



Savannah Harbor Expansion Project

Evaluation of Chloride Impacts with
Proposed Mitigation Plan

December 2007

Introduction

This report summarizes the results of chloride impacts on Abercorn Creek at the City of Savannah's water intake pipe with implementation of the proposed mitigation plan to alter flows in the estuary at each alternative navigation channel depth (44 ft, 45 ft, 46 ft, and 48 ft). The two proposed plans are: Plan 6b for the 44 ft depth, and Plan 6a for the 45 ft, 46 ft, and 48 ft depths. Details of each of the mitigation plans are shown in Figures 1 and 2. For details on how these plans were developed and selected, please see the main report document for this project.

Figure 1: Plan 6a (proposed mitigation for 45 ft, 46 ft and 48 ft channel depths)

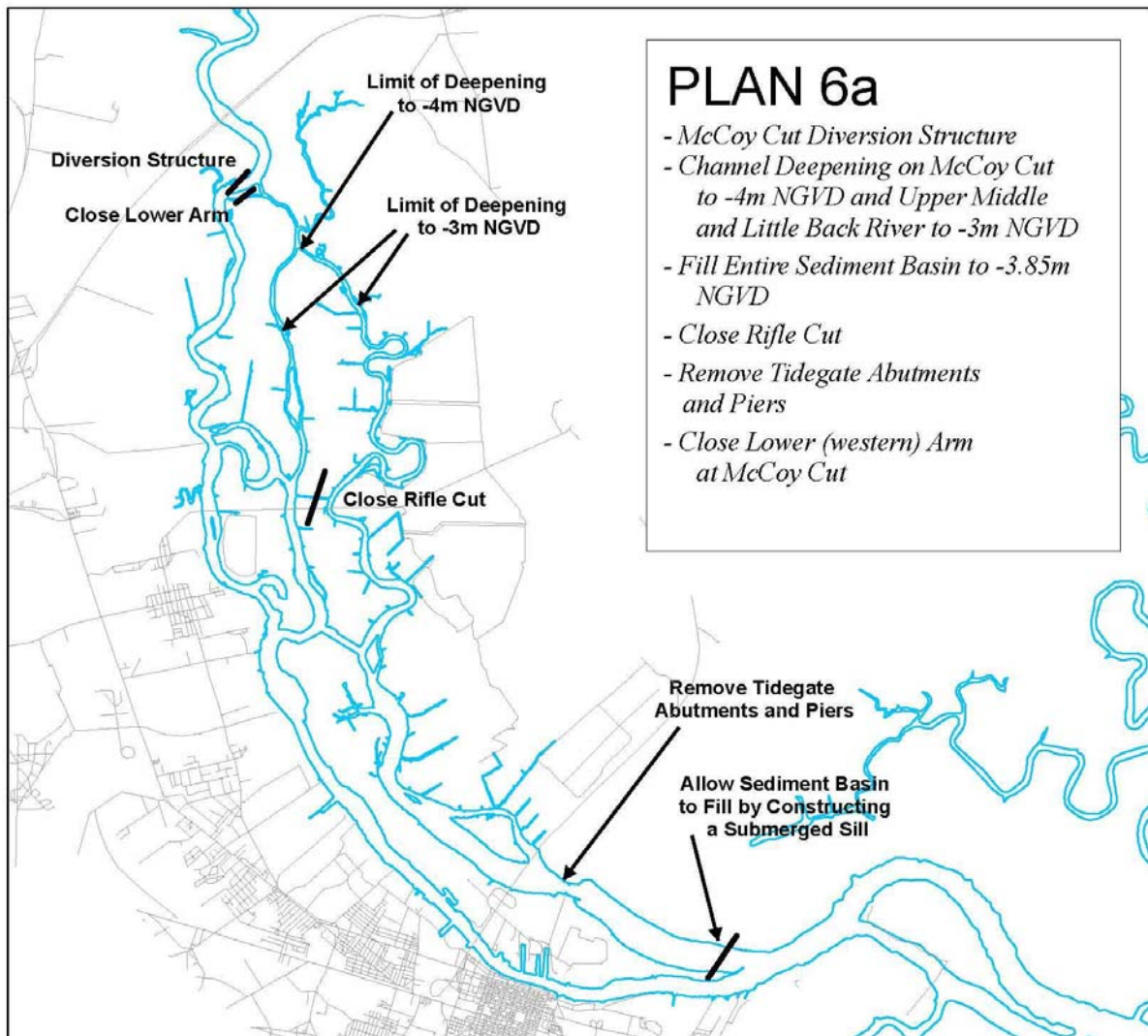
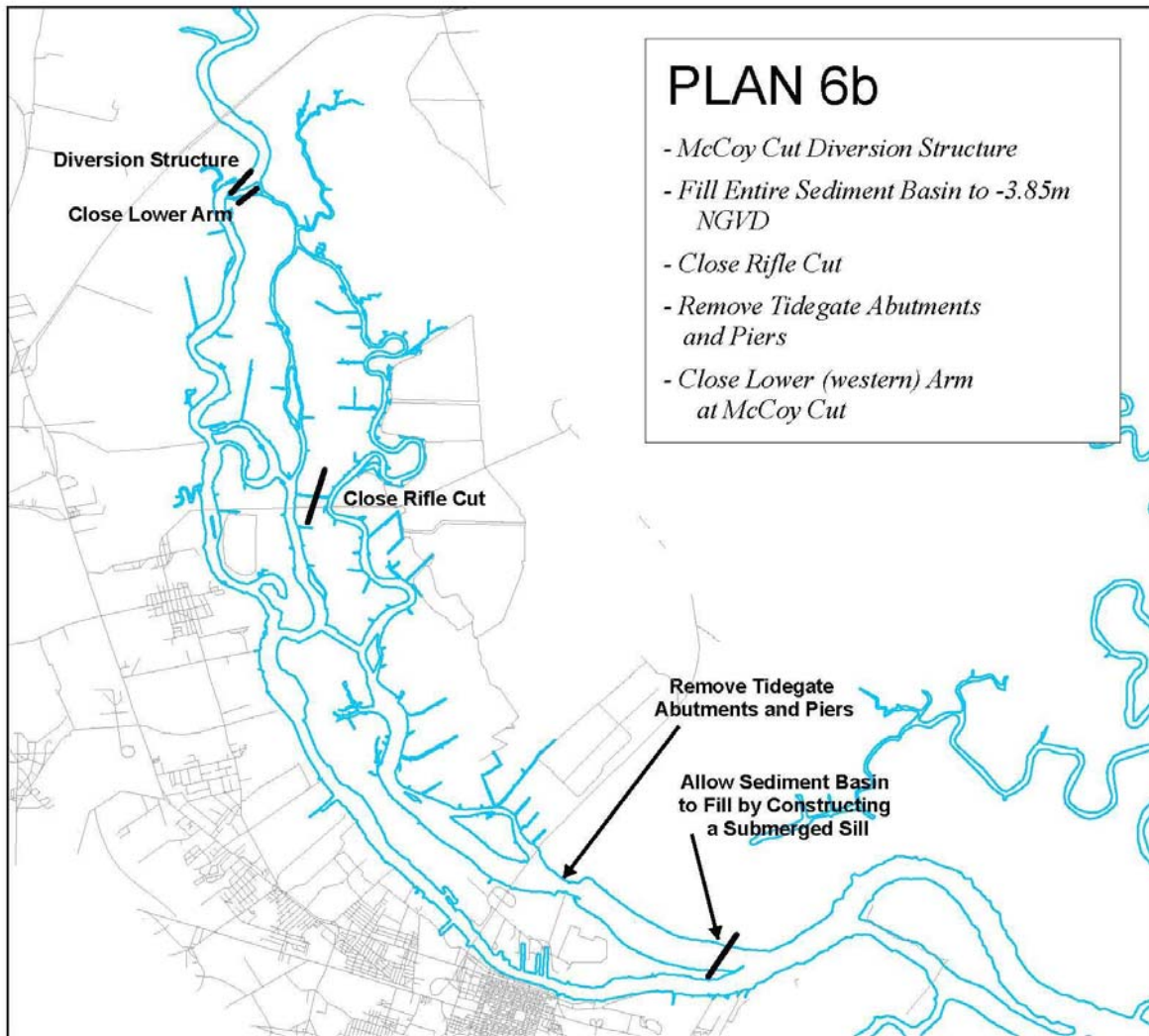


Figure 2: Plan 6b (proposed mitigation for 44 ft channel depth)



Hydrodynamic Model Input

The plans were evaluated using the 3D hydrodynamic model EFDC, which predicts salinity values. The salinity values are then converted to chlorides. The calculations for linking salinity values and chloride values are described in *Savannah Harbor Expansion Project- Chloride Data Analysis and Model Development* report dated November 15, 2006 prepared by Tetra Tech.

The run period and flow parameters are shown below and were specified by the Savannah Harbor Expansion Water Quality Technical Evaluation Group and have been consistent throughout the study process. The group developed two model input scenarios for evaluation (See Table 1).

Table 1: Model Input Conditions

<i>Run Scenario</i>	<i>River Flow</i>	<i>Evaluation Period</i>
Basic Evaluation	<i>Critical Flow Conditions</i>	<i>1-May to 1-November 1999</i>
Sensitivity Analysis #1	<i>Average Flow Conditions</i>	<i>1-May to 1-November 1997</i>
*Sensitivity Analysis #2	<i>Low Flow Conditions</i>	<i>1-May to 1-November 2001</i>

**Sensitivity Analysis #2 was evaluated in addition to the two scenarios proposed by the technical evaluation group, because it has lower freshwater flows than that of 1999 and indicates a greater chloride impact on Abercorn Creek.*

Output Presented

This report includes analysis of chloride values on Abercorn Creek near the City of Savannah’s water intake pipe. All output was evaluated in the hydrodynamic model (EFDC) at cell 8_130, which is representative of the water quality conditions at the City’s intake pipe. The analysis includes tables showing (1) percent exceedance chloride values, (2) maximum and minimum chloride values and (3) number of days the chloride values are greater than 12 ppm. There are also three figures at the end of the report that show the percent exceedance chloride values presented in the tables in graphic form for each of the three run scenarios. All chloride values presented in the output are in units of ppm.

Results

The results of the analysis show that there is little impact expected on chloride values near the City’s intake pipe. The graphics make for a quick interpretation of the results and show the obvious slight impact to the chloride values. The largest increases in chlorides were found during the low flow period of 2001. At 1 percent exceedance the chloride value increase is less than 0.4 ppm with the 48 ft channel deepening. There are no changes in the number of days the chloride values are above 12 ppm when comparing existing conditions and proposed channel geometries. When viewing the three flow conditions, it becomes apparent that lower freshwater flow conditions contribute to higher salinity values in the harbor and thus chloride values at the City’s intake increase as well. The number of days that the chloride value is above 12 ppm jumps from 95 to 180 when you compare average and drought flow conditions.

Conclusion

In summary, Mitigation Plans 6a and 6b are the proposed flow altering mitigation plans to reduce impacts in the estuary. The model results show that chloride values do increase at the intake, despite mitigation efforts, but the increases are certainly not significant. The variability of chlorides at the City’s intake is highly dependent on freshwater flow conditions, much more so than deepening the navigation channel.

Basic Evaluation

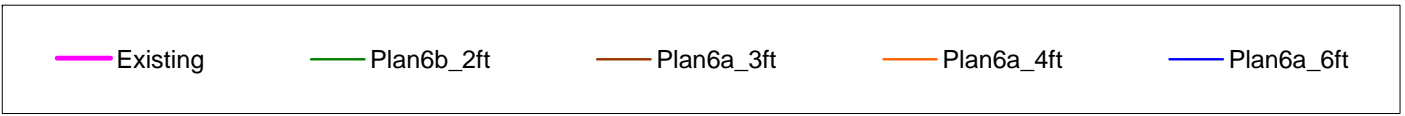
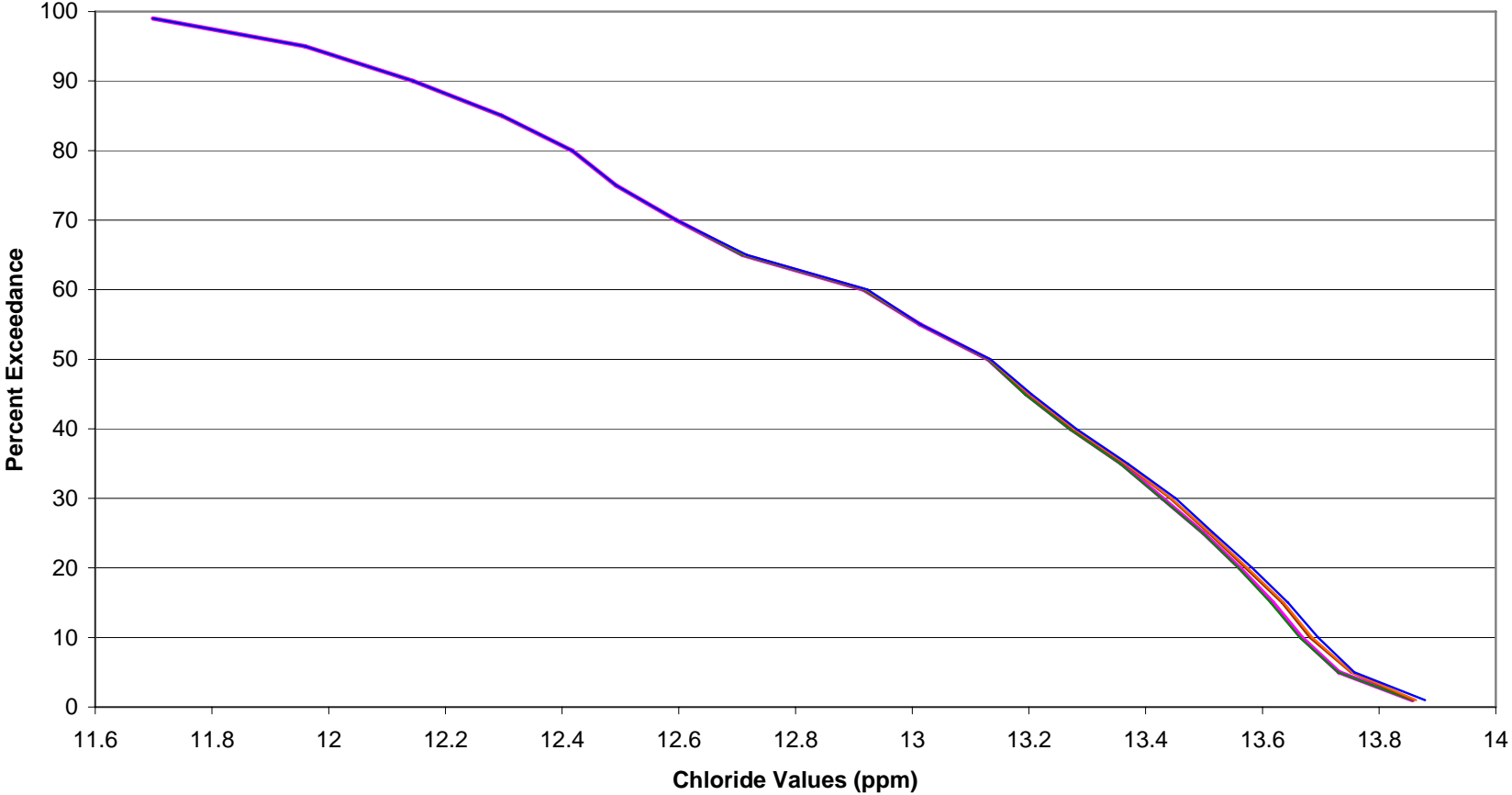
Simulation Period: May 1, 1999 to November 1, 1999

Percent Exceedance	Existing Conditions No Deepening No Mitigation	44 ft Channel Depth Mitigation Plan 6b	45 ft Channel Depth Mitigation Plan 6a	46 ft Channel Depth Mitigation Plan 6a	48 ft Channel Depth Mitigation Plan 6a
99	11.70	11.70	11.70	11.70	11.70
95	11.96	11.96	11.96	11.96	11.96
90	12.14	12.14	12.14	12.14	12.14
85	12.30	12.30	12.30	12.30	12.30
80	12.42	12.42	12.42	12.42	12.42
75	12.49	12.49	12.49	12.49	12.49
70	12.60	12.60	12.60	12.60	12.60
65	12.71	12.71	12.71	12.71	12.72
60	12.92	12.92	12.92	12.92	12.92
55	13.01	13.01	13.01	13.01	13.01
50	13.13	13.13	13.13	13.13	13.13
45	13.20	13.19	13.20	13.20	13.20
40	13.27	13.27	13.28	13.28	13.28
35	13.36	13.36	13.36	13.37	13.37
30	13.43	13.43	13.44	13.44	13.45
25	13.50	13.50	13.51	13.51	13.52
20	13.56	13.56	13.57	13.57	13.58
15	13.62	13.61	13.63	13.64	13.64
10	13.67	13.66	13.68	13.69	13.70
5	13.73	13.73	13.75	13.75	13.76
1	13.86	13.86	13.86	13.86	13.88
Maximum	13.88	13.88	13.89	13.89	13.90
Minimum	11.63	11.63	11.63	11.63	11.63
# days above 12ppm	173	173	173	173	173

All values presented are chloride parts per million (ppm).

CHLORIDE MITIGATION PLANS EVALUATION RESULTS

Basic Evaluation #1- 1999



Sensitivity Analysis #1

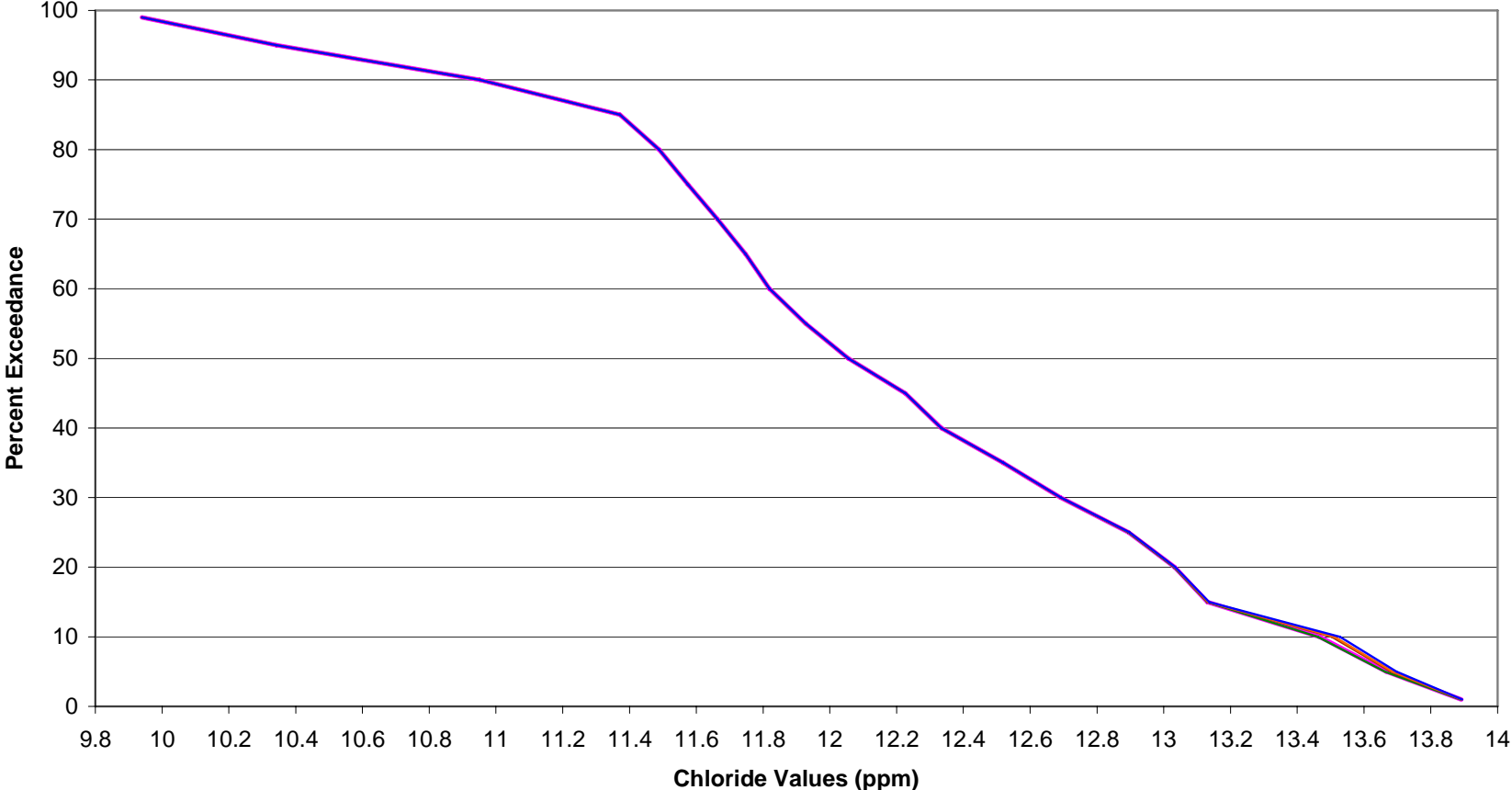
Simulation Period: May 1, 1997 to November 1, 1997

Percent Exceedance	Existing Conditions No Deepening No Mitigation	44 ft Channel Depth Mitigation Plan 6b	45 ft Channel Depth Mitigation Plan 6a	46 ft Channel Depth Mitigation Plan 6a	48 ft Channel Depth Mitigation Plan 6a
99	9.94	9.94	9.94	9.94	9.94
95	10.34	10.34	10.34	10.34	10.34
90	10.95	10.95	10.95	10.95	10.95
85	11.37	11.37	11.37	11.37	11.37
80	11.49	11.49	11.49	11.49	11.49
75	11.57	11.57	11.57	11.57	11.57
70	11.66	11.66	11.66	11.66	11.66
65	11.75	11.75	11.75	11.75	11.75
60	11.82	11.82	11.82	11.82	11.82
55	11.93	11.93	11.93	11.93	11.93
50	12.06	12.06	12.06	12.06	12.06
45	12.23	12.23	12.23	12.23	12.23
40	12.33	12.33	12.33	12.33	12.33
35	12.52	12.52	12.52	12.52	12.52
30	12.69	12.69	12.69	12.69	12.69
25	12.90	12.89	12.90	12.90	12.90
20	13.03	13.03	13.03	13.03	13.03
15	13.13	13.13	13.13	13.13	13.14
10	13.47	13.46	13.50	13.51	13.53
5	13.67	13.66	13.68	13.69	13.70
1	13.89	13.89	13.89	13.89	13.89
Maximum	13.98	13.97	13.98	13.98	13.98
Minimum	9.92	9.92	9.92	9.92	9.92
# days above 12ppm	95	95	95	95	95

All values presented are chloride parts per million (ppm).

CHLORIDE MITIGATION PLANS EVALUATION RESULTS

Sensitivity Analysis #1- 1997



Sensitivity Analysis #2

Simulation Period: May 1, 2001 to November 1, 2001

Percent Exceedance	Existing Conditions No Deepening No Mitigation	44 ft Channel Depth Mitigation Plan 6b	45 ft Channel Depth Mitigation Plan 6a	46 ft Channel Depth Mitigation Plan 6a	48 ft Channel Depth Mitigation Plan 6a
99	11.48	11.50	11.50	11.50	11.50
95	12.90	12.91	12.91	12.91	12.91
90	13.36	13.36	13.37	13.37	13.38
85	13.51	13.51	13.52	13.52	13.52
80	13.65	13.64	13.66	13.66	13.67
75	13.74	13.73	13.75	13.76	13.76
70	13.83	13.83	13.84	13.84	13.84
65	13.90	13.89	13.90	13.91	13.91
60	13.96	13.96	13.97	13.97	13.98
55	14.00	14.00	14.03	14.03	14.05
50	14.04	14.03	14.06	14.06	14.08
45	14.07	14.07	14.10	14.11	14.13
40	14.13	14.13	14.15	14.16	14.19
35	14.17	14.17	14.22	14.24	14.27
30	14.22	14.21	14.27	14.29	14.32
25	14.28	14.27	14.33	14.34	14.38
20	14.35	14.35	14.41	14.42	14.44
15	14.45	14.45	14.48	14.49	14.53
10	14.50	14.50	14.55	14.57	14.61
5	14.53	14.53	14.63	14.66	14.73
1	14.58	14.58	14.78	14.82	14.92
Maximum	14.66	14.65	14.92	14.98	15.10
Minimum	11.28	11.28	11.28	11.28	11.28
# days above 12ppm	180	180	180	180	180

All values presented are chloride parts per million (ppm).

CHLORIDE MITIGATION PLANS EVALUATION RESULTS

Sensitivity Analysis #2- 2001

