

Indicators are . . .

direct or indirect measures of some valued component or quality of a defined system, used to assess and communicate the status and trends of that system's "health".

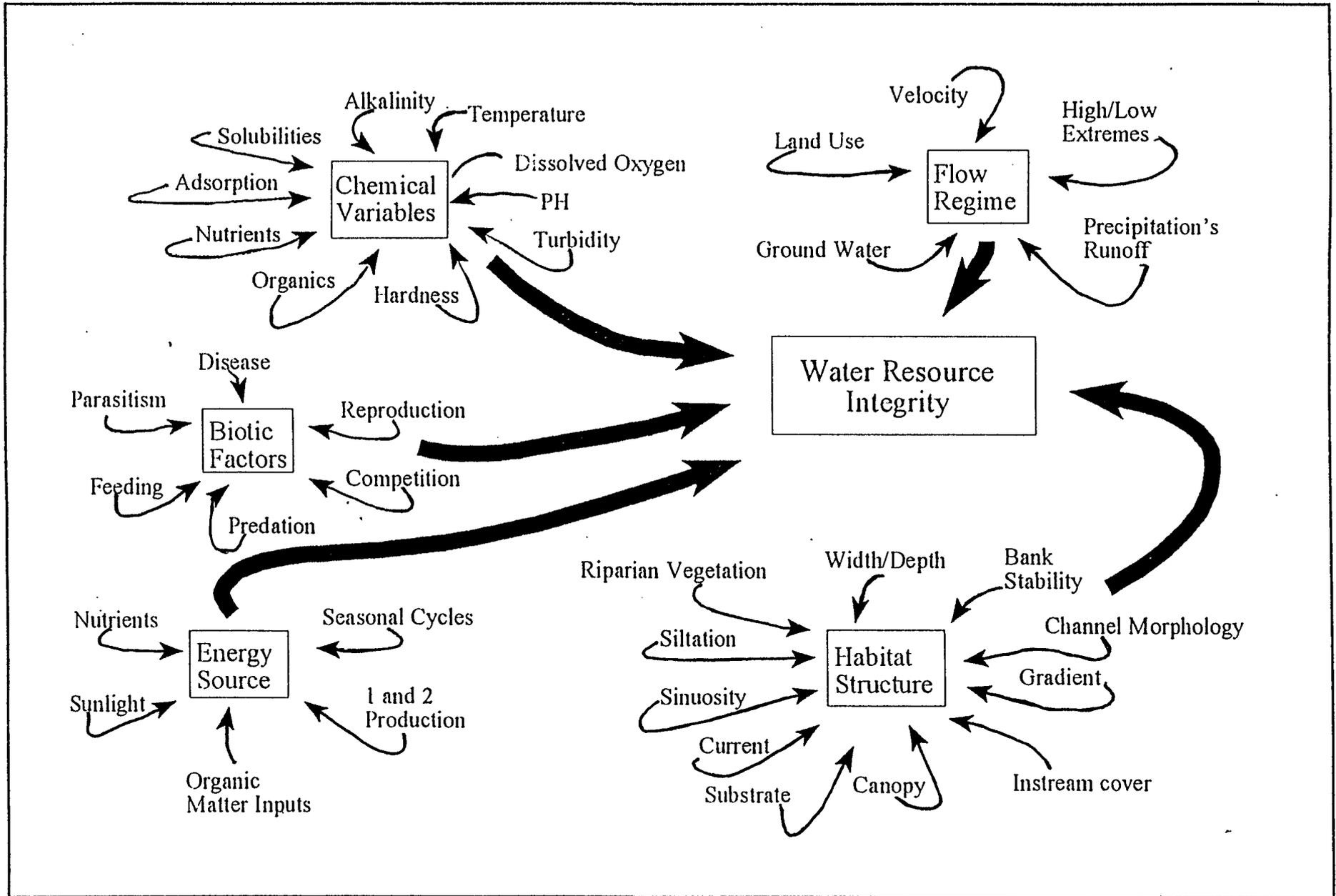
Indicator Systems

Two questions . . .

- What is the scope or boundaries of the system?
- How will the various pieces or components of the system be organized (and communicated)?

Figure 2.2 Environmental Factors

The five principal factors, with some of their important chemical, physical and biological components that influence and determine the integrity of surface water resources (modified from Karr et al. 1986).



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Figure 1— Objectives and indicators.

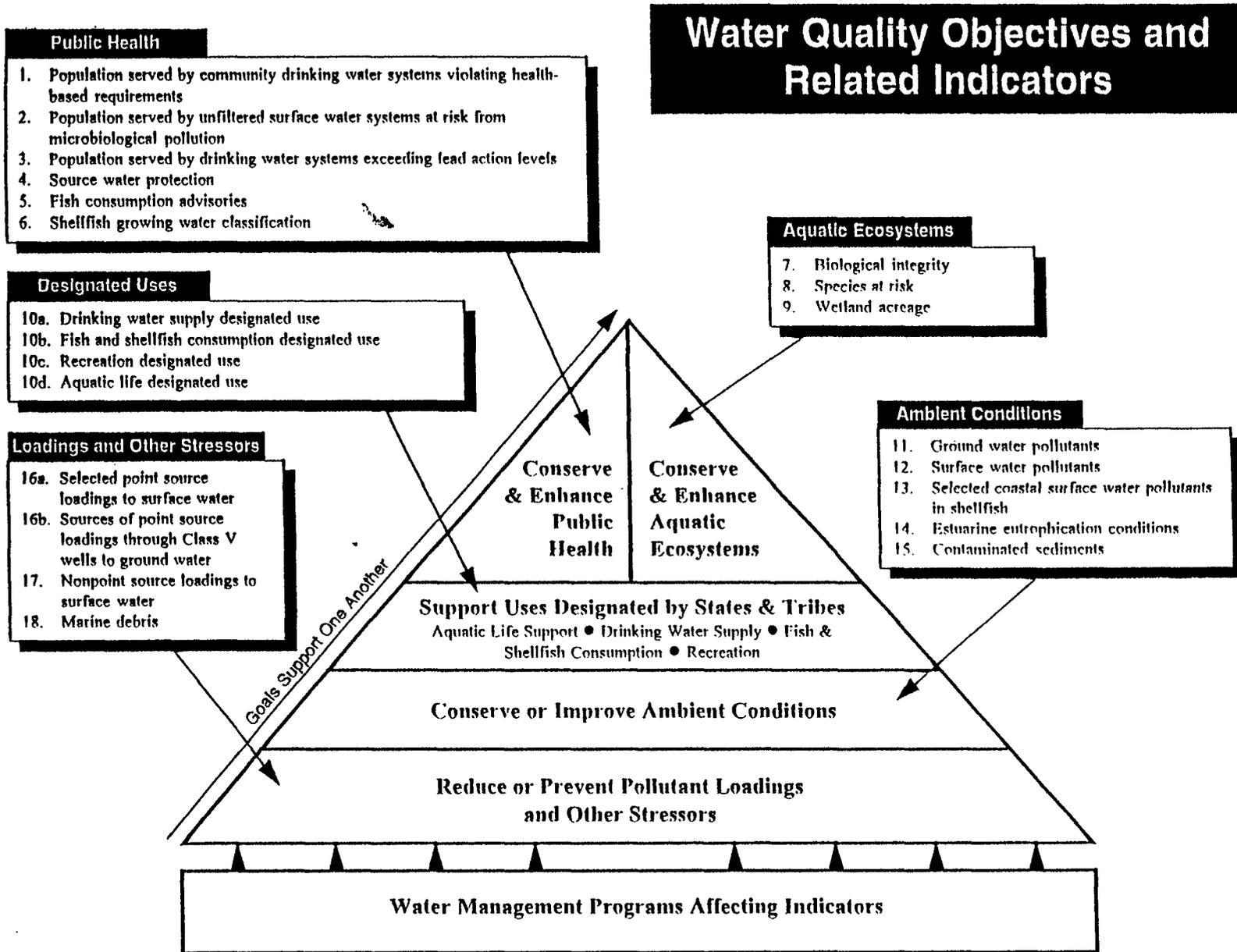
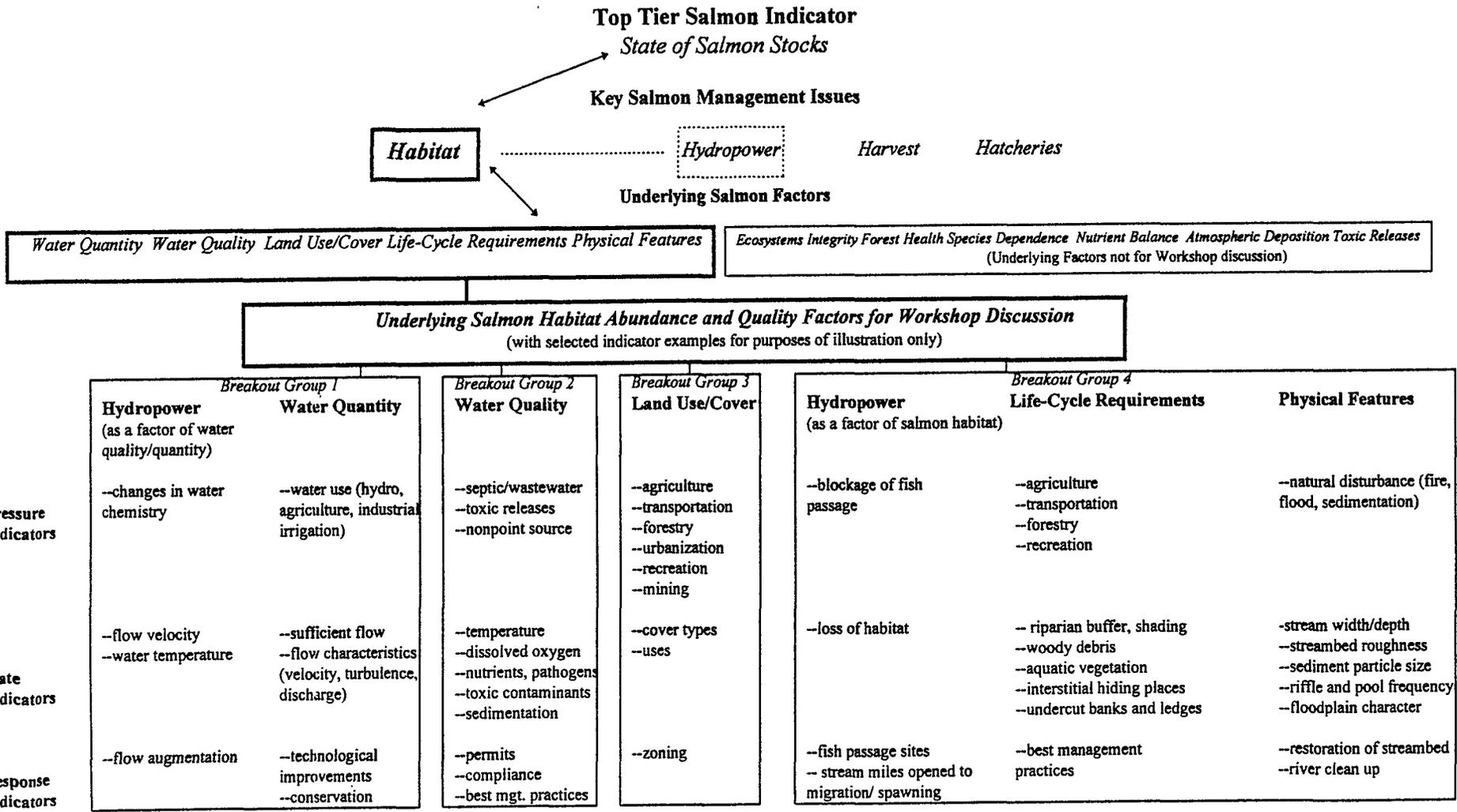


Figure 1. PNWEIWG Salmon Indicators Hierarchy



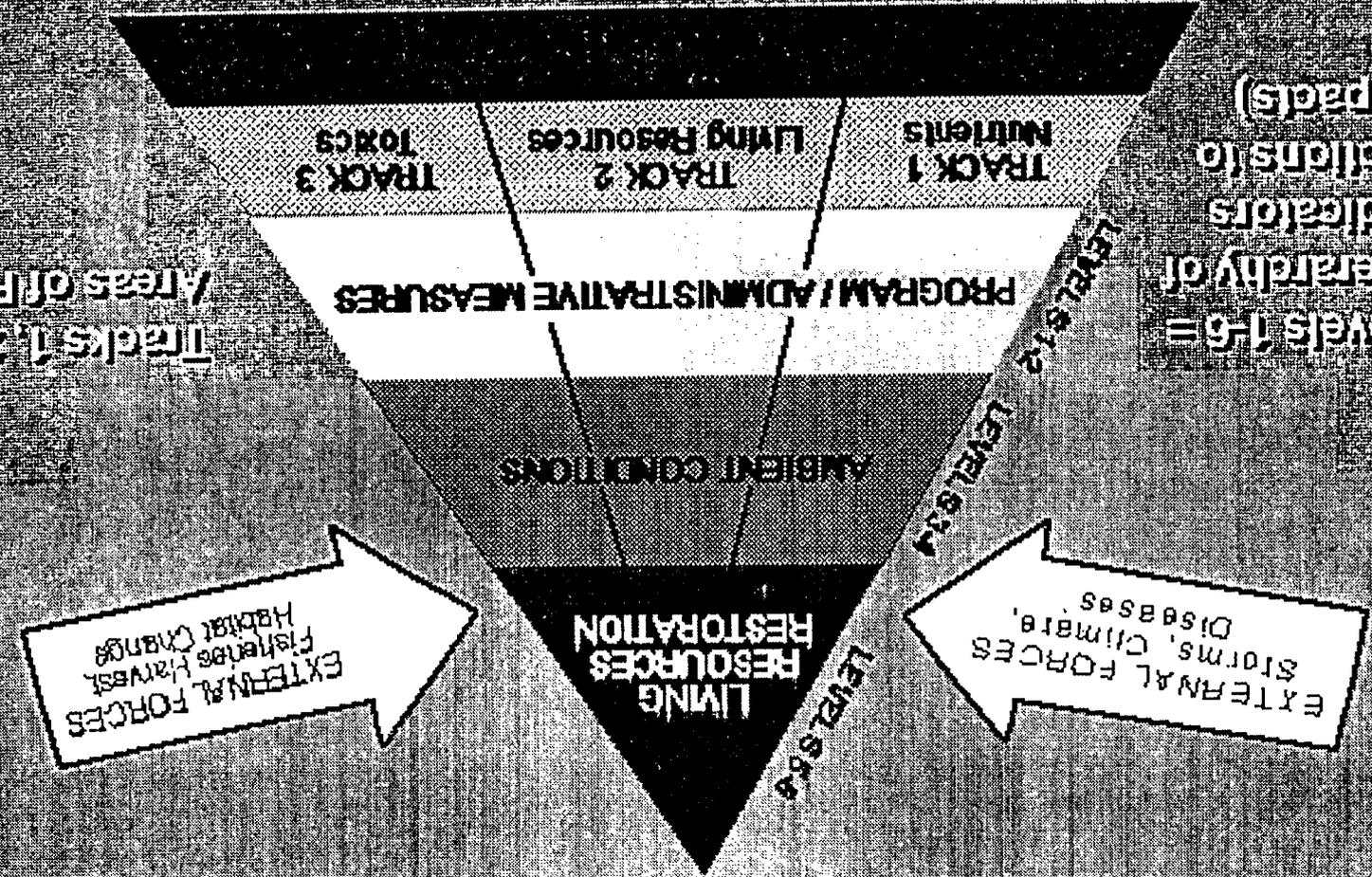
Valued Components

Upon what basis are you determining “valued components”?

- ↳ Why are you choosing to measure one part of the system and instead of others?
- ↳ Who is making that decision? What are their reasons and criteria?

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How the Hierarchy and Tracks Work Together

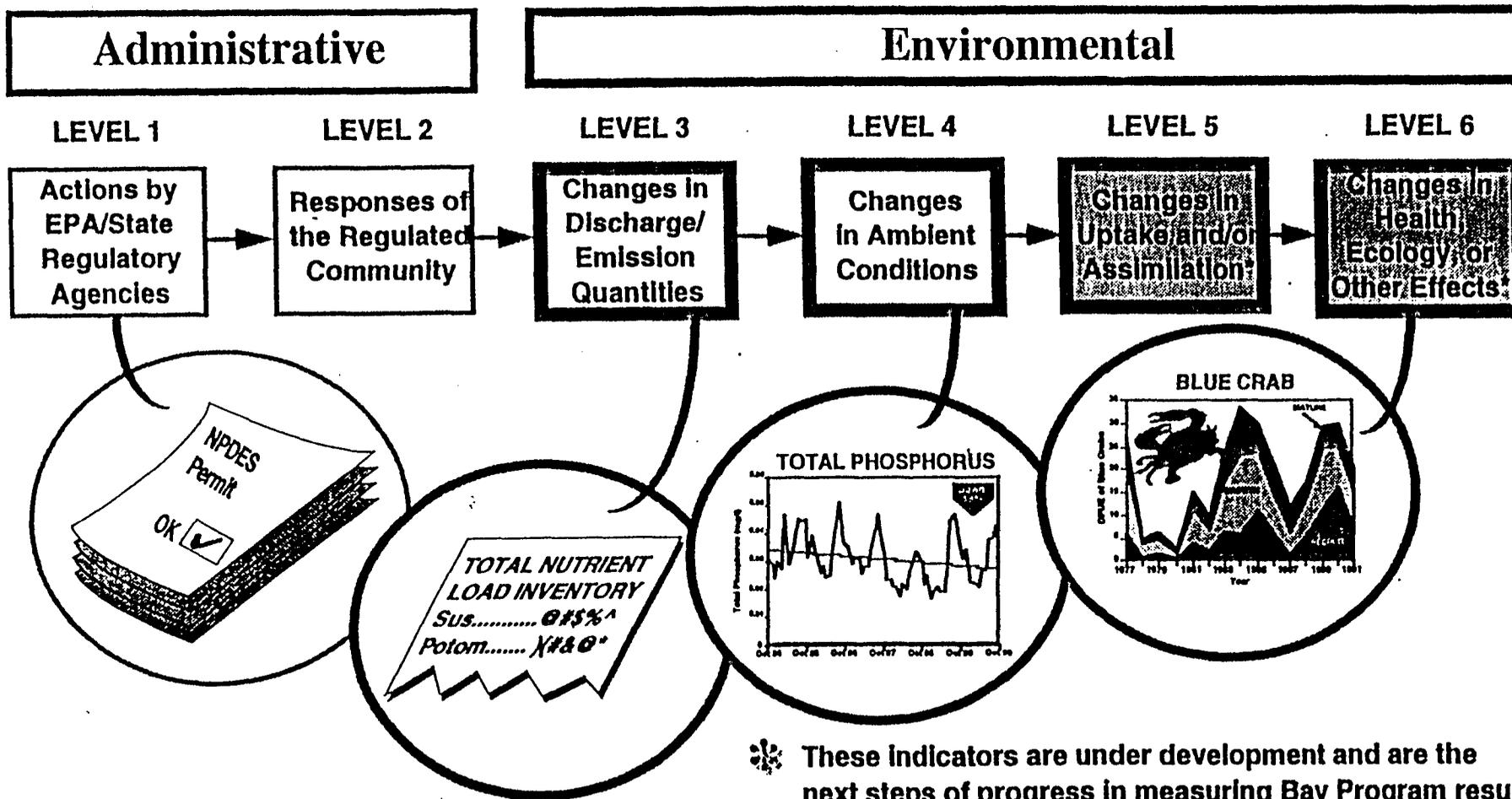


Levels 1-6 =
Hierarchy of
Indicators
(actions to
impacts)

Tracks 1, 2, & 3 =
Areas of Focus

Hierarchy of Indicators

This flow chart is the preferred method for measuring environmental change



The Key to Indicator Development

To be truly effective, environmental indicators must clearly represent a condition or quality of the environment that somebody thinks is important.

↳ Bring the “right people” together and have them engage in a dialogue about what can and should be the indicators.

↳ Who are the right people?

1. People who understand how the environment (or the system) works.
2. People who care about the environment.
3. People able (or required) to use the information to make better decisions.

System Design (Purpose, Audience, and Structure)

- ☞ Why do you want to develop and use indicators (i.e., for what purpose(s) are the indicators being developed)?

- ☞ What *decision arenas* are the indicators intended to inform?
 - ↳ Whose decisions are the indicators intended to inform?
 - ↳ How are those decisions currently being made?
 - ↳ What additional/different information do actors within these decision arenas want and/or need?

- ☞ What is the scope of the indicator system (geographic, political, issues, etc.) and how will the indicator system be organized (framework, goals, issue areas, geographic scale/regions, etc.)?

- ☞ How will you balance idealism (i.e., identifying and developing over time the “best” set of indicators) with pragmatism (i.e., identifying a set of indicators for which the data already exists and can be reported now)?

Process Design

☞ Who is/will be responsible for:

- ☞ answering the questions about purpose, audience, and structure?
- ☞ generating possible indicators?
- ☞ identifying, cataloging, and characterizing existing data?
- ☞ developing selection criteria?
- ☞ evaluating the possible indicators?
- ☞ selecting the indicators?
- ☞ collecting and managing the supporting data?
- ☞ reporting the indicators?
- ☞ developing and implementing a mechanism for reviewing the utility of the indicators for their intended purpose and adjusting the system in response to this review?

Process Design (cont.)

- ☞ In each of the above steps, what will be the role of
 - ↳ the general public and/or interested stakeholders?
 - ↳ representatives of government agencies (leadership and staff)?
 - ↳ scientists or other technical personnel outside of government?
 - ↳ elected officials?
 - ↳ other relevant, interested, or affected parties?

- ☞ How will you identify those parties most likely to advocate *against* the use of the indicators and how will engage them in the process?

- ☞ Where will the resources come from to implement your answers to the above questions? (What can you accomplish with your *existing* resources?)

Linking with Other Activities

- ☛ What other related indicator development efforts (past or present) already exist within your state/community/region?
 - ↳ What are their work products (indicators, data reviews, public surveys, etc.) and how might you use them?
 - ↳ If a current effort, what are you proposing to do that is different and/or better than the existing effort?
 - ↳ Are their opportunities for communication, cooperation and/or collaboration with the other effort(s)? How will these be explored?

- ☛ What other related environmental planning and management activities (e.g. visioning, goal-setting, comparative risk, strategic planning, benchmarking, etc.) are taking place within your state/community/region?
 - ↳ How will your process communicate and/or link with these other activities?
 - ↳ How will your indicators inform and/or be integrated into these other activities?
 - ↳ How will you learn more about these other activities?
 - ↳ How will these other activities inform the development and selection of the indicators?

Six Steps For Developing Indicators

/ Per GMI

1. Identify and provide initial answers to key questions regarding the purpose, audience and decision arenas the indicators intend to inform.
2. Connect with individuals and organizations who should/need to be involved in the indicator development process; identify their potential interest and support for the process (i.e., how the development and use of indicators could help them) and what role they can/will play.
3. Design and implement an indicator development and selection process.
4. Build the indicators (data discovery, statistical analysis, data management).
5. Communicate the indicators to the intended audience(s).
6. Develop opportunities for audience feedback and subsequent revisions to individual indicators or the whole system.

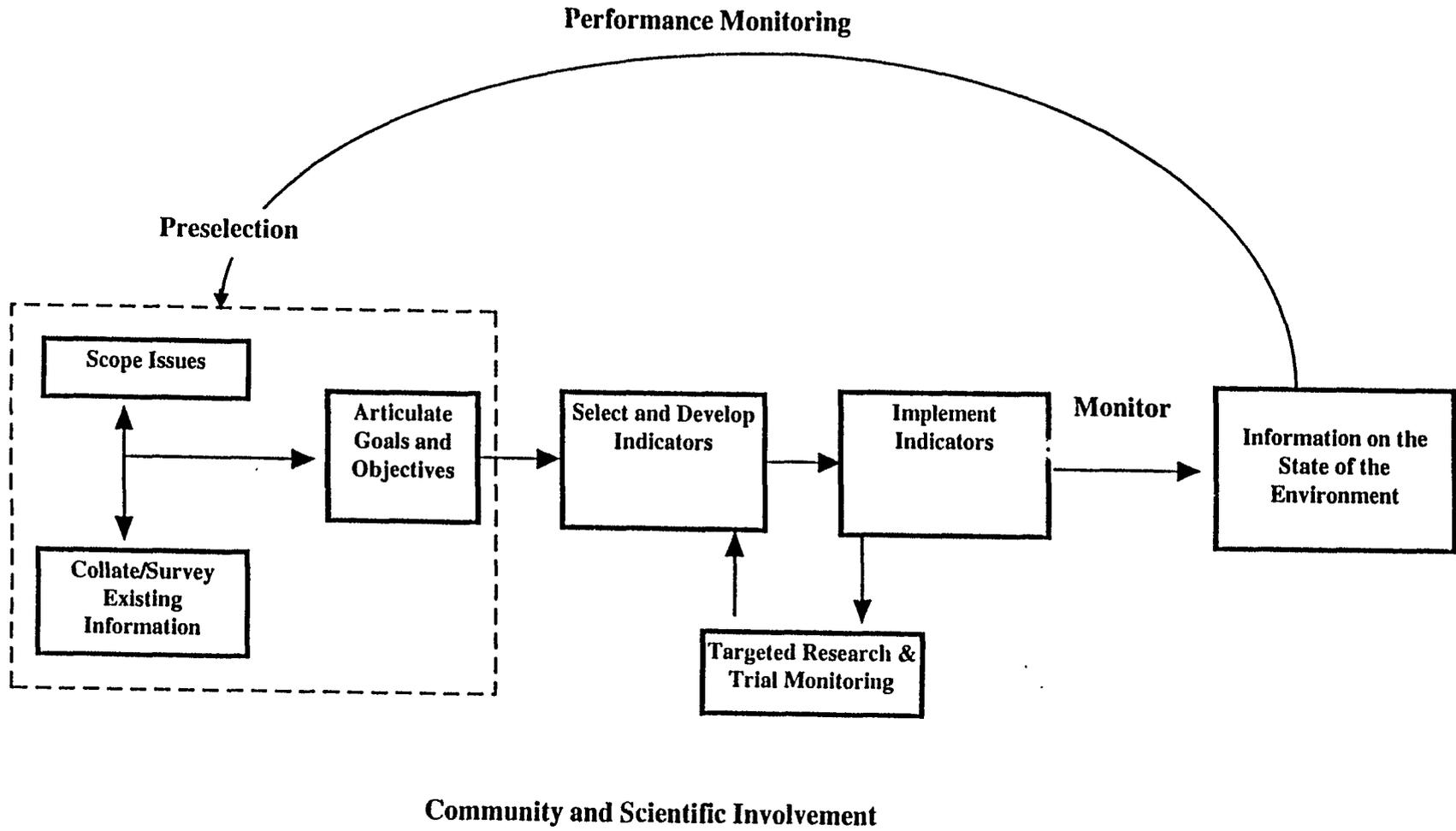
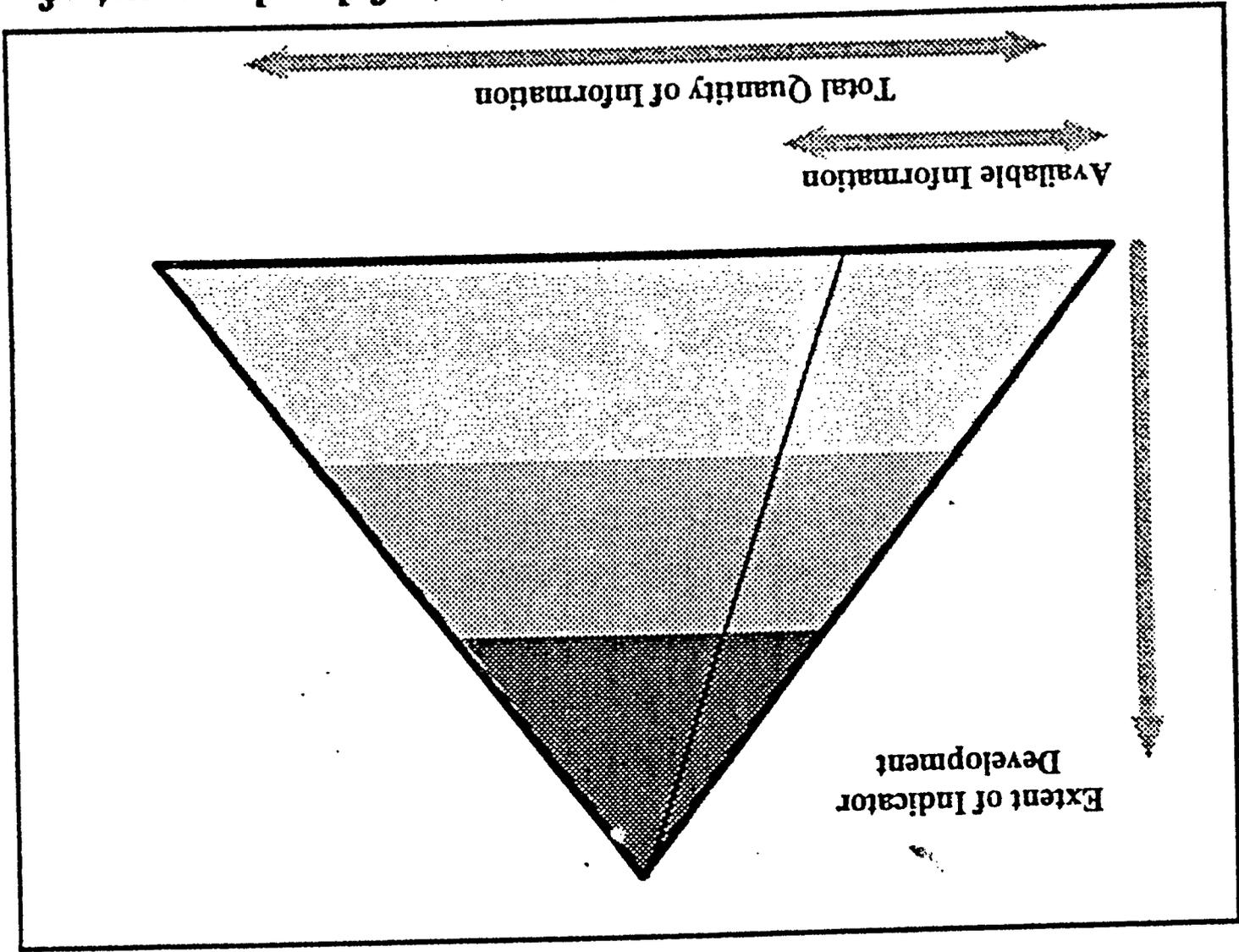


Figure 5: A proposed process for the development of environmental indicators (modified after Water Quality Guidelines Task Group of the Canadian Councils of Ministers of the Environment 1994).

The effects of uncertainty on the extent of development of environmental indicators.



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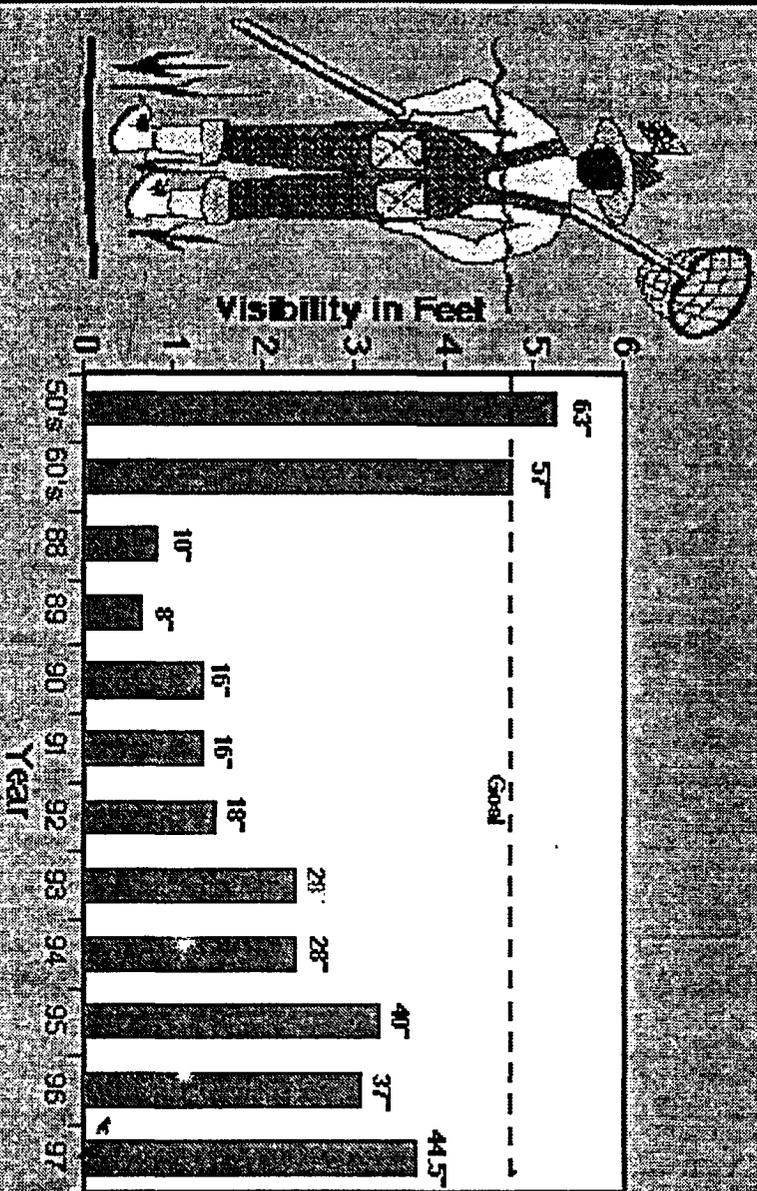
Biotic Integrity Index Aids Aquatic Inventories

Table 1. Metrics used to assess fish communities (alter Karr et al. 1986).

Category	Metric	Scoring criteria ^a					
		5	3	1			
Species richness and composition	1. Total number of fish species	Expectations for metrics 1-5 vary with stream size and region					
	2. Number and identity of darter species						
	3. Number and identity of sunfish species						
	4. Number and identity of sucker species						
	5. Number and identity of intolerant species						
	6. Proportion of individuals as green sunfish				<5%	5-20%	>20%
Trophic composition	7. Proportion of individuals as omnivores	<20%	20-45%	>45%			
	8. Proportion of individuals as insectivores	>45%	45-20%	<20%			
	9. Proportion of individuals as piscivores (top carnivores)	>5%	5-1%	<1%			
Fish abundance and condition	10. Number of individuals in sample	Expectations for metric 10 vary with stream size and other factors					
	11. Proportion of individuals as hybrids				0%	>0-1%	>1%
	12. Proportion of individuals with disease, tumors, fin damage, and skeletal anomalies				0-2%	>2-5%	>5%

^aRatings of 5, 3, and 1 are assigned to each metric according to whether its value approximates, deviates somewhat from, or deviates strongly from the value expected at a comparable site that is relatively undisturbed.

Bernie Fowler's "Sneaker Index"



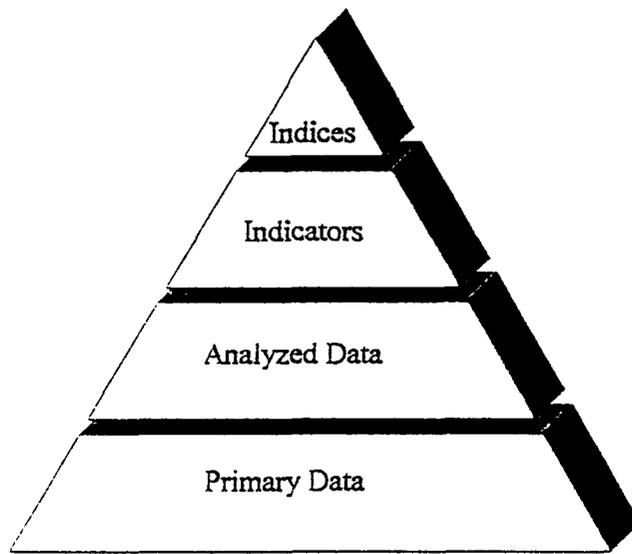
GOAL: Restore Bernie's sneaker visibility to chest depth (57 to 63 inches).

STATUS: Wading in the Patuxent River at Broome's Island, MD, Bernie has seen improvements in water clarity during the last nine years. He says, "although this is not a scientific measure, it puts restoring the River on a human scale."

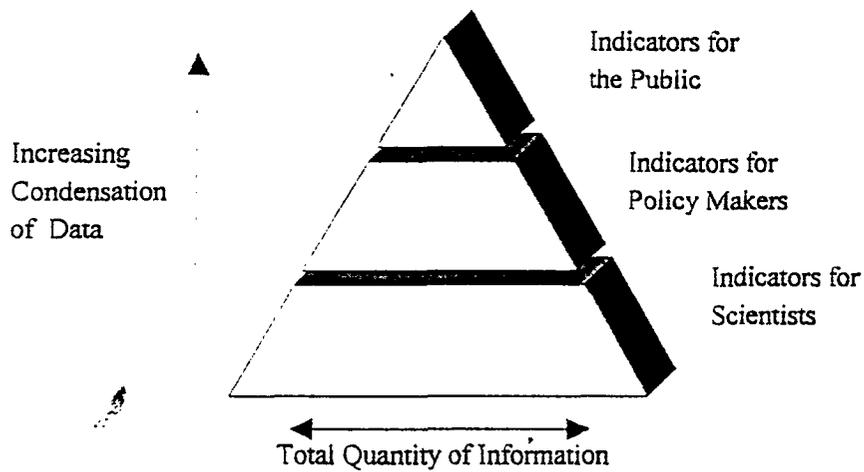
Source: G. Bernard Fowler, 1992-1993 Chair of the Chesapeake Bay Commission; Kent Murnford, U.S. EPA Chesapeake Bay Program.

A Reminder . . .

- within any framework and the system it represents, there are assumed (or hypothesized) relations between different pieces of the system
- your assumptions may not be clear or agreed to by others



1



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¹ *Environmental Indicators: A Systematic Approach to Measuring and Reporting on Environmental Policy Performance in the Context of Sustainable Development*, World Resources Institute, May 1995, p. 1.

² Braat, Leon. "The Predictive Meaning of Sustainability Indicators," in Kuik, Onno. and Verbruggen, Harmen. *In Search of Indicators of Sustainable Development*, Kluwer Academic Publishers, Dordrecht, The Netherlands, 1991, p.59.

Six Steps to Taking Indicators from Words to Reportable Measures

1. Verify/reconcile/refine indicator language.

- *What does the indicator measure?*
- *What does the indicator mean?*

Communication: A dialogue between policy and technical staff to understand what the words mean and their data and monitoring implications.

Product: An annotated list of indicators.

2. Identify data sets and responsible parties that support the indicators.

- *What data set(s) support the indicator?*
- *Who holds/manages the data?*

Communication: Using the annotated list with information resource management staff.

Product: List of data sources by agency and associated contact persons.

3. Develop/modify a data screening tool.

- *What are the key data characteristics necessary to building indicators?*
- *How much information about the data is needed for operationalizing the indicators?*

Communication: Using a draft tool, consult with data managers and environmental monitoring staff.

Product: Data screening tool questionnaire.

4. Implement the data screening tool.

- *What is the most effective means to acquire and document information about the data sets?*

Communication: Staff building the indicator system send the data screening tool to data managers along with description of project/process in advance of 15-20 minute interview per data set.

Product: Compilation of the responses in the form of a data catalog.

5. Review the data sets with indicators, identify data gaps, and develop strategies to improve the data.

- *What are the similarities, differences, and gaps for the data set(s) supporting the indicator(s)?*
- *What can be done to fill information gaps, including improvements to existing programs in data collection, data analysis, and information management?*

Employ a decision tree process:

1. Match the data sets to the indicators. If several data sets are appropriate for use with an indicator, select the one with the best fit.

2. If the available data are either inadequate and can be improved or are not available, a data gap exists. Document the data gap.
3. If the information can be made available by changes in existing data management or data analysis procedures, develop a strategy for making the needed changes.
4. If the information cannot be made available by changes to existing data management or data analysis procedures, determine if there is a data collection and analysis program. If there is no data collection program, design such a program.

Communication: Staff building the indicator system report back to data managers.

Report: Similarities, differences, data gaps and strategies for dealing with them are compiled into a report.

6. Select a data repository, acquire the data, and develop displays of the indicators.

- *How can the data best be represented visually?*
- *At what scale will the data be presented (e.g., regional, state-by-state, watershed)?*
- *What entity has the capability to serve as the data repository and display the indicators graphically?*

Communication: Hold a workshop bringing together the data managers, policy, and planning staff, and the users of the indicators to visualize the indicators.

Product: A set of fully-realized, graphically-displayed indicators.

**Regardless of the sophistication of the technical information,
any indicator fails if it does not readily and transparently
communicate its message to the intended audience. The
ultimate goal is to educate people and inform their decisions.**

Don Willard
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