MARCH 2005

Clean Estuary Partnership

North of Dumbarton Bridge Copper and Nickel Development and Selection of Final Translators

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Table of Contents

List of Tables

List of Figures

GLOSSARY OF ACRONYMS

10th percentile	10% of data lies below this value
25th percentile	25% of data lies below this value
75th percentile	75% of data lies below this value
90th percentile	90% of data lies below this value
µg/L	Micrograms per liter, or parts per billion
mg/L	Milligrams per liter, or parts per million
Ave.	Average
BPA	Basin Plan Amendment
CCC	Criterion Continuous Concentration
CFR	Code of Federal Regulations
CMC	Criterion Maximum Concentration
CTR	California Toxics Rule
Cu	Copper
EOA	Eisenberg, Olivieri, and Associates
NDB	North of Dumbarton Bridge
Ni	Nickel
NPDES	National Pollutant Discharge Elimination System
OAL	Office of Administrative Law
QA/QC	Quality Assurance/Quality Control
r^2	Statistical measure of the degree to which two variables are related; ranges from 0-1, with 1 representing the strongest correlation
RMP	Regional Monitoring Program
SDB	South of Dumbarton Bridge
SIP	Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California; aka State Implementation Policy
SSO	Site-Specific Objective
SWRCB	State Water Resources Control Board
TOC	Total Organic Carbon
TSS	Total Suspended Solids
US EPA	United States Environmental Protection Agency
WQO	Water Quality Objective

1. INTRODUCTION

The California Toxics Rule (CTR) metals water quality objectives (WQO) are expressed as dissolved concentrations. The values for copper are 4.8 μg/L (acute) and 3.1 μg/L (chronic), and for nickel 74 μg/L (acute) and 8.2 μg/L (chronic). However, by federal regulations (40 CFR 122.45(c)), NPDES permit limits must be expressed as total recoverable metals. Thus an additional factor, a translator, is required to convert the dissolved criteria into total recoverable effluent limits. Translators are unitless values ranging from zero to one that represent the ratio of dissolved metals concentration to total metals concentration.

The 1995 Basin Plan WQOs (carried forward from the 1986 Basin Plan) are expressed as total recoverable metals. These are the metal WQOs currently applicable to the Bay North of the Dumbarton Bridge (NDB), except for copper. The CTR copper WQO applies NDB since the Basin Plan does not currently contain an applicable WQO (following remand of the 4.9 μg/L total recoverable site-specific objective). Translators therefore, have not previously been required to derive most NDB effluent limits. Translators will be required if site-specific objectives (SSO) for copper and nickel are adopted NDB by the RWQCB as was done in May 2002 for the Bay south of Dumbarton Bridge (SDB).

On January 21, 2004 the Regional Board adopted Basin Plan Amendments (BPA) replacing the current total recoverable metals WQOs with the CTR dissolved metals WQOs. Translators will be needed to evaluate and calculate metals effluent limits throughout the Bay once the BPA are in effect (following approval by SWRCB, OAL and EPA).

2. TRANSLATOR CALCULATION

The most conservative translator is a value of one, implying that all metals discharged in an effluent to a receiving water body will be present in the dissolved form. Effluent limits derived using a unity translator simply treat the CTR dissolved criteria as total recoverable values. The next option is to use the EPA's "conversion factor" (listed in the CTR) as a default translator. The federal saltwater copper criteria conversion factor is 0.83; the nickel conversion factor is 0.99. The dissolved CTR criteria are adjusted to a total recoverable basis by dividing by these conversion factors. Effluent limits derived using the default conversion factors would be slightly higher than those based on a unity translator. The third option is to develop a site-specific translator based on an analysis of sample data collected from the receiving water. The State Implementation Plan (SIP) Section 1.4.1 describes the conditions under which site-specific translators may be used.

In *The Metals Translator: Guidance for Calculating A Total Recoverable Permit Limit from a Dissolved Criterion (June 1996)*, EPA identifies three methods for calculating a site-specific translator. One is direct measurement of the dissolved and total recoverable metal concentrations in water samples. The translator can then be calculated as the ratio of dissolved to total concentrations. For the second method, if a relationship between translators and total suspended solids (TSS) is found, a translator can be calculated by developing an appropriate regression equation and inserting a representative (EPA recommends median) TSS concentration. The third method is determination of a translator indirectly by means of a partition coefficient, which is functionally related to the number of binding sites associated with the adsorbent. The partition coefficient may be derived as a function of TSS and other factors such as pH, salinity, TOC, etc. In this analysis, translators have been derived using both the simple ratio method and the TSS regression method, and for both individual station and pooled station datasets.

3. RECEIVING WATER SAMPLING

The Copper and Nickel North of the Dumbarton Bridge Step 1 Water Effects Ratio (NDB WER) project collected ambient copper and nickel data during four sampling events in 2000 – 2001 at thirteen stations. The data were used in part to conduct a preliminary analysis of potential copper and nickel dissolved to total recoverable metals translators (*Cu/Ni North of Dumbarton Bridge – Preliminary Translator Data Analysis*, EOA, June 9, 2003, revised June 27, 2003).

Given that eight of the thirteen stations corresponded with established Regional Monitoring Program (RMP) stations, the NDB Coordinating Committee requested that copper and nickel sample data collected by the RMP at these stations from 1993 – 2000 be added to the Step 1 dataset. During that time period the RMP typically collected three samples each year (approximately in February, April and August). The complete combined Step 1 and RMP data and results were presented in the EOA memorandum *Cu/Ni North of Dumbarton Bridge – Preliminary Translator Data Analysis Including Both Step 1 and RMP Data* (July 18, 2003). Key findings from that memo are presented in this report.

Table 1 presents the sampling stations and key characteristics for the Step 1 project. **Table 2** presents the sample event dates and the associated environmental conditions.

Table 1. Sampling Locations

Station	Site Description	Deep/Shallow	Central/North Bay
BA40	Redwood Creek	Shallow	Central
BB15	San Bruno	Deep	Central
LCB01	Lower Central Bay (midpoint on transect)	Shallow	Central
LCB02	Lower Central Bay (near shore on transect)	Shallow	Central
BB30	Oyster Point	Deep	Central
BC10	Yerba Buena Island	Shallow	Central
BD20	San Pablo Bay	Shallow	North
SPB01	San Pablo Bay between BD15 & BD20	Shallow	North
BD15	Petaluma River (western SPB)	Shallow	North
SPB02	Eastern San Pablo Bay (midpoint on transect)	Shallow	North
SPB03	Eastern San Pablo Bay (near shore on transect)	Shallow	North
BF10	Pacheco Creek	Deep	North
BF20	Grizzly Bay	Shallow	North

Table 2. Sample Events

Event	Date	Season	Conditions
Event 1	September 5/7, 2000	dry	Glassy water conditions on Bay
Event 2	February 13/15, 2001	wet	Turbid conditions on Bay
Event 3	April 22/24, 2001	wet	Scheduled to coincide with increased Delta outflow conditions
Event 4	June 13/19, 2001	dry	Windy summer conditions

Additional information on sampling, laboratory analysis, QA/QC, and raw data is available in the July 2002 report *Copper and Nickel North of the Dumbarton Bridge; Step 1 Impairment Assessment*.

4. TRANSLATOR DATA AND ANALYSIS

The July 18, 2003 translator memo included all raw data and analysis of direct ratio and TSS linear-regression based translators. Results were arranged in tables (from top to bottom) and graphs (from left to right) to correspond to the San Francisco Bay geographically, from the southernmost location (BA40, Redwood Creek) to the farthest sample location upstream in the estuary (BF20, Grizzly Bay).

Translators were calculated for each sample event where a dissolved and total metal concentration was available. Results for individual stations and for pooled groupings of stations are presented as box and whisker plots. The box plots show summary statistics for the data sets. The number of samples for each location is shown as “N =” above the location names. The horizontal line within the box is the median or central tendency of the data. The top of the box represents the

75th percentile, while the bottom of the box is the 25th percentile of the data. The length of the box indicates the variability of the data. The ends of the whiskers, or lines outside the box, represent the largest and smallest observed values that are not "outliers" (outliers as defined by the statistical software). A "o" represents a data point that is an "outlier", and a "*" represents a data point that is an extreme value. The software defines an outlier as a value that is 1.5 to 3 box lengths from the upper or lower edge of the box. Extreme values are more than 3 box lengths from the upper or lower edge of the box.

With the inclusion of the approximately 22 to 27 RMP data points per station over 7 years, the variable of evaluating results by sampling Event (four events), as included in the WER analysis, is no longer applicable. However, the individual station plots are useful for viewing station-to-station variability in the Bay.

4.1 Individual Station Analysis

Data summaries for results from each of the individual sampling stations are presented in Appendix A. **Figures 1** and **2** present the translator data in box and whisker plots, as described above. It can be seen that the copper and nickel translators in the Central Bay appear relatively similar at all the stations. In the North Bay the near shore transect (SPB01, 02, 03) copper and nickel translator median values appear slightly higher than the RMP sampling station translators, although the overall variability is still within the range of the RMP North Bay stations. The difference appears to be an artifact of the fact that the near shore station values are based on only the four (Step 1) data points taken over a one year period versus the 24 to 27 datapoints available at the RMP stations. The several years of RMP data have captured the wider range of environmental conditions experienced at these sites under different water year and climatic conditions.

Figure 1. Copper Translator by Station

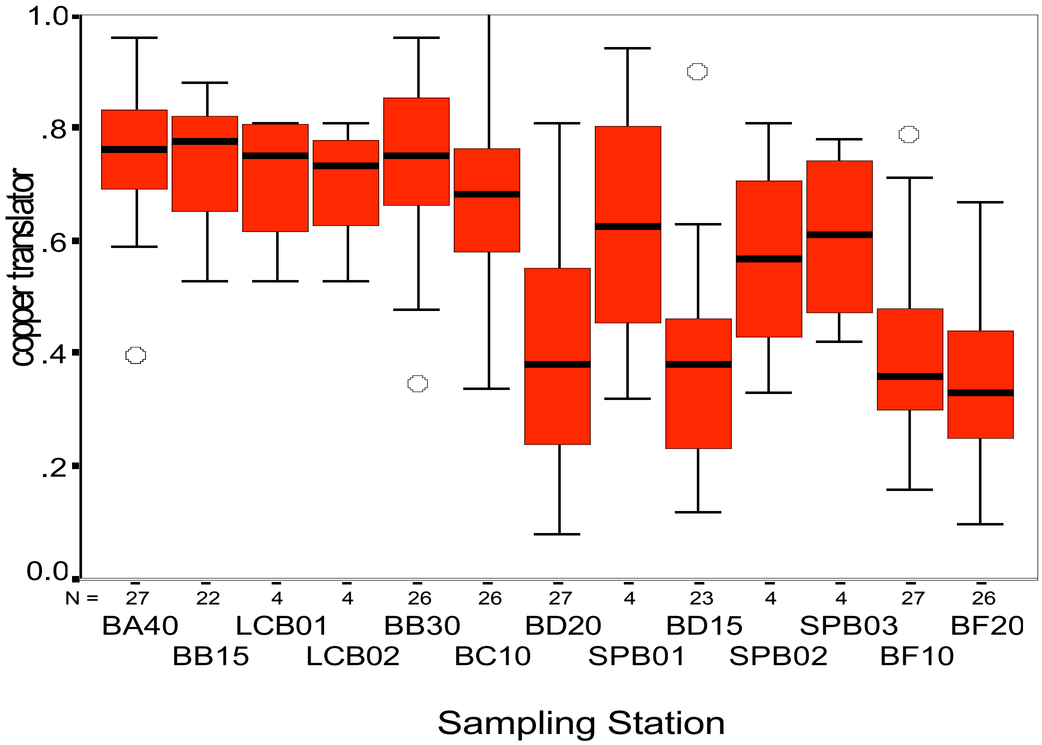


Figure 2. Nickel Translator by Station

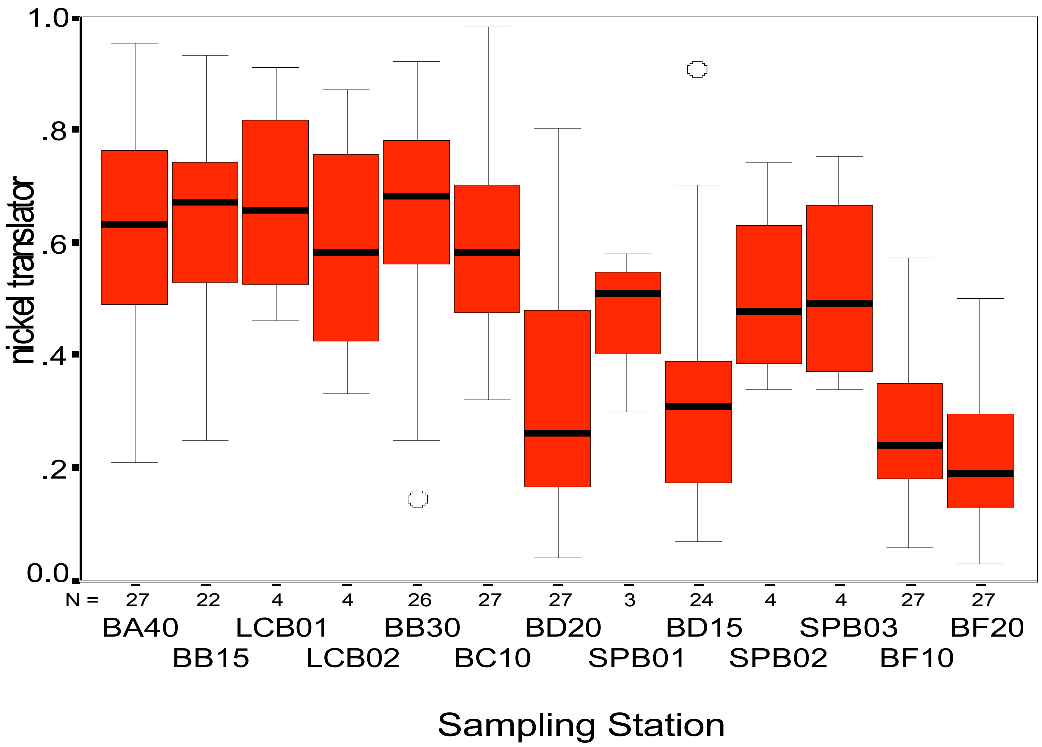
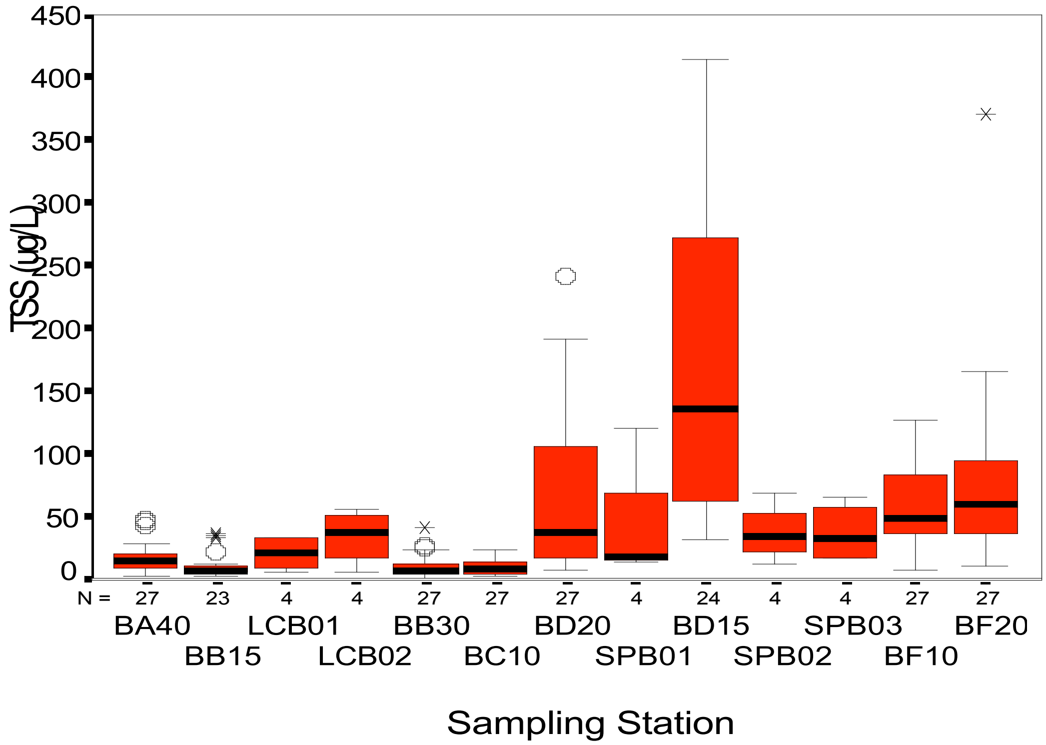


Figure 3. TSS Concentration by Station, mg/L



EPA guidance states that if the translator is found to be dependent on TSS, regression equations relating the fraction of dissolved (i.e. the translator) to TSS should be developed. EPA guidance also states that the regression equation should be used to develop translator values by inputting representative TSS values for the site under consideration. The Lower South San Francisco Bay copper and nickel translator development work found that a linear regression with log TSS and log translator (excluding data from two near shore stations) provided the best fit, with an r^2 value of 0.715.

Similar log-log XY plots of TSS concentrations vs copper and nickel translators were developed for the North of Dumbarton Bridge data. The log plots present the TSS and translator data with a simple linear regression line. Such plots show the extent to which there is a linear relationship between TSS concentrations and translators. As one would intuit, higher TSS concentrations typically correspond to lower translator values, because more metals binding sites are likely present in the greater amount of TSS present. The linear regression r-squared values indicate how good a predictor TSS is of translator values. The higher the r-squared value, the better the predictor.

4.2 Pooled Station Data Analysis

The June 9, 2003 translator memorandum had recommended, and the Coordinating Committee had agreed, that the data should be pooled into representative data sets rather than deriving translators for use at each station throughout the Bay. The data were pooled using the same categories as for the NDB WER study. These categories included Central Bay, North Bay, All Data, and All Data but BD15 (mouth of Petaluma River).

The copper translator, nickel translator and TSS summary statistics for these pooled categories are shown in **Tables 3** through **5** below, respectively. The Petaluma River sampling station (BD15) copper and nickel concentrations are considerably higher than at any other station as can be seen on the station concentration bar and boxplot graphs. However, a review of the copper and nickel translator box plots in **Figures 4** and **5**, where the BD15 results are broken out and shown separately, indicates that the translator values at BD15 fall within the range of values for the remaining North Bay stations.

Because both dissolved and total concentrations were elevated at BD15 (Appendix A), the impact on calculated translators was not as pronounced as would otherwise be expected. Comparing the All grouping versus the All but BD15 showed that removing BD15 from dataset only changed (raised) the resultant translator by a few one hundredths.

Each of the summary statistic measures of central tendency (arithmetic mean, geometric mean, and median) for a given grouping typically only varied by a few hundredths for copper and up to several hundredths for nickel. The SIP (1.4.1) directs that translators shall be derived using the median of data for translation of chronic data (CCC) and the 90th percentile of observed data for translation of acute criteria (CMC). Given these SIP directives, subsequent discussion focuses on those statistics.

The greatest relative differences exist between the North Bay and Central Bay groupings of stations. This is likely explained by the greater influence of oceanic flushing on the Central Bay sites. The All Station grouping gave results closer to the Central than the North Bay results.

Table 3. Copper Translator Summary Statistics

Summary Statistics	Central Bay	North Bay	All	All but BD15
Number	109	115	224	201
Minimum	0.34	0.08	0.08	0.08
Maximum	1.00	0.94	1.00	1.00
Arithmetic Mean	0.72	0.41	0.56	0.58
Geometric Mean	0.71	0.37	0.51	0.53
90th percentile	0.88	0.67	0.83	0.84
Median	0.74	0.38	0.60	0.63
Standard Deviation	0.13	0.19	0.23	0.22
Regression w/median TSS	0.72	0.36	0.51	0.55

Table 4. Nickel Translator Summary Statistics

Summary Statistics	Central Bay	North Bay	All	All but BD15
Number	110	117	227	203
Minimum	0.15	0.03	0.03	0.03
Maximum	0.98	1.00	1.00	1.00
Arithmetic Mean	0.63	0.31	0.46	0.48
Geometric Mean	0.60	0.25	0.38	0.40
90th percentile	0.85	0.57	0.79	0.80
Median	0.65	0.27	0.46	0.51
Standard Deviation	0.18	0.20	0.25	0.24
Regression w/median TSS	0.61	0.24	0.39	0.42

Table 5. TSS Summary Statistics, mg/L

Summary Statistics	Central Bay	North Bay	All	All but BD15
Number	112	117	229	205
Minimum	1.00	7.20	1.00	1.00
Maximum	56.0	414	414	371
Arithmetic Mean	13.0	85.9	50.3	35.9
Geometric Mean	9.10	55.9	23.0	18.8
90th percentile	29.8	190	121	89.8
Median	8.40	59.2	22.4	17.6
Standard Deviation	11.8	86.6	72.2	46.0
10th percentile	3.4	15	4	4.1

Figure 4. Copper Translators for North Bay, Central Bay and Petaluma River Sampling Stations

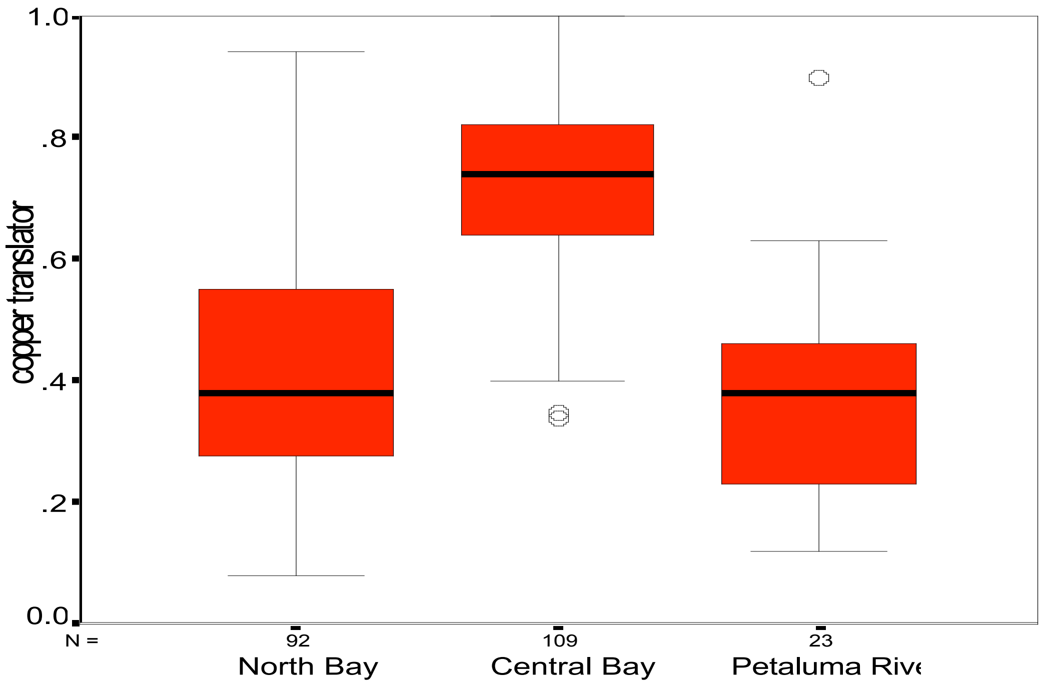
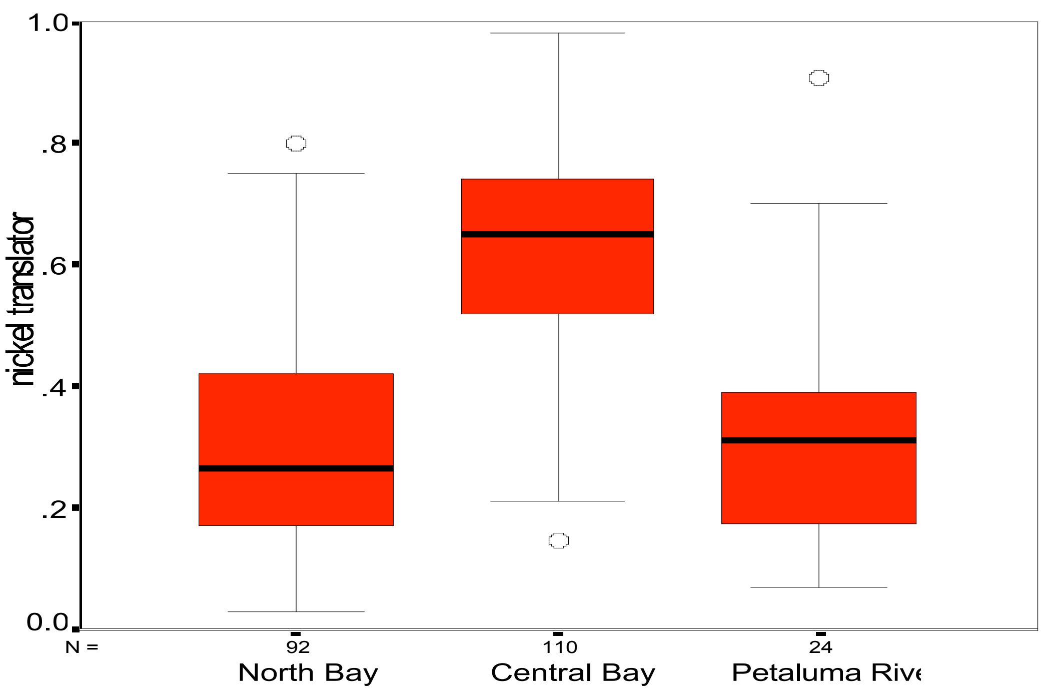


Figure 5. Nickel Translators for North Bay, Central Bay and Petaluma River Sampling Stations



In the prior Technical Memos, evaluation of pooled datasets for mudflat stations (<4m water depth) and main channel stations (>4m) and for wet season events and dry season events had shown minimal differences for these groupings. Therefore those groupings are not evaluated further.

Examples of translator results using the regression approach with median TSS values (per EPA guidance) used in the regression equations are shown in **Figures 6** and **7**. The coefficients of the regression equations are shown on the individual copper and nickel log-log XY plots. The translator value is calculated from the equation: translator = 10^(b[0] – b[1] x log(TSS)); where b[0] is the y intercept and b[1] is the slope.

Figures 6 and **7** show the regression lines with 95% confidence intervals. These intervals are very close to the regression lines. Calculating a translator using the median TSS value and the upper 95% confidence interval was estimated to only change the translator results by approximately two one hundredths (based on visual interpolation from the graphs). TSS is a surrogate for the numerous other factors that can affect the partitioning and bioavailability of dissolved metals. Given the relatively weak relationships shown in the translator TSS XY plots, and the fewer potentially convoluting variables involved, it appears appropriate to use the direct ratio method to calculate translators with these data.

Figure 6. North Bay Copper Translator Regression

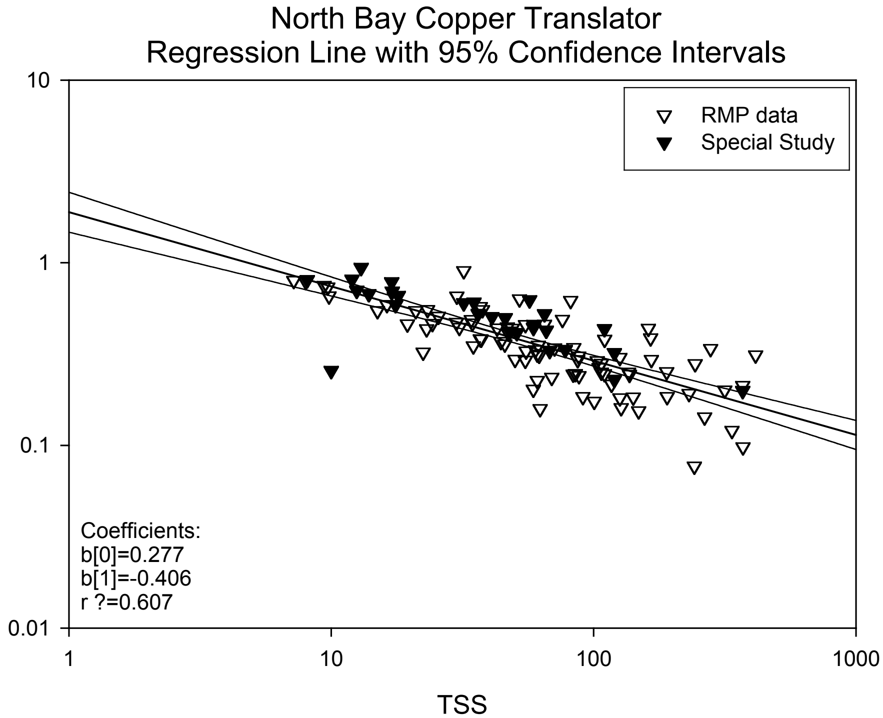
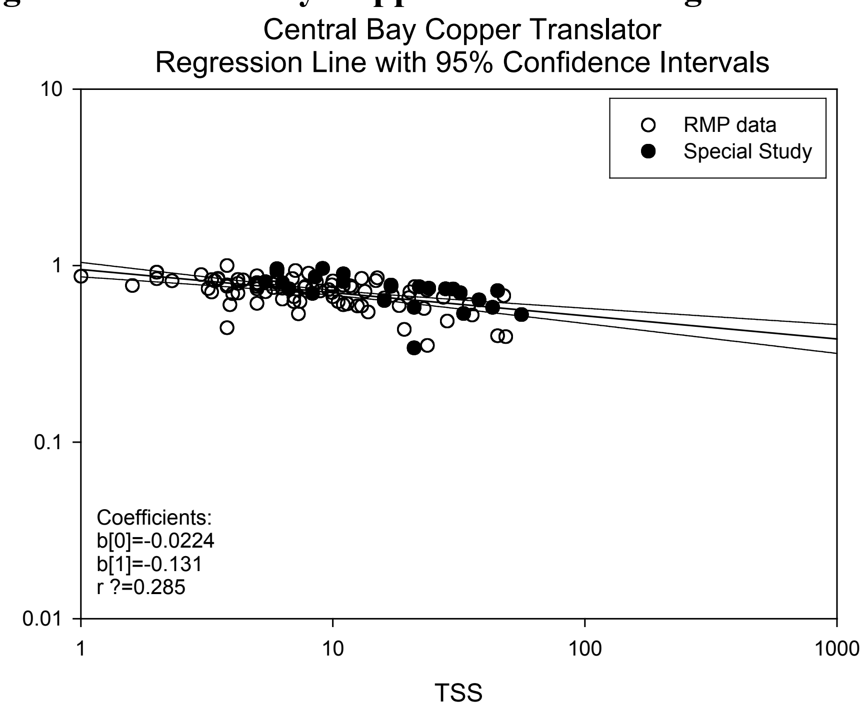


Figure 7. Central Bay Copper Translator Regression



In comparing the results from the regression approach to the direct approach (**Table 6**), the regression approach generated translator values that were typically quite similar to the corresponding "central tendency" translators (i.e., arithmetic mean, geometric mean, or median) calculated using the direct ratio approach. For copper, the regression approach using a median TSS for "all data" yielded a value of 0.52 versus a geometric mean of 0.51 for the direct ratio approach. For nickel, the equivalent regression approach yielded a value of 0.39 versus a geometric mean value of 0.38 for the direct ratio approach.

Table 6. Comparison of Regression and Direct Ratio Based Translators from Combined North of Dumbarton Bridge Study and RMP Datasets

	r^2	Median TSS, mg/l	Translator	Median of Direct Ratio Based Translators	Difference
Copper					
All Stations	0.68	22	0.52	0.60	0.08
Central Bay	0.29	8.4	0.72	0.74	0.02
North Bay	0.61	59	0.36	0.38	0.02
Nickel					
All Stations	0.62	22	0.39	0.46	0.07
Central Bay	0.35	8.4	0.61	0.65	0.04
North Bay	0.46	59	0.24	0.27	0.03

As discussed previously, the higher the r^2 value of the linear regression, the better a predictor TSS is of translator values. The r^2 values for some of the pooled data are low (pooled copper Central Bay r^2 value of 0.29 and pooled nickel Central and North Bay r^2 values of 0.35 and 0.46, respectively). As presented in the July 18, 2003 Translator Memo, most individual station translator-TSS regressions also showed only low to moderately strong correlations.

By way of comparison, the r^2 values from the Lower South Bay copper and nickel translator linear regression equations were somewhat higher at 0.72. However, there were also only very small (hundredths) differences between the South Bay regression based and direct ratio based translators.

5. CONCLUSIONS

The Step 1 NDB WER and associated station RMP data were combined, as recommended by the Coordinating Committee. Also as recommended by the CC, and consistent with the Lower South Bay translator approach, individual station data were pooled. The groupings used included Central Bay, North Bay, AllStations, and All Stations but BD15. Several observations and conclusions were drawn from the data analysis.

Moderately significant differences were observed between North and Central Bay stations (see **Figure 8** and **9**). The median North and South Bay translators (all data) were 0.38 and 0.74 for copper, and 0.27 and 0.65 for nickel, respectively. The All Stations grouping median copper results of 0.60 were slightly closer to the Central Bay results than the North Bay results. The All Stations median nickel results of 0.46 were exactly mid-way between the North and Central Bay results.

Figure 8. Copper Translators by Pooled North Bay and Central Bay Sampling Stations

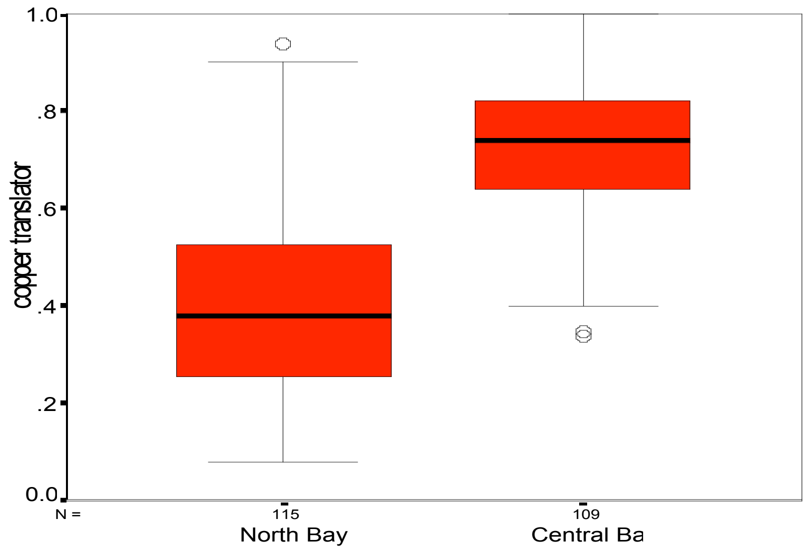
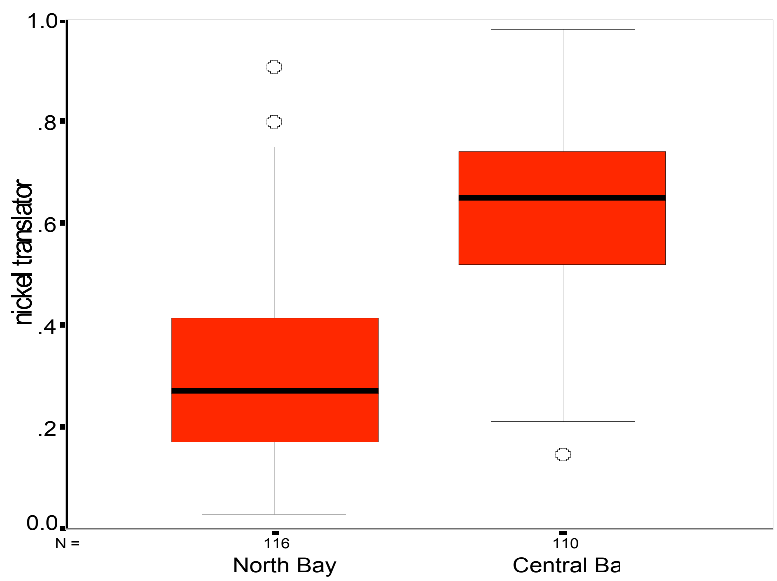


Figure 9. Nickel Translators by Pooled North Bay and Central Bay Sampling Stations



Seasonal differences did not appear to be significant. When grouped according to depth, the shallow (mudflat) stations had somewhat lower median translator values than main channel (deep) stations. However, the range and variability of the data appear very similar and the differences do not appear significant.

For the "All Stations" grouping, the regression approach, using a median TSS value in the regression equation, resulted in very similar translator values to those from any of the "central tendency" values calculated using the "direct" approach. For example, for copper, the regression approach yields a value of 0.52 versus a median value of 0.60 for the direct approach. For nickel, the regression approach yields 0.39 versus a median value of 0.46 for the direct approach. Given the low r^2 values for the regression approach it appears appropriate that the central tendency values be used to represent the translators.

Based on the above analysis, it appears that it may be appropriate to consider adoption of separate direct ratio based median and 90^{th} percentile translators for the Central Bay and North Bay areas, as defined by these pooled data.

Table 7. Potential Final Translator Values

	Copper Translator		Nickel Translator	
	Chronic (median)	Acute (90^{th} percentile)	Chronic (median)	Acute (90^{th} percentile)
Central Bay	0.74	0.88	0.65	0.85
North Bay	0.38	0.67	0.27	0.57
All Stations	0.60	0.83	0.46	0.79

Alternatively, an argument can be made that it is administratively more complicated to implement multiple translators. The All Stations values are only slightly more than one standard deviation (0.23) above and below the Central and North Bay copper values, respectively. The All Stations nickel values are less than one standard deviation (0.25) above and below the Central and North Bay copper values, respectively. Applying All Stations translators to the Central Bay could be perceived as allowing for slightly under protective conditions while applying them to the North Bay could be perceived as causing slightly overprotective conditions.

In the South Bay, selection of translator and SSO values was considered jointly, iteratively, and in the context of potential impacts on effluent limit calculations and permit compliance. Such additional analysis is included in the NDB SSO Derivation and Selection portion of this report.

This technical analysis was performed for two distinct regions of the Bay, and for all stations combined. Translators based on the RMP regional distinctions may be another option, as well as discharge-specific translator calculations. A quick analysis of translators based on the segmentation used for the development of SSOs (RMP new region classification) is provided in **Table 8**. Regional and statewide policy decisions need to be made to determine the appropriate distribution of translators.

Discussions held during workgroup meetings regarding the issue of choosing translators for the Bay NDB recognized that to date, absent regional translator policy guidance, translators have most commonly been applied on a discharger by discharger, case-by-case basis by NPDES permit writers. However, it was proposed that one or more pooled, regional translators, particularly for deep-water dischargers, may be appropriate. Shallow-water dischargers may need to evaluate site-specific translators, develop a rationale for using regional RMP-based translators, or create groupings based on shallow regions (i.e., Napa River region). Translator issues need to be addressed on a regional basis by dischargers, permit writers, Basin Plan staff, and TMDL staff.

Table 8. Alternative North of Dumbarton Copper Translators

NDB Area	Ratio Translator[1]	Ratio Translator[1] with upper 95% CI	Bay-wide Regression Equation Translator[2] (R^2=0.68)	Bay-wide Regression Translator[2] with upper 95% CI	n
Baywide	0.60	0.63	0.52	0.63	224
North Bay	0.38	0.41	0.37	0.47	115
Central Bay	0.74	0.77	0.71	0.83	109
Region 1	0.35	0.39	0.38	0.48	53
Region 2	0.44	0.49	0.36	0.45	62
Region 3	0.72	0.76	0.74	0.87	52
Region 4	0.76	0.79	0.66	0.78	57

1. Ratio translators are based on median ratio translator values for each NDB area
2. Regression translators are based on median TSS values for each NDB area

6. REFERENCES

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Appendix A

Data used in Translator Calculations

Total Copper, µg/L

Station	Location	No.	min	max	90th %ile	median	avg mean	geo mean	std dev
BA40	Redwood Creek	27	2.10	4.33	3.93	2.97	3.05	2.99	0.62
BB15	San Bruno	23	1.31	4.14	3.56	2.58	2.62	2.52	0.75
LCB01	L. Central Bay (mid-point on transect)	4	3.02	5.05	4.73	3.53	3.78	3.69	0.95
LCB02	L. Central Bay (near shore on transect)	4	3.41	4.70	4.52	3.97	4.01	3.99	0.54
BB30	Oyster Point	27	0.96	3.40	3.17	2.28	2.18	2.06	0.70
BC10	Yerba Buena Island	27	0.82	3.66	2.38	1.80	1.92	1.85	0.54
BD20	San Pablo Bay	27	2.13	14.3	9.22	4.50	5.47	4.72	3.08
SPB01	SPB between BD15 & BD20	4	2.70	7.53	6.56	3.50	4.31	3.92	2.27
BD15	Petaluma River (western SPB)	24	0.57	21.6	17.0	9.40	10.5	8.68	5.39
SPB02	Eastern SPB (mid-point on transect)	4	3.12	6.08	5.86	4.78	4.69	4.54	1.30
SPB03	Eastern SPB (near shore on transect)	4	2.60	6.56	6.02	4.36	4.47	4.23	1.66
BF10	Pacheco Creek	27	2.49	8.10	7.68	5.01	5.21	4.95	1.63
BF20	Grizzly Bay	27	1.70	15.30	10.1	5.31	6.26	5.62	3.05

Dissolved Copper, µg/L

Station	Location	No.	min	max	90th %ile	median	avg mean	geo mean	std dev
BA40	Redwood Creek	27	1.40	3.29	2.87	2.25	2.23	2.19	0.46
BB15	San Bruno	24	1.30	2.96	2.59	1.94	1.93	1.88	0.46
LCB01	L. Central Bay (mid-point on transect)	4	2.45	2.79	2.76	2.58	2.60	2.59	0.17
LCB02	L. Central Bay (near shore on transect)	4	2.48	3.02	2.95	2.77	2.76	2.75	0.22
BB30	Oyster Point	27	0.90	2.70	2.20	1.60	1.59	1.52	0.49
BC10	Yerba Buena Island	27	0.80	1.94	1.66	1.20	1.26	1.23	0.29
BD20	San Pablo Bay	27	1.10	2.54	2.13	1.60	1.70	1.66	0.37
SPB01	SPB between BD15 & BD20	4	1.79	2.54	2.53	2.47	2.32	2.29	0.36
BD15	Petaluma River (western SPB)	24	2.20	4.77	4.28	3.42	3.36	3.27	0.79
SPB02	Eastern SPB (mid-point on transect)	4	1.88	3.41	3.23	2.42	2.53	2.46	0.72
SPB03	Eastern SPB (near shore on transect)	4	2.01	3.44	3.24	2.40	2.56	2.50	0.68
BF10	Pacheco Creek	27	1.20	2.83	2.67	1.90	1.94	1.88	0.50
BF20	Grizzly Bay	27	1.10	2.80	2.75	1.95	1.97	1.91	0.51

Copper Translator

Station	Location	No.	min	max	90th %ile	median	avg mean	geo mean	std dev
BA40	Redwood Creek	27	0.40	0.96	0.90	0.76	0.75	0.73	0.13
BB15	San Bruno	22	0.53	0.88	0.84	0.77	0.75	0.74	0.10
LCB01	L. Central Bay (mid-point on transect)	4	0.53	0.81	0.81	0.75	0.71	0.70	0.13
LCB02	L. Central Bay (near shore on transect)	4	0.53	0.81	0.79	0.73	0.70	0.69	0.12
BB30	Oyster Point	26	0.35	0.96	0.93	0.75	0.74	0.73	0.15
BC10	Yerba Buena Island	26	0.34	1.00	0.81	0.68	0.67	0.65	0.14
BD20	San Pablo Bay	27	0.08	0.81	0.74	0.38	0.41	0.35	0.22
SPB01	SPB between BD15 & BD20	4	0.32	0.94	0.86	0.62	0.63	0.59	0.25
BD15	Petaluma River (western SPB)	23	0.12	0.90	0.62	0.38	0.38	0.34	0.19
SPB02	Eastern SPB (mid-point on transect)	4	0.33	0.81	0.75	0.56	0.57	0.54	0.20
SPB03	Eastern SPB (near shore on transect)	4	0.42	0.78	0.76	0.61	0.61	0.59	0.16
BF10	Pacheco Creek	27	0.16	0.79	0.61	0.36	0.41	0.38	0.16
BF20	Grizzly Bay	26	0.10	0.67	0.51	0.33	0.35	0.32	0.14

Total Nickel, µg/L

Station	Location	No.	min	max	90th %ile	median	avg mean	geo mean	std dev
BA40	Redwood Creek	27	2.10	10.4	5.62	3.88	4.32	4.02	1.92
BB15	San Bruno	23	1.34	6.20	4.73	3.07	3.22	2.99	1.29
LCB01	L. Central Bay (mid-point on transect)	4	3.14	7.53	6.50	4.04	4.69	4.43	1.94
LCB02	L. Central Bay (near shore on transect)	4	4.44	6.56	6.35	5.23	5.36	5.29	1.03
BB30	Oyster Point	27	1.11	8.50	4.35	2.59	2.86	2.52	1.65
BC10	Yerba Buena Island	27	1.09	3.81	3.33	2.40	2.38	2.27	0.70
BD20	San Pablo Bay	27	2.17	30.0	16.9	6.40	8.57	6.70	6.70
SPB01	SPB between BD15 & BD20	4	2.40	10.8	9.07	4.19	5.39	4.57	3.77
BD15	Petaluma River (western SPB)	24	5.60	47.6	38.5	20.5	22.1	18.7	12.1
SPB02	Eastern SPB (mid-point on transect)	4	3.74	9.39	8.74	5.71	6.14	5.71	2.67
SPB03	Eastern SPB (near shore on transect)	4	2.95	8.96	8.56	6.04	6.00	5.47	2.78
BF10	Pacheco Creek	27	2.80	16.6	11.3	6.30	7.21	6.52	3.37
BF20	Grizzly Bay	27	3.20	24.1	14.8	8.70	9.06	7.86	5.16

Dissolved Nickel, µg/L

Station	Location	No.	min	max	90th %ile	median	avg mean	geo mean	std dev
BA40	Redwood Creek	27	1.70	3.8	3.02	2.19	2.35	2.30	0.54
BB15	San Bruno	24	1.20	3.2	2.30	1.90	1.92	1.87	0.45
LCB01	L. Central Bay (mid-point on transect)	4	2.27	3.6	3.58	2.96	2.95	2.89	0.70
LCB02	L. Central Bay (near shore on transect)	4	2.15	3.9	3.82	3.07	3.04	2.93	0.89
BB30	Oyster Point	27	1.00	3.0	2.28	1.60	1.66	1.59	0.51
BC10	Yerba Buena Island	27	0.99	2.4	2.04	1.23	1.37	1.33	0.40
BD20	San Pablo Bay	27	1.00	3.7	2.56	1.63	1.81	1.73	0.60
SPB01	SPB between BD15 & BD20	4	1.95	3.2	3.02	2.53	2.56	2.52	0.52
BD15	Petaluma River (western SPB)	24	1.70	37.4	11.4	4.05	6.64	4.83	7.49
SPB02	Eastern SPB (mid-point on transect)	4	2.19	3.2	3.14	2.92	2.80	2.77	0.44
SPB03	Eastern SPB (near shore on transect)	4	2.22	3.1	3.06	2.81	2.73	2.70	0.41
BF10	Pacheco Creek	27	0.70	3.8	2.66	1.48	1.64	1.52	0.72
BF20	Grizzly Bay	27	0.80	4.5	2.50	1.40	1.62	1.47	0.84

Nickel Translator

Station	Location	No.	min	max	90th %ile	median	avg mean	geo mean	std dev
BA40	Redwood Creek	27	0.21	0.9	0.82	0.63	0.61	0.57	0.19
BB15	San Bruno	22	0.25	0.9	0.83	0.67	0.64	0.62	0.17
LCB01	L. Central Bay (mid-point on transect)	4	0.46	0.9	0.86	0.66	0.67	0.65	0.19
LCB02	L. Central Bay (near shore on transect)	4	0.33	0.9	0.80	0.58	0.59	0.55	0.23
BB30	Oyster Point	26	0.15	0.9	0.89	0.68	0.66	0.62	0.19
BC10	Yerba Buena Island	27	0.32	1.0	0.78	0.58	0.60	0.58	0.16
BD20	San Pablo Bay	27	0.04	0.8	0.70	0.26	0.33	0.26	0.22
SPB01	SPB between BD15 & BD20	4	0.30	1.0	0.88	0.55	0.60	0.55	0.29
BD15	Petaluma River (western SPB)	24	0.07	0.9	0.54	0.31	0.31	0.26	0.20
SPB02	Eastern SPB (mid-point on transect)	4	0.34	0.7	0.67	0.47	0.51	0.49	0.17
SPB03	Eastern SPB (near shore on transect)	4	0.34	0.8	0.70	0.49	0.52	0.49	0.19
BF10	Pacheco Creek	27	0.06	0.6	0.48	0.24	0.27	0.23	0.14
BF20	Grizzly Bay	27	0.03	0.5	0.39	0.19	0.22	0.19	0.12

TSS Concentration, mg/L

Station	Location	No.	min	max	90th %ile	median	avg mean	geo mean	std dev
BA40	Redwood Creek	27	2.00	48.5	34.8	14.8	16.8	12.6	12.9
BB15	San Bruno	23	2.00	38.0	32.6	6.3	10.9	7.70	10.9
LCB01	L. Central Bay (mid-point on transect)	4	6.30	33.0	32.7	21.5	20.6	16.4	13.9
LCB02	L. Central Bay (near shore on transect)	4	5.40	56.0	52.7	37.5	34.1	25.3	21.9
BB30	Oyster Point	27	1.00	43.0	25.2	7.0	10.3	7.00	9.97
BC10	Yerba Buena Island	27	2.30	23.0	19.9	7.7	9.54	7.79	6.14
BD20	San Pablo Bay	27	7.20	242	142	37.3	66.4	40.4	62.0
SPB01	SPB between BD15 & BD20	4	13.0	120	89.4	17.8	42.2	26.5	51.9
BD15	Petaluma River (western SPB)	24	32.0	414	360	136	173	130	124
SPB02	Eastern SPB (mid-point on transect)	4	12.0	68.0	58.5	34.2	37.1	31.2	23.2
SPB03	Eastern SPB (near shore on transect)	4	17.0	65.0	59.9	32.6	36.8	30.9	23.8
BF10	Pacheco Creek	27	8.00	127	115	49.0	59.3	48.7	34.6
BF20	Grizzly Bay	27	10.0	371	138	60.0	75.7	55.8	71.5

Appendix B

Response to Comments

1) Richard Looker Comment: I thought the report was fine.

Response: *No response necessary.*

2) City of San Jose Comment: The City of San José (City) appreciates the opportunity to submit comments on the Clean Estuary Partnership (CEP) report entitled *North of Dumbarton Bridge Copper and Nickel Development and Selection of Final Translators* (Translator Report) on behalf of the City and the San José/Santa Clara Water Pollution Control Plant. The City supports CEP's effort to develop technically defensible site-specific translators for San Francisco Bay north of the Dumbarton Bridge (NDB). City staff has reviewed the Translator Report and offers the following observations and comments.

Response: *No response necessary.*

3) City of San Jose Comment: The Translator Report is well written, concise, and easy to follow. The authors used appropriate, current Environmental Protection Agency and State Implementation Policy guidelines for deriving translators. The City concurs with the report's contention that regression analysis showed only a low to moderate relationship between copper and nickel translator values and TSS. Therefore, the City supports the use of the direct ratio approach for deriving NDB translators. The City supports the use of all available copper, nickel, and suspended solids data, including Regional Monitoring Program data. The City also concurs with the Coordinating Committee's recommendation that individual station data be pooled. However, the City believes that translators should be derived for each Bay Region.

The discussion of regional translators should precede the selection of final NDB translators. The derivation of chronic (using median values) regional translators (Table 1) for copper illustrates the appropriateness of combining Bay Region 3 and 4 translator results to derive a "Central Bay" translator. It also illustrates the need to further evaluate the appropriateness of combining copper translator data for Regions 1 & 2. Separate translators may be appropriate for San Pablo and Suisun Bays.

Response: *A brief discussion of regional translators has been incorporated. At this time, regional policy decisions need to be made regarding regional translators versus discharge-specific translators versus some other means of grouping translator values.*

4) City of San Jose Comment: Similar to the copper translators (shown in Table 1), regional translators should also be derived for nickel.

Response: *The same protocols applied for copper will be used for nickel translators.*

5) City of San Jose Comment: The City will continue to actively participate in the review of the NDB approach to SSOs, translators, triggers, and action plan development. San José supports equity among regulatory approaches throughout San Francisco Bay. Therefore, the City supports combining the development of the NDB Water Quality Attainment Strategy (WQAS) with a review of the WQAS for the South Bay during the Basin Planning process. The City looks forward to participating in development of consistent Bay-wide policies.

Response: *Attempts will be made to approach the WQAS as a joint effort.*