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ECO-System Restoration Challenges and Opportunities

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*Dr. Peter Gleick**

It is now my very great pleasure to introduce our luncheon speaker, Dr. Peter Gleick. Peter is the president and co-founder of the Pacific Institute. And, while we would like to claim some sort of affiliation with Peter and the great work that he does at the Pacific Institute, I am afraid we have no formal institutional relationships, but we do have personal relationships and professional relationships. There's one small indicator of the breadth of the work that Peter has done, and perhaps to some extent, mirroring the breadth of expertise in our faculty. Peter has both worked in the international sector with my colleague, Steve McCaffrey, and he has also worked with me, or rather I've worked with him in work he's done here in California as a member of the advisory committee to the Department of Water Resources update to the California Water Plan.

The full title of the institute that Peter works for is the Pacific Institute for Studies in Development, Environment, and Security. It's based just down the road in Oakland. Many of you know him. Those of you who don't should know that his research and writing addresses the critical connections between water and human health, the hydrologic impacts of climate change, sustainable water use, privatization and globalization, and international conflicts over water resources. Peter did some of the initial work looking at modeling climate change impacts on California water resources. I believe that was part of his PhD dissertation work a number of years ago, and many of you know that he has played a very leading role in the National Academy of Sciences' work with water and climate change. Peter is internationally recognized in many different areas. He was named a

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* Dr. Peter H. Gleick is co-founder and President of the Pacific Institute for Studies in Development, Environment, and Security in Oakland, California. The Institute is one of the world's leading non-partisan research groups addressing global environment and development problems, especially in the area of freshwater resources. Dr. Gleick is an internationally recognized water expert, and in 2003 was awarded the prestigious MacArthur Fellowship for his science and policy work on water issues worldwide. His research and writing address the critical connections between water and human health, the human right to water, the hydrologic impacts of climate change, sustainable water use, privatization and globalization, and international conflicts over water resources

Dr. Gleick received a BS from Yale University, and a MS and PhD from the University of California, Berkeley. He serves on the boards of numerous journals and organizations, and was elected an Academician of the International Water Academy in Oslo, Norway, in 1999. In 2006, he was elected to the U.S. National Academy of Sciences. Dr. Gleick is the author of many scientific papers and four books, including the biennial water report The World's Water published by Island Press (Washington, D.C.). The latest volume of The World's Water will be released in fall 2006. In just the past three years, he has published peer-reviewed articles in the journals Science, Nature, Annual Reviews of Environment and Resources, Issues in Ecology, Ecological Applications, Scientific American, and Environment. Speech given at International Law Conference: Transboundary Freshwater Ecosystem Restoration: The Role of Law, Process and Lawyers held on February 18-19, 2005 at the University of the Pacific, McGeorge School of Law, Sacramento, California.

MacArthur Fellow in October of 2003, dubbed a visionary on the environment by the British Broadcasting Corporation, is on the National Academy of Sciences Water Science and Technology Board, and is an academician of the International Water Academy in Oslo. He has a BS from Yale, and both a masters and a doctorate from Berkeley. He is on the board of numerous journals and organizations, has written too many scientific papers to list here, four books, and perhaps most relevant for this group, he heads the work on writing the biennial water report, *The World's Water*, which is published by Island Press in Washington, D.C.

I asked Peter to speak—I basically said he could talk about whatever he wants because whatever he has to say, we will all learn from it. More specifically, I asked him to look at some of the challenges and opportunities from his perspective as a scientist, as someone who is quite comfortable talking with policy makers, such as economists and engineers, about some of the challenges and opportunities for ecosystem restoration. So, Peter will talk for about a half an hour, and then he's graciously consented to entertain questions. So please give a warm welcome to Dr. Peter Gleick.

Thank you Greg [Weber]. I'm delighted to be here. You will note that among the things that Greg didn't say was anything at all about ecosystems. So, I'm not actually sure why I'm here, although he did say he was somewhat flexible in his instructions to me, so I'm going to take that literally and really talk about what I want to talk about.

I did know Greg previously, and the work that he has done in getting a very large and amorphous group of people to try to move in a single direction on the California Water Plan—an extremely difficult job—he did extremely ably. I've also known and respected for many, many years Steve McCaffrey, who I think has done some of the most difficult things in the international transboundary water area. Years ago in the late 1990s, I really wanted to write a paper on the human right to water. I really thought it was both an under-addressed and a timely issue. What are the legal and institutional issues around the human right to water? You know the first thing academics do when they look around and they want to write something: they look and see what, if anything, has been written before them. Almost nothing had been written about the human right to water. Nothing intelligent, except for this one piece that I just couldn't avoid by Steve McCaffrey, who had done it years before and had raised the issue of the human right to water and written about the legal aspects of it. So I, with trepidation, followed a little bit in his footsteps, and he continues to do wonderful things. So thank you for inviting me. I'm very happy to be here.

Now the issue of water is of course a critical one—it touches on everything that we care about, all aspects of our lives. It's especially critical in California and in the Western United States, as is the connection between water and ecosystems, and its importance to our neighbors (which is growing worldwide) so I was asked to talk about some of the challenges and opportunities in this area. Most of the people talking at this conference have far more expertise in this area

than I. So, what I'd like to do is broaden the issue a little bit to the wider range of water challenges facing us in the next few decades, and maybe to help stimulate thinking.

What I'd like to do is end with a vision, a little bit of a vision for what our water situation could look like in the year 2030, and offer some thoughts about how to get there. We actually live in a pretty amazing time in the water area. For water managers, ecologists, hydrologists, engineers, lawyers, policy makers, and all those who care about water, it's a time of new challenges, new thinking, new tools, new methods, and new approaches. I think we're at the start of what I'd like to think of is the third era for water, and I hope as this era progresses we'll finally see the provision of safe water and sanitation for all, which is something we don't have at the moment; the true integration of human and ecological concerns together, rather than thinking about them as separate disparate things; and the development of new tools and approaches for overcoming the water problems that face us. Thus, what I'd like to do is talk about these three eras in water, these challenges, and some of the new tools and techniques.

For most people living on earth, the first era for water really extended from ancient times up until the mid-eighteenth century. It consisted of primary reliance on the natural hydrologic cycle to provide water, and to take away the things that we didn't want. Our rivers and streams were the sources of our water, and they were also where we placed our waste. They were the sinks for our industrial and human detritus. That was okay when the population of the world was small. That worked reasonably well, although not necessarily for ecosystems. Life was short and brutish anyway; people didn't live very long, and the high incidence of water-related diseases was swamped by plague, the terrible consequences of childbirth, pox, and malnutrition.

The second era for water may have begun in some isolated pockets of civilization in the ancient cities of the Romans and the Greeks, in the agricultural fields of the Indus Valley where intentional irrigation began to be practiced, and places where growing concentrations of people really required something a little bit smarter than just dumping our wastes in the river. The nineteenth century was a time when the big cities of North America and Europe were reaching critical size, when they were outgrowing and contaminating their water supplies, and when human ingenuity, engineering, and science started to blossom. In 1828, the poet Coleridge wrote in what could be described as a clear call for environmental awareness, "the River Rhine it is well known doth wash the City of Cologne, but tell me nymphs what powers divine shall henceforth wash the River Rhine?" So in 1828, the following thought was present: we have this divine river that cleanses the city, but what will cleanse the river? This is also a period when people like Dr. John Snow of London made the first connection between cholera, which was rampant in London, and water. I don't know how many of you know this story (it's sort of well known in the water area) but there was a huge outbreak—as there was periodically—of cholera. He was convinced that there was a connection between contaminated wells and cholera. The city and health

officials didn't believe him. Dr. Snow went and removed the pump handle, which is the handle from a pump at the center of one of these outbreaks, so that people couldn't use this contaminated well anymore. The outbreak of cholera disappeared, which really drove home the connection between water and the cholera outbreak. In fact, there's a pub called the John Snow Pub in London, where they claim to have the pump handle that he removed on the wall behind the bar.

So this era, remarkable advances in chemistry, biology, medicine, and engineering led to remarkable improvements in our understanding of the connections between human and environmental health, and the condition of our watersheds and our water supply. It was also characterized by pretty remarkable changes in technology as applied to water. We saw the first physical, chemical, and biological treatment of water and wastewater. We also saw the first dams built at gigantic scale to hold back floodwaters, to provide water supply in dry periods, and to produce clean hydroelectricity. We developed and deployed technology to build aqueducts from hundreds to thousands of kilometers long, instead of tens of kilometers long, dug out of dirt. We started to re-plumb the planet. Large-scale irrigation systems permitted farmers to grow crops in places at times not previously possible.

The second era also brought enormous benefits, although not necessarily for ecosystems. Cholera and dysentery disappeared in industrialized nations, and in cities like Philadelphia, New Orleans, Chicago, and New York. The green revolution, which some have described as a revolution of fertilizers and pesticides, was as much a revolution of the application of irrigation technology as anything else, and that helped us avoid massive starvation in the twentieth century as the population on earth grew from one billion people, to three billion people, to six billion people, and so on. Despite these advances, we are in the twenty-first century, and we still have a lot of big water problems. We haven't solved all of our water problems. In spite of the hundreds of billions of dollars spent by towns, utilities, nations, and the international community, we have a whole series of unresolved water challenges. Per capita water availability is declining as our population grows. It's now 6.5 billion, and it's going to go to 7 billion, then 8 billion, then maybe 11 billion, and who knows where it's going to stop. Although the amount of water on the planet is fixed, the amount of people on the plant at the moment isn't constant, thus per capita availability is declining. In some regions, per capita demands for water are growing, sometimes very rapidly, as populations and economies grow, industrial development continues, and demand for goods and services grow.

There are still billions of people without access to basic water services. There are 1.1 billion people or so without access to clean drinking water. According to the World Health Organization, there are 2.6 billion people without access to adequate sanitation services. I always think it's ironic—I'm sure the conference organizers didn't think about this—but I always think it's ironic to see bottled water on our tables at these conferences, because our tap water in the United

States is so good. Here we are in Sacramento near the Sierra Nevada; the water we get is coming from the Sierra Nevada, and it's mostly superb water. This whole phenomenon of bottled water is for another talk. So, there are billions of people without access to basic drinking water and sanitation (which we Americans take for granted), and that means there are still hundreds of millions of cases a year of water-related diseases, cholera, dysentery, schistosomiasis, and guinea worm. There's a class of diseases associated with our failure to provide clean water and adequate sanitation services—an estimated two to five million deaths a year, mostly of small children, almost entirely preventable, from this failure. There are industrial water quality challenges of new and different kinds almost all the time as new industrial contaminants are either discovered in our water, or our understanding of the implications of them is better understood, resulting in new pressure to resolve them.

Although the area of irrigated land worldwide is growing, it's growing slower than the population is growing. Thus, per capita irrigated land is declining worldwide. We actually have less irrigated land per person every year as population growth outstrips our ability to expand irrigation. Many regions of the world are experiencing uncontrolled groundwater over draft. We over draft a million acre-feet of groundwater in California every year. Northern China has seriously over drafted ground water. Large parts of India have over drafted groundwater. We're depending on a substantial fraction of our food production— maybe as much as twenty percent—from non-sustainable groundwater. Eventually, that ground water is going to become too expensive to pump, and then what are we going to do?

Ultimately, and perhaps more relevant to this particular conference but associated with all of those problems, ecosystems around the world continue to be destroyed or degraded by overuse of water by humans, by pollution of water, and by land mismanagement that contaminates ecosystems. There is a Kashmiri proverb that says, "it's easy to throw anything into the river, but difficult to take it out again." If there's anything we've learned through all the experience we've had is that it's easy to throw something in the river and hard to take it out (or the lake, as we heard this morning).

As a consequence, many species of fish are threatened or endangered, and aquatic ecosystems have been completely destroyed in some cases. An estimated thirty percent of all North American fresh water fauna populations are now threatened with extinction, which is a trend mirrored around the world. Adequate river flows no longer reach the delta of many major rivers including the Colorado River—there's a whole session on this tomorrow—the Nile, the Huang He, which is the yellow river in China, the Amu Darya, and the Syr Darya, which flows into the Aral Sea as you'll hear about too. All of this leads to nutrient depletion or excessive nutrients, to loss of habitat for native fisheries to plummeting populations of birds, shoreline erosion, and human impacts. Ecosystems are not just fish. It's not just the Calaveras' jumping frog; it's also the impact on human populations, as we've seen for example in the communities around the Aral Sea.

Now our first traditional reaction to this broad suite of problems is that we need to pay more attention, and put more effort and money into addressing them, which is partly true. We need to pay more attention, put more effort into it, and in some cases, spend more money. But I'd like to argue that doing more of the same, doing more of what we've done isn't actually enough. The tools and the methods that brought us great benefits in the twentieth century in addressing water problems aren't necessarily going to be enough to solve what are now twenty-first century water problems. Those tools and methods did bring great benefits, but they also brought unexpected costs—political costs, economic costs, social costs and environmental costs. Maybe we should be looking elsewhere for new ideas. We've already heard here some of these and we'll hear more. Many of you are working in these areas as well, but I think that's broadly where we need to go.

I'd like to argue that it's time to recognize the third era in water, and in fact that over the last few decades, we've been already moving in this direction. There are new ideas, new challenges, and new people entering this arena that are moving us toward a new way of thinking about water. The first hints of this were people and ideas that challenged traditional thinking. In California, this included people like John Muir, who a century ago challenged the idea that we should just develop our rivers, turn them into lakes, and build big dams to capture the benefits. He devoted his life to protecting the Sierra Nevada, and the evidence of that is all around us, with the wonderful protections that we have for large parts of the Sierra. He believed that the environment has an intrinsic value and an intrinsic beauty beyond simple commercial and industrial interests. He felt that his great failure was the loss of Hetch Hetchy. He fought to protect Hetch Hetchy Valley, and it broke his heart when the dam was built, even though San Francisco has a wonderful water supply as a result. It was quite a unique thing, because a hundred years ago, no one was saying these things. Even before that, John Wesley Powell, who was the first white man to go down the Colorado River and then headed up the U.S. Geological Survey, argued fairly strongly that the West shouldn't be carved into these square states that we ended up with, but into watersheds—a completely radical notion from a political point of view. The truth is we would have been a lot better off if somebody had paid attention to that odd idea of his. David Brower, who brought politics into the environment in an interesting way to help protect the Grand Canyon from a series of dams that were going to be built, helped mobilize, I think, the public in a new way during the 1960s.

Throughout the West, and indeed throughout the world, projects to change the way we manage our water resources including new technologies to let us use water more efficiently and effectively, and new ways of restoring degraded ecosystems and ones we're protecting, are appearing in different places, ways, and times at a pretty astounding rate. There are all sorts of good news out there. More than five hundred dams have been removed in the United States in the last ten or fifteen years. How many people know that? We hear stories about

individual dams being removed, but more than five hundred of them actually have been taken out. Most of them were very small, however they had quite important damaging ecological effects, and we've removed them—some of them a couple of feet or a couple of meters high. But we're moving up the scale, and as you know, there have been proposals to remove some pretty big dams. Despite opposition, some pretty big dams are going to be removed over time. The Edwards Dam on the Kennebec, which is I believe in Maine, was a pretty substantial dam with hydroelectricity benefits, and it's gone. Within a couple of months of its removal, fish were spawning miles up stream. It's possible to restore an ecosystem in ways that we hadn't actually thought possible.

South Africa has a major program to remove what they call alien vegetation, exotic vegetation, and non-native plants from watersheds, and they're seeing two benefits. One, they're seeing restored flows. They go in and remove a certain number of plants that have dried up a number of rivers by sucking up water. The other benefit is that it's a huge employment opportunity for local communities. They hire thousands of people who get involved in ecosystem restoration, which is both a water and a community benefit. The wood that's removed from cutting down gum trees that suck up the water is sold in the local communities. It's really quite a remarkable program. South Africa also has an advantage that we don't have, which is they threw out their government in 1992, and wrote a new constitution. They wrote a completely new constitution. They got rid of their old water law, and the new constitution, signed in 1994, has basic water rights for humans and the environment. They say "we'll provide guaranteed water for all our citizens and the ecosystem and we'll figure out how to measure that and then we'll let everybody argue about how to allocate the rest of the water." It's been a really wonderful sort of case study of what's been going on.

Billions of dollars are being provided to restore the Everglades. We're finding it a little harder to get billions of federal dollars to restore the Sacramento-San Joaquin Delta under CalFed. I'm not sure why. Australia is putting limits on water withdrawals from the Murry Darling Basin, their biggest river, which crosses several states. In Australia, it has been an interesting political battle; but they're trying to protect cities, fisheries, ecosystems, and their delta. Close to here, groups like the Nature Conservancy and many others are breaching levies to help restore "riverine" habitat, forests, bird habitat, and fisheries. There's a wonderful project on the Cosumnes River, which is not many miles from here, where they breached some levies in conjunction with farmers—they're working with farmers to do this. It's really been a remarkable project and there are many examples I could give. We've heard some already and you'll hear more.

So, for the remainder of my talk, let me offer an alternative future, a positive vision for this new era now beginning. After all, we live, I think, in a period of opportunity where a whole lot of different and innovative ideas are being explored, where more attention is being given to water problems, and where there are some great people doing some great things every day. First of all, my crystal

ball is no clearer than anyone else's, but I can imagine a world in which the human right to water is acknowledged, and where all basic human needs for water are met. This is my top priority. I think it ought to be the world's top priority in the twenty-first century. I think getting clean water and sanitation to everyone is critical—it doesn't get much more basic than that, and I can imagine a world where we actually do that. I don't think it would be all that expensive.

I can imagine a world where water is properly priced and allocated among all the different competing uses; where cities and farmers actually collaborate on water policy rather than fight about water policy; and where water quality is universally monitored and protected. The Clean Water Act and the Safe Drinking Water Act is a wonderful thing, but we have to fight to protect it every day, and there are many parts of the world where we don't have comparable protections. Where more food is grown with the same amount of water we're using today—or even with less—there are enormous opportunities to improve the efficiency of agricultural water use.

I can imagine a world where ground water pumping is brought within sustainable limits and where conflicts over water are addressed, not militarily, but diplomatically and socially. Again, we've made enormous progress in this area. Steve is working on the Nile Basin discussion. The Nile has a treaty that was signed in 1959 between the Sudan and Egypt. There are eight other countries that share the Nile, including Ethiopia, the headwaters of the Blue Nile, and they've never been brought into the fold. There's an opportunity to really do it right, to bring all of the parties together, and we're seeing that more and more. Israel and Jordan signed a peace treaty and there's a special annex to that treaty, Annex Six, which is devoted to water—and I think it's a wonderful thing. Finally, I can imagine a world where aquatic ecosystems are carefully restored and guaranteed water.

Now for California, let me be a little more explicit. Let's pretend that it's the year 2030 and that we're all here at the twenty-fifth anniversary of this conference. They roll my wheelchair in and I give a summary of the last twenty-five years and what we've accomplished. In the last twenty-five years, the waters of California's wild and scenic rivers' system have been expanded. They continue to be protected by law and public sentiment. Institutional mechanisms for maintaining the health of the Sacramento-San Joaquin Delta, and of the wetlands that were put in place during the 1990s were comprehensively developed and implemented. Water managers have specific ecosystem goals, such as restoring and maintaining healthy populations of fresh water and anadromous fish, keeping salinity below certain levels, and protecting habitat for waterfowl. The anadromous fish populations of the California rivers have managed to survive the turn of the century and remained healthy. There are new runs of southern Steelhead up the Santa Clara, the Santa Ana, the Santa Inez and the Los Angeles Rivers (the newly restored Los Angeles River). The total area of riparian forest, river, and ecosystems in the Central Valley and coastal wetlands has grown and not shrunk away from the ninety-nine percent losses that we heard

about this morning, and substantial fractions are being restored. The Colorado River Delta in Mexico has blossomed and re-blossomed into a huge and ecologically critical stop on the Pacific Flyway, unfortunately made even more critical by the collapse of the Salton Sea, which I wasn't able to figure out how to save (although Michael Cohen will tell you tomorrow how to save the Salton Sea). That happened because the United States and Mexico agreed to guarantee flows to the Delta, and a few alfalfa farmers in Arizona may have had to cut back their use of water.

I could go on. This type of back casting, if you will, is a lot of fun. But the final thing that we should talk a little bit about on how to move forward. We can identify easily where we want to be in 2030. We can broadly identify a positive vision for California, the ecosystems, the western United States, or for the world, but how do we get there? That's really the challenge. I think we need to do that, I think we ought to project positive visions that often helps focus the debate about how to move forward, and what kind of institutions and mechanisms we want to put in place to get to where we want to be. Let me offer a few thoughts in that area.

Most important is that water planners accept, as many are starting to do now, that planning is more than a technical exercise for engineers to carry out behind closed doors. That's the way we did water planning in the twentieth century, and I'm willing to acknowledge the benefits that it brought if they're willing to acknowledge the costs that it brought. We are beginning to move away from that model.

Today, planning is increasingly viewed as an exercise in the sense that democratic control of water and bringing communities affected by water decisions into the process. The Bulletin 160 process that Greg helped in the initial stages was an example of that, and it's unclear whether it is ultimately going to be successful. But you can't do a process like that now in California without public participation. That shift alone is a step forward. Open access to information is a part of that. The fact that we're having trouble sharing information in Macedonia and Albania isn't a surprise. Israelis and the Jordanians have trouble sharing information too, and sometimes California and Arizona. But without shared information—and this is a fundamental principle of international water law now—you can't get good agreements, which I think is well understood, and there's been more and more cooperation in all of those areas.

Sustainable management also requires that the environment be a player at the table—somehow, that the environment be represented. Not as sort of a secondary thing, but as a real thing with a voice and mechanisms. Environmental groups partly play that role, and governments sometimes have to play that role, but figuring out how to do that is critical.

Other factors, many of which are going to be discussed here, include the use of existing and new technologies that offer enormous potential for improving the efficiency with which we use water. Our ability to do the things we want to do

with less water is vast. Most people don't know this, but we use less water today in California for everything than we used twenty-five years ago, despite the vast increases in population and our economy over the last quarter century. We use less water today in the United States as a whole than we used twenty years ago. It's really quite remarkable. We've broken the assumption that as population and our economy grow exponentially that water use has to grow exponentially, and we've done that by improving the efficiency with which we use water. We're doing the things we want to do with less water. The only toilet you can buy today is a 1.6 gallon per flush toilet. That's the national standard. In 1980, it was six gallons per flush. We still have plenty of 6 gallon per flush and 3.5 gallon per flush toilets, but slowly that old stock of inefficient toilets is being removed. In Australia, the standard is a dual flush toilet. It's got two buttons. One is 1.6 gallons and the other is 1 gallon. There is also a water savings from technological advances. It used to take two hundred tons of water to make a ton of steel in the United States. That was in the 1930s. In the 1980s, it was down to about twenty tons of water to make a ton of steel, not because we were trying to save water, but because we were trying to save our steel industry, which was having its lunch eaten by Japan, Korea, and so on. The best steel plants today use three to four tons of water to make a ton of steel. We have an enormous ability to do what we want to do with less water and there are lots of examples of that.

We also need to use new economic tools in new ways: rate designs may encourage people to efficiently use water by signaling that the more water they use, the more it costs us in terms of new supply or ecological damage; water marketing to transfer water among different users; precision subsidies could be used—I'm not opposed to all subsidies, but I think we better be smarter about where we apply them and when; and the elimination of some subsidies. The U.S. government is on the verge of signing new, twenty-five year contracts for the Central Valley Project in California to provide a very small number of water users with extraordinarily subsidized water for another twenty-five years. If those contracts get signed and not overturned in subsequent lawsuits, California's water policy will be set back a couple of decades. Ultimately, we need newer and smarter institutions—and not always new institutions. We heard this morning that we need to make the existing institutions work if we can (I think that is the first step) and sometimes, we need to consider new institutions. There are new organizations around forcing the state or local agencies to think about wastewater not as a liability, but as an asset. Wastewater is an enormous asset to us if we can figure out how to capture, treat, and use it.

I'd like to believe that heroic or extraordinary actions are not going to be required on the part of any individual or sector to move towards this more positive vision. The necessary efforts are starting in many places. In some cases, the tools for the shift in direction are already in place. Sometimes this can be achieved by incremental technological improvement, rethinking supply and demand, integrating the environment into our decision making, working with industries and communities and by modifying governmental and industrial

policies. That may be wishful thinking on my part. In some places we may need some heroic efforts. We probably will. However, I also truly believe that the tools for moving forward already largely exist and are actually being practiced in lots of places all the time. Now, can we reach this rosy future, or are we condemned to a perpetual water crisis? That is perhaps a future that we can see more clearly, but we clearly know we don't want. Casey Stengel said, "Making predictions is very difficult, especially about the future." Although he was talking about baseball, obviously it applies. I don't know where we're going to end up, but I would argue that the gloomy pessimists and the rosy optimists—sometimes I'm both—don't know either because the answer to where we end up depends on the choices that we make as lawyers, engineers, policy makers, activists, or whatever. I think that we can make the right choices, but only time will only tell if we do. Thank you very much.

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