

APPENDIX

มหาวิทยาลัยเชียงใหม่
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(continue)

Phylum, Class, Order	Family	Average number of Macroinvertebrate at each site											
		site											
		S1	S2	S3	P1	P2	P3	IC1	IC2	IC3	SC1	SC2	SC3
O.Hymenoptera	Scelionidae	-	-	0.5	-	-	-	-	-	-	-	-	-
O.Megaloptera	Sialidae	-	-	-	-	-	0.5	-	-	-	-	-	-
O. Odonata	Coenagrionidae	1.5	0.5	-	-	-	-	-	-	-	-	-	-
	Cordulegastridae	1	-	-	-	-	-	-	-	-	-	-	-
	Gomphidae	1.5	5.5	15	0.5	-	-	-	1	-	-	-	-
	Lestidae	0.5	0.5	-	-	-	-	-	-	-	-	-	-
	Libellulidae	-	1	-	-	-	-	-	-	-	-	-	-
	Macromiidae	-	-	0.5	-	-	-	-	-	-	-	-	-
O.Plecoptera	Peltoperidae	1.5	1.5	-	0.5	-	-	-	-	-	-	-	-
	Pteronarcyidae	1.5	-	-	-	-	-	-	-	-	-	-	-
	Perlodidae	0.5	-	-	-	-	-	-	-	-	-	-	-
O.Trichoptera	Glossosomatidae	0.5	10	-	-	-	-	-	-	-	-	-	-
	Helicopsychidae	-	-	0.5	-	-	-	-	-	-	-	-	-
	Hydroptilidae	3	0.5	-	0.5	-	-	-	-	-	-	-	-
	Hydropsychidae	8.5	8.5	0.5	-	-	-	-	-	-	-	-	-
	Lepidostomatidae	0.5	-	-	-	-	-	-	-	-	-	-	-
	Limnephilidae	-	-	-	0.5	-	-	-	0.5	-	-	-	-
	Odontoceridae	0.5	-	-	-	-	-	-	-	-	-	-	-
	Polycentropodidae	1.5	1	-	-	-	-	-	-	-	-	-	-
	Rhyacophilidae	-	5	-	-	6	1.5	-	-	-	-	-	-
	Sericostomatidae	1	0.5	-	-	-	-	-	-	-	-	-	-
C.Crustacean	(crab)Potamidae	0.5	-	1	-	-	-	-	-	1	-	-	-
O.Decapoda	(shrimp)												
	Palaemonidae	-	-	-	-	-	-	-	1.5	-	-	-	-

Table 3. Habitat Assessment Field Data Sheet

Habitat Parameter	Category			
Primary parameter	Excellent	Good	Fair	Poor
1. bottom substrate available cover	> 50% rubble gravel, submerged logs, undercut banks or other stable habitat 16-20	30-50% rubble, gravel or other stable habitat 11-15	10-30% rubble, gravel or other stable habitat availability less than desirable 6-10	< 10% rubble gravel or other stable habitat. Lack of habitat is obvious 0-5
2. Embeddeness	gravel, cobble, and boulder particles are between 0-25 % surrounded by fine sediment 16-20	gravel, cobble, and boulder particles are between 25-50 % surrounded by fine sediment 11-15	gravel, cobble, and boulder particles are between 50-75% surrounded by fine sediment 6-10	gravel, cobble, and boulder particles are > 75% surrounded by fine sediment 0-5
3. > 0.15 cms (5 cfs) Velocity / Depth	Habitat all present 16-20	Only 3 of 4 habitats present 11-15	Only 2 of the 4 habitats 6-10	Dominated by one velocity/depth category (pool) 0-5
Secondary parameter				
4. Channel alteration	Little or not enlargement of island or point bars, and /or no channelization. 12-15	Some new increase in bar formation, mostly from coarse gravel; and /or some channelization present 8-11	Moderate deposition of new gravel, coarse sand on old and new bars: pools partially filled w/silt: and / or embankments on both banks. 4-7	Heavy deposits of fine material. increased bar development: most pools filled w/silt: and/or extensive channelization 0-3
5. Bottom scouring and deposition	< 5% of the bottom affected by scouring and deposition 12-15	5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools. 8-11	30-50% affected. Deposits and scour at obstructions, constrictions and bends . some filling of pools 4-7	> 50% of the bottom changing nearly year long. Pools almost absent due to deposition. Only large rocks in riffle exposed. 0-3
6. Pool/ riffle, run / bend ratio (distance between riffles divided by stream width)	5-7 Variety of habitat. Deep riffles and pools 12-15	7-15 Adequate depth in pools and riffles. Bends provide habitat 8-11	15-25 Occasional riffle or bend. Bottom contours provide some habitat 4-7	>25 Essentially a straight stream. Generally all flat water or shallow riffle. Poor habitat 0-3

<p>Tertiary Parameters</p> <p>7. Bank stability</p>	<p>Stable. No evidence of erosion or bank failure. Side slopes generally < 30% . Little potential for future problem.</p> <p>9-10</p>	<p>Moderately stable. Infrequent, small areas of erosion mostly healed over. Side slopes up to 40% on one bank. Slight potential in extreme floods</p> <p>6-8</p>	<p>Moderately unstable. Moderate frequency and size of erosional areas. Side slopes up to 60% on some banks. High erosion potential during extreme high flow</p> <p>3-5</p>	<p>Unstable. Many eroded areas. Side slopes > 60% common. " Raw" areas frequent along straight sections and bends.</p> <p>0-2</p>
<p>8. Bank vegetative stability</p>	<p>> 80% of the streambank surfaces covered by vegetation or boulders and cobble</p> <p>9-10</p>	<p>50-79% of the streambank surface covered by vegetation, gravel or larger material.</p> <p>6-8</p>	<p>25-49% of the streambank surfaces covered by vegetation, gravel, or larger material.</p> <p>3-5</p>	<p>< 25% of the streambank surfaces covered by vegetation, gravel, or larger material</p> <p>0-2</p>
<p>9. Streamside cover</p>	<p>Dominant vegetation is shrub.</p> <p>9-10</p>	<p>Dominant vegetation is of tree form.</p> <p>6-8</p>	<p>Dominant vegetation is grass or forbes.</p> <p>3-5</p>	<p>Over 50% of the streambank has no vegetation and dominant material is soil , rock, bridge materials , culverts, or mine tailings.</p> <p>0-2</p>

Column Totals

Score _____

Some Physical Characterization

Date.....

Site.....

Riparian zone / Instream Feature :

@ Predominant Surrounding Land Use : Forest Field / Pasture Agriculture
 Residential Industrial Other.....

@ Local Watershed Erosion : None Moderate Heavy

@ Estimate Stream Width m

Estimate Stream Depth Riffle.....m Run..... m Pool.....m

@ Canopy Cover : Open Partly open Partly Shaded Shaded

Sediment / Substrate :

@ Sediment Deposits: Sludge Sawdust Paper Fiber Sand
 Rolicit Shell Other.....

Inorganic Substrate Components

Substrate type	Diameter (inch)	% component in sampling site
Bedrock		
Boulder	> 256 mm (10in)	
Cobble	64 -256 " (2.5 - 10in)	
Gravel	2 - 64 " (0.1 - 2.5in)	
Sand	0.06 - 2 " (gritty)	
Silt	0.004 - 0.06 mm	
Clay	< 0.004 mm (slick)	

Organic Substrate Components

Substrate Type	Characteristic	% Component in Area
Detritus	Stick, Wood, Coarse Plant material (CPOM)	
Muck - Mud	Black Very Fine Organic (FPOM)	
Marl	Grey, Shell Fragment	

Nitrogen, Nitrate

by

Cadmium Reduction Method

(Using Powder Pillows or AccuVac Ampuls)

1. Enter the stored program number for medium range nitrate nitrogen ($\text{NO}_3^- \text{ - N}$) powder pillows. Press : 353 READ / ENTER The display will show: DIAL nm TO 400
2. Rotate the wavelenght dial untill display shows: 400 nm.
3. Press: READ / ENTER The display will show: mg/l N $\text{NO}_3^- \text{ - M}$
4. Fill a sample cell with 25 ml. of sample (the prepared sample).
5. Fill another cell with 25 ml. of deionized water (the blank).
6. Add the contents of one NitraVer 5 Nitrate Reagent Powder Pillow to each cell. Stopper.
7. Press: SHIF TIME A one-minute reaction period will begin. Shake untill the timer beeps.
8. When the time beeps, press: SHIF TIME A five-minute reaction period will begin.
9. When the timer beeps, the display will show: mg/l N $\text{NO}_3^- \text{ - M}$ Remove the stopper. Place the blank into the cell holder. Close the light shield.
10. Press: ZERO The display will show: WAIT then: 0.0 mg/l N $\text{NO}_3^- \text{ - M}$
11. Place the prepared sample into the cell holder. Close the light shield.
12. Press: READ / ENTER The display will show WAIT then the result in mg /L nitrate expressed as nitrogen ($\text{NO}_3^- \text{ - N}$) will be displayed.

Phosphorus , Reactive (Orthophosphate)

by

Ascorbic Acid Method

(Powder Pillow or AccuVac Ampuls)

1. Enter a stored program number for reactive phosphorus powder pillows. Press: 490 READ / ENTER for units of mg/l PO₄ 3- or Press : 496 READ/ ENTER for unit of mg/l P The display will show: DAIL nm TO 890
2. Rotated the wavelenght dail untill the small display shows: 890 nm
3. Press READ/ENTER The display will show: mg/l PO₄ 3- PV or mg/l P PV
4. Fill a small cell with 25 ml of sample.
5. Add the contents of one PhosVer3 Phosphate Powder Pillow to the cell (the prepare sample). Swirl immediately to mix.
6. Press: SHIF TIMER A two-monute reaction peroid will begin.
7. Fill another sample cell (the blank) with 25 ml. of sample. Place it into the cell holder.
8. When the timer beeps, the display will show: mg/l P PV Press: ZERO The display will show: WAIT then : 0.00 mg/l PO₄ 3- PV or 0.00mg/l P PV
9. Place the prepared sample into the cell holder. Close the light shield.
10. Press: READ / ENTER The display will show : WAIT then the results in mg/l PO₄ 3- or mg/l P will be displayed.

The following parameter were detected by HACH DR/ 2000 Spectrophotometer

Nitrogen , Ammonia

by

Nessler Method

1. Enter the stored program number for ammonia nitrogen ($\text{NH}_3 - \text{N}$). Press : 380
READ / ENTER The display will show : DIAL nm TO 425
2. Rotate the wavelenght dial until the small display shows: 425 nm.
3. Press: READ / ENTER The display will show: mg/l N NH_3 Ness
4. Fill a 25 ml. mixing graduated cylinder (the prepared sample) to the 25 ml.
mark with sample.
5. Fill another 25 ml. mixing graduted cylinder (the blank) with deionized water.
6. Add three drops of Mineral Stabilizer to each cylinder. Invert several times to
mix. Add three drops of Polyvinyl Alcohol Dispersing Agent to each cylinder by
holding the dropping bottle straight. Invert several times to mix.
7. Pipet 1.0 ml. of Nessler Reagent into each cylinder. Stopper. Invert several times
to mix.
8. Press : SHIFT TIME A one- minute reaction period will begin.
9. Pour each solution into a sample cell.
10. When the timer beeps, the display will show: mg/l N NH_3 Ness place the blank
into the cell holder. Close the light shield. Press: ZERO The display will show:
WAIT then 0.00 mg/l N NH_3 Ness
11. Place the prepared sample into the cell holder. Close the light shield.
12. Press: READ / ENTER The display will show: WAIT then the result in mg/l
ammonia expressed as nitrogen ($\text{NH}_3 - \text{N}$) will be displayed.

Surface Water

TABLE 4 Surface Water Quality Classification And Standards

Parameters	Units	Statistic	Standard Values for Class***				
			1	2	3	4	5
1. Temperature	°C	—	n	n	n	n	—
2. pH value	—	—	n	5-9	5-9	5-9	—
3. Dissolved oxygen	mg/l	P20	n	6	4	2	—
4. BOD (5 days, 20°C)	mg/l	P80	n	1.5	2.0	4.0	—
5. Coliform, Bacteria			n				
— Total coliform	MPN/100 ml	P80		5,000	20,000	—	—
— Fecal coliform	"	P80		1,000	1,000	—	—
6. NO ₃ - N	mg/l	Max. allowance	n	← 5.0 →			—
7. NH ₃ - N	"	"	n	:	0.5	:	—
8. Phenols	"	"	n	:	0.005	:	—
9. Cu	"	"	n	:	0.1	:	—
10. Ni	"	"	n	:	0.1	:	—
11. Mn	"	"	n	:	1.0	:	—
12. Zn	"	"	n	:	1.0	:	—
13. Cd	"	"	n	:	0.005* 0.05**	:	—
14. Cr (Hexavalent)	"	"	n	:	0.05	:	—
15. Pb	"	"	n	:	0.05	:	—
16. Hg (total)	"	"	n	:	0.002	:	—
17. As	"	"	n	:	0.01	:	—
18. CN	"	"	n	:	0.005	:	—
19. Radioactivity							
— Gross α	Becquerel/l	"	n	:	0.1	:	—
— Gross β	"	"	n	:	1.0	:	—
20. Pesticides (Total)	mg/l	"	n	:	0.05	:	—
— DDT	ug/l	"	n	:	1.0	:	—
— α BHC	"	"	n	:	0.02	:	—
— Dieldrin	"	"	n	:	0.1	:	—
— Aldrin	"	"	n	:	0.1	:	—
— Heptachlor & Heptachlor epoxide	"	"	n	:	0.2	:	—
— Endrin	"	"	n	← none →			—

Note: P = Percentile value
 n = naturally
 n = naturally but changing not more than 3°C
 * = when water hardness not more than 100 mg/l as CaCO₃
 ** = when water hardness more than 100 mg/l as CaCO₃
 *** = Water Classification

Classifications	Condition & Beneficial usages
Class 1	Extra clean fresh surface water resources using for: (1) conservation, not necessary pass through water treatment processes require only ordinary process for pathogenic destruction (2) ecosystem conservation which basic living organisms can spread breeding naturally
Class 2	Very clean fresh surface water resources using for: (1) consumption which require the ordinary water treatment process before uses (2) aquatic organism conservation for living and assisting for fishery (3) fishery (4) recreation
Class 3	Medium clean fresh surface water resources using for (1) consumption but have to pass through an ordinary treatment process before uses (2) agriculture
Class 4	Fairly clean fresh surface water resources using for (1) consumption but require special water treatment process before uses. (2) industry (3) other activities
Class 5	The resources which are not classified in class 1-4 and using for (1) navigation

Source: Notification of the Ministry of Science, Technology and Energy (B.E. 2528 (1985)), published in the Royal Government Gazette, Vol. 103, Part 60, dated April 15, B.E. 2529 (1986).

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