Turners Falls Instream Flow Study

Study Process Overview

Study Plan Scoping Meeting

April 16, 2013

Study Timing Relative to ILP schedule

ILP Schedule

- Proposed Study Plans (PSP): 4/15/13
- Study Plan Meeting: 5/14-15/13
- Additional Fish and Aquatic Meetings: 5/21-22, 6/4-5/13
- Seeking to conduct IFIM Study July timeframe
- Comments due on PSP: 7/14/13
- Revised Study Plans (RSP): 8/13/13
- Comments due on RSP: 8/28/13
- FERC Issues Study Plan Determination Letter 9/12/13 (assuming no disputes)

- We need stakeholder and FERC approval before initiating study

Why Accelerate?

- Findings will inform other studies, fish passage alternatives, and potential impacts on hydropower generation

TERMINOLOGY

Macrohabitat – water quality and hydrology

Mesohabitat – commonly occurring habitat types

Critical habitat – important to a species even if not common

Microhabitat – depth, velocity and cover within each mesohabitat

Weighted Usable Area - quantitative index of habitat suitability

PHABSIM Study

1. Study Planning
2. Locate reaches and transects
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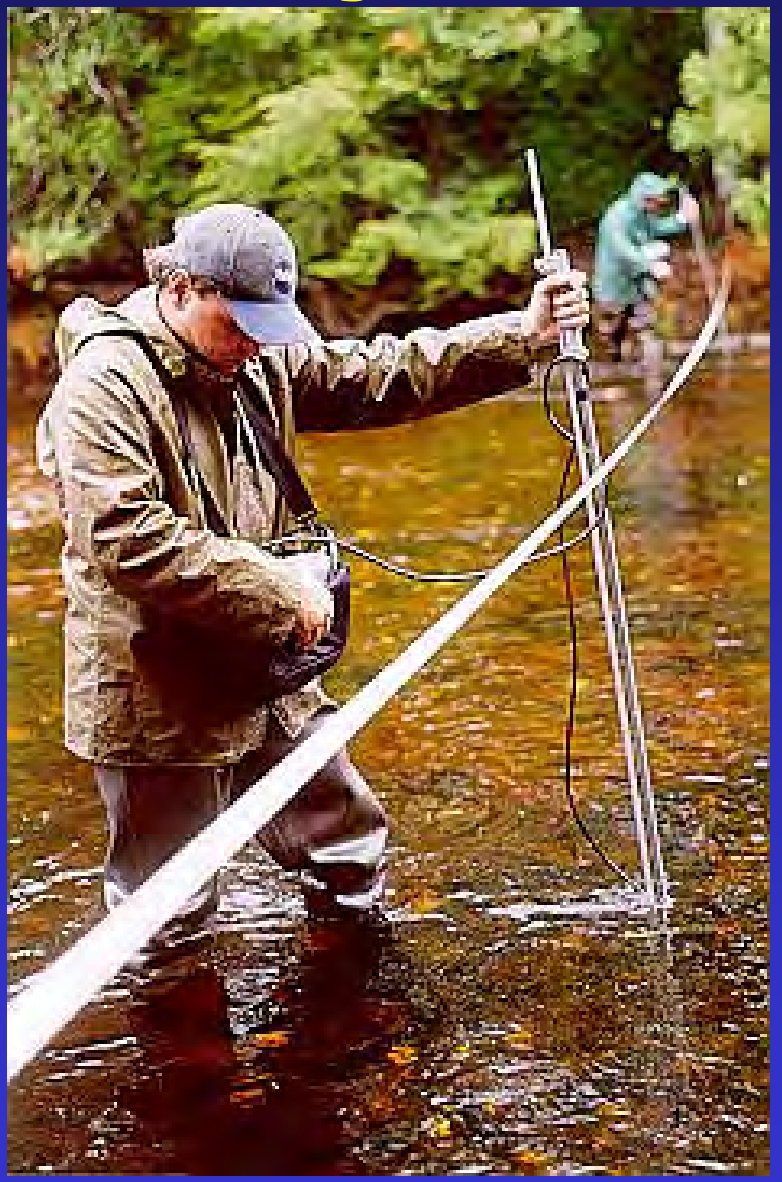

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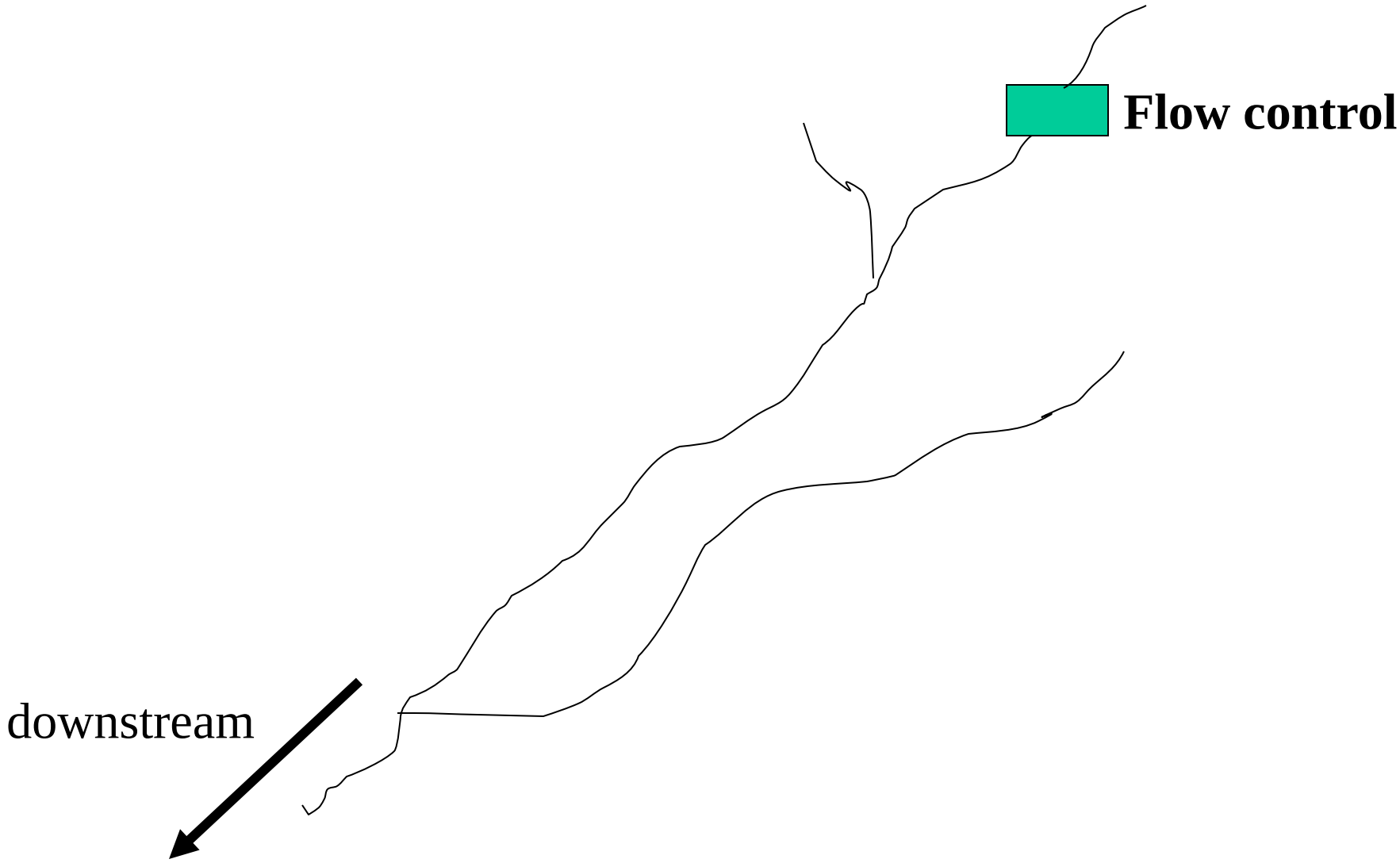
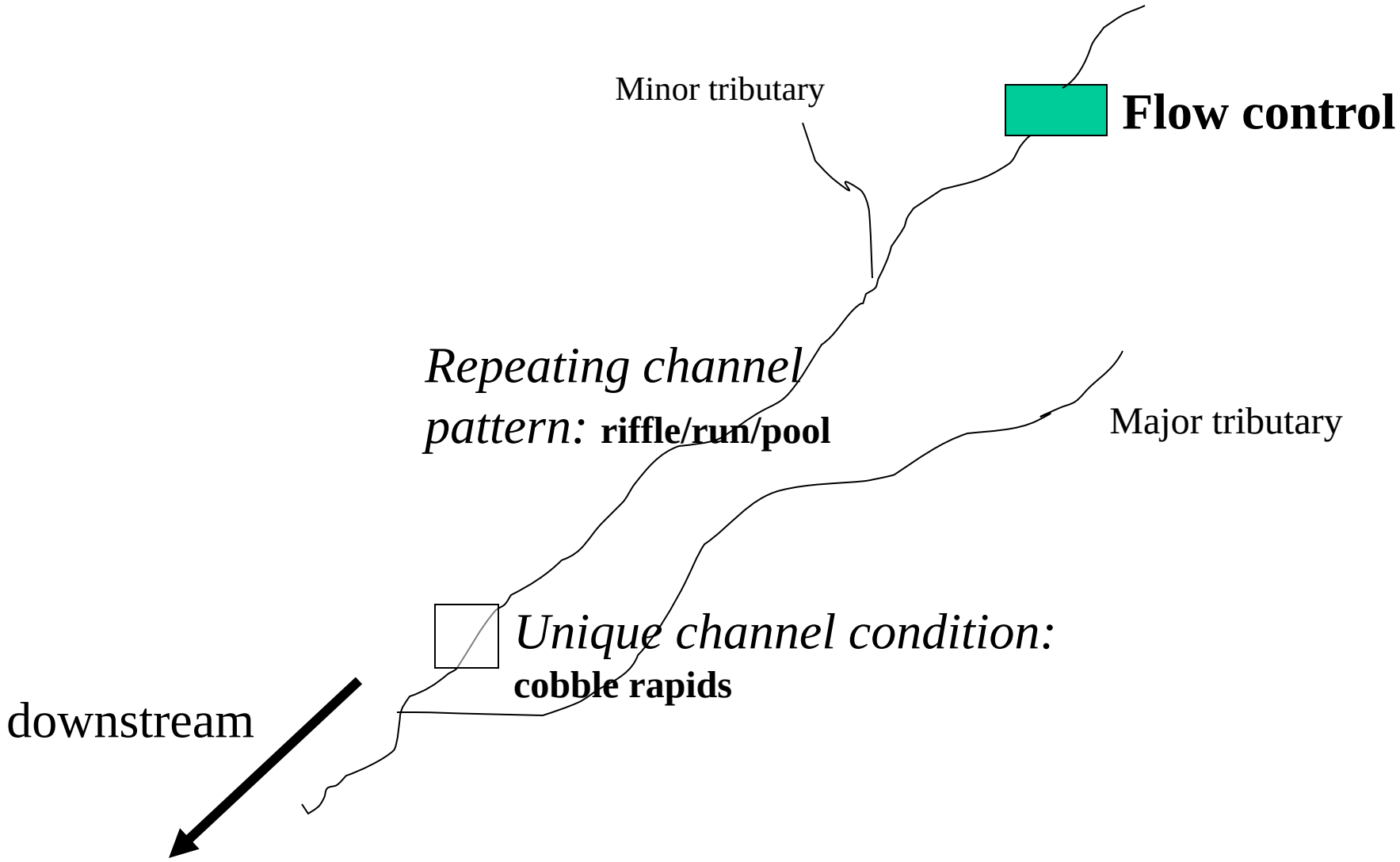
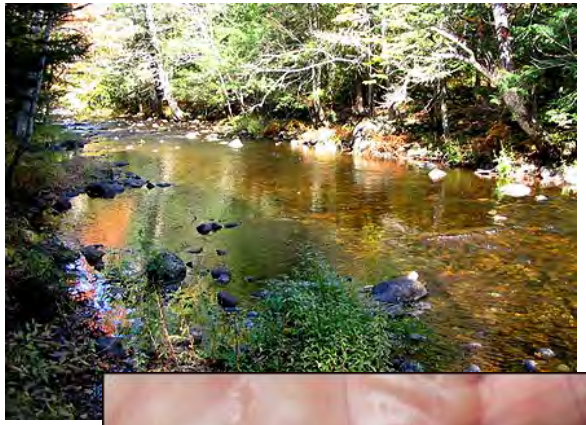
Hypothetical flow control issue

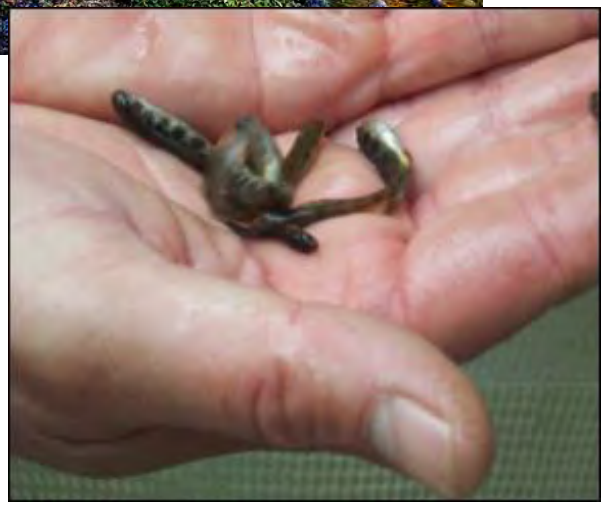


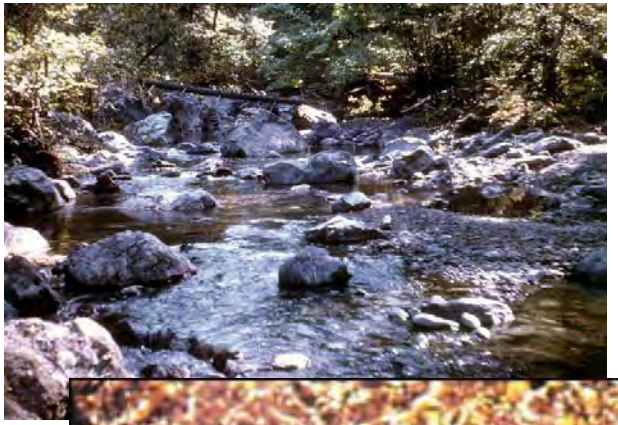
Review physical characteristics

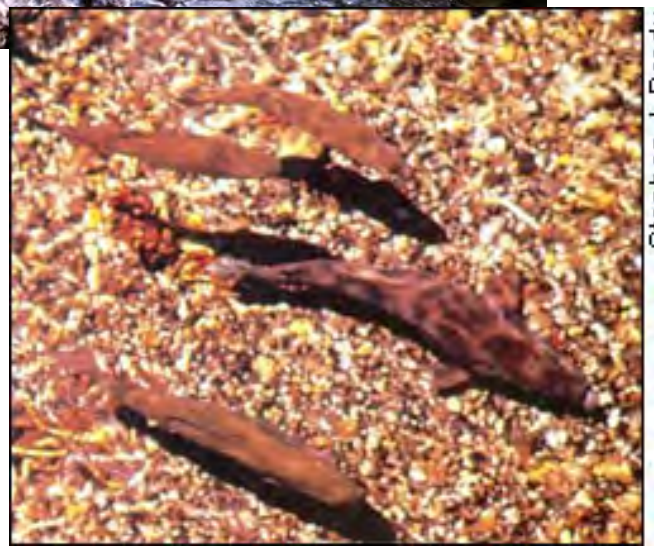


Link species/lifestages or guilds to specific mesohabitats



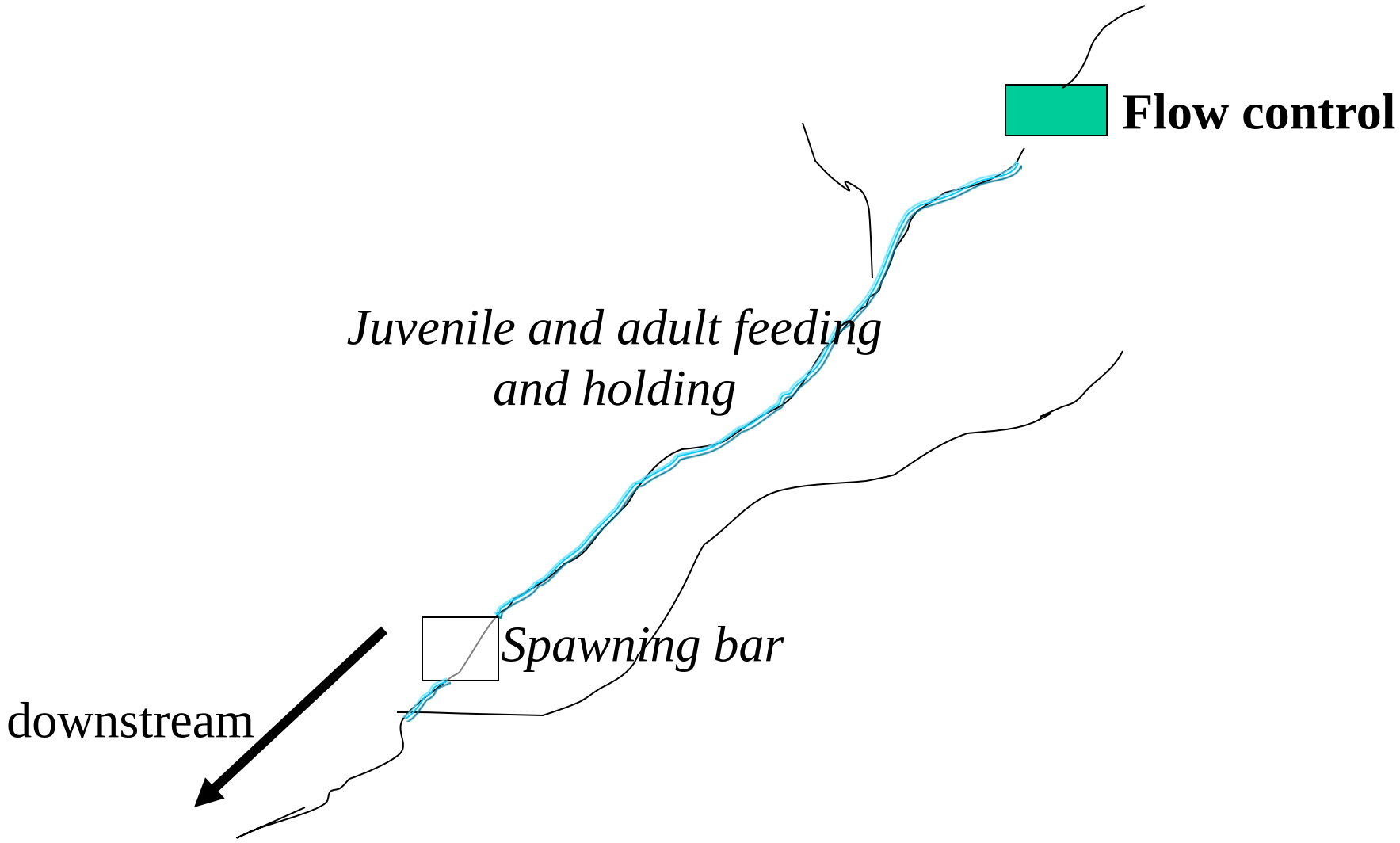




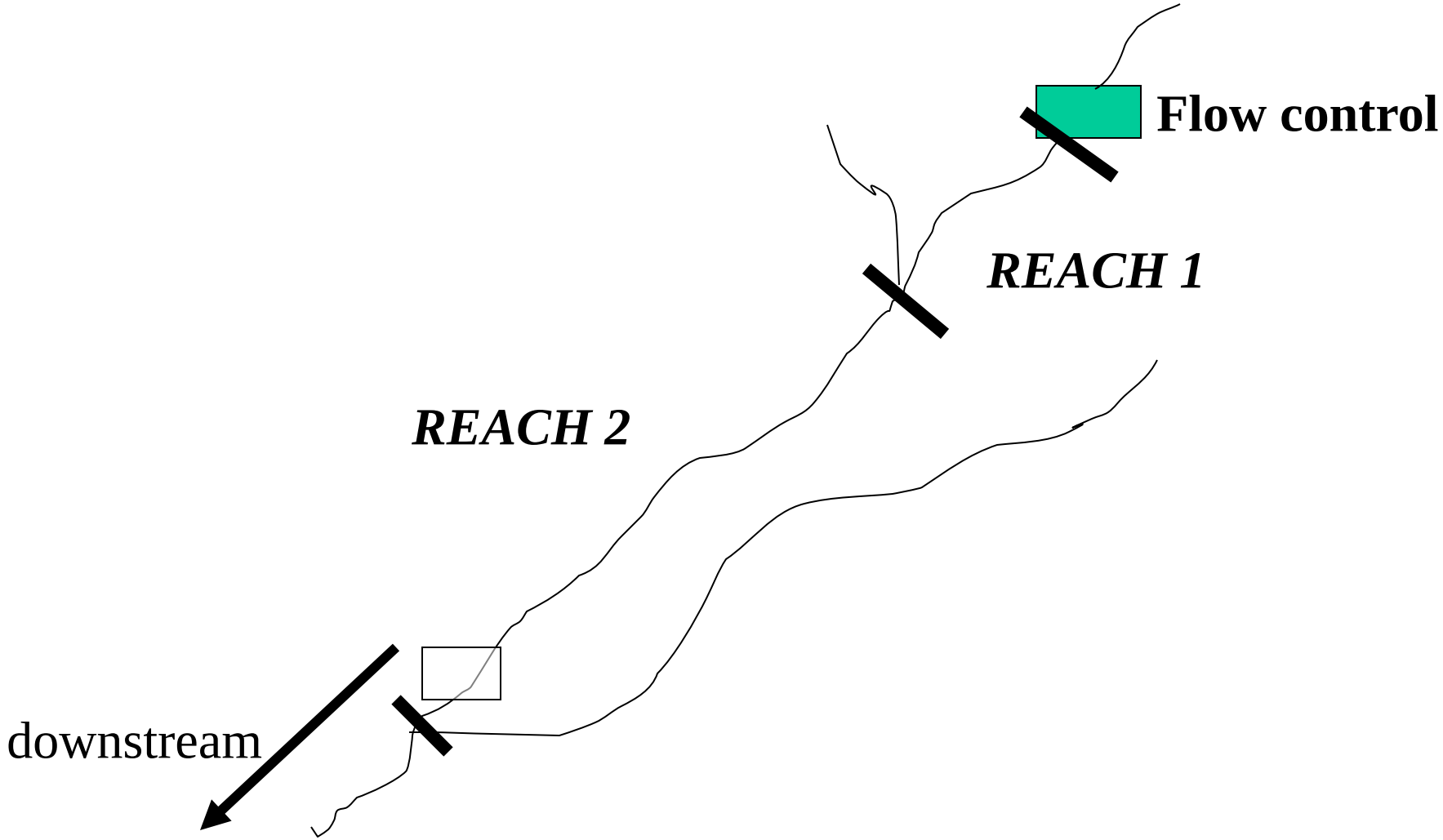


Stephen J. Brady

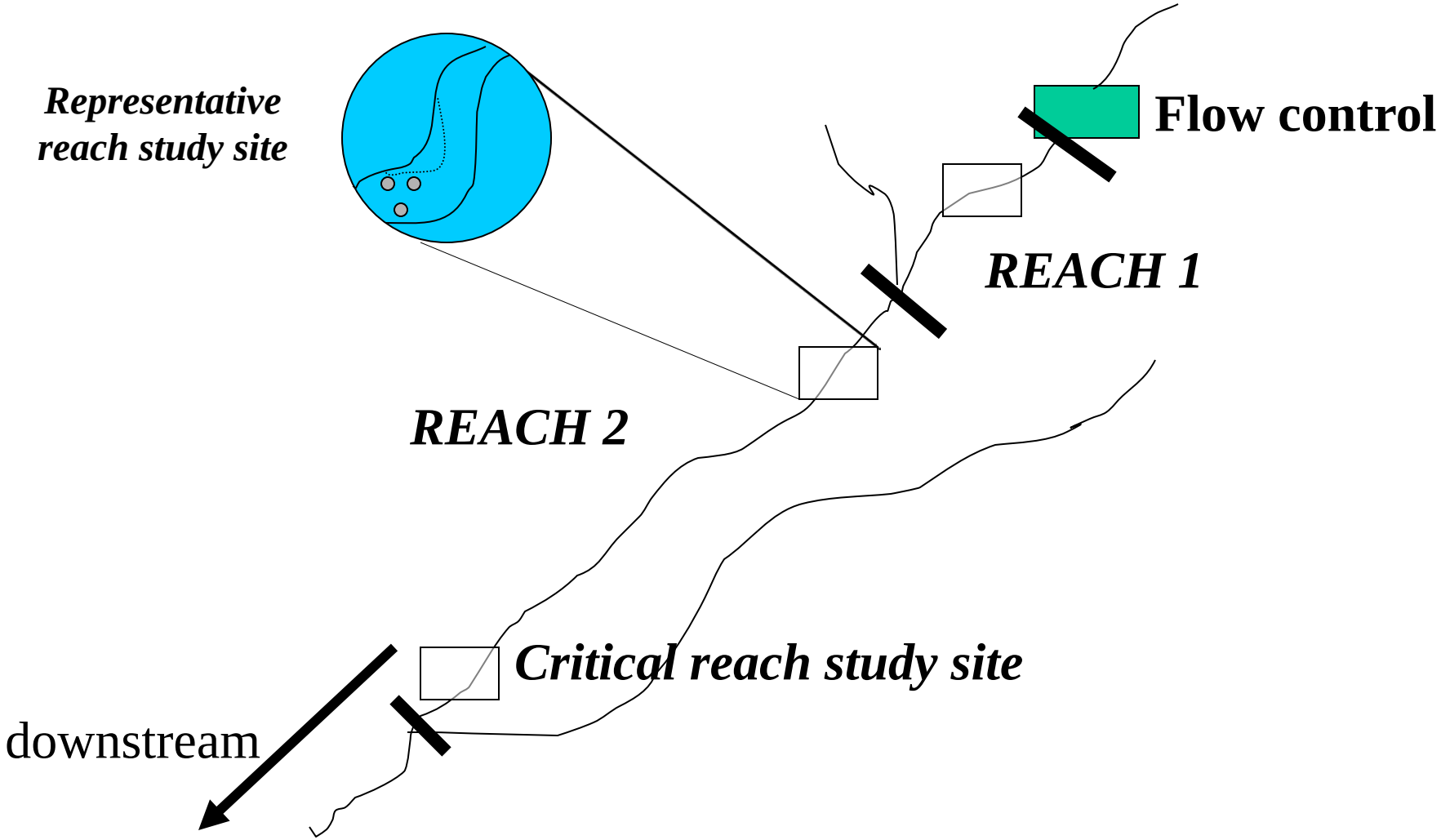
Define overall ***study area***



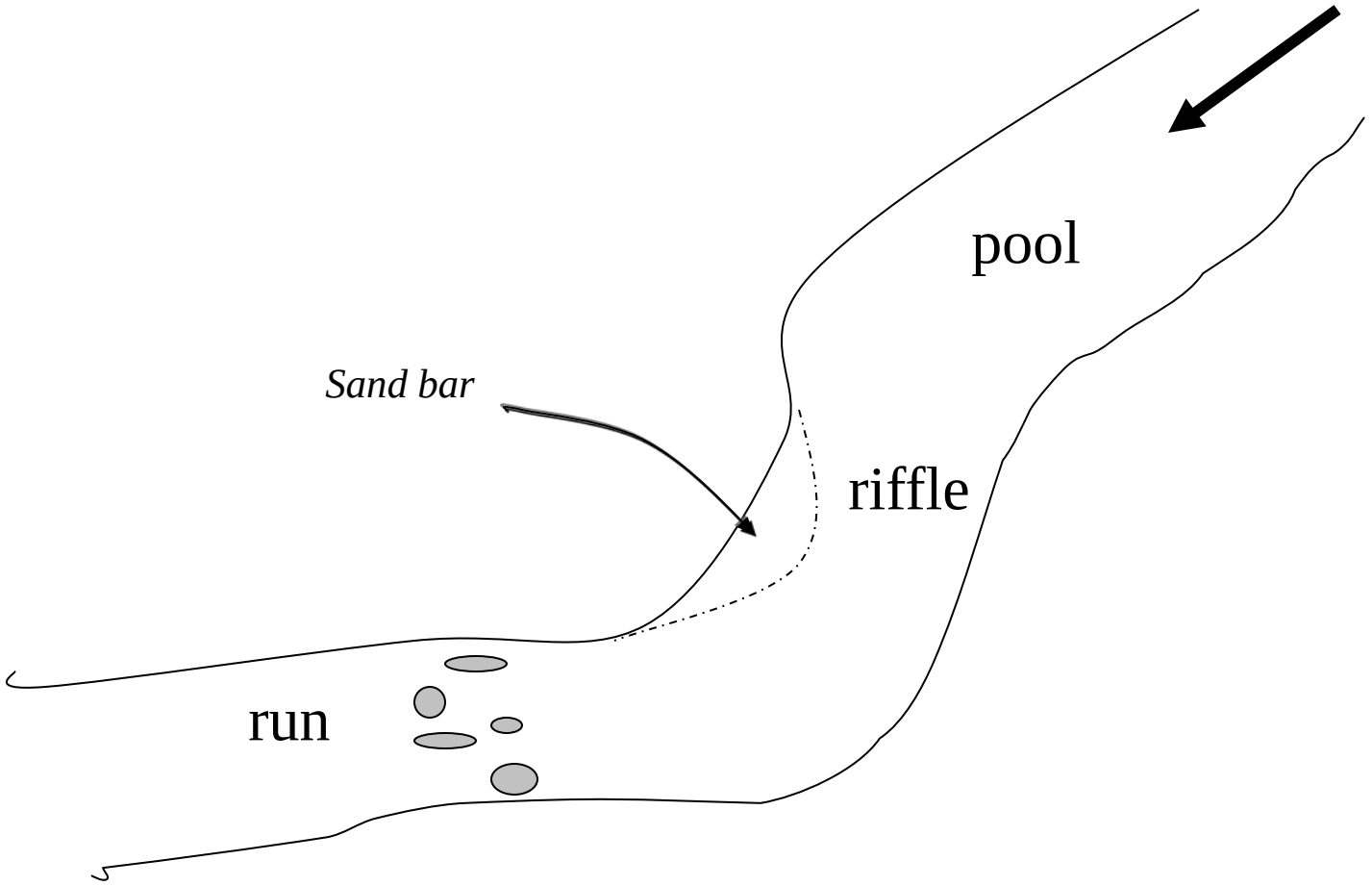
Stratify ***reaches*** according to physical, hydrologic and habitat use characteristics



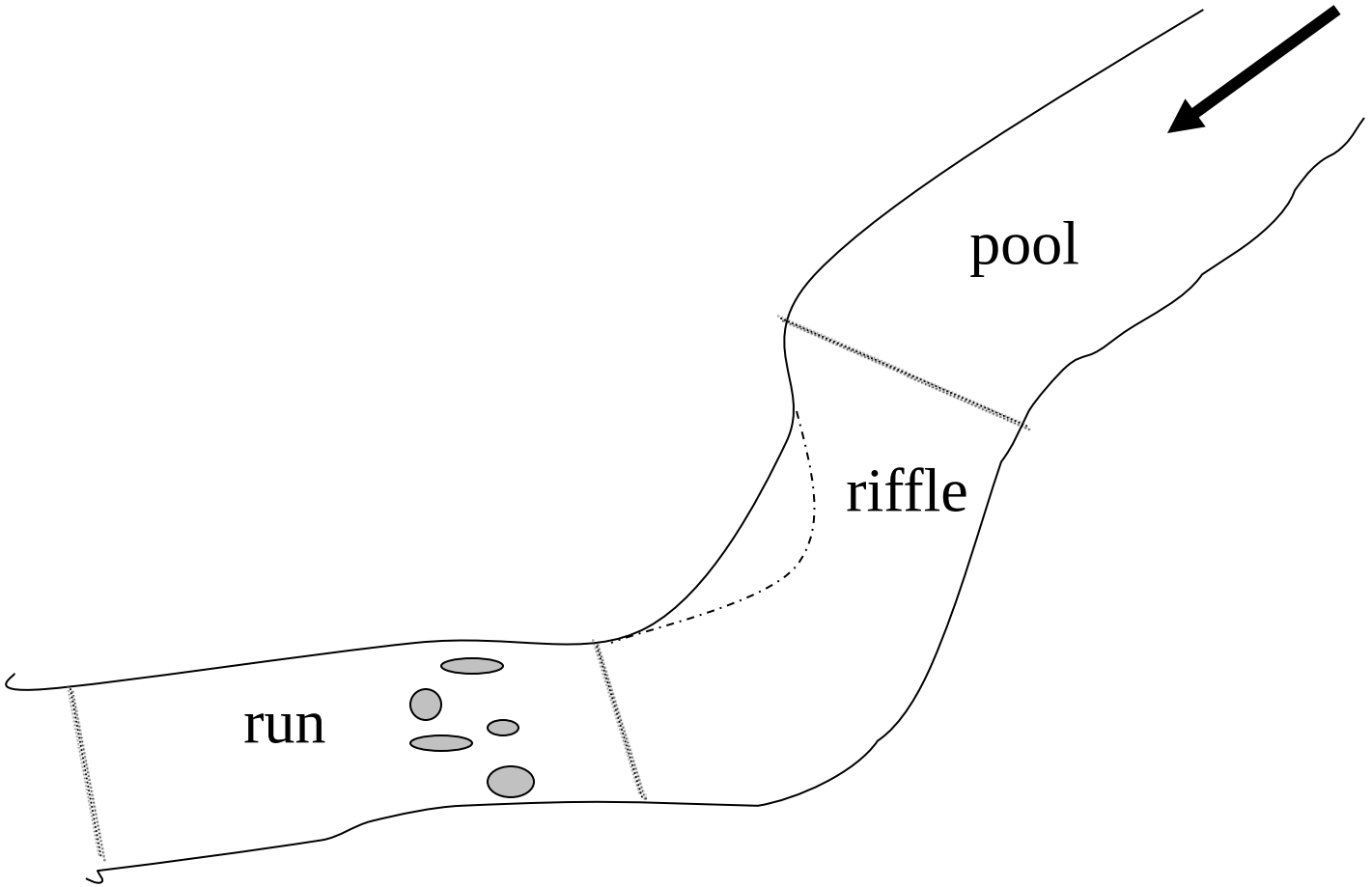
Select ***study sites*** representative of each reach



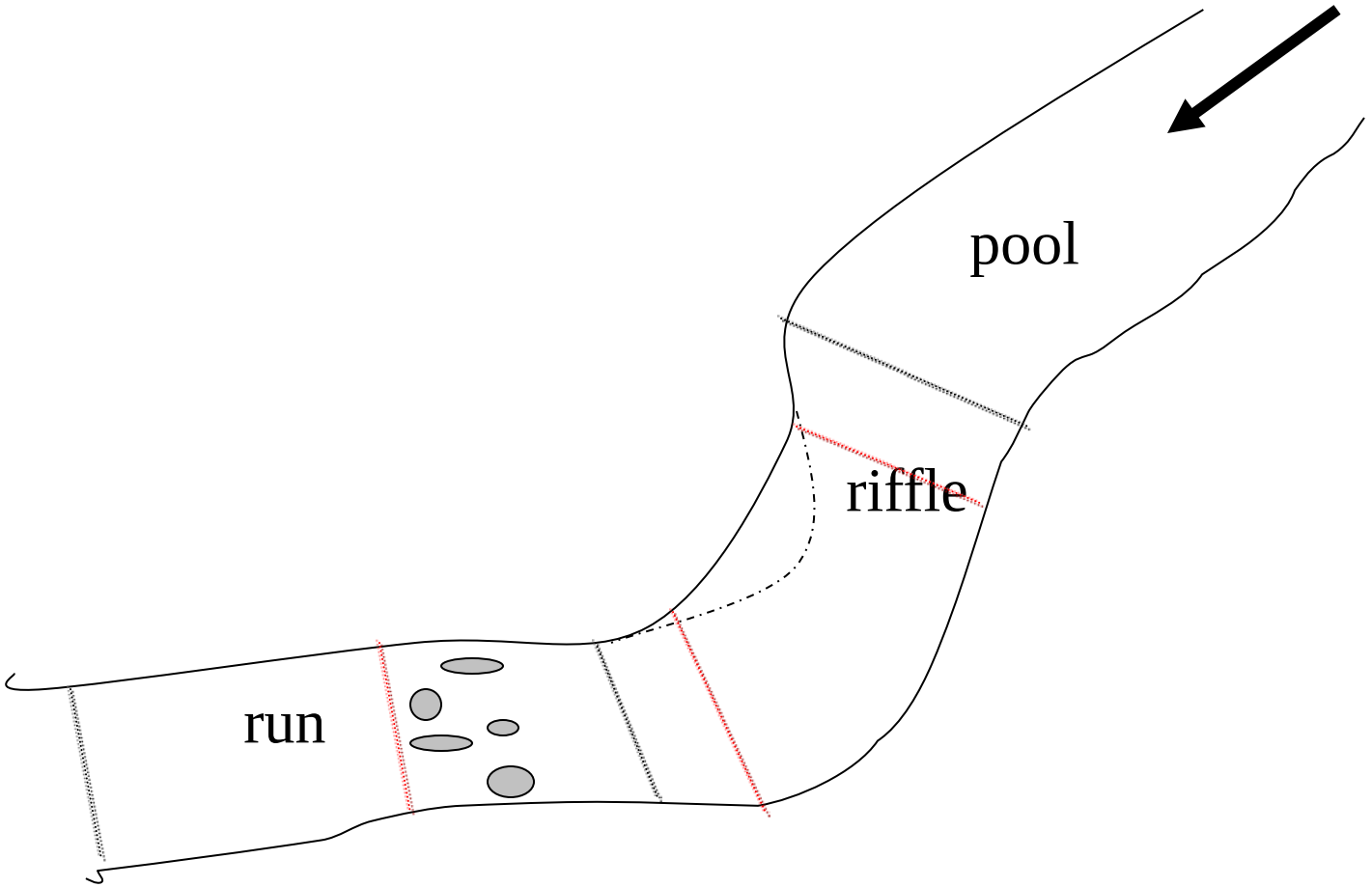
Representative Study Site



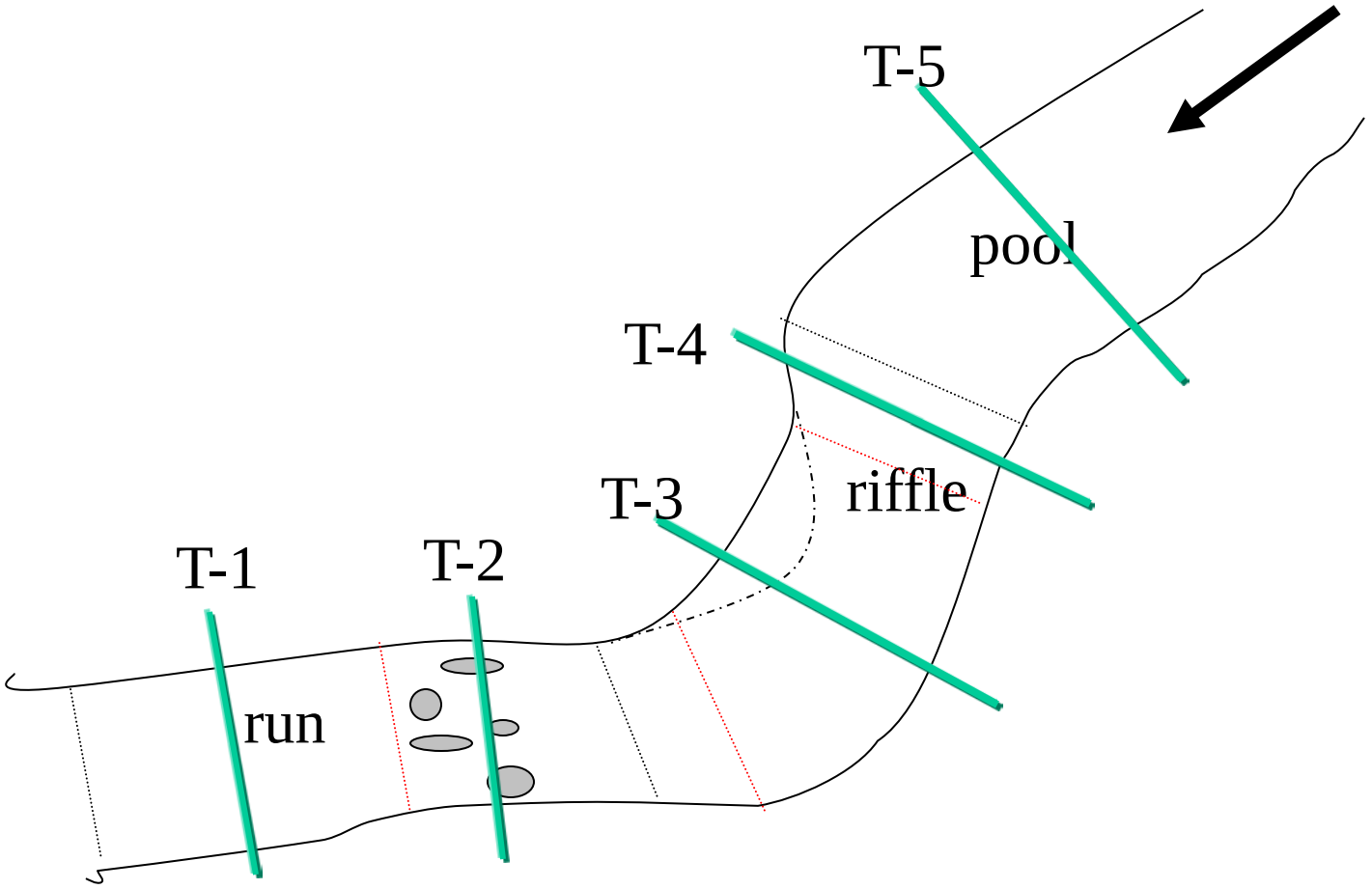
Cell Boundaries are located at breaks in habitat types

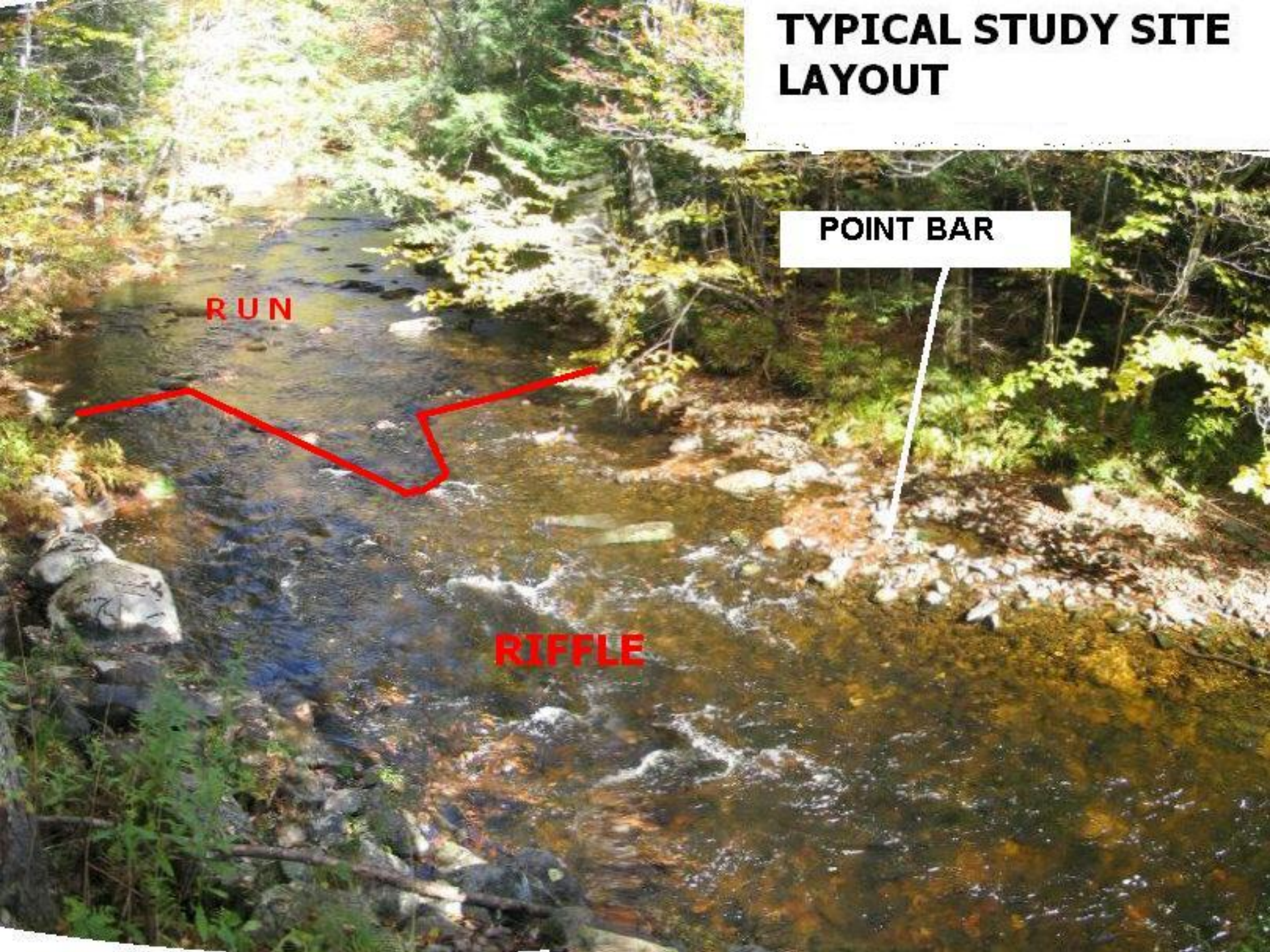


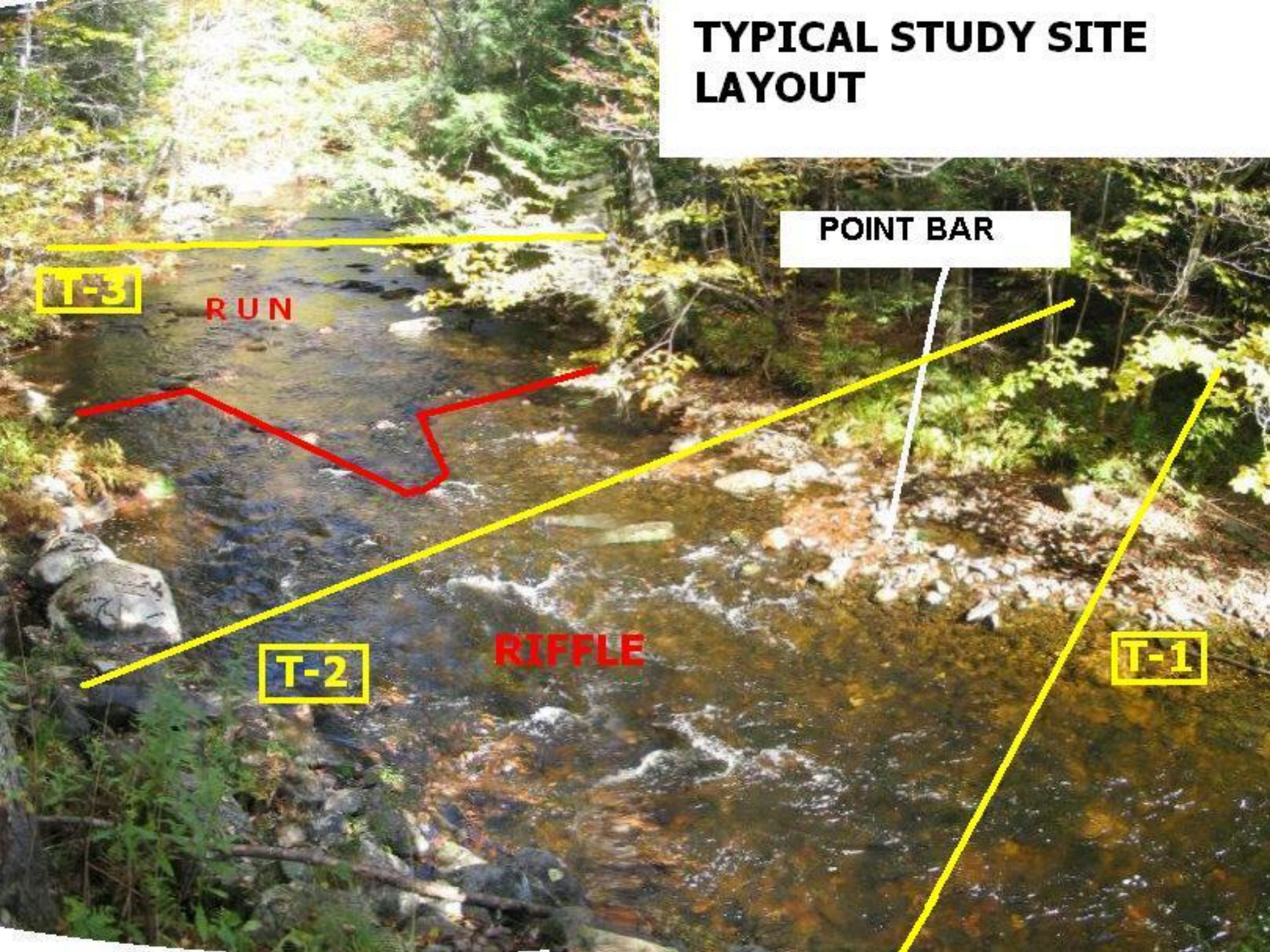
Cell Boundaries (*continued*)



One transect is located within each longitudinal cell




TYPICAL STUDY SITE LAYOUT
POINT BAR
RUN
RIFFLE


TYPICAL STUDY SITE LAYOUT
POINT BAR
T-3
RUN
T-2
RIFFLE
T-1

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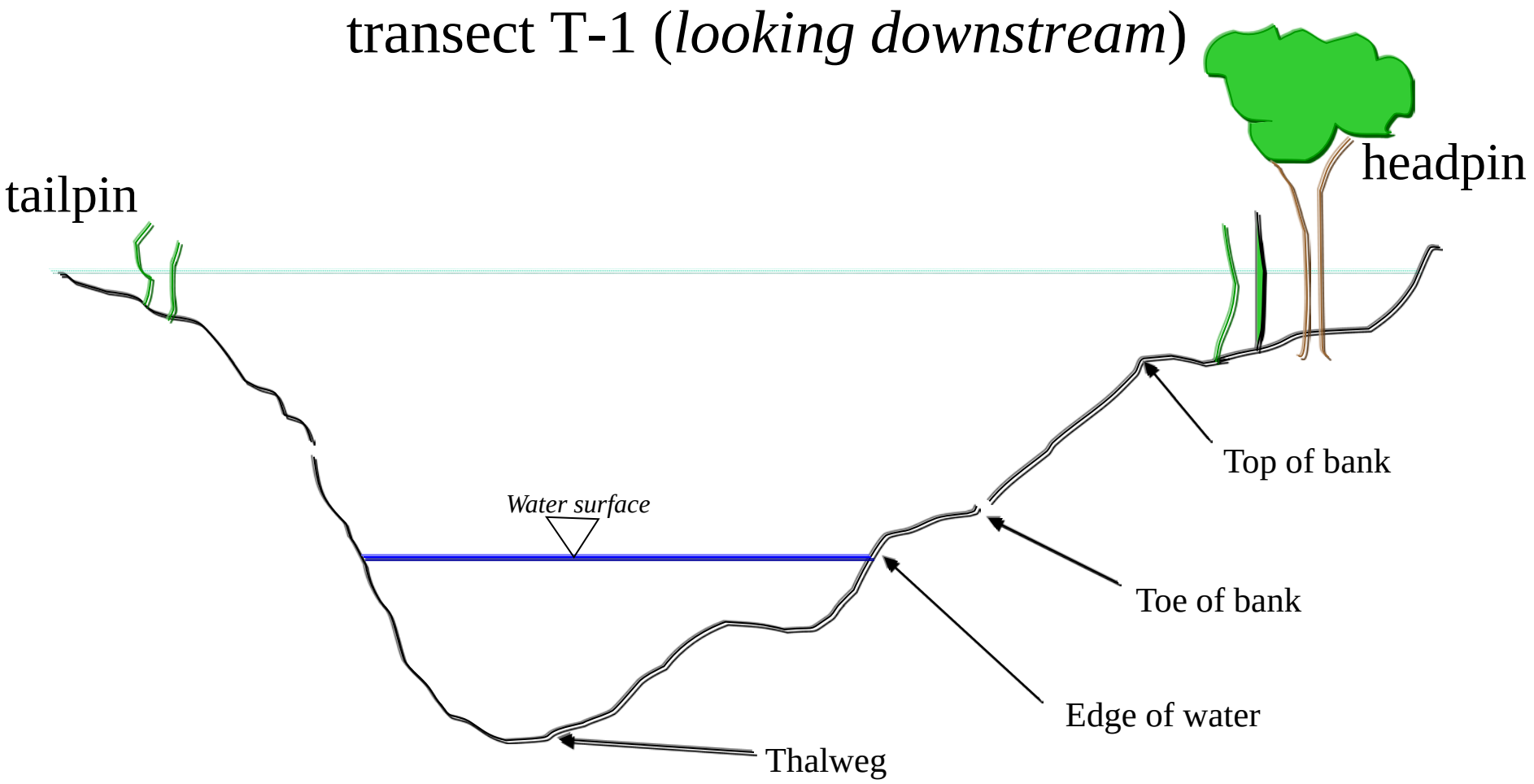
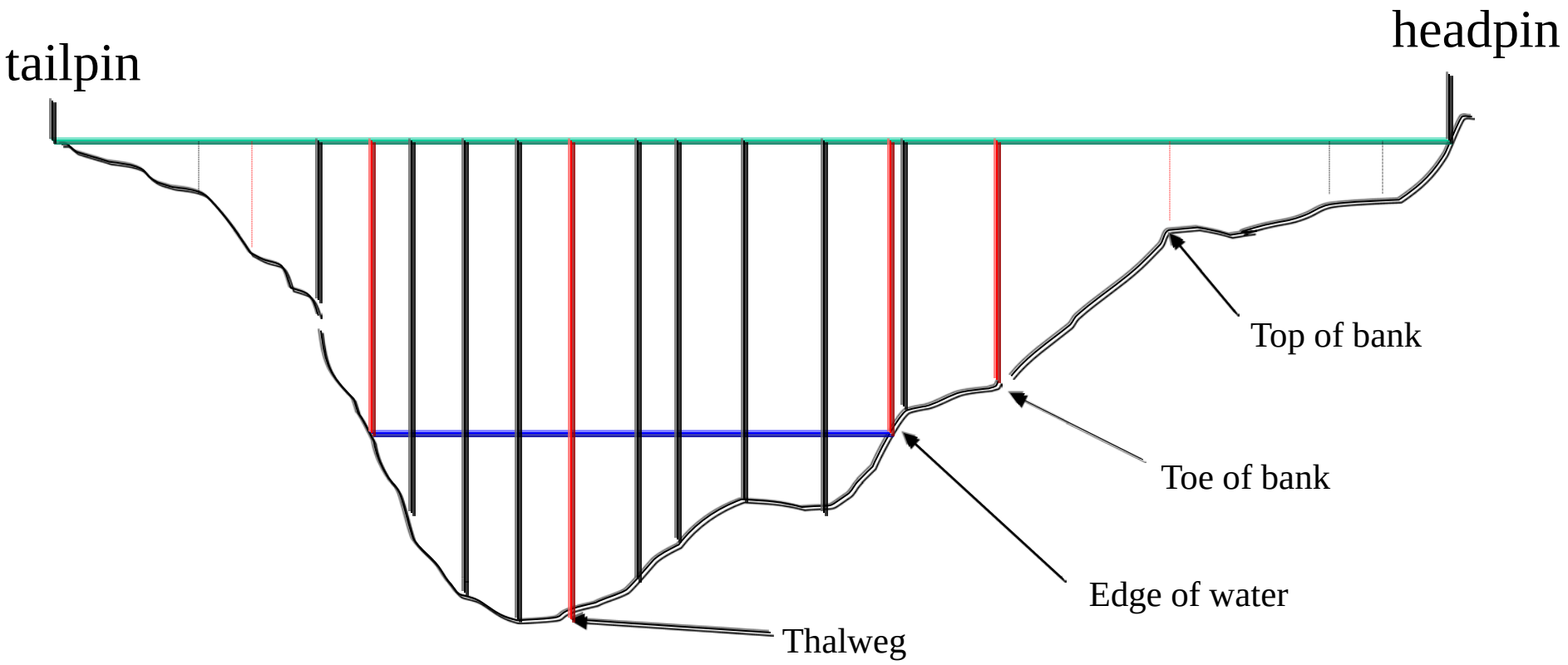
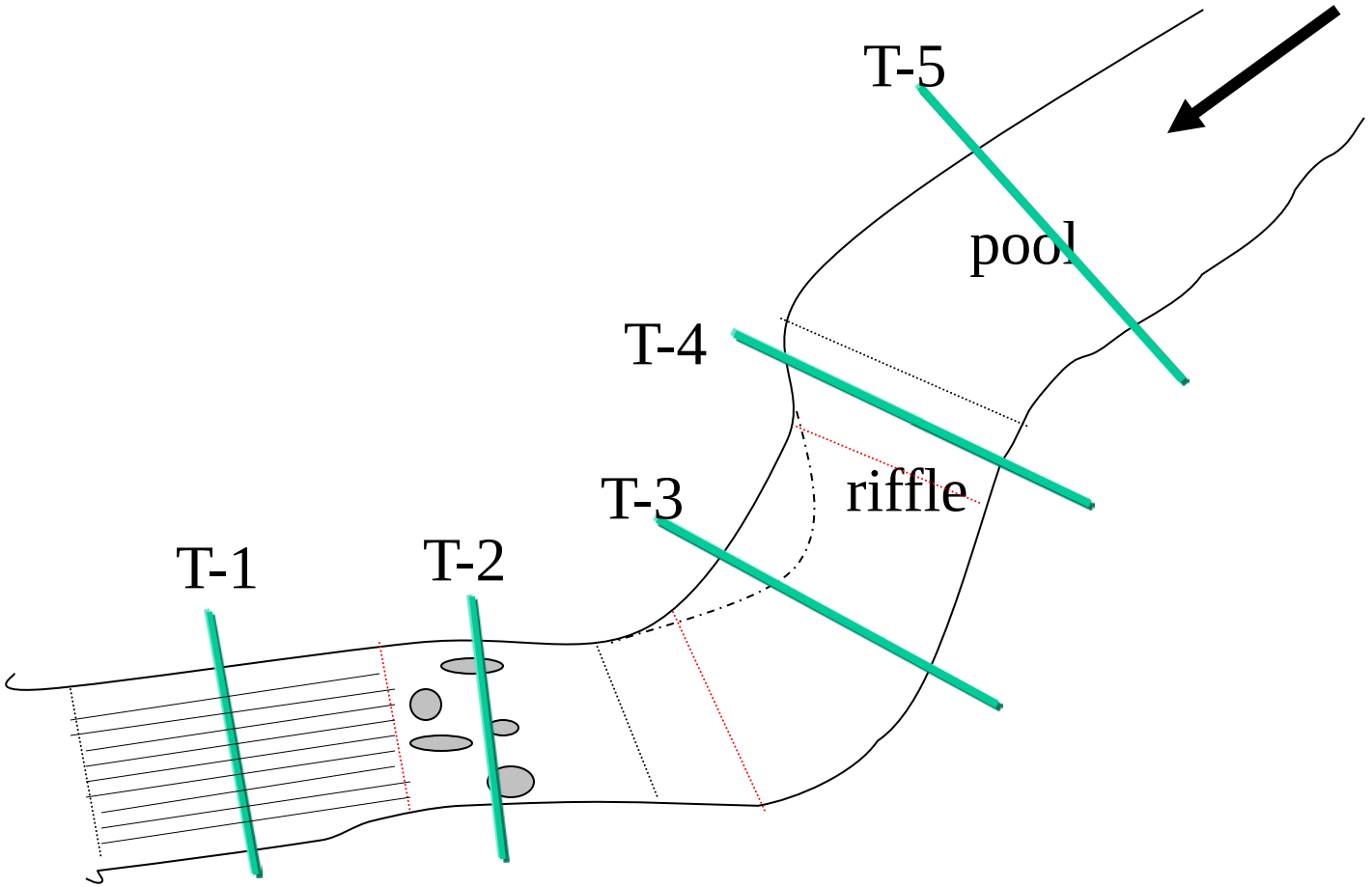

transect T-1 (*looking downstream*)
tailpin
headpin
Top of bank
Water surface
Toe of bank
Edge of water
Thalweg

Verticals are located along each transect to capture key substrate and profile features



Verticals and cell boundaries act to divide each segment into a mosaic of known areas



SUBSTRATE CLASSIFICATION

IMBEDDEDNESS

un-imbedded

highly imbedded

VELOCITY REFUGE

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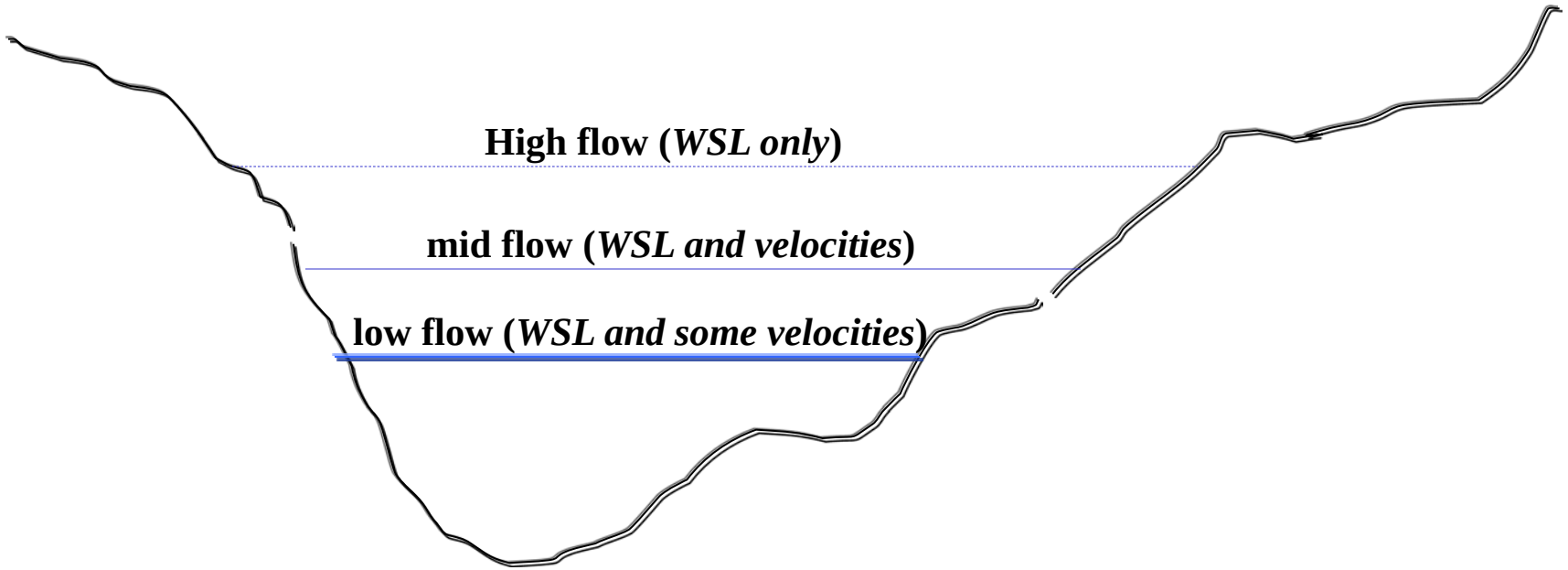
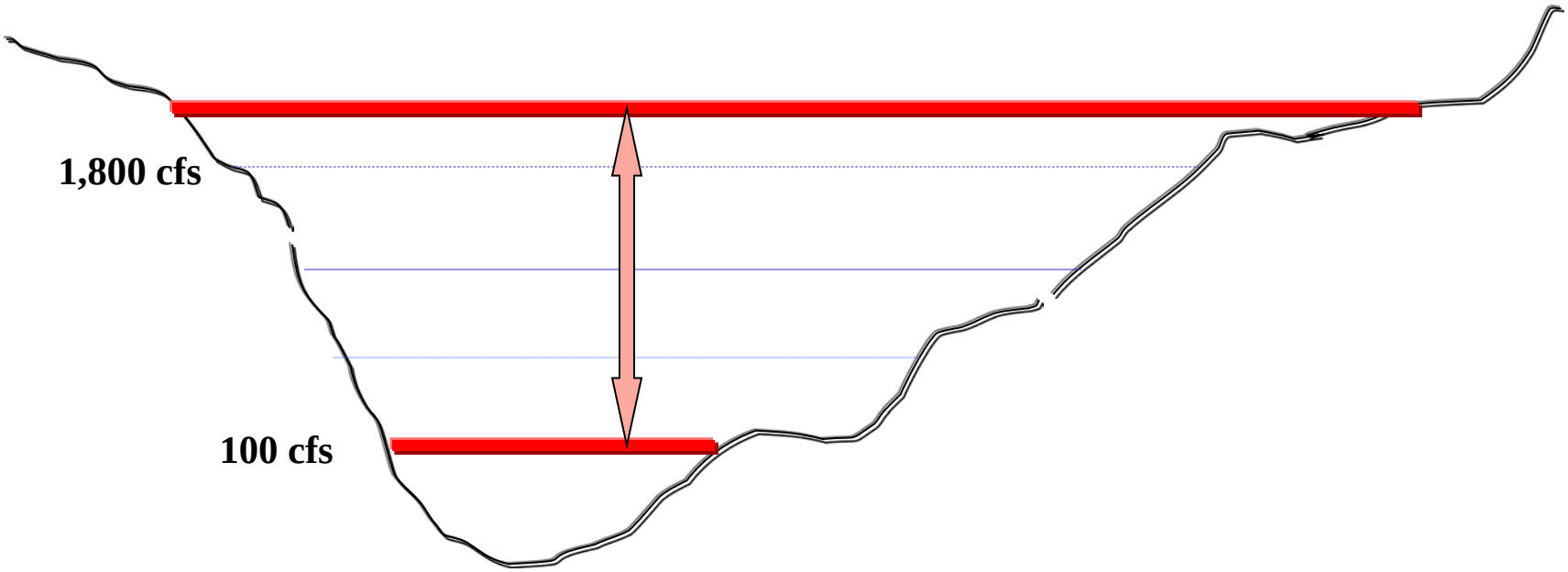
Calibration flows are gathered across the flow range of interest



This permits interpolation and extrapolation of other flows



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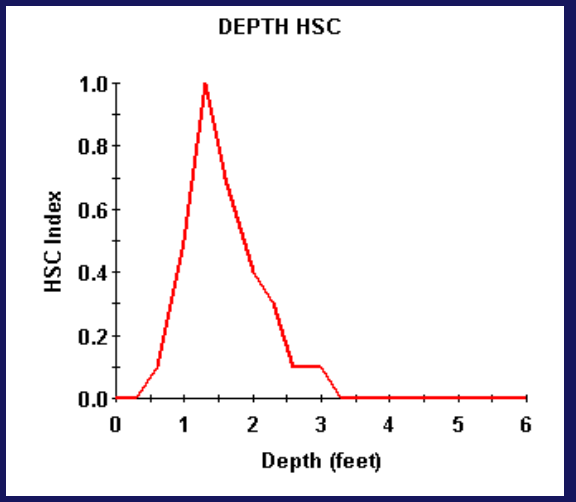
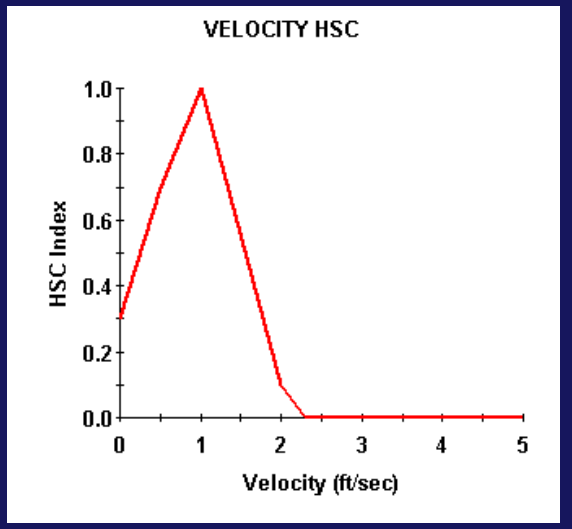
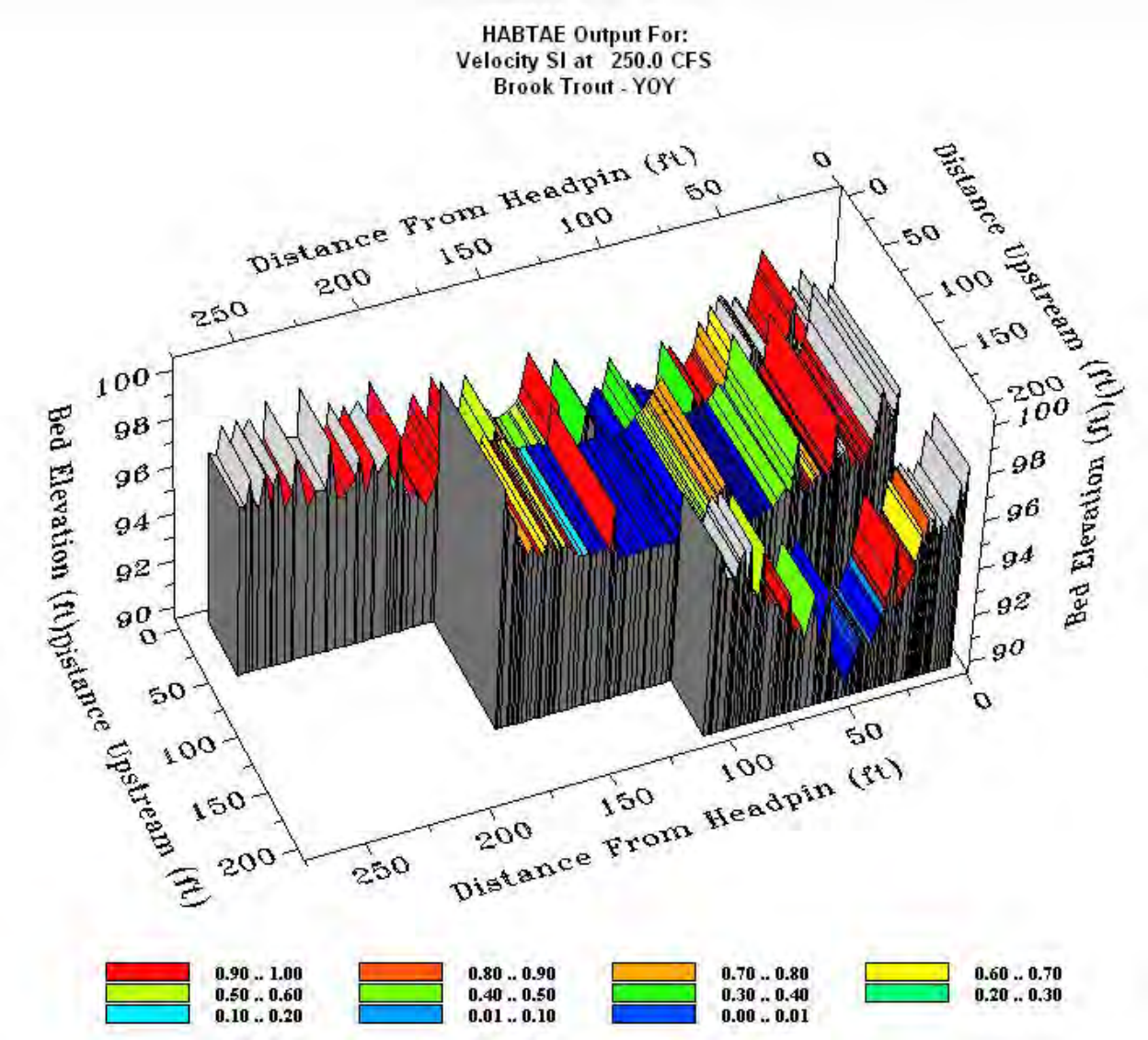
Habitat Suitability Criteria

- Depth
- Velocity
- Channel Index

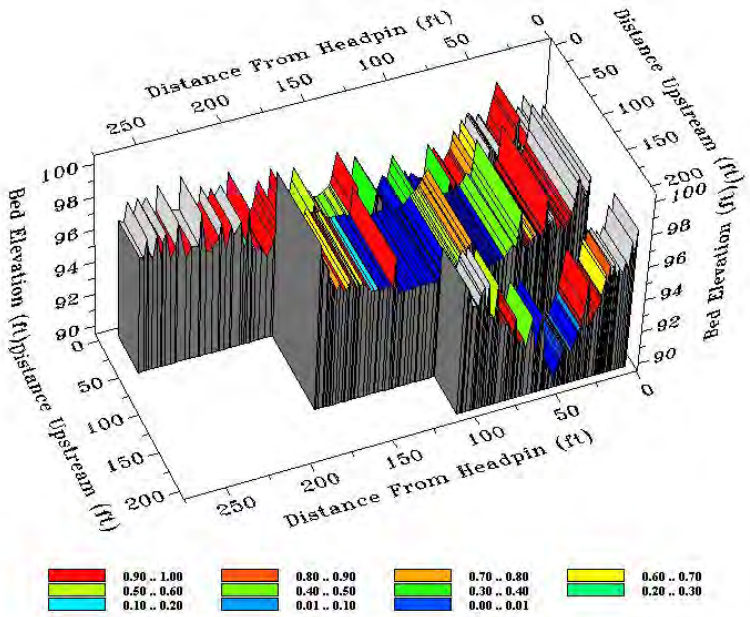




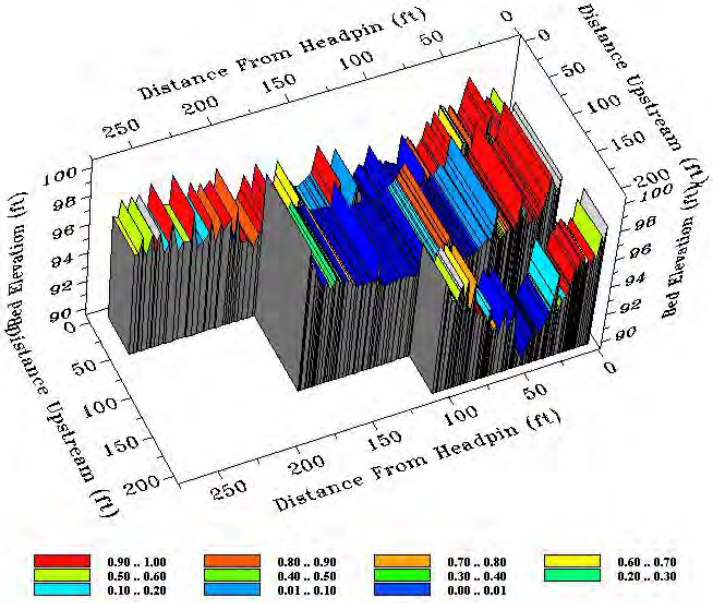
Habitat is “pixilated” into a mosaic of known dimensions



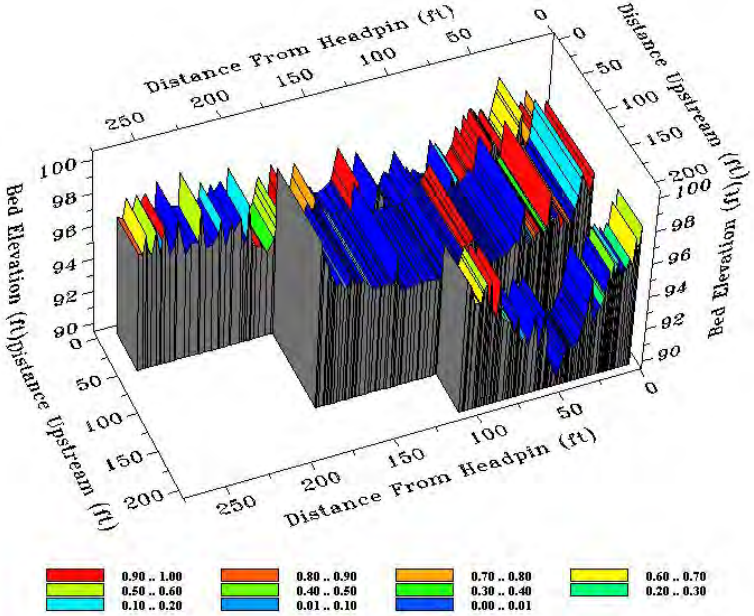
HABTAE Output For:
Velocity SI at 250.0 CFS
Brook Trout - YOY



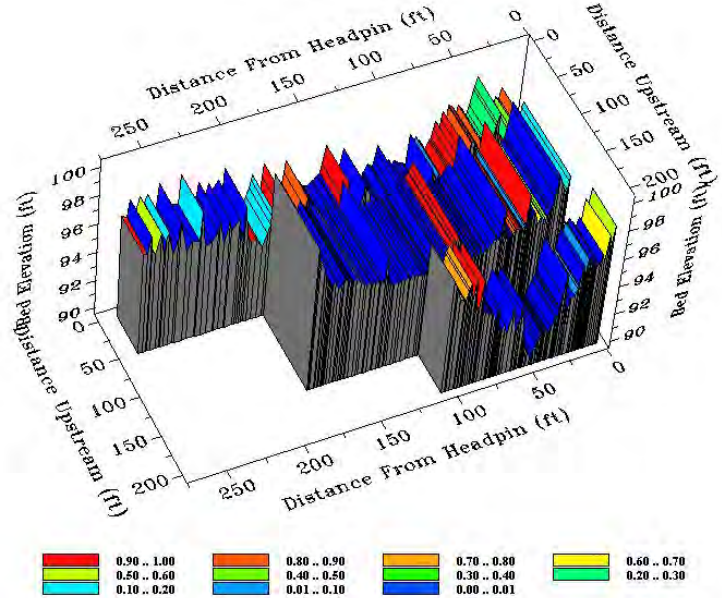
HABTAE Output For:
Combined SI at 500.0 CFS
Brook Trout - YOY



HABTAE Output For:
Velocity SI at 1000.0 CFS
Brook Trout - YOY



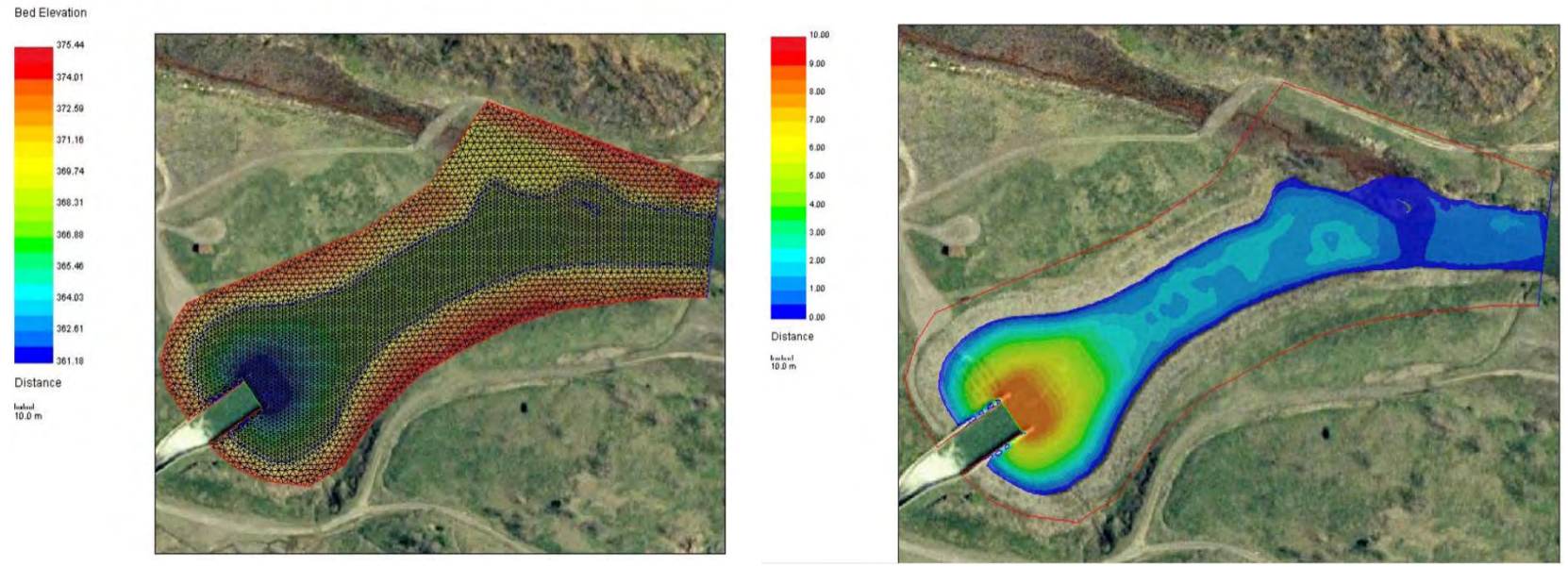
HABTAE Output For:
Combined SI at 1500.0 CFS
Brook Trout - YOY



2D Finite Elements Model

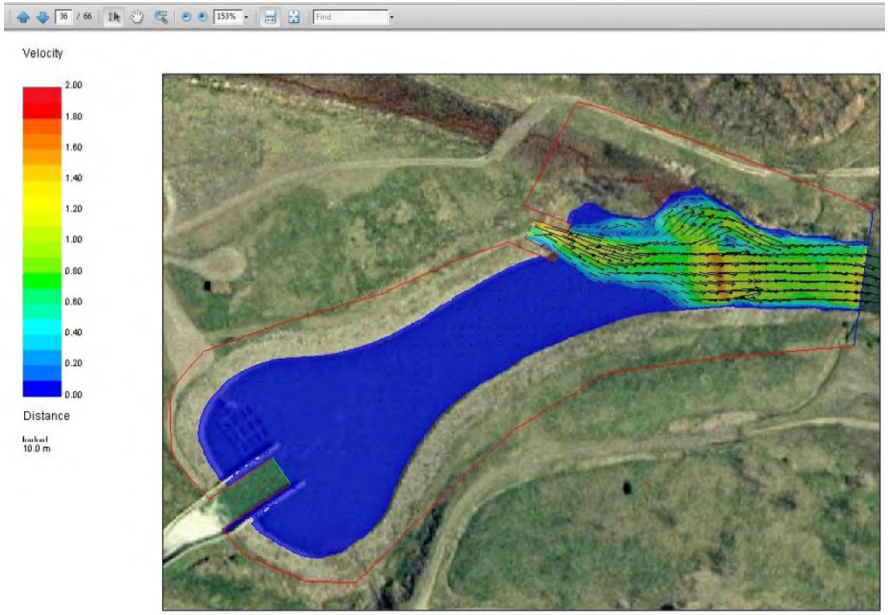
Survey elevations **bathymetry**

Figure 4: Domain with Elevations (in meters) and Initial Computational Mesh

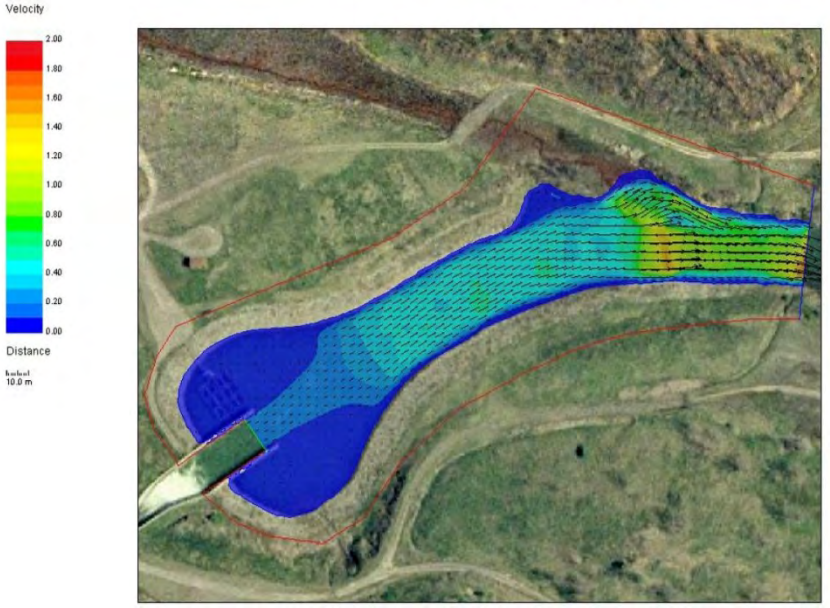


2D Finite Elements Model

Scenario “A”



Scenario “B”



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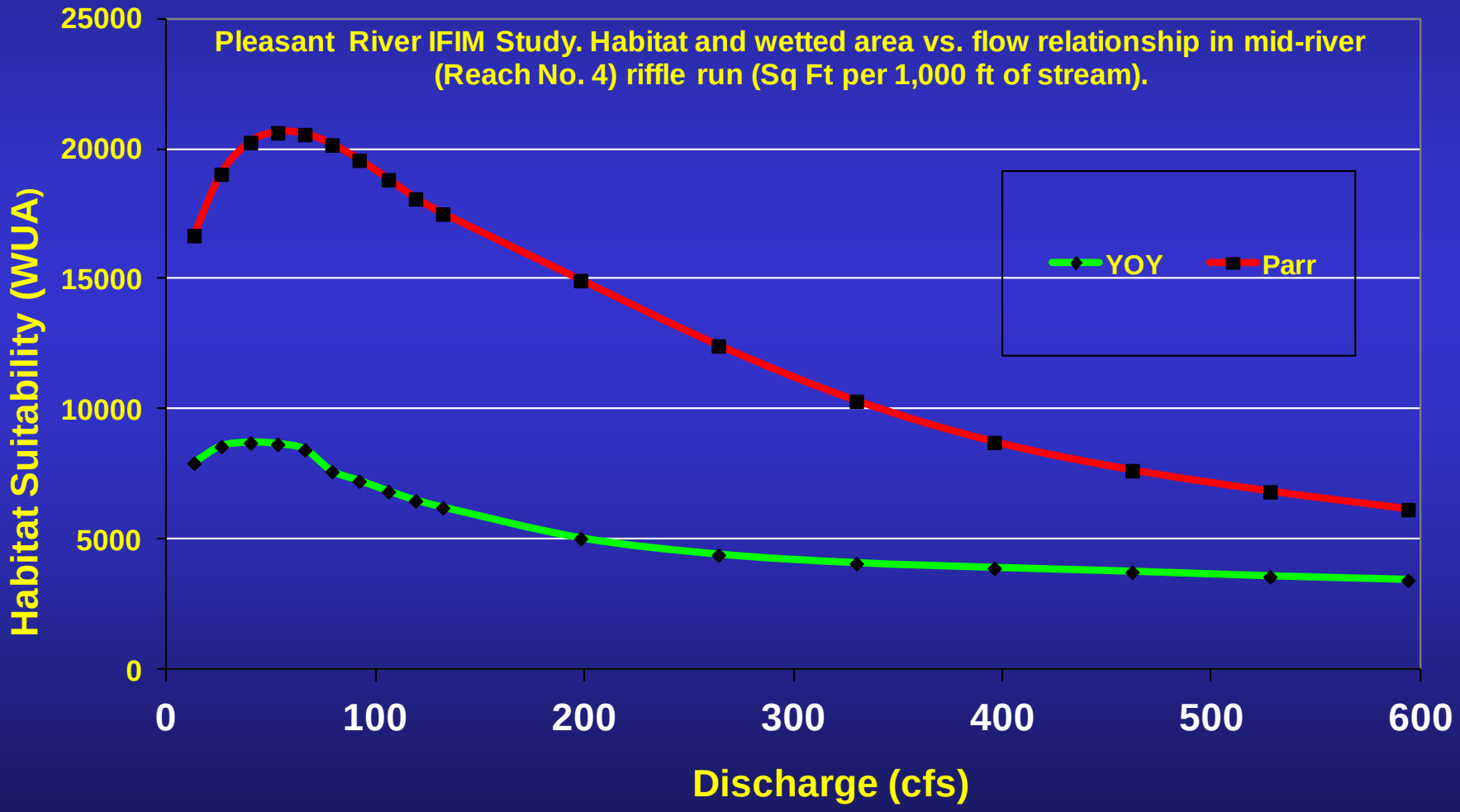
Model output:
Habitat-flow relationships for each study reach



Suggested Problem-Solving Process

Review hydrology time series

Compare habitat under existing and alternate flow scenarios

Compare project operation under existing and alternate flow scenarios

Assess extent to which ***all*** objectives are met under each flow scenario

Evaluate trade-offs

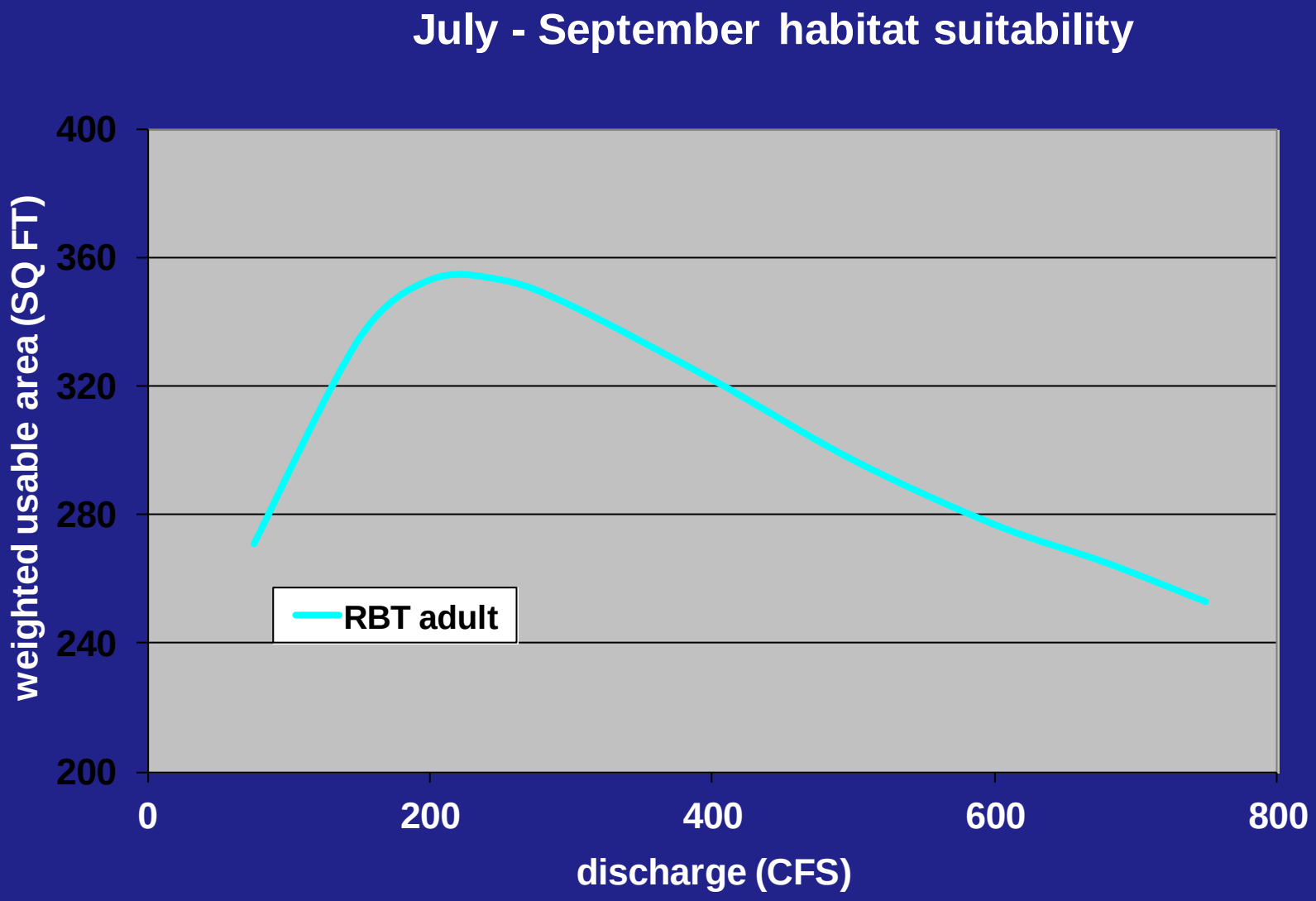
Re-run alternative scenarios

Problem-Solving Options

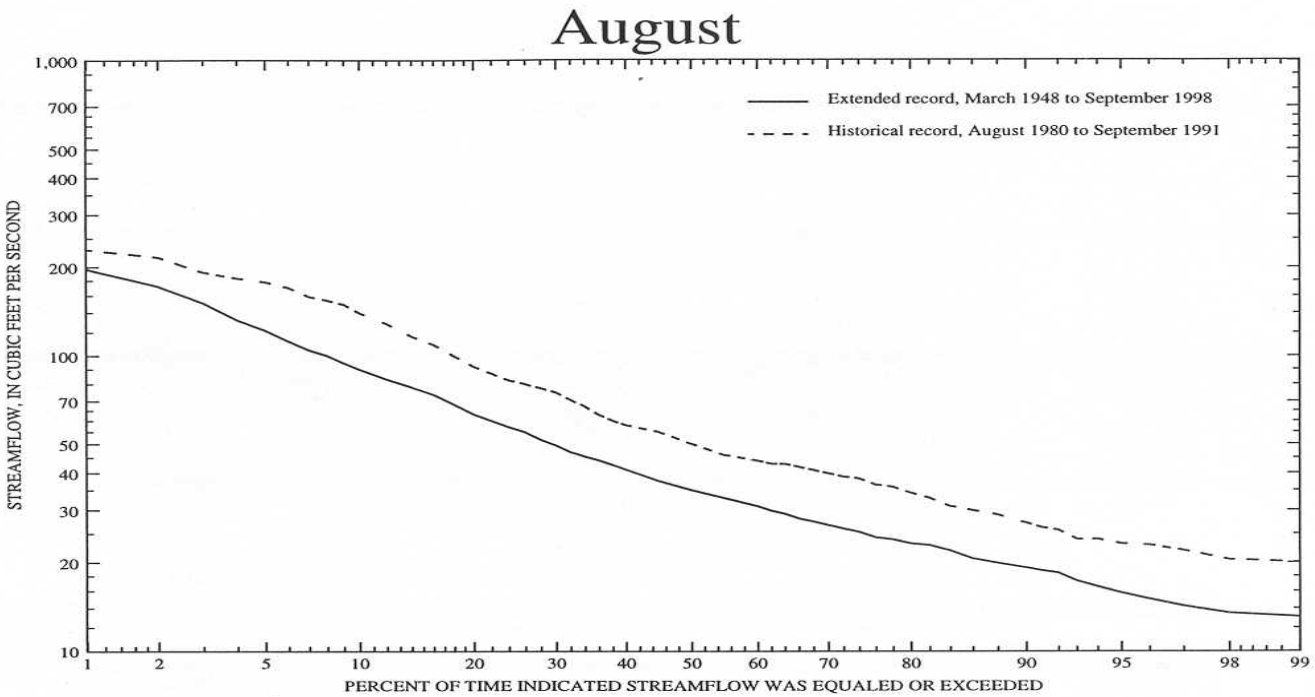
- Habitat Time Series
  - Define applicable bio-periods
  - develop flow duration data for each
  - Merge WUA/flow curve with flow duration curve
  - Look for alternatives that meet habitat and operation objectives

- Persistent Habitat Analysis
  - Map spatial distribution of habitat “hotspots” at paired flows in GIS
  - Look for pair combinations that provide consistently good habitat
  - Develop matrix for species/lifestages
  - Iteratively look for scenarios that balance both operation and habitat objectives

Habitat suitability relationship

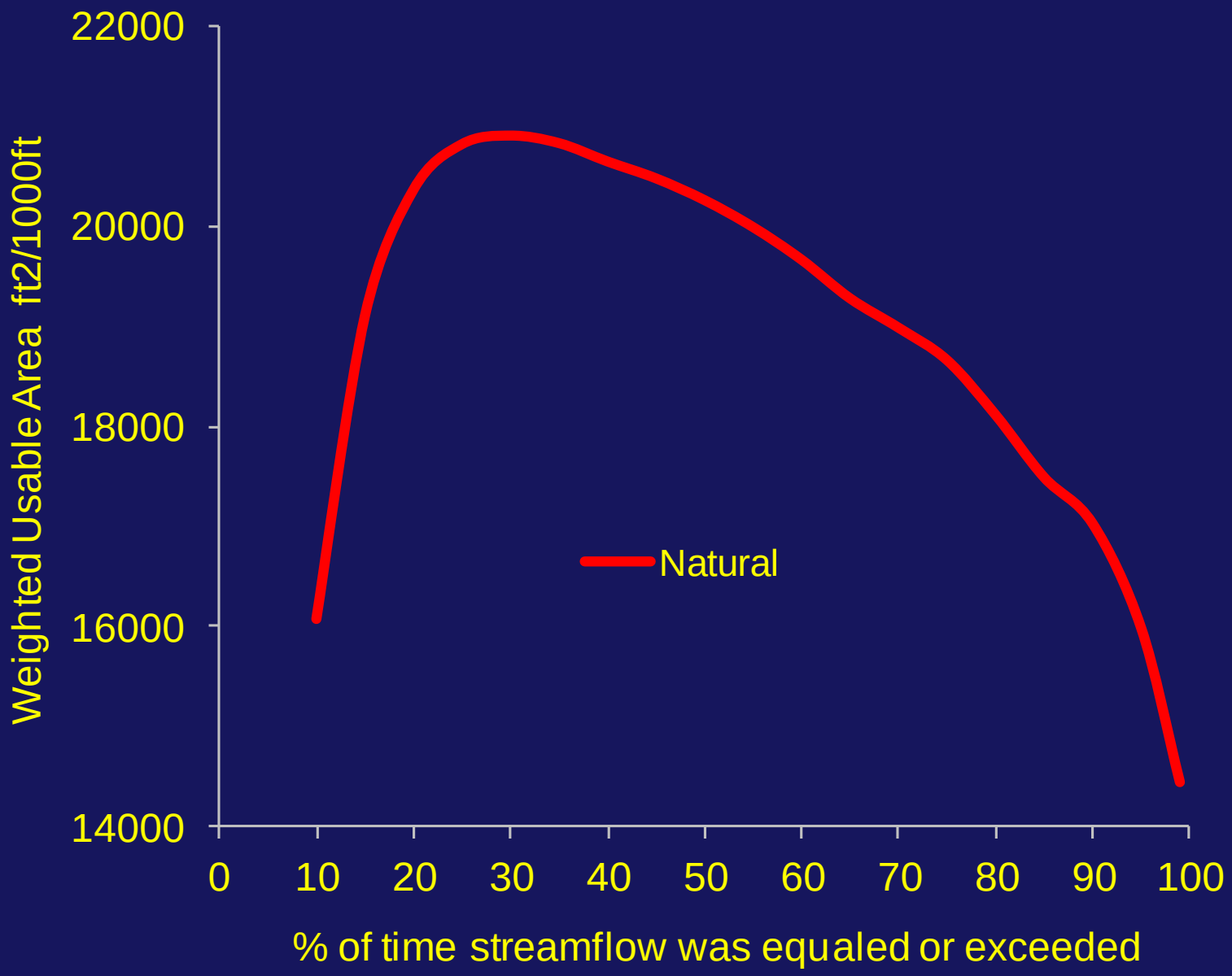


Hydrologic Data

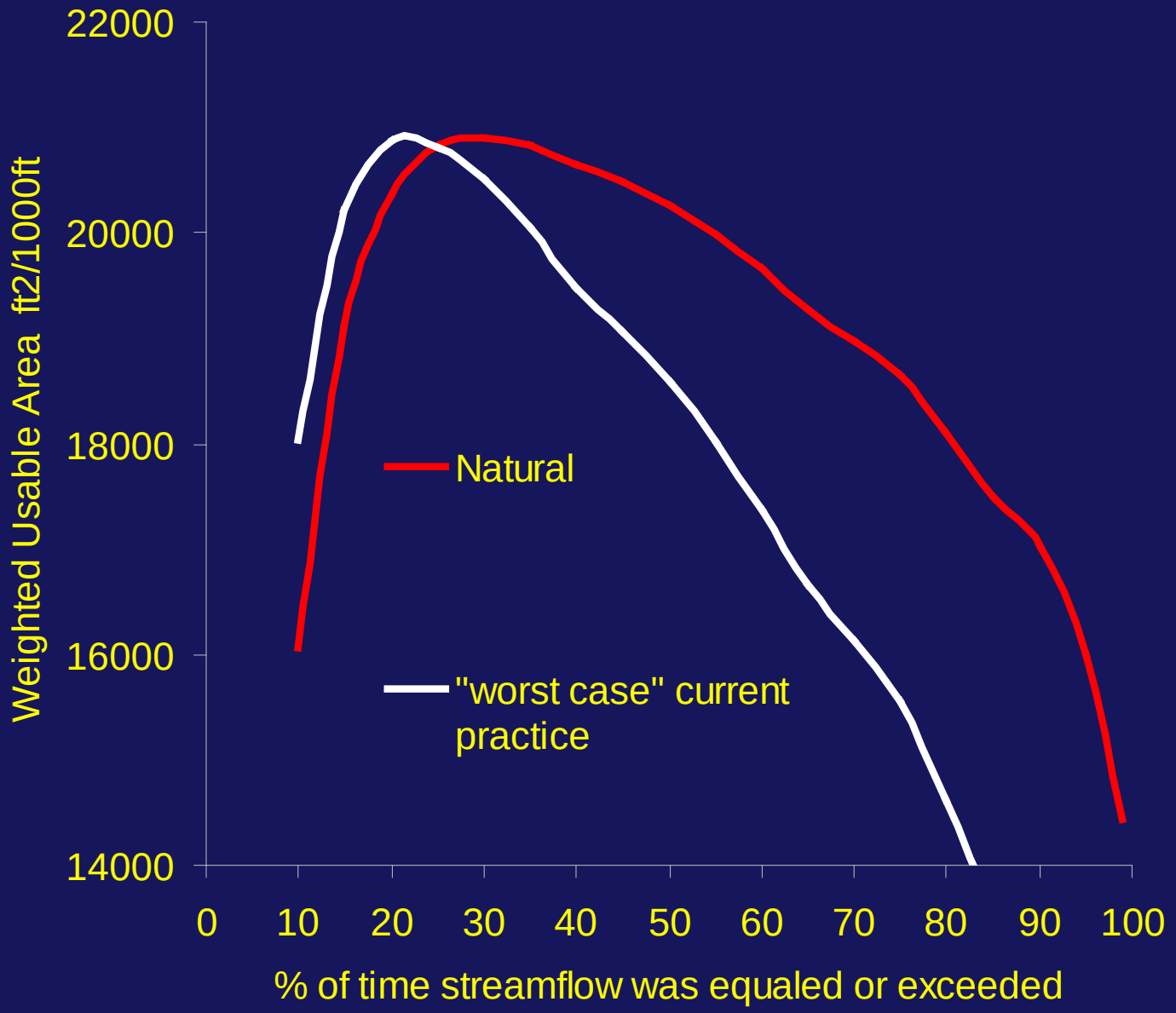


Percent of time indicated streamflow was equaled or exceeded	Streamflow, in cubic feet per second	Percent of time indicated streamflow was equaled or exceeded	Streamflow, in cubic feet per second
1	196	55	33
5	122	60	31
10	90	65	28
15	76	70	27
20	63	75	25
25	56	80	23
30	49	85	21
35	45	90	19
40	41	95	16
45	38	99	13
50	35		

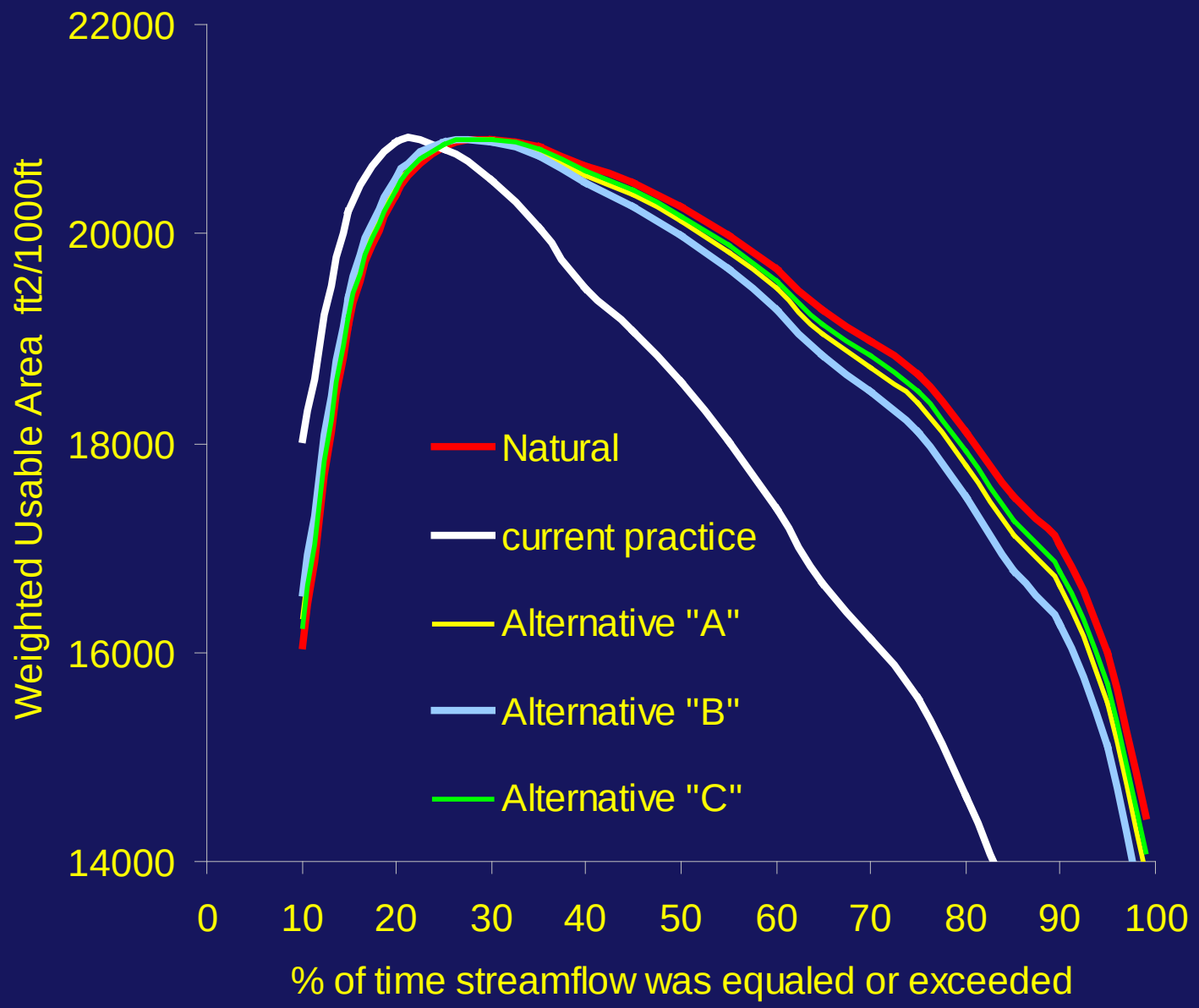
Hydrograph + habitat



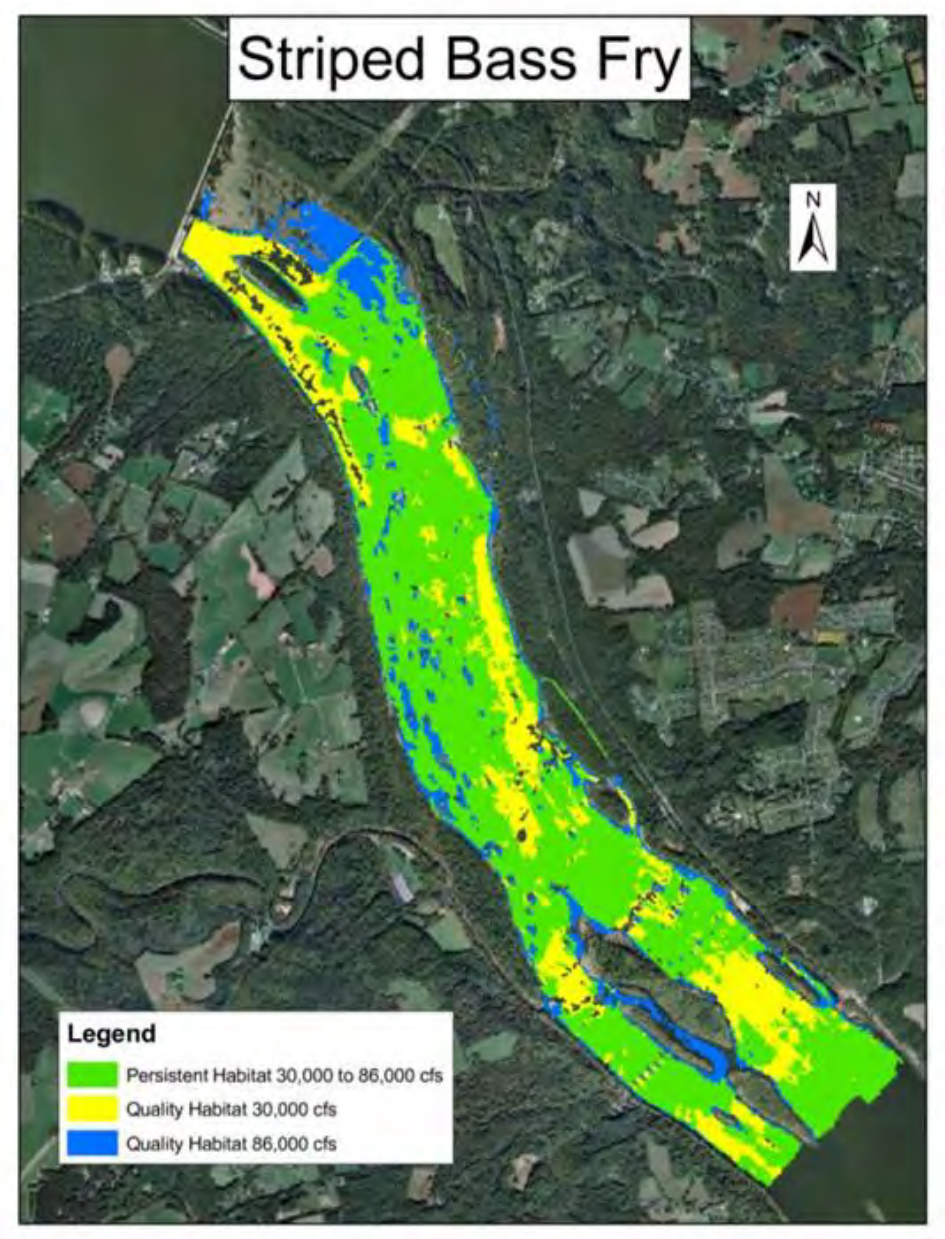
Effect of existing flow diversion



Effect of alternative diversion strategies



Persistent Habitat



Persistent Habitat

Smallmouth Bass Spawning Persistent Quality Habitat Area (FT^2), by Flow Pairs (cfs).

	Generation Flow (cfs)													
Minimum Flow (cfs)	2,000	3,500	5,000	7,500	10,000	15,000	20,000	30,000	40,000	50,000	60,000	70,000	80,000	86,000
2,000	**965,602**	935,388	900,783	828,447	704,149	466,328	349,382	250,317	163,334	100,220	66,922	52,090	20,395	20,395
3,500		**1,001,643**	946,040	847,423	715,979	474,856	356,830	255,438	167,045	103,931	66,922	52,090	24,105	24,105
5,000			**1,049,421**	877,745	726,708	480,531	362,039	256,572	168,179	103,931	66,922	52,090	24,105	24,105
7,500				**937,519**	768,238	506,749	385,227	262,861	168,858	103,931	66,922	52,090	24,105	24,105
10,000					**805,333**	535,976	400,443	276,022	175,295	108,936	68,323	52,090	24,105	24,105
15,000						599,897	436,737	310,020	194,184	115,771	72,740	55,314	27,329	27,329
20,000							**468,765**	331,818	208,709	121,782	76,365	55,521	30,954	30,954
30,000								**376,417**	252,176	163,836	107,240	65,648	36,979	35,693
40,000									**290,844**	200,063	142,759	98,469	53,680	52,394
50,000										**238,531**	171,216	122,087	77,299	67,568
60,000											**207,370**	151,608	101,943	88,365
70,000												**189,642**	128,686	113,520
80,000													**156,313**	139,663
86,000														**149,553**