the whole year phreatic levels are very close to surface levels. Digitising of the area enclosed by this boundary results in a catchment area of 33 ha. This catchment size is used in the calculations of the water balance.

5.2 Water balance

5.2.1 Seasonal differences

The results of the water balance for the period September 1990 to April 1992 are acquired by using the following equation:

$$v_d = P - E - Q - \Delta S \qquad (5.1)$$

with	v_d	: downward seepage	(mm)
	P	: precipitation	(mm)
	E	: evapotranspiration	(mm)
	Q	: discharge	(mm)
	ΔS	: increase in storage	(mm)

The used precipitation data are the averaged week sums of the two hand raingauges.

For the evapotranspiration the average of the lysimeters is used after correcting these data for periods of overflow by interpolation (Appendix 8c). The differences caused by type of vegetation have not been counted for, because no detailed map of the vegetation of Raheenmore Bog was available during this study. The vegetation cover, however, is not expected to make much difference in the evapotranspiration figures, because most existing vegetation types and plant species with both good and poor acrotelm circumstances are represented in the set of lysimeters.

The evapotranspiration for the period September 1990 - April 1991, in which there are no lysimeter data, are acquired by relating the evapotranspiration measured with the lysimeters to the Penman evapotranspiration taken from the meteorological stations at Birr and Mullingar. The derived function from the regression curve (par. 4.2) gives the estimated actual evapotranspiration for this period.

The discharge data are the continuously acquired outflow figures from the Rossum V-notch in m^3/hour, digitised at OPW. To convert these figures for a determined water balance period into millimetres the rate of discharge is divided by the assumed catchment size of 330000 m^2. Corrections for discharge in each period have been added to account for differences between the recession limb coming from the former period and the one flowing into the next. For this recession curves fitted for different rates of discharge (par. 6.1) have been used.

The storage (Appendix 11) is determined using the acquired data of the groundwater recorder and phreatic tubes of the east-west transect, as well as all the levelling data in the same period (Appendices 17, 18 and 19a). For the storage coefficient the average of the results of the lysimeter test, μ = 0.31 (Appendix 10) is taken. At this stage storage due to swelling and shrinkage of the peat surface is not reckoned with, because for the first two periods no benchmark data is available.

The downward seepage remains as the unknown factor in the equation above.

Dividing the period September 1990 - April 1992 in equal seasons, as far as the dates on which the measurements were done allow this, the results of the water balance are as follows in mm:

Period	***P***	***E***	***Q***	**ΔS**	**v_d**
18 sep '90 - 6 jan '91	423	92	179	45	106
6 jan '91 - 19 apr '91	273	106	200	8	-42
19 apr '91 - 31 jul '91	196	241	23	-38	-30
31 jul '91 - 17 oct '91	153	128	25	25	-25
17 oct '91 - 10 jan '92	280	51	125	13	91
10 jan '92 - 24 apr '92	248	137	90	4	17

In more detail (weekly data) these results can be found in Appendix 5; figure 5.1 gives the partition of all components in the water balance for each season.

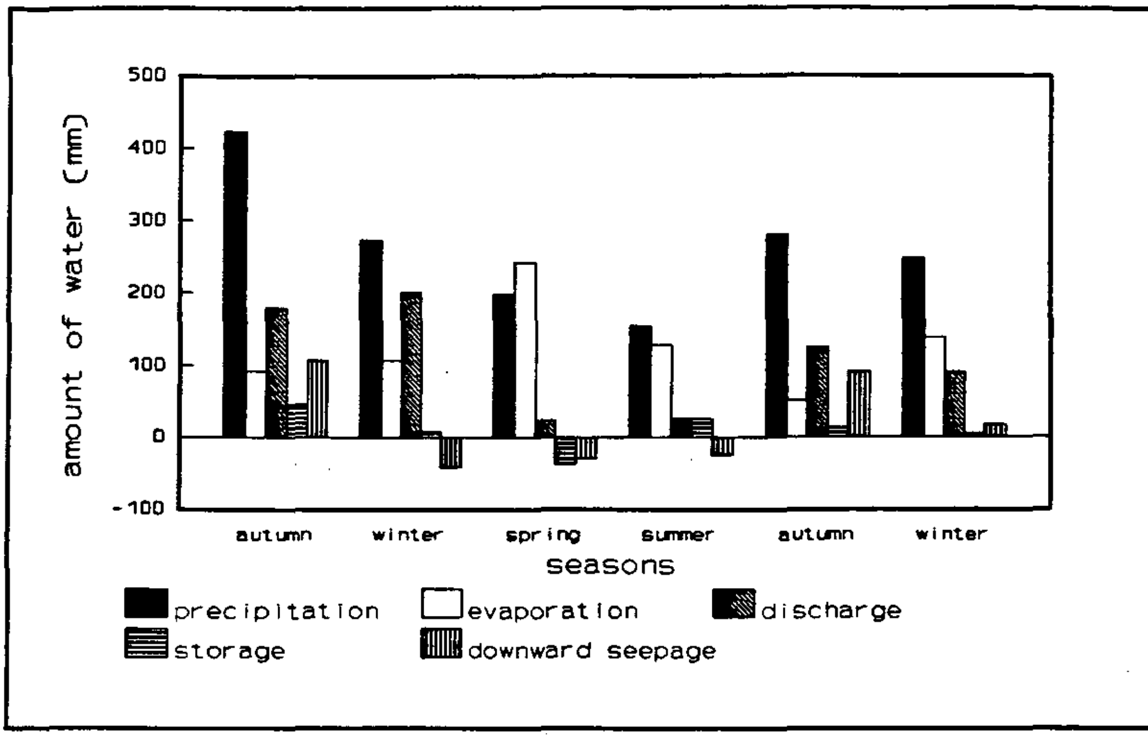


Figure 5.1 Seasonal water balance September 1990 - April 1992

These results show for the downward seepage a major fluctuation over the year, which could partly be caused by errors due to inaccuracy, but looking at the differences in hydraulic heads of the tubes on both transects over the year it is impossible that upward seepage occurs. In general a trend in hydraulic head similar to the trend in downward seepage over the year is found, that could be responsible for these fluctuations to a very small extend.

Furthermore these differences could partly be explained by the extra storage due to shrinkage and swelling of the peat surface. This is calculated using the data from the rise and fall of the metal plates connected to the benchmarks (BM1, BM2 and BM3) and the water percentage of 95% for the acrotelm (Appendix 12). The results for the last four seasons of the water balance are:

Storage by swelling and shrinkage of the peat surface in mm:

Period	**BM1**	**BM2**	**BM3**	**AVG**
19 apr '91 - 31 jul '91	-43	-29	-27	-33
31 jul '91 - 17 oct '91	-16	-9	6	-6
17 oct '91 - 10 jan '92	35	15	22	24
10 jan '92 - 20 mar '92	-9	1	5	-1
Year total	-33	-22	6	-16

These results do make a difference in that way of diminishing the fluctuations, though still in one period upward seepage is found. Unfortunately after the 20th of March the benchmarks were no longer monitored, so no data for the 24th of April (end of the last season) is available. The swelling or shrinkage, however, in this period is assumed to be negligible, because the phreatic water level hardly changed.

5.2.2 Annual water balance

It is now reasonable to give a total water balance over the lysimeter year and add the storage results by swelling and shrinkage to the storage by groundwater fluctuations.
The annual water balance for the period from 19 April 1991 to 24 April 1992 (Appendix 5) then shows the following results:

Period	*P*	*E*	*Q*	*ΔS*	v_d
19 apr '91 - 31 jul '91	196	241	23	-71	3
31 jul '91 - 17 oct '91	153	128	25	19	-19
17 oct '91 - 10 jan '92	280	51	125	37	67
10 jan '92 - 24 apr '92	248	137	90	3	18
Year total	877	557	263	-12	69

The partition of all components of the water balance over the seasons of the year is shown in figure 5.2.

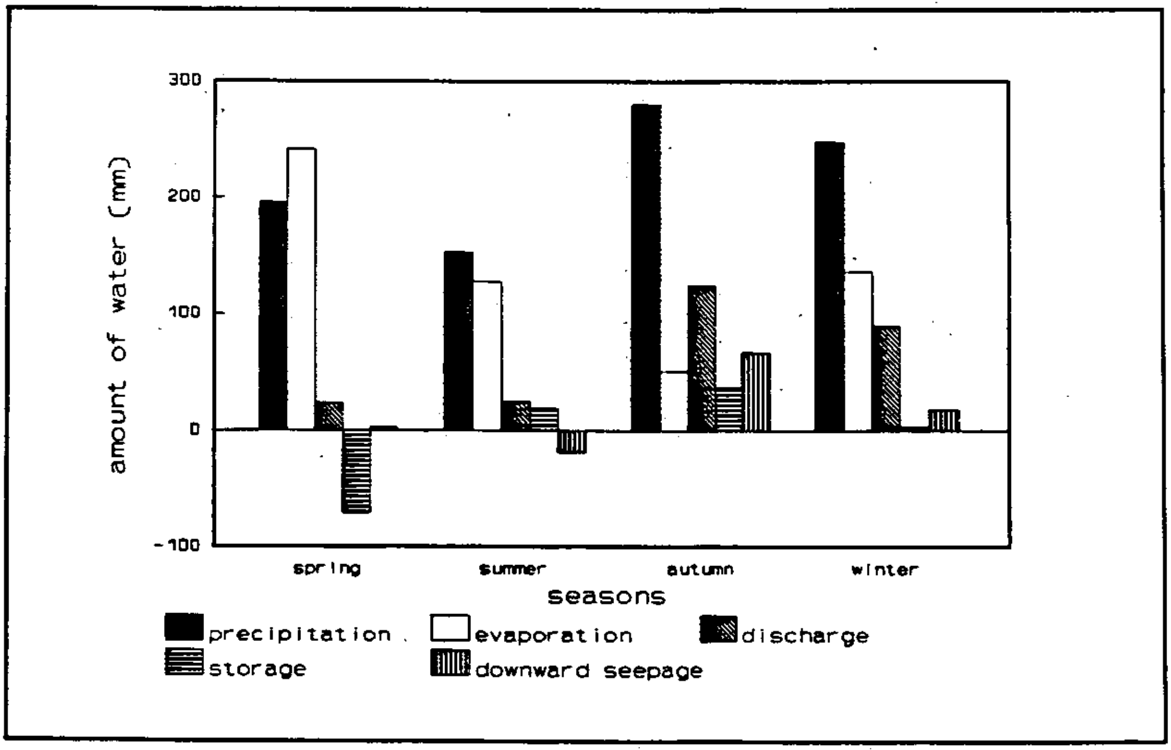


Figure 5.2 Seasonal water balance April 1991 - April 1992

The inaccuracy of the seasonal changes in storage are highly reduced when regarding the annual results (see chapter 7), because both groundwater levels and surface levels at the begin (April 1991) and the end (April 1992) of this period are high and about equal.

The results give a downward seepage over the year of 69 mm, which is rather high regarding the figures for downward seepage determined in par. 4.5. A possible explanation for this can be that there are other losses of water in periods of peak discharges. These losses then are probably caused by leakage along the edges of the bog, such as channel and pipe flow, and runoff through the old set of drains (Appendix 2b) in periods of peak flow, which is not registered at the Rossum V-notch. It is difficult to estimate these losses to make the water balance more accurate.

Another explanation could be that the catchment size is overestimated. Due to the shape of the catchment area a little shift of the catchment boundaries can result in a significant change of area. Table 5.1 gives the resulting downward seepage and discharge for different catchment sizes, ignoring possible losses mentioned above.

Table 5.1 *Influence of changes in catchment size on the components in the water balance*

Catchment (ha)	26	27	29	31	32
Discharge (mm)	334	321	299	280	271
Downward seepage (mm)	-2	10	32	52	60

The minimal catchment size, when downward seepage is set to zero level, reads 26 ha; a catchment size of about 30 ha would match the in par. 4.5 calculated downward seepage.

6 Hydrograph analysis

6.1 Hydrograph separation

A catchment can be derived from the rainfall-discharge relationship for a single floodwave. After storms of short duration one can see clear increases of storage and discharge. When discharges have decreased to normal level it can be concluded that all the water coming from the storm has left the area. It is then possible to calculate the specific area from where the water was originated.

With the help of equation 6.1 the size of the catchment can be derived,

$$\sum_{t_0}^{\infty} q(t) = \sum_{t_0}^{t_n} p(t) \, . \, A \qquad (6.1)$$

with
- $q(t)$: the discharge for a single floodwave (m^3/s)
- $p(t)$: rainfall (m)
- t_0 : start of rainfall
- t_n : end of rainfall
- A : catchment area (m^2)

If new storms occur while discharge is still recessing, then a correction has to be made for storage or the further recession of discharge has to estimated. The storage, however, is a highly inaccurate factor since there is only one groundwater recorder and therefore it is tried to describe the discharges.

Any flood hydrograph may be considered as a hydrograph of direct runoff superposed on a hydrograph of baseflow. It is also clear that such fluctuations as may exist in groundwater discharge are of a different character and usually of a lower order of magnitude than the fluctuations in surface runoff, since they are caused by different types of flow. It is thus logical to attempt a separation of a flood-period hydrograph into two parts, so that the phenomenon of direct runoff can be analyzed.

In practice a single crested floodwave seldom occurs. New floodwaves are mostly superposed on the recession limb of a preceding floodwave. The recession limb includes the remaining part of the hydrograph, which may or may not decrease to zero depending on the amount of the base flow or groundwater flow. It represents the withdrawal of the water from storage after excess rainfall has ceased.

Under wet conditions, when absorption by peat is negligible, it is not unreasonable to assume that the discharge is only a function of the storage in the effective pore volume,

$$\Delta S = \alpha \cdot q \tag{6.2}$$

where ΔS is storage, q is discharge and α is a constant having the dimension of time (reservoir coefficient).

It can easily be shown that the discharge on cessation of supply follows the equation

$$q = q_0 \cdot e^{-t/\alpha} \tag{6.3}$$

where q_0 is the value of the discharge at the instant at which the recession begins; α can be shown to be equal to the time elapsed between the occurrence of any discharge q and q/e in the graph of recession. The recession, which is asymptotic to zero is capable of simple mathematical treatment and roughly resembles the recession of storm runoff and baseflow one comes across in practice.
According to equation 6.3 the recession limb should produce a straight line when plotted on semilogarithmic paper. For two points q_1 and q_2 taken at time t_1 and resp t_2 from a recession curve parameter α in equation 6.4 can be determined:

$$\alpha = (t_2 - t_1) / \ln (q_1/q_2) \tag{6.4}$$

(Warmerdam, 1987)

A linear reservoir coefficient is calculated for several discharges. The reservoir coefficients found for different discharges vary in such range that it can be concluded that runoff follows a non-linear line (figure 6.1). It is, however, still possible to estimate the discharges with the help of figure 6.1. Therefore it is tried to fit a curve through this cloud of reservoir coefficients and a formula as in equation 6.5 seemed to fit best:

$$\alpha = const./q_0 \tag{6.5}$$

In figure 6.1 the α values are plotted against the top value q_0 of the discharge interval. The highest value from the recession limb of a peak flow (q_0) is the start for the fitting of the curve. For this value a linear reservoir coefficient is calculated according to equation 6.5. For a certain time or discharge interval the recession limb is calculated according to equation 6.3. The last calculated q-value becomes the starting point for the next time or discharge interval. Again a linear reservoir coefficient is derived from equation 6.5, and the procedure is repeated until the discharge has become negligible small (figure 6.2.).

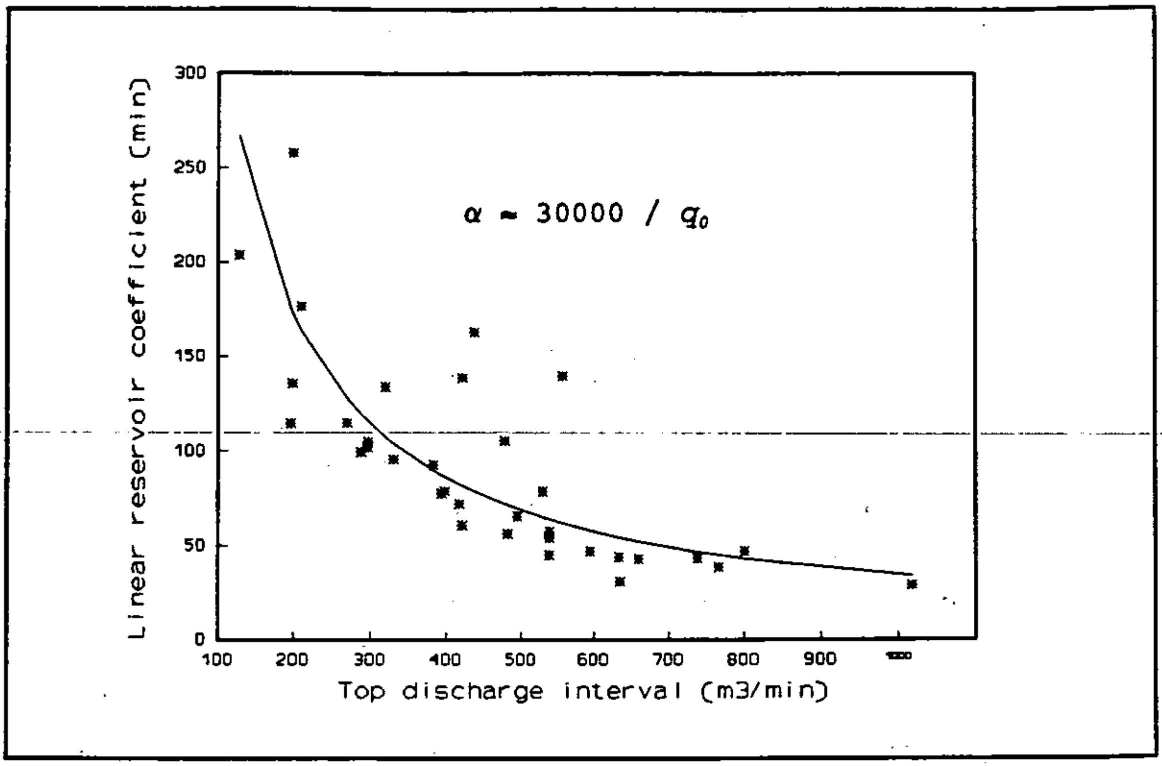


Figure 6.1 Linear reservoir coefficients for maximum values of discharge intervals.

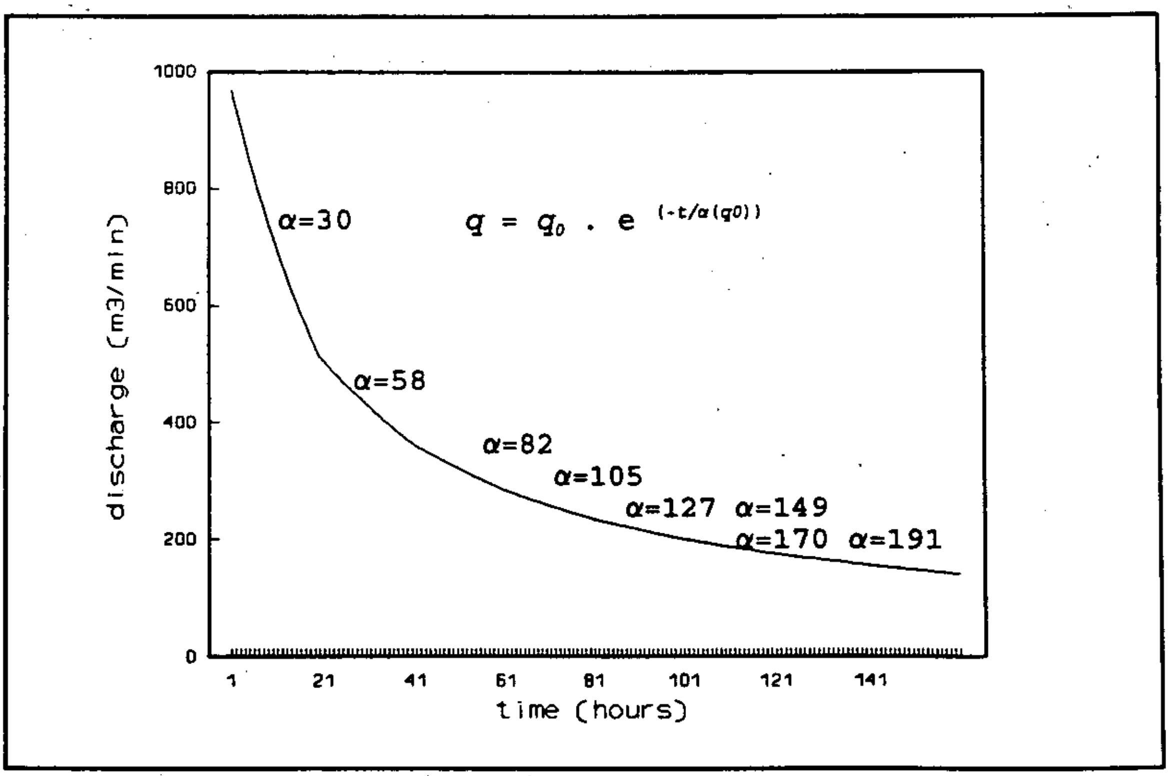


Figure 6.2 Recession limb for the discharges derived from the equations 6.4 and 6.6.

For six periods the catchment size was calculated according to the estimated series of discharges (Appendix 16). The results from the rainfall-discharge relationship do not give a clear answer to the size of the catchment. The catchment areas derived vary in a range of 10 to 18 ha with an exception of 23 ha and are considerably smaller than the catchment found by contour lines. The errors made in this calculation will take a part in the explanation of it. Besides the errors there are more possibilities to consider, for instance a shifting catchment. When the water level rises, the natural (depressions, ridges) and artificial blockages (drains, dams) become overflooded and loose their function. Water streams, which initially followed canals, will now participate in the overland flow.

6.2 Acrotelm characteristics

Linear systems have homogeneous aquifers. From the former paragraph it is concluded that discharges follow a non-linear system. In this paragraph the causes of this non-linearity are discussed.
Non-linearity is found in two ways: absence of the acrotelm along the borders of the bog and differences in transmissivity over depth.

Absence of the acrotelm.

Ten Kate en van 't Hullenaar (1991) have done a mapping of the acrotelm along the east-west transect. Figure 6.3 shows the relation between slope and acrotelm thickness according to their results. It seems that no acrotelm can be expected with slopes exceeding 0.3 percent. A map with slope data was made according to the surface levelling done by OPW (1990). The area with slopes exceeding 0.3 percent within the catchment based on contour lines reads about 10 ha (Appendix 2b). The conclusion is that the area without acrotelm is more or less of the same order of magnitude as catchment sizes derived from the hydrographs.

Differences in transmissivities over depth

Transmissivities have been measured for different depths and locations. Sijtsma and Veldhuizen (1992) have related these transmissivities to a formula given by Ivanov and Romanov, which describes transmissivities over depth empirically (see chapter 4.2). According to this formula transmissivities decrease rapidly with depth.
In figure 6.4 the reservoir coefficients found for different discharges have been plotted against the phreatic water level. It appears that reservoir coefficients follow more or less the same line as the transmissivities. The true relation between the reservoir coefficients and the transmissivities is not discussed in this report, but the non-linearity of the acrotelm as a system for runoff is clear.

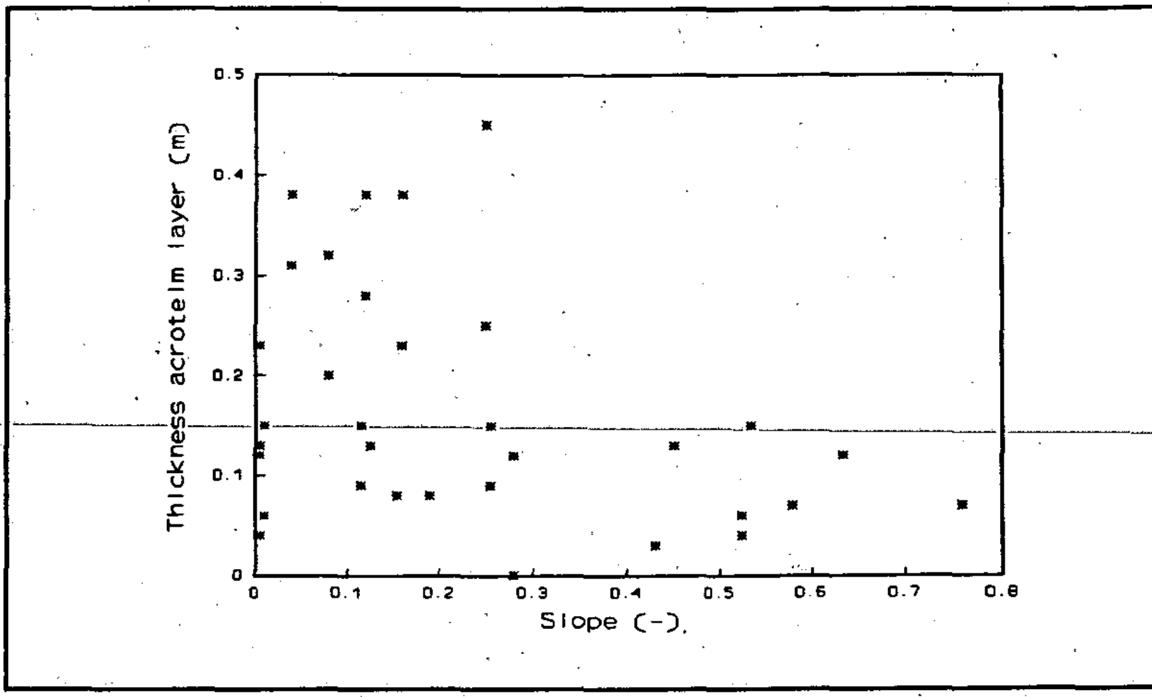


Figure 6.3 Relation between acrotelm thickness and slope according to the acrotelm thickness measurements done by ten Kate and van 't Hullenaar (1991).

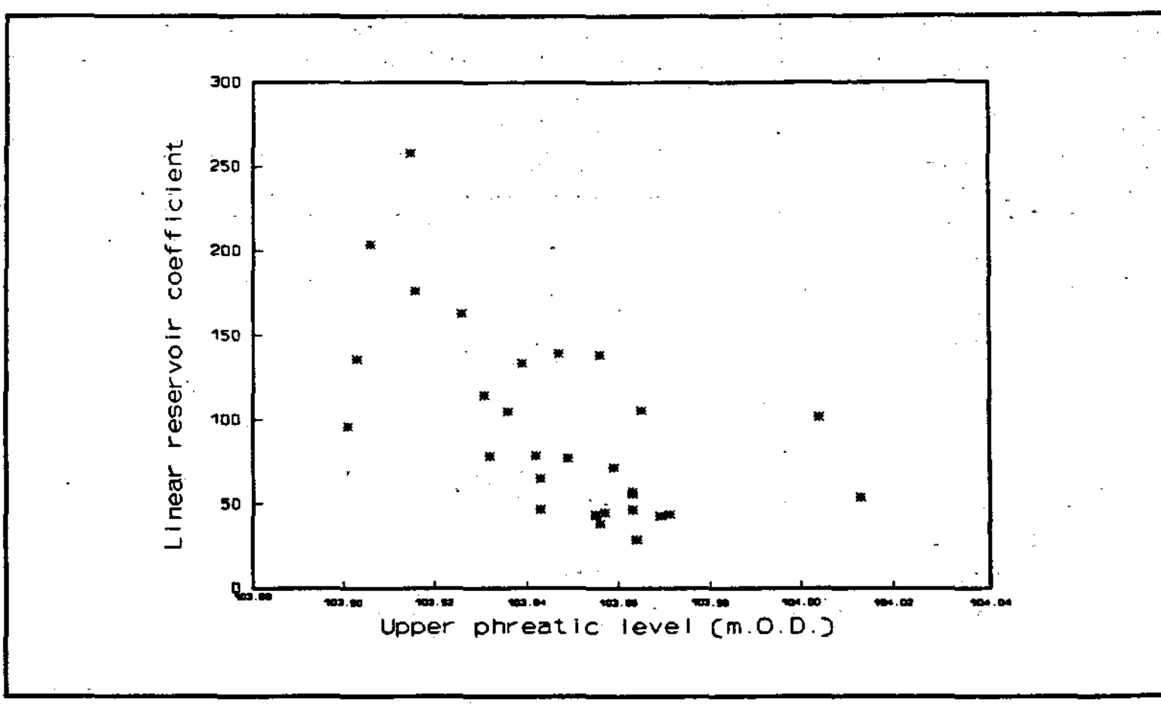


Figure 6.4 Linear reservoir coefficient plotted against the phreatic water level (groundwater recorder)

7 Error analysis

Error transmission

Errors in elementary calculations

Each error made in a stage before is transmitted to succeeding calculations. Only first order effects are observed. Therefore the following equations are available:

$$\delta(a+b) = \delta a + \delta b\ , \qquad E(a+b) = E(a) + E(b)$$
$$\delta(a-b) = \delta a - \delta b\ , \qquad E(a-b) = E(a) + E(b)$$
$$\delta(a*b) = a\delta a + b\delta b\ , \qquad E(a*b) = |a|E(a) + |b|E(b)$$

Sometimes it is more clear to use the relative error $(\delta a)/a$ or the possible relative error $E(a)/|a|$, specially with a multiplication or division. The first order "possible relative error" (neglecting the second and higher order terms like $\delta a*\delta b$) gives

$$\frac{E(a*b)}{|a*b|} = \frac{E(a)}{|a|} + \frac{E(b)}{|b|}\ , \qquad \frac{E(a/b)}{|a/b|} = \frac{E(a)}{|a|} + \frac{E(b)}{|b|}\ ,$$

Thus, the possible relative error in a product (or quotient) is the sum of the possible relative errors in the factors. From this it follows that a product can never be more accurate than the most inaccurate factor.

The relative error shows also that adding is more reliable than subtracting. If a and b are both negative or positive then

$$\frac{E(a+b)}{|a+b|} = \frac{E(a) + E(b)}{|a+b|} \le \frac{E(a)}{|a|} + \frac{E(b)}{|b|}$$

Thus, adding numbers which are both negative or positive gives a possible relative error of at most the sum of the possible relative errors. However, when a and b are about equal in size (that is, $|a-b| << |a|$ and $|a-b| << |b|$) then

$$\frac{E(a-b)}{|a-b|} = \frac{E(a) + E(b)}{|a-b|} = \frac{E(a)}{|a|}\frac{|a|}{|a-b|} + \frac{E(b)}{|b|}\frac{|b|}{|a-b|}$$

Thus, the possible relative error is magnified by a factor inversely proportional to the relative difference. When, for example, a and b have the same first 4 decimals, then the relative difference is about 10^{-4} and the possible relative error made with this subtraction is about 10^{4} larger than those made in the terms a and b (de Gee, 1988).

Error transmission in the water balance

Example

$$v_d = (P - E - \Delta S) - \frac{Q}{A} \qquad (7.1)$$

v_d	=	69	mm
P	=	887	mm
E	=	557	mm
ΔS	=	-12	mm
Q	=	86790	m^3
A	=	33	ha

Absolute errors:

E(P) = 10 % x 887 = 88,7
E(E) = 20 % x 557 = 111,4
E(ΔS) = 30 % X 12 = 3,6
-------------------------- +
202,7

Relative errors:

$$\frac{E(Q)}{|Q|} = 20\ \% \qquad \frac{E(A)}{|A|} = 20\ \%$$

$$\frac{E(Q/A)}{|Q/A|} = \frac{E(Q)}{|Q|} + \frac{E(A)}{|A|} = 20\ \% + 20\ \% = 40\ \%$$

$$\frac{E(P\text{-}E\text{-}\Delta S)}{|P\text{-}E\text{-}\Delta S|} = \frac{202{,}7}{(877\text{-}557\text{+}12)} = \frac{202{,}7}{332} = 61\ \%$$

$$\frac{E(v_d)}{|v_d|} = \frac{E([P\text{-}E\text{-}\Delta S]-[Q/A])}{|[P\text{-}E\text{-}\Delta S]-[Q/A]|} = \frac{61\ \% \times 332 + 40\ \% \times 263}{|332 - 263|} = 447\ \%$$

The error calculated above is the maximum error if errors made in the individual water balance components succeed in further calculations and accumulate in the same direction (worst case situation).

In table 7.1 error transmission is calculated changing the error for each component, while the others stay the same.

Relative errors:

P = 10 %, E = 20 %, ΔS = 30 %, Q = 20 % en A = 20 %

Table 7.1 *Error transmission in the water balance*

P	v_d	E	v_d	ΔS	v_d	Q	v_d	A	v_d
5%	383%	10%	367%	50%	451%	10%	409%	10%	409%
10%	447%	20%	447%	100%	459%	20%	447%	20%	447%
15%	511%	30%	528%	150%	468%	30%	485%	30%	485%

From the results in table 7.1 it can be concluded that an increasing error in the precipitation or evapotranspiration data could have much more influence on the resulting downward seepage than errors in the other components. The inaccurate change of storage hardly influences the outcome of downward seepage in the annual water balance.

8 Conclusions

The conclusions drawn here are related to the assembling, processing and analyzing of data; furthermore the results of the analysis are evaluated.

Assembling and processing of data

For water balance studies a continuous record of data is needed. It was, however, impossible to acquire a complete set of data without gaps:

- The Rossum V-notch functioned well, so discharge measurements are almost complete.

- Precipitation measurements with the automatic recorders failed in times of excessive rainfall; weekly readings of both hand raingauges are available.

- The one groundwater recorder is not enough for a reliable determination of storage and certainly not representative for the whole catchment.

- The lysimeters failed in times of excessive rainfall through overflow; leakage occurred in only one of sixteen and approximately half of the lysimeters tended to become oval shaped due to intensive weighing. Nevertheless the evapotranspiration figures are conform values given in literature about evapotranspiration of peatlands and Penman figures of surrounding meteorological stations.

- The recharge to the pump in the lysimeter test for determining the storage coefficient over depth was so slow that a depth below 20 cm could not be reached within the limited time period of 10 days.

Regarding the lack of data mentioned above, a great part of the analysis for the water balance had to be done using weekly readings.

Analysis

The conductivity test for the horizontal groundwater flow does not give the result that had been expected; there is no decrease in conductivity towards depth due to compaction. The measured k-values are in such order (maximum 0.0056 m/day) that horizontal flow is neglected in further calculations. A calculation with a model given by Bakker showed a horizontal outflow of less than a millimetre a year.

The lysimeters give a result of 557 mm over a year (19 April 1991 - 24 April 1992), which is 25% higher than the average Penman evapotranspiration of two nearest weather stations.

As can be expected, the major part of this difference is related to the winter period.

Between the evapotranspirations according to Penman and the lysimeters a linear relation exists. A regression function is derived in order to estimate actual evapotranspiration in periods preceding the lysimeter measurements on the bog.

There is a precipitation excess of 320 mm over the lysimeter year with a small shortage of water in late spring and summer of 1991. Precipitation over the same period is 877 mm.

The storage coefficient determined with the lysimeters show no clear trend over depth, but there is a significant difference between good (μ = 0.35) and poor (μ = 0.26) acrotelm. The average storage coefficient used in the water balance is: **μ = 0.31**, resulting in a storage of 4 mm over the lysimeter year. An extra storage is caused by swelling and shrinkage of the peat surface; according to the benchmark data the maximum fluctuation is 7 cm. Assuming a water content of 95% in the acrotelm an extra storage of -16 mm over the lysimeter year results. The total change of storage over the year is -12 mm.

The gradients in hydraulic heads on both transects indicate downward seepage. Three methods, using Darcy's law, give an estimation for these losses in the water balance. The *k*-values for vertical flow are assumed to be limited by the *k*-values for horizontal flow. Therefore the determined seepage rate in each method can be seen as a maximum.

Method 1: harmonic average for the hydraulic conductivity over depth and hydraulic gradients averaged over all available piezometer depth intervals (from B-tubes downwards); for both transects.
v_d = 36 mm/year

Method 2: harmonic average for the hydraulic conductivity over depth and hydraulic gradients averaged over maximum piezometer depth intervals (from phreatic tubes to the bottom of the peat); for both transects.
v_d = 46 mm/year

In method 1 and 2 the concerning piezometer sets have been weighed for the area they represent.

Method 3: hydraulic resistance and difference in hydraulic head (specific for concerning peat layer); for five sets of piezometers in the middle of the bog.
v_d = 55 mm/year

The first water balance for six equal seasons, neglecting the swelling and shrinkage of the peat surface, shows great fluctuations in downward seepage and even indicates upward seepage in three seasons. If swelling and shrinkage is taken into account for the last four seasons (the lysimeter year) these fluctuations diminish.

The water balance, in which the downward seepage is the unknown variable, as a total over this year reads:

Precipitation	:	**877 mm**
Evapotranspiration	:	**557 mm**
Discharge	:	**263 mm**
Change in storage	:	**-12 mm**
Downward seepage	:	**69 mm**

This result for downward seepage approaches the seepage found with the methods using Darcy's law, regarding an error range of 10-40% in the individual water balance components.

Catchment size determination by hydrograph analysis is not possible, because the acrotelm, through which most of the discharges goes, behaves like a non-linear system; the linear reservoir coefficients derived for different values of discharges increase rapidly for decreasing discharges. Curve fitting for the recession limb is well possible with a discretion for discharge, fitting recession limbs for linear reservoirs on small intervals of discharges. The catchment sizes derived from the hydrograph are only half the size of the catchment based on surface contours.

Non-linearity is explained in two ways: absence of acrotelm along the borders of the bog and decreasing transmissivities with depth in the acrotelm. The area without acrotelm is in the same order of magnitude as the catchment sizes derived from the hydrographs. The transmissivities over depth follow about the same line the linear reservoir coefficients do for the phreatic water level.

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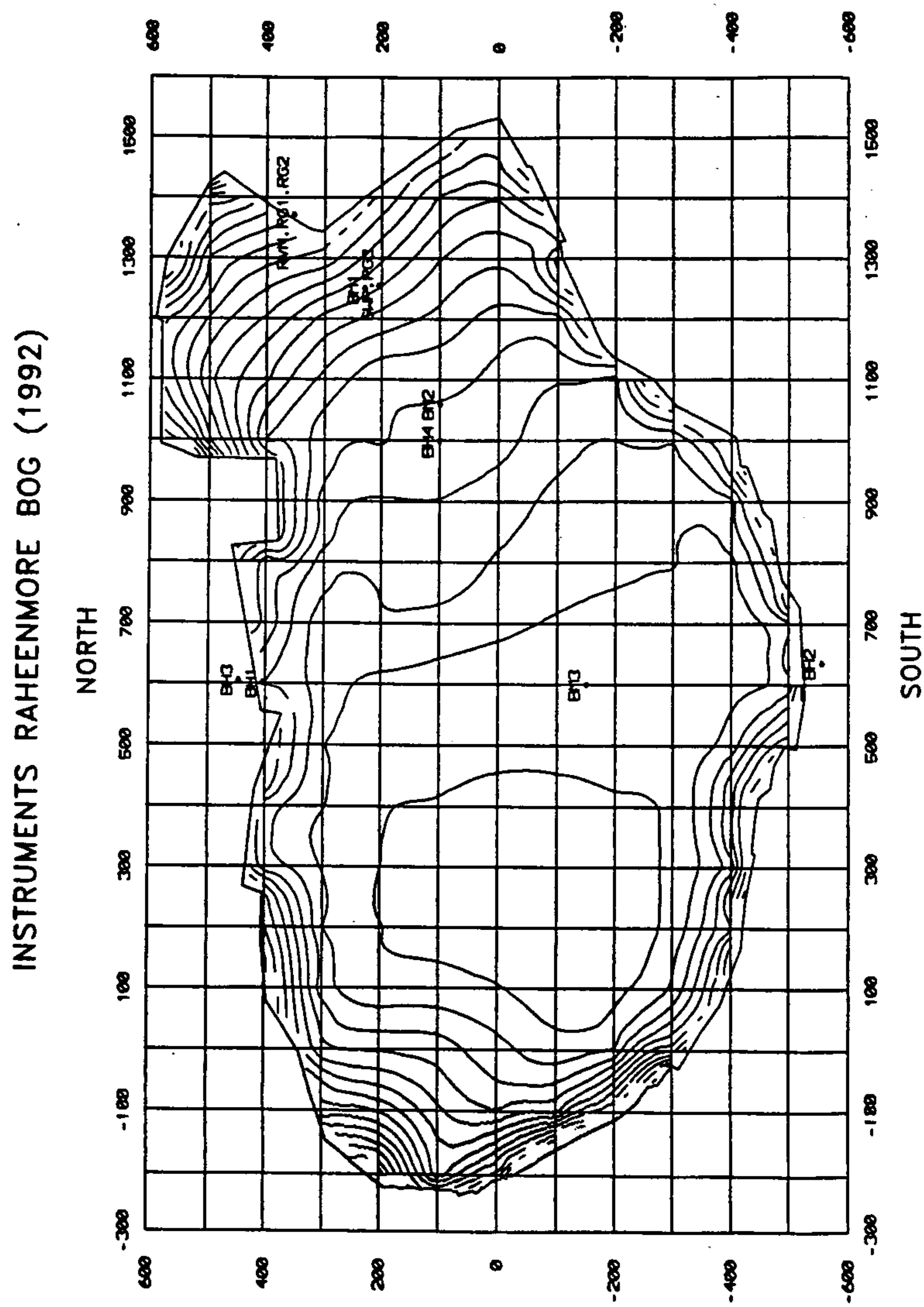
APPENDIX 1a

Raheenmore Bog: position of instruments (scale 1 : 10000)

———— contour line; BH = Borehole; BM = Benchmark;
RG = Raingauge; RVN = Rossum V-notch; GWR = Groundwater recorder

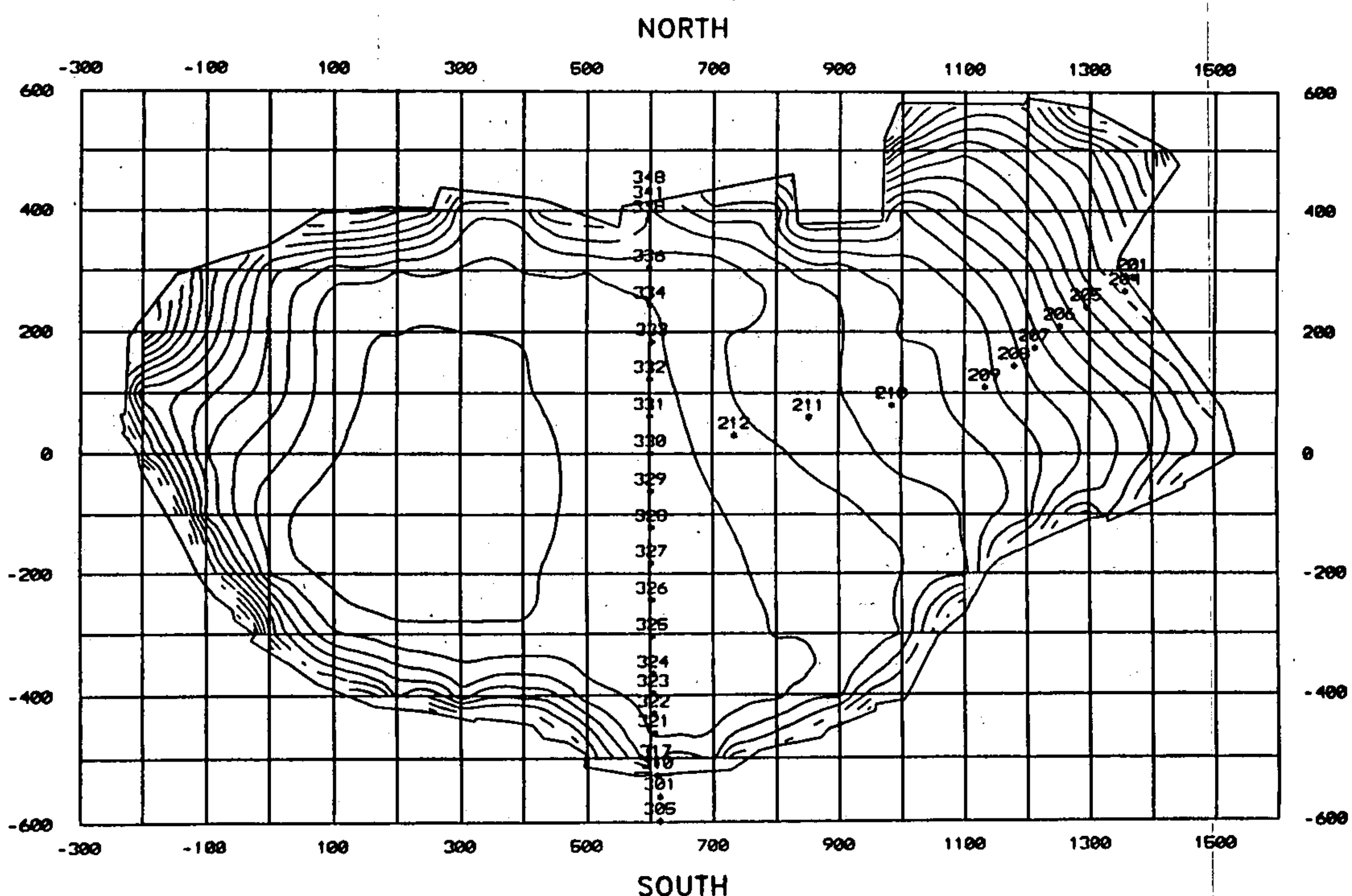


APPENDIX 1b

Raheenmore Bog: position of piezometers (scale 1 : 10000)

201 - 212: east-west transect
301 - 348: north-south transect

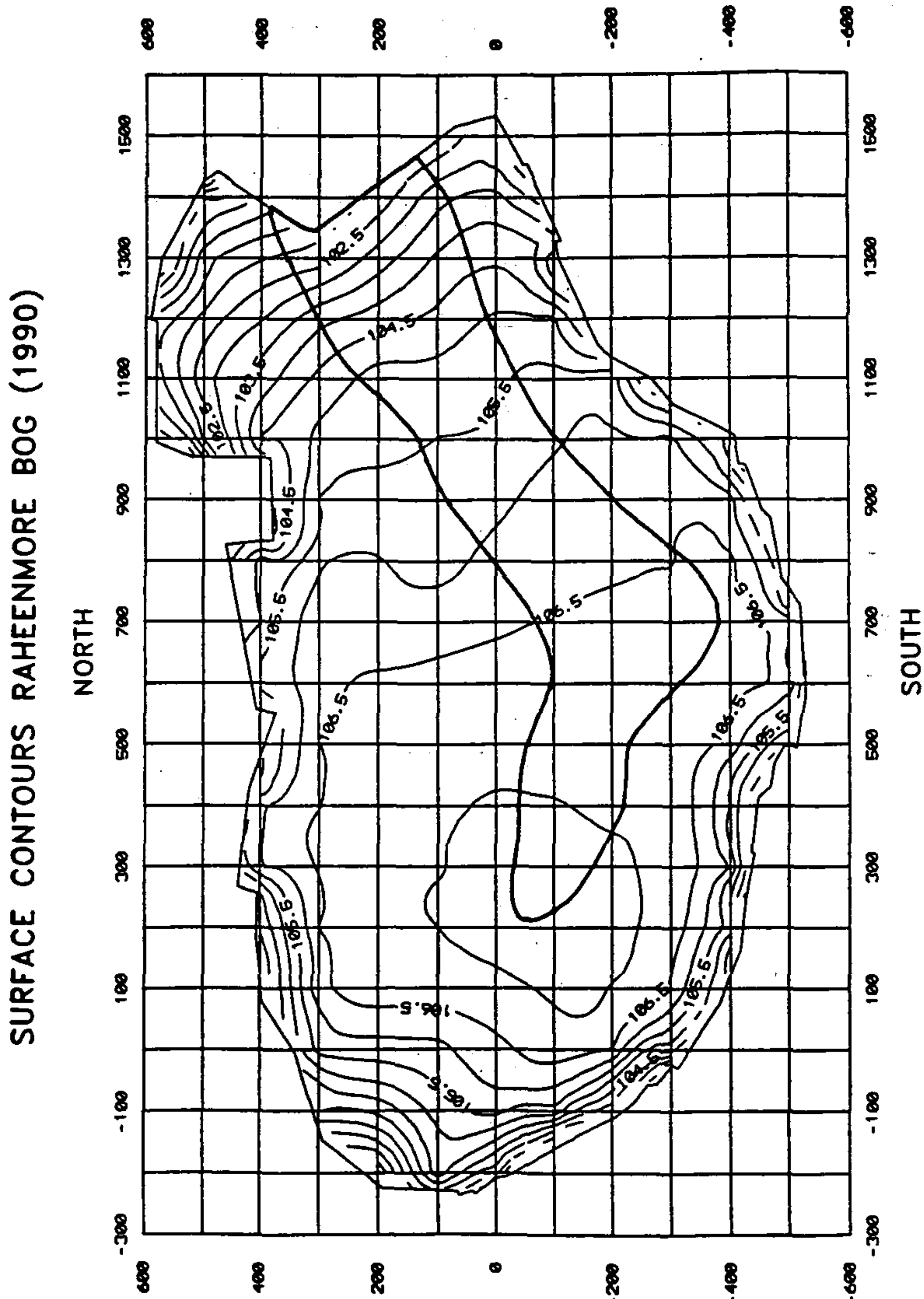
TUBES RAHEENMORE BOG (1992)



APPENDIX 2a

Raheenmore Bog: catchment based on contour lines (scale 1 : 10000)

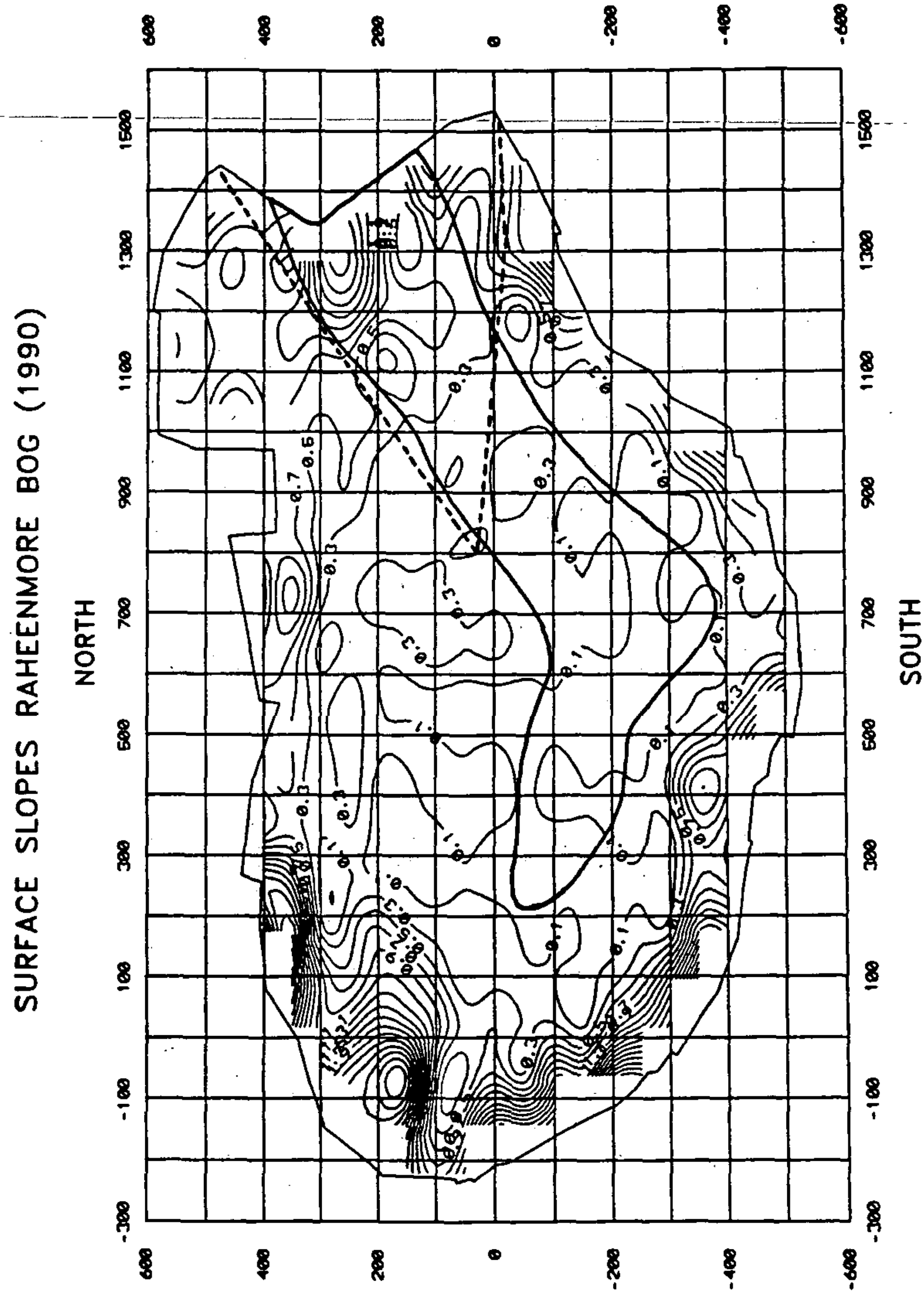
——————— catchment (33 ha)
—104.5— contour line (m.O.D.)



APPENDIX 2b

Raheenmore Bog: gradients in surface levels (scale 1 : 10000)

—0.3— slope contour of 0.3 percent
--------- old set of drains



APPENDIX 3

Guinness method

This method is suitable for acrotelm-transmissivity values of 25 m^2/day and more.

A square hole, penetrating the acrotelm (about 40 cm deep), is dug. The size (approximately 20x20 cm) is measured and the effective radius is calculated with:

$$r_{eff} = \frac{\frac{a+b}{2\sqrt{\pi}} + \frac{a+b}{\pi}}{2}$$

in which	a,b	:	sides of the hole	(m)
	r_{eff}	:	effective radius	(m)

With a pump a constant discharge is taken out, until the water level in the acrotelm hole is constant. The drawdown, the discharge and the time of pumping is measured.
Assuming radial flow towards a well, the transmissivity can be calculated according to:

$$T = \frac{Q \ln(n)}{2 \pi s_w}$$

in which	T	:	transmissivity	(m^2/s)
	Q	:	discharge	(m^3/s)
	n	:	ratio of the radius of the drawdown cone to the radius of the well	(-)
	s_w	:	drawdown	(m)

With the following implicit equation n can be calculated:

$$t = \left(1 + \frac{\mu \, (n^2 - 2\ln(n) - 1)}{2\ln(n)}\right) \times \frac{\pi \, r_w^2 \, s_w}{Q}$$

in which	t	:	time needed to reach "semi steady state"	(s)
	μ	:	storage coefficient	(-)
	r_w	:	radius of the well	(m)

The most important conditions that have to be met to apply the Guinness method are:

- horizontal and radial flow, which implies a wholly penetrating hole, relative impermeability of the catotelm, a horizontal phreatic level before pumping and a relatively small drawdown (5-10% of the aquifer); it should be realized that the transmissivity of the acrotelm underestimates considerably anyway, especially when the water levels are high; usually the drawdown high water is less than 5%.
- a homogeneous aquifer
- a constant thickness of the acrotelm
- a constant discharge

APPENDIX 4

Results of acrotelm-transmissivity measurements

loc.	date: 17/04/91		date: 05/06/91		date: 01/11/91	
X Y	*z*	*T*	*z*	*T*	*z*	*T*
L13	3	63				
L12	5	61				
L11	2	116			16.9	28
L 9	2	1182	17.5	11.5	7.5	442
L 8	0	67	20.4	12.3	10.1	62
L 7	7	20			8.9	4.8
L 6	0	58	6.3	11.3	1.9	29
L 5	0	51	11	8.5	4.9	25
L 4	2	17			6.0	2.7
L 3	2	85	8.5	77	4.5	190
L 2	2	28	11.5	10.8	5.0	71
L 1	8	11.2			7.1	2.9
L 0	3	6.3			2.2	4.4
L-1	4	10.4			1.4	34
J 6	1	11.4			-0.6	16
K 6	2	24			0.9	19
M 6	2	100	10.5	50	0.7	131
N 6	0	31	9.2	25	1.1	53
O 6	2	43	12.7	34	2.0	160
P 6	3	28	15	40	2.4	81
Q 6	2	62			0.8	259

loc.	date: 19/11/91		date: ??/05/92		
X Y	*z*	*T*	*z*	*T*	*T*(avg)
L13	2.9	50			56.5
L12	6.4	59	5.9	41	60.0
L11	4.0	84	4.4	37	76.0
L 9	4.2	733	4.1	778	592.1
L 8	5.5	339	7.8	96	120.1
L 7	7.1	6.4	7.3	43	10.4
L 6	0.9	22	0.1	25	30.1
L 5	1.0	851	1.5	42	233.9
L 4	3.4	3.5	4.4	3	7.7
L 3	5.4	96			112.0
L 2	6.0	82			48.0
L 1	9.2	5.7			6.6
L 0	3.0	3.4			4.7
L-1	2.0	10.6			18.3
J 6	-0.2	5.2			10.9
K 6	1.7	9.9			17.6
M 6	1.0	110			97.8
N 6	0.9	55			41.0
O 6	2.2	104			85.3
P 6	3.2	43			48.0
Q 6	2.5	95			138.7

z : height water level under surface (cm)
T : transmissivity (m^2/day)

APPENDIX 5

Seasonal water balance Raheenmore Bog September 1990 - April 1992

Catchment area : 330000 m²
Storage coefficient : 0.31

Date	Time	Roundtime	Data-date	P (mm)	E (mm)	Q (0.1 m³)	ΔS cum (mm)
18-Sep-90	10.57	11:00	26-Sep-90	13.04			0
26-Sep-90	11.34	12:00	03-Oct-90	30.90			
03-Oct-90	14.20	14:00	09-Oct-90	22.69			30
09-Oct-90	15.38	16:00	17-Oct-90	69.01			
17-Oct-90			24-Oct-90	8.16			41
24-Oct-90	17.45	18:00	01-Nov-90	22.87			
01-Nov-90	11.35	12:00	06-Nov-90	1.50			31
06-Nov-90	11.30	12:00	14-Nov-90	13.11			
14-Nov-90	15.55	16:00	20-Nov-90	32.51			36
20-Nov-90	11.45	12:00	27-Nov-90	31.15			
27-Nov-90	16.25	16:00	04-Dec-90	0.60			25
04-Dec-90	12.38	13:00	07-Dec-90	9.45			
07-Dec-90			18-Dec-90	1.78			23
18-Dec-90	11.00	11:00	23-Dec-90	48.08			
23-Dec-90	13.55	14:00	06-Jan-91	97.78			
06-Jan-91	15.15	15:00	11-Jan-91	20.25	92.2	536987	45
Corrections:						53436	-
Total 18 sep 1990 - 6 jan 1991 in mm:				423	92	179	45

$v_d = P - E - Q - \Delta S = 106$ mm

Date	Time	Roundtime	Data-date	P (mm)	E (mm)	Q (0.1 m³)	ΔS cum (mm)
11-Jan-91		13:00	17-Jan-91	3.28			
17-Jan-91	11.45	12:00	18-Jan-91	5.75			
18-Jan-91			24-Jan-91				-8
24-Jan-91			01-Feb-91	5.60			
01-Feb-91	13.50	14:00	07-Feb-91	16.30			-9
07-Feb-91	13.50	14:00	14-Feb-91	7.20			
14-Feb-91	11.50	12:00	21-Feb-91	24.45			-2
21-Feb-91	10.25	10:00	28-Feb-91	27.75			
28-Feb-91	14.20	14:00	08-Mar-91	34.80			22
08-Mar-91	12.40	13:00	15-Mar-91	18.85			
15-Mar-91	12.00	12:00	22-Mar-91	42.55			19
22-Mar-91	10.30	11:00	28-Mar-91	2.40			
28-Mar-91	13.50	14:00	04-Apr-91	17.45			17
04-Apr-91	11.55	12:00	12-Apr-91	66.05			
12-Apr-91	14.40	15:00	19-Apr-91	0.30	106.3	681306	8
Corrections:						-20514	-
Total 6 jan 1991 - 19 apr 1991 in mm :				273	106	200	8

$v_d = P - E - Q - \Delta S = -42$ mm

Date	Time	Roundtime	Data-date	P (mm)	E (mm)	Q (0.1 m³)	ΔS cum (mm)
19-Apr-91	10.30	11:00	26-Apr-91	15.50	14.08	16484	0
26-Apr-91	13.10	13:00	03-May-91	24.80	18.54	31637	2
03-May-91	13.25	13:00	10-May-91	3.15	15.93	12311	
10-May-91	11.32	12:00	17-May-91	1.25	16.01	4976	-21
17-May-91	11.45	12:00	23-May-91	0.40	14.53	1485	
23-May-91	12.40	13:00	31-May-91	0.30	23.13	485	-50
31-May-91	13.00	13:00	07-Jun-91	7.35	13.81		
07-Jun-91			14-Jun-91	31.15	18.40	1569	-22
14-Jun-91	15.30	16:00	22-Jun-91	23.75	18.19	1868	
22-Jun-91	17.05	17:00	27-Jun-91	23.10	11.94	5148	-13
27-Jun-91	14.55	15:00	04-Jul-91	19.45	10.80	15039	
04-Jul-91	12.10	12:00	11-Jul-91	12.15	21.40	5889	-20
11-Jul-91	13.45	14:00	31-Jul-91	33.70	44.33	6354	-38
Correction:						-26143	-33
Total 19 apr 1991 - 31 jul 1991 in mm :				196	241	23	-71

$v_d = P - E - Q - \Delta S = 3$ mm

Date	Time	Roundtime	Data-date	P (mm)	E (mm)	Q (0.1 m³)	ΔS cum (mm)
31-Jul-91	13.20	13:00	09-Aug-91	20.35	18.76	6784	24
09-Aug-91	16.12	16:00	15-Aug-91	6.05	11.71	5431	
15-Aug-91	12.20	12:00	23-Aug-91	8.50	18.21	1221	1
23-Aug-91	12.25	12:00	29-Aug-91	0.15	8.56	124	
29-Aug-91	10.30	11:00	06-Sep-91	0.00	18.52	1	-32
06-Sep-91	10.55	11:00	12-Sep-91	0.00	9.36	0	
12-Sep-91	12.40	13:00	20-Sep-91	21.20	14.24	0	-19
20-Sep-91	12.00	12:00	27-Sep-91	23.05	8.47	1931	
27-Sep-91	11.45	12:00	03-Oct-91	21.95	7.65	3083	20
03-Oct-91	12.30	13:00	07-Oct-91	37.30	4.46	7074	
07-Oct-91	13.17	13:00	12-Oct-91	2.55	4.99	15389	
12-Oct-91	11.40	12:00	17-Oct-91	11.85	2.68	18653	25
Correction:						23201	-6
Total 31 jul 1991 - 17 oct 1991 in mm :				153	128	25	19

$v_d = P - E - Q - \Delta S = -19$ mm

Date	Time	Roundtime	Data-date	P (mm)	E (mm)	Q (0.1 m³)	ΔS cum (mm)
17-Oct-91	12.20	12:00	24-Oct-91	1.10	4.43	9488	
24-Oct-91	16.00	16:00	01-Nov-91	47.45	5.87	20496	11
01-Nov-91	12.10	12:00	08-Nov-91	26.25	5.80	45617	
08-Nov-91	15.40	16:00	15-Nov-91	30.80	4.97	45722	9
15-Nov-91	14.38	15:00	22-Nov-91	15.50	2.03	36505	
22-Nov-91	10.40	11:00	29-Nov-91	23.30	4.63	33805	9
29-Nov-91	13.47	14:00	30-Nov-91	1.50	0.57		
30-Nov-91	16.38	17:00	06-Dec-91	0.10	3.47	19436	
06-Dec-91	14.45	15:00	13-Dec-91	0.13	1.37	7438	-3
13-Dec-91	11.08	11:00	20-Dec-91	38.55	3.92	17551	
20-Dec-91	14.58	15:00	27-Dec-91	34.70	3.92	59445	11
27-Dec-91	14.39	15:00	03-Jan-92	10.30	6.45	24384	
03-Jan-92	13.58	14:00	10-Jan-92	50.35	3.73	77639	13
Correction:						13612	24
Total 17 oct 1991 - 10 jan 1992 in mm :				280	51	125	37

$v_d = P - E - Q - \Delta S = 67$ mm

Date	Time	Roundtime	Data-date	P (mm)	E (mm)	Q (0.1 m³)	ΔS cum (mm)
10-Jan-92	15.02	15:00	17-Jan-92	0.70	1.00	26825	
17-Jan-92	12.33	13:00	24-Jan-92	2.80	2.85	15523	-6
24-Jan-92	11.27	11:00	31-Jan-92	8.80	4.35	14854	
31-Jan-92	14.35	15:00	07-Feb-92	3.40	5.39	8778	
07-Feb-92	15.15	15:00	14-Feb-92	17.55	6.20	9335	
14-Feb-92	11.58	12:00	21-Feb-92	9.85	7.98	12970	-5
21-Feb-92	13.22	13:00	28-Feb-92	24.00	8.36	23548	
28-Feb-92	16.44	17:00	06-Mar-92	8.40	8.51	17627	
06-Mar-92	15.20	15:00	12-Mar-92	30.45	7.60	22289	
12-Mar-92	16.42	17:00	20-Mar-92	16.60	10.52	25371	3
20-Mar-92	14.25	14:00	25-Mar-92	29.90	7.55	29189	
25-Mar-92	12.55	13:00	03-Apr-92	20.10	15.34	28062	
03-Apr-92	14.5	15:00	10-Apr-92	20.10	16.17	25581	
10-Apr-92	15.18	15:00	17-Apr-92	26.30	19.15	25776	
17-Apr-92	15.5	16:00	24-Apr-92	28.70	15.94	21109	4
24-Apr-92	12.37	13:00					
Correction:						-10743	-1
Total 10 jan 1992 - 17 apr 1992 in mm :				248	137	90	3

$v_d = P - E - Q - \Delta S = 18$ mm

	Rainfall (mm)	Evapotr. (mm)	Discharge (mm)	Storage (mm)	Seepage (mm)
Total 18 sep 1990 - 6 jan 1991 in mm :	423	92	179	45	106
Total 6 jan 1991 - 19 apr 1991 in mm :	273	106	200	8	-42
Total 19 apr 1991 - 31 jul 1991 in mm :	196	241	23	-71	3 (-30)
Total 31 jul 1991 - 17 oct 1991 in mm :	153	128	25	19	-19 (-25)
Total 17 oct 1991 - 10 jan 1992 in mm :	280	51	125	37	67 (91)
Total 10 jan 1992 - 24 apr 1992 in mm :	248	137	90	3	18 (17)

(...): without correction swelling and shrinkage

APPENDIX 6

Precipitation data Raheenmore Bog

Codes for charts: R = Reliable
U = Unreliable
M = Missing
P = Partly missing

CHART				WEEKLY CHECK		OCCASIONAL CHECK	
Start	End	C	total (mm)	Date	total (mm)	Date	total (mm)
14-Oct-89	21-Oct-89	U					
21-Oct-89	28-Oct-89	R					
28-Oct-89	04-Nov-89	U					
04-Nov-89	13-Nov-89	M					
13-Nov-89	20-Nov-89	U					
20-Nov-89	27-Nov-89	U					
27-Nov-89	05-Dec-89	U					
05-Dec-89	12-Dec-89	M					
12-Dec-89	19-Dec-89	M		11-Dec-89	0.1		
19-Dec-89	26-Dec-89	M		19-Dec-89	51		
26-Dec-89	02-Jan-90	M		26-Dec-89	18.5		
02-Jan-90	09-Jan-90	M		04-Jan-90	13.65		
09-Jan-90	16-Jan-90	M		13-Jan-90	18.75		
16-Jan-90	23-Jan-90	M		21-Jan-90	21.4		
23-Jan-90	30-Jan-90	M		27-Jan-90	42.9		
30-Jan-90	06-Feb-90	M		31-Jan-90	11.95		
06-Feb-90	09-Feb-90	M		08-Feb-90	85.35		
09-Feb-90	15-Feb-90	U		15-Feb-90	25.4		
15-Feb-90	22-Feb-90	U		22-Feb-90	19.63		
22-Feb-90	01-Mar-90	U		01-Mar-90	47.87		
01-Mar-90	08-Mar-90	U		08-Mar-90	6.93		
08-Mar-90	15-Mar-90	M		16-Mar-90	5.08		
15-Mar-90	22-Mar-90	M		22-Mar-90	1.19		
22-Mar-90	28-Mar-90	R	6.7	28-Mar-90	6.7		
29-Mar-90	05-Apr-90	R	19.72	05-Apr-90	19.34		
05-Apr-90	12-Apr-90	R	6.78	12-Apr-90	4.74		
12-Apr-90	18-Apr-90	R	19.79	18-Apr-90	19.12		
18-Apr-90	25-Apr-90	R	0.3	26-Apr-90	3.29		
26-Apr-90	04-May-90	R	0.7	04-May-90	0.83		
04-May-90	10-May-90	R	9.5	10-May-90	9.67		
10-May-90	17-May-90	R	17.7	17-May-90	17.01		
17-May-90	24-May-90	R	0	24-May-90	0		
24-May-90	31-May-90	R	18.5	31-May-90	19.63		
31-May-90	07-Jun-90	R	17.2	07-Jun-90	17.44		
07-Jun-90	14-Jun-90	R		14-Jun-90	5.5		
14-Jun-90	21-Jun-90	R	21.7	21-Jun-90	20.86		
21-Jun-90	27-Jun-90	R	17.6	27-Jun-90	17.91		
27-Jun-90	05-Jul-90	U		05-Jul-90	62.85		
05-Jul-90	13-Jul-90	R		13-Jul-90	8.91		
13-Jul-90	19-Jul-90	R	0.7	19-Jul-90	1.27		
19-Jul-90	25-Jul-90	R	0	25-Jul-90	0		
25-Jul-90	01-Aug-90	R	24.94	01-Aug-90	25.14		
01-Aug-90	08-Aug-90	R	0	08-Aug-90	0		
08-Aug-90	15-Aug-90	R	14.8	15-Aug-90	14.83		
15-Aug-90	23-Aug-90	R	26.95	23-Aug-90	28.19		
23-Aug-90	29-Aug-90	U		29-Aug-90	49.5		
29-Aug-90	06-Sep-90		15.51	06-Sep-90	17.53		
06-Sep-90	12-Sep-90	R	0.5	12-Sep-90	0.55		
12-Sep-90	18-Sep-90	R	1.09	18-Sep-90	1.09		

CHART				WEEKLY CHECK		OCCASIONAL CHECK	
Start	End	C	total (mm)	Date	total (mm)	Date	total (mm)
18-Sep-90	26-Sep-90	R	13	26-Sep-90	13.04		
26-Sep-90	03-Oct-90	R	19	03-Oct-90	30.9		
03-Oct-90	09-Oct-90	R	22	09-Oct-90	22.69		
09-Oct-90	17-Oct-90	U		17-Oct-90	69.01		
17-Oct-90	24-Oct-90	R	8.34	24-Oct-90	8.16		
24-Oct-90	01-Nov-90	R	23.48	01-Nov-90	22.87		
01-Nov-90	06-Nov-90	R	1.67	06-Nov-90	1.5		
06-Nov-90	14-Nov-90	R	10.76	14-Nov-90	13.11		
14-Nov-90	20-Nov-90	R	31.02	20-Nov-90	32.51		
20-Nov-90	27-Nov-90	U	24.99	27-Nov-90	31.15		
27-Nov-90	05-Dec-90	U		04-Dec-90	0.6		
05-Dec-90	12-Dec-90	M		07-Dec-90	9.45		
12-Dec-90	19-Dec-90	M		18-Dec-90	1.78		
19-Dec-90	26-Dec-90	U		23-Dec-90	48.08		
23-Dec-90	06-Jan-91	U		06-Jan-91	97.78		
06-Jan-91	11-Jan-91	U		11-Jan-91	20.25		
11-Jan-91	17-Jan-91	U		17-Jan-91	3.28		
18-Jan-91	24-Jan-91	U		24-Jan-91		18-Jan-91	5.75
24-Jan-91	29-Jan-91	U		01-Feb-91	5.6		
29-Jan-91	05-Feb-91	U		07-Feb-91	16.3		
		M		14-Feb-91	7.2		
		M		21-Feb-91	24.45		
		M			27.75		
		M		08-Mar-91	34.8		
09-Mar-91	15-Mar-91	R	18.1	15-Mar-91	18.85		
15-Mar-91	22-Mar-91	U		22-Mar-91	42.55		
22-Mar-91	28-Mar-91	R	2.1	28-Mar-91	2.4		
28-Mar-91	04-Apr-91	R	16.9	04-Apr-91	17.45		
04-Apr-91	12-Apr-91	U		12-Apr-91	66.05		
12-Apr-91	19-Apr-91	U		19-Apr-91	0.3		
19-Apr-91	26-Apr-91	R	15.9	26-Apr-91	15.5		
26-Apr-91	03-May-91	U		03-May-91	24.8		
03-May-91	10-May-91	R	2.6	10-May-91	3.15		
10-May-91	17-May-91	R	1.3	17-May-91	1.25		
17-May-91	23-May-91	R	0.4	23-May-91	0.4		
23-May-91	31-May-91	R	0.5	31-May-91	0.3		
31-May-91	07-Jun-91	R	7.4	07-Jun-91	7.35		
07-Jun-91	14-Jun-91	R	31	14-Jun-91	31.15		
14-Jun-91	22-Jun-91	U		22-Jun-91	23.75		
22-Jun-91	27-Jun-91	U		27-Jun-91	23.1		
27-Jun-91	04-Jul-91	U		04-Jul-91	19.45		
04-Jul-91	12-Jul-91	U		11-Jul-91	12.15		
		M					
		M					
		M		31-Jul-91	33.7		
31-Jul-91	03-Aug-91	U					
03-Aug-91	09-Aug-91	R	20.5	09-Aug-91	20.35		
09-Aug-91	15-Aug-91	U		15-Aug-91	6.05		
15-Aug-91	21-Aug-91	M					
21-Aug-91	23-Aug-91	R	2	23-Aug-91	8.5		
23-Aug-91	29-Aug-91	R	0	29-Aug-91	0.15		
29-Aug-91	05-Sep-91	R	0	06-Sep-91	0		
05-Sep-91	12-Sep-91	R	0	12-Sep-91	0		
12-Sep-91	20-Sep-91	R	21.2	20-Sep-91	21.2		
20-Sep-91	27-Sep-91	R	21.8	27-Sep-91	23.05		
27-Sep-91	03-Oct-91	R	21.3	11-Oct-91	21.95	07-Oct-91	37.3
03-Oct-91	11-Oct-91	R	37.6	12-Oct-91	2.55		
11-Oct-91	17-Oct-91	R	14.44	17-Oct-91	11.85		
17-Oct-91	24-Oct-91	R	1.3	24-Oct-91	1.1		
24-Oct-91	01-Nov-91	U		01-Nov-91	47.45		

CHART				WEEKLY CHECK		OCCASIONAL CHECK	
Start	End	C	total (mm)	Date	total (mm)	Date	total (mm)
01-Nov-91	08-Nov-91	P		08-Nov-91	26.25		
08-Nov-91	15-Nov-91	U		15-Nov-91	30.8		
15-Nov-91	22-Nov-91	U		22-Nov-91	15.5		
22-Nov-91	29-Nov-91	R		29-Nov-91	23.3		
29-Nov-91	06-Dec-91	R		06-Dec-91	1.6	30-Nov-91	1.5
06-Dec-91	13-Dec-91	R		13-Dec-91	0.13		
13-Dec-91	20-Dec-91	R		20-Dec-91	38.6	17-Dec-91	9.4
20-Dec-91	27-Dec-91	R		27-Dec-91	34.7		
27-Dec-91	03-Jan-92	R		03-Jan-92	10.3		
03-Jan-92	10-Jan-92	R		10-Jan-92	50.35		
10-Jan-92	17-Jan-92	P		17-Jan-92	0.7		
17-Jan-92	24-Jan-92	P		24-Jan-92	2.8		
24-Jan-92	31-Jan-92	R		31-Jan-92	8.8		
31-Jan-92	07-Feb-92	R		07-Feb-92	3.4		
07-Feb-92	14-Feb-92			14-Feb-92	17.55		
14-Feb-92	21-Feb-92			21-Feb-92	9.85		
21-Feb-92	28-Feb-92			28-Feb-92	24		
28-Feb-92	06-Mar-92			06-Mar-92	8.4		
06-Mar-92	13-Mar-92			12-Mar-92	30.45		
13-Mar-92	20-Mar-92			20-Mar-92	16.6		
20-Mar-92	27-Mar-92			25-Mar-92	29.9		
27-mrt-92	03-apr-92			03-apr-92	20,1		
03-apr-92	10-apr-92			10-apr-92	20,1		
10-apr-92	17-apr-92			17-apr-92	26,3		
17-apr-92	24-apr-92			24-apr-92	28,7		

APPENDIX 7

Penman evapotranspiration in mm:

Month	Birr	Mullingar	AVG
aug 1989	63.0	54.0	58.5
sep	34.0	35.0	34.5
oct	19.0	21.0	20.0
nov	4.0	3.0	3.5
dec	0.0	0.0	0.0
jan 1990	5.5	3.8	4.7
feb	18.0	18.4	18.2
mrt	34.5	36.4	35.4
apr	49.4	53.1	51.3
may	76.0	78.3	77.1
jun	71.4	75.5	73.4
jul	93.4	95.8	94.6
aug	57.5	58.5	58.0
sep	38.4	37.5	37.9
oct	20.6	16.2	18.4
nov	1.1	0.0	0.6
dec	0.0	0.0	0.0
jan 1991	1.5	0.0	0.7
feb	7.5	6.4	7.0
mar	22.6	23.0	22.8
apr	46.0	58.2	52.1
may	68.3	76.2	72.2
jun	69.1	73.8	71.5
jul	68.4	80.3	74.3
aug	57.7	61.0	59.4
sep	40.6	47.4	44.0
oct	15.6	15.9	15.7
nov	3.8	2.6	3.2
dec	1.2	0.0	0.6
jan 1992	1.2	6.9	4.1
feb	15.5	12.9	14.2
mar	26.3	28.0	27.2
apr	42.9	43.0	43.0
may	77.0	82.4	79.7
jun	80.1	90.8	85.5
jul	69.4	75.5	72.5
aug	57.0	66.5	61.8

APPENDIX 8a

Evapotranspiration according to the lysimeters (example)

Radius	=	0.2 m
Surface area	=	0.13 m²
Lysimeter	=	1
Vegetation	=	heather (*Calluna vulgaris* (+ *Erica*))

Mass balance $\Delta W = P + A - E$

with

W	:	Weight lysimeter	(m)
P	:	Precipitation	(m)
A	:	Amount of water added to lysimeter	(m)
E	:	Evapotranspiration	(m)

PERIOD t-1	t	WEIGHT t-1 (kg)	t (kg)	ΔW (kg)	RAIN (mm)	(ml)	ADDING date	after/ before weighing	(l)	tot. (l)	EVAPO (ml)	(mm/d)
1991												
	19/04		64.3									
19/04	26/04	64.3	66.1	1.8	15.50	1948	19/04	after	2.00	2.00	2148	2.44
26/04	03/05	66.1	66.3	0.2	24.80	3116	26/04	after	-0.70	-0.70	2216	2.52
							03/05	before	0.00			
03/05	10/05	66.3	64.9	-1.4	3.15	396	08/05		0.50	0.50	2296	2.61
10/05	17/05	64.9	62.9	-2.0	1.25	157	15/05		1.00	1.00	3157	3.59
17/05	23/05	62.9	62.5	-0.4	0.40	50	17/05	after	1.00	2.00	2450	3.25
							21/05		1.00			
							23/05	before	0.00			
23/05	31/05	62.5	60.1	-2.4	0.30	38	28/05		0.70	0.70	3138	3.12
31/05	07/06	60.1	60.0	-0.1	7.35	924	31/05	after	1.00	2.00	3024	3.44
							04/06		1.00			
07/06	14/06	60.0	62.9	2.9	31.15	3914	07/06	after	0.00	0.00	1014	1.15
							10/06		0.00			
14/06	22/06	62.9	64.3	1.4	23.75	2985	14/06	after ?	0.50	0.50	2085	2.07
							18/06		0.00			
22/06	27/06	64.3	66.4	2.1	23.10	2903	22/06	after ?	0.00	-0.34	463	0.74
							26/06		-0.34			
27/06	04/07	66.4	65.6	-0.8	19.45	2444	27/06	after	-0.86	-1.81	1434	1.63
							28/06		0.00			
							01/07		-0.95			
04/07	11/07	65.6	66.0	0.4	12.15	1527	04/07	after	0.52	1.52	2647	3.01
							09/07		1.00			
11/07	31/07	66.0	64.4	-1.6	33.70	4235	11/07	after	0.00	0.00	5835	2.32
31/07	09/08	64.4	66.7	2.3	20.35	2557	31/07	after	0.00	-1.07	-813	-0.72
							02/08		0.00			
							06/08		-1.07			
							09/08	before	0.00			
09/08	15/08	66.7	64.3	-2.4	6.05	760	10/08		-1.46	-1.46	1700	2.26
15/08	23/08	64.3	64.4	0.1	8.50	1068	15/08	after	0.00	1.64	2608	2.59
							19/08		1.64			
23/08	29/08	64.4	64.8	0.4	0.15	19	23/08	after	0.00	1.62	1239	1.64
							28/08		1.62			
29/08	05/09	64.8	61.2	-3.6	0.00	0	02/09		0.86	0.86	4460	5.07
05/09	12/09	61.2	61.1	-0.1	0.00	0	05/09	after	0.93	1.49	1590	1.81
							09/09		0.56			
12/09	20/09	61.1	62.2	1.1	21.20	2664				0.00	1564	1.56
20/09	27/09	62.2	64.7	2.5	23.05	2897	20/09	after	0.92	0.48	877	1.00
							24/09		-0.44			
27/09	03/10	64.7	66.2	1.5	21.95	2758	01/10		-0.82	-0.82	438	0.58

PERIOD		WEIGHT		ΔW	RAIN		ADDING				EVAPO	
t-1	t	t-1 (kg)	t (kg)	(kg)	(mm)	(ml)	date	after/ before weighing	(l)	tot. (l)	(ml)	(mm/d)
03/10	11/10	66.2	65.5	-0.7	39.85	5008	03/10	after	-0.82	-5.62	88	0.09
							05/10		-1.03			
							07/10		-1.48			
							11/10	before	-2.29			
11/10	17/10	65.5	65.2	-0.3	11.85	1489	12/10	after	-0.51	-1.52	269	0.36
							14/10		-1.01			
							16/10		0.00			
17/10	24/10	65.2	64.6	-0.6	1.10	138			0.00	0.00	738	0.84
24/10	01/11	64.6	66.0	1.4	47.45	5963	29/10		-0.93	-3.43	1133	1.13
							31/10		-2.50			
01/11	08/11	66.0	65.3	-0.7	26.25	3299	01/11	after	-0.93	-3.34	659	0.75
							04/11		-0.95			
							08/11	before	-1.46			
08/11	15/11	65.3	65.7	0.4	30.80	3870	12/11		-1.85	-3.74	-270	-0.31
							14/11		-1.89			
15/11	22/11	65.7	65.9	0.2	15.50	1948	18/11		-1.51	-1.51	238	0.27
22/11	29/11	65.9	65.6	-0.3	23.30	2928	25/11		-2.02	-2.02	1208	1.37
1992												
29/11	06/12	65.6	64.8	-0.8	1.60	201	29/11	after	-0.52	-0.52	481	0.55
06/12	13/12	64.8	64.6	-0.2	0.13	16			0.00	0.00	216	0.25
13/12	20/12	64.6	66.8	2.2	38.6	4851	13/12	after	1.00	-0.24	2411	2.74
							18/12		0.12			
							20/12	before	-1.36			
20/12	27/12	66.8	67.2	0.4	34.7	4361	23/12		-0.92	-0.92	3041	3.46
27/12	03/01	67.2	66.1	-1.1	10.3	1294	27/12	after	0.00	-1.07	1324	1.51
							03/01	before	-1.07			
03/01	10/01	66.1	66.8	0.7	50.35	6327	06/01		-1.51	-1.51	4117	4.68
10/01	17/01	66.8	66.5	-0.3	0.7	88			0.00	0.00	388	0.44
17/01	24/01	66.5	66.3	-0.2	2.8	352			0.00	0.00	552	0.63
24/01	31/01	66.3	66.4	0.1	8.8	1106	31/01	before	-0.41	-0.41	596	0.68
31/01	07/02	66.4	65.8	-0.6	3.4	427			0.00	0.00	1027	1.17
07/02	14/02	65.8	66.3	0.5	17.55	2205	11/02		0.00	-1.47	235	0.27
							14/02	before	-1.47			
14/02	21/02	69.1	69.3	0.2	9.85	1238	21/02		0.00	0.00	1078	1.23
21/02	25/02	69.3	69.1	-0.2	10.8	1357	25/02	before	-0.95	-0.95	607	1.21
25/02	06/03	**LYSIMETER TEST FOR STORAGE COEFFICIENT**										
06/03	12/03	65.6	68.7	3.1	30.45	3826	11/03		0.00	0.00	726	0.96
							12/03	before	0.00			
12/03	20/03	68.7	69.0	0.3	16.6	2086	20/03	before	0.00	0.00	1786	1.78
20/03	25/03	69.0	69.1	0.1	29.85	3751	25/03	before	0.00	0.00	3651	5.81
25/03	03/04	69.1	69.1	0.0	20.1	2526	29/03		-0.46	-0.46	2066	1.83
							03/04	before	0.00			
03/04	13/04	69.1	68.9	-0.2	30.55	3839	06/04	nvt	-0.80	-0.80	3239	2.58
13/04	17/04	68.9	69.1	0.2	15.8	1985	17/04	before	0.00	0.00	1785	3.55
17/04	24/04	69.1										

APPENDIX 8b

Evapotranspiration according to the lysimeters

Lysimeter 1 & 2 : Bad Acrotelm, Heather (*Calluna vulgaris* (+*Erica*))
Lysimeter 3 & 5 : Bad acrotelm, Bog Asphodel (*Narthecium ossifragum*)
Lysimeter 4 & 6 : Bad acrotelm, Common Cotton-Grass (*Eriophorum vaginatum*)
Lysimeter 7 & 8 : Bad acrotelm, Peat Moss (*Sphagnum*)
Lysimeter 9 & 10 : Good acrotelm, Peat Moss (*Sphagnum*)
Lysimeter 11 & 12 : Good acrotelm, Common Cotton-Grass (*Eriophorum vaginatum*)
Lysimeter 13 & 14 : Good acrotelm, Bog Asphodel (*Narthecium ossifragum*)
Lysimeter 15 & 16 : Good acrotelm, Heather (*Calluna vulgaris* (+*Erica*))

PERIOD		LYSIMETER															
mm/dd	mm/dd	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1991																	
04/19	04/26	2.44	2.10	1.76	1.96	1.94	1.65	2.10	2.56	1.76	2.10	2.21	2.21	1.65	1.99	1.76	1.99
04/26	05/03	2.52	1.52	2.27	2.75	2.72	2.42	2.45	2.86	4.10	2.75	2.77	2.75	2.38	3.12	2.47	2.53
05/03	05/10	2.61	2.38	1.93	2.16	1.47	1.81	2.50	3.06	2.16	3.41	2.50	2.50	1.81	2.16	1.70	2.27
05/10	05/17	3.59	2.22	1.74	1.88	1.32	1.54	2.68	3.13	2.34	3.36	2.45	2.45	1.88	2.11	1.66	2.22
05/17	05/23	3.25	2.59	2.19	2.06	1.39	1.79	2.92	3.58	2.98	3.91	1.66	2.32	2.20	1.79	1.66	2.45
05/23	05/31	3.12	2.52	2.33	1.83	1.83	2.13	4.02	4.31	3.72	3.42	2.92	2.92	2.72	3.02	2.33	3.12
05/31	06/07	3.44	2.02	1.73	1.33	1.50	1.62	2.87	2.98	2.64	2.64	1.14	1.16	1.45	2.02	1.85	1.16
06/07	06/14	1.15	2.06	1.95	3.20	4.09	1.72	2.23	2.57	3.68	3.76	2.97	2.37	3.38	3.09	1.66	2.18
06/14	06/22	2.07	2.57	2.14	1.75	1.78	1.84	2.44	2.89	2.39	2.64	3.09	2.57	1.87	1.97	1.87	2.49
06/22	06/27	0.74	3.03	2.74	2.71	2.68	2.55	2.55	3.19	2.68	0.69	2.71	2.71	2.85	1.91	1.76	2.71
06/27	07/04	1.63	0.71	1.38	-1.56	1.51	1.97	1.87	0.86	1.74	2.11	0.23	-0.47	0.98	1.79	1.89	0.48
07/04	07/11	3.01	3.07	2.29	2.61	2.63	2.91	3.45	3.91	3.36	3.16	4.10	3.03	2.60	2.65	1.94	4.20
07/11	07/31	2.32	2.24	1.96	2.12	2.08	2.08	2.44	2.76	2.20	2.20	2.68	2.48	1.88	2.00	1.72	2.28
07/31	08/09	-0.72	-0.67	-0.36	-2.50	-0.25	-0.44	-0.05	-1.74	-0.06	-0.02	-0.68	-0.44	-0.51	-0.32	-0.26	-0.19
08/09	08/15	2.26	1.98	1.57	1.71	1.64	1.92	2.60	2.43	2.15	1.80	1.94	1.94	1.80	1.86	1.62	2.02
08/15	08/23	2.59	2.35	1.67	2.02	1.83	1.93	2.39	2.98	2.23	2.24	3.46	2.52	1.73	2.01	1.96	2.52
08/23	08/29	1.64	1.32	0.93	1.19	1.06	1.32	1.59	1.87	1.32	1.43	2.58	1.59	1.01	1.40	0.82	1.72
08/29	09/05	5.07	2.27	1.93	2.18	1.71	2.16	3.15	3.64	2.73	2.73	2.73	2.73	1.93	2.16	1.82	3.18
09/05	09/12	1.81	1.78	1.25	-0.03	1.30	1.25	2.10	2.22	1.81	1.61	1.75	0.00	1.14	1.50	1.59	1.33
09/12	09/20	1.56	1.95	1.56	2.85	1.46	1.56	2.05	2.35	1.95	1.66	1.95	1.95	1.36	1.36	0.86	2.05
09/20	09/27	1.00	0.22	0.68	1.66	1.24	1.33	1.78	1.64	1.25	1.36	1.54	1.53	1.12	0.79	0.97	1.26
09/27	10/03	0.58	1.13	1.02	1.20	1.16	1.23	1.40	1.43	1.16	1.09	0.83	1.54	0.86	0.97	1.14	3.66
10/03	10/11	0.09	1.28	1.20	1.16	1.18	0.98	1.38	1.36	1.41	0.94	2.08	1.32	0.85	0.87	0.77	0.97
10/11	10/17	0.36	-5.47	0.09	-0.11	0.18	0.10	0.30	-1.08	0.36	0.20	-1.25	0.63	-0.02	0.14	0.47	0.71
10/17	10/24	0.84	0.16	0.38	0.73	0.50	0.61	0.73	0.95	0.61	0.61	0.95	0.95	0.50	0.50	0.38	0.73
10/24	11/01	1.13	1.65	0.86	1.06	2.45	0.85	1.99	1.80	2.72	0.86	0.51	1.50	0.64	1.05	0.86	0.64
11/01	11/08	0.75	-0.83	0.58	0.82	0.84	0.48	1.18	0.51	1.54	0.48	1.06	1.99	0.73	0.57	0.84	0.64
11/08	11/15	-0.31	-0.24	0.46	0.69	0.88	0.65	1.14	0.38	1.39	0.41	0.88	0.90	1.07	0.51	0.68	0.56
11/15	11/22	0.27	0.38	0.28	0.18	0.28	0.16	0.26	0.07	0.53	0.02	0.52	0.37	0.28	0.36	0.38	0.28
11/22	11/29	1.37	0.28	0.34	0.62	0.83	0.28	0.78	0.30	1.41	0.01	0.83	1.02	0.60	0.68	0.70	0.52
11/29	12/06	0.55	0.46	0.48	0.36	0.62	0.61	0.78	0.68	0.44	0.60	-0.06	0.55	0.69	0.67	0.49	0.64
12/06	12/13	0.25	0.13	0.13	0.13	0.25	0.02	0.02	1.04	0.02	0.02	0.25	0.25	0.13	0.13	0.13	0.25
12/13	12/20	2.74	0.28	1.96	0.73	4.62	1.60	2.66	1.76	3.87	2.16	3.26	3.46	1.05	1.82	0.73	2.22
12/20	12/27	3.46	3.90	1.22	3.58	4.04	3.64	3.48	3.06	4.67	2.24	2.30	4.50	1.34	4.12	2.18	3.39
1992																	
12/27	01/03	1.51	1.04	0.98	1.02	1.02	0.83	0.88	0.30	0.83	0.73	1.04	1.30	0.98	0.98	1.02	-0.22
01/03	01/10	4.68	5.32	5.06	4.62	5.81	5.31	6.04	5.81	6.36	3.44	5.20	5.83	1.87	3.71	4.75	4.00
01/10	01/17	0.44	0.10	0.10	0.10	0.10	0.10	-0.01	0.10	-0.01	0.10	0.10	0.10	0.10	0.21	0.33	0.33
01/17	01/24	0.63	0.51	0.40	0.29	0.29	0.29	0.29	0.40	0.29	0.17	0.51	0.51	0.40	0.51	0.51	0.51
01/24	01/31	0.68	0.89	0.79	1.04	0.69	0.90	0.14	0.90	1.12	0.15	0.65	0.64	0.09	0.11	0.23	0.89
01/31	02/07	1.17	0.71	-0.74	0.71	0.71	0.60	0.60	0.71	0.49	0.37	1.05	0.94	0.71	-2.58	0.83	0.60
02/07	02/14	0.27	1.18	1.79	-2.04	-2.05	0.97	0.55	0.72	-0.24	0.35	-2.33	1.62	0.52	1.44	0.97	0.65
02/14	02/21	1.23	1.18	0.95	0.95	1.29	1.07	0.95	1.07	1.75	0.73	1.63	1.18	0.84	0.95	1.18	1.29
02/21	02/25	1.21	0.77	0.81	-0.12	1.90	1.73	0.91	1.15	0.83	0.81	1.51	1.27	1.27	1.13	1.59	0.83
02/25	03/06	LYSIMETER TEST FOR STORAGE COEFFICIENT															
03/06	03/12	0.96	0.96	0.87	1.32	2.10	1.49	1.23	1.23	1.23	1.08	0.43	1.63	1.23	1.49	1.63	1.36
03/12	03/20	1.78	1.88	1.00	1.19	0.93	1.28	1.48	1.58	0.64	0.22	2.17	1.68	1.28	1.48	1.18	1.28
03/20	03/25	5.81	3.90	5.30	5.33	6.77	5.02	5.17	2.31	5.52	3.95	2.63	4.38	2.69	5.17	2.63	2.95
03/25	04/03	1.83	1.74	1.57	1.73	1.78	1.32	1.69	1.92	2.11	1.44	2.22	1.84	1.37	1.66	1.45	1.62
04/03	04/13	2.58	2.39	2.31	2.70	2.77	2.70	2.34	2.61	2.78	1.71	2.36	2.60	1.59	2.06	1.77	1.69
04/13	04/17	3.55	2.36	3.15	0.00	3.00	1.46	1.46	2.73	2.70	1.76	2.52	3.53	1.60	3.08	1.55	1.95

APPENDIX 8c

Corrected lysimeter data (evapotranspiration in mm)

original data		**corrected data**				**with rainfall date corresponding data**	
date	*weeksum*	*period*		*day avg*	*weeksum*	*date*	*weeksum*
26-Apr-91	12.74	04/19/91	04/26/91	2.01	14.08	26-Apr-91	14.08
03-May-91	18.58	04/26/91	05/03/91	2.65	18.58	03-May-91	18.54
10-May-91	14.79	05/03/91	05/10/91	2.28	5.93	10-May-91	15.93
17-May-91	13.64	05/10/91	05/17/91	2.29	16.01	17-May-91	16.01
23-May-91	13.54	05/17/91	05/23/91	2.42	14.53	23-May-91	14.53
31-May-91	22.93	05/23/91	05/31/91	2.89	23.13	31-May-91	23.13
07-Jun-91	13.33	05/31/91	06/07/91	1.97	13.81	07-Jun-91	13.81
14-Jun-91	18.94	06/07/91	06/14/91	2.63	18.40	14-Jun-91	18.40
22-Jun-91	17.20	06/14/91	06/22/91	2.27	18.19	22-Jun-91	18.19
27-Jun-91	12.85	06/22/91	06/27/91	2.39	11.94	27-Jun-91	11.94
04-Jul-91	9.87	06/27/91	07/04/91	1.54	10.80	04-Jul-91	10.80
11-Jul-91	20.11	07/04/91	07/11/91	3.06	21.40	11-Jul-91	21.40
31-Jul-91	43.29	07/11/91	07/31/91	2.22	44.33	31-Jul-91	44.33
09-Aug-91	0.00	07/31/91	08/09/91	2.08	18.76	09-Aug-91	18.76
15-Aug-91	12.44	08/09/91	08/15/91	1.95	11.71	15-Aug-91	11.71
23-Aug-91	16.70	08/15/91	08/23/91	2.28	18.21	23-Aug-91	18.21
29-Aug-91	7.13	08/23/91	08/29/91	1.43	8.56	29-Aug-91	8.56
06-Sep-91	18.92	08/29/91	09/05/91	2.42	16.96	06-Sep-91	18.52
12-Sep-91	8.24	09/05/91	09/12/91	1.56	10.92	12-Sep-91	9.36
20-Sep-91	13.84	09/12/91	09/20/91	1.78	14.24	20-Sep-91	14.24
27-Sep-91	7.91	09/20/91	09/27/91	1.21	8.47	27-Sep-91	8.47
03-Oct-91	7.26	09/27/91	10/03/91	1.28	7.65	03-Oct-91	7.65
12-Oct-91	12.51	10/03/91	10/11/91	1.11	8.91	07-Oct-91	4.46
17-Oct-91	0.00	10/11/91	10/17/91	0.54	3.21	12-Oct-91	4.99
24-Oct-91	4.28	10/17/91	10/24/91	0.63	4.43	17-Oct-91	2.68
01-Nov-91	11.75	10/24/91	11/01/91	0.73	5.87	24-Oct-91	4.43
08-Nov-91	6.23	11/01/91	11/08/91	0.83	5.80	01-Nov-91	5.87
15-Nov-91	6.22	11/08/91	11/15/91	0.71	4.97	08-Nov-91	5.80
22-Nov-91	2.74	11/15/91	11/22/91	0.29	2.03	15-Nov-91	4.97
29-Nov-91	5.55	11/22/91	11/29/91	0.66	4.63	22-Nov-91	2.03
06-Dec-91	4.47	11/29/91	12/06/91	0.57	4.01	29-Nov-91	4.63
13-Dec-91	1.37	12/06/91	12/13/91	0.20	1.37	30-Nov-91	0.57
20-Dec-91	13.54	12/13/91	12/20/91	0.56	3.92	06-Dec-91	3.47
27-Dec-91	21.53	12/20/91	12/27/91	0.56	3.92	13-Dec-91	1.37
03-Jan-92	7.22	12/27/91	01/03/92	0.92	6.45	20-Dec-91	3.92
10-Jan-92	33.01	01/03/92	01/10/92	0.53	3.73	27-Dec-91	3.92
17-Jan-92	1.05	01/10/92	01/17/92	0.14	1.00	03-Jan-92	6.45
24-Jan-92	2.85	01/17/92	01/24/92	0.41	2.85	10-Jan-92	3.73
31-Jan-92	4.26	01/24/92	01/31/92	0.62	4.35	17-Jan-92	1.00
07-Feb-92	4.35	01/31/92	02/07/92	0.77	5.39	24-Jan-92	2.85
14-Feb-92	17.55	02/07/92	02/14/92	0.89	6.20	31-Jan-92	4.35
21-Feb-92	9.85	02/14/92	02/21/92	1.14	7.98	07-Feb-92	5.39
28-Feb-92	24.00	02/21/92	02/25/92	1.18	4.71	14-Feb-92	6.20
06-Mar-92	8.40	02/25/92	03/06/92	1.22	12.16	21-Feb-92	7.98
12-Mar-92	30.45	03/06/92	03/12/92	1.27	7.60	28-Feb-92	8.36
20-Mar-92	16.60	03/12/92	03/20/92	1.32	10.52	06-Mar-92	8.51
25-Mar-92	29.90	03/20/92	03/25/92	1.51	7.55	12-Mar-92	7.60
03-Apr-92	20.10	03/25/92	04/03/92	1.70	15.34	20-Mar-92	10.52
10-Apr-92	20.10	04/03/92	04/13/92	2.31	23.10	25-Mar-92	7.55
17-Apr-92	26.30	04/13/92	04/17/92	3.05	12.22	03-Apr-92	15.34
24-Apr-92	28.70					10-Apr-92	16.17
						17-Apr-92	19.15

APPENDIX 9a

Water levels in lysimeters measured from the top of the tube

DATE MM/DD	TIME	WL1	WL2	WL3	WL4	WL5	WL6	WL7	WL8 (centimetres)	WL9	WL10	WL11	WL12	WL13	WL14	WL15	WL16	
1991																		
04/07		23,7	24,1	26,4	23,2	24,2	26,6	25,1	26,0	25,6	27,7	26,5	27,5	27,7	28,5	29,5	31,4	
04/15		25,9	24,7	27,6	24,9	23,8	26,7	24,2	26,6	26,6	30,0	27,1	26,5	26,6	27,7	26,5	27,7	
04/19		29,1	26,9	31,0	29,3	28,0	29,8	28,0	31,0	29,7	23,0	30,3	29,4	28,7	30,2	28,1	30,5	BA,BW
04/19		20,9	23,7	25,4	23,7	21,2	23,7	23,2	25,8	23,9	27,2	26,0	25,3	24,5	25,5	24,2	25,2	AA,AW
04/26		21,8	23,5	23,8	22,1	20,5	23,1	23,1	27,2	23,5	27,3	25,5	25,6	24,0	26,4	23,3	25,8	
05/03		21,2	23,0	26,0	23,1	24,7	24,9	22,2	26,3	25,9	25,7	24,7	25,2	25,6	26,2	25,2	26,0	AA
05/10		26,2	24,1	27,5	27,5	27,5	27,5	25,5	27,5	26,3	27,7	27,5	28,2	27,3	29,0	26,2	29,1	
05/15		29,7	25,9	30,9	31,8	29,2	30,2	28,8	32,9	30,1	32,0	29,8	30,7	29,4	31,2	28,0	31,7	BA
05/15		27,3	26,1	26,4	26,2	24,5	30,4	26,0	26,2	25,6	25,0	26,8	27,8	26,7	27,4	28,2	29,0	AA
05/17	9,15	30,3	26,8	29,2	29,1	26,6	31,1	28,2	29,5	27,9	28,7	28,6	29,7	28,1	29,0	28,7	30,8	BA,BW
05/21		31,0	29,2	32,0	34,0	28,6	33,0	30,3	32,1	28,5	29,9	29,7	31,3	29,0	29,2	29,4	31,5	
05/23		31,2	28,3	30,5	30,7	26,1	31,3	29,5	32,3	28,1	29,2	28,8	30,2	28,3	28,5	28,5	30,4	
05/28		36,8	33,6	34,6	38,7	32,2	34,7	35,4	37,0	31,6	32,8	32,5	32,2	30,5	31,7	31,0	34,5	
05/31	11,10	37,7	36,6	37,0	34,1	35,9	36,1	36,1	36,1	32,0	32,8	33,3	32,7	31,1	32,7	31,9	35,7	
06/04	15,00	41,2	38,0	38,5	41,4	34,8	36,2	37,8	40,5	32,8	33,9	34,6	33,4	32,2	35,1	33,2	36,3	
06/07	16,00	34,3	31,6	33,0	29,9	27,1	33,4	31,3	31,4	28,0	28,9	30,2	27,7	28,1	30,0	31,7	33,3	
06/10	10,30	27,0	26,2	25,6	23,0	19,8	26,7	24,1	24,4	22,2	21,8	25,6	24,8	24,1	25,1	28,5	28,5	
06/14		28,5	27,6	29,3	27,0	26,2	29,0	27,1	27,3	27,1	28,5	27,8	26,7	26,4	28,0	29,5	30,7	
06/18		29,0	28,7	28,5	27,9	27,5	29,6	25,5	26,8	26,2	27,3	28,0	27,5	26,6	28,5	29,8	30,4	
06/22	18,00	25,1	26,0	23,2	24,5	21,3	25,9	23,2	25,3	23,2	22,7	26,0	25,0	23,3	25,8	27,3	27,4	
06/26		21,8	25,5	23,2	22,9	21,5	24,8	22,8	25,4	23,9	22,6	25,4	23,9	24,0	25,8	26,8	27,0	
06/27		20,0	24,5	23,1	23,0	21,4	23,5	22,0	24,1	21,5	23,3	24,0	22,9	23,8	25,2	25,8	26,0	
06/28	17,00	23,5	25,7	27,0	25,0	25,4	26,5	23,0	25,8	26,1	29,5	24,5	25,1	26,7	27,5	27,9	27,2	
07/01	12,00	20,5	22,9	22,4	20,1	20,3	23,6	21,0	22,6	22,1	25,4	23,0	21,5	23,9	24,7	25,5	24,5	
07/04	1	23,6	23,9	27,0	21,7	23,9	26,7	23,0	22,9	26,3	27,8	25,5	22,5	26,6	27,2	27,9	27,7	
07/09	13,00	27,3	29,5	31,0	30,8	26,9	30,8	28,7	29,6	30,6	33,0	32,0	30,5	31,4	32,0	32,5	32,7	
07/11	12,00	21,6	23,7	26,5	24,7	24,4	26,8	24,4	25,3	25,3	27,3	28,0	25,5	26,4	26,4	26,6	26,9	
07/31	11,30	28,3	26,3	29,9	28,0	28,3	30,6	28,5	29,7	29,6	30,5	29,9	29,0	27,6	28,9	27,9	30,1	
08/02	15,00	29,4	28,8	28,8	28,3	27,4	31,1	29,6	29,9	31,5	33,2	32,1	30,8	31,0	31,6	31,1	32,0	
08/06	12,30	19,1	21,7	20,5	19,9	19,3	22,0	21,1	21,5	20,8	20,9	23,8	22,2	21,2	21,6	22,9	23,2	
08/09	12,30	20,6	24,6	25,3	20,0	26,1	26,2	24,4	21,8	25,2	28,3	27,7	25,4	27,2	27,0	26,8	27,6	
08/10	11,35	19,9	23,9	23,1	20,9	23,2	25,0	22,7	22,1	23,8	25,4	25,4	24,6	24,6	25,9	26,8	27,0	
08/10	13,00	25,1	25,2	27,1	26,4	26,9	26,2	22,7	24,3	25,9	28,1	25,4	24,6	27,6	28,7	28,3	28,7	AA
08/15	12,00	27,5	26,6	28,6	29,5	28,2	28,4	25,3	26,2	27,6	30,1	29,0	26,6	28,6	30,0	28,9	31,1	
08/19	12,00	30,0	29,3	31,5	32,9	29,4	31,9	28,0	30,2	29,9	31,9	32,9	29,5	30,5	31,4	30,3	31,8	
08/19	13,00	24,0	26,0	24,0	22,5	23,9	27,0	23,1	24,5	26,0	27,9	27,6	26,7	28,2	28,2		28,5	AA
08/23	11,30	27,0	27,3	28,4	27,0	26,1	29,1	25,2	26,4	28,0	30,0	29,3	27,9	29,2	29,6	30,4	30,2	BA
08/23	11,30								24,8		26,9	26,5						AA
08/28	10,30	34,6	34,0	35,8	35,6	33,8	36,0	32,6	32,9	35,5	35,6	34,0	35,0	35,8	36,6	35,7	37,8	BA
08/28	11,00	29,0	30,5	30,1	29,5	27,7	29,4	28,9	29,7	31,2	31,2	31,3	31,7	33,6	34,2		34,1	AA
08/29	9,00	31,4	31,5	32,2	31,7	30,2	31,0	30,4	31,0	33,1	33,2	32,1	33,0	34,7	35,3	35,9	35,7	
09/02	16,00	34,8	31,1	31,0	34,0	29,6	30,6	30,2	32,0	32,0	32,4	30,3	30,6	31,4	34,3	33,2	33,9	BA
09/02	16,30	31,3			28,9			27,2	28,4									AA
09/05	11,45	35,2	32,7	32,4	33,6	32,7	31,9	30,8	32,5	33,6	33,9	32,0	31,9	32,4	35,7	33,8	34,9	BA
09/05	12,45	30,6	29,1		28,9	27,4		29,2	28,2	30,9							33,0	AA
09/09	15,30	40,1	39,1	38,4	40,9	38,9	38,9	39,0	38,9	39,8	40,9	39,8	39,1	39,2	41,8	39,3	40,9	BA
09/09	16,00	36,9	36,3		36,3	34,2		35,6	35,1	36,9	38,8	38,2	37,0					AA
09/12	12,00	39,8	39,7	40,3	40,9	38,9	40,5	38,9	39,0	40,5	41,8	40,5	39,6	41,2	42,5	40,0	42,3	
09/16	15,30	28,6	26,9	28,1	25,7	23,7	28,9	28,5	28,4	29,0	30,9	29,9	30,4	29,4	31,4	30,8	33,3	
09/20	10,30	31,8	30,5	30,9	30,0	26,2	31,1	31,2	32,4	31,7	33,7	33,0	33,2	31,1	33,5	32,5	35,5	
09/20	11,15	28,4				29,1		28,5	28,4			30,5	30,5	32,5		33,5	32,8	AA,AW
09/24	16,00	23,8	24,9	24,6	21,8	19,6	25,0	25,8	24,9	26,5	27,3	26,4	27,2	27,3	28,4	30,5	30,3	BA
09/24	16,30	25,8	26,1	27,3	26,1	24,7	27,2							28,9	30,1			AA
09/27	10,30	27,0	26,4	27,6	26,5	25,3	27,8	26,7	26,2	27,5	28,8	27,0	28,3	29,5	30,5	29,9	30,9	
10/01	10,20	20,9	23,7	21,6	22,0	19,4	22,9	23,8	23,8	23,9	24,8	25,1	25,7	25,7	26,7	27,4	27,9	BA
10/01	11,10	24,5	24,8	28,2	25,4	25,6	27,1		25,2	26,2	27,8	26,1		28,2	28,9	28,6		AA
10/03	11,15	21,1	24,1	25,5	23,5	22,8	25,1	23,6	24,9	24,5	26,0	25,5	25,5	26,3	27,1	27,9	27,9	BW
10/03	12,45	25,2	24,6	27,5	26,5	27,0	27,7	23,3	24,2	26,7	27,2	25,4	26,2	28,2	28,3	28,5	27,6	AW
10/05	13,45	19,6	21,7	20,3	20,1	18,6	21,6	20,3	21,3	22,1	21,4	22,4	23,3	22,4	23,1	24,5	24,8	BA
10/05	14,45	22,6	23,1	26,0	23,7	22,9	24,2	22,8	23,9	25,2	25,9	24,8	25,5	26,7	27,1	27,4	26,3	AA
10/07	13,20	19,4	22,2	22,7	21,9	20,6	22,5	21,5	22,7	22,6	22,6	23,5	23,8	24,2	25,1	25,3	24,5	BA
10/07	14,30	24,2	24,6	28,0	25,2	25,9	26,4	23,7	23,9	26,3	29,2	25,4	25,6	27,9	28,6	28,2	27,3	AA
10/11	11,30	18,4	23,3	22,5	21,6	20,4	22,6	21,2	21,7	22,6	24,4	23,6	23,5	24,8	25,5	25,9	24,4	BA,BW
10/11	12,30	24,7	24,6	29,2	28,3	27,2	27,2	23,3	23,6	25,8	28,2	24,7	25,3	27,4	27,9	28,2	26,8	AA,BW
10/11	13,05	24,3	24,5	28,5	27,5	27,0	26,6	22,4	23,3	25,7	27,9	24,7	25,3	27,4	27,8	28,1	26,9	AA,AW
10/12	10,50	22,4	20,3	26,2	25,1	24,7	24,8	21,7	20,9	24,3	26,0	24,4	24,2	25,9	26,7	27,1	25,5	BA,BW
10/12	13,35	25,7	23,8	28,2	26,9	26,9	27,3	23,2	22,8	26,6	28,6	25,8	25,2	27,2	28,5	28,9	28,3	AA,AW
10/14	15,30	21,4	19,6	23,1	22,4	21,3	23,3	21,2	21,2	23,3	24,7	24,3	23,3	24,3	26,0	27,2	25,8	BA
10/14	16,30	25,8	22,8	28,1	26,2	25,9	27,1	23,4	23,2	26,2	28,5	25,1	24,9	27,4	28,1	28,4	27,9	AA
10/16	10,15	24,3	22,9	26,6	24,6	24,5	25,8	22,8	22,6	24,8	27,0	24,7	24,4	26,6	27,3	27,4	27,2	BA
10/16	11,00			29,4	27,8	26,8	28,3	23,8	24,8	26,3		25,7	25,7	27,9	28,8	29,2	28,3	AA
10/17	10,40	25,6	24,1	29,2	27,8	26,4	28,2	23,6	24,1	26,4	27,4	26,2	25,8	27,8	29,3	29,1	28,6	BW
10/17	10,50	25,3	24,6	29,2	27,4	26,3	27,6	23,5	24,1	25,9	27,5	26,5	25,8	28,0	28,7	28,9	28,2	AW
10/22	9,50	27,3		29,8	29,5	27,6	28,7	24,4	25,2	27,2	29,1	26,7	26,9	28,7	29,7	29,7	29,5	
10/24	15,15	27,3		29,8	29,6	27,6	28,6	24,2	25,3	27,2	29,2	26,9	27,0	28,6	29,7	29,7	29,5	BW
10/24	16,45	26,3		30,2	29,6	27,4	28,1	24,7	25,6	27,1	28,8	27,1	27,3	28,2	29,4	29,8	29,2	AW
10/29	13,15	20,4	23,0	23,7	23,5	21,3	23,3	22,1	22,8	23,3	23,3	24,8	24,6	24,8	25,8	27,0	25,6	BA
10/29	14,10	24,8	24,5	28,2	26,8	26,0	26,6	23,4	24,2	26,3	28,2			27,2	28,0	29,1	27,6	AA
10/31	11,50	17,0		19,0	19,6	19,0	18,5	19,3	20,4	20,3	19,2	20,5	21,0	20,3	21,1	22,9	20,8	
10/31	13,15	23,9		26,3	24,1	26,3	24,5	23,4	24,2	27,1	28,0	24,7	24,4	26,1	26,7	26,8	25,5	
11/01	10,30	21,4	22,8	24,2	23,0	23,8	23,1	21,8	22,6	25,6	25,8	24,0	23,6	24,8	25,3	25,8	24,7	BA,BW
11/01	11,30	21,8	22,8	24,7	23,5	23,1	23,0	21,7	22,4	25,0	25,9	23,9	23,4	24,9	25,2	26,2	25,2	AW,BA
11/01	12,20	25,6	24,3	28,3	26,8	25,4	26,2	23,4	24,2	26,8	29,1	24,9	24,3	26,8	27,0	27,5	26,8	AW,AA
11/04		20,0	22,0	21,9	22,6	19,0	21,7	20,6	21,5	22,6	22,6	23,0	22,8	23,0	23,4	25,2	24,0	BA
11/04		23,7	23,4	25,8	25,2	24,1	24,8	23,1	23,6	25,6	28,7	24,3	24,1	26,1	26,5	27,1	26,5	AA
11/08	11,30	19,3	19,5	21,2	21,6	18,7	20,9	20,5	20,8	22,5	21,9	22,2	22,4	22,2	22,8	24,2	23,0	BW,BA
11/08	12,50	24,7		26,7	26,7	24,6	25,5	23,8	24,1	26,0	29,9	24,3	24,7	26,9	27,6	27,3	26,8	AA,BW

DATE MM/DD	TIME	WL1	WL2	WL3	WL4	WL5	WL6	WL7	WL8	WL9	WL10	WL11	WL12	WL13	WL14	WL15	WL16	
									(centimetres)									
11/08	15,15	25,4	24,7	27,2	26,4	25,4	25,4	23,8	23,7	26,1	30,0	24,7	24,8	27,1	27,6	26,9	26,8	AW,AA
11/12	10,30	20,0	22,2	21,9	21,8	19,7	21,8	20,8	21,4	20,7	24,1	22,7	22,2	23,3	23,7	24,0	23,5	BA
11/14	13,10	18,8	20,9	21,0	20,9	18,4	20,7	20,7	20,6	21,0	21,9	21,8	21,8	22,7	22,6	23,5	22,5	BA
11/14	14,40	24,8	23,9	27,9	25,7	26,0	26,2	24,0	24,7	26,3	29,8	24,2	24,9	28,1	27,9	27,3	26,9	AA
11/15	14,45	24,5	23,8	27,3	25,3	25,4	25,7	23,8	24,3	25,9	29,2	23,9	24,5	27,6	27,3	27,1	26,6	BW
11/15	15,45	24,5	24,0	26,4	25,6	24,6	25,4	23,4	23,9	26,0	28,8	23,8	24,7	27,7	27,2	27,4	25,7	AW
11/18	14,20	19,4	22,2	21,4	21,2	18,6	21,5	20,5	21,4	21,9	22,3	21,8	22,1	23,9	23,4	24,6	22,5	BA
11/18	15,35	24,7	24,2	27,3	25,4	25,8	25,8	23,4	24,3	26,7	29,5	24,2	25,4	27,4	28,0	27,6	26,5	AA
11/22	1	24,1	24,0	26,2	24,4	24,2	24,5	22,5	23,2	25,3	27,9	23,9	25,0	26,4	27,1	27,2	25,5	BW
11/22	11,35	23,3	23,5	26,4	24,4	24,4	24,9	22,5	23,5	25,2	27,9	24,8	24,2	25,7	27,1	27,3	25,9	AW
11/25	14,15	19,5	20,6	20,9	20,0	18,5	20,6	20,0	20,5	22,5	20,9	22,4	21,0	21,0	22,5	23,5	21,7	BA
11/25	16,00	26,2	23,4	27,7	25,3	26,1	24,9	24,4	24,4	27,4	28,0	25,5	24,6	27,1	28,1	27,6	26,4	AA
11/30	14,20	24,1	22,6	24,0	23,0	22,2	23,3	22,3	22,4	23,5	24,6	24,7	23,8	25,4	27,0	26,7	25,0	BA
11/30	16,30	26,8	25,6	26,9	26,0	26,6	25,7	24,8	25,7	27,0	29,3	27,2	25,9	27,8	30,1	26,9	26,7	AA
06/12	11,30	27,2	25,4	27,8	26,2	27,0	25,6	24,4	25,7	26,7	29,8	27,4	26,0	27,1	29,2	27,7	27,4	BW
12/06	13,30	27,4	25,4	27,1	25,8	25,9	25,0	24,6	24,7	26,1	29,1	26,8	25,3	27,4	29,2	28,1	27,0	AW
12/13	10,22	28,3	26,0	28,7	27,6	27,6	26,0	24,2	24,9	26,1	28,7	28,3	25,9	27,5	29,4	28,3	28,3	BA,BW
12/13	12,08	28,2	26,0	28,3	26,0	26,8	26,3	24,4	24,9	26,4	28,7	27,6	26,0	27,2	29,3	27,3	27,2	AW,BA
12/13	12,25	23,8				21,0						25,3						AA,AW
12/18	12,15	20,2		21,9		18,4				22,1								AA
12/18	12,30	20,5		23,3		20,3				22,8								AW
12/20	11,38	17,3	19,3	19,2	17,3	17,9	17,8	19,3	20,5	20,7	20,0	20,4	22,2	19,6	21,7	20,2	21,2	BW,BA
12/20	13,00	21,8	22,2	22,5	20,9	20,4	20,5	21,0	22,9	22,4	22,0	22,7	23,1	21,9	22,4	23,4	23,5	AA,BW
12/20	14,15	21,4	21,1	22,3	21,0	19,9	21,4	20,7	22,2	22,2	21,9	22,9	23,1	22,1	22,4	23,5	23,4	AW,AA
12/23	14,35	17,9	20,5	18,3	19,2	18,4	19,3	18,1	19,5	22,3	19,4	20,3	22,3	19,0	21,5	20,0	21,1	BA
12/23	15,45	20,5	21,9	21,0	21,4	21,1	21,3	21,8	22,4	24,7	24,6	23,4	23,6	22,3	24,3	22,4	24,2	AA
12/27	12,00	20,4	21,4	21,8	21,0	20,5	21,1	21,0	21,7	23,4	23,7	23,5	23,3	21,8	23,6	22,0	23,5	BA,BW
12/27	13,07	19,6	21,5	21,2	20,5	20,4	20,3	20,6	21,7	23,2	23,2	22,9	23,8	22,1	24,0	22,4	23,7	AW,BA
12/27	13,26			23,6	22,5													AA,AW
1992																		
01/03	11,26	19,9	21,2	22,6	20,8	20,0	19,5	19,9	21,0	21,2	21,6	23,2	23,5	21,2	23,0	21,6	22,4	BW,BA
01/03	12,15	23,5	22,7	23,4	22,2	21,7	22,7	21,9	23,2	24,8	23,2	24,8	25,1	24,7	28,2	24,3	25,0	AA,BW
01/03	13,27	23,2	22,4	22,4	21,3	20,7	22,2	21,4	22,3	23,0	24,3	24,5	24,2	23,7	27,8	23,7	25,5	AW,AA
01/06	14,40	18,2	20,6	20,2	18,7	19,3	19,9	20,3	20,3	22,4	19,2	22,3	23,6	18,0	22,1	21,4	21,3	BA
01/06	15,48	22,9	22,4	24,9	22,4	22,7	22,1	22,5	23,4	25,5	27,5	23,7	23,7	24,4	27,9	24,5	24,9	AA
01/10	11,01	21,0	21,5	21,9	20,3	20,2	20,5	20,5	21,7	21,8	22,2	23,3	23,2	21,1	25,3	23,3	24,0	BW
01/10	12,17	21,4	22,0	22,2	21,5	20,3	20,9	21,1	21,9	23,1	23,3	23,6	22,7	21,7	25,2	23,9	24,4	AW
01/17	11,06	22,4	22,3	22,4	21,2	20,5	21,0	21,3	21,8	24,0	24,3	23,6	22,7	21,8	24,9	23,8	24,8	BW
01/17	12,00	22,7	22,0	22,4	21,0	21,0	21,3	21,0	21,9	23,7	24,6	23,7	23,0	21,6	25,2	23,5	24,2	AW
01/24	14,00	22,8	21,9	22,6	21,2	20,5	21,1	20,2	21,6	22,7	23,1	24,0	23,0	21,3	24,7	23,3	23,9	BW
01/24	14,45	22,1	22,0	22,6	21,0	20,6	20,4	20,4	21,7	22,8	23,2	23,5	23,3	21,6	24,4	24,4	23,8	AW
01/31	11,55	21,6	21,7	21,7	20,6	19,6	20,0	18,5	21,3	22,1	21,5	22,7	22,1	20,4	22,8	22,9	23,6	BW,BA
01/31	12,33	23,1	22,8	22,7	22,0	23,6	21,4	22,2	22,7	24,9	25,0	23,3	23,5	22,2	24,3	23,6	24,8	AA,BW
01/31	14,05	22,8	22,3	23,0	22,3	23,4	21,5	22,1	22,8	24,5	24,6	23,8	23,6	22,4	24,6	23,1	25,0	AW,AA
02/07	13,34	24,2	22,6	23,6	22,5	23,5	21,8	21,9	23,1	24,4	24,5	24,4	24,3	22,9	25,5	23,2	24,9	BW
02/07	14,44	23,5	22,3	23,4	22,2	23,6	22,0	21,7	23,2	24,3	24,0	24,3	24,4	22,8	25,4	23,6	24,6	AW
02/11	10,56									21,1	21,8							BA
02/11	11,12									24,4	26,1							AA
02/14	11,19	18,3	20,4	21,7	19,9	20,3	19,4	17,6	20,1	20,1	20,8	22,3	23,1	19,8	22,7	21,4	21,4	BW,BA
02/14	12,39	22,9	22,8	24,5	22,5	24,6	22,7	22,8	24,5	26,3	28,7	25,3	25,2	25,6	27,0	23,1	24,4	AA,BW
02/14	13,39	23,2	23,1	24,4	22,1	23,9	22,1	21,6	23,9	25,3	27,7	25,0	24,5	25,2	26,7	22,9	24,0	AW,AA
02/21	11,33	22,8	22,9	22,4	21,1	22,6	20,9	20,7	22,9	24,0	25,6	25,2	24,5	23,2	25,5	22,8	23,9	BW
02/21	12,25	22,8	22,6	22,7	21,3	22,6	21,0	20,9	23,0	24,4	25,6	25,2	24,5	23,5	26,0	22,7	24,0	AW
02/25	14,30	20,2	21,0	20,9	20,4	20,6	19,8	18,6	20,7	19,9	21,1	24,0	22,7	20,8	23,7	21,4	22,0	
02/25	15,37	24,0	22,7	23,4	23,3	26,7	22,5	21,5	23,5	24,6	26,3	25,9	25,2	24,1	26,2	23,4	24,4	
02/25	16,25	23,9	22,8	23,2	23,6	25,6	22,3	21,2	23,1	23,9	25,9	26,3	24,6	24,0	26,4	23,3	24,4	
02/27	12,20	20,3	21,0	21,1	20,6	20,4	19,0	18,2	20,0	20,9	20,6	24,1	22,3	20,4	22,7	21,7	21,6	
02/27	14,18	28,5	27,0	28,6	28,5	27,8	26,9	26,0	27,5	29,1	28,6	27,7	27,6	27,3	28,2	27,3	27,8	
02/27	15,17	27,7	26,7	27,9	27,7	27,8	26,8	25,7	27,4	27,5	28,7	28,0	27,3	27,3	28,0	26,7	27,4	
02/28	14,48	28,1	27,1	28,1	27,8	27,8	27,5	26,0	28,1	28,0	29,0	28,0	27,6	27,2	28,1	27,0	27,6	
02/28	16,51	30,9	29,9	31,6	35,7	36,2	29,8	28,1	32,5	31,8	33,3	32,3	31,3	31,8	33,4	30,9	33,8	
02/29	14,28	30,8	29,2	31,0	32,8	31,3	29,3	27,2	31,5	29,0	32,4	32,0	30,7	31,2	33,0	30,5	33,4	
02/29	16,07	33,3	34,1	33,0	43,6	44,5	32,1	29,8	34,3	42,0	37,8	36,8	32,0	32,9	37,9	31,8	35,0	
03/01	13,30	31,6	30,4	31,3	34,4	31,1	29,9	27,5	32,1	29,2	35,5	32,7	31,8	31,2	33,2	31,0	34,0	
03/01	15,40	35,0	35,3	34,0	47,0	46,5	33,3	32,7	37,1	47,0	38,4	39,6	33,3	33,6	45,6	33,5	36,1	
03/02	11,40	35,2	34,1	34,0	40,8	30,1	32,1	31,0	35,8	31,5	38,2	37,0	33,1	33,1	36,8	33,4	35,9	
03/02	13,57	37,2	40,5	36,4	40,7	46,5	35,0	33,6	39,6	37,0	39,6	38,7	35,0	35,8	44,4	35,5	37,9	
03/03	14,20	36,8	36,9	35,7	40,0	41,5	34,0	33,2	39,2	32,6	38,9	38,6	34,8	34,5	38,7	35,1	37,5	
03/03	16,10	51,7	53,0	41,3	54,8	40,7	46,1	42,6	44,2	54,1	42,9	56,5	36,8	38,7	52,0	37,2	39,6	
03/04	15,00	40,4	40,5	37,5	45,1	41,8	36,2	36,1	42,2	34,7	41,5	43,1	36,8	36,8	41,8	36,7	39,2	
03/05	14,55	40,4	40,6	37,6	44,8	41,7	36,3	35,5	42,2	34,2	41,8	43,3	36,8	36,6	41,5	36,9	39,1	
03/05	16,25	52,1	38,3	43,7	43,5	40,4	46,6	33,2	45,9	32,6	53,3	58,8	35,6	40,6	40,1	35,6	40,3	
03/06	13,40	41,4	37,5	38,6	40,9	37,6	36,8	33,5	42,9	32,9	43,6	45,7	35,8	37,6	38,9	35,5	39,9	
03/06	15,30	28,4	28,0	27,4	23,8	24,8	29,7	27,0	30,7	28,1	24,4	32,7	31,0	29,9	30,3	31,0	32,7	
03/09	15,07	24,5	25,3	21,7	20,3	20,7	24,7	23,4	26,6	23,1	30,3	29,3	28,1	26,3	26,8	28,1	29,2	
03/11	14,24	23,2	24,8	21,1	20,0	20,8	23,6	22,7	25,7	21,4	29,1	29,0	27,5	25,7	26,1	27,4	28,0	BA
03/11	14,43			23,7	22,4	23,6				25,0	25,9	27,4	26,6					AA
03/12	15,15	21,4	23,7	21,4	20,8	21,1	22,7	21,9	25,0	21,1	24,0	26,5	25,9	24,4	25,4	26,8	27,2	BW
03/12	16,17	21,5	23,7	25,0	22,3	24,1	22,3	22,3	25,2	24,0	24,0	26,8	26,4	24,6	25,3	27,6	27,4	AW
03/20	10,50	20,6	23,2	22,4	21,0	21,8	21,2	21,4	24,9	21,3	22,4	26,8	25,9	23,6	24,4	26,2	25,8	BA
03/20	11,50	21,1	23,3	24,9	23,3	24,0	21,3	21,3	25,1	25,2	27,9	26,8	25,8	23,3	25,1	26,0	26,8	AA
04/04	11,26	21,7	22,3	22,0	21,1	23,6	20,7	20,6	22,5	24,6	21,9	24,7	25,3	22,3	25,6	22,3	24,1	BW
04/03	12,33	21,8	22,3	23,6	22,6	23,3	21,6	21,7	21,9	23,9	26,4	25,7	24,5	24,7	24,6	23,4	25,7	AW
04/10	16,00								23,2	26,8	27,6	26,5	25,4	25,4	26,8	24,3	26,0	AW
04/10	15,30								23,6	26,7	27,9	26,1	25,6	25,7	27,2	24,0	26,2	
04/13	13,10	22,2	22,2	23,6	23,3	23,7	22,0	22,8										BW
04/13	13,42	22,9	22,6	24,0		23,7	22,0	22,8										AW

Explanation codes at the end of the line:

BA	:	Before Adding/removing water
AA	:	After Adding/removing water
BW	:	Before Weighing
AW	:	After Weighing

APPENDIX 9b

Volume of water added to or removed from the lysimeters in litres

(after = after weighing)

Lysimeters 1 - 8

DATE	ADD	V1	V2	V3	V4	V5	V6	V7	V8
1991									
13-Apr	-	-2.30	-3.23	-3.55	-3.04	88.88	-3.21	-2.27	-3.00
19-Apr	after	2.00	2.00	1.50	1.68	1.26	2.00	2.00	2.00
26-Apr	after	-0.70	-0.44	0.00	-0.44	-0.96	-0.69	-0.26	0.00
03-May	before	0.00	-0.94	-1.32	-0.46	-0.46	-1.00	0.00	0.00
08-May	-	0.50	0.50	0.50	0.00	0.00	0.00	0.00	1.00
15-May	-	1.00	0.00	1.07	1.00	1.00	0.00	1.00	2.00
17-May	after	1.00	0.00	0.00	0.00	0.00	0.00	0.45	0.55
21-May	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
23-May	before	0.00	0.00	0.00	0.00	0.00	0.00	0.70	1.00
28-May	_	0.70	0.00	0.00	1.00	0.00	0.00	1.00	1.50
31-May	after	1.00	1.00	0.55	0.00	1.00	1.00	1.50	1.00
04-Jun	-	1.00	0.55	0.45	0.65	0.50	0.00	1.00	2.00
07-Jun	after	0.00	0.00	0.00	-0.59	-0.52	0.00	0.35	0.65
10-Jun		0.00	0.00	0.00	0.69	0.90	0.00	0.00	0.00
14-Jun		0.50	0.00	0.57	0.00	0.00	0.00	0.97	0.92
18-Jun		0.00	0.00	0.00	-0.73	0.00	-0.43	0.00	0.00
22-Jun		0.00	0.00	-0.50	-0.32	-0.83	0.00	0.00	0.00
26-Jun	after	-0.34	0.00	-0.48	-0.48	-0.49	0.00	0.00	0.00
27-Jun	after	-0.86	-0.34	-0.96	-0.98	-0.94	-0.85	-0.49	-0.89
28-Jun		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01-Jul		-0.95	-0.48	-0.87	-2.44	-0.58	-0.96	-0.71	0.00
04-Jul	after	0.52	0.00	0.00	-0.95	0.59	0.93	0.00	0.00
09-Jul		1.00	1.47	0.29	0.72	0.00	0.00	0.51	0.51
11-Jul	after	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.59
31-Jul	after	0.00	-0.43	0.00	0.00	0.00	0.00	0.54	0.65
02-Aug		0.00	-0.52	-0.39	-0.39	-0.46	0.00	0.00	0.00
06-Aug		-1.07	-1.47	-1.47	-1.57	-1.48	-1.55	-0.95	-1.37
09-Aug	before	0.00	0.00	0.00	-0.92	0.00	0.00	0.00	0.00
10-Aug		-1.46	-0.47	-0.78	-1.77	-0.32	-0.51	0.00	-0.93
15-Aug	after	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19-Aug	nvt	1.64	0.99	0.91	1.46	0.97	0.97	1.53	1.93
23-Aug	after	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.51
28-Aug		1.62	1.08	1.08	1.08	1.08	1.08	1.08	1.08
02-Sep		0.86	0.00	0.00	0.62	0.00	0.00	0.67	0.70
05-Sep	after	0.93	0.55	0.00	0.46	0.41	0.00	0.46	0.89
09-Sep		0.56	0.42	0.00	0.51	0.43	0.00	0.69	0.66
20-Sep		0.92	0.00	0.00	0.00	-0.50	0.00	0.57	0.85
24-Sep		-0.44	-0.50	-0.80	-0.94	-0.91	-0.43		
01-Oct		-0.82	-0.51	-1.49	-0.95	-1.28	-1.03		-0.48
03-Oct	after	-0.82	-0.38	-0.27	-0.65	-0.47	-0.47	0.00	0.00
05-Oct		-1.03	-1.07	-1.93	-1.51	-1.37	-1.04	-1.08	-1.44
07-Oct		-1.48	-1.89	-1.00	-1.02	-1.18	-1.31	-1.06	-0.52
11-Oct	before	-2.29	-0.78	-1.30	-1.56	-1.30	-1.30	-0.78	-0.78
12-Oct	after	-0.51	-2.81	-0.25	-0.26	-0.25	-0.49	-0.51	-1.03
14-Oct		-1.01	-2.50	-0.88	-0.91	-0.75	-0.93	-1.00	-0.93
16-Oct				-0.49	-0.50	-0.25	-0.49	-0.25	-0.54
29-Oct		-0.93	-0.70	-0.70	-0.60	-0.70	-0.71	-0.41	-0.55
31-Oct		-2.50	-2.50	-3.00	-2.50	-2.00	-2.50	-1.75	-2.00
01-Nov	after	-0.93	-0.93	-0.61	-0.90	-0.25	-0.93	-0.68	-0.87
04-Nov		-0.95	-1.00	-1.01	-0.84	-1.08	-1.01	-1.03	-1.02
08-Nov	before	-1.46	-3.00	-1.47	-1.64	-1.33	-1.54	-1.45	-1.66
12-Nov		-1.85	-1.50	-1.50	-1.50	-1.50	-1.50	-1.50	-1.50
14-Nov		-1.89	-2.18	-1.97	-1.56	-1.70	-1.90	-1.47	-1.94
18-Nov		-1.51	-1.51	-1.50	-1.49	-1.50	-1.51	-1.22	-1.49

Lysimeters 1 - 8

DATE	ADD	V1	V2	V3	V4	V5	V6	V7	V8
25-Nov		-2.02	-1.98	-2.13	-1.98	-1.80	-1.88	-2.04	-2.06
29-Nov	after	-0.52	-1.50	-0.48	-0.48	-0.54	-0.55	-0.50	-0.99
13-Dec	after	1.00	0.00			1.00			
18-Dec		0.12		0.34		0.70			
20-Dec	before	-1.36	-1.30	-2.27	-2.41	-0.89	-1.34	-0.71	-1.00
23-Dec		-0.92	-1.03	-2.59	-1.01	-0.91	-1.06	-1.30	-1.27
27-Dec	after			-0.86	-0.42				
1992									
03-Jan	before	-1.07	-1.08	-0.37	-0.58	-0.60	-1.36	-0.72	-1.03
06-Jan		-1.51	-1.05	-1.68	-1.86	-1.02	-0.96	-1.01	-1.42
31-Jan	before	-0.41	-0.52	-0.51	-0.49	-1.00	-0.51	-1.28	-0.51
14-Feb	before	-1.47	-1.57	-0.83	-1.00	-1.34	-1.55	-1.62	-1.97
25-Feb	after	-0.95	-0.97	-1.05	-0.96	-0.48	-0.99	-1.00	-0.98
27-Feb	after	-2.28	-4.04	-1.86	-1.92	-1.44	-2.95	-3.57	-4.41
28-Feb	nvt	-1.24	-1.07	-1.07	-1.12	-0.79	-0.84	-0.89	-1.81
29-Feb	before	-0.79	-0.77	-0.53	-0.58	-0.42	-0.61	-0.71	-0.74
01-Mar	after	-1.02	-0.84	-0.57	-0.62	-0.57	-0.67	-1.13	-1.33
02-Mar		-0.61	-0.86	-0.76		-0.48	-0.87	-0.90	-1.15
03-Mar	after	-0.69	-0.66	-0.72	-0.53		-0.73	-0.76	-0.91
05-Mar	after	-0.46		-0.51			-0.48		-0.61
06-Mar	after	3.00	2.00	3.00	3.00	2.00	2.00	2.00	3.00
11-Mar		0.00	0.00	-0.92	-0.97	-0.47			
12-Mar	before			-0.95	-0.76	-0.57			
20-Mar	after			-0.48	-0.49	-0.45			
03-Apr	after			-0.47	-0.47		-0.52	-0.43	

Lysimeters 9 - 16

DATE	ADD	V9	V10	V11	V12	V13	V14	V15	V16
1991									
13-Apr	-	-1.30	-3.10	-3.44	-3.14	-1.75	-2.61	-0.86	-1.52
19-Apr	after	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
26-Apr	after	-0.31	0.00	-0.38	-0.40	-0.79	-0.37	-0.80	-0.47
03-May	before	0.00	0.00	0.00	0.00	-0.83	0.00	-0.84	-0.42
08-May	-	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
15-May	-	1.50	2.00	1.00	1.00	1.00	1.50	0.00	1.00
17-May	after	1.00	1.00	0.50	0.50	0.50	0.50	0.00	0.50
21-May	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
23-May	before	1.00	1.00	0.50	1.00	0.81	0.50	0.00	0.00
28-May	_	1.00	1.00	0.50	0.50	0.50	0.50	0.00	0.00
31-May	after	1.50	1.50	0.98	1.00	0.55	0.45	0.00	
04-Jun	-	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
07-Jun	after	0.00	0.00	0.00	-0.53	-0.24	0.00	-0.35	0.00
10-Jun		0.62	0.99	0.00	0.00	0.40	0.60	0.00	0.00
14-Jun		0.52	0.47	0.52	0.00	0.00	0.00	0.00	0.52
18-Jun		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22-Jun		-0.72	-0.82	0.00	0.00	-0.94	-0.84	-0.40	0.00
26-Jun	after	0.00	-0.55	0.00	0.00	-0.47	-0.36	0.00	0.00
27-Jun	after	-1.38	-1.34	-0.45	-0.90	-1.41	-1.39	-1.17	-0.42
28-Jun		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01-Jul		-1.13	-0.35	-1.29	-1.46	-0.97	-0.98	-1.41	-1.00
04-Jul	after	0.99	0.47	0.00	-1.00	0.00	0.00	0.00	0.00
09-Jul		0.54	0.98	0.48	0.54	0.56	1.30	0.98	0.97
11-Jul	after	0.00	0.00	0.49	0.00	0.00	0.00	0.00	0.00
31-Jul	after	0.00	0.00	0.00	0.00	-0.49	-0.51	-0.73	0.00

Lysimeters 9 - 16

DATE	ADD	V9	V10	V11	V12	V13	V14	V15	V16
02-Aug		0.31	0.52	0.37	0.35	0.00	0.39	0.00	0.00
06-Aug		-1.23	-1.90	-1.80	-1.51	-2.04	-2.10	-1.92	-1.47
09-Aug	before	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10-Aug		-0.44	-0.50	0.00	0.00	-0.90	-0.96	-0.84	-0.44
15-Aug	after	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19-Aug	nvt	0.97	0.98	1.91	0.97	0.57	0.95	0.00	0.97
23-Aug	after	0.00	0.58	0.75	0.00	0.00	0.00	0.00	0.00
28-Aug		1.08	1.08	1.08	1.08	0.54	0.54	0.00	1.08
02-Sep		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05-Sep	after	0.50	0.00	0.00	0.00	0.00	0.42	0.00	0.47
09-Sep		0.49	0.42	0.54	0.50	0.00	0.00	0.00	0.00
20-Sep		0.00	0.00	0.46	0.45	-0.46	0.00	-0.44	0.51
24-Sep						-0.45	-0.50		
01-Oct		-0.48	-0.54	-0.53		-0.51	-0.53	-0.50	
03-Oct	after	-0.42	-0.39	0.00	0.00	-0.45	-0.49	-0.49	0.00
05-Oct		-0.90	-1.52	-1.54	-1.01	-1.33	-1.52	-1.27	-1.05
07-Oct		-1.02	-1.56	-1.00	-0.73	-1.29	-1.34	-1.44	-1.08
11-Oct	before	-0.78	-0.78	-0.52	-0.78	-0.78	-0.78	-1.04	-0.78
12-Oct	after	-0.50	-0.51	-0.50	-0.51	-0.52	-0.51	-0.52	-0.51
14-Oct		-0.71	-0.75	-0.50	-0.76	-0.98	-0.76	-0.51	-0.75
16-Oct		-0.35	0.00	-0.47	-0.42	-0.50	-0.53	-0.66	-0.28
29-Oct		-0.68	-1.05			-0.72	-0.51	-0.70	-0.52
31-Oct		-1.75	-3.25	-3.25	-2.25	-3.00	-2.50	-2.00	-2.50
01-Nov	after	-0.32	-0.77	-0.54	-0.43	-0.72	-0.70	-0.69	-0.66
04-Nov		-0.63	-1.27	-0.90	-0.63	-0.90	-1.03	-0.86	-0.97
08-Nov	before	-0.89	-1.94	-1.43	-0.99	-1.64	-1.67	-1.41	-1.61
12-Nov		-1.50	-1.50	-1.50	-1.50	-1.50	-1.50	-1.50	-1.50
14-Nov		-1.35	-1.71	-1.50	-1.48	-1.93	-1.92	-1.97	-1.88
18-Nov		-1.28	-1.53	-1.49	-1.62	-1.00	-1.53	-1.51	-1.50
25-Nov		-1.19	-2.02	-2.00	-1.83	-2.00	-2.03	-2.31	-1.97
29-Nov	after	-0.51	-0.96	-1.04	-0.51	-0.38	-1.10	-0.26	-0.53
13-Dec	after			1.00					
18-Dec		0.17							
20-Dec	before	-0.32	-1.15	-1.48	-0.31	-2.03	-0.25	-1.61	-1.00
23-Dec		-0.45	-2.49	-2.44	-0.50	-2.88	-1.14	-1.44	-1.48
27-Dec	after								
1992									
03-Jan	before	-0.66	-1.05	-0.98	-0.75	-1.03	-1.93	-1.40	-1.49
06-Jan		-0.63	-3.10	-1.05	-0.50	-4.08	-1.96	-1.85	-1.91
31-Jan	before	-0.42	-1.07	-0.53	-0.54	-1.03	-0.51	-0.50	-0.52
		-0.34	-0.72						
14-Feb	before	-1.48	-2.28	-1.78	-0.88	-2.51	-1.44	-0.95	-1.23
25-Feb	after	-0.94	-1.05	-1.00	-0.92	-0.98	-0.99	-0.96	-1.04
27-Feb	after	-1.69	-2.05	-1.92	-2.43	-2.38	-1.94	-2.90	-2.96
28-Feb	nvt	-0.78	-2.00	-1.82	-1.66	-2.36	-2.44	-2.10	-3.67
29-Feb	before	-0.59	-2.00	-0.66	-0.53	-0.50	-0.73	-1.10	-0.68
01-Mar	after	-0.73	-1.02	-1.39	-0.80	-0.81	-0.99	-1.17	-0.96
02-Mar		-0.75	-0.43	-0.48	-0.92	-0.95	-0.74	-1.17	-0.96
03-Mar	after	-0.64	-1.14	-1.02	-0.83	-0.81	-0.60	-0.94	-0.78
05-Mar	after		-1.24	-0.76		-0.58			-0.64
06-Mar	after	2.00	3.00	3.00	2.00	3.00	3.00	3.00	3.00
11-Mar		-0.50	1.39	0.97	0.50				
12-Mar	before	-0.60							
20-Mar	after	-0.64	-0.96						
03-Apr	after		-0.94	-0.47	0.00	-0.46		-0.51	-0.53

APPENDIX 9c

Weight of the lysimeters

DATE MM/DD	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16
1991																
04/07	65,5	62,5	63,2	64,4	66,9	64,0	64,4	64,4	65,1	63,6	63,3	63,9	62,2	63,1	59,4	63,3
04/15	65,4	63,0	63,1	64,2	67,0	64,0	65,0	63,8	65,0	63,0	62,9	64,7	62,8	63,4	61,9	65,0
04/19	64,3	61,7	61,8	62,9	65,9	62,9	63,3	61,9	63,5	61,6	61,4	62,8	61,7	61,9	60,8	63,3
04/26	66,1	63,8	63,7	64,8	67,4	65,4	65,4	63,6	65,9	63,8	63,5	64,8	64,2	64,1	63,2	65,5
05/03	66,3	64,2	63,5	64,6	66,7	64,7	66,1	64,2	65,1	64,4	64,2	65,1	63,6	64,1	62,5	65,5
05/10	64,9	63,0	62,7	63,1	65,8	63,5	64,3	62,9	64,6	63,8	62,6	63,3	62,4	62,6	61,4	63,9
05/17	62,9	61,2	62,4	62,6	65,8	62,3	63,1	62,3	64,2	63,9	61,8	62,3	61,9	62,4	60,1	63,1
05/23	62,5	60,3	61,8	62,1	65,8	62,0	63,1	62,2	65,0	64,6	61,9	63,1	62,6	63,1	59,9	62,8
05/31	60,1	57,8	59,5	61,3	64,0	59,9	60,1	59,4	62,3	61,7	59,5	60,7	60,4	60,6	57,6	59,7
06/07	60,0	58,5	59,9	61,7	65,1	60,4	61,0	60,7	63,4	62,8	60,6	62,6	61,6	61,2	56,9	60,6
06/14	62,9	60,6	62,1	62,9	65,8	62,8	63,3	63,0	64,7	63,9	62,2	63,9	62,7	63,0	59,0	62,6
06/22	64,3	61,0	63,5	63,4	67,0	63,5	64,8	64,0	65,8	65,1	63,0	64,3	63,8	64,0	60,1	63,6
06/27	66,4	62,0	63,7	63,8	66,9	64,8	66,1	64,9	66,3	64,9	64,1	65,5	63,5	64,5	61,5	64,8
07/04	65,6	63,0	63,1	64,2	66,5	63,7	65,7	65,7	64,7	63,7	63,0	66,0	62,7	63,0	59,7	65,4
07/11	66,0	63,3	62,9	63,2	66,3	63,6	64,7	64,3	64,8	63,9	62,1	64,4	62,5	63,5	60,5	64,2
07/31	64,4	61,9	62,2	62,1	65,3	62,6	62,8	62,2	63,5	62,6	60,7	62,4	62,0	62,7	60,4	62,7
08/09	66,7	62,8	63,3	64,6	66,2	64,1	65,0	66,0	65,2	63,8	62,1	64,3	62,6	63,4	60,6	64,0
08/15	64,3	61,6	62,1	62,3	65,4	62,9	63,8	64,0	63,9	62,7	61,3	63,6	61,1	61,8	59,3	62,8
08/23	64,4	61,3	62,4	62,8	65,6	63,0	64,0	64,0	63,7	62,5	61,4	63,1	61,0	61,8	58,4	62,3
08/29	64,8	61,4	62,8	63,0	65,9	63,1	63,9	64,2	63,8	63,1	62,1	63,0	60,8	61,3	57,8	62,1
09/05	61,2	59,4	61,1	61,7	64,4	61,2	61,8	61,7	61,4	60,7	59,9	60,6	59,1	59,4	56,2	59,3
09/12	61,1	58,8	60,0	72,7	72,1	60,1	61,1	61,3	60,8	59,7	58,8	59,6	58,1	58,5	54,8	58,6
09/20	62,2	59,5	61,1	62,5	65,3	61,2	61,7	61,6	61,5	60,7	59,7	60,3	59,4	59,8	56,6	59,2
09/27	64,7	61,7	62,6	63,0	72,2	22,5	63,6	63,9	63,3	62,4	62,0	62,3	60,4	61,5	58,2	61,5
10/03	66,2	63,1	63,1	63,9	66,3	63,3	65,3	65,1	64,7	63,8	63,1	63,9	62,0	33,3	33,3	33,3
10/11	65,5	62,7	62,4	63,0	65,8	63,2	66,0	66,0								
10/12									65,3	63,8	63,8	65,3	62,5	63,2	59,8	64,4
10/17	65,2	63,0	62,2	62,9	65,9	62,7	65,5	65,8	64,7	63,6	63,1	64,3	61,7	62,5	59,0	63,6
10/24	64,6		62,0	62,4	65,6	62,3	65,0	65,1	64,3	63,2	62,3	63,6	61,4	62,2	58,8	63,1
11/01	66,0	64,1	63,4	64,2	66,4	64,2	66,8	66,7	65,1	64,0	64,1	65,8	63,0	64,1	61,2	65,4
11/08	65,3	63,2	63,1	63,4	66,3	63,6	65,9	66,0	65,2	62,9	64,0	65,3	62,4	63,5	60,8	64,9
11/15	65,7	63,6	63,1	63,6	66,2	63,5	65,8	66,1	65,0	63,2	64,3	65,4	61,9	63,5	60,6	64,9
11/22	65,9	63,7	63,3	63,9	66,4	63,8	66,3	66,5	65,2	63,6	64,3	65,4	62,6	63,6	60,7	65,1
11/29	65,6	64,4	63,8	64,3	66,8	64,6	66,5	67,1	65,7	64,5	64,3	65,6	63,0	63,9	60,7	65,6
12/06	64,8	62,7	63,1	63,7	66,1	63,9	65,7	65,9	65,0	63,4	62,9	65,0	62,4	62,6	60,4	64,9
12/13	64,6	62,6	63,0	63,6	65,9	63,9	65,7	65,0	65,0	63,4	62,6	64,8	62,3	62,5	60,3	64,7
12/20	66,8	65,9	64,2	65,4	67,5	66,0	67,5	67,3	66,3	65,2	65,7	66,3	64,2	65,5	62,9	66,6
12/27	67,2	65,8	64,9	65,6	67,4	66,1	67,5	67,7	66,1	65,1	65,4	66,2	64,5	65,1	63,9	66,5
1992																
01/03	66,1	65,1	64,1	65,0	67,2	65,3	67,3	67,7	66,0	64,7	64,6	65,6	63,9	63,6	62,9	65,5
01/10	66,8	65,7	64,3	65,4	67,4	66,0	67,3	67,5	66,1	64,9	65,4	66,3	64,5	64,7	63,2	66,4
01/17	66,5	65,7	64,3	65,4	67,4	66,0	67,4	67,5	66,2	64,9	65,3	66,3	64,5	64,6	63,0	66,2
01/24	66,3	65,6	64,3	65,5	67,5	66,1	67,5	67,5	66,3	65,1	65,1	66,2	64,5	64,5	62,9	66,1
01/31	66,4	65,4	64,2	65,2	67,0	65,9	67,2	67,3	66,0	65,0	65,2	66,2	64,5	65,0	63,3	65,9
01/31	0,0	0,0	67,1						69,1	67,9						
02/07	65,8	65,2	67,1	65,0	66,8	65,8	67,1	67,1	66,0	65,1	64,7	68,7	64,3	67,7	63,0	65,8
02/07			67,9	69,7				67,6								
02/14	66,3	64,8	66,9	68,0	69,8	65,6	67,2	66,7	65,7	64,0	67,2	68,6	63,5	67,2	63,4	66,2
02/14	69,1	67,8														
02/21	69,3	68,0	67,3	68,4	69,9	65,9	67,6	67,0	66,0	64,6	67,0	68,8	64,0	67,6	63,6	66,3
02/27	67,7	65,2	66,3	66,4	68,9	63,8	65,2	64,7	64,8	63,8	65,7	67,1	62,6	66,6	61,4	64,5
02/29	66,2	63,8	64,9	65,1	67,9	62,7	64,3	62,7	64,0	61,8	63,6	65,2	60,2	64,0	58,6	61,3
03/01	65,7	63,4	64,7	64,8	67,9	62,4	63,9	62,3	63,6	60,1	63,1	64,9	60,0	63,5	57,8	60,8
03/03	63,9	61,5	63,4	64,0	66,7	60,9	61,8	59,7	62,1	58,6	60,9	63,0	58,2	61,7	55,4	58,8
03/05	63,1	60,7	62,5	63,5	60,0	61,0	58,5	61,2	57,3	59,6	61,9	57,3	61,0	54,4	57,8	
03/06	62,6	60,8	62,1	63,4	66,1	59,7	61,0	58,1	61,4	56,3	58,9	62,0	57,0	61,2	54,6	57,4
03/12	68,7	65,9	66,4	67,5	69,3	64,4	65,9	64,0	65,2	63,2	65,4	67,1	62,9	66,9	60,2	63,2
03/20	69,0	66,1	67,0	67,9	70,0	65,2	66,5	64,5	66,0	64,6	65,3	67,5	63,7	67,5	61,1	64,0
04/03	69,1	67,5	66,8	68,0	69,7	65,9	66,8	66,7	65,7	64,0	66,5	68,5	63,6	67,7	63,1	65,1
04/10								66,1	65,1	63,7	66,1	68,3	63,3	67,0	62,7	64,9
04/13	68,9	67,4	66,7	67,7	69,6	64,8	66,3									

APPENDIX 10

Storage coefficients lysimeter test

LYSIMETER 1

h1	*h2*	*μ*
46.5	46.6	
38.7	46.5	0.23
36.0	38.7	0.32
35.2	36.0	
31.6	35.2	0.23
30.0	31.6	0.39
26.4	30.0	0.15
25.4	26.4	0.40
average		0.29
w.avg		0.25

LYSIMETER 2

h1	*h2*	*μ*
47.0	47.7	0.35
40.9	47.0	0.47
38.8	40.9	0.53
37.6	38.8	0.28
33.9	37.6	0.18
31.1	33.9	0.29
27.5	31.1	0.15
average		0.32
w.avg		0.33

LYSIMETER 3

h1	*h2*	*μ*
46.6	46.8	
39.6	46.6	0.21
36.7	39.6	0.38
36.4	36.7	
33.7	36.4	0.17
32.0	33.7	0.37
30.2	32.0	0.32
29.1	30.1	0.33
average		0.30
w.avg		0.27

LYSIMETER 4

h1	*h2*	*μ*
46.5	46.7	
39.3	46.5	0.21
34.3	39.3	0.21
32.7	34.3	0.17
26.3	32.7	0.08
26.3	27.1	
25.3	27.1	0.23
average		0.18
w.avg		0.17

LYSIMETER 5

h1	*h2*	*μ*
47.2	47.4	
40.0	47.2	0.15
36.5	40.0	0.22
36.5	36.7	
36.7	37.7	
26.5	36.7	0.03
average		0.13
w.avg		0.10

LYSIMETER 6

h1	*h2*	*μ*
48.9	49.7	0.34
41.2	49.7	0.28
39.4	41.2	0.45
38.8	39.4	
36.6	38.8	0.24
34.7	36.6	0.36
32.5	34.7	0.26
31.9	32.4	0.48
average		0.34
w.avg		0.31

LYSIMETER 7

h1	*h2*	*μ*
48.8	49.2	
41.4	49.2	0.33
40.2	41.4	0.64
39.9	40.2	
36.4	39.9	0.26
34.2	36.4	0.37
31.3	34.2	0.21
average		0.36
w.avg		0.32

LYSIMETER 8

h1	*h2*	*μ*
47.8	48.5	0.35
40.4	48.5	0.34
37.0	40.4	0.47
36.4	37.0	
32.7	36.4	0.29
29.3	32.7	0.30
26.3	29.3	0.24
25.6	26.3	0.45
average		0.35
w.avg		0.35

LYSIMETER 9
2

h1	*h2*	*μ*
47.9	48.9	0.30
40.8	47.9	0.19
39.8	40.8	0.70
39.6	39.8	
37.3	39.6	0.25
36.2	37.3	0.56
34.1	36.2	0.24
average		0.37
w.avg		0.28

LYSIMETER 10

h1	*h2*	*μ*
48.3	48.8	
40.4	48.8	0.19
37.0	40.4	0.47
33.9	37.0	0.44
31.2	33.9	0.30
30.5	31.2	
27.9	30.5	
25.8	27.6	0.42
average		0.36
w.avg		0.32

LYSIMETER 11

h1	*h2*	*μ*
44.5	44.6	
40.6	44.5	0.39
36.6	40.6	0.42
35.9	36.6	
31.6	35.9	0.26
30.0	31.6	0.42
25.5	30.0	0.18
22.9	25.3	0.23
average		0.32
w.avg		0.31

LYSIMETER 12

h1	*h2*	*μ*
46.5	46.9	
41.6	46.9	0.36
38.5	41.6	0.47
38.4	38.5	
36.1	38.4	0.28
34.4	36.1	0.50
32.4	34.4	0.03
average		0.33
w.avg		0.34

LYSIMETER 13

h1	*h2*	μ
47.0	47.4	
40.6	47.4	0.28
36.6	40.6	0.49
36.6	36.6	
34.7	36.6	0.34
33.3	34.7	0.55
31.0	33.3	0.28
30.2	31.2	0.25
average		0.37
w.avg		0.35

LYSIMETER 14

h1	*h2*	μ
45.8	46.8	0.15
41.4	46.8	0.29
36.5	41.4	0.43
36.3	36.5	
32.7	36.3	0.20
30.8	32.7	0.36
27.7	30.8	0.15
average		0.26
w.avg		0.29

LYSIMETER 15

h1	*h2*	μ
46.8	47.1	
41.5	46.8	0.44
38.0	41.5	0.64
37.5	38.0	
35.1	37.5	0.39
33.4	35.1	0.57
31.8	33.4	0.47
average		0.50
w.avg		0.50

LYSIMETER 16

h1	*h2*	μ
48.5	48.9	
42.9	48.9	0.39
37.1	42.9	0.45
36.5	37.1	
34.6	36.5	0.40
33.0	34.6	0.52
31.3	33.0	0.37
30.6	31.4	0.40
average		0.42
w.avg		0.42

Weighed average over all lysimeters: $\mu = 0.31$

APPENDIX 11

Storage determined with absolute phreatic water levels (m.O.D.) of the tubes and groundwater recorder on the east-west transect

Date	MR201A	MR202A	MR203A	MR204A	MR205A	MR206A	GRWREC	....
19-Apr-91	100.17	101.07	101.92	102.25	103.01	103.94	103.89	....
03-May-91	100.18	101.08	101.92	102.26	103.03	103.95	103.90	....
17-May-91	100.02	101.04	101.87	102.20	102.91	103.86	103.81	....
31-May-91	99.85	100.94	101.81	102.10	102.79	103.74	103.71	....
14-Jun-91	99.90	101.06	101.91	102.21	102.97	103.88	103.82	....
28-Jun-91	99.91	101.06	101.81	102.23	103.03	103.94	103.90	....
11-Jul-91	99.88	101.04	101.84	102.20	102.98	103.90	103.84	....
31-Jul-91	99.83	101.00	101.79	102.14	102.89	103.82	103.78	....
09-Aug-91	99.85	101.06	101.86	102.23	103.01	103.93	103.87	....
23-Aug-91	99.82	101.00	101.78	102.14	102.89	103.82	103.78	....
06-Sep-91	99.68	100.87	101.68	102.03	102.75	103.68	103.63	....
20-Sep-91	99.74	100.89	101.72	102.09	102.82	103.73	103.69	....
03-Oct-91	99.85	101.03	101.80	102.21	103.03	103.93	103.85	....
17-Oct-91	99.89	101.02	101.82	102.21	103.03	103.94	103.89	....
01-Nov-91	99.94	101.05	101.83	102.25	103.06	103.98	103.92	....
15-Nov-91	99.91	101.03	101.83	102.24	103.05	103.97	103.92	....
29-Nov-91	99.94	101.03	101.83	102.23	103.05	103.98	103.93	....
13-Dec-91	99.96	100.99	101.83	102.19	102.99	103.93	103.87	....
27-Dec-91	100.00	101.02	101.84	102.23	103.05	103.97	103.93	....
10-Jan-92	100.03	101.00	101.86	102.24	103.05	103.98	103.92	....
24-Jan-92	100.04	101.01	101.84	102.22	103.01	103.96	103.90	....
21-Feb-92	100.12	101.01	101.83	102.22	103.04	103.96	103.91	....
20-Mar-92	100.18	101.03	101.84	102.25	103.07	103.99	103.94	....
27-Apr-92	100.15	101.03	101.84	102.24	103.07	103.98	103.95	....

Date	.....	MR207A	MR208A	MR209A	MR210A	MR211A	MR212A	Average	Rise (mm)	ΔS cum (mm)
19-Apr-91	.....	104.13	104.57	104.96	105.57	105.81	106.23	103.66	0	0
03-May-91	.....	104.14	104.58	104.96	105.57	105.82	106.24	103.66	8	2
17-May-91	.....	104.03	104.53	104.90	105.51	105.74	106.21	103.59	-76	-21
31-May-91	.....	103.96	104.44	104.83	105.46	105.66	106.14	103.49	-94	-50
14-Jun-91	.....	104.05	104.52	104.90	105.50	105.72	106.20	103.59	91	-22
28-Jun-91	.....	104.07	104.55	104.92	105.56	105.76	106.23	103.61	29	-13
11-Jul-91	.....	104.06	104.52	104.90	105.56	105.73	106.22	103.59	-24	-20
31-Jul-91	.....	104.01	104.48	104.87	105.53	105.64	106.14	103.53	-58	-38
09-Aug-91	.....	104.10	104.54	104.92	105.58	105.75	106.23	103.61	76	-15
23-Aug-91	.....	104.00	104.47	104.87	105.54	105.68	106.18	103.54	-73	-37
06-Sep-91	.....	103.87	104.38	104.77	105.48	105.62	106.15	103.43	-107	-71
20-Sep-91	.....	103.94	104.43	104.82	105.49	105.64	106.16	103.47	45	-57
03-Oct-91	.....	104.10	104.56	104.91	105.55	105.72	106.20	103.60	123	-19
17-Oct-91	.....	104.12	104.57	104.93	105.58	105.76	106.23	103.61	19	-13
01-Nov-91	.....	104.16	104.61	104.98	105.61	105.81	106.25	103.65	35	-2
15-Nov-91	.....	104.16	104.61	104.97	105.61	105.81	106.26	103.64	-7	-4
29-Nov-91	.....	104.16	104.60	104.96	105.61	105.81	106.25	103.64	2	-4
13-Dec-91	.....	104.09	104.55	104.92	105.58	105.77	106.21	103.61	-38	-15
27-Dec-91	.....	104.15	104.62	104.97	105.61	105.81	106.26	103.65	44	-2
10-Jan-92	.....	104.16	104.62	104.99	105.62	105.82	106.27	103.66	7	0
24-Jan-92	.....	104.12	104.60	104.96	105.61	105.78	106.25	103.64	-20	-6
21-Feb-92	.....	104.11	104.57	104.93	105.60	105.78	106.23	103.64	3	-5
20-Mar-92	.....	104.15	104.61	104.96	105.61	105.79	106.25	103.67	27	3
27-Apr-92	.....	104.16	104.61	104.98	105.62	105.83	106.25	103.67	4	4
Total storage over the year:										4

APPENDIX 12

Storage by swelling and shrinkage

Rise and fall of the metal plates of the benchmarks in cm:

DATE	BM1A	BM1B	BM1C	BM1D	AVG	BM2A	BM2B	BM2C	BM2D	AVG	BM3A	BM3B	BM3C	BM3D	AVG
19-Apr-91	78.4	77.2	77.6	79.3	78.1	63.0	62.4	63.2	63.7	63.1	83.5	84.1	83.3	82.9	83.5
03-May-91	80.0	79.0	78.9	78.1	79.0	65.5	64.7	64.7	64.3	64.8	84.9	85.0	85.2	84.8	85.0
17-May-91	80.7	79.4	78.5	79.5	79.5	65.0	64.3	65.0	65.8	65.0	85.6	86.1	85.9	85.4	85.8
31-May-91	81.0	82.5	81.2	81.0	81.4	66.0	65.2	66.1	66.9	66.1	87.1	87.6	87.2	86.7	87.2
14-Jun-91	80.3	81.4	82.5	81.2	81.4	65.7	65.0	65.9	66.7	65.8	86.7	86.2	86.6	87.1	86.7
28-Jun-91	80.1	81.2	82.1	81.0	81.1	64.6	64.0	66.2	65.3	65.0	85.7	85.5	85.1	85.3	85.4
11-Jul-91	80.1	81.8	83.2	81.8	81.7	65.0	65.9	66.8	65.7	65.9	85.8	85.3	85.7	86.1	85.7
31-Jul-91	81.8	82.5	83.8	82.4	82.6	65.4	66.3	67.0	66.2	66.2	86.3	85.8	86.2	86.7	86.3
09-Aug-91	82.3	83.6	81.4	82.4	82.4	66.2	65.3	66.1	66.9	66.1	86.2	85.9	85.4	85.6	85.8
23-Aug-91	82.0	82.9	83.0	84.1	83.0	65.4	66.1	66.3	67.1	66.2	85.9	85.9	86.0	86.4	86.1
06-Sep-91	86.3	85.0	84.9	83.9	85.0	68.9	68.1	68.0	67.0	68.0	88.5	88.8	88.4	88.0	88.4
20-Sep-91	84.2	85.5	86.5	85.2	85.4	68.0	68.8	67.9	67.1	68.0	88.5	88.5	88.1	88.9	88.5
03-Oct-91	83.8	84.6	84.8	86.0	84.8	66.9	67.6	67.7	68.7	67.7	87.9	87.1	87.5	87.5	87.5
17-Oct-91	84.3	83.1	84.3	85.5	84.3	66.6	66.8	67.0	67.9	67.1	86.0	85.7	85.8	85.4	85.7
01-Nov-91	82.9	83.9	85.3	83.9	84.0	65.4	66.2	67.3	66.5	66.4	84.6	84.9	84.2	84.7	84.6
15-Nov-91	81.5	82.6	82.6	84.0	82.7	66.1	66.9	65.9	65.1	66.0	83.9	83.5	84.2	84.0	83.9
29-Nov-91	80.7	81.7	81.7	82.9	81.8	65.1	65.8	66.1	66.9	66.0	84.0	83.5	83.3	82.9	83.4
13-Dec-91	81.1	81.9	83.2	82.1	82.1	65.8	67.0	67.8	66.5	66.8	85.4	85.0	84.5	84.8	84.9
27-Dec-91	81.5	80.6	81.5	82.7	81.6	65.2	66.3	67.2	66.0	66.2	83.6	84.1	83.9	83.4	83.8
10-Jan-92	80.5	79.5	80.5	81.8	80.6	65.6	64.7	65.4	66.5	65.6	83.7	83.3	83.4	83.0	83.4
24-Jan-92	79.9	80.8	82.0	80.7	80.9	64.9	65.9	66.9	65.7	65.9	83.5	83.9	83.7	83.3	83.6
20-Feb-92	81.4	80.4	81.3	82.6	81.4	65.2	65.9	67.0	66.1	66.1	84.0	83.4	84.3	83.9	83.9
20-Mar-92	81.4	82.6	81.4	80.6	81.5	65.2	66.4	65.3	64.5	65.4	82.7	83.3	82.6	83.0	82.9

Storage ΔS due to swelling and shrinkage of the peat surface in mm:

DATE	BM1	RISE	ΔS	BM2	RISE	ΔS	BM3	RISE	ΔS	ΔS AVG
19-Apr-91	78.1			63.1			83.5			
31-Jul-91	82.6	-4.5	-43	66.2	-3.1	-29	86.3	-2.8	-27	-33
17-Oct-91	84.3	-1.7	-16	67.1	-0.9	-9	85.7	0.6	6	-6
10-Jan-92	80.6	3.7	35	65.5	1.6	15	83.4	2.3	22	24
20-Mar-92	81.5	-0.9	-9	65.4	0.1	1	82.9	0.5	5	-1
Total storage:			**-32**			**-22**			**6**	**-16**

Level and rise of benchmarks in cm.
Water content acrotelm 95%.

APPENDIX 13

Seepage method 1

$$v_d = k \cdot \frac{dH}{dz}$$

East-west transect: *k* = 0.0007 m/day

Tube	depth	*dH*	*dz*	*dH/dz*	v_d	avg v_d	w	w.v_d
NR 201	B-C	66.2	150	0.441	113	67	0.014	0.9
	C-D	5.1	60	0.084	22			
NR 202	B-C	12.0	150	0.080	20	30	0.022	0.6
	C-D	22.7	150	0.151	39			
NR 204	B-C	4.5	150	0.030	8	2	0.085	0.2
	C-D	2.3	150	0.015	4			
	D-E	-3.2	150	-0.021	-5			
NR 206	B-C	6.7	150	0.045	11	9	0.177	1.7
	C-D	6.1	147	0.042	11			
	D-E	0.7	153	0.005	1			
	E-S	3.7	65	0.057	15			
NR 209	B-C	1.8	150	0.012	3	3	0.198	0.6
	C-D	3.5	150	0.023	6			
	D-E	-0.4	150	-0.002	-1			
	E-F	11.2	771	0.015	4			
NR 210	B-C	1.9	150	0.013	3	0	0.183	0.1
	C-D	-1.7	150	-0.011	-3			
	D-E	0.5	150	0.003	1			
NR 211	B-C	5.7	150	0.038	10	12	0.165	2.0
	C-D	3.8	150	0.026	7			
	D-E	3.8	150	0.026	7			
	E-F	81.1	839	0.097	25			
NR 212	B-C	2.0	150	0.013	3	3	0.157	0.5
	C-D	1.6	150	0.010	3			
	D-E	1.8	150	0.012	3			
Average:				0.048	12	**Sum:**	1	6

North-south transect: *k* = 0.0015 m/day

Tube	depth	*dH*	*dz*	*dH/dz*	v_d	avg v_d	w	w.v_d
NR 305	B-C	-3.3	75	-0.044	-24	-24	0.012	-0.3
NR 307	B-C	3.4	75	0.045	25	25	0.016	0.4
NR 310	B-C	-2.3	85	-0.028	-15	-15	0.014	-0.2
NR 313	B-C	0.7	75	0.010	5	6	0.005	0.0
	C-D	1.4	100	0.014	7			
NR 315	B-C	9.1	100	0.091	50	133	0.007	0.9
	C-D	45.4	115	0.394	216			
NR 317	B-C	22.0	140	0.157	86	62	0.028	1.7
	C-D	9.2	135	0.068	37			
NR 321	B-C	3.5	150	0.023	13	85	0.072	6.1
	C-D	32.3	150	0.215	118			
	D-E	60.7	265	0.229	125			
NR 324	B-C	1.3	150	0.008	5	70	0.139	9.8
	C-D	13.6	150	0.091	50			
	D-F	134.3	471	0.285	156			
NR 327	B-C	0.7	0					
	C-D	0.4	300	0.001	1	96	0.183	17.6
	D-F	302.7	865	0.350	192			
NR 330	B-C	0.4	150	0.003	2	23	0.183	4.1
	C-D	1.0	150	0.007	4			
	D-E	81.9	717	0.114	63			
NR 333	B-C	1.1	150	0.007	4	42	0.183	7.6
	C-D	1.2	150	0.008	4			
	D-F	224.9	1055	0.213	117			
NR 336	B-C	33.5	149	0.225	123	110	0.109	12.0
	C-D	26.3	150	0.176	96			
	D-E	-2.3	6					
NR 340	B-C	22.5	75	0.299	164	148	0.026	3.9
	C-D	26.7	110	0.243	133			
NR 342	B-C	14.2	95	0.150	82	82	0.012	1.0
NR 344	B-C	10.5	95	0.110	60	60	0.010	0.6
Average:				0.120	65	**Sum:**	1	65

dH and *dz* in cm;
v_d mm/year

APPENDIX 14

Seepage method 2

$$v_d = k \; . \; \frac{dH}{dz}$$

East-west transect: *k* = 0.0007 m/day

Tube	depth	*dH*	*dz*	*dH/dz*	v_d	w	$w.v_d$
NR 201	A-D	87.2	367	0.238	61	0.014	0.8
NR 202	A-D	40.3	457	0.088	23	0.022	0.5
NR 204	A-E	3.3	607	0.005	1	0.085	0.1
NR 206	A-S	20.4	672	0.030	8	0.177	1.4
NR 209	A-F	18.1	1378	0.013	3	0.198	0.7
NR 210	A-E	0.6	607	0.001	0	0.183	0.0
NR 211	A-F	92.7	1446	0.064	16	0.165	2.7
NR 212	A-E	6.7	607	0.011	3	0.157	0.4
Average:				0.056	14		
Sum :						1	7

North-south transect: *k* = 0.0015 m/day

Tube	depth	*dH*	*dz*	*dH/dz*	v_d	w	$w.v_d$
NR 305	A-C	-2.6	227	-0.012	-6	0.012	-0.1
NR 307	A-C	6.9	227	0.031	17	0.016	0.3
NR 310	A-C	-3.8	262	-0.015	-8	0.014	-0.1
NR 313	A-D	14.6	377	0.039	21	0.005	0.1
NR 315	A-D	59.0	417	0.142	78	0.007	0.5
NR 317	A-D	39.4	477	0.083	45	0.028	1.3
NR 321	A-E	97.5	767	0.127	70	0.072	5.0
NR 324	A-F	143.9	973	0.148	81	0.139	11.3
NR 327	A-F	305.0	1367	0.223	122	0.183	22.3
NR 330	A-F	253.2	1257	0.201	110	0.183	20.2
NR 333	A-F	227.4	1557	0.146	80	0.183	14.6
NR 336	A-E	61.1	507	0.121	66	0.109	7.2
NR 340	A-D	62.6	387	0.162	89	0.026	2.3
NR 342	A-C	24.6	297	0.083	45	0.012	0.5
NR 344	A-C	16.7	277	0.060	33	0.010	0.3
Average:				0.103	56		
Sum :						1	86

dH and *dz* in cm;
v_d in mm/year

APPENDIX 15

Seepage method 3

$$v_d = \frac{dH}{c}$$

PIEZOMETER 211

Hydraulic head			Layers between piezometer depths		Conductivity	
ΔH (m)	z (m)		v_d (mm/y)	c (d)	z (m)	k (m/d)
	- 0	A			0	-
ΔH=			v_d=	c=		
	- 1.5	B				
					2	k=0.0033
ΔH=0.057			v_d=40.9	c=508		
	- 3.0	C			3	k=0.0019
ΔH=0.038			v_d=9.9	c=1395	4	k=0.0008
	- 4.5	D				
ΔH=0.038			v_d=16.6	c=833		
	- 6.0	E				
					7	k=0.0032
ΔH= 0.811			v_d=75.3	c=3931	10	k=0.0009
					13	k=
	-14.39	F				

↓ ↓ ↓ ↓

v_d=35.7

PIEZOMETER 210

Hydraulic head ΔH (m)	z (m)		Layers between piezometer depths: v_d (mm/y)	c (d)
	0	A		
ΔH=			v_d=	c=
	1.5	B		
ΔH=0.019			v_d=4.4	c=1579
	3.0	C		
ΔH=0.04			v_d=0.9	c=1579
	6.0	E		
ΔH=			v_d=	c=
	-	F		

Conductivity z (m)	k (m/d)
0	-
2	k=0.0006
3	k=0.0020
4	k=0.0020
7	k=0.0016
10	k=0.0021
13	k=

v_d=2.7 mm

PIEZOMETER 324

Hydraulic head ΔH (m)	z (m)		Layers between piezometer depths: v_d (mm/y)	c (d)
	0	A		
ΔH=			v_d=	c=
	1.5	B		
ΔH=0.013			v_d=15.4	c=308
	3.0	C		
ΔH=0.136			v_d=94.4	c=526
	4.5	D		
8 ΔH=1.343			v_d=112.4	c=4361
	9.21	F		

Conductivity z (m)	k (m/d)
0	-
2	k=0.0053
3	k=0.0036
4	k=0.0026
7	k=0.0010
10	k=
13	k=

v_d=74.0

PIEZOMETER 327

Hydraulic head			Layers between piezometer depths		Conductivity	
ΔH (m)	z (m)		v_d (mm/y)	c (d)	z (m)	k (m/d)
	0	A			0	-
ΔH=			v_d=	c=		
	1.5	B				
					2	k=0.0033
ΔH=			v_d=	c=		
	3.0	C			3	k=0.0055
ΔH=0.004			v_d=2.7	c=545	4	k=0.0056
	4.5	D				
					7	k=0.0040
ΔH=3.027			v_d=229.9	c=4806		
					10	k=0.0004
	-13.15	F			13	k=
			v_d=116.3			

PIEZOMETER 330

Hydraulic head			Layers between piezometer depths		Conductivity	
ΔH (m)	z (m)		v_d (mm/y)	c (d)	z (m)	k (m/d)
	0	A			0	-
ΔH=			v_d=	c=		
	1.5	B				
					2	k=0.0024
ΔH=0.004			v_d=2.2	c=652		
	3.0	C			3	k=0.0021
ΔH=0.01			v_d=8.0	c=455	4	k=0.0045
	4.5	D				
					7	k=0.0049
ΔH=0.819			v_d=150.1	c=1992		
					10	k=0.0011
	11.7	E				
					13	k=0.0010
			v_d=53.5			

APPENDIX 16

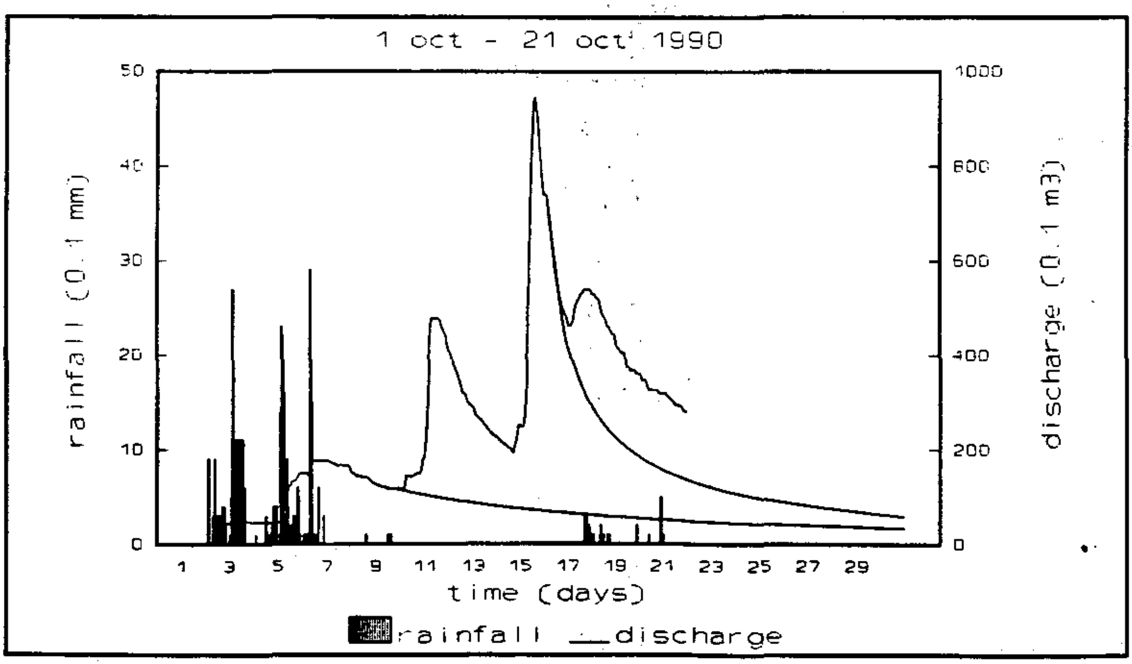
Hydrographs

Catchment sizes derived from rainfall-discharge relationship:

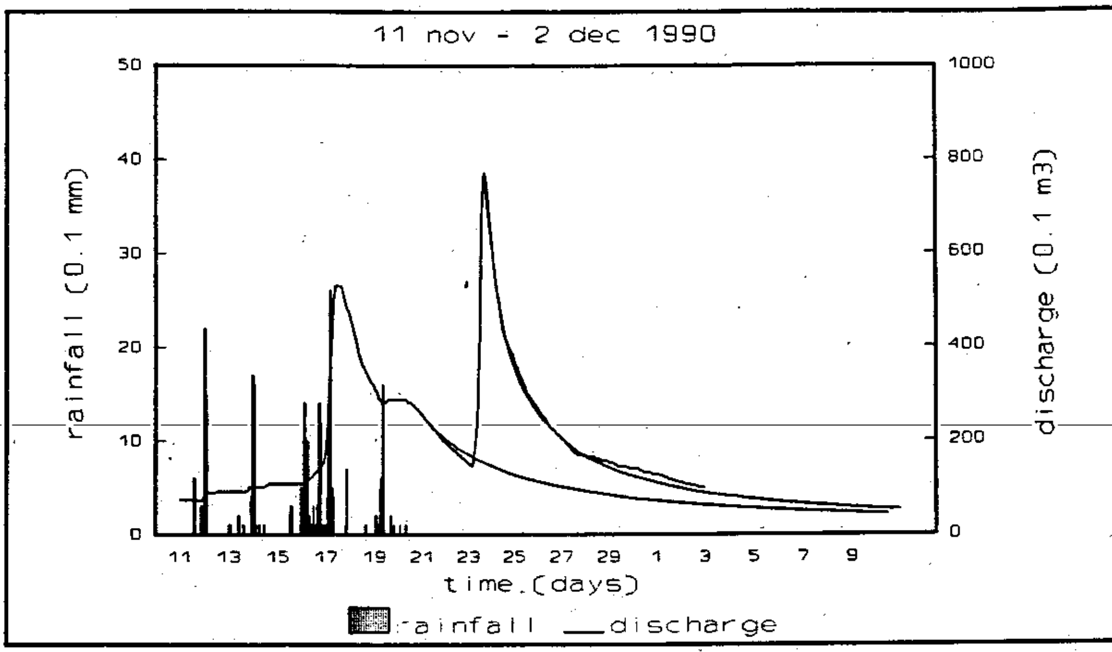
$$A = \frac{Q}{(\Delta S + P - E)}$$

with	P	:	precipitation
	E	:	evapotranspiration
	Q	:	discharge
	ΔS	:	change in storage
	A	:	catchment area

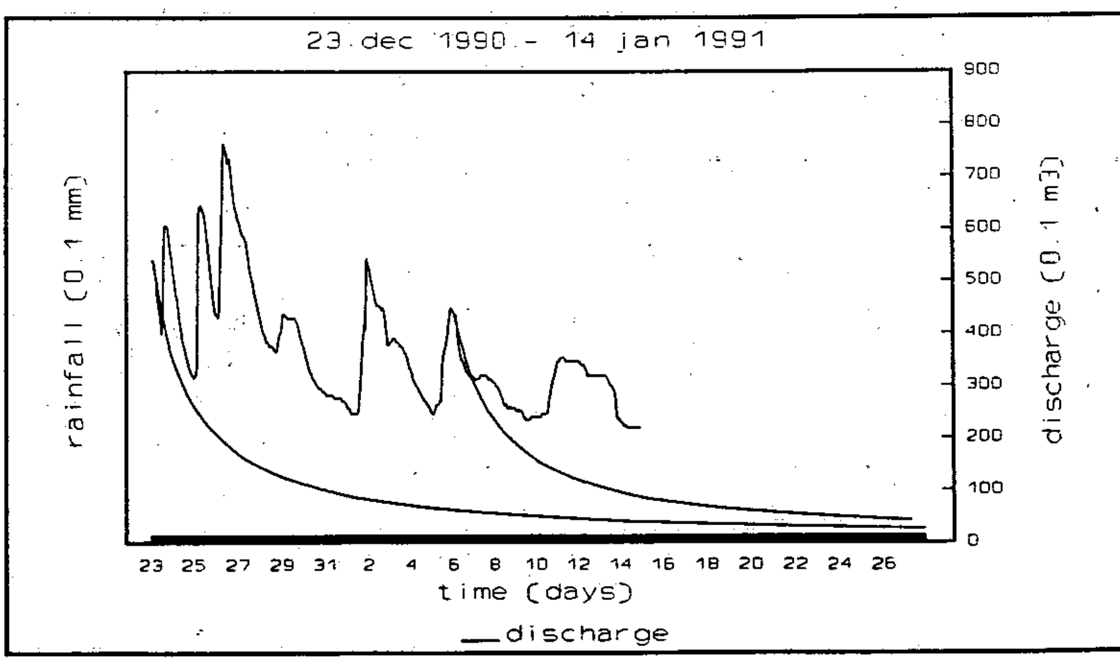
N.B. In all graphs a lot of rainfall gaps occur; in that case weeksums of the hand raingauges are used.



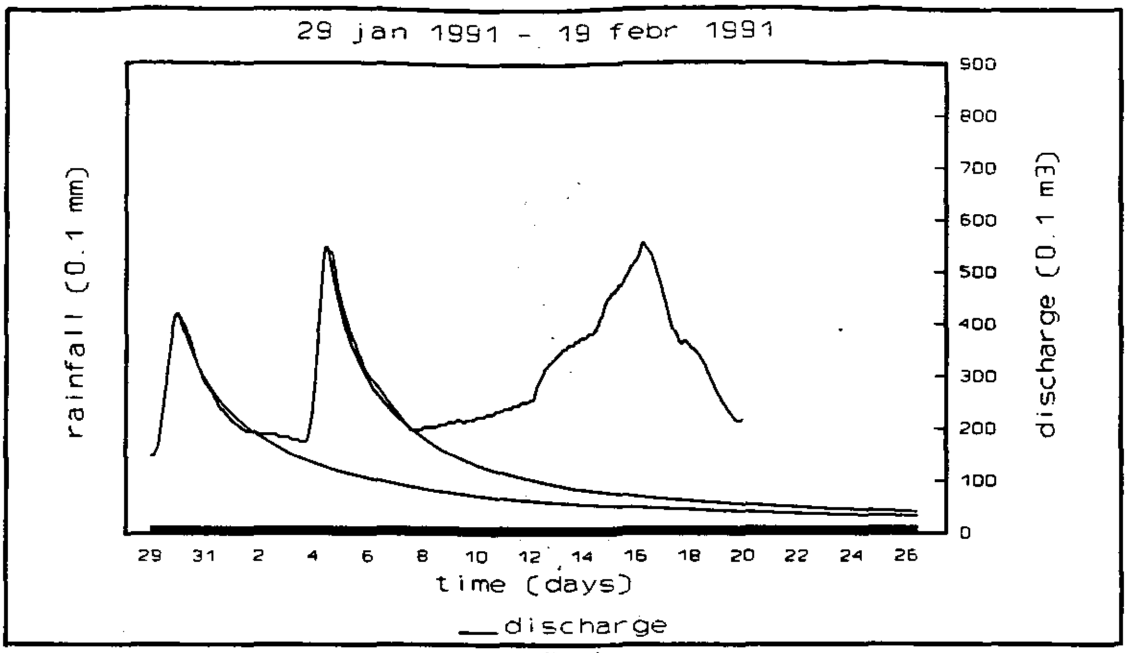
P	=	69.0	(mm)
Q	=	7872.6	(0.1 m³)
E	=	0.0	(mm)
ΔS	=	0.0	(mm)
A	=	11.4	(ha)



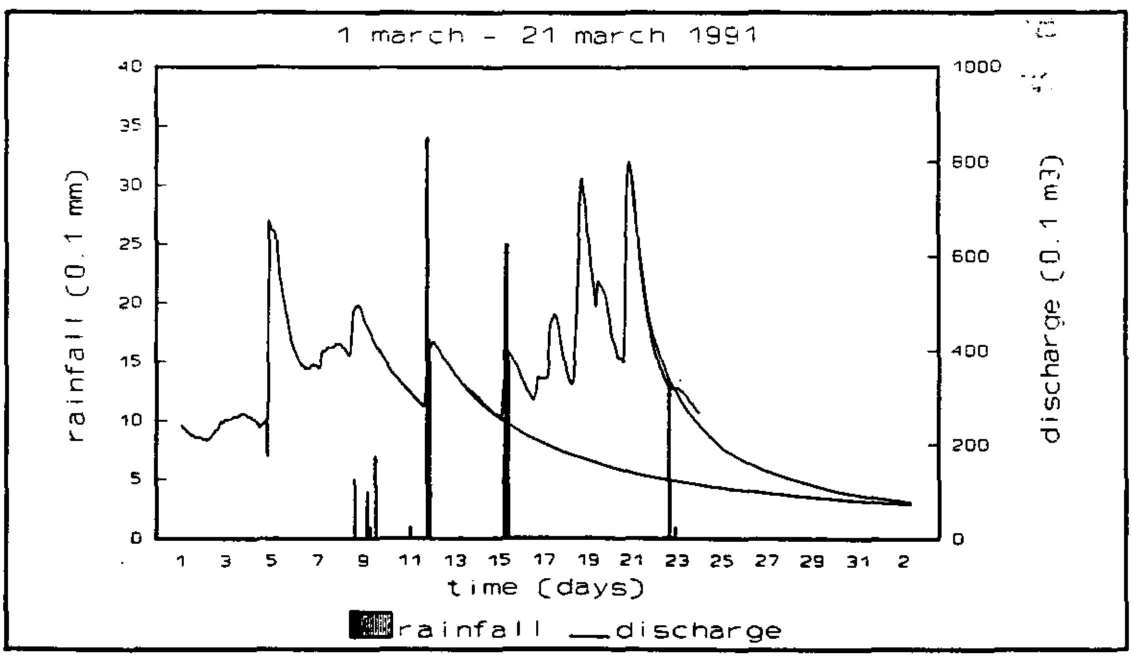
P	=	31.2	(mm)
Q	=	3288.0	(0.1 m^3)
E	=	0.0	(mm)
ΔS	=	0.0	(mm)
A	=	11.0	(ha)



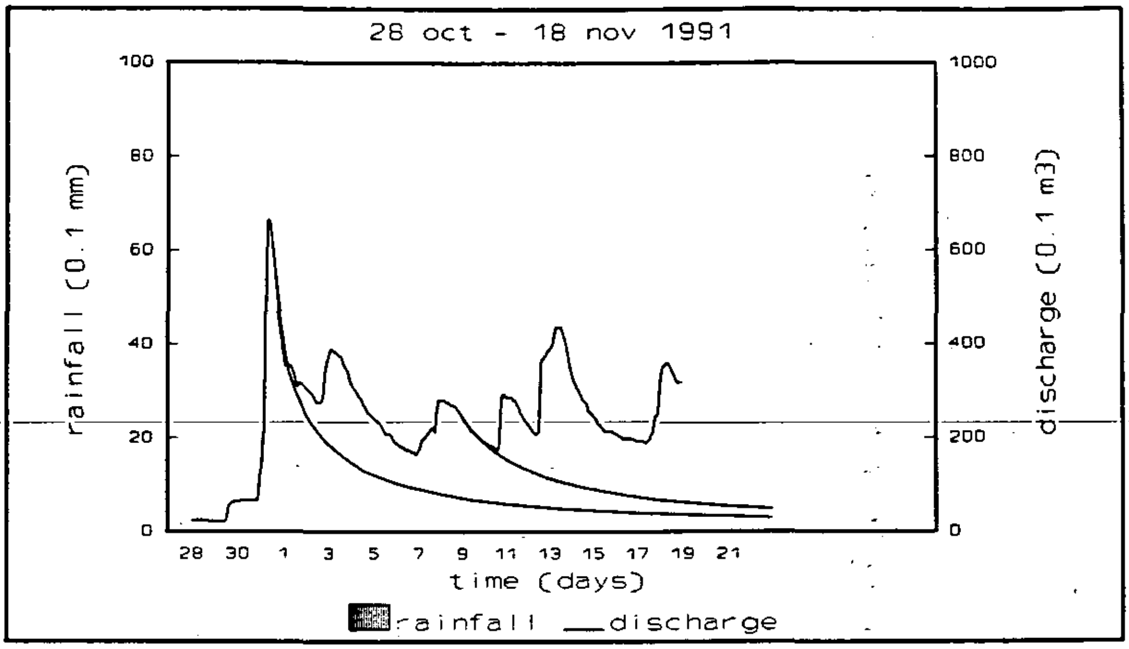
P	=	98.0	(mm)
Q	=	12123.0	(0.1 m^3)
E	=	0.0	(mm)
ΔS	=	0.0	(mm)
A	=	12.0	(ha)



P	=	16.3	(mm)
Q	=	3445.0	(0.1 m³)
E	=	0.0	(mm)
Δ*S*	=	0.0	(mm)
A	=	23.0	(ha)



P	=	43.0	(mm)
Q	=	6680.0	(0.1 m³)
E	=	6.0	(mm)
Δ*S*	=	0.0	(mm)
A	=	18.0	(ha)



P	=	26.3	(mm)
Q	=	4113.4	(0.1 m^3)
E	=	0.0	(mm)
ΔS	=	0.0	(mm)
A	=	15.7	(ha)

APPENDIX 17

Recorder checks

Rossum V-notch Date	Time	Check (cm)	Gauge (cm)	**Groundwater recorder** Date	Time	Check (cm)
25-07-90	11.33	123.1		25-07-90		
01-08-90	11.07	122.6		01-08-90		
08-08-90	10.55	128.0		08-08-90		
15-08-90	10.44	132.0		15-08-90		
23-08-90	10.55	122.8		23-08-90		
29-08-90	12.24	114.8		29-08-90		
06-09-90	11.13	116.5		06-09-90		
12-09-90	10.17	119.4		12-09-90		
18-09-90	10.13	121.4		18-09-90		
26-09-90	10.55	122.3	24.5	26-09-90		
03-10-90	14.15	116.7		03-10-90		
09-10-90	17.00	114.2	30.8	09-10-90		
19-09-90	10.00	121.4		18-09-90	10.57	69.4
26-09-90	10.55	122.3		26-09-90	11.34	67.3
03-10-90	14.15	116.7		03-10-90	14.20	54.7
09-10-90	17.00	114.2		09-10-90	15.38	55.2
20-10-90	13.30	109.8		20-10-90	13.45	49.4
24-10-90	18.30	111.4		24-10-90	17.45	48.9
01-11-90	11.03	112.5		01-11-90	11.35	48.7
06-11-90	10.45	114.9		06-11-90	11.30	52.1
14-11-90	15.45	114.2		14-11-90	15.55	48.1
20-11-90	11.05	111.4		20-11-90	11.45	47.3
27-11-90	16.32	112.5		27-11-90	16.25	48.9
04-12-90	11.45	114.7		04-12-90	12.38	50.5
18-12-90	10.45	118.9		18-12-90	11.00	51.2
19-12-90	13.25	117.0				
23-12-90	12.50	108.4		23-12-90	13.55	45.9
06-01-91	14.50	109.3		06-01-91	15.15	46.2
11-01-91	11.15	109.0				
17-01-91	12.15	111.8		17-01-91	11.45	46.7
01-02-91	13.45	111.4	32.5	01-02-91	13.50	49.0
07-02-91	13.15	111.3		07-02-91	13.50	50.5
14-02-91	11.40	108.1		14-02-91	11.50	48.2
21-02-91	10.05	110.0		21-02-91	10.25	46.3
28-02-91	14.30	110.2	33.5	28-02-91	14.20	46.4
08-03-91	12.30	106.8		08-03-91	12.40	44.4
15-03-91	11.35	107.8	35.8	15-03-91	12.00	44.7
22-03-91	10.10	108.5	35.5	22-03-91	10.30	45.7
28-03-91	13.40	112.0	31.8	28-03-91	13.50	48.5
04-04-91	11.08	110.9	32.5	04-04-91	11.55	44.2
12-04-91	14.50	101.5	42.0	12-04-91	14.40	43.6
19-04-91	10.05	112.8	30.5	19-04-91	10.30	51.6
26-04-91	13.20	112.5	31.5	26-04-91	13.10	48.7
03-05-91	13.35	112.4	31.0	03-05-91	13.25	50.8
10-05-91	11.40	115.0	29.0	10-05-91	11.32	53.0
17-05-91	11.12	117.1	27.0	17-05-91	11.45	59.7
23-05-91	12.30	118.1	25.7	23-05-91	12.40	62.9
31-05-91	12.45	119.9	24.2	31-05-91	13.00	69.8

Rossum V-notch Date	Time	Check (cm)	Gauge (cm)	Groundwater recorder Date	Time	Check (cm)
05-06-91	13.55	120.5	23.7	05-06-91	14.02	72.1
14-06-91	15.00	117.0	26.5	14-06-91	15.30	59.5
22-06-91	16.50	116.4	28.0	22-06-91	17.05	57.1
27-06-91	12.55	113.9	30.0	27-06-91	14.55	51.1
04-07-91	12.00	113.7	29.5	04-07-91	12.10	52.9
11-07-91	13.00	116.2	27.5	11-07-91	13.45	57.5
31-07-91	13.10	117.9	25.5	31-07-91	13.20	63.1
03-08-91	15.45	116.4	27.0	03-08-91	15.52	61.4
09-08-91	16.05	114.0	28.8	09-08-91	16.12	53.8
15-08-91	12.30	116.4	26.8	15-08-91	12.20	57.6
23-08-91	12.05	118.4	25.3	23-08-91	12.25	63.2
29-08-91	10.20	119.5	24.2	29-08-91	10.30	72.5
06-09-91	10.40	130.2		06-09-91	10.55	78.2
16-09-91	15.50	131.3	24.5	16-09-91	15.40	68.8
20-09-91	11.42	129.0	16.5	20-09-91	12.00	72.0
27-09-91	11.35	119.2	25.8	27-09-91	11.45	64.1
03-10-91	12.20	116.1	27.5	03-10-91	12.30	56.1
07-10-91	14.40	110.3		07-10-91	13.17	52.1
11-10-91	11.58	109.9	32.0	11-10-91	12.08	50.5
17-10-91	12.15	111.4	30.5	17-10-91	12.20	52.2
24-10-91	15.40	114.4	27.9	24-10-91	16.00	57.6
01-11-91	12.00	106.7	35.5	01-11-91	12.10	49.0
08-11-91	15.34	107.6	34.5	08-11-91	15.40	48.4
15-11-91	14.35	108.6	33.5	15-11-91	14.38	49.0
22-11-91	10.25	110.0	32.2	22-11-91	10.40	49.5
29-11-91	13.32	109.6	32.7	29-11-91	13.47	47.9
06-12-91	14.30	112.4	29.9	06-12-91	14.45	52.2
10-12-91	16.35	113.5	29.1	10-12-91	16.45	53.3
13-12-91	10.40	114.0	28.3	13-12-91	11.08	54.0
20-12-91	14.48	106.8	35.5	20-12-91	14.58	47.3
27-12-91	13.56	109.4	33.0	27-12-91	14.39	48.3
03-01-92	13.52	109.9	32.6	03-01-92	13.58	49.4
10-01-92	14.37	108.7	33.6	10-01-92	15.02	48.6
17-01-92	12.22	111.2	30.9	17-01-92	12.33	49.8
24-01-91	11.08	112.7	30.0	24-01-91	11.27	51.2
31-01-92	14.32	112.9	29.3	31-01-92	14.35	50.1
07-02-92	15.00	114.0	28.3	07-02-92	15.15	51.3
14-02-92	11.52	112.1	30.2	14-02-92	11.58	47.8
21-02-92	12.37	113.0	29.3	21-02-92	13.22	50.1
28-02-92	16.39	111.1	31.1	28-02-92	16.44	48.0
06-03-92	15.11	113.0	29.4	06-03-92	15.20	48.9
12-03-92	16.37	109.5	32.6	12-03-92	16.42	46.3
20-03-92	14.04	111.8	30.7	20-03-92	14.25	47.1
03-04-92	14.25	111.5	31.0	04-04-92	12.32	48.8
10-04-92	15.10	111.3	30.9	10-04-92	15.18	48.8
17-04-92	15.40	111.2	31.5	17-04-92	15.50	48.6
24-04-92	12.25	105.5	37.7	24-04-92	12.37	45.9

APPENDIX 18

Levelling data

Tube levels east-west transect Raheenmore Bog

Date	15-Aug-90		13-Sep-90		13-Jan-91		25-Apr-91		09-Aug-91		20-Nov-91	
Tube nr	top tube	surface	top tube	surface	top tube	surface	top tube	surface	top tube	surface	top tube	surface
201A	100.57	100.37	100.53	100.33	100.56	100.36	100.59	100.37	100.57	100.39	100.55	100.35
201B	100.57	100.32	100.53	100.33	100.56	100.36	100.59	100.37	100.57	100.36	100.56	100.35
201C	100.57	100.29	100.53	100.33	100.56	100.36	100.59	100.37	100.56	100.37	100.56	100.35
201D	100.57	100.25	100.53	100.33	100.56	100.36	100.59	100.37	100.57	100.37	100.56	100.35
202A	101.28	101.05	101.26	101.07	101.31	101.13	101.35	101.17	101.32	101.14	101.29	101.13
202C	101.28	101.06	101.26	101.07	101.31	101.13	101.35	101.17	101.31	101.14	101.28	101.13
202D	101.28	101.03	101.26	101.07	101.31	101.13	101.31	101.13	101.31	101.13	101.28	101.13
203A	101.96	101.71	101.94	101.78	102.01	101.84	102.08	101.84	102.00	101.85	101.98	101.85
204A	102.42	102.17	102.44	102.22	102.49	102.29	102.52	102.29	102.49	102.28	102.48	102.19
204B	102.42	102.18	102.44	102.22	102.46	102.29	102.48	102.29	102.47	102.27	102.46	102.19
204C	102.42	102.20	102.44	102.22	102.47	102.29	102.50	102.29	102.48	102.28	102.46	102.19
204D	102.42	102.18	102.44	102.22	102.47	102.29	102.48	102.29	102.48	102.28	102.47	102.19
205A	103.30	103.05	103.30	103.10	103.30	103.10	103.35	103.15	103.34	103.16	103.35	103.16
206A	104.03	103.78	104.14	103.92	104.11	103.95	104.17	103.98	104.17	103.98	104.18	103.99
206B	104.03	103.79	104.14	103.92	104.11	103.95	104.15	103.98	104.16	103.97	104.17	103.99
206C	104.03	103.80	104.14	103.92	104.11	103.95	104.16	103.98	104.17	103.99	104.17	103.99
206D	104.03	103.81	104.14	103.92	104.11	103.95	104.15	103.98	104.16	104.01	104.17	103.99
206S	104.06	103.81	104.17	103.93	104.13	103.93	104.17	103.98	104.19	103.97	104.20	104.00
207A	104.11	103.86	104.32	104.14	104.30	104.13	104.35	104.18	104.35	104.19	104.36	104.19
208A	104.26	104.01	104.81	104.60	104.77	104.56	104.84	104.63	104.84	104.63	104.86	104.66
209A	104.53	104.28	105.20	104.99	105.14	104.92	105.21	104.98	105.21	104.99	105.22	104.97
209B	104.53	104.29	105.20	104.99	105.14	104.92	105.20	104.98	105.21	104.97	105.22	104.97
209C	104.53	104.29	105.20	104.99	105.14	104.92	105.20	104.98	105.21	104.99	105.21	104.97
209D	104.53	104.28	105.20	104.99	105.14	104.92	105.20	104.98	105.21	105.02	105.22	104.97
209F		105.20	104.99	105.14	104.93	105.20	104.98	105.21	105.00	105.21	104.97	
210A	105.30	105.05	105.83	105.58	105.77	105.52	105.86	105.61	105.86	105.62	105.87	105.59
210B	105.30	105.05	105.83	105.58	105.77	105.52	105.85	105.61	105.85	105.62	105.86	105.59
210C	105.30	105.08	105.83	105.58	105.77	105.52	105.85	105.61	105.85	105.62	105.87	105.59
210D	105.30	105.05	105.83	105.58	105.77	105.52	105.85	105.61	105.85	105.62	105.86	105.59
211A	105.80	105.55	106.09	105.83	105.97	105.76	106.06	105.76	106.06	105.78	106.06	105.77
211B	105.80	105.60	106.09	105.83	105.97	105.76	106.06	105.76	106.06	105.78	106.06	105.77
211C	105.80	105.64	106.09	105.83	105.97	105.76	106.06	105.76	106.06	105.78	106.06	105.77
211D	105.80	105.62	106.09	105.83	105.97	105.76	106.06	105.76	106.06	105.78	106.06	105.77
211F		106.09	105.83	105.97	105.70	106.06	105.76	106.06	105.78	106.06	105.77	
212A	106.18	105.92	106.56	105.34	106.42	106.11	106.54	106.24	106.56	106.29	106.56	106.33
212B	106.18	105.93	106.56	106.34	106.42	106.11	106.54	106.24	106.56	106.29	106.56	106.33
212C	106.18											
212D	106.18	105.95	106.56	106.34	106.42	106.11	106.54	106.24	106.56	106.29	106.56	106.33
213S		105.93	99.05	99.05			99.60	99.60	99.60	99.60	99.60	99.60

Tube levels north-south transect Raheenmore Bog

Date	22-Sep-90		01-Nov-90		12-Jan-91		14-May-91		30-Aug-91		20-Oct-91	
Tube nr	top tube	surface	top tube	surface	top tube	surface	top tube	surface	top tube	surface	top tube	surface
301	103.12	102.04	103.12	102.04	103.12	102.04	103.05	101.97	103.04	101.97	103.03	101.97
303A	104.64	104.14	104.64	104.14	104.64	104.14	104.26	103.79	104.29	103.79	104.29	103.76
303B	104.66	104.14	104.64	104.14	104.64	104.14	104.26	103.79	104.30	103.79	104.29	103.76
303GW	104.39	104.14	104.39	104.14	104.39	104.14	104.07	103.79	104.05	103.79	104.04	103.76
304GW	104.21	103.89	104.21	103.89	104.21	103.89	104.15	103.82	104.13	103.81	104.13	103.77
305A	104.34	103.86	104.34	103.86	104.34	103.86	104.05	103.58	104.03	103.56	104.03	103.56
305B	104.37	103.86	104.34	103.86	104.34	103.86	104.05	103.58	104.03	103.56	104.03	103.56
305C	104.37	103.86	104.34	103.86	104.34	103.86	104.05	103.58	104.03	103.56	104.03	103.56
305GW	104.13	103.86	104.13	103.86	104.13	103.86	103.83	103.58	103.81	103.56	103.80	103.56
306GD	103.60	103.60	103.60	103.60	103.60	103.60	103.56	103.56	103.53	103.53	103.53	103.49
307GD	104.16	104.04	104.16	104.04	104.16	104.04	103.74	103.61	103.71	103.67	103.72	103.57
307A	104.51	104.04	104.51	104.04	104.51	104.04	104.14	103.61	104.16	103.67	104.11	103.57
307B	104.53	104.04	104.51	104.04	104.51	104.04	104.14	103.61	104.12	103.67	104.13	103.57
307C	104.54	104.04	104.51	104.04	104.51	104.04	104.14	103.61	104.12	103.67	104.13	103.57
307GW	104.22	104.04	104.22	104.04	104.22	104.04	103.85	103.61	103.82	103.67	103.82	103.57
308GD	103.86	103.86	103.86	103.86	103.86	103.86	103.82	103.82	103.79	103.79	103.81	103.81
309GD	104.01	103.98	104.01	103.98	104.01	103.98	103.96	103.94	103.93	103.91	103.96	103.96
310GD	104.11	103.96	104.11	103.96	104.11	103.96	104.05	103.92	103.99	103.87	104.04	103.90
310A	104.44	103.96	104.44	103.96	104.44	103.96	104.41	103.92	104.37	103.87	104.40	103.90
310B	104.45	103.96	104.44	103.96	104.44	103.96	104.41	103.92	104.38	103.87	104.40	103.90
310C	104.45	103.96	104.44	103.96	104.44	103.96	104.41	103.92	104.38	103.87	104.39	103.90
311GD	104.12	104.08	104.12	104.08	104.12	104.08	104.08	104.04	104.05	104.04	104.07	104.01
312GD	105.14	105.08	105.14	105.08	105.14	105.08	105.09	105.03	105.06	105.03	105.08	105.05
313GD	105.33	105.33	105.33	105.33	105.33	105.33	105.06	105.06	105.03	105.06	105.05	105.05
313A	105.71	105.33	105.72	105.33	105.72	105.33	105.26	105.11	105.43	105.06	105.45	105.05
313B	105.72	105.33	105.72	105.33	105.72	105.33	105.26	105.11	105.43	105.06	105.46	105.05
313C	105.72	105.33	105.72	105.33	105.72	105.33	105.26	105.11	105.44	105.06	105.45	105.05
313D	105.72	105.33	105.72	105.33	105.72	105.33	105.26	105.11	105.44	105.06	105.45	105.05
313GW	105.51	105.33	105.51	105.33	105.51	105.33	105.05	105.11	105.23	105.06	105.25	105.05
314GW	105.56	105.34	105.56	105.34	105.56	105.34	105.50	105.28	105.46		105.49	105.28

Date Tube nr	22-Sep-90 top tube	surface	01-Nov-90 top tube	surface	12-Jan-91 top tube	surface	14-May-91 top tube	surface	30-Aug-91 top tube	surface	20-Oct-91 top tube	surface
315GD	105.89	105.83	105.89	105.83	105.89	105.83	105.62	105.59	105.56	105.55	105.60	105.58
315A	106.23	105.83	106.23	105.83	106.23	105.83	105.99	105.59	105.94	105.55	105.97	105.58
315B	106.23	105.83	106.23	105.83	106.23	105.83	105.99	105.59	105.95	105.55	105.97	105.58
315C	106.23	105.83	106.23	105.83	106.23	105.83	106.99	105.59	105.94	105.55	105.97	105.58
315D	106.23	105.83	106.23	105.83	106.23	105.83	106.99	105.59	105.95	105.55	105.97	105.58
315GW	106.02	105.83	106.02	105.83	106.02	105.83	105.79	105.59	105.74	105.55	105.77	105.58
316GD	105.90	105.88	105.90	105.88	105.90	105.88	105.90	105.88	105.83	105.83	105.88	105.88
317GD	106.40	106.34	106.40	106.34	106.40	106.34	106.15	106.07	106.09	106.02	106.12	106.06
317A	106.77	106.34	106.78	106.34	106.78	106.34	106.53	106.07	106.46	106.02	106.49	106.06
317B	106.78	106.34	106.78	106.34	106.78	106.34	106.53	106.07	106.47	106.02	106.49	106.06
317C	106.79	106.34	106.78	106.34	106.78	106.34	106.53	106.07	106.48	106.02	106.49	106.06
317D	106.80	106.34	106.78	106.34	106.78	106.34	106.53	106.07	106.48	106.02	106.49	106.06
317GW	106.56	106.34	106.56	106.34	106.56	106.34	106.31	106.07	106.25	106.02	106.28	106.06
318GD	106.41	106.36	106.41	106.36	106.41	106.36	106.39	106.34	106.34	106.34	106.37	106.13
319GD	106.61	106.57	106.61	106.57	106.61	106.57	106.56	106.52	106.53	106.52	106.54	106.50
320GD	106.76	106.72	106.76	106.72	106.76	106.72	106.71	106.67	106.68	106.67	106.70	106.64
321GD	106.80	106.72	106.80	106.72	106.80	106.72	106.75	106.65	106.72	106.62	106.74	106.64
321A	107.18	106.72	107.19	106.72	107.19	106.72	107.14	106.65	107.13	106.62	107.14	106.64
321B	107.19	106.72	107.19	106.72	107.19	106.72	107.14	106.65	107.12	106.62	107.14	106.64
321C	107.20	106.72	107.19	106.72	107.19	106.72	107.14	106.65	107.13	106.62	107.14	106.64
321D	107.21	106.72	107.19	106.72	107.19	106.72	107.14	106.65	107.12	106.62	107.14	106.64
321E	107.27	106.72	107.19	106.72	107.19	106.72	107.14	106.65	107.12	106.62	107.14	106.64
322GD	106.77	106.77	106.77	106.77	106.77	106.77	106.73	106.73	106.70	106.70	106.72	106.68
323GD	106.77	106.72	106.77	106.72	106.77	106.72	106.72	106.67	106.70	106.65	106.70	106.61
324GD	106.77	106.76	106.77	106.76	106.77	106.76	106.72	106.71	106.70	106.59	106.72	106.62
324A	106.96	106.76	106.96	106.76	106.96	106.76	106.91	106.71	106.90	106.59	106.91	106.62
324B	107.16	106.76	106.96	106.76	106.96	106.76	106.91	106.71	106.90	106.59	106.91	106.62
324C	107.16	106.76	106.96	106.76	106.96	106.76	106.91	106.71	106.90	106.59	106.91	106.62
324D	107.17	106.76	106.96	106.76	106.96	106.76	106.91	106.71	106.90	106.59	106.90	106.62
324F		106.96	106.76	106.96	106.76	106.91	106.71	106.90	106.59	106.90	106.62	
325GD	106.75	106.70	106.75	106.70	106.75	106.70	106.72	106.67	106.70	106.65	106.71	106.61
326GD	106.74	106.71	106.74	106.71	106.74	106.71	106.71	106.68	106.69	106.68	106.72	106.67
327GD	106.81	106.77	106.81	106.77	106.81	106.77	106.78	106.69	106.77	106.64	106.79	106.64
327A	107.21	106.77	107.21	106.77	107.21	106.77	107.17	106.69	107.16	106.64	107.19	106.64
327B	107.21	106.77	107.21	106.77	107.21	106.77	107.17	106.69	107.16	106.64	107.18	106.64
327C	107.21	106.77	107.21	106.77	107.21	106.77	107.17	106.69	107.16	106.64	107.18	106.64
327D	107.21	106.77	107.21	106.77	107.21	106.77	107.17	106.69	107.16	106.64	107.16	106.64
327F		107.21	106.77	107.21	106.77	107.17	106.69	107.16	106.64	107.16	106.64	
328GD	106.78	106.74	106.78	106.74	106.78	106.74	106.77	106.73	106.75	106.73	106.77	106.75
329GD	106.74	106.67	106.74	106.67	106.74	106.67	106.75	106.68	106.73	106.66	106.75	106.68
330GD	106.68	106.68	106.68	106.68	106.68	106.68	106.74	106.69	106.72	106.64	106.74	106.66
330A	107.13	106.68	107.12	106.68	107.12	106.68	107.11	106.69	107.09	106.64	107.11	106.66
330B	107.13	106.68	107.12	106.68	107.12	106.68	107.12	106.69	107.11	106.64	107.11	106.66
330C	107.13	106.68	107.12	106.68	107.12	106.68	107.12	106.69	107.10	106.64	107.11	106.66
330D	107.13	106.68	107.12	106.68	107.12	106.68	107.08	106.69	107.10	106.64	107.10	106.66
330E	107.24	106.68	107.12	106.68	107.12	106.68	107.08	106.69	107.08	106.64	107.09	106.66
330F	107.12	106.68	107.12	106.68	107.08	106.69	107.08	106.64	107.08	106.66		
331GD	106.79	106.73	106.79	106.73	106.79	106.73	106.82	106.75	106.78	106.71	106.81	106.67
332GD	106.70	106.70	106.70	106.70	106.70	106.70	106.72	106.72	106.69	106.69	106.72	106.66
333GD	106.64	106.58	106.64	106.58	106.64	106.58	106.58	106.55	106.57	106.57	106.59	106.54
333A	107.05	106.58	107.04	106.58	107.04	106.58	107.03	106.55	107.02	106.57	107.02	106.54
333B	107.04	106.58	107.04	106.58	107.04	106.58	107.03	106.55	107.02	106.57	107.02	106.54
333C	107.05	106.58	107.04	106.58	107.04	106.58	107.03	106.55	107.02	106.57	107.02	106.54
333D	107.04	106.58	107.04	106.58	107.04	106.58	107.03	106.55	107.02	106.57	107.01	106.54
333F		107.04	106.58	107.04	106.58	107.03	106.55	107.02	106.57	107.02	106.54	
334GD	106.42	106.33	106.42	106.33	106.42	106.33	106.41	106.32	106.40	106.35	106.42	106.37
335GD	106.38	106.32	106.38	106.32	106.38	106.32	106.39	106.33	106.38	106.33	106.39	106.32
336GD	106.33	106.10	106.13	106.10	106.13	106.10	106.20	106.16	106.18	106.18	106.20	106.13
336A	106.62	106.10	106.62	106.10	106.62	106.10	106.60	106.16	106.60	106.18	106.62	106.13
336B	106.63	106.10	106.62	106.10	106.62	106.10	106.60	106.16	106.61	106.18	106.62	106.13
336C	106.65	106.10	106.62	106.10	106.62	106.10	106.60	106.16	106.61	106.18	106.62	106.13
336D	106.65	106.10	106.62	106.10	106.62	106.10	106.60	106.16	106.60	106.18	106.62	106.13
336E	106.65	106.10	106.65	106.10	106.65	106.10	106.60	106.16	106.60	106.18	106.61	106.13
337GD	106.03	105.97	106.03	105.97	106.03	105.97	105.96	105.90	105.95	105.90	105.97	105.86
338GD	105.77	105.71	105.77	105.71	105.77	105.71	105.76	105.70	105.75	105.71	105.77	105.71
339GD	105.82	105.76	105.82	105.76	105.82	105.76	105.81	105.75	105.80	105.75	105.82	105.75
340GD	105.56	105.53	105.56	105.53	105.56	105.53	105.50	105.47	105.49	105.47	105.50	105.46
340A	105.84	105.53	105.84	105.53	105.84	105.53	105.83	105.47	105.82	105.47	105.83	105.46
340B	105.95	105.53	105.84	105.53	105.84	105.53	105.83	105.47	105.82	105.47	105.83	105.46
340C	105.96	105.53	105.84	105.53	105.84	105.53	105.83	105.47	105.82	105.47	105.83	105.46
340D	105.96	105.53	105.84	105.53	105.84	105.53	105.83	105.47	105.82	105.47	105.83	105.46
341GD	105.54	105.49	105.54	105.49	105.54	105.49	105.54	105.49	105.53	105.47	105.54	105.48
342GD	105.26	105.21	105.26	105.21	105.26	105.21	105.32	105.27	105.31	105.28	105.33	105.24
342A	105.65	105.21	105.65	105.21	105.65	105.21	105.69	105.27	105.69	105.28	105.70	105.24
342B	105.66	105.21	105.65	105.21	105.65	105.21	105.69	105.27	105.69	105.28	105.70	105.24
342C	105.66	105.21	105.65	105.21	105.65	105.21	105.69	105.27	105.70	105.28	105.71	105.24
342GW	105.40	105.21	105.40	105.21	105.40	105.21	105.44	105.27	105.44	105.28	105.44	105.24
343GD	105.20	105.20	105.20	105.20	105.20	105.20	105.19	105.19	105.18	105.18	105.20	105.19
344A	105.58	105.14	105.58	105.14	105.58	105.14	105.58	105.07	105.58	105.08	105.58	105.09
344B	105.60	105.14	105.58	105.14	105.58	105.14	105.58	105.07	105.58	105.08	105.59	105.09
344C	105.60	105.14	105.58	105.14	105.58	105.14	105.58	105.07	105.58	105.08	105.59	105.09
344GW	105.39	105.14	105.39	105.14	105.39	105.14	105.38	105.07	105.38	105.08	105.38	105.09
345GW	105.14	104.82	105.14	104.82	105.14	104.82	105.12	104.80	105.12	104.83	105.13	104.80
346A	105.04	104.59	105.04	104.59	105.04	104.59	105.02	104.64	105.03	104.68	105.03	104.63
346B	105.06	104.59	105.04	104.59	105.04	104.59	105.02	104.64	105.03	104.68	105.03	104.63
346GW	104.85	104.59	104.85	104.59	104.85	104.59	104.82	104.64	104.83	104.68	104.84	104.63
348	103.15	102.02	103.15	102.02	103.15	102.02	102.49		102.50		102.50	

APPENDIX 19a

Piezometric heads

Monitoring data east-west transect Raheenmore Bog

DATE NR	201A	201B	201C	201D	202A	202B	202C	202D	203A	204A	204B	204C	204D	204E	205A	206A
16-Nov-89	96.0	102.0	151.0	9999	26.0	34.0	56.0	85.0	19.0	31.0	34.0	43.0	44.0	8888	32.0	26.0
27-Nov-89	70.0	80.0	151.0	9999	31.0	37.0	56.0	82.0	22.0	31.0	36.0	42.0	43.0	8888	35.0	27.0
11-Dec-89	69.0	78.0	149.0	151.0	34.0	37.0	61.0	80.0	23.0	32.0	36.0	41.0	42.0	8888	40.0	31.0
19-Dec-89	67.0	78.0	142.0	146.0	24.0	35.0	56.0	75.0	19.0	30.0	32.0	40.0	41.0	8888	32.0	24.0
04-Jan-90	63.0	85.0	145.0	149.0	25.0	35.0	44.0	73.0	20.0	27.0	32.0	39.0	39.0	8888	30.0	24.0
21-Jan-90	62.0	73.0	142.0	148.0	26.0	34.0	37.0	71.0	20.0	29.0	31.0	37.0	37.0	8888	31.0	24.0
31-Jan-90	60.0	70.0	133.0	140.0	25.0	32.0	32.0	64.0	20.0	25.0	31.0	35.0	34.0	8888	31.0	24.0
15-Feb-90	62.0	72.0	134.0	141.0	25.0	34.0	31.0	54.0	18.0	27.0	30.0	44.0	31.0	8888	30.0	21.0
01-Mar-90	61.0	70.0	134.0	139.0	25.0	33.0	25.0	51.0	16.0	24.0	28.0	32.0	29.0	8888	29.0	21.0
16-Mar-90	63.0	72.0	143.0	150.0	33.0	37.0	47.0	54.0	21.0	31.0	33.0	34.0	32.0	8888	36.0	28.0
29-Mar-90	65.0	87.0	146.0	150.0	36.0	39.0	50.0	60.0	22.0	34.0	34.0	35.0	35.0	8888	42.0	33.0
12-Apr-90	66.0	74.0	146.0	149.0	35.0	37.0	48.0	63.0	21.0	33.0	33.0	35.0	35.0	8888	39.0	30.0
26-Apr-90	67.0	75.0	148.0	152.0	35.0	38.0	49.0	66.0	22.0	32.0	34.0	36.0	37.0	8888	40.0	31.0
10-May-90	72.0	81.0	150.0	154.0	39.0	40.0	72.0	70.0	24.0	35.0	37.0	38.0	40.0	8888	47.0	36.0
24-May-90	78.0	87.0	155.0	161.0	43.0	43.0	57.0	74.0	26.0	40.0	40.0	39.0	42.0	8888	53.0	43.0
07-Jun-90	71.0	82.0	152.0	157.0	37.0	39.0	53.0	74.0	23.0	32.0	35.0	39.0	42.0	8888	40.0	32.0
21-Jun-90	73.0	83.0	151.0	158.0	34.0	39.0	53.0	79.0	24.0	31.0	37.0	40.0	44.0	8888	39.0	31.0
05-Jul-90	68.0	78.0	150.0	156.0	25.0	8888	48.0	77.0	15.0	24.0	8888	37.0	43.0	8888	31.0	22.0
19-Jul-90	75.0	83.0	153.0	158.0	38.0	8888	54.0	82.0	25.0	40.0	8888	42.0	44.0	42.0	52.0	42.0
01-Aug-90	80.0	87.0	154.0	160.0	40.0	8888	54.0	83.0	27.0	37.0	8888	43.0	45.0	44.0	48.0	41.0
15-Aug-90	83.0	93.0	157.0	162.0	35.0	8888	56.0	83.0	28.0	38.0	8888	44.0	46.0	47.0	54.0	43.0
29-Aug-90	62.2	78.2	149.4	156.2	23.8	8888	48.2	82.7	17.7	24.3	8888	37.4	44.2	42.2	30.2	23.1
12-Sep-90	72.0	83.3	152.2	157.7	35.0	8888	52.3	86.0	21.8	37.2	8888	40.0	46.5	44.0	47.6	39.1
26-Sep-90	76.5	88.6	152.3	158.1	39.3	8888	54.4	85.6	21.6	36.5	8888	40.5	46.5	44.1	49.1	40.3
09-Oct-90	66.0	78.5	150.8	155.8	24.5	8888	50.1	85.3	17.0	28.6	8888	38.8	44.9	42.3	33.0	25.9
24-Oct-90	62.3	74.4	139.5	144.5	24.4	8888	49.0	79.3	13.4	25.9	8888	35.4	38.3	33.0	30.3	21.1
06-Nov-90	67.9	80.8	141.9	148.0	26.5	8888	52.8	76.2	16.6	28.7	8888	35.0	37.7	33.1	33.5	23.5
20-Nov-90	62.5	74.8	138.4	142.3	25.2	8888	50.4	70.3	15.1	24.0	8888	32.0	35.4	30.7	29.8	20.2
04-Dec-90	64.1	80.1	139.7	144.6	27.6	8888	52.1	69.2	23.5	28.3	8888	32.4	34.9	30.7	32.8	22.6
18-Dec-90	60.8	75.7	137.4	142.5	29.1	8888	51.8	67.6	19.6	28.5	8888	34.7	31.4	32.2	33.9	23.7
11-Jan-91	45.5	69.2	126.0	130.4	24.2	8888	41.1	54.8	14.2	23.4	8888	26.6	27.0	22.6	28.2	19.1
24-Jan-91	48.8	69.2	132.2	137.2	26.4	8888	45.6	55.9	17.3	26.0	8888	28.1	28.6	23.8	30.2	20.7
07-Feb-91	42.8	69.4	131.5	137.5	28.7	8888	45.0	56.2	17.8	27.6	8888	29.0	30.3	25.0	31.4	21.7
21-Feb-91	39.4	66.0	131.0	137.0	25.8	8888	41.4	54.5	15.0	23.1	8888	25.1	27.0	21.5	28.7	19.1
08-Mar-91	39.3	65.4	128.8	134.5	23.2	8888	38.2	51.7	13.9	21.7	8888	23.9	24.4	18.4	26.0	17.0
22-Mar-91	41.0	70.9	129.3	135.1	26.1	8888	36.5	51.2	16.0	23.1	8888	23.4	24.6	18.1	28.9	18.5
04-Apr-91	42.3	70.3	134.2	139.0	24.0	8888	40.4	49.6	14.7	22.6	8888	23.5	24.6	22.7	27.9	18.1
19-Apr-91	42.5	74.6	139.2	141.1	27.6	8888	40.9	54.2	16.5	26.8	8888	26.3	26.4	22.2	34.1	23.2
03-May-91	41.3	76.0	141.4	146.2	26.9	8888	39.0	56.5	16.1	25.7	8888	25.9	28.0	23.5	32.0	22.0
17-May-91	56.6	81.1	147.6	151.5	31.3	8888	42.5	60.0	20.7	32.0	8888	27.4	30.8	27.1	44.0	30.8
31-May-91	74.5	91.6	157.6	160.4	41.1	8888	44.6	64.2	26.8	42.0	8888	30.8	34.4	32.0	56.1	43.0
14-Jun-91	69.3	85.8	155.8	159.0	29.4	8888	41.1	65.4	17.5	30.8	8888	31.0	34.8	32.8	38.5	29.4
28-Jun-91	65.7	83.3	154.8	159.2	25.6	8888	40.3	68.4	18.9	26.3	8888	31.3	35.7	33.6	31.1	23.3
11-Jul-91	68.7	85.0	155.9	160.0	27.7	8888	43.0	70.5	16.0	28.7	8888	31.4	36.2	33.8	36.1	27.1
31-Jul-91	73.9	88.8	159.0	162.2	32.1	8888	45.1	74.1	20.7	34.9	8888	32.7	38.4	36.2	44.6	34.8
09-Aug-91	71.8	86.6	157.5	161.3	26.2	8888	44.1	74.8	14.2	26.3	8888	32.4	38.9	36.3	32.7	24.4
23-Aug-91	75.2	89.4	158.3	162.0	32.4	8888	46.3	75.4	21.6	34.7	8888	36.8	33.0	39.3	44.8	35.2
06-Sep-91	89.4	99.0	164.2	167.2	45.5	8888	50.5	80.9	32.2	46.4	8888	37.6	43.7	41.4	59.1	49.4
20-Sep-91	83.3	97.9	165.8	168.5	42.9	8888	52.5	81.9	28.1	40.5	8888	38.6	44.5	43.4	51.6	44.3
03-Oct-91	70.0	87.3	153.3	159.0	26.2	8888	50.6	82.1	17.6	27.5	8888	37.1	43.6	41.6	32.1	25.0
17-Oct-91	65.8	78.7	146.3	152.8	26.6	8888	49.7	80.8	15.8	26.9	8888	35.3	42.1	39.1	31.8	23.6
01-Nov-91	60.8	74.6	141.6	147.5	23.8	8888	47.9	78.3	15.3	23.4	8888	33.3	39.5	36.1	29.5	20.0
15-Nov-91	64.4	77.2	137.2	143.2	25.8	8888	46.9	77.4	15.4	24.4	8888	32.3	35.2	28.6	30.4	20.7
29-Nov-91	60.6	73.5	137.0	142.9	25.8	8888	48.8	76.0	15.4	24.6	8888	30.8	32.6	27.2	29.6	20.0
13-Dec-91	59.0	73.4	139.8	145.9	30.4	8888	53.0	74.8	14.8	28.8	8888	31.0	34.6	30.7	35.6	25.0
27-Dec-91	55.2	71.5	137.2	142.9	27.4	8888	47.7	72.7	14.2	25.2	8888	30.1	32.8	27.2	30.4	20.7
10-Jan-92	52.5	71.8	134.8	140.3	28.7	8888	45.6	67.5	12.5	24.3	8888	28.4	30.1	24.1	30.5	20.3
24-Jan-92	50.8	69.3	138.3	144.8	28.3	8888	48.6	65.1	13.8	26.0	8888	28.1	30.9	26.6	34.0	22.5
21-Feb-92	43.2	66.4	139.5	146.5	28.5	8888	47.0	66.6	14.6	25.9	8888	28.9	33.2	29.6	30.9	21.7
20-Mar-92	37.5	60.7	136.5	144.5	26.4	8888	43.0	65.5	13.8	23.4	8888	27.9	32.4	28.6	28.4	18.7

Monitoring data east-west transect Raheenmore Bog

DATE NR	206B	206C	206D	206E	206G	207A	208A	209A	209B	209C	209D	209E	209F	210A	210B	210C	210D
16-Nov-89	36.0	46.0	50.0	8888	51.0	28.0	30.0	29.0	32.0	35.0	36.0	8888	8888	8888	8888	8888	8888
27-Nov-89	36.0	44.0	50.0	8888	53.0	28.0	32.0	30.0	32.0	35.0	38.0	8888	8888	34.0	35.0	36.0	32.0
11-Dec-89	36.0	44.0	51.0	8888	51.0	31.0	32.0	31.0	33.0	34.0	38.0	8888	8888	36.0	34.0	35.0	33.0
19-Dec-89	33.0	42.0	48.0	8888	49.0	24.0	28.0	25.0	31.0	33.0	36.0	8888	8888	29.0	32.0	34.0	31.0
04-Jan-90	34.0	42.0	48.0	8888	49.0	26.0	28.0	27.0	32.0	35.0	36.0	8888	8888	30.0	32.0	34.0	31.0
21-Jan-90	32.0	41.0	46.0	8888	48.0	27.0	30.0	27.0	31.0	34.0	35.0	8888	8888	29.0	30.0	33.0	30.0
31-Jan-90	32.0	39.0	42.0	8888	43.0	24.0	27.0	26.0	30.0	31.0	34.0	8888	8888	28.0	31.0	31.0	29.0
15-Feb-90	30.0	38.0	41.0	8888	42.0	20.0	23.0	21.0	27.0	29.0	33.0	8888	8888	24.0	26.0	29.0	25.0
01-Mar-90	29.0	37.0	41.0	8888	41.0	19.0	21.0	20.0	26.0	28.0	32.0	8888	8888	23.0	26.0	38.0	25.0
16-Mar-90	32.0	39.0	44.0	8888	44.0	28.0	29.0	28.0	30.0	32.0	35.0	8888	8888	31.0	32.0	32.0	30.0
29-Mar-90	35.0	40.0	47.0	8888	48.0	31.0	32.0	31.0	32.0	34.0	37.0	8888	8888	35.0	34.0	35.0	32.0
12-Apr-90	33.0	39.0	46.0	8888	47.0	31.0	32.0	31.0	31.0	33.0	36.0	8888	8888	35.0	33.0	35.0	32.0
26-Apr-90	34.0	39.0	47.0	8888	48.0	31.0	32.0	31.0	32.0	34.0	36.0	8888	8888	36.0	34.0	35.0	32.0
10-May-90	37.0	41.0	49.0	8888	50.0	33.0	35.0	34.0	35.0	35.0	38.0	8888	8888	36.0	39.0	37.0	33.0
24-May-90	40.0	43.0	52.0	8888	53.0	39.0	39.0	38.0	37.0	37.0	39.0	8888	8888	37.0	37.0	39.0	35.0
07-Jun-90	37.0	42.0	50.0	8888	52.0	31.0	33.0	33.0	35.0	36.0	38.0	8888	8888	38.0	37.0	38.0	35.0
21-Jun-90	38.0	42.0	52.0	8888	53.0	30.0	32.0	33.0	35.0	36.0	38.0	8888	8888	38.0	37.0	38.0	35.0
05-Jul-90	8888	42.0	49.0	8888	52.0	23.0	26.0	25.0	8888	34.0	36.0	37.0	8888	31.0	8888	35.0	33.0
19-Jul-90	8888	45.0	52.0	52.0	54.0	37.0	37.0	34.0	8888	36.0	40.0	40.0	8888	38.0	8888	38.0	35.0
01-Aug-90	8888	46.0	54.0	55.0	57.0	37.0	37.0	35.0	8888	37.0	40.0	41.0	8888	41.0	8888	40.0	36.0
15-Aug-90	8888	46.0	55.0	57.0	58.0	37.0	38.0	36.0	8888	38.0	41.0	42.0	8888	40.0	8888	41.0	37.0
29-Aug-90	8888	41.9	49.6	50.1	56.4	25.0	28.4	29.1	8888	35.6	38.8	38.7	8888	32.9	8888	36.2	35.0
12-Sep-90	8888	44.9	51.8	53.2	58.1	36.3	37.2	33.7	8888	36.9	40.4	39.9	8888	37.8	8888	37.4	36.1
26-Sep-90	8888	45.4	52.5	54.6	58.4	36.6	37.0	35.3	8888	37.2	40.7	40.5	8888	40.1	8888	38.3	37.1
09-Oct-90	8888	42.8	49.9	47.9	55.1	26.9	28.9	26.0	8888	35.1	38.7	38.1	8888	31.8	8888	35.7	34.3
24-Oct-90	8888	38.9	44.0	43.1	49.2	21.0	25.2	24.7	8888	31.5	36.5	36.6	8888	28.9	8888	31.6	30.2
06-Nov-90	8888	41.8	46.1	44.8	50.8	25.8	26.9	27.7	8888	33.6	38.9	36.9	8888	33.2	8888	33.8	31.7
20-Nov-90	8888	36.9	42.3	40.9	46.7	20.0	24.1	24.6	8888	30.8	35.8	35.6	48.1	28.4	8888	31.0	30.1
04-Dec-90	8888	38.8	43.1	41.6	47.7	24.6	28.1	26.9	8888	32.2	36.7	36.0	47.8	32.1	8888	32.2	30.2
18-Dec-90	8888	36.9	42.9	43.6	47.0	23.7	30.6	26.9	8888	32.4	37.2	37.0	48.7	34.7	8888	33.3	32.4
11-Jan-91	8888	33.0	36.9	35.4	40.2	18.3	22.5	21.4	8888	28.0	33.4	31.9	43.5	24.4	8888	27.5	25.5
24-Jan-91	8888	35.2	39.2	39.0	43.0	21.1	25.0	25.0	8888	30.0	34.5	34.1	45.5	28.5	8888	29.2	28.1
07-Feb-91	8888	34.0	39.2	40.0	42.2	21.4	26.0	24.0	8888	29.8	34.8	34.0	47.0	29.5	8888	29.5	28.5
21-Feb-91	8888	30.5	37.0	38.1	39.0	20.0	24.5	23.1	8888	28.4	23.3	23.1	45.6	27.6	8888	28.6	28.1
08-Mar-91	8888	29.6	35.0	35.5	37.5	17.7	21.7	21.8	8888	27.0	32.8	32.5	43.0	24.5	8888	26.9	26.5
22-Mar-91	8888	30.5	35.8	35.3	37.7	18.8	23.2	21.4	8888	27.5	32.4	31.8	43.0	24.5	8888	26.5	25.0
04-Apr-91	8888	27.3	33.8	36.0	35.8	19.1	23.8	23.7	8888	27.0	32.6	32.5	44.6	28.2	8888	27.6	27.6
19-Apr-91	8888	31.1	37.0	37.0	39.1	22.5	26.6	25.5	8888	28.6	33.3	32.6	43.2	28.7	8888	28.1	27.1
03-May-91	8888	31.6	37.0	37.0	39.5	21.5	26.5	25.1	8888	29.0	33.0	32.2	43.0	29.0	8888	29.0	27.9
17-May-91	8888	32.7	39.3	40.4	41.6	32.5	31.5	30.6	8888	31.1	35.0	34.1	44.6	35.2	8888	32.0	30.9
31-May-91	8888	35.2	42.5	45.8	45.9	39.5	40.1	37.6	8888	34.0	37.2	36.6	37.3	40.2	8888	34.6	33.6
14-Jun-91	8888	34.8	41.2	43.3	45.1	30.1	32.1	31.5	8888	33.7	36.2	35.7	46.0	36.0	8888	33.9	32.7
28-Jun-91	8888	35.4	41.9	42.0	45.8	27.6	29.2	28.7	8888	33.4	36.5	35.2	45.1	30.0	8888	32.8	30.8
11-Jul-91	8888	35.2	41.4	43.4	46.4	28.6	32.1	30.7	8888	32.6	36.4	36.1	46.0	30.5	8888	31.0	31.0
31-Jul-91	8888	36.0	44.2	47.4	48.5	34.5	36.4	33.7	8888	33.8	37.4	37.0	47.8	33.0	8888	32.2	32.0
09-Aug-91	8888	36.4	43.4	45.3	48.3	25.2	30.4	29.4	8888	33.7	37.1	36.1	46.4	28.2	8888	31.3	31.3
23-Aug-91	8888	36.0	44.3	48.2	49.1	35.2	36.8	34.2	8888	33.2	37.1	37.4	47.9	32.5	8888	31.9	32.4
06-Sep-91	8888	40.8	49.3	53.7	54.8	47.9	46.1	43.8	8888	39.4	42.6	41.8	52.2	38.5	8888	35.5	35.2
20-Sep-91	8888	41.3	50.4	55.1	56.3	40.7	41.5	38.9	8888	38.0	39.8	40.0	50.8	37.4	8888	36.7	36.2
03-Oct-91	8888	40.8	48.4	50.0	54.2	25.8	30.0	30.6	8888	36.1	38.5	38.4	48.6	32.0	8888	35.0	34.0
17-Oct-91	8888	38.2	43.8	43.8	50.2	24.1	29.4	29.5	8888	33.6	37.3	36.8	48.1	28.6	8888	31.7	31.8
01-Nov-91	8888	35.7	41.9	40.2	48.2	20.0	24.8	24.2	8888	30.8	35.2	34.7	46.7	26.3	8888	29.9	30.2
15-Nov-91	8888	35.8	39.3	38.2	46.3	20.3	25.5	24.6	8888	30.8	35.2	34.2	46.0	25.7	8888	29.4	29.2
29-Nov-91	8888	35.1	39.2	38.2	45.3	20.5	26.1	25.9	8888	30.4	35.4	34.5	46.6	26.4	8888	29.2	29.1
13-Dec-91	8888	37.1	42.1	43.0	48.3	27.4	30.8	30.3	8888	32.8	37.5	36.4	47.7	28.6	8888	30.4	30.7
27-Dec-91	8888	35.4	38.9	37.9	45.5	20.6	24.4	25.2	8888	35.2	30.6	34.2	45.8	25.6	8888	29.0	28.6
10-Jan-92	8888	34.3	37.5	36.6	43.1	20.4	23.9	23.5	8888	21.9	34.3	33.2	45.0	25.3	8888	28.3	27.6
24-Jan-92	8888	33.3	38.2	39.4	43.1	24.5	26.4	25.8	8888	30.4	35.4	34.7	46.3	26.5	8888	28.8	29.0
21-Feb-92	8888	33.2	38.5	39.9	43.2	24.6	28.6	28.9	8888	31.7	35.7	35.0	45.9	27.5	8888	29.8	29.8
20-Mar-92	8888	30.7	36.3	37.6	40.6	21.0	25.1	26.0	8888	30.1	34.5	33.9	45.1	25.7	8888	28.4	28.9

Monitoring data east-west transect Raheenmore Bog

NR DATE	210E	211A	211B	211C	211D	211E	211F	212A	212B	212C	212D	212E	213S	GAUGE 104P	GAUGE 106P
16-Nov-89	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	38.0	8888	8888
27-Nov-89	8888	36.0	40.0	46.0	48.0	8888	8888	36.0	36.0	38.0	38.0	8888	40.0	8888	8888
11-Dec-89	8888	36.0	42.0	47.0	48.0	8888	8888	36.0	37.0	39.0	39.0	8888	9999	8888	8888
19-Dec-89	8888	27.0	35.0	41.0	41.0	8888	8888	32.0	33.0	36.0	36.0	8888	37.0	8888	8888
04-Jan-90	8888	29.0	36.0	43.0	43.0	8888	8888	34.0	34.0	37.0	37.0	8888	38.0	8888	8888
21-Jan-90	8888	29.0	36.0	41.0	43.0	8888	8888	32.0	33.0	35.0	37.0	8888	40.0	8888	8888
31-Jan-90	8888	26.0	32.0	37.0	39.0	8888	8888	30.0	31.0	35.0	36.0	8888	36.0	8888	8888
15-Feb-90	8888	21.0	19.0	35.0	37.0	8888	8888	28.0	28.0	31.0	33.0	8888	38.0	8888	8888
01-Mar-90	8888	21.0	28.0	34.0	36.0	8888	8888	27.0	28.0	31.0	33.0	8888	36.0	8888	8888
16-Mar-90	8888	29.0	35.0	40.0	42.0	8888	8888	32.0	34.0	36.0	37.0	8888	50.0	29.7	8888
29-Mar-90	8888	35.0	39.0	44.0	47.0	8888	8888	35.0	36.0	38.0	39.0	8888	61.0	26.9	8888
12-Apr-90	8888	34.0	39.0	44.0	46.0	8888	8888	36.0	36.0	37.0	38.0	8888	61.0	27.0	8888
26-Apr-90	8888	36.0	41.0	46.0	47.0	8888	8888	37.0	37.0	38.0	39.0	8888	70.0	26.0	8888
10-May-90	8888	41.0	44.0	49.0	50.0	8888	8888	38.0	39.0	40.0	40.0	8888	92.0	24.8	8888
24-May-90	8888	40.0	46.0	50.0	51.0	8888	8888	41.0	40.0	41.0	41.0	8888	9999	15.0	8888
07-Jun-90	8888	39.0	46.0	49.0	49.0	8888	8888	37.0	38.0	39.0	40.0	8888	108.0	34.3	8888
21-Jun-90	8888	39.0	46.0	49.0	50.0	8888	8888	38.0	38.0	39.0	40.0	8888	123.0	25.3	8888
05-Jul-90	38.0	29.0	8888	43.0	43.0	44.0	8888	31.0	8888	36.0	37.0	41.0	83.0	35.9	8888
19-Jul-90	36.0	40.0	8888	49.0	50.0	50.0	8888	38.0	8888	40.0	41.0	43.0	79.0	26.1	13.5
01-Aug-90	37.0	42.0	8888	50.0	51.0	52.0	8888	38.0	8888	42.0	42.0	44.0	113.0	35.1	13.6
15-Aug-90	40.0	43.0	8888	51.0	52.0	53.0	8888	40.0	8888	43.0	43.0	45.0	152.0	0.0	10.4
29-Aug-90	35.5	33.1	8888	37.7	41.7	45.1	8888	32.3	8888	37.6	39.4	40.9	59.3	32.2	14.9
12-Sep-90	36.5	36.1	8888	40.4	45.0	47.9	8888	36.3	8888	39.4	41.4	42.8	74.4	26.2	14.6
26-Sep-90	37.7	40.2	8888	41.5	45.8	48.9	8888	35.2	8888	40.1	41.7	43.5	105.8	24.5	13.4
09-Oct-90	34.5	31.1	8888	36.7	40.5	43.7	8888	32.8	8888	37.1	39.3	40.8	55.8	30.8	15.0
24-Oct-90	30.7	27.3	8888	31.7	37.0	40.3	8888	31.2	8888	34.6	37.6	39.2	49.5	33.7	15.9
06-Nov-90	31.7	30.0	8888	34.4	39.2	42.3	8888	32.0	8888	36.4	38.7	40.3	53.2	30.0	15.3
20-Nov-90	30.6	26.2	8888	30.7	36.3	40.0	141.9	30.6	8888	33.9	37.1	38.7	47.9	33.7	16.1
04-Dec-90	31.1	28.9	8888	32.7	37.7	41.1	126.9	31.4	8888	35.4	37.6	39.8	51.7	31.0	14.5
18-Dec-90	32.8	32.9	8888	34.1	39.1	43.3	127.7	33.9	8888	35.8	38.2	40.1	57.6	28.5	14.5
11-Jan-91	25.8	22.0	8888	36.6	32.5	37.2	113.2	28.6	8888	31.0	33.2	35.5	85.6	36.5	16.5
24-Jan-91	28.5	26.0	8888	29.0	35.0	38.5	113.0	30.0	8888	39.9	36.2	38.0	43.3	32.5	15.5
07-Feb-91	28.8	25.2	8888	29.2	35.2	38.5	115.0	31.0	8888	33.4	36.2	38.0	43.7	32.5	15.5
21-Feb-91	28.3	24.5	8888	27.2	33.0	38.3	112.6	30.4	8888	32.1	34.9	37.0	44.2	33.5	16.0
08-Mar-91	26.5	21.7	8888	25.2	31.8	36.2	40.0	27.7	8888	30.5	33.6	35.6	40.0	38.7	17.5
22-Mar-91	25.0	21.4	8888	26.2	31.6	36.0	107.0	27.7	8888	30.9	33.4	35.5	41.0	35.5	16.0
04-Apr-91	28.2	24.0	8888	26.5	33.8	38.5	109.1	29.8	8888	31.6	35.2	36.8	8888	32.5	16.0
19-Apr-91	27.2	24.6	8888	27.8	33.8	37.8	108.3	30.6	8888	33.0	36.1	37.6	44.9	30.5	14.0
03-May-91	27.5	24.0	8888	27.5	33.5	37.3	111.0	30.1	8888	33.2	35.6	37.7	45.7	31.0	15.0
17-May-91	30.8	31.8	8888	31.8	38.2	42.3	118.0	32.7	8888	35.7	37.7	39.6	65.2	27.0	18.5
31-May-91	33.5	40.5	8888	36.3	42.4	46.6	125.4	39.8	8888	38.7	40.1	42.3	98.5	24.2	10.2
14-Jun-91	32.7	34.0	8888	35.0	40.5	45.3	125.2	34.3	8888	37.6	38.3	40.3	82.8	26.5	8888
28-Jun-91	31.4	29.6	8888	33.7	38.1	42.8	126.4	32.8	8888	36.7	38.3	39.6	67.7	30.0	14.5
11-Jul-91	31.5	33.4	8888	33.9	39.6	44.0	129.9	33.7	8888	36.3	38.4	40.2	75.5	27.5	8888
31-Jul-91	33.1	41.6	8888	40.8	46.5	51.0	139.7	42.4	8888	42.9	45.1	46.9	92.0	25.5	12.0
09-Aug-91	31.2	31.4	8888	34.1	38.9	43.3	132.8	33.1	8888	37.2	39.2	40.7	69.6	28.8	13.5
23-Aug-91	33.0	37.8	8888	35.2	41.8	46.0	137.4	38.5	8888	37.6	39.3	41.6	8888	25.3	11.7
06-Sep-91	35.9	43.6	8888	39.7	44.8	48.7	141.4	41.5	8888	41.7	42.6	44.2	122.5	7.8	8.0
20-Sep-91	36.9	42.1	8888	40.2	44.5	49.2	142.5	40.4	8888	42.3	42.4	44.2	127.4	16.5	10.0
03-Oct-91	34.6	33.9	8888	37.7	41.7	46.1	140.0	36.0	8888	39.5	40.4	41.7	74.0	27.5	12.5
17-Oct-91	32.1	30.0	8888	33.4	38.3	42.8	137.7	33.5	8888	36.6	38.8	39.8	59.0	30.5	14.0
01-Nov-91	31.3	25.1	8888	30.2	35.8	40.5	135.9	30.8	8888	34.5	36.7	38.4	56.5	35.5	15.1
15-Nov-91	26.9	25.0	8888	29.8	34.8	39.5	132.3	30.3	8888	34.0	36.5	37.9	52.2	33.7	14.9
29-Nov-91	29.5	25.2	8888	29.6	35.3	39.9	127.8	31.5	8888	34.2	36.7	38.3	51.8	32.7	14.8
13-Dec-91	31.0	29.1	8888	32.8	38.6	42.8	128.2	34.9	8888	36.4	39.1	40.2	56.4	28.3	13.9
27-Dec-91	28.7	25.2	8888	30.0	35.0	39.3	122.9	29.6	8888	34.3	36.2	37.9	8888	33.0	14.4
10-Jan-92	28.3	24.1	8888	28.4	33.6	38.2	118.2	28.7	8888	32.8	35.1	36.5	8888	33.6	14.6
24-Jan-92	29.6	27.6	8888	30.0	36.2	40.8	118.1	31.5	8888	34.4	36.9	38.6	52.2	30.0	13.5
21-Feb-92	29.8	27.7	8888	31.1	36.7	41.3	121.4	33.5	8888	35.7	37.4	39.0	54.8	29.3	13.7
20-Mar-92	29.2	26.6	8888	28.9	35.0	40.0	121.0	31.1	8888	34.1	36.3	38.1	52.5	30.7	14.0

APPENDIX 19b

Piezometric heads

Monitoring data north-south transect Raheenmore Bog

NR / DATE	301 GWD	303A	303B	303 GWW	304 GWW	305A	305B	305C	305 GWW	306 GWD	307 GWD	307A	307B	307C	307 GWW	308 GWD
27-okt-87	89,0	138,0	146,0	120,0	102,0	87,0	88,0	86,0	69,0	19,0	23,0	67,0	69,0	72,0	48,0	21,0
25-nov-87	93,0	135,0	142,0	121,0	103,0	88,0	86,0	85,0	68,0	23,0	26,0	67,0	70,0	73,0	39,0	19,0
31-dec-87	90,0	137,0	147,0	118,0	98,0	81,0	90,0	89,0	62,0	7,0	10,0	70,0	72,0	73,0	32,0	15,0
28-jan-88	90,0	131,0	137,0	118,0	96,0	79,0	79,0	79,0	60,0	14,0	16,0	64,0	65,0	68,0	34,0	15,0
23-feb-88	94,0	130,0	137,0	120,0	100,0	86,0	81,0	81,0	66,0	26,0	18,0	65,0	69,0	71,0	42,0	16,0
21-mrt-88	86,0	132,0	141,0	117,0	94,0	76,0	82,0	82,0	57,0	12,0	15,0	63,0	68,0	71,0	32,0	14,0
26-apr-88	93,0	136,0	145,0	120,0	103,0	90,0	90,0	89,0	71,0	30,0	34,0	71,0	76,0	76,0	46,0	23,0
23-mei-88	94,0	145,0	153,0	9999	90,0	106,0	102,0	100,0	90,0	36,0	40,0	86,0	89,0	89,0	55,0	31,0
28-jun-88	93,0	147,0	155,0	9999	118,0	104,0	106,0	103,0	94,0	9999	9999	87,0	91,0	91,0	66,0	9999
27-jul-88	83,0	148,0	156,0	9999	118,0	108,0	102,0	99,0	90,0	40,0	46,0	80,0	83,0	85,0	58,0	33,0
30-aug-88	72,0	145,0	151,0	9999	109,0	98,0	96,0	93,0	77,0	27,0	28,0	74,0	76,0	80,0	43,0	24,0
28-sep-88	72,0	145,0	150,0	9999	108,0	95,0	100,0	98,0	75,0	5,0	17,0	77,0	79,0	82,0	37,0	20,0
26-okt-88	63,0	139,0	143,0	116,0	90,0	76,0	88,0	88,0	56,0	6,0	16,0	67,0	69,0	73,0	28,0	16,0
23-nov-88	87,0	136,0	141,0	121,0	103,0	93,0	87,0	87,0	73,0	30,0	34,0	70,0	74,0	75,0	46,0	24,0
31-dec-88	88,0	135,0	141,0	120,0	99,0	88,0	85,0	85,0	69,0	26,0	26,0	68,0	71,0	75,0	40,0	18,0
26-jan-89	88,0	133,0	140,0	121,0	101,0	90,0	85,0	83,0	71,0	18,0	24,0	67,0	71,0	73,0	39,0	18,0
28-feb-89	82,0	132,0	138,0	118,0	93,0	80,0	81,0	81,0	60,0	8,0	16,0	66,0	68,0	70,0	35,0	15,0
31-mrt-89	83,0	128,0	138,0	118,0	95,0	82,0	81,0	81,0	62,0	10,0	16,0	64,0	68,0	71,0	36,0	15,0
26-okt-89	88,0	191,0	183,0	9999	9999	9999	138,0	131,0	110,0	9999	9999	93,0	101,0	109,0	63,0	9999
13-nov-89	87,0	168,0	161,0	9999	116,0	108,0	112,0	110,0	9999	35,0	33,0	72,0	78,0	86,0	43,0	22,0
27-nov-89	90,0	160,0	156,0	9999	9999	112,0	112,0	108,0	92,0	9999	9999	84,0	87,0	86,0	56,0	31,0
11-dec-89	90,0	157,0	157,0	9999	9999	114,0	115,0	112,0	94,0	9999	9999	92,0	94,0	93,0	63,0	35,0
04-jan-90	85,0	146,0	147,0	9999	110,0	100,0	103,0	100,0	79,0	29,0	26,0	69,0	76,0	78,0	37,0	16,0
21-jan-90	85,0	147,0	149,0	9999	112,0	101,0	103,0	102,0	79,0	32,0	26,0	69,0	76,0	78,0	38,0	18,0
03-feb-90	82,0	142,0	142,0	9999	109,0	94,0	96,0	94,0	73,0	20,0	22,0	63,0	67,0	70,0	32,0	13,0
15-feb-90	81,0	132,0	127,0	118,0	104,0	92,0	91,0	89,0	71,0	19,0	21,0	61,0	64,0	65,0	33,0	14,0
01-mrt-90	76,0	134,0	135,0	116,0	101,0	87,0	91,0	90,0	65,0	8,0	20,0	60,0	66,0	67,0	31,0	16,0
16-mrt-90	88,0	140,0	141,0	9999	9999	103,0	100,0	96,0	84,0	40,0	43,0	79,0	80,0	76,0	54,0	30,0
12-apr-90	91,0	150,0	150,0	9999	9999	111,0	111,0	106,0	9999	9999	9999	89,0	89,0	89,0	63,0	9999
26-apr-90	90,0	162,0	162,0	9999	9999	114,0	113,0	110,0	93,0	9999	9999	94,0	96,0	94,0	68,0	9999
10-mei-90	92,0	158,0	157,0	9999	9999	120,0	119,0	115,0	101,0	9999	9999	101,0	103,0	101,0	74,0	9999
24-mei-90	91,0	165,0	165,0	9999	9999	121,0	125,0	121,0	122,0	9999	9999	109,0	109,0	106,0	91,0	9999
07-jun-90	95,0	170,0	166,0	9999	9999	9999	127,0	124,0	9999	9999	9999	104,0	104,0	108,0	73,0	9999
20-jun-90	97,0	175,0	171,0	9999	9999	9999	131,0	128,0	9999	9999	9999	112,0	119,0	180,0	83,0	9999
05-jul-90	86,0	182,0	174,0	9999	115,0	105,0	135,0	130,0	69,0	27,0	32,0	82,0	95,0	124,0	44,0	29,0
20-jul-90	96,0	181,0	170,0	9999	9999	9999	121,0	118,0	104,0	9999	9999	97,0	95,0	102,0	74,0	9999
01-aug-90	95,0	183,0	172,0	9999	9999	9999	127,0	123,0	108,0	9999	9999	110,0	110,0	110,0	94,0	9999
15-aug-90	94,0	188,0	177,0	9999	9999	9999	136,0	132,0	9999	9999	9999	115,0	119,0	119,0	21,0	9999
29-aug-90	88,7	190,2	180,5	9999	9999	9999	142,2	136,4	99,0	9999	9999	105,5	114,4	118,1	67,5	9999
12-sep-90	87,7	190,4	180,4	9999	9999	9999	135,4	130,8	99,5	9999	9999	103,3	104,0	109,9	78,2	9999
26-sep-90	87,8	192,1	180,8	9999	9999	9999	137,7	133,4	9999	9999	9999	111,2	113,5	114,4	86,0	9999
09-okt-90	86,6	192,5	180,1	9999	9999	114,0	133,4	130,7	95,5	9999	41,5	80,9	92,6	107,7	51,7	30,3
24-okt-90	84,5	170,3	164,1	9999	118,3	105,8	109,2	107,1	85,8	42,3	34,0	72,7	73,6	82,5	42,8	21,4
06-nov-90	86,1	162,1	155,5	9999	119,7	108,8	106,1	101,5	89,3	39,8	40,9	78,8	76,8	78,6	51,4	28,3
20-nov-90	82,6	155,0	152,0	121,1	112,6	100,4	105,2	101,2	79,5	29,4	27,1	68,9	75,9	74,7	36,6	18,8
04-dec-90	86,4	152,2	149,1	9999	118,2	106,6	103,6	98,9	89,8	41,5	9999	80,6	78,7	83,9	50,9	28,5
18-dec-90	88,4	153,6	150,5	9999	9999	110,1	107,6	103,0	9999	9999	9999	88,0	87,2	90,5	58,6	33,2
11-jan-91	77,0	145,4	140,4	117,3	110,0	90,6	93,5	90,5	71,0	22,0	9999	63,4	66,6	67,0	33,0	15,0
24-jan-91	100,6	145,0	141,2	121,7	112,8	98,5	95,0	91,2	77,0	32,0	32,0	69,8	72,0	74,5	40,0	18,0
07-feb-91	82,5	145,6	142,3	120,6	110,0	97,7	96,2	93,5	75,5	30,8	31,5	37,7	72,4	72,2	40,0	17,5
21-feb-91	80,5	144,3	142,0	117,2	105,8	93,0	96,4	93,5	70,8	26,5	24,0	65,5	70,5	69,6	32,6	16,0
08-mrt-91	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888
22-mrt-91	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888
04-apr-91	82,4	142,2	139,3	121,5	109,5	95,8	96,4	91,5	74,8	31,0	31,5	75,6	79,2	76,9	40,0	20,5
19-apr-91	82,1	140,5	137,9	122,6	112,7	99,8	91,9	87,9	78,0	35,5	39,0	74,6	73,0	80,9	47,6	23,0
03-mei-91	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888
17-mei-91	85,5	146,6	145,9	9999	119,9	112,6	107,8	99,8	8888	9999	9999	92,0	92,5	97,1	64,2	37,0
31-mei-91	88,0	155,7	153,9	9999	9999	9999	118,2	109,7	9999	9999	9999	104,5	105,1	110,3	78,0	9999
14-jun-91	89,9	163,3	160,1	9999	9999	9999	124,4	116,2	9999	9999	9999	102,1	105,7	104,6	70,6	9999
28-jun-91	89,5	166,8	162,6	122,7	122,8	118,7	123,6	117,9	121,4	9999	48,0	89,8	96,6	91,8	57,0	31,5
11-jul-91	88,6	167,7	160,8	9999	8888	118,9	116,2	113,2	8888	9999	9999	92,0	92,0	97,5	64,9	9999
31-jul-91	85,5	174,1	165,8	122,1	8888	8888	125,3	118,4	121,3	8888	8888	99,1	100,3	106,7	74,5	8888
09-aug-91	81,3	175,4	164,8	131,8	123,4	117,4	123,2	118,2	122,3	9999	9999	90,7	95,5	93,2	59,9	33,5
23-aug-91	83,7	178,0	166,0	9999	9999	9999	122,5	118,3	8888	9999	9999	99,6	100,0	107,3	75,0	9999
06-sep-91	84,4	184,0	172,0	9999	9999	9999	134,5	125,2	9999	9999	9999	112,9	113,1	120,7	89,8	9999
20-sep-91	85,6	190,5	179,4	9999	9999	9999	145,4	134,5	9999	9999	9999	117,2	121,1	125,2	9999	9999
03-okt-91	83,8	192,1	181,2	9999	9999	9999	147,5	137,5	9999	9999	9999	112,2	115,0	115,0	80,5	9999
17-okt-91	80,7	187,0	181,5	9999	9999	109,9	116,0	119,2	8888	38,5	37,0	75,3	78,7	82,9	45,5	25,5
01-nov-91	75,0	179,0	163,5	9999	114,0	100,2	109,2	111,4	77,7	28,0	25,5	67,1	70,6	73,5	34,4	22,0
15-nov-91	77,3	165,3	149,5	9999	113,2	100,0	100,3	98,7	77,0	29,5	26,5	64,7	67,8	70,6	35,1	19,0
29-nov-91	79,0	157,3	144,8	9999	114,5	100,5	99,5	96,4	77,5	30,5	30,0	68,6	71,5	74,0	37,6	19,5
13-dec-91	83,6	157,0	147,7	9999	9999	110,5	108,0	102,0	88,0	9999	9999	86,7	91,8	92,4	57,5	30,5
27-dec-91	121,5	153,2	145,3	9999	115,4	103,4	100,0	98,0	79,9	31,6	31,5	69,2	74,1	76,8	40,6	19,7
13-jan-92	80,3	151,8	142,0	9999	115,7	102,2	97,8	94,3	79,6	32,8	37,0	70,2	76,0	78,1	42,1	20,4
24-jan-92	83,7	152,0	145,5	9999	9999	108,0	104,5	99,3	9999	44,4	43,1	84,7	89,4	90,4	52,5	26,7
20-feb-92	84,5	159,6	148,5	8888	116,5	104,6	106,4	103,5	82,5	38,8	43,0	82,0	86,2	86,5	51,1	25,8
20-mrt-92	82,6	152,2	145,4	9999	113,6	100,7	100,0	97,8	9999	31,3	33,0	78,3	77,5	72,2	41,8	20,6

Monitoring data north-south transect Raheenmore Bog

NR DATE	309 GWD	310 GWD	310A	310B	310C	311 GWD	312 GWD	313 GWD	313A	313B	313C	313D	313 GWW	314 GWW	315 GWD	315A	315B
27-okt-87	11,0	7777	46,0	43,0	40,0	12,0	9999	9999	97,0	111,0	121,0	107,0	75,0	66,0	32,0	70,0	77,0
25-nov-87	13,0	7777	0,0	44,0	41,0	7777	9999	9999	98,0	113,0	117,0	108,0	78,0	69,0	34,0	71,0	78,0
31-dec-87	7777	7777	9999	44,0	40,0	7777	9999	9999	93,0	115,0	120,0	113,0	71,0	59,0	27,0	67,0	75,0
28-jan-88	7777	7777	9999	42,0	38,0	7777	9999	9999	96,0	105,0	109,0	100,0	73,0	67,0	33,0	71,0	77,0
23-feb-88	14,0	7777	9999	43,0	42,0	10,0	9999	9999	100,0	104,0	104,0	104,0	79,0	70,0	35,0	72,0	80,0
21-mrt-88	7777	7777	9999	42,0	38,0	8,0	9999	9999	93,0	114,0	114,0	114,0	72,0	63,0	30,0	68,0	66,0
26-apr-88	22,0	12,0	9999	47,0	44,0	14,0	9999	9999	104,0	114,0	110,0	113,0	84,0	75,0	39,0	78,0	81,0
23-mei-88	26,0	13,0	9999	55,0	55,0	11,0	9999	9999	120,0	119,0	122,0	127,0	98,0	92,0	9999	92,0	94,0
28-jun-88	36,0	16,0	9999	55,0	55,0	18,0	9999	9999	120,0	9999	119,0	126,0	98,0	93,0	9999	95,0	95,0
27-jul-88	32,0	14,0	9999	51,0	49,0	115,0	9999	9999	112,0	9999	122,0	122,0	91,0	85,0	9999	88,0	87,0
30-aug-88	16,0	12,0	9999	46,0	44,0	13,0	9999	9999	104,0	116,0	122,0	114,0	82,0	72,0	38,0	77,0	78,0
28-sep-88	9,0	0,0	9999	47,0	45,0	10,0	9999	9999	100,0	9999	120,0	121,0	78,0	64,0	32,0	71,0	79,0
26-okt-88	7777	7777	9999	41,0	39,0	9,0	9999	9999	87,0	9999	114,0	108,0	66,0	58,0	31,0	69,0	76,0
23-nov-88	24,0	12,0	9999	45,0	43,0	14,0	9999	9999	103,0	9999	104,0	104,0	82,0	73,0	40,0	78,0	79,0
31-dec-88	13,0	7777	9999	44,0	42,0	12,0	9999	9999	100,0	110,0	115,0	11,0	78,0	71,0	36,0	74,0	77,0
26-jan-89	10,0	7777	9999	44,0	41,0	7777	9999	9999	101,0	112,0	112,0	112,0	82,0	69,0	35,0	73,0	76,0
28-feb-89	6,0	7777	9999	42,0	40,0	10,0	9999	9999	92,0	9999	110,0	107,0	71,0	65,0	33,0	72,0	75,0
31-mrt-89	8,0	7777	9999	42,0	39,0	10,0	9999	9999	94,0	9999	108,0	106,0	73,0	67,0	33,0	71,0	74,0
26-okt-89	33,0	22,0	59,0	60,0	55,0	26,0	9999	9999	114,0	130,0	150,0	141,0	85,0	65,0	9999	74,0	82,0
13-nov-89	21,0	12,0	52,0	46,0	44,0	14,0	9999	9999	102,0	116,0	129,0	111,0	79,0	65,0	33,0	72,0	78,0
27-nov-89	30,0	18,0	55,0	50,0	44,0	19,0	9999	9999	110,0	117,0	125,0	124,0	108,0	76,0	41,0	79,0	80,
11-dec-89	34,0	20,0	59,0	54,0	53,0	23,0	9999	9999	114,0	123,0	125,0	127,0	92,0	82,0	9999	85,0	85,0
04-jan-90	16,0	10,0	48,0	44,0	40,0	12,0	9999	9999	94,0	110,0	121,0	109,0	72,0	61,0	26,0	63,0	73,0
21-jan-90	19,0	11,0	49,0	46,0	41,0	14,0	9999	9999	96,0	110,0	121,0	110,0	76,0	62,0	29,0	67,0	73,0
03-feb-90	13,0	11,0	48,0	42,0	39,0	12,0	9999	9999	91,0	108,0	127,0	124,0	70,0	59,0	22,0	61,0	74,0
15-feb-90	13,0	10,0	46,0	41,0	38,0	11,0	9999	9999	83,0	106,0	114,0	102,0	62,0	61,0	23,0	61,0	74,0
01-mrt-90	9,0	9,0	46,0	40,0	39,0	11,0	9999	9999	89,0	110,0	115,0	102,0	57,0	57,0	22,0	60,0	73,0
16-mrt-90	29,0	13,0	53,0	48,0	46,0	16,0	9999	9999	104,0	119,0	117,0	118,0	84,0	73,0	41,0	79,0	80,0
12-apr-90	30,0	23,0	61,0	57,0	56,0	26,0	9999	9999	110,0	126,0	123,0	128,0	89,0	79,0	9999	83,0	83,0
26-apr-90	9999	23,0	62,0	59,0	59,0	27,0	9999	9999	115,0	129,0	125,0	134,0	93,0	86,0	9999	91,0	91,0
10-mei-90	9999	28,0	66,0	63,0	64,0	34,0	9999	9999	119,0	135,0	129,0	141,0	99,0	9999	9999	100,0	100,0
24-mei-90	9999	34,0	72,0	67,0	68,0	41,0	9999	9999	131,0	152,0	135,0	148,0	104,0	9999	9999	106,0	108,0
07-jun-90	9999	27,0	66,0	68,0	67,0	34,0	9999	9999	121,0	144,0	140,0	148,0	9999	9999	9999	106,0	106,0
20-jun-90	9999	32,0	70,0	71,0	71,0	38,0	9999	9999	9999	148,0	143,0	152,0	112,0	9999	9999	111,0	111,0
05-jul-90	18,0	10,0	49,0	62,0	58,0	14,0	9999	9999	113,0	149,0	148,0	147,0	86,0	58,0	27,0	63,0	93,0
20-jul-90	9999	30,0	67,0	60,0	59,0	36,0	9999	9999	121,0	132,0	142,0	132,0	100,0	86,0	9999	94,0	93,0
01-aug-90	9999	31,0	68,0	67,0	66,0	38,0	9999	9999	9999	87,0	90,0	153,0	103,0	9999	9999	100,0	100,0
15-aug-90	9999	31,0	71,0	73,0	73,0	38,0	9999	9999	122,0	147,0	145,0	151,0	9999	9999	9999	109,0	110,0
29-aug-90	36,1	23,2	61,3	68,5	66,1	28,2	9999	9999	121,5	145,9	147,8	151,4	107,1	94,1	9999	88,3	101,4
12-sep-90	9999	29,8	68,3	63,8	63,1	36,4	9999	9999	121,5	135,7	146,3	140,0	100,0	85,3	9999	92,0	92,2
26-sep-90	9999	31,3	70,0	68,0	68,2	38,5	9999	9999	9999	138,9	146,2	147,5	103,5	9999	9999	100,4	102,0
09-okt-90	29,3	18,3	54,6	56,5	51,5	21,8	9999	9999	116,0	133,7	146,1	128,8	88,1	61,7	39,3	76,6	83,1
24-okt-90	21,4	16,0	52,6	49,6	46,2	18,1	9999	9999	110,0	118,1	134,2	112,0	85,8	61,8	27,3	66,2	76,6
06-nov-90	28,5	17,9	55,8	52,7	51,7	22,3	9999	9999	111,8	119,4	128,7	116,5	88,1	67,1	40,5	78,3	79,2
20-nov-90	15,1	12,8	48,2	50,1	43,3	15,2	9999	9999	100,6	120,1	126,9	115,2	77,3	58,1	26,1	64,4	72,5
04-dec-90	28,7	16,2	54,3	51,8	49,7	19,7	9999	9999	108,6	118,8	124,6	118,2	86,7	66,0	45,0	78,2	78,2
18-dec-90	36,6	18,2	55,7	54,5	51,5	22,4	9999	9999	112,4	123,0	125,2	123,5	90,4	71,7	9999	81,1	81,7
11-jan-91	10,5	10,0	45,4	44,2	39,2	12,0	9999	8888	94,0	107,8	117,2	105,0	71,4	53,4	24,5	62,0	73,2
24-jan-91	17,5	13,0	48,2	46,7	42,3	15,0	9999	9999	99,5	111,2	116,5	107,5	76,0	58,5	30,0	68,4	73,5
07-feb-91	18,5	12,3	47,8	45,5	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888
21-feb-91	14,5	10,5	46,0	45,3	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888
08-mrt-91	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888
22-mrt-91	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888
04-apr-91	17,0	10,5	46,5	47,1	42,3	12,0	9999	9999	97,4	109,6	107,3	116,4	74,6	57,2	28,0	65,8	72,1
19-apr-91	24,5	12,5	49,1	46,0	44,2	14,5	9999	9999	102,6	105,2	103,1	114,6	79,7	65,9	41,5	78,1	75,4
03-mei-91	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888
17-mei-91	36,5	21,0	58,7	55,4	55,4	25,0	9999	9999	115,6	121,7	109,0	129,0	93,6	79,5	9999	88,2	86,0
31-mei-91	9999	27,0	67,1	63,0	63,4	34,0	9999	9999	120,7	132,5	116,1	137,0	100,6	89,8	9999	99,1	98,2
14-jun-91	9999	25,5	63,1	61,5	60,5	31,0	9999	9999	120,3	136,5	119,3	139,3	103,7	9999	9999	99,1	100,6
28-jun-91	32,0	17,5	55,6	59,0	57,1	21,0	9999	9999	120,1	137,2	121,1	137,4	95,6	63,7	39,0	77,8	91,5
11-jul-91	37,5	23,5	59,5	57,5	57,0	28,0	9999	9999	116,6	127,9	120,8	128,8	93,0	74,0	9999	83,0	83,4
31-jul-91	8888	26,5	70,0	65,9	66,0	32,0	8888	8888	119,7	134,1	123,7	136,6	100,1	8888	8888	91,8	91,3
09-aug-91	32,5	19,5	55,6	57,3	55,1	23,0	9999	9999	111,0	132,7	123,4	132,5	86,2	61,7	40,0	77,3	83,5
23-aug-91	9999	25,0	62,6	60,4	60,2	30,5	9999	9999	118,9	130,9	124,6	134,5	96,5	82,5	9999	90,1	89,4
06-sep-91	9999	35,5	72,4	68,0	69,1	42,0	9999	9999	120,4	140,6	129,4	144,4	106,0	9999	9999	103,8	103,8
20-sep-91	9999	31,0	70,1	70,7	69,4	39,0	9999	9999	120,7	145,8	132,9	148,9	112,5	9999	9999	106,6	107,3
03-okt-91	9999	25,5	63,2	64,8	64,0	31,0	9999	9999	119,1	141,6	133,3	147,6	106,0	9999	9999	94,1	101,1
17-okt-91	25,0	17,5	53,2	51,9	49,0	21,5	9999	9999	112,5	121,8	129,0	116,3	87,7	60,0	38,0	74,5	79,9
01-nov-91	12,0	10,5	46,7	49,8	44,0	13,5	9999	9999	98,4	119,3	124,0	121,0	74,3	51,3	24,5	61,8	77,5
15-nov-91	14,0	13,5	48,1	47,7	42,5	16,0	9999	9999	99,0	111,3	117,6	110,3	75,5	58,0	30,0	67,6	76,6
29-nov-91	15,0	13,5	49,4	48,8	43,8	16,5	9999	9999	97,7	113,3	114,0	112,8	74,0	57,7	29,5	67,1	74,3
13-dec-91	30,3	17,6	55,2	54,3	51,0	20,9	9999	9999	110,0	9999	316,5	126,0	87,0	69,0	44,3	82,0	81,0
27-dec-91	17,6	13,6	49,4	47,7	43,6	15,7	9999	9999	98,0	111,8	110,9	112,6	74,5	57,7	31,8	69,6	74,4
13-jan-92	19,7	35,3	48,9	47,5	42,8	14,6	9999	9999	98,1	111,1	107,0	112,5	75,3	59,0	33,0	70,3	74,9
24-jan-92	25,5	35,8	51,7	50,4	47,1	15,4	9999	9999	106,9	119,3	109,9	122,6	85,0	69,5	42,0	81,0	80,0
20-feb-92	24,3	34,2	49,5	49,3	45,5	14,6	8888	8888	99,0	121,2	113,5	122,6	76,3	59,4	34,1	72,5	75,9
20-mrt-92	18,0	33,3	47,9	46,8	42,9	12,9	9999	9999	97,5	114,9	110,6	116,5	9999	59,1	31,9	70,7	74,3

Monitoring data north-south transect Raheenmore Bog

NR / DATE	315C	315D	315 GWW	316 GWD	317 GWD	317A	317B	317C	317D	317 GWW	318 GWD	319 GWD	320 GWD	321 GWD	321A	321B	321C
27-okt-87	90,0	126,0	49,0	25,0	29,0	68,0	72,0	95,0	103,0	50,0	12,0	13,0	21,0	14,0	58,0	60,0	64,0
25-nov-87	88,0	123,0	52,0	26,0	31,0	68,0	72,0	90,0	98,0	52,0	12,0	14,0	19,0	12,0	58,0	59,0	62,0
31-dec-87	88,0	128,0	45,0	20,0	25,0	66,0	70,0	92,0	100,0	46,0	6,0	10,0	11,0	10,0	57,0	58,0	61,0
28-jan-88	85,0	104,0	49,0	25,0	28,0	67,0	70,0	85,0	92,0	49,0	10,0	12,0	15,0	14,0	56,0	57,0	60,0
23-feb-88	87,0	116,0	53,0	18,0	32,0	69,0	73,0	87,0	96,0	51,0	13,0	14,0	22,0	13,0	57,0	59,0	62,0
21-mrt-88	86,0	119,0	46,0	20,0	27,0	75,0	70,0	86,0	93,0	47,0	9,0	12,0	13,0	12,0	54,0	56,0	60,0
26-apr-88	90,0	135,0	55,0	33,0	35,0	72,0	76,0	94,0	103,0	54,0	15,0	16,0	25,0	17,0	58,0	61,0	63,0
23-mei-88	97,0	148,0	66,0	40,0	35,0	89,0	90,0	103,0	115,0	66,0	22,0	16,0	24,0	18,0	64,0	64,0	65,0
28-jun-88	97,0	146,0	73,0	9999	9999	91,0	92,0	102,0	106,0	73,0	30,0	28,0	31,0	20,0	65,0	65,0	68,0
27-jul-88	93,0	142,0	66,0	39,0	42,0	80,0	81,0	101,0	113,0	61,0	20,0	18,0	28,0	17,0	62,0	63,0	66,0
30-aug-88	90,0	136,0	55,0	29,0	31,0	73,0	75,0	99,0	107,0	51,0	11,0	14,0	18,0	14,0	60,0	61,0	63,0
28-sep-88	91,0	140,0	48,0	24,0	29,0	70,0	76,0	97,0	109,0	48,0	8,0	121,0	15,0	11,0	59,0	60,0	63,0
26-okt-88	84,0	130,0	48,0	23,0	26,0	65,0	71,0	92,0	100,0	47,0	8,0	10,0	10,0	10,0	56,0	58,0	61,0
23-nov-88	86,0	130,0	56,0	30,0	33,0	72,0	76,0	92,0	102,0	53,0	14,0	14,0	20,0	15,0	60,0	61,0	64,0
31-dec-88	86,0	131,0	53,0	28,0	33,0	71,0	74,0	90,0	100,0	53,0	14,0	14,0	22,0	12,0	57,0	60,0	64,0
26-jan-89	84,0	124,0	52,0	28,0	31,0	72,0	74,0	88,0	98,0	50,0	10,0	12,0	16,0	13,0	57,0	60,0	61,0
28-feb-89	82,0	121,0	51,0	24,0	30,0	66,0	71,0	85,0	93,0	48,0	9,0	12,0	14,0	12,0	54,0	57,0	60,0
31-mrt-89	85,0	120,0	50,0	26,0	30,0	67,0	72,0	84,0	93,0	50,0	10,0	12,0	15,0	12,0	55,0	58,0	62,0
26-okt-89	9999	157,0	53,0	30,0	28,0	65,0	76,0	111,0	139,0	49,0	14,0	16,0	21,0	16,0	61,0	63,0	68,0
13-nov-89	89,0	128,0	50,0	25,0	24,0	64,0	72,0	102,0	114,0	44,0	12,0	14,0	21,0	16,0	61,0	64,0	69,0
27-nov-89	88,0	136,0	55,0	32,0	34,0	69,0	74,0	101,0	112,0	51,0	19,0	19,0	24,0	18,0	60,0	62,0	67,0
11-dec-89	91,0	148,0	60,0	39,0	39,0	78,0	80,0	101,0	115,0	56,0	24,0	22,0	27,0	21,0	62,0	62,0	66,0
04-jan-90	85,0	121,0	41,0	22,0	23,0	61,0	68,0	94,0	101,0	41,0	11,0	13,0	18,0	14,0	58,0	60,0	66,0
21-jan-90	84,0	119,0	44,0	24,0	23,0	63,0	68,0	91,0	99,0	44,0	12,0	14,0	19,0	14,0	59,0	60,0	65,0
03-feb-90	83,0	110,0	39,0	21,0	22,0	61,0	67,0	88,0	91,0	42,0	10,0	12,0	16,0	12,0	56,0	58,0	63,0
15-feb-90	82,0	108,0	39,0	20,0	16,0	61,0	61,0	78,0	87,0	42,0	9,0	10,0	6,0	13,0	55,0	58,0	68,0
01-mrt-90	82,0	109,0	36,0	18,0	21,0	59,0	66,0	88,0	85,0	38,0	7,0	10,0	14,0	11,0	55,0	57,0	61,0
16-mrt-90	85,0	134,0	55,0	32,0	34,0	72,0	74,0	92,0	93,0	51,0	19,0	18,0	24,0	16,0	58,0	60,0	53,0
12-apr-90	94,0	155,0	60,0	28,0	40,0	78,0	80,0	101,0	110,0	57,0	24,0	21,0	26,0	20,0	60,0	61,0	64,0
26-apr-90	98,0	159,0	68,0	9999	46,0	86,0	92,0	104,0	115,0	65,0	26,0	20,0	27,0	19,0	60,0	60,0	61,0
10-mei-90	104,0	166,0	79,0	9999	9999	97,0	98,0	110,0	124,0	78,0	34,0	29,0	33,0	27,0	64,0	65,0	78,0
24-mei-90	113,0	168,0	85,0	9999	9999	103,0	106,0	117,0	133,0	84,0	42,0	37,0	9999	36,0	68,0	68,0	71,0
07-jun-90	113,0	173,0	84,0	9999	9999	97,0	101,0	118,0	135,0	78,0	32,0	25,0	28,0	22,0	65,0	66,0	69,0
20-jun-90	116,0	177,0	88,0	9999	103,0	106,0	120,0	120,0	140,0	83,0	37,0	30,0	32,0	27,0	67,0	78,0	69,0
05-jul-90	111,0	172,0	42,0	23,0	28,0	64,0	84,0	120,0	136,0	44,0	10,0	12,0	17,0	15,0	59,0	62,0	68,0
20-jul-90	102,0	161,0	70,0	9999	9999	90,0	90,0	116,0	132,0	70,0	37,0	34,0	9999	32,0	67,0	67,0	70,0
01-aug-90	106,0	167,0	77,0	9999	9999	96,0	98,0	119,0	136,0	75,0	37,0	32,0	36,0	30,0	68,0	69,0	72,0
15-aug-90	112,0	175,0	86,0	9999	9999	104,0	108,0	122,0	139,0	82,0	37,0	35,0	42,0	29,0	73,0	73,0	73,0
29-aug-90	113,8	116,8	66,5	34,2	38,0	77,8	93,2	123,2	143,0	53,3	13,2	13,3	18,4	14,1	62,0	65,1	70,4
12-sep-90	105,3	168,3	68,3	43,3	9999	88,2	89,8	120,4	138,4	66,2	30,4	27,6	36,6	27,3	66,7	67,4	71,6
26-sep-90	107,2	172,1	76,8	9999	9999	95,9	98,7	120,4	140,5	74,0	34,4	28,4	32,4	26,2	67,4	68,0	72,6
09-okt-90	106,8	163,0	52,4	25,3	30,2	68,8	78,9	118,8	135,1	45,5	15,2	16,1	22,1	16,1	62,8	64,5	69,8
24-okt-90	90,7	130,9	43,9	21,6	25,1	64,9	71,8	106,1	116,4	43,1	11,6	13,1	16,8	16,0	60,0	61,1	66,2
06-nov-90	89,0	134,3	54,5	26,6	28,9	68,4	74,3	105,0	110,7	47,9	16,0	15,3	22,2	14,5	61,7	61,9	66,9
20-nov-90	87,7	138,0	41,7	19,6	23,4	61,5	68,3	100,8	106,0	41,9	10,5	11,8	15,8	12,2	58,6	58,9	63,1
04-dec-90	78,6	130,6	54,1	27,2	29,3	67,3	72,4	98,7	102,7	47,4	15,8	15,4	21,2	5,4	60,1	60,0	64,7
18-dec-90	90,1	140,8	57,3	29,9	31,8	70,1	74,3	99,3	105,3	49,7	18,5	16,6	22,2	16,6	60,4	60,2	63,7
11-jan-91	81,4	112,2	40,2	18,0	21,0	58,8	69,0	90,9	91,0	38,6	8,2	9,5	14,0	11,5	55,4	56,7	60,2
24-jan-91	82,5	113,5	48,8	22,0	24,0	62,5	68,0	94,0	92,3	42,2	11,0	13,0	17,5	13,5	57,6	58,7	62,1
07-feb-91	8888	8888	8888	8888	8888	8888	8888	92,7	91,0	43,5	12,0	13,0	18,2	14,3	57,2	57,4	61,8
21-feb-91	8888	8888	8888	8888	8888	8888	8888	91,0	89,5	40,5	9,5	11,5	15,5	11,5	55,5	55,2	59,6
08-mrt-91	8888	8888	8888	8888	8888	8888	8888	88,2	84,0	37,1	5,5	7,5	13,5	8,5	54,1	54,6	59,2
22-mrt-91	8888	8888	8888	8888	8888	8888	8888	86,6	80,1	41,6	8,5	10,0	13,5	10,0	54,1	54,7	59,0
04-apr-91	80,3	125,3	44,0	20,5	23,0	62,0	68,0	88,8	87,2	40,2	8,0	9,5	16,5	12,0	54,7	54,0	57,1
19-apr-91	83,3	118,3	54,1	27,5	30,0	67,9	70,8	90,9	86,6	47,5	15,5	12,5	22,0	14,5	56,8	56,5	60,0
03-mei-91	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888
17-mei-91	91,9	140,8	64,4	39,5	43,0	80,7	81,5	97,6	101,0	60,6	26,0	21,0	30,0	21,0	60,0	59,1	61,8
31-mei-91	100,6	152,4	77,4	9999	9999	95,5	95,5	103,8	114,3	76,1	36,5	30,5	9999	34,0	66,0	64,1	65,3
14-jun-91	104,7	157,6	77,2	9999	9999	89,2	93,4	107,0	121,5	70,0	30,0	22,5	27,5	22,0	63,3	62,6	65,6
28-jun-91	95,1	158,8	54,0	31,5	34,5	69,0	81,2	108,9	121,5	48,1	16,0	16,0	21,0	19,0	60,3	61,0	64,6
11-jul-91	95,4	147,9	59,5	33,5	37,0	74,8	79,0	106,5	117,0	53,5	21,5	18,0	24,0	17,5	60,5	60,0	63,5
31-jul-91	99,7	154,8	68,0	43,0	8888	86,3	87,0	108,5	121,2	65,1	28,5	24,5	33,5	23,0	62,5	61,3	64,5
09-aug-91	99,1	115,3	53,7	28,0	32,0	69,5	77,4	108,2	118,9	48,5	14,5	14,0	21,5	15,5	59,9	59,9	63,8
23-aug-91	96,1	151,6	67,3	42,0	48,0	85,0	86,0	108,7	119,1	64,5	29,0	23,0	32,5	23,5	62,4	61,6	64,0
06-sep-91	107,5	163,3	82,2	9999	9999	100,3	101,5	114,3	129,0	80,9	42,0	35,5	9999	39,5	69,7	67,5	68,7
20-sep-91	113,5	169,7	84,0	9999	9999	100,2	103,5	118,3	136,3	81,0	38,0	30,5	36,0	28,5	69,5	68,5	70,0
03-okt-91	112,6	168,6	71,0	39,0	40,0	78,2	89,3	118,0	136,5	54,3	18,0	14,5	20,5	16,0	64,0	64,5	68,3
17-okt-91	97,5	139,6	51,9	25,0	29,5	66,4	73,7	109,9	124,0	45,5	14,5	15,0	21,0	13,5	61,2	61,2	65,8
01-nov-91	90,8	143,2	39,2	20,0	24,5	61,1	71,4	103,5	118,8	40,2	9,0	10,5	15,5	13,0	57,2	58,1	62,8
15-nov-91	87,2	118,6	44,5	22,0	26,0	63,0	69,0	99,7	108,7	42,0	11,0	12,0	18,0	13,0	58,1	58,2	63,3
29-nov-91	85,4	118,0	44,8	22,0	25,5	63,0	68,8	98,7	104,3	41,8	11,5	12,5	17,5	14,5	57,9	58,0	62,3
13-dec-91	89,5	135,5	57,4	32,4	34,5	72,5	76,2	100,8	108,0	50,5	20,0	17,7	24,0	17,5	61,0	60,7	64,8
27-dec-91	87,8	122,4	46,4	23,8	27,0	66,0	69,8	97,9	103,2	43,7	12,1	12,9	18,7	13,5	58,5	59,1	63,7
13-jan-92	84,4	117,8	48,2	25,2	27,3	65,2	70,7	96,3	99,3	44,0	12,0	12,0	18,8	13,1	58,2	58,5	63,3
24-jan-92	85,6	131,0	57,4	29,7	31,0	69,6	74,7	97,8	103,3	45,3	13,3	12,4	22,9	11,8	58,8	58,7	62,6
20-feb-92	90,1	141,0	49,9	25,7	28,9	65,7	72,0	100,0	107,4	45,1	13,1	13,3	19,4	14,2	59,0	58,5	63,0
20-mrt-92	83,8	124,9	47,7	23,9	27,0	63,6	70,9	95,8	101,2	41,9	18,5	11,1	16,3	11,8	57,3	57,8	60,8

Monitoring data north-south transect Raheenmore Bog

DATE / NR	321D	321E	322 GWD	323 GWD	324 GWD	324A	324B	324C	324D	324F	325 GWD	326 GWD	327 GWD	327A	327B	327C	327D
27-okt-87	95,0	8888	7777	7777	7777	32,0	53,0	175,0	67,0	8888	7777	7777	7777	51,0	51,0	52,0	53,0
25-nov-87	94,0	8888	10,0	7777	8,0	31,0	53,0	88,0	67,0	8888	7777	7777	7777	51,0	51,0	52,0	53,0
31-dec-87	93,0	8888	7777	7777	7777	31,0	52,0	62,0	66,0	8888	7777	7777	7777	53,0	52,0	52,0	54,0
28-jan-88	103,0	8888	8,0	7777	7777	29,0	49,0	51,0	65,0	8888	7777	7777	7777	48,0	49,0	50,0	50,0
23-feb-88	96,0	8888	9,0	7777	7777	30,0	52,0	53,0	67,0	8888	7777	7777	7777	49,0	51,0	51,0	52,0
21-mrt-88	92,0	8888	7777	7777	7777	30,0	50,0	51,0	66,0	8888	7777	7777	7777	48,0	49,0	49,0	50,0
26-apr-88	94,0	8888	11,0	9,0	12,0	32,0	55,0	55,0	69,0	8888	7,0	6,0	15,0	53,0	53,0	53,0	54,0
23-mei-88	98,0	8888	13,0	11,0	12,0	36,0	57,0	59,0	70,0	8888	9,0	10,0	16,0	58,0	58,0	58,0	57,0
28-jun-88	97,0	8888	18,0	16,0	16,0	37,0	58,0	60,0	71,0	8888	12,0	12,0	16,0	58,0	58,0	58,0	58,0
27-jul-88	97,0	8888	14,0	13,0	13,0	36,0	57,0	57,0	70,0	8888	11,0	10,0	15,0	56,0	56,0	56,0	57,0
30-aug-88	95,0	8888	10,0	10,0	10,0	34,0	54,0	56,0	68,0	8888	8,0	6,0	13,0	54,0	55,0	55,0	55,0
28-sep-88	94,0	8888	8,0	5,0	10,0	34,0	54,0	55,0	69,0	8888	6,0	6,0	14,0	54,0	54,0	55,0	55,0
26-okt-88	92,0	8888	5,0	7777	7777	33,0	52,0	52,0	66,0	8888	7777	7777	7777	50,0	51,0	52,0	52,0
23-nov-88	96,0	8888	10,0	10,0	10,0	32,0	54,0	54,0	68,0	8888	7,0	5,0	15,0	53,0	53,0	54,0	54,0
31-dec-88	95,0	8888	8,0	7,0	9,0	31,0	53,0	54,0	68,0	8888	7777	7777	13,0	52,0	52,0	53,0	53,0
26-jan-89	93,0	8888	9,0	8,0	6,0	31,0	53,0	53,0	68,0	8888	7777	7777	12,0	51,0	51,0	51,0	52,0
28-feb-89	93,0	8888	6,0	7777	7777	30,0	51,0	51,0	66,0	8888	7777	7777	7777	50,0	50,0	50,0	52,0
31-mrt-89	95,0	8888	8,0	7777	7777	27,0	51,0	53,0	67,0	8888	7777	7777	7777	50,0	50,0	51,0	51,0
26-okt-89	100,0	162,0	12,0	13,0	14,0	36,0	57,0	59,0	72,0	8888	11,0	11,0	19,0	56,0	57,0	58,0	58,0
13-nov-89	102,0	146,0	10,0	10,0	11,0	37,0	57,0	59,0	72,0	8888	10,0	8,0	14,0	56,0	57,0	57,0	58,0
27-nov-89	101,0	151,0	13,0	13,0	14,0	36,0	57,0	59,0	73,0	8888	10,0	11,0	18,0	58,0	57,0	58,0	58,0
11-dec-89	100,0	156,0	16,0	14,0	16,0	37,0	59,0	59,0	72,0	8888	13,0	12,0	19,0	58,0	58,0	58,0	59,0
04-jan-90	100,0	145,0	10,0	9,0	9,0	33,0	56,0	58,0	71,0	8888	7,0	7,0	13,0	54,0	55,0	56,0	56,0
21-jan-90	100,0	143,0	10,0	10,0	11,0	34,0	56,0	58,0	71,0	8888	8,0	8,0	16,0	55,0	56,0	56,0	56,0
03-feb-90	97,0	132,0	8,0	8,0	7,0	32,0	53,0	56,0	69,0	8888	5,0	3,0	10,0	52,0	53,0	54,0	54,0
15-feb-90	96,0	116,0	7,0	6,0	5,0	29,0	62,0	54,0	67,0	8888	3,0	8888	9,0	50,0	51,0	52,0	53,0
01-mrt-90	96,0	110,0	5,0	4,0	3,0	28,0	51,0	53,0	67,0	8888	1,0	8888	8,0	49,0	50,0	51,0	52,0
16-mrt-90	99,0	117,0	11,0	10,0	10,0	32,0	55,0	56,0	70,0	8888	10,0	8,0	13,0	55,0	55,0	55,0	56,0
12-apr-90	97,0	126,0	16,0	16,0	16,0	36,0	57,0	58,0	71,0	8888	14,0	13,0	19,0	58,0	57,0	57,0	58,0
26-apr-90	98,0	131,0	14,0	16,0	14,0	37,0	58,0	59,0	72,0	8888	13,0	12,0	20,0	58,0	58,0	58,0	58,0
10-mei-90	99,0	136,0	22,0	20,0	19,0	38,0	60,0	60,0	73,0	8888	18,0	16,0	21,0	60,0	60,0	60,0	60,0
24-mei-90	101,0	142,0	29,0	26,0	23,0	40,0	61,0	62,0	76,0	8888	20,0	19,0	23,0	61,0	61,0	61,0	61,0
07-jun-90	98,0	143,0	18,0	16,0	19,0	40,0	61,0	61,0	73,0	8888	12,0	14,0	21,0	60,0	60,0	60,0	61,0
20-jun-90	99,0	235,0	21,0	20,0	20,0	42,0	61,0	61,0	64,0	8888	9999	16,0	23,0	61,0	61,0	61,0	61,0
05-jul-90	97,0	218,0	10,0	10,0	10,0	40,0	57,0	58,0	73,0	8888	9,0	8,0	15,0	56,0	57,0	58,0	58,0
20-jul-90	102,0	215,0	25,0	21,0	20,0	38,0	60,0	61,0	75,0	8888	16,0	15,0	23,0	60,0	60,0	60,0	61,0
01-aug-90	102,0	210,0	24,0	21,0	21,0	41,0	61,0	62,0	75,0	8888	17,0	18,0	24,0	61,0	61,0	61,0	61,0
15-aug-90	102,0	208,0	23,0	22,0	22,0	43,0	62,0	62,0	76,0	8888	19,0	17,0	23,0	63,0	62,0	62,0	62,0
29-aug-90	100,2	199,3	11,2	12,3	13,6	39,3	58,9	60,2	73,4	8888	12,8	11,6	17,1	58,1	59,0	59,9	60,2
12-sep-90	103,6	196,9	20,3	18,4	18,2	39,3	60,3	61,7	75,3	8888	14,5	14,6	21,0	60,1	60,1	60,9	61,3
26-sep-90	103,6	195,4	20,1	18,1	18,1	40,3	60,6	62,5	76,0	8888	15,9	15,2	21,7	61,2	60,8	61,2	61,5
09-okt-90	101,2	183,2	12,2	12,9	13,3	37,1	58,0	59,6	73,3	8888	9,7	10,4	16,5	56,8	57,7	58,7	59,1
24-okt-90	98,3	171,6	9,9	9,6	9,7	33,8	54,8	56,1	40,5	8888	7,9	5,7	11,7	53,6	54,4	55,7	56,2
06-nov-90	100,2	164,7	12,1	11,3	10,6	35,7	36,4	38,6	52,8	188,9	9,2	8,7	14,8	55,3	55,7	56,6	57,2
20-nov-90	95,7	159,9	8,8	8,7	8,8	33,0	34,0	35,2	49,7	179,8	6,7	4,9	12,6	52,6	53,1	54,7	55,3
04-dec-90	98,9	158,7	11,5	10,1	10,9	34,9	35,1	37,2	51,4	180,0	9,2	7,2	12,6	53,6	53,6	55,2	56,1
18-dec-90	97,7	163,0	12,4	12,3	10,5	36,0	35,3	37,1	51,2	178,6	10,2	9,3	14,0	55,0	54,6	56,1	56,9
11-jan-91	93,7	146,0	6,2	4,0	4,3	29,5	29,5	31,5	48,5	166,2	3,0	0,8	8,4	49,6	49,5	51,4	51,0
24-jan-91	97,4	148,7	9,0	8,0	8,5	32,0	32,8	34,8	49,4	169,0	7,0	4,5	11,5	50,6	52,2	53,0	53,0
07-feb-91	96,4	149,8	8,5	7,8	8,5	32,2	33,5	34,1	49,3	167,2	5,5	4,0	12,0	51,8	51,8	53,0	54,0
21-feb-91	93,0	147,4	8,0	7,5	6,5	30,6	31,0	32,2	46,6	165,6	4,5	3,0	11,0	50,5	50,4	52,2	52,4
08-mrt-91	91,9	141,3	5,0	4,0	4,0	28,3	29,9	31,1	45,3	162,3	2,5	0,0	8,0	48,7	49,4	50,5	50,5
22-mrt-91	93,0	134,2	6,0	4,0	4,0	28,9	29,0	31,4	47,0	163,4	2,5	0,5	8,5	48,7	49,0	50,7	50,7
04-apr-91	90,2	136,3	7,0	7,0	6,5	30,2	30,0	31,1	46,1	159,5	5,5	3,0	10,0	50,1	50,0	50,9	51,5
19-apr-91	95,1	136,4	9,5	9,0	8,0	31,1	31,2	33,1	48,5	164,7	6,0	4,5	11,5	51,7	50,7	52,0	52,2
03-mei-91	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	5,5	4,0	10,0	50,9	50,9	51,8	52,0
17-mei-91	95,9	142,0	15,0	13,0	13,0	34,4	34,0	35,2	50,1	172,6	11,0	9,5	14,0	54,2	53,4	54,1	54,2
31-mei-91	97,6	147,1	24,0	19,5	17,5	37,5	37,0	37,6	52,0	178,5	14,5	14,5	19,5	57,8	56,6	56,8	57,0
14-jun-91	95,2	148,3	17,5	16,0	15,5	37,0	36,3	37,4	51,0	182,2	12,5	11,5	17,0	56,5	56,0	56,5	56,3
28-jun-91	95,1	148,2	14,5	15,0	16,0	35,8	35,8	37,5	51,1	184,9	13,5	10,5	16,0	54,6	54,9	55,9	57,0
11-jul-91	94,1	148,5	14,5	13,0	14,0	35,5	35,5	36,2	50,0	184,0	10,5	9,0	14,0	54,2	54,4	55,2	55,5
31-jul-91	95,5	152,6	18,5	16,0	16,0	42,3	42,0	42,6	56,5	193,9	12,0	12,0	16,5	56,1	55,6	56,7	57,0
09-aug-91	95,7	151,3	12,0	12,0	12,5	35,8	36,1	37,6	51,4	189,7	10,5	7,5	13,0	54,4	54,7	56,0	56,2
23-aug-91	95,0	154,4	17,0	16,5	17,5	37,0	36,5	37,0	51,3	190,0	14,5	11,5	17,0	56,7	56,5	57,0	57,6
06-sep-91	100,0	159,0	29,5	24,0	22,0	40,2	39,3	44,1	54,4	392,0	17,0	16,0	19,0	59,9	59,1	59,2	59,5
20-sep-91	99,0	161,5	23,0	20,5	19,5	40,5	40,5	40,5	54,0	196,5	16,0	15,5	20,5	60,0	60,0	60,0	60,0
03-okt-91	67,2	161,0	13,0	14,0	15,0	38,4	38,4	40,0	53,0	198,0	12,5	10,5	15,5	56,4	57,3	58,5	58,4
17-okt-91	95,6	160,0	11,5	12,0	12,5	35,7	35,7	37,1	50,8	192,5	9,5	7,0	12,0	53,5	54,4	55,8	56,3
01-nov-91	93,6	163,0	8,0	7,5	7,5	32,4	33,4	34,4	48,4	186,4	6,5	4,0	10,5	51,4	52,4	53,8	54,2
15-nov-91	94,5	163,1	8,5	8,0	7,0	31,8	32,3	34,2	48,7	182,5	6,5	4,0	10,0	50,8	51,6	52,8	53,1
29-nov-91	95,4	163,4	9,0	9,0	8,0	32,1	32,8	33,8	49,1	177,0	6,5	4,5	10,5	50,8	51,3	52,6	52,7
13-dec-91	97,5	167,5	13,4	11,9	12,0	35,4	35,3	36,3	51,1	179,0	7,6	6,9	11,2	52,8	52,8	54,0	54,4
27-dec-91	96,2	164,2	8,9	8,0	7,8	37,2	33,0	34,5	49,4	173,8	5,6	3,8	9,6	51,2	51,5	52,7	52,6
13-jan-92	96,0	161,6	8,3	7,4	7,2	31,6	31,8	34,3	50,8	170,5	5,9	3,8	9,7	50,8	51,3	52,1	52,2
24-jan-92	94,9	164,0	9,6	9,1	8,9	33,3	33,3	34,4	49,7	170,3	7,0	4,4	10,0	51,3	51,8	52,4	53,7
20-feb-92	95,2	165,1	10,5	10,0	9,7	33,7	33,9	35,3	50,0	175,8	6,3	4,9	10,4	51,8	51,9	52,8	53,0
20-mrt-92	52,6	162,9	8,7	8,1	7,6	32,4	32,1	33,1	48,4	172,3	6,1	3,5	9,2	50,1	50,7	51,6	51,7

Monitoring data north-south transect Raheenmore Bog

NR DATE	327F	328 GWD	329 GWD	330 GWD	330A	330B	330C	330D	330E	330F	331 GWD	332 GWD	333 GWD	333A	333B	333C	333D
27-okt-87	8888	7777	7777	7777	47,0	47,0	48,0	57,0	8888	8888	16,0	12,0	13,0	53,0	53,0	0,0	56,0
25-nov-87	8888	7777	10,0	7777	48,0	48,0	48,0	49,0	8888	8888	15,0	13,0	14,0	54,0	53,0	54,0	56,0
31-dec-87	8888	7777	7777	7777	46,0	50,0	49,0	49,0	8888	8888	14,0	12,0	15,0	53,0	52,0	54,0	55,0
28-jan-88	8888	7777	7777	7777	44,0	44,0	45,0	47,0	8888	8888	16,0	12,0	15,0	53,0	52,0	53,0	54,0
23-feb-88	8888	7777	7777	7777	47,0	46,0	46,0	47,0	8888	8888	15,0	13,0	12,0	54,0	53,0	54,0	55,0
21-mrt-88	8888	7777	7777	7777	44,0	44,0	46,0	46,0	8888	8888	15,0	10,0	13,0	53,0	51,0	53,0	54,0
26-apr-88	8888	13,0	11,0	10,0	51,0	51,0	50,0	51,0	8888	8888	18,0	14,0	15,0	55,0	55,0	55,0	56,0
23-mei-88	8888	15,0	13,0	11,0	53,0	52,0	54,0	51,0	8888	8888	16,0	14,0	12,0	59,0	57,0	57,0	58,0
28-jun-88	8888	15,0	14,0	13,0	54,0	53,0	53,0	53,0	8888	8888	18,0	15,0	16,0	58,0	57,0	58,0	58,0
27-jul-88	8888	12,0	13,0	11,0	51,0	51,0	51,0	52,0	8888	8888	16,0	14,0	15,0	56,0	56,0	56,0	57,0
30-aug-88	8888	12,0	11,0	9,0	49,0	49,0	52,0	52,0	8888	8888	16,0	13,0	14,0	55,0	54,0	56,0	56,0
28-sep-88	8888	10,0	10,0	8,0	49,0	49,0	50,0	50,0	8888	8888	17,0	13,0	14,0	54,0	54,0	55,0	56,0
26-okt-88	8888	7777	7777	7777	45,0	46,0	47,0	48,0	8888	8888	15,0	12,0	12,0	52,0	52,0	53,0	55,0
23-nov-88	8888	9,0	9,0	8,0	49,0	49,0	50,0	50,0	8888	8888	16,0	14,0	14,0	55,0	54,0	55,0	55,0
31-dec-88	8888	9,0	10,0	6,0	48,0	48,0	50,0	50,0	8888	8888	16,0	13,0	14,0	55,0	53,0	54,0	55,0
26-jan-89	8888	10,0	9,0	7777	47,0	47,0	47,0	48,0	8888	8888	14,0	12,0	14,0	54,0	53,0	54,0	54,0
28-feb-89	8888	6,0	7777	7777	47,0	47,0	47,0	48,0	8888	8888	14,0	12,0	13,0	53,0	52,0	53,0	54,0
31-mrt-89	8888	7777	7777	7777	47,0	47,0	48,0	48,0	8888	8888	16,0	12,0	13,0	53,0	53,0	53,0	55,0
26-okt-89	8888	13,0	14,0	10,0	50,0	51,0	52,0	53,0	154,0	8888	21,0	14,0	16,0	53,0	53,0	9999	57,0
13-nov-89	8888	10,0	11,0	9,0	51,0	52,0	52,0	54,0	144,0	8888	19,0	13,0	14,0	55,0	55,0	57,0	58,0
27-nov-89	8888	13,0	13,0	11,0	52,0	52,0	51,0	52,0	147,0	8888	21,0	13,0	16,0	55,0	55,0	57,0	58,0
11-dec-89	8888	14,0	14,0	12,0	52,0	52,0	52,0	54,0	153,0	8888	20,0	14,0	16,0	55,0	55,0	57,0	58,0
04-jan-90	8888	10,0	10,0	7,0	49,0	50,0	51,0	52,0	142,0	8888	12,0	19,0	12,0	54,0	53,0	54,0	55,0
21-jan-90	8888	11,0	12,0	8,0	49,0	49,0	50,0	51,0	138,0	8888	16,0	13,0	13,0	54,0	52,0	56,0	59,0
03-feb-90	8888	8,0	8,0	5,0	48,0	46,0	48,0	50,0	127,0	8888	16,0	12,0	12,0	52,0	52,0	55,0	55,0
15-feb-90	8888	7,0	6,0	5,0	46,0	46,0	46,0	48,0	113,0	8888	16,0	11,0	10,0	52,0	53,0	51,0	54,0
01-mrt-90	8888	5,0	5,0	4,0	44,0	46,0	46,0	48,0	113,0	8888	16,0	11,0	10,0	52,0	51,0	53,0	54,0
16-mrt-90	8888	9,0	12,0	9,0	50,0	50,0	49,0	51,0	119,0	8888	14,0	13,0	14,0	55,0	54,0	55,0	56,0
12-apr-90	8888	16,0	16,0	13,0	52,0	52,0	51,0	52,0	125,0	8888	19,0	16,0	18,0	56,0	55,0	56,0	57,0
26-apr-90	8888	14,0	14,0	11,0	53,0	52,0	52,0	52,0	127,0	8888	20,0	14,0	16,0	57,0	56,0	56,0	56,0
10-mei-90	8888	16,0	16,0	14,0	55,0	55,0	55,0	54,0	131,0	8888	22,0	16,0	19,0	58,0	57,0	57,0	58,0
24-mei-90	8888	19,0	19,0	16,0	56,0	55,0	55,0	55,0	135,0	8888	26,0	19,0	22,0	61,0	59,0	59,0	59,0
07-jun-90	8888	14,0	16,0	14,0	56,0	54,0	54,0	55,0	136,0	8888	21,0	16,0	18,0	57,0	57,0	58,0	58,0
20-jun-90	8888	18,0	16,0	16,0	56,0	55,0	55,0	56,0	193,0	8888	22,0	18,0	19,0	58,0	57,0	58,0	59,0
05-jul-90	8888	11,0	11,0	8,0	51,0	52,0	53,0	53,0	171,0	8888	19,0	17,0	15,0	54,0	54,0	56,0	56,0
20-jul-90	8888	16,0	17,0	16,0	54,0	53,0	54,0	55,0	167,0	8888	23,0	20,0	21,0	58,0	57,0	58,0	58,0
01-aug-90	8888	17,0	18,0	17,0	55,0	54,0	55,0	56,0	164,0	8888	25,0	19,0	22,0	59,0	57,0	58,0	59,0
15-aug-90	8888	19,0	18,0	17,0	55,0	56,0	56,0	57,0	163,0	8888	24,0	19,0	22,0	60,0	59,0	59,0	60,0
29-aug-90	8888	12,2	13,5	10,8	51,2	52,4	53,4	53,5	157,3	8888	20,5	14,2	15,8	55,5	54,9	56,9	57,4
12-sep-90	8888	14,7	15,6	14,1	53,7	53,3	53,5	55,1	161,1	8888	21,7	16,6	19,6	57,7	56,3	57,8	58,2
26-sep-90	8888	15,5	16,5	14,5	54,2	53,7	54,2	55,6	162,4	8888	21,4	16,6	18,3	57,9	56,3	57,6	58,3
09-okt-90	8888	11,3	12,9	8,3	49,2	50,5	52,0	53,8	153,1	8888	19,5	13,6	15,5	55,1	53,8	56,1	56,5
24-okt-90	8888	8,7	10,2	6,4	46,5	47,4	48,6	51,5	147,5	8888	18,5	11,7	11,6	52,5	51,6	54,0	56,2
06-nov-90	7777	8,6	12,2	7,4	47,6	47,3	47,7	50,6	139,1	7777	19,0	13,4	14,9	54,6	53,0	54,6	54,9
20-nov-90	300,0	8,7	10,3	4,7	44,9	45,4	46,7	49,2	134,1	7777	17,4	11,4	11,8	49,5	49,8	51,7	53,7
04-dec-90	7777	9,0	11,7	7,6	46,1	46,2	46,7	48,7	133,8	7777	18,8	12,4	13,4	50,8	49,8	52,3	53,6
18-dec-90	9999	10,0	12,2	8,2	45,2	46,8	47,3	48,9	136,6	9999	18,2	15,0	9,5	52,4	51,5	52,9	54,6
11-jan-91	7777	7,0	5,5	3,1	40,6	42,1	42,5	44,4	119,2	7777	14,0	9,5	5,0	91,1	48,8	49,5	51,2
24-jan-91	7777	8,5	9,5	5,0	42,6	44,4	44,5	46,3	121,5	293,4	17,0	11,5	7,0	50,5	50,0	51,0	52,7
07-feb-91	7777	6,3	9,5	5,0	42,6	44,5	45,2	46,4	120,2	285,6	16,5	11,5	8,0	51,2	50,0	51,2	53,0
21-feb-91	7777	8,5	7,0	5,0	41,2	43,2	43,8	45,0	117,4	279,9	16,5	9,5	5,5	49,5	48,6	51,2	51,7
08-mrt-91	310,0	6,0	5,0	3,5	40,2	41,7	43,5	43,6	110,0	272,8	14,0	8,0	3,0	49,0	47,5	49,5	51,5
22-mrt-91	309,6	6,0	6,5	3,0	40,3	41,7	42,3	43,5	104,5	266,7	14,5	8,5	2,5	48,7	47,9	49,2	50,9
04-apr-91	301,8	7,0	5,5	4,0	41,6	42,8	43,3	44,3	107,3	265,9	16,0	9,5	4,0	49,2	48,3	49,7	51,7
19-apr-91	303,0	7,5	8,5	5,0	43,5	44,1	43,9	44,8	107,4	264,8	16,5	10,5	6,5	50,5	49,6	50,1	51,7
03-mei-91	324,8	7,5	7,5	4,5	43,0	44,1	44,1	44,5	107,8	226,3	16,5	10,0	6,5	49,9	49,5	50,0	51,8
17-mei-91	341,5	9,5	9,5	8,0	45,9	46,4	46,0	46,2	111,8	255,5	17,0	12,0	9,0	52,5	51,5	51,9	53,1
31-mei-91	354,4	14,0	13,5	12,5	49,4	49,6	49,0	48,8	115,8	273,5	22,0	15,0	13,5	56,1	54,6	54,5	55,3
14-jun-91	362,5	12,0	11,5	10,5	47,8	48,5	48,3	48,5	115,7	281,9	19,5	13,5	11,0	53,2	52,5	54,1	54,5
28-jun-91	7777	12,0	11,0	11,0	45,3	47,4	48,3	49,4	115,3	292,6	17,5	14,5	11,0	51,8	51,8	53,0	54,2
11-jul-91	380,0	10,0	8,5	8,5	45,2	47,0	46,8	47,5	116,0	304,8	18,5	11,5	10,0	52,2	51,2	52,0	53,7
31-jul-91	387,0	11,0	10,5	11,0	47,9	47,9	47,9	49,3	121,0	317,0	19,0	13,0	10,0	54,6	53,3	53,9	55,1
09-aug-91	396,6	9,0	8,0	7,5	45,6	47,0	47,6	48,5	121,4	320,7	18,0	10,0	7,5	52,0	51,9	52,3	54,1
23-aug-91	392,5	12,5	11,5	11,5	48,0	48,0	48,0	49,2	123,3	327,0	21,0	13,5	12,0	53,8	52,9	53,4	55,0
06-sep-91	405,2	16,0	15,5	15,0	51,1	51,2	51,0	51,0	128,5	333,5	23,5	17,0	16,0	57,4	56,4	56,0	57,4
20-sep-91	409,0	14,0	15,0	15,0	51,0	51,9	51,7	52,0	131,5	340,0	22,0	15,5	14,0	56,9	56,5	56,3	57,7
03-okt-91	404,4	10,5	10,5	8,5	48,3	48,7	49,9	50,4	132,0	337,5	20,5	12,0	10,5	53,2	52,7	53,9	55,5
17-okt-91	401,5	9,0	8,5	6,0	43,2	45,0	46,1	47,8	129,5	338,8	18,0	10,5	8,0	52,3	50,7	52,2	54,0
01-nov-91	392,0	7,5	6,5	3,5	41,2	43,2	44,4	46,1	129,3	339,0	16,0	8,5	5,0	49,2	48,8	50,6	52,4
15-nov-91	380,4	7,5	6,5	3,5	40,9	43,0	43,5	45,2	126,3	333,9	14,5	9,0	5,0	49,0	48,4	49,6	51,9
29-nov-91	363,4	8,0	7,0	4,5	41,2	43,0	43,2	44,3	124,5	324,9	15,5	9,5	5,0	49,3	48,8	49,6	51,7
13-dec-91	361,0	8,0	7,3	5,3	43,8	43,7	44,3	45,4	126,0	317,0	16,3	10,4	5,7	51,4	49,6	51,4	52,9
27-dec-91	353,0	6,8	6,3	3,5	41,0	43,2	43,1	43,9	122,5	303,5	13,2	8,8	4,6	49,4	48,7	49,4	51,5
13-jan-92	332,8	7,3	5,8	4,1	42,0	43,4	43,1	43,8	118,2	287,6	14,4	8,2	5,1	49,4	48,7	49,4	51,4
24-jan-92	326,1	6,2	5,4	4,4	43,0	43,6	44,0	43,3	118,9	282,1	13,9	8,5	4,4	50,2	29,2	50,2	51,4
20-feb-92	347,0	7,0	6,7	5,0	43,1	44,1	44,4	44,2	117,5	275,4	15,1	9,3	5,6	51,0	50,1	50,4	52,0
20-mrt-92	348,8	6,0	5,1	3,8	41,9	43,4	43,5	43,6	113,6	279,9	13,0	7,9	4,0	49,7	48,9	49,4	51,3

Monitoring data north-south transect Raheenmore Bog

NR DATE	333F	334 GWD	335 GWD	336 GWD	336A	336B	336C	336D	336E	337 GWD	338 GWD	339 GWD	340 GWD	340A	340B	340C	340D
27-okt-87	8888	7777	9,0	16,0	57,0	62,0	93,0	118,0	8888	17,0	16,0	24,0	15,0	54,0	85,0	85,0	111,0
25-nov-87	8888	7777	12,0	17,0	51,0	60,0	94,0	118,0	8888	17,0	17,0	16,0	14,0	53,0	64,0	85,0	109,0
31-dec-87	8888	7777	7777	12,0	56,0	60,0	94,0	115,0	8888	12,0	7777	7777	7777	50,0	62,0	82,0	103,0
28-jan-88	8888	7777	7777	14,0	55,0	56,0	90,0	114,0	8888	16,0	12,0	18,0	10,0	42,0	58,0	78,0	104,0
23-feb-88	8888	7777	12,0	17,0	57,0	58,0	94,0	118,0	8888	18,0	13,0	25,0	11,0	44,0	54,0	81,0	110,0
21-mrt-88	8888	7777	7777	14,0	56,0	59,0	91,0	112,0	8888	15,0	12,0	12,0	6,0	40,0	52,0	78,0	103,0
26-apr-88	8888	12,0	14,0	18,0	59,0	60,0	94,0	116,0	8888	18,0	17,0	30,0	12,0	46,0	56,0	81,0	107,0
23-mei-88	8888	10,0	15,0	22,0	65,0	64,0	95,0	118,0	8888	18,0	28,0	43,0	12,0	50,0	60,0	82,0	105,0
28-jun-88	8888	14,0	20,0	30,0	68,0	66,0	96,0	120,0	8888	28,0	31,0	9999	22,0	55,0	63,0	84,0	111,0
27-jul-88	8888	12,0	16,0	20,0	63,0	63,0	97,0	118,0	8888	20,0	20,0	42,0	17,0	52,0	65,0	84,0	111,0
30-aug-88	8888	10,0	12,0	15,0	58,0	62,0	97,0	108,0	8888	16,0	17,0	26,0	8,0	46,0	65,0	84,0	109,0
28-sep-88	8888	8,0	11,0	14,0	58,0	62,0	97,0	118,0	8888	14,0	14,0	15,0	6,0	42,0	63,0	84,0	108,0
26-okt-88	8888	7777	8,0	14,0	55,0	60,0	93,0	116,0	8888	14,0	9,0	10,0	5,0	40,0	62,0	82,0	108,0
23-nov-88	8888	9,0	13,0	17,0	59,0	60,0	96,0	117,0	8888	16,0	15,0	28,0	10,0	44,0	63,0	87,0	113,0
31-dec-88	8888	10,0	13,0	18,0	58,0	60,0	96,0	115,0	8888	16,0	15,0	25,0	10,0	43,0	63,0	82,0	113,0
26-jan-89	8888	8,0	12,0	15,0	57,0	59,0	94,0	114,0	8888	15,0	14,0	22,0	9,0	41,0	60,0	83,0	107,0
28-feb-89	8888	7777	10,0	14,0	56,0	59,0	91,0	112,0	8888	14,0	11,0	16,0	8,0	41,0	59,0	77,0	101,0
31-mrt-89	8888	8,0	11,0	12,0	56,0	59,0	91,0	122,0	8888	14,0	12,0	18,0	8,0	41,0	58,0	82,0	108,0
26-okt-89	8888	11,0	14,0	16,0	57,0	64,0	98,0	128,0	131,0	18,0	12,0	25,0	11,0	41,0	74,0	98,0	131,0
13-nov-89	8888	10,0	12,0	14,0	59,0	62,0	101,0	128,0	124,0	18,0	12,0	22,0	9,0	44,0	71,0	100,0	132,0
27-nov-89	8888	11,0	14,0	18,0	61,0	63,0	100,0	130,0	125,0	21,0	16,0	32,0	14,0	48,0	73,0	98,0	130,0
11-dec-89	8888	12,0	16,0	21,0	63,0	64,0	100,0	131,0	129,0	23,0	20,0	38,0	19,0	51,0	73,0	98,0	125,0
04-jan-90	8888	9,0	11,0	13,0	57,0	61,0	99,0	127,0	128,0	16,0	11,0	16,0	8,0	41,0	67,0	97,0	115,0
21-jan-90	8888	9,0	11,0	14,0	49,0	54,0	102,0	129,0	132,0	16,0	12,0	21,0	9,0	43,0	69,0	98,0	124,0
03-feb-90	8888	8,0	10,0	12,0	57,0	59,0	95,0	121,0	126,0	16,0	10,0	14,0	8,0	40,0	63,0	90,0	116,0
15-feb-90	8888	7,0	9,0	13,0	56,0	58,0	95,0	121,0	121,0	13,0	9,0	12,0	7,0	40,0	60,0	79,0	115,0
01-mrt-90	8888	5,0	8,0	11,0	55,0	58,0	94,0	122,0	116,0	13,0	8,0	11,0	6,0	39,0	49,0	88,0	115,0
16-mrt-90	8888	10,0	12,0	16,0	59,0	61,0	97,0	126,0	120,0	21,0	18,0	33,0	14,0	48,0	61,0	90,0	117,0
12-apr-90	8888	13,0	16,0	21,0	62,0	63,0	96,0	125,0	121,0	24,0	23,0	38,0	20,0	50,0	66,0	88,0	114,0
26-apr-90	8888	12,0	16,0	18,0	63,0	69,0	96,0	125,0	121,0	22,0	24,0	40,0	16,0	51,0	66,0	88,0	115,0
10-mei-90	8888	16,0	19,0	26,0	67,0	66,0	96,0	126,0	123,0	27,0	29,0	9999	24,0	56,0	67,0	88,0	104,0
24-mei-90	8888	21,0	24,0	9999	73,0	72,0	99,0	128,0	135,0	36,0	37,0	9999	34,0	63,0	71,0	91,0	120,0
07-jun-90	8888	13,0	16,0	24,0	66,0	69,0	97,0	125,0	122,0	25,0	21,0	42,0	22,0	54,0	73,0	89,0	115,0
20-jun-90	8888	16,0	19,0	27,0	69,0	71,0	98,0	127,0	140,0	29,0	26,0	9999	26,0	59,0	109,0	9999	116,0
05-jul-90	8888	8,0	11,0	14,0	57,0	67,0	95,0	125,0	125,0	18,0	10,0	17,0	8,0	42,0	78,0	87,0	116,0
20-jul-90	8888	17,0	21,0	9999	73,0	67,0	100,0	130,0	134,0	40,0	40,0	9999	32,0	62,0	74,0	93,0	124,0
01-aug-90	8888	17,0	22,0	9999	72,0	74,0	100,0	130,0	133,0	34,0	30,0	9999	30,0	59,0	74,0	94,0	125,0
15-aug-90	8888	19,0	22,0	9999	77,0	79,0	102,0	131,0	134,0	34,0	42,0	9999	31,0	67,0	78,0	94,0	121,0
29-aug-90	8888	9,6	12,2	14,1	58,5	69,1	100,5	129,2	130,8	17,3	10,3	26,5	8,7	44,4	78,4	93,4	121,1
12-sep-90	8888	14,7	17,6	28,6	68,8	68,3	101,4	133,0	134,3	32,2	31,3	46,7	24,4	56,5	76,4	95,8	128,1
26-sep-90	8888	14,5	18,5	28,7	70,6	71,2	101,1	131,8	133,5	30,8	27,1	9999	27,5	59,6	76,2	9999	28,0
09-okt-90	8888	10,8	12,9	15,8	59,5	67,6	99,1	131,0	129,9	19,4	14,2	27,3	11,1	45,3	73,6	9999	126,5
24-okt-90	8888	8,0	11,2	12,2	56,8	62,2	98,8	127,7	126,8	14,7	8,6	17,0	6,7	42,1	71,7	9999	120,3
06-nov-90	7777	9,9	13,2	85,7	59,1	62,6	98,8	128,7	126,9	21,3	14,0	28,6	10,5	44,7	59,4	9999	117,1
20-nov-90	7777	7,1	11,0	11,9	56,1	60,4	98,1	123,8	122,3	14,3	8,3	14,6	6,4	40,2	58,2	9999	106,1
04-dec-90	7777	9,5	12,4	14,8	58,0	62,1	98,6	128,4	126,4	18,1	15,5	28,5	10,9	44,4	56,0	8888	113,4
18-dec-90	295,1	8,6	12,0	16,4	58,7	61,8	97,7	126,6	127,6	17,8	15,3	30,4	11,0	44,6	56,6	8888	109,5
11-jan-91	250,4	5,3	9,0	10,5	55,0	57,6	92,7	117,6	113,5	12,1	8,0	12,0	5,0	38,7	53,0	8888	99,9
24-jan-91	253,7	7,0	11,0	13,0	56,0	60,0	97,0	123,9	120,7	16,0	11,0	19,0	7,5	41,0	51,2	8888	101,3
07-feb-91	245,8	5,5	10,5	13,5	57,0	59,7	97,0	122,5	119,5	16,0	11,5	23,5	8,0	42,0	51,4	8888	202,5
21-feb-91	253,7	5,0	10,0	11,5	55,4	57,6	93,7	119,0	113,7	15,0	9,5	15,0	5,5	38,9	49,6	8888	94,2
08-mrt-91	243,0	4,0	8,4	9,0	53,5	56,8	92,3	116,2	113,2	12,0	7,0	10,0	3,5	37,2	47,2	8888	90,5
22-mrt-91	236,2	4,5	9,0	10,5	54,3	56,7	92,3	116,0	105,2	14,0	9,0	16,0	5,5	38,2	44,9	8888	69,5
04-apr-91	203,9	5,0	9,0	11,0	54,4	58,0	92,7	114,7	111,5	13,0	7,5	14,5	4,0	39,0	45,6	67,0	85,9
19-apr-91	207,0	6,0	11,0	15,0	77,5	58,8	94,7	120,8	110,9	18,5	17,0	31,5	11,0	44,0	44,4	69,5	97,2
03-mei-91	253,8	5,0	10,5	13,5	57,1	59,0	93,5	119,8	111,9	15,5	14,0	27,5	8,5	42,2	43,9	69,9	97,8
17-mei-91	266,6	9,0	13,0	22,5	63,2	62,2	95,3	121,5	115,9	26,5	27,5	44,0	20,5	51,8	47,6	70,3	98,1
31-mei-91	227,0	14,5	16,5	9999	74,1	68,9	96,5	122,6	119,1	38,5	39,5	9999	32,5	63,6	53,6	72,3	99,0
14-jun-91	286,1	10,5	13,5	20,0	62,5	68,1	94,3	118,7	117,0	24,5	21,0	38,5	16,5	49,8	55,3	71,2	96,8
28-jun-91	299,8	9,5	15,5	17,0	58,3	63,9	93,8	120,1	114,7	17,5	14,5	21,0	11,5	42,3	52,5	72,7	100,8
11-jul-91	300,0	7,5	12,0	18,0	60,2	62,4	94,9	120,0	114,9	22,0	19,0	35,5	15,0	46,4	51,7	72,0	99,0
31-jul-91	312,0	11,5	13,5	26,0	71,1	69,6	101,4	127,8	122,3	29,5	28,5	43,0	22,0	54,5	52,6	73,6	101,8
09-aug-91	321,0	6,0	10,5	14,0	59,4	62,8	95,4	124,8	116,7	18,0	13,5	31,5	9,0	44,0	51,6	74,5	104,6
23-aug-91	318,0	12,0	14,0	26,0	66,5	63,9	96,4	123,4	118,5	29,0	27,0	45,0	23,5	54,0	52,6	73,8	101,0
06-sep-91	333,3	18,0	21,0	9999	78,3	72,4	100,7	130,3	123,6	42,0	41,5	9999	38,0	68,3	57,0	78,3	111,1
20-sep-91	334,0	15,0	17,5	9999	74,5	76,5	100,0	129,6	125,0	33,0	31,5	9999	30,0	62,6	60,9	80,3	108,8
03-okt-91	334,7	8,5	11,5	15,5	59,6	68,6	97,9	132,5	126,1	19,0	11,5	32,0	11,5	46,2	59,2	79,7	110,4
17-okt-91	333,0	6,5	11,5	15,0	58,0	62,9	97,4	124,7	123,4	19,0	13,0	24,0	9,5	43,2	56,3	78,9	107,0
01-nov-91	326,0	5,0	10,0	11,5	55,5	60,4	95,4	119,6	121,1	15,0	9,5	15,0	6,5	39,7	53,4	75,9	103,8
15-nov-91	314,0	5,0	9,0	11,5	56,3	59,5	95,2	121,3	118,0	15,0	9,5	18,0	7,5	40,4	50,5	78,1	106,8
29-nov-91	298,2	4,5	9,5	12,0	56,2	59,6	96,2	123,1	118,0	15,5	10,0	17,5	8,0	40,1	50,6	79,7	107,3
13-dec-91	279,5	5,2	10,3	16,0	59,9	66,6	99,9	126,3	124,0	20,0	16,4	33,5	12,2	46,5	53,5	8888	111,7
27-dec-91	280,4	4,1	9,4	13,8	56,7	59,9	97,1	124,9	188,8	15,4	11,1	22,2	8,4	41,3	48,6	80,9	109,2
13-jan-92	258,7	3,9	8,7	13,0	57,1	59,8	96,6	124,1	116,8	15,4	11,8	24,5	8,4	41,6	46,4	79,2	108,2
24-jan-92	251,0	3,8	7,8	10,8	58,3	60,4	97,7	122,5	119,9	14,9	15,5	33,0	8,3	44,7	48,5	77,4	103,9
20-feb-92	259,0	4,2	9,1	13,6	57,7	60,2	96,5	122,8	119,0	16,3	12,5	22,8	7,8	41,1	48,5	76,1	104,4
20-mrt-92	259,5	3,4	7,7	11,0	56,2	58,6	94,6	119,7	115,2	13,6	8,3	17,9	5,2	39,1	43,7	71,3	98,0

Monitoring data north-south transect Raheenmore Bog

NR DATE	341 GWD	342 GWD	342A	342B	342C	342 GWW	343 GWD	344A	344B	344C	344 GWW	345 GWW	346A	346B	346 GWW	348 GWD
27-Oct-87	21,0	22,0	59,0	71,0	85,0	35,0	22,0	106,0	106,0	120,0	86,0	82,0	94,0	122,0	67,0	98,0
25-Nov-87	20,0	21,0	58,0	69,0	178,0	30,0	22,0	108,0	104,0	104,0	87,0	89,0	95,0	128,0	77,0	101,0
31-Dec-87	13,0	7777	56,0	69,0	98,0	20,0	12,0	96,0	109,0	108,0	66,0	66,0	99,0	107,0	52,0	94,0
28-Jan-88	20,0	18,0	57,0	65,0	66,0	26,0	19,0	102,0	96,0	106,0	84,0	72,0	81,0	116,0	59,0	96,0
23-Feb-88	20,0	23,0	60,0	67,0	71,0	33,0	23,0	108,0	107,0	105,0	90,0	90,0	85,0	113,0	76,0	98,0
21-Mar-88	16,0	15,0	55,0	65,0	67,0	22,0	16,0	98,0	99,0	109,0	77,0	66,0	90,0	112,0	53,0	92,0
26-Apr-88	21,0	26,0	63,0	70,0	74,0	37,0	25,0	110,0	108,0	115,0	89,0	95,0	102,0	140,0	81,0	100,0
23-May-88	24,0	36,0	70,0	78,0	80,0	33,0	36,0	120,0	118,0	126,0	9999	9999	9999	155,0	9999	102,0
28-Jun-88	37,0	41,0	79,0	81,0	83,0	51,0	9999	119,0	118,0	127,0	9999	111,0	113,0	157,0	145,0	102,0
27-Jul-88	32,0	38,0	77,0	76,0	82,0	48,0	9999	113,0	122,0	136,0	96,0	106,0	109,0	150,0	91,0	102,0
30-Aug-88	18,0	24,0	62,0	74,0	77,0	24,0	25,0	111,0	115,0	124,0	9999	96,0	104,0	134,0	84,0	103,0
28-Sep-88	16,0	12,0	56,0	75,0	79,0	15,0	16,0	112,0	115,0	126,0	62,0	89,0	109,0	131,0	74,0	96,0
26-Oct-88	16,0	13,0	54,0	70,0	74,0	22,0	15,0	88,0	106,0	120,0	64,0	58,0	93,0	104,0	43,0	88,0
23-Nov-88	18,0	24,0	61,0	70,0	78,0	28,0	26,0	110,0	118,0	116,0	89,0	93,0	96,0	138,0	82,0	105,0
31-Dec-88	20,0	22,0	60,0	69,0	75,0	29,0	18,0	108,0	105,0	117,0	85,0	89,0	93,0	135,0	75,0	101,0
26-Jan-89	16,0	16,0	58,0	67,0	70,0	24,0	16,0	110,0	115,0	113,0	89,0	91,0	93,0	140,0	76,0	100,0
28-Feb-89	16,0	16,0	56,0	66,0	66,0	24,0	12,0	101,0	105,0	112,0	82,0	71,0	89,0	112,0	58,0	96,0
31-Mar-89	17,0	17,0	57,0	65,0	71,0	22,0	13,0	105,0	101,0	111,0	83,0	78,0	86,0	120,0	65,0	97,0
26-Oct-89	20,0	23,0	57,0	84,0	112,0	29,0	21,0	9999	142,0	152,0	9999	103,0	124,0	151,0	88,0	102,0
13-Nov-89	20,0	21,0	58,0	80,0	104,0	29,0	20,0	112,0	117,0	138,0	9999	92,0	103,0	135,0	82,0	94,0
27-Nov-89	24,0	29,0	66,0	79,0	100,0	40,0	30,0	119,0	123,0	136,0	9999	104,0	112,0	148,0	87,0	101,0
11-Dec-89	29,0	38,0	74,0	84,0	99,0	49,0	38,0	119,0	127,0	136,0	9999	9999	117,0	163,0	91,0	101,0
04-Jan-90	16,0	19,0	55,0	73,0	93,0	27,0	14,0	106,0	113,0	128,0	88,0	92,0	104,0	133,0	82,0	98,0
21-Jan-90	19,0	21,0	57,0	73,0	91,0	33,0	18,0	109,0	114,0	125,0	9999	9999	104,0	134,0	92,0	92,0
03-Feb-90	18,0	18,0	53,0	65,0	82,0	26,0	14,0	99,0	103,0	116,0	81,0	84,0	93,0	120,0	71,0	94,0
15-Feb-90	18,0	19,0	53,0	64,0	92,0	25,0	13,0	100,0	98,0	113,0	81,0	84,0	195,0	130,0	73,0	93,0
01-Mar-90	16,0	16,0	51,0	62,0	69,0	22,0	11,0	95,0	99,0	111,0	66,0	74,0	93,0	123,0	62,0	90,0
16-Mar-90	26,0	32,0	68,0	69,0	82,0	43,0	32,0	120,0	110,0	118,0	9999	104,0	106,0	151,0	90,0	103,0
12-Apr-90	29,0	36,0	72,0	76,0	88,0	49,0	36,0	120,0	123,0	129,0	9999	9999	119,0	154,0	94,0	109,0
26-Apr-90	26,0	37,0	78,0	79,0	91,0	51,0	38,0	120,0	126,0	132,0	9999	9999	119,0	156,0	95,0	108,0
10-May-90	36,0	9999	83,0	86,0	97,0	57,0	9999	9999	132,0	138,0	9999	111,0	125,0	158,0	101,0	8888
24-May-90	9999	9999	91,0	91,0	104,0	65,0	9999	122,0	138,0	144,0	98,0	122,0	141,0	164,0	111,0	101,0
07-Jun-90	32,0	42,0	79,0	90,0	102,0	54,0	9999	9999	140,0	145,0	9999	9999	136,0	161,0	110,0	101,0
20-Jun-90	9999	9999	87,0	93,0	104,0	164,0	9999	9999	143,0	149,0	9999	9999	138,0	163,0	8888	111,0
05-Jul-90	19,0	7,0	54,0	78,0	104,0	24,0	14,0	98,0	137,0	149,0	78,0	77,0	132,0	146,0	67,0	96,0
20-Jul-90	9999	9999	87,0	84,0	103,0	59,0	9999	121,0	131,0	146,0	9999	109,0	122,0	156,0	98,0	109,0
01-Aug-90	9999	9999	84,0	92,0	107,0	59,0	9999	9999	137,0	148,0	9999	118,0	128,0	159,0	110,0	108,0
15-Aug-90	9999	9999	95,0	98,0	110,0	66,0	9999	9999	144,0	153,0	9999	106,0	137,0	163,0	116,0	111,0
29-Aug-90	18,4	18,2	57,4	90,3	109,8	26,9	16,8	119,9	144,3	156,1	9999	110,0	139,8	157,3	114,6	94,7
12-Sep-90	37,4	43,8	80,3	86,7	109,0	55,2	9999	120,4	132,6	153,5	9999	100,0	131,6	160,2	103,3	104,3
26-Sep-90	38,8	9999	83,2	90,8	111,4	57,3	9999	120,4	138,3	153,8	9999	116,6	134,4	162,4	109,8	100,0
09-Oct-90	21,4	22,2	59,9	84,1	109,1	32,0	18,2	109,7	124,7	151,8	89,6	95,3	128,1	146,2	82,1	96,9
24-Oct-90	17,5	14,3	53,7	77,6	96,7	22,0	15,4	108,7	113,9	136,7	88,6	96,6	107,8	135,7	82,9	93,9
06-Nov-90	21,2	59,8	73,0	97,4	32,5	23,3	21,7	116,7	115,2	131,1	95,4	105,0	111,4	145,5	86,6	96,2
20-Nov-90	16,5	16,1	53,0	71,0	87,6	23,5	11,3	103,4	112,8	130,1	83,1	89,8	110,5	126,6	79,8	91,4
04-Dec-90	21,4	23,3	60,4	70,5	90,6	32,6	23,3	117,6	114,1	127,1	96,5	105,5	110,2	145,2	98,0	96,1
18-Dec-90	19,2	23,5	61,2	70,4	87,5	33,6	25,7	120,4	119,0	129,5	97,9	106,2	115,8	147,5	91,4	8888
11-Jan-91	13,5	13,2	49,7	61,9	80,0	20,8	9,5	95,2	102,4	115,8	75,4	9999	94,9	123,2	63,0	8888
24-Jan-91	18,0	18,0	55,0	65,1	82,5	27,2	14,0	107,6	107,5	118,0	87,8	95,6	101,6	134,0	83,2	8888
07-Feb-91	20,0	21,0	57,4	65,0	79,0	30,0	16,0	109,5	109,0	120,0	9999	91,0	103,0	147,2	82,3	27,0
21-Feb-91	15,5	16,5	52,6	61,6	75,2	23,2	10,0	98,0	106,7	119,7	628,7	8888	105,8	128,5	72,0	25,0
08-Mar-91	13,0	8,0	49,7	66,2	71,3	19,7	8,0	86,4	105,6	115,0	45,4	80,5	99,0	118,7	65,5	19,0
22-Mar-91	15,0	16,0	52,5	59,0	75,2	24,5	11,5	102,0	101,2	111,5	82,0	86,5	93,2	112,7	74,4	26,0
04-Apr-91	14,0	12,0	51,1	64,8	70,7	20,5	10,3	109,6	112,1	117,0	92,9	102,5	104,6	134,5	85,1	28,7
19-Apr-91	23,0	26,5	62,6	63,8	77,6	36,9	24,0	119,1	108,2	117,2	94,1	106,5	102,0	136,6	88,0	33,0
03-May-91	19,0	23,0	58,8	65,3	80,7	32,9	18,5	111,5	111,0	120,4	88,3	97,6	104,1	133,7	83,3	30,7
17-May-91	33,5	40,0	76,3	71,8	84,5	51,3	38,5	120,2	121,0	127,8	9999	9999	112,6	149,5	95,3	36,8
31-May-91	9999	9999	89,3	103,1	93,8	62,9	9999	120,3	129,2	136,3	9999	122,0	120,4	154,0	102,0	8888
14-Jun-91	29,5	34,5	70,7	82,3	98,1	45,0	33,0	120,2	130,5	137,9	9999	9999	126,4	153,5	103,2	8888
28-Jun-91	19,0	18,0	55,4	71,2	97,0	25,5	17,0	106,4	126,9	139,5	85,3	102,3	121,8	142,5	90,5	8888
11-Jul-91	25,0	29,5	65,0	73,8	89,5	38,7	28,0	120,0	121,9	135,5	98,3	8888	117,2	146,4	93,0	36,0
31-Jul-91	36,5	43,5	80,0	79,0	94,4	54,3	8888	8888	135,5	145,0	8888	8888	128,9	158,3	109,0	34,6
09-Aug-91	20,5	22,0	60,6	76,7	97,2	31,9	19,0	118,2	128,8	140,3	94,1	9999	109,4	149,4	97,0	32,5
23-Aug-91	36,0	43,0	79,1	78,9	94,0	53,2	9999	120,5	130,4	140,5	9999	8888	116,5	152,4	102,5	40,0
06-Sep-91	9999	9999	93,8	89,8	106,6	67,5	9999	120,5	139,7	148,1	9999	9999	126,5	161,3	112,3	41,0
20-Sep-91	9999	9999	89,2	95,3	111,1	63,0	9999	120,5	144,4	153,0	9999	9999	134,6	167,2	9999	40,0
03-Oct-91	21,5	26,5	63,3	84,4	112,0	34,9	28,5	120,5	144,1	154,6	9999	9999	140,0	169,3	123,2	35,5
17-Oct-91	20,5	21,0	58,4	76,9	102,8	30,4	17,0	115,7	125,0	146,8	94,8	93,5	122,6	143,5	80,8	32,0
01-Nov-91	16,0	15,0	51,8	70,0	95,9	23,0	12,0	101,6	120,3	137,6	79,5	83,0	112,5	127,7	73,5	23,7
15-Nov-91	16,5	18,5	54,5	70,8	93,3	25,7	12,5	104,4	109,5	128,6	83,0	87,5	101,5	123,8	78,8	8888
29-Nov-91	17,0	17,5	53,9	69,3	89,4	25,3	13,0	109,0	110,0	125,0	88,8	93,2	101,6	133,1	80,8	8888
13-Dec-91	24,4	28,5	65,4	73,0	91,3	38,8	26,3	121,2	120,2	129,6	9999	107,7	109,4	148,5	89,4	21,8
27-Dec-91	17,9	20,0	56,0	68,4	87,8	28,1	14,8	110,0	110,2	124,7	90,6	94,0	100,6	133,5	82,5	8888
13-Jan-92	18,3	20,6	56,8	66,2	85,5	29,5	16,1	114,7	108,4	120,3	94,1	95,8	137,4	99,6	83,5	28,4
24-Jan-92	19,3	24,4	64,3	69,2	83,7	33,0	23,6	9999	116,3	124,0	9999	107,2	105,9	145,4	88,9	33,5
20-Feb-92	16,6	19,5	56,8	67,4	85,0	28,8	14,5	113,8	119,0	127,6	92,8	97,2	110,5	143,4	83,0	33,0
20-Mar-92	14,1	15,6	53,3	64,2	78,3	22,4	12,1	116,2	120,8	111,9	9999	97,5	105,0	136,3	84,1	31,6

APPENDIX 20a

Differences in piezometric heads

dH tubes east-west transect Raheenmore Bog

NR / DATE	201 A-D	B-C	C-D	202 A-D	B-C	C-D	204 A-E	B-C	C-D	D-E	206 A-G	B-C	C-D	D-E	E-G	209 A-F
16-Nov-89	9999	49.0	9999	59.0	22.0	29.0	8888	9.0	1.0	8888	25.0	10.0	-4.0	8888	8888	8888
27-Nov-89	9999	71.0	9999	51.0	19.0	26.0	8888	6.0	1.0	8888	26.0	8.0	6.0	8888	8888	8888
11-Dec-89	82.0	71.0	2.0	46.0	24.0	19.0	8888	5.0	1.0	8888	20.0	8.0	7.0	8888	8888	8888
19-Dec-89	79.0	64.0	4.0	51.0	21.0	19.0	8888	8.0	1.0	8888	25.0	9.0	6.0	8888	8888	8888
04-Jan-90	86.0	60.0	4.0	48.0	9.0	29.0	8888	7.0	0.0	8888	25.0	8.0	6.0	8888	8888	8888
21-Jan-90	86.0	69.0	6.0	45.0	3.0	34.0	8888	6.0	0.0	8888	24.0	9.0	5.0	8888	8888	8888
31-Jan-90	80.0	63.0	7.0	39.0	0.0	32.0	8888	4.0	-1.0	8888	19.0	7.0	3.0	8888	8888	8888
15-Feb-90	79.0	62.0	7.0	29.0	-3.0	23.0	8888	14.0	-13.0	8888	21.0	8.0	3.0	8888	8888	8888
01-Mar-90	78.0	64.0	5.0	26.0	-8.0	26.0	8888	4.0	-3.0	8888	20.0	8.0	4.0	8888	8888	8888
16-Mar-90	87.0	71.0	7.0	21.0	10.0	7.0	8888	1.0	-2.0	8888	16.0	7.0	5.0	8888	8888	8888
29-Mar-90	85.0	59.0	4.0	24.0	11.0	10.0	8888	1.0	0.0	8888	15.0	5.0	7.0	8888	8888	8888
12-Apr-90	83.0	72.0	3.0	28.0	11.0	15.0	8888	2.0	0.0	8888	17.0	6.0	7.0	8888	8888	8888
26-Apr-90	85.0	73.0	4.0	31.0	11.0	17.0	8888	2.0	1.0	8888	17.0	5.0	8.0	8888	8888	8888
10-May-90	82.0	69.0	4.0	31.0	32.0	-2.0	8888	1.0	2.0	8888	14.0	4.0	8.0	8888	8888	8888
24-May-90	83.0	68.0	6.0	31.0	14.0	17.0	8888	-1.0	3.0	8888	10.0	3.0	9.0	8888	8888	8888
07-Jun-90	86.0	70.0	5.0	37.0	14.0	21.0	8888	4.0	3.0	8888	20.0	5.0	8.0	8888	8888	8888
21-Jun-90	85.0	68.0	7.0	45.0	14.0	26.0	8888	3.0	4.0	8888	22.0	4.0	10.0	8888	8888	8888
05-Jul-90	88.0	72.0	6.0	52.0	8888	29.0	8888	8888	6.0	8888	30.0	8888	7.0	8888	8888	8888
19-Jul-90	83.0	70.0	5.0	44.0	8888	28.0	2.0	8888	2.0	-2.0	12.0	8888	7.0	0.0	2.0	8888
01-Aug-90	80.0	67.0	6.0	43.0	8888	29.0	7.0	8888	2.0	-1.0	16.0	8888	8.0	1.0	2.0	8888
15-Aug-90	79.0	64.0	5.0	48.0	8888	27.0	9.0	8888	2.0	1.0	15.0	8888	9.0	2.0	1.0	8888
29-Aug-90	94.0	71.2	6.8	58.9	8888	34.5	17.9	8888	6.8	-2.0	33.3	8888	7.7	0.5	6.3	8888
12-Sep-90	85.7	68.9	5.5	51.0	8888	33.7	6.8	8888	6.5	-2.5	19.0	8888	6.9	1.4	4.9	8888
26-Sep-90	81.6	63.7	5.8	46.3	8888	31.2	7.6	8888	6.0	-2.4	18.1	8888	7.1	2.1	3.8	8888
09-Oct-90	89.8	72.3	5.0	60.8	8888	35.2	13.7	8888	6.1	-2.6	29.2	8888	7.1	-2.0	7.2	8888
24-Oct-90	82.2	65.1	5.0	54.9	8888	30.3	7.1	8888	2.9	-5.3	28.1	8888	5.1	-0.9	6.1	8888
06-Nov-90	80.1	61.1	6.1	49.7	8888	23.4	4.4	8888	2.7	-4.6	27.3	8888	4.3	-1.3	6.0	8888
20-Nov-90	79.8	63.6	3.9	45.1	8888	19.9	6.7	8888	3.4	-4.7	26.5	8888	5.4	-1.4	5.8	23.5
04-Dec-90	80.5	59.6	4.9	41.6	8888	17.1	2.4	8888	2.5	-4.2	25.1	8888	4.3	-1.5	6.1	20.9
18-Dec-90	81.7	61.7	5.1	38.5	8888	15.8	3.7	8888	-3.3	0.8	23.3	8888	6.0	0.7	3.4	21.8
11-Jan-91	84.9	56.8	4.4	30.6	8888	13.7	-0.8	8888	0.4	-4.4	21.1	8888	3.9	-1.5	4.8	22.1
24-Jan-91	88.4	63.0	5.0	29.5	8888	10.3	-2.2	8888	0.5	-4.8	22.3	8888	4.0	-0.2	4.0	20.5
07-Feb-91	94.7	62.1	6.0	27.5	8888	11.2	-2.6	8888	1.3	-5.3	20.5	8888	5.2	0.8	2.2	23.0
21-Feb-91	97.6	65.0	6.0	28.7	8888	13.1	-1.6	8888	1.9	-5.5	19.9	8888	6.5	1.1	0.9	22.5
08-Mar-91	95.2	63.4	5.7	28.5	8888	13.5	-3.3	8888	0.5	-6.0	20.5	8888	5.4	0.5	2.0	21.2
22-Mar-91	94.1	58.4	5.8	25.1	8888	14.7	-5.0	8888	1.2	-6.5	19.2	8888	5.3	-0.5	2.4	21.6
04-Apr-91	96.7	63.9	4.8	25.6	8888	9.2	0.1	8888	1.1	-1.9	17.7	8888	6.5	2.2	-0.2	20.9
19-Apr-91	98.6	64.6	1.9	26.6	8888	13.3	-4.6	8888	0.1	-4.2	15.9	8888	5.9	0.0	2.1	17.7
03-May-91	104.9	65.4	4.8	29.6	8888	17.5	-2.2	8888	2.1	-4.5	17.5	8888	5.4	0.0	2.5	17.9
17-May-91	94.9	66.5	3.9	28.7	8888	17.5	-4.9	8888	3.4	-3.7	10.8	8888	6.6	1.1	1.2	14.0
31-May-91	85.9	66.0	2.8	23.1	8888	19.6	-10.0	8888	3.6	-2.4	2.9	8888	7.3	3.3	0.1	0.0
14-Jun-91	89.7	70.0	3.2	36.0	8888	24.3	2.0	8888	3.8	-2.0	15.7	8888	6.4	2.1	1.8	14.5
28-Jun-91	93.5	71.5	4.4	42.8	8888	28.1	7.3	8888	4.4	-2.1	22.5	8888	6.5	0.1	3.8	16.4
11-Jul-91	91.3	70.9	4.1	42.8	8888	27.5	5.1	8888	4.8	-2.4	19.3	8888	6.2	2.0	3.0	15.3
31-Jul-91	88.3	70.2	3.2	42.0	8888	29.0	1.3	8888	5.7	-2.2	13.7	8888	8.2	3.2	1.1	14.1
09-Aug-91	89.5	70.9	3.8	48.6	8888	30.7	10.0	8888	6.5	-2.6	23.9	8888	7.0	1.9	3.0	17.0
23-Aug-91	86.8	68.9	3.7	43.0	8888	29.1	4.6	8888	-3.8	6.3	13.9	8888	8.3	3.9	0.9	13.7
06-Sep-91	77.8	65.2	3.0	35.4	8888	30.4	-5.0	8888	6.1	-2.3	5.4	8888	8.5	4.4	1.1	8.4
20-Sep-91	85.2	67.9	2.7	39.0	8888	29.4	2.9	8888	5.9	-1.1	12.0	8888	9.1	4.7	1.2	11.9
03-Oct-91	89.0	66.0	5.7	55.9	8888	31.5	14.1	8888	6.5	-2.0	29.2	8888	7.6	1.6	4.2	18.0
17-Oct-91	87.0	67.6	6.5	54.2	8888	31.1	12.2	8888	6.8	-3.0	26.6	8888	5.6	0.0	6.4	18.6
01-Nov-91	86.7	67.0	5.9	54.5	8888	30.4	12.7	8888	6.2	-3.4	28.2	8888	6.2	-1.7	8.0	22.5
15-Nov-91	78.8	60.0	6.0	51.6	8888	30.5	4.2	8888	2.9	-6.6	25.6	8888	3.5	-1.1	8.1	21.4
29-Nov-91	82.3	63.5	5.9	50.2	8888	27.2	2.6	8888	1.8	-5.4	25.3	8888	4.1	-1.0	7.1	20.7
13-Dec-91	86.9	66.4	6.1	44.4	8888	21.8	1.9	8888	3.6	-3.9	23.3	8888	5.0	0.9	5.3	17.4
27-Dec-91	87.7	65.7	5.7	45.3	8888	25.0	2.0	8888	2.7	-5.6	24.8	8888	3.5	-1.0	7.6	20.6
77-Jan-92	87.8	63.0	5.5	38.8	8888	21.9	-0.2	8888	1.7	-6.0	22.8	8888	3.2	-0.9	6.5	21.5
24-Jan-92	94.0	69.0	6.5	36.8	8888	16.5	0.6	8888	2.8	-4.3	20.6	8888	4.9	1.2	3.7	20.5
21-Feb-92	103.3	73.1	7.0	38.1	8888	19.6	3.7	8888	4.3	-3.6	21.5	8888	5.3	1.4	3.3	17.0
20-Mar-92	107.0	75.8	8.0	39.1	8888	22.5	5.2	8888	4.5	-3.8	21.9	8888	5.6	1.3	3.0	19.1

NR / AVG	201 A-D	B-C	C-D	202 A-D	B-C	C-D	204 A-E	B-C	C-D	D-E	206 A-G	B-C	C-D	D-E	E-G	209 A-F
dH (cm)	87.2	66.2	5.1	40.3	12.0	22.7	3.3	4.5	2.3	-3.2	20.4	6.7	6.1	0.7	3.7	18.1
dz (cm)	367	150	60	457	150	150	607	150	150	150	672	150	147	153	65	1378
dH/dz	0.24	0.44	0.08	0.09	0.08	0.15	0.01	0.03	0.02	-0.02	0.03	0.04	0.04	0.00	0.06	0.01

dH tubes east-west transect Raheenmore Bog

	NR 209				210				211					212			
DATE	B-C	C-D	D-E	E-F	A-E	B-C	C-D	D-E	A-F	B-C	C-D	D-E	E-F	A-E	B-C	C-D	D-E
16-Nov-89	3.0	1.0	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888
27-Nov-89	3.0	3.0	8888	8888	8888	1.0	-4.0	8888	8888	6.0	2.0	8888	8888	8888	2.0	0.0	8888
11-Dec-89	1.0	4.0	8888	8888	8888	1.0	-2.0	8888	8888	5.0	1.0	8888	8888	8888	2.0	0.0	8888
19-Dec-89	2.0	3.0	8888	8888	8888	2.0	-3.0	8888	8888	6.0	0.0	8888	8888	8888	3.0	0.0	8888
04-Jan-90	3.0	1.0	8888	8888	8888	2.0	-3.0	8888	8888	7.0	0.0	8888	8888	8888	3.0	0.0	8888
21-Jan-90	3.0	1.0	8888	8888	8888	3.0	-3.0	8888	8888	5.0	2.0	8888	8888	8888	2.0	2.0	8888
31-Jan-90	1.0	3.0	8888	8888	8888	0.0	-2.0	8888	8888	5.0	2.0	8888	8888	8888	4.0	1.0	8888
15-Feb-90	2.0	4.0	8888	8888	8888	3.0	-4.0	8888	8888	16.0	2.0	8888	8888	8888	3.0	2.0	8888
01-Mar-90	2.0	4.0	8888	8888	8888	12.0	-13.0	8888	8888	6.0	2.0	8888	8888	8888	3.0	2.0	8888
16-Mar-90	2.0	3.0	8888	8888	8888	0.0	-2.0	8888	8888	5.0	2.0	8888	8888	8888	2.0	1.0	8888
29-Mar-90	2.0	3.0	8888	8888	8888	1.0	-3.0	8888	8888	5.0	3.0	8888	8888	8888	2.0	1.0	8888
12-Apr-90	2.0	3.0	8888	8888	8888	2.0	-3.0	8888	8888	5.0	2.0	8888	8888	8888	1.0	1.0	8888
26-Apr-90	2.0	2.0	8888	8888	8888	1.0	-3.0	8888	8888	5.0	1.0	8888	8888	8888	1.0	1.0	8888
10-May-90	0.0	3.0	8888	8888	8888	-2.0	-4.0	8888	8888	5.0	1.0	8888	8888	8888	1.0	0.0	8888
24-May-90	0.0	2.0	8888	8888	8888	2.0	-4.0	8888	8888	4.0	1.0	8888	8888	8888	1.0	0.0	8888
07-Jun-90	1.0	2.0	8888	8888	8888	1.0	-3.0	8888	8888	3.0	0.0	8888	8888	8888	1.0	1.0	8888
21-Jun-90	1.0	2.0	8888	8888	8888	1.0	-3.0	8888	8888	3.0	1.0	8888	8888	8888	1.0	1.0	8888
05-Jul-90	8888	2.0	1.0	8888	7.0	8888	-2.0	5.0	8888	8888	0.0	1.0	8888	10.0	8888	1.0	4.0
19-Jul-90	8888	4.0	0.0	8888	-2.0	8888	-3.0	1.0	8888	8888	1.0	0.0	8888	5.0	8888	1.0	2.0
01-Aug-90	8888	3.0	1.0	8888	-4.0	8888	-4.0	1.0	8888	8888	1.0	1.0	8888	6.0	8888	0.0	2.0
15-Aug-90	8888	3.0	1.0	8888	0.0	8888	-4.0	3.0	8888	8888	1.0	1.0	8888	5.0	8888	0.0	2.0
29-Aug-90	8888	3.2	-0.1	8888	2.6	8888	-1.2	0.5	8888	8888	4.0	3.4	8888	8.6	8888	1.8	1.5
12-Sep-90	8888	3.5	-0.5	8888	-1.3	8888	-1.3	0.4	8888	8888	4.6	2.9	8888	6.5	8888	2.0	1.4
26-Sep-90	8888	3.5	-0.2	8888	-2.4	8888	-1.2	0.6	8888	8888	4.3	3.1	8888	8.3	8888	1.6	1.8
09-Oct-90	8888	3.6	-0.6	8888	2.7	8888	-1.4	0.2	8888	8888	3.8	3.2	8888	8.0	8888	2.2	1.5
24-Oct-90	8888	5.0	0.1	8888	1.8	8888	-1.4	0.5	8888	8888	5.3	3.3	8888	8.0	8888	3.0	1.6
06-Nov-90	8888	5.3	-2.0	8888	-1.5	8888	-2.1	0.0	8888	8888	4.8	3.1	8888	8.3	8888	2.3	1.6
20-Nov-90	8888	5.0	-0.2	12.5	2.2	8888	-0.9	0.5	8888	8888	5.6	3.7	101.9	8.1	8888	3.2	1.6
04-Dec-90	8888	4.5	-0.7	11.8	-1.0	8888	-2.0	0.9	98.0	8888	5.0	3.4	85.8	8.4	8888	2.2	2.2
18-Dec-90	8888	4.8	-0.2	11.7	-1.9	8888	-0.9	0.4	94.8	8888	5.0	4.2	84.4	6.2	8888	2.4	1.9
11-Jan-91	8888	5.4	-1.5	11.6	1.4	8888	-2.0	0.3	91.2	8888	-4.1	4.7	76.0	6.9	8888	2.2	2.3
24-Jan-91	8888	4.5	-0.4	11.4	0.0	8888	-1.1	0.4	87.0	8888	6.0	3.5	74.5	8.0	8888	-3.7	1.8
07-Feb-91	8888	5.0	-0.8	13.0	-0.7	8888	-1.0	0.3	89.8	8888	6.0	3.3	76.5	7.0	8888	2.8	1.8
21-Feb-91	8888	-5.1	-0.2	22.5	0.7	8888	-0.5	0.2	88.1	8888	5.8	5.3	74.3	6.6	8888	2.8	2.1
08-Mar-91	8888	5.8	-0.3	10.5	2.0	8888	-0.4	0.0	18.3	8888	6.6	4.4	73.8	7.9	8888	3.1	2.0
22-Mar-91	8888	4.9	-0.6	11.2	0.5	8888	-1.5	0.0	85.6	8888	5.4	4.4	71.0	7.8	8888	2.5	2.1
04-Apr-91	8888	5.6	-0.1	12.1	0.0	8888	0.0	0.6	85.1	8888	7.3	4.7	70.6	7.0	8888	3.6	1.6
19-Apr-91	8888	4.7	-0.7	10.6	-1.5	8888	-1.0	0.1	83.7	8888	6.0	4.0	70.5	7.0	8888	3.1	1.5
03-May-91	8888	4.0	-0.8	10.8	-1.5	8888	-1.1	-0.4	87.0	8888	6.0	3.8	73.7	7.6	8888	2.4	2.1
17-May-91	8888	3.9	-0.9	10.5	-4.4	8888	-1.1	-0.1	86.2	8888	6.4	4.1	75.7	6.9	8888	2.0	1.9
31-May-91	8888	3.2	-0.6	0.7	-6.7	8888	-1.0	-0.1	84.9	8888	6.1	4.2	78.8	2.5	8888	1.4	2.2
14-Jun-91	8888	2.5	-0.5	10.3	-3.3	8888	-1.2	0.0	91.2	8888	5.5	4.8	79.9	6.0	8888	0.7	2.0
28-Jun-91	8888	3.1	-1.3	9.9	1.4	8888	-2.0	0.6	96.8	8888	4.4	4.7	83.6	6.8	8888	1.6	1.3
11-Jul-91	8888	3.8	-0.3	9.9	1.0	8888	0.0	0.5	96.5	8888	5.7	4.4	85.9	6.5	8888	2.1	1.8
31-Jul-91	8888	3.6	-0.4	10.8	0.1	8888	-0.2	1.1	98.1	8888	5.7	4.5	88.7	4.5	8888	2.2	1.8
09-Aug-91	8888	3.4	-1.0	10.3	3.0	8888	0.0	-0.1	101.4	8888	4.8	4.4	89.5	7.6	8888	2.0	1.5
23-Aug-91	8888	3.9	0.3	10.5	0.5	8888	0.5	0.6	99.6	8888	6.6	4.2	91.4	3.1	8888	1.7	2.3
06-Sep-91	8888	3.2	-0.8	10.4	-2.6	8888	-0.3	0.7	97.8	8888	5.1	3.9	92.7	2.7	8888	0.9	1.6
20-Sep-91	8888	1.8	0.2	10.8	-0.5	8888	-0.5	0.7	100.4	8888	4.3	4.7	93.3	3.8	8888	0.1	1.8
03-Oct-91	8888	2.4	-0.1	10.2	2.6	8888	-1.0	0.6	106.1	8888	4.0	4.4	93.9	5.7	8888	0.9	1.3
17-Oct-91	8888	3.7	-0.5	11.3	3.5	8888	0.1	0.3	107.7	8888	4.9	4.5	94.9	6.3	8888	2.2	1.0
01-Nov-91	8888	4.4	-0.5	12.0	5.0	8888	0.3	1.1	110.8	8888	5.6	4.7	95.4	7.6	8888	2.2	1.7
15-Nov-91	8888	4.4	-1.0	11.8	1.2	8888	-0.2	-2.3	107.3	8888	5.0	4.7	92.8	7.6	8888	2.5	1.4
29-Nov-91	8888	5.0	-0.9	12.1	3.1	8888	-0.1	0.4	102.6	8888	5.7	4.6	87.9	6.8	8888	2.5	1.6
13-Dec-91	8888	4.7	-1.1	11.3	2.4	8888	0.3	0.3	99.1	8888	5.8	4.2	85.4	5.3	8888	2.7	1.1
27-Dec-91	8888	-4.6	3.6	11.6	3.1	8888	-0.4	0.1	97.7	8888	5.0	4.3	83.6	8.3	8888	1.9	1.7
10-Jan-92	8888	12.4	-1.1	11.8	3.0	8888	-0.7	0.7	94.1	8888	5.2	4.6	80.0	7.8	8888	2.3	1.4
24-Jan-92	8888	5.0	-0.7	11.6	3.1	8888	0.2	0.6	90.5	8888	6.2	4.6	77.3	7.1	8888	2.5	1.7
21-Feb-92	8888	4.0	-0.7	10.9	2.3	8888	0.0	0.0	93.7	8888	5.6	4.6	80.1	5.5	8888	1.7	1.6
20-Mar-92	8888	4.4	-0.6	11.2	3.5	8888	0.5	0.3	94.4	8888	6.1	5.0	81.0	7.0	8888	2.2	1.8

	NR 209				210				211					212			
AVG	B-C	C-D	D-E	E-F	A-E	B-C	C-D	D-E	A-F	B-C	C-D	D-E	E-F	A-E	B-C	C-D	D-E
dH (cm)	1.8	3.5	-0.4	11.2	0.6	1.9	-1.7	0.5	92.7	5.7	3.8	3.8	81.1	6.7	2.0	1.6	1.8
ds (cm)	150	150	150	771	607	150	150	150	1446	150	150	150	839	607	150	150	150
dH/ds	0.01	0.02	-0.00	0.01	0.00	0.01	-0.01	0.00	0.06	0.04	0.03	0.03	0.10	0.01	0.01	0.01	0.01

APPENDIX 20b

Differences in piezometric heads

dH tubes north-south transect Raheenmore Bog

NR	305		307		310		313			315			317		
DATE	A-C	B-C	A-C	B-C	A-C	B-C	A-D	B-C	C-D	A-D	B-C	C-D	A-D	B-C	C-D
27-Oct-87	-1.0	-2.0	5.0	3.0	8888	-3.0	10.0	10.0	-14.0	56.0	13.0	36.0	35.0	23.0	8.0
25-Nov-87	-3.0	-1.0	6.0	3.0	8888	-3.0	10.0	4.0	-9.0	52.0	10.0	35.0	30.0	18.0	8.0
31-Dec-87	8.0	-1.0	3.0	1.0	8888	-4.0	20.0	5.0	-7.0	61.0	13.0	40.0	34.0	22.0	8.0
28-Jan-88	0.0	0.0	4.0	3.0	8888	-4.0	4.0	4.0	-9.0	33.0	8.0	19.0	25.0	15.0	7.0
23-Feb-88	-5.0	0.0	6.0	2.0	8888	-1.0	4.0	0.0	0.0	44.0	7.0	29.0	27.0	14.0	9.0
21-Mar-88	6.0	0.0	8.0	3.0	8888	-4.0	21.0	0.0	0.0	51.0	20.0	33.0	18.0	16.0	7.0
26-Apr-88	-1.0	-1.0	5.0	0.0	8888	-3.0	9.0	-4.0	3.0	57.0	9.0	45.0	31.0	18.0	9.0
23-May-88	-6.0	-2.0	3.0	0.0	8888	0.0	7.0	3.0	5.0	56.0	3.0	51.0	26.0	13.0	12.0
28-Jun-88	-1.0	-3.0	4.0	0.0	8888	0.0	6.0	8888	7.0	51.0	2.0	49.0	15.0	10.0	4.0
27-Jul-88	-9.0	-3.0	5.0	2.0	8888	-2.0	10.0	8888	0.0	54.0	6.0	49.0	33.0	20.0	12.0
30-Aug-88	-5.0	-3.0	6.0	4.0	8888	-2.0	10.0	6.0	-8.0	59.0	12.0	46.0	34.0	24.0	8.0
28-Sep-88	3.0	-2.0	5.0	3.0	8888	-2.0	21.0	8888	1.0	69.0	12.0	49.0	39.0	21.0	12.0
26-Oct-88	12.0	0.0	6.0	4.0	8888	-2.0	21.0	8888	-6.0	61.0	8.0	46.0	35.0	21.0	8.0
23-Nov-88	-6.0	0.0	5.0	1.0	8888	-2.0	1.0	8888	0.0	52.0	7.0	44.0	30.0	16.0	10.0
31-Dec-88	-3.0	0.0	7.0	4.0	8888	-2.0	8888	5.0	8888	57.0	9.0	45.0	29.0	16.0	10.0
26-Jan-89	-7.0	-2.0	6.0	2.0	8888	-3.0	11.0	0.0	0.0	51.0	8.0	40.0	26.0	14.0	10.0
28-Feb-89	1.0	0.0	4.0	2.0	8888	-2.0	15.0	8888	-3.0	49.0	7.0	39.0	27.0	14.0	8.0
31-Mar-89	-1.0	0.0	7.0	3.0	8888	-3.0	12.0	8888	-2.0	49.0	11.0	35.0	26.0	12.0	9.0
26-Oct-89	8888	-7.0	16.0	8.0	-4.0	-5.0	27.0	20.0	-9.0	83.0	8888	8888	74.0	35.0	28.0
13-Nov-89	2.0	-2.0	14.0	8.0	-8.0	-2.0	9.0	13.0	-18.0	56.0	11.0	39.0	50.0	30.0	12.0
27-Nov-89	-4.0	-4.0	2.0	-1.0	-11.0	-6.0	14.0	8.0	-1.0	57.0	8.0	48.0	43.0	27.0	11.0
11-Dec-89	-2.0	-3.0	1.0	-1.0	-6.0	-1.0	13.0	2.0	2.0	63.0	6.0	57.0	37.0	21.0	14.0
04-Jan-90	0.0	-3.0	9.0	2.0	-8.0	-4.0	15.0	11.0	-12.0	58.0	12.0	36.0	40.0	26.0	7.0
21-Jan-90	1.0	-1.0	9.0	2.0	-8.0	-5.0	14.0	11.0	-11.0	52.0	11.0	35.0	36.0	23.0	8.0
03-Feb-90	0.0	-2.0	7.0	3.0	-9.0	-3.0	33.0	19.0	-3.0	49.0	9.0	27.0	30.0	21.0	3.0
15-Feb-90	-3.0	-2.0	4.0	1.0	-8.0	-3.0	19.0	8.0	-12.0	47.0	8.0	26.0	26.0	17.0	9.0
01-Mar-90	3.0	-1.0	7.0	1.0	-7.0	-1.0	13.0	5.0	-13.0	49.0	9.0	27.0	26.0	22.0	-3.0
16-Mar-90	-7.0	-4.0	-3.0	-4.0	-7.0	-2.0	14.0	-2.0	1.0	55.0	5.0	49.0	21.0	18.0	1.0
12-Apr-90	-5.0	-5.0	0.0	0.0	-5.0	-1.0	18.0	-3.0	5.0	72.0	11.0	61.0	32.0	21.0	9.0
26-Apr-90	-4.0	-3.0	0.0	-2.0	-3.0	0.0	19.0	-4.0	9.0	68.0	7.0	61.0	29.0	12.0	11.0
10-May-90	-5.0	-4.0	0.0	-2.0	-2.0	1.0	22.0	-6.0	12.0	66.0	4.0	62.0	27.0	12.0	14.0
24-May-90	0.0	-4.0	-3.0	-3.0	-4.0	1.0	17.0	-17.0	13.0	62.0	5.0	55.0	30.0	11.0	16.0
07-Jun-90	8888	-3.0	4.0	4.0	1.0	-1.0	27.0	-4.0	8.0	67.0	7.0	60.0	38.0	17.0	17.0
20-Jun-90	8888	-3.0	68.0	61.0	1.0	0.0	8888	-5.0	9.0	66.0	5.0	61.0	34.0	0.0	20.0
05-Jul-90	8888	-5.0	42.0	29.0	9.0	-4.0	34.0	-1.0	-1.0	109.0	18.0	61.0	72.0	36.0	16.0
20-Jul-90	8888	-3.0	5.0	7.0	-8.0	-1.0	11.0	10.0	-10.0	67.0	9.0	59.0	42.0	26.0	16.0
01-Aug-90	8888	-4.0	0.0	0.0	-2.0	-1.0	8888	3.0	63.0	67.0	6.0	61.0	40.0	21.0	17.0
15-Aug-90	8888	-4.0	4.0	0.0	2.0	0.0	29.0	-2.0	6.0	66.0	2.0	63.0	35.0	14.0	17.0
29-Aug-90	8888	-5.8	12.6	3.7	4.8	-2.4	29.9	1.9	3.6	28.5	12.4	63.0	65.2	30.0	19.8
12-Sep-90	8888	-4.6	6.6	5.9	-5.2	-0.7	18.5	10.6	-6.3	76.3	13.1	63.0	50.2	30.6	18.0
26-Sep-90	8888	-4.3	3.2	0.9	-1.8	0.2	8888	7.3	1.3	71.7	5.2	64.9	44.6	21.7	20.1
09-Oct-90	16.7	-2.7	26.8	15.1	-3.1	-5.0	12.8	12.4	-17.3	86.4	23.7	56.2	66.3	39.9	16.3
24-Oct-90	1.3	-2.1	9.8	8.9	-6.4	-3.4	2.0	16.1	-22.2	64.7	14.1	40.2	51.5	34.3	10.3
06-Nov-90	-7.3	-4.6	-0.2	1.8	-4.1	-1.0	4.7	9.3	-12.2	56.0	9.8	45.3	42.3	30.7	5.7
20-Nov-90	0.8	-4.0	5.8	-1.2	-4.9	-6.8	14.6	6.8	-11.7	73.6	15.2	50.3	44.5	32.5	5.2
04-Dec-90	-7.7	-4.7	3.3	5.2	-4.6	-2.1	9.6	5.8	-6.4	52.4	0.4	52.0	35.4	26.3	4.0
18-Dec-90	-7.1	-4.6	2.5	3.3	-4.2	-3.0	11.1	2.2	-1.7	59.7	8.4	50.7	35.2	25.0	6.0
11-Jan-91	-0.1	-3.0	3.6	0.4	-6.2	-5.0	11.0	9.4	-12.2	50.2	8.2	30.8	32.2	21.9	0.1
24-Jan-91	-7.3	-3.8	4.7	2.5	-5.9	-4.4	8.0	5.3	-9.0	45.1	9.0	31.0	29.8	26.0	-1.7
07-Feb-91	-4.2	-2.7	34.5	-0.2	8888	8888	8888	8888	8888	8888	8888	8888	91.0	8888	-1.7
21-Feb-91	0.5	-2.9	4.1	-0.9	8888	8888	8888	8888	8888	8888	8888	8888	89.5	8888	-1.5
08-Mar-91	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	84.0	8888	-4.2
22-Mar-91	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	80.1	8888	-6.5
04-Apr-91	-4.3	-4.9	1.3	-2.3	-4.2	-4.8	19.0	-2.3	9.1	59.5	8.2	45.0	25.2	20.8	-1.6
19-Apr-91	-11.9	-4.0	6.3	7.9	-4.9	-1.8	12.0	-2.1	11.5	40.2	7.9	35.0	18.7	20.1	-4.3
03-May-91	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888
17-May-91	-12.8	-8.0	5.1	4.6	-3.3	0.0	13.4	-12.7	20.0	52.6	5.9	48.9	20.3	16.1	3.4
31-May-91	8888	-8.5	5.8	5.2	-3.7	0.4	16.3	-16.4	20.9	53.3	2.4	51.8	18.8	8.3	10.5
14-Jun-91	8888	-8.2	2.5	-1.1	-2.6	-1.0	19.0	-17.4	20.0	58.5	4.1	52.9	32.3	13.6	14.5
28-Jun-91	-0.8	-5.7	2.0	-4.8	1.5	-1.9	17.3	-16.1	16.3	81.0	3.6	63.7	52.5	27.7	12.6
11-Jul-91	-5.7	-3.0	5.5	5.5	-2.5	-0.5	12.2	-7.1	8.0	64.9	12.0	52.5	42.2	27.5	10.5
31-Jul-91	8888	-6.9	7.6	6.4	-4.0	0.1	16.9	-10.4	12.9	63.0	8.4	55.1	34.9	21.5	12.7
09-Aug-91	0.8	-5.0	2.5	-2.3	-0.5	-2.2	21.5	-9.3	9.1	38.0	15.6	16.2	49.4	30.8	10.7
23-Aug-91	8888	-4.2	7.7	7.3	-2.4	-0.2	15.6	-6.3	9.9	61.5	6.7	55.5	34.1	22.7	10.4
06-Sep-91	8888	-9.3	7.8	7.6	-3.3	1.1	24.0	-11.2	15.0	59.5	3.7	55.8	28.7	12.8	14.7
20-Sep-91	8888	-10.9	8.0	4.1	-0.7	-1.3	28.2	-12.9	16.0	63.1	6.2	56.2	36.1	14.8	18.0
03-Oct-91	8888	-10.0	2.8	0.0	0.8	-0.8	28.5	-8.3	14.3	74.5	11.5	56.0	58.3	28.7	18.5
17-Oct-91	9.3	3.2	7.6	4.2	-4.2	-2.9	3.8	7.2	-12.7	65.1	17.6	42.1	57.6	36.2	14.1
01-Nov-91	11.2	2.2	6.4	2.9	-2.7	-5.8	22.6	4.7	-3.0	81.4	13.3	52.4	57.7	32.1	15.3
15-Nov-91	-1.3	-1.6	5.9	2.8	-5.6	-5.2	11.3	6.3	-7.3	51.0	10.6	31.4	45.7	30.7	9.0
29-Nov-91	-4.1	-3.1	5.4	2.5	-5.6	-5.0	15.1	0.7	-1.2	50.9	11.1	32.6	41.3	29.9	5.6
13-Dec-91	-8.5	-6.0	5.7	0.6	-4.2	-3.3	16.0	8888	8888	53.5	8.5	46.0	35.5	24.6	7.2
27-Dec-91	-5.4	-2.0	7.6	2.7	-5.8	-4.1	14.6	-0.9	1.7	52.8	13.4	34.6	37.2	28.1	5.3
13-Jan-92	-7.9	-3.5	7.9	2.1	-6.1	-4.7	14.4	-4.1	5.5	47.5	9.5	33.4	34.1	25.6	3.0
24-Jan-92	-8.7	-5.2	5.7	1.0	-4.6	-3.3	15.7	-9.4	12.7	50.0	5.6	45.4	33.7	23.1	5.5
20-Feb-92	-1.1	-2.9	4.5	0.3	-4.0	-3.8	23.6	-7.7	9.1	68.5	14.2	50.9	41.7	28.0	7.4
20-Mar-92	-2.9	-2.2	-6.1	-5.3	-5.0	-3.9	19.0	-4.3	5.9	54.2	9.5	41.1	37.6	24.9	5.4

NR	305		307		310		313			315			317		
AVG	A-C	B-C	A-C	B-C	A-C	B-C	A-D	B-C	C-D	A-D	B-C	C-D	A-D	B-C	C-D
dH (cm)	-2.6	-3.3	6.9	3.4	-3.8	-2.3	14.6	0.7	1.4	59.0	9.1	45.4	39.4	22.0	9.2
ds (cm)	227	75	227	75	262	85	377	75	100	417	100	115	477	140	135
dH/ds	-0.01	-0.04	0.03	0.05	-0.01	-0.03	0.04	0.01	0.01	0.14	0.09	0.39	0.08	0.16	0.07

dH tubes north-south transect Raheenmore Bog

NR DATE	321 A-E	B-C	C-D	D-E	324 A-F	B-C	C-D	D-F	327 A-F	B-C	C-D	D-F	330 A-F	B-C	C-D	D-E
27-Oct-87	8888	4.0	31.0	8888	8888	8888	8888	8888	8888	1.0	1.0	8888	8888	1.0	9.0	8888
25-Nov-87	8888	3.0	32.0	8888	8888	8888	8888	8888	8888	1.0	1.0	8888	8888	0.0	1.0	8888
31-Dec-87	8888	3.0	32.0	8888	8888	10.0	4.0	8888	8888	0.0	2.0	8888	8888	-1.0	0.0	8888
28-Jan-88	8888	3.0	43.0	8888	8888	2.0	14.0	8888	8888	1.0	0.0	8888	8888	1.0	2.0	8888
23-Feb-88	8888	3.0	34.0	8888	8888	1.0	14.0	8888	8888	0.0	1.0	8888	8888	0.0	1.0	8888
21-Mar-88	8888	4.0	32.0	8888	8888	1.0	15.0	8888	8888	0.0	1.0	8888	8888	2.0	0.0	8888
26-Apr-88	8888	2.0	31.0	8888	8888	0.0	14.0	8888	8888	0.0	1.0	8888	8888	-1.0	1.0	8888
23-May-88	8888	1.0	33.0	8888	8888	2.0	11.0	8888	8888	0.0	-1.0	8888	8888	2.0	-3.0	8888
28-Jun-88	8888	3.0	29.0	8888	8888	2.0	11.0	8888	8888	0.0	0.0	8888	8888	0.0	0.0	8888
27-Jul-88	8888	3.0	31.0	8888	8888	0.0	13.0	8888	8888	0.0	1.0	8888	8888	0.0	1.0	8888
30-Aug-88	8888	2.0	32.0	8888	8888	2.0	12.0	8888	8888	0.0	0.0	8888	8888	3.0	0.0	8888
28-Sep-88	8888	3.0	31.0	8888	8888	1.0	14.0	8888	8888	1.0	0.0	8888	8888	1.0	0.0	8888
26-Oct-88	8888	3.0	31.0	8888	8888	0.0	14.0	8888	8888	1.0	0.0	8888	8888	1.0	1.0	8888
23-Nov-88	8888	3.0	32.0	8888	8888	0.0	14.0	8888	8888	1.0	0.0	8888	8888	1.0	0.0	8888
31-Dec-88	8888	4.0	31.0	8888	8888	1.0	14.0	8888	8888	1.0	0.0	8888	8888	2.0	0.0	8888
26-Jan-89	8888	1.0	32.0	8888	8888	0.0	15.0	8888	8888	0.0	1.0	8888	8888	0.0	1.0	8888
28-Feb-89	8888	3.0	33.0	8888	8888	0.0	15.0	8888	8888	0.0	2.0	8888	8888	0.0	1.0	8888
31-Mar-89	8888	4.0	33.0	8888	8888	2.0	14.0	8888	8888	1.0	0.0	8888	8888	1.0	0.0	8888
26-Oct-89	101.0	5.0	32.0	62.0	8888	2.0	13.0	8888	8888	1.0	0.0	8888	8888	1.0	1.0	8888
13-Nov-89	85.0	5.0	33.0	44.0	8888	2.0	13.0	8888	8888	0.0	1.0	8888	8888	0.0	2.0	90.0
27-Nov-89	91.0	5.0	34.0	50.0	8888	2.0	14.0	8888	8888	1.0	0.0	8888	8888	-1.0	1.0	95.0
11-Dec-89	94.0	4.0	34.0	56.0	8888	0.0	13.0	8888	8888	0.0	1.0	8888	8888	0.0	2.0	99.0
04-Jan-90	87.0	6.0	34.0	45.0	8888	2.0	13.0	8888	8888	1.0	0.0	8888	8888	1.0	1.0	90.0
21-Jan-90	84.0	5.0	35.0	43.0	8888	2.0	13.0	8888	8888	0.0	0.0	8888	8888	1.0	1.0	87.0
03-Feb-90	76.0	5.0	34.0	35.0	8888	3.0	13.0	8888	8888	1.0	0.0	8888	8888	2.0	2.0	77.0
15-Feb-90	61.0	10.0	28.0	20.0	8888	-8.0	13.0	8888	8888	1.0	1.0	8888	8888	0.0	2.0	65.0
01-Mar-90	55.0	4.0	35.0	14.0	8888	2.0	14.0	8888	8888	1.0	1.0	8888	8888	0.0	2.0	65.0
16-Mar-90	59.0	-7.0	46.0	18.0	8888	1.0	14.0	8888	8888	0.0	1.0	8888	8888	-1.0	2.0	68.0
12-Apr-90	66.0	3.0	33.0	29.0	8888	1.0	13.0	8888	8888	0.0	1.0	8888	8888	-1.0	1.0	73.0
26-Apr-90	71.0	1.0	37.0	33.0	8888	1.0	13.0	8888	8888	0.0	0.0	8888	8888	0.0	0.0	75.0
10-May-90	72.0	13.0	21.0	37.0	8888	0.0	13.0	8888	8888	0.0	0.0	8888	8888	0.0	-1.0	77.0
24-May-90	74.0	3.0	30.0	41.0	8888	1.0	14.0	8888	8888	0.0	0.0	8888	8888	0.0	0.0	80.0
07-Jun-90	78.0	3.0	29.0	45.0	8888	0.0	12.0	8888	8888	0.0	1.0	8888	8888	0.0	1.0	81.0
20-Jun-90	168.0	-9.0	30.0	136.0	8888	0.0	3.0	8888	8888	0.0	0.0	8888	8888	0.0	1.0	137.0
05-Jul-90	159.0	6.0	29.0	121.0	8888	1.0	15.0	8888	8888	1.0	0.0	8888	8888	1.0	0.0	118.0
20-Jul-90	148.0	3.0	32.0	113.0	8888	1.0	14.0	8888	8888	0.0	1.0	8888	8888	1.0	1.0	112.0
01-Aug-90	142.0	3.0	30.0	108.0	8888	1.0	13.0	8888	8888	0.0	0.0	8888	8888	1.0	1.0	108.0
15-Aug-90	135.0	0.0	29.0	106.0	8888	0.0	14.0	8888	8888	0.0	0.0	8888	8888	0.0	1.0	106.0
29-Aug-90	137.3	5.3	29.8	99.1	8888	1.3	13.2	8888	8888	0.9	0.3	8888	8888	1.0	0.1	103.8
12-Sep-90	130.2	4.2	32.0	93.3	8888	1.4	13.6	8888	8888	0.8	0.4	8888	8888	0.2	1.6	106.0
26-Sep-90	128.0	4.6	31.0	91.8	8888	1.9	13.5	8888	8888	0.4	0.3	8888	8888	0.5	1.4	106.8
09-Oct-90	120.4	5.3	31.4	82.0	8888	1.6	13.7	8888	8888	1.0	0.4	8888	8888	1.5	1.8	99.3
24-Oct-90	111.6	5.1	32.1	73.3	8888	1.3	8888	8888	8888	1.3	0.5	8888	8888	1.2	2.9	96.0
06-Nov-90	103.0	5.0	33.3	64.5	153.2	2.2	14.2	136.1	8888	0.9	0.6	8888	8888	0.4	2.9	88.5
20-Nov-90	101.3	4.2	32.6	64.2	146.8	1.2	14.5	130.1	8888	1.6	0.6	244.7	8888	1.3	2.5	84.9
04-Dec-90	98.6	4.7	34.2	59.8	145.1	2.1	14.2	128.6	8888	1.6	0.9	8888	8888	0.5	2.0	85.1
18-Dec-90	102.6	3.5	34.0	65.3	142.6	1.8	14.1	127.4	8888	1.5	0.8	8888	8888	0.5	1.6	87.7
11-Jan-91	90.6	3.5	33.5	52.3	136.7	2.0	17.0	117.7	8888	1.9	-0.4	8888	8888	0.4	1.9	74.8
24-Jan-91	91.1	3.4	35.3	51.3	137.0	2.0	14.6	119.6	8888	0.8	0.0	8888	8888	0.1	1.8	8888
07-Feb-91	92.6	4.4	34.6	53.4	135.0	0.6	15.2	117.9	8888	1.2	1.0	8888	243.0	0.7	1.2	73.8
21-Feb-91	91.9	4.4	33.4	54.4	135.0	1.2	14.4	119.0	8888	1.8	0.2	8888	238.7	0.6	1.2	72.4
08-Mar-91	87.2	4.6	32.7	49.4	134.0	1.2	14.2	117.0	259.5	1.1	0.0	259.5	232.6	1.8	0.1	66.4
22-Mar-91	80.1	4.3	34.0	41.2	134.5	2.4	15.6	116.4	258.9	1.7	0.0	258.9	226.4	0.6	1.2	61.0
04-Apr-91	81.6	3.1	33.1	46.1	129.3	1.1	15.0	113.4	250.3	0.9	0.6	250.3	224.3	0.5	1.0	63.0
19-Apr-91	79.6	3.5	35.1	41.3	133.6	1.9	15.4	116.2	250.8	1.3	0.2	250.8	221.3	-0.2	0.9	62.6
03-May-91	8888	8888	8888	8888	8888	8888	8888	8888	272.8	0.9	0.2	272.8	183.3	0.0	0.4	63.3
17-May-91	82.0	2.7	34.1	46.1	138.2	1.2	14.9	122.5	287.3	0.7	0.1	287.3	209.6	-0.4	0.2	65.6
31-May-91	81.1	1.2	32.3	49.5	141.0	0.6	14.4	126.5	297.4	0.2	0.2	297.4	224.1	-0.6	-0.2	67.0
14-Jun-91	85.0	3.0	29.6	53.1	145.2	1.1	13.6	131.2	306.2	0.5	-0.2	306.2	234.1	-0.2	0.2	67.2
28-Jun-91	87.9	3.6	30.5	53.1	149.1	1.7	13.6	133.8	8888	1.0	1.1	8888	247.3	0.9	1.1	65.9
11-Jul-91	88.0	3.5	30.6	54.4	148.5	0.7	13.8	134.0	324.5	0.8	0.3	324.5	259.6	-0.2	0.7	68.5
31-Jul-91	90.1	3.2	31.0	57.1	151.6	0.6	13.9	137.4	330.0	1.1	0.3	330.0	269.1	0.0	1.4	71.7
09-Aug-91	91.4	3.9	31.9	55.6	153.9	1.5	13.8	138.3	340.4	1.3	0.2	340.4	275.1	0.6	0.9	72.9
23-Aug-91	92.0	2.4	31.0	59.4	153.0	0.5	14.3	138.7	334.9	0.5	0.6	334.9	279.0	0.0	1.2	74.1
06-Sep-91	89.3	1.2	31.3	59.0	8888	4.8	10.3	337.6	345.7	0.1	0.3	345.7	282.4	-0.2	0.0	77.5
20-Sep-91	92.0	1.5	29.0	62.5	156.0	0.0	13.5	142.5	349.0	0.0	0.0	349.0	289.0	-0.2	0.3	79.5
03-Oct-91	97.0	3.8	8888	8888	159.6	1.6	13.0	145.0	346.0	1.2	-0.1	346.0	289.2	1.2	0.5	81.6
17-Oct-91	98.8	4.6	29.8	64.4	156.8	1.4	13.7	141.7	345.2	1.4	0.5	345.2	295.6	1.1	1.7	81.7
01-Nov-91	105.8	4.7	30.8	69.4	154.0	1.0	14.0	138.0	337.8	1.4	0.4	337.8	297.8	1.2	1.7	83.2
15-Nov-91	105.0	5.1	31.2	68.6	150.7	1.9	14.5	133.8	327.3	1.2	0.3	327.3	293.0	0.5	1.7	81.1
29-Nov-91	105.5	4.3	33.1	68.0	144.9	1.0	15.3	127.9	310.7	1.3	0.1	310.7	283.7	0.2	1.1	80.2
13-Dec-91	106.5	4.1	32.7	70.0	143.6	1.0	14.8	127.9	306.6	1.2	0.4	306.6	273.2	0.6	1.1	80.6
27-Dec-91	105.7	4.6	32.5	68.0	136.6	1.5	14.9	124.4	300.4	1.2	-0.1	300.4	262.5	-0.1	0.8	78.6
13-Jan-92	103.4	4.8	32.7	65.6	138.9	2.5	16.5	119.7	280.6	0.8	0.1	280.6	245.6	-0.3	0.7	74.4
24-Jan-92	105.2	3.9	32.3	69.1	137.0	1.1	15.3	120.6	272.4	0.6	1.3	272.4	239.1	0.4	-0.7	75.6
20-Feb-92	106.1	4.5	32.2	69.9	142.1	1.4	14.7	125.8	294.0	0.9	0.2	294.0	232.3	0.3	-0.2	73.3
20-Mar-92	105.6	3.0	8888	8888	139.9	1.0	15.3	123.9	297.1	0.9	0.1	297.1	238.0	0.1	0.1	70.0

NR DATE	321 A-E	B-C	C-D	D-E	324 A-F	B-C	C-D	D-F	327 A-F	B-C	C-D	D-F	330 A-F	B-C	C-D	D-E
dH (cm)	97.5	3.5	32.3	60.7	143.9	1.3	13.6	134.3	305.0	0.7	0.4	302.7	253.2	0.4	1.0	81.9
ds (cm)	767	150	150	265	973	150	150	471	1367	0	300	865	1257	150	150	717
dH/ds	0.13	0.02	0.22	0.23	0.15	0.01	0.09	0.29	0.22		0.00	0.35	0.20	0.00	0.01	0.11

dH tubes north-south transect Raheenmore Bog

NR	333				336				340			342		344	
DATE	A-F	B-C	C-D	D-F	A-E	B-C	C-D	D-E	A-D	B-C	C-D	A-C	B-C	A-C	B-C
27-Oct-87	8888	8888	8888	8888	8888	31.0	25.0	8888	57.0	8888	26.0	8888	8888	14.0	14.0
25-Nov-87	8888	1.0	2.0	8888	8888	34.0	24.0	8888	56.0	21.0	24.0	8888	8888	-4.0	0.0
31-Dec-87	8888	2.0	1.0	8888	8888	34.0	21.0	8888	53.0	20.0	21.0	8888	8888	12.0	-1.0
28-Jan-88	8888	1.0	1.0	8888	8888	34.0	24.0	8888	62.0	20.0	26.0	9.0	1.0	4.0	10.0
23-Feb-88	8888	1.0	1.0	8888	8888	36.0	24.0	8888	66.0	27.0	29.0	11.0	4.0	-3.0	-2.0
21-Mar-88	8888	2.0	1.0	8888	8888	32.0	21.0	8888	63.0	26.0	25.0	12.0	2.0	11.0	10.0
26-Apr-88	8888	0.0	1.0	8888	8888	34.0	22.0	8888	61.0	25.0	26.0	11.0	4.0	5.0	7.0
23-May-88	8888	0.0	1.0	8888	8888	31.0	23.0	8888	55.0	22.0	23.0	10.0	2.0	6.0	8.0
28-Jun-88	8888	1.0	0.0	8888	8888	30.0	24.0	8888	56.0	21.0	27.0	4.0	2.0	8.0	9.0
27-Jul-88	8888	0.0	1.0	8888	8888	34.0	21.0	8888	59.0	19.0	27.0	5.0	6.0	23.0	14.0
30-Aug-88	8888	2.0	0.0	8888	8888	35.0	11.0	8888	63.0	19.0	25.0	15.0	3.0	13.0	9.0
28-Sep-88	8888	1.0	1.0	8888	8888	35.0	21.0	8888	66.0	21.0	24.0	23.0	4.0	14.0	11.0
26-Oct-88	8888	1.0	2.0	8888	8888	33.0	23.0	8888	68.0	20.0	26.0	20.0	4.0	32.0	14.0
23-Nov-88	8888	1.0	0.0	8888	8888	36.0	21.0	8888	69.0	24.0	26.0	17.0	8.0	6.0	-2.0
31-Dec-88	8888	1.0	1.0	8888	8888	36.0	19.0	8888	70.0	19.0	31.0	15.0	6.0	9.0	12.0
26-Jan-89	8888	1.0	0.0	8888	8888	35.0	20.0	8888	66.0	23.0	24.0	12.0	3.0	3.0	-2.0
28-Feb-89	8888	1.0	1.0	8888	8888	32.0	21.0	8888	60.0	18.0	24.0	10.0	0.0	11.0	7.0
31-Mar-89	8888	0.0	2.0	8888	8888	32.0	31.0	8888	67.0	24.0	26.0	14.0	6.0	6.0	10.0
26-Oct-89	8888	8888	8888	8888	74.0	34.0	30.0	3.0	90.0	24.0	33.0	55.0	28.0	8888	10.0
13-Nov-89	8888	2.0	1.0	8888	65.0	39.0	27.0	-4.0	88.0	29.0	32.0	46.0	24.0	26.0	21.0
27-Nov-89	8888	2.0	1.0	8888	64.0	37.0	30.0	-5.0	82.0	25.0	32.0	34.0	21.0	17.0	13.0
11-Dec-89	8888	2.0	1.0	8888	66.0	36.0	31.0	-2.0	74.0	25.0	27.0	25.0	15.0	17.0	9.0
04-Jan-90	8888	1.0	1.0	8888	71.0	38.0	28.0	1.0	74.0	30.0	18.0	38.0	20.0	22.0	15.0
21-Jan-90	8888	4.0	3.0	8888	83.0	48.0	27.0	3.0	81.0	29.0	26.0	34.0	18.0	16.0	11.0
03-Feb-90	8888	3.0	0.0	8888	69.0	36.0	26.0	5.0	76.0	27.0	26.0	29.0	17.0	17.0	13.0
15-Feb-90	8888	-2.0	3.0	8888	65.0	37.0	26.0	0.0	75.0	19.0	36.0	39.0	28.0	13.0	15.0
01-Mar-90	8888	2.0	1.0	8888	61.0	36.0	28.0	-6.0	76.0	39.0	27.0	18.0	7.0	16.0	12.0
16-Mar-90	8888	1.0	1.0	8888	61.0	36.0	29.0	-6.0	69.0	29.0	27.0	14.0	13.0	-2.0	8.0
12-Apr-90	8888	1.0	1.0	8888	59.0	33.0	29.0	-4.0	64.0	22.0	26.0	16.0	12.0	9.0	6.0
26-Apr-90	8888	0.0	0.0	8888	58.0	27.0	29.0	-4.0	64.0	22.0	27.0	13.0	12.0	12.0	6.0
10-May-90	8888	0.0	1.0	8888	56.0	30.0	30.0	-3.0	48.0	21.0	16.0	14.0	11.0	8888	6.0
24-May-90	8888	0.0	0.0	8888	62.0	27.0	29.0	7.0	57.0	20.0	29.0	13.0	13.0	22.0	6.0
07-Jun-90	8888	1.0	0.0	8888	56.0	28.0	28.0	-3.0	61.0	16.0	26.0	23.0	12.0	8888	5.0
20-Jun-90	8888	1.0	1.0	8888	71.0	27.0	29.0	13.0	57.0	8888	8888	17.0	11.0	8888	6.0
05-Jul-90	8888	2.0	0.0	8888	68.0	28.0	30.0	0.0	74.0	9.0	29.0	50.0	26.0	51.0	12.0
20-Jul-90	8888	1.0	0.0	8888	61.0	33.0	30.0	4.0	62.0	19.0	31.0	16.0	19.0	25.0	15.0
01-Aug-90	8888	1.0	1.0	8888	61.0	26.0	30.0	3.0	66.0	20.0	31.0	23.0	15.0	8888	11.0
15-Aug-90	8888	0.0	1.0	8888	57.0	23.0	29.0	3.0	54.0	16.0	27.0	15.0	12.0	8888	9.0
29-Aug-90	8888	2.0	0.5	8888	72.3	31.4	28.7	1.6	76.7	15.0	27.7	52.4	19.5	36.2	11.8
12-Sep-90	8888	1.5	0.4	8888	65.5	33.1	31.6	1.3	71.6	19.4	32.3	28.7	22.3	33.1	20.9
26-Sep-90	8888	1.3	0.7	8888	62.9	29.9	30.7	1.7	8888	8888	8888	28.2	20.6	33.4	15.5
09-Oct-90	8888	2.3	0.4	8888	70.4	31.5	31.9	-1.1	81.2	8888	8888	49.2	25.0	42.1	27.1
24-Oct-90	8888	2.4	2.2	8888	70.0	36.6	28.9	-0.9	78.2	8888	8888	43.0	19.1	28.0	22.8
06-Nov-90	8888	1.6	0.3	8888	67.8	36.2	29.9	-1.8	72.4	8888	8888	8888	8888	14.4	15.9
20-Nov-90	8888	1.9	2.0	8888	66.2	37.7	25.7	-1.5	65.9	8888	8888	34.6	16.6	26.7	17.3
04-Dec-90	8888	2.5	1.3	8888	68.4	36.5	29.8	-2.0	69.0	8888	8888	30.2	20.1	9.5	13.0
18-Dec-90	8888	1.4	1.7	8888	68.9	35.9	28.9	1.0	64.9	8888	8888	26.3	17.1	9.1	10.5
11-Jan-91	8888	0.7	1.7	199.2	58.5	35.1	24.9	-4.1	61.2	8888	8888	30.3	18.1	20.6	13.4
24-Jan-91	203.2	1.0	1.7	201.0	64.7	37.0	26.9	-3.2	60.3	8888	8888	27.5	17.4	10.4	10.5
07-Feb-91	194.6	1.2	1.8	192.8	62.5	37.3	25.5	-3.0	8888	8888	8888	21.6	14.0	10.5	11.0
21-Feb-91	204.2	2.6	0.5	202.0	58.3	36.1	25.3	-5.3	55.3	8888	8888	22.6	13.6	21.7	13.0
08-Mar-91	194.0	2.0	2.0	191.5	59.7	35.5	23.9	-3.0	53.3	8888	8888	21.6	5.1	28.6	9.4
22-Mar-91	187.5	1.3	1.7	185.3	50.9	35.6	23.7	-10.8	31.3	8888	8888	22.7	16.2	9.5	10.3
04-Apr-91	154.7	1.4	2.0	152.2	57.1	34.7	22.0	-3.2	46.9	21.4	18.9	19.6	5.9	7.4	4.9
19-Apr-91	156.5	0.5	1.6	155.3	33.4	35.9	26.1	-9.9	53.2	25.1	27.7	15.0	13.8	-1.9	9.0
03-May-91	203.9	0.5	1.8	202.0	54.8	34.5	26.3	-7.9	55.6	26.0	27.9	21.9	15.4	8.9	9.4
17-May-91	214.1	0.4	1.2	213.5	52.7	33.1	26.2	-5.6	46.3	22.7	27.8	8.2	12.7	7.6	6.8
31-May-91	170.9	-0.1	0.8	171.7	45.0	27.6	26.1	-3.5	35.4	18.7	26.7	4.5	-9.3	16.0	7.1
14-Jun-91	232.9	1.6	0.4	231.6	54.5	26.2	24.4	-1.7	47.0	15.9	25.6	27.4	15.8	17.7	7.4
28-Jun-91	248.0	1.2	1.2	245.6	56.4	29.9	26.3	-5.4	58.5	20.2	28.1	41.6	25.8	33.1	12.6
11-Jul-91	247.8	0.8	1.7	246.3	54.7	32.5	25.1	-5.1	52.6	20.3	27.0	24.5	15.7	15.5	13.6
31-Jul-91	257.4	0.6	1.2	256.9	51.2	31.8	26.4	-5.5	47.3	21.0	28.2	14.4	15.4	8888	9.5
09-Aug-91	269.0	0.4	1.8	266.9	57.3	32.6	29.4	-8.1	60.6	22.9	30.1	36.6	20.5	22.1	11.5
23-Aug-91	264.2	0.5	1.6	263.0	52.0	32.5	27.0	-4.9	47.0	21.2	27.2	14.9	15.1	20.0	10.1
06-Sep-91	275.9	-0.4	1.4	275.9	45.3	28.3	29.6	-6.7	42.8	21.3	32.8	12.8	16.8	27.6	8.4
20-Sep-91	277.1	-0.2	1.4	276.3	50.5	23.5	29.6	-4.6	46.2	19.4	28.5	21.9	15.8	32.5	8.6
03-Oct-91	281.5	1.2	1.6	279.2	66.5	29.3	34.6	-6.4	64.2	20.5	30.7	48.7	27.6	34.1	10.5
17-Oct-91	280.7	1.5	1.8	279.0	65.4	34.5	27.3	-1.3	63.8	22.6	28.1	44.4	25.9	31.1	21.8
01-Nov-91	276.8	1.8	1.8	273.6	65.6	35.0	24.2	1.5	64.1	22.5	27.9	44.1	25.9	36.0	17.3
15-Nov-91	265.0	1.2	2.3	262.1	61.7	35.7	26.1	-3.3	66.4	27.6	28.7	38.8	22.5	24.2	19.1
29-Nov-91	248.9	0.8	2.1	246.5	61.8	36.6	26.9	-5.1	67.2	29.1	27.6	35.5	20.1	16.0	15.0
13-Dec-91	228.1	1.8	1.5	226.6	64.1	33.3	26.4	-2.3	65.2	8888	8888	25.9	18.3	8.4	9.4
27-Dec-91	231.0	0.7	2.1	228.9	8888	37.2	27.8	8888	67.9	32.3	28.3	31.8	19.4	14.7	14.5
13-Jan-92	209.3	0.7	2.0	207.3	59.7	36.8	27.5	-7.3	66.6	32.8	29.0	28.7	19.3	5.6	11.9
24-Jan-92	200.8	8888	1.2	199.6	61.6	37.3	24.8	-2.6	59.2	28.9	26.5	19.4	14.5	8888	7.7
20-Feb-92	208.0	0.3	1.6	207.0	61.3	36.3	26.3	-3.8	63.3	27.6	28.3	28.2	17.6	13.8	8.6
20-Mar-92	209.8	0.5	1.9	208.2	59.0	36.0	25.1	-4.5	58.9	27.6	26.7	25.0	14.1	-4.3	-8.9

NR	333				336				340			342		344	
DATE	A-F	B-C	C-D	D-F	A-E	B-C	C-D	D-E	A-D	B-C	C-D	A-C	B-C	A-C	B-C
dH (cm)	227.4	1.1	1.2	224.9	61.1	33.5	26.3	-2.3	62.6	22.5	26.7	24.6	14.2	16.7	10.5
ds (cm)	1557	150	150	1055	507	149	150	6	387	75	110	297	95	277	95
dH/ds	0.15	0.01	0.01	0.21	0.12	0.22	0.18		0.16	0.30	0.24	0.08	0.15	0.06	0.11