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California Coalition for Clean Water

February 18, 2004

CCCW Participants

- Agricultural Water Quality Coalition
- California Alliance for Jobs
- California Association of Sanitation Agencies
- California Building Industry Association
- California Business Properties Association
- California Cattlemen's Association
- California Chamber of Commerce
- California Farm Bureau Federation
- California Manufacturers and Technology Association
- California-Nevada Conference of Operating Engineers
- California State Association of Counties
- California State Council of Laborers
- Coalition for Practical Regulation
- Consulting Engineers and Land Surveyors of California
- International Council of Shopping Centers
- National Association of Industrial & Office Properties – CA Chapters
- Regional Council of Rural Counties
- Southern California Rock Products Association
- Southern San Joaquin Valley Water Quality Coalition
- Western States Petroleum Association

Mr. Craig J. Wilson, Chief
TMDL Listing Unit
Division of Water Quality
State Water Resources Control Board
P.O. Box 100
Sacramento, CA 95812-0100

Subject: Comments on *Draft Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List*

Dear Mr. Wilson,

The California Coalition for Clean Water (CCCW) respectfully submits the following comments on the State Water Resources Control Board's (SWRCB's) draft 303(d) Listing/De-Listing Policy, dated December 2, 2003. These comments also reference the SWRCB's draft policy of July 1, 2003.

The CCCW is a diverse group of stakeholders concerned about the current application and implementation of California's water quality program. The CCCW is a voluntary alliance of local public agencies, labor, agriculture, business, housing and development interests working together towards the development and implementation of a sound water quality program that protects water quality while balancing economic and social needs of local communities and the state.

We fully support the SWRCB's goal of establishing a standardized approach for assigning water bodies to the 303(d) list, including requirements for consistent and statistically valid data evaluations, requirements for data quality and quantity, and implementation provisions.

In July 2001, the National Research Council (NRC) published a report to Congress[1] that examined the scientific basis of the TMDL program and that included several findings and recommendations that are directly relevant to the State of California's 303(d) listing policy. For example, the NRC recommended that states develop

appropriate use designations for water bodies prior to the 303(d) listing process, and that states refine use designations prior to TMDL development. The NRC advised that water quality criteria be defined in terms of magnitude, frequency, and duration. The NRC also recommended creation of both a "preliminary list" and an "action list" rather than a single 303(d) list. We believe that the NRC's recommendations are important and should be incorporated into California's listing policy

Behind the NRC's recommendations to Congress is a recognition that water quality standards (beneficial uses and water quality objectives) upon which listing decisions are made may be based upon outdated data or otherwise inappropriate. Deficiencies in California's water quality standards have been widely documented[2] and have led to listings and to the development of TMDLs that may be unnecessary or inappropriate. Thus, California's 303(d) listing/de-listing policy should incorporate a standards review to ensure that standards are appropriate prior to the listing of water bodies on the 303(d) list. Additionally, as a backstop for those cases where a standards review prior to listing is infeasible, we endorse the SWRCB's approach, detailed in the document *A Process for Addressing Impaired Waters in California*, December 2003, of evaluating the appropriateness of water quality standards prior to the development of a TMDL.

We further endorse many of the concepts embodied in the SWRCB's draft listing/de-listing policy. Many listings contained in the State's previous 303(d) lists, and incorporated into the 2002 303(d) list without further review, were based upon limited data, or have occurred despite evidence that natural sources have caused or contributed to the impairment. The basis and rationale for some additional listing decisions is unclear. Thus, we support the proposed Policy provisions regarding the requirements for and transparency of listing decisions. We further encourage the SWRCB to reinstate language from the July 2003 draft that would provide for a re-evaluation of each water body identified on the 2002 303(d) list. Although the December 2003 draft policy specifies that water segments and pollutants on the section 303(d) list shall be reevaluated if new data and information become available, we encourage the SWRCB to ensure that earlier listings are consistent with the new listing policy, even when a listing review would not be triggered by new data or information.

Consistent with the NRC's recommendations and with the SWRCB's July 2003 draft listing policy, we strongly support the concept of "dual lists," and we encourage the SWRCB to re-instate the use of dual lists in its final listing/de-listing policy. Use of a "planning list" would be appropriate for impairments with undetermined causes, for use when insufficient data exist to determine a water body's impairment status, or for cases where water quality standards may be inappropriate.

Based upon our discussions with SWRCB staff and in response to testimony presented at recent hearings on the draft listing/de-listing policy, we requested that Info Tech, a statistical consulting firm with expertise on biostatistical, environmental, and ecological issues, review the statistical components of the draft policy. Info Tech has in recent years

[2] See, e.g., *A Review of the Los Angeles Basin Plan Administrative Record*, by Environmental Defense Sciences, February 2003; and *A Review of the Administrative Record for the Central Valley's Water Quality Control Plan, 1975-1994*, by Larry Walker Associates, Inc., September 2003.

conducted extensive analyses of the statistical methods that can be used to make listing decisions. Their analysis and summary is attached to this letter. Info Tech's conclusions can be summarized as follows:

> *"In conclusion, we find the statistical procedures contained in the State of California's draft listing policy to be appropriate and scientifically defensible. The binomial test is best when analyzing environmental data since the sample size is often limited and the parametric assumptions are not satisfied. The hypotheses to list and de-list are correct, and are tested at the environmentally protective 90% confidence level. Care should be taken regarding decisions based on small samples, and effects of anomalous data should be closely monitored. Adequate spatial and temporal coverage is also necessary to assure reliable statistical results. Following the proposed procedures with these caveats will lead to sound and reliable decisions regarding both listing and de-listing California's water bodies. ."*

In short, we support the use of the binomial approach in the draft policy, and strongly encourage the State Board to retain this methodology in the final policy.

We are particularly concerned that the language contained in Sections 3.1.6, 3.1.8, and 3.1.9 of the December 2003 draft policy appears to indicate that a water body can be listed due to toxicity, adverse biological response, or degradation of biological populations even in the absence of a clear link to a specific pollutant as the cause of such effects. We encourage the SWRCB to reinstate the planning list for situations such as these.

We are also concerned with language contained in Section 6.2.5.6 of the December 2003 draft policy. This section would allow data to be "pooled" together for the purpose of impairment evaluations, and it appears that a reach could be listed as impaired if only one sample from that reach met the listing criteria, provided that sufficient data related to the same pollutant were available from adjacent reaches.

We are concerned that inclusion of Sections 3.1.10 (Trends in Water Quality) and 3.1.11 (Alternate Data Evaluation) could result in the continued inclusion of water bodies on the State's 303(d) list in the absence of sufficient information that water quality standards are exceeded or that beneficial uses are impaired. For example, short-term trends in water quality may be more closely linked to hydrologic conditions (e.g., drought periods) than to increases in pollutant loading or real degradation of water quality conditions. Similarly, alternate data evaluation methods as specified in the draft policy could allow considerable discretion in evaluating water bodies and may lead to inappropriate listings. We encourage the SWRCB to carefully address these concerns so that objective methods are used to evaluate impairments and produce scientifically defensible 303(d) listings.

We also note that the proposed draft policy would allow listing decisions to be made on the basis of the concentrations of chemical constituents in sediments (see Section 6.2.3, Item 1). California currently does not have adopted sediment quality objectives (SQOs)

upon which to base listing decisions. In fact, the State Board is currently working to develop a state policy that will include SQOs for enclosed bays and estuaries and associated implementation provisions which is scheduled to be available for review in August 2005. Even though California has not promulgated SQOs, the SWRCB's draft policy would allow RWQCBs to utilize sediment quality guidelines that have been developed in other jurisdictions and for other purposes. Because of site-specific factors that influence sediment toxicity (e.g., organic carbon content, acid volatile sulfides, sediment grain size) and because guidelines developed for use elsewhere are not legally promulgated standards within California, this approach is inappropriate and would not result in scientifically sound listing decisions. Thus, we request that the SWRCB modify the draft policy so that listing decisions be based upon actual measurements of sediment toxicity or upon properly adopted SQOs.

Other coalition participants may be submitting their own comments in addition to the comments being submitted by the CCCW. We thank you for the opportunity to submit comments on this draft policy, and we look forward to working with you.

Sincerely,

Clifford H. Moriyama
Coalition Coordinator

Attachment

info tech
The Information Technology Company

February 18, 2004

Cliff Moriyama, Coordinator
California Coalition for Clean Water
1121 L Street, Suite 809
Sacramento, CA

Dear Mr. Moriyama,

Info Tech is pleased to provide analysis and comments on California's Draft Listing/De-Listing Policy. These comments are provided at the request of the California Coalition for Clean Water (CCCW). In support of this analysis, we reviewed Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List, and the accompanying Functional Equivalent Document. We paid particular attention to Issue 6: Statistical Evaluation of Numeric Water Quality Data and the Appendix: Draft Water Quality Control Policy. In addition, we relied upon the knowledge and expertise we gained in detailed evaluations of the State of Florida's Listing Policy (Chapter 62-303, Identification of Impaired Surface Waters) and supporting documentation. Our previous experience is particularly relevant to our analysis of California's proposed listing policy because California's draft policy utilizes the same statistical method (the binomial method) as contained in Florida's policy.

Summary of Analysis

The goal of a scientifically sound listing policy is to develop a methodology that maximizes the probability of making correct listing decisions, fully acknowledging that no method can achieve 100% accuracy. Statistical analysis methods are used to calculate the false positive and false negative rates, thus quantifying the probability of making an incorrect decision, and allowing listing decisions to be based on those probabilities. Statistical analysis methods are critically important when a water body has an exceedance rate at or near the "decision point" (also known in statistics as the "critical value") at which a listing or de-listing will occur.

We find the statistical evaluation procedures contained in the State of California's draft listing policy to be appropriate and scientifically defensible. We find that the State Water Resources Control Board (SWRCB) staff considered an impressive array of statistical methodologies that could be used to evaluate compliance with water quality standards and other measures of impairment. The selected statistical methodology, which utilizes the binomial distribution, is an appropriate and scientifically sound method for the evaluation of environmental data for the following reasons:

- The method relies upon a statistical approach which quantifies the probability of making a correct decision

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- The exact binomial test is useful when analyzing environmental data, since 1) the analyses often involve small sample sizes, 2) parametric distributional assumptions are not needed, 3) limited information makes a more complex analysis impossible, and 4) because the test is less sensitive to values below the detection limit and outliers than other statistical methods.
- The policy utilizes an appropriate and environmentally protective 90% confidence level, which is common in environmental studies and accepted in the scientific literature.
- The minimum sample sizes have been set appropriately to use as much information as possible for making a listing decision.
- The Data Quality Assessment Process is provided to screen out invalid data.
- The proposed methodology utilizes the correct form of the null and alternative hypotheses.
- The policy requires adequate spatial and temporal representation of the water body.

The recommended evaluation procedures constitute an objective, scientifically-based methodology for use in evaluating impairments. Additional detail of our analysis of California's draft listing/de-listing policy is provided below.

Summary of Qualifications

Info Tech is a statistical consulting firm founded in 1977. Info Tech has provided statistical consulting services on hundreds of projects for both public and private clients. Much of our work has been on biostatistical, environmental, and ecological issues, including:

1. Developing and applying statistical methodology for the development of the EPA's effluent guidelines for timber processing plants, sugar refineries, pesticide manufacturers, and the pulp and paper industry;
2. Experimental design and data analysis of radioactivity levels in foods grown on reclaimed lands mined for phosphate;
3. Statistical analysis of data measuring ecological risks associated with pesticide usage (for EPA Ecological Effects Branch);
4. Statistical modeling of various water and air quality parameters for the development and testing of risk-tolerance limits, including a five-year study of acid rain deposition in Florida;
5. More than ten years' experience providing statistical analyses and opinions regarding efforts by regulatory and private entities to monitor and control phosphorus levels in the Everglades Protection Area, including testimony in federal court and before the Environmental Regulation Commission of the State of Florida;
6. Analysis of the Florida Department of Protection Rule, Chapter 62-303, Identification of Impaired Surface Waters.

Dr. McClave's professional training is in physics and statistics. He earned a Ph.D. in statistics from the University of Florida in 1971. Over the next twenty years he was a member of the

faculties of the State University of New York at Buffalo and of the University of Florida. During his tenure on university faculties he taught statistics to more than 25,000 students at both the undergraduate and graduate levels. Courses he taught ranged from basic introductory statistics to advanced statistical theory, and included several courses in biostatistics, which is the application of statistics and the scientific method to the biological sciences. During the course of his academic career he authored six textbooks in statistics, two of which are in their eighth edition. These textbooks have been adopted by hundreds of colleges and universities in the United States and internationally, and have been translated into at least two other languages. He has been President and CEO of Info Tech since founding the firm, and has led Info Tech's extensive statistical involvement in biostatistical and environmental science for more than 25 years.

Ms. Hewitt's professional training is in mathematics and statistics. She earned her Masters degree in Statistics from the University of Florida in 1982. Upon graduating, she worked for two years as a biostatistician at the National Center for Toxicological Research. She has since worked at Info Tech as a statistical consultant, having a critical role as lead analyst of the environmental studies. Past clients include the Center for Solid and Hazardous Waste Management, the Florida Institute for Phosphate Research, Florida Electric Power Consulting Group, Committee for Responsible Water Use of Southwest Florida, and the Sugar Cane Growers Cooperative of Florida. In particular, Ms. Hewitt has worked on statistical issues related to the protection of the Everglades for over 10 years and was involved in the Florida rule making process for the Identification of Impaired Surface Waters.

Detailed Comments

The Functional Equivalent Document presents a thorough review of different statistical methodologies that were considered for use in testing compliance with a water quality standard (e.g. see Table 12 in Issue 6B). Ultimately, the nonparametric approach, which uses the binomial distribution, is recommended by the SWRCB. Info Tech supports the use of the binomial test as appropriate for evaluating environmental monitoring data, which often involve small sample sizes and have limited information for a more complex analysis. The binomial test requires fewer assumptions than alternative parametric methods, and is less sensitive to outliers and below detection limit measurements, both of which are relatively common in environmental data.

The binomial test is used to determine whether a water body achieves water quality standards, or conversely, that a water body included on the Section 303(d) list continues to fail to achieve standards. Of course, the use of a simple 'exceedance' or 'no exceedance' evaluation procedure ignores various factors that can affect water quality. Additional statistical analyses can be performed, if desired and the data sufficient, to provide more information for better understanding the condition of the water body (e.g., using parametric models such as regression analysis to account for spatial and temporal variability).

The following is a discussion of other statistical issues regarding California's draft policy:

1. Why Use a Statistical Approach?

A statistical approach uses the scientific method and quantifies the probabilities of correct and incorrect decisions. Therefore, the agency proceeds with eyes open to the odds of success (i.e., correctly determining the impairment status of a water body) versus failure (i.e., failing to list an impaired water body, or improperly listing a water body that is not impaired).

Alternatively, the non-statistical approach most commonly taken can be called the raw score or "bright line" approach. Although this approach is simple, a raw score approach sacrifices any objective measure of the reliability of the decisions resulting from its application. A decision to list or not to list is reached with no consideration of the likelihood that the listing decision is correct. Science is not exact, but the "bright line" approach would pretend that it is. This is a formula for failure (i.e., for inappropriate listing decisions).

A statistical approach is needed to estimate the chance of correctly determining whether the water body complies with a water standard or other appropriate measure of impairment. The agency uses the statistical result to help make the correct policy decision. In this matter, the decisions can be simply demonstrated in a two-way table:

	True State of Nature:	
	In Compliance	Out of Compliance
Decision:		
In Compliance	Correct	Incorrect (False Positive)
Out of Compliance	Incorrect (False Negative)	Correct

The goal of a scientifically sound listing policy is to develop a methodology that maximizes the probability of making correct decisions, fully acknowledging that no method can achieve 100% accuracy. Statistical analysis methods are used to calculate the false positive and false negative rates, thus quantifying the probability of making an incorrect decision, and allowing listing decisions to be based on those probabilities. Statistical analysis methods are critically important when a water body has an exceedance rate at or near the "decision point" (also known in statistics as the "critical value") at which a listing or de-listing will occur.

Consider, for example, a river segment that is not on the 303(d) list and is being sampled to determine compliance with appropriate water quality standards. Three sampling scenarios are possible:

a. Fewer than 10% of all samples collected are out of compliance (e.g., fewer than 10 of 100 samples, or fewer than 2 of 20 samples). The river segment would be determined to be in compliance and should not be placed on the list of impaired waters.

b. *Statistically significantly* more than 10% of all samples collected are out of compliance (e.g., of 100 total samples, 15 or more samples exceed standards; or for a sample size of 20, 5 or more samples exceed standards). Again, the river segment is determined to be out of compliance and should be listed as impaired.

c. Only 10% or slightly more of all samples are out of compliance, but the number of samples out of compliance is not statistically significant (e.g., for 100 total samples, between 10 and 14 samples are out of compliance; or for a sample size of 20, between 2 and 4 samples are out of compliance). This is the "gray area" that can result in listing errors. As illustrated in Figure 1, these results can occur even when the river segment is in compliance, and declaring the river segment out of compliance in this range will result in large numbers of false positives, that is, listing the water body when it is truly in compliance with water quality standards. Statisticians advise no action in the gray area, except perhaps to conduct more sampling to improve the understanding of the true status of the water body.

Next assume that the river segment is already listed as impaired. The situation is reversed; see how in Figure 2 the blue, red, and grey areas are reversed. Now the water body must "prove" at a 90% confidence level that it is unimpaired in order to be removed from the impaired waters list. This example demonstrates the objective, unbiased balance of the testing procedure: the existing listing status, whether that is Unimpaired or Impaired, remains the accepted condition unless the data can show with 90% confidence that it should be changed.

2. Why use the binomial test?

The various tests considered by SWRCB staff are summarized in Table 12, of Issue 6, Statistical Evaluation of Numeric Water Quality Data. As noted above, the raw score approach does not consider a measure of the reliability of the decision. The One Sample Student's t-test for the Mean, Percent Lower Confidence Limits, and Bayesian Test require distributional assumptions, which can be difficult to satisfy with limited data. The Wilcoxon Signed Rank Test for the Mean requires a symmetric distribution, which is not characteristic of water quality data, and repeated or tied (i.e, equal) measurements, such as those below the detection limit, are problematic. Although the Chen Test has desirable properties for analyzing water quality data, such as rightward skewed data, this method requires sufficient and adequate data to estimate the skewness, and is not appropriate for small sample sizes. The One-sample Proportion Test is a large sample approximation to the exact binomial test, and is not appropriate for small sample sizes. Finally, the Hypergeometric Test assumes that the population is finite, a false assumption when samples will be collected repeatedly from a given water body into the foreseeable future.

The binomial test is therefore most appropriate for determining the impairment status of a water body because:

- The binomial distribution is used to estimate the probability of a yes/no response, in this case exceed/do not exceed a water quality standard
- The method satisfies the requirement that the population from which samples are gathered is infinite
- The binomial test is useful when evaluating small sample sizes
- The binomial test does not require the assumptions of a parametric analysis, which can be difficult to meet with environmental data
- The binomial test is not sensitive to values below the detection limit or outliers, which can result in inaccurate listing decisions with other statistical methods

3. 10% Exceedance Rate at 90% Confidence Level

We have confirmed that the listing and de-listing tables (Tables 3.1 and 4.1 of the Water Quality Control Policy Appendix) are correct for a critical exceedance rate of 10% at a 90% confidence level. If a site-specific exceedance rate is used instead of 10 percent (e.g., for bacteria water quality criteria where recreational uses apply, as discussed in Section 3.1.3 of the Appendix) then similar tables should be constructed and used for determining compliance with bacteria water quality objectives at those specific locations.

The 10% exceedance rate is tested at the 90% confidence level, which is common in environmental studies, since the goal is to be protective of the environment. It is also common to use 95% confidence levels, which would be less protective than a 90% confidence level and would make it more difficult to reject the null hypothesis, and therefore more difficult to get on (or, perhaps later, off) the impaired waters list. Thus, California's proposed listing policy adopts a confidence level that is both commonly accepted in the scientific literature and is at the end of the spectrum of acceptable confidence limits that favors environmental protection of water bodies.

4. Minimum Sample Size

Although the binomial test is the appropriate method for small sample sizes there still is a need to address minimum sample size requirements. When the sample size is too small there is insufficient information on which to base a reliable statistical determination. Both the insufficient size and coverage of the samples can result in incorrect listing decisions. In California's proposed policy, a small sample size is defined as fewer than 10 or 20 samples to list and fewer than 22 samples to de-list. These are reasonable definitions of small samples, since statistical tests based on samples of smaller size will have less power than larger samples for making sound and reliable decisions. It is particularly appropriate for listing purposes to set the lower limit for sample size at 10 or 20 samples, since raising the minimum sample size will most likely prevent listing decisions for intermediate-sized samples. It is also necessary, as shown by calculations associated with the binomial test, that the minimum size to de-list must be 22 samples.

If small-sample exceedances to list a water body occur at or above the minimum levels, as defined in the draft Policy, we recommend that additional samples be collected for further

investigation and that the water body not be listed until sufficient samples are available to allow a statistically meaningful evaluation of the impairment status. Although a decision to list should not be made when sample sizes are small, exceedances of water quality standards, even with small sample sizes, clearly indicate that a potential problem exists, and additional data collection is the prudent approach. Note that a "planning list" is the logical home for water bodies for which impairment may be indicated but for which additional data collection is required. In our experience with the State of Florida, the use of a planning list can be a valuable tool to determine the impairment status of water bodies when data are insufficient to yield statistically conclusive results. Small-sample exceedances to de-list should not be an issue, since once a water body is listed, it is likely to be closely monitored, producing additional samples and thereby satisfying the minimum sample-size requirements.

5. Anomalous Data

The Data Quality Assessment Process is intended to screen data so that only acceptable and valid data will be considered for use in the statistical analysis upon which the listing decision is made. Info Tech's experience is that even with sound QA/QC procedures, anomalous data will occasionally pass through the quality screens. This is of special concern in California's proposed policy, since data may be collected from "any interested party." The opportunity for error increases when data are obtained from multiple sources. Thus, we suggest that the SWRCB incorporate the use of a statistical test or, at the very least, simple graphical methods to identify outliers or anomalous data, and that those outlying data points be closely examined for validity and usefulness in the analysis. Identification of outliers can be as simple as reviewing a time series or box-and-whiskers plot of the data, to more sophisticated statistical tests that control for factors which contribute to variability, such as season and location, thus enabling field and measurement errors to be identified.

6. Spatial and Temporal Representation

Spatial and temporal variability refers to the naturally occurring differences in the water quality data over area (spatial variability) and over time (temporal variability). Even if a network of stations is located in the same water body, the sample measurements will vary among stations and over time due to naturally occurring factors. To the extent possible, data should be collected at more than one spatially independent station to better capture the true condition of the water body.

The data should also be collected to capture temporal variability (e.g., by requiring data collected from at least two seasons). From a statistical perspective sampling should not be conducted only (or even mostly) when "water quality objectives exceedances would be expected to be clearly manifested" [see Section 6.2.5.4, Temporal Representation, Appendix to the Functional Equivalent Document] or during just the critical conditions for a particular pollutant. The best estimator of the true condition of a water body with respect to a given water quality parameter is some measure of central tendency, not an extreme value. If extreme or maximum values are used, then the probability of false positives increases (i.e., we would be more likely to declare a water body out of compliance when in reality it is not). The standard probability calculations are

thereby misleading and incorrect when extreme or maximum values are used. The methodology for determining compliance with a numeric water quality criterion is predicated on the fact that random sampling will provide a representative data set from the population (i.e., that each individual sample provides a random snapshot of water quality at a given moment in time). The goal then is to estimate the true state of the water body, both spatially and temporally, not the maximum state at a single time or place.

Conclusion

In conclusion, we find the statistical procedures contained in the State of California's draft listing policy to be appropriate and scientifically defensible. The binomial test is best when analyzing environmental data since the sample size is often limited and the parametric assumptions are not satisfied. The hypotheses to list and de-list are correctly specified, and are tested at the environmentally protective 90% confidence level. Care should be taken regarding decisions based on small samples, and effects of anomalous data should be closely monitored. Adequate spatial and temporal coverage is also necessary to assure reliable statistical results. Following the proposed procedures with these caveats will lead to sound and reliable decisions regarding both listing and de-listing California's water bodies.

Sincerely,

James T. McClave, Ph.D.
President

Cynthia C. Hewitt
Project Director/Senior Consultant

Figure 1

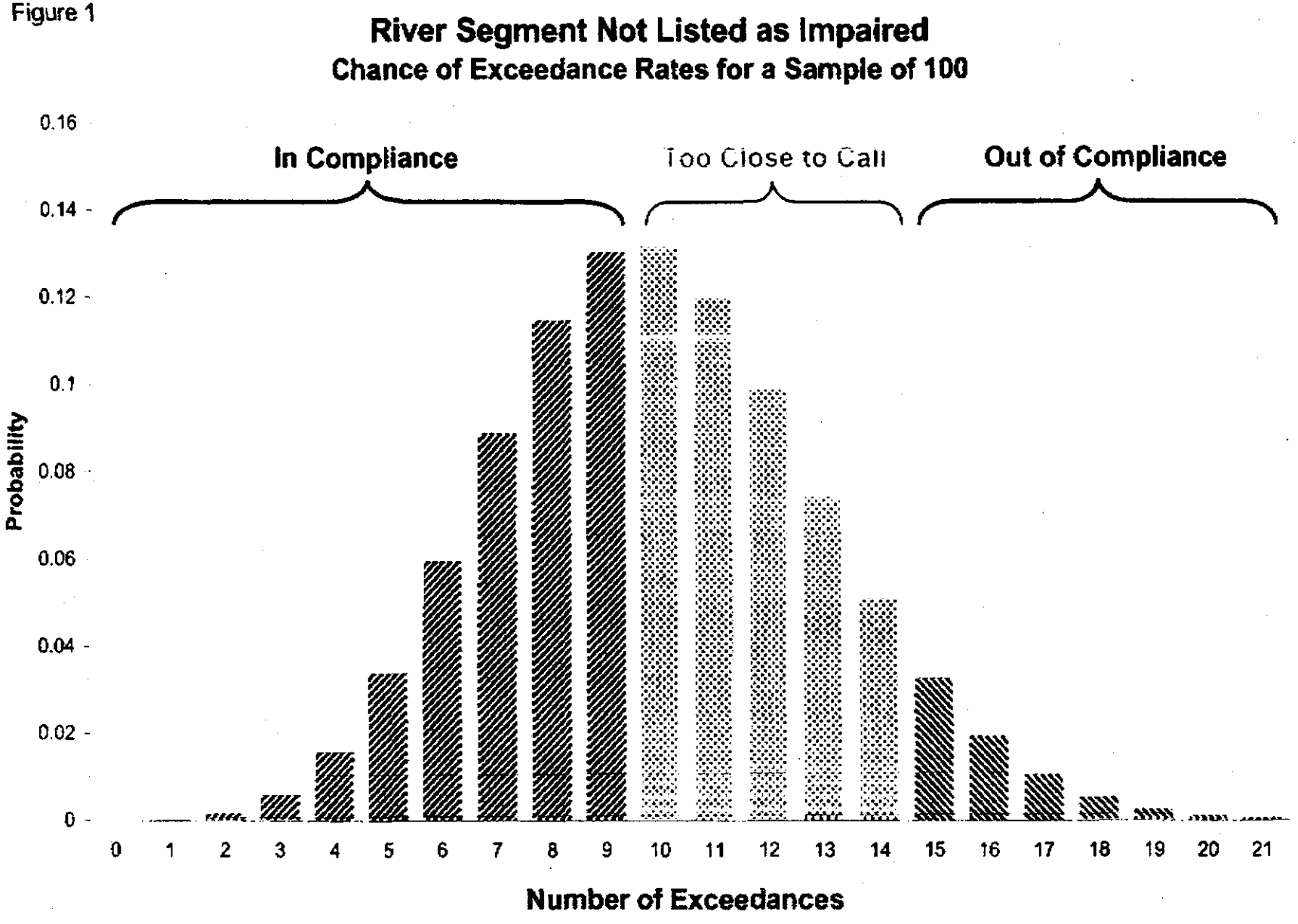
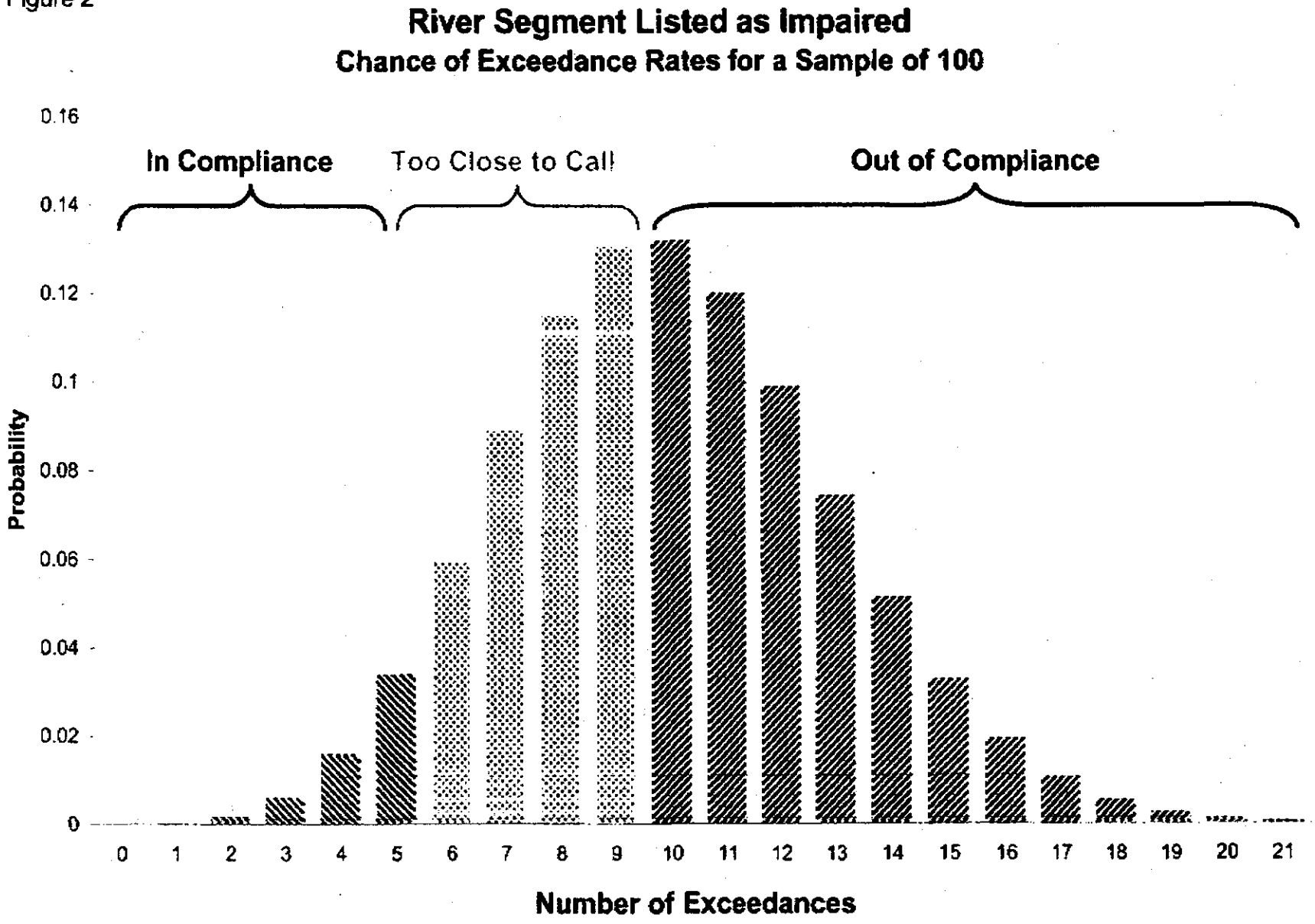

River Segment Not Listed as Impaired
Chance of Exceedance Rates for a Sample of 100
In Compliance
Too Close to Call
Out of Compliance
Probability
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
Number of Exceedances

Figure 2


River Segment Listed as Impaired
Chance of Exceedance Rates for a Sample of 100
In Compliance
Too Close to Call
Out of Compliance
Probability
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
Number of Exceedances