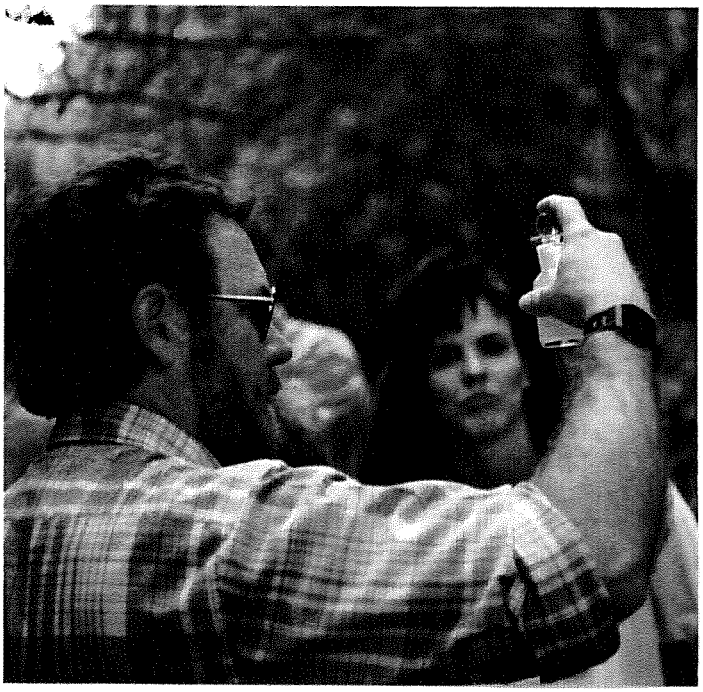
CITIZEN WATER QUALITY MONITORING OF THE TOWN LAKE WATERSHED

A PROJECT OF AUSTIN'S ENVIRONMENTAL AND CONSERVATION SERVICES DEPARTMENT



CITIZEN WATER QUALITY MONITORING PROGRAM FOR THE TOWN LAKE WATERSHED

INTRODUCTION

Citizen monitoring of Town Lake and the streams which feed it is one of the most effective and economical methods of surveying this large watershed for sites which may be heavily polluted. Involving citizens in monitoring not only provides data but also educates people about the concept of nonpoint source pollution. Nonpoint source pollution results from small releases of insecticides, fertilizers, automobile oils and emissions, heavy metals from paints and brake linings, animal wastes, septic and wastewater sewage leaks, trash, and irresponsible chemical disposal practices. When it rains all these pollutants from our streets, roofs, and lawns are washed into stormwater sewers, then to our urban creeks, then to Town Lake from which we draw a portion of the City's drinking water. Because everyone has been part of the problem, everyone must now be part of the solution. With the help of a Clean Lakes Grant from the EPA, Austin's Environmental and Conservation Services Department has developed a citizen monitoring program that enlists a wide range of support in the detection and clean-up of nonpoint source pollution.

Two national conferences have been held to promote citizen water quality monitoring programs. These programs are currently developing nationwide and are recognized and encouraged by the EPA as one of the most effective ways of combating nonpoint source pollution. During the first conference at the The University of Rhode Island, the City of Austin's Environmental Department reported three of its established programs: 1) Household Chemical Collection Day, 2) Voluntary Vehicle Emissions Testing, and 3) The Environmental Hot Line for citizen watchdogging. Austin also announced plans to expand the volunteer program to include water quality monitoring. During the second national conference in New Orleans it was recommended that citizen monitoring programs collect data to develop baseline studies and identify long-term trends for use in management decisions and for future research.

OBJECTIVES

The City's Environmental and Conservation Services Department (ECSD) has developed a citizen monitoring program that is well organized, equipped, and managed. Meaningful water quality data for numerous sites along our urban creeks can be used to help pinpoint problem areas in our watershed. To assure quality results, team leaders experienced in scientific procedure have been recruited by interfacing our program with science classes of Austin Community College and Austin High Schools. The community college brings to the program a broad spectrum of citizenry and college instructors with a variety of expertise including knowledge of organic chemistry, macroinvertebrates, geology, botany, and statistical

analysis. A merger of academia and citizenship is just the kind of partnership that will lead to the "consciousness raising" necessary to attack nonpoint source pollution. The students benefit enormously by working on a "real world" project instead of artifical lab exercises, and may perhaps be more encouraged to pursue environmental careers or volunteer work. Some have already been hired by the City's Water and Wastewater utility.

ECSD's Town Lake monitoring program is closely coordinated with the Colorado River Watch Network of the Clear Clean Colorado (CCC) River Association which is primarily supported by the Lower Colorado River Authority (LCRA). In fact, the City's basic program was modeled after CCC's program, and CCC staff have continued to provide tremendous technical assistance to ECSD.

The data collected in this project will be used in determining seasonal and temporal trends and evaluating the water quality status of tributaries to Town Lake. Comparisons can then be made between these sites, Town Lake sites, and points on the lower and upper Colorado River studied by others involved with the CCC. This program creates an opportunity for science students to learn basic scientific procedures for water quality monitoring, to gain an appreciation for their own local watershed, and to integrate their results into a larger long term study.

Other related objectives include visual monitoring of streams for bank erosion, algal blooms, foul odors, fish kills, illegal dumping, animal wastes, storm sewer mapping and analysis, trash inventory and clean-up projects, and providing information on watershed land use.

Evaluation of the data is performed by ECSD staff in conjunction with the CCC. Graphic representation of this data is produced and shown to teams on a regular basis. Data significance, proposals for monitoring modifications, and continuing research suggestions are all subjects of discussion at regular team meetings. A final report of all citizen monitoring data, efforts, and future recommendations will be written for the EPA towards the end of the grant period.

STUDY AREA AND SITE SELECTION

Town Lake is a 202 hectare reservoir formed by Longhorn Dam, located within the City of Austin in Travis County, Texas. Its watershed is drained by nine creeks: Blunn, Shoal, Barton, Johnson, Dry, Harper's Branch, East and West Bouldin, and Waller (see attached watershed map). The shore of Town Lake consists of 329 hectares of parkland, and several greenbelt parks are incorporated into the nine creeks feeding the lake. The remainder of the shoreline and watershed is covered by a relatively dense mixture of residential and commercial property.

Monitoring points on the nine urban creeks include small pools at the headwaters, mid course, and mouths of each system. Other points of interest are storm sewer outfalls emptying into the creeks and problem areas along the streams recognized by algal blooms, discoloration, or odor. City staff located three accessible and strategic monitoring points on each creek and Town Lake itself for teams. Other sampling points of

interest can be targeted as the program unfolds.

MONITORING PARAMETERS AND EQUIPMENT

The water quality of Town Lake and its watershed is monitored using the same methods as the Clear Clean Colorado organization employs to monitor various areas up and down the Colorado River. Using Field Manual for Water Quality Monitoring by Mitchell and Stapp as a reference, a wide variety of basic biological, chemical, and analytical principals and techniques are employed to guide a team of students in the understanding of how their lakes and streams are affected by pollution. This manual recommends using nine water quality parameters, setting points on streams to be tested, seasonal comparison, comparison of different streams during similar periods of time, and determining sources of pollution entering streams from storm drains. The nine parameters are quantified and assigned importance values for the National Sanitation Foundation's Water Quality Index. This allows conversion of raw data into an overall water quality value for a point on a stream. Students can construct computerized graph results of stream data on the Apple Macintosh.

The nine parameters to be tested for the National Sanitation Foundation's Water Quality index in order of importance are as follows: dissolved oxygen, fecal coliform, pH, biochemical oxygen demand, temperature, total phosphorus, nitrates, turbidity, and total solids. We have added three other parameters for additional information: a total dissolved solids test to give a general indication of dissolved chemicals in the water, a fecal streptococcus analysis to differentiate fecal matter as human or animal, and an ammonia test to detect sanitary sewage leaks. The manual recommends using HACH kits or their equivalent to test water quality parameters; a whole set of testing equipment can be purchased for under $700.00. Initially five sets of kits were necessary to get this program started: one for each of the three ACC campuses, one to sponsor Travis High School, and one for the City Environmental Planning Division to use for training and special stormwater monitoring projects. Schools provide such equipment as analytical balances, incubators, ovens, and standard laboratory facilities.

In addition to monitoring for our regular parameters, we hope to involve students in use of atomic absorption spectrometry for analysis of heavy metals and gas chromatography for detection of specific pesticides and total organic carbons (street oils). This equipment is already available at ACC, but additional hardware may be required for analysis of particular metals and compounds of interest in the Town Lake Study. Some special projects of interest requiring this equipment include an analysis of sediments at the mouth of each creek feeding Town Lake, an analysis of water at the mouth of each creek following a storm event, and further analysis of fish tissue coming from Town Lake. These analyses are very costly if contracted out to a professional lab, but would be relatively inexpensive if accomplished by students under the direction of a qualified instructor. When high levels of pollutants are discovered through this screening process by students, quality control can be assured by sending duplicate samples to a professional lab for analysis.

Other studies which are encouraged as a part of citizen monitoring are surveys of benthic macroinvertebrates, vegetation, geology and land use of each stream system. The most significant sampling a team can do besides monitoring their site at a scheduled time is to be ready to monitor their site during a storm event. This stormwater monitoring will provide valuable data concerning pollutant loading of Town Lake during and following rain events.

PROGRESS REPORT

On April 10, 1990, in coordination with Earth Day 1990, teams monitored the mouths of all nine streams feeding Town Lake and three points on Town Lake itself (See attached discussion and graphs). Channel 24 News (Earth Watch Segment) covered this event, and it aired April 10th and 11th.

On June 6, 1990 teams monitored the mouth and midreach of all streams and three points on Town Lake (data is currently being processed for this event). Channel 36 News covered this event, and it aired that night.

Storm sewer outfalls are in the process of being mapped and discharge from these outfalls is being analyzed. Travis High students discovered a suspicious sewer outfall on Blunn Creek with high fecal coliform counts. ACC reported foul gaseous odors at a particular location on Dry Creek, and this report led to an investigation by Austin's Environmental and Conservation Services Department and the Texas Water Commission. A gas leak was discovered at nearby service station.

A macroinvertebrate inventory is ongoing for several streams under the direction of Dr. Steve Ziser, biology professor at ACC. Dr. Ziser leads volunteers up urban creeks on Tuesday mornings to assess the biological health of each stream by the identification of benthic macroinvertebrates.

Teams go out the first Friday of every month to do work on their assigned streams and several teams have monitored storm events. Simultaneous monitoring events are planned every three months, and a planning meeting is scheduled prior to each of these events.

A recent addition to our citizen participation is a team from the Austin Rowing Club, some of the most frequent users of Town Lake. They have agreed to monitor the midreach of Town Lake from boats on a weekly basis.

POTENTIAL

With a relatively small investment, this program has attracted and enlisted the help of ACC, CCC, AISD, and the Austin Rowing Club. Hundreds of citizens have already been involved in water quality monitoring, many students are receiving valuable training in scientific procedure, and our teachers have embraced the program and made it a part of their curriculum. The enthusiasm is definitely there for expansion of this program within each of the above mentioned institutions and with other citizen groups as well. The City's Environmental and Conservation Services Department is committed to organizing a "state of the art" citizen monitoring program, because we believe that solving the problem of nonpoint source pollution requires a tremendous amount of public involvement.

DISCUSSION OF RESULTS FOR 4/10/90 TOWN LAKE WATERSHED MONITORING

The overall water quality was "fair" for the Town Lake watershed on April 10, 1990. The average water quality index for the Town Lake Watershed was 77.76 on a scale of 0 to 100. Water quality index numbers were generated from averages of all data received from all monitoring teams (ACC, CCC, Travis High).

One of the most important factors affecting a water quality analysis is the rainfall recorded prior to sampling. Austin recorded measurable precipitation on seven of the fourteen days preceding our sampling on April 10th: March 26 = 0.5", March 27 = 0.12", March 28 = 0.03", March 29 = 0.15", March 30 = 0.15", April 6 = 0.37", April 9 = 0.06" (National Weather Service). By the time we sampled on April 10th, the watershed had received seven recent rinsings. Hypothetically, most of the nutrients and fecal coliform had been flushed from the streams, resulting in a relatively good water quality index at each of our monitoring points.

STREAM WATER QUALITY

Surprisingly, Shoal Creek received the highest water quality index of all streams (82.95). The biggest surprise at Shoal Creek was the best fecal coliform quality of all monitoring points (2 colonies/100ml). Shoal's weakest areas of quality were total phosphorus (0.4 mg/l) and total solids (275 mg/l) (see graphs for comparison).

Not so surprising was the good water quality index recorded at Barton Creek (82.01). Barton's weakest areas included fecal coliform (17 colonies/100ml), total solids (302 mg/l), and B.O.D. (3.18 mg/l).

E. Bouldin Creek was the third ranking stream in water quality index (80.23). E. Bouldin's weakest areas included fecal coliform (19 colonies/100ml), D.O. (70% saturation), and nitrates (3.3 mg/l).

Harper's Branch was the fourth ranking stream in water quality index (79.88). Harper's weakest areas included fecal coliform (29 colonies/100ml), B.O.D. (6 mg/l), and total solids (274 mg/l).

Blunn Creek was the fifth ranking stream in water quality index (79.01). Blunn's weakest areas included fecal coliform (21 colonies/100ml), and total phosphorous (0.6 mg/l).

Waller Creek was the sixth ranking stream in water quality index (77.76). Waller's weakest areas included fecal coliform (17 colonies/100ml), B.O.D. (6.57 mg/l), and total solids (300 mg/l).

Dry Creek had a significantly lower water quality index than the other streams (68.24) (possibly resulting from lower flow). Dry's problem areas were D.O. (33% saturation), fecal coliform (62 colonies/100ml), and total phosphorous (0.42 mg/l).

Johnson Creek had the lowest water quality index of all streams (67.75)

(possibly resulting from low flow). There may be a real problem with fecal coliform in this stream since we recorded a dangerous level of coliform (200 colonies/100ml) even during these good conditions. We should check land use on this stream to see if there might be some old septic systems leaking. Interesting was the fact that the worst fecal coliform recorded in Town Lake itself was just below the mouth of Johnson Creek at Austin High (Mopac location on graph). This correlation is hard to ignore. Other weak areas at Johnson included B.O.D. (4.43 mg/l), and total solids (400 mg/l).

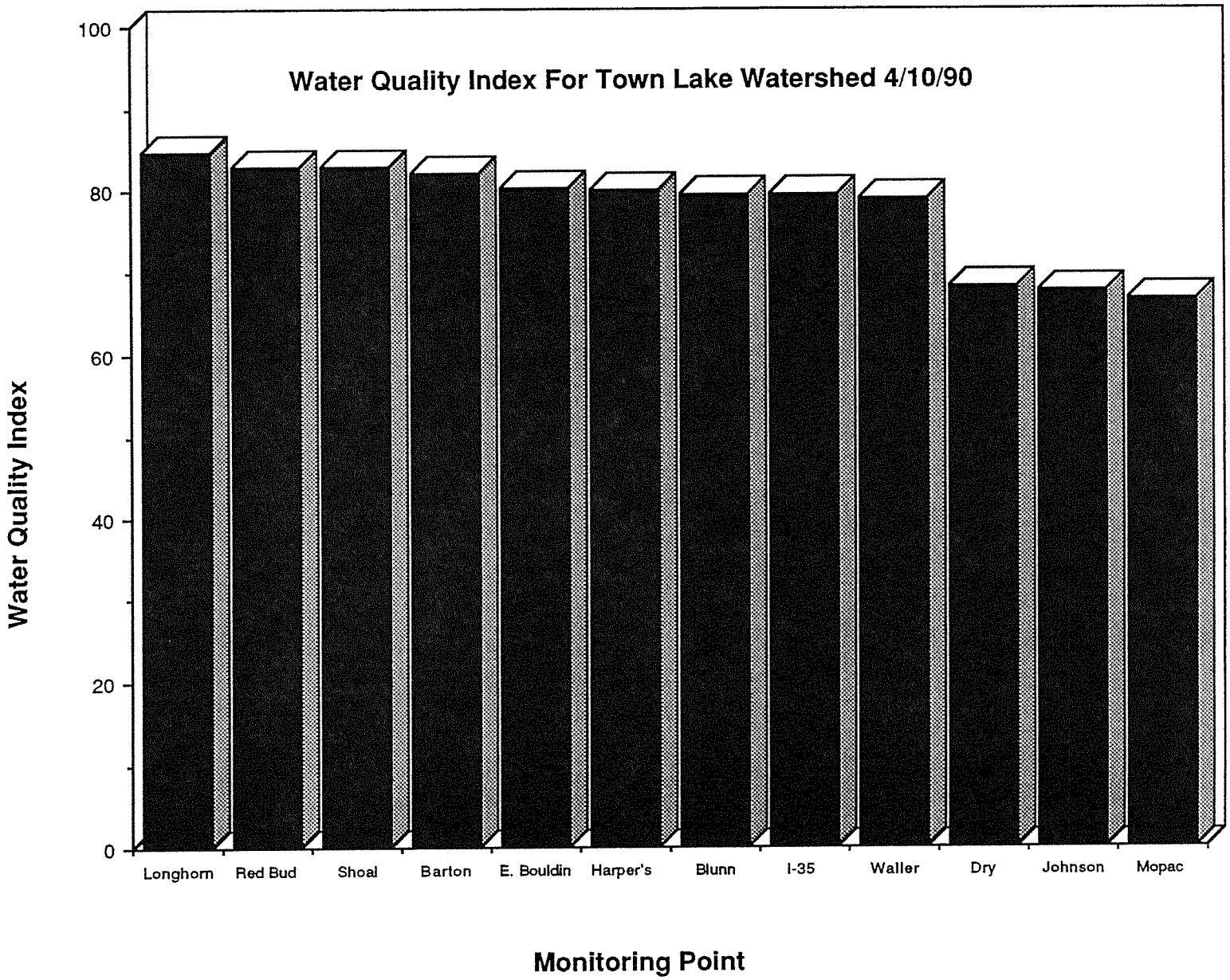
TOWN LAKE WATER QUALITY

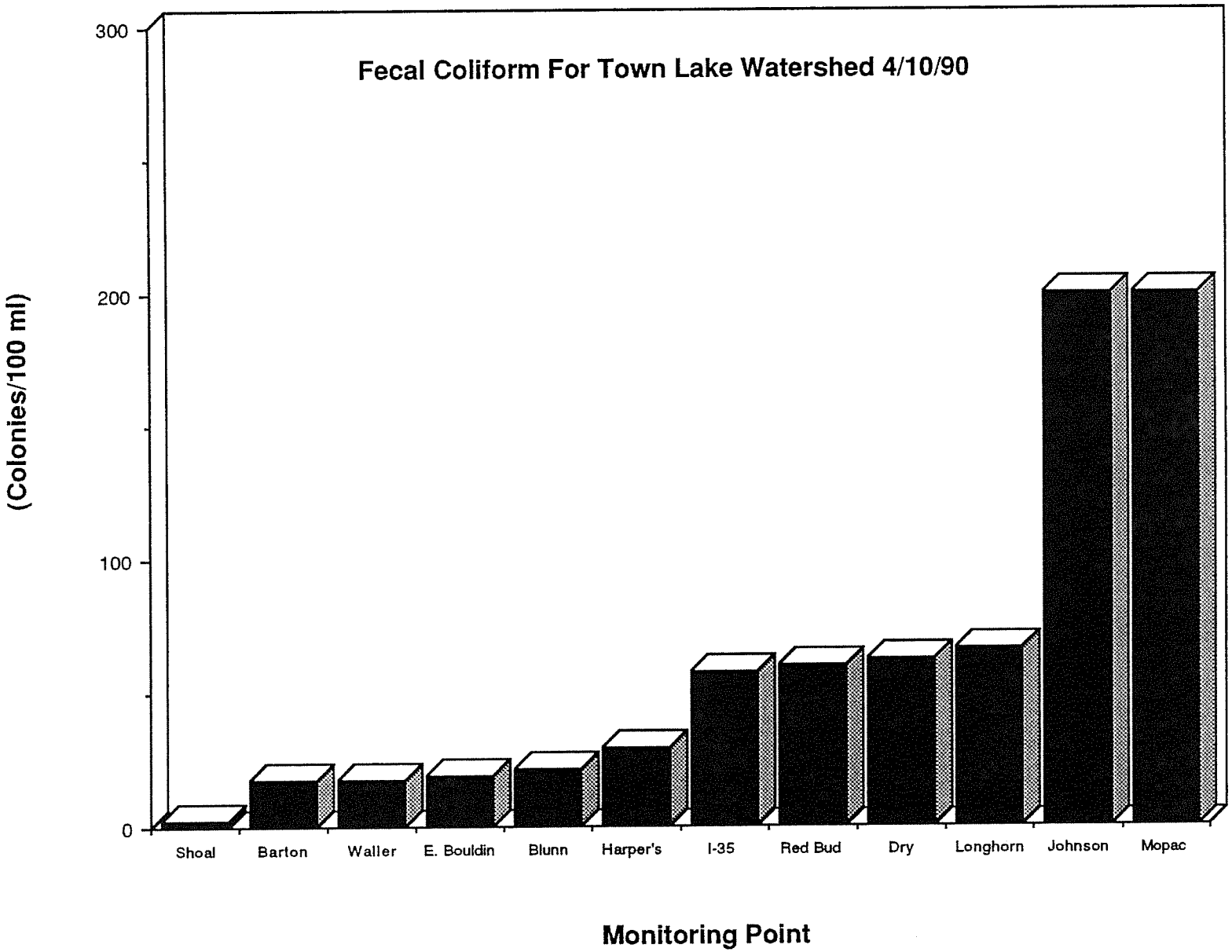
The best water quality index was recorded at Longhorn Dam. The weakest areas included fecal coliform (60 colonies/100ml), and total solids (545 mg/l).

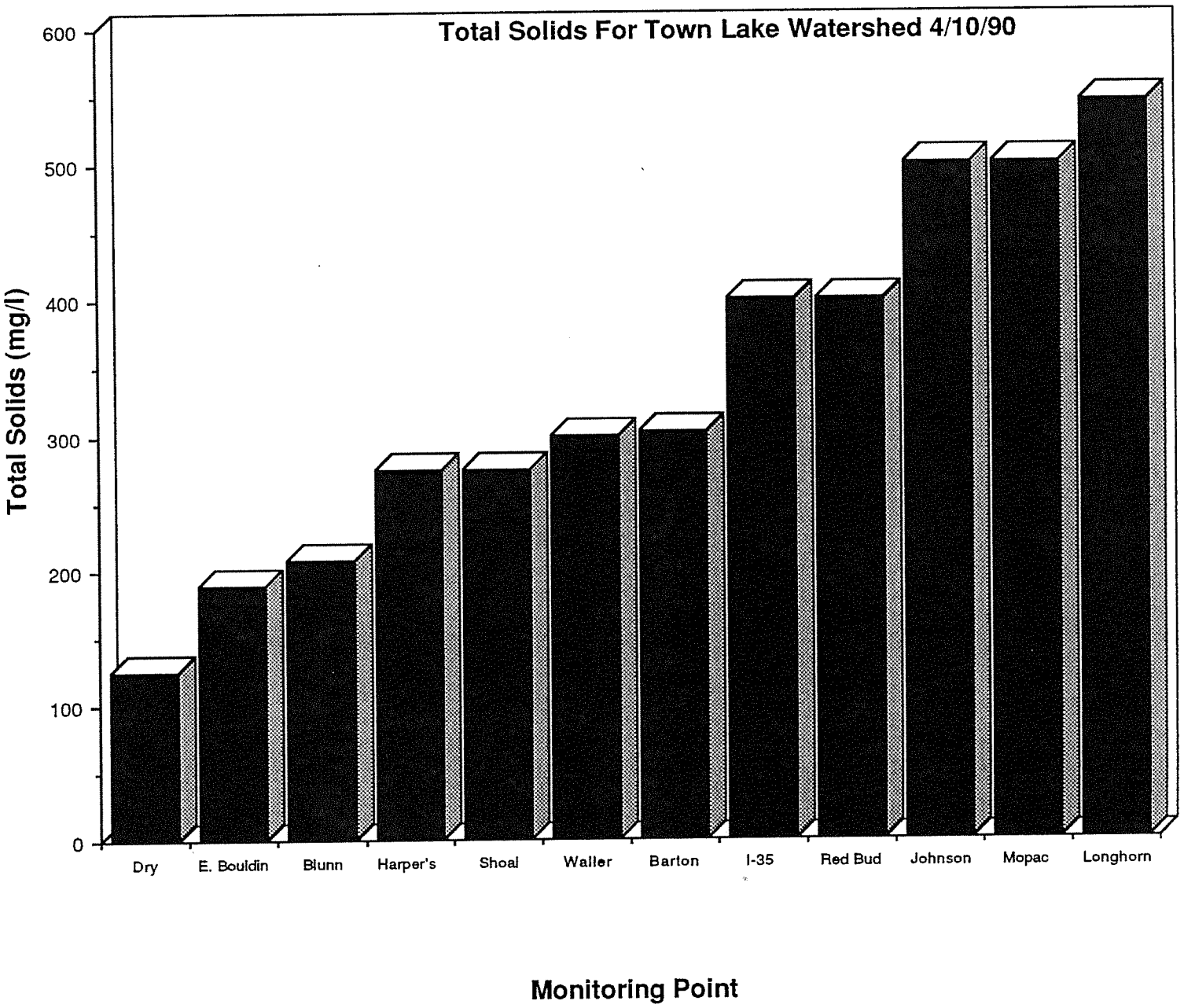
Red Bud Isle was a close second in water quality index (82.97). The weakest areas included fecal coliform (60 colonies/100ml), and total solids (400 mg/l).

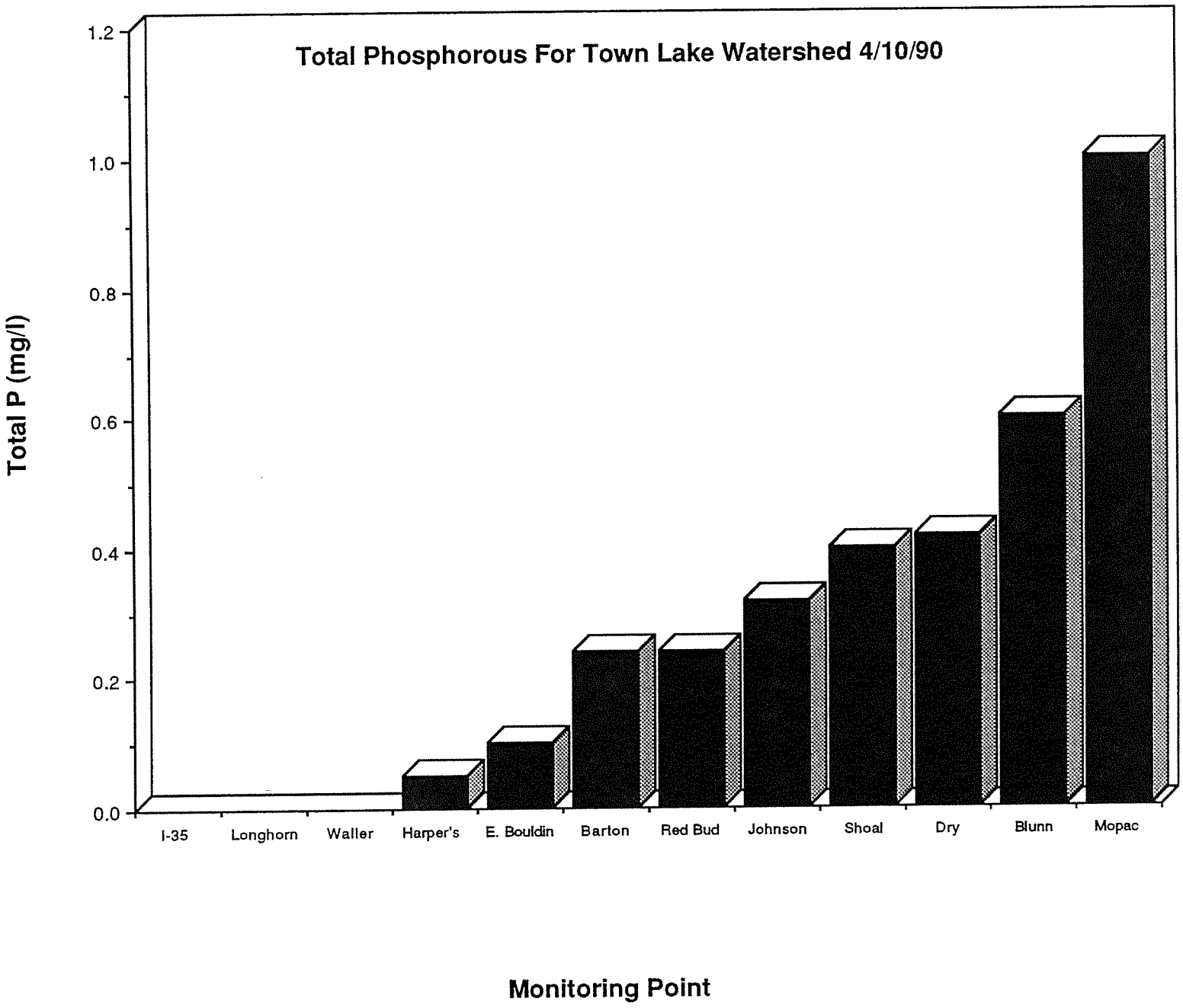
The I35 Bridge was third in water quality index (79.54). The weakest areas included fecal coliform (58 colonies/100ml), B.O.D. (4.53 mg/l), and total solids (400 mg/l).

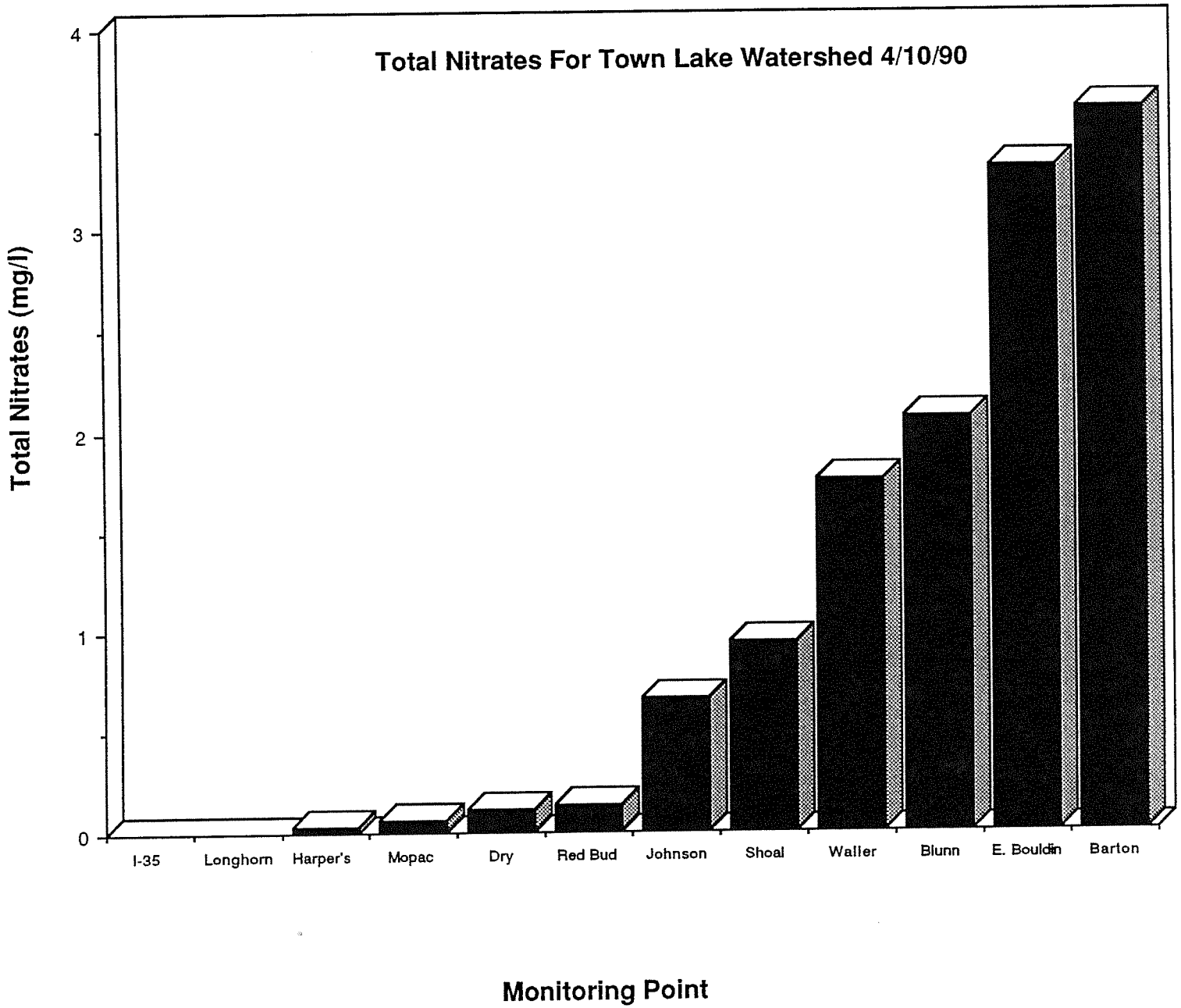
The worst water quality index was recorded at the Mopac Bridge (Austin High area) (66.88). Weak areas included fecal coliform (200 colonies/100ml), B.O.D. (4.53 mg/l), total phosphorous (1.0 mg/l), and total solids (500 mg/l). This spot on the lake may have been fouled by the poor water entering the lake here from Johnson Creek.

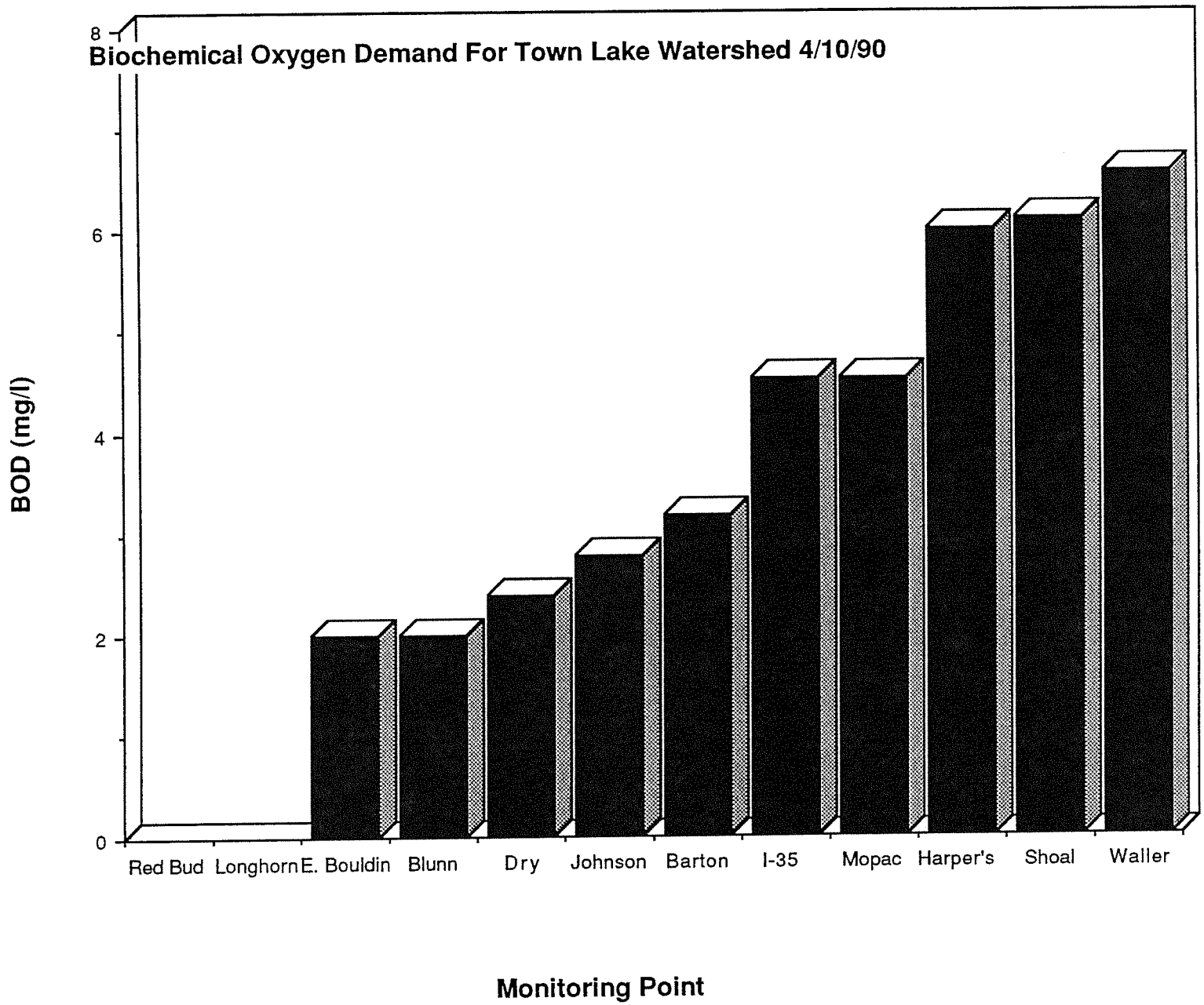

Water Quality Index For Town Lake Watershed 4/10/90
Water Quality Index
100
80
60
40
20
0
Longhorn
Red Bud
Shoal
Barton
E. Bouldin
Harper's
Blunn
I-35
Waller
Dry
Johnson
Mopac
Monitoring Point


Fecal Coliform For Town Lake Watershed 4/10/90
(Colonies/100 ml)
300
200
100
0
Shoal
Barton
Waller
E. Bouldin
Blunn
Harper's
I-35
Red Bud
Dry
Longhorn
Johnson
Mopac
Monitoring Point


Total Solids For Town Lake Watershed 4/10/90
Total Solids (mg/l)
600
500
400
300
200
100
0
Dry
E. Bouldin
Blunn
Harper's
Shoal
Waller
Barton
I-35
Red Bud
Johnson
Mopac
Longhorn
Monitoring Point


Total Phosphorous For Town Lake Watershed 4/10/90
Total P (mg/l)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
I-35
Longhorn
Waller
Harper's
E. Bouldin
Barton
Red Bud
Johnson
Shoal
Dry
Blunn
Mopac
Monitoring Point


Total Nitrates For Town Lake Watershed 4/10/90
Total Nitrates (mg/l)
0
1
2
3
4
I-35
Longhorn
Harper's
Mopac
Dry
Red Bud
Johnson
Shoal
Waller
Blunn
E. Bouldin
Barton
Monitoring Point


Biochemical Oxygen Demand For Town Lake Watershed 4/10/90
BOD (mg/l)
0
2
4
6
8
Red Bud
Longhorn
E. Bouldin
Blunn
Dry
Johnson
Barton
I-35
Mopac
Harper's
Shoal
Waller
Monitoring Point