

COMMUNICATION OF FLOOD-RISK INFORMATION

by

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SUMMARY

Measures for flood loss reduction are often costly and/or restrictive. The local officials and general public making up a community are not likely to agree on or approve such measures unless they understand the need for them and believe that the economic and other benefits outweigh the costs and associated negative aspects of the measure.

Public participation in planning and rational consideration and approval of proposed projects depends on understanding of the flood risk, alternatives for action, related environmental and economic considerations, and other aspects of proposed projects. Proposals are likely to be deferred or rejected if the engineers, planners and other technical specialists fail to convey these kinds of information in a fashion that is easily understandable to the non-professional. In order to improve the acceptability of their work, technical specialists must use plain English and diligently explain concepts and procedures.

Previous research concerning the extent to which local officials and the public understand terminology related to floodplain management indicated that their level of understanding is generally low. However, review of the literature related to risk communication suggested that some ways existed to make reports and presentations easier to understand.

A case study was undertaken to verify and expand knowledge of the problem by testing the level of understanding of local officials and the public concerned with an actual project. The American River Study being conducted at that time by the Sacramento District office of the Corps of Engineers was chosen for the case study because of its convenient location, stage of the study, keen local interest in the outcome of the study, and its typical nature.

This paper describes lessons learned from a review of the literature and a case study focusing on the success with which the public participation program was carried out in the American River Study. It presents conclusions and recommendations thought to be applicable to public participation elements of other projects.

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INTRODUCTION

Risk communication usually involves providing information about: the existence and seriousness of a threat; and steps that can be take to reduce or eliminate the threat. The purpose of the risk communication may be limited to providing a basis for decision making or go further and encompass efforts to persuade people to take some recommended action.

Risk communication in the field of flood loss reduction is often complex for several reasons.

- The risk is probabilistic.
- Numerous alternatives for reducing risk are usually apparent or can be developed, each of which can often be implemented in different ways and to different degrees, and many of which can be used in various combinations with one another.
- The alternatives that may be used for reducing risk often differ radically in the nature and amount of their costs and benefits.
- Many of the available alternatives are multi-purpose in nature and require parallel consideration of the needs for and benefits of water supply, electric power generation, and other functions.
- Alternatives often have significant environmental impacts, broad-scale economic impacts, and others that can not be quantified for easy comparison and consideration.

In addition, communication of information about flood risks and steps that might be taken to mitigate the risk is handicapped by a generally low level of understanding on the part of public officials and the general public concerning the basic technical facts about flooding. These include: the major causes and types of flooding; the relationship between flood magnitudes and frequency; the concept of a floodway including such notions as the floodway and flood fringe; and the reality that severe floods can occur in most areas.

Such misconceptions and lack of information about flooding and the degree of flood risk make it difficult for people to appreciate the importance of solving flood problems. The result often is a failure to take any action at all until a damaging flood makes the risk obvious. Even then, lack of understanding of the nature of flooding makes it difficult for people to rationally consider solutions that might be suggested. As a result of the public's lack of understanding of flood risk, needed programs and projects are often delayed for years or not implemented at all, contributing significantly to flood losses.

William Ruckelshaus presented the following excellent summary of the communication problem in his "The Center's Tenth Anniversary" observations in the Newsletter of the Center for Risk Management (Spring 1997).

...Our ability in the future to effectively communicate information about risks, and to successfully involve the public in the process of controlling them, will determine our progress in managing those risks in a sensible manner. Experience to date tells us we have a long way to go.

For just as we know more about potential risks today than we did ten years ago, we also have continued to vest in our citizens the power to say "no." That power is an awesome responsibility in our democracy and one that demands of our citizens much attention, if it is to be exercised with care.

We have learned that the willingness of people to say "no" will not disappear just because it is inconvenient or messy to the rest of society. The responsibility of informing the public as it participates in the process of controlling risk now becomes an even greater task. It is toward this task that the center has dedicated much of its effort.

We have made strides in risk characterization and risk communication over the last ten years. But much more needs to be done. The challenge of successfully involving the public in tough and ever more complex risk management decisions will be one measure of our success in the years ahead. One reason for this is that accomplishing meaningful public involvements is essential to restoring trust in the institutions of our government. Nothing has so defined the past three decades of growing environmental awareness and action than a parallel decline in public faith in government. Reversing this decline is then essential for a successful democracy.

Demonstrating our ability to address environmental problems in the context of free institutions will help reassert our traditional international environmental leadership at a time when the developing world is ramping up its economic growth. The environmental impact of the inevitable development in the Third World can hardly be imagined if it follows the path that the developed nations have already taken.

One hopeful sign is emerging. We are seeing the growth of efforts to deal with development problems through consensus-based, collaborative decision-making processes in the United States - particularly in the West. These efforts have so far concentrated on natural resource and environmental issues. By one count, over sixty basin or watershed efforts are now under way in the Colorado River drainage alone. It is essential to understand that each of these efforts is unique to the problems, the locale, even the personalities involved. This approach is not something you can stamp out with a cookie cutter. Yet it has met with some preliminary successes: the Clark Fork River in Montana and the Old Growth Forest Commission in Washington State are cases in point.

Such cooperative decision-making processes are by no means panaceas for every environmental problem. They are extremely difficult to bring off,

frustrating to participate in, often lengthy and grueling for their members, and they can easily fail. They can fail, for example, when short-term economic interests overwhelm all other factors or when one party believes it can get a better deal elsewhere. But they are an important start that needs to be encouraged and nurtured.

Thomas Jefferson once pointed out that if the people appeared not enlightened enough to exercise their control of government, the solution was not to take away the control but to “inform their discretion by education.” The collaborative processes that are springing up around the country are doing just that, giving to large numbers of citizens new comprehension of the complexity involved in government decisions, out of which has to come a heightened appreciation of, and tolerance for, the necessary work of government...

RISK-COMMUNICATION RESEARCH

Research into the field of risk communication as it relates to flood loss reduction was undertaken by the Hydrologic Engineering Center (HEC) of the U.S. Army Corps of Engineers beginning in 1988. The overall objective of the research was to improve the presentation of flood risk information in the agency’s dealings with communities and individuals. Three major activities were undertaken: 1) survey of the literature and preparation of a document on explaining flood risk; 2) collection and analysis of informational materials currently in use; and 3) conduct of case study.

Literature review. The first activity undertaken was a general survey of the literature related to risk communication and summarization of what experts in that newly emerging field had to say about what works and what either doesn’t work or might even be counterproductive. That part of the research led to preparation of a brief summary of the literature and a brochure about the basic techniques of risk communication. The best references found at the time were noted in Engineering Pamphlet, EP 1110-2-8, “Explaining Flood Risk,” developed by HEC in 1992.

Since that literature review, risk-communication-problems awareness has received much attention. In 1993, the Corps Institute for Water Resources, IWR, published a report entitled “Guidebook for Risk Perception and Communication in Water Resources Planing.” In 1996, “Rx for Risk Communication” was published in ASCE’s Civil Engineering magazine

Risk-Communication Materiels. The second activity of the research effort was collection of informational materials presently in use by states, the Corps of Engineers, and other federal agencies to explain flood risk. Twenty-one states and the Commonwealth of Puerto Rico responded to the request for example materials with a total of 94 items. Another 37 items were collected from Corps of Engineers offices and other federal agencies. Each of the 131 submitted items were reviewed to determine the extent to which they conveyed information intended to help the reader understand the basic facts about flood risk. The evaluation found that few materials were in use which provided rudimentary information about flood risk in a manner that was easy to understand. The conclusion of the investigation was that some improved educational tools were

clearly needed if the public's poor understanding of flood risk is to be improved.

It is apparent that one reason why the general public is uninformed about flood risk is the small number and nature of the materials that have been made available to inform them. Probably only a small percentage of the population has seen anything relating to flood risk and what they have seen tends to be limited to a perfunctory, rather dull and impersonal description of the amount of national or state flood losses. Only three of the items reviewed attempted to personalize the concept of flood risk in easily understood terms such as by showing the probability of flooding over the life of a home mortgage and only one item demonstrated the possibility of large floods through a map showing the occurrence of large floods in the past.

Some appropriate educational tools are needed if the public's poor understanding of flood risk is to be improved. Informational materials explaining flood risk should be coordinated and consistent with one another. Some state and federal agencies share the same need for informational materials explaining flood risk, it would be most efficient if a single set of high quality materials were prepared and made available for common use.

Design of the informational materials should take advantage of information in the literature relating to risk communication with respect to the effectiveness of communication techniques. The following paragraphs summarize pertinent guidance from the literature.

1) Risk communication must be free of jargon. Every field makes use of a shorthand of specialized words that are meaningful to specialists in the field and enable quicker communications. However, non-specialists do not often understand these terms or only understand their barest meaning. Unfortunately, the use of jargon tends to be perceived by the lay person as an indication that the user really doesn't care enough to explain the information in an understandable way or, even worse, that the jargon is an intentional effort to suppress questions and/or cover up a lack of knowledge. It is important that any new educational tools use simple, easily understood language.

2) There must be a consensus of opinion among experts. Differences in expert opinion sometimes make risk communications ineffective. The public is generally willing to concede that specialists in a field have detailed knowledge beyond that generally possessed and are willing to put some trust in the experts' viewpoints. However, the public expects that several experts armed with the same set of basic facts will come to the same conclusions and offer more or less the same recommendations. The risk communication tools that are developed should be based on facts generally accepted by the overwhelming majority of knowledgeable floodplain managers.

3) The material and the source of the material must be credible. Members of the public often lack the knowledge and experience needed to interpret many of the facts related to risk or to put them into a proper perspective. They are forced to rely on the expert for those insights and the extent that they do so depends on the credibility of the expert. Credibility is a function of several factors such as past performance, openness, and apparent capability. It also depends on the public's perceptions about such things as 'hidden agenda' and 'axes to grind.' It is important

that the views and materials making up the educational tools be attributed to respected and trusted sources and that the material be presented without bias.

4) The material must be tailored to the audience. The public is composed of individuals and groups that have different interests and priorities and which evaluate information according to their particular concerns. For some, flooding is of interest due to its economic impact. Others may be primarily concerned about its human dimensions. Still others may measure the potential seriousness of flooding according to its effect on the environment. In order to catch and hold the interest of such groups, the material must be couched in relevant terms, address the appropriate aspects of flooding, and make use of examples that are pertinent to the audience's special concerns.

5) The information should be personalized to the extent possible. It is important to personalize information on risk. It's one thing, for instance, for a person to see some figure for national or state flood losses and quite another to see what it means to their personal pocketbook, their personal safety, or their local economy. The public's strong interest in personalized information is apparent in the questions that are often asked at informational meetings dealing with risk such as "would you drink the water," "would you let your family live there," or "what are you doing about this problem."

6) Motivation should stress a positive approach and the possibility of success. Fear is a poor tool for motivating action. In fact, some studies indicate that the use of fear may occasionally backfire and lead to a hardening of existing positions and views rather than their modification. Allied to this is peoples' reluctance to attack problems that seem too large to be solved or appear beyond the control of the individual or community. Together, these lead to an attitude of resignation rather than to action. It is important that informational materials treat risk as one more fact of life to be dealt with and show that individuals and communities can have some control over the problem.

7) Data on risk must be presented in a meaningful way. An individual does not have an unlimited capacity to absorb and consider all of the information that is available on life's risks, even if it comes from a credible source and is presented in an interesting way. People typically sort out risk information by simply disregarding information about smaller risks on the basis that attention should be given to those events that are more likely to occur. One problem with this seemingly reasonable procedure is that people often fail to consider the seriousness of the consequences of an event along with its probability of occurrence. A second problem is that peoples' selection of what warrants concern is based on their personal perception of the probability of occurrence as opposed to whatever the actual probability may be. Studies show that peoples' perception of the probabilities of various risks has more to do with the nature of the risk than its statistical frequency of occurrence. In general, people tend to overestimate the rate of occurrence of events that are dramatic or unusual and therefore more newsworthy and underestimate the more commonplace risks. These kinds of errors lead to equating small probabilities with zero probability and to a lack of concern with the relatively uninteresting problem of flooding.

One way of countering these problems is to present flood risk in a way that does not encourage dismissing it because of the small annual probability of a large flood. For example, the chance of flooding for particular property might be stated either as: a) a 30 percent chance of flooding over the life of a mortgage; b) a 10 percent chance of flooding over the next decade; c) a 1 percent chance of flooding in any particular year; or d) a 0.01 probability for any year. While all of the means of stating the risk might be equivalent, some are obviously more meaningful than others and more likely to make an impression to be remembered and perhaps stimulate interest in what can be done to reduce flooding. Whatever technical data and information are being presented should be presented in ways that are easily understandable and can be related to the experience of the members of the intended audiences.

Case Study. The third major activity was conduct of a case study focusing on the risk communication aspects of a major flood-related investigation by Corps of Engineers. The area selected for study was Sacramento, California. While several flood-related investigations were underway by the Corps for the Sacramento area, the case study focused on the American River Watershed Investigation.

The case study was conducted in two phases: Phase 1, initiating the study and doing the first round of participant interviews; and Phase 2, conducting the final participant interviews and preparing the final report. A summary of the case study report (HEC, 1992) is presented in the next section.

The objective of Phase 1 was to establish a baseline condition with respect to the level of understanding of flood-related matters against which the findings of the remainder of the study could be measured. The principal activities in Phase 1 were as follows.

- Reviewing materials relating to the District's work to become familiar with the studies underway and planned for the Sacramento area.
- Interviewing key District personnel to identify current attitudes and views of risk communication and their views as to the kinds of information needed by local decision makers.
- Identifying and interviewing a selected set of influential individuals concerned with solution of Sacramento's flood problem to determine their level of knowledge about the flood problem, constraints on planning, issues related to the solution of Sacramento's flood problems, concerns, perceived needs for information and other relevant points.

Phase 2 of the study provided for monitoring the remainder of the District's risk communication effort and preparing the final report. This included the following.

- Conducting final interviews with members of the selected set of influential individuals to assess whether and to what extent their views have been affected by

the District's risk communication efforts, effectiveness of various types of informational efforts, and current concerns.

- Continuously monitoring the District's risk communication activities and related events including attending public meetings, collecting newspaper articles, etc.
- Conducting final interviews with key District personnel to identify changes in perceptions relating to risk communication over the course of the study.
- Comparison and analysis of results obtained from the interviews and testing of participants.

SACRAMENTO CASE STUDY

Due to its location on the floodplain at the junction of two major rivers, the Sacramento area has been subject to flood problems since its earliest development. Indian folklore and newspaper accounts mention at least nine major floods prior to 1900. Large floods subsequently occurred in 1904, 1907, 1909, 1955, 1964, 1969, 1970, 1982, 1986, and 1997.

Numerous small projects to alleviate flood risk were carried out in the Sacramento area in the late 1800's and the first half of this century. Through the 1950's and 1960's, planning and construction was underway on several major projects affecting flood risk to the expanding development in the Sacramento area. The extensive construction programs of this era, combined with the earlier private and public measures for flood protection and other purposes, have produced an extraordinarily complicated system for water management in the area. The chief measures and features include: Folsom Dam and Lake; Nimbus Dam and its reservoir, Lake Natoma; American River Levees; levees along the Natomas East Main Drainage Canal, etc.; Sacramento River weirs and the Sacramento Bypass and Yolo Bypass; various non-federal levees; numerous small upstream reservoirs in the American River; and floodgates operated by the City of Sacramento.

It was widely thought after construction of Folsom Dam that the dam and reservoir provided the Sacramento area adequate protection against flooding. Floods of 1955, 1964, 1969, 1970 and 1982 were greatly reduced by the project. However, the flood of record which occurred in February of 1986 dispelled thoughts of safety from floods. Inflows to Folsom Reservoir during a several day period exceeded the design capacity, requiring releases greater than designed downstream channel capacities, and largely eliminating the project's ability to regulate flood flows. The record flows encroached into the levee freeboard at several locations, causing severe erosion of levees at some places. A major disaster was averted by only a narrow margin.

Upon updating the flood frequency curve, the Corps of Engineers indicated that the February 1986 flood had an average annual exceedance frequency of only 65 to 75 years. The fact that the flow nearly overtopped the levees showed that the level of protection they provided

was much lower than formerly believed. This new understanding of the flood threat caused a greater appreciation of the vulnerability of the area to flooding and sparked local interest in improved flood control. Interest in the investigation of improved flood protection for the Sacramento area was also spurred by considerations related to the flood insurance program. When mapping is completed for the area, premium rates for areas having less than a 100-year level of protection are due to rise steeply. In addition, further development of areas lacking a 100-year level of protection would be restricted by regulations required pursuant to the National Flood Insurance Program. Among others, these would limit new construction and require substantial improvements to existing structures to include protection from flooding.

Identification of Case Study Participants. It was estimated at the outset that the budget for Phase I of the case study would enable investigating the knowledge and views of about 20 individuals in addition to Corps staff. Several procedures were employed for selecting these participants.

Initially, representatives of several organizations making up the American River Watershed Investigation Executive Committee were asked to recommend a member of their organization's governing board as a case study participant. Since the objective of the case study depended on measuring a change in knowledge over time, it was asked that the recommended person be someone who was not actively engaged at that time in the American River Watershed Investigation. The persons suggested were contacted and asked to participate, resulting in the identification of 13 participants.

Sacramento District staff concerned with the American River Watershed Investigation were then asked to suggest the names of media representatives generally familiar with the flood problem and the American River Watershed Investigation. Contact was made with each of the suggested parties, leading to the identification of another three participants.

The selection of additional participants was then delayed pending the hearings held by Sacramento Area Flood Control Agency (SAFCA). Following the hearings, four individuals representing organizations expressing an interest in the study were asked to participate. Of the 20 persons originally agreeing to participate, only one eventually failed to provide the requested information at the initial round of interviews. The positions of the participants selected are shown below.

Director, American River Coalition
Director, American River Flood Control District
Director, State Reclamation Board
Director, Reclamation District 1001
Director, Sacramento Metropolitan Chamber of Commerce
Executive Director of a Sacramento area association of business interests
Executive Director of a statewide association of water-related agencies
Executive Director of a regional flood control organization
Member, Sacramento City Council

Reporter, Sacramento Union
Reporter, Sacramento Bee
Reporter, Channel 3 Television
Staff, California Department of Water Resources
Staff, Planning and Conservation League
Staff, county water resources agency
Supervisor, El Dorado County
Supervisor, Placer County
Supervisor, Sutter County
Supervisor, Yolo County

Findings of Participant Interviews. Participant interview forms were reviewed to assess the general level of information and knowledge exhibited by the participants. The results are described in the following sections. In each case, the results are for only the 11 participants that completed both the initial and final interviews. Results shown in brackets are for the second round of interviews.

1) Flood-Related Terminology. Participants in the case study were asked to indicate whether or not they understood the meaning of 53 terms, most of which were taken from reports concerning the American River Watershed Investigation that had been issued by the Sacramento District. All of the terms not taken from the District's reports were terms commonly used in the description of flood problems and flood loss reduction measures. Participants were not asked to demonstrate knowledge of their understanding so it was possible for them to falsely claim to know the meaning of any term.

On the average, participants indicated an understanding of 54 (72) percent of the terms. Individuals scores ranged from 18 [24] percent to 94 [88]. Table 1 lists some of the terms and the percentage of participants that indicated that they understood their meaning at the time of the initial and final interviews.

Table 1
Knowledge of Flood-Related Terminology

<u>Term</u>	Percent of Participants <u>Understanding</u>		<u>Term</u>	Percent of Participants <u>Understanding</u>	
	(Initial)	(Final)		(Initial)	(Final)
Ace-Foot	100	100	Peak Flood Stage	81	90
Backwater	36	72	Reconnaissance Study	81	90
Flood ins. rate map	90	90	Recurrence interval	45	63
Hydrograph	36	72	Spillway	72	90
Nonstructural measure	45	54	Stage-frequency curves	27	54

2) Key Terms. Participants in the case study were asked to demonstrate their knowledge of 10 key terms relating to floods and flood loss reduction through a two step process. First, they were asked to choose from among several meanings offered for a term and second, to indicate the level of confidence that they felt in having chosen the correct meaning. The participants averaged 60 [63] percent correct answers with a confidence level in the correctness of their answers of 54 [43] based on a scale of 0 being a pure guess and 100 being certainty of the correct answer. Table 2 lists some of those key terms and the percentage of correct answers and the average confidence level indicated for each term.

Table 2
Understanding of Key Terms

<u>Term</u>	Percent <u>Correct</u>		Level of <u>Confidence</u>	
	(Initial)	(Final)	(Initial)	(Final)
Flood probability	36	63	52	63
Freeboard	54	63	51	28
Floodplain	81	81	75	30
Flood stage	36	45	82	30
Level of protection	100	100	56	37
Flood fringe	54	72	26	55
Floodplain management	63	90	77	60

3) General Information on Floods and Flooding. This portion of the interview was intended to obtain a measure of the participants' general knowledge about floods and flood loss reduction measures. Participants were asked to choose among several answers for each of 19 questions and to then indicate their level of certainty about their answer. The participants averaged 64 [57] percent correct answers and indicated an average level of confidence of 45 [37] in their answers. Table 3 lists some of the subject matter of the questions and the respective percentage of correct answers and levels of confidence.

4) Sacramento's Flood Problem. This portion of the written interview was intended to obtain a measure of the participants knowledge about the flood problem in the Sacramento area. Participants were asked to choose among several answers for each of 22 questions and to then indicate their level of certainty about their answer. For an additional two questions, participants were asked to supply answers. The two questions for which multiple answers were not provided asked the participants to: a) identify any major alternatives for reducing flood losses along the American River that they were aware had been considered; and b) identify the purposes of Folsom Dam of which they were aware. Participants identified an average of 2.2 [3] alternatives for reducing flood losses with individuals mentioning from 0 [2] to 5 [5] alternatives. On the second question, participants identified an average of 3.1 [3-2] purposes with individual responses ranging from 2 [0] to 4 [5] correct responses.

Table 3
General Information on Floods and Floods and Flooding

<u>Subject</u>	<u>Percent Correct</u>		<u>Confidence Level</u>	
	(Initial)	(Final)	(Initial)	(Final)
Annual probability of 100-year flood	54	54	60	53
Likelihood of another flood after one occurs	100	100	67	48
Federal cost sharing for flood damage	72	90	53	30
Non-federal share of cost for dams and levees	90	81	55	44
Probability of flooding on 100-year floodplain	36	18	47	45

In the initial round of interviewing, for the 22 questions for which multiple choice answers were provided, the participants averaged 62 [59] percent correct answers with an indicated confidence level of 56 [37]. Table 4 lists some of the subject matter of these 22 questions and the respective percentage of correct answers and levels of confidence.

Table 4
Sacramento's Flood Problem

<u>Subject</u>	<u>Percent Correct</u>		<u>Level of Confidence</u>	
	(Initial)	(Final)	(Initial)	(Final)
Season when floods are most likely	27	45	16	48
Size of February 1986 flood	45	27	56	20
Role of Corps of Engineers	36	27	62	43
Average annual flood losses in Sacramento	27	9	0	10
Location of Folsom Dam	100	100	51	9
Current level of protection vis a vis 1986 flood	36	36	67	37

5) Planning Procedure and Status. This portion of the interview was intended to obtain a measure of the participants' knowledge the overall procedure for the planning that was being followed in the American River Watershed Investigation and the current status of that planning. Participants were asked to choose among several answers for each of 5 questions and to then indicate their level of certainty about their answer. Participants averaged 44 [40] percent correct answers and indicated an average level of confidence of 62 [53] in their answers.

6) Views and Opinions. This portion of the interview was intended to identify participants' views on a number of policy-type issues. Participants were asked to choose among several offered answers or provide their own answer(s) for each of 7 questions. Table 5 shows the respondents views on the different sources of information available to them.

Table 5
 Respondents' Perceived Credibility of Flood-Problem Information Sources
 (Greatest credibility = 1; Least credibility = 7)

<u>Source</u>	<u>Relative Rank</u> (Initial) (Final)	
Sacramento area elected officials	4.1	4.4
Sacramento area local government professional staff	2.9	2.4
Corps of Engineers staff	2.5	1.6
State agency staff	2.8	2.4
Newspaper editorials and articles	3.3	4.8
Chamber of Commerce	3.6	5.3
Environmental organizations	5.3	5.1

General Observations on Public Information Programs. The role of the Corps of Engineers in a complex study like that conducted for the American River Watershed is one of collecting and analyzing pertinent data and information, investigating alternatives and eventually recommending whatever actions appear to deal best with the problem. The agency is not a dispassionate observer with no stake in the outcome. The opportunity to proceed from planning to design and construction is a welcome one to an engineering organization of the Corps' type. On the other hand, the Corps is not free to promote approval of a proposed project like some private special interest. The staff of the agency are bound by professionalism as well as by voluminous laws, regulations, guidance manuals and other instructions. The view of the majority of Corps personnel is doubtless that the agency is the "honest broker" presenting facts and providing technical expertise.

While the Corps may recommend an action and show it to be beneficial, the decision to proceed beyond the planning stage depends in part on approval of the proposed action or project by the elected officials and other key people in the project area. This approval need not be unanimous and it is not alone sufficient to ensure moving ahead. However, lack of a general approval almost certainly dooms a project.

Because of this need for local approval, it is customarily assumed by water resources planners that it is important for the local officials to understand the key facts about the flood problem, the alternatives investigated, and the recommended actions. Many feel that it is important also for the general public to be well informed on the proposed action and the reasons why it is recommended because of the public's influence on local officials.

Findings and Recommendations. The following sections pertain specifically to the situation in the Sacramento Case Study.

1) Selection of Study Participants. The number of study participants was limited by funding and their method of selection, as explained earlier, was informal. If there was a deficiency in the selection of participants, it was in choosing representatives of some organizations that were too far out of the local decision-making process. This was done deliberately so as to avoid any "too well educated" participants.

Participants should be chosen from those that are in the thick of the study and controversy. This will provide the best measure of the understanding of local officials and "influentials." It will also enable the process to provide some initial steps toward consensus building.

2) Number of Participants. Twenty participants (subjects) were originally identified for the study. Of the 20, only 19 completed the first round of interviews and substantial difficulty was experienced in getting the last few of those to complete their promised role. By the time of the second round of interviews, only seven of the twenty were willing to complete their promised role and another four partially completed their participation.

This is too small a number of participants to serve as surrogates for the important interests and views and range of people represented. It is also too small a sample for reliable statistical analysis. It would have been preferable to begin with about fifty participants had funding for that level of work been available. Also, the length of the written interview may have been daunting.

3) Method of Performing Interviews. In the first round of interviews, the investigator met with the participant, delivered the interview form and instructions, and waited for the subject to complete the form. This achieved a high level of properly completed forms (19 out of 20). During the second round of interviews, most participants were mailed or given the interview form and asked to complete it and mail it back within two weeks. This was somewhat unsatisfactory as evidenced by the low number (7 of 20) of properly completed forms.

It would be preferable to personally hand out the form, have the participant complete it in the investigator's presence, and collect it on the spot. This would increase participation, speed up the process, ensure sections of the interview form are not omitted, and block any possible effort by participants to copy the form, look up answers, or ask others for assistance. Also, the interview and form (questions) were too long and complicated to encourage their participation and willingness to learn more.

4) Initial Level of Understanding of Participants. The Corps study had been underway for several years at the time this investigation was initiated. The selected participants had presumably studied some of the following reports issued by the Corps.

- Special Study on the Lower American River, March 1987
- Information Paper: American River Watershed, November 1987

- Reconnaissance Report: American River Watershed Investigation, January 1988
- Initial Appraisal Report, Sacramento Urban Area, May 1988

In addition, most of the participants had been exposed in other ways to the study including attendance at meetings where the study was explained and individualized briefings. According to later interviews with Corps personnel, all difficult to understand terminology had been removed from reports that were issued. Nevertheless, for a list of terms taken largely from Corps reports, participants indicated understanding of only about half of the terms. Even this relatively poor showing is thought to be inflated by participants' overestimation of their knowledge. The interview contained no safeguard against such errors and no means of detecting such errors.

For 10 key terms that are basic to understanding flood control work, participants scored 64 percent correct but with a confidence level in their answers of only 54 [halfway between a pure guess and certain knowledge]. Again, both the percentage of correct answers and the degree of certainty are suspected to be high. There was no means of detecting guessing and it was not unusual to find participants claiming a high degree of certainty about a wrong answer.

With respect to general information about floods, participants averaged 64 percent correct answers and a degree of certainty of 54. Regarding knowledge of Sacramento's flood problems, scores were even worse. Participants averaged only 44 percent correct answers.

These low scores suggest that it would have been difficult for the participants to obtain an in-depth and correct understanding of the Corps study results through either the written reports or formal presentations. Yet, few questions were asked at informational meetings.

An extensive investigation should be made at the outset of any major study to assess the extent to which the local officials and other influential understand flood-related terminology and concepts. Audiences for reports and presentations should be specifically identified and the information on levels of understanding should be used to guide the report writing and preparation of presentations. In addition, key materials should be tested on a sample of the intended audience to ensure they are easily understandable.

In addition, emphasis should be put on conducting information exchange in an atmosphere that is conducive to asking questions and special care should be given to soliciting such questions. It should never be assumed that a lack of questions or only a few good questions means that full understanding has been achieved.

5) Improvement of Scores Over Time. Comparison of the participants' performance on the first and second interviews shows little improvement in their level of knowledge over the intervening period during which they dealt with the "Alternatives Report" and the draft "Feasibility Report." For each improved score, one can point to a score that showed less knowledge. The variations in any event tend to be small and well within the accuracy of analysis using such a small sample. This failure to improve over the time and number of informational

opportunities that were available suggests that the public information program was not effective. That this fact went undiscovered by the Corps personnel points out the need for operating some type of feedback mechanism over the course of the study.

Public informational programs should be designed based on identification of each intended audience, analysis of each audiences' beginning level of understanding, and a clearly stated goal as to the improvements in understanding to be sought for each audience.

Following design of the public information program, a continuing program of testing and information collection should be implemented to measure progress toward the goal for each group and to guide staff in putting emphasis on critical issues.

6) The Corps as "Honest Broker." The Corps was ranked as the most credible source of information about the flood problem at Sacramento. However, that top ranking was not the result of unanimous agreement as to the agency's credibility. Indeed, the Corps was ranked most credible by only a minority of the participants. The high ranking was a result of being consistently ranked in the upper part of the spectrum and never lower than fourth.

With regard to the best solution to Sacramento's flood problem, individuals ranked the Corps credibility from first to sixth. In fact, it was rated the most credible by only three of the 11 participants whose views were tallied. The agency's top rating, tied with local government professional staff, was again due to being often in the top part of the rankings rather than any clear consensus on the Corps' impartiality.

Corps personnel do not see their agency as others see it. The Corps' performance and assumptions about important matters are likely to be affected by the overly optimistic view of the District personnel about how the agency is perceived by the public. This kind of error in understanding the framework in which planning and information exchange takes place can breed attitudes which can be seen as arrogance by local officials and which can further interfere with effective communication.

The Corps faces a credibility problem with several audiences. Dealing with this problem requires that the agency's personnel recognize that others have ideas that they believe are important. Less emphasis should be put on the Corps overwhelming command of physical and technical facts and more time on consensus building. This will require providing mechanisms to identify and recognize the beliefs and ideas of others and letting others share in the true decision-making.

Letting others share in the decision-making will not be an easy task. Especially in the case of groups lacking technical capability, it may be necessary for the Corps to provide the group with the funding or other assistance needed to participate in a meaningful way.

7) Need for Staff Education. Few if any of the Corps project managers and planners have a background in risk communication. They are likely to be unaware of the requirements for good

communication and effective participation. They may also be unsympathetic to the need for improved public information. A need exists for educating them.

A two-pronged effort should be mounted to sensitize key planning staff about the needs for and means of effective communication. One part of the effort should focus on gaining some familiarity with the literature in the field of risk communication. The second should be the provision of good models of how effective public information programs can be designed and carried out. There is no substitute for demonstrated success.

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