

Providing Water Quality Data for Research, Decision-Making, and Education

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Abstract:

The Houston-Galveston Area Council of Governments (H-GAC) has developed a water quality clearinghouse with data collected throughout the Gulf Coast Planning Region. The clearinghouse is distributed through H-GAC's website, where users of all levels can access data.

H-GAC compiles data from five different local government agencies under a regional Quality Assurance Project Plan as well as from the Texas Natural Resource Conservation Commission (TNRCC) for the database. Data received from each local agency are formatted to TNRCC specifications and quality assured. A portion of this data is then sent to TNRCC for inclusion in the state Surface Water Quality Monitoring database.

Collectively, there are over 40 parameters monitored at over 350 stations throughout the 13-county region. Through the Internet, users can interactively map stations based on their area of interest and view information associated with each station. The user can then go to the water quality database and retrieve data. The database contains field and conventional parameters, bacteriological, metals, and Quality Assurance data. Users may view the data by parameter, station, or TNRCC-designated segment, interactively graph data for a user-defined time period, or download a set of data directly.

The website also contains general water quality information, state water quality standards, and explanations of what each parameter indicates about the health of the waterbody.

H-GAC

The Houston-Galveston Area Council of Governments (H-GAC) is a voluntary organization of 148 local governments within the 13-county Gulf Coast Planning Region, an area of over 12,500 square miles with 4.3 million people.

The Environmental Planning Program is involved in disaster mitigation planning and implementation projects, habitat protection and management studies, as well as solid waste regional planning and public education. The department also works with the Galveston Bay Estuary Program in the development of a web-based environmental data clearinghouse. Water quality programs within the Community and Environmental Planning Department include the Regional Water Quality Management Plan (CWA 604 Program), Alternative On-Site Wastewater Initiatives (CWA 319 Nonpoint Source Program), and the Texas Clean Rivers Program.

H-GAC's Role in the Texas Clean Rivers Program

H-GAC is the lead organization for the regional Texas Clean Rivers Program, overseeing water quality activities within the following drainage basins:

- San Jacinto River Basin
- Trinity-San Jacinto Coastal Basin
- San Jacinto-Brazos Coastal Basin
- Brazos-Colorado Coastal Basin

In addition to coordinating regional monitoring and serving as a data clearinghouse for regional water quality data, H-GAC coordinates special projects both by region and by subwatershed. H-GAC also heads a major public outreach campaign in the region. Included in this campaign is the Texas Watch Volunteer Water Quality Monitoring Program. H-GAC has also begun a new effort to incorporate actual data into public outreach materials and programs. The data collected from all the various aspects of the Clean Rivers Program are located on H-GAC's website and are integrated to be a practical information source as well as an educational tool.

The focus of this paper will be on the water quality data aspect of the program and how that data is used for analysis as well as for an educational tool for the general public. The topic emphasized in this paper will be the Regional Data Clearinghouse and Water Quality pages of H-GAC's website. How data is integrated into special projects and public outreach programs is covered as well.

Various Audiences for the Data Clearinghouse

The water quality clearinghouse is intended to be useful to water quality professionals interested in doing specific data analysis as well as those interested in learning more about water quality, specifically in the H-GAC region. The interface is interactive and allows the user to query data for a region or to download entire databases by drainage basin.

Potential Audiences for the Data Clearinghouse

- Citizens
- Students (Upper high school and college levels)
- Research scientists
- Local government associations
- Public sector/utilities

- Private/nonprofit organizations
- Federal and state agencies
- Environmental consulting firms

Uses of the Data

- Supplemental or stand-alone information for special studies
 - Reduce sampling costs by placing stations in areas not covered by H-GAC data
- University studies
- TMDL studies
- “Before and After” Studies (site specific)
- Education about local environments and local watersheds (fluctuation of variables’ values with seasons, for example, understanding inputs and resulting water quality parameter values)
- Trend Analysis (regional and local/site specific)
- Incorporation into water quality models

Different Sections for Different Levels of Users/Technical Information and Educational Information

With such a wide variety of audiences, the website must contain information that is not too technical for the layman and not too simplistic for environmental professionals.

One of the major goals with the website is to give the user a comprehensive overview of watershed and water quality dynamics by introducing concepts and providing actual data. For users new to environmental concepts, the data will be more than just numbers. Extensive educational resources provide a basis for understanding what the numbers mean and what they indicate about the health of waterbodies in the Houston-Galveston region. The website contains information such as state standards in an effort to allow the user to examine how local waterbodies stand against criteria. Other types of environmental data are also readily available to allow users to obtain other valuable sources of information without having to go and search the web for other types of quality-assured data.

An outline of the Clean Rivers portion of the website is provided below.

- I. Clean Rivers Program Overview
 - Water Quality forms for local agency data submittals and station information
 - Basin Highlights Report
 - Regional Water Quality Data Analyses
- II. Monitoring Stations Tables
 - Basin
 - Agency
 - Station Description
- III. Special Studies
 - Current Projects
 - Summary
 - Status
 - Completed Projects
 - Summary
 - Data
 - Conclusions
- IV. Data Clearinghouse
 - Information
 - Data Quality Objectives

- Data Status
 - Interactive Monitoring Location Maps
 - Query monitoring station locations
 - Search by monitoring agency, watershed, zip code, or parameter
 - View Station Information
 - Interactive Regional Water Quality Data Query
 - Statistics of station and parameters available
 - Graph selected data
 - Convert selected data to raw data to import to other programs
 - Link to map of station
 - Link to water quality education pages
 - Raw Data/MS Access database of water quality data by basin
 - Table Descriptions
 - Regional geographic data
- V. Watershed and Water Quality Information
- Locate local watersheds
 - Watershed Dynamics
 - Geographic Effects on Water Quality
 - Climate
 - Geology
 - Soil Type and Vegetation
 - Land Use
 - Agricultural
 - Industry
 - Urban
 - Barren
 - Water Quality Parameter Descriptions
 - Ranges of Water Quality Parameters
 - Sources of Pollution
 - Texas State water quality standards by segment
 - Regional pollution complaint contact information
 - Additional Information
 - Local government home pages
 - Other sources and types of data
 - Educational information and materials
 - Technical documents
 - Local environmental organizations and involvement opportunities
 - Email questions to an H-GAC representative

The general water quality information is available for those who are interested in learning more about water quality and watershed characteristics. Instead of giving information based solely on parameters and numbers, the website introduces other concepts and issues relating to and affecting water quality to the users. Some of these concepts include how climate affects water quality, how land use affects water quality, as well as definitions and examples of sources of pollution. These sections will assist users in understanding why the parameter values are at a certain level as well as in determining potential reasons why a parameter for a stream fluctuates throughout the year. Also, users may be able to generate a hypothesis of why a particular measurement is out of the normal, historical range.

The actual information for these sections came from a variety of sources, including H-GAC, United States Geological Survey (USGS), Texas Natural Resource Conservation Commission (TNRCC), and individual/private organization websites. A search of water quality sites was performed and a list of suitable sites for different levels was produced and made available through either direct links from a subject (ex. The water quality data descriptions are linked to a USGS site with excellent definitions and explanations.) or through the “Additional

Information” section under the “Educational” heading. This format allows users to find a number of perspectives and explanations for these complicated issues.

Once users are comfortable with their understanding of general water quality parameters and what the values of those parameters indicate about the health of the waterbody, they can move on to querying station locations and data. If users prefer to look at summary data on a TNRCC segment basis, a report is available in PDF format to download. In addition, special study summaries and results are available for review on the website.

For users wishing to do their own special studies, statistical analysis, or a review of independent values associated with a particular station or segment, the interactive application for mapping monitoring stations is an excellent source of monitoring location information for the region. Users can view stations by agency, watershed, zip code, or parameter and are able to zoom in and zoom out. Clicking on an individual station reveals information such as who monitors that station, what parameters are measured at that station, and how many times a year the station is monitored. Once individuals determine the station(s) from which they would like view data, they can move to the water quality database to query the data.

In addition, the “Additional Information” section contains a number of links to agencies that supply other data that can be used in conjunction with the water quality data in the clearinghouse. Some of the additional data links include USGS real-time stream flow data, United States Fish and Wildlife Service (USFWS) National Wetland Inventory data, Environmental Protection Agency (EPA) watershed characteristics, other TNRCC surface water data, and aerial photographs, topographic maps, and satellite imagery from Microsoft’s Terraserver. The ease of accessibility to these other types of data encourages the use of a wide variety of geographic data when analyzing environmental systems and when attempting to detect sources of pollution or explain why a parameter value is at a certain level.

Technical Issues

The Clearinghouse database utility is built on Active Server Pages (ASP) technology, providing each Internet user with interactive access to multiple water quality databases. The database utility is a series of HTML-based documents with Form menus, enabling users to submit custom database queries.

A feature of MS Windows NT Internet Information Server, ASP enables relatively quick development of powerful applications, without complicated compiling or substantial coding experience required. Internet applications such as the database utility can utilize popular scripting languages such as VBScript and Jscript, and be integrated directly within HTML documents.

Data Clearinghouse Querying Features

Users can perform simple queries on the regional water quality data. Data can be viewed, downloaded, and graphed for a user-defined time period by selecting a station number, monitoring agency, or TNRCC-designated stream segment. Users may also query data based on a station number and parameter. Raw data may be downloaded for statistical analysis.

First, users are prompted to choose to query by basin or by monitoring agency. Then, users must choose a station or TNRCC-designated segment. They can then view all data associated with that station or, if the user chooses an entire segment, a list of stations on that segment. Those querying by segment can select a station from the list and view all data associated with that station. Maps are provided next to pull-down menus in case users not familiar with basin or segment locations. If a user chooses to query by monitor, they are able to view maps all of the stations monitored by that particular agency before choosing a station.

Users may constrain the query by selecting up to three parameters to view at a time. This feature was added to allow individuals to view certain parameters in relation to one another on the same screen. Users may also limit the search by defining a timeframe for which they would like to view data. A link to parameter code descriptions is available next to the menu of parameter choices.

Available Data Resources within the Clearinghouse

There are over 450 monitoring stations throughout the region, and, collectively, there are over 40 parameters collected by the following local agencies:

- Galveston County Health District
- Harris County Pollution Control
- City of Houston Health and Human Services
- City of Houston Public Works and Engineering
- San Jacinto River Authority
- Texas Natural Resource Conservation Commission
- City of Houston Water Quality Control
- United States Geological Survey

Within the information section of the data clearinghouse, users can view data quality objectives, such as sampling method and minimum analytical levels, for each local monitoring agency. The status of the data for each agency is also included on this page based on what data has been received and run through a quality control process.

There is a link to the water quality information page here for users not familiar with water quality information or for individuals who wish to view information like state standards, specific projects, or summary tables of all local monitoring stations. All stations are available in spreadsheet format by basin, agency, and station name.

Using Data in Special Studies and Incorporating Results into Technical and Educational Information for All Levels

H-GAC oversees a number of special studies every year. Users are able to access information through the Internet about each current and completed project. Summaries of the reasoning behind the study, results of the study, and corresponding data are included for each completed study. For each current project, a summary and status report of that project is provided.

This section of the website was added in an effort to make the general public aware of the projects conducted in their area. Additional data and results are included to keep the public aware of the outcome of those studies and the environmental integrity of their local area. In addition, for completed projects with corresponding data available, users may want to incorporate those results in their own special studies.

Public Outreach Efforts, Data, and How They Relate to One Another to Achieve Goals

Volunteer Monitoring Incorporation into Database

One of H-GAC's major outreach programs is the regional Texas Watch Volunteer Water Quality Monitoring Program. This is a statewide effort to educate and involve citizens in actively monitoring their local streams and major rivers. Volunteers are provided with a LaMotte surface water quality monitoring kit to perform routine measurements of water temperature, pH, conductivity, dissolved oxygen, and field observations.

The data provided by regional volunteers will be included in a similar format in the data clearinghouse with an attached field level of confidence. Volunteers who participate in a bi-annual quality assurance review will have their data included for review with professional data used in Total Maximum Daily Load studies.

Incorporation of Data into brochures and newsletters

H-GAC prepares a brochure of characteristics of one or more watersheds within its region a year. With the upcoming Greens Bayou Watershed Brochure, H-GAC has incorporated regional data from local agencies and governments along with physical characteristics and summary information of factors within the watershed.

The data is presented in graphical format. This approach may be more valuable to the layman who is not familiar with technical data. The brochure also incorporates the entire “watershed approach” with technical data; thus illustrating watershed dynamics with “real-world” data.

Another attempt to incorporate data in public outreach activities has been with the Texas Watch volunteer bi-annual newsletter. Volunteers are able to view their data and learn how it is being used to assess local waterbodies. Volunteer data may be used in special studies where applicable, and they will be able to see how their data was used to supplement the study. Individuals are also able to further their understanding of water quality information and to see how it relates to activities in their watershed.

Summary

The Houston-Galveston Area Council has made a major effort to make regional water quality monitoring data available for research, decision-making, and education. The data clearinghouse is on H-GAC’s website in a user-friendly query format. For users not familiar with environmental issues, specifically water quality information, there are extensive explanations and educational resources available on the website as well. In addition to the clearinghouse, H-GAC is incorporating regional data into brochures and newsletters and other public outreach activities to allow individuals to view data in summary and graphical formats.