Reviewer's Report

of

"Measuring the Economic Benefits of America's Everglades Restoration"

Prepared by

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INTRODUCTION

The Mather Economics (Mather) report "Measuring the Economic Benefits of America's Everglades Restoration" (Report) attempts to place an economic valuation on Everglades Restoration. The Report concludes that Ground Water Purification represents a net present value (NPV) best estimate of $13.15 billion dollars, which ranks second out of the six ecosystem services evaluated with regard to Comprehensive Everglades Restoration Plan (CERP). Valuation for Ground Water Purification exceeds the initial investment valuation of $11.5 billion estimated for the entire CERP.

The Everglades Restoration Plan. Before discussing the specifics of the Mather Report it may be useful to briefly describe the basic outline of the Restoration Plan that is the basis of the analysis. Mather skips this step and instead jumps directly to one of their central conclusions about the Plan. The Report states "*CERP, if enacted as planned, will restore Everglades sheet flow. Restored sheet flow will, in turn, provide additional fresh surface water and groundwater. Consequently, water available for municipal and private use will be less saline, that is, ground water extracted for use by South Floridians will be less saline and require less electricity to become usable and potable."* (Mather Report, page ii)

There is no disputing that the Restoration Plan will restore Everglades sheet flow, but mostly in Water Conservation Area 3-A and Everglades National Park, not the entire Everglades, and certainly not in a way that will affect urban water supplies in any significant way. However the CERP has many components not related to Everglades sheet flow that will positively affect water resources in other areas. The goal of these components is to restore various environmental features, primarily by the storage of excess water during wet periods to be used to meet environmental objectives in dry periods. Some of these other features could benefit specific utilities in certain areas but eleven years after Congress approved the CERP no benefits to water supply have been achieved, nor are any on the horizon. To the contrary, requirements in the Congressional Authorization for the CERP led the Water Management District to change its rules to prevent utilities in southeast Florida from increasing their pumpage from the surficial aquifer. This has resulted in many utilities experiencing significant negative economic consequences related to the CERP rather than the immense economic benefits the Mather Report suggests.

Ground Water Purification. As described in the Report the Restoration Plan will provide Ground Water Purification based on the assumption that the Plan will provide less saline surface water and groundwater for municipal and private use over the entire geographic area of the South Florida Water Management District. The logic is that the use of less saline water would result in cost savings, as less energy is required to remove salts from low salinity compared to high salinity source water. A fundamental assumption inherent in the evaluation is that surface water and shallow groundwater used for water supply in South Florida has become increasingly saline over time, to the extent that desalination will be required unless the implied benefits of Restoration are realized. As an example, the Report states on page iv that "Groundwater in the coastal counties of the South Florida Water

Management District (SFWMD) is growing increasingly brackish. It will have to be desalinated before most uses".

The Report's basic assumption that surface water and shallow groundwater used for water supply has experienced increasing salinity trends over the past few decades is not supported when the appropriate data are used. Detailed review of individual data locations from the SFWMD DBHYDRO database, upon which the Report relied to develop the apparent increasing salinity trend, indicates that approximately 90% of the data points used by Mather are not relevant to potential water supply benefits of Restoration. Evaluation of the remaining potentially relevant DBHYDRO data points reveals no discernible increase in salinity over time.

In addition to the fundamental flaw regarding the assumed salinity increase, the overall approach to the data assessment and interpretation reflects a general lack of understanding of the hydrogeologic conditions and actual water supply usage throughout the SFWMD. For example, the assumption that any sample collected from a depth less than 500 feet would apply to potential Restoration benefits is simply untrue. Throughout the southwest portion of the SFWMD, multiple aquifers exist within this depth range that are exploited extensively for water supply; however, they are hydraulically isolated from the shallow-most aquifer, which itself may be unrelated to potential water supply benefits from Restoration projects. Many of the sites included in the DBHYDRO, and also the USGS NWIS database, apply to these deeper aquifers.

DBHYDRO DATA UTILIZED IN THE MATHER REPORT

Salinity data (represented as aqueous chloride concentrations) from the SFWMD DBHYDRO database are presented in the right panel of Figure 1, taken from the Mather Report. The subject Figure provides the average values by year based on a total of 6,205 individual samples. The data as plotted suggest a trend indicating an overall increase in chloride concentrations, from values in the range of 100 to 200 milligrams per liter (mg/L) throughout the 70s, 80s and 90s, to concentrations in excess of several thousand mg/L during the 21st century.

Presented in Figure 2 of this report are the more than 1,000 locations for the 6,205 DBHYDRO samples used to develop the apparent increasing salinity trend as described in the Mather Report. It is obvious from even a cursory glance at the sample locations that most of the sample sites have no relevance to potential water supply projects associated with the Restoration. This would include the 400+ sample sites located north of Lake Okeechobee and the C-44 and C-43 Canals, which occur in Orange, Osceola, Polk, Highlands, St. Lucie, Martin, Highlands, Charlotte, Glades, and Okeechobee Counties. While some restoration projects are planned for these counties, none is designed to affect groundwater in a way that would have any bearing on urban water supply in those areas.

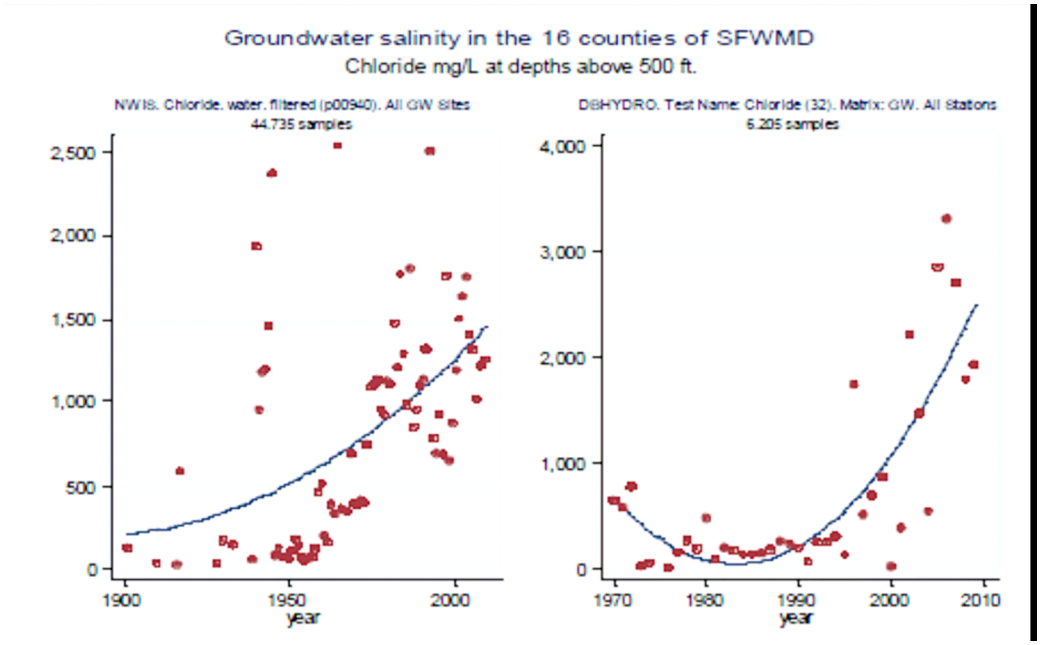

Figure 1. Figure provided in the Mather Report purporting to show an increasing trend in chloride concentration in the shallow aquifer system.

Detailed review of the 1,060 DBHYDRO sample locations depicted in left panel of Figure 2 reveal that a majority of the sites located south of Lake Okeechobee and the C-44/C-43 canals are also not relevant to the evaluation of water supply as it may pertain to the Restoration. Sites rejected as irrelevant include the following:

- Sites monitoring conditions beneath the Surficial Aquifer System (SAS), which include the Sandstone Aquifer, Hawthorn Aquifer, and Floridan Aquifer;
- Sites related to evaluation of surface water and/or extremely shallow groundwater, such as those pertaining to Stormwater Treatment Areas (STAs), Everglades Nutrient Removal (ENR) Projects, C-111 Project, and the Mercury Flux Study;
- Coastal sites located within or adjacent to saline water, such as tidally influenced sites or ones known to be saline originally.

The right panel of Figure 2 presents sample locations from the DBHYDRO database identified as "potentially relevant" to water supply benefits of Restoration. It depicts 161 sites, for which 706 individual chloride samples are reported. Figure 3 illustrates chloride concentrations versus time for the sample locations presented in Figure 2. All 706 individual data points are presented in Figure 3, along with the average value for each year. With the reduced data set compared to the Report, no data are available for 1982, 1997, 1999-2003, and 2005; only one sample is available for 1996 and 2004.

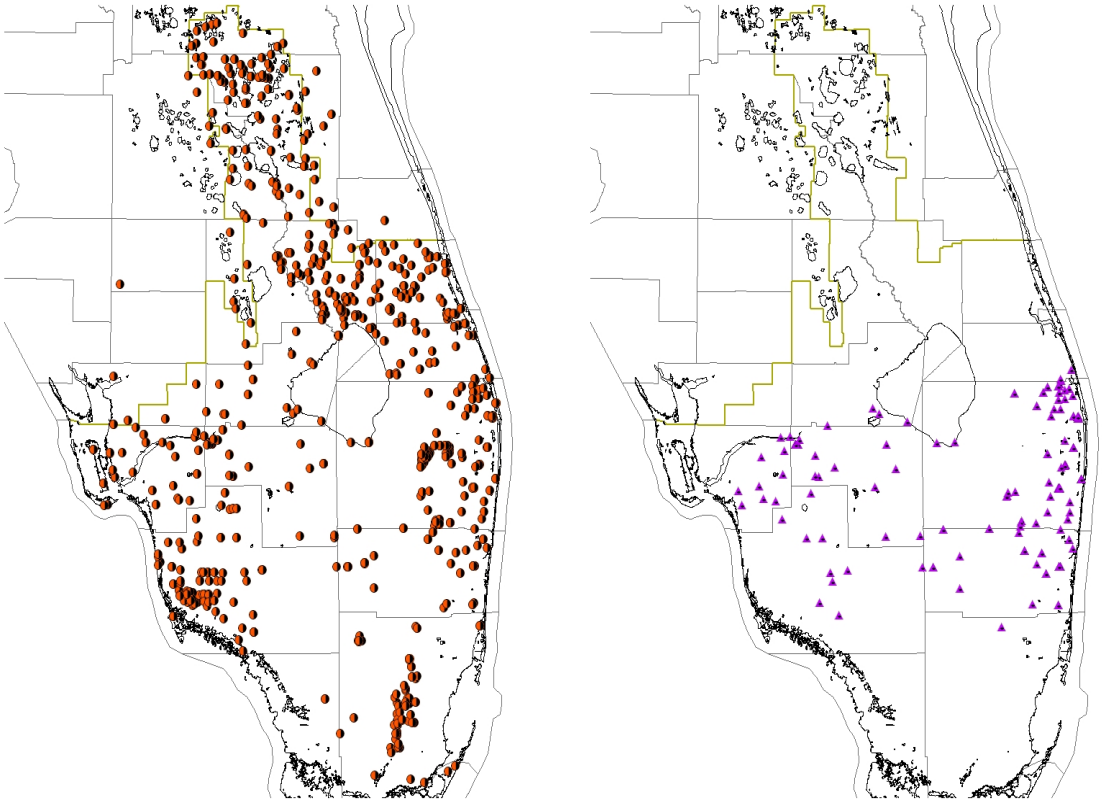

Figure 2. (left) Mather Report DataLocations: 1060 Sites, 6205 individual samples. (right) Potentially relevant data locations: 161 sites, 706 samples

Chloride versus time data presented in Figure 3 do not show evidence of a trend of increasing salinity for potentially relevant sample locations from the DBHYDRO database. In fact, there appears to be a *decrease* in average chloride concentrations in the most recent years compared to earlier periods. Of the 706 samples represented in Figure 3, less than 4% (28 samples) involve chloride concentrations greater than 250 mg/L, which corresponds to "saline" water according to criteria applied by SFWMD for Consumptive Use Permitting. Most of the samples that could be considered saline are from locations where there exists "connate" water, i.e. residual seawater resulting from periods of higher sea level that occurred during the Pleistocene Epoch compared to present day. Water from these areas is not used for urban water supply presently nor is such use contemplated in the future.

In conclusion, potentially relevant DBHYDRO data sites provide no evidence of increasing salinity in groundwater throughout South Florida. Consequently, the basic premise on which the estimated $13.15 billion economic value for Ground Water Purification resulting from Restoration is incorrect. This suggests that the high valuation developed for Ground Water Purification associated with Everglades Restoration is not valid as described in the Mather Report.

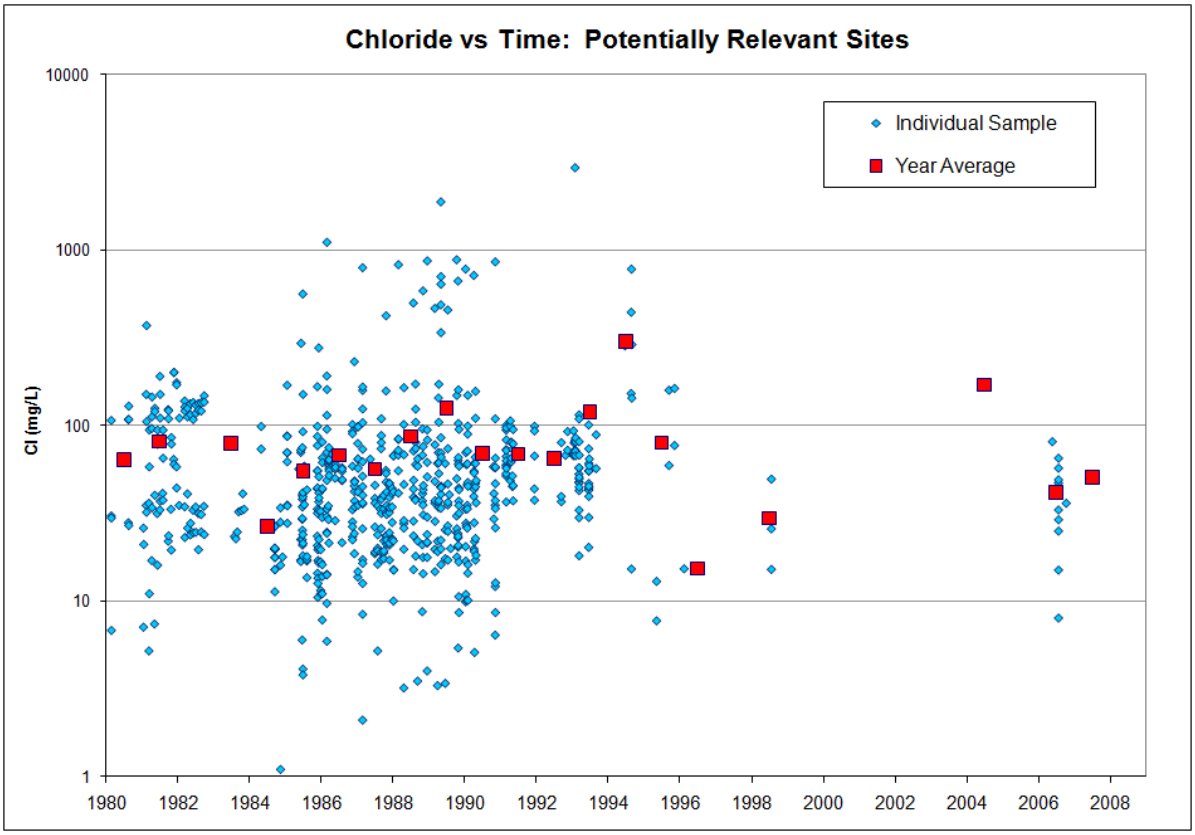

Figure 3. Plot of the chloride concentrations versus time for sites that may be relevant to the Everglades Restoration Plan.

OTHER COMMENTS

A Specific Example. There is a relatively high density of "potentially relevant" sample sites located in northeast Palm Beach, in the vicinity of Town of Jupiter and Seacoast Utilities Authority. These two utilities currently are authorized to withdraw approximately 44 million gallons per day (MGD) from the Surficial Aquifer System (SAS). Long term (many decades) monitoring of SAS groundwater by these utilities has shown no evidence of increasing salinity such that desalination treatment would be needed. However, various Restoration projects evaluated throughout past decades have projected additional aquifer recharge to SAS wellfields operated by these utilities. Both utilities have for the most part given up on receiving any of this water and their respective Consumptive Use Permits have not accounted for such deliveries when issuing an allocation from the SAS. This is the case despite the fact that the utilities have invested millions of dollars in infrastructure development, already in place, to receive deliveries for aquifer recharge when theoretically made available from the Restoration. This case is noteworthy because it reflects the experience many utilities in southeast Florida have had with respect to Restoration projects. The costs to utilities, which can be very significant, are often incurred early in the process and the benefits come much later or never come at all.

Other Saline Water. Surface saline water referenced in Table 1.1 of the Report, which includes more than 3.75 billion gallons per day (2005) represents withdrawals for "Thermoelectric once-through", according to the excel file downloaded from the USGS website cited in the Mather Report. Such withdrawals have no relevance to potential desalination related to municipal or private water use.

Misconceptions About Utilities. Overall, the Report suggests an absence of even the most basic understanding by the authors of how South Florida utilities actually operate, including what are the main drivers of treatment processes for water quality requirements (e.g. nanofiltration to address high organics to meet new FDEP requirements; Low Pressure Reverse Osmosis (LPRO) systems to treat brackish water from the Floridan Aquifer). Furthermore, the utilities, with vigilant monitoring by the SFWMD, are well aware of potential salinity increases within the SAS in coastal regions. Under no circumstances would a utility be allowed to, or even seek to, increase pumpage in a way that would increase the salinity of their groundwater source. The Mather Report, on the other hand, implies that utilities will do exactly that. That just won't happen.

ABOUT THE AUTHOR

Paul M Stout, Ph.D., P.G. Dr. Stout is a Principal Hydrogeologist and co-founder in 2003 of JLA Geosciences, Inc., a firm specializing in water resources. Clients include many of the largest water supply utilities operating throughout South Florida. He has more than 25 years professional experience working in academia, government, and private consulting. His expertise includes hydrogeologic investigations, groundwater and geochemical modeling, and water use permitting. He was principal author of a Groundwater Data Strategic Plan Document prepared for SFWMD. The study evaluated practices involved with monitoring, processing and archiving groundwater data. In preparing the report for SFWMD, interviews were conducted with SFWMD staff, staff from other Florida Water Management Districts, and the USGS. The study evaluated past and current practices associated with the SFWMD DBHYDRO and USGS NWIS databases, and provided recommendations and approaches to improve data-handling practices.

Dr. Stout received his A.B. with High Honors in Geology from Colgate University, a M.S. in Geology from Duke University, and a Ph.D. in Earth Sciences from the Scripps Institution of Oceanography, University of California, San Diego.