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**THE IMPACT ON AGRICULTURE OF THE
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Doctor of Philosophy

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APPENDIX 1

FIELD STUDY RESULTS - SOIL MOISTURE DATA.

During the field study which was undertaken in 1979 and 1980 in connection with the Shropshire Groundwater Scheme, a Wallingford Neutron Probe was used to monitor the soil moisture. The study itself has been discussed in detail in Chapter 5, as have the results obtained from the field measurements. Figs A1.1 to A1.3 show the three sites in the Tern Area where the soil moisture studies were undertaken.

The tables in Appendix 1 present the results of observations made at the three sites investigated. The spreadsheet and graphics facilities of the JAZZ package produced by Lotus Development Corporation for the Apple Macintosh computer were employed in the analysis of the Neutron probe, rainfall and groundwater level data. Tables A1.1 to A1.5 are direct printouts from the spreadsheets prepared for the five access tubes installed at the Greenfields site. Similarly Tables A1.6 to A1.10 are the results from the five tubes at Heath House, and Tables A1.11 to A1.14 are for the four at Childs Ercall.

Neutron Probe readings are shown in terms of the count rate. Appropriate calibration curves, which enable these readings to be converted to moisture content, are given in Table 5.1 and, as explained in Sect. 5.7, for post-inquiry analysis of the data the relationship derived by Wood (1981) was employed.

Fig A1.1 The Greenfields Site.



Fig A1.2 The Heath House Site.

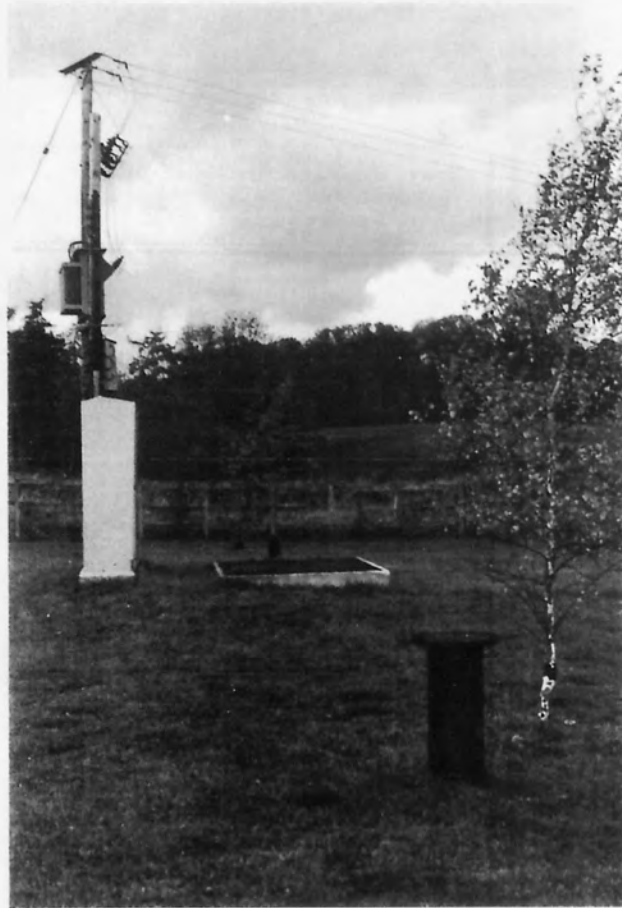


Fig A1.3 The Childs Ercall Site.



SHROPSHIRE GROUNDWATER SCHEME		TUBE No. 1		NEUTRON PROBE COUNT RATE												NOTES
SOIL MOISTURE FIELD DATA		G.W. LEVEL below Obs. Well Head (m)		NEUTRON PROBE COUNT RATE												NOTES
DATE	TIME	RAINFALL (mm)	G.W. LEVEL @ 10m	0 cm	20 cm	40 cm	60 cm	80 cm	100 cm	120 cm	140 cm	160 cm	180 cm	194 cm		
SITE	Greenfields		TUBE No. 1													
26-Apr-79	n/a				533	457	458	454	443	424	393	393	384	391	Site Set Up	
30-May-79	2:45 pm	n/a	2.6	59	52	453	459	456	433	433	390	380	363	366		
07-May-79	11:55 am	1.9	2.74	58	51.2	450	457	457	431	428	396	400	392	399		
09-May-79	12:27 pm	0.6	2.8	45	50.9	435	459	456	433	427	395	386	390	393		
11-May-79	11:25 am	14.4	2.63	54	53.8	463	467	451	433	432	394	395	396	397		
14-May-79	10:30 am	0	2.75	54	49.4	432	460	451	441	426	388	390	399	391		
16-May-79	12:35 pm	0	2.63	41	47.0	428	460	453	442	425	387	385	388	384		
18-May-79	11:17 am	10.5	2.75	56	50.6	437	468	458	451	430	397	385	390	384		
21-May-79	1:32 pm	9.5	2.71	50	50.8	442	460	445	427	427	388	379	398	392		
23-May-79	12:37 pm	10.2	2.85	56	51.9	445	470	452	436	430	393	387	392	381		
25-May-79	11:22 am	5.1	2.6	54	52.6	440	459	452	431	428	391	393	397	391		
28-May-79	11:30 am	21.1	2.58	60	53.8	465	469	453	450	434	388	394	405	394		
30-May-79	11:22 am	0	2.79	62	52.3	441	466	465	437	429	392	390	384	393	Pumping started	
01-Jun-79	10:45 am	9.2	6.805	58	53.5	457	475	449	444	437	388	392	390	397		
04-Jun-79	10:45 am	0.4	8.33	63	50.9	439	466	455	437	429	401	394	393	392		
08-Jun-79	1:00 pm	7.9	7.67	65	50.1	442	459	453	431	418	383	384	384	391		
12-Jun-79	10:17 am	0	8.64	44	47.0	416	459	461	444	426	397	385	388	387		
15-Jun-79	12:50 pm	19.1	9	50	49.7	435	454	457	435	434	397	386	392	393		
19-Jun-79	2:20 pm	0	8.82	44	43.4	405	454	452	433	434	404	390	388	386		
22-Jun-79	1:00 pm	0	9.12	38	40.4	388	448	485	438	436	390	389	398	387	Pump off - 2.30. Probe broken	
26-Jun-79	2:30 pm	30.9	9.06	50	43.0	401	471	456	442	423	389	395	389	390		
29-Jun-79	12:54 pm	0	4	4	4.05	4.24	4.24	4.24	4.24	4.24	4.24	4.24	4.24	4.24	GW & site survey only	
03-Jul-79	3:15 pm	0	3.6	3.63												
06-Jul-79	7:00 pm	?	3.45	3.78												
31-Jul-79	?	?	3.02	3.35	25.2	24.2	34.0	36.4	41.8	43.2	39.0	39.3	39.4	39.0	Hairgauge removed 16.7.79 Tubes removed - site cleared	
17-Nov-79	?	?	3.11	3.35	32	32	34.0	36.4	41.8	43.2	39.0	39.3	39.4	39.0		

Table A1.1 Field Study Neutron Probe, Rainfall and Groundwater Level Results - Greenfields Access Tube 1.

SITE	DATE	SURFACE GROUNDWATER SCHEME		TUBE No.	G.W. LEVEL @ 10m	RAINFALL (mm)	NEUTRON PROBE COUNT RATE	NEUTRON PROBE COUNT RATE										Meters
		Soil Moisture Field Data	Soil Moisture Field Data					0 cm	20 cm	40 cm	60 cm	80 cm	90 cm	100 cm	120 cm	140 cm	160 cm	
26-Apr-79	3:00 pm	n/a	3.2	1	2.29	0	335	345	404	473	466	416	483	526	491	491	Site set up	
30-May-79	5:10 pm	19.5	3.84	3.17	2.49	0	335	341	415	473	473	425	473	526	491	491	Site set up	
30-May-79	11:55 am	2.1	3.84	3.19	2.49	0	335	341	415	473	473	425	473	526	491	491	Site set up	
30-May-79	10:58 am	0.4	3.9	3.2	2.5	0	335	341	415	473	473	425	473	526	491	491	Site set up	
10-May-79	1:30 pm	4.5	3.84	2.475	2.77	0	335	341	415	473	473	425	473	526	491	491	Site set up	
10-May-79	4:30 pm	n/a	6.825	4.92	3.22	0	335	341	415	473	473	425	473	526	491	491	Site set up	
11-May-79	1:32 pm	10.9	7.78	5.66	4.065	0	335	341	415	473	473	425	473	526	491	491	Site set up	
11-May-79	12:35 pm	0	7.995	5.875	4.42	0	335	341	415	473	473	425	473	526	491	491	Site set up	
18-May-79	11:02 am	0	8.01	5.88	4.43	0	335	341	415	473	473	425	473	526	491	491	Site set up	
18-May-79	5:30 pm	10.3	8.21	6.02	4.6	0	335	341	415	473	473	425	473	526	491	491	Site set up	
21-May-79	2:30 pm	10.69	8.25	6.015	4.92	0	335	341	415	473	473	425	473	526	491	491	Site set up	
21-May-79	11:19 am	2.2	8.25	6.015	4.92	0	335	341	415	473	473	425	473	526	491	491	Site set up	
29-May-79	1:07 pm	4.1	9.31	6.098	4.91	0	335	341	415	473	473	425	473	526	491	491	Site set up	
29-May-79	1:25 pm	20.6	8.364	6.06	4.74	0	335	341	415	473	473	425	473	526	491	491	Site set up	
30-May-79	1:10 pm	4.6	8.52	6.26	4.99	0	335	341	415	473	473	425	473	526	491	491	Site set up	
30-May-79	12:40 pm	9.3	8.41	6.14	4.935	0	335	341	415	473	473	425	473	526	491	491	Site set up	
30-Jun-79	12:37 pm	0.3	8.42	6.101	4.815	0	335	341	415	473	473	425	473	526	491	491	Site set up	
30-Jun-79	11:05 am	12.7	8.42	6.13	4.82	0	335	341	415	473	473	425	473	526	491	491	Site set up	
12-Jun-79	12:10 pm	0.2	8.7	6.15	4.905	0	335	341	415	473	473	425	473	526	491	491	Site set up	
12-Jun-79	11:22 am	27.4	8.7	6.32	5.12	0	335	341	415	473	473	425	473	526	491	491	Site set up	
19-Jun-79	3:22 pm	T	8.52	6.16	4.95	0	335	341	415	473	473	425	473	526	491	491	Site set up	
22-Jun-79	1:32 pm	T	8.52	6.2	5.15	0	335	341	415	473	473	425	473	526	491	491	Site set up	
22-Jun-79	11:55 pm	46.3	8.63	6.24	5.05	0	335	341	415	473	473	425	473	526	491	491	Site set up	
23-Jul-79	11:19 am	T	8.7	6.2	5.2	0	335	341	415	473	473	425	473	526	491	491	Site set up	
23-Jul-79	5:32 pm	T	8.67	6.2	5.2	0	335	341	415	473	473	425	473	526	491	491	Site set up	
30-Jul-79	3:30 pm	0	4.6	3.26	2.03	0	335	341	415	473	473	425	473	526	491	491	Site set up	
16-Jul-79	12:50 pm	0.4	4.16	3.56	2.31	0	335	341	415	473	473	425	473	526	491	491	Site set up	
31-Jul-79	11:30 am	8.7	4.14	3.53	2.53	0	335	341	415	473	473	425	473	526	491	491	Site set up	
15-Sep-79	11:35 am	82.3	4.02	3.38	2.74	0	335	341	415	473	473	425	473	526	491	491	Site set up	
26-Sep-79	11:30 am	15.6	3.3	3.3	2.66	0	335	341	415	473	473	425	473	526	491	491	Site set up	
05-Oct-79	11:30 am	1.3	4	3.33	2.66	0	335	341	415	473	473	425	473	526	491	491	Site set up	
24-Oct-79	11:50 am	24.6	4.01	3.33	2.69	0	335	341	415	473	473	425	473	526	491	491	Site set up	
17-Nov-79	11:30 am	69.5	4.05	3.31	2.73	0	335	341	415	473	473	425	473	526	491	491	Site set up	
14-Dec-79	11:30 am	103.6	3.975	3.302	2.616	0	335	341	415	473	473	425	473	526	491	491	Site set up	
10-Jan-80	11:15 am	58.6	3.165	3.165	2.49	0	335	341	415	473	473	425	473	526	491	491	Site set up	
22-Jan-80	11:15 am	23.6	3.02	2.99	2.39	0	335	341	415	473	473	425	473	526	491	491	Site set up	
19-Feb-80	10:45 am	8	2.82	2.82	2.11	0	335	341	415	473	473	425	473	526	491	491	Site set up	
25-Mar-80	11:22 am	44.3	2.55	2.55	2.01	0	335	341	415	473	473	425	473	526	491	491	Site set up	
31-Mar-80	12:25 pm	73.4	2.5	2.5	1.97	0	335	341	415	473	473	425	473	526	491	491	Site set up	
15-Apr-80	7:3	2	2.09	2.09	1.53	0	335	341	415	473	473	425	473	526	491	491	Site set up	
21-May-80	11:45 am	4	3.44	2.738	2.095	0	335	341	415	473	473	425	473	526	491	491	Site set up	
19-Jun-80	11:30 am	113.5	3.32	2.58	1.97	0	335	341	415	473	473	425	473	526	491	491	Site set up	
16-Jul-80	10:40 am	48.6	3.324	2.686	1.97	0	335	341	415	473	473	425	473	526	491	491	Site set up	
21-Aug-80	10:30 am	43.1	3.45	2.744	2.076	0	335	341	415	473	473	425	473	526	491	491	Site set up	

Table A1.6 Field Study Neutron Probe, Rainfall and Groundwater Level Results - Heath House Access Tube 1.

SITE	DATE	TIME	RAINFALL (mm)		G.W. LEVEL below Oa Well Head (m)		TYPE No.	NEUTRON PROBE COUNT RATE	NEUTRON PROBE COUNT RATE										Notes
			(mm)	(mm)	@ 10cm	@ 20cm			0.5m	20 cm	40 cm	60 cm	80 cm	100.5m	120 cm	140 cm	160 cm	180 cm	
Healthhouse	26 Apr-79	3:00 pm	n/a	3.2	2.29	74	586	412	381	392	481	511	481	439	406	413	433	Site Set Up	
	27 May-79	5:10 pm	19.5	3.81	2.49	76	511	398	405	405	434	434	434	439	410	410	409		
	30 May-79	11:56 am	2.1	3.82	3.13	71	588	427	395	395	465	511	472	444	328	412	412		
	30 May-79	10:58 am	0.4	3.2	2.5	91	515	400	393	393	473	503	456	456	410	413	423		
	10 May-79	4:30 pm	4.5	3.85	3.16	115	515	412	382	393	473	503	456	456	410	414	423		
	10 May-79	4:20 pm	n/a	6.82	3.22	113	516	415	385	387	480	533	487	460	406	416	423	Pump start - 2:45 pm	
	11 May-79	12:25 pm	0	7.78	5.68	118	549	421	385	395	481	517	486	454	417	418	418		
	11 May-79	12:25 pm	0	7.95	5.87	95	526	431	385	375	473	511	450	450	406	422	422		
	16 May-79	11:02 am	0	8.0	5.88	68	511	433	381	371	461	534	485	409	415	418	418		
	16 May-79	3:50 pm	10.3	8.2	6.02	90	509	413	380	367	458	527	488	404	412	432	432		
	21 May-79	10:55 am	10.05	8.25	4.6	93	536	440	378	354	447	526	486	450	421	432	432		
	21 May-79	11:13 am	2	7	6.01	108	544	417	378	347	430	500	489	404	411	428	428		
	23 May-79	11:13 am	4	6.95	4.9	108	553	433	376	350	430	540	474	444	407	413	431		
	23 May-79	1:07 pm	1	9.3	4.9	108	553	433	376	350	430	540	474	444	407	413	431		
	28 May-79	1:25 pm	20.6	8.36	5.08	118	505	431	381	351	431	511	481	455	411	409	433		
	30 May-79	1:10 pm	4.8	8.5	6.2	93	523	433	381	351	431	511	481	455	411	409	433		
	31 May-79	12:40 pm	3.3	8.4	6.1	93	514	433	381	351	431	511	481	455	411	409	433		
	31 May-79	12:37 pm	0.3	8.4	6.1	78	515	415	381	351	431	511	481	455	411	409	433		
	31 May-79	12:37 pm	0.3	8.4	6.1	98	525	409	365	343	433	523	482	452	416	422	422		
	31 May-79	11:05 am	12.7	8.4	6.1	98	525	409	365	343	433	523	482	452	416	422	422		
	12 Jun-79	12:10 pm	0.2	8.5	6.15	66	489	407	365	333	421	521	482	452	416	422	422		
	15 Jun-79	11:22 am	27.4	8.7	6.32	102	537	423	365	328	421	521	482	452	416	422	422		
	19 Jun-79	3:22 pm	Tt	8.52	6.16	65	501	455	364	332	401	522	485	406	410	419	434		
	22 Jun-79	1:22 am	1.7	8.6	6.2	68	485	389	365	330	393	517	486	406	416	422	422	Probe broken	
	26 Jun-79	12:55 pm	48.2	8.62	6.24	50	499	411	371	348	432	525	478	416	416	442	442		
	27 Jun-79	11:17 am	Tt	8.7	6.3	55	477	396	365	333	415	531	495	466	411	426	433	Pump off - 2:45 pm	
	29 Jul-79	5:32 pm	Tt	8.6	6.0	55	477	396	365	333	415	531	495	466	411	426	433		
	30 Jul-79	5:30 pm	0	8.6	6.0	48	410	383	352	320	365	517	480	459	410	423	423		
	16 Jul-79	12:50 pm	0.6	4.1	3.56	96	410	383	352	320	365	517	480	459	410	423	423		
	21 Jul-79	11:30 am	5.1	4.14	3.56	96	410	383	352	320	365	517	480	459	410	423	423		
	15 Sep-79	11:35 am	8.9	4.0	3.38	27	273	273	273	273	273	273	273	273	273	273	273		
	26 Sep-79	11:30 am	15.6	3.3	2.66	41	202	244	232	212	232	232	232	232	232	232	232		
	30 Oct-79	11:30 am	13	3.3	2.66	47	210	241	235	215	235	235	235	235	235	235	235		
	24 Oct-79	11:50 am	24.8	4.0	3.3	48	203	240	237	218	237	237	237	237	237	237	237		
	17 Nov-79	11:30 am	69.5	4.05	3.3	71	467	366	243	193	213	255	352	352	352	352	352		
	14 Dec-79	11:30 am	103.6	3.97	3.302	73	503	449	406	336	328	330	357	357	357	357	357		
	10 Jan-80	11:15 am	53.8	3.165	2.49	28	547	559	475	408	494	510	461	454	416	442	442	Tubes broken - best thinned	
	22 Jan-80	10:45 am	23.6	3.01	2.39	28	547	559	475	408	494	510	461	454	416	442	442	Tubes restated: bottom @ 210 cm	
	19 Feb-80	10:45 am	44.3	2.88	2.11	25	544	554	472	472	602	521	471	468	420	438	438	Made run by tube 7	
	23 Mar-80	11:22 am	7.3	2.55	2.0	25	509	550	542	492	595	520	472	471	425	441	441		
	31 Mar-80	12:25 pm	7.3	2.55	1.8	29	566	566	556	525	603	522	482	465	421	443	443		
	15 Apr-80	11:05 am	7.3	2.55	1.9	24	483	535	511	488	598	537	474	467	423	443	443	Tubes 2, 3 & 4 removed	
	21 May-80	11:45 am	2	2.92	2.05	24	483	535	511	488	598	537	474	467	423	443	443		
	19 Jun-80	10:40 am	48.6	3.32	2.66	191	266	266	266	266	266	266	266	266	266	266	266	Tube 5 cut by farmer	
	16 Jul-80	10:40 am	48.6	3.32	2.66	191	266	266	266	266	266	266	266	266	266	266	266		
	21 Aug-80	10:30 am	43.1	3.45	2.74	43.1	266	266	266	266	266	266	266	266	266	266	266		

Table A1.7 Field Study Neutron Probe, Rainfall and Groundwater Level Results - Health House Access Tube 2.

SITE	SURFACE GROUNDWATER SCHEME		RAINFALL (mm)	TUBE NO.	G.W. LEVEL below Cms Well Head (m) @ 10cm	G.W. LEVEL below Cms Well Head (m) @ 100cm	NEUTRON PROBE COUNT RATE										NEUTRON PROBE COUNT RATE	Site set up Pump 1hr/L Pump stop Site closed	26.4.79 10.5.88 3.7.79 21.8.80	Notes
	DATE	TIME					0.0m	20.0m	40.0m	60.0m	80.0m	100.0m	120.0m	140.0m	160.0m	180.0m				
26.Apr.79	3:00 pm	N/A	3.21	5	2.22	0.97	305	210	193	219	186	202	226	370	404	479	475	Site Set Up		
29.MAY.79	6:10 pm	19.5	3.62	3.17	2.49	1.03	479	217	182	214	186	203	230	384	411	478	463			
07.MAY.79	11:55 am	2.1	3.83	3.13	2.42	0.90	466	203	205	212	195	209	227	373	411	478	463			
09.MAY.79	10:58 am	0.4	3.32	3.12	2.5	0.64	309	209	183	223	197	202	219	351	404	478	463			
10.MAY.79	1:30 pm	4.5	3.86	3.15	2.475	0.79	458	206	195	219	184	198	217	352	413	473	458			
10.MAY.79	4:20 pm	N/A	6.825	4.97	3.23	0.92	459	195	195	214	189	198	227	372	409	464	479	Pump start 2.45 pm		
11.MAY.79	1:32 pm	0	7.79	5.66	4.065	0.99	457	215	194	214	188	202	218	356	404	464	479			
14.MAY.79	13:35 pm	0	7.995	5.875	4.41	0.69	450	205	194	219	190	200	212	372	409	478	478			
16.MAY.79	11:02 am	0	8.0	5.88	4.43	0.57	443	201	194	214	180	193	186	252	362	464	477			
18.MAY.79	3:50 pm	10.3	8.21	6.02	4.6	0.83	458	206	194	217	184	192	182	217	299	411	433			
21.MAY.79	10:55 am	10.3	8.25	6.015	4.6	0.79	455	200	186	212	178	189	181	209	255	319	346			
23.MAY.79	11:15 am	7.2	8.3	6.1	4.7	0.99	460	200	200	216	186	195	172	204	229	287	298			
25.MAY.79	1:07 pm	4.1	8.3	6.055	4.78	0.72	444	210	207	209	190	191	178	195	224	261	270			
28.MAY.79	1:25 pm	20.6	8.365	6.08	4.74	0.82	471	213	203	213	181	192	173	190	213	238	253			
30.MAY.79	1:10 pm	4.8	8.5	6.29	4.98	0.51	492	213	213	219	195	194	172	198	213	239	239			
31.JUN.79	12:40 pm	0.3	8.4	6.14	4.895	0.79	475	214	202	215	193	195	174	192	213	236	233			
04.JUN.79	12:37 pm	0.3	8.4	6.101	4.815	0.62	459	211	202	211	192	193	180	192	201	229	240			
08.JUN.79	11:05 am	12.7	8.4	6.13	4.87	0.72	461	208	195	211	195	194	174	192	201	235	235			
12.JUN.79	12:10 pm	0	8.5	6.15	4.905	0.49	424	209	195	211	195	193	182	192	201	235	235			
15.JUN.79	12:12 pm	27.4	8.7	6.32	5.12	0.75	463	205	195	214	189	197	178	192	211	228	228			
19.JUN.79	3:22 pm	Tt	8.55	6.16	4.95	0.45	434	205	195	200	194	189	177	189	209	227	227			
22.JUN.79	1:22 am	1.7	8.6	6.2	5.15	0.45	424	206	185	213	174	175	175	194	202	229	230	Probe broken		
26.JUN.79	11:52 am	48.2	8.63	6.24	5.2	0.52	440	196	197	211	199	177	177	192	211	226	232			
29.JUN.79	11:19 am	Tt	8.7	6.2	5.2	0.38	419	200	184	209	180	189	176	192	211	224	227	Pump off 2.45 pm		
30.JUL.79	6:32 pm	Tt	8.67	6.2	5.07	0.38	419	200	184	209	180	189	176	192	211	224	227			
06.JUL.79	6:30 pm	0	8.6	6.3	5.3	0.31	303	251	183	192	176	189	175	191	213	225	227			
16.JUL.79	12:50 pm	0.4	4.16	3.56	2.81	0.4	303	251	183	192	176	189	175	191	213	225	227			
31.JUL.79	11:30 am	8.9	4.11	3.55	2.81	0.24	251	182	142	175	172	184	167	189	201	221	227			
15.SEP.79	11:35 am	8.9	4.05	3.58	2.74	0.24	251	182	142	175	172	184	167	189	201	221	227			
26.SEP.79	11:30 am	15.6	3.3	2.66	2.1	0.41	161	110	32	113	125	164	164	183	201	230	238			
05.OCT.79	11:30 am	13	3.3	2.66	2.1	0.41	161	110	32	113	125	164	164	183	201	230	238			
24.OCT.79	11:50 am	24.6	4.04	3.3	2.69	0.35	203	161	110	147	147	162	160	183	201	231	231			
17.NOV.79	11:30 am	69.5	4.05	3.31	2.73	0.74	321	112	121	148	148	164	164	183	201	242	249			
14.DEC.79	11:30 am	103.6	3.975	3.302	2.616	0.59	503	251	220	241	259	174	165	165	210	245	252	Tubes broken - level barrier		
10.JAN.80	11:15 am	58	3.161	2.49	2.09	0.46	435	352	211	203	233	199	232	372	414	452	452	Tubes reinstalled, bottom @		
25.FEB.80	10:45 am	37	2.85	2.11	1.8	0.40	404	456	343	224	250	210	412	423	433	517	517			
19.FEB.80	11:42 am	4.1	2.52	2.01	1.6	0.34	400	476	353	224	216	305	421	431	428	521	521			
05.MAR.80	11:22 am	4.1	3.05	2.52	1.81	0.36	419	471	356	226	348	427	419	436	441	529	529			
31.MAR.80	12:25 pm	7.8	3.25	2.73	1.91	0.31	432	321	208	226	348	422	422	431	434	529	529	Tubes 2, 3 & 4 removed		
15.APR.80	11:29 am	2.2	2.575	2.02	1.59	0.36	371	171	163	239	325	201	417	417	429	525	525	Weeds around tube, 0.3m high		
21.MAY.80	11:45 am	4.2	3.4	2.75	2.08	0.3	423	252	141	200	256	370	412	431	431	531	531	Weeds around tube, 0.3m high		
19.JUN.80	11:30 am	113.5	3.3	2.616	1.97	0.50	361	423	252	141	200	256	370	412	431	531	531	Weeds around tube, 0.3m high		
16.JUL.80	10:40 am	48.6	3.391	2.698	2.076	0.50	346	252	141	200	256	370	412	431	531	531	531	Weeds around tube, 0.3m high		
21.AUG.80	10:30 am	43.1	3.45	2.74	2.1	0.50	346	252	141	200	256	370	412	431	531	531	531	Weeds around tube, 0.3m high		

Table A1.10 Field Study Neutron Probe, Rainfall and Groundwater Level Results - Heath House Access Tube 5.

APPENDIX 2

FIELD STUDY RESULTS - PROFILES AND ANALYSIS OF SOILS.

When the three sites within the Tern Area of the Shropshire Groundwater Scheme were closed, trial pits were dug at each, records of the soil profiles made and both undisturbed and loose soil samples taken (see Sect. 5.7). The methods employed in the analysis of soil samples have been described in Sect. 6.1, and the results together with profile descriptions are given in this Appendix.

Fig A2.1 describes the soil profile exposed by the trial pit dug at the Greenfields site. Figs A2.2 to A2.6 are profile descriptions at Heath House, and Figs A2.7 and A2.8 are descriptions from the trial pits dug at Childs Ercall. For each site there is a table giving analysis results for the disturbed samples (Table A2.1 for Greenfields, Table A2.4 for Heath House and Table A2.7 for Childs Ercall). Similarly, there are three tables of results for the undisturbed samples (Tables A2.2, A2.5 and A2.8), and finally particle size distribution summaries and appropriate horizon texture classes are given in Tables A2.3, A2.6 and A2.9.

0-15	Dark brown silt, some stones, well developed angular blocky structure.
15-20	Topsoil, some roots, some stones.
20-30	Light brown silt, some stones, grading through to sand - well developed structure at top horizon, with some stones.
30-40	Hard mottled brownish horizon - sand and silt, quite distinct blocky structure.
40-55	Lighter mottled silt, some stones, with shades of yellowish-brown, some with large pieces of stones.
55-65	Layer of fine sand - yellowish-brown structure.
65-150	Reddish-brown, predominantly fine sand and clay, with pale grey brown silt.

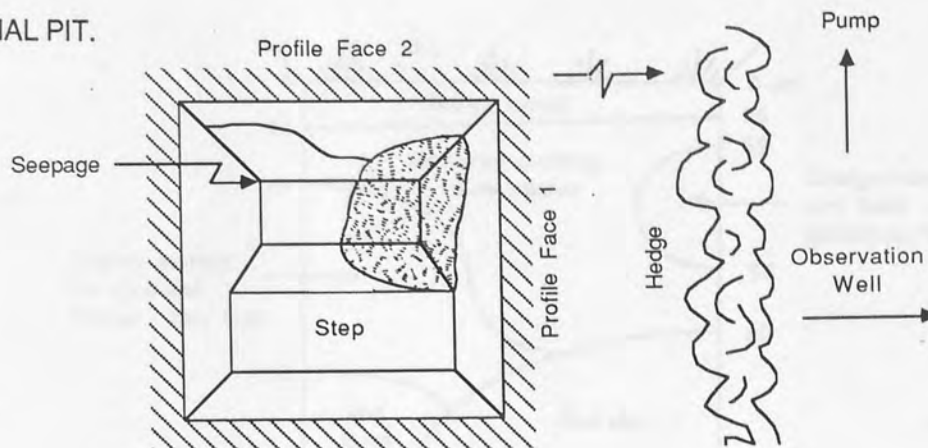
TRIAL PIT PAGE 3

DEPTH (cm)	DESCRIPTION
0-20	Dark brown silt - as for top 1.
20-55	Whitish mottled silt, some stones with a large proportion of stones.
55-120	Slightly mottled red sand with a large proportion of stones - quite hard.
120-150	Uniform red sand - some silt.

- OBSERVATIONS
1. Small amount of sewage in contact with sand.
 2. Stones 1-20% to 40 cm.

Fig A2.1 Greenfields Soil Profile Description - Trial Pit in the Vicinity of Access Tube 1.

PLAN OF TRIAL PIT.



TRIAL PIT FACE 1.

<u>Depth below G.L.</u> (cm)	<u>Horizon Description</u>
0-15	Dark brown topsoil, some stones, well developed angular blocky/granular structure.
15-20	Topsoil/organic material complex - bottom of plough zone.
20-30	Transition zone, dark brown grading through to sand - well developed structure as top horizon, with some stones.
30-45	Hard mottled brown/orange horizon - sand and stones: quite distinct orange 'nodules'.
45-80	Lighter mottled region, predominantly pale with shades of white/brown/pink/orange: sandy with large patches of stones.
80-88	Layer of fine sand - grey/pink/orange colouration.
88-150	Pit bottom. Predominantly pink coloured clay with pale grey-brown streaks.

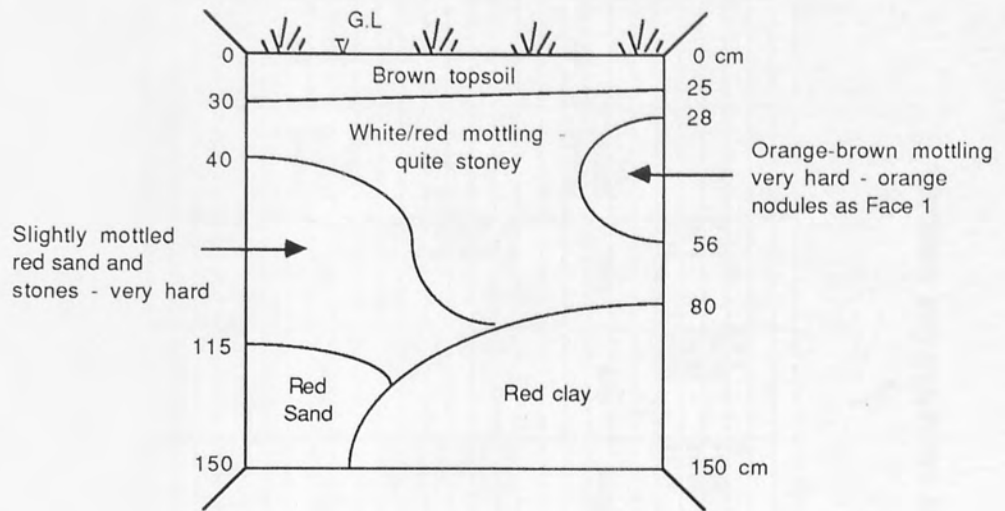
TRIAL PIT FACE 2.

<u>Depth below G.L.</u> (cm)	<u>Horizon Description</u>
0-30	Dark brown topsoil - as for face 1.
30-55	White/red mottled sandy horizon with a high proportion of stones.
55-120	Slightly mottled red sand with a lower proportion of stones - quite hard.
120-150	Uniform red sand - quite hard.

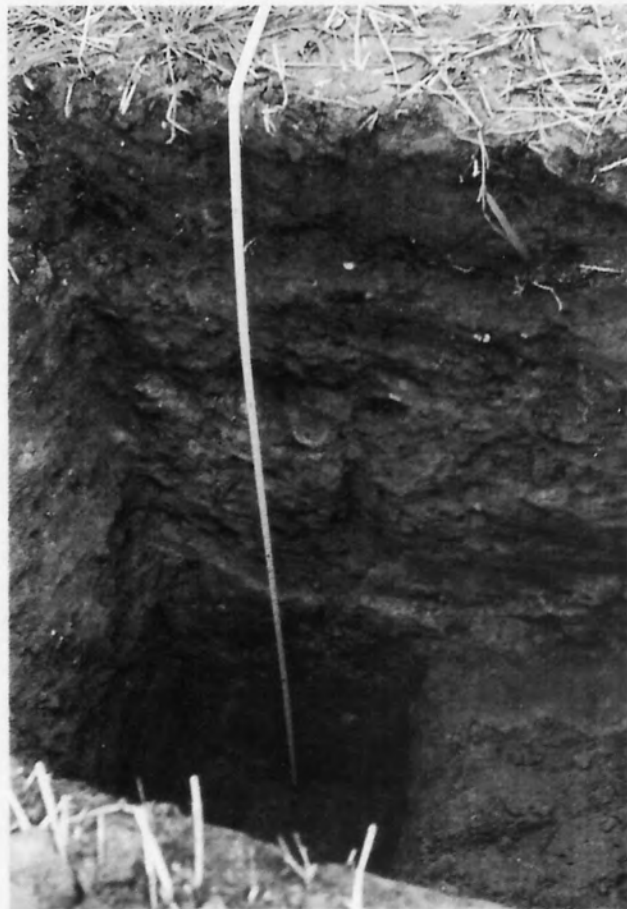
OBSERVATIONS

1. Small amount of seepage in corner of pit (see plan).
2. Roots visible to 85 cms.

Fig A2.1 Greenfields Soil Profile Description Continued.



SKETCH OF PROFILE FACE 2



GREENFIELDS TRIAL PIT - 2nd October 1981

SHROPSHIRE GROUNDWATER SCHEME - TERN AREA		DISTURBED SAMPLES		GREENFIELDS		ORGANIC CONTENT (%)		pH		Sp GRAVITY		
SOIL ANALYSIS RESULTS		PARTICLE SIZE DISTRIBUTION - % PASSING GIVEN SIEVE SIZE		PARTICLE SIZE DISTRIBUTION - % PASSING GIVEN SIEVE SIZE		ORGANIC CONTENT (%)		pH		Sp GRAVITY		
TRIAL PIT	DEPTH below GL (cm)	2mm	600µm	300µm	212µm	150µm	63µm	20µm	6µm	2µm	bulk sample	fine fraction
Face 1	0 - 20	98.33	98.57	86.43	76.79	65.71	48.93	25.54	18.52	14.39		
	20 - 30	98.31	97.64	81.42	69.93	58.45	41.55	22.63	17.01	13.1		
	30 - 45	95.88	93.59	71.76	57.14	41.86	23.59	12.04	8.03	6.52		
	45 - 80	95.75	94.23	89.97	71.43	40.43	18.24	7.81	4.9	4.29		
	80 - 88	99.7	99.08	96.62	60.31	40.62	23.08	13.79	11.31	9.76		
	88 - 150	99.83	99.21	97.74	89.7	85.23	71.93	51.45	37.73	28.41		2.7
TUBE No	DEPTH below GL (cm)	2mm	600µm	300µm	212µm	150µm	63µm	20µm	6µm	2µm	ORGANIC CONTENT (%)	Sp GRAVITY
Face 2	0 - 30	99.37	98.74	82.97	72.87	62.15	45.74	21.76	19.54	14.3		
	30 - 55	98.46	97.85	95.39	78.15	64.62	32.62	13.32	10.85	8.06		
	55 - 120	96.6	95.06	92.9	79.32	68.21	33.33	20.34	16.75	14.7		
	120 - 150	99.7	98.8	95.78	68.98	47.29	6.33	5	3.03	?		

Table A2.1 Greenfields - Analysis Results for Disturbed Soil Samples.

SHROPSHIRE GROUNDWATER SCHEME - TERN AREA				
SOIL ANALYSIS RESULTS - UNDISTURBED SAMPLES				
SITE :- GREENFIELDS				
TUBE No	DEPTH below GL (cm)	BULK DENSITY (gm/cc)	SATURATED CONDUCTIVITY (m/day)	
Trial Pit	0 - 20	1.54	1.16	
	20 - 40	1.53	2.42	
	40 - 60	1.73	2.61	
	60 - 75	1.66	0.79	
	75 - 90	1.74	0.24	
	90 - 105	1.71	0.59	
	105 - 120	1.77	negligible	
	120 - 135	1.81	negligible	

Table A2.2 Greenfields - Analysis Results for Undisturbed Soil Samples.

SHROPSHIRE GROUNDWATER SCHEME - TERN AREA										
SOIL ANALYSIS RESULTS										
SITE :- GREENFIELDS										
TUBE No	DEPTH below GL (cm)	GRAVEL (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	TOTAL SAND (%)	SILT (%)	CLAY (%)	TEXTURE	CLASS
Face 1	0 - 20	1.07	1.07	21.07	27.86	50	34.54	14.39	sand loam/sand silt loam	
	20 - 30	1.69	2.36	26.02	28.38	56.76	28.45	13.1	sandy loam	
	30 - 45	4.32	5.31	33.23	33.55	72.09	17.07	6.52	loamy sand/sandy loam	
	45 - 80	4.25	5.78	33.13	38.6	77.51	13.95	4.29	loamy sand	
	80 - 88	0.3	3.08	36.31	37.23	76.62	13.32	9.76	sandy loam	
	88 - 150	0.1700000	2.09	8.04	17.77	27.9	43.52	28.41	clay loam	
Face 2	0 - 30	0.63	2.84	23.66	27.13	53.63	31.44	14.3	sandy loam	
	30 - 55	1.54	3.07	30.77	32	65.84	24.56	8.06	sandy loam	
	55 - 120	3.4	3.7	24.69	34.88	63.27	18.63	14.7	sandy loam	
	120 - 150	0.3	3.92	48.49	40.96	93.37	?	?	?	

Table A2.3 Greenfields - Summary of Particle Size Distributions.

Fig A2.2 Heath House Soil Profile Description - Trial Pit at Access Tube 1.

<u>Depth below G.L.</u> (cm)	<u>Horizon Description</u>
0-25	Dark brown topsoil.
25-45	Slightly mottled light/dark brown.
45-52	Black horizon burnt stubble ?
52-64	Grading dark brown into grey white.
64-84	Light grey/brown.
84-97	Changing from light grey/brown to yellow/orange.
97-105	Rusty coloured horizon - very stoney.
105-134	Red-brown sand - mottling red/yellow.
134- 139	Uniform red sand to pit bottom.
139-150	Uniform red sand from augered hole.

- OBSERVATIONS:
1. Soil saturated below 134 cms.
 2. Visible root penetration to 126 cms.



TRIAL PIT AT HEATH HOUSE ACCESS TUBE 1 - 15th April 1980.

Fig A2.3 Heath House Soil Profile Description - Trial Pit at Access Tube 2.

<u>Depth below G.L.</u> (cm)	<u>Horizon Description</u>
0-20	Dark brown topsoil.
20-43	Mottled grey-brown, red patches (and 'ghosts' ?).
43-54	Darker brown layer, mottled.
54-82	Dark brown grading into very light brown.
82-94	Stones and yellow sand.
94-122	Mottled red/orange/white sand - some pebbles.
122-240	Uniform red sand - to 240 cms with auger.

OBSERVATIONS:

1. Seepage line at 110 cm.
2. Visible root penetration to 120 cms.
3. Water level attained 115 cm.
4. Depth dug to reinstate damaged tube - 60 cm.



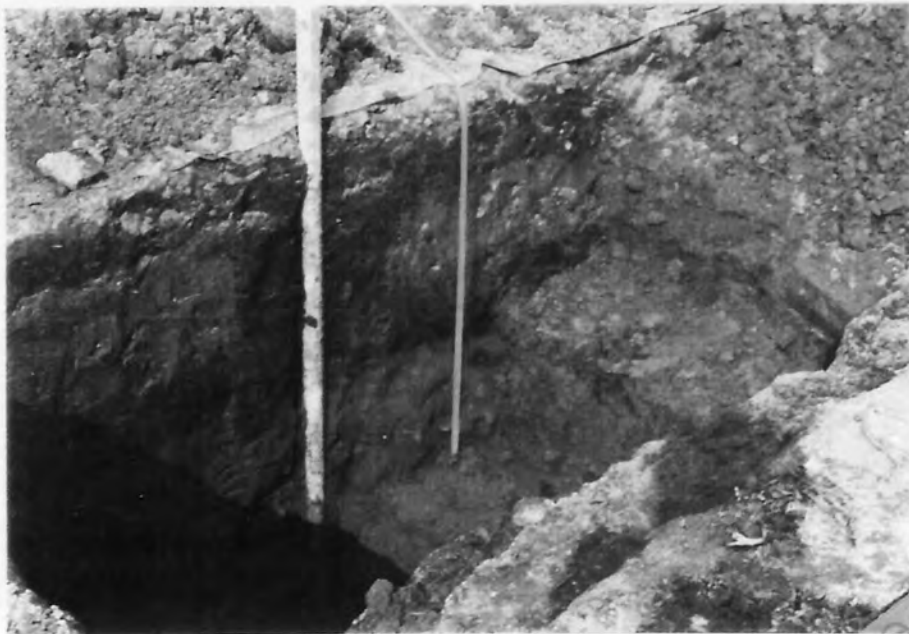
TRIAL PIT AT HEATH HOUSE ACCESS TUBE 2 - 15th April 1980.

Fig A2.4 Heath House Soil Profile Description - Trial Pit at Access Tube 3.

<u>Depth below G.L.</u> (cm)	<u>Horizon Description</u>
0-20	Dark brown topsoil.
20-37	Dark brown mottled with light brown.
37-50	Mottled layer grading into black - contains black 'tongues' from below.
50-58	Black horizon.
58-67	Black grading through dark brown to grey-brown.
67-79	Light brown sand.
79-96	Orange mottled with grey, brown and orange - stoney.
96-115	Predominantly red mottled with light brown.
115-117	Soft light brown sand - seepage zone.
117-127	Orange/red hard sand.
127-150	Predominantly red mottled with light red/brown - hard sand.
150-240	Uniform red sand from auger hole.

OBSERVATIONS:

1. Seepage level 114 cms.
2. Depth to standing water 146 cms.
3. Visible root penetration to 146 cms.
4. Depth dug to reinstate damaged tube 55 cms.



TRIAL PIT AT HEATH HOUSE ACCESS TUBE 3 - 15th April 1980.

Fig A2.5 Heath House Soil Profile Description - Trial Pit at Access Tube 4.

<u>Depth below G.L.</u> (cm)	<u>Horizon Description</u>
0-18	Dark brown topsoil.
18-38	Dark brown - mottled grading into white/brown.
38-59	Light white/brown.
59-80	Orange/red/white brown mottled - high proportion of stones.
80-100	Red sand, slightly mottled orange/white.
100-145	Uniform red sand

- OBSERVATIONS:
1. Water observed 145+ cms with auger.
 2. Visible root penetration to 136 cms.
 3. Depth dug to reinstate damaged tube 60 cms.

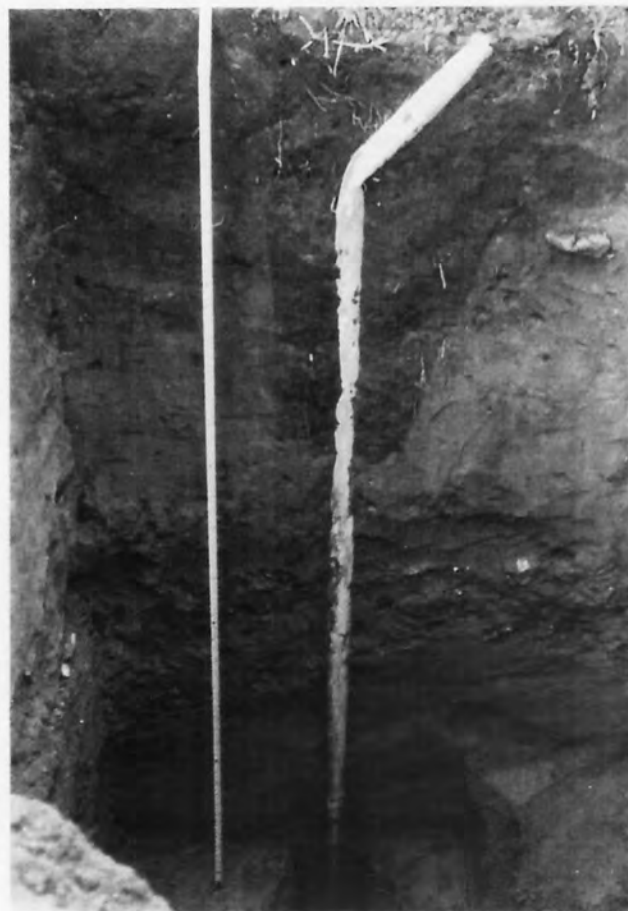


TRIAL PIT AT HEATH HOUSE ACCESS TUBE 4 - 15th April 1980.

Fig A2.6 Heath House Soil Profile Description - Trial Pit at Access Tube 5.

<u>Depth below G.L.</u> (cm)	<u>Horizon Description</u>
0-30	Dark brown topsoil; no structure; a few stones.
30-51	Transition zone - dark brown to yellow brown; distinct oxidation around roots.
51-95	Yellow brown sand, few stones and reasonable root distribution - patches of darker brown around roots.
95-117	Band of redish sand with quite densely packed gravel.
117-185	Pit bottom. Uniform red sand, slightly streaked indicating bedding at approximately 25° to horizontal. A few traces of whiter sand towards bottom of pit.

- OBSERVATIONS:
1. On removal of tube, standing water observed at 238 cm.
 2. Visible root penetration to 180 cms (alongside access tube).
 3. Depth dug to reinstate damaged tube 72 cms.
 4. A few large stones (up to 15cm) encountered throughout profile - none adjacent to access tube.



TRIAL PIT AT HEATH HOUSE ACCESS TUBE 5 - 29th October 1980.

SHROPSHIRE GROUNDWATER SCHEME - TERN AREA - DISTURBED SAMPLES		SITE: HEATH HOUSE										Sp. GRAVITY bulk sample			
SOIL ANALYSIS RESULTS		PARTICLE SIZE DISTRIBUTION - % PASSING GIVEN SIEVE SIZE										line fraction			
TUBE No.	DEPTH below GL (cm)	2mm	1.18mm	600µm	300µm	212µm	150µm	63µm	20µm	6µm	2µm	ORGANIC CONTENT (%)	pH	Sp. GRAVITY bulk sample	Sp. GRAVITY line fraction
1	0 - 25	99.51	98.41	79.95	61.51	43.98	24.59	9.8	6	4.8	3.3	6.75	2.57	2.61	2.61
	25 - 45	98.35	97.01	79.71	65.23	48.13	28.3	12.18	8	5.6	1.8	7	2.61	2.61	2.61
	45 - 52	99.9	98.45	79.45	63.26	45.82	24.78	12.89	7	4.6	2.1	6.5	2.62	2.62	2.62
	52 - 64	99.87	98.19	76	59.01	40.44	19.07	5.9	1.5	1.5	0.7	6.5	2.64	2.64	2.64
	64 - 84	99.83	98.06	72.7	54.31	35.31	17.54	6.7	4.8	3.7	0.7	6	2.63	2.63	2.63
	84 - 97	99.41	96.76	68.98	50.91	32.1	14.17	3.6	2.1	1.4	0.8	6	2.68	2.68	2.68
	97 - 105	76.92	72.98	57.29	46.43	36.84	19.73	7.4	5.1	4.2	0.5	5.75	2.67	2.67	2.67
	105 - 134	100	99.9	73.05	54.54	43.32	20.74	6.1	5.6	4.4	0.5	6	2.67	2.67	2.67
	134 - 150	100	99.9	69.99	38.6	17.02	5.39	0.9	0.32	0.3	0.3	6	2.67	2.67	2.67
2	0 - 20	97.65	96.81	82.4	66.93	47.91	27.06	13.96	8.3	6.4	4.8	6	2.56	2.56	2.56
	20 - 40	99.94	99.13	84.53	70.09	52.42	32.62	18.89	12.3	9.3	3.7	6	2.58	2.58	2.58
	40 - 60	99.55	97.87	80.85	65.49	47.79	28.2	14.3	11.8	6.3	2.7	5.75	2.61	2.61	2.61
	60 - 80	99.68	97.37	78.58	61.31	40.07	18.92	6.7	2.5	0.7	99.02	6	2.63	2.63	2.63
	80 - 100	98.99	97.26	76	58.04	35.92	15.36	3.9	2.2	0.5	0.7	6	2.63	2.63	2.63
	100 - 120	96.06	94.33	73.24	55.03	34.63	14.68	2.5	1.4	0.05	0.5	6	2.65	2.65	2.65
	120 - 140	99.76	99.74	84.71	63.45	34.54	16.38	12.83	11.62	8	0.5	6	2.63	2.63	2.63
	140 - 240	100	99.89	70.93	58.21	36.82	13.24	7.6	6.92	5.93	0.1	5.75	2.66	2.66	2.66
3	0 - 20	99.02	98.77	81.65	65.59	45.63	25.31	15.06	10.95	7.93	3	6	2.53	2.53	2.53
	20 - 37	98.27	96.92	81.98	66.68	47.19	25.23	15	9.68	7.06	0.8	5.75	2.62	2.62	2.62
	37 - 50	99.45	99.27	82.55	66.23	46.96	26.2	13.63	10.59	7.49	1.4	6	2.62	2.62	2.62
	50 - 58	99.93	99.7	82.95	65.13	42.97	20.51	12.15	8.52	6.8	2.9	6	2.62	2.62	2.62
	58 - 67	99.69	98.72	83.48	67.23	47.02	25.57	15.47	10.64	7.38	1.3	6	2.63	2.63	2.63
	67 - 79	99.65	98.59	80.99	62.43	38.39	14.67	8.03	6.05	4.47	0.8	6.25	2.64	2.64	2.64
	79 - 96	99.43	98.15	82.59	64.97	40.67	14.82	8.4	6.73	5.85	0.7	5.75	2.64	2.64	2.64
	96 - 115	100	99.99	96.39	88.44	51.73	11.58	7.05	5.77	4.29	0.3	6	2.64	2.64	2.64
	115 - 117	100	99.97	94.41	74.98	41.38	14.19	9.29	8.04	6.59	0.2	6	2.66	2.66	2.66
	117 - 146	100	99.99	97.26	83.45	46.04	13.46	9.56	8.58	7.55	0.2	6	2.66	2.66	2.66
	146 - 240	100	99.93	94.87	77.66	42.11	12.35	8.09	6.82	5.93	0.1	5.5	2.66	2.66	2.66

SHROPSHIRE GROUNDWATER SCHEME - TERN AREA - DISTURBED SAMPLES

SHROPSHIRE GROUNDWATER SCHEME - TERRA AREA		DISTURBED SAMPLES		HEATH HOUSE										
SOIL ANALYSIS RESULTS		PARTICLE SIZE DISTRIBUTION - % PASSING GIVEN SIEVE SIZE		PARTICLE SIZE DISTRIBUTION - % PASSING GIVEN SIEVE SIZE										
TUBE No.	DEPTH below GL (cm)	1.18mm	600µm	300µm	212µm	150µm	63µm	20µm	6µm	2µm	ORGANIC CONTENT (%)	pH	Sp GRAVITY bulk sample	Sp GRAVITY fine fraction
4	0 - 18	98.54	97	81.18	64.05	44.08	24.23	15.36	11.44	7.83	3.6	6	2.55	2.48
	18 - 38	99.84	97.63	75.3	56.79	36.54	17.93	10.72	7.63	6.12	1.3	6	2.82	2.69
	38 - 59	99.84	96.89	69.51	49.52	29.99	13.73	8.86	6.41	5.15	0.5	6	2.83	2.69
	59 - 80	86.66	83.66	67.19	50.3	28.85	9.16	4.53	3.3	1.9	0.4	6	2.59	2.74
	80 - 100	99.85	99.81	92.12	69.16	32.24	10.43	5.92	4.22	2.69	0.2	6	2.65	2.74
	100 - 146	100	99.95	89.18	67.64	32.98	12.57	6.51	5.03	3.99	0.1	6	2.66	2.84
146 - 180	100	100	89.95	66.93	32.07	12.66	8.46	7.63	6.89	0.04	6	2.64	2.8	
5	0 - 30	95.09	94.9	78.06	62.49	42.93	23.53	11.1	6	4	3.5	6	2.56	2.56
	30 - 51	96.76	96.42	77.65	60.63	40.16	20.46	9.4	4.9	2.6	1.3	6	2.62	2.62
	51 - 95	92.1	92.03	70.94	55.53	36.92	12.61	3.2	1.3	0.2	0.3	6	2.64	2.71
	95 - 117	64.98	64.15	48.41	31.85	15.37	4.5	0.4	0.1	0	0.1	6	2.63	2.64
	117 - 185	100	99.98	89.97	67.57	31.65	9.39	3.3	2.7	1.9	0.3	6	2.64	2.63

Table A2.4 Heath House - Analysis Results for Disturbed Soil Samples.

SHROPSHIRE GROUNDWATER SCHEME - TERN AREA SOIL ANALYSIS RESULTS		HEATH HOUSE		UNDISTURBED SAMPLES		UNDISTURBED SAMPLES		UNDISTURBED SAMPLES		UNDISTURBED SAMPLES		UNDISTURBED SAMPLES		UNDISTURBED SAMPLES	
TUBE No	DEPTH below GL (cm)	BULK DENSITY (gm/cc)	SATURATED CONDUCTIVITY (m/day)	TUBE No	DEPTH below GL (cm)	BULK DENSITY (gm/cc)	SATURATED CONDUCTIVITY (m/day)	TUBE No	DEPTH below GL (cm)	BULK DENSITY (gm/cc)	SATURATED CONDUCTIVITY (m/day)	TUBE No	DEPTH below GL (cm)	BULK DENSITY (gm/cc)	SATURATED CONDUCTIVITY (m/day)
2	0 - 20	1.5	0.806	4	0 - 20	1.53	0.768	5	0 - 20	1.53	3.96				
	20 - 40	1.44	1.53		20 - 40	1.55	2.45		20 - 40	1.55	1.81				
	40 - 60	1.72	0.135		40 - 60	1.64	1.38		40 - 60	1.65	0.87				
	60 - 80	1.63	0.66		60 - 80	1.57	6.05?		60 - 80	1.61	4.71				
	80 - 100	1.78	0.5		80 - 100	1.64	1.88		80 - 100	1.75	1.75				
	100 - 120	1.6	3.08		100 - 120	1.7	0.38		100 - 120	1.86	1.25				
	120 - 140	1.74	0.31		120 - 140	1.75	?		120 - 140	1.79	0.71				
									140 - 160	1.78	0.24				
									160 - 180	1.78	1.14				
									180 - 200	1.75	0.53				

Table A2.5 Heath House - Analysis Results for Undisturbed Soil Samples.

SHROPSHIRE GROUNDWATER SCHEME - TERN AREA									
SOIL ANALYSIS RESULTS									
SITE : HEATH HOUSE									
SOIL					TEXTURE				
TUBE No	DEPTH below GL (cm)	GRAVEL (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	TOTAL SAND (%)	SILT (%)	CLAY (%)	TEXTURE
1	0 - 25	0.49	1.11	36.89	36.92	74.92	19.79	4.8	loamy sand
	25 - 45	1.65	1.34	31.78	36.93	70.05	22.7	5.6	sandy loam
	45 - 52	0.1000000	1.45	35.19	38.48	75.12	20.18	4.6	loamy sand
	52 - 64	0.13	1.68	39.18	39.94	80.8	17.57	1.5	loamy sand
	64 - 84	0.1700000	1.77	43.75	36.77	82.29	13.84	3.7	loamy sand
	84 - 97	0.5900000	2.65	45.85	36.74	85.24	12.77	1.4	sand/loamy sand
	97 - 105	23.08	3.96	26.53	26.7	57.19	15.53	4.2	loamy sand
	105 - 134	0	0.1000000	45.36	33.8	79.26	16.34	4.4	loamy sand
134 - 150	0	0.1000000	61.3	33.21	94.61	5.09	0.3	sand	
TUBE No	DEPTH below GL (cm)	GRAVEL (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	TOTAL SAND (%)	SILT (%)	CLAY (%)	TEXTURE
2	0 - 20	2.15	0.98	29.94	39.87	70.79	20.66	6.4	sandy loam
	20 - 40	0.0600000	0.81	29.04	37.47	67.32	23.32	9.3	sandy loam
	40 - 60	0.4500000	1.68	32.38	37.29	71.35	21.9	6.3	loamy sand
	60 - 80	0.3200000	1.3	37.07	42.39	80.76	18.22	0.7	loamy sand
	80 - 100	1.01	1.73	39.22	42.68	83.63	14.86	0.5	loamy sand
	100 - 120	3.94	1.71	39.32	40.35	81.38	14.63	0.05	sand/loamy sand
	120 - 140	0.24	0.3	36.01	47.07	83.38	8.38	8	loamy sand
	140 - 240	0	0.11	41.68	44.97	86.76	7.31	5.93	sand
TUBE No	DEPTH below GL (cm)	GRAVEL (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	TOTAL SAND (%)	SILT (%)	CLAY (%)	TEXTURE
3	0 - 20	0.9800000	1.33	32.1	40.28	73.71	17.38	7.93	sandy loam
	20 - 37	1.73	1.35	30.24	41.45	73.04	18.17	7.06	sandy loam
	37 - 50	0.55	1.15	32.02	40.08	73.25	18.71	7.49	sandy loam
	50 - 58	0.0700000	1.24	33.51	44.67	79.42	14.23	6.28	loamy sand
	58 - 67	0.3100000	0.97	31.49	41.66	74.12	18.19	7.38	sandy loam
	67 - 79	0.25	1.16	36.16	47.76	85.08	10.2	4.47	loamy sand
	79 - 96	0.5700000	1.28	33.18	50.15	84.61	9.17	5.65	loamy sand
	96 - 115	0	0.0100000	11.55	76.86	89.42	7.29	4.29	sand
	115 - 117	0	0.0300000	25.01	60.77	85.81	7.6	6.59	loamy sand
	117 - 146	0	0.0100000	16.54	69.99	86.54	5.91	7.55	loamy sand
146 - 240	0	0.0700000	22.27	65.31	87.65	6.72	5.63	sand	
TUBE No	DEPTH below GL (cm)	GRAVEL (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	TOTAL SAND (%)	SILT (%)	CLAY (%)	TEXTURE
4	0 - 18	1.46	1.54	32.95	39.82	74.31	16.4	7.83	sandy loam
	18 - 38	0.16	2.21	40.84	38.86	81.91	11.81	6.12	loamy sand
	38 - 59	0.16	2.95	47.37	35.79	86.11	8.58	5.15	loamy sand
	59 - 80	13.34	3	33.36	41.14	77.5	7.26	1.9	sand
	80 - 100	0.1500000	0.26	30.41	58.75	89.42	7.74	2.69	sand
	100 - 146	0	0.0500000	32.31	55.07	87.43	8.58	3.99	sand
	146 - 180	0	0	33.07	54.27	87.34	5.77	6.89	loamy sand
TUBE No	DEPTH below GL (cm)	GRAVEL (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	TOTAL SAND (%)	SILT (%)	CLAY (%)	TEXTURE
5	0 - 30	4.91	1.35	31.25	38.96	71.56	19.53	4	loamy sand
	30 - 51	3.24	1.72	34.41	40.17	76.3	17.86	2.6	loamy sand
	51 - 95	7.3	2.59	34.52	42.98	80.09	12.41	0.2	sand
	95 - 117	35.02	2.01	31.12	27.35	60.48	4.5	0	sand
	117 - 185	0	0.0200000	32.41	58.18	90.61	7.49	1.9	sand

Table A2.6 Heath House - Summary of Particle Size Distributions.

Fig A2.7 Childs Ercall Soil Profile Description - Trial Pit at Access Tube 2.

FACE ADJACENT TO ACCESS TUBE.

<u>Depth below G.L.</u> (cm)	<u>Horizon Description</u>
0-37.	Dark brown topsoil with a few stones.
37-49	Yellow sand with an abundance of stones.
49-85	Predominantly white/grey horizon with black streaks.
85-113	Mottled red/orange/white sand.

- OBSERVATIONS:
1. Cavities against tube:
 - i) small 1x1cm at 46, 15 and 40 cm;
 - ii) large 7cm long x 1cm deep at 41 cm.
 2. Seepage at white/grey horizon (49 to 85 cm).

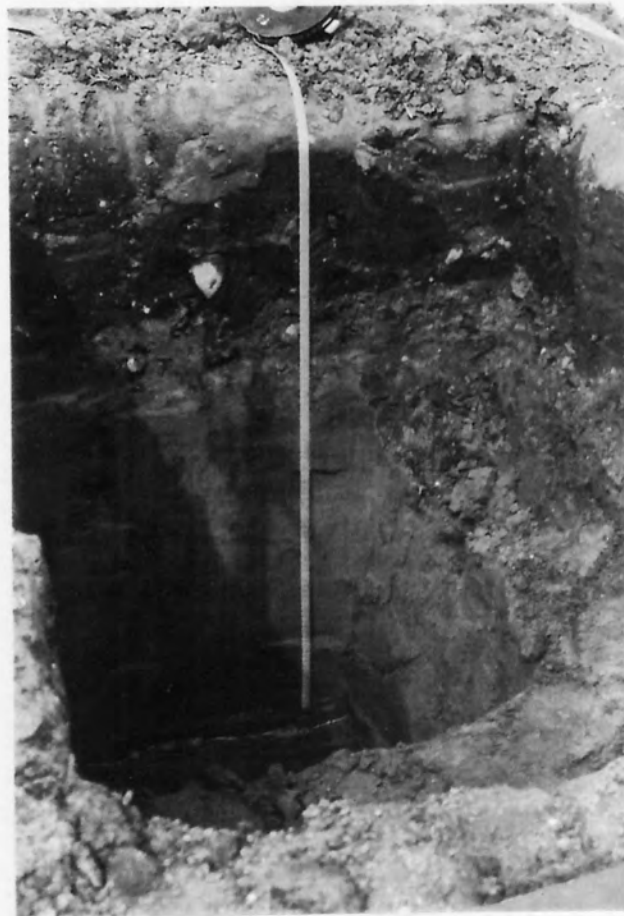


TRIAL PIT AT CHILDS ERCALL ACCESS TUBE 2 - 16th April 1980.

Fig A2.8 Childs Ercall Soil Profile Description - Trial Pit at Access Tube 3.

<u>Depth below G.L.</u> (cm)	<u>Horizon Description</u>
0-42	Dark brown topsoil.
42-63	Band of orange stones and sand.
63-110	Mottled red/white/orange sand.
110-115	Band of hard white sand.
115-128	Band of hard red sand.
128 - ?	Hard red sand from submerged auger hole.

OBSERVATIONS: 1. Seepage at hard white sand horizon (110 to 115 cm).



TRIAL PIT AT CHILDS ERCALL ACCESS TUBE 3 - 16th April 1980.

SHROPSHIRE GROUNDWATER SCHEME - TERN AREA				
SOIL ANALYSIS RESULTS			UNDISTURBED SAMPLES	
SITE :- CHILDS ERCALL				
TUBE No	DEPTH below GL (cm)	BULK DENSITY (gm/cc)	SATURATED CONDUCTIVITY (m/day)	
3	0 - 20	1.52	2.12	
	20 - 40	1.48	1.37	
	40 - 60	1.65	2.33	
	60 - 80	1.74	0.79	
	80 - 100	1.72	0.77	
	100 - 120	?	0.25	

Table A2.8 Child Ercall - Analysis Results for Undisturbed Soil Samples.

SHROPSHIRE GROUNDWATER SCHEME - TERN AREA									
SOIL ANALYSIS RESULTS									
SITE :- CHILDS ERCALL									
TUBE No	DEPTH below GL (cm)	GRAVEL (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	TOTAL SAND (%)	SILT (%)	CLAY (%)	TEXTURE
2	0 - 37	0.9500000	9.16	25.32	25.95	54.43	43.03	1.59	sandy clay
	37 - 49	0.33	4.64	46.35	27.16	78.15	14.52	7	loamy sand
	49 - 85	0	0	68.12	22.19	90.31	8.27	1.42	sand
	85 - 104	0	0.3200000	58.47	20.12	78.91	18.19	2.9	loamy sand
TUBE No	DEPTH below GL (cm)	GRAVEL (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	TOTAL SAND (%)	SILT (%)	CLAY (%)	TEXTURE
3	0 - 41	3.19	2.56	25.88	26.84	55.28	26.25	15.28	sandy loam
	41 - 68	22.21	13.2	24.71	15.45	53.36	19.48	4.95	loamy sand
	68 - 110	0	0.11	53.38	31.88	85.37	8.55	6.08	loamy sand
	110 - 115	0	1.26	29.24	43.4	73.9	17.39	8.71	sandy loam

Table A2.9 Child Ercall - Summary of Particle Size Distributions.

APPENDIX 3

LABORATORY STUDY - RESULTS FROM THE SOIL COLUMNS.

The series of laboratory experiments on soil columns was described in Chapter 6. Appendix 3 presents the data gathered from those experiments, the results of which are summarised in Table A3.1. This table also includes data relating to the studies conducted by undergraduate students under the author's supervision: AS83/1 to AS83/3 (Sargent, 1983); RJ85/1 to RJ85/5 (Jones, 1985); and, MP86/1 to MP86/6 (Parsonage, 1986).

Two sets of recordings were made for each test conducted by the author. The exception to this were those tests undertaken in order to study water table recovery (Sect 6.5: Column Refs 88/H1 to H4), where only one set was made for each.

For all experiments the field capacity moisture profiles and bulk density profiles were obtained when the columns were stripped. These results are presented in Tables A3.2 to A3.26. Figs A3.1, A3.2, A3.3 and A3.4 provide plots of the field capacity moisture profile for each column.

Tables A3.27 to A3.47 are printouts of the spreadsheet records of the drainage data for Cols 87/0 to 87/8 and 88/1 to 88/12 - no drainage information was collected for Cols 88/H1 to 88/H4.

COL REF	TEXTURE	GRAVEL (%)				SAND (%)				SILT (%)				CLAY (%)				BULK DENS. BD (gm/cc)				CRIT. H _c (mm)	Sat Cap. Fr. hc (mm)	Saturated MC. ϕ_s (%)	Residual MC. ϕ_r (%)	EXPERIMENT DURATION (Δt , hrs)	TOT DRAM (gm)	K sat (m/day)	BD (sat test) (gm/cc)	UNF COEF U=d60/d10
		GRAVEL	SAND	SILT	CLAY	BULK DENS. BD	BULK DENS. BD	BULK DENS. BD	BULK DENS. BD	POH	POH	POH	POH	POH	POH	POH	POH	POH	POH											
AS83/1	sand	1	92.8	6.1	0.1	1.45	600	200	29.5	16	2.8	66.5																		
AS83/2	sand	1	92.8	6.1	0.1	1.46	530	190	31.5	15	2.4	57																		
AS83/3	sand	1	92.8	6.1	0.1	1.5	700	150	30.5	19	5	110.5																		
RJ85/1	silty loam	?	?	?	?	1.18	1160	510	32	12.5	4	96																		
RJ85/2	sandy loam	0	68.7	25.6	5.5	1.56	?	800	33	?	?	49																		
RJ85/3	sandy loam	0	68.4	31.1	0.5	1.48	?	?	34	?	?	94																		
RJ85/4	sandy loam	0	73.5	21.8	4.7	1.59	?	940	37.5	?	?	51																		
RJ85/5	sandy loam	0	72.2	21.3	6.5	1.48	?	710	35.5	?	?	194																		
MP86/1	sandy loam	0	73	22	5	1.89	?	680	41	?	?	7																		
MP86/2	sandy loam	0	65	25	10	1.3	?	?	37.5	?	?	7																		
MP86/3	sandy silt loam	0	40	60	0	1.88	?	?	40	?	?	7																		
MP86/4	clay	0	30	40	40	1.88	?	?	36	?	?	7																		
MP86/5	sand	0	99.9	0.1	0	1.67	?	280	24	?	?	Est 5																		
MP86/6	sandy loam	0	72	21	7	1.55	?	?	30	?	?	7																		
87/0	sand	0	97.4	1.2	1.4	1.5	820	160	34.5	7	15	360.8	922.98	5.94	1.51	2.3														
87/1	sand	0.3	95.1	2.1	2.5	1.525	760	140	33.1	9	43	1036.6	813.73	7.21	1.49	2.1														
87/2	sand	0.2	89.6	5.7	4.5	1.57	650	160	36	14.5	46	1098	784.37																	
87/3	sand/loamy sand	0.4	87.1	8.3	4.2	1.61	580	260	31	14	57	1361.7	594.38	4.71	1.55	27.8														
87/4	loamy sand	0	85.6	12.7	1.7	1.55	1500	350	31.9	7.5	42	1066.7	688.42	1.55	1.59	5														
87/5	sand	0	89.3	9	1.7	1.58	1400	150	34	?	14	336.8	799.25																	
87/6	loamy sand	0	79.6	18.2	2.2	1.55	>2000	510	29.2	?	12	293.7	461.07	1.3	1.6	7.1														
87/7	sand	0	93.7	3.5	2.8	1.51	860	250	35.4	8.5	15	361.2	851.66																	
87/8	sand	0.2	98.9	0.2	0.7	1.625	800	320	32.6	5	14	337.3	896.59	5.19	1.63	1.6														
88/1	sand	0	90.2	8	1.8	1.66	1260	320	37.7	6.5	21	508.6	918.34																	
88/2	sand	0	93.7	3.3	3	1.55	800	300	36.3	7	21	508.4	957.91																	
88/3	sand	0	95.5	3	1.5	1.53	770	250	33.6	7	27	649.5	867.47																	
88/4	loamy sand	1	84.2	8.5	6.2	1.57	880	320	32.9	10	27	652.3	737.69	5.52	1.57	50.9														
88/5	loamy sand	0	79.7	17	3.3	1.64	2300	540	31.9	6	19	313.2	566.53	1.03	1.63	9.4														
88/6	sand	0	90	5.4	4.6	1.54	800	290	33.2	8.5	13	314.1	796.4																	
88/7	sand	0	93.9	2.6	3.7	1.55	750	250	32.4	9	16	387.1	758.28																	
88/8	loamy sand	0	79.9	14.7	5.4	1.6	1200	470	29.5	9	16	387.8	560.9	2.75	1.61	13.8														
88/9	loamy sand	0	76.8	22	1.2	1.64	1900	720	34.9	8.5	36	869.8	586.65	0.54	1.6	7.2														
88/10	sand	0	86.9	5.7	5.4	1.58	750	260	36.7	15	36	870.4	780.3	4.19	1.59	5														
88/11	loamy sand	0	84.5	6	9.5	1.61	1500	120	33.4	16	42	1008	502.72	1	1.62	68.6														
88/12	loam sand/sand fm	0	79.2	11.3	9.5	1.53	1570	310	34.2	18.5	42	1014.7	400.18	0.26	1.52	46.7														
88/H3	sand	0	89	8.3	2.7	1.57	1250	340	33.5	6.5	n/a	n/a	n/a	3.84	1.5	3.5														

Table A3.1 Summary of Results Obtained from Soil Column Experiments undertaken between 1983 and 1989 Inclusive.

Soil Moisture Column Drainage Analysis										Experiment Ref No :-	C87/0
Date :-	18/9/87		Column Ref :-	A		W.T. level above base:-	85				
Segment No	Ht Above Base (mm)	Ht Above W.T. (mm)	Wt contrn (gm)	Wt + moist soil (gm)	Wt + dry soil (gm)	Dry Soil (gm)	Bulk Dens (gm/cc)	Wt Water (gm)	Vol Moist Content (%)	<-	Notes
20	1950	1865	7.37	252.1	247.96	240.59	1.61026887	4.14	2.77108434		Soil lost from segment (c
19	1850	1765	5.93	326.48	316.54	310.61	1.49682959	9.94	4.79036145		
18	1750	1665	5.94	326.54	314.45	308.51	1.48670969	12.09	5.82650602		
17	1650	1565	5.97	333.06	319.6	313.63	1.51138297	13.48	6.49638554		
16	1550	1465	6.02	327.12	314.38	308.36	1.48598684	12.74	6.13975904		
15	1450	1365	6	336.27	322.23	316.23	1.52391237	14.04	6.76626506		
14	1350	1265	5.95	330.06	316.18	310.23	1.49499837	13.88	6.68915663		
13	1250	1165	5.95	337.51	322.73	316.78	1.52656282	14.78	7.12289157		
12	1150	1065	5.95	329.06	314.8	308.85	1.48834815	14.26	6.87228916		
11	1050	965	5.97	334.66	319.61	313.64	1.51143116	15.05	7.25301205		
10	950	865	6	329.01	314.62	308.62	1.48723978	14.39	6.93493976		
9	850	765	5.94	335.66	320	314.06	1.51345514	15.66	7.54698795		
8	750	665	5.94	332.69	316.23	310.29	1.49528751	16.46	7.93253012		
7	650	565	5.96	339.96	320.34	314.36	1.51499722	19.62	9.45542169		
6	550	465	6	342.69	317.96	311.96	1.50333524	24.73	11.9180723		
5	450	365	5.99	354.85	322.45	316.46	1.525202074	32.4	15.6144578		
4	350	265	6.05	368.4	318.2	312.15	1.50425085	50.2	24.1927711		
3	250	165	6	383.8	315.14	309.14	1.48974566	68.66	33.0891566		
2	150	65	5.94	385.86	315.13	309.19	1.48998661	70.73	34.0867470		
1	50	-35	5.98	384.78	313.26	307.28	1.48078232	71.52	34.4674699		
MEAN :-							1.50702659		12.2983133		
Final Total (gm) =								508.77			
Col Sat MC (gm) =								1431.75			
Drainage (gm) =								922.98			

Table A3.2 Field Capacity Moisture profile and Bulk Density Data for Col 87/0.

Soil Moisture Column Drainage Analysis										Experiment Ref No :-	C87/1
Date :-	28/8/87		Column Ref :-	A		W.T. level above base:-	88				
Segment No	Ht Above Base (mm)	Ht Above W.T. (mm)	Wt contrn (gm)	Wt + moist soil (gm)	Wt + dry soil (gm)	Dry Soil (gm)	Bulk Dens (gm/cc)	Wt Water (gm)	Vol Moist Content (%)	<-	Notes
20	1950	1862	7.383	298.538	286.313	278.93	1.34416367	12.225	5.891566627		
19	1850	1762	5.937	333.368	318.221	312.284	1.50489660	15.147	7.29975904		
18	1750	1662	5.938	335.914	320.077	314.139	1.51383584	15.837	7.63229916		
17	1650	1562	5.967	325.201	309.772	303.805	1.46403629	15.429	7.43566265		Some Soil Lost
16	1550	1462	6.02	334.001	317.99	311.97	1.50338343	16.01	7.71614458		
15	1450	1362	6.004	338.595	321.301	315.297	1.51941624	17.294	8.33445783		
14	1350	1262	5.954	341.553	323.431	317.477	1.52992166	18.122	8.73349398		
13	1250	1162	5.955	336.053	319.141	313.186	1.50924333	16.912	8.15036145		
12	1150	1062	5.95	339.204	321.214	315.264	1.51925722	17.99	8.66987952		
11	1050	962	5.97	342.433	323.362	317.392	1.52951205	19.071	9.19084337		
10	950	862	6.002	344.501	324.61	318.608	1.53537195	19.891	9.58602410		
9	850	762	5.932	337.582	318.688	312.756	1.50717116	18.894	9.10554217		
8	750	662	5.942	350.363	329.05	323.108	1.55705745	21.313	10.2713253		
7	650	562	5.952	346.75	323.706	317.754	1.53125653	23.044	11.1055422		
6	550	462	5.999	345.598	318.526	312.527	1.50606761	27.072	13.0467470		
5	450	362	5.989	363.98	325.284	319.295	1.53868260	38.696	18.6486747		
4	350	262	6.044	376.886	324.908	318.864	1.53660562	51.978	25.0496386		
3	250	162	6.011	378.311	317.561	311.55	1.50135945	60.75	29.2771084		
2	150	62	5.959	391.33	325.794	319.835	1.54128486	65.536	31.5836145		
1	50	-38	5.985	392.678	323.973	317.988	1.53238417	68.705	33.1108434		
MEAN :-							1.51124539		13.4919759		
Final Total (gm) =								559.917			
Col Sat MC (gm) =								1373.65			
Drainage (gm) =								813.733			

Table A3.3 Field Capacity Moisture profile and Bulk Density Data for Col 87/1.

Soil Moisture Column Drainage Analysis							Experiment Ref No :-	C87/2		
Date :-	28/8/87		Column Ref	B		W.T. level above base:-	57			
Segment No	Ht Above Base (mm)	Ht Above W.T. (mm)	Wt contrn (gm)	Wt + moist soil (gm)	Wt + dry soil (gm)	Dry Soil (gm)	Bulk Dens (gm/cc)	Wt Water (gm)	Vol Moist Content (%)	
20	1950	1893	5.929	349.654	326.271	320.342	1.54372810	23.383	11.2689157	
19	1850	1793	7.365	359.82	335.151	327.786	1.57960073	24.669	11.8886747	
18	1750	1693	5.935	349.995	325.283	319.348	1.53893801	24.712	11.9093976	
17	1650	1593	5.964	355.018	328.881	322.917	1.55613702	26.137	12.5961446	
16	1550	1493	6.016	353.967	327.422	321.406	1.54885551	26.545	12.7927711	
15	1450	1393	6	354.446	327.319	321.319	1.54843626	27.127	13.0732530	
14	1350	1293	5.953	358.758	330.75	324.797	1.56519674	28.008	13.4978313	
13	1250	1193	5.953	360.81	332.037	326.084	1.57139880	28.773	13.8665060	
12	1150	1093	5.947	351.896	323.255	317.308	1.52910725	28.641	13.8028916	
11	1050	993	5.971	361.952	332.432	326.461	1.57321556	29.52	14.2265060	
10	950	893	5.999	358.865	329.115	323.116	1.56709600	29.75	14.3373494	
9	850	793	5.934	359.995	329.797	323.863	1.56069580	30.198	14.5532530	
8	750	693	5.939	361.235	330.764	324.825	1.56533167	30.471	14.6848193	
7	650	593	5.954	364.247	333.342	327.388	1.57768277	30.905	14.8939759	
6	550	493	6	354.384	324.05	318.05	1.53268295	30.334	14.6187952	
5	450	393	5.992	373.7	338.341	332.349	1.60158983	35.359	17.0404819	
4	350	293	6.05	378.25	328.065	322.015	1.55179028	50.185	24.1855422	
3	250	193	6.024	400.238	335.636	329.612	1.58840023	64.602	31.1334940	
2	150	93	5.991	398.039	332.45	326.459	1.57320592	65.589	31.6091566	
1	50	-7	5.966	404.462	329.735	323.769	1.56024281	74.727	36.0130120	
							MEAN :-	1.56116661	17.0996386	
							Final Total (gm) =	709.635		
							Col Sat MC (gm) =	1494		
							Drainage (gm) =	784.365		

Table A3.4 Field Capacity Moisture profile and Bulk Density Data for Col 87/2.

Soil Moisture Column Drainage Analysis							Experiment Ref No :-	C87/3		
Date :-	18/9/87		Column Ref	C		W.T. level above base:-	79			
Segment No	Ht Above Base (mm)	Ht Above W.T. (mm)	Wt contrn (gm)	Wt + moist soil (gm)	Wt + dry soil (gm)	Dry Soil (gm)	Bulk Dens (gm/cc)	Wt Water (gm)	Vol Moist Content (%)	
20	1950	1871	7.375	356.411	332.411	325.036	1.56634848	24	11.5662651	
19	1850	1771	5.938	363.002	339.211	333.273	1.60604259	23.791	11.4655422	
18	1750	1671	5.94	348.504	325.203	319.263	1.53852840	23.301	11.2293976	
17	1650	1571	5.973	353.588	329.437	323.464	1.55877302	24.151	11.6390361	
16	1550	1471	6.02	364.281	338.584	332.564	1.60262592	25.697	12.3840964	
15	1450	1371	6.008	355.432	329.679	323.671	1.55977055	25.753	12.4110843	
14	1350	1271	5.956	368.974	341.89	335.734	1.61790215	27.284	13.1489157	
13	1250	1171	5.956	365.81	338.075	332.119	1.60048146	27.735	13.3662651	
12	1150	1071	5.953	367.344	339.012	333.059	1.60501132	28.332	13.6539759	
11	1050	971	5.977	365.982	337.529	331.552	1.59774909	28.453	13.7122892	
10	950	871	6.004	369.06	340.078	334.074	1.60990261	28.982	13.9672289	
9	850	771	5.934	372.328	342.416	336.482	1.62150676	29.912	14.4154217	
8	750	671	5.943	365.393	336.619	330.676	1.59352764	28.774	13.8669880	
7	650	571	5.954	371.044	341.03	335.076	1.61473124	30.014	14.4645783	
6	550	471	6.002	368.727	338.223	332.221	1.60097300	30.504	14.7007229	
5	450	371	5.996	374.868	337.561	331.565	1.59781173	37.307	17.9792771	
4	350	271	6.044	410.086	347.78	341.736	1.64682578	62.306	30.0269880	
3	250	171	6.008	397.869	335.156	329.148	1.58816421	62.713	30.2231325	
2	150	71	5.943	406.235	343.502	337.559	1.62669682	62.733	30.2327711	
1	50	-29	5.979	401.434	336.902	330.923	1.59471794	64.532	31.0997590	
							MEAN :-	1.59730454	16.7776867	
							Final Total (gm) =	696.274		
							Col Sat MC (gm) =	1290.65		
							Drainage (gm) =	594.376		

Table A3.5 Field Capacity Moisture profile and Bulk Density Data for Col 87/3.

Soil Moisture Column Drainage Analysis							Experiment Ref No :-	C87/4		
Date :-		9:9:1987		Column Ref	D		W.T. level above base:-	70		
Segment No	Ht Above Base (mm)	Ht Above W.T. (mm)	Wt contrn (gm)	Wt + moist soil (gm)	Wt + dry soil (gm)	Dry Soil (gm)	Bulk Dens (gm/cc)	Wt Water (gm)	Vol Moist Content (%)	
20	1950	1880	5.978	340.224	326.451	320.475	1.54436902	13.773	6.63759036	
19	1850	1780	6.091	340.58	326.658	320.567	1.54481237	13.922	6.70939759	
18	1750	1680	5.995	339.418	325.101	319.106	1.53777181	14.317	6.89975904	
17	1650	1580	6.024	343.188	328.264	322.24	1.55287456	14.924	7.19228916	
16	1550	1480	5.986	341.994	326.647	320.661	1.54526536	15.347	7.39614458	
15	1450	1380	6.026	341.164	325.342	319.316	1.53878390	15.822	7.62506024	
14	1350	1280	6.027	345.254	328.663	322.636	1.55478288	16.591	7.99566265	
13	1250	1180	6.053	345.13	327.894	321.841	1.55095178	17.236	8.30650602	
12	1150	1080	6.039	343.468	325.341	319.302	1.53871634	18.127	8.73590361	
11	1050	980	6.091	351.1	331.074	324.983	1.56609308	20.026	9.65108434	
10	950	880	6.003	350.567	328.657	322.654	1.55486963	21.91	10.5590361	
9	850	780	6.004	353.563	329.014	323.01	1.55658519	24.549	11.8308434	
8	750	680	5.985	357.82	328.816	322.831	1.55572259	29.004	13.9778313	
7	650	580	6.071	368.772	332.783	326.712	1.57442513	35.989	17.3440964	
6	550	480	6.008	369.525	326.681	320.673	1.54532319	42.844	20.6477108	
5	450	380	6.038	392.878	331.855	325.817	1.57011212	61.023	29.4086747	
4	350	280	5.994	395.027	331.375	325.381	1.56801104	63.652	30.6756627	
3	250	180	6.032	395.683	330.525	324.493	1.56373177	65.158	31.4014458	
2	150	80	6.021	396.663	331.594	325.573	1.56893629	65.069	31.3585542	
1	50	-20	5.992	390.424	324.278	318.286	1.53382023	66.146	31.8775904	
							MEAN :-	1.55329791		15.3115422
							Final Total (gm) =		635.429	
							Col Sat MC (gm) =		1323.85	
							Drainage (gm) =		688.421	

Table A3.6 Field Capacity Moisture profile and Bulk Density Data for Col 87/4.

Soil Moisture Column Drainage Analysis							Experiment Ref No :-	C87/5		
Date :-		5:10:87		Column Ref	A		W.T. level above base:-	105		
Segment No	Ht Above Base (mm)	Ht Above W.T. (mm)	Wt contrn (gm)	Wt + moist soil (gm)	Wt + dry soil (gm)	Dry Soil (gm)	Bulk Dens (gm/cc)	Wt Water (gm)	Vol Moist Content (%)	
20	1950	1845	5.93	344.837	331.62	325.69	1.56950011	13.217	6.36963855	
19	1850	1745	6.067	350.291	336.524	330.457	1.59247228	13.767	6.63469880	
18	1750	1645	5.983	349.003	334.902	328.919	1.58506066	14.101	6.79566265	
17	1650	1545	6.013	344.188	330.027	324.014	1.56142347	14.161	6.82457831	
16	1550	1445	5.977	349.426	334.585	328.808	1.58356195	14.841	7.15228916	
15	1450	1345	6.032	351.608	336.236	330.204	1.59125308	15.37	7.40722892	
14	1350	1245	6.024	344.854	329.408	323.384	1.55838750	15.446	7.44385542	
13	1250	1145	6.067	350.193	333.838	327.571	1.57856465	16.555	7.97831325	
12	1150	1045	6.021	355.903	337.923	331.902	1.59943574	17.98	8.66506024	
11	1050	945	6.055	352.461	333.414	327.359	1.57754302	19.047	9.17927711	
10	950	845	5.988	356.449	335.132	329.144	1.58614494	21.317	10.2732530	
9	850	745	5.993	360.985	336.959	330.966	1.59492515	24.026	11.5787952	
8	750	645	5.992	361.355	333.126	327.134	1.57645875	28.229	13.6043373	
7	650	545	6.062	371.708	335.371	329.309	1.58694007	36.337	17.5118072	
6	550	445	6.007	385.446	338.867	332.86	1.60405234	46.579	22.4477108	
5	450	345	6.063	381.119	334.282	328.219	1.58168736	46.837	22.5720482	
4	350	245	6.03	396.591	335.298	329.268	1.58674249	61.293	29.5387952	
3	250	145	6.075	390.489	334.555	328.48	1.58294512	55.934	26.9561448	
2	150	45	6.015	397.357	331.236	325.221	1.56724000	66.121	31.8655422	
1	50	-55	6.144	409.436	338.846	332.702	1.60329094	70.59	34.0192771	
							MEAN :-	1.58338148		14.7409157
							Final Total (gm) =		611.748	
							Col Sat MC (gm) =		1411	
							Drainage (gm) =		799.252	

Table A3.7 Field Capacity Moisture profile and Bulk Density Data for Col 87/5.

Soil Moisture Column Drainage Analysis										Experiment Ref No :-	C87/6
Date :-		29:9:1987		Column Ref	B	W.T. level above base:-				54	
Segment No	Ht Above Base (mm)	Ht Above W.T. (mm)	Wt contrn (gm)	Wt + moist soil (gm)	Wt + dry soil (gm)	Dry Soil (gm)	Bulk Dens (gm/cc)	Wt Water (gm)	Vol Moist Content (%)	<-	Notes
20	1950	1896	5.952	347.296	333.346	327.394	1.57771169	13.95	6.72289157		Some voids in segment
19	1850	1796	6.07	359.486	341.939	335.869	1.61855271	17.547	8.45638554		
18	1750	1696	5.989	356.05	337.773	331.784	1.59886710	18.277	8.80819277		
17	1650	1596	6.003	367.174	347.224	341.221	1.64434400	19.95	9.61445783		
16	1550	1496	5.973	359.552	338.92	332.947	1.60447159	20.632	9.94313253		
15	1450	1396	6.012	361.926	339.781	333.769	1.60843281	22.145	10.6722892		
14	1350	1296	6.023	371.884	347.629	341.606	1.64619931	24.255	11.6891566		
13	1250	1196	6.051	366.259	340.68	334.629	1.61257715	25.579	12.3272289		
12	1150	1096	6.014	370.646	342.432	336.418	1.62119834	28.214	13.5971084		
11	1050	996	6.053	376.782	345.095	339.042	1.63384340	31.687	15.2708434		
10	950	896	5.984	373.449	339.283	333.299	1.60616788	34.166	16.4655422		
9	850	796	6.002	383.836	344.108	338.106	1.62933281	39.728	19.1460241		
8	750	696	6.006	392.42	345.169	339.163	1.63442650	47.251	22.7715663		
7	650	596	6.056	395.47	341.478	335.422	1.61639862	53.992	26.0202410		
6	550	496	6.004	406.527	347.654	341.651	1.64641135	58.873	28.325301		
5	450	396	6.053	404.311	345.169	339.116	1.63420000	59.142	28.5021687		
4	350	296	6.046	401.836	343.549	337.503	1.62642696	58.287	28.0901205		
3	250	196	6.098	403.133	345.519	339.421	1.63566980	57.614	27.7657831		
2	150	96	6.184	403.505	344.608	338.424	1.63086526	58.897	28.3840864		
1	50	-4	6.286	404.052	343.51	337.224	1.62508246	60.542	29.1768675		
MEAN :-							1.62256899		18.0898313		
Final Total (gm) =								750.728			
Col Sat MC (gm) =								1211.8			
Drainage (gm) =								461.072			

Table A3.8 Field Capacity Moisture profile and Bulk Density Data for Col 87/6.

Soil Moisture Column Drainage Analysis										Experiment Ref No :-	C87/7
Date :-		6:10:1987		Column Ref	C	W.T. level above base:-				85	
Segment No	Ht Above Base (mm)	Ht Above W.T. (mm)	Wt contrn (gm)	Wt + moist soil (gm)	Wt + dry soil (gm)	Dry Soil (gm)	Bulk Dens (gm/cc)	Wt Water (gm)	Vol Moist Content (%)	<-	Notes
20	1950	1865	5.945	319.419	305.325	299.38	1.44271222	14.094	6.79228916		
19	1850	1765	6.06	332.7	317.334	311.274	1.50002941	15.366	7.40530120		
18	1750	1665	5.972	332.225	316.411	310.439	1.49600554	15.814	7.62120482		
17	1650	1565	5.997	332.928	316.951	310.954	1.49848733	15.977	7.69975904		
16	1550	1465	5.965	334.647	318.263	312.298	1.50496406	16.384	7.89590361		
15	1450	1365	6.012	332.646	316.225	310.213	1.49491645	16.421	7.91373494		
14	1350	1265	6.017	334.735	318.212	312.195	1.50446770	16.523	7.96289157		
13	1250	1165	6.04	336.67	319.657	313.617	1.51132032	17.013	8.19903614		
12	1150	1065	6.016	337.935	320.646	314.63	1.51620197	17.289	8.33204819		
11	1050	965	6.059	338.453	320.942	314.883	1.51742118	17.51	8.43903614		
10	950	865	5.987	337.92	320.187	314.2	1.5141298	17.733	8.54602410		
9	850	765	5.993	339.683	321.346	315.353	1.51968611	18.337	8.83710843		
8	750	665	5.99	339.796	319.735	313.745	1.51193715	20.06	9.66795181		
7	650	565	6.064	345.348	321.208	315.144	1.51867894	24.14	11.6337349		
6	550	465	6.008	358.277	323.295	317.287	1.52900605	34.982	16.8587952		
5	450	365	6.06	369.118	320.461	314.401	1.51509842	48.657	23.4491566		
4	350	265	6.058	391.361	320.373	314.315	1.51468398	70.988	34.2110843		
3	250	165	6.068	393.126	319.654	313.586	1.51117093	73.472	35.4081928		
2	150	65	6.157	393.239	319.823	313.666	1.51155645	73.416	35.3812048		
1	50	-35	6.307	393.047	319.789	313.482	1.51066976	73.258	35.3050602		
MEAN :-							1.50715719		14.8779759		
Final Total (gm) =								617.436			
Col Sat MC (gm) =								1469.1			
Drainage (gm) =								851.664			

Table A3.9 Field Capacity Moisture profile and Bulk Density Data for Col 87/7.

Soil Moisture Column Drainage Analysis								Experiment Ref No :-	C87/8
Date :- 6:10:87		Column Ref :- D			W.T. level above base:-			64	
Segment No	Ht Above Base (mm)	Ht Above W.T. (mm)	Wt contrn (gm)	Wt + moist soil (gm)	Wt + dry soil (gm)	Dry Soil (gm)	Bulk Dens (gm/cc)	Wt Water (gm)	Vol Moist Content (%)
20	1950	1886	7.37	350.365	342.184	334.814	1.61346867	8.181	3.94265060
19	1850	1786	5.936	350.902	342.052	336.116	1.61974300	8.85	4.26506024
18	1750	1686	5.941	353.397	344.112	338.171	1.62964605	9.285	4.47469880
17	1650	1586	5.97	352.22	342.678	336.708	1.62259585	9.542	4.59855422
16	1550	1486	6.019	354.031	344.429	338.41	1.63079779	9.602	4.62746988
15	1450	1386	6.009	353.255	343.565	337.556	1.62668236	9.69	4.66987952
14	1350	1286	5.955	351.95	342.21	336.255	1.62041284	9.74	4.69397590
13	1250	1186	5.957	350.903	340.901	334.944	1.61409514	10.002	4.82024096
12	1150	1086	5.954	353.279	343.11	337.156	1.62475476	10.169	4.90072289
11	1050	986	5.977	351.874	341.781	335.804	1.61823948	10.093	4.86409639
10	950	886	6.005	353.374	343.253	337.248	1.62519811	10.121	4.87759036
9	850	786	5.936	356.586	346.402	340.466	1.64070565	10.184	4.90795181
8	750	686	5.943	358.3	347.458	341.515	1.64576078	10.842	5.22506024
7	650	586	5.952	358.257	345.24	339.288	1.63502887	13.017	6.27325301
6	550	486	6.003	366.25	346.99	340.987	1.64321635	19.26	9.28192771
5	450	386	6.003	375.289	345.195	339.192	1.63456625	30.094	14.5031325
4	350	286	6.074	413.657	348.65	342.576	1.65087374	65.007	31.3286747
3	250	186	6.116	415.331	348.956	342.84	1.65214696	66.375	31.9879518
2	150	86	6.039	412.944	346.284	340.245	1.63964065	66.66	32.1253012
1	50	-14	6.102	415.385	347.789	341.687	1.64658965	67.596	32.5763855
							MEAN :-	1.63170810	10.9472289
							Final Total (gm) =	454.31	
							Col Sat MC (gm) =	1352.9	
							Drainage (gm) =	898.59	

Table A3.10 Field Capacity Moisture profile and Bulk Density Data for Col 87/8.

Soil Moisture Column Drainage Analysis								Experiment Ref No :-	88/1
Date :- 9:8:88		Column Ref :- A			W.T. level above base:-			83.5	
Segment No	Ht Above Base (mm)	Ht Above W.T. (mm)	Wt contrn (gm)	Wt + moist soil (gm)	Wt + dry soil (gm)	Dry Soil (gm)	Bulk Dens (gm/cc)	Wt Water (gm)	Vol Moist Content (%)
20	1950	1866.5	6.013	343.833	333.195	327.182	1.57669006	10.638	5.12674699
19	1850	1766.5	6.035	345.539	334.151	328.116	1.58119100	11.388	5.48819277
18	1750	1666.5	5.969	343.59	331.972	326.003	1.57100846	11.618	5.59903614
17	1650	1566.5	5.972	340.434	328.704	322.732	1.55524551	11.73	6.65301205
16	1550	1466.5	5.995	346.713	334.264	328.269	1.58192831	12.449	5.99951807
15	1450	1366.5	6.018	346.651	333.855	327.837	1.57984650	12.796	6.16674699
14	1350	1266.5	6.051	346.129	333.123	327.072	1.57615997	13.006	6.26795181
13	1250	1166.5	5.967	344.345	330.936	324.969	1.56602561	13.409	6.46216867
12	1150	1066.5	5.994	348.714	334.207	328.213	1.58165845	14.507	6.99132530
11	1050	966.5	5.982	354.172	338.064	332.082	1.60030316	16.108	7.76289157
10	950	866.5	5.963	354.114	336.15	330.187	1.59117115	17.964	8.65734940
9	850	766.5	5.966	355.307	334.733	328.767	1.58432817	20.574	9.91518072
8	750	666.5	5.946	361.257	336.257	330.311	1.59176871	25	12.0481928
7	650	566.5	6.069	371.226	336.835	330.766	1.59396135	34.391	16.5739759
6	550	466.5	6.072	377.375	334.105	328.033	1.58079103	43.27	20.8530120
5	450	366.5	5.95	404.986	336.566	330.616	1.59323850	68.42	32.9734940
4	350	266.5	6.004	414.158	337.906	331.902	1.59943574	76.252	36.7479518
3	250	166.5	6.036	411.966	335.179	329.143	1.58614012	76.787	37.0057831
2	150	66.5	5.946	413.975	336.341	330.395	1.59217350	77.634	37.4139759
1	50	-33.5	5.989	415.548	337.278	331.289	1.59648169	78.27	37.7204819
							MEAN :-	1.58397735	15.5713494
							Final Total (gm) =	646.211	
							Col Sat MC (gm) =	1564.55	
							Drainage (gm) =	918.339	

Table A3.11 Field Capacity Moisture profile and Bulk Density Data for Col 88/1.

Soil Moisture Column Drainage Analysis						Experiment Ref No :-		88/2			
Date :-		9:6:88		Column Ref :-		B		W.T. level above base:-		59	
Segment No	Ht Above Base (mm)	Ht Above W.T. (mm)	Wt contrn (gm)	Wt + moist soil (gm)	Wt + dry soil (gm)	Dry Soil (gm)	Bulk Dens (gm/cc)	Wt Water (gm)	Vol Moist Content (%)	<	Notes
20	1950	1891	5.993	336.863	323.978	317.985	1.53236971	12.885	6.20963855		
19	1850	1791	5.968	338.502	325.051	319.083	1.53766098	13.451	6.48240964		
18	1750	1691	6.026	337.214	323.819	317.793	1.53144447	13.395	6.45542169		
17	1650	1591	5.988	337.282	323.892	317.904	1.53197938	13.39	6.45301205		
16	1550	1491	5.989	339.945	326.28	320.291	1.54348233	13.665	6.58554217		
15	1450	1391	5.965	343.389	329.325	323.36	1.55827184	14.064	6.77783133		
14	1350	1291	5.982	339.958	325.915	319.933	1.54175713	14.043	6.76771084		
13	1250	1191	6.062	339.261	324.95	318.868	1.53672127	14.311	6.89686747		
12	1150	1091	5.985	338.692	324.621	318.636	1.53550688	14.071	6.78120482		
11	1050	991	5.993	337.158	323.111	317.118	1.52819164	14.047	6.76963855		Some soil lost?
10	950	891	5.954	340.497	326.135	320.181	1.54295224	14.362	6.92144578		
9	850	791	5.997	342.179	327.302	321.305	1.54836879	14.877	7.16963855		
8	750	691	5.959	342.977	327.107	321.148	1.54761221	15.87	7.64819277		
7	650	591	5.983	343.726	325.31	319.327	1.53883681	18.416	8.87518072		
6	550	491	5.961	352.124	327.418	321.457	1.54910128	24.706	11.9065060		
5	450	391	5.984	365.837	327.095	321.111	1.54743391	38.742	18.6708434		
4	350	291	5.961	403.135	331.338	325.377	1.56799176	71.797	34.6009639		
3	250	191	5.993	397.89	329.074	323.081	1.55692734	68.816	33.1643373		
2	150	91	5.946	395.634	327.259	321.313	1.54840735	68.375	32.9518072		
1	50	-9	5.973	403.491	328.233	322.26	1.55297094	75.258	36.2689157		
							MEAN :-	1.54389941		13.2178554	
							Final Total (gm) =		548.541		
							Col Sat MC (gm) =		1506.45		
							Drainage (gm) =		957.909		

Table A3.12 Field Capacity Moisture profile and Bulk Density Data for Col 88/2.

Soil Moisture Column Drainage Analysis						Experiment Ref No :-		88/3			
Date :-		14:6:88		Column Ref :-		C		W.T. level above base:-		74	
Segment No	Ht Above Base (mm)	Ht Above W.T. (mm)	Wt contrn (gm)	Wt + moist soil (gm)	Wt + dry soil (gm)	Dry Soil (gm)	Bulk Dens (gm/cc)	Wt Water (gm)	Vol Moist Content (%)	<	Notes
20	1950	1876	5.993	332.536	322.097	316.104	1.52330518	10.439	5.03084337		
19	1850	1776	5.966	330.961	319.231	313.265	1.50962403	11.73	5.65301205		
18	1750	1676	6.024	332.637	320.269	314.245	1.51434665	12.368	5.96048193		
17	1650	1576	5.985	336.243	323.17	317.185	1.52851451	13.073	6.30024096		
16	1550	1476	5.988	334.861	321.444	315.456	1.52018246	13.417	6.46602410		
15	1450	1376	5.964	333.832	320.192	314.228	1.51426473	13.64	6.57349398		
14	1350	1276	5.979	335.77	321.843	315.864	1.52214862	13.927	6.71180723		
13	1250	1176	6.059	338.963	324.376	318.317	1.53396962	14.587	7.02987952		
12	1150	1076	5.98	336.927	322.559	316.579	1.52559420	14.368	6.92433735		
11	1050	976	5.99	338.07	323.829	317.839	1.53186614	14.241	6.86313253		
10	950	876	5.951	341.305	326.587	320.636	1.54514488	14.718	7.09301205		
9	850	776	5.994	336.095	321.466	315.472	1.52025957	14.629	7.05012048		
8	750	676	5.955	337.825	322.438	316.483	1.52513158	15.387	7.41542169		
7	650	576	5.98	345.09	326.372	320.392	1.54396905	18.718	9.0202289		
6	550	476	5.958	349.877	324.42	318.462	1.53466838	25.457	12.2684337		
5	450	376	5.983	360.786	323.265	317.282	1.52898196	37.52	18.0824096		
4	350	276	5.963	390.113	326.842	320.879	1.54831590	63.271	30.4920482		
3	250	176	5.996	393.397	326.084	320.088	1.54250407	67.313	32.44		
2	150	76	5.961	394.023	325.51	319.549	1.53990663	68.513	33.0183139		
1	50	-24	5.995	394.369	324.751	318.756	1.53608516	69.618	33.5508434		
							MEAN :-	1.52932917		12.6972289	
							Final Total (gm) =		526.935		
							Col Sat MC (gm) =		1394.4		
							Drainage (gm) =		867.465		

Table A3.13 Field Capacity Moisture profile and Bulk Density Data for Col 88/3.

Soil Moisture Column Drainage Analysis							Experiment Ref No :- 88/4			
Date :- 14:6:88		Column Ref :D			W.T. level above base:- 69					
Segment No	Ht Above Base (mm)	Ht Above W.T. (mm)	Wt contnr (gm)	Wt + moist soil (gm)	Wt + dry soil (gm)	Dry Soil (gm)	Bulk Dens (gm/cc)	Wt Water (gm)	Vol Moist Content (%)	
20	1950	1881	6.011	349.097	333.039	327.028	1.57594793	16.058	7.73879518	
19	1850	1781	6.033	348.441	331.693	325.66	1.56935554	16.748	8.07132530	
18	1750	1681	5.957	347.816	330.319	324.362	1.56310048	17.497	8.43228916	
17	1650	1581	5.975	348.745	330.658	324.683	1.56464738	18.087	8.71662651	
16	1550	1481	5.994	353.791	334.838	328.844	1.58469924	18.953	9.13397590	
15	1450	1381	6.018	352.587	333.303	327.285	1.57718641	19.284	9.29349398	
14	1350	1281	6.049	353.707	334.008	327.959	1.58043442	19.699	9.49349398	
13	1250	1181	5.97	352.05	332.043	326.073	1.57134579	20.007	9.64192771	
12	1150	1081	5.995	353.329	332.866	326.871	1.57519135	20.463	9.86168675	
11	1050	981	5.982	357.276	336.046	330.064	1.59057842	21.23	10.2313253	
10	950	881	5.962	354.026	332.549	326.587	1.57382275	21.477	10.3503614	
9	850	781	5.967	354.752	332.594	326.627	1.57401551	22.158	10.6785542	
8	750	681	5.95	355.113	331.74	325.79	1.56998201	23.373	11.2640964	
7	650	581	6.072	358.002	332.461	326.389	1.57286859	25.541	12.3089157	
6	550	481	6.075	365.218	334.107	328.032	1.58078621	31.111	14.9932530	
5	450	381	5.951	383.503	337.197	331.246	1.59627447	46.306	22.3161446	
4	350	281	6.012	396.794	329.883	323.871	1.56073435	66.91	32.2462651	
3	250	181	6.042	397.749	330.444	324.402	1.56329324	67.305	32.4361446	
2	150	81	5.976	397.764	330.552	324.576	1.56413174	67.212	32.3913253	
1	50	-19	6.008	397.849	329.604	323.596	1.55940912	68.245	32.8851566	
							MEAN :-	1.57339025		15.1244578
							Final Total (gm) =		827.665	
							Col Sat MC (gm) =		1365.35	
							Drainage (gm) =		737.685	

Table A3.14 Field Capacity Moisture profile and Bulk Density Data for Col 88/4.

Soil Moisture Column Drainage Analysis							Experiment Ref No :- 88/5			
Date :- 4:7:88		Column Ref :A			W.T. level above base:- 82.5					
Segment No	Ht Above Base (mm)	Ht Above W.T. (mm)	Wt contnr (gm)	Wt + moist soil (gm)	Wt + dry soil (gm)	Dry Soil (gm)	Bulk Dens (gm/cc)	Wt Water (gm)	Vol Moist Content (%)	
20	1950	1867.5	6.013	350.236	334.371	328.358	1.58235720	15.865	7.64578313	
19	1850	1767.5	6.032	360.615	344.026	337.994	1.62879309	16.589	7.99469880	
18	1750	1667.5	5.954	366.208	348.48	342.526	1.65063279	17.728	8.54361446	
17	1650	1567.5	5.973	361.396	343.167	337.194	1.62493789	18.229	8.78506024	
16	1550	1467.5	5.995	365.092	345.675	339.68	1.63691792	19.417	9.35759036	
15	1450	1367.5	6.018	367.118	346.38	340.362	1.64020448	20.738	9.99421687	
14	1350	1267.5	6.049	366.316	344.278	338.229	1.62992555	22.038	10.6207229	
13	1250	1167.5	5.988	370.873	346.717	340.749	1.64206943	24.156	11.6414458	
12	1150	1067.5	5.993	371.422	345.29	339.297	1.63507224	26.132	12.5937349	
11	1050	967.5	5.98	371.52	343.147	337.167	1.62480777	28.373	13.6737349	
10	950	867.5	5.963	381.367	348.593	342.63	1.65113397	32.774	15.7946988	
9	850	767.5	5.964	382.831	345.916	339.952	1.63822869	36.915	17.7903614	
8	750	667.5	5.944	391.85	347.427	341.483	1.64560658	44.223	21.3122892	
7	650	567.5	6.067	411.899	351.232	345.165	1.66335013	60.667	29.2371084	
6	550	467.5	6.072	407.559	345.423	339.351	1.63533247	62.136	29.9450602	
5	450	367.5	5.949	409.526	349.768	343.819	1.65686376	59.758	28.7990361	
4	350	267.5	6.015	407.087	346.892	340.877	1.64268626	60.195	29.0096386	
3	250	167.5	6.048	409.475	346.785	340.737	1.64201160	62.69	30.2120482	
2	150	67.5	5.962	407.74	345.343	339.381	1.63547704	62.397	30.0708434	
1	50	-32.5	5.998	418.951	352.753	346.755	1.67101234	66.198	31.9026506	
							MEAN :-	1.63887106		18.2462169
							Final Total (gm) =		757.218	
							Col Sat MC (gm) =		1323.85	
							Drainage (gm) =		566.632	

Table A3.15 Field Capacity Moisture profile and Bulk Density Data for Col 88/5.

Soil Moisture Column Drainage Analysis						Experiment Ref No :-	88/6				
Date :-		4:7:88		Column Ref	B	W.T. level above base:-		53			
Segment No	Ht Above Base (mm)	Ht Above W.T. (mm)	Wt contrn (gm)	Wt + moist soil (gm)	Wt + dry soil (gm)	Dry Soil (gm)	Bulk Dens (gm/cc)	Wt Water (gm)	Vol Moist Content (%)		
20	1950	1897	5.993	337.3	320.781	314.798	1.51696337	16.519	7.96096386		
19	1850	1797	5.967	339.89	322.845	316.878	1.52703508	17.045	8.21445783		
18	1750	1697	6.024	338.073	321.365	315.341	1.51962828	16.708	8.05204819		
17	1650	1597	5.984	339.518	322.622	316.638	1.52587852	16.896	8.14265060		
16	1550	1497	5.987	343.083	325.652	319.665	1.54046563	17.431	8.40048193		
15	1450	1397	5.963	342.08	324.615	318.652	1.53558399	17.465	8.41686747		
14	1350	1297	5.98	343.132	325.939	319.959	1.54188242	17.193	8.28578313		
13	1250	1197	6.06	340.981	323.464	317.404	1.52956988	17.517	8.44192771		
12	1150	1097	5.982	340.171	322.763	316.781	1.52656784	17.408	8.38939759		
11	1050	997	5.99	340.84	323.185	317.195	1.52856270	17.655	8.50843373		
10	950	897	5.952	342.306	324.241	318.289	1.53383469	18.065	8.70602410		
9	850	797	5.996	345.304	327.212	321.216	1.54793990	18.092	8.71903614		
8	750	697	5.955	347.426	328.297	322.342	1.55336610	19.129	9.21879518		
7	650	597	5.981	347.684	326.751	320.77	1.54579063	20.933	10.0881928		
6	550	497	5.96	353.523	326.966	321.006	1.54692791	26.557	12.7985542		
5	450	397	5.982	364.402	327.334	321.352	1.54859529	37.068	17.8640964		
4	350	297	5.966	394.736	330.343	324.377	1.56317276	64.393	31.0327711		
3	250	197	5.995	397.73	328.742	322.747	1.55531779	68.988	33.2472289		
2	150	97	5.964	394.512	327.079	321.115	1.54745318	67.433	32.4978313		
1	50	-3	6.001	399.846	330.937	324.936	1.56586658	68.909	33.2091566		
MEAN :-							1.54002012	14.0097349			
Final Total (gm) =							581.404				
Col Sat MC (gm) =							1377.8				
Drainage (gm) =							796.396				

Table A3.16 Field Capacity Moisture profile and Bulk Density Data for Col 88/6.

Soil Moisture Column Drainage Analysis						Experiment Ref No :-	88/7				
Date :-		7:7:88		Column Ref	C	W.T. level above base:-		80			
Segment No	Ht Above Base (mm)	Ht Above W.T. (mm)	Wt contrn (gm)	Wt + moist soil (gm)	Wt + dry soil (gm)	Dry Soil (gm)	Bulk Dens (gm/cc)	Wt Water (gm)	Vol Moist Content (%)		
20	1950	1870	6.011	340.886	324.152	318.141	1.53312148	16.734	8.06457831		
19	1850	1770	6.033	343.167	326.272	320.239	1.54323174	16.895	8.14216867		
18	1750	1670	5.954	344.061	326.692	320.738	1.54563642	17.369	8.37060241		
17	1650	1570	5.974	342.854	325.156	319.182	1.53813806	17.698	8.52915663		
16	1550	1470	5.995	343.983	326.255	320.26	1.54333294	17.728	8.54361446		
15	1450	1370	6.019	347.198	328.416	322.397	1.55363114	18.782	9.05156627		
14	1350	1270	6.05	343.138	324.321	318.271	1.53374795	18.817	9.06843373		
13	1250	1170	5.971	344.506	326.472	320.501	1.54449432	18.034	8.69108434		
12	1150	1070	5.991	345.535	326.994	321.003	1.54691346	18.541	8.93542169		
11	1050	970	5.98	347.939	329.039	323.059	1.55682132	18.9	9.10843373		
10	950	870	5.965	348.964	330.299	324.334	1.56296555	18.665	8.99518072		
9	850	770	5.966	350.118	330.654	324.688	1.56467147	19.464	9.38024096		
8	750	670	5.948	347.737	327.669	321.721	1.55037350	20.068	9.67132530		
7	650	570	6.068	351.747	330.133	324.065	1.56166923	21.614	10.4163855		
6	550	470	6.078	357.471	330.29	324.212	1.56237763	27.181	13.0992771		
5	450	370	5.951	368.17	329.431	323.48	1.55885012	38.739	18.6693976		
4	350	270	6.017	393.894	331.957	325.94	1.57070486	61.937	29.8491566		
3	250	170	6.053	398.127	332.262	326.209	1.57200117	65.865	31.7421687		
2	150	70	5.965	396.687	330.594	324.629	1.56438715	66.093	31.8520482		
1	50	-30	6.007	397.833	330.637	324.63	1.56439197	67.196	32.3836145		
MEAN :-							1.55357307	14.1281928			
Final Total (gm) =							586.32				
Col Sat MC (gm) =							1344.6				
Drainage (gm) =							758.28				

Table A3.17 Field Capacity Moisture profile and Bulk Density Data for Col 88/7.

Soil Moisture Column Drainage Analysis							Experiment Ref No :-	88/8		
Date :- 17:7:88		Column Ref: D			W.T. level above base:-			54		
Segment No	Ht Above Base (mm)	Ht Above W.T. (mm)	Wt contnr (gm)	Wt + moist soil (gm)	Wt + dry soil (gm)	Dry Soil (gm)	Bulk Dens (gm/cc)	Wt Water (gm)	Vol Moist Content (%)	
20	1950	1896	5.994	356.373	339.542	333.548	1.60736781	16.831	8.11132530	
19	1850	1796	5.97	354.122	337.191	331.221	1.59815400	16.931	8.15951807	
18	1750	1696	6.025	357.94	340.182	334.157	1.61030258	17.758	8.55807229	
17	1650	1596	5.988	351.004	333.411	327.423	1.57785144	17.593	8.47855422	
16	1550	1496	5.987	352.894	334.977	328.99	1.58540281	17.917	8.63469880	
15	1450	1396	5.965	357.846	339.292	333.327	1.60630281	18.554	8.94168675	
14	1350	1296	5.98	356.331	337.707	331.727	1.59889241	18.624	8.97542169	
13	1250	1196	6.062	351.883	333.1	327.038	1.57599612	18.583	8.95566265	
12	1150	1096	5.983	357.584	337.96	331.977	1.59979716	19.624	9.45734940	
11	1050	996	5.99	358.038	337.143	331.153	1.59582631	20.895	10.0698795	
10	950	896	5.952	359.454	336.648	330.696	1.59362402	22.806	10.9908434	
9	850	796	5.981	364.337	338.405	332.424	1.60195126	25.932	12.4973494	
8	750	696	5.994	370.179	339.887	333.893	1.60903037	30.292	14.5985542	
7	650	596	5.958	374.69	338.318	332.36	1.60164284	36.372	17.5286747	
6	550	496	5.96	400.874	342.988	337.028	1.62413793	57.886	27.8968675	
5	450	396	5.986	405.196	343.594	337.608	1.62893295	61.602	29.6877108	
4	350	296	5.982	399.624	337.764	331.782	1.59885746	61.86	29.8120482	
3	250	196	6.025	404.875	343.696	337.671	1.62723655	61.179	29.4838554	
2	150	96	5.978	404.062	343.143	337.165	1.62479813	60.919	29.3585542	
1	50	-4	6.017	402.649	341.454	335.437	1.61647090	61.195	29.4915663	
							MEAN :-	1.60391379		15.9844096
							Final Total (gm) =		663.353	
							Col Sat MC (gm) =		1224.25	
							Drainage (gm) =		560.897	

Table A3.18 Field Capacity Moisture profile and Bulk Density Data for Col 88/8.

Soil Moisture Column Drainage Analysis							Experiment Ref No :-	88/9		
Date :- 22:8:88		Column Ref: A			W.T. level above base:-			76		
Segment No	Ht Above Base (mm)	Ht Above W.T. (mm)	Wt contnr (gm)	Wt + moist soil (gm)	Wt + dry soil (gm)	Dry Soil (gm)	Bulk Dens (gm/cc)	Wt Water (gm)	Vol Moist Content (%)	
20	1950	1874	6.138	356.436	337.506	331.37	1.59687203	18.93	9.12289157	
19	1850	1774	6.157	364.75	345.774	339.617	1.63661432	18.976	9.14506024	
18	1750	1674	6.075	363.107	343.245	337.17	1.62482223	19.862	9.57204819	
17	1650	1574	6.097	371.487	349.839	343.742	1.65649270	21.648	10.4327711	
16	1550	1474	6.117	368.146	345.283	339.156	1.63444095	22.863	11.0183133	
15	1450	1374	6.145	365.732	341.812	335.667	1.61757927	23.92	11.5277108	
14	1350	1274	6.173	377.293	349.946	343.773	1.65664209	27.347	13.1792771	
13	1250	1174	6.094	375.361	346.424	340.33	1.64005027	28.937	13.9455422	
12	1150	1074	6.118	374.489	343.584	337.466	1.62624865	30.905	14.8939759	
11	1050	974	6.103	383.041	347.769	341.666	1.64648845	35.272	16.9985542	
10	950	874	6.088	387.059	347.953	341.865	1.64744743	39.106	18.8462651	
9	850	774	6.088	391.706	346.561	340.473	1.64073939	45.145	21.7566265	
8	750	674	6.068	418.705	353.354	347.286	1.67357123	65.351	31.4944578	
7	650	574	6.192	411.247	345.948	339.756	1.63728416	65.299	31.4693976	
6	550	474	6.201	414.055	348.367	342.166	1.64889795	65.688	31.6568675	
5	450	374	6.076	417.45	350.046	343.97	1.65759143	67.404	32.4838554	
4	350	274	6.148	413.835	349.559	343.411	1.65489761	64.276	30.9763855	
3	250	174	6.184	415.755	352.435	346.251	1.66858357	63.32	30.5156827	
2	150	74	6.107	417.084	352.114	346.007	1.66740773	64.97	31.3108434	
1	50	-26	6.138	424.725	352.245	346.107	1.66788963	72.48	34.9301205	
							MEAN :-	1.64502808		20.7638313
							Final Total (gm) =		861.699	
							Col Sat MC (gm) =		1448.35	
							Drainage (gm) =		586.651	

Table A3.19 Field Capacity Moisture profile and Bulk Density Data for Col 88/9.

Soil Moisture Column Drainage Analysis							Experiment Ref No :-	88/10		
Date :-	22:8:88		Column Ref:	B		W.T. level above base:-	54			
Segment No	Ht Above Base (mm)	Ht Above W.T. (mm)	Wt contrn (gm)	Wt + moist soil (gm)	Wt + dry soil (gm)	Dry Soil (gm)	Bulk Dens (gm/cc)	Wt Water (gm)	Vol Moist Content (%)	
20	1950	1896	6.116	354.104	330.697	324.581	1.56415584	23.407	11.2804819	
19	1850	1796	6.091	355.934	331.124	325.033	1.56633403	24.81	11.9566265	
18	1750	1696	6.149	359.194	333.897	327.748	1.57941761	25.297	12.1913253	
17	1650	1596	6.11	359.664	332.295	326.185	1.57188551	27.369	13.1898795	
16	1550	1496	6.11	357.772	329.537	323.427	1.55859471	28.235	13.6072289	
15	1450	1396	6.088	367.373	337.84	331.752	1.59871289	29.533	14.2327711	
14	1350	1296	6.102	361.346	332.517	326.415	1.57299388	28.829	13.8934940	
13	1250	1196	6.187	361.122	331.175	324.988	1.56611717	29.947	14.4322892	
12	1150	1096	6.107	364.865	336.285	330.178	1.59112778	28.58	13.7734940	
11	1050	996	6.116	367.503	334.439	328.323	1.58218854	33.064	15.9344578	
10	950	896	6.076	361.369	329.425	323.349	1.55821883	31.944	15.3946988	
9	850	796	6.105	366.988	336.696	330.591	1.59311803	30.292	14.5985542	
8	750	696	6.121	364.063	333.453	327.332	1.57741291	30.61	14.7518072	
7	650	596	6.079	364.86	331.957	325.878	1.57040608	32.903	15.8568675	
6	550	496	6.09	375.627	339.94	333.85	1.60882315	35.687	17.1985542	
5	450	396	6.126	371.471	335.95	329.824	1.58942186	35.52	17.1185542	
4	350	296	6.115	394.838	335.336	329.221	1.58651600	59.502	28.6756627	
3	250	196	6.163	405.289	340.363	334.2	1.6105098	64.926	31.2896386	
2	150	96	6.13	405.131	339.074	332.944	1.60445714	66.057	31.8346988	
1	50	-4	6.158	412.323	336.088	329.93	1.58993267	76.235	36.7397590	
							MEAN :-	1.58201722	17.8975422	
							Final Total (gm) =	742.748		
							Col Sat MC (gm) =	1523.05		
							Drainage (gm) =	780.302		

Table A3.20 Field Capacity Moisture profile and Bulk Density Data for Col 88/10.

Soil Moisture Column Drainage Analysis							Experiment Ref No :-	88/11		
Date :-	25:8:88		Column Ref:	C		W.T. level above base:-	94			
Segment No	Ht Above Base (mm)	Ht Above W.T. (mm)	Wt contrn (gm)	Wt + moist soil (gm)	Wt + dry soil (gm)	Dry Soil (gm)	Bulk Dens (gm/cc)	Wt Water (gm)	Vol Moist Content (%)	
20	1950	1856	6.104	373.587	340.823	334.719	1.61301086	32.764	15.7898795	
19	1850	1756	6.081	373.06	340.017	333.936	1.60923758	33.043	15.9243973	
18	1750	1656	6.139	373.601	339.082	332.943	1.60445232	34.519	16.6356627	
17	1650	1556	6.1	372.008	336.62	330.52	1.59277588	35.388	17.0544578	
16	1550	1456	6.1	378.634	337.827	331.727	1.59859241	40.807	19.6660241	
15	1450	1356	6.078	370.776	340.775	334.697	1.61290484	30.001	14.4583133	
14	1350	1256	6.093	374.472	337.874	331.781	1.59885264	36.598	17.6375904	
13	1250	1156	6.177	382.158	334.746	328.569	1.58337401	47.412	22.8491566	
12	1150	1056	6.098	378.598	340.26	334.162	1.61032668	38.338	18.4761446	
11	1050	956	6.104	378.64	339.483	333.379	1.60655340	39.157	18.8708434	
10	950	856	6.064	384.924	338.922	332.858	1.60404270	46.002	22.1696386	
9	850	756	6.096	382.617	343.018	336.922	1.62362712	39.599	19.0838554	
8	750	656	6.112	379.937	341.122	335.01	1.61441319	68.815	18.7060241	
7	650	556	6.077	390.561	341.04	334.963	1.61418670	49.52	23.8655422	
6	550	456	6.085	387.774	345.597	339.512	1.63610833	42.177	20.3262651	
5	450	356	6.123	384.798	343.293	337.17	1.62482223	41.505	20.0024096	
4	350	256	6.127	402.45	340.813	334.686	1.61285183	61.637	29.7045783	
3	250	156	6.21	403.051	343.035	336.825	1.62315967	60.016	28.9233735	
2	150	56	6.176	408.665	341.954	335.778	1.61811418	66.71	32.1498795	
1	50	-44	6.331	407.075	337.702	331.371	1.59687685	69.373	33.4327711	
							MEAN :-	1.60991417	21.2863373	
							Final Total (gm) =	883.383		
							Col Sat MC (gm) =	1386.1		
							Drainage (gm) =	502.717		

Table A3.21 Field Capacity Moisture profile and Bulk Density Data for Col 88/11.

Soil Moisture Column Drainage Analysis							Experiment Ref No :-	88/12		
Date :-	25:8:88		Column Ref:	D		W.T. level above base:-	76:			
Segment No	Ht Above Base (mm)	Ht Above W.T. (mm)	Wt contrn (gm)	Wt + moist soil (gm)	Wt + dry soil (gm)	Dry Soil (gm)	Bulk Dens (gm/cc)	Wt Water (gm)	Vol Moist Content (%)	
20	1950	1874	6.123	360.532	322.554	316.431	1.52488099	37.978	18.3026506	
19	1850	1774	6.147	358.995	320.772	314.625	1.51617787	38.223	18.4207229	
18	1750	1674	6.066	359.639	320.796	314.73	1.51668387	38.843	18.7195181	
17	1650	1574	6.086	361.264	321.659	315.573	1.52074629	39.605	19.0867470	
16	1550	1474	6.107	361.734	323.076	316.969	1.52747361	38.658	18.6303614	
15	1450	1374	6.136	365.626	324.41	318.274	1.53376241	41.216	19.8631325	
14	1350	1274	6.166	368.51	324.852	318.686	1.53574783	43.658	21.04	
13	1250	1174	6.09	367.148	322.267	316.177	1.52365696	44.881	21.6293976	
12	1150	1074	6.111	363.772	319.738	313.627	1.51136851	44.034	21.2212048	
11	1050	974	6.096	368.614	324.499	318.403	1.53438406	44.115	21.2602410	
10	950	874	6.08	372.821	325.927	319.847	1.54134269	46.894	22.5995181	
9	850	774	6.082	375.016	325.803	319.721	1.54073550	49.213	23.7171084	
8	750	674	6.093	377.162	322.771	316.678	1.52607128	54.391	26.2125301	
7	650	574	6.233	385.81	326.464	320.231	1.54319319	59.346	28.6004819	
6	550	474	6.255	382.044	328.081	321.826	1.55087949	53.963	26.0062651	
5	450	374	6.144	385.792	324.876	318.732	1.53596951	60.916	29.3571084	
4	350	274	6.218	393.053	323.45	317.232	1.52874101	69.603	33.5436145	
3	250	174	6.213	395.224	324.63	318.417	1.53445152	70.594	34.0212048	
2	150	74	6.139	400.457	328.466	322.327	1.55329381	71.991	34.6944578	
1	50	-26	6.382	397.777	326.777	320.395	1.54398350	71	34.2166675	
							MEAN :-	1.53217720	24.5571566	
							Final Total (gm) =	1019.122		
							Col Sat MC (gm) =	1419.3		
							Drainage (gm) =	400.178		

Table A3.22 Field Capacity Moisture profile and Bulk Density Data for Col 88/12.

Soil Moisture Column Drainage Analysis							Experiment Ref No :-	88/H1		
Date :-	2:12:88		Column Ref	A			WT level above base :-	945		
Segment No	Ht Above Base (mm)	Ht Above W.T. (mm)	Wt contrn (gm)	Wt + moist soil (gm)	Wt + dry soil (gm)	Dry Soil (gm)	Bulk Dens (gm/cc)	Wt Water (gm)	Vol Moist Content (%)	
20	1950	1867	6.128	349.614	332.732	326.604	1.57390468	16.882	8.13590361	
19	1850	1787	6.148	351.764	333.847	327.699	1.57918148	17.917	8.63469880	
18	1750	1667	6.067	354.535	334.977	328.911	1.58501729	19.558	9.42554217	
17	1650	1567	6.084	357.52	335.732	329.648	1.58857971	21.788	10.5002410	
16	1550	1467	6.109	359.635	334.499	328.39	1.58251141	25.136	12.1137349	
15	1450	1367	6.133	368.665	338.445	332.312	1.60141153	30.22	14.5638554	
14	1350	1267	6.165	374.604	336.053	329.888	1.58973027	38.551	18.5787952	
13	1250	1167	6.083	389.212	335.417	329.334	1.58706055	53.795	25.9253012	
12	1150	1067	6.112	399.165	335.685	329.573	1.58821229	63.48	30.5927711	
11	1050	967	6.099	400.142	335.049	328.95	1.58521005	65.093	31.3701205	
10	950	867	6.082	400.897	336.026	329.944	1.59000014	64.871	31.2831325	
9	850	767	6.089	399.439	334.894	328.805	1.58451129	64.545	31.1060241	
8	750	667	6.08	402.317	338.195	332.115	1.60046218	64.122	30.9021687	
7	650	567	6.21	406.06	341.241	335.031	1.61451439	64.819	31.2380723	
6	550	467	6.221	398.131	334.192	327.971	1.58049225	63.939	30.8139759	
5	450	367	6.12	405.761	339.628	333.508	1.60717505	66.133	31.8713253	
4	350	267	6.209	407.492	336.554	330.345	1.59193255	70.938	34.1869880	
3	250	167	6.242	409.111	338.635	332.393	1.60180187	70.476	33.9643373	
2	150	67	6.161	408.766	336.891	330.73	1.59378787	71.875	34.6385542	
1	50	-33	6.214	418.225	341.325	335.111	1.61489991	76.9	37.0602410	
							MEAN :-	1.59201954	24.8442892	
							Final MC :-	1031.038:gm		
							Sat MC :-	1435.9:gm		
							Removed :-	404.862:gm		

Table A3.23 Field Capacity Moisture profile and Bulk Density Data for Col 88/H1.

Soil Moisture Column Drainage Analysis							Experiment Ref No :-	88/H2		
Date :-	2:12:88		Column Ref	B			WT level above base:-	943		
Segment No	Ht Above Base (mm)	Ht Above W.T. (mm)	Wt contrn (gm)	Wt + moist soil (gm)	Wt + dry soil (gm)	Dry Soil (gm)	Bulk Dens (gm/cc)	Wt Water (gm)	Vol Moist Content (%)	
20	1950	1897	6.114	332.289	318.54	312.426	1.50558089	13.749	6.62602410	
19	1850	1797	6.09	340.671	325.392	319.302	1.53871634	15.279	7.36337349	
18	1750	1697	6.148	345.247	327.926	321.778	1.55064818	17.321	8.34746988	
17	1650	1597	6.106	347.698	328.379	322.273	1.55303359	19.319	9.31036145	
16	1550	1497	6.108	347.184	325.267	319.159	1.53802722	21.917	10.5624096	
15	1450	1397	6.089	352.536	325.82	319.731	1.54078369	26.716	12.8751807	
14	1350	1297	6.101	364.693	328.582	322.481	1.55403594	36.111	17.4028916	
13	1250	1197	6.189	381.759	328.636	322.447	1.55387209	53.123	25.6014458	
12	1150	1097	6.105	391.201	326.036	319.931	1.54174749	65.165	31.4048193	
11	1050	997	6.113	391.444	325.505	319.392	1.53915005	65.939	31.7778313	
10	950	897	6.075	391.477	323.885	317.81	1.53152639	67.592	32.5744578	
9	850	797	6.103	397.917	331.806	325.703	1.56956276	66.111	31.8607229	
8	750	697	6.118	396.506	330.768	324.65	1.56448835	65.738	31.6809639	
7	650	597	6.093	394.953	328.788	322.695	1.55506720	66.165	31.8867470	
6	550	497	6.095	393.634	327.774	321.679	1.55017110	65.86	31.7397590	
5	450	397	6.133	399.544	331.206	325.073	1.56652679	68.338	32.9339759	
4	350	297	6.156	402.037	329.922	323.766	1.56022835	72.115	34.7542169	
3	250	197	6.24	400.602	327.658	321.418	1.54891334	72.944	35.1537349	
2	150	97	6.28	400.021	328.76	322.48	1.55403112	71.261	34.3426506	
1	50	-3	6.322	404.941	331.15	324.828	1.56534613	73.791	35.5619277	
							MEAN :-	1.54907285	24.6880482	
							Final MC :-	1024.554:gm		
							Sat MC :-	1475.74:gm		
							Removed :-	451.186:gm		

Table A3.24 Field Capacity Moisture profile and Bulk Density Data for Col 88/H2.

Soil Moisture Column Drainage Analysis							Experiment Ref No :-	88/H3	
Date :-	15:11:88	Column Ref	C	W.T. level above base :-			94		
Segment No	Ht Above Base (mm)	Ht Above W.T. (mm)	Wt contrn (gm)	Wt + moist soil (gm)	Wt + dry soil (gm)	Dry Soil (gm)	Bulk Dens (gm/cc)	Wt Water (gm)	Vol Moist Content (%)
20	1950	1856	6.129	341.308	328.24	322.111	1.55225291	13.068	6.29783133
19	1850	1756	6.152	341.61	328.326	322.174	1.55255651	13.284	6.40192771
18	1750	1656	6.069	347.293	333.349	327.28	1.57716232	13.944	6.72
17	1650	1556	6.086	347.556	333.17	327.084	1.57621780	14.386	6.93301205
16	1550	1456	6.111	346.432	331.863	325.752	1.56979889	14.569	7.02120482
15	1450	1356	6.134	346.513	331.649	325.515	1.56865678	14.864	7.16337349
14	1350	1256	6.17	345.199	329.88	323.71	1.55995849	15.319	7.38265060
13	1250	1156	6.087	349.07	332.621	326.534	1.57356735	16.449	7.92722892
12	1150	1056	6.114	354.856	337.152	331.038	1.59527212	17.704	8.53204819
11	1050	956	6.102	352.411	333.613	327.511	1.57827551	18.798	9.05927711
10	950	856	6.084	354.142	333.612	327.528	1.57835743	20.53	9.89397590
9	850	756	6.09	355.967	332.5	326.41	1.57296979	23.467	11.3093976
8	750	656	6.074	365.633	337.898	331.824	1.59905986	27.735	13.3662651
7	650	556	6.206	367.535	334.41	328.204	1.58161508	33.125	15.9638554
6	550	456	6.216	375.857	333.457	327.241	1.57697438	42.4	20.4337349
5	450	356	6.1	399.688	334.15	328.05	1.58087295	65.538	31.5845783
4	350	256	6.188	406.712	337.543	331.355	1.59679974	69.169	33.3344578
3	250	156	6.219	403.244	334.063	327.844	1.57988024	69.181	33.3402410
2	150	56	6.129	403.831	334.393	328.264	1.58190422	69.438	33.4640964
1	50	-44	6.195	402.449	332.98	326.785	1.57477691	69.469	33.4790361
						MEAN :-	1.57634646		15.4804096
						Final MC :-		642.437	
						Sat MC :-		1389.42	
						Drainage :-		746.983	

Table A3.25 Field Capacity Moisture profile and Bulk Density Data for Col 88/H3.

Soil Moisture Column Drainage Analysis							Experiment Ref No :-	88/H4	
Date :-	26:10:88	Column Ref	D	W.T. level above base :-			901		
Segment No	Ht Above Base (mm)	Ht Above W.T. (mm)	Wt contrn (gm)	Wt + moist soil (gm)	Wt + dry soil (gm)	Dry Soil (gm)	Bulk Dens (gm/cc)	Wt Water (gm)	Vol Moist Content (%)
20	1950	1874	6.123	335.82	320.516	314.366	1.51492975	15.304	7.37542169
19	1850	1774	6.15	345.438	328.366	322.297	1.55314924	17.072	8.22746988
18	1750	1674	6.069	343.421	324.914	318.825	1.53641757	18.507	8.91903614
17	1650	1574	6.089	341.013	320.58	314.469	1.51542611	20.433	9.84722892
16	1550	1474	6.111	345.116	321.312	315.176	1.51883314	23.804	11.4718072
15	1450	1374	6.136	353.437	323.053	316.885	1.52706881	30.384	14.6428916
14	1350	1274	6.168	366.083	324.84	318.752	1.53606589	41.243	19.8761446
13	1250	1174	6.088	363.678	322.849	316.74	1.52637006	60.829	29.3151807
12	1150	1074	6.109	393.79	323.688	317.59	1.53046621	70.102	33.7840964
11	1050	974	6.098	397.181	326.571	320.487	1.54442685	70.61	34.0289157
10	950	874	6.084	395.754	325.17	319.09	1.53769471	70.584	34.0163855
9	850	774	6.08	398.858	327.155	321.065	1.54721223	71.703	34.5556627
8	750	674	6.09	397.929	326.676	320.441	1.54420518	71.253	34.3387952
7	650	574	6.235	400.376	328.265	322.016	1.55179510	72.111	34.7522892
6	550	474	6.249	398.257	327.519	321.371	1.54868685	70.738	34.0906024
5	450	374	6.148	397.286	326.422	320.181	1.54295224	70.864	34.1513253
4	350	274	6.241	398.551	329.451	323.215	1.55757308	69.1	33.3012048
3	250	174	6.236	401.462	329.114	322.897	1.55604064	72.348	34.8665060
2	150	74	6.217	400.293	328.7	322.402	1.55365524	71.593	34.5026506
1	50	-26	6.298	397.839	327.501	321.203	1.54787726	70.338	33.8978313
						MEAN :-	1.53954231		25.9980723
						Final MC :-		1078.92	
						Sat MC :-		1444.2	
						Drainage :-		365.28	

Table A3.26 Field Capacity Moisture profile and Bulk Density Data for Col 88/H4.

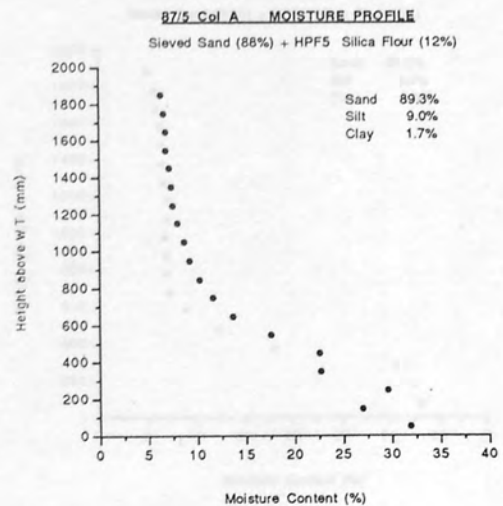
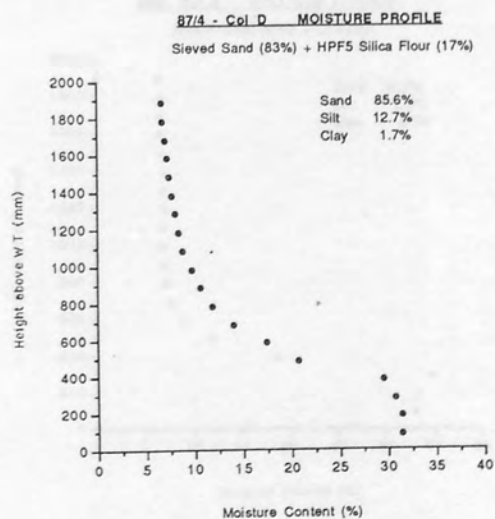
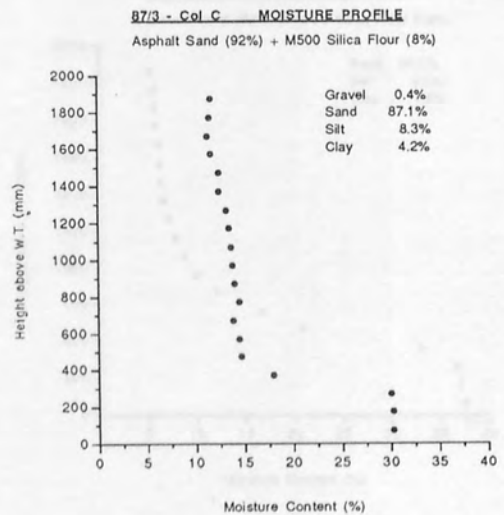
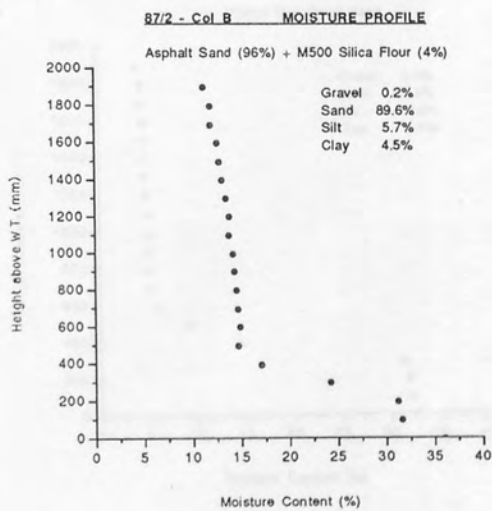
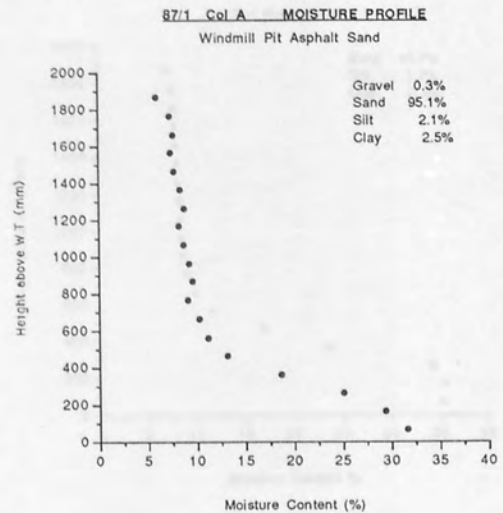
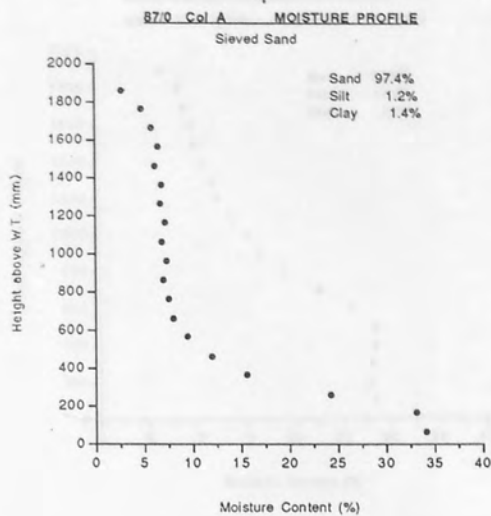


Fig A3.1 Field Capacity Moisture Profiles: Cols 87/0 to 87/5.

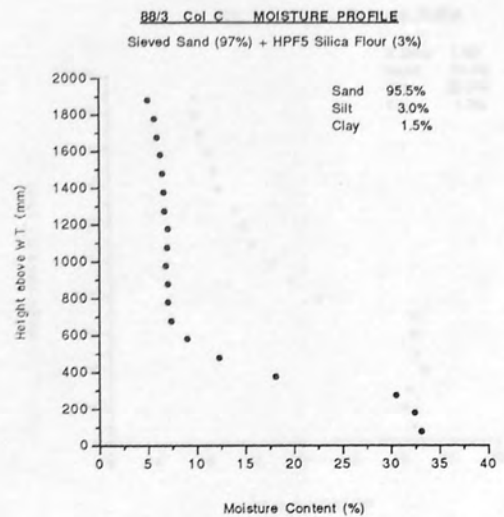
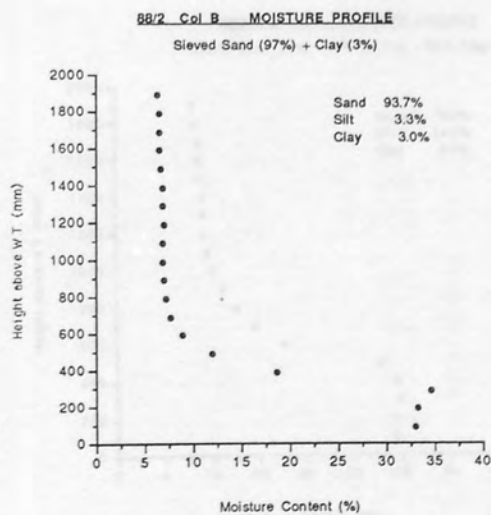
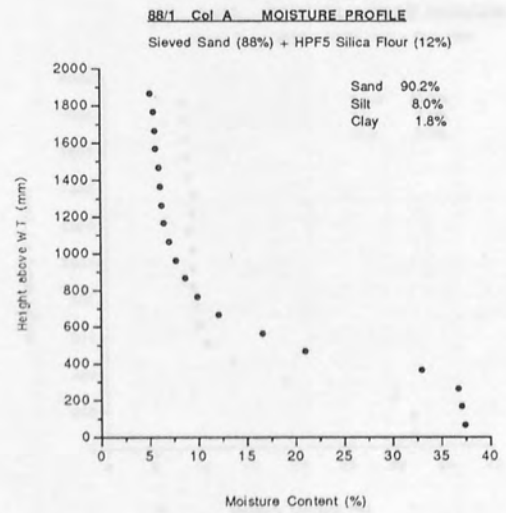
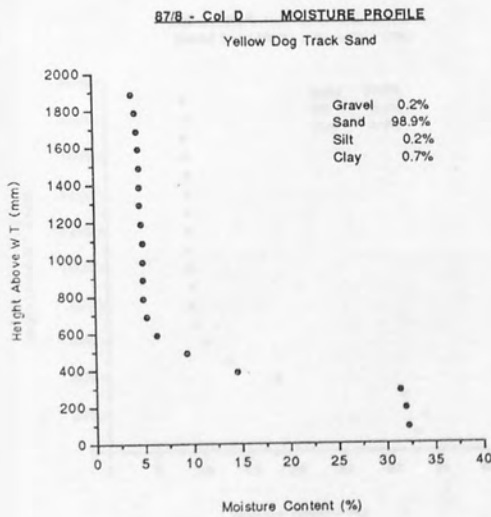
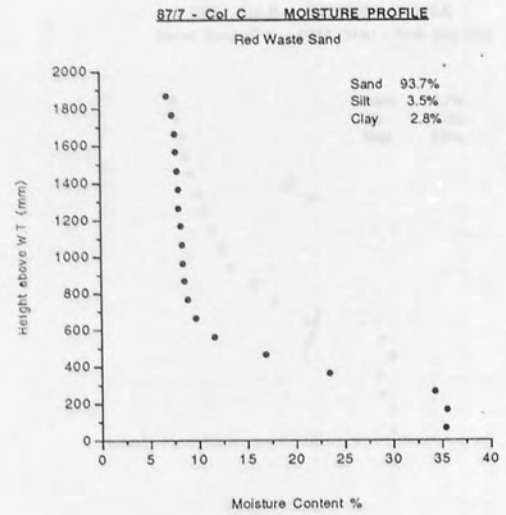
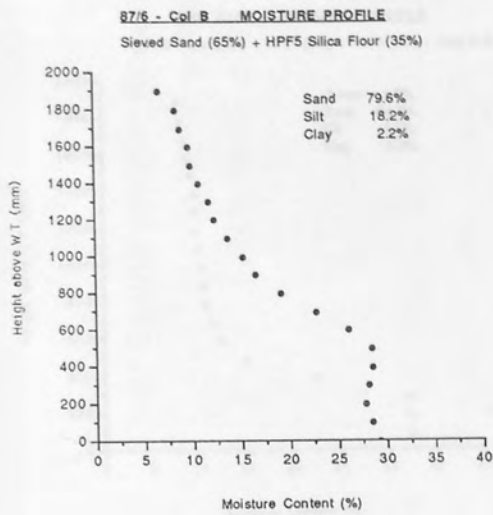
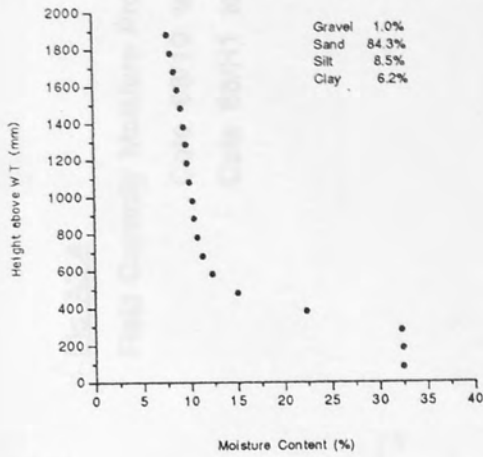


Fig A3.2 Field Capacity Moisture Profiles: Cols 87/6 to 87/8;
Cols 88/1 to 88/3.

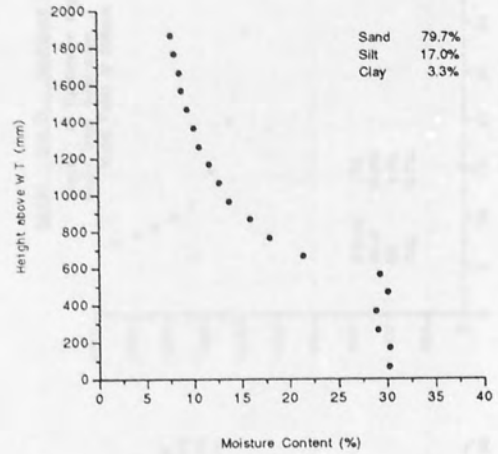
88/4 Col D MOISTURE PROFILE

Asphalt Sand (88%) + HPF1 (8%) + HPF5 (3%) + Clay (1%)



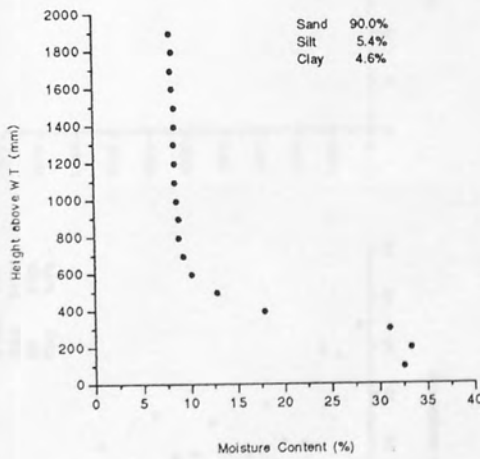
88/5 Col B MOISTURE PROFILE

Sieved Sand (67%) + HPF5 (31%) + Brick Clay (2%)



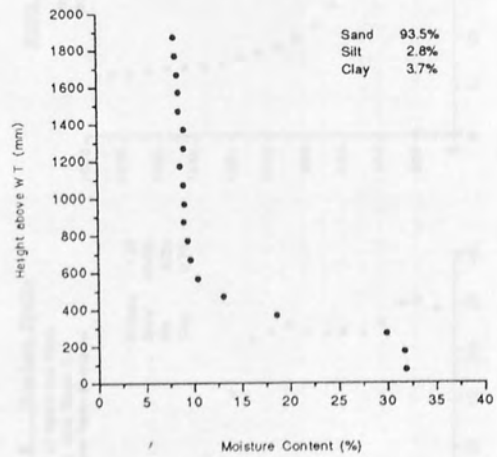
88/6 Col B MOISTURE PROFILE

Sieved Sand (93%) + Brick Clay (7%)



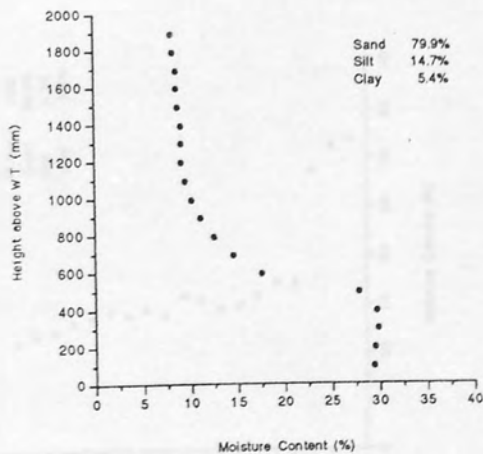
88/7 Col C MOISTURE CONTENT VARIATION

Sieved Sand (89%) + HPF5 (3%) + Clay (8%)



88/8 Col D MOISTURE PROFILE

Sieved Sand (77%) + HPF5 (17%) + Brick Clay (6%)



88/9 Col A Moisture Profile

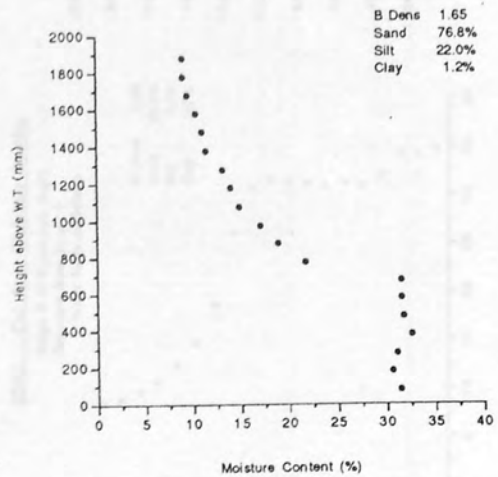
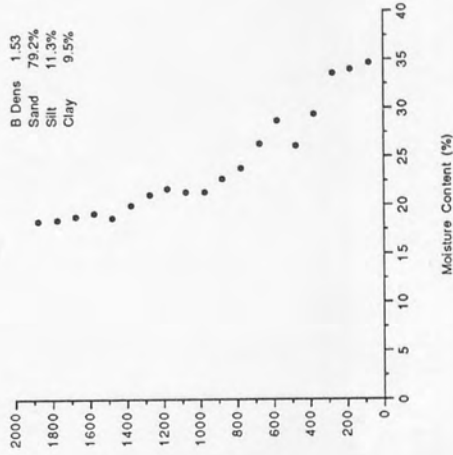


Fig A3.3 Field Capacity Moisture Profiles: Cols 88/4 to 88/9.

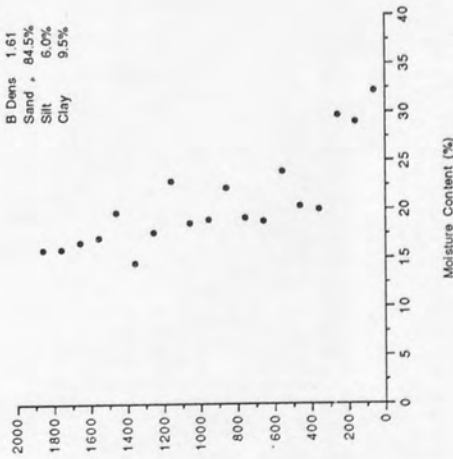
Fig A3.4

Field Capacity Moisture Profiles:
 Cols 88/10 to 88/12;
 Cols 88/H1 to 88/H4.

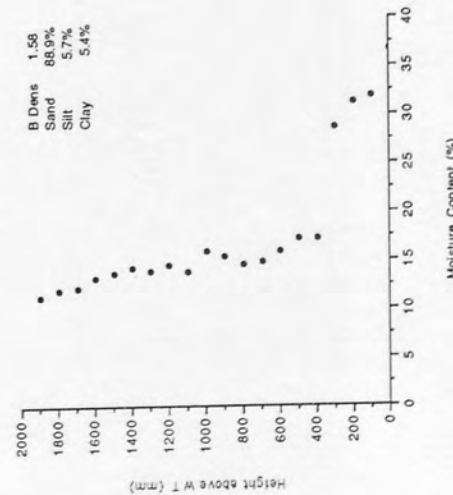
88/12 Col D Moisture Profile



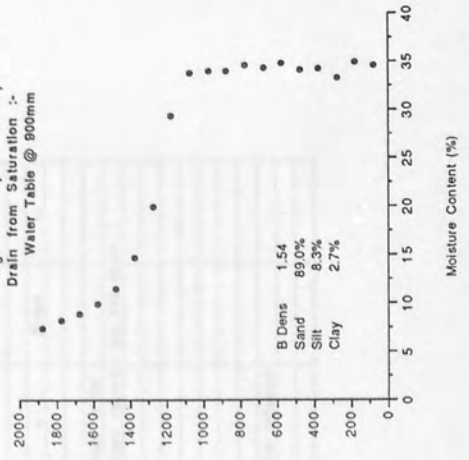
88/11 Col C Moisture Profile



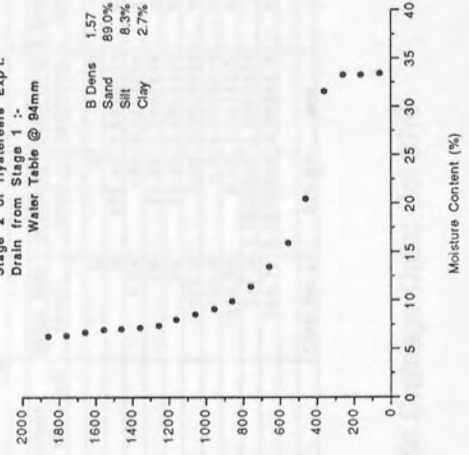
88/10 Col B Moisture Profile



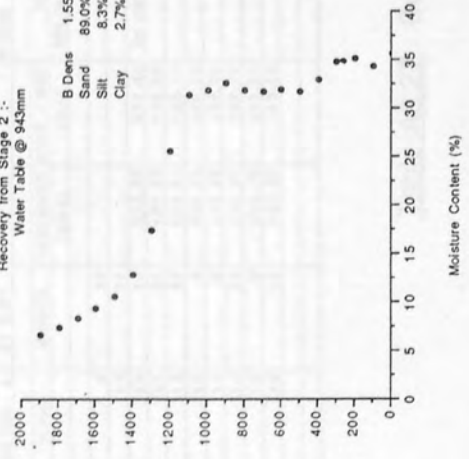
88/H4 Col D Moisture Profile



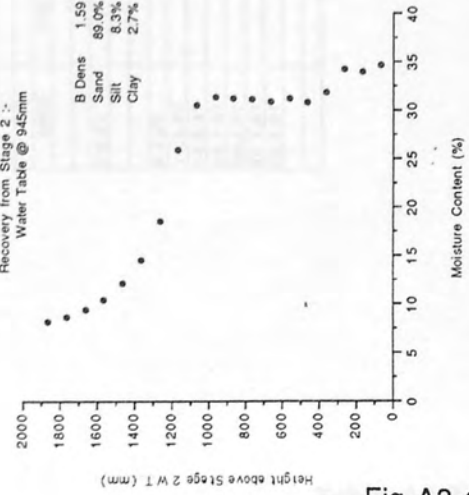
88/H3 Col C Moisture Profile



88/H2 Col B Moisture Profile



88/H1 Col A Moisture Profile



Experiment:		Ref No = 87/1		COLUMN DRAINAGE ANALYSIS		Bulk Dens = 1.525		Start Hr = 10.75		Notes	
Experiment:		Col Ref = A		SOIL ANAL: % Gravel = 0.3		% Sand = 95.1		Tot. Drain. = 813.73		Est Initial drainage	
Experiment:		Start Date = 8:7:87		MIN deg C		MAX deg C		DRAINAGE (gm/min)		DRAINAGE (gms)	
Experiment:		End Date = 20:8:87		TEMPERATURE		TOTAL TIME (hrs)		DRAINAGE (gm/min)		DRAINAGE (gms)	
DATE	DAY	MINUTE	CONTAINER (gms)	CONT + WAT (gms)	MIN deg C	MAX deg C	no Record	no Record	no Record	no Record	no Record
8:7:87	0	10	45	197.487	292.048	no Record	no Record	0	813.351	0	813.351
	0	11	15	199.865	315.907	no Record	no Record	0.5	94.551	3.1520333	907.912
	0	12	35	197.071	298.044	no Record	no Record	1.8333333	117.042	1.463025	1024.954
	0	16	20	197.487	325.706	no Record	no Record	5.5833333	100.873	0.4487689	1125.927
9:7:87	1	8	30	195.316	215.51	no Record	no Record	21.75	128.226	0.1321918	1254.153
	1	15	0	215.51	245.308	no Record	no Record	28.25	20.194	0.0517795	1274.347
10:7:87	2	9	30	196.385	258.014	no Record	no Record	46.75	29.198	0.0268450	1304.145
	2	15	15	196.385	258.014	no Record	no Record	119.5	61.629	0.0141189	1365.774
13:7:87	5	10	30	196.517	201.058	no Record	no Record	142.75	4.451	0.0031907	1370.225
14:7:87	6	9	30	196.41	211.134	no Record	no Record	167.75	14.724	0.0009816	1384.949
15:7:87	7	10	30	33.867	37.363	no Record	no Record	195.25	3.496	0.0021186	1388.443
16:7:87	8	14	0	256.907	264.408	no Record	no Record	216.25	7.501	0.0005932	1395.946
17:7:87	9	11	45	231.88	237.256	no Record	no Record	312	5.376	0.0009358	1401.322
21:7:87	1	10	45	197.97	201.763	no Record	no Record	362	3.793	0.0012643	1405.115
23:7:87	1	12	45	43.853	38	no Record	no Record	480.75	12.47	0.0017048	1417.262
28:7:87	2	11	30	200.027	202.227	no Record	no Record	509.59333	2.2	0.0017717	1419.862
29:7:87	2	16	25	38.718	40.519	no Record	no Record	557.66667	1.801	0.0006243	1421.663
31:7:87	2	16	25	204.794	206.997	no Record	no Record	627.61667	2.193	0.0005222	1423.456
3:8:87	2	14	22	192.818	194.477	no Record	no Record	675.61667	1.659	0.0005760	1425.115
5:8:87	2	14	22	44.653	46.379	no Record	no Record	723.43333	1.749	0.0006099	1426.864
7:8:87	3	11	15	39.218	41.738	no Record	no Record	868.36667	2.52	0.0002898	1428.384
13:8:87	3	15	30	48.104	50.6	no Record	no Record	1007.75	2.496	0.0002988	1431.88
19:8:87	4	2	30	192.755	193.134	no Record	no Record	1036.5333	0.379	0.0002187	1432.259
20:8:87	4	15	23	192.755	193.134	no Record	no Record	1036.5333	0.379	0.0002187	1432.259
								ΣObs. Drain	618.909		

Table A3.28 Column Drainage Data: Col 87/1

COLUMN DRAINAGE ANALYSIS											
Experiment:	Ref No =	87/2	SOIL ANAL:	Bulk Dens =	1.57	Start Hr =	16.5				
Experiment:	Col Ref =	B	% Gravel =	0.2	% Sand =	89.6					
Experiment:	Start Date =	13:7:87	% Silt =	5.2	% Clay =	4.5	Tot. Drain =	784.37	gms		
Experiment:	End Date =	28:9:87									
DATE	DAY	HOUR	MINUTE	CONTAINER COMT + WAT (gms)	TEMPERATURE MN deg C	MAX deg C	TOTAL TIME (hrs)	DRAINAGE (gms)	DRAIN RATE (gm/min)	% DRAINAGE (gms)	Notes
13:7:87	0	16	30	195.502	272.91	No Record	0	294.252	0	294.252	Est initial drainage
	0	17	5	194.432	300.61		0.5933333	77.406	2.2115571	371.66	
	0	18	0	195.237	264.959		1.5	106.182	1.9305818	477.842	
	0	19	10	191.99	318.433		2.6666667	69.722	0.9960286	547.564	
14:7:87	1	9	30	195.878	241.905		4.2	46.038	0.936853	720.14	
15:7:87	2	10	30	211.134	231.945		69.5	20.812	0.126133	740.952	
16:7:87	3	14	0	37.353	48.095		90.5	10.732	0.085175	751.684	
17:7:87	4	11	0	264.408	259.181		186.25	4.773	0.008308	756.457	
21:7:87	8	10	45	198.236	208.403		236.25	10.167	0.00389	766.624	
23:7:87	13	11	30	201.793	205.3		355	3.577	0.005020	770.201	
29:7:87	16	16	25	58	58.81		383.91667	0.8140000	0.004692	771.015	
31:7:87	18	16	30	202.227	203.905		432	1.678	0.005816	772.693	PH away
3:8:87	21	14	24	40.519	41.686		501.9	1.167	0.002783	773.86	
5:8:87	23	14	25	206.997	207.643		549.91667	0.659	0.002287	774.519	
7:8:87	25	14	13	194.477	195.08		597.71667	0.6080000	0.002120	775.127	
13:8:87	31	15	8	199.599	204.77		742.63333	5.269	0.005991	780.356	
19:8:87	37	10	30	41.738	43.066		882	1.328	0.001588	781.664	
21:8:87	39	15	0	50.6	51.222		934.5	0.622	0.001975	782.286	PH reading
25:8:87	43	15	15	193.006	194.383		1030.75	1.377	0.002384	783.663	
29:8:87	46	10	30	208.235	208.94		1098	0.7070000	0.000152	784.37	
							Σ Obs Drain	490.118			

Table A3.29 Column Drainage Data: Col 87/2

COLUMN DRAINAGE ANALYSIS															
DATE	DAY	HOUR	MINUTE	CONTAINER (gms)	CONT. + WAT. (gms)	TEMPERATURE MIN deg C	TEMPERATURE MAX deg C	TOTAL TIME (hrs)	DRAINAGE (gms)	DRAIN RATE (gm/min)	DRAINAGE (gms)	Start Hr. =	Tot. Drain =	Notes	
Experiment:		Ref No. =	87/3	SOIL ANAL:		Bulk Dens =		No. readings		DRAINAGE		DRAINAGE			
Experiment:		Col. Ref. =	C	55.288	393.45	% Gravel =		1.6		0.402885		19.5			
Experiment:		Start Date =	13:7:87	201.97	246.57	% Sand =		0.4		0.030367		518.1765			
Experiment:		End Date =	8:9:87	241.906	256.907	% Silt =		87.1		15.001		0.009091		533.17865	
				191.974	197.977	% Clay =		8.3		6.003		0.004764		539.18165	
				48.095	62.325			4.2		14.227		0.002470		553.40865	
				199.776	200.065			233.25		0.290000		9.71525		553.69865	
				208.403	218.618			380.91667		3.14035		0.00181		568.054	
				58.814	64.745			429.05		5.931		0.0020537		573.385	
				46.308	47.349			739.66667		1.041		5.3857E-5		575.026	
				204.778	222.557			879		17.779		0.0021267		592.805	
				43.066	43.795			931.5		0.729		0.000231		593.534	
				51.224	52.022			1027.75		0.805		0.000139		594.339	
				194.383	194.4			1095.037000		9.1698E-6		594.376		594.376	
				208.942	208.945			1221.25		0.0040000		5.2805E-7		594.38	
				38.585	38.585			1361.6667		0		0		594.38	
				Obs Drain: 459.83435											
13:7:87	0	19	30	0	134.54565	0	134.54565	0	134.54565	0	134.54565	Start Drain	est Init drain		
14:7:87	1	9	30	55.288	393.45			14	338.172	0.402885	472.71765				
15:7:87	2	10	30	201.97	246.57			39	45.46	0.030367	518.1765				
16:7:87	3	14	0	241.906	256.907			66.5	15.001	0.009091	533.17865				
17:7:87	4	11	0	191.974	197.977			87.5	6.003	0.004764	539.18165				
21:7:87	8	11	0	48.095	62.325			183.5	14.227	0.002470	553.40865				
23:7:87	10	12	43	199.776	200.065			233.25	0.290000	9.71525	553.69865				
23:7:87	15	11	30	208.403	218.618			352	11.215	0.0015740	564.91365				
23:7:87	16	16	25	58.814	64.745			380.91667	3.14035	0.00181	568.054				
31:7:87	18	16	33	46.308	47.349			429.05	5.931	0.0020537	573.385			est drain	
13:8:87	31	15	10	46.308	47.349			739.66667	1.041	5.3857E-5	575.026			est drain	
19:8:87	37	10	30	204.778	222.557			879	17.779	0.0021267	592.805			PH return	
21:8:87	39	15	0	43.066	43.795			931.5	0.729	0.000231	593.534				
21:8:87	43	15	15	51.224	52.022			1027.75	0.805	0.000139	594.339				
25:8:87	46	10	30	194.383	194.4			1095.037000	9.1698E-6		594.376				
29:8:87	51	16	45	208.942	208.945			1221.25	0.0040000	5.2805E-7	594.38				
8:9:87	57	13	10	38.585	38.585			1361.6667	0	0	594.38			Col stripped	

Table A3.30 Column Drainage Data: Col 87/3

COLUMN DRAINAGE ANALYSIS													
DATE	DAY	HOUR	MINUTE	CONTAINER	CONT. + WAT	TEMPERATURE	TOTAL TIME	DRAINAGE	DRAIN RATE	DRAINAGE	Notes		
				(gms)	(gms)	MIN deg C	(hrs)	(gms)	(gm/min)	(gms)	<-	>-	
15:9:87	0	14	0			22	0	0	0	0	0	0	0
	0	14	6.5				0.1083333	211.839	32.590615	211.839	Start meas	est	init drain
	0	15	2				1.0333333	79.289	1.4286306	291.128			
	0	16	9				2.15	69.403	1.0358657	360.531			
	0	17	36				3.5	69.382	0.8043908	430.513			
16:9:87	1	8	37			22.5	18.616667	261.663	0.2904140	692.176			
	1	16	53			22	26.883333	32.193	0.0689052	724.365			
	2	15	26			22	49.433333	31.949	0.0236135	756.319			
17:9:87	3	18	7			22	76.116667	13.598	0.0085559	770.016			
18:9:87	3	18	7			22	140.16667	15.939	0.0041475	785.955			
21:9:87	7	13	51			22.5	167.85	6.552	0.0039446	792.507			
22:9:87	7	17	8			22	195.13333	0.8360000	0.0005107	793.343			
23:9:87	8	17	45			22	219.75	3.845	0.0026032	797.189			
24:9:87	9	17	45			22	307.41667	1.568	0.0003171	798.856			
28:9:87	13	9	25			22	336.75	0.394	0.0002239	799.25	Col stopped		
29:9:87	14	14	45			22							
							ΣObs Drain	587.411					

Table A3.32 Column Drainage Data: Col 87/5

COLUMN DRAINAGE ANALYSIS													
DATE	DAY	HOUR	MINUTE	CONTAINER (gms)	CONT + WAT (gms)	TEMPERATURE (deg C)	MIN	MAX	TOTAL TIME (hrs)	DRAINAGE (gms)	DRAIN RATE (g/min)	DRAINAGE (gms)	Notes
16:9:87	0	8	57			22.5			0.1833333	0	0	0	Drain from sat
	0	9	8						0.9833333	40.257	0.8366875	40.257	0 Start measurem't
	0	9	56	197.552	237.809				0.9833333	101.49	0.5341579	141.747	
	0	13	6	31.997	133.077	22			4.1	74.186	0.3229478	215.933	
	0	16	56	203.642	277.828	22			7.9833333	161.753	0.1200839	377.686	
17:9:87	1	15	23	198.547	350.3	22.5			30.433333	55.2	0.0337732	427.873	
18:9:87	2	16	9	47.9	98.087	22			55.2	29.921	0.0075249	457.694	
21:9:87	5	10	12	205.222	235.043	22			121.25	5.039	0.0030355	462.733	
22:9:87	6	13	22	58.076	64.118	22			148.9166	1.185	0.0069326	473.918	no drain ?
23:9:87	7	17	9	215.295	229.48	22.5			176.2	0	0	473.918	no drain ?
24:9:87	8	17	46	202.71	202.71	22			200.81667	0	0	473.918	no drain ?
28:9:87	12	9	37	55.14	55.14	22			288.66667	0	0	473.918	no drain ?
28:9:87	12	14	40	206.632	206.632	22.5			293.71667	0	0	473.918	Col stripped
									Σ Obs Drain	473.918			

Table A3.33 Column Drainage Data: Col 87/6

COLUMN DRAINAGE ANALYSIS														
DATE	DAY	HOUR	MINUTE	CONTAINER CONT. + WAT. (gms)	TEMPERATURE MIN deg C	TEMPERATURE MAX deg C	TOTAL TIME (hrs)	DRAINAGE (gms)	DRAIN RATE (gm/min)	DRAINAGE (gms)	DRAIN RATE (gm/min)	DRAINAGE (gms)	DRAIN RATE (gm/min)	Notes
15:9:87	0	15	31		22	22	0	0	0	0	0	0	0	Drain from sat
	0	15	41.5				0.175	107.73	10.261905	107.73	10.261905	107.73	10.261905	Start measurm1 - est [init drain
	0	16	6	194.994			0.5833333	120.942	4.9364082	228.682	4.9364082	228.682	4.9364082	
	0	16	44	29.667			1.2166667	132.587	3.4891316	361.279	3.4891316	361.279	3.4891316	
	0	17	34	195.47			2.05	108.355	2.1571	469.634	2.1571	469.634	2.1571	
16:9:87	1	8	40	191.61			17.15	263.931	0.2913146	733.565	0.2913146	733.565	0.2913146	Minor drain loss?
	1	16	57	37.68			23.25	32.667	0.0657284	766.232	0.0657284	766.232	0.0657284	
17:9:87	2	3	25	203.143			47.9	32.94	0.024362	799.172	0.024362	799.172	0.024362	
18:9:87	3	18	10	158.261			74.65	17.869	0.011333	817.041	0.011333	817.041	0.011333	
21:9:87	6	10	13	44.184			138.7	17.433	0.004363	834.474	0.004363	834.474	0.004363	
22:9:87	7	13	54	205.821			166.38333	5.188	0.0031234	839.662	0.0031234	839.662	0.0031234	
23:9:87	8	17	11	64.118			193.66667	4.695	0.0028519	844.347	0.0028519	844.347	0.0028519	
24:9:87	9	17	47	229.48			218.26667	3.359	0.0006380	850.391	0.0006380	850.391	0.0006380	
26:9:87	13	9	32	202.673			361.25	1.269	0.0003829	851.56	0.0003829	851.56	0.0003829	Col stripped
30:9:87	15	16	46	55.104										
							ΣObs drain	7.43.91						

Table A3.34 Column Drainage Data: Col 8717

COLUMN DRAINAGE ANALYSIS										
DATE	DAY	HOUR	MINUTE	CONTAINER CONT. WATER (gms)	MIN TEMP deg C	MAX TEMP deg C	TOTAL TIME (hrs)	DRAINAGE (gms)	DRAIN RATE (gm/min)	Notes
15:9:87	0	14	5		22		0	0	0	0. Drain from sat
	0	14	17.5				0.2083333	50.512	4.04096	50.512 Start Measurm't - est Init drain
	0	14	25	193.372			0.3333333	109.382	14.584267	159.894
	0	14	41	200.285	22		0.6	118.952	7.42925	178.746
	0	14	1	200.722			0.9333333	108.771	5.438955	387.517
	0	15	28	201.316			1.3833333	84.481	3.1289259	471.998
	0	16	8	192.032			2.95	69.814	1.74535	541.812
	0	17	37	192.312	22.5		3.5333333	92.062	1.034045	633.874
16:9:87	0	17	50	198.986	22		18.75	161.302	0.1766725	795.176
	1	16	59	195.208		23	26.9	22.061	0.0451745	817.237
	2	16	26	47.922	22.5		49.35	26.132	0.194001	843.369
17:9:87	3	16	12	201.384	22		76.116667	28.688	0.0178636	872.058
18:9:87	6	16	14	203.609	23		140.15	13.132	0.0034180	885.19
21:9:87	7	16	58	61.616	22.5		167.93333	4.0	0.002442	889.2
22:9:87	8	17	12	211.009	22.5		195.11667	3.112	0.0019010	892.312
23:9:87	11	17	48	68.803	22		219.71667	2.292	0.0015549	894.607
24:9:87	13	17	33	232.165	22		307.46667	3.457	0.0006566	898.064
28:9:87	9	18	22	206.032	22		337.28333	0.5260000	0.0002940	898.59 Col stripped
29:9:87	14	18	22	206.032	22					
							Σ Obs. Drain	848.078		

Table A3.35 Column Drainage Data: Col 87/8

COLUMN DRAINAGE ANALYSIS												
DATE	DAY	HOUR	MINUTE	CONTAINER (gms)	CONT. + WAT (gms)	TEMPERATURE MIN deg C	MAX deg C	TOTAL TIME (hrs)	DRAINAGE (gms)	DRAIN RATE (gm/min)	DRAINAGE (gms)	Notes
16:5:88	0	11	31			26	26	0	0	0	0	0:Start drain
	0	11	35.5					0.075	0	0	0	0:End Init drain
	0	11	50.5	136.877	244.953			0.325	108.076	7.2050667	108.076	
	0	11	52.3					0.355	11.92356	6.402	119.5996	Est. of drain
	0	12	0	111.448	154.564			0.4833333	43.116	5.5994805	162.7156	
	0	12	18.5	119.616	208.996			0.7916667	89.38	4.8313514	252.0956	
	0	13	36.5	130.542	197.852			1.8833333	67.31	3.7394444	319.4056	
	0	13	24	117.2	230.294			1.8833333	113.094	2.3809263	432.4996	
	0	14	24.5	130.173	212.232			2.8916667	82.059	1.3563171	514.5566	
	0	15	56	121.16	195.53			4.4166667	74.371	0.8127878	588.9286	
	0	19	41	132.436	212.908			8.1666667	80.472	0.3765333	669.4016	Thermometer installed
17:5:88	1	9	59					22.466667	0	0	669.4016	Beaker broken
	1	13	20	125.443	134.997			25.916667	9.554	0.0475323	678.9556	
	1	17	30	121.588	132.07			29.983333	10.423	0.041592	689.3786	
18:5:88	2	9	15	109.858	128.816	22	28.5	45.733333	18.988	0.0200514	708.3366	
	2	17	4	120.206	125.798			53.55	5.592	0.0119232	713.9286	
19:5:88	3	9	17	110.96	116.988	22	26.5	69.766667	6.023	0.0061901	719.9516	
	3	16	18	122.648	128.572			76.783333	5.927	0.0140784	725.8786	
20:5:88	4	9	47	120.892	124.68	21	26	94.266667	3.795	0.0036171	729.6736	
21:5:88	5	11	52	115.991	120.53	21	27	120.35	4.589	0.0029000	734.2136	
23:5:88	7	11	37	125.666	130.63	21	27	169.1	4.965	0.0017330	739.1716	
24:5:88	8	9	30	124.879	126.408	21	25.5	189.98333	1.53	0.0011653	740.7076	
25:5:88	9	15	15	116.275	117.708	21	26	219.73333	1.43	0.0008011	742.1376	
26:5:88	10	9	25	129.748	130.328	20.5	26	237.9	0.5800000	0.0005321	742.7176	
28:5:88	12	0	55	121.96	123.286	21.5	26	287.4	1.898	0.0006158	744.5466	
31:5:88	15	9	24	116.489	118.448	19.5	26.5	357.88333	1.996	0.0004720	746.5426	
3:6:88	17	9	25	129.203	130.552	21	26	405.9	1.354	0.0004700	747.8966	
6:6:88	21	9	8	120.033	122.084	20.5	26.5	501.51667	2.051	0.0003575	749.9476	
6:6:88	21	16	8	122.9	122.8			508.61667	0	0	749.9476	Column Stripped
								X:Obs. drain.	749.9476			

Table A3.36 Column Drainage Data: Col 88/1

***** COLUMN DRAINAGE ANALYSIS *****														
Experiment:		Ref No =	88/2	SOIL ANAL:		% Sand =	93.7	Start Hr =		11.75				
Experiment:		Col Ref =	B	% Silt =		3.3	Drainage =		957.9					
Experiment:		Start Date =	16:5:88	% Clay =		3								
Experiment:		End Date =	6:6:88											
DATE	DAY	HOUR	MINUTE	CONTAINER (gms)	CONT + WAT (gms)	TEMPERATURE MIN deg C	TEMPERATURE MAX deg C	TOTAL TIME (hrs)	DRAINAGE (gms)	DRAIN RATE (gm/min)	DRAINAGE (gms)	Start drain	Notes	
16:5:88	0	11	45					0	0	0	0	0	0	
	0	11	49.5	122.623	216.608	26	26	0.075	107.827	23.974889	107.827	Initial Drainage - estimated		
	0	12	0.5	122.623	216.608			0.2583333	93.979	8.543545	201.866			
	0	12	19	115.525	231.008			0.5666667	135.483	7.3234054	337.349			
	0	12	37	116.322	209.97			0.8666667	93.626	5.2014444	430.975			
	0	13	25	116.122	244.052			1.6666667	127.93	2.665208	558.905			
	0	14	25	117.454	195.822			2.6666667	78.374	1.3062333	537.279			
	0	15	57	122.618	193.08			4.2	70.462	0.7658913	707.741			
	0	19	42	117.805	222.768			7.95	104.963	0.4665022	812.704			
17:5:88	1	10	4	118.078	202.00			22.316667	83.927	0.0973631	896.631			
	1	13	21	119.865	186.72			25.6	6.859	0.034171	903.49			
	1	17	31	120.41	128.51			29.766667	8.105	0.03244	911.595			
	2	9	15	124.025	138.518	22	22	14.493	0.0153528	0.0153528	926.088			
18:5:88	2	17	4	120.674	126.283			45.5	5.607	0.0119552	931.695			
	3	9	17	124.97	130.37	22	22	59.533333	5.404	0.0055540	937.099			
	3	16	16	120.844	122.49			76.5	1.653	0.003264	938.752			
20:5:88	4	9	47	121.221	124.51	21	21	94.033333	3.236	0.003142	942.048			
21:5:88	5	11	52	121.202	124.478	21	21	120.11667	3.276	0.0020933	945.324			
23:5:88	7	11	37	121.941	125.18	21	21	167.86667	3.239	0.0011300	948.663			
24:5:88	8	9	30	125.941	137.21	21	21	189.75	1.37	0.0009673	949.833			
25:5:88	9	15	122.856	124.24				219.5	1.407	0.0007882	951.24			
26:5:88	10	9	23	121.864	122.91	20.5	20.5	237.66667	0.949	0.0003700	952.189			
28:5:88	12	10	55	125.933	127.703	21.5	21.5	287.16667	1.772	0.0003960	953.951			
31:5:88	15	9	24	120.693	122.793	19.5	19.5	357.65	2.1	0.0004966	956.061			
2:6:88	17	9	25	122.696	123.67	21	21	405.66667	0.9780000	0.0003395	957.039			
5:6:88	21	9	2	124.038	124.85	20.5	20.5	501.28333	0.816	0.0001422	957.955			
6:6:88	21	9	2	120.84	120.893			508.38333	0.0550000	0.000129	957.91	Column Stripped		
								Σ Obs drain	850.023					

Table A3.37 Column Drainage Data: Col 88/2

COLUMN DRAINAGE ANALYSIS												
Experiment: Ref No = 88/3												
Col Ref = C												
Experiment: Start Date = 17:5:88												
End Date = 13:6:88												
DATE	DAY	HOUR	MINUTE	CONTAINER (gms)	CONT + WAT (gms)	TEMPERATURE MIN deg C	TEMPERATURE MAX deg C	TOTAL TIME (hrs)	DRAINAGE (gms)	DRAIN RATE (g/min)	DRAINAGE (gms)	Notes
17:5:88	0	10	12					0	0	0	0	Start drain
	0	10	17			25	25	0.0916667	106.64	19.389091	106.64	initial drainage - estimated
	0	10	35	116.206	238.815			0.3916667	122.609	5.8116111	229.249	
	0	10	56	112.208	178.991			0.7333333	66.783	3.2577073	296.032	
	0	11	24	117.227	199.148			1.4	81.921	2.92575	377.953	
	0	11	53	112.24	197.134			1.6833333	84.894	2.9273793	462.847	
	0	13	1	120.52	229.219			3.0	108.667	3.622074	571.514	
	0	15	5	116.574	223.093			5.6333333	106.409	0.8865097	677.923	
	0	17	3	126.674	160.956			7.3833333	34.282	0.3264952	712.205	
18:5:88	1	9	5	117.839	202.506	22	28.5	22.8833333	84.667	0.0910388	796.872	
	1	17	9	120.009	145.148			30.99	25.139	0.0519401	822.011	
19:5:88	2	9	5	120.885	122.289	22	26.5	47.216667	2.004	0.0020533	824.015	
	2	16	5	116.277	122.02			54.1833333	5.103	0.0121829	829.12	
20:5:88	3	9	5	121.681	124.8	21	26.5	71.16667	3.119	0.0029648	832.239	
21:5:88	4	11	5	119.888	125.88	21	27.5	97.75	6.292	0.0040282	838.531	
23:5:88	6	11	8	117.971	123.707	21	27	145.5	5.836	0.0020370	844.367	
24:5:88	7	9	3	129.429	130.809	21	25.5	167.4	1.38	0.0010502	845.747	
25:5:88	8	15	2	123.889	124.893	21	26	197.13333	1.014	0.0005684	846.76	
26:5:88	9	9	0	114.209	114.945	20	25	215.5	0.736	0.0006752	847.497	
28:5:88	11	11	5	127.607	129.464	21.5	26.5	264.8	1.857	0.0006253	849.354	
31:5:88	14	9	2	124.889	135.882	19.5	26.5	335.18333	11.193	0.0026505	860.547	
26:88	16	9	2	114.1	115.839	21	26	383.26667	1.729	0.0005993	862.276	
5:6:88	20	9	9	128.008	131.292	20	26.5	478.86667	2.324	0.0004019	864.6	
8:6:88	23	8	1	122.244	123.077	23	27.5	526.01667	0.833	0.0002948	865.433	
13:6:88	27	11	4	122.898	124.935	20	27	649.46667	2.037	0.0002740	867.47	Drain Complete
											760.81	

Table A3.38 Column Drainage Data: Col 88/3

COLUMN DRAINAGE ANALYSIS																
DATE	DAY	HOURL	MINUTE	CONTAINER	CONT + WAT	TEMPERATURE	SOIL ANAL	% Gravel =	% Sand =	% Silt =	% Clay =	TOTAL TIME	DRAINAGE	DRAIN RATE	DRAINAGE	Notes
				(gms)	(gms)	MIN deg C	MAX deg C					(hrs)	(gms)	(gm/min)	(gms)	<-
																<-
17.5.88	0	10	26									0	0	0	0	Start drain
	0	10	36									0.166667	84.375	8.4375	84.375	End Init Drain - estimated
	0	10	57	118.757	231.197	25.5	25.5					0.516667	112.44	5.3542857	196.815	
	0	11	25	121.127	195.991							0.983333	74.769	2.6703314	271.584	
	0	11	54	129.19	208.67							1.466667	79.369	2.7568621	350.973	
	0	13	16	120.11	211.124							2.893333	91.008	1.1098537	441.951	
	0	13	51	120.568	194.923							5.416667	74.355	0.479097	516.316	
	0	17	36	134.984	162.913							7.166667	27.829	0.2650381	544.145	
	1	9	6	119.815	232.158	23	28.5					22.666667	112.343	0.1207989	656.488	
	1	9	9	120.02	133.055							30.716667	13.036	0.0268938	669.566	
	2	25	22	122.451	130.959	22	26.5					46.983333	8.408	0.0086148	677.934	
	2	16	23	130.374	132.826							53.95	2.452	0.0058660	680.386	
	3	55	11	116.901	122.395	21	26.5					71.483333	5.494	0.0052224	685.88	
	4	11	57	122.548	129.341	21	27.5					97.516667	6.793	0.0043489	692.673	
	6	11	42	121.447	130.355	21	27					115.26667	8.903	0.0031092	701.581	
	7	9	36	122.152	125.356	21	25					167.16667	3.397	0.0025852	704.978	
	8	15	20	125.585	129.69	21	25					196.9	4.103	0.0023010	709.083	
	9	30	120	120.793	123.022	20.5	25					215.06667	2.227	0.0020431	711.31	
	11	11	0	125.718	131.094	21.5	26.5					264.56667	5.376	0.0018101	716.686	
	14	9	23	123.391	129.48	19.5	26.5					314.95	5.089	0.001419	722.725	
	16	9	28	122.85	128.375	21	26.5					393.03333	3.522	0.0012208	726.275	
	16	9	28	122.85	128.375	21	26.5					393.03333	3.522	0.0012208	726.275	
	20	5	7	122.481	127.553	20.5	26.5					478.68333	5.165	0.0009002	731.483	
	22	13	127	127.035	128.781	22	27.5					525.78333	1.746	0.0006178	733.209	
	27	1	45	120.895	125.376	20	27					652.31667	4.481	0.0005902	737.59	Drain Complete
												Σ Obs drain	653.315			

Table A3.39 Column Drainage Data: Col 88/4

COLUMN DRAINAGE ANALYSIS													
DATE	DAY	HOUR	MINUTE	CONTAINER (gms)	CONT + WAT (gms)	TEMPERATURE MIN deg C	TEMPERATURE MAX deg C	TOTAL TIME (hrs)	DRAINAGE (gms)	DRAIN RATE (gm/min)	DRAINAGE (gms)	DRAIN RATE (gm/min)	Notes
20:6:88	0	9	30	n/a	n/a	26.5	n/a	0	0	0	0	0	Drain from east
	0	9	36	n/a	n/a			0.1	42.588	7.098	42.588	7.098	End init drain - estimated
	0	10	12	135.586	177.433			0.7	41.84	1.1624167	84.43	1.1624167	
	0	10	28	118.265	138.177			0.9666667	19.911	1.2444375	104.346	1.2444375	
	0	10	53	119.015	141.497			1.3833333	22.482	0.89928	126.828	0.89928	
	0	12	0	113.295	166.956			2.5	53.664	0.8009552	180.492	0.8009552	
	0	13	47	125.784	192.186			4.2833333	66.402	0.6205794	246.894	0.6205794	
	0	15	58	119.94	206.082	n/a		7.4666667	66.133	0.4609843	333.02	0.4609843	
21:6:88	1	8	52	115.298	262.913	23.5	30.5	23.3666667	147.617	0.1947348	480.649	0.1947348	
	1	10	1	129.375	146.316		30.5	30.5166667	17.541	0.408881	498.19	0.408881	
22:6:88	2	8	38	126.715	144.406	24.5	29.5	48.1333333	17.69	0.167360	515.88	0.167360	
23:6:88	3	11	26	117.945	131.104	24	30.5	73.9333333	13.159	0.0085006	529.039	0.0085006	
24:6:88	4	1	57	127.35	135.665	24.5	28.5	102.45	8.471	0.049532	537.516	0.049532	
27:6:88	7	1	25	122.405	133.157	22.5	28.5	175.83333	10.755	0.0024410	546.269	0.0024410	
30:6:88	10	13	5	113.645	118.856	22	27.5	243.58333	5.31	0.0013072	553.579	0.0013072	
3:7:88	13	10	45	128.985	142.04	21	27.5	313.25	13.051	0.0031222	566.63	0.0031222	Drain complete
								Σ Obs. drain	524.042				

Table A3.40 Column Drainage Data: Col 88/5

COLUMN DRAINAGE ANALYSIS												
DATE	DAY	HOUR	MINUTE	CONTAINER (gms)	CONT + WAT (gms)	TEMPERATURE MIN deg C	TEMPERATURE MAX deg C	TOTAL TIME (hrs)	DRAINAGE (gms)	DRAIN RATE (g/m/min)	DRAINAGE (gms)	Notes
20:6:88	0	9	50	n/a	n/a	26.5		0	0	0	0	Start drain from set
	0	9	57	n/a	n/a			0.1166667	53.059	7.5798571	53.059	End init drain - estimated
	0	10	55	122.217	254.166			0.5833333	131.948	4.7124643	185.008	
	0	10	58	126.483	245.89			1.1333333	119.207	3.6133333	304.215	
	0	12	4	128.794	244.761			2.2333333	115.967	1.7570758	420.182	
	0	13	51	116.59	198.307			4.0166667	81.717	0.7637103	501.899	
	0	17	3	135.162	218.222		30.5	7.2166667	83.06	0.4326042	584.959	
	1	8	57	121.548	207.822	25.5		23.1166667	86.27	0.0904340	571.23	
	1	16	7	173.583	123.295			30.2933333	9.712	0.0225860	680.943	
	2	9	45	141.022	151.659	24.5		47.9166667	10.53	0.0100482	691.576	
23:6:88	3	11	31	121.744	132.256	24		73.6833333	10.51	0.0067995	702.088	
	4	16	2	115.4	126.394	24.5		102.2	10.991	0.0064255	713.082	
27:6:88	7	17	28	137.289	146.28	22		175.63333	18.991	0.0043103	732.073	
	10	13	4	125.77	135.147	22		243.53333	9.37	0.003109	741.446	
3:7:88	13	10	45	113.172	123.192	21		312.91667	10.02	0.0023966	751.466	
5:7:88	15	16	48	126.687	131.053	21		366.96667	4.366	0.0013463	755.832	
6:7:88	16	12	54	129.267	131.715	20		387.06667	2.448	0.0020299	758.28	Drain Completed
								ΣObs drain	705.22			

Table A3.42 Column Drainage Data: Col 88/7

COLUMN DRAINAGE ANALYSIS														
Experiment	Ref No	Col Ref	Start Date	End Date	MINUTE	CONTAINER (gms)	CONT + WAT (gms)	TEMPERATURE MIN deg C	TEMPERATURE MAX deg C	TOTAL TIME (hrs)	DRAINAGE (gms)	DRAIN RATE (g/m/min)	DRAINAGE (gms)	Notes
	8978	D	20:6:88	6:7:88										
					SOIL ANAL									
					% Gravel = 79.91									
					% Sand = 14.74									
					% Silt = 5.35									
					% Clay =									
					NB :- assume no drainage in initial period									
DATE	DAY	HOURL	MINUTE	CONTAINER (gms)	CONT + WAT (gms)	TEMPERATURE MIN deg C	TEMPERATURE MAX deg C	TOTAL TIME (hrs)	DRAINAGE (gms)	DRAIN RATE (g/m/min)	DRAINAGE (gms)	Notes		
20:6:88	0	10	0	n/a	n/a	26.5		0.0833333	0	0	0	0: Start drain from sat		
	0	10	5	n/a	n/a			0.1666667	28.348	1.4174	28.348	0: End drain from sat		
	0	10	25	121.592	149.946			0.4166667	59.311	1.8033636	87.859			
	0	10	58	123.992	183.506			0.9666667	80.898	1.2257273	168.757			
	0	12	4	124.374	205.273			2.0666667	3.85	88.57	0.8277570	257.327		
	0	13	51	129.908	218.479				100.306	0.5224271	357.631			
21:6:88	0	17	3	130.204	230.51		30.5	7.05	132.93	0.1390394	459.268			
	1	8	57	124.315	256.948		30.5	22.95	17.461	0.0405128	507.729			
	1	16	8	125.038	142.499			30.1333333	14.163	0.0133952	521.892			
22:6:88	2	9	45	132.14	146.303		24.5	47.75	14.293	0.0092332	536.185			
23:6:88	3	11	33	123.723	138.016		24.5	73.55	10.02	0.0058596	546.205			
24:6:88	4	16	3	126.073	136.093		24.5	102.05	15.00	0.0033984	561.209			
27:6:88	7	38	38	130.88	145.884		22.5	28.5	7.857	0.0019414	569.062			
30:6:88	10	13	5	124.487	132.344		22.5	27.5	31.2	0.0019	577.008			
3:7:88	13	10	45	120.592	128.534		21	31.2	7.942	0.0019	580.265			
5:7:88	15	16	48	134.143	137.4		21	366.8	3.257	0.0010043	581.301	Drain Completed		
6:7:88	16	13	46	131.764	132.8		20	25.5	1.036	0.0008235	581.301			
										Σ Obs drain		581.301		

Table A3.43 Column Drainage Data: Col 88/8

COLUMN DRAINAGE ANALYSIS													
Experiment:	Ref No. =	88/9	SOIL ANAL:			TEMPERATURE		CONTAINER: CONT + WAT		COLUMN DRAINAGE ANALYSIS			
Col Ref =	A		% Gravel =	% Sand =	% Silt =	MIN deg C	MAX deg C	(gms)	(gms)	TOTAL TIME (hrs)	DRAINAGE (gms)	DRAIN RATE (gm/min)	Notes
Experiment: Start Date =	12-7-88		% Clay =										
Experiment: End Date =	17-8-88												
DAY	HOUR	MINUTE	MINUTE	MINUTE	MINUTE	MINUTE	MINUTE	MINUTE	MINUTE	MINUTE	MINUTE	MINUTE	MINUTE
DATE	DAY	HOUR	MINUTE	MINUTE	MINUTE	MINUTE	MINUTE	MINUTE	MINUTE	MINUTE	MINUTE	MINUTE	MINUTE
12-7-88	0	0	50	0	0	22	22	0	0	0.0833333	118.8755	23.7751	0
	0	0	55	0	0			0	0		118.8755	23.7751	0
	0	0	50	125.138	170.797			1	45.659	3.9166667	103.1622	0.8301636	164.5345
	0	15	45	120.975	7			5	5.965667	5.965667	42.879	0.5995	267.697
	0	14	48	116.365	159.244			5	5.965667	9.3333333	50.314	0.3486098	310.576
	0	10	10	130.78	181.104			9	3.3333333	24.416667	117.02	0.2490782	360.89
13-7-88	1	15	15	122.138	239.154	19	25	24.416667	31.516667	31.516667	34.841	0.1930309	477.91
	1	16	21	117.43	152.378			31	5.166667	49.166667	21.677	0.0204593	534.428
14-7-88	2	10	0	131.93	153.607	20.5	20.5	25	49.166667	74.166667	12.631	0.0082118	547.059
15-7-88	3	11	27	122.938	135.569	20.5	23.5	23.5	74.166667	117.735	0.0027735	0.0027735	558.791
18-7-88	6	9	57	133.78	149.323	20.5	24.5	18.5	116.667	175.9	3.259	0.0017845	562.05
19-7-88	7	15	44	125.125	128.384	21.5	27.5	27.5	175.9	221.1	3.387	0.0012489	565.437
21-7-88	9	15	56	115.413	118.8	22.5	22.5	22.5	221.1	245.25	2.572	0.0017750	568.009
22-7-88	10	14	5	128.165	130.737	22.5	27	27	245.25	4.399	0.0010152	0.0010152	572.408
25-7-88	13	14	18	123.363	127.763	19.5	27	31.7	46.667	1.803	0.0005564	0.0005564	574.215
27-7-88	15	11	11	115.909	117.716	20	26	35.3	35	1.658	0.0005501	0.0005501	575.874
29-7-88	17	1	27	124.423	126.082	20	20	43.6	61.667	1.957	0.0004544	0.0004544	577.831
1-8-88	20	14	14	118.998	120.955	20	20	48.5	48.5	1.126	0.0003911	0.0003911	578.957
3-8-88	22	13	13	122.578	123.704	21	25	53.3	38.333	1.048	0.0003616	0.0003616	580.003
5-8-88	24	14	26	124.636	125.882	21.5	28	58.1	6	1.27	0.0002969	0.0002969	581.281
8-8-88	27	14	10	121.455	123.333	21.5	29.9	63.3	33.333	3.333	0.0011592	0.0011592	584.515
10-8-88	29	1	6	117.675	120.949	24	30	70.1	26.667	0.952	0.0002153	0.0002153	586.358
12-8-88	31	15	52	126.548	127.339	20.5	28	75.1	0.33333	0.299	0.0001079	0.0001079	586.65
15-8-88	34	17	33	127.882	128.334	20	27	82.4	71.667	0.952	0.0002153	0.0002153	586.358
17-8-88	36	14	40	120.71	121.002	21.5	27	85.9	83.333	0.299	0.0001079	0.0001079	586.65
								Σ Obs drain	467.7745				Drain End

Table A3.44 Column Drainage Data: Col 88/9

COLUMN DRAINAGE ANALYSIS															
Experiment: Ref No = 88/12		SOIL ANAL:		TEMPERATURE		CONTAINER CONT + WAT		TOTAL TIME		DRAINAGE		DRAIN RATE		Notes	
DATE	DAY	HOUR	MINUTE	(gms)	(gms)	MIN deg C	MAX deg C	(hrs)	(gms)	(gm/min)	(gm/min)	(gms)	(gms)	Σ DRAINAGE	Σ DRAINAGE
13.7.88	0	9	33			21		0	0	0	0	0	0	0	0
	0	9	38					0.0833333	135.173	27.0346	0	0	0	135.173	0: Drain from sat
	0	11	3	126.547	155.599			1.5	29.052	0.3417882	0	0	0	164.225	End init drain - estimated
	0	18	18	127.192	144.831			8.75	17.639	0.0405494	0	0	0	181.864	
14.7.88	1	0	4	129.377	133.342	20.5	22	24.516667	3.843	0.0041702	0	0	0	185.809	
	1	17	7	128.809	129.331			31.956667	0.5220000	0.0012340	0	0	0	186.331	
15.7.88	2	11	33	136.306	137.074	20.5	23.5	50.7680000	0.0006944	0.0006944	0	0	0	187.099	
18.7.88	5	10	3	130.027	153.18	20.5	24.5	120.5	23.163	0.0054759	0	0	0	210.262	
19.7.88	6	16	49	130.955	135.807	27.5	27.5	151.26667	24.852	0.0134626	0	0	0	235.114	
21.7.88	8	14	2	126.07	133.433	22.5	22	196.48333	7.365	0.0027140	0	0	0	242.477	
22.7.88	9	14	13	127.069	136.742	22.5	22	220.66667	9.676	0.0066895	0	0	0	252.153	
25.7.88	12	14	23	123.436	149.84	19.5	21	282.83333	26.401	0.0060979	0	0	0	278.557	
27.7.88	14	12	15	123.415	141.265	20	26	338.7	17.85	0.0064862	0	0	0	296.407	
29.7.88	16	14	34	116.875	126.832	20	26	399.01667	9.95	0.0032991	0	0	0	306.357	
1.8.88	19	14	22	122.514	138.287	20	25	460.81667	15.773	0.0036613	0	0	0	322.14	
3.8.88	21	14	26	122.894	132.238	21	25	508.93333	9.285	0.0032161	0	0	0	331.425	
5.8.88	23	14	33	135.397	144.282	21.5	25	557	8.895	0.0030856	0	0	0	340.324	
8.8.88	26	14	17	122.789	139.892	21.5	25	628.73333	17.104	0.0039740	0	0	0	357.428	
10.8.88	28	14	16	130.333	138.332	24	30	676.71667	7.955	0.0027631	0	0	0	365.393	
12.8.88	30	16	57	124.774	131.709	20.5	28	727.4	6.935	0.0022805	0	0	0	372.318	
15.8.88	32	17	40	137.588	146.2	20	22	800.11667	8.542	0.0019578	0	0	0	380.86	
17.8.88	35	14	15	127.93	137.42	21.5	27	844.7	4.57	0.0017084	0	0	0	385.43	
19.8.88	37	16	46	122.637	132.42	22	28.5	895.21667	4.765	0.0015721	0	0	0	390.195	
23.8.88	41	17	23	126.084	134.229	20.5	27	991.83333	8.145	0.0014050	0	0	0	398.34	
24.8.88	42	16	16	128.341	130.18	21.5	22	1014.7167	1.82	0.0013401	0	0	0	400.18	End Drain
								Σ Obs Drain	265.007						

Table A3.47 Column Drainage Data: Col 88/12.

APPENDIX 4

SUMMARY OF GLEADTHORPE E.H.F. DATA.

The rationale for using data from irrigation studies undertaken at Gleadthorpe Experimental Husbandry Farm in order to develop crop yield decline functions has already been discussed in Sect.7.3.2. Summaries of the data used are presented in this Appendix. Tables A4.1 to A4.4 detail the data employed in the determination of the yield functions for sugar beet, spring barley, main crop potatoes and early potatoes respectively.

Analysis of the data was undertaken using the STATWORKS package on an Apple Macintosh Plus computer, and the crop yield equations were obtained through linear regression (see Table 7.3). The analysis of variance results showed that in some instances the standard error of estimate and the Student's t test yielded relatively poor results for the constants in the regression equations. However, such results are only to be expected given both the number of variables, other than irrigation application, which could have influenced the crop yields, and the small sample sizes. Under the circumstances, therefore, the regression equations were accepted for determining the effect of groundwater drawdown on crop yield.

****	GLEADTHORPE EXPERIMENTAL HUSBANDRY FARM - MAFF		****
****	SUGAR BEET IRRIGATION EXPERIMENTS		****
****	1955-76		****
Operating Rules	Year	Total Application (mm)	Yield Increase ΔY (tonne/ha)
		I	B
		(mm)	(mm.days)
Full watering	1955	175	30.9
	1958	69.5	2.7
	1959	250	45.7
Half watering	1955	87	25.1
	1958	46	1.5
	1959	200	34.2
Early start	1962	73	0.5
	1963	88.5	0.5
	1964	131	4.5
Late start	1963	63.5	0.7
	1964	93	6
Irrigate if SMD@50mm	1965	50	2.6
	1966	50	1.5
	1970	100	11.3
Irrigate if SMD@100mm	1967	75	9.5
	1970	75	8.1
Irrigate if SMD@75mm	1967	100	16.6
	1970	100	11.5
	1973	57	3.87
	1976	213	30.6
			10975
			6613
			21025
			5075
			3128
			14800
			6156
			7334
			10159
			4508
			6169
			3150
			4250
			9750
			5625
			6825
			7350
			8900
			3578
			15637

Table A4.1 Gleadthorpe E.H.F. - Sugar Beet Irrigation Experiments 1955 to 1976.

****	GLEADTHORPE EXPERIMENTAL HUSBANDRY FARM - MAFF	****
****	SPRING BARLEY IRRIGATION EXPERIMENTS	****
****	1960-70	****
Operating Rules	Year	Moisture Benefit
	Total Application	Yield Increase
	I (mm)	ΔY (kg/ha)
	B	(mm.days)
Early irrigation only	1961	30 110 2190
	1962	38 790 2580
	1964	38 870 2774
	1965	33 390 2211
Two Irrigations	1961	72 590 4458
	1962	76 880 4332
	1964	70 1160 4544
	1961	44 250 2376
Late irrigation only	1962	38 860 1824
	1964	32 590 1880
	1967	38 370 1710
	1968	38 180 1900
	1970	48 1040 2832
(Arthur Rickwood EHF)	(1967)	(40) (300) (1360)
	(1969)	(38) (2500) (13680)

Table A4.2 Gleadthorpe E.H.F - Spring Barley Irrigation Experiments 1960 to 1970.

**** GLEADTHORPE EXPERIMENTAL HUSBANDRY FARM - MAFF ****				
**** MAINCROP POTATO IRRIGATION EXPERIMENTS ****				1960-80
Operating Rules	Year	Total	Yield	Moisture
		Application	Increase	Benefit
		I	ΔY	B
		(mm)	(tonne/ha)	(mm.days)
Regime 1	1964	103	5.8	7823
Regime 2	1969	103	13.3	6631
	1970	199	24.1	13871
	1971	88	3.7	6726
	1974	104	0.5	8529
	1976	232	41.8	15296
	1977	111	24.3	7066
	1978	91	4.3	74.82
	1979	112	16.2	8209
Regime 3	1969	93	12	5932
	1970	209	22.6	15811
Regime 4	1964	88	5.1	5879
Regime 5	1963	42	1.4	2058
	1964	81	1.9	5039
	1969	88	4.8	5425
	1970	193	23.3	13147
	1971	85	2.7	5756
	1973	64	1.3	3712
	1974	75	6.3	5335
Regime 6	1969	58	10.2	3654
	1970	172	19.9	11408
NOTE:	Regime 1 :	a) on emergence if SMD>20.3mm return soil to field capacity (FC)		
		b) subsequently return to FC if SMD>20.3mm		
	Regime 2 :	a) at tuber initiation (+ next 6 weeks) if SMD>19/15mm return soil to FC		
		b) subsequently return to FC if SMD>38mm		
	Regime 3 :	a) at tuber initiation (+ next 6 weeks) if SMD>20/25mm return soil to FC		
		b) subsequently return to FC if SMD>20/35mm		
	Regime 4 :	a) at tuber marble size if SMD>20.3mm return soil to FC		
		b) subsequently return to FC if SMD>20.3mm		
	Regime 5 :	a) at tuber marble size if SMD>38/40mm return soil to FC		
		b) subsequently return to FC if SMD>38/40mm		
	Regime 6 :	a) at tuber marble size if SMD>57mm return soil to FC		
		b) subsequently return to FC if SMD>57mm		

Table A4.3 Gleadthorpe E.H.F - Maincrop Potatoes Irrigation Experiments
1960 to 1980.

***** GLEADTHORPE EXPERIMENTAL HUSBANDRY FARM - MAFF						
***** EARLY POTATO IRRIGATION EXPERIMENTS					1960-68	
Strain	Irrigation Rules	Year	Total Application I (mm)	Yield Increase ΔY (tonne/ha)	Moisture Benefit B (mm.days)	
Arran Pilot (late lift'g)	SMD>10mm	1960	76.8	7.3	3233	
		1963	64.3	3.9	1425	
	SMD>20mm	1960	64.2	2.9	2317	
		1963	64	4.3	1117	
		1964	83.5	6.3	2810	
		1965	42.9	2.6	1123	
		1966	59.4	5.1	1806	
		1967	104.2	9.1	2356	
	SMD>30mm	1960	74.2	6.6	2750	
		1963	31.5	0.7	788	
SMD>38mm		1964	78.1	2.4	2334	
		1965	37.8	2.1	308	
Ulster Prince (late lift'g)	SMD>10mm	1960	76.8	3.89	3233	
		1963	64.2	5.34	2317	
	SMD>20mm	1960	64	4.62	1117	
		1963	64	4.62	1117	
	SMD>30mm	1960	74.2	6.02	2750	
		1963	31.5	5.11	788	
	Arran Pilot (early lift'g)	SMD>10mm	1960	76.8	3.1	2080
			1963	64.3	0.5	1425
		SMD>20mm	1960	64.2	3.3	1724
			1963	64	1.9	1117
1964			62.2	4.1	1643	
SMD>30mm		1960	74.2	1.3	1637	
		1963	31.5	0.7	787	
		1964	38.9	3.7	1245	
Ulster Prince (early lift'g)	SMD>10mm	1960	76.8	1.95	2080	
		1963	64.2	1.95	1724	
	SMD>20mm	1960	64	1.45	1117	
		1963	64	1.45	1117	
	SMD>30mm	1960	74.2	1.46	1637	
		1963	31.5	0.72	787	
NOTES: a) data for 1961 & 1962 averaged together						
b) early lifting assumes harvested by 30th June						
c) late lifting assumes harvested by 15th July						

Table A4.4 Gleadthorpe E.H.F - Early Potatoes Irrigation Experiments 1960 to 1968.

APPENDIX 5

DOCUMENTATION OF MAP PROGRAMS.

A5.1 INTRODUCTION.

The programs detailed in Appendix 5 were written on a BBC B Microcomputer with an Aries-B20 Ram expansion board, giving a total of 52K of memory. The additional 20K RAM was required to enable two dimensional arrays of 60 x 50 to be handled. However, the suite of programs have been designed to be as versatile as possible and can therefore be run on any BBC Micro with one single side 40 track disc drive. Each operator will have to determine the maximum size of array that can be processed on his/her own particular machine.

Section 8.2 described the development and operation of the "Map" suite of programs, with Fig 8.1 and Fig 9.1 illustrating how they relate to each other. In Appendix 5 flow diagrams are provided for each of the programs but, as they have been written to be user-friendly, the details provided are as brief as possible - listings can be obtained from the author on request. Where appropriate examples of output are given, and in some instances these have been used to illustrate the program's main function. For each program the main objective, the subsidiary capabilities and the limitations are listed below.

A5.2 MAPCOM.

Main Objective:	set up command data file to define array size for map data, annotate map and provide key.
Subsidiary Capabilities:	edit and print command file.
Limitations:	save function accessed through edit and set up functions only; no facility for making backup copies of command file.
Flow Diagram:	Fig A5.1.
Example of Output:	Fig A5.2.

A5.3 MDATIN.

Main Objective: open new map data file and input map data.
Subsidiary Capabilities: edit data file and view command file.
Limitations: save facility accessed through set up, data entry and edit functions only.
Flow Diagram: Fig A5.3.

A5.4 MPRINT.

Main Objective: print entire map and individual squares using key codes (0 to 9).
Subsidiary Capabilities: print command file, view command file and view individual squares.
Limitations: for complete map, output covers more than one sheet of A4 paper.
Flow Diagram: Fig A5.4.
Example of Output: Fig A5.5; Fig A5.6.

A5.5 MAPSEE.

Main Objective: view whole map and individual squares in colour.
Subsidiary Capabilities: view command file and print out individual squares.
Limitations: takes approx 4 mins to display each map.
Flow Diagram: Fig A5.7.
Example of Output: Fig A5.5; Fig A5.8.

A5.6 MAPDUMP.

Main Objective: dump map and key, as displayed on VDU screen using shading, to Epson printer; calculate area of each parameter on map and output results to printer.

Subsidiary Capabilities: view all functions, as an alternative to producing a hard copy; view command file.

Limitations: print out of map is quite small, and some symbols are poorly defined on hard copy - especially when all the available 10 codes are employed.

Flow Diagram: Fig A5.9.

Example of Output: Fig A5.10.

A5.7 MSIMPLY.

Main Objective: reduce the number of codes employed in a map key by combining them where appropriate.

Subsidiary Capabilities: none.

Limitations: command file for output has to be prepared for simplified map, using MAPCOM, before MSIMPLY entered.

Flow Diagram: Fig A5.11.

Example of Operation: Fig A5.12.

A5.8 MMERGE.

Main Objective: enable a composite to be produced from two maps.

Subsidiary Capabilities: none.

Limitations: for the memory available to the author, working on an array of 60 x 50 it was only possible to process 15 combinations of map codes at any one time. The command file has to be prepared for the resulting composite map (using MAPCOM) before MMERGE entered.

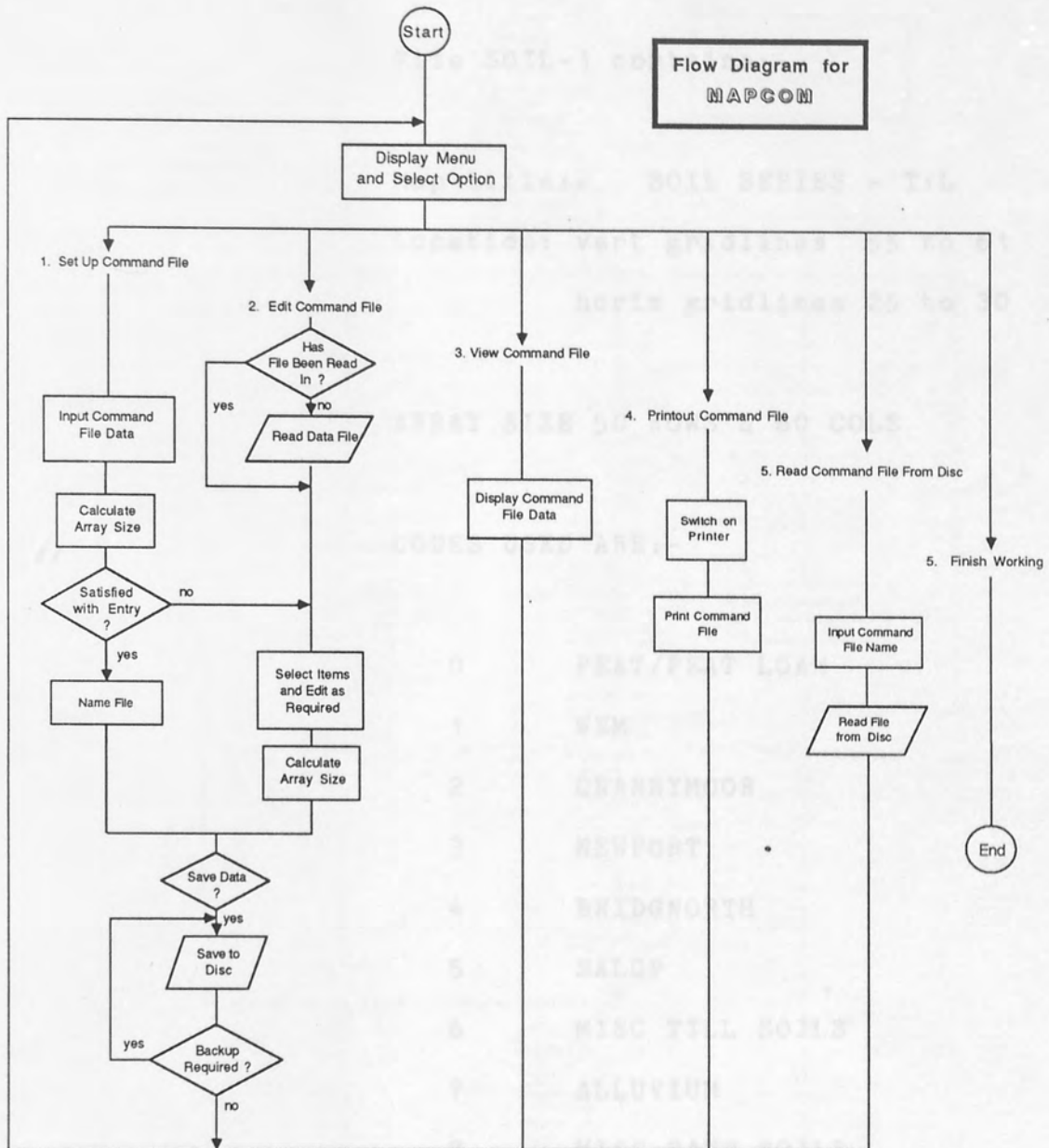
Flow Diagram: Fig A5.13.

Example of Operation: Fig A5.14.

A5.9 MAPSURF.

MAPSURF offers the operator a choice of three further programs for determining the values of a parameter at each of the 100 elements within a grid square. The values at surrounding grid line intersections - or nodes - have to be specified. Initially MAPSURF inputs a screen dump routine to memory before displaying a menu which allows the operator to select an appropriate program. As each of the three calculation programs, MAPSR1, MAPSR4 and MAPSR16, operates in a similar manner they are treated here under the umbrella title of MAPSURF. However, separate flow diagrams, output examples and listings are provided.

- Main Objective: for a specified parameter representative values for each of the 100 elements within a grid square are calculated from values specified for surrounding node points.
- Subsidiary Capabilities: output in either hard copy or VDU display format; facility for determining the difference between the surface shapes calculated for two parameters.
- Limitations: MAPSR4 and MAPSR16 are very slow. Tendency for discontinuities to occur at the boundaries between two adjacent squares, for which element values were calculated separately (see Fig A5.16). The wider the node spacings, the greater the inaccuracy in simulating rapid changes within grid squares.
- Flow Diagrams: Fig A5.15; Fig A5.17; Fig A5.19; Fig A5.21.
- Example of Output: Fig A5.18; Fig A5.20; Fig A5.22.



Variables Required For MAPCOM:

1. Map Title
2. Grid Square Location
Bounding Vertical Grid Lines
Bounding Horizontal Grid Lines
3. Key for Map Data
Codes 0 to 9
Description for Each Code

Fig A5.1 Flow Diagram of MAPCOM.

File SOIL-1 contains:-

Map title:- SOIL SERIES - T:L

Location: vert gridlines 55 to 61

horiz gridlines 25 to 30

ARRAY SIZE 50 ROWS & 60 COLS

CODES USED ARE:-

- | | |
|---|-----------------|
| 0 | PEAT/PEAT LOAM |
| 1 | WEM |
| 2 | CRANNYMOOR |
| 3 | NEWPORT |
| 4 | BRIDGNORTH |
| 5 | SALOP |
| 6 | MISC TILL SOILS |
| 7 | ALLUVIUM |
| 8 | MISC SAND SOILS |
| 9 | HODNET |

Fig A5.2 Example of Output from MAPCOM - Command File Data.

Fig A5.3 Flow Diagram of MDATIN.

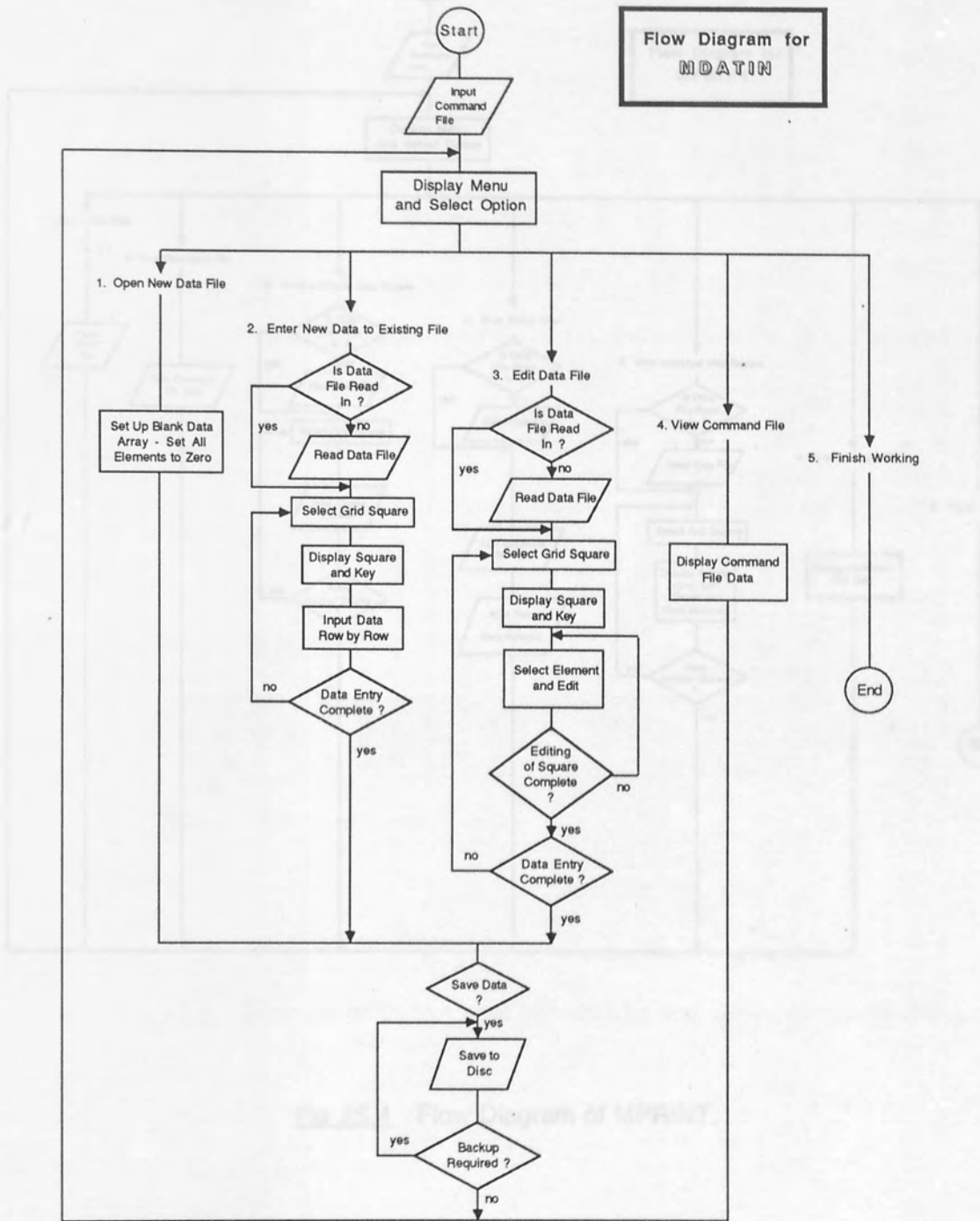


Fig A5.3 Flow Diagram of MDATIN.

Map Title:- SOIL SERIES - T:L

Command file = SOIL-1 Data file = DSOIL-1
Location: vert gridlines 55 to 61
horiz gridlines 25 to 30

CODES USED ARE:-
0 PEAT/PEAT LOAM
1 WEM
2 CRANNYMOOR
3 NEWPORT
4 BRIDGNORTH
5 SALOP
6 MISC TILL SOILS
7 ALLUVIUM
8 MISC SAND SOILS
9 HODNET



```
55      56      57      58      59      60      61
:      :      :      :      :      :      :
30.....:
:2222221733:3333311991:1444999999:9999999999:999999155:5511111155:
:2222221733:3333311911:1444999999:9999999999:9999999999:9999955555:
:333323133:3331111144:4444449999:4999999999:9999999999:9999955551:
:3323377736:3669999144:4444444444:4999999999:9999999999:9999955551:
:3323777366:6699999944:4444444444:4999999999:9999999999:9999955555:
:3377377666:6699999944:4444444444:4999999999:9999999999:999995951:
:3773337666:6699999944:4444444444:4499999999:9999999999:9999999999:
:3733666666:6699999944:4444444444:4499999999:9999999999:9999999999:
:7736666666:6999999944:4444444444:4433333339:9999999999:9999911999:
:7366666666:6999999944:4444444444:3333113333:3339999999:9999911999:
29.....:
:7666666661:1999944444:4444444444:4443111133:3113399999:9999999999:
:3766666661:4444444444:4444444444:4443111111:1111739999:9999999999:
:3766666614:4444444444:4444444444:4433311111:1114477999:9999999999:
:7766666114:4444444444:4444444444:3333311111:1444444777:9997779999:
:7666661144:4444444444:4444444444:4433431111:1444999999:7779977999:
:6666661444:4444444444:4444444444:4444331111:1449999999:9999999779:
:6666614444:4444444444:4444444444:4441111111:1449889999:9999999997:
:6666114444:4444444444:4444444444:4444333111:1449888999:9999999943:
:6661142424:4444444444:4444444444:4444433341:1448889999:9999999443:
:6661444222:2442244444:4444444444:4444433444:4448889999:9999994433:
28.....:
:6114444222:222222224:4444444444:4444443444:4448899999:9999994411:
:1144434422:222222224:4443344444:4444444444:4448899999:9999994431:
:1444433444:222222244:4443444444:4444444444:4448999994:4999944331:
:4444433444:4244424444:4434444444:4444444444:4448999994:4999944331:
:4444330044:4444444444:4334444444:4444444443:4489999994:4994444311:
:4444330004:4444444444:4344444444:4444444444:4489999934:4444443311:
:4443330004:4444444444:3344444444:4444444434:4499999433:4444333111:
:4443330000:4444443333:3244444443:3334444334:4499994433:4443333111:
:4443300000:3443330000:0024444333:3333333334:3449994443:3333131331:
:4433151000:0003000000:0000022233:3333333333:3444444444:3111131331:
27.....:
:4333155110:0001100000:0000002222:2322223333:3334444444:3331331333:
:4444155111:1000330000:0000002222:2222223332:2324433333:3333331333:
:7774441111:1111110000:0000002222:2222222222:2222333331:1112223333:
:4447774111:111555330:0000022222:2222222222:2222333333:1111222333:
:4144447111:1111115551:2222444244:2422222222:222233313:3321122231:
:4144447411:111111151:3444444444:4422244222:222233113:3222112211:
:4144447411:1111111111:3444444444:4422222222:2122443313:3332211121:
:4444774411:1111111111:3444144444:4422222222:2122444333:3422221113:
:4444744111:1111111111:3344144444:4222222222:2124444334:4222222222:
:4444744411:1111111111:1344444444:4222222222:2124444344:4222222222:
26.....:
:4444744441:1444444441:1344444444:2222222222:2124444442:2222222223:
:4444744444:4444444444:1344444444:2222222222:2124444442:2222222223:
:4444774444:4444444444:4444444431:1222222222:1124444422:2222222223:
:4444774444:4444444444:4444444331:1122244422:2224444422:2222222243:
:4444374444:4344444444:4444443311:1442444242:2224444222:2222222223:
:4443377443:3331144444:4444443111:1444442222:2224444222:2222222224:
:4433771131:1333114444:4444431111:1444422222:2224444222:2222244444:
:333377131:1333113344:4444437111:444222212:2224444222:2222244444:
:33377113:3111113334:4444317114:424222112:2222444422:4441111144:
:337337111:1333311334:4444317114:2244421112:2222444444:4441111144:
25.....:
:
:
:
:
:
:
55      56      57      58      59      60      61
```

Fig A5.6 Example of Output from MPRINT - Entire Map (Soil Series - T.L.).

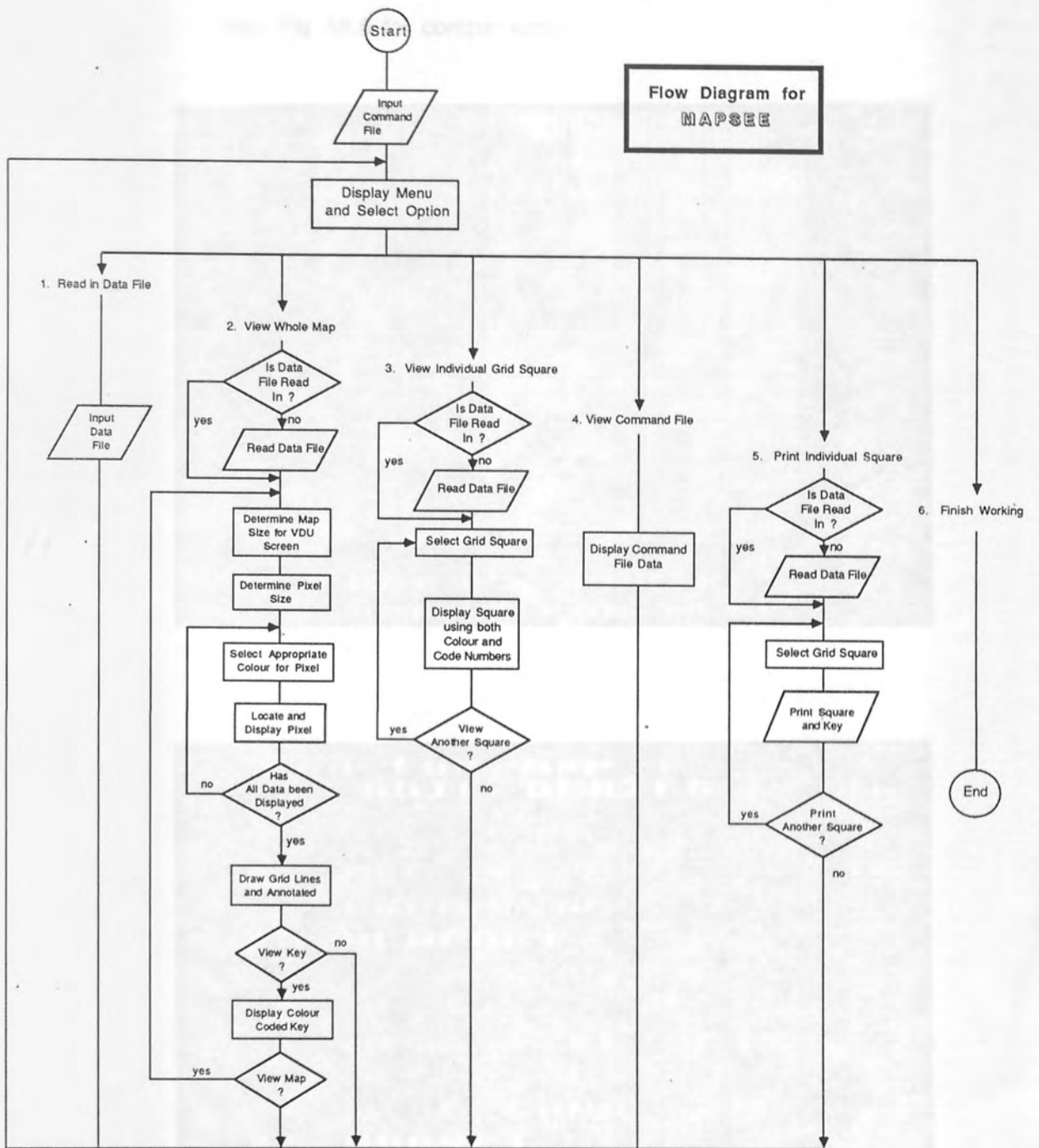


Fig A5.7 Flow Diagram of MAPSEE.

Fig A5.8 Example of Output from MAPSEE - Screen Display (Soil Series - T.L).
(see Fig A5.6 for comparison)



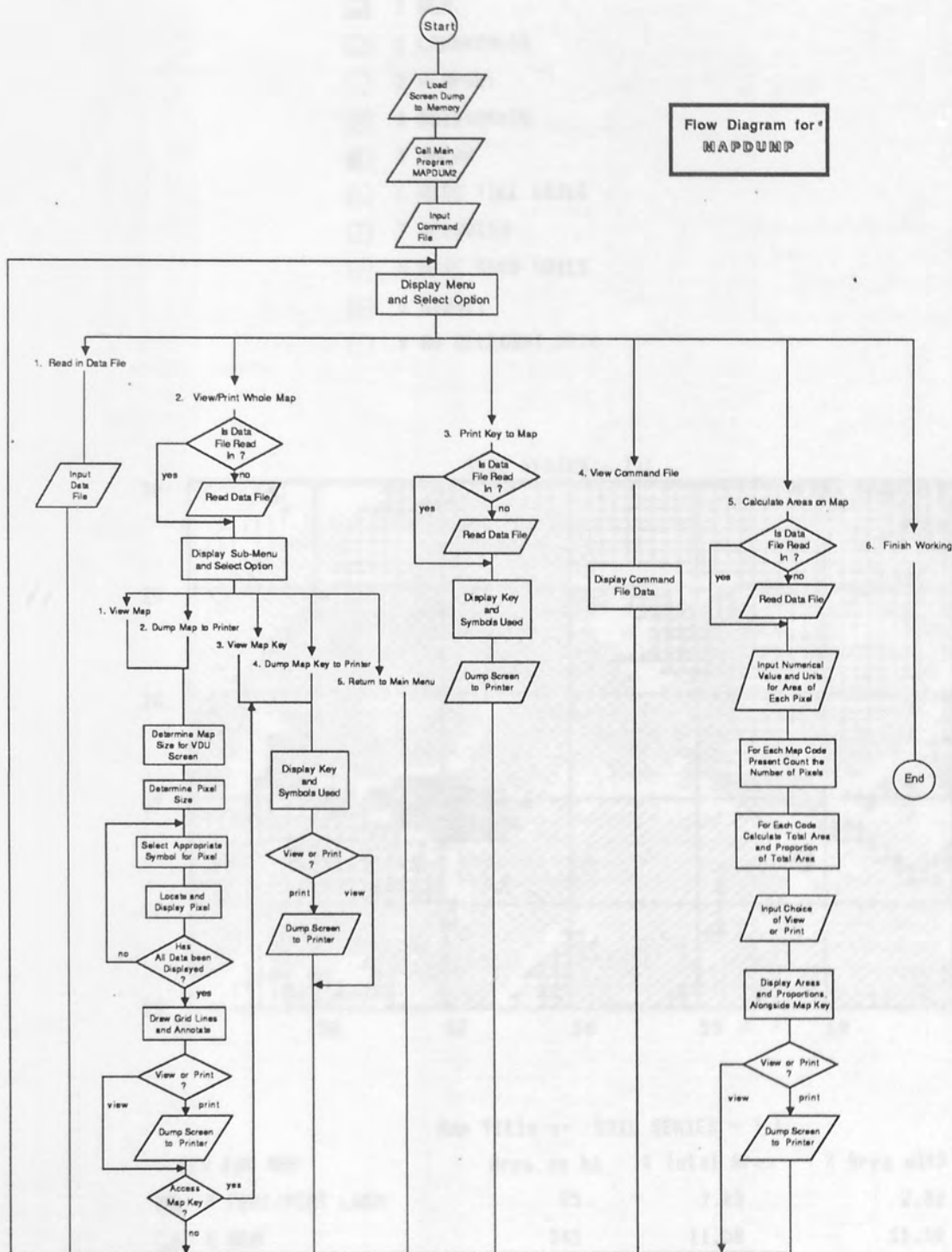
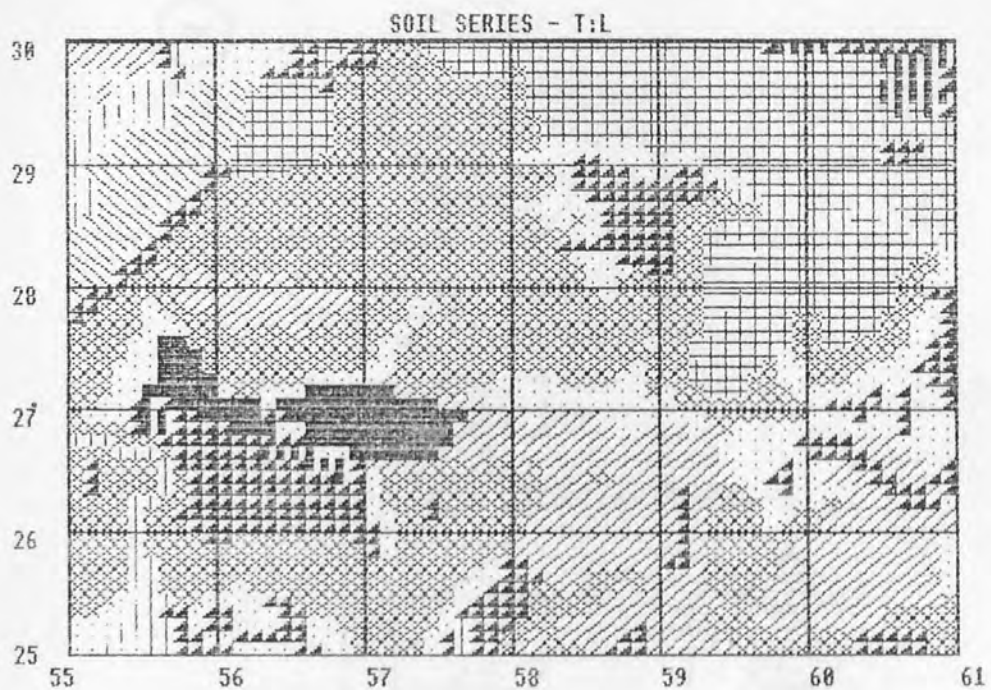


Fig A5.9 Flow Diagram of MAPDUMP.

KEY FOR MAP

- 0 PERT/PERT LOAM
- 1 WEM
- 2 CRANNYMOOR
- 3 NEWPORT
- 4 BRIDGNORTH
- 5 SALOP
- 6 MISC TILL SOILS
- 7 ALLUVIUM
- 8 MISC SAND SOILS
- 9 HODNET
- x NO RELEVANT DATA



Map Title :- SOIL SERIES - T:L

KEY FOR MAP	Area in ha	% Total Area	% Area with Data
0 PERT/PERT LOAM	85	2.83	2.83
1 WEM	345	11.50	11.50
2 CRANNYMOOR	411	13.70	13.70
3 NEWPORT	357	11.90	11.90
4 BRIDGNORTH	1092	36.40	36.40
5 SALOP	38	1.27	1.27
6 MISC TILL SOILS	95	3.17	3.17
7 ALLUVIUM	78	2.60	2.60
8 MISC SAND SOILS	19	0.63	0.63
9 HODNET	480	16.00	16.00
x NO RELEVANT DATA	0	0.00	
TOTAL AREA	3000		
AREA WITH DATA	3000	100.00	

Fig A5.10 Example of Output from MAPDUMP - Entire Map (Soil Series - T.L.).

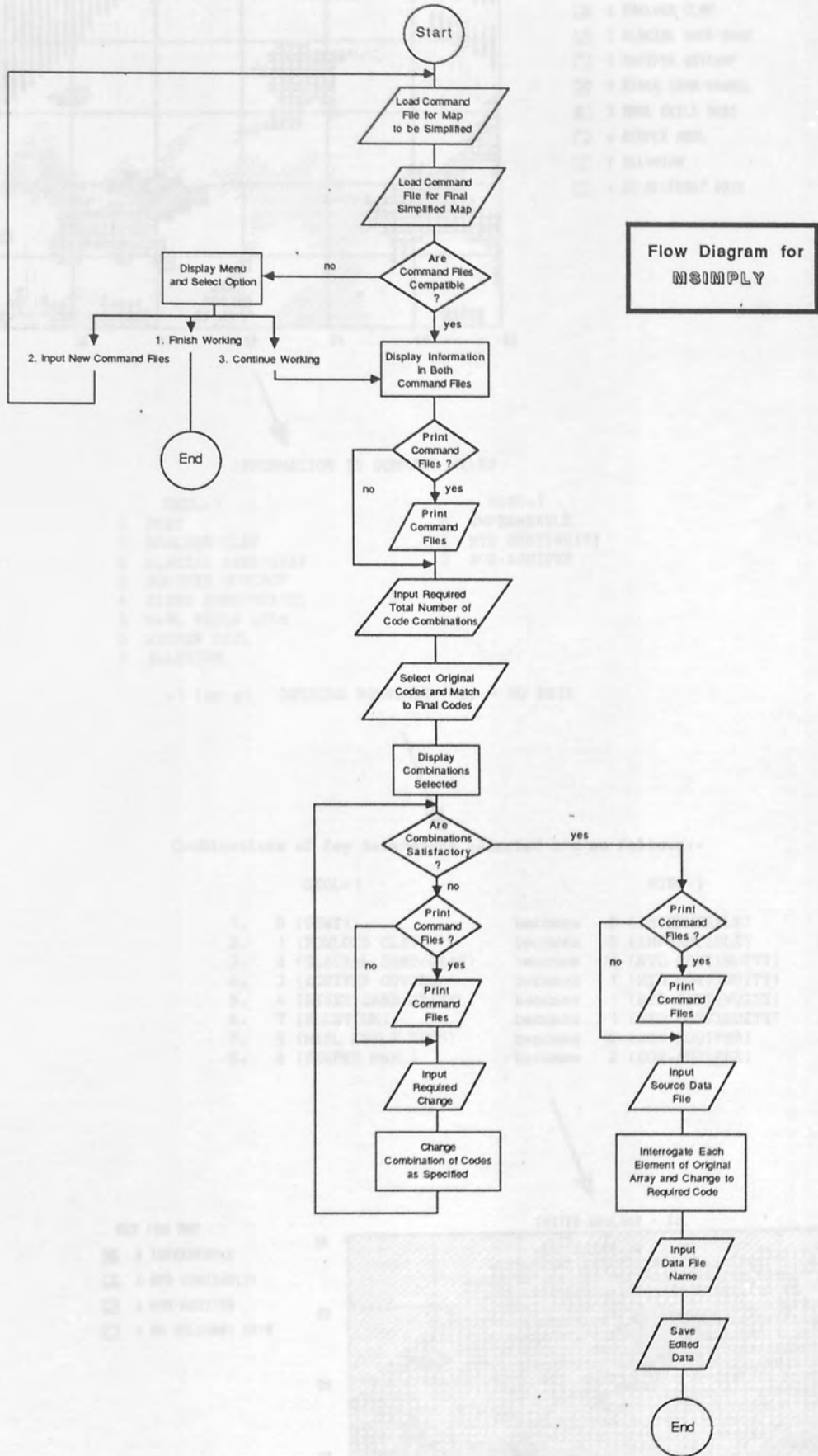
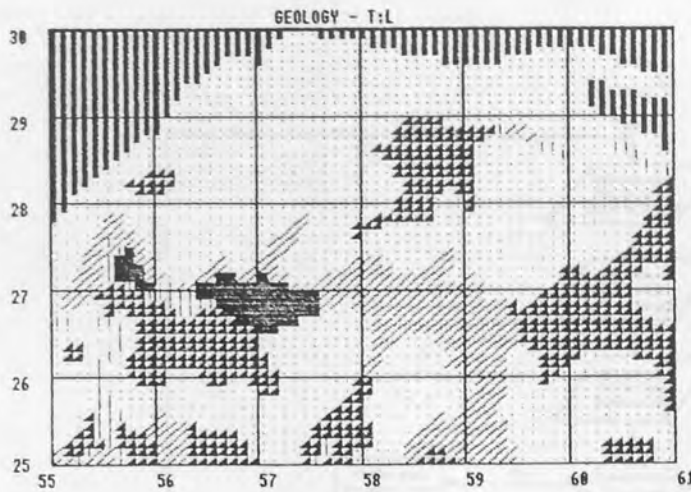


Fig A5.11 Flow Diagram of MSIMPLY.



KEY FOR MAP

- 0 PEAT
- 1 BOULDER CLAY
- 2 GLACIAL SAND/GRAV
- 3 AQUIFER OUTCROP
- 4 RIVER SAND/GRAVEL
- 5 MARL KEELE BEDS
- 6 KEUPER MARL
- 7 ALLUVIUM
- x NO RELEVANT DATA

INFORMATION IN COMMAND FILES

- | | |
|---|------------------|
| GEOL-1 | NGEO-1 |
| 0 PEAT | 0 IMPERMEABLE |
| 1 BOULDER CLAY | 1 HYD CONTINUITY |
| 2 GLACIAL SAND/GRAV | 2 NON-AQUIFER |
| 3 AQUIFER OUTCROP | |
| 4 RIVER SAND/GRAVEL | |
| 5 MARL KEELE BEDS | |
| 6 KEUPER MARL | |
| 7 ALLUVIUM | |
| -1 (or x) OUTSIDE BOUNDARY - or - NO DATA | |

Combinations of Key References selected are as follows:-

- | GEOL-1 | | NGEO-1 |
|--------------------------|---------|--------------------|
| 1. 0 (PEAT) | becomes | 0 (IMPERMEABLE) |
| 2. 1 (BOULDER CLAY) | becomes | 0 (IMPERMEABLE) |
| 3. 2 (GLACIAL SAND/GRAV) | becomes | 1 (HYD CONTINUITY) |
| 4. 3 (AQUIFER OUTCROP) | becomes | 1 (HYD CONTINUITY) |
| 5. 4 (RIVER SAND/GRAVEL) | becomes | 1 (HYD CONTINUITY) |
| 6. 7 (ALLUVIUM) | becomes | 1 (HYD CONTINUITY) |
| 7. 5 (MARL KEELE BEDS) | becomes | 2 (NON-AQUIFER) |
| 8. 6 (KEUPER MARL) | becomes | 2 (NON-AQUIFER) |

KEY FOR MAP

- 0 IMPERMEABLE
- 1 HYD CONTINUITY
- 2 NON-AQUIFER
- x NO RELEVANT DATA

EDITED GEOLOGY - T:L

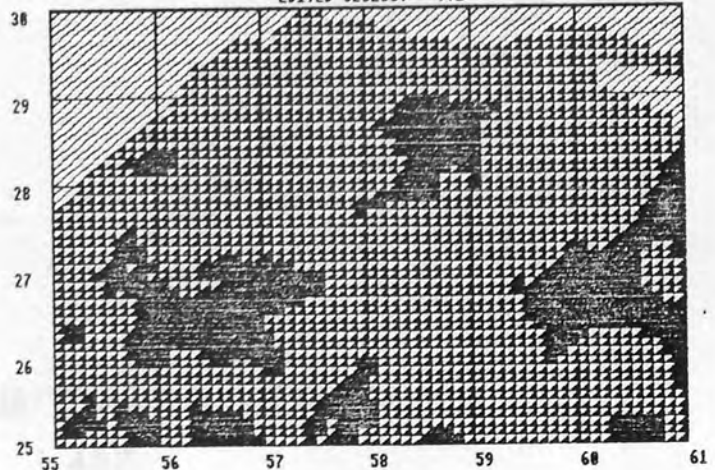


Fig A5.12

Example of Operation of MSIMPLY.

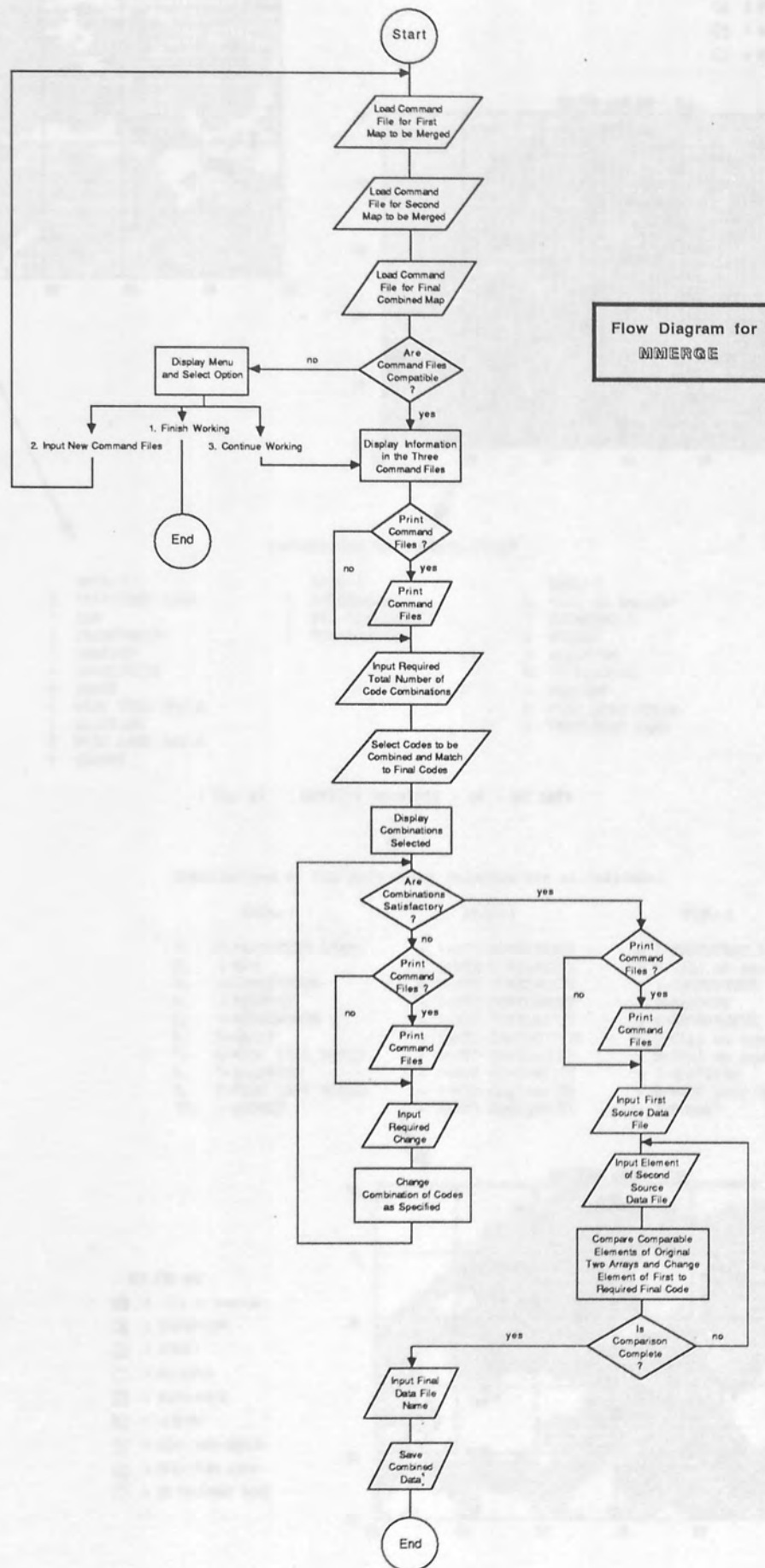
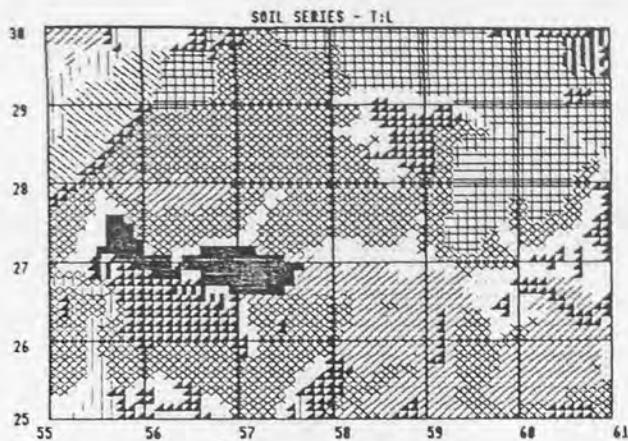
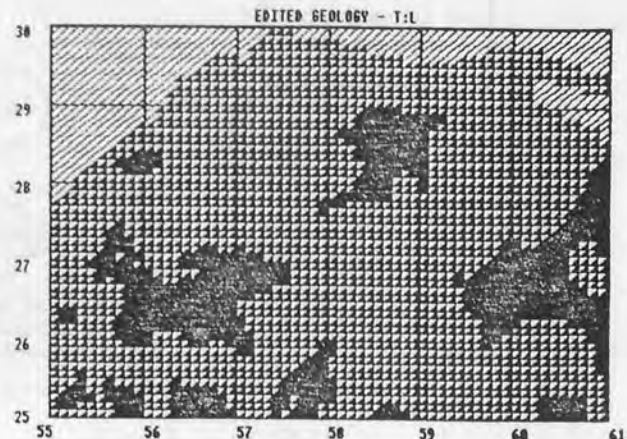


Fig A5.13 Flow Diagram of MMERGE.



- KEY FOR MAP
- 0 PEAT/PEAT LOAM
 - 1 WEM
 - 2 CRANNYMOOR
 - 3 NEWPORT
 - 4 BRIDGNORTH
 - 5 SALOP
 - 6 MISC TILL SOILS
 - 7 ALLUVIUM
 - 8 MISC SAND SOILS
 - 9 HODNET
 - x NO RELEVANT DATA



- KEY FOR MAP
- 0 IMPERMEABLE
 - 1 HYD CONTINUITY
 - 2 NON-AQUIFER
 - x NO RELEVANT DATA

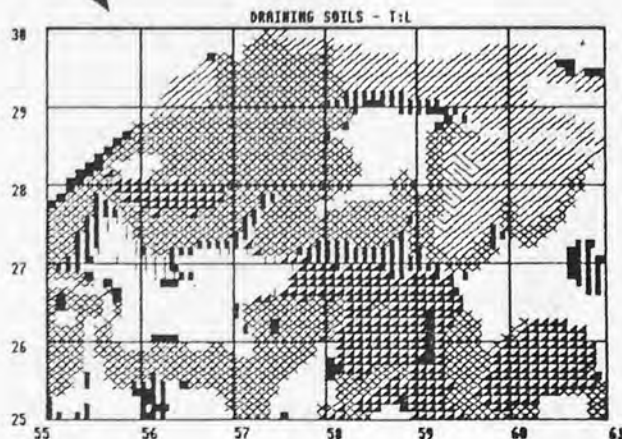
INFORMATION IN COMMAND FILES

- | | | |
|-------------------|------------------|-------------------|
| SOIL-1 | NGEO-1 | NSOL-1 |
| 0 PEAT/PEAT LOAM | 0 IMPERMEABLE | 0 Till on Aquifer |
| 1 WEM | 1 HYD CONTINUITY | 1 CRANNYMOOR |
| 2 CRANNYMOOR | 2 NON-AQUIFER | 2 HODNET |
| 3 NEWPORT | | 3 ALLUVIUM |
| 4 BRIDGNORTH | | 4 BRIDGNORTH |
| 5 SALOP | | 5 NEWPORT |
| 6 MISC TILL SOILS | | 6 MISC SAND SOILS |
| 7 ALLUVIUM | | 7 PEAT/PEAT LOAM |
| 8 MISC SAND SOILS | | |
| 9 HODNET | | |

-1 (or x) OUTSIDE BOUNDARY - or - NO DATA

Combinations of Key References selected are as follows:-

- | SOIL-1 | NGEO-1 | NSOL-1 |
|----------------------|--------------------|---------------------|
| 1. 0-PEAT/PEAT LOAM | + 1-HYD CONTINUITY | = 7-PEAT/PEAT LOAM |
| 2. 1-WEM | + 1-HYD CONTINUITY | = 0-Till on Aquifer |
| 3. 2-CRANNYMOOR | + 1-HYD CONTINUITY | = 1-CRANNYMOOR |
| 4. 3-NEWPORT | + 1-HYD CONTINUITY | = 5-NEWPORT |
| 5. 4-BRIDGNORTH | + 1-HYD CONTINUITY | = 4-BRIDGNORTH |
| 6. 5-SALOP | + 1-HYD CONTINUITY | = 0-Till on Aquifer |
| 7. 6-MISC TILL SOILS | + 1-HYD CONTINUITY | = 0-Till on Aquifer |
| 8. 7-ALLUVIUM | + 1-HYD CONTINUITY | = 3-ALLUVIUM |
| 9. 8-MISC SAND SOILS | + 1-HYD CONTINUITY | = 6-MISC SAND SOILS |
| 10. 9-HODNET | + 1-HYD CONTINUITY | = 2-HODNET |



- KEY FOR MAP
- 0 Till on Aquifer
 - 1 CRANNYMOOR
 - 2 HODNET
 - 3 ALLUVIUM
 - 4 BRIDGNORTH
 - 5 NEWPORT
 - 6 MISC SAND SOILS
 - 7 PEAT/PEAT LOAM
 - x NO RELEVANT DATA

Fig A5.14 Example of Operation of MMERGE.

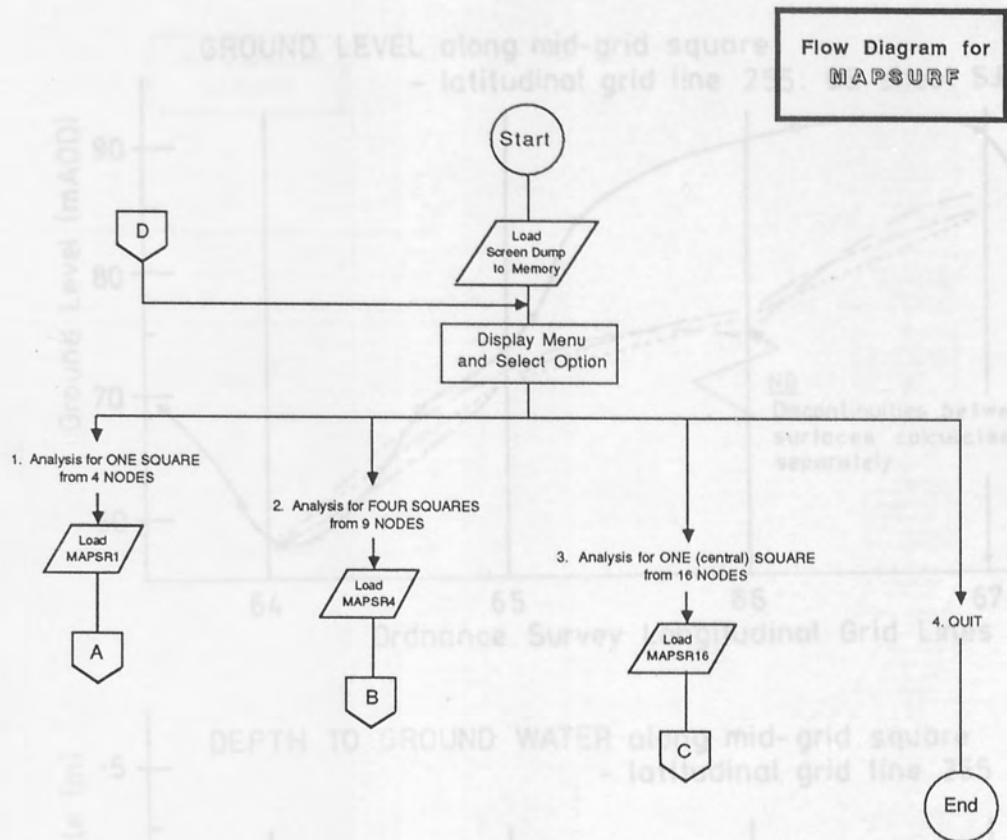
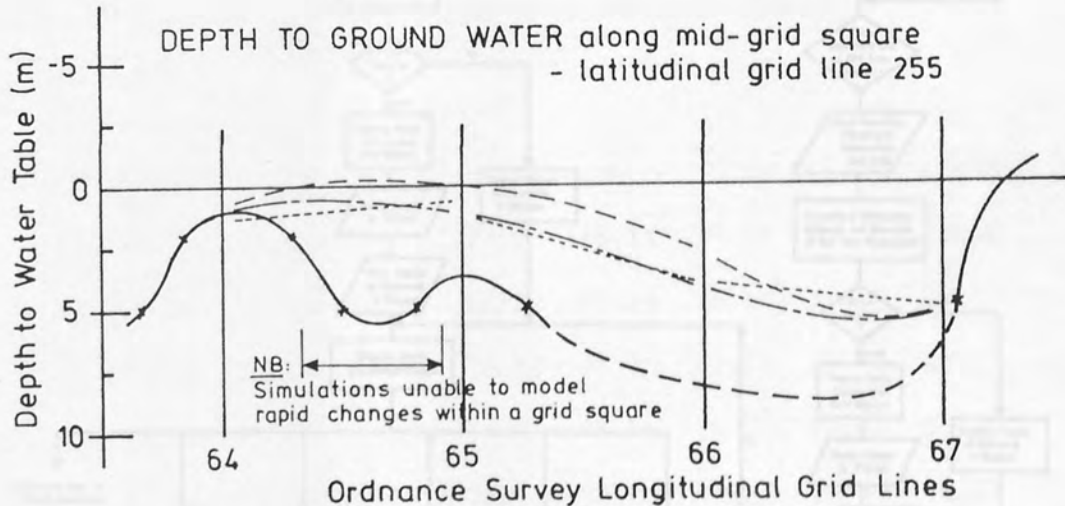
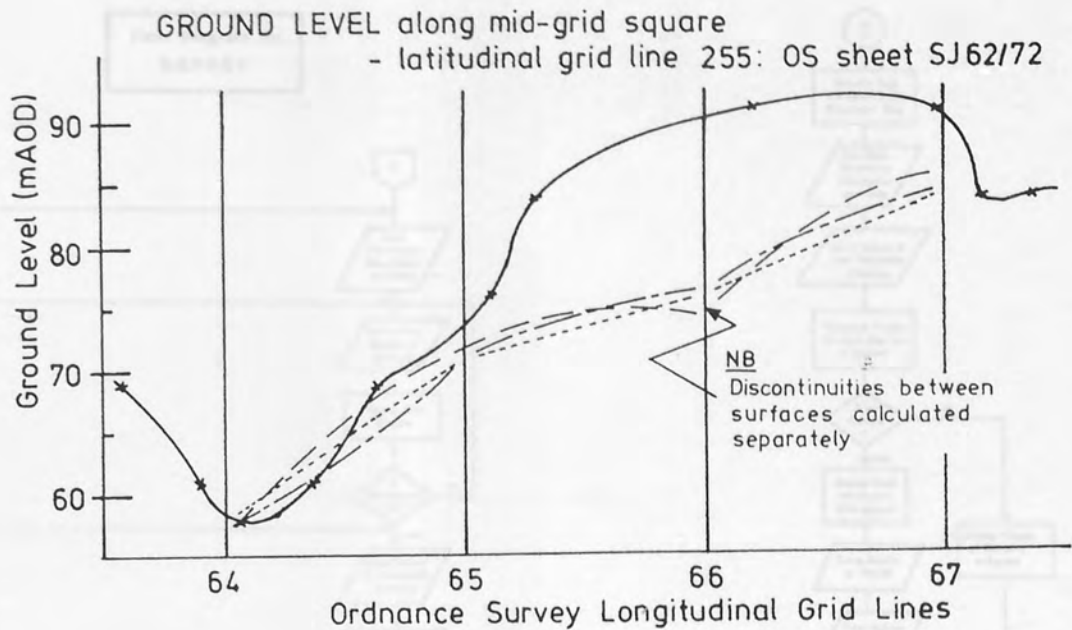


Fig A5.15 Flow Diagram of MAPSURF.



Fig A5.16 Example of Evaluation of MAPSURF group of Programs - Comparison between Simulated Surfaces and Sections Taken from Mid-Grid Squares of Relevant Maps.



KEY:

- section from appropriate map
- simulated surface using MAPSR1
- simulated surface using MAPSR4
- simulated surface using MAPSR16

Fig A5.16 Example of Evaluation of MAPSURF group of Programs - Comparison between Simulated Surfaces and Sections Taken from Mid-Grid Squares of Relevant Maps.

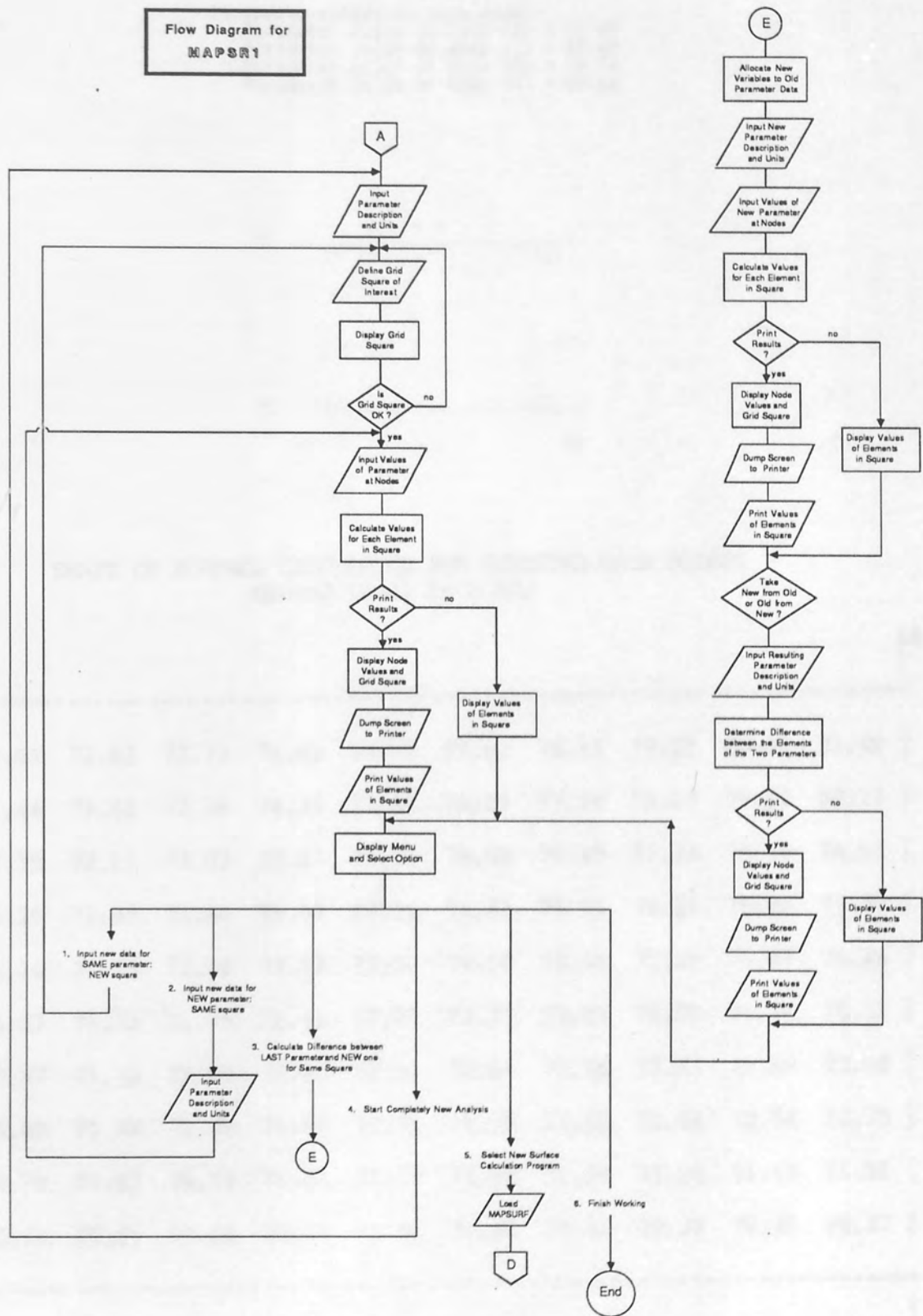
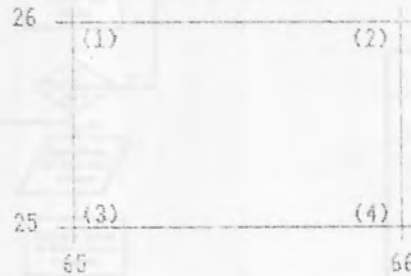


Fig A5.17 Flow Diagram of MAPSR1.

ANALYSIS FOR ONE SQUARE WITH 4 NODES
 Parameter = Ground Level in units of m AOD

Parameter values at each node:-
 Parameter value at Node (1) = 71.88
 Parameter value at Node (2) = 82.60
 Parameter value at Node (3) = 78.78
 Parameter value at Node (4) = 69.68



SHAPE OF SURFACE CALCULATED FOR SELECTED GRID SQUARE
 Ground Level in m AOD

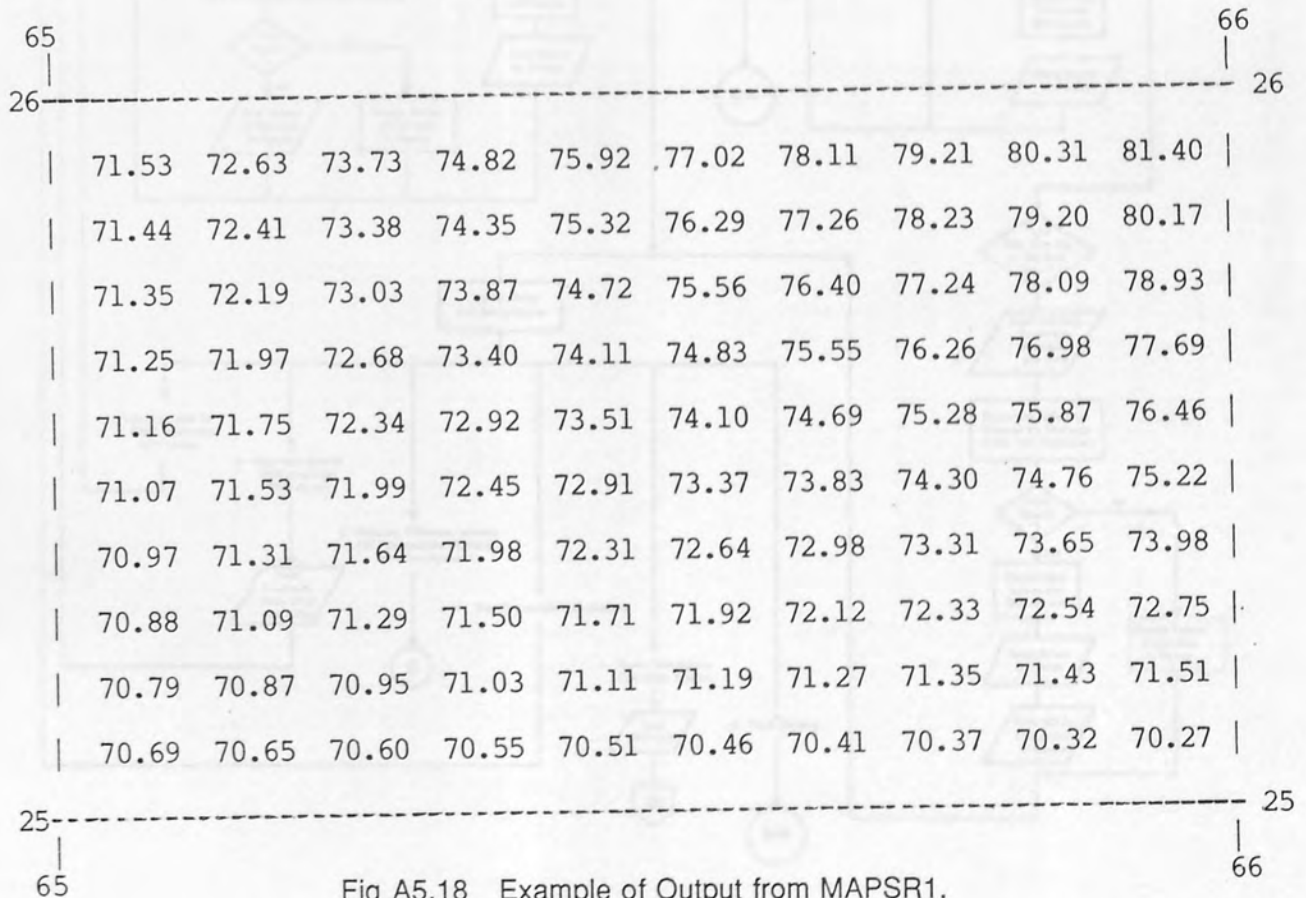


Fig A5.18 Example of Output from MAPSR1.

Flow Diagram for MAPSR4

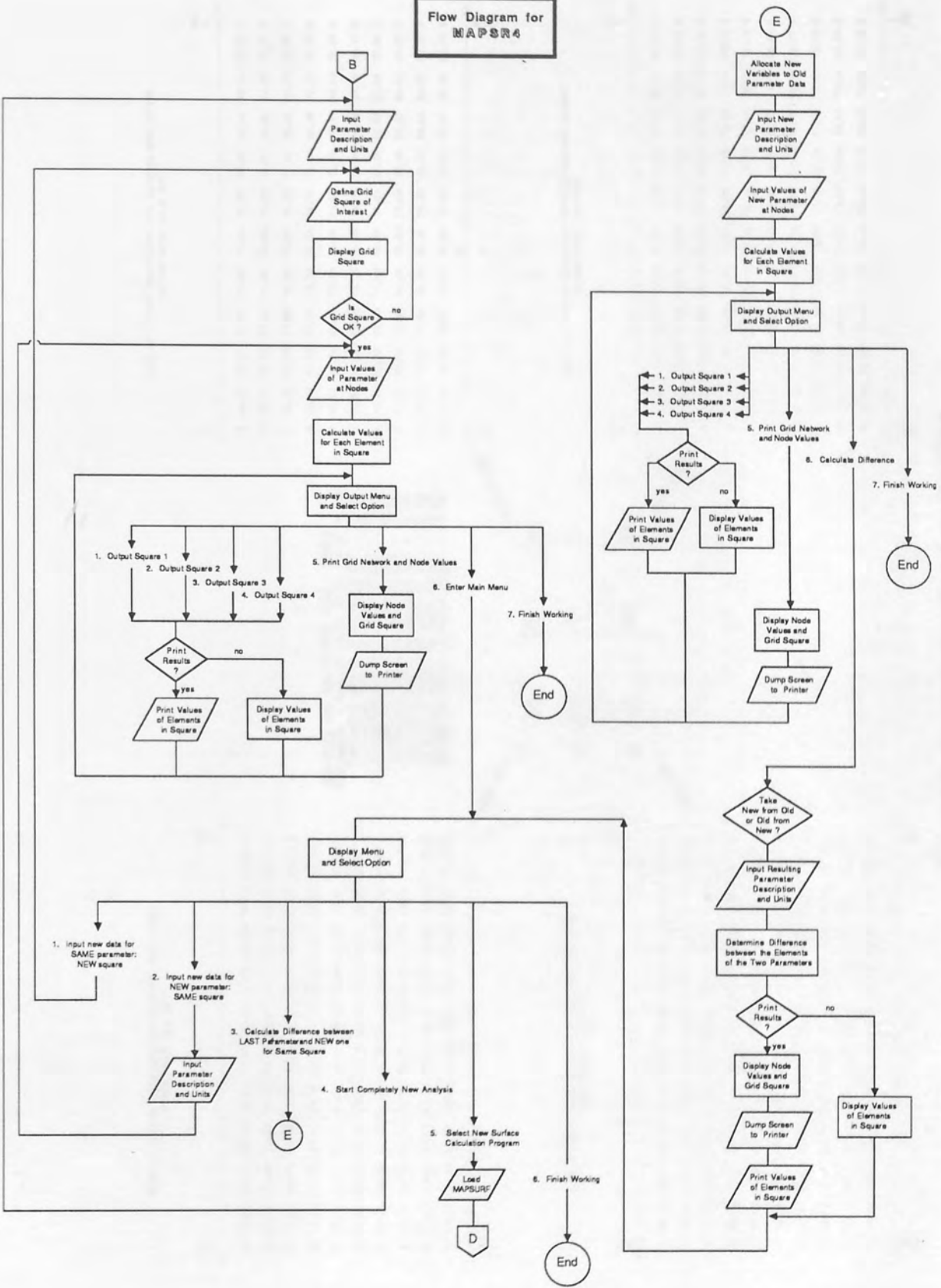


Fig A5.19 Flow Diagram of MAPSR4.

SHAPE OF SURFACE CALCULATED FOR SELECTED GRID SQUARE
Ground Level in m AOD

64	27	65	27	66
1	69.58	70.20	70.75	71.22
1	69.91	70.65	71.33	71.96
1	70.22	71.06	71.86	72.62
1	70.49	71.43	72.33	73.20
1	70.74	71.75	72.74	73.71
1	70.96	72.04	73.10	74.15
1	71.15	72.28	73.40	74.50
1	71.32	72.48	73.64	74.79
1	71.45	72.64	73.82	74.99
1	71.56	72.75	73.94	75.12
26	71.64	72.83	74.01	75.18
1	71.69	72.86	74.02	75.16
1	71.71	72.85	73.97	75.07
1	71.71	72.80	73.87	74.90
1	71.67	72.71	73.70	74.65
1	71.61	72.58	73.48	74.33
1	71.52	72.40	73.20	73.93
1	71.40	72.18	72.87	73.46
1	71.26	71.92	72.47	72.92
1	71.08	71.62	72.02	72.29
26	70.92	71.56	72.00	71.66
1	70.87	71.51	71.97	71.62
1	70.74	71.43	71.86	71.54
1	70.63	71.33	71.76	71.43
1	70.54	71.24	71.66	71.34
1	70.47	71.17	71.59	71.27
1	70.42	71.12	71.54	71.22
1	70.38	71.08	71.50	71.18
1	70.35	71.05	71.47	71.15
1	70.33	71.03	71.45	71.13
1	70.32	71.02	71.44	71.12
1	70.31	71.01	71.43	71.11
1	70.30	71.00	71.42	71.10
1	70.29	70.99	71.41	71.09
1	70.28	70.98	71.40	71.08
1	70.27	70.97	71.39	71.07
1	70.26	70.96	71.38	71.06
1	70.25	70.95	71.37	71.05
1	70.24	70.94	71.36	71.04
1	70.23	70.93	71.35	71.03
1	70.22	70.92	71.34	71.02
1	70.21	70.91	71.33	71.01
1	70.20	70.90	71.32	71.00
1	70.19	70.89	71.31	70.99
1	70.18	70.88	71.30	70.98
1	70.17	70.87	71.29	70.97
1	70.16	70.86	71.28	70.96
1	70.15	70.85	71.27	70.95
1	70.14	70.84	71.26	70.94
1	70.13	70.83	71.25	70.93
1	70.12	70.82	71.24	70.92
1	70.11	70.81	71.23	70.91
1	70.10	70.80	71.22	70.90
1	70.09	70.79	71.21	70.89
1	70.08	70.78	71.20	70.88
1	70.07	70.77	71.19	70.87
1	70.06	70.76	71.18	70.86
1	70.05	70.75	71.17	70.85
1	70.04	70.74	71.16	70.84
1	70.03	70.73	71.15	70.83
1	70.02	70.72	71.14	70.82
1	70.01	70.71	71.13	70.81
1	70.00	70.70	71.12	70.80
1	69.99	70.69	71.11	70.79
1	69.98	70.68	71.10	70.78
1	69.97	70.67	71.09	70.77
1	69.96	70.66	71.08	70.76
1	69.95	70.65	71.07	70.75
1	69.94	70.64	71.06	70.74
1	69.93	70.63	71.05	70.73
1	69.92	70.62	71.04	70.72
1	69.91	70.61	71.03	70.71
1	69.90	70.60	71.02	70.70
1	69.89	70.59	71.01	70.69
1	69.88	70.58	71.00	70.68
1	69.87	70.57	70.99	70.67
1	69.86	70.56	70.98	70.66
1	69.85	70.55	70.97	70.65
1	69.84	70.54	70.96	70.64
1	69.83	70.53	70.95	70.63
1	69.82	70.52	70.94	70.62
1	69.81	70.51	70.93	70.61
1	69.80	70.50	70.92	70.60
1	69.79	70.49	70.91	70.59
1	69.78	70.48	70.90	70.58
1	69.77	70.47	70.89	70.57
1	69.76	70.46	70.88	70.56
1	69.75	70.45	70.87	70.55
1	69.74	70.44	70.86	70.54
1	69.73	70.43	70.85	70.53
1	69.72	70.42	70.84	70.52
1	69.71	70.41	70.83	70.51
1	69.70	70.40	70.82	70.50
1	69.69	70.39	70.81	70.49
1	69.68	70.38	70.80	70.48
1	69.67	70.37	70.79	70.47
1	69.66	70.36	70.78	70.46
1	69.65	70.35	70.77	70.45
1	69.64	70.34	70.76	70.44
1	69.63	70.33	70.75	70.43
1	69.62	70.32	70.74	70.42
1	69.61	70.31	70.73	70.41
1	69.60	70.30	70.72	70.40
1	69.59	70.29	70.71	70.39
1	69.58	70.28	70.70	70.38
1	69.57	70.27	70.69	70.37
1	69.56	70.26	70.68	70.36
1	69.55	70.25	70.67	70.35
1	69.54	70.24	70.66	70.34
1	69.53	70.23	70.65	70.33
1	69.52	70.22	70.64	70.32
1	69.51	70.21	70.63	70.31
1	69.50	70.20	70.62	70.30
1	69.49	70.19	70.61	70.29
1	69.48	70.18	70.60	70.28
1	69.47	70.17	70.59	70.27
1	69.46	70.16	70.58	70.26
1	69.45	70.15	70.57	70.25
1	69.44	70.14	70.56	70.24
1	69.43	70.13	70.55	70.23
1	69.42	70.12	70.54	70.22
1	69.41	70.11	70.53	70.21
1	69.40	70.10	70.52	70.20
1	69.39	70.09	70.51	70.19
1	69.38	70.08	70.50	70.18
1	69.37	70.07	70.49	70.17
1	69.36	70.06	70.48	70.16
1	69.35	70.05	70.47	70.15
1	69.34	70.04	70.46	70.14
1	69.33	70.03	70.45	70.13
1	69.32	70.02	70.44	70.12
1	69.31	70.01	70.43	70.11
1	69.30	70.00	70.42	70.10
1	69.29	69.99	70.41	70.09
1	69.28	69.98	70.40	70.08
1	69.27	69.97	70.39	70.07
1	69.26	69.96	70.38	70.06
1	69.25	69.95	70.37	70.05
1	69.24	69.94	70.36	70.04
1	69.23	69.93	70.35	70.03
1	69.22	69.92	70.34	70.02
1	69.21	69.91	70.33	70.01
1	69.20	69.90	70.32	70.00
1	69.19	69.89	70.31	69.99
1	69.18	69.88	70.30	69.98
1	69.17	69.87	70.29	69.97
1	69.16	69.86	70.28	69.96
1	69.15	69.85	70.27	69.95
1	69.14	69.84	70.26	69.94
1	69.13	69.83	70.25	69.93
1	69.12	69.82	70.24	69.92
1	69.11	69.81	70.23	69.91
1	69.10	69.80	70.22	69.90
1	69.09	69.79	70.21	69.89
1	69.08	69.78	70.20	69.88
1	69.07	69.77	70.19	69.87
1	69.06	69.76	70.18	69.86
1	69.05	69.75	70.17	69.85
1	69.04	69.74	70.16	69.84
1	69.03	69.73	70.15	69.83
1	69.02	69.72	70.14	69.82
1	69.01	69.71	70.13	69.81
1	69.00	69.70	70.12	69.80
1	68.99	69.69	70.11	69.79
1	68.98	69.68	70.10	69.78
1	68.97	69.67	70.09	69.77
1	68.96	69.66	70.08	69.76
1	68.95	69.65	70.07	69.75
1	68.94	69.64	70.06	69.74
1	68.93	69.63	70.05	69.73
1	68.92	69.62	70.04	69.72
1	68.91	69.61	70.03	69.71
1	68.90	69.60	70.02	69.70
1	68.89	69.59	70.01	69.69
1	68.88	69.58	70.00	69.68
1	68.87	69.57	69.99	69.67
1	68.86	69.56	69.98	69.66
1	68.85	69.55	69.97	69.65
1	68.84	69.54	69.96	69.64
1	68.83	69.53	69.95	69.63
1	68.82	69.52	69.94	69.62
1	68.81	69.51	69.93	69.61
1	68.80	69.50	69.92	69.60
1	68.79	69.49	69.91	69.59
1	68.78	69.48	69.90	69.58
1	68.77	69.47	69.89	69.57
1	68.76	69.46	69.88	69.56
1	68.75	69.45	69.87	69.55
1	68.74	69.44	69.86	69.54
1	68.73	69.43	69.85	69.53
1	68.72	69.42	69.84	69.52
1	68.71	69.41	69.83	69.51
1	68.70	69.40	69.82	69.50
1	68.69	69.39	69.81	69.49
1	68.68	69.38	69.80	69.48
1	68.67	69.37	69.79	69.47
1	68.66	69.36	69.78	69.46
1	68.65	69.35	69.77	69.45
1	68.64	69.34	69.76	69.44
1	68.63	69.33	69.75	69.43
1	68.62	69.32	69.74	69.42
1	68.61	69.31	69.73	69.41
1	68.60	69.30	69.72	69.40
1	68.59	69.29	69.71	69.39
1	68.58	69.28	69.70	69.38
1	68.57	69.27	69.69	69.37
1	68.56	69.26	69.68	69.36
1	68.55	69.25	69.67	69.35
1	68.54	69.24	69.66	69.34
1	68.53	69.23	69.65	69.33
1	68.52	69.22	69.64	69.32

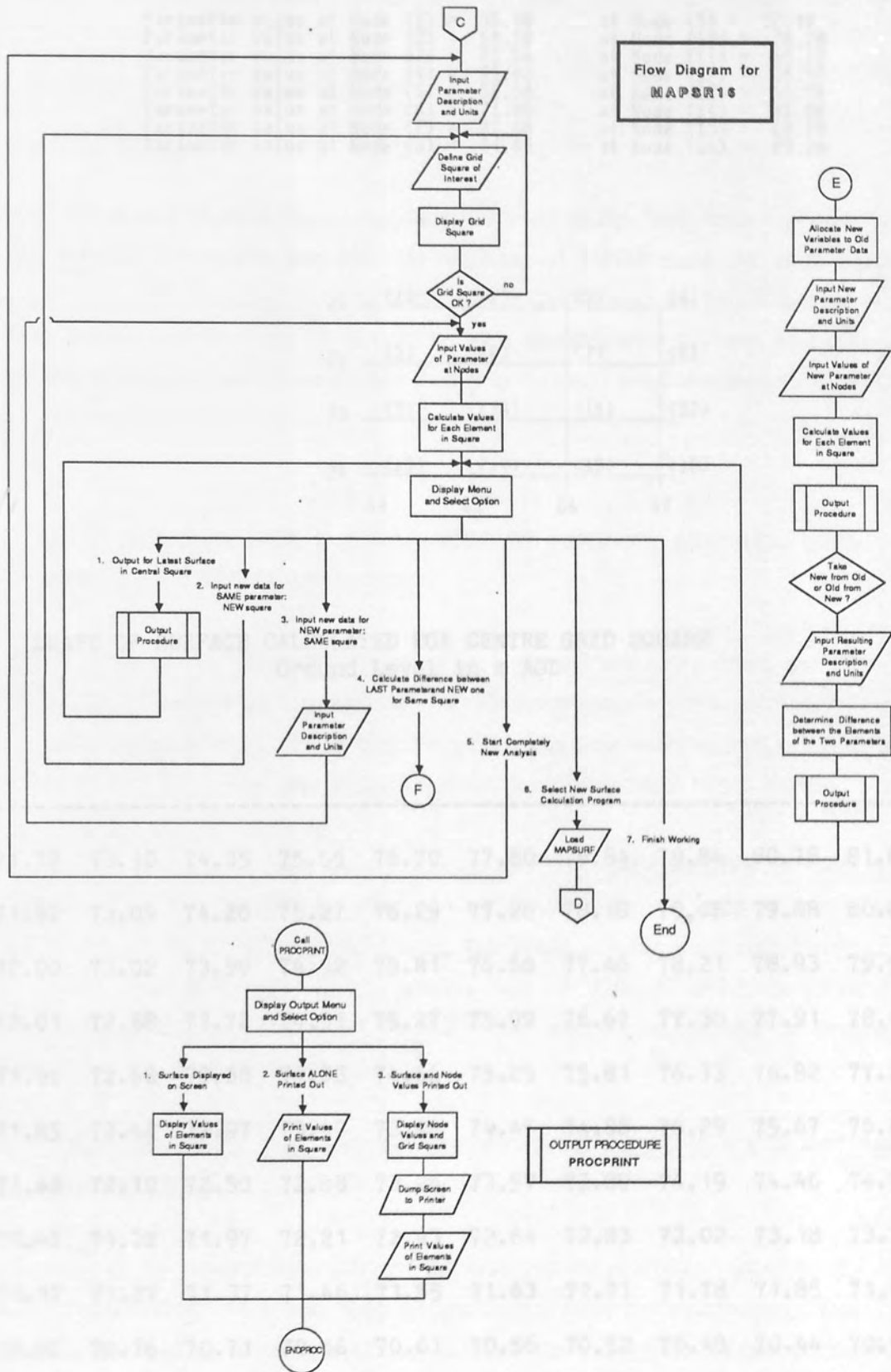


Fig A5.21 Flow Diagram of MAPSR16.

APPENDIX B

INPUT VALUES OF GROUND LEVEL AT NODES ARE :-

Parameter value at Node (1) = 58.98	at Node (9) = 57.48
Parameter value at Node (2) = 69.18	at Node (10) = 78.78
Parameter value at Node (3) = 71.58	at Node (11) = 69.68
Parameter value at Node (4) = 91.88	at Node (12) = 94.48
Parameter value at Node (5) = 58.58	at Node (13) = 66.58
Parameter value at Node (6) = 71.88	at Node (14) = 61.88
Parameter value at Node (7) = 82.68	at Node (15) = 68.78
Parameter value at Node (8) = 84.48	at Node (16) = 69.28

27	(1)	(2)	(3)	(4)
26	(5)	(6)	(7)	(8)
25	(9)	(10)	(11)	(12)
24	(13)	(14)	(15)	(16)
	64	65	66	67

SHAPE OF SURFACE CALCULATED FOR CENTRE GRID SQUARE

Ground Level in m AOD

65											66
26											26
¶	71.79	73.10	74.35	75.55	76.70	77.80	78.84	79.84	80.78	81.67	¶
¶	71.92	73.09	74.20	75.27	76.29	77.26	78.18	79.06	79.88	80.66	¶
¶	72.00	73.02	73.99	74.92	75.81	76.66	77.46	78.21	78.93	79.59	¶
¶	72.01	72.88	73.72	74.51	75.27	75.99	76.67	77.30	77.91	78.47	¶
¶	71.96	72.68	73.38	74.03	74.66	75.25	75.81	76.33	76.82	77.28	¶
¶	71.85	72.42	72.97	73.49	73.98	74.45	74.88	75.29	75.67	76.03	¶
¶	71.68	72.10	72.50	72.88	73.24	73.57	73.89	74.19	74.46	74.71	¶
¶	71.46	71.72	71.97	72.21	72.43	72.64	72.83	73.02	73.18	73.34	¶
¶	71.17	71.27	71.37	71.46	71.55	71.63	71.71	71.78	71.85	71.90	¶
¶	70.82	70.76	70.71	70.66	70.61	70.56	70.52	70.48	70.44	70.41	¶
25											25
¶											¶
65											66

Fig A5.22 Example of Output from MAPSR16.

APPENDIX 6

ASTON AGRICULTURAL SURVEY AND MAFF RETURNS.

A6.1 THE AGRICULTURAL SURVEY.

Details of the survey of agriculture undertaken in 1980 in the Tern Area are given in Sect. 8.3.4. During the survey land use was recorded on 1:2500 scale Ordnance Survey maps. A colour coded map, at the same scale, was prepared from the originals and the data were then transferred directly to the computer. As a consequence the only hard copy which exist for the survey data are the coloured map, Fig 7.1, and computer output, of which Fig 8.7 is an example.

A6.2 MAFF RETURNS FOR THE PARISHES OF HODNET, STANTON UPON HINE HEATH AND STOKE UPON TERN.

The British Government has been collecting agricultural data since 1866, but until 1917 the submission of returns by farmers was entirely on a voluntary basis (Public Record Office, 1987). Some 4,500 volumes and folders of data now exist, but all original Returns are destroyed and the lowest unit of consolidation for the statistics is the parish.

Tables A6.1, A6.2 and A6.3 have been prepared from the MAFF Returns for 1969 to 1985. For 1969 to 1979, the statistics for the three parishes of interest were acquired from the regional MAFF offices at Shrewsbury. During the 1980s records were transferred to the Public Record Office at Kew in London, and the data for 1980 to 1985 inclusive were obtained there. In October 1988, when the visit to Kew was made, the most up to date statistics available were those for 1985.

A6.3 COMPARISON OF THE ASTON SURVEY DATA AND THE MAFF RETURNS FOR 1980.

A comparison of the Returns for 1980 and the summarised computer output for the Aston survey is given in Table A6.4. The 1980 Return figures have been reduced by that proportion of the total parish area not covered in the survey. A detailed discussion of the results appears in Sect. 8.3.4.

Year	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
No of Holdings	76	77	69	65	66	67	62	62	61	59	60	54	54	53	52	49	40
Total Area	3203.6823	3136.7293	3136.7293	3152.4893	3228.5148	3251.5178	3261.6	3245.8	3169.3	3234.6	3233	3226.3	3226.4	3226	3136.1	3129.8	3170
Total Crops & Grass	3200.7286	3206.9200	3106.5156	3113.3549	3227.7620	3206.9842	3214.8	3199.9	3193.6	3161	3154.6	3117.2	3109.9	3147.3	3093.9	3093.9	3094
Wheat	237.96034	238.16289	221.97491	146.70174	140.22693	212.96694	142	145.1	116.7	173	179.3	177.3	152	209.6	290.2	227.3	216.8
Barley	572.55172	617.26045	552.61028	577.90368	695.99352	659.97572	730.5	750.5	735.4	756.2	767.9	726	829.1	831.3	772.7	767.3	805.9
Oats	86.32132	90.85306	98.05748	78.42748	103.60178	85.98669	61.9	140.3	39.7	59.7	35.2	10.1	14.5	15.5	29.3	4.5	15.4
Mixed Corn	67.179260	65.277216	42.897612	47.95293	28.65237	37.231896	19.8	22.6	11.7	0	0	0	0	0	0	0	0
Rye	2.428166	0	0	0	0.6070417	0	0	0	0	0	0	0	0	0	0	5.7	11
Early Potatoes	2.2845002	9.4230808	9.7126669	9.6317200	11.655200	20.558476	3.2	16.2	27.7	29.4	32	28.5	57.5	30.1	42.5	134.5	149.7
Main Potatoes	15.074866	26.658395	23.460542	28.854715	32.496945	22.379603	51.2	58.5	68.6	98.7	86.7	113	92.5	100.4	83.1	194.5	149.7
Sugar Beet	141.44071	178.47524	153.98624	149.92756	136.09875	154.33093	175.2	209.1	202.3	221.8	249	241.2	249.4	224.9	218.5	236.3	238.4
Temporary Grass	700.79226	636.96902	652.33913	622.42007	679.68484	619.40956	621.4	671.4	734.3	611.9	597.3	594.3	544.2	575.2	583.5	567.4	593
Permanent Grass	1289.7289	1222.7843	1260.4533	1342.8976	1298.1789	1312.7273	1313.3	1104.4	1114	1136.6	1065.5	1232.2	1113.2	1083.1	949.3	934.4	1011
Rough Grazing	47.146904	48.684743	41.197896	40.590854	37.434237	31.405223	13.2	12.6	12.1	16	43.6	8.5	27.2	18.2	17.9	15	18.4
Maize (feed) #	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maize (feed) #	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tump, Beet etc (feed)	14.569000	13.678873	12.343161	15.904492	13.152570	17.118575	18.4	11.6	7.5	4	15.1	12.2	14.6	7.8	12.3	11.9	19.7
Morrad	9.7126669	11.452853	10.925750	10.17381	4.985836	0	7.2	9.3	12.5	13.9	18.1	16.5	17.5	7.2	6.1	3.6	15.6
Rape (feed)	1.618778	1.2140834	1.2140834	1.2140834	1.2140834	1.2140834	0	0	3.2	7.7	0	7.3	10.2	4.5	4.5	3.1	3.1
Rape (oilseed)	0	0	0	0	0	0	0	0	21.5	16.3	0	0	0	0	25.9	31.8	24
Lucerne	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lucerne (feed)	4.0469445	4.4516390	5.4751133	4.0469448	13.759611	8	5.2	5.7	5.7	0	3.4	0	4	0	6.1	0	20.3
Other feed	29.542329	32.959095	31.363890	34.722784	34.601376	37.434237	34.6	28.8	0	0	20.5	9.5	44	8.7	20.7	11.8	31
Bees	2.932617	0	0	0	0	0	1.6	1.6	1.6	1	0	0	0	0	0	0	0
Other Non Feed	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0
Share fallow	2.4046945	2.6305140	1.0117361	1.0117361	1.0117361	1.0117361	0.2	0.2	0.2	0	0	0	0	0	0	0	0
Woodland	14.973698	20.841764	20.841764	25.900445	25.900445	25.900445	31.2	23	33.8	36.6	39.2	58.9	50.2	44.8	44.8	42	44.4
Other Land	7.3654391	7.2035613	7.2035613	12.052695	10.318709	12.869284	17.6	19.7	20.2	29.1	29.9	27.5	25.1	29.8	32.6	35	30.6
Veg & Nursery Stock	1.2140834	1.4164306	2.1448506	2.4281667	3.3589640	2.822612	3	0	0	7.9	0.2	23.1	20	6.1	0.2	12.9	0.2
Orchard & Small Fruit	1.4164306	0.5281028	0.7284500	0.6070417	0.6070417	0.5281028	0.4	0.4	0	0	0	0	0	0	0	0	0
Area under Glass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cattle & calves	4802	4588	4975	5142	5775	6002	5598	5440	5125	4533	4404	4336	4225	4368	4635	4789	4461
Pigs	2075	2148	2158	2127	2254	2112	2250	2112	1572	1581	1931	1628	2171	2704	2659	2368	2671
Sheep & lambs	1264	1272	1465	1650	1982	1590	2320	2890	2988	2884	2802	2571	2347	2783	3972	4010	2903
Poultry	18858	9314	7956	7457	5715	5586	2726	1977	1984	2399	1050	180	523	2319	2740	21870	313
SUMMARY																	
Permanent Pasture	1316.8756	1271.4690	1321.6512	1383.4885	1335.6131	1344.2331	1326.5	1116.9	1126.1	1156.6	1109.7	1240.5	1141.2	1082	951	1014.4	1030.4
Key Pasture	730.73725	636.96902	652.33913	622.42007	679.68484	619.40956	621.4	671.4	734.3	611.9	597.3	594.3	544.2	575.2	583.5	567.4	593
Woodland	7	15.49794	21.57024	21.448806	26.507487	26.021854	31.6	27.4	33.8	36.6	39.2	58.9	50.2	44.8	44.8	42	44.4
Cereal	956.45083	1011.5243	915.54927	850.78915	969.08134	975.96115	859.3	1058.6	897.5	988.9	982.4	913.8	968.8	1096.6	1049.2	1004.8	1048.8
Sugar Beet	141.44071	178.47524	153.98624	149.92756	136.09875	154.33093	175.2	209.1	202.3	221.8	249	241.2	249.4	224.9	218.5	236.3	238.4
Potatoes	22.459369	36.058776	32.173209	38.466443	44.152165	42.838682	54.4	74	96.3	128.1	116.7	141.6	150	130.5	135.5	134.5	149.7
Fallow	0.4046945	2.6305140	1.0117361	1.0117361	1.0117361	1.0117361	0.2	0.2	0	0	0	0	0	0	0	0	0
Lucerne	58.276002	72.359565	60.825571	69.243231	63.133335	78.025091	77.2	68.3	77.1	53.7	78.1	75.6	94.7	47.6	101	82.5	124.3
Mixed Cereals	1.2140834	1.4164306	2.1448506	2.4281667	3.3589640	2.822612	3	0	0	7.9	0.2	23.1	20	6.1	0.2	12.9	0.2
Total Grass	2047.6700	1908.4581	1943.9903	2005.6085	2015.8975	1957.6592	1947.5	1768.3	1860.4	1768.5	1706.6	1744.9	1642	1657.7	1546.6	1581.8	1533.9

NOTE: * Malting and Early potatoes - combined total only after 1983
 # Lucerne and Maize (feed) - not a separate category after 1979 - assumed included in 'Other feed'

Table A6.1 MAFF Agricultural Returns 1969 to 1985 - The Parish of Hodnet.

Year	SHROPSHIRE GROUNDWATER SCHEME MAFF AGRICULTURAL RETURNS										1982	1983	1984	1985	
	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978					
Area Under	31	31	31	31	31	31	31	31	31	31	28	27	27	24	24
Total Area	1974.6724	1970.5787	2025.4148	2011.4520	2019.1420	2106.4	2058.2	2076.6	2076.6	1958.2	1947.2	1922.0	1935.6	1909.6	1860.6
Total Crops & Grass	2013.6816	1931.6771	1924.8817	1974.9899	1972.7531	1968.4338	2012.3	2031.2	2031.2	1911.3	1927.8	1910.7	1894.7	1865.4	1820.6
Wheat	75.273168	103.39443	73.047349	52.205865	75.192330	82.411972	66.8	22.9	37.2	28.2	76.3	51.1	112.3	93	127.8
Barley	610.68395	575.21246	542.81667	526.38600	591.15011	633.06354	698.3	667.1	682.6	640.5	643	769.5	611.3	654.9	544.2
Oats	45.123438	65.965194	47.851539	58.529277	51.588543	56.379398	51.8	4.9	54.5	36.3	14.8	12.4	12.4	7.7	13.6
Mixed Com	0	35.613112	4.0469446	4.8563335	10.319709	8.4751133	7.4	7.4	0	0	0	0	24.7	3.8	0
Pyre	2.8328612	4.0469446	2.0534723	0	0	0	6.7	3.6	0	0	0	0	0	0	0
Early Potatoes	16.187778	18.211251	23.067584	27.923917	26.769834	33.067554	23.4	32.7	26.4	30.5	27.5	27.9	28.5	20.3	20.3
Main Potatoes	61.918255	69.931202	62.322946	50.168113	53.217321	49.372724	62.3	85.3	64.4	60.4	65.5	62	70.3	77.7	94.9
Swamp Beet	208.61099	201.94252	198.09794	159.85431	192.43221	193.44395	213.2	219.7	242.4	193.9	244.2	241.8	237.6	238.3	241.1
Temporary Grass	423.53411	352.61021	385.07851	370.21449	391.94652	386.28082	371.8	304.4	324.9	265.3	312.4	271	206.7	266.6	345.1
Permanent Grass	484.84531	500.69704	477.40899	521.51769	510.72444	501.53784	558.4	585.4	542.6	568.9	487.3	528.9	515.4	462.8	373.7
Plough Grass	22.665231	20.437036	24.999352	25.495251	22.172858	22.007895	34.4	24.5	21.8	55.5	31.3	32.3	33.2	41.3	33.4
Maize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maize (feed)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Turkey Beet etc (feed)	11.250504	6.0741616	17.401862	14.569000	26.102792	19.020632	30.5	24.3	28.2	31.8	23.5	5.2	12.5	8.2	10.5
Murphy	1.0117361	2.1448936	7.0821530	2.6328612	1.2140834	2.8328612	0.8	0.8	0.4	1.3	2.3	2.3	1.9	2.5	1.7
Rape (seed)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rape (oilseed)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lucerne	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beans (feed)	38.243626	31.485232	34.567382	20.324723	11.938486	11.331442	6.1	8.1	6.9	46.5	1.2	6.4	6.4	0	13.3
Other feed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non Feed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Straw	45.576896	20.032378	21.044112	26.925684	19.142948	35.010111	7.4	9.6	6	5.1	4.7	0.1	4.8	0	0
Woodland	13.273978	13.273978	13.273978	13.273978	13.273978	14.771944	24.2	14.8	13.2	12	12	3.7	4.3	3.4	1.8
Other Land	7.8166036	8.2152925	8.0938921	8.4751133	11.048159	15.6	21.3	26.2	24.9	26.2	29.5	21	24.7	39	35.2
Ag & Nursery Stock	0	0	0.2023472	0	0	0	0.4	0.2	0	0.3	2.3	0.3	0.4	0	0.4
Orchard & Small Fruit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Area under Glass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cattle & calves	1304	1768	1682	1913	2086	2242	2071	1948	1864	1876	1613	1572	1514	1585	1601
Sheep	1328	1871	1488	1741	1670	1693	1573	1048	389	284	448	322	299	788	691
Pigs	531	491	1134	1607	1332	1622	1472	1573	1598	2190	2318	2398	1433	1185	1277
Other	3656	431	16364	8331	270	16559	1648	8445	408	18250	7188	8203	16145	16242	14687
SUMMARY															
Permanent Pasture	507.81090	561.04411	522.17726	577.01305	522.90168	540.84211	593.1	610	544.4	621.4	518.2	551.2	538.2	496	539.6
Leys Pasture	423.53411	352.61021	385.07851	370.21449	391.94652	386.28082	371.8	304.4	324.9	265.3	312.4	271	206.7	266.6	345.1
Woodland	13.273978	13.273978	13.273978	13.273978	13.273978	14.771944	24.2	14.8	13.2	12	12	3.7	4.3	3.4	1.8
Cereal	733.81340	734.83716	669.48604	742.04775	736.50626	739.53865	773.6	754.4	742.6	750.3	705.5	745.6	802.2	780.7	759.3
Swamp Beet	208.61099	201.94252	198.09794	159.85431	192.43221	193.44395	213.2	219.7	242.4	193.9	244.2	241.8	237.6	238.3	241.1
Potatoes	76.106030	88.142452	85.390530	78.106030	79.927155	72.448598	78.9	85.7	118	90	91	90	99.6	98	94.9
Fallow	25.576896	20.032378	21.044112	26.935684	19.142948	35.010111	7.4	9.6	6	5.1	4.7	0.1	4.8	0	0
Misc Crops	50.505868	39.700526	63.051396	47.753946	39.256362	33.184842	37.8	38.1	38.9	34.2	34.2	22.3	30.2	15	34.1
Market Gardens	0	0	0.2023472	0	0	0	0.4	0.2	0	0.3	2.3	0.3	0.4	0	0.4
Total Grass	331.44478	873.55439	908.35577	947.22784	924.84824	929.82598	964.9	914.4	889.3	886.7	831.3	822.2	745.6	782.6	760.1

NOTE:
 #1 Maltcrop and Early potatoes - combined total only after 1983
 #2 Lucerne and Maize (feed) - not a separate category after 1979; assumed included in 'Other feed'

Table A6.2 MAFF Agricultural Returns 1969 to 1985 - The Parish of Stanton Upon Hine Heath.

Parish	SHROPSHIRE GROUNDWATER SCHEME																
	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
MAFF AGRICULTURAL RETURNS	STOKE UPON TERN																
MAFF Ref.	MAFF Ref.																
Area Units	Area Units																
Hectares	Hectares																
No of Holdings	66	61	59	59	51	51	49	50	46	45	45	44	45	45	43	42	
Total Area	1850.1546	1839.4577	1819.4355	1751.6390	1908.5391	1764.4	1752.9	1727.9	1737	1725	1747.2	1711.1	1734.3	1754.4	1725.2	1801.3	
Total Crops & Grass	1815.2165	1811.0401	1813.3032	1753.9393	1890.9580	1741.5	1732	1699.5	1699.2	1678.2	1670.4	1694	1707.8	1718	1692.9	1768.6	
Wheat	115.3372	121.4034	107.1630	115.9616	148.5229	145.5	86	48.2	84.5	79.2	71.3	73	73	80	69.2	59.7	73.9
Barley	354.6361	320.4370	343.2513	380.0080	377.7033	439.5	373.2	454	471.5	461.1	449.3	480.2	473.6	473.2	464.8	481.9	419.1
Oats	17.0710	20.6394	15.9854	18.1892	18.0089	18.2112	8.8	4.3	6.1	4.0	5.7	2.5	2.5	2.2	2.4	2.4	2.4
Mixed Corn	29.9878	47.6700	8.4985	5.6572	0	0	0	0	0	0	0	0	0	0	0	0	0
Hay	2.0234	7.23	2.4261	2.9234	2.0234	0	1.2	0	4.5	6.1	3.2	3.2	1.6	2	0	0	0
Early Potatoes	4.2493	12.6669	12.8692	5.4633	9.7126	16.1677	25.5	25.5	20.4	30.1	21.4	21.4	21.2	21.2	12.4	12.4	12.4
Main Potatoes	49.7774	49.7774	47.9562	41.8118	47.9562	53.8457	60.5	60.5	60.5	48.5	55.6	55.6	55.6	46.1	46.1	46.1	46.1
Super Bean	105.2205	116.1473	100.9712	118.9801	104.8158	134.7625	123.4	137.3	156.6	174.4	196.8	205.8	200.5	209	204.4	204.7	222.3
Temporary Grass	310.5329	305.3187	316.8911	275.5193	336.0178	301.6992	307.2	318.2	273.2	304.4	298.4	277.2	261.8	250.5	230.7	267.9	288.4
Permanent Grass	894.3745	774.3824	802.6386	768.6386	887.1713	793.8213	914.2	864.2	850.5	845.8	818.7	849.5	875.3	802.1	862.8	839.9	828.2
Rough Grazing	45.0424	37.7593	22.9629	31.5651	9.8340	7.2840	10.4	10.4	9.2	11.6	9.6	9.6	9.6	7.6	7.6	10.1	10.1
Maize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maize (feed) #	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tump, Beet etc (feed)	9.1153	5.9847	9.3079	13.1527	8.9032	14.5690	4.4	2.3	14.7	4.1	2	2	2	0.2	12.5	0	2.9
Mung	9.7126	6.0741	7.0921	5.6572	4.8553	6.4751	8.2	5.3	8.2	5.6	4	4	2	2	2	2	2
Rape (feed)	5.4633	5.2102	3.6422	3.6422	0	0	0	0	2.1	1.5	0	0	0	0	0	0	2.5
Rape (oilseed)	0	0	0	0	0	0	0	0	5.7	3.9	0	0	0	0	0	0	0
Suecine #	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beans (feed)	4.4513	5.0586	12.0589	4.4513	5.2610	14.9858	15.7	17.4	0	0	0	0	0	0	0	0	0
Other feed	4.4513	5.0586	12.0589	4.4513	5.2610	14.9858	15.7	17.4	0	0	0	0	0	0	0	0	0
Hay	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non Feed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Straw	4.4513	5.0586	12.0589	4.4513	5.2610	14.9858	15.7	17.4	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Barley	4.4513	5.0586	12.0589	4.4513	5.2610	14.9858	15.7	17.4	0	0	0	0	0	0	0	0	0
Woodland	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Other Land	20.3561	6.6774	6.6774	12.6693	11.8574	11.3314	11.2	14.4	15.2	22.4	33.2	29.7	26.2	25.3	24.9	20.2	21
Veg & Nassy Stock	0.8093	3.1568	7.6891	5.6774	9.1056	14.3665	7.6	4	8.5	9.8	9.2	9.2	9.2	11.2	8.9	2.6	2.7
Orchard & Small Fruit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Area under Glass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cattle & calves	2437	2076	2103	2072	2284	2444	2308	2245	2215	1881	1956	1961	2040	2150	2116	2291	2434
Pigs	1681	1604	1673	1733	1828	1544	1380	1295	1130	963	770	604	716	843	827	853	613
Sheep & lambs	814	874	1503	1274	1204	1333	1140	737	738	493	595	514	644	806	806	1509	1615
Poultry	63472	53637	43041	52139	49781	49781	90234	109970	115486	86934	107479	97101	88924	96590	107310	105418	177195
SUMMARY																	
Permanent Pasture	939.4174	812.1403	825.4957	800	897.0029	788.1829	856	895	858	553	609	559	584	609	570	547	638
Key Pasture	310.6029	305.3419	316.9971	275.5193	336.0178	301.6992	307.2	316	273	304	298	277	261	250	230	267	288
Woodland	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Cereal	519.2534	512.5860	482.9218	527.6406	511.3719	606.5565	595	462	507	569	547	596	552	565	507	494	494
Sugar Beet	105.2056	116.1473	100.9712	116.8011	104.8158	134.7625	123.4	137.3	156.6	174.4	196.8	205.8	200.5	209	204.4	204.7	222.3
Potatoes	54.0267	62.4435	60.8557	46.9452	57.6886	70.1355	61.4	86.4	71.2	78.6	77.7	77.7	77.7	68.2	68.2	64.6	64.6
Other	4.4513	5.0586	12.0589	4.4513	5.2610	14.9858	15.7	17.4	0	0	0	0	0	0	0	0	0
Fallow	31.1617	22.3780	32.0227	26.9121	19.0263	29.5426	25.5	31.9	32	25.7	16.5	15.3	15.3	11.5	14.6	4	3.1
Misc Crops	0.8093	3.1568	7.6891	5.6774	9.1056	14.3665	7.6	4	8.5	9.8	9.2	9.2	9.2	11.2	8.9	2.6	2.7
Market Gardens	1.850	2.023	1.117	4.828	1.142	4.828	1.142	4.828	1.142	4.828	1.142	4.828	1.142	4.828	1.142	4.828	1.142
Total Grass	1850.1546	1839.4577	1819.4355	1751.6390	1908.5391	1764.4	1752.9	1727.9	1737	1725	1747.2	1711.1	1734.3	1754.4	1725.2	1801.3	
NOTE																	

** Maincrop and Early potatoes - combined total only after 1983
 # Lucerne and Maize (feed) - not a separate category after 1975, assumed included in 'Other feed'

Table A6.3 MAFF Agricultural Returns 1969 to 1985 - The Parish of Stoke Upon Tern.

APPENDIX 7

DOCUMENTATION OF PROGRAM EIACOST.

The program EIACOST was developed to calculate the effect of moisture loss on crop yields. An outline of the program's operation is given in Sect 8.5.1.5, and a flow diagram presented in Fig 8.30.

Two versions of EIACOST were produced: the first to determine crop losses for sandy, Bridgnorth and Wem/Misc Till soil groups (EIACOST); the second for Peaty Loam and Salop/Hodnet soil groups (EIACOS2). A listing of the first program follows after Figs A7.1, A7.2 and A7.3. These latter are examples of the output available from each of the two programs.

<pre> Map Title :- CEREALS ON AQUIF T:R Crop :- Cereals CODES USED ARE :- 0.00 SANDY SOILS 1.00 BRIDGNORTH 2.00 WEM/MISC TILL </pre>	<pre> Map Title :- CEREALS ON AQUIF T:R Crop :- Cereals CODES USED ARE :- 0 Peat/Peaty Loam 1 Sandy Soils 2 Wem/Misc Till 3 Salop/Hodnet </pre>
<pre> 63 64 65 28 *****2 28 ***0*****:***22****2 ***000*****:***20**** **1*000***:***** *****000***:***** *****000***:***0***** *****00***:***00***** *****00***:***00***** *****00***:***00***** *****00***:***00***** 27 *****:***** 27 *****1****:***** 2*****:***** *****:***00***** *****:***00***** *****:***00***** *2*****:***0***** *****:***0***** *****:***** *****:***** 26 *****:***** 26 </pre>	<pre> 63 64 65 28 ****1*****:*****2 28 ***1*****:***22****2 **0111*****:***21**** **10111***:***** ****111***:***** ****111***:***1***** ****11***:***11***** ****11***:***11***** ****11***:***11***** ****11***:***11***** *****:***3***** 27 ****1****:***3***** 2*****:***** 3*****:***113**** *3*****:***11**** *****:***11**** *2*****:***1***** *****:***1***** *****:***** *****:***** *****:***** 26 *****:***** 26 </pre>
63 64 65	63 64 65
a) Data prepared for EIACOST	b) Data prepared for EIACOS2

Fig A7.1 Printout of Input Crop/Soil Data - Cereals.
(Group of Grid Squares Ref 6328)

MOISTURE LOSS RESULTING FROM GROUNDWATER DRAWDOWN :-

Square Ref:- V1 = 63 H3 = 28

Crop = Cereals
Rooting Depth = 2.10

Drawdown Conditions :- Groundwater Depth - 1974 conditions
Pumping start day:- 150.00

Moisture Loss in mm	Area Affected in ha		
	Sandy Soils	Bridgnorth	Wem/Misc Till
0 to 5	2	0	2
10 to 15	1	1	0
25 to 30	0	0	1
30 to 35	1	0	0
35 to 40	0	0	2
45 to 50	0	0	1
55 to 60	16	0	0
60 to 65	2	0	0
80 to 85	0	0	1
110 to 115	2	0	
120 to 125	0	1	
155 to 160	1		
160 to 165	6		
165 to 170	5		
Artesian Area Affected	0	0	0
Total Yield Loss (tonne)	39.75	1.67	3.24
TOTAL LOSS (tonne)		44.66	
TOTAL LOSS (£)		4465.75	

Fig A7.2 Example of Output from Version of EIACOST for Sandy, Bridgnorth and Wem/Misc Till Groups Soil (Group of Grid Squares Ref 6328).

MOISTURE LOSS RESULTING FROM GROUNDWATER DRAWDOWN :-

Square Ref:- V1 = 63 H3 = 28

Crop = Cereals
Rooting Depth = 2.10

Drawdown Conditions :- Groundwater Depth - 1974 conditions
Pumping start day:- 150.00

Moisture Loss in mm	Area Affected in ha	
	Peaty Loam	Salop/Hodnet
0 to 5	1	0
15 to 20	1	0
45 to 50	0	1
50 to 55	0	1
Artesian Area Affected	0	0
Total Area Affected (ha)	2	2
Total Yield Loss (tonne)	0.42	1.26
TOTAL LOSS (tonne)		1.67
TOTAL LOSS (£)		167.38

Fig A7.3 Example of Output from Version of EIACOST for Peaty Loam and Salop/Hodnet Soil Groups (Group of Grid Squares Ref 6328).

```

10 REM ***** E I A C O S T *****
20 REM ***** Version for Sandy soils; Bridgnorth; Wem/Misc Till *****
30 REM ***** Last Mod:- Egn for moist loss duration 5:789 PDH *****
40 *FX 5,1
50 *FX 6,10
60 MODE 0
70 DIM SOL$(20,20),DD(20,20),GW(20,20),TEM(20,20)
80 DIM S$(34),B$(27),W$(17)
90 DIM SMC(6),BMC(6),WMC(6),MCP(6)
100 DIM J$(4),CODE$(4)
110 SMC(1)=4.94: SMC(2)=8.63: SMC(3)=16.94: SMC(4)=31.26: SMC(5)=49.92:
SMC(6)=58.19
120 BMC(1)=3.64: BMC(2)=6.45: BMC(3)=12.92: BMC(4)=24.41: BMC(5)=39.71:
BMC(6)=46.49
130 WMC(1)=1.68: WMC(2)=2.94: WMC(3)=5.43: WMC(4)=11.60: WMC(5)=25.40:
WMC(6)=37.87
140 TAG%=0
150 MKR%=0: CHK%=0: SOCHK%=0
160 HOS=1.5: HOB=1.5: HOW=2.6
170 CLS
180 PRINT TAB(30,2);"E I A C O S T "
190 PRINT TAB(19);"ANALYSIS FOR FOUR SQUARES WITH 9 NODES"
200 PRINT TAB(16);"EVALUATION OF DRAWDOWN EFFECT ON CROP YIELD"
210 PRINT TAB(5);"Select Appropriate Crop Description :-"
220 PRINT TAB(27);"1. Cereals"
230 PRINT TAB(27);"2. Sugar Beet"
240 PRINT TAB(27);"3. Potatoes"
250 PRINT TAB(27);"4. Miscellaneous Crops"
260 PRINT TAB(27);"5. Permanent Pasture"
270 PRINT TAB(27);"6. Ley Grass"
280 PRINT TAB(15);"Select Appropriate Reference Code (1 to 6) = "
290 CR$=GET$
300 IF CR$="1" THEN CROP$="Cereals" ELSE 320
310 CDR=2.1: VCE=100: GOTO 420
320 IF CR$="2" THEN CROP$="Sugar Beet" ELSE 340
330 CDR=2.1: VSB=30: GOTO 420
340 IF CR$="3" THEN CROP$="Potatoes" ELSE 360
350 CDR=1.5: VMP=60: VEP=115: GOTO 420
360 IF CR$="4" THEN CROP$="Misc Crops" ELSE 380
370 CDR=1.5: VMISC=50: GOTO 420
380 IF CR$="5" THEN CROP$="Permanent Pasture" ELSE 400
390 CDR=1.75: VMG=0.174: VRG=0.1: GOTO 420
400 IF CR$="6" THEN CROP$="Ley Grass" ELSE 290
410 CDR=0.6: VMG=0.174: VRG=0.1
420 PRINT TAB(25);"Crop Selected = ";CROP$
430 PRINT TAB(22);"Happy with this selection (Y/N) ?"
440 AN$=GET$
450 IF AN$="Y" THEN 470
460 IF AN$="N" THEN 170 ELSE 440
470 REM ***** input soil data relating to crop *****
480 CHK%=0
490 CLS
500 PRINT TAB(4,5);"READ CROP / SENSITIVE SOIL DATA FROM DISC :-"

510 MKR%=1
520 PROCFILENAME
530 Z=OPENIN CRFIL$.
540 INPUT FZ,TIT$,P
550 INPUT FZ,CH1%,CH2%,CH3%,CV1%,CV2%,CV3%
560 FOR R=1 TO P
570 INPUT FZ,J$(R),CODE$(R)
580 NEXT R
590 FOR Y%=1 TO 20
600 FOR X%=1 TO 20
610 INPUT FZ,SOL$(Y%,X%)
620 NEXT X%
630 NEXT Y%
640 CLOSEFZ
650 CLS
660 PRINT TAB(19,5);"EIA ANALYSIS OF DRAWDOWN FOR FOUR SQUARES"
670 PRINT TAB(30);"Crop = ";CROP$
680 VDU 24,0;0;1279;500;
690 VDU 28,0,14,79,0
700 PROCDRAW(CH1%,CH2%,CH3%,CV1%,CV2%,CV3%)
710 PRINT TAB(28);"IS SQUARE BELOW OK (Y/N) ?"
720 AN$=GET$
730 IF AN$="Y" THEN 790
740 IF AN$="N" THEN 750 ELSE 720
750 PRINT TAB(10);"Do you want to input a new file (F) or quit (Q) ?"
760 AN$=GET$
770 IF AN$="F" THEN 470
780 IF AN$="Q" THEN 1260 ELSE 760
790 VDU 26: CLS
800 IF TAG%=2 THEN GOTO 990
810 REM ***** input GROUNDWATER surface *****
820 PRINT TAB(4,5);"READ GROUNDWATER DEPTH DATA FROM DISC :-"
830 MKR%=2: PROCFILENAME
840 PROCINSURF
850 CLS
860 REM ***** input DRAWDOWN surface *****
870 PRINT TAB(4,5);"READ DRAWDOWN DATA FROM DISC :-"
880 MKR%=3: PROCFILENAME
890 PROCINSURF
900 PRINT TAB(10);"Number of Days from Year Start when Pumping Commenced = ";
910 INPUT PDAT
920 PRINT TAB(23);"Happy with No Days Input (Y/N) ?"
930 AN$=GET$
940 IF AN$="Y" THEN 970
950 IF AN$="N" THEN PRINT TAB(33);"TRY AGAIN !" ELSE 930
960 GOTO 900
970 CLS
980 REM ***** Main Menu *****
990 PROCCHK
1000 IF SOCHK%=4 THEN 1270

```

```

1010 CLS
1020 PRINT TAB(22,2);"M A I N M E N U"
1030 PRINT 'TAB(15);"Options Available Are :-"
1040 PRINT 'TAB(17);"1. Input NEW groundwater & drawdown data: SAME parameter"
1050 PRINT 'TAB(17);"2. Input data for NEW crop: same GW level and drawdown"
1060 PRINT 'TAB(17);"3. Print out crop/soil data"
1070 PRINT 'TAB(17);"4. DETERMINE EFFECT OF DRAWDOWN"
1080 PRINT 'TAB(17);"5. View or Print Effect of Drawdown"
1090 PRINT 'TAB(17);"6. Finish working"
1100 INPUT 'TAB(15)"INPUT APPROPRIATE OPTION NUMBER (1-6) = "TAG%
1110 IF TAG%=1 THEN 650
1120 IF TAG%=2 THEN 150
1130 IF TAG%=3 THEN MKR%=1 ELSE 1160
1140 PROCOUTDAT(CH1%,CH2%,CH3%,CV1%,CV2%,CV3%)
1150 GOTO 1010
1160 IF TAG%=4 THEN PROCALC ELSE 1180
1170 GOTO 1010
1180 IF TAG%=5 THEN 1190 ELSE 1240
1190 IF CHK%=1 THEN PROCMLOUT ELSE 1210
1200 GOTO 1010
1210 PRINT 'TAB(25);"EFFECT NOT CALCULATED YET"
1220 PROCTIM: PROCALC
1230 GOTO 1010
1240 IF TAG%=6 THEN 1270 ELSE PRINT TAB(22);"INVALID INPUT - TRY AGAIN"
1250 PROCTIM: GOTO 1010
1260 VDU 26: CLS
1270 PRINT 'TAB(22);"FINISHED - EIACOST signing off....Bye-Bye !"
1280 END
1290 REM *****
1300 DEF PROCTIM
1310 FTIM=TIME+300
1320 REPEAT UNTIL TIME=FTIM
1330 ENDPROC
1340 REM *****
1350 DEF PROCDRAW(H1%,H2%,H3%,V1%,V2%,V3%)
1360 @%=&03
1370 MOVE 420,100: DRAW 860,100
1380 MOVE 420,250: DRAW 860,250
1390 MOVE 420,400: DRAW 860,400
1400 MOVE 440,80: DRAW 440,420
1410 MOVE 640,80: DRAW 640,420
1420 MOVE 840,80: DRAW 840,420
1430 VDU 5
1440 MOVE 350,120: PRINT H1%
1450 MOVE 350,270: PRINT H2%
1460 MOVE 350,420: PRINT H3%
1470 MOVE 410,60: PRINT V1%
1480 MOVE 610,60: PRINT V2%
1490 MOVE 810,60: PRINT V3%
1500 VDU 4: @%=10

1510 ENDPROC
1520 REM *****
1530 DEF PROCSpace
1540 PRINT 'TAB(28);"PRESS SPACE BAR TO CONTINUE"
1550 REPEAT UNTIL GET=32
1560 ENDPROC
1570 REM *****
1580 DEF PROCNoise
1590 SOUND 1,-10,97,10
1600 SOUND 1,-10,105,10
1610 SOUND 1,-10,89,10
1620 SOUND 1,-10,69,20
1630 ENDPROC
1640 REM *****
1650 DEF PROCINSURF
1660 IF MKR%=2 THEN 1680
1670 IF MKR%=3 THEN 1780
1680 Z=OPENIN GWFIL$
1690 INPUT £Z,GWINF$,GWUNIT$
1700 INPUT £Z,GWH1%,GWH2%,GWH3%,GWH1%,GWH2%,GWH3%
1710 FOR Y=1 TO 20
1720 FOR X=1 TO 20
1730 INPUT £Z,GW(Y,X)
1740 NEXT X
1750 NEXT Y
1760 CLOSEZ
1770 GOTO 1870
1780 Z=OPENIN DDFIL$
1790 INPUT £Z,DDINF$,DDUNIT$
1800 INPUT £Z,DDH1%,DDH2%,DDH3%,DDV1%,DDV2%,DDV3%
1810 FOR Y=1 TO 20
1820 FOR X=1 TO 20
1830 INPUT £Z,DD(Y,X)
1840 NEXT X
1850 NEXT Y
1860 CLOSEZ
1870 ENDPROC
1880 REM *****
1890 DEF PROCdisc
1900 PRINT 'TAB(18);"Want to see disc directory (Y/N) ?"
1910 DGET$=GET$
1920 IF DGET$="N" THEN 2020
1930 IF DGET$="Y" THEN 1940 ELSE 1910
1940 PRINT
1950 *
1960 PRINT 'TAB(18);"Happy with this disc (Y/N) ?"
1970 DGET$=GET$
1980 IF DGET$="N" THEN 2000
1990 IF DGET$="Y" THEN 2020
2000 PRINT 'TAB(20);"Change Disc"

```

```

2010 PRINT: PROCSpace: GOTO 1940
2020 ENDPROC
2030 REM *****
2040 DEF PROCOUTdat(H1%,H2%,H3%,V1%,V2%,V3%)
2050 VDU2
2060 PROCKEY
2070 PRINT " "
2080 PRINT TAB(5);V1%;TAB(15);V2%;TAB(26);V3%
2090 PRINT TAB(0);H3%;
2100 FOR Y%=1 TO 20
2110 IF Y%=10 THEN PRINT H2%;
2120 IF Y%=11 THEN 2130 ELSE 2140
2130 PRINT TAB(6);".....";
2140 IF Y%=20 THEN PRINT H1%;
2150 PRINT TAB(6);
2160 @%=&01
2170 FOR X%=1 TO 20
2180 IF X%=11 THEN PRINT": ";
2190 IF SOL%(Y%,X%)=-1 THEN PRINT "##"; ELSE PRINT SOL%(Y%,X%);
2200 NEXT X%
2210 @%=&02
2220 IF Y%=1 THEN PRINT TAB(32);H3%;
2230 IF Y%=10 THEN PRINT TAB(32);H2%;
2240 IF Y%=20 THEN PRINT TAB(32);H1%;
2250 PRINT
2260 NEXT Y%
2270 PRINT TAB(5);V1%;TAB(15);V2%;TAB(26);V3%
2280 @%=10
2290 VDU 12
2300 VDU 3
2310 ENDPROC
2320 REM *****
2330 DEF PROCKEY
2340 PRINT TAB(2); "Map Title :- ";TIT$
2350 PRINT TAB(2); "Crop :- ";CROP$
2360 PRINT "CODES USED ARE :-"
2370 FOR R=1 TO P
2380 PRINT TAB(2);J%(R);TAB(9);CODE$(R)
2390 NEXT R
2400 ENDPROC
2410 REM *****
2420 DEF PROCFILENAME
2430 PRINT: PROCDISC
2440 INPUT "TAB(14);Input Data File Name (max 7 chrs) = ";FIL$
2450 PRINT "TAB(20);Happy with this File Name (Y/N) ?"
2460 AN$=GET$
2470 IF AN$="Y" THEN 2490
2480 IF AN$="N" THEN 2430 ELSE 2460
2490 IF MKR%=1 THEN CRFIL$=FIL$
2500 IF MKR%=2 THEN GWFIL$=FIL$

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```

2510 IF MKR%=3 THEN DDFIL$=FIL$
2520 PRINT "TAB(28);DATA BEING READ"
2530 ENDPROC
2540 REM *****
2550 DEF PROCALC
2560 CHK%=1
2570 PRINT "TAB(20);UNDERTAKING CALCULATION - be patient !!"
2580 FOR Z=1 TO 34: S%(Z)=0: NEXT Z
2590 FOR Z=1 TO 27: B%(Z)=0: NEXT Z
2600 FOR Z=1 TO 17: W%(Z)=0: NEXT Z
2610 FOR Z=1 TO 6: MC(Z)=0: NEXT Z
2620 ARTS%=0: ARTB%=0: ARTW%=0
2630 FOR Y%=1 TO 20
2640 FOR X%=1 TO 20
2650 ML=0: N=0: TZ=0
2660 IF SOL%(Y%,X%)=0 THEN 2670 ELSE 2800
2670 FOR X=1 TO 6
2680 MCP(X)=SMC(X)
2690 NEXT X
2700 HO=HOS
2710 PROCMOISTLOSS
2720 ARTS%=ARTS%+ART%
2730 IF ML<=0 THEN 3070
2740 REPEAT
2750 N=N+1
2760 TZ=N*5: BZ=TZ-5
2770 UNTIL ML<TZ AND ML>=BZ
2780 S%(N)=S%(N)+1
2790 GOTO 3070
2800 IF SOL%(Y%,X%)=1 THEN 2810 ELSE 2940
2810 FOR X=1 TO 6
2820 MCP(X)=BMC(X)
2830 NEXT X
2840 HO=HOB
2850 PROCMOISTLOSS
2860 ARTB%=ARTB%+ART%
2870 IF ML<=0 THEN 3070
2880 REPEAT
2890 N=N+1
2900 TZ=N*5: BZ=TZ-5
2910 UNTIL ML<TZ AND ML>=BZ
2920 B%(N)=B%(N)+1
2930 GOTO 3070
2940 IF SOL%(Y%,X%)=2 THEN 2950 ELSE 3070
2950 FOR X=1 TO 6
2960 MCP(X)=MWC(X)
2970 NEXT X
2980 HO=HOW
2990 PROCMOISTLOSS
3000 ARTW%=ARTW%+ART%

```



```

3010 IF ML<=0 THEN 3070
3020 REPEAT
3030 N=N+1
3040 TZ=N*5: BZ=TZ-5
3050 UNTIL ML<TZ AND ML>=BZ
3060 WK(N)=WK(N)+1
3070 NEXT X%
3080 NEXT Y%
3090 IF CR$="1" THEN PROCGRASS
3100 IF CR$="2" THEN PROCBET
3110 IF CR$="3" THEN PROCPOTS
3120 IF CR$="4" THEN PROCPOTS
3130 IF CR$="5" OR CR$="6" THEN PROCGRASS
3140 PROCNOISE
3150 PROCMLOUT
3160 ENDPROC
3170 REM ***** CALCULATE MOISTURE LOSS *****
3180 DEF PROCMOISTLOSS
3190 PNTX=0: ARTX=0
3200 DS=HO+CDR
3210 REM ***** Is Soil Sens Depth < GW Depth ? *****
3220 IF GW(Y%,X%)>DS THEN 3590
3230 REM ***** Is GW ARTESIAN ? *****
3240 IF GW(Y%,X%)<0 THEN ARTX=1 ELSE 3270
3250 GOTO 3590
3260 REM ***** Crop Affected - Calc Loss *****
3270 ZONE=HO/6: ML=0
3280 IF DD(Y%,X%)<0 THEN 3590
3290 NOD=INT(DD(Y%,X%)/ZONE)
3300 IF (DD(Y%,X%)/ZONE-NOD)>0.5 THEN NOD=NOD+1
3310 IF NOD>6 THEN NOD=6
3320 REM ***** Ho ABOVE OR BELOW GL *****
3330 IF GW(Y%,X%)<HO THEN 3420
3340 REM ***** Ho BELOW GL *****
3350 IF CDR>=GW(Y%,X%) THEN MLMAX=HO ELSE MLMAX=CDR-(GW(Y%,X%)-HO)
3360 NOM=INT(MLMAX/ZONE)
3370 IF (MLMAX/ZONE-NOM)>0.5 THEN NOM=NOM+1
3380 FOR X=1 TO 6
3390 IF X>NOM THEN MC(X)=0 ELSE MC(X)=MCP(X)
3400 NEXT X
3410 GOTO 3540
3420 REM ***** Ho ABOVE GL *****
3430 IF CDR>=GW(Y%,X%) THEN MLMAX=GW(Y%,X%) ELSE MLMAX=CDR
3440 PNTX=1
3450 AGL=HO-GW(Y%,X%)
3460 NOM=INT((MLMAX+AGL)/ZONE)
3470 IF ((MLMAX+AGL)/ZONE-NOM)>0.5 THEN NOM=NOM+1
3480 NOA=INT(AGL/ZONE)
3490 IF (AGL/ZONE-NOA)>0.5 THEN NOA=NOA+1
3500 FOR X=1 TO 6
3510 IF X>NOM OR X<=NOA THEN MC(X)=0 ELSE MC(X)=MCP(X)
3520 NEXT X
3530 REM ***** CALC MOIST LOSS *****
3540 IF NOD<NOM THEN X1=(NOM-NOD+1) ELSE X1=1
3550 IF X1>6 THEN 3590
3560 FOR X=X1 TO 6
3570 ML=ML+MC(X)
3580 NEXT X
3590 ENDPROC
3600 REM ***** OUTPUT MOIST LOSS RESULTS *****
3610 DEF PROCMLOUT
3620 PRINT "TAB(16);"Do You Want to PRINT OUT or VIEW Results (P/V) ?"
3630 AN$=GET$
3640 IF AN$="V" THEN 3680
3650 IF AN$="P" THEN VDU 2 ELSE 3630
3660 PND$="F"
3670 GOTO 3690
3680 PND$="o"; CLS
3690 PRINT TAB(15);"MOISTURE LOSS RESULTING FROM GROUNDWATER DRAWDOWN :--"
3700 PRINT "TAB(20);"Square Ref:- V1 = "CV1%"; H3 = "CH3%
3710 @%=&20209
3720 PRINT "TAB(25);"Crop = "CROP$
3730 PRINT TAB(25);"Rooting Depth = "CDR
3740 PRINT "TAB(15);"Drawdown Conditions :- "DDINF$
3750 PRINT TAB(18);"Pumping start day:- "INT(PDAT)
3760 PRINT "TAB(10);"Moisture Loss;"TAB(40);"Area Affected in ha"
3770 PRINT TAB(14);"in mm;"TAB(30);"Sandy Soils;"TAB(45);"Bridgnorth;"TAB(60);
      "Wem/Misc Till"
3780 PRINT
3790 FOR Z%=1 TO 17
3800 IF S%(Z%)=0 AND B%(Z%)=0 AND W%(Z%)=0 THEN 3850
3810 TZ%=Z%*5:BZ%=TZ%-5
3820 @%=10
3830 PRINT TAB(10);BZ%;TAB(15);"Lo";TAB(20);TZ%;
3840 PRINT TAB(34);S%(Z%);TAB(49);B%(Z%);TAB(64);W%(Z%)
3850 NEXT Z%
3860 FOR Z%=18 TO 27
3870 IF S%(Z%)=0 AND B%(Z%)=0 THEN 3910
3880 TZ%=Z%*5:BZ%=TZ%-5
3890 PRINT TAB(10);BZ%;TAB(15);"Lo";TAB(20);TZ%;
3900 PRINT TAB(34);S%(Z%);TAB(49);B%(Z%)
3910 NEXT Z%
3920 FOR Z%=28 TO 34
3930 IF S%(Z%)=0 THEN 3970
3940 TZ%=Z%*5:BZ%=TZ%-5
3950 PRINT TAB(10);BZ%;TAB(15);"Lo";TAB(20);TZ%;
3960 PRINT TAB(34);S%(Z%)
3970 NEXT Z%
3980 PRINT "TAB(5);"Artesian Area Affected";TAB(34);ARTS%;TAB(49);ARTB%;
      TAB(64);ARTW%
3990 IF CR$="4" THEN PRINT "TAB(40);"No Monetary Value Assigned" ELSE 4010
4000 GOTO 4190

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```

4010 @#=#&2020709
4020 IF CR#="5" OR CR#="6" THEN 4130
4030 IF CR#="3" THEN 4080
4040 PRINT 'TAB(5);"Total Yield Loss (tonne)";TAB(34);SYD;TAB(49);BYD;
TAB(64);WYD
4050 PRINT 'TAB(10);"TOTAL LOSS (tonne)";TAB(49);TYD
4060 PRINT 'TAB(10);"TOTAL LOSS (";PND$;"");TAB(49);TYDM
4070 GOTO 4190
4080 PRINT 'TAB(5);"Yield Loss Maincrop (ton)";TAB(34);SYD;TAB(49);BYD;
TAB(64);WYD
4090 PRINT 'TAB(5);"Yield Loss Earlies (ton)";TAB(34);SYDE;TAB(49);BYDE;
TAB(64);WYDE
4100 PRINT 'TAB(10);"TOTAL LOSS (tonne)";TAB(49);TYD
4110 PRINT 'TAB(10);"TOTAL LOSS (";PND$;"");TAB(49);TYDM
4120 GOTO 4190
4130 PRINT 'TAB(5);"Yield Loss Maincrop Litres Milk";TAB(34);SYDM;TAB(49);BYDM;
TAB(64);WYDM
4140 PRINT 'TAB(5);"TOTAL LOSS (litres milk)";TAB(49);TYDM
4150 PRINT 'TAB(5);"TOTAL LOSS (milk in ";PND$;"");TAB(49);TYDMM
4160 PRINT 'TAB(5);"Beef Cattle Requiring Feed";TAB(34);SYDB;TAB(49);BYDB;
4165 TAB(64);WYDB
4170 PRINT 'TAB(5);"TOTAL CATTLE TO BE FED";TAB(49);TYDB
4180 PRINT 'TAB(5);"TOTAL COST (feed in ";PND$;"");TAB(49);TYDEM
4190 IF AN#="V" THEN PROCSPACE ELSE 4210
4200 GOTO 4220
4210 VDU 12: VDU 3
4220 ENDPROC
4230 REM ***** CALC CERIAL CROP LOSS *****
4240 DEF PROCERIAL
4250 SYD=0: BYD=0: WYD=0
4260 FOR Z=1 TO 34
4270 IF S%(Z)=0 THEN 4300
4280 MDEBT=(Z*5-2.5)*(212-PDAT-1.2)
4290 SYD=SYD+(0.18*MDEBT+104)*S%(Z)/1000
4300 NEXT Z
4310 FOR Z=1 TO 27
4320 IF B%(Z)=0 THEN 4350
4330 MDEBT=(Z*5-2.5)*(212-PDAT-2.0)
4340 BYD=BYD+(0.18*MDEBT+104)*B%(Z)/1000
4350 NEXT Z
4360 FOR Z=1 TO 17
4370 IF W%(Z)=0 THEN 4410
4380 MDEBT=(Z*5-2.5)*(212-PDAT-3.2)
4390 IF MDEBT<=0 THEN 4410
4400 WYD=WYD+(0.18*MDEBT+104)*W%(Z)/1000
4410 NEXT Z
4420 TYD=SYD+BYD+WYD
4430 TYDM=TYD*VCE
4440 ENDPROC
4450 REM ***** CALC SUGAR BEET CROP LOSS *****
4460 DEF PROCBEET
4470 SYD=0: BYD=0: WYD=0
4480 FOR Z=1 TO 34
4490 IF S%(Z)=0 THEN 4530
4500 MDEBT=(Z*5-2.5)*(288-PDAT-1.2)

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4510 SYDI=(0.0025*MDEBT-7.71)*S%(Z)
4520 IF SYDI>0 THEN SYD=SYD+SYDI
4530 NEXT Z
4540 FOR Z=1 TO 27
4550 IF B%(Z)=0 THEN 4590
4560 MDEBT=(Z*5-2.5)*(288-PDAT-2.0)
4570 BYDI=(0.0025*MDEBT-7.71)*B%(Z)
4580 IF BYDI>0 THEN BYD=BYD+BYDI
4590 NEXT Z
4600 FOR Z=1 TO 17
4610 IF W%(Z)=0 THEN 4660
4620 MDEBT=(Z*5-2.5)*(288-PDAT-3.2)
4630 IF MDEBT<=0 THEN 4660
4640 WYDI=(0.0025*MDEBT-7.71)*W%(Z)
4650 IF WYDI>0 THEN WYD=WYD+WYDI
4660 NEXT Z
4670 TYD=SYD+BYD+WYD
4680 TYDM=TYD*VSB
4690 ENDPROC
4700 REM ***** CALC POTATO YIELD LOSS (+ MISC CROP) *****
4710 REM ***** MAINCROP *****
4720 DEF PROCPOTS
4730 SYD=0: BYD=0: WYD=0: SYDE=0: BYDE=0: WYDE=0
4740 FOR Z=1 TO 34
4750 IF S%(Z)=0 THEN 4790
4760 MDEBT=(Z*5-2.5)*(258-PDAT-1.2)
4770 SYDI=(0.0017*MDEBT-0.116)*S%(Z)*0.75
4780 IF SYDI>0 THEN SYD=SYD+SYDI
4790 NEXT Z
4800 FOR Z=1 TO 27
4810 IF B%(Z)=0 THEN 4850
4820 MDEBT=(Z*5-2.5)*(258-PDAT-2.0)
4830 BYDI=(0.0017*MDEBT-0.116)*B%(Z)*0.75
4840 IF BYDI>0 THEN BYD=BYD+BYDI
4850 NEXT Z
4860 FOR Z=1 TO 17
4870 IF W%(Z)=0 THEN 4920
4880 MDEBT=(Z*5-2.5)*(258-PDAT-3.2)
4890 IF MDEBT<=0 THEN 4920
4900 WYDI=(0.0017*MDEBT-0.116)*W%(Z)*0.75
4910 IF WYDI>0 THEN WYD=WYD+WYDI
4920 NEXT Z
4930 REM ***** EARLIES *****
4940 FOR Z=1 TO 34
4950 IF S%(Z)=0 THEN 5000
4960 MDEBT=(Z*5-2.5)*(166-PDAT-1.2)
4970 IF MDEBT<=0 THEN 5000
4980 SYDI=(0.0017*MDEBT-0.116)*S%(Z)*0.25
4990 IF SYDI>0 THEN SYDE=SYDE+SYDI
5000 NEXT Z
5010 FOR Z=1 TO 27
5020 IF B%(Z)=0 THEN 5070
5030 MDEBT=(Z*5-2.5)*(166-PDAT-2.0)
5040 IF MDEBT<=0 THEN 5070

```

```

5050 BYDI=(0.0017*MDEBT-0.116)*B%(Z)*0.25
5060 IF BYDI>0 THEN BYDE=BYDE+BYDI
5070 NEXT Z
5080 FOR Z=1 TO 17
5090 IF W%(Z)=0 THEN 5140
5100 MDEBT=(Z*5-2.5)*(166-PDAT-3.2)
5110 IF MDEBT<=0 THEN 5140
5120 WYDI=(0.0017*MDEBT-0.116)*W%(Z)*0.25
5130 IF WYDI>0 THEN WYDE=WYDE+WYDI
5140 NEXT Z
5150 TYD=SYD+BYD+WYD+SYDE+BYDE+WYDE
5160 IF CR$="4" THEN 5180
5170 TYDM=(SYD+BYD+WYD)*VMP+(SYDE+BYDE+WYDE)*VEP
5180 ENDPROC
5190 REM ***** CALC GRASS YIELD LOSS *****
5200 DEF PROCGRASS
5210 SYDM=0: BYDM=0: WYDM=0: SYDB=0: BYDB=0: WYDB=0
5220 FOR Z=1 TO 34
5230 IF S%(Z)=0 THEN 5270
5240 MDEBT=(Z*5-2.5)
5250 SYDM=SYDM+(15.3*MDEBT)*S%(Z)
5260 SYDB=SYDB+(0.0135*MDEBT)*S%(Z)
5270 NEXT Z
5280 FOR Z=1 TO 27
5290 IF B%(Z)=0 THEN 5330
5300 MDEBT=(Z*5-2.5)
5310 BYDM=BYDM+(15.3*MDEBT)*B%(Z)
5320 BYDB=BYDB+(0.0135*MDEBT)*B%(Z)
5330 NEXT Z
5340 FOR Z=1 TO 17
5350 IF W%(Z)=0 THEN 5390
5360 MDEBT=(Z*5-2.5)
5370 WYDM=WYDM+(15.3*MDEBT)*W%(Z)
5380 WYDB=WYDB+(0.0135*MDEBT)*W%(Z)
5390 NEXT Z
5400 TYDM=SYDM+BYDM+WYDM: TYDMM=TYDM*VMG
5410 SDFE=285-PDAT-1.2: BDFE=285-PDAT-2.0: WDFE=285-PDAT-3.2
5420 IF SDFE>180 THEN SDFE=180
5430 IF BDFE>180 THEN BDFE=180
5440 IF WDFE>180 THEN WDFE=180
5450 TYDB=SYDB+BYDB+WYDB
5460 TYDM=(SYDB*SDFE+BYDB*BDFE+WYDB*WDFE)*3.5*VBG
5470 ENDPROC
5480 REM ***** CHECK COMPATIBILITY OF INPUT DATA *****
5490 DEF PROCCHK
5500 IF CH1%<=GW1% AND CH1%<=DDH1% THEN SOCHK%=0 ELSE 5530
5510 IF CV1%<=GMV1% AND CV1%<=DDV1% THEN SOCHK%=0 ELSE 5530
5520 GOTO 5580
5530 SOCHK%=4
5540 PRINT "TAB(25);"INPUT DATA NOT COMPATIBLE"
5550 PRINT "TAB(30);CROP$;TAB(40);"GW Dept$h";TAB(50);"Drawdown"
5560 PRINT "TAB(20);"H3";TAB(33);CH3%;TAB(43);GMV3%;TAB(53);DDH3%
5570 PRINT TAB(20);"V1";TAB(33);CV1%;TAB(43);GMV1%;TAB(53);DDV1%
5580 ENDPROC

```

APPENDIX 8

EIA ANALYSIS RESULTS.

Chapter 8 is devoted to the development of the EIA technique for evaluating the effects of drawdown on crops and trees. Within the same chapter the technique is applied to the Tern Area of the Shropshire Groundwater Scheme for two simulated pumping events - under the drought conditions of 1974 and 1976. The results of this exercise are summarised in Table 8.11 and presented graphically in Figs 8.32 to 8.39. The tables provided in this Appendix show the results obtained for each group of 4 grid squares analysed.

Each block of grid squares is referenced by the vertical grid line (i.e. 63) and horizontal grid line (i.e. 28) passing through the top left hand corner of the group (i.e. Square Ref 6328). It should be noted that, since each sub-map covering the study area comprised 5 x 6 grid squares (i.e. 30 squares), whole multiples of blocks of 4 squares could not fully cover each sub-map. As a consequence, in order to avoid duplication of the results, groups of certain grid squares (those referenced 6127, 6327, 6322 and 6522) only contained crop/soil data within the bottom two grid squares - the top two were blank.

The results are presented in terms of:

- i) the area of each crop type affected
 - detailed in Tables A8.1 and A8.2;
 - summarised in Tables A8.3 and A8.4;
- ii) the monetary loss experienced by each crop type
 - detailed in Tables A8.5, A8.6, A8.7 and A8.8;
 - summarised in Tables A8.9 and A8.10.

Square Feet	CEREALS				EIA COST EVALUATION 1974 - 76 DRAWDOWN				PERM PASTURE				Total Loss Area (ha)	
	Sandy soil	Bridgnorth	Went/Misc	Peaty Loam	Sandy soil	Bridgnorth	Went/Misc	Peaty Loam	Sandy soil	Bridgnorth	Went/Misc	Peaty Loam		Salopp/Hoedon
6130	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6330	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6530	3	3	3	3	3	3	3	3	3	3	3	3	3	3
6128	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6328	3	3	3	3	3	3	3	3	3	3	3	3	3	3
6528	9	9	9	9	9	9	9	9	9	9	9	9	9	9
6127	10	10	10	10	10	10	10	10	10	10	10	10	10	10
6327	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6527	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6125	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6325	4	4	4	4	4	4	4	4	4	4	4	4	4	4
6525	6	6	6	6	6	6	6	6	6	6	6	6	6	6
6123	2	2	2	2	2	2	2	2	2	2	2	2	2	2
6323	11	11	11	11	11	11	11	11	11	11	11	11	11	11
6523	21	21	21	21	21	21	21	21	21	21	21	21	21	21
6322	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6522	2	2	2	2	2	2	2	2	2	2	2	2	2	2
TOTAL	280	91	64	90	26	55	17	35	15	20	41	22	22	19
6130	3	3	3	3	3	3	3	3	3	3	3	3	3	3
6330	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6530	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6128	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6328	4	4	4	4	4	4	4	4	4	4	4	4	4	4
6528	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6127	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6327	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6527	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6125	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6325	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6525	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6123	2	2	2	2	2	2	2	2	2	2	2	2	2	2
6323	5	5	5	5	5	5	5	5	5	5	5	5	5	5
6523	11	11	11	11	11	11	11	11	11	11	11	11	11	11
6322	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6522	2	2	2	2	2	2	2	2	2	2	2	2	2	2
TOTAL	28	13	9	28	9	26	17	35	15	20	41	22	22	19
6130	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6330	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6530	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6128	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6328	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6528	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6127	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6327	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6527	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6125	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6325	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6525	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6123	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6323	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6523	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6322	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6522	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table A8.2 EIA for 1976 Pumping Event - Results in Terms of Area of Each Crop Affected for Given Soil Types within Groups of 4 Grid Squares.

CROP	EIA IMPACT EVALUATION					Total Loss Area (ha)
	1974 DRAWDOWN					
	Sandy soil	Bridgnorth	Wem/Misc	Peaty Loam	Salop/Hodnet	
Sugar Beet	124	23	15	35	12	209
Cereals	289	93	63	93	23	561
Potatoes	26	13	9	28	0	76
Misc Crops	9	0	1	0	2	12
Perm Grass	214	41	42	236	19	552
Ley Grass	23	3	12	10	4	52
Total	685	173	142	402	60	1462

Table A8.3 EIA for 1974 Pumping Event - Summary of Results in Terms of Area of Each Crop Affected.

CROP	EIA COST EVALUATION					Total Loss Area (ha)
	1974 - 76 DRAWDOWN					
	Sandy soil	Bridgnorth	Wem/Misc	Peaty Loam	Salop/Hodnet	
Sugar Beet	110	22	17	35	16	200
Cereals	280	91	65	90	26	552
Potatoes	28	13	9	28	0	78
Misc Crops	9	0	1	0	2	12
Perm Grass	207	41	42	226	19	535
Ley Grass	23	3	10	10	4	50
Total	657	170	144	389	67	1427

Table A8.4 EIA for 1976 Pumping Event - Summary of Results in Terms of Area of Each Crop Affected.

Square Ref	EIA COST EVALUATION													
	1974					DRAWDOWN								
CEREALS	Sandy soil	Bridgnorth	Went/Misc	Peaty Loam	Salop/Hodnet	Total Loss (tonne)	Value (£)	Sandy soil	Bridgnorth	Went/Misc	Peaty Loam	Salop/Hodnet	Total Loss (tonne)	Value (£)
6130	48.9	21.24	0	0	0	70.14	70.14	0	0	0	0	0	0	0
6330	7.55	0	0	0.76	0	10.91	10.91	70.95	0	10.91	0	0	70.95	2101.5
6330	0	0	0	0.25	0.52	24.91	24.91	16.21	0	1.56	6.12	0	16.21	486.3
6126	0.25	0	0	0.35	1.35	2.05	2.05	3.4	0	0	0	0	3.4	112
6326	39.75	1.63	0	0.72	1.25	46.34	46.34	572.3	33.94	0	19.96	14.61	640.71	1922.18
6326	8.03	0	0	1.34	0.79	10.15	10.15	0	0	0	0	0	0	0
6127	14.99	6.49	0	3.54	0.34	26.23	26.23	516.16	0	0	6.57	0	522.73	15681.9
6327	0.73	1.85	0	0.79	0	3.37	3.37	0	0	0	0	0	0	0
5725	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5925	1.68	2.75	0	1.43	0	5.86	5.86	17.04	22.04	4.93	24.3	0	68.31	2049.3
5923	5.49	0	0	1.43	0	6.41	6.41	251.26	0	13.22	0	4.87	269.35	8090.5
6125	12.48	27.83	1.78	14.48	0	56.58	56.58	3.4	0	0	0	0	3.4	102
6325	10.07	3.05	0	0.81	0	13.93	13.93	0	0	0	0	0	0	0
6325	2.62	1.35	0	3.7	0.26	8.08	8.08	75.19	0	0	16.5	0	91.99	2750.7
6123	2.05	0	0	1.05	0	3.25	3.25	0	0	0	0	0	0	0
6323	3.5	3.5	0	5.52	0	12.52	12.52	820.25	8.44	15.52	20.72	0	668.11	19943.3
6323	53.5	5.4	10.1	6.81	3.08	78.68	78.68	102.92	0	16.74	59.28	0	175.92	5395.5
6322	1.42	3.08	0	1.42	0	4.55	4.55	32.46	59.08	0	0	0	91.54	2745.2
6522	2.55	0	0	0.9	0	3.45	3.45	0	0	0	0	0	0	0
TOTAL	268.45	80.61	29.92	40.6	8.32	427.65	427.65	2272.6	123.5	53.07	153.42	19.46	2622.02	78660.6
Square Ref	ROTATOES													
	Sandy soil	Bridgnorth	Went/Misc	Peaty Loam	Salop/Hodnet	Total Loss (tonne)	Value (£)	Sandy soil	Bridgnorth	Went/Misc	Peaty Loam	Salop/Hodnet	Total Area (ha)	Value (£)
6130	48.4	30.61	0	0	0	79.26	4937.78	0	0	0	0	0	0	0
6330	0	0	0.25	0	0	0.25	14.62	0	0	0	0	0	0	0
6330	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6128	1.66	0	0	0	0	1.66	102.61	0	0	0	0	0	0	0
6128	1.71	0	0	0	0	1.71	103.78	0	0	0	0	0	0	0
6328	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6127	0	0	0	0	0	0	0	2	0	1	0	2	5	0
6327	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5725	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5925	3.8	49.87	1.62	3.22	0	58.51	3630.34	0	0	0	0	0	0	0
5923	1.67	0	0	0	0	1.67	102.61	0	0	0	0	0	0	0
6125	0	1.62	3.23	0.92	0	5.88	356.21	0	0	0	0	0	0	0
6325	0	0	0.43	2.4	0	2.83	174.08	0	0	0	0	0	0	0
6325	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6123	0.53	0	0.25	0.74	0	1.52	119.58	0	0	0	0	0	0	0
6323	14.03	0	1.62	14.01	0	29.65	1829.72	0	0	0	0	0	0	0
6523	37.55	0	5.79	7.38	0	50.72	3139.45	0	0	0	0	0	0	0
6322	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6522	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	109.37	82.53	13.27	28.67	0	234.14	14510.93	0	9	1	0	2	12	0

Table A8.5 EIA for 1974 Pumping Event - Results in Terms of Crop Loss for Given Soil Types within Groups of 4 Grid Squares: Cereals, Sugar Beet and Potatoes.

Square Ref	PERM PASTURE				EIA COST EVALUATION 1974.76 DRAWDOWN				PERM PASTURE				EIA COST EVALUATION 1974.76 DRAWDOWN			
	Sandy soil	Bridgnorth	Peaty Loam	Salopp/Hodnet	Total Loss (litres)	Value (£)	Sandy soil	Bridgnorth	Peaty Loam	Salopp/Hodnet	Beet Cattle Requiring Feed	Worm/Misc	Peaty Loam	Salopp/Hodnet	Total Cattle for Feed	Value (£)
6130	7879.5	0	0	0	7879.5	1371.933	6.95	0	0	0	0	0	0	0	6.95	283.08
6330	9294.75	0	38.25	1606.5	10937.5	1903.473	8.2	0	0	0	0.03	1.42	0	0	9.66	400.14
6530	37293.75	0	1262.25	1797.75	382.5	40736.25	7088.1075	33.9	0	0	1.11	1.58	0.33	0	31.98	1496.12
6128	688.5	0	38.25	878.75	420.75	2027.95	352.741	0.7	0	0	0.03	0.76	0	1.72	79.38	
6328	58675.5	0	3945.25	40812.75	13377	103611.05	18653.92	51.7	0	0	2.6	36.01	1.22	0	91.5	3775.45
6528	33315.75	1912	2524	114.25	37691.5	5886.942	29.4	0	0	0	1.69	2.3	0	0	33.42	1397.17
6127	13540.5	8147.25	2216	6888	2180.25	32771.5	573.041	11.95	0	0	7.19	1.99	0	0	11.99	433.2
6327	2639.25	0	0	4628.25	7267.5	1284.542	2.33	0	0	0	0	6.08	1.92	0	6.41	253.2
5725	76.5	0	76.5	0	153	26.622	0.07	0	0	0	0.07	0	0	0	0.14	5.57
5925	5278.5	1927.5	1071	19622.25	45249.75	7973.4565	4.66	17.01	0	0	0.95	17.31	0	0	39.93	1640.16
5923	8233.75	0	38.25	4016.25	726.75	13005	2292.87	7.26	0	0	0.03	0.64	0	0	11.47	473.54
6125	956.25	9524.25	191.25	1185.75	11857.5	2063.205	0.84	0	0	0	0.17	1.05	0	0	10.46	431.68
6325	497.25	688.5	0	841.5	2027.25	352.7415	0.44	0	0	0	0	0.74	0	0	1.76	73.58
6525	344.25	0	0	2256.75	0	2601	452.574	0	0	0	0	1.99	0	0	2.29	91.95
6123	688.5	1147.5	229.5	5489.75	7535.25	1311.3335	0.61	0	0	0	0.2	4.69	0	0	6.95	271.97
6323	20004.75	3327.75	4666	11857.5	39856.5	6935.031	17.62	2.9	0	0	4.32	10.46	0	0	35.17	1449.77
6523	19622.25	0	535	1721.25	344.25	2223.5	386.8455	17.31	0	0	0.51	1.52	0	0	19.5	813.45
6322	8839	573.75	0	5499.25	5499.25	951.7395	4.52	0	0	0	0.51	0	0	0	4.93	200.53
6522	7803	0	0	7803	135.722	6.89	0	0	0	0	0	0	0	0	6.89	286.28
TOTAL	231374.25	44943.75	15935.5	10356	401280.75	69822.850	204.19	39.66	0	0	13.97	91.4	4.99	0	354.08	14620.14
Square Ref	LEY GRASS				EIA COST EVALUATION 1974.76 DRAWDOWN				LEY GRASS				EIA COST EVALUATION 1974.76 DRAWDOWN			
6130	Sandy soil	Bridgnorth	Peaty Loam	Salopp/Hodnet	Total Loss (litres)	Value (£)	Sandy soil	Bridgnorth	Peaty Loam	Salopp/Hodnet	Beet Cattle Requiring Feed	Worm/Misc	Peaty Loam	Salopp/Hodnet	Total Cattle for Feed	Value (£)
6330	6578	0	0	956.25	7535.25	1311.3335	5.8	0	0	0	0	0	0	0	6.65	275.74
6530	918	0	0	287.75	1185.75	206.3205	0	0	0	0	0	0	0	0	0	0
6128	497.25	0	0	2256.75	0	2601	0.9	0	0	0	0	0	0	0	0	0
6328	1844.25	0	0	497.25	497.25	86.5215	0.44	0	0	0	0	0	0	0	0	0
6528	2830.5	114.75	114.75	382.5	3524.5	439.263	1.45	0	0	0	0.78	0	0	0	0.44	18.24
6127	1491.75	0	0	3672	3672	638.998	2.3	0	0	0	0.2	0.1	0	0	2.23	92.08
6327	0	0	0	1491.75	1491.75	259.5645	1.32	0	0	0	0	0	0	0	0.34	134.16
5725	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5925	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5923	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6325	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6525	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6123	229.5	0	0	5489.75	420.75	73.5215	0.2	0	0	0	0	0	0	0	0	0
6323	0	0	0	956.25	956.25	166.3875	0.2	0	0	0	0.17	0	0	0	0.37	15.35
6523	0	0	0	956.25	956.25	166.3875	0	0	0	0	0	0	0.84	0	0.84	34.37
6122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6322	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6522	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	14190.75	114.75	1300.5	2295	382.5	4823.5	12.53	0.1	1.15	2.02	0.34	16.14	0	0	667.94	

Table A8.7 EIA for 1976 Pumping Event - Results in Terms of Crop Loss for Given Soil Types within Groups of 4 Grid Squares: Cereals, Sugar Beet and Potatoes.

Square Ref	CEREALS				EACOST EVALUATION				SUGARBEET				TOTAL			
	Sandy soil	Bridgnorth	Went/Misc	Peaty Loam	Sandy soil	Bridgnorth	Went/Misc	Peaty Loam	Sandy soil	Bridgnorth	Went/Misc	Peaty Loam	Sandy soil	Bridgnorth	Went/Misc	Peaty Loam
6130	45.75	16.48	0	0	60.38	60.38	0	0	0	0	0	0	0	0	0	0
6130	6.85	2.61	0	0.93	10.38	10.38	0	0	100.09	100.09	0	0	0	0	0	0
6130	21.14	0	0.85	0.24	22.71	22.71	0	0	11.13	11.13	0	0	0	0	0	0
6128	0.25	0	0.75	0.4	2.66	2.66	0	0	2.13	2.13	0	0	0	0	0	0
6128	39.19	1.3	3.47	0.36	46.14	46.14	0	0	129.89	129.89	0	0	0	0	0	0
6128	7.68	0	1.18	0.64	9.5	9.5	0	0	29.35	29.35	0	0	0	0	0	0
6127	12.5	5.16	0.75	2.77	21.65	21.65	0	0	455.85	455.85	0	0	0	0	0	0
6127	0	1.47	0	0.64	2.11	2.11	0	0	0	0	0	0	0	0	0	0
5725	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5925	2.39	2.23	2.24	1.31	8.23	8.23	0	0	51.37	51.37	0	0	0	0	0	0
5925	0	0	1.25	0	5.94	5.94	0	0	223.98	223.98	0	0	0	0	0	0
5923	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6125	9.78	21.81	1.44	11.51	44.54	44.54	0	0	2.18	2.18	0	0	0	0	0	0
6125	4.95	2.45	0	0.72	8.13	8.13	0	0	64.4	64.4	0	0	0	0	0	0
6125	2.06	1.1	0.12	2.92	6.52	6.52	0	0	0	0	0	0	0	0	0	0
6123	1.89	0	0.12	0.83	2.69	2.69	0	0	0	0	0	0	0	0	0	0
6123	25.08	1.79	6.92	3.71	37.56	37.56	0	0	431.69	431.69	0	0	0	0	0	0
6123	56.82	7.55	10.64	5.71	83.41	83.41	0	0	81.08	81.08	0	0	0	0	0	0
6122	1.16	2.44	0	0	3.6	3.6	0	0	27.2	27.2	0	0	0	0	0	0
6122	1.98	0	0.75	0	2.73	2.73	0	0	0	0	0	0	0	0	0	0
TOTAL	241.52	66.39	30.45	32.96	379.85	379.85	8.53	0	2762.06	2762.06	108.33	70.82	159.73	87.25	3127.97	93839.1
Square Ref	CEREALS				EACOST EVALUATION				SUGARBEET				TOTAL			
6130	39.83	25.35	0	0	65.18	65.18	0	0	0	0	0	0	0	0	0	0
6130	0	0	0	0	0.2	0.2	0	0	0	0	0	0	0	0	0	0
6130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6128	1.38	0	0	0	1.38	1.38	0	0	0	0	0	0	0	0	0	0
6128	1.99	0	0	0	1.99	1.99	0	0	0	0	0	0	0	0	0	0
6128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6127	0	0	0	0	0	0	0	0	21	21	0	0	0	0	0	0
6127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5725	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5925	3.72	81.95	1.9	5.53	73.13	73.13	0	0	0	0	0	0	0	0	0	0
5923	1.39	0	0	0	1.39	1.39	0	0	0	0	0	0	0	0	0	0
6125	1.36	0	2.69	0.72	4.67	4.67	0	0	0	0	0	0	0	0	0	0
6125	0	0	0.41	1.95	2.36	2.36	0	0	0	0	0	0	0	0	0	0
6125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6123	0.41	0.41	0.59	0	1.61	1.61	0	0	0	0	0	0	0	0	0	0
6123	11.58	1.34	12.81	0	25.71	25.71	0	0	3	3	0	0	0	0	0	0
6123	47.91	0	4.75	6.12	58.81	58.81	0	0	0	0	0	0	0	0	0	0
6122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	108.18	89.08	11.53	27.75	236.57	236.57	0	0	9	9	0	1	0	2	12	0

Table A8.8 EIA for 1976 Pumping Event - Results in Terms of Crop Loss for Given Soil Types within Groups of 4 Grid Squares: Permanent Pasture and Grass Leys.

		****	EIA COST EVALUATION		****		
		****	1974	DRAWDOWN	****		
CROP	LOSS (£)		LOSS (£)		LOSS (tonne)		LOSS (tonne)
Sugar Beet	78660.6		78660.6		2622.02		2622.02
Cereals	42765		42765		427.65		427.65
Potatoes	14510.93		14510.93		234.14		234.14
Perm Grass	14714.65	< ** ->	71671.818		316.71	< ** ->	411907
Ley Grass	733.29	< ** ->	3101.463		15.74	< ** ->	17824.5
Total	151384.47		210709.81				
NB Grass	Cattle Feed	< ** ->	Milk Yield		No of Cattle to be Fed	< ** ->	Milk Yield Loss (litres)

Table A8.9 EIA for 1974 Pumping Event - Summary of Results in Terms of Crop Loss.

		****	EIA COST EVALUATION		****		
		****	1974-76	DRAWDOWN	****		
CROP	LOSS (£)		LOSS (£)		LOSS (tonne)		LOSS (tonne)
Sugar Beet	93839.1		93839.1		3127.97		3127.97
Cereals	37985		37985		379.85		379.85
Potatoes	14194.2		14194.2		236.57		236.57
Perm Grass	14620.14	< ** ->	69822.850		354.08	< ** ->	401280.75
Ley Grass	667.94	< ** ->	3181.329		16.14	< ** ->	18283.5
Total	161306.38		219022.48				
NB Grass	Cattle Feed	< ** ->	Milk Yield		No of Cattle to be Fed	< ** ->	Milk Yield Loss (litres)

Table A8.10 EIA for 1976 Pumping Event - Summary of Results in Terms of Crop Loss.

APPENDIX 9

GLOSSARY OF TERMS EMPLOYED IN THE THESIS.

ADAS - Agricultural Development and Advisory Service; a branch of MAFF.

Aquifer - for the purpose of this study the term aquifer refers to the Triassic sandstones (a variety of Bunter and Keuper sandstones) underlying the EIA Area.

Critical height (h_0) - the height above the water table at which the tension becomes equal to the critical value, S_0 .

Critical tension (S_0) - the point in the conductivity/tension relationship of an unsaturated soil at which the conductivity drops very rapidly as a result of which further drainage under gravity is reduced to negligible proportions.

Drainable moisture - the total volume of moisture which can drain under gravity from an initially saturated profile as a result of drawdown.

Drawdown response time (DRT_m) - the time taken in days for a given proportion, m (expressed in %), of the drainable moisture to have been lost from the profile in response to groundwater drawdown.

EA - Environmental Assessment: current terminology for EIA.

EHF - experimental husbandry farm.

EIA - environmental impact assessment (sometimes referred to simply as environmental assessment: **EA**).

EIA Area - that portion of the Tern Area of the Shropshire Groundwater Scheme for which data were available for all features of interest to this study.

FAO - Food and Agricultural Organisation of the United Nations.

GIS - geographical information system(s).

JAZZ - a package produced by Lotus Development Corporation for the Apple Macintosh computer which was employed for data storage and manipulation.

MAFF - Ministry of Agriculture, Fisheries and Food.

Moisture benefit (B) - irrigation application in mm of water multiplied by the period of irrigation benefit - the time in days between the date of application and harvest or senescence.

Moisture debt (MD) - the loss of moisture from the root zone as a result of groundwater drawdown multiplied by the period of moisture debt - the time in days between the date of moisture removal from the soil profile and harvest or senescence.

Moisture loss (ML) - the total moisture loss from the crop root zone as a result of groundwater drawdown.

MORECS - Meteorological Office Rainfall and Evaporation Calculation System; a computer model for determining SMD and evaporation from measured meteorological parameters. Results are published weekly for 40 x 40 km squares covering the UK.

PC - personal computer.

RAM - random access memory.

Residual moisture content (θ_r) - the moisture content of the field capacity profile at and above the critical height.

ROM - read only memory.

Saturated capillary fringe (h_c) - the height of the capillary fringe within which the moisture content is effectively constant and saturated.

SMD - soil moisture deficit - usually expressed in terms of mm of water.

Soil sensitivity depth (D) - the maximum depth to the water table for which the vegetation under consideration will be affected by the removal of available moisture due to drawdown caused by pumping.

$D = \text{the critical height } (h_c) + \text{the crop rooting depth } (d_r).$

Statworks - a package produced for the Apple Macintosh computer for statistical analysis.

Time of drawdown response (TDR) - the time taken for a soil to drain from saturation to the field capacity profile.

VDU - visual display unit.

WA - Water Authority.

Yield decline (YD) - the crop loss or other detrimental effect on agricultural production resulting from either a moisture debt or a moisture decline.

MAPCOM
MDATIN
MPRINT
MAPSEE
MAPDUMP
MMERGE
MSIMPLY
MAPSURF
MAPSR1
MAPSR4
MAPSR16
MSQSAVE
EIACOST
EIACOS2

a suite of programmes developed in BASIC for the BBC micro to enable maps to be digitised and overlaid in order to assess the impact of groundwater drawdown on vegetation (see Sect 8.2.1, Sect 8.5.1.3, Sect 8.5.1.5 and Appendix 5).



The Impact on Agriculture of the Drawdown of Shallow Watertables.

PhD Thesis - P.D. Hedges.

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5.31	146
5.32	147
5.33	148
5.34	149
5.41	159
5.42	160

PDH 28:02:90

SOIL MOISTURE IN Counts per Second

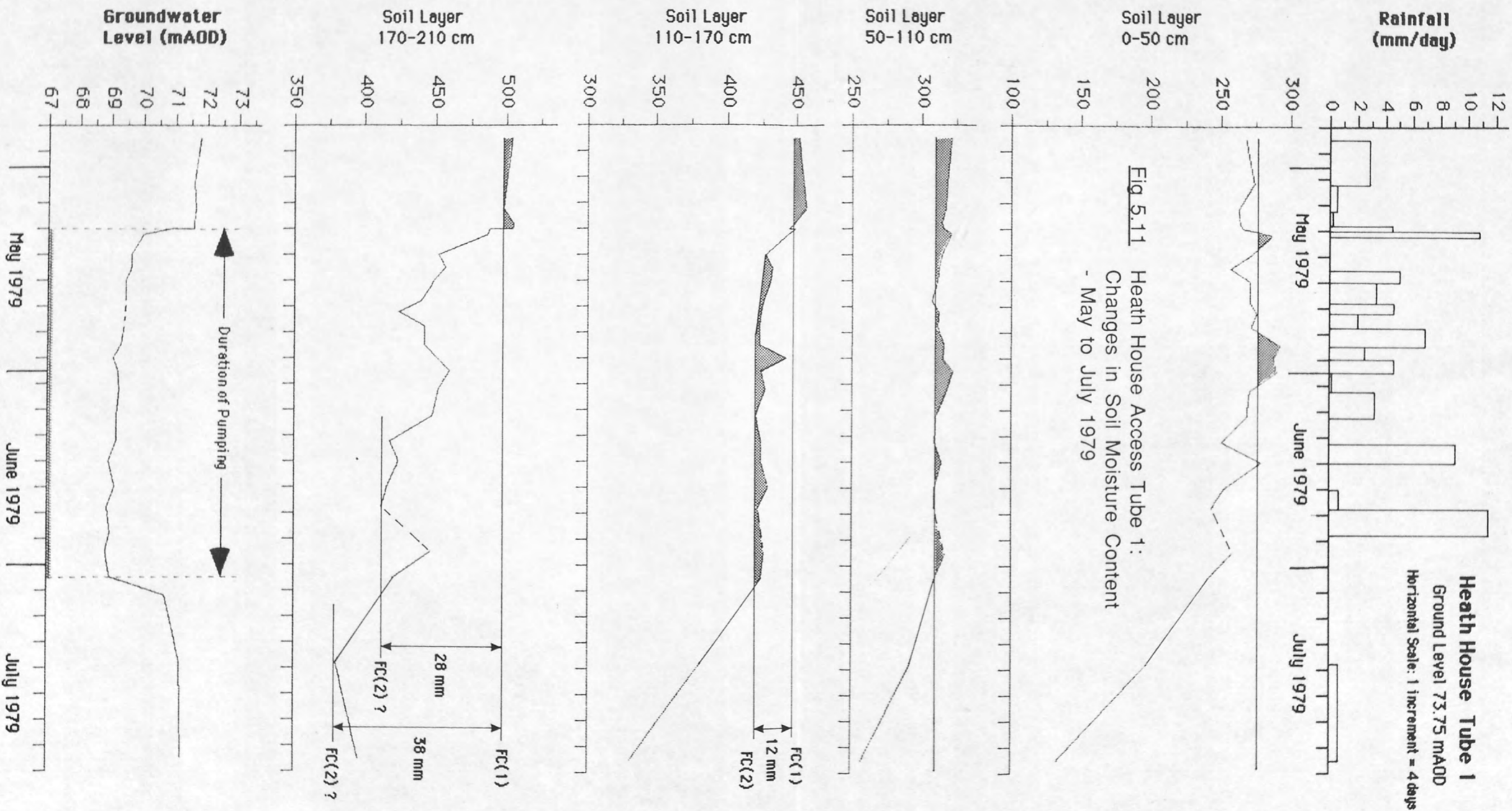


Fig 5.11

SOIL MOISTURE IN Counts per Second

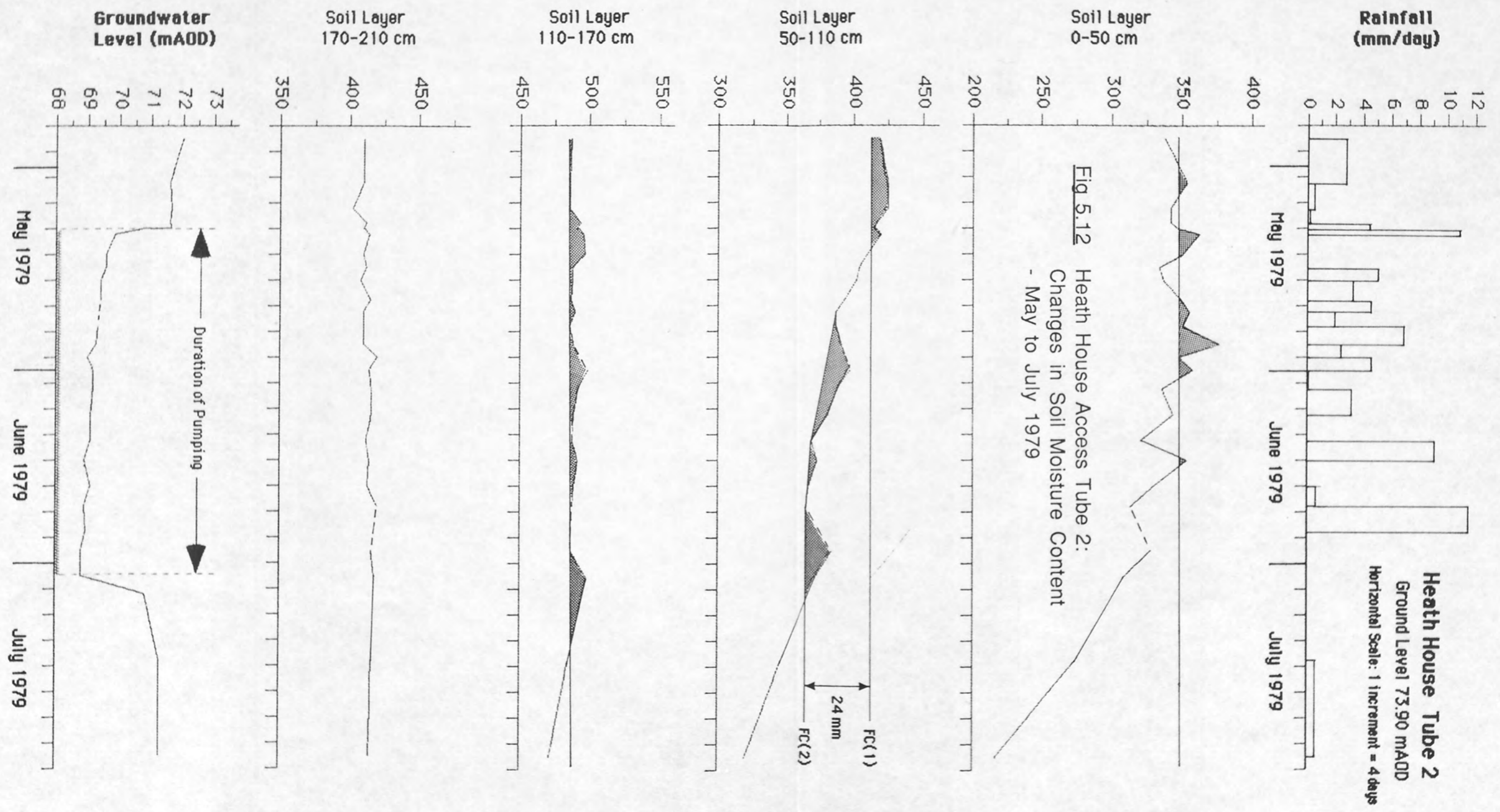


Fig 5.12

SOIL MOISTURE IN Counts per Second

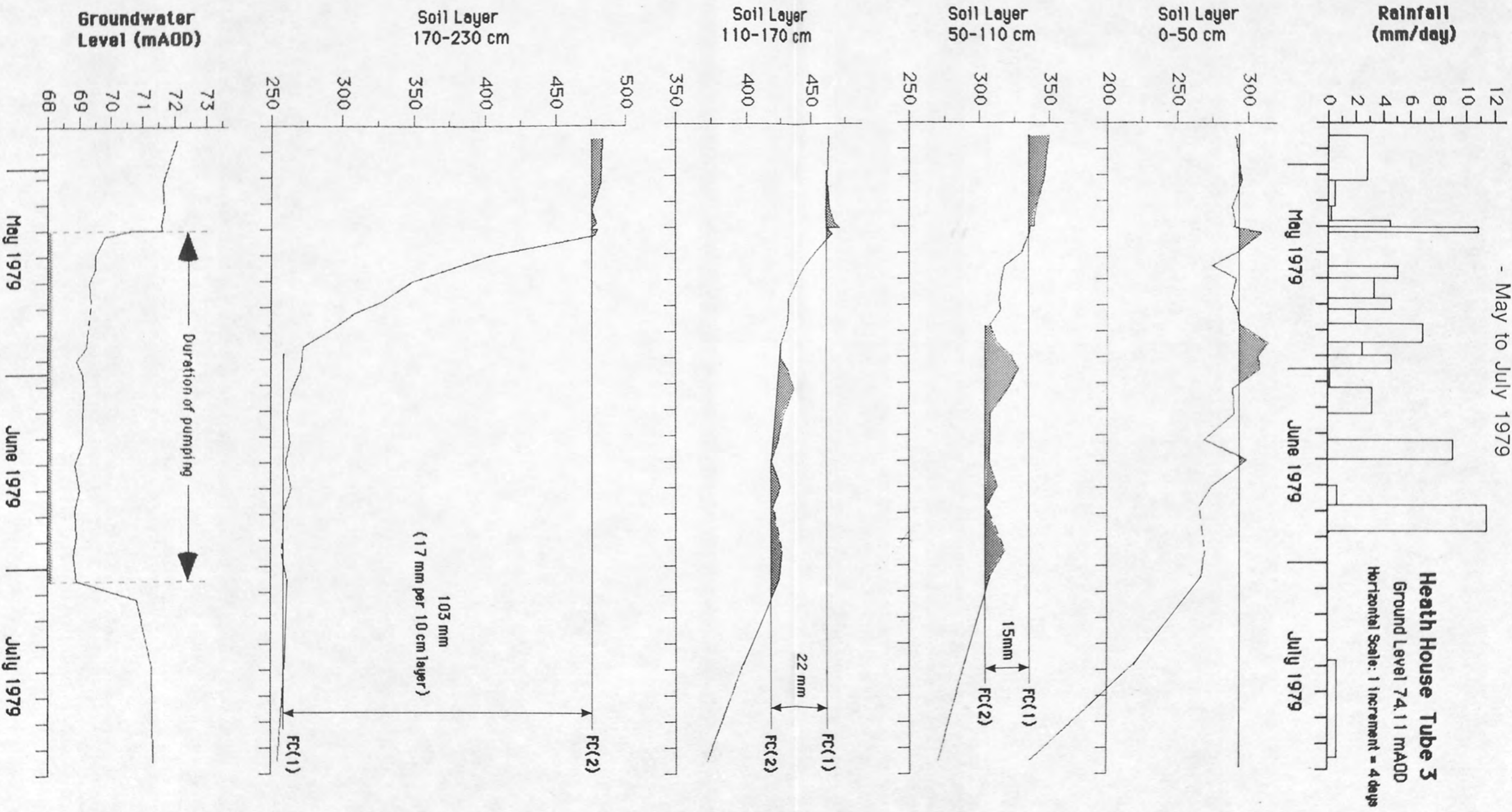


Fig 5.13 Heath House Access Tube 3:
 Changes in Soil Moisture Content
 - May to July 1979

Fig 5.13

Fig 5.14 Heath House Access Tube 4:
Changes in Soil Moisture Content
- May to July 1979

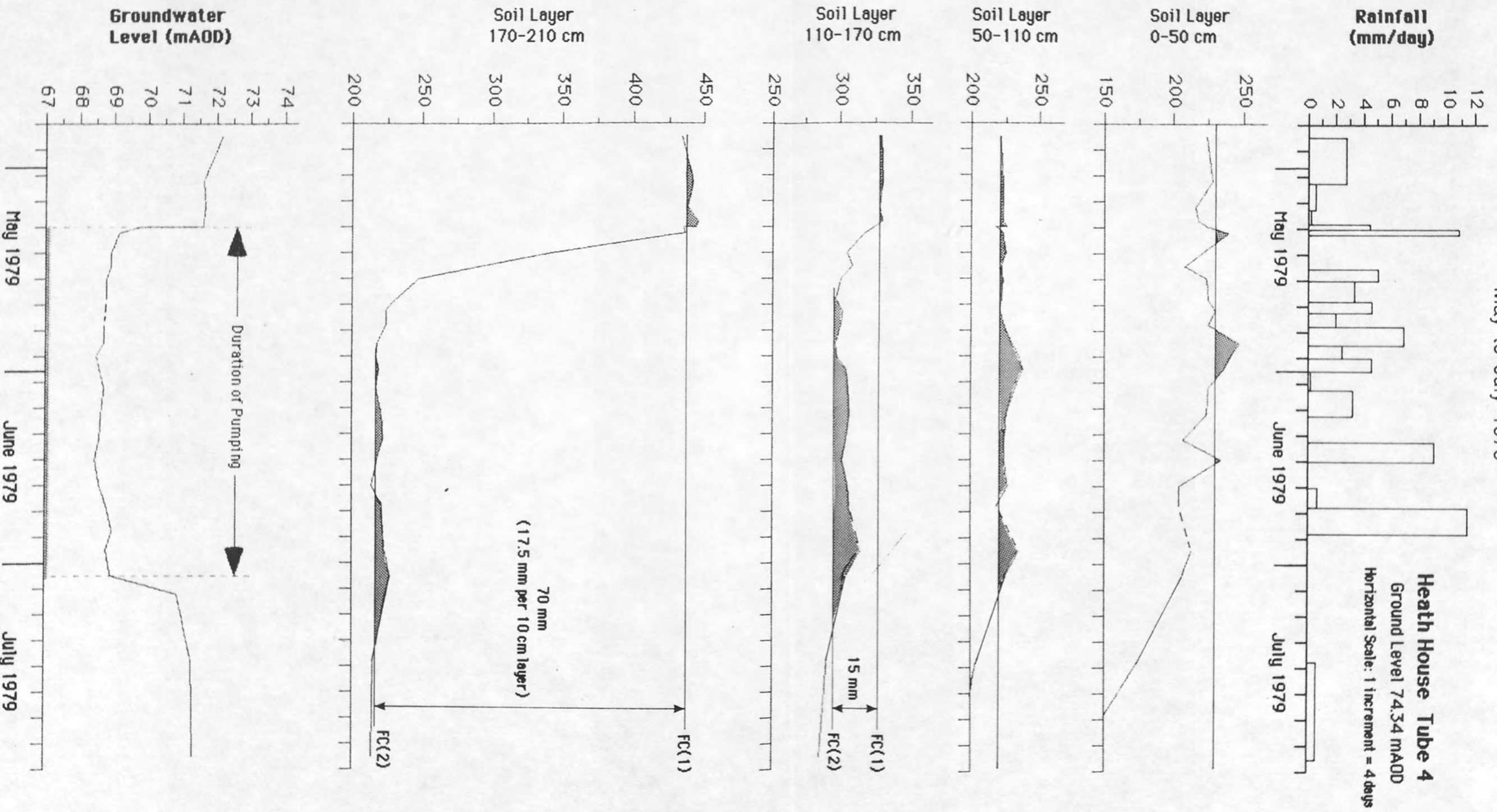


Fig 5.14

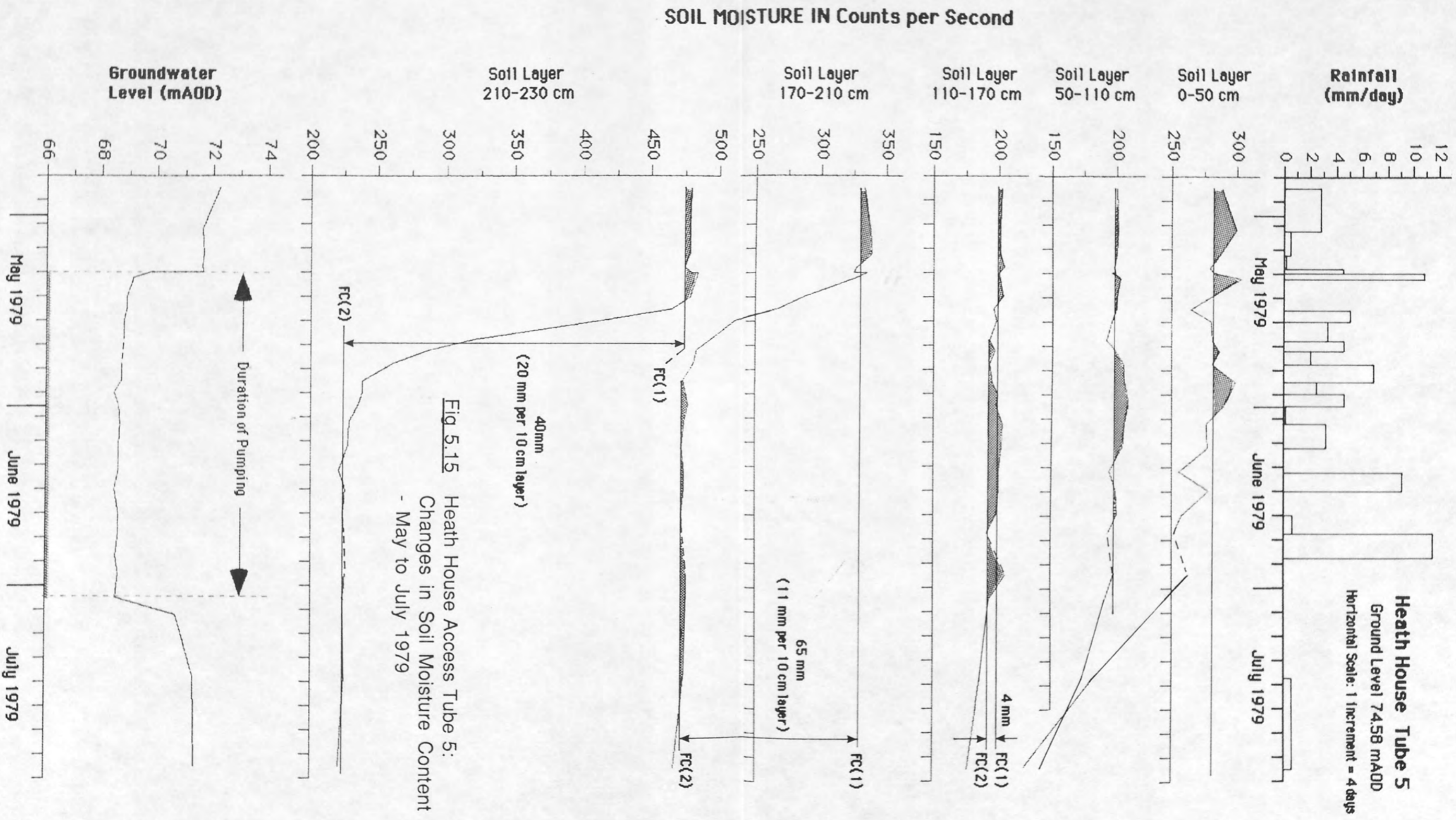


Fig 5.15 Heath House Access Tube 5:
Changes in Soil Moisture Content
- May to July 1979

Fig 5.15

SOIL MOISTURE IN Counts per Second

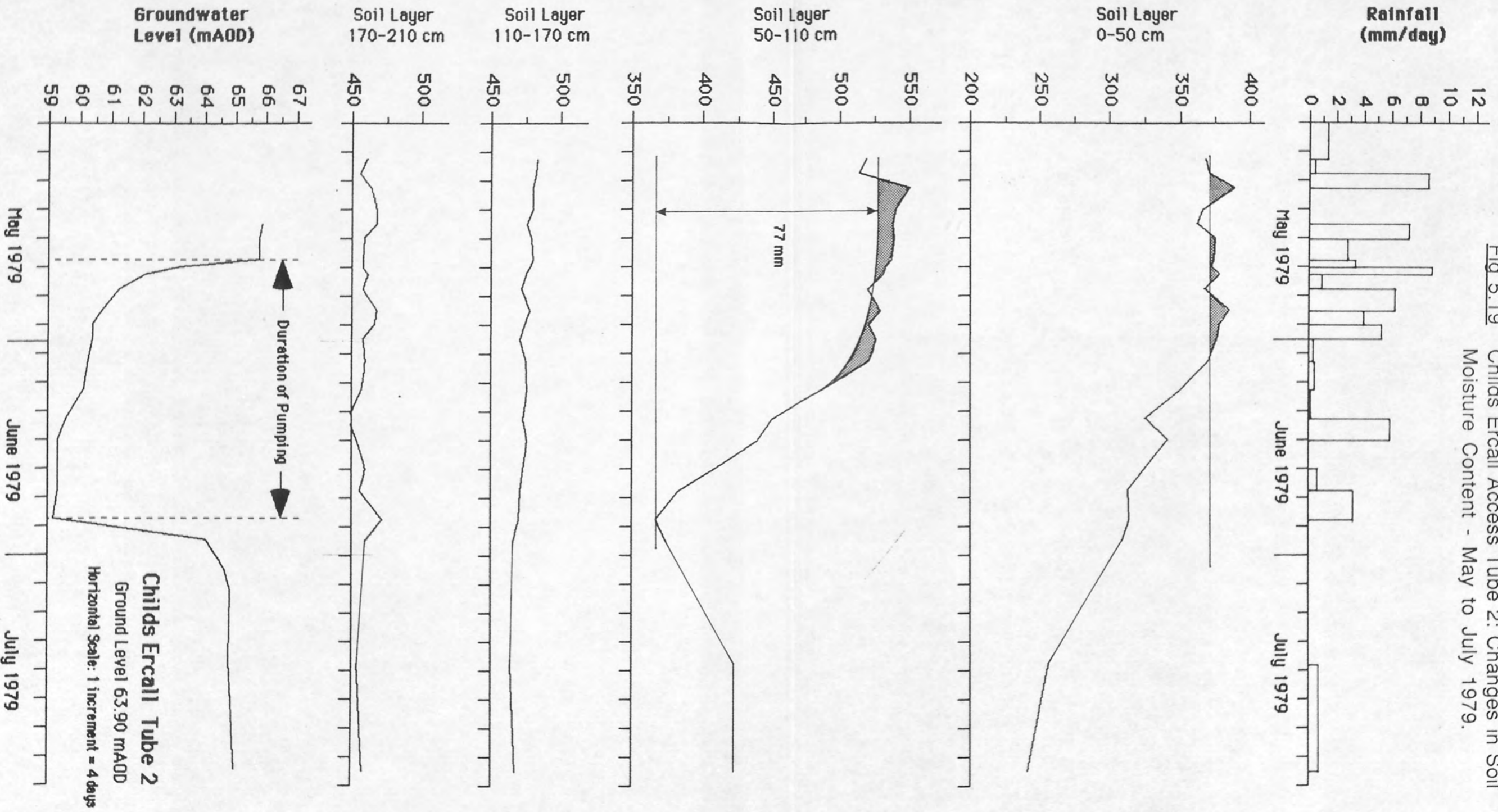


Fig 5.19 Childs Ercall Access Tube 2: Changes in Soil Moisture Content - May to July 1979.

Fig 5.20 Childs Ercall Access Tube 3: Changes in Soil Moisture Content - May to July 1979.

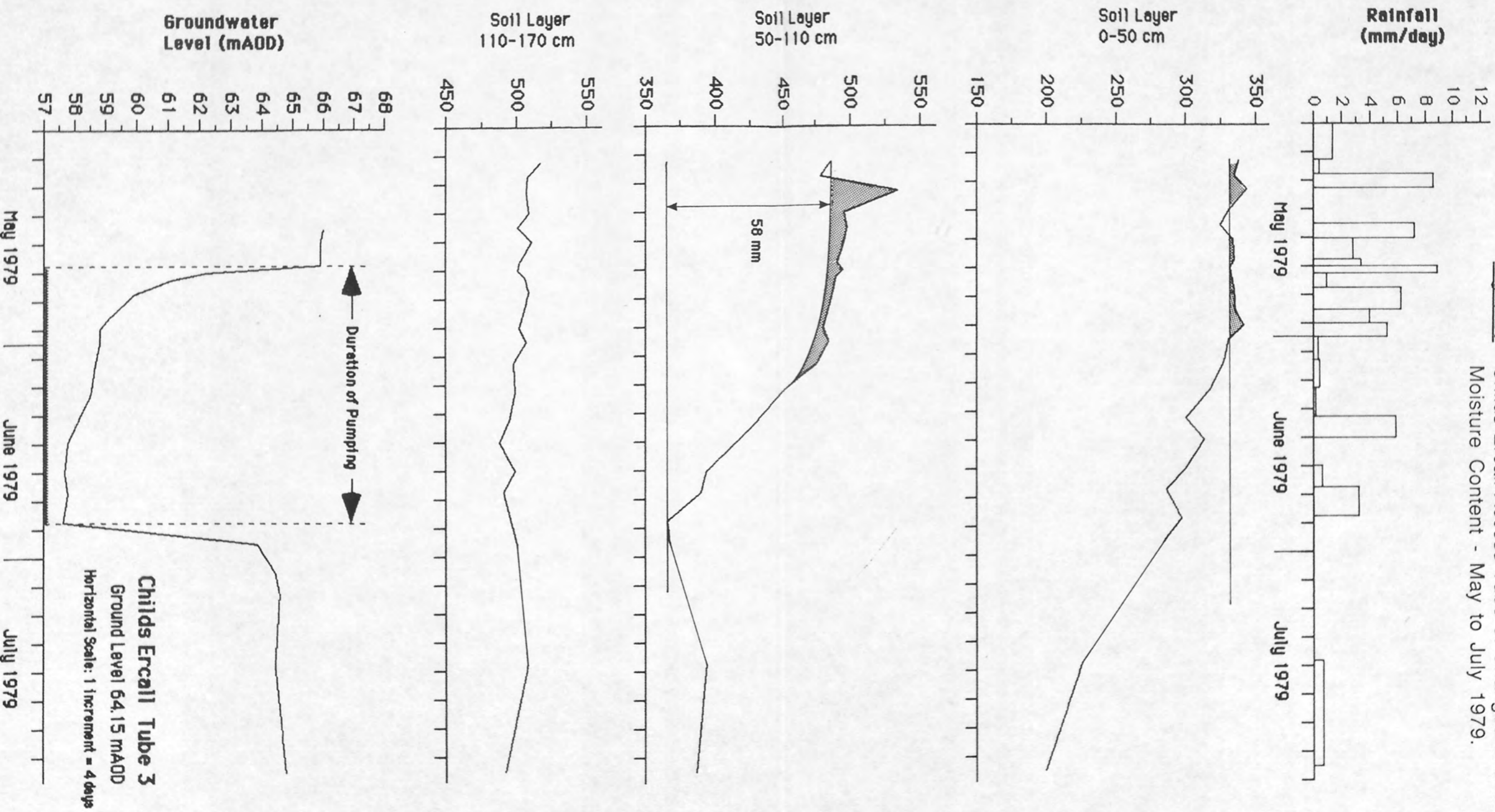


Fig 5.20

Fig 5.21 Childs Ercall Access Tube 4: Changes in Soil Moisture Content - May to July 1979.

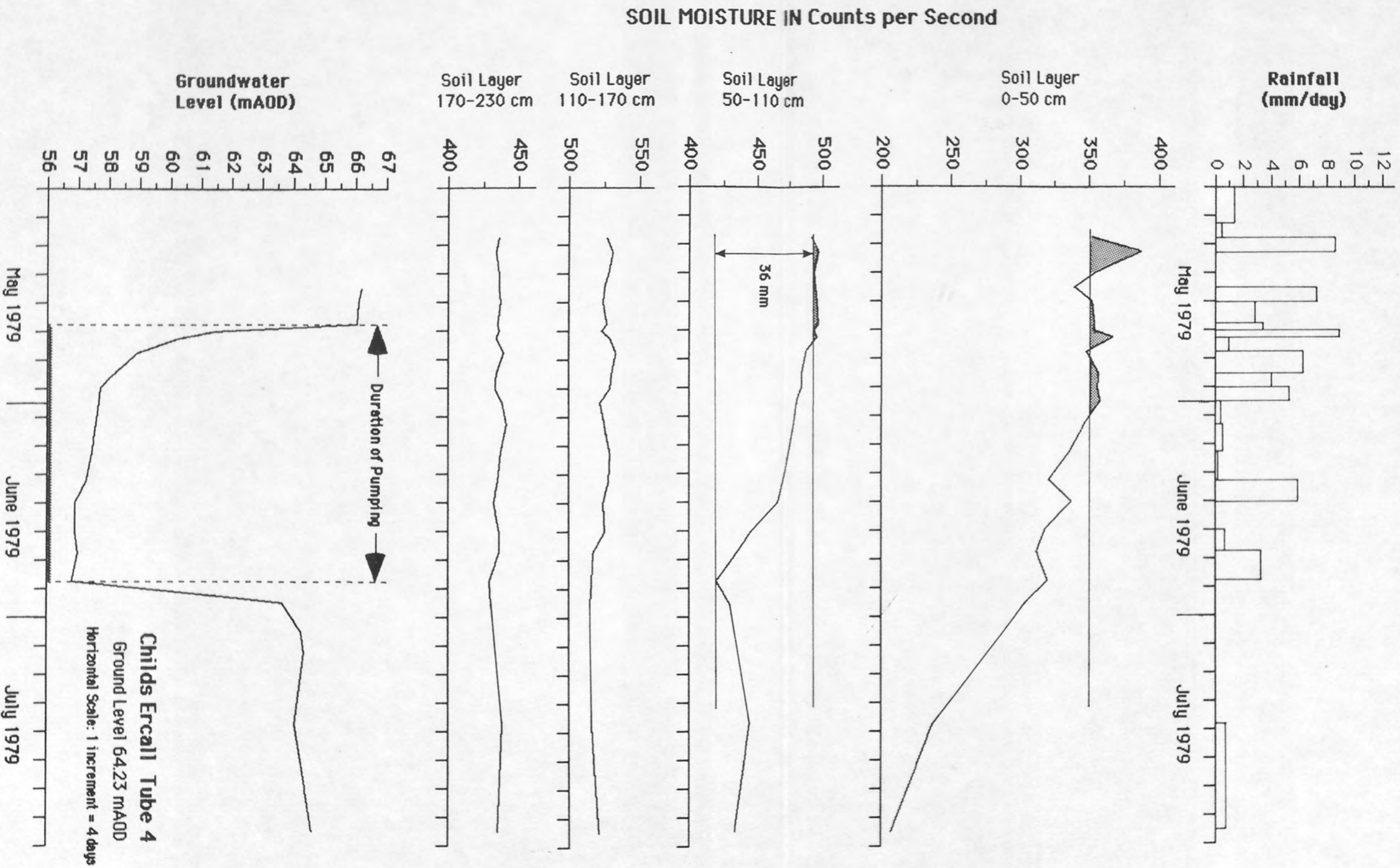
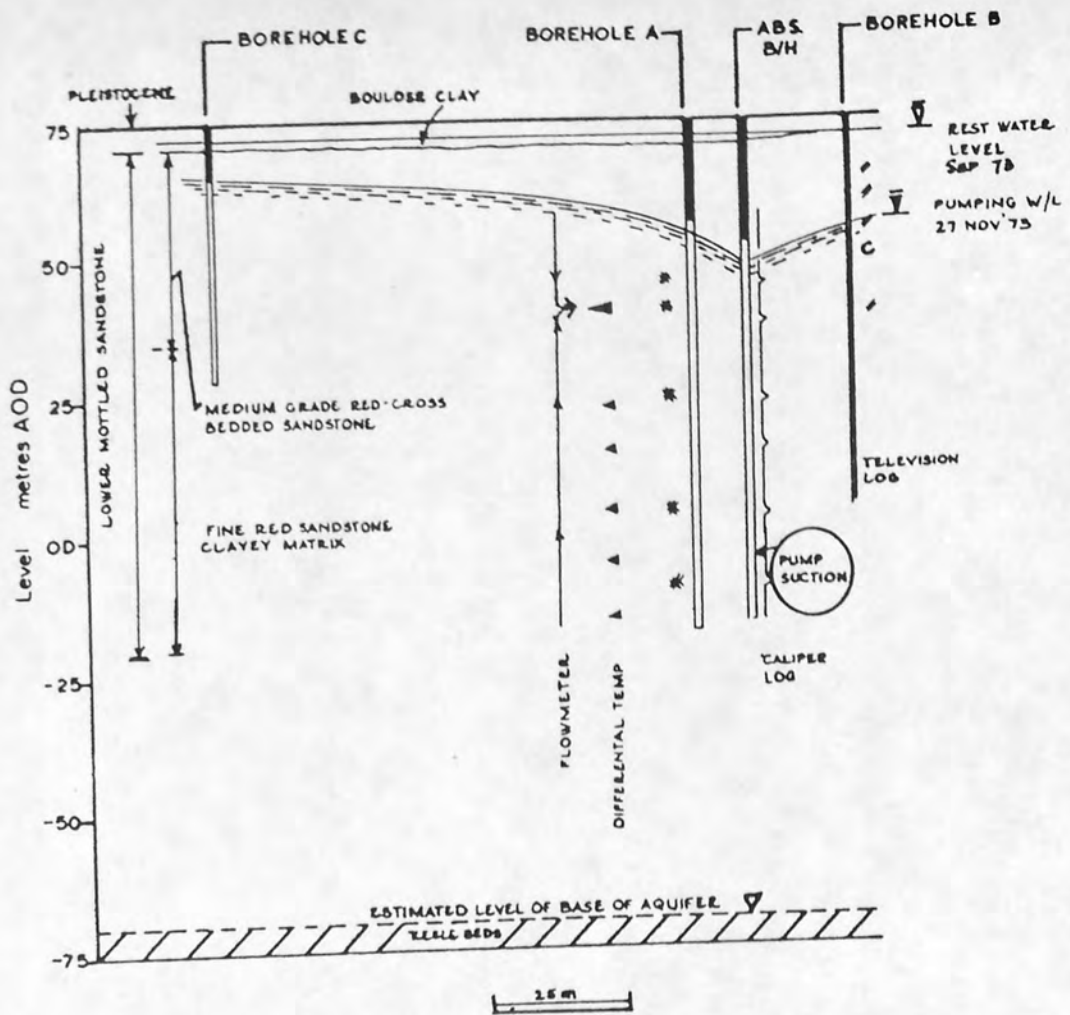


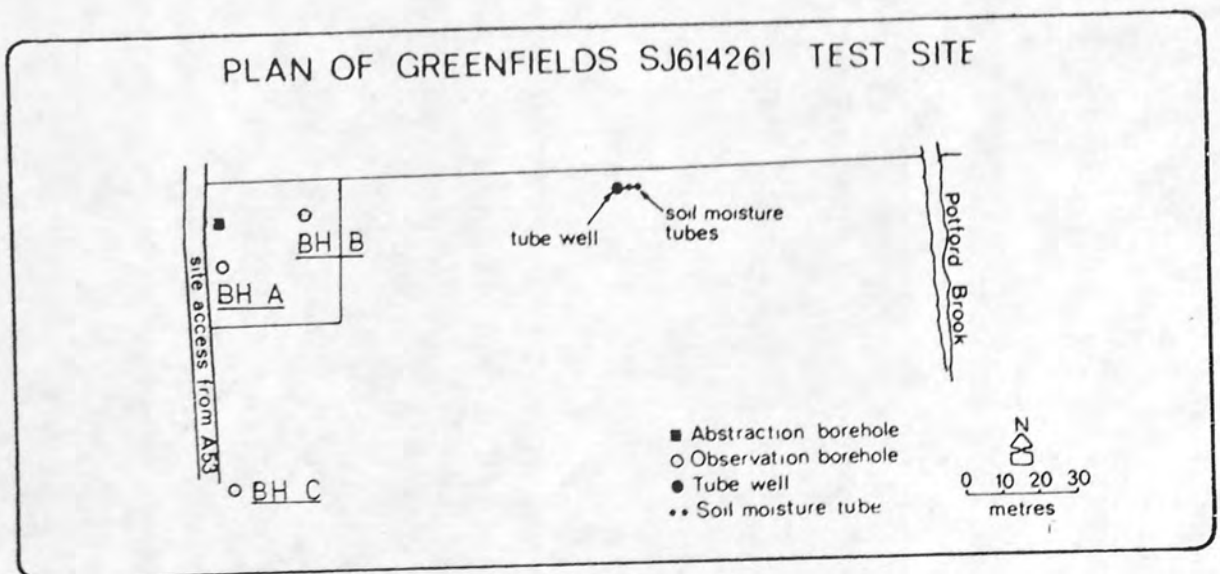
Fig 5.21



- KEY**
- CASING
 - FISSURES
 - CAVITIES - TV INSPECTION
 - FRACTURED ROCK FROM LITHOLOGICAL LOGS
 - ▲ DIFFERENTIAL TEMPERATURE ANOMALIES
 - DIRECTION OF FLOW OF WATER IN BOREHOLE FROM FLOW METER LOGS

**DETAILED GEOLOGICAL SECTION
AT GREENFIELDS**

(a) Geological Section (Severn River Authority, 1974).



(b) Site Plan (Severn Trent Water Authority, 1975).

Fig 5.28 Detailed Geological Section and Plan of Greenfields Test Site taken from 2nd and 3rd Groundwater Scheme Reports.

Fig 5.30 Heath House Access Tube 1: Changes in Soil Moisture Content Observed for Entire Study Period.

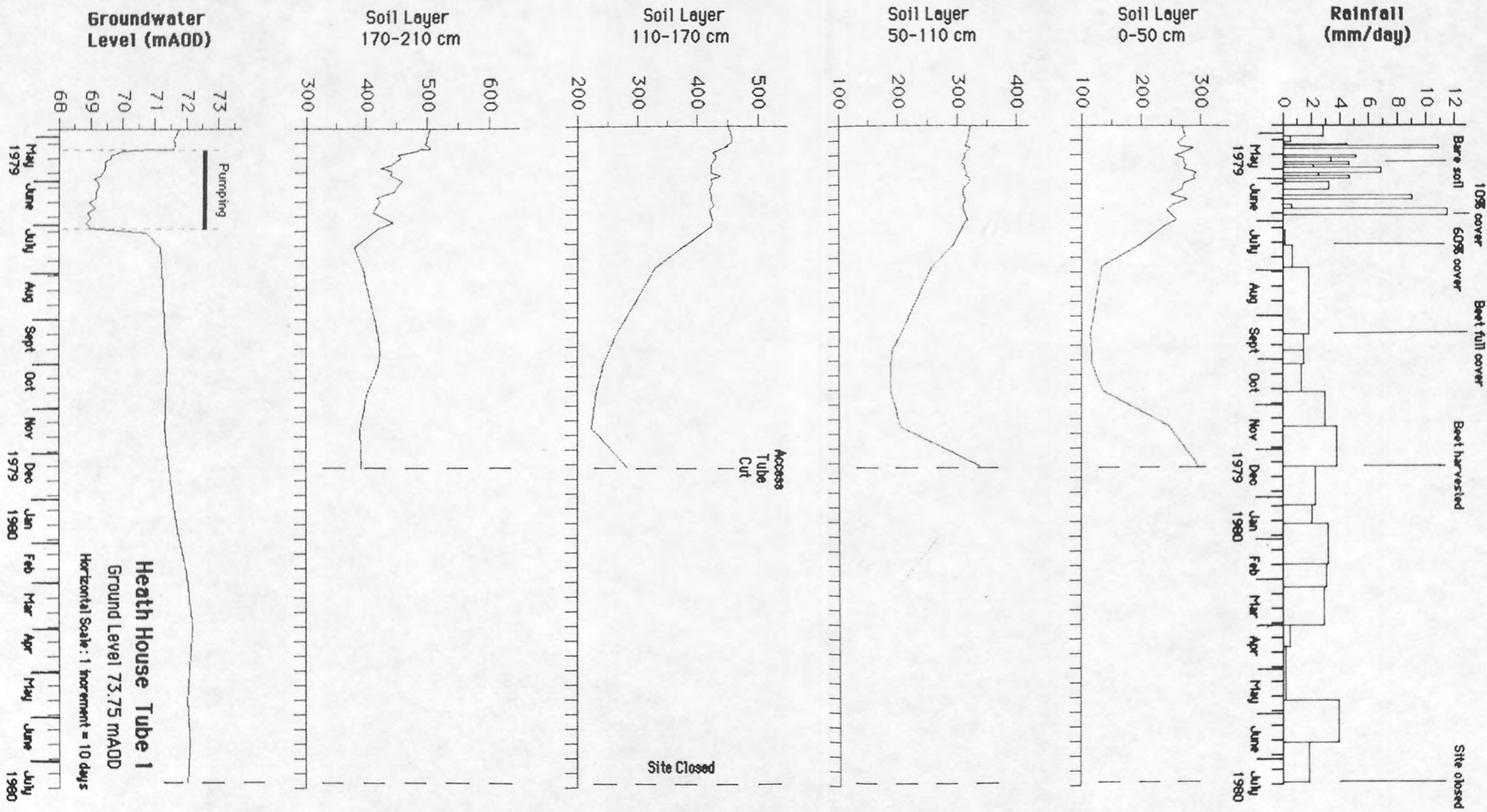


Fig 5.30

Fig 5.31 Heath House Access Tube 2: Changes in Soil Moisture Content Observed for Entire Study Period.

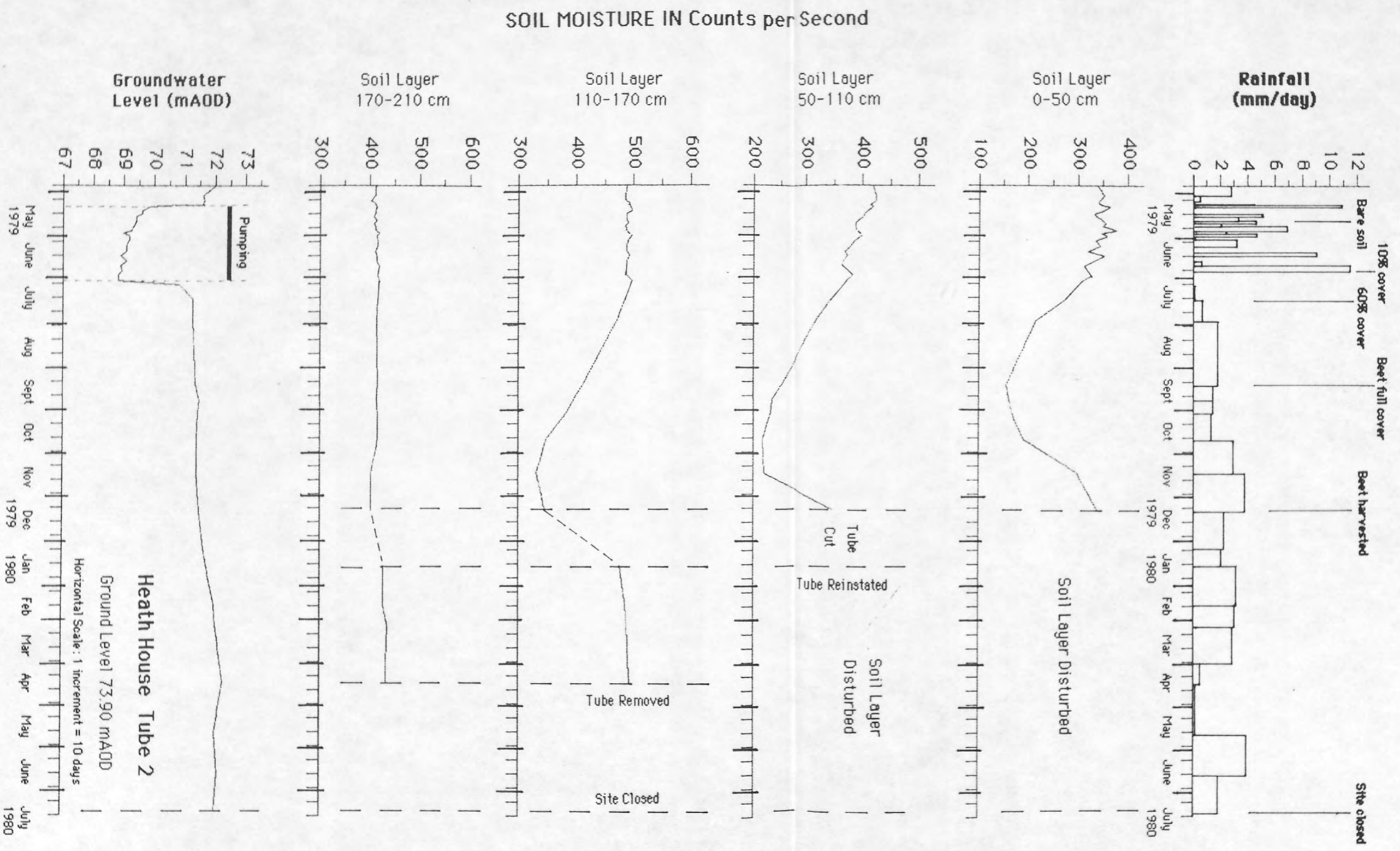


Fig 5.31

SOIL MOISTURE IN Counts per Second

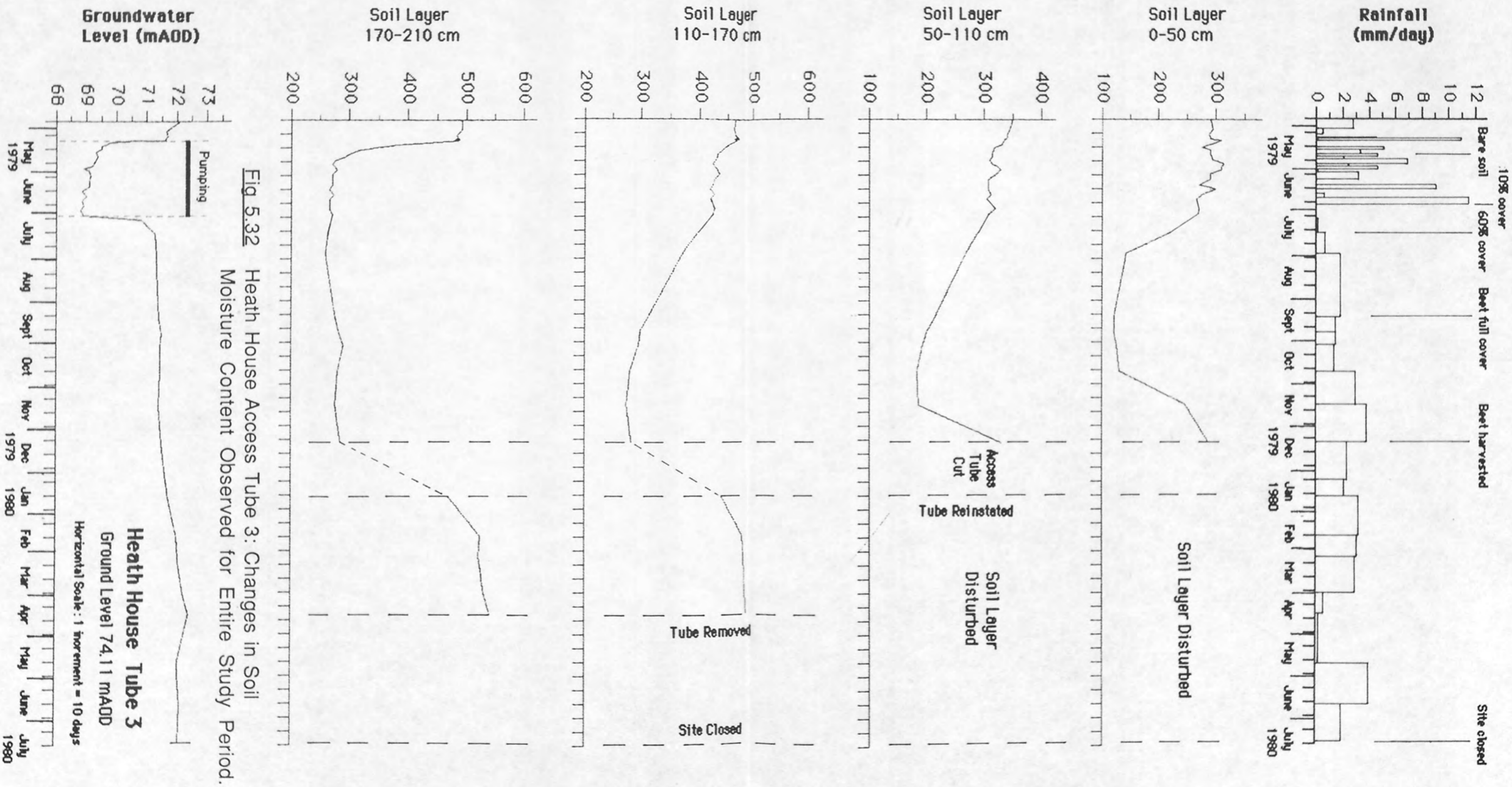


Fig 5.32 Heath House Access Tube 3: Changes in Soil Moisture Content Observed for Entire Study Period.

Heath House Tube 3
Ground Level 74.11 mAOD
Horizontal Scale: 1 increment = 10 days

Fig 5.32

SOIL MOISTURE IN Counts per Second

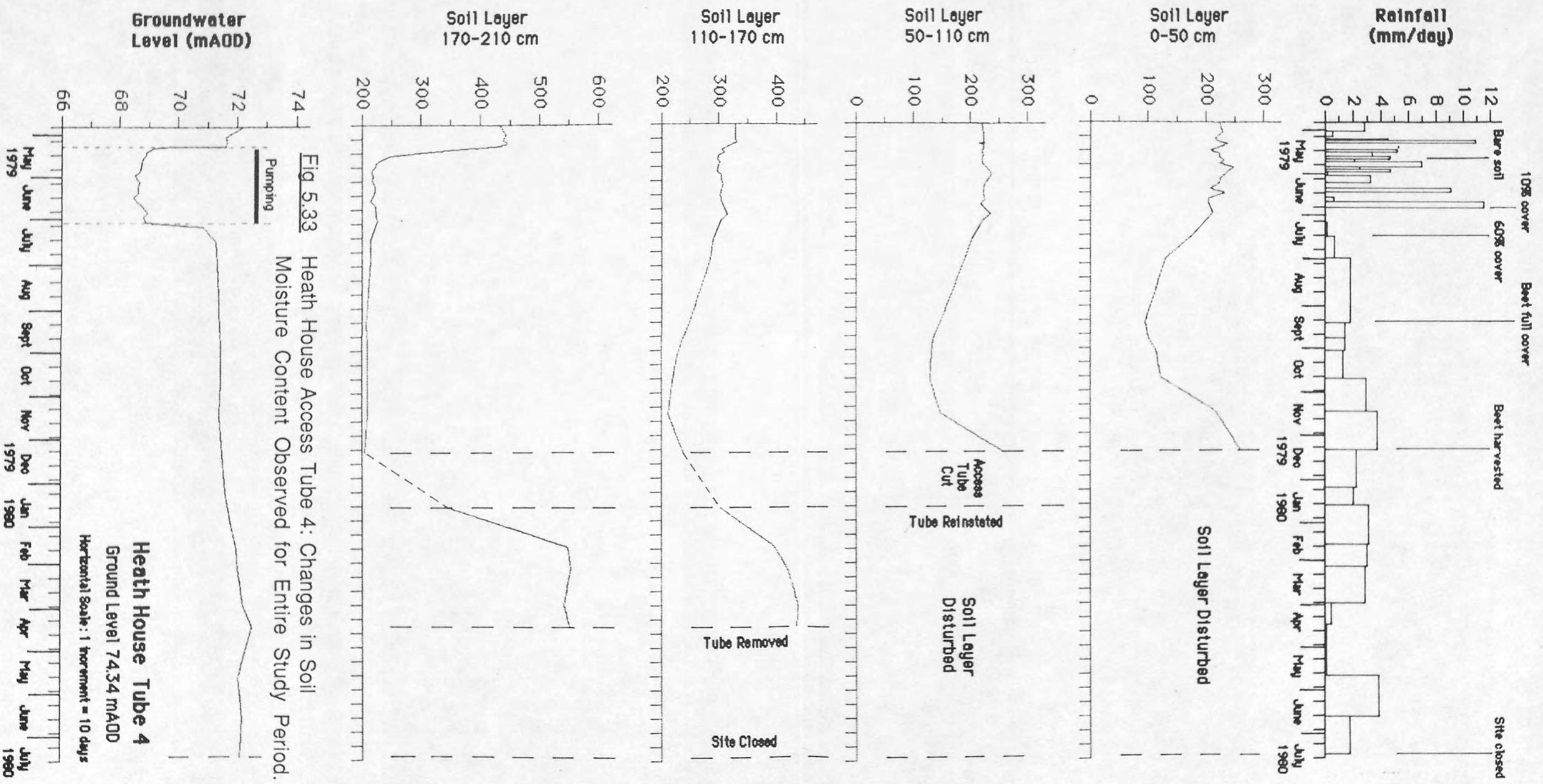


Fig 5.33 Heath House Access Tube 4: Changes in Soil Moisture Content Observed for Entire Study Period.

SOIL MOISTURE IN Counts per Second

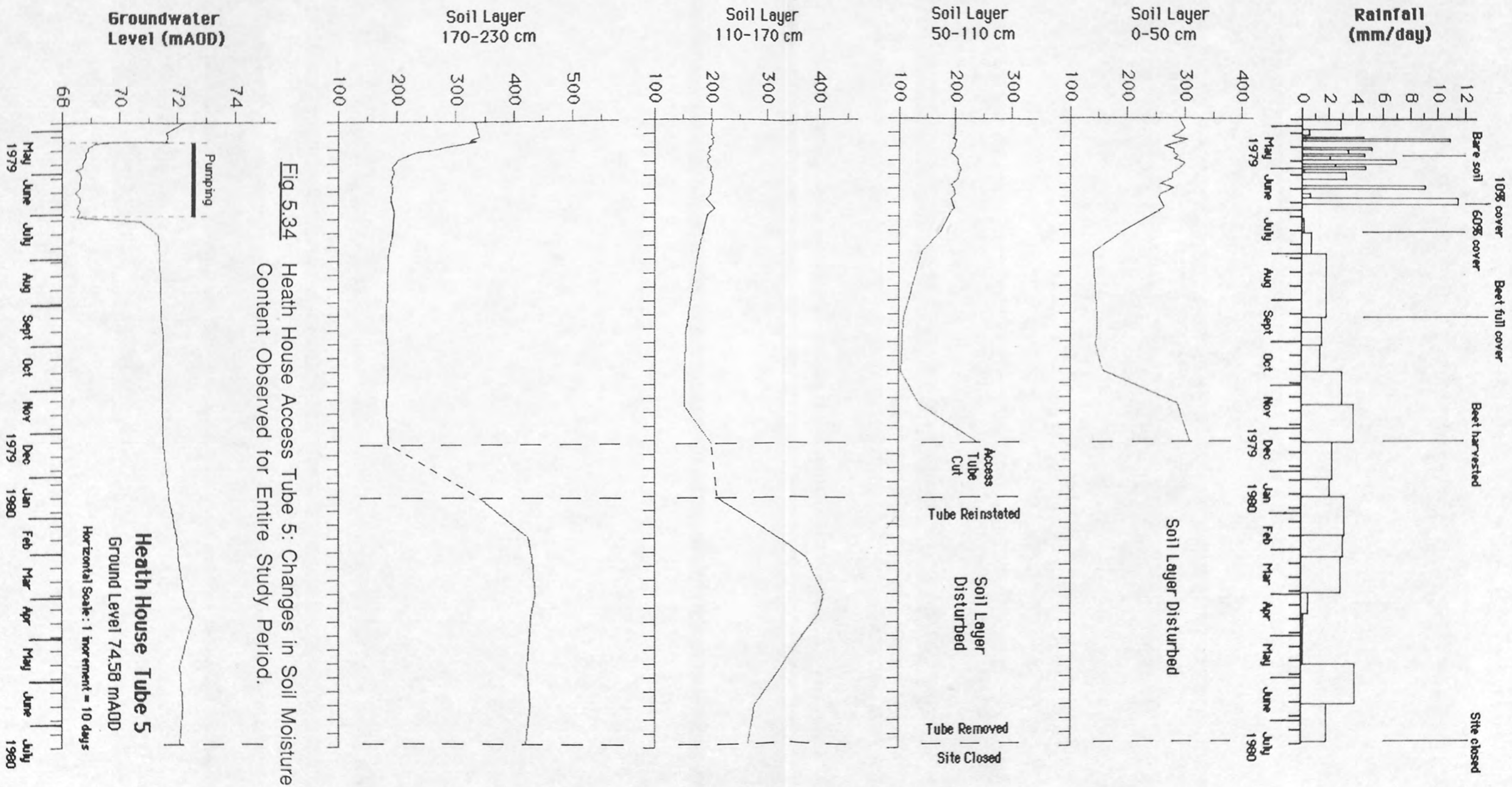


Fig 5.34 Heath House Access Tube 5: Changes in Soil Moisture Content Observed for Entire Study Period.

Fig 5.34

SOIL MOISTURE IN Counts per Second

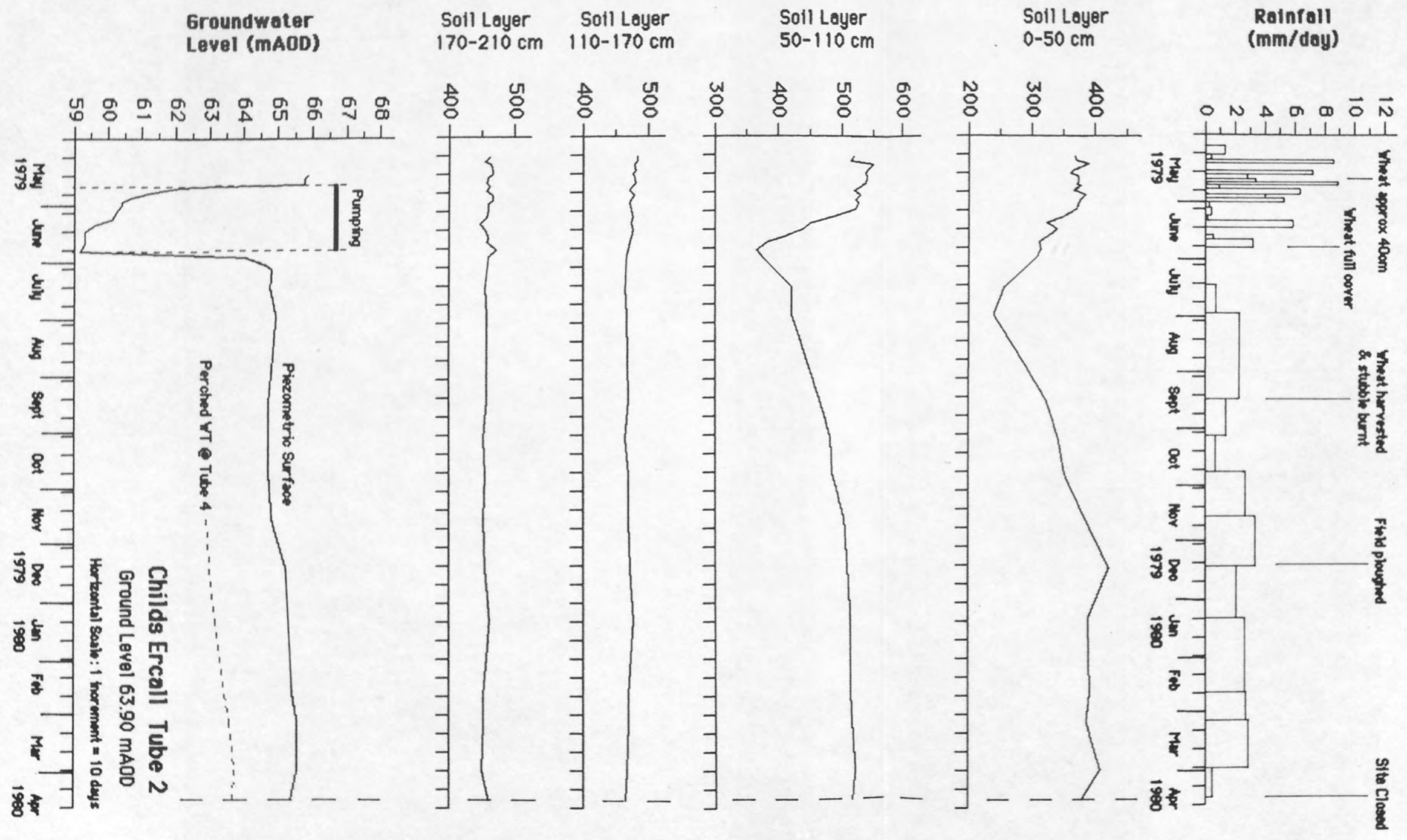


Fig 5.41 Childs Ercall Access Tube 2: Changes in Soil Moisture Content Observed for Entire Study Period.

Fig 5.41

Fig 5.42 Childs Ercall Access Tube 3: Changes in Soil Moisture Content Observed for Entire Study Period.

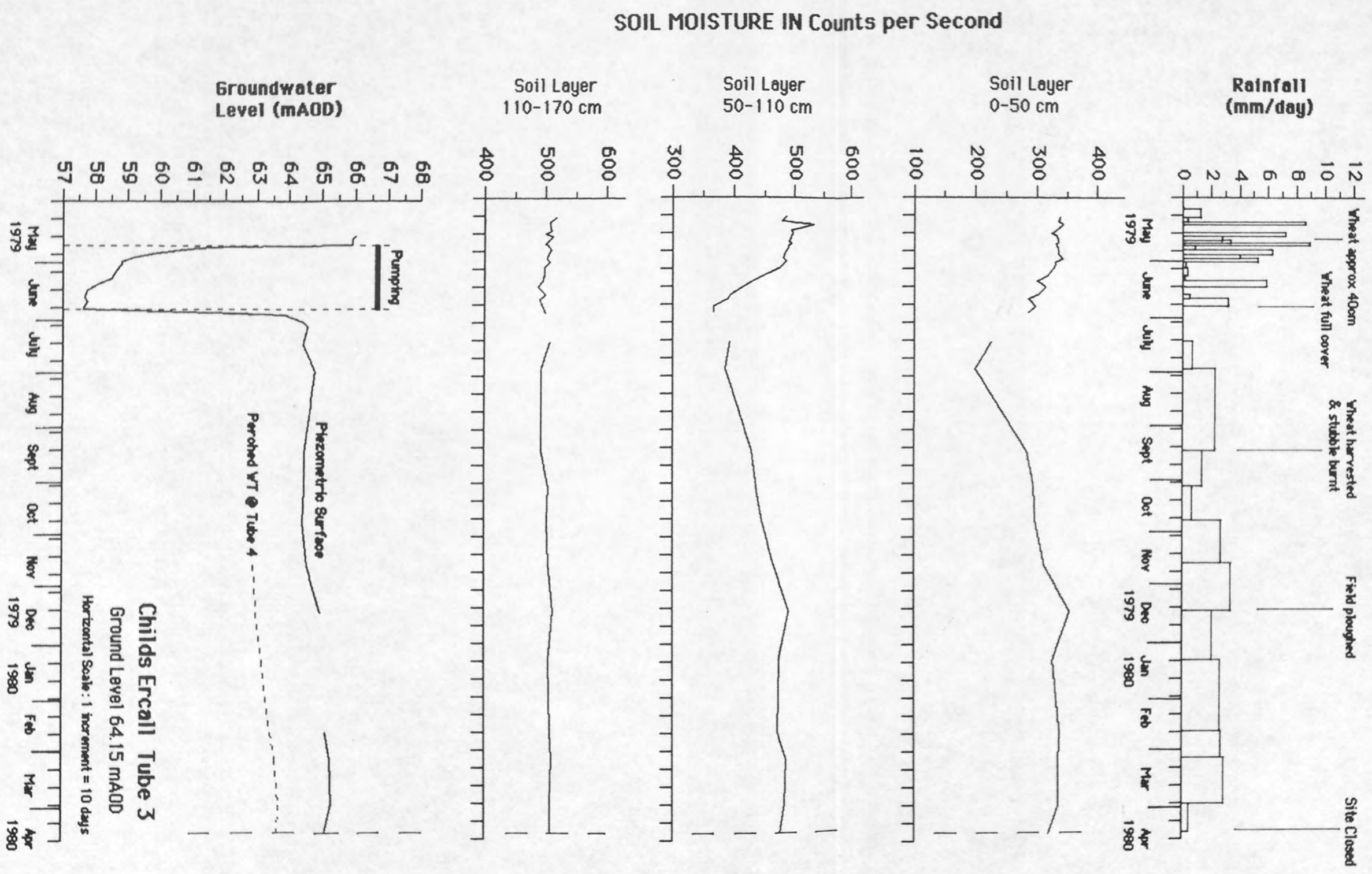


Fig 5.42