

**FRASER RIVER  
ACTION PLAN**



Survey of  
Agricultural  
Practices in the  
Thompson  
Basin - 1995

DOE FRAP 1996-14

# **SURVEY OF AGRICULTURAL PRACTICES IN THE THOMPSON BASIN - 1995**

DOE FRAP 1996-14

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## TABLE OF CONTENTS

TABLE OF CONTENTS -----	i
LIST OF FIGURES-----	ii
LIST OF TABLES -----	ii
ABSTRACT/ RÉSUMÉ-----	iii
1.0 INTRODUCTION -----	1
2.0 METHODS AND SURVEY RESULTS -----	1
2.1 Regional Referral Process -----	2
2.2 Priority and Site Rating -----	3
2.3 Water Quality Sampling-----	4
2.4 Site Improvements-----	7
3.0 DISCUSSION -----	7
3.1 Peer Referrals -----	7
3.2 Identification of Sites-----	8
3.3 Environmental Stewardship -----	8
3.4 Normal vs. Historic Farm Practices-----	9
3.5 Native Peer Advisor Instruction -----	9
4.0 CONCLUSION-----	10
4.1 Recommendations -----	10
REFERENCES -----	11
ACKNOWLEDGMENTS-----	11

## LIST OF FIGURES

Figure 1	Flight Patterns-----	19
Figure 2	1994/95 Total nitrogen concentrations in Durand Creek - upstream, downstream and midpoints of confined livestock area-----	12
Figure 3	1994/95 Total phosphorus concentrations in Durand Creek - upstream, downstream and midpoints of confined livestock area-----	13
Figure 4	1994/95 True color levels in Durand Creek - upstream, downstream and midpoints of confined livestock area-----	14
Figure 5	1994/95 Turbidity levels in Durand Creek - upstream, downstream and midpoints of confined livestock area-----	15
Figure 6	1994/95 Total Organic Carbon concentrations in Durand Creek - upstream, downstream and midpoints of confined livestock area-----	16
Figure 7	1994/95 Total Ammonia concentrations in Durand Creek - upstream, downstream and midpoints of confined livestock area-----	17
Figure 8	1994/95 Fecal Coliform levels in Durand Creek - upstream, downstream and midpoints of confined livestock area-----	18

## LIST OF TABLES

Table 1	Summary of 1994 Referrals to BC Cattlemen's Association-----	2
Table 2	Status of 1994 Survey Referrals to BC Cattlemen's Association---	3
Table 3	Ministry of Environment Site Ratings for 1995 Fly-Over Sites-----	3
Table 4	Field Conditions at Time of Sampling-----	5

## LIST OF PLATES

Plate 1	Durand Creek Sampling Sites through Confined Livestock Area --	5
<b>Appendix 1</b>	-----	<b>20</b>

## **ABSTRACT**

The reduction in loading of nutrients and other contaminants from agricultural sources can be achieved through the identification of sources and contaminants and the implementation of abatement and prevention measures.

The second year of the “Survey of Agricultural Practices in the Thompson Basin” expanded the inventory of agricultural practices using three helicopter fly-overs. These fly-overs identified seventy (70) sites of potential environmental impact (SPEI) from agriculture, bringing the total to one hundred and seventy-three (173) sites. The sites were prioritized and are being evaluated by the staff of the Thompson Nicola sub-region of the Ministry of Environment, Lands and Parks.

During the second year of surveying agricultural practices in the Thompson Basin it has become apparent that there is a need to:

1. continue the ongoing identification of SPEIs,
2. encourage stewardship awareness and incorporate these practices into farm management practices,
3. clarify acceptable practices relative to the “Code of Agricultural Practices for Waste Management” and
4. incorporate native/aboriginal agricultural operations into the regional study.

The peer advisory referral system has been found to be generally ineffective in dealing with regional environmental impact concerns.

The success of implementing the Agricultural Waste Control Regulation depends on the use of a multi-agency approach, follow-up inspections and on-going monitoring. Monitoring includes both site visits and water quality assessments. The combination of these factors successfully implemented will promote a sustainable agricultural industry.

## **RÉSUMÉ**

On peut réduire la charge de nutriments et d'autres contaminants des sources agricoles en décelant les sources et les contaminants et en mettant en oeuvre des mesures de réduction et de prévention.

Pour la deuxième année de la «Survey of Agricultural Practices in the Thompson Basin» (enquête sur les pratiques agricoles dans le bassin Thompson), on a élargi la zone d'inventaire des pratiques agricoles grâce à trois survols d'hélicoptère. Ainsi, on a pu relever soixante-dix (70) sites d'impacts environnementaux potentiels (SIEP) attribuables à des activités agricoles, ce qui en porte le total à cent soixante-treize (173). Ces sites, classés par ordre de priorité, sont actuellement évalués par le personnel de la sous-région Thompson Nicola du ministère de l'Environnement, des Terres et des Parcs.

Au cours de la deuxième année d'enquête sur les pratiques agricoles dans le bassin Thompson, il est devenu évident qu'il faudra :

1. continuer à relever les SIEP;
2. encourager la sensibilisation aux pratiques de bonne intendance de l'environnement et inclure celles-ci dans les pratiques de gestion des exploitations agricoles;
3. préciser les pratiques acceptables quant au «Code of Agricultural Practices for Waste Management» (code des pratiques agricoles en vue de la gestion des déchets);
4. inclure les pratiques agricoles des autochtones dans l'étude régionale.

En gros, le système consultatif d'examen par les pairs a été jugé inefficace pour ce qui est des préoccupations relatives aux impacts sur l'environnement à l'échelon régional.

L'application efficace du Agricultural Waste Control Regulation (Règlement sur la lutte aux déchets agricoles) dépend du recours à une approche combinant les efforts de plusieurs organismes, des inspections de suivi et une surveillance constante. Cette dernière comprend des visites des lieux et des évaluations de la qualité de l'eau. Ces facteurs favoriseront ensemble l'exploitation d'une industrie agricole durable.

## 1.0 INTRODUCTION

Identification of sources and contaminants from agricultural runoff is crucial to the reduction in the loading of nutrients and other contaminants to the Thompson River drainage basin. The 1992 Thompson River Water Quality Assessment and Objectives technical appendix states that “the South Thompson River receives an unknown quantity of material as a result of agricultural activities, particularly cattle operations.” Although “significant effects on water quality have been noted ... few data are available to document these problems (nutrient input, erosion, suspended sediment) and more effort should be expended in investigating this potentially serious problem” (Nordin & Holmes, p. 20).

The degree of nutrient contamination and other concerns arising from agricultural sources is closely tied to the prevention and waste control measures used by ranchers. In the Thompson Okanagan region the total number of cattle amounts to 131,000 head in the winter. Manure generated by “typical” seasonal feeding in confined livestock operations amounts to 98,250,000 kg of manure (Broersma et al., 1995). The *Agricultural Waste Control Regulation* (AWCR) (BC Reg. 131/92) and the *Code of Agricultural Practice for Waste Management, April 1, 1992* (“Code”) define acceptable practices for using, storing and managing agricultural waste in an environmentally sound manner. The “Environmental Guidelines for Beef Producers in British Columbia” were developed to help ranchers incorporate acceptable practices at the ‘on farm’ level (Ministry of Agriculture, Fisheries and Food, 1992). It is the mandate of BC Environment to administer the AWCR and the “Code”.

## 2.0 METHODS AND SURVEY RESULTS

In April of 1995, staff from the Thompson-Nicola sub region of BC Environment, accompanied by representatives from the BC Cattlemen’s Association (BCCA), initiated the second year of the “Survey of Agricultural Practices in the Thompson Basin”. Similar to the previous year, the purpose of the inventory was to identify runoff and contaminant sources and to determine compliance with the “Code” (John & Geier, 1994). Three separate helicopter routes were flown (Figure 1). On the flights, sites were initially selected visually for “potential” impact and photographed. The representatives of BCCA assisted in the identification of ownership of the properties. Ground locations and addresses were then determined and “on farm” site visits initiated. A representative selection of sites is provided with attached photos in Appendix 1. The information collected from the fly-overs is used to determine site specific abatement and prevention measures that need to be implemented at every identified site. An inventory of sites is maintained by BC Environment.

The fly-overs identified a total of seventy (70) potential impact sites. Eight (8) of these sites were carry-overs from the 1994 survey.

## 2.1 REGIONAL REFERRAL PROCESS

As a result of the “Survey of Agricultural Practices in the Thompson Basin - 1994”, twenty five (25) sites were referred to the BC Cattlemen’s Association for peer inspections. Details of these referrals are tabulated in Table 1. When a referral is received, the Association forwards the concern to a local peer inspector who is expected to visit the site, assess the situation, and provide advice regarding corrective measures. It was considered that a two (2) month response time for referrals would be acceptable to BC Environment in most cases. If a peer inspection did not take place within that time frame, the producer would not likely receive sufficient time to take corrective measures to ensure that the concern (e.g. contaminated runoff) did not recur the following winter. It is recognized that the sources and contaminants from agricultural runoff in the beef cattle industry throughout the Thompson basin often occur during the winter months when intensive feeding and calving occurs and snowmelt conditions exist. The producers with problems as identified from the helicopter fly-overs and subsequent site visits are generally given reasonable time to commence and complete necessary remediations.

**Table 1: Summary of 1994 Referrals to BC Cattlemen’s Association**

SITE #	Referral Date	1994 BCCA REFERRAL SUMMARY			Status
		Inspected?	Referral Resent	Inspection/Report Satisfactory?	
<i>Flight #1</i>					
1.2	Sep 8/94	no	Feb 6/95	reverted to MOE	open
1.5	Sep 8/94	no		reverted to MOE	open
1.6	Sep 8/94	Dec 28/94	Feb 6/95	Yes	closed
1.13	Sep 8/94	no	Feb 6/95	n/a	open
1.16	Sep 8/94	Nov 14/94	Feb 6/95	No	open
1.21	Sep 8/94	Feb 16/95	Feb 6/95	OK	closed
1.27	Sep 8/94	Oct 5/94		Yes	closed
<i>Flight #2</i>					
2.4	Sep 8/94	no	Feb 6/95	reverted to MOE	open
2.8	Sep 8/94	Oct 29/95		Yes	closed
2.11	Sep 8/94	Oct 14/94		Yes	closed
2.17/18	Sep 8/94	Oct 14/94		Yes	closed
<i>Flight #3</i>					
3.3	Sep 8/94	no		reverted to MOE	open
3.4	Sep 8/94	Oct 18/94		OK	closed
3.5	Sep 8/94	no	Feb 6/95	reverted to MOE	closed
3.17	Sep 8/94	Oct 26/94		follow-up required	open
3.18	Sep 8/94	Oct 22/94		No	open
3.19	Sep 8/94	Nov 10/94		No	open
3.20	Sep 8/94	Oct 6/94		Yes	closed
3.21	Sep 8/94	Nov 7/94		Yes	closed
<i>Flight #4</i>					
4.4	Sep 8/94	Nov 8/94		No	open
4.18	Sep 8/94	no		n/a	closed
4.22	Sep 8/94	Oct 17/94		No	open
4.24	Sep 8/94	no	Feb 6/95	n/a	open
4.25	Sep 8/94	no	Feb 6/95	n/a	open
4.27	Sep 8/94	no	Feb 6/95	n/a	open

Total results of the 25 referrals to the BC Cattlemen's Association (BCCA) from the 1994 survey are reported in Table 2.

**Table 2: Status of 1994 Survey Referrals to BC Cattlemen's Association**

1994 BCCA REFERRAL TOTALS						
SITES	PEER INSPECTED			INSPECTION SATISFACTORY		REFERRAL
	YES	NO	Within 2 Months	YES	NO	RESENT
25	15	10	12	10	5	11

*(Updated February 1996)*

Ten (10) of the twenty five (25) referrals to the BC Cattlemen's Association peer advisors in 1994 were considered to be satisfactorily inspected for the purposes of the Thompson Basin project. Referrals for 1995, the second year of the study, were not continued under the BCCA peer advisory system pending satisfactory improvement in the process. The consequences of a breakdown in the referral system is discussed in Section 3.1.

## 2.2 Priority and Site Rating

A priority rating system showing potential impact based on several operational factors was formulated during the first year of the study (John & Geier, 1994). In 1995, it was determined that all sites identified in the second year of fly-overs required a Ministry of Environment site visit. From the aerial photos, the impacts were prioritized subjectively from 1 (low) to 5 (high) (Table 2).

**Table 3: Ministry of Environment Site Ratings for 1995 Fly-Over Sites**

IMPACT	RATING	# of SITES
5	HIGH	3
4		13
3	MODERATE	28
2		13
1	LOW	5
carry-over from 1994		8
<b>TOTAL</b>		<b>70</b>

### 2.3 Water Quality Sampling

Water quality monitoring during the second year of the project largely consisted of runoff event driven sampling. When a runoff event was occurring and it was designated as a potentially high impact event to the receiving environment, water samples were taken to assess the impact.

In the first year of the project, two study areas were selected for ongoing water quality monitoring. Both study areas were considered to have high potential impact to the receiving environment. The producers involved have undertaken initiatives to reduce impacts from their operations and have supported the water quality monitoring.

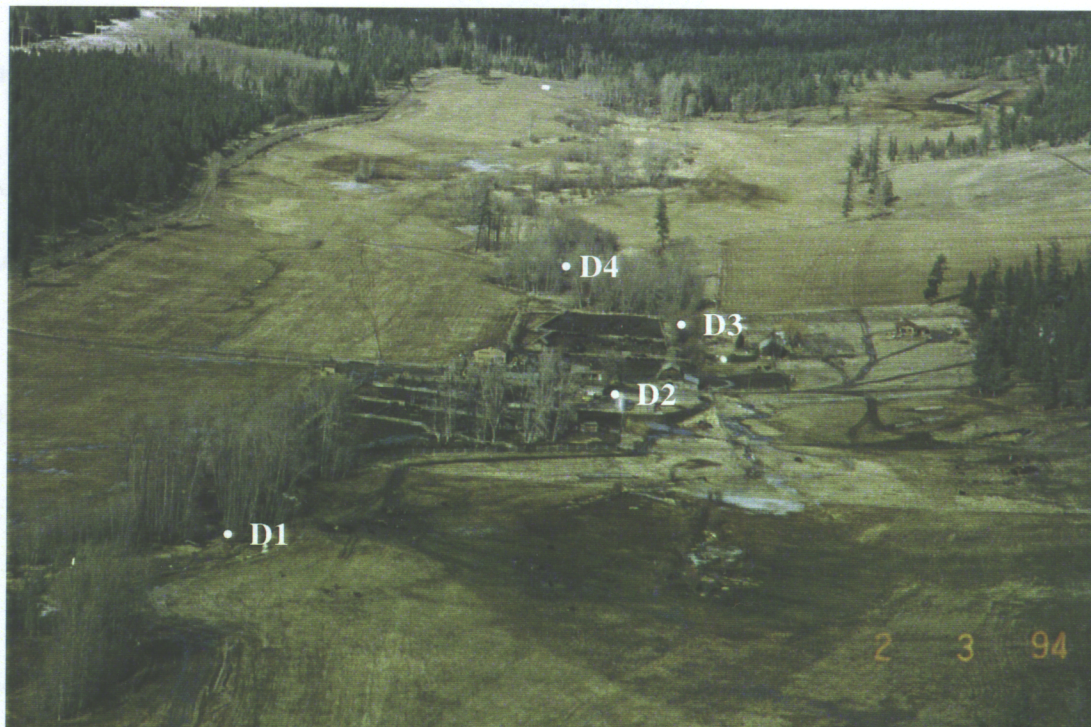
One of the study areas consisted of a series of 28 horse pens with direct access to a creek. Livestock were permitted to roam freely along the streambank. Sampling was initiated immediately upstream of the confined areas, which was downstream of a marshy wetland. Difficulty in separating contaminant sources, and the fact that all pens were subsequently relocated to a distance >30 meters from the watercourse (livestock access to the creek was denied), resulted in this area being discontinued for ongoing water quality monitoring.

The second study area selected for long term monitoring was a ranch that historically wintered cattle in pens immediately adjacent to the banks of Durand Creek. There was no electric power to the area. The ranch had approximately 1000 cows and anywhere from 200 to 500 head were winter fed in these pens, depending on the year. Approximately ten (10) pens were situated on either side of the watercourse. Three hundred and fifty (350) heifers calved at this site during the winter of 1995. Livestock access to Durand Creek has since been denied and feeding now occurs at a distance >30 meters from the watercourse. Approximately 50% of the pens have had the manure scraped from them during the summer and fall of 1994. There remains some potential for runoff to enter the watercourse from some pens and it is suspected that leaching could occur from the buildup of manure in several pens.

The estimated dry matter manure generated from “typical” winter feeding (150 days) at this study area, using an average of 350 head and the nutrient content of beef manure from the North Okanagan Soil Conservation Group as adapted by Broersma (Broersma et al., 1995), would amount to:

350 head x 5 kg manure/day x 150 days/year = 262,500 kg and includes 1050 kg Nitrogen (N), 551 kg Phosphorus (P), 115,500 kg/day Biochemical Oxygen Demand (BOD) and 567,000 kg/day Chemical Oxygen Demand.

Four (4) sampling sites along the length of Durand Creek were selected as seen in Plate 1. Site D2 at the bridge is located halfway through the confined areas. The diversion site location D3 is adjacent to the most downstream of the confined areas and where water can be diverted for irrigation. Both are susceptible to potential runoff and/or leaching conditions. The downstream site D4 is accessed on occasion by seasonally grazing cattle. Site D4 samples downstream were collected above areas of trampling and manure deposit. Site D1 was a control upstream of the confined area.



**Plate 1: Durand Creek Sampling Sites through Confined Livestock Area**

The results of four water quality sampling events for this site have been graphed for true color, turbidity, total organic carbon, ammonia, total nitrogen, total phosphorus and fecal coliforms (Figures 2-8). Field conditions at the time of sampling are reported in Table 4.

**Table 4: Field Conditions at time of Sampling**

SITE #	LOCATION	° CELSIUS	TEMPERATURE		DATE	
			94/09/27	94/11/30	95/04/19	95/10/31
D1	Durand Crk US	air	20	2	6	-3
		water	10	-2	6	7
D2	Durand Crk @ bridge	air	19	3	6	-3
		water	11	-2	6	6
D3	Durand Crk @ diversion	air	18	3	7	-3
		water	11	-1	6	6
D4	Durand Crk DS	air	19	7	7	-3
		water	8	-3	6	5

The observations on the water quality sampling results are as follows:

Total Nitrogen	-	Concentration from sites D2 and D3 increased relative to D1 and D2 sampling sites on two occasions (Figure 2).
	-	Highest concentrations were during cold runoff conditions, November 94
	-	Lowest concentrations occurred during cool, low flow conditions, Oct. 95.
Phosphorus	-	Downstream site D4 indicated a cumulative loading on four sampling events (Figure 3)
	-	Highest overall concentrations occurred in April 1995.
	-	Highest background concentration at D1 occurred in April 1995.
	-	Lowest concentrations at site D4 during cool, low flow conditions, October 1995.
True Color	-	Highest levels occurred in April 1994 (Figure 4).
	-	Lowest levels occurred during warm, low flow conditions, September 1994.
Turbidity	-	Highest levels occurred in April 1994 (Figure 5).
	-	Lowest levels overall were during cool, low flow conditions, October 1995.
Total Organic Carbon	-	Upstream site D1 recorded highest overall results in April 1994 (Figure 6).
	-	Highest concentrations occurred in April 1994.
	-	Lowest overall concentrations were during cool, low flow conditions, October 1995.
Ammonia	-	Highest individual concentrations occurred during the cold runoff conditions in November 1994 at site D1 (Figure 7).
	-	Concentrations increased at site D4 relative to site D3 during November 1994, April 1995, and October 1995.
Fecal Coliforms	-	Increase in levels between D1 and three downstream sites in 3 sampling events and site D3 only on one event (Figure 8).
	-	Highest levels occurred in April 1995.
	-	Lowest levels occurred during cold runoff conditions.

The results to date demonstrate some preliminary trends. Five of the seven parameters examined in this report indicate that the greatest impact occurred on April 19, 1994, concurrent with intensive winter livestock feeding. Results from samples taken at the bridge (D2) and the diversion site (D3) indicated that the confined areas were impacting

on Durand Creek under a variety of seasonal conditions. Water quality monitoring will continue at these sites in 1996. The ongoing monitoring of Durand Creek should illustrate the benefits of these works over time.

## 2.4 Site Improvements

Since the initiation of the program, BC Environment has advised upon various site improvements on numerous ranches. Fence lines have been moved back from creeks, livestock waterers have been installed and access to watercourses has been restricted or denied. Berms, diversion ditches and creation of buffer zones combined are expected to reduce the effects of runoff from agricultural operations.

Some producers have been recognized as a group for their work in pollution prevention and abatement in an article published in January/February 1996 issue of the Beef in BC magazine (John, 1996, p. 47). BC Environment nominated Eagle Valley Ranch, the 1995 winners of the prestigious BCCA Environmental Stewardship Award. Eagle Valley Ranch on Loon Lake was a site identified in the 1994 fly-overs of the Thompson Basin Study and “was transformed from an operation that was in total non-compliance in 1994 with the Agricultural Code of Practice for Waste Management to a “model operation” in 1995” (Leach, 1995, p.31).

## 3.0 DISCUSSION

The 1995 work found that there are several regional issues affecting the potential progress towards achieving a goal of reducing the loading of nutrients and other contaminant sources from agricultural operations. Resolution or improvement in the following has or will be initiated and will likely result in a reduction in the contaminant loading to local watercourses.

### 3.1 Peer Referrals

The Environmental Guidelines for the various commodity groups published by the Ministry of Agriculture, Fisheries and Food (MAFF) discuss the system in place for resolving agricultural environmental concerns (e.g. Environmental Guidelines for Beef Cattle Producers in British Columbia, 1992). The Agricultural Environmental Protection Council (AEPC) and the B.C. Cattlemen’s Association (EnvirAlert) are both continuing to improve upon a peer advisor program developed to respond to and resolve nuisance and pollution complaints in the province. The guidelines demonstrate the referral process mechanism from the complaint routing, investigation, reporting and response time.

The referrals initiated by the Thompson Basin study have been tracked since 1994 (Table 1). The results of these referrals do not meet the standards of expectations as laid out by the AEPC in the Environmental Guidelines for Beef Cattle Producers (MAFF, pp. 59-61).

This is a breakdown in a non-regulatory approach designed for farmers or ranchers to address and resolve complaints within their industry. As a consequence, representatives of the Ministry of Environment, Lands and Parks (MELP) are responding to 98% of registered complaints. For the farmer and rancher, this means a decreased opportunity for advice and education and a higher incidence of enforcement.

### 3.2 Identification of Sites

The Survey of Agricultural Practices in the Thompson Basin has identified one hundred seventy three (173) potential impact sites using seven (7) helicopter fly-overs in 1994 and 1995. Staff of the Ministry of Environment, Lands and Parks responded to thirty three (33) unrelated public complaints in the same time period. Sites identified to date have been through a general synoptic approach and not a comprehensive watershed approach. It is apparent that regional geography does not presently support a high incidence of public involvement in identifying problems. Most sites identified during the fly-overs are not visible from the road or by the neighbours.

Cessation of helicopter fly-overs would lead to a reduction in the ongoing identification of potential impact sites. Response to public complaints generally results in a reactive regulatory enforcement approach and eliminates or reduces the proactive, educational approach.

### 3.3 Environmental Stewardship

Numerous site visits conducted by MELP as a result of the Thompson Basin Survey have illustrated the fact that, while a producer may be in compliance with the letter of the “Code”, damage to the riparian zone can and does occur. The immediate result is not necessarily “pollution” but habitat degradation that can result in increased erosion and reduced water quality. A good example of this is often evident with seasonal grazing. Part 9, Sections 26 and 27 of the “Code” addresses seasonal feeding areas and access to water. Since access is allowed under the “Code”, many producers still allow their livestock to loiter along the banks of watercourses, resulting in manure deposits, damage to vegetation and erosion from trampling. These impacts are not specifically addressed by the “Code” at this time. Education and motivation are the primary tools necessary to instill stewardship values to change these “traditional practices”. There are currently no programs and few publications that fulfill the requirements to meet this vital issue. Site visits are currently used to raise the topic but are not as effective when done in conjunction with a regulatory compliance site visit.

### 3.4 Normal vs. Historic Farm Practices

The Ministry of Agriculture, Fisheries and Food has defined normal farm practices in their publication titled “Strengthening Farming in British Columbia” (MAFF, 1996). As a result of the Thompson Basin Survey, it has become apparent that historic practices are often considered by the producer to be normal without consideration being given to the fact that these practices are contributing to the loading of nutrients and other contaminants.

As an example, area dairy producers have been spreading manure under unfavourable conditions due to a lack of sufficient storage. This has been practiced for so many years, by so many producers, that it is often felt that this is a normal farm practice. In response to public and agency concerns, a helicopter fly-over of the Salmon River in Salmon Arm was conducted during runoff conditions in February 1995. Video footage and still photos demonstrated that the practice of spreading manure during unfavourable conditions is extensive. Representatives of the Ministry of Environment, Lands and Parks, the Ministry of Agriculture, Fisheries and Food and the local dairy peer advisors met in March of 1996 to initiate a solution to this practice without unnecessary enforcement of legislation. It is the intention of the agencies involved to share a common interpretation of the “Code” and eliminate the practice of spreading under unfavourable conditions by providing sufficient manure storage before the winter of 1997.

### 3.5 Native Peer Advisor Instruction

The helicopter fly-overs in 1994 and 1995 identified nine agricultural sites that were on native reservations. The fly-overs often intentionally avoided reserve land because the “Code” is provincial legislation and has no jurisdiction on a federal reserve. In order to address potential impacts, an offer was extended to provide area native bands with an educational workshop. As an initial step, representatives of the Ministry of Environment, Lands and Parks and the Ministry of Agriculture, Fisheries and Food delivered an informational seminar in March of 1996 to a small group of members of the Upper Nicola Band. The workshop addressed stewardship issues and explained the environmental guidelines and the “Code of Agricultural Practice for Waste Management.” It was the intent of the agency representatives that the workshop provide natives with the tools necessary to educate and motivate their peers in the agricultural industry, resulting in a decrease in the loading of nutrients to local watercourses. There is an opportunity for the native peers to expand their participation within the industry advisory system.

## 4.0 CONCLUSION

The second year of the inventory of agricultural sites being undertaken to assess the potential for environmental impact in the Thompson-Nicola sub region has identified seventy (70) sites requiring attention. Evaluation of each of the sites has been initiated by MELP staff.

Referrals to the peer system have been deferred until its effectiveness improves.

Response to public complaints continues on a reactive basis.

Ongoing identification of potential impact sites, increasing stewardship awareness of wetlands and watercourses, changing historic (“normal”) farm practices and addressing native agricultural operations are challenging regional issues. Specific plans have been initiated that will address each topic. Combined with the evidence of numerous site improvements being implemented in the Thompson region, a reduction in the loading of nutrients and other contaminants from agricultural sources is ensured.

### 4.1 RECOMMENDATIONS

Based on results of the project to date, the following recommendations are offered:

1. Continuation of a multi-agency approach in the identification, evaluation and remediation of impact sites is preferred and should continue to be used.
2. Quick resolution of the peer advisory referral system difficulties.
3. Continued identification and evaluation of potential sources of contaminants is required as many sites have likely yet to be identified. A *comprehensive* survey of agricultural practices using a watershed approach should be considered.
4. Water quality monitoring at sites designated as a high impact should be conducted during the 1996 runoff and continued in order to demonstrate the effectiveness of improved management practices.
5. Development and delivery of a proactive educational package addressing stewardship and native issues is required and should be presented to various associations and commodity groups.

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FIGURE 2

1994/95 TOTAL NITROGEN CONCENTRATIONS IN DURAND CREEK - UPSTREAM, DOWNSTREAM AND MIDPOINTS OF CONFINED LIVESTOCK AREA

SITE #	mg/L	94/09/27	94/11/30	95/04/19	95/10/31
D1	Total N	0.44	0.35	0.46	0.31
D2	Total N	0.42	0.46	0.45	0.35
D3	Total N	0.41	0.54	0.52	0.34
D4	Total N	0.5	0.52	0.53	0.29

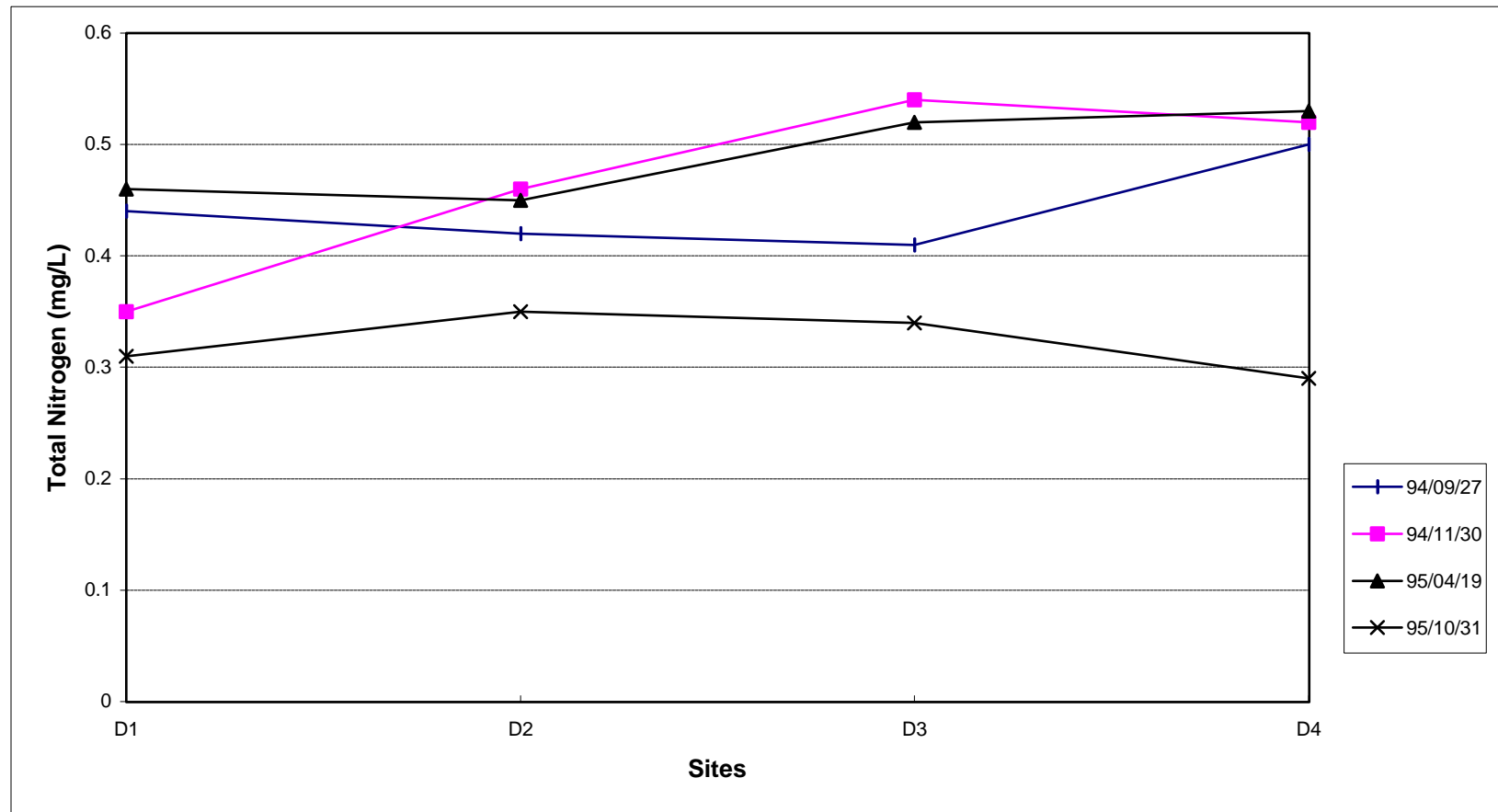


FIGURE 3

1994/95 TOTAL PHOSPHORUS CONCENTRATIONS IN DURAND CREEK-UPSTREAM, DOWNSTREAM AND MIDPOINTS OF CONFINED LIVESTOCK AREA

Site #	mg/L	94/09/27	94/11/30	95/04/19	95/10/31
D1	Total P	0.035	0.049	0.066	0.054
D2	Total P	0.045	0.071	0.075	0.052
D3	Total P	0.045	0.088	0.075	0.051
D4	Total P	0.091	0.097	0.097	0.06

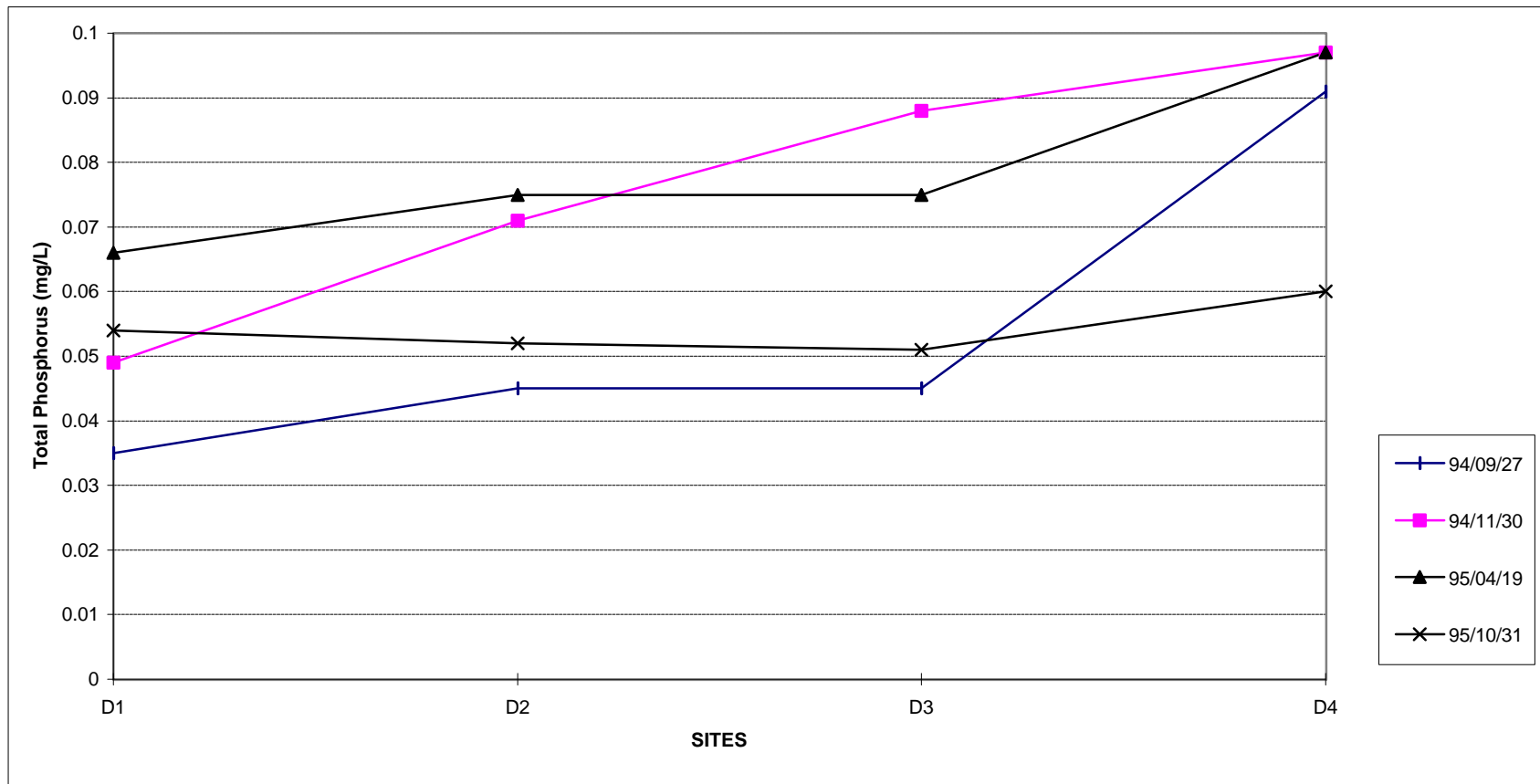


FIGURE 4

1994/95 TRUE COLOR LEVELS IN DURAND CREEK - UPSTREAM, DOWNSTREAM AND MIDPOINTS OF CONFINED LIVESTOCK AREA

SITE #	COL. UNITS	94/09/27	94/11/30	95/04/19	95/10/31
D1	Color True	<5	5	15	5
D2	Color True	<5	5	10	5
D3	Color True	<5	5	20	10
D4	Color True	5	5	15	15

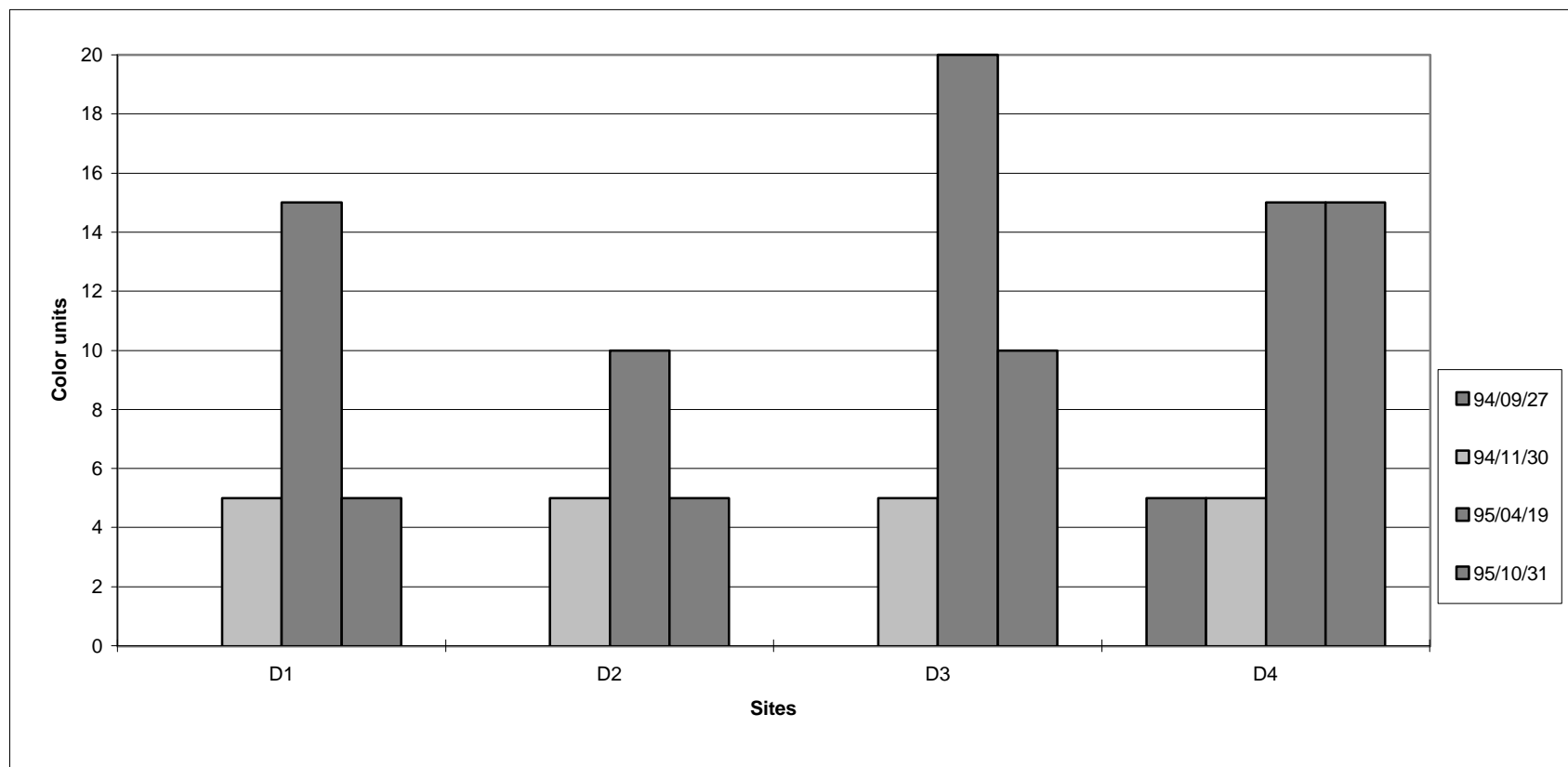


FIGURE 5

1994/95 TURBIDITY LEVELS IN DURAND CREEK - UPSTREAM, DOWNSTREAM AND MIDPOINTS OF CONFINED LIVESTOCK AREA

SITE #	NTU	94/09/27	94/11/30	95/04/19	95/10/31
D1	Turbidity	0.3	0.2	2.1	0.1
D2	Turbidity	0.8	0.3	2.5	0.3
D3	Turbidity	0.9	2	2.5	0.5
D4	Turbidity	2.9	3.2	3.9	0.6

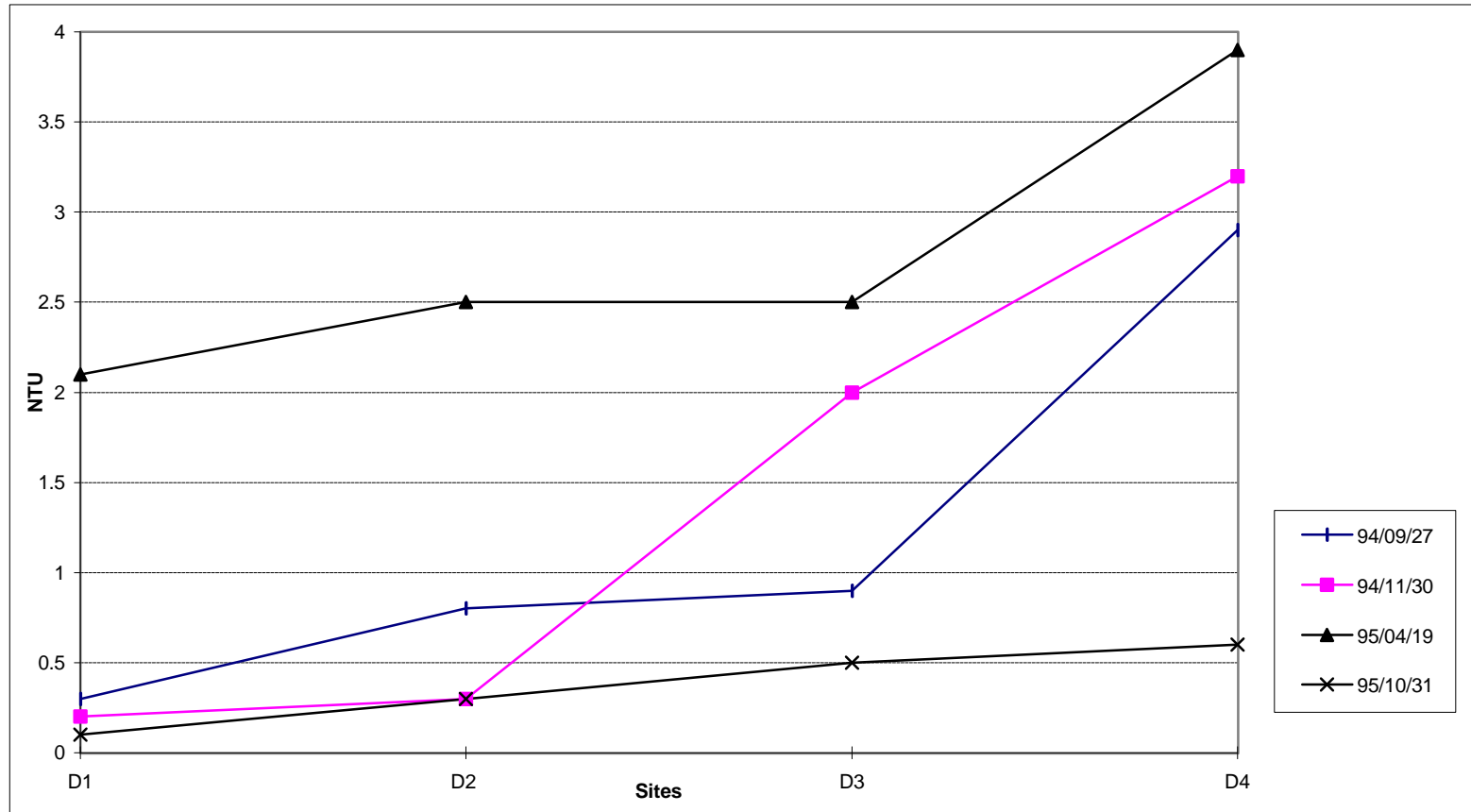


FIGURE 6

1994/95 TOTAL ORGANIC CARBON CONCENTRATIONS IN DURAND CREEK - UPSTREAM, DOWNSTREAM AND MIDPOINTS OF CONFINED LIVESTOCK AREA

SITE #	mg/L	94/09/27	94/11/30	95/04/19	95/10/31
D1	TOC	4	3.3	7.6	2.7
D2	TOC	3.7	3	7.2	2.7
D3	TOC	2.9	3.5	7	2.8
D4	TOC	3.6	3.5	6.6	3.9

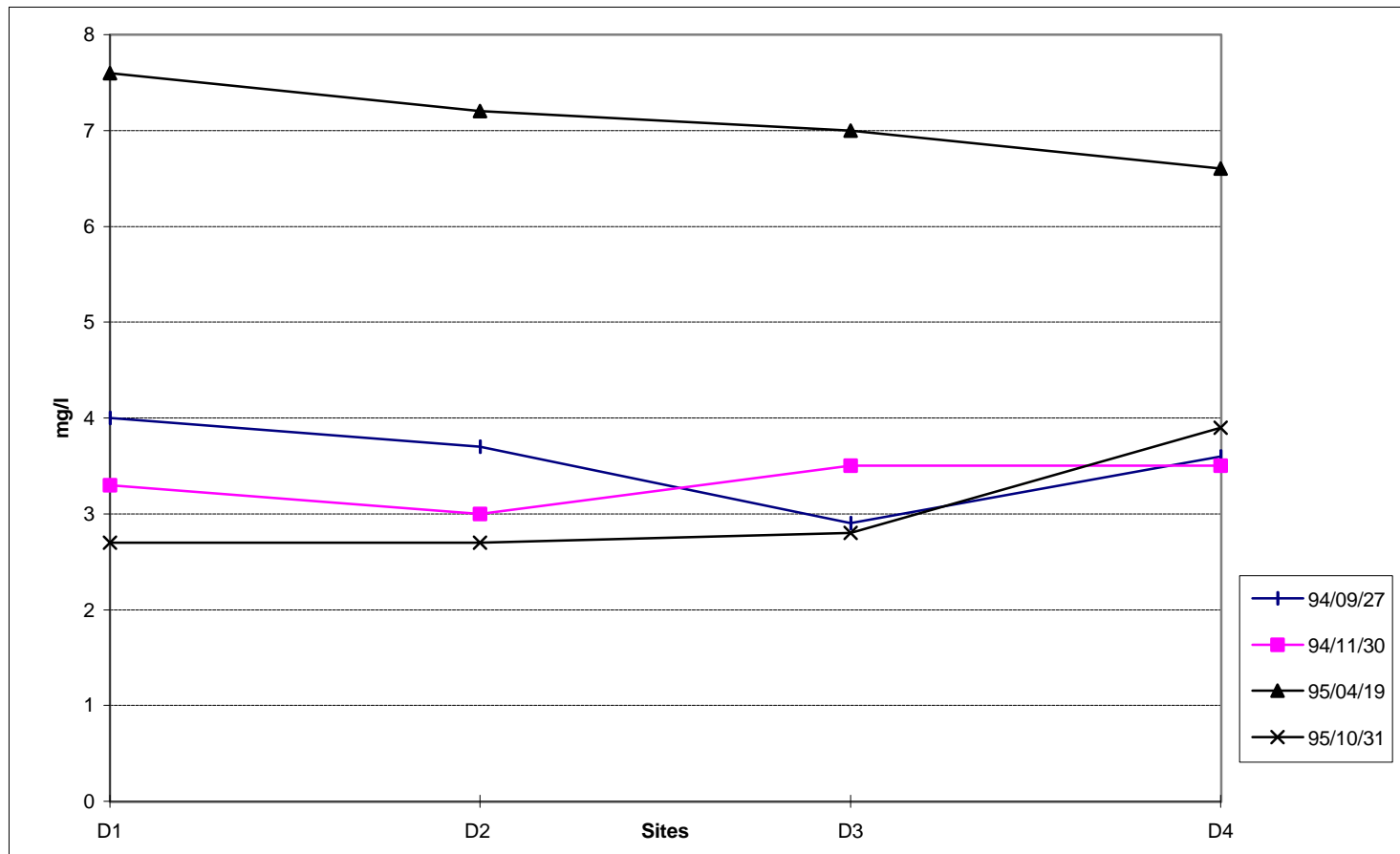


FIGURE 7

1994/95 AMMONIA CONCENTRATIONS IN DURAND CREEK - UPSTREAM, DOWNSTREAM AND MIDPOINTS OF CONFINED LIVESTOCK AREA

SITE #	mg/L	94/09/27	94/11/30	95/04/19	95/10/31
D1	Ammonia	<0.005	0.056	<0.005	<0.005
D2	Ammonia	<0.005	<0.005	<0.005	<0.005
D3	Ammonia	<0.005	0.014	<0.005	<0.005
D4	Ammonia	<0.005	0.027	0.026	0.01

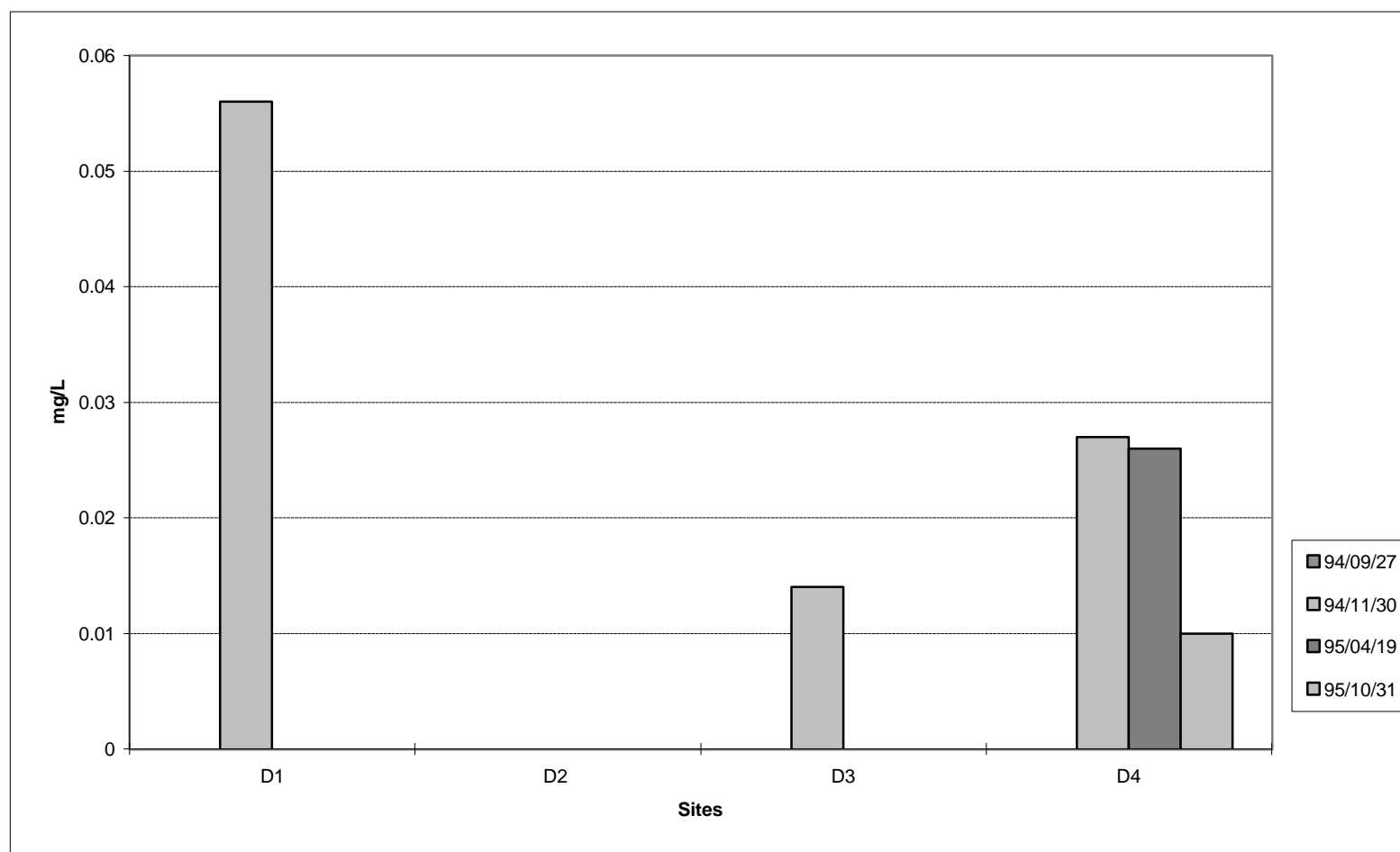
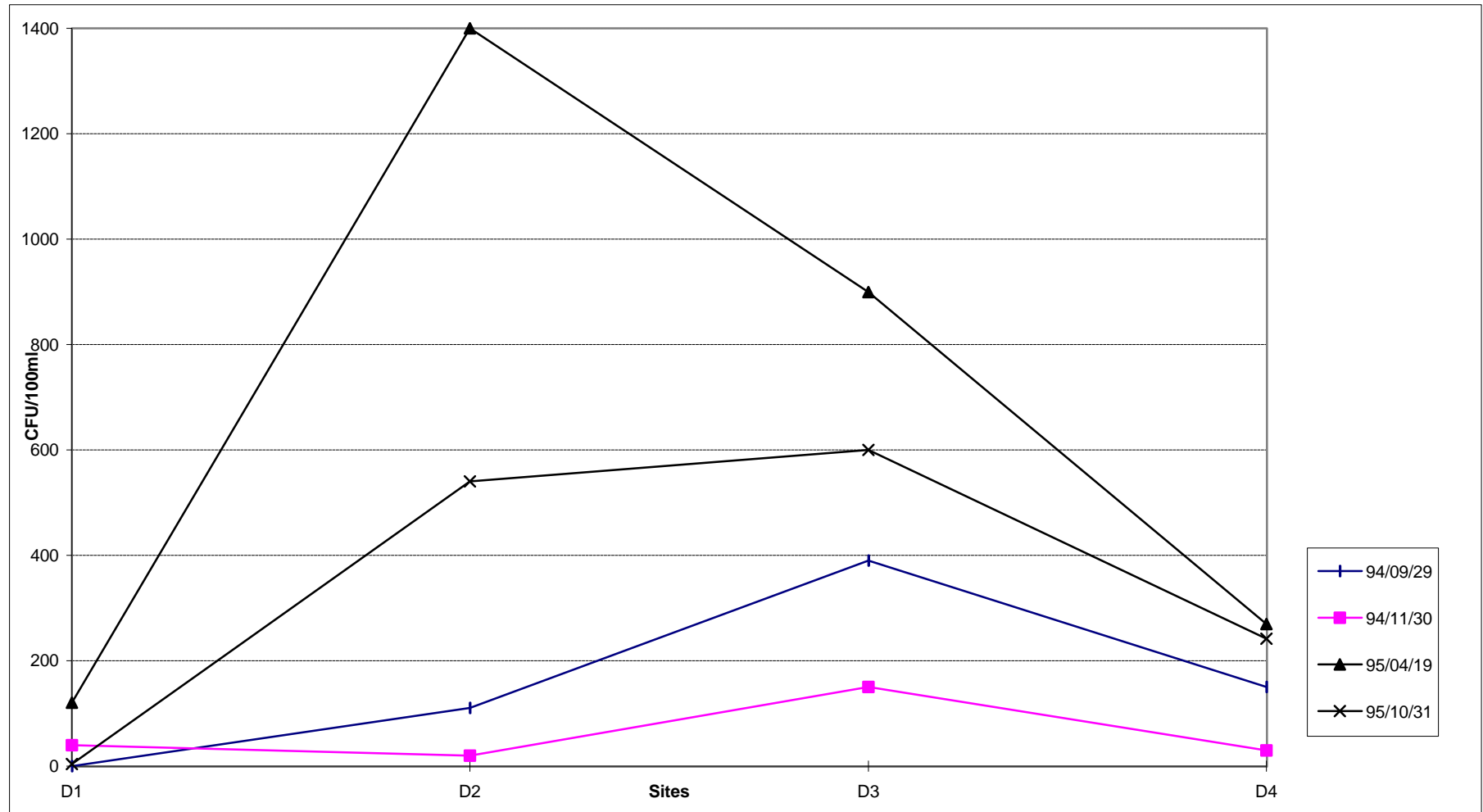


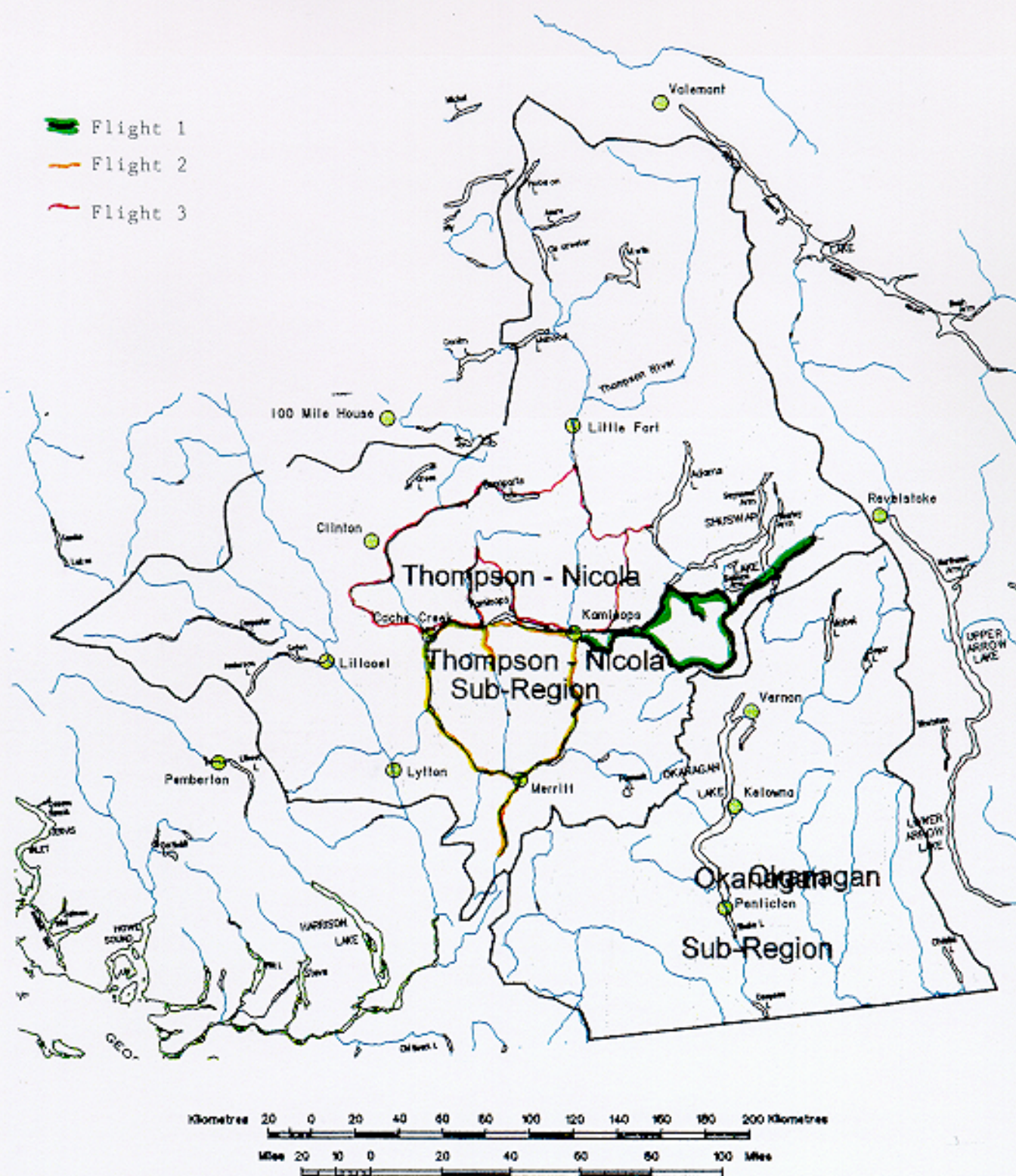
FIGURE 8

1994/95 FECAL COLIFORM LEVELS IN DURAND CREEK - UPSTREAM, DOWNSTREAM AND MIDPOINTS OF CONFINED LIVESTOCK AREA

SITE #	CFU/100ml	94/09/29	94/11/30	95/04/19	95/10/31
D1	Fecal Coliforms	0	40	120	4
D2	Fecal Coliforms	110	20	1400	540
D3	Fecal Coliforms	390	150	900	600
D4	Fecal Coliforms	150	30	270	242



# Southern Interior Region Thompson / Nicola Sub-Region



## **APPENDIX 1**



SITE 1.7 Confined area and feeding <30 m from watercourse



SITE 1.9 Confined areas with access to watercourse



SITE 1.10 Runoff from confined area has potential to enter watercourse



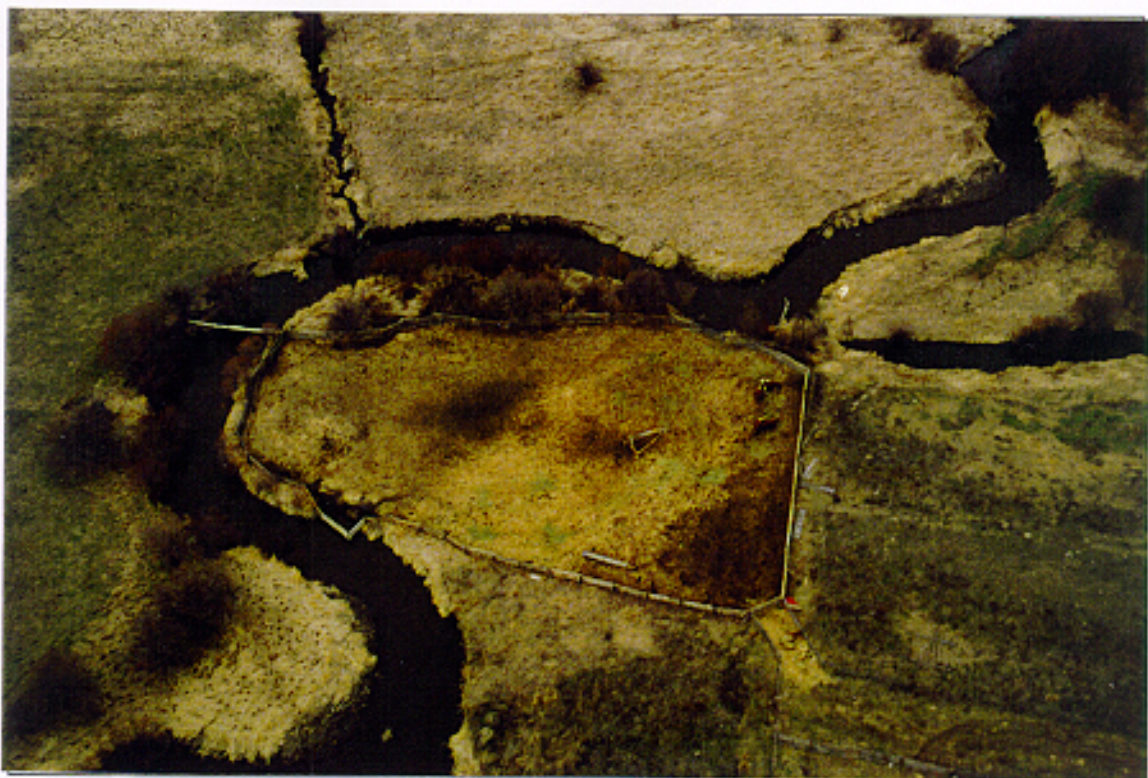
SITE 1.10 Runoff from confined areas has potential to enter watercourse



SITE 1.11 Feeding <30 m from watercourse



SITE 1.12 Confined areas with access to watercourse



SITE 1.16 Feeding <30 m from watercourse



SITE 1.16 Feeding < 30m from watercourse



SITE 1.19 Feeding < 30m from high water mark



SITE 1.20 Confined feeding area with watercourse running through it



SITE 2.1 Confined areas with watercourse running through them



SITE 2.2 Direct access to watercourse



SITE 2.3 Unrestricted access to watercourse



SITE 2.4 Feeding < 30m from watercourse



SITE 3.5 Unrestricted access to watercourse



SITE 3.6 Feeding < 30m and confined area with watercourse running through it



SITE 3.9 Feeding < 30m from watercourse



SITE 3.10 Confined area with watercourse running through it



SITE 3.21 Confined area with access to a watercourse



SITE 3.21 Confined area with access to a watercourse



SITE 3.22 Confined area with watercourse running through it



SITE 3.23 Confined area with watercourse running through it



SITE 3.25 Confined area with watercourse running through it



SITE 3.28 Confined area <30m from watercourse



SITE 3.30 Confined area with access to watercourse



SITE 3.31 Confined area <30m from watercourse