

Formulae for
Assessing Historical Trends

7. Estimate the mean and the variance of the estimated mean for period 1 (first half of data record)

$$\bar{y}_1 = \frac{\sum_{t=1}^M d_{1t} \times g_t \times \bar{y}_t}{\sum_{t=1}^M d_{1t} \times g_t}$$

$$\hat{v}ar(\bar{y}_1) = \left[\frac{1 - f_1}{m_1} \times S_1^2 \right] + [f_1 \times \hat{v}ar_1]$$

$$\hat{v}ar_1 = \frac{\sum_{t=1}^M (d_{1t} \times g_t)^2 \times \hat{v}ar(\bar{y}_t)}{\left[\sum_{t=1}^M d_{1t} \times g_t \right]^2}$$

$$S_1^2 = \frac{\sum_{t=1}^M d_{1t} \times g_t \times (\bar{y}_t - \bar{y}_1)^2}{m_1 - 1}$$

$$m_1 = \sum_{t=1}^M (d_{1t} \times g_t)$$

$$f_1 = \frac{m_1}{\sum_{t=1}^M d_{1t}}$$

$d_{1t} = 1$ if $t < M/2$, and $d_{1t} = 0$ otherwise
 $g_t = 1$ if mean and variance estimates are available for year t , and $g_t = 0$ otherwise

Formulae for
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8. Estimate the mean and the variance of the estimated mean for period 2 (second half of data record)

$$\bar{y}_2 = \frac{\sum_{t=1}^M d_{2t} \times g_t \times \bar{y}_t}{\sum_{t=1}^M d_{2t} \times g_t}$$

$$\hat{v}ar(\bar{y}_2) = \left[\frac{1 - f_2}{m_2} \times S_2^2 \right] + [f_2 \times \hat{v}ar_2]$$

$$\hat{v}ar_2 = \frac{\sum_{t=1}^M (d_{2t} \times g_t)^2 \times \hat{v}ar(\bar{y}_t)}{\left[\sum_{t=1}^M d_{2t} \times g_t \right]^2}$$

$$S_2^2 = \frac{\sum_{t=1}^M d_{2t} \times g_t \times (\bar{y}_t - \bar{y}_2)^2}{m_2 - 1}$$

$$m_2 = \sum_{t=1}^M (d_{2t} \times g_t)$$

$$f_2 = \frac{m_2}{\sum_{t=1}^M d_{2t}}$$

$d_{2t} = 1$ if $t > M/2$, and $d_{2t} = 0$ otherwise
 $g_t = 1$ if mean and variance estimates are available for year t , and $g_t = 0$ otherwise

Formulae for
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9. Estimate the difference (between period 1 and period 2 means) and the variance of the estimated difference

$$\hat{\Delta} = \bar{y}_1 - \bar{y}_2$$

$$\hat{v}ar(\hat{\Delta}) = \hat{v}ar(\bar{y}_1) + \hat{v}ar(\bar{y}_2)$$

10. Calculate confidence limits for the estimated difference

$$\text{lower limit} = \hat{\Delta} - \left[1.96 \times \sqrt{\hat{v}ar(\hat{\Delta})} \right]$$

$$\text{upper limit} = \hat{\Delta} + \left[1.96 \times \sqrt{\hat{v}ar(\hat{\Delta})} \right]$$

11. Calculate the probability of an estimated difference being as large or larger than observed, given that the true difference=0

$$2 \times Pr \left(Z > \left| \frac{\hat{\Delta}}{\sqrt{\hat{v}ar(\hat{\Delta})}} \right| \right)$$

where Z is a standard Normal random variable

Myakka River Basin

Trend Analysis of EQL Data from the Lower Myakka River

Charlotte Harbor National Estuary Program
 Synthesis of Existing Information
 Water Quality Data Analysis - Myakka River Basin
 EQL DATA

Conductivity (µmhos/cm)

Comparison by Division of Period of Record

Station Name	# of Years of Sampling	First Year of Sampling	Last Year of Sampling	Number of Samples	Mean Difference Estimate	Upper 95% Limit	Lower 95% Limit	P Value for Diff. Test
Lower Myakka River	17	76	94	404	0.78424	3.02965	-1.46116	0.49362

Color (CPU)

Slope Analyzed Over Entire Record

Station Name	# of Years of Sampling	Annual Slope Estimate	Lower 95% Limit	Upper 95% Limit	P Value for Trend Test	Percent Change per Year	Number of Samples
Lower Myakka River	14	5.76253	4.76145	6.76361	0	0.060836	326

Nitrite/Nitrate (µg/l)

Slope Analyzed Over Entire Record

Station Name	# of Years of Sampling	Annual Slope Estimate	Lower 95% Limit	Upper 95% Limit	P Value for Trend Test	Percent Change per Year	Number of Samples
Lower Myakka River	14	.0031294	.00061497	.0056437	0.014712	0.096188	326

Ortho-Phosphate (µg/l)

Slope Analyzed Over Entire Record

Station Name	# of Years of Sampling	Annual Slope Estimate	Lower 95% Limit	Upper 95% Limit	P Value for Trend Test	Percent Change per Year	Number of Samples
Lower Myakka River	14	.0040848	.0024474	.0057221	.0000010094	0.016502	326

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Total Phosphorus (mg/l)

Slope Analyzed Over Entire Record

Station Name	# of Years of Sampling	Annual Slope Estimate	Lower 95% Limit	Upper 95% Limit	P Value for Trend Test	Percent Change per Year	Number of Samples
Lower Myakka River	14	-.0018006	-.0043726	.00077146	0.17003	-.0060862	321

Turbidity (NTU)

Slope Analyzed Over Entire Record

Station Name	# of Years of Sampling	Annual Slope Estimate	Lower 95% Limit	Upper 95% Limit	P Value for Trend Test	Percent Change per Year	Number of Samples
Lower Myakka River	14	-.0068668	-0.045754	0.032020	0.72926	-.0021008	326

Total Kjeldahl Nitrogen (mg/l)

Slope Analyzed Over Entire Record

Station Name	# of Years of Sampling	Annual Slope Estimate	Lower 95% Limit	Upper 95% Limit	P Value for Trend Test	Percent Change per Year	Number of Samples
Lower Myakka River	10	0.039975	0.025714	0.054236	.000000039253	0.041351	235

Chlorophyll a (ug/l)

Slope Analyzed Over Entire Record

Station Name	# of Years of Sampling	Annual Slope Estimate	Lower 95% Limit	Upper 95% Limit	P Value for Trend Test	Percent Change per Year	Number of Samples
Lower Myakka River	14	0.63694	0.32279	0.95109	.000070716	0.10835	326

Charlotte Harbor National Estuary Program
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 Water Quality Data Analysis - Myakka River Basin

USGS DATA

Chloride (mg/L)

Comparison by Division of Period of Record

Station Name	# of Years of Sampling	First Year of Sampling	Last Year of Sampling	Number of Samples	Mean Difference Estimate	Upper 95% Limit	Lower 95% Limit	P Value for Diff. Test
Myakka River near Sarasota	8	63	80	83	-0.18139	3.35086	-3.71364	0.91983

Ortho-Phosphate (mg/L)

Comparison by Division of Period of Record

Station Name	# of Years of Sampling	First Year of Sampling	Last Year of Sampling	Number of Samples	Mean Difference Estimate	Upper 95% Limit	Lower 95% Limit	P Value for Diff. Test
Myakka River near Sarasota	7	63	80	75	-0.29503	-0.19034	-0.39973	.000000033284

Conductivity (us/cm)

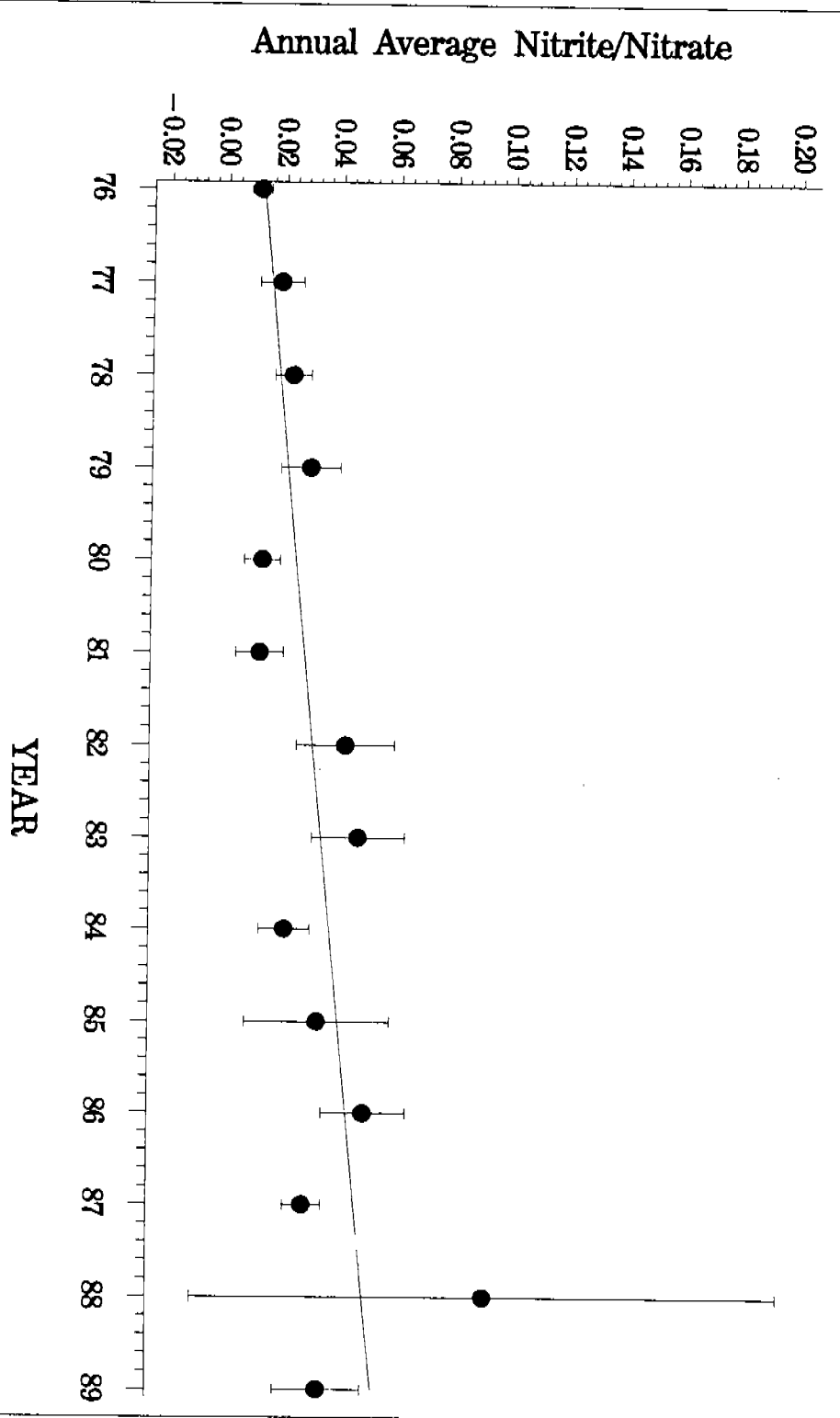
Comparison by Division of Period of Record

Station Name	# of Years of Sampling	First Year of Sampling	Last Year of Sampling	Number of Samples	Mean Difference Estimate	Upper 95% Limit	Lower 95% Limit	P Value for Diff. Test
Myakka River near Sarasota	10	63	80	96	89.9405	116.876	63.0053	5.9606E-11

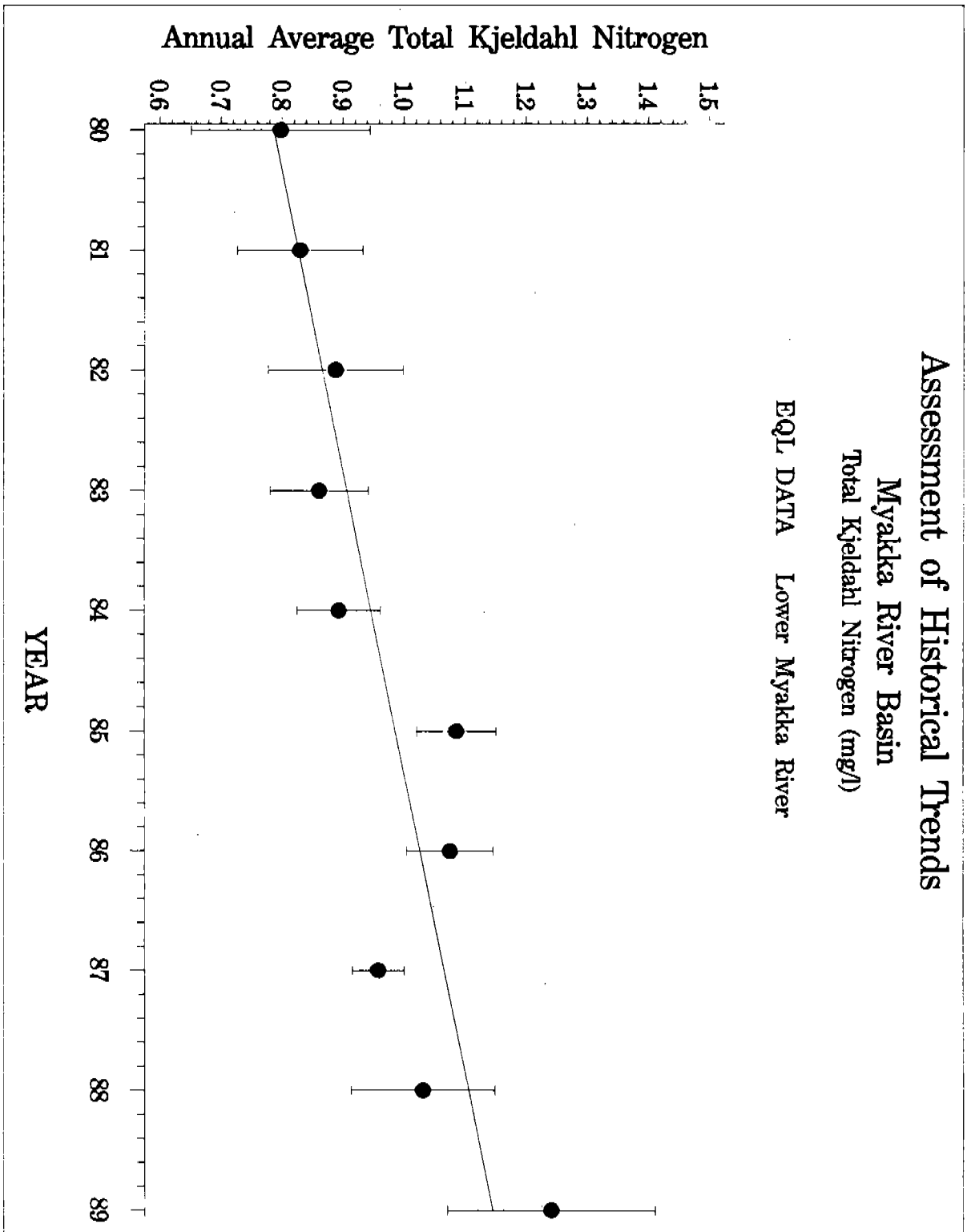
Assessment of Historical Trends

Myakka River Basin
Nitrite/Nitrate (mg/l)

EQL DATA Lower Myakka River



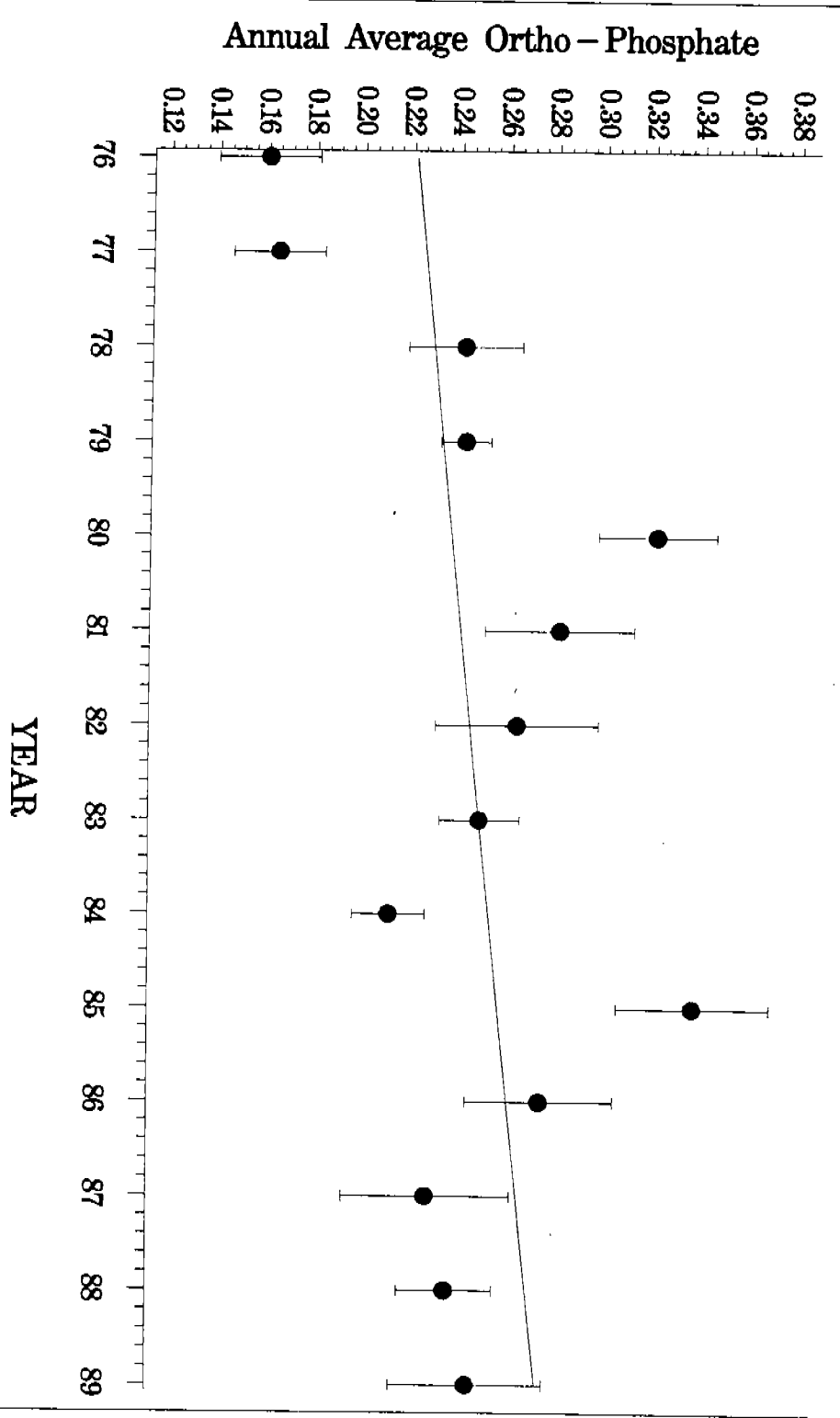
Assessment of Historical Trends
Myakka River Basin
Total Kjeldahl Nitrogen (mg/l)
EQL DATA Lower Myakka River



Assessment of Historical Trends

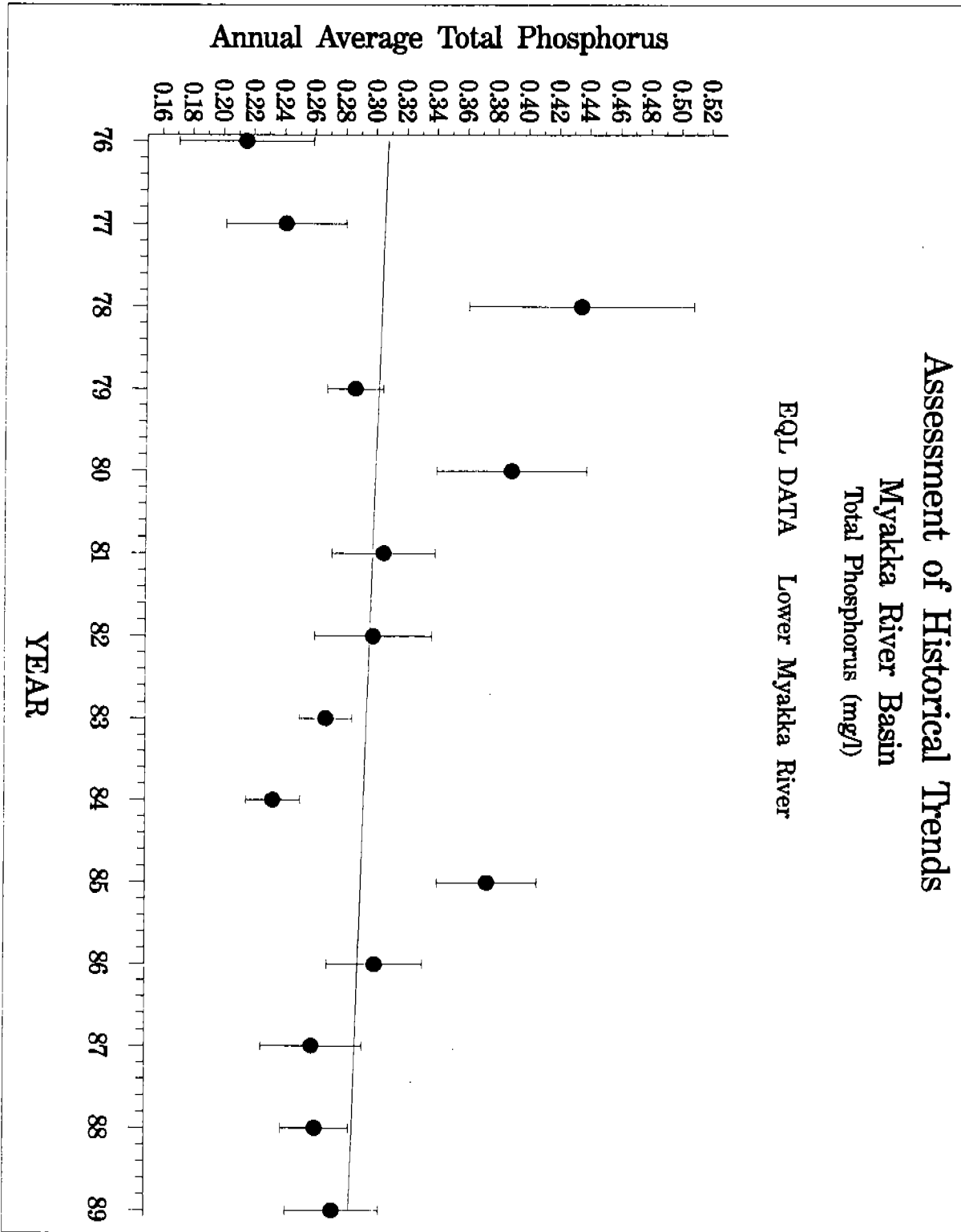
Myakka River Basin
Ortho-Phosphate (mg/l)

EQL DATA Lower Myakka River



Assessment of Historical Trends
 Myakka River Basin
 Total Phosphorus (mg/l)

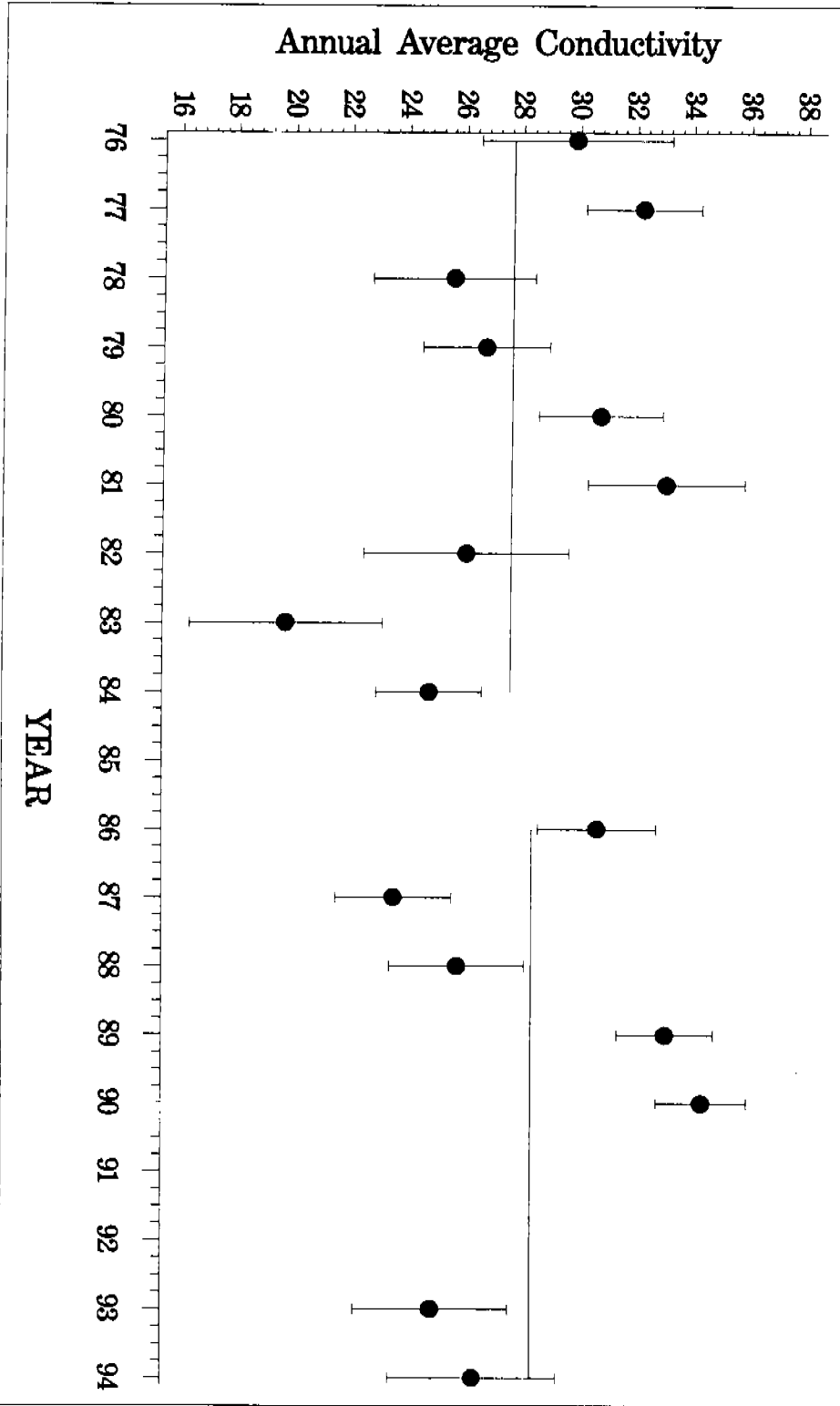
EQL DATA Lower Myakka River



Assessment of Historical Trends

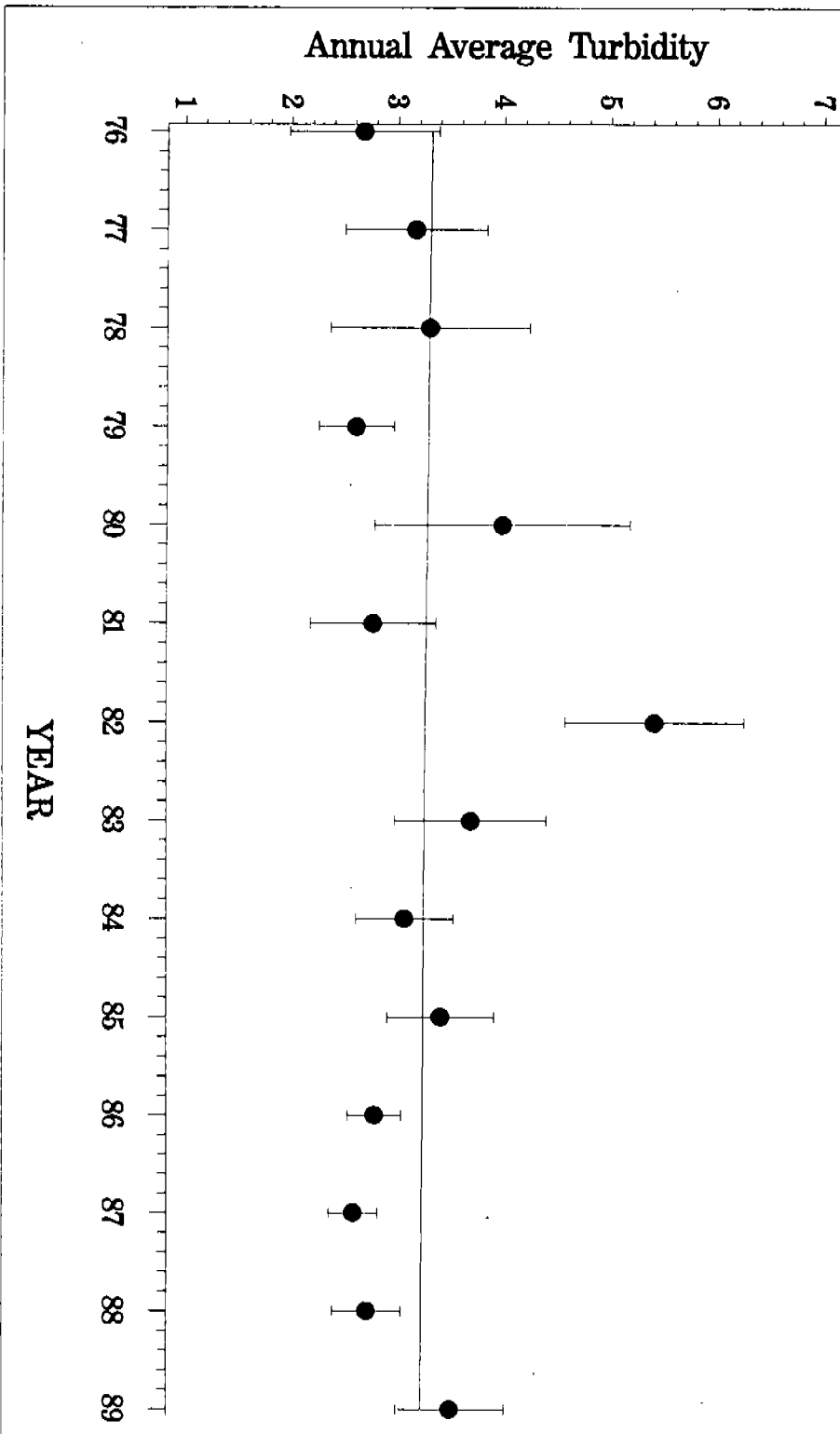
Myakka River Basin
Conductivity (mmhos/cm)

EQL DATA Lower Myakka River



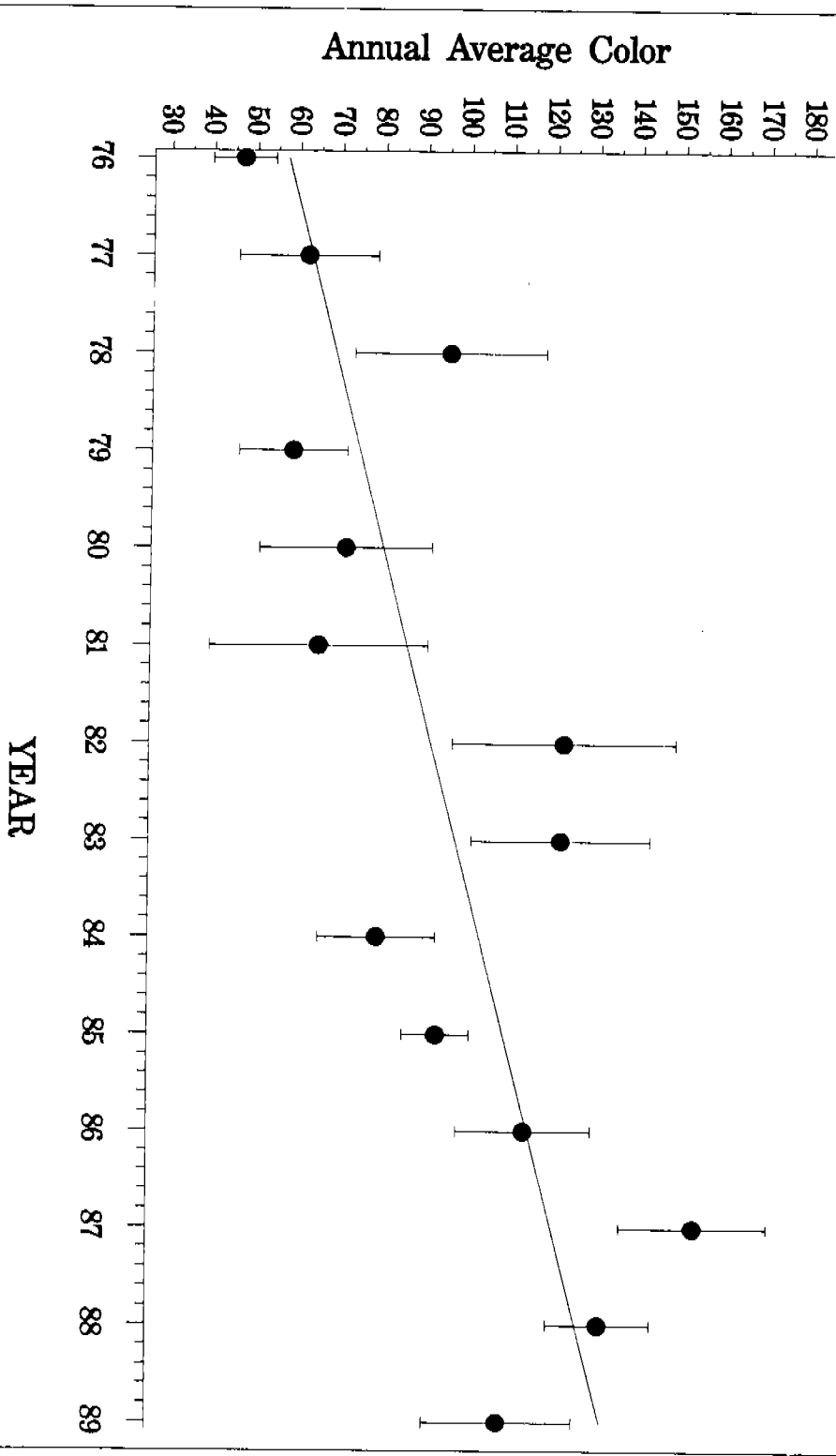
Assessment of Historical Trends
Myakka River Basin
Turbidity (NTU)

EQL DATA Lower Myakka River



Assessment of Historical Trends
Myakka River Basin
Color (CPU)

EQL DATA Lower Myakka River

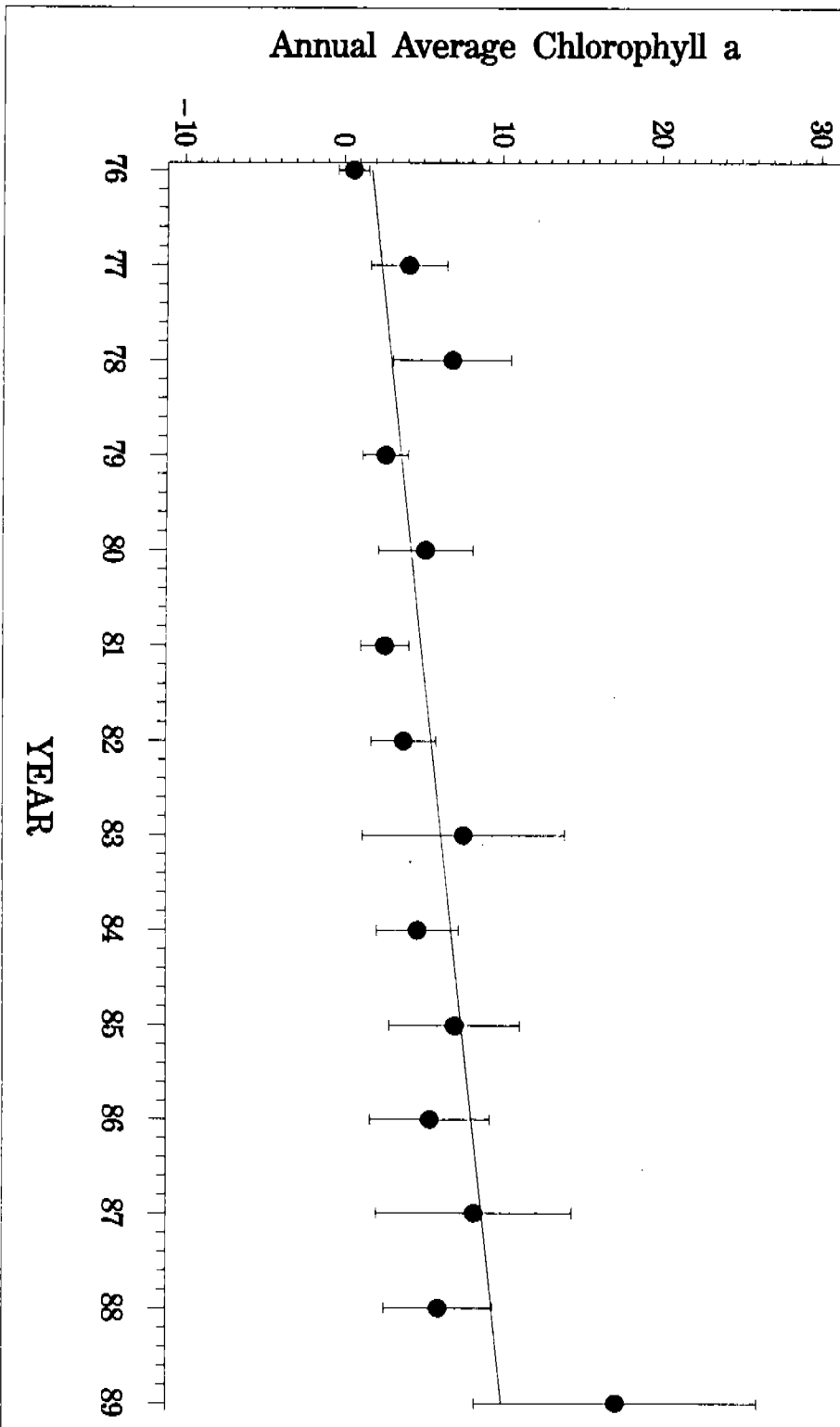


Assessment of Historical Trends

Myakka River Basin

Chlorophyll a ($\mu\text{g/l}$)

EQL DATA Lower Myakka River



Peace River Basin

Trend Analysis of EQL Data from the Peace River Basin