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Keynote Address by Mark W. Cowin

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Introduction

The last few years have been a historic era for California water. Much of our state has been in the clutches of drought with some level of impact for most of the last eight years. However, the last three years of extraordinary drought have brought water to the front pages of newspapers and back into the consciousness of most Californians.

Those of us in the water industry, that work on managing our water resources through not only drought, but flood years, and even the occasional mythical “average” water year, know that we must take advantage of these moments. We have to use the public’s interest in water, however brief or tenuous it is, to push California water policy forward.

So, how have we done? By my reckoning: so far so good.

First, Governor Brown’s administration laid out a California Water Action Plan; a comprehensive policy for improving our management of California water resources over the next five years. This plan adopts the “all of the above approach.” It includes specific actions in 10 areas that will improve the efficiency of water use, generate new supplies through recycling, desalination, and smarter water storage operations, and provide ecosystem improvements that will improve the resiliency of the natural systems that we humans share water with.

This plan has given us the footing to move forward aggressively in a number of areas.

For example, we used the plan to define the Administration’s priorities for a revamped water bond, and in 2014, California voters passed Proposition 1, a \$7.5 billion bond act that will provide state funding for water infrastructure and projects and programs to improve water management. Most of those funds will be awarded to local agencies through competitive grants that will leverage local cost shares, increasing the total investment substantially.

We also passed historic groundwater management legislation that will fundamentally improve the sustainability of our water supplies in the future. Over time, I expect this reform to result in much more investment in California water, once we finally cut up the credit card of unsustainable groundwater overdraft that we have been using as an easy alternative to that investment.

Perhaps most fundamentally, we have seen an ethic of water conservation emerge as an accepted part of the California lifestyle, and we have locked some of these behaviors in with new building codes and landscape ordinances that will make human use of water much more efficient in the future, whether we are in the throes of drought - or not.

All of this is great progress. But there is more to be done.

And at the top of my list, is tackling perhaps the most intractable challenge in California water: management of the Sacramento-San Joaquin Delta. I'd like to spend the rest of my time with you today talking a bit about the Delta and California WaterFix, which is a key component of Governor Brown's plan to improve the functionality of the Delta, and I'd like to share some of my experience and observations in attempting to move this project forward.

As you would expect, the planning, engineering, and financing of this project are formidable, just as they are with any major infrastructure project. But they are not the toughest challenge we face. No, the most difficult aspect of California WaterFix is something that you, as Civil Engineers, may not necessarily think of as part of your job. Our greatest challenge is the capacity and capability of our human institutions, to operate wisely in the face of great uncertainty that will only be amplified by climate change.

Can our regulations and regulatory bodies balance protection of the environment, water rights holders, property owners, and the public trust? Can they handle that job without become paralyzed? Can they set the rules for management of a system so complex that it only seems to grow in complexity the more we learn? How do we use science to eliminate some uncertainty and make better decisions? And ultimately, how do we build the scientific and intellectual structures we need so that we adjust promptly, properly and collaboratively to changing conditions, without gridlock or political mayhem?

I'm foreshadowing my conclusion here, but I want you engineers – you builders and doers – to make our human institutions part of your purview.

The Delta

A lot of you work on California water issues and know the Delta conundrum firsthand. For the sake of those in the audience who haven't had the privilege, I'll give you a quick overview of the problem we face and how we propose to fix it.

The Delta is a low-lying region between Sacramento and Stockton. It is the spout on a funnel that drains nearly half of California's land mass. The Delta was once a vast mosaic of tidal and freshwater wetlands and riparian forest where salty tides from San Francisco Bay tangled with the outflow of the Sacramento and San Joaquin rivers. Now the Delta consists of roughly 67 islands, most of them farmed, and many of them 15 to 20 feet below sea level.

Waterways once webbed the Delta like veins on a leaf. But the land was drained and diked, and now there are far fewer channels. Those channels are now lined with levees and a lot of rip rap, but they still give passage to salmon moving between the Pacific Ocean and Central Valley rivers and are home to pelagic native species like Delta smelt.

When we built our major water projects, starting in the 1940s, the federal and state governments installed big pumping plants a couple of miles apart in the south Delta, near Tracy. Those pumping plants are the heart of the system that supply water to most of California's population and a third of its

irrigated farmland. The pumps lift water from Delta channels into the aqueducts and pipes that carry water hundreds of miles, including over the Tehachapis.

Old Infrastructure

Those Delta pumping plants sit on dead-end channels that cannot be properly screened and require us to repeatedly – sometimes several times a day -- lift fish out of channels with buckets, put the fish in trucks, and haul them to a safer release spot in the Delta. It's an endless operation that is conducted by a lot of dedicated people. But frankly we just end up with a lot of dead fish.

More importantly, the influence of the pumps can extend to that key ecological zone where fresh and salt water meet. When operating, the pumps change the hydrodynamics and salinity gradient in the Delta, which can scramble migratory clues for fish. The pumps create cross-Delta flows (reverse flows) which interfere with a more natural tidally-mixed, upstream-downstream gradient.

Let's be clear - the federal and state water projects are not the only stress upon Delta wildlife. Long before the projects were built, the Delta was drastically altered, with most of its wetlands destroyed and its waterways invaded by non-native species. The resulting loss of rearing habitat and food sources and has been destructive for native fish. All of these issues and more, including factors that affect these native fish in other parts of their life cycles both upstream and in the ocean, have led to the decline of their populations.

But reverse flows from the water projects are one potential source of harm to the Delta smelt and chinook salmon listed today under the state and federal endangered species acts. In the winter and spring, storms and snowmelt fill rivers. These are the best times for the water projects to export water from the Delta. But for salmon and smelt, those are bad times to create reverse flows.

That is the central conflict that we seek to ease with a project we call California WaterFix. We seek to build three intakes with state of the art fish screens on the east bank of the Sacramento River, along a five-mile stretch north and south of Hood. We would also construct two 30-mile-long tunnels under the Delta to carry water from the intakes south to the existing pumping plants that sit at the head of the major aqueducts. The tunnels would be 150 feet deep, allowing life to go on as normal on the surface. These new intakes and tunnels would allow us to stop depending solely on our 50-year-old south Delta pumping plants for diversions.

With this new conveyance system in the Delta, we could pump some of the high flows from winter storms on the Sacramento River without interfering with south Delta flow patterns or drawing fish toward the pumps. And that would allow us to regain reliability for our water project deliveries.

Water Lost This Winter

Between January 1 and today, we estimate that if we had had the new tunnels and intakes in place, we could have captured and stored about a half of a million acre-feet of water, without violating the biological opinions in place to protect salmon and smelt. That's enough water to supply 3.5 million people for a year. I cannot overstate the importance of these missed opportunities. It is an astonishing fact, but our state of 39 million people, with its \$2 trillion economy, subsists largely on the bounty of five or six major storms each year.

With new infrastructure, we could take advantage of high runoff in the rivers without harming fish or degrading water quality. We could then reduce pumping at other, drier times, when exports poses more risk to wildlife and water quality. But in all, we'd gain reliability and reduce the conflict between fish and water project operations.

Eroding Baseline

If we do not modernize our Delta conveyance system and take other actions such as stepping up habitat restoration in the Delta, the trajectory of the past 40 years shows us that native fish populations will continue to decline. Federal and state endangered species laws presumably would limit south Delta pumping to ever-more narrow windows, and water deliveries would be further restricted. By doing nothing, we would strand the billions of dollars that we as a state and nation have invested in our major water projects.

We would plunge deeper into the chronic trouble of the last three decades, including more frequent water shortages, ever-lower populations of endangered species, and most likely, a return to an expensive and unproductive battle of litigation.

Guarding Against Disaster

In addition to curbing reverse flows, California WaterFix would prevent sudden disruption of water deliveries from the Delta. The Delta has always been California's low country. Starting after the Gold Rush, people built levees to drain the land so they could farm the peat soil. That soil, made up of thousands of years' worth of decomposing tules, is so rich in carbon it simply oxidizes and disappears as it is dried and repeatedly tilled. That's why land surfaces are often 20 and 30 feet below sea level on these islands.

And sea levels are rising. Government leaders in the cities ringing San Francisco Bay are struggling to find ways to adapt as the Bay swamps its shoreline. Higher sea levels will mean more pressure and higher, more frequent storm surge against Delta levees.

Scientists tell us future storms are more likely to be warm, bringing rain instead of the snow that we have long counted on to pile up safely in the Sierra and melt gradually in the spring. That means we should expect a flashier system.

Levee failures – many caused by high water -- have caused the flooding of Delta islands 158 times since 1900. That risk remains, even though we have invested more than \$300 million in strengthening Delta levees in the past decade - and Delta levees are in their best shape ever. Risk is inevitable when we expect earthen berms to hold back water 24 hours a day, seven days a week in a low-lying place that drains 40 percent of the state’s landmass. Powerful natural forces will always threaten Delta levees, and climate change makes the intensity of those forces unpredictable.

And there’s another risk. The possibility of earthquakes in the Delta feels remote to a lot of people, but our 150 years of experience with Delta levees is nothing in geologic time. The U.S. Geological Survey in 2003 concluded that there is a 62 percent probability of a major, damaging earthquake striking the greater San Francisco Bay region over the 30-year period from 2002 to 2031.

We can safeguard the water delivery system in the Delta by adding intakes in the north and conveying water underground in seismically safe, flood-proof tunnels. If disaster were to strike the central Delta, enough water to meet basic health and safety needs could still be delivered through those intakes and tunnels to the 25 million people who get some or all of their supply from the Delta.

The Value of Reliability and Sustainability

There is great value in achieving a sustainable level of water deliveries from the Delta, which the flexibility afforded by California WaterFix would allow us to do. Knowing what that level is and knowing it is dependable will enable public water districts in Southern California, the San Joaquin Valley, the East Bay and Silicon Valley, to invest confidently in water recycling plants, desalination, groundwater banking space, long-term water transfers, or whatever strategy they see fit to stretch and augment supplies from the Delta.

You might argue, as some do, that we don’t need to modernize our Delta conveyance system. Instead, we should invest more heavily in conservation, stormwater capture, desalination, and recycling to make up for what we get from the Delta. As I noted earlier, this administration is fundamentally committed to an “all of the above” approach to water resources, in which we advance every feasible method of ensuring reliable supplies. But water from the Delta cannot be easily, quickly, or cheaply replaced.

Consider this: In the last couple of decades, we’ve gotten roughly 5 million acre-feet of water, on average, each year from the Delta. To replace just 1 million acre-feet of that water would require 18 desalination plants of the size recently completed in Carlsbad, at a cost of \$1 billion each. Or we could replace it by building 111 water recycling plants of the size recently completed in San Jose for \$72 million each. Both projects took years of planning and permitting.

A policy of reducing our general reliance on the Delta is appropriate, and it's also California Law. But a goal of abandoning Delta supplies is simply unrealistic.

Next Steps

My department and the U.S. Bureau of Reclamation expect to finalize environmental review documents for California WaterFix this fall. In coming months, the public water agencies will begin to weigh the costs and benefits of the project and decide whether they want to continue to fund it.

In the meantime, the State Water Resources Control Board will begin several months of hearings to weigh our application to build three new intakes on the Sacramento River. The board's charge is to protect all legal users of water in the Delta. It will be our responsibility in those hearings to demonstrate that our proposal will not injure any other legal user of water and to show how we would protect fish and wildlife from any unreasonable impacts of the change.

But the Water Board has an additional duty, assigned to it by the Legislature with enactment of the 2009 Delta Reform Act. Under that law, the Water Board must include "appropriate Delta flow criteria" should it approve the application from my Department and the U.S. Bureau of Reclamation to build new intakes on the Sacramento River.

What does that mean, "appropriate Delta flow criteria"? Californians have been arguing for more than 30 years about how much water should flow into and out of the Delta for the sake of fish and wildlife, farms, and cities. While no one will argue that fish don't need water, there is still much more to be learned about how native fish species respond to different flows at different times and under different conditions. So it will not be simple or easy for the Water Board to decide what "appropriate Delta flow criteria" should be.

Whatever they decide, it will affect how much water can be delivered to farms and cities. And whatever the Water Board decides will not be the final word, either. The Board's standards and fish protection rules may be revised based on how the Delta system and species respond. That's why we need vigorous, comprehensive monitoring and research programs and a network of federal and state agencies working together daily. Our management in the Delta must be adaptive and collaborative.

Regulations and Human Institutions

So, why wouldn't we make this investment to modernize the state and federal water projects? If we detect that a heavily used bridge is at high risk of imminent failure, we (usually) don't spend years debating if we should fix it. We get on with it.

Well, not so fast when it comes to resolving issues in the Delta. For starters, there are any number of different interests that have a stake in the future of the Delta. And among them, they have an

extremely diverse set of histories, perspectives, and values. It's hard to have a rational conversation when the participants start with such limited shared understanding. Unfortunately, battle lines are usually drawn in the Delta before any rational conversation starts.

When this level of entrenched disagreement persists, we must depend on our human institutions for resolution. And the applicable human institutions are plentiful. To move forward with California WaterFix we must complete exhaustive NEPA and CEQA processes, and obtain permits or approvals from USFWS, NMFS, CDFW, SWRCB, USACE, USEPA, and others.

We are more than 8 years and about \$240 million into that effort. The complexity of these processes is staggering. And while we have produced tens of thousands of pages of information in our effort to comply with regulation, I would argue that this has produced little in terms of new found common understanding among the parties that are either for or against California WaterFix.

So if the regulations themselves are not sufficient to provide for a shared vision for the future, we must depend on the governmental bodies that retain the authority over the regulations. My experience working on our proposed Delta project these last 6 years, together with the unnerving new level of uncertainty that climate change has injected into water resource planning, convince me that we must build capacity and leadership in our institutions, and particularly in government bodies that regulate.

In the world of California water, regulators of water quality, environmental protection, and water rights are the recourse for anyone worried about the potential adverse effects of major infrastructure. Major infrastructure projects cannot move forward without regulatory approval. Depending upon how it is used, regulatory authority can engender trust with the public – or sow mistrust. Public trust in turn affects political will. So it is in everyone's interest to ensure that regulatory agencies have the budget, staff, talent, and capacity they need to plan and analyze and carry out their duties. Otherwise, we lose public trust, we lose political will, we struggle to understand the costs and benefits of our investments, and we fail to invest to keep California working for the next generation.

I'd argue that nowhere in California right now do we need more regulatory capacity, political will and public trust than in the Sacramento-San Joaquin Delta.

Willingness to Pay

Faith in our regulatory processes and human institutions has a profound effect on the willingness of water districts to pay the estimated \$15 billion cost of our proposed project. Urban water districts cannot shrink water use easily. In cities, the economic upheaval tied to water shortages is tremendous and reliability is valuable. So for urban water districts, this project is very clearly a good investment. I'm confident that when the urban water district board members in Southern California, the East Bay, and the Silicon Valley step back and consider their entire portfolio now and for the next generation, they will realize the benefits of stabilizing water deliveries from the Delta.

Farmers, on the other hand, can fallow land (however reluctantly) when water supplies shrink. And they have less ability to pay more for water than city dwellers. Clearly, agricultural irrigation districts must weigh carefully the decision whether to invest in California WaterFix.

The regulatory uncertainty tied to this project is a real challenge for growers engaged in this debate. While I can argue confidently that farmers will have more reliable water supplies with California WaterFix than without it, I cannot tell them what kind of flows through the Delta the Water Board and wildlife agencies will require in the future, and therefore I can't guarantee any specific quantity of water. So they are stuck with the question, will I receive enough water to grow enough of a crop to shoulder the significant debt burden that comes with California WaterFix?

As they weigh investment in the project, I hope irrigation district leaders and farmers will take into account factors that go beyond the project itself:

- San Joaquin Valley growers who depend upon supplies from the Delta almost certainly face reduced water supplies without California WaterFix.
- Their major alternative supply, groundwater, will be restricted in the future as implementation of the Sustainable Groundwater Management Act takes hold.
- Restricted groundwater supplies will make sustainable surface supplies more valuable. California WaterFix would catalyze a transfer market, enabling the shifting of more water across the state, which leads to better water security.
- Climate change is expected to disrupt agricultural markets worldwide, which leads me to believe that sustainable water supplies in one of the world's most productive agricultural regions will only become more valuable over time.

This will be a weighty decision that could shape the future landscape of California in profound ways. But as tough as it is, the decision is, indeed, upon us.

Building Our Capacity to Manage the Delta

The Delta is one of the most intensely studied systems in the world. But there is much we don't know, and that always will be the case. The place is ecologically dynamic, vulnerable to climate change, and fundamentally tied to the economic well-being and way of life of most Californians. We must manage the Delta in the face of high stakes and uncertainty.

That fact brings me back to my point about the capacity and capability of our human institutions, including our regulations and regulatory bodies. Managing the Delta is a task that sorely tests these institutions. If we are to manage for the best possible outcomes we need good leadership, smart collaboration, sufficient resources, and perhaps most importantly, vision.

Historically, Civil Engineers have often been society's greatest visionaries. So who better to ask than all of you - to take the time to consider our human institutions - and to join the work to improve them?

Building that capacity for the 21st century may be the most fundamental thing necessary to advance the work we are all devoted to.

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