Little Canyon/Holes/Long Hollow Monitoring Report 2001

Developed for:

Lewis Soil Conservation District
Idaho Soil Conservation Commission
Idaho State Department of Agriculture

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Technical Results Summary CDM-LCC-01

IASCD
IDAHO ASSOCIATION OF Soil Conservation Districts

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Acknowledgements

James Teply initiated the Little Canyon Complex (LCC) study and also carried out most of the fieldwork. David Horras helped James and myself with fieldwork for this project. Chuck Pentzer of the Soil Conservation Commission and the Lewis Soil Conservation District provided valuable insight and encouragement that tremendously aided in the completion of this document.

Executive Summary

Water quality monitoring was performed on Little Canyon Complex (LCC) by the Idaho Association of Soil Conservation Districts (IASCD) from May 17, 2000 to May 21, 2001. One monitoring site near the mouth of Little Canyon, one site near the mouth of Holes Creek and three sites on Long Hollow Creek were selected to represent watershed water quality with sampling occurring every two weeks. Laboratory analysis of nitrogen (N), phosphorus (P), and total suspended solids (TSS) was performed by University of Idaho, Analytical Science Laboratories (UIASL) and bacteria samples were analyzed by Anatek Laboratories. Parameters measured were total suspended solids, nitrate+nitrite (NO_3+NO_2), ammonia (NH_3), total kjeldahl nitrogen (TKN), total phosphorus (TP) and ortho-phosphorus (OP). Other measurements include flow, pH, specific conductance (Cond), total dissolved solids (TDS), dissolved oxygen (DO), % saturation (% Sat), turbidity, and temperature (temp). The data generated from this monitoring program will be used by IASCD, Idaho Soil Conservation Commission (ISCC), and the Lewis Soil Conservation District (LSCD) to determine loads within the stream, identify areas where best management practices (BMPs) would have the greatest benefit, provide baseline data prior to TMDL development, and identify changes as BMPs are implemented.

The monitoring program for Little Canyon/ Holes/ Long Hollow Complex was successfully carried out as planned. Protocols were followed, QA/QC standards were met, and specific information per TMDL parameter for each subwatershed was collected. DO concentrations and water temperature levels complied with the state standard at sites LCC-1 and LCC-2. These standards were exceeded at sites LCC-3, LCC-4, and LCC-5 just before the stream went dry. All pH concentrations during the monitoring period were found to be within the acceptable range. Exceedance of nitrate+nitrite concentrations was substantial during spring runoff. This appears to be coming from fall and/or spring application of nitrogen based fertilizer. Health issues become important when nitrate concentrations exceed 10 mg/L, which was observed during the runoff period at sites LCC-1 and LCC-5. TKN concentrations were elevated at all monitoring sites but were extremely high downstream of the City of Nezperce as were ammonia concentrations at this site. Average fecal coliform and *E. coli* concentrations exceeded the recommended criteria at sites LCC-3 and LCC-4, which is most likely driven by conditions at the Nezperce wastewater treatment ponds as well as high TKN concentrations. Most exceedances of sediment and turbidity were observed downstream of the City of Nezperce after a dredging event of the stream channel. Sediment inputs into waterways from agriculture were extremely low. Phosphorus exceedance was extremely high downstream of the City of Nezperce at sites LCC-3 and LCC-4. The high TP values correspond with the dredging event that occurred within city limits. Total phosphorus inputs from agricultural sites (LCC-2, LCC-3, and LCC-5) exceeded the criteria over half of the events sampled. Significant correlations were found at these sites between TP and TSS, but TSS was only found at these sites in extremely low concentrations. Little Canyon Creek (LLC-1) exceeded the recommended standard for TP at every sampling event and NO_3+NO_2 during spring runoff. However it appears from upstream data that this site (LCC-1) was acting as a conduit for anthropogenic influences of Long Hollow and Holes Creek watersheds.

Introduction

Monitoring Program

Water quality monitoring was performed on Little Canyon Complex (LCC) by the Idaho Association of Soil Conservation Districts (IASCD) from May 17, 2000 to May 21, 2001. One monitoring site near the mouth of Little Canyon, one site near the mouth of Holes Creek and three sites on Long Hollow Creek were selected to represent watershed water quality with sampling occurring every two weeks. Laboratory analysis of nitrogen (N), phosphorus (P), and total suspended solids (TSS) was performed by University of Idaho, Analytical Science Laboratories (UIASL) and bacteria samples were analyzed by Anatek Laboratories. Parameters measured were total suspended solids, nitrate+nitrite (NO_3+NO_2), ammonia (NH_3), total kjeldahl nitrogen (TKN), total phosphorus (TP) and ortho-phosphorus (OP). Other measurements include flow, pH, specific conductance (Cond), total dissolved solids (TDS), dissolved oxygen (DO), % saturation (% Sat), turbidity, and temperature (temp). The data generated from this monitoring program will be used by IASCD, Idaho Soil Conservation Commission (ISCC), and the Lewis Soil Conservation District (LSCD) to determine loads within the stream, identify areas where best management practices (BMPs) would have the greatest benefit, provide baseline data prior to TMDL development, and identify changes as BMPs are implemented.

Site Descriptions

Monitoring site locations relative to the Little Canyon/Holes/ Long Hollow watersheds are shown in Figure 1. Monitoring Station LCC-1 is located near the mouth of Little Canyon Creek approximately 300 m before it enters Big Canyon Creek. This site was concurrently monitored by the Nez Perce Tribe. LCC-2 is located near the mouth of Holes Creek near the stream crossing with State Highway 62. Site LCC-3 is located near the mouth of Long Hollow Creek. LCC-4 is located on Long Hollow Creek downstream of State Highway 7 near the aeration pools of the wastewater treatment facility downstream of the City of Nezperce. LCC-5 is located on Long Hollow Creek just upstream of the City of Nezperce at the State Highway 7 stream crossing.

Methods

Water Quality

A representative depth-integrated sample was collected at each site by collecting approximately 4 liters of stream water. Water samples were collected with a one-liter Nalgene bottle and transferred into a 2.5-gallon polyethylene churn sample splitter. The polyethylene churn splitter was thoroughly rinsed with ambient water at each location prior to sample collection. The resultant composite sample was thoroughly homogenized before filling the appropriate sample containers. Ortho-phosphorus samples were filtered through a 0.45 μm GN-6 Gelman metricel filter. The resultant filtrate was transferred directly into sample bottle. The filtration unit was thoroughly rinsed with deionized water and equipped with a new 0.45 μm filter at each sampling location. Water samples requiring preservation (total phosphorus) were transferred into preserved (H_2SO_4 pH <2) 500 mL sample containers. Water quality samples (TSS, NO_2+NO_3, NH_3, TKN, TP, and OP) were analyzed at the UIASL in Moscow, Idaho.

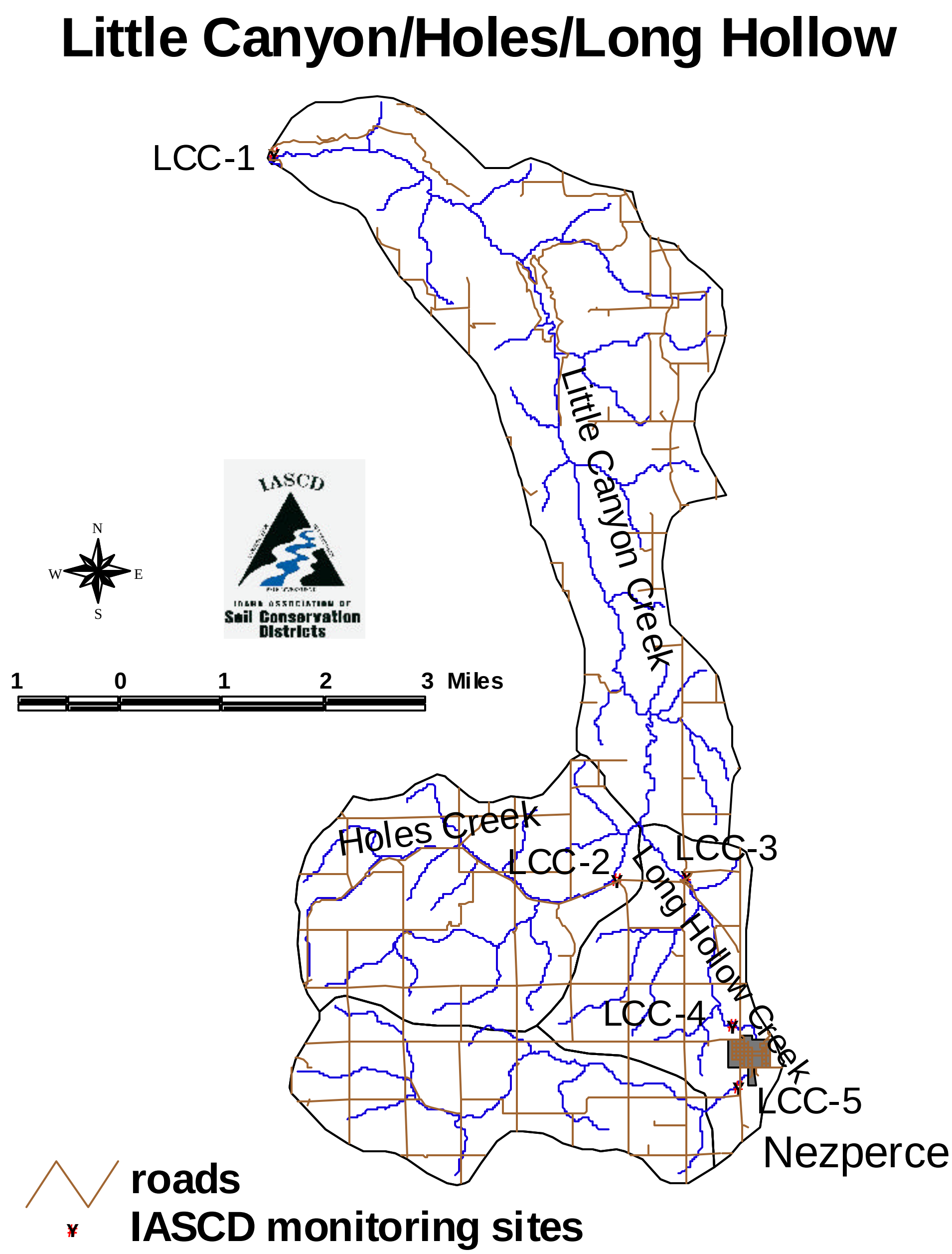

Figure 1. Little Canyon Complex study site locations.

Bacteriological samples (fecal coliform and *Escherichia coli* (*E. coli*)) were collected directly from the thalweg into sterile sample containers. The samples were shipped to Anatek Labs in Spokane, Washington for analysis. Most probable number (MPN) multiple tube fermentation was used to determine fecal coliform levels in the water sample.

A list of parameters, sample sizes, preservation, holding times, and analytical methods are displayed in Table 1. All sample containers were labeled with waterproof markers with the following information: station location, sample identification, date of collection, and time of collection. Samples were placed on ice and transported to the laboratory the same day as collection. Chain-of-custody forms accompanied each sample shipment.

Table 1. Water Quality Parameters

Parameters	Sample Size	Preservation	Holding Time	Method
Non Filterable Residue (TSS)	1L	Cool 4°C	7 Days	EPA 160.2
Nitrogen(NO_3/NO_2) Ammonia TKN	60 mL	Cool 4°C, H_2SO_4 pH < 2	28 Days	EPA 353.2 EPA 350.1 EPA 351.2
Total Phosphorus	100 mL	Cool 4°C, H_2SO_4 pH < 2	28 Days	EPA 365.4
Ortho Phosphorus	100 mL	Filtered , Cool 4°C	24 Hours	EPA 365.2
Fecal Coliform	100 mL	Cool 4°C	30 Hours	SM9221
Escherichia coli	100 mL	Cool 4°C	30 Hours	MPN

Field Measurements

At each location, field parameters for dissolved oxygen, specific conductance, pH, temperature, turbidity, and total dissolved solids were measured. Calibration of all field equipment will be in accordance with the manufacturer specifications. Field measurements, equipment and calibration techniques are shown in Table 2.

Table 2. Field Measurements

Parameters	Instrument	Calibration
Dissolved Oxygen	YSI Model 55	Ambient air calibration
Temperature	YSI Model 55 StowAway temperature logger Model XTI 02	Centigrade thermometer Centigrade thermometer
Conductance & TDS	Orion Model 115	Specific Conductance (25^oC standard)
pH	Orion Model 210A	Standard buffer (7,10) bracketing for linearity
Turbidity	Hach Model 2100P	Formazin Primary Standard

All field measurements were recorded in a field notebook along with any pertinent observations about the site, including weather conditions, flow rates, personnel on site, and any problems observed that might affect water quality.

Flow Measurements

Flow measurements were collected at each site using a Marsh McBirney Flow Mate Model 2000 flow meter. The six-tenths depth method (0.6 of the total depth from the surface of the water surface) was used. At each monitoring station, a transect line was established across the width of the drain/creek at an angle perpendicular to the flow for the calculation of cross-sectional area. The discharge was computed by summing the products of the partial areas (partial sections) of the flow cross-sections and the average velocities for each of those sections. Stream discharge was reported as cubic feet per second (cfs).

Quality Assurance and Quality Control (QA/QC)

The UIASL utilizes methods approved and validated by the Environmental Protection Agency (EPA). A method validation process, including precision and accuracy performance evaluations and method detection limit studies, are required of UIASL Standard Methods. Method performance evaluations include quality control samples, analyzed with a batch to ensure sample data integrity. Internal laboratory spikes and duplicates are part of UIASL's quality assurance program. Laboratory QA/QC results generated from this project can be provided upon request.

QA/QC procedures from the field-sampling portion of this project included a duplicate and a blank sample (one set per sampling day). The field blanks consisted of laboratory-grade deionized water, transported to the field and poured off into the appropriate sample containers. The blank sample was used to determine the integrity of the field teams handling of samples, the condition of the sample containers and deionized water supplied by the laboratory and the accuracy of the laboratory methods. Duplicates were obtained by filling two sets of sample containers with homogenized composite water from the same sampling site. The duplicate and blank samples were not identified as such to laboratory personnel to ensure laboratory precision.

Data Handling

All of the field data and analytical data generated from each survey was reviewed and submitted to ISDA for review. Each batch of data was reviewed to insure that all necessary observations, measurements, and analytical results have been properly recorded. The analytical results were evaluated for completeness and accuracy. Any suspected errors were investigated and resolved, if possible. The data was then be stored electronically and made available to any interested entity.

Results and Discussion

Descriptive data is presented in Table 3. This table includes maximum, minimum, and average values for each measured parameter as well as the number and percentage of sampling events that exceeded state water quality standards and EPA criteria.

Dissolved Oxygen

The State of Idaho standard for DO states that dissolved oxygen must exceed 6.0 mg/L for cold water biota at all times. No exceedance of DO (mg/L) was observed on either Little Canyon or Holes Creek over the monitoring period (Figure 2, Table 3). On Long Hollow Creek, DO values dropped below 6.0 mg/L, once at LCC-3, 5 times below the city of Nezperce, and once upstream of the city of Nezperce (Figure 2, Table 3). LCC-3, LCC-4, and LCC-5 only dropped below the criteria just before the stream dried up in mid-July (Figure 2, Table 3). Average and median values for all sites were well above the recommended standard (Table 3).

Water Temperature

The State of Idaho water quality standard for temperature support of cold water biota is less than 22^{o}C. At no time in the sampling period did instantaneous water temperature exceed the state's temperature standards at sites LCC-1, LCC-2, LCC-3 and LCC-5 (Figure 3, Table 3). There was one sampling event, just before the stream went dry, at site LCC-4, when this standard was exceeded (Figure 3, Table 3).

Specific Conductance and Total Dissolved Solids

No standards or criteria exist that set limits of conductance or TDS. Both conductance and TDS are high relative to other small streams in Idaho (Figure 4, Table 3). These high values probably reflect parent geology that this stream comes in contact with.

pH

The State of Idaho water quality standard for pH states that H^+ concentration must fall between 6.5 and 9.5. No exceedance of pH was observed at any site during the sampling period (Figure 5, Table 3).

Table 1. Descriptive statistics for Little Canyon, Holes and Long Hollow Creeks. Data collected from May 15, 2000 to May 21, 2001.

	LC-1 D.O.	LC-1 % Sat	LC-1 Temp	LC-1 Cond	LC-1 TDS	LC-1 pH	LC-1 Turbidity	LC-1 TSS	LC-1 NO3 -NO2	LC-1 TP	LC-1 OP	LC-1 NH3	LC-1 TKN	LC-1 F-Coli	LC-1 E-Coli	LC-1 Flow
Maximum	13.9	125%	21.3	306.0	158.0	8.9	19.0	12.0	14.0	0.2	0.2	0.6	0.9	1700.0	240.0	102.9
Minimum	8.9	89%	2.5	105.9	55.0	7.6	1.0	0.0	0.0	0.1	0.1	0.0	0.0	4.0	4.0	1.6
Average	11.8	104%	10.2	261.6	133.6	8.4	5.1	4.2	2.1	0.2	0.1	0.1	0.2	131.0	59.3	17.2
Median	11.8	103%	8.5	269.0	138.0	8.5	3.4	4.6	0.4	0.2	0.1	0.0	0.0	20.0	20.0	7.2
# exceedance	0.0		0.0			0.0	0.0		15.0	25.0	23.0			1.0	3.0	
% exceedance	0%		0%			0%	0%		60%	100%	92%			4%	13%	
# sampling events	25.0	25.0	25.0	25.0	25.0	23.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	23.0	23.0	25.0

	LC-2 D.O.	LC-2 % Sat	LC-2 Temp	LC-2 Cond	LC-2 TDS	LC-2 pH	LC-2 Turbidity	LC-2 TSS	LC-2 NO3 -NO2	LC-2 TP	LC-2 OP	LC-2 NH3	LC-2 TKN	LC-2 F-Coli	LC-2 E-Coli	LC-2 Flow
Maximum	14.8	118%	17.0	400.0	205.0	8.5	19.3	23.0	5.4	0.4	0.3	0.3	1.3	500.0	270.0	8.6
Minimum	7.6	79%	0.1	326.0	161.0	7.7	1.5	0.0	0.2	0.1	0.0	0.0	0.0	2.0	2.0	0.1
Average	11.3	92%	7.2	360.3	182.5	8.1	5.6	3.6	1.1	0.1	0.1	0.0	0.4	86.6	67.5	2.3
Median	11.1	90%	7.0	356.0	182.0	8.1	4.9	0.0	0.5	0.1	0.1	0.0	0.0	20.0	20.0	1.4
# exceedance	0.0		0.0			0.0	0.0		22.0	17.0	7.0			1.0	5.0	
% exceedance	0%		0%			0%	0%		88%	68%	28%			4%	22%	
# sampling events	25.0	25.0	25.0	25.0	25.0	23.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	23.0	23.0	25.0

	LC-3 D.O.	LC-3 % Sat	LC-3 Temp	LC-3 Cond	LC-3 TDS	LC-3 pH	LC-3 Turbidity	LC-3 TSS	LC-3 NO3 -NO2	LC-3 TP	LC-3 OP	LC-3 NH3	LC-3 TKN	LC-3 F-Coli	LC-3 E-Coli	LC-3 Flow
Maximum	14.2	116%	21.3	519.0	271.0	8.7	23.6	40.0	9.4	1.2	0.7	0.3	3.9	2400.0	2400.0	12.3
Minimum	5.9	7%	0.9	370.0	185.0	7.8	1.6	0.0	0.1	0.1	0.1	0.0	0.0	17.0	14.0	0.0
Average	10.5	86%	10.0	427.8	220.1	8.2	7.9	6.1	1.8	0.4	0.3	0.0	1.2	268.5	227.4	3.0
Median	11.5	94%	9.4	419.0	211.0	8.2	4.3	4.0	0.8	0.3	0.3	0.0	0.9	20.0	20.0	1.3
# exceedance	1.0		0.0			0.0	0.0		13.0	14.0	14.0			2.0	3.0	
% exceedance	7%		0%			0%	0%		87%	93%	93%			13%	20%	
# sampling events	15.0	15.0	15.0	15.0	15.0	14.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0

	LC-4 D.O.	LC-4 % Sat	LC-4 Temp	LC-4 Cond	LC-4 TDS	LC-4 pH	LC-4 Turbidity	LC-4 TSS	LC-4 NO3 -NO2	LC-4 TP	LC-4 OP	LC-4 NH3	LC-4 TKN	LC-4 F-Coli	LC-4 E-Coli	LC-4 Flow
Maximum	13.5	105%	23.9	612.0	325.0	9.2	168.0	78.0	8.7	2.5	1.2	4.8	12.0	5000.0	3000.0	8.1
Minimum	0.7	26%	0.6	387.0	199.0	7.3	3.1	0.0	0.2	0.2	0.1	0.3	1.0	20.0	20.0	0.0
Average	8.4	73%	8.8	481.3	246.2	8.2	36.6	26.6	1.3	0.9	0.5	1.1	4.2	871.2	426.5	2.0
Median	9.7	78%	7.4	483.5	243.0	8.1	21.1	13.0	0.5	0.5	0.4	0.6	1.9	130.0	80.0	0.7
# exceedance	5.0		1.0			0.0	9.0		14.0	18.0	18.0			7.0	8.0	
% exceedance	28%		6%			0%	50%		78%	100%	100%			41%	47%	
# sampling events	18.0	18.0	18.0	18.0	18.0	17.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	17.0	17.0	17.0

	LC-5 D.O.	LC-5 % Sat	LC-5 Temp	LC-5 Cond	LC-5 TDS	LC-5 pH	LC-5 Turbidity	LC-5 TSS	LC-5 NO3 -NO2	LC-5 TP	LC-5 OP	LC-5 NH3	LC-5 TKN	LC-5 F-Coli	LC-5 E-Coli	LC-5 Flow
Maximum	14.6	103%	20.4	526.0	277.0	8.4	26.5	28.0	11.0	0.3	0.2	0.2	1.4	80.0	40.0	11.5
Minimum	4.9	54%	0.0	186.8	94.0	7.9	1.5	0.0	0.0	0.1	0.1	0.0	0.0	20.0	20.0	0.0
Average	11.3	91%	7.1	412.7	210.3	8.1	9.7	7.3	2.0	0.2	0.1	0.0	0.7	25.8	22.5	2.6
Median	11.5	93%	5.8	419.5	203.5	8.2	7.5	6.5	0.7	0.1	0.1	0.0	0.8	20.0	20.0	1.6
# exceedance	1.0		0.0			0.0	1.0		7.0	11.0	6.0			0.0	0.0	
% exceedance	8%		0%			0%	8%		58%	92%	50%			0%	0%	
# sampling events	12.0	12.0	12.0	12.0	12.0	11.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0

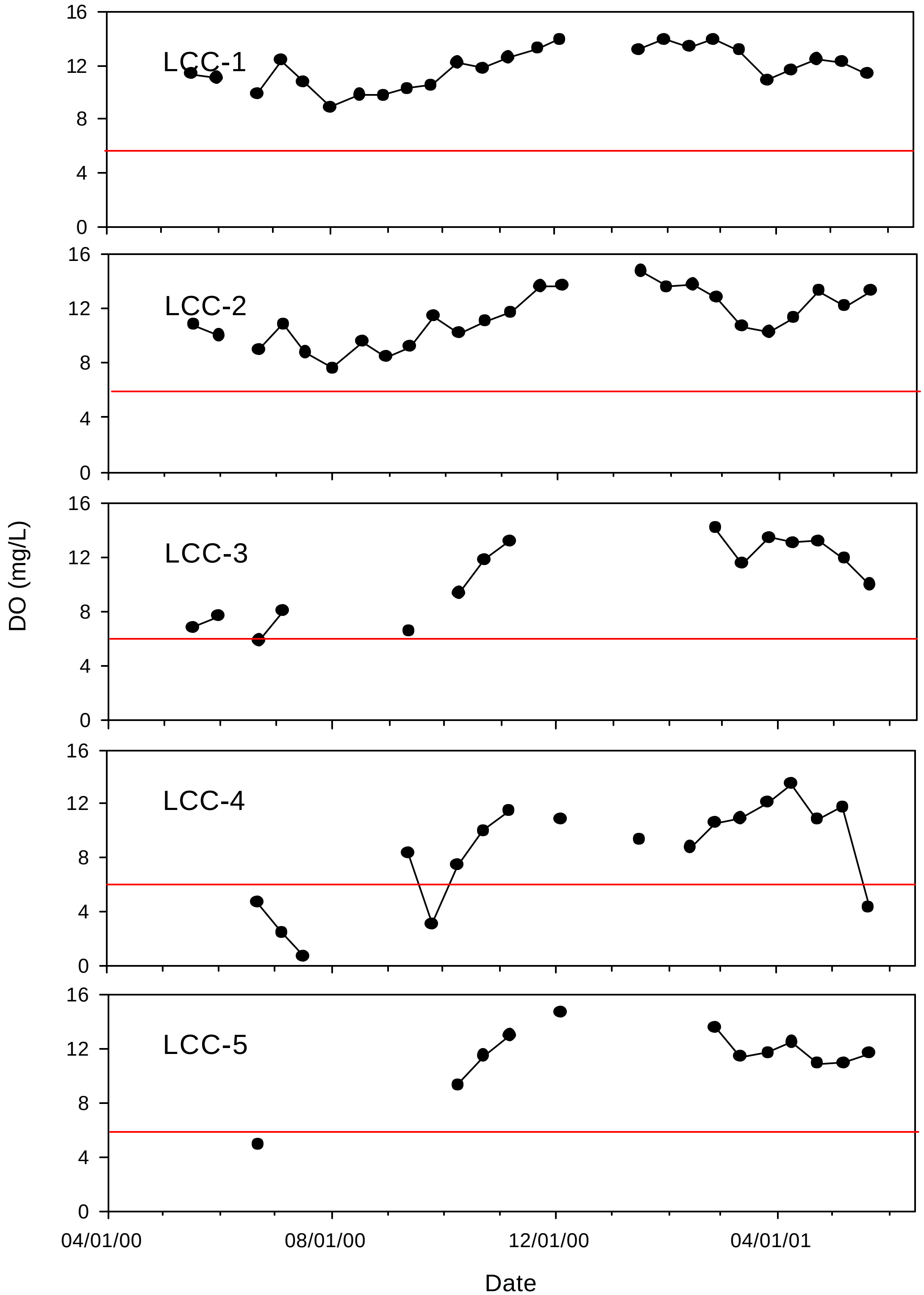

Figure 2. Dissolved oxygen data collected for Little Canyon, Holes, and Long Hollow from May 17, 2000 to May 21, 2001.

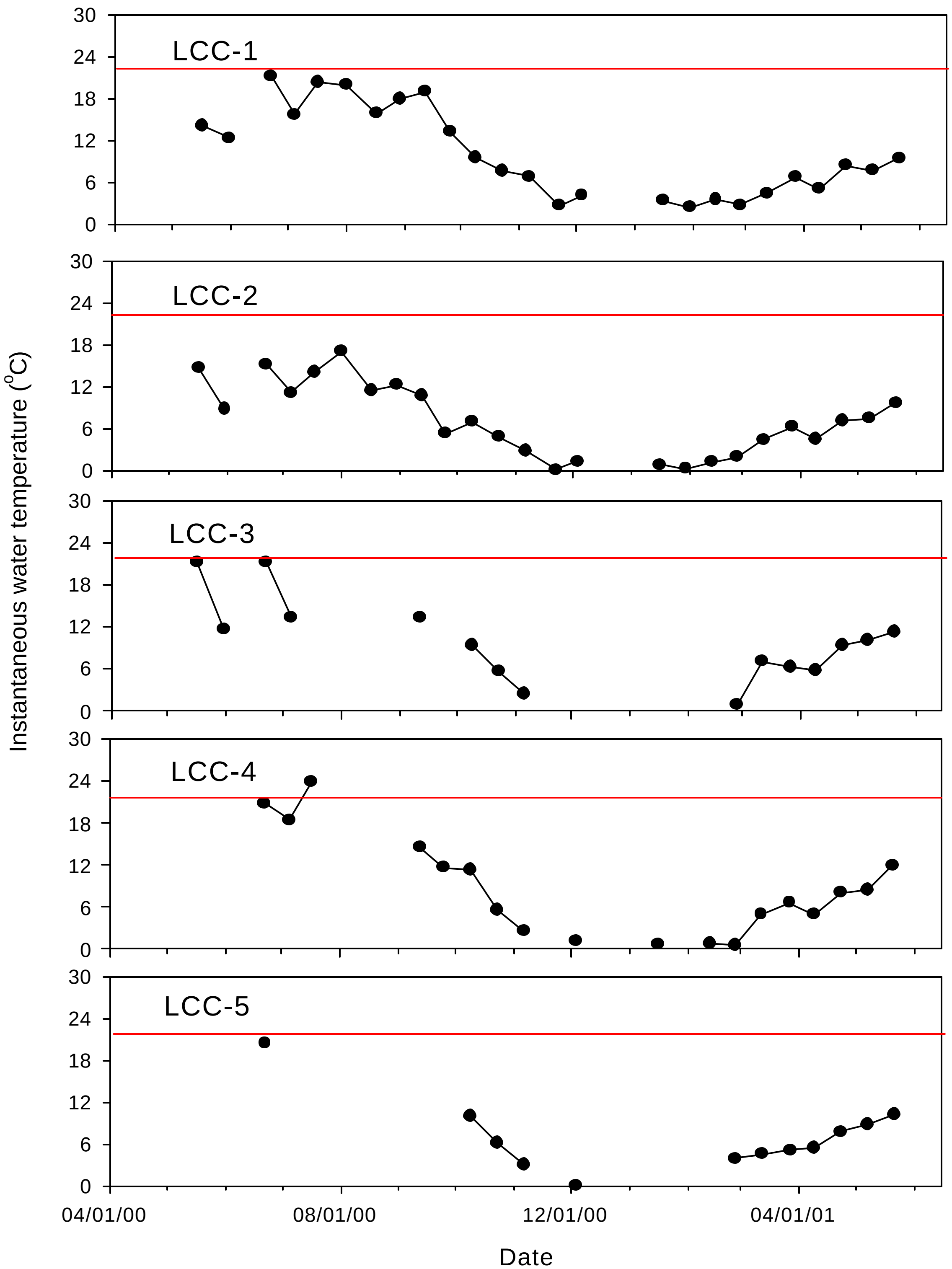

Figure 3. Instantaneous water temperature data collected for Little Canyon, Holes, and Long Hollow from May 17, 2000 to May 21, 2001.

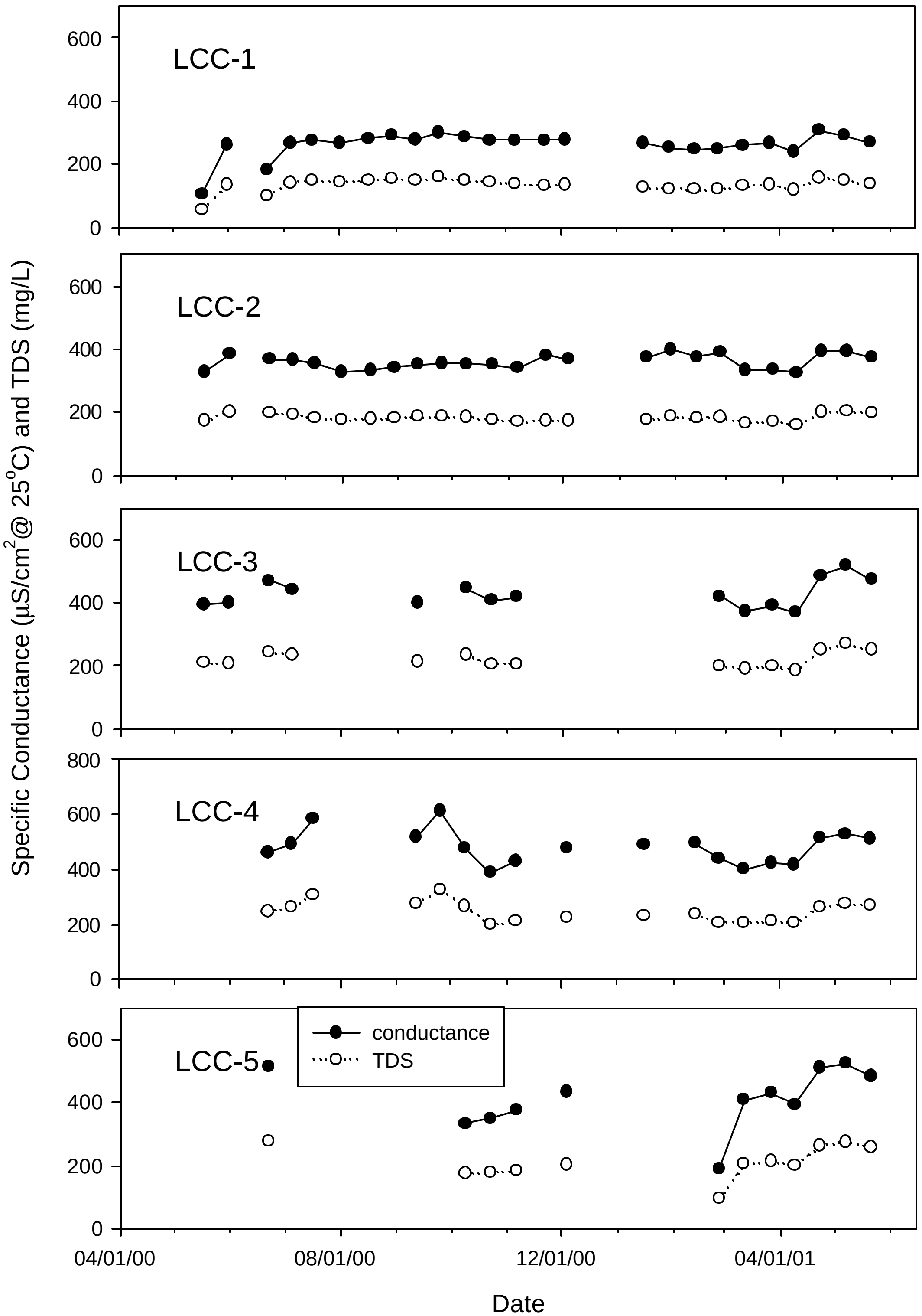

Figure 4. Specific conductance (cond) and total dissolved solids (TDS) data collected for Little Canyon, Holes, and Long Hollow from May 17, 2000 to May 21, 2001.

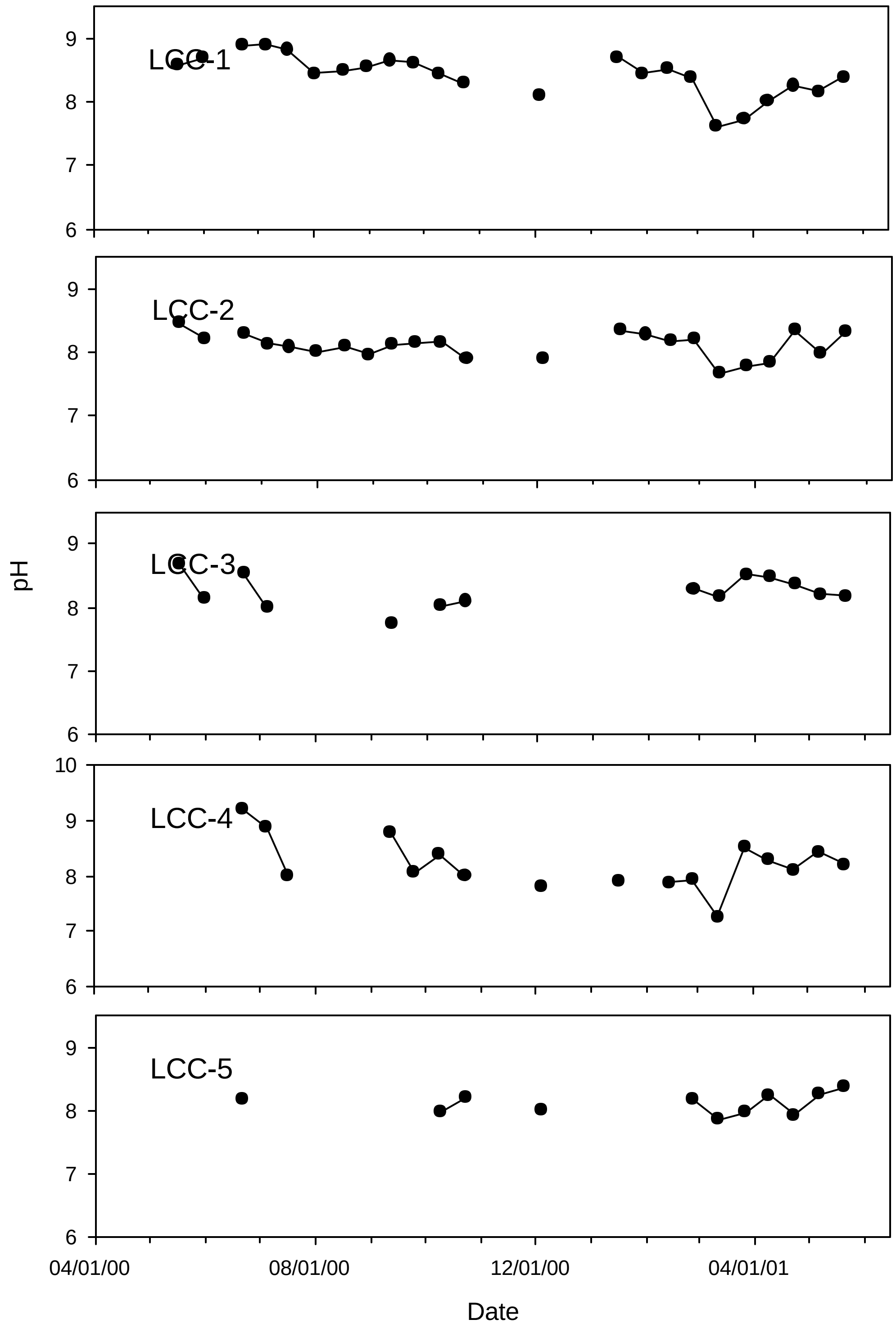

Figure 5. pH measurements collected for Little Canyon, Holes, and Long Hollow from May 17, 2000 to May 21, 2001.

Turbidity and Total Suspended Solids

The State of Idaho water quality standard for Turbidity states that measurements should not exceed 25 NTU for more than 10 consecutive days. No Idaho numerical standard exists for TSS, but significant direct associations ($p<0.001$) were found between the two measurements at all sites. Turbidity and TSS were observed to be well within acceptable values at all sites except for LCC-4 (Figure 6, Table 3). Long Hollow Creek was dredged within the city limits of Nezperce with a trackhoe excavator for purposes of flood control. Site LCC-4 lies directly downstream of both the city limits as well as the wastewater treatment aeration ponds. Spikes in turbidity and TSS were observed following the dredging event and then later during fall rain events (Figure 6, Table 3). The relationship between TSS and discharge is shown in Figure 7. Significant positive correlations ($p<0.05$) were found at LCC-1 and LCC-2, but associations were not found to be significant at sites LCC-3, LCC-4, and LCC-5. The lack of association between TSS and discharge at sites LCC-3 and LCC-4 was probably due to landuse and position in the watershed. The low TSS concentrations and lack of association between TSS vs. discharge at LCC-5 is indicative of stable banks and vegetation.

Nitrogen (NO_3+NO_2), NH_3, and TKN

The EPA Gold Book warns that nitrate values in excess of 10 mg/L could be hazardous to young infants if ingested. All sites approached or exceeded 10 mg/L with the exception of LCC-2 during spring runoff (Figure 8, Table 3). The literature suggests that NO_3 values in excess of 0.30 would contribute to excessive plant production and eutrophication. All measured NO_3+NO_2 values at all monitoring sites drastically exceeded the recommended standard for aquatic life (Figure 8). Significant associations between nitrate and discharge were found at all sites except for LCC-2. This indicates that nitrogen is mobilized by flow of spring runoff. Fall application of anhydrous ammonia is a common farming practice in this watershed. It appears that the ammonia is converted to nitrates, protected by snow accumulations in the winter, and transported to the stream during spring runoff. Ammonia concentrations were low except during late summer at sites LCC-1 and LCC-4 (Figure 9, Table 3). High TKN values were observed at all sites with peaks occurring in late summer and spring (Figure 9, Table 3). TKN is an indicator of sewage, both as animal as well as septic system problems. The high TKN values at LCC-3 and LCC-4 are directly below the wastewater treatment ponds of Nezperce and seem to indicate large quantities of organic nitrogen are leaching into Long Hollow Creek from this source. In addition TKN as well as ammonia were an order of magnitude higher at site LCC-4 than all other LCC monitoring sites.

Phosphorus (Total Phosphorus and Ortho-Phosphate)

Ortho-phosphate refers the dissolved or soluble portion of particles less than 0.45 µm. Total phosphorus refers to the total amount of P suspended in the water column ($<0.45 + >0.45$). The EPA Gold Book criterion for total phosphorus concentrations is 0.100 mg/L for streams or rivers not discharging directly into lakes or reservoirs. Phosphorus exceedances were observed at every site with most spikes occurring between July and November (Figure 10). Total phosphorus was significantly associated with TSS at sites LCC-2, LCC-4, and LCC-5. The high concentrations that were observed at site LCC-4 during the summer also were probably a result of the dredging that occurred in the City of Nezperce.

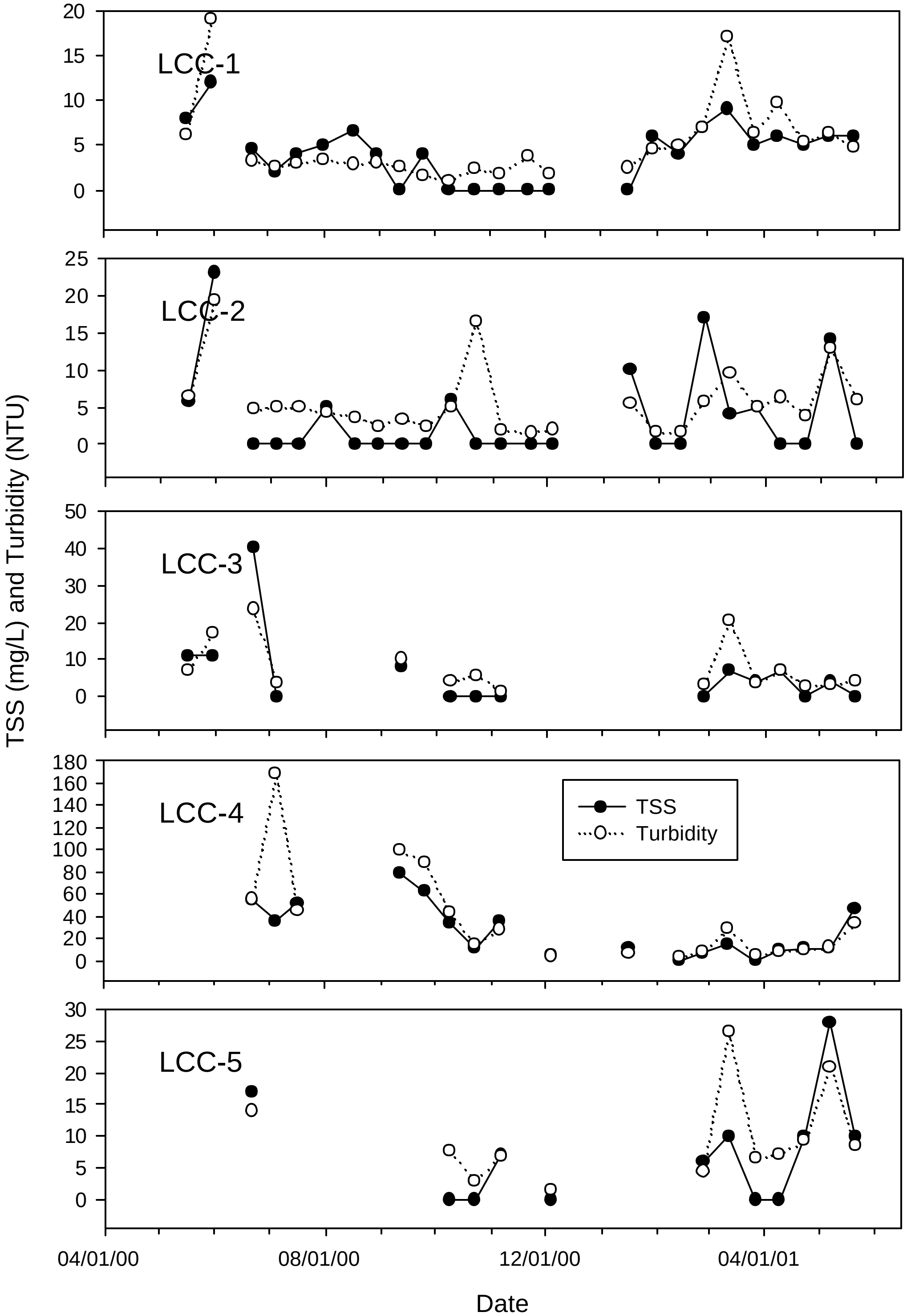

Figure 6. Total suspended solids (TSS) and Turbidity data collected for Little Canyon, Holes, and Long Hollow from May 17, 2000 to May 21, 2001.

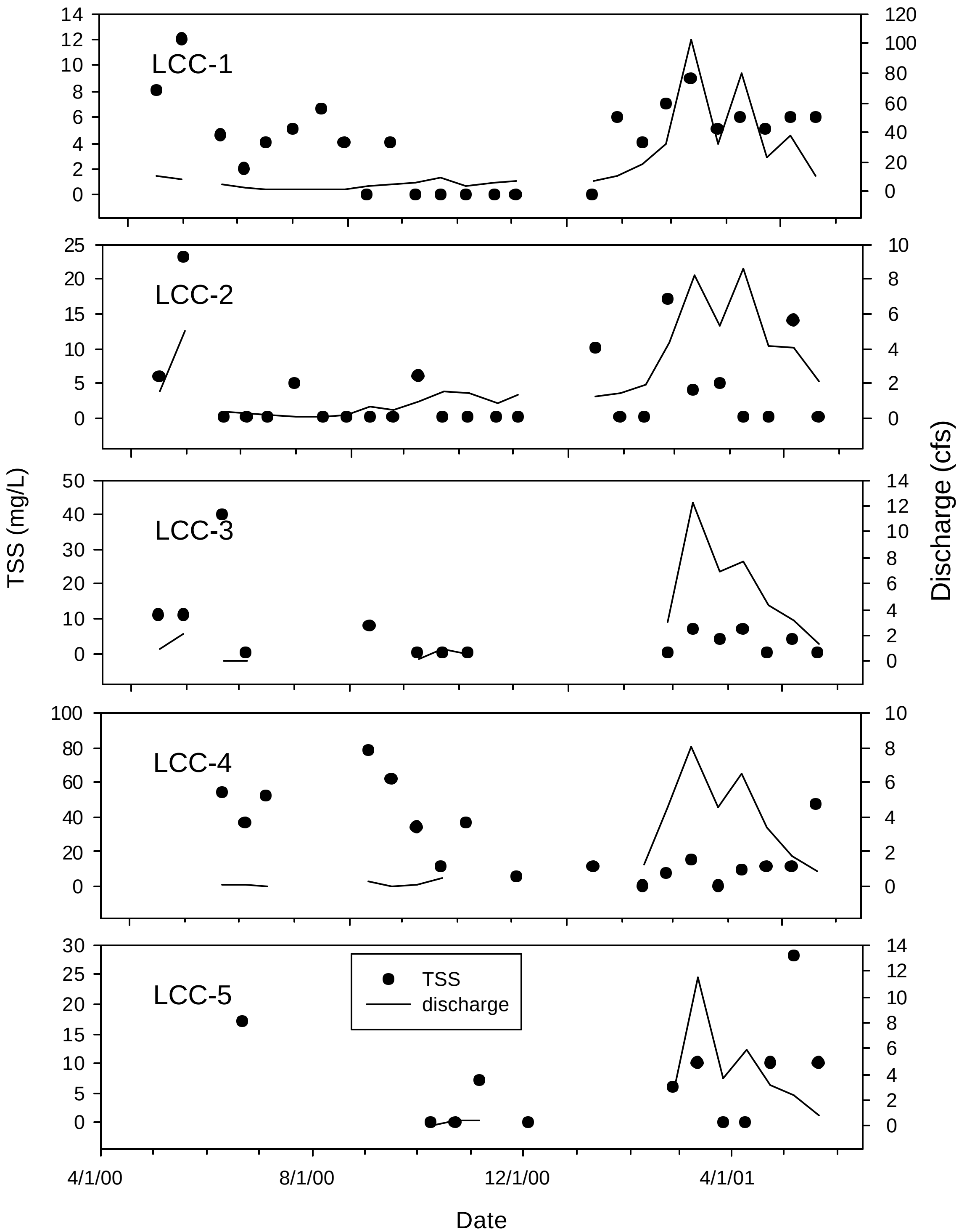

Figure 7. Total suspended solids and stream discharge data collected for Little Canyon, Holes, and Long Hollow from May 17, 2000 to May 21, 2001.

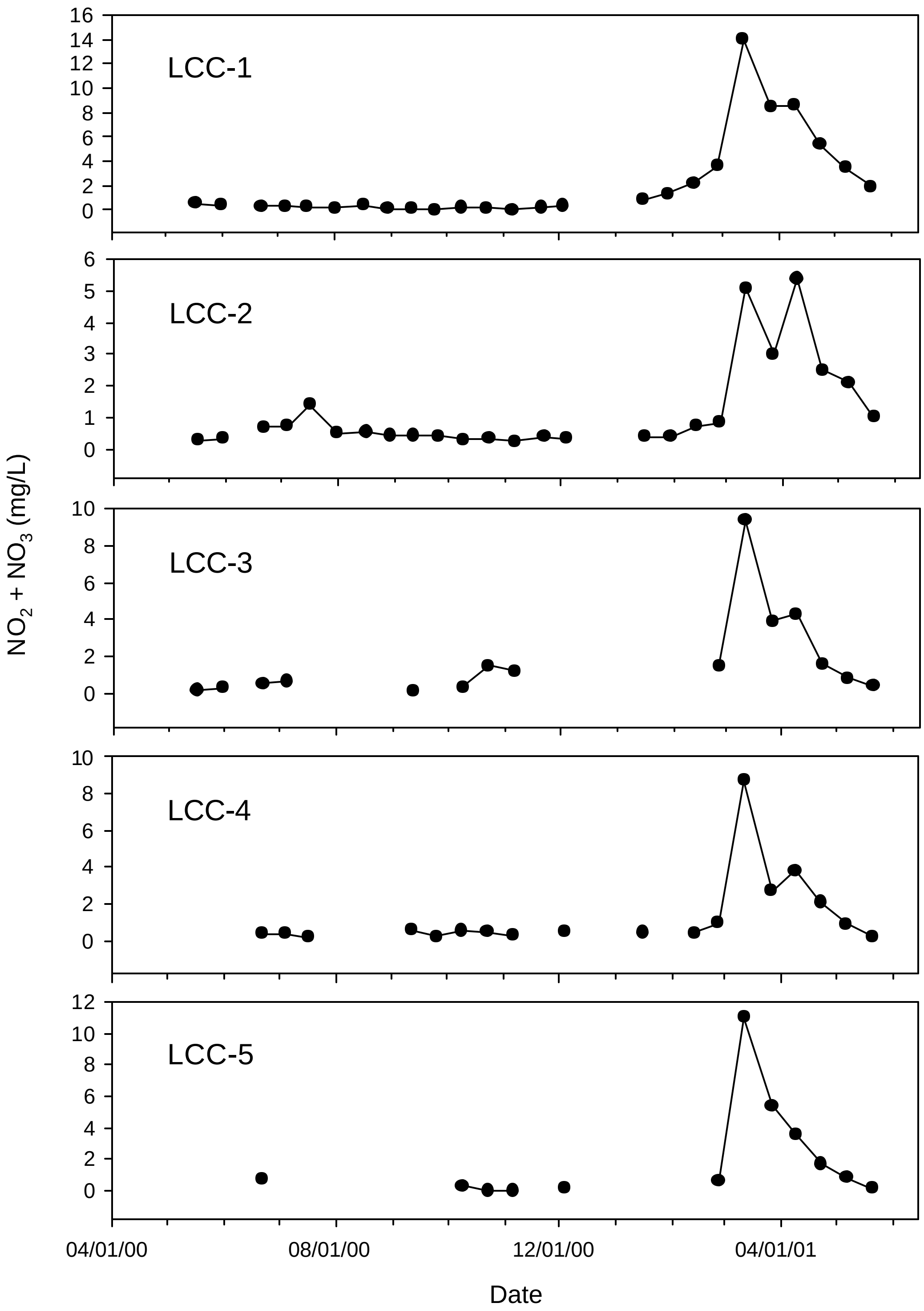

Figure 8. Nitrate + Nitrite data collected for Little Canyon, Holes, and Long Hollow from May 17, 2000 to May 21, 2001.

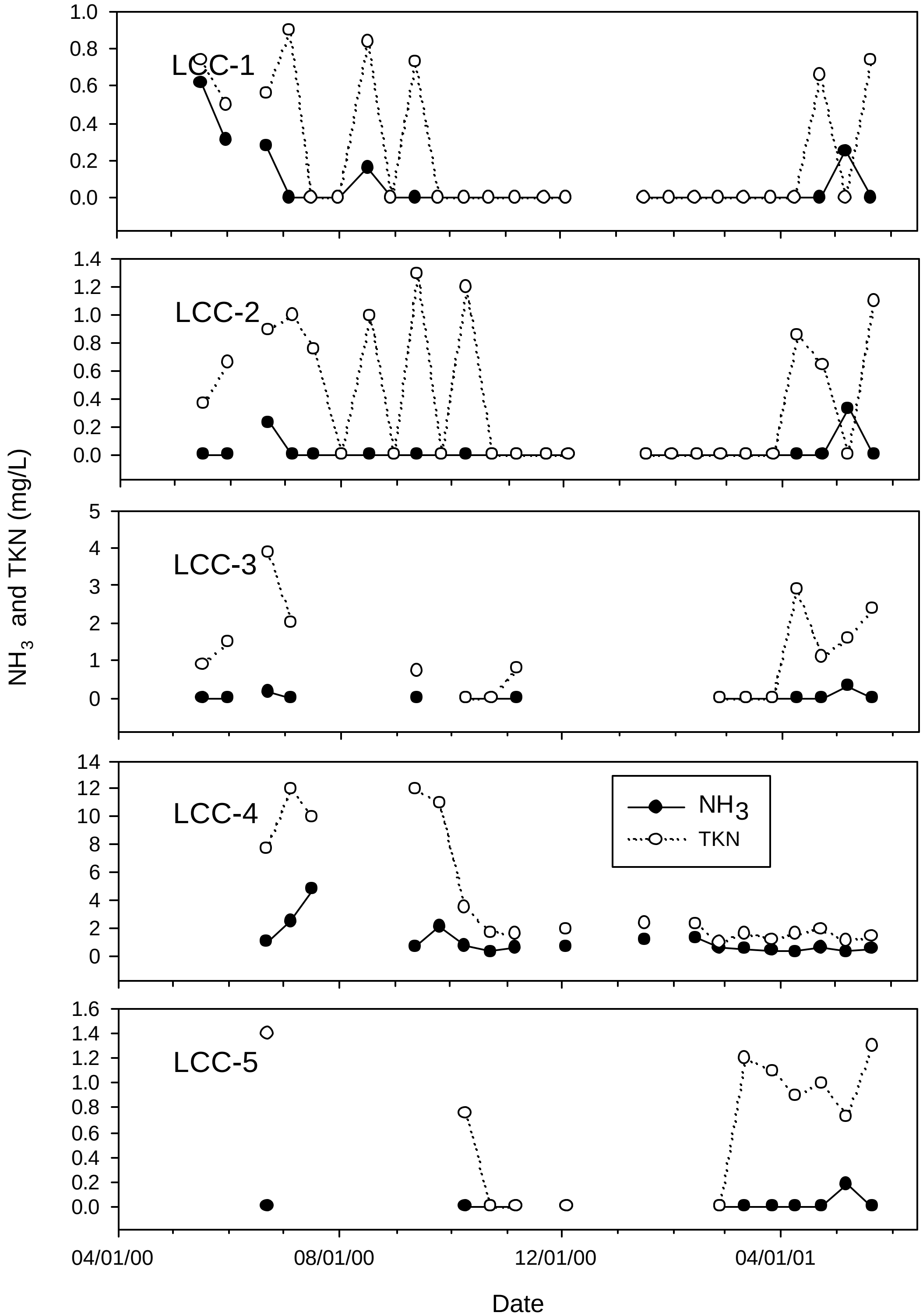

Figure 9. Ammonia (NH_3) and total kjedehal nitrogen (TKN) data collected for Little Canyon, Holes, and Long Hollow from May 17, 2000 to May 21, 2001.

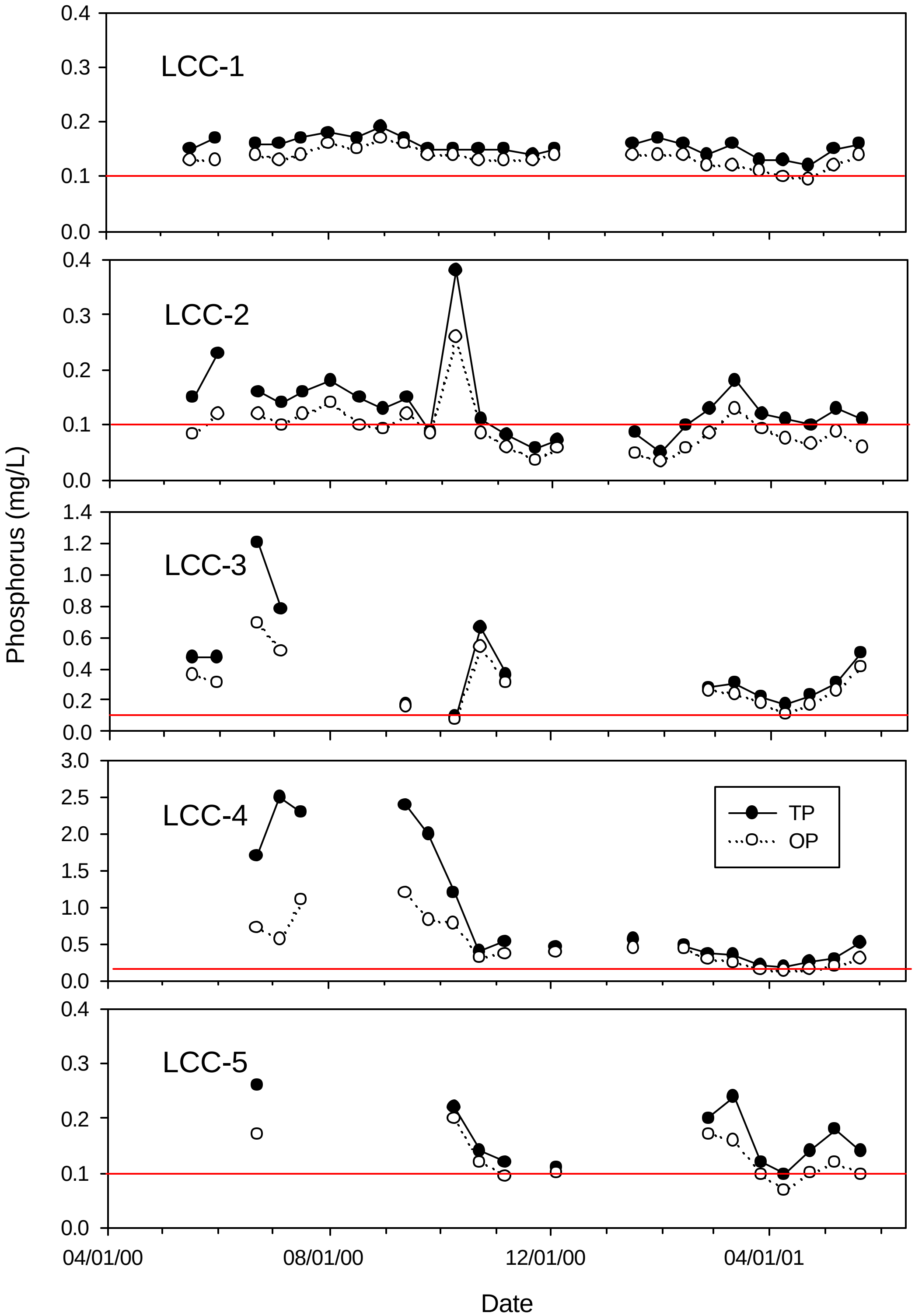

Figure 10. Total phosphorus and ortho-phosphorus (<0.45 µm) data collected for Little Canyon, Holes, and Long Hollow from May 17, 2000 to May 21, 2001.

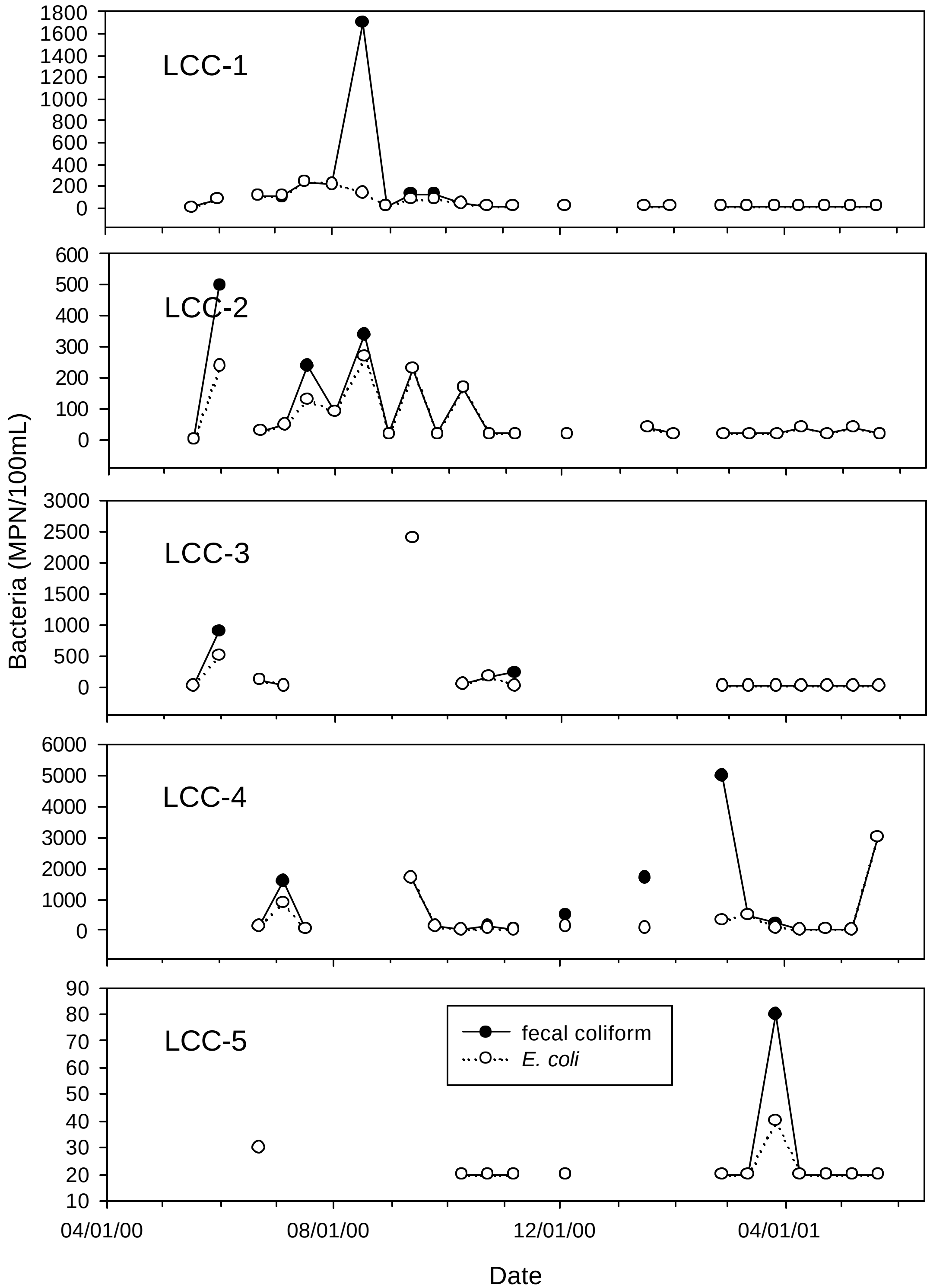

Figure 11. Bacteria data (fecal coliform and *E. coli*) collected for Little Canyon, Holes, and Long Hollow from May 17, 2000 to May 21, 2001.

Bacteria (*E. coli* and fecal coliform)

The standard for *E. coli* is that concentrations should not exceed 126 organisms/100 mL, which should be based on a geometric mean. The *E. coli* standard for primary contact is not to exceed 406 organisms/100 mL at any time and not to exceed 576 organisms/100 mL at any time for secondary contact. The standard for fecal coliform states that water samples should not exceed 500 organisms/100 mL at any time for primary contact and should not exceed 800 organisms/100mL at any time for secondary contact. Average fecal coliform and *E. coli* concentrations exceeded the recommended criteria at sites LCC-3 and LCC-4 (Table 3, Figure 11). Bacteria concentrations at these sites are most likely driven by conditions at the Nezperce wastewater treatment ponds.

Conclusions

The monitoring program for Little Canyon/ Holes/ Long Hollow Complex was successfully carried out as planned. Protocols were followed, QA/QC standards were met, and specific information per TMDL parameter for each subwatershed was collected. DO concentrations and water temperature levels complied with the state standard at sites LCC-1 and LCC-2. These standards were exceeded at sites LCC-3, LCC-4, and LCC-5 just before the stream went dry. All pH concentrations during the monitoring period were found to be within the acceptable range. Exceedance of nitrate+nitrite concentrations was substantial during spring runoff. This appears to be coming from fall and/or spring application of nitrogen based fertilizer. Health issues become important when nitrate concentrations exceed 10 mg/L, which was observed during the runoff period at sites LCC-1 and LCC-5. TKN concentrations were elevated at all monitoring sites but were extremely high downstream of the City of Nezperce as were ammonia concentrations at this site. Average fecal coliform and *E. coli* concentrations exceeded the recommended criteria at sites LCC-3 and LCC-4, which is most likely driven by conditions at the Nezperce wastewater treatment ponds as well as high TKN concentrations. Most exceedances of sediment and turbidity were observed downstream of the City of Nezperce after the dredging event of the stream channel. Sediment inputs into waterways from agriculture were extremely low. Phosphorus exceedance was extremely high downstream of the City of Nezperce at sites LCC-3 and LCC-4. The high TP values correspond with the dredging event that occurred within city limits. Total phosphorus inputs from agricultural sites (LCC-2, LCC-3, and LCC-5) exceeded the criteria over half of the events sampled. Significant correlations were found at these sites between TP and TSS, but TSS was only found at these sites in extremely low concentrations. Little Canyon Creek (LLC-1) exceeded the recommended standard for TP at every sampling event and NO_3+NO_2 during spring runoff. However it appears from upstream data that this site (LCC-1) was acting as a conduit for anthropogenic influences of Long Hollow and Holes Creek watersheds.

Recommendations

Nezperce City officials should closely look at the wastewater treatment facilities to determine if further wastewater treatment is required or if current systems are failing. Dredging within the city caused sediment and phosphorus exceedances. City officials should examine other methods of flood control other than dredging of the channel within city limits. The NP Tribe, LSCD, NRCS, and the ISCC should work with local landowners and operators in the area to implement a nutrient management strategy to prevent overapplication of nitrogen based fertilizer. Very few riparian species were observed near study sites on Long Hollow and Holes Creeks. Buffer strips, tree plantings and fencing of the stream in pastured areas would probably be the most beneficial BMP that could be implemented in the Holes and Long Hollow watersheds. Future monitoring should evaluate where phosphorus is coming from, at the agricultural sites, since it appears to be linked to something other than sediment transport. In addition, nitrogen, phosphorus, and bacteria should be monitored downstream of the City of Nezperce wastewater treatment ponds. Other future investigations might specifically address effects of highways in close proximity to these waterways and water quality monitoring during fall/spring fertilizer applications.

References

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