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Attitudes for Environmental Planning in the 1970's

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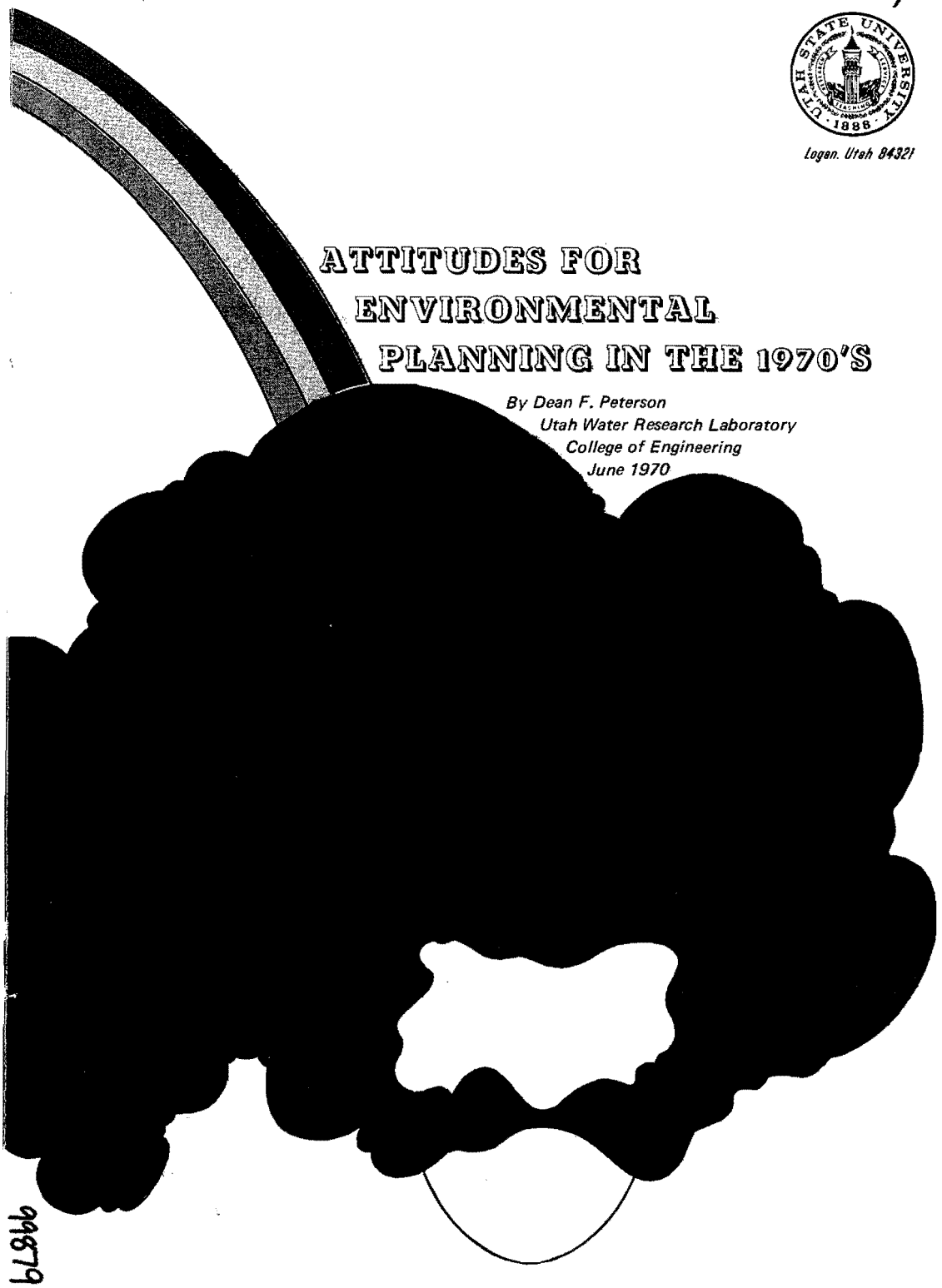

ATTITUDES FOR ENVIRONMENTAL PLANNING IN THE 1970'S

By Dean F. Peterson
Utah Water Research Laboratory
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ATTITUDES FOR ENVIRONMENTAL DESIGN FOR THE 1970's

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Address delivered at Engineers' Week banquet,
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Utah Water Research Laboratory
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Dean F. Peterson

Dr. Dean F. Peterson is Dean of the College of Engineering at Utah State University and is an internationally recognized expert in the water resources field. He has served as Director of the Office of Water for Peace, U.S. Department of State, functioning as a special assistant to Undersecretary of State for Political Affairs responsible for coordination and leadership in international water resources matters in which the United States was engaged or which were of interest. He also has served as Technical Assistant in the Office of Science and Technology within the Executive Office of the President; and Chairman of the Committee on Water Resources Research, Federal Council for Science and Technology. His responsibilities were coordination and management of the Federal water resources research program, and rendering advice in the water resources area to the Special Assistant to the President for Science and Technology.

Dr. Peterson was born in Delta, Utah. He received his bachelor's degree from Utah State University, and his doctorate in civil engineering at Rensselaer Polytechnic Institute. He has had extensive experience as a civil hydraulic engineer with both government and private industry. After World War II he was associated with Colorado State University as head of Civil Engineering. Since 1957 he has been Dean of the College of Engineering at USU.

In addition to his academic responsibilities, Dr. Peterson has served, in recent years, with the Agency for International Development (AID) and the Department of State as an irrigation and water resources consultant. He is Chairman of the U.S. National Committee for the International Hydrological Decade.

He is a member of ten scientific and professional societies, and is the author of some 80 publications.

ATTITUDES FOR ENVIRONMENTAL DESIGN FOR THE 1970's

By Dean F. Peterson

It certainly is a great compliment when a studentbody asks its own dean to be its banquet speaker on Engineers' Day. I appreciate this a great deal--I hope I am "with it."

First, I would like to compliment the engineering students on the excellent job done in developing Engineers' Week here at Utah State and their contributions to the effectiveness of Engineers' Week throughout the state. I believe this year we engineers have received about as much news coverage and presented about as good an image as ever before. A great deal is owed to the enthusiasm and perserverance of our engineering students. I don't know how many of you have read Governor Rampton's proclamation on Engineers' Week. Many have, but I believe it would be worth reading again.

Proclamation

WHEREAS, our first President, George Washington, whose birthday we celebrate each February 22nd, was an engineer; and

WHEREAS, the profession of engineering performs the vital role of effectively applying mankind's scientific discoveries; and

WHEREAS, the need for more professional engineers is a matter of national security, concern to our economy, and essential to environmental design; and

WHEREAS, an insight into the study and practice of engineering should further motivate interested youth to adequately prepare itself; and

WHEREAS, with the growth of the nation, there is a challenge to the engineer to be ever more responsive in professional and community participation; and

WHEREAS, it is vital that we conserve our natural resources, assure the purity of our air and water and the proper use of our land; and

WHEREAS, engineering can and must develop a responsive Environmental Design for the 1970's:

NOW, THEREFORE, I, Calvin L. Rampton, Governor of the State of Utah, do hereby declare the week of February 22nd through 28th, 1970, as

NATIONAL ENGINEERS' WEEK

in Utah, and call upon our schools, our civic organizations, and our citizens to mark this occasion with appropriate observances.

The engineer stands between science and society and it is his special job to apply science to the use of resources for the benefit of man. The engineer has no unique claim on this task, which is shared by many professionals--in the application of science. The engineer is trained to draw on a broad base of scientific and resource information and integrate it into useful machines, structures, and systems. Many of these are of great complexity and may have major impacts on the lives of people and the institutions, customs, and laws within which people work and live.

Let us turn back to the theme of Engineers' Week:-- Engineering-- Environmental Design for the 1970's. Engineers, since the beginning of their profession, have been concerned with improving environmental conditions under which people work and live. Let me cite a few examples.

Until a century ago, except perhaps in ancient Rome and some other ancient cities, public water supplies were nonexistent or highly dangerous to health if they existed at all. In the seventeenth century a citizen of Paris, on the average, had available only about two and one-half quarts of water per day; scarcely enough to drink, let alone take a bath. Water-borne disease was a major scourge which contributed materially to population control in those days. Hydraulic science, with the invention of pumps, and an understanding of the bacterial nature of disease, led to engineering works for supplying water and treating sewage, which by early in the twentieth century, had nearly wiped out water-borne disease in the cities of Western Europe and the United States. Citizens could now enjoy the amenities of 100 gallons of water per day. Doubtless the decrease in mass B.O. had some salutory effects on the atmospheric quality in the salons of Europe.

In agriculture, engineering has made it possible to control the environment on cropped fields by providing irrigation water, by developing power driven tillage and harvesting equipment, and the processes and plants for the production and transportation of fertilizer.

Improvements in transportation have made possible the exchange of materials and goods so that people may live and work under more comfortable conditions all over our country. Improved transportation permits people to travel farther and faster so that they can see more and do more, and perhaps most important, to exchange ideas and information.

Widespread distribution of electricity, along with transportation and manufacturing, has been a major factor in improving the environments in which people work and live. For the first time, for example, the hard desert environment has been turned into a place for comfortable living, with all the amenities, for millions of people in our own southwest using air conditioning and new materials for housing. Machines and devices of all kinds are available to provide refrigeration, ventilation, and temperature and humidity control in our living and working spaces.

Engineers have made major contributions to the art of city and urban planning and to regional planning and development. They are responsible for the design of sensing devices, telemetering and data

processing, and displaying devices and systems which measure and record information about the weather, water supply, climate, soil conditions, and environmental quality. High speed computers make possible the simulation and optimization of complex plans for water and land development. These systems-analysis techniques make possible sophisticated studies which can lead to better decisions about how to manage our environment.

Engineers have taken a leading role in bringing together the various disciplines concerned about environmental matters in multi and interdisciplinary approaches to environmental matters. Engineers will continue to enlarge and exercise their roles in environmental design during the 1970's.

While man has applied his technology and his resources to improve many aspects of the environment, his diverse activities have led to depreciation in the quality of other parts of the environment which are external to the part he may be improving. When population was smaller, and man's industrial activity was at a much lower level, the adverse effects of his activities were most often quite adequately diluted by the extent and self-healing properties of the general environment. Today, in a growing number of instances, the environment is no longer able to heal itself; dilution may not be adequate and some results may trigger imbalances that lead to irreversible results or spread to much broader areas. A case in point is the eutrophication-- sometimes called "dying"--of a lake. In this instance, levels of nitrates and phosphates stimulate the growth of algae removing the oxygen. This initiates a process that may be irreversible, so that the lake continues indefinitely in an anaerobic condition.

With more crowding, an increasing use by man of open spaces which are becoming more limited, people are becoming more and more conscious of the aesthetics, the appearance and harmony, of the environment around them. There is a growing concern with preserving natural values, with retaining areas in which nature is relatively undisturbed. All of us recognize and appreciate the need for these aesthetic and natural values.

A relatively new aspect of pollution is the introduction of toxic material into the environment--pesticides--for controlling insect and plant pests. Use of these materials has been extremely profitable in controlling disease and increasing the production of crops. Malaria, which a few years ago disabled a significant share of the world's population, is no longer a major health problem. Pesticides, of course, are poisons. Often they are quite specific. That is they are lethal to only one or a few species. Often they degrade, in relatively short periods, into harmless materials. Some, like DDT, are harmful to most insects. They do not degrade, and as higher animals eat the insects and animals eat other animals, the toxic materials enter the food chain, so that they become concentrated in the tissues of such animals as fish, birds, and humans to the point where concentrations may reach harmful levels. Moreover, over-use of pesticides may kill natural enemies of pests as well as the pests themselves and permit the development of populations of resistant pests which are even more harmful than the ones there in the first instance. There are many examples where pesticides have resulted in significant crop increases in the first few years, but then become quite ineffective resulting in yields which were lower than those obtained in the first place. You can see that the effect of pesticides becomes an extremely complex ecological problem, often not very well understood in advance. Pesticides have proven extremely valuable, but they should be used with great caution and we need to be reasonably confident that we understand the ecological system in which they are used.

A major environmental hazard is the urban slum or urban ghetto. Here are concentrated those who, for some reason or another, lack economic opportunity to better themselves. These may be self-forcing systems. That is, the environment in the slum may be such that new generations of its inhabitants cannot get the resources or do not obtain the education or training necessary to enter a different world of economic competition. As agriculture becomes more industrialized, the rural poor finally, in desperation, move to the urban ghetto. This problem is bad enough in the United States; it is significantly worse in the lesser developed countries where high population growth and industrialization of agriculture displace large numbers of the rural poor. There is a great risk that unrest in the urban ghettos may explode to the point where the entire administrative system of cities, states, or nations as well as the complicated technological system which produces and distributes essential goods and supplies, may be disrupted resulting in major hardships, and social unrests of national scales.

Environmental design for the 1970's must deal in a much more effective way with the side effects of technological advancement. Until recent years these have been relatively unimportant; at present levels of population and industrial growth this is no longer the case. With our growing technological capability, there is an increasing danger that environmental disruptions may be initiated which could result in major disaster. If we are to be effective, engineers as well as all of us need to reconsider our attitudes as human beings and to greatly broaden our understanding of the world in which we live. I suggest four ideas, which, among many others, need to be considered by engineers in connection with environmental design for the 1970's.

1. We need to understand and appreciate ourselves as part of nature, not as separate from it. Every living creature is a closed system which continuously has to adapt to the environment around it if it is to live. In order to do this it must draw sustenance from the environment, use this sustenance as fuel or energy, and return a less valuable substance to the external environment. Thus, life itself is a process of environmental degradation. Normally, the earth environment is restored because a large amount of energy pours into it from the sun. You who understand thermodynamics will recognize the elegance of this concept. Man, alone among animals, has a special capability to draw extra sustenance from his earth environment. Technology permits him to build special environments outside the closed capsule of his own body. These make him more comfortable, they increase his competitive capability with other species, they permit him to vastly multiply his food supply and open up a vast intellectual environment of science, philosophy, religion, and art. They also provide him with a vast array of physical artifacts which may be useful, interesting, or whose possession merely increases his status in the eyes of his fellow human beings. But man cannot escape the inevitable thermodynamics--these things can only be done by degrading the quality of the general earth environment; nor can he escape the inevitable biology, that he must somehow continue to fit into a larger ecological system.

2. We need to recognize that absolute solutions to environmental problems do not exist, that solutions are choices among options. If we wish to use steel, we must mine the raw materials, refine them, process them and transport the products. All of these

operations will change, in fact degrade, the earth environment. If the healing power of the earth environment is too slow, or inadequate for our taste, then we have choices like the following: discontinue the use of steel--this certainly would be inconvenient and certainly increase hunger; reduce the use of steel--maybe we could give up some of our less useful artifacts, or shift from 2.5 ton automobiles to 50-lb bicycles (this is known as lowering our standard of living); substitute different materials, if we can find them, which can be produced at lower environmental cost; try to invent a new steel technology which does less damage to our earth environment. The last option is an example of a set of alternatives which engineers should think about in the context of "Engineering--Environmental Design for the 1970's." We should invent and select technologies which do the least damage to the common environment.

In the present mood of our country, to stamp out all pollution regardless of its importance and cost, there is great danger that we will expend our energies quite ineffectively by scattering our shots, actually create new inadvertent environmental problems in a thoughtless haste to solve old ones, and wear ourselves out treating symptoms rather than choosing and dealing with our most important and least costly options. I certainly welcome our nation's determination to do something about the common environment, indeed we must move rapidly in most cases, but let us not thoughtlessly spin our wheels because we do not understand the alternatives.

3. We need to recognize and understand the difficulty of the decision-making process when the common earth environment is involved. Only society can make and implement a decision to improve the quality of the general environment. This process is difficult because the interests of individuals, as they see them, are almost always in conflict with what is best for everybody as a group from a general environmental point of view. Let me try to illustrate this point. A mining and metal processing plant brings material prosperity to a community of 50,000 people, but at the same time it rips up the earth and pollutes the atmosphere. Suppose now a decision is made to restore the damage to the landscape and reduce or eliminate the air pollution at company expense. It costs money to install and operate the additional equipment. To meet its payrolls the company either has to increase the price of its product, reduce the wages it

pays its employees, or reduce the taxes it pays to the state. If it increases its prices, it cannot compete and it loses money, so discard that alternative. Would you then as a wage earner be willing to take a reduced pay check in order to clean up the place? Would you if you were the Governor, under great pressure to find the money to operate the State's schools, be willing to reduce the company's taxes? These are the kinds of conflicts that invariably arise in environmental problems; conflicts which make them extremely difficult to solve. Somebody always has to pay. Nearly everyone thinks it should be somebody else. Invariably, therefore, solutions to problems of the common environment are political ones. All of us, particularly engineers, need to recognize and understand this, and think about how the decision process can be improved.

4: **We need to reassess our own personal values.** Hopefully, better technology can reduce damage to the environment or help correct or improve existing damage. By and large, though, conservation and improvement of the common environment will require some sacrifice of individual material goods now available or technologically possible in the future. But these individual goods are mine; the environment is everybody elses. Are you willing to pay a higher price to operate your car or even to forego the status symbol of a new Cadillac in order to have cleaner air? Are you willing to pay more for electricity, or increase your income tax payments in order to disperse new cities or to improve economic opportunities for those in the urban ghettoes? Unless large numbers of people decide that these and similar environmental values mean more to them than an ever-increasing stream of material goods, then it seems unlikely that the political decisions will be made until there is a crisis.

I have mentioned four points that I think need to be strengthened within the intellectual equipment of engineers who aspire to Environmental Design for the 1970's. There are others. I think these are important ones.

You recognize also that, while we may not be facing a desperate crisis, our country and perhaps the whole human race are experiencing troubling and disquieting times. The feelings of frustration, insecurity, and apprehension reflect upon us all. Somehow the specter of total war, human starvation, human inequity, deteriorating

environmental quality, spoliation of nature and even our country's own economy seems to stand disquietingly in the background. Many say that science and technology have created these haunts and conclude, therefore, that science and technology should be abandoned. Now it takes only about one sequence of logical thought to decide the utter nonsense of this position. Without viable and productive science and technology the human race today would not stand a chance. It would not survive.

Change has come upon us very rapidly. Sometimes it is hard to realize the magnitude of this change. We can now communicate at the speed of light. We can travel between places on the earth at nearly orbital velocity. One man can produce enough food for 45 or 50 others. Until two or three centuries ago, throughout history, disease and high death rate limited world population to about one-fourth billion people; today we have 3.5 billion and we wonder how we are going to turn off the increase. All of these changes have occurred in a few short years. Man must now deal with new problems of a kind and complexity far beyond those he has previously experienced. Many of these problems, in contrast to those of the past, cannot be solved by individuals, by corporations, by cities, states, or even, in some cases, countries. In an almost frightening degree many of these problems require the concerted action of society at the community, state, national, and international level. We must learn somehow to make wise and rational choices at these levels of society and to implement and execute these decisions.

Let us not be pessimistic, but let us neither discount the magnitude and importance of the problems which we face. There has never been a greater challenge-- nor a greater opportunity--for engineers. We are at a great watershed of human experience. We have discovered the universe; let us learn to live in it.