FRESHWATER BIOASSESSMENT WORKSHOP

INTRODUCTION TO SWAMP PROCEDURES

Physical Habitat

Spring-Summer 2010

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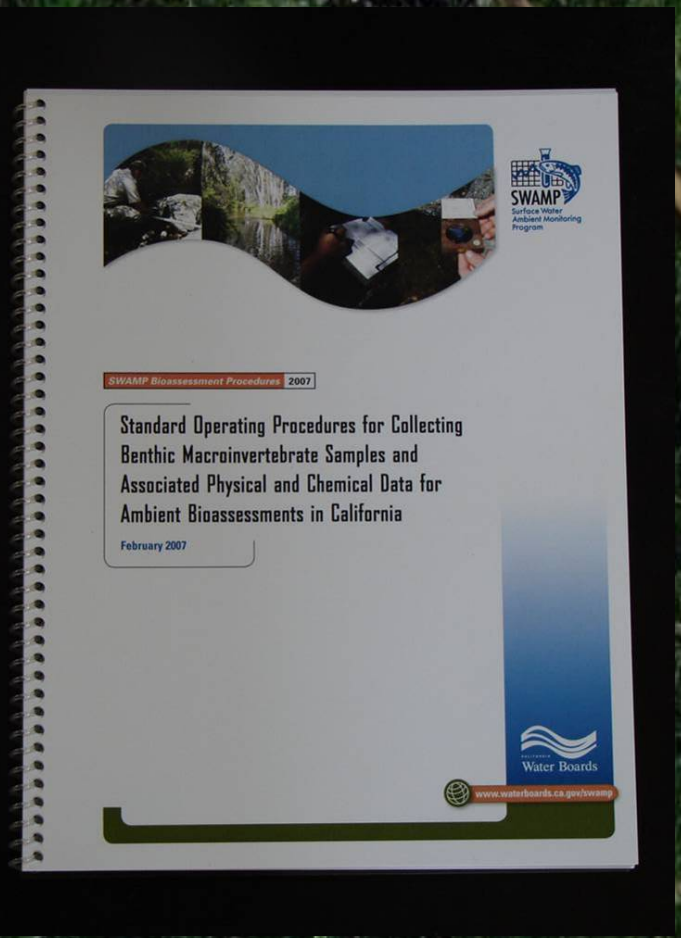
WPCL Bioassessment Laboratory

SWAMP
Surface Water Ambient Monitoring Program

Rapid Biological Assessment
2007 SWAMP Procedures



Collect BMIs

Measure Phab

Measure Basic Chemistry

Uses of PHab Data

Help describe the stream environment

Provide data for SWAMP researchers to develop helpful tools

Provide information to diagnose what is causing biotic disturbance

Table 1. Summary of physical habitat and water chemistry and proposal for basic, full, and optional levels of effort.

Survey Task	Parameter(s)	Basic	Full	Option	Comments
REACH DELINEATION and WATER QUALITY [Conducted before entering stream to sample BMIs or conduct any habitat surveys]	Layout reach and mark transects, record GPS coordinates	X	X		Use 150-m reach length if wetted width ≤10 m; Use 250-m reach length if wetted width > 10 m
	Temperature, pH, specific conductance, DO, alkalinity	X	X		Multi-meter (e.g., YSI, Hydrolab, VWR Symphony)
	Turbidity, Silica			X	Use test kit or meter
	Notable field conditions	X	X		Recent rainfall, fire events, dominant local landuse
CROSS-SECTIONAL TRANSECTS BASIC Measurements at main 11 transects only FULL Measurements at 11 main transects (A, B, C, D, E, F, G, H, I, J, K) or 21 transects (11 main plus 10 inter-transects) for substrate size classes only	Wetted width	X	X		Stadia rod is useful here
	Flow habitat delineation	X	X		Record proportion of habitat classes in each inter-transect zone
	Depth and Pebble Count + CPOM		X		5 -point substrate size, depth and CPOM records at all 21 transects
	Cobble embeddedness		X		All cobble-sized particles in pebble count. Supplement with "random walk" if needed for 25
	Slope (%)	See reach scale	X		Average slope calculated from 10 transect to transect slope measurements. Use autolevel for slopes ≤ 1%; clinometer is OK for steeper gradients
	Sinuosity		X		Record compass readings between transect centers
	Canopy cover	X	X		Four densiometer readings at center of channel (facing L bank R bank, Upstream +Downstream)
	Riparian Vegetation		X		Record % or categories
	Instream Habitat		X		
	Human Influence		X		
	Bank Stability	X	X		Eroding / Vulnerable / Stable
	Bankfull Dimensions		X		

Survey Task	Parameter(s)	Basic	Full	Option	Comments
DISCHARGE TRANSECT	Discharge measurements		X		Velocity-Area Method or Neutrally Buoyant Object Method
REACH SCALE MEASURE-MENTS:	EPA-RBP visual scoring of habitat features	*		X	*Used for citizen monitoring and comparison with legacy data
	Selected RBP visuals:		X		Channel alteration, sediment deposition, epifaunal substrate (redundant if doing EPA-RBP scoring)
	Slope (%, not degrees)	X	See transect scale		Single measurement for entire reach only for BASIC. Use autolevel for slopes ≤ 1%, clinometer is OK for higher gradients
	Photo documentation	X	X		Upstream (A, F, K) Downstream (F)

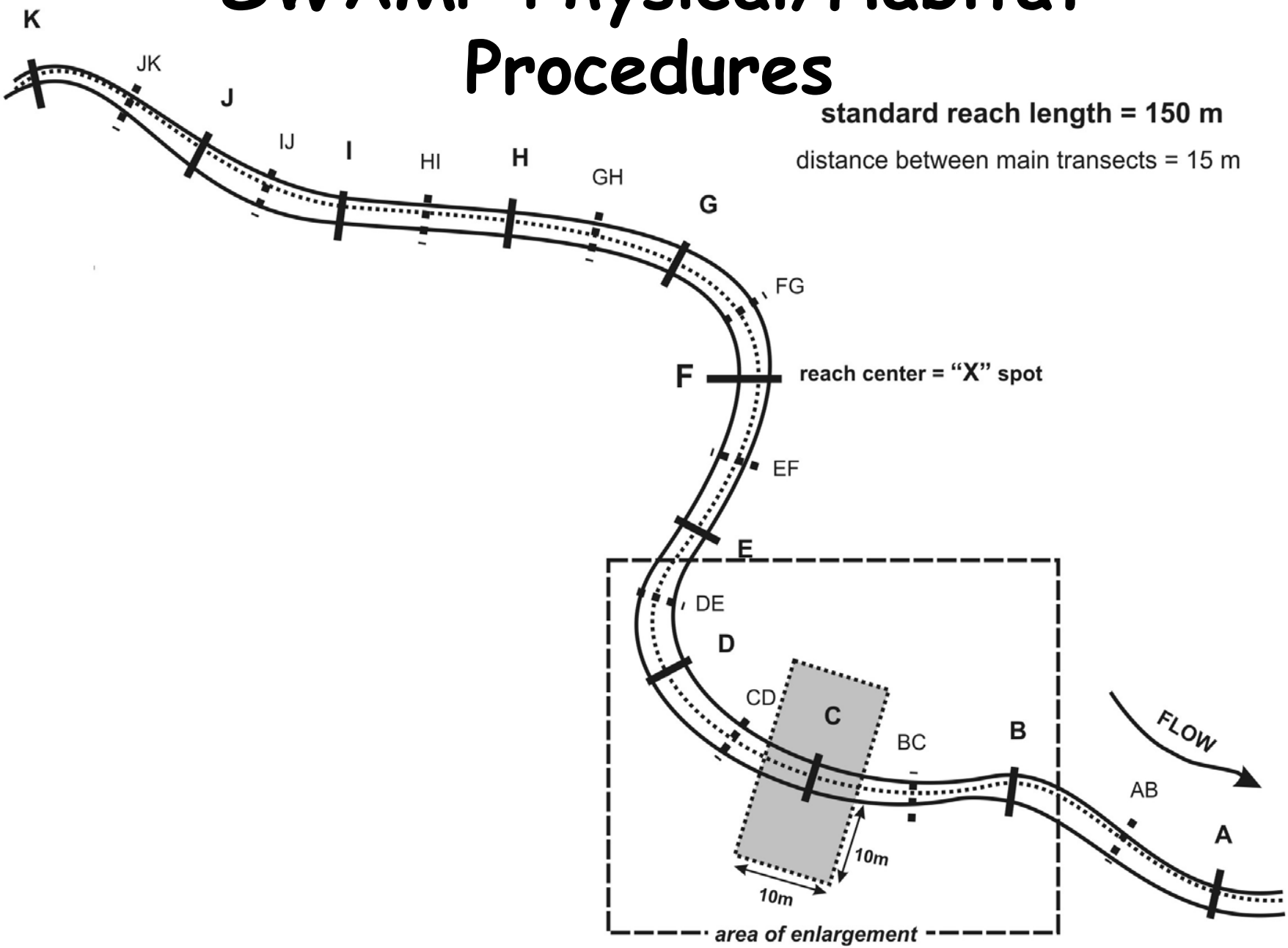
SWAMP BIOASSESSMENT FIELD FORMS - APRIL 2009

THE EQUIPMENT YOU WILL NEED

Table 2. Field equipment and supplies

Physical Habitat	BMI Collection	General/ Ambient Chemistry
• GPS receiver • topographic maps • measuring tape (150-m) • small metric ruler or gravelometer for substrate measurements • digital watch, random number table or ten-sided die • stadia rod • clinometer • autolevel (for slopes < 1%) • handlevel (optional) • current velocity meter • stopwatch for velocity measurements • convex spherical densitometer • flags/ flagging tape • rangefinder	• D-frame kick net (fitted with 500-µ mesh bag) • standard # 35 sieve (500-µ mesh) • wide-mouth 500-mL or 1000 mL plastic jars • white sorting pan (enamel or plastic) • 95% EtOH • fine tipped forceps or soft forceps • waterproof paper and tape for attaching labels • 10-20-L plastic bucket for sample elutriation • preprinted waterproof labels (e.g., Rite-in-the-Rain™) • disposable gloves/ elbow length insulated gloves	• sampling SOP (this document) • hip or chest waders, or wading boots/shoes • field forms printed on waterproof paper (e.g., Rite-in-the-Rain™) • clip board and pencils • digital camera • centigrade thermometer • pH meter • DO meter • conductivity meter • field alkalinity meter • water chemistry containers • calibration standards • spare batteries for meters • first aid kit

SWAMP Physical/Habitat Procedures



standard reach length = 150 m

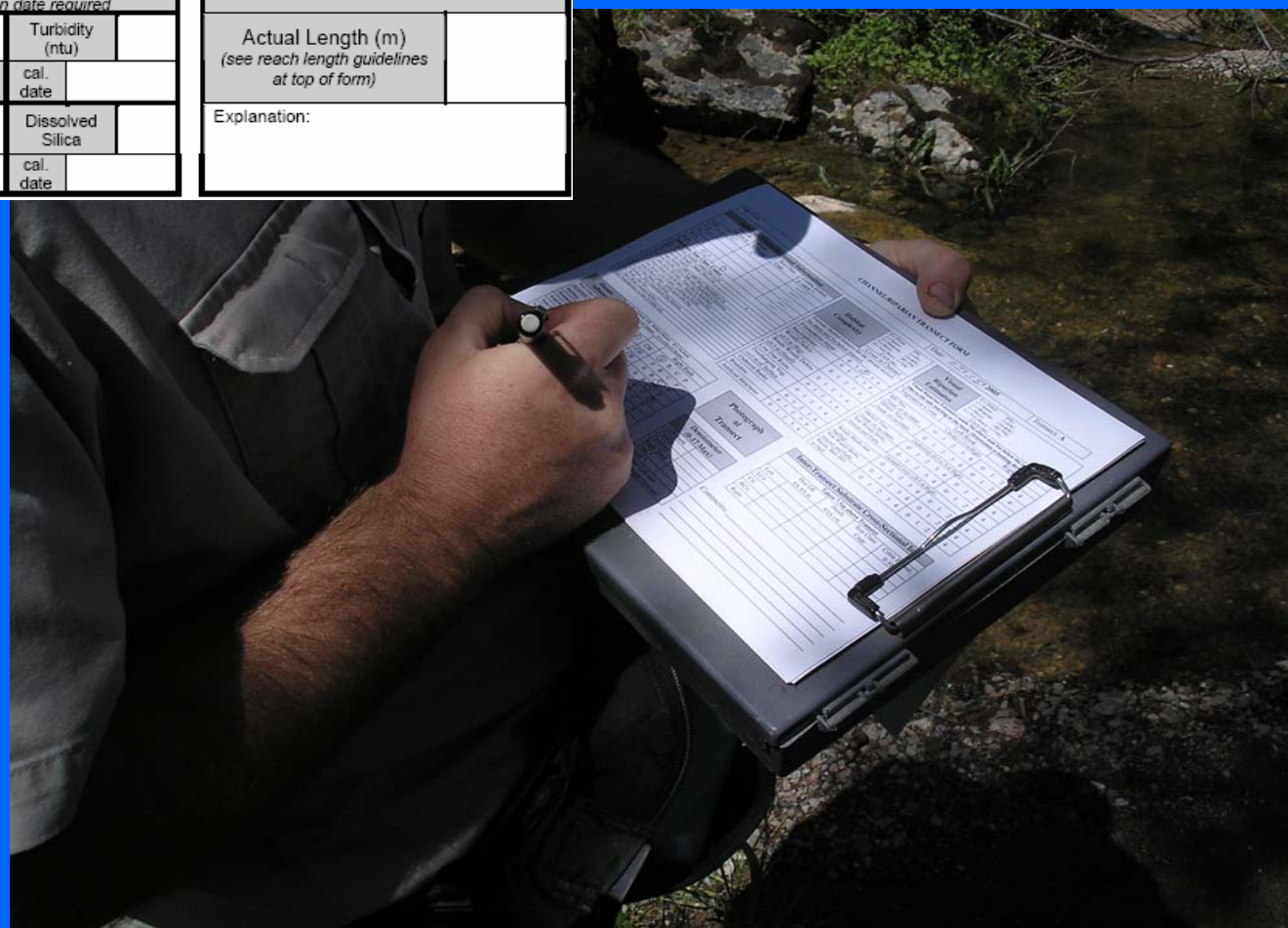
distance between main transects = 15 m

SWAMP BIOASSESSMENT FIELD FORMS - APRIL 2009

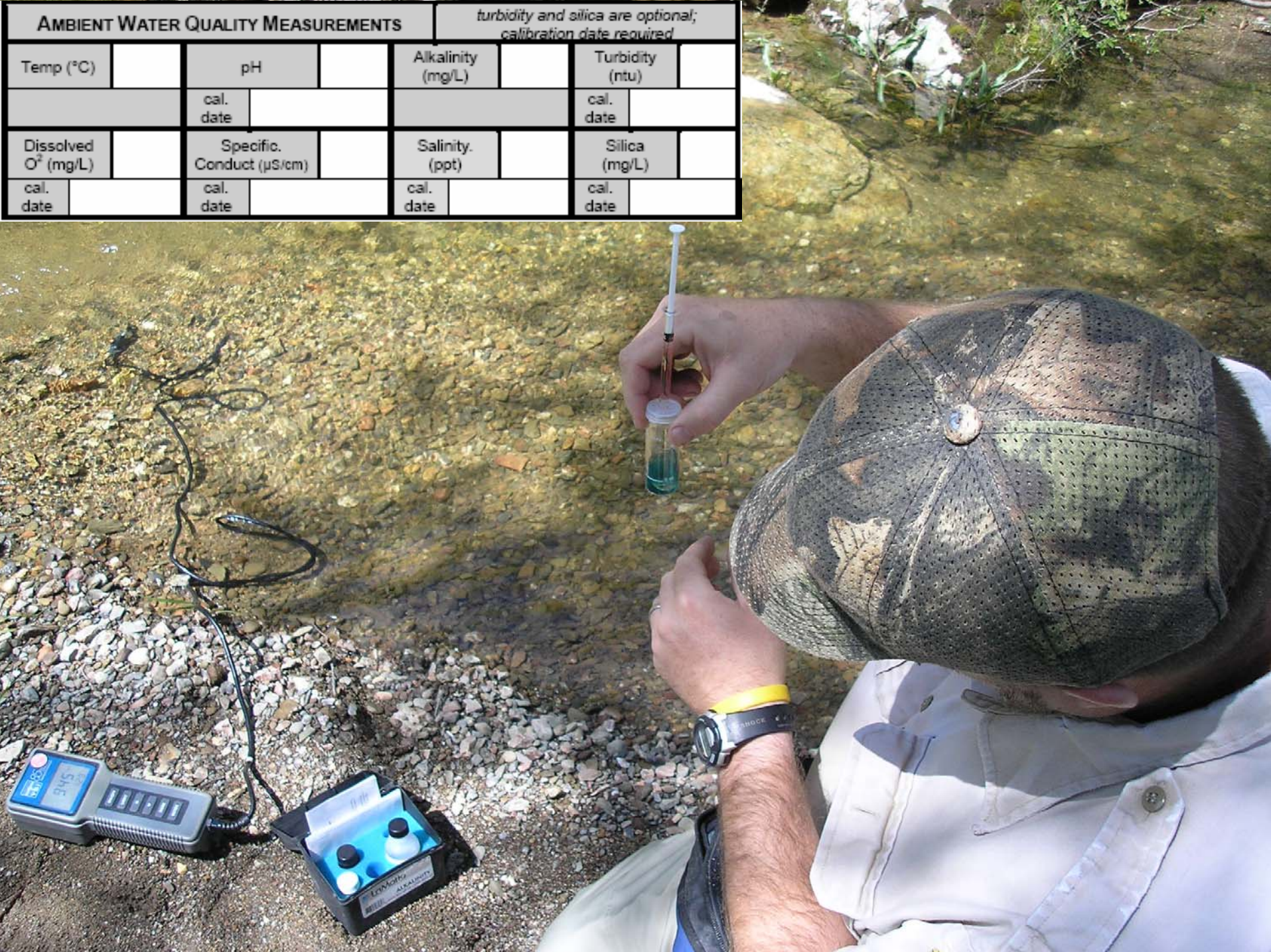
REACH DOCUMENTATION	Standard Reach Length (wetted width ≤ 10 m) = 150 m Distance between transects = 15 m Alternate Reach Length (wetted width >10 m) = 250 m Distance between transects = 25 m	
Project Name:	Date:	Time:
Stream Name:	Site Name/ Description:	
Site Code:	Crew Members:	
Latitude: °N	datum: NAD83	
Longitude: °W	other:	

AMBIENT WATER QUALITY MEASUREMENTS	*turbidity and silica are optional; calibration date required*							
Temp (°C)		pH		Alkalinity (mg/L)		Turbidity (ntu)		
		cal. date				cal. date		
Dissolved O^2 (mg/L)		Specific. Conduct (µS)		Salinity. (ppt)		Dissolved Silica		
cal. date		cal. date		cal. date		cal. date		

REACH LENGTH	
Actual Length (m) *(see reach length guidelines at top of form)*	
Explanation:	



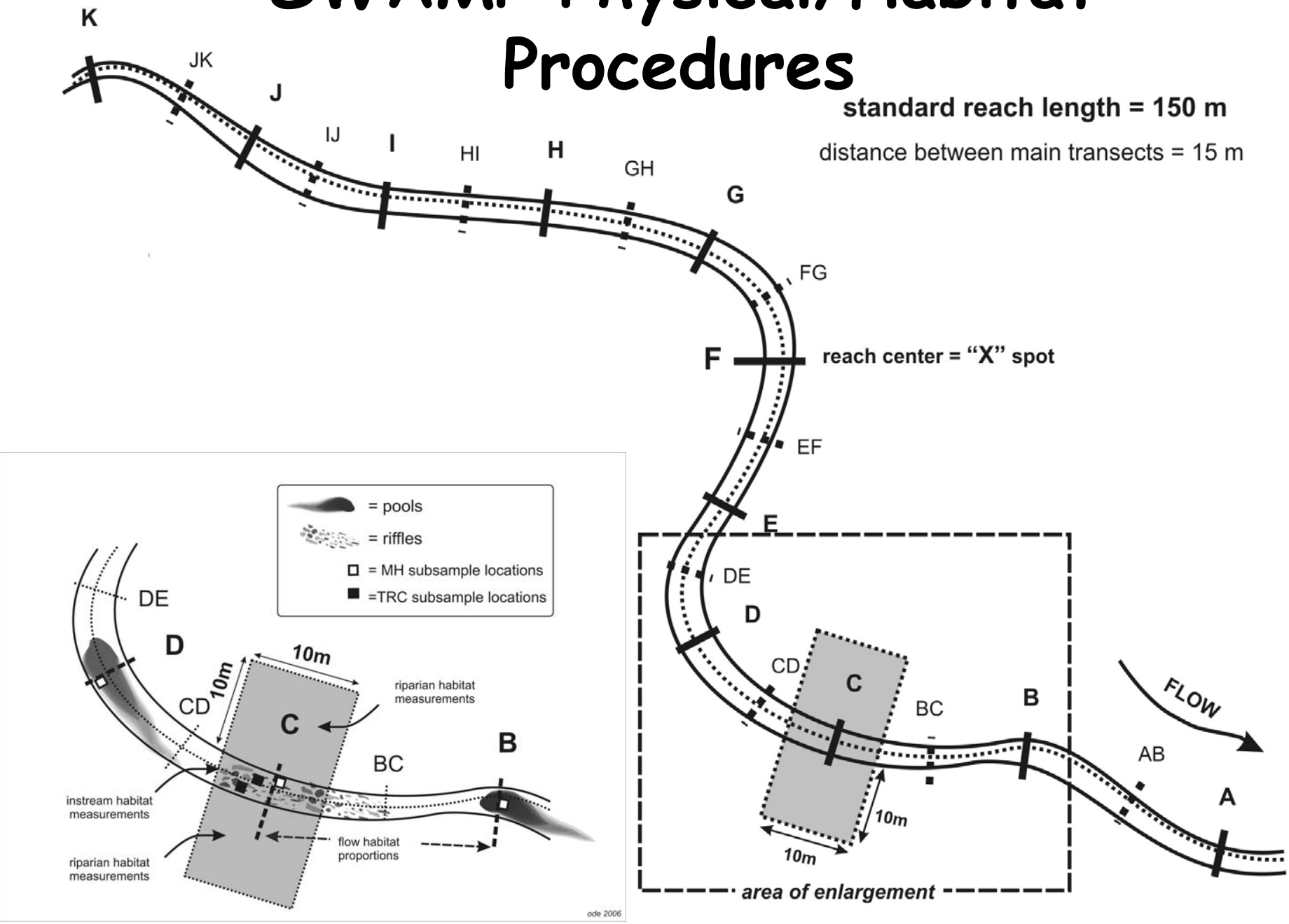
AMBIENT WATER QUALITY MEASUREMENTS				*turbidity and silica are optional; calibration date required*			
Temp (°C)		pH		Alkalinity (mg/L)		Turbidity (ntu)	
		cal. date				cal. date	
Dissolved O^2 (mg/L)		Specific. Conduct (µS/cm)		Salinity. (ppt)		Silica (mg/L)	
cal. date		cal. date		cal. date		cal. date	



SWAMP BIOASSESSMENT FIELD FORMS - APRIL 2009

NOTABLE FIELD CONDITIONS (check one box per topic)						
Evidence of recent rainfall (enough to increase surface runoff)	NO		minimal		>10% flow increase	
Evidence of fires in reach or immediately upstream (<500 m)	NO		< 1 year		< 5 years	
Dominant landuse/ landcover in area surrounding reach	Agriculture		Forest		Rangeland	
	Urban/ Industrial		Suburb/Town		Other	

SWAMP Physical/Habitat Procedures

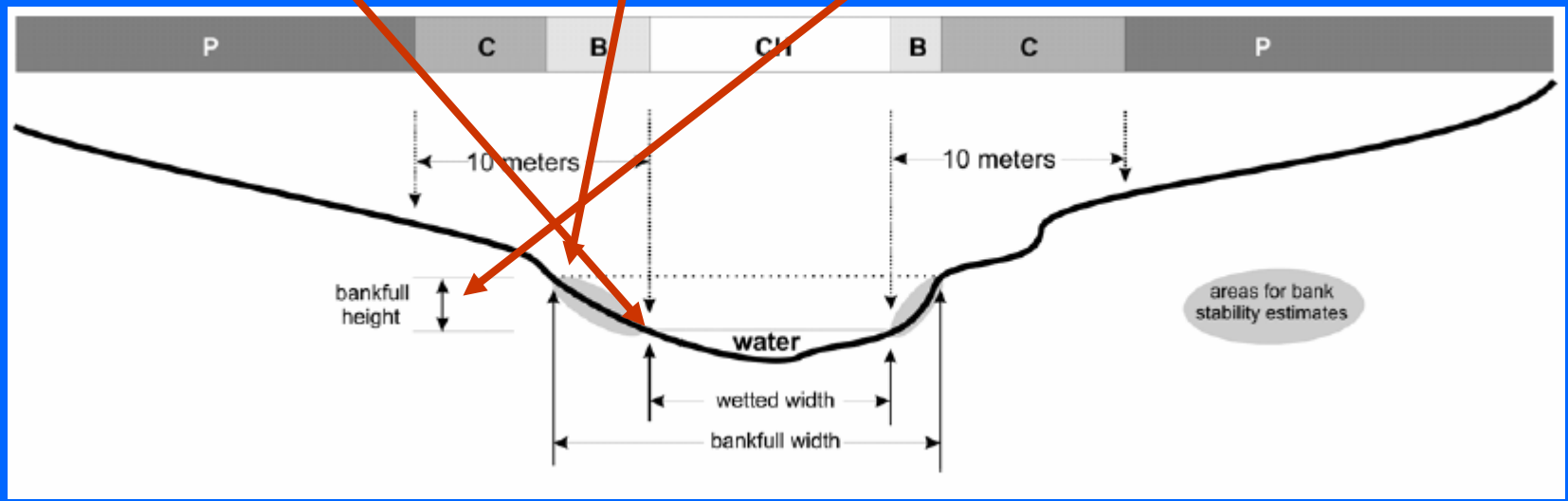


ode 2006

SWAMP BIOASSESSMENT FIELD FORMS - APRIL 2009

CHANNEL DEMENTIONS ON TRANSECTS

Site Code:	Site Name:	Date: __ __ / __ __ / __ __ __ __
Wetted Width (m):	Bankfull Width (m):	Bankfull Height (m):	**Transect A**




Bankfull Width
Wetted Width

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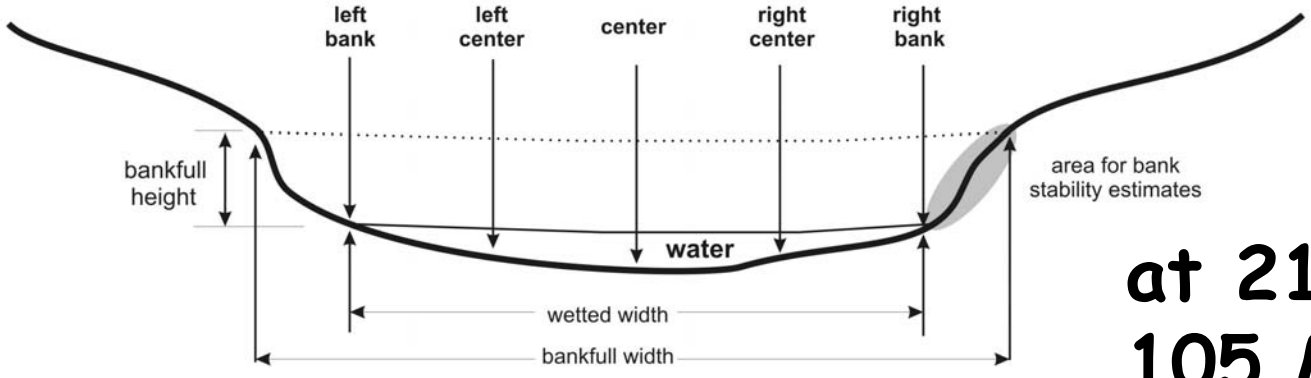
5 Pebbles/Transect
for 11
Primary Trassects A-K

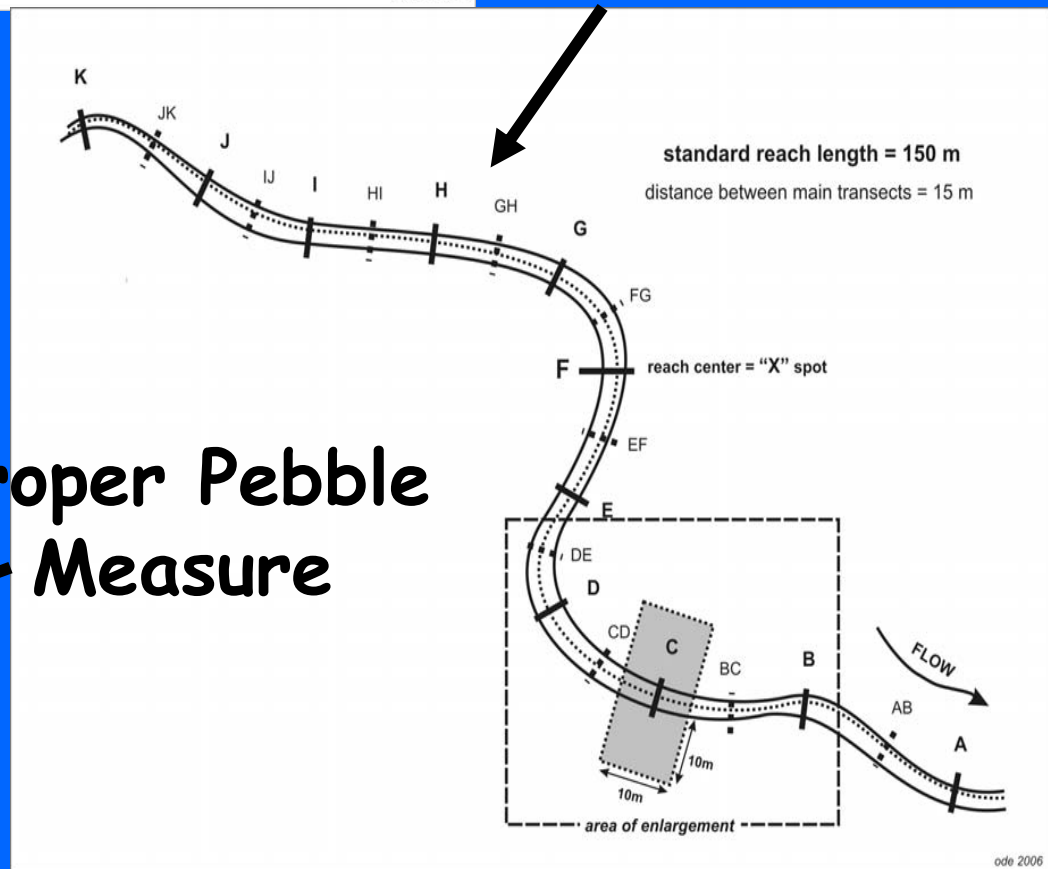
TRANSECT SUBSTRATES					Cobble Embed-dedness (%)
Position	Dist from LB (cm)	Depth (cm)	mm/ size class	CPOM	
Left Bank				P A	
Left Center				P A	
Center				P A	
Right Center				P A	
Right Bank				P A	

5 Pebbles/Transect
for 10
Inter Trassects AB- JK

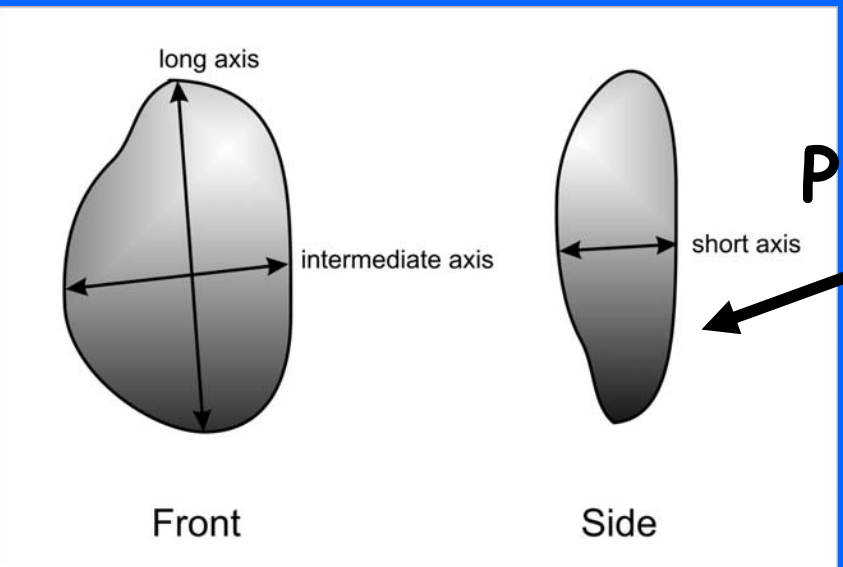
INTER-TRANSECT SUBSTRATES (measure in mm or use size classes)					Cobble Embedded-ness (%)
Position	Dist from LB (cm)	Depth (cm)	mm/ size class	CPOM	
Left Bank				P A	
Left Center				P A	
Center				P A	
Right Center				P A	
Right Bank				P A	



at 21 Transects for 105 Measures Total



Pebble Counts for Substrate Composition



Proper Pebble Measure

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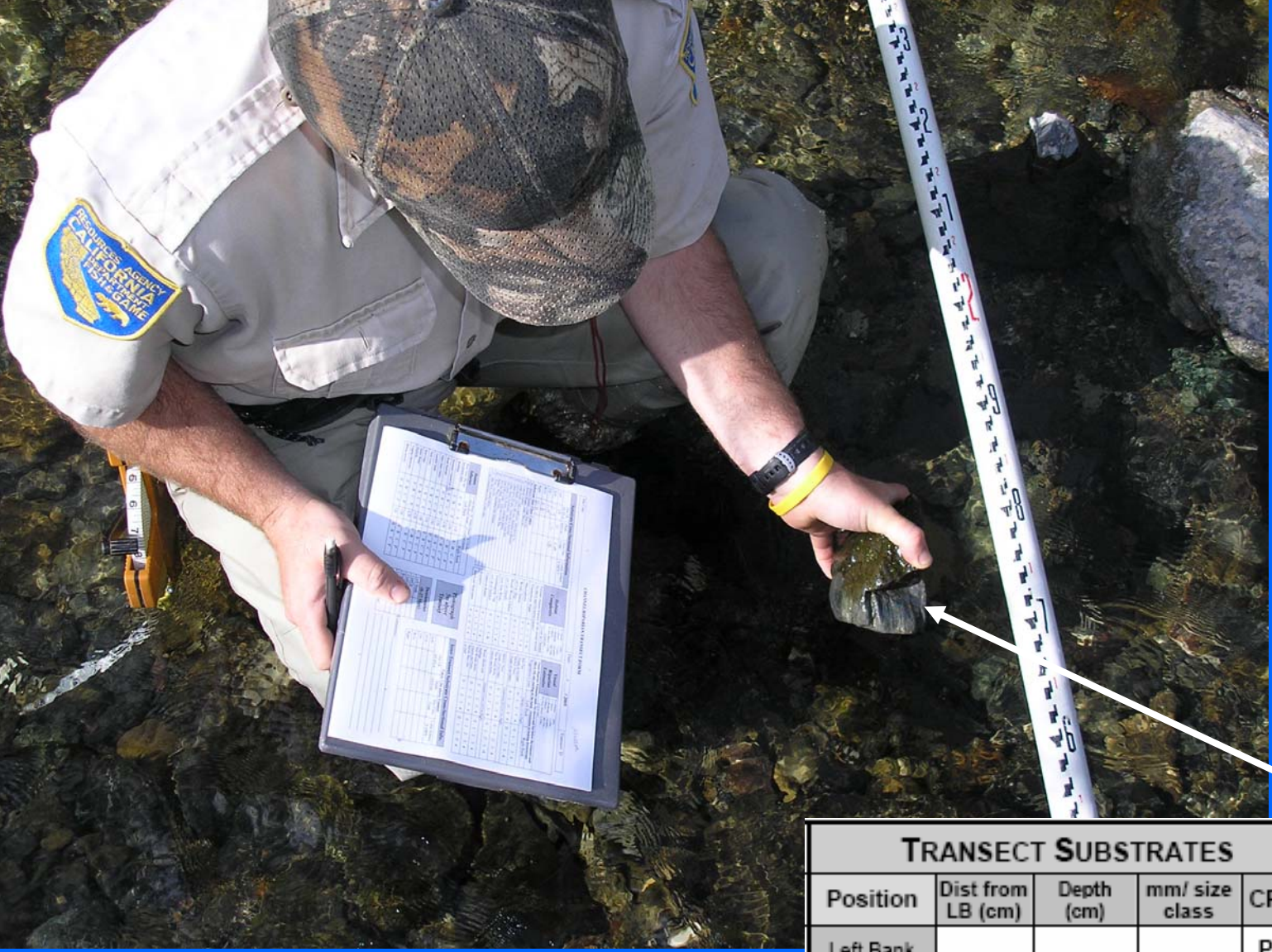
MEASURING SUBSTRATE SIZE

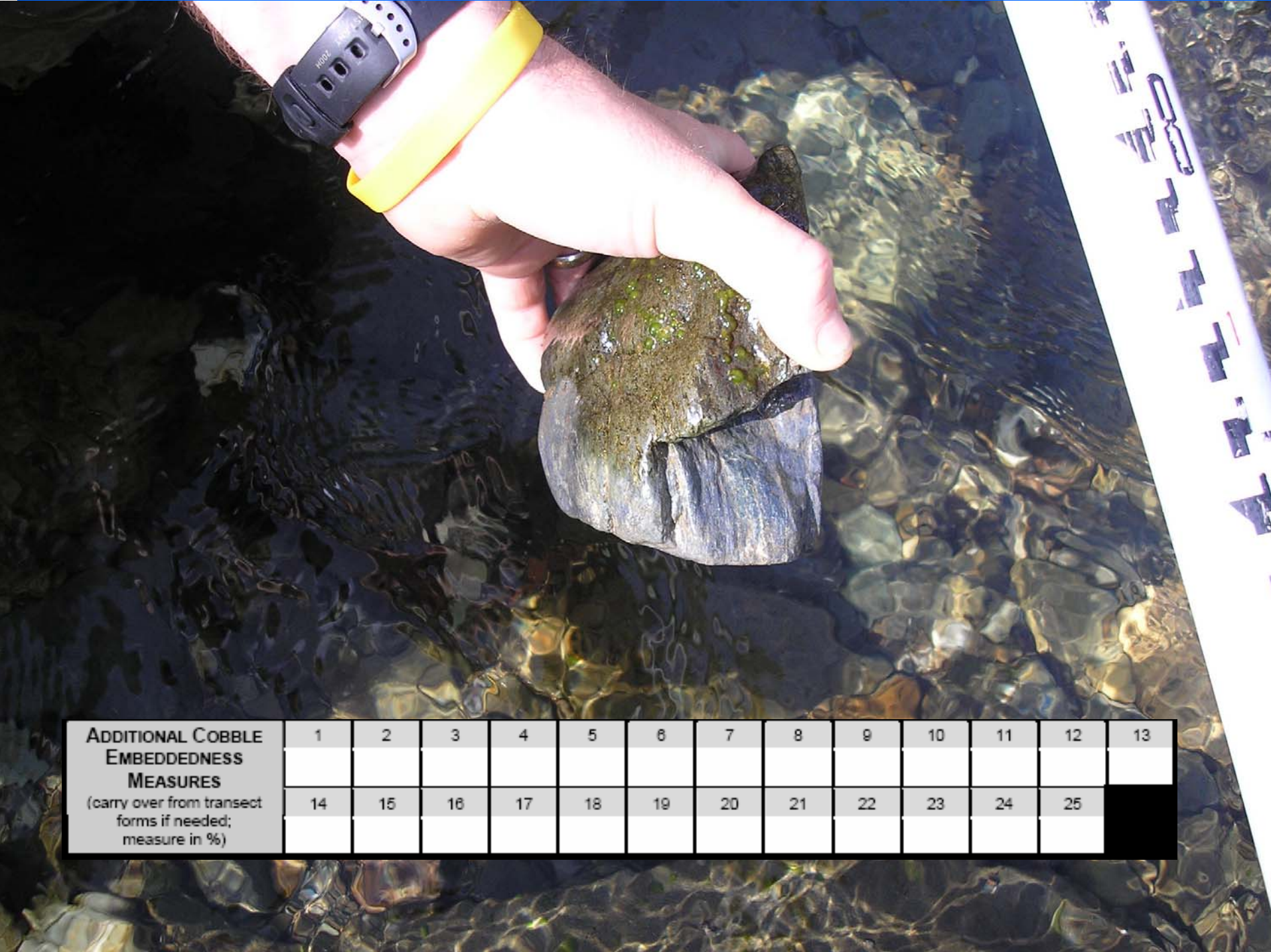
These size classes are measured directly in mm

Size Class Code	Size Class Range	Size Class Description	Common Size Reference
RS	> 4 m	bedrock, smooth	larger than a car
RR	> 4 m	bedrock, rough	larger than a car
XB	1 - 4 m	boulder, large	meter stick to car
SB	25 cm - 1.0 m	boulder, small	basketball to meter stick
CB	64 - 250 mm	cobble	tennis ball to basketball
GC	16 - 64 mm	gravel, coarse	marble to tennis ball
GF	2 – 16 mm	gravel, fine	ladybug to marble
SA	0.06 – 2 mm	sand	gritty to ladybug
FN	< 0.06 mm	fines	not gritty
HP	< 0.06 mm	hardpan (consolidated fines)	
WD	NA	wood	
RC	NA	concrete/ asphalt	
OT	NA	other	



TRANSECT SUBSTRATES					Cobble Embed-dedness (%)
Position	Dist from LB (cm)	Depth (cm)	mm/ size class	CPOM	
Left Bank				P A	
Left Center				P A	
Center				P A	
Right Center				P A	
Right Bank				P A	

Cobble Embeddedness



ADDITIONAL COBBLE EMBEDDEDNESS MEASURES (carry over from transect forms if needed; measure in %)	1	2	3	4	5	6	7	8	9	10	11	12	13
	14	15	16	17	18	19	20	21	22	23	24	25	

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MEASURING HUMAN INFLUENCE

HUMAN INFLUENCE (circle only the closest to wetted channel)	0 = Not Present B = On Bank C = Between Bank and 10 m from Channel P = >10 m + <50 m from Channel Channel (record Yes or No)									
	Left Bank				Channel		Right Bank			
Walls/ Rip-rap/ Dams	P	C	B	0	Y	N	0	B	C	P
Buildings	P	C	B	0	Y	N	0	B	C	P
Pavement/ Cleared Lot	P	C	B	0			0	B	C	P
Road/ Railroad	P	C	B	0	Y	N	0	B	C	P
Pipes (Inlet/ Outlet)	P	C	B	0	Y	N	0	B	C	P
Landfill/ Trash	P	C	B	0	Y	N	0	B	C	P
Park/ Lawn	P	C	B	0			0	B	C	P
Row Crops	P	C	B	0			0	B	C	P
Pasture/ Range	P	C	B	0			0	B	C	P
Logging Operations	P	C	B	0			0	B	C	P
Mining Activity	P	C	B	0	Y	N	0	B	C	P
Vegetation Management	P	C	B	0			0	B	C	P
Bridges/ Abutments	P	C	B	0	Y	N	0	B	C	P
Orchards/ Vineyards	P	C	B	0			0	B	C	P

SWAMP BIOASSESSMENT FIELD FORMS - APRIL 2009

MEASURING RIPARIAN VEGETATION

RIPARIAN VEGETATION (facing downstream)	0 = Absent (0%) 1 = Sparse (<10%) 2 = Moderate (10-40%) 3 = Heavy (40-75%) 4 = Very Heavy>75%) circle one	
Vegetation Class	**Left Bank**	**Right Bank**
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs and saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

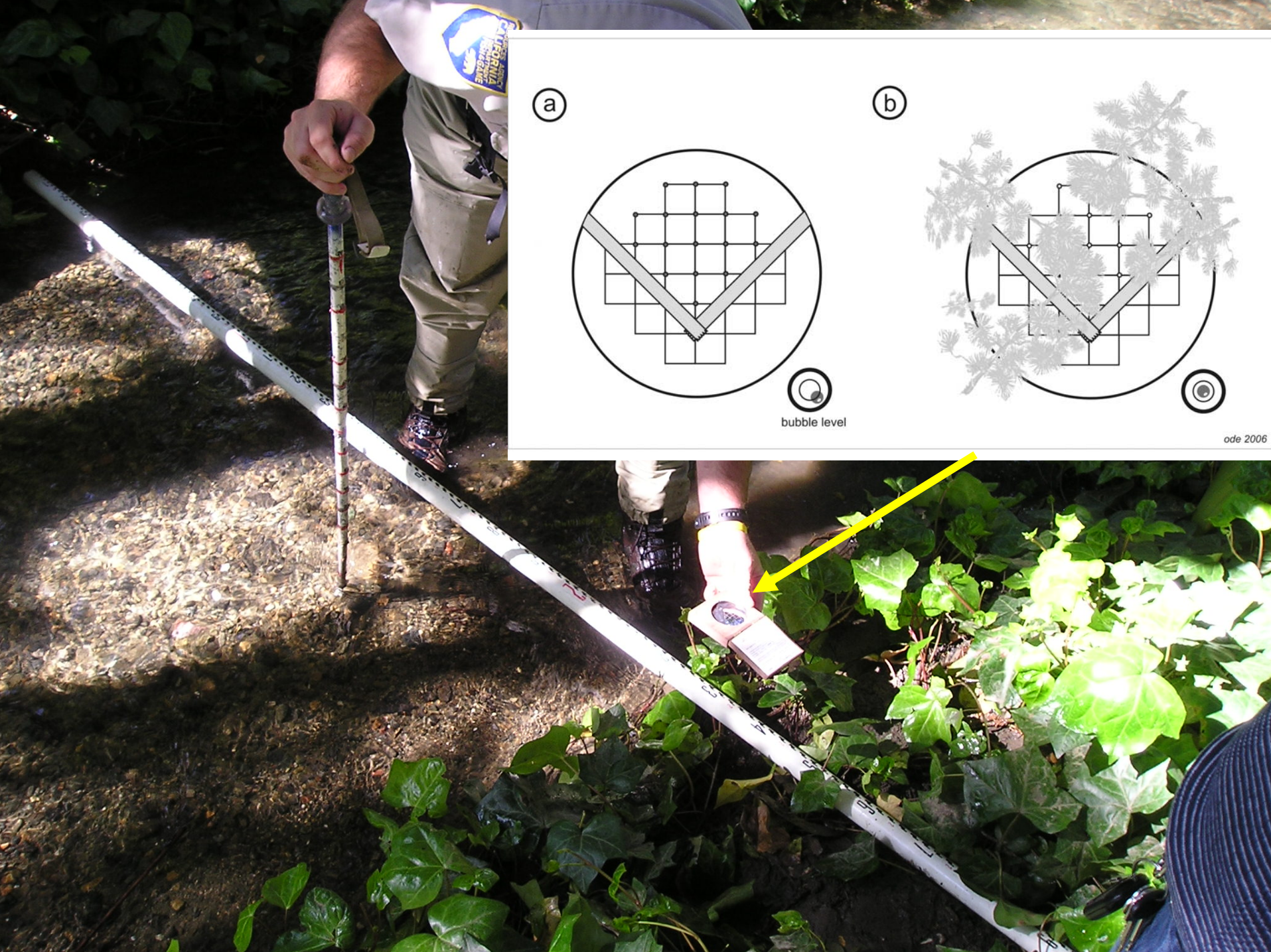
SWAMP BIOASSESSMENT FIELD FORMS - APRIL 2008

MEASURING HABITAT COMPLEXITY
MEASURING BANK STABILITY
MEASURING CANOPY COVER

INSTREAM HABITAT COMPLEXITY	0 = Absent (0%) 1 = Sparse (<10%) 2 = Moderate (10-40%) 3 = Heavy (40-75%) 4 = Very Heavy (>75%)
Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

BANK STABILITY (score zone 5m up and 5m downstream of transect between bankfull - wetted width)			
Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

DENSIOMETER READINGS (0-17) *count covered dots*	
Center Left	
Center Upstream	
Center Downstream	
Center Right	
Left Bank (optional)	
Right Bank (optional)	


a
b
bubble level
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SWAMP BIOASSESSMENT FIELD FORMS - APRIL 2009

Slope and Bearing Measurement

Site Code: Date: / /

SLOPE and BEARING FORM (transect based - for Full PHAB only)

AUTOLEVEL ☐
CLINOMETER ☐
HANDLEVEL ☐
OTHER ☐

Starting Transect	MAIN SEGMENT (record percent of inter-transect distance in each segment if supplemental segments are used)					SUPPLEMENTAL SEGMENT (record percent of inter-transect distance in each segment if supplemental segments are used)				
	Stadia rod measurements	Slope (%) or Elevation Difference cm ☐ % ☐	Segment Length (m)	Bearing (0°-359°)	Percent of Total Length (%)	Stadia rod measurements	Slope or Elevation Difference cm ☐ % ☐	Segment Length (m)	Bearing (0°-359°)	Percent of Total Length (%)
K										
J										
I										
H										
G										
F										
E										
D										
C										
B										
A										
additional calculation area										

SWAMP BIOASSESSMENT FIELD FORMS - APRIL 2009

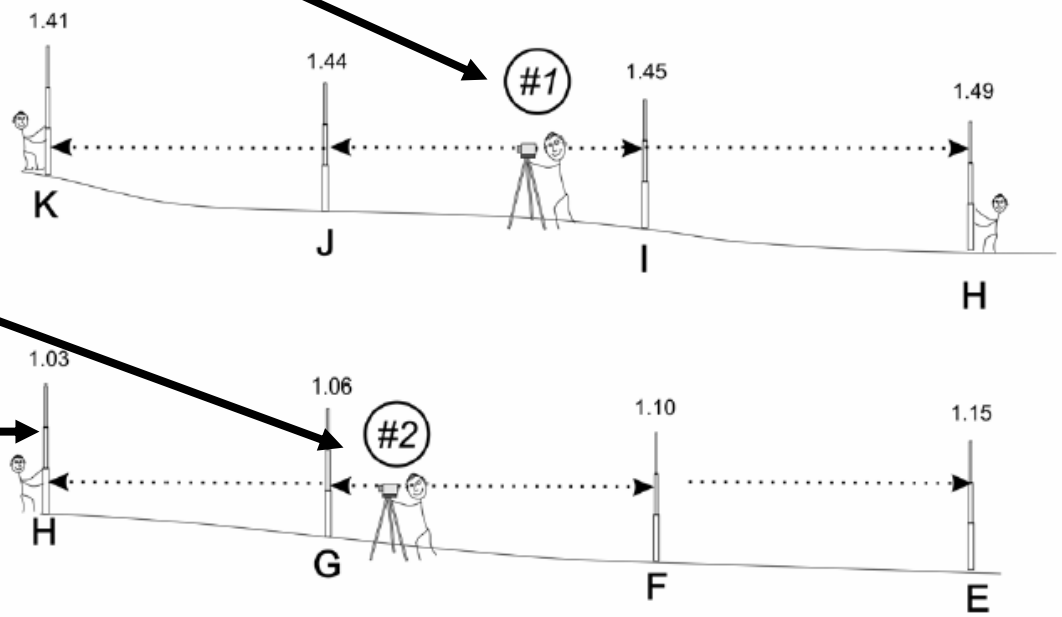
SLOPE AND BEARING FORM

Set up Level @ Site 1

Record Height of Each Transect

Move Level to Site 2 and Back-sight Last Transect

Starting Transect	Main Segment (record percent of inter-transect distance in each segment if supplemental segments are used)						Supplemental Segment (record percent of inter-transect distance in each segment if supplemental segments are used)					
	Stadia rod measurements		Slope (%) or Elevation Difference cm ■ % □	Segment Length (m)	Bearing (0°-359°)	Percent of Total Length (%)	Stadia rod measurements		Slope or Elevation Difference cm □ % □	Segment Length (m)	Bearing (0°-359°)	Percent of Total Length (%)
K	1.41											
J	1.44		3	15	140	100						
I	1.45		1	15	145	100						
H	1.49	1.03	4	15	150	100						
G		1.06	3	15	143	100						
F		1.10	4	15	187	100						
E		1.15	5	15	195	100						




SUUNTO

SWAMP BIOASSESSMENT FIELD FORMS - APRIL 2009

MEASURING FLOW HABITAT TYPES

Flow Habitat Type	DESCRIPTION
Cascades	Short, high gradient drop in stream bed elevation often accompanied by boulders and considerable turbulence
Falls	High gradient drop in elevation of the stream bed associated with an abrupt change in the bedrock
Rapids	Sections of stream with swiftly flowing water and considerable surface turbulence. Rapids tend to have larger substrate sizes than riffles
Riffles	Shallow sections where the water flows over coarse stream bed particles that create mild to moderate surface turbulence; (< 0.5 m deep, > 0.3 m/s).
Runs	Long, relatively straight, low-gradient sections without flow obstructions. The stream bed is typically even and the water flows faster than it does in a pool; (> 0.5 m deep, > 0.3 m/s). A **step-run** is a series of runs separated by short riffles or flow obstructions that cause discontinuous breaks in slope
Glides	A section of stream with little or no turbulence, but faster velocity than pools; (< 0.5 m deep, < 0.3 m/s)
Pools	A reach of stream that is characterized by deep, low-velocity water and a smooth surface; (> 0.5 m deep, < 0.3 m/s)

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3 Methods for Discharge Measurements

DISCHARGE MEASUREMENTS

1st measurement – left bank (looking downstream)

check if discharge measurements not possible (explain in field notes section) ☐

VELOCITY AREA METHOD (preferred)

	Distance from Left Bank (cm)	Depth (cm)	Velocity (m/sec)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Transect Width:

	Distance from Left Bank (cm)	Depth (cm)	Velocity (m/sec)
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

BOUYANT OBJECT METHOD (use ONLY if velocity area method not possible)

	Float 1	Float 2	Float 3
Distance			
Float Time			

Float Reach Cross Section

width (m) depth	Upper Section	Middle Section	Lower Section
Width			
Depth 1			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

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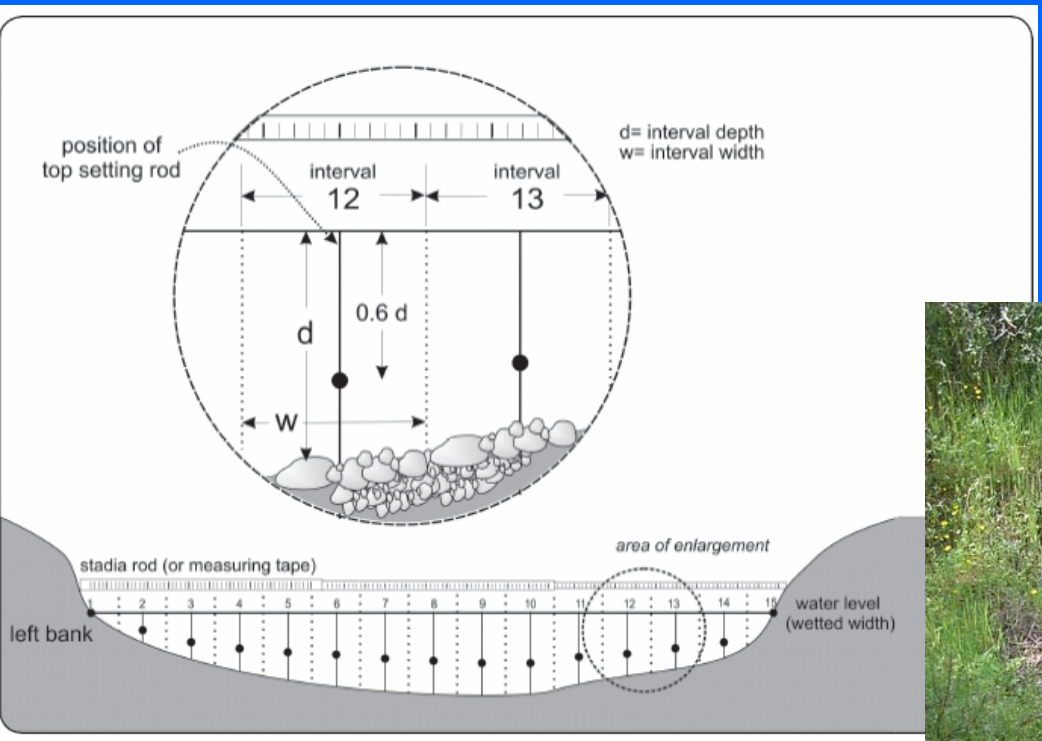
Preferred Method for Discharge Measurements



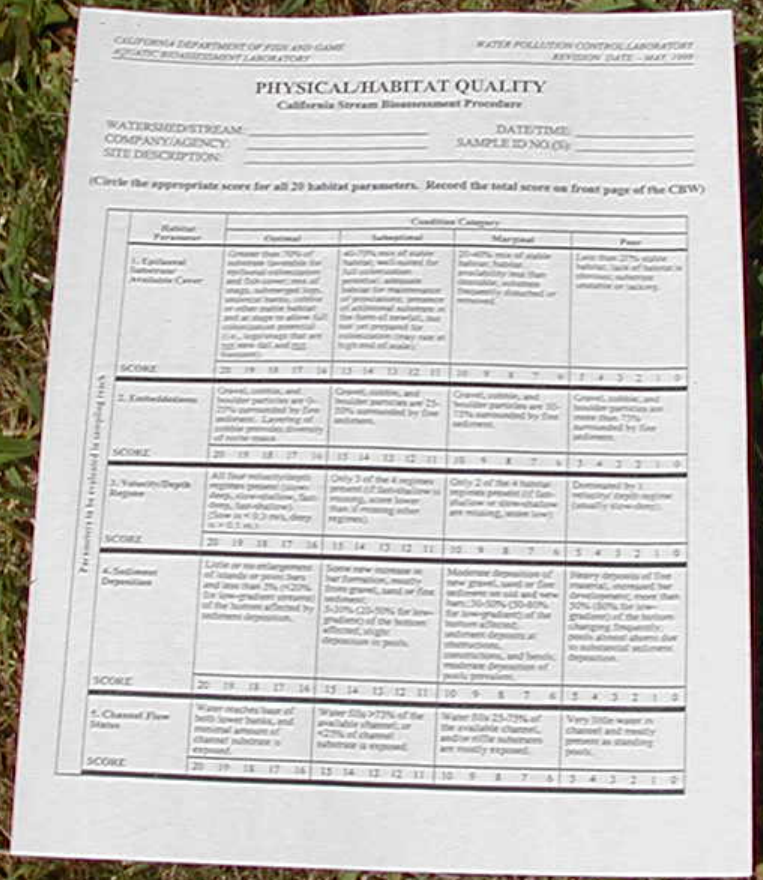
Velocity Area Method

SWAMP BIOASSESSMENT FIELD FORMS - APRIL 2009

MEASURING HUMAN INFLUENCE

Parameter	Optimal	Suboptimal	Marginal	Poor
Epifaunal Substrate/ Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover (50% for low-gradient streams); mix of submerged logs, undercut banks, cobble or other stable habitat	40-70% mix of stable habitat (30-50% for low-gradient streams); well-suited for full colonization potential	20-40% mix of stable habitat (10-30% in low-gradient streams); substrate frequently disturbed or removed	Less than 20% stable habitat (10% in low-gradient streams); lack of habitat is obvious; substrate unstable or lacking
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition (<20% in low-gradient streams)	Some new increase in bar formation, mostly from gravel, sand, or fine sediment; 5-30% of the bottom affected (20-50% in low-gradient streams)	Moderate deposition of new gravel, sand, or fine sediment on bars; 30-50% of the bottom affected (50 - 80% in low-gradient streams)	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently (>80% in low-gradient streams)
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, (e.g., bridge abutments); evidence of past channelization (> 20yrs) may be present but recent channelization not present	Channelization may be extensive: embankments or shoring structures present on both banks; 40 to 80% of stream reach disrupted	Banks shored with gabian or cement; Over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

EPA (RBP) PHYSICAL/HABITAT QUALITY
SWAMP "BASIC" PHAB



CALIFORNIA DEPARTMENT OF FISH AND GAME
AQUATIC BIOASSESSMENT LABORATORY

WATER POLLUTION CONTROL LABORATORY
REVISION DATE: MAY 1999

PHYSICAL/HABITAT QUALITY
California Stream Bioassessment Procedure

WATERSHED/STREAM: _____ DATE/TIME: _____
COMPANY/AGENCY: _____ SAMPLE ID NO.(S): _____
SITE DESCRIPTION: _____

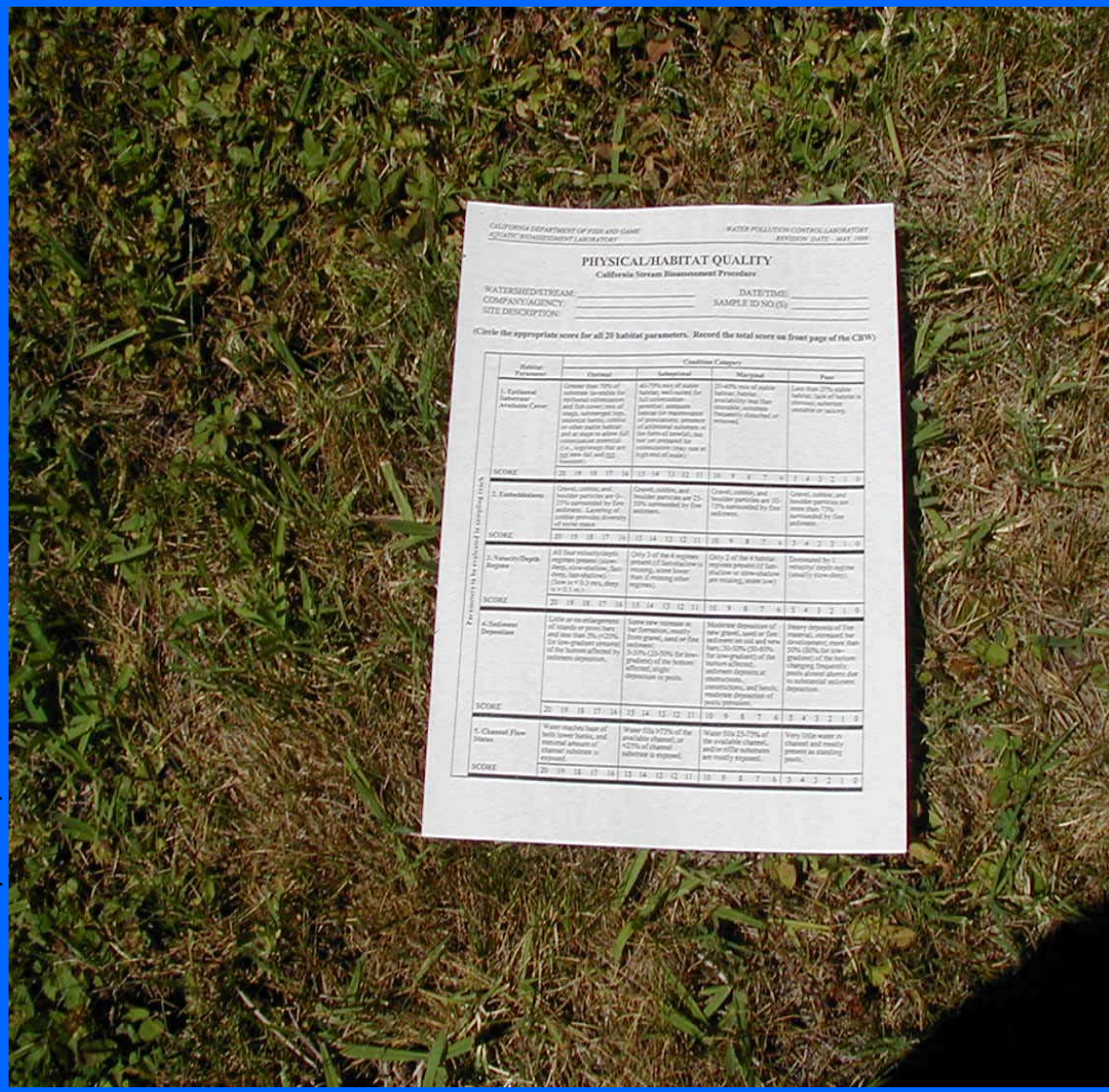
(Circle the appropriate score for all 20 habitat parameters. Record the total score on front page of the CBW)

Parameters to be evaluated in sampled reach

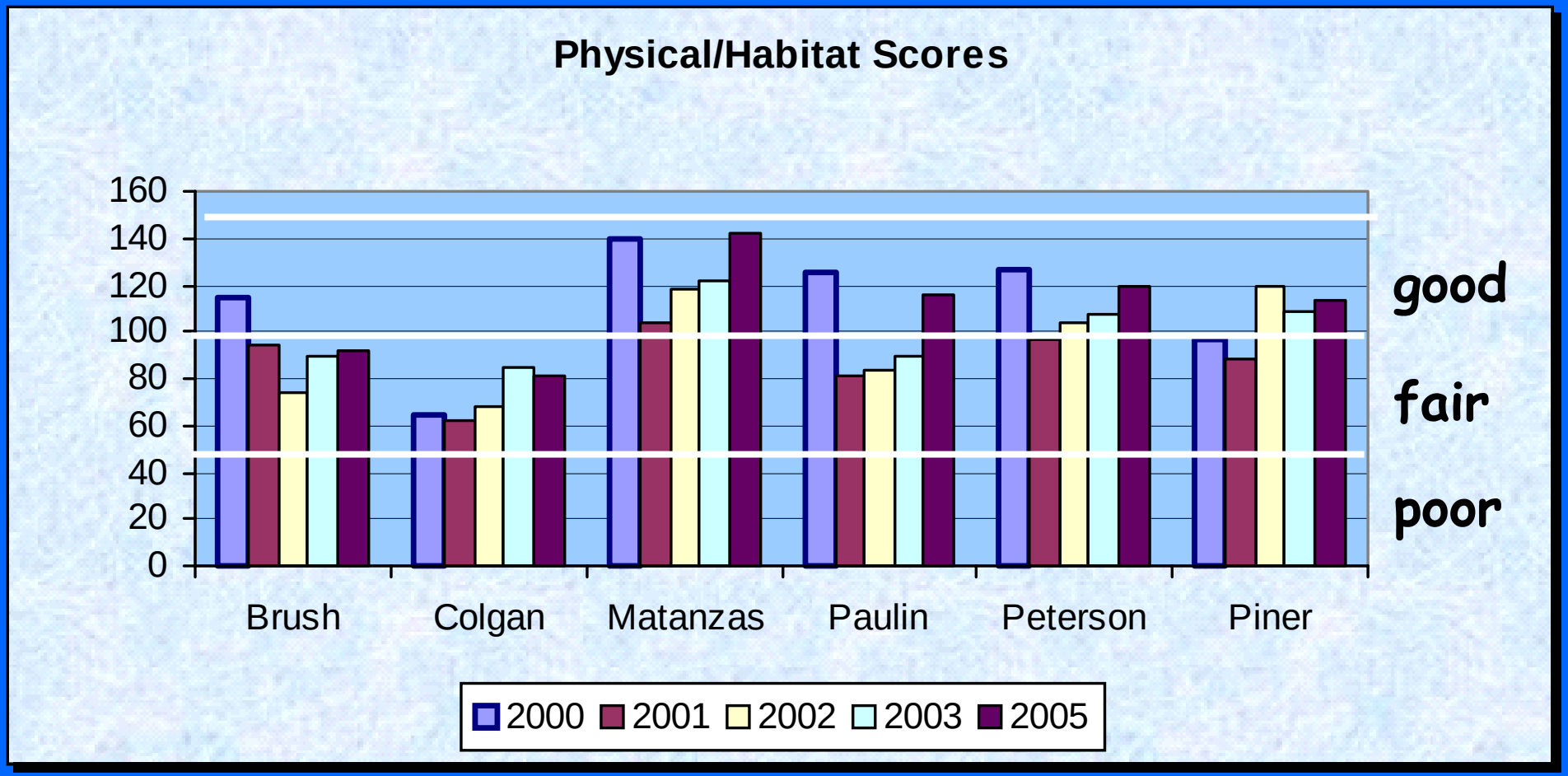
Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is <0.3 m/s, deep is >0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

EPA RBP P/hab Quality (Barbour et al. 1999):

1 Epifaunal Substrate
2 Embeddedness
3 Velocity/Depth
4 Sediment Deposition
5 Channel Flow Status
6 Channel Alteration
7 Frequency of Riffles
8 Bank Stability
9 Vegetative Protection
10 Riparian Vegetation Zone Width



Variability in Urban Stream Scores



New Zealand Mud Snail

Quality Assurance Management Plan

for the California Department of Fish and Game's
Aquatic Bioassessment Laboratory:

Field and Laboratory Procedures for Conducting Freshwater Bioassessment

California Department of Fish and Game
Office of Spill Prevention and Response
Fish and Wildlife Water Pollution Control Laboratory
2005 Nimbus Road
Rancho Cordova, CA 95670


NOW LET'S GO
GET SOME BUGS