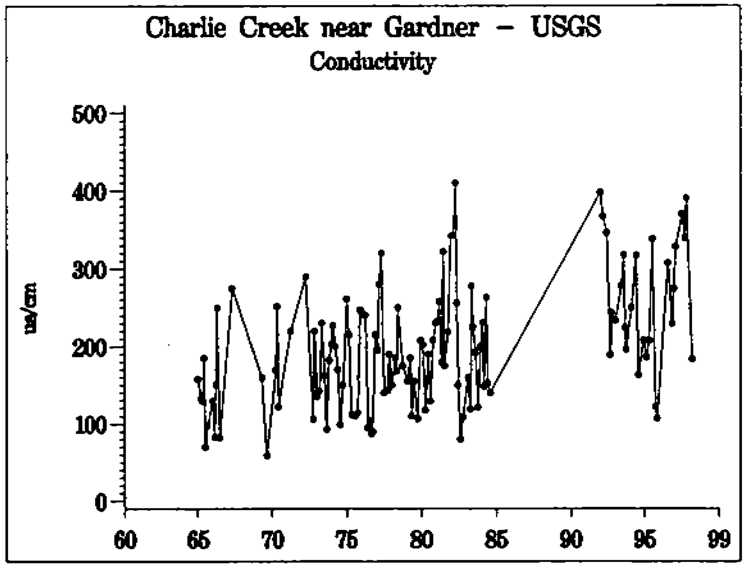
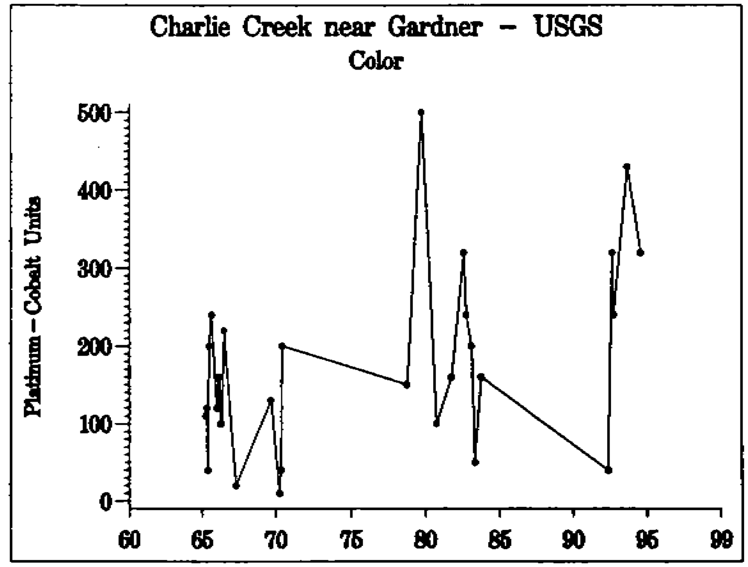
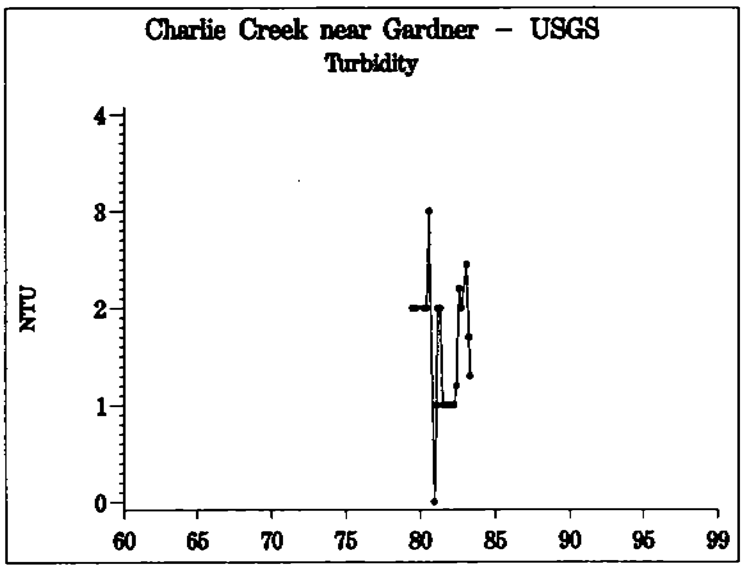
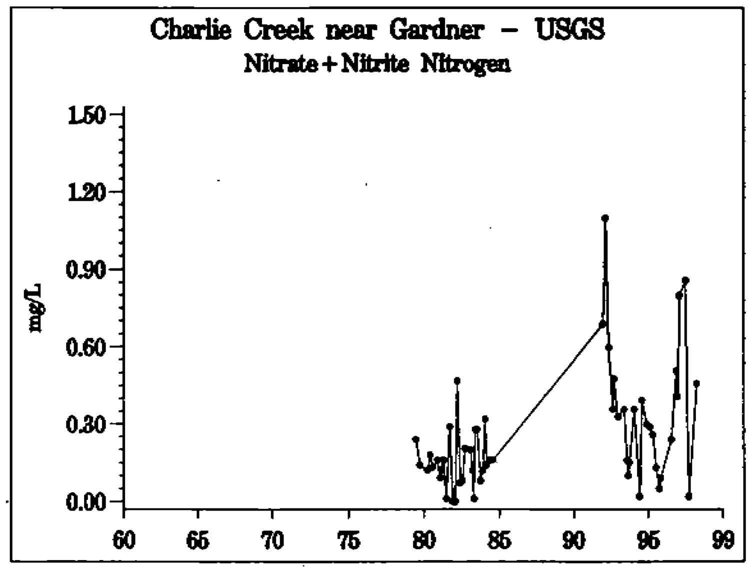
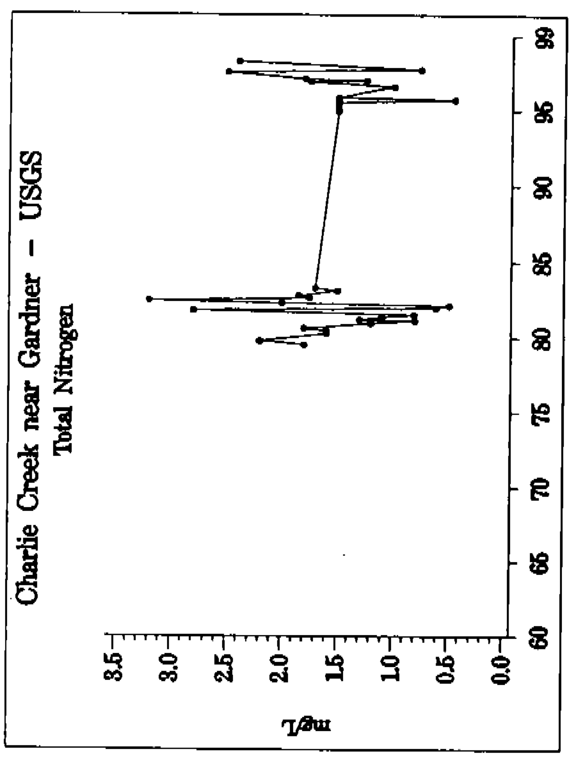
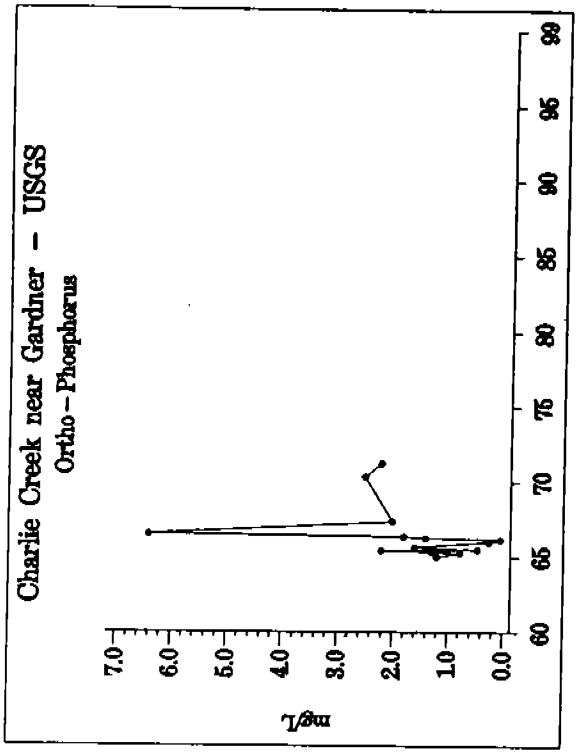

Charlie Creek near Gardner – USGS
Conductivity
us/cm
500
400
300
200
100
0
60
65
70
75
80
85
90
95
99

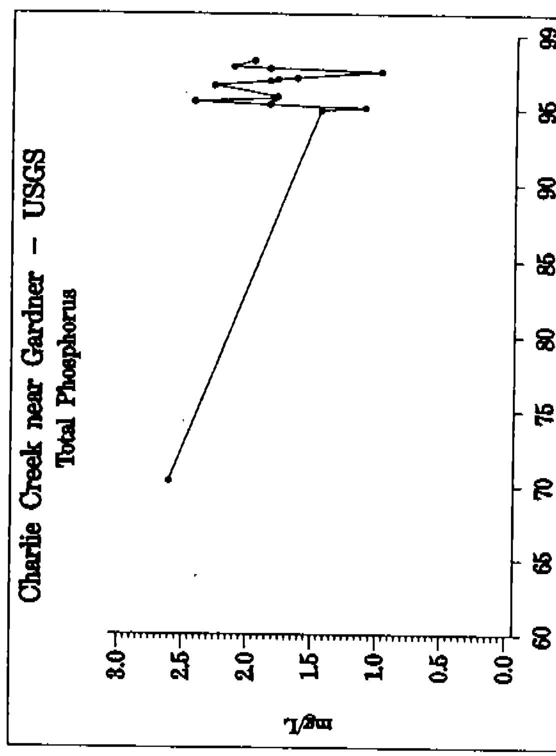

Charlie Creek near Gardner – USGS
Color
Platinum – Cobalt Units
500
400
300
200
100
0
60
65
70
75
80
85
90
95
99

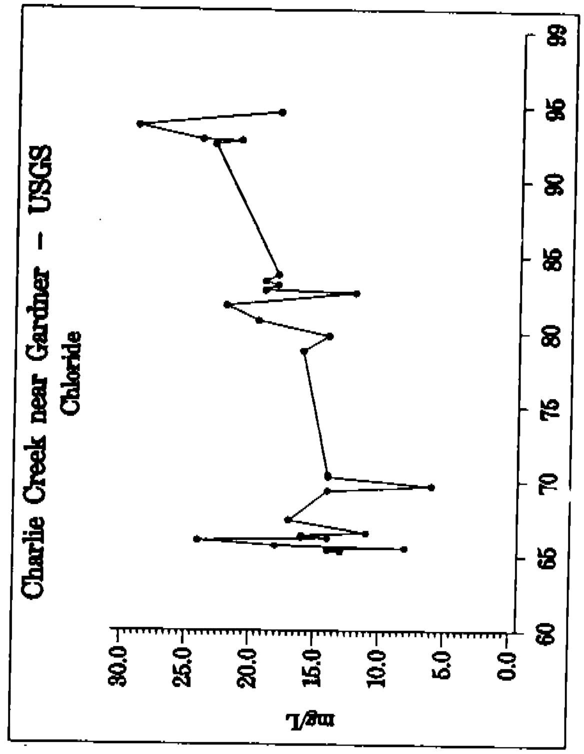

Charlie Creek near Gardner – USGS
Turbidity
NTU
4
3
2
1
0
60
65
70
75
80
85
90
95
99

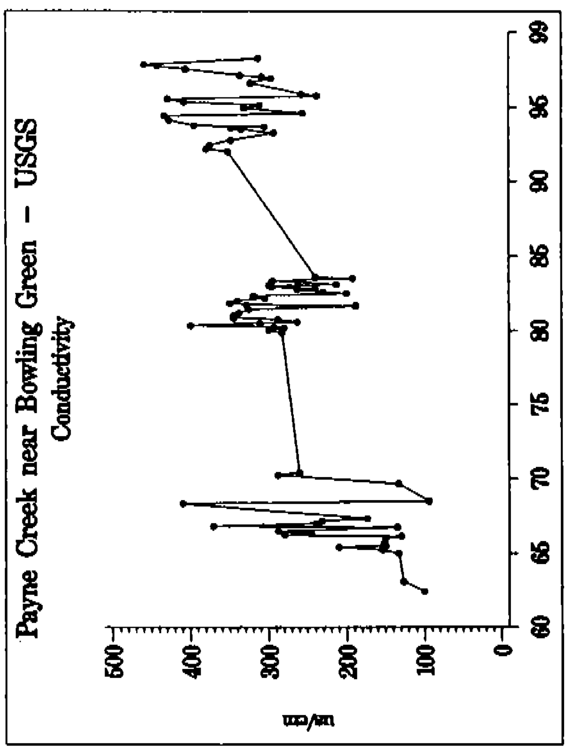

Charlie Creek near Gardner – USGS
Nitrate + Nitrite Nitrogen
mg/L
1.50
1.20
0.90
0.60
0.30
0.00
60
65
70
75
80
85
90
95
99

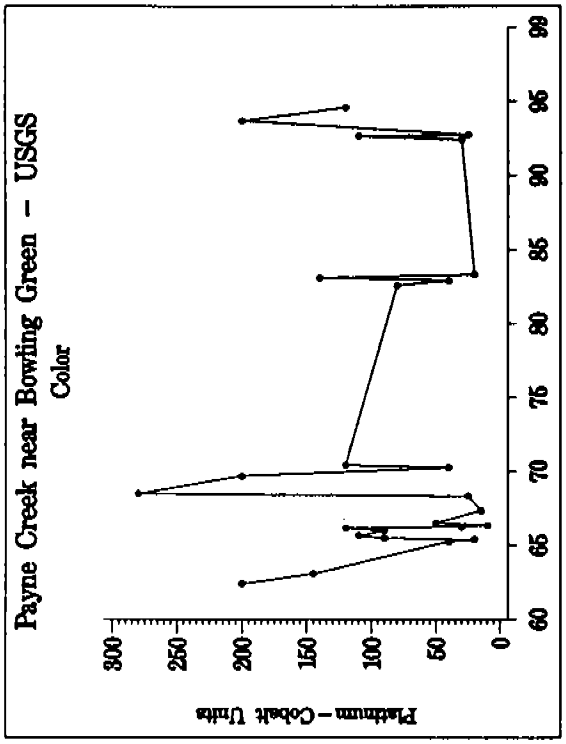

Charlie Creek near Gardner - USGS
Total Nitrogen
mg/L
3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
60 65 70 75 80 85 90 95 99

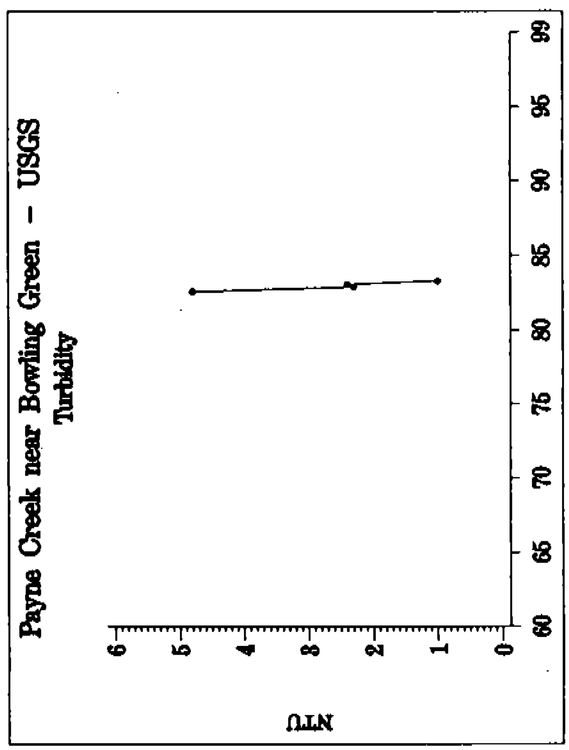

Charlie Creek near Gardner - USGS
Ortho-Phosphorus
mg/L
7.0 6.0 5.0 4.0 3.0 2.0 1.0 0.0
60 65 70 75 80 85 90 95 99

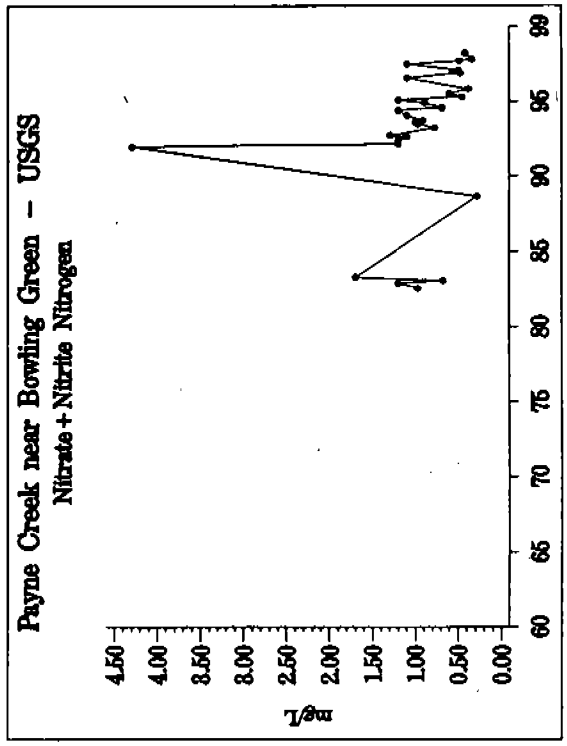

Charlie Creek near Gardner - USGS
Total Phosphorus
mg/L
3.0 2.5 2.0 1.5 1.0 0.5 0.0
60 65 70 75 80 85 90 95 99

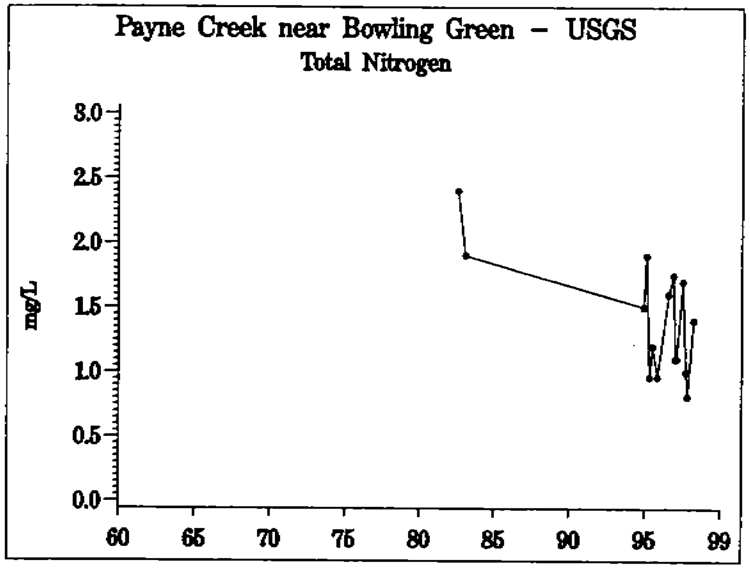

Charlie Creek near Gardner - USGS
Chloride
mg/L
30.0 25.0 20.0 15.0 10.0 5.0 0.0
60 65 70 75 80 85 90 95 99

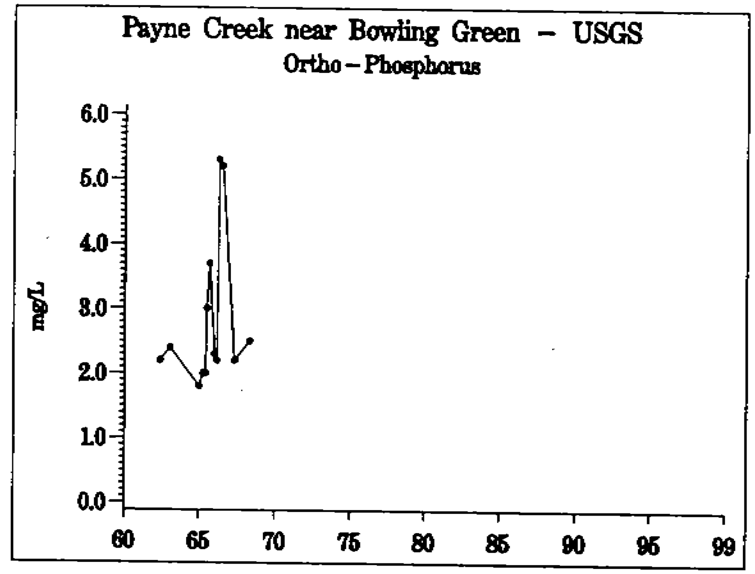

Payne Creek near Bowling Green - USGS
Conductivity
us/cm

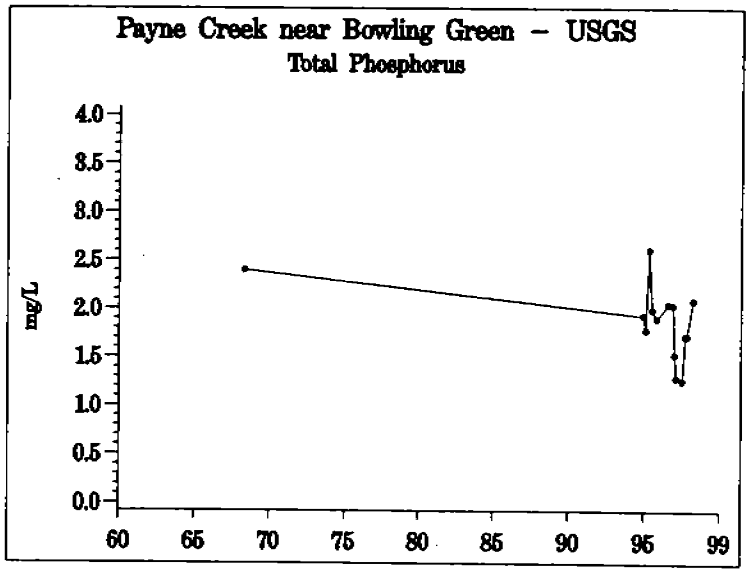

Payne Creek near Bowling Green - USGS
Color
Platinum - Cobalt Units

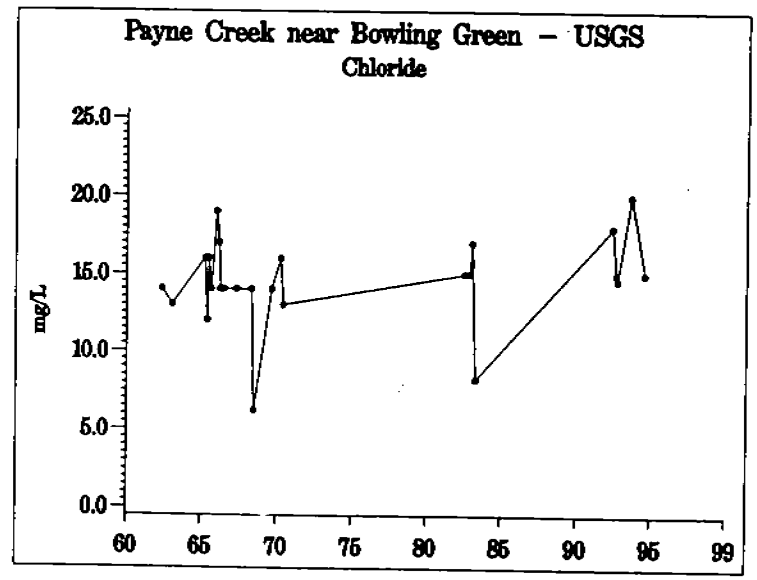

Payne Creek near Bowling Green - USGS
Turbidity
NTU

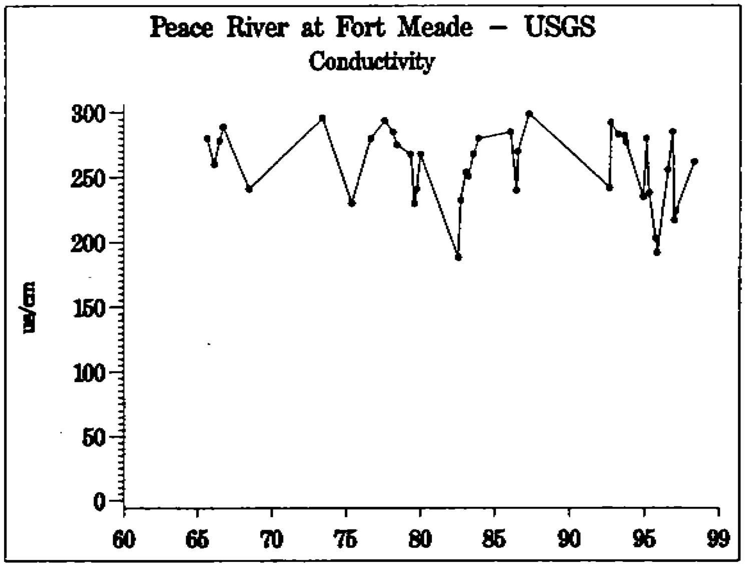

Payne Creek near Bowling Green - USGS
Nitrate + Nitrite Nitrogen
mg/L

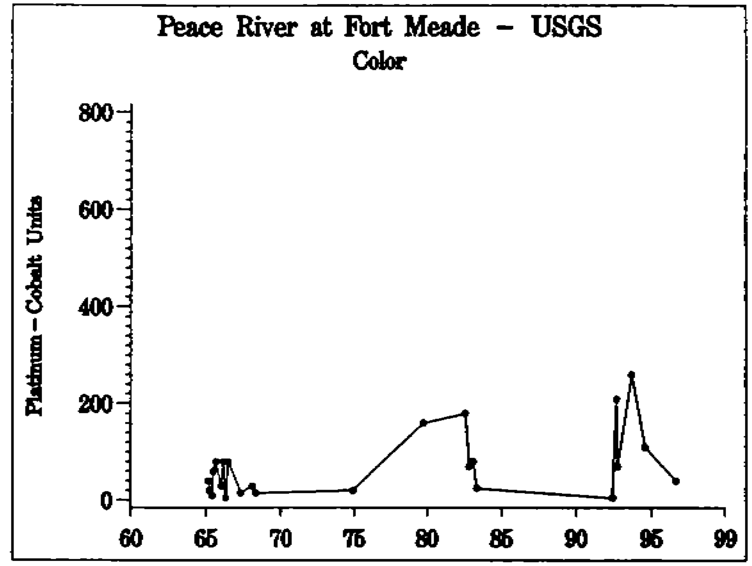

Payne Creek near Bowling Green – USGS
Total Nitrogen
mg/L
3.0
2.5
2.0
1.5
1.0
0.5
0.0
60
65
70
75
80
85
90
95
99

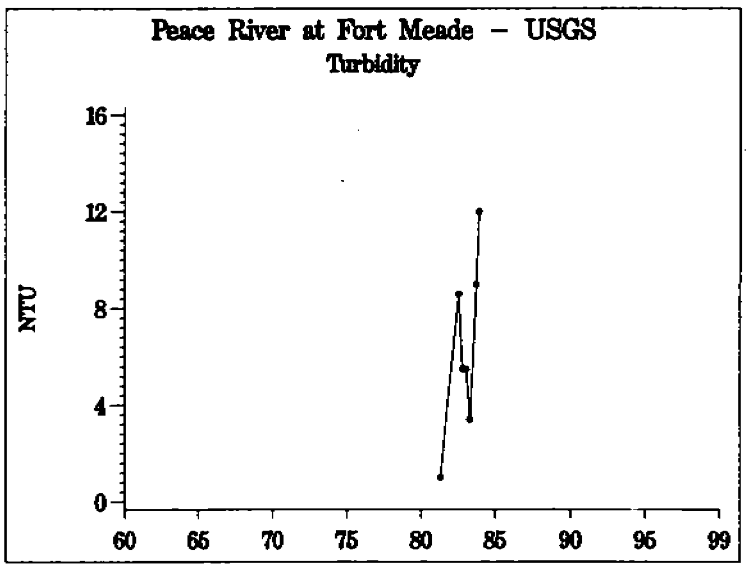

Payne Creek near Bowling Green – USGS
Ortho – Phosphorus
mg/L
6.0
5.0
4.0
3.0
2.0
1.0
0.0
60
65
70
75
80
85
90
95
99

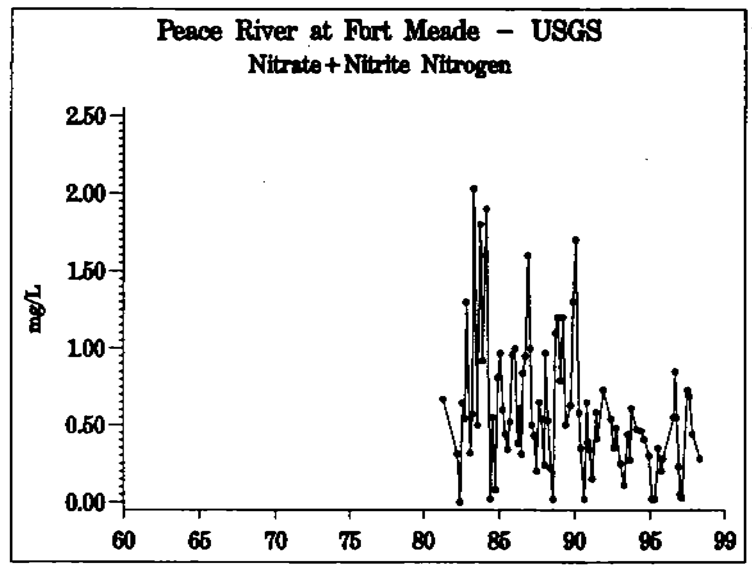

Payne Creek near Bowling Green – USGS
Total Phosphorus
mg/L
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
60
65
70
75
80
85
90
95
99

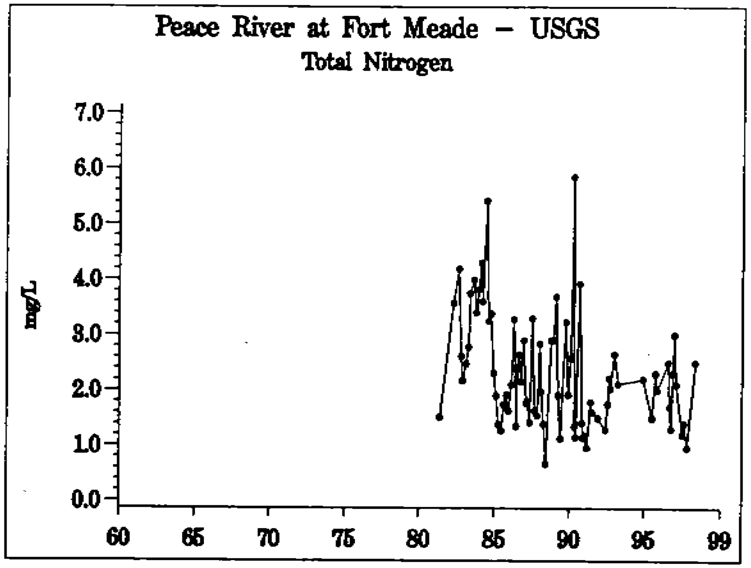

Payne Creek near Bowling Green – USGS
Chloride
mg/L
25.0
20.0
15.0
10.0
5.0
0.0
60
65
70
75
80
85
90
95
99

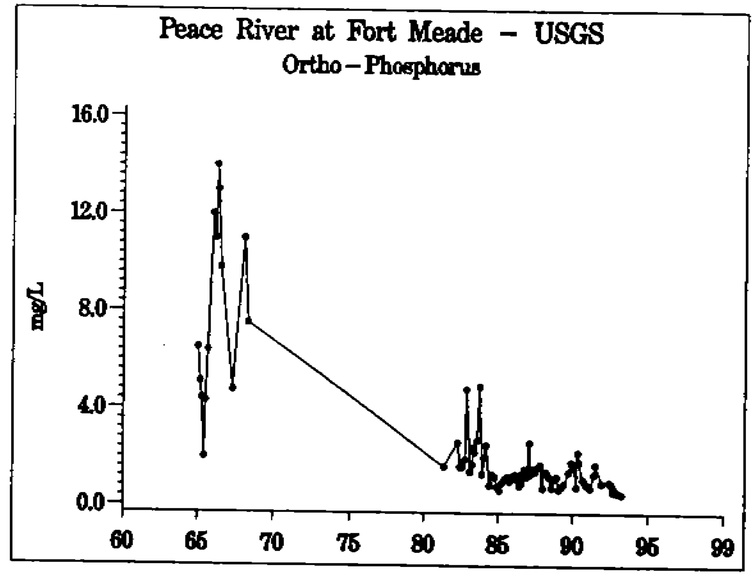

Peace River at Fort Meade – USGS
Conductivity
us/cm
300
250
200
150
100
50
0
60
65
70
75
80
85
90
95
99

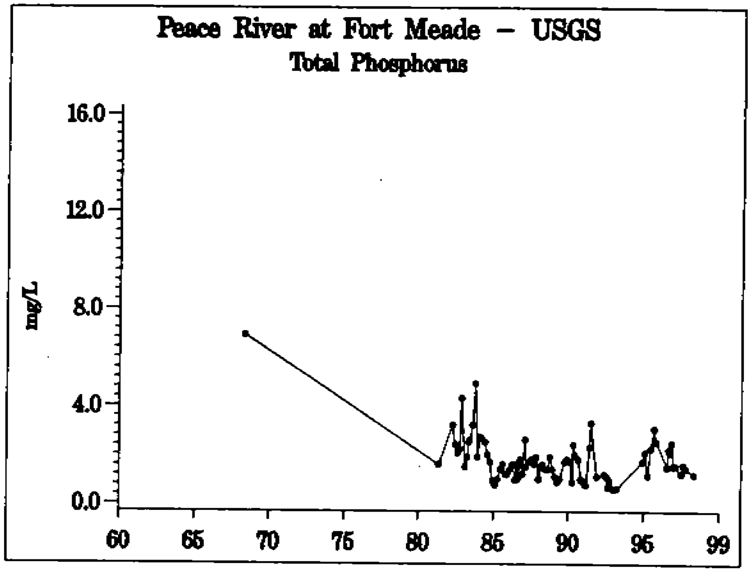

Peace River at Fort Meade – USGS
Color
Platinum – Cobalt Units
800
600
400
200
0
60
65
70
75
80
85
90
95
99

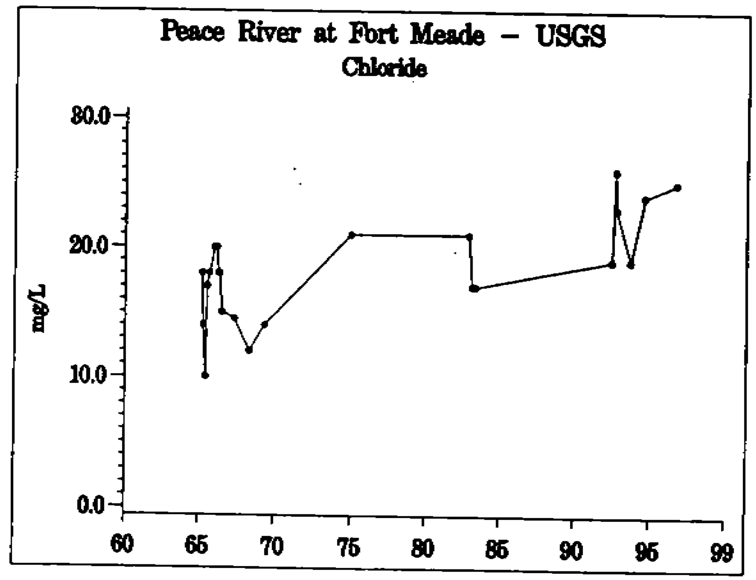

Peace River at Fort Meade – USGS
Turbidity
NTU
16
12
8
4
0
60
65
70
75
80
85
90
95
99


Peace River at Fort Meade – USGS
Nitrate + Nitrite Nitrogen
mg/L
2.50
2.00
1.50
1.00
0.50
0.00
60
65
70
75
80
85
90
95
99


Peace River at Fort Meade – USGS
Total Nitrogen
mg/L
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
60
65
70
75
80
85
90
95
99


Peace River at Fort Meade – USGS
Ortho – Phosphorus
mg/L
16.0
12.0
8.0
4.0
0.0
60
65
70
75
80
85
90
95
99


Peace River at Fort Meade – USGS
Total Phosphorus
mg/L
16.0
12.0
8.0
4.0
0.0
60
65
70
75
80
85
90
95
99


Peace River at Fort Meade – USGS
Chloride
mg/L
30.0
20.0
10.0
0.0
60
65
70
75
80
85
90
95
99

Appendix D

Pollution potential model for basins within the Charlotte Harbor Study Area

Myakka River Basin
Peace River Basin
Charlotte Harbor Basin
Pine Island/ Matlacha Pass Basin
Caloosahatchee River Basin
Estero Bay Basin
Coastal Venice Basin

Estimation of Pollution Potential

Pollution potential was estimated by computing nonpoint source pollution loads based on estimated rainfall, land use, and soil cover by subbasin. The pollution load potential was estimated in order to prioritize subbasins for the CCMP. Thus, the method development was focused on estimating loads in a consistent manner among subbasins. This was done to estimate the most accurate pollutant loads while avoiding biasing the subbasin prioritization.

Specifically, the precipitation, land use, and soil data sources of acceptable quality, accuracy, and precision were selected to meet the following three criteria jointly:

- Current Data - The most current data that met all of the selection criteria were chosen.
- Consistency - The data were chosen from large and comprehensive Water Management District databases to maximize consistency among the subbasins.
- Completeness - A group of datasets was selected that encompassed the entire geographic study area.

Runoff Discharge Methods

Urban, industrial, and agricultural development have changed the natural landscape within the study area, and this has resulted in changes in the physical manner in which runoff responds to rainfall. The detailed rainfall, 1988 SFWMD land cover, SWFWMD 1990 land cover, and USDA soil data that were discussed in Section B-1 were used to estimate relative runoff discharge rates for the subbasins. Using a surface-fitting approach, rainfall values for each month were computed for each of the subbasins by estimating mean monthly values averaged over the years 1970 to 1996 using the equation:

$$\hat{p}_{j,t} = \frac{\sum_{k=1}^{K_j}\left[P_{k,t}\frac{1}{D^2_{j,k}}\right]}{\sum_{k=1}^{K_j}\left[\frac{1}{D^2_{j,k}}\right]}$$

where $\hat{p}_{j,t}$ = the estimated total monthly precipitation in the t^{th} month for the j^{th} subbasin,

K_j = the number of precipitation monitoring stations used to estimate precipitation in the j[th] subbasin,

$P_{k,t}$ = the total monthly precipitation in the t[th] month recorded at the k[th] precipitation monitoring station, and

$D_{j,k}$ = the distance between the geographic centroid of the j[th] subbasin and the k[th] precipitation monitoring station.

The geographic centroid of each subbasin was computed as the area-weighted center of its basin boundary. Monthly specific runoff discharge estimates were then calculated by applying the subbasin specific rainfall estimates to each parcel in the detailed GIS land cover and soil characteristics database. Discharge was computed by multiplying the rainfall estimate by a literature-based runoff coefficient value. Runoff coefficients used for these analyses were specific for south Florida, varied by land use/cover and hydrologic soil group, and were adjusted for wet or dry season conditions. The runoff coefficients used for these analyses are presented in Table D-1. For the final step in this calculation, runoff discharge estimates for each individual land parcel were summed to compute the total expected runoff discharge for each land use within a subbasin using the equation:

$$\hat{q}_{j,t,l} = \sum_{s=1}^{S} A_{j,s,l}\, \hat{p}_{j,t}\, C_{s,l,t}$$

where $\hat{q}_{j,t,l}$ = the estimated total monthly runoff discharge in the t[th] month for the j[th] subbasin for land use l,

$A_{j,s,l}$ = the area of soil type s in land use category l in the j[th] subbasin,

$\hat{p}_{j,t}$ = the estimated total monthly precipitation in the t[th] month for the j[th] subbasin, and

$C_{s,l,t}$ = the runoff coefficient for soil s and land use l in the t[th] month, with season-specific runoff coefficients for south Florida urban land uses.

Hydrologic loadings were estimated based on an "off the land" basis, and it was assumed that all runoff entered the system surface water, whether pumps or gravity flow was used to carry water from the subbasin to the surface water body.

Pollutant Loadings Methods

Agricultural, industrial, and urban development have also led to increased suspended solids (TSS), total nitrogen (TN), and total phosphorous (TP) loadings to the estuary. The runoff discharge model discussed previously was used to estimate relative loading rates for these pollutants for each subbasin. Monthly-specific pollutant loading estimates were computed for each individual parcel of unique land use and soil within a subbasin. Loadings were computed using land use specific pollutant concentration estimates (Table D-1) specific for south Florida. Loading estimates for each pollutant were then computed using the equation:

$$L_{j,t,l} = \hat{q}_{j,t,l}\, E_l$$

where $L_{j,t,l}$ = the estimated monthly pollutant load in the t[th] month for the j[th] subbasin basin for land use l,

$\hat{q}_{j,t,l}$ = the estimated total monthly runoff discharge in the t[th] month for the j[th] subbasin for land use l, as described previously, and

E_l = the pollutant concentration for land use l.

TSS, TN, and TP concentrations reported in the literature have widely varying values. Average concentration values were computed from different studies as listed in Table D-1. The widely varying concentration data resulted in an increased level of uncertainty in the absolute values of the load estimates. However, more intensively developed land uses such as medium and high density residential and intensive agriculture clearly have a higher potential for TSS, TN, and TP loading to the estuary. For management purposes, the pollutant load prioritization of subbasins for this study reflects these load source patterns.

Table D-1. Land Use	Hydrologic Soil Group	Wet Season Runoff Coefficient	Dry Season Runoff Coefficient
Low Density Residential	A	0.15	0.25
Low Density Residential	B	0.18	0.28
Low Density Residential	C	0.21	0.31
Low Density Residential	D	0.24	0.34
Medium Density Residential	A	0.25	0.35
Medium Density Residential	B	0.3	0.4
Medium Density Residential	C	0.35	0.45
Medium Density Residential	D	0.4	0.5
High Density Residential	A	0.35	0.5
High Density Residential	B	0.42	0.57
High Density Residential	C	0.5	0.65
High Density Residential	D	0.58	0.75
Commercial	A	0.7	0.79
Commercial	B	0.74	0.83
Commercial	C	0.78	0.87
Commercial	D	0.82	0.91
Industrial	A	0.65	0.75
Industrial	B	0.7	0.8
Industrial	C	0.75	0.85
Industrial	D	0.8	0.9
Mining	A	0.4	0.5
Mining	B	0.45	0.55
Mining	C	0.5	0.6
Mining	D	0.55	0.65
Institutional,Transportation,Utilities	A	0.4	0.5
Institutional,Transportation,Utilities	B	0.45	0.55
Institutional,Transportation,Utilities	C	0.5	0.6
Institutional,Transportation,Utilities	D	0.55	0.65
Range Lands	A	0.1	0.18
Range Lands	B	0.14	0.22
Range Lands	C	0.18	0.26
Range Lands	D	0.22	0.3
Barren Lands	A	0.45	0.55
Barren Lands	B	0.5	0.6
Barren Lands	C	0.55	0.65
Barren Lands	D	0.6	0.7
Pasture	A	0.1	0.18

Table D-1. Land Use	Hydrologic Soil Group	Wet Season Runoff Coefficient	Dry Season Runoff Coefficient
Pasture	B	0.14	0.22
Pasture	C	0.18	0.26
Pasture	D	0.22	0.3
Groves	A	0.1	0.18
Groves	B	0.14	0.22
Groves	C	0.18	0.26
Groves	D	0.22	0.3
Feedlots	A	0.8	0.9
Feedlots	B	0.8	0.9
Feedlots	C	0.8	0.9
Feedlots	D	0.8	0.9
Nursery	A	0.2	0.3
Nursery	B	0.25	0.35
Nursery	C	0.3	0.4
Nursery	D	0.35	0.45
Row and Field Crops	A	0.2	0.3
Row and Field Crops	B	0.25	0.35
Row and Field Crops	C	0.3	0.4
Row and Field Crops	D	0.35	0.45
Upland Forests	A	0.1	0.18
Upland Forests	B	0.14	0.22
Upland Forests	C	0.18	0.26
Upland Forests	D	0.22	0.3

Land Use	TN Concentration (mg/L)	TP Concentration (mg/L)	TSS Concentration (mg/L)
Low Density Residential	1.88438	0.29625	18.16
Medium Density Residential	2.2475	0.33075	34
High Density Residential	2.08857	0.37593	64.56
Commercial	1.83833	0.26167	73.8833
Industrial	1.668	0.276	93.925
Mining	1.63	0.245	50.3
Institutional,Transportation,Utilities	1.204	0.074	11.0667
Range Lands	2.6	1.3	12.1
Barren Lands	1.18	0.05	10
Pasture	2.66	0.81	8.6
Groves	2.02	0.28783	9.85
Feedlots	19.7	3.8	50
Nursery	2	0.3	55
Row and Field Crops	3.1675	1.295	34.65
Upland Forests	3.79	0.54	55.3

Appendix E

Land Use data from SWFWMD based on Florida Department of Transportation (FDOT) "Florida Land Use and Cover Classification System" (FLUCCS), Levels II and III for the Charlotte Harbor Study Area

Myakka River Basin
Peace River Basin
Charlotte Harbor Basin
Pine Island/ Matlacha Pass Basin
Caloosahatchee River Basin
Estero Bay Basin
Coastal Venice Basin