

Report for 2003RI15B: A Preliminary Web Portal for RI Water Resources

There are no reported publications resulting from this project.

Report Follows

INTRODUCTION

"When the well's dry, we know the worth of water."- Ben Franklin

Although southern New England is not commonly considered a region in which water abundance (as distinct from water quality) is a problem, the record from the previous few years suggests that water abundance is indeed an issue about which RI citizens need to be informed. This was exemplified during the most recent draught (2002), when water levels in New England's reservoirs reached historic lows and citizens were asked to restrict water use to only the most urgent applications (e.g. WRB 2002). Our project was a response to this situation. The purpose of the project was to a) construct a widely available and easily comprehensible website documenting water abundance in RI; and b) present current and historical data pertaining to the Scituate Reservoir and its water levels. The goal was to provide a pilot website that eventually will afford a comprehensive, accurate, lucid, and real-time presentation of Rhode Island's water resources.

Although it is relatively easy to find water-related websites in the State of Rhode Island, no comprehensive, real-time, easily understood treatment of water level issues in Rhode Island exists. Providence Water (www.provwater.com) provides regular press releases qualitatively describing the abundance of water in Rhode Island. Details – if provided – pertain only to conditions in the Scituate Reservoir. The US Geological Survey (water.usgs.gov/cgi-bin/daily) maintains a web site that shows maps of “real-time streamflow” data presented in a historical context. NOAA (www.noaa.gov) provides climatological data such as rainfall, temperature, drought indices, and other climatic variables. The State of Rhode Island Water Resources Board (www.wrb.state.ri.us) provides a broad range of data, web links, and press releases dealing with water-related issues.

But none of the agencies and sites listed above provides a comprehensive, easily understood, real-time treatment of water levels in key RI reservoirs and aquifers. Because the Scituate Reservoir is perhaps the most important (and visible) public water source in the state of Rhode Island, we have chosen to focus attention on it for this preliminary study. We have compiled a multi-year graphic record of water levels in the Scituate Reservoir, and have associated fluxes in these levels with climatic events and relevant historical data (e.g., average water levels in previous years). Examples of these records are incorporated into the body of this report.

Public education and awareness are crucial aspects of drought management. Sometimes, random drought messages through the news media can cause alarm regarding the integrity of supply or the safety of drinking water. A concerted education and outreach program is essential to provide information when wells go dry, or to inform the public and major users of ways to conserve or find alternate sources of water. The web site was designed to provide meaningful information to a wide range of constituents, including students; all of whom, as a result of the web-site, will be in a better position to understand water-use policies.

METHODS

A project website was created using the Dreamweaver MX software package by Macromedia Inc. (licensed to PI). The website was uploaded to the Department of Geosciences webserver (Dell PowerEdge 6400) and was titled “RI Drinking Water Supply Data Base”. The webserver is secured from unauthorized access by various safety measures (including a firewall and password access protection). The server and the website are remotely accessible to the PI, allowing for frequent updates and additions of data. The website can be accessed via <http://ri-water.geo.uri.edu/scituate.asp> . It was embedded into an existing “Environmental Restoration” website, which provides links to other water related projects of the Geosciences department.

Scituate water level data were collected by the Providence Water Supply Board (PWRB) using fully automated procedures. The data consisted of four readings per day (every six hours) and include, in addition to Scituate Reservoir water levels, PWRB drinking water plant influent, water consumption by 11 water suppliers served by PWRB, and water levels in 5 water storage facilities are recorded. The data set is delivered by email to the PI at 7 AM every morning. Table 1 shows an example of the daily transmitted data set. Because of security concerns, it was decided not to publicize any of the additional daily data.

| | | | | | | | | | | | | | | | | | | |
|---|-------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-----------|---------|---------|---------|---------|---------|---------|
| From: root <root@provwater.com> Date: Wed, 19 May 2004 07:10:00 -0400 To: boving@uri.edu | | | | | | | | | | | | | | | | | | |
| 05/18/04 | 13:00 | 285.057 | 69.1417 | 480.658 | 393.631 | 303.78 | 12.697 | 227.949 | 225.499 | 9.26518 | 1.24969 | 2.28791 | 3.3138 | 4.72344 | 6.96557 | 6.88278 | 4.85958 | 8.15824 |
| 05/18/04 | 19:00 | 285.057 | 83.5459 | 483.33 | 396.523 | 302.938 | 12.598 | 226.943 | 224.598 | 9.36466 | 1.25306 | 2.40513 | 3.27106 | 4.38828 | 6.63736 | 9.55678 | 4.11722 | 8.57436 |
| 05/19/04 | 01:00 | 285.028 | 86.2091 | 482.377 | 395.497 | 303.121 | 12.2964 | 227.946 | 224.598 | 8.76713 | 0 | 0.0318018 | 0 | 3.43773 | 2.23297 | 2.97436 | 3.7265 | 5.96044 |
| 05/19/04 | 07:00 | 285.057 | 86.7664 | 481.249 | 393.241 | 304.879 | 12.796 | 229.448 | 225.8 | 9.16408 | 0 | 2.48425 | 3.33578 | 3.95971 | 6.82784 | 8.6337 | 4.1514 | 9.19853 |

Figure 1: Example of the daily updated Scituate Reservoir levels automatically recorded by the PWRB every six hours (first three columns). All other columns show water fluxes to the main PRWB customers, elevations in local water storage facilities, and PRWB drinking water plant influent.

RESULTS

The “RI Drinking Water Supply Data Base” website was designed to adhere to latest industry standards, as well as for ease-of-use. All descriptions and explanations were kept short and scientific jargon was minimized. The material presented is understandable by users Grade 7 and higher, an important consideration since it was our intent that this resource be available to and useful for secondary-school students.. The website relies heavily on visualization (e.g. a graph of the current Sciutuate Reservoir level can be uploaded by simply clicking on a thumb-nail picture). Resolution and graph size were kept at moderate levels for minimal download times. This was deemed necessary to serve those citizens that do not have access to high-speed internet connections. The website also provides links to key water-supply resources, such as the Providence Water Supply Board (PWSB), the Rhode Island Water Resources Board (WRB) and the Rhode Island Water Resources Center websites. The WRB in particular provides additional information about the status of Rhode Island’s water resources. For example, the WRB issues a *Draught Advisory*, *Watch*, *Warning*, and *Emergency* (in order of increasing draught severeness) if warranted.

The central parts of the project website are a description of the data flow and the graphic representation of the water level and water consumption data. The following paragraph is an excerpt from the website.

“The Scituate Reservoir, located about 15 miles west of Providence, RI, serves most of Rhode Island’s population with drinking water. Water storage in the main Scituate reservoir began in 1925 and a nearby treatment plant went in operation in 1926. Since then, the water level in the reservoir has been constantly monitored. In recent years, the Scituate Reservoir was equipped with modern computer based recording equipment to monitor reservoir water level and treatment plant influent. The digital records are collected by the Providence Water Supply Board (PWBS), which operates the Scituate Reservoir. PWBS then forwards water level and plant influent data automatically to Dr. Boving’s data base where the data stream is converted into graphs for immediate display on this website.”

Figure 2 shows an example of the water data as displayed on the project website. The graph was generated from daily data sets supplied automatically via email by PWBS. All incoming data were retrieved over a T-1 line. At URI-GEO the incoming data converted into a common data format (ASCII comma delimited format). Incoming data was stored on a PC (Dell Dimension 8200) and backed up on an external hard-drive (Maxtor 120 GB) on a weekly basis. Raw data are loaded into MS-EXCEL (the statewide standard).

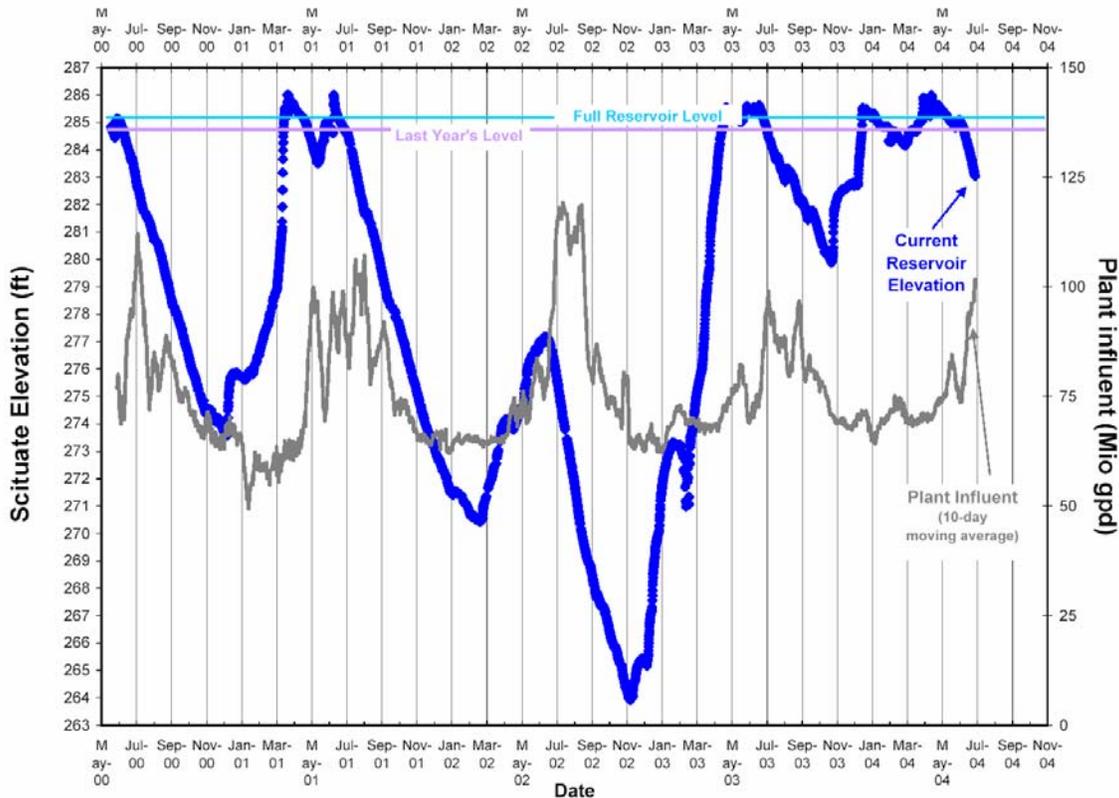


Figure 2. Water levels in the Scituate Reservoir, 05/01/00 – 06/30/04. Diamond line represents approximately 5700 data points taken at a rate of 4/day. Solid line represents a 10-day moving average of plant influent. Also indicated are last year’s reservoir level and the Scituate Reservoir overflow elevation (285 ft above sea level).

In the future, an upgrade to an ORACLE database system may become necessary as the amount of data generated approaches the capacity of EXCEL. Within the MS-EXCEL environment, data are organized by: data source, date and time of collection, sampling location, sample value, and comments. Besides calculating delta-values (=changes), the data are continuously added to graphs and tables. EXCEL graphs were converted into Adobe Acrobat files (pdf format). The graphs show, for example, daily water table fluctuations at a given measurement point. The 10-day moving average of the plant influent was calculated and graphed together with the daily water-level data. Currently, the raw data cannot not be downloaded from the website.

We have had preliminary success with a pilot system (Java script) that automatically extracts data from incoming PWRB email (see Figure 1) and converts it into an EXCEL graph. Currently, problems remain with linking the graph to the server. The ultimate goal is to automatically update the website in near real-time and to include data from as many reliable sources as possible. It is expected that a network will evolve and develop over a period of years, as additional monitoring, quality control, and data exchange systems are implemented and as hydrological modeling is incorporated. Our project is ongoing, and will continue even after the end of the current funding period.

ACKNOWLEDGEMENTS

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REFERENCES

State of Rhode Island Water Resources Board (WRB) – Press releases on 01/17/2002 and 10/02/02.