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**The Evaluation of Salt Front Advancement in the Hudson River Due to Climate Change and Action Plan to Prevent Salt from Entering the Drinking Water**

***Joint Legislative Public Hearing SFY Executive Budget Proposal:  
Environment Conservation***

Thank you to the chairs and members of the Senate and Assembly committees for considering our request for a budget allocation to evaluate salt front advancement in the Hudson River due to climate change and develop a pro-active action plan over the next 3 ½ years. The evaluation of the salt front will determine the location of the salt front and the number of days they will affect drinking water intakes over the next 50 years. The action plan will provide pro-active recommendations to include detailed projects, schedules, and costs to prevent salt from entering drinking water intakes or removing salt from the drinking water. The project is critical to approximately 10 million people in New York State.

**Background**

Riverkeeper and the Hudson River Drinking Water Intermunicipal Council (Hudson 7) recommend that \$400,000 be allocated to evaluate the salt front advancement in the Hudson River due to climate change. The evaluation should include probabilistic prediction of salt front location from 2025 until 2075 at a budget cost of \$250,000 and a pro-active action plan to maintain drinking water quality for the five water treatment plants and New York City Chelsea Pumping Station at a budget cost of \$150,000.

The five treatment plants are located in Ulster and Dutchess County between the Kingston - Rhinecliff Bridge and the Mid-Hudson Bridges. These five plants provide drinking to the Hudson 7. The members include:

- City of Poughkeepsie
- Town of Poughkeepsie
- Town of Esopus
- Town of Llyod
- Village of Rhinebeck
- Town of Rhinebeck
- Town of Hyde Park

Hudson 7 provides safe drinking water to 106,000 residents, three hospitals, three colleges, and major regional employers for human consumption, firefighting, industry, and more. Water is also distributed to residential and commercial properties in the Town of East Fishkill via the Central Dutchess Water Transmission Line.

The City's Chelsea Pumping Station can provide 100 million gallons per day (MGD) during droughts to the City's water system, which serves 9.5 million people in the City and upstate

municipalities. The pumping station is located in the Town of Fishkill and is approximately 12 miles downstream of the Poughkeepsie's intakes.

In the Hudson River, the salt front is where the chloride reaches 100 mg/L, far less than 19,000 mg/L in saltwater. The Department of Health recommends sodium concentrations of less than 20 mg/L for very low sodium diets and 270 mg/L for moderately restricted diets. Poughkeepsie and the City's Chelsea Pumping Station have already exceeded the Department of Health (DOH) recommended standards for people with low sodium diets during low river flows.

According to the National Oceanic and Atmospheric Administration (NOAA), sea level could rise by two feet by 2045 and six and a half feet by 2100. Water utilities on the Delaware and Savannah Rivers have already performed these evaluations to keep their water supplies safe. For the Delaware River, the Delaware River Basin Commission (DRBC) has determined that if the sea level rises 3 feet, the salt front will move 28 miles upstream. If this happens in the Hudson River, all five water treatment plants operated by Hudson 7 would have salinity problems by 2045, which is less than 25 years away. Therefore, planning should start immediately.

According to the Department of Environmental Conservation (DEC), in "The State of the Hudson River":

"Drought tends to allow water with higher salinity to move north in the Hudson. Most aquatic organisms have limited tolerance to wide or rapidly changing ranges of salt content. The impacts of climate change on sea level, rainfall, and snow melts may affect the position of the salt front. Understanding the impacts of climate change on salinity will have important implications for people and ecosystems."

## **Funding and Contracting**

We suggest that the DEC directly authorize USGS to probabilistically predict the salt front location from 2025 to 2075 under an existing contract. USGS has the expertise to perform this evaluation. USGS has been collecting salinity data for the Hudson River since at least 1991, has been collecting stream and river flow data since the turn of the 20<sup>th</sup> century, has developed models for the Hudson River, and conducted the study for the Delaware River for Army Corp of Engineers and DRBC.

To determine the actions required to maintain drinking water quality for the five water treatment plants and New York City Chelsea Pumping Station, a qualified consulting engineer with water source and reverse osmosis experience should perform the work. The cost of this study is estimated at approximately \$150,000.

## Scope of Work

The following scope of work for probabilistic prediction of the salt front location (Phase 1) should include the following:

1. Determine the annual river flow for the period 2025 to 2075 based on the river flow for the past ten years, the drought of the 1960s, and climate change effects.
2. Determine sea level rise for the Hudson River based on the most recent data from NOAA.
3. Develop a 3-Dimensional Hydrodynamic Model of the Hudson River to predict the location of the salt front.
4. For every five-year increment, determine the number of days per year (plus statistical uncertainty) the salt front reaches each water treatment plant's intake and the City's Chelsea Pumping Station and salinity concentrations for a maximum year, an average year, and a drought year river flows. For example, there will be a 90% chance that the sodium concentration will exceed 20 mg/L for X days.
5. Prepare a draft report for peer review. Revised the draft report based on agreed-upon comments and to submit a final report for publication.

Phase 1 will cost approximately \$250,000 and take about two years to complete.

The work for a pro-active action plan to maintain drinking water quality for the five water treatment plants and New York City Chelsea Pumping Station (Phase 2) should be performed after the completion of the salt front location evaluation and should include the following tasks:

1. Evaluate the following alternatives:
  - a. Storing more water in upstream reservoirs and releasing higher amounts during droughts
  - b. Obtaining water from other sources such as other water utilities, new intakes upstream of the salt front, and groundwater wells
  - c. Installing desalination equipment such as reverse osmosis at the existing water treatment plants or point of filters in homes
  - d. Mixing high salinity water with low salinity water to be below the recommended standards.
2. Perform cost-benefit analysis for promising alternatives for each intake. This analysis should consider the following:
  - a. Number of days when the alternative must be used
  - b. The life-cycle costs for the next 20 years
  - c. Non-cost benefits of each alternative
  - d. Using the life-cycle costs and benefits determine which alternative for each intake provides the most benefits for the lowest cost
  - e. Develop a proactive action plan with recommendations detailing the projects necessary, schedules to implement the programs, capital costs, and operations and maintenance costs.
3. Prepare a draft report with an action plan for peer review. Revised the draft report based on agreed-upon comments and submit a final report for publication.

Phase 2 will cost approximately \$150,000 and take about 18 months to complete.

## **Conclusion**

This critical project should be implemented as soon as possible since Poughkeepsie and the City's Chelsea Pumping Station have already experienced unacceptable salinity concentrations. Also, to conduct studies, designs and construction may take 20-25 years, at which time all the intakes could be affected. The allocation of the estimated \$400,00 over the next 3 ½ years will be an excellent first step to ensure persons in the Hudson Valley and New York City are provided with safe drinking water.