

Alternate Proposed Box Model for Trophic Condition

Evaluation Results for Ohio EPA's TIC Development Data

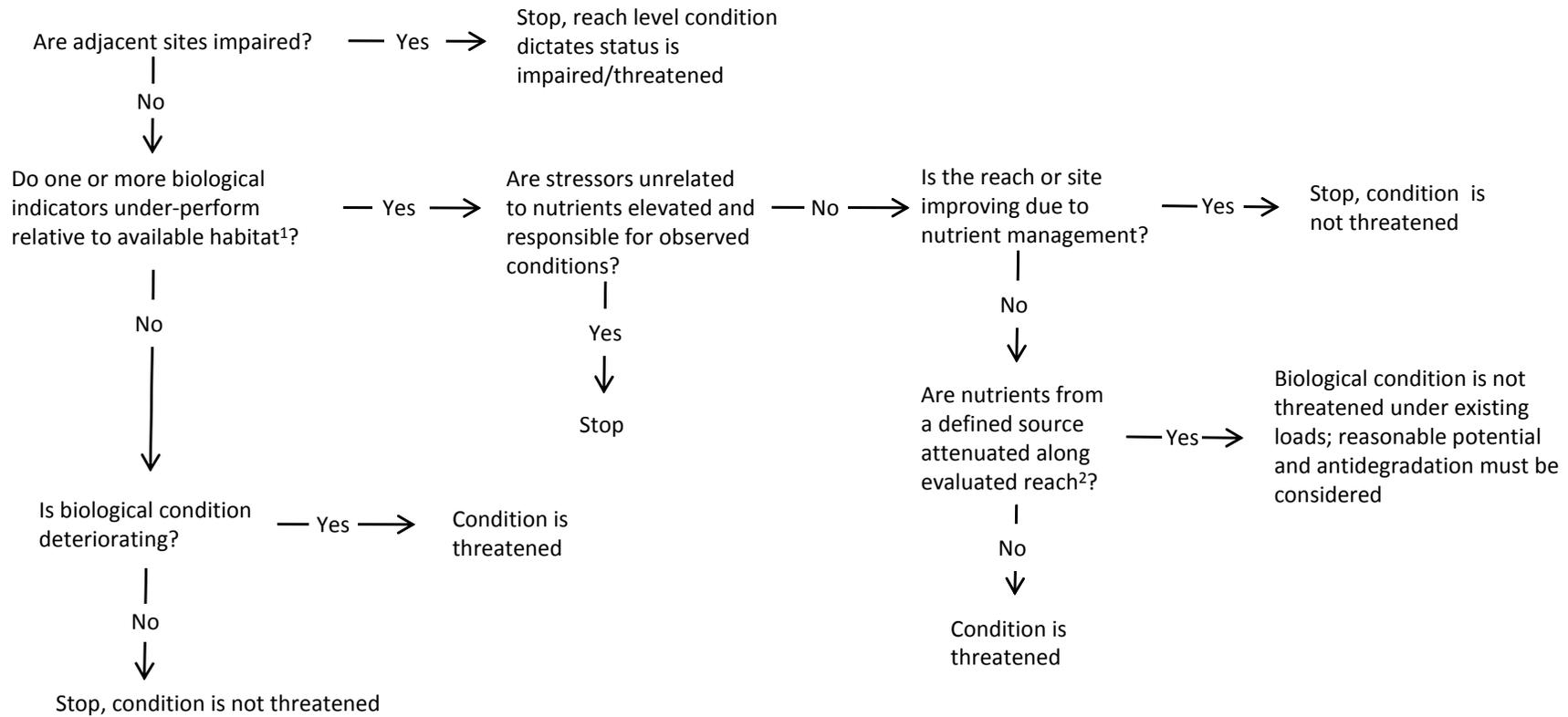
1	2	3	4	
Biological Criteria	DO Swing	Benthic Chlorophyll	Trophic Condition Status of Evaluated Reach or Waterbody	
All indices attaining or in non-significant departure [84]	Normal or low swings (<6.5 mg/l) [64]	Low to moderate (<320 mg/m ²) [60]	Attaining use / Not threatened [60]	
		High (>320 mg/m ²) [4]	Attaining use, but may be threatened [24]	See Table A
	Wide swings (>6.5 mg/l) [20]	Low (<183 mg/m ²) [11]		
		Moderate to high (>183 mg/m ²) [9]		
Non-attaining (one or more indices below non-significant departure) [44]	Normal or low swings (<6.5 mg/l) [36]	Low to moderate (<320 mg/m ²) [34]	Impaired, but cause(s) other than nutrients [34]	See Table B
		High (>320 mg/m ²) [2]	Impaired; likely nutrients over-enrichment [5]	See Table C
	Wide swings (>6.5 mg/l) [8]	Low (<183 mg/m ²) [3]		
		Moderate to high (>183 mg/m ²) [5]	Impaired; Nutrients over-enrichment [5]	

Nutrient Threatened **[8]**

Not nutrient threatened **[16]**

[x] = number of sites from TIC development data for small rivers & streams

Table A. Decision matrix for determining when biologically attaining condition status is threatened



¹Equations to help determine whether biological indicators are under-performing relative to available habitat.

All Ecoregions EWH IBI (25 th percentile)		All Ecoregions EWH EPT (25 th percentile)	
35.91 + 0.1786*QHEI		1.59 + 0.1381*QHEI + 2.30836*Log10(Drainage Area)	
All Other Aquatic Life Uses (15 th percentiles)			
HELP	22.00 + 0.1212*QHEI	HELP	2.13 + 3.59324*Log10(Drainage Area)
EOLP	34.00 + 0.0606*QHEI	EOLP	9
IP, WAP, ECBP	20.50 + 0.3107*QHEI	IP, WAP, ECBP	-3.58 + 0.1589*QHEI + 2.22110*Log10(Drainage Area)

²Concentrations of total phosphorus (TP) and dissolved inorganic nitrogen (DIN) arrayed by narrative levels of ecological risk.

TP Concentration	DIN Concentration				
	<0.44	0.45 < 1.10	1.10 < 3.60	3.60 < 6.70	>6.70
<0.040	background levels typical of least disturbed conditions	levels typical of developed lands; little or risk to beneficial uses	levels typical of modestly enriched condition in phosphorus limited systems; low risk to beneficial use if allied stressors are within normal ranges	levels typical of enriched condition in phosphorus limited systems; moderate risk to beneficial use if allied stressors are elevated	characteristic of tile-drained lands; otherwise atypical condition with moderate risk to beneficial use if allied stressors are elevated (1.1% of observations)
0.041 < 0.080	levels typical of developed lands; little or risk to beneficial uses	levels typical of developed lands; little or risk to beneficial uses	levels typical of working landscapes; low risk to beneficial use if allied stressors are within normal ranges	levels typical of enriched condition in phosphorus limited systems; moderate risk to beneficial use if allied stressors are elevated	characteristic of tile-drained lands; moderate risk to beneficial use if allied stressors are elevated (1.1% of observations)
0.080 < 0.131	levels typical of modestly enriched condition in nitrogen limited systems; low risk to beneficial use if allied stressors are within normal ranges	levels typical of working landscapes; low risk to beneficial use if allied stressors are within normal ranges	levels typical of working landscapes; low risk to beneficial use if allied stressors are within normal ranges	characteristic of tile-drained lands; moderate risk to beneficial use if allied stressors are elevated; increased risk with poor habitat	characteristic of tile-drained lands; moderate risk to beneficial use if allied stressors are elevated (1.0% of observations)
0.131 < 0.400	levels typical of modestly enriched condition in nitrogen limited systems; low risk to beneficial use if allied stressors are within normal ranges	levels typical of enriched condition; low risk to beneficial use if allied stressors are within normal ranges	levels typical of enriched condition; low risk to beneficial use if allied stressors are within normal ranges; increased risk with poor habitat	enriched condition; generally high risk to beneficial uses; often co-occurring with multiple stressors; increased risk with poor habitat	enriched condition; generally high risk to beneficial uses; often co-occurring with multiple stressors
>0.400	atypical condition (1.3% of observations);	atypical condition (1% of observations);	enriched condition; generally high risk to beneficial uses; often co-occurring with multiple stressors; increased risk with poor habitat	enriched condition; generally high risk to beneficial uses; often co-occurring with multiple stressors ; increased risk with poor habitat	enriched condition; generally high risk to beneficial uses; often co-occurring with multiple stressors

Frequency of occurrence in database

Total Phosphorus	Dissolved Inorganic Nitrogen				
	<0.44	0.45 < 1.10	1.10 < 3.60	3.60 < 6.70	>6.70
<0.040	18.14	5.00	4.26	1.13	0.66
0.041 < 0.080	6.50	5.66	4.87	1.11	0.29
0.080 < 0.131	3.30	3.77	5.20	1.01	0.31
0.131 < 0.400	3.62	4.31	11.39	3.01	1.45
>0.400	1.33	0.99	4.84	4.07	3.78

Table B. Decision matrix for determining biological impairment is caused by stressors other than nutrients

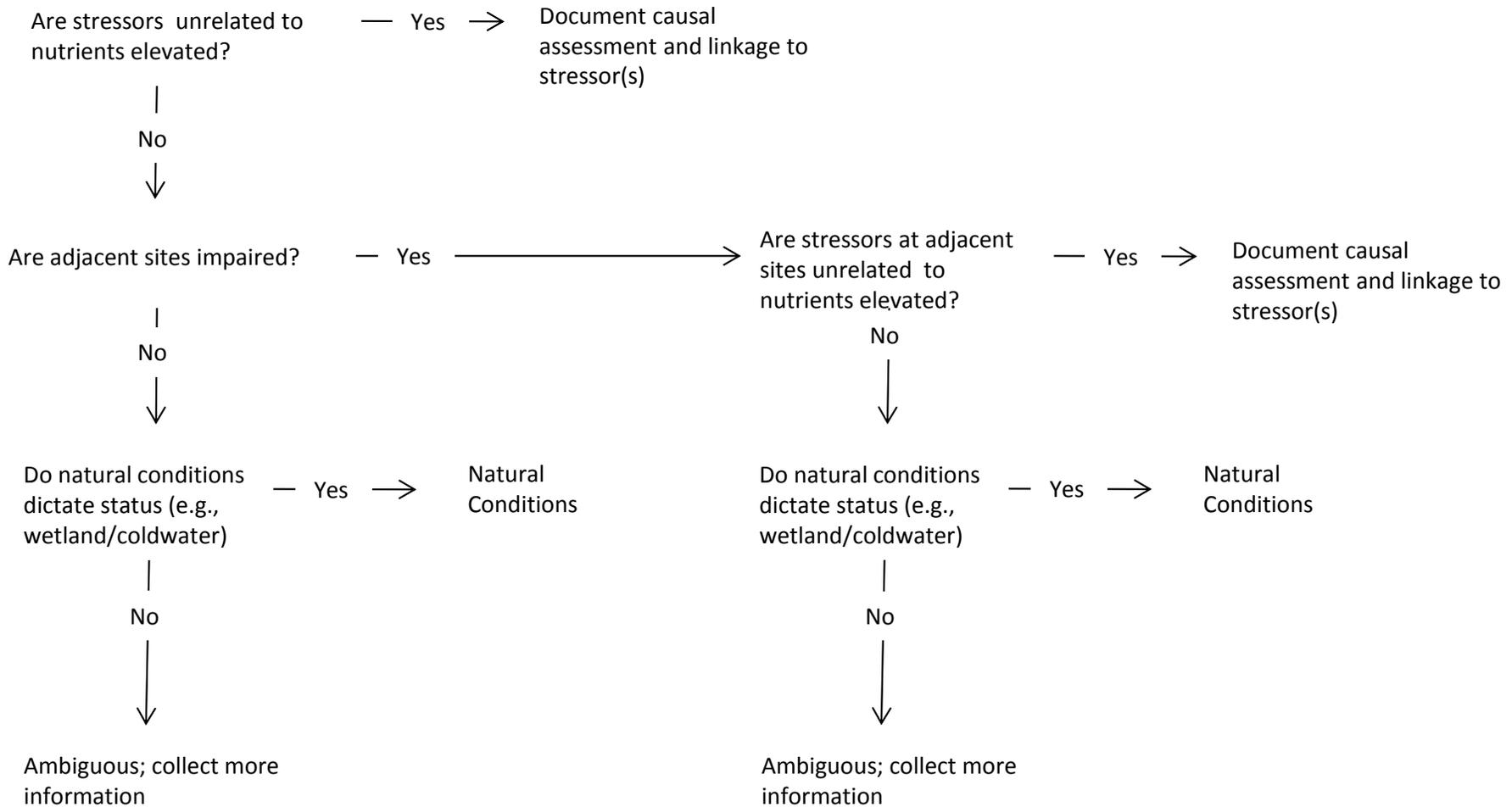


Table C. Decision matrix for determining biological impairment is caused by nutrients

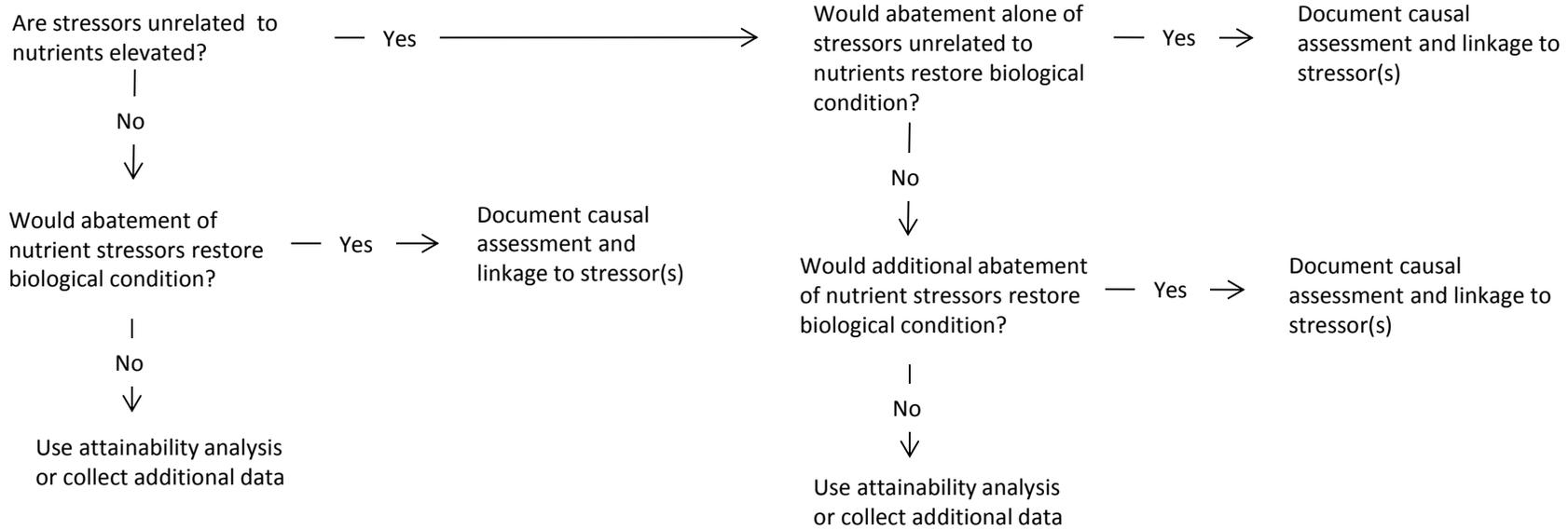


TABLE A Decision matrix for determining when biologically attaining condition status is threatened by nutrients

Use of decision matrix by Bob Miltner to evaluate condition status of sites used in OEPA's TIC development data. Total of 24 sites attaining but possibly threatened.

<u>Threatened (Y/N)</u>	<u>STORET Station ID</u>	<u>Description</u>
Normal D.O. range, high chlorophyll		
N	300817	Limitat Warmwater Habitat
N	M01P29	Little Miami, improving trend due to existing nutrient management
N	M01W55	Little Miami, improving trend due to existing nutrient management
N	M01W83	Biology improving
Wide D.O. range, low chlorophyll		
N	601260	excellent habitat, high gradient
N	301872	excellent habitat, high gradient
Y	500270	biology declining
Y*	M04P09	adjacent site impaired, reach level
N	M04S51	biology stable
N	300811	excellent habitat and biology, high gradient
Y	H09W49	Clear Creek (lower GMR) drains to impaired reach
Y	300812	Clear Creek (lower GMR) drains to impaired reach
Y*	H07G07	adjacent site impaired, reach level
Y*	300589	adjacent site impaired, reach level
N	R04K20	excellent habitat, high gradient
Wide D.O. range, moderate to high chlorophyll		
Y	V02G05	biology under-performs available habitat, reach immediately upstream channelized
Y	M01P02	biology under-performs available habitat, reach immediately upstream channelized
N	H02P12	stable biology, excellent habitat
Y*	300818	reach level impairment
Y	H07P07	modified habitat, fish kill observed due to wide D.O. swings
Y	H07K07	modified habitat, fish kill observed due to wide D.O. swings
N	R03W06	stable/improving biology
N	R03S33	stable/improving biology
Y	B01S30	biology stuck in ns departure

* Threatened, but located in segment with adjacent sites impaired (i.e., reach level impairment)

TABLE B Decision matrix for determining when biological impairment is caused by stressors other than nutrients

Use of decision matrix by Bob Miltner to evaluate condition status of sites used in OEPA's TIC development data. Total of 34 sites impaired but with causes other than nutrients.

STORET Station ID	Causes
203089	habitat, nutrients, low D.O.
203721	habitat, sediment
301083	metals
301220	habitat, nutrients
301738	habitat
301984	habitat, sediment
601800	organic and nutrient enrichment
B01P01	dam/culvert
B01P05	sediment, nutrients
B01S14	organic and nutrient enrichment
B01S38	habitat
H02P04	habitat, nutrient enrichment
H06S01	natural
H07K02	organic and nutrient enrichment
H07K27	natural, habitat
H07W17	natural, habitat
H09P01	natural, habitat
M04S03	unknown
M04S05	unknown
M04S10	unknown
M04S12	habitat, low D.O.
M04S35	organic enrichment, low D.O.
M04S46	natural condition, low D.O.
M04W05	organic enrichment
R01G01	sediment, nutrients
R01P19	nutrients, flow alteration
R01P22	metals
R09K06	low D.O., H2S
R09K12	habitat, sediment
V01S23	chemical spill
V02P07	ammonia
V02P09	habitat, nutrients
V02S07	habitat, nutrients, D.O.
V03W06	sediment contamination

TABLE C Decision matrix for determining when biological impairment is caused by nutrients

Use of decision matrix by Bob Miltner to evaluate condition status of sites used in OEPA's TIC development data. Total of 5 sites impaired with nutrients as likely primary stressor.

Low DO Swing / High Benthic Chlorophyll

STORET station ID	Description
C03S01	nutrient enrichment (D.O. range = 6.24, TP and DIN at high risk levels, TDS elevated, but not to levels likely to be the primary driver of impairment)
H07W08	organic and nutrient enrichment (organic enrichment problem currently being addressed, scheduled for re-evaluation)

High DO Swing / Low Benthic Chlorophyll

STORET station ID	Description
B01K21	low D.O., organic enrichment; (nutrients not likely primary driver of impairment)
201629	nutrient and organic enrichment, habitat (reach immediately upstream from sampling location is channelized)
201630	nutrient and organic enrichment (Household Sewage Treatment Systems)