RIVER BASIN WATER QUALITY

STATUS REPORT

Yakima River Basin

ENVIRONMENTAL PROTECTION AGENCY

SURVEILLANCE AND ANALYSIS DIVISION REGION X SEATTLE WASHINGTON

1975

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FORWARD

This basin status report is one of 27 scheduled for completion in Region X of EPA for the calendar year 1975. The information presented herein is based upon all of the documented data available to EPA at the time of the report distribution.

Several of these reports include a minimal amount of information which may not be enough to adequately evaluate the water quality status of the basin. We feel that it is important to distribute these reports regardless of the availability of data since the knowledge of a lack of data is also important to the decision makers.

A report update is scheduled annually, therefore, additional data made available in 1975 will be included in the next report.

We welcome comments on this report as well as information concerning additional data and/or sources where additional data might be obtained. Any correspondence can be addressed to Bill Schmidt, Chief, Water Quality Monitoring Section, 1200 Sixth Avenue, Seattle, Washington, 98101. Telephone (206)(442-1193).

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PROFILE SUMMARY

YAKIMA PROFILE SUMMARY

A. Ambient Profile Discussion:

Long term analyses using the "two-year running average" technique,[1/] were completed from 1968 to the present time for stream flow, nitrite + nitrate (NO_2+NO_3-N), ammonia (NH_3-N), total phosphorus (T-P), dissolved orthophosphate (Ortho-P), specific conductance (Cond), total coliforms (T-Coli), and dissolved oxygen (DO) at two stations on the Yakima River. The stations are located at Kiona (1), 30 miles above the mouth, and at Parker (2), just below the Yakima metropolitan area at R.M. 104.6. These analyses indicated the following:

1. Of the parameters studied, except for DO, most values were higher at Kiona (1) than at Parker (2).

2. Although no major long term trends in NO_2+NO_3-N levels are discernable, those levels at Parker have approached, and those in the lower river have greatly exceeded the potential algal bloom limiting concentration of .30 mg/1.

3. Ammonia levels have increased greatly at both stations, then leveled off in 1974. This increase is approaching the 0.2 mg/1 level which is considered an indication of organic pollution.

4. T-P and Ortho-P levels have generally shown a slight decrease over the past four years. For both parameters, all levels at both stations were above the potential algal bloom limiting concentrations of .05 mg/1 and .01 mg/1, respectively. T-P concentrations appear to be inversely related to river flow based on data at Kiona indicating point source effects, however the same relationship is not as clear at the station at Parker.

5. Specific conductance levels appear to be flow-related, particularly in the lower river.

6. T-Coli populations have consistently exceeded State of Washington water quality standards at both locations. Due to a lack of point source data, however, the sources of the bacteria are not known at this time.

7. Daytime DO values were well above State standards at both stations. It appears, however, that diurnal DO fluctuations produced some nighttime levels that violated State standards at a few locations.
(See Graph 18, Cause-Effect section).

[1/] Two year running average technique is explained in the Ambient Profile section of this report.

B. Source Profile Discussion:

1. Considering the total BOD and suspended solids loading from known M&I sources in the basin, industrial sources contribute about 2/3 of the BOD and 1/2 of the SS. Major contributors are Boise Cascade at Yakima and the Yakima industrial treatment plant (BOD & SS), U&I Sugar at Toppenish (BOD & NH_3-N), and the Prosser industrial treatment plant (BOD, SS, T-P & NH_3-N). All these discharge directly to the Yakima River. BOD and SS data on the tributaries and drains are not available.

2. The principal municipal contributors are the treatment plants at Yakima (municipal), Ellensburg, and Richland (directly to the river), and at Union Gap, Toppenish, and Sunnyside (via a major creek or drain).

3. Data taken by the U.S. Bureau of Reclamation May - October 1974 indicate that most of the basin's known nutrient loadings, during the irrigation season, are provided by the tributaries and irrigation drains below Yakima. Of these, the loadings from the Main (Marion) Drain, Toppenish Creek and Sulphur Creek Wasteway are especially high. Wide Hollow Creek, although not a significant contributor of nitrates, is responsible for 1/4 of the basin's known ammonia, plus considerable T-P loading. Because data for most of Winter 1973-1974 are not available, the trib./drain loadings cannot be determined for this period. Individual point source loadings are shown on Tables 2, 3, & 4.

C. Cause-Effect Discussion:

1. The water quality of the Yakima River is adversly influenced by sources between Selah (R.M. 118) and the mouth.

2. Non-irrigation season concentrations are generally greater than those during the irrigating season, with the exception of pH, T-Coli and temperature.

3. Most nutrient concentrations exceed potential algal bloom levels from Yakima to the mouth. The detrimental effects of municipal and industrial sources plus that of the tributaries and drains in the Yakima area are reflected in the graphs of these parameters. Similarly, the considerable nutrient input of the drains between Toppenish and Mabton is also very noticeable.

4. Municipal and industrial sources and Wide Hollow Creek cause a dramatic increase in NH_3-N levels in the Yakima area. U&I Sugar at Toppenish plus the other drains between Toppenish and Mabton contribute to a further increase downstream.

5. A progressive increase in conductivity, and to a lesser ex-

tent turbidity, is obvious from the upper reaches to the mouth. The increase in the irrigation season levels between Toppenish and Mabton is particularly obvious.

6. Most total coliform samplings violated the State water quality standards below Ellensburg during the period evaluated. Due to a lack of point source data, it is not clear at this time what is causing these high levels.

7. Graph 16 shows no DO violations since these samples were taken during daytime hours; however, diurnal data taken earlier (Graph 18) shows violations of State water quality standards on the middle and lower reaches of the river. The diurnal DO-percent saturation level variations, and the chlorophyll-A data on Graph 19 are indicative of algal bloom activity at various locations from immediately upstream of Roza Dam to the mouth.

D. Three tributaries to the mainstem Yakima are designated as separate State water quality segments. Available data for selected parameters were graphed, over the same time period as the cause-effect graphs, for the downstream station on each tributary. Winter 1973-74 data was not available for the Wilson Creek and Naches River stations.

1. Wilson Creek:
Spring and summer NO_2+NO_3-N levels approached, and at one point exceeded, the potential algal bloom concentration. Phosphorus concentrations exceeded the potential algal bloom levels throughout the 1974 irrigation season. pH levels were within the water quality limits over the period for which data was available.

2. Naches River:
The water quality of the Naches River, as measured near the mouth, appears to be quite good. NO_2+NO_3-N concentrations were well below the potential algal bloom level. T-P levels were generally below, and Ortho-P levels averaged at, their respective potential bloom concentrations, with the highest occuring in the spring. Ammonia levels were low, and pH values were well within the limits of the State standard throughout the period.

3. Wide Hollow Creek:
Nutrient levels in Wide Hollow Creek greatly exceeded their respective potential algal bloom levels, especially during the winter. Some winter/spring NH_3-N concentrations approached or exceeded that level considered as being indicative of organic pollution. Total coliform levels were well above the Washington water quality standard over the entire period studied. pH values were rather high, reaching the upper limit of the State standard in late July and early August.

DATA SUMMARY

	Data Needs						Data Available	Data Deficient
	W.Q. Trends	Waste Load Alloc.	Modeling	W.Q. Standards			(P=partial data available)	
A Physical								
1. Receiving Water	X	X	X				X	
2. Reservoirs	X	X	X				X	
3. Outfall Information		X	X				P	X
4. Tributaries & Diversions	X	X	X				X	
5. Groundwater Accretions	X	X	X					X
B Meteorological		X	X					
C Water Quantity								
1. Steamflow	X	X	X				P	X winter flows
2. Stage, Tide								
3. Point Source Discharge		X	X				P	X
4. Non-Point Source Discharge		X	X				P	X
5. Lake & Res. Water Levels	X	X	X				X	
D Water Quality								
1. Carbon data	X	X	X	X			P	X susp. solids
2. Nutrients	X	X	X	X			P	X winter data
3. Metals								
4. D.O., Temp., pH, Cond.	X	X	X	X			P	X diurnal d.o.
5. Pesticides	X	X	X	X			P	X
6. Transfer Ratio		X	X					X
E Biological								
1. Phytoplankton & Zooplankton	X		X				P	X
2. Benthic Macroinvertebrates	X							X
3. Microorganisms	X	X	X	X			P	X
4. Algal & bio assays	X	X						X
F Sediments								
1. Chemical Composition	X	X	X				P	X
2. Partical Size	X							X
3. Pesticides	X						P	X
4. Transfer Ratio		X	X					X

BASIN DESCRIPTION

YAKIMA RIVER BASIN

INTRODUCTION

The Yakima Subregion, an area covering 6,062 square miles and representing about 2 percent of the total area of the Columbia-North Pacific Region, lies totally within the State of Washington. About 45 square miles are water and 6,017 are land.

The Cascade Range, rising on the western border of the Yakima Subregion to elevations of six to eight thousand feet, is flanked for many miles on the east by southeastward trending upwarped ridges. The Wenatchee Mountains, largest of the uplifts, comprise the northern border of the subregion. The Yakima River flows east and south through the Kittitas Valley from its ruggedly glaciated headwaters area. South of the valley, the river cuts through the flanking Manastash and Umtanum Ridges in a deep canyon. The river enters the middle valley above Yakima through a gap cut in Selah Ridge and leaves it through Union Gap in Ahtanum Ridge. Cleman and Cowiche Mountains, Tieton, Selah, Yakima, and Ahtanum Ridges border the middle valley. Rattlesnake Hills crossing eastern Yakima and northern Benton Counties and Horse Heaven Hills to the south are prominent features bordering the lower valley in its 80-mile reach from Union Gap to the Columbia River. The Yakima River joins the Columbia River at an elevation of 340 feet. The valley bottoms, the adjoining terraces, and the surrounding gentle slopes contain the subregion's agricultural land.

The larger glacial lakes fed from the mountain headwater area have been improved as storage reservoirs. The Yakima River is the outlet of Keechelus Lake, the westernmost of three such lakes. Ten miles downstream the Yakima River is joined by the Kachess River, a larger reservoir outlet; and 10 miles farther down its course the Yakima is joined by the Cle Elum River flowing from Cle Elum Lake, largest on the Yakima system. Teanaway River, Swauk Creek, and several smaller creeks contribute drainage from the Wenatchee Mountains. Taneum, Manastash, and Umtanum Creeks flow eastward between parallel ridges to join the Yakima from the west.

Joining the Yakima below its deep canyon section, the Naches River also taps a large and productive watershed east of the Cascade summit. Of its tributaries, Bumping River, flowing from the lake of that name, and Tieton River, outlet of Rimrock Lake (Tieton Dam), and Clear Lake reservoirs are the most important. Below Union Gap

the major tributaries of the Yakima are Ahtanum, Toppenish, and Satus Creeks entering from the west.

Geology of the subregion is relatively simple as the entire area is underlain by a great thickness of flows of dark gray to black basaltic lava. Fairly large exposures of rock may be found along the larger stream valleys and at higher elevations on the hills. A few layers of sediments are interbedded in the lava.

A period of deformation followed deposition of the lava, and anticlinal ridges and closed basins developed in the lava. Coarse, heavy sediments accumulated in the depressions. When a drainage system again developed and streams began to entrench their channels, the major streams cut deep, steep-walled canyons through the ridges. Much of the sediment was removed from the basins. Gravel deposits were left in many of the valleys.

During glacial time, the main river system was dammed, and the canyons and deeper basins were flooded. Thick deposits of silty to sandy sediments of glacial origin accumulated in the lake. After the dam broke and the streams were again free to cut their channels to former depths, much of the lake sediment was eroded. Remnants still remain throughout the area.

Since the disappearance of the lake, windblown materials have blanketed most of the area. Some of the material is of local origin, while other material has been transported from outside the subregion. Much of the soil, especially in the upland areas, has developed from the windblown mantle. This has left predominant soils of medium textured sandy loams and silty loams of considerable depth. The soils have developed under scant rainfall and have a high content of the mineral elements of fertility.

Precipitation

There is a sharp reduction in precipitation as the elevation decreases in an easterly direction from the summit of the Cascade Range.

For example, within a distance of 20 miles, annual precipitation decreases from 92 inches at Stampede Pass (elevation 3,958 feet) to 22 inches at Cle Elum (elevation 1,920 feet). Within the next 20 miles, it decreases to 9 inches at Ellensburg (elevation 1,727 feet). Annual precipitation ranges from less than 10 inches in the lower valleys to 100 inches or more at the crest of the mountains. Approximately 50 percent of the precipitation falls in the four months October through January, and 75 percent in the period October through March. Total rainfall for the two driest months, July and August, is less than 5 percent of the annual.

Average Monthly and Annual Precipitation (inches), Yakima Subregion, 1931-1960

Station	Elevation	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Benton City 2NW 1/	680	1.08	0.85	0.65	0.46	0.51	0.63	0.17	0.30	0.51	0.74	1.14	1.11	8.15
Bumping Lake	3440	7.85	6.03	4.82	2.29	1.77	1.59	0.53	0.64	1.52	4.28	7.25	9.25	47.82
Ellensburg FAA AP 2/	1727	1.26	0.90	0.76	0.49	0.59	0.83	0.13	0.23	0.44	0.66	1.20	1.37	8.86
Lake Cle Elum	2255	5.87	4.31	3.67	1.57	1.31	1.09	0.36	0.42	1.32	3.61	6.00	6.96	36.49
Rimrock-Tieton Dam	2730	4.21	2.89	2.41	1.16	0.96	1.02	0.34	0.50	0.76	2.36	4.21	5.30	26.12
Snoqualmie Pass 2/	3020	14.77	12.74	11.72	6.39	4.68	4.86	1.67	2.03	4.81	10.46	15.41	18.06	107.60
Sunnyside	747	0.89	0.66	0.48	0.42	0.51	0.84	0.18	0.21	0.35	0.72	0.76	0.88	6.90
Yakima AP 1/	1061	1.19	0.87	0.62	0.47	0.54	0.81	0.13	0.20	0.35	0.60	0.96	1.12	7.86

1/ Period may be longer or shorter than the 30-year normal.
2/ 1930-1959.

SURFACE WATER

The principal streams draining the east slope of the Cascade Range in the northern portion of the subregion are the Yakima, Kachess, and Cle Elum Rivers. Farther south is the Naches River, whose main tributaries, Bumping and Tieton Rivers, also head in the east slope of the Cascades. Issuing from the foothills of the Cascade Range south of the Naches River are the North and South Forks of Ahtanum Creek, Toppenish, and Satus Creeks.

Quantity

The average annual discharge from the subregion is about 3,240 cfs or 0.54 cfs per square mile, one of the lower rates in the region.

Present Utilization

Average annual diversions within this subregion total about 2,400,000 acre-feet for irrigation of approximately 500,000 acres. Diversions for other uses such as industrial, municipal, etc. are small in comparison. Diversions are comprised of natural flow, storage releases, and return flows. There are also some diversions made for hydroelectric power generation.

Reservoirs Having a Total Capacity of 5,000 Acre-Feet or More

Name	Stream	Total Storage (acre-feet)	Active Storage (acre-feet)	Surface Area (acres)	Use 1/
Bumping Lake	Bumping R.	33,700	33,700	1,310	IR
Cle Elum Lake	Cle Elum R.	436,900	436,900	4,800	IR
Clear Creek Lake	N.F. Tieton R.	5,300	5,300	265	IR
Kachess Lake	Kachess R.	239,000	239,000	4,525	IR
Keechelus Lake	Yakima R.	157,800	157,800	2,526	IR
Rimrock Lake	Tieton R.	198,000	198,000	2,528	IR

1/ R - recreation, I - irrigation.

Streamflow Summary for Selected Sites

Stream	Station	Station Number	Gage Datum	Drainage Area (sq mi)	Period of Record	Annual Flow 1/ (cfs) Mean	Max.	Min.	Momentary Flow 2/ (cfs) Max.	Min.
Yakima River	Martin	4745	2,422.40	54.7	03-65	327	563	169	7,370	0
Kachess River	Easton	4760	2,188.10	63.6	03-65	286	526	134	2,530	0
Cle Elum River	Roslyn	4790	2,102.10	203	03-65	911	1,630	537	18,700	0
Yakima River	Cle Elum	4795	1,900	495	06-65	1,575	3,092	879	25,600	46
Yakima River	Untanum	4845	1,300.00	1,594	06-65	2,325	4,394	1,290	41,000	138
Bumping River	Nile	4880	3,367.10	70.7	09-65 3/	288	538	154	5,180	0
American River	Nile	4885	2,700.00	78.9	39-65 3/	235	420	150	2,600	20
Tieton River	Tieton Dam	4915	2,680.99	187	25-65 3/	495	887	278	8,450	0
Naches River	Naches	4940	1,549.67	941	08-65 3/	1,478	2,769	786	32,200	1
N. F. Ahtanum Creek	Tampico	5005	2,450	68.9	07-65	65	119	29	823	4
S. F. Antanum Creek	Conrad Ranch	5010	2,400	24.8	15-65	19	34	7	424	2
Yakima River	Parker	5050	885.89	3,668	08-65	1,894	5,113	356	65,000	4
Yakima River	Kiona	5105	454.41	5,615	33-65 3/	3,240	6,843	1,540	67,000	105

1/ Regulated values for base period (1929-1958) 1970 conditions.
2/ Observed values for period of record.
3/ Denotes other short periods of record.

Modified Mean Discharge, in CFS, in Yakima Subregion

Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Annual
						MAXIMUM						
4833	7670	17995	12038	10383	9209	11718	19033	15877	4143	1821	4062	9898
						MAXIMUM YEAR						
4255	7670	6443	4718	3013	6076	11718	19033	12796	2124	1537	2736	6843
						20 PERCENT						
2349	4118	3975	3614	3950	5146	4832	9072	7156	2040	1729	2105	4174
						MEAN						
2051	3134	3533	2966	3344	3685	3552	5712	5409	1911	1584	1994	3240
						80 PERCENT						
1492	2023	1885	1746	2063	2452	1380	1674	1950	1517	1486	1648	1776
						MINIMUM YEAR						
1548	1730	1536	1339	1637	925	1268	1905	2042	1534	1487	1525	1540
						MINIMUM						
572	1573	958	1339	1488	925	930	1196	1426	1181	1144	1057	1149

20 percent and 80 percent represents the runoff available 20 percent and 80 percent of the time.

Surface Water Rights, Yakima Subregion, 1967

Basin No. 1/	River Basin	Municipal	Irrigation	Individual and Community Domestic	Industrial and Commercial	Fish Propagation	Stock	Total 2/	Reservoir Storage Rights
		(Cubic Feet per Second)							(Acre-Feet)
37	Lower Yakima	115.20	637.88	1608.19 3/	105.55	23.30	0.03	1895.20 4/	175
38	Naches	30.00	50.30	52.37	50.00	27.81	0.02	121.97	242,600 9/
39	Upper Yakima	1.00	2526.48 7/	3542.08 7/	2.00	7.00	0.96	3636.71 7/	835,111 10/
Appropriative Totals		146.20	3214.66	5202.64	157.55	58.11	1.01	5653.88	1,077,886
37	Lower Yakima	-	204.19 5/	204.19 5/	-	-	203.81 5/	204.19 5/	-
38	Naches	-	44.25 6/	44.25 6/	-	-	44.25 6/	44.25 6/	-
39	Upper Yakima	-	349.68 8/	157.58 8/	-	-	157.58 8/	349.48 8/	-
Adjudicated Totals		-	598.12	406.02	-	-	405.64	597.92	-
Combined Totals (Approp. & Adjud.)		146.20	3812.78	5608.66	157.55	58.11	406.65	6251.80	1,077,886

1/ Water Resource Inventory Area number
2/ Total prime right quantities do not agree with the sum of the uses because (1) only the more important use categories are listed and (2) water right quantities that are common to two or more uses are listed under each applicable use category.
3/ Includes 1000.00 cfs common with power generation use and 600.00 cfs common with irrigation use.
4/ Includes 1013.00 cfs for power generation use.
5/ Nearly all of the quantities for stock use and individual and community domestic supply are common with irrigation use.
6/ The quantities for irrigation, individual and community domestic supply and stock use are all common.
7/ A total of 2443.00 cfs is common among hydroelectric power generation, irrigation, and individual and community domestic uses.
8/ A total of 157.58 cfs is common among irrigation, individual and community domestic supply and stock uses.
9/ Includes 5800 acre-feet in Clear Lake, 202,500 acre-feet in Rimrock Lake, and 34,000 acre-feet in Bumping Lake.
10/ Includes 437,000 acre-feet in Cle Elum Lake, 157,800 acre-feet in Keechelus Lake, and 239,000 acre-feet in Kachess Lake.

YAKIMA RIVER BASIN

1. Projected Population (thousands) -

1980	2000	2020
211.2	258.4	327.0

2. Average Precipitation - 20.3 inches

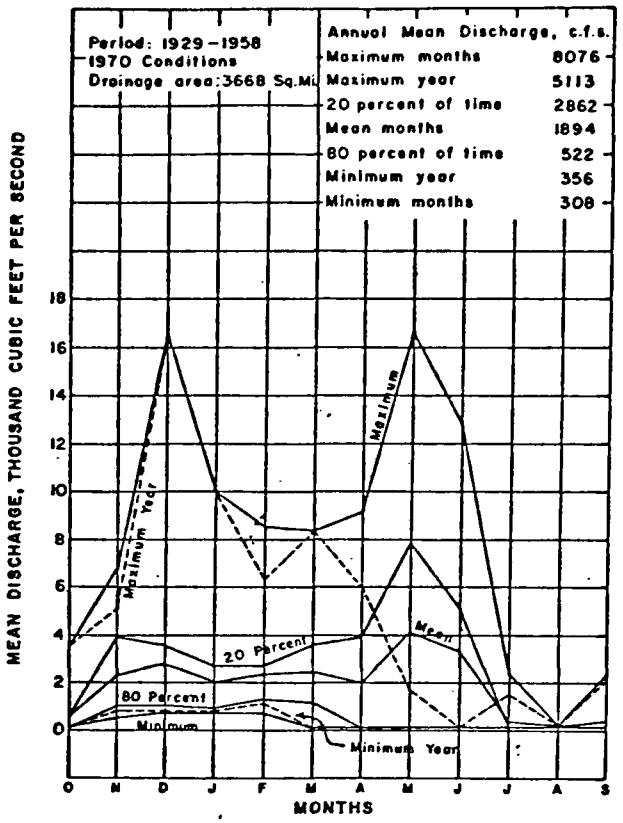
3. Drainage Area - 6,062 sq. miles

4. Mainstem Mileage - RM 0.0 - RM 214.5

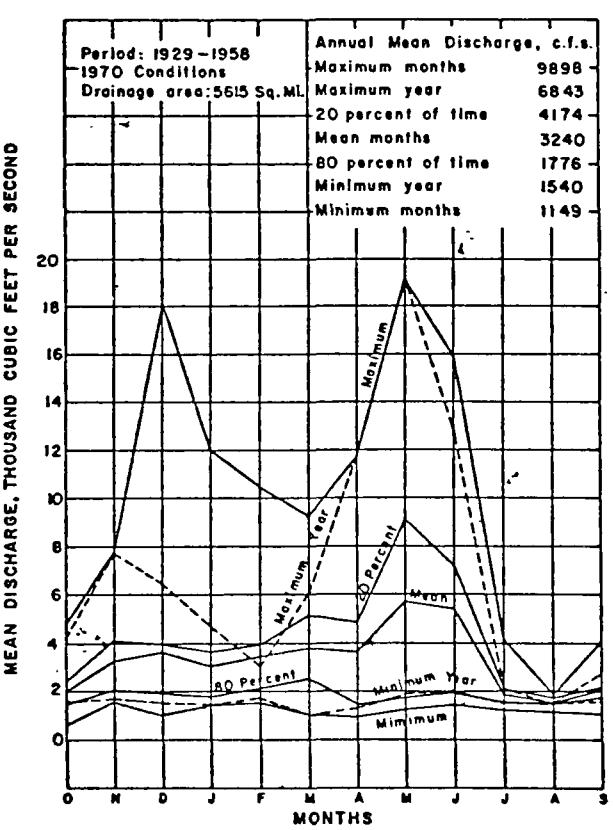
5. Water Supplies from Mainstem - 1: Ellensburg

6. Average Discharge - 3,240 cfs

GRAPH 1



Monthly discharge, Yakima River near Parker



Monthly discharge, Yakima River at Kiona

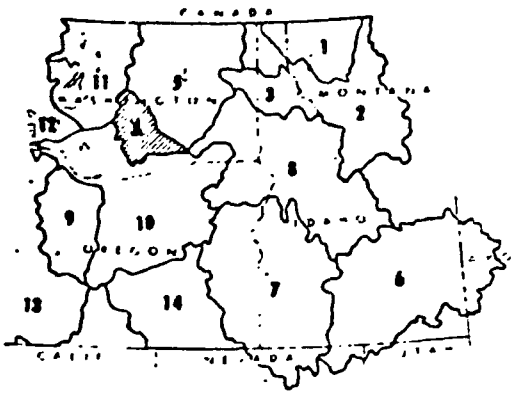
STATE WATER QUALITY SEGMENTS

YAKIMA RIVER BASIN

MARCH 1974

Segment Number	Segment Name	Class
18-37-01	Yakima R. & tribs. from mouth to Sunnyside Dam Bridge	WQ-NPS
18-37-02	Yakima R. & tribs. from Sunnyside Dam Bridge to Wilson Cr.	WQ-NPS
18-37-03	Wide Hollow Cr. & tribs.	WQ-NPS
18-39-04	Yakima R. from Wilson Cr. to Thorp	EFF
18-39-05	Yakima R. & tribs. from Thorp to headwaters	WQ-NPS
18-39-06	Wilson Cr. & tribs.	WQ-NPS
18-38-07	Naches R. & tribs.	WQ-NPS

FIGURE 1



LOCATION MAP

Base Rev Oct 1969

CIRCLED STATIONS REPRESENT MAINSTEM STATIONS USED FOR THE AMBIENT PROFILES & CAUSE-EFFECT ANALYSES.

SAMPLING STATION LOCATIONS

● WASH. D.O.E./U.S.G.S. STATIONS

○ DITTO, NOT USED IN THIS REPORT

▲ U.S.B.R. STATIONS

KEY TO STATION LOCATION MAP

MAP NO.	STATION NUMBER	STATION NAME
1.	YAV 140	Yakima R. at Cle Elum
2.	YAV 147	Yakima R. at Ellensburg
3.	YAV 145	Wipple W.W. at Thrall Road
	YAV 146	Wilson Creek at Thrall Road
4.	YAV 148	Yakima R. at Umtanum
5.	YAV 101	Yakima R. at Harrison Bridge
6.	YAV 102	Naches R. at Nelson Bridge
7.	37A210	Yakima R. near Terrace Heights
8.	YAV 104	Drain at Birchfield Road
9.	37E070	Wide Hollow Creek at Union Gap
10.	YAV 109	Antanum Creek at Mouth
11.	37A190	Yakima R. at Parker
	12505000	Yakima R. near Parker
12.	37A170	Yakima R. near Toppenish
13.	YAV 128	E. Toppenish Drain at Wilson Road
14.	YAV 129	Sub-Drain 35 at Parton Road
15.	YAV 137	Granger Drain at Hwy 223 aboye Granger
16.	37D080	Marion (Main) Drain near Granger
17.	37C060	Toppenish Creek near Satus
18.	37B060	Satus Creek at Satus
19.	SC-1 (CH_2M Hill)	Sulphur Creek at Green Valley Road
	YAV 120	Sulphur Creek W.W. at Morse Road
	YAV 121	Sulphur Creek W.W. at McGee Road
20.	YAV 135	South Drain at Hwy 22 near Satus
21.	37A130	Yakima R. at Mabton
22.	37A110	Yakima R. at Prosser
23.	YAV 138	Spring Creek at Hess Road
	YAV 139	Snipes Creek at Old Inland Empire Road
24.	37A090	Yakima R. at Kiona
	543005	Yakima R. at Kiona
25.	37A060	Yakima R. at Van Giessen Bridge

NOT USED IN THIS REPORT:

26.	39B070	Cle Elum R. near Cle Elum
27.	39A090	Yakima R. near Cle Elum
28.	39A070	Yakima R. near Thorp
29.	39C070	Wilson Creek at Thrall
30.	38A070	Naches R. at Yakima

AMBIENT PROFILE

PROFILE GRAPH EXPLANATION

The two-year running average technique is a graphical representation of long term ambient data designed to smooth out irregularities in the data. The technique has no statistical significance; however, it does show long term trends in the data.

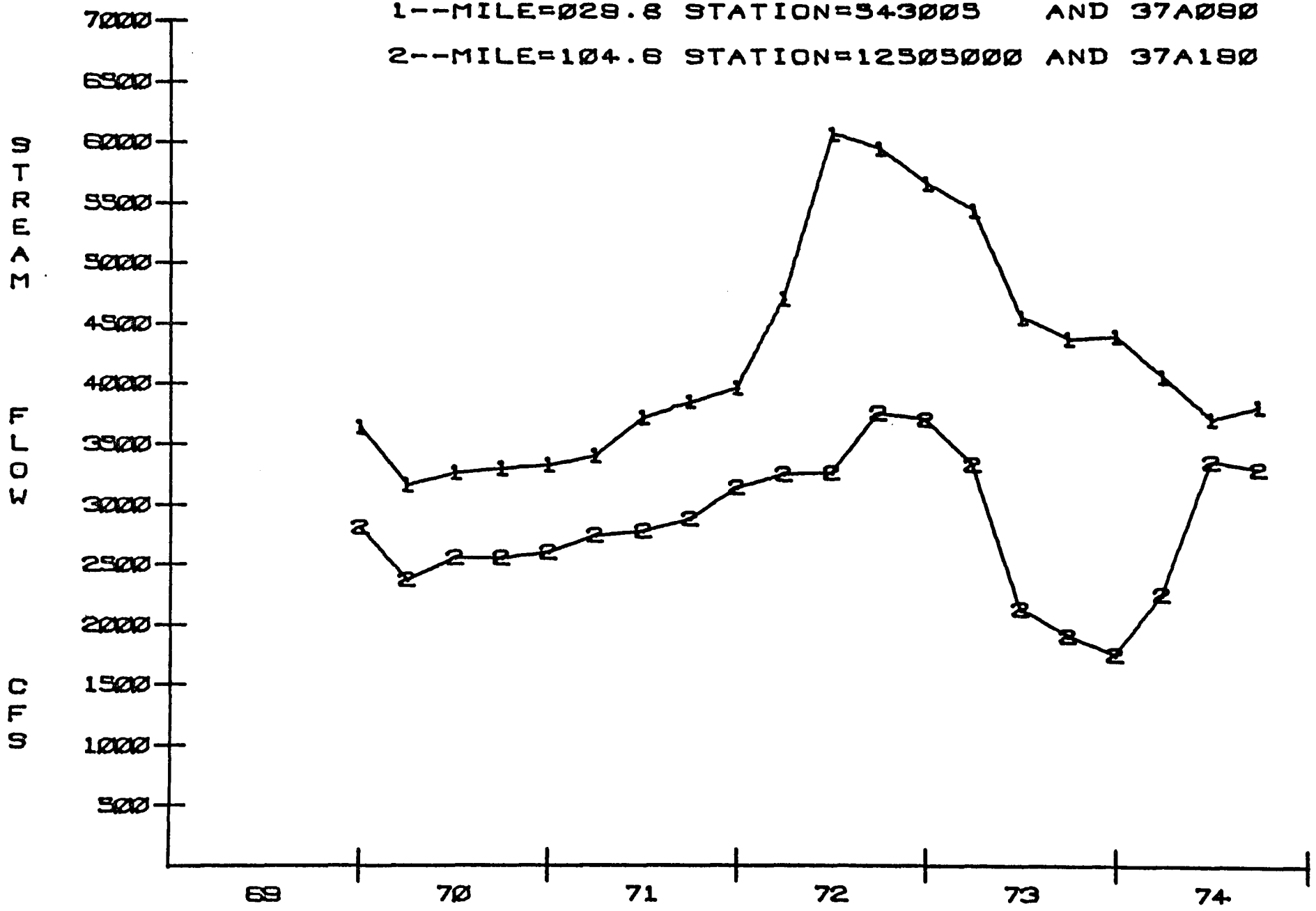
Data from 1968 to 1974 was first reduced to consecutive monthly averages. Then the monthly averages for two years, January 1968 to December 1969, were averaged and the point plotted at December 1969 (using the flow graph as an example). Next, the time plot was advanced 3 months and the monthly averages for that corresponding two-year period April 1968 to March 1970, were averaged and the point plotted at March 1970. This process was continued at 3 month increments until September 1974, and 20-21 points in all were plotted per graph. Total coliform points represent geometric means as dictated by convention.

GRAPH 2

YAKIMA RIVER TRENDS

1--MILE=028.8 STATION=543005 AND 37A080

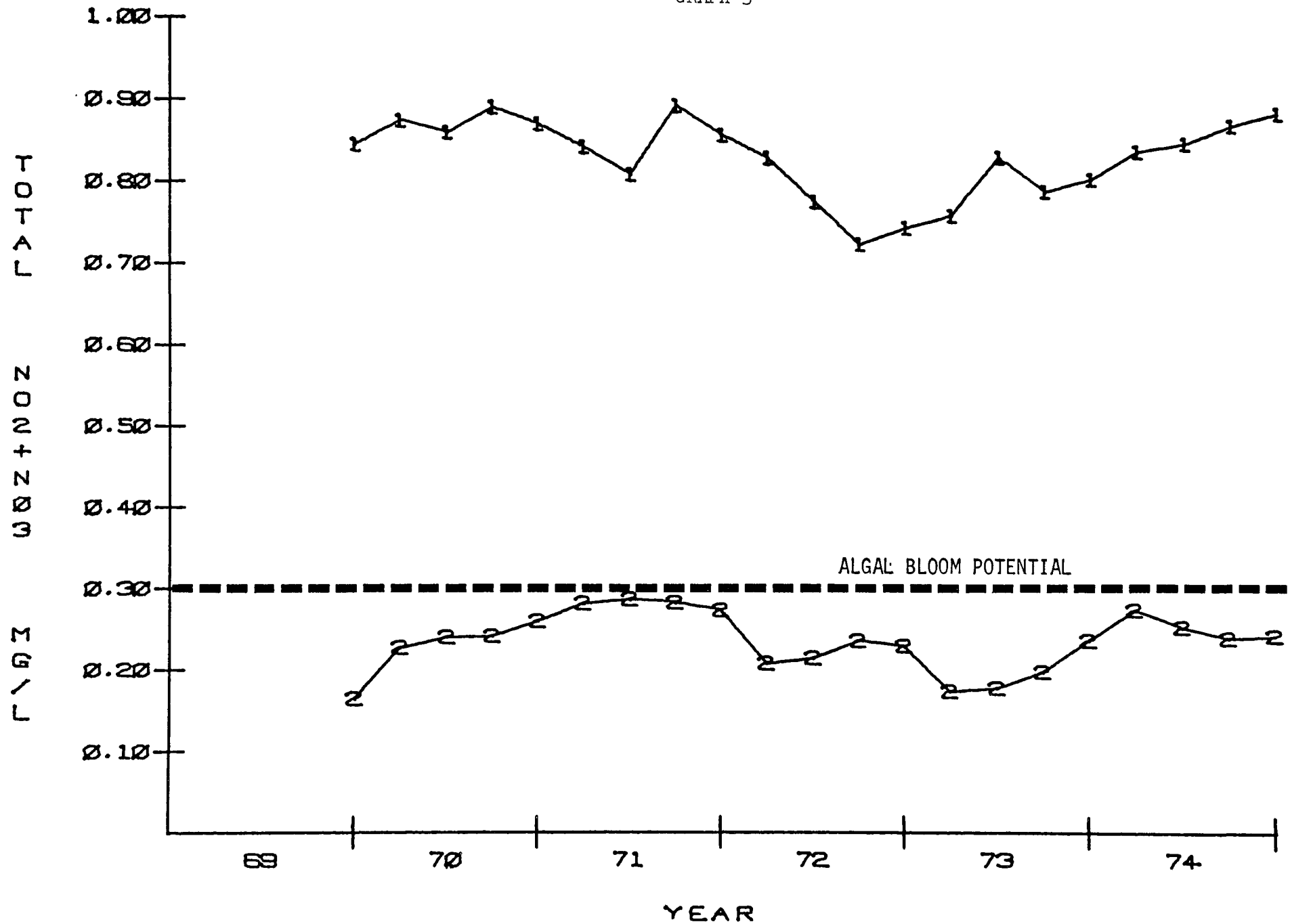
2--MILE=104.6 STATION=12505000 AND 37A180



1--MILE=029.8 STATION=543005 AND 37A090

2--MILE=104.8 STATION=12505000 AND 37A190

GRAPH 3

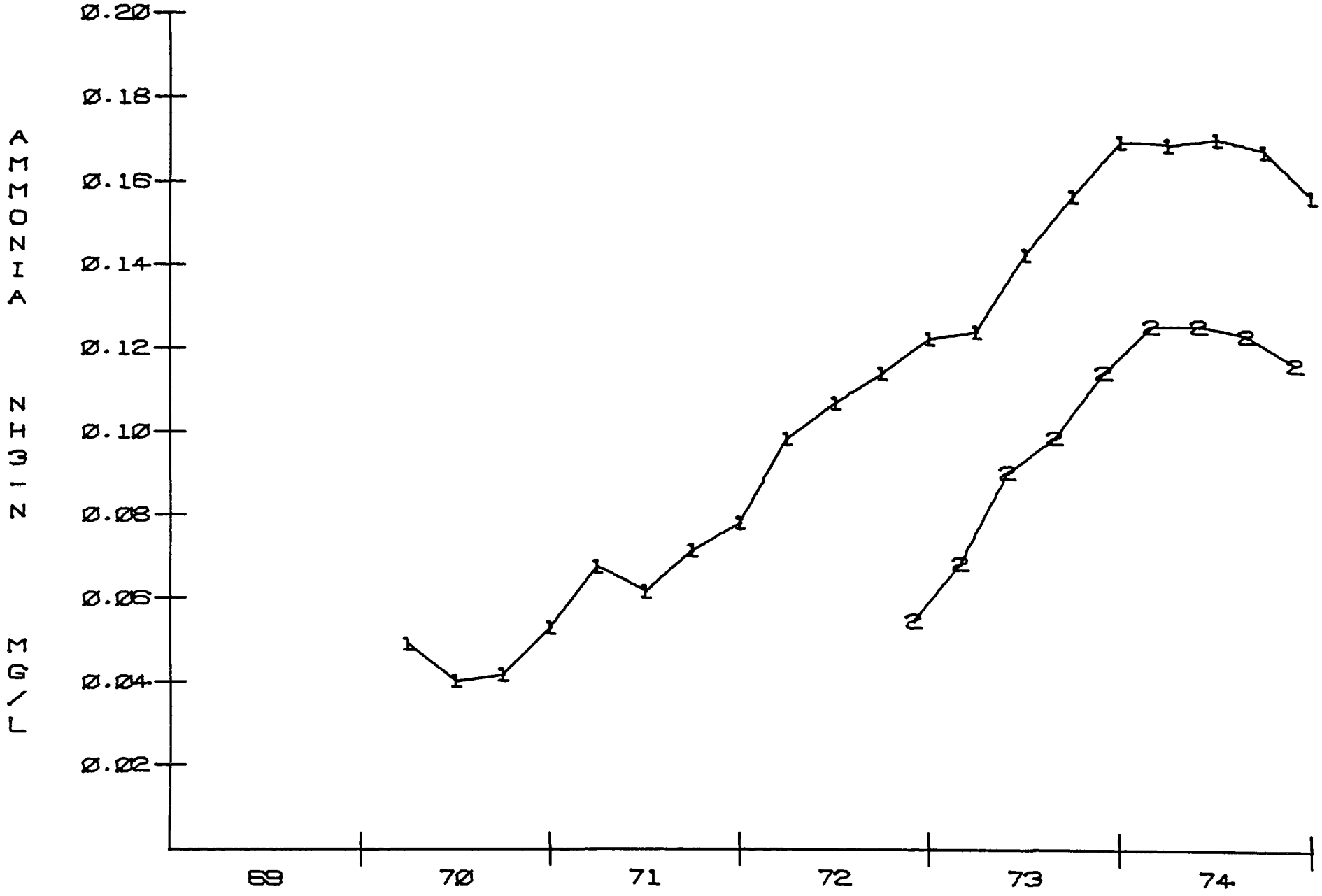


YAKIMA RIVER TRENDS

1--MILE=029.8 STATION=543005 AND 37A090

2--MILE=104.6 STATION=37A190

GRAPH 4

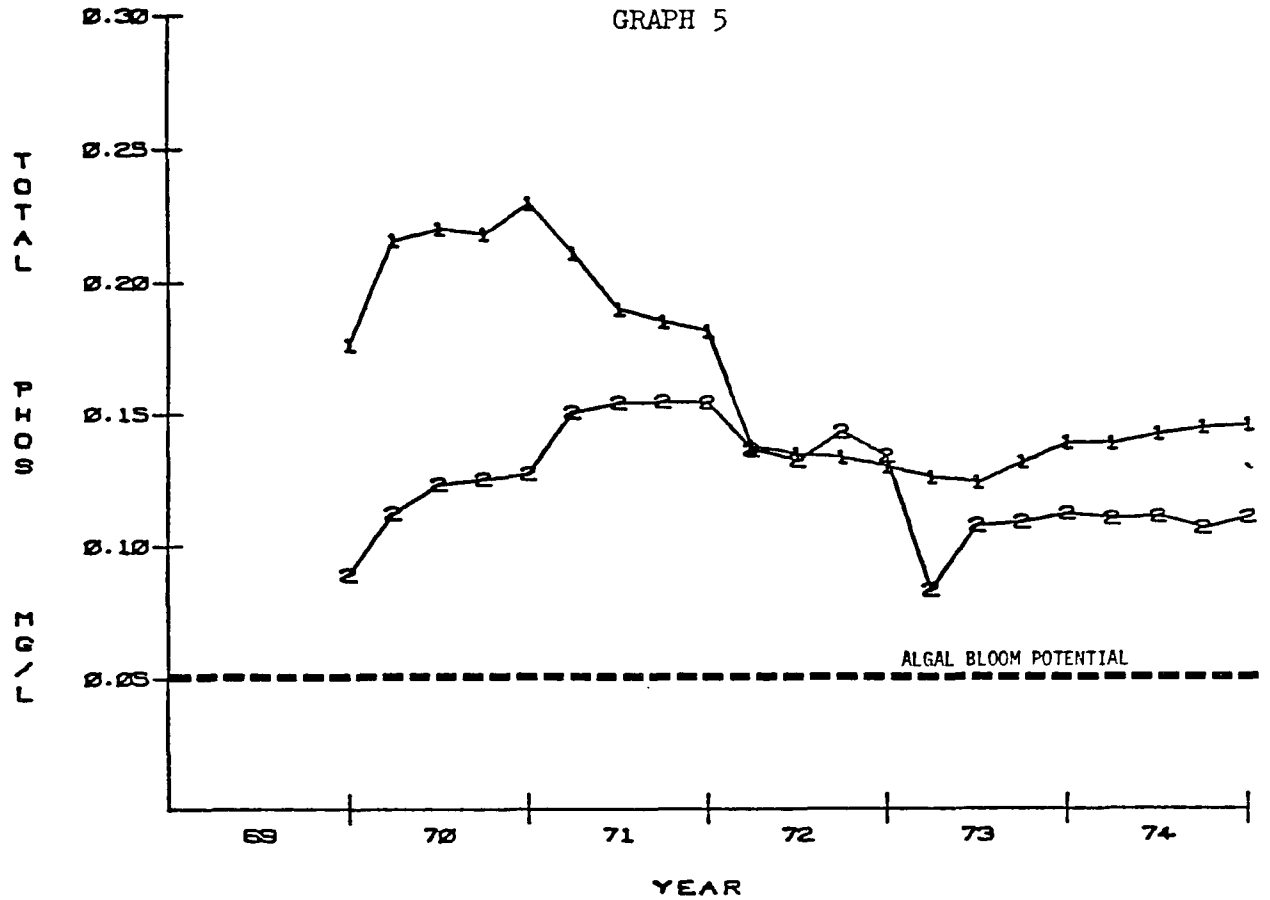


YAKIMA RIVER TRENDS

1--MILE=029.8 STATION=543005 AND 37A090

2--MILE=104.8 STATION=12505000 AND 37A190

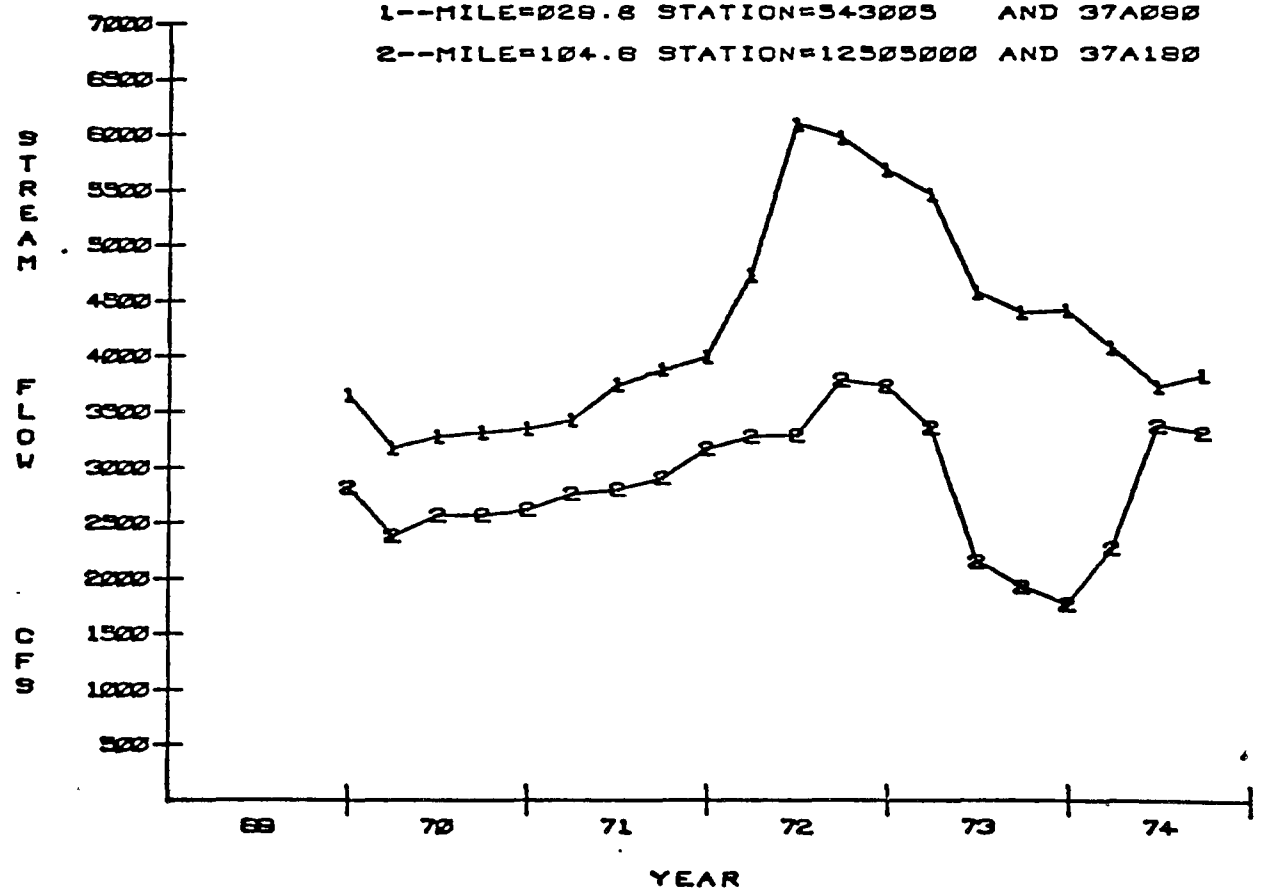
GRAPH 5



YAKIMA RIVER TRENDS

1--MILE=029.8 STATION=543005 AND 37A090

2--MILE=104.8 STATION=12505000 AND 37A180

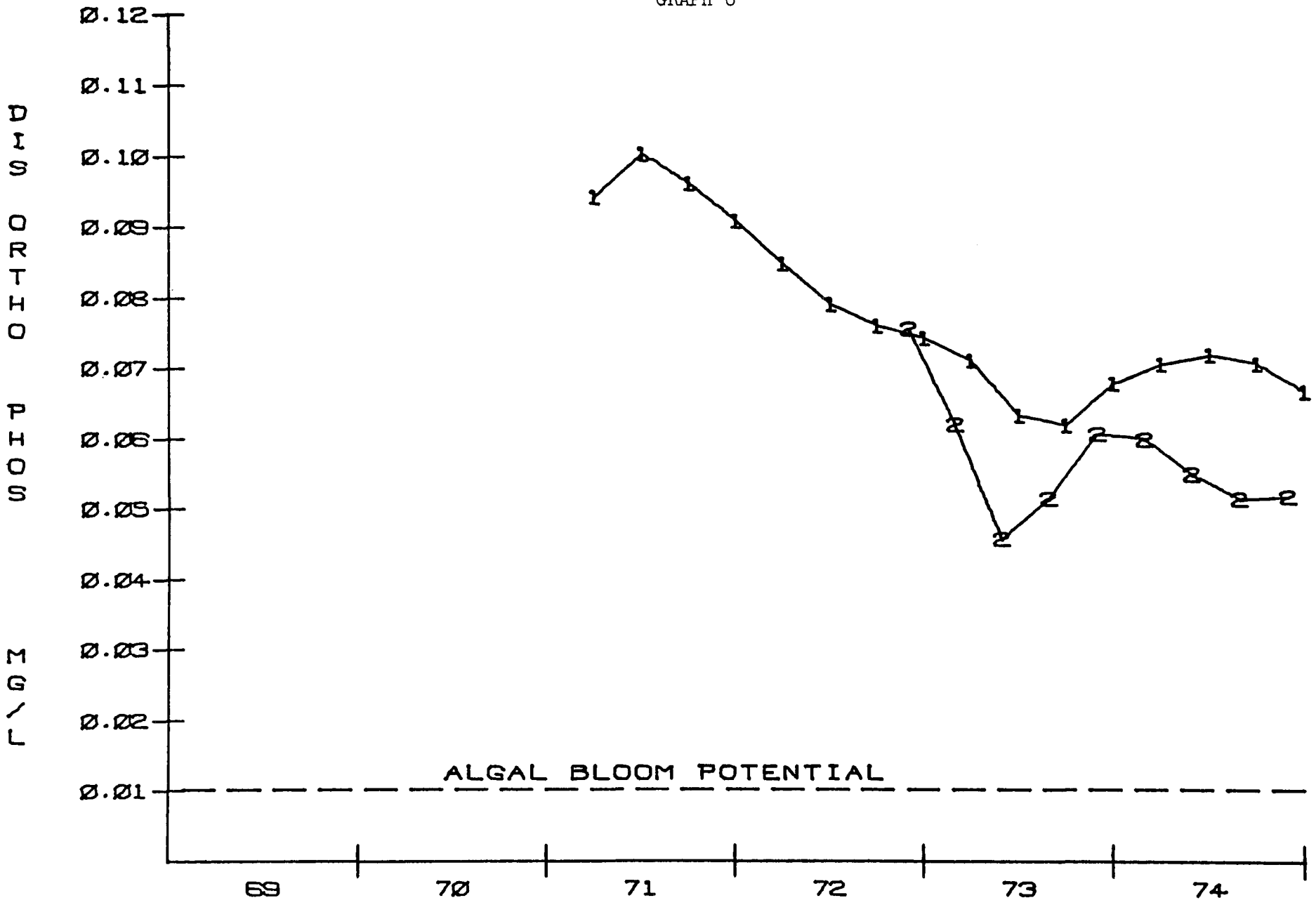


PARTHENIA RIVER TRENDS

1--MILE=029.8 STATION=543005 AND 37A090

2--MILE=104.6 STATION=37A190

GRAPH 6

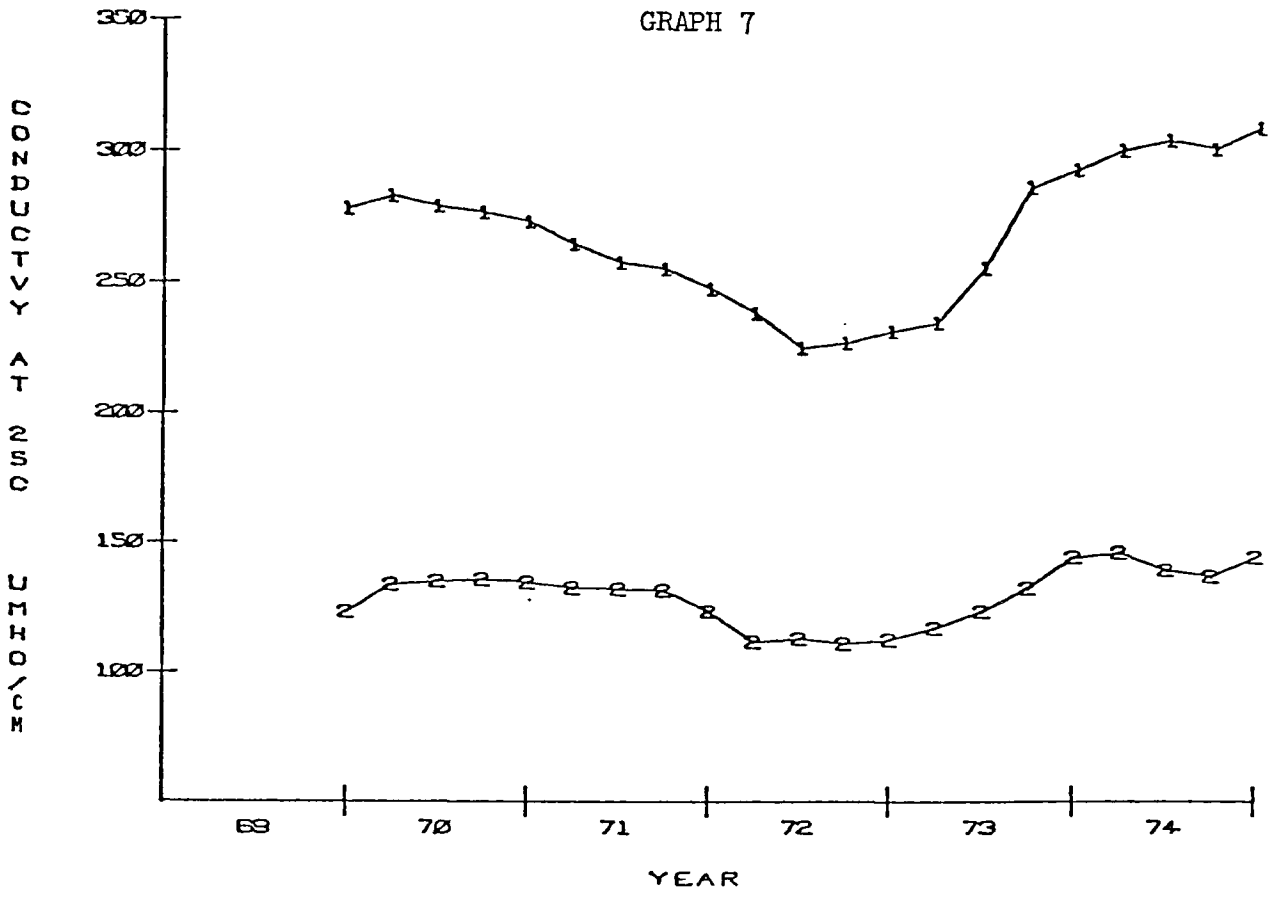


YAKIMA RIVER TRENDS

1--MILE=029.8 STATION=543005 AND 37A090

2--MILE=104.8 STATION=12505000 AND 37A190

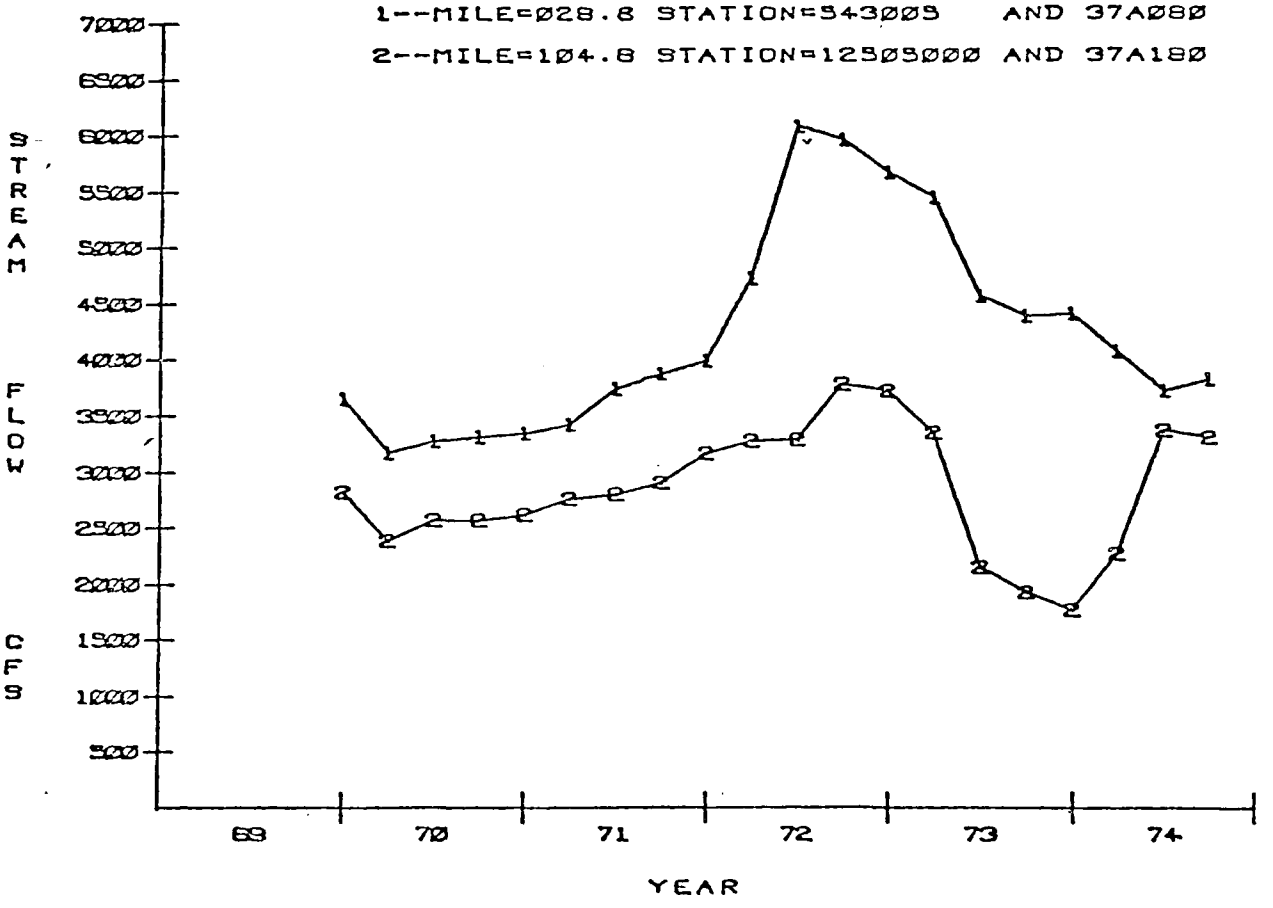
GRAPH 7



YAKIMA RIVER TRENDS

1--MILE=028.8 STATION=543005 AND 37A080

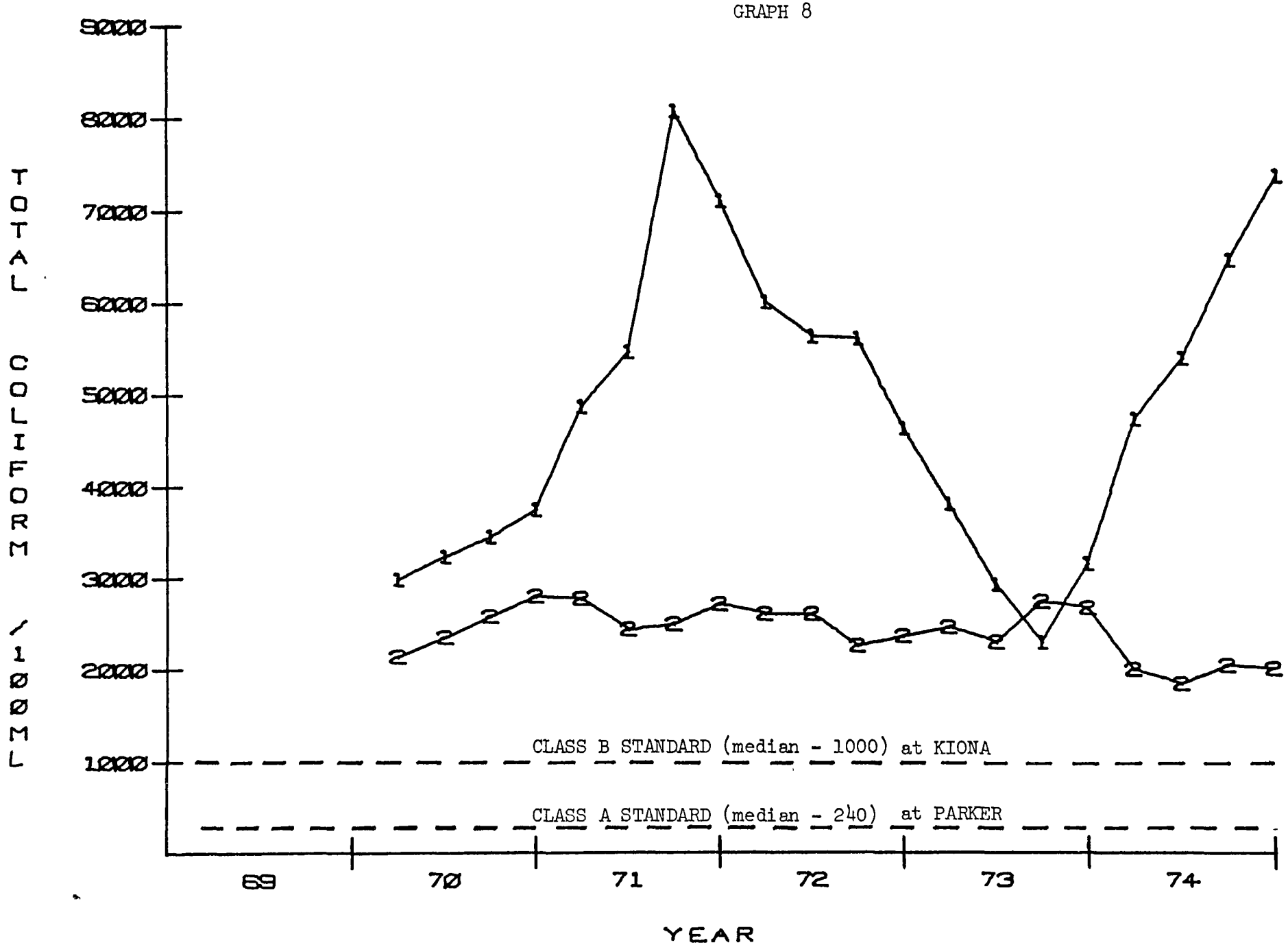
2--MILE=104.8 STATION=12505000 AND 37A180



1--MILE=029.8 STATION=543005 AND 37A090 AT KIONA

2--MILE=104.8 STATION=12505000 AND 37A190 AT PARKER

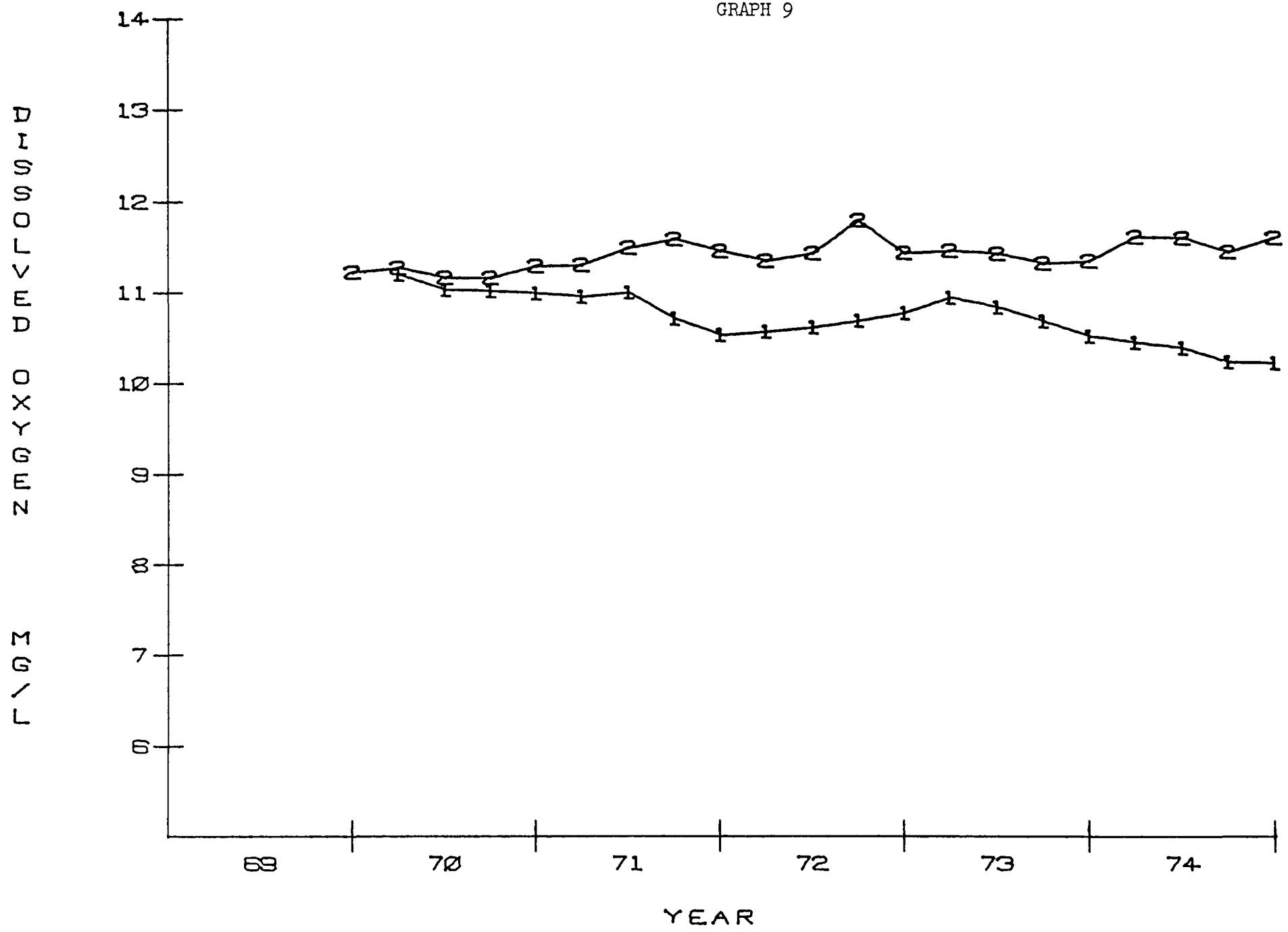
GRAPH 8



1--MILE=029.8 STATION=543005 AND 37A090

2--MILE=104.6 STATION=12505000 AND 37A190

GRAPH 9



SOURCE PROFILE

TABLE 1

YAKIMA RIVER BASIN

TOTAL BASIN LOADINGS
BY SOURCE TYPE

	BOD	SS	$(NO_2 + NO_3)$-N	NH_3-N	Total-P
% Municipal	33	49	20	22	36
% Industrial	67	51	Negl.	32	8
% Tribs./Drains	-	-	80	46	56

YAKIMA RIVER BASIN

MUNICIPAL POINT SOURCE LOADINGS

MUNICIPAL SOURCE	RECEIVING WATER	MAINSTEM RIVER MILE	AVERAGE FLOW (MGD)	BOD_5			SUSPENDED SOLIDS			NO_3 -N			TOTAL P			NH_3 -N		
				Pounds/Day	% Munic.	% Basin	Pounds/Day	% Munic.	% Basin	Pounds/Day	% Munic.	% Basin	Pounds/Day	% Munic.	% Basin	Pounds/Day	% Munic.	% Basin
Hyak/Snoqualmie Pass	Coal Creek	220.1	.065	10	-	-	17	-	-	2 *	-	-	2 *	-	-	-	-	-
Ronald	Cle Elum R.	185.6	.02 *	6 *	-	-	6 *	-	-	4 *	-	-	2 *	-	-	-	-	-
Roslyn	Crystal Creek	183.1	.07	31 *	-	-	31 *	-	-	22 *	-	-	8 *	-	-	-	-	-
South Cle Elum	Yakima R.	182.5	.04	56 *	-	-	56 *	-	-	10 *	-	-	4 *	-	-	-	-	-
Cle Elum	Yakima R.	180.7	.17 *	240 *	3.5	1.2	240 *	3.4	1.7	43 *	1.7	-	15 *	1.0	-	-	-	-
Ellensburg	Yakima R.	151.7	5.7	1000	14.7	4.8	710	10.2	5.0	660 *	26.8	5.2	255 *	18.8	6.7	-	-	-
Kittitas	Cooke Creek	147.0	.5	110 *	1.6	-	110 *	1.6	-	20 *	-	-	7 *	-	-	-	-	-
Yakima Firing Center	Yakima R.	120.5	.01 *	3 *	-	-	3 *	-	-	2 *	-	-	2 *	-	-	-	-	-
Selah	Drain Ditch	117.0	.5	25	-	-	50	-	-	500 *	20.3	4.0	200 *	14.7	5.3	-	-	-
Naches	Naches R.	116.3	.10	46 *	-	-	46 *	-	-	15 *	-	-	6 *	-	-	-	-	-
Cowiche S.D.	N.F. Cowiche Creek	116.3	.11	170 *	2.5	-	170 *	2.4	1.2	30 *	1.2	-	10 *	-	-	-	-	-
Terrace Heights S.D.	Yakima R.	112.2	.12	50	-	-	83	1.2	-	4	-	-	15	1.0	-	30	4.9	1.0
Yakima Municipal	Yakima R.	111.1	9.6	1230	18.1	6.0	985	14.1	6.9	1	-	-	360	26.5	9.5	425	69.1	15.2
Moxee City	Moxee Drain	107.8	.045	21	-	-	26	-	-	16 *	-	-	6 *	-	-	-	-	-
Union Gap	Wide Hollow Creek	107.4	.9	650	9.6	3.1	700 *	10.0	4.9	1	-	-	3	-	-	130.	21.1	4.6
Zillah	Yakima R.	88.9	.11	63	-	-	67	-	-	25 *	1.0	-	10 *	-	-	-	-	-
Toppenish	E. Toppenish Drain	86.0	1.3	630	9.3	3.1	900	12.9	6.3	125 *	5.1	-	50 *	3.7	1.3	-	-	-
Harrah	Harrah Drain	83.5	.04 *	50 *	-	-	50 *	-	-	9 *	-	-	3 *	-	-	-	-	-
Wapato	Wanity Slough	83.5	.47	165	2.4	-	280	4.0	2.0	190 *	7.7	1.5	73 *	5.4	1.9	-	-	-
B.I.A. - Yakima Indian Comm.	Wanity Slough	83.5	.03(Est)	60 *	-	-	60 *	-	-	60 *	2.4	-	25 *	1.8	-	-	-	-
Granger	Yakima R.	82.8	.13	76	1.1	-	88	1.3	-	34 *	1.4	-	13 *	1.0	-	-	-	-
Sunnyside	Sulphur Creek W.W.	61.0	1.4	850	12.5	4.1	620	8.9	4.4	30	1.2	-	18	1.3	-	-	-	-
Mabton	Yakima R.	59.0	.12	145 *	2.1	-	145 *	2.1	1.0	26 *	1.0	-	9 *	-	-	-	-	-
Grandview	Yakima R.	53.0	1.9	390	5.7	1.9	810	11.6	5.7	1	-	-	19	1.4	-	29	4.9	1.0
Prosser	Yakima R.	46.1	.34	71	1.0	-	45	-	-	64 *	2.6	-	25 *	1.8	-	-	-	-
Richland	Yakima R.	2.0	3.3	660	9.7	3.2	690	9.9	4.8	560 *	22.7	4.4	220 *	16.2	5.8	-	-	-
SUB-TOTAL				6,810			6,990			2,465			1,360			615		
TOTAL BASIN				20,640			14,230			12,645			3,780			2,300		

Permanent population only

Estimates based upon per capita calculations, including any industrial P.E.

Less than 1%

TABLE 2

YAKIMA RIVER BASIN

INDUSTRIAL POINT SOURCE LOADINGS

INDUSTRIAL SOURCE	RECEIVING WATER	MAINSTEM RIVER MILE	AVERAGE FLOW (MGD)	BOD_5			SUSPENDED SOLIDS			NO_3 -N			TOTAL -P			NH_3 -N		
				Pounds/Day	% Indust	% Basin	Pounds/Day	% Indust	% Basin	Pounds/Day	% Indust	% Basin	Pounds/Day	% Indust	% Basin	Pounds/Day	% Indust	% Basin
Schaake Packing Corp.	Yakima	152.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ellensburg Cement Products	Mercer Creek	147.0	.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boise Cascade	Wilson Creek	147.0	.01	3	-	-	3	-	-	Neg.	-	-	Neg.	-	-	-	-	-
Yakima Cement Products	Yakima	118.0	2.16(MAX)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yakima Asphalt Paving	Yakima	118.0	.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Northwestern Fruit & Produce	Ditch	116.3	.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yakima WTP (FILT. B.W.)	Naches R.	116.3	.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boise Cascade #1	Yakima	114.5	4.5	413	3.0	2.0	413	5.7	2.9	4	9.5	*	4	*	*	-	-	-
Boise Cascade #2	Yakima	114.5	.21	22	*	*	22	*	*	Neg.	-	-	-	-	-	-	-	-
Snokist Cannery	Yakima	113.0	.8	60	*	*	115	1.6	*	25	59.5	*	11	*	*	-	-	-
Central Pre-Mix Concrete	Yakima	112.2	.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Snokist Exchange Whse.	Wide Hollow Cr.	107.4	.008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yakima Industrial T.P.	Yakima	109.9	3.0	2350	17.0	11.4	900	12.4	6.3	-	-	-	18	*	*	5	*	*
Snokist (Sawyer Plant)	Ditch	97.9	.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U & I Sugar	Yakima	92.1	4.4	860	6.2	4.2	-	-	-	9	21.4	*	21	*	*	320	35.8	11.4
Flavorland Industries	Wanity Slough	83.5	.35	123	*	*	225	3.1	1.6	3	7.1	*	20	*	*	70	7.8	2.5
Snokist Plant #1	Wanity Slough	83.5	.030	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Snokist Plant #2	Wanity Slough	83.5	.008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boise Cascade	Simcoe Creek	81.6	.005(MAX)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Snokist (Grandview #1)	Sulphur Creek	61.0	.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Prosser Ind. T.P.	Yakima	46.1	.5	10000	72.3	48.4	5560	76.8	39.1	2			230	75.6	6.1	500	53.9	17.9
SUB-TOTALS				13,830			7,240			44			304			895		
TOTAL BASIN				20,640			14,230			12,645			3,790			2,800		

\# Summer Discharge only

* Less than 1%

\- No information available

TABLE 3

YAKIMA RIVER BASIN

MAJOR TRIBS. & DRAINS - 1974 IRRIGATION SEASON
U.S.B.R. & DOE/USGS DATA

TRIB./DRAIN	YAKIMA RIVER MILE	NO_2+NO_3 -N #/ DAY	NO_2+NO_3 -N % TRIBS./ DRAINS	NO_2+NO_3 -N % BASIN	NH_3 - N #/ DAY	NH_3 - N % TRIBS./ DRAINS	NH_3 - N % BASIN	TOTAL - P #/ DAY	TOTAL - P % TRIBS./ DRAINS	TOTAL - P % BASIN
Wilson Creek	147.0	133	1.3	*	8	*	*	58	2.7	1.5
Naches River	116.3	250	2.5	2.0	10	*	*	240	11.3	6.3
Moxee Drain	107.8	170	1.7	1.3	7	*	*	81	3.8	2.1
Wide Hollow Creek	107.4	95	.9	*	670	52.0	23.9	330	15.6	8.7
Ahtanum Creek	106.9	115	1.1	*	3	*	*	42	2.0	1.1
East Toppenish Drain	86.0	700	6.9	5.5	45	3.5	1.6	60	2.8	1.6
Sub-Drain 35	84.2	680	6.7	5.4	6	*	*	35	1.7	*
Main (Marion) Drain	83.5	2610	25.7	20.6	190	14.7	6.8	240	11.3	6.3
Granger Drain	83.7	250	2.5	2.0	25	1.9	*	85	4.0	2.2
Toppenish Creek	81.6	1225	12.1	9.7	95	7.4	3.4	135	6.4	3.6
Satus Creek	69.6	710	7.0	5.6	70	5.4	2.5	125	5.9	3.3
South Drain	62.4	600	5.9	4.7	8	*	*	80	3.8	2.1
Sulphur Creek	61.0	2340	23.0	18.5	145	11.2	5.2	520	24.6	13.8
Snipes Cr. + Spring Cr.	41.5	275	2.7	2.2	5	*	*	85	4.0	2.2
Subtotals		10,150			1290			2115		
Total Basin		12,645			2800			3780		

* Less than 1%

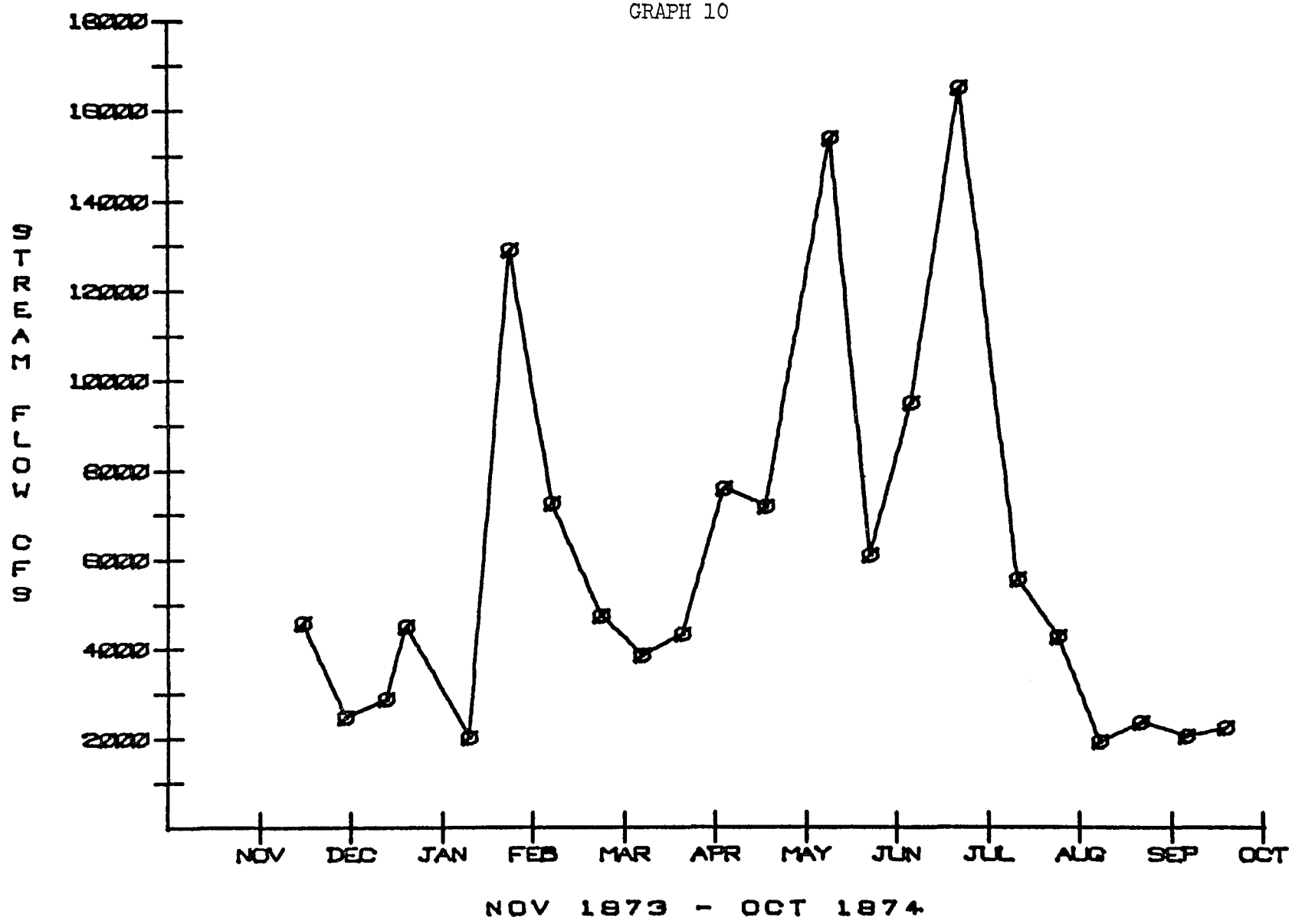
TABLE 4

CAUSE-EFFECT ANALYSIS

YAKIMA RIVER AT KIONA - R.M. 29.8

SEGMENT 18-37-01

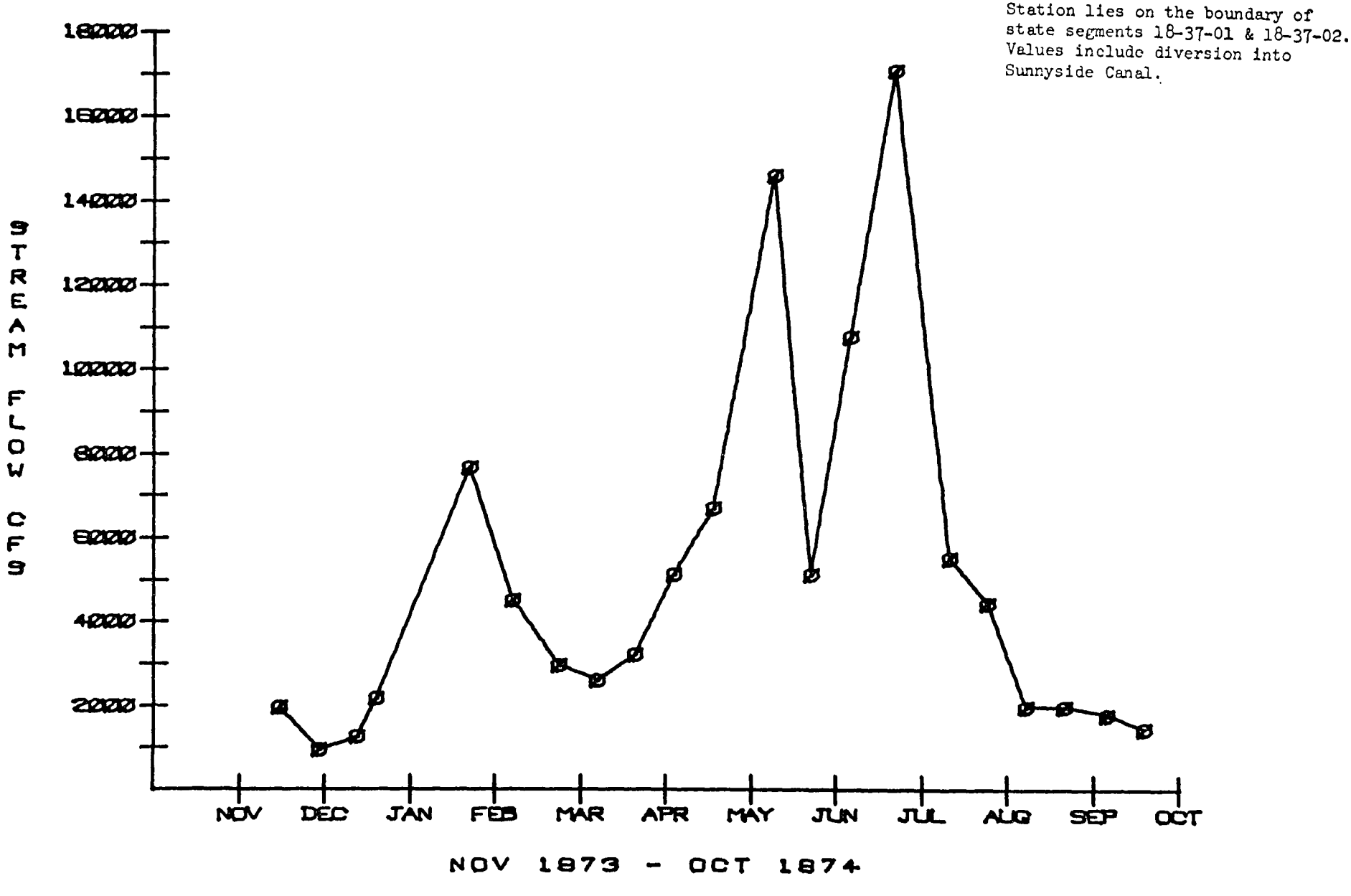
GRAPH 10



NOV 1873 - OCT 1874

YAKIMA RIVER AT PARKER - R.M. 103.8

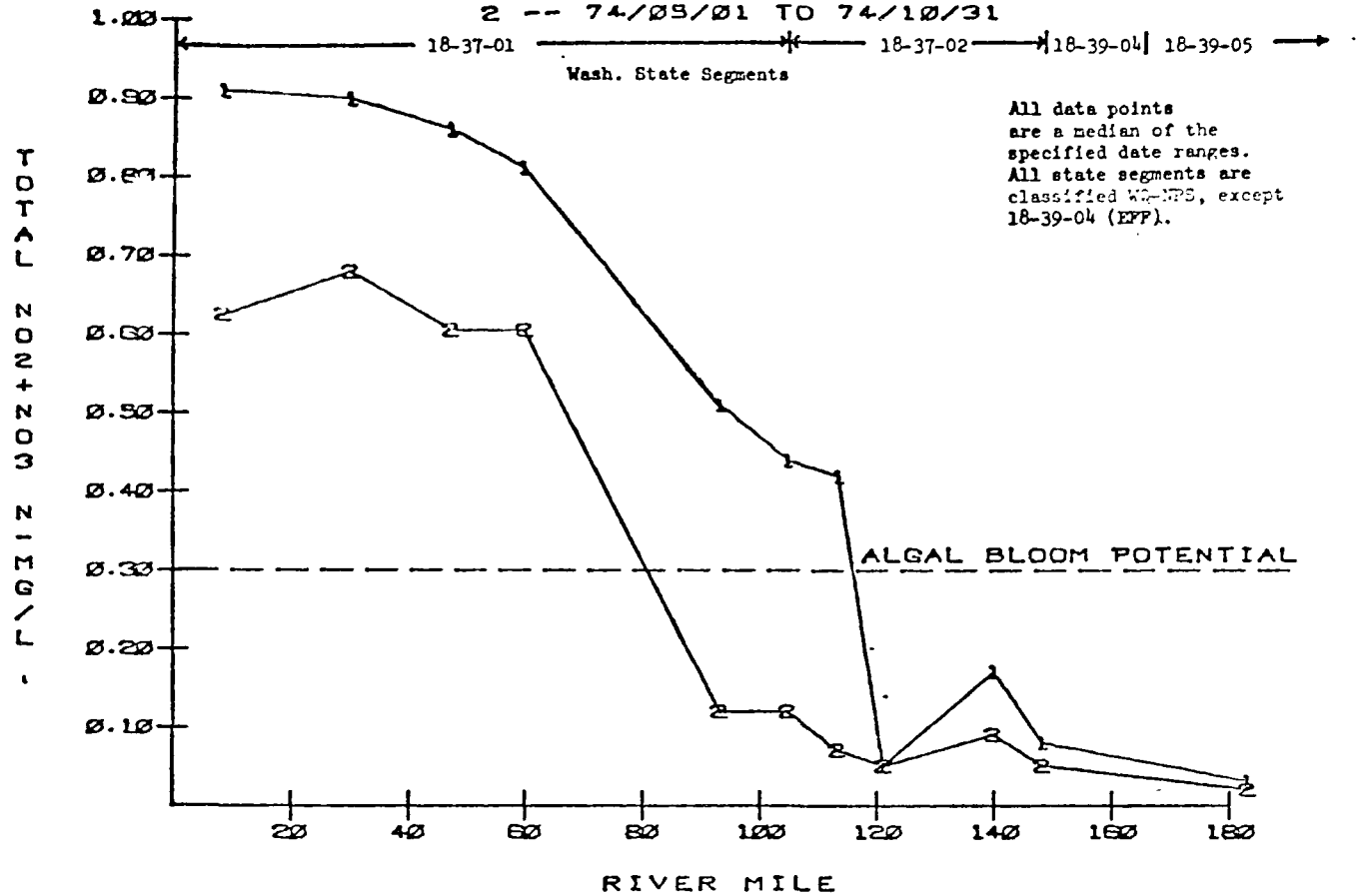
GRAPH 11

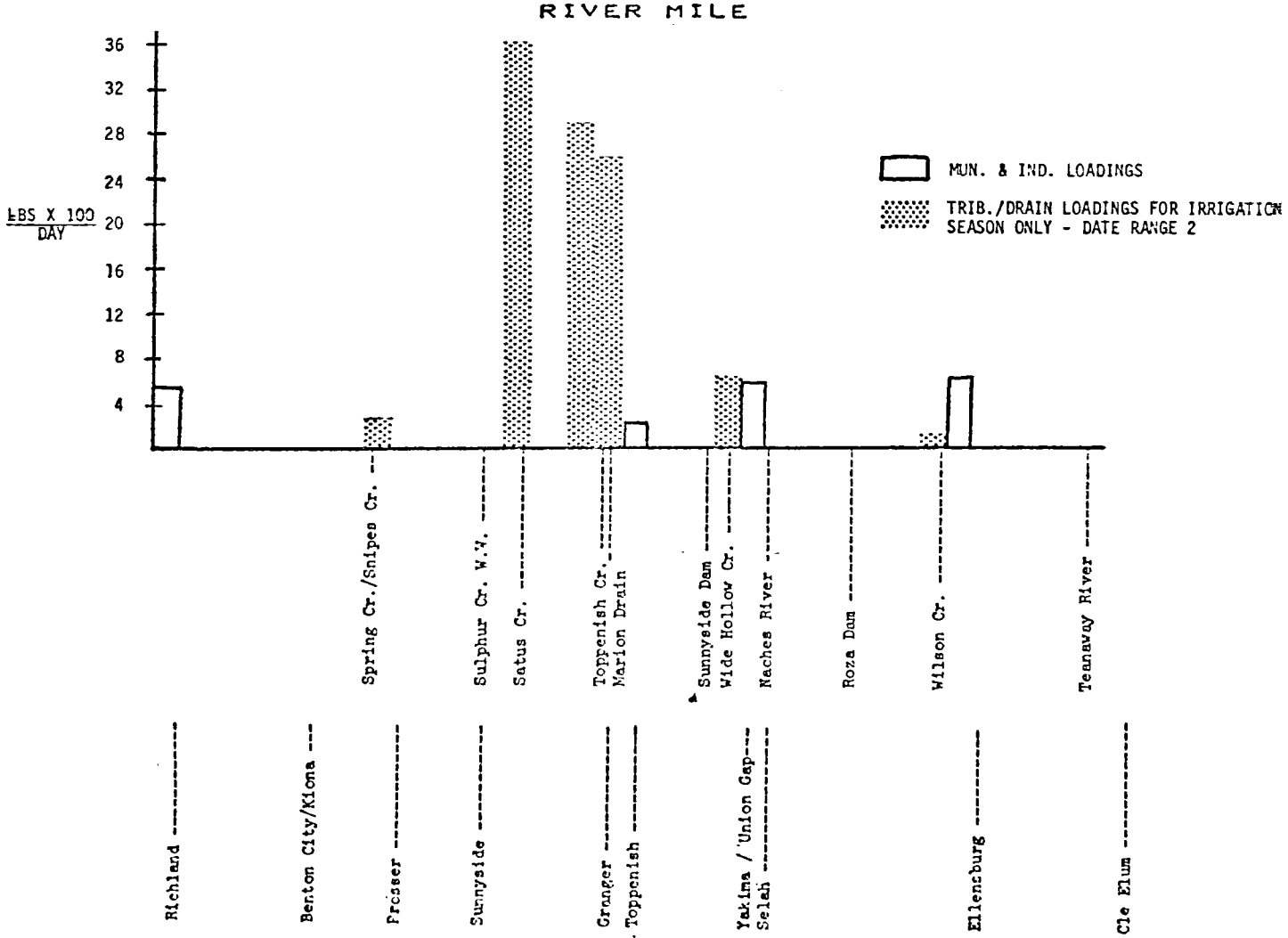


GRAPH 12

YAKIMA RIVER

1 -- 73/11/01 TO 74/03/31
2 -- 74/05/01 TO 74/10/31

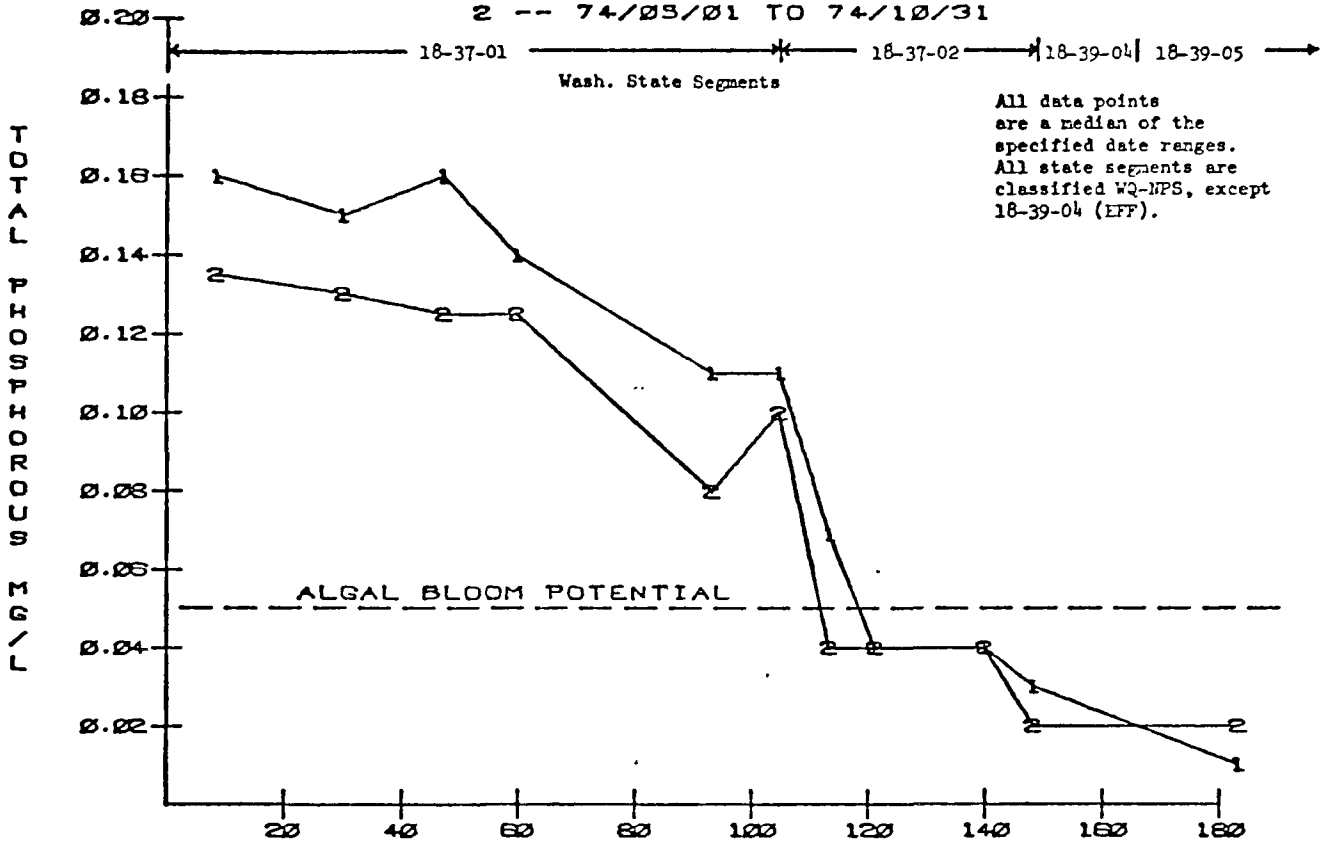


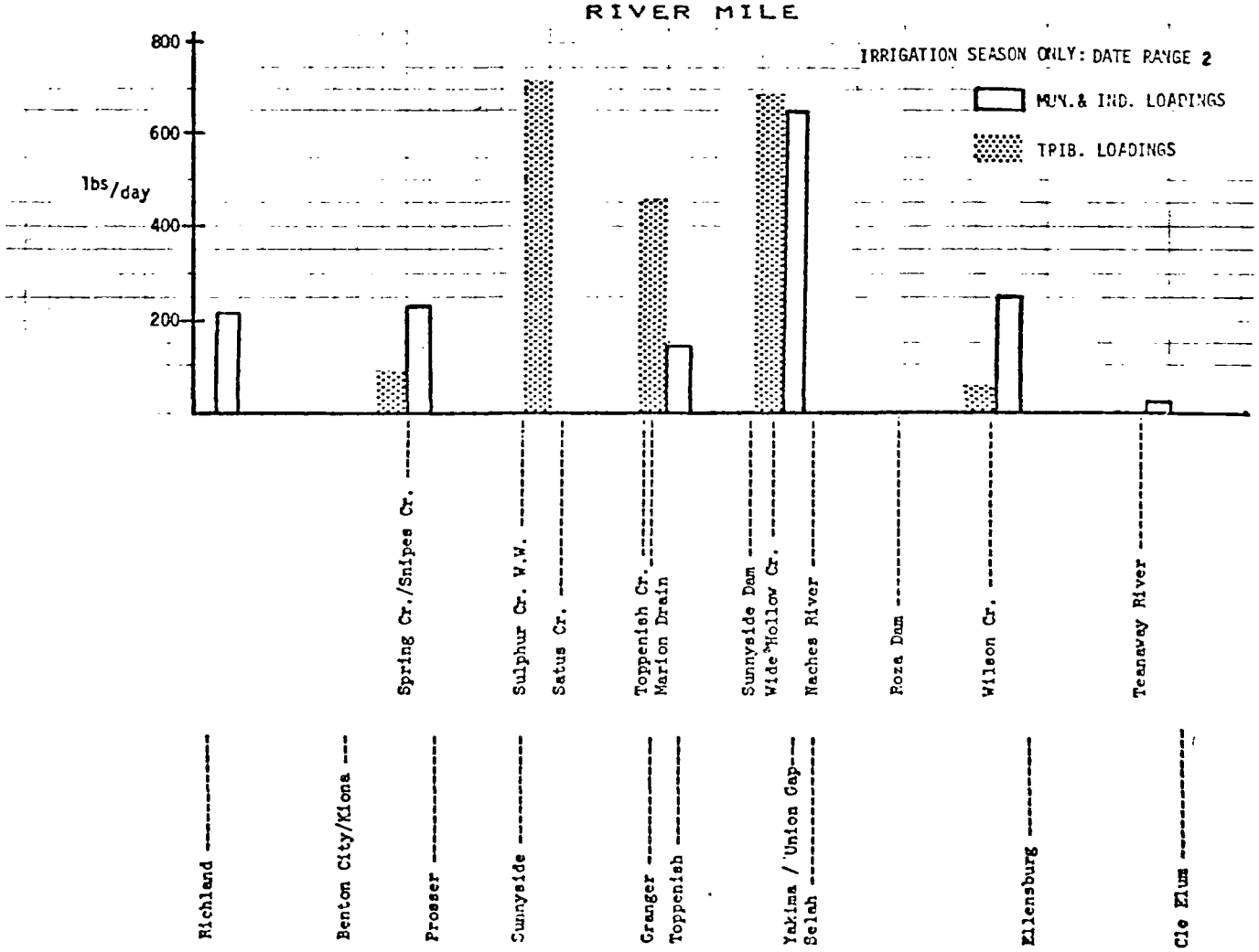


GRAPH 13

YAKIMA RIVER

1 -- 73/11/01 TO 74/03/31
2 -- 74/05/01 TO 74/10/31

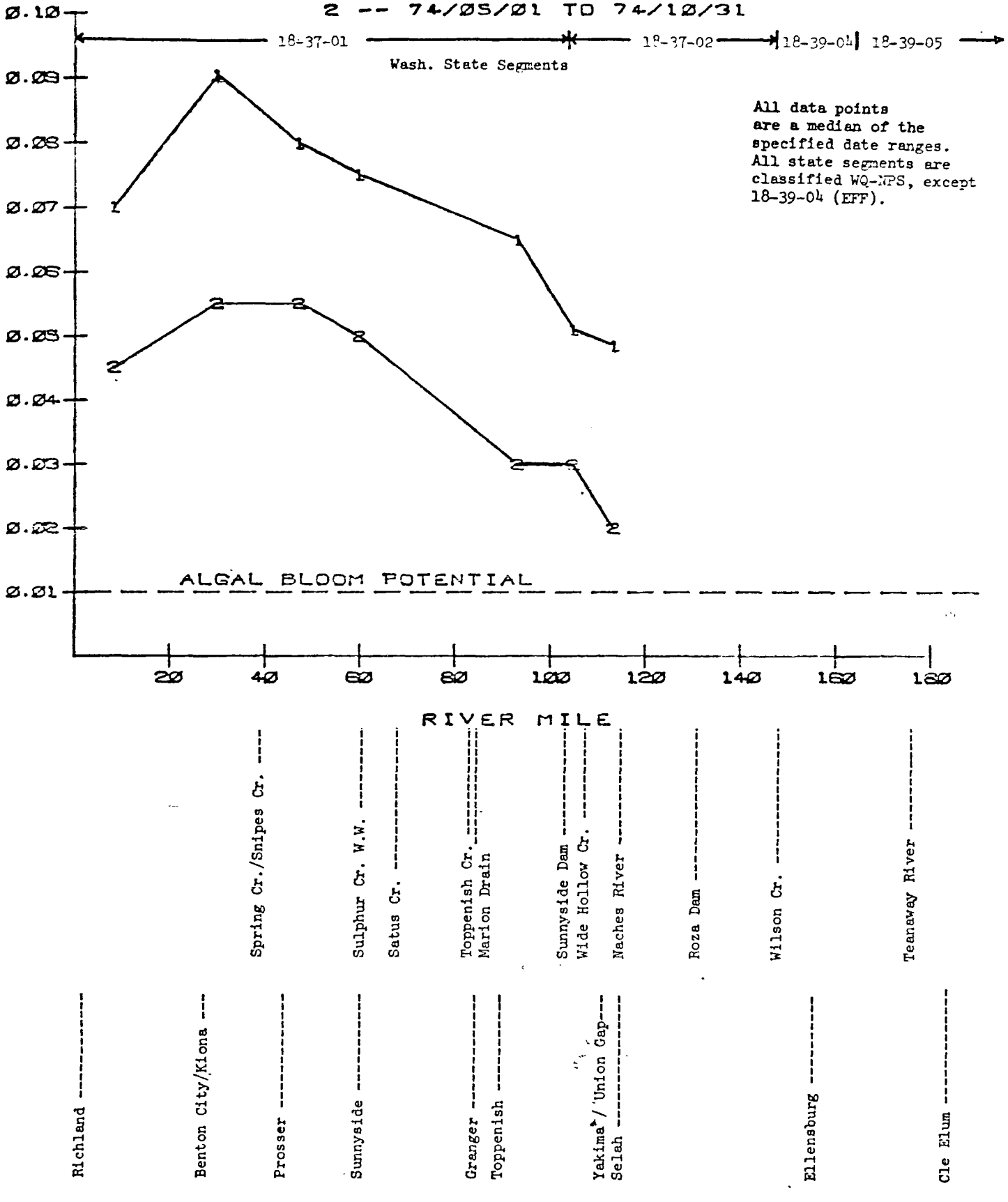




GRAPH 14

YAKIMA RIVER

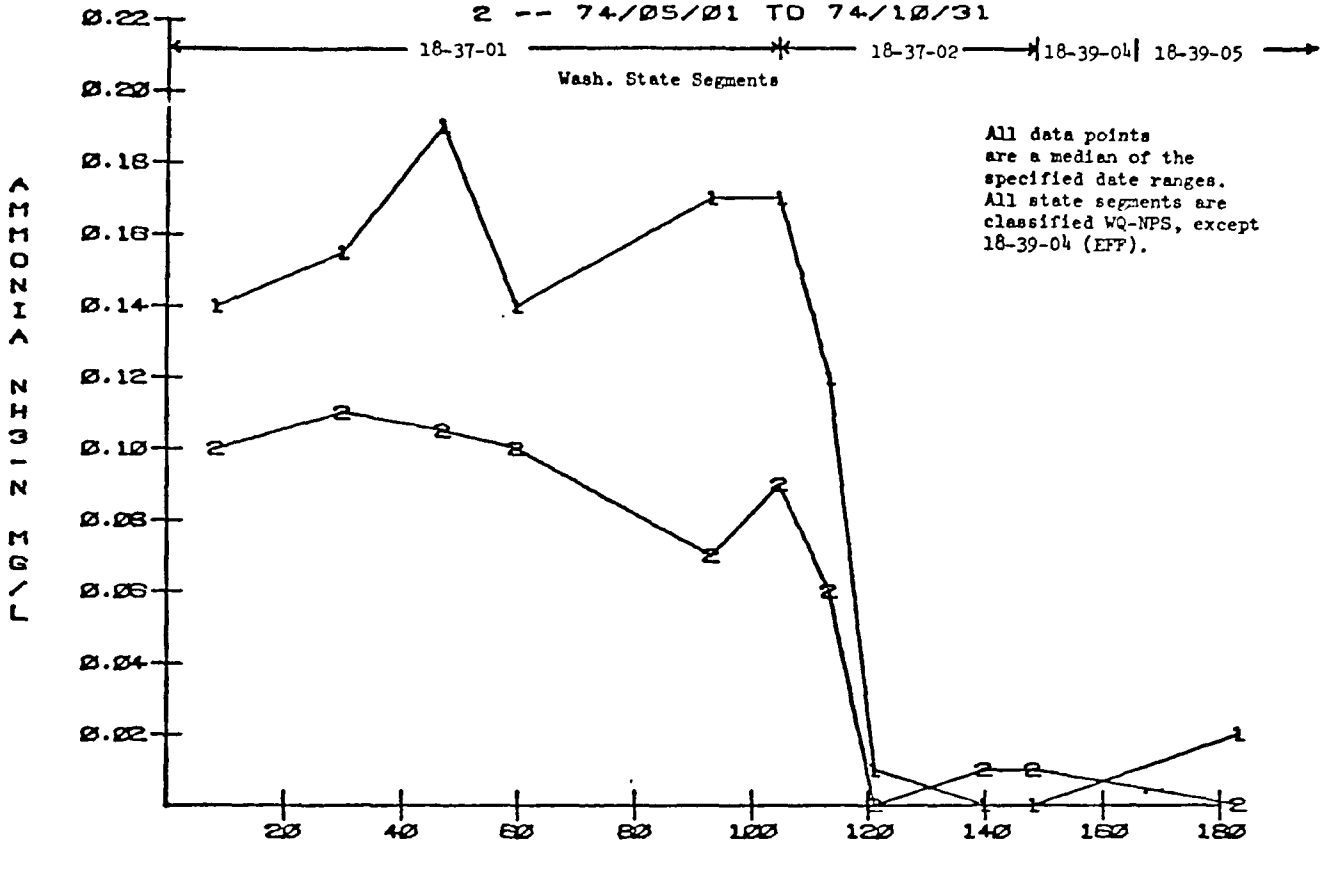
1 -- 73/11/01 TO 74/03/31
2 -- 74/05/01 TO 74/10/31

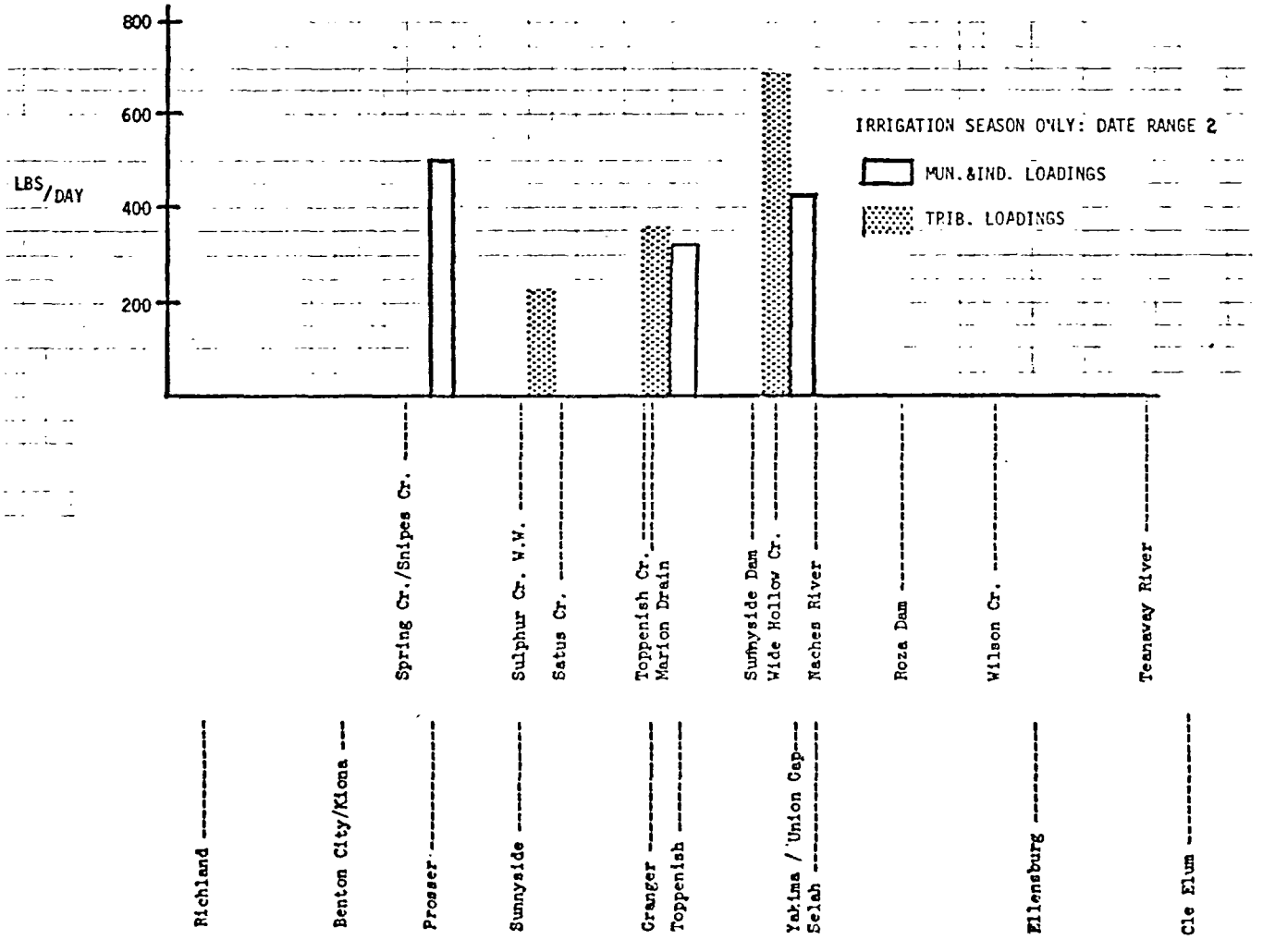


GRAPH 15

YAKIMA RIVER

1 -- 73/11/01 TO 74/03/31
2 -- 74/05/01 TO 74/10/31

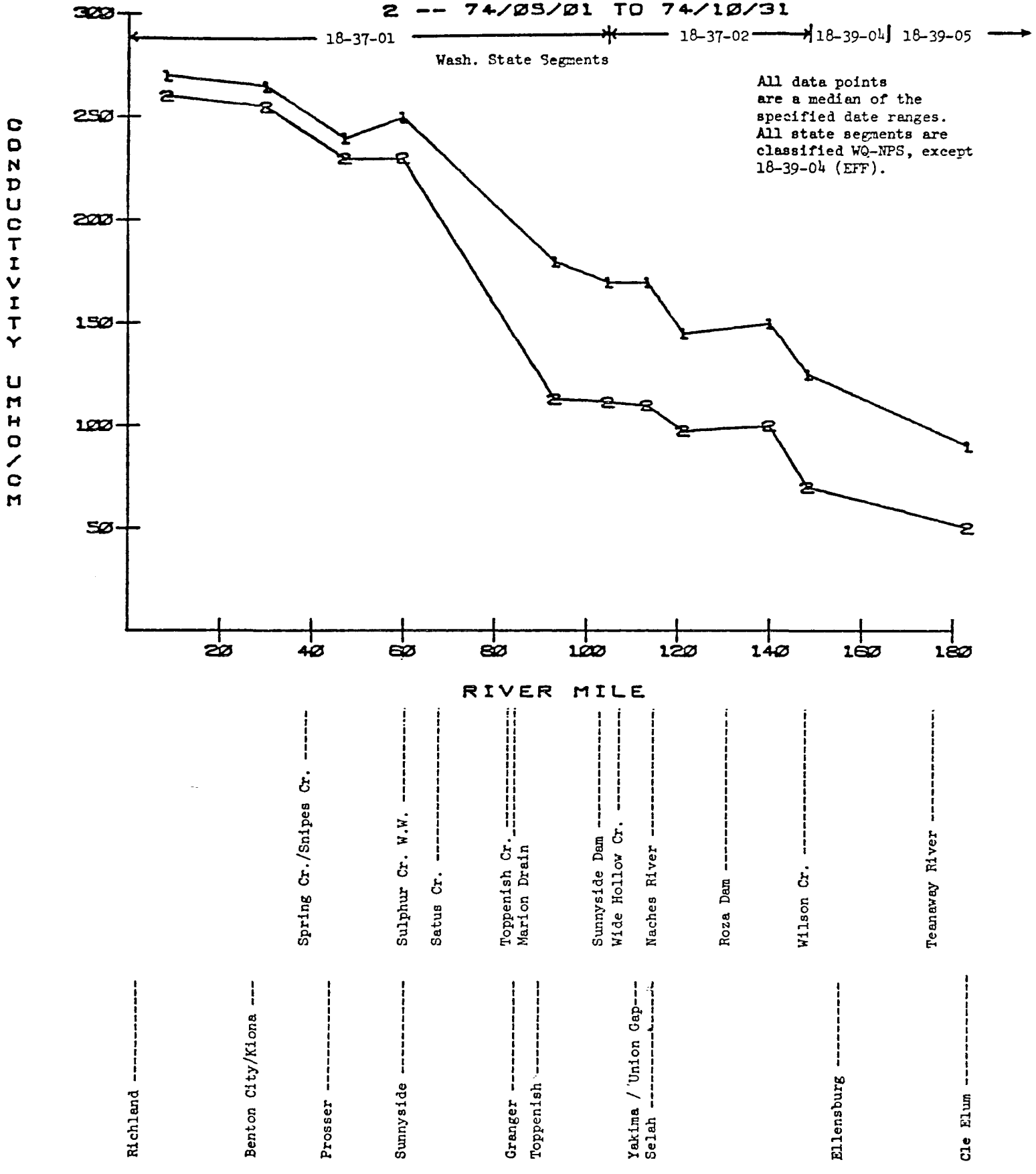




GRAPH 16

YAKIMA RIVER

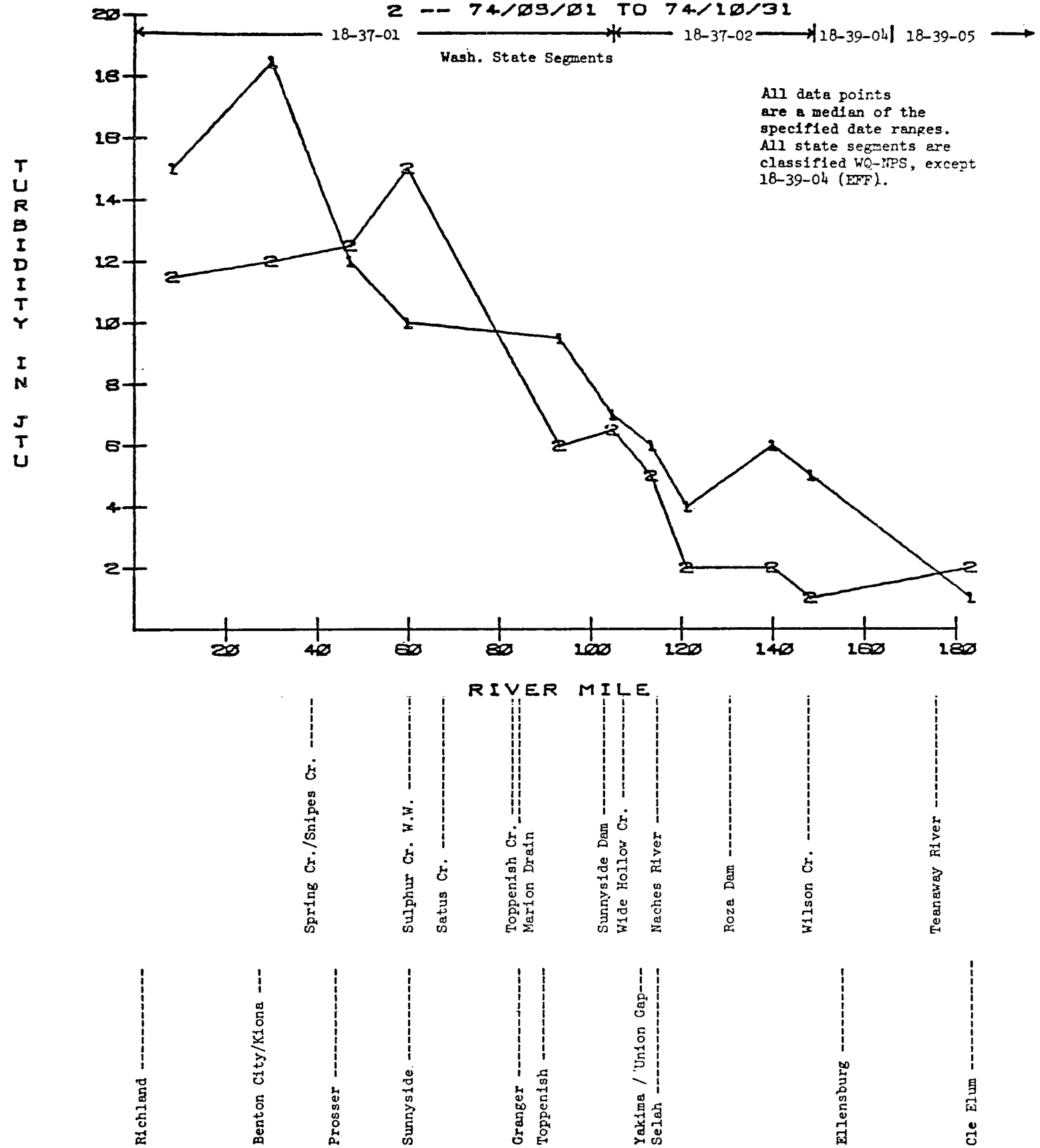
1 -- 73/11/01 TO 74/03/31
2 -- 74/05/01 TO 74/10/31



GRAPH 17

YAKIMA RIVER

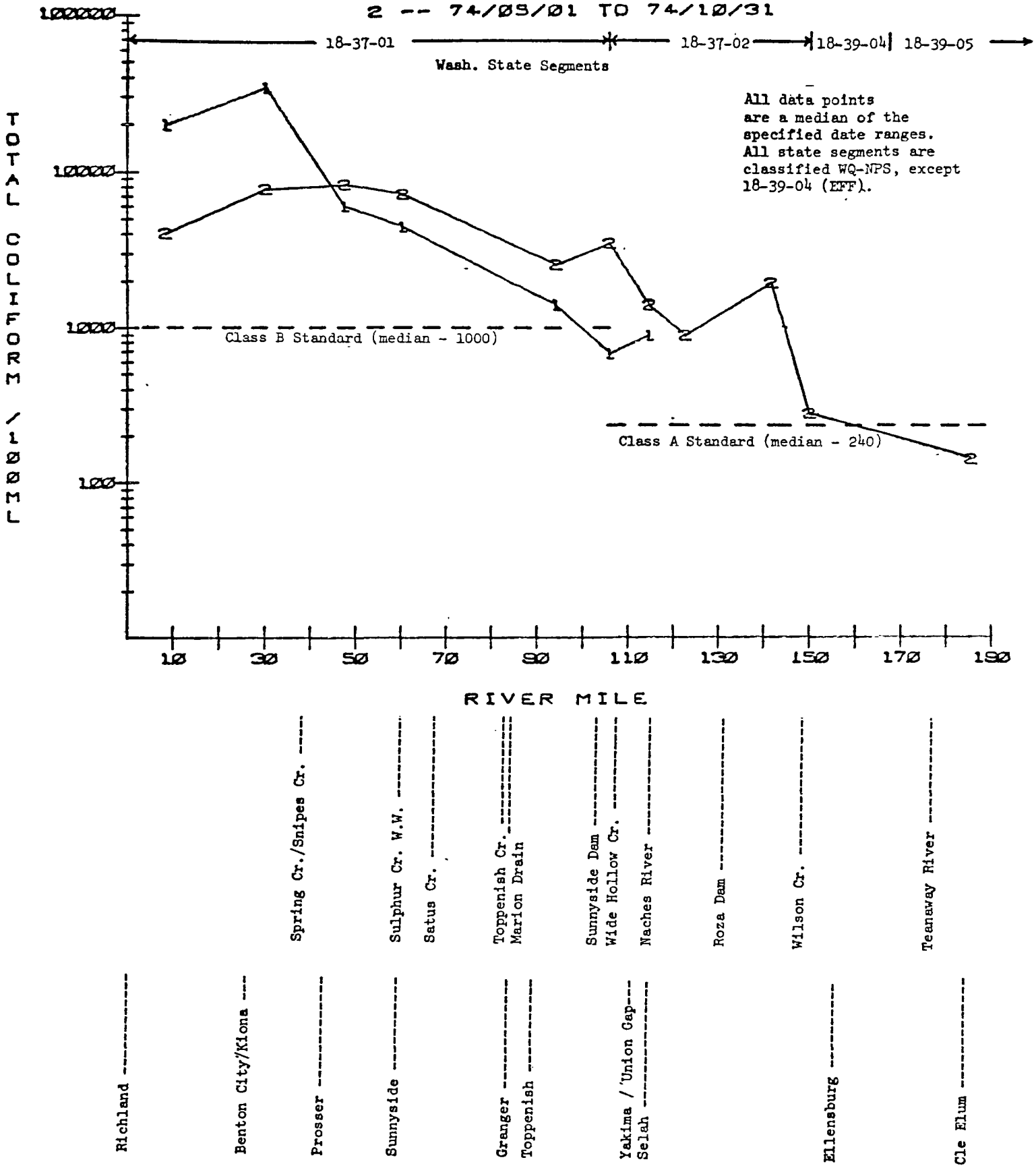
1 -- 73/11/01 TO 74/03/31
2 -- 74/03/01 TO 74/10/31



GRAPH 18

YAKIMA RIVER

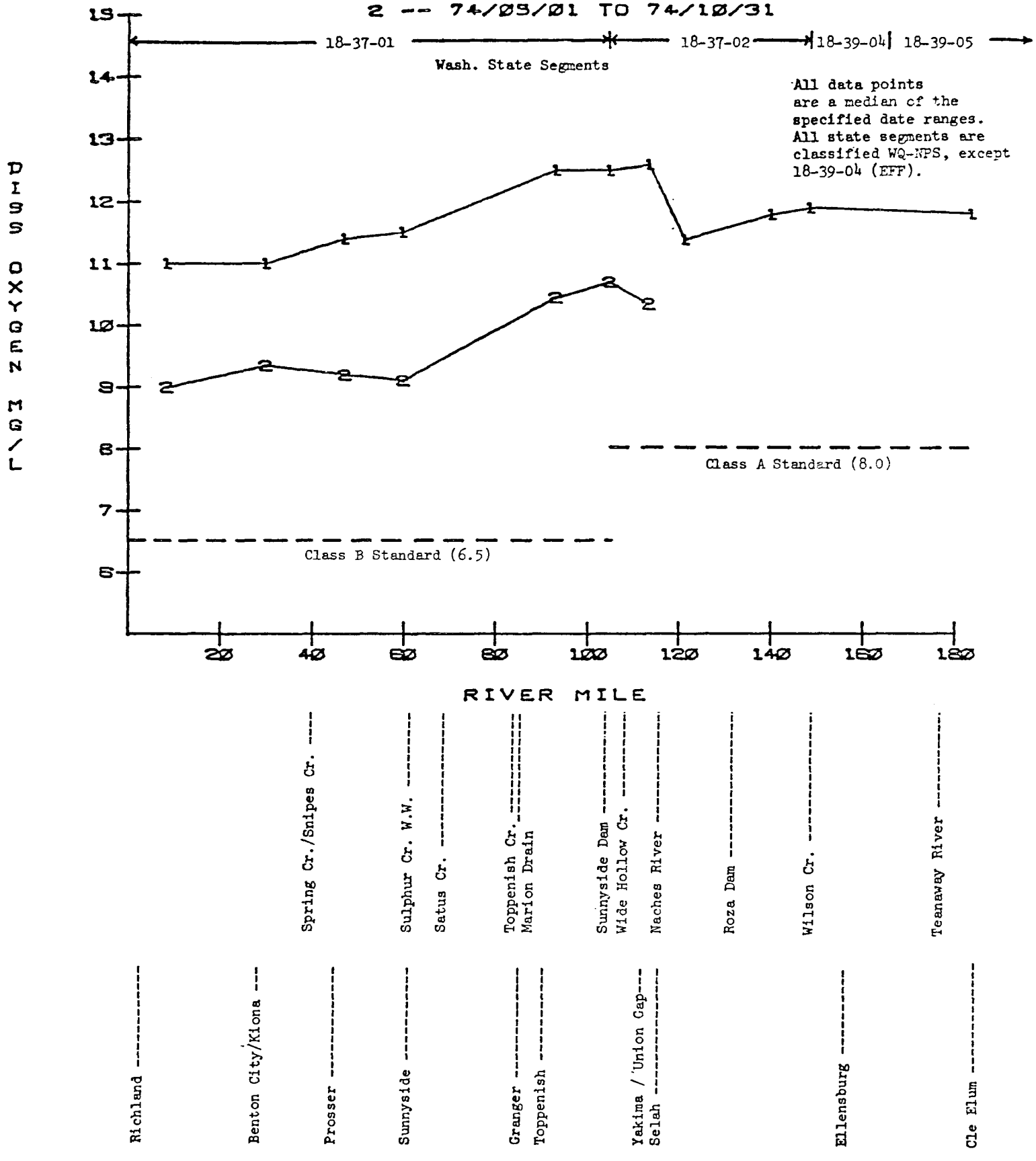
1 -- 73/11/01 TO 74/03/31
2 -- 74/05/01 TO 74/10/31



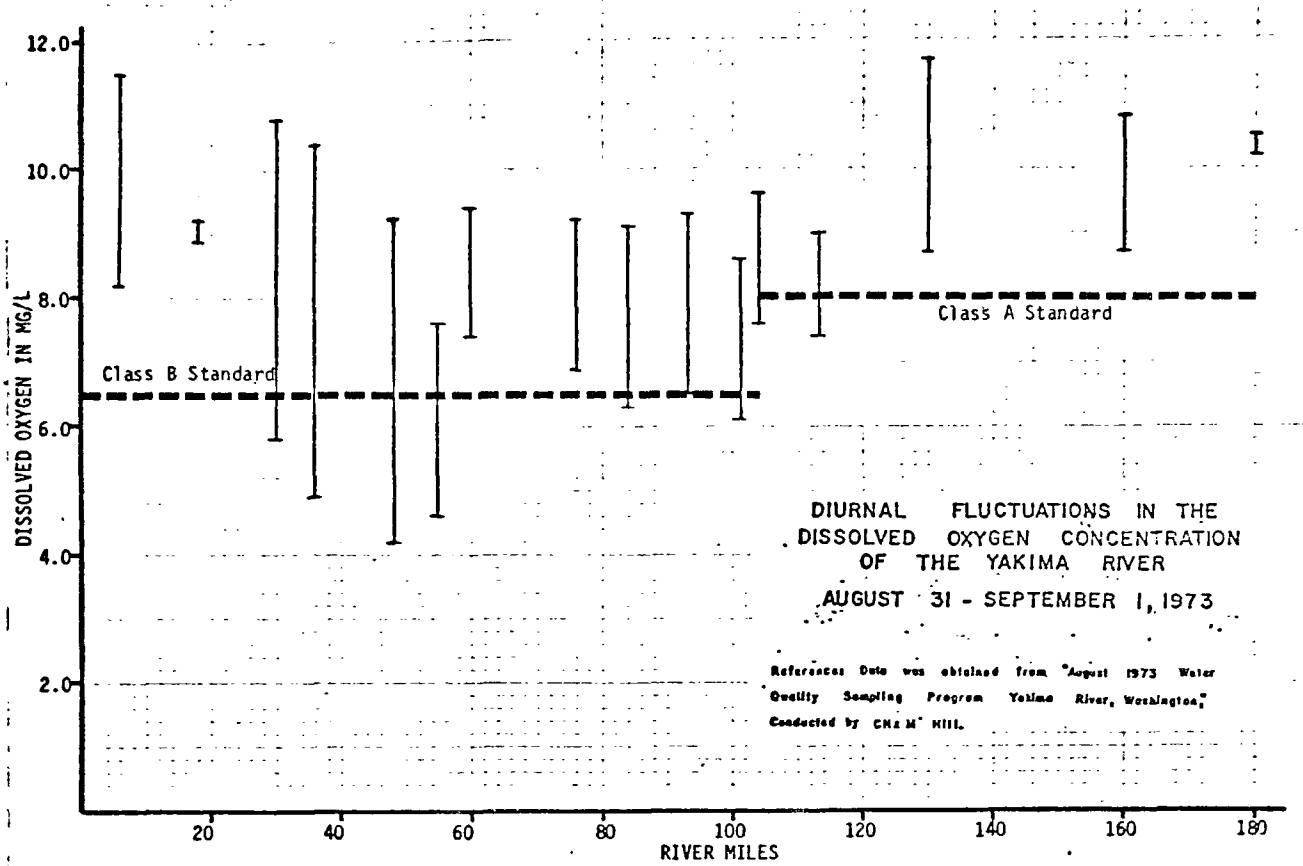
GRAPH 19

YAKIMA RIVER

1 -- 73/11/01 TO 74/03/31
2 -- 74/05/01 TO 74/10/31

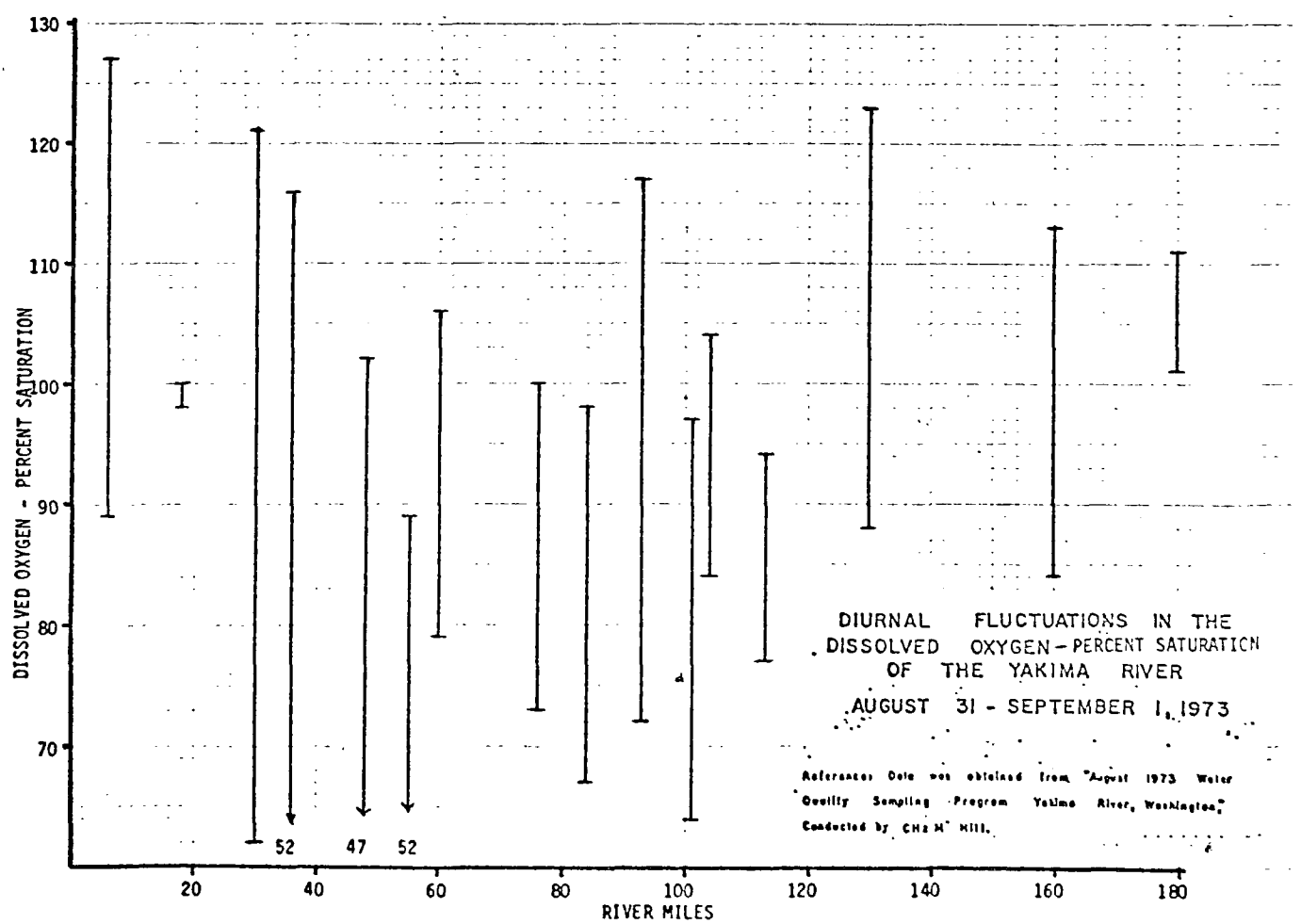


GRAPH 20



DIURNAL FLUCTUATIONS IN THE DISSOLVED OXYGEN CONCENTRATION OF THE YAKIMA RIVER
AUGUST 31 - SEPTEMBER 1, 1973

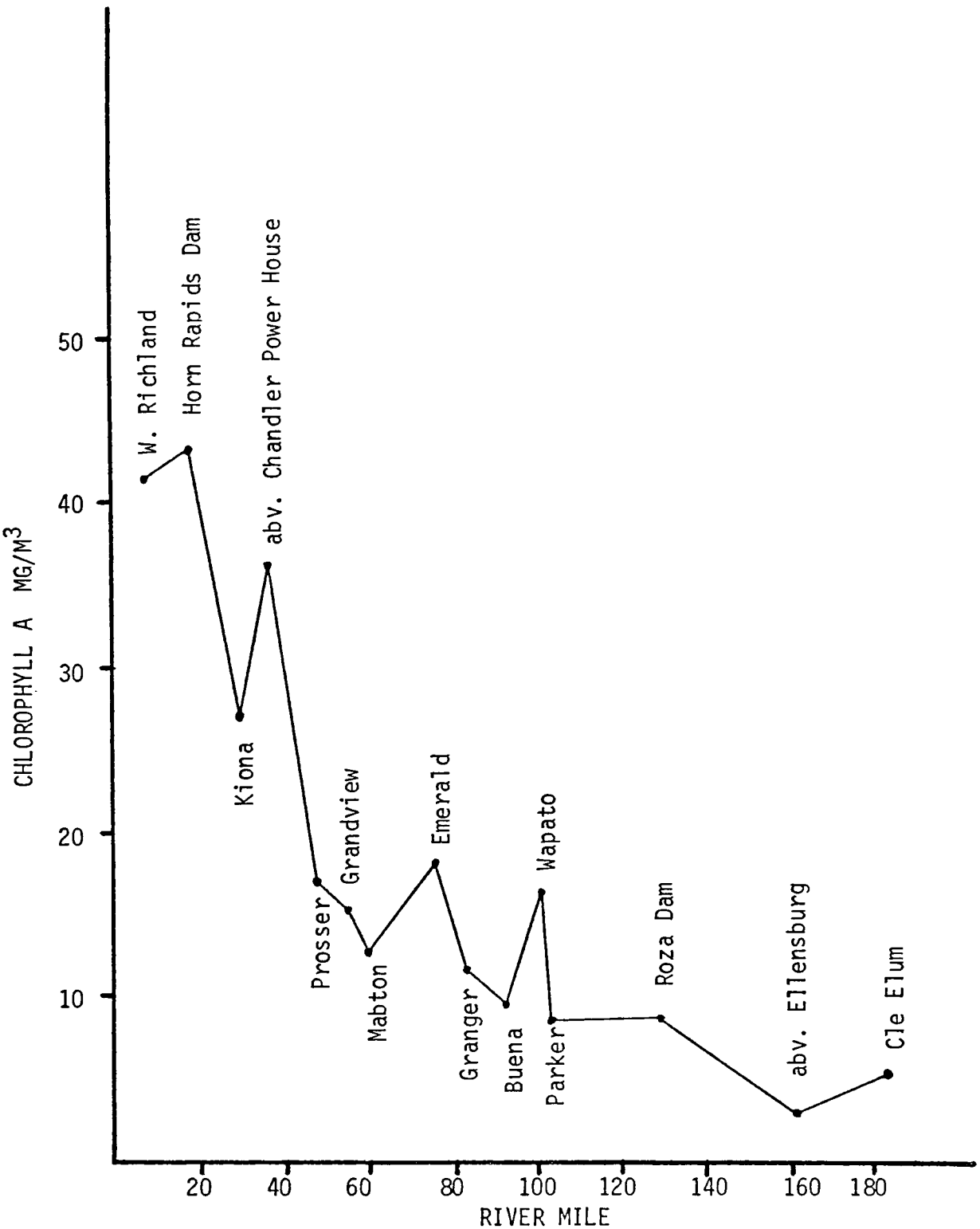
References Data was obtained from "August 1973 Water Quality Sampling Program Yakima River, Washington," Conducted by CH2 M Hill.



DIURNAL FLUCTUATIONS IN THE DISSOLVED OXYGEN - PERCENT SATURATION OF THE YAKIMA RIVER
AUGUST 31 - SEPTEMBER 1, 1973

References Data was obtained from "August 1973 Water Quality Sampling Program Yakima River, Washington," Conducted by CH2 M Hill.

GRAPH 21



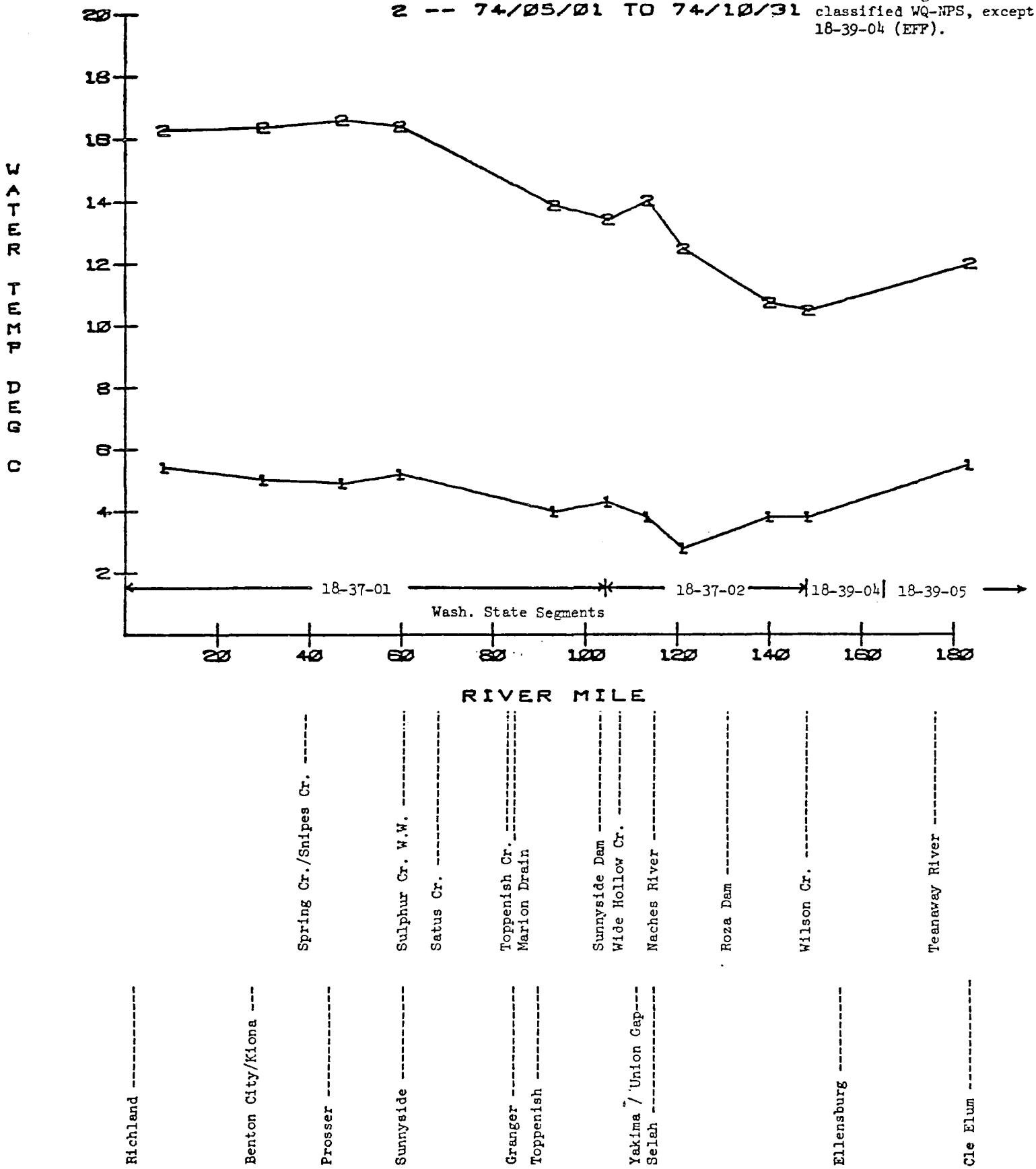
CHLOROPHYLL A vs. RIVER MILE ON THE YAKIMA RIVER
AUGUST 1973 (CH_2M HILL)

GRAPH 22

YAKIMA RIVER

1 -- 73/11/01 TO 74/03/31
2 -- 74/05/01 TO 74/10/31

All data points are a median of the specified date ranges. All state segments are classified WQ-NPS, except 18-39-04 (EFF).

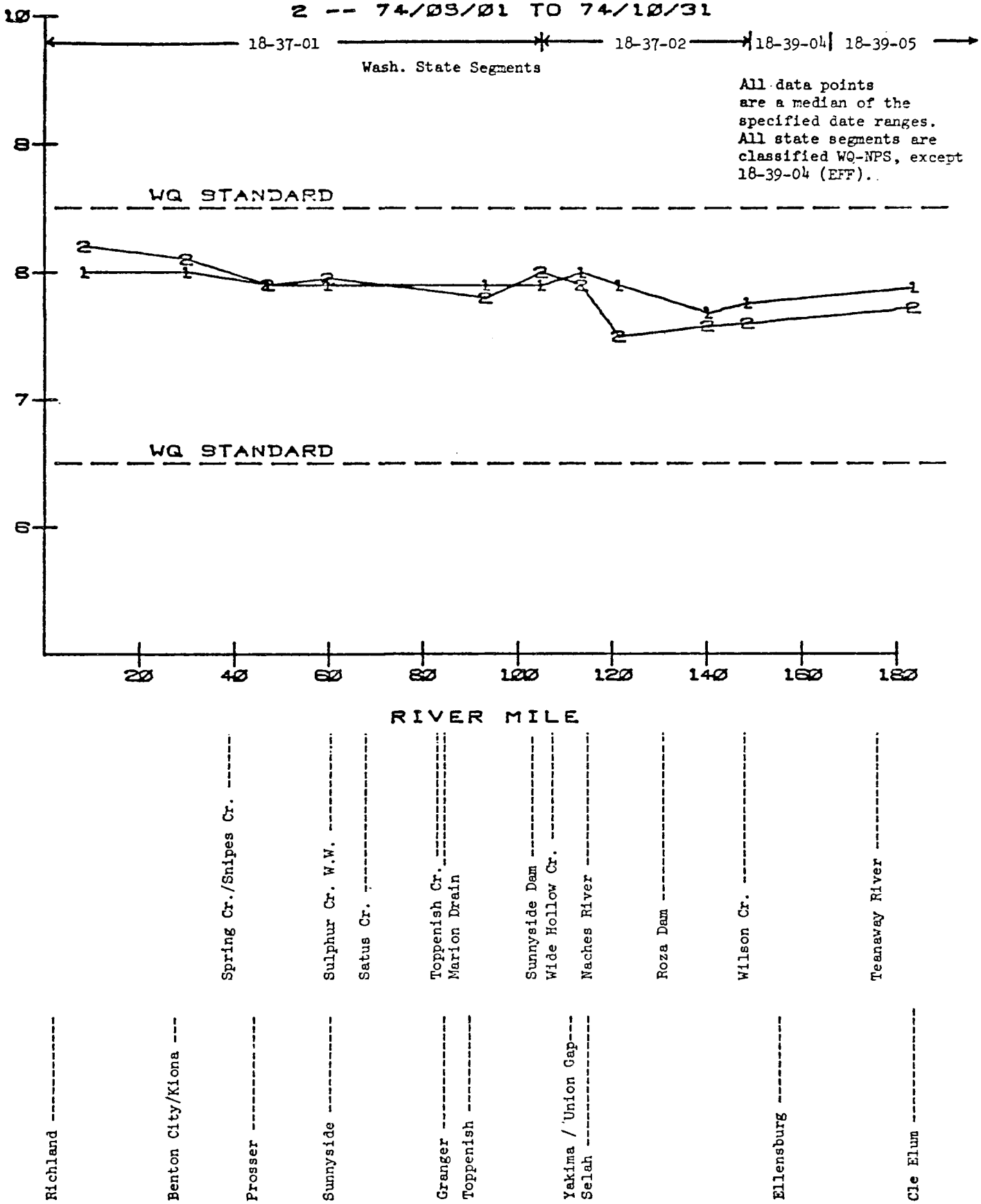


GRAPH 23

YAKIMA RIVER

1 -- 73/11/01 TO 74/03/31

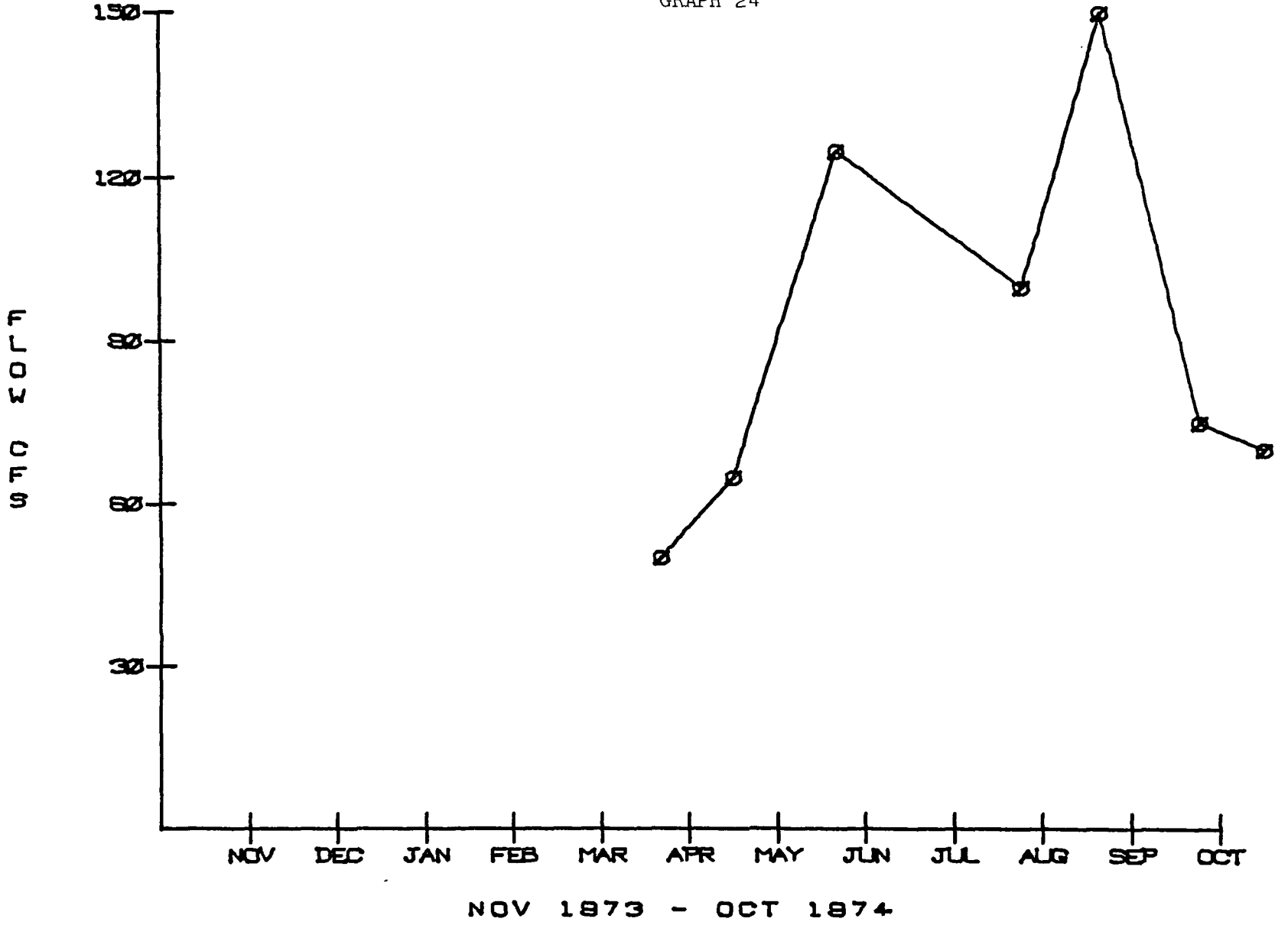
2 -- 74/03/01 TO 74/10/31



WILSON CREEK AT R.M. 1.1

SEGMENT 18-38-08

GRAPH 24

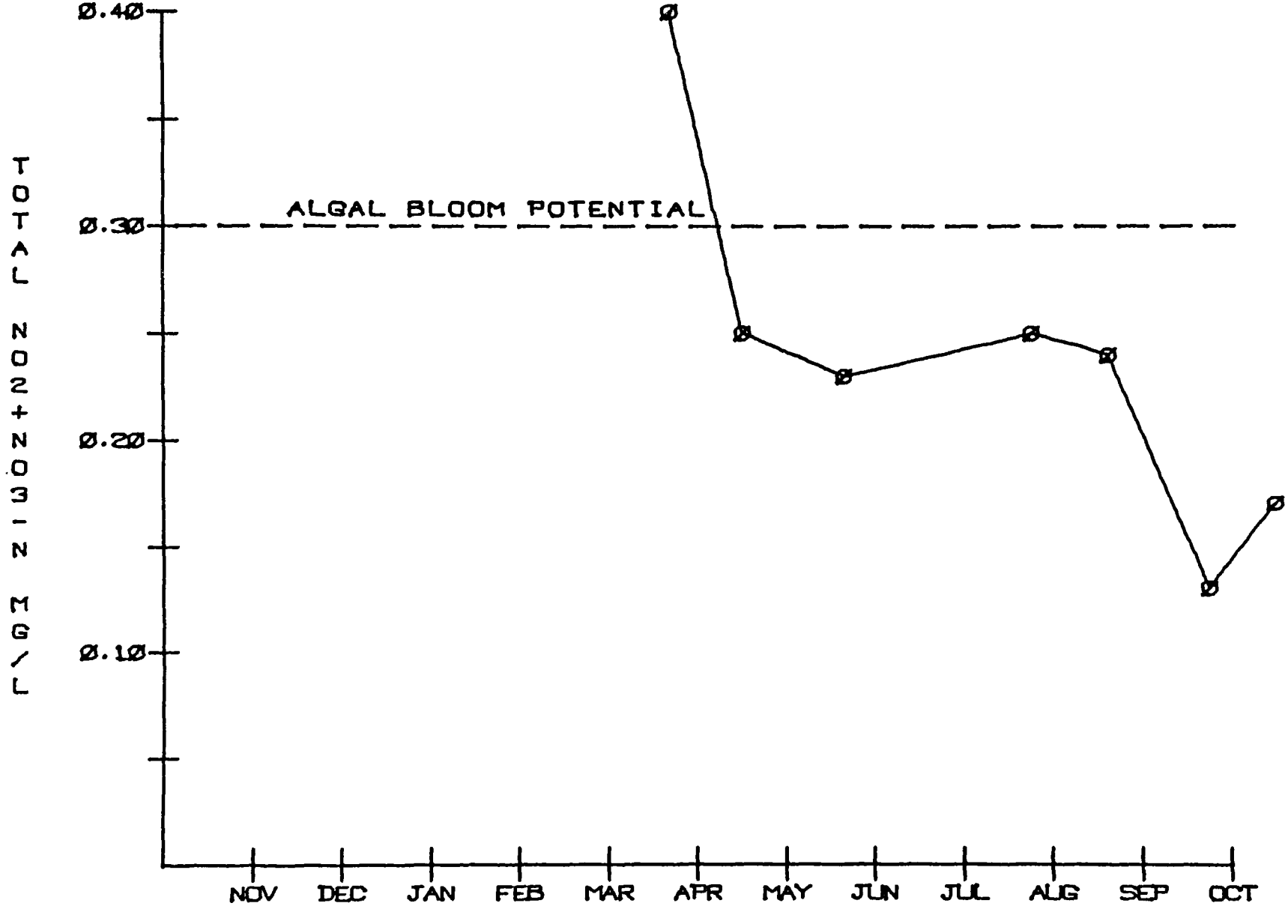


NOV 1973 - OCT 1974

GRAPH 25

WILSON CREEK AT R.M. 1.1

SEGMENT 18-38-08

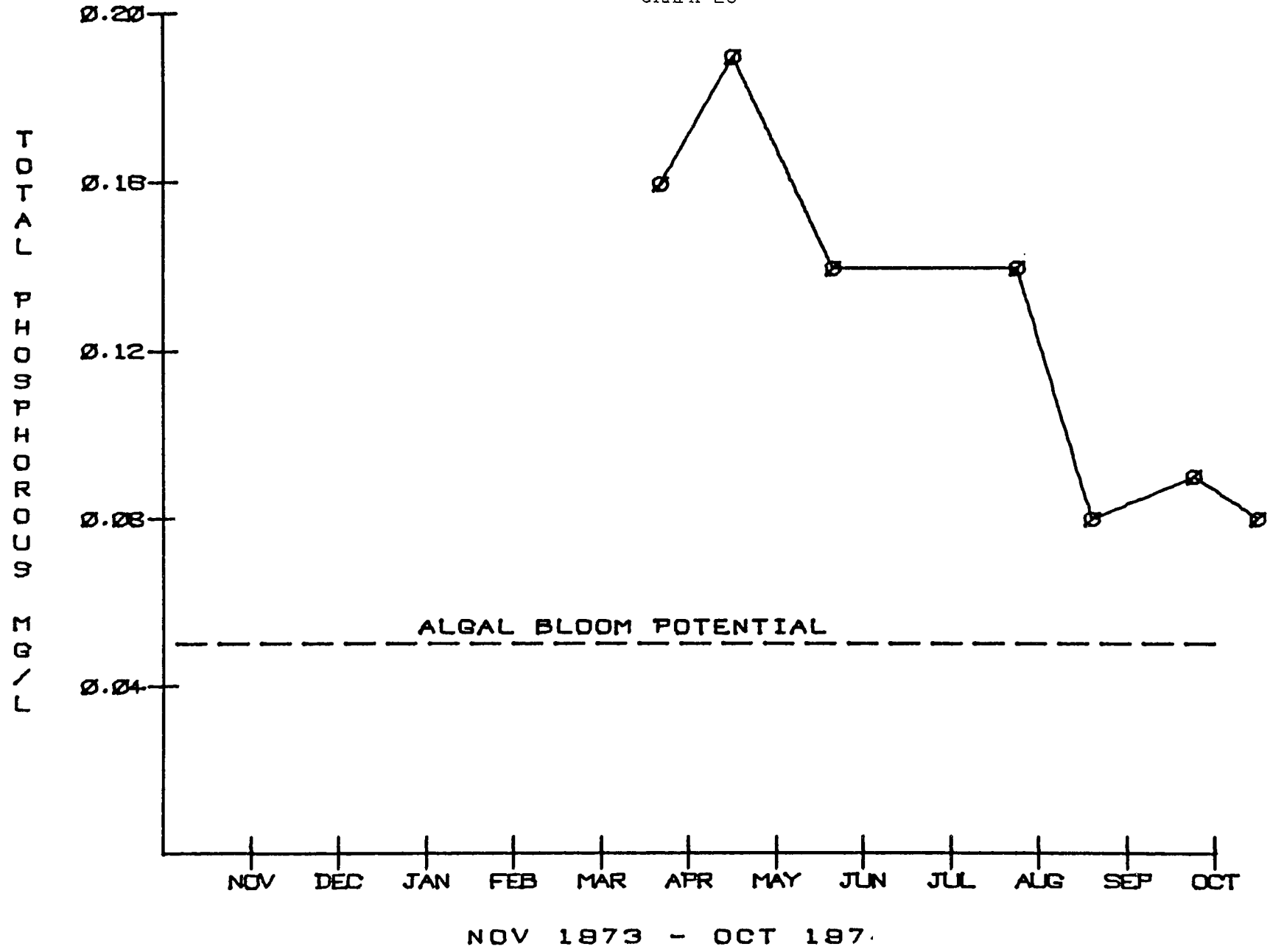


NOV 1973 - OCT 1974

WILSON CREEK AT R.M. 1.1

SEGMENT 18-38-08

GRAPH 26

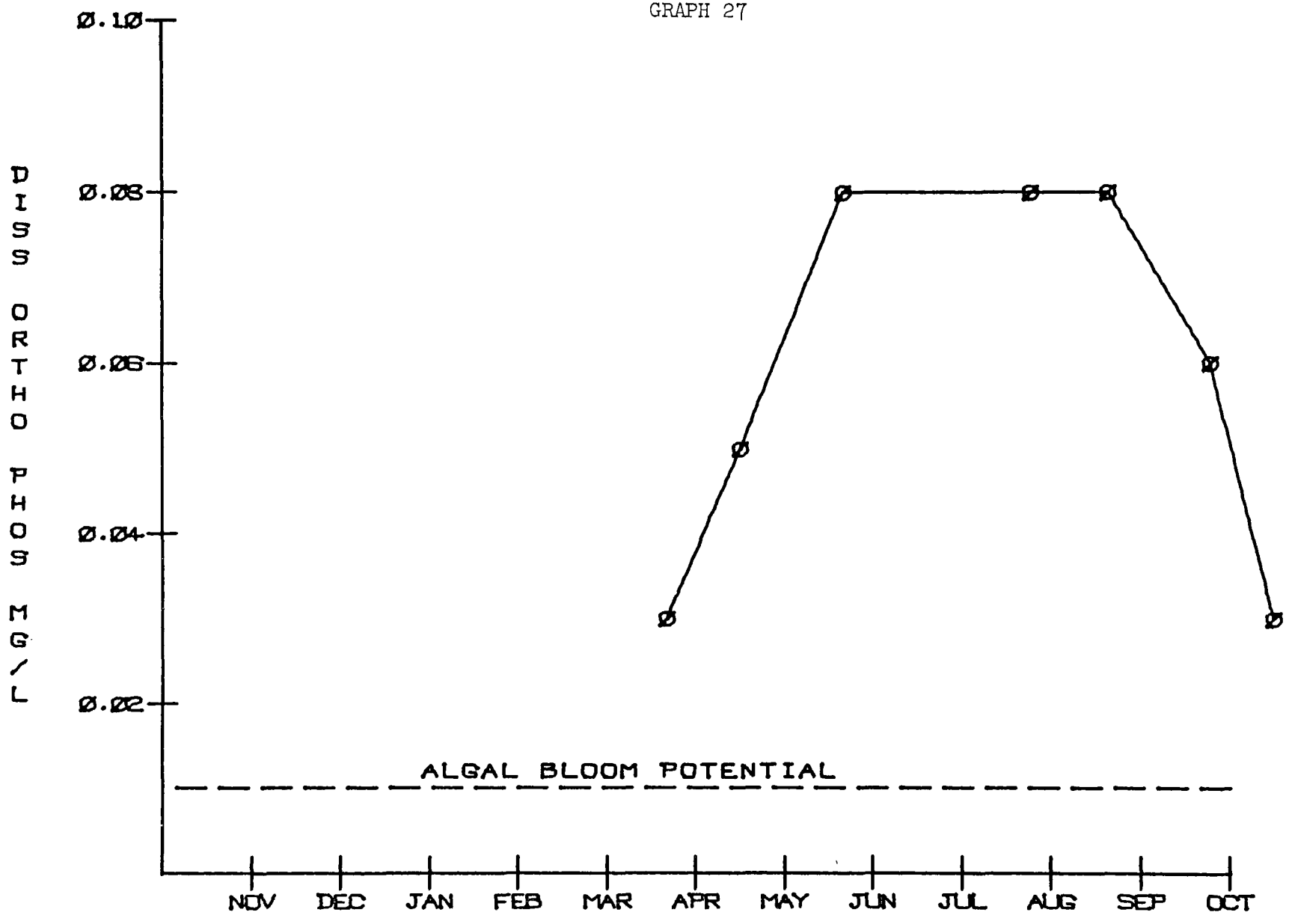


NOV 1973 - OCT 197

WILSON CREEK AT R.M. 1.1

SEGMENT 18-38-08

GRAPH 27

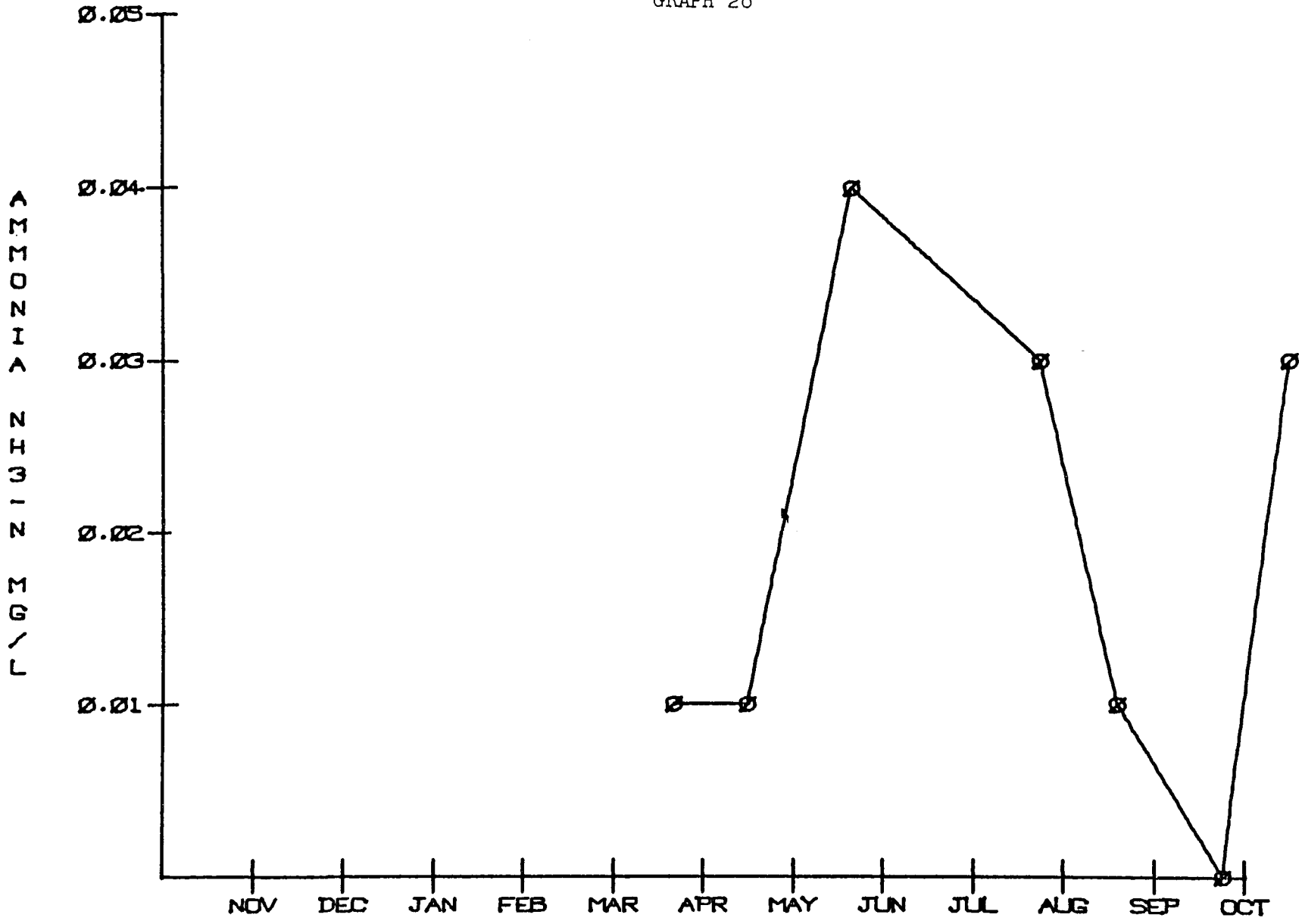


NOV 1973 - OCT 1974

WILSON CREEK AT R.M. 1.1

SEGMENT 18-38-08

GRAPH 28

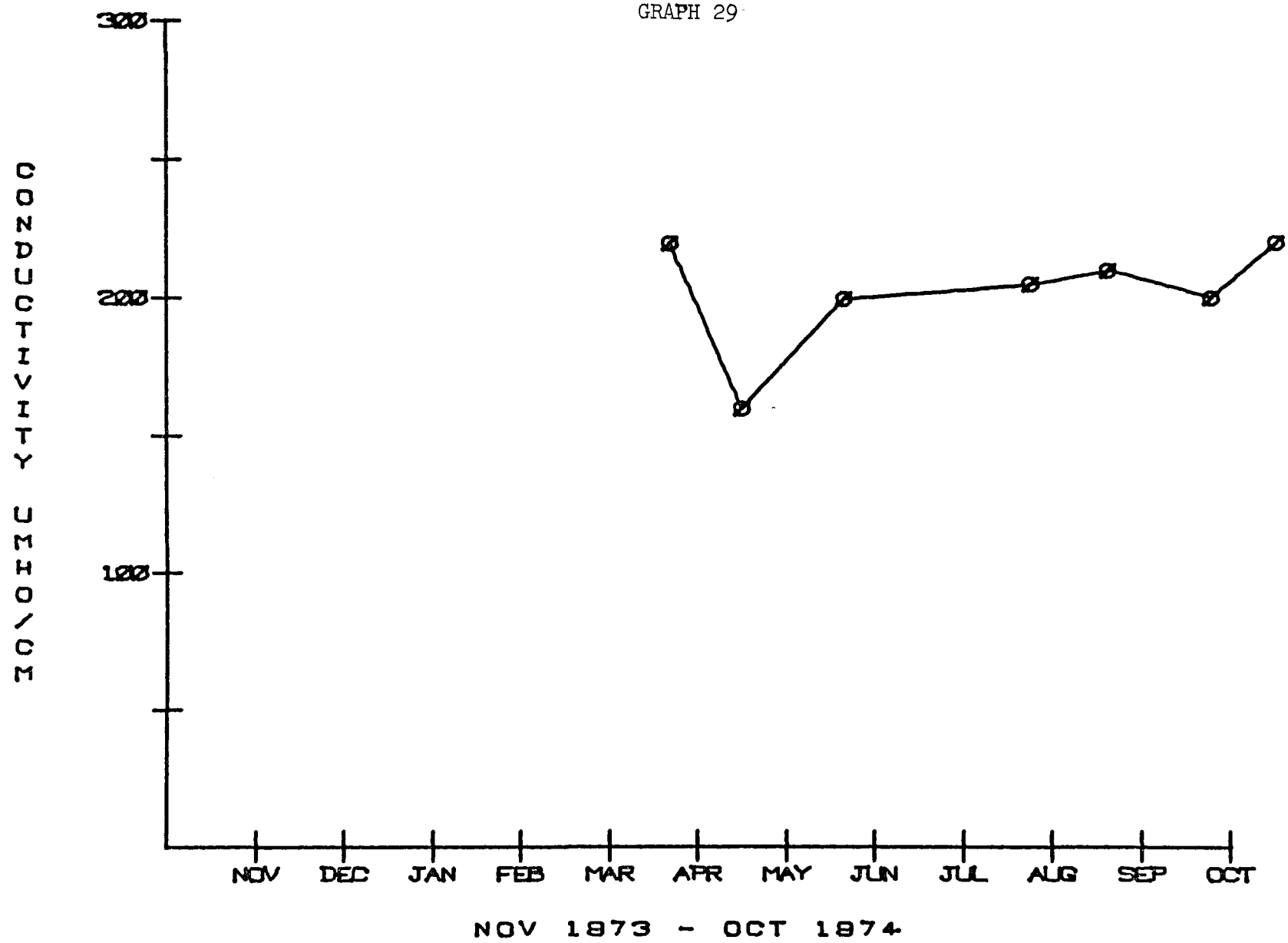


NOV 1973 - OCT 1974

WILSON CREEK AT R.M. 1.1

SEGMENT 18-38-08

GRAPH 29

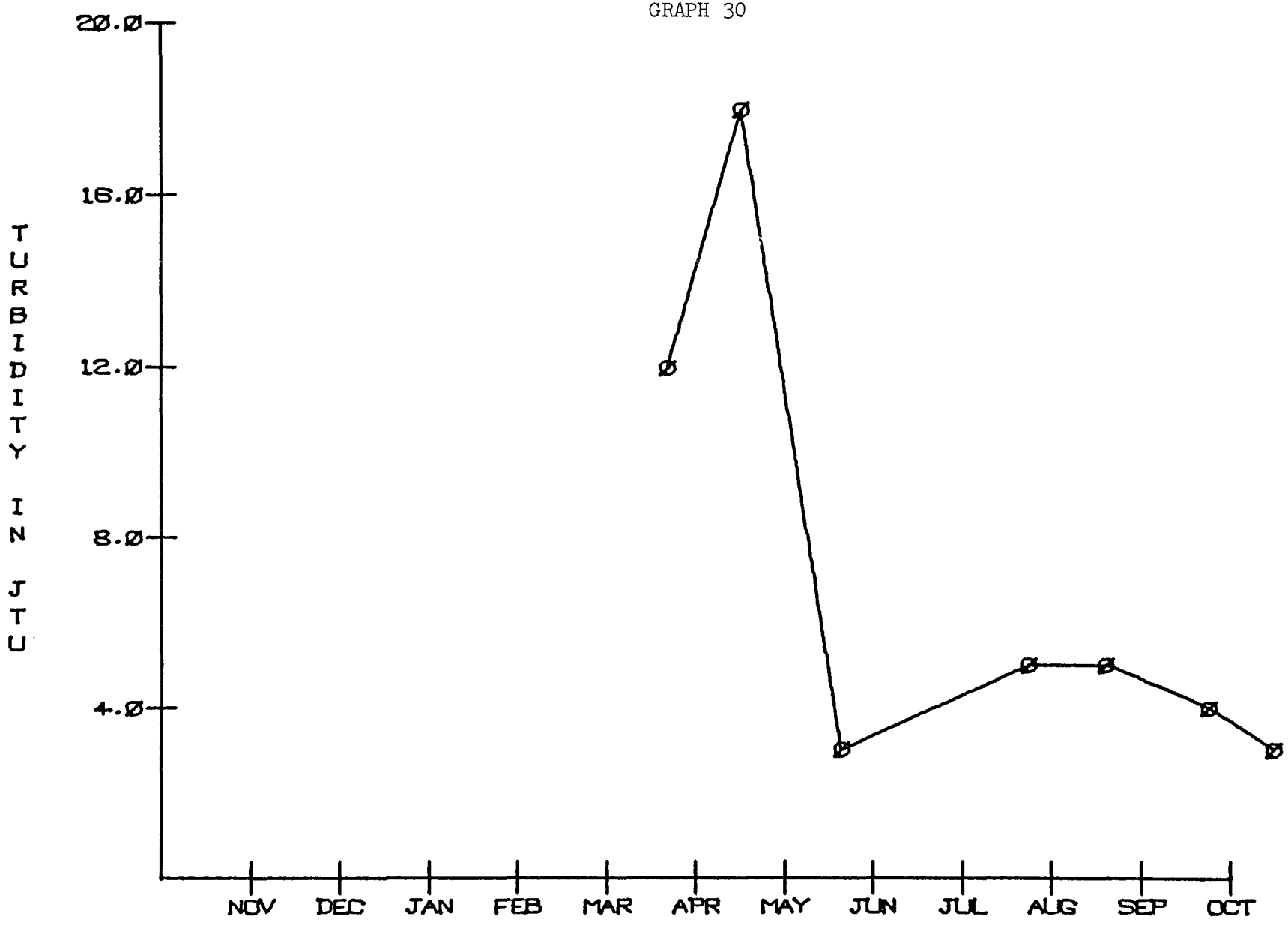


NOV 1973 - OCT 1974

WILSON CREEK AT R.M. 1.1

SEGMENT 18-39-08

GRAPH 30

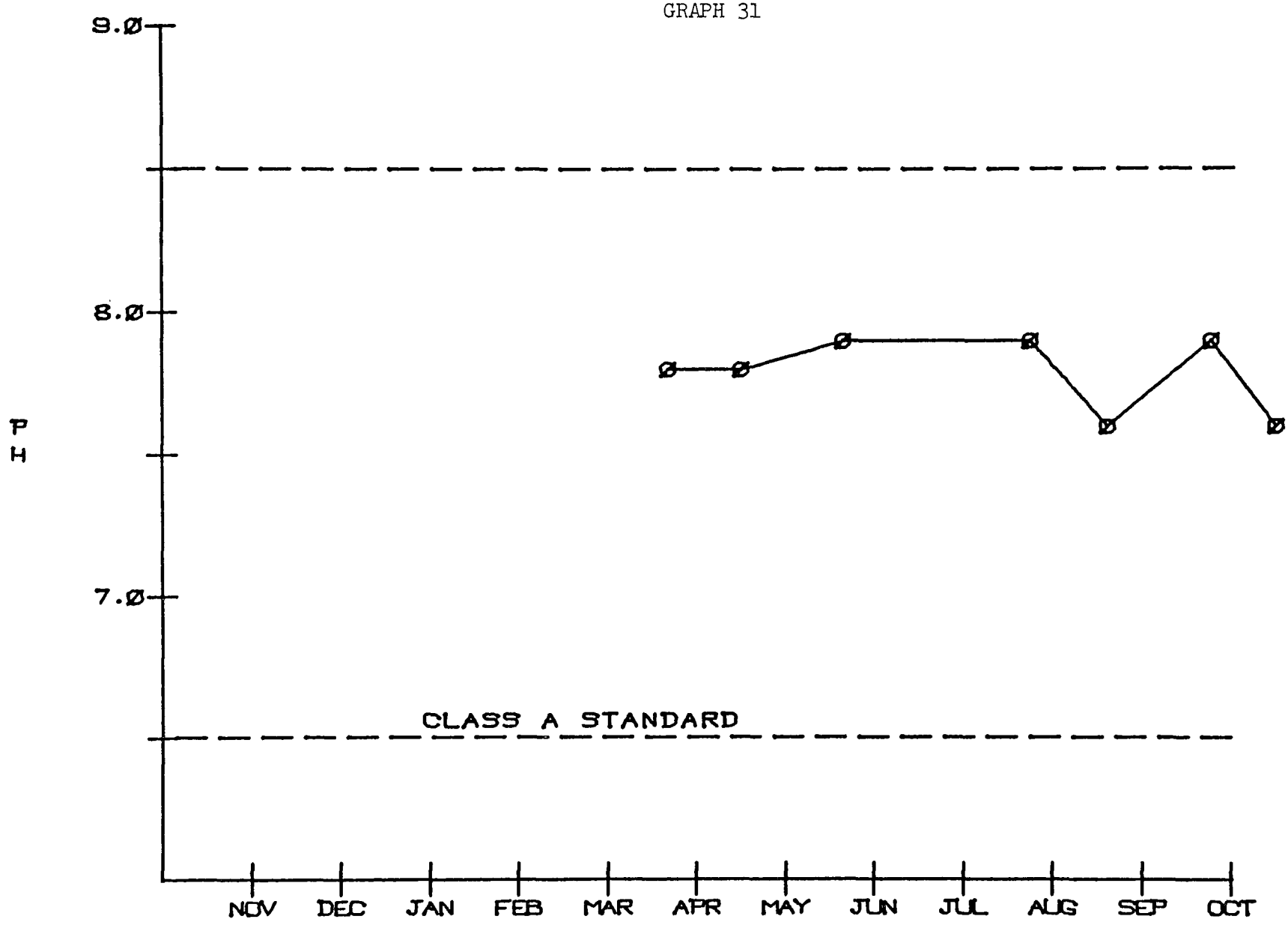


NOV 1973 - OCT 1974

WILSON CREEK AT R.M. 1.1

SEGMENT 18-38-Ø8

GRAPH 31

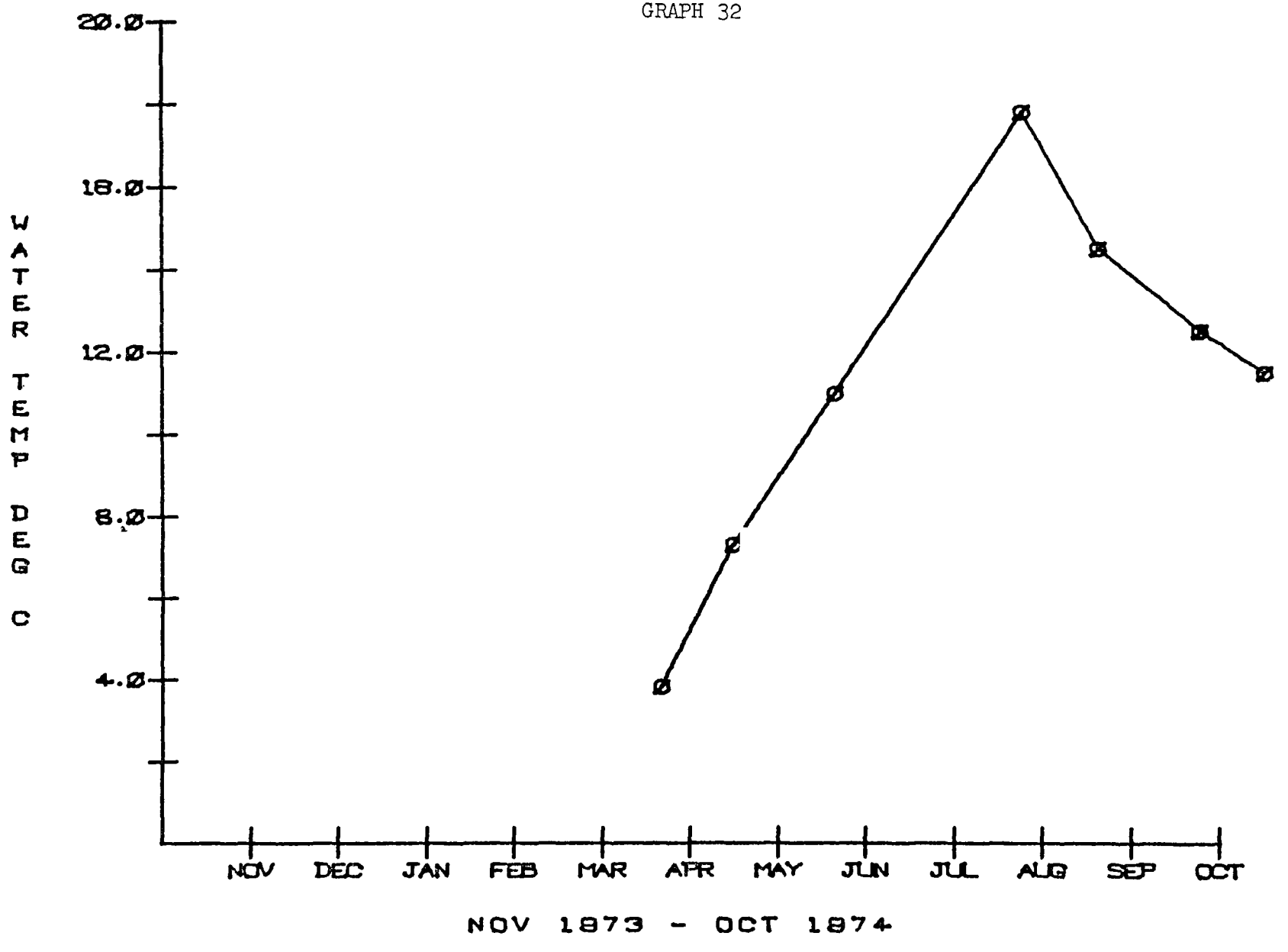


NOV 1973 - OCT 1874

WILSON CREEK AT R.M. 1.1

SEGMENT 18-38-08

GRAPH 32

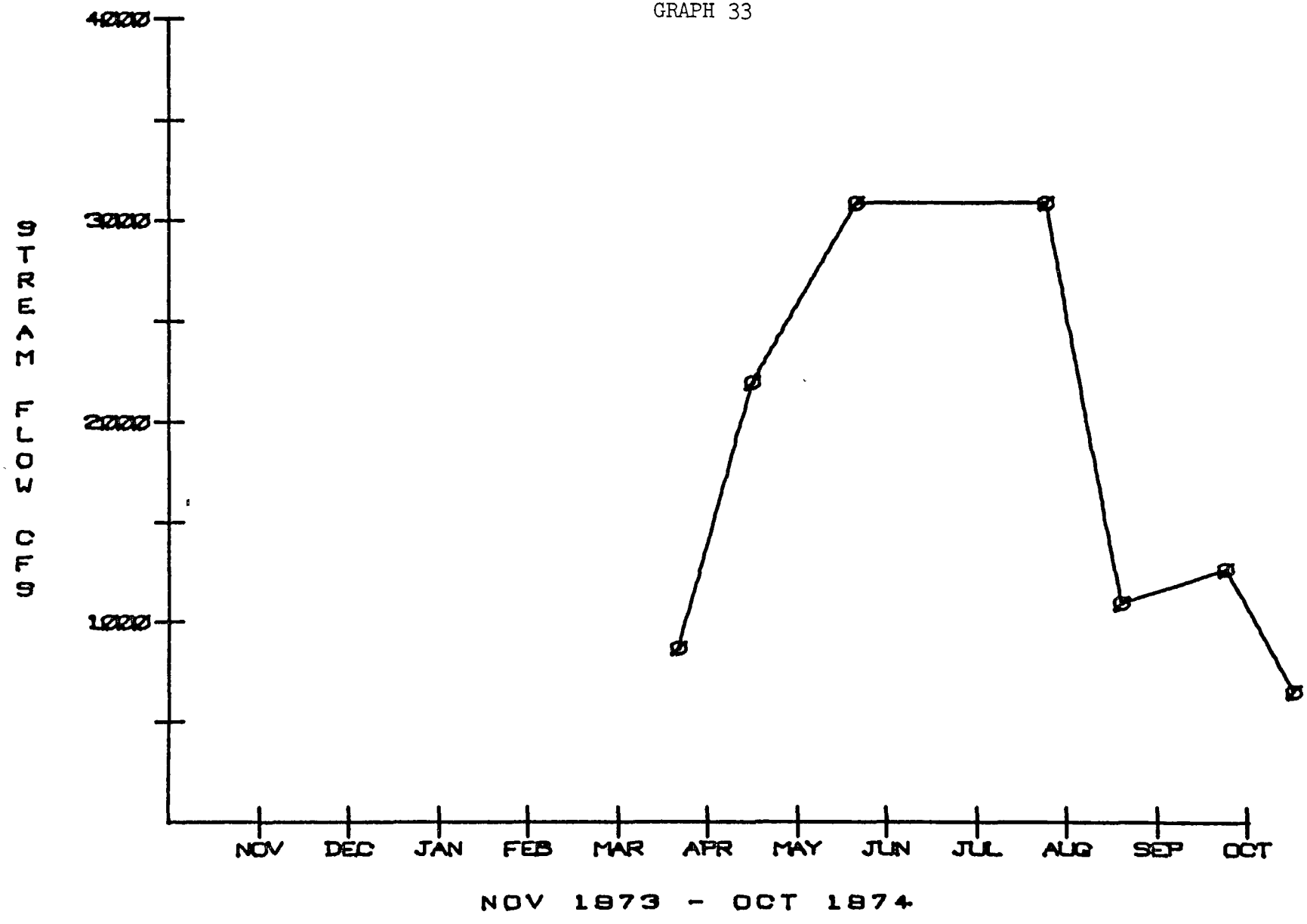


NOV 1973 - OCT 1974

NACHES RIVER AT R.M. 3.7

SEGMENT 18-37-07

GRAPH 33

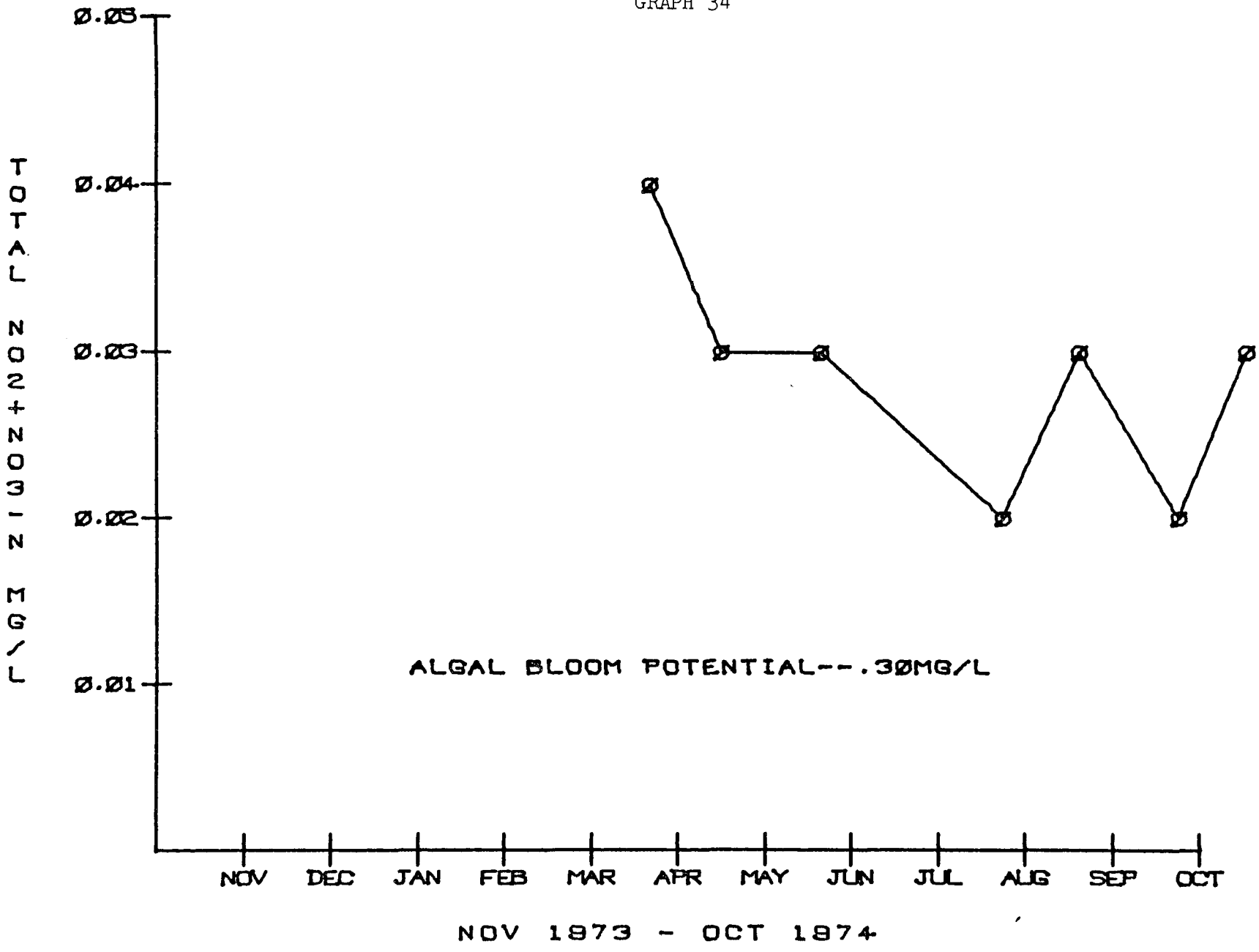


NOV 1973 - OCT 1974

NACHES RIVER AT R.M. 3.7

SEGMENT 18-38-07

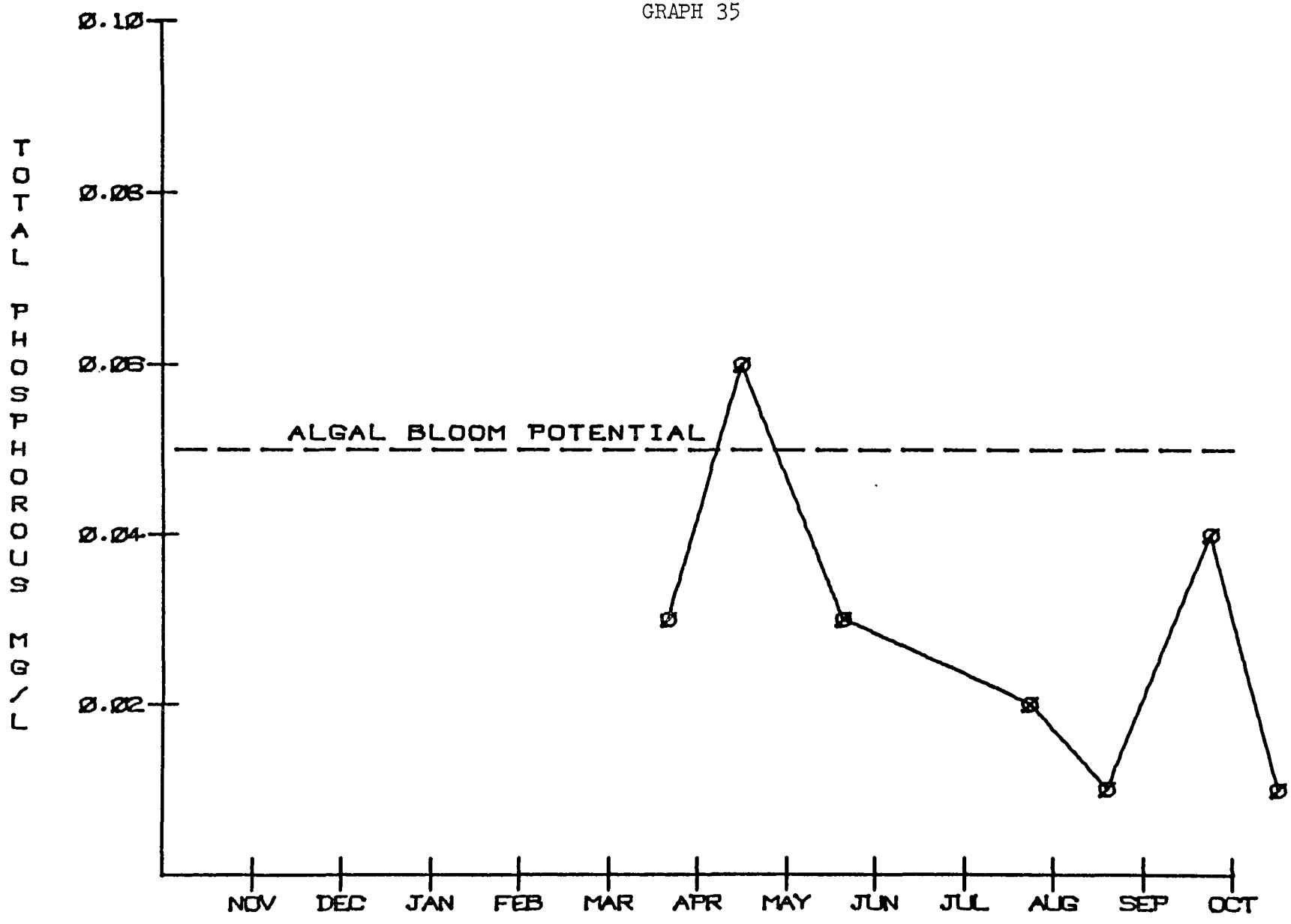
GRAPH 34



NACHES RIVER AT R.M. 3.7

SEGMENT 18-38-07

GRAPH 35

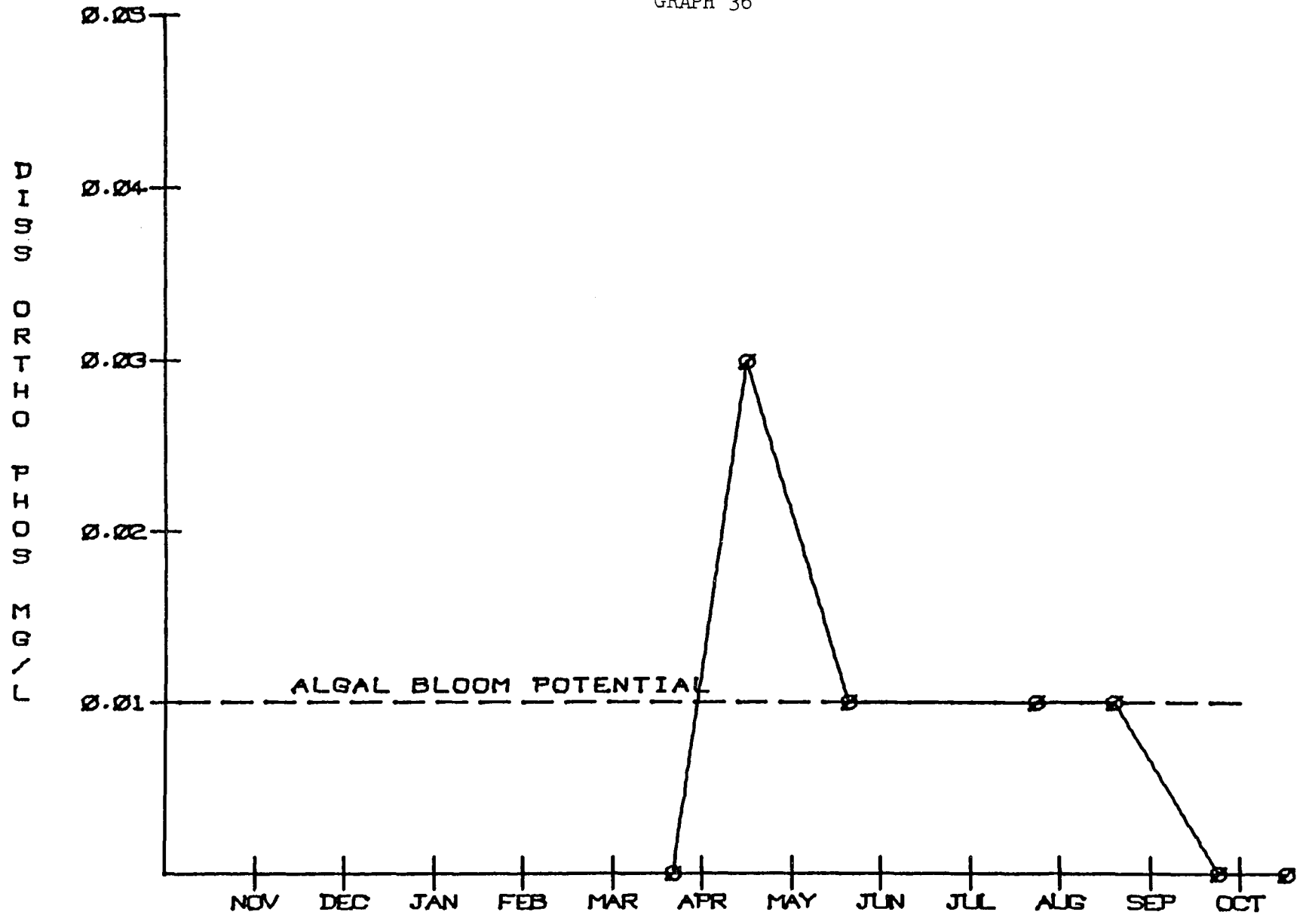


NOV 1973 - OCT 1974

NACHES RIVER AT R.M. 3.7

SEGMENT 18-38-07

GRAPH 36

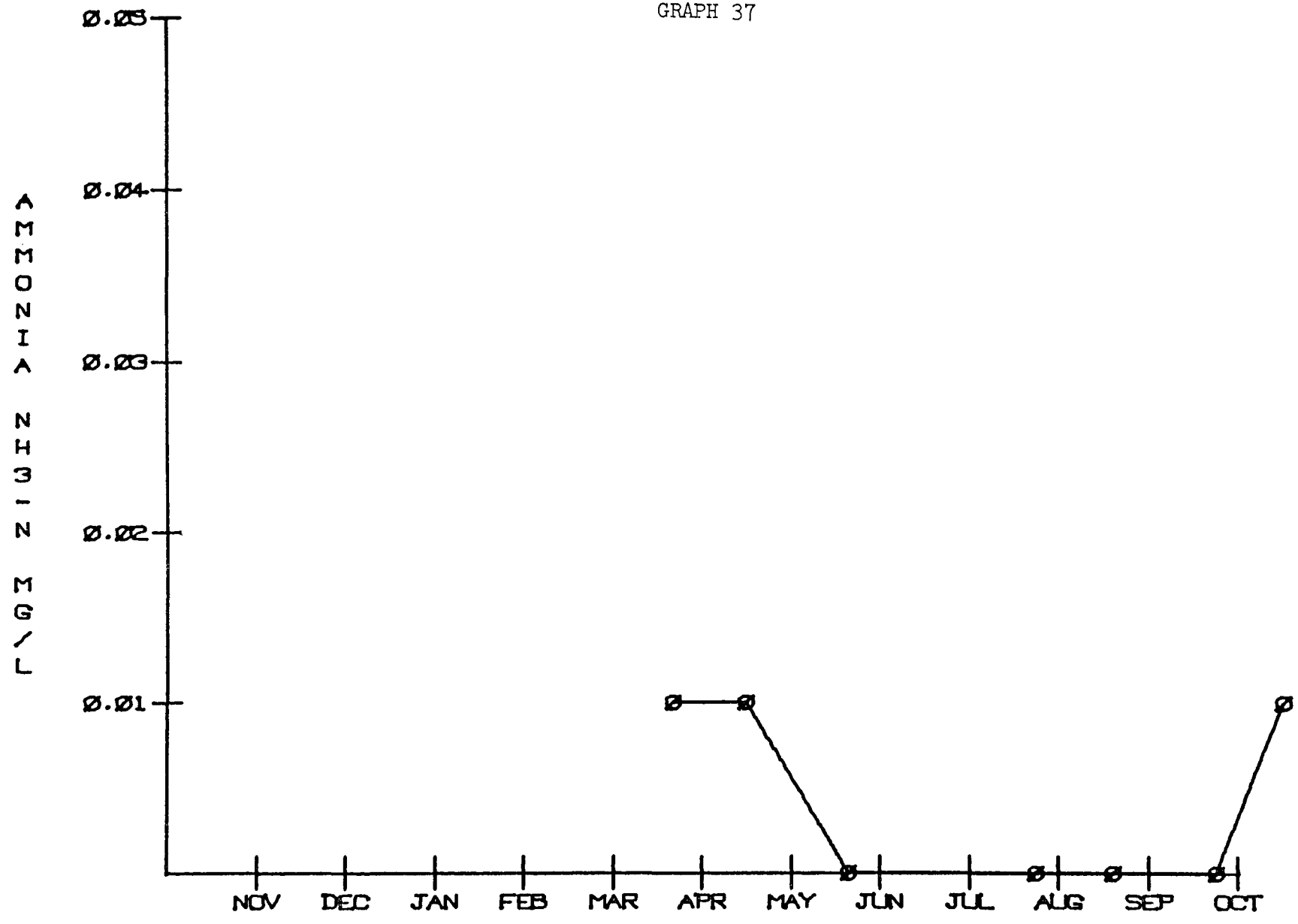


NOV 1973 - OCT 1974

NACHES RIVER AT R.M. 3.7

SEGMENT 18-38-07

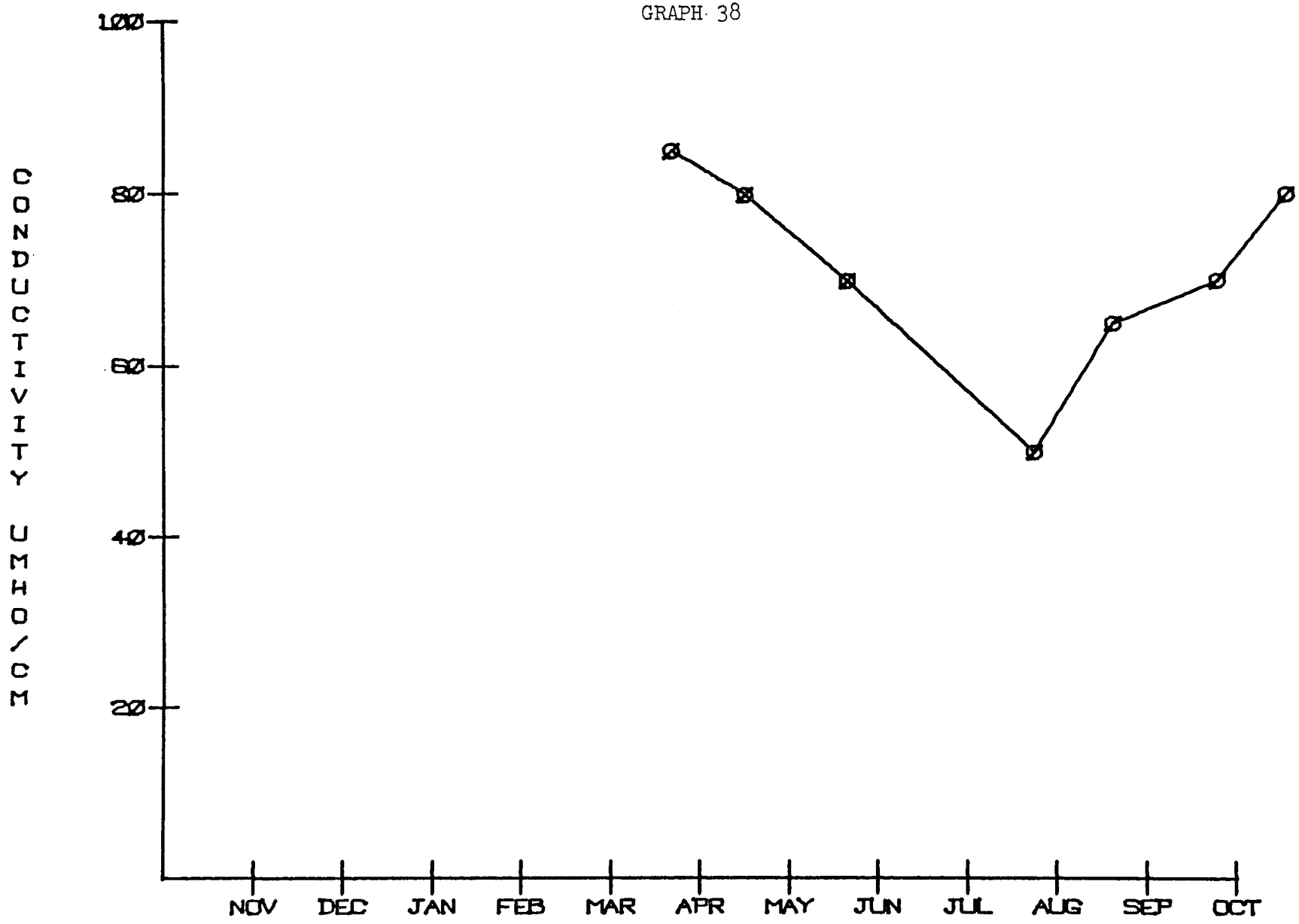
GRAPH 37



NACHES RIVER AT R.M. 3.7

SEGMENT 18-38-07

GRAPH 38

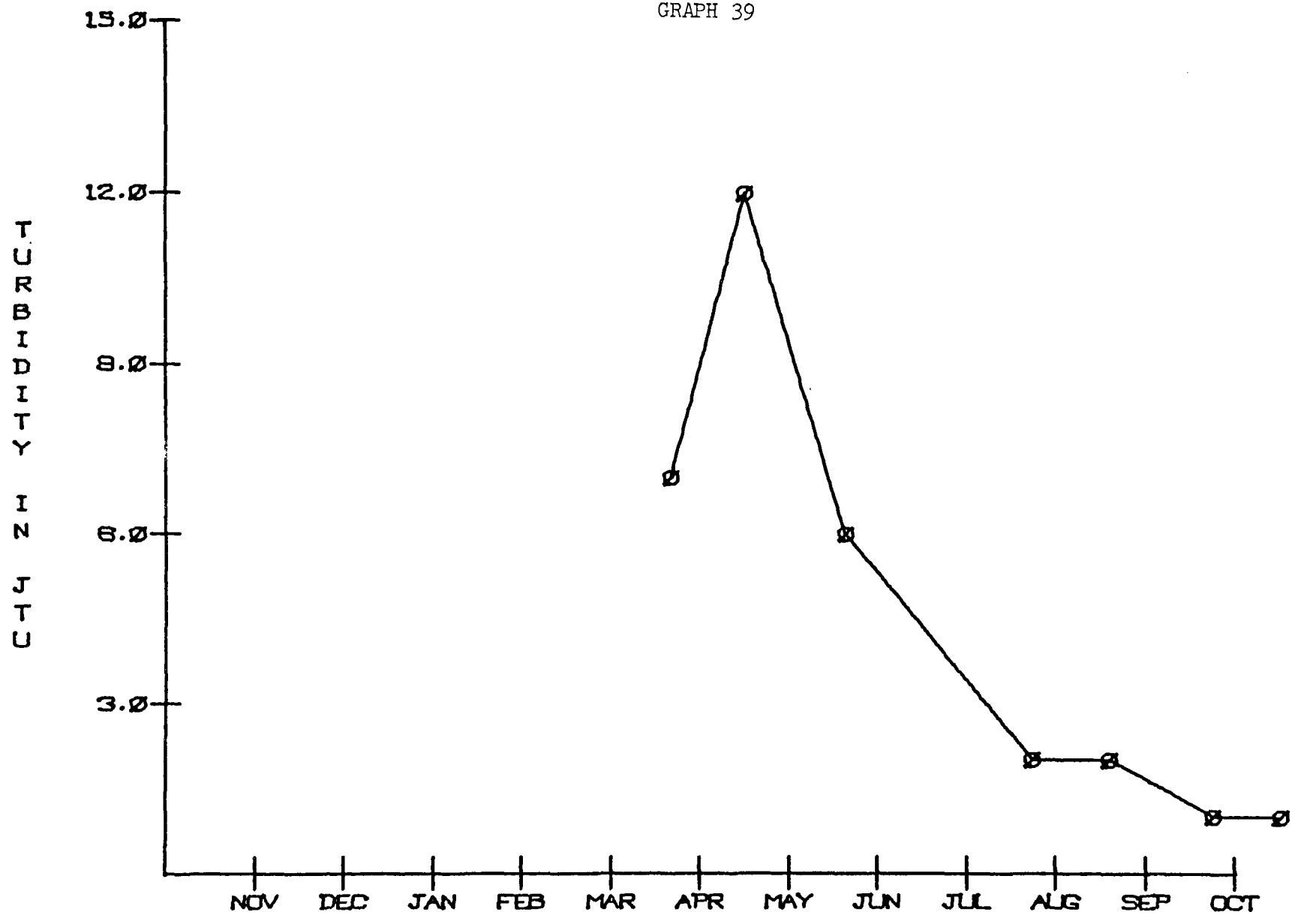


NOV 1973 - OCT 1974

NACHES RIVER AT R.M. 3.7

SEGMENT 18-38-07

GRAPH 39

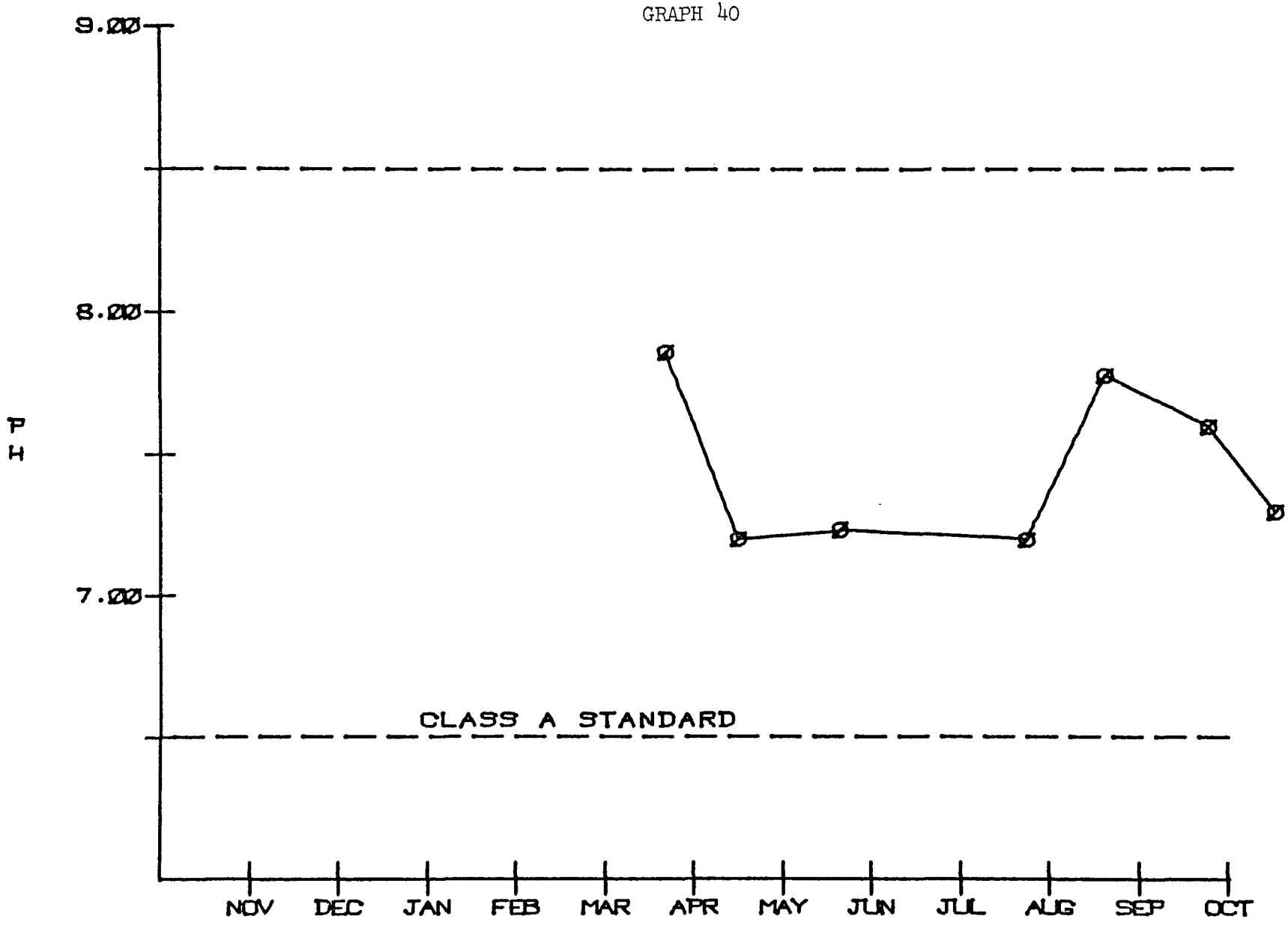


NOV 1973 - OCT 1974

NACHES RIVER AT R.M. 3.7

SEGMENT 18-38-Ø7

GRAPH 40

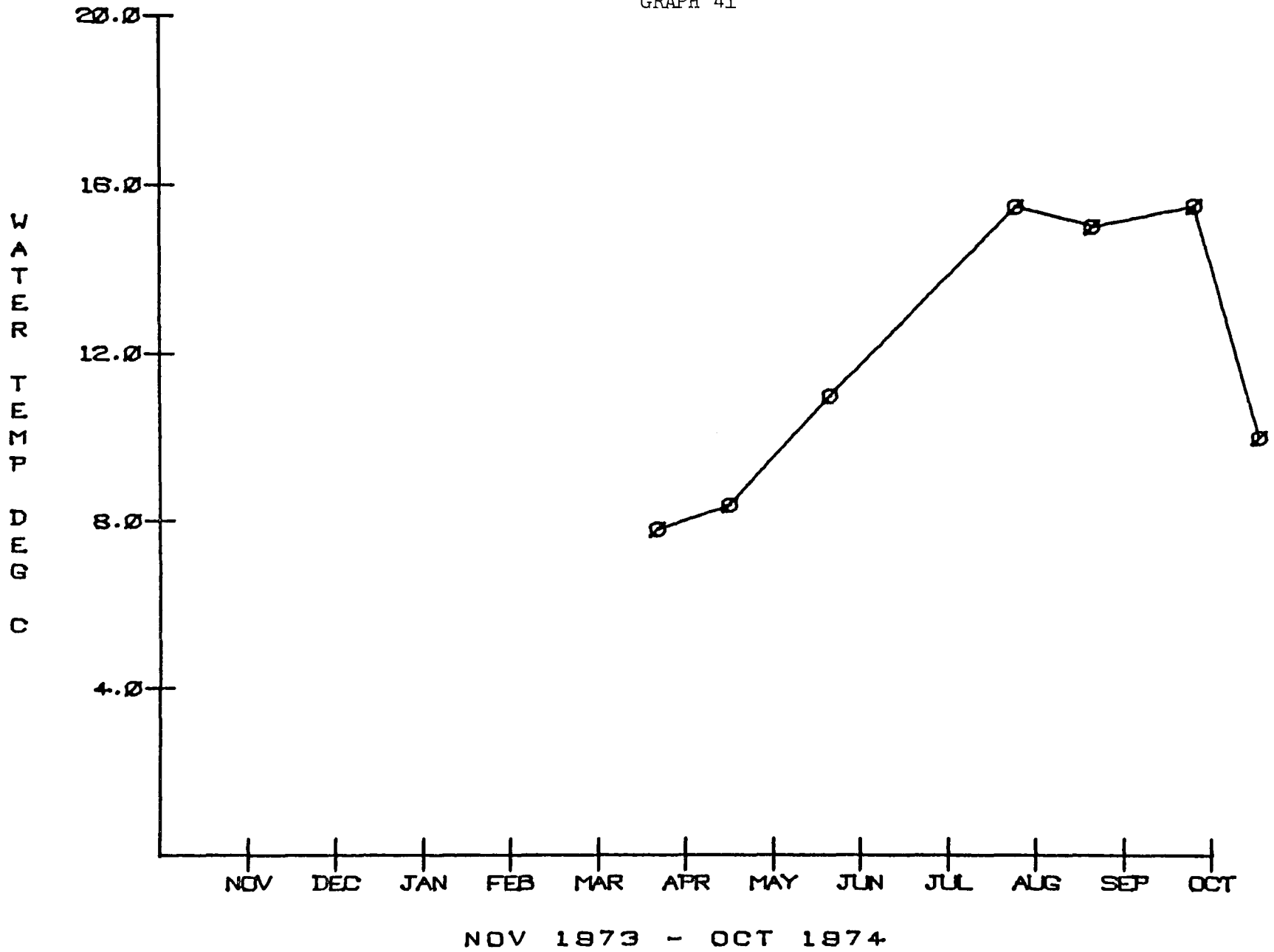


NOV 1973 - OCT 1974

NACHES RIVER AT R.M. 3.7

SEGMENT 18-38-Ø7

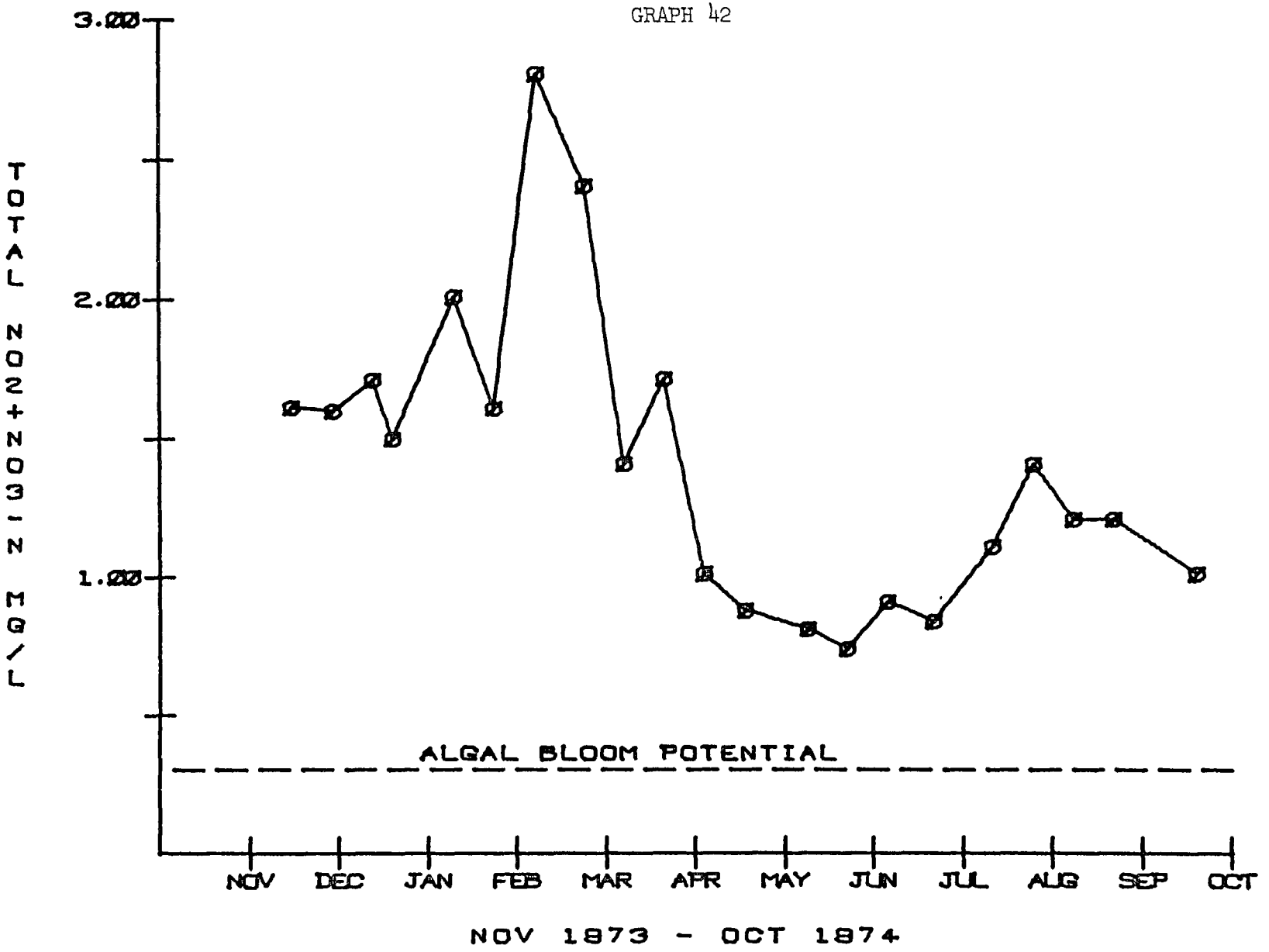
GRAPH 41



WIDE HOLLOW CREEK AT R.M. 1.5

SEGMENT 18-37-03

GRAPH 42

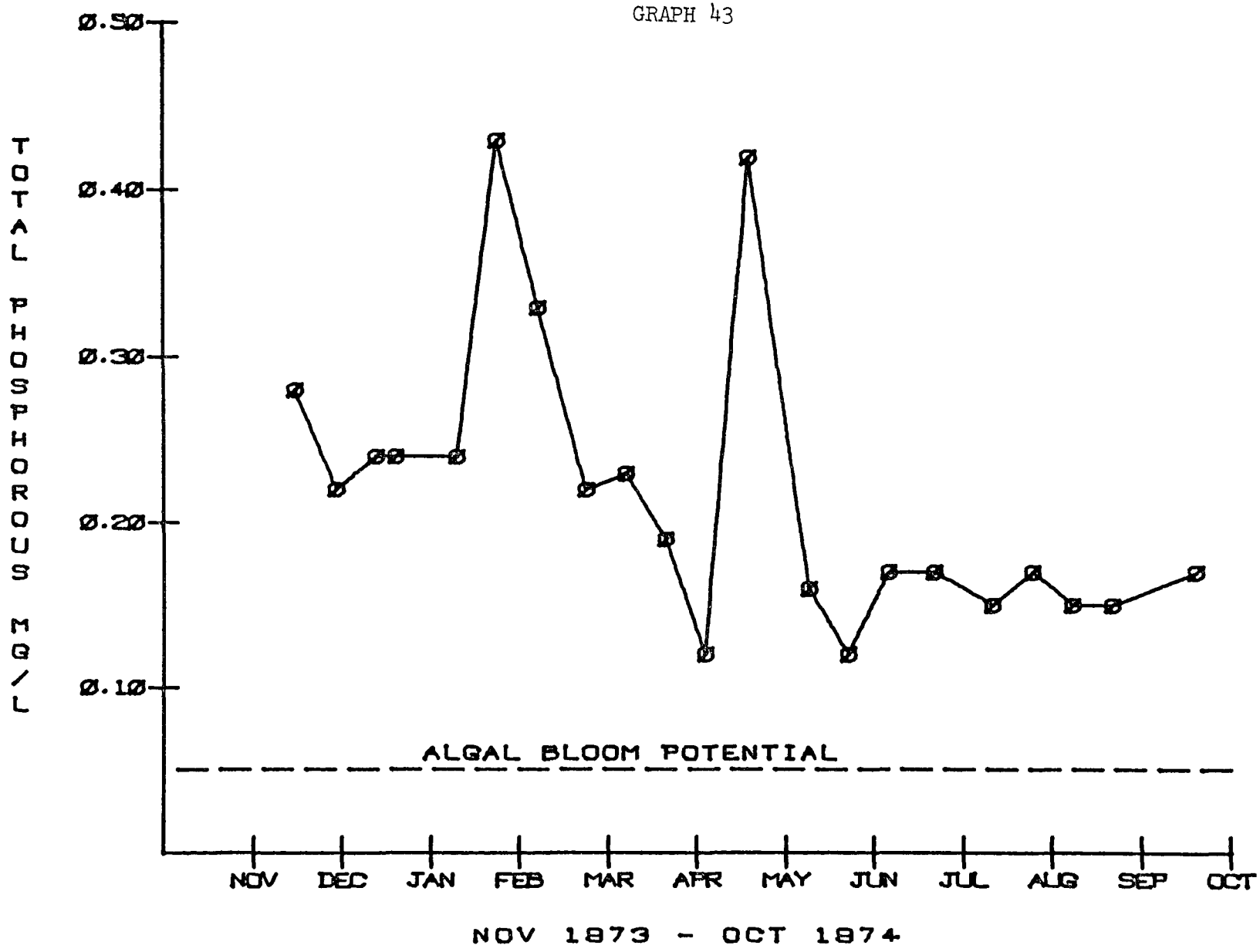


NOV 1973 - OCT 1974

WIDE HOLLOW CREEK AT R.M. 1.5

SEGMENT 18-37-03

GRAPH 43

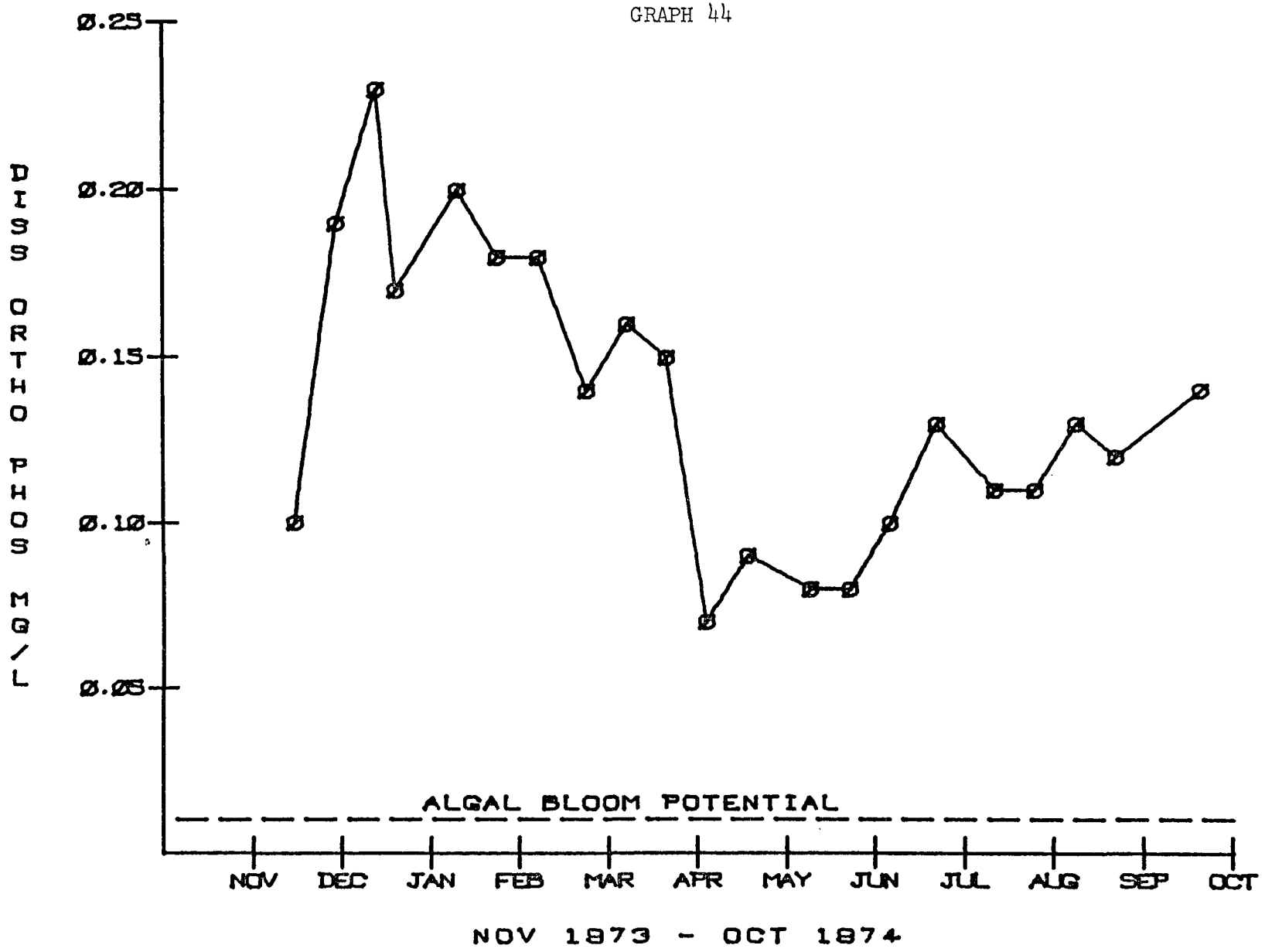


NOV 1873 - OCT 1874

WIDE HOLLOW CREEK AT R.M. 1.5

SEGMENT 18-37-03

GRAPH 44

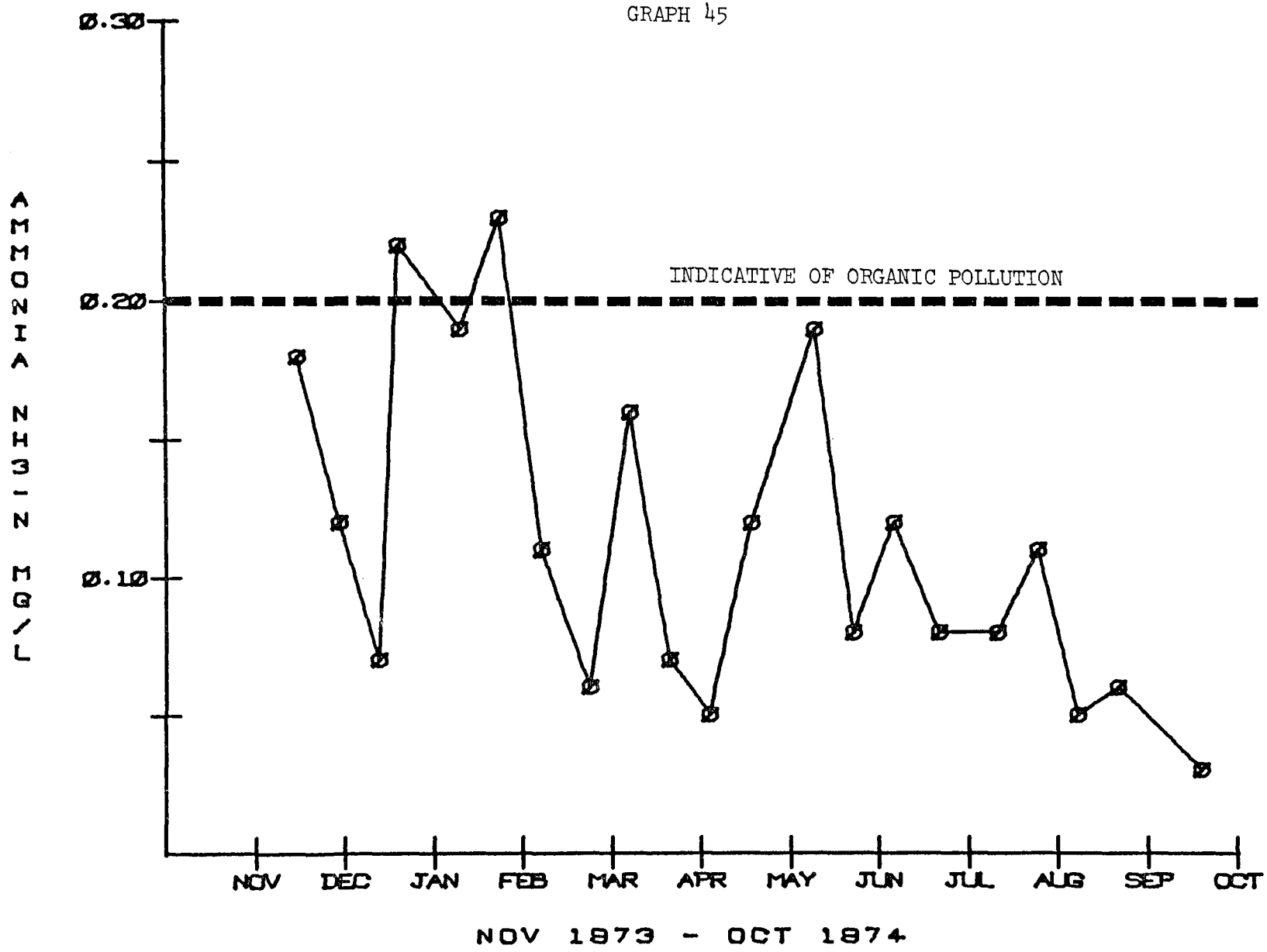


NOV 1973 - OCT 1974

WIDE HOLLOW CREEK AT R.M. 1.5

SEGMENT 18-37-03

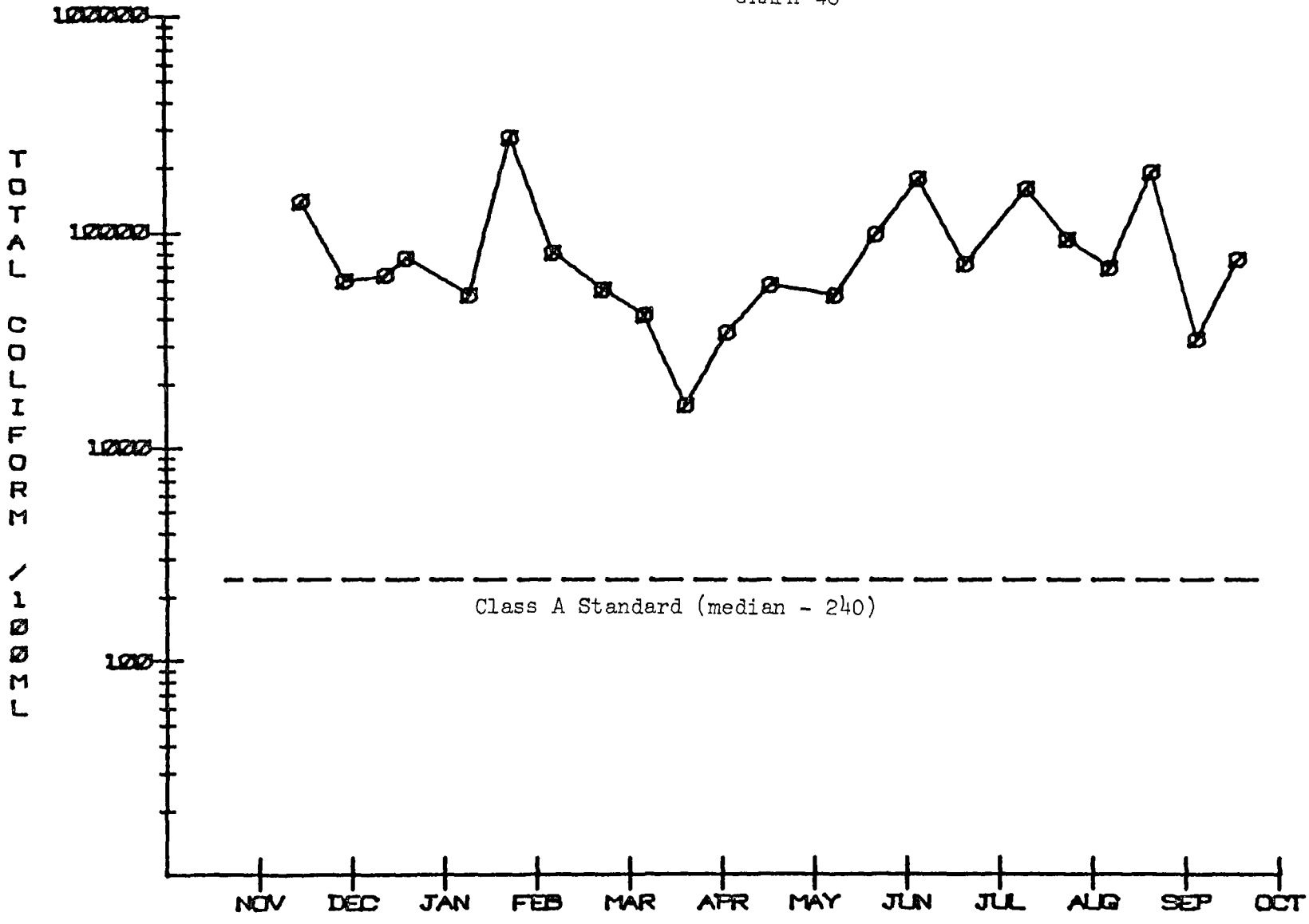
GRAPH 45



WIDE HOLLOW CREEK AT R.M. 1.5

SEGMENT 18-37-03

GRAPH 46

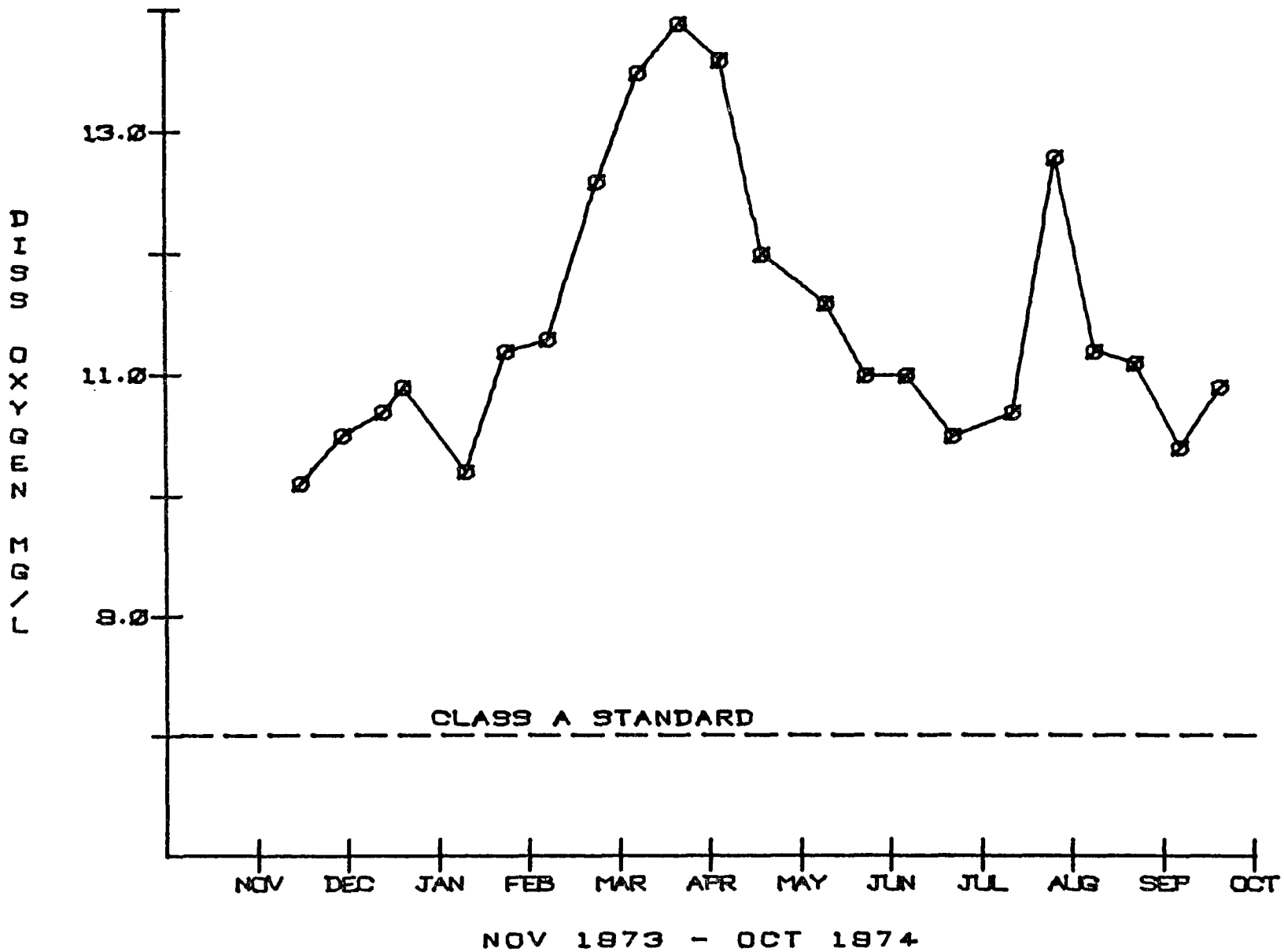


NOV 1973 - OCT 1974

GRAPH 47

WIDE HOLLOW CREEK AT R.M. 1.5

SEGMENT 18-37-03

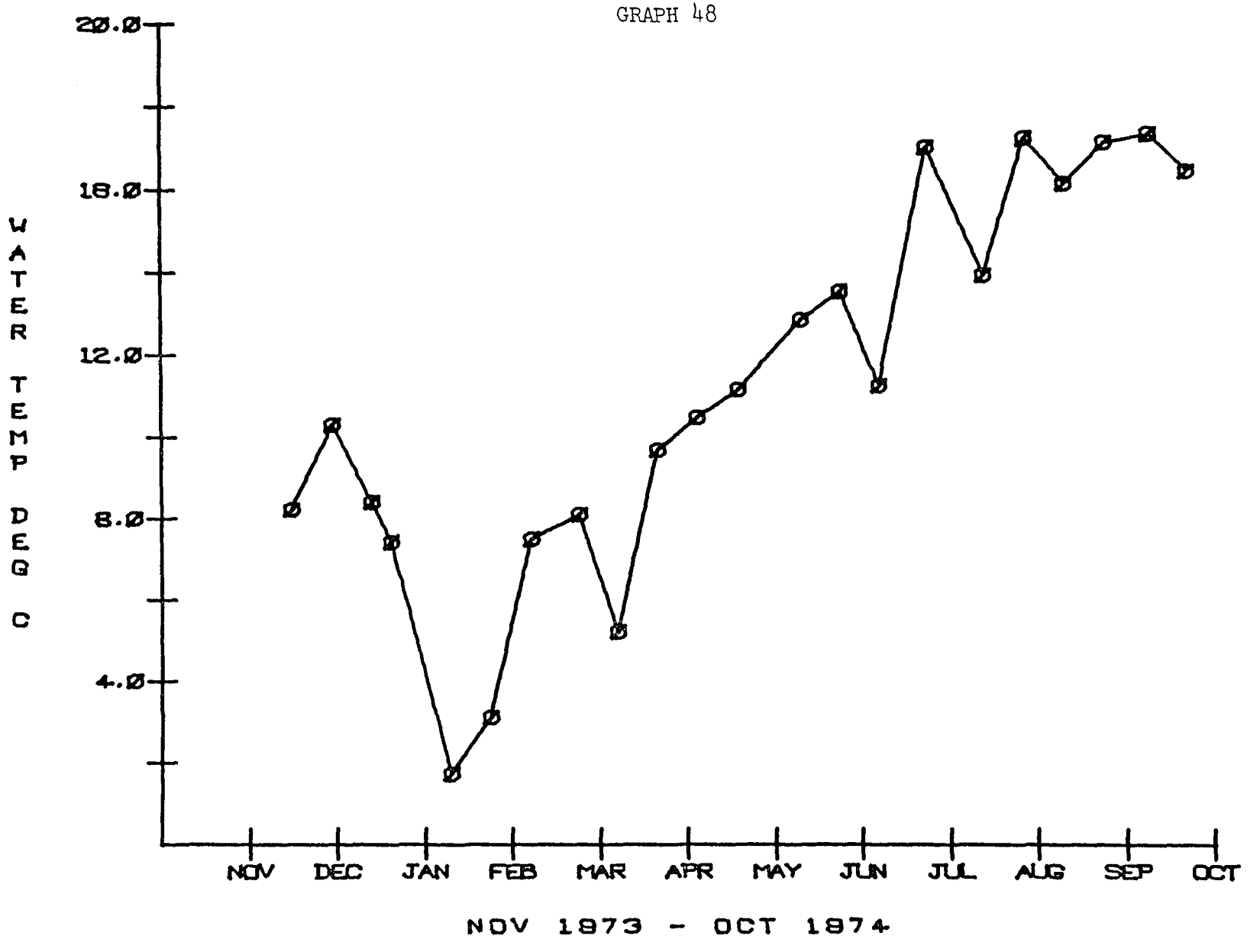


NOV 1973 - OCT 1974

WIDE HOLLOW CREEK AT R.M. 1.5

SEGMENT 18-37-03

GRAPH 48

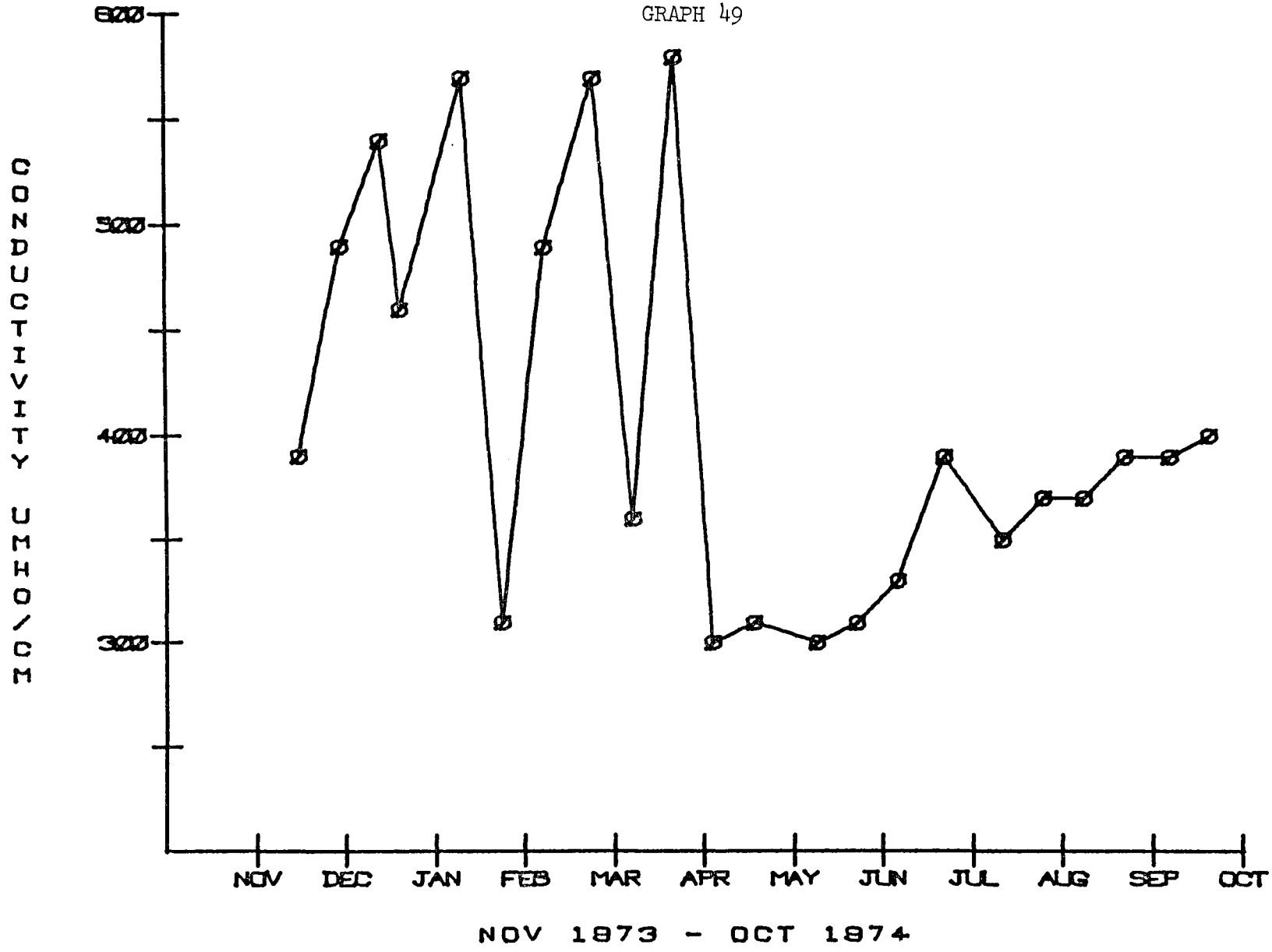


NOV 1973 - OCT 1974

WIDE HOLLOW CREEK AT R.M. 1.5

SEGMENT 18-37-03

GRAPH 49

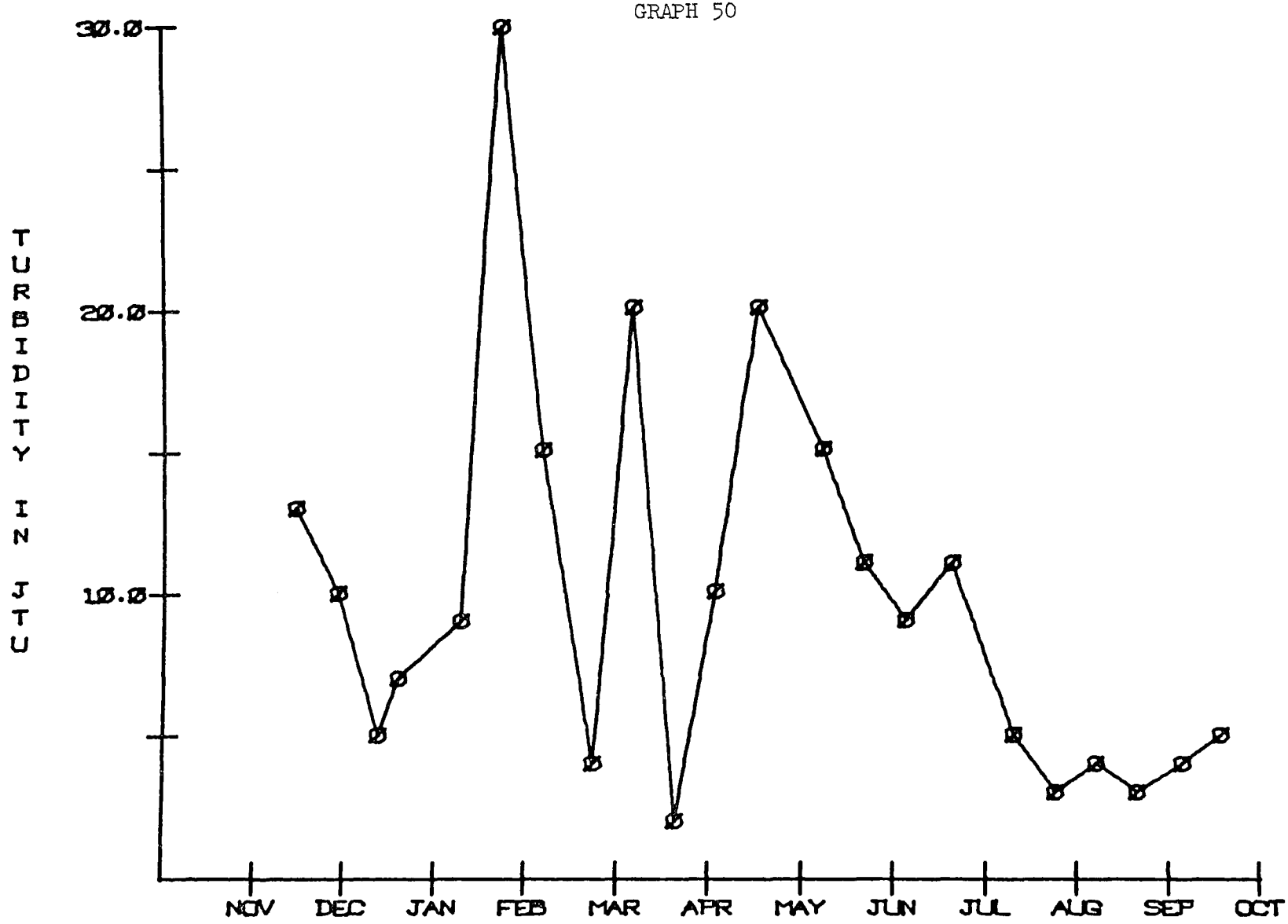


NOV 1973 - OCT 1974

WIDE HOLLOW CREEK AT R.M. 1.5

SEGMENT 18-37-03

GRAPH 50

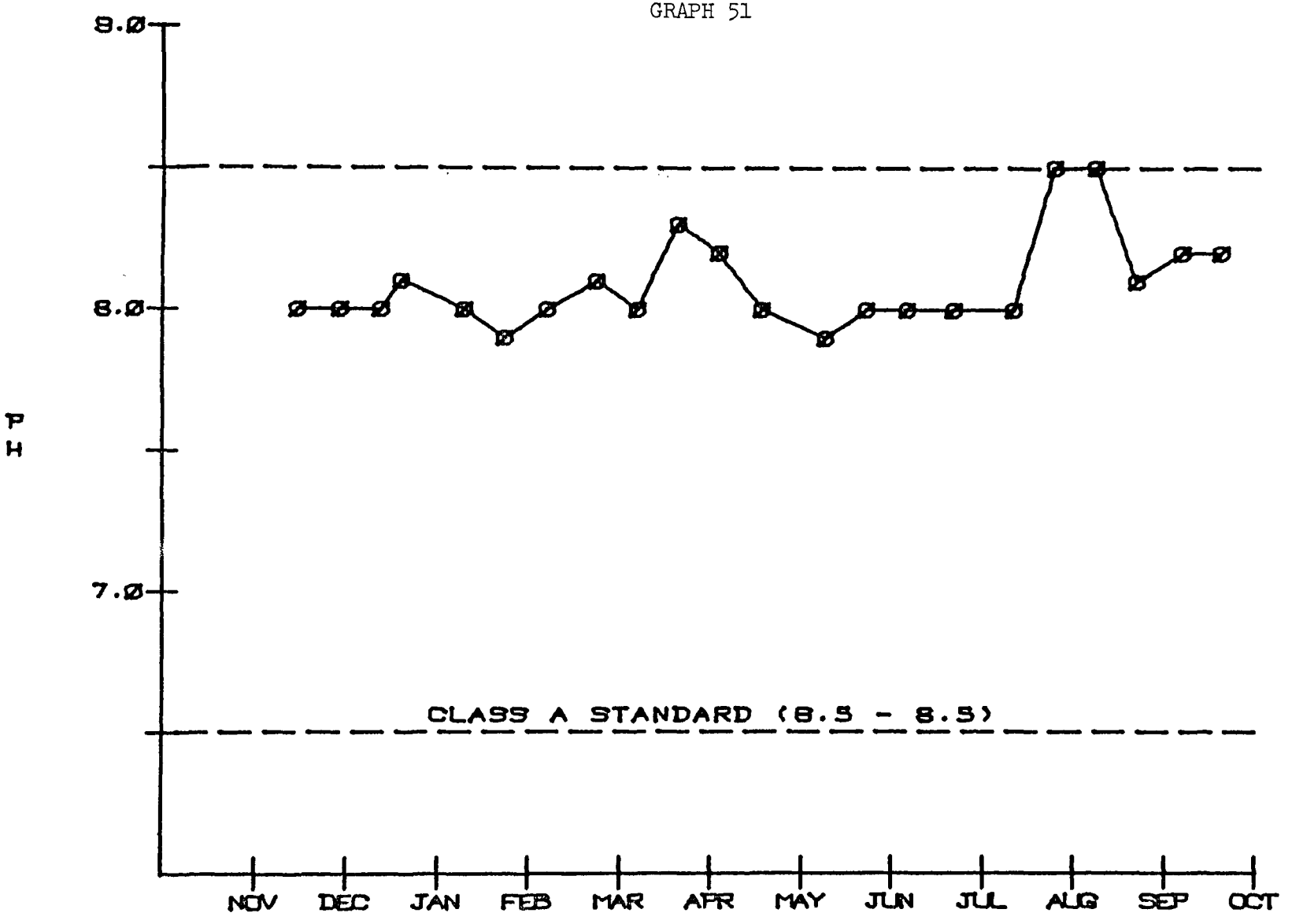


NOV 1973 - OCT 1974

WIDE HOLLOW CREEK AT R.M. 1.5

SEGMENT 18-37-Ø3

GRAPH 51



NOV 1973 - OCT 1974