

**INVESTIGATION INTO THE POTENTIAL FOR
ESTABLISHING A SELF-SUSTAINABLE
WETLAND ECOSYSTEM OVER
PYRITIC MINE TAILINGS**

Volume II - Appendices

By

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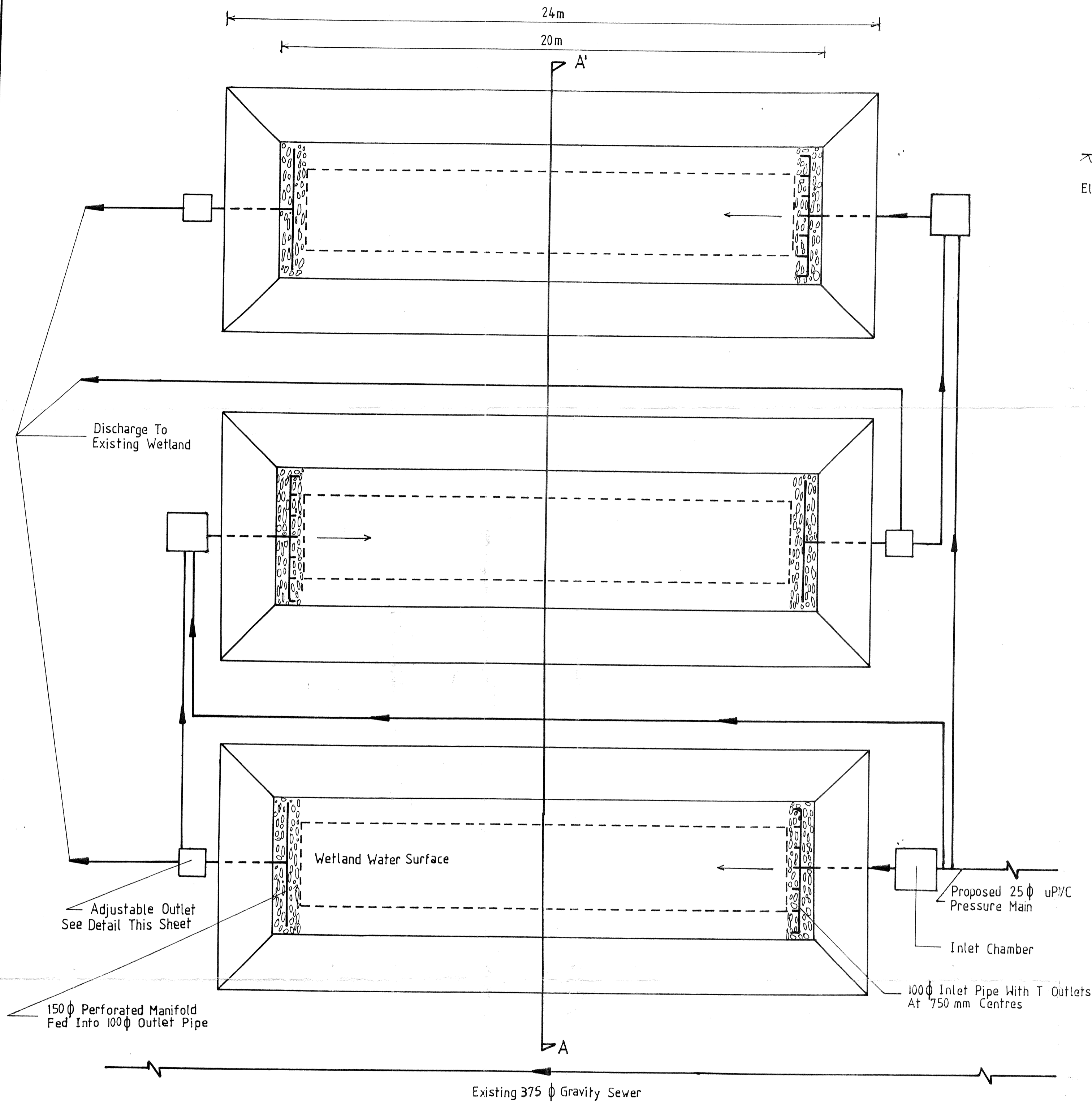
**Submitted to the Higher Education and Training Awards Council
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Philosophy**

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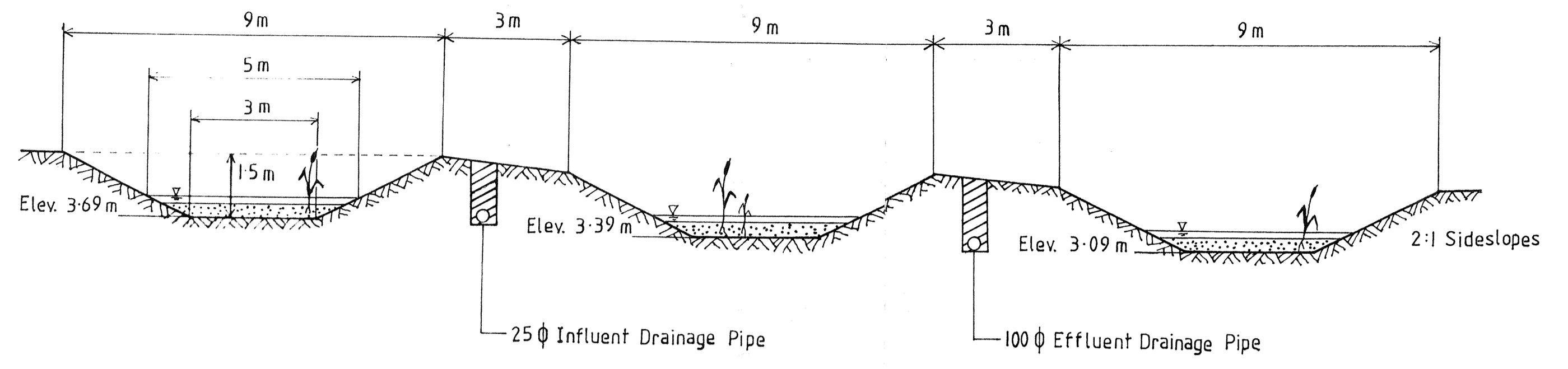
**Research conducted at the
School of Science, Institute of Technology, Sligo,
under the supervision of
Mr. J. P. Timpson, Head of School of Science
Institute of Technology, Sligo**

APPENDIX A

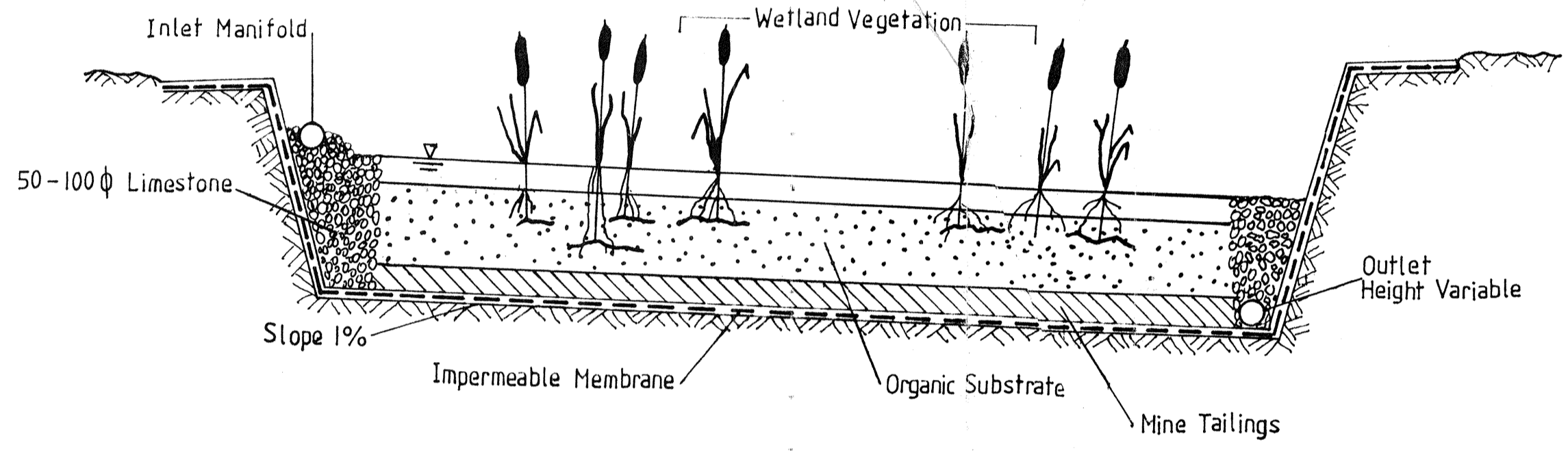
**DESIGN PLAN FOR PILOT SCALE WETLAND SYSTEM CONSTRUCTED
AT THE INSTITUTE OF TECHNOLOGY, SLIGO**



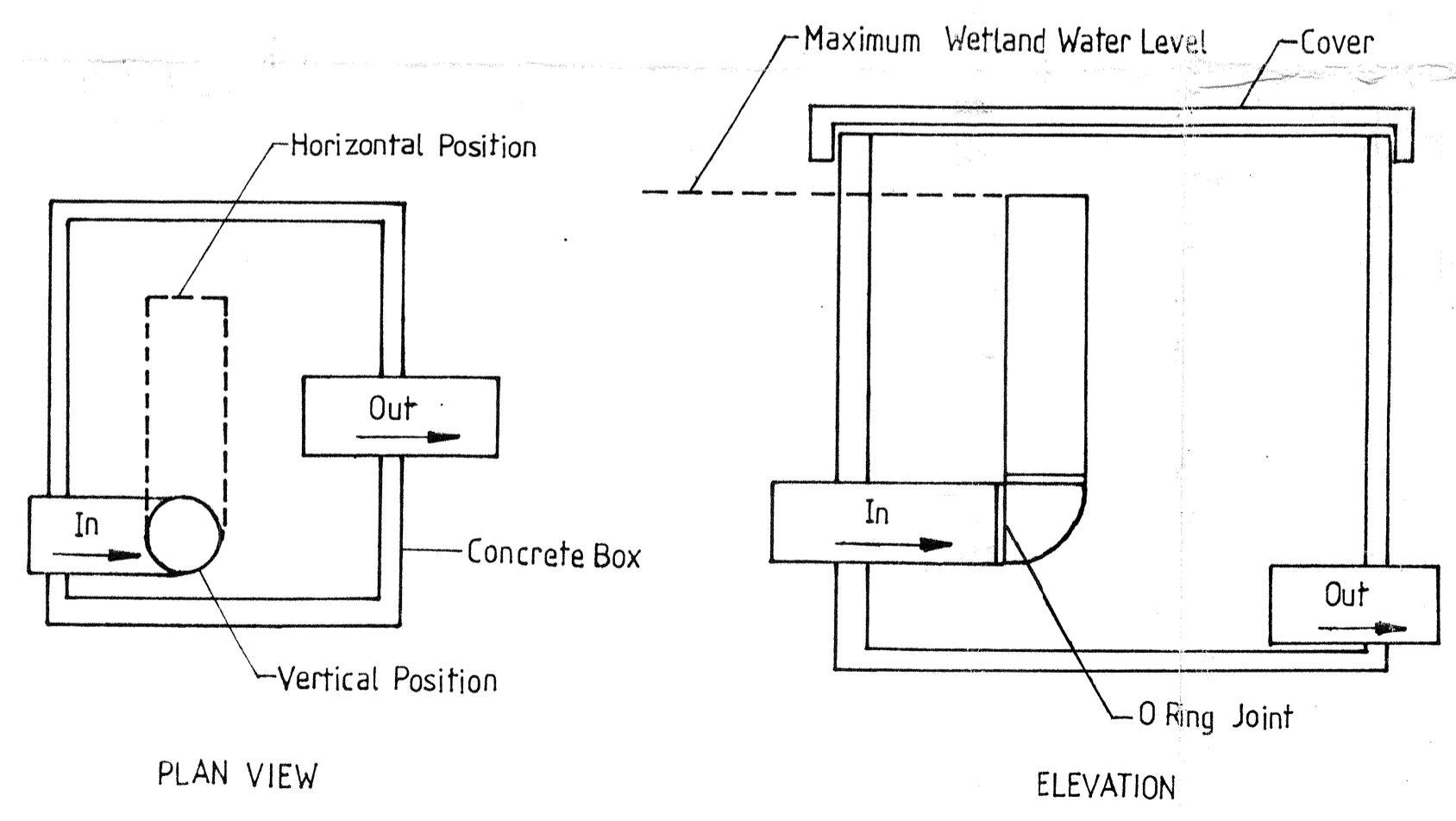
PLAN VIEW
SCALE 1:100



SECTION A-A'
SCALE 1:100



LONGITUDINAL SECTION THROUGH FWS WETLAND
NOT TO SCALE



ADJUSTABLE OUTLET STRUCTURE
NOT TO SCALE

PILOT-SCALE
WETLAND CELLS

RTC SLIGO
BALLINODE

SCALE: AS SHOWN

DATE: 14/7/97

DRAWN BY: Paula Treacy, Sligo RTC

APPENDIX B
ECOLOGICAL CALCULATIONS

Table B.1 Summary of data from quadrat sampling in *Typha latifolia* section of TMF Wetland, summer 1999.

Total No. of Quadrats (k) = 10

Quadrat Area = 1 m²

Total Quadrat Area = 10 m²

Species (i)	No. of Individuals (n _i)	Density (D _i) D _i = n _i /A	Relative Density (RD _i) RD _i = n _i /Σn	Present in how many quadrats? (j _i)	Frequency (f _i) f _i = j _i /k	Relative Frequency (Rf _i) Rf _i = f _i /Σf	Coverage (C _i) C _i = a _i /A	Relative Coverage (RC _i) RC _i = C _i /ΣC	Importance Value (IV _i) IV _i = (RD _i + Rf _i + RC _i)	Importance % (IV%) IV% = IV _i /3
<i>Typha latifolia</i>	162	16.2	0.72	10	1.0	0.2	0.095	0.18	1.1	37%
<i>Phragmites australis</i>	0	0	0	0	0	0	-	-	-	-
<i>Juncus effuses</i>	10 E7 } 7	0.7	0.03	6	0.6	0.12	0.027	0.05	0.2	7%
<i>Juncus acutiflorus</i>	3	0.3	0.01	2	0.2	0.04	0.004	0.01	0.06	2%
<i>Scirpus maritimus</i>	4	0.4	0.02	3	0.3	0.06	-	-	0.08	3%
<i>Equisetaceae</i>	2	0.2	0.01	2	0.2	0.04	-	-	0.05	2%
<i>Onagraceae</i>	16	1.6	0.07	8	0.8	0.16	-	-	0.23	8%
<i>Iris pseudacorus</i>	15	1.5	0.07	3	0.3	0.06	0.001	-	0.13	4%
<i>Potamogeton</i>	5	0.5	0.02	5	0.5	0.1	0.017	0.03	0.12	4%
<i>Gramineae</i>	10	1.0	0.044	10	1.0	0.2	0.386	0.73	0.964	32%
<i>Bryophytes</i>	1	0.1	0.004	1	0.1	0.02	-	-	0.024	1%
Totals	Σn=225	ΣD=22.50	ΣRD=1.0		Σf=5.0	ΣRf=1.0	ΣC=0.53	ΣRC=1.0		

Table B.2 Summary of data from quadrat sampling in *Typha latifolia* section of Control Wetland, summer 1999.

Total No. of Quadrats (k) = 10

Quadrat Area = 1 m²

Total Quadrat Area = 10 m²

Species (i)	No. of Individuals (n _i)	Density (D _i) D _i = n _i /A	Relative Density (RD _i) RD _i = n _i /Σn	Present in how many quadrats? (j _i)	Frequency (f _i) f _i = j _i /k	Relative Frequency (Rf _i) Rf _i = f _i /Σf	Coverage (C _i) C _i = a _i /A	Relative Coverage (RC _i) RC _i = C _i /ΣC	Importance Value (IV _i) IV _i = (RD _i + Rf _i + RC _i)	Importance % (IV%) IV% = IV _i / 3
<i>Typha latifolia</i>	245	24.5	0.698	10	1.0	0.18	0.14	0.29	1.168	39%
<i>Phragmites australis</i>	2	0.2	0.006	1	0.1	0.02	0.00002	-	0.026	1%
<i>Juncus effusus</i>	0	0	-	0	0	-	-	-	-	-
<i>Juncus acutiflorus</i>	10	1.0	0.028	5	0.5	0.09	-	-	0.118	4%
<i>Scirpus maritimus</i>	27	2.7	0.077	8	0.8	0.14	0.00002	-	0.217	7%
<i>Equisetaceae</i>	5	0.5	0.014	3	0.3	0.05	-	-	0.064	2%
<i>Onagraceae</i>	39	3.9	0.111	7	0.7	0.12	0.0002	-	0.231	8%
<i>Mentha aquatica</i>	0	0	0	0	-	-	-	-	-	-
<i>Potamogeton</i>	9	0.9	0.026	9	0.9	0.16	0.07	0.15	0.336	11%
<i>Gramineae</i>	10	1.0	0.028	10	1.0	0.18	0.27	0.56	0.768	26%
<i>Bryophytes</i>	4	0.4	0.011	4	0.4	0.07	-	-	0.081	3%
Totals	Σn = 351	ΣD = 35.1	ΣRD = 1.0		Σf = 5.7	ΣRf = 1.0	ΣC = 0.480	ΣRC = 1.0		

Table B.3 Summary of data from quadrat sampling in *Phragmites australis* section of TMF Wetland, summer 1999.

Total No. of Quadrats (k) = 10

Quadrat Area = 1 m²

Total Quadrat Area = 10 m²

Species (i)	No. of Individuals (n _i)	Density (D _i) D _i = n _i /A	Relative Density (RD _i) RD _i = n _i /Σn	Present in how many quadrats? (j _i)	Frequency (f _i) f _i = j _i /k	Relative Frequency (Rf _i) Rf _i = f _i /Σf	Coverage (C _i) C _i = a _i /A	Relative Coverage (RC _i) RC _i = C _i /ΣC	Importance Value (IV _i) IV _i = (RD _i + Rf _i + RC _i)	Importance % (IV%) IV% = IV _i /3
<i>Typha latifolia</i>	87	8.7	0.23	9	0.9	0.15	0.017	0.03	0.41	14%
<i>Phragmites australis</i>	226	22.6	0.60	10	1.0	0.17	0.043	0.08	0.85	21%
<i>Juncus effusus</i>	I } 1 E }	0.1	0.003	1	0.1	0.02	0.001	0.002	0.03	1%
<i>Juncus acutiflorus</i>	14	1.4	0.04	7	0.7	0.12	0.009	0.02	0.18	5%
<i>Scirpus maritimus</i>	17	1.7	0.05	6	0.6	0.1	0.001	0.002	0.15	5%
<i>Equisetaceae</i>	1	0.1	0.003	1	0.1	0.02	-	-	0.02	1%
<i>Onagraceae</i>	15	1.5	0.04	7	0.7	0.12	-	-	0.16	5%
<i>Iris pseudacorus</i>	-	-	-	-	-	-	-	-	-	-
<i>Potamogeton</i>	8	0.8	0.02	8	0.8	0.13	0.118	0.23	0.38	13%
<i>Gramineae</i>	10	1.0	0.03	10	1.0	0.17	0.320	0.62	0.82	27%
<i>Bryophytes</i>	1	0.1	0.003	1	0.1	0.02	0.005	0.01	0.03	1%
Totals	Σn=380	ΣD=38.0	ΣRD=1.0		Σf=6	ΣRf=1.0	ΣC=0.514	ΣRC=1.0		

Table B.4 Summary of data from quadrat sampling in *Phragmites australis* section of Control Wetland, summer 1999.

Total No. of Quadrats (k) = 10

Quadrat Area = 1 m²

Total Quadrat Area = 10 m²

Species (i)	No. of Individuals (n _i)	Density (D _i) D _i = n _i /A	Relative Density (RD _i) RD _i = n _i /Σn	Present in how many quadrats? (j _i)	Frequency (f _i) f _i = j _i /k	Relative Frequency (Rf _i) Rf _i = f _i /Σf	Coverage (C _i) C _i = a _i /A	Relative Coverage (RC _i) RC _i = C _i /ΣC	Importance Value (IV _i) IV _i = (RD _i + Rf _i + RC _i)	Importance % (IV%) IV% = IV _i /3
<i>Typha latifolia</i>	183	18.3	0.30	10	1.0	0.16	0.048	0.06	0.52	17%
<i>Phragmites australis</i>	353	35.3	0.57	9	0.9	0.14	0.071	0.08	0.79	26%
<i>Juncus effusus</i>	1	0.1	0.002	1	0.1	0.02	0.007	0.008	0.03	1%
<i>Juncus acutiflorus</i>	6	0.6	0.01	4	0.4	0.06	0.003	0.004	0.074	3%
<i>Scirpus maritimus</i>	24	2.4	0.04	10	1.0	0.16	0.044	0.051	0.251	8%
<i>Equisetaceae</i>	3	0.3	0.01	2	0.2	0.03	-	-	0.04	1%
<i>Onagraceae</i>	25	2.5	0.04	7	0.7	0.11	0.0004	0.0005	0.15	5%
<i>Mentha aquatica</i>	5	0.5	0.008	1	0.1	0.02	-	-	0.028	1%
<i>Potamogeton</i>	10	1.0	0.02	10	1.0	0.16	0.368	0.424	0.60	20%
<i>Gramineae</i>	9	0.9	0.015	9	0.9	0.14	0.326	0.376	0.53	18%
<i>Bryophytes</i>	1	0.1	0.002	1	0.1	0.02	-	-	0.02	1%
Totals	Σn = 620	ΣD = 62.0	ΣRD = 1.0		Σf = 6.4	ΣRf = 1.0	ΣC = 0.8674	ΣRC = 1.0		

Table B.5 Summary of data from quadrat sampling in *Juncus effusus* section of TMF Wetland, summer 1999.

Total No. of Quadrats (k) = 10

Quadrat Area = 1 m²

Total Quadrat Area = 10 m²

Species (i)	No. of Individuals (n _i)	Density (D _i) D _i = n _i /A	Relative Density (RD _i) RD _i = n _i /Σn	Present in how many quadrats? (j _i)	Frequency (f _i) f _i = j _i /k	Relative Frequency (Rf _i) Rf _i = f _i /Σf	Coverage (C _i) C _i = a _i /A	Relative Coverage (RC _i) RC _i = C _i /ΣC	Importance Value (IV _i) IV _i = (RD _i + Rf _i + RC _i)	Importance % (IV%) IV% = IV _i /3
<i>Typha latifolia</i>	78	7.8	0.42	9	0.9	0.17	0.026	0.08	0.67	17%
<i>Phragmites australis</i>	21	2.1	0.11	4	0.4	0.08	0.0004	0.001	0.19	5%
<i>Juncus effusus</i>	II } E32 } 33	3.3	0.18	10	1.0	0.19	0.189	0.57	0.94	24%
<i>Juncus acutiflorus</i>	4	0.4	0.02	2	0.2	0.04	0.0003	0.001	0.22	6%
<i>Scirpus maritimus</i>	-	-	-	-	-	-	-	-	-	-
<i>Equisetaceae</i>	22	2.2	0.12	8	0.8	0.15	-	-	0.27	7%
<i>Onagraceae</i>	10	1.0	0.05	3	0.3	0.06	-	-	0.11	3%
<i>Iris pseudacorus</i>	0	0	0	-	-	-	-	-	-	-
<i>Potamogeton</i>	7	0.7	0.04	7	0.7	0.14	0.046	0.14	0.32	8%
<i>Gramineae</i>	9	0.9	0.05	9	0.9	0.17	0.068	0.21	0.43	11%
<i>Bryophytes</i>	-	-	-	-	-	-	-	-	-	-
Totals	Σn=184	ΣD=18.4	ΣRD=1.0		Σf=5.2	ΣRf=1.0	ΣC=0.33	ΣRC=1.0		

Table B.6 Summary of data from quadrat sampling in *Juncus effusus* section of Control Wetland, summer 1999.

Total No. of Quadrats (k) = 5

Quadrat Area = 1 m²

Total Quadrat Area = 5 m²

Species (i)	No. of Individuals (n _i)	Density (D _i) D _i = n _i /A	Relative Density (RD _i) RD _i = n _i /Σn	Present in how many quadrats? (j _i)	Frequency (f _i) f _i = j _i /k	Relative Frequency (Rf _i) Rf _i = f _i /Σf	Coverage (C _i) C _i = a _i /A	Relative Coverage (RC _i) RC _i = C _i /ΣC	Importance Value (IV _i) IV _i = (RD _i + Rf _i + RC _i)	Importance % (IV%) IV% = IV _i /3
<i>Typha latifolia</i>	67	13.4	0.519	5	1.0	0.14	0.025	0.046	0.705	24%
<i>Phragmites australis</i>	5	1.0	0.039	1	0.2	0.03	0.0001	0.0002	0.069	2%
<i>Juncus effusus</i>	11	2.2	0.085	5	1.0	0.14	0.096	0.178	0.403	13%
<i>Juncus acutiflorus</i>	10	2.0	0.078	5	1.0	0.14	0.0002	0.0004	0.218	7%
<i>Scirpus maritimus</i>	7	1.4	0.054	3	0.6	0.08	0.015	0.028	0.162	5%
<i>Equisetaceae</i>	5	1.0	0.039	2	0.4	0.06	-	-	0.099	3%
<i>Onagraceae</i>	14	2.8	0.109	5	1.0	0.14	-	-	0.249	8%
<i>Mentha aquatica</i>	-	-	-	0	0	-	-	-		
<i>Potamogeton</i>	3	0.6	0.023	3	0.6	0.08	0.006	0.011	0.114	4%
<i>Gramineae</i>	5	1.0	0.039	5	1.0	0.14	0.396	0.736	0.915	31%
<i>Bryophytes</i>	2	0.4	0.016	2	0.4	0.06	-	-	0.076	3%
Totals	Σn = 129	ΣD = 12.9	ΣRD = 1.0		Σf = 7.2	ΣRf = 1.0	ΣC = 0.538	ΣRC = 1.0		

TMF Wetland - Ranked data for Relative Abundance, Dominance-Density and Species Importance Curves

	Abund.	Density	Rank Den.	Cover	Rank Cov.	Frequency	Rank Freq.	IV	Rank IV
Typha	339	11.3	1	0.045	4	0.93	2	0.691	2
Phragmites	247	8.23	2	0.015	5	0.47	6	0.43	3
Juncus E	41	1.37	3.5	0.072	2	0.57	4.5	0.305	4
Juncus A	20	0.67	8.5	0.004	6	0.37	7.5	0.108	7
Scirpus	21	0.7	7	0.0003	8.5	0.3	9	0.091	9
Equisetaceae	25	0.83	6	0.0001	10.5	0.37	7.5	0.1	8
Onagraceae	41	1.37	3.5	0.0001	10.5	0.6	4.5	0.16	6
Iris	15	0.5	10	0.0004	8.5	0.1	10	0.04	10
Potamogeton	20	0.67	8.5	0.06	3	0.67	3	0.281	5
Gramineae	29	0.97	5	0.298	1	0.97	1	0.82	1
Bryophytes	2	0.07	11	0.002	7	0.07	11	0.018	11

Control Wetland - Ranked data for Relative Abundance, Dominance-Density and Species Importance Curves

	Abund.	Density	Rank Den.	Cover	Rank Cov.	Frequency	Rank Freq.	IV	Rank IV
Typha	495	19.8	1	0.081	3	0.16	1	0.74	1
Phragmites	358	14.32	2	0.03	4	0.07	7	0.45	3
Juncus E	12	0.48	9	0.02	5.5	0.04	10	0.08	8
Juncus A	26	1.04	5	0.001	8	0.09	6	0.11	7
Scirpus	58	2.32	4	0.02	5.5	0.13	4	0.21	5
Equisetaceae	13	0.52	8	0.0001	9.5	0.05	8.5	0.06	9.5
Onagraceae	78	3.12	3	0.0002	7	0.12	5	0.19	6
Mentha	5	0.2	11	0.0001	9.5	0.01	11	0.02	11
Potamogeton	22	0.88	7	0.178	2	0.14	3	0.44	4
Gramineae	24	0.96	6	0.318	1	0.15	2	0.66	2
Bryophytes	7	0.28	10	0.0001	9.5	0.05	8.5	0.06	9.5

SPECIES DIVERSITY

1) Margalef's Index

$$D_a = (s-1) / \text{Log } N$$

s = No. of species

N = No. of individuals

TMF Wetland:

<i>Total Cell</i>	s =12 N=798	$D_a = (12-1) / \log (798) = 11 / 2.902 = 3.79$
<i>Region A Typha</i>	s =11 N=225	$D_a = (11-1) / \log 225 = 10 / 2.352 = 4.252$
<i>Region B Phragmites</i>	s =10 N=380	$D_a = (10-1) / \log 380 = 9 / 2.580 = 3.488$
<i>Region C Juncus</i>	s =9 N=184	$D_a = (9-1) / \log 184 = 8 / 2.265 = 3.532$

Control Wetland:

<i>Total Cell</i>	s =11 N=1098	$D_a = (11-1) / \log 1098 = 10 / 3.041 = 3.288$
<i>Region A Typha</i>	s =9 N=351	$D_a = (9-1) / \log 351 = 8 / 2.545 = 3.143$
<i>Region B Phragmites</i>	s =11 N=620	$D_a = (11-1) / \log 620 = 10 / 2.792 = 3.582$
<i>Region C Juncus</i>	s =10 N=129	$D_a = (10-1) / \log 129 = 9 / 2.111 = 4.263$

2) Simpson's Index

Simpson's Dominance (I)

$$I = \frac{\sum n_i (n_i - 1)}{N (n - 1)} \quad \text{Inverse of } I: d_s = 1 / I$$

Simpson Diversity (D_s)

$$D_s = 1 - \frac{\sum n_i (n_i - 1)}{N (n - 1)}$$

TMF Wetland:

Total Cell

$$D_s = 1 - \frac{[339 (338) + 247 (246) + 41 (40) + 20 (19) + 21 (20) + (25) (24) + 41 (40) + 15 (14) + 20 (19) + 29 (28) + (2) (1)]}{798 (797)}$$

$$D_s = 1 - 0.285 = 0.715$$

$$d_s = 1 / 0.285 = 3.509$$

Region A - Typha

$$D_s = 1 - \frac{[162 (161) + 7 (6) + 3 (2) + 4 (3) + 2 (1) + 16 (15) + 15 (14) + 5 (4) + 10 (9)]}{225 (224)}$$

$$D_s = 1 - 0.53 = 0.47$$

$$d_s = 1 / 0.53 = 1.888$$

Region B - Phragmites

$$D_s = 1 - \frac{[87 (86) + 226 (225) + 14 (13) + 17 (16) + 15 (14) + 8 (7) + 10 (9)]}{380 (379)}$$

$$D_s = 1 - [0.41] = 0.589$$

$$d_s = 1 / 0.41 = 2.439$$

Region C - Juncus

$$D_s = 1 - \frac{[(78 (77) + 21 (20) + 33 (32) + 4 (3) + 22 (21) + 10 (9) + 7 (6) + 9 (8))]}{184 (183)}$$

$$D_s = 1 - 0.242 = 0.758$$

$$d_s = 1 / 0.242 = 4.132$$

Control Wetland

Total Cell

$$D_s = 1 - \frac{[495 (494) + 358 (357) + 12 (11) + 26 (25) + 58 (57) + 13 (12) + 78 (77) + 5 (4) + 22 (21) + 24 (23) + 7 (6)]}{1098 (1097)}$$

$$D_s = 1 - 0.319 = 0.682$$
$$d_s = 1 / 0.319 = 3.135$$

Region A - Typha

$$D_s = 1 - \frac{[245 (244) + 2 (1) + 10 (9) + 27 (26) + 20 + 39 (38) + 9 (8) + 12 + 90]}{351 (350)}$$

$$D_s = 1 - 0.507 = 0.493$$
$$d_s = 1 / 0.507 = 1.972$$

Region B - Phragmites

$$D_s = 1 - \frac{[183 (182) + 353 (352) + 30 + 24 (23) + 6 + 25 (24) + 90 + 9 (8) + 20]}{620 (619)}$$

$$D_s = 1 - 0.414 = 0.586$$
$$d_s = 1 - 0.414 = 2.415$$

Region C - Juncus

$$D_s = 1 - \frac{[(67) (66) + 20 + 110 + 42 + 20 + 14 (13) + 6 + 2 + 20]}{129 (128)}$$

$$D_s = 1 - 0.292 = 0.708$$
$$d_s = 1 / 0.292 = 3.425$$

3) Shannon Diversity Index

(i) Shannon Diversity Index of Plant Abundance

$$H^1 = - \sum p_i \log p_i \quad \text{Where: } p_i = n_i / N$$

TMF Wetland

$$H^1_1 = - [0.43 \log 0.43 + 0.31 \log (0.31) + 0.05 \log (0.05) \\ + 0.03 \log (0.03) \times 5 + 0.05 \log (0.05) \\ + 0.02 \log (0.02) + 0.04 \log (0.04)]$$

$$H^1_1 = - [-0.764] = \mathbf{0.764}$$

Control Wetland

$$H^1_2 = - [0.45 \log 0.45 + 0.33 \log (0.33) + 0.01 \log (0.01) \\ 0.02 \log 0.02 + 0.05 \log (0.05) + 0.01 \log (0.01) \\ + 0.07 \log (0.07) + 0.01 \log (0.01) + 0.02 \log (0.02) \\ 0.02 (\log 0.02) + 0.01 \log (0.01)]$$

$$H^1_2 = - [0.877] = \mathbf{0.877}$$

(ii) Shannon Diversity Index of Plant Coverage

$$H^1 = - \sum p_i \log p_i \quad \text{Where: } p_i = c_i / C$$

TMF Wetland

$$H^1_1 = - [0.125 \log 0.125 + 0.046 \log 0.046 \\ + 0.031 \log 0.031 + 0.002 \log 0.002 \\ + 0.031 \log 0.031 + 0.0003 \log 0.0003 \\ + 0.275 \log 0.275 + 0.491 \log 0.491]$$

$$H^1_1 = - [-0.580] = \mathbf{0.5803}$$

Control Wetland

$$H^1_2 = - [0.091 \log 0.091 + 0.03 \log 0.03 \\ + 0.145 \log 0.145 + 0.008 \log 0.008 \\ + 0.001 \log 0.001 + 0.001 \log 0.001 \\ + 0.121 \log 0.121 + 0.6 \log 0.6 \\ + 0.004 \log 0.004]$$

$$H^1_2 = - [-0.538] = \mathbf{0.5385}$$

(iii) Comparing Indices of Shannon Diversity

$$H^1 = - \sum p_i \log p_i \quad \text{is equivalent to} \quad H^1 = \frac{n \log n - \sum f_i \log f_i}{n}$$

Where n denotes sample size and f_i the number of observations in each category i, thus $p_i = f_i / n$. To compare Shannon diversity indices from two collections of data (H^1_1 and H^1_2) we need to compute the variance (s^2) of H^1 for each collection where:

$$s^2 = \frac{\sum f_i \log^2 f_i - (\sum f_i \log f_i)^2/n}{n^2}$$

The t test and degrees of freedom (v) used to compare Shannon diversity indices were:

$$t = \frac{H^1_1 - H^1_2}{\sqrt{s^2_1 + s^2_2}} \qquad v = \frac{(s^2_1 + s^2_2)^2}{\frac{(s^2_1)^2}{n_1} + \frac{(s^2_2)^2}{n_2}}$$

(a) Comparing Diversity of Plant Abundance between TMF and Control Wetlands

The null hypothesis is:

H_0 : The diversity of plant abundance in the TMF wetland is the same as the diversity of plant abundance in the Control.

TMF Wetland

	f_i	$f_i \log f_i$	$f_i \log^2 f_i$
Typha l.	339	857.738	2170.248
Phragmites a.	247	590.996	1414.248
Juncus e.	41	66.124	106.644
Juncus a.	20	26.021	33.854
Scirpus m.	21	27.767	36.714
Equisetaceae	25	34.949	48.856
Onagraceae	41	66.124	106.644
Iris p.	15	17.641	20.748
Potamogeton	20	26.021	33.853
Gramineae	29	42.410	62.020
Bryophytes	2	0.602	0.181

$$N_1 = \sum f_i = 800$$

$$\sum f_i \log f_i = 1756.393$$

$$\sum f_i \log^2 f_i = 4033.837$$

$$H_1^1 = \frac{n \log n - \sum f_i \log f_i}{n} = \frac{2322.472 - 1756.393}{800}$$

$$H_1^1 = 0.708$$

$$s_1^2 = \frac{\sum f_i \log^2 f_i - (\sum f_i \log f_i)^2 / n}{n^2} = \frac{4033.837 - (1756.393)^2 / 800}{(800)^2}$$

$$s_1^2 = 0.00027764$$

Control Wetland

	f_i	$f_i \log f_i$	$f_i \log^2 f_i$
Typha l.	495	1333.83	3594.144
Phragmites a.	358	914.290	2334.99
Juncus e.	12	12.950	13.976
Juncus a.	26	36.789	52.056
Scirpus m.	58	102.279	180.361
Equisetaceae	13	14.481	16.131
Onagraceae	78	147.583	279.242
Mentha a.	5	3.495	2.443
Potamogeton	22	29.533	39.646
Gramineae	24	33.125	45.720
Bryophytes	7	5.916	4.999

$$N_2 = \sum f_i = 1098$$

$$\sum f_i \log f_i = 2634.271$$

$$\sum f_i \log^2 f_i = 6563.708$$

$$H_2^1 = \frac{n \log n - \sum f_i \log f_i}{n} = \frac{3338.581 - 2634.271}{1098}$$

$$H_2^1 = 0.641$$

$$s_2^2 = \frac{\sum f_i \log^2 f_i - (\sum f_i \log f_i)^2 / n}{n^2} = \frac{6563.708 - 6320.022}{1205604}$$

$$s_2^2 = 0.000202128$$

Comparison between TMF and Control Wetlands

$$\sqrt{s_1^2 + s_2^2} = \sqrt{0.00027764 + 0.000202128}$$

$$\sqrt{s_1^2 + s_2^2} = 0.021904$$

$$t = \frac{H_1^1 - H_2^1}{\sqrt{s_1^2 + s_2^2}} = \frac{0.708 - 0.641}{0.0219} = 3.0594$$

$$v = \frac{\frac{(s_1^2 + s_2^2)^2}{\frac{(s_1^2)^2}{n_1} + \frac{(s_2^2)^2}{n_2}}}{n_1 + n_2}$$

$$v = \frac{(0.00027764 + 0.000202128)^2}{\frac{(0.00027764)^2}{800} + \frac{(0.000202128)^2}{1098}} = 1722$$

Computed $t = 3.0594$

$v = 1722$

From t tables: $t_{0.001(2)1722} = 3.098$

$t_{0.05(2)1722} = 1.96$ Therefore, reject H_0 at 0.05 significance level.

(b) Comparing Diversity of Plant Coverage between between TMF and Control Wetlands

The null hypothesis is:

H_0 : The diversity of plant coverage in the TMF wetland is the same as the diversity of plant coverage in the Control.

TMF Wetland

	f_i	$f_i \log f_i$	$f_i \log^2 f_i$
Typha l.	0.045	- 0.0606	0.0816
Phragmites a.	0.015	- 0.0274	0.0499
Juncus e.	0.072	- 0.0823	0.094
Juncus a.	0.004	- 0.096	0.023
Scirpus m.	0.0003	- 0.0096	0.037
Equisetaceae	-	-	-
Onagraceae	-	-	-
Iris p.	0.0004	- 0.0014	0.00462
Potamogeton	0.06	-0.0733	0.0896
Gramineae	0.298	- 0.1567	0.0824
Bryophytes	0.002	- 0.0054	0.0146

$$N_2 = \sum f_i = 0.4967$$

$$\sum f_i \log f_i = - 0.4178$$

$$\sum f_i \log^2 f_i = 0.4434$$

$$H_1^1 = \frac{n \log n - \sum f_i \log f_i}{n} = \frac{(-0.151) + 0.4178}{.4967} = 0.5371$$

$$s_1^2 = \frac{\sum f_i \log^2 f_i - (\sum f_i \log f_i)^2 / n}{n^2} = \frac{(0.4434) - (0.4178)^2}{0.4967} = \frac{0.4967}{(0.4967)^2}$$

$$s_1^2 = 0.3728$$

Control Wetland

	f_i	$f_i \log f_i$	$f_i \log^2 f_i$
Typha l.	0.081	- 0.088	0.0965
Phragmites a.	0.03	- 0.0457	0.0696
Juncus e.	0.02	- 0.034	0.0577
Juncus a.	0.001	- 0.003	0.009
Scirpus m.	0.02	- 0.034	0.0577
Equisetaceae	-	-	-
Onagraceae	0.002	- 0.00074	0.00274
Mentha a.	-	-	-
Potamogeton	0.178	- 0.1334	0.100
Gramineae	0.318	- 0.1582	0.0787
Bryophytes	-	-	-

$$N_2 = \sum f_i = 0.6482 \quad \sum f_i \log f_i = - 0.4970 \quad \sum f_i \log^2 f_i = 0.4719$$

$$H_2^1 = \frac{n \log n - \sum f_i \log f_i}{n^2} = \frac{(-0.122) + 0.4970}{0.420} = 0.8929$$

$$s_2^2 = \frac{\sum f_i \log^2 f_i - (\sum f_i \log f_i)^2 / n}{n^2} = \frac{(0.4719) - 0.3811}{0.4202}$$

$$s_2^2 = 0.2161$$

Comparison between TMF and Control Wetlands

$$\sqrt{s_1^2 + s_2^2} = \sqrt{0.3728 + 0.2161}$$

$$\sqrt{s_1^2 + s_2^2} = 0.7674$$

$$t = \frac{H_1^1 - H_2^1}{\sqrt{s_1^2 + s_2^2}} = \frac{0.5371 - 0.8929}{0.7674} = -0.4636$$

$$v = \frac{\frac{(s_1^2 + s_2^2)^2}{(s_1^2)^2 + (s_2^2)^2}}{\frac{n_1}{n_2}}$$

$$v = \frac{(0.3728 + 0.2161)^2}{\frac{(0.3728)^2}{0.4967} + \frac{(0.2161)^2}{0.6482}} = 0.986$$

Computed $t = -0.4636$

$v = 0.986$

Tables: $t_{0.05(2)1} = 12.706$ Therefore, accept H_0 at 0.05 significance level.

COMMUNITY SIMILARITY

Indices of Community Similarity

1) Coefficient of Community

(i) Jacard Coefficient

$$CC_J = \frac{c}{s_1 + s_2 - c}$$

Where s_1 and s_2 are the number of species in each community and c is the number of species common to both communities.

For the TMF and Control Wetland

$$s_1 = 12$$

$$s_2 = 11$$

$$c = 10$$

$$CC_J = \frac{10}{12+11-10} = \frac{10}{13} = 0.77$$

The CC_J indicates 77% similarity between the communities.

(ii) Sorensen Quotient of Similarity

$$CC_s = \frac{2c}{s_1 + s_2} = \frac{2(10)}{12+11} = \frac{20}{23} = 0.87$$

The CC_s indicates 87% similarity between the communities.

2) Proportional Similarity in Abundance between Wetlands

$$P.S. = 1 - \sum |p_i - q_i| / 2 \quad \text{or} \quad P.S. = \sum (p_i \text{ or } q_i, \text{ whichever is lower})$$

	TMF Cell $p_i = (x_i/N_1) \times 100$	Control Cell $q_i = (y_i/N_2) \times 100$
Typha l.	43%	45%
Phragmites a.	31%	33%
Juncus i.	0.1%	0%
Juncus e.	5%	1%
Juncus a.	3%	2%
Scirpus m.	3%	5%
Equisetaceae	3%	1%
Onagraceae	5%	7%
Iris p.	2%	0%
Potamogeton	3%	2%
Gramineae	4%	2%
Bryophytes	0.3%	1%
Mentha a.	0%	1%

$$P.S. = 0.43 + 0.31 + 0.01 + 0.02 + 0.03 + 0.01 + 0.05 + 0.02 + 0.02 + 0.003$$

$$P.S. = 0.903$$

The P.S. indicates 90% proportional similarity in plant abundance between the communities.

3) Bray and Curtis Indices for Measuring Differences in Species Abundance between Wetlands

$$I_{BC} = 1 - \frac{\sum |x_i - y_i|}{\sum (x_i + y_i)}$$

	TMF Cell Abundance	Control Cell Abundance
Typha l.	339	495
Phragmites a.	241	358
Juncus i.	1	0
Juncus e.	40	12
Juncus a.	20	26
Scirpus m.	21	58
Equisetaceae	25	13
Onagraceae	41	78
Iris p.	15	0
Potamogeton	20	22
Gramineae	29	24
Bryophytes	2	7
Mentha a.	-	5

$$I_{BC} = 1 - \frac{[339-495] + [241-358] + [1-0] + [40-12] + [20-26] + [21-58] + [25-13] + [41-78] + [15-0] + [20-22] + [29-24] + [2-7] + [0-5]}{(339+495) + (241+358) + (1+0) + (40+12) + (20+26) + (21+58) + (25+13) + (41+78) + (15+0) + (20+22) + (29+24) + (2+7) + (0+5)}$$

$$I_{BC} = 1 - [0.225] = 0.775$$

Values for I_{BC} range from 0 when two communities are vastly different to 1.0 when the two are identical in species composition and abundance.

4) Dominance Indices - Morisita's Index of Community Similarity

The Morisita's index of community similarity is based on Simpson's Index of Dominance (I). Simpson's Index of Dominance for communities 1 and 2 are:

$$I_1 = \frac{\sum x_i (x_i - 1)}{N_1 (N_1 - 1)} \qquad I_2 = \frac{\sum y_i (y_i - 1)}{N_2 (N_2 - 1)}$$

The Morisita index of community similarity is:

$$I_M = \frac{2 \sum x_i y_i}{(I_1 + I_2) N_1 N_2}$$

TMF Wetland $l_1 = 0.285$

Control Wetland $l_2 = 0.319$

$$\begin{aligned} \sum x_i y_i = & (339)(495) + (241)(358) + 0 + (40)(12) + (20)(26) \\ & + (21)(58) + (25)(13) + (41)(78) + 0 + (26)(22) \\ & + (29)(24) + 14 \end{aligned}$$

$$= 260974$$

$$I_M = \frac{2(260974)}{(0.285 + 0.319)(800)(1098)}$$

$I_M = 0.984$

Values for I_M range from 0 when two communities have no similarity to approximately 1.0 when the two are identical.

5) Information Theoretic Index – Horn's Index of Community Similarity

To calculate Horn's index of community similarity ("community overlap") (R_o) the Shannon diversity index (H^1) for each community is first calculated.

TMF Wetland $H^1_1 = 0.764$

Control Wetland $H^1_2 = 0.877$

Then:

$$H^1_3 = [N \log N - \sum (x_i + y_i) \log (x_i + y_i)] / N$$

Where, $N = N_1 + N_2$

For wetlands $N = 800 + 1098 = 1898$

$$\begin{aligned} H^1_3 = & 1898 \log 1898 - [834 \log 834 + 599 \log 599 + 1 \log 1 \\ & + 52 \log 52 + 46 \log 46 + 79 \log 79 + 38 \log 38 + 119 \log 119 \\ & + 15 \log 15 + 42 \log 42 + 53 \log 53 + 9 \log 9 + 5 \log 5] \end{aligned}$$

$$1898$$

$H^1_3 = 0.6904$

Then,

$$H_4^1 = \frac{(N \log N - \sum x_i \log x_i - \sum y_i \log y_i)}{N}$$

For wetlands

$$H_4^1 = 1898 \log 1898 - (4371.69)$$

$$H_4^1 = 0.975$$

Then,

$$H_5^1 = (N_1 H_1^1 + N_2 H_2^1) / N$$

For wetlands

$$H_5^1 = (800)(0.708) + (1098)(0.641) / 1898$$

$$H_5^1 = 0.669$$

Horn's Index of Community Similarity:

$$R_o = \frac{H_4^1 - H_3^1}{H_4^1 - H_5^1}$$

For wetlands

$$R_o = \frac{0.975 - 0.690}{0.975 - 0.669} = \frac{0.285}{0.306}$$

$$R_o = 0.93$$

Horn's index R_o is 0 when the two communities have no species in common and is a maximum of 1.0 when the species are identical in both communities.

APPENDIX C

**WATER CHEMISTRY PARAMETERS MEASURED IN SUMMER 1999 AND
SEASONALLY THROUGHOUT 1999 AND 2000, AND METAL
CONCENTRATIONS IN WATER COLUMN MEASURED SEASONALLY**

Water Chemistry Parameters Measured in Each Quadrat of the TMF and Control Wetlands in Summer 1999.

TMF WETLAND						CONTROL WETLAND					
Quadrant	pH Water	Cond.	Temp.	D.O.	Depth	Quadrant	pH Water	Cond.	Temp.	D.O.	Depth
1	7.28	0.24	17.1	10.8	0.05	31	7.35	0.2	13.8	10.3	0.03
2	.	0.15	19.4	11.4	0.02	32	7.9	0.21	14.3	11.4	0.03
3	7.38	0.24	17.8	13.1	0.02	33	8	0.21	14	9.6	0.09
4	7.45	0.22	15.5	5.1	0.05	34	7.1	0.24	12.4	8.4	0.02
5	6.37	0.21	16.6	4.3	0.01	35	7.29	0.23	14.6	12.6	0.03
6	7.22	0.23	15	6.8	0.04	36	6.9	0.21	13.1	7.6	0.03
7	7.16	0.24	.	.	0.05	37	7.6	0.22	13.7	11.2	0.05
8	7.12	0.25	17.5	7	0.08	38	7.33	0.22	14.1	10.8	0.04
9	8.49	0.29	16.4	9.3	0.08	39	7.21	0.23	14.3	7.3	0.04
10	7.05	0.26	18.1	8.5	0.04	40	7.23	0.22	14.4	7.2	0.06
11	5.59	0.46	19.5	4.7	0.05	41	7.15	0.24	15.9	5.6	0.05
12	7.01	0.27	17.8	8.9	0.07	42	7.55	0.24	13.8	.	0.06
13	7.18	0.22	17.7	0.9	.	43	7.26	0.26	14.2	.	0.03
14	7.73	0.27	17.3	7.03	0.08	44	6.88	0.23	15.4	5.4	0.06
15	7.48	0.25	16.4	5.6	0.06	45	7.12	0.24	15.1	.	0.06
16	8.12	0.27	16.9	5.3	0.1	46	7.11	0.26	14.4	.	0.07
17	7.94	0.27	17.7	2.9	0.07	47	6.88	0.25	14.7	.	0.07
18	7.74	0.27	18.5	4.2	0.1	48	7.06	0.24	12.5	4.5	0.08
19	7.73	0.28	17.7	5.2	0.12	49	.	0.24	13	3.3	0.07
20	7.98	0.27	17.6	3.5	0.09	50	.	0.26	.	.	0.06
21	8	0.3	18.5	4.37	0.08	51	7.11	0.22	13.1	5.11	0.04
22	7.8	0.28	17.7	6.2	0.08	52	6.9	0.23	12.6	4.9	0.06
23	7.99	0.26	16.8	5.6	0.1	53	6.72	0.16	10.9	4.3	0.05
24	7.63	0.28	19	2.9	0.08	54
25	7.54	0.27	19.9	1.73	0.11	55	7.16	0.2	10.1	5.1	0.04
26	7.94	0.29	19.4	4.6	0.17						
27	7.76	0.26	14	5.4	0.15						
28	7.67	0.28	16.5	6.9	0.15						
29	7.29	0.24	17.5	5	0.11						
30	7.62	0.29	18.1	6.1	0.17						

CELL 1

Date	Temp	D.O.	pHW	Cond.	Temp	D.O.	pHW	pHS	Cond.	Depth	Temp	D.O.	pHW	pHS	Cond.	Depth	Temp	D.O.	pHW	pHS	Cond.	Depth	Temp	D.O.	pHW	Cond.
	Inflow				Top						Middle						End						Outflow			
Summer 1999	9	12.3	7.57	0.24	17.00	8.20	7.11	6.98	0.25	0.05	18.00	4.99	7.85	7.28	0.27	0.09	18.00	4.70	7.64	7.44	0.27	0.13				
Autumn 1999					7.80	4.17	7.35		0.19	0.07	8.30	7.90	7.14		0.19	0.08	7.20	6.20	7.37		0.19	0.125				
Autumn 1999					9.10	9.70	7.16		0.26	0.06	9.50	6.60	7.34		0.28	0.11	9.10	7.20	7.31		0.29	0.180				
Winter 1999					6.50	11.80	6.85		0.28	0.02	6.00	9.50	8.64		0.32	0.07	6.00	11.10	8.30		0.30	0.120				
Winter 2000					4.80	5.80	6.90		0.17	0.05	4.80	5.50	6.40		0.16	0.12	4.70	7.20	5.90		0.16	0.140				
Winter 2000	8.00	11.66	8.58		7.97	10.23	8.05		0.30	0.05	8.10	10.07	8.04		0.29	0.07	8.13	9.10	8.02		0.28	0.120	7.40	10.46	8.22	0.27
Winter 2000	7.03		7.07	0.291	7.40		6.37		0.309	0.04	7.40		6.37		0.29	0.08	7.70		5.90		0.278	0.110	6.60		6.00	0.286
Spring 2000	7.00	9.53	7.75	0.18	7.30	6.66	7.38		0.23	0.05	7.10	6.93	7.27		0.20	0.12	6.80	6.40	7.10		0.19	0.170	5.60	8.30	7.49	0.18
Spring 2000	7.20	19.90	7.64	0.293	7.6	18.70	8.07		0.274	0.06	7.9	17.86	7.96		0.263	0.11	8.50	18.86	7.71		0.276	0.230	8.4	20.26	7.97	0.262
Spring 2000	8.06	10.90	7.26	0.195	8.20	8.93	7.40		0.214	0.05	8.53	9.50	7.24		0.216	0.13	9.36	6.10	7.01		0.216	0.280	9.10	8.40	7.40	0.211
Spring 2000	10	9.76	7.13	0.224	9.93	10.56	6.95	6.79	0.225	0.07	9.40	5.633	7.22	6.72	0.239	0.10	10.7	5.966	7.19	7.1	0.232	0.26	10.43	9.1	7.36	0.230
Spring 2000	8.73	9.5	5.85	0.271	7.36	2.76	5.81	5.92	0.267	0.06	7.56	5.1	6.52	6.32	0.214	0.11	9.23	5.4	6.59	6.50	0.232	0.23	9.00	8.63	6.60	0.238
Summer 2000	9.00	12.30	7.57	0.24	12.00	10.50	7.50	7.13	0.26	0.06	10.00	10.20	6.36	6.69	0.24	0.09	10.00	10.90	7.02	6.71	0.26	0.160	10.00	9.50	6.99	0.250
Summer 2000	8.00	7.80	7.25	0.29	17.00	5.15	7.23	6.61	0.22	0.09	17.00	9.50	7.34	6.55	0.24	0.08	18.00	11.60	6.79	5.89	0.27	0.110	16.00		7.40	0.26

CELL 2

Date	Temp	D.O.	pHW	Cond.	Temp	D.O.	pHW	pHS	Cond.	Depth	Temp	D.O.	pHW	pHS	Cond.	Depth	Temp	D.O.	pHW	pHS	Cond.	Depth	Temp	D.O.	pHW	Cond.
	Inflow				Top						Middle						End						Outflow			
Summer 1999					14.00	9.27	7.37		0.23	0.04	14.00	4.64	7.01		0.24	0.06	11.00	4.70	6.94		0.18	0.05				
Autumn 1999					8.4	7.2	7.48		0.19	0.070	8.5	6.4	7.40		0.19	0.090	8.5	6.5	7.31		0.18	0.050				
Autumn 1999					9.3	9.0	7.37		0.29	0.06	10.1	6.2	7.45		0.33	0.07	9.7	6.2	7.41		0.31	0.06				
Winter 1999					5.9	12.1	7.21		0.31	0.06	5.2	8.1	7.37		0.32	0.04	4.7	9.9	8.18		0.30	0.06				
Winter 2000					9.2	5.3	6.50		0.17	0.05	5.2	6.2	5.7		0.15	0.04	5.6	5.7	6.20		0.17	0.07				
Winter 2000	7.70	11.66	8.38	0.25	8.10	10.50	8.07		0.27	0.04	8.20	7.60	8.18		1.02	0.07	7.90	10.70	8.30			0.05	7.80	10.90	8.52	
Winter 2000	7.26		6.81	0.291	7.36		6.83		0.294	0.06	7.73		5.62		0.307	0.05	7.73		5.73		0.290	0.07	7.70		6.40	0.290
Spring 2000	6.40	8.63	7.59	0.214	6.40	7.40	7.28		0.212	0.06	7.06	7.06	7.08		0.202	0.06	7.53	7.60	7.27		0.211	0.06	6.30	9.23	7.53	0.213
Spring 2000	6.3	20.16	7.89	0.253	6.0	20.26	7.67		0.276	0.05	5.4	15.83	7.42		0.166	0.09	7.0	15.53	7.58		0.350	0.08	6.6	19.30	7.49	0.318
Spring 2000	9.00	10.76	7.52	0.207	8.90	9.10	7.20		0.212	0.06	9.80	6.33	7.07		0.188	0.07	10.30	6.30	7.01		0.215	0.1	9.00	9.50	7.37	0.218
Spring 2000	10.3	10.33	7.54	0.218	10.26	10.13	7.49	7.31		0.05	11.63	7.96	7.23		0.277	0.06	11.1	4.13	7.28	7.11	0.264	0.06	10.4	8.7	7.58	0.243
Spring 2000	8.5	9.73	6.85	0.261	8.3	9.33	6.91	6.33	0.238	0.06	8	6.3	6.42	6.31	0.234	0.07	8.96	9.93	6.58	6.37		0.1	9.6	9.3	6.62	0.218
Summer 2000	10.00	10.20	7.33	0.24	10.00	7.06	6.87	6.52	0.27	0.05	10.00	7.20	6.78	6.43	0.30	0.04	9.00	7.20	6.49	6.21	0.23	0.040	8.00	14.10	7.35	0.330
Summer 2000	17.00		7.40	0.26	18.00	8.50	7.01	6.05	0.29	0.07	16.00	6.07	6.52	6.07	0.26	0.06	17.00	4.50	6.22	5.72	0.20	0.030	16.00	6.80	6.97	0.28

CELL 1

Seasonal Metals Concentrations in TMF Wetland																					
Date	Cd	Fe	Mn	Pb	Zn	Cd	Fe	Mn	Pb	Zn	Cd	Fe	Mn	Pb	Zn	Cd	Fe	Mn	Pb	Zn	
	Inflow mg/l					Top mg/l					Middle mg/l					End mg/l					Outfl
Summer 1999						0.003	10.731	1.743	2.925	1.485	0.000	0.931	0.124	0.031	0.064	0.001	2.661	0.252	0.262	0.193	
Autumn 1999	0.001	3.485	0.594	0.078	0.191	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Autumn 1999	0.000	0.080	0.007	0.000	0.016	0.000	0.069	0.005	0.000	0.028	0.000	0.083	0.008	0.000	0.019	0.000	0.109	0.023	0.000	0.019	
Autumn 1999	0.000	0.164	0.034	0.000	0.057	0.003	13.129	0.922	2.533	1.162	0.001	0.252	0.040	0.000	0.070	0.003	0.964	0.088	0.239	0.504	
Winter 2000	0.000	0.118	0.034	0.000	0.014	0.002	12.974	0.702	1.416	0.738	0.000	0.492	0.062	0.010	0.045	0.000	0.481	0.045	0.051	0.057	
Winter 2000	0.000	0.162	0.035	0.002	0.061	0.000	0.421	0.099	0.026	0.168	0.000	1.454	0.108	0.133	0.221	0.000	0.149	0.014	0.008	0.035	
Spring 2000	0.000	0.101	0.008	0.001	0.008	0.000	0.189	0.022	0.007	0.007	0.000	0.393	0.023	0.030	0.029	0.000	0.08	0.005	0.003	0.054	
Summer 2000	0.000	0.140	0.014	0.000	0.000	0.000	0.540	0.059	0.025	0.080	0.000	0.269	0.030	0.013	0.052	0.000	0.11	0.007	0.002	0.065	
Summer 2000	0.001	0.342	0.028	0.000	0.047	0.001	13.761	0.331	0.818	0.362	0.001	0.327	0.037	0.005	0.020	0.001	0.86	0.040	0.095	0.112	
Seasonal Metals Concentrations in Control																					
Date	Cd	Fe	Mn	Pb	Zn	Cd	Fe	Mn	Pb	Zn	Cd	Fe	Mn	Pb	Zn	Cd	Fe	Mn	Pb	Zn	
	Inflow mg/l					Top mg/l					Middle mg/l					End mg/l					Outfl
Summer 1999						0.004	67.521	7.285	0.244	0.848	0.002	41.45	3.094	0.171	0.632	0.002	27.76	2.883	0.197	0.713	
Autumn 1999	0.000	2.553	0.121	0.015	0.018	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.000	0.000	0.000	0.000	0.00	0.000	0.000	0.000	0.000
Autumn 1999	0.000	0.103	0.012	0.000	0.008	0.000	0.077	0.006	0.000	0.009	0.000	0.08	0.003	0.000	0.006	0.000	0.14	0.024	0.000	0.000	
Autumn 1999	0.000	0.136	0.036	0.000	0.038	0.003	25.435	0.743	0.299	0.242	0.001	14.17	0.582	0.109	0.293	0.000	0.38	0.052	0.000	0.047	
Winter 2000	0.000	0.129	0.032	0.000	0.011	0.000	0.514	0.042	0.000	0.026	0.000	5.51	0.233	0.007	0.082	0.001	4.02	0.178	0.012	0.085	
Winter 2000	0.000	0.130	0.016	0.001	0.137	0.000	0.515	0.063	0.007	0.035	0.001	9.02	0.372	0.044	0.183	0.000	0.52	0.061	0.005	0.030	
Spring 2000	0.000	0.118	0.008	0.002	0.000	0.000	0.219	0.014	0.002	0.055	0.000	0.48	0.081	0.001	0.000	0.000	0.16	0.041	0.002	0.000	
Summer 2000	0.000	0.178	0.042	0.000	0.066	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.000	0.000	0.000	0.000	0.00	0.000	0.000	0.000	
Summer 2000	0.001	0.440	0.082	0.000	0.009	0.001	2.794	0.231	0.019	0.031	0.001	4.21	0.211	0.031	0.048	0.008	99.98	1.675	0.509	2.085	

Cd	Fe	Mn	Pb	Zn
ow mg/l				
0.000	0.034	0.004	0.007	0.017
0.000	0.372	0.046	0.005	0.011
0.000	0.077	0.008	0.000	0.007
0.000	0.264	0.054	0.000	0.057
0.000	0.064	0.028	0.000	0.015
0.000	0.103	0.011	0.001	0.163
0.000	0.157	0.018	0.007	0.079
0.000	0.232	0.013	0.013	0.056
0.001	0.210	0.010	0.000	0.008
Cd	Fe	Mn	Pb	Zn
ow mg/l				
0.001	10.00	1.352	0.267	0.075
0.000	0.10	0.003	0.000	0.000
0.000	0.26	0.051	0.000	0.052
0.000	0.15	0.030	0.000	0.013
0.000	0.25	0.041	0.003	0.019
0.000	0.16	0.342	0.002	0.001
0.000	1.07	0.182	0.000	0.065
0.001	0.39	0.042	0.000	0.004

CELL 1

APPENDIX D

**METAL CONCENTRATIONS OF SEDIMENT,
WATER AND PLANT MATRICES IN SUMMER 1999**

TMF Wetland

Cd Concentrations in Soil, Water and Tissues of *Typha latifolia* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Rhizome Conc. mg/kg	Stem Conc. mg/kg
Cd	1	0.586	0.001	2.81	.	0.962
Cd	1	0.586	0.001	0.282	0.2	<0.001
Cd	2	0.13	<0.001	1.26	0.348	0.626
Cd	2	0.13	<0.001	0.58	0.388	0.269
Cd	3	0.527	0.002	0.827	0.797	0.259
Cd	4	0.378	<0.001	4.601	1.197	0.417
Cd	4	0.378	<0.001	0.796	0.139	0.169
Cd	5	0.139	0.001	0.487	0.427	.
Cd	5	0.139	0.001	0.606	0.249	0.235
Cd	5	0.139	0.001	0.488	0.238	0.428
Cd	6	0.388	<0.001	0.856	0.3	1.942
Cd	6	0.388	<0.001	1.049	1.152	0.489
Cd	6	0.388	<0.001	1.705	<0.001	<0.001
Cd	7	0.23	<0.001	0.04	<0.001	<0.001
Cd	7	0.23	<0.001	<0.001	<0.001	<0.001
Cd	7	0.23	<0.001	<0.001	<0.001	<0.001
Cd	8	0.56	<0.001	0.922	0.705	0.556
Cd	8	0.56	<0.001	0.926	0.672	0.385
Cd	8	0.56	<0.001	.	.	1.436
Cd	9	0.635	<0.001	1.55	1.573	1.157
Cd	9	0.635	<0.001	1.681	0.596	0.473
Cd	9	0.635	<0.001	0.544	0.584	0.616
Cd	10	0.994	0.013	1.002	0.8	0.663
Cd	10	0.994	0.013	1.388	0.408	0.436
Cd	10	0.994	0.013	1.395	0.667	0.417
Cd	11	0.298	0.001	0.797	0.881	0.944
Cd	11	0.298	0.001	1.054	0.219	0.574
Cd	11	0.298	0.001	0.687	0.316	0.376
Cd	12	0.361	0.002	0.832	0.306	0.455
Cd	12	0.361	0.002	0.848	0.237	0.505
Cd	12	0.361	0.002	1.075	0.666	0.567
Cd	13	0.596	0.012	0.576	0.597	0.814
Cd	13	0.596	0.012	0.866	0.691	0.461
Cd	13	0.596	0.012	1.263	0.545	0.378
Cd	13	0.596	0.012	0.589	0.298	0.434

TMF Wetland

Cd Concentrations in Soil, Water and Tissues of *Phragmites australis* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Rhizome Conc. mg/kg	Stem Conc. mg/kg
Cd	14	0.695	<0.001	0.782	0.534	0.437
Cd	14	0.695	<0.001	0.751	0.425	0.458
Cd	15	0.398	<0.001	0.604	0.435	0.735
Cd	15	0.398	<0.001	2.669	<0.001	2.274
Cd	15	0.398	<0.001	.	.	0.474
Cd	16	3.007	<0.001	0.934	<0.001	<0.001
Cd	16	3.007	<0.001	0.997	0.207	.
Cd	17	0.596	<0.001	0.04	<0.001	<0.001
Cd	17	0.596	<0.001	0.671	0.494	0.187
Cd	17	0.596	<0.001	0.461	.	<0.001
Cd	18	0.694	<0.001	0.059	0.326	<0.001
Cd	18	0.694	<0.001	0.476	0.01	0.287
Cd	19	0.364	<0.001	0.544	<0.001	0.138
Cd	19	0.364	<0.001	<0.001	<0.001	<0.001
Cd	20	0.267	<0.001	0.242	0.05	<0.001
Cd	20	0.267	<0.001	<0.001	0	<0.001
Cd	20	0.267	<0.001	0.486	0.099	<0.001
Cd	21	0.237	<0.001	0.33	0.08	0.059
Cd	21	0.237	<0.001	0.354	0.039	0.109
Cd	21	0.237	<0.001	<0.001	0.189	0.169
Cd	22	0.198	0.001	0.392	0.379	0.845
Cd	22	0.198	0.001	1.436	0.499	0.294
Cd	23	0.238	<0.001	0.552	0.584	0.169
Cd	23	0.238	<0.001	0.981	0.26	0.442
Cd	23	0.238	<0.001	.	0.217	0.374

TMF Wetland

Cd Concentrations in Soil, Water and Tissues of *Juncus effusus* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Stem Conc. mg/kg
Cd	1	0.586	0.001	.	0.349
Cd	2	0.13	<0.001	.	.
Cd	2	0.13	<0.001	0.825	.
Cd	2	0.13	<0.001	0.498	0.836
Cd	3	0.527	0.002	0.558	0.986
Cd	4	0.378	<0.001	.	0.388
Cd	24	0.348	0.001	0.307	.
Cd	24	0.348	0.001	0.357	0.306
Cd	25	0.578	0.001	0.369	1.426
Cd	26	0.495	<0.001	0.648	0.328
Cd	27	0.25	<0.001	0.355	0.081
Cd	27	0.25	<0.001	0.149	0.208
Cd	28	0.597	<0.001	.	<0.001
Cd	29	0.69	0.002	0.238	0.208
Cd	30	0.1	<0.001	0.148	<0.001

TMF Wetland

Fe Concentrations in Soil, Water and Tissues of *Typha latifolia* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Rhizome Conc. mg/kg	Stem Conc. mg/kg
Fe	1	1422.871	0.998	500.744	.	23.512
Fe	1	1422.871	0.998	203.955	48.961	22.034
Fe	2	937.363	2.898	1457.495	57.962	95.967
Fe	2	937.363	2.898	955.835	146.667	31.437
Fe	3	1078.806	9.021	2703.187	297.669	50.617
Fe	4	1643.51	0.549	.	2521.444	122.54
Fe	4	1643.51	0.549	2884.707	905.649	28.896
Fe	5	536.041	2.202	706.302	89.122	.
Fe	5	536.041	2.202	631.433	47.104	43.57
Fe	5	536.041	2.202	1387.782	277.094	58.197
Fe	6	897.472	0.375	346.376	127.198	31.468
Fe	6	897.472	0.375	1887.635	307.57	67.02
Fe	6	897.472	0.375	1234.411	109.098	60.883
Fe	7	594.044	0.873	413.324	115.262	29.886
Fe	7	594.044	0.873	484.115	63.674	31.54
Fe	7	594.044	0.873	2231.306	346.473	34.776
Fe	8	2484.803	0.714	854.749	165.375	39.035
Fe	8	2484.803	0.714	801.148	113.372	0
Fe	8	2484.803	0.714	.	.	8.301
Fe	9	1312.029	0.656	780.803	118.757	11.843
Fe	9	1312.029	0.656	2443.654	165.01	39.432
Fe	9	1312.029	0.656	1075.599	85.873	26.713
Fe	10	404.037	35.901	1463.683	295.773	56.029
Fe	10	404.037	35.901	2207.474	1316.889	31.095
Fe	10	404.037	35.901	719.928	195.362	36.467
Fe	11	2024.335	6.224	356.744	72.277	40.151
Fe	11	2024.335	6.224	631.312	111.961	72.702
Fe	11	2024.335	6.224	268.526	138.96	49.516
Fe	12	1365.915	8.441	803.366	181.343	38.568
Fe	12	1365.915	8.441	565.932	164.559	58.538
Fe	12	1365.915	8.441	717.612	113.374	38.592
Fe	13	812.922	51.37	816.438	245.469	42.701
Fe	13	812.922	51.37	204.419	74.432	42.586
Fe	13	812.922	51.37	1797.394	121.729	38.331
Fe	13	812.922	51.37	3106.387	370.897	76.529

TMF Wetland

Fe Concentrations in Soil, Water and Tissues of *Phragmites australis* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Rhizome Conc. mg/kg	Stem Conc. mg/kg
Fe	14	3553.525	0.486	2955.032	406.701	77.672
Fe	14	3553.525	0.486	1642.956	682.043	67.656
Fe	15	2028.392	1.074	902.376	148.159	44.38
Fe	15	2028.392	1.074	3928.832	87.849	35.854
Fe	15	2028.392	1.074	.	.	54.853
Fe	16	16650.46	0.386	1862.799	207.59	46.665
Fe	16	16650.46	0.386	1836.888	244.926	.
Fe	17	975.06	0.732	1185.797	71.386	56.721
Fe	17	975.06	0.732	2398.359	25.578	22.947
Fe	17	975.06	0.732	895.303	.	33.207
Fe	18	2546.977	1.551	1547.023	289.188	62.735
Fe	18	2546.977	1.551	589.728	118.187	34.796
Fe	19	737.49	0.876	4923.433	248.36	67.437
Fe	19	737.49	0.876	1584.836	132.894	41.929
Fe	20	2208.539	0.961	1280.291	59.057	37.232
Fe	20	2208.539	0.961	1927.825	470.22	107.579
Fe	20	2208.539	0.961	3094.884	78.078	28.179
Fe	21	1036.089	0.19	1637.33	73.679	43.839
Fe	21	1036.089	0.19	1247.204	254.83	29.406
Fe	21	1036.089	0.19	2202.713	300.895	181.818
Fe	22	462.644	2.219	1079.028	101.357	59.324
Fe	22	462.644	2.219	1239.443	64.945	40.432
Fe	23	2441.299	0.831	1519.807	221.694	53.103
Fe	23	2441.299	0.831	916.394	60.328	30.047
Fe	23	2441.299	0.831	.	86.265	25.394

TMF Wetland

Fe Concentrations in Soil, Water and Tissues of *Juncus effusus* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Stem Conc. mg/kg
Fe	1	1422.871	0.998	.	78.375
Fe	2	937.363	2.898	13049.97	.
Fe	2	937.363	2.898	1443.914	.
Fe	2	937.363	2.898	2750.796	1410.945
Fe	3	1078.806	9.021	711.81	61.952
Fe	4	1643.51	0.549	.	47.794
Fe	24	1505.673	4.843	809.84	.
Fe	24	1505.673	4.843	3804.861	25.079
Fe	25	676.271	2.862	1086.922	23.838
Fe	26	2004.261	0.416	3897.408	32.652
Fe	27	1363.074	1.045	5879.246	67.458
Fe	27	1363.074	1.045	1038.255	26.42
Fe	28	1622.762	1.417	.	32.309
Fe	29	2504.536	5.124	947.661	18.101
Fe	30	633.413	2.922	4358.807	37.401

TMF Wetland

Mn Concentrations in Soil, Water and Tissues of *Typha latifolia* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Rhizome Conc. mg/kg	Stem Conc. mg/kg
Mn	1	60.651	0.218	64.744	.	231.548
Mn	1	60.651	0.218	2.542	27.978	109.172
Mn	2	113.505	0.4	86.887	41.6	187.264
Mn	2	113.505	0.4	71.743	29.95	138.723
Mn	3	93.035	1.42	83.865	163.28	282.22
Mn	4	95.21	0.123	203.992	104.578	154.741
Mn	4	95.21	0.123	166.567	89.693	121.662
Mn	5	11.021	0.481	71.69	42.42	.
Mn	5	11.021	0.481	56.636	29.154	121.083
Mn	5	11.021	0.481	38.469	23.124	114.306
Mn	6	21.999	0.065	34.847	44.165	157.538
Mn	6	21.999	0.065	22.873	46.294	132.641
Mn	6	21.999	0.065	61.212	42.007	244.727
Mn	7	11.293	0.394	44.48	23.71	82.586
Mn	7	11.293	0.394	48.916	22.345	153.451
Mn	7	11.293	0.394	15.354	80.616	249.16
Mn	8	22.096	0.24	50.863	35.658	127.632
Mn	8	22.096	0.24	51.248	32.886	4.049
Mn	8	22.096	0.24	.	.	43.076
Mn	9	46.249	0.178	49.285	35.981	138.431
Mn	9	46.249	0.178	69.988	34.394	99.763
Mn	9	46.249	0.178	89.947	35.912	123.436
Mn	10	71.5	5.989	78.488	19.85	147.298
Mn	10	71.5	5.989	57.692	32.624	111.111
Mn	10	71.5	5.989	52.267	35.231	240.759
Mn	11	168.951	1.127	47.42	52.277	258.895
Mn	11	168.951	1.127	46.421	100.437	491.878
Mn	11	168.951	1.127	52.689	65.823	173.453
Mn	12	85.933	1.507	93.366	55.084	270.075
Mn	12	85.933	1.507	65.19	56.895	271.296
Mn	12	85.933	1.507	53.93	64.09	225.482
Mn	13	85.666	7.326	58.04	58.952	240.318
Mn	13	85.666	7.326	57.325	37.907	175.316
Mn	13	85.666	7.326	85.638	68.795	368.18
Mn	13	85.666	7.326	145.509	61.568	243.984

TMF Wetland

Mn Concentrations in Soil, Water and Tissues of *Phragmites australis* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Rhizome Conc. mg/kg	Stem Conc. mg/kg
Mn	14	100	0.129	265.739	38.842	26.718
Mn	14	100	0.129	85.655	70.13	85.094
Mn	15	24.308	0.154	87.723	52.949	65.131
Mn	15	24.308	0.154	352.646	85.159	71.076
Mn	15	24.308	0.154	.	.	89.148
Mn	16	186.447	0.108	710.997	101.169	70.047
Mn	16	186.447	0.108	658.274	65.419	.
Mn	17	23.45	0.123	255.122	81.57	92.754
Mn	17	23.45	0.123	543.081	72.684	48.257
Mn	17	23.45	0.123	276.119	.	49.513
Mn	18	19.227	0.225	151.321	84.305	79.953
Mn	18	19.227	0.225	71.882	42.95	46.164
Mn	19	37.234	0.1	472.799	40.664	76.619
Mn	19	37.234	0.1	293.36	76.53	76.575
Mn	20	39.138	0.101	243.336	47.127	81.116
Mn	20	39.138	0.101	111.615	61.644	106.693
Mn	20	39.138	0.101	407.297	81.659	66.64
Mn	21	34.507	0.066	591.003	83.948	89.652
Mn	21	34.507	0.066	179.411	122.733	46.04
Mn	21	34.507	0.066	117.817	34.394	68.579
Mn	22	16.845	0.152	162.089	46.607	60.636
Mn	22	16.845	0.152	183.277	80.06	63.788
Mn	23	73.5	0.082	360.071	76.207	87.311
Mn	23	73.5	0.082	60.019	77.607	47.526
Mn	23	73.5	0.082	.	29.644	18.701

TMF Wetland

Mn Concentrations in Soil, Water and Tissues of *Juncus effusus* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Stem Conc. mg/kg
Mn	1	60.651	0.218	.	109.824
Mn	2	113.505	0.4	361.338	.
Mn	2	113.505	0.4	92.88	.
Mn	2	113.505	0.4	50.955	104.279
Mn	3	93.035	1.42	37.343	259.97
Mn	4	95.21	0.123	.	311.506
Mn	24	24.781	0.772	72.857	.
Mn	24	24.781	0.772	62.401	246.64
Mn	25	30.309	0.225	60.108	205.865
Mn	26	68.074	0.155	139.382	267.17
Mn	27	47.405	0.127	68.227	331.265
Mn	27	47.405	0.127	22.456	170.196
Mn	28	36.112	0.162	.	499.802
Mn	29	17.847	0.201	93.081	176.063
Mn	30	25.664	0.119	141.291	170.242

TMF Wetland

Pb Concentrations in Soil, Water and Tissues of *Typha latifolia* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Rhizome Conc. mg/kg	Stem Conc. mg/kg
Pb	1	107.306	0.036	2.397	.	<0.001
Pb	1	107.306	0.036	<0.001	<0.001	<0.001
Pb	2	17.754	0.218	98.418	0.955	2.106
Pb	2	17.754	0.218	61.351	10.448	1.138
Pb	3	16.119	0.942	124.502	12.154	2.387
Pb	4	108.925	0.005	.	197.187	18.187
Pb	4	108.925	0.005	99.462	24.807	6.776
Pb	5	23.828	0.091	113.817	13.71	.
Pb	5	23.828	0.091	50.666	7.433	6.493
Pb	5	23.828	0.091	36.875	<0.001	<0.001
Pb	6	41.907	0.004	9.458	<0.001	<0.001
Pb	6	41.907	0.004	3.795	<0.001	<0.001
Pb	6	41.907	0.004	37.032	0.577	<0.001
Pb	7	36.378	0.017	16.878	<0.001	<0.001
Pb	7	36.378	0.017	19.163	<0.001	<0.001
Pb	7	36.378	0.017	15.354	<0.001	<0.001
Pb	8	101.48	0.021	57.902	12.018	8.939
Pb	8	101.48	0.021	56.383	7.209	<0.001
Pb	8	101.48	0.021	.	.	<0.001
Pb	9	89.718	<0.001	33.784	<0.001	<0.001
Pb	9	89.718	<0.001	157.572	<0.001	<0.001
Pb	9	89.718	<0.001	34.831	<0.001	<0.001
Pb	10	25.159	18.211	89.899	3.753	<0.001
Pb	10	25.159	18.211	143.438	15.019	<0.001
Pb	10	25.159	18.211	25.548	8.061	3.577
Pb	11	42.511	0.279	12.552	4.059	4.87
Pb	11	42.511	0.279	38.072	0	<0.001
Pb	11	42.511	0.279	8.765	0	<0.001
Pb	12	45.356	2.188	32.673	3.258	<0.001
Pb	12	45.356	2.188	25.228	2.074	4.655
Pb	12	45.356	2.188	50.249	7.055	3.979
Pb	13	29.92	8.436	22.262	10.157	7.448
Pb	13	29.92	8.436	7.564	10.76	9.222
Pb	13	29.92	8.436	141.038	9.417	13.929
Pb	13	29.92	8.436	78.543	13.726	3.254

TMF Wetland

Pb Concentrations in Soil, Water and Tissues of *Phragmites australis* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Rhizome Conc. mg/kg	Stem Conc. mg/kg
Pb	14	220.854	0	256.638	35.975	15.594
Pb	14	220.854	0	40.802	15.705	12.156
Pb	15	55.987	0.038	26.634	12.965	14.793
Pb	15	55.987	0.038	113.595	1.195	<0.001
Pb	15	55.987	0.038	.	.	89.247
Pb	16	1011.628	0.027	37.622	<0.001	<0.001
Pb	16	1011.628	0.027	78.693	20.197	.
Pb	17	37.659	0.073	9.35	5.24	1.287
Pb	17	37.659	0.073	17.158	8.789	<0.001
Pb	17	37.659	0.073	21.071	.	0.517
Pb	18	187.413	0.114	17.449	6.128	5.739
Pb	18	187.413	0.114	31.033	7.701	<0.001
Pb	19	54.965	<0.001	42.212	2.486	<0.001
Pb	19	54.965	<0.001	6.343	1.377	<0.001
Pb	20	37.161	<0.001	12.924	<0.001	<0.001
Pb	20	37.161	<0.001	43.088	10.919	<0.001
Pb	20	37.161	<0.001	11.799	<0.001	<0.001
Pb	21	60.312	<0.001	17.54	16.949	<0.001
Pb	21	60.312	<0.001	18.831	16.266	<0.001
Pb	21	60.312	<0.001	25.04	24.95	2.779
Pb	22	11.99	0.025	74.668	68.363	<0.001
Pb	22	11.99	0.025	0.845	0.199	<0.001
Pb	23	54.529	0.034	21.581	21.675	<0.001
Pb	23	54.529	0.034	<0.001	<0.001	<0.001
Pb	23	54.529	0.034	.	<0.001	<0.001

TMF Wetland

Pb Concentrations in Soil, Water and Tissues of *Juncus effusus* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Stem Conc. mg/kg
Pb	1	107.306	0.036	.	0
Pb	2	17.754	0.218	1040.215	.
Pb	2	17.754	0.218	68.914	.
Pb	2	17.754	0.218	112.162	69.552
Pb	3	16.119	0.942	24.497	12.55
Pb	4	108.925	0.005	.	9.34
Pb	24	81.608	0.309	6.335	.
Pb	24	81.608	0.309	25	0
Pb	25	31.306	0.252	27.711	4.089
Pb	26	112.564	0.019	451.645	7.344
Pb	27	89.321	0.084	38.705	4.137
Pb	27	89.321	0.084	22.456	170.196
Pb	28	116.594	0.155	.	4.559
Pb	29	213.666	0.644	62.748	2.671
Pb	30	28.36	0.374	10.664	0

TMF Wetland

Zn Concentrations in Soil, Water and Tissues of *Typha latifolia* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Rhizome Conc. mg/kg	Stem Conc. mg/kg
Zn	1	162.2	0.097	302.479	.	170.635
Zn	1	162.2	0.097	139.124	112.21	50.977
Zn	2	55.556	0.207	314.83	155.255	77.886
Zn	2	55.556	0.207	113.609	97.91	82.435
Zn	3	39.602	1.234	160.458	105.2	33.313
Zn	4	101.968	0.022	.	252.643	43.033
Zn	4	101.968	0.022	141.776	151.14	22.818
Zn	5	23.828	0.207	84.99	60.004	.
Zn	5	23.828	0.207	56.428	24.378	56.059
Zn	5	23.828	0.207	71.856	118.4	32.531
Zn	6	49.472	0.062	44.803	88.429	106.851
Zn	6	49.472	0.062	231.123	194.019	69.916
Zn	6	49.472	0.062	149.275	104.718	18.006
Zn	7	24.885	0.044	62.351	60.47	18.53
Zn	7	24.885	0.044	50.429	52.699	34.803
Zn	7	24.885	0.044	31.705	82.395	28.65
Zn	8	65.987	0.046	82.986	27.91	25.03
Zn	8	65.987	0.046	59.102	46.909	<0.001
Zn	8	65.987	0.046	.	.	31.275
Zn	9	105.101	0.068	28.219	9.634	9.804
Zn	9	105.101	0.068	202.649	80.119	13.703
Zn	9	105.101	0.068	63.725	52.434	14.3
Zn	10	27.247	5.891	113.316	95.003	62.166
Zn	10	27.247	5.891	215.603	78.576	69.123
Zn	10	27.247	5.891	30.658	17.914	1.093
Zn	11	74.295	0.393	18.031	5.149	76.526
Zn	11	74.295	0.393	81.113	135.804	42.294
Zn	11	74.295	0.393	14.243	75.114	61.178
Zn	12	92.155	0.646	54.653	37.907	19.383
Zn	12	92.155	0.646	29.786	27.262	13.471
Zn	12	92.155	0.646	53.333	29.312	11.836
Zn	13	174.553	7.473	79.507	39.534	34.657
Zn	13	174.553	7.473	63.097	87.562	65.913
Zn	13	174.553	7.473	173.264	131.245	54.062
Zn	13	174.553	7.473	117.465	35.807	19.231

TMF Wetland

Zn Concentrations in Soil, Water and Tissues of *Phragmites australis* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Rhizome Conc. mg/kg	Stem Conc. mg/kg
Zn	14	188.679	0.001	222.698	72.544	49.066
Zn	14	188.679	0.001	64.908	55.215	55.002
Zn	15	60.769	0.073	48.416	42.854	41.104
Zn	15	60.769	0.073	182.254	28.685	47.944
Zn	15	60.769	0.073	.	.	89.247
Zn	16	1192.161	0.052	267.035	45.68	10.556
Zn	16	1192.161	0.052	150.178	60.887	.
Zn	17	70.35	0.084	104.138	65.256	33.063
Zn	17	70.35	0.084	113.764	30.417	47.469
Zn	17	70.35	0.084	68.92	.	40.465
Zn	18	169.177	0.152	62.401	44.376	89.551
Zn	18	169.177	0.152	51.953	34.064	39.64
Zn	19	137.214	0.017	116.26	41.261	35.15
Zn	19	137.214	0.017	58.176	43.085	40.453
Zn	20	118.897	0.022	97.435	52.098	41.501
Zn	20	118.897	0.022	87.162	101.052	49.114
Zn	20	118.897	0.022	127.603	42.272	35.495
Zn	21	126.656	<0.001	79.653	41.476	55.49
Zn	21	126.656	<0.001	113.216	41.207	81.98
Zn	21	126.656	<0.001	67.837	58.549	61.433
Zn	22	57.57	0.197	119.686	60.479	69.583
Zn	22	57.57	0.197	100.507	72.582	43.572
Zn	23	111.542	0.038	66.713	55.523	54.992
Zn	23	111.542	0.038	42.971	54.834	56.068
Zn	23	111.542	0.038	.	<0.001	19.685

TMF Wetland

Zn Concentrations in Soil, Water and Tissues of *Juncus effusus* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Stem Conc. mg/kg
Zn	1	162.2	0.097	.	137.081
Zn	2	55.556	0.207	1154.688	.
Zn	2	55.556	0.207	200.378	.
Zn	2	55.556	0.207	205.016	140.697
Zn	3	39.602	1.234	36.985	54.582
Zn	4	101.968	0.022	.	132.75
Zn	24	156.648	0.325	47.416	.
Zn	24	156.648	0.325	58.929	46.344
Zn	25	248.953	0.209	50.738	62.138
Zn	26	170.333	0.013	197.906	69.274
Zn	27	189.122	0.048	68.523	35.798
Zn	27	189.122	0.048	37.858	55.413
Zn	28	366.096	0.115	.	106.541
Zn	29	283.179	0.41	68.695	46.291
Zn	30	368.584	0.232	44.333	18.385

Control Wetland

Cd Concentrations in Soil, Water and Tissues of *Typha latifolia* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Rhizome Conc. mg/kg	Stem Conc. mg/kg
Cd	31	0.397	0.003	0.595	0.109	0.409
Cd	31	0.397	0.003	1.083	0	0.803
Cd	31	0.397	0.003	.	2.393	0.486
Cd	32	0.395	0.001	0.691	0.305	0.407
Cd	34	0.398	0.005	.	0.694	0.632
Cd	34	0.398	0.005	1.887	0.718	0.317
Cd	34	0.398	0.005	1.975	0.645	0.375
Cd	35	0.297	0.001	.	0.703	0.812
Cd	35	0.297	0.001	1.748	0.464	0.489
Cd	35	0.297	0.001	1.023	0.367	0.159
Cd	36	0	0.001	.	0.228	<0.001
Cd	36	0	0.001	0.775	0.359	0.3
Cd	36	0	0.001	0.617	0.316	0.443
Cd	37	0.348	0.002	.	0.316	0.877
Cd	37	0.348	0.002	1.501	0.366	0.563
Cd	37	0.348	0.002	1.259	0.459	0.404
Cd	38	0.653	0.003	1.082	0.529	0.979
Cd	38	0.653	0.003	.	1.355	0.708
Cd	38	0.653	0.003	2.209	1.224	0.611
Cd	39	0.417	0.002	3.794	2.995	0.796
Cd	39	0.417	0.002	1.08	0.926	0.819
Cd	39	0.417	0.002	10.972	0.465	0.129
Cd	40	0.447	0.001	1.142	0.397	0.2
Cd	40	0.447	0.001	0.518	<0.001	<0.001
Cd	40	0.447	0.001	0.274	0.01	<0.001
Cd	41	0.561	0.006	1.078	0.316	4.326
Cd	41	0.561	0.006	.	5.316	0.07
Cd	41	0.561	0.006	.	1.396	0.698
Cd	42	0.438	0.005	1.914	0.325	0.47
Cd	42	0.438	0.005	0.965	1.074	0.099
Cd	42	0.438	0.005	0.684	0.268	1.921
Cd	43	0.467	0.013	1.159	0.168	0.208
Cd	43	0.467	0.013	1.479	0.181	.
Cd	43	0.467	0.013	1.978	<0.001	0.693
Cd	46	0.496	0.001	0.987	0.322	0.256
Cd	46	0.496	0.001	.	0.07	<0.001
Cd	47	0.593	0.001	0.646	0.079	<0.001
Cd	47	0.593	0.001	0.428	0.147	<0.001

Control Wetland

Cd Concentrations in Soil, Water and Tissues of *Phragmites australis* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Rhizome Conc. mg/kg	Stem Conc. mg/kg
Cd	44	0.367	0.002	.	.	<0.001
Cd	44	0.367	0.002	0.933	<0.001	0.04
Cd	44	0.367	0.002	.	.	<0.001
Cd	45	0.319	0.002	<0.001	<0.001	0.445
Cd	45	0.319	0.002	0.476	<0.001	<0.001
Cd	46	0.496	0.001	.	<0.001	<0.001
Cd	47	0.593	0.001	0.129	<0.001	0.03
Cd	48	0.198	0.002	0.375	<0.001	<0.001
Cd	48	0.198	0.002	0.548	0.239	0.428
Cd	48	0.198	0.002	1.117	0.03	<0.001
Cd	49	0.397	0.004	.	3.994	0.206
Cd	49	0.397	0.004	0.409	<0.001	0.56
Cd	49	0.397	0.004	0.547	0.988	0.129
Cd	50	0.495	0.002	0.9	0.258	<0.001
Cd	50	0.495	0.002	0.573	0.079	<0.001
Cd	50	0.495	0.002	0.685	0.03	0.1
Cd	51	0.595	0.004	1.039	<0.001	<0.001
Cd	51	0.595	0.004	0.179	0.159	0.099
Cd	51	0.595	0.004	8.758	0.428	0.926
Cd	52	.	0.002	<0.001	<0.001	<0.001
Cd	52	.	0.002	<0.001	<0.001	<0.001
Cd	52	.	0.002	<0.001	<0.001	<0.001

Control Wetland

Cd Concentrations in Soil, Water and Tissues of *Juncus effusus* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Stem Conc. mg/kg
Cd	32	0.395	0.001	3.867	0.487
Cd	33	0.695	<0.001	.	0.966
Cd	53	.	.	1.736	0.79
Cd	54	.	.	0.634	0.388
Cd	55	.	0.002	1.375	1.271

Control Wetland
Fe Concentrations in Soil, Water and Tissues of *Typha latifolia* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Rhizome Conc. mg/kg	Stem Conc. mg/kg
Fe	31	9824.941	32.969	5120.022	1148.822	147.476
Fe	31	9824.941	32.969	4357.956	55.863	714.64
Fe	31	9824.941	32.969	.	80.658	1084.127
Fe	32	10630.59	11.187	10862.58	535.918	48.512
Fe	34	7038.706	57.927	.	331.814	65.896
Fe	34	7038.706	57.927	9214.52	1122.01	107.639
Fe	34	7038.706	57.927	7407.058	1411.175	594.533
Fe	35	8024.55	69.269	.	1132.204	191.858
Fe	35	8024.55	69.269	7070.556	1797.297	455.416
Fe	35	8024.55	69.269	4532.181	1954.032	103.785
Fe	36	8804.594	35.652	.	613.262	0
Fe	36	8804.594	35.652	4968.61	3634.316	246.753
Fe	36	8804.594	35.652	6583.88	1280.935	102.067
Fe	37	7018.371	47.119	.	674.106	73.878
Fe	37	7018.371	47.119	9468.876	2171.745	149.21
Fe	37	7018.371	47.119	5688.02	2295.115	185.481
Fe	38	4570.17	69.522	9590.689	3079.11	318.002
Fe	38	4570.17	69.522	.	1263.647	126.082
Fe	38	4570.17	69.522	5927.807	549.269	146.224
Fe	39	5831.877	26.74	5101.414	2717.109	98.468
Fe	39	5831.877	26.74	15118.86	5408.652	1072.485
Fe	39	5831.877	26.74	8587.32	842.6	160.566
Fe	40	6907.963	20.227	3913.605	1245.778	114.716
Fe	40	6907.963	20.227	4853.058	1290.839	86.121
Fe	40	6907.963	20.227	2137.143	1527.602	101.932
Fe	41	8023.247	74.389	5335.184	767.642	105.539
Fe	41	8023.247	74.389	.	1184.68	103.05
Fe	41	8023.247	74.389	5414.819	852.999	131.757
Fe	42	4976.821	37.97	5394.077	491.626	74.1
Fe	42	4976.821	37.97	9090.144	4693.241	134.269
Fe	42	4976.821	37.97	7231.251	5107.058	253.486
Fe	43	4654.771	289.727	6515.368	1203.703	75.833
Fe	43	4654.771	289.727	8146.642	901.633	.
Fe	43	4654.771	289.727	8564.491	3663.465	170.43
Fe	46	9301.033	8.943	2985.943	789.774	64.555
Fe	46	9301.033	8.943	.	1480.634	80.708
Fe	47	9905.731	18.841	5875.492	559.045	72.779
Fe	47	9905.731	18.841	17422.52	2284.557	255.705

Control Wetland

Fe Concentrations in Soil, Water and Tissues of *Phragmites australis* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Rhizome Conc. mg/kg	Stem Conc. mg/kg
Fe	44	7529.954	142.379	.	.	119.978
Fe	44	7529.954	142.379	58.744	2436.169	227.633
Fe	44	7529.954	142.379	.	.	9625.455
Fe	45	7196.098	23.422	5273.615	1454.139	53.225
Fe	45	7196.098	23.422	12255.95	888.834	126.774
Fe	46	9301.033	8.943	.	0	62.709
Fe	47	9905.731	18.841	9666.551	609.207	54.801
Fe	48	11298.2	24.998	9956.067	560.68	182.414
Fe	48	11298.2	24.998	8270.513	3149.452	591.961
Fe	48	11298.2	24.998	5455.074	1385.817	351.827
Fe	49	10139.41	19.71	.	3594.149	465.448
Fe	49	10139.41	19.71	18880.83	2964.371	278.99
Fe	49	10139.41	19.71	7682.063	2597.055	196.18
Fe	50	8905.05	32.089	14668.77	5124.529	326.126
Fe	50	8905.05	32.089	14467.88	4093.934	1099.741
Fe	50	8905.05	32.089	9537.616	3777.268	387.877
Fe	51	10226.44	37.097	3294.243	3116.367	133.862
Fe	51	10226.44	37.097	9043.262	4762.634	276.04
Fe	51	10226.44	37.097	14451.44	1659.326	204.167
Fe	52	.	22.85	27257.83	2300.61	113.054
Fe	52	.	22.85	13099.17	2398.703	162.308
Fe	52	.	22.85	3284.98	2611.457	94.909

Control Wetland

Fe Concentrations in Soil, Water and Tissues of *Juncus effusus* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Stem Conc. mg/kg
Fe	32	10630.59	11.187	30921.49	122.542
Fe	33	9414.266	6.988	.	67.6
Fe	53	.	.	18264.71	335.878
Fe	54	.	.	2712.46	125.308
Fe	55	.	27.764	3628.684	109.413

Control Wetland

Mn Concentrations in Soil, Water and Tissues of *Typha latifolia* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Rhizome Conc. mg/kg	Stem Conc. mg/kg
Mn	31	127.676	0.29	136.615	104.789	413.291
Mn	31	127.676	0.29	103.582	1158.988	149.573
Mn	31	127.676	0.29	.	389.831	178.671
Mn	32	103.895	0.31	162.061	204.684	857.44
Mn	34	77.91	2.966	.	131.318	257.36
Mn	34	77.91	2.966	130.64	64.793	253.571
Mn	34	77.91	2.966	193	164.649	903.296
Mn	35	68.006	4.378	.	90.612	318.938
Mn	35	68.006	4.378	187.447	170.152	509.376
Mn	35	68.006	4.378	147.894	161.383	739.741
Mn	36	17.005	0.881	.	124.777	0
Mn	36	17.005	0.881	56.36	371.463	733.167
Mn	36	17.005	0.881	139.013	248.569	456.89
Mn	37	20.457	2.052	.	177.661	374.177
Mn	37	20.457	2.052	129.44	120.103	330.641
Mn	37	20.457	2.052	198.584	131.904	1397.853
Mn	38	21.477	3.781	346.049	157.622	769.041
Mn	38	21.477	3.781	.	132.516	316.483
Mn	38	21.477	3.781	167.323	174.566	523.861
Mn	39	38.232	1.693	75.198	159.014	411.279
Mn	39	38.232	1.693	129.754	162.199	1072.485
Mn	39	38.232	1.693	89.977	164.127	429.264
Mn	40	56.791	1.084	332.473	299.324	842.951
Mn	40	56.791	1.084	145.248	165.225	346.177
Mn	40	56.791	1.084	51.657	151.959	341.833
Mn	41	69.346	5.462	203.516	150.623	359.885
Mn	41	69.346	5.462	.	240.879	493.223
Mn	41	69.346	5.462	230.498	172.54	295.731
Mn	42	26.562	1.102	125.711	141.773	290.935
Mn	42	26.562	1.102	291.477	198.807	368.598
Mn	42	26.562	1.102	147.002	133.797	523.47
Mn	43	36.978	58.766	170.936	258.937	798.929
Mn	43	36.978	58.766	230.992	162.976	.
Mn	43	36.978	58.766	66.35	79.851	317.835
Mn	46	76.946	0.147	186.338	283.718	609.184
Mn	46	76.946	0.147	.	348.302	976.032
Mn	47	90.02	0.144	645.025	215.624	501.13
Mn	47	90.02	0.144	331.857	164.954	570.239

Control Wetland

Mn Concentrations in Soil, Water and Tissues of *Phragmites australis* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Rhizome Conc. mg/kg	Stem Conc. mg/kg
Mn	44	64.868	5.815	.	.	120.824
Mn	44	64.868	5.815	74.137	39.489	161.367
Mn	44	64.868	5.815	.	.	66.425
Mn	45	43.102	1.32	1617.278	401.647	107.37
Mn	45	43.102	1.32	870.125	277.074	172.121
Mn	46	76.946	0.147	.	<0.001	113.93
Mn	47	90.02	0.144	3821.365	298.567	154.073
Mn	48	19.557	0.131	1862.47	159.387	83.333
Mn	48	19.557	0.131	1484.862	361.894	301.235
Mn	48	19.557	0.131	325.841	290.77	253.565
Mn	49	62.599	5.214	.	269.379	205.601
Mn	49	62.599	5.214	2229.439	297.545	188.129
Mn	49	62.599	5.214	705.893	348.132	241.186
Mn	50	163.861	2.446	1227.498	401.15	241.427
Mn	50	163.861	2.446	646.669	367.099	200.278
Mn	50	163.861	2.446	627.844	417.747	366.194
Mn	51	89.466	6.145	550.373	373.244	257.579
Mn	51	89.466	6.145	638.646	433.546	392.97
Mn	51	89.466	6.145	3659.036	452.471	214.483
Mn	52	.	1.963	2057.932	277.297	184.184
Mn	52	.	1.963	1747.489	318.862	197.363
Mn	52	.	1.963	1934.019	325.966	197.94

Control Wetland

Mn Concentrations in Soil, Water and Tissues of *Juncus effusus* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Stem Conc. mg/kg
Mn	32	103.895	0.31	341.609	230.487
Mn	33	108.981	0.287	.	184.076
Mn	53	.	.	191.048	487.399
Mn	54	.	.	90.234	125.308
Mn	55	.	2.883	331.631	295.289

**Control Wetland
Pb Concentrations in Soil, Water and Tissues of *Typha latifolia* in Summer 1999**

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Rhizome Conc. mg/kg	Stem Conc. mg/kg
Pb	31	95.163	0.473	71.35	7.124	3.792
Pb	31	95.163	0.473	42.349	4.647	19.143
Pb	31	95.163	0.473	.	12.263	24.107
Pb	32	138.395	0.09	33.794	15.45	15.476
Pb	34	49.552	0.453	.	2.279	0.889
Pb	34	49.552	0.453	41.632	9.171	2.183
Pb	34	49.552	0.453	12.634	2.977	<0.001
Pb	35	29.499	0.241	.	10.992	3.764
Pb	35	29.499	0.241	39.806	6.51	<0.001
Pb	35	29.499	0.241	77.275	11.096	<0.001
Pb	36	43.954	0.106	.	<0.001	<0.001
Pb	36	43.954	0.106	24.969	17.736	2.198
Pb	36	43.954	0.106	40.824	8.092	3.642
Pb	37	54.419	0.123	.	6.913	2.393
Pb	37	54.419	0.123	90.26	12.366	6.444
Pb	37	54.419	0.123	14.273	6.181	8.176
Pb	38	43.844	0.242	32.051	10.176	1.019
Pb	38	43.844	0.242	.	11.076	3.442
Pb	38	43.844	0.242	51.506	6.813	2.564
Pb	39	21.648	0.152	31.563	10.082	<0.001
Pb	39	21.648	0.152	39.223	13.993	<0.001
Pb	39	21.648	0.152	50.683	2.572	2.374
Pb	40	24.523	0.05	18.57	7.65	1.597
Pb	40	24.523	0.05	27.695	9.338	4.679
Pb	40	24.523	0.05	10.514	8.409	0.697
Pb	41	9.752	0.314	16.874	<0.001	<0.001
Pb	41	9.752	0.314	.	5.071	<0.001
Pb	41	9.752	0.314	49.7	4.207	<0.001
Pb	42	33.526	0.182	25.091	<0.001	<0.001
Pb	42	33.526	0.182	22.273	14.115	<0.001
Pb	42	33.526	0.182	26.027	24.95	<0.001
Pb	43	52.485	0.404	31.815	7.407	<0.001
Pb	43	52.485	0.404	22.489	3.267	.
Pb	43	52.485	0.404	48.863	42.376	4.456
Pb	46	94.122	0.06	26.719	10.537	4.484
Pb	46	94.122	0.06	.	19.366	2.641
Pb	47	57.312	0.139	16.329	<0.001	<0.001
Pb	47	57.312	0.139	65.797	1.321	<0.001

Control Wetland

Pb Concentrations in Soil, Water and Tissues of *Phragmites australis* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Rhizome Conc. mg/kg	Stem Conc. mg/kg
Pb	44	73.101	0.215	.	.	3.882
Pb	44	73.101	0.215	4.555	6.173	4.124
Pb	44	73.101	0.215	.	.	18.891
Pb	45	71.969	0.182	12.156	6.888	0.099
Pb	45	71.969	0.182	59.849	5.84	3.647
Pb	46	94.122	0.06	.	<0.001	3.268
Pb	47	57.312	0.139	31.729	3.445	<0.001
Pb	48	31.312	0.131	48.397	<0.001	<0.001
Pb	48	31.312	0.131	37.516	21.535	1.863
Pb	48	31.312	0.131	19.515	93.595	0.228
Pb	49	118.839	0.165	.	28.944	4.904
Pb	49	118.839	0.165	46.133	11.976	1.867
Pb	49	118.839	0.165	31.953	14.526	<0.001
Pb	50	38.614	0.117	50.855	20.107	5.423
Pb	50	38.614	0.117	40.225	20.22	17.104
Pb	50	38.614	0.117	27.146	10.668	1.467
Pb	51	62.488	0.267	21.588	17.316	2.863
Pb	51	62.488	0.267	25.05	21.23	3.713
Pb	51	62.488	0.267	89.178	13.202	2.611
Pb	52	.	0.171	51.075	17.706	2.046
Pb	52	.	0.171	30.431	15.968	2.834
Pb	52	.	0.171	27.354	28.84	3.101

Control Wetland

Pb Concentrations in Soil, Water and Tissues of *Juncus effusus* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Stem Conc. mg/kg
Pb	32	138.395	0.09	800.491	14.399
Pb	33	129.545	0.083	.	6.208
Pb	53	.	.	45.051	3.94
Pb	54	.	.	22.514	2.454
Pb	55	.	0.197	21.356	1.36

**Control Wetland
Zn Concentrations in Soil, Water and Tissues of *Typha latifolia* in Summer 1999**

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Rhizome Conc. mg/kg	Stem Conc. mg/kg
Zn	31	80.789	0.291	44.524	31.565	22.85
Zn	31	80.789	0.291	33.602	56.654	28.665
Zn	31	80.789	0.291	.	28.814	59.425
Zn	32	478.45	0.198	103.249	55.501	69.048
Zn	34	77.214	1.319	.	64.321	12.942
Zn	34	77.214	1.319	39.582	32.297	14.782
Zn	34	77.214	1.319	22.8	51.806	15.098
Zn	35	135.815	0.372	.	36.839	20.503
Zn	35	135.815	0.372	64.238	76.84	13.266
Zn	35	135.815	0.372	62.078	55.28	30.578
Zn	36	60.362	0.225	.	73.059	<0.001
Zn	36	60.362	0.225	37.709	39.159	11.588
Zn	36	60.362	0.225	70.491	31.873	15.65
Zn	37	81.728	0.464	.	53.723	19.342
Zn	37	81.728	0.464	136.58	130.787	37.303
Zn	37	81.728	0.464	32.367	13.26	20.095
Zn	38	53.246	0.44	52.018	35.215	22.255
Zn	38	53.246	0.44	.	49.644	43.765
Zn	38	53.246	0.44	78.807	107.919	<0.001
Zn	39	26.316	0.602	0.517	28.149	<0.001
Zn	39	26.316	0.602	30.903	24.734	<0.001
Zn	39	26.316	0.602	27.904	41.551	0.396
Zn	40	54.011	0.312	97.815	158.554	21.066
Zn	40	54.011	0.312	75.692	82.367	24.393
Zn	40	54.011	0.312	48	92.501	15.538
Zn	41	36.939	1.793	42.347	49.022	25.756
Zn	41	36.939	1.793	.	137.603	23.121
Zn	41	36.939	1.793	.	72.263	26.132
Zn	42	67.947	1.436	142.447	82.66	39.714
Zn	42	67.947	1.436	76.114	73.161	22.049
Zn	42	67.947	1.436	55.716	64.215	59.121
Zn	43	78.529	2.289	51.227	53.822	14.968
Zn	43	78.529	2.289	42.206	40.563	.
Zn	43	78.529	2.289	81.108	62.772	48.623
Zn	46	63.94	0.209	59.596	113.909	27
Zn	46	63.94	0.209	.	75.639	18.558
Zn	47	69.269	0.251	164.418	66.976	10.515
Zn	47	69.269	0.251	92.564	48.923	27.648

Control Wetland

Zn Concentrations in Soil, Water and Tissues of *Phragmites australis* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Rhizome Conc. mg/kg	Stem Conc. mg/kg
Zn	44	74.092	1.128	.	.	23.094
Zn	44	74.092	1.128	21.139	25.728	27.524
Zn	44	74.092	1.128	.	.	82.567
Zn	45	79.435	0.363	88.681	74.534	34.626
Zn	45	79.435	0.363	89.972	48.307	33.024
Zn	46	63.94	0.209	.	0	25.3
Zn	47	69.269	0.251	211.259	85.984	27.491
Zn	48	32.892	0.308	102.78	31.256	20.883
Zn	48	32.892	0.308	142.606	62.114	54.891
Zn	48	32.892	0.308	120.458	47.145	28.103
Zn	49	54.849	0.743	.	48.023	54.049
Zn	49	54.849	0.743	165.61	67.864	25.55
Zn	49	54.849	0.743	74.955	53.656	31.834
Zn	50	55.545	0.592	259.383	94.646	29.635
Zn	50	55.545	0.592	88.753	92.854	62.053
Zn	50	55.545	0.592	84.023	82.154	39.214
Zn	51	44.832	1.032	87.42	73.224	28.532
Zn	51	44.832	1.032	79.047	68.345	39.208
Zn	51	44.832	1.032	143.774	76.923	24.729
Zn	52	.	0.433	186.182	90.203	58.613
Zn	52	.	0.433	119.116	95.11	32.664
Zn	52	.	0.433	120.027	57.879	43.909

Control Wetland

Zn Concentrations in Soil, Water and Tissues of *Juncus effusus* in Summer 1999

	Quadrat	Soil Conc. mg/kg	Water Conc. mg/l	Root Conc. mg/kg	Stem Conc. mg/kg
Zn	32	478.45	0.198	543.867	85.005
Zn	33	82.456	0.077	.	67.6
Zn	53	.	.	92.996	82.797
Zn	54	.	.	46.543	60.99
Zn	55	.	0.713	166.68	48.6

APPENDIX E

WATER AND SEDIMENT METAL CONCENTRATIONS (TOTAL METALS, POTENTIALLY BIOAVAILABLE AND FREE-METAL-ION SPECIES) IN THE PILOT PLANT WETLANDS AND SILVERMINES WETLAND IN 2000

Wetland	Region	Metal	Water Conc. (ppm)	Total Metals (mg/kg)	Sum of Exts. (mg/kg)	Pot. Bio. (mol/g)	[Mz+] (mol/L)
TMF Wet.	<i>Typha</i>	Cd	<0.001	0	0.245	6.67E-10	2.42E-13
TMF Wet.	<i>Typha</i>	Cd	<0.001	0.145	0.08	4E-10	1.16E-13
TMF Wet.	<i>Typha</i>	Cd	<0.001	0	0.025	0	0
TMF Wet.	<i>Typha</i>	Cd	<0.001	0.469	0.646	4E-10	4.14E-13
TMF Wet.	<i>Typha</i>	Cd	<0.001	1.857	2.211	8.39E-09	5.69E-12
TMF Wet.	<i>Typha</i>	Cd	<0.001	0.01	0.759	2.94E-09	1.06E-12
TMF Wet.	<i>Typha</i>	Cd	<0.001	0.863	1.548	1.84E-09	5.34E-13
TMF Wet.	<i>Typha</i>	Cd	<0.001	0.049	1.937	1.82E-09	1.85E-12
TMF Wet.	<i>Typha</i>	Cd	<0.001	0.534	0.708	1.79E-09	1.85E-12
TMF Wet.	<i>Typha</i>	Cd	<0.001	1.535	1.908	5.03E-09	3.41E-12
TMF Wet.	<i>Phrag.</i>	Cd	<0.001	0	0.189	0	0
TMF Wet.	<i>Phrag.</i>	Cd	<0.001	0.484	0.23	1.78E-10	2.68E-13
TMF Wet.	<i>Phrag.</i>	Cd	<0.001	0.308	1.163	4.8E-09	8.7E-12
TMF Wet.	<i>Phrag.</i>	Cd	<0.001	4.577	0.675	3.69E-09	4.38E-12
TMF Wet.	<i>Phrag.</i>	Cd	<0.001	0.319	0.655	4.11E-09	4.07E-12
TMF Wet.	<i>Phrag.</i>	Cd	<0.001	0.12	0.428	1.45E-09	1E-12
TMF Wet.	<i>Phrag.</i>	Cd	<0.001	0.413	0.597	2.48E-09	3.75E-12
TMF Wet.	<i>Phrag.</i>	Cd	<0.001	0.685	0.932	6.43E-09	1.16E-11
TMF Wet.	<i>Phrag.</i>	Cd	<0.001	0.554	0.438	3.46E-09	4.1E-12
TMF Wet.	<i>Phrag.</i>	Cd	<0.001	0.319	20.992	5.54E-09	5.49E-12
TMF Wet.	<i>Juncus</i>	Cd	<0.001	0.96	1.43	5.87E-09	8.69E-12
TMF Wet.	<i>Juncus</i>	Cd	<0.001	1.657	1.567	6.33E-09	6E-12
TMF Wet.	<i>Juncus</i>	Cd	<0.001	2.47	4.4	1.83E-08	2.12E-11
TMF Wet.	<i>Juncus</i>	Cd	<0.001	0.21	2.134	4.28E-09	8.28E-12
TMF Wet.	<i>Juncus</i>	Cd	<0.001	0	0.692	4.85E-09	8.98E-12
TMF Wet.	<i>Juncus</i>	Cd	<0.001	0.96	1.13	6.55E-09	9.7E-12
TMF Wet.	<i>Juncus</i>	Cd	<0.001	1.657	0.993	5.11E-09	4.84E-12
TMF Wet.	<i>Juncus</i>	Cd	<0.001	2.47	3.036	1.02E-08	1.18E-11
TMF Wet.	<i>Juncus</i>	Cd	<0.001	0.21	0.447	3.67E-09	7.09E-12
TMF Wet.	<i>Juncus</i>	Cd	<0.001	0.205	0.518	3.67E-09	6.8E-12
Control	<i>Phrag.</i>	Cd	0.001	0.532	0.256	2.8E-09	5.96E-11
Control	<i>Phrag.</i>	Cd	0.001	0.638	0.342	2.42E-09	5.14E-11
Control	<i>Phrag.</i>	Cd	0.001	0.268	0.151	1.89E-09	4.03E-11
Control	<i>Phrag.</i>	Cd	0.001	1.309	1.007	3.14E-09	6.69E-11
Control	<i>Phrag.</i>	Cd	0.001	0.435	0.58	4.2E-09	8.92E-11
Control	<i>Phrag.</i>	Cd	0.001	0.396	1.348	1.07E-08	2.27E-10
Control	<i>Phrag.</i>	Cd	0.001	0	1.238	7.48E-09	1.59E-10
Control	<i>Phrag.</i>	Cd	0.001	0.368	0.987	7.67E-09	1.63E-10
Control	<i>Phrag.</i>	Cd	0.001	0.354	1.164	9.06E-09	1.93E-10
Control	<i>Phrag.</i>	Cd	0.001	0.576	1.04	7.4E-09	1.57E-10
Silvermines		Cd	0.027	54.897	55.69	4.3E-07	0.000577
Silvermines		Cd	0.001	7.93	7.623	5.92E-08	1.86E-05
Silvermines		Cd	0.001	11.098	13.947	1.17E-07	3.57E-05
Silvermines		Cd	0.061	24.059	32.24	2.45E-07	6.77E-05
Silvermines		Cd	0.061	30.255	35.382	3.06E-07	9.78E-05
Silvermines		Cd	0.061	5.559	4.704	3.04E-08	1.44E-05
Silvermines		Cd	0.061	14.685	7.37	4.5E-08	2.03E-05
Silvermines		Cd	0.027	68.643	38.982	2.5E-07	0.000367
Silvermines		Cd	0.001	9.246	7.109	5.79E-08	2.63E-05
Silvermines		Cd	0.001	10.241	11.838	1.02E-07	4.3E-05
Silvermines		Cd	0.061	25.626	22.81	1.98E-07	8.77E-05
Silvermines		Cd	0.061	28.279	30.903	2.3E-07	0.000105
Silvermines		Cd	0.061	5.005	4.149	2.72E-08	1.35E-05
Silvermines		Cd	0.061	14.871	2.791	1.83E-08	7.87E-06

Wetland	Region	Metal	Water Conc. (ppm)	Total Metals (mg/kg)	Sum of Exts. (mg/kg)	Pot. Bio. (mol/g)	[Mz+] (mol/L)
TMF Wet.	<i>Typha</i>	Fe	0.54	630.34	786.027	6.85E-06	4.73E-06
TMF Wet.	<i>Typha</i>	Fe	0.54	1246.015	1223.388	6.75E-06	5.05E-06
TMF Wet.	<i>Typha</i>	Fe	0.54	1016.099	409.8	3.4E-06	2.6E-06
TMF Wet.	<i>Typha</i>	Fe	0.54	3067.737	1164.523	9.71E-06	7.41E-06
TMF Wet.	<i>Typha</i>	Fe	0.54	7310.042	8784.677	3.56E-05	2.66E-05
TMF Wet.	<i>Typha</i>	Fe	0.54	2107.464	1608.022	1.19E-05	9.03E-06
TMF Wet.	<i>Typha</i>	Fe	0.54	2725.442	1383.49	7.16E-06	5.57E-06
TMF Wet.	<i>Typha</i>	Fe	0.54	909.621	514.702	3.17E-06	2.4E-06
TMF Wet.	<i>Typha</i>	Fe	0.54	2547.577	1342.894	9.01E-06	7.28E-06
TMF Wet.	<i>Typha</i>	Fe	0.54	7269.513	7368.263	3.27E-05	2.67E-05
TMF Wet.	<i>Phrag.</i>	Fe	0.269	2843.267	1664.311	1.44E-05	9.46E-06
TMF Wet.	<i>Phrag.</i>	Fe	0.269	3319.173	378.978	5.19E-06	3.38E-06
TMF Wet.	<i>Phrag.</i>	Fe	0.269	2118.337	3857.067	8.72E-06	6.55E-06
TMF Wet.	<i>Phrag.</i>	Fe	0.269	2924.016	1017.974	6.89E-06	4.98E-06
TMF Wet.	<i>Phrag.</i>	Fe	0.269	1178.067	274.076	2.02E-06	1.58E-06
TMF Wet.	<i>Phrag.</i>	Fe	0.269	3199.6	1664.647	1.38E-05	1.08E-05
TMF Wet.	<i>Phrag.</i>	Fe	0.269	1775.177	1152.373	4.84E-06	3.79E-06
TMF Wet.	<i>Phrag.</i>	Fe	0.269	3133.294	3217.306	1.17E-05	7.73E-06
TMF Wet.	<i>Phrag.</i>	Fe	0.269	2970.495	1534.973	8.35E-06	5.85E-06
TMF Wet.	<i>Phrag.</i>	Fe	0.269	1178.067	1254.53	6.07E-06	4.59E-06
TMF Wet.	<i>Juncus</i>	Fe	0.109	5711.583	5587.361	1.32E-05	9.12E-06
TMF Wet.	<i>Juncus</i>	Fe	0.109	9412.478	5367.12	1.66E-05	1.24E-05
TMF Wet.	<i>Juncus</i>	Fe	0.109	12618.73	15463.12	2.98E-05	2.04E-05
TMF Wet.	<i>Juncus</i>	Fe	0.109	656.355	375.776	2.23E-06	1.73E-06
TMF Wet.	<i>Juncus</i>	Fe	0.109	1080.745	702.46	4.3E-06	3.32E-06
TMF Wet.	<i>Juncus</i>	Fe	0.109	5711.583	4458.088	1.59E-05	1.2E-05
TMF Wet.	<i>Juncus</i>	Fe	0.109	9408.754	4696.092	1.92E-05	1.47E-05
TMF Wet.	<i>Juncus</i>	Fe	0.109	12618.73	13616.1	2.85E-05	2.14E-05
TMF Wet.	<i>Juncus</i>	Fe	0.109	656.355	471.7	3.26E-06	2.63E-06
TMF Wet.	<i>Juncus</i>	Fe	0.109	1122.759	799.636	6.2E-06	4.95E-06
Control	<i>Phrag.</i>	Fe	5.89	11321.53	7652.083	5.81E-05	5.81E-05
Control	<i>Phrag.</i>	Fe	5.89	11651.68	9199.192	7.29E-05	7.29E-05
Control	<i>Phrag.</i>	Fe	5.89	12453.65	8072.129	6.21E-05	6.21E-05
Control	<i>Phrag.</i>	Fe	5.89	11679.75	7084.928	4.78E-05	4.78E-05
Control	<i>Phrag.</i>	Fe	5.89	13964.15	10653.01	7.59E-05	7.59E-05
Control	<i>Phrag.</i>	Fe	5.89	13180.27	8513.008	7.03E-05	7.03E-05
Control	<i>Phrag.</i>	Fe	5.89	12137.19	9744.434	6.7E-05	6.7E-05
Control	<i>Phrag.</i>	Fe	5.89	10699.52	9542.449	6.9E-05	6.9E-05
Control	<i>Phrag.</i>	Fe	5.89	11421.99	7975.153	4.74E-05	4.74E-05
Control	<i>Phrag.</i>	Fe	5.89	12341.91	7908.275	8.04E-05	8.04E-05
Silvermines		Fe	2956.833	156313.4	282801.2	0.000844	0.000745
Silvermines		Fe	6.484	354555.2	374625.8	0.003459	0.003177
Silvermines		Fe	6.484	339016.4	354990.6	0.00362	0.003285
Silvermines		Fe	45.881	398589.3	334522	0.003753	0.003615
Silvermines		Fe	45.881	416595.5	313839	0.003249	0.003128
Silvermines		Fe	45.881	310795.3	259954.4	0.00235	0.002112
Silvermines		Fe	45.881	251890.5	272723.1	0.002578	0.002224
Silvermines		Fe	2956.833	208888.3	110414	0.000762	0.000679
Silvermines		Fe	6.484	288790.2	302186.2	0.002362	0.002206
Silvermines		Fe	6.484	405861.2	317113.5	0.002595	0.002366
Silvermines		Fe	45.881	362003.6	238256.2	0.002348	0.002258
Silvermines		Fe	45.881	364888.1	211159.5	0.002276	0.002189
Silvermines		Fe	45.881	297276.9	261829.8	0.002211	0.002014
Silvermines		Fe	45.881	309971.6	272006.1	0.002613	0.002321

Wetland	Region	Metal	Water Conc. (ppm)	Total Metals (mg/kg)	Sum of Exts. (mg/kg)	Pot. Bio. (mol/g)	[Mz+] (mol/L)
TMF Wet.	<i>Typha</i>	Mn	0.059	13.261	35.252	3.76E-07	0.079508
TMF Wet.	<i>Typha</i>	Mn	0.059	57.876	50.658	8.33E-07	0.165016
TMF Wet.	<i>Typha</i>	Mn	0.059	50.677	10.205	1.78E-07	0.068661
TMF Wet.	<i>Typha</i>	Mn	0.059	129.938	463.409	8.29E-06	1.118523
TMF Wet.	<i>Typha</i>	Mn	0.059	239.219	297.258	4.79E-06	0.179858
TMF Wet.	<i>Typha</i>	Mn	0.059	47.137	59.921	1.01E-06	0.112263
TMF Wet.	<i>Typha</i>	Mn	0.059	110.637	80.43	1.36E-06	0.245063
TMF Wet.	<i>Typha</i>	Mn	0.059	47.906	37.24	6.56E-07	0.27369
TMF Wet.	<i>Typha</i>	Mn	0.059	120.049	102.783	1.79E-06	0.246009
TMF Wet.	<i>Typha</i>	Mn	0.059	227.12	269.568	4.51E-06	0.16917
TMF Wet.	<i>Phrag.</i>	Mn	0.03	33.911	26.473	2.32E-07	0.024539
TMF Wet.	<i>Phrag.</i>	Mn	0.03	60.898	126.567	9.42E-07	0.279112
TMF Wet.	<i>Phrag.</i>	Mn	0.03	91.935	77.14	1.21E-06	0.185424
TMF Wet.	<i>Phrag.</i>	Mn	0.03	79.577	44.66	7.54E-07	0.151494
TMF Wet.	<i>Phrag.</i>	Mn	0.03	34.364	14.166	2.58E-07	0.163176
TMF Wet.	<i>Phrag.</i>	Mn	0.03	36.3	31.478	5.46E-07	0.050511
TMF Wet.	<i>Phrag.</i>	Mn	0.03	104.15	87.377	1.52E-06	0.400645
TMF Wet.	<i>Phrag.</i>	Mn	0.03	76.42	156.164	2.34E-06	0.303015
TMF Wet.	<i>Phrag.</i>	Mn	0.03	80.901	117.504	1.38E-06	0.235195
TMF Wet.	<i>Phrag.</i>	Mn	0.03	34.364	62.94	7.53E-07	0.163956
TMF Wet.	<i>Juncus</i>	Mn	0.007	125.861	156.963	2.6E-06	0.28505
TMF Wet.	<i>Juncus</i>	Mn	0.007	149.332	108.747	1.78E-06	0.143041
TMF Wet.	<i>Juncus</i>	Mn	0.007	256.094	332.598	5.1E-06	0.250121
TMF Wet.	<i>Juncus</i>	Mn	0.007	61.917	39.427	6.98E-07	0.404236
TMF Wet.	<i>Juncus</i>	Mn	0.007	39.309	20.062	3.44E-07	0.103874
TMF Wet.	<i>Juncus</i>	Mn	0.007	125.861	189.878	2.72E-06	0.226684
TMF Wet.	<i>Juncus</i>	Mn	0.007	149.273	140.356	2.02E-06	0.137842
TMF Wet.	<i>Juncus</i>	Mn	0.007	256.094	357.359	5.4E-06	0.251941
TMF Wet.	<i>Juncus</i>	Mn	0.007	61.917	165.202	2.95E-06	1.124127
TMF Wet.	<i>Juncus</i>	Mn	0.007	38.795	51.503	5.67E-07	0.11437
Control	<i>Phrag.</i>	Mn	0.25	101.351	112.879	1.85E-06	0.031799
Control	<i>Phrag.</i>	Mn	0.25	181.681	215.051	3.64E-06	0.049946
Control	<i>Phrag.</i>	Mn	0.25	208.902	227.032	3.89E-06	0.06267
Control	<i>Phrag.</i>	Mn	0.25	121.891	150.23	2.48E-06	0.051994
Control	<i>Phrag.</i>	Mn	0.25	190.923	195.117	3.27E-06	0.043048
Control	<i>Phrag.</i>	Mn	0.25	97.653	108.528	1.81E-06	0.025692
Control	<i>Phrag.</i>	Mn	0.25	191.295	218.624	3.64E-06	0.054359
Control	<i>Phrag.</i>	Mn	0.25	219.704	223.744	3.76E-06	0.054466
Control	<i>Phrag.</i>	Mn	0.25	133.317	138.653	2.26E-06	0.047638
Control	<i>Phrag.</i>	Mn	0.25	193.138	214.085	3.64E-06	0.045328
Silvermines		Mn	4.324	11041.14	5885.421	0.000104	0.032859
Silvermines		Mn	4.324	31886.15	12260.54	0.000217	0.066007
Silvermines		Mn	8.159	58610.4	67769.51	0.001195	0.330564
Silvermines		Mn	8.159	64962.68	84641.94	0.001506	0.481667
Silvermines		Mn	8.159	796.506	984.776	7.72E-06	0.003654
Silvermines		Mn	8.159	700.437	618.605	9.08E-06	0.004082
Silvermines		Mn	3.098	2031.909	1084.27	1.73E-05	0.025455
Silvermines		Mn	4.324	16004.67	6754.57	0.00012	0.054422
Silvermines		Mn	4.324	24483.5	10363.77	0.000183	0.077454
Silvermines		Mn	8.159	69080.75	52986.76	0.000944	0.418212
Silvermines		Mn	8.159	71382.01	55127.41	0.000981	0.448265
Silvermines		Mn	8.159	450.736	556.453	8.32E-06	0.004132
Silvermines		Mn	8.159	712.724	577.984	8.98E-06	0.00387

Wetland	Region	Metal	Water Conc. (ppm)	Total Metals (mg/kg)	Sum of Exts. (mg/kg)	Pot. Bio. (mol/g)	[Mz+] (mol/L)
TMF Wet.	<i>Typha</i>	Pb	0.025	5.083	11.369	6.92E-09	4.52E-10
TMF Wet.	<i>Typha</i>	Pb	0.025	83.606	106.146	7.83E-08	3.98E-09
TMF Wet.	<i>Typha</i>	Pb	0.025	48.646	23.614	2.34E-08	6.54E-09
TMF Wet.	<i>Typha</i>	Pb	0.025	222.865	121.363	1.55E-07	1.55E-08
TMF Wet.	<i>Typha</i>	Pb	0.025	609.004	494.989	4.44E-07	8.7E-09
TMF Wet.	<i>Typha</i>	Pb	0.025	27.71	39.898	6.73E-08	2.3E-09
TMF Wet.	<i>Typha</i>	Pb	0.025	235.86	157.456	1.47E-07	6.78E-09
TMF Wet.	<i>Typha</i>	Pb	0.025	38.917	42.938	7.2E-08	2.18E-08
TMF Wet.	<i>Typha</i>	Pb	0.025	197.725	144.436	2.17E-07	2.21E-08
TMF Wet.	<i>Typha</i>	Pb	0.025	568.344	604.222	6.19E-07	1.21E-08
TMF Wet.	<i>Phrag.</i>	Pb	0.013	78.851	53.183	1.04E-07	5.82E-09
TMF Wet.	<i>Phrag.</i>	Pb	0.013	258.325	48.536	1.4E-07	4.24E-08
TMF Wet.	<i>Phrag.</i>	Pb	0.013	103.321	306.785	2.55E-07	4.6E-08
TMF Wet.	<i>Phrag.</i>	Pb	0.013	182.283	71.255	8.2E-08	1.37E-08
TMF Wet.	<i>Phrag.</i>	Pb	0.013	75.363	38.347	3.81E-08	1.73E-08
TMF Wet.	<i>Phrag.</i>	Pb	0.013	85.5	74.733	1.51E-07	7.43E-09
TMF Wet.	<i>Phrag.</i>	Pb	0.013	97.168	130.043	1.48E-07	3.98E-08
TMF Wet.	<i>Phrag.</i>	Pb	0.013	225.596	296.427	3.51E-07	5.38E-08
TMF Wet.	<i>Phrag.</i>	Pb	0.013	199.01	89.269	1E-07	1.42E-08
TMF Wet.	<i>Phrag.</i>	Pb	0.013	75.363	88.716	1.06E-07	1.65E-08
TMF Wet.	<i>Juncus</i>	Pb	0.002	331.484	453.738	4.84E-07	5.31E-08
TMF Wet.	<i>Juncus</i>	Pb	0.002	609.484	456.315	8.09E-07	4.49E-08
TMF Wet.	<i>Juncus</i>	Pb	0.002	884.623	1394.773	1.79E-06	7.15E-08
TMF Wet.	<i>Juncus</i>	Pb	0.002	29.412	38.844	3.99E-08	2.9E-08
TMF Wet.	<i>Juncus</i>	Pb	0.002	63.919	59.692	5.37E-08	1.95E-08
TMF Wet.	<i>Juncus</i>	Pb	0.002	331.484	399.997	5.08E-07	4.23E-08
TMF Wet.	<i>Juncus</i>	Pb	0.002	609.243	469.418	9.18E-07	4.31E-08
TMF Wet.	<i>Juncus</i>	Pb	0.002	884.623	1294.852	2.05E-06	7.8E-08
TMF Wet.	<i>Juncus</i>	Pb	0.002	29.412	21.651	3.56E-08	1.7E-08
TMF Wet.	<i>Juncus</i>	Pb	0.002	65.573	48.923	8.37E-08	2.04E-08
Control	<i>Phrag.</i>	Pb	0.041	48.156	80.449	1.04E-07	4.65E-09
Control	<i>Phrag.</i>	Pb	0.041	66.254	74.81	1.19E-07	4.22E-09
Control	<i>Phrag.</i>	Pb	0.041	54.923	53.836	9.72E-08	4.06E-09
Control	<i>Phrag.</i>	Pb	0.041	126.072	128.916	2.32E-07	1.26E-08
Control	<i>Phrag.</i>	Pb	0.041	78.763	73.829	1.26E-07	4.3E-09
Control	<i>Phrag.</i>	Pb	0.041	45.404	66.982	1.83E-07	6.76E-09
Control	<i>Phrag.</i>	Pb	0.041	68.285	84.605	1.94E-07	7.51E-09
Control	<i>Phrag.</i>	Pb	0.041	53.551	74.348	1.69E-07	6.35E-09
Control	<i>Phrag.</i>	Pb	0.041	130.222	125.195	2.93E-07	1.6E-08
Control	<i>Phrag.</i>	Pb	0.041	78.093	72.606	1.99E-07	6.41E-09
Silvermines		Pb	8.853	10512.5	10337.84	4.63E-05	1.29E-07
Silvermines		Pb	0.007	2025.278	2205.019	7.81E-06	8.33E-10
Silvermines		Pb	0.007	2575.902	1808.88	5.53E-06	5.71E-10
Silvermines		Pb	8.045	1237.921	1273.485	4.97E-06	1.33E-09
Silvermines		Pb	8.045	1565.585	1337.062	5.28E-06	1.63E-09
Silvermines		Pb	8.045	2709.748	3355.703	1.29E-05	5.88E-09
Silvermines		Pb	8.045	3612.423	3680.385	1.38E-05	5.98E-09
Silvermines		Pb	8.853	10681.6	8347.289	3.65E-05	1.11E-07
Silvermines		Pb	0.007	2139.292	2083.752	7.26E-06	1.12E-09
Silvermines		Pb	0.007	2023.265	1605.366	4.85E-06	6.95E-10
Silvermines		Pb	8.045	1197.557	882.899	3.36E-06	1.44E-09
Silvermines		Pb	8.045	1558.952	1084.973	4.32E-06	1.9E-09
Silvermines		Pb	8.045	2973.503	2950.004	1.13E-05	5.42E-09
Silvermines		Pb	8.045	3734.587	2379.808	8.54E-06	3.55E-09

Wetland	Region	Metal	Water Conc. (ppm)	Total Metals (mg/kg)	Sum of Exts. (mg/kg)	Pot. Bio. (mol/g)	[Mz+] (mol/L)
TMF Wet.	<i>Typha</i>	Zn	0.08	8.01	158.966	4.96E-07	7.08E-08
TMF Wet.	<i>Typha</i>	Zn	0.08	71.455	257.535	3.21E-07	4.29E-08
TMF Wet.	<i>Typha</i>	Zn	0.08	59.537	53.246	3.14E-08	4.91E-08
TMF Wet.	<i>Typha</i>	Zn	0.08	234.737	254.568	8.16E-07	4.47E-07
TMF Wet.	<i>Typha</i>	Zn	0.08	1781.294	1422.85	1.44E-05	1.46E-06
TMF Wet.	<i>Typha</i>	Zn	0.08	93.149	76.31	4.4E-07	3.3E-08
TMF Wet.	<i>Typha</i>	Zn	0.08	230.502	263.368	1.46E-06	1.77E-07
TMF Wet.	<i>Typha</i>	Zn	0.08	67.266	119.421	1.08E-06	1.83E-06
TMF Wet.	<i>Typha</i>	Zn	0.08	236.597	180.826	1.1E-06	6.11E-07
TMF Wet.	<i>Typha</i>	Zn	0.08	1637.282	1396.274	1.45E-05	1.47E-06
TMF Wet.	<i>Phrag.</i>	Zn	0.052	54.386	725.27	1.02E-07	2.93E-08
TMF Wet.	<i>Phrag.</i>	Zn	0.052	291.584	168.596	6.61E-07	1.46E-06
TMF Wet.	<i>Phrag.</i>	Zn	0.052	122.414	374.08	1.88E-06	2.71E-06
TMF Wet.	<i>Phrag.</i>	Zn	0.052	246.85	256.841	6.04E-07	6.57E-07
TMF Wet.	<i>Phrag.</i>	Zn	0.052	115.392	52.884	1.07E-07	2.75E-07
TMF Wet.	<i>Phrag.</i>	Zn	0.052	102.49	72.325	3.82E-07	9.57E-08
TMF Wet.	<i>Phrag.</i>	Zn	0.052	111.231	110.392	5.25E-07	1.03E-06
TMF Wet.	<i>Phrag.</i>	Zn	0.052	286.313	457.597	3.64E-06	4.45E-06
TMF Wet.	<i>Phrag.</i>	Zn	0.052	271.089	251.317	1.4E-06	1.29E-06
TMF Wet.	<i>Phrag.</i>	Zn	0.052	115.392	196.348	1.14E-06	1E-06
TMF Wet.	<i>Juncus</i>	Zn	0.065	344.645	584.785	2.12E-06	1.57E-06
TMF Wet.	<i>Juncus</i>	Zn	0.065	661.488	2700.046	2.2E-06	7.19E-07
TMF Wet.	<i>Juncus</i>	Zn	0.065	897.471	1757.916	5.72E-06	1.52E-06
TMF Wet.	<i>Juncus</i>	Zn	0.065	55.357	73.085	1.34E-07	7.87E-07
TMF Wet.	<i>Juncus</i>	Zn	0.065	74.346	77.123	1.68E-07	4.79E-07
TMF Wet.	<i>Juncus</i>	Zn	0.065	344.645	562.886	4.09E-06	2.3E-06
TMF Wet.	<i>Juncus</i>	Zn	0.065	661.227	546.944	3.83E-06	1.06E-06
TMF Wet.	<i>Juncus</i>	Zn	0.065	897.471	1297.07	6.43E-06	1.62E-06
TMF Wet.	<i>Juncus</i>	Zn	0.065	55.357	153.105	1.44E-06	5.57E-06
TMF Wet.	<i>Juncus</i>	Zn	0.065	49.833	504.408	7.22E-07	1.38E-06
Control	<i>Phrag.</i>	Zn	0.059	299.251	215.883	2.35E-06	1.23E-06
Control	<i>Phrag.</i>	Zn	0.059	238.432	144.344	1.56E-06	6.49E-07
Control	<i>Phrag.</i>	Zn	0.059	45.256	83.757	9.2E-07	4.51E-07
Control	<i>Phrag.</i>	Zn	0.059	277.155	120.408	1.14E-06	7.26E-07
Control	<i>Phrag.</i>	Zn	0.059	83.07	73.278	5.83E-07	2.34E-07
Control	<i>Phrag.</i>	Zn	0.059	48.039	115.101	1.24E-06	5.36E-07
Control	<i>Phrag.</i>	Zn	0.059	42.081	137.137	9.17E-07	4.16E-07
Control	<i>Phrag.</i>	Zn	0.059	37.199	98.151	1.09E-06	4.83E-07
Control	<i>Phrag.</i>	Zn	0.059	108.469	107.827	1.02E-06	6.57E-07
Control	<i>Phrag.</i>	Zn	0.059	98.312	129.297	1.03E-06	3.89E-07
Silvermines		Zn	8.664	20907.91	14459.53	0.000182	5.27E-06
Silvermines		Zn	1.633	8898.394	6237.513	6.18E-05	2.63E-08
Silvermines		Zn	1.633	11876.44	6334.857	6.99E-05	2.88E-08
Silvermines		Zn	7.083	18953.76	17131.16	0.000235	4.4E-07
Silvermines		Zn	7.083	18350.22	19313.3	0.000263	5.68E-07
Silvermines		Zn	7.083	3759.976	2755.032	1.43E-05	4.58E-08
Silvermines		Zn	7.083	5880.433	3316.178	2.2E-05	6.68E-08
Silvermines		Zn	8.664	24808.25	5973.089	4.64E-05	1.48E-06
Silvermines		Zn	1.633	9339.63	6295.807	5.73E-05	3.51E-08
Silvermines		Zn	1.633	10858.62	6363.227	6.94E-05	3.96E-08
Silvermines		Zn	7.083	19808.6	14625.16	0.000201	6.01E-07
Silvermines		Zn	7.083	19437.87	14996.31	0.000208	6.42E-07
Silvermines		Zn	7.083	3753.974	2734.701	1.55E-05	5.2E-08
Silvermines		Zn	7.083	5107.938	2455.869	9.9E-06	2.88E-08

APPENDIX F

**METAL EXTRACTIONS FROM THE SEDIMENTS OF THE PILOT PLANT
WETLANDS AND SILVERMINES WETLAND IN 2000**

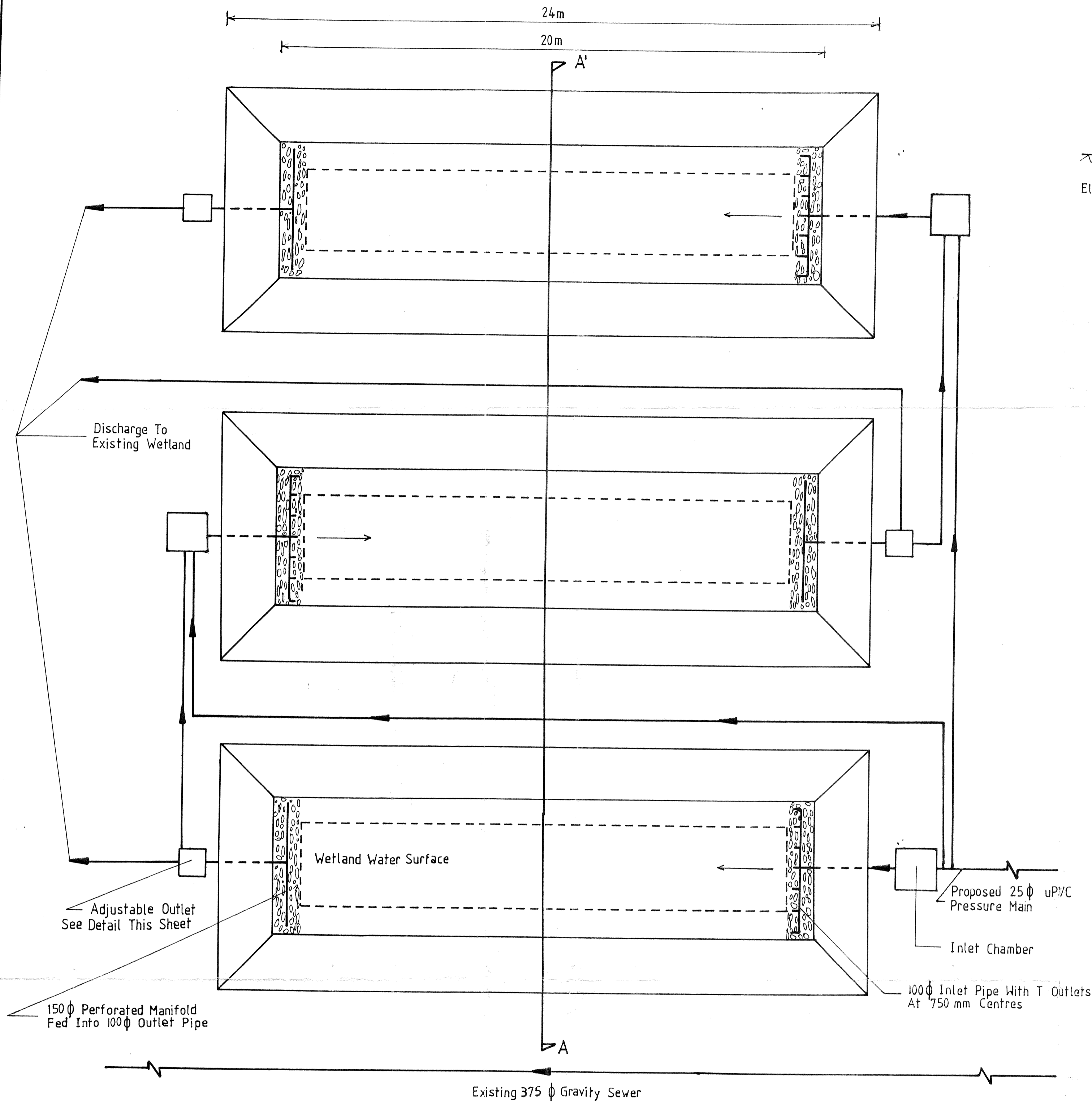
Soil	Region	Metal	Exchangeable	Reducible	Oxidisable	Residual	Total
TMF Wetland	<i>Typha</i>	Cd	0.048	0	0.076	0.094	0.245
TMF Wetland	<i>Typha</i>	Cd	0.036	0	0.035	0	0.08
TMF Wetland	<i>Typha</i>	Cd	0	0	0	0.025	0.025
TMF Wetland	<i>Typha</i>	Cd	0	0	0.601	0	0.646
TMF Wetland	<i>Typha</i>	Cd	0	0.124	1.168	0.1	2.211
TMF Wetland	<i>Typha</i>	Cd	0.064	0.172	0.294	0.135	0.759
TMF Wetland	<i>Typha</i>	Cd	0.024	0.12	0.517	0.824	1.548
TMF Wetland	<i>Typha</i>	Cd	0.044	0.096	0.21	1.522	1.937
TMF Wetland	<i>Typha</i>	Cd	0	0.168	0.392	0.115	0.708
TMF Wetland	<i>Typha</i>	Cd	0.056	0.376	1.238	0.105	1.908
TMF Wetland	<i>Phrag.</i>	Cd	0	0	0.189	0	0.189
TMF Wetland	<i>Phrag.</i>	Cd	0	0	0.105	0.105	0.23
TMF Wetland	<i>Phrag.</i>	Cd	0	0.339	0.573	0.05	1.163
TMF Wetland	<i>Phrag.</i>	Cd	0.204	0.08	0.105	0.155	0.675
TMF Wetland	<i>Phrag.</i>	Cd	0.165	0.15	0.193	0	0.655
TMF Wetland	<i>Phrag.</i>	Cd	0.044	0.044	0.245	0.02	0.428
TMF Wetland	<i>Phrag.</i>	Cd	0.056	0.188	0.238	0.08	0.597
TMF Wetland	<i>Phrag.</i>	Cd	0.239	0.295	0.209	0	0.932
TMF Wetland	<i>Phrag.</i>	Cd	0.08	0.172	0.049	0	0.438
TMF Wetland	<i>Phrag.</i>	Cd	0.12	0.219	0	20.369	20.992
TMF Wetland	<i>Juncus</i>	Cd	0.184	0.316	0.77	0	1.43
TMF Wetland	<i>Juncus</i>	Cd	0.224	0.32	0.686	0.17	1.567
TMF Wetland	<i>Juncus</i>	Cd	0.324	0.599	2.098	0.245	4.4
TMF Wetland	<i>Juncus</i>	Cd	0.172	0.172	0.28	1.373	2.134
TMF Wetland	<i>Juncus</i>	Cd	0.172	0.208	0.042	0.105	0.692
TMF Wetland	<i>Juncus</i>	Cd	0.144	0.371	0.349	0.045	1.13
TMF Wetland	<i>Juncus</i>	Cd	0.112	0.263	0.384	0.035	0.993
TMF Wetland	<i>Juncus</i>	Cd	0.195	0.634	1.883	0.01	3.036
TMF Wetland	<i>Juncus</i>	Cd	0.1	0.156	0	0.035	0.447
TMF Wetland	<i>Juncus</i>	Cd	0.176	0.104	0	0.105	0.518
Control	<i>Phrag.</i>	Cd	0.039	0.253	0	0	0.256
Control	<i>Phrag.</i>	Cd	0.036	0.234	0.125	0	0.342
Control	<i>Phrag.</i>	Cd	0.036	0.155	<0.001	0	0.151
Control	<i>Phrag.</i>	Cd	0.036	0.315	0.614	0.04	1.007
Control	<i>Phrag.</i>	Cd	0.076	0.394	<0.001	0.115	0.58
Control	<i>Phrag.</i>	Cd	0.633	0.434	<0.001	0.159	1.348
Control	<i>Phrag.</i>	Cd	0.236	0.515	0.377	0.02	1.238
Control	<i>Phrag.</i>	Cd	0.235	0.474	0.125	0	0.987
Control	<i>Phrag.</i>	Cd	0.215	0.553	0.111	0.035	1.164
Control	<i>Phrag.</i>	Cd	0.191	0.473	0.208	0	1.04
Silvermines		Cd	8.42	36.563	4.61	2.758	55.69
Silvermines		Cd	3.731	2.323	0.346	0.625	7.623
Silvermines		Cd	6.507	5.403	0.496	0.277	13.947
Silvermines		Cd	6.969	18.184	0.762	3.979	32.24
Silvermines		Cd	8.167	22.505	0.908	0.083	35.382
Silvermines		Cd	1.899	1.039	0.665	0.625	4.704
Silvermines		Cd	2.754	1.648	0.721	1.585	7.37
Silvermines		Cd	3.551	21.926	5.276	5.656	38.982
Silvermines		Cd	3.564	2.443	0.576	0.021	7.109
Silvermines		Cd	6.053	4.35	0.34	0.069	11.838
Silvermines		Cd	7.247	13.605	0.549	0	22.81
Silvermines		Cd	6.325	18.309	0.752	4.325	30.903
Silvermines		Cd	1.693	1.06	0.551	0.538	4.149
Silvermines		Cd	0.02	1.376	0.202	0.537	2.791

Soil	Region	Metal	Exchangeable	Reducible	Oxidisable	Residual	Total
TMF Wetland	<i>Typha</i>	Fe	31.548	264.365	257.847	145.65	786.027
TMF Wetland	<i>Typha</i>	Fe	18.58	281.97	834.602	11.737	1223.388
TMF Wetland	<i>Typha</i>	Fe	8.28	145.12	219.8	0	409.8
TMF Wetland	<i>Typha</i>	Fe	28.052	414.106	598.881	23.227	1164.523
TMF Wetland	<i>Typha</i>	Fe	105.147	1486.017	6652.134	144.878	8784.677
TMF Wetland	<i>Typha</i>	Fe	24.463	504.167	839.482	102.878	1608.022
TMF Wetland	<i>Typha</i>	Fe	14.299	310.974	945.891	37.594	1383.49
TMF Wetland	<i>Typha</i>	Fe	13.772	133.932	318.423	19.212	514.702
TMF Wetland	<i>Typha</i>	Fe	13.76	406.8	808.99	30.6	1342.894
TMF Wetland	<i>Typha</i>	Fe	51.189	1489.031	5473.147	66.234	7368.263
TMF Wetland	<i>Phrag.</i>	Fe	126.96	528.2	730.31	132.4	1664.311
TMF Wetland	<i>Phrag.</i>	Fe	30.826	188.522	45.561	43.441	378.978
TMF Wetland	<i>Phrag.</i>	Fe	18.122	365.752	3255.234	115.008	3857.067
TMF Wetland	<i>Phrag.</i>	Fe	29.711	277.997	552.344	81.026	1017.974
TMF Wetland	<i>Phrag.</i>	Fe	1.142	88.268	135.453	25.837	274.076
TMF Wetland	<i>Phrag.</i>	Fe	29.461	603.393	751.557	142.166	1664.647
TMF Wetland	<i>Phrag.</i>	Fe	10.47	211.628	836.573	45.255	1152.373
TMF Wetland	<i>Phrag.</i>	Fe	88.521	431.754	2462.112	99.132	3217.306
TMF Wetland	<i>Phrag.</i>	Fe	18.985	326.693	969.279	99.312	1534.973
TMF Wetland	<i>Phrag.</i>	Fe	14.324	256.599	889.297	26.284	1254.53
TMF Wetland	<i>Juncus</i>	Fe	56.617	509.316	4711.076	139.894	5587.361
TMF Wetland	<i>Juncus</i>	Fe	108.829	693.131	4328.577	111.089	5367.12
TMF Wetland	<i>Juncus</i>	Fe	145.32	1139.467	13535.57	262.961	15463.12
TMF Wetland	<i>Juncus</i>	Fe	2.038	96.404	225.829	25.569	375.776
TMF Wetland	<i>Juncus</i>	Fe	9.784	185.184	436.661	25.744	702.46
TMF Wetland	<i>Juncus</i>	Fe	40.969	670.071	3492.879	77.491	4458.088
TMF Wetland	<i>Juncus</i>	Fe	42.874	819.082	3602.206	19.86	4696.092
TMF Wetland	<i>Juncus</i>	Fe	108.997	1196.971	11867.15	155.026	13616.1
TMF Wetland	<i>Juncus</i>	Fe	5.519	146.691	276.655	12.697	471.7
TMF Wetland	<i>Juncus</i>	Fe	12.96	276.64	435.82	17.6	799.636
Control	<i>Phrag.</i>	Fe	277.83	2881.346	3435.463	969.661	7652.083
Control	<i>Phrag.</i>	Fe	274.37	3638.594	3895.513	1232.43	9199.192
Control	<i>Phrag.</i>	Fe	225.266	3082.318	3388.818	1215.883	8072.129
Control	<i>Phrag.</i>	Fe	126.608	2419.22	3128.89	1287.509	7084.928
Control	<i>Phrag.</i>	Fe	193.884	3834.366	4333.599	2079.639	10653.01
Control	<i>Phrag.</i>	Fe	164.49	3675.08	4455.951	130.324	8513.008
Control	<i>Phrag.</i>	Fe	160.743	3493.011	4298.612	1702.276	9744.434
Control	<i>Phrag.</i>	Fe	165.413	3583.602	4473.383	1217.91	9542.449
Control	<i>Phrag.</i>	Fe	101.84	2455.296	3353.247	1973.794	7975.153
Control	<i>Phrag.</i>	Fe	123.153	4291.223	2756.354	663.324	7908.275
Silvermines		Fe	2771.387	41607.18	27729.13	207917.1	282801.2
Silvermines		Fe	537.81	177430.7	66408.11	115011.9	374625.8
Silvermines		Fe	542.461	183454.5	66916.93	85916.86	354990.6
Silvermines		Fe	384.964	201903.5	81966.32	42950.43	334522
Silvermines		Fe	387.048	174680.7	83114	49296.19	313839
Silvermines		Fe	890.262	117931.9	38353.4	90326.76	259954.4
Silvermines		Fe	1424.928	124193.7	39676.5	89062.38	272723.1
Silvermines		Fe	2918.095	37931.28	43543.33	24338.51	110414
Silvermines		Fe	301.584	123205.3	70246.85	100024.8	302186.2
Silvermines		Fe	463.584	132145	60224.31	111960.5	317113.5
Silvermines		Fe	482.875	126123.1	74518.97	32601.81	238256.2
Silvermines		Fe	298.837	122254	58072.28	25967.29	211159.5
Silvermines		Fe	1293.187	112501.8	41654.04	96681.08	261829.8
Silvermines		Fe	2126.083	129626	38820.64	87234.39	272006.1

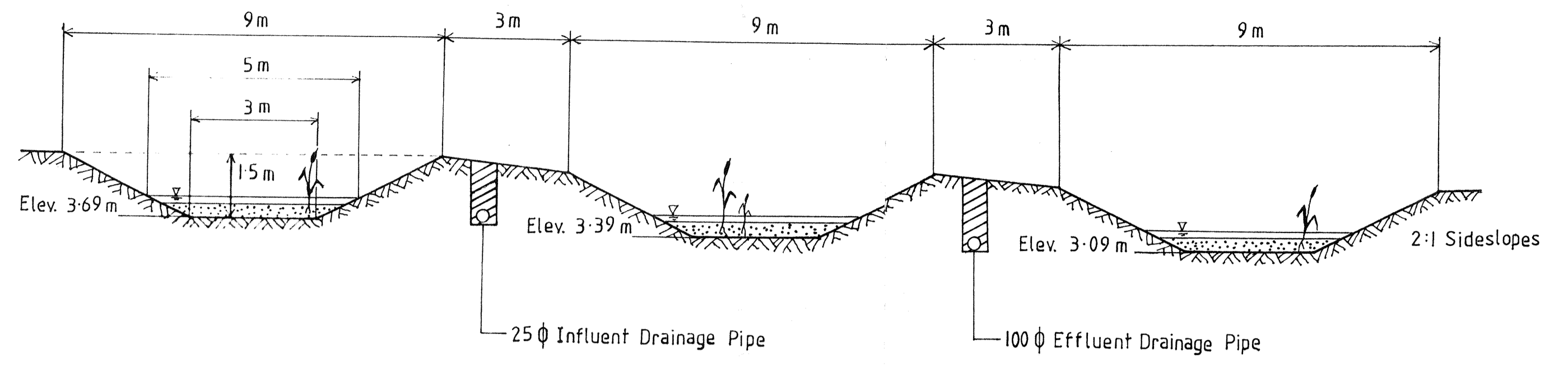
Soil	Region	Metal	Exchangeable	Reducible	Oxidisable	Residual	Total
TMF Wetland	<i>Typha</i>	Mn	5.317	10.119	13.403	1.176	35.252
TMF Wetland	<i>Typha</i>	Mn	20.857	14.065	4.65	0.245	50.658
TMF Wetland	<i>Typha</i>	Mn	5.08	0	0.21	0.195	10.205
TMF Wetland	<i>Typha</i>	Mn	423.217	15.305	7.622	0.23	463.409
TMF Wetland	<i>Typha</i>	Mn	128.616	83.118	33.583	0.805	297.258
TMF Wetland	<i>Typha</i>	Mn	27.193	17.907	2.77	1.484	59.921
TMF Wetland	<i>Typha</i>	Mn	35.319	24.883	5.312	0.165	80.43
TMF Wetland	<i>Typha</i>	Mn	19.493	10.14	1.188	0	37.24
TMF Wetland	<i>Typha</i>	Mn	52.252	27.72	4.2	0.155	102.783
TMF Wetland	<i>Typha</i>	Mn	122.569	79.361	21.678	0.14	269.568
TMF Wetland	<i>Phrag.</i>	Mn	7.4	0	13.09	0.635	26.473
TMF Wetland	<i>Phrag.</i>	Mn	26.195	10.878	74.325	0.49	126.567
TMF Wetland	<i>Phrag.</i>	Mn	13.172	33.53	9.57	0.868	77.14
TMF Wetland	<i>Phrag.</i>	Mn	19.074	13.196	2.169	1.07	44.66
TMF Wetland	<i>Phrag.</i>	Mn	1.457	9.173	0	0	14.166
TMF Wetland	<i>Phrag.</i>	Mn	16.898	6.946	1.118	0.384	31.478
TMF Wetland	<i>Phrag.</i>	Mn	45.327	23.417	3.706	0.28	87.377
TMF Wetland	<i>Phrag.</i>	Mn	46.207	30.837	27.017	0.474	156.164
TMF Wetland	<i>Phrag.</i>	Mn	34.711	25.646	24.08	17.853	117.504
TMF Wetland	<i>Phrag.</i>	Mn	18.925	15.162	21.367	0.195	62.94
TMF Wetland	<i>Juncus</i>	Mn	63.415	49.26	13.854	0.32	156.963
TMF Wetland	<i>Juncus</i>	Mn	48.075	30.397	10.779	0.455	108.747
TMF Wetland	<i>Juncus</i>	Mn	130.097	89.502	51.184	1.104	332.598
TMF Wetland	<i>Juncus</i>	Mn	19.377	9.988	0.909	0.19	39.427
TMF Wetland	<i>Juncus</i>	Mn	8.466	4.553	1.048	0.095	20.062
TMF Wetland	<i>Juncus</i>	Mn	70.98	49.147	40.002	0.484	189.878
TMF Wetland	<i>Juncus</i>	Mn	55.261	32.894	29.202	0.11	140.356
TMF Wetland	<i>Juncus</i>	Mn	140.373	92.259	59.978	0.782	357.359
TMF Wetland	<i>Juncus</i>	Mn	21.488	132.533	2.869	0.15	165.202
TMF Wetland	<i>Juncus</i>	Mn	15.052	9.04	19.95	0.435	51.503
Control	<i>Phrag.</i>	Mn	77.444	18.868	7.204	4.127	112.879
Control	<i>Phrag.</i>	Mn	133.333	47.29	9.797	5.261	215.051
Control	<i>Phrag.</i>	Mn	149.409	47.192	8.488	4.821	227.032
Control	<i>Phrag.</i>	Mn	76.762	30.466	8.234	5.533	150.23
Control	<i>Phrag.</i>	Mn	119.016	47.256	9.134	6.475	195.117
Control	<i>Phrag.</i>	Mn	69.506	25.119	8.29	1.015	108.528
Control	<i>Phrag.</i>	Mn	128.994	58.147	13.488	4.992	218.624
Control	<i>Phrag.</i>	Mn	137.871	56.478	12.816	4.627	223.744
Control	<i>Phrag.</i>	Mn	79.642	34.848	8.215	6.365	138.653
Control	<i>Phrag.</i>	Mn	124.305	63.066	11.398	2.581	214.085
Silvermines		Mn	3625.892	1616.052	92.176	59.084	5885.421
Silvermines		Mn	5362.373	5478.928	277.687	73.078	12260.54
Silvermines		Mn	5316.157	57709.08	1534.953	592.053	67769.51
Silvermines		Mn	5757.905	73894.91	1790.167	99.762	84641.94
Silvermines		Mn	244.915	121.952	501.395	59.57	984.776
Silvermines		Mn	333.804	109.108	71.207	48.779	618.605
Silvermines		Mn	147.353	706.358	90.495	44.121	1084.27
Silvermines		Mn	4242.351	1873.489	95.925	64.037	6754.57
Silvermines		Mn	4674.697	4566.898	229.976	67.275	10363.77
Silvermines		Mn	6616.738	43410.82	1061.432	48.049	52986.76
Silvermines		Mn	5208.236	46904.16	1160.345	67.685	55127.41
Silvermines		Mn	295.339	106.295	48.247	51.046	556.453
Silvermines		Mn	358.052	81.392	49.891	34.742	577.984

Soil	Region	Metal	Exchangeable	Reducible	Oxidisable	Residual	Total
TMF Wetland	<i>Typha</i>	Pb	0.413	0.238	5.694	4.241	11.369
TMF Wetland	<i>Typha</i>	Pb	2.277	10.548	85.376	4.545	106.146
TMF Wetland	<i>Typha</i>	Pb	0.36	2.92	17.08	1.8	23.614
TMF Wetland	<i>Typha</i>	Pb	3.756	22.777	86.923	2.348	121.363
TMF Wetland	<i>Typha</i>	Pb	14.353	53.493	381.379	21.514	494.989
TMF Wetland	<i>Typha</i>	Pb	4.077	6.156	22.594	3.368	39.898
TMF Wetland	<i>Typha</i>	Pb	5.072	19.011	121.478	5.442	157.456
TMF Wetland	<i>Typha</i>	Pb	4.112	7.226	24.521	3.493	42.938
TMF Wetland	<i>Typha</i>	Pb	5.8	31.96	97.65	1.725	144.436
TMF Wetland	<i>Typha</i>	Pb	13.826	89.99	463.007	13.037	604.222
TMF Wetland	<i>Phrag.</i>	Pb	4.68	13.72	29.33	2.335	53.183
TMF Wetland	<i>Phrag.</i>	Pb	2.919	10.558	15.047	4.399	48.536
TMF Wetland	<i>Phrag.</i>	Pb	1.437	39.118	241.623	12.394	306.785
TMF Wetland	<i>Phrag.</i>	Pb	2.519	9.677	48.705	5.568	71.255
TMF Wetland	<i>Phrag.</i>	Pb	0	5	29.97	0.472	38.347
TMF Wetland	<i>Phrag.</i>	Pb	4.511	21.796	39.82	3.543	74.733
TMF Wetland	<i>Phrag.</i>	Pb	5.514	19.78	96.923	2.448	130.043
TMF Wetland	<i>Phrag.</i>	Pb	13.603	48.31	211.529	12.117	296.427
TMF Wetland	<i>Phrag.</i>	Pb	2.122	15.355	63.969	4.537	89.269
TMF Wetland	<i>Phrag.</i>	Pb	2.554	15.202	63.96	2.743	88.716
TMF Wetland	<i>Juncus</i>	Pb	12.155	67.573	338.944	14.414	453.738
TMF Wetland	<i>Juncus</i>	Pb	21.598	127.467	274.863	13.819	456.315
TMF Wetland	<i>Juncus</i>	Pb	48.147	254.041	956.408	67.596	1394.773
TMF Wetland	<i>Juncus</i>	Pb	0.559	3.716	28.526	2.043	38.844
TMF Wetland	<i>Juncus</i>	Pb	0.719	6.43	45.637	2.935	59.692
TMF Wetland	<i>Juncus</i>	Pb	10.173	76.952	288.531	6.233	399.997
TMF Wetland	<i>Juncus</i>	Pb	12.934	149.261	276.647	2.495	469.418
TMF Wetland	<i>Juncus</i>	Pb	45.153	309.734	831.115	38.657	1294.852
TMF Wetland	<i>Juncus</i>	Pb	1.08	4.479	14.277	0	21.651
TMF Wetland	<i>Juncus</i>	Pb	2.4	11.88	30.73	0.85	48.923
Control	<i>Phrag.</i>	Pb	2.744	15.18	56.732	2.09	80.449
Control	<i>Phrag.</i>	Pb	2.501	20.21	47.876	2.323	74.81
Control	<i>Phrag.</i>	Pb	1.551	15.823	32.144	1.541	53.836
Control	<i>Phrag.</i>	Pb	5.224	39.238	77.041	3.838	128.916
Control	<i>Phrag.</i>	Pb	3.148	22.114	44.347	3.387	73.829
Control	<i>Phrag.</i>	Pb	8.678	22.611	28.424	0.547	66.982
Control	<i>Phrag.</i>	Pb	8.267	26.837	43.54	0.799	84.605
Control	<i>Phrag.</i>	Pb	7.244	22.846	37.542	1.791	74.348
Control	<i>Phrag.</i>	Pb	9.269	45.231	61.193	3.332	125.195
Control	<i>Phrag.</i>	Pb	7.307	27.998	31.553	0	72.606
Silvermines		Pb	2781.312	6214.386	595.236	145.44	10337.84
Silvermines		Pb	31.216	1454.769	198.82	388.586	2205.019
Silvermines		Pb	12.234	1022.437	129.467	533.511	1808.88
Silvermines		Pb	3.913	971.906	131.183	111.568	1273.485
Silvermines		Pb	3.524	1044.19	141.417	102.202	1337.062
Silvermines		Pb	86.944	2344.65	368.935	319.067	3355.703
Silvermines		Pb	111.145	2414.721	390.869	428.596	3680.385
Silvermines		Pb	120.817	6733.829	591.867	191.261	8347.289
Silvermines		Pb	26.97	1382.784	216.726	361.922	2083.752
Silvermines		Pb	12.423	900.972	124.539	476.533	1605.366
Silvermines		Pb	5.242	664.866	82.974	102.8	882.899
Silvermines		Pb	2.64	857.3	115.931	74.877	1084.973
Silvermines		Pb	84.741	2077.45	339.612	262.45	2950.004
Silvermines		Pb	0.001	1578.091	261.909	348.608	2379.808

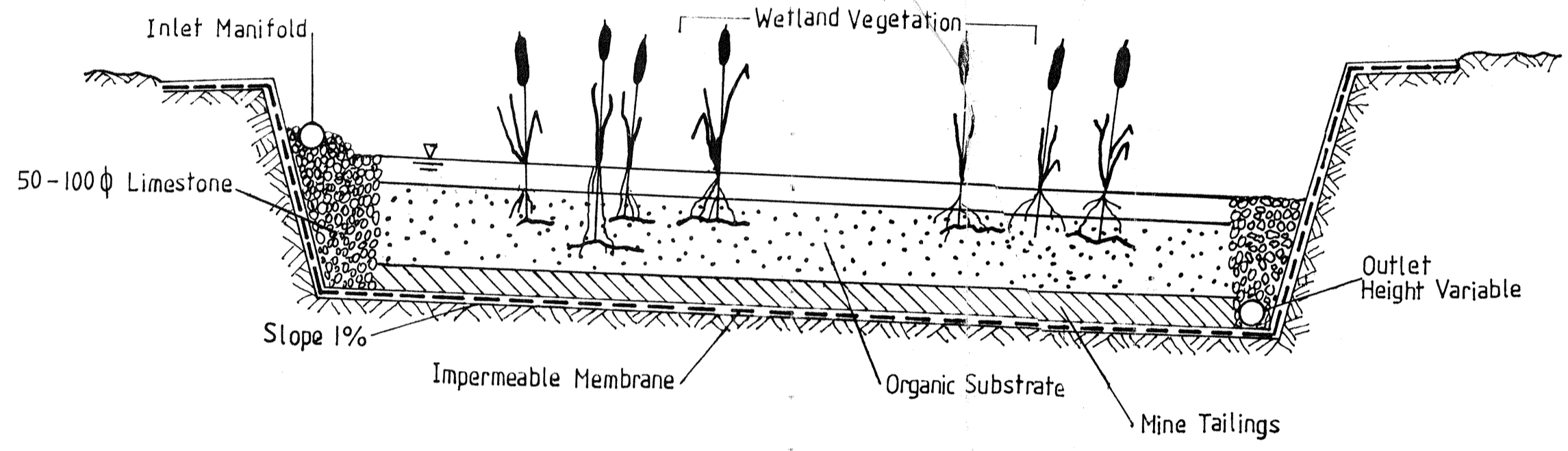
Soil	Region	Metal	Exchangeable	Reducible	Oxidisable	Residual	Total
TMF Wetland	<i>Typha</i>	Zn	11.865	12.698	65.139	61.409	158.966
TMF Wetland	<i>Typha</i>	Zn	0.839	11.867	235.221	1.349	257.535
TMF Wetland	<i>Typha</i>	Zn	0	0	49.84	1.35	53.246
TMF Wetland	<i>Typha</i>	Zn	27.812	19.461	188.322	12.877	254.568
TMF Wetland	<i>Typha</i>	Zn	172.394	580.39	462.189	20.455	1422.85
TMF Wetland	<i>Typha</i>	Zn	8.474	15.189	28.68	18.837	76.31
TMF Wetland	<i>Typha</i>	Zn	8.427	35.706	131.962	36.146	263.368
TMF Wetland	<i>Typha</i>	Zn	4.032	55.609	37.236	11.327	119.421
TMF Wetland	<i>Typha</i>	Zn	16.28	26.96	83.79	25.3	180.826
TMF Wetland	<i>Typha</i>	Zn	158.122	621.578	434.615	12.637	1396.274
TMF Wetland	<i>Phrag.</i>	Zn	2.64	0	689.08	29.5	725.27
TMF Wetland	<i>Phrag.</i>	Zn	29.914	7.079	98.96	26.394	168.596
TMF Wetland	<i>Phrag.</i>	Zn	6.506	93.843	230.237	21.205	374.08
TMF Wetland	<i>Phrag.</i>	Zn	8.557	17.435	56.823	160.502	256.841
TMF Wetland	<i>Phrag.</i>	Zn	0	0	45.886	0	52.884
TMF Wetland	<i>Phrag.</i>	Zn	5.868	3.034	31.367	15.968	72.325
TMF Wetland	<i>Phrag.</i>	Zn	10.829	18.661	51.469	24.625	110.392
TMF Wetland	<i>Phrag.</i>	Zn	55.769	122.509	207.619	12.167	457.597
TMF Wetland	<i>Phrag.</i>	Zn	14.199	45.069	146.994	13.062	251.317
TMF Wetland	<i>Phrag.</i>	Zn	14.364	38.504	110.883	11.072	196.348
TMF Wetland	<i>Juncus</i>	Zn	48.86	70.372	323.481	123.001	584.785
TMF Wetland	<i>Juncus</i>	Zn	61.834	60.514	2493.081	63.194	2700.046
TMF Wetland	<i>Juncus</i>	Zn	129.098	172.85	1327.63	56.288	1757.916
TMF Wetland	<i>Juncus</i>	Zn	0.32	2.477	44.746	19.577	73.085
TMF Wetland	<i>Juncus</i>	Zn	4.673	2.516	0	66.144	77.123
TMF Wetland	<i>Juncus</i>	Zn	49.107	128.892	286.995	8.577	562.886
TMF Wetland	<i>Juncus</i>	Zn	65.669	130.06	295.299	1.048	546.944
TMF Wetland	<i>Juncus</i>	Zn	122.347	202.57	830.208	46.179	1297.07
TMF Wetland	<i>Juncus</i>	Zn	35.633	33.593	53.679	5.049	153.105
TMF Wetland	<i>Juncus</i>	Zn	15.44	12	441.7	15.5	504.408
Control	<i>Phrag.</i>	Zn	72.341	69.211	53.881	8.469	215.883
Control	<i>Phrag.</i>	Zn	4.09	74.846	26.196	16.478	144.344
Control	<i>Phrag.</i>	Zn	4.016	43.972	9.462	14.114	83.757
Control	<i>Phrag.</i>	Zn	6.3	22.411	17.725	28.113	120.408
Control	<i>Phrag.</i>	Zn	2.67	28.608	15.34	19.823	73.278
Control	<i>Phrag.</i>	Zn	16.202	50.438	24.174	9.902	115.101
Control	<i>Phrag.</i>	Zn	7.029	29.233	59.475	17.722	137.137
Control	<i>Phrag.</i>	Zn	9.95	37.692	17.274	9.353	98.151
Control	<i>Phrag.</i>	Zn	14.998	32.501	20.467	20.388	107.827
Control	<i>Phrag.</i>	Zn	9.333	28.991	35.792	26.261	129.297
Silvermines		Zn	7085.76	3823.888	1444.622	1139.435	14459.53
Silvermines		Zn	2197.701	1435.088	675.156	1524.904	6237.513
Silvermines		Zn	2183.845	1863.04	707.544	1055.322	6334.857
Silvermines		Zn	6664.41	7630.424	1305.133	450.539	17131.16
Silvermines		Zn	6056.19	8336.381	1609.75	519.464	19313.3
Silvermines		Zn	480.981	299.88	635.285	1184.479	2755.032
Silvermines		Zn	729.267	502.766	614.211	1265.363	3316.178
Silvermines		Zn	238.358	2093.812	164.99	2772.167	5973.089
Silvermines		Zn	2144.06	1257.107	1040.079	1510.369	6295.807
Silvermines		Zn	2626.315	1447.113	707.015	1120.212	6363.227
Silvermines		Zn	5980.026	6359.337	1099.027	396.903	14625.16
Silvermines		Zn	5317.32	7723.507	1093.103	303.3	14996.31
Silvermines		Zn	537.052	321.076	548.496	1173.705	2734.701
Silvermines		Zn	56.7	409.781	473.231	1335.586	2455.869



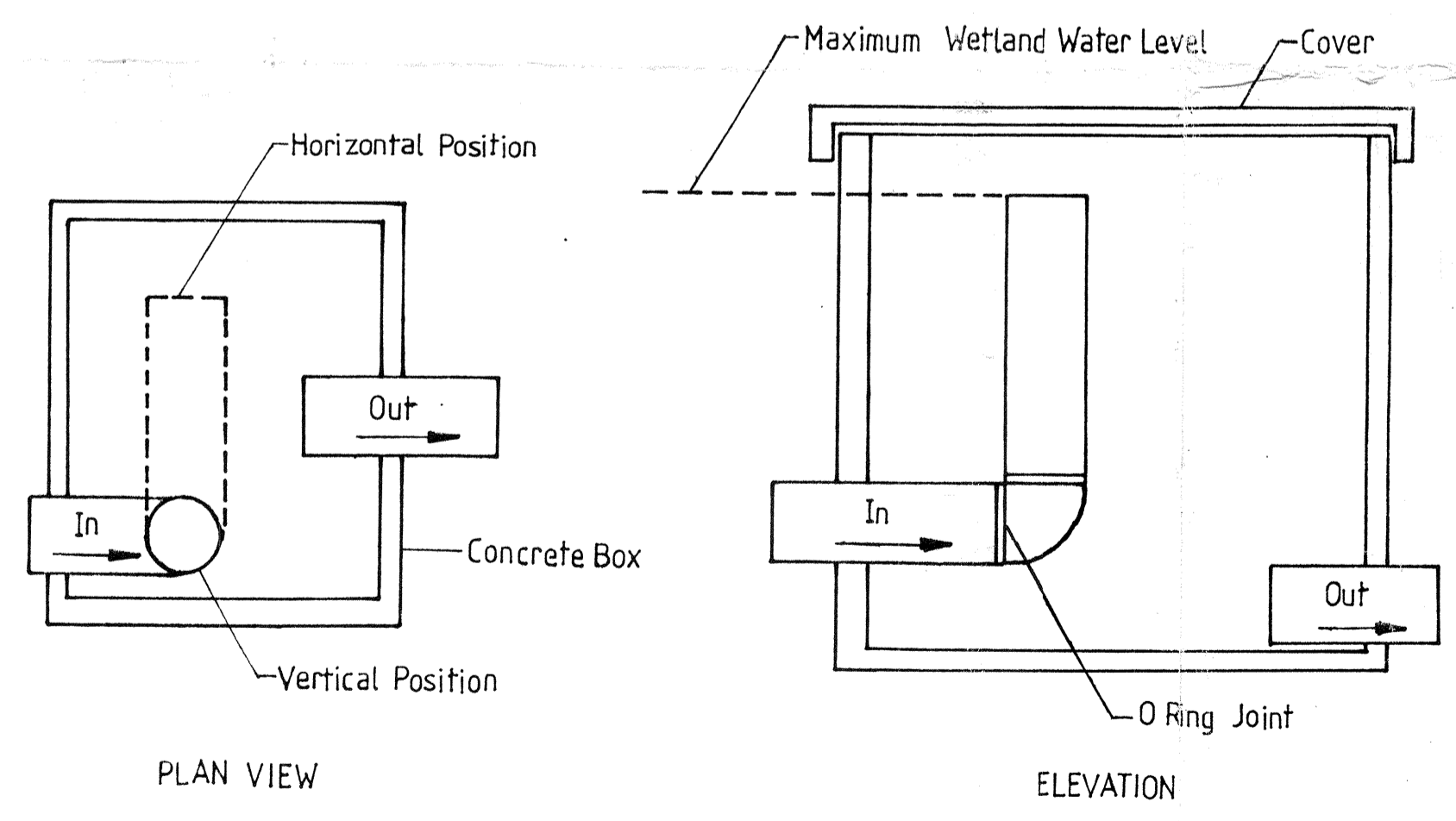
PLAN VIEW
SCALE 1:100



SECTION A-A'
SCALE 1:100



LONGITUDINAL SECTION THROUGH FWS WETLAND
NOT TO SCALE



ADJUSTABLE OUTLET STRUCTURE
NOT TO SCALE

PILOT-SCALE
WETLAND CELLS

RTC SLIGO
BALLINODE

SCALE: AS SHOWN

DATE: 14/7/97

DRAWN BY: Paula Treacy, Sligo RTC