MEMO FOR THE NEXT PRESIDENT

New Perspectives on the Western Water Crisis

by Benjamin Deniston

March 27—"Right now [California] has only about one year of water supply left in its reservoirs, and our strategic backup supply, groundwater, is rapidly disappearing. California has no contingency plan for a persistent drought like this one (let alone a 20-plus-year megadrought), except, apparently, staying in emergency mode and praying for rain."

This was the assessment given by Jay Famiglietti of NASA's Jet Propulsion Laboratory in a March 12 op-ed for the *Los Angeles Times*.

As has been covered by Lyndon LaRouche and his *EIR* magazine for decades,[1] the water situation in California (and the entire Southwest) has been heading towards a crisis, and new initiatives are needed to secure the future of the region. Despite coverage, warnings, and repeated campaigns by LaRouche and his associates, this issue has not been addressed, and we are looking into the beginning of the depths of a new stage in the crisis.

Farming is already taking a huge hit, with over 500,000 acres of the nation's most productive farmland going unplanted last year, and probably around 1 million acres won't be planted this year. Farmers of the Central Valley will receive only zero to twenty percent of the water they are generally allocated from the state's two main water projects. Towns like East Porterville have already begun to run out of water, and if this trend is not reversed, we could see people migrating out of the largest and most productive state in the nation, as agriculture and entire population centers would be forced to simply shut down. This has been a long-building crisis, now reaching a breaking point.

Here we will again address this challenge, but from a new vantage point.

While many in California (and the nation) are suffering the consequences of inaction, we will start by looking to the region in the world which has acted to begin to address their water crisis, China. Lyndon LaRouche has recently pointed to China's activity as the critical point of reference for addressing the water challenges of California, Texas, and the Southwest. The United States needs more than a water program, it needs a shift in thinking—the fullest expressions of which are clearest in the implications of China's orientation to the development of space, through their lunar program, and the new perspective provided by such an orientation. In the view of this author, this takes mankind to the highest currently accessible viewpoint for addressing the crisis, *a galactic perspective*.

From this vantage point, we will then examine the options for solving the western water crisis.[2]

1. As well as by his LaRouche Political Action Committee since its formation.

2. This is based on the longer analysis this author developed in 2014.

China Progresses While the USA Stagnates

Over the past two years, Lyndon LaRouche has increasingly emphasized that *the activity of China* is the reference point for understanding how to handle the current water crisis in the western United States. In the recent years, China has started to complete some of the largest and most important water management projects ever developed.

As the Hoover Dam and the Grand Coulee Dam were leading expressions of the great United States economic leap led by Franklin Roosevelt in the 1930s, today China's Three Gorges Dam (on the Yangtze River) stands as an emblem of China's economic surge. The Three Gorges is the largest power production facility in the world,[3] with a capacity of 22.5 GW, well above the Hoover Dam's 2.1 GW and the Grand Coulee's 6.8 GW. In terms of storage capacity, the Three Gorges' 40 km^3 surpasses the 35 km^3 of Hoover and 12 km^3 of Grand Coulee.

And the Three Gorges is just one part of the largest water development program ever undertaken by mankind, currently in process in China. Their South-North Water Transfer river diversion program is in the process of completing two of its three parts, the Eastern and Central routes (with the third, the Western route, still in planning).

Compare these programs to develop and utilize China's Yangtze and Yellow River basins with the earlier projects in the United States to develop the Colorado, Sacramento, and San Joaquin rivers. Five projects (All American Canal, Colorado River Aqueduct, Central Valley Project, California State Water Project, and Central Arizona Project) enabled the diversion of 20 km^3 of water, to the direct benefit of 65 to 80 million people.

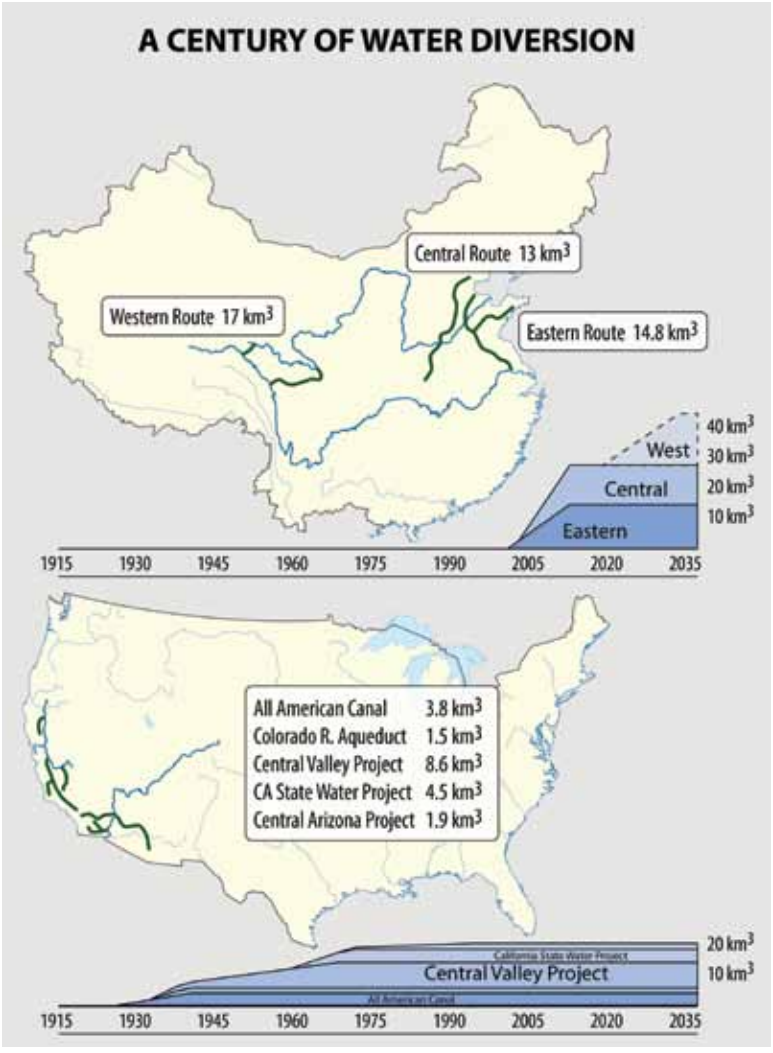
Just the Eastern and Central routes of China's project are expected to divert a greater amount, 27 km^3, directly benefiting somewhere in the range of 400 million people. The planned Western route would bring the total of China's South-North Water program to 45 km^3, over double the five cited projects of the southwestern United States.

The southwestern United States hasn't initiated any new projects of this scale since the 1960s, while China has developed their projects in the recent decades, with much of the work being done in the past ten years (**Figure 1**).

But these projects, themselves, are shadows, expressions of something deeper.

While California, Texas, and other western states are traveling deeper into water crisis, it is not because they have run out of viable options or programs, which could address the western water crisis. In the administration of President John F. Kennedy, plans for the nuclear desalination of seawater were developed, and

FIGURE 1



See "Solve the World Water Crisis," *EIR* Jan. 30, 2015; or this author's contribution to the "EIR special Report: The New Silk Road Becomes the World Land-Bridge," Dec. 1, 2014.

3. Not only the largest hydropower station, but the largest power station of any kind.

more advanced nuclear desalination plans have been created since. In the 1960s, the North American Water and Power Alliance (NAWAPA) was designed and proposed as a plan to divert a fraction of the abundant freshwater of the northwestern regions (Alaska and Canada) down throughout the Southwest—a project which would have ensured the water needs for the entire western region.

So while California is suffering from the national turn away from the future orientation which existed from the 1930s to the 1960s, China is surpassing those achievements of our past. Clearly, the issue is not merely the designs and projects, as such, but the spirit—the commitment to the creation of the future.

As Lyndon LaRouche has emphasized, *this*—a grasp on the creation of the future—is expressed even more clearly in China's space program. Heading towards the completion of their lunar exploration program, China is poised to initiate a development of the Moon, bringing mankind into a new relationship with the Solar System. The potential leading driver is the expressed interest in developing the Moon's helium-3 resources as a fuel for advanced fusion power systems.

While to many this may seem unrelated, this provides the needed vantage point to develop a broader conceptual perspective to better understand deeper and more fundamental aspects of the global water system—insights which may transform how we address the water crisis facing California and the western United States.

Increasing the Physical Productivity Of the North American Water Cycle

The North American continental water cycle can be estimated to be about 3,150 km^3 per year (as measured by freshwater river runoff). Of that, 1,466 km^3 flows out of the northwest, and only 113 km^3 from the southwest. Using measurements and analysis from NASA earth monitoring satellites, the total amount of photosynthetic production can be estimated for these same regions. Comparing these two values allows for a simple, but insightful measure of the productivity of the continental water cycle, and of its respective basins. The figures below are measuring "billions of tonnes of photosynthesis per year" divided by "cubic kilometers of freshwater runoff per year," to measure the productivity as "tonnes of photosynthesis per cubic kilometer of freshwater flow."

North America: 7.4 billion tonnes / 3,150 km^3 = 2.3 million tonnes per km^3

Northwest: 1.5 billion tonnes / 1,466 km^3 = 1 million tonnes per km^3

Southwest: 0.6 billion tonnes / 113 km^3 = 5.5 million tonnes per km^3

High Plains: 1.2 billion tonnes / 251 km^3 = 4.8 million tonnes per km^3

These figures show, in terms of photosynthetic production, the water of the southwest is five and a half times more productive than the water of the northwest. This is a confirmation of what is intuitively clear, there is an excess of freshwater in the northwest, where the cold climate and lack of sunlight limit a more productive use of that water. By these values, a first order estimation of the effect of NAWAPA can be made, by estimating the potential increase in photosynthesis, and the increase in the productivity of the continental water cycle.

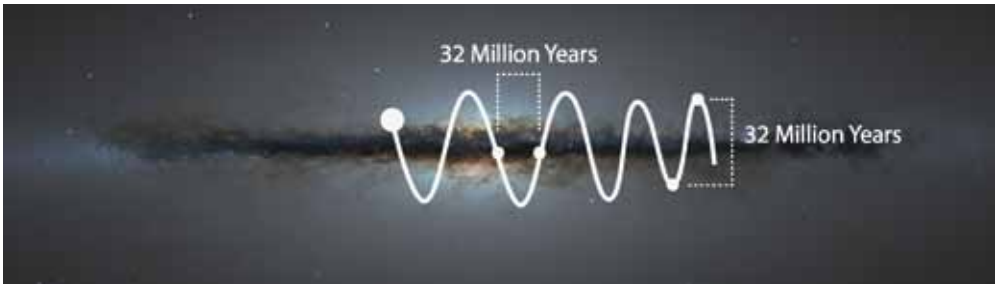
Southwest: 159 km^3 of new freshwater from NAWAPA, at a productivity of 5.5 million tonnes per km^3, could increase the annual photosynthesis of the southwest from 0.6 to 1.5 billion tonnes.
High Plains: 37 km^3 of new freshwater from NAWAPA, at a productivity of 4.8 million tonnes per km^3, could increase the annual photosynthesis of the High Plains from 1.2 to 1.4 billion tonnes.

A Top-Down (Galactic) Perspective

Here we will add some new considerations, allowing us to rethink what we are actually dealing with when we speak of California's water crisis.

It is mankind's mission and obligation on this planet to improve the conditions for life—to develop and improve the planet, by understanding, managing, and improving the systems and processes at play. That is what mankind naturally does, what he must

FIGURE 2
Galactic Motion



continue to do, and the global water system is a critical case in point.

Ultimately the hydrological cycle is a single global system. For mankind, the most fundamental characteristic of this is the evaporation of ocean water, the transport of atmospheric water vapor, the precipitation of atmospheric water over land, and the eventual flow of surface and ground water back into the oceans.[4] This is what provides the vast majority of water resources utilized all over the world. The general challenge mankind has been dealing with for millennia is to manage and improve these cycles.

Starting with the earliest irrigation systems, man better utilized small streams and rivers. This expanded to larger scale systems. Reservoirs and flood control systems were developed. By the early 20th Century, the United States set new standards with the Tennessee Valley Authority and the management and diversion of the Colorado River (along with other impressive projects).

Today, China has responded to the needs created by the past 50 years of economic and technological growth by raising the bar higher with their Three Gorges Dam and their South-North Water project. Tomorrow, to continue this process of natural development, we will need to go to larger (international, continental) systems, like NAWAPA, but, also, we'll need to make a new leap, toward understanding how to better control these cycles (and not just on a larger scale, but from a qualitatively higher level).

This takes us to the cosmic (solar and galactic) perspective, implicitly provided by China's space program.

The Earth, and all its systems (water included), was never an isolated body.

In terms of bulk energy input, the electromagnetic radiation from the Sun drives the entire global water cycle, by pumping the atmosphere full of water vapor via evaporation. Another Solar System process contributes to the circulation of the atmospheric water vapor: the rotation of the Earth.

While these are well-recognized cosmic drivers of climate and the water cycle, growing evidence indicates that another cosmic factor plays a significant role: *the activity of the galaxy.* For example, one of the most recent pieces of evidence comes from a new study indicating that cyclical variations in the Earth's climate correspond to the travels of our Solar System through the galaxy. As our Solar System travels around the Milky Way, it oscillates above and below the plane of the galactic disk, experiencing varying galactic environments as it does so. In this recent study the authors indicate that the Earth's climate appears to fluctuate in correspondence with these galactic travels, in a roughly 32-million-year cycle (**Figure 2**).[5]

Many will ask what such a slow and long-term variation (32 million years) has to do with our immediate water crisis, where California has only one year of water left?

In the most basic sense, understanding this factor means better understanding the fundamental nature of the Earth's climate system, but, even more specifically, this galactic vantage point could be what's needed to enable us to see new solutions for California, Texas, and other water-starved regions.

A leading theory for explaining the interaction between our Solar System's galactic environment and the climate on Earth, points to the role high-energy galactic cosmic rays play in controlling the ionization and electrical properties of the lower atmosphere, factors which appear to affect cloud formation and the con-

4. Obviously there are many other aspects to the global water system, and various sub-cycles as well, but this serves to provide the basic conceptual framework needed here. Again, for more information see this author's contribution to the "EIR special report: The New Silk Road Becomes the World Land-bridge," Dec. 1, 2014.

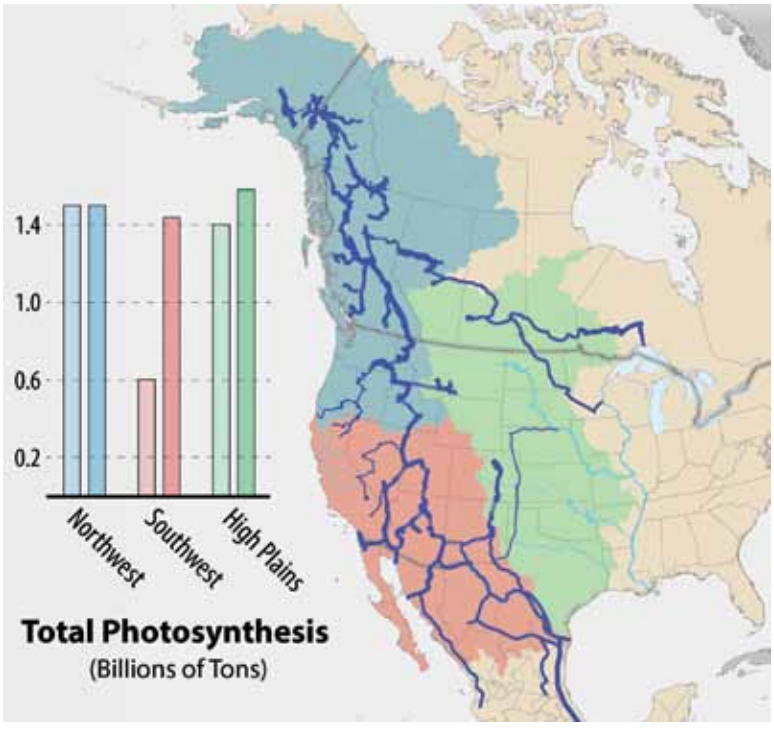
5. "Is the Solar System's Galactic Motion Imprinted in the Phanerozoic Climate?" Nir J. Shaviv, Andreas Prokoph, and Ján Veizer, *Nature Scientific Reports,* August 2014, #6150.

densation of atmospheric water vapor, though the details of these interactions are still being investigated.

If we can learn to better understand the microphysics of these processes, perhaps we could begin to manage and control the atmospheric ionization and electrical conditions affecting cloud formations and precipitation. If adequate control could be developed, this would mean that we would no longer be limited to accessing the water which has already fallen to the ground (on average, about 113,000 cubic kilometers of water precipitates over land each year), because we could begin to tap the much larger amount of atmospheric moisture, including the stores over the oceans (on average, about 413,000 cubic kilometers of water evaporates from the ocean each year, 90% of which simply precipitates back into the ocean without making it to land).

For California, for example, the moist atmosphere above the Pacific Ocean would become the largest reservoir the state has ever seen. This is not mere speculation. As will be discussed and cited below, various systems have already been successful in generating rainfall by tapping into these processes, though more work needs to be done (**Figure 3**).

FIGURE 3



Time for Solutions

Recent analysis of the long-term history of California's hydrological system, further points to the importance of this galactic perspective. The existing hydrological systems and precipitation patterns found in California (and other regions) are not static, but vary and change (over years, decades, and centuries), underscoring the need to look beyond the management of local and regional water supplies, and seek a qualitatively higher level of control over the system.

Based on developing and studying various records of the climate and hydrology of California over the past few thousand years, recent research has shown that the 20th Century did not represent average conditions, but was more of an anomaly.[6] Compared to the past few thousand years, the 20th Century for California was generally wetter and more stable, with earlier centuries regularly experiencing more extreme variations. This included periodic mega-droughts, lasting decades or more, and mega-floods (which have been known to fill the entire Central Valley with water!).

Presently, there is a serious concern that California could be heading into a period of prolonged drought, averaging significantly less precipitation and river flow than the state had become accustomed to throughout the 20th Century.

Cosmic factors (for example, variations in solar activity and galactic cosmic rays) as well as terrestrial factors (for example, cycles in regional ocean temperatures and volcanic activity) all play a role in such climate variations. While ongoing efforts are still trying to determine the varying relative strength of these different effects, the bottom line is clear: California, and the West generally, can't simply rely on local, or even regional water cycles.

With expanding populations and variations in precipitation and water availability, the future of the West depends upon two categories of approach. First, the expansion of regional water management and diversion systems to a continental scale (*Category I*). Second, to

6. "The West Without Water: What Past Floods, Droughts, and Other Climatic Clues Tell Us about Tomorrow," by Lynn Ingram and Frances Malamud-Roam, University of California Press, Feb. 12, 2015.

transcend the management of surface and ground water (that which has already precipitated), by going to the oceans and to the atmosphere to bring new flows and cycles of freshwater onto the land (*Category II*).

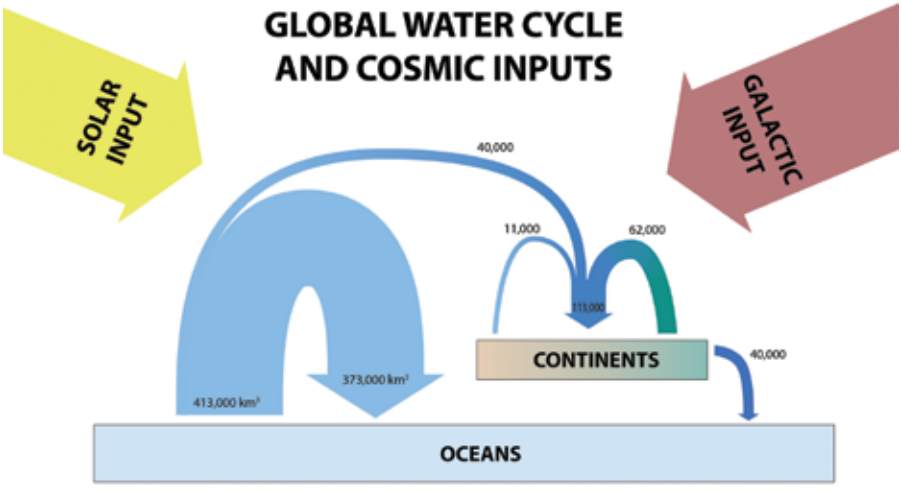
Category I.

Continental Water Management

This publication has extensively presented efforts to revive the NAWAPA project (from the 1980s through today), a grand design to improve the water cycle of the North American continent by directing northwestern water throughout the Southwest. This would ensure stable and adequate water to not only California and Texas, but to the entire elevated regions of the Great Basin as well. The scale of this project is truly impressive, potentially diverting between 130 and 200 km^3 per year (compared with the 45 km^3 per year of the full South-North Water program of China.)[7]

There is a wealth of information available for the NAWAPA project (**Figure 4**).[8]

FIGURE 4



Category II.

A. Desalination

A way to ensure the availability of freshwater for the coastal regions is by purifying ocean water through desalination. This is effectively the creation of new, *man-made water cycles*. The ocean water brought onto land by man-made desalination will participate in various biological and economic processes, before ultimately returning to the ocean (as will all terrestrial water, for the most part). So it is not fundamentally different than what already occurs naturally, but, rather than being subject to the limitations (or variations) of natural cycles, desalination allows mankind to generate and control his own cycles, when and where needed (at least in coastal regions).

Currently, the most efficient (in terms of required energy per unit of freshwater produced) is to pump ocean water through membranes in a reverse osmosis process, though this is considered to be an energy-intensive process.[9]

The key to vastly expanding the use of this capability is to increase the *energy-flux density* of the national economy, as measured as power per capita and power per square kilometer. This can be translated into a lowering of the cost of power, enabling large-scale desalination as a mode of resource development to enter the realm of economically affordable options. To do this today will require the rapid expansion of advanced nuclear power systems, and the greatest potential would come from a crash program for the development of *fusion* power, as LaRouche has called for in his economic policy memorandum for the United States.[10]

7. Although there is a potential to add an major extension to the Western route of China's project, which could add another 200 km^3 per year to the system.

8. See, "Solve the World Water Crisis," *EIR,* Jan. 30, 2015; "NAWAPA XXI," LaRouchePAC Special Report, 2012; and "Nuclear NAWAPA XXI: Gateway to the Fusion Economy," *21st Century Science & Technology* Special Report, 2013.

9. While energy-intensive relative to our current economic stage, it is worth noting that man-made desalination is actually much more efficient than what what occurs naturally. All (or the vast majority) of the freshwater used by life on land has also gone through a desalination process, as the Sun evaporates water from the oceans, creating a flux of fresh (desalinated) water into the atmosphere. Taking the total solar power reaching the Earth's oceans (~60,000 terawatts), and comparing that to the amount of ocean water desalinated by solar power (~413,000 cubic kilometers per year), results in an average efficiency of about 4,700 megajoules per cubic meter. If we only include solar desalinated water which makes it on the land, the average efficiency of the entire system is an order of magnitude less, about 48,000 megajoules per cubic meter. Modern man-made desalination plants are 100 to 1,000 times more efficity, operating at around 10 to 15 megajoules per cubic meter.

10. "The Four New Laws To Save the U.S.A. Now! Not an Option: An Immediate Necessity," by Lyndon H. LaRouche, Jr., June 10, 2014. [[https://larouchepac.com/four-laws]]

B. Ionization-Based Weather Modification

Another avenue exists, one that is less explored, but holds greater potential if successfully developed: *tapping into atmospheric moisture directly*. As stated above, 90% of all the ocean water evaporated by the Sun precipitates back into the oceans, without participating in any productivity activity on land. This precipitation over the ocean is well over three times the amount of total precipitation which occurs over the land.

Since the Sun has already expended a tremendous amount of energy evaporating (desalinating and transporting) this water, the potential exists for this to be a much more efficient resource, *if* we can figure out how to tap into it.

This brings us back to our *galactic perspective* of the global water system. If high-energy galactic cosmic radiation has an important influence on processes of condensation of atmospheric water vapor and cloud formation, through the process of ionization, why can't we generate similar and related actions?

One method has been developed and demonstrated in a number of locations (Mexico, Australia, Israel, Oman, Abu Dhabi, etc.) utilizing ground-based atmospheric ionization systems.[11] These systems require running only a relatively small amount of power through a system of wires connecting a small array of towers, altering the ionization of the local atmosphere. The challenge is tuning the system to provide the correct ionization and electrical effects required to tap into these atmospheric reservoirs.

From what has been demonstrated already, some of these systems can induce condensation and rainfall over a 100 kilometer radius, and, perhaps most important, can utilize a small array of such stations to create pressure gradients which draw more atmospheric moisture inland (from over the ocean).

Perhaps additional methods and technologies (other than ionization) could be developed to enable further control over, and development of these reservoirs of the sky. This would be another method for generating new water cycles, bringing more water on to land, to participate in productive biological and economic activity, before returning to the ocean in a cycle which can be potentially more steady and sustainable than what nature provides alone.

Time To Act

For the cases of California and Texas, desalination and atmospheric ionization should be employed as soon as possible along the relevant coastal regions.

We know nuclear-powered desalination systems can work, and will work the best in the context of a national fusion driver program—raising the energy-flux density of the economy and providing the critical physical economic growth factor needed to get our nation out of the present economic collapse, including the water crisis.

Demonstration and testing of ionization-based weather modification systems can begin almost immediately, as the facilities are generally small and relatively simple to construct. For a few tens of millions of dollars, demonstration facilities could be constructed and utilized to better understand the viability and potential of these systems.

These are the approaches needed to ensure the stable and continual water supply for at least the coastal regions of California and Texas.

Ultimately a continental perspective will likely be required as well, with some variation of the NAWAPA design. This can address the needs of the high-elevation regions of the Great Basin, and the places which may be too far inland for the effects of desalination and ionization to effectively reach.

This brings us back to the opening point. The objective solutions exist; it is the commitment to the future which is lacking. In just the last decade, China has demonstrated that successful actions can be taken, while the United States has effectively done nothing.

Underlying this stark distinction in expressed actions (or inactions) is the deeper issue, the cultural recognition (or lack thereof) of mankind's unique role as a creative force, on the planet, and soon beyond. With this inherent power comes the responsibility, not for maintenance, but for improvement.

Mankind is the only species on this planet which can begin to understand such grand processes as the changing relationship of our Solar System to the Milky Way galaxy, and utilize that understanding to improve the conditions for life here on Earth. It is time we act accordingly.

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11. See "Expanding NAWAPA XXI: Weather Modification To Stop Starvation," *EIR*, Aug. 9, 2013, as well as this author's contribution to the "EIR Special Report: The New Silk Road Becomes the World Land-Bridge," Dec. 1, 2014.