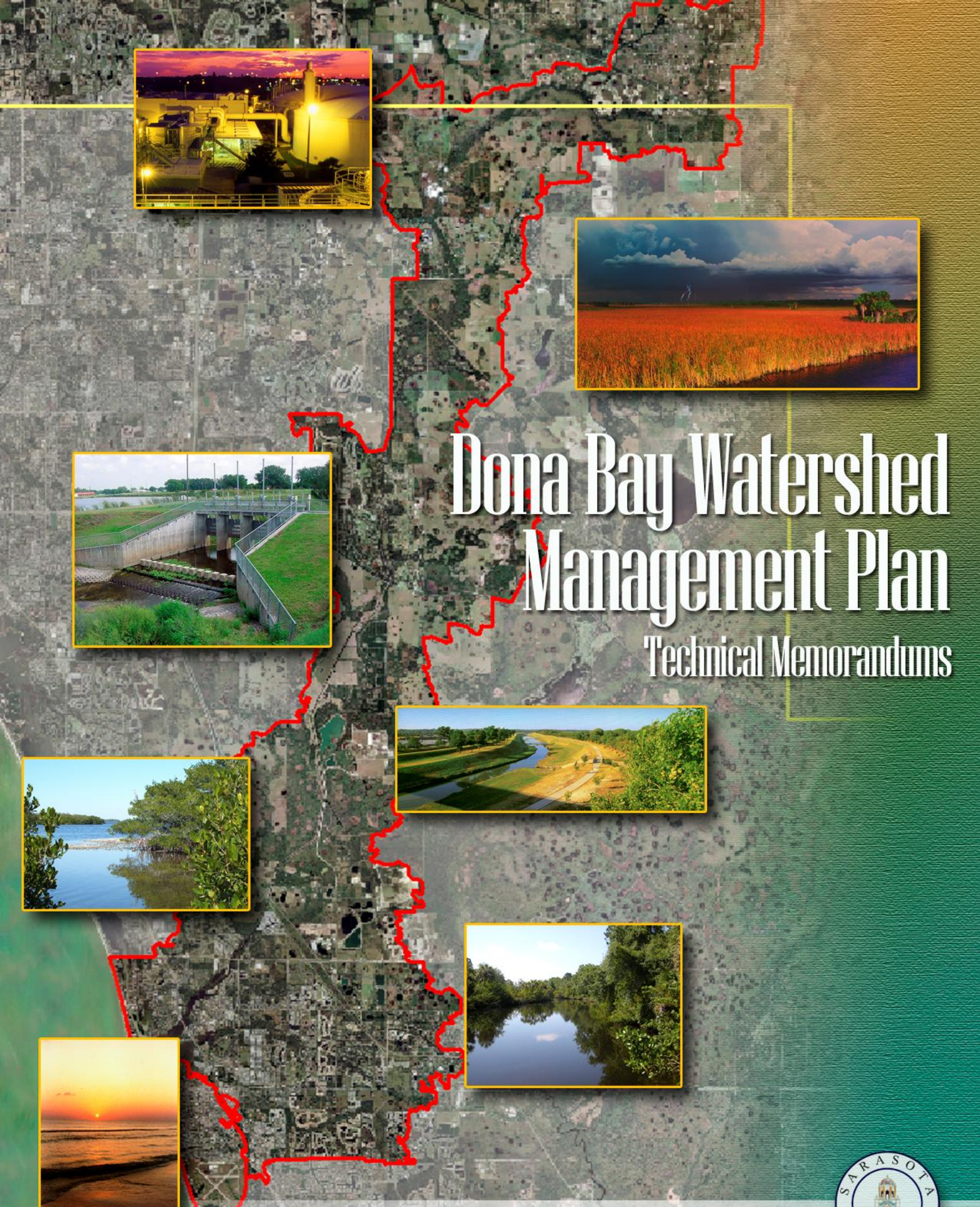


Dona Bay Watershed Management Plan

Technical Memorandums

Prepared by:

Kimley-Horn and Associates, Inc.

Southwest Florida Water Management District

Sarasota County

DONA BAY
WATERSHED MANAGEMENT PLAN

Final Report Appendices
Technical Memorandums
January 2007
(Revised April 2007)

Prepared By:

Kimley-Horn & Associates, Inc.
2601 Cattleman Road, Suite 500
Sarasota, Florida 34232

In Cooperation with:

Integrated Water Resources
Post, Buckley, Schuh & Jernigan
Biological Research Associates, Ltd
Earth Balance
Mote Marine Laboratory
University of South Florida
Southwest Florida Water Management District

Prepared For:

Sarasota County Government
Contract No. 2005-483
Environmental Service Business Center
Integrated Water Resources
1001 Sarasota Center Boulevard
Sarasota, Florida 34240

LIST OF TECHNICAL MEMORANDUMS

NATURAL SYSTEMS

TM 4.1.1.1 - DATA COLLECTION AND REVIEW (PBSJ)
GIS MAPPING OF SHORELINE
DRAFT MONITORING PLAN
TM 4.1.1.2 - DATA COLLECTION AND REVIEW (BRA)
TM 4.1.2 - DEVELOPMENT OF NATURAL SYSTEM WATER BUDGET
TM 4.1.3.1 - DATA ANALYSIS (PBSJ)
TM 4.1.3.2 - DATA ANALYSIS (BRA)
TM 4.1.4 - EVALUATION OF RESTORATION/ENHANCEMENT VALUE
TM 4.1.5 - ALTERNATIVE IMPACT ANALYSIS (BRA)
MOTE MARINE - SALINITY TARGETS FOR WATERSHED MANAGEMENT IN DONA AND ROBERTS BAYS AND THEIR TRIBUTARIES

WATER SUPPLY

TM 4.2.1 - WATER QUALITY ANALYSIS AND WATER TREATMENT OPTIONS ANALYSIS
TM 4.2.2 - WATER QUANTITY | WATER BUDGET APPROACH
TM 4.2.3 - WATER QUANTITY | FLOW DIVERSION APPROACH
TM 4.2.4.1 - EVALUATION OF SURFACE STORAGE (Venice Minerals Site)
TM 4.2.4.2 - EVALUATION OF SURFACE STORAGE (Albritton Site)
TM 4.2.4.3 - EVALUATION OF SUBSURFACE STORAGE
TM 4.2.5 - DETERMINATION OF SURFACE WATER TREATMENT PLANT LOCATION
TM 4.2.7 - DEVELOPMENT OF PHASING PLAN
TM 4.2.8 - WATER SUPPLY WATERSHED PROTECTION PLAN (DRAFT)

WATER QUALITY

TM 4.3.1 - DATA COLLECTION AND REVIEW
TM 4.3.2 - DATA ANALYSIS
TM 4.3.3 - ALTERNATIVE IMPACT ANALYSIS

FLOOD PROTECTION

TM 4.4.1 - INCLUSION OF WATERSHED CONNECTIONS
TM 4.4.2 - CONTINUE MODEL VALIDATION
TM 4.4.3 - REGIONAL STORMWATER FEASIBILITY STUDY
TM 4.4.4 - DEVELOPMENT OF SCS SOIL CONSERVATION PLAN OVERLAYFOR PINELANDS AREA
TM 4.4.5 - ALTERNATIVE IMPACT ANALYSIS

Chapter 5 - Water Quality Appendices

Photo of Dona Bay at Venice Jetty submitted to Sarasota County

TM 4.3.1 – DATA COLLECTION AND REVIEW

1.0 BACKGROUND

Sarasota County in cooperation with the Peace River Manasota Regional Water Supply Authority and the Southwest Florida Water Management District (SWFWMD) are currently completing the necessary, pre-requisite data collection and analysis as well as the comprehensive watershed management plan for the Dona Bay Watershed. Kimley-Horn and Associates, Inc. (KHA), PBS&J, Biological Research Associates (BRA), Earth Balance, and Mote Marine Laboratory have been contracted by Sarasota County Government (SCG), with funding assistance from the SWFWMD, to prepare the Dona Bay Watershed Management Plan (DBWMP).

This regional initiative promotes and furthers the implementation of the Charlotte Harbor National Estuary Program (CHNEP) Comprehensive Conservation Management Plan, SWFWMD's Southern Coastal Watershed Comprehensive Watershed Management Plan; and Sarasota County's Comprehensive Plan. Specifically, this initiative is to plan, design, and implement a comprehensive watershed management plan for the Dona Bay watershed that will address the following general objectives:

a. Provide a more natural freshwater/saltwater regime in the tidal portions of Dona Bay.
b. Provide a more natural freshwater flow regime pattern for the Dona Bay watershed.
c. Protect existing and future property owners from flood damage.
d. Protect existing water quality.
e. Develop potential alternative surface water supply options that are consistent with, and support other plan objectives.

This Technical Memorandum has been prepared by PBS&J to summarize the techniques used to develop a comprehensive and relational database for the DBWMP, consistent with Task 4.3.1 of the DBWMP contract.

2.0 INTRODUCTION

This effort is part of the overall Water Quality efforts defined in Task 4.3 of the DBWMP. Specifically, this task includes related water quality evaluations and as-needed sampling and analysis. To facilitate data evaluation and analysis, data from multiple agencies and sampling programs needed to be gathered and combined in one comprehensive database. PBS&J was charged with Task 4.3.1 to “conduct a through search and review” of existing data sources including STORET/IWR databases and various agencies such as Sarasota County and the Southwest Florida Water Management District (SWFWMD). The end result of this effort is a single, relational Access database.

The multiple values of a relational database for the DBWMP include the following:

- All data collected within the geographic area of interest is located in a central location
- Each and every data point can be accessed in a logical manner
- Descriptive information (collection sites, collection method) can be queried in a similar manner as the data itself
- All parameters (including those not originally queried) collected at any given location can be graphically displayed
- The degree of independence or inter-dependence of data sets can be graphically displayed

The two basic techniques for displaying contents in a relational database are the traditional tabular display, and a graphic representation of the relationship between different data sets. For users more accustomed to a simple listing of data sets available for the DBWMP, the "Show Table" query displays the data sets available for query. For the DBWMP, there are 42 data sets. These include the following general categories:

- USGS flow and stage data for Shakett Creek and Blackburn Canal
- Rainfall data
- Continuous recording water quality data collected by Sarasota County
- Monthly water quality data collected by SWFWMD
- Monthly water quality data collected by Mote Marine Laboratory
- Oyster health and distributions
- Seagrass health and distributions
- Wetland types and water levels in the Pinelands Preserve
- Data sets available from IWR run 23.1

In a relational database, the complete listing of databases is available in a format that allows for the user to easily determine the totality of data available for various locations, and the different data sets available for a single parameter. For example, a query of the "Relationships" display would allow a user to determine that in addition to data on the health of oysters in Dona Bay, additional data sets exist at those same locations for dissolved oxygen, temperature, pH, salinity, water depth and turbidity. This would allow a data user to decide whether or not data are available to test for potential relationships between oyster health and salinity, or oyster health and turbidity values, as two examples.

3.0 DATA COLLECTION AND DATABASE CREATION

Data were collected from a variety of sources, though most of the data included in the final database were provided to PBS&J via the Sarasota County ftp site:

ftp://ftp.co.sarasota.fl.us/Pub/Stormwater/ToolsResources/DBWMP

The data on this ftp site included data from multiple agencies such as Sarasota County, Mote Marine Laboratory (Mote), the United States Geological Survey (USGS), and

SWFWMD. The other main source of data was run 23.1 of the Impaired Waters Rule (IWR) database. Some of the data from the IWR duplicated that obtained from Sarasota County. Hard copies of previous reports and studies on DARB are located at this location. At an appropriate time, it would be a simple matter of copying pdf files of these reports to a website that the public could easily access, such as the County's Water Atlas site.

A relational MS Access® database was created that compiled all collected data from all agencies. Separate tables were created in the database for station information and collected data. Links were created between station tables and all tables containing data collected at those stations. Thus, a query can be run to output all data in the database for a specific station, or set of station locations.

The database includes hydrologic data (discharge, gage height, and rainfall) collected from the Sarasota County Government's (SCG) Automated Rainfall Monitoring Stations (ARMS) from 2003-2005. Additional rainfall data include CMR data from 1998 to early 2004 and Pinelands rainfall data from 2002-2005. The database contains biological data from SCG monitoring of seagrass and oyster habitat along with associated water clarity and water quality data. Water quality data also include Mote grab samples, as contracted by SCG. Additionally, data recorded by SCG water quality data loggers are included in the database. Data from USGS gages in the Dona Bay watershed are also provided. Finally, several tables in the database contain data regarding cover and discharge in the Pinelands wetlands. All data tables in the database can be updated as more data are acquired from long term monitoring projects.

4.0 LOCATION OF THE RELATIONAL DATABASE

Due to the large amount of data collected and displayed within this relational data base, there is not a way to produce a meaningful hard copy report containing its contents. The size of the database is presently 53,832 KB. By its very nature, relational databases are meant to be accessed in an interactive manner. As an interim procedure, the relational database, titled "Dona Bay.mdb" is presently located at the following ftp site:

ftp://ftp.co.sarasota.fl.us/Pub/Stormwater/ToolsResources/DBWMP/Products/Task%204%20-%20Watershed%20Management%20Plan/Task%204.3%20-%20Water%20Quality/Task%204.3.1%20-%20Data%20Collection/

A permanent location for this database is most likely to be the County's Watershed Atlas website, which would allow the general public to access these data themselves (providing they have the software to run it, and the bandwidth to allow for transmission of such a large amount of data in a reasonable amount of time).

TM 4.3.2 – DATA ANALYSIS

1.0 BACKGROUND

Sarasota County in cooperation with the Peace River Manasota Regional Water Supply Authority and the Southwest Florida Water Management District (SWFWMD) are currently completing the necessary, pre-requisite data collection and analysis as well as the comprehensive watershed management plan for the Dona Bay Watershed. Kimley-Horn and Associates, Inc. (KHA), PBS&J, Biological Research Associates (BRA), Earth Balance, and Mote Marine Laboratory have been contracted by Sarasota County Government (SCG), with funding assistance from the SWFWMD, to prepare the Dona Bay Watershed Management Plan (DBWMP).

This regional initiative promotes and furthers the implementation of the Charlotte Harbor National Estuary Program (CHNEP) Comprehensive Conservation Management Plan, SWFWMD's Southern Coastal Watershed Comprehensive Watershed Management Plan; and Sarasota County's Comprehensive Plan. Specifically, this initiative is to plan, design, and implement a comprehensive watershed management plan for the Dona Bay watershed that will address the following general objectives:

a. Provide a more natural freshwater/saltwater regime in the tidal portions of Dona Bay.
b. Provide a more natural freshwater flow regime pattern for the Dona Bay watershed.
c. Protect existing and future property owners from flood damage.
d. Protect existing water quality.
e. Develop potential alternative surface water supply options that are consistent with, and support other plan objectives.

This Technical Memorandum has been prepared by PBS&J to present a summary of efforts to develop a statistically robust and scientifically valid relationship between salinity and flows in Dona and Roberts Bays. These relationships were developed using existing and potential flow regimes, based on data supplied from KHA as part of the water budget development portion of the DBWMP contract. This effort is consistent with Task 4.3.2 of the DBWMP contract.

2.0 INTRODUCTION

This effort is part of the overall Water Quality efforts defined in Task 4.3 of the DBWMP. Specifically, this task includes related evaluations and an assessment of potential restoration/enhancement sites for the study area. Since the intent of the project is to consider alternatives for watershed restoration/enhancement of the Dona Bay watershed and its hydrologic regimes, PBS&J was tasked with performing regression analyses of salinity and flow data, to determine existing and potential salinity values at various locations throughout Shakett Creek and Dona Bay.

Most estuarine organisms are classified as "euryhaline" meaning they can tolerate a broad range of salinities. Salinities are important not only in terms of the "average" salinity value, but also in terms of the minimum, maximum, and variation in salinity that is experienced. The salinity regimes considered appropriate for the long-term survival of various organisms found in Dona and Roberts Bays were summarized by Estevez (2006). The salinity requirements derived by Estevez (2006) vary by species.

Hard clams do best in areas where the mean bottom salinity is maintained above 20 ppt, while oysters do best within a range of salinities between 10 and 28 ppt.

For oysters, while adults can tolerate salinities as low as 6 ppt for up to 2 weeks, they cannot tolerate salinities below 2 ppt for much longer than a single week. Juvenile oysters are less tolerant of low salinities than adults, and the most successful spawning events occur when salinities are above 10 ppt.

For successful spawning and larval recruitment (based on data from red drum, seatrout and snook) salinities should be within the range of "seasonally appropriate levels." Red drum and seatrout larvae can tolerate salinities between 15 and 35 ppt.

In contrast, juvenile snook require freshwater for successful development. The need for freshwater habitats for juvenile snook is not due to a lethal impact of salt on the fish themselves; rather, it is related to lethal impacts of salinity on the preferred prey of juvenile snook (Estevez 2006).

3.0 DEVELOPMENT OF SALINITY VS. FLOW DATA SETS, AND COMPARISON TO "TARGET" SALINITY VALUES FOR DONA BAY

KHA developed an historical flow record for Cow Pen Slough, using techniques outlined previously outlined by SWFWMD and referenced in Technical Memorandum 4.2.2 - Water Quantity|Water Budget Approach. These data were supplied to PBS&J as a record of monthly flow values for the period between November 1966 and December 2005.

During the period of August 2003 to September 2005, the SWFMWD recorded salinities at 25 stations located throughout the DARB system (Figure 1).

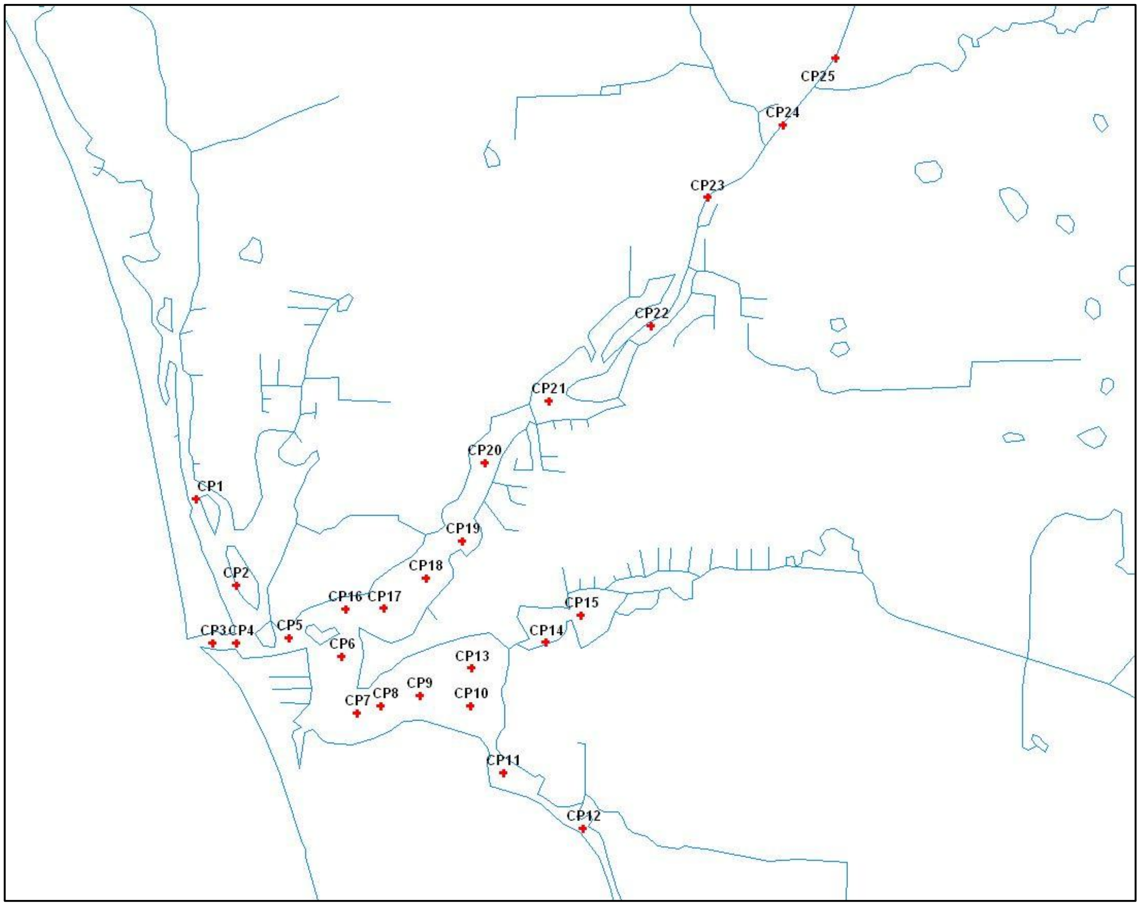


Figure 1 – Location of SWFWMD Water Quality Monitoring Stations

Salinity data from these locations and flow data down Cow Pen Canal were then compared to determine if there was a relationship between flows (monthly averages) and salinity values collected during that same month. To reduce the possibility of including confounding errors, salinity data were normalized for sampling depths (0.5 meters below the surface). Also to avoid the inclusion of confounding influences, data were restricted to that time period when salinity data were available from all locations (March 2004 to September 2005). At several locations (stations 4, 8, and 15) there was insufficient data to allow for a statistically valid comparison of flows vs. salinities (at least at depths of 0.5 m for the period of March 2004 to September 2005) – these stations were excluded from further analysis.

A comparison of various potentially significant regression types was run for all stations except 4, 8, and 15 using StatGraphics©. This software package allows for a comparison of more than 20 mathematical regression techniques. The regression equation with the highest R-squared value (the best fit) was then selected, as illustrated in Figure 2 using data from Station 25.

Station 25

Comparison of Alternative Models

Model	*Correlation*	*R-Squared*
Logarithmic-X	**-0.8147**	**66.37%**
Square root-Y logarithmic-X	-0.8092	65.48%
Squared-Y logarithmic-X	-0.7643	58.41%
Logarithmic-Y square root-X	-0.7407	54.87%
Multiplicative	-0.7380	54.47%
Square root-X	-0.7174	51.46%
Reciprocal-Y	0.7022	49.31%
Reciprocal-Y square root-X	0.6932	48.06%
Exponential	-0.6640	44.09%
Squared-Y square root-X	-0.6526	42.59%
Reciprocal-Y squared-X	0.6465	41.79%
Reciprocal-Y logarithmic-X	0.5863	34.37%
Reciprocal-X	0.5849	34.21%
Linear	-0.5724	32.76%
Squared-Y reciprocal-X	0.5638	31.79%
Square root-Y reciprocal-X	0.5568	31.00%
Logarithmic-Y squared-X	-0.5407	29.24%
Squared-Y	-0.5061	25.61%
Square root-Y squared-X	-0.4658	21.69%
S-curve model	0.4620	21.34%
Squared-X	-0.4103	16.83%
Double squared	-0.3508	12.31%
Double reciprocal	-0.2917	8.51%

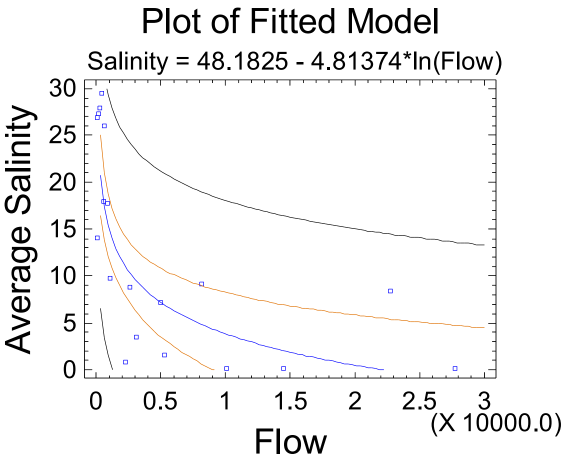


Figure 2 – Regression Output for Flow vs. Salinity for Station 25

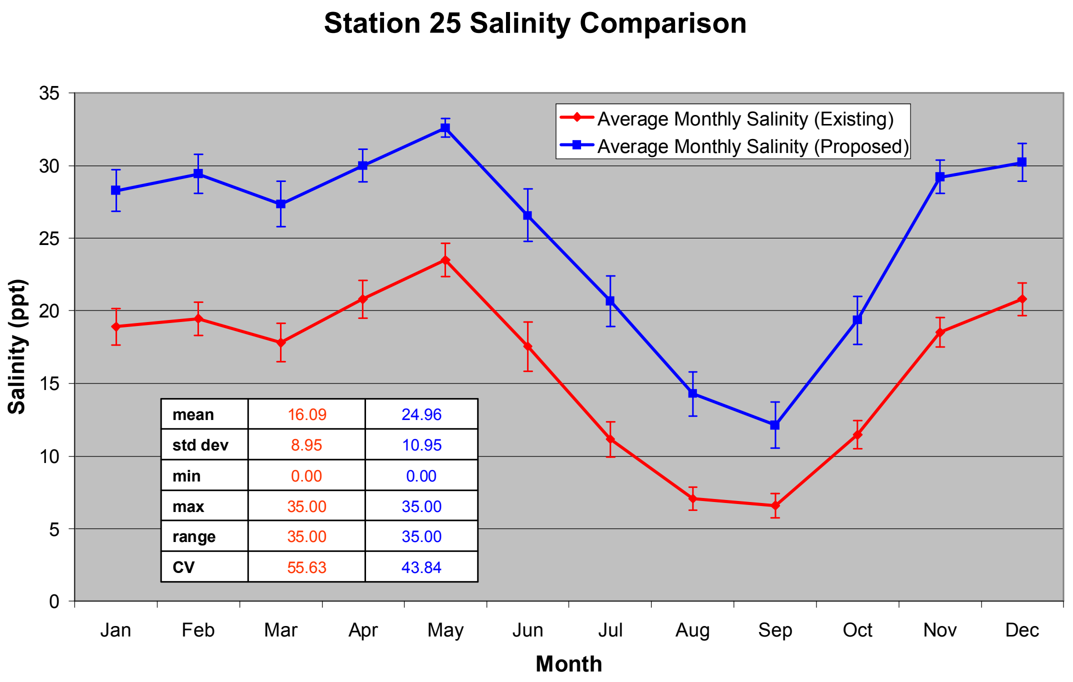
For Station 25, the best-fit equation for the relationship between flow (as the independent variable) and salinity (as the potentially significant independent variable) was that of a logarithmic-X vs. non-transformed Y. The relationship was highly statistically significant ($p < 0.01$).

For stations located in either Roberts Bay or Curry Creek / Blackburn Canal, regressions were compared between salinity and flows at Cow Pen Slough vs. salinity and flows from Blackburn Canal. As should be expected, at all these stations (7, 9, 10, 11, 12, 13, and 14) there was a similarly strong relationship between salinity and flows in Blackburn Canal as there was between salinity and flows down Cow Pen Canal. At station 8, there was not a similar data set at the same water depth and time period (described above). As the intent of this effort was to examine the potential for reduced flows to affect salinities, and as the only flows likely to be reduced via the proposed watershed/hydrologic restoration projects, flow-salinity relationships were further developed only for those station in Shakett Creek and Dona Bay.

For each station, the regression equation developed (as in Figure 1) was then used to calculate the predicted salinity for each of the months from November 1966 to December

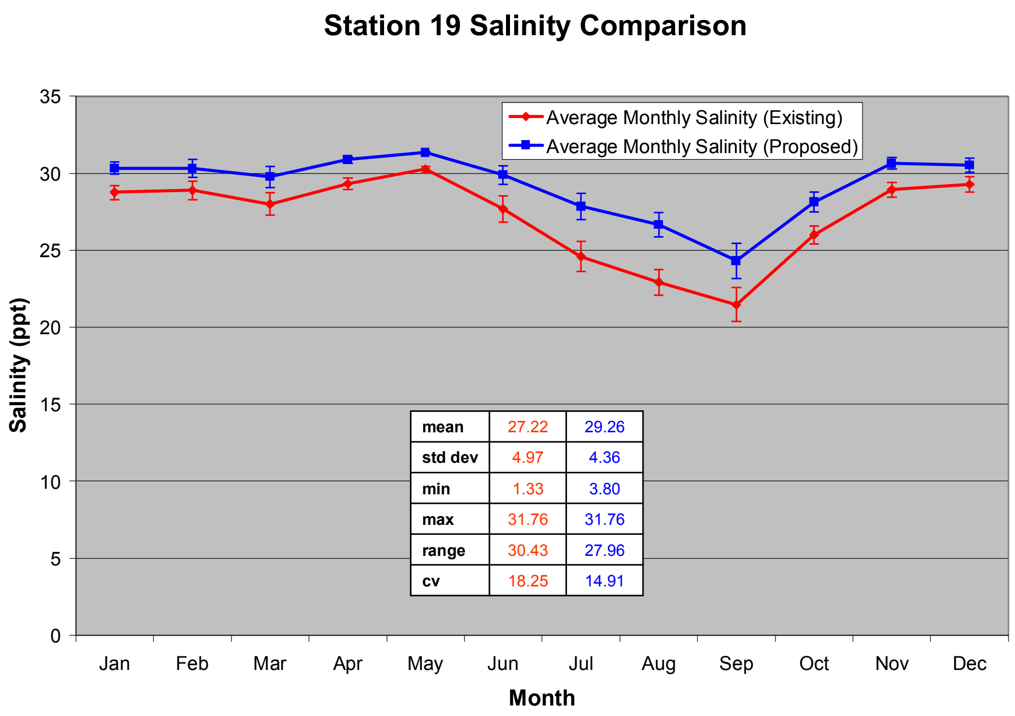
2005. This allowed for the production of approximately 480 monthly salinity estimates (12 months per year times 40 years). Monthly salinities were then re-calculated using estimates of Cow Pen Canal flows that either bypass, over flow or are generated by the watershed located between the upper and lower water level control structures under the conceptual Phase 3 watershed/hydrologic restoration plan. These flows represent the volume of freshwater that would be still delivered to Shakett Creek and Dona Bay from the Cow Pen Canal.

The average salinities for each month (e.g., January, February, etc.) over the period of record were then calculated for each scenario – existing vs. potential (i.e. Phase 3 configuration). The following figures represent differences in existing vs. potential salinity regimes at stations 25, 19, and 5. These stations represent potential changes in salinity regimes at the base of the weir on Cow Pen Slough, at Shakett Creek at U.S. 41, and in Dona Bay close to Venice Inlet, respectively.



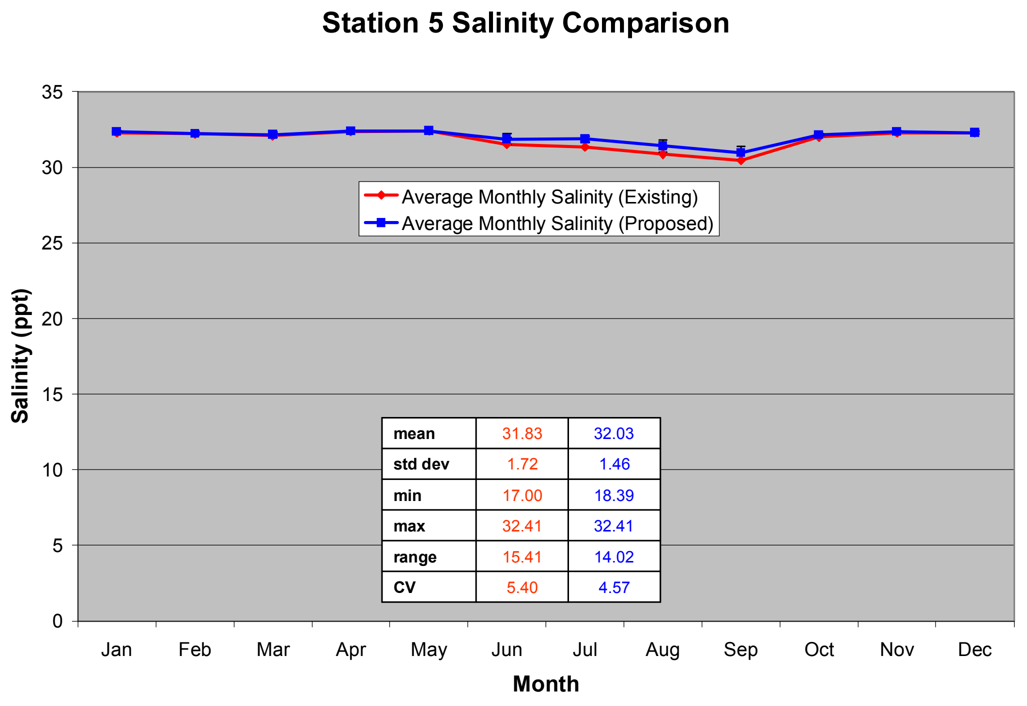
mean	16.09	24.96
std dev	8.95	10.95
min	0.00	0.00
max	35.00	35.00
range	35.00	35.00
CV	55.63	43.84

Figure 3 – Existing vs. Potential Salinity Regimes at Station 25 (means ± s.e.)



mean	27.22	29.26
std dev	4.97	4.36
min	1.33	3.80
max	31.76	31.76
range	30.43	27.96
cv	18.25	14.91

Figure 4 – Existing vs. Potential Salinity Regimes at Station 19 (means ± s.e.)



mean	31.83	32.03
std dev	1.72	1.46
min	17.00	18.39
max	32.41	32.41
range	15.41	14.02
CV	5.40	4.57

Figure 5 – Existing vs. Potential Salinity Regimes at Station 5 (means ± s.e.)

The results from these analyses suggest that while substantial changes in salinity are possible in some of the locations in the Shakett Creek, with implementation of the watershed/hydrologic restoration plans s envisioned, other locations are not likely to be strongly affected.

In the upper reaches of Shakett Creek, such as at Station 25, salinities might be expected to increase such that salinities would be less likely to drop below 10 ppt, with implementation of the Phase 3 watershed/hydrologic restoration plans. Based on data from Estevez (2006) these locations might be likely to produce salinity regimes more supportive of successful spawning events for oysters.

At locations closer to Venice Inlet, such as Station 5, results indicate changes in salinity would be minimal to the point of perhaps not being detectable. Habitats in this area dependent upon the existing salinity regimes in Dona Bay would not likely be impacted.

For those locations in the lower reaches of Shakett Creek down to the upper portions of Dona Bay, potential changes in salinity regimes are likely to be intermediate between those found for Stations 25 and 5. In these locations, benefits to biological communities might be more strongly related to a reduction in the variability of salinity values, rather than responses to changes in mean values.

In general, responses of benthic habitats to altered salinity regimes associated with the reduced freshwater volumes resulting from the watershed/hydrologic restoration plans are likely to be either positive (upper Shakett Creek), intermediate (lower Shakett Creek and upper Dona Bay) or minimal to absent (lower Dona Bay). There is no information that would suggest that the watershed/hydrologic restoration plans would have a deleterious impact to benthic communities, should potential flow reduction scenarios be implemented.

The figures below are paired for the remaining stations, with the first figure showing the results of the flow vs. salinity regression modeling, and the second figure showing the plots of existing vs. potential salinity regimes, using potential flow diversion scenarios. Station 25, discussed above is not repeated, and stations 7 through 15 which are in either Roberts Bay or Curry Creek (discussed above) are not included.

Station 24

Comparison of Alternative Models

Model	*Correlation*	*R-Squared*
Logarithmic-X	**-0.8195**	**67.15%**
Square root-Y logarithmic-X	-0.8008	64.13%
Squared-Y logarithmic-X	-0.7790	60.69%
Logarithmic-Y square root-X	-0.7320	53.58%
Square root-X	-0.7288	53.11%
Multiplicative	-0.7259	52.70%
Reciprocal-Y	0.7133	50.88%
Reciprocal-Y square root-X	0.7037	49.52%
Squared-Y square root-X	-0.6694	44.81%
Exponential	-0.6581	43.31%
Reciprocal-Y squared-X	0.6577	43.26%
Square root-Y	-0.6250	39.06%
Reciprocal-Y logarithmic-X	0.5952	35.43%
Linear	-0.5881	34.59%
Reciprocal-X	0.5851	34.24%
Squared-Y reciprocal-X	0.5732	32.86%
Square root-Y reciprocal-X	0.5469	29.91%
Logarithmic-Y squared-X	-0.5369	28.82%
Squared-Y	-0.5232	27.37%
Square root-Y squared-X	-0.4751	22.57%
S-curve model	0.4517	20.40%
Squared-X	-0.4281	18.32%
Double squared -	0.3669	13.46%
Double reciprocal	-0.2964	8.78%

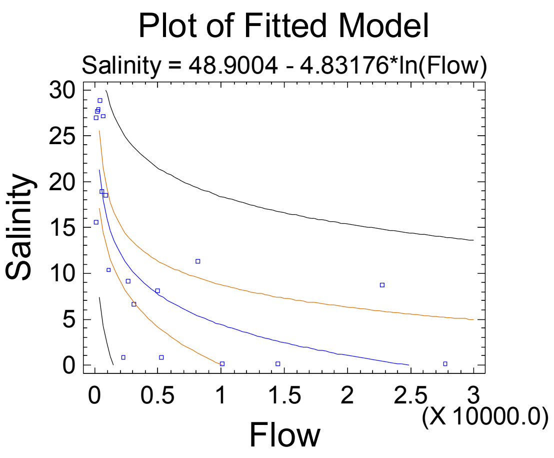


Figure 6 – Regression Output for Flow vs. Salinity for Station 24

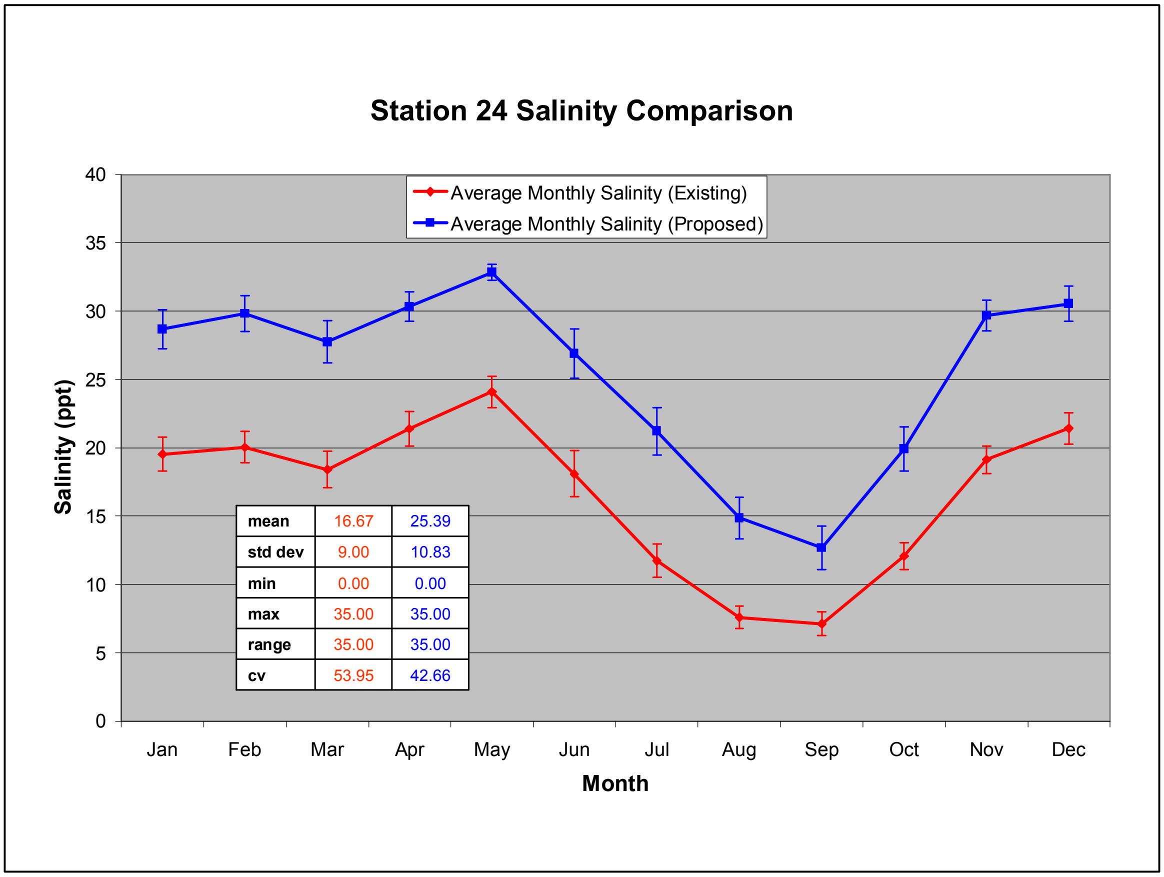


Figure 7 – Existing vs. Potential Salinity Regimes at Station 24 (means ± s.e.)

Station 23

Comparison of Alternative Models

Model	*Correlation*	*R-Squared*
Logarithmic-X	**-0.8552**	**73.13%**
Square root-Y logarithmic-X	-0.8405	70.64%
Squared-Y logarithmic-X	-0.8219	67.56%
Square root-X	-0.7749	60.04%
Logarithmic-Y square root-X	-0.7707	59.40%
Multiplicative	-0.7613	57.95%
Squared-Y square root-X	-0.7255	52.63%
Reciprocal-Y	0.7186	51.63%
Reciprocal-Y square root-X	0.7037	49.51%
Exponential	-0.6965	48.51%
Reciprocal-Y squared-X	0.6709	45.01%
Linear	-0.6321	39.96%
Reciprocal-Y logarithmic-X	0.5925	35.10%
Reciprocal-X	0.5840	34.11%
Squared-Y	-0.5751	33.07%
Logarithmic-Y squared-X	-0.5724	32.77%
Squared-Y reciprocal-X	0.5624	31.63%
Square root-Y reciprocal-X	0.5587	31.22%
Square root-Y squared-X	-0.5112	26.13%
S-curve model	0.4706	22.15%
Squared-X	-0.4626	21.40%
Double squared	-0.4058	16.47%
Double reciprocal	-0.2963	8.78%

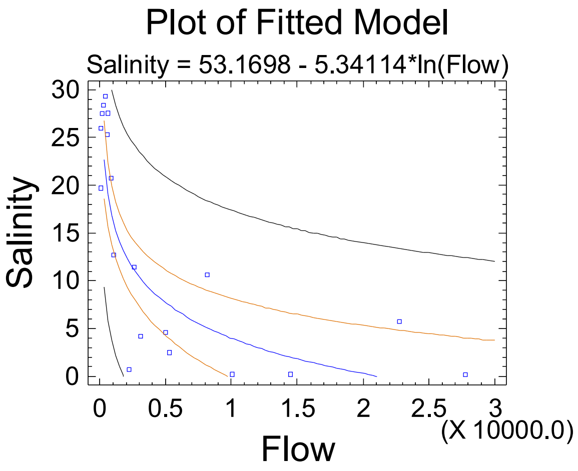


Figure 8 – Regression Output for Flow vs. Salinity for Station 23

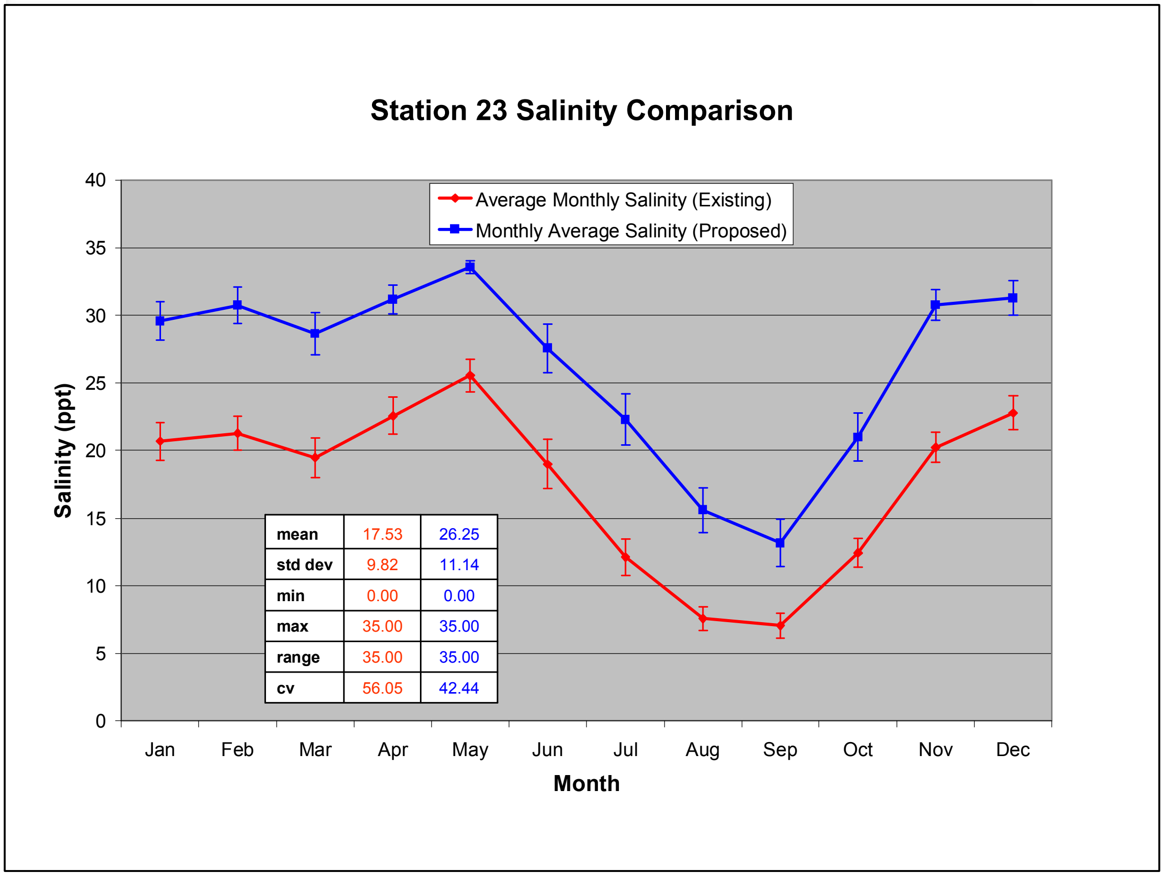


Figure 9 – Existing vs. Potential Salinity Regimes at Station 23 (means ± s.e.)

Station 22

Comparison of Alternative Models

Model	*Correlation*	*R-Squared*
Logarithmic-X	**-0.8579**	**73.59%**
Squared-Y logarithmic-X	-0.8394	70.46%
Square root-Y logarithmic-X	-0.8309	69.04%
Square root-X	-0.7937	63.00%
Logarithmic-Y square root-X	-0.7863	61.83%
Reciprocal-Y squared-X	0.7690	59.14%
Squared-Y square root-X	-0.7462	55.68%
Exponential	-0.7411	54.93%
Multiplicative	-0.7333	53.77%
Square root-Y	-0.7063	49.89%
Reciprocal-Y square root-X	0.7058	49.81%
Linear	-0.6576	43.24%
Logarithmic-Y squared-X	-0.6348	40.30%
Squared-Y	-0.5948	35.38%
Squared-Y reciprocal-X	0.5766	33.25%
Reciprocal-X	0.5734	32.88%
Reciprocal-Y logarithmic-X	0.5566	30.98%
Square root-Y squared-X	-0.5531	30.60%
Square root-Y reciprocal-X	0.5269	27.77%
Squared-X	-0.4867	23.69%
Double squared	-0.4208	17.71%
S-curve model	0.4179	17.46%
Double reciprocal	-0.2541	6.46%

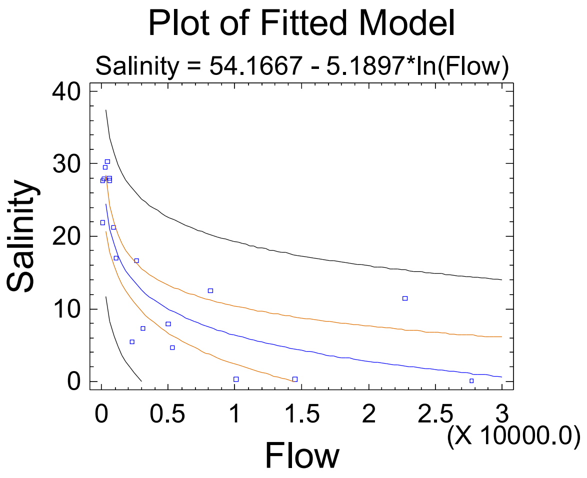
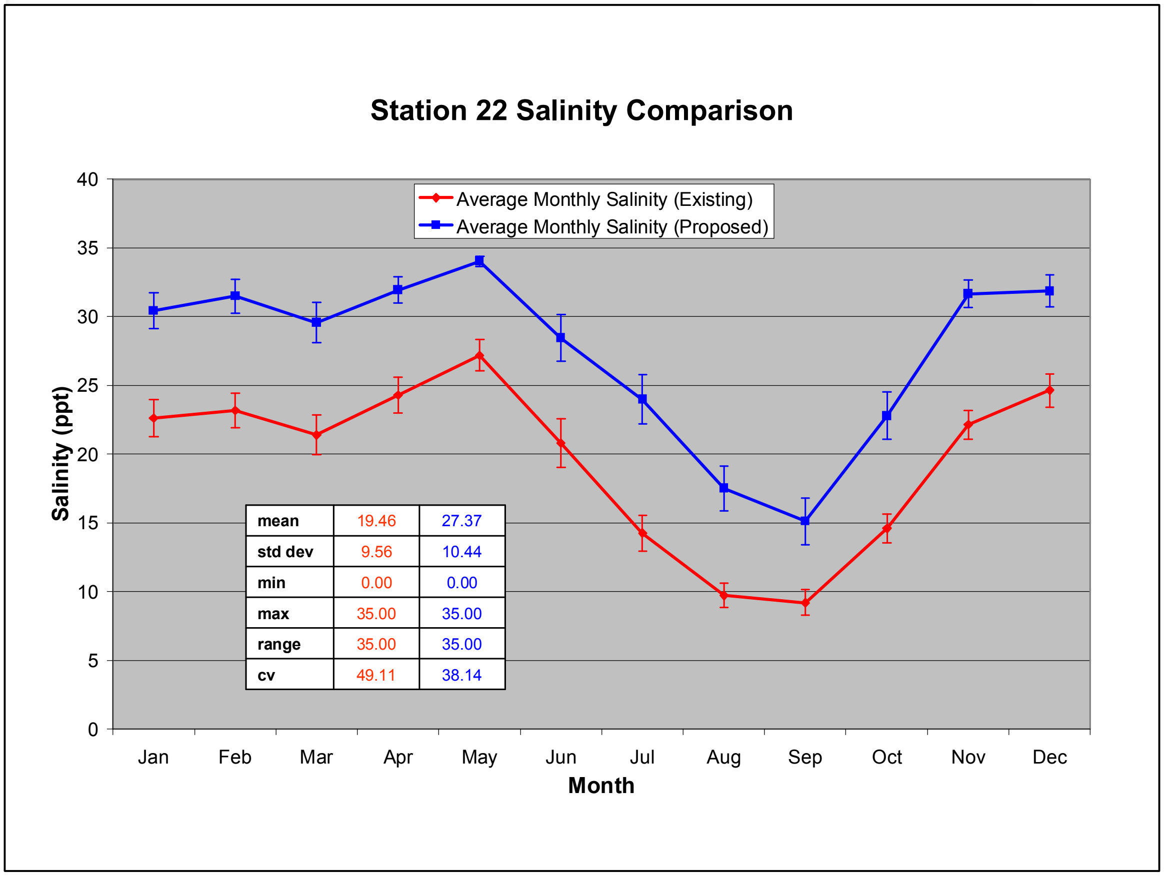


Figure 10 – Regression Output for Flow vs. Salinity for Station 22



mean	19.46	27.37
std dev	9.56	10.44
min	0.00	0.00
max	35.00	35.00
range	35.00	35.00
cv	49.11	38.14

Figure 11 – Existing vs. Potential Salinity Regimes at Station 22 (means ± s.e.)

Station 21

Comparison of Alternative Models

Model	*Correlation*	*R-Squared*
Squared-Y logarithmic-X	**-0.8661**	**75.01%**
Logarithmic-X	-0.8576	73.56%
Square root-X	-0.8473	71.79%
Square root-Y logarithmic-X	-0.8054	64.87%
Squared-Y square root-X	-0.8042	64.68%
Logarithmic-Y square root-X	-0.7830	61.32%
Square root-Y	-0.7702	59.32%
Exponential	-0.7569	57.29%
Linear	-0.7443	55.39%
Multiplicative	-0.7048	49.68%
Squared-Y	-0.6679	44.61%
Logarithmic-Y squared-X	-0.6585	43.36%
Reciprocal-Y	0.6420	41.21%
Square root-Y squared-X	-0.6369	40.57%
Reciprocal-Y square root-X	0.6253	39.10%
Squared-X	-0.5866	34.40%
Reciprocal-Y squared-X	0.5827	33.95%
Squared-Y reciprocal-X	0.5682	32.29%
Reciprocal-X	0.5310	28.20%
Reciprocal-Y logarithmic-X	0.5133	26.35%
Double squared	-0.4942	24.42%
Square root-Y reciprocal-X	0.4715	22.23%
S-curve model	0.3812	14.53%
Double reciprocal	-0.2416	5.84%

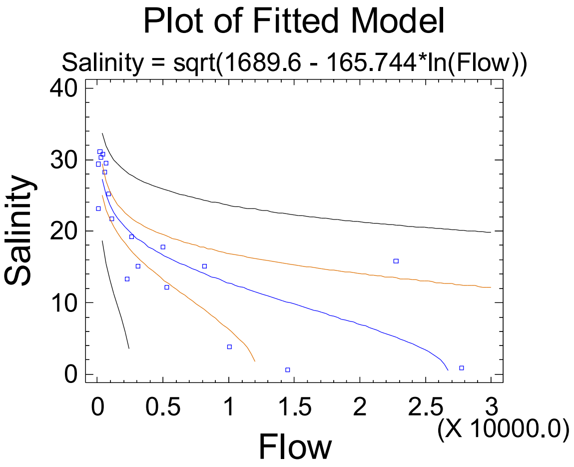
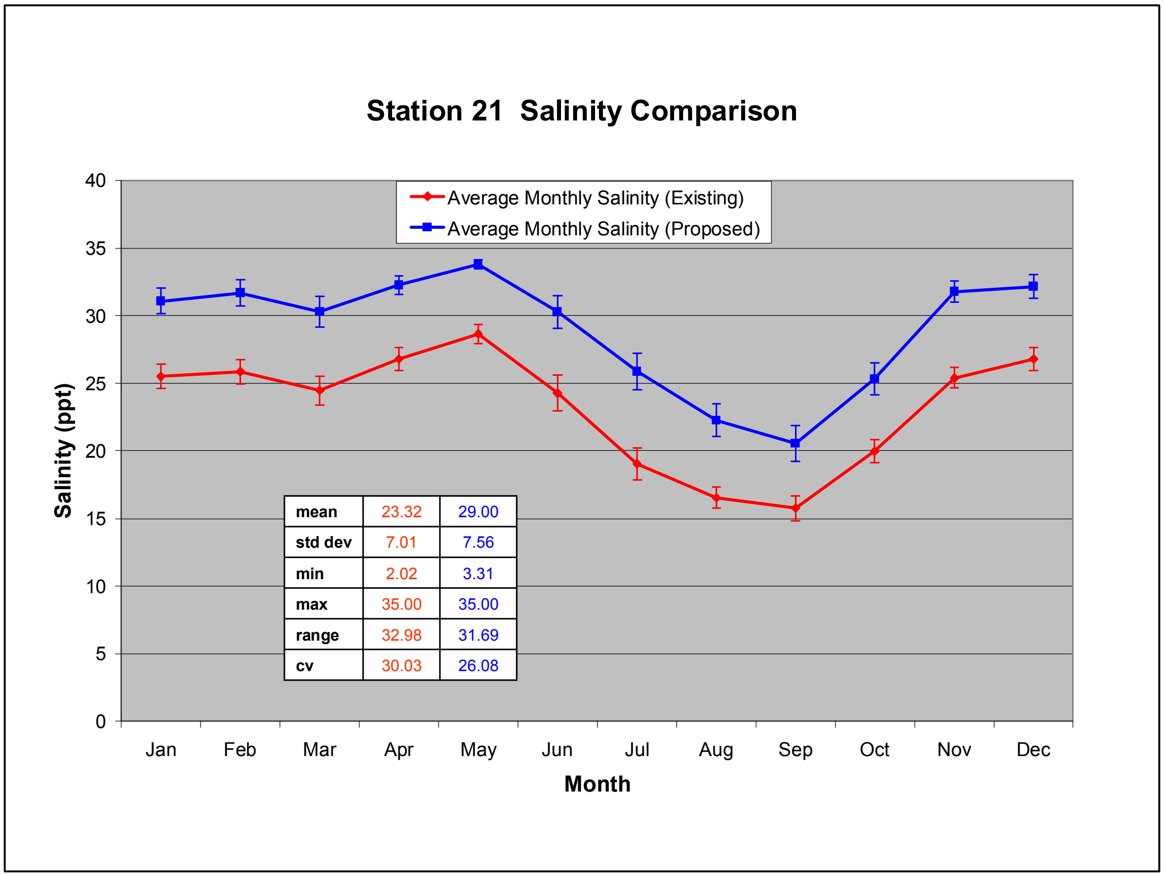


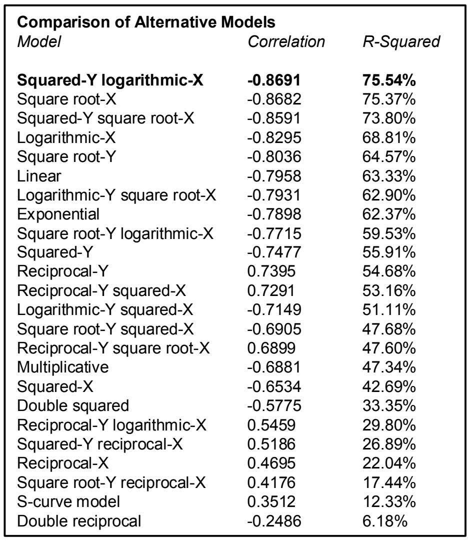
Figure 12 – Regression Output for Flow vs. Salinity for Station 21



mean	23.32	29.00
std dev	7.01	7.56
min	2.02	3.31
max	35.00	35.00
range	32.98	31.69
cv	30.03	26.08

Figure 13 – Existing vs. Potential Salinity Regimes at Station 21 (means ± s.e.)

Station 20



Comparison of Alternative Models

Model	*Correlation*	*R-Squared*
Squared-Y logarithmic-X	**-0.8691**	**75.54%**
Square root-X	-0.8682	75.37%
Squared-Y square root-X	-0.8591	73.80%
Logarithmic-X	-0.8295	68.81%
Square root-Y	-0.8036	64.57%
Linear	-0.7958	63.33%
Logarithmic-Y square root-X	-0.7931	62.90%
Exponential	-0.7898	62.37%
Square root-Y logarithmic-X	-0.7715	59.53%
Squared-Y	-0.7477	55.91%
Reciprocal-Y	0.7395	54.68%
Reciprocal-Y squared-X	0.7291	53.16%
Logarithmic-Y squared-X	-0.7149	51.11%
Square root-Y squared-X	-0.6905	47.68%
Reciprocal-Y square root-X	0.6899	47.60%
Multiplicative	-0.6881	47.34%
Squared-X	-0.6534	42.69%
Double squared	-0.5775	33.35%
Reciprocal-Y logarithmic-X	0.5459	29.80%
Squared-Y reciprocal-X	0.5186	26.89%
Reciprocal-X	0.4695	22.04%
Square root-Y reciprocal-X	0.4176	17.44%
S-curve model	0.3512	12.33%
Double reciprocal	-0.2486	6.18%

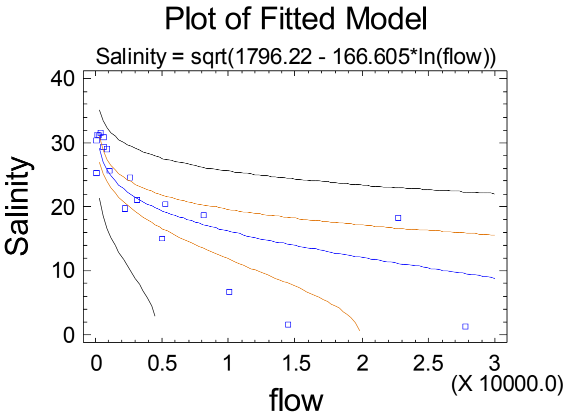
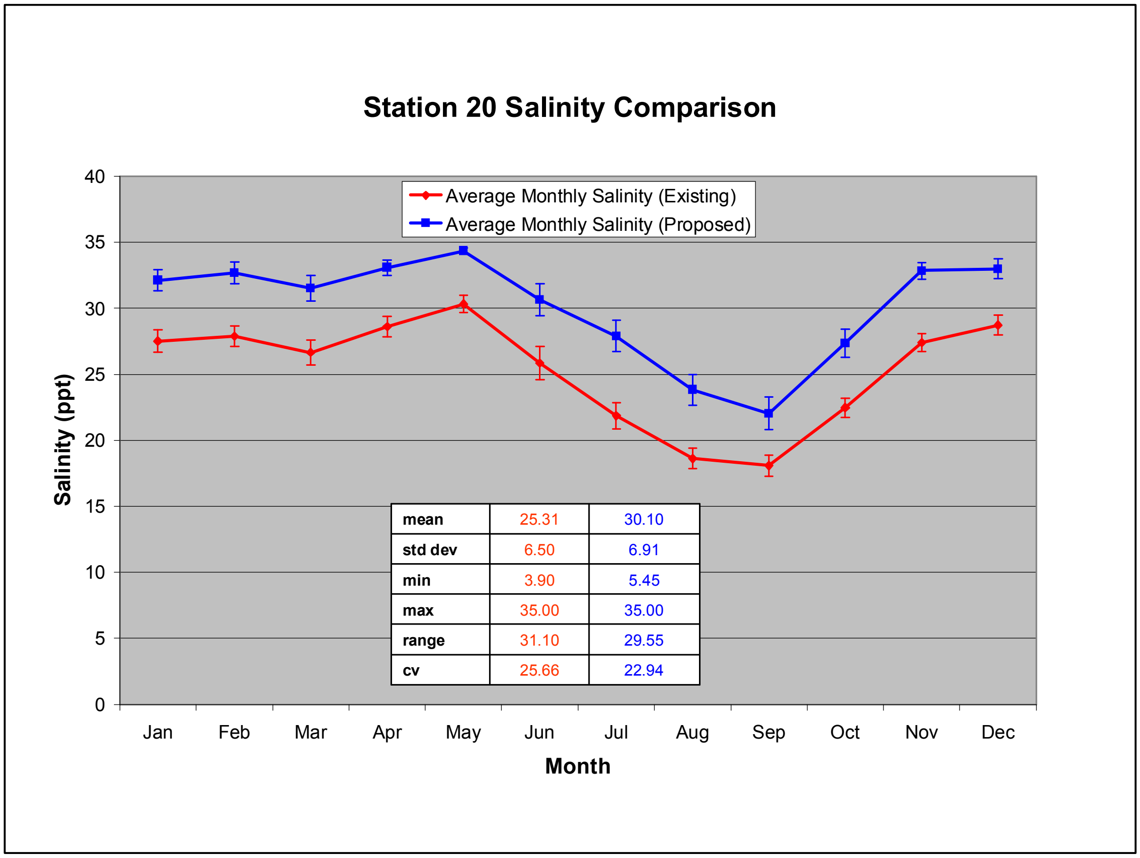


Figure 14 – Regression Output for Flow vs. Salinity for Station 20



mean	25.31	30.10
std dev	6.50	6.91
min	3.90	5.45
max	35.00	35.00
range	31.10	29.55
cv	25.66	22.94

Figure 15 – Existing vs. Potential Salinity Regimes at Station 20 (means ± s.e.)

Station 19

Comparison of Alternative Models

Model	*Correlation*	*R-Squared*
Squared-Y square root-X	**-0.8378**	**70.19%**
Squared-Y logarithmic-X	-0.8376	70.17%
Square root-X	-0.8348	69.68%
Logarithmic-X	-0.7964	63.43%
Reciprocal-Y squared-X	0.7874	62.01%
Square root-Y	-0.7836	61.40%
Logarithmic-Y square root-X	-0.7810	60.99%
Exponential	-0.7805	60.92%
Linear	-0.7761	60.23%
Square root-Y logarithmic-X	-0.7518	56.52%
Reciprocal-Y	0.7495	56.17%
Logarithmic-Y squared-X	-0.7467	55.75%
Squared-Y	-0.7419	55.04%
Square root-Y squared-X	-0.7132	50.87%
Reciprocal-Y square root-X	0.6919	47.87%
Multiplicative	-0.6911	47.77%
Squared-X	-0.6750	45.56%
Double squared	-0.6016	36.19%
Reciprocal-Y logarithmic-X	0.5575	31.08%
Squared-Y reciprocal-X	0.4921	24.21%
Reciprocal-X	0.4510	20.34%
Square root-Y reciprocal-X	0.4135	17.09%
S-curve model	0.3658	13.38%
Double reciprocal	-0.2673	7.15%

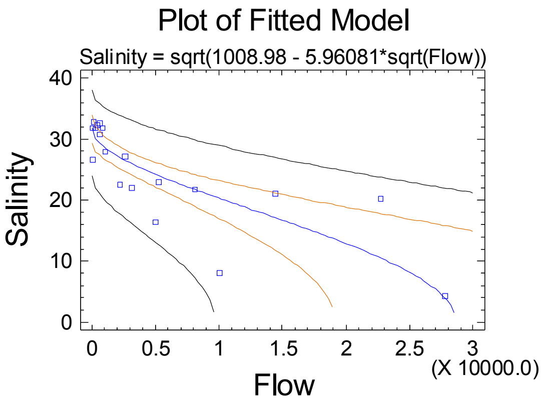
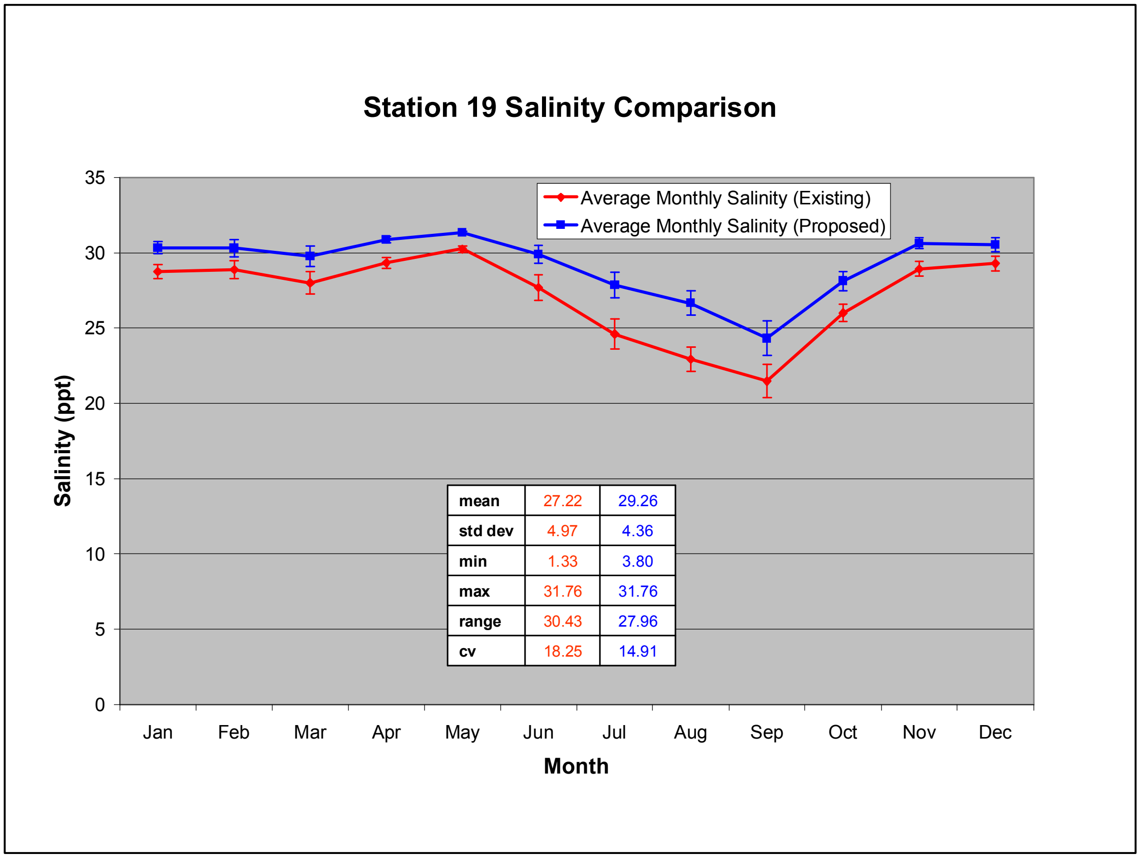


Figure 16 – Regression Output for Flow vs. Salinity for Station 19



mean	27.22	29.26
std dev	4.97	4.36
min	1.33	3.80
max	31.76	31.76
range	30.43	27.96
cv	18.25	14.91

Figure 17 – Existing vs. Potential Salinity Regimes at Station 19 (means ± s.e.)

Station 18

Comparison of Alternative Models

Model	*Correlation*	*R-Squared*
Reciprocal-Y squared-X	**0.7564**	**57.21%**
Reciprocal-Y	0.7132	50.86%
Exponential	-0.7009	49.13%
Logarithmic-Y squared-X	-0.6996	48.94%
Square root-X	-0.6962	48.47%
Squared-Y square root-X	-0.6935	48.09%
Square root-Y	-0.6878	47.31%
Logarithmic-Y square root-X	-0.6861	47.08%
Linear	-0.6720	45.15%
Squared-Y logarithmic-X	-0.6709	45.01%
Square root-Y squared-X	-0.6642	44.11%
Reciprocal-Y square root-X	0.6589	43.41%
Logarithmic-X	-0.6440	41.47%
Squared-Y	-0.6393	40.86%
Squared-X	-0.6279	39.43%
Square root-Y logarithmic-X	-0.6232	38.84%
Multiplicative	-0.5972	35.66%
Double squared	-0.5631	31.70%
Reciprocal-Y logarithmic-X	0.5351	28.63%
Squared-Y reciprocal-X	0.3775	14.25%
Reciprocal-X	0.3518	12.38%
Square root-Y reciprocal-X	0.3330	11.09%
S-curve model	0.3104	9.63%
Double reciprocal	-0.2598	6.75%

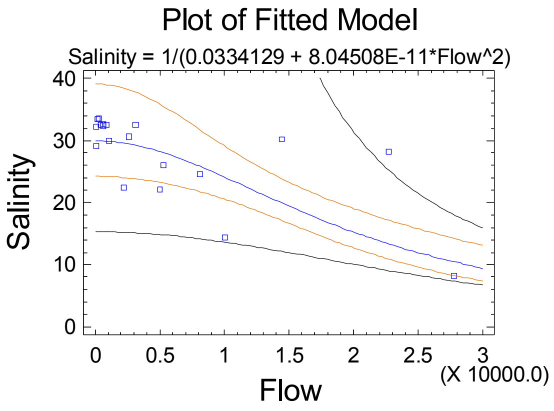
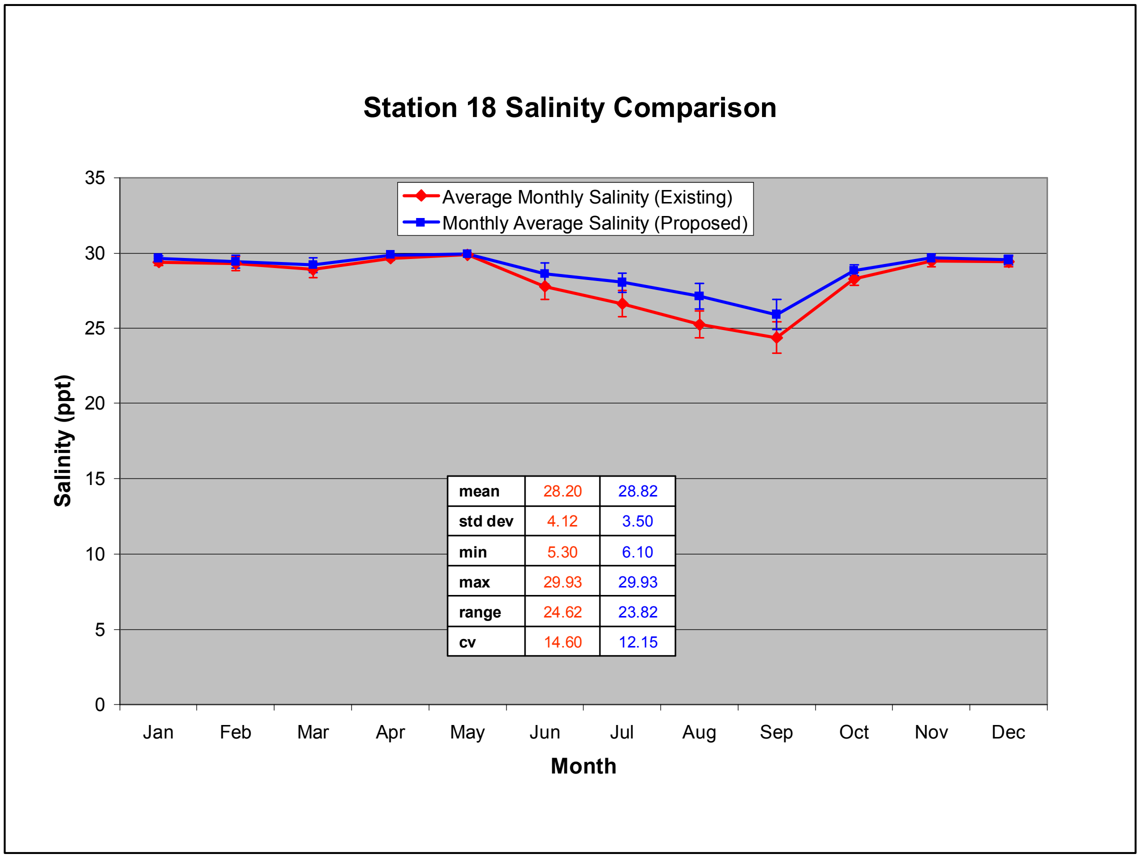


Figure 18 – Regression Output for Flow vs. Salinity for Station 18



mean	28.20	28.82
std dev	4.12	3.50
min	5.30	6.10
max	29.93	29.93
range	24.62	23.82
cv	14.60	12.15

Figure 19 – Existing vs. Potential Salinity Regimes at Station 18 (means ± s.e.)

Station 17

Comparison of Alternative Models

Model	*Correlation*	*R-Squared*
Squared-Y square root-X	**-0.7935**	**62.97%**
Square root-X	-0.7873	61.98%
Logarithmic-Y square root-X	-0.7779	60.51%
Reciprocal-Y square root-X	0.7648	58.50%
Squared-Y logarithmic-X	-0.7546	56.94%
Reciprocal-Y	0.7526	56.64%
Exponential	-0.7492	56.12%
Square root-Y	-0.7467	55.75%
Linear	-0.7438	55.32%
Squared-Y	-0.7372	54.35%
Logarithmic-X	-0.7362	54.20%
Square root-Y logarithmic-X	-0.7253	52.61%
Multiplicative	-0.7133	50.88%
Reciprocal-Y squared-X	0.7053	49.75%
Reciprocal-Y logarithmic-X	0.6860	47.06%
Logarithmic-Y squared-X	-0.6821	46.52%
Square root-Y squared-X	-0.6705	44.96%
Squared-X	-0.6592	43.45%
Double squared	-0.6377	40.67%
Squared-Y reciprocal-X	0.4217	17.79%
Reciprocal-X	0.4063	16.51%
Square root-Y reciprocal-X	0.3974	15.79%
S-curve model	0.3877	15.03%
Double reciprocal	-0.3659	13.39%

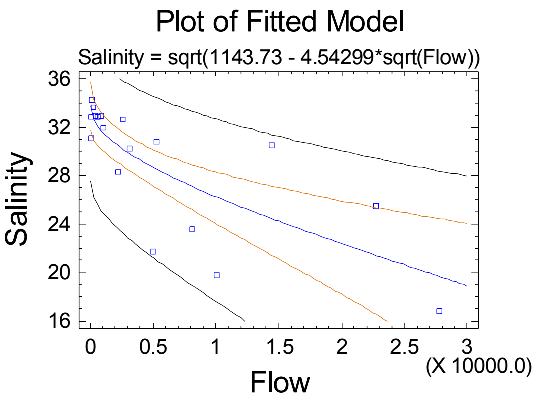
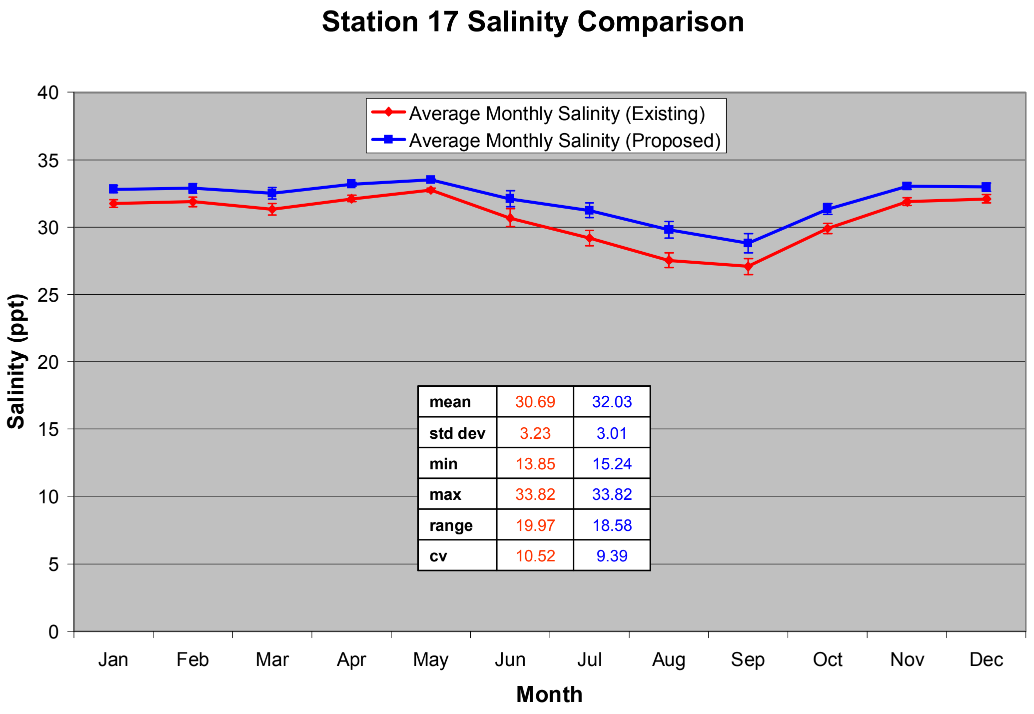


Figure 20 – Regression Output for Flow vs. Salinity for Station 17



mean	30.69	32.03
std dev	3.23	3.01
min	13.85	15.24
max	33.82	33.82
range	19.97	18.58
cv	10.52	9.39

Figure 21 – Existing vs. Potential Salinity Regimes at Station 17 (means ± s.e.)

Station 16

Comparison of Alternative Models

Model	*Correlation*	*R-Squared*
Squared-Y logarithmic-X	**-0.7568**	**57.28%**
Logarithmic-X	-0.7259	52.69%
Squared-Y square root-X	-0.7145	51.05%
Square root-Y logarithmic-X	-0.7066	49.93%
Square root-X	-0.6879	47.32%
Multiplicative	-0.6846	46.87%
Logarithmic-Y square root-X	-0.6506	42.32%
Reciprocal-Y logarithmic-X	0.6331	40.08%
Squared-Y	-0.6073	36.89%
Reciprocal-Y square root-X	0.6024	36.29%
Linear	-0.5833	34.03%
Square root-Y	-0.5675	32.21%
Exponential	-0.5490	30.14%
Squared-Y reciprocal-X	0.5162	26.64%
Reciprocal-Y	0.5043	25.43%
Reciprocal-X	0.4889	23.91%
Square root-Y reciprocal-X	0.4728	22.36%
Double squared	-0.4599	21.15%
S-curve model	0.4550	20.70%
Squared-X	-0.4372	19.12%
Square root-Y squared-X	-0.4222	17.83%
Double reciprocal	-0.4149	17.21%
Logarithmic-Y squared-X	-0.4046	16.37%
Reciprocal-Y squared-X	0.3621	13.11%

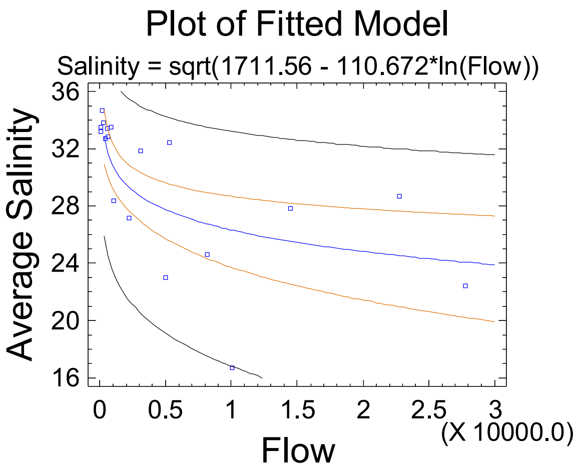
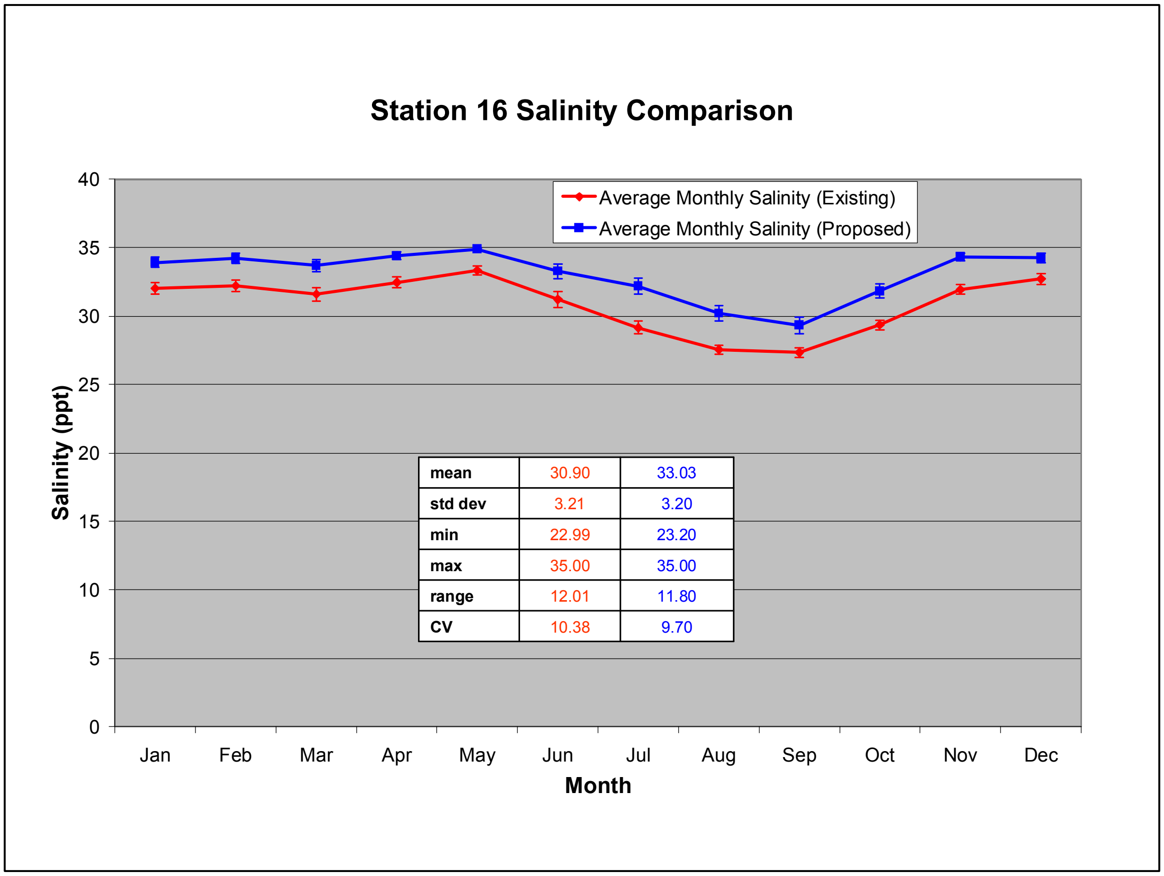


Figure 22 – Regression Output for Flow vs. Salinity for Station 16



mean	30.90	33.03
std dev	3.21	3.20
min	22.99	23.20
max	35.00	35.00
range	12.01	11.80
CV	10.38	9.70

Figure 23 – Existing vs. Potential Salinity Regimes at Station 16 (means ± s.e.)

Station 6

Comparison of Alternative Models

Model	*Correlation*	*R-Squared*
Squared-Y logarithmic-X	**-0.6590**	**43.43%**
Logarithmic-X	-0.6461	41.74%
Square root-Y logarithmic-X	-0.6393	40.87%
Multiplicative	-0.6322	39.97%
Reciprocal-Y logarithmic-X	0.6175	38.13%
Squared-Y square root-X	-0.6124	37.50%
Square root-X	-0.5967	35.60%
Logarithmic-Y square root-X	-0.5798	33.62%
Reciprocal-Y square root-X	0.5620	31.58%
Squared-Y	-0.5005	25.05%
Linear	-0.4836	23.39%
Square root-Y	-0.4747	22.54%
Exponential	-0.4656	21.68%
Squared-Y reciprocal-X	0.4589	21.06%
Reciprocal-X	0.4506	20.31%
Reciprocal-Y	0.4466	19.95%
Square root-Y reciprocal-X	0.4463	19.92%
S-curve model	0.4420	19.53%
Double reciprocal	-0.4329	18.74%
Double squared	-0.3437	11.81%
Squared-X	-0.3270	10.69%
Square root-Y squared-X	-0.3183	10.13%
Logarithmic-Y squared-X	-0.3095	9.58%
Reciprocal-Y squared-X	0.2911	8.48%

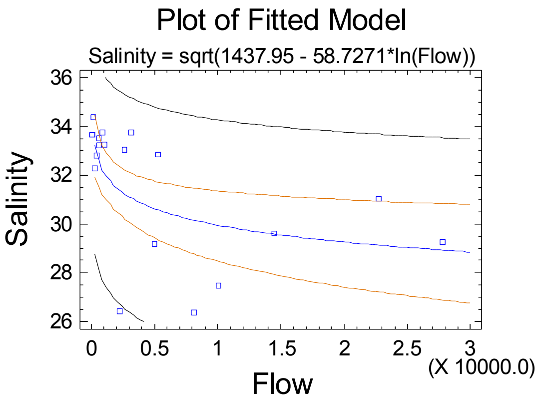
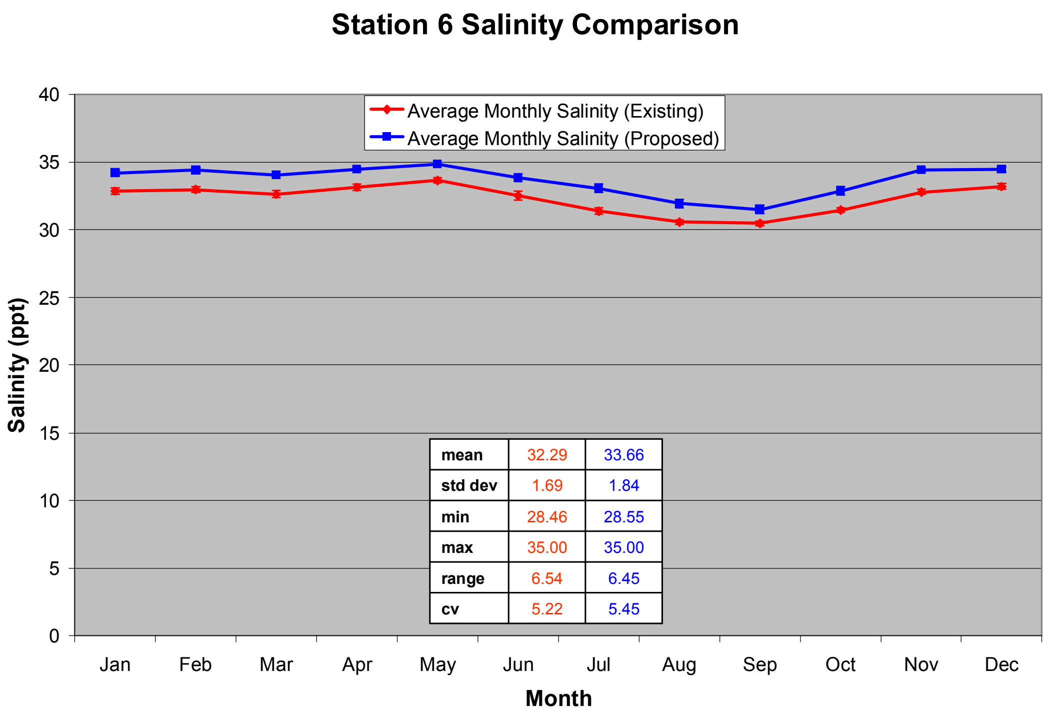


Figure 24 – Regression Output for Flow vs. Salinity for Station 6



mean	32.29	33.66
std dev	1.69	1.84
min	28.46	28.55
max	35.00	35.00
range	6.54	6.45
cv	5.22	5.45

Figure 25 – Existing vs. Potential Salinity Regimes at Station 6 (means ± s.e.)

Station 5

Comparison of Alternative Models

Model	*Correlation*	*R-Squared*
Reciprocal-Y squared-X	**0.8540**	**72.93%**
Reciprocal-Y	0.8497	72.19%
Exponential	-0.8470	71.75%
Square root-Y	-0.8446	71.33%
Linear	-0.8415	70.81%
Logarithmic-Y squared-X	-0.8370	70.06%
Squared-Y	-0.8336	69.48%
Squared-Y square root-X	-0.8319	69.20%
Square root-X	-0.8289	68.71%
Square root-Y squared-X	-0.8275	68.48%
Logarithmic-Y square root-X	-0.8231	67.75%
Squared-X	-0.8176	66.84%
Reciprocal-Y square root-X	0.8143	66.30%
Double squared	-0.7965	63.43%
Squared-Y logarithmic-X	-0.7440	55.35%
Logarithmic-X	-0.7309	53.42%
Square root-Y logarithmic-X	-0.7233	52.31%
Multiplicative	-0.7149	51.11%
Reciprocal-Y logarithmic-X	0.6961	48.45%
Squared-Y reciprocal-X	0.4213	17.75%
Reciprocal-X	0.4080	16.65%
Square root-Y reciprocal-X	0.4007	16.06%
S-curve model	0.3929	15.44%
Double reciprocal	-0.3760	14.14%

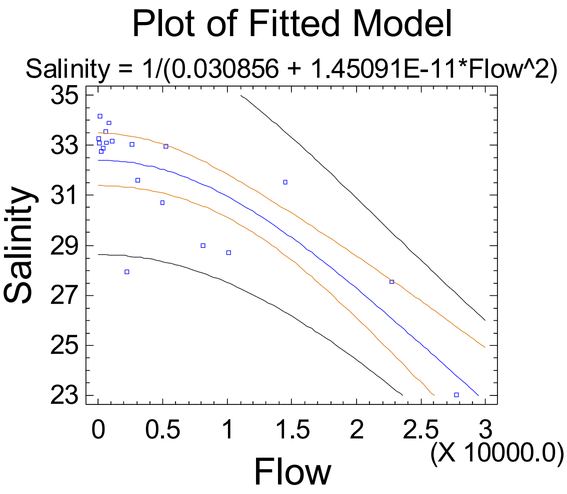
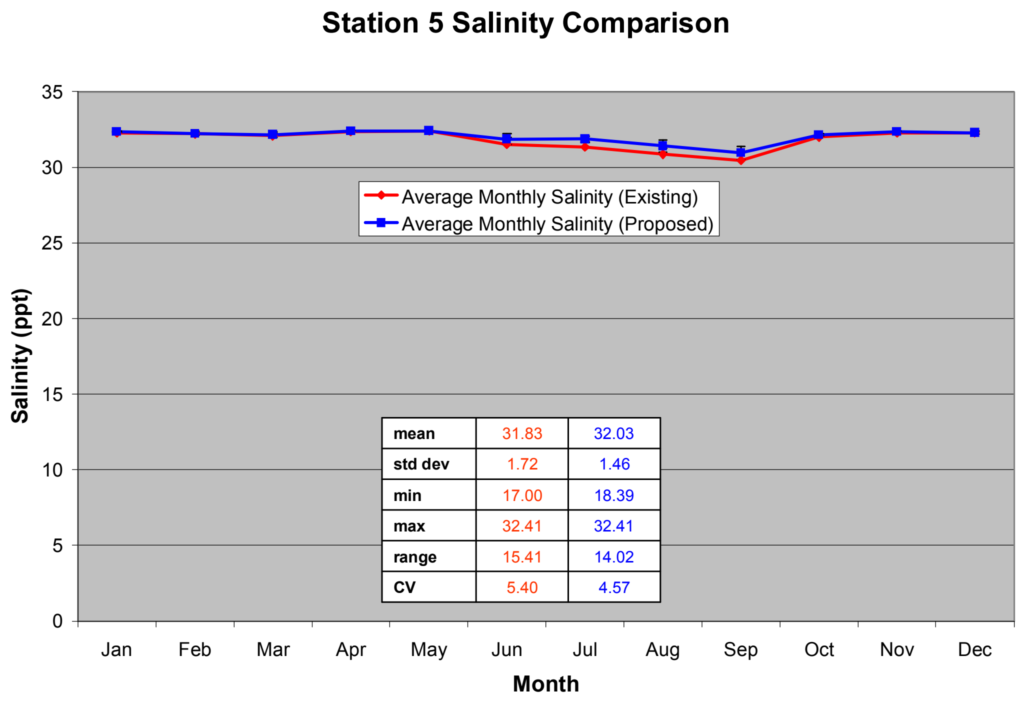


Figure 26 – Regression Output for Flow vs. Salinity for Station 5



mean	31.83	32.03
std dev	1.72	1.46
min	17.00	18.39
max	32.41	32.41
range	15.41	14.02
CV	5.40	4.57

Figure 27 – Existing vs. Potential Salinity Regimes at Station 5 (means ± s.e.)

Station 3

Comparison of Alternative Models

Model	*Correlation*	*R-Squared*
Reciprocal-Y squared-X	**0.6901**	**47.63%**
Logarithmic-Y squared-X	-0.6754	45.62%
Reciprocal-Y	0.6750	45.57%
Exponential	-0.6685	44.69%
Square root-Y squared-X	-0.6679	44.61%
Square root-Y	-0.6650	44.22%
Linear	-0.6613	43.73%
Squared-X	-0.6603	43.60%
Logarithmic-Y square root-X	-0.6556	42.98%
Square root-X	-0.6553	42.94%
Reciprocal-Y square root-X	0.6551	42.92%
Squared-Y square root-X	-0.6541	42.78%
Squared-Y	-0.6536	42.71%
Double squared	-0.6450	41.60%
Squared-Y logarithmic-X	-0.6051	36.62%
Logarithmic-X	-0.5993	35.92%
Multiplicative	-0.5925	35.11%
Reciprocal-Y logarithmic-X	0.5847	34.19%
Squared-Y reciprocal-X	0.3745	14.02%
Reciprocal-X	0.3662	13.41%
Square root-Y reciprocal-X	0.3618	13.09%
S-curve model	0.3572	12.76%
Double reciprocal	-0.3475	12.08%

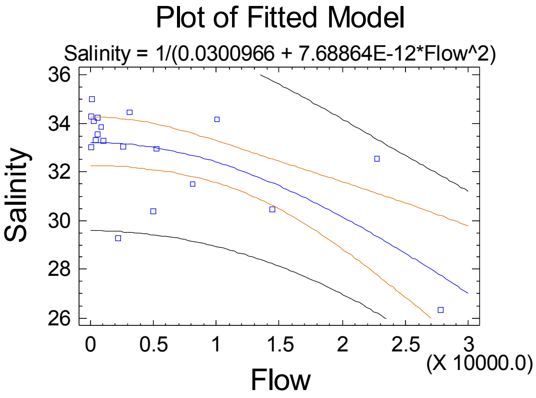
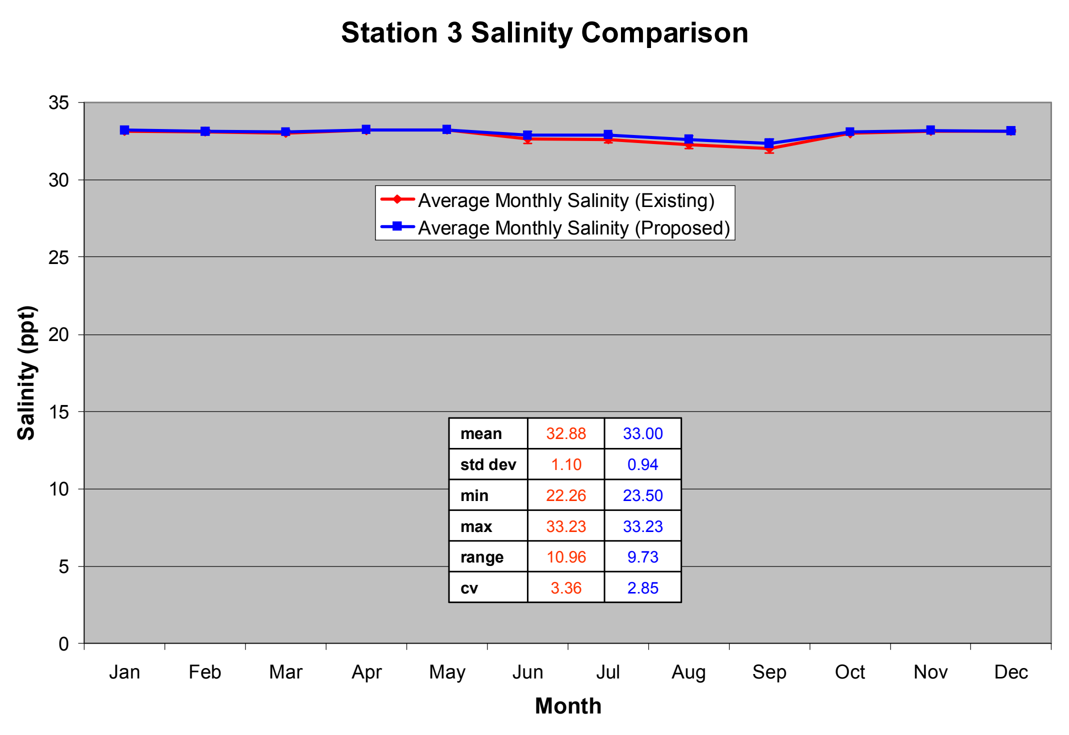


Figure 28 – Regression Output for Flow vs. Salinity for Station 3



mean	32.88	33.00
std dev	1.10	0.94
min	22.26	23.50
max	33.23	33.23
range	10.96	9.73
cv	3.36	2.85

Figure 29 – Existing vs. Potential Salinity Regimes at Station 3 (means ± s.e.)

Station 2

Comparison of Alternative Models

Model	*Correlation*	*R-Squared*
Squared-Y square root-X	**-0.5770**	**33.30%**
Square root-X	-0.5735	32.89%
Logarithmic-Y square root-X	-0.5695	32.43%
Reciprocal-Y square root-X	0.5650	31.92%
Squared-Y logarithmic-X	-0.5623	31.62%
Logarithmic-X	-0.5573	31.06%
Multiplicative	-0.5520	30.47%
Reciprocal-Y logarithmic-X	0.5464	29.85%
Squared-Y	-0.5256	27.63%
Linear	-0.5231	27.37%
Square root-Y	-0.5217	27.22%
Exponential	-0.5201	27.05%
Reciprocal-Y	0.5166	26.69%
Double squared	-0.4544	20.65%
Squared-X	-0.4532	20.54%
Square root-Y squared-X	-0.4523	20.46%
Logarithmic-Y squared-X	-0.4513	20.37%
Reciprocal-Y squared-X	0.4490	20.16%
Squared-Y reciprocal-X	0.3202	10.25%
Reciprocal-X	0.3151	9.93%
Square root-Y reciprocal-X	0.3125	9.77%
S-curve model	0.3100	9.61%
Double reciprocal	-0.3049	9.29%

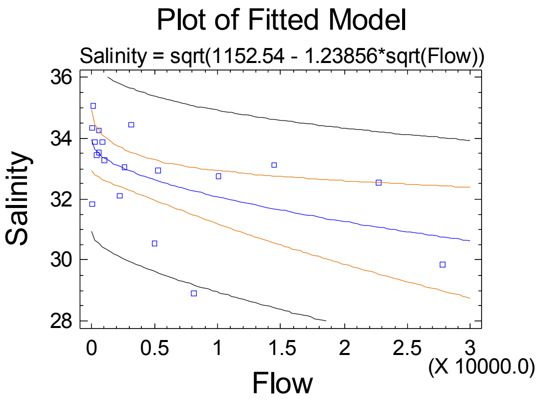
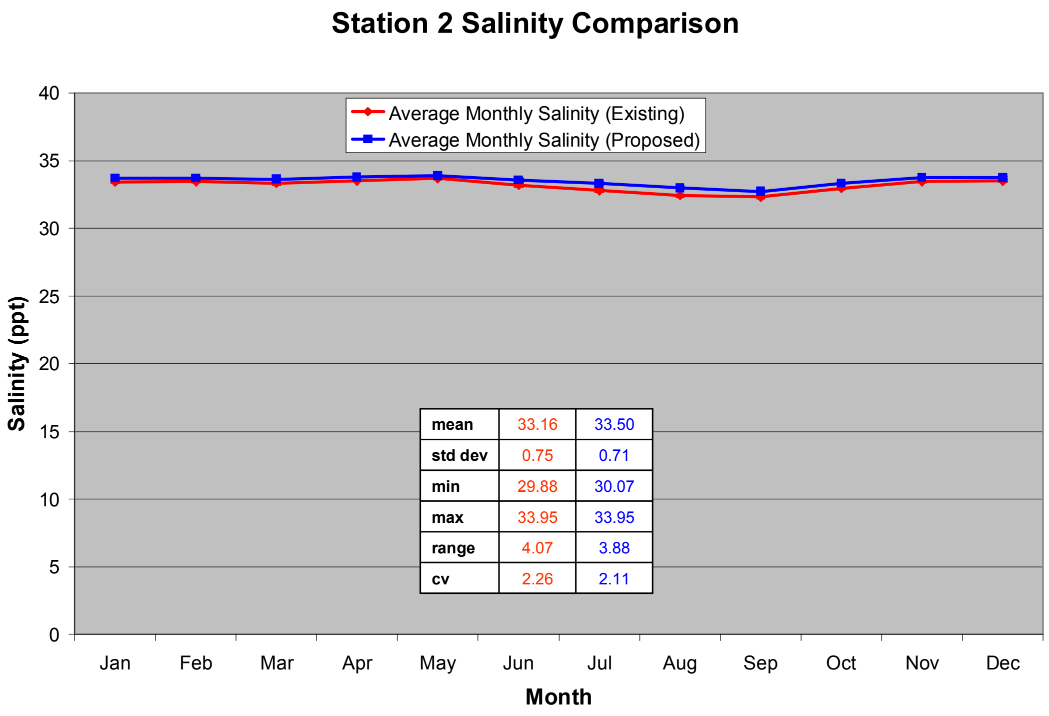


Figure 30 – Regression Output for Flow vs. Salinity for Station 2



mean	33.16	33.50
std dev	0.75	0.71
min	29.88	30.07
max	33.95	33.95
range	4.07	3.88
cv	2.26	2.11

Figure 31 – Existing vs. Potential Salinity Regimes at Station 2 (means ± s.e.)

Station 1

Comparison of Alternative Models

Model	*Correlation*	*R-Squared*
Reciprocal-Y squared-X	**0.6616**	**43.77%**
Logarithmic-Y squared-X	-0.6518	42.48%
Square root-Y squared-X	-0.6468	41.83%
Squared-X	-0.6417	41.17%
Double squared	-0.6312	39.84%
Reciprocal-Y	0.6010	36.12%
Exponential	-0.5949	35.39%
Square root-Y	-0.5917	35.01%
Linear	-0.5885	34.63%
Squared-Y	-0.5818	33.84%
Reciprocal-Y square root-X	0.5248	27.54%
Logarithmic-Y square root-X	-0.5225	27.30%
Square root-X	-0.5201	27.05%
Squared-Y square root-X	-0.5174	26.77%
Squared-Y logarithmic-X	-0.3934	15.47%
Logarithmic-X	-0.3903	15.23%
Multiplicative	-0.3871	14.98%
Reciprocal-Y logarithmic-X	0.3839	14.74%
Squared-Y reciprocal-X	0.1539	2.37%
Reciprocal-X	0.1455	2.12%
Square root-Y reciprocal-X	0.1414	2.00%
S-curve model	0.1374	1.89%
Double reciprocal	-0.1295	1.68%

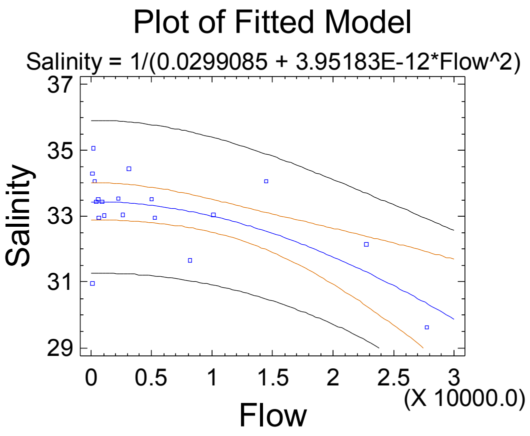
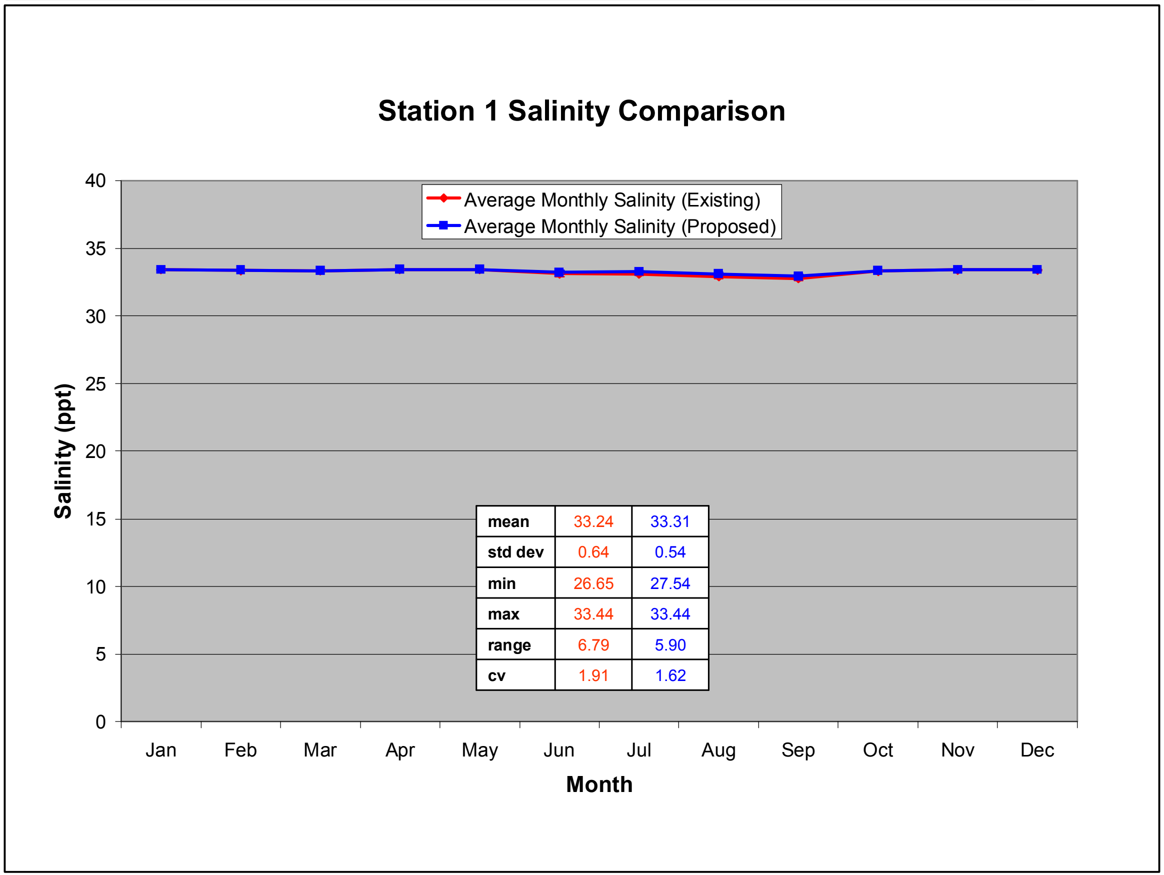


Figure 32 – Regression Output for Flow vs. Salinity for Station 1



mean	33.24	33.31
std dev	0.64	0.54
min	26.65	27.54
max	33.44	33.44
range	6.79	5.90
cv	1.91	1.62

Figure 33 – Existing vs. Potential Salinity Regimes at Station 1 (means ± s.e.)

This page intentionally left blank

TM 4.3.3 – ALTERNATIVE IMPACT ANALYSIS

1.0 BACKGROUND

Sarasota County in cooperation with the Peace River Manasota Regional Water Supply Authority and the Southwest Florida Water Management District (SWFWMD) are currently completing the necessary, pre-requisite data collection and analysis as well as the comprehensive watershed management plan for the Dona Bay Watershed. Kimley-Horn and Associates, Inc. (KHA), PBS&J, Biological Research Associates (BRA), Earth Balance, and Mote Marine Laboratory have been contracted by Sarasota County Government (SCG), with funding assistance from the SWFWMD, to prepare the Dona Bay Watershed Management Plan (DBWMP).

This regional initiative promotes and furthers the implementation of the Charlotte Harbor National Estuary Program (CHNEP) Comprehensive Conservation Management Plan, SWFWMD's Southern Coastal Watershed Comprehensive Watershed Management Plan; and Sarasota County's Comprehensive Plan. Specifically, this initiative is to plan, design, and implement a comprehensive watershed management plan for the Dona Bay watershed that will address the following general objectives:

a. Provide a more natural freshwater/saltwater regime in the tidal portions of Dona Bay.
b. Provide a more natural freshwater flow regime pattern for the Dona Bay watershed.
c. Protect existing and future property owners from flood damage.
d. Protect existing water quality.
e. Develop potential alternative surface water supply options that are consistent with, and support other plan objectives.

This Technical Memorandum has been prepared by PBS&J to present a summary of efforts to develop a statistically robust and scientifically valid estimate of pollutant load reduction estimates to Dona Bay associated with the implementation of potential flow diversion scenarios. These estimates were developed using existing and potential flow regimes, based on data supplied from KHA as part of Technical Memorandum 4.2.2 – Water Quantity | Water Budget Approach. This effort is consistent with Task 4.3.3 of the DBWMP contract.

2.0 INTRODUCTION

This effort is part of the overall Water Quality efforts defined in Task 4.3 of the DBWMP. Specifically, this task includes related evaluations and an assessment of potential restoration/enhancement sites for the study area. Since the intent of the project is to consider alternatives for watershed restoration/enhancement of the Dona Bay watershed and its hydrologic regimes, PBS&J was tasked with estimating potential reductions in pollutant loads that would be predicted based upon potential watershed/hydrologic restoration scenarios for Dona Bay.

In both Tampa and Sarasota Bays, recent increases in seagrass coverage have accompanied concurrent increases in water quality. In turn, these improvements in water quality have been linked to significant reductions in anthropogenic nutrient loads (e.g., Johansson 1991, Johansson and Greening 1999, Tomasko et al. 2005).

If proposed freshwater reduction scenarios as proposed under the Dona Bay watershed/hydrologic restoration plans were to be implemented, there is a potential for the concurrent reduction in pollutant loads delivered to Shakett Creek and Dona Bay.

3.0 DEVELOPMENT OF POLLUTANT LOAD REDUCTION SCENARIOS FOR DONA BAY

Based upon transferred equations originally developed by SWFWMD, KHA developed an historical flow record for the Cow Pen Canal as referenced in Technical Memorandum 4.2.2 – Water Quantity | Water budget Approach. This resulted in a data subset of monthly flow values for the period between November 1966 and December 2005 that was used for the purposes of this task. An estimate of the potential load reduction into Dona Bay from the Cow Pen Canal was constructed using the historical flow record developed for the Cow Pen Canal.

These monthly flow estimates were then re-calculated using excess Cow Pen Canal flows remaining after Phases 1, 2 and 3 of proposed watershed/hydrologic restoration projects. These hases represent the diversion of an annual average of 5, 10 and 15 mgd of excess freshwater from the Cow Pen Canal, respectively. The remaining excess flows would be delivered into Shakett Creek even after the implementation of each of the phases of the proposed watershed/hydrologic restoration plan.

A standard technique for developing pollutant loading models is to estimate nonpoint source loads based on a combination of flows and pollutant concentrations. This technique has been used for Tampa Bay (e.g., Pribble et al. 2001), Lemon Bay (Tomasko et al. 2001) and Charlotte Harbor (Squires et al. 1998). For this task, flows into Dona Bay were based on estimates for the period November 1966 to December 2005. These flows were then multiplied by “event mean concentration” values for the land use of “rangeland” used for the Charlotte Harbor watershed, and contained within the report conducted for the SWFWMD’s Charlotte Harbor SWIM program (Coastal Environmental, Inc. 1995). The land use category of rangeland was thought to be an appropriate one to use, based on the low-density agricultural activities that characterize most of the watershed. Although there is a substantial amount of urbanization located in the coastal area that immediately surrounds Dona Bay, these areas do not contribute to the flows measured at the lower water level control structure at the Cow Pen Canal gage site. Event mean concentrations, or EMC values, are the concentration required to account for a measured load; they are synonymous with the term “flow-weighted average.” Measured flows were multiplied by EMC values for total nitrogen (1.24 mg / liter), total phosphorus (0.01 mg / liter), and total suspended solids (11.0 mg / liter) as found in Coastal Environmental, Inc. (1995).

Monthly loads were calculated over the period of record, and then summed to create an annual load for each calendar year. This resulted in an average of 40 annual load estimates (1966 to 2005) for each of the four scenarios examined – current conditions vs. potential load reductions associated with implementation of Phases 1, 2, and 3 of the proposed watershed/hydrologic restoration project.

An additional effort was conducted to determine the potential for pollutant load reductions not directly associated with the volume of water redirected through the historical flow path and storage of the original and enhanced Cow Pen Slough anticipated under each of the phases.

One of the potential configurations for developing a linked habitat restoration – water supply augmentation scenario for flow diversions is the creation or enhancement of significant wetland and storage features in the Dona Bay watershed. If such a system was to involve re-routing water from the Cow Pen Canal through a series the original slough flow path that would now consist of marshes and deep ponds / reservoirs. The load reduction associated with routing water through such a system, as opposed to the channelized delivery of water that now occurs, is expected to have significant pollutant removal potential.

As a means of developing an "upper boundary" of pollutant load reductions, load reduction efficiencies associated with a typical wet detention system were applied to the quantity of water re-directed to the Cow Pen Slough flow path. The load reduction efficiencies used were 30, 50 and 80 percent for total nitrogen, total phosphorus, and total suspended solids, respectively. These load reduction efficiencies are either equal to or lower than values used by the SWFWMD to estimate reductions in pollutant loads for the Melburne Pond Stormwater Retrofit project (SWFWMD 2003).

The figures shown below contain estimates of loads for nitrogen, phosphorus and total suspended solids for each of four scenarios: 1) existing conditions, 2) loads after Phase I implementation, 3) loads after Phase II implementation, and 4) loads after Phase III implementation.

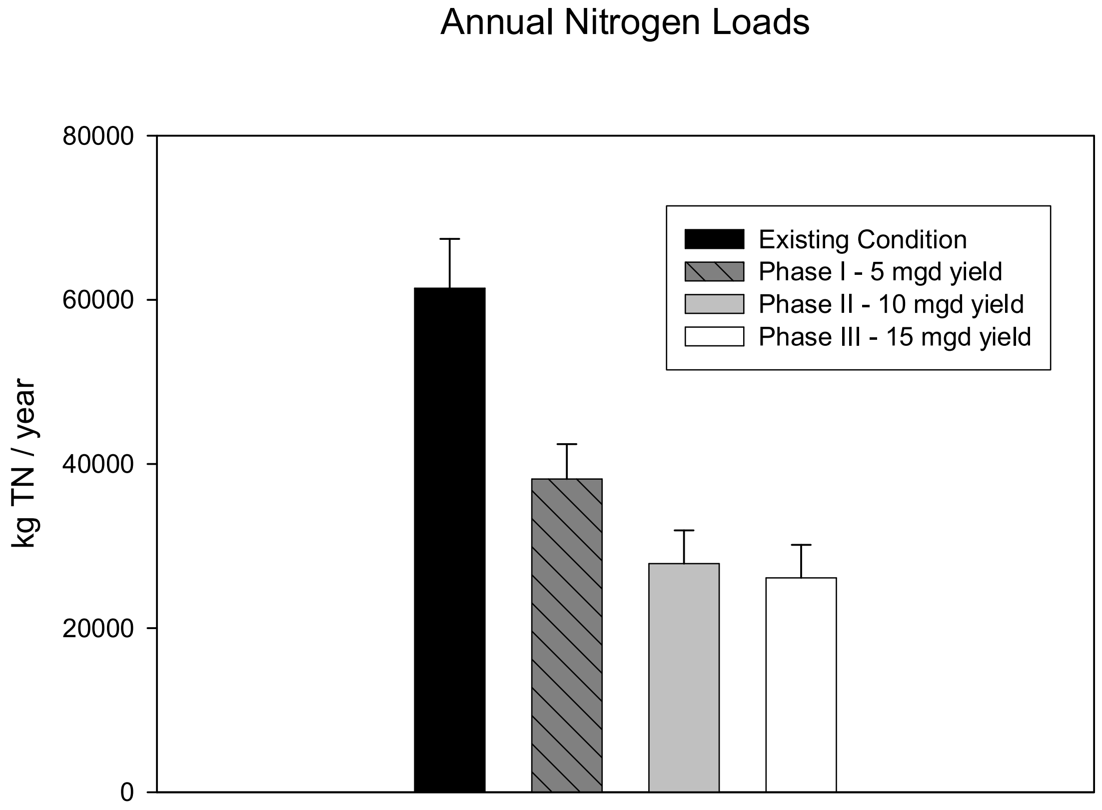


Figure 1 – Loads of Total Nitrogen from the Cow Pen Canal for Four Scenarios (means ± s.e.)

Results suggest that nitrogen loads to Shakett Creek and Dona Bay from the Cow Pen Canal could be reduced by 38 to perhaps 57 percent.

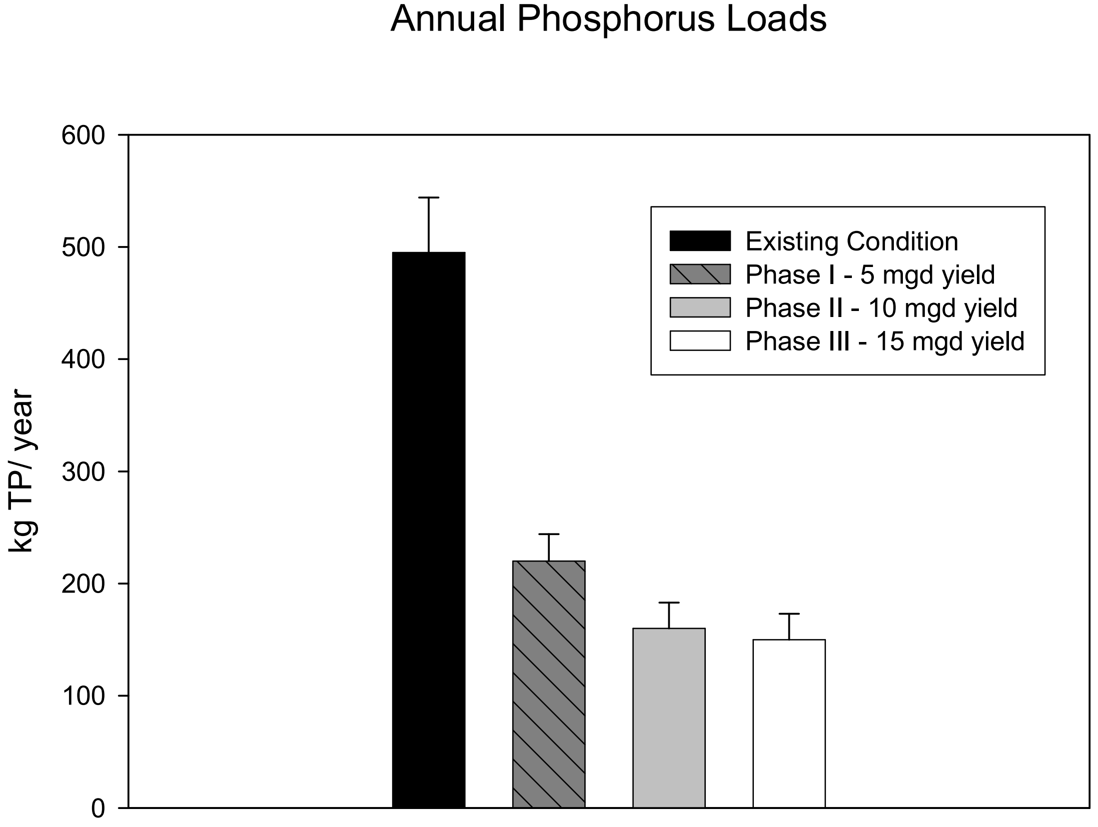


Figure 2 – Loads of Total Phosphorus from Cow Pen Canal for Four Scenarios (means ± s.e.)

For phosphorus, results suggest that loads to Shakett Creek and Dona Bay from the Cow Pen Canal could be reduced by 56 to 70 percent, reflecting the relatively higher load reduction expected for phosphorus, compared to nitrogen.

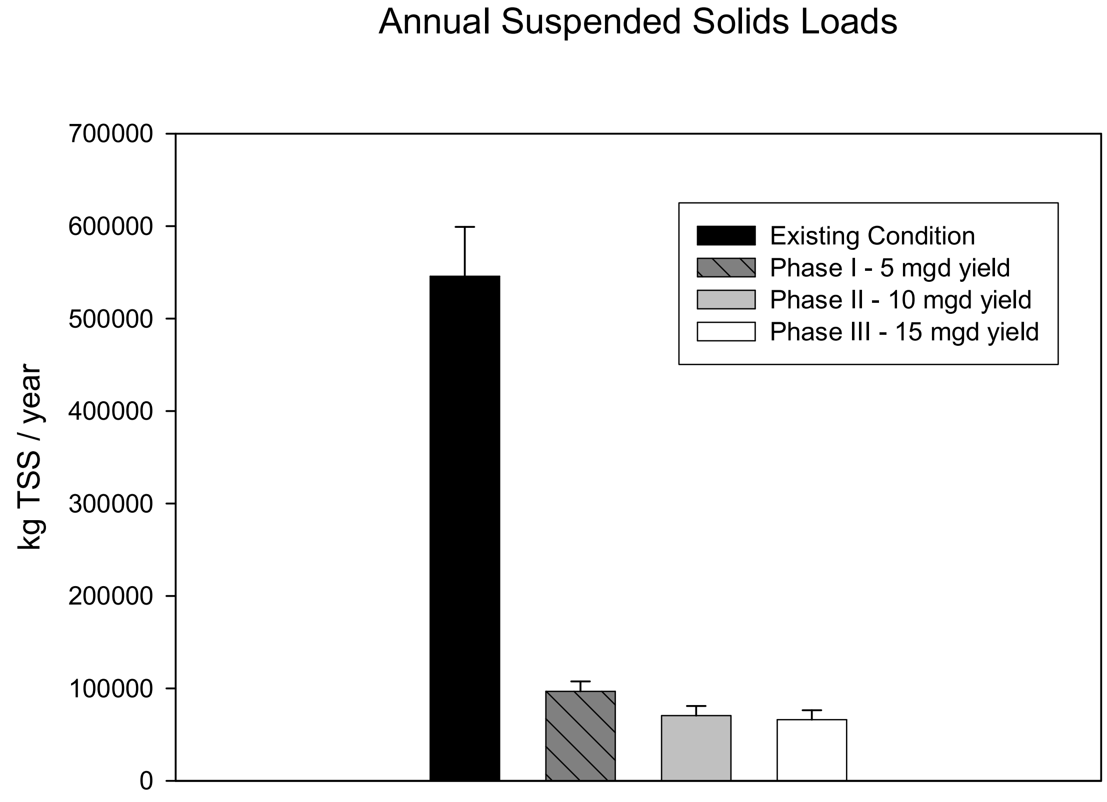


Figure 3 – Loads of Total Suspended Solids from the Cow Pen Canal for Four Scenarios (means ± s.e.)

Load reduction estimates for total suspended solids range between 82 and 88 percent. The load reduction estimate for total suspended solids contains the highest percent reduction calculated, which is based on the extremely efficient reduction in suspended materials that occurs with most stormwater runoff treatment systems.

In general, responses of benthic habitats to pollutant load reductions associated with potential flow diversion scenarios are likely to be significant. This analysis suggests that the all three phases of the proposed watershed/hydrologic restoration project would have a beneficial effect to benthic communities. The percent reduction in nitrogen loads possible (38 to 57 percent) would be similar to the percent load reductions for nitrogen that were experienced by Tampa Bay and Sarasota Bay in recent years (Tomasko et al. 2005).

Therefore it is likely that a similar degree of improvement in estuarine health, such as seagrass recovery, might be possible for Dona Bay, should the watershed/hydrologic restoration project be implemented.