



**DEVON AREA
INTERNAL REPORT**

**INVESTIGATION INTO ALGAL
BLOOM CONDITIONS IN THREE
FRESH WATER PONDS LOCATED
AT THE MINIATURE PONY
CENTRE
MORTONHAMPSTEAD.**

**NOVEMBER 1996
DEV/WQ/12/96**

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INVESTIGATIONS TECHNICIAN**

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ENVIRONMENT AGENCY

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INVESTIGATION INTO ALGAL BLOOM CONDITIONS IN THREE FRESH WATER PONDS LOCATED AT THE MINIATURE PONY CENTRE, MORTONHAMSTEAD.

1. INTRODUCTION

The miniature pony centre is a commercial tourist attraction located on the outskirts of Mortonhamstead Devon at N.G.R. SX 718 846.

The centre has three spring fed fresh water ponds within the grounds. The ponds are used as an exhibit whilst creating a habitat for rainbow trout, geese, ornamental and wild ducks.

During the summer of 1996 an algal bloom appeared in two of the three ponds at the centre, these events have coincided with mortalities of a large number of rainbow trout and four ducks.

2. TERMS OF REFERENCE

The proprietor of the miniature pony centre Mr H. Owens approached the Environment Agency for assistance regarding the algal growth and the fish mortalities.

The Devon Area Investigations team was requested by J. Collett. (Devon Area Senior Biologist) to deploy suitable water quality monitoring equipment for the period of one week, and provide relevant data to assist her investigation into the possible causes of the algal bloom and the fish mortalities.

2.1. OBJECTIVES

Collection of relevant data by the deployment of suitable water monitoring equipment in the three ponds over the period of one week during algal bloom conditions.

2.2. PROJECT TEAM

T. Cronin (Project leader)
J. Collett (Project Manger)
N. Hicks (Project Technician)

3. SITE DESCRIPTION

A plan of the site to be investigated is shown in Figure 1.

For reference the ponds are named as Top, Middle, Bottom.

The pond area is easily accessible to the public to observe the ducks and fish at close range. Fish feeding by the public is encouraged by the provision of food dispensers on the bank

The Top pond is fed by two fresh water springs and discharges into the Middle pond.

ENVIRONMENT AGENCY



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It is an irregular shape of approximately 15 meters at its widest point and the overall depth is unknown, the pond was heavily silted when waded into. Within this pond there are approximately 350 rainbow trout and it is largely populated by ducks and geese.

There has been no reported sightings of any Algal bloom in this pond during 1996.

The Middle pond is of an irregular shape of approximately 25M at its widest point. There is a small island located in the centre of the pond, the overall depth is unknown. Within this pond there are approximately 400 rainbow trout, however birds are not inclined to use this pond.

During 1996 there has been constant growth of algae within this pond.

The Middle pond discharges into the Bottom pond which appears to be a shallow circular shape of approximately 12 M in diameter, this pond does not contain any fish but it is largely populated by ducks & geese.

During 1996 there has been constant growth of algae within this pond.

4. METHODS

The monitoring equipment used during this exercise consisted of three Solomat sondes connected to one Solomat logger box and one Grant Y.S.I. sonde and logger. (Solomat sonde PS 803, logger WP 4007, Grant Y.S.I. sonde 3815 logger 3812.)

A Solomat sonde was deployed in the top pond suspended from a metal stake approximately 4 meters from the bank.

Two Solomat sondes were deployed 20 meters apart in the middle pond, both were suspended from buoys approximately 6 meters from the bank. The logger box was located between the ponds in a weather proof container.

A daily weather /observation proformer was provided to pony centre staff to complete as an aide to interpretation of results. appendix 1.

5. RESULTS

The water quality monitors were deployed on Tuesday 10 /10/96 and recovered on Tuesday 21/10/96. The data was downloaded from the two logger boxes and imported into a Lotus 123 format.

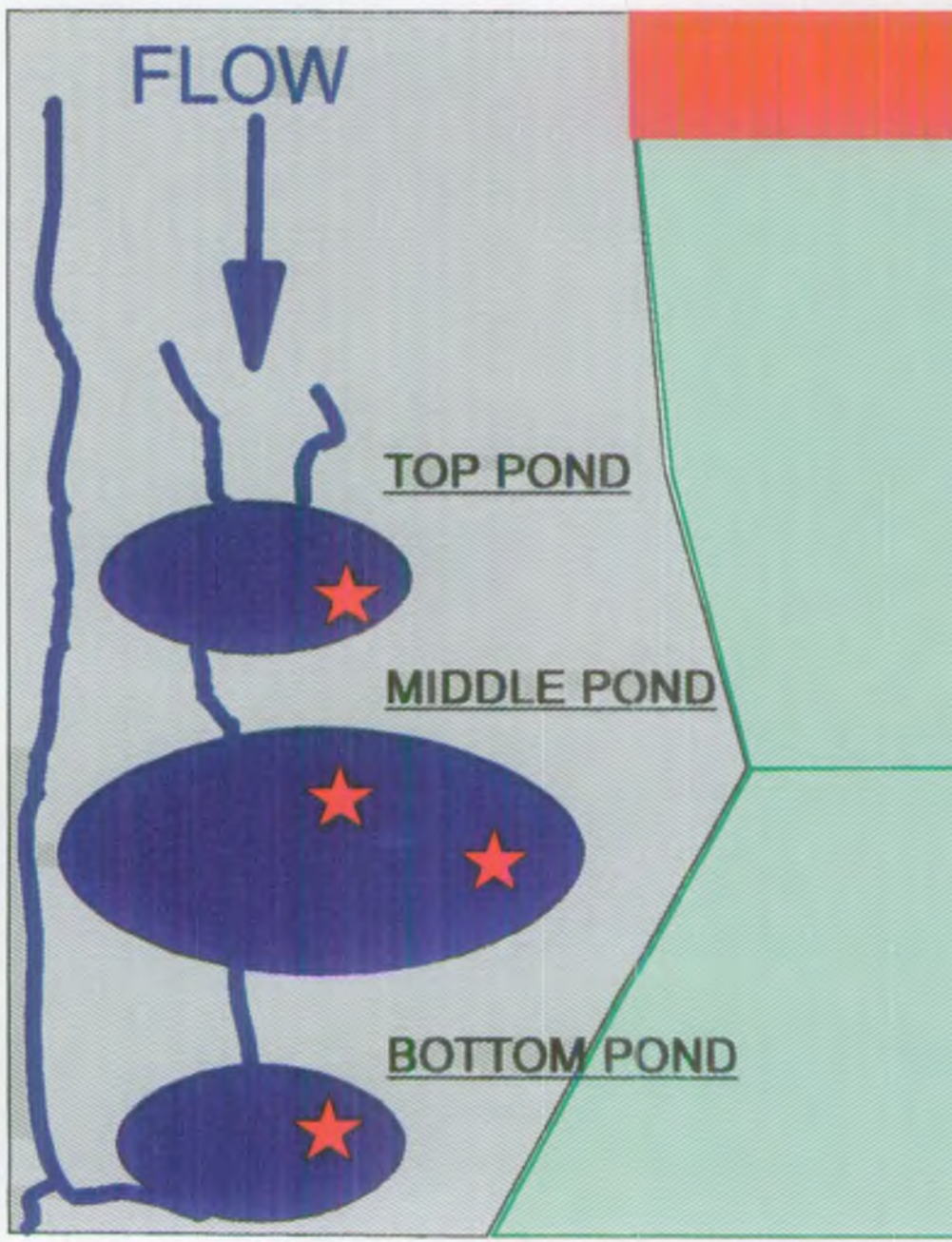
For spot sample results see. table 1 & 2.

Graphs were produced of all monitor data collected see. figures 1 - 4.

For weather /observation proformers see. appendix 1.

All data recorded was saved to a floppy disk named " Morton" and passed to J. Collett. (Devon Area Senior Biologist) for analysis and recommendations.

Figure 1. Site plan of ponds at the Miniature pony centre Mortonhamstead





KEY

	BUILDINGS
	GRAZING FIELDS
	PONDS
	PUBLIC ACCESS
	WATERCOURSE
	SONDE LOCATIONS



NOT TO SCALE

APPENDIX I

MINIATURE PONY CENTRE MORETONHAMPSTEAD POND INVESTIGATION

DAY / DATE.
WEATHER. Description
SUNSHINE. Total hours.
WIND. Direction & speed.

Tues. 15/10
 Cloud Sun, with heavy shed.
 C. Thunders.
 N/N.W. varying to W.
 0-2 gusting to 4.

TOP POND OBSERVATIONS

Algae present. ~~Yes~~ / no

Algae surface area %.

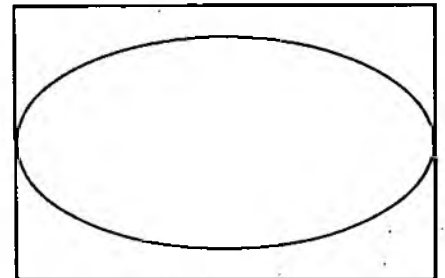
PLOT ON MAP RIGHT

Algae colour.

Algae depth From surface.

Pump used Yes / No. From / Untill.

General Comments.



MIDDLE POND OBSERVATIONS

Algae present. Yes / ~~No~~

Algae surface area %.

40%

PLOT ON MAP RIGHT

Algae colour.

Light Red / Oxide patches.

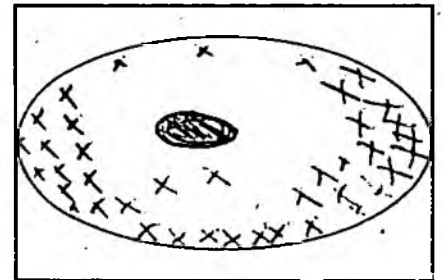
Algae depth From surface.

Flucting

Pump used Yes / No. From / Untill.

General Comments.

Generally thin with concentrations due to wind junction, adjacent to E. banks.



BOTTOM POND OBSERVATIONS

Algae present. Yes / ~~No~~

Algae surface area %.

Flucting 80%

PLOT ON MAP RIGHT

Algae colour.

light Red.

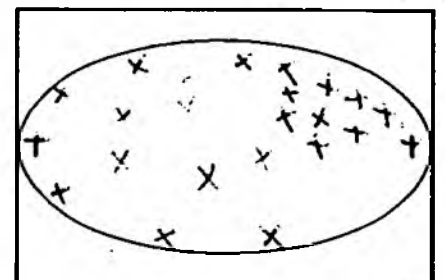
Algae depth From surface.

Flucting

Pump used Yes / No. From / Untill.

General Comments.

V. thin but widely spreads



MINIATURE PONY CENTRE MORETONHAMPSTEAD POND INVESTIGATION

DAY / DATE.

WEATHER.

SUNSHINE.

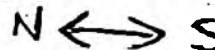
WIND.

Description

Total hours.

Direction & speed.

Wed. 16/10
 Sunny - isolated showers.
 6-8 hrs
 light S.W. wind



TOP POND OBSERVATIONS

Algae present.

~~Yes~~ / no

Algae surface area %.

PLOT ON MAP RIGHT

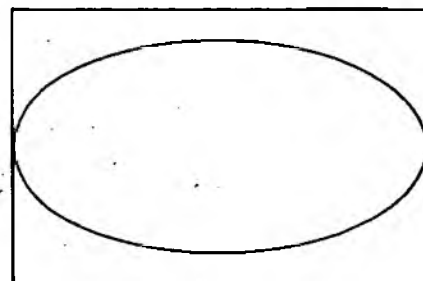
Algae colour.

Algae depth From surface.

Pump used

~~Yes~~ / No. From / Untill.

General Comments.



MIDDLE POND OBSERVATIONS

Algae present.

Yes / ~~no~~

Algae surface area %.

80%

PLOT ON MAP RIGHT

Algae colour.

L. Red.

Algae depth From surface.

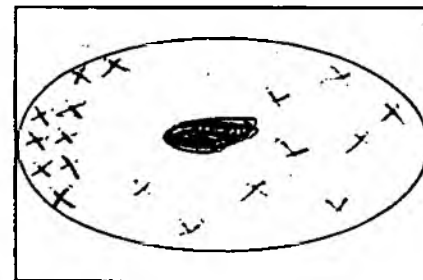
Surface.

Pump used

~~Yes~~ / No. From / Untill.

General Comments.

V. light film - more concentrated @ N. end



BOTTOM POND OBSERVATIONS

Algae present.

Yes / ~~no~~

Algae surface area %.

80%

PLOT ON MAP RIGHT

Algae colour.

L. Red.

Algae depth From surface.

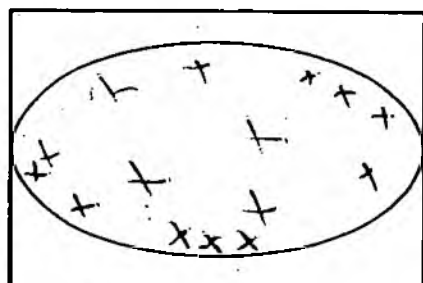
Surface & down to 1"

Pump used.

~~Yes~~ / No. From / Untill.

General Comments.

Water flow modest.



MINIATURE PONY CENTRE MORETONHAMPSTEAD POND INVESTIGATION

DAY / DATE.

WEATHER.

SUNSHINE.

WIND.

Description

Total hours.

Direction & speed.

Thurs 17/10
Sunny
Shrs
V. light S.

TOP POND OBSERVATIONS

Algae present.

~~Yes~~ / no

Algae surface area %.

PLOT ON MAP RIGHT

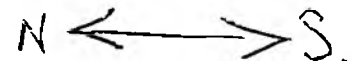
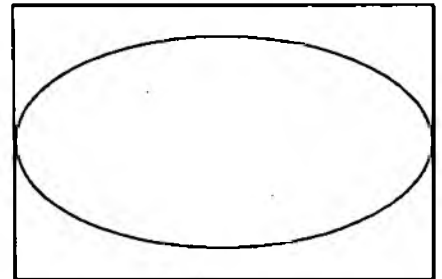
Algae colour.

Algae depth From surface.

Pump used

~~Yes~~ / No. From / Untill.

General Comments.



MIDDLE POND OBSERVATIONS

Algae present.

Yes / ~~NO~~

Algae surface area %.

60%

PLOT ON MAP RIGHT

Algae colour.

L. Red generally - oxide in S.W.

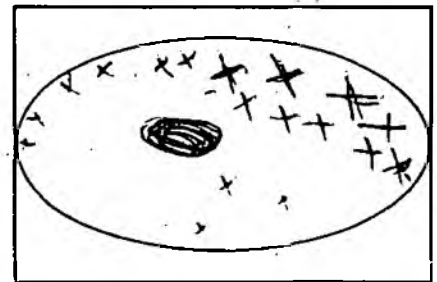
Algae depth From surface.

Floating

Pump used

~~Yes~~ / No. From / Untill.

General Comments.



BOTTOM POND OBSERVATIONS

Algae present.

Yes / ~~NO~~

Algae surface area %.

50%

PLOT ON MAP RIGHT

Algae colour.

L. Red.

Algae depth From surface.

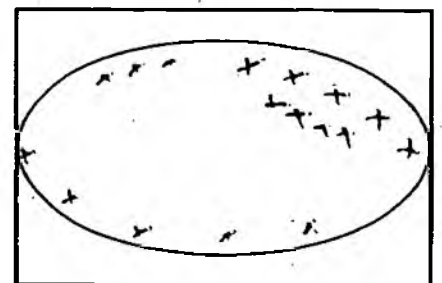
Floating

Pump used.

~~Yes~~ / No. From / Untill.

General Comments.

0' night frost -



o/n. Strong S-SW winds & heavy rain.

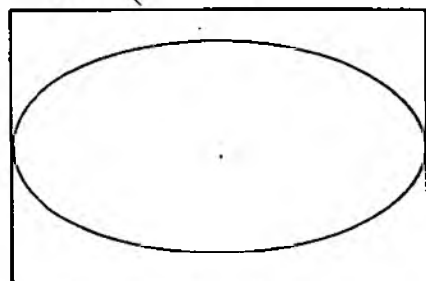
MINIATURE PONY CENTRE MORETONHAMPSTEAD POND INVESTIGATION

DAY / DATE.
WEATHER. Description
SUNSHINE. Total hours.
WIND. Direction & speed.

Fri. 18/10.
Heavy Rain pm.
2hrs.
S-SW. - blustery to F.3

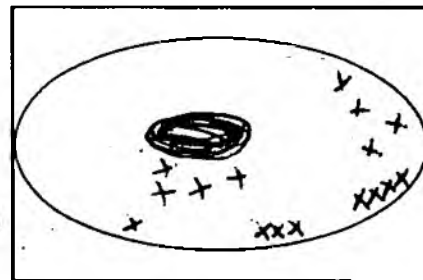
TOP POND OBSERVATIONS

Algae present. ~~Yes~~ / no
Algae surface area %. PLOT ON MAP RIGHT
Algae colour.
Algae depth From surface.
Pump used. ~~Yes~~ / No. From /Untill.
General Comments.



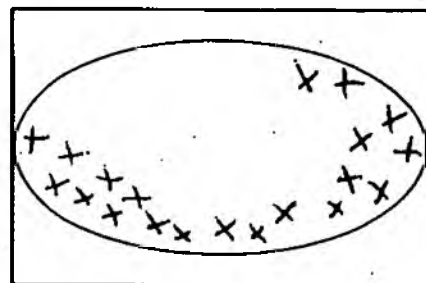
MIDDLE POND OBSERVATIONS

Algae present. Yes / ~~No~~
Algae surface area %. 30%
Algae colour. L. Red to Orange on edges
Algae depth From surface. Floccing
Pump used. ~~Yes~~ / No. From /Untill.
General Comments.



BOTTOM POND OBSERVATIONS

Algae present. Yes / ~~No~~
Algae surface area %. 50%
Algae colour. L. Red.
Algae depth From surface. Floccing
Pump used. ~~Yes~~ / No. From /Untill.
General Comments. Higher water flow.



O/N Clear with occasional rain.

MINIATURE PONY CENTRE MORETONHAMPSTEAD POND INVESTIGATION

DAY / DATE.

WEATHER.

SUNSHINE.

WIND.

Description

Total hours.

Direction & speed.

Sat 19/10.
Clouding, drizzle
2hrs.
SW-W. gusting Force 3.

TOP POND OBSERVATIONS

Algae present.

~~Yes~~ / no

Algae surface area %.

PLOT ON MAP RIGHT

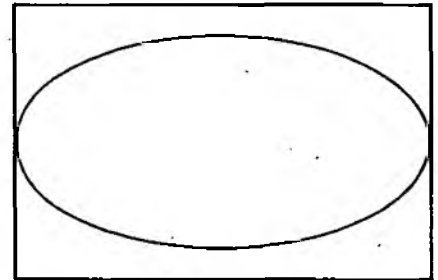
Algae colour.

Algae depth From surface.

Pump used

~~Yes~~ / No. From / Untill.

General Comments.



MIDDLE POND OBSERVATIONS

Algae present.

Yes / ~~no~~

Algae surface area %.

40%

PLOT ON MAP RIGHT

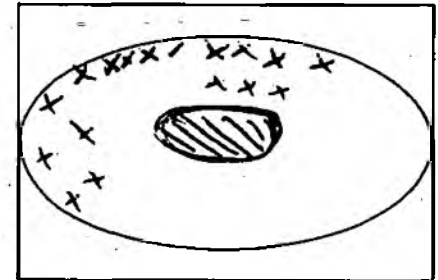
Algae colour.

L. Red to D. Red on Eastern edge.

Algae depth From surface.

Floccing
~~Yes~~ / No. From / Untill.

General Comments.



BOTTOM POND OBSERVATIONS

Algae present.

Yes / ~~no~~

Algae surface area %.

30%

PLOT ON MAP RIGHT

Algae colour.

L. Red. (v. thin).

Algae depth From surface.

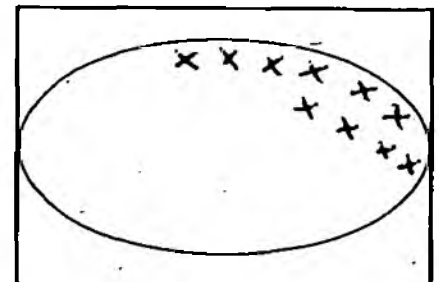
Floccing

Pump used.

~~Yes~~ / No. From / Untill.

General Comments.

Water flow fair



0/N. Strong S/SW. winds - heavy rain

MINIATURE PONY CENTRE MORETONHAMPSTEAD POND INVESTIGATION

DAY / DATE.
WEATHER. Description
SUNSHINE. Total hours.
WIND. Direction & speed.

Sun. 20/10.
Cloudy, Hot, gusty.
S/SW gusty to F.4.

TOP POND OBSERVATIONS

Algae present. ~~Yes~~ / no

Algae surface area %.

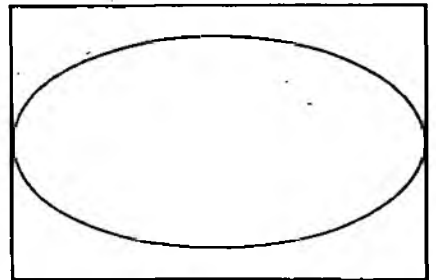
PLOT ON MAP RIGHT

Algae colour.

Algae depth From surface.

Pump used ~~Yes~~ / No. From / Untill.

General Comments.



← IN S →

MIDDLE POND OBSERVATIONS

Algae present. ~~Yes~~ / no

Algae surface area %.

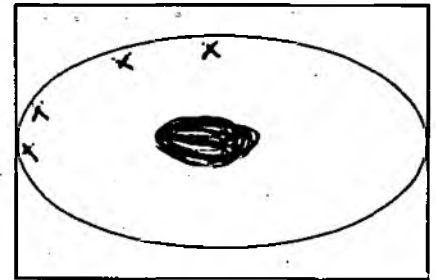
PLOT ON MAP RIGHT

Algae colour.

Algae depth From surface.

Pump used ~~Yes~~ / No. From / Untill.

General Comments.



Thin greyish/reddish film
floating on the periphery.

Algae appear virtually absent - but red h
in N end.

BOTTOM POND OBSERVATIONS

Algae present. ~~Yes~~ / no

Algae surface area %.

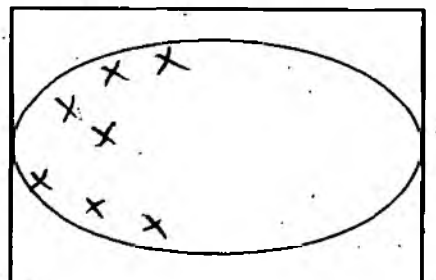
PLOT ON MAP RIGHT

Algae colour.

Algae depth From surface.

Pump used ~~Yes~~ / No. From / Untill.

General Comments.



L. Red.
?
Red hue more obvious than in the
middle pond - but in the water tank
then floating.

Still clear O/N.

MINIATURE PONY CENTRE MORETONHAMPSTEAD POND INVESTIGATION

DAY / DATE.
WEATHER. Description
SUNSHINE. Total hours.
WIND. Direction & speed.

Mon. 21/10.
Cloudy with bright per
2-4 hrs.
Light S.

TOP POND OBSERVATIONS

Algae present. ~~Yes~~ / no

Algae surface area %.

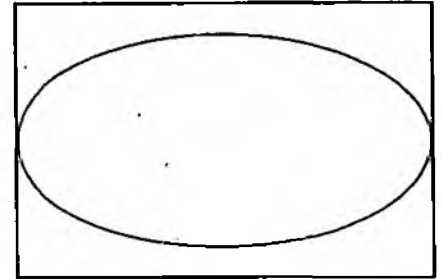
PLOT ON MAP RIGHT

Algae colour.

Algae depth From surface.

Pump used ~~Yes~~ / No. From / Untill.

General Comments.



← N.

MIDDLE POND OBSERVATIONS

Algae present. Yes / ~~no~~

Algae surface area %.

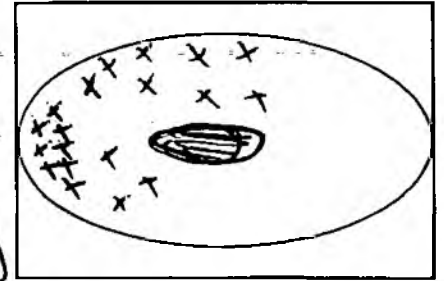
PLOT ON MAP RIGHT

Algae colour.

Algae depth From surface.

Pump used ~~Yes~~ / No. From / Untill.

General Comments.



'Grassy' film with increasing
red' to the N. and. J
Surface.

BOTTOM POND OBSERVATIONS

Algae present. Yes / ~~no~~

Algae surface area %.

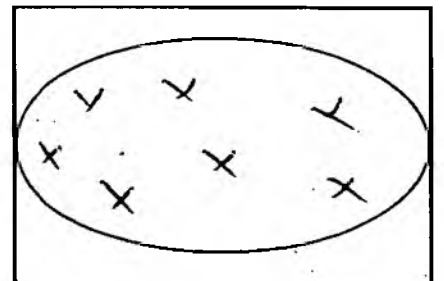
PLOT ON MAP RIGHT

Algae colour.

Algae depth From surface.

Pump used ~~Yes~~ / No. From / Untill.

General Comments.



Red hue to whole
pond - no pronounced
fleshy algae.

Table 1: Spot Sample Results - 15 Oct 96

Parameter (Units)	Location		
	Top Pond	Middle Pond	Bottom Pond
pH (pH units)	7.40	7.15	7.00
Conductivity at 20 Deg C (mS/cm)	132	141	146
Biochemical Oxygen Demand ATU (mg/l O)	5.6	5.7	13.2
Total Organic Carbon (mg/l C)	2.7	5.2	6.2
Ammonia (mg/l N)	0.08	0.06	0.37
Total Oxidised Nitrogen (mg/l N)	1.1	< 0.2	< 0.2
Nitrate (mg/l N)	1.08	< 0.2	< 0.2
Nitrite (mg/l N)	0.021	0.015	0.010
Suspended Solids at 105 Deg C (mg/l)	13	18	172
Alkalinity at 4.5 pH (mg/l)	32	34	38
Chloride Ion (mg/l Cl)	19	22	22
Fluoride (mg/l)	0.06	0.07	0.07
Ortho-Phosphate (mg/l P)	< 0.02	< 0.02	0.03
Dissolved Silicate (mg/l SiO2)	5.3	3.2	2.6
Sulphate (mg/l)	< 10.0	< 10.0	< 10.0

Time of Sampling: Top Pond 11:45, Middle Pond 11:55, Bottom Pond 12:05

Table 2: Spot Sample Results - 22 Oct 96

Parameter (Units)	Location			
	Top Pond	Middle Pond 1	Middle Pond 2	Bottom Pond
pH (pH units)	7.30	7.10	7.00	7.05
Conductivity at 20 Deg C (mS/cm)	135	137	138	140
Biochemical Oxygen Demand ATU (mg/l O)	3.6	4.0	6.4	4.4
Ammonia (mg/l N)	0.08	0.12	0.07	0.42
Total Oxidised Nitrogen (mg/l N)	1.40	0.35	0.30	<0.2
Nitrate (mg/l N)	1.380	0.328	0.280	<0.2
Nitrite (mg/l N)	0.023	0.022	0.020	0.019
Suspended Solids at 105 Deg C (mg/l)	7.7	7.0	11.0	5.9
Chloride Ion (mg/l Cl)	20	21	21	21
Ortho-Phosphate (mg/l P)	<0.02	<0.02	<0.02	0.02
Dissolved Silicate (mg/l SiO2)	5.8	3.9	3.7	3.4
Sulphate (mg/l)	<10.0	<10.0	<10.0	<10.0
Turbidity (FTU)	3	3	3	4
Chemical Oxygen Demand (mg/l O)	20	29	35	31
Cadmium (ug/l)	< 0.1	0.3	< 0.1	< 0.1
Sodium (mg/l Na)	11	12	11	11
Potassium (mg/l K)	2.1	2.9	3.0	3.4
Copper (mg/l Cu)	0.004	0.008	0.003	0.003
Magnesium (mg/l Mg)	2.6	2.5	2.5	2.6
Calcium (mg/l Ca)	12	11	11	11
Zinc (mg/l Zn)	0.024	0.029	0.010	0.012
Boron (mg/l B)	<0.1	<0.1	<0.1	<0.1
Aluminium (mg/l Al)	0.06	0.08	0.06	0.10
Lead (mg/l Pb)	<0.002	0.005	0.003	0.003
Vanadium (mg/l V)	<0.002	<0.002	<0.002	<0.002
Chromium (mg/l Cr)	<0.001	<0.001	<0.001	<0.001
Iron (ug/l Fe)	0.11	1.2	1.5	1
Nickel (mg/l Ni)	<0.005	<0.005	<0.005	<0.005

Time of Sampling: Top Pond 13:00, Middle Pond 13:10, Bottom Pond 13:20

Figure 1. Top pond graphed data.

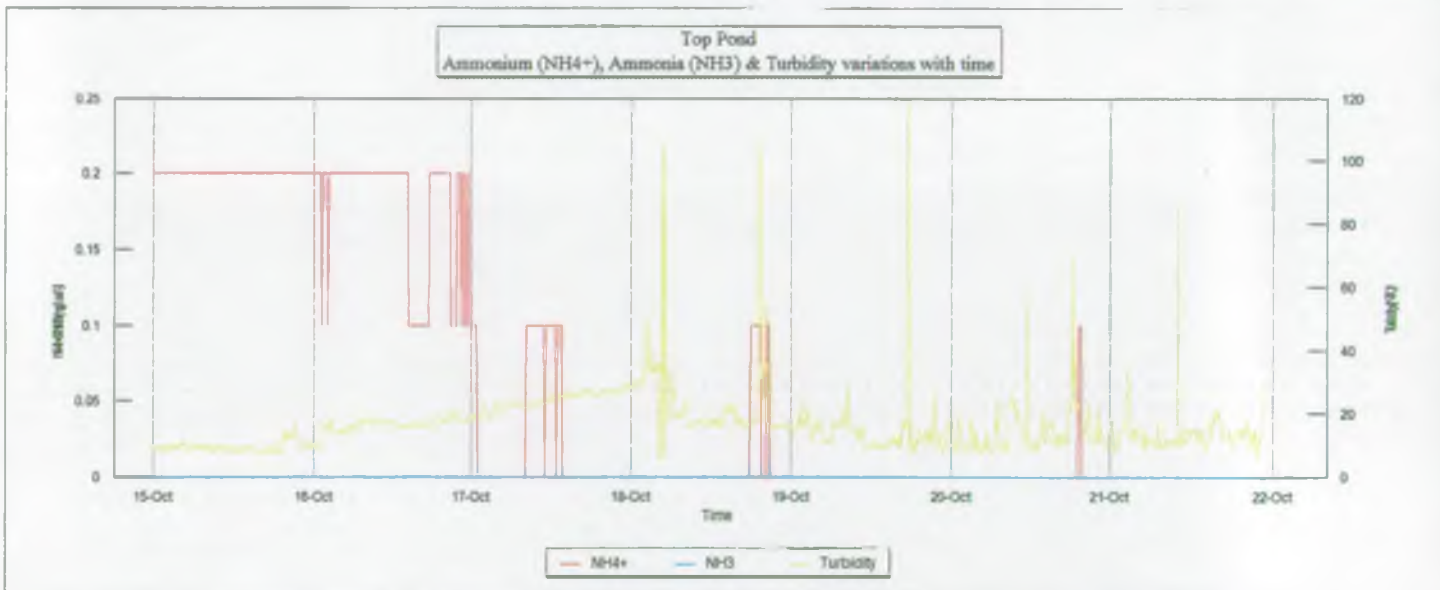
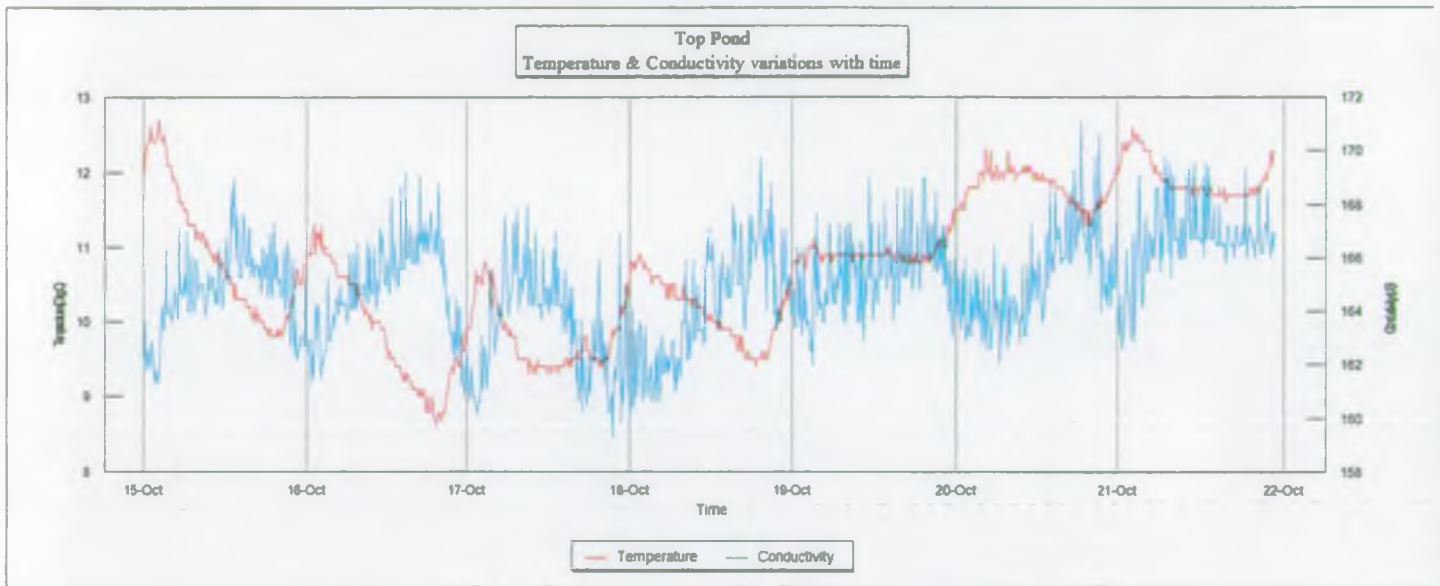
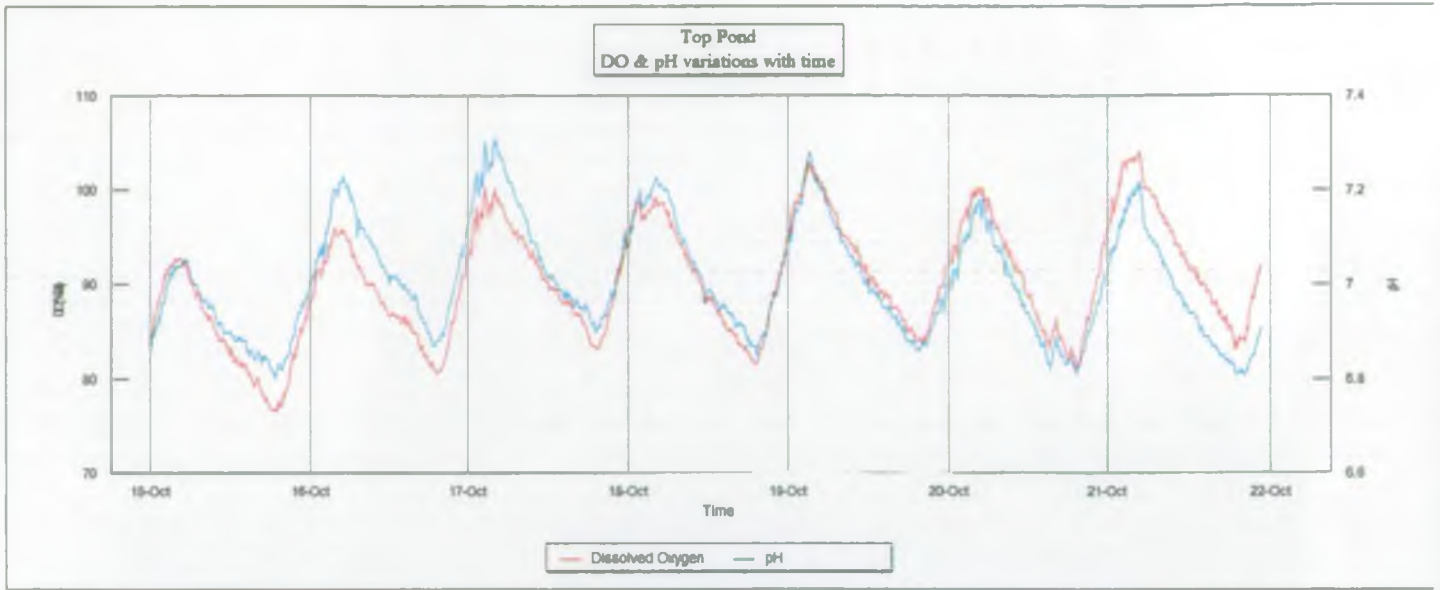
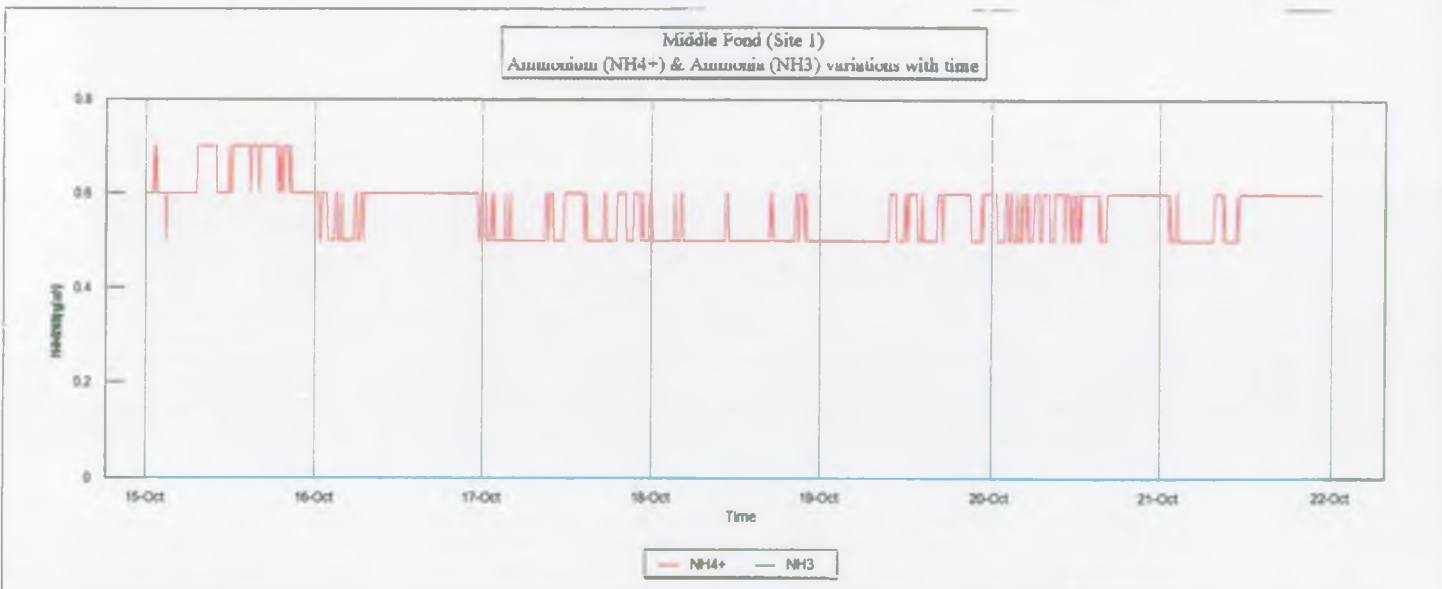
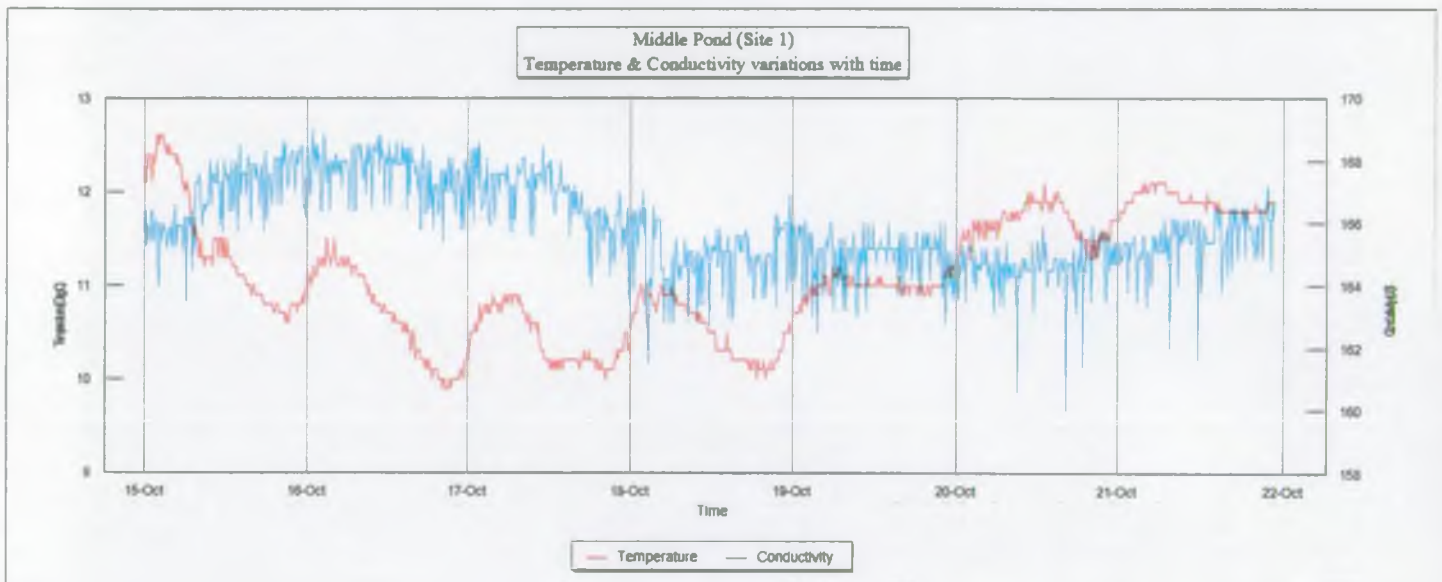
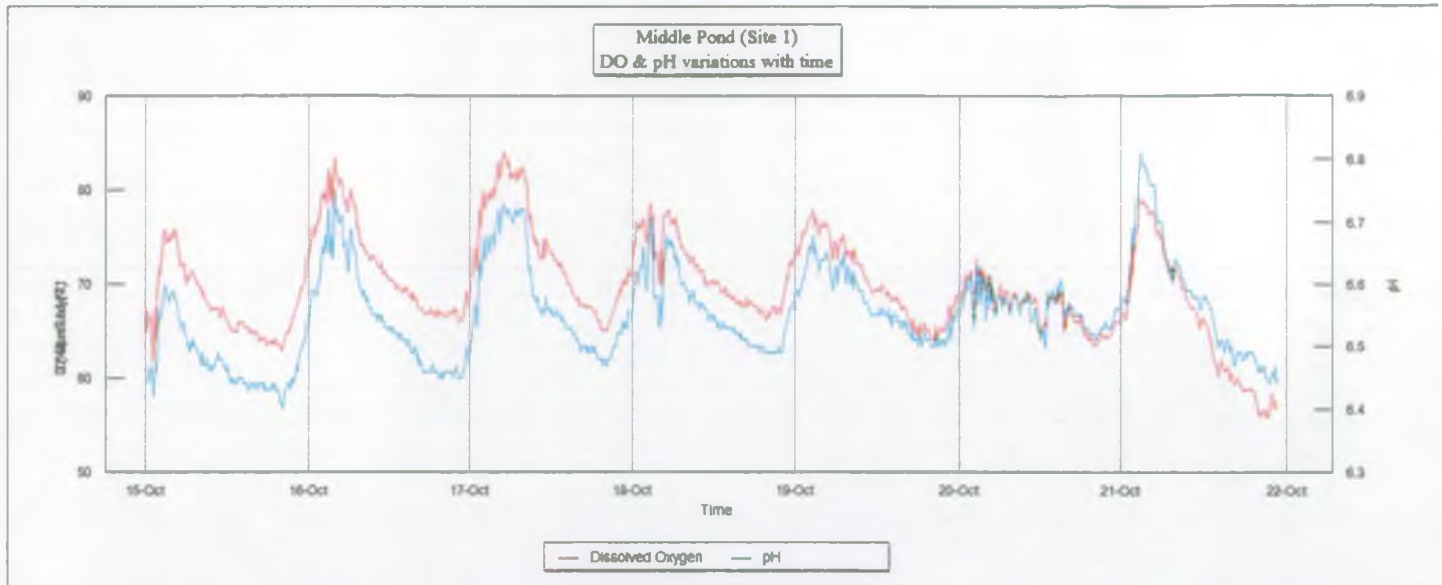
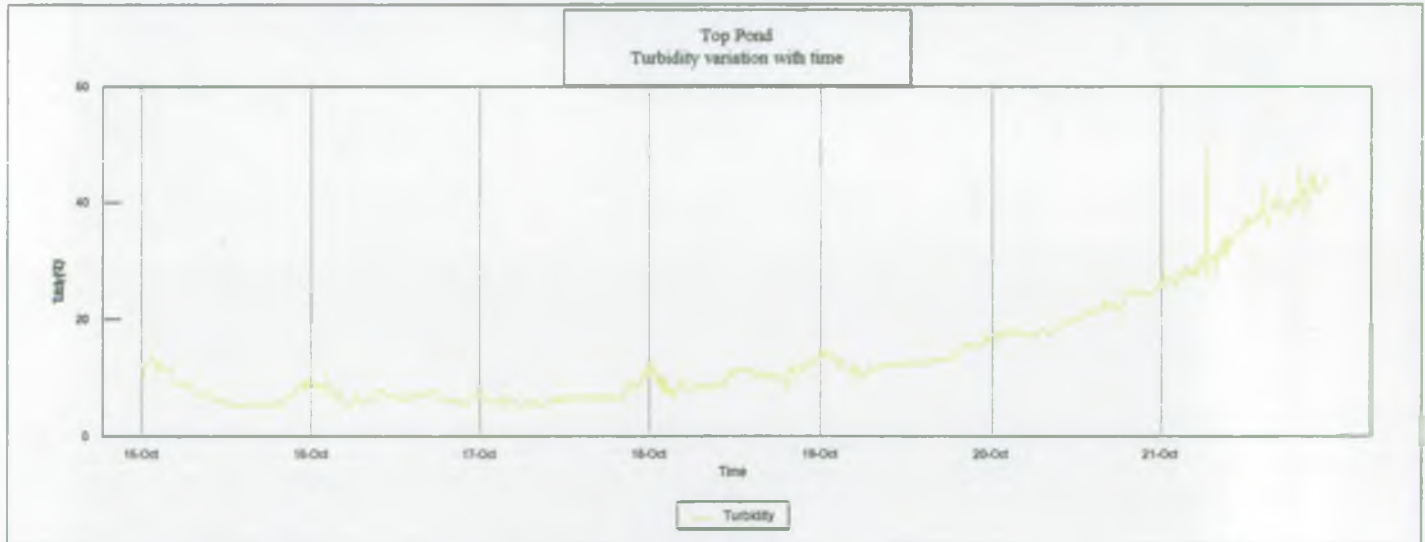
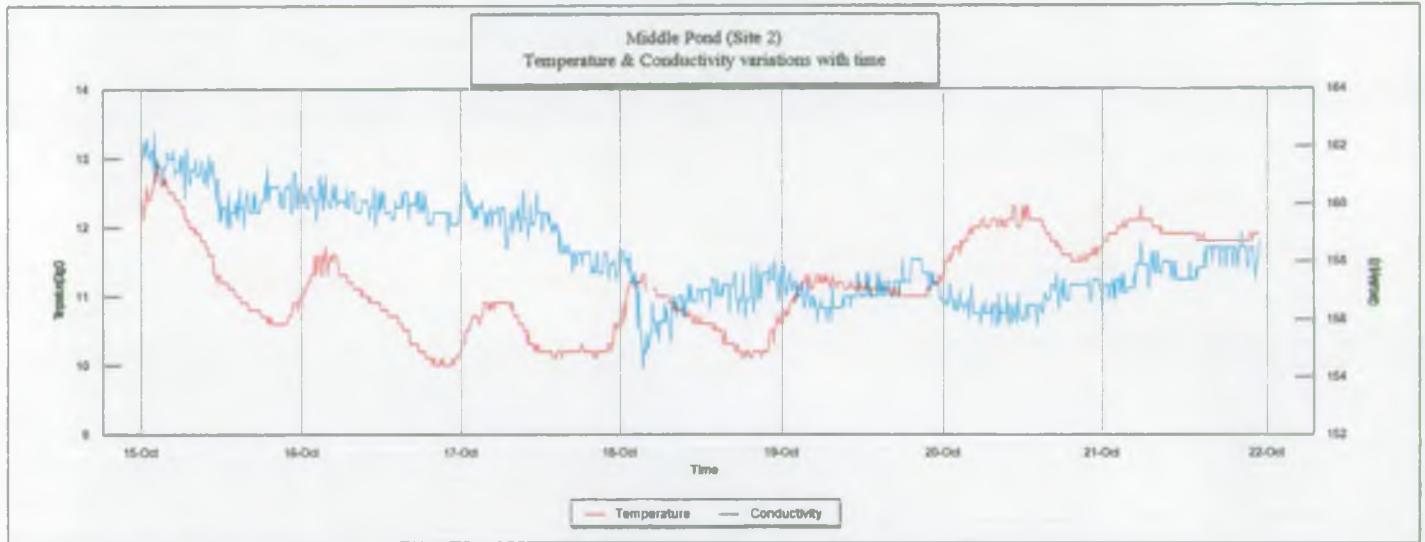
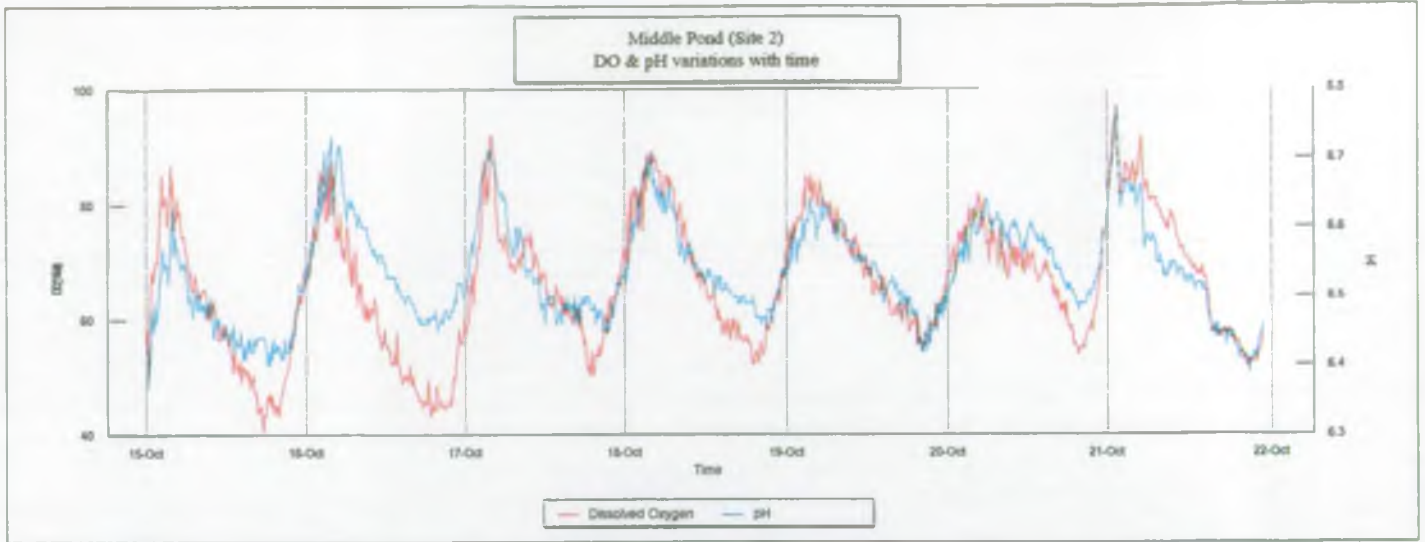


Figure 2. Middle pond, site 1 graphed data.



Note: Turbidity is not plotted due to poor results.

Figure 3. Middle pond, site 2 graphed data.



Note: Ammonium (NH₄⁺) and Ammonia (NH₃) are not plotted as all values recorded were 0.0 mg/l (as N)

Figure 4. Bottom pond graphed data.

