Water Quality Functional Assessment Method Project (WQFAM)

A-Team Meeting Notes

1926 Victoria Ave. Ft. Myers, FL 33901

Meeting 2 – January 25, 2012
Scheduled 1:30 p.m. – 4:30 p.m.

Attending

In Person:	Via WebEx:
James Evans	Harry Phillips
Betty Staugler	Kim Haag
Mike Kirby	Michael Jones
Steve Adams	Rhonda Evans
Karen Bickford	Charles Kovach
Lisa Beever	Mac Hatcher
Rick Bartleson	Lindsay Cross
Judy Ott	Mike Bauer
Melanie Grigsby	Katie Laakkonen
Jim Beever	
Whitney Gray	

After introductions, Jim Beever gave some background of the WQFAM project and presented the goals for the meeting: selection of the water quality (WQ) parameters to be assessed, start the list of candidate visual indicators of water quality for the selected WQ parameters, and review and add to the list of locations of existing and proposed treatment wetlands.

Several clarifications of the project were brought out. Judy mentioned that the need for a method like WQFAM was brought up at another meeting she recently attended. Mike Kirby asked if the method would be applicable to stormwater detention ponds and rain gardens. Jim replied that, no, it would not. Jim clarified that the method would concentrate on filter marshes, and could include floating vegetation mats created for water quality treatment, and wetland restoration projects if water quality treatment was a stated goal of the restoration. Steve asked if the method could be applicable to Everglades STAs. Jim replied that it could, but that currently those were outside of the geographic study area.

Jim proceeded with an activity for selecting water quality parameters to be assessed by the WQFAM method. Large posters were provided that contained a table of water quality parameters gathered from the Florida Department of Environmental Protection list of water quality impairments and additional suggested parameters. Each meeting participant present in person was given five green dot stickers and five red dot stickers. The participants were instructed to use their green dots to indicate the five water quality parameters they felt were the most important to assess using WQFAM. Red dots could be used to indicate parameters that should not be assessed using WQFAM. WebEx participants used the WebEx chat function to send their choices to Whitney, who transferred those choices to the posters with dots. (See Figures 1 and 2)

Green dots counted as a +1 and red dots counted as a -1, yielding the results in Table 1 below.

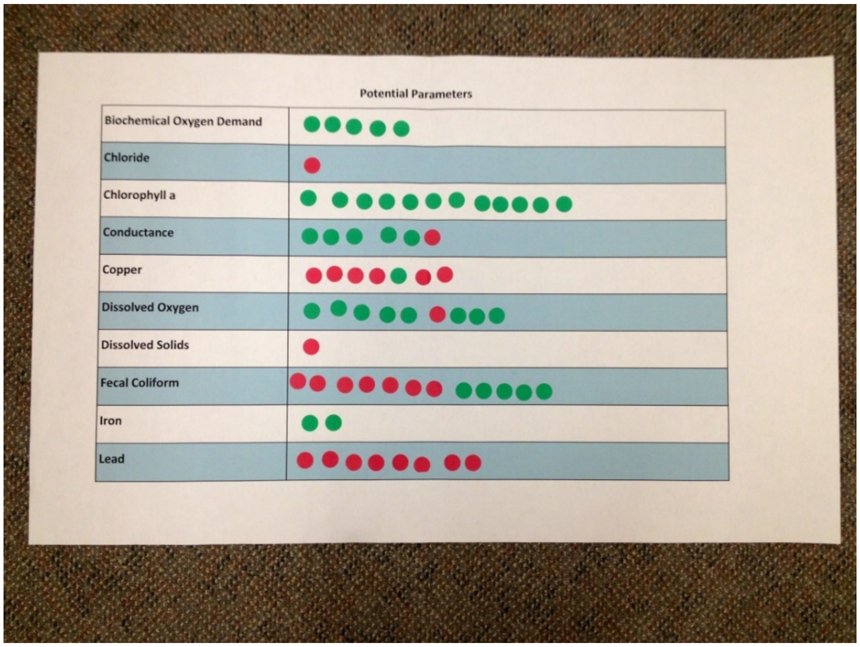


Figure 1

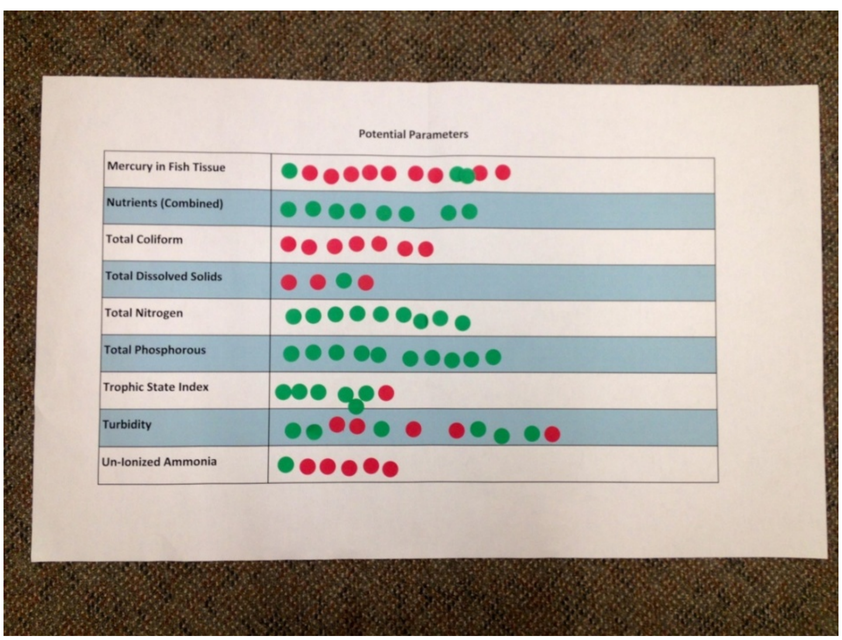


Figure 2

Biochemical Oxygen Demand	**+5**
Chloride	**-1**
Chlorophyll-a	**+12**
Conductance	**+4**
Copper	**-5**
Dissolved Oxygen	**+7**
Dissolved Solids	**-1**
Fecal Coliform	**+2**
Iron	**-2**
Lead	**-8**
Mercury in Fish Tissue	**-7**
Nutrients (Combined)	**+9**
Total Coliform	**-7**
Total Dissolved Solids	**-2**
Total Nitrogen	**+9**
Total Phosphorous	**+10**
Trophic State Index	**+4**
Turbidity	**+2**
Un-Ionized Ammonia	**-4**

Table 1

From this input, the top five water quality parameters to be assessed by WQFAM were: chlorophyll-a, total phosphorus, total nitrogen, nutrients (combined), and dissolved oxygen. Discussion ensued. James pointed out that oxygen redox potential may be a good surrogate. Several participants commented on conductance, and Lisa offered that it can determine limiting nutrients, and, since the other parameters chosen are indicative of nutrients, including conductance would be beneficial since it is not generally considered to be nutrient-related, and also provides information about hydrology. Charles suggested that conductance is easily measured using an instrument; but it was also mentioned that, if conductance is altered in a wetland for long enough, changes to the vegetation community occur, making those changes a visual indicator of conductance changes. Steve asked what would be “good” conductance as contrasted with “bad” conductance, and it was explained that that would be relative to the site. James asked if speciation of nitrogen should be considered and Jim explained that, when nitrogen measurements in TMDLs are evaluated, nitrogen speciation is generally limited to ammonia, and that the group could discuss this topic more fully at a future meeting. The result of this discussion was a consensus to include conductance as a sixth parameter to be assessed with WQFAM.

Whitney then presented “Shopping for Variables,” a look at two HGM models and UMAM for potential visual indicators that could be used in WQFAM. The group added several potential visual indicators, resulting in Table 2.

The group then did an “Envelopes” exercise in which each participant was to suggest visual indicators for each of the six water quality parameters chosen earlier in the meeting. Six large manila envelopes were presented, one for each water quality parameter. Participants were given pieces of paper and were instructed to write down potential visual indicators specific to the water quality parameters and put them in the appropriate envelopes. One indicator was to be written on each piece of paper. Any number of indicators could be submitted for each water quality parameter. WebEx participants were asked to email their submissions to Whitney. Results were to be compiled after the close of the meeting and would be reported on at the next meeting.

Finally, Jim presented the results of a search for treatment wetlands and filter marshes completed, under construction, or being planned across the study area. Maps were provided. The group was asked for additional locations that they know of. Some additions were provided. This list is still being compiled and additions are welcome at any time.

A Doodle poll will be sent out to find the next meeting date for February.
A procedure for submitting travel expenses was briefly outlined by Whitney.

The meeting ended at 3:45.

Biological	***Geochemical***	***Hydrologic***	***Geomorphic***
emergent macrophytic veg cover	surface soil texture	surface outlet	microtopographic features
periphyton cover	surface soil texture	water levels and flows	change in catchment size
number of native wetland species		water level indicators	upland land use
plant species composition		soil moisture	
macrophytic vegetation cover		direct observation of standing water	
understory vegetation biomass		existing water quality data	
tree basal area		water depth, wave energy, currents, light penetration	
absence of invasive plant species *		siltation or algal growth	
quality of benefits to downstream habitats			
zonation of vegetation			
absence of hydrologic stress in vegetation			
use by animals with specific hydrologic requirements			
plant community composition			
appropriate plant species in various strata			
absence of invasive plant species *			
regeneration and recruitment of vegetation			
age and size distribution of vegetation			
plant condition			
number and diversity of benthic species			
non-native or inappropriate benthic species			
regeneration, recruitment and age distribution of benthic species			
condition of appropriate benthic species			

* Exotic or not

Table 2

Additional indicators added by the group

(All were from UMAM)

erosion/deposition

coarse woody debris, dens, snags

topographic relief

benthic spawning and nesting areas

Results of Envelopes Activity

Each participant suggested visual indicators for each of the six water quality parameters chosen earlier in the meeting. Six large manila envelopes were presented, one for each water quality parameter. Participants were given pieces of paper and were instructed to write down potential visual indicators specific to the water quality parameters and put them in the appropriate envelopes. One indicator was to be written on each piece of paper. Any number of indicators could be submitted for each water quality parameter. WebEx participants were asked to email their submissions to Whitney.

Below are the raw results of that activity:

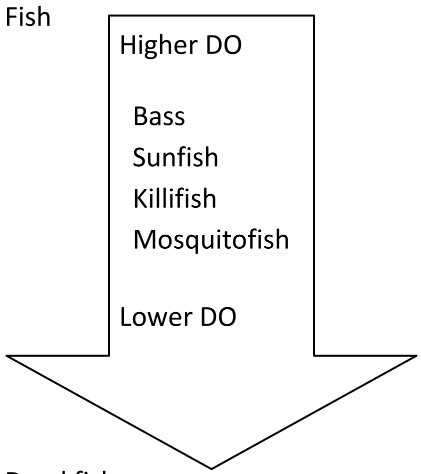
Visual Indicators Suggested for Assessing Chosen Water Quality Parameters (from 1/25/2012 meeting)
This is a list of all the responses put into the envelopes.

1. Chlorophyll a
    a. Light penetration – clearer is better
    b. Light penetration
    c. Green filamentous algae
    d. Clear, tea colored water (good)
    e. No/few cattails (good)
    f. Condition of vegetation (material dying, growing, etc.)
    g. Green – plankton or mat or filaments
    h. Excessive vegetative growth (cattails etc.)
    i. Algae mat cover/periphyton cover
    j. Green color
    k. Green scum
    l. Water clarity
    m. Poor clarity
    n. Trophic state; amount of nutrients
    o. Distribution of plant species appropriate for specific wetland
    p. Distribution of well balanced benthic macroinvertebrates
    q. Lack of blue green or green algal blooms
    r. Existing water quality data
    s. Periphyton cover
    t. Plant species composition
    u. Zonation of vegetation
    v. Secchi disk
    w. Algal growth
    x. Color
    y. Algae growth
    z. Light penetration
    aa. Emergent macrophytic beg cover
    bb. Periphyton/algae
    cc. sonde

2. Conductance
    a. Salt tolerant plants
    b. Vegetative community
    c. Sulfur smell

d. Field measurement
e. Stressed plants
f. Changing plant communities
g. Algae species presence (micro/macro)
h. Dead vegetation in system where there is supposed to be low conductance
i. Vegetation community structure
j. Dying salt intolerant plants
k. Fish community structure
l. Distribution of plant species appropriate for specific wetland
m. Distribution of well balanced benthic macroinvertebrates
n. Field measurement with instrument
o. Existing water quality data
p. Plant species composition
q. Plant community composition
r. Plant condition
s. Plant species composition
t. YSI measurement
u. Soil texture
v. Flow
w. sonde

3. Dissolved oxygen
a. Fish gulping air (bad)
b. Field measure with Hach kit or meter
c. Dead fish (low D.O.)
d. Distribution of well balanced macroinvertebrates
e. Distribution of plant species appropriate for specific wetland
f. Bluegill nests
g. Fish



h. Dead fish
i. Fish gulping air
j. Stagnation/surface scum
k. Low animal (invertebrate) densities
l. White and black sediment
m. Bubbles coming out of the mud (H_2S)
n. Chalky water from sulfur precipitation

o. High % of low-oxygen-tolerant fish (bad)
p. Low % of oxygen sensitive fish (bad)
q. Fish kills
r. Aquatic life (snails present can be observed when DO is higher and nutrient uptake is occurring)
s. Lack of benthos
t. Algal bloom suggesting high daytime DO, low nighttime DO
u. Fish kills indicating low DO
v. Odor; stronger the odor the more nutrients in the system
w. Soils → silt layer; more silt the lower the DO
x. Undecomposed vegetative mat = low DO
y. High diversity of benthic animal species (good DO)
z. Changes in diversity and number of benthic species
aa. Existing water quality data
bb. Number and diversity of benthic species
cc. Regeneration, recruitment and age distribution of benthic species
dd. Use by animals with specific hydrologic requirements
ee. Condition of appropriate benthic species
ff. Soil moisture
gg. Observation of standing waters
hh. Spawning/nesting (benthic)
ii. Odor
jj. Plant species composition
kk. Benthic species present
ll. YSI measurement
mm. Gasping fish at surface
nn. Dead fish
oo. Macrophytic veg. cover
pp. Soil texture
qq. Benthic community
rr. Flow
ss. Temperature
tt. sonde

4. Total nitrogen
   a. Lack of green or blue green algae blooms
   b. Distribution of well balanced benthic macroinvertebrates
   c. Distribution of plant species appropriate for specific wetland
   d. Green (color) brown - stronger the color the more algae
   e. Oxygen redox potential
   f. Blue green algae – high N
   g. Water clarity – clear – low N
   h. Existing water quality data
   i. Periphyton cover
   j. Invasive species
   k. Algae growth
   l. Light penetration
   m. emergent macrophytic veg. cover

n. land management (potential fertilizer sources surrounding wetland)
o. sonde

5. Total phosphorus
    a. Water clarity – clear – low P
    b. Dominance of cattails
    c. Phyto bloom
    d. Blue green algae – high P
    e. Green (color) brown – stronger the color the more algae
    f. Cyanobacteria bloom (high phosphorus) or total nutrient load
    g. Lack of green or blue green algae bloom
    h. Distribution of well balanced benthic macroinvertebrates
    i. Distribution of plant species appropriate for specific wetland
    j. Existing water quality data
    k. Periphyton cover
    l. Plant species composition
    m. Invasive species
    n. Algae growth
    o. Light penetration
    p. Emergent macrophytic veg. cover
    q. Land management (potential fertilizer sources surrounding wetland)
    r. sonde

6. Nutrients (combined)
    a. Lack of green or blue green algae bloom
    b. Distribution of well balanced benthic macroinvertebrates
    c. Distribution of plant species appropriate for specific wetland
    d. Green (color) brown – stronger the color the more algae
    e. Water clarity – clear – low nutrient
    f. Strong algal odor – high nutrients
    g. Algal growth – green color
    h. Loss of submerged plants in deep water
    i. Organic muck on bottom
    j. Opportunistic plant species like cattail – nutrient enrichment
    k. Epiphytic algae on submerged plants
    l. Excessive micro or macro algae indicative of nutrient imbalance
    m. Macroalgae mat (high nutrient)
    n. Blue green algae – high nutrient
    o. Water clarity
    p. Blue green algae presence indicative of elevated nutrients
    q. Vegetation surrounding wetland (recently cut by mowing, any evidence of spraying)
    r. Floating debris in water (size of debris indicates strength of weather event runoff)
    s. Algae blooms
    t. Excessive macrophyte growth
    u. No/few cattails (good)
    v. Clear, tea colored water (good)
    w. Green filamentous algae
    x. Existing water quality data

y. Periphyton cover
z. Macrophytic vegetation cover
aa. Plant community composition
bb. Appropriate plant species in various strata
cc. Plant condition
dd. Regeneration and recruitment of vegetation
ee. Erosion/deposition
ff. Invasive species
gg. Algae growth
hh. Light penetration
ii. Emergent macrophytic veg. cover
jj. Land management (potential fertilizer sources surrounding wetland)
kk. Periphyton/algae
ll. Benthic community
mm. Plant community composition
nn. Flow
oo. sonde

The contents of each envelope were then sorted into groups that emerged.

Chlorophyll a

Trophic state; amount of nutrients

Clarity	**Algae**	**Plant Species**	**Plant Condition**	**Animal Species**	**Inappropriate Chlorophyll-a levels**
Clear, tea colored water (good)	Green color	Distribution of plant species appropriate for specific wetland	Condition of vegetation (material dying, growing, etc.)	Distribution of well balanced benthic macroinvertebrates	sonde
Poor clarity	Lack of blue green or green algal blooms	Excessive vegetative growth (cattails etc.)			existing water quality data
Water clarity	Green scum	No/few cattails (good)			
Light penetration	Algae mat cover/periphyton cover	Plant species composition			
Light penetration – clearer is better	Green – plankton or mat or filaments	Zonation of vegetation			
Secchi disk	Green filamentous algae	Emergent macrophytic veg. cover			
Color	Periphyton cover				
Light penetration	Algal growth				
	Algae growth				
	Periphyton/algae				
9	**11**	**6**	**1**	**1**	**2**

Conductance

Inappropriate Conductance Level	**Animal Species**	**Plant Species**	**Plant Condition**	**Odor**	**Hydrology**	**Substrate**
Field measurement with instrument	Fish community structure	Salt tolerant plants	Stressed plants	Sulfur smell	Flow	Soil texture
Field measurement	Distribution of well balanced benthic macroinvertebrates	Vegetative community	Changing plant communities			
YSI measurement		Vegetation community structure	Dead vegetation in system where there is supposed to be low conductance			
sonde		Distribution of plant species appropriate for specific wetland	Dying salt intolerant plants			
existing water quality data		Algae species presence (micro/macro)	Plant condition			
		Plant species composition				
		Plant community composition				
		Plant species composition				
5	**2**	**8**	**5**	**1**	**1**	**1**

Dissolved oxygen

Animal Species	Animal Condition	Plant Species	Inappropriate Oxygen Level	Substrate	Algae	Physical Attributes
Changes in diversity and number of benthic species	Fish kills indicating low DO	Distribution of plant species appropriate for specific wetland	Field measure with Hach kit or meter	Soils □ silt layer; more silt the lower the DO	Stagnation/surface scum	Chalky water from sulfur precipitation
High diversity of benthic animal species (good DO)	Fish gulping air	Plant species composition	YSI measurement	Bubbles coming out of the mud (H2S)	Algal bloom suggesting high daytime DO, low nighttime DO	Odor; stronger the odor the more nutrients in the system
Lack of benthos	Dead fish	Macrophytic veg. cover	sonde	White and black sediment		Observation of standing waters
Aquatic life (snails present can be observed when DO is higher and nutrient uptake is occurring)	Dead fish (low D.O.)		existing water quality data	Undecomposed vegetative mat = low DO		Odor
Low % of oxygen sensitive fish (bad)	Fish gulping air (bad)			Soil moisture		Flow
High % of low-oxygen-tolerant fish (bad)	Fish kills			Soil texture		Temperature
Low animal (invertebrate) densities	Regeneration, recruitment and age distribution of benthic species					
Distribution of well balanced macroinvertebrates	Condition of appropriate benthic species					
Fish Higher DO Bass Sunfish Killifish Mosquitofish Lower DO	Gasping fish at surface					

Number and diversity of benthic species	Dead fish					
Use by animals with specific hydrologic requirements						
Benthic species present						
Benthic community						
Bluegill nests						
Spawning/nesting (benthic)						
16	**11**	**3**	**4**	**6**	**2**	**6**

Total nitrogen

Algae	**Water Clarity**	**Plant Species**	**Animal Species**	**Water Chemistry**	**Inappropriate Total Nitrogen**	**Surrounding Land Use**
Blue green algae – high N	Water clarity – clear – low N	Distribution of plant species appropriate for specific wetland	Distribution of well balanced benthic macroinvertebrates	Oxygen redox potential	Existing water quality data	land management (potential fertilizer sources surrounding wetland)
Lack of green or blue green algae blooms	Green (color) brown - stronger the color the more algae	Invasive species	Invasive species		sonde	
Periphyton cover	Light penetration	emergent macrophytic veg. cover				
Algae growth						
4	**3**	**3**	**2**	**1**	**2**	**1**

Total phosphorus

Algae	**Plant Species**	**Animal Species**	**Water Clarity/Color**	**Inappropriate Phosphorus Levels**	**Surrounding Land Use**
Lack of green or blue green algae bloom	Distribution of plant species appropriate for specific wetland	Distribution of well balanced benthic macroinvertebrates	Water clarity – clear – low P	Existing water quality data	Land management (potential fertilizer sources surrounding wetland)
Cyanobacteria bloom (high phosphorus) or total nutrient load	Dominance of cattails	Invasive species	Green (color) brown – stronger the color the more algae	sonde	
Blue green algae – high P	Plant species composition		Light penetration		
Phyto bloom	Invasive species				
Periphyton cover	Emergent macrophytic veg. cover				
Algae growth					
6	**5**	**2**	**3**	**2**	**1**

Nutrients (combined)

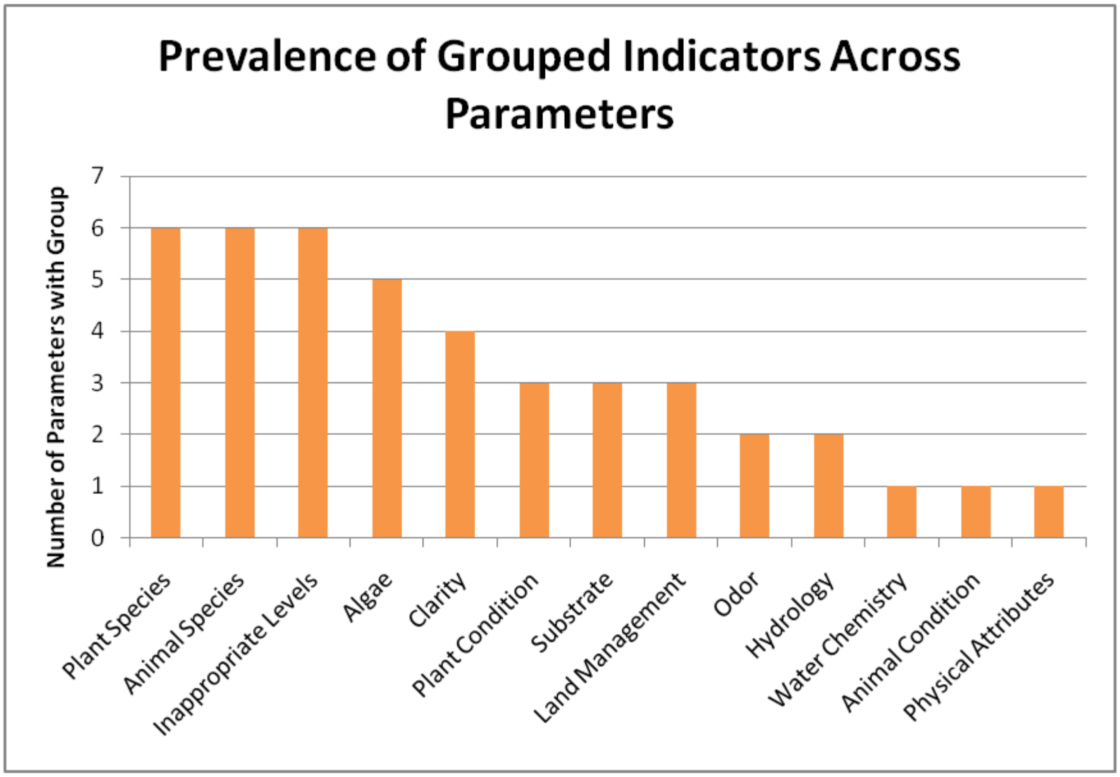
Algae	Plant Species	Plant Condition	Animal Species	Water Clarity	Land Management	Sediments	Odor	Inappropriate Nutrient Levels	Hydrology
Green filamentous algae	No/few cattails (good)	Epiphytic algae on submerged plants	Distribution of well balanced benthic macroinvertebrates	Clear, tea colored water (good)	Floating debris in water (size of debris indicates strength of weather event runoff)	Organic muck on bottom	Strong algal odor – high nutrients	Existing water quality data	Flow
Algae blooms	Opportunistic plant species like cattail – nutrient enrichment	Plant condition	Invasive species	Water clarity	Vegetation surrounding wetland (recently cut by mowing, any evidence of spraying)	Erosion/deposition		sonde	
Blue green algae presence indicative of elevated nutrients	Loss of submerged plants in deep water	Regeneration and recruitment of vegetation	Benthic community	Water clarity – clear – low nutrient	Excessive macrophyte growth				
Blue green algae – high nutrient	Distribution of plant species appropriate for specific wetland			Green (color) brown – stronger the color the more algae	Land management (potential fertilizer sources surrounding wetland)				
Macroalgae mat (high nutrient)	Macrophytic vegetation cover			Algal growth – green color					
Excessive micro or macro algae	Plant community			Light penetration					

indicative of nutrient imbalance	composition								
Lack of green or blue green algae bloom	Appropriate plant species in various strata								
Periphyton cover	Invasive species								
Algae growth	Emergent macrophytic veg. cover								
Periphyton/algae	Plant community composition								
10	**10**	**3**	**3**	**6**	**4**	**2**	**1**	**2**	**1**

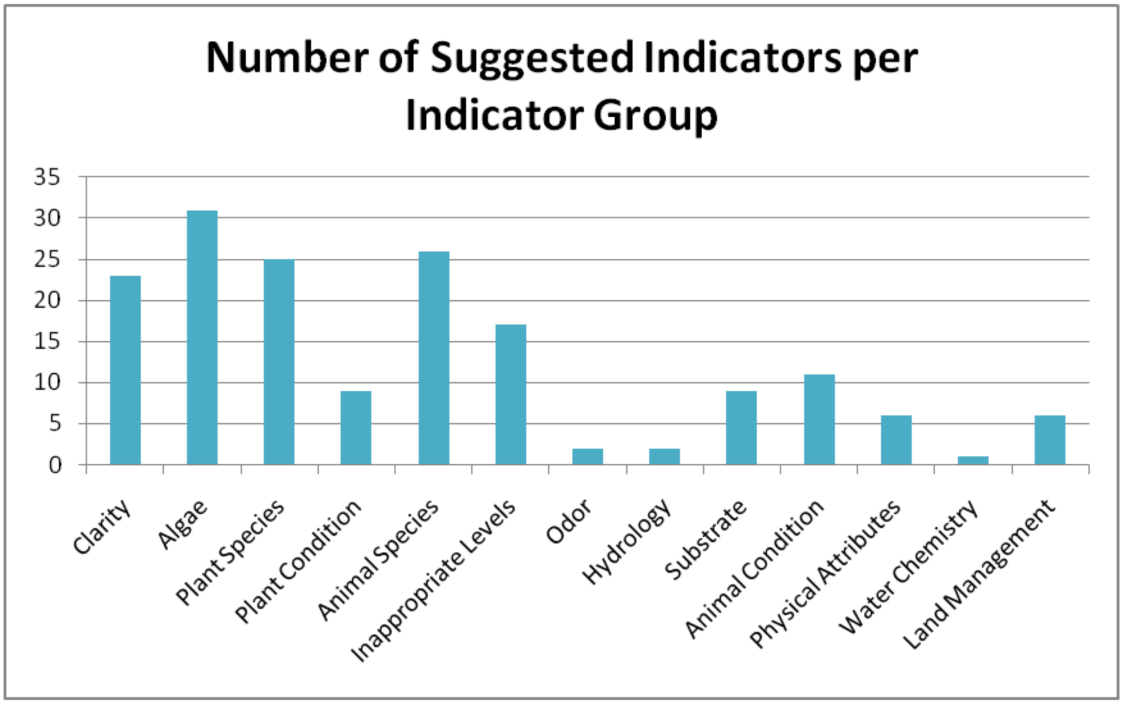
Next, this information was compiled into one table showing how many visual indicators were suggested for each parameter by indicator group.

	Clarity	**Algae**	**Plant Species**	**Plant Condition**	**Animal Species**	**Inappropriate Levels**	**Odor**	**Hydrology**	**Substrate**	**Animal Condition**	**Physical Attributes**	**Water Chemistry**	**Land Management**	**Totals**
Parameter														
Chlorophyll-a	9	11	6	1	1	2								**30**
Conductance			8	5	2	5	1	1	1					**23**
Dissolved Oxygen	2		3		16	4			6	11	6			**48**
Nutrients (combined)	6	10		3	3	2	1	1	2				4	**32**
Total Nitrogen	3	4	3		2	2						1	1	**16**
Total Phosphorus	3	6	5		2	2							1	**19**
Totals	**23**	**31**	**25**	**9**	**26**	**17**	**2**	**2**	**9**	**11**	**6**	**1**	**6**	**168**

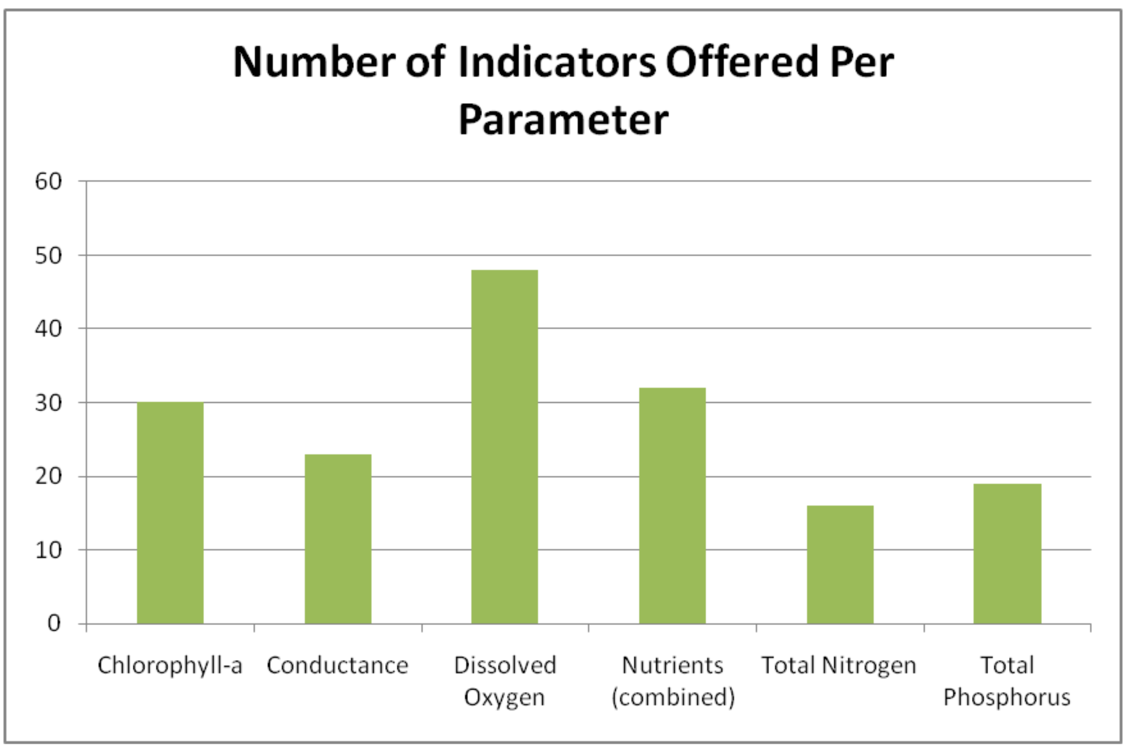
The following charts are a brief analysis of these results.



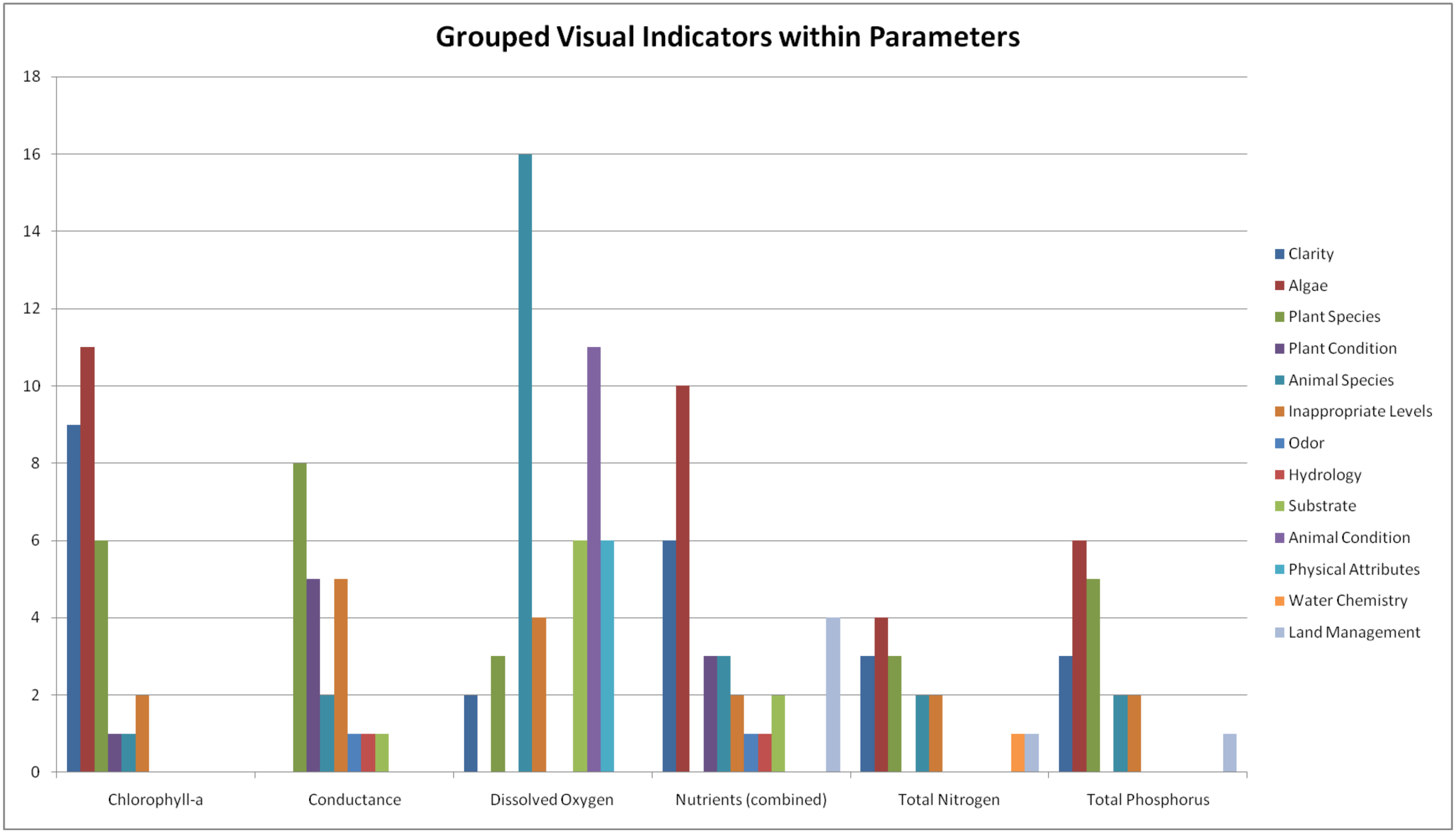
This shows how the indicator groups are represented in each parameter. For example, the group Plant Species is found as an indicator for all six parameters, while the group Physical Attributes is found as an indicator for just one parameter.



Shows how the suggested indicators were grouped. In other words, there were 31 suggested indicators that were grouped into "Algae". This may indicate the priority of developing that indicator for use in the WQFAM method.



This shows how many total visual indicators were suggested for each parameter.



This shows the breakdown of grouped visual indicators per parameter. For example, for the parameter Chlorophyll-a, the indicator groups include Clarity (9 suggestions), Algae (11 suggestions), Plant Species (6 suggestions), Plant Condition (1 suggestions), Animal Species (1 suggestion), and Water Chemistry (2 suggestions). This can provide focus on what types of indicators would be first developed for which parameters.