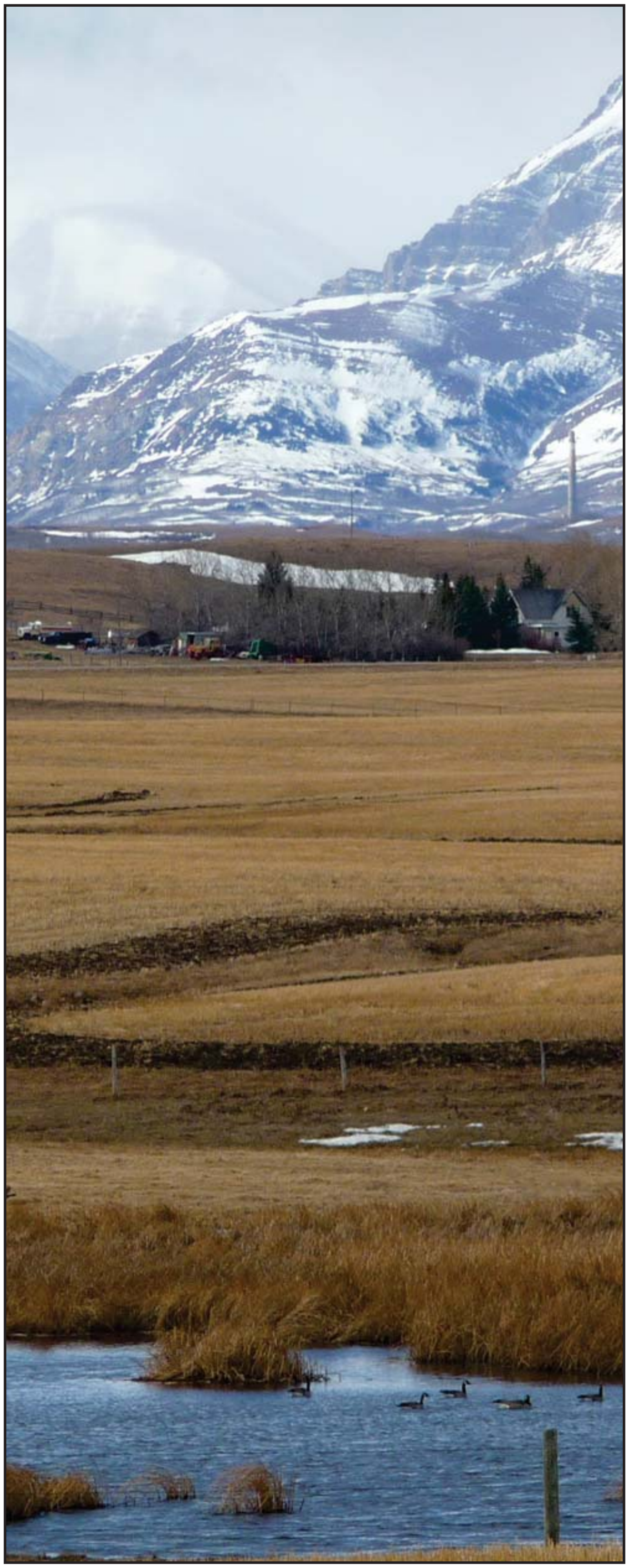
9 APPENDICES



Appendix 1. The long and short versions of the land use and economic data collection survey forms.

Long Version – six pages

FARM MANAGEMENT INFORMATION. Farm ID: ______________ Date: ____________

Farm-scale Land Management Data

1. What crops do you grow?

   Crop 1________________Crop 2____________________Crop 3______________________

   Crop 4________________Crop 5____________________Crop 6 ______________________

2. Do you remove crop residue after harvest? ☐ Yes ☐ No

3. Source of livestock water supply:

   ☐ Stream/Canal ☐ Reservoir/Dugout

   ☐ Water Well (provide depth to water table) ___________ ☐ Other _____________

4. Source of irrigation water supply:

   ☐ Stream/Canal ☐ Reservoir/Dugout

   ☐ Water Well (provide depth to water table) ____________ Other _____________

5. How many acres of land do you currently own? __________________; rent? __________________

6. List farm operations that you custom hire out: ____

   ____

Type of Livestock:

☐ **Dairy**

☐ Loafing Barn ☐ Open Lot ☐ Pasture

☐ Open Access Grazing ☐ Rotational Grazing

Livestock Inventory (average number and weight per year):

Milking cows: _________ Dry cows: ________ Heifer (1 to 2 yrs old): __________

Bulls: _________________ Calves (< 1 yr old): ______________

Livestock Sales (number per year):

Cull cows: __________ Bulls: _________ Calves: _________ Heifers: ________

☐ **Swine**

☐ Farrow to finish ☐ Finishing ☐ Breeding ☐ Farrow ☐ Nursery

Production System:

☐ Open lot ☐ Confined ☐ Other

Livestock Inventory (average number per year):

Nursery Pig: ______________ Growing/Finishing Pig: ________________

Sows: ______________ Boars: ______________

Livestock Sales (average number per year):

Sows: _______ Boars: ______ Nursery Pig: _______ Growing/Finishing Pig: ________

☐ **Cow/calf and Feedlot**

☐ Cow/calf ☐ Feedlot

Livestock Inventory (average number and weight per year):

Cattle: __________ Calves: __________ Backgrounding: ______ Finishing: ________

Livestock Sales (number per year):

Cattle: __________ Calves: __________ Backgrounding: ______ Finishing: ________

☐ **Grazing Data:**

1. How many days do livestock spend on pasture in a typical year? ______________________________
2. Do you use planned or rational grazing? ☐ Yes ☐ No
3. Where do the pastured livestock go for wintering?

   ☐ Enclosed barn ☐ Open lot corral ☐ Pasture field ☐ Cereal field
4. Do pastured livestock have access to streams or creeks at least part of the time? ☐ Yes ☐ No

   If yes: Do you provide alternative livestock watering system? ☐ Yes ☐ No
   How many pastured animals have stream/creek access? _______________

   For how many days of the grazing time do they have access to streams/creeks? ________

☐ **Manure Handling**

1. How do you store manure?

   ☐ Open lots ☐ Confinement bldgs ☐ Manure pit ☐ Waste storage pond

   ☐ Piled on lot till it is applied ☐ Other: _____________
2. Does the runoff from the manure storage facility drains directly into

   ☐ Catch basin ☐ Natural waterway ☐ Farm field ☐ Other: ______________
3. How often do you spread manure on the same field? __________________
4. How much manure is handled as:

   Liquid: ______% Slurry: ______% Solid: ______% Compost: _______%
5. What percentage of manure used on your operation is applied in?

   Spring ______% Summer _______% Fall ________% Winter _________ %
6. Select applicable manure application method used on your farm

   ☐ Broadcasted on surface ☐ Incorporated into soil ☐ Injected ☐ Applied by irrigation
7. Which of the following is applicable to the manure produced or used on your farm?

   ☐ Applied on this farm ☐ Sold or given to others ☐ Bought or received from others

   ☐ Composted ☐ Dried/Processed ☐ Stored
8. What percentage of manure used on your operation is applied to:

   Crop fields: _______ % Hay fields: _______ % Pasture _______ % Other _________ %
9. Do you fertilize the land that does not receive manure? ☐ Yes ☐ No

☐ **Table 1a. Inventory of owned equipment used on the farm: ______________ Farm ID: ____________**

Equipment Code	Equipment Description (make and model)	Application Width or Horsepower	Year New	Current Value ($)
E1	*Manure spreader*	*10 feet*	*1997*	*2000*
E2	*Tractor 2 wd, Case IH 7230*	*105 HP*	*2000*	*45000*
OE1				
OE2				
OE3				
OE4				
OE5				
OE6				
OE7				
OE8				
OE9				
OE10				
OE11				
OE12				
OE13				
OE14				
OE15				
OE16				
OE17				
OE18				
OE19				
OE20				

☐ **Table 1b. Inventory of leased equipment used on the farm: __________ Farm ID: __________**

Equipment Code	Equipment Description (make and model)	Application Width or Horsepower	Lease Rate	Year Lease	
				Start	End
LE1					
LE2					
LE3					
LE4					
LE5					
LE6					
LE7					
LE8					
LE9					
LE11					
LE12					
LE13					
LE14					
LE15					
LE16					
LE17					
LE18					
LE19					
LE20					

Table 2. Field-scale land management data (select appropriate field category) ☐ **Crop** ☐ **Hay/Forage**

Farm ID: ______________________________ Operation Year: _________________

Field description data

Field ID: ______________
Tenure: ______________
Crop Variety: __________
Grain Grade: ___________
Annual Yield: _________
% Residue removed after harvest: ______________

Forage / Hay variety:
____
Annual Yield: _________
% Legume: ___________

Area (acres): ___________
Existing Irrigation system:
____

Existing soil test results (ppm):
Organic matter: ________
NO_3-N: ______________
Total N: _____________
Labile P: _____________
*Lab. method*_________
Total P: ______________
Sampling depth (inch):
____

Existing BMP Structures:
Dugout: ______________
Grass waterway: _______
Berm: ________________
Reservoir: _____________
Terrace: ______________
Other: _______________

Sequence, type and description of operations					
Date (mm/dd)	**Type of operations** (e.g. Tillage, Manure spreading, Seeding, Irrigation, Harvest)	**Description of operations**			
		Type Equipment (Enter code from Table 1a & 1b)	**Depth** (units) **and/or Method of application** (e.g. liquid injected, solid incorporated)	**Chemicals / Fertilizer / Manure[1] Application**	
				Type (e.g. Horizon, Accent, 2,4-D / ANH-NH3, Urea, 06-24-24 / Hog, Beef)	**Rate** (units)

Cost ($ / acre):	**Hail and Crop Insurance:**	***Tenure:***	**Additional information:**
Seeds: _________________ Chemicals: ______________ Fertilizers: _______________ Custom work: ____________ Twine/Plastic: ____________	Receipts: ________________ Premiums: ________________ Land rent: ________________ Expected crop market price: ____________________	*Own, rent, private lease, forestry reserve, gov't. lease, community pasture*	

[1] Manure / Fertilizer type and application rate (N-P-K) per year, with P expressed as P_2O_5, and K as K_2O

Table 3. Field-scale pasture management data Farm ID: ____________________ Operation Year: _________ _______

Field description data

Field ID: ____________

Grass variety:

____

Tenure: _____________

*Year seeded:*_________

Forage Yield (unit):

: ________________

% Moisture: _________

% Legume: __________

Area (acres): _________

Existing Irrigation system:

____

Existing soil test results (ppm):

Organic matter: _______

NO_3-N: ____________

Total N: _____________

Labile P: ____________

*Lab. method*_________

*Total P:*____________

Sampling depth (inch):

____

Existing BMP Structures:

Dugout: _____________

Grass waterway: ______

Berm: _______________

Reservoir: ___________

Terrace: ____________

Watering system: _____

Other: ______________

Sequence, type and description of operations						
Date (mm/dd) (Also, indicate date in & out of grazing cycle)	**Type of operations** (e.g. Manure spreading, Irrigation, Grazing)	**Description of operations**				
		Type and number of animals	**Animal average weight** (units)	**Depth** (units) **and/or Method of application** (e.g. liquid injected, solid incorporated))	**Chemicals / Fertilizer / Manure [1] Application**	
					Type (e.g. Horizon, Accent, 2,4-D / ANH-NH3, Urea, 06-24-24 / Hog, Beef)	**Rate** (units)
05/15	*Fertilizer*	*N.A*	*N.A*	*Surface*	*30-15-00*	*80 lb/acre*
06/15	*Start grazing*	*Cows, 50*	*1000 lb*	*N.A*	*N.A*	*N.A*

Grass variety examples:	***Tenure:***	**Cost ($ / acre):**	**Hail and Crop Insurance:**
Tame, native grassland, woodland, annual cereal, swath grazing, winter grazing	*Own, rent, private lease, forestry reserve, govt. lease, community pasture*	Seeds: ____________ Chemicals: __________ Fertilizers: __________ Custom work: _______ Twine/Plastic: _______	Receipts: ____________ Premiums: ___________ Land Rent: ___________ Expected market price for grazing ($/AUM): ____________________

[1] Manure / Fertilizer type and application rate (N-P-K) per year, with P expressed as P_2O_5, and K as K_2O

Short Version – three pages

FARM MANAGEMENT INFORMATION. Farm ID: _______________ Date: _____________

Farm-scale Land Management Data

1. What crops do you grow?

   Crop 1________________Crop 2____________________Crop 3______________________

   Crop 4________________Crop 5____________________Crop 6 ______________________

2. Do you remove crop residue after harvest? ☐ Yes ☐ No

3. Source of livestock water supply:

   ☐ Stream/Canal ☐ Reservoir/Dugout

   ☐ Water Well (provide depth to water table) ___________ ☐ Other _____________

4. Source of irrigation water supply:

   ☐ Stream/Canal ☐ Reservoir/Dugout

   ☐ Water We ll (provide depth to water table) ____________ ☐ Other _____________

Type of Livestock:

☐ **Dairy**

☐ Loafing Barn ☐ Open Lot ☐ Pasture

☐ Open Access Grazing ☐ Rotational Grazing

Livestock Inventory (average number and weight per year):

Milking cows: _________ Dry cows: ________ Heifer (1 to 2 yrs old): __________

Bulls: _________________ Calves (< 1 yr old): ______________

☐ **Swine**

☐ Farrow to finish ☐ Finishing ☐ Breeding ☐ Farrow ☐ Nursery

Production System:

☐ Open lot ☐ Confined ☐ Other

Livestock Inventory (average number per year):

Nursery Pig: _______________ Growing/Finishing Pig: ________________

Sows: ______________ Boars: ______________

☐ **Cow/calf and Feedlot**

☐ Cow/calf ☐ Feedlot

Livestock Inventory (average number and weight per year):

Cow/Bulls: _________ Calves: _________ Backgrounding: _____ Finishing: _______

☐ Grazing Data:

1. How many days do livestock spend on pasture in a typical year? ______________________________
2. Do you use planned or rational grazing? ☐ Yes ☐ No
3. Where do the pastured livestock go for wintering?

   ☐ Enclosed barn ☐ Open lot corral ☐ Pasture field ☐ Cereal field
4. Do pastured livestock have access to streams or creeks at least part of the time? ☐ Yes ☐ No

   If yes: Do you provide alternative livestock watering system? ☐ Yes ☐ No

   How many pastured animals have stream/creek access? _______________

   For how many days of the grazing time do they have access to streams/creeks? _______

☐ Manure Handling

1. How do you store manure?

   ☐ Open lots ☐ Confinement bldgs ☐ Manure pit ☐ Waste storage pond

   ☐ Piled on lot till it is applied Other: ____________
2. Does the runoff from the manure storage facility drains directly into

   ☐ Catch basin ☐ Natural waterway ☐ Farm field ☐ Other: ______________
3. How often do you spread manure on the same field? _________________
4. How much manure is handled as:

   Liquid: _____% Slurry: _____% Solid: _____% Compost: ______%
5. What percentage of manure used on your operation is applied in?

   Spring _____% Summer ______% Fall _______% Winter ________ %
6. Select applicable manure application method used on your farm

   ☐ Broadcasted on surface ☐ Incorporated into soil ☐ Injected ☐ Applied by irrigation
7. Which of the following is applicable to the manure produced or used on your farm?

   ☐ Applied on this farm ☐ Sold or given to others ☐ Bought or received from others

   ☐ Composted ☐ Dried/Processed ☐ Stored
8. What percentage of manure used on your operation is applied to:

   Crop fields: ______ % Hay fields: ______ % Pasture ______ % Other ________ %
9. Do you fertilize the land that does not receive manure? ☐ Yes ☐ No

☐ **Table 1. Farmland management inventory**

Field ID	Field Description						Chemicals /Manure / Fertilizer [I]		
							Type	Application	
	Field Type	Tillage / Grazing Intensity	Year	Crop / Forage Variety	Crop / Forage Yield (units)	Area (acres)		Rate (units)	Method [II]

Existing soil test results (ppm)

Field ID: ________	Field ID: _______	Field ID: _______	Field ID: ______	Field ID: ______	Field ID: _________
OM: ___________	*OM:* ___________	*OM:* __________	*OM:* __________	*OM:* __________	*OM:* _____________
NO_3-N: ________	*NO_3-N:* _________	*NO_3-N:* ________	*NO_3-N:* _______	*NO_3-N:* ________	*NO_3-N:* ___________
Total N: ______	*Total N:* _______	*Total N:* ______	*Total N:* ______	*Total N:* ______	*Total N:* ___________
Labile P: _______	*Labile P:* _______	*Labile P:* ______	*Labile P:* ______	*Labile P:* _______	*Labile P:* _________
*Lab. method*_____	*Lab. method*______	*Lab. method*_____	*Lab. method*_____	*Lab. method*______	*Lab. method*________
Total P: ______	*Total P:* _______	*Total P:* _______	*Total P:* _______	*Total P:* _______	*Total P:* ___________
Sampling depth (inch): ____________	*Sampling depth (inch):* ____________	*Sampling depth (inch):* ____________	*Sampling depth (inch):* ____________	*Sampling depth (inch):* ____________	*Sampling depth (inch):* ____________

[I]Manure / Fertilizer type and application rate (N-P-K) per year, with P expressed as P_2O_5, and K as K_2O
[II] Application methods: liquid surface, liquid injected, solid surface (broadcasted), solid incorporated

Appendix 2. Water analysis quality assurance and quality control during the switch of laboratories.

Introduction

Water samples that were collected during Nutrient Beneficial Management Practices Evaluation Project from 2007 to 2009 were analyzed by ALS Canada Limited. In January 2010, a new request for proposal for water analysis services was issued in order to comply with new legislation (The Trade, Investment, Labour Mobility Agreement and the Agreement of Internal Trade) in Alberta. The end result was a new contract for water analysis was awarded to Exova Canada Incorporated until December 2012. In order to ensure the continuous scientific integrity of water analysis for the project, it was critical that the same methods, minimum detection limits, and laboratory processing times were used for water quality comparisons for the length of the project. This was true for most parameters except for total Kjeldahl nitrogen (TKN). Due to the toxicity of the chemical used in the TKN analysis (wet chemical oxidation method), Exova uses the less hazardous TN method (catalytic high temperature oxidation chemiluminescence), which also is a more acceptable method.

The information presented here documents the quality-control data of the ALS Laboratory, inter-laboratory quality assurance samples, and blind reference samples throughout the contracting period.

Methods

In 2008, seven duplicate samples (collected on the same days and at the same water quality monitoring stations) were analyzed by the Alberta Agriculture and Rural Development (ARD) and ALS laboratories. Sixteen reference samples, containing known amounts of nitrogen (N) and phosphorus (P), were also submitted to the ALS laboratory from 2008 to 2009.

Replicate water samples (126 total) collected from the field were analyzed for pH, electrical conductivity (EC), chloride (Cl), nitrate nitrogen (NO_3-N), ammonia nitrogen (NH_3-N), total nitrogen (TN), orthophosphate (PO_4-P), total dissolved phosphorus (TDP), total phosphorus (TP), and total suspended solids (TSS) by ALS and Exova laboratories during the laboratory transition period from January 13 to May 12, 2010. In addition, a 37-sample sub-set of the 126 water samples were analyzed by the ARD laboratory. An evaluation of TN measurements by the three laboratories, in the post-ALS contract phase, was completed in order to document any shifts in TN concentrations that could be due to the change in TN methods that occurred during the laboratory transition.

Statistical Definitions

Analysis of variance. Analysis of variance (ANOVA) is a general technique that can be used to test the hypothesis that the means among two or more groups are equal, under the assumption that the sampled populations are normally distributed.

Concordance correlation coefficient. The concordance correlation coefficient (r_c) (Lin 1989) evaluates the degree to which pairs of observations fall on the 45-degree line through the origin.

Control chart. The individual analytical values in a series are plotted and evaluated against control limits. The limits are calculated as the mean historic target value ±3 standard deviations of historic target value as upper and lower control limits.

Control limit. The individual analytical values in the series are plotted and evaluated against control limits. The control limits are calculated as the mean historic target of percent recovery ±3 standard deviations of percent recovery as upper and lower control limits.

Correlation coefficient. The correlation coefficient (r) is a measure of the degree of linear relationship between two variables. The correlation coefficient is a value between -1 and +1. If one variable tends to increase as the other decreases, the correlation coefficient is negative. Conversely, if the two variables tend to increase together the correlation coefficient is positive.

Relative standard deviation. Relative standard deviation (% RSD) is calculated from repeated analysis [(standard deviation ÷ mean value of replicate observed values) × 100].

Two-samples t-test. Hypothesis test for two population means to determine whether they are significantly different. This procedure uses the null hypothesis that the difference between two population means is equal to a hypothesized value (H_0: $m_1 - m_2 = m_0$), and tests it against an alternative hypothesis, which can be left-tailed ($m_1 - m_2 < m_0$), right-tailed ($m_1 - m_2 > m_0$), or two-tailed ($m_1 - m_2 \neq m_0$).

Quality Control Chart Evaluation for ALS and Exova Laboratories

There were no laboratory blank failures from 2007 to 2009 for the ALS laboratory (Table 2.1A) or for the Exova laboratory in 2010 (Table 2.2A). The quality control results from the ALS laboratory resulted in six TKN control sample failures and one TSS control sample failure from 2007 to 2009. There was one Cl, five TDP/TP, and two TSS control samples failures at the Exova laboratory in 2010. Exova had tighter control limits for the control samples and this may be the reason why there were more failures than at the ALS laboratory (Tables 2.1A and 2.2A). There were also more failures in Exova duplicate samples compared with ALS, but the RSD levels were stricter for Cl, NH_3-N, NO_3-N, TN, and TSS at Exova. Control and duplicate samples were re-ran when they were outside of the laboratory control limits and were not passed until the values were within the control limits. The laboratories reported the original failure values and the re-run values.

Table 2.1A. ALS Laboratory quality-control data assessment from 2007 to 2009.

	Control samples				Lab blank	Duplicate samples			Spike samples		
Parameter	Sets	Historic run mean	Historic run control limit	Sets failed	Sets failed	Sets	% RSD	Sets failed	Sets	Control limit	Sets failed
EC	188	99.9%	90-108%	0	0	120	9.8	1			
Cl	258	102.2%	90-111%	0	0	258	13	2	39	80-113%	0
NH_3-N	179	100.6%	86-113%	0	0	466	10	0	246	77-121%	0
NO_3-N	179	99.9%	89-109%	0	0	557	16	5	100	76-117%	0
TKN (Nicotinic)	201	97.1%	81-114%	6	0	174	17	0	156	61-140%	0
TKN (NH_4)	269	99.8%	69-131%	0	0						
TKN (Glyceine)	269	99.6%	83-118%	2	0						
PO_4-P	174	99.3%	85-123%	0	0	307	6.5	0	133	72-111%	5
TDP/TP	150	99.7%	63-138%	0	0	272	9.5	1			
TSS	166	96.5%	72-111%	1	0	385	12	3			

Table 2.2A. Exova Laboratory quality-control data assessment in 2010.

	Control samples					Lab blank	Duplicate samples		
Parameter	Sets	Level	Historic run mean	Historic run control limit	Sets failed	Sets failed	Sets	% RSD	Sets failed
EC	106	Low	100.00%	92.11-107.89%	0	0	101	10	0
	110	High	100.00%	95.62-104.38%	0				
Cl	84	Low	99.60%	90.01-109.99%	0	0	110	10	2
	92	High	100.55%	94.10-107.00%	1				
NH_3-N	98	Low	98.75%	91.25-106.25%	0	0	74	10	1
	100	High	100.32%	92.34-100.32%	0				
NO_3-N	109	Low	100.00%	90.01-109.99%	0	0	83	10	4
	57	High	100.00%	95.10-104.90%	0				
TN	101	Trace	104.50%	86.00-123.00%	0	0	101	10	3
	55	Mid	100.27%	90.27-110.27%	0				
	95	High	98.83%	87.19-110.47%	0				
PO_4-P	59	Trace	100.00%	79.99-120.01%	0	0	86	10	2
	80	Low	96.88%	80.00-113.76%	0				
TDP/TP	58	Low	100.00%	79.99-120.01%	0	0	83	10	3
	44	Mid	100.00%	90.01-109.99%	5				
TSS	90	Low	97.50%	75.00-120.00%	0	0	89	10	11
	92	High	99.49%	94.36-104.62%	2				

Inter-Laboratory Quality Control Assessment (ALS contract period)

The correlation coefficient (r) for the duplicate sample TN and TP measurements showed agreement between the ARD and ALS laboratories. The concordance coefficient (r_c) showed that the slope of the regression closely fell on the 1:1 line through the origin between both laboratories and the two-sample t-test showed no significant difference between the two laboratories (Table 2.3A).

Table 2.3A. Collaborative laboratories evaluation of duplicate samples analyzed by Alberta Agriculture and Rural Development (ARD) and ALS laboratories in 2008.

		ARD Laboratory		ALS Laboratory		Two-sample t-test (without pooling variances)					
Parameter	n	Mean Rd.	SE	Mean Rd.	SE	DF	t	P [z]	Significant difference	r	Concordance coefficient (r_c)[y]
NH_3-N	7	<0.10		<0.05							
NO_3-N	7	<0.10		<0.05							
TN	7	0.571	0.0565	0.597	0.068	11	0.28	0.783	NO	0.850	0.824
PO_4-P	7	<0.010		<0.005							
TDP	7	<0.010		<0.005							
TP	7	0.0607	0.0103	0.065	0.010	11	0.31	0.766	NO	0.999	0.982

[z] Significance level of $P = 0.05$ was used.
[y] Lin 1989, 2000.

Results from blind reference-sample analyses indicated that 100% of the samples analyzed for NH_3-N, PO_4-P, TDP, and TP were within control limits (Figure 2.1A). One out of 16 analyzed for NO_3-N exceeded the laboratory control limits and one out of 15 analyzed for TN exceeded control limits.

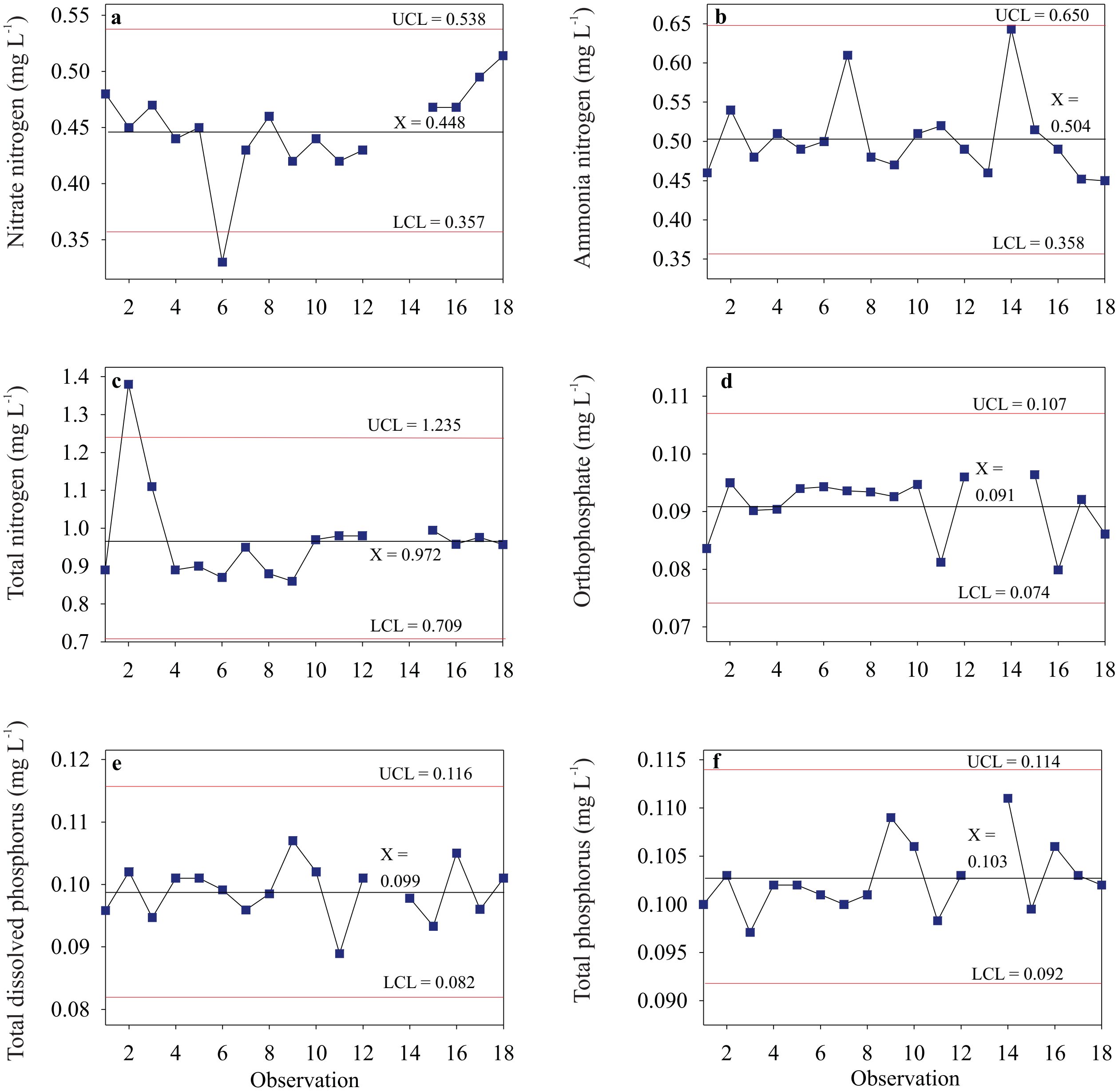


Figure 2.1A. Control chart of certified blind reference sample results from ALS Laboratory from 2008 to 2009 for (a) nitrate nitrogen, (b) ammonia nitrogen, (c) total nitrogen, (d) orthophosphate, (e) total dissolved phosphorus, and (f) total phosphorus. UCL = upper control limit, X = mean, and LCL = lower control limit.

Inter-laboratory Quality Control Assessment during Post-ALS Contract Period from January to March 2010

The ANOVA test at the 5% level showed there were no significant differences among the three laboratories for all parameters, except for pH (Table 2.4A). The TN analytical method passed the ANOVA test among the three laboratories and this suggests that the ARD, ALS, and Exova measurements are comparable and interchangeable in the post-ALS contract phase.

Table 2.4A. Collaborative laboratories evaluation of triplicate samples among the Alberta Agriculture and Rural Development (ARD), Exova, and ALS laboratories.

		ARD Laboratory		Exova Laboratory		ALS Laboratory				
Parameter	n	Mean Rd.	SE	Mean Rd.	SE	Mean Rd.	SE	df1/df2	F value	Significant difference between labs at 5% level (ANOVA)
pH	37	8.28	0.023	7.78	0.032	8.05	0.030	2/108	75.09	YES
EC	37	0.923	0.078	0.879	0.782	0.875	0.074	2/108	0.12	NO
Cl	37	24.82	2.76	23.72	2.687	24.00	2.715	2/108	0.04	NO
NH_3-N	37	1.334	0.258	1.373	0.264	1.326	0.251	2/90	0.01	NO
NO_3-N	37	2.644	0.796	2.577	0.791	2.478	0.709	2/84	0.01	NO
TN	37	5.402	0.716	5.396	0.731	7.125	0.688	2/108	1.96	NO
PO_4-P	37	1.228	0.189	1.252	0.198	1.154	0.177	2/105	0.07	NO
TDP	37	1.247	0.188	1.231	0.192	1.257	0.192	2/108	0.00	NO
TP	37	1.528	0.197	1.521	0.198	1.508	0.196	2/102	0.00	NO
TSS	37	65.34	32.56	55.31	26.19	37.34	11.75	2/75	0.32	NO

Examination of Total Nitrogen Analytical Methods in other Studies

The TN method using the Shimadzu TOC Instrument with TNM-1 Unit (TNs) was accurate and reliable for surface water samples when compared to calculating TN by a summation of TKN, NO_3-N, and NO_2-N (TNk) (Westerhoff et al. 2003; Au et al. 2005).

The regression equations between TNk and TNs established by ARD (Au et al. 2005) and Arizona State University (ASU) Laboratory (Westerhoff et al. 2003) showed very strong agreement (Table 2.5A), i.e., both methods were accurate and gave comparable and reliable measurements of TN in surface water samples.

Table 2.5A. TNk versus TNs relationship results from the Alberta Agriculture and Rural Development (ARD; Au et al. 2005) and Arizona State University (ASU; Westerhoff et al. 2003) laboratories.

	n		r	r_c	Year
ARD Laboratory (TNk vs. TNs)	105	TNk = 0.0074 + 1.0405 × TNs	0.990	0.986	2005
ASU Laboratory (TNk vs. TNs)	110	TNk = -0.0384 + 0.9893 × TNs	0.995	N/A	2003

Examination of Total Nitrogen Analytical Methods between Three Laboratories during the Post-ALS Contract Period

The regression equations of TN between laboratories showed very strong relationships (Table 2.6A). However, the intercept values showed that the ALS method overestimated the TN values compared with ARD and Exova values in the post-ALS contract phase. The strongest relationship existed between the ARD and Exova Laboratory TN measurements, and this was similar to the ARD and ASU TN measurement relationship (Table 2.5A). This suggests that ARD and Exova TN measurements are comparable and interchangeable in the post-ALS contract phase.

Table 2.6A. Regression relationship between laboratories (post-ALS contract period from January 2010 to May 2010).

	n		r	r_c
ALS(TNk) vs. ARD(TNs)	37	ALS(TNk) = 2.2855 + 0.90 × ARD(TNs)	0.932	0.859
ARD(TN_S) vs. Exova(TN_S)	54	ARD(TNk) = 0.01733 + 1.01 × Exova(TNs)	0.997	0.997
ALS(TNk) vs. Exova(TN_S)	126	ALS(TNk) = 1.46804 + 0.93 × Exova (TN_S)	0.967	0.951

Summary and Conclusions

There was good agreement between the ALS laboratory and ARD laboratory duplicate sample TN and TP concentrations and the blind reference samples were generally within the ALS control limits during the ALS contract period. There were no significant differences between the three laboratories for all parameters, except pH, in the post-ALS contract period. The TN regression relationships were strong for all three laboratories in the post-ALS contract period. The strongest relationship was between the ARD and Exova Laboratory TN measurements, and this relationship was similar to those found in other studies. These findings suggest that the change in the TN method upon switching laboratories from ALS to Exova did not result in a shift in the TN concentrations and this was evident when viewing the historical and current TN data at the outlet of Indianfarm Creek (Figure 2.2A). Therefore, the laboratory switchover was successful and the TN data did not require modifications in the post-ALS contract period.

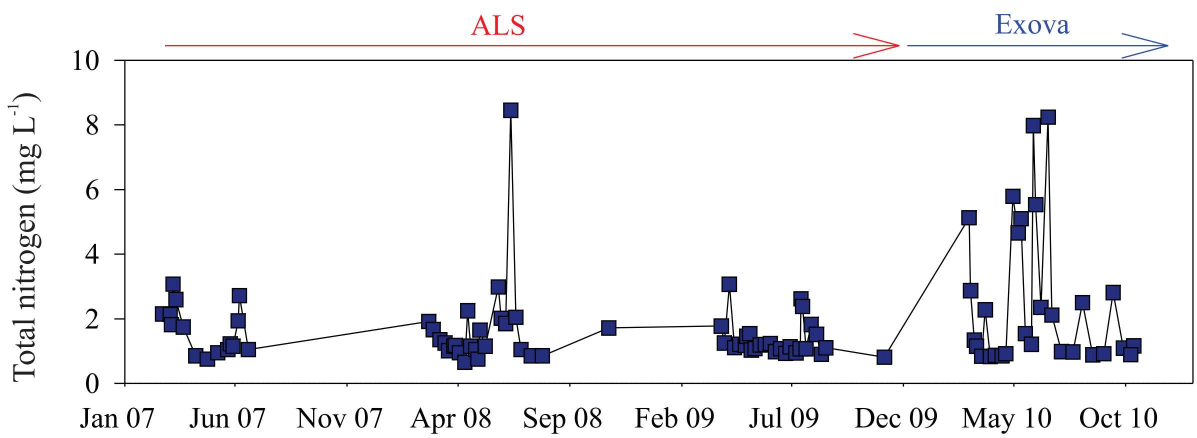


Figure 2.2A. Indianfarm Creek outlet total nitrogen (TN) concentration from 2007 to 2010. ALS Laboratory TN data are shown from 2007 to 2009 and Exova TN data are shown for 2010.

Appendix 3. Laboratory quality control and quality assurance.

Table 3.1A. Laboratory water chemical analysis quality standards and control limits.

	Quality control protocol						
	Reference material (QC) CI at 99%	Method blank	Verification standard	Sample duplicate	Matrix spike CI at 99%	Number of standards used in calibration	Detection limit (DL)
EC Control limit	1/batch 90 – 108%	Every 1-20 samples	Every 1-20 samples	Every 1-20 samples 9.8 %		1	3 µS/cm
pH Control limit	1/batch 6.9–7.2			Every 1-20 samples		3	0.1 pH
Chloride Control limit	90 – 111%						<0.1 ppm
TSS Control limit	1/batch 72-111%	1/batch		Every 1-20 samples			3 mg/L
NO_3-N Control limit	1/calibration 89 – 109%	1/batch < DL	1/batch	1/batch 16%	1/batch 76 -117%	7 R^2 >0.995	<0.05 ppm
NO_2-N Control limit	1/calibration 89 – 111%	1/batch < DL	1/batch	1/batch 16%	1/batch 81 –123%	7 R^2 >0.995	<0.05 ppm
NH_3-N Control limit	1/calibration	1/batch < DL	1/batch	1/batch 10%	1/batch 75 -112%	R^2 >0.995	<0.05 ppm
TKN Control limit	3/batch 81 – 114% 69 – 131% 83 – 118%	1/batch < DL	1/10 samples	5% of batch 16%	1/batch 61 –140%	R^2 >0.995	<0.2 ppm
PO_4-P Control limit	1/batch 85 – 123%	1/batch < DL	1/batch	1/batch 6.5%	1/matrix type per day 72 –111%	8 R^2 >0.995	<0.005 ppm
TDP Control limit	86 – 112%	1/batch < DL	1/10 samples	1/batch 9.5%	1/batch 79 –112%	8 R^2 >0.995	<0.005 ppm
TP Control limit	86– 112%	1/batch < DL	1/10 samples	1/batch 9.5%	1/batch 79 –112%	8 R^2 >0.995	<0.005 ppm
Chlorophyll *a* Control limit	65 – 135%						<1 µg/L

Table 3.2A. Laboratory total coliforms and *Escherichia coli* water analysis.

Method quality control	Minimum frequency
Method blank	1 per batch
Positive control for Fluorescence, *Escherichia coli*, inoculated in sterile water	1 per batch
Positive control for yellow colour change but no fluorescence, *Enterobacter aerogenes*, inoculated in sterile water	1 per batch
Negative control for non-coliform, colorless, no fluorescence, *Pseudomonas aeruginosa*, inoculated in sterile water	1 per batch

Appendix 4. Summary of soil characteristics for the beneficial management practices sites.

Table 4.1A. Measured parameters of the soil characterization samples from the North Manure Field site in Indianfarm Creek Watershed in 2008.[z]

Depth (cm)	Horizon	OM (%)	Sand (%)	Silt (%)	Clay (%)	Texture	pH	EC (dS m^{-1})	Ca[y]	Mg[y]	Na[y]	K[y]	SAR	TP	TN	NO_3-N	NH_4-N	PO_4-P	K
									(mg kg^{-1})										
0-26	Ap	8.0	24.0	35.0	41.0	C	6.8	0.60	48.2	12.1	22.8	8.0	0.9	900	3000	10.1	4.6	40.0	482
26-58	Bm	5.0	11.0	41.0	48.0	SiC	6.9	0.70	67.2	14.1	19.8	1.9	0.7	560	1700	2.2	4.3	3.0	257
58-100	Cca	2.0	22.0	47.0	31.0	CL	7.8	9.30	48.4	17.6	17.6	2.2	0.9	650	800	3.3	2.1	0.5	67
120-160	Ck	2.0	27.0	43.0	30.0	CL	7.9	1.50	41.7	45.6	35.7	1.3	1.4	640	500	5.8	1.9	0.5	61
0-26	Ap	6.0	10.0	42.0	48.0	SiC	6.8	1.00	87.6	24.0	21.0	6.6	0.7	770	2400	5.9	4.3	0.5	438
26-47	Bm	5.0	18.0	31.0	52.0	C	7.2	0.80	58.0	20.1	21.4	3.1	0.8	610	1600	6.0	4.4	3.0	266
50-100	I Ck	3.0	14.0	29.0	57.0	C	7.8	1.60	66.6	55.2	76.8	2.4	2.2	650	900	12.9	3.1	0.5	181
140-180	II Ck	2.0	37.0	27.0	37.0	CL	7.9	3.40	67.1	116.1	205.8	2.5	5.0	610	500	6.2	2.3	0.5	93
0-12	Ap	6.0	25.0	27.0	48.0	C	7.6	0.90	74.5	16.6	19.3	24.8	0.6	890	2100	16.9	3.9	53.0	929
12-30	Bm	4.0	23.0	27.0	50.0	C	7.7	0.70	47.4	20.5	23.7	2.6	0.9	730	1400	7.7	4.0	0.5	277
50-100	I Ck	3.0	22.0	29.0	49.0	C	8.1	0.90	23.9	37.2	37.2	1.9	1.4	680	1000	7.6	3.1	0.5	195
140-180	II Ck	2.0	33.0	25.0	43.0	C	8.1	1.30	26.7	42.8	86.2	3.1	3.1	720	0600	5.9	2.6	2.0	143
0-21	Ap	6.0	27.0	32.0	42.0	C	6.8	0.90	73.8	23.2	20.7	5.5	0.7	730	2000	5.3	3.7	11.0	373
21-31	Bm1	5.0	25.0	28.0	47.0	C	7.4	0.50	43.5	18.9	18.9	2.5	0.7	660	1600	2.4	4.1	2.0	310
31-42	Bm2	5.0	17.0	28.0	55.0	C	7.2	0.60	38.9	19.4	15.4	2.0	0.6	760	1700	2.0	4.5	1.0	293
50-100	Ck1	3.0	15.0	27.0	58.0	C	7.7	0.60	18.3	17.1	29.5	1.2	1.5	710	0900	3.2	3.0	0.5	155
120-160	Ck2	3.0	10.0	23.0	67.0	HC	7.8	0.60	69.5	73.0	150.5	5.3	3.2	810	800	12.3	4.8	0.5	171
0-13	Ap	7.0	28.0	25.0	48.0	C	7.5	1.60	74.9	17.3	30.2	15.8	1.0	1080	2500	17.7	4.5	101	733
20-50	I Ck	3.0	23.0	26.0	51.0	C	7.7	0.90	35.3	23.4	16.0	1.7	0.7	710	1000	9.6	3.2	0.5	163
60-90		3.0	18.0	27.0	55.0	C	8.0	1.10	25.5	48.1	27.3	1.2	1.0	660	0800	14.8	2.6	0.5	120
100-130	II Cca	2.0	37.0	22.0	42.0	C	8.1	1.40	29.2	55.6	44.8	2.2	1.5	660	600	14.1	2.5	1.0	93
150-180	II Ck	3.0	9.0	27.0	65.0	HC	7.8	3.10	268.9	210.9	190.0	4.8	2.1	730	800	9.7	5.7	0.5	198
0-19	Ap	7.0	16.0	34.0	50.0	C	7.3	1.20	122.6	30.7	32.9	8.8	0.8	770	1900	10.5	4.9	8.0	303
30-50	Cca	3.0	13.0	37.0	50.0	C	7.8	0.60	42.2	12.6	15.1	1.3	0.7	700	1000	4.8	3.5	1.0	88
60-80		3.0	11.0	41.0	48.0	SiC	8.0	0.60	26.2	24.3	12.2	0.6	0.5	650	700	10.0	2.9	0.5	69
120-150	Ck	3.0	11.0	30.0	59.0	C	8.4	0.80	15.0	44.2	79.9	3.8	2.4	690	700	8.2	3.8	0.5	154

[z] OM = organic matter, EC = electrical conductivity, Ca = calcium, Mg = magnesium, Na = sodium, K = potassium, SAR = sodium adsorption ratio, TP = total phosphorus, TN = total nitrogen, NO_3-N = extractable nitrate nitrogen, NH_4-N = extractable ammonium nitrogen, PO_4-P = extractable phosphate phosphorus.
[y] Water extractable by saturated paste method.

Table 4.2A. Measured parameters of the soil characterization samples from the Pasture (Pasture A) site in Indianfarm Creek Watershed in 2007. [z]

Depth (cm)	Horizon	OM (%)	Sand (%)	Silt (%)	Clay (%)	Texture	pH	EC (dS m^{-1})	Ca[y]	Mg[y]	Na[y]	K[y]	SAR	TP	TN	NO_3-N	NH_4-N	PO_4-P	K
									(mg kg^{-1})										
0-19	Ap	7.0	20.0	41.0	39.0	SiCL	6.2	0.90	78.5	27.1	11.2	18.5	0.34	630	2900	1.2	9.5	7.0	na[x]
20-40	Bm	5.0	3.0	50.0	48.0	SiC	6.7	1.40	135.9	49.7	31.7	8.3	0.71	670	2200	1.2	8.2	2.0	na
50-80	Cca	4.0	4.0	44.0	52.0	SiC	7.6	0.80	49.8	24.6	14.0	3.4	0.54	650	1300	1.0	5.7	0.5	na
140-170	Ck2	3.0	27.0	34.0	39.0	CL	7.9	1.10	18.7	52.0	18.2	3.6	0.68	560	1100	1.0	3.6	2.0	na
0-12	Ap	11.0	18.0	33.0	49.0	C	6.7	1.60	254.6	69.6	11.2	111.8	0.17	960	4300	1.0	24.7	103.0	na
12-28	Bm	6.0	11.0	37.0	52.0	C	6.8	1.10	102.9	30.1	14.0	53.2	0.37	580	2500	0.8	5.5	9.0	na
30-50	Cca1	3.0	19.0	25.0	57.0	C	7.4	0.90	56.6	19.4	20.4	4.6	0.84	530	1200	0.6	4.0	1.0	na
70-100	Cca3	3.0	5.0	42.0	54.0	SiC	7.9	0.90	31.3	41.9	21.8	3.5	0.78	620	1000	1.2	5.0	1.0	na
120-160	Ck1	2.0	12.0	30.0	58.0	C	8.0	1.30	16.9	50.7	38.1	3.3	1.52	610	700	1.0	3.3	0.5	na
0-10	Ah	19.0	29.0	29.0	42.0	C	6.5	1.60	387.7	102.7	16.4	156.2	0.16	1140	7700	2.5	19.1	63.0	na
10-30	Bm	7.0	17.0	27.0	56.0	C	6.9	1.00	89.1	26.8	13.4	52.9	0.39	900	3600	1.6	5.2	30.0	na
50-70	Cca	4.0	10.0	26.0	64.0	HC	7.3	0.70	67.9	14.7	9.4	18.9	0.35	740	2100	1.0	3.7	2.0	na
110-130	Ck	5.0	14.0	33.0	52.0	C	7.4	0.80	77.4	11.0	11.0	10.4	0.39	780	2100	1.0	4.6	2.0	na
0-11	Ah	13.0	36.0	31.0	33.0	CL	6.6	1.10	180.9	46.4	10.7	107.1	0.17	980	5900	2.0	12.2	13.0	na
11-30	Bm	6.0	16.0	46.0	38.0	SiCL	7.0	0.80	74.1	25.3	9.1	16.9	0.29	680	2200	0.8	3.9	2.0	na
50-70	Cca	3.0	9.0	57.0	34.0	SiCL	7.9	0.80	29.9	30.5	51.2	3.0	2.02	630	1100	0.8	3.6	0.5	na
160-190	Csk	4.0	8.0	61.0	31.0	SiCL	7.7	5.70	494.3	633.6	474.3	13.9	3.79	590	700	0.8	7.2	0.5	na
0-10	Ah	10.0	31.0	33.0	36.0	CL	6.6	2.10	432.1	93.3	9.7	43.1	0.12	770	4400	1.4	7.6	9.0	na
10-30	Bm	8.0	24.0	38.0	37.0	CL	6.8	1.00	145.5	33.0	6.0	10.5	0.13	660	3200	0.6	5.1	2.0	na
50-70	Cca1	4.0	5.0	56.0	39.0	SiCL	7.8	0.70	29.3	28.6	44.2	2.6	1.73	620	1300	0.8	4.6	0.5	na
120-150	Cca2	3.0	1.0	69.0	29.0	SiL	7.8	5.70	616.7	856.3	642.6	18.4	3.78	690	800	0.8	4.9	0.5	na

[z] OM = organic matter, EC = electrical conductivity, Ca = calcium, Mg = magnesium, Na = sodium, K = potassium, SAR = sodium adsorption ratio, TP = total phosphorus, TN = total nitrogen, NO_3-N = extractable nitrate nitrogen, NH_4-N = extractable ammonium nitrogen, PO_4-P = extractable phosphate phosphorus.

[y] Water extractable by saturated paste method.

[x] na = not analyzed.

Table 4.3A. Measured parameters of the soil characterization samples from the corral area at the Pasture site in Indianfarm Creek Watershed in 2007.[z]

Depth (cm)	Horizon	OM (%)	Sand (%)	Silt (%)	Clay (%)	Texture	pH	EC (dS m^{-1})	Ca[y]	Mg[y]	Na[y]	K[y]	SAR	TP	TN	NO_3-N	NH_4-N	PO_4-P	K
									(mg kg^{-1})										
0-20	Ah	21.0	39.0	23.0	38.0	CL	6.6	1.20	335.8	59.8	10.2	80.3	0.11	1330	8800	4.5	13.1	65.0	na[x]
30-50	Bmgj	6.0	10.0	37.0	53.0	C	6.9	0.80	77.7	14.7	9.4	30.8	0.31	1220	3100	1.8	5.8	48.0	na
70-90	Ccagj	3.0	6.0	32.0	62.0	HC	7.3	0.80	56.7	13.0	5.9	37.8	0.25	820	1500	1.4	3.3	7.0	na
120-150	Ckgj	3.0	2.0	38.0	61.0	HC	7.5	0.80	51.0	11.8	11.8	31.4	0.52	770	1300	1.2	3.3	5.0	na
13-23	Cca1	9.0	14.0	31.0	55.0	C	7.0	1.40	94.7	32.3	15.4	195.6	0.40	1250	4300	1.7	5.2	125.0	na
30-50	Cca2	3.0	13.0	25.0	62.0	HC	7.7	1.40	35.6	9.7	13.0	212.2	0.68	760	1900	1.0	3.0	8.0	na
60-80	Cca3	3.0	17.0	27.0	56.0	C	8.0	1.40	26.0	11.4	16.1	181.5	0.92	660	1300	1.2	1.9	2.0	na
120-150	Ck1	3.0	16.0	31.0	53.0	C	7.6	1.90	91.3	51.0	71.4	5.6	2.08	650	1100	1.0	3.3	1.0	na
160-190	Ck2	2.0	20.0	30.0	49.0	C	7.5	2.10	112.0	60.0	55.5	4.5	1.49	610	1000	1.2	4.0	2.0	na
8-16	Ap	17.0	57.0	15.0	28.0	SCL	7.1	1.10	143.5	49.7	14.7	166.1	0.25	1570	8400	7.5	6.0	208.0	na
16-30	Bm	6.0	20.0	22.0	59.0	C	7.4	1.10	60.2	18.2	8.4	159.6	0.29	1040	3200	2.8	2.9	98.0	na
30-50	Cca	4.0	21.0	23.0	55.0	C	7.7	1.20	37.4	9.4	8.8	154.4	0.46	600	1600	1.6	2.4	6.0	na
70-90	Cca	4.0	18.0	26.0	56.0	C	7.7	0.90	44.8	20.6	14.7	83.2	0.60	640	1800	1.6	2.3	3.0	na
120-150	Ck	3.0	5.0	36.0	59.0	C	7.9	0.80	39.0	34.2	30.6	4.2	1.11	680	1300	1.6	3.6	2.0	na

[z] OM = organic matter, EC = electrical conductivity, Ca = calcium, Mg = magnesium, Na = sodium, K = potassium, SAR = sodium adsorption ratio, TP = total phosphorus, TN = total nitrogen, NO_3-N = extractable nitrate nitrogen, NH_4-N = extractable ammonium nitrogen, PO_4-P = extractable phosphate phosphorus.
[y] Water extractable by saturated paste method.
[x] na = not analyzed.

Table 4.4A. Measured parameters of the soil characterization samples from the Wintering site in Indianfarm Creek Watershed in 2007.[z]

Depth (cm)	Horizon	OM (%)	Sand (%)	Silt (%)	Clay (%)	Texture	pH	EC (dS m^{-1})	Ca^y	Mg^y	Na^y	K^y	SAR	TP	TN	NO_3-N	NH_4-N	PO_4-P	K
									(mg kg^{-1})										
8-25	Ahk	7.0	11.0	48.0	41.0	SiC	7.0	1.60	156.4	44.9	21.8	71.9	0.49	950	2,900	2.8	5.7	81.0	na[x]
30-50	Cca	4.0	1.0	66.0	33.0	SiCL	7.5	0.70	51.4	24.0	16.2	5.8	0.58	630	1,500	1.4	4.8	2.0	na
70-90	Cca	3.0	1.0	57.0	42.0	SiC	7.8	1.00	39.5	52.9	44.9	2.0	1.34	580	900	1.6	4.9	0.5	na
140-170	Ck	3.0	2.0	74.0	24.0	SiL	7.7	2.40	139.7	212.4	212.4	12.6	2.68	580	900	1.0	30.7	0.5	na
0-7	Ap	9.0	54.0	15.0	30.0	SCL	6.6	1.50	236.5	51.0	8.1	55.9	0.14	780	3,900	2.6	27.3	38.0	na
7-23	Bm	7.0	51.0	18.0	31.0	SCL	6.8	1.00	106.0	27.3	5.0	11.8	0.14	740	2,900	2.0	9.7	35.0	na
60-80	Cca	2.0	57.0	16.0	26.0	SCL	7.6	0.70	41.4	12.3	6.1	4.5	0.34	440	700	1.0	6.4	1.0	na
150-180	Ck	3.0	25.0	27.0	48.0	C	8.0	1.10	28.6	57.7	32.2	3.6	1.11	590	1,200	1.2	5.2	1.0	na
0-8	Apk	11.0	25.0	22.0	54.0	C	6.7	1.40	178.9	50.7	27.6	35.6	0.50	1080	4,900	3.5	17.9	47.0	na
8-28	Bmk	6.0	28.0	22.0	50.0	C	7.2	1.00	110.1	23.7	6.4	20.5	0.18	840	3,200	1.6	5.9	12.0	na
30-50	Cca	3.0	19.0	27.0	54.0	C	7.5	0.80	65.2	17.5	9.0	5.8	0.35	570	1,500	1.2	5.6	1.0	na
70-90	Cca	2.0	16.0	27.0	57.0	C	7.9	0.70	17.6	29.9	20.1	2.4	0.97	610	900	1.2	8.1	0.5	na
150-180	Ck	2.0	44.0	25.0	31.0	CL	8.0	0.90	13.9	23.9	47.5	1.7	2.76	480	700	1.2	3.1	0.5	na
0-7	Ap	42.0	15.0	48.0	37.0	SiCL	6.4	1.40	429.0	154.0	38.5	602.2	0.24	1840	17,900	25.5	31.5	145.0	na
7-30	Bm	7.0	19.0	30.0	51.0	C	6.7	0.80	62.9	19.2	10.4	91.0	0.34	750	3,600	4.6	6.3	41.0	na
30-50	Cca1	3.0	19.0	27.0	54.0	C	7.4	1.30	81.5	29.5	13.5	25.5	0.46	650	1,300	31.4	5.4	1.0	na
60-80	Cca2	3.0	14.0	44.0	42.0	SiC	7.8	1.10	40.5	44.5	47.9	3.4	1.64	560	1,000	6.0	6.1	0.5	na
150-180	Ck	2.0	1.0	52.0	48.0	SiC	8.3	4.50	53.3	286.1	565.7	8.0	7.96	580	700	21.4	27.2	0.5	na

[z] OM = organic matter, EC = electrical conductivity, Ca = calcium, Mg = magnesium , Na = sodium, K = potassium, SAR = sodium adsorption ratio, TP = total phosphorus, TN = total nitrogen, NO_3-N = extractable nitrate nitrogen, NH_4-N = extractable ammonium nitrogen, PO_4-P = extractable phosphate phosphorus.
[y] Water extractable by saturated paste method.
[x] na = not analyzed.

Table 4.5A. Measured parameters of the soil characterization samples from the South Manure Field site in Indianfarm Creek Watershed in 2008.[z]

Depth (cm)	Horizon	OM (%)	Sand (%)	Silt (%)	Clay (%)	Texture	pH	EC (dS m^{-1})	Ca[y]	Mg[y]	Na[y]	K[y]	SAR	TP	TN	NO_3-N	NH_4-N	PO_4-P	K
									(mg kg^{-1})										
0-13	Ap	11.0	42.0	29.0	29.0	CL	6.6	1.20	70.4	23.0	33.9	55.0	1.1	1180	4800	14.8	3.3	124	1060
13-41	Bm	4.0	30.0	31.0	39.0	CL	6.8	0.60	23.5	9.0	25.0	2.0	1.6	1490	1500	3.8	3.1	2	243
41-70	Bc	2.0	44.0	27.0	29.0	CL	7.5	1.00	40.4	22.6	19.7	1.4	0.9	350	900	2.0	2.9	0.5	128
70-100	Cca	2.0	32.0	30.0	38.0	CL	7.9	1.30	47.5	43.2	36.2	1.1	1.2	580	900	3.2	2.3	0.5	100
150-180	Ck	2.0	33.0	36.0	31.0	CL	8.0	1.70	31.7	59.5	55.2	1.9	1.9	530	600	7.5	2.8	0.5	110
0-16	Ap	14.0	36.0	35.0	29.0	CL	6.5	0.80	48.3	14.2	27.0	46.2	1.0	1370	6400	12.7	4.2	121	1080
16-40	Bm1	4.0	25.0	38.0	37.0	CL	6.7	0.50	20.0	6.5	27.0	1.5	1.9	570	1800	3.6	3.0	2	194
50-80	Bm2	3.0	30.0	32.0	38.0	CL	7.4	0.80	33.1	14.9	16.8	1.4	0.9	340	1000	1.9	2.7	1	151
100-120	Cca	2.0	53.0	12.0	35.0	SCL	7.7	1.30	46.1	27.9	30.4	1.5	1.2	500	700	10.0	2.6	0.5	106
150-180	Csk	2.0	29.0	36.0	35.0	CL	7.9	0.90	22.4	22.4	41.1	0.5	2.0	580	600	10.0	2.6	0.5	108
0-17	Ap	11.0	33.0	34.0	33.0	CL	6.2	0.80	70.9	16.9	18.2	16.3	0.6	980	5100	8.7	3.5	44	561
20-50	Bm1	4.0	31.0	32.0	37.0	CL	6.5	0.40	19.2	4.7	17.2	1.6	1.2	430	1400	2.9	3.7	0.5	136
60-100	Cca	2.0	27.0	36.0	37.0	CL	7.8	0.90	42.1	22.9	17.7	1.6	0.8	560	800	7.5	2.8	0.5	68
140-180	Csk	2.0	27.0	33.0	40.0	C	8.1	1.10	23.8	45.9	44.3	2.2	1.7	520	600	3.1	3.2	0.5	82
0-31	Ap	9.0	54.0	13.0	33.0	SCL	6.6	0.70	56.7	15.3	18.9	4.3	0.7	810	3800	9.3	4.1	15	275
40-75	Bm	4.0	61.0	6.0	33.0	SCL	7.1	0.50	26.3	9.5	12.9	0.6	0.7	350	1100	3.9	2.9	0.5	117
80-100	Cca	2.0	31.0	35.0	34.0	CL	7.7	0.60	27.0	12.2	9.9	0.5	0.6	620	900	4.6	2.3	0.5	59
130-160	Ck	2.0	24.0	38.0	38.0	CL	8.0	1.20	19.4	28.8	31.3	0.7	1.8	590	600	4.8	2.2	0.5	58

[z] OM = organic matter, EC = electrical conductivity, Ca = calcium, Mg = magnesium, Na = sodium, K = potassium, SAR = sodium adsorption ratio, TP = total phosphorus, TN = total nitrogen, NO_3-N = extractable nitrate nitrogen, NH_4-N = extractable ammonium nitrogen, PO_4-P = extractable phosphate phosphorus.
[y] Water extractable by saturated paste method.

Table 4.6A. Measured parameters of the soil characterization samples from the Dairy Manure Field site in Indianfarm Creek Watershed in 2008.[z]

Depth (cm)	Horizon	OM (%)	Sand (%)	Silt (%)	Clay (%)	Texture	pH	EC (dS m^{-1})	Ca[y]	Mg[y]	Na[y]	K[y]	SAR	TP	TN	NO_3-N	NH_4-N	PO_4-P	K
									(mg kg^{-1})										
0-18	Ap	6.0	47.0	25.0	28.0	SCL	6.9	1.90	156.4	40.3	20.1	12.7	0.5	840	2800	6.4	3.0	49	397
18-36	Bm	3.0	43.0	33.0	25.0	L	7.5	0.80	48.0	13.7	23.0	2.5	1.1	530	1500	1.7	2.9	8	182
50-80	Cca	2.0	29.0	32.0	39.0	CL	7.9	1.40	62.1	35.6	53.5	2.7	1.8	610	900	1.4	3.3	1	205
120-150	Cca	2.0	10.0	48.0	42.0	SiC	8.3	3.30	71.9	298.7	421.1	5.8	6.4	660	600	2.9	2.2	0.5	86
0-16	Ap	7.0	39.0	31.0	30.0	CL	6.9	1.30	65.0	27.0	23.4	49.4	0.9	890	2900	2.2	3.1	71	989
16-29	Bm	3.0	37.0	35.0	29.0	CL	7.4	0.60	35.7	9.7	16.3	11.7	0.9	540	1400	1.5	2.6	10	493
50-90	Cca	1.0	44.0	29.0	27.0	L	8.1	0.60	14.0	12.4	17.2	4.0	1.3	510	500	1.6	1.7	3	203
120-160	Ck	2.0	48.0	33.0	19.0	L	8.3	0.60	9.6	19.7	16.8	2.4	1.0	580	500	1.8	1.5	1	162
0-19	Ap	7.0	42.0	25.0	33.0	CL	6.3	0.50	34.2	9.0	5.6	9.5	0.3	1000	3100	6.0	3.4	51	545
19-43	Bm	4.0	33.0	34.0	33.0	CL	6.9	0.50	28.6	8.2	8.2	3.1	0.5	680	1700	1.1	3.3	4	297
43-73	Btj	4.0	28.0	29.0	43.0	C	7.1	0.50	29.5	8.9	15.3	4.1	0.8	620	1200	1.2	3.0	2	433
100-134	Cca	2.0	45.0	26.0	29.0	CL-SCL	7.6	0.60	27.5	8.1	12.6	4.1	0.8	660	700	2.0	2.0	3	225
0-16	Ap	6.0	38.0	28.0	34.0	CL	7.8	0.70	25.6	12.2	55.5	3.1	2.9	960	2300	5.6	3.2	69	359
20-50	Cca	3.0	34.0	30.0	37.0	CL	7.9	0.80	18.9	13.4	66.5	2.4	3.6	630	900	2.2	2.2	1	232
60-90	Cca	2.0	29.0	31.0	41.0	C	8.3	0.90	13.4	33.5	64.3	2.7	2.6	650	700	1.3	1.8	4	196
120-150	Csk	3.0	18.0	32.0	50.0	C	8.3	1.00	11.2	29.7	101.6	2.6	4.5	560	800	4.6	2.3	0.5	252
0-8	Apk	9.0	25.0	30.0	45.0	C	7.6	0.60	54.0	9.2	14.9	9.9	0.6	1230	3300	7.3	3.9	103	606
80-21	Bmk	4.0	16.0	29.0	55.0	C	7.7	0.50	46.0	11.0	15.3	3.7	0.6	810	1500	3.8	3.9	4	265
40-70	Cca	3.0	17.0	30.0	53.0	C	8.2	0.60	16.6	25.2	46.1	0.7	2.0	760	800	1.6	2.4	0.5	102
110-150	Ck	3.0	37.0	31.0	32.0	CL	7.8	6.30	248.0	298.4	291.5	5.3	4.0	580	500	0.9	5.3	0.5	101

[z] OM = organic matter, EC = electrical conductivity, Ca = calcium, Mg = magnesium, Na = sodium, K = potassium, SAR = sodium adsorption ratio, TP = total phosphorus, TN = total nitrogen, NO_3-N = extractable nitrate nitrogen, NH_4-N = extractable ammonium nitrogen, PO_4-P = extractable phosphate phosphorus.

[y] Water extractable by saturated paste method.

Table 4.7A. Measured parameters of the soil characterization samples from the Reference site in Indianfarm Creek Watershed in 2008.[z]

Depth (cm)	Horizon	OM (%)	Sand (%)	Silt (%)	Clay (%)	Texture	pH	EC (dS m^{-1})	Ca[y]	Mg[y]	Na[y]	K[y]	SAR	TP	TN	NO_3-N	NH_4-N	PO_4-P	K
									(mg kg^{-1})										
0-16	Ap	9.0	19.0	38.0	43.0	C	7.4	0.70	29.1	6.1	9.0	6.4	0.7	990	3700	2.2	4.0	66	745
16-34	Bm	7.0	16.0	39.0	45.0	C	7.4	0.50	29.8	11.8	14.9	1.2	0.8	730	2400	1.1	3.0	10	264
50-90	Cca	4.0	11.0	26.0	63.0	HC	8.0	0.70	27.7	25.3	57.7	1.6	2.1	680	1100	1.2	3.3	0.5	214
120-150	Ck	4.0	9.0	25.0	66.0	HC	7.7	4.80	461.2	301.6	260.4	8.4	2.6	640	1000	0.9	6.1	1	175
0-21	Ap	7.0	8.0	36.0	56.0	C	7.5	1.80	254.3	31.3	15.0	7.5	0.3	730	2600	1.5	4.6	7	427
21-42	Bmk	4.0	7.0	44.0	49.0	SiC	7.7	0.50	48.0	10.5	9.8	0.8	0.4	720	1600	1.1	3.1	0.5	121
50-80	Cca	3.0	5.0	37.0	58.0	C	7.9	0.50	26.6	16.8	16.1	0.7	0.7	670	1000	0.8	2.6	0.5	84
120-150	Ck1	3.0	6.0	31.0	63.0	HC	8.2	1.50	34.2	97.2	137.7	4.5	2.9	750	900	1.2	3.3	0.5	162
0-34	Ap	7.0	16.0	45.0	39.0	SiCL	7.3	0.70	50.2	16.7	14.3	15.5	0.6	900	3300	1.2	3.3	38	665
34-58	Bm	3.0	21.0	54.0	25.0	SiL	7.6	0.60	31.8	12.2	14.8	2.7	0.8	740	1100	1.3	3.0	2	143
65-74	Ahb	3.0	22.0	43.0	35.0	CL	na[x]	na	na	na	na	na	na	780	1500	2.2	3.4	1	172
80-100	Cca	2.0	33.0	40.0	27.0	L	7.9	0.50	25.8	12.0	8.7	1.4	0.5	650	1000	0.9	2.1	1	98
150-180	Csk	4.0	16.0	42.0	43.0	SiC	7.8	0.80	39.0	26.7	20.8	2.6	0.8	680	900	5.6	3.1	1	315
0-24	Ap	6.0	23.0	46.0	31.0	CL	7.7	0.70	54.9	9.2	11.0	14.0	0.5	950	2600	2.1	2.7	31	507
30-50	Cca	2.0	15.0	55.0	30.0	SiCL	7.8	0.50	33.3	10.8	7.8	2.0	0.4	690	1100	0.9	2.5	1	118
60-90	Cca	1.0	37.0	43.0	20.0	L	8.1	0.50	12.4	15.6	5.2	1.6	0.4	580	700	0.9	2.0	1	94
140-170	Ck1	2.0	47.0	33.0	20.0	L	8.3	0.60	6.0	24.5	11.2	1.7	0.7	580	700	2.8	2.0	1	96
0-10	Apk	6.0	9.0	31.0	60.0	HC	7.7	0.60	54.7	14.2	15.6	6.4	0.6	970	2200	1.7	3.8	13	388
10-24	Bm	4.0	7.0	27.0	66.0	HC	7.7	0.50	31.5	14.7	17.4	2.0	0.8	750	1400	0.9	3.0	0.5	204
30-60	Cca	3.0	8.0	24.0	68.0	HC	8.0	0.60	19.0	21.2	42.3	0.7	1.8	720	1100	0.6	2.9	0.5	126
100-140	Csk	4.0	11.0	21.0	68.0	HC	7.8	6.30	506.9	545.9	437.1	9.3	3.3	640	800	0.6	6.0	0.5	153

[z] OM = organic matter, EC = electrical conductivity, Ca = calcium, Mg = magnesium, Na = sodium, K = potassium, SAR = sodium adsorption ratio, TP = total phosphorus, TN = total nitrogen, NO_3-N = extractable nitrate nitrogen, NH_4-N = extractable ammonium nitrogen, PO_4-P = extractable phosphate phosphorus.
[y] Water extractable by saturated paste method.
[x] na = not analyzed.

Table 4.8A. Measured parameters of the soil characterization samples from the West Field site in Whelp Creek Sub-watershed in 2009.[z]

Depth (cm)	Horizon	OM (%)	Sand (%)	Silt (%)	Clay (%)	Texture	pH	EC (dS m^{-1})	Ca[y]	Mg[y]	Na[y]	K[y]	SAR	TP	TN	NO_3-N	NH_4-N	PO_4-P	K
									----	----	----	----	----	(mg kg^{-1})	----	----	----	----	----
0-19	Ap	9.1	36.0	43.0	21.0	L	6.66	0.72	70.4	14.5	15.2	1.8	0.54	746	4230	5.54	7.90	20.2	147
19-56	Bm	5.7	36.0	43.0	21.0	L	7.47	0.48	47.6	10.3	8.9	1.3	0.38	585	2490	3.16	4.96	1.0	139
73-120	Cca	1.3	47.0	39.0	14.0	L	7.72	0.68	38.6	11.8	5.5	1.1	0.31	535	550	1.90	2.66	1.0	84
150-180	Ck	1.0	50.0	37.0	13.0	L	7.88	0.43	19.8	8.6	4.6	0.9	0.34	612	250	2.00	2.88	1.0	69
0-23	Ap	9.8	34.0	47.0	19.0	L	6.69	0.58	58.9	8.5	10.8	1.4	0.45	918	4480	10.30	6.20	6.3	138
23-55	Ah	7.5	26.0	53.0	21.0	SiL	7.02	0.52	56.6	9.1	5.1	1.2	0.22	701	3350	5.15	5.77	1.0	130
55-100	Bm	2.0	39.0	39.0	23.0	L	6.47	0.50	26.2	5.9	4.2	1.3	0.30	321	530	1.89	5.73	1.0	160
105-180	Cca	1.4	48.0	39.0	13.0	L	7.85	0.53	31.1	6.1	4.2	1.0	0.28	746	350	3.66	4.07	1.0	95
180-210		1.2	44.0	40.0	16.0	L	8.19	0.41	18.3	3.8	6.9	1.3	0.65	926	460	3.60	4.24	1.0	120
0-15	Ap	10.7	30.0	41.0	30.0	CL	7.64	0.86	93.8	28.9	10.5	1.3	0.30	777	4950	6.58	8.91	12.1	170
15-30	Bmk	4.6	28.0	41.0	31.0	CL	7.96	0.65	44.6	20.4	8.8	1.0	0.38	453	1820	3.94	6.45	1.0	204
40-70	Ck1	1.4	49.0	27.0	24.0	SCL	8.01	0.47	17.4	11.6	7.7	0.8	0.54	393	360	2.30	3.65	1.0	125
110-160	Ck2	1.6	18.0	62.0	21.0	SiL	7.98	0.32	12.8	9.5	7.4	1.4	0.54	1060	330	2.72	5.24	1.0	150
0-16	Ap	6.9	28.0	52.0	20.0	SiL	6.11	0.64	50.5	8.8	9.8	2.4	0.47	531	3050	12.00	6.33	15.2	162
16-24	Aej	2.2	34.0	38.0	28.0	CL	6.64	0.43	33.7	4.9	8.8	1.1	0.55	235	740	3.01	7.41	1.0	166
24-55	Bt	2.1	32.0	40.0	28.0	L-CL	6.81	0.33	21.7	3.2	5.9	0.9	0.45	496	580	2.14	5.72	1.0	157
60-100	Cca	1.3	42.0	35.0	23.0	L	7.73	0.74	52.5	6.4	6.1	0.8	0.33	513	350	2.13	4.34	1.0	129

[z] OM = organic matter, EC = electrical conductivity, Ca = calcium, Mg = magnesium, Na = sodium, K = potassium, SAR = sodium adsorption ratio, TP = total phosphorus, TN = total nitrogen, NO_3-N = extractable nitrate nitrogen, NH_4-N = extractable ammonium nitrogen, PO_4-P = extractable phosphate phosphorus.
[y] Water extractable by saturated paste method.

Table 4.9A. Measured parameters of the soil characterization samples from the North Field site in Whelp Creek Sub-watershed in 2009.[z]

Depth (cm)	Horizon	OM (%)	Sand (%)	Silt (%)	Clay (%)	Texture	pH	EC (dS m^{-1})	Ca[y]	Mg[y]	Na[y]	K[y]	SAR	TP	TN	NO_3-N	NH_4-N	PO_4-P	K
									(mg kg^{-1})										
0-17	Ap	9.9	36.0	42.0	22.0	L	6.43	0.67	60.9	14.1	9.9	3.7	0.38	583	4660	10.10	8.33	23.3	208
24-38	Bt1	1.9	25.0	45.0	31.0	CL	7.22	0.56	31.1	9.4	12.2	1.5	0.70	325	630	1.68	4.84	1.0	199
50-74	Bt2	1.7	34.0	38.0	27.0	L	7.52	0.62	40.8	12.0	10.2	1.7	0.48	405	480	1.53	4.46	1.0	181
100-120	Cca	2.7	39.0	39.0	22.0	L	7.44	0.82	47.3	11.4	9.7	2.7	0.49	493	810	3.79	3.87	1.0	155
120-150	Csk	1.1	41.0	39.0	21.0	L	7.55	0.45	23.3	5.3	7.0	2.1	0.52	586	310	1.75	3.56	1.0	149
210-240	-	1.1	45.0	37.0	19.0	L	7.94	0.50	24.0	6.4	10.2	3.4	0.75	na[x]	270	1.59	4.55	1.0	145
0-24	Ap	8.0	34.0	42.0	24.0	L	7.26	0.55	38.3	10.3	16.2	5.3	0.79	776	3650	10.30	4.59	36.3	327
24-49	Bm	1.8	34.0	38.0	28.0	CL	7.34	0.88	38.9	15.5	21.4	1.8	1.06	357	620	14.60	3.18	1.0	181
50-100	Cca	1.4	36.0	40.0	24.0	L	8.00	0.69	29.1	15.9	13.6	1.3	0.74	543	490	14.10	3.50	1.0	134
110-150	Ck	1.1	39.0	40.0	21.0	L	7.90	0.68	27.0	15.3	10.5	1.6	0.59	506	340	8.86	4.04	1.0	136
0-21	Apk	11.3	31.0	41.0	28.0	CL	7.49	1.70	133.5	60.9	47.9	24.9	1.02	901	5620	32.60	5.38	55.0	442
21-38	Ahejk	4.0	35.0	37.0	27.0	L	7.98	0.87	30.1	31.8	31.5	1.8	1.30	480	1830	8.56	3.22	1.0	133
40-80	I Cca	1.3	46.0	30.0	24.0	L	7.85	1.09	26.6	25.2	40.4	2.4	2.03	353	420	6.27	3.20	1.0	111
86-100	II Ck	1.1	42.0	38.0	20.0	L	7.82	1.18	36.7	24.0	34.8	3.7	1.67	461	320	9.28	4.88	1.0	146
0-18	Ap	11.6	35.0	45.0	21.0	L	6.72	1.13	91.1	22.2	40.7	20.1	1.20	697	5210	18.50	6.23	41.4	494
21-50	Bt	2.6	33.0	34.0	33.0	CL	7.12	0.85	50.1	19.9	13.3	2.3	0.55	284	760	9.15	4.93	1.0	194
70-100	Cca	2.3	30.0	36.0	34.0	CL	7.74	0.72	38.3	16.9	18.0	1.3	0.82	389	490	11.20	4.67	1.0	153
120-160	Csk	2.1	37.0	38.0	25.0	L	7.76	0.60	23.8	11.1	20.5	0.9	1.27	438	420	9.35	3.93	1.0	117
0-32	Ap	7.7	42.0	40.0	18.0	L	6.22	1.48	94.1	19.3	39.9	10.5	1.32	630	3600	22.20	18.40	27.8	294
32-54	Bm	2.6	44.0	35.0	21.0	L	7.12	0.51	22.8	5.6	12.9	1.1	0.98	505	1200	2.69	3.50	1.0	117
70-100	Cca	0.5	47.0	34.0	19.0	L	7.69	0.48	19.2	4.6	5.0	1.3	0.47	455	250	1.90	2.55	1.0	92
120-150	Csk	0.5	49.0	33.0	19.0	L	7.61	0.40	11.4	2.9	3.6	1.3	0.50	446	220	1.38	2.86	1.0	105

[z] OM = organic matter, EC = electrical conductivity, Ca = calcium, Mg = magnesium, Na = sodium, K = potassium, SAR = sodium adsorption ratio, TP = total phosphorus, TN = total nitrogen, NO_3-N = extractable nitrate nitrogen, NH_4-N = extractable ammonium nitrogen, PO_4-P = extractable phosphate phosphorus.
[y] Water extractable by saturated paste method.
[x] na = not available.

Table 4.10A. Measured parameters of the soil characterization samples from the East Field site in Whelp Creek Sub-watershed in 2009.[z]

Depth (cm)	Horizon	OM (%)	Sand (%)	Silt (%)	Clay (%)	Texture	pH	EC (dS m^{-1})	Ca[y]	Mg[y]	Na[y]	K[y]	SAR	TP	TN	NO_3-N	NH_4-N	PO_4-P	K
									(mg kg^{-1})										
0-20	Ap	5.8	36.0	48.0	16.0	L	5.81	0.40	30.6	6.0	11.7	5.0	0.71	702	2590	3.14	3.71	92.6	265
20-40	Bm1	na[x]	37.0	42.0	21.0	L	6.35	0.32	12.5	2.2	18.9	1.0	2.03	352	960	1.78	3.39	8.9	122
70-90	Bm2	1.0	54.0	33.0	13.0	SL	6.83	0.46	14.4	2.4	11.9	0.9	1.39	305	300	1.40	2.58	4.8	98
150-180	Cca	0.5	62.0	29.0	9.0	SL	7.22	0.51	16.6	2.5	7.2	1.0	0.86	375	250	1.97	2.14	1.0	84
0-20	Ap	6.0	35.0	50.0	15.0	SiL-L	5.61	0.25	21.0	3.6	4.6	3.5	0.35	790	2680	2.37	3.94	92.5	240
20-50	Bt	1.9	40.0	40.0	20.0	L	6.40	0.26	14.3	1.9	10.1	1.1	1.00	406	690	1.34	3.46	12.7	136
60-100	Cca	0.5	60.0	34.0	6.0	SL	6.78	0.36	9.3	1.4	6.3	1.1	1.02	327	100	0.93	1.36	7.2	52
120-150	Ck	1.1	62.0	30.0	8.0	SL	6.82	0.60	22.2	2.8	6.0	2.0	0.66	379	400	1.31	1.94	11.9	89
0-20	Ap	10.7	40.0	45.0	15.0	L	5.76	0.30	33.0	5.7	7.4	5.5	0.38	954	4610	3.45	5.30	56.3	277
25-40	Bt	2.6	41.0	37.0	22.0	L	6.31	0.27	15.7	2.9	8.1	1.1	0.75	395	990	1.44	3.78	14.7	142
50-100	Bm	1.5	60.0	27.0	13.0	SL	6.39	0.28	9.0	1.9	8.7	0.8	1.15	312	410	0.92	3.19	6.6	105
120-180	C	2.3	70.0	21.0	9.0	SL	6.38	0.51	23.8	3.5	4.2	0.7	0.35	493	100	1.28	3.22	1.0	70
0-17	Ap	4.6	32.0	52.0	17.0	SiL	5.73	0.27	18.8	4.3	5.6	2.4	0.43	643	2090	1.24	3.19	60.9	185
20-50	Bt1	1.6	48.0	31.0	21.0	L	6.06	0.20	7.4	1.6	7.2	1.0	1.03	434	530	1.13	3.75	27.3	125
60-80	Bm	2.2	52.0	29.0	19.0	L	5.73	0.17	4.3	1.1	6.0	1.0	1.12	416	400	1.03	3.85	15.8	145
80-100	Bt2	2.2	20.0	55.0	25.0	SiL	6.55	0.55	43.7	9.2	9.0	2.8	0.45	575	670	0.90	5.14	15.7	188
105-150	II Cca	1.8	12.0	65.0	23.0	SiL	7.36	0.49	32.5	7.4	4.6	1.7	0.27	625	550	2.30	4.53	1.0	151
0-18	Ap	4.9	36.0	49.0	16.0	L	6.19	0.49	37.3	6.3	7.9	9.0	0.44	672	2370	1.52	3.30	71.5	325
20-50	Bt	1.5	58.0	22.0	20.0	SL-SCL	6.54	0.25	10.3	1.4	7.7	1.2	0.99	364	430	1.39	3.39	19.4	126
75-100	Bm	1.3	60.0	25.0	15.0	SL	6.86	0.47	26.4	2.7	4.6	1.2	0.38	430	270	2.52	3.03	5.0	89
115-140	II Cca	1.4	57.0	28.0	16.0	SL	7.43	0.51	33.1	3.0	4.8	0.8	0.33	424	220	3.39	3.57	1.0	80

[z] OM = organic matter, EC = electrical conductivity, Ca = calcium, Mg = magnesium, Na = sodium, K = potassium, SAR = sodium adsorption ratio, TP = total phosphorus, TN = total nitrogen, NO_3-N = extractable nitrate nitrogen, NH_4-N = extractable ammonium nitrogen, PO_4-P = extractable phosphate phosphorus.
[y] Water extractable by saturated paste method.
[x] na = not available.

Table 4.11A. Measured parameters of the soil characterization samples from the South Field site in Whelp Creek Sub-watershed in 2009.[z]

Depth (cm)	Horizon	OM (%)	Sand (%)	Silt (%)	Clay (%)	Texture	pH	EC (dS m^{-1})	Ca^y	Mg^y	Na^y	K^y	SAR	TP	TN	NO_3-N	NH_4-N	PO_4-P	K
									(mg kg^{-1})										
0-29	Ap	6.0	36.0	44.0	19.0	L	6.48	0.52	36.2	7.4	14.4	2.1	0.77	794	2860	7.72	4.00	15.0	145
29-57	Bm	1.6	40.0	39.0	20.0	L	7.01	0.51	27.4	5.9	11.4	1.1	0.80	434	670	1.71	3.27	1.0	99
73-100	Cca	1.1	40.0	44.0	16.0	L	7.66	0.51	25.6	5.1	4.8	0.9	0.37	638	300	1.50	2.94	1.0	72
120-160	Ck	1.3	24.0	59.0	17.0	SiL	7.21	0.58	34.7	7.5	5.8	1.9	0.35	744	430	6.23	3.77	1.0	119
0-34	Ap	7.0	33.0	48.0	19.0	L	6.22	0.68	57.7	11.2	14.8	3.2	0.60	848	3190	7.83	5.29	19.2	182
40-74	Bm	1.6	44.0	33.0	24.0	L	6.54	0.50	27.6	6.2	8.4	2.6	0.58	297	660	1.05	4.26	1.0	130
90-110	Cca	1.6	31.0	52.0	16.0	SiL	7.22	0.62	38.5	8.1	5.4	1.9	0.31	621	510	2.60	4.71	1.0	121
110-160	Cksa	1.8	26.0	57.0	17.0	SiL	7.27	0.69	41.8	9.4	5.2	2.3	0.28	581	520	5.28	5.77	1.0	152
0-18	Ap	12.1	42.0	37.0	20.0	L	6.02	0.82	53.7	10.9	18.4	16.7	0.80	800	3110	11.50	3.94	89.1	443
8-41	Bm	1.6	57.0	24.0	19.0	SL	6.35	0.68	35.0	6.0	10.7	1.9	0.73	356	610	1.59	3.02	9.4	105
53-90	Cca	1.2	53.0	32.0	16.0	SL	7.19	0.92	45.4	6.4	13.6	1.2	0.84	311	410	5.66	2.24	2.0	102
100-150	Ck	1.7	49.0	37.0	14.0	L	7.20	0.87	51.3	7.9	7.1	2.4	0.38	495	480	9.46	3.31	4.6	154
0-12	Ap	4.6	35.0	48.0	18.0	L	5.87	0.60	37.7	7.0	19.1	14.0	1.03	704	2540	12.10	3.38	85.5	363
12-31	Bt	2.0	33.0	41.0	26.0	L	5.79	0.54	30.4	4.3	12.4	1.8	0.85	285	750	3.23	4.37	11.6	152
41-46	Bt	2.0	37.0	34.0	29.0	CL	6.41	0.71	52.5	6.6	19.0	2.4	0.92	247	580	2.65	7.01	8.4	163
60-90	C	1.1	57.0	28.0	15.0	SL	6.05	0.81	43.4	4.2	8.2	1.0	0.53	433	270	3.42	3.40	4.5	96
120-150	Ck	1.0	56.0	29.0	15.0	SL	6.63	0.49	23.7	2.5	6.1	1.0	0.57	489	220	4.00	3.27	1.0	91
0-24	Ap	7.3	29.0	53.0	19.0	SiL	6.44	0.67	62.8	10.7	18.4	9.3	0.72	832	3830	7.54	4.92	59.0	337
24-48	Bm	1.7	40.0	38.0	22.0	L	6.87	0.33	14.4	3.0	10.4	1.2	1.04	241	630	3.60	4.05	2.8	137
53-73	Btj	1.8	36.0	41.0	23.0	L	6.16	0.48	20.6	4.3	8.7	1.3	0.72	289	460	3.78	4.87	2.2	151
110-160	I Cca	1.7	38.0	42.0	20.0	L	7.11	0.66	36.9	6.6	4.6	1.3	0.29	338	360	10.20	4.38	1.0	151

[z] OM = organic matter, EC = electrical conductivity, Ca = calcium, Mg = magnesium, Na = sodium, K = potassium, SAR = sodium adsorption ratio, TP = total phosphorus, TN = total nitrogen, NO_3-N = extractable nitrate nitrogen, NH_4-N = extractable ammonium nitrogen, PO_4-P = extractable phosphate phosphorus.
[y] Water extractable by saturated paste method.

Table 4.12A. Measured parameters of the soil characterization samples from the North Pasture site in Whelp Creek Sub-watershed in 2009.[z]

Depth (cm)	Horizon	OM (%)	Sand (%)	Silt (%)	Clay (%)	Texture	pH	EC (dS m^{-1})	Ca^y	Mg^y	Na^y	K^y	SAR	TP	TN	NO_3-N	NH_4-N	PO_4-P	K
									(mg kg^{-1})										
0-19	Ahk	12.1	48.0	30.0	22.0	L	7.93	2.06	51.2	27.2	319.0	7.3	10.60	873	5950	2.99	6.32	9.5	311
19-41	Aek	1.2	66.0	17.0	17.0	SL	7.94	1.23	13.8	6.9	77.2	0.7	7.27	366	580	1.43	1.40	1.0	87
41-72	Cca	1.1	40.0	37.0	23.0	L	7.69	0.93	16.7	6.2	46.8	0.7	4.16	462	300	1.15	1.14	1.0	87
72-90	Ckg	1.2	24.0	49.0	27.0	SiL-L	7.70	0.74	14.3	4.6	49.9	0.8	4.46	569	330	1.77	2.34	1.0	135
100-130	Ck	1.5	34.0	41.0	25.0	L	7.73	0.66	12.6	3.7	50.8	0.8	5.01	421	340	1.43	2.76	1.0	143
0-16	Apk	14.7	42.0	36.0	22.0	L	7.79	2.01	93.0	53.3	345.3	18.5	7.18	981	7930	6.02	11.50	8.0	338
16-38	Bmk	4.7	53.0	26.0	20.0	SL-SCL	7.65	2.26	74.0	31.1	168.8	1.5	5.82	516	2470	2.21	2.64	1.0	116
38-63	Cca	1.1	47.0	30.0	24.0	L	7.72	1.00	24.9	7.8	53.4	0.8	3.83	409	550	1.89	1.76	1.0	98
70-100	Cksa	1.4	40.0	38.0	22.0	L	7.77	0.80	22.5	6.2	46.2	0.9	3.44	349	450	1.44	2.21	1.0	126
150-180	Ckg	0.5	49.0	37.0	14.0	L	7.63	0.81	15.6	4.3	34.5	1.6	3.66	382	320	0.89	2.17	1.0	135

[z] OM = organic matter, EC = electrical conductivity, Ca = calcium, Mg = magnes ium, Na = sodium, K = potassium, SAR = sodium adsorption ratio, TP = total phosphorus, TN = total nitrogen, NO_3-N = extractable nitrate nitrogen, NH_4-N = extractable ammonium nitrogen, PO_4-P = extractable phosphate phosphorus.
[y] Water extractable by saturat ed paste method.

Table 4.13A. Measured parameters of the soil characterization samples from the South Pasture site in Whelp Creek Sub-watershed in 2009.[z]

Depth (cm)	Horizon	OM (%)	Sand (%)	Silt (%)	Clay (%)	Texture	pH	EC (dS m^{-1})	Ca[y]	Mg[y]	Na[y]	K[y]	SAR	TP	TN	NO_3-N	NH_4-N	PO_4-P	K
									(mg kg^{-1})										
0-30	Ap	8.3	46.0	36.0	18.0	L	6.34	0.70	73.8	13.1	20.1	2.2	0.72	514	3620	1.53	5.45	6.8	148
50-100	Bmgj	1.3	55.0	30.0	15.0	SL	7.37	0.37	19.4	4.5	4.1	0.8	0.36	351	430	1.18	2.65	1.0	121
110-140	Ccag	1.3	45.0	37.0	18.0	L	7.40	0.59	29.8	6.9	4.3	0.7	0.30	462	380	1.36	2.71	1.0	104
150-170	Ck	0.5	41.0	42.0	17.0	L	7.32	0.49	21.1	4.9	3.9	1.0	0.35	526	300	1.39	2.62	1.0	88
0-30	Ap	10.5	35.0	47.0	18.0	L	6.39	0.49	49.6	9.9	19.9	4.9	0.82	721	4640	1.59	5.52	17.7	251
54-82	Bm	2.6	44.0	35.0	20.0	L	6.88	0.29	15.3	3.5	6.3	1.0	0.59	365	1150	1.16	3.06	1.0	140
93-120	II Bm	2.3	27.0	36.0	37.0	CL	7.16	0.66	37.8	9.9	8.2	1.6	0.45	425	600	1.55	4.41	1.0	187
120-170	C	1.3	58.0	20.0	22.0	SCL	7.43	0.53	20.1	5.2	6.2	1.3	0.55	366	340	0.94	2.56	1.0	119
0-30	Ap	10.1	34.0	42.0	24.0	L	6.77	0.66	65.7	17.6	15.7	2.0	0.55	746	4540	1.53	5.71	29.3	203
52-70	Bm	1.2	53.0	28.0	19.0	SL	7.57	0.51	25.2	7.7	5.4	0.8	0.38	291	440	0.96	2.87	1.0	147
70-100	Cca1	1.5	30.0	41.0	29.0	CL	7.71	0.50	28.6	9.1	5.4	1.3	0.33	491	610	1.24	3.66	1.0	169
130-170	Cca2	2.5	31.0	43.0	26.0	L	7.86	0.48	30.4	9.4	7.1	1.4	0.40	746	710	1.30	4.74	1.0	148

[z] OM = organic matter, EC = electrical conductivity, Ca = calcium, Mg = magnesium, Na = sodium, K = potassium, SAR = sodium adsorption ratio, TP = total phosphorus, TN = total nitrogen, NO_3-N = extractable nitrate nitrogen, NH_4-N = extractable ammonium nitrogen, PO_4-P = extractable phosphate phosphorus.
[y] Water extractable by saturated paste method.

Table 4.14A. Measured parameters of the soil characterization samples from the Reference 1 site in Whelp Creek Sub-watershed in 2009.[z]

Depth (cm)	Horizon	OM (%)	Sand (%)	Silt (%)	Clay (%)	Texture	pH	EC (dS m^{-1})	Ca^y	Mg^y	Na^y	K^y	SAR	TP	TN	NO_3-N	NH_4-N	PO_4-P	K
									-- (mg kg^{-1}) --										
0-18	Ap	6.2	35.0	49.0	17.0	L	5.47	0.61	42.0	6.3	6.4	3.2	0.35	653	2650	2.44	4.34	26.5	174
18-58	Btj	2.3	32.0	45.0	23.0	L	6.81	0.52	33.2	5.5	5.2	1.4	0.33	359	690	0.91	3.97	1.0	100
58-87	I Cca	1.9	47.0	38.0	15.0	L	6.60	0.48	25.2	4.6	4.4	1.1	0.32	410	430	0.66	2.84	2.3	63
120-160	II Csk	1.3	53.0	36.0	10.0	SL	7.49	0.49	20.7	3.4	3.7	0.8	0.36	476	270	1.13	2.40	1.0	51
240-270	-	1.7	34.0	40.0	25.0	L	7.65	0.37	23.2	4.5	4.5	2.6	0.33	562	380	1.89	4.93	1.0	144
0-26	Ap	7.6	46.0	40.0	14.0	L	5.76	0.62	43.6	6.0	5.5	2.2	0.30	785	3170	11.70	4.41	14.0	119
26-60	Bm	4.8	47.0	38.0	15.0	L	7.35	0.40	35.0	2.9	3.5	1.2	0.22	840	1900	2.46	3.88	2.2	85
100-130	Cca	2.5	47.0	34.0	19.0	L	7.57	0.62	37.7	5.7	3.7	2.2	0.24	575	920	2.73	4.71	5.6	110
130-150	Ck	2.6	39.0	36.0	26.0	L	7.73	0.51	38.9	6.8	4.6	3.1	0.26	529	770	3.29	5.68	3.8	147
0-21	Ap	na[y]	36.0	44.0	21.0	L	5.71	0.55	38.2	5.1	5.3	2.4	0.30	714	2970	4.17	4.91	27.4	171
40-70	Bm	2.2	48.0	31.0	21.0	L	6.85	0.36	18.3	3.2	3.5	1.4	0.31	364	530	1.36	4.03	5.5	107
80-110	Cca	2.0	36.0	32.0	32.0	CL	7.50	0.73	50.9	7.6	5.7	2.1	0.28	618	520	2.11	4.96	1.0	101
130-150	Ck	2.2	38.0	35.0	27.0	L-CL	7.46	0.68	53.9	8.2	6.3	3.0	0.30	574	640	2.27	4.74	1.0	128
0-16	Ap	6.9	28.0	48.0	23.0	L	5.61	0.75	50.5	9.8	8.8	9.9	0.41	633	3010	4.90	5.85	24.4	348
16-43	Btgj	2.6	30.0	42.0	28.0	L-CL	6.60	0.34	18.9	4.5	4.7	1.9	0.38	283	640	0.90	5.44	1.0	177
50-90	I Cgj	1.7	52.0	28.0	21.0	SCL	6.58	0.48	20.7	5.7	4.8	1.1	0.38	342	360	0.73	3.66	4.4	82
120-150	II Cca	1.3	55.0	27.0	18.0	SL	7.61	0.41	17.3	3.9	4.8	1.2	0.47	446	210	1.93	3.28	1.0	86

[z] OM = organic matter, EC = electrical conductivity, Ca = calcium, Mg = magnesium, Na = sodium, K = potassium, SAR = sodium adsorption ratio, TP = total phosphorus, TN = total nitrogen, NO_3-N = extractable nitrate nitrogen, NH_4-N = extractable ammonium nitrogen, PO_4-P = extractable phosphate phosphorus.
[y] Water extractable by saturated paste method.

Table 4.15A. Measured parameters of the soil characterization samples from the Reference 2 site in Whelp Creek Sub-watershed in 2009.[z]

Depth (cm)	Horizon	OM (%)	Sand (%)	Silt (%)	Clay (%)	Texture	pH	EC (dS m^{-1})	Ca[y]	Mg[y]	Na[y]	K[y]	SAR	TP	TN	NO_3-N	NH_4-N	PO_4-P	K
									(mg kg^{-1})										
0-20	Ap	10.5	36.0	49.0	16.0	L	6.07	0.36	41.9	7.0	8.2	3.9	0.37	1000	4510	7.87	6.34	10.8	173
50-70	Bt	2.8	25.0	42.0	33.0	CL	5.68	0.18	10.8	2.7	4.4	1.6	0.45	554	820	3.22	6.33	3.4	218
70-100	BC	1.1	64.0	22.0	14.0	SL	6.85	0.60	32.4	7.0	5.1	1.8	0.36	489	440	3.11	3.77	3.1	76
150-200	Ck	0.5	62.0	26.0	13.0	SL	7.62	0.50	19.7	3.5	5.0	1.2	0.52	482	240	3.92	3.57	1.0	71
0-20	Ap	12.0	31.0	52.0	17.0	SiL	6.14	0.40	44.7	9.9	10.6	3.0	0.43	844	5310	9.20	6.60	5.7	160
50-70	Bm	2.7	28.0	46.0	26.0	L	6.97	0.29	19.9	6.7	4.1	1.0	0.28	256	760	3.52	6.33	1.0	156
90-115	C1	1.7	28.0	46.0	26.0	L	7.71	0.50	30.3	11.3	6.7	1.1	0.39	472	500	3.74	4.86	1.0	133
135-200	II Ck	1.6	28.0	47.0	25.0	L	7.78	0.79	36.5	17.6	9.8	1.0	0.50	491	350	3.52	5.59	1.0	134
0-20	Ap	11.9	22.0	49.0	29.0	CL	7.52	1.31	138.6	40.2	76.0	2.5	1.61	849	5750	5.63	9.97	9.3	205
35-60	Bgj	2.2	12.0	57.0	31.0	SiCL	7.82	0.63	26.3	7.5	40.8	1.1	2.43	685	610	3.75	4.77	1.0	155
120-150	Cgj	2.0	5.0	57.0	38.0	SiCL	7.78	0.65	24.1	7.5	49.0	1.1	2.93	577	490	3.74	6.46	1.0	182
0-20	Ap	10.2	24.0	53.0	23.0	SiL	6.17	0.33	28.6	8.1	11.8	1.9	0.61	852	4590	7.26	6.22	5.2	197
30-50	Bt	3.4	20.0	43.0	37.0	SiCL-CL	6.68	0.37	21.9	8.8	10.7	1.1	0.64	344	940	3.78	6.43	1.0	195
70-90	Cca	2.1	7.0	51.0	42.0	SiC	7.78	0.81	45.1	22.4	36.9	1.3	1.40	466	570	3.59	4.56	1.0	88
100-140	Ck1	0.5	36.0	46.0	18.0	L	8.00	0.64	14.0	6.4	23.5	0.6	2.27	549	230	2.72	2.85	1.0	51

[z] OM = organic matter, EC = electrical conductivity, Ca = calcium, Mg = magnesium, Na = sodium, K = potassium, SAR = sodium adsorption ratio, TP = total phosphorus, TN = total nitrogen, NO_3-N = extractable nitrate nitrogen, NH_4-N = extractable ammonium nitrogen, PO_4-P = extractable phosphate phosphorus.
[y] Water extractable by saturated paste method.

Table 4.16A. Measured parameters of the soil characterization samples from the Battersea Drain Field site in 2010.[z]

Depth (cm)	Horizon	OM (%)	Sand (%)	Silt (%)	Clay (%)	Texture	pH	EC (dS m^{-1})	Ca[y]	Mg[y]	Na[y]	K[y]	SAR	TP	TN	NO_3-N	NH_4-N	PO_4-P	K
									(mg kg^{-1})										
0-28	Ap	3.9	53.3	31.5	15.2	SL	6.96	1.68	42.3	27.8	19.0	43.0	0.85	994	1900	25.10	2.61	262.0	861
30-60	Bm1	1.9	54.7	28.0	17.3	SL	7.53	1.21	40.0	18.8	25.4	2.2	1.35	460	750	4.53	1.90	20.3	138
80-110	Cca	1.3	41.0	38.1	20.9	L	7.62	2.32	80.6	38.2	39.7	2.6	1.48	475	530	28.80	1.69	5.7	76
150-170	Ck	0.5	92.5	3.9	3.6	S	7.98	1.25	18.5	15.4	11.8	2.0	0.98	263	100	5.95	0.95	2.0	30
0-14	Apk	4.5	59.8	29.3	10.9	SL	7.28	0.80	26.1	10.4	6.5	35.7	0.41	1220	2120	4.50	2.86	317.0	694
14-30	Btjk	2.6	62.6	21.1	16.3	SL	7.42	1.07	22.6	15.5	7.7	34.3	0.52	764	1220	2.52	1.88	198.0	837
40-60	Cca1	1.3	73.3	11.7	14.9	SL	7.95	0.71	22.7	7.3	9.9	4.6	0.80	387	590	2.23	1.16	9.3	129
80-100	Cca2	0.5	86.4	6.4	7.3	LS	7.88	0.90	23.3	7.0	14.9	2.5	1.27	329	250	5.12	1.08	2.7	60
140-160	Ck	1.8	12.9	50.5	36.6	SiCL	7.84	1.58	62.6	50.0	37.6	5.3	1.12	564	480	30.50	2.42	1.0	116
0-30	Ap	3.7	63.8	23.4	12.7	SL	7.06	1.32	32.4	15.3	7.1	59.4	0.41	993	1730	6.40	2.43	286.0	828
30-48	Bm	1.1	74.3	12.6	13.1	SL	6.78	2.09	37.3	16.2	11.3	43.3	0.75	540	580	2.45	1.16	93.4	638
48-82	Cca1	1.2	66.4	20.0	13.6	SL	7.66	1.91	46.6	14.4	27.2	4.7	1.69	426	500	3.44	1.27	8.9	170
82-113	Cca2	1.4	50.7	29.7	19.5	L	7.67	2.11	68.8	31.6	23.1	1.6	0.98	392	470	17.80	1.44	4.9	101
113-150	Ck	0.5	91.4	3.6	5.0	S	7.81	1.19	19.9	19.1	6.4	3.5	0.47	335	220	7.13	1.02	4.2	61
210-270	Ck	0.5	96.2	1.0	2.9	S	8.33	1.47	9.9	28.8	18.2	3.2	1.26	222	100	20.30	0.40	1.0	37
0-30	Ap	5.1	52.2	31.2	16.6	L-SL	7.32	0.90	29.4	12.3	5.8	51.4	0.32	1050	2470	17.10	2.55	303.0	953
30-61	Bmk	1.9	65.6	17.8	16.5	SL	7.70	0.82	21.0	10.1	9.7	8.8	0.75	437	720	2.53	1.20	32.5	350
61-90	Cca	1.5	72.6	14.4	13.0	SL	8.01	1.14	23.3	22.8	15.9	1.5	0.97	434	710	4.99	1.05	14.6	58
90-150	Ck1	0.5	89.9	4.3	5.8	S	8.20	0.95	11.7	19.5	11.6	1.3	0.87	325	100	9.20	0.94	2.9	34
0-19	Ap	4.0	54.6	26.8	18.6	SL	7.15	0.89	27.9	12.9	4.7	34.6	0.28	995	1990	11.20	2.22	274.0	815
19-45	Bm	1.5	66.8	17.6	15.6	SL	7.04	0.90	27.1	10.1	8.3	9.9	0.62	498	730	2.50	1.41	93.3	342
45-69	Cca	1.8	23.4	40.3	36.3	CL	7.78	2.30	111.9	78.0	54.6	42.5	1.28	621	570	7.87	1.74	2.3	534
120-150	Ck	0.5	90.9	4.2	5.0	S	7.81	0.43	11.2	3.1	8.5	2.5	1.07	297	220	4.80	0.98	1.0	53
0-28	Apk	3.0	60.3	24.9	14.8	SL	7.57	1.50	50.9	24.9	15.9	49.3	0.72	901	1460	12.00	1.82	227.0	657
28-38	Cca	1.7	75.0	16.8	8.1	SL	7.92	0.56	18.5	5.8	11.5	0.8	1.08	398	1480	1.09	1.34	10.7	42
38-53	Ahb	2.6	50.7	29.6	19.7	L	7.80	2.51	102.9	63.6	58.9	23.7	1.70	446	1180	15.90	1.72	27.3	470
58-63	Bm	1.9	46.0	33.6	20.4	L	7.66	3.12	135.3	74.7	71.5	11.8	1.93	362	810	19.40	1.80	11.5	319
80-100	Bg	1.9	40.0	32.4	27.7	L-CL	7.60	3.50	170.7	75.4	104.3	10.9	2.55	513	620	27.30	1.66	30.8	353
140-170	Cg	0.5	78.4	9.2	11.9	SL	7.54	2.31	63.6	22.2	54.8	6.9	2.77	435	640	21.30	1.05	36.7	179

[z] OM = organic matter, EC = electrical conductivity, Ca = calcium, Mg = magnesium, Na = sodium, K = potassium, SAR = sodium adsorption ratio, TP = total phosphorus, TN = total nitrogen, NO_3-N = extractable nitrate nitrogen, NH_4-N = extractable ammonium nitrogen, PO_4-P = extractable phosphate phosphorus.
[y] Water extractable by saturated paste method.

Table 4.17A. Measured parameters of the soil characterization samples from the Lower Little Bow site, northwest quarter section, in 2010.[z]

Depth (cm)	Horizon	OM (%)	Sand (%)	Silt (%)	Clay (%)	Texture	pH	EC (dS m^{-1})	Ca[y]	Mg[y]	Na[y]	K[y]	SAR	TP	TN	NO_3-N	NH_4-N	PO_4-P	K
									(mg kg^{-1})										
0-15	Ap	4.8	48.6	35.4	16.0	L	7.49	1.08	50.2	22.3	10.0	41.4	0.42	1260	1990	23.30	7.13	270.0	701
15-33	Bm	3.1	44.8	35.4	19.8	L	7.90	1.53	66.9	34.6	24.7	23.1	0.90	627	2470	14.80	6.52	73.4	983
40-70	Cca1	2.0	9.3	62.0	28.6	SiCL	8.11	4.41	104.9	178.7	222.6	7.0	4.19	509	2430	37.30	4.55	1.0	115
100-120	Cca2	3.1	7.8	44.5	47.7	SiC	7.92	6.19	285.8	302.7	308.9	14.0	3.89	551	2330	35.20	8.26	1.0	198
150-180	Csk	4.8	48.6	35.4	16.0	L	7.89	2.67	51.4	58.4	40.7	5.5	1.67	304	1180	29.20	2.06	1.0	58
0-13	Apk	0.5	91.1	4.7	4.3	S	7.58	1.23	45.6	19.3	14.5	74.4	0.65	1190	3420	23.20	7.60	307.0	985
25-50	I Cca	5.2	45.3	38.9	15.8	L	7.95	1.06	32.7	13.4	30.3	8.2	1.76	434	660	17.20	4.38	1.0	174
50-75	I Cca	2.0	44.3	32.4	23.4	L	8.01	2.45	52.3	54.9	97.2	8.2	3.39	405	1050	13.10	3.64	1.0	150
100-130	II Ck1	9.1	38.7	38.0	23.4	L	8.06	4.88	86.0	182.2	236.2	7.8	4.75	490	820	27.00	3.88	1.0	143
160-180	Ck	7.0	21.9	54.1	24.0	SiL	7.83	7.14	225.7	319.0	367.3	15.9	5.15	392	940	5.58	6.48	3.5	203
0-30	Ap	1.9	41.7	29.5	28.7	CL	7.36	0.99	39.1	14.8	9.9	35.2	0.53	970	1820	14.80	5.20	230.0	685
40-70	Bm	3.9	63.4	25.3	11.3	SL	7.76	3.08	153.8	46.8	47.1	11.7	1.46	463	1570	13.00	2.98	14.6	248
100-120	Cca	1.8	67.7	21.3	11.0	SL	8.01	4.70	95.0	162.3	136.3	2.2	3.02	527	1730	69.20	3.05	4.8	105
150-170	Cca	1.8	40.2	42.2	17.6	L	8.06	5.43	119.2	272.6	121.6	2.4	2.04	540	1870	78.40	3.11	5.6	127
170-190	Ck1	2.0	35.8	40.7	23.6	L	8.06	5.57	138.7	242.1	95.7	5.3	1.78	557	1640	55.40	2.73	7.9	92
0-16	Apk	3.8	59.2	30.3	10.5	SL	7.77	1.05	39.9	15.3	8.3	38.6	0.44	1040	2850	15.30	5.41	191.0	604
16-46	Cca	1.5	56.2	31.2	12.6	SL	7.99	1.57	42.6	20.3	30.0	11.4	1.60	421	1600	36.40	2.39	4.5	174
50-80	C	0.5	90.5	5.3	4.1	S	8.28	1.11	18.9	16.5	22.0	3.4	1.62	261	1070	11.00	2.36	1.0	51
120-160	C	0.5	91.3	4.7	4.0	S	8.32	0.71	6.9	13.7	12.6	4.9	1.15	342	1030	6.41	1.85	1.0	77
0-25	Ap	4.5	56.3	29.6	14.0	SL	7.80	6.56	228.5	299.5	206.4	28.3	3.05	894	2040	46.20	5.12	237.0	402
30-60	Btjk	2.4	54.2	29.9	15.8	SL	8.03	7.37	212.9	344.0	210.4	4.1	3.22	423	760	27.00	4.67	3.4	113
60-100	Cca	2.0	38.3	35.3	26.4	L	7.99	5.80	128.5	289.8	183.4	9.8	2.99	439	1290	28.70	4.04	1.0	125
100-130	Csk	3.7	38.9	59.0	2.1	SiL	7.78	5.15	229.8	198.4	112.6	13.9	1.97	369	1000	14.00	7.16	1.0	143
150-180	Ckg	2.5	29.8	61.0	9.2	SiL	7.74	3.88	250.8	117.3	75.5	14.2	1.43	444	660	4.75	7.09	1.0	171

[z] OM = organic matter, EC = electrical conductivity, Ca = calcium, Mg = magnesium, Na = sodium, K = potassium, SAR = sodium adsorption ratio, TP = total phosphorus, TN = total nitrogen, NO_3-N = extractable nitrate nitrogen, NH_4-N = extractable ammonium nitrogen, PO_4-P = extractable phosphate phosphorus.
[y] Water extractable by saturated paste method.

Table 4.18A. Measured parameters of the soil characterization samples from the Lower Little Bow site, northeast quarter section, in 2010.[z]

Depth (cm)	Horizon	OM (%)	Sand (%)	Silt (%)	Clay (%)	Texture	pH	EC (dS m^{-1})	Ca[y]	Mg[y]	Na[y]	K[y]	SAR	TP	TN	NO_3-N	NH_4-N	PO_4-P	K
									(mg kg^{-1})										
0-20	Ap	3.9	52.6	33.1	14.3	SL	7.67	12.6	270.7	572.5	925.5	143.9	10.00	1060	2340	166.0	6.1	418.0	1100
26-30	Bmsa	3.3	49.5	34.7	15.8	L	7.79	12.8	266.2	618.3	906.5	103.2	9.66	775	2040	110.0	4.8	253.0	780
40-60	Cca	1.8	24.8	52.9	22.2	SiL	8.02	12.0	241.3	609.6	853.4	17.8	9.32	548	1000	64.9	2.5	13.4	152
120-160	Ck	0.5	68.1	20.7	11.2	SL	7.97	7.08	107.3	241.0	333.9	15.3	6.62	434	380	15.9	1.6	6.3	151
0-20	Apksaj	4.4	39.4	42.6	18.0	L	7.46	3.37	224.2	74.0	92.7	64.9	1.82	1080	2520	76.5	7.2	296.0	864
50-80	Cca	1.9	30.2	40.5	29.3	CL	7.83	3.13	93.6	144.5	79.2	11.2	1.63	559	880	52.1	2.8	19.9	213
100-180	Ck	0.5	91.2	5.3	3.5	S	8.05	2.77	36.3	76.3	30.7	7.8	1.24	337	280	39.3	0.5	2.5	82
0-20	Ap	4.6	50.2	34.2	15.5	L	7.39	1.31	64.1	23.3	20.9	66.7	0.79	1150	2600	40.1	5.8	374.0	820
30-50	Cca	1.4	61.6	24.0	14.4	SL	7.50	1.12	38.7	12.1	13.3	15.8	0.81	368	680	24.7	1.6	18.1	254
56-72	11Cca	1.2	43.5	34.1	22.4	L	8.03	1.04	17.0	26.1	23.3	5.4	1.31	397	400	19.8	3.8	1.0	153
120-180	Ck	1.2	46.1	50.7	3.2	SiL	7.69	4.39	232.4	140.1	64.9	14.0	1.31	392	420	27.0	7.5	1.0	162
0-20	Ap	3.6	45.6	30.6	23.9	L	7.33	0.85	53.0	15.9	10.9	12.0	0.48	682	1810	20.8	5.9	116.0	469
28-41	Bm	2.7	34.1	40.6	25.2	L	7.58	0.75	42.6	11.3	12.2	2.3	0.63	531	1210	15.7	2.6	7.2	206
50-70	Cca	1.8	21.4	51.6	27.1	SiL-CL	7.89	0.78	25.6	16.7	24.8	2.2	1.36	606	860	10.9	2.2	3.0	120
80-107	II Cca	1.4	44.3	32.0	23.7	L	8.19	1.29	13.9	33.1	55.9	5.0	2.78	402	480	9.8	2.8	1.0	149
120-180	Ck	1.3	45.6	31.7	22.6	L	8.22	2.22	16.0	53.6	118.0	7.1	4.76	544	410	14.4	3.3	1.0	179
0-20	Ap	2.9	65.9	19.7	14.4	SL	7.33	0.93	45.4	14.8	11.4	20.0	0.59	692	1570	9.4	4.6	159.0	459
30-60	Bm	1.6	67.7	16.6	15.7	SL	7.56	0.83	36.6	9.4	9.2	5.1	0.60	360	730	3.0	1.5	24.7	231
90-110	Cca	1.3	63.7	26.3	10.0	SL	7.93	0.63	17.3	9.2	15.9	2.3	1.31	440	480	4.0	1.3	12.2	188
140-180	Ck	1.2	42.8	35.1	22.1	L	7.83	1.15	33.2	21.4	22.7	3.9	1.22	476	550	13.3	1.3	4.0	161
0-15	Apk	4.3	31.7	44.9	23.4	L	7.53	1.37	91.7	30.1	12.7	44.2	0.40	1080	2300	35.8	7.2	226.0	665
35-50	Cca2	1.6	40.4	41.3	18.2	L	7.71	3.38	118.8	109.1	78.4	5.7	1.97	466	750	18.6	3.6	2.8	99
67-93	Ck	1.3	41.1	34.3	24.5	L	7.88	6.44	213.5	297.0	176.8	11.4	2.76	429	520	28.0	6.9	1.0	160

[z] OM = organic matter, EC = electrical conductivity, Ca = calcium, Mg = magnesium, Na = sodium, K = potassium, SAR = sodium adsorption ratio, TP = total phosphorus, TN = total nitrogen, NO_3-N = extractable nitrate nitrogen, NH_4-N = extractable ammonium nitrogen, PO_4-P = extractable phosphate phosphorus.
[y] Water extractable by saturated paste method.

Appendix 5. Riparian transect tables.

5.1A Scientific and common riparian and rangeland plant species names and associated naming codes used in the report.

Code	Scientific name	Common name
Achi mil	*Achillea millefolium*	Yarrow
Agro cris	*Agropyron cristatum*	Crested wheat grass
Agro das	*Agropyron dasystachyum*	Northern wheat grass
Agro pec	*Agropyron pectiniforme*	Crested wheat grass
Agro rep	*Agropyron repens*	Quackgrass
Agro smi	*Agropyron smithii*	Western wheat grass
Agro tra	*Agropyron trachycaulus*	Awned wheat grass
Agros spp	*Agrostis spp.*	Bentgrass
Amar ret	*Amaranthus retroflexus*	Redroot pigweed
Amel aln	*Amelanchier alnifolia*	Saskatoon
Anem spp	*Anenome spp*	Anenome
Ante apr	*Antennaria aprica*	Low everlasting
Ante spp	*Antennaria spp*	Everlasting
Arct min	*Arctium minus*	Common Burdock
Arte fri	*Artemisia frigida*	Pasture sage
Arte lud	*Artemisia ludoviciana*	Prairie sagewort
Ascl spp	*Asclepais*	Milkweed
Aste spp	Aster spp	Aster
Bess wyo	*Besseya wyomingensis*	Kittentails
Bras kab	*Brassica kaber*	Wild mustard
Bras spp	*Brassica*	Mustard
Brom ine	*Bromus inermis*	Smooth brome
Brom rip	*Bromus riparius*	Meadow brome
Caps bur	*Capsella bursa-pastoris*	Shepherd's Purse
Care spp	*Carex spp*	Sedge
Carrot	Apiaceae	Carrot family
Cast lut	*Castilleja lutescens*	Stiff yellow paintbrush
Cera spp	*Cerastium spp*	Chickweed
Chen alb	*Chenopodium album*	Lamb's quarters
Cirs arv	*Cirsium arvense*	Canada thistle
Cirs und	*Cirsium undulatum*	Wavyleaf thistle
Coma umb	*Comandra umbellata*	Pale comandra
Conv arv	*Convolvulus arvensis*	Field Bindweed
Cyno off	*Cynoglossum officinale*	Hound's tongue
Cyno vir	*Cynoglossum virginianum*	Wild Comfrey
Dact glo	*Dactylis glomerata*	Orchard grass

Code	Scientific name	Common name
Desc sop	*Descurainia sophia*	Flixweed
Drya spp	*Dryas spp*	Mountain avens
Echi spp	*Echinacea spp*	Cone flower
Elae com	*Elaeagnus commutata*	Wolf willow
Eleo aci	*Eleocharis acicularis*	Needle spike-rush
Eleo spp	*Eleocharis spp*	Spike-rush
Elym tra	*Elymus trachycaulus*	Slender wheat grass
Epil ang	*Epilobium angustifolium*	Common fireweed
Equi arv	*Equisetum arvense*	Common horsetail
Equi spp	*Equisetum spp*	Horsetail
Erig gla	*Erigeron glabellus*	Smooth fleabane
Fest sca	*Festuca scabrella*	Northern rough fescue
Fest spp	*Festuca spp*	Fescue
Frag vir	*Fragaria virginiana*	Wild strawberry
Gali bor	*Galium boreale*	Northern bedstraw
Gali spp	*Galium spp*	Bedstraw
Gera spp	*Geranium spp*	Geranium
Gera vis	*Geranium viscosissimum*	Stcky purple geranium
Geum spp.	*Geum spp*	Avens
Geum tri	*Geum triflorum*	Three-flowered avens
Glyc lep	*Glycyrrhiza lepidota*	Wild licorice
Grin squ	*Grindelia squarrosa*	Gumweed
Guti sar	*Gutierrezia sarothrae*	Broomweed
Hack flo	*Hackelia floribunda*	Large-flowered stickseed
Heli pet	*Helianthus petiolaris*	Prairie sunflower
Hord jub	*Hordeum jubatum*	Foxtail barley
Junc bal	*Juncus balticus*	Arctic rush
Junc spp	*Juncus spp*	Rush
Koel mac	*Koelaria macrantha*	June grass
Lact ser	*Lactuca serriola*	Prickly lettuce
Lath spp	*Lathyrus spp*	Peavine
Lilly	*Liliaceae*	Lilly family
Lina vul	*Linaria vulgaris*	Toadflax
Linu usi	*Linum usitatissimum*	Common flax
Lith inc	*Lithospermum incisum*	Yellow stoneseed
Lith rud	*Lithospermum ruderale*	Wooly gromwell
Lupi spp	*Lupinus spp*	Lupin
Medi lup	*Medicago lupulina*	Black medic
Ment arv	*Mentha arvensis*	Wild mint

Code	Scientific name	Common name
Mona fis	*Monarda fistulosa*	Western wild bergamot
Moss	na	Moss
Mushroom	na	Mushroom
Mustard	na	Mustard
Oeno bie	*Oenothera biennis*	Yellow evening-primrose
Pens nit	*Penstemon nitidus*	Smooth blue beardtongue
Phal aru	*Phalaris arundinacea*	Reed canary grass
Phle pra	*Phleum pratense*	Timothy
Phlo hoo	*Phlox hoodii*	Moss phlox
Plan maj	*Plantago major*	Common plantain
Plan pat	*Plantago patagonica*	Woolly plantain
Poa pra	*Poa pratensis*	Kentucky bluegrass
Poly spp	*Polygynum spp*	Buckwheat
Popu bal	*Populus balsamifera*	Balsam poplar
Pote ans	*Potentilla anserina*	Silvery cinquefoil
Pote gra	*Potentilla gracilis*	Graceful cinquefoil
Pote spp	*Potentilla spp*	Cinquefoil/Silverweed
Prun vir	*Prunus pensylvanica*	Pin cherry
Pucc spp	*Puccinellia spp*	Alkali grass
Ranu spp	*Ranunculus spp*	Buttercup
Rati col	*Ratibida columnifera*	Prairie coneflower
Rosa aci	*Rosa acicularis*	Prickly rose
Rosemary	*Rosmarinus officinalis*	Rosemary
Rume spp	*Rumex spp*	Dock
Sagi cun	*Sagittaria cuneata*	Arum-leaved arrowhead
Sali exi	*Salix exigua*	Narrow-leaved willow
Sali spp	*Salix spp*	Willow
Scir spp	*Scirpus spp*	Bulrush
Shep can	*Shepherdia canadensis*	Canada buffaloberry
Sisy mon	*Sisyrinchium monatum*	Blue-eyed grass
Smil spp	*Smilacina spp*	False Solomon's-seal
Smil ste	*Smilacina stellata*	Star-flowered false Solomon's-seal
Smil tri	*Smilacina trifolia*	Three-leaved false Solomon's-seal
Soli can	*Solidago canadensis*	Canada goldenrod
Sonc asp	*Sonchus asper*	Spiny-leaved sow thistle
Spar spp	*Spartina spp*	Cordgrass
Spha coc	Sphaeralcea coccinea	Scarlet mallow
Stac pal	*Stachys palustris*	Hemp-nettle
Stel med	*Stellaria media*	Common chickweed
Stip com	*Stipa comata*	Needle-and-thread grass

Code	Scientific name	Common name
Stip vir	*Stipa viridula*	Green needlegrass
Symp alb	*Symphoricarpos albus*	Common snowberry
Symp occ	*Symphoricarpos occidentalis*	Western snowberry
Tara off	*Taraxacum officinale*	Common dandelion
Thal spp	*Thalictrum*	Meadow rue
Thal ven	*Thalictrum venulosum*	Veiny meadow rue
Ther rho	*Thermopsis rho*	Buffalo bean
Thla arv	*Thlaspi arvense*	Stinkweed
Trag dub	*Tragopogon dubius*	Goat's beard
Trif spp	*Trifolium spp*	Clover
Urti dio	*Urtica dioica*	Stinging Nettle
Vici ame	*Vicia americana*	Wild vetch
Viol adu	*Viola adunca*	Early blue violet

5.2A Control Site Riparian Results

Methods

For riparian quality assessment field and statistical methods used for the Control site, refer to Sub-section 2.11.2. Because the control transects were established in 2010 and the pre-BMP transect data at BMP sites were from 2008 or 2009, the control sites were used mostly to assess the commonality of between-year differences in communities in the absence of a management change. Communities in each zone in 2010, 2011, and 2012 were compared.

Results and Discussion

For the control site plots, a one-way PERMANOVA test showed that overall, communities were significantly different in at least two year-zone combinations. Pairwise comparisons between groups showed that the only significant differences in communities between years in a given zone were in the transition zone, which had statistically significant differences in communities between 2010 and 2012, and between 2011 and 2012, but not between 2010 and 2011(Table 5.1A). Evenness (E) was normally distributed, so a generalized linear model was used. However, species richness (SR) and effective Shannon diversity (ED) were right skewed, so a generalized linear model with Poisson distribution and log link function was used to evaluate those two parameters. The interaction between year and zone was not significant for any analysis, so it was removed before the final analysis. Zone had no effect on any of the three metrics, but was kept in the analysis as it was a design factor (Tables 5.2A and 5.3A).

The 2010 versus 2011 community differences (Table 5.4A) in the control site upland plots, although not statistically significant, were mostly attributable to (in order of importance from most to least, for those species whose contribution to overall difference was greater than 4%) an increase in the percent cover of Kentucky bluegrass (*Poa pra*), western wheat grass (*Agro smi*), yarrow (*Achi mil*), and a decrease in percent cover of prickly rose (*Rosa aci*), western snowberry (*Symp occ*), and smooth brome (*Brom ine*). The community differences in the transition plots between these years, although not statistically significant, were mostly attributable to an increase in Kentucky bluegrass and a decrease in smooth brome, western snowberry, and prickly rose. The community differences in the riparian plots, although not statistically significant, were mostly attributable to an increase in sedge (*Care spp*), smooth brome, Kentucky bluegrass, and rush (*Junc spp*) and a decrease in western snowberry, prickly rose, and willow (*Sali spp*).

Community differences in the upland plots between 2010 and 2012 were mostly attributable to an increase in Kentucky bluegrass, prickly rose, wild vetch (*Vici ame*), and aster (*Aste spp*) and a decrease in western snowberry, clover (*Trif spp*), western wheat grass, and smooth brome. The differences in the transition plots were mostly attributable to an increase in Kentucky bluegrass, western snowberry, quackgrass (*Agro rep*), timothy (*Phle pra*), and wolf willow (*Elae com*) and a decrease in smooth brome, and prickly rose. Riparian community differences were mostly due to an increase in Kentucky bluegrass, wild mint (*Ment arv*), quackgrass and a decrease in western snowberry, prickly rose, sedge, and smooth brome.

The community differences in the upland plots between 2011 and 2012 were mostly attributable to an increase in prickly rose, smooth brome, and aster and a decrease in Kentucky bluegrass and western wheat grass. Transition plot differences were mostly due to increases in western snowberry, smooth brome, Kentucky bluegrass, quackgrass, timothy, and wolf willow and decreases in prickly rose. Riparian community increases between these years were greatest for Kentucky bluegrass, wild mint, quackgrass, prickly rose, western snowberry, and Canada goldenrod (*Soli can*) and decreases were greatest for sedge, smooth brome, and rush.

The SR was greatest in 2012 and lowest in 2010, and was significantly different in all years (Table 5.3A). The ED was greatest in 2012, intermediate in 2011, and lowest in 2010. These values were not significantly different between 2010 and 2011, but these two years were significantly less than 2012. The E was greatest in 2010, intermediate in 2012, and lowest in 2011. Evenness in 2010 was significantly higher than in 2011 and 2012.

Even though species richness and the effective Shannon diversity index values increased from 2010 to 2012, many of the species that increased in each zone were invader and non-native species. For example, Kentucky bluegrass was the highest contributing plant to the increases in the plant communities from 2010 to 2012 and it increased in all zones (upland, transition, and riparian) and quackgrass increased in the transition and riparian zones from 2010 to 2012. There were also decreases in some desirable shrub species including, snowberry in the uplands and riparian zones and prickly rose in the transition and riparian zones. However, there were increases in snowberry in the transition zone and prickly rose in the uplands zone and decreases in the non-native species smooth brome in all the zones from 2010 to 2012.

Table 5.1A. Analysis of differences in the overall plant communities (percent cover) between year and vegetation zone combinations at the Control site.[z]

Overall model

Source	Sum of squares	F	*P*
Year×Zone	12.84	4.169	0.0001
Total	18.2		

Differences between Year×Zone combinations[y]
Bonferroni-corrected P values

	2010 Up	2010 Tr	2010 Ri	2011 Up	2011 Tr	2011 Ri	2012 Up	2012 Tr	2012 Ri
2010 Up	-	0.043	1.000	1.000	0.223	0.544	1.000	0.004	1.000
2010 Tr		-	1.000	0.277	1.000	0.018	0.022	0.014	0.029
2010 Ri			-	1.000	1.000	1.000	1.000	0.004	0.997
2011 Up				-	0.090	1.000	1.000	0.130	1.000
2011 Tr					-	0.900	0.104	0.004	0.310
2011 Ri						-	1.000	0.007	1.000
2012 Up							-	0.004	1.000
2012 Tr								-	0.007
2012 Ri									-

[z] One-way PERMANOVA statistical test .
[y] Up = upland, Tr = transition, Ri = riparian.

Table 5.2A. Type 3 tests of fixed effects (year, zone) in the analysis of species richness (SR), effective diversity (ED), and evenness (E) in plots from the Control Site transects.

Effect	Num DF	Den DF	F value	*P* value
		SR[z]		
Zone	2	84	0.88	0.4192
Year	2	84	24.84	<0.0001
		ED[z]		
Zone	2	84	0.99	0.3756
Year	2	84	14.95	<0.0001
		E		
Zone	2	84	1.78	0.1746
Year	2	84	3.43	0.0370

[z] Generalized linear model (with a Poisson error distribution and log link function) used rather than a general linear model.

Table 5.3A. Type 3 tests of fixed effects (year, zone) in the analysis of species richness (SR), effective diversity (ED), and evenness (E) at the Control site.[z] Values shown are least square means.

Effect[y]		SR	ED	E
Year[x]	2010	5.9*a*	4.2*a*	0.75*a*
	2011	8.6*b*	5.4*a*	0.61*b*
	2012	11.7*c*	7.8*b*	0.67*b*
Zone[x]	Riparian	8.4*a*	5.9*a*	0.72*a*
	Transition	7.8*a*	5.1*a*	0.66*a*
	Upland	9.0*a*	5.9*a*	0.65*a*

[z] Generalized linear model (with a Poisson error distribution and log link function) used rather than a general linear model.
[y] Year × Zone interaction was not significant.
[x] Means for year or zone followed by the same letter are not significantly different ($P < 0.1$).

Table 5.4A. Percent contribution of each plant species to total dissimilarity (using a Bray-Curtis distance measure) of Control site transect plots in different years.

	Upland 2010 vs 2011 Overall average dissimilarity = 74.09			Average percent cover	
Taxon	Ave. dissim.	Contrib. %	Cumulative %	2010	2011
Poa pra	23.98	32.36	32.36	2.5	40
Rosa aci	9.697	13.09	45.45	15.7	0
Agro smi	7.985	10.78	56.22	10.8	20
Symp occ	6.72	9.07	65.29	16.3	7.5
Brom ine	5.506	7.432	72.73	9.17	0
Trif spp	4.564	6.159	78.88	6.67	1
Achi mil	1.817	2.453	81.34	0.167	3
Aste spp	1.798	2.426	83.76	3.5	0
Arte fri	1.704	2.3	86.06	1.67	3
Cirs arv	1.685	2.274	88.34	0.667	3
Elae com	1.606	2.167	90.5	0.833	2.5
Soli can	1.327	1.791	92.29	1.83	0
Vici ame	1.028	1.387	93.68	1.5	0.5
Rume spp	0.9622	1.299	94.98	0	1.5
Phle pra	0.9075	1.225	96.21	1.33	0
Tara off	0.6436	0.8686	97.07	0	1
Trag dub	0.6436	0.8686	97.94	0	1
Ante spp	0.6415	0.8658	98.81	0	1
Lina vul	0.5623	0.7588	99.57	1.17	0
Cera spp	0.3207	0.4329	100	0	0.5
Junc spp	0	0	100	0	0
Grin squ	0	0	100	0	0
Arct min	0	0	100	0	0
Glyc lep	0	0	100	0	0
Gera spp	0	0	100	0	0
Carrot	0	0	100	0	0
Gali spp	0	0	100	0	0
Hord jub	0	0	100	0	0
Urti dio	0	0	100	0	0
Sagi cun	0	0	100	0	0
Frag vir	0	0	100	0	0
Care spp	0	0	100	0	0
Agro rep	0	0	100	0	0
Fest sca	0	0	100	0	0
Poly spp	0	0	100	0	0

Erig gla	0	0	100	0	0
Equi arv	0	0	100	0	0
Phlo hoo	0	0	100	0	0
Epil ang	0	0	100	0	0
Agro tra	0	0	100	0	0
Plan maj	0	0	100	0	0
Pens nit	0	0	100	0	0
Oeno bie	0	0	100	0	0
Pote ans	0	0	100	0	0
Ranu spp	0	0	100	0	0
Mustard	0	0	100	0	0
Moss	0	0	100	0	0
Desc sop	0	0	100	0	0
Sali spp	0	0	100	0	0
Smil ste	0	0	100	0	0
Arte lud	0	0	100	0	0
Sonc asp	0	0	100	0	0
Spha coc	0	0	100	0	0
Stac pal	0	0	100	0	0
Mona fis	0	0	100	0	0
Ment arv	0	0	100	0	0
Thal spp	0	0	100	0	0
Cyno off	0	0	100	0	0
Medi lup	0	0	100	0	0
Linu usi	0	0	100	0	0
Conv arv	0	0	100	0	0
Agro das	0	0	100	0	0
Agro das	0	0	100	0	0

	Upland 2010 vs 2012				
	Overall average dissimilarity = 62.4			Average percent cover	
Taxon	Ave. dissim.	Contrib. %	Cumulative %	2010	2012
Poa pra	10.18	16.31	16.31	2.5	16.8
Symp occ	8.081	12.95	29.26	16.3	5
Rosa aci	6.794	10.89	40.15	15.7	16
Trif spp	6.221	9.97	50.12	6.67	4.25
Agro smi	5.777	9.258	59.38	10.8	8.75
Brom ine	5.479	8.78	68.16	9.17	6
Vici ame	4.122	6.606	74.76	1.5	6
Aste spp	2.875	4.608	79.37	3.5	4.5
Phlo hoo	1.72	2.757	82.13	0	2.5
Agro tra	1.645	2.636	84.76	0	2.5

Arte fri	1.575	2.524	87.29	1.67	2
Soli can	1.387	2.223	89.51	1.83	0
Achi mil	0.9871	1.582	91.09	0.167	1.5
Phle pra	0.9467	1.517	92.61	1.33	0
Ante spp	0.8961	1.436	94.05	0	1.25
Elae com	0.6149	0.9854	95.03	0.833	0
Lina vul	0.5785	0.9271	95.96	1.17	0
Grin squ	0.5377	0.8617	96.82	0	0.75
Cirs arv	0.5148	0.825	97.65	0.667	0
Pens nit	0.4658	0.7465	98.39	0	0.75
Agro das	0.4658	0.7465	99.14	0	0.75
Spha coc	0.3584	0.5744	99.71	0	0.5
Trag dub	0.1792	0.2872	100	0	0.25
Junc spp	0	0	100	0	0
Tara off	0	0	100	0	0
Cera spp	0	0	100	0	0
Arct min	0	0	100	0	0
Hord jub	0	0	100	0	0
Urti dio	0	0	100	0	0
Glyc lep	0	0	100	0	0
Gera spp	0	0	100	0	0
Carrot	0	0	100	0	0
Gali spp	0	0	100	0	0
Rume spp	0	0	100	0	0
Frag vir	0	0	100	0	0
Care spp	0	0	100	0	0
Agro rep	0	0	100	0	0
Fest sca	0	0	100	0	0
Poly spp	0	0	100	0	0
Erig gla	0	0	100	0	0
Plan maj	0	0	100	0	0
Equi arv	0	0	100	0	0
Epil ang	0	0	100	0	0
Pote ans	0	0	100	0	0
Ranu spp	0	0	100	0	0
Oeno bie	0	0	100	0	0
Mustard	0	0	100	0	0
Sagi cun	0	0	100	0	0

Sali spp	0	0	100	0	0
Smil ste	0	0	100	0	0
Moss	0	0	100	0	0
Sonc asp	0	0	100	0	0
Desc sop	0	0	100	0	0
Stac pal	0	0	100	0	0
Arte lud	0	0	100	0	0
Mona fis	0	0	100	0	0
Thal spp	0	0	100	0	0
Ment arv	0	0	100	0	0
Cyno off	0	0	100	0	0
Medi lup	0	0	100	0	0
Linu usi	0	0	100	0	0
Conv arv	0	0	100	0	0

	Upland 2011 vs 2012				
	Overall average dissimilarity = 72.27			Average percent cover	
Taxon	Ave. dissim.	Contrib.%	Cumulative %	2011	2012
Poa pra	13.92	23.38	23.38	40	16.8
Rosa aci	9.415	15.81	39.19	0	16
Agro smi	6.902	11.59	50.78	20	8.75
Brom ine	3.579	6.009	56.79	0	6
Vici ame	3.419	5.741	62.53	0.5	6
Symp occ	2.922	4.907	67.44	7.5	5
Aste spp	2.705	4.543	71.98	0	4.5
Trif spp	2.278	3.825	75.8	1	4.25
Cirs arv	1.817	3.051	78.86	3	0
Phlo hoo	1.55	2.603	81.46	0	2.5
Achi mil	1.522	2.555	84.01	3	1.5
Arte fri	1.521	2.553	86.57	3	2
Elae com	1.51	2.535	89.1	2.5	0
Agro tra	1.49	2.503	91.61	0	2.5
Ante spp	1.087	1.826	93.43	1	1.25
Rume spp	0.9058	1.521	94.95	1.5	0
Tara off	0.6057	1.017	95.97	1	0
Grin squ	0.4823	0.8099	96.78	0	0.75
Trag dub	0.4449	0.7471	97.53	1	0.25
Pens nit	0.4249	0.7136	98.24	0	0.75
Agro das	0.4249	0.7136	98.95	0	0.75
Spha coc	0.3215	0.54	99.49	0	0.5
Cera spp	0.3019	0.507	100	0.5	0
Junc spp	0	0	100	0	0

Hord jub	0	0	100	0	0
Arct min	0	0	100	0	0
Glyc lep	0	0	100	0	0
Thal spp	0	0	100	0	0
Urti dio	0	0	100	0	0
Lina vul	0	0	100	0	0
Gera spp	0	0	100	0	0
Carrot	0	0	100	0	0
Gali spp	0	0	100	0	0
Sagi cun	0	0	100	0	0
Frag vir	0	0	100	0	0
Care spp	0	0	100	0	0
Agro rep	0	0	100	0	0
Fest sca	0	0	100	0	0
Poly spp	0	0	100	0	0
Erig gla	0	0	100	0	0
Plan maj	0	0	100	0	0
Equi arv	0	0	100	0	0
Phle pra	0	0	100	0	0
Pote ans	0	0	100	0	0
Ranu spp	0	0	100	0	0
Epil ang	0	0	100	0	0
Oeno bie	0	0	100	0	0
Mustard	0	0	100	0	0
Sali spp	0	0	100	0	0
Smil ste	0	0	100	0	0
Soli can	0	0	100	0	0
Sonc asp	0	0	100	0	0
Moss	0	0	100	0	0
Stac pal	0	0	100	0	0
Desc sop	0	0	100	0	0
Arte lud	0	0	100	0	0
Mona fis	0	0	100	0	0
Ment arv	0	0	100	0	0
Cyno off	0	0	100	0	0
Medi lup	0	0	100	0	0
Linu usi	0	0	100	0	0
Conv arv	0	0	100	0	0

	Transition 2010 vs 2011 Overall average dissimilarity = 57.03			Average percent cover	
Taxon	Ave. dissim.	Contrib.%	Cumulative%	2010	2011
Brom ine	12.68	22.23	22.23	33.5	24.5
Symp occ	11.16	19.57	41.79	34.3	22.2
Rosa aci	11.02	19.32	61.11	21.4	19.2
Poa pra	8.863	15.54	76.66	12.3	18.6
Elae com	2.152	3.773	80.43	2.8	2.56
Soli can	1.824	3.198	83.63	1.87	2.36
Smil ste	1.074	1.883	85.51	1.53	1.4
Agro das	1.042	1.826	87.34	0	2.28
Fest sca	0.9941	1.743	89.08	0	2
Agro smi	0.6811	1.194	90.27	0.333	1.2
Achi mil	0.5084	0.8914	91.16	0.333	0.68
Trif spp	0.5073	0.8894	92.05	0	1
Frag vir	0.5054	0.8861	92.94	0.733	0.44
Vici ame	0.5029	0.8818	93.82	0.333	0.8
Aste spp	0.4897	0.8586	94.68	1	0.16
Rume spp	0.4568	0.801	95.48	0.733	0.2
Erig gla	0.3927	0.6885	96.17	0	0.84
Cirs arv	0.376	0.6592	96.83	0.333	0.32
Tara off	0.3625	0.6356	97.47	0.4	0.48
Equi arv	0.2382	0.4176	97.88	0.2	0.36
Gera spp	0.1904	0.3339	98.22	0.333	0.04
Mona fis	0.179	0.3139	98.53	0	0.4
Ment arv	0.144	0.2524	98.78	0	0.24
Phle pra	0.1285	0.2253	99.01	0.2	0
Ante spp	0.1054	0.1847	99.19	0	0.2
Care spp	0.09928	0.1741	99.37	0	0.24
Cera spp	0.0821	0.144	99.51	0	0.16
Arte fri	0.07962	0.1396	99.65	0	0.16
Trag dub	0.07638	0.1339	99.78	0	0.16
Mustard	0.03504	0.06144	99.85	0	0.08
Cyno off	0.02641	0.04631	99.89	0	0.08
Junc spp	0.02107	0.03695	99.93	0	0.04
Pote ans	0.02107	0.03695	99.97	0	0.04
Glyc lep	0.01922	0.03369	100	0	0.04
Lina vul	0	0	100	0	0
Urti dio	0	0	100	0	0
Hord jub	0	0	100	0	0

Grin squ	0	0	100	0	0
Arct min	0	0	100	0	0
Spha coc	0	0	100	0	0
Sonc asp	0	0	100	0	0
Carrot	0	0	100	0	0
Sali spp	0	0	100	0	0
Gali spp	0	0	100	0	0
Sagi cun	0	0	100	0	0
Agro rep	0	0	100	0	0
Ranu spp	0	0	100	0	0
Poly spp	0	0	100	0	0
Plan maj	0	0	100	0	0
Phlo hoo	0	0	100	0	0
Epil ang	0	0	100	0	0
Agro tra	0	0	100	0	0
Pens nit	0	0	100	0	0
Stac pal	0	0	100	0	0
Oeno bie	0	0	100	0	0
Moss	0	0	100	0	0
Thal spp	0	0	100	0	0
Desc sop	0	0	100	0	0
Arte lud	0	0	100	0	0
Medi lup	0	0	100	0	0
Linu usi	0	0	100	0	0
Conv arv	0	0	100	0	0

	Transition 2010 vs 2012 Overall average dissimilarity = 51.93			Average percent cover	
Taxon	Ave. dissim.	Contrib. %	Cumulative %	2010	2012
Brom ine	8.384	16.14	16.14	33.5	31.8
Poa pra	8.234	15.86	32	12.3	29.6
Rosa aci	7.005	13.49	45.49	21.4	16.8
Symp occ	6.088	11.72	57.21	34.3	40.2
Agro rep	5.943	11.44	68.66	0	17.6
Phle pra	2.846	5.48	74.14	0.2	8.2
Elae com	2.364	4.552	78.69	2.8	6.56
Soli can	1.167	2.248	80.94	1.87	2.16
Smil ste	1.158	2.229	83.17	1.53	2.88
Frag vir	0.9307	1.792	84.96	0.733	2.56
Rume spp	0.8006	1.542	86.5	0.733	1.84
Tara off	0.7109	1.369	87.87	0.4	2.08

Ment arv	0.5477	1.055	88.93	0	2.04
Cirs arv	0.5249	1.011	89.94	0.333	1.32
Agro tra	0.5094	0.981	90.92	0	1.4
Equi arv	0.4161	0.8012	91.72	0.2	1.16
Agro smi	0.4099	0.7894	92.51	0.333	1
Aste spp	0.3564	0.6864	93.19	1	0.16
Sali spp	0.2873	0.5533	93.75	0	1.04
Achi mil	0.2795	0.5382	94.29	0.333	0.56
Agro das	0.2626	0.5058	94.79	0	0.64
Vici ame	0.2415	0.465	95.26	0.333	0.44
Mona fis	0.2304	0.4436	95.7	0	0.72
Arct min	0.2288	0.4407	96.14	0	0.8
Junc spp	0.2123	0.4089	96.55	0	0.8
Poly spp	0.1903	0.3665	96.92	0	0.6
Gera spp	0.1862	0.3586	97.27	0.333	0.28
Gali spp	0.1854	0.357	97.63	0	0.68
Arte lud	0.1401	0.2699	97.9	0	0.4
Glyc lep	0.1359	0.2616	98.16	0	0.32
Linu usi	0.1215	0.234	98.4	0	0.36
Sagi cun	0.1065	0.205	98.6	0	0.4
Ranu spp	0.1062	0.2045	98.81	0	0.4
Erig gla	0.1022	0.1969	99	0	0.36
Medi lup	0.07168	0.138	99.14	0	0.2
Urti dio	0.06661	0.1283	99.27	0	0.2
Moss	0.05721	0.1102	99.38	0	0.2
Carrot	0.05295	0.102	99.48	0	0.2
Care spp	0.05295	0.102	99.58	0	0.2
Plan maj	0.04607	0.08871	99.67	0	0.16
Trag dub	0.04453	0.08574	99.76	0	0.12
Trif spp	0.02664	0.05131	99.81	0	0.08
Sonc asp	0.02489	0.04793	99.86	0	0.08
Hord jub	0.02118	0.04078	99.9	0	0.08
Pote ans	0.02118	0.04078	99.94	0	0.08
Thal spp	0.02118	0.04078	99.98	0	0.08
Epil ang	0.01059	0.02039	100	0	0.04
Lina vul	0	0	100	0	0
Grin squ	0	0	100	0	0
Cera spp	0	0	100	0	0
Stac pal	0	0	100	0	0

Spha coc	0	0	100	0	0
Ante spp	0	0	100	0	0
Fest sca	0	0	100	0	0
Phlo hoo	0	0	100	0	0
Pens nit	0	0	100	0	0
Oeno bie	0	0	100	0	0
Mustard	0	0	100	0	0
Desc sop	0	0	100	0	0
Cyno off	0	0	100	0	0
Conv arv	0	0	100	0	0
Arte fri	0	0	100	0	0

	Transition 2011 vs 2012 Overall average dissimilarity = 59.53			Average percent cover	
Taxon	Ave. dissim.	Contrib. %	Cumulative %	2011	2012
Symp occ	9.602	16.13	16.13	22.2	40.2
Brom ine	8.631	14.5	30.63	24.5	31.8
Poa pra	8.328	13.99	44.62	18.6	29.6
Rosa aci	6.738	11.32	55.94	19.2	16.8
Agro rep	6.285	10.56	66.5	0	17.6
Phle pra	3.001	5.042	71.54	0	8.2
Elae com	2.54	4.267	75.81	2.56	6.56
Soli can	1.326	2.228	78.04	2.36	2.16
Smil ste	1.139	1.913	79.95	1.4	2.88
Agro das	0.99	1.663	81.61	2.28	0.64
Frag vir	0.9027	1.516	83.13	0.44	2.56
Fest sca	0.7589	1.275	84.4	2	0
Tara off	0.7224	1.213	85.62	0.48	2.08
Agro smi	0.7141	1.2	86.82	1.2	1
Rume spp	0.7131	1.198	88.01	0.2	1.84
Ment arv	0.6594	1.108	89.12	0.24	2.04
Cirs arv	0.5717	0.9605	90.08	0.32	1.32
Agro tra	0.5423	0.911	90.99	0	1.4
Equi arv	0.4789	0.8044	91.8	0.36	1.16
Achi mil	0.4134	0.6945	92.49	0.68	0.56
Trif spp	0.4066	0.6831	93.18	1	0.08
Vici ame	0.398	0.6687	93.84	0.8	0.44
Erig gla	0.3684	0.6188	94.46	0.84	0.36
Mona fis	0.3641	0.6116	95.07	0.4	0.72
Sali spp	0.2993	0.5027	95.58	0	1.04
Arct min	0.2387	0.401	95.98	0	0.8

Junc spp	0.2346	0.3941	96.37	0.04	0.8
Poly spp	0.2009	0.3376	96.71	0	0.6
Gali spp	0.1928	0.324	97.03	0	0.68
Glyc lep	0.1584	0.2661	97.3	0.04	0.32
Arte lud	0.1485	0.2495	97.55	0	0.4
Care spp	0.129	0.2167	97.77	0.24	0.2
Linu usi	0.1285	0.2159	97.98	0	0.36
Sagi cun	0.1106	0.1858	98.17	0	0.4
Ranu spp	0.1103	0.1853	98.35	0	0.4
Aste spp	0.1047	0.1759	98.53	0.16	0.16
Gera spp	0.1017	0.1708	98.7	0.04	0.28
Trag dub	0.09497	0.1595	98.86	0.16	0.12
Ante spp	0.07937	0.1333	98.99	0.2	0
Medi lup	0.07639	0.1283	99.12	0	0.2
Urti dio	0.07019	0.1179	99.24	0	0.2
Cera spp	0.06223	0.1045	99.34	0.16	0
Arte fri	0.06077	0.1021	99.45	0.16	0
Moss	0.05968	0.1003	99.55	0	0.2
Carrot	0.05499	0.09239	99.64	0	0.2
Plan maj	0.0481	0.0808	99.72	0	0.16
Pote ans	0.03695	0.06208	99.78	0.04	0.08
Mustard	0.02746	0.04613	99.83	0.08	0
Sonc asp	0.0261	0.04385	99.87	0	0.08
Thal spp	0.022	0.03695	99.91	0	0.08
Hord jub	0.022	0.03695	99.95	0	0.08
Cyno off	0.02173	0.03651	99.98	0.08	0
Epil ang	0.011	0.01848	100	0	0.04
Lina vul	0	0	100	0	0
Grin squ	0	0	100	0	0
Stac pal	0	0	100	0	0
Spha coc	0	0	100	0	0
Phlo hoo	0	0	100	0	0
Pens nit	0	0	100	0	0
Oeno bie	0	0	100	0	0
Desc sop	0	0	100	0	0
Conv arv	0	0	100	0	0

	Riparian 2010 vs 2011 Overall average dissimilarity = 59.53			Average percent cover	
Taxon	Ave. dissim.	Contrib. %	Cumulative %	2010	2011
Symp occ	15.81	22.72	22.72	30	6.25
Rosa aci	11.68	16.79	39.51	21.3	4.5
Care spp	8.307	11.94	51.45	7.5	10
Brom ine	6.973	10.02	61.47	11.3	13.8
Poa pra	6.673	9.59	71.06	0	10
Junc spp	5.409	7.774	78.83	3.75	6.25
Sali spp	3.597	5.169	84	4	3.5
Agro smi	2.524	3.627	87.63	2.5	2.5
Soli can	2.499	3.591	91.22	3.75	0.5
Rume spp	1.501	2.157	93.38	0	2.25
Cirs arv	0.9133	1.313	94.69	1.25	0.25
Erig gla	0.852	1.224	95.92	0	1.25
Smil ste	0.8409	1.208	97.12	1.25	0
Mona fis	0.8349	1.2	98.32	0	1.25
Tara off	0.5003	0.719	99.04	0	0.75
Conv arv	0.1704	0.2449	99.29	0	0.25
Vici ame	0.1704	0.2449	99.53	0	0.25
Frag vir	0.1659	0.2385	99.77	0.25	0
Ranu spp	0.1595	0.2292	100	0	0.25
Trif spp	0	0	100	0	0
Cera spp	0	0	100	0	0
Arct min	0	0	100	0	0
Gera spp	0	0	100	0	0
Carrot	0	0	100	0	0
Gali spp	0	0	100	0	0
Glyc lep	0	0	100	0	0
Grin squ	0	0	100	0	0
Hord jub	0	0	100	0	0
Urti dio	0	0	100	0	0
Lina vul	0	0	100	0	0
Sagi cun	0	0	100	0	0
Ante spp	0	0	100	0	0
Agro rep	0	0	100	0	0
Fest sca	0	0	100	0	0
Pote ans	0	0	100	0	0
Poly spp	0	0	100	0	0
Equi arv	0	0	100	0	0

Phlo hoo	0	0	100	0	0
Phle pra	0	0	100	0	0
Epil ang	0	0	100	0	0
Plan maj	0	0	100	0	0
Aste spp	0	0	100	0	0
Agro tra	0	0	100	0	0
Pens nit	0	0	100	0	0
Oeno bie	0	0	100	0	0
Elae com	0	0	100	0	0
Mustard	0	0	100	0	0
Moss	0	0	100	0	0
Desc sop	0	0	100	0	0
Arte lud	0	0	100	0	0
Ment arv	0	0	100	0	0
Sonc asp	0	0	100	0	0
Spha coc	0	0	100	0	0
Stac pal	0	0	100	0	0
Cyno off	0	0	100	0	0
Medi lup	0	0	100	0	0
Thal spp	0	0	100	0	0
Trag dub	0	0	100	0	0
Linu usi	0	0	100	0	0
Arte fri	0	0	100	0	0
Agro das	0	0	100	0	0
Achi mil	0	0	100	0	0

	Riparian 2010 vs 2012 Overall average dissimilarity = 75.4			Average percent cover	
Taxon	Ave. dissim.	Contrib. %	Cumulative %	2010	2012
Symp occ	11.65	15.45	15.45	30	10
Poa pra	10.44	13.85	29.3	0	24
Rosa aci	9.367	12.42	41.72	21.3	6.75
Ment arv	6.328	8.393	50.11	0	15.8
Agro rep	5.786	7.673	57.78	0	13.8
Care spp	5.026	6.666	64.45	7.5	5
Brom ine	3.848	5.104	69.56	11.3	6.75
Sali spp	2.983	3.957	73.51	4	5.25
Soli can	2.821	3.742	77.25	3.75	6
Junc spp	2.303	3.054	80.31	3.75	2
Equi arv	2.066	2.74	83.05	0	4.5
Agro smi	1.685	2.235	85.28	2.5	1.25

Phle pra	1.368	1.815	87.1	0	2.5
Stac pal	1.221	1.62	88.72	0	2.5
Poly spp	1.119	1.483	90.2	0	2.5
Pote ans	0.9577	1.27	91.47	0	1.75
Cirs arv	0.852	1.13	92.6	1.25	1.25
Carrot	0.8132	1.078	93.68	0	1.25
Smil ste	0.702	0.931	94.61	1.25	0.25
Glyc lep	0.6841	0.9073	95.52	0	1.25
Ranu spp	0.6841	0.9073	96.42	0	1.25
Oeno bie	0.4879	0.6471	97.07	0	0.75
Sagi cun	0.418	0.5544	97.62	0	1
Rume spp	0.3364	0.4462	98.07	0	0.75
Aste spp	0.3253	0.4314	98.5	0	0.5
Desc sop	0.3253	0.4314	98.93	0	0.5
Elae com	0.2442	0.3239	99.26	0	0.5
Sonc asp	0.1738	0.2305	99.49	0	0.5
Medi lup	0.1368	0.1815	99.67	0	0.25
Frag vir	0.1269	0.1683	99.84	0.25	0
Tara off	0.1221	0.162	100	0	0.25
Lina vul	0	0	100	0	0
Urti dio	0	0	100	0	0
Trif spp	0	0	100	0	0
Hord jub	0	0	100	0	0
Grin squ	0	0	100	0	0
Cera spp	0	0	100	0	0
Arct min	0	0	100	0	0
Spha coc	0	0	100	0	0
Gera spp	0	0	100	0	0
Gali spp	0	0	100	0	0
Ante spp	0	0	100	0	0
Fest sca	0	0	100	0	0
Erig gla	0	0	100	0	0
Plan maj	0	0	100	0	0
Phlo hoo	0	0	100	0	0
Epil ang	0	0	100	0	0
Agro tra	0	0	100	0	0

Pens nit	0	0	100	0	0
Mustard	0	0	100	0	0
Moss	0	0	100	0	0
Arte lud	0	0	100	0	0
Mona fis	0	0	100	0	0
Cyno off	0	0	100	0	0
Linu usi	0	0	100	0	0
Conv arv	0	0	100	0	0
Thal spp	0	0	100	0	0
Trag dub	0	0	100	0	0
Arte fri	0	0	100	0	0
Agro das	0	0	100	0	0
Vici ame	0	0	100	0	0
Achi mil	0	0	100	0	0

	Riparian 2011 vs 2012 Overall average dissimilarity = 73.24			Average percent cover	
Taxon	Ave. dissim.	Contrib. %	Cumulative %	2011	2012
Poa pra	9.765	13.33	13.33	10	24
Ment arv	7	9.558	22.89	0	15.8
Agro rep	6.474	8.841	31.73	0	13.8
Care spp	5.827	7.957	39.69	10	5
Brom ine	5.737	7.834	47.52	13.8	6.75
Rosa aci	5.661	7.729	55.25	4.5	6.75
Symp occ	4.439	6.062	61.31	6.25	10
Junc spp	4.129	5.638	66.95	6.25	2
Soli can	3.064	4.184	71.13	0.5	6
Sali spp	2.635	3.598	74.73	3.5	5.25
Equi arv	2.318	3.165	77.9	0	4.5
Agro smi	1.948	2.66	80.56	2.5	1.25
Phle pra	1.566	2.138	82.7	0	2.5
Stac pal	1.376	1.879	84.58	0	2.5
Poly spp	1.255	1.714	86.29	0	2.5
Pote ans	1.096	1.497	87.79	0	1.75
Rume spp	1.023	1.396	89.18	2.25	0.75
Carrot	0.9568	1.306	90.49	0	1.25
Ranu spp	0.8472	1.157	91.65	0.25	1.25
Glyc lep	0.7829	1.069	92.71	0	1.25
Erig gla	0.7417	1.013	93.73	1.25	0
Mona fis	0.7279	0.994	94.72	1.25	0
Oeno bie	0.5741	0.7839	95.5	0	0.75

Cirs arv	0.5705	0.779	96.28	0.25	1.25
Sagi cun	0.4641	0.6337	96.92	0	1
Tara off	0.4371	0.5969	97.51	0.75	0.25
Aste spp	0.3827	0.5226	98.04	0	0.5
Desc sop	0.3827	0.5226	98.56	0	0.5
Elae com	0.2752	0.3758	98.94	0	0.5
Sonc asp	0.1889	0.2579	99.19	0	0.5
Medi lup	0.1566	0.2138	99.41	0	0.25
Vici ame	0.1483	0.2025	99.61	0.25	0
Conv arv	0.1483	0.2025	99.81	0.25	0
Smil ste	0.1376	0.1879	100	0	0.25
Lina vul	0	0	100	0	0
Urti dio	0	0	100	0	0
Trif spp	0	0	100	0	0
Hord jub	0	0	100	0	0
Grin squ	0	0	100	0	0
Cera spp	0	0	100	0	0
Arct min	0	0	100	0	0
Spha coc	0	0	100	0	0
Gera spp	0	0	100	0	0
Gali spp	0	0	100	0	0
Frag vir	0	0	100	0	0
Ante spp	0	0	100	0	0
Fest sca	0	0	100	0	0
Plan maj	0	0	100	0	0
Phlo hoo	0	0	100	0	0
Epil ang	0	0	100	0	0
Agro tra	0	0	100	0	0
Pens nit	0	0	100	0	0
Mustard	0	0	100	0	0
Moss	0	0	100	0	0
Arte lud	0	0	100	0	0
Cyno off	0	0	100	0	0
Thal spp	0	0	100	0	0
Trag dub	0	0	100	0	0
Linu usi	0	0	100	0	0
Arte fri	0	0	100	0	0
Agro das	0	0	100	0	0
Achi mil	0	0	100	0	0

5.3A Percent contribution of each plant species to total dissimilarity for the pre- and post-BMP periods at the Impoundment, Pasture, and Wintering beneficial management practices (BMP) sites.

Table 5.5A. Percent contribution of each plant species to total dissimilarity (using a Bray-Curtis distance measure) of plots before (2008 for Transects 1 to 5 and 2009 for Transects 6 and 7) and after (2012) BMP implementation at the Impoundment site.

	Transects 1 to 5 - Riparian Zone Overall average dissimilarity = 84.3			Average percent cover	
Taxon	Ave. dissim.	Contrib. %	Cumulative %	Pre-BMP	Post-BMP
Junc bal	16.16	19.17	19.17	14.5	25
Carex spp.	15.09	17.9	37.07	19.8	12.1
Poa pra	10.27	12.19	49.25	7.41	14.3
Agro rep	7.547	8.953	58.21	13.5	0.909
Puccinellia	4.701	5.576	63.78	0	8.14
Ment arv	4.388	5.205	68.99	1.48	6.95
Eleo R.	3.84	4.555	73.54	5.19	0
Cirs arv	3.168	3.758	77.3	2.26	4.45
Brom ine	2.688	3.188	80.49	2.22	2.59
Symp occ	2.379	2.822	83.31	0.037	4.77
Pote ans	2.045	2.426	85.74	2.96	0.455
Soli can	1.424	1.69	87.43	1.59	0.955
Phle pra	1.281	1.52	88.95	0	2.55
Agrostis spp.	1.204	1.428	90.38	1.11	0.864
Tera off	1.063	1.262	91.64	1.04	0.955
Agro cris	0.8295	0.9839	92.62	0.889	0
Mono nut	0.7934	0.9412	93.56	0	1
Plan maj	0.6964	0.8261	94.39	0.0741	1.09
Salix	0.5594	0.6636	95.05	0	0.636
Elae com	0.5582	0.6622	95.71	0	0.909
Aster spp.	0.555	0.6584	96.37	0	1.14
Equi arv	0.4424	0.5248	96.9	0	0.909
Smil tri	0.4346	0.5156	97.41	0	0.818
Rumex spp.	0.3626	0.4302	97.84	0.111	0.591
Agro smi	0.3511	0.4165	98.26	0	0.682
Rosa aci	0.3323	0.3942	98.65	0	0.636
Ranu jel	0.2591	0.3073	98.96	0	0.455
Achi mil	0.2164	0.2567	99.22	0.037	0.409
Polygonum	0.1078	0.1279	99.35	0	0.227
Thro rho	0.1071	0.127	99.47	0.185	0
Frag vir	0.1033	0.1225	99.6	0	0.227
Vici ame	0.08848	0.105	99.7	0	0.182
Guti sar	0.07778	0.09227	99.79	0.111	0

Hord jub	0.06573	0.07797	99.87	0	0.0909
Trifloium	0.05353	0.06349	99.93	0	0.0909
Arte lud	0.03286	0.03898	99.97	0	0.0455
Trag dub	0.02245	0.02663	100	0	0.0455
Medi lup	0	0	100	0	0
lupin	0	0	100	0	0
Conv arv	0	0	100	0	0
Grin squ	0	0	100	0	0
Glycorrhiza	0	0	100	0	0
Sonc asp	0	0	100	0	0
Geum tri	0	0	100	0	0
Brassica	0	0	100	0	0
Smil ste	0	0	100	0	0
Gera vis	0	0	100	0	0
Shep can	0	0	100	0	0
Stip com	0	0	100	0	0
Gali bor	0	0	100	0	0
Elym tra	0	0	100	0	0
Agro pec	0	0	100	0	0
Arte fri	0	0	100	0	0
Nesl pan	0	0	100	0	0
Desc sop	0	0	100	0	0
Agro das	0	0	100	0	0

Transects 1 to 5 - Transition Zone Overall average dissimilarity = 79.57				Average percent cover	
Taxon	Ave. dissim.	Contrib. %	Cumulative %	Pre-BMP	Post-BMP
Poa pra	18.3	23	23	25.3	36.4
Agro rep	16.47	20.71	43.7	30.3	0.0357
Brom ine	10.83	13.61	57.31	16.7	11.8
Eleo R.	4.976	6.254	63.56	6.33	0
Agrostis spp.	4.768	5.992	69.55	0	9
Symp occ	4.533	5.697	75.25	0.667	9.36
Agro pec	3.803	4.78	80.03	0	6.68
Cirs arv	2.202	2.768	82.8	0.333	3.61
Tera off	1.499	1.884	84.68	1.93	1.07
Glycorrhiza	1.348	1.694	86.37	0	2.86
Aster spp.	1.309	1.646	88.02	0.0667	2.64
Agro cris	1.276	1.603	89.62	2.67	0
Achi mil	1.261	1.585	91.21	2.13	0.643
Agro smi	1.203	1.511	92.72	0	1.79
Soli can	0.8978	1.128	93.85	1.53	0.393
Puccinellia	0.6879	0.8645	94.71	0	0.929
Vici ame	0.5129	0.6446	95.36	0	0.75

Rumex spp.	0.4538	0.5703	95.93	0	0.679
Rosa aci	0.4023	0.5056	96.43	0	0.893
Grin squ	0.3436	0.4319	96.86	0	0.679
Pote ans	0.3246	0.408	97.27	0.133	0.464
Ment arv	0.288	0.362	97.63	0	0.536
Stip com	0.2574	0.3235	97.96	0	0.357
Elae com	0.2381	0.2992	98.26	0	0.357
Trifloium	0.1938	0.2436	98.5	0	0.286
Phle pra	0.1753	0.2203	98.72	0	0.286
Arte lud	0.1203	0.1512	98.87	0	0.286
Arte fri	0.119	0.1496	99.02	0	0.214
Trag dub	0.1105	0.1388	99.16	0	0.214
Smil tri	0.1093	0.1374	99.3	0	0.25
Nesl pan	0.1046	0.1314	99.43	0.133	0
Conv arv	0.09808	0.1233	99.55	0	0.214
Elym tra	0.09079	0.1141	99.67	0	0.179
Gera vis	0.07817	0.09824	99.77	0	0.179
Sonc asp	0.06063	0.0762	99.84	0	0.107
Medi lup	0.03612	0.0454	99.89	0	0.0714
Agro das	0.02794	0.03512	99.92	0	0.0714
Desc sop	0.02489	0.03129	99.95	0	0.0357
Geum tri	0.0215	0.02702	99.98	0	0.0357
Frag vir	0.01547	0.01944	100	0	0.0357
lupin	0	0	100	0	0
Junc bal	0	0	100	0	0
Hord jub	0	0	100	0	0
Guti sar	0	0	100	0	0
Thro rho	0	0	100	0	0
Carex spp.	0	0	100	0	0
Brassica	0	0	100	0	0
Smil ste	0	0	100	0	0
Shep can	0	0	100	0	0
Salix	0	0	100	0	0
Gali bor	0	0	100	0	0
Ranu jel	0	0	100	0	0
Polygonum	0	0	100	0	0
Plan maj	0	0	100	0	0
Equi arv	0	0	100	0	0
Mono nut	0	0	100	0	0

	Transects 6 and 7 - Riparian Zone Overall average dissimilarity = 76.91			Average percent cover	
Taxon	Ave. dissim.	Contrib. %	Cumulative %	Pre-BMP	Post-BMP
Symp occ	9.438	12.27	12.27	20	1.67
Brom ine	9.112	11.85	24.12	19.4	18.3
Frag vir	6.38	8.296	32.42	0.25	11.7
Carex spp.	5.923	7.701	40.12	9	6.67
Salix	5.573	7.247	47.36	0	10
Achi mil	4.588	5.965	53.33	1.5	8.33
Poa pra	4.006	5.208	58.54	8	0
Equi arv	3.066	3.987	62.52	3.38	4.67
Agro rep	2.642	3.435	65.96	3.63	0
Soli can	2.566	3.336	69.29	1.88	3.33
Puccinellia	2.355	3.063	72.36	0	3.33
Agro smi	2.245	2.92	75.28	0	3.33
Thro rho	2.126	2.764	78.04	3.38	0
Rumex spp.	1.972	2.565	80.61	0	2.33
Elae com	1.796	2.336	82.94	0	2.67
Rosa aci	1.55	2.015	84.96	2.75	0.667
Trag dub	1.523	1.981	86.94	0	1.67
Smil ste	1.523	1.98	88.92	3.25	0
Junc bal	1.495	1.943	90.86	1.25	2
Agro cris	1.401	1.821	92.68	1.88	0
Aster spp.	1.117	1.452	94.13	1.75	0.333
Shep can	0.8912	1.159	95.29	1.25	0
Ment arv	0.832	1.082	96.37	0	1.67
Gali bor	0.82	1.066	97.44	1.25	0
Glycorrhiza	0.6093	0.7923	98.23	0	0.667
Phle pra	0.4992	0.6491	98.88	0	1
Pote ans	0.3047	0.3961	99.28	0	0.333
Vici ame	0.202	0.2626	99.54	0.375	0
Arte fri	0.09339	0.1214	99.66	0.125	0
Agro das	0.07914	0.1029	99.76	0.125	0
Arte lud	0.07248	0.09424	99.86	0.125	0
Tera off	0.06273	0.08157	99.94	0.125	0
Cirs arv	0.04585	0.05961	100	0.125	0
Medi lup	0	0	100	0	0
lupin	0	0	100	0	0
Conv arv	0	0	100	0	0
Hord jub	0	0	100	0	0
Agrostis spp.	0	0	100	0	0
Guti sar	0	0	100	0	0

Grin squ	0	0	100	0	0
Stip com	0	0	100	0	0
Sonc asp	0	0	100	0	0
Geum tri	0	0	100	0	0
Brassica	0	0	100	0	0
Smil tri	0	0	100	0	0
Gera vis	0	0	100	0	0
Ranu jel	0	0	100	0	0
Elym tra	0	0	100	0	0
Agro pec	0	0	100	0	0
Polygonum	0	0	100	0	0
Eleo R.	0	0	100	0	0
Plan maj	0	0	100	0	0
Nesl pan	0	0	100	0	0
Trifloium	0	0	100	0	0
Mono nut	0	0	100	0	0
Desc sop	0	0	100	0	0

Transects 6 and 7 - Transition Zone

Overall average dissimilarity = 72.27				Average percent cover	
Taxon	Ave. dissim.	Contrib. %	Cumulative %	Pre-BMP	Post-BMP
Symp occ	15.73	21.77	21.77	11.4	20.2
Brom ine	15.72	21.75	43.52	28.9	19
Poa pra	9.363	12.96	56.48	7.14	9.6
Frag vir	4.159	5.755	62.23	0.714	4.4
Agro smi	3.518	4.868	67.1	0	4
Cirs arv	2.848	3.94	71.04	0.857	3
Agro das	2.625	3.632	74.67	3.14	0
Rosa aci	2.458	3.401	78.07	3.71	0
Rumex spp.	2.066	2.858	80.93	0	2.2
lupin	2.005	2.774	83.71	0	2.4
Achi mil	1.853	2.565	86.27	0.714	2
Aster spp.	1.724	2.385	88.66	2.14	0
Trag dub	1.703	2.356	91.01	0	2
Phle pra	1.404	1.943	92.96	0	1.4
Agrostis spp.	0.9629	1.332	94.29	0	1
Vici ame	0.9337	1.292	95.58	1.29	0.4
Glycorrhiza	0.727	1.006	96.59	0.714	0
Carex spp.	0.5734	0.7934	97.38	0.714	0
Thro rho	0.5703	0.7892	98.17	0.571	0
Agro rep	0.4235	0.5861	98.76	1	0
Equi arv	0.4199	0.581	99.34	1	0

Tera off	0.2048	0.2833	99.62	0.143	0.2
Arte fri	0.155	0.2145	99.83	0.143	0
Smil ste	0.12	0.166	100	0.286	0
Conv arv	0	0	100	0	0
Junc bal	0	0	100	0	0
Hord jub	0	0	100	0	0
Guti sar	0	0	100	0	0
Grin squ	0	0	100	0	0
Medi lup	0	0	100	0	0
Stip com	0	0	100	0	0
Sonc asp	0	0	100	0	0
Soli can	0	0	100	0	0
Geum tri	0	0	100	0	0
Brassica	0	0	100	0	0
Gera vis	0	0	100	0	0
Salix	0	0	100	0	0
Gali bor	0	0	100	0	0
Ranu jel	0	0	100	0	0
Puccinellia	0	0	100	0	0
Elym tra	0	0	100	0	0
Arte lud	0	0	100	0	0
Agro pec	0	0	100	0	0
Shep can	0	0	100	0	0
Pote ans	0	0	100	0	0
Smil tri	0	0	100	0	0
Polygonum	0	0	100	0	0
Eleo R.	0	0	100	0	0
Plan maj	0	0	100	0	0
Elae com	0	0	100	0	0
Nesl pan	0	0	100	0	0
Mono nut	0	0	100	0	0
Ment arv	0	0	100	0	0
Trifloium	0	0	100	0	0
Desc sop	0	0	100	0	0
Agro cris	0	0	100	0	0

Table 5.6A. Percent contribution of each plant species to total dissimilarity (using a Bray-Curtis distance measure) of plots before (2008) and after (2012) BMP implementation at the Pasture site.

	Pasture site transects - Upland Overall average dissimilarity = 75.9			Average percent cover	
Taxon	Ave. dissim.	Contrib. %	Cumulative %	2008	2012
Brom ine	11.99	15.8	15.8	17.2	29.6
Agro smi	9.499	12.52	28.32	21.3	6.42
Poa pra	8.649	11.4	39.71	8.89	23.3
Rosa aci	5.673	7.475	47.19	9.22	14.8
Symp occ	5.565	7.332	54.52	7.44	12.7
Stip vir	3.421	4.507	59.03	7.78	0
Arte fri	2.846	3.749	62.78	2.78	3.92
Koel mac	2.544	3.351	66.13	6.11	0.417
Elae com	2.227	2.935	69.06	0.222	4.92
Medi sat	2.178	2.87	71.93	1.67	2.92
Ante mar	1.675	2.206	74.14	4.44	0
Frag vir	1.655	2.181	76.32	0.667	4.67
Agro das	1.169	1.54	77.86	1.11	1.25
Aste spp	1.106	1.457	79.32	2.33	1.17
Shep can	1.015	1.338	80.66	1.67	0
Soli can	0.9926	1.308	81.96	2.22	0.417
Rume spp	0.9404	1.239	83.2	0.556	2.5
Arte lud	0.8664	1.141	84.34	1.11	1.08
Mona fis	0.8596	1.133	85.48	0	2.92
Equi arv	0.7443	0.9806	86.46	0.111	2.08
Gali spp	0.7351	0.9686	87.43	1.11	0.667
Cirs arv	0.728	0.9591	88.38	0	1.17
Agro rep	0.7105	0.9362	89.32	1.11	0
Chen alb	0.7105	0.9362	90.26	1.11	0
Achi mil	0.645	0.8498	91.11	0	1.92
Gera spp	0.6087	0.802	91.91	0.222	1.67
Vici ame	0.5803	0.7646	92.67	0.111	1.67
Spha coc	0.5043	0.6645	93.34	0.778	0.417
Agro tra	0.448	0.5902	93.93	0	0.833
Coma umb	0.4463	0.588	94.52	0	0.833
Erig gla	0.4295	0.5659	95.08	0	0.917
Ther rho	0.3874	0.5105	95.59	0.333	0.75
Glyc lep	0.342	0.4506	96.04	0	0.917
Amel aln	0.3237	0.4265	96.47	0.778	0
Junc spp	0.3166	0.4171	96.89	0	1
Pote spp	0.2783	0.3667	97.25	0.556	0.0833

Guti sar	0.2708	0.3568	97.61	0.444	0
Linu usi	0.2524	0.3326	97.94	0	0.583
Lith rud	0.2375	0.3129	98.26	0.556	0
Phlo hoo	0.2231	0.294	98.55	0	0.417
Smil spp	0.1892	0.2493	98.8	0.111	0.25
Oeno bie	0.1769	0.2331	99.03	0	0.25
Bras kab	0.1641	0.2162	99.25	0	0.25
Grin squ	0.1641	0.2162	99.46	0	0.25
Moss	0.1267	0.167	99.63	0.111	0.25
Tara off	0.1197	0.1577	99.79	0.222	0.0833
Heli pet	0.05897	0.07769	99.87	0	0.0833
Anem spp	0.05053	0.06658	99.93	0	0.167
Cast lut	0.05053	0.06658	100	0	0.167
Prun vir	0	0	100	0	0
Popu bal	0	0	100	0	0
Poly spp	0	0	100	0	0
Plan maj	0	0	100	0	0
Eleo aci	0	0	100	0	0
Bess wyo	0	0	100	0	0
Phle pra	0	0	100	0	0
Phal aru	0	0	100	0	0
Mushroom	0	0	100	0	0
Echi cru	0	0	100	0	0
Desc sop	0	0	100	0	0
Ment arv	0	0	100	0	0
Ranu spp	0	0	100	0	0
Medi lup	0	0	100	0	0
Dact glo	0	0	100	0	0
Conv arv	0	0	100	0	0
Lith inc	0	0	100	0	0
Viol adu	0	0	100	0	0
Lilly	0	0	100	0	0
Trag club	0	0	100	0	0
Lact ser	0	0	100	0	0
Thal ven	0	0	100	0	0
Ante pat	0	0	100	0	0
Stac pal	0	0	100	0	0
Spar spp	0	0	100	0	0
Sonc asp	0	0	100	0	0
Sonc arv	0	0	100	0	0
Solo ste	0	0	100	0	0
Guen spp	0	0	100	0	0
Carrot	0	0	100	0	0

Sisy mon	0	0	100	0	0
Scir spp	0	0	100	0	0
Sali spp	0	0	100	0	0
Geum spp.	0	0	100	0	0
Care spp	0	0	100	0	0
Trif spp	0	0	100	0	0
Urti dio	0	0	100	0	0
Rosemary	0	0	100	0	0
Rati col	0	0	100	0	0
Ante apr	0	0	100	0	0

Pasture site transects - Transition Overall average dissimilarity = 67.07				Average percent cover	
Taxon	Ave. dissim.	Contrib. %	Cumulative %	2008	2012
Brom ine	10.78	16.07	16.07	22.4	26
Poa pra	9.972	14.87	30.94	6.82	27.9
Rosa aci	9.682	14.44	45.37	24.6	25.5
Symp occ	8.652	12.9	58.27	18	24.6
Agro rep	4.116	6.136	64.41	9.76	1.04
Agro smi	2.669	3.98	68.39	2.84	4.36
Elae com	2.643	3.94	72.33	0.257	6.03
Soli can	2.491	3.714	76.04	3.05	4.39
Sali spp	2.074	3.093	79.13	2.65	3.04
Rume spp	1.26	1.878	81.01	0.199	3.1
Shep can	1.037	1.545	82.56	2.75	0
Stip vir	0.9394	1.401	83.96	2.61	0
Frag vir	0.845	1.26	85.22	0.485	2.12
Cirs arv	0.737	1.099	86.32	0.625	1.09
Glyc lep	0.6595	0.9833	87.3	0.265	1.44
Care spp	0.6231	0.929	88.23	0.588	1.18
Medi sat	0.5754	0.8578	89.09	0.412	0.675
Pote spp	0.5746	0.8566	89.94	0.941	0.508
Dact glo	0.5026	0.7493	90.69	0.956	0
Tara off	0.4752	0.7085	91.4	0.551	0.767
Equi arv	0.4694	0.6999	92.1	0.162	1.32
Achi mil	0.4155	0.6195	92.72	0.485	0.567
Phle pra	0.4116	0.6137	93.33	0	1.1
Aste spp	0.3901	0.5816	93.91	0.654	0.433
Arte lud	0.3655	0.5449	94.46	0.0956	1.05
Vici ame	0.3314	0.4942	94.95	0.14	0.733
Smil spp	0.3244	0.4837	95.44	0.184	0.642
Gera spp	0.2989	0.4457	95.88	0.169	0.667
Gali spp	0.2419	0.3607	96.24	0.14	0.583
Agro das	0.2018	0.3008	96.54	0.294	0.15

Mona fis	0.192	0.2862	96.83	0	0.6
Arte fri	0.1765	0.2631	97.09	0.309	0.0667
Erig gla	0.1676	0.2499	97.34	0.00735	0.367
Eleo aci	0.134	0.1998	97.54	0.184	0
Poly spp	0.1296	0.1932	97.74	0	0.25
Junc spp	0.1218	0.1816	97.92	0.118	0.183
Moss	0.1145	0.1707	98.09	0.0368	0.292
Lith rud	0.1112	0.1657	98.26	0	0.292
Spar spp	0.09769	0.1456	98.4	0.294	0
Sonc asp	0.09603	0.1432	98.54	0	0.125
Echi cru	0.09498	0.1416	98.69	0.221	0
Amel aln	0.09297	0.1386	98.82	0.0368	0.292
Urti dio	0.08759	0.1306	98.95	0.199	0
Popu bal	0.06268	0.09344	99.05	0	0.167
Ther rho	0.05102	0.07607	99.12	0.0735	0.0417
Sonc arv	0.04264	0.06358	99.19	0	0.0333
Solo ste	0.04153	0.06192	99.25	0.11	0
Linu usi	0.03659	0.05455	99.3	0	0.0583
Ment arv	0.0358	0.05337	99.36	0.0294	0.0667
Conv arv	0.03458	0.05156	99.41	0.0735	0.0167
Ante apr	0.03425	0.05106	99.46	0.0735	0
Spha coc	0.03415	0.05091	99.51	0.0515	0.0167
Lilly	0.0324	0.04831	99.56	0.0956	0
Prun vir	0.02947	0.04393	99.6	0.0735	0
Grin squ	0.02734	0.04075	99.64	0	0.05
Bess wyo	0.02709	0.04039	99.68	0.0662	0
Agro tra	0.01826	0.02723	99.71	0	0.0417
Trif spp	0.01825	0.02721	99.74	0.0147	0.0333
Heli pet	0.01785	0.02661	99.77	0	0.0333
Stac pal	0.01671	0.02491	99.79	0	0.0333
Bras kab	0.01502	0.02239	99.81	0	0.025
Rati col	0.0148	0.02207	99.83	0.0294	0
Phal aru	0.01328	0.0198	99.85	0	0.0417
Viol adu	0.01183	0.01763	99.87	0.0221	0
Rosemary	0.009384	0.01399	99.89	0.0221	0
Lith inc	0.009116	0.01359	99.9	0.0221	0
Ante pat	0.009035	0.01347	99.91	0.0221	0
Medi lup	0.007122	0.01062	99.92	0	0.00833
Sisy mon	0.007122	0.01062	99.93	0	0.00833
Plan maj	0.006362	0.009485	99.94	0.0147	0
Mushroom	0.006098	0.009092	99.95	0.0147	0
Oeno bie	0.005778	0.008614	99.96	0	0.00833
Carrot	0.004561	0.0068	99.97	0	0.00833

Lact ser	0.003632	0.005415	99.97	0.00735	0
Anem spp	0.003479	0.005186	99.98	0.00735	0
Phlo hoo	0.003407	0.00508	99.98	0.00735	0
Desc sop	0.003181	0.004743	99.99	0.00735	0
Geum spp.	0.003012	0.00449	99.99	0.00735	0
Coma umb	0.002149	0.003204	100	0.00735	0
Trag club	0.002149	0.003204	100	0.00735	0
Ranu spp	0	0	100	0	0
Thal ven	0	0	100	0	0
Koel mac	0	0	100	0	0
Chen alb	0	0	100	0	0
Cast lut	0	0	100	0	0
Guti sar	0	0	100	0	0
Guen spp	0	0	100	0	0
Ante mar	0	0	100	0	0
Scir spp	0	0	100	0	0

Pasture site transects - Riparian Overall average dissimilarity = 82.71				Average percent cover	
Taxon	Ave. dissim.	Contrib. %	Cumulative %	2008	2012
Sali spp	10.53	12.73	12.73	16.5	15.3
Brom ine	9.443	11.42	24.15	6.02	18.1
Care spp	8.931	10.8	34.95	13	9.96
Poa pra	8.884	10.74	45.69	1.2	20.1
Rosa aci	8.687	10.5	56.19	9.57	14.7
Symp occ	8.019	9.695	65.89	6.57	14.9
Agro rep	5.773	6.98	72.87	12.7	2.72
Rume spp	2.458	2.972	75.84	1.87	3.83
Junc spp	2.2	2.66	78.5	0.5	3.52
Pote spp	2.141	2.589	81.09	1.89	3.13
Poly spp	1.771	2.141	83.23	0	3.09
Soli can	1.352	1.635	84.86	0.907	2.63
Eleo aci	0.9906	1.198	86.06	1.39	0
Equi arv	0.9453	1.143	87.2	0.315	1.72
Ment arv	0.9432	1.14	88.34	0.611	1.39
Glyc lep	0.8917	1.078	89.42	0.037	1.78
Agro smi	0.882	1.066	90.49	0.556	0.889
Dact glo	0.8218	0.9935	91.48	1.26	0
Elae com	0.6579	0.7954	92.28	0.0926	1.24
Scir spp	0.6544	0.7912	93.07	0.556	0.37
Cirs arv	0.5483	0.6629	93.73	0.222	0.926
Phle pra	0.5353	0.6472	94.38	0	1.3
Echi cru	0.5204	0.6292	95.01	0.741	0
Tara off	0.4941	0.5974	95.6	0.407	0.685

Agro das	0.356	0.4304	96.03	0.648	0.148
Smil spp	0.3178	0.3842	96.42	0	0.685
Carrot	0.2009	0.2428	96.66	0	0.278
Plan maj	0.1841	0.2225	96.88	0.148	0.167
Aste spp	0.1802	0.2179	97.1	0	0.278
Stac pal	0.1711	0.2069	97.31	0	0.407
Frag vir	0.1666	0.2014	97.51	0.148	0.259
Ther rho	0.1647	0.1991	97.71	0.185	0.0926
Phal aru	0.1625	0.1964	97.91	0	0.222
Mona fis	0.1579	0.1909	98.1	0	0.407
Arte lud	0.1575	0.1904	98.29	0	0.463
Vici ame	0.1563	0.1889	98.48	0.0185	0.222
Bess wyo	0.1538	0.186	98.66	0.222	0
Koel mac	0.1478	0.1787	98.84	0.185	0
Trif spp	0.1114	0.1347	98.98	0.037	0.13
Arte fri	0.09877	0.1194	99.1	0	0.222
Desc sop	0.09484	0.1147	99.21	0.0926	0
Sonc asp	0.08668	0.1048	99.31	0.0185	0.0556
Ranu spp	0.0755	0.09128	99.41	0	0.167
Guen spp	0.0754	0.09116	99.5	0.0926	0
Medi sat	0.07298	0.08823	99.59	0	0.0556
Gera spp	0.07229	0.0874	99.67	0	0.167
Gali spp	0.05839	0.07059	99.74	0	0.13
Shep can	0.05625	0.06801	99.81	0.13	0
Conv arv	0.0389	0.04703	99.86	0	0.0926
Bras kab	0.03655	0.04418	99.9	0	0.0556
Achi mil	0.03211	0.03882	99.94	0	0.0556
Erig gla	0.01917	0.02318	99.96	0	0.0556
Thal ven	0.01312	0.01586	99.98	0.0185	0
Lact ser	0.008471	0.01024	99.99	0.0185	0
Lilly	0.007818	0.009452	100	0.0185	0
Prun vir	0	0	100	0	0
Popu bal	0	0	100	0	0
Phlo hoo	0	0	100	0	0
Anem spp	0	0	100	0	0
Oeno bie	0	0	100	0	0
Mushroom	0	0	100	0	0
Moss	0	0	100	0	0
Medi lup	0	0	100	0	0
Amel aln	0	0	100	0	0
Lith rud	0	0	100	0	0
Lith inc	0	0	100	0	0
Viol adu	0	0	100	0	0

Linu usi	0	0	100	0	0
Coma umb	0	0	100	0	0
Urti dio	0	0	100	0	0
Trag club	0	0	100	0	0
Stip vir	0	0	100	0	0
Chen alb	0	0	100	0	0
Ante pat	0	0	100	0	0
Agro tra	0	0	100	0	0
Spha coc	0	0	100	0	0
Heli pet	0	0	100	0	0
Spar spp	0	0	100	0	0
Grin squ	0	0	100	0	0
Cast lut	0	0	100	0	0
Sonc arv	0	0	100	0	0
Solo ste	0	0	100	0	0
Guti sar	0	0	100	0	0
Ante mar	0	0	100	0	0
Sisy mon	0	0	100	0	0
Geum spp.	0	0	100	0	0
Rosemary	0	0	100	0	0
Rati col	0	0	100	0	0
Ante apr	0	0	100	0	0

Table 5.7A. Percent contribution of each plant species to total dissimilarity (using a Bray-Curtis distance measure) of plots before (2008) and after (2012) BMP implementation at the Wintering site.

	Wintering site transects - Upland Overall average dissimilarity = 66.11			Average percent cover	
Taxon	Ave. dissim.	Contrib. %	Cumulative %	2008	2012
Poa pra	14.45	21.86	21.86	30.1	54.2
Symp occ	8.632	13.06	34.91	12.1	29.2
Agro smi	7.919	11.98	46.89	16.9	13.8
Brom ine	6.461	9.772	56.66	7.81	15
Agro das	3.375	5.104	61.77	5.88	4.5
Rosa aci	2.856	4.321	66.09	3.63	5.33
Tara off	2.437	3.686	69.77	5.25	3.83
Achi mil	2.365	3.577	73.35	0.938	6.67
Cirs arv	2.213	3.347	76.7	0.125	4.83
Aste spp	1.851	2.8	79.5	1.56	3.5
Agro rep	1.412	2.136	81.63	3.13	0.5
Stel med	1.28	1.935	83.57	0.188	3.33
Moss	1.164	1.761	85.33	0.938	2.5
Nest pan	1.136	1.719	87.05	2.94	0
Arte fri	1.118	1.691	88.74	1.69	2
Guti sar	0.87	1.316	90.06	2.19	0
Care spp	0.6472	0.9789	91.03	1.63	0
Phlo hoo	0.6032	0.9124	91.95	0	1.67
Soli can	0.5718	0.8649	92.81	0.5	1.17
Trif spp	0.4303	0.6508	93.46	0	1.17
Brom rip	0.3868	0.585	94.05	0	0.833
Agro tra	0.3868	0.585	94.63	0	0.833
Elae com	0.371	0.5611	95.19	0.25	0.833
Eleo spp	0.3543	0.5359	95.73	0.938	0
Gali spp	0.3239	0.49	96.22	0.0625	0.833
Linu usi	0.3016	0.4562	96.68	0	0.833
Fest spp	0.3016	0.4562	97.13	0	0.833
Trag dub	0.2564	0.3878	97.52	0.125	0.667
Koel mac	0.2438	0.3687	97.89	0.625	0
Lina vul	0.2014	0.3046	98.19	0.5	0
Grin squ	0.1962	0.2968	98.49	0	0.5
Medi sat	0.129	0.1951	98.69	0.313	0
Ther rho	0.129	0.1951	98.88	0.313	0
Erig gla	0.1206	0.1825	99.06	0	0.333
Frag vir	0.1026	0.1551	99.22	0.25	0

Spha coc	0.08061	0.1219	99.34	0.0625	0.167
Vici ame	0.07736	0.117	99.46	0	0.167
Thla arv	0.07736	0.117	99.57	0	0.167
Gera spp	0.06032	0.09124	99.66	0	0.167
Phlo rho	0.05033	0.07612	99.74	0.125	0
Ranu spp	0.05033	0.07612	99.82	0.125	0
Chen alb	0.04724	0.07145	99.89	0.125	0
Areu can	0.02516	0.03806	99.93	0.0625	0
Anem spp	0.02516	0.03806	99.96	0.0625	0
Rume spp	0.02335	0.03532	100	0.0625	0
Plan pat	0	0	100	0	0
Plan maj	0	0	100	0	0
Echi spp	0	0	100	0	0
Drya spp	0	0	100	0	0
Ascl spp	0	0	100	0	0
Amar ret	0	0	100	0	0
Mona fis	0	0	100	0	0
Desc sop	0	0	100	0	0
Ment arv	0	0	100	0	0
Dact glo	0	0	100	0	0
Oeno spe	0	0	100	0	0
Phal aru	0	0	100	0	0
Phle pra	0	0	100	0	0
Arte lud	0	0	100	0	0
Medi lup	0	0	100	0	0
Lupi spp	0	0	100	0	0
Cyno vir	0	0	100	0	0
Coma umb	0	0	100	0	0
Agro pec	0	0	100	0	0
Lath spp	0	0	100	0	0
Cirs und	0	0	100	0	0
Junc spp	0	0	100	0	0
Hord jub	0	0	100	0	0
Hesp com	0	0	100	0	0
Hack flo	0	0	100	0	0
Symp alb	0	0	100	0	0
Carrot	0	0	100	0	0
Ante spp	0	0	100	0	0
Stel smi	0	0	100	0	0
Glyc lep	0	0	100	0	0
Sonc arv	0	0	100	0	0
Son ch	0	0	100	0	0
Smil spp	0	0	100	0	0

Scir spp	0	0	100	0	0
Caps bur	0	0	100	0	0
Anle mic	0	0	100	0	0
Sali exi	0	0	100	0	0
Pote gra	0	0	100	0	0
Pote ans	0	0	100	0	0
Equi spp	0	0	100	0	0
Urti dio	0	0	100	0	0
Poly spp	0	0	100	0	0
Ely corn	0	0	100	0	0

	Wintering site transects - Transition Overall average dissimilarity = 63.43			Average percent cover	
Taxon	Ave. dissim.	Contrib. %	Cumulative %	2008	2012
Brom ine	12.55	19.78	19.78	30.6	38.1
Poa pra	11.48	18.1	37.88	11.2	32.7
Symp occ	10.66	16.8	54.68	26.5	29.8
Rosa aci	4.747	7.483	62.16	10.9	8.8
Agro smi	3.086	4.866	67.03	4.58	4.31
Agro rep	2.917	4.599	71.63	7.57	0.302
Tara off	2.517	3.968	75.6	3.61	4.91
Agro das	1.913	3.015	78.61	4.34	0.632
Cirs arv	1.53	2.411	81.02	1.29	2.65
Phle pra	1.089	1.716	82.74	0	2.86
Achi mil	0.9558	1.507	84.25	1.04	1.87
Frag vir	0.7492	1.181	85.43	0.561	1.55
Aste spp	0.7189	1.133	86.56	1.03	0.991
Rume spp	0.693	1.092	87.65	0.252	1.57
Soli can	0.6011	0.9476	88.6	0.841	0.802
Sali exi	0.5824	0.918	89.52	0.234	1.21
Trif spp	0.38	0.599	90.12	0.0467	0.868
Glyc lep	0.3799	0.5988	90.72	0.206	0.764
Eleo spp	0.3738	0.5893	91.31	1.1	0
Elae com	0.3648	0.575	91.88	0.168	0.774
Koel mac	0.3195	0.5036	92.39	0.187	0.566
Ther rho	0.3001	0.4731	92.86	0.327	0.415
Gali spp	0.2837	0.4473	93.31	0.0841	0.67
Vici ame	0.2828	0.4458	93.75	0.215	0.585
Symp alb	0.282	0.4445	94.2	0.659	0
Equi spp	0.2656	0.4187	94.61	0.196	0.472
Erig gla	0.2654	0.4184	95.03	0.234	0.311
Thla arv	0.2612	0.4118	95.44	0.439	0.132
Phal aru	0.2003	0.3158	95.76	0	0.538
Medi sat	0.2	0.3152	96.08	0.29	0.217

Fest spp	0.1975	0.3114	96.39	0	0.443
Arte fri	0.1674	0.2639	96.65	0.215	0.179
Stel med	0.1501	0.2367	96.89	0.243	0.142
Poly spp	0.1163	0.1834	97.07	0.028	0.217
Linu usi	0.1113	0.1755	97.25	0	0.264
Hord jub	0.1076	0.1697	97.42	0	0.208
Mona fis	0.1037	0.1635	97.58	0	0.292
Amar ret	0.09381	0.1479	97.73	0	0.16
Trag dub	0.08614	0.1358	97.86	0.0374	0.179
Nest pan	0.0847	0.1335	98	0.187	0
Lath spp	0.07919	0.1248	98.12	0	0.198
Plan maj	0.07434	0.1172	98.24	0.00935	0.113
Dact glo	0.07234	0.114	98.35	0	0.189
Lina vul	0.05847	0.09217	98.45	0.14	0
Agro tra	0.05628	0.08873	98.53	0	0.132
Oeno spe	0.05514	0.08692	98.62	0	0.0943
Pote ans	0.05498	0.08667	98.71	0.0187	0.113
Moss	0.05462	0.08611	98.79	0.0187	0.151
Stel smi	0.0527	0.08308	98.88	0.121	0
Care spp	0.05032	0.07933	98.96	0.0561	0.0472
Sonc arv	0.05014	0.07904	99.04	0.0467	0.066
Brom rip	0.04562	0.07192	99.11	0	0.0943
Junc spp	0.04532	0.07145	99.18	0.0467	0.0943
Arte lud	0.04394	0.06927	99.25	0.0841	0
Echi spp	0.04253	0.06704	99.31	0	0.113
Carrot	0.04114	0.06486	99.38	0	0.0755
Ante spp	0.04017	0.06332	99.44	0	0.0943
Gera spp	0.03403	0.05365	99.5	0.00935	0.0849
Chen alb	0.02971	0.04684	99.54	0.0467	0.0189
Smil spp	0.02696	0.0425	99.59	0.0374	0.0283
Guti sar	0.02688	0.04237	99.63	0.0561	0
Spha coc	0.02559	0.04034	99.67	0.0561	0
Agro pec	0.02421	0.03816	99.71	0	0.0472
Coma umb	0.02334	0.0368	99.74	0	0.0566
Ment arv	0.02308	0.03639	99.78	0	0.0472
Pote gra	0.01959	0.03088	99.81	0.0467	0
Son ch	0.01926	0.03035	99.84	0.0467	0
Hesp com	0.0155	0.02444	99.87	0	0.0377
Caps bur	0.01283	0.02023	99.89	0	0.0283
Desc sop	0.01221	0.01925	99.91	0.00935	0.0189
Cirs und	0.01191	0.01877	99.92	0.028	0
Grin squ	0.01099	0.01733	99.94	0	0.0283
Anem spp	0.01067	0.01682	99.96	0.00935	0.0189

Medi lup	0.008091	0.01276	99.97	0	0.0189
Drya spp	0.006632	0.01046	99.98	0	0.0189
Cyno vir	0.004615	0.007275	99.99	0	0.00943
Anle mic	0.004113	0.006484	100	0.00935	0
Lupi spp	0.003114	0.004909	100	0	0.00943
Plan pat	0	0	100	0	0
Phlo rho	0	0	100	0	0
Phlo hoo	0	0	100	0	0
Ascl spp	0	0	100	0	0
Areu can	0	0	100	0	0
Urti dio	0	0	100	0	0
Hack flo	0	0	100	0	0
Scir spp	0	0	100	0	0
Ranu spp	0	0	100	0	0
Ely corn	0	0	100	0	0

	Wintering site transects - Riparian Overall average dissimilarity = 82.29			Average percent cover	
Taxon	Ave. dissim.	Contrib. %	Cumulative %	2008	2012
Brom ine	17.49	21.25	21.25	12.5	30.1
Poa pra	11.82	14.36	35.61	2.33	23.6
Symp occ	10.73	13.03	48.65	8.57	17.2
Care spp	8.758	10.64	59.29	4.87	14.4
Sali exi	5.386	6.545	65.83	7.57	3.56
Rosa aci	4.657	5.659	71.49	3.4	6.44
Equi spp	2.987	3.63	75.12	0.633	5.35
Rume spp	2.715	3.3	78.42	0.567	5.03
Phle pra	2.198	2.671	81.09	0	3.91
Tara off	1.552	1.886	82.98	1.07	2.56
Pote ans	1.245	1.513	84.49	0.333	2.26
Soli can	1.19	1.446	85.94	0.0667	2.15
Agro das	0.9421	1.145	87.08	1.5	0.294
Ment arv	0.8901	1.082	88.17	0.0667	1.44
Agro rep	0.8768	1.065	89.23	1.37	0
Scir spp	0.8517	1.035	90.27	0.333	1.62
Moss	0.8351	1.015	91.28	0	1.76
Poly spp	0.8021	0.9747	92.26	0	1.15
Mona fis	0.6915	0.8403	93.1	0.7	0.559
Elae com	0.6644	0.8074	93.9	0	1.32
Cirs arv	0.5584	0.6785	94.58	0.267	0.676
Plan maj	0.4617	0.561	95.14	0.0333	0.647
Junc spp	0.4589	0.5576	95.7	0	0.912
Eleo spp	0.3958	0.4809	96.18	0.667	0
Frag vir	0.3622	0.4402	96.62	0.167	0.618

Agro smi	0.3121	0.3792	97	0	0.529
Glyc lep	0.2823	0.3431	97.34	0	0.5
Aste spp	0.2798	0.34	97.68	0.133	0.412
Thla arv	0.2521	0.3064	97.99	0	0.324
Trif spp	0.2377	0.2889	98.28	0.0333	0.353
Ranu spp	0.1929	0.2344	98.51	0.0333	0.412
Medi sat	0.1498	0.1821	98.7	0	0.324
Oeno spe	0.1339	0.1628	98.86	0	0.118
Achi mil	0.1271	0.1545	99.01	0.1	0.176
Plan pat	0.1119	0.136	99.15	0.167	0
Agro tra	0.1018	0.1237	99.27	0	0.147
Sonc arv	0.06002	0.07294	99.35	0	0.0882
Grin squ	0.05313	0.06457	99.41	0	0.0588
Chen alb	0.04644	0.05643	99.47	0	0.0588
Phal aru	0.04622	0.05616	99.52	0	0.0882
Brom rip	0.04572	0.05556	99.58	0	0.0882
Caps bur	0.0441	0.05359	99.63	0	0.0588
Ely corn	0.0435	0.05286	99.68	0.0667	0
Carrot	0.04224	0.05133	99.74	0	0.0588
Desc sop	0.0387	0.04703	99.78	0.0333	0.0294
Vici ame	0.0344	0.0418	99.82	0	0.0588
Echi spp	0.02986	0.03629	99.86	0	0.0588
Smil spp	0.02692	0.03272	99.89	0	0.0588
Ascl spp	0.02112	0.02566	99.92	0	0.0294
Hack flo	0.01899	0.02308	99.94	0	0.0294
Urti dio	0.01766	0.02146	99.96	0.0333	0
Anem spp	0.01605	0.01951	99.98	0.0333	0
Erig gla	0.01346	0.01636	100	0	0.0294
Phlo rho	0	0	100	0	0
Phlo hoo	0	0	100	0	0
Nest pan	0	0	100	0	0
Drya spp	0	0	100	0	0
Amar ret	0	0	100	0	0
Dact glo	0	0	100	0	0
Arte lud	0	0	100	0	0
Medi lup	0	0	100	0	0
Lupi spp	0	0	100	0	0
Cyno vir	0	0	100	0	0
Linu usi	0	0	100	0	0
Lina vul	0	0	100	0	0
Coma umb	0	0	100	0	0
Arte fri	0	0	100	0	0
Agro pec	0	0	100	0	0

Lath spp	0	0	100	0	0
Koel mac	0	0	100	0	0
Cirs und	0	0	100	0	0
Hord jub	0	0	100	0	0
Areu can	0	0	100	0	0
Hesp com	0	0	100	0	0
Trag dub	0	0	100	0	0
Ther rho	0	0	100	0	0
Guti sar	0	0	100	0	0
Symp alb	0	0	100	0	0
Ante spp	0	0	100	0	0
Stel smi	0	0	100	0	0
Stel med	0	0	100	0	0
Spha coc	0	0	100	0	0
Gera spp	0	0	100	0	0
Son ch	0	0	100	0	0
Gali spp	0	0	100	0	0
Anle mic	0	0	100	0	0
Fest spp	0	0	100	0	0
Pote gra	0	0	100	0	0

5.4A. Type 3 tests of fixed effects (year, zone) in the analysis of species richness (SR), effective diversity (ED), and evenness (E) at the Impoundment, Pasture, and Wintering sites.

Table 5.8A. Type 3 tests of fixed effects (year, zone) in the analysis of species richness (SR), effective diversity (ED), and evenness (E) at the Impoundment site.

Effect	Numerator df	Denominator df	F value	*P* value
		Transects 1 to 5 - SR[z]		
Zone	1	89	0.45	0.5024
Year	1	89	40.8	<0.0001
		Transects 1 to 5 - ED[z]		
Zone	1	89	0.18	0.6709
Year	1	89	15.3	0.0002
		Transects 1 to 5 - E		
Zone	1	89	0.03	0.8534
Year	1	89	12.3	0.0007
		Transects 6 and 7 - SR		
Zone	1	20	5.1	0.0352
Year	1	20	0.43	0.5205
		Transects 6 and 7 - ED		
Zone	1	20	6.57	0.0186
Year	1	20	2.72	0.1149
		Transects 6 and 7 - E		
Zone	1	20	0.23	0.6391
Year	1	20	1.05	0.3177

[z] Generalized linear model (with a Poisson error distribution and log link function) used rather than a general linear model.

Table 5.9A. Type 3 tests of fixed effects (year, zone) in the analysis of species richness (SR), effective diversity (ED), and evenness (E) at the Pasture site.

Effect	Num df	Den df	F Value	P Value
		SR[z]		
Zone	2	379	11.9	<0.0001
Year	1	379	78.9	<0.0001
Zone×Year	2	379	10.1	<0.0001
		ED		
Zone	2	379	8.92	0.0002
Year	1	379	76.9	<0.0001
Zone×Year	2	379	7.81	0.0005
		E[z]		
Zone	2	381	0.09	0.914
Year	1	381	0.43	0.513

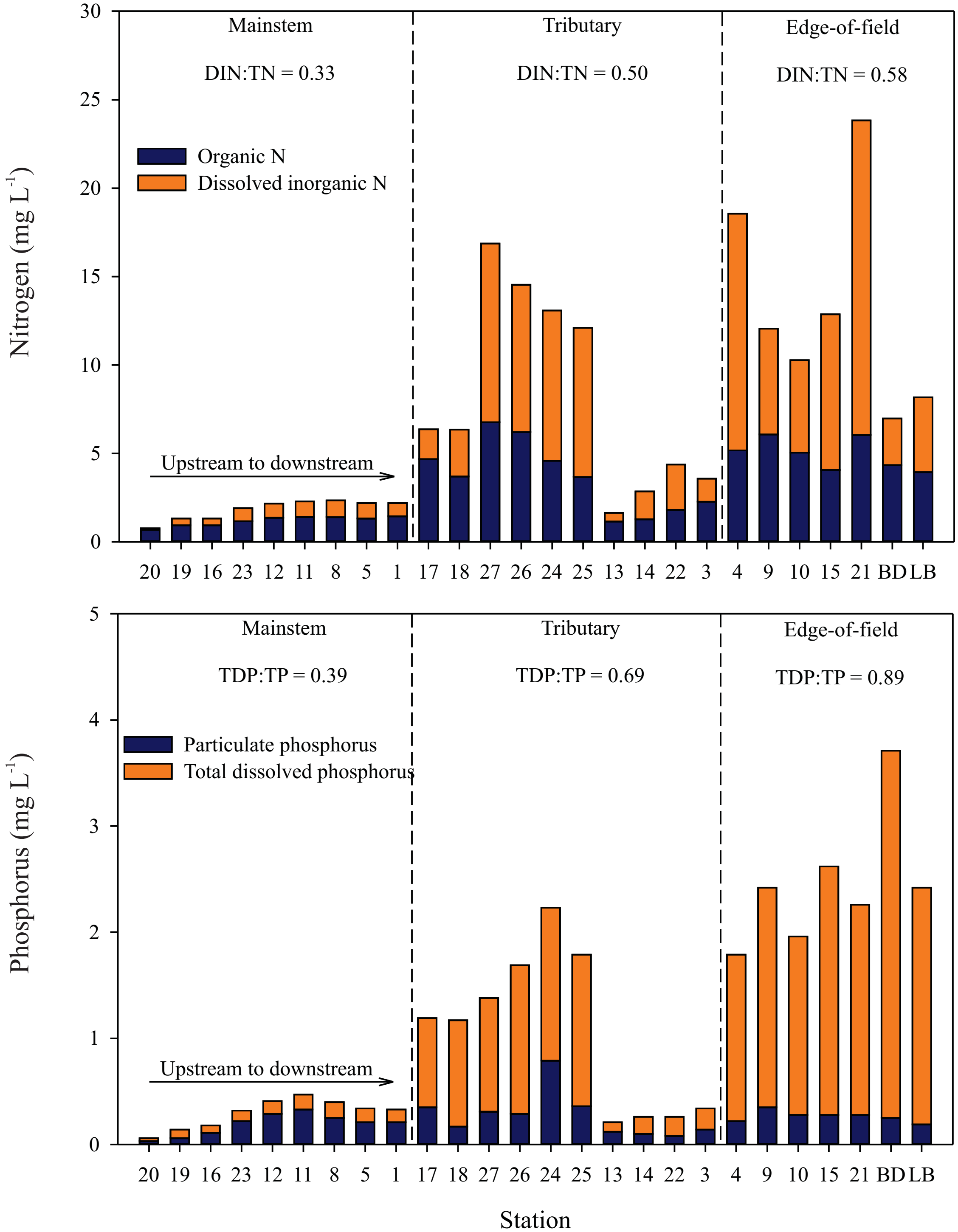
[z] Generalized linear model (with a poisson error distribution and log link function) used rather than a general linear model

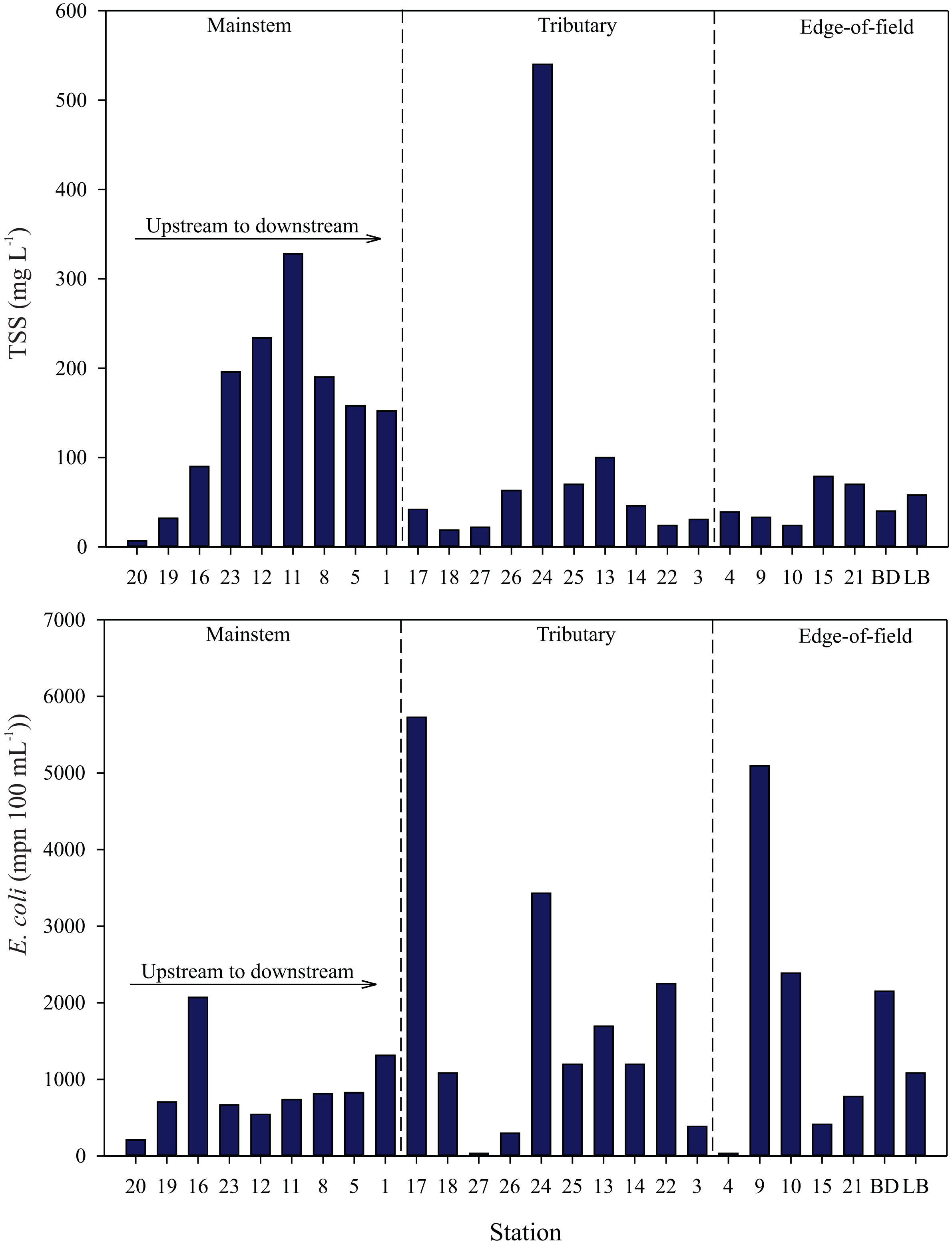
Table 5.10A. Type 3 tests of fixed effects (year, zone) in the analysis of species richness (SR), effective diversity (ED), and evenness (E) at the Wintering site.

Effect	Num DF	Den DF	F Value	*P* Value
		SR[z]		
Zone	2	293	12.4	<0.0001
Year	1	293	86.7	<0.0001
Zone × Year	2	293	5.64	0.004
		ED[z]		
Zone	2	295	1.11	0.331
Year	1	295	55.4	<0.0001
		E		
Zone	2	295	15.5	<0.0001
Year	1	295	22.2	<0.0001

[z] Generalized linear model (with a Poisson error distribution and log link function) used rather than a general linear model.

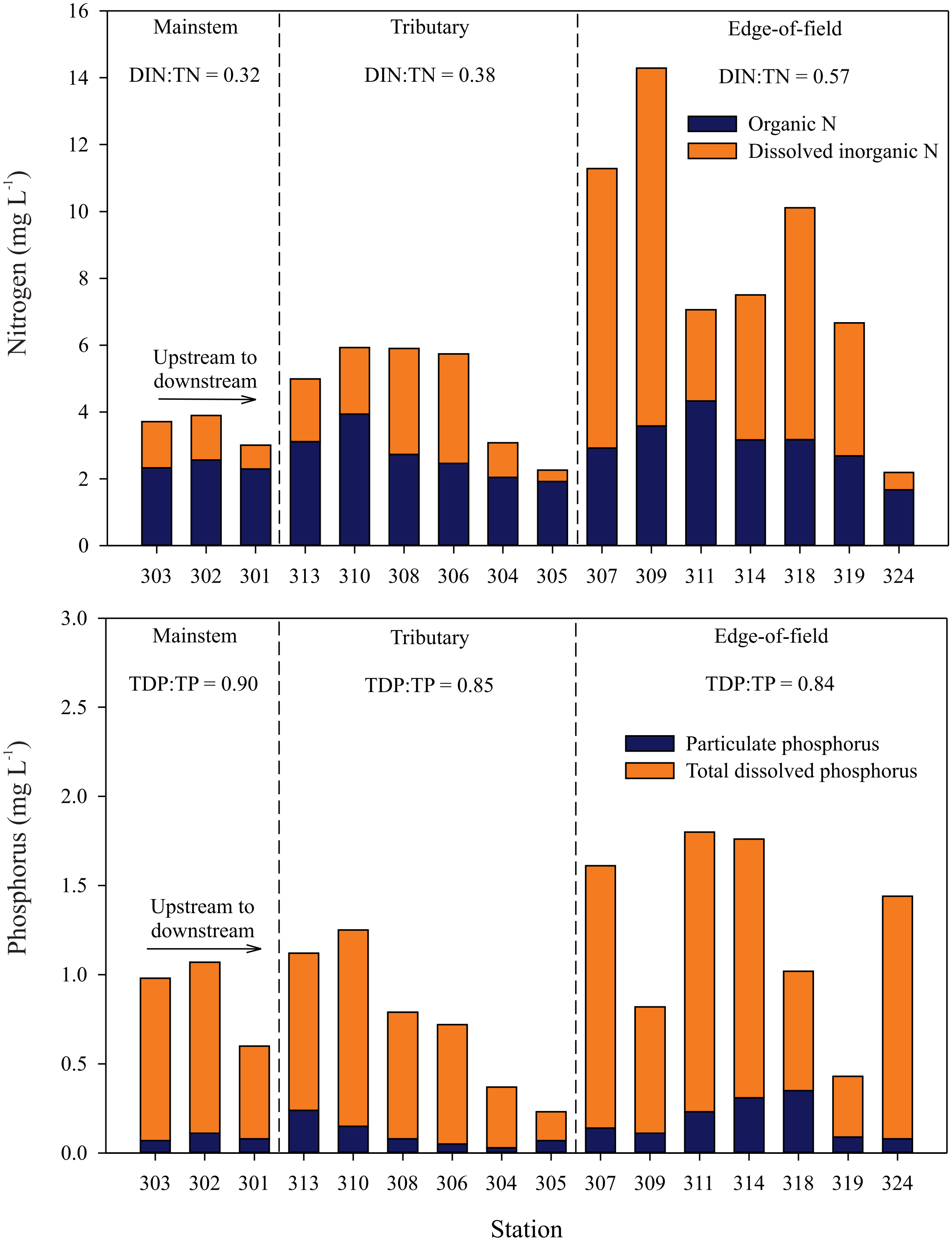
Appendix 6. Average concentration of nitrogen, phosphorus, total suspended solids (TSS), and *Escherichia coli* (*E. coli*) measured at monitoring stations in Indianfarm Creek Watershed and at the Battersea Drain Field (BD) and Lower Little Bow Field (LB).

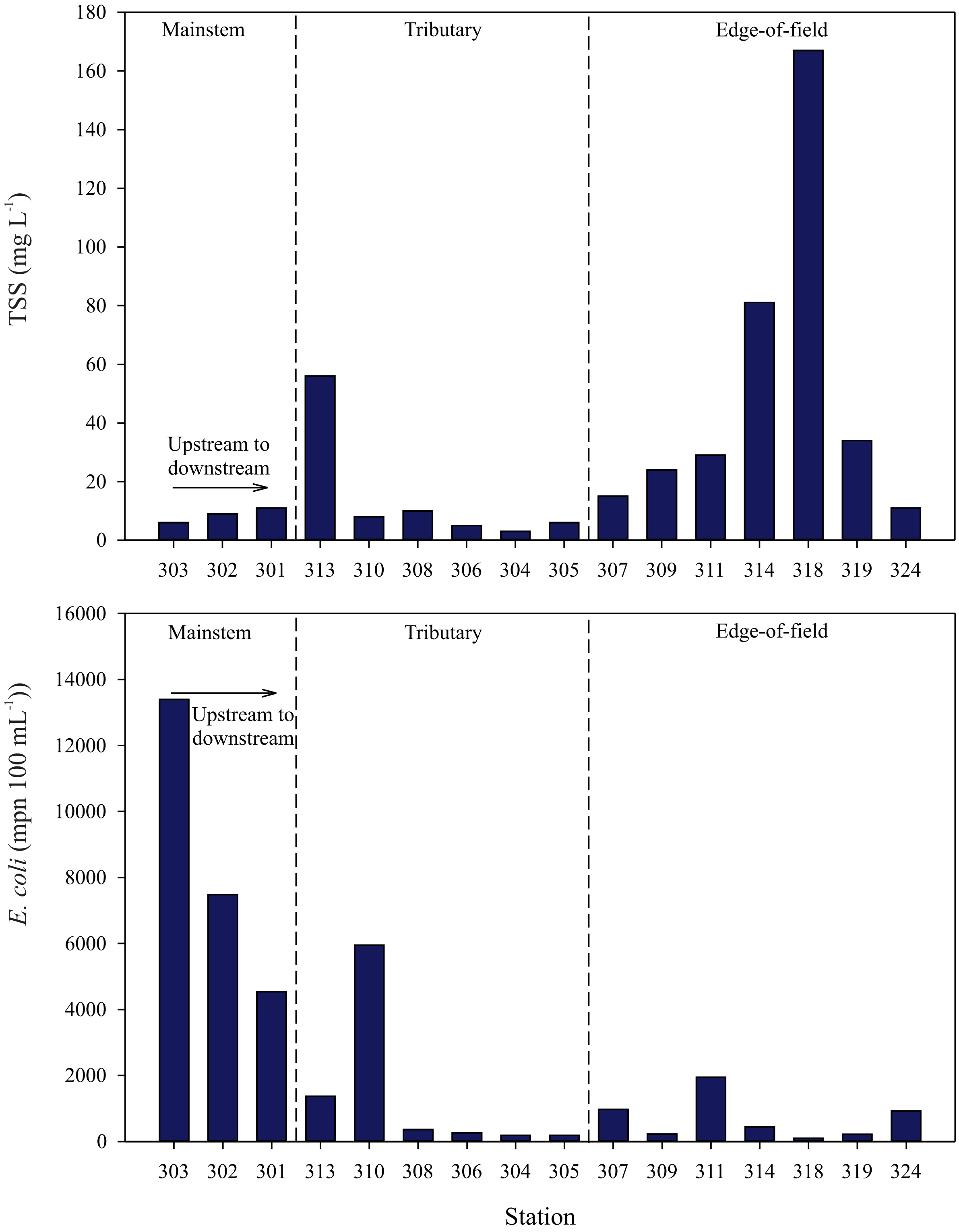




TSS (mg L-1)
600
500
400
300
200
100
0
Mainstem
Tributary
Edge-of-field
Upstream to downstream
20 19 16 23 12 11 8 5 1 17 18 27 26 24 25 13 14 22 3 4 9 10 15 21 BD LB
E. coli (mpn 100 mL-1))
7000
6000
5000
4000
3000
2000
1000
0
Mainstem
Tributary
Edge-of-field
Upstream to downstream
20 19 16 23 12 11 8 5 1 17 18 27 26 24 25 13 14 22 3 4 9 10 15 21 BD LB
Station

Appendix 7. Average concentration of nitrogen, phosphorus, total suspended solids (TSS), and *Escherichia coli* (*E. coli*) measured at monitoring stations in Whelp Creek Sub-watershed.




TSS (mg L-1)
Mainstem
Tributary
Edge-of-field
Upstream to downstream
180
160
140
120
100
80
60
40
20
0
303 302 301 313 310 308 306 304 305 307 309 311 314 318 319 324
E. coli (mpn 100 mL-1))
16000
14000
12000
10000
8000
6000
4000
2000
0
Station