Bacteriological Survey of the Atascosa River (Segment 2107)

Texas Department of Water Resources
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BACTERIOLOGICAL SURVEY OF THE ATASCOSA RIVER (SEGMENT 2107)

by

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INTRODUCTION

DIRECTIVE

This water quality evaluation was accomplished in accordance with the Texas Water Quality Act, Section 21.257 as amended in 1973. The report is to be used in developing and maintaining the State Water Quality Strategy.

PURPOSE

The purpose of this water quality evaluation is to provide the Texas Department of Water Resources with a valid information source:

1) to determine the bacteriological quality of the Atascosa River;

2) to collect bacteriological data that will document the compliance or non-compliance of the Atascosa River with existing stream standards; and

3) to determine the major sources of bacteriological contamination of the Atascosa River.

METHODS

Water samples were collected for bacteriological analyses in sterilized bottles furnished by the Texas Department of Health. The samples were placed on ice immediately after collection and transported to a suitable work area. Fecal coliform analysis was by the membrane filter technique utilizing a Millipore Portable Water Lab and a Millipore Portable Incubator. Fecal streptococcus analyses were conducted by the San Antonio River Authority at their laboratory in San Antonio. Parametric coverage, sampling frequencies and spatial relationships of sampling stations were consistent with the particular objectives of this evaluation and with known or suspected forms and variability of pollution occurring in the area.

DESCRIPTION OF THE SURVEY AREA

The Atascosa River (Segment 2107) originates in Medina County in South-Central Texas and flows generally southeastward to Live Oak County where it joins the Frio River near the City of Three Rivers (Figure 1). About 105 river miles are included in the Segment. The area around the headwaters consists mostly of irrigated farmland with some livestock grazing. Further south, unimproved rangeland becomes more prevalent and the lower reaches of the river flow through terrain characteristic of the South Texas Brush Region.

Stream flow in the upper reaches is normally low, less than 0.5 cfs at the uppermost sampling site on the West Fork near the Medina-Atascosa County Line. Flow is increased somewhat by the confluence of the North Fork of the Atascosa and the discharge from the Lytle Sewage Treatment Plant. About eight miles downstream of Lytle the river dries up or runs underground. The river reemerges a few miles upstream of Poteet and gradually increases in flow as it moves southeastward. A number of small creeks discharge into the Atascosa, but most of them do not flow during dry periods. Heavy rainfall can produce a rapid rise in the river, but flow returns to normal very quickly.

Figure 1
Map of Survey Area

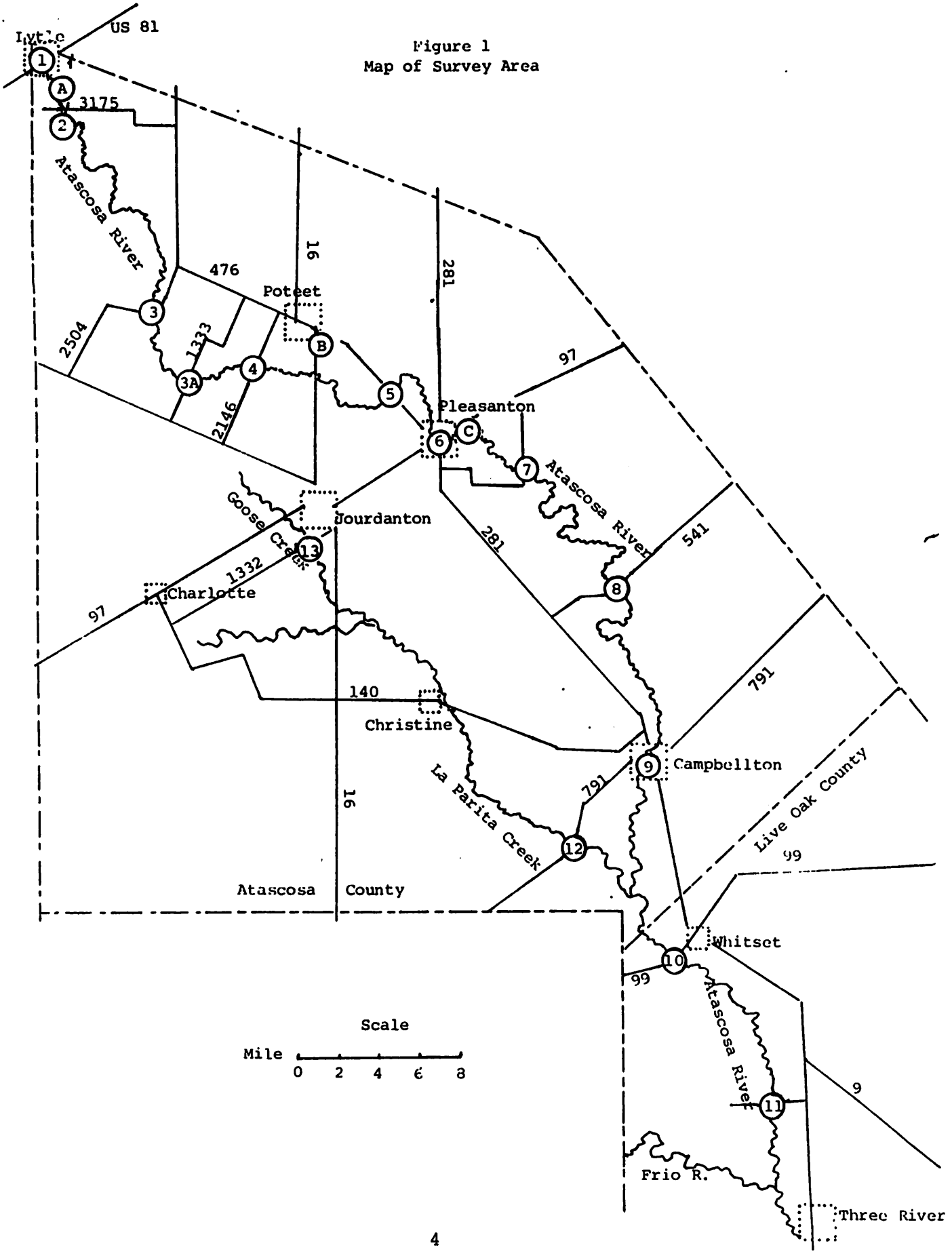


TABLE 1
SAMPLING STATIONS

Station No.	Location
1	West Fork of the Atascosa River at US 181 in Lytle (river mile 101.0)
2	Atascosa River at country road off of FM 3175 (river mile 97.3)
3	Atascosa River at FM 2504 (river mile 82.7)
3A	Atascosa River at FM 1333 (river mile 78.0)
4	Atascosa River at FM 2146 (river mile 72.4)
5	Atascosa River at FM 476 (river mile 63.3)
6	Atascosa River at US 281 in Pleasanton (river mile 63.3)
6A	Atascosa River at railroad crossing just downstream of Pleasanton STP discharge (river mile 56.2)
7	Atascosa River at FM 1334 (river mile 49.7)
8	Atascosa River at FM 541 (river mile 35.2)
9	Atascosa River at US 281 in Campbellton (river mile 25.5)
10	Atascosa River at FM 99 (river mile 12.8)
11	Atascosa River at county road near Three Rivers (river mile 2.2)
12	La Parita Creek at FM 791 west of Campbellton
13	Goose Creek at FM 1332 near Jourdanton

TABLE 2
WASTEWATER DISCHARGERS

Station No.	Discharger
A	City of Lytle - discharge from sewage treatment plant oxidation pond into Atascosa River at mile 99.4; no chlorination; average discharge 0.09 MGD
B	City of Poteet - discharge from sewage treatment plant oxidation pond into marshy area which drains into a small creek which discharges into the Atascosa River about 1 1/2 miles below the plant; average discharge 0.06 MGD
C	City of Pleasanton - discharge from sewage treatment plant directly into the Atascosa River at mile 56.0; no chlorination; average discharge of 0.517 MGD

DISCUSSION OF DATA

A bacteriological special survey was conducted on the Atascosa River, Segment 2107, during the period from November 1977 to June 1978. Concentrations of fecal coliform and fecal streptococci bacteria were the only parameters considered on this survey. These bacteria are commonly found in the digestive tracts of warm-blooded animals including man. Some fecal coliform bacteria are present in almost all natural waters; however, the presence of high concentrations of these organisms specifically indicates fecal waste contamination. Standards have been established which limit the number of fecal coliforms permitted in natural waters based on how these waters are used. Segment 2107 is classified by the Texas Department of Water Resources as water suitable for contact recreation requiring a fecal coliform concentration of less than 200 organisms per 100 ml of water (logarithmic mean of at least five samples collected within a 30 day period). Furthermore, no more than 10% of all samples collected within a 30 day period may exceed 400 organisms per 100 ml of sample. Routine water samples collected by the Department of Water Resources as part of the regular stream monitoring program indicated the presence of high levels of fecal coliform organisms in Segment 2107. The purpose of this survey, therefore, was to document the existance of high levels of fecal coliform bacteria, locate the source(s) of contamination and determine if the Segment is in compliance with the established standard.

A series of 13 sampling sites were selected on the Atascosa River and specific tributaries between Lytle and Three Rivers. The locations of these sampling stations are described in Table 1 and shown on Figure 1. The effluent of three municipal sewage treatment plants which discharge to the river were also sampled (Table 2). A fourth sewage treatment plant in the area, the City of Jourdanton STP was not sampled directly; however, samples were collected from the receiving waters downstream of the plant (Station 13, Goose Creek). Samples were collected and analyzed for fecal coliform bacteria at approximately monthly intervals. The results of these samples are shown in Table 3. Figure 2 shows the spatial relationships of sampling stations and wastewater dischargers. (Extremely high levels of fecal coliforms found at Stations 1 through 6 on April 10 were due to storm water runoff and were not included in the data represented in Figure 2.)

Station 1 was upstream of all known sources of wastewater and served as a control station. The City of Lytle discharges effluent from oxidation ponds into the river between Station 1 and 2. The river goes dry or runs underground a short distance downstream of Station 2 so the effects of this discharge are confined to a relatively short section of the river. Surface flow resumes at Station 4. Fecal coliform levels at Station 4 were low and comparable to levels found at Station 1.

Table 3
Fecal Coliform
No./100 ml

Station No.	Date									
	11/7/77	12/13/77	2/21/78	3/20/78	4/10/78	5/16/78	5/24/78	5/31/78	6/6/78	6/12/78
1	1255	32	4	-	10,300*	75	65	208	195	55
2	-	-	-	180	42,200*	775	-	224	1373	510
3	-	-	-	-	90,400*	-	-	-	-	-
3A	-	-	-	-	150,000*	-	-	-	-	-
4	645	63	20	108	58,000*	125	55	4	50	180
5	-	110	117	390	41,800*	370	115	580	240	135
6	1280	16	16	12	125,000*	90	460	60	180	285
6A	236,000	167,000	-	-	-	-	-	-	-	-
7	845	883	1357	272	8800	11,650	1620	632	827	370
8	700	180	180	44	150	285	1240	4340	360	250
9	1790**	276	67	300	350	105	870	488	560	460
10	1000**	100	147	212	100	130	1200	356	2570	550
11	9500**	2700	93	184	52	5	1200	600	580	490
12	9500**	2700	205	1220	700	610	510	508	2920	430
13	2745	2610	250	1322	-	-	-	-	-	300
A	3215	9200	3164	-	-	-	-	-	-	100
B	-	-	>1,000,000	500,000	2,570,000	350,000	-	-	-	<100,000
C	-	-	>1,000,000	750,000	6,100,000	4,500,000	-	-	-	2,420,000

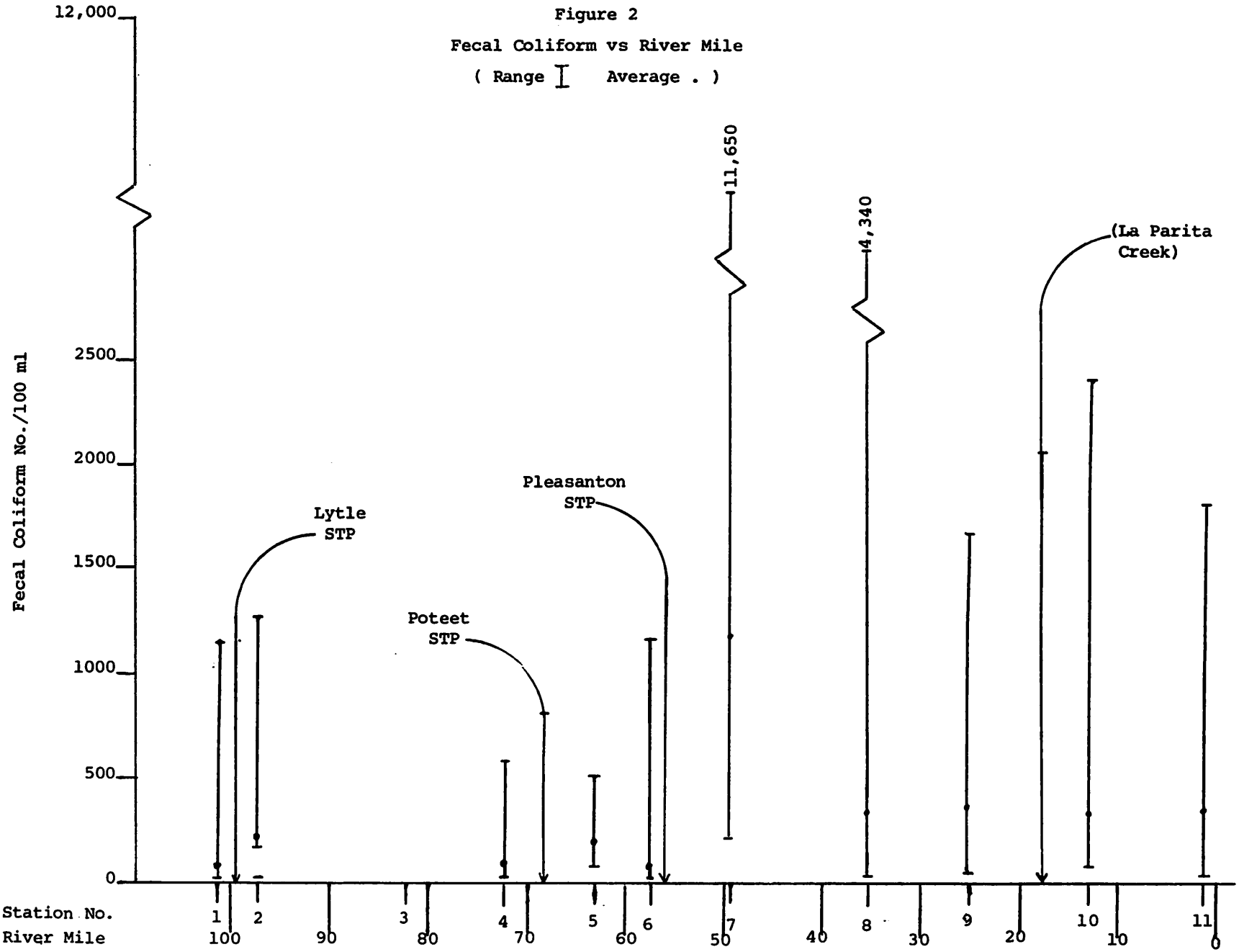
*samples collected under heavy run-off conditions

** light rainfall the previous night; some runoff possible

Figure 2

Fecal Coliform vs River Mile

(Range I Average .)



The City of Poteet STP discharges into a small creek which joins the Atascosa at river mile 68. Access to the river near the junction was impossible to obtain, but fecal coliform levels at Station 5 about four miles downstream were elevated. It should be noted, however, cattle were frequently seen drinking and wading in the river at this station and likely contributed to the high levels.

The most significant source of wastewater to the segment is the discharge from the City of Pleasanton Sewage Treatment Plant. Unchlorinated effluent containing high levels of fecal coliform bacteria is discharged from an oxidation pond directly into the river. Adverse effects of this discharge were evident in the area immediately downstream of the discharge. Heavy growths of filamentous algae on submerged rocks, patches of floating scum, green colored water and a strong sewage odor prevailed for some distance downstream. These conditions became less apparent at Station 7, although high fecal coliform levels were still present.

Average fecal coliform levels in the lower reaches of the Atascosa, Stations 8 through 11, remained fairly constant although individual samples varied considerably. The discharge from the City of Jourdanton STP apparently does not affect the bacteriological level of the Atascosa. The Jourdanton plant discharges into a tributary of Goose Creek about 28 miles from the river. Goose Creek merges with La Parita Creek which eventually joins the Atascosa River near Three Rivers. Sampling sites to determine the effects of this discharge were on Goose Creek downstream of Jourdanton (Station 13) and on La Parita Creek west of Campbellton (Station 12). Since Goose Creek was not flowing on several occasions, it is believed fecal coliforms found at Station 12 are the result of livestock activities.

Samples collected on April 10 were coincidental with heavy rainfall in the upper Atascosa watershed (Table 3). The river had crested at about three feet above normal and was high and muddy at Stations 1 through 6. This was the only occasion flow was observed at Station 3. Flood waters had not passed the City of Pleasanton at the time samples were collected and the river at Station 7 through 11 was clear and flow was normal. These data clearly show that storm runoff is a significant contributor of fecal coliform organisms to the Atascosa River.

Five sampling runs were made during the last 30 days of the study to satisfy the requirements for determining compliance with the stream standards. The results and computed logarithmic means obtained from these samples are shown in Table 4. The data indicate the stream is not in compliance with the fecal coliform standard. Only three stations (numbers 1, 4, and 6) had log means less than 200 organisms per 100 ml of water. Of these three stations, Station 2 was marginally out of compliance, as one of the samples had a fecal coliform concentration of more than 400 organisms per 100 ml.

TABLE 4
FECAL COLIFORM
(LOG - MEAN)

Sample No.	Date					Log Mean	% Over 400
	5/16/78	5/24/78	5/31/78	6/6/78	6/12/78		
1	75	65	208	195	55	117	0
2	775	1300	224	1373	510	691	80
4	125	55	4	50	180	47	0
5	370	115	580	240	135	240	20
6	90	460	60	180	285	166	20
7	11,650	1620	632	827	370	1295	80
8	285	1240	4340	360	250	673	40
9	105	870	488	560	460	409	80
10	130	1200	356	2570	550	601	60
11	5	1200	600	580	490	251	80

On February 22 samples from five stations were analyzed for fecal streptococcus bacteria, as well as fecal coliform. The purpose of this analysis was to determine the ratio between the two organisms (Table 5). The fecal coliform/fecal streptococcus ratio is a source indicator of fecal contamination, providing the samples are collected at a point no more than 24 hours travel time from the source. After 24 hours bacterial die-off can obscure the true ratio. Generally if the FC/FS ratio is greater than 4 the source of contamination is human wastes. Animal wastes produce a ratio of 0.7 or lower. Ratios between these extremes indicate a mixed source of waste and suggest more samples should be collected nearer the suspected source. Since time of travel studies were not done on this survey the data obtained is presented as a suggestion of the type of pollution and should not be considered conclusive. However, only Station 7, which is located downstream from the Pleasanton sewage treatment plant, had a FC/FS ratio greater than 4, indicating contamination from human sources.

TABLE 5
FECAL COLIFORM/FECAL STREPTOCOCCUS

Date	Station No.	Fecal Coliform	Fecal Strep.	Ratio*	Most Probable Source of Contamination
2/22/78	5	117	150	0.78	animal
2/22/78	6	16	30	0.50	animal
2/22/78	7	1357	210	6.50	man
2/22/78	10	147	240	0.60	animal
2/22/78	13	250	300	0.83	animal

*A Fecal/Fecal Strep. ratio of greater than 4 indicates the source of the organism is predominately human.

CONCLUSIONS

This bacteriological evaluation has determined that a fecal coliform problem does exist in Segment 2107. The more significant continuous sources of fecal contamination are the City of Pleasanton Sewage Treatment Plant discharge and to a lesser extent, the Cities of Lytle and Poteet. A new sewage treatment plant is scheduled to be built at Pleasanton in 1980. Repairs and improvements to the existing plant, including the addition of chlorination facilities, are also underway at the present time. Upon completion of these projects the water quality is expected to improve significantly.

Occasional high levels of fecal coliform organisms are likely to continue to appear in the Atascosa River as a result of storm water runoff. Effects from this source of pollution are short-lived, however, and levels should drop to normal as flood waters recede.

Livestock contribution to the bacterial levels of the river has not been fully determined, but does not appear to be a major factor. Another survey should be conducted on the lower reaches of Segment 2107 after the new treatment plant at Pleasanton begins operation to document projected bacteriological improvements and determine more accurately the extent of livestock pollution.