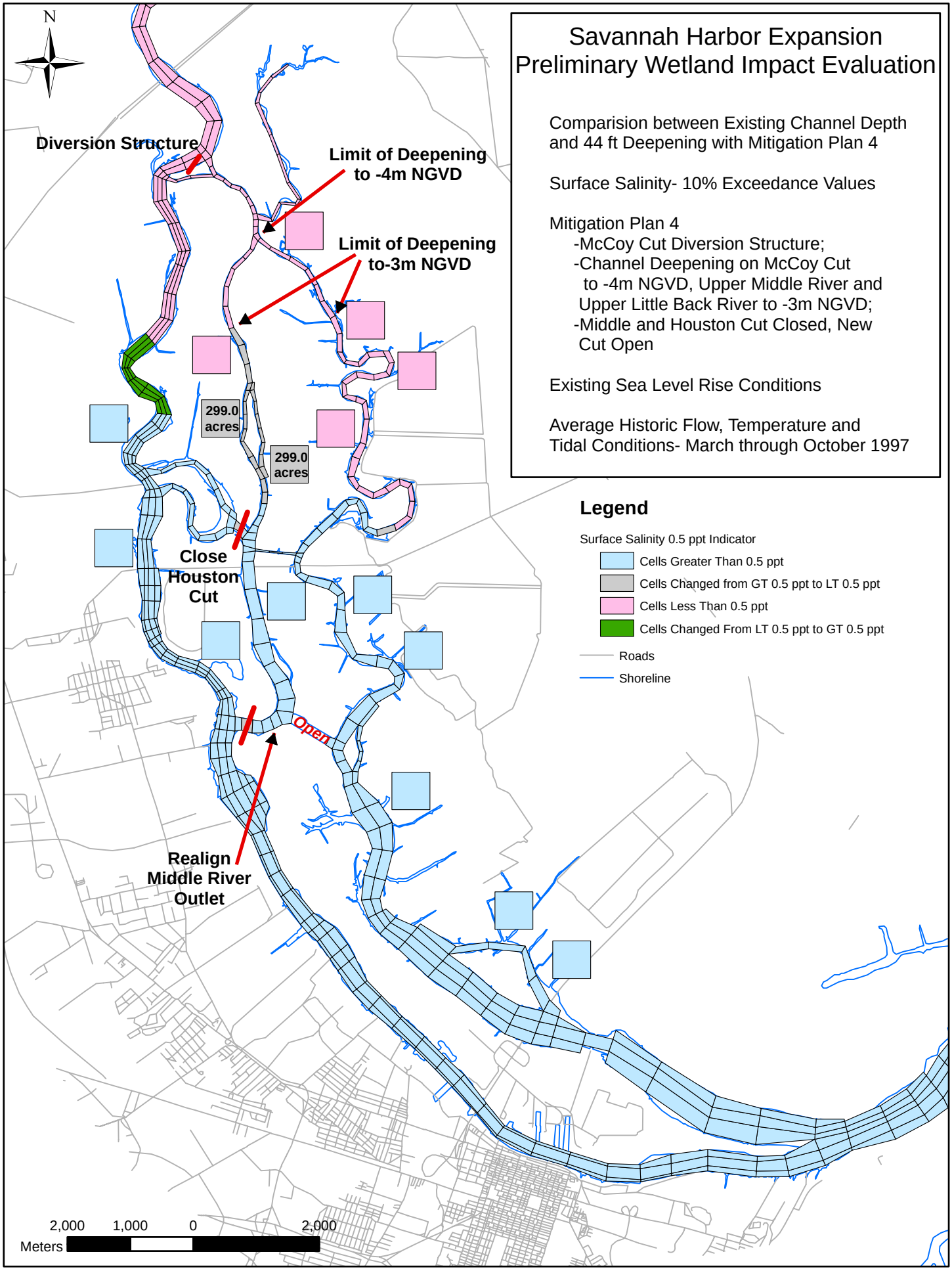
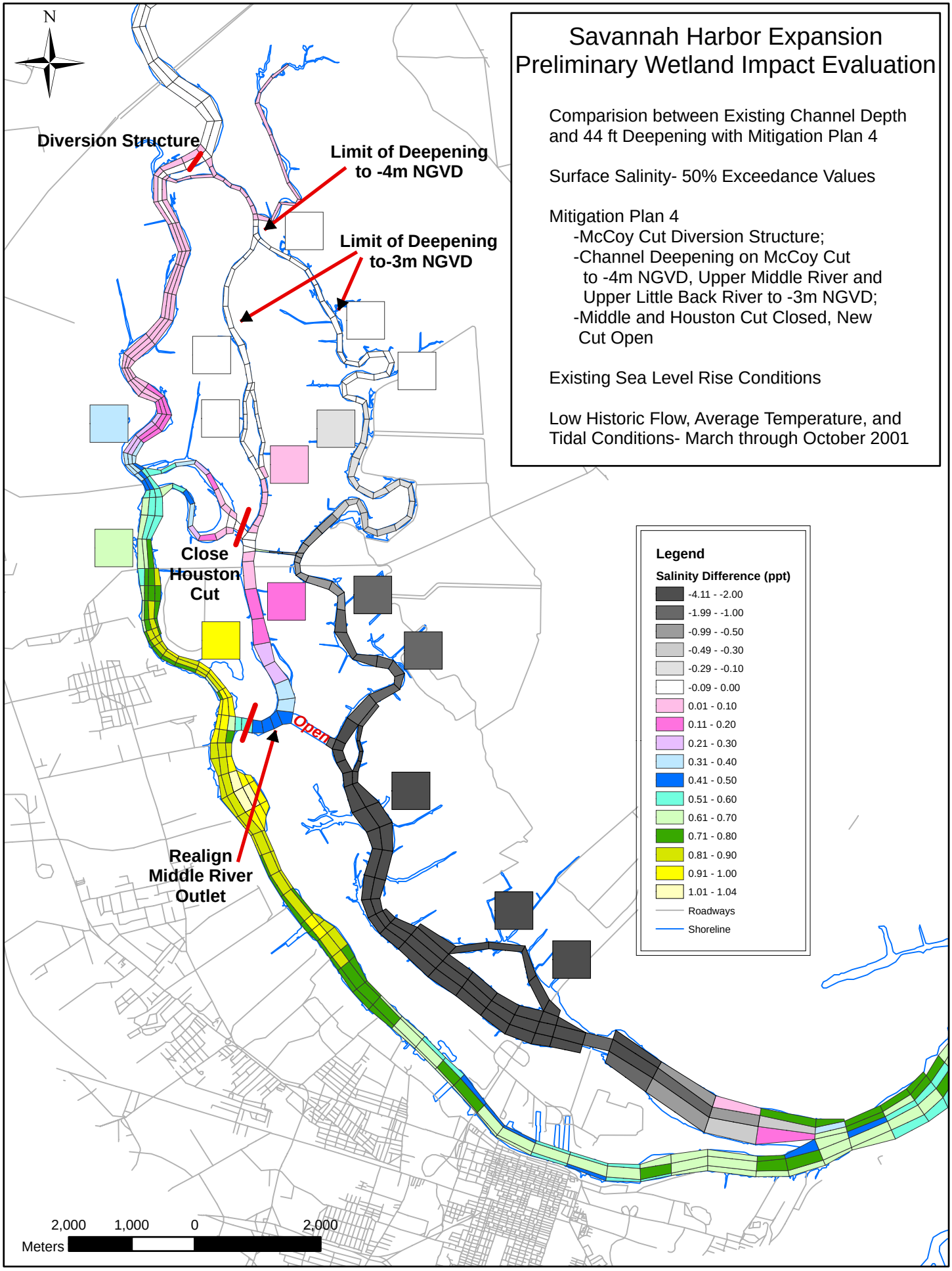
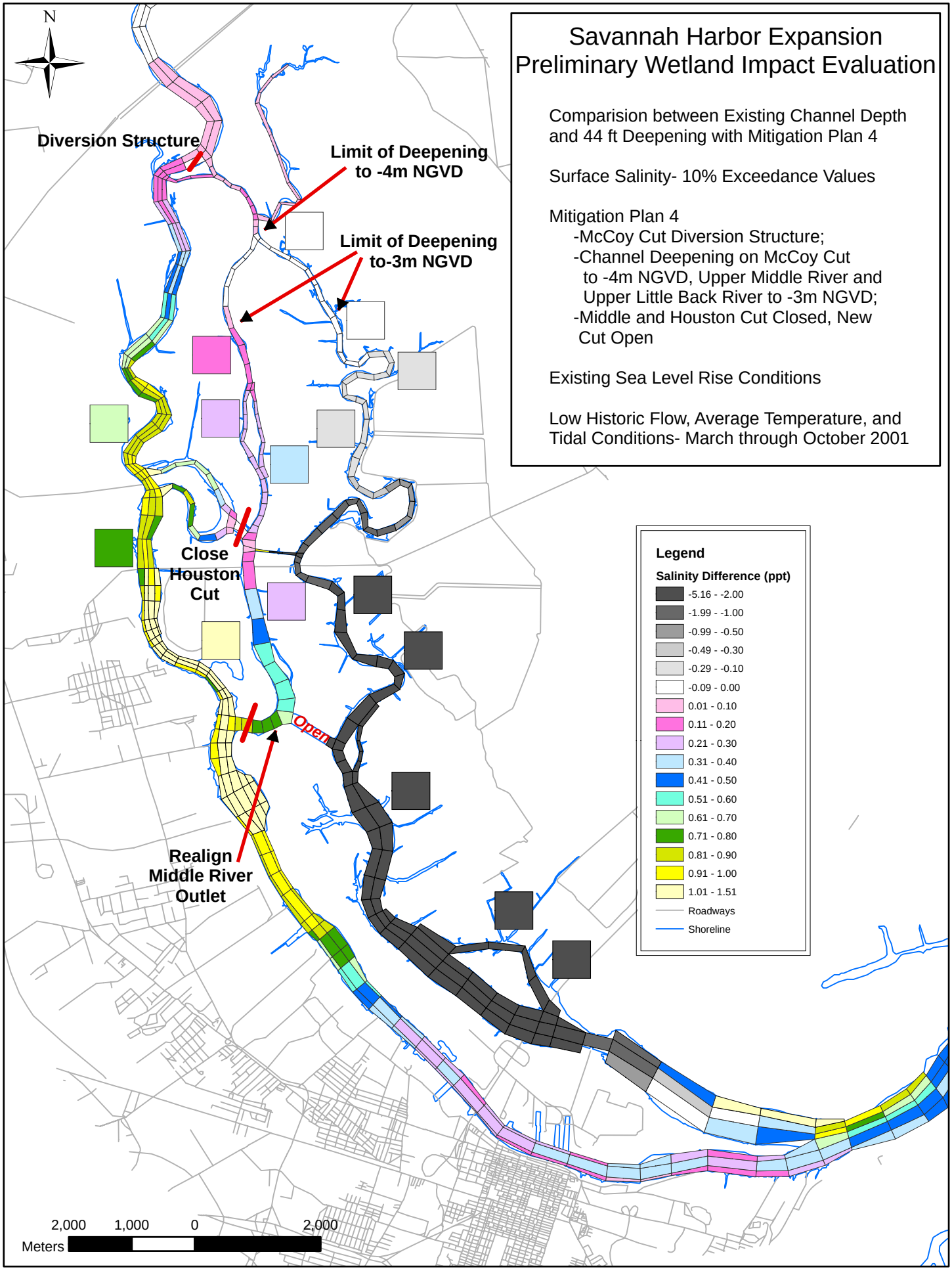


January 2007

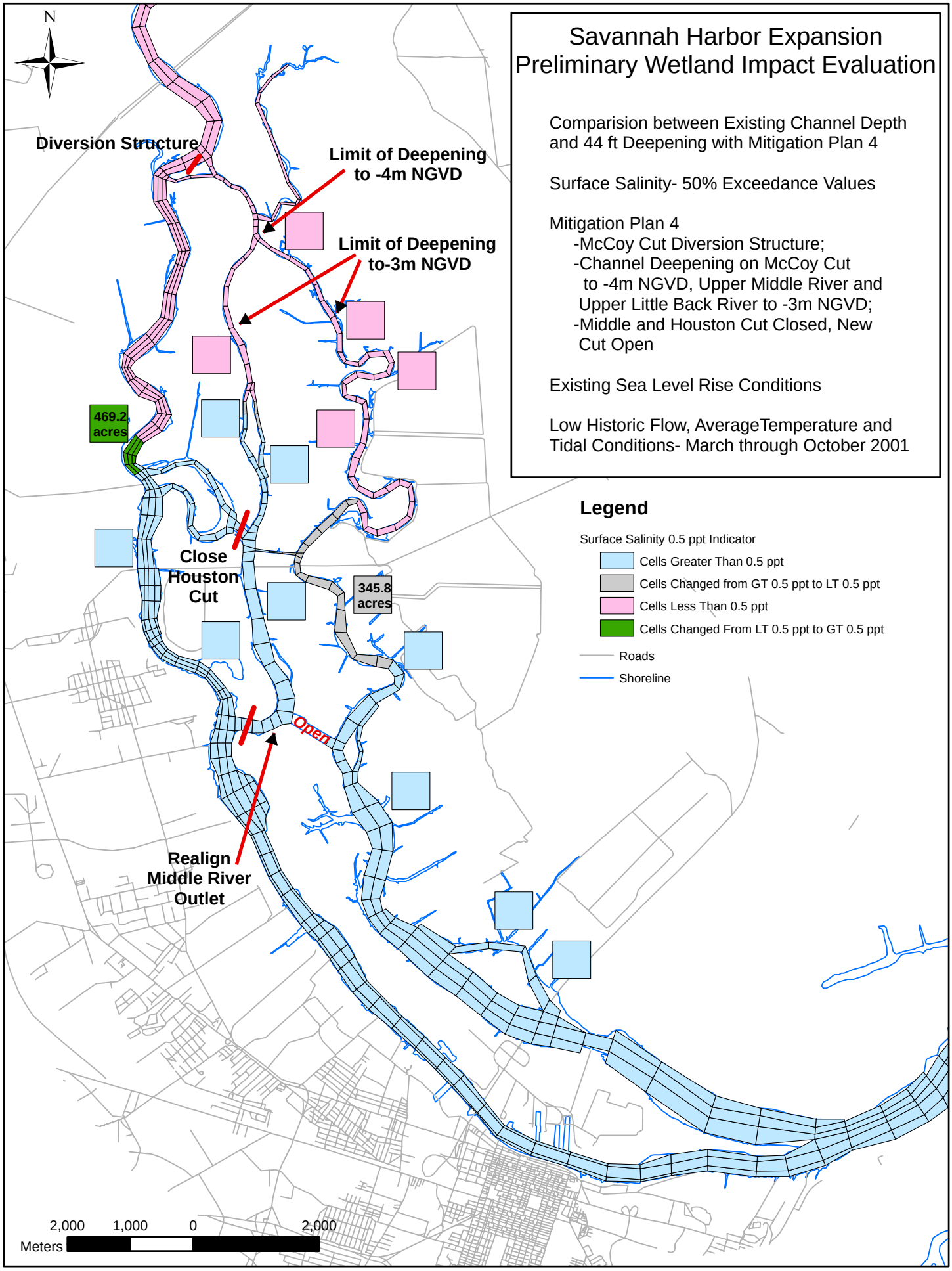
Sensitivity Analysis #1



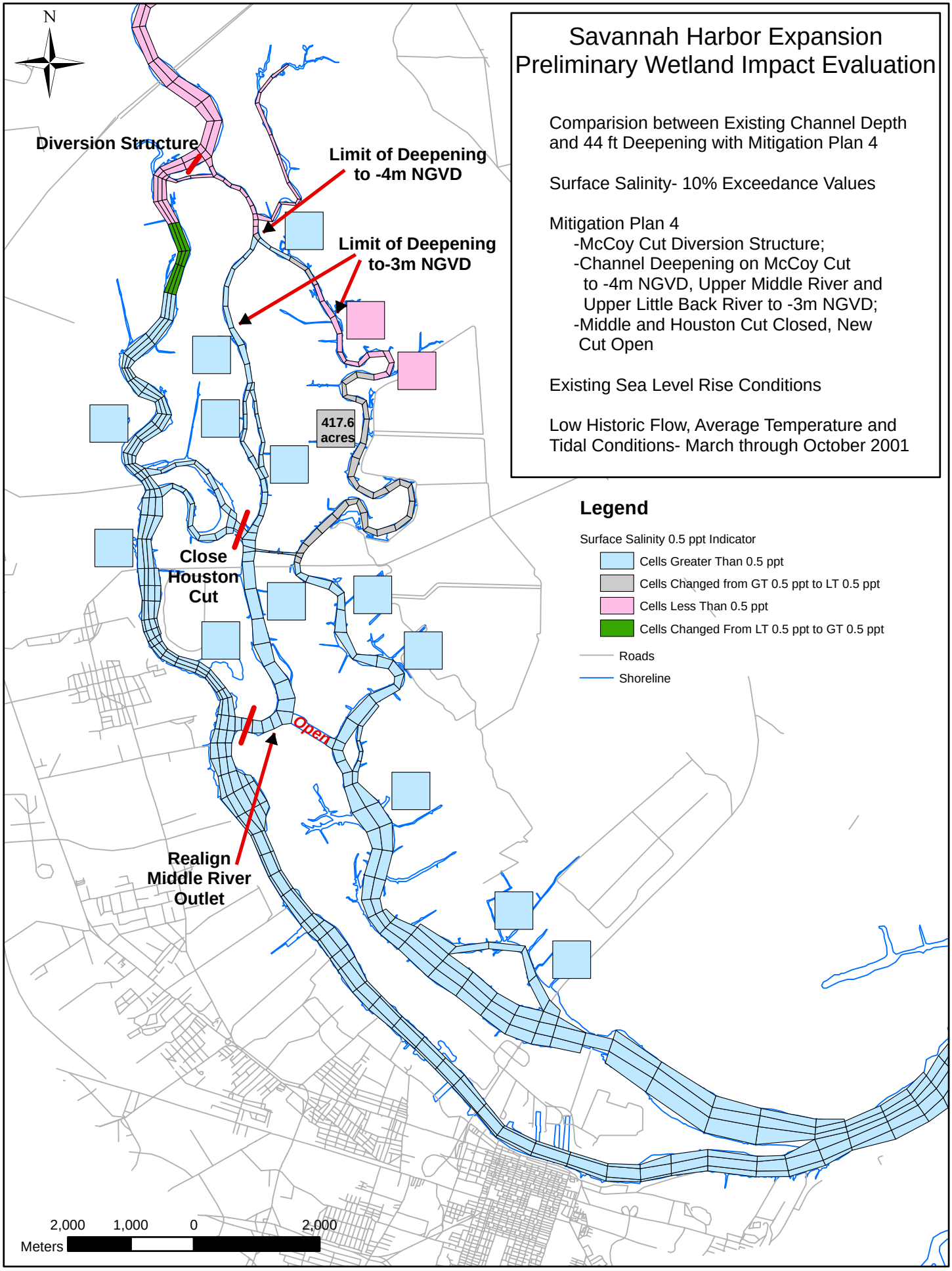
January 2007



January 2007

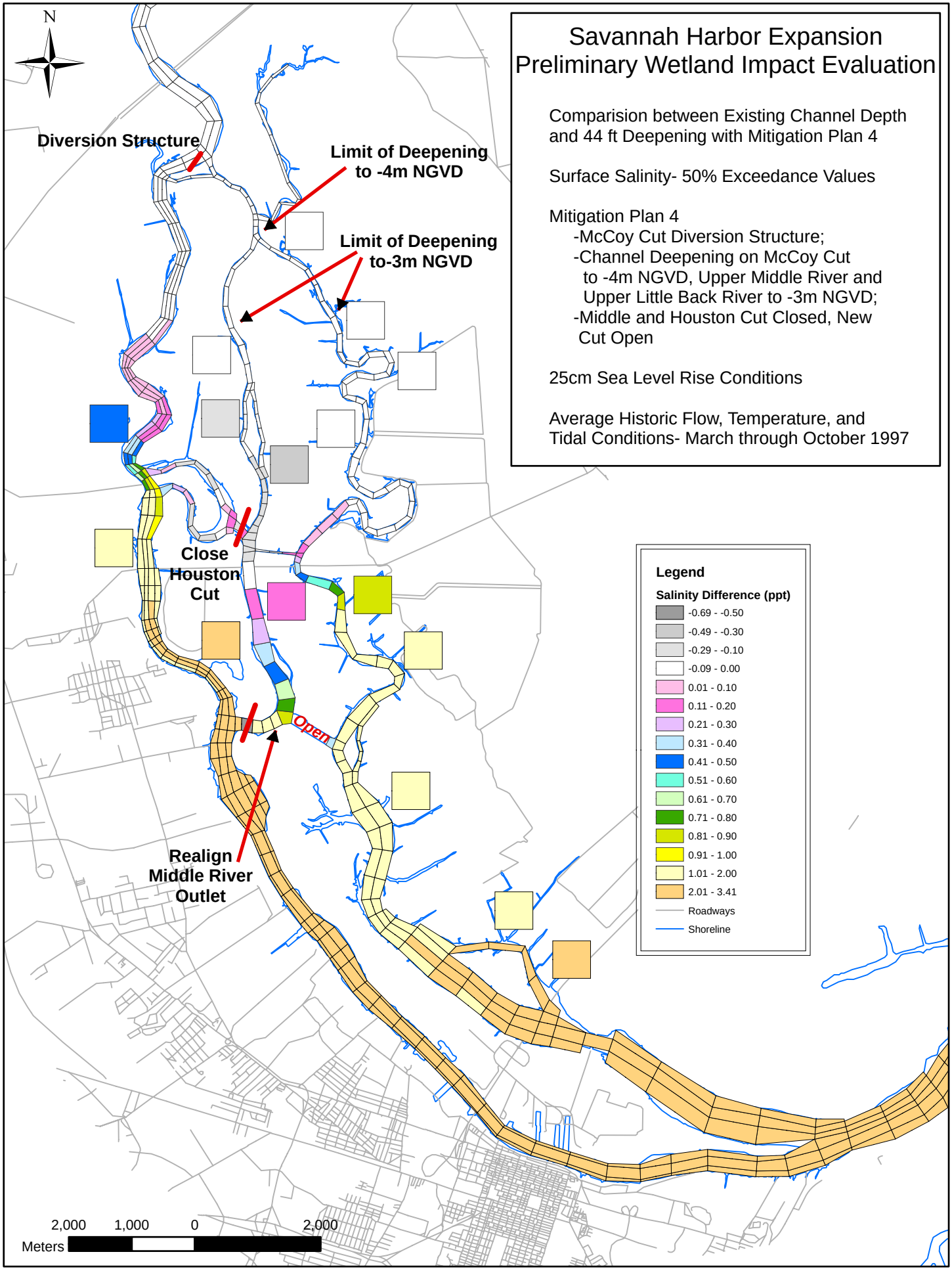


January 2007

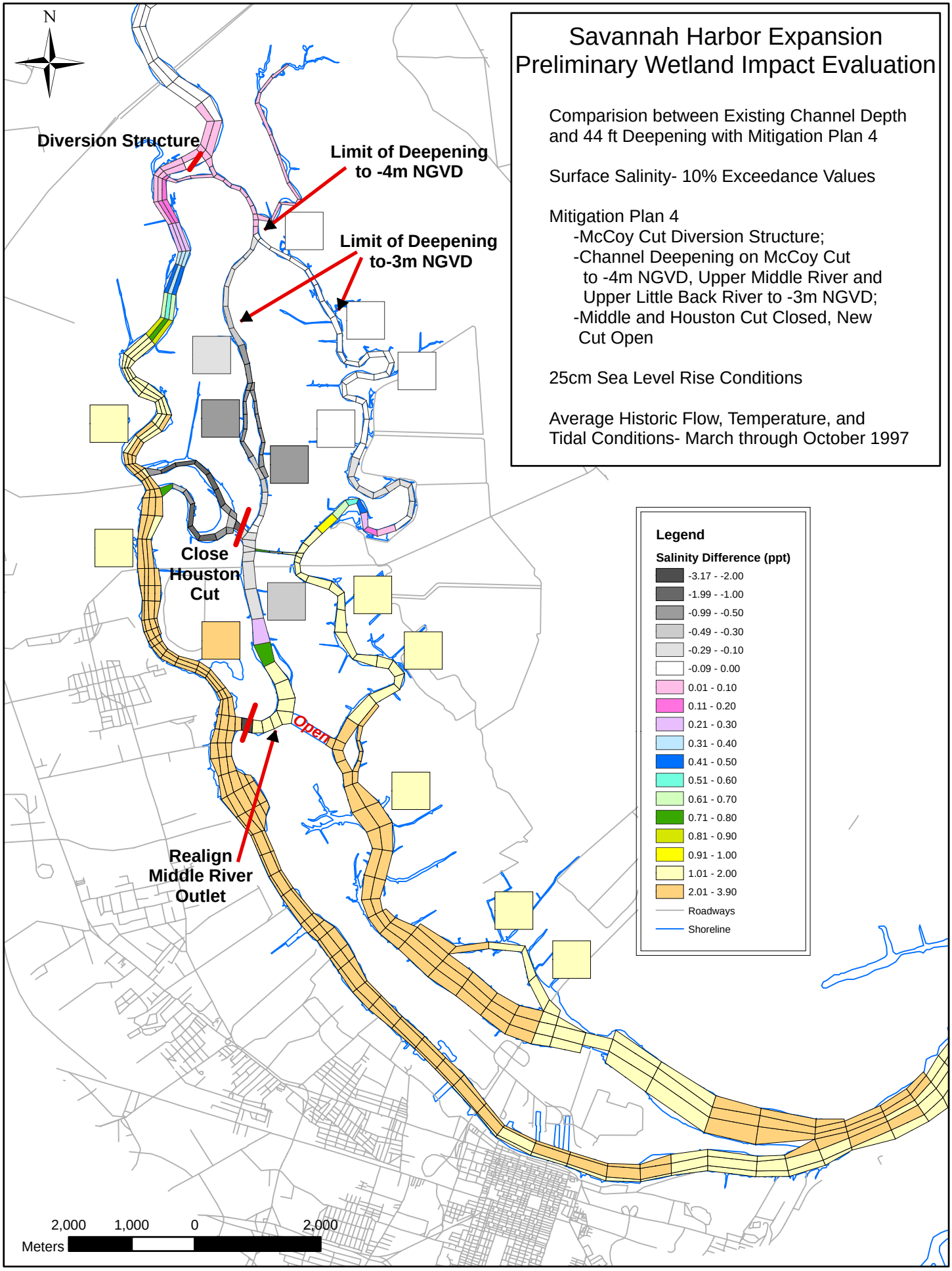


January 2007

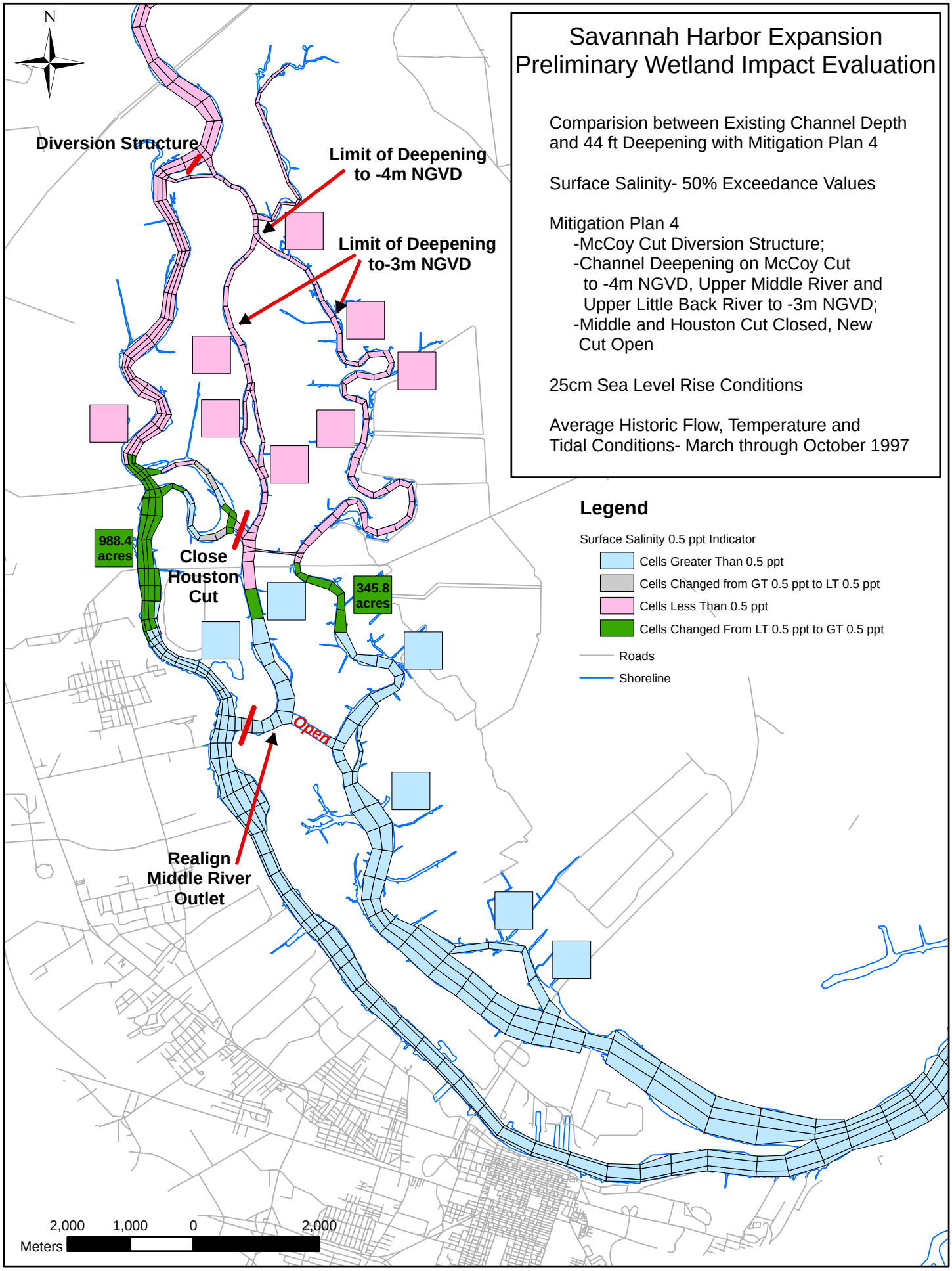
Sensitivity Analysis #2A



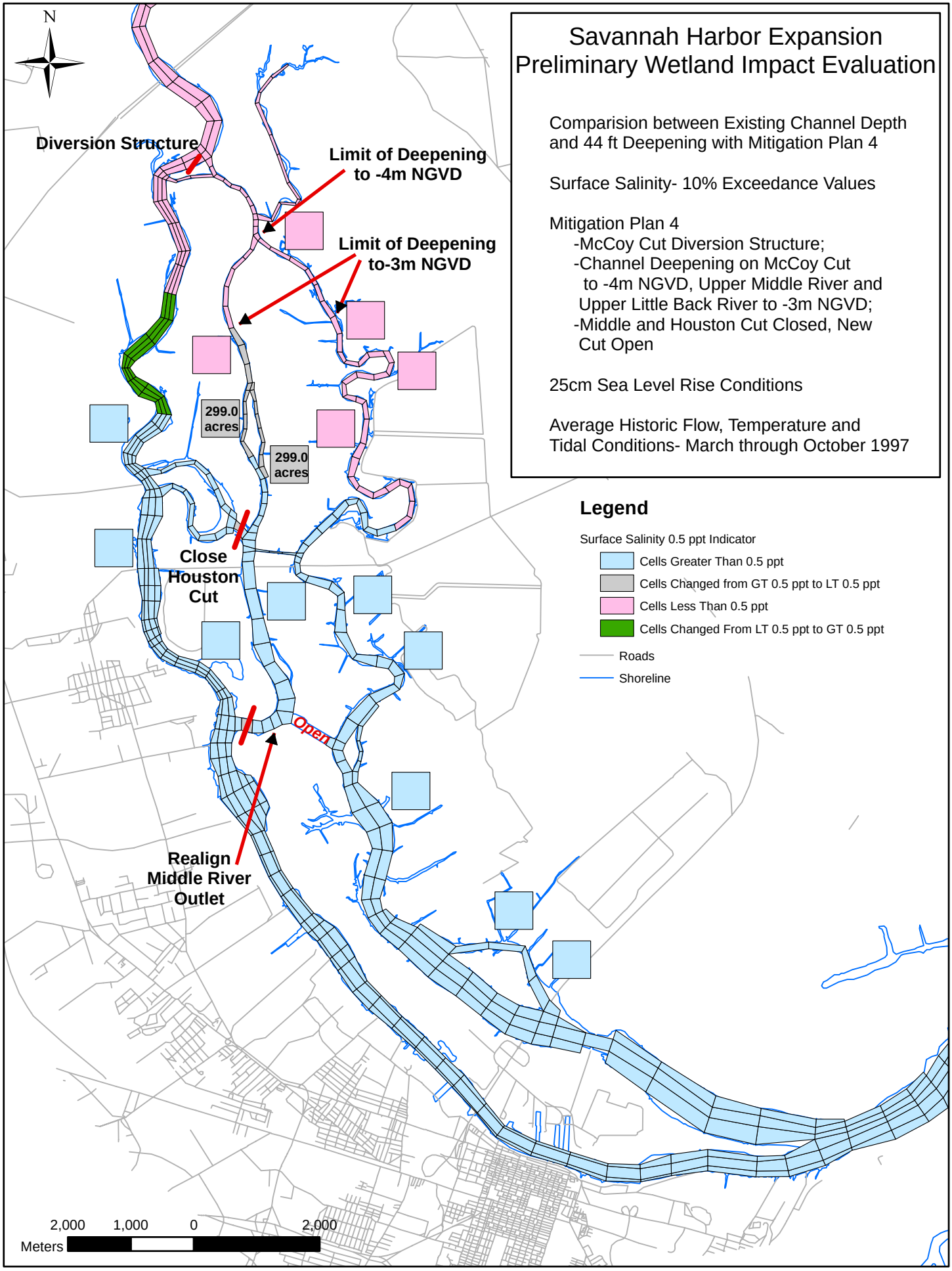
January 2007



January 2007

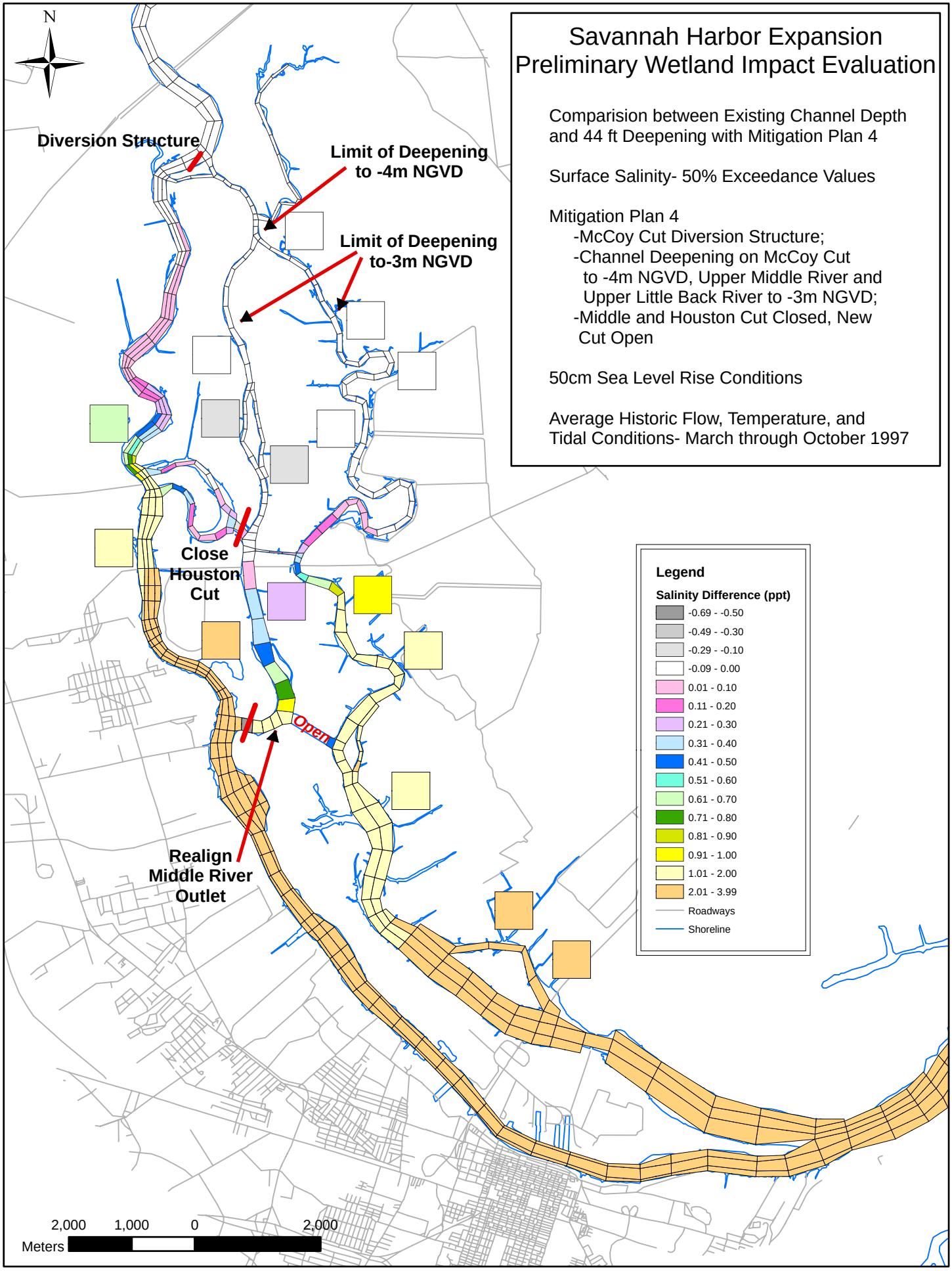


January 2007

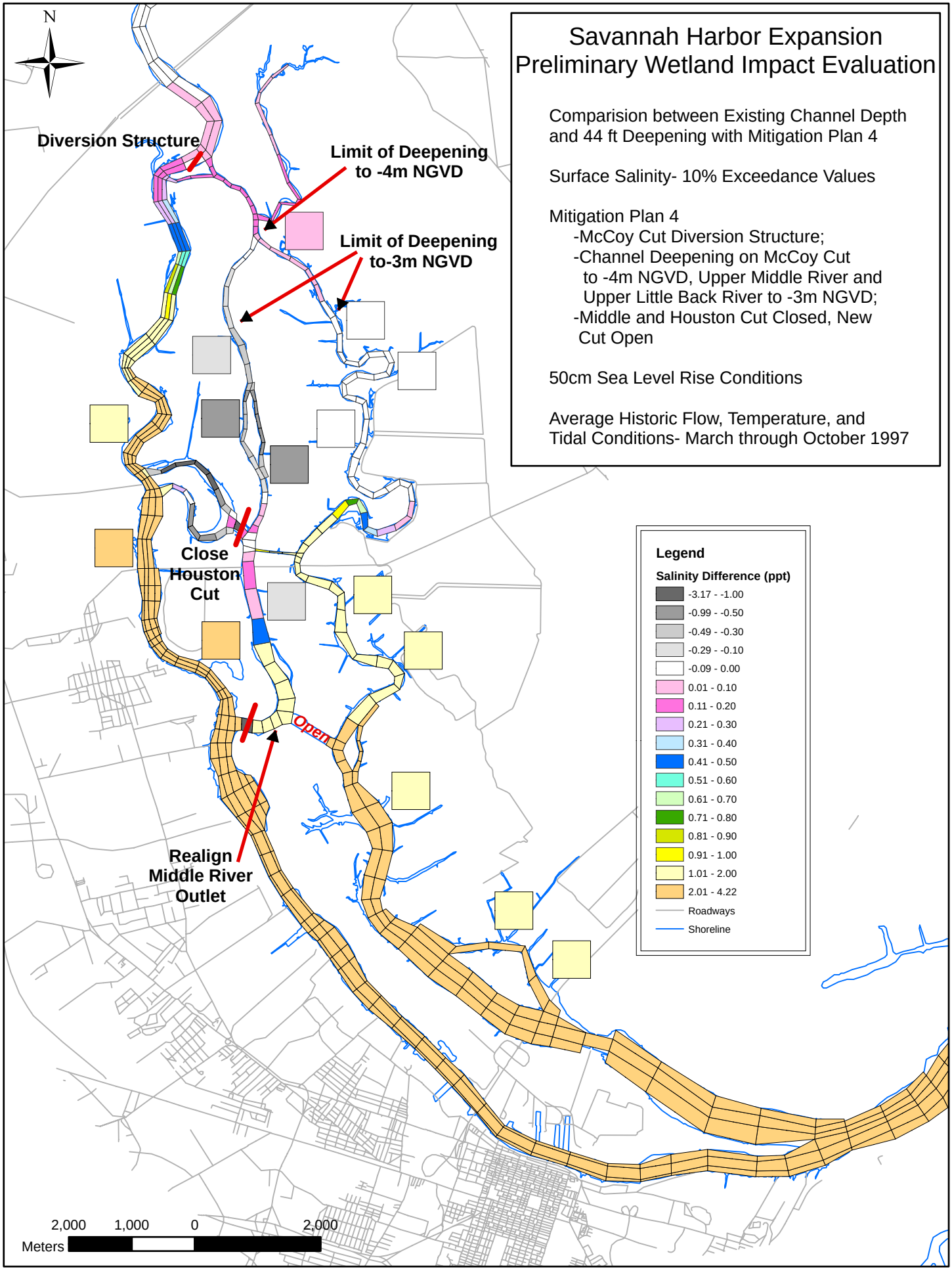


January 2007

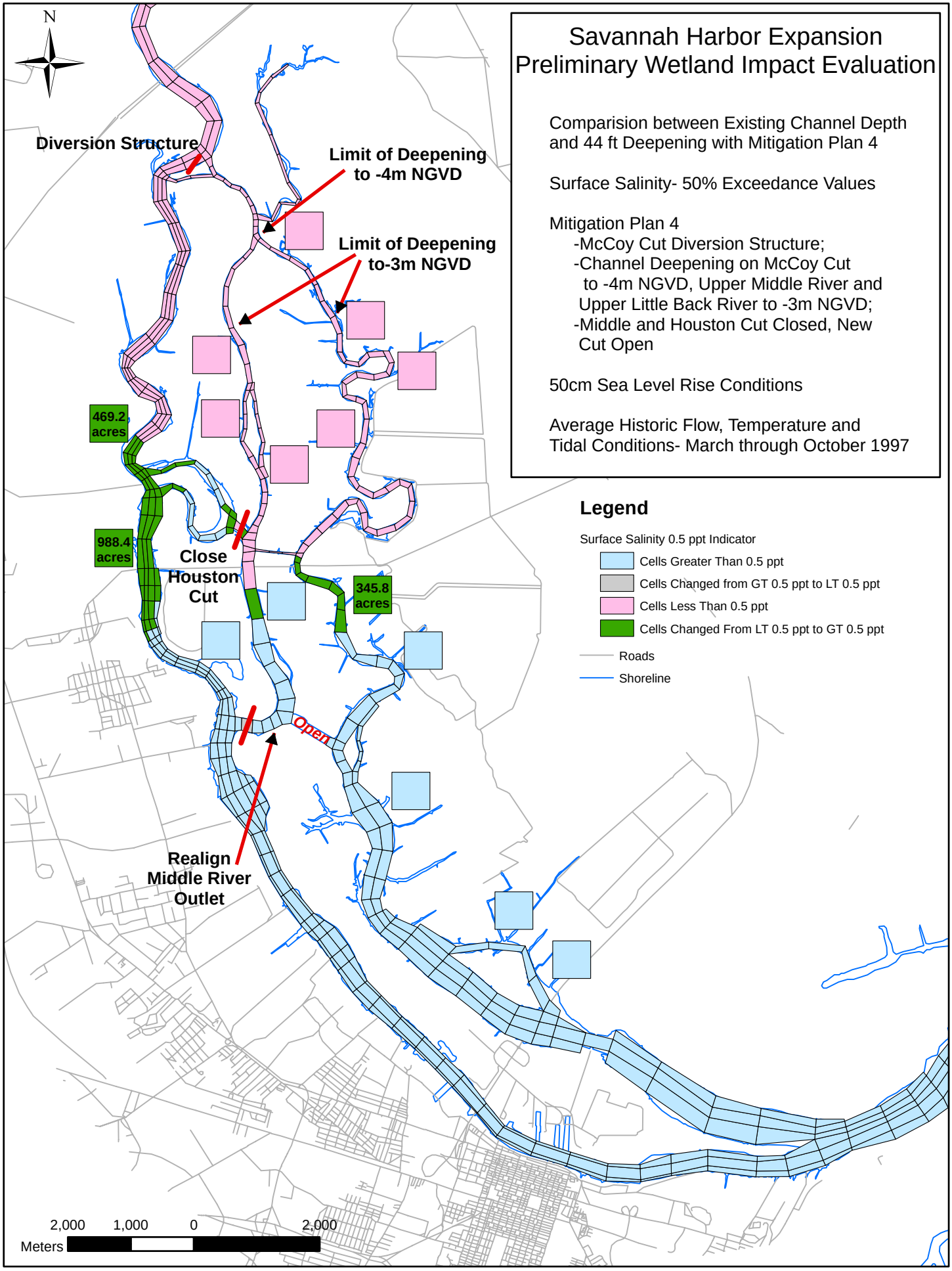
Sensitivity Analysis #2B



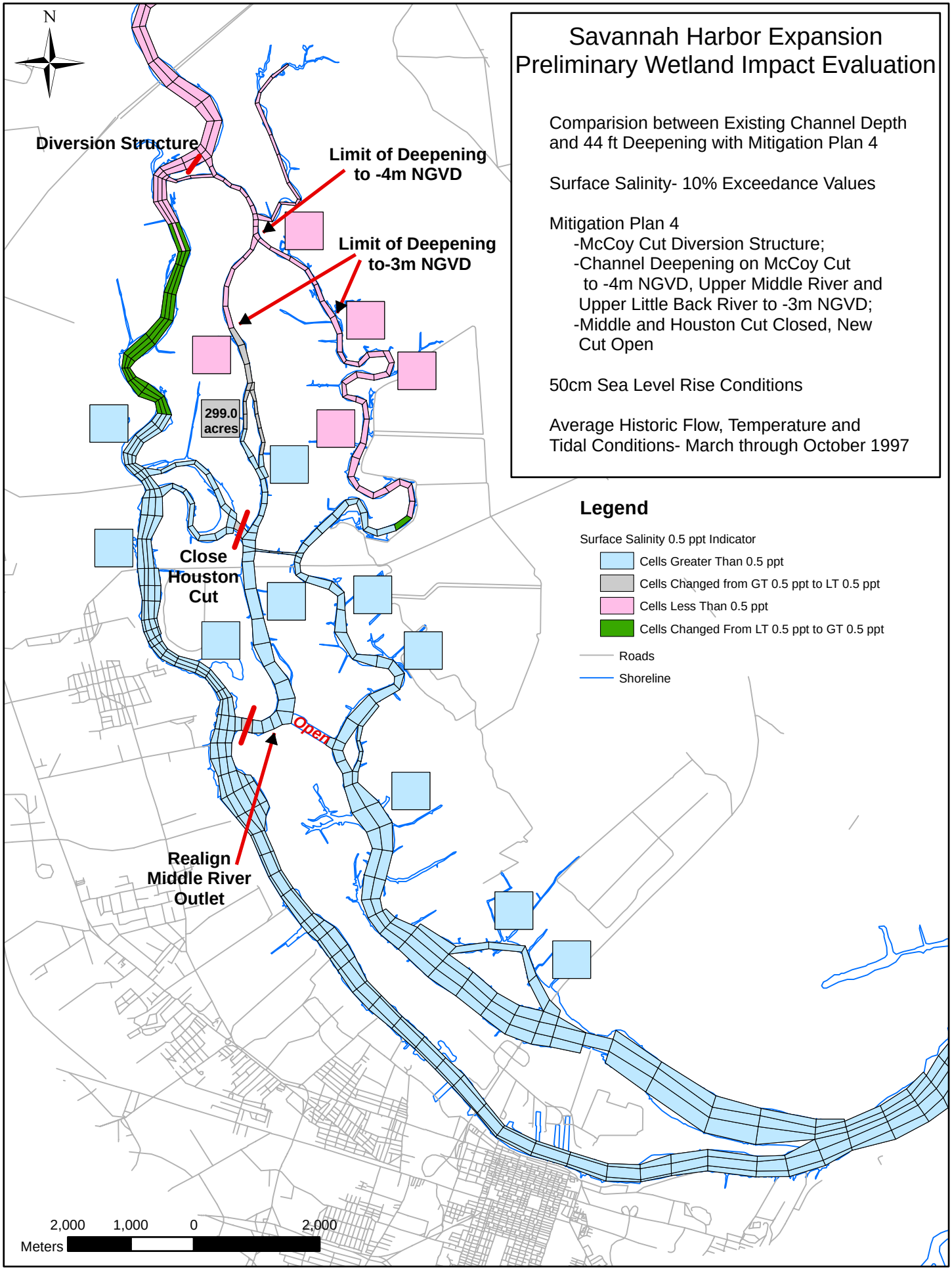
January 2007



January 2007



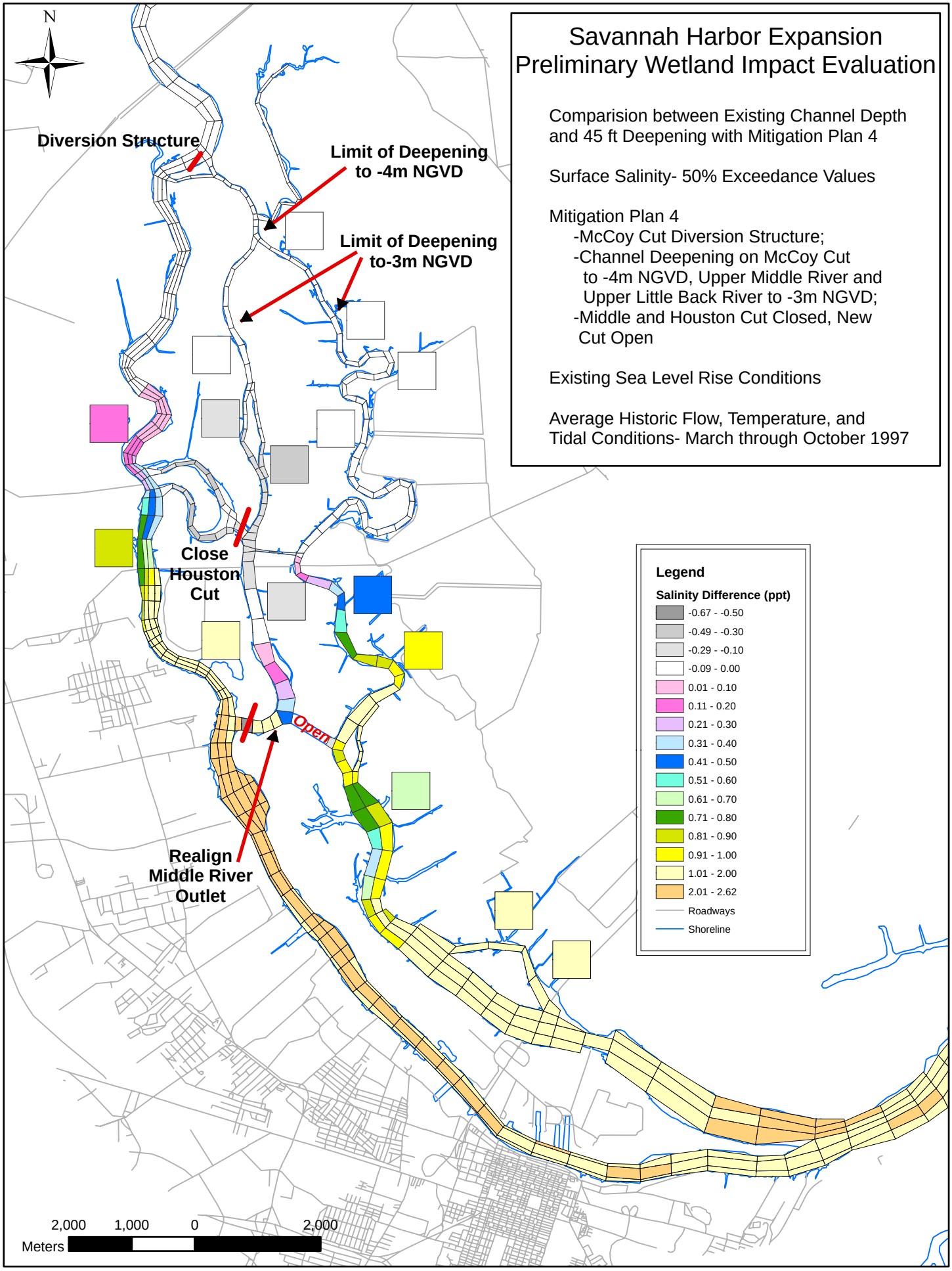
January 2007



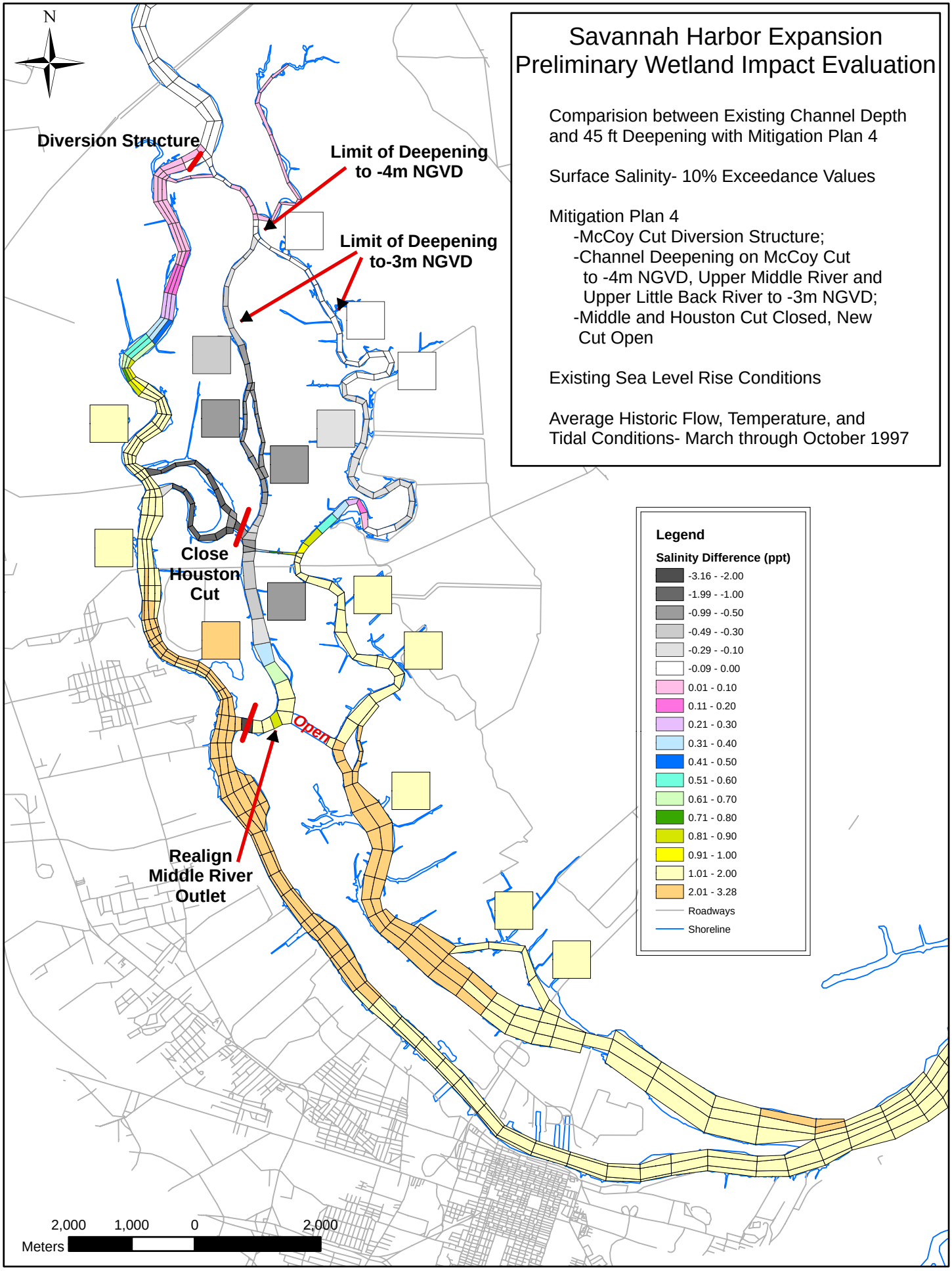
January 2007

45-ft Deepening

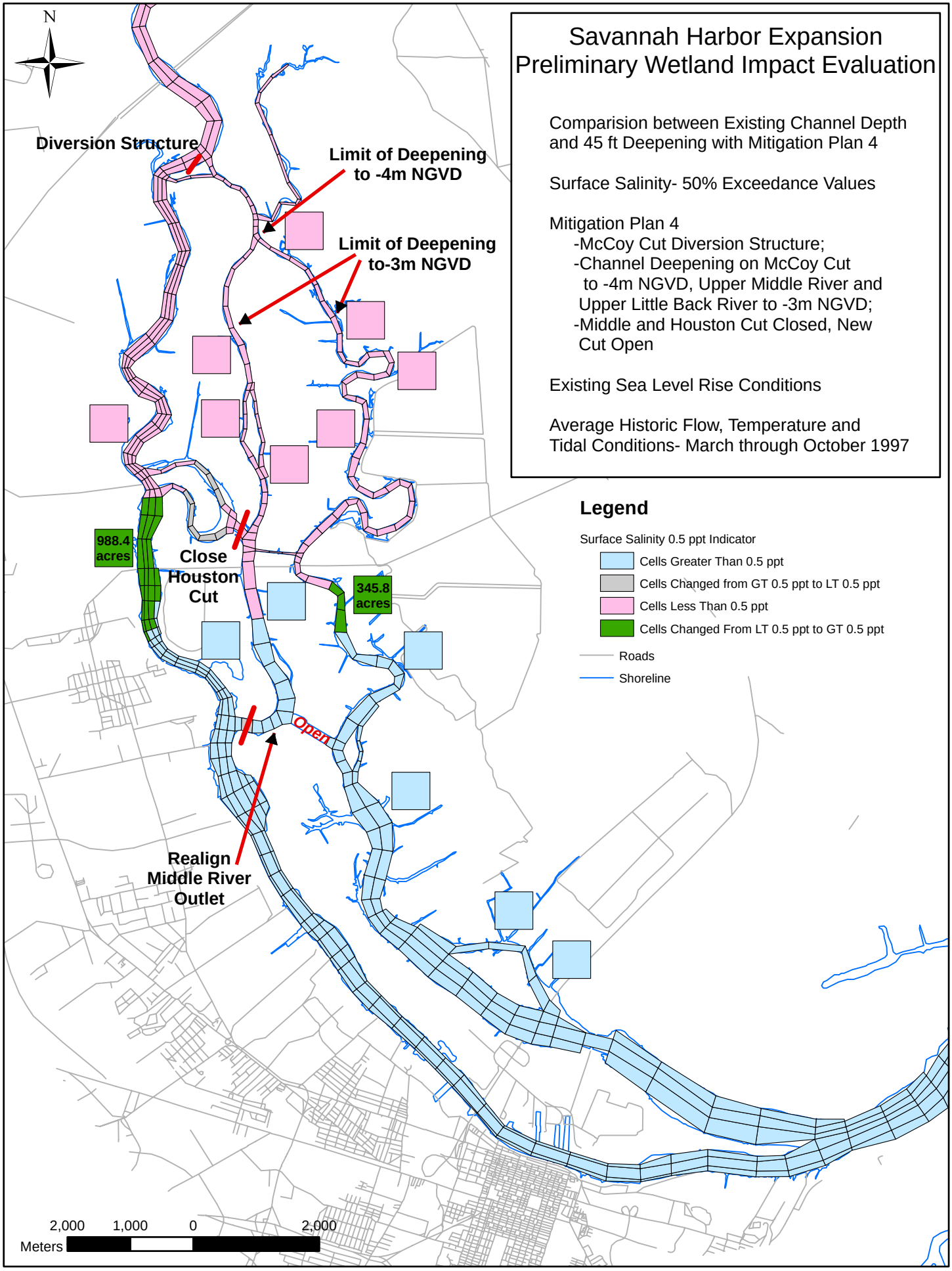
Basic Evaluation



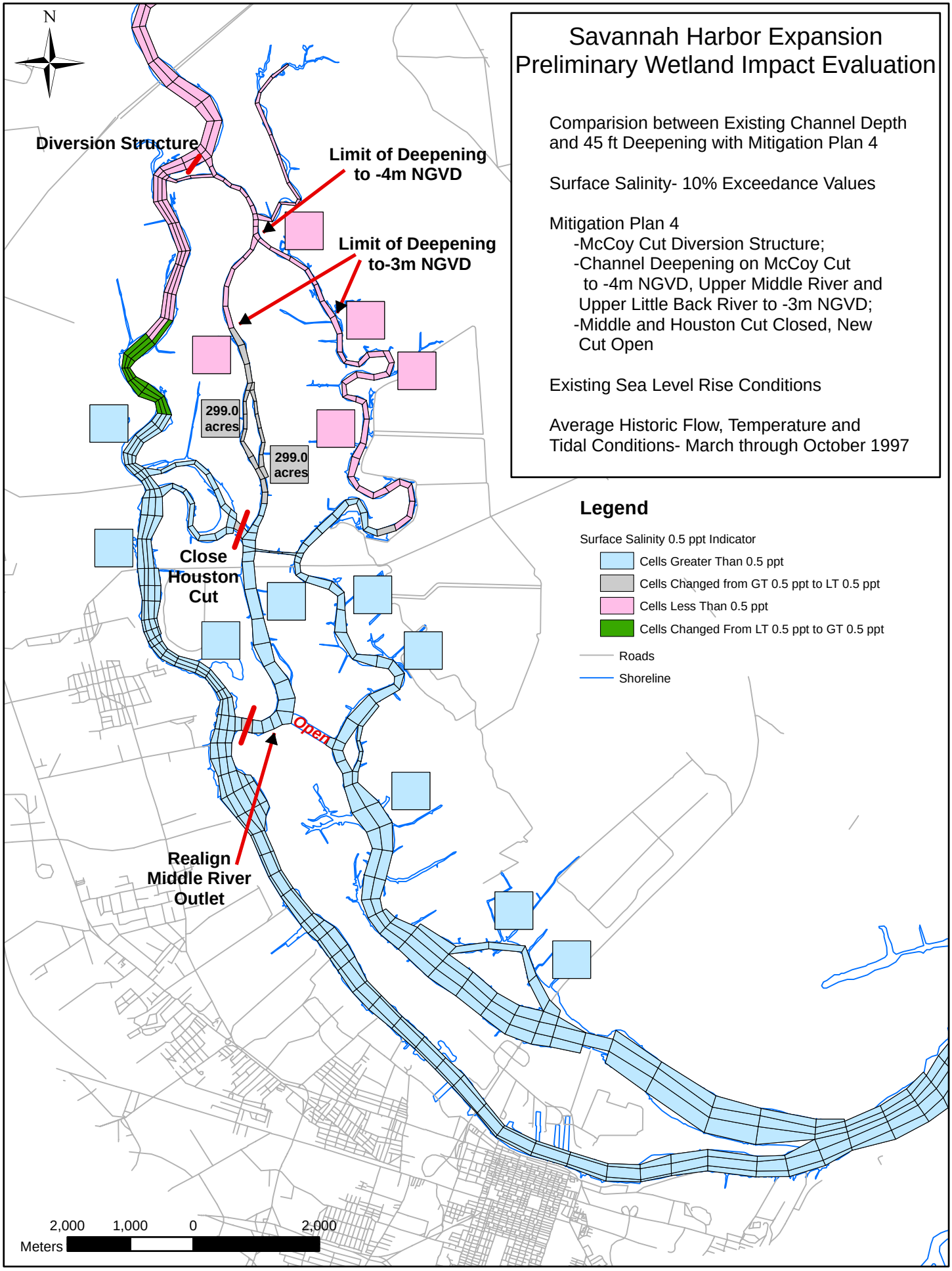
January 2007



January 2007

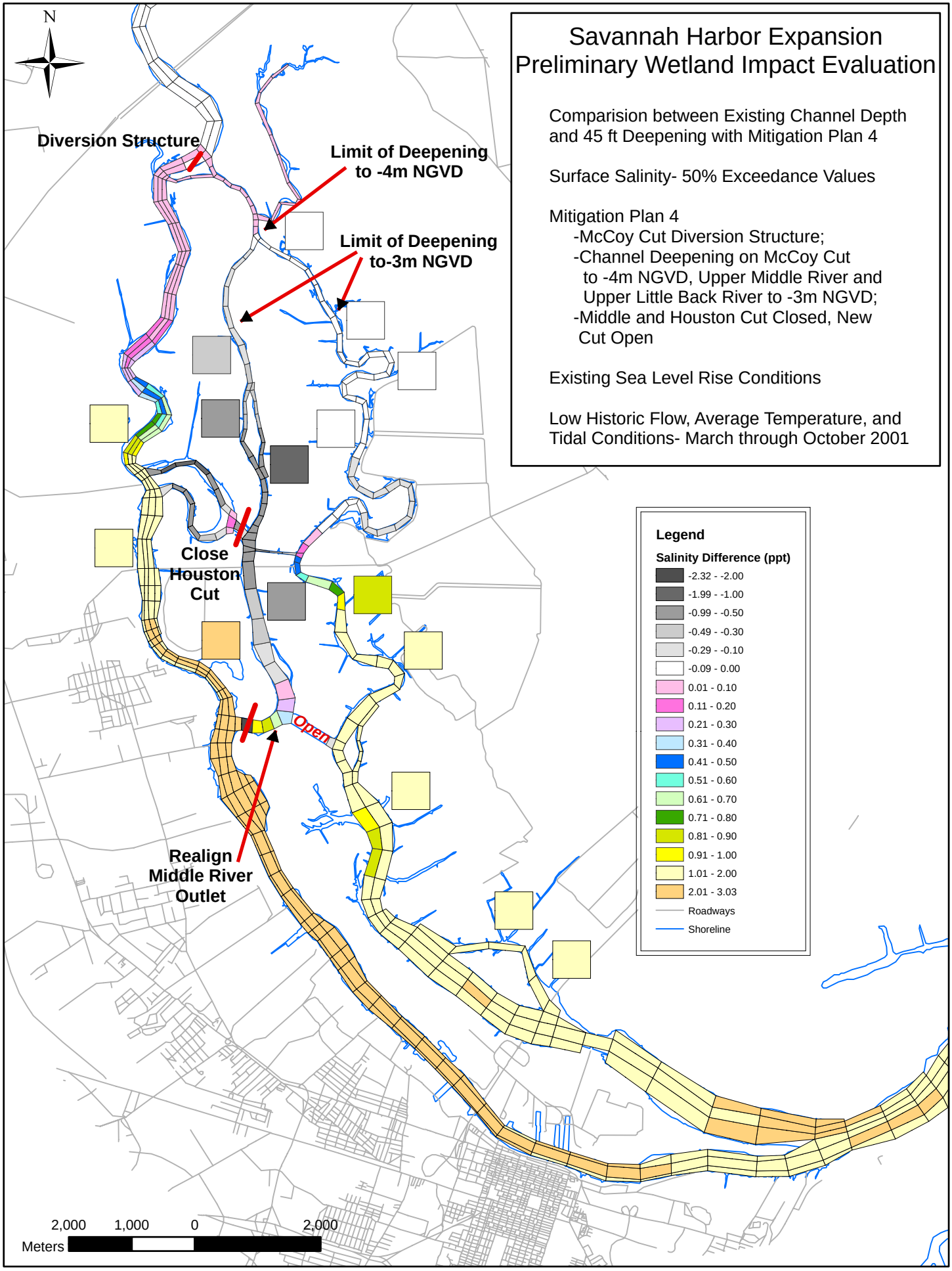


January 2007

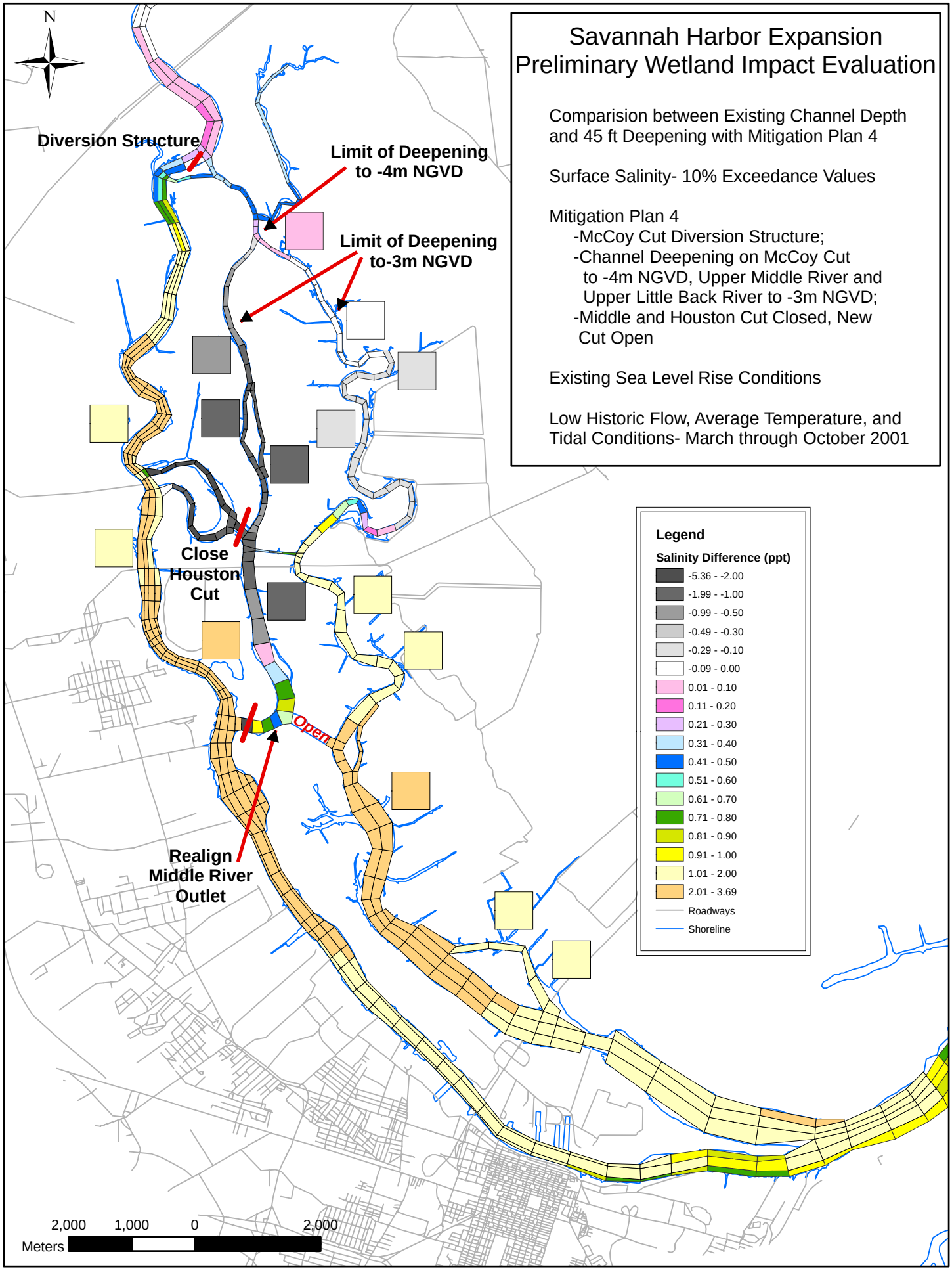


January 2007

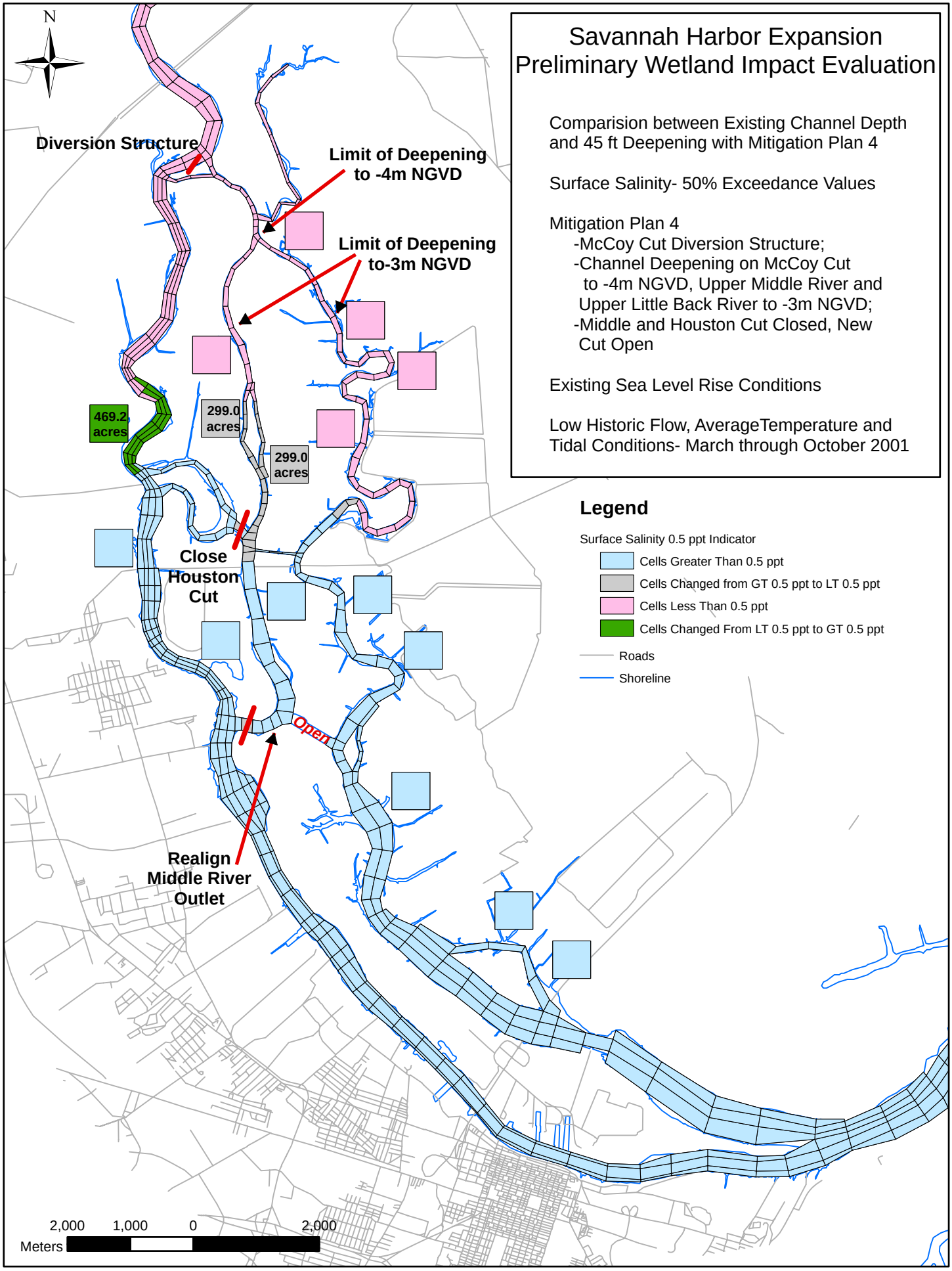
Sensitivity Analysis #1



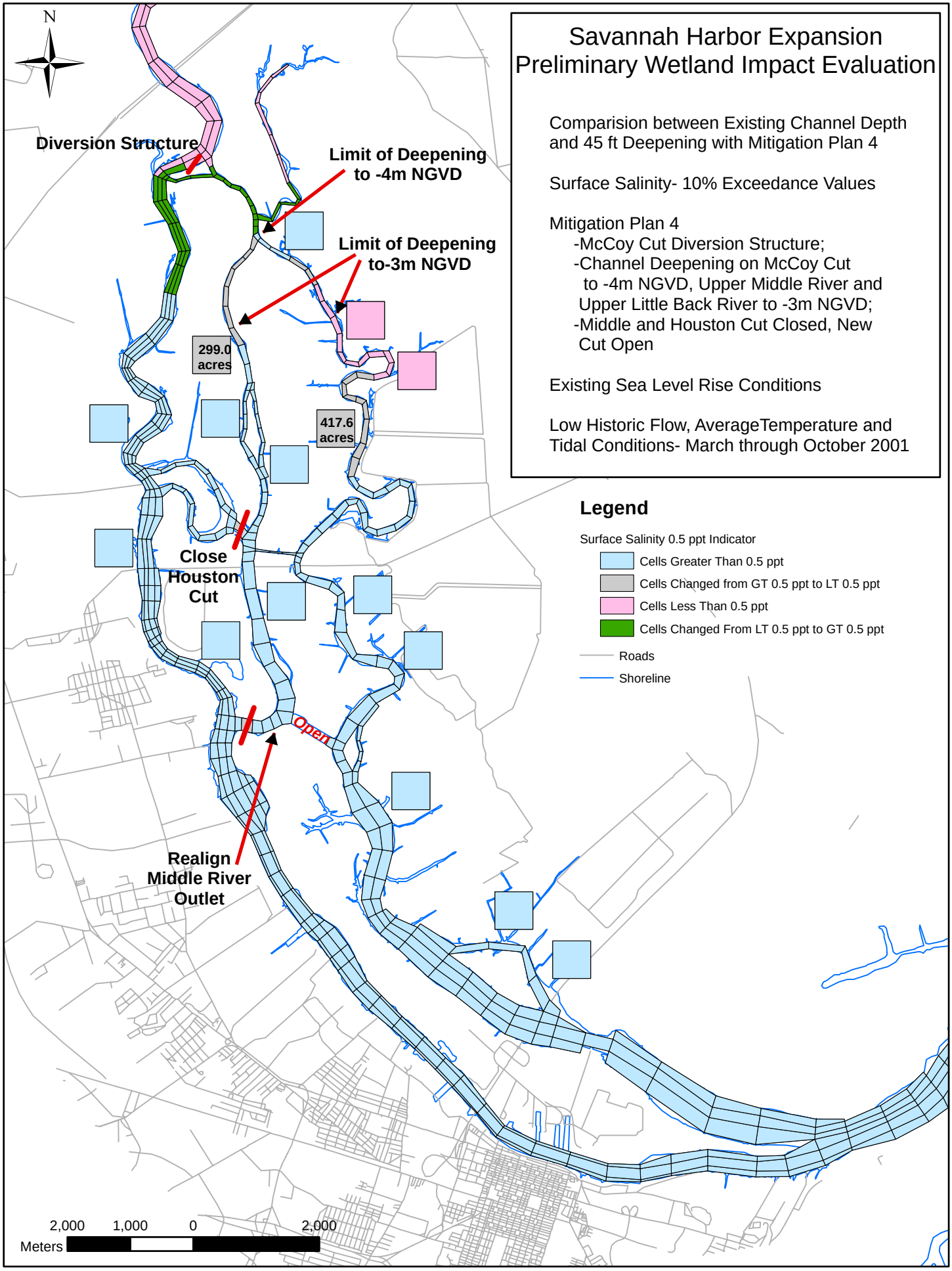
January 2007



January 2007

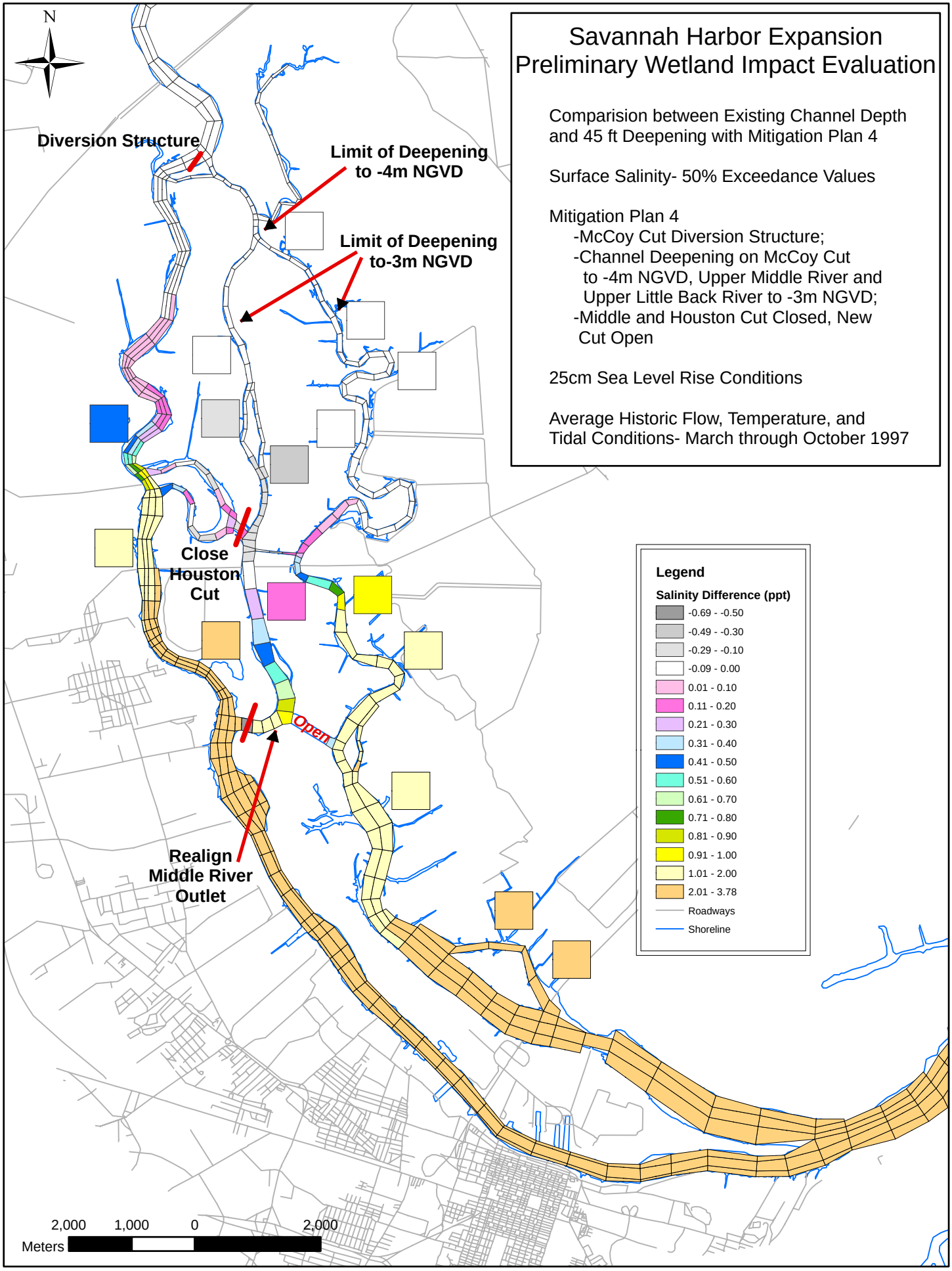


January 2007



January 2007

Sensitivity Analysis #2A



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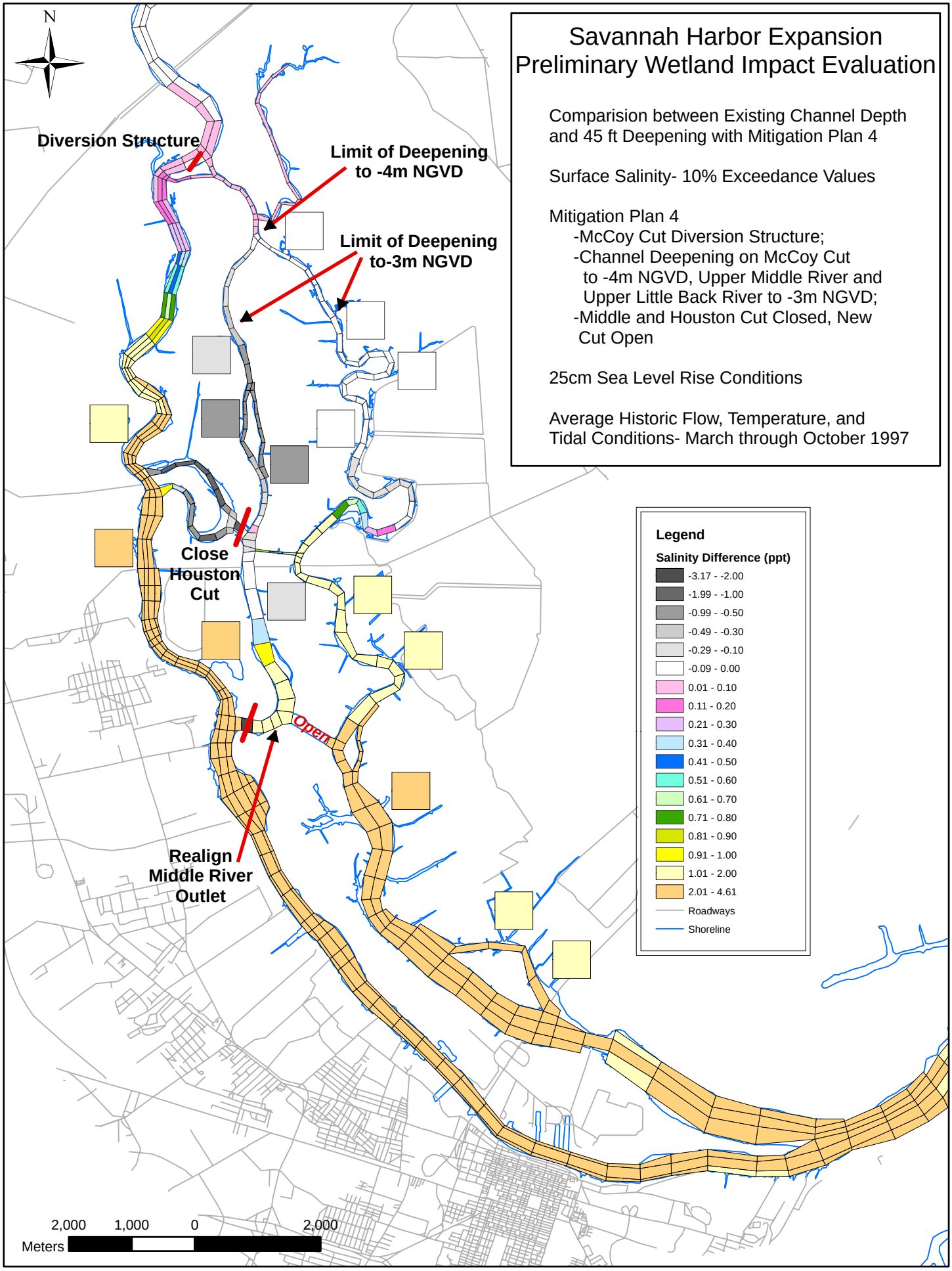
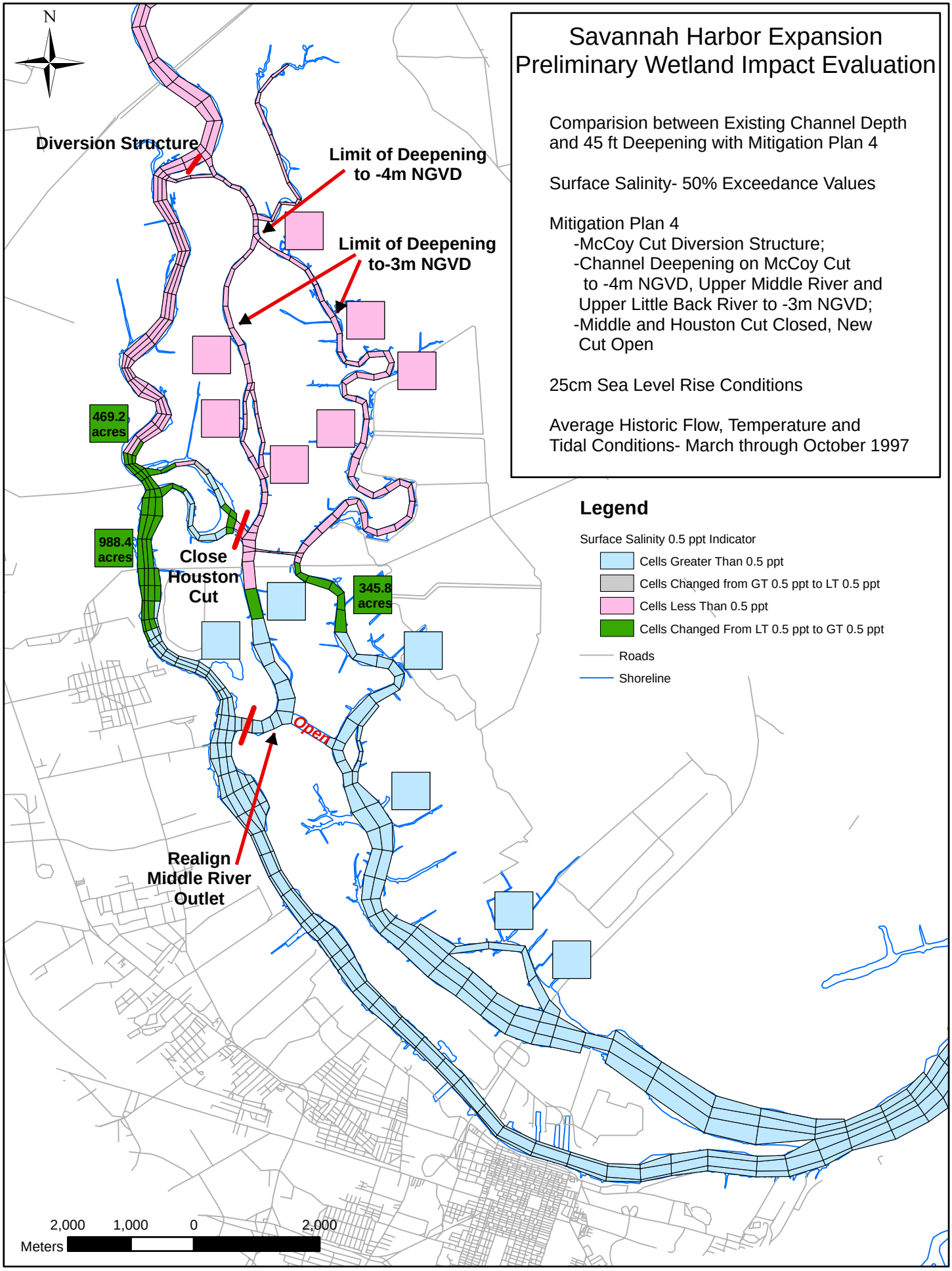
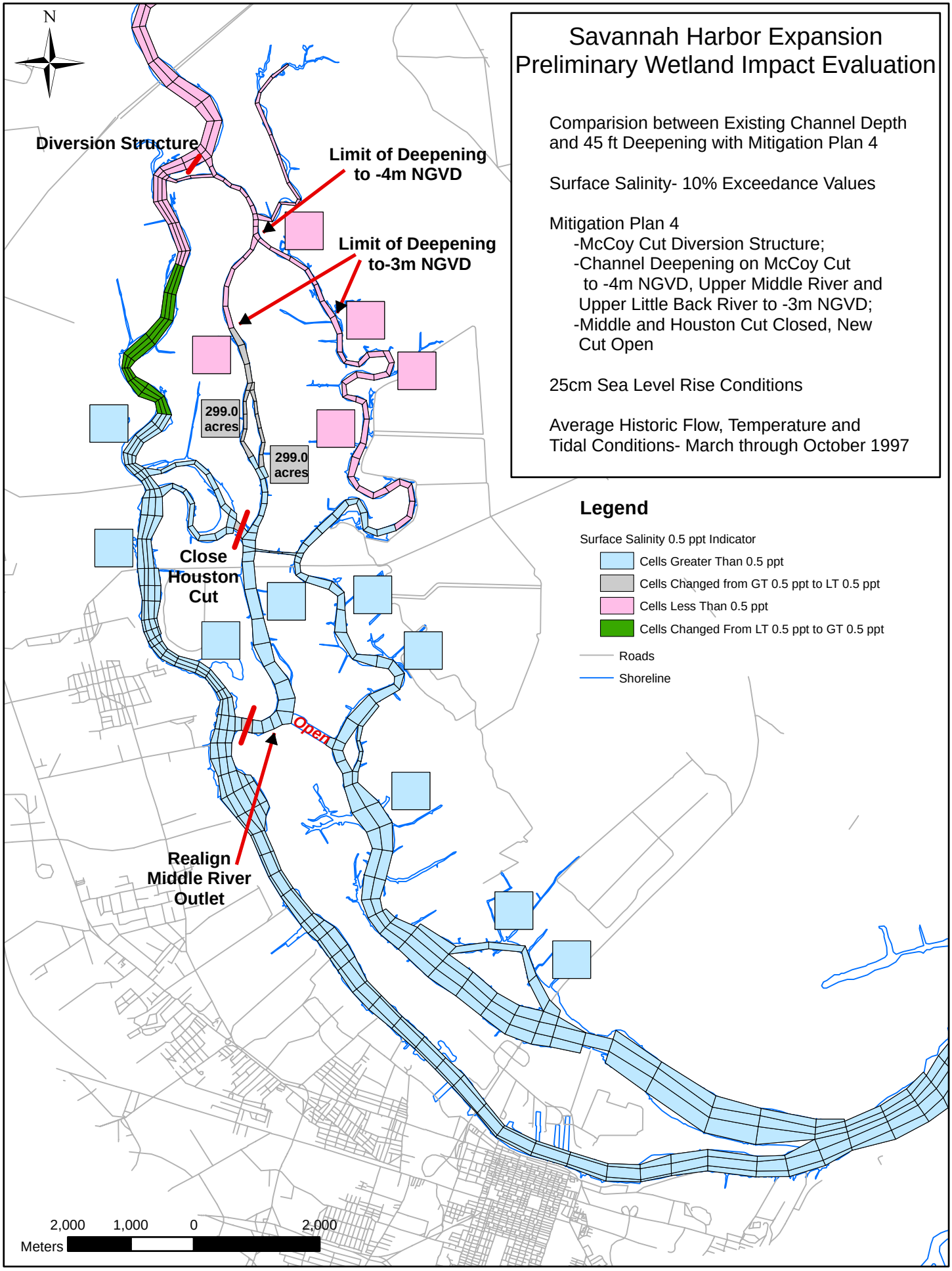


January 2007

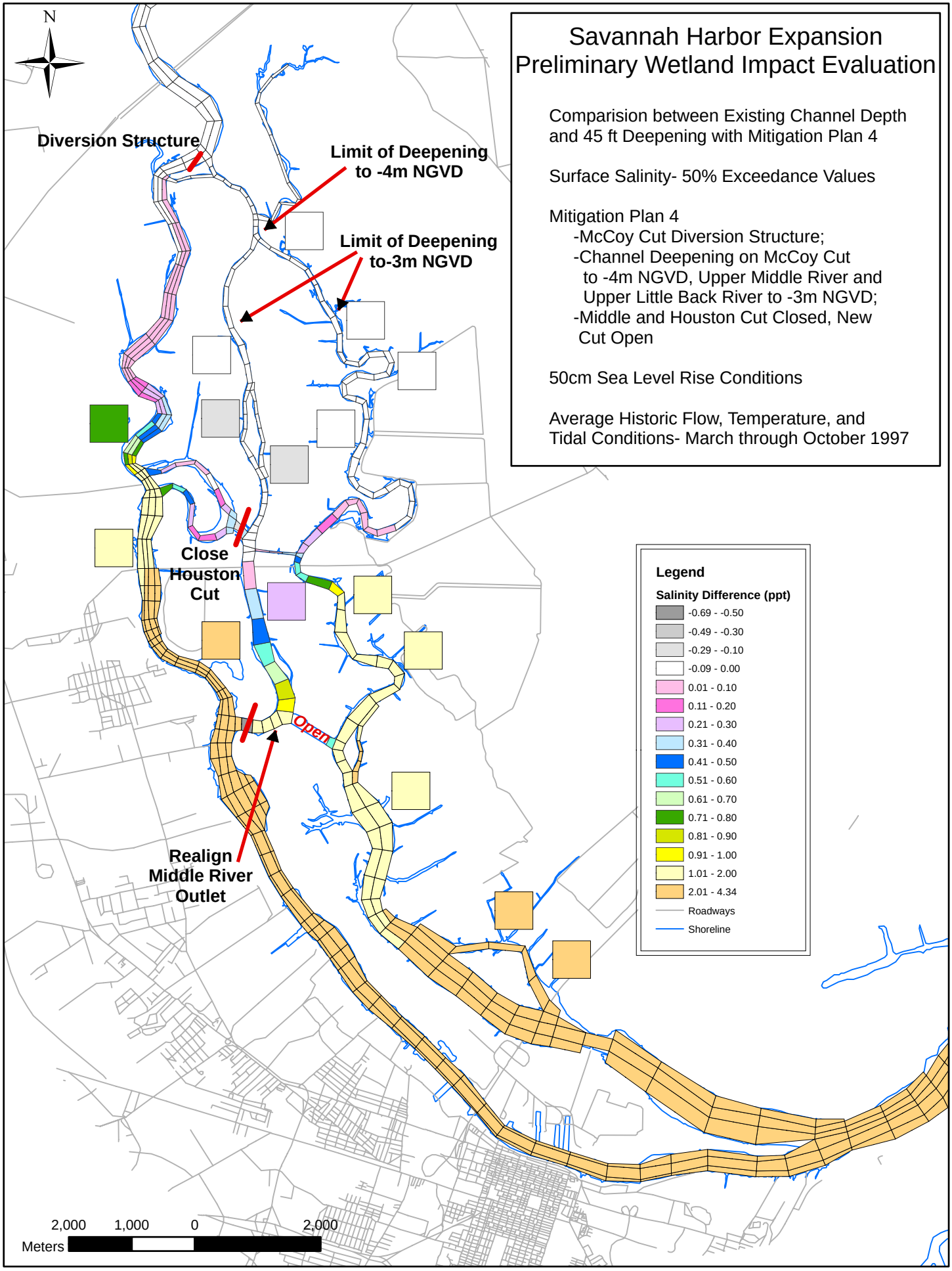


January 2007

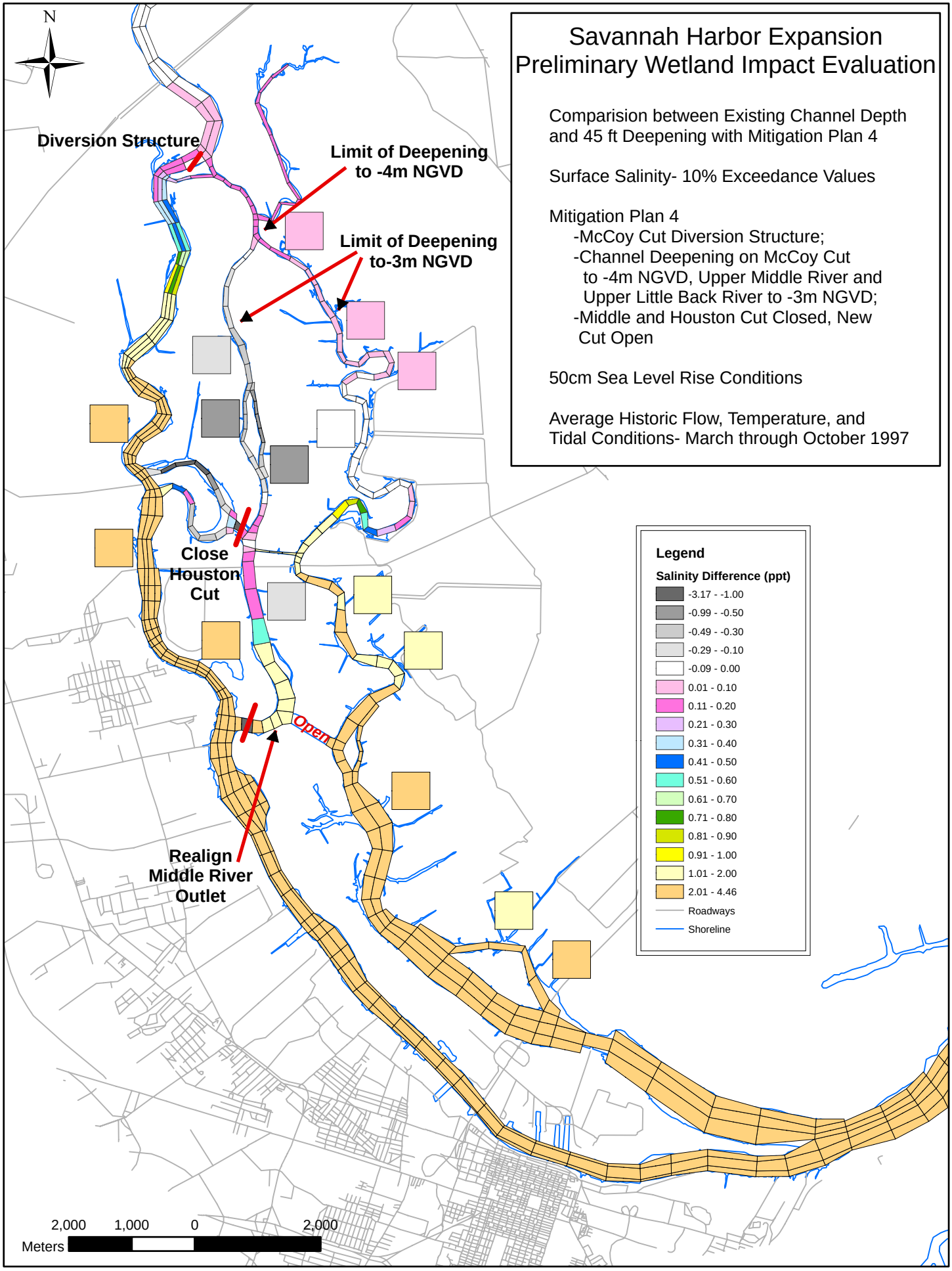


January 2007

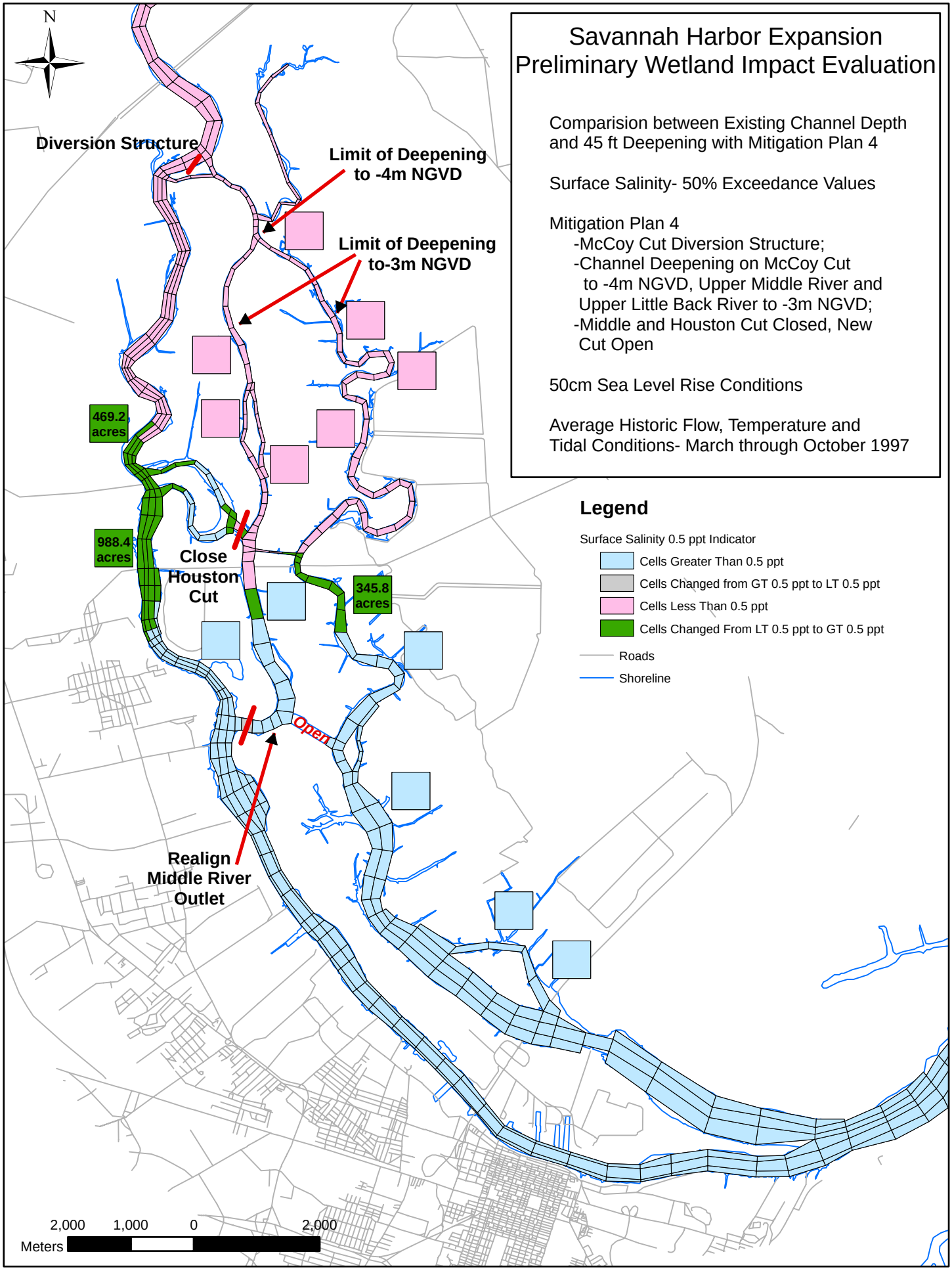
Sensitivity Analysis #2B



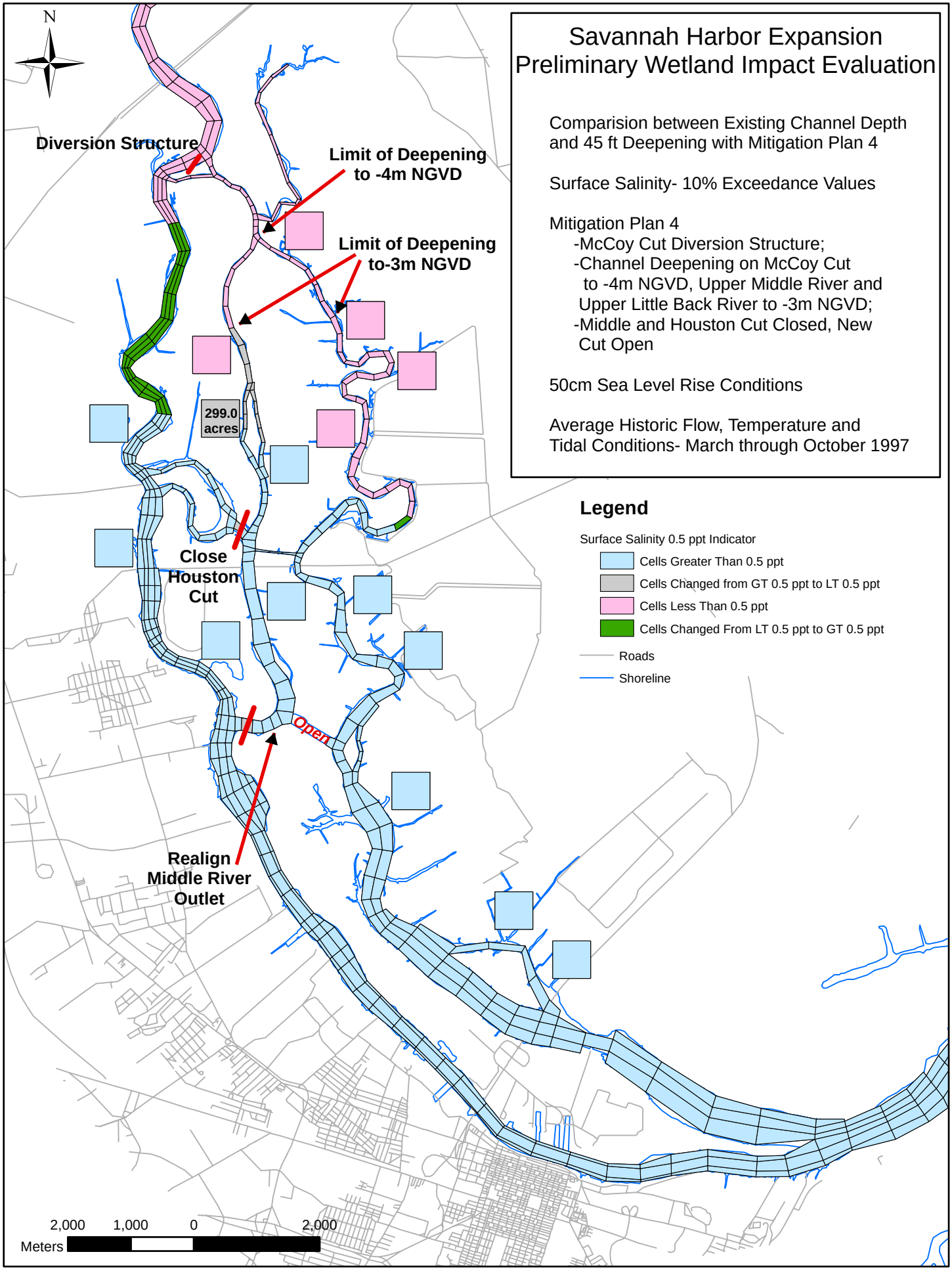
January 2007



January 2007



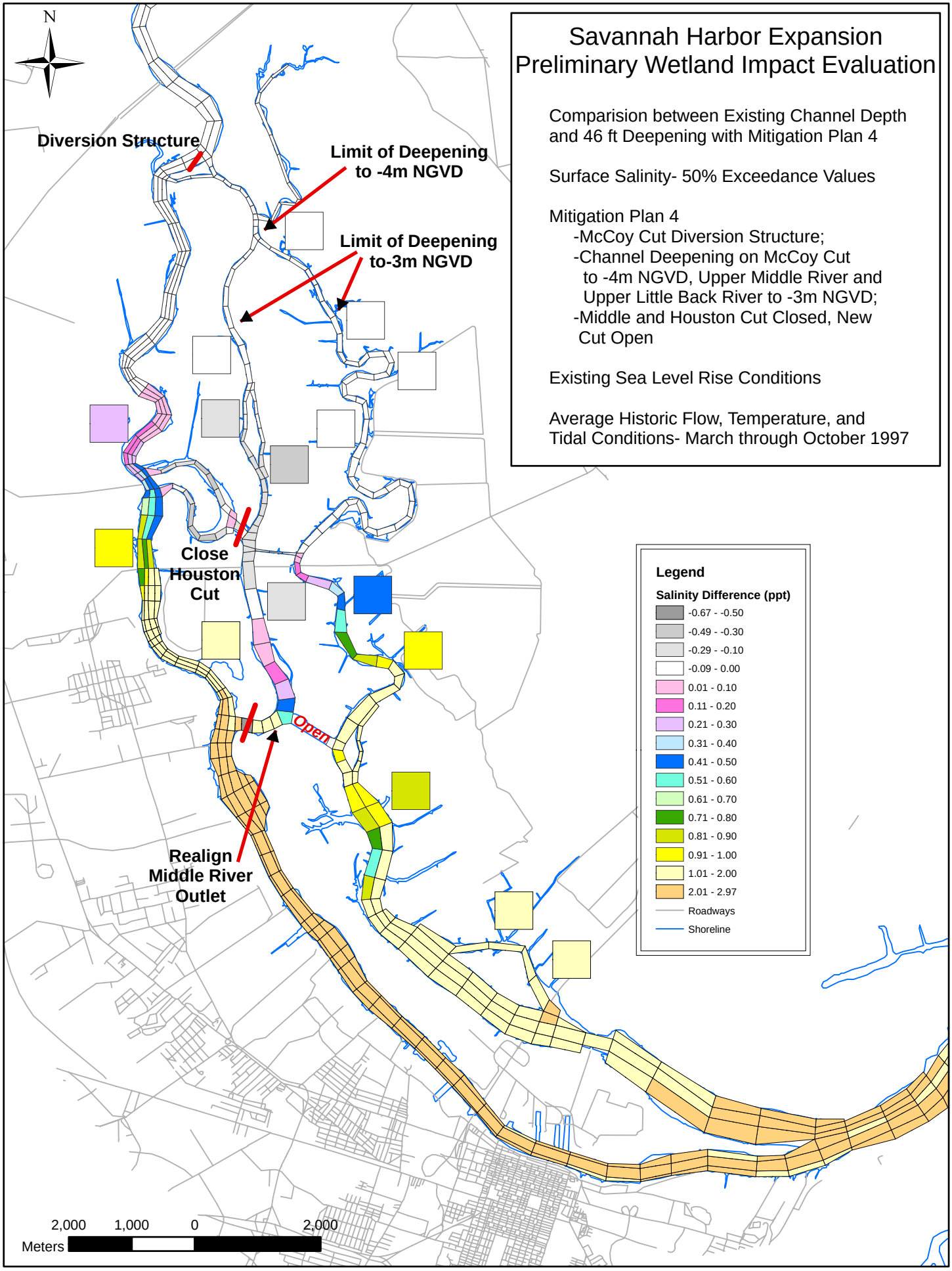
January 2007



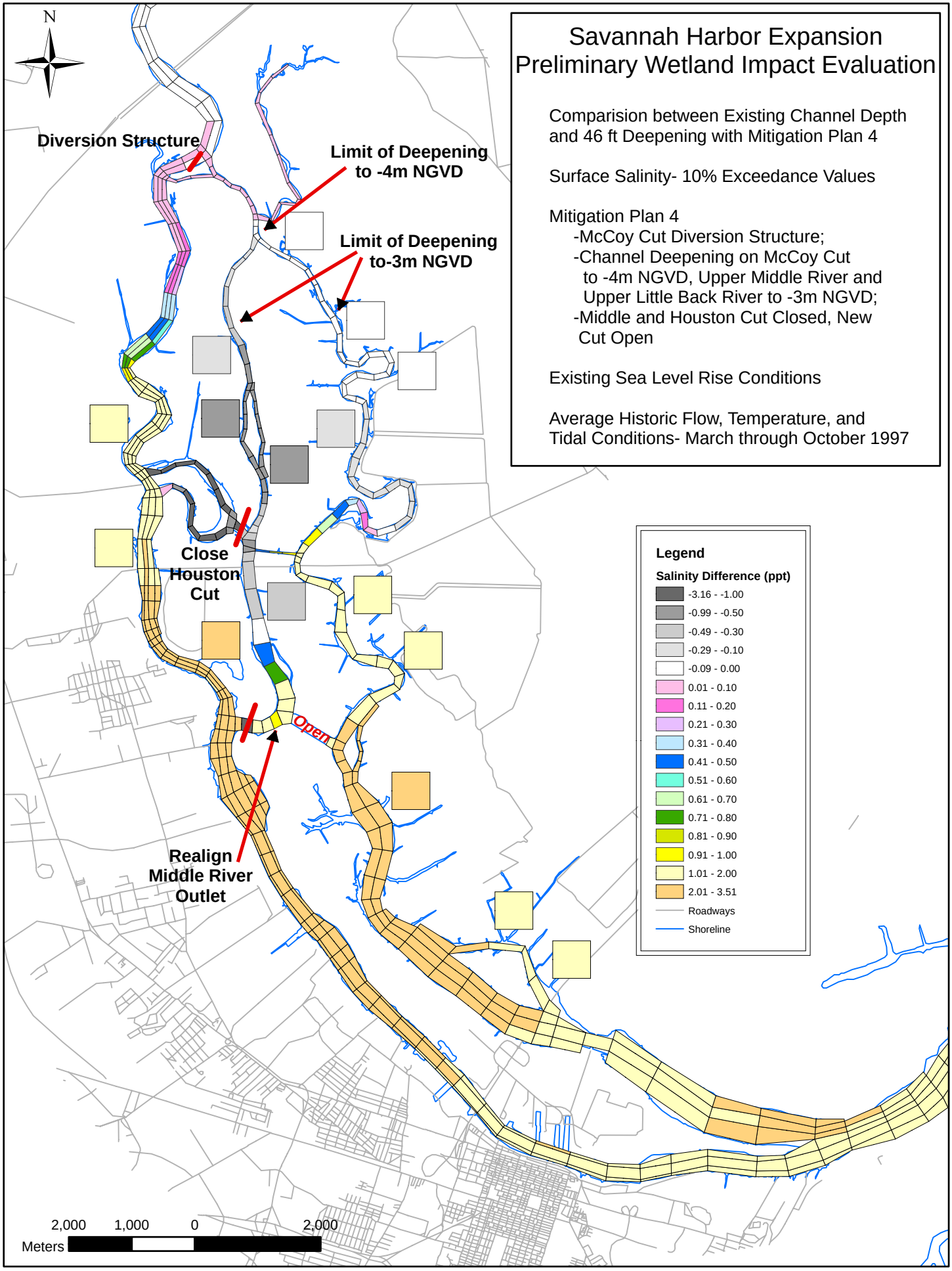
January 2007

46-ft Deepening

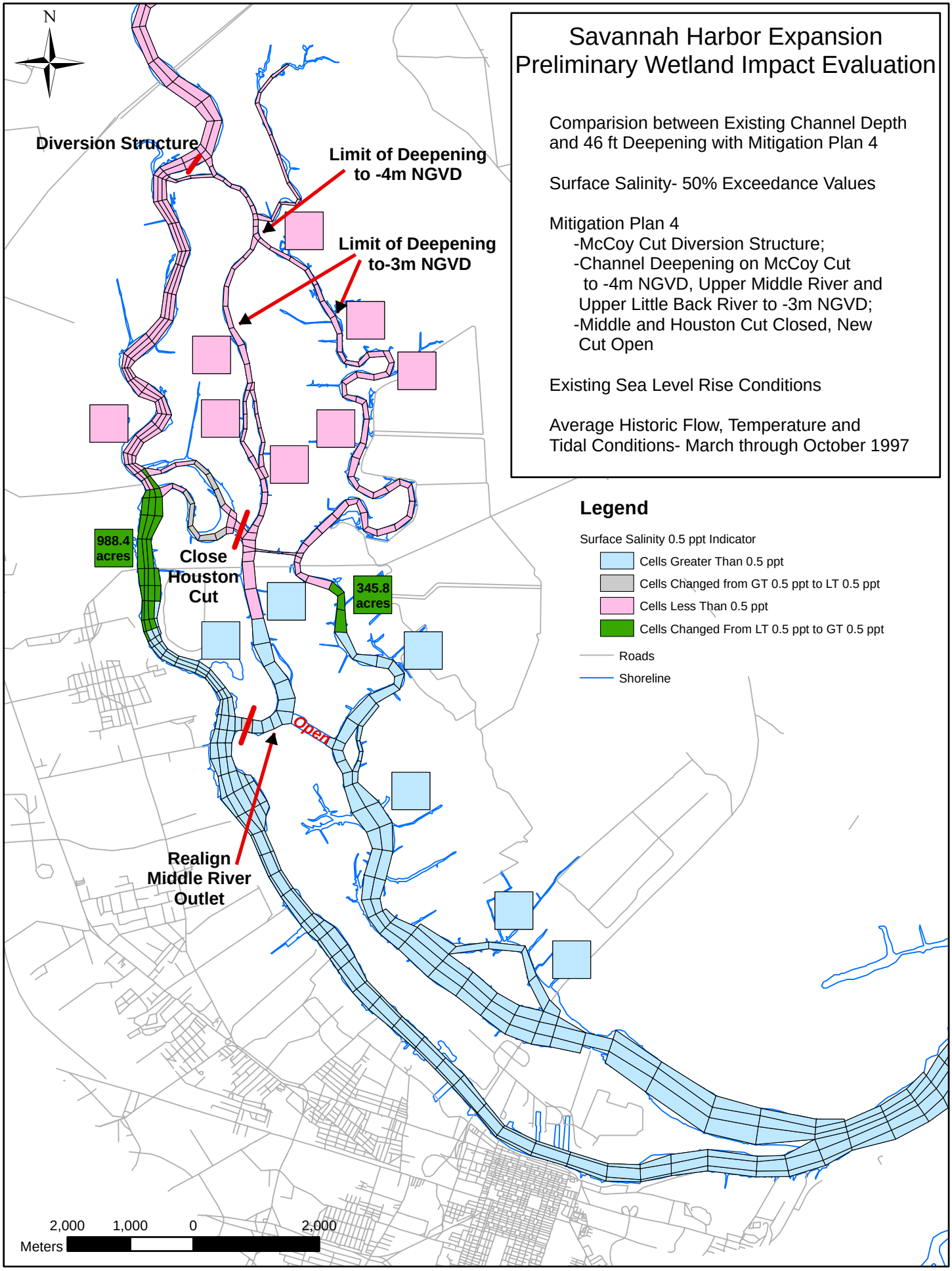
Basic Evaluation



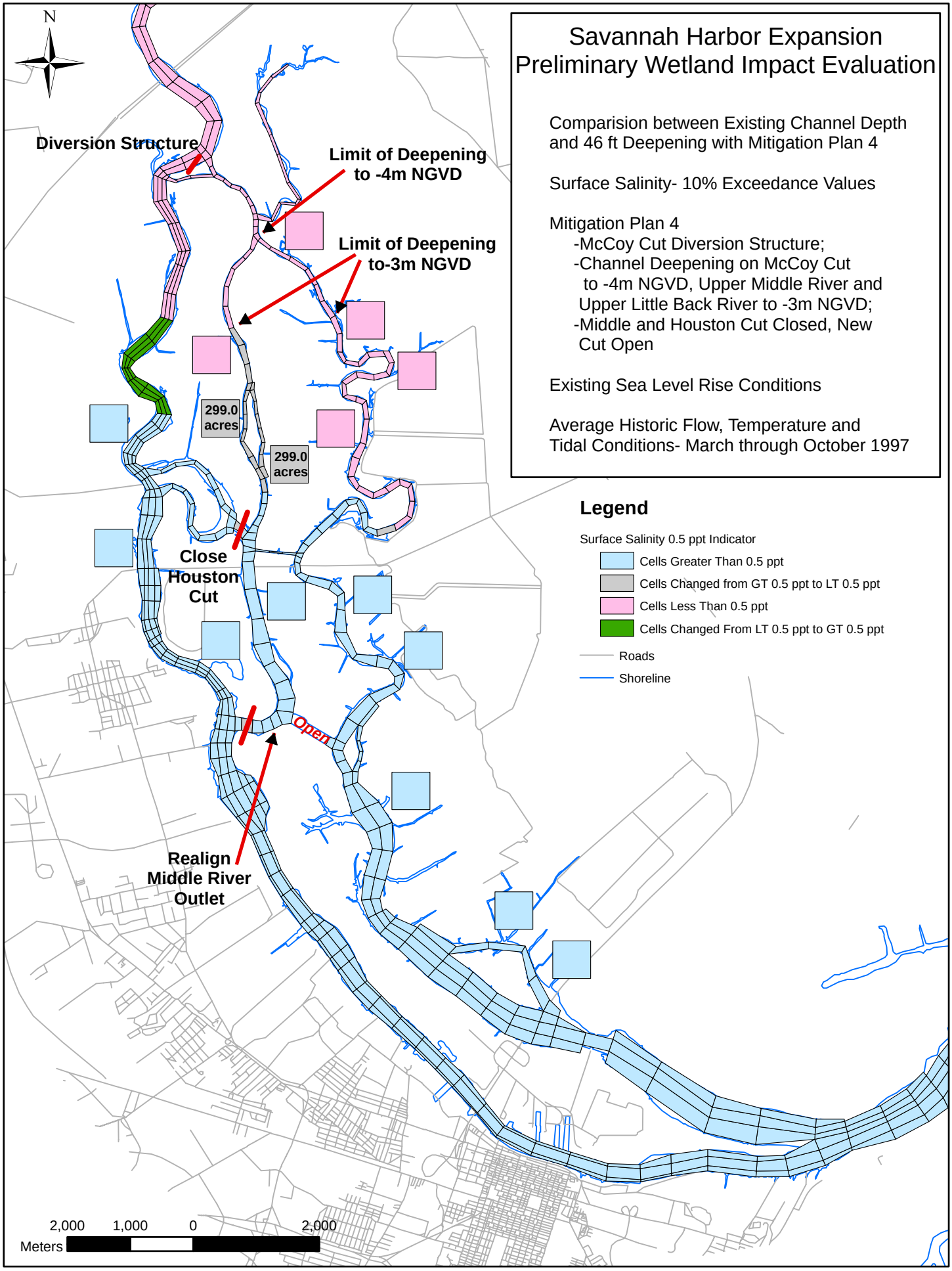
January 2007



January 2007

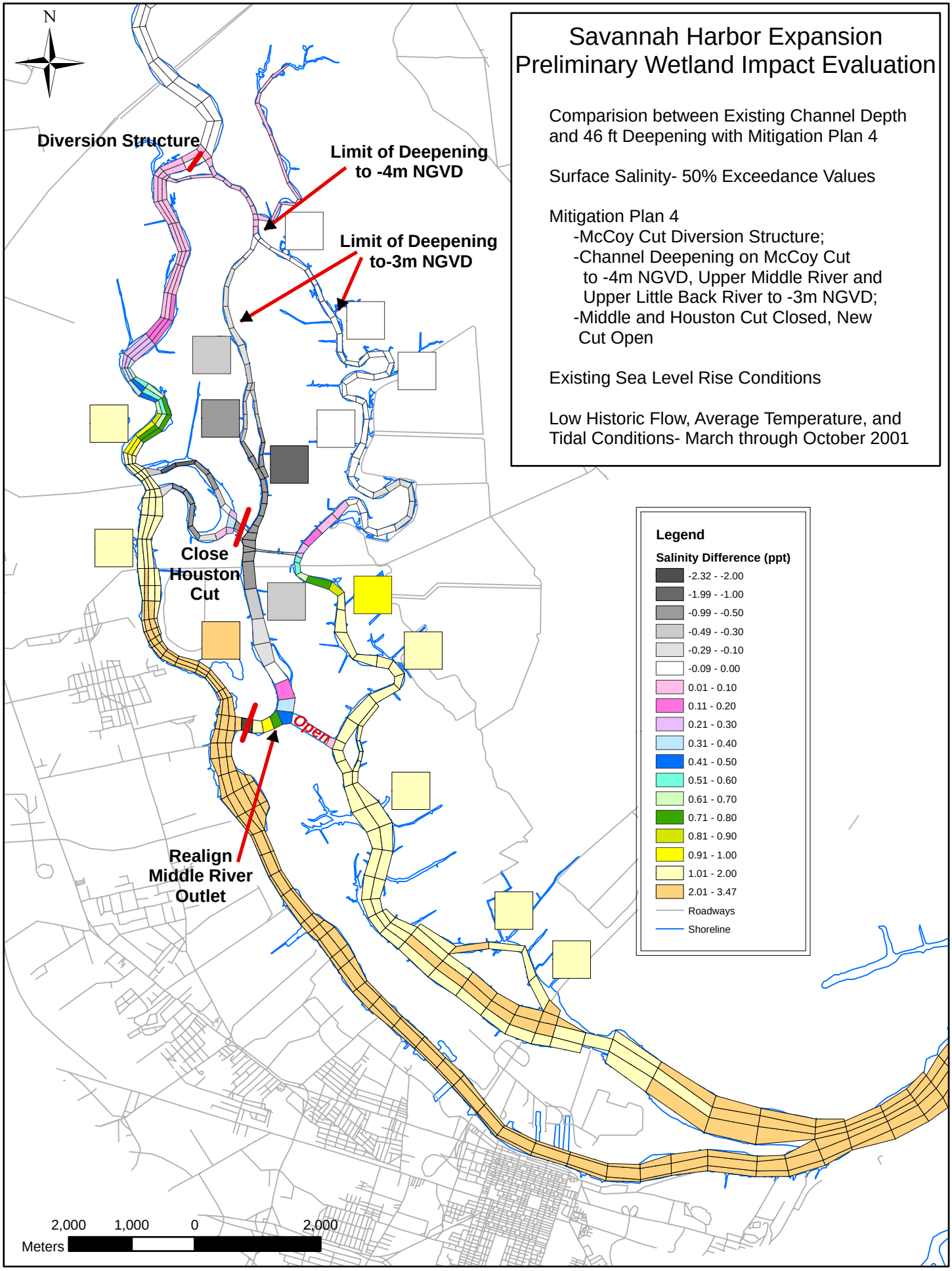


January 2007

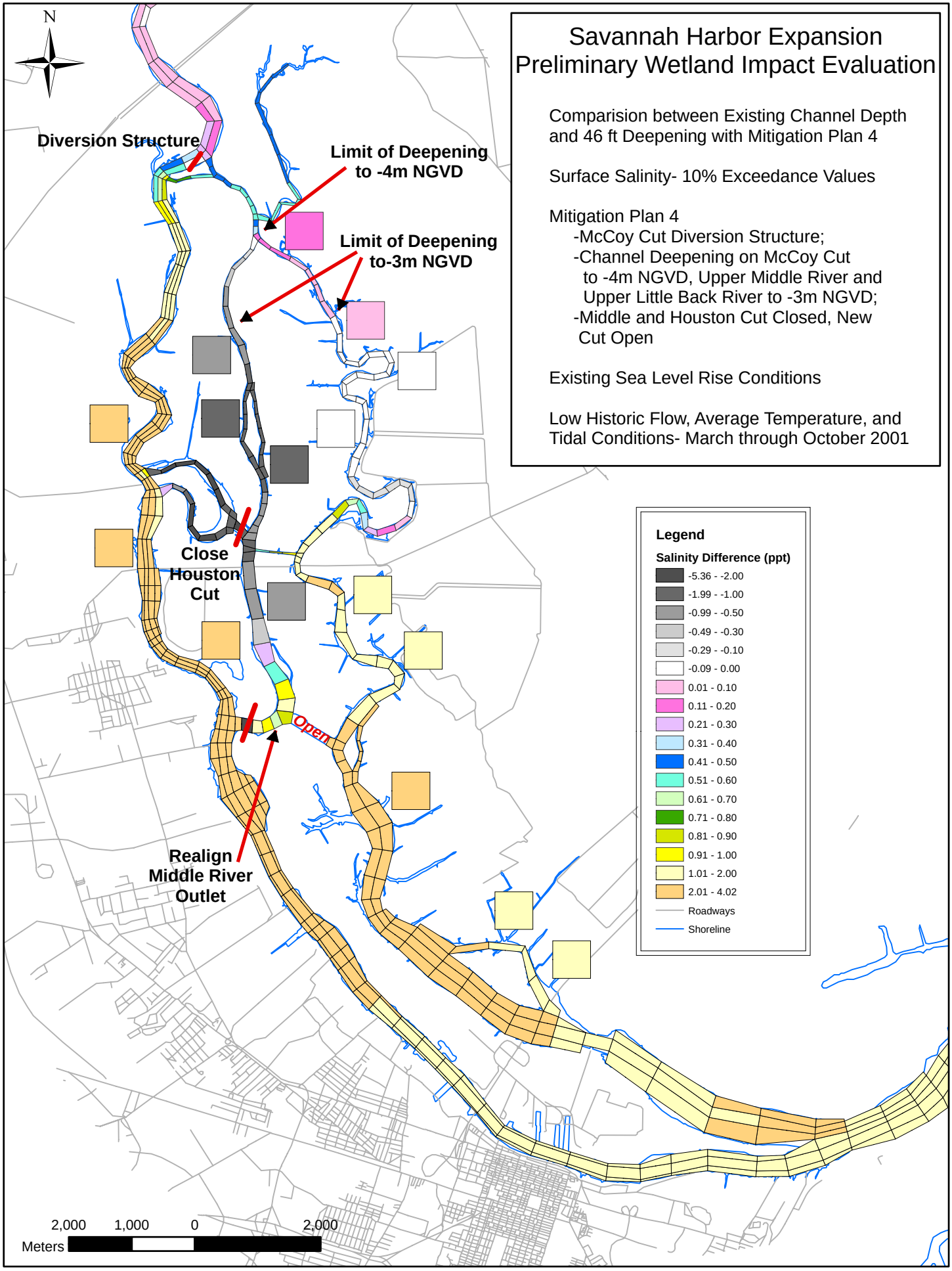


January 2007

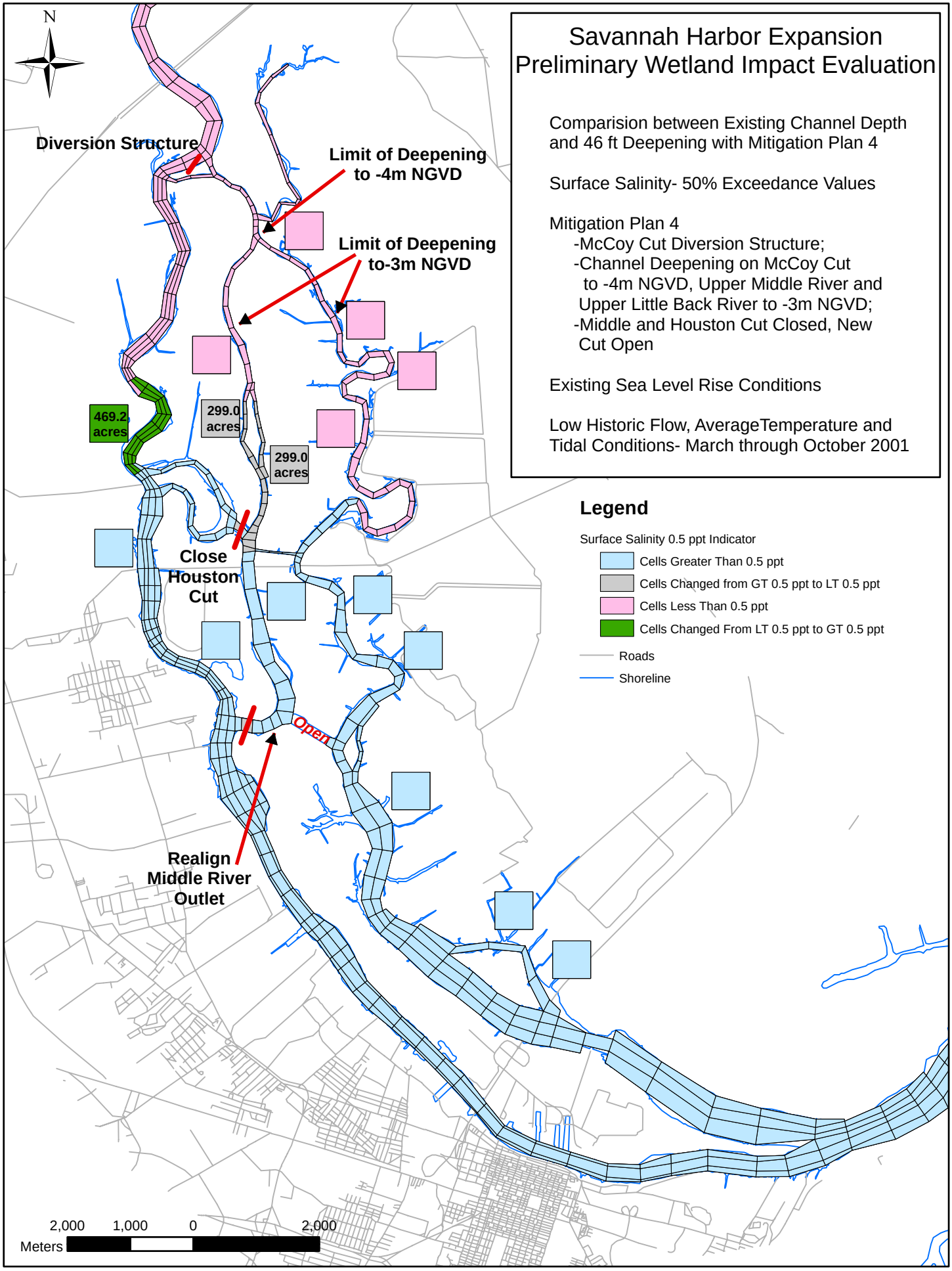
Sensitivity Analysis #1



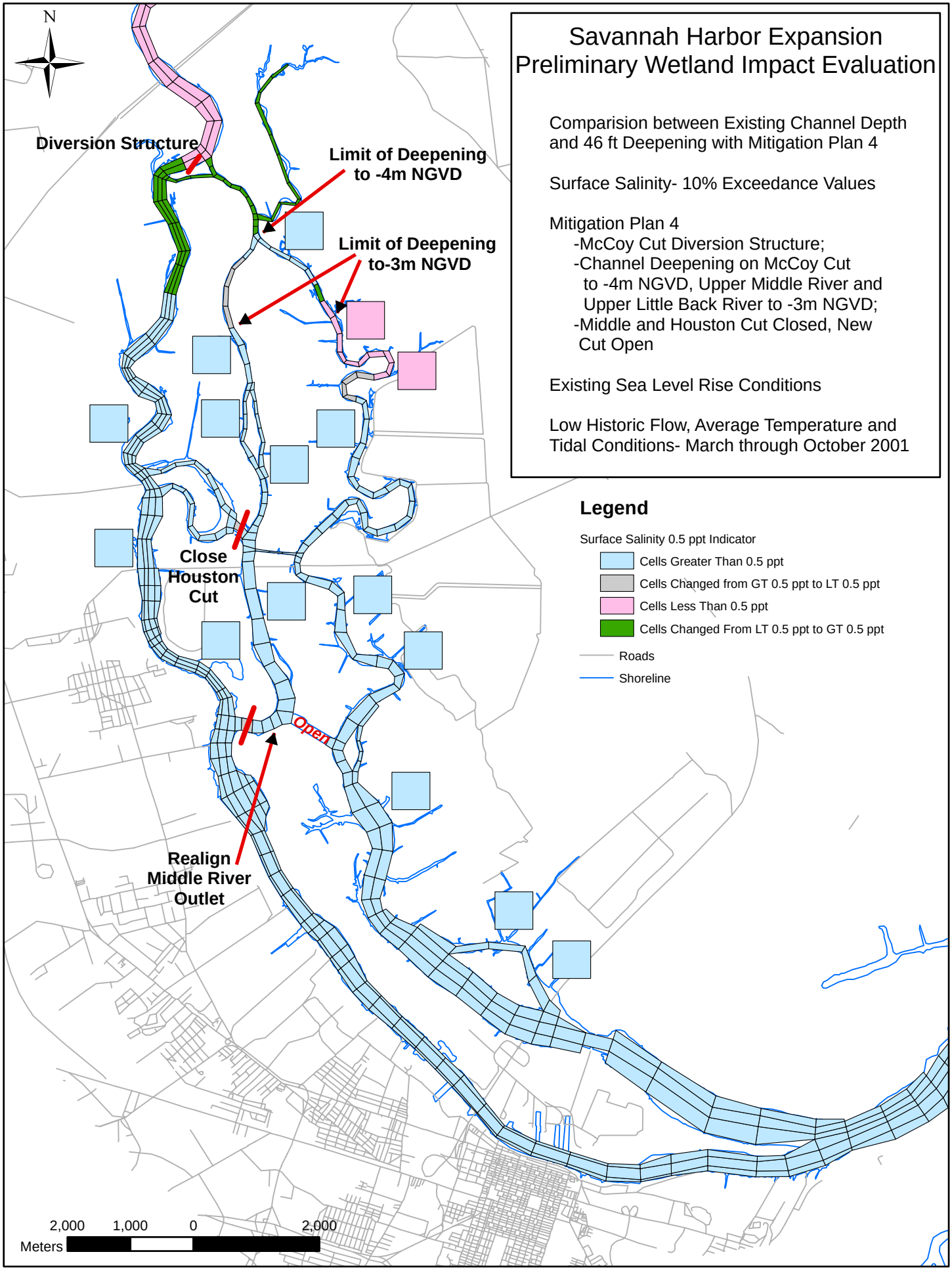
January 2007



January 2007

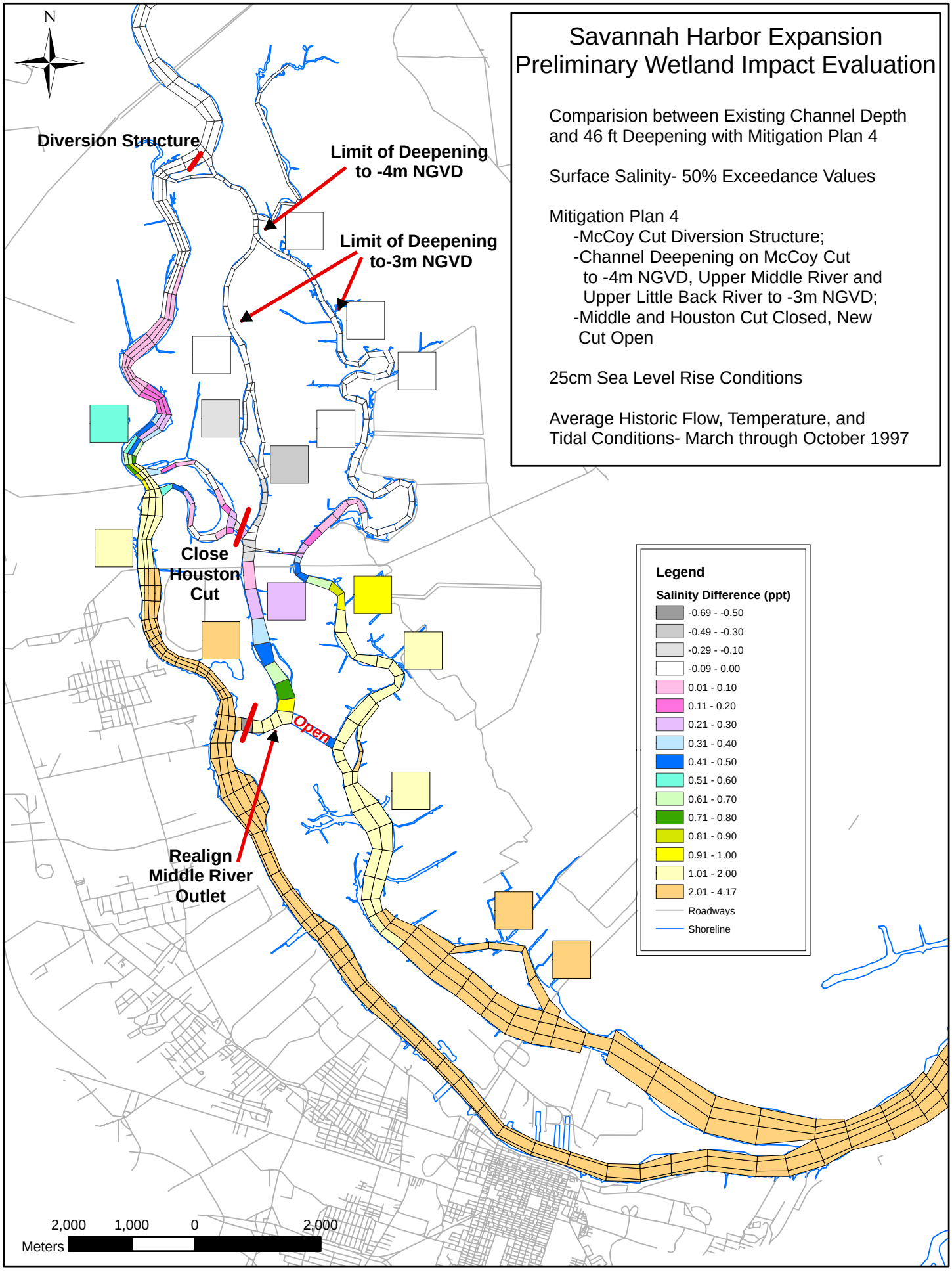


January 2007

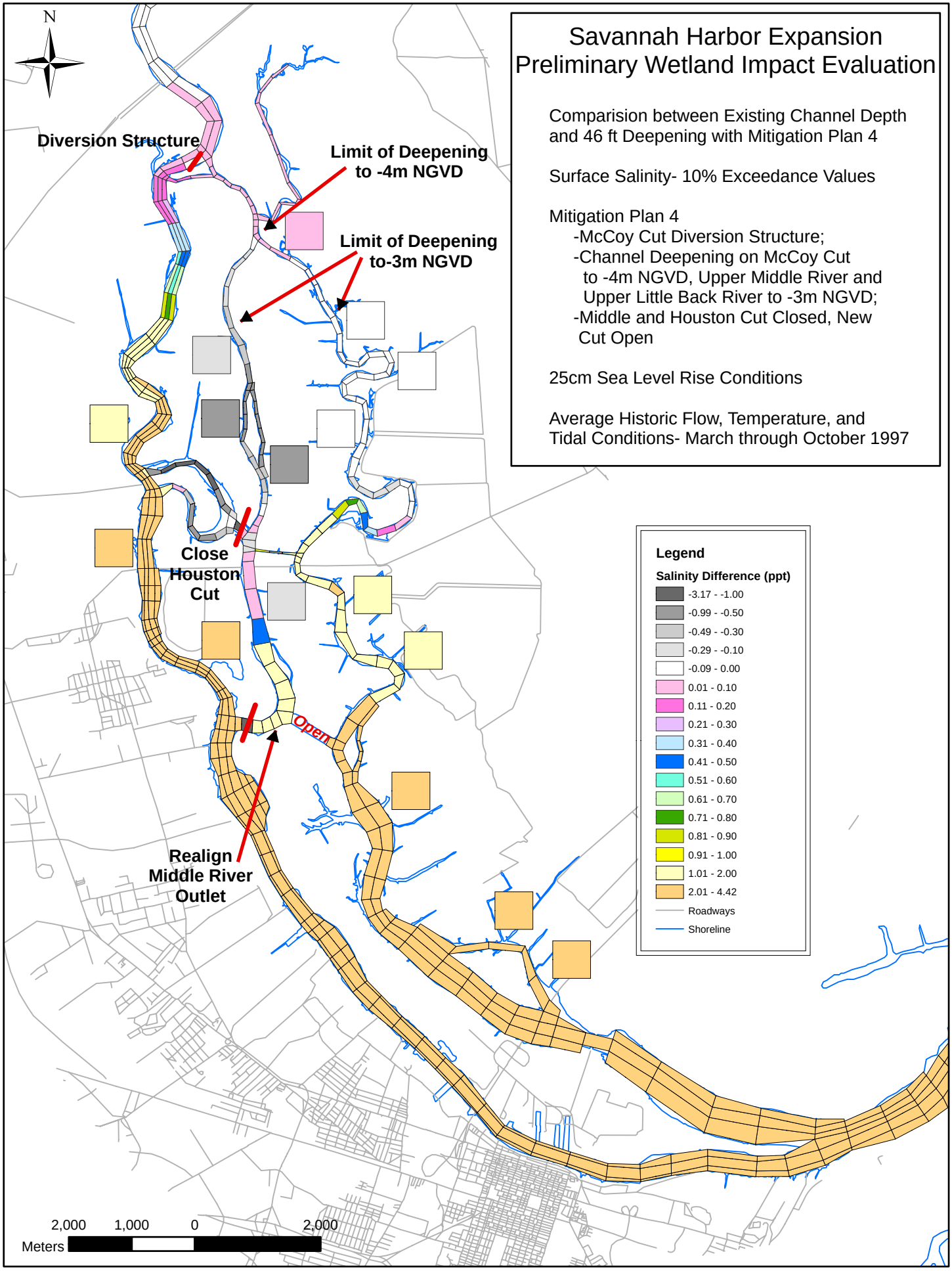


January 2007

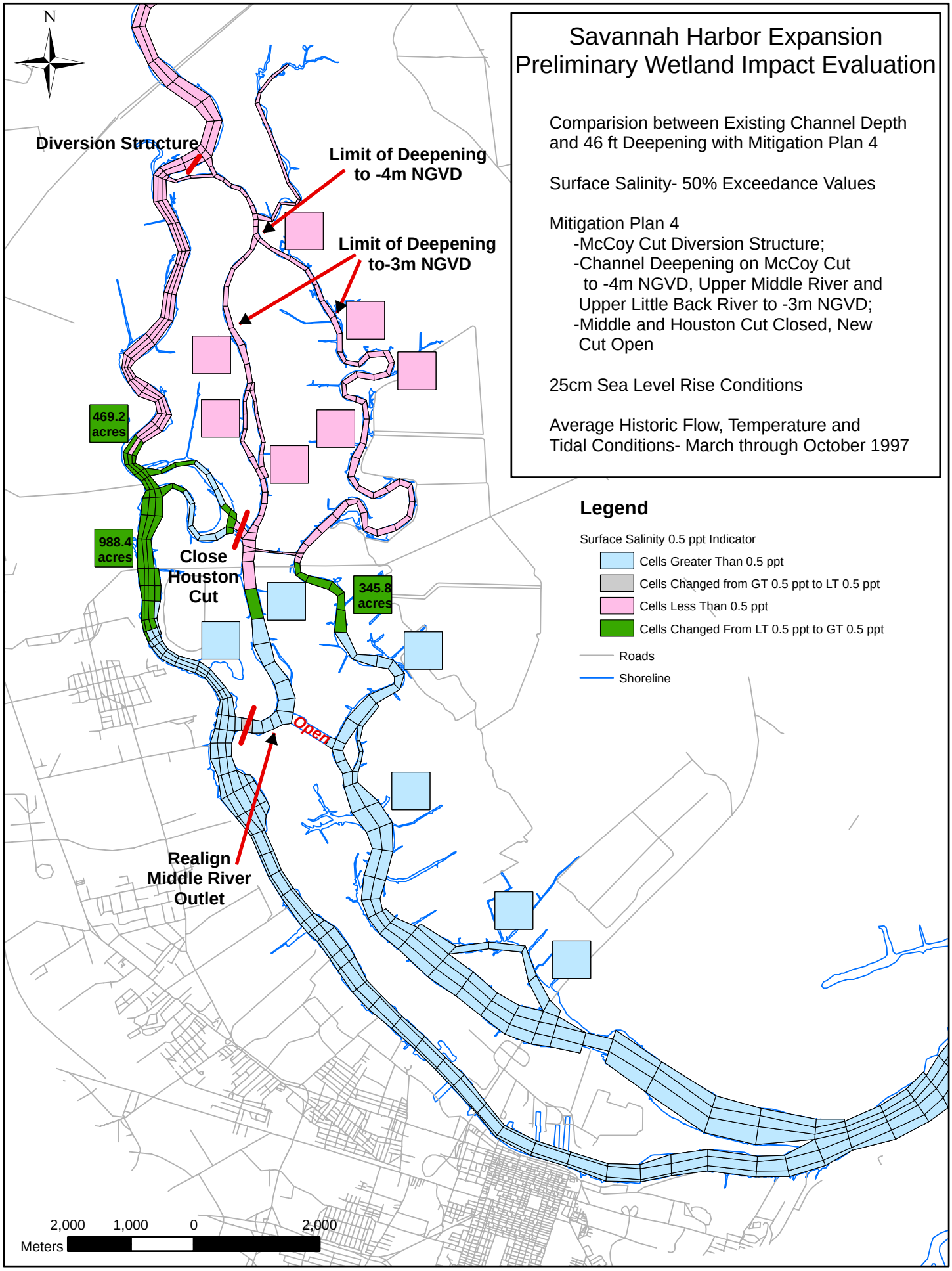
Sensitivity Analysis #2A



January 2007



January 2007



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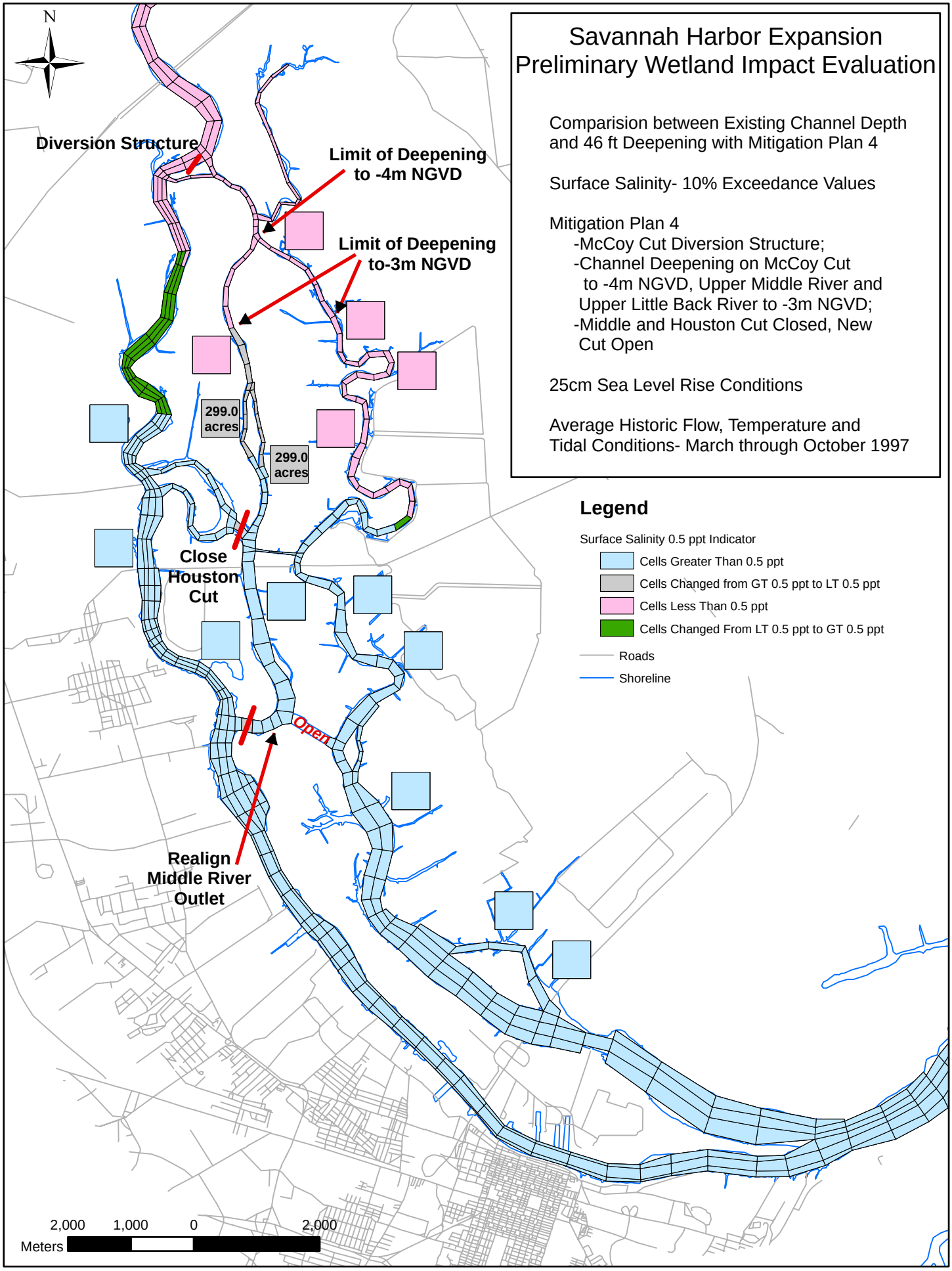
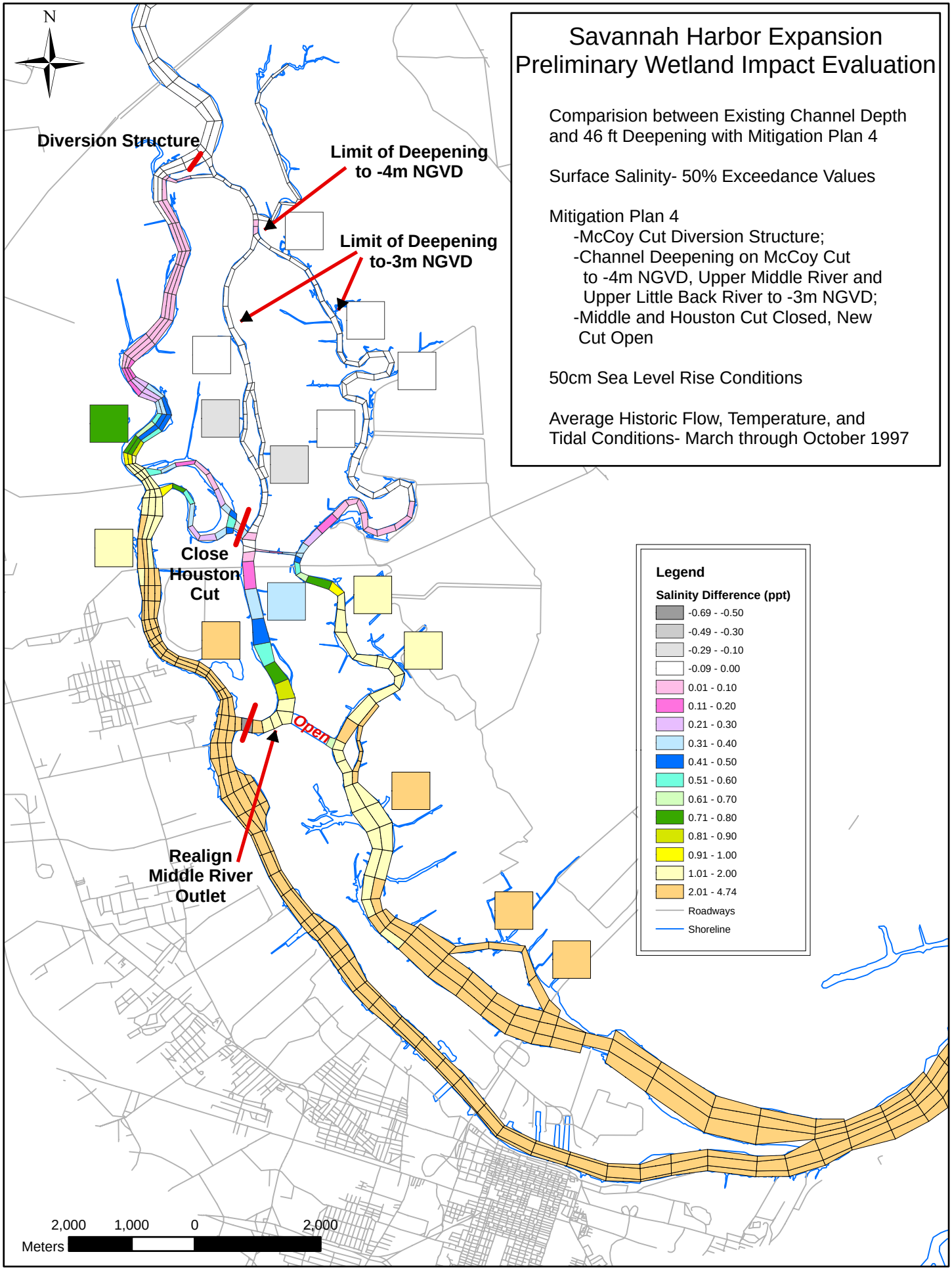
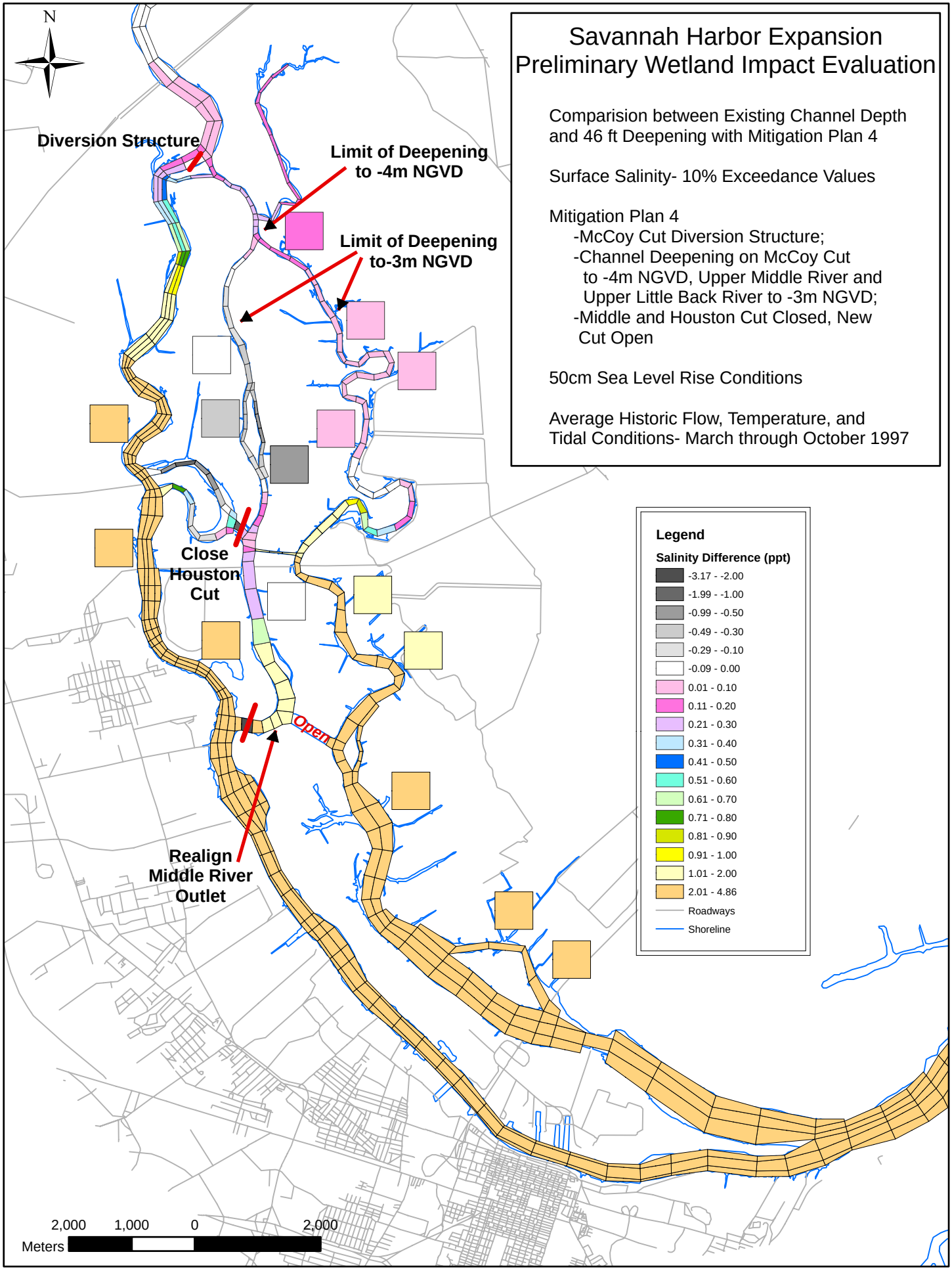


January 2007

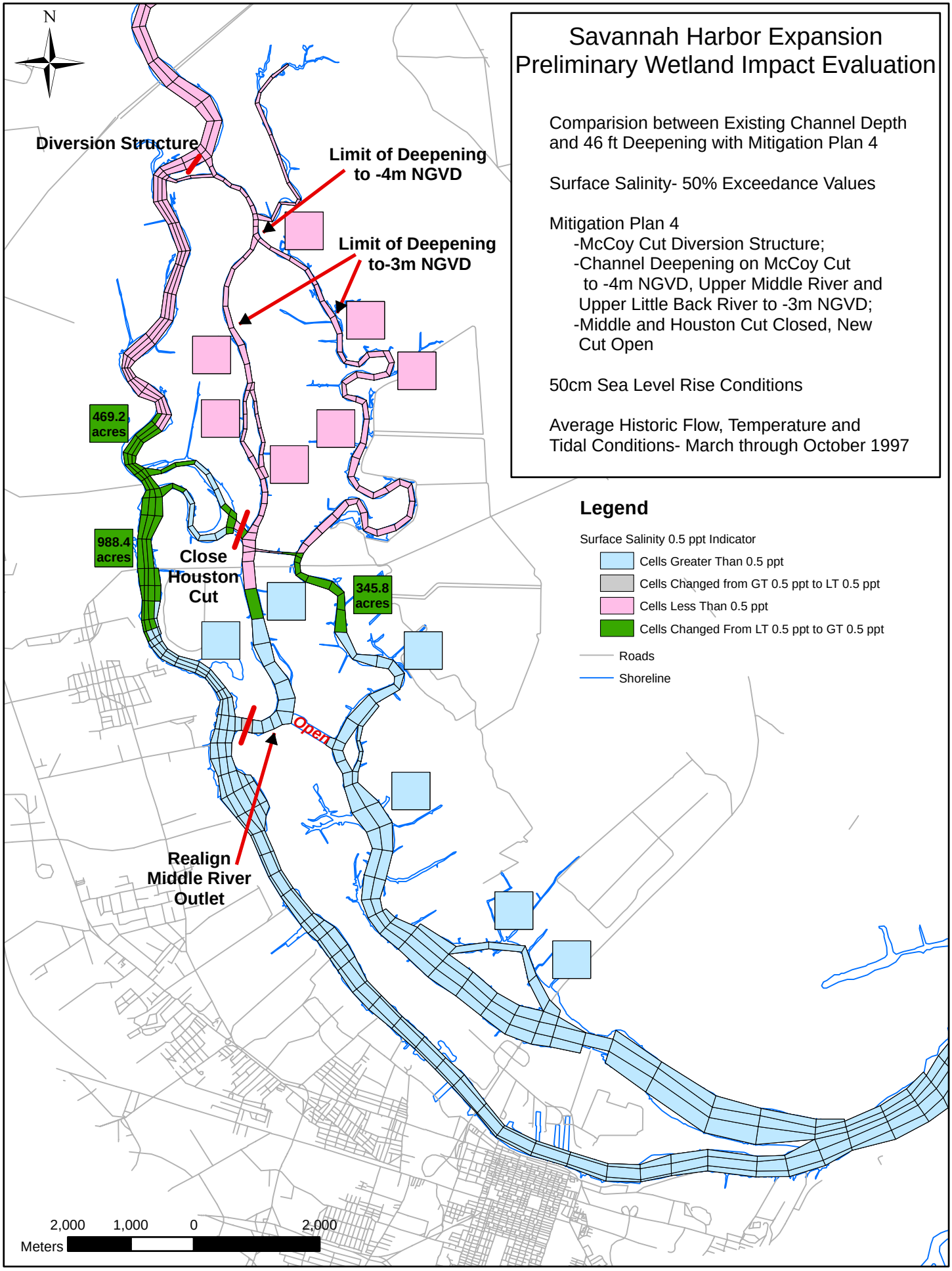
Sensitivity Analysis #2B



January 2007



January 2007



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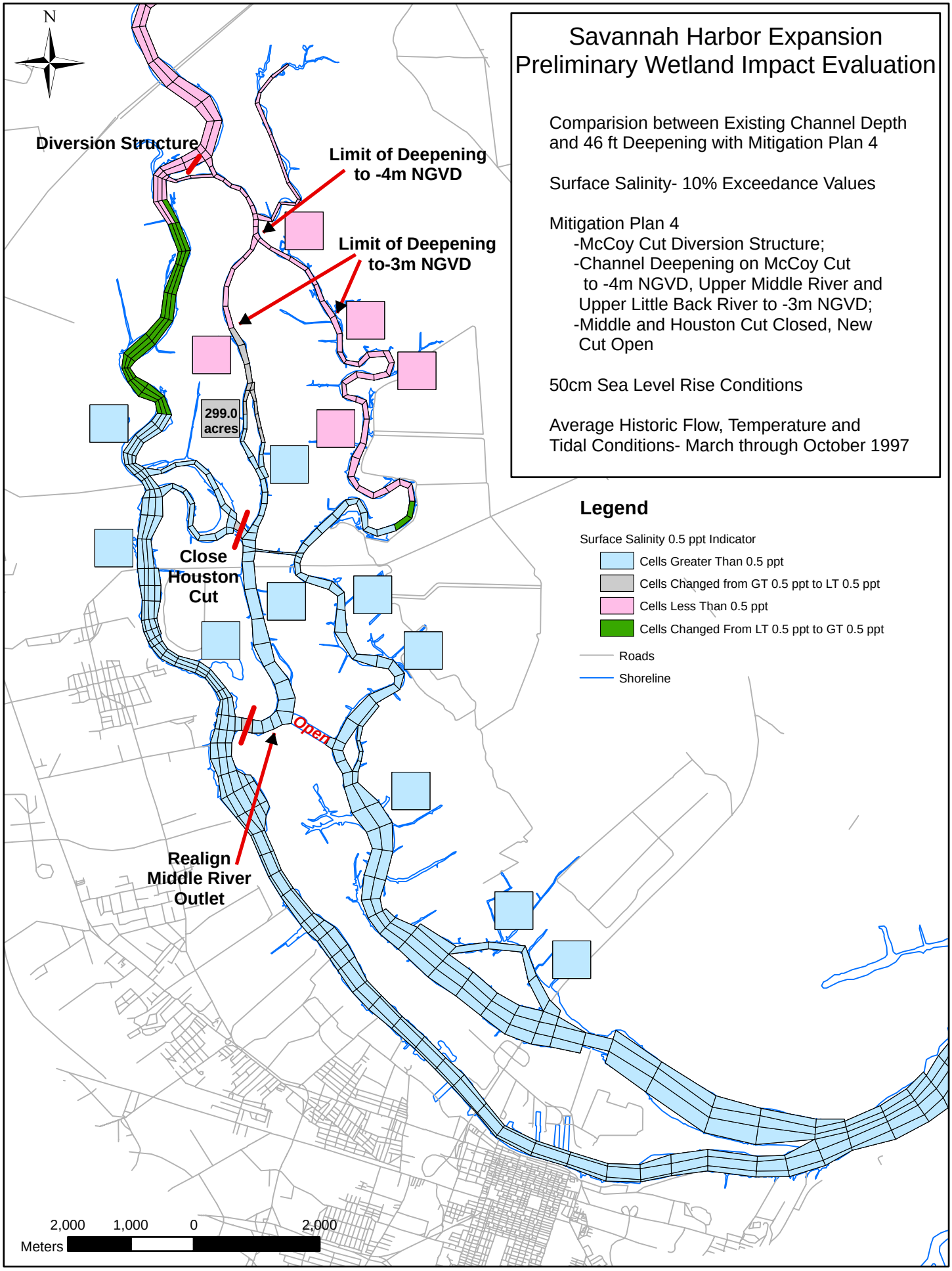
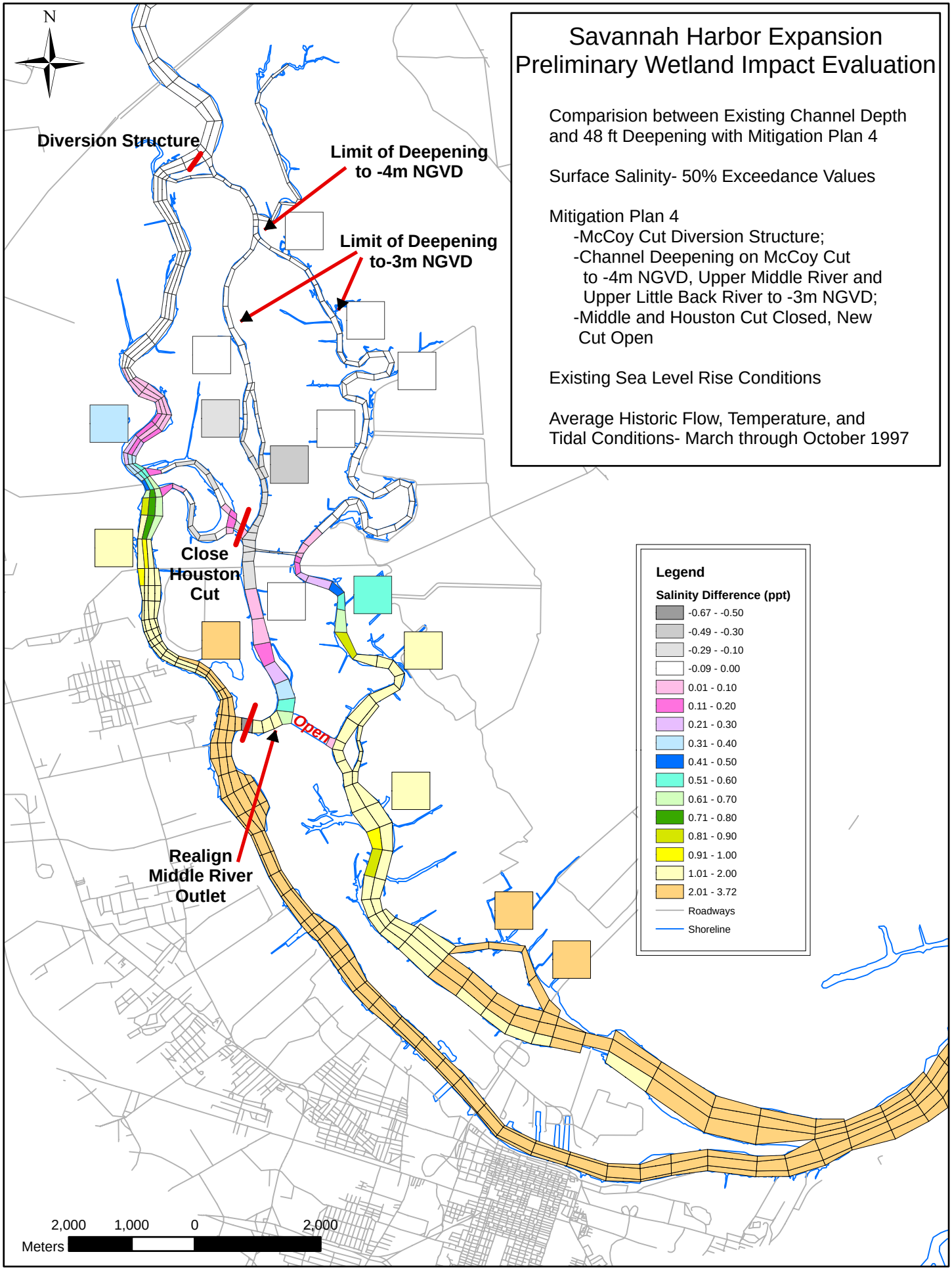


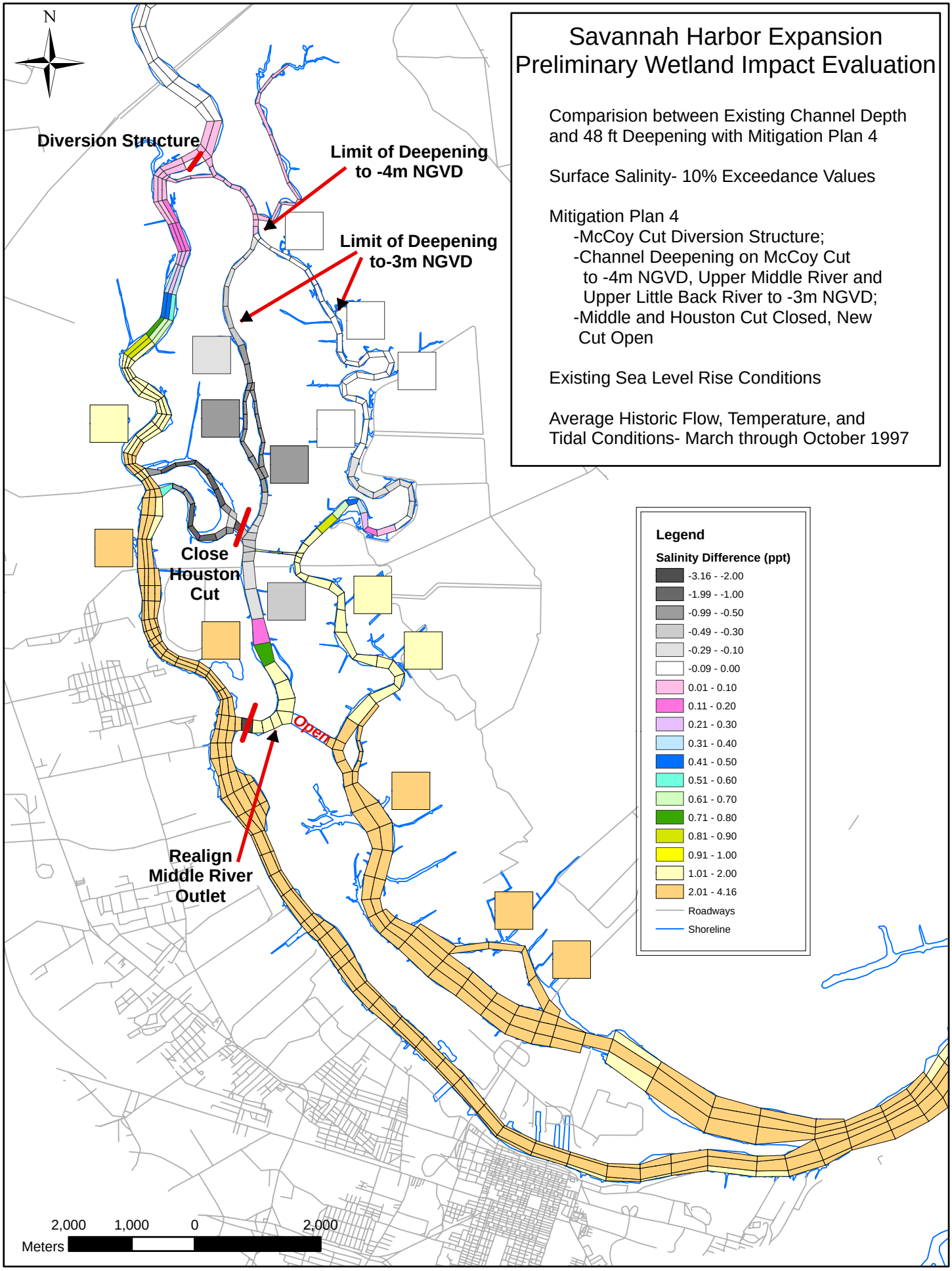
January 2007

48-ft Deepening

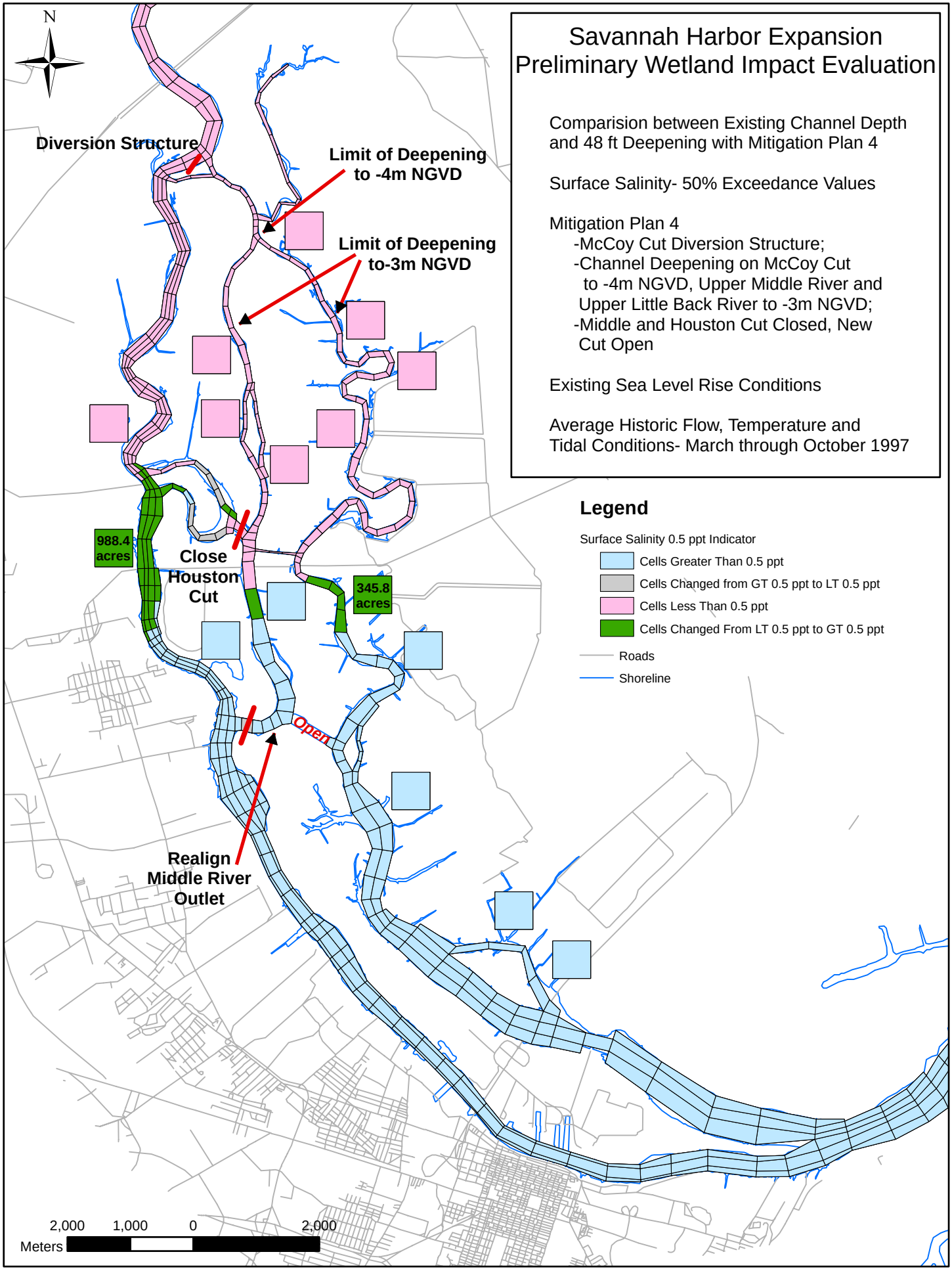
Basic Evaluation



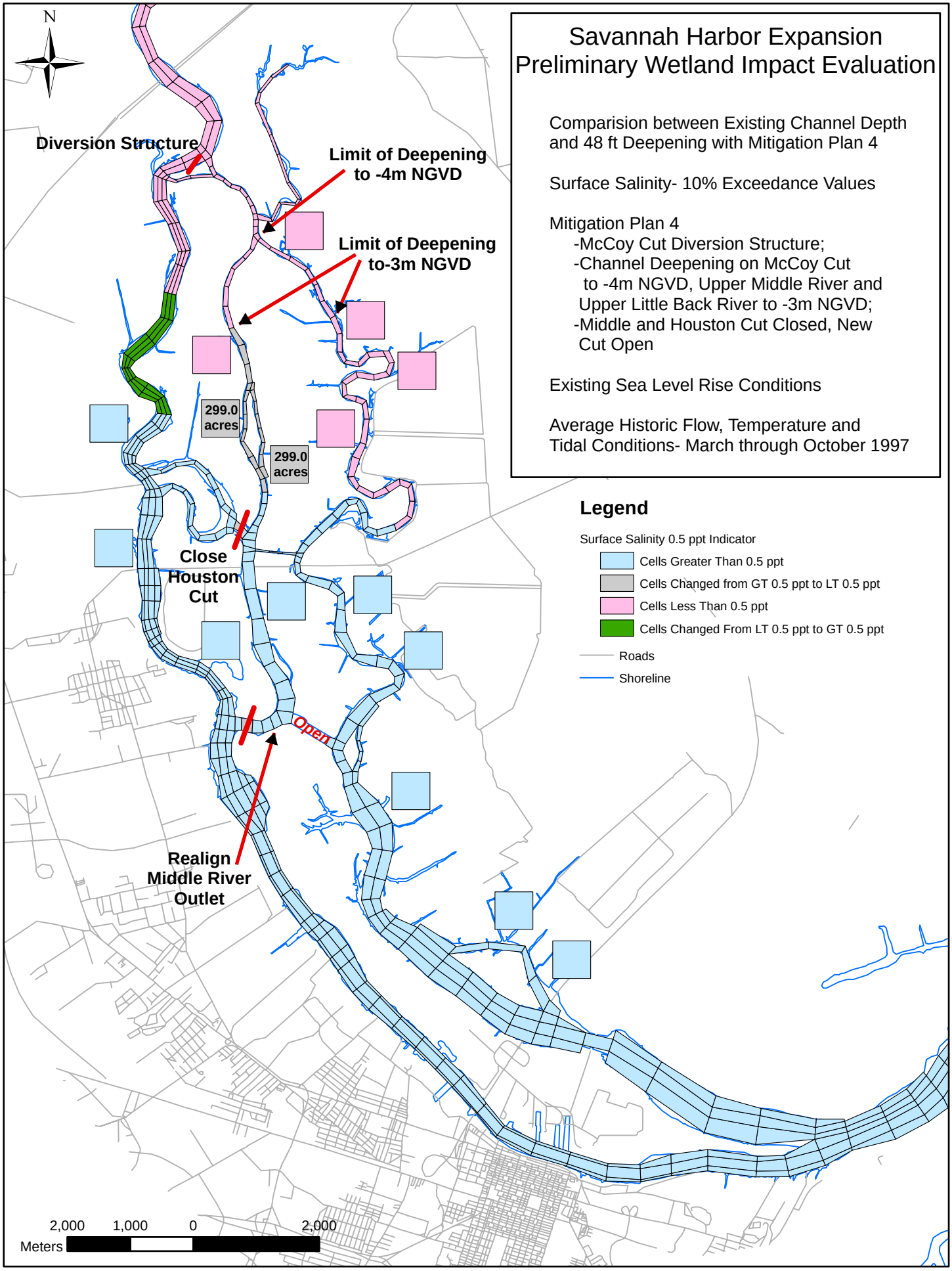
January 2007



January 2007

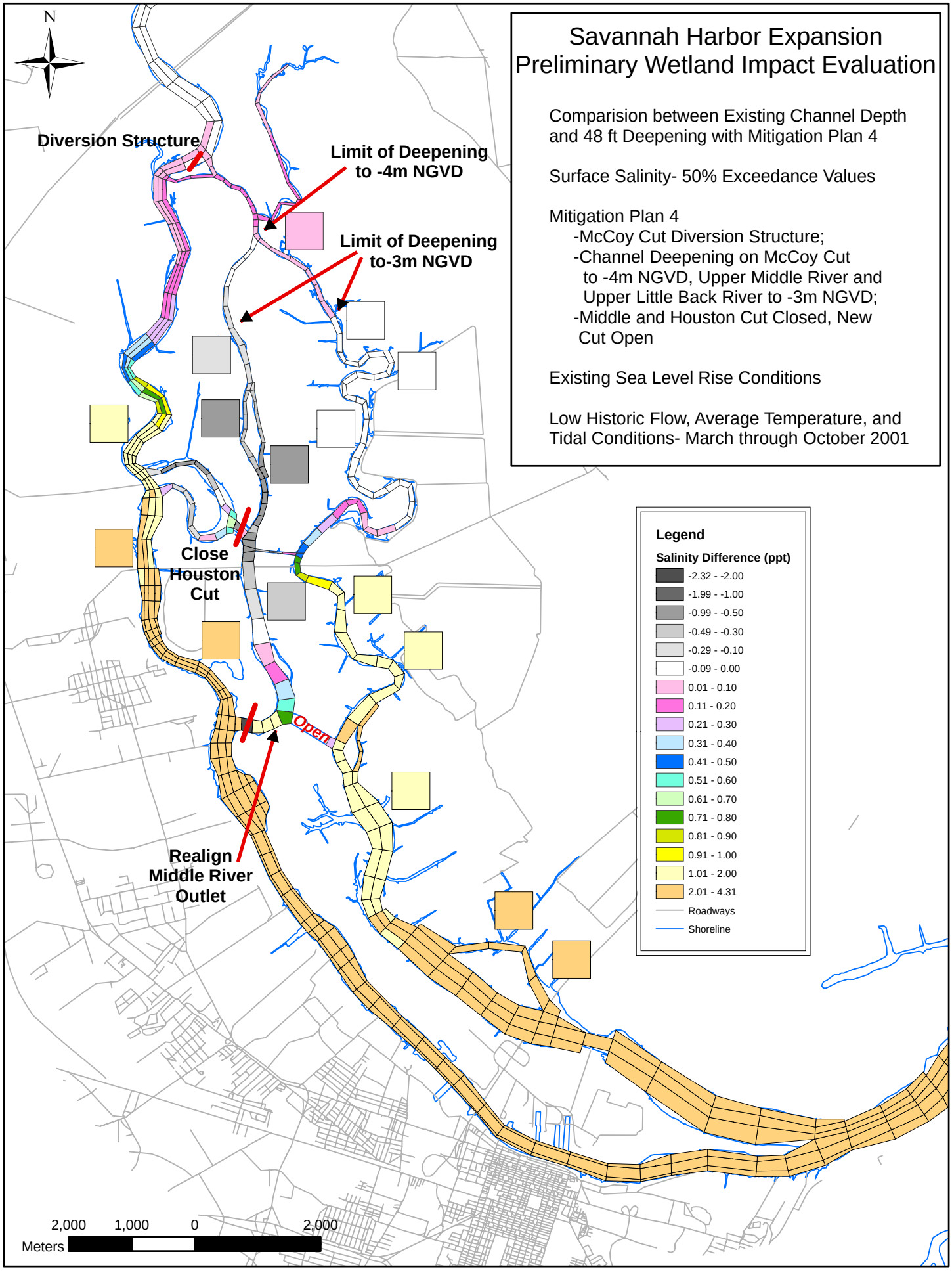


January 2007

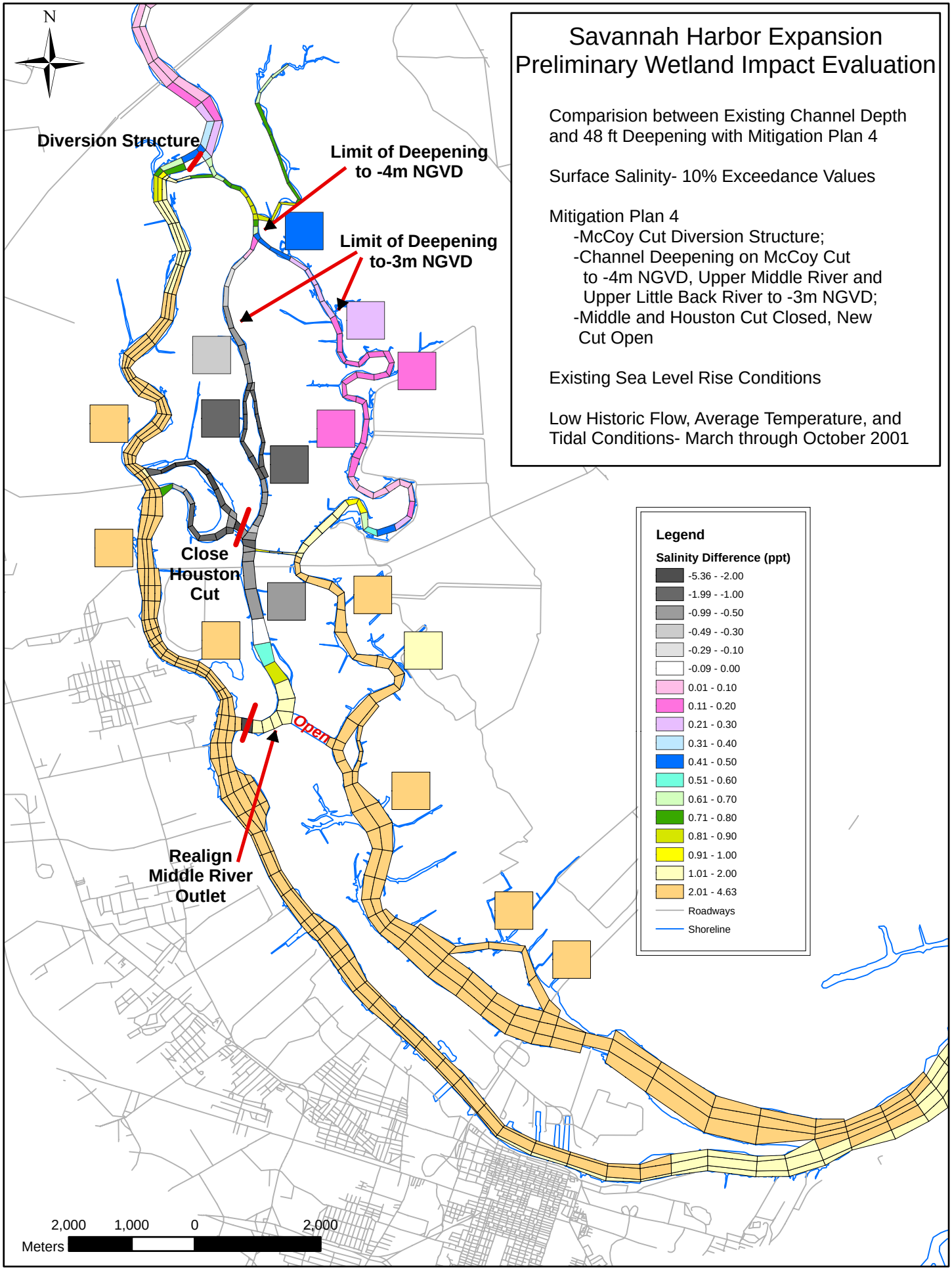


January 2007

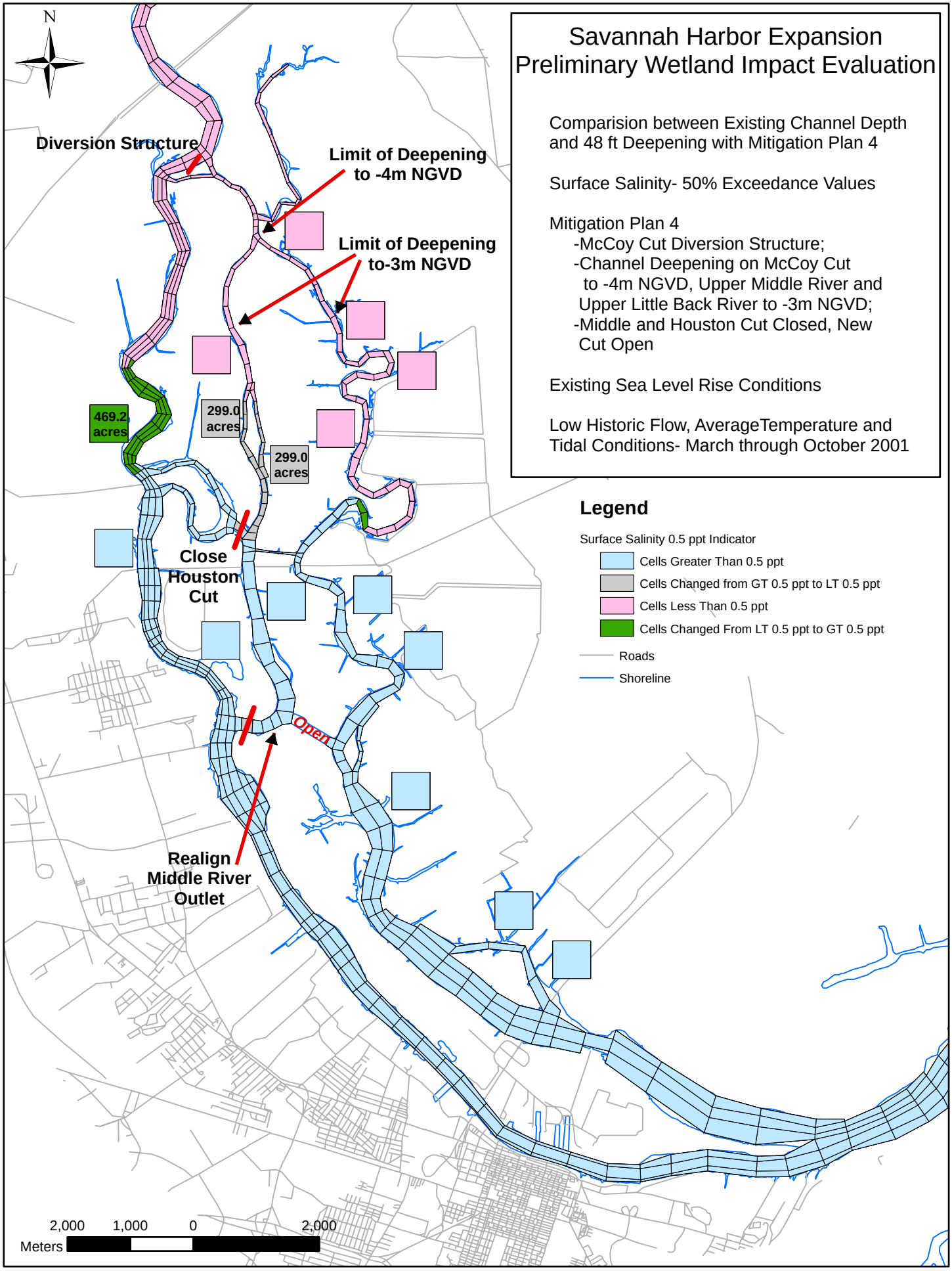
Sensitivity Analysis #1



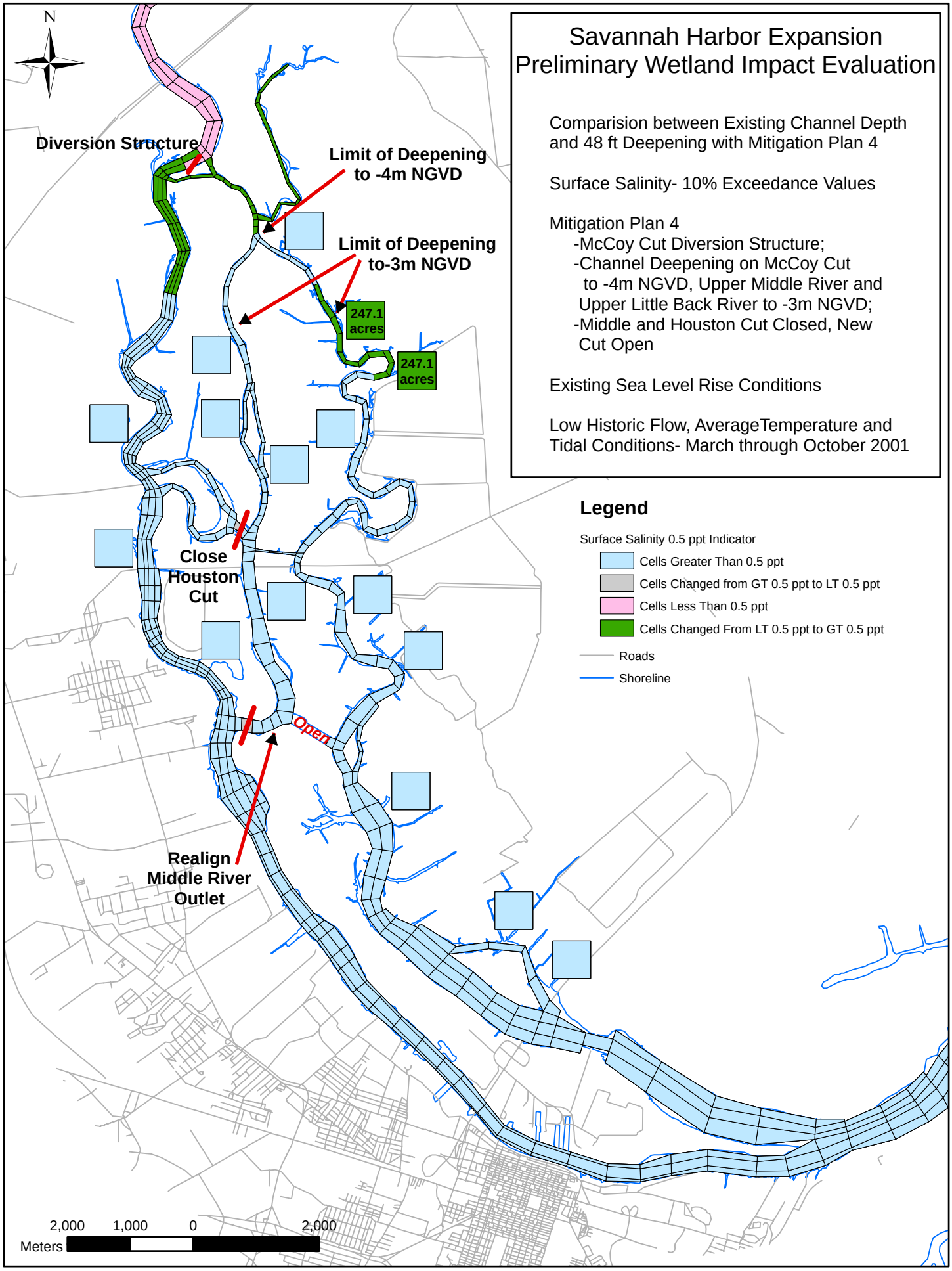
January 2007



January 2007

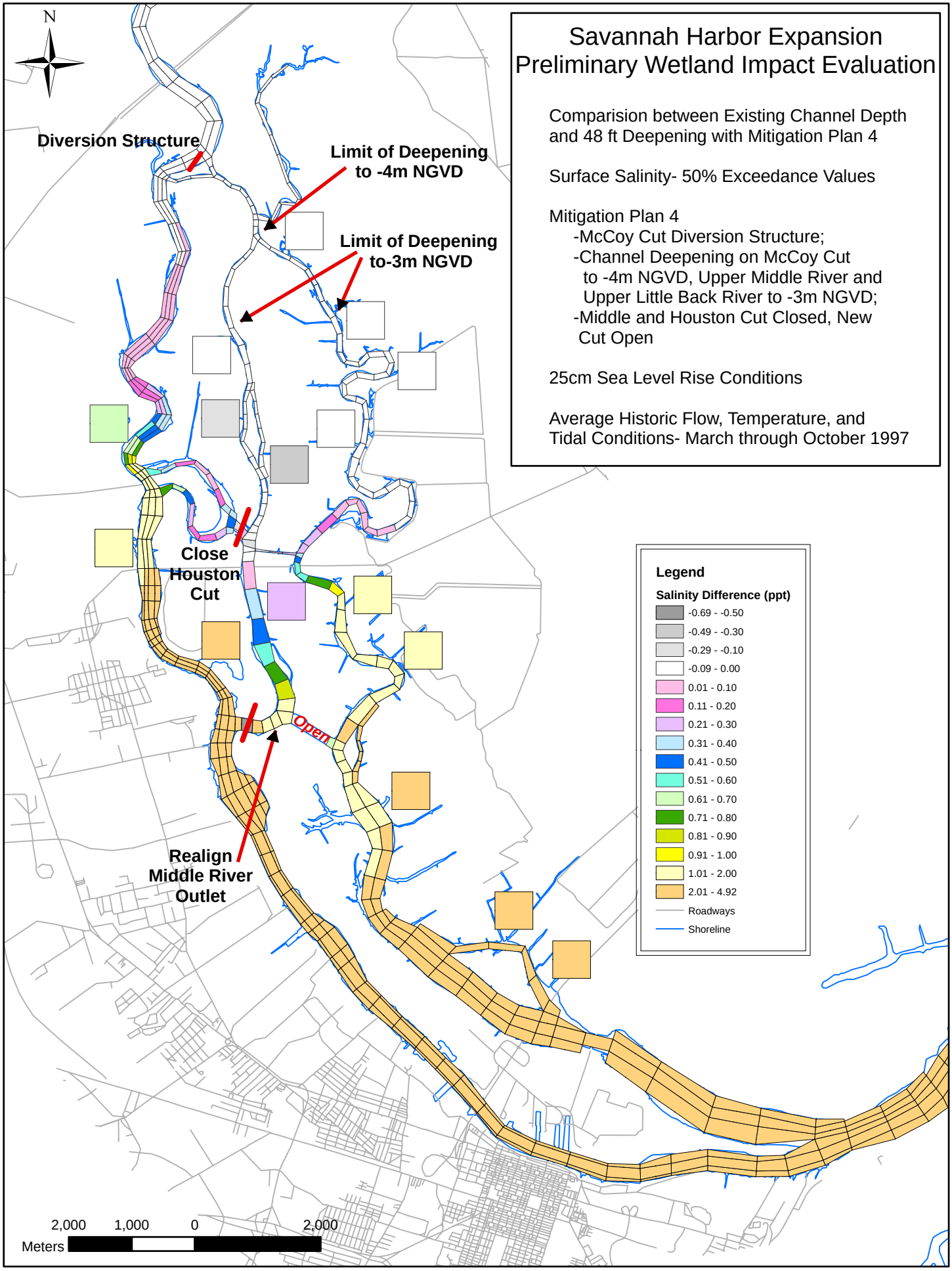


January 2007

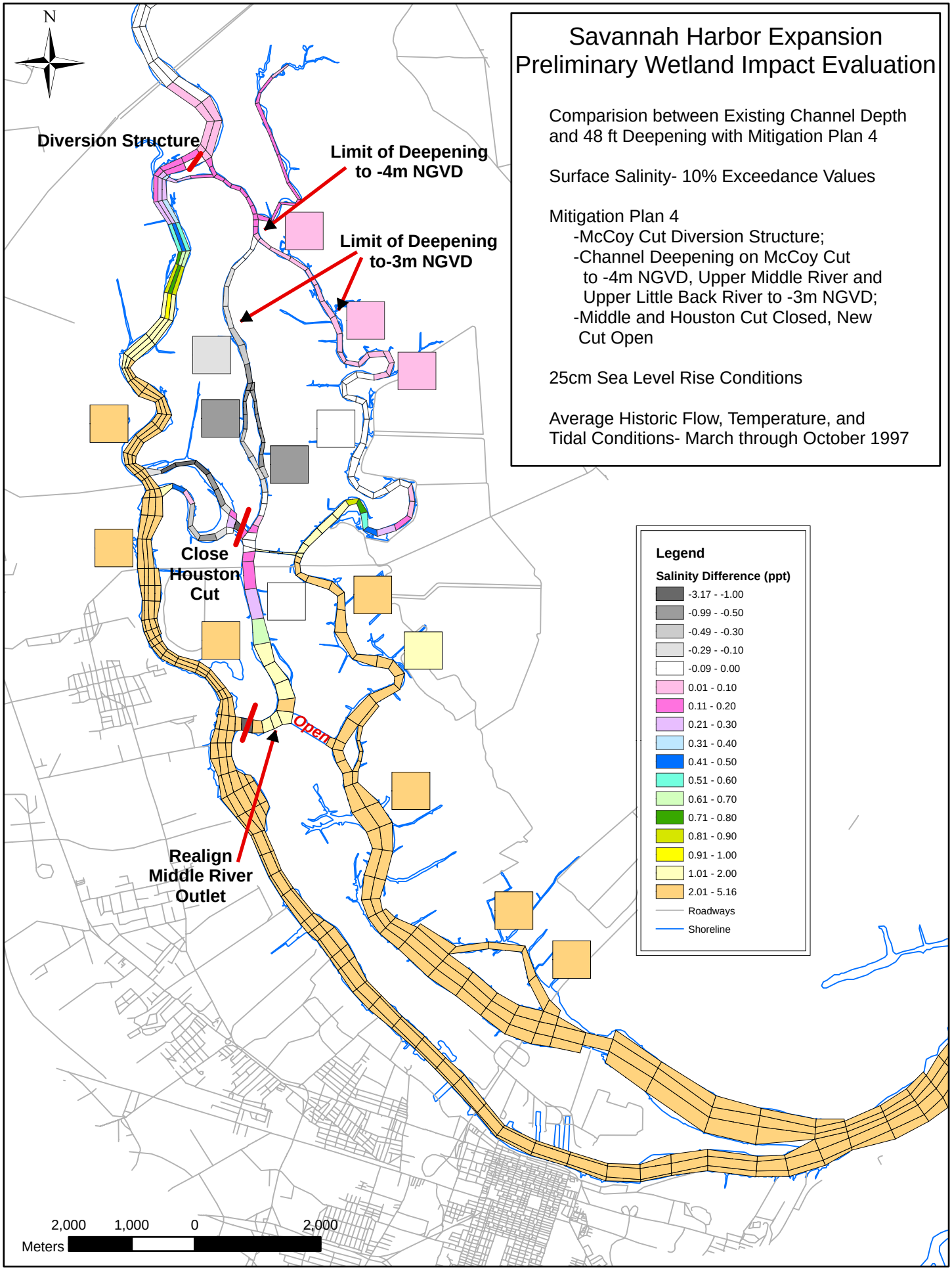


January 2007

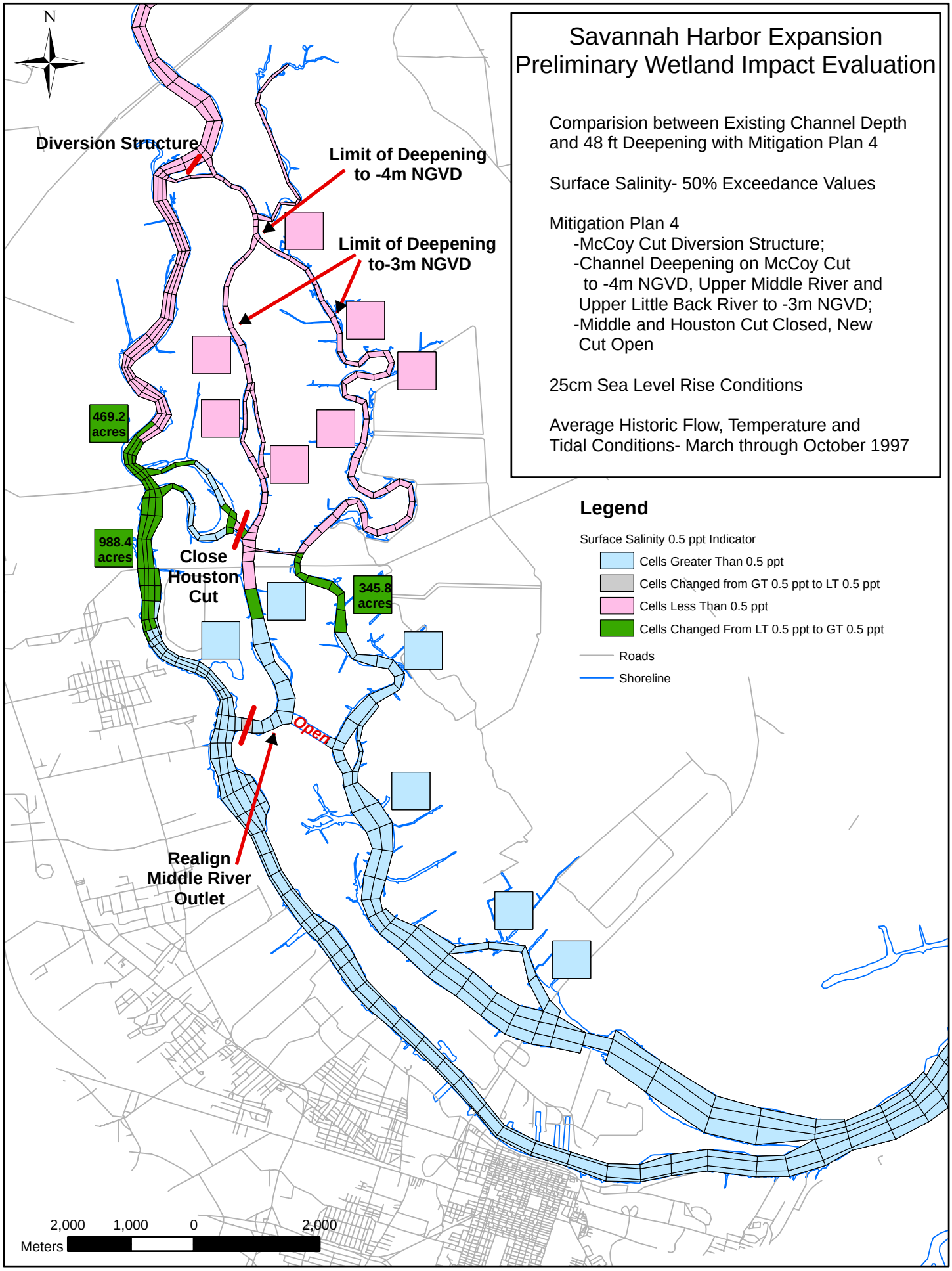
Sensitivity Analysis #2A



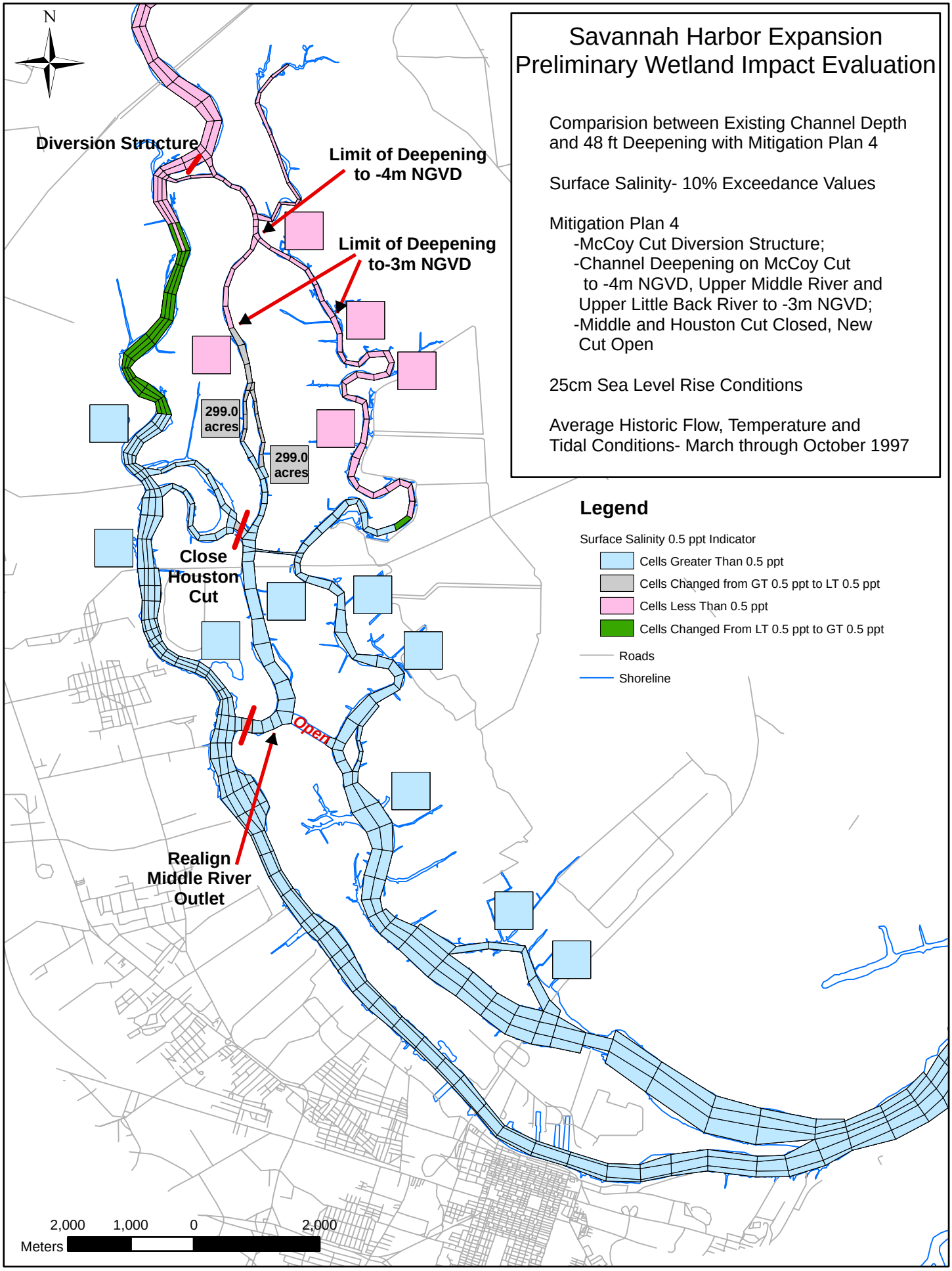
January 2007



January 2007

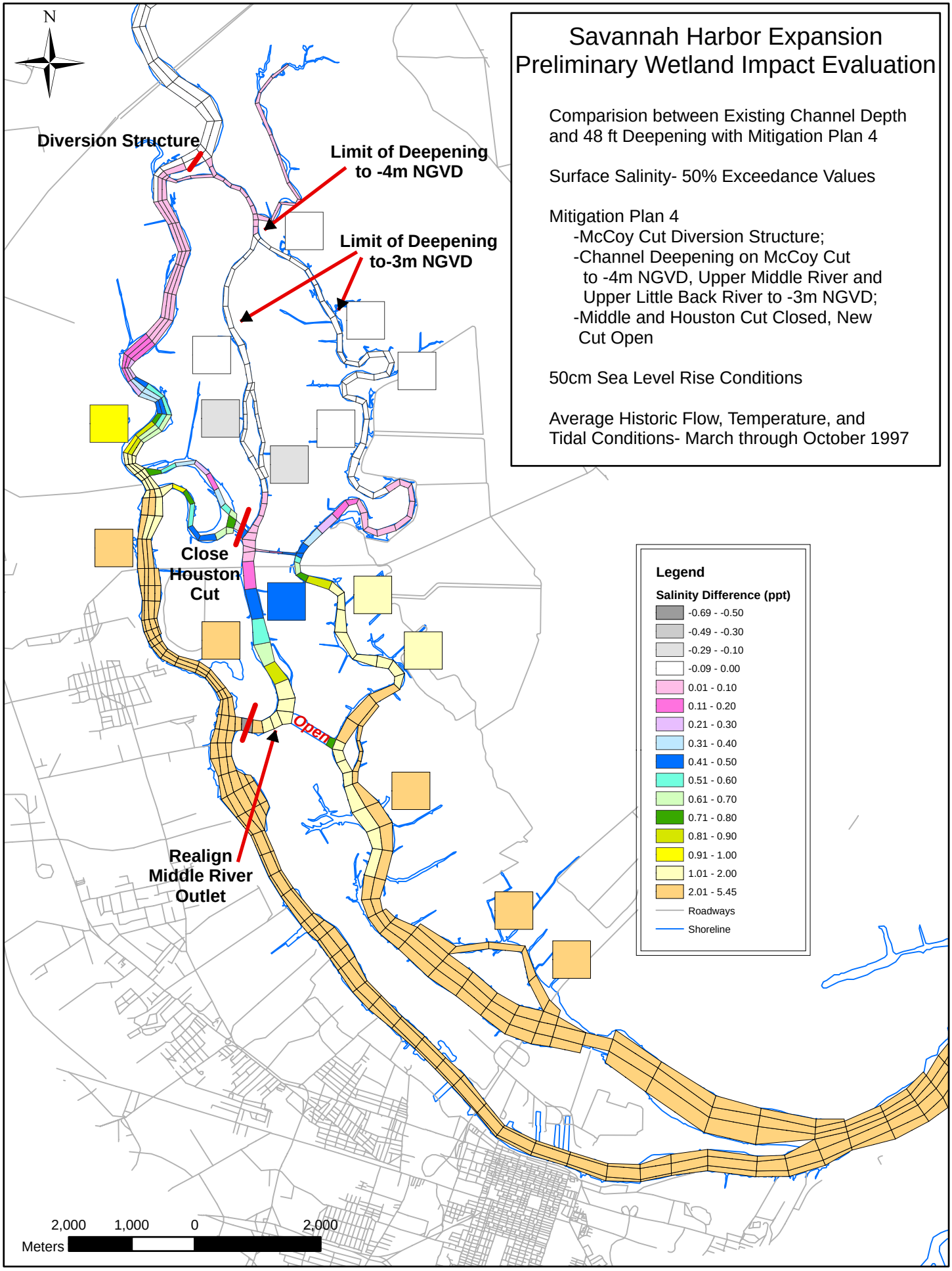


January 2007

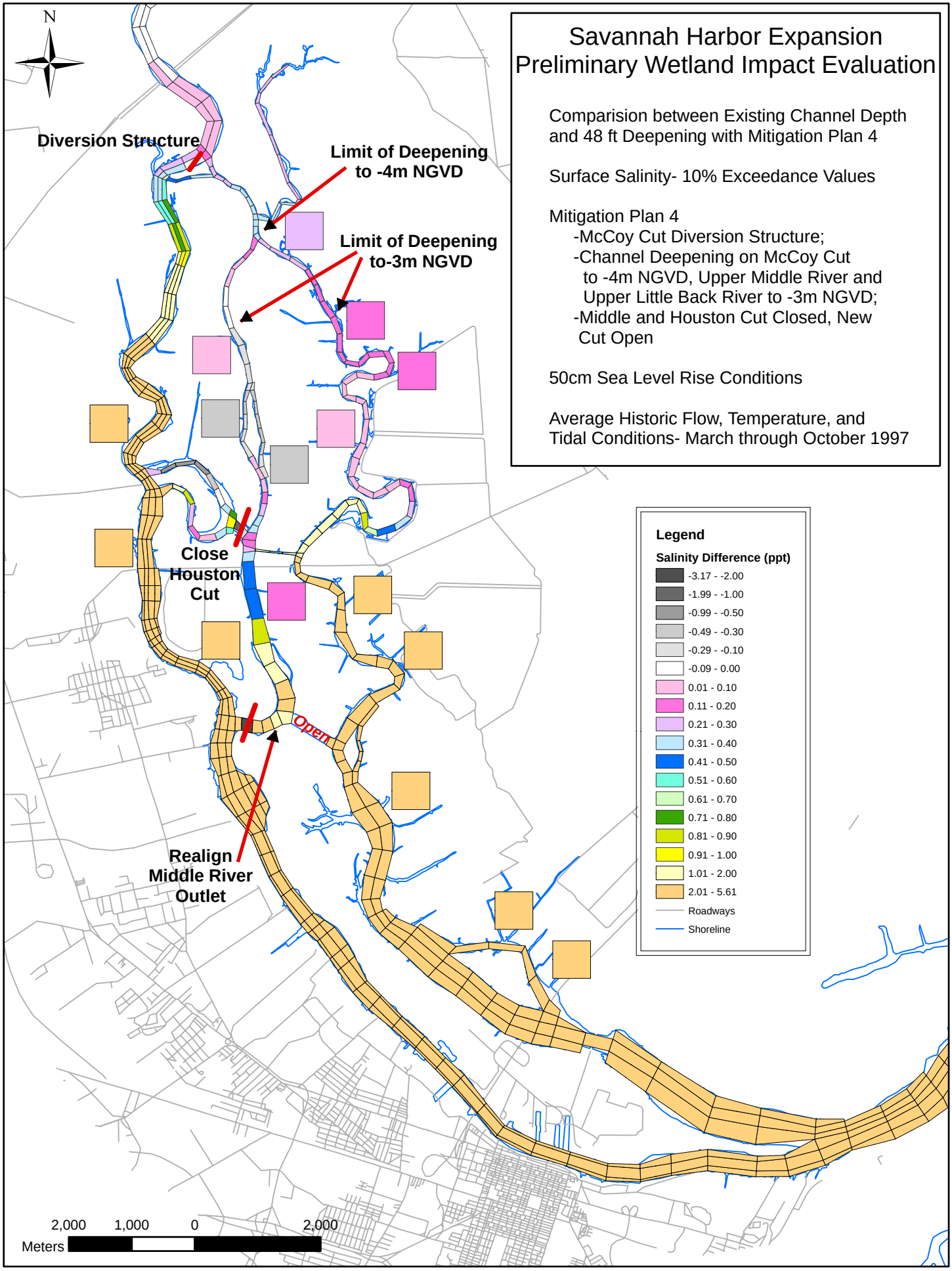


January 2007

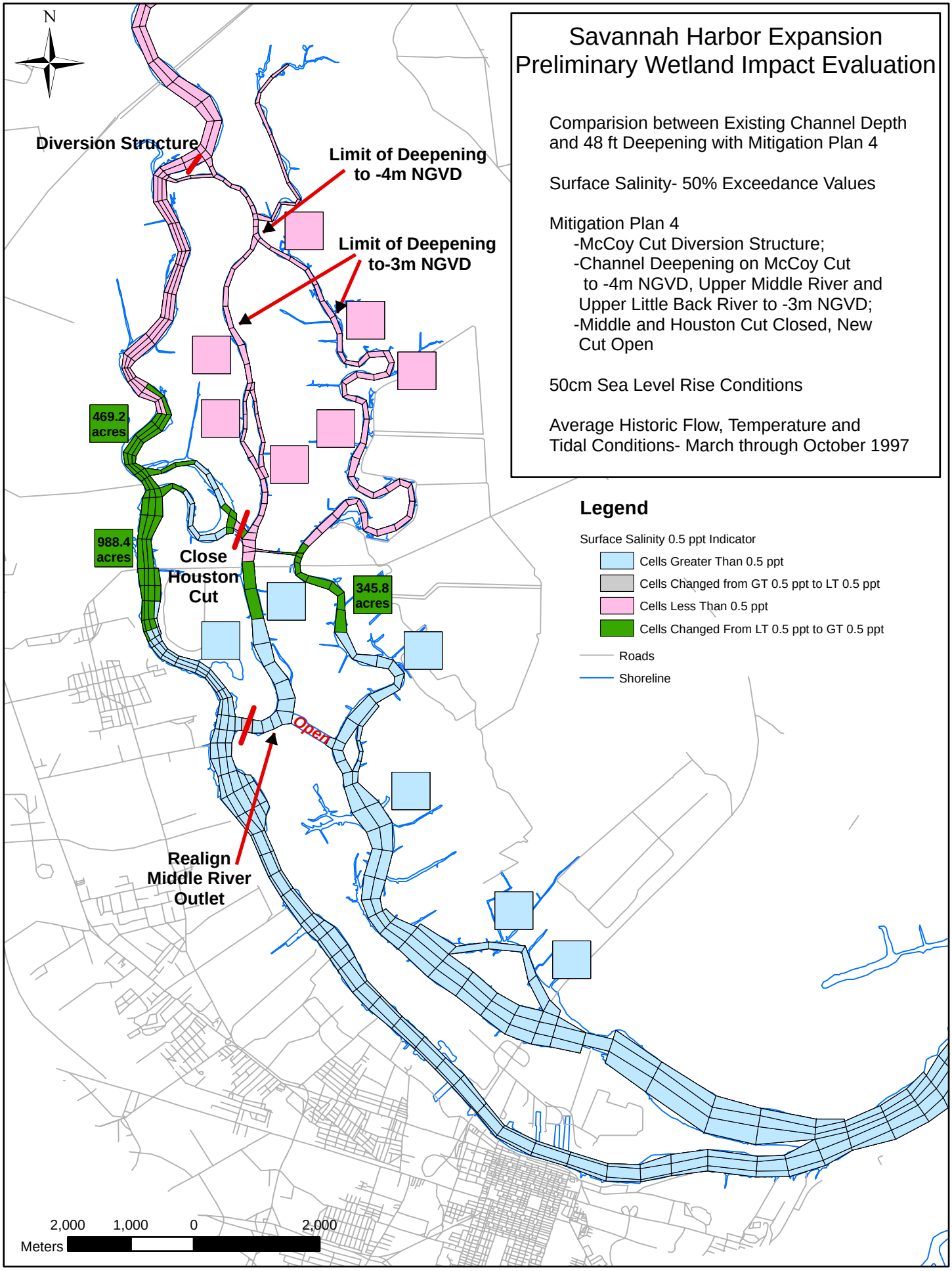
Sensitivity Analysis #2B



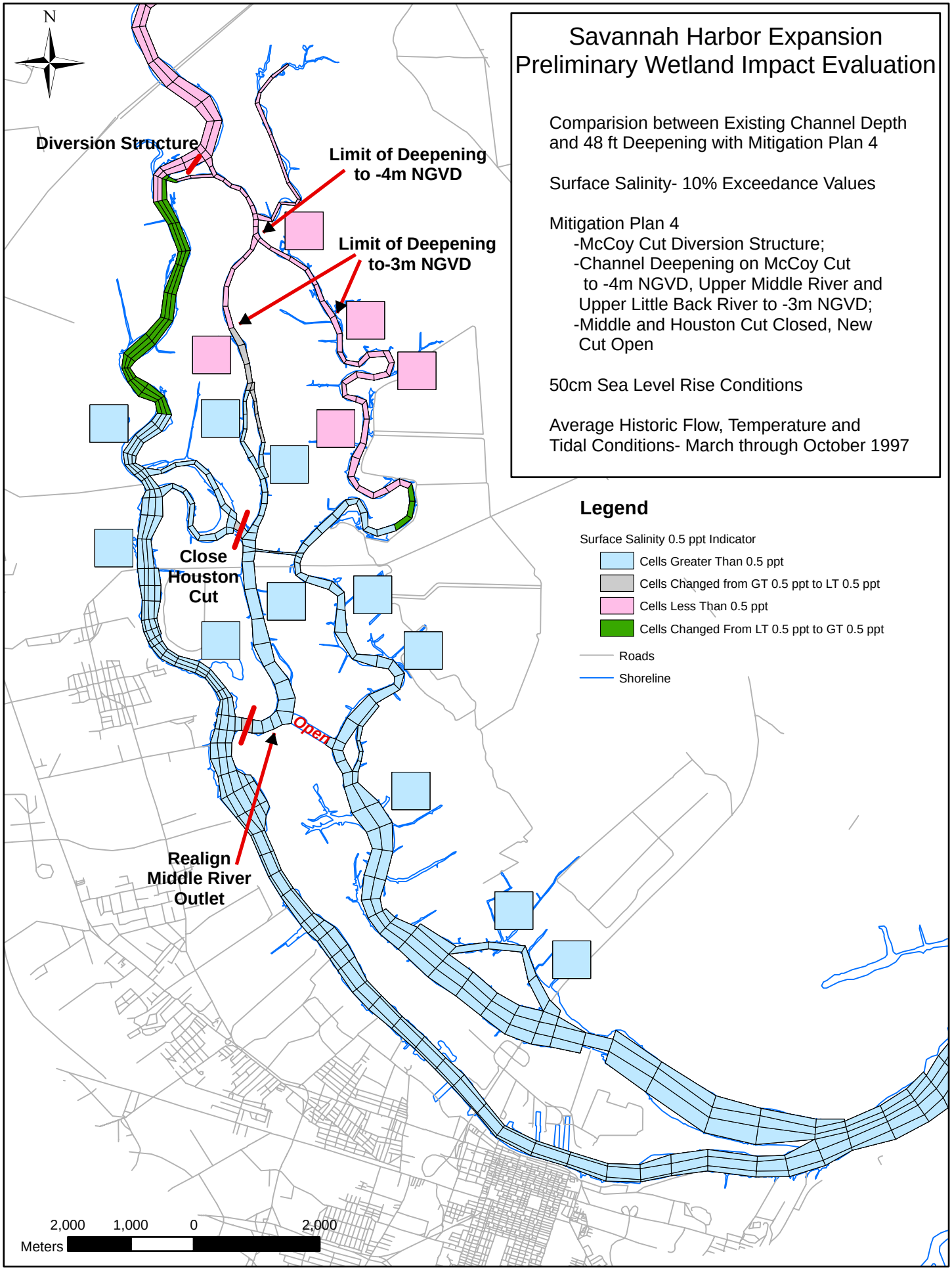
January 2007



January 2007



January 2007



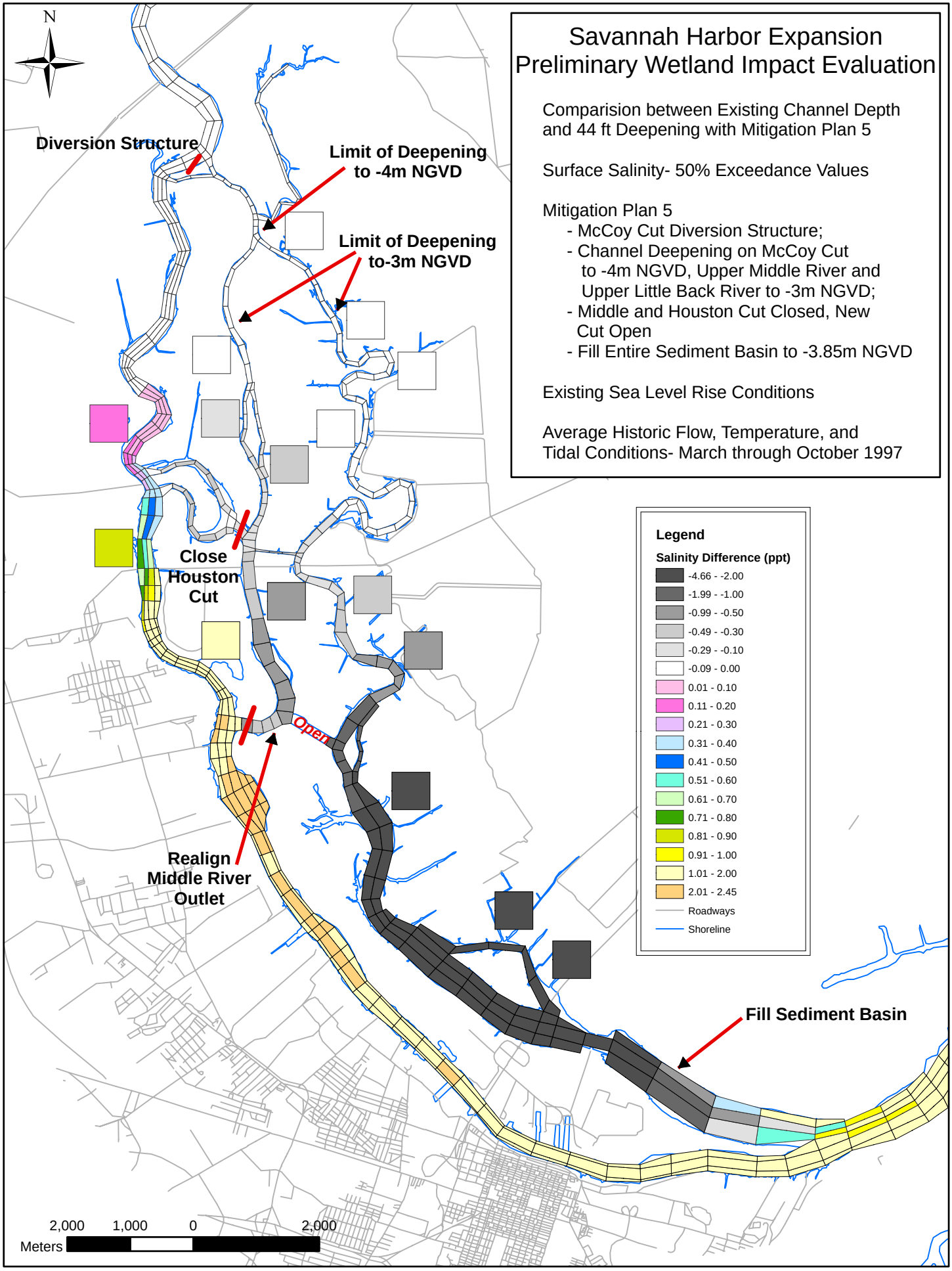
January 2007

MITIGATION PLAN 5

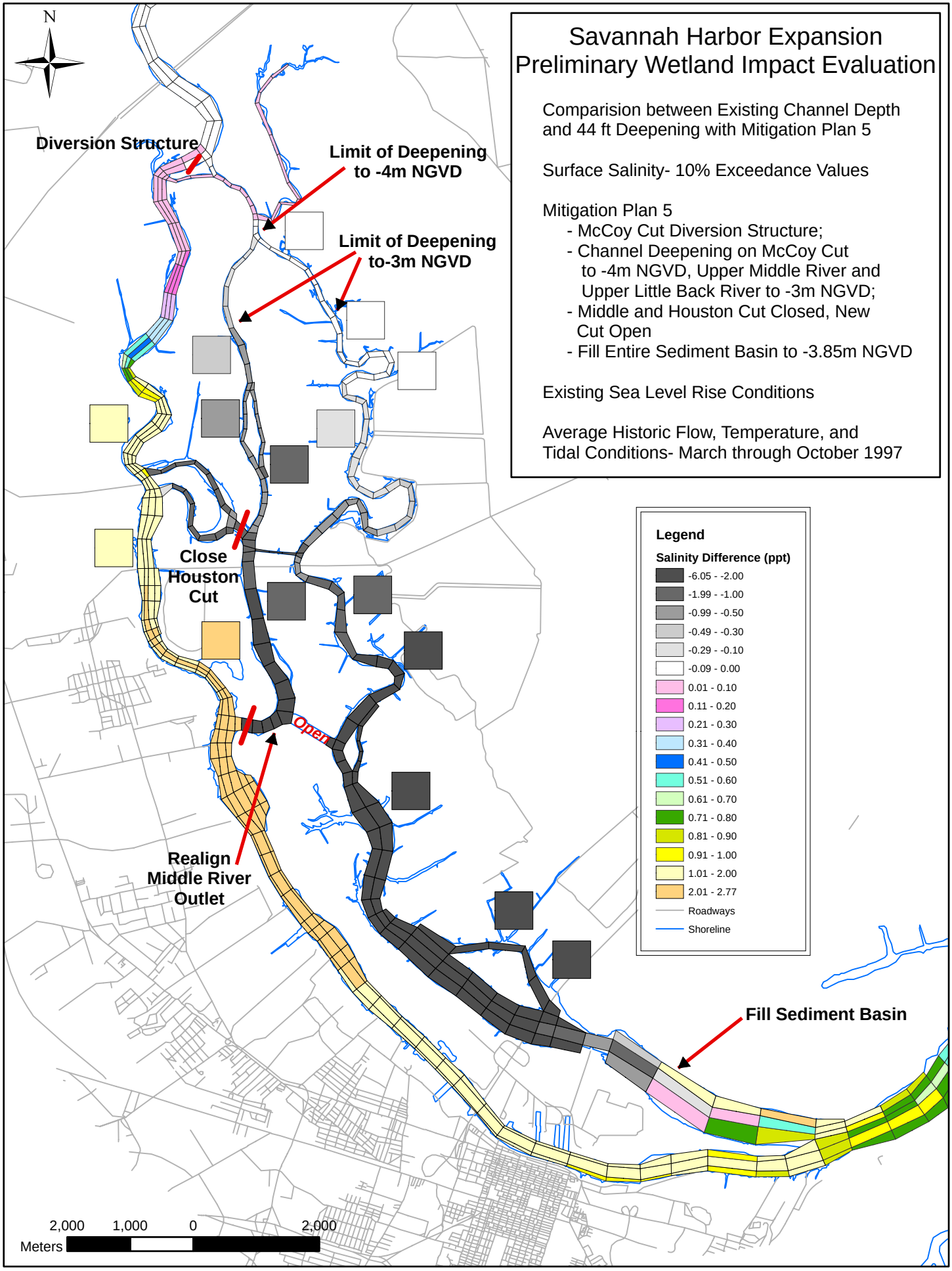
- ***McCoy Cut Diversion Structure***
- ***Channel Deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD***
- ***Realign Middle River Outlet by Closing Middle River at Front River and Opening New Cut***
- ***Close Houston Cut***
- ***Fill Entire Sediment Basin to -3.85m NGVD***

44-ft Deepening

Basic Evaluation



January 2007



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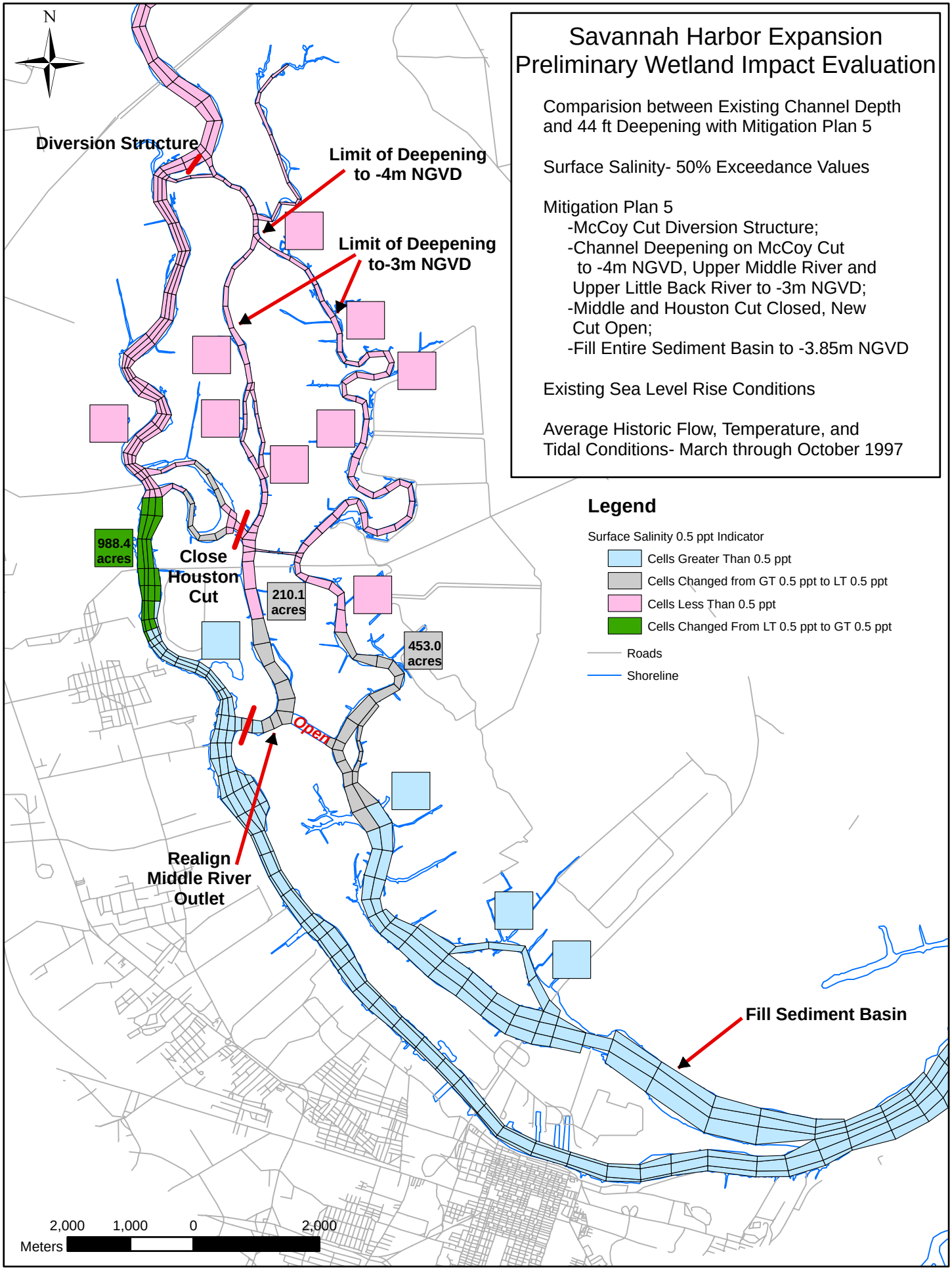

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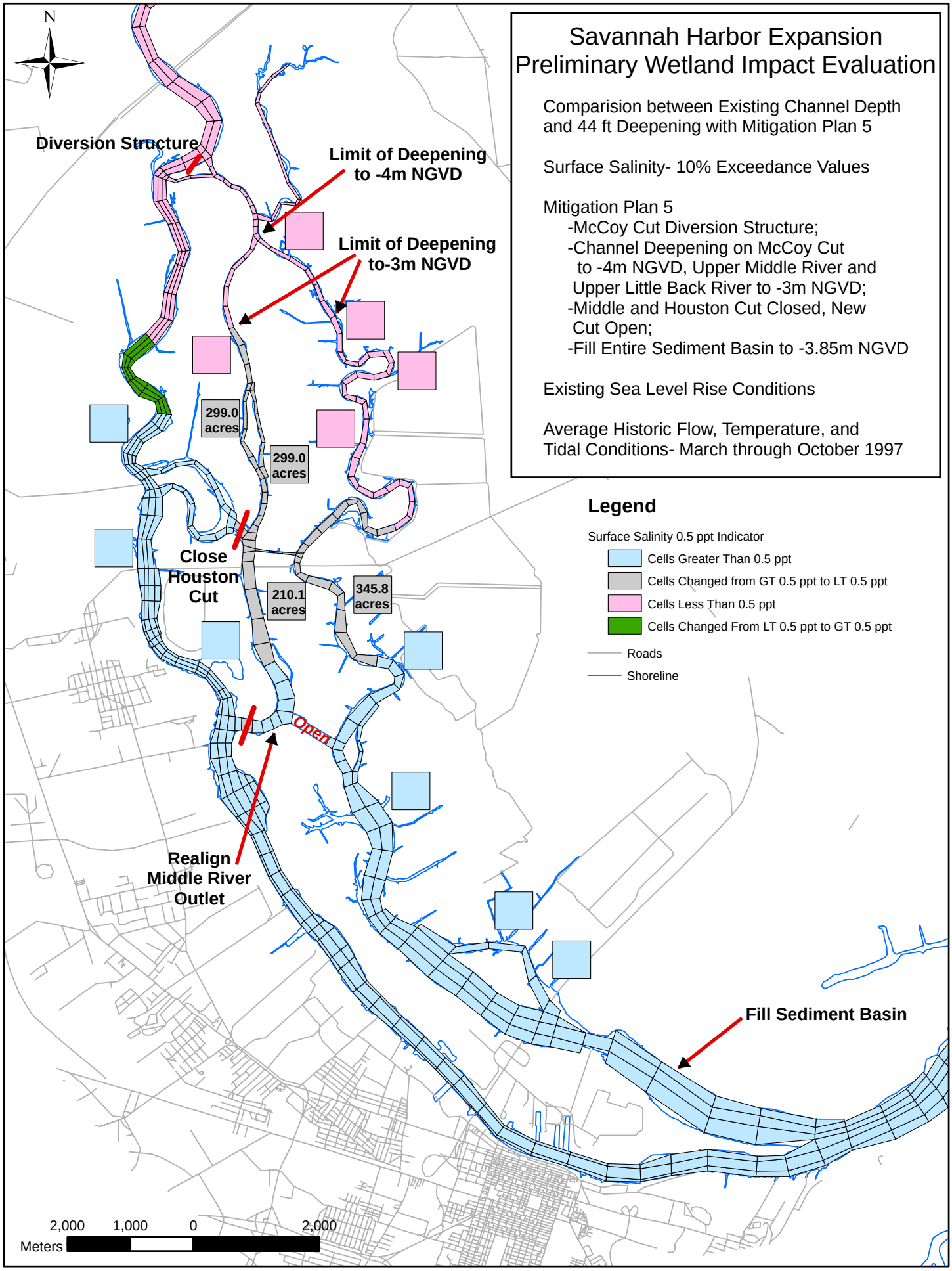
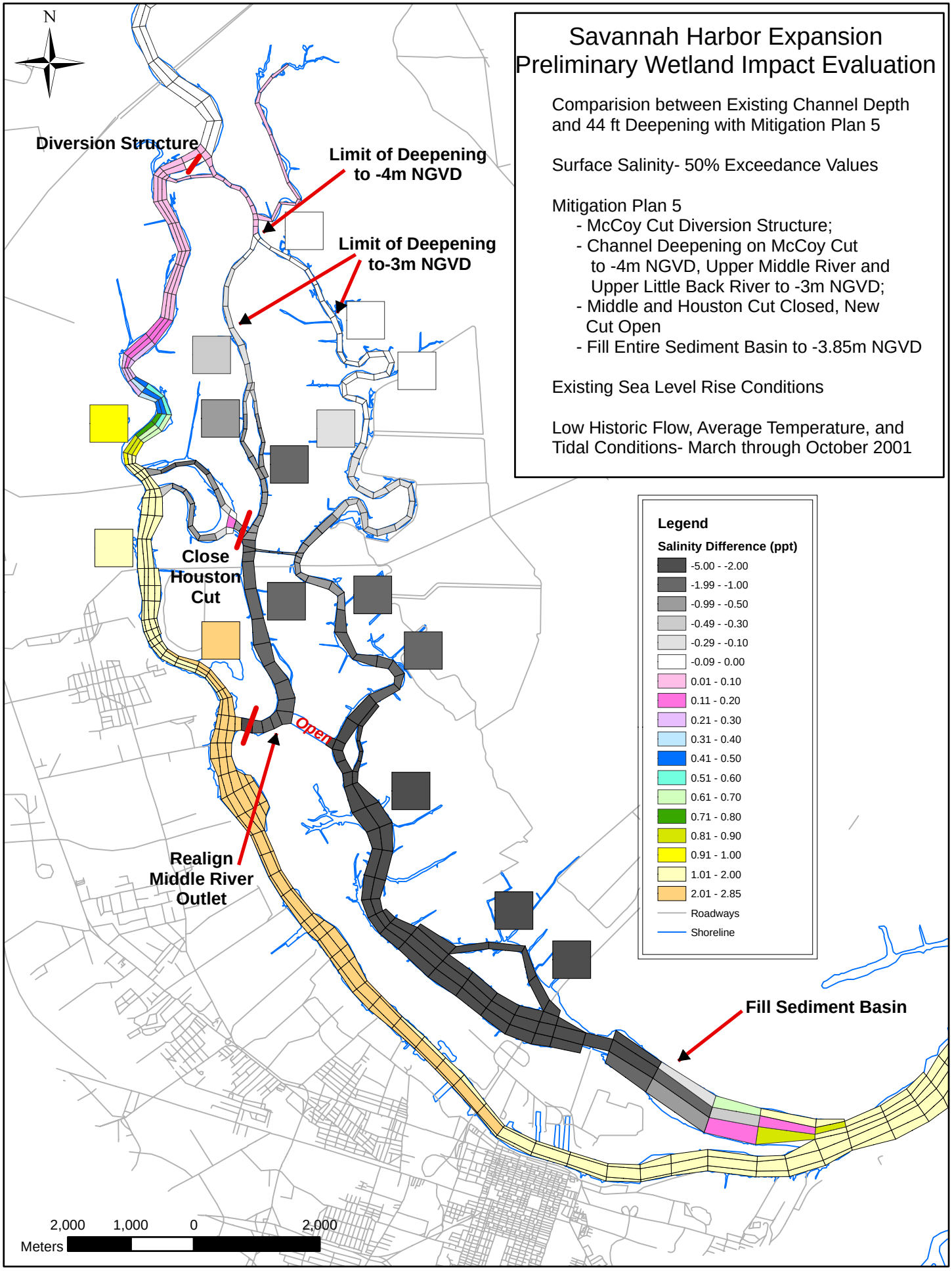


January 2007

Sensitivity Analysis #1



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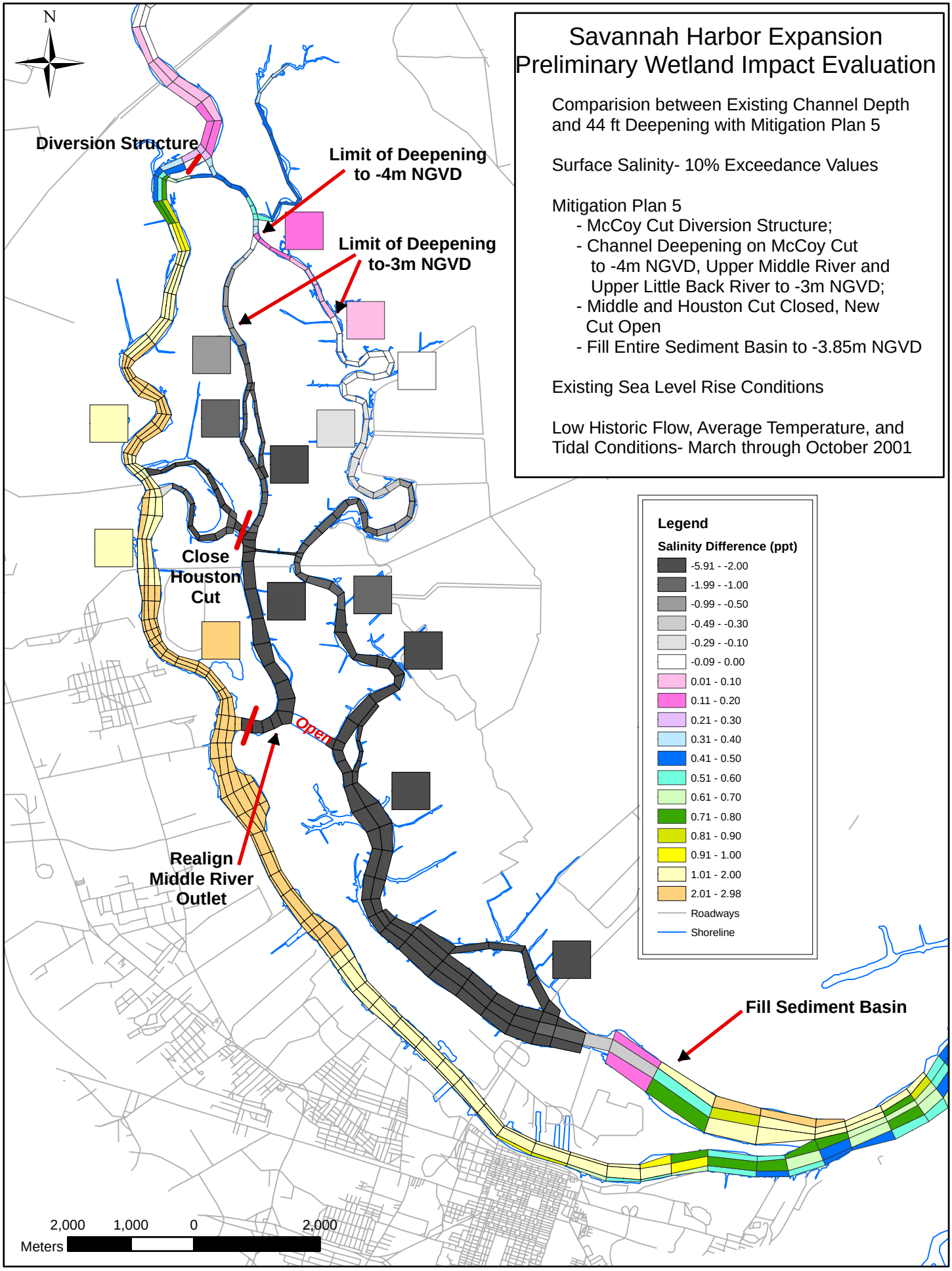
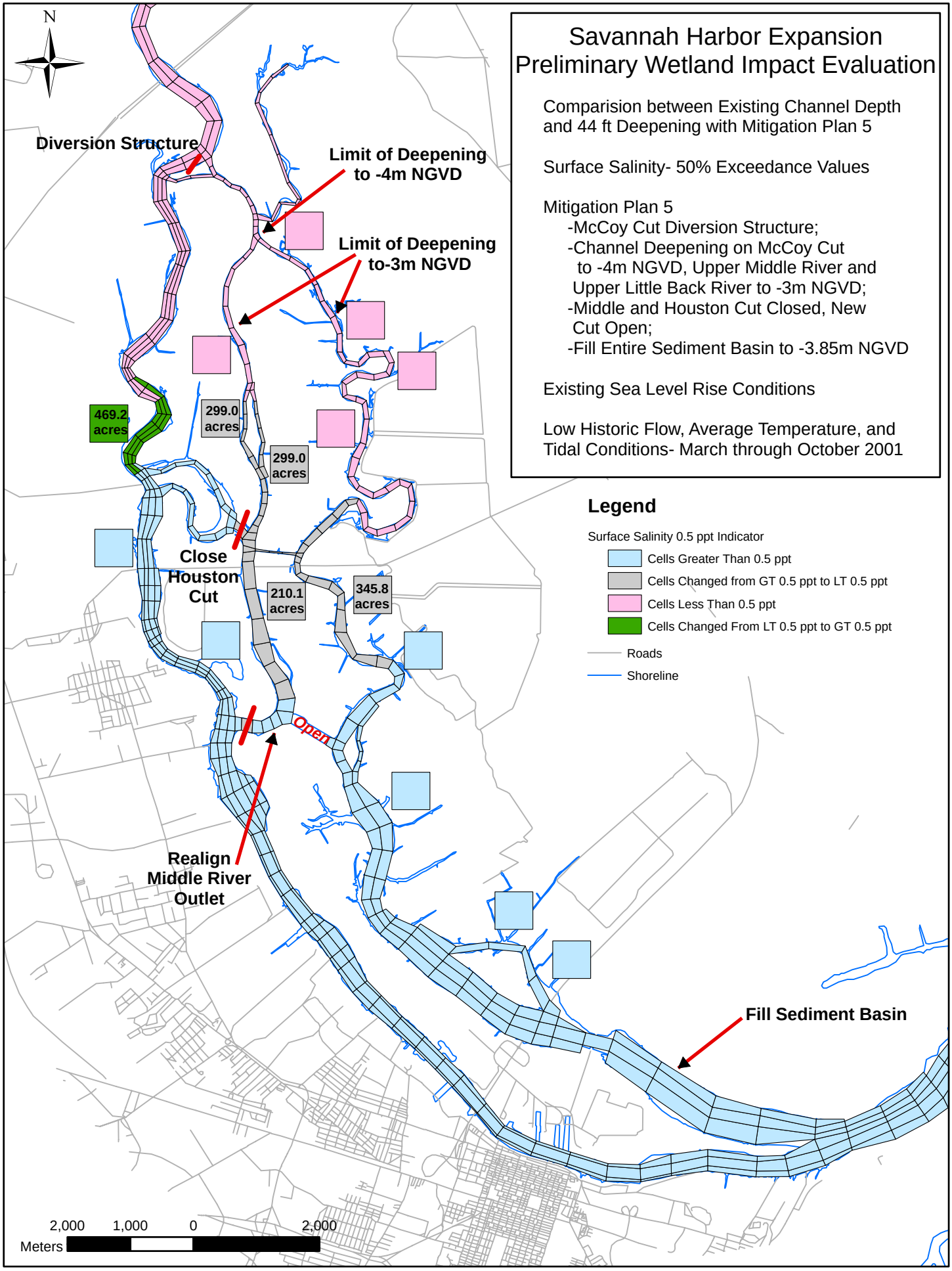
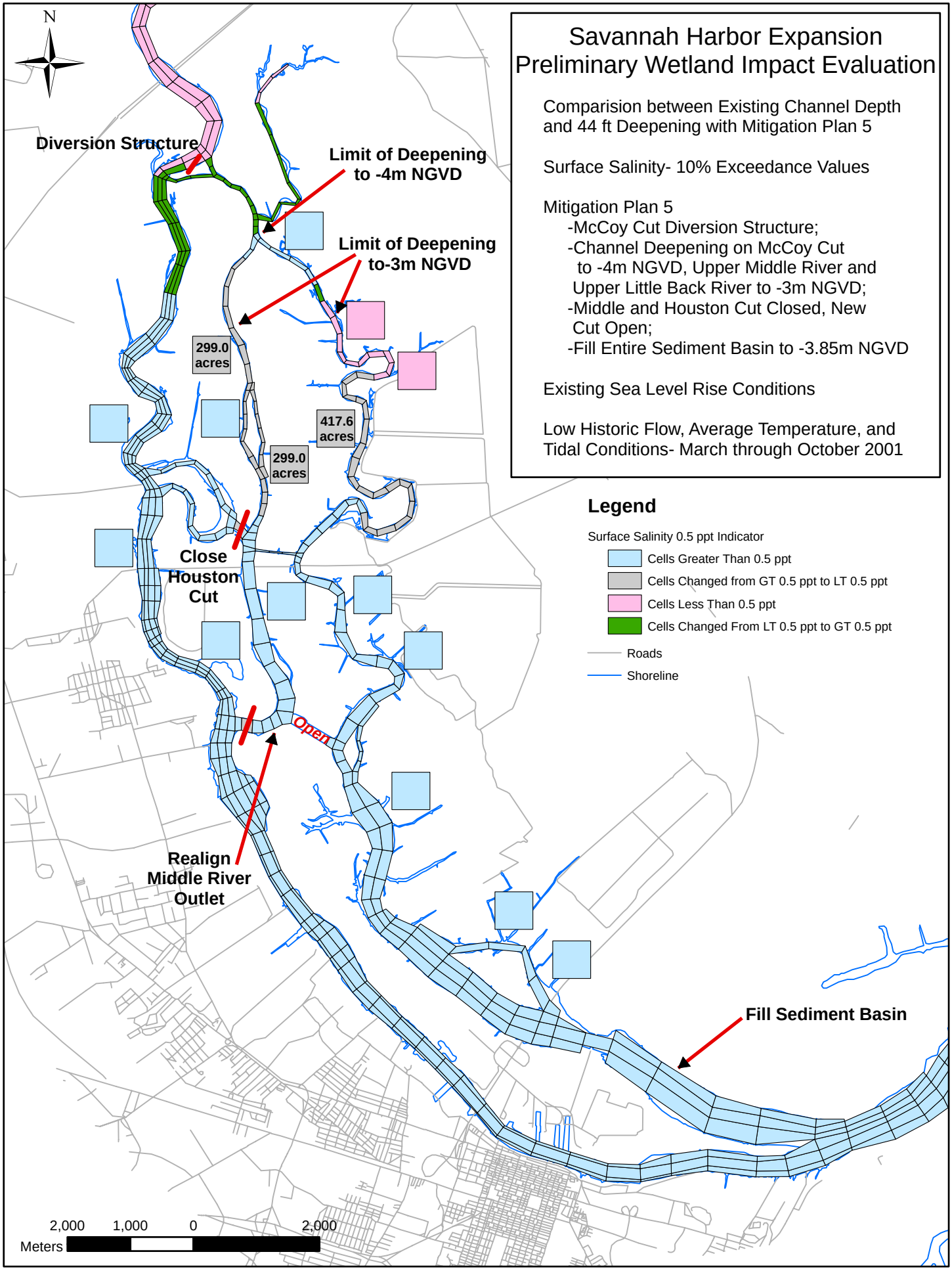


January 2007



January 2007



January 2007

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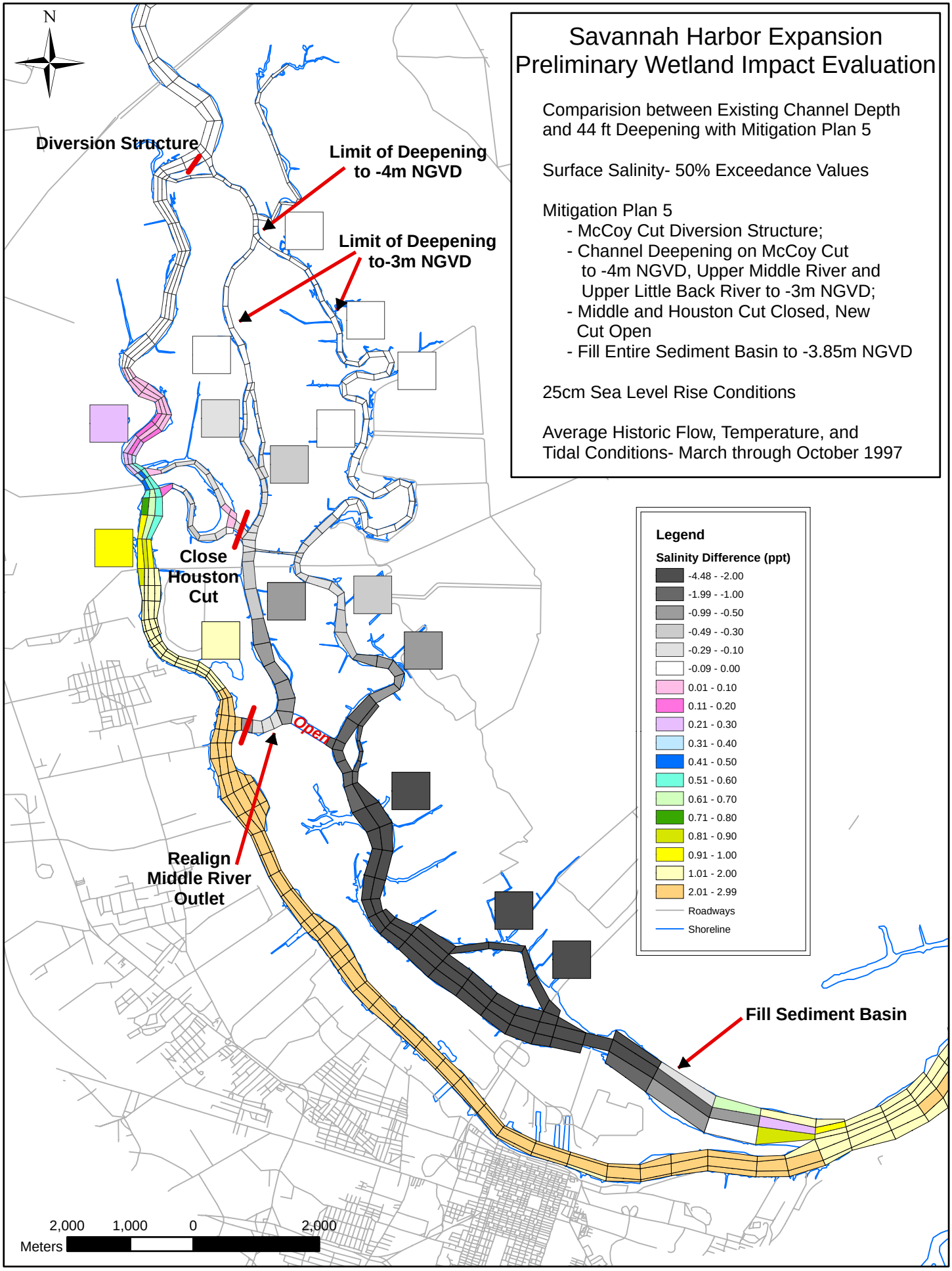

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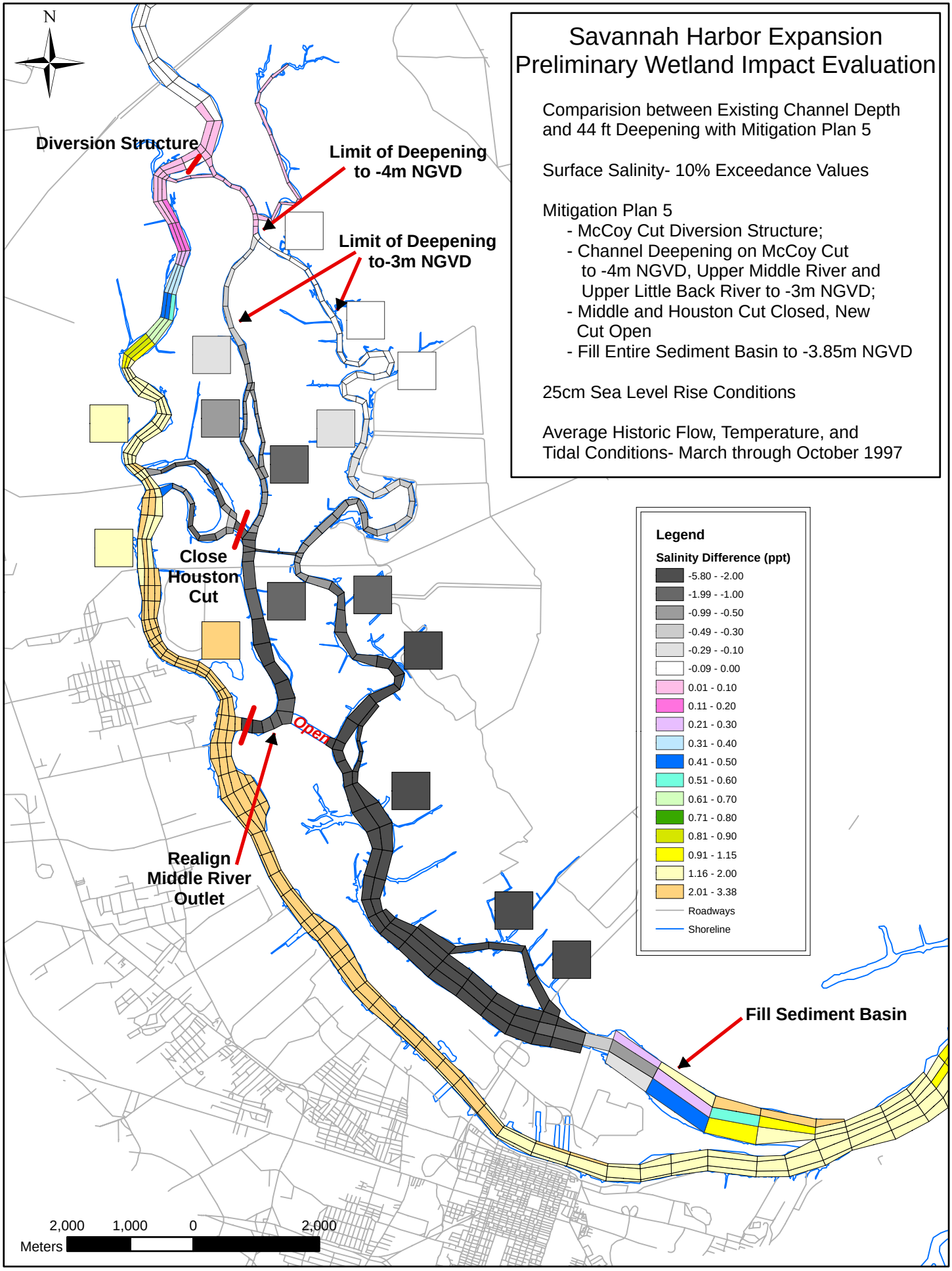

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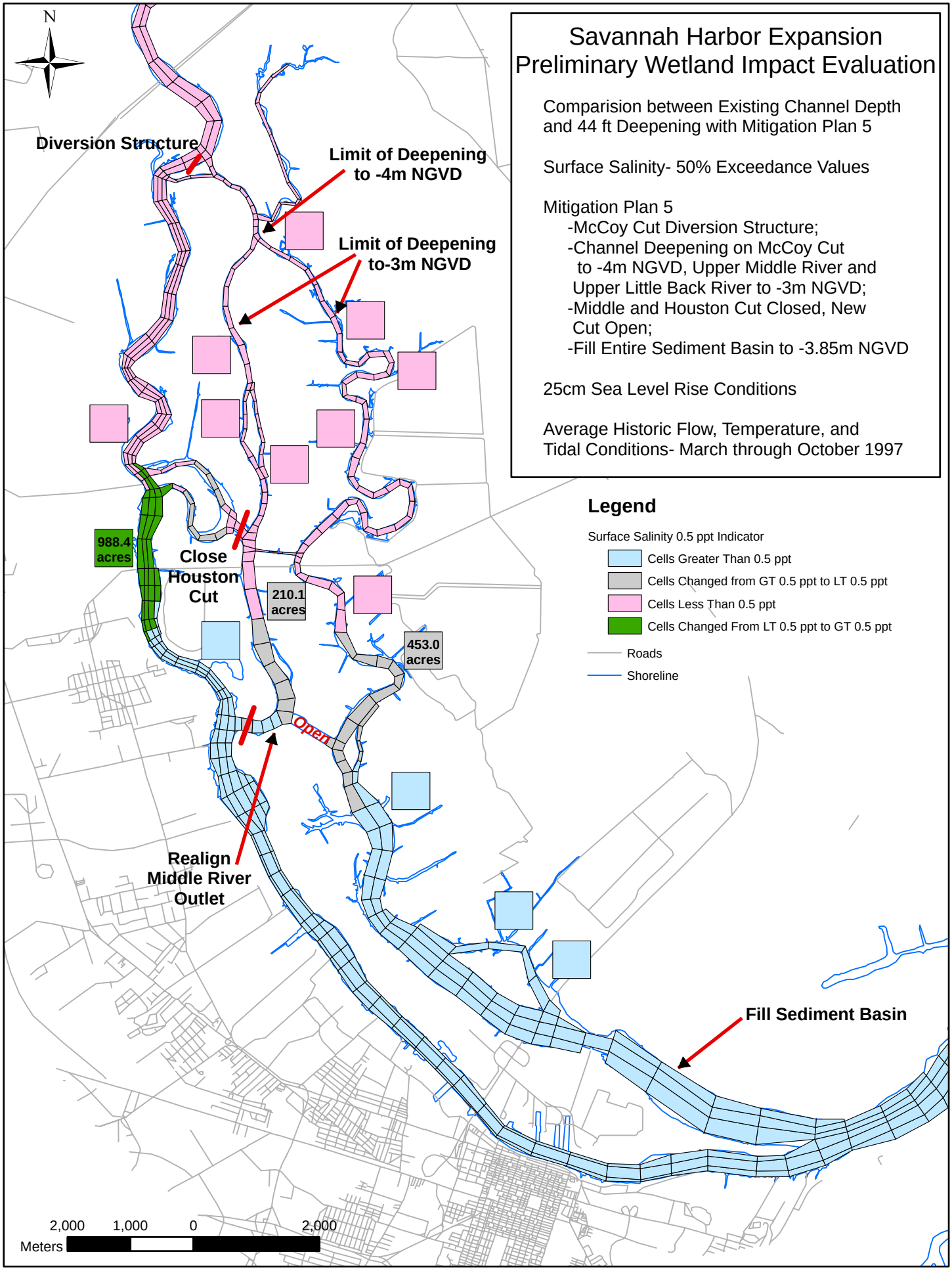

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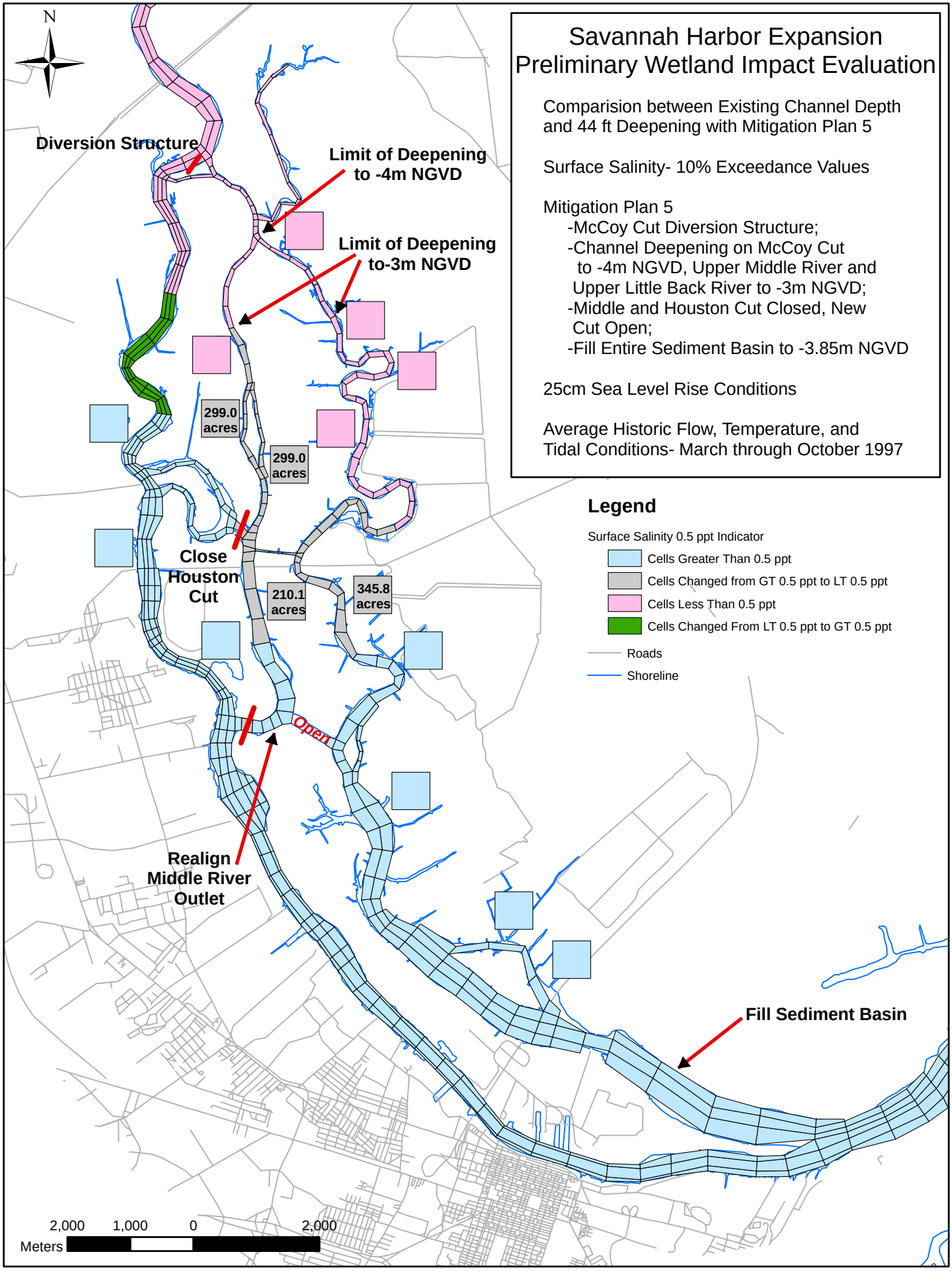

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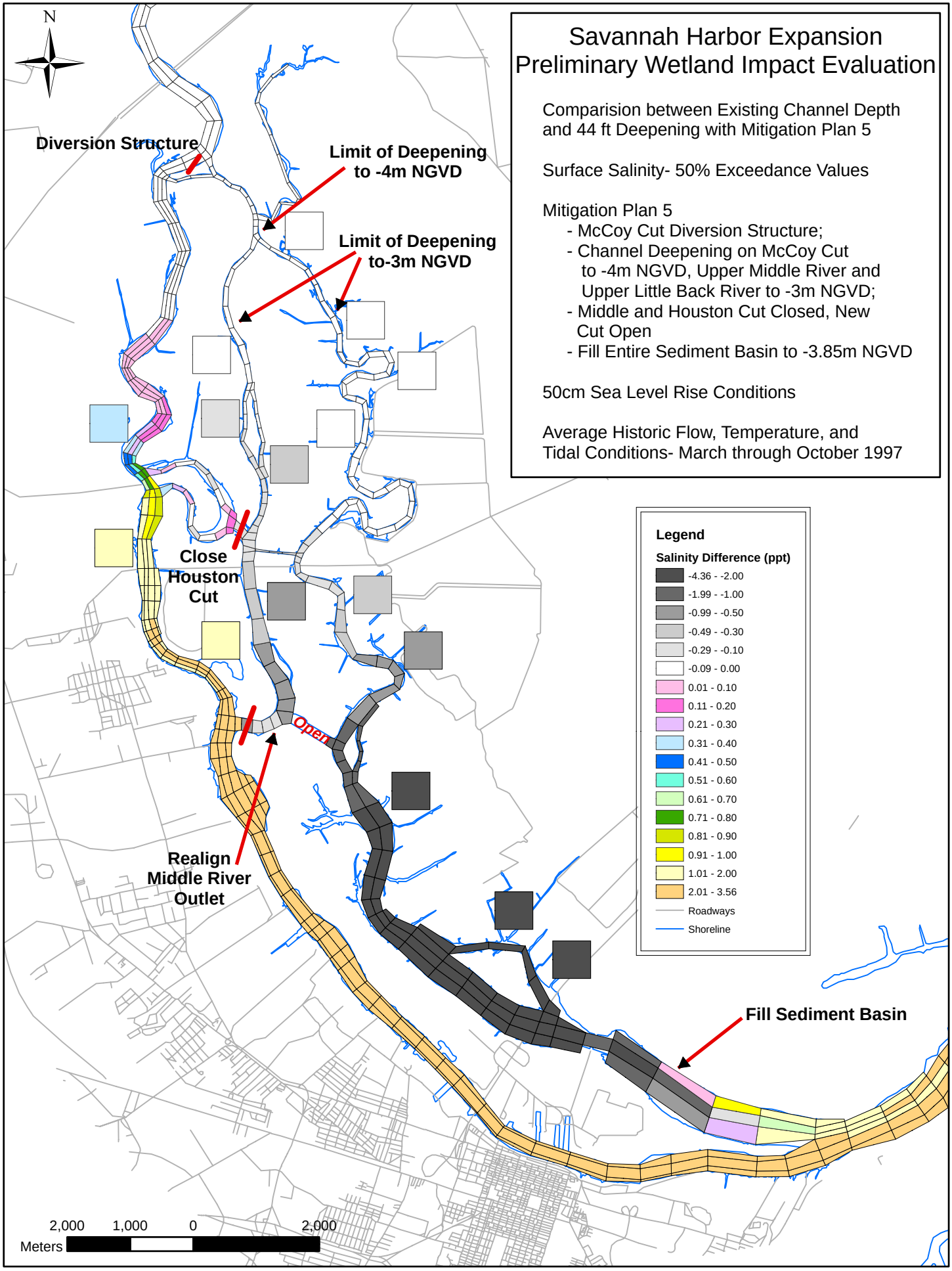

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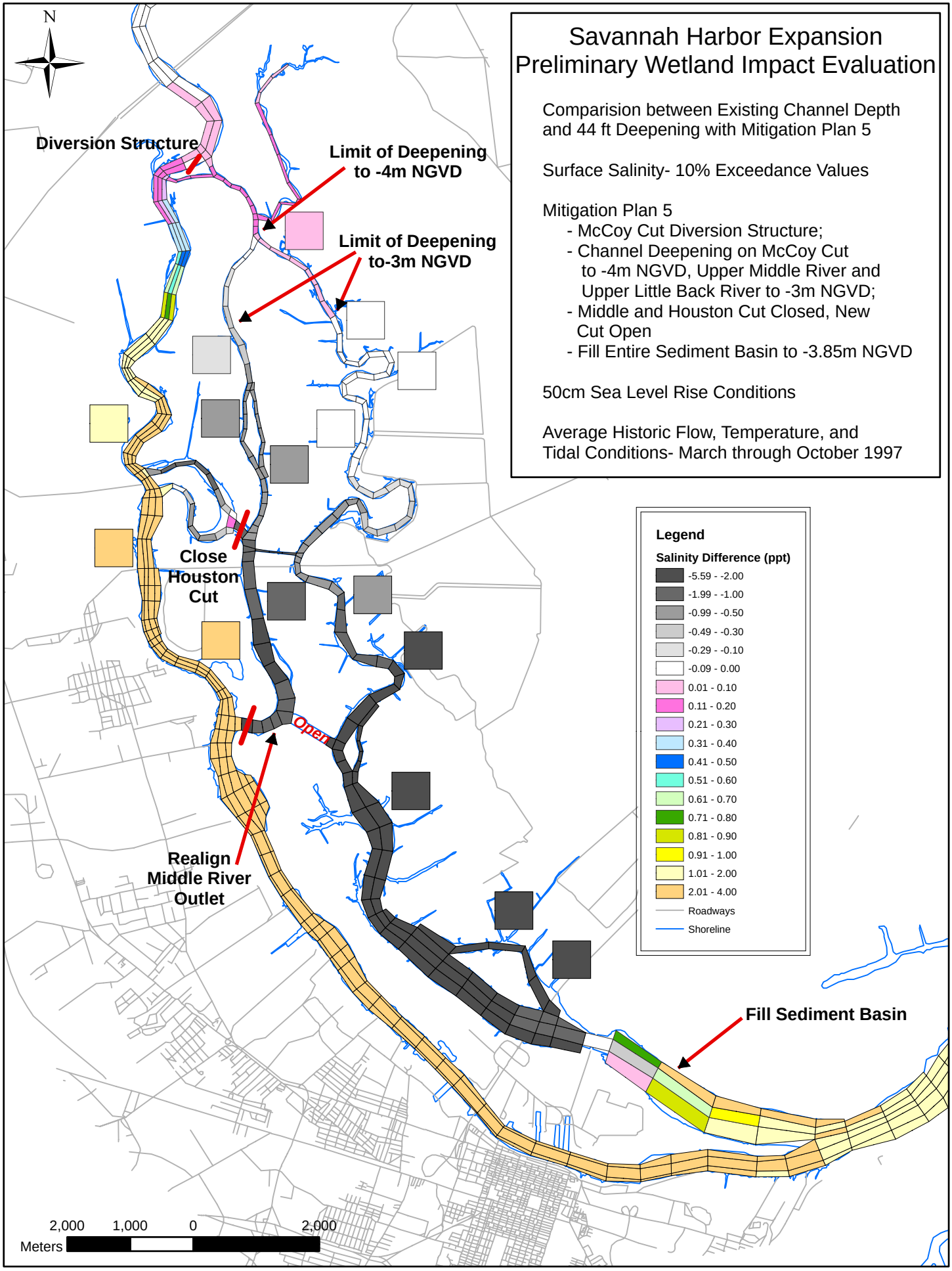

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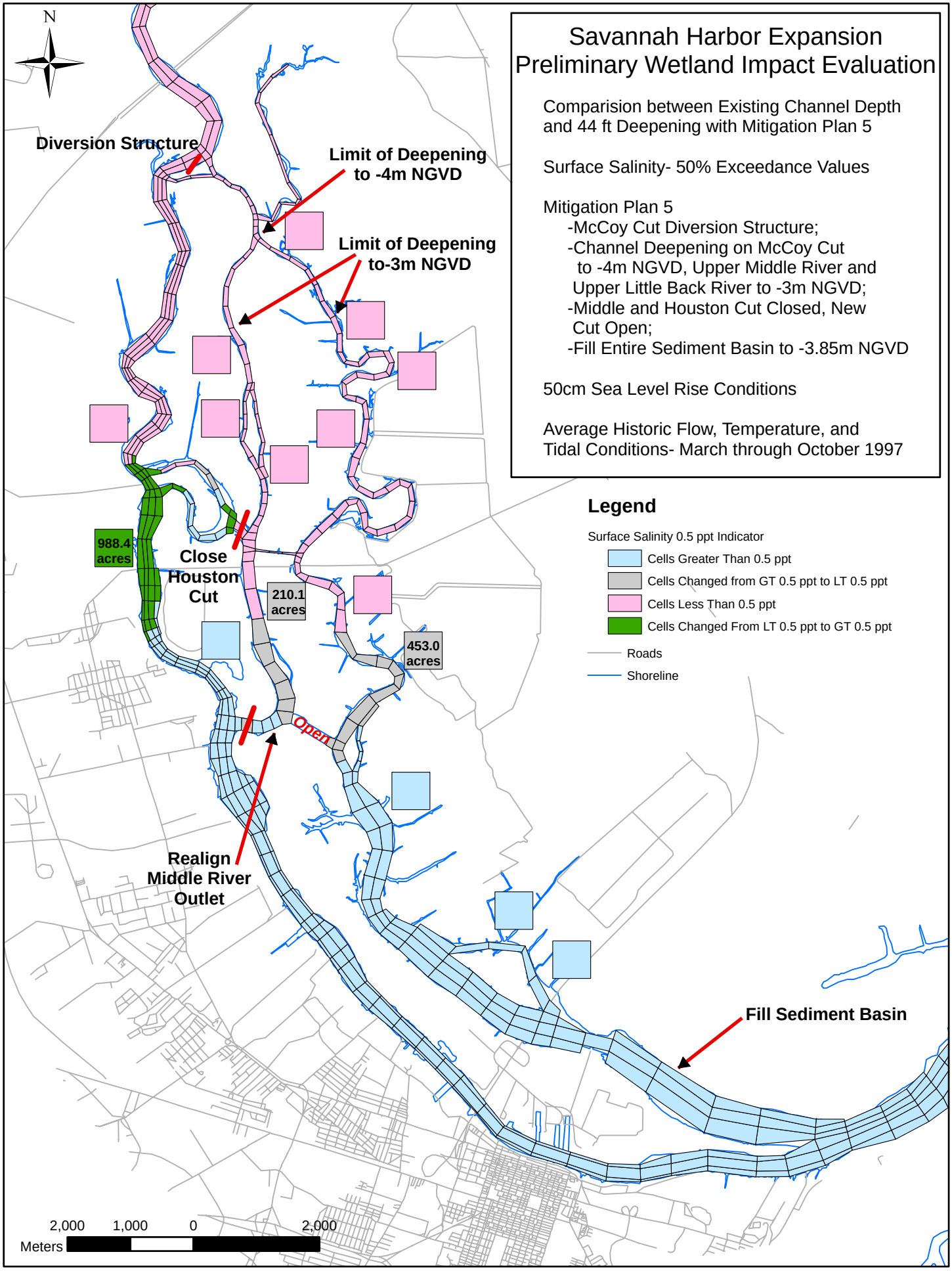

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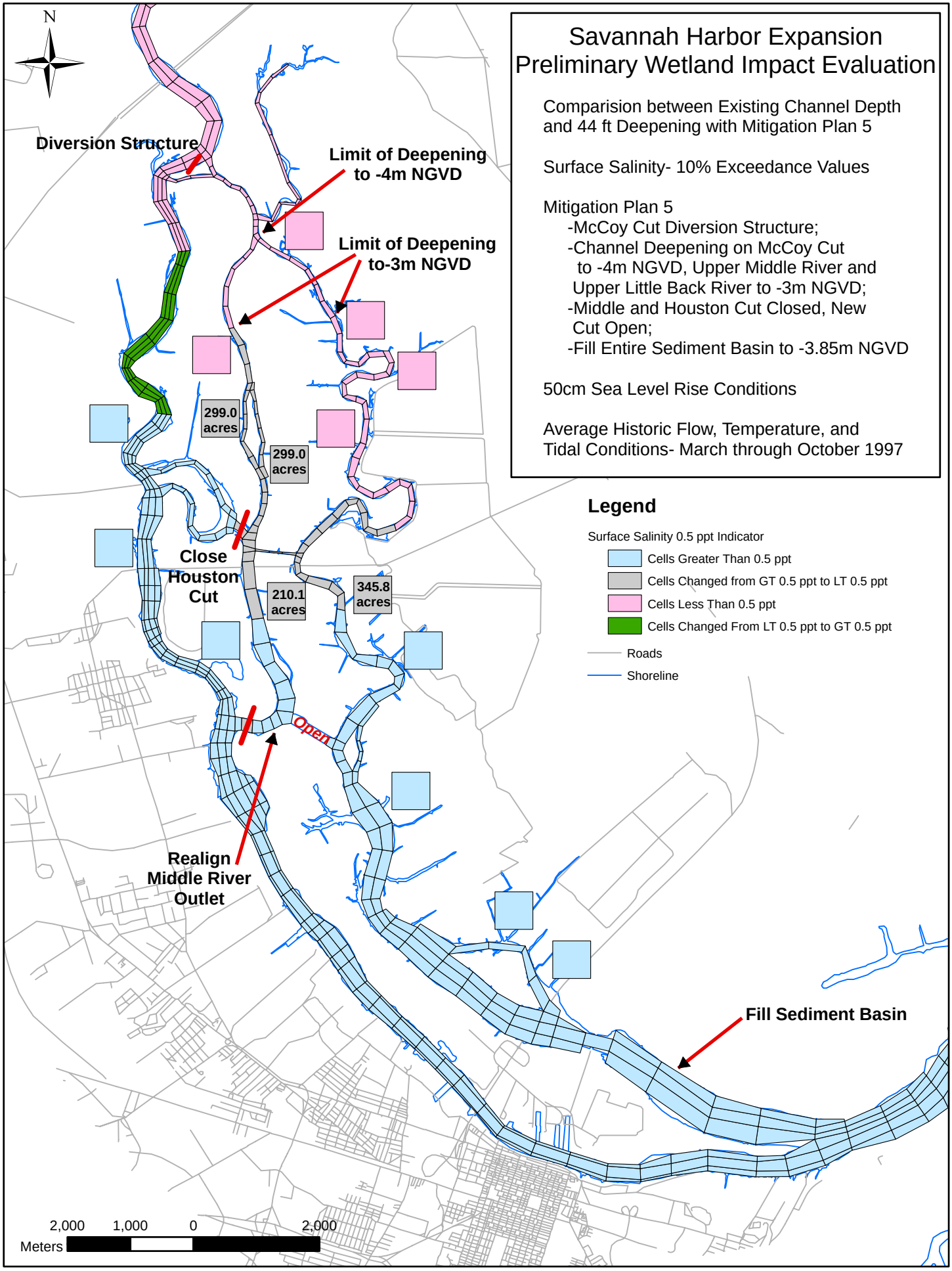
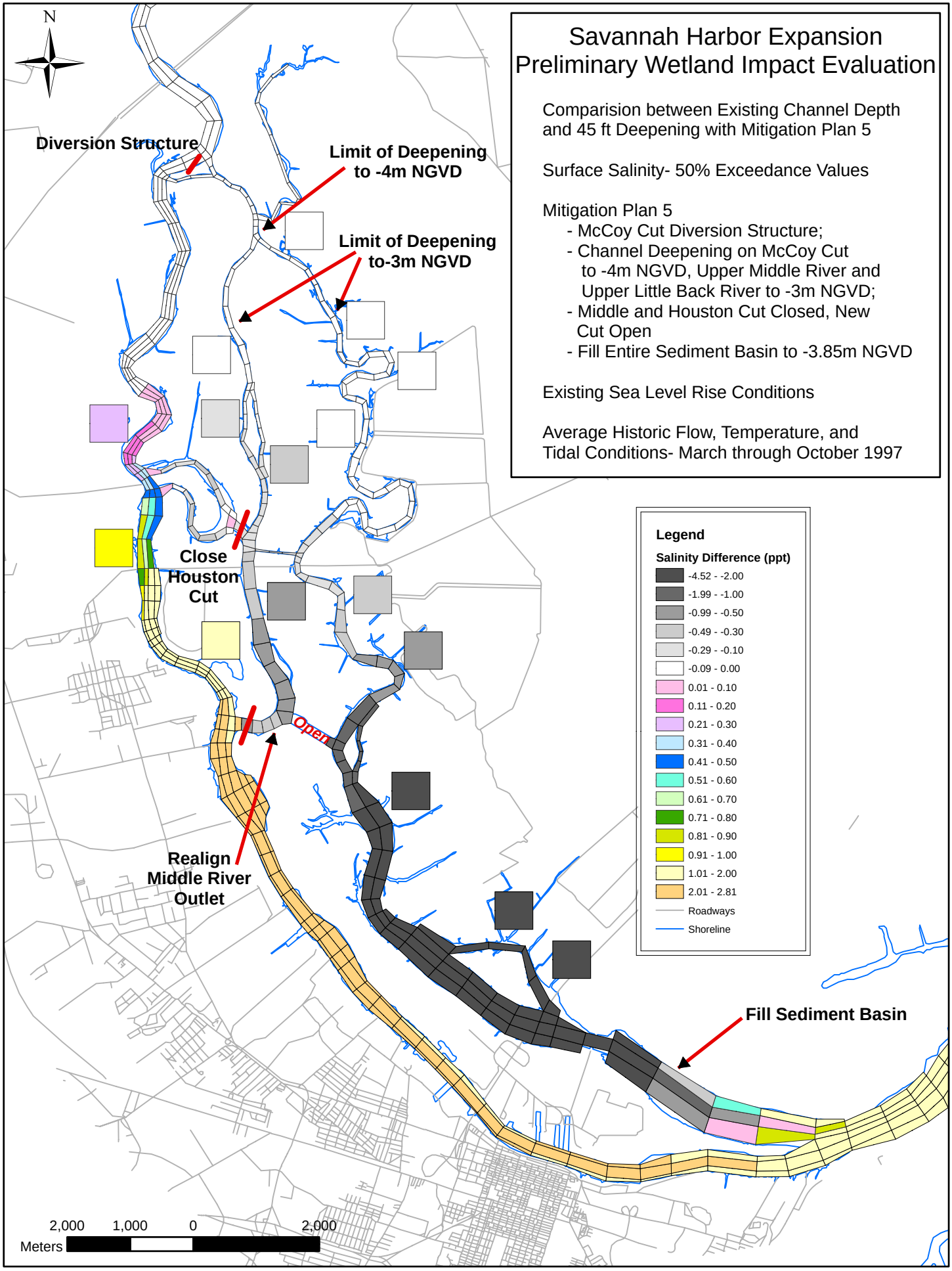


January 2007

45-ft Deepening

Basic Evaluation



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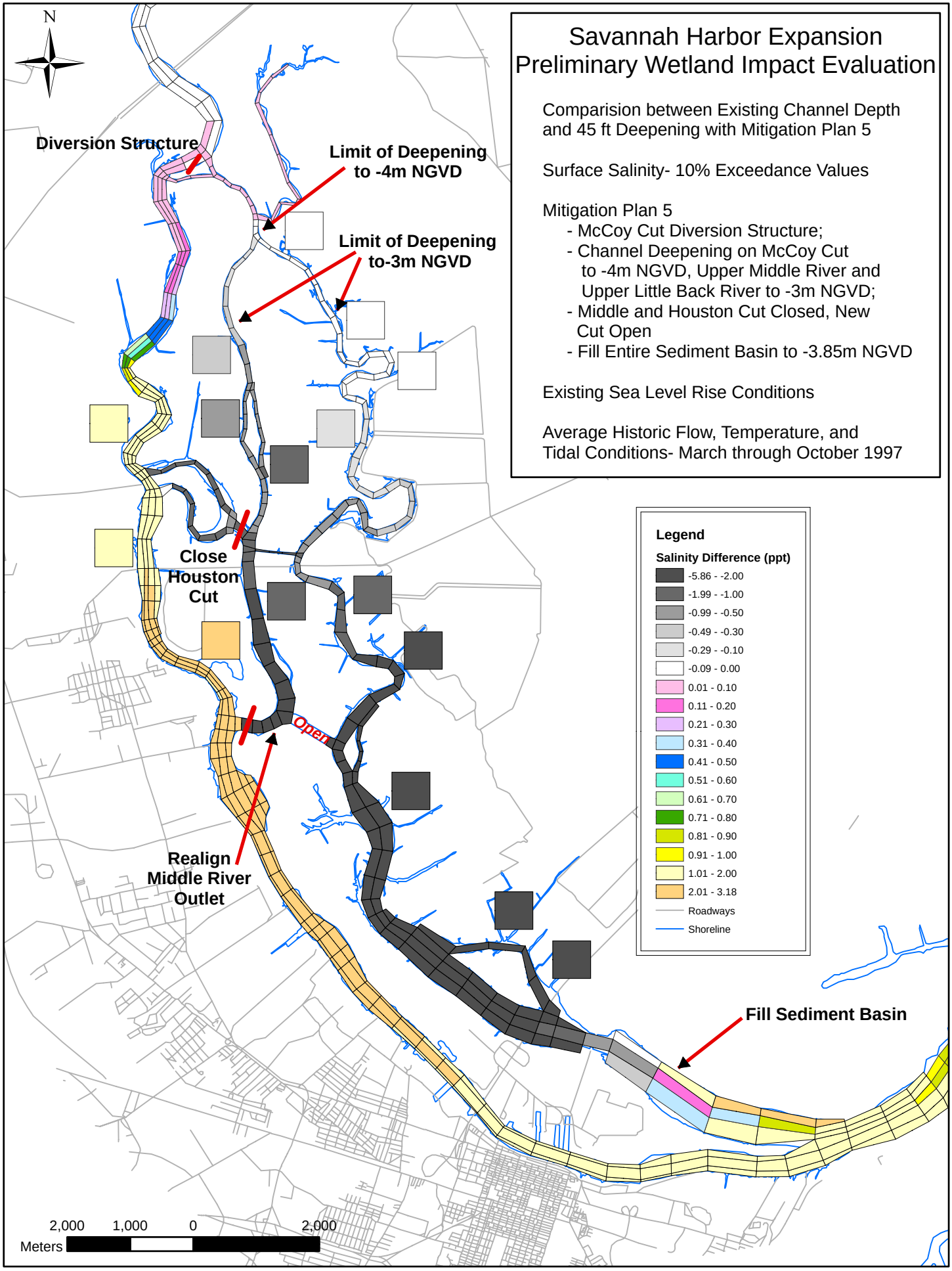

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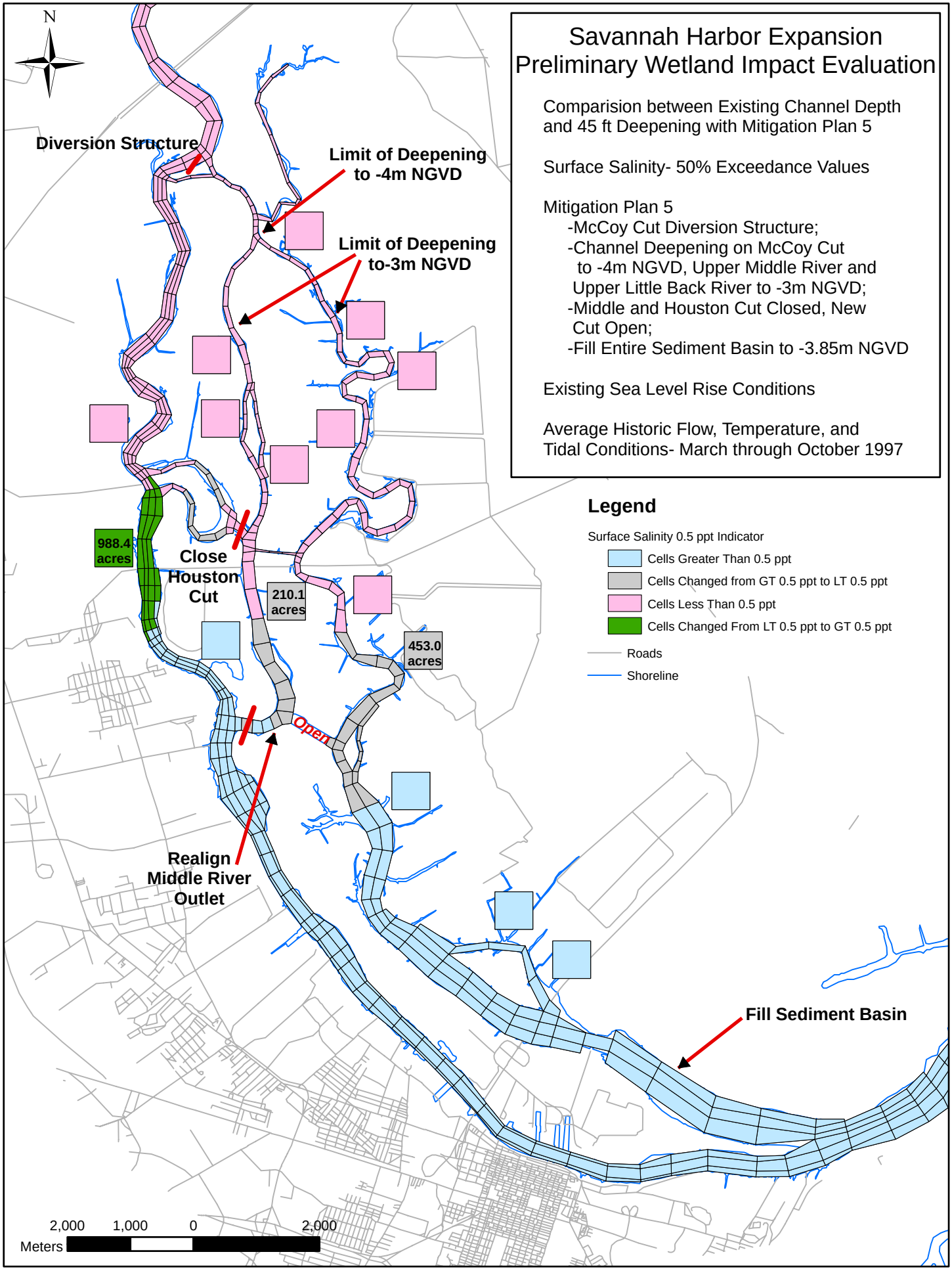

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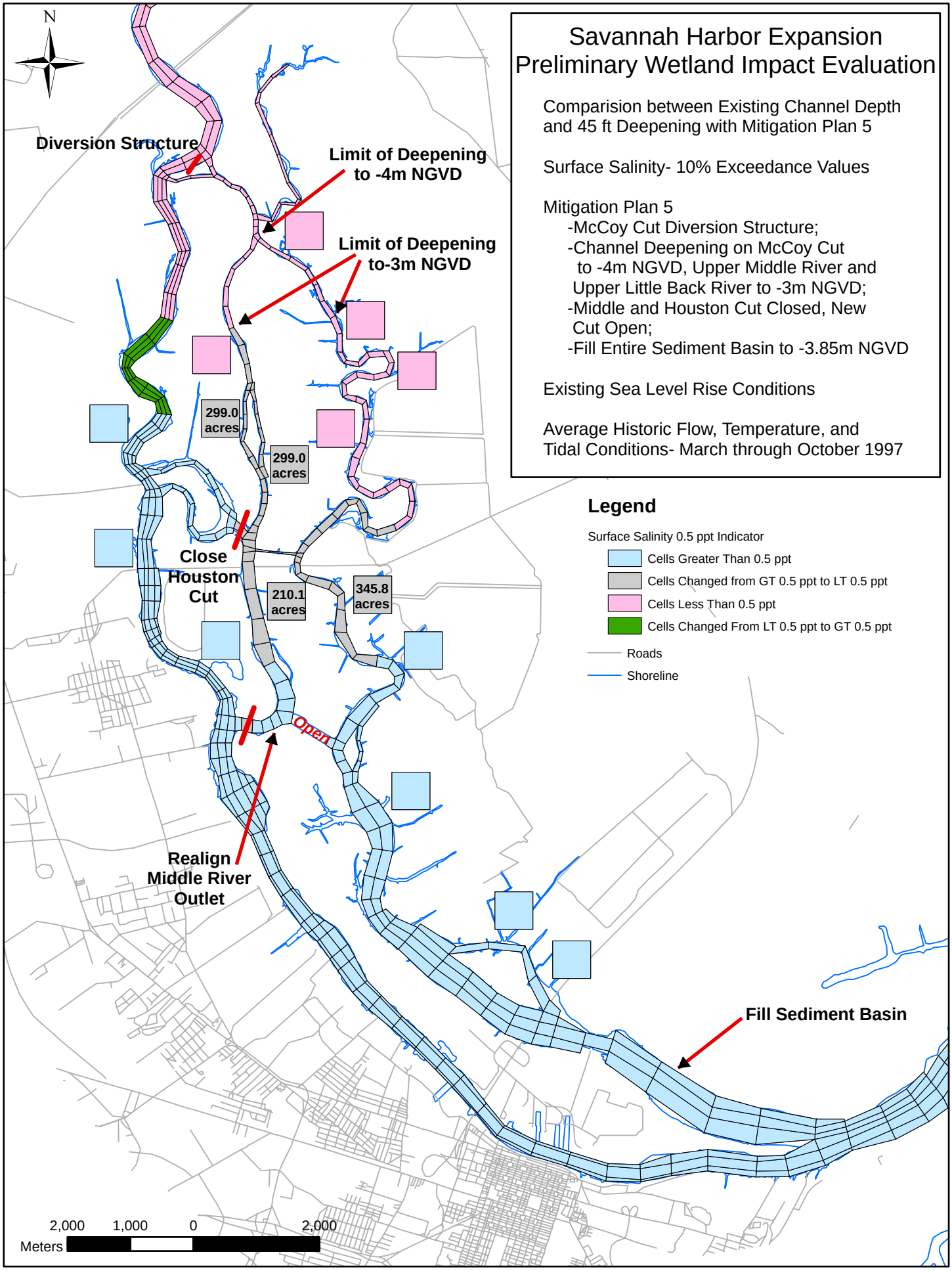
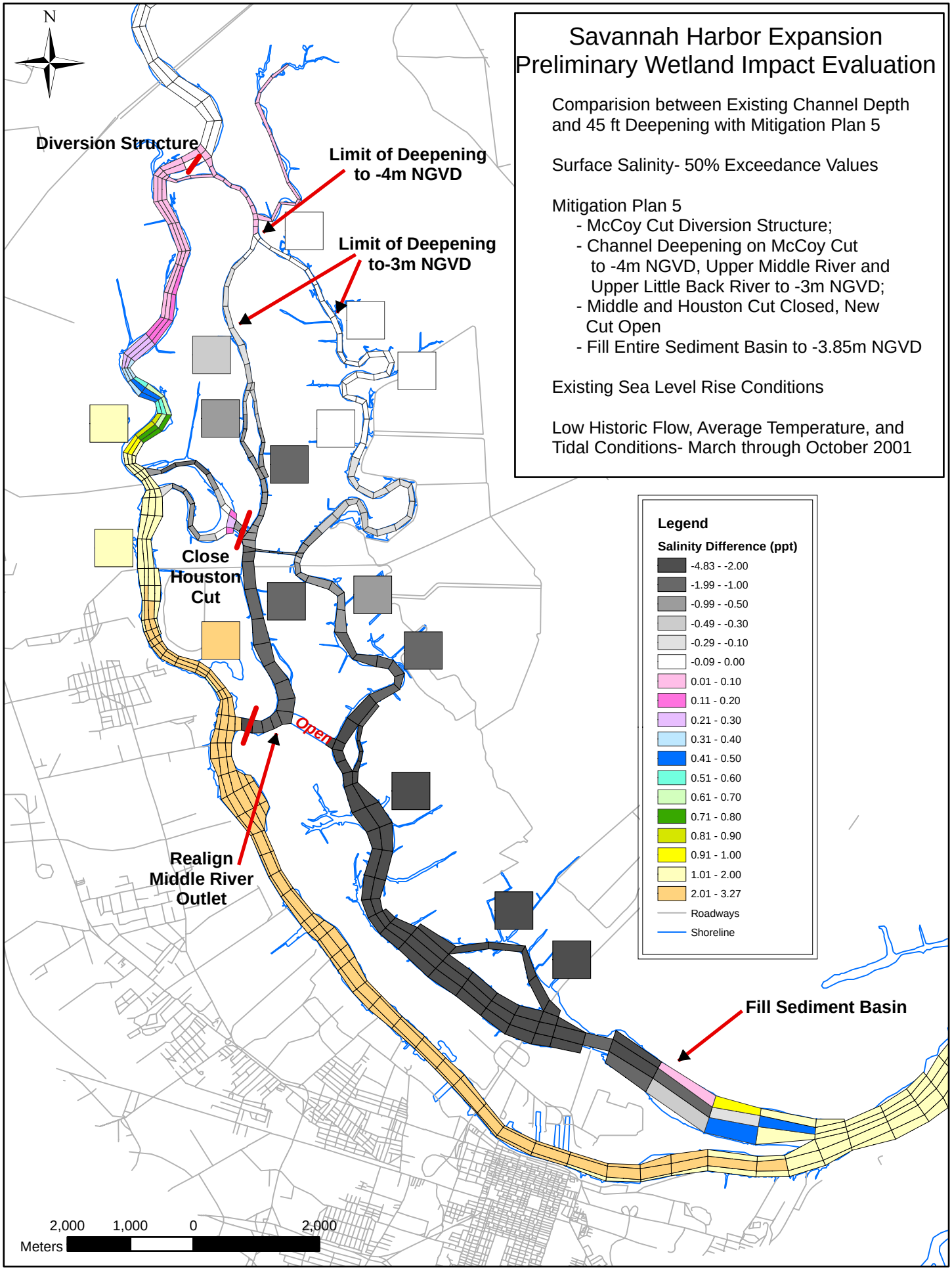


January 2007

Sensitivity Analysis #1



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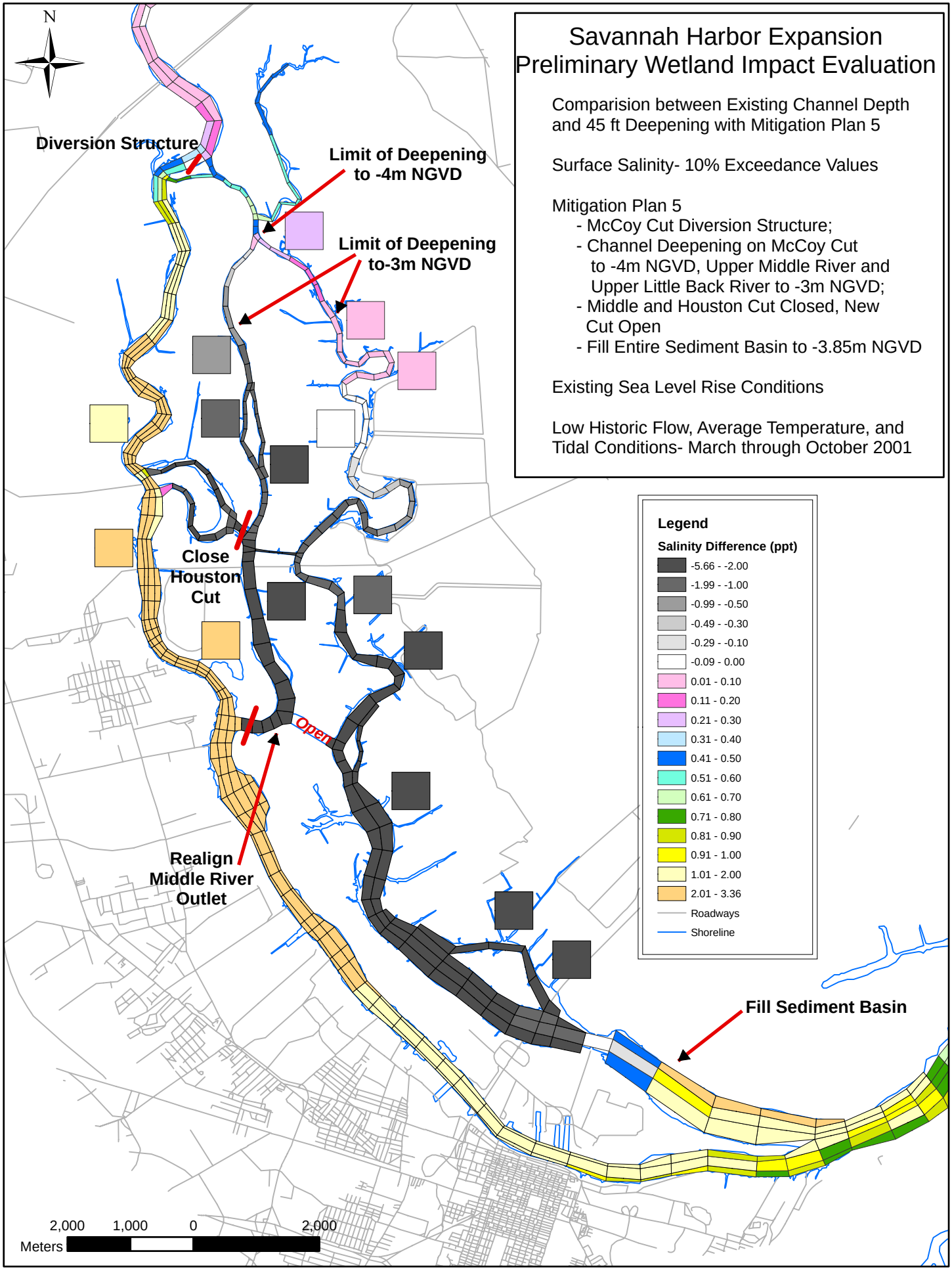

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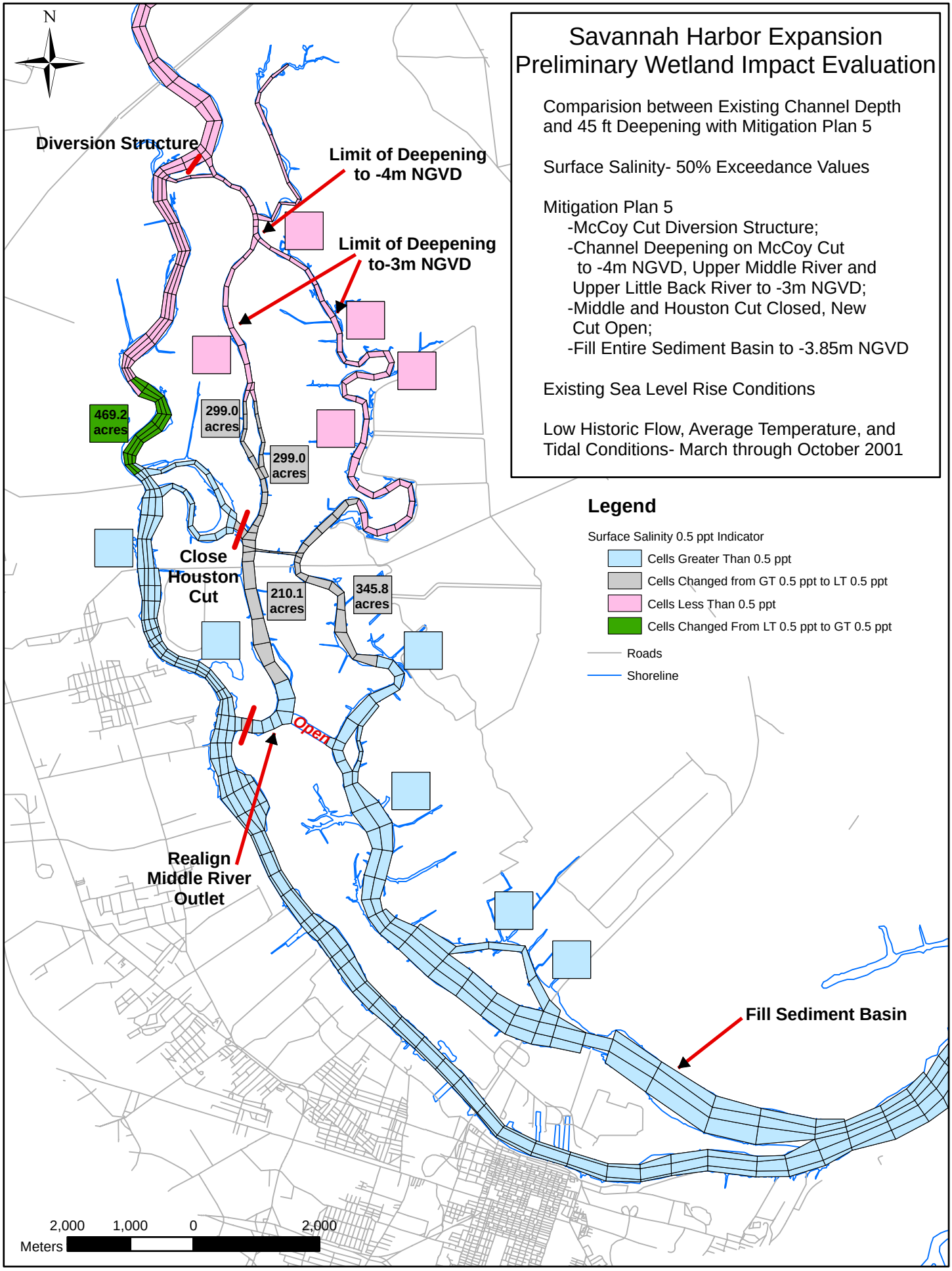

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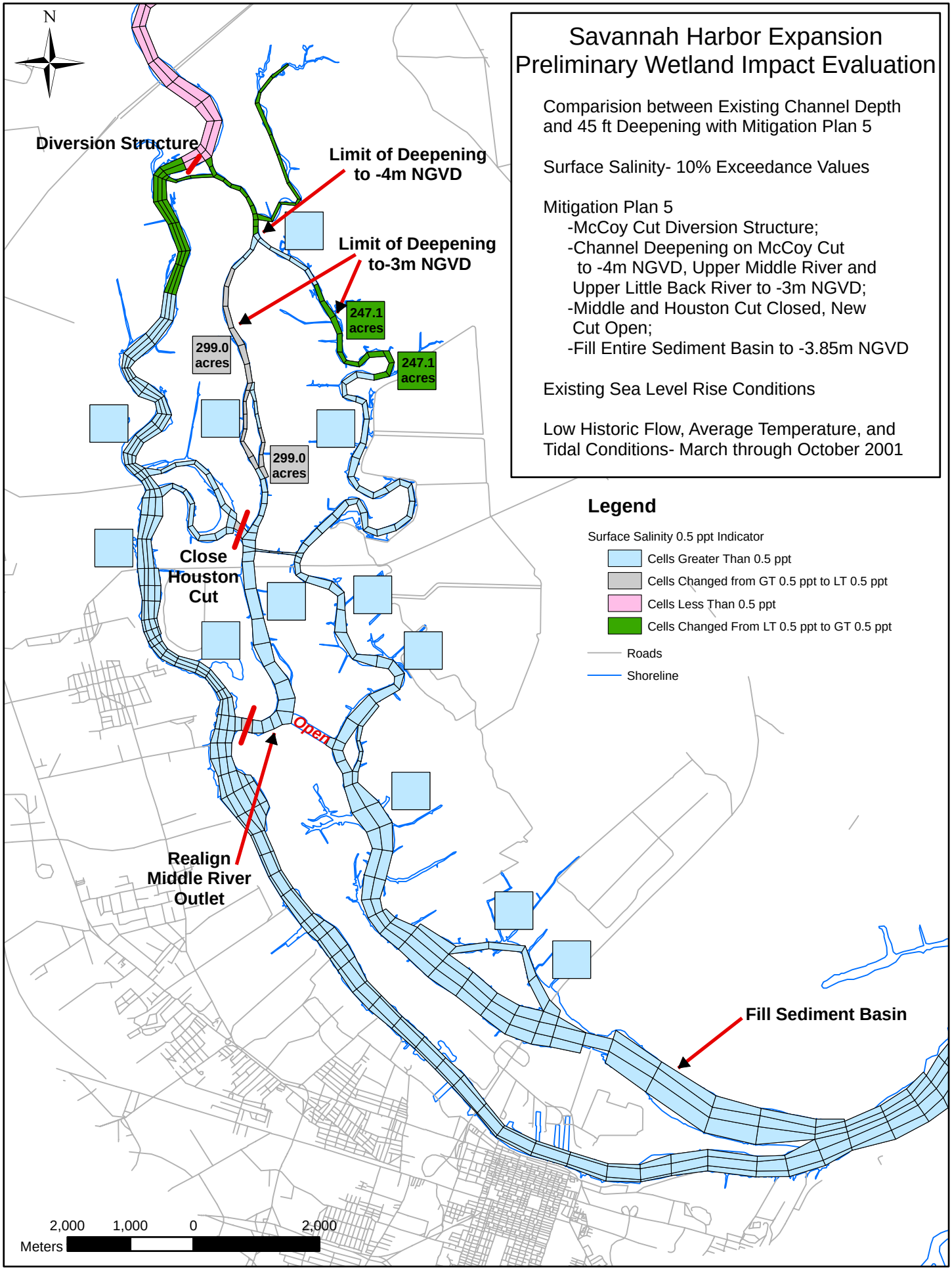
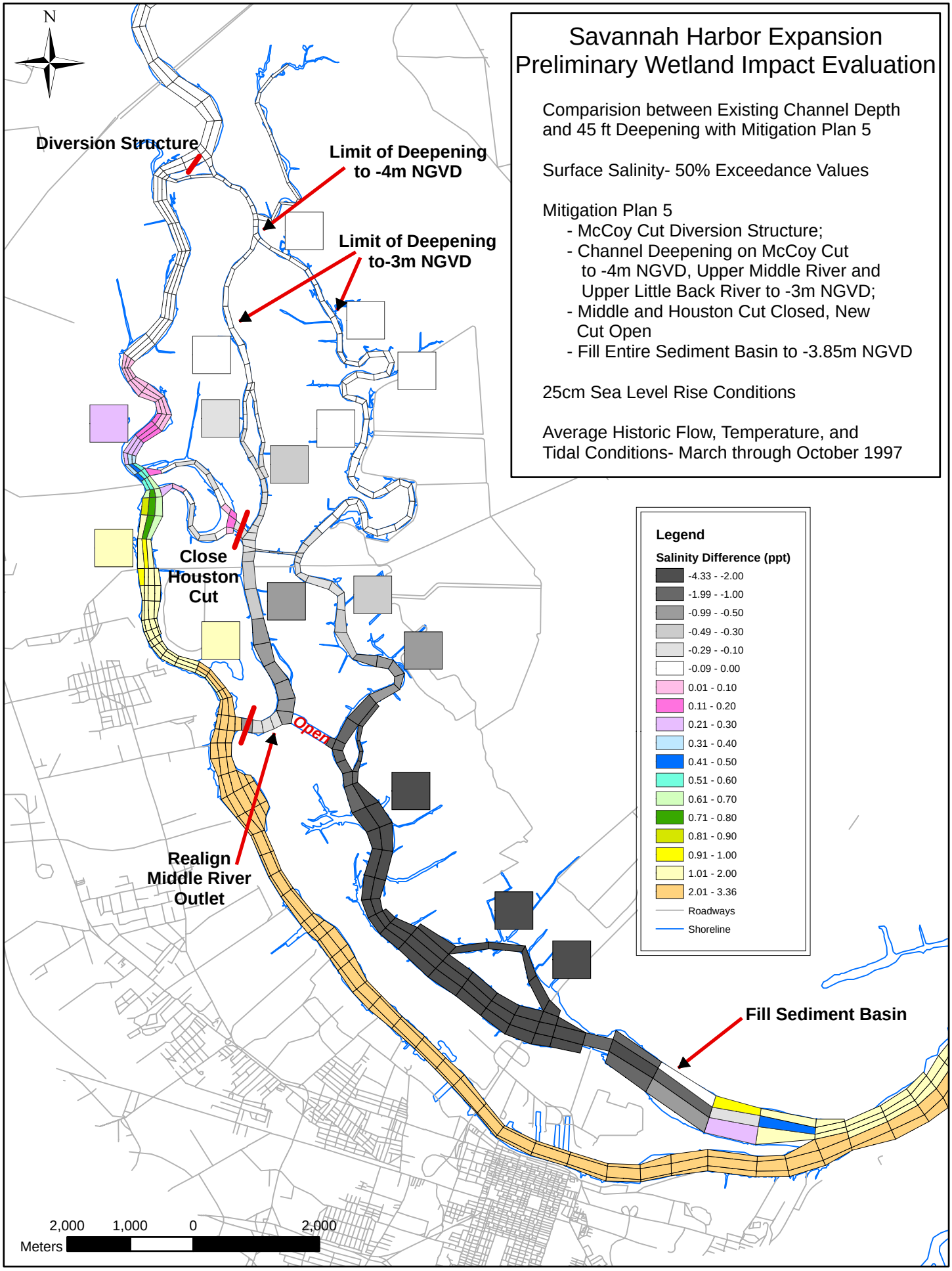


January 2007

Sensitivity Analysis #2A



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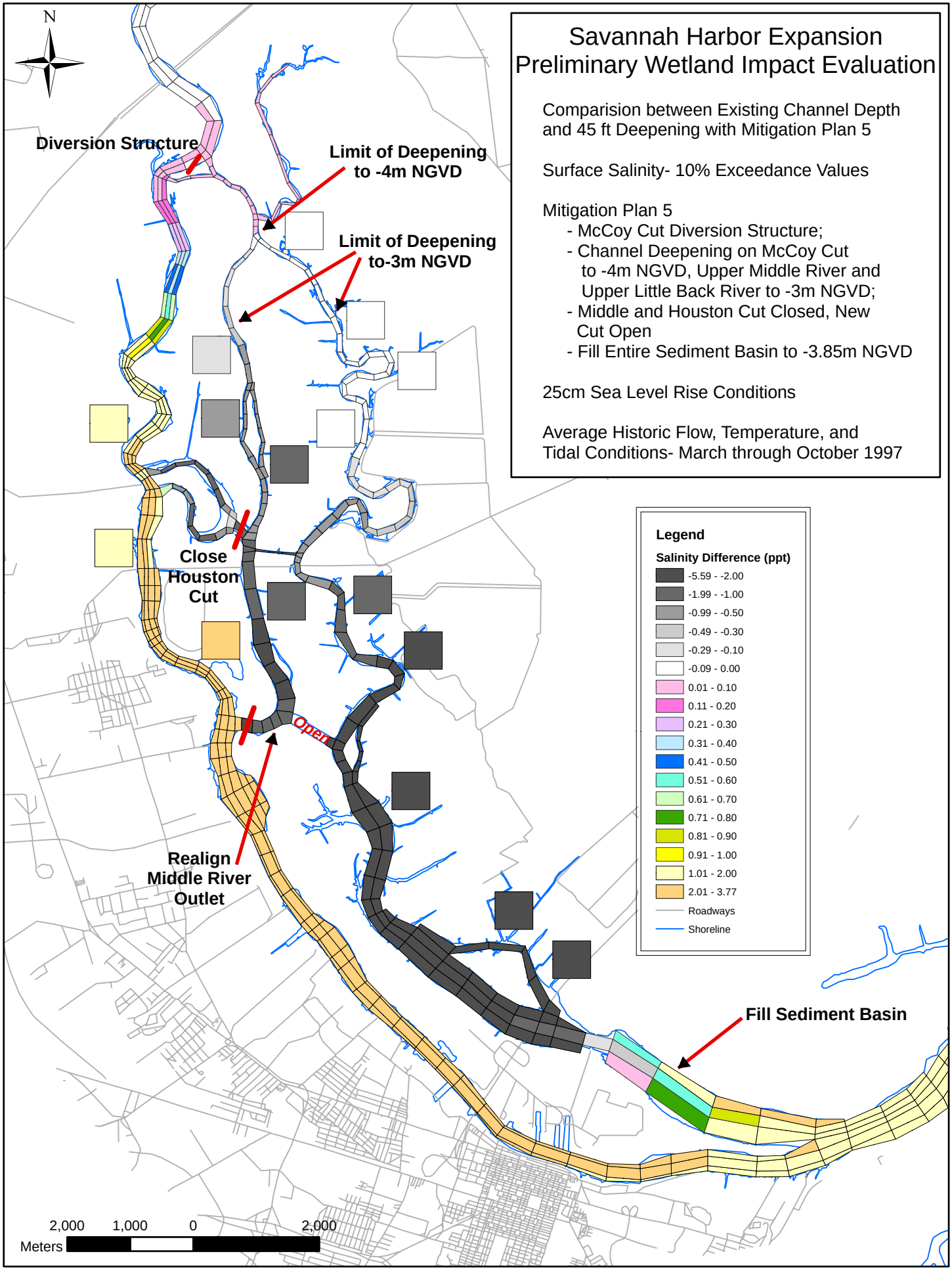

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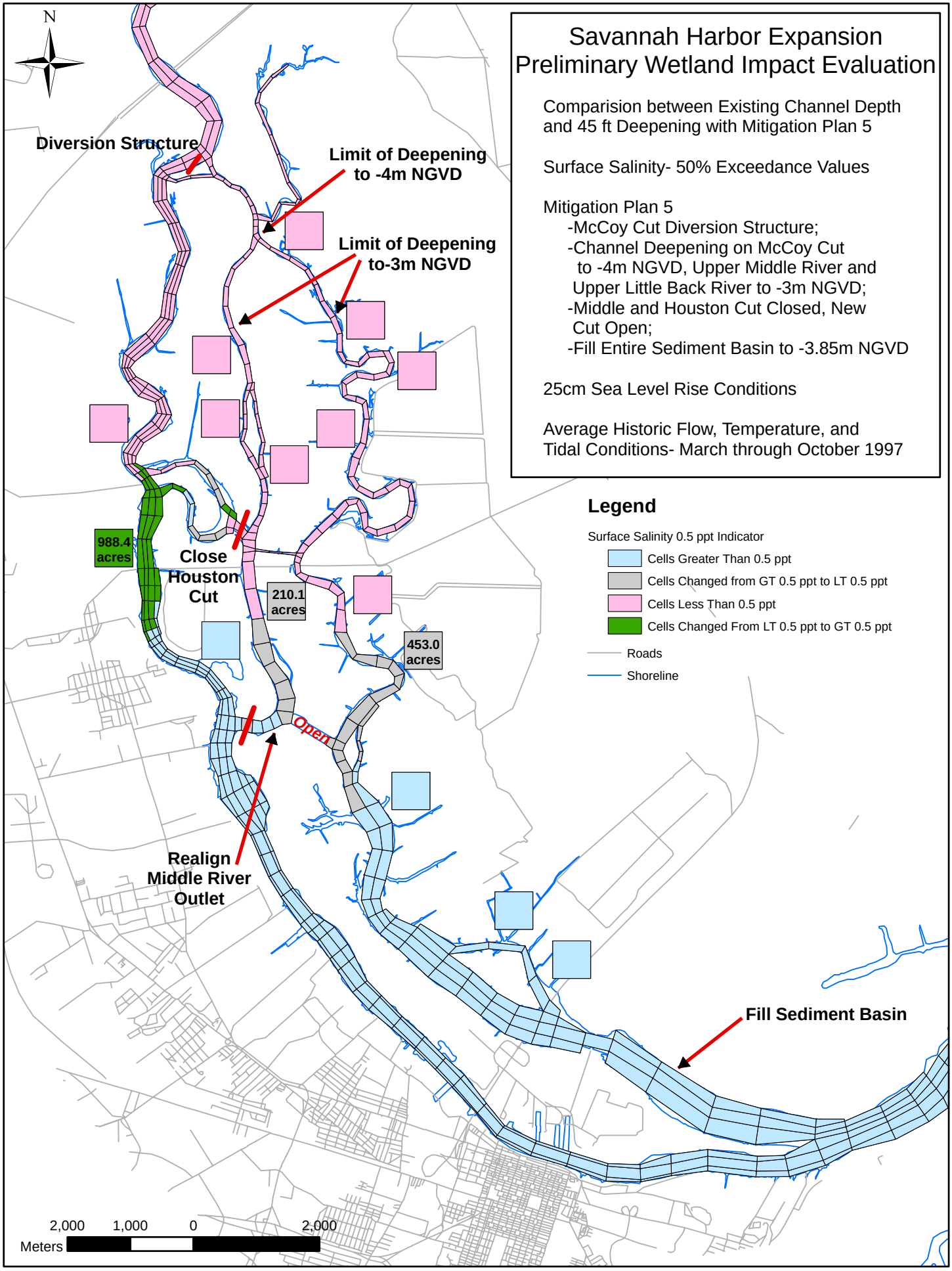

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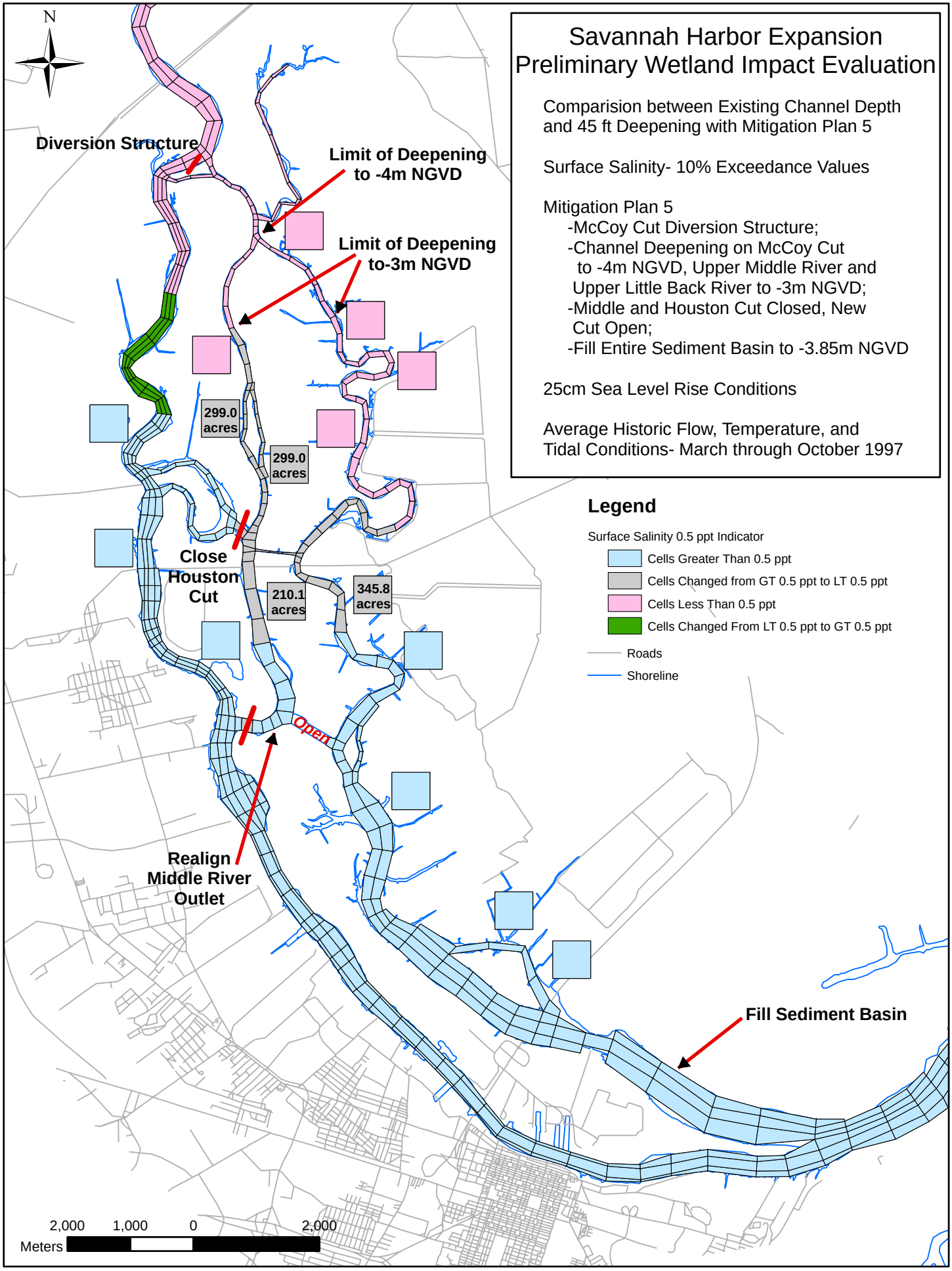

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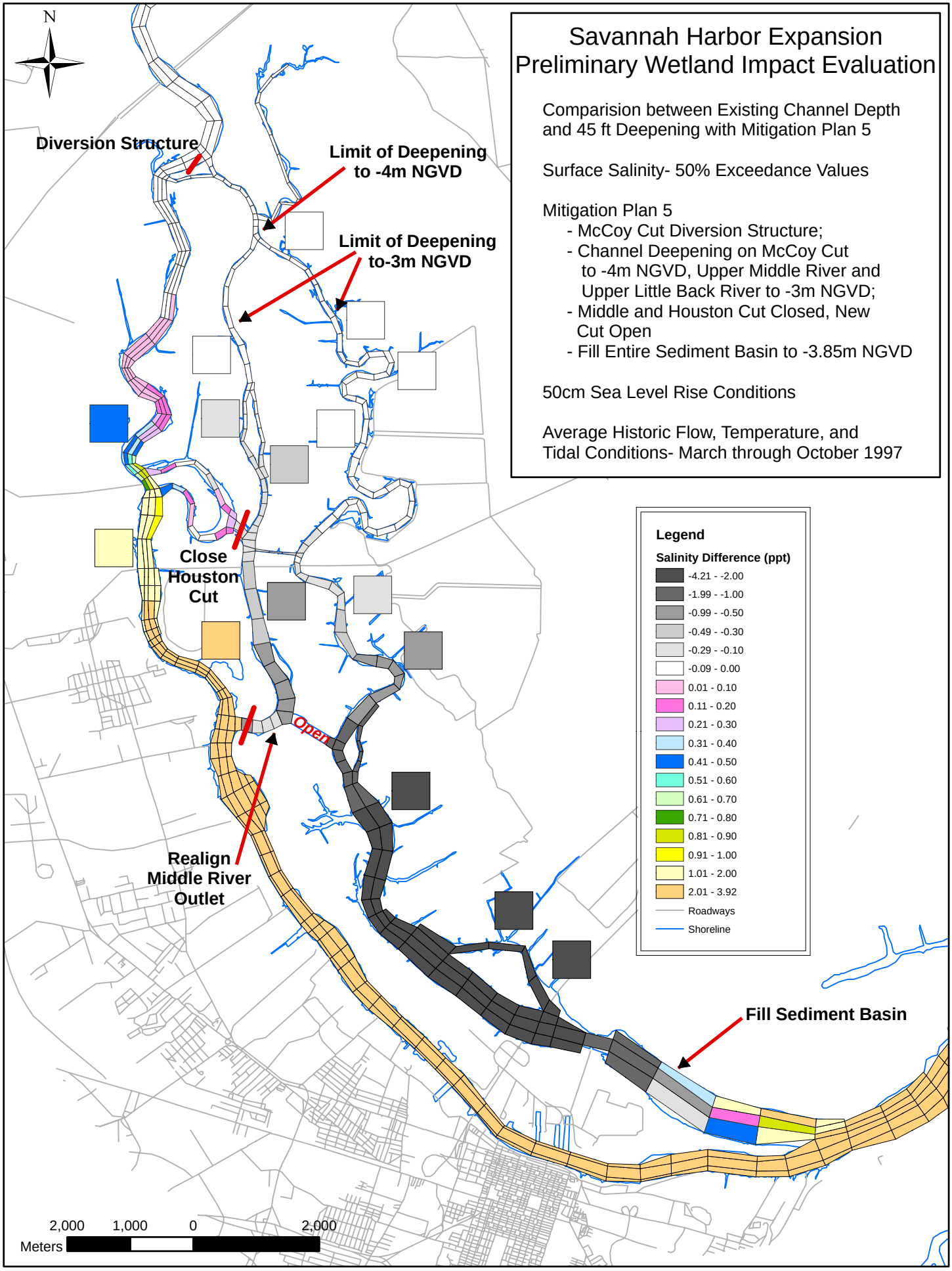

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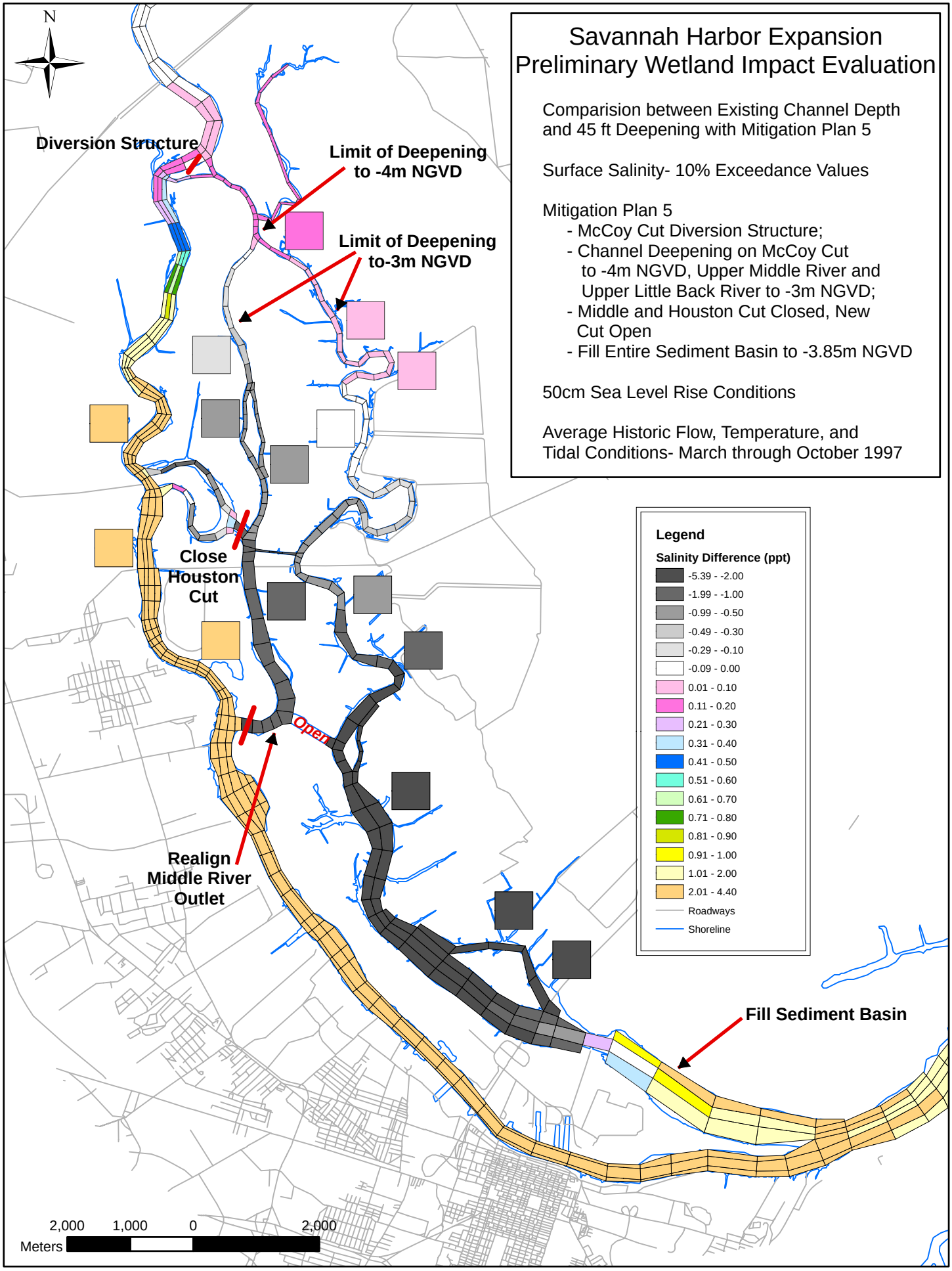

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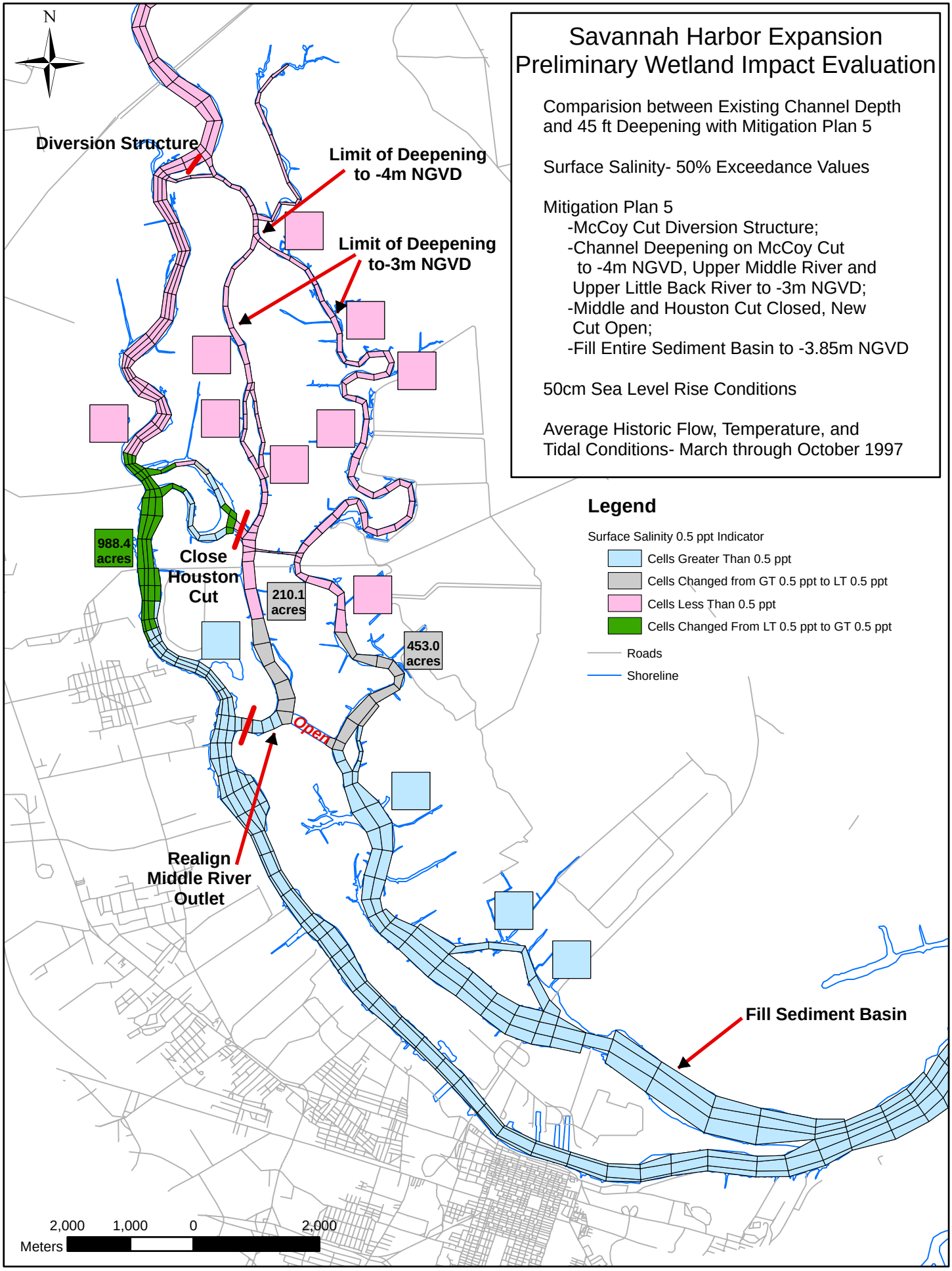

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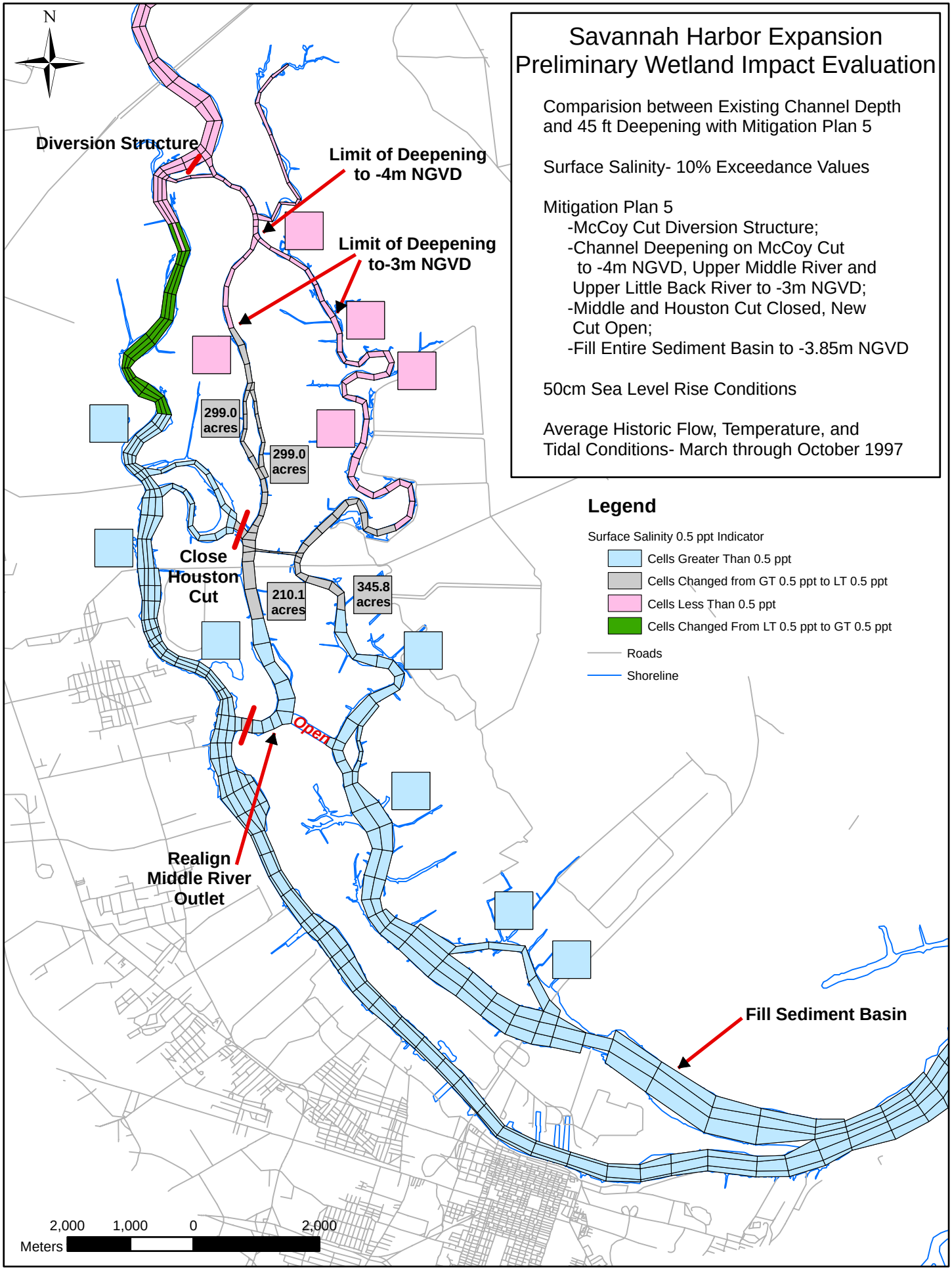
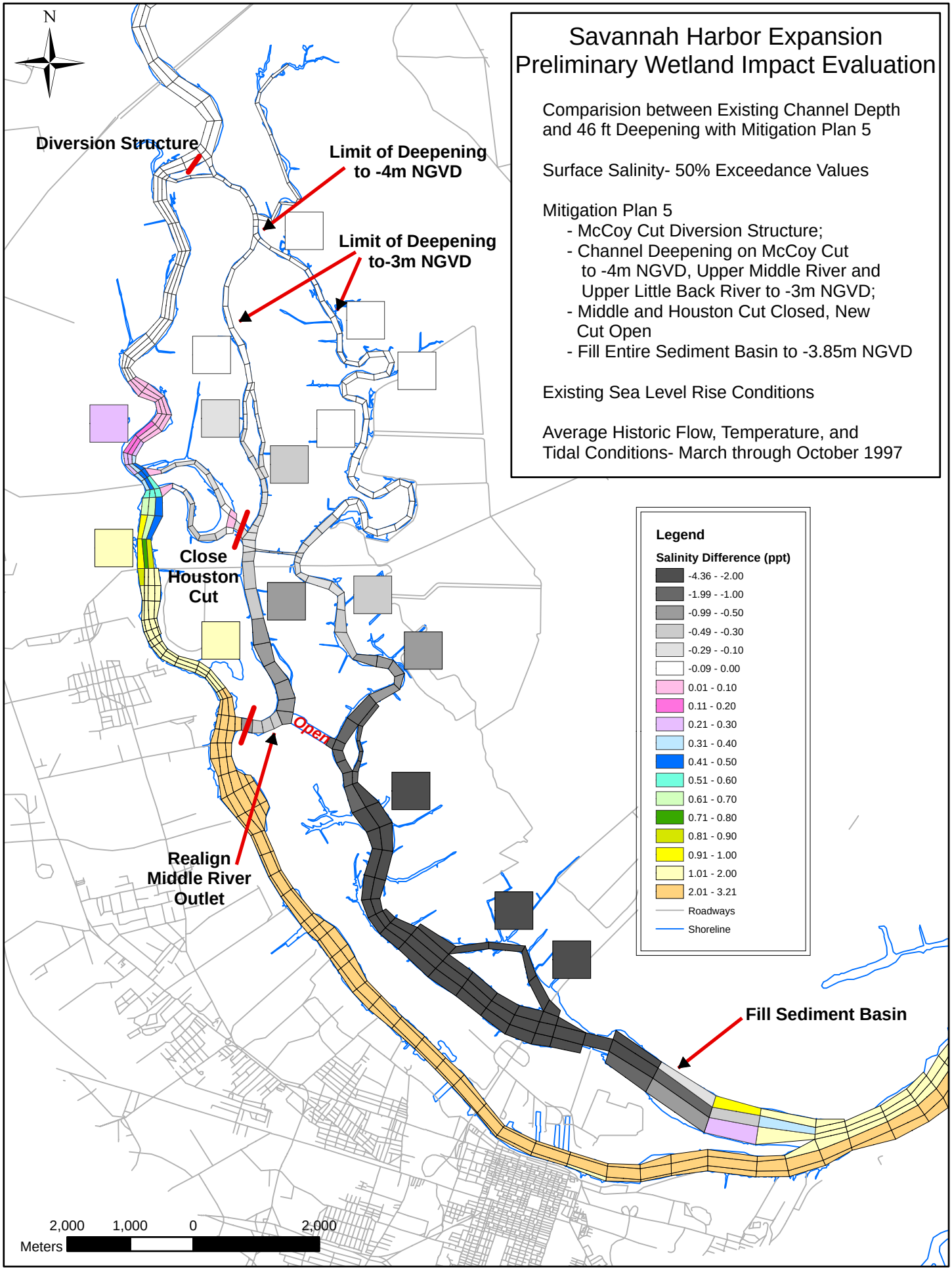


January 2007

46-ft Deepening

Basic Evaluation



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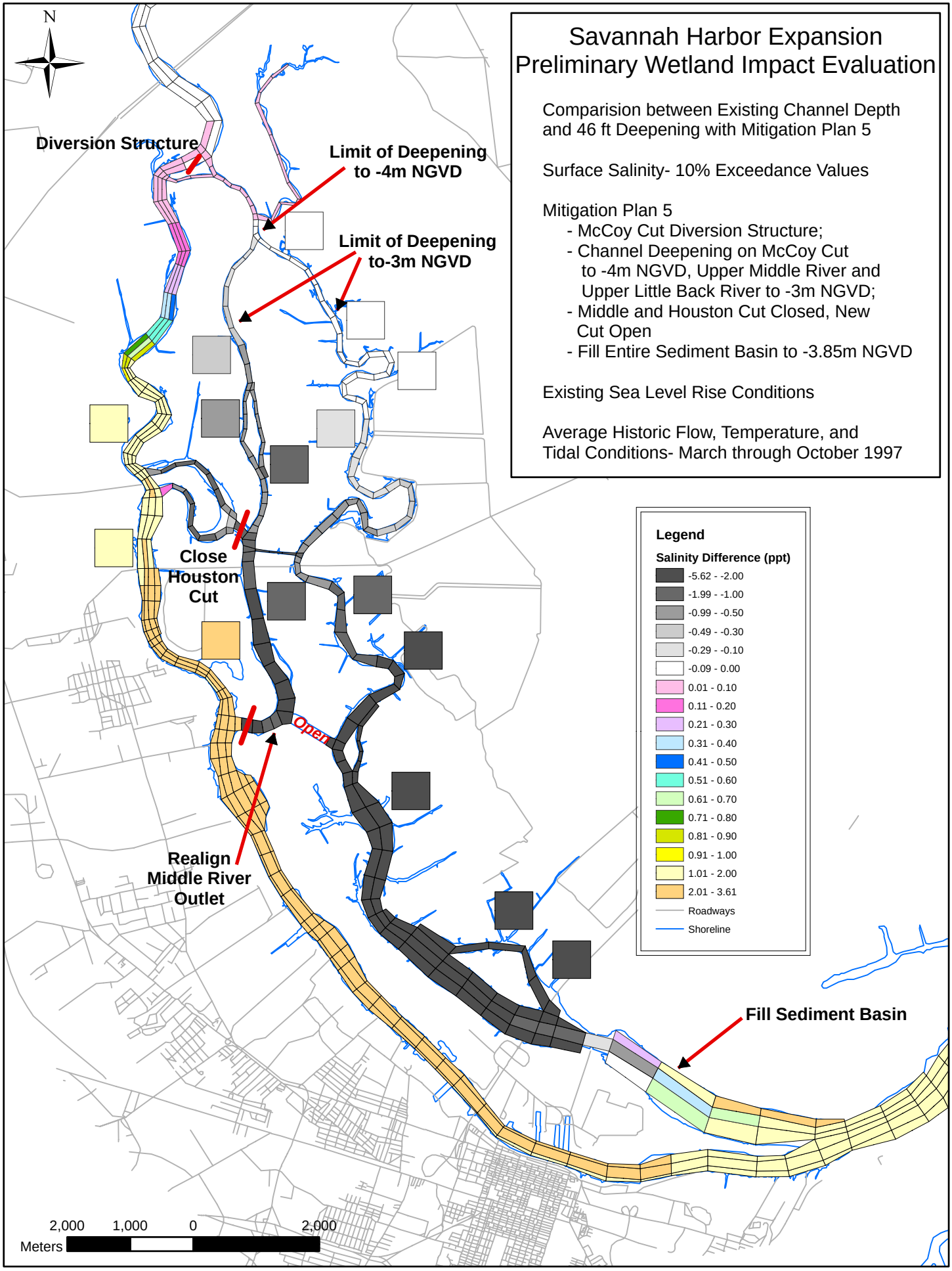

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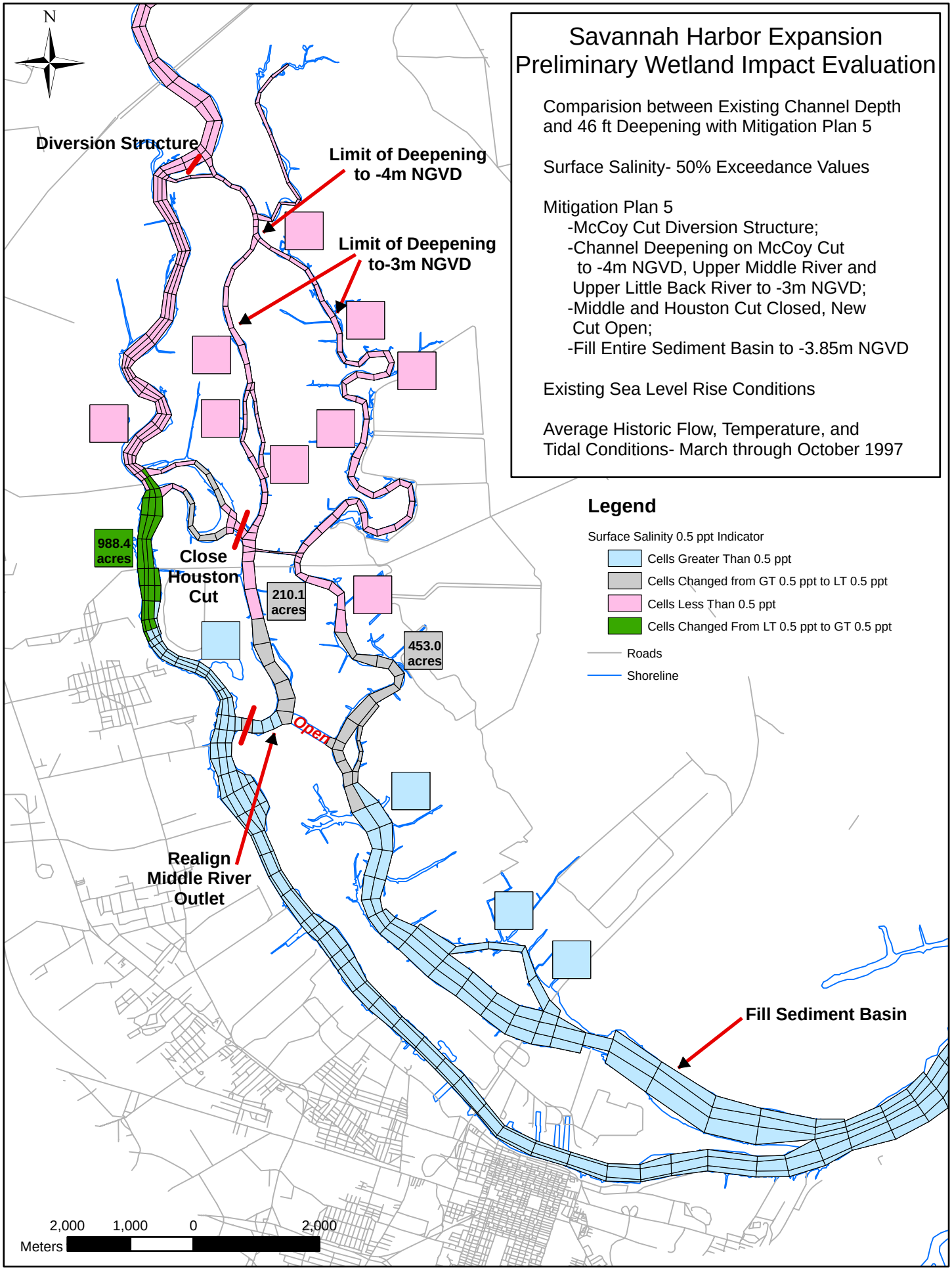

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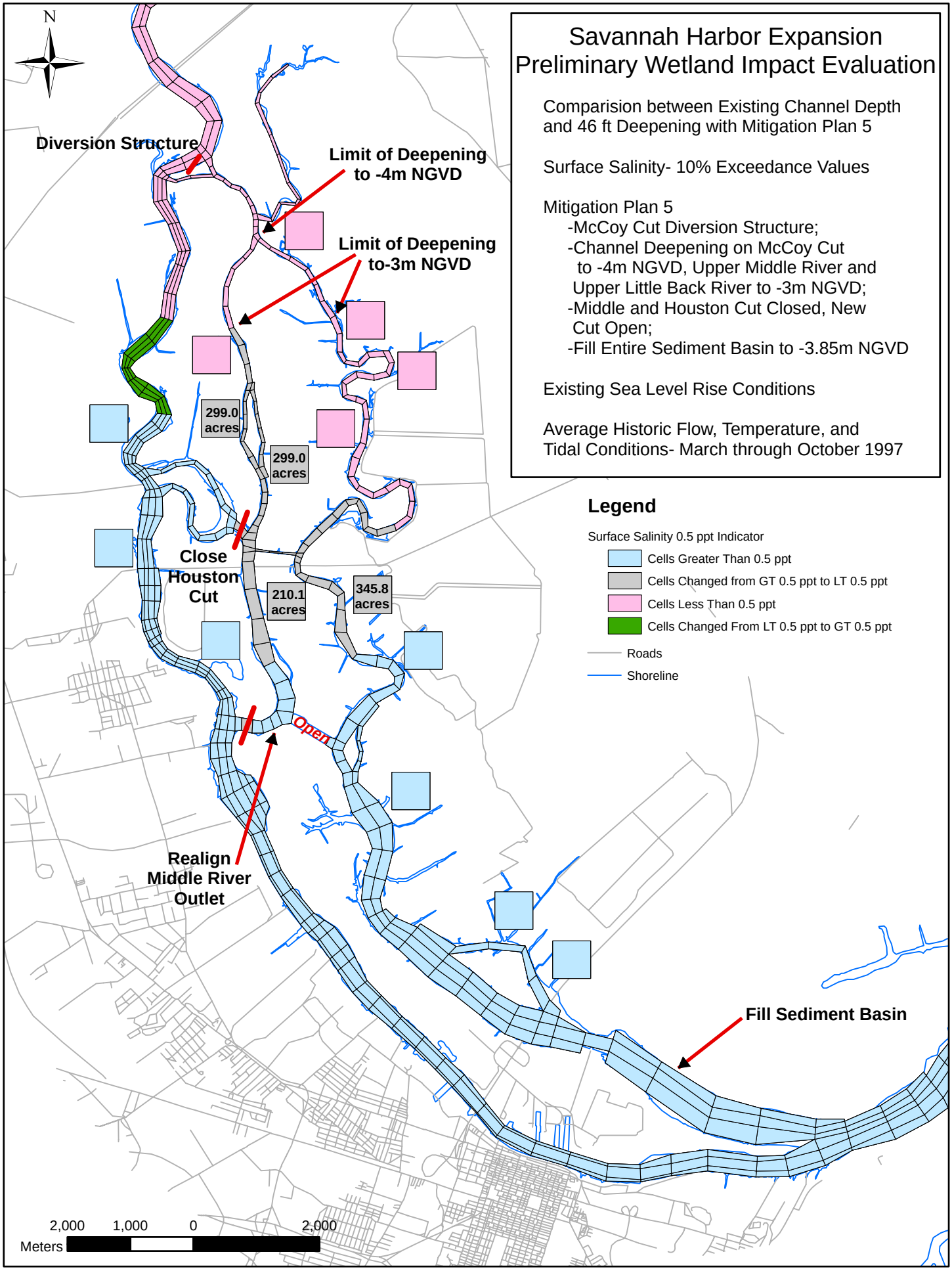

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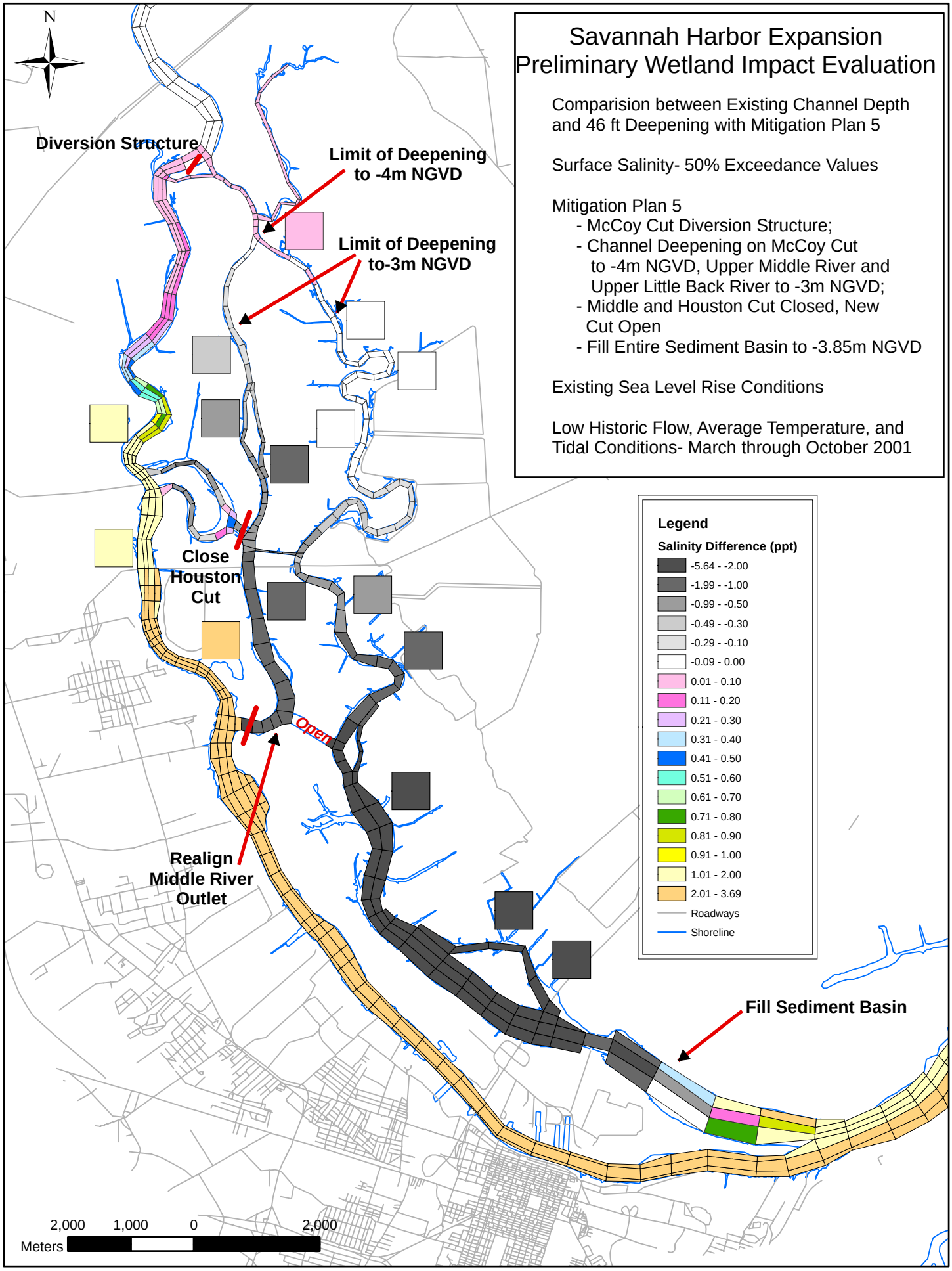
Sensitivity Analysis #1



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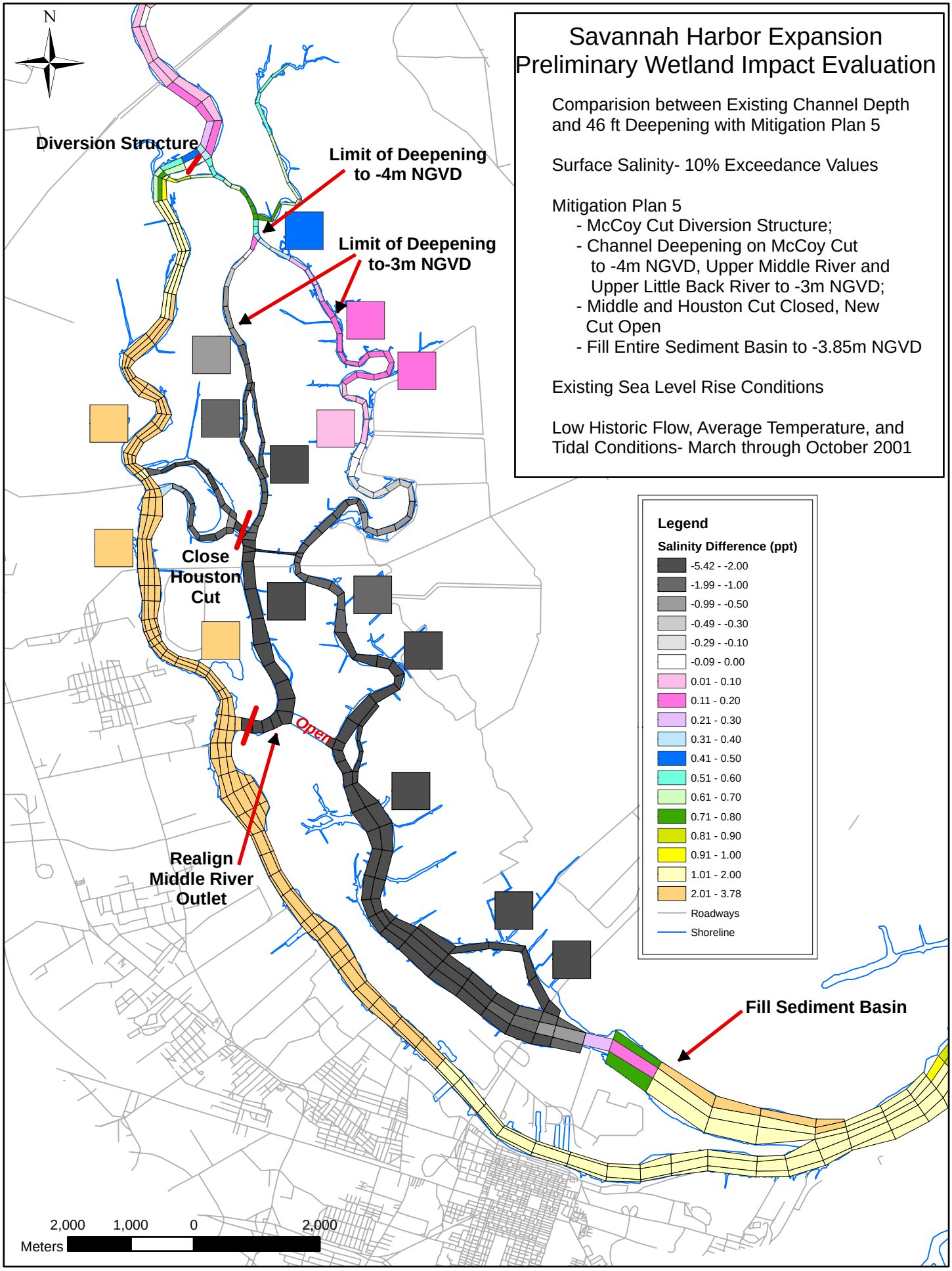

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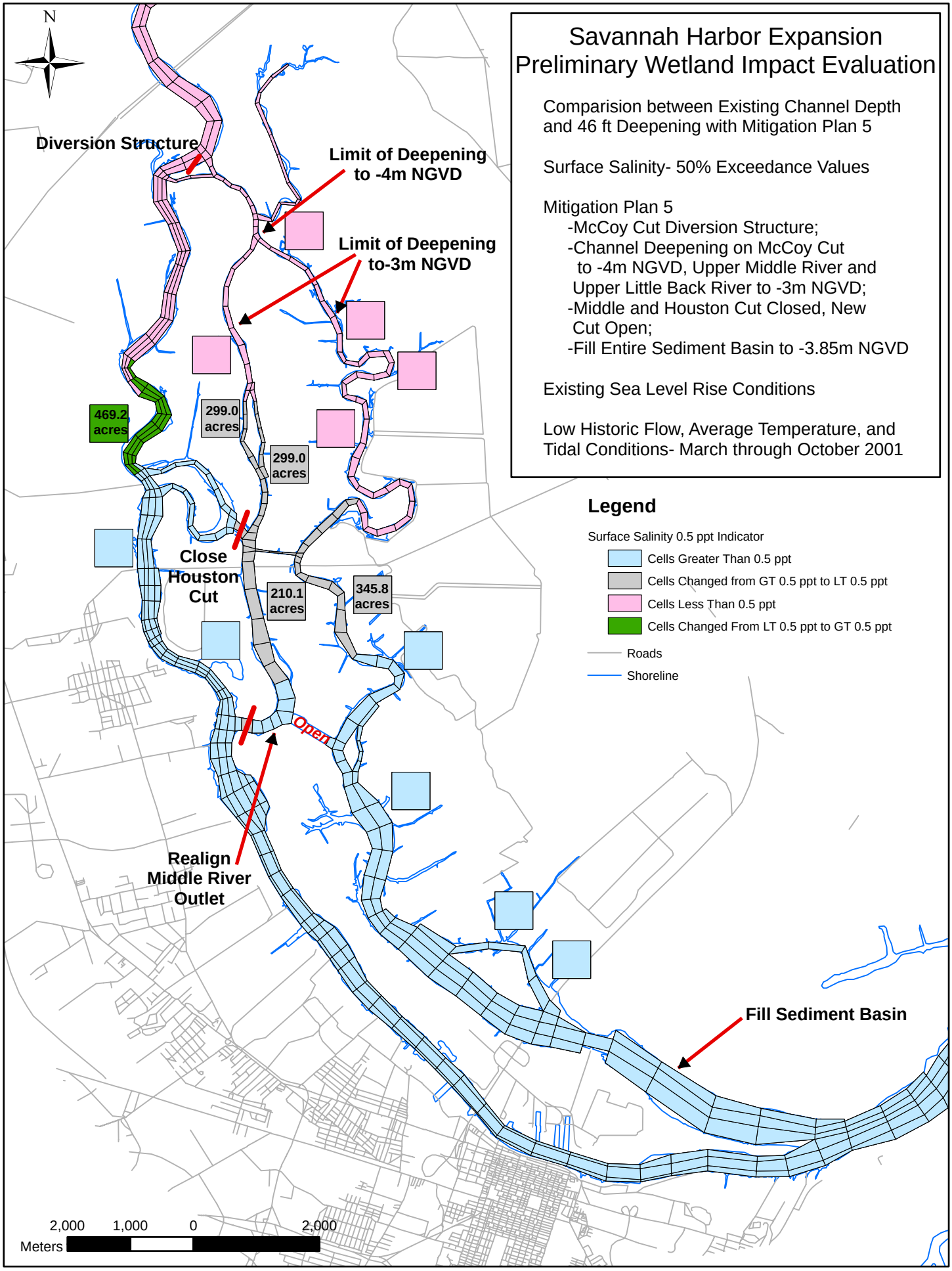

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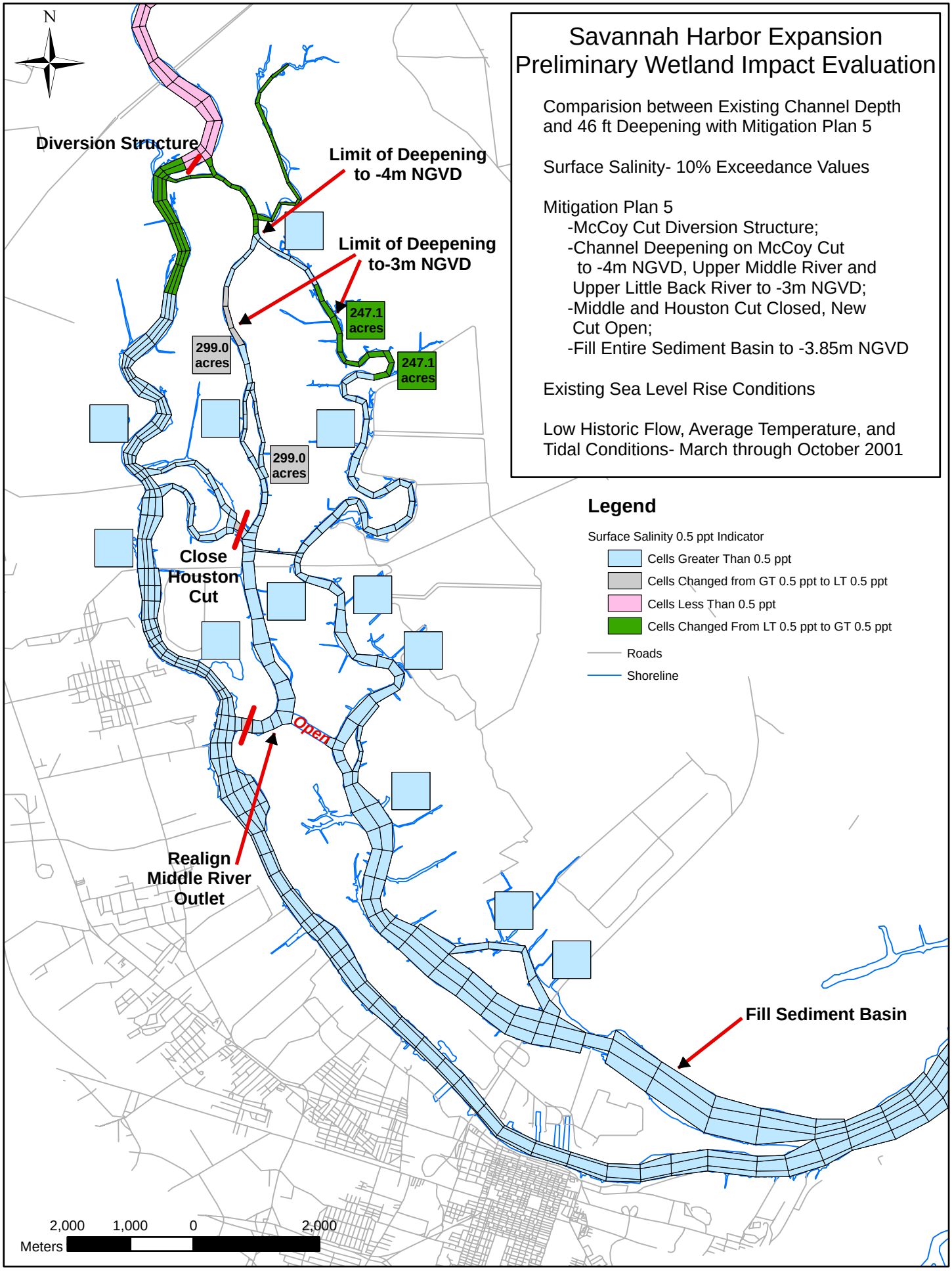
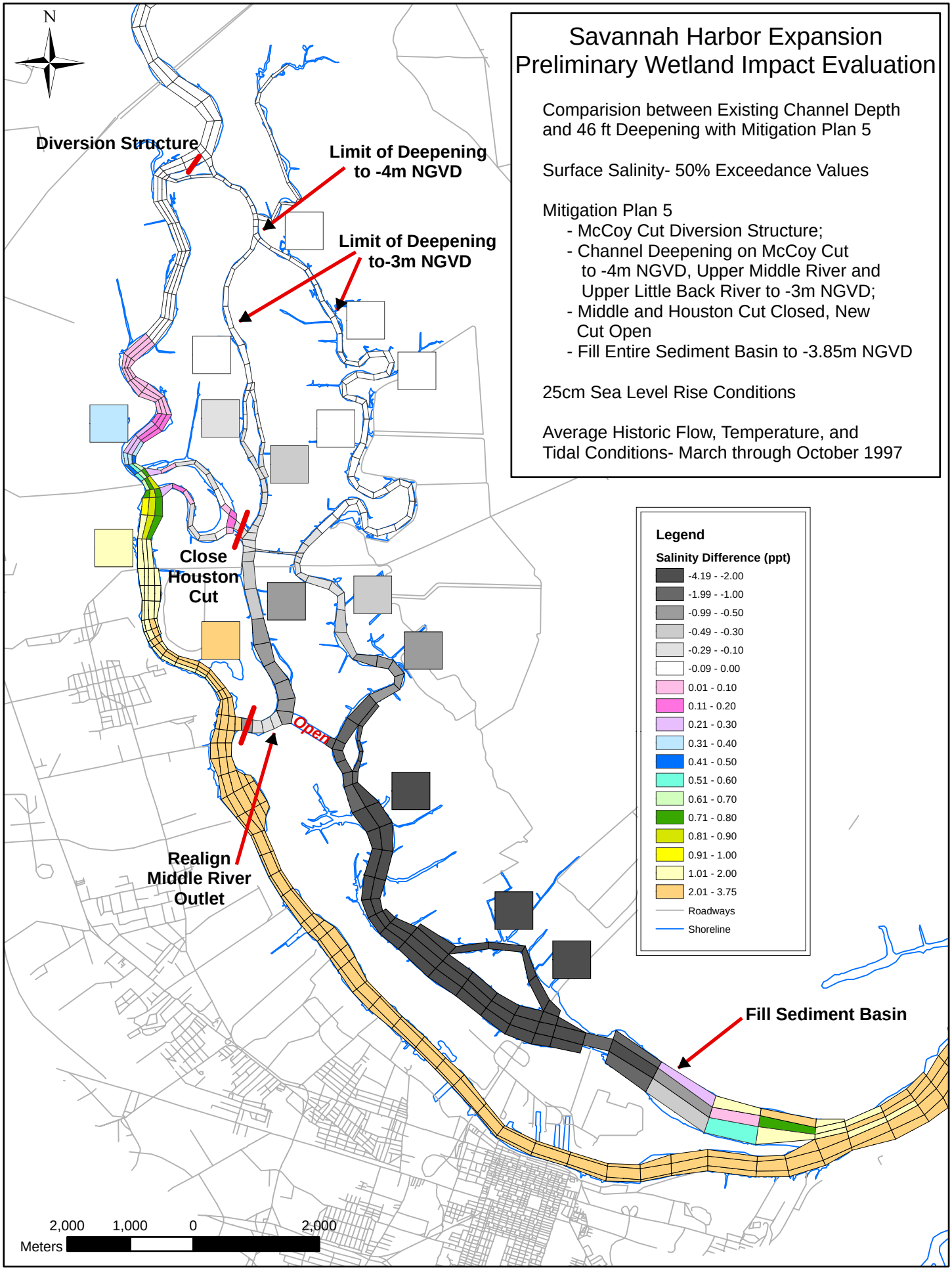


January 2007

Sensitivity Analysis #2A



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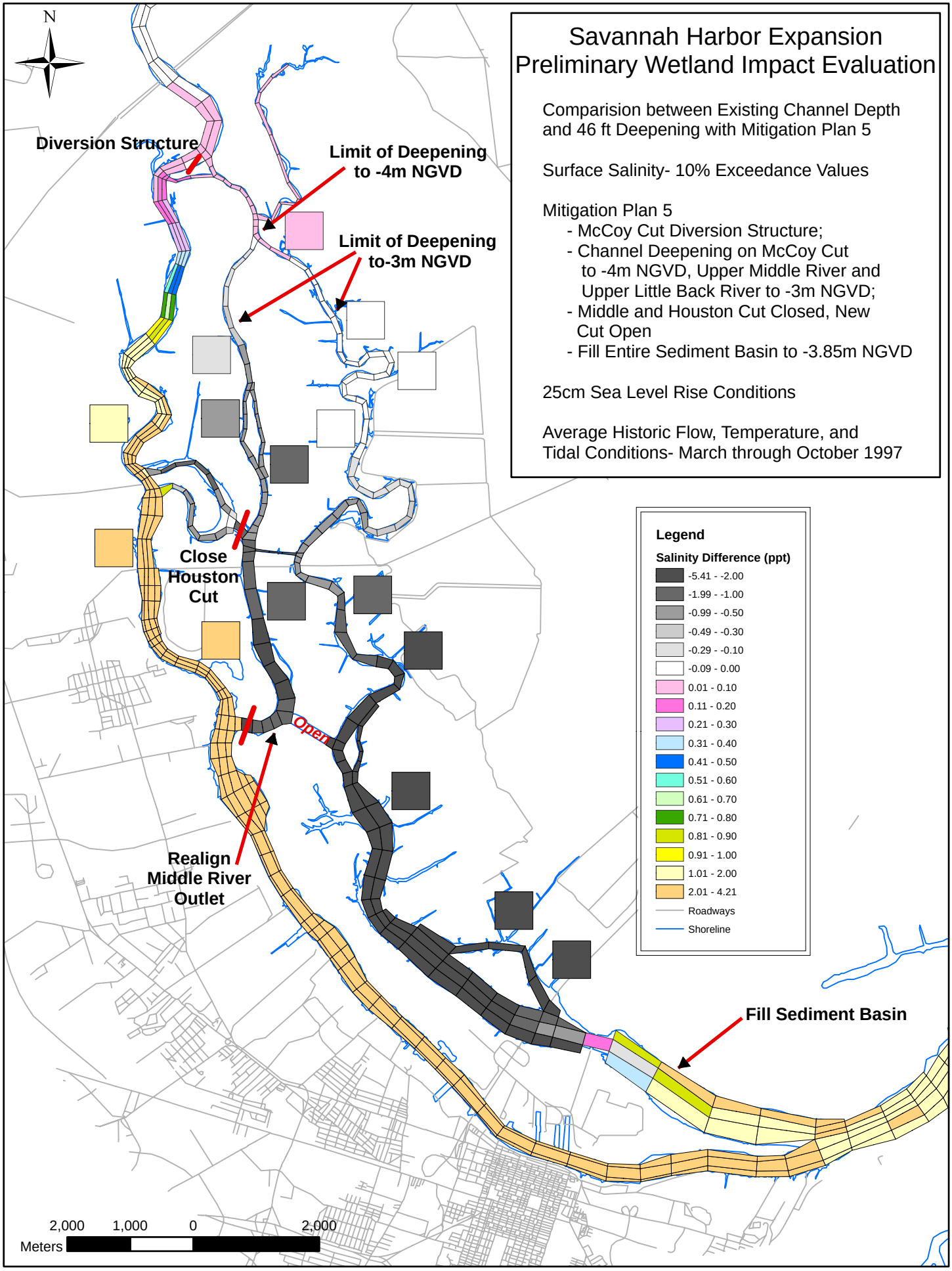

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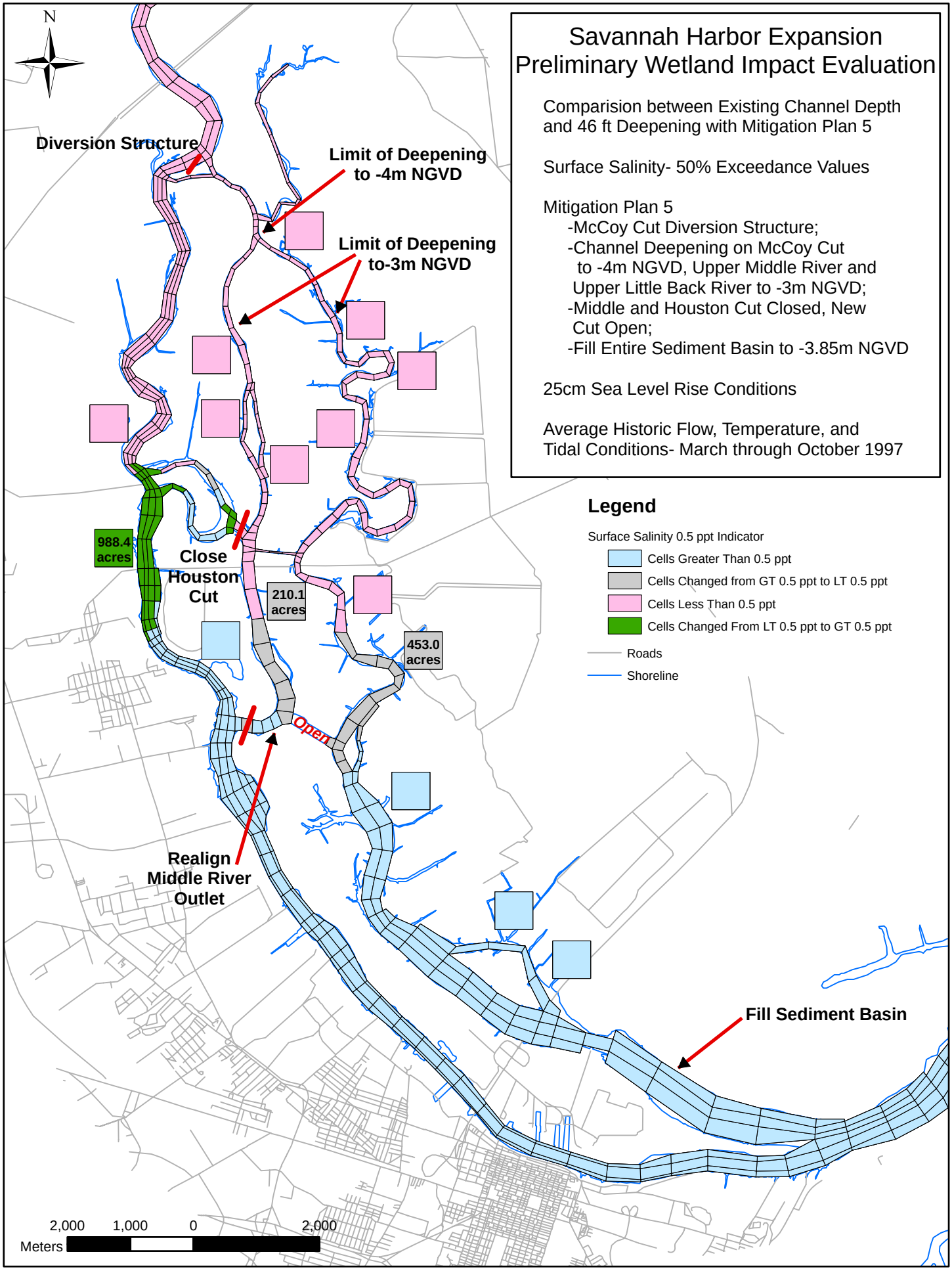

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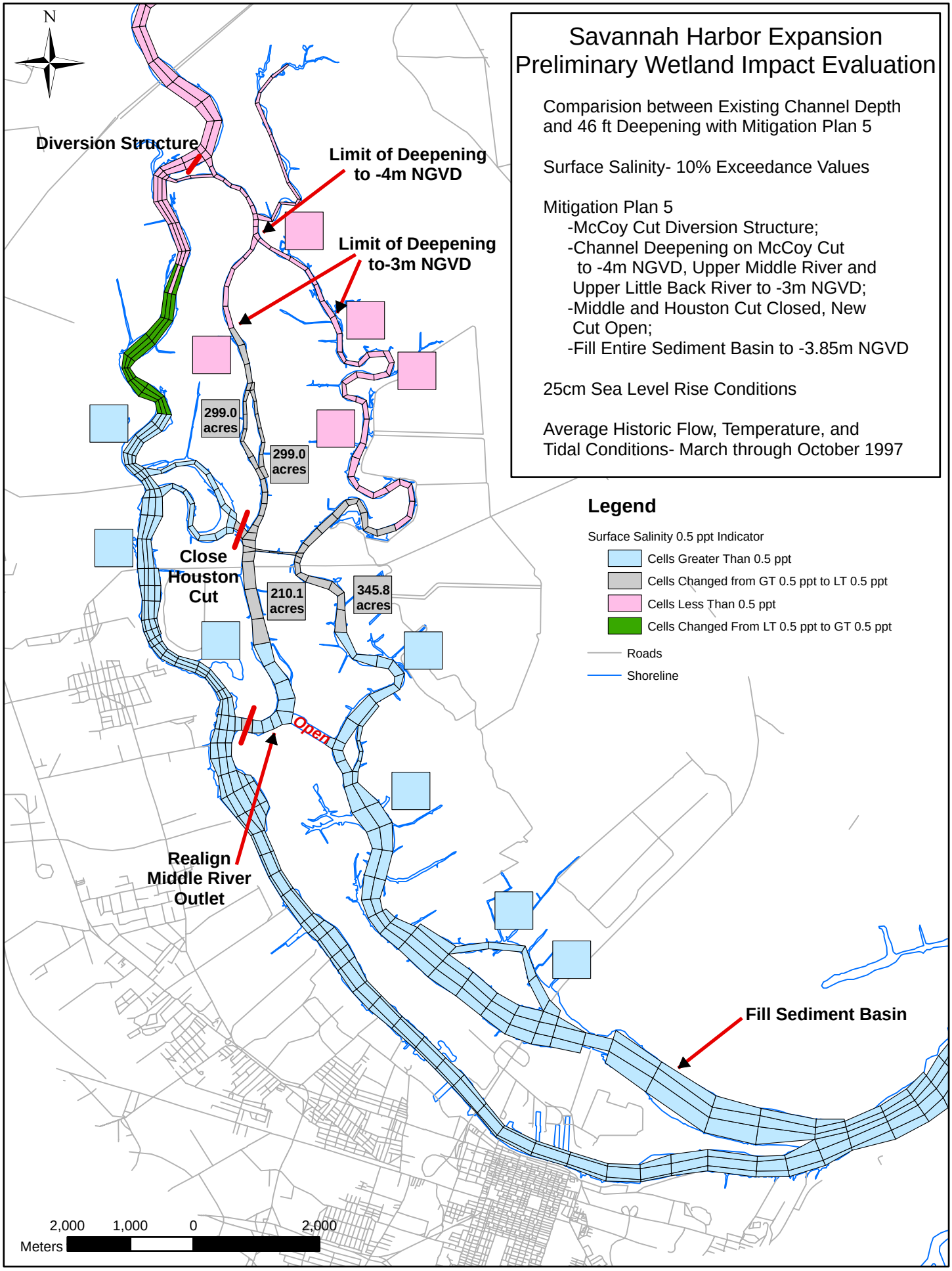

January 2007

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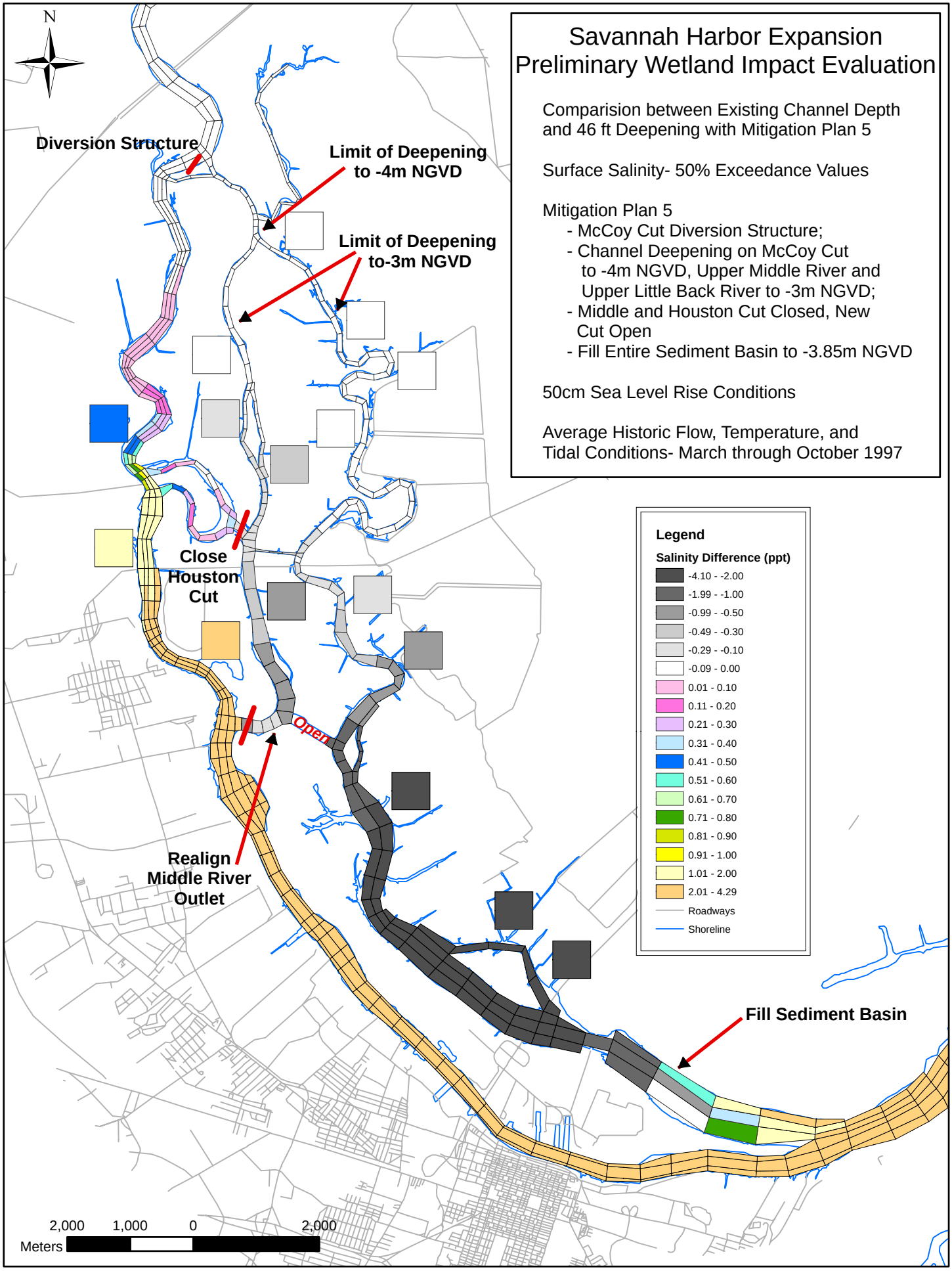

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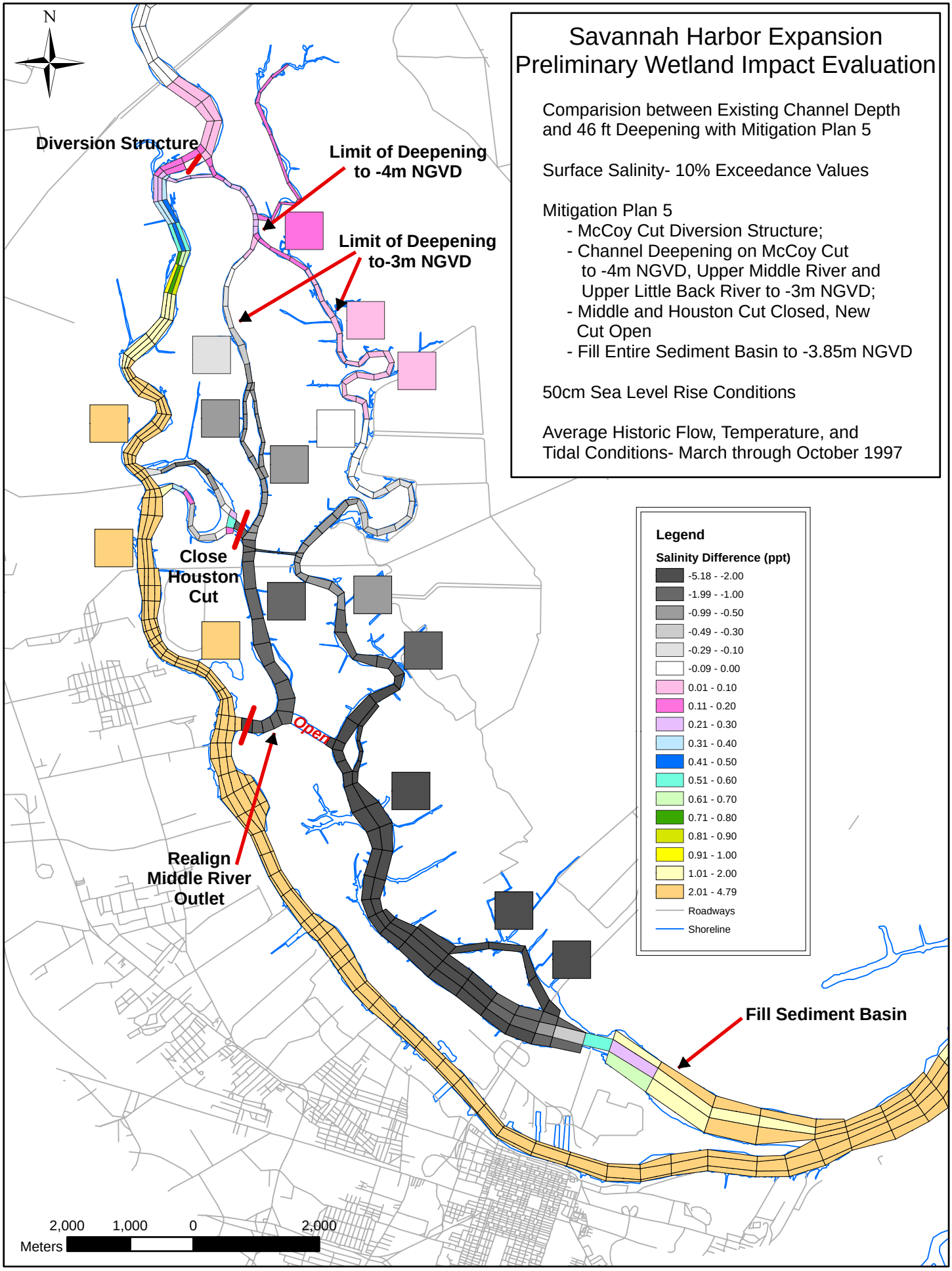

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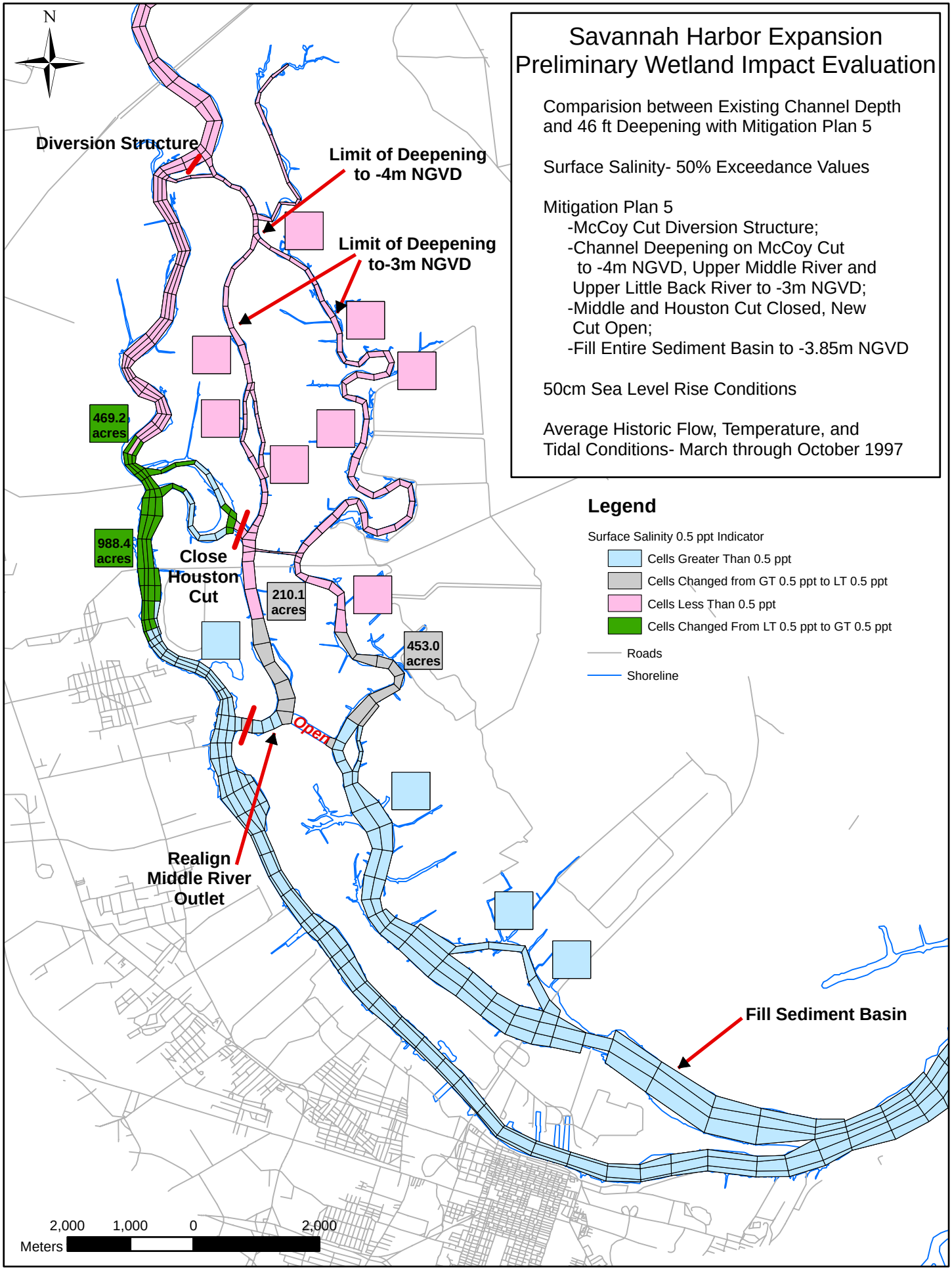

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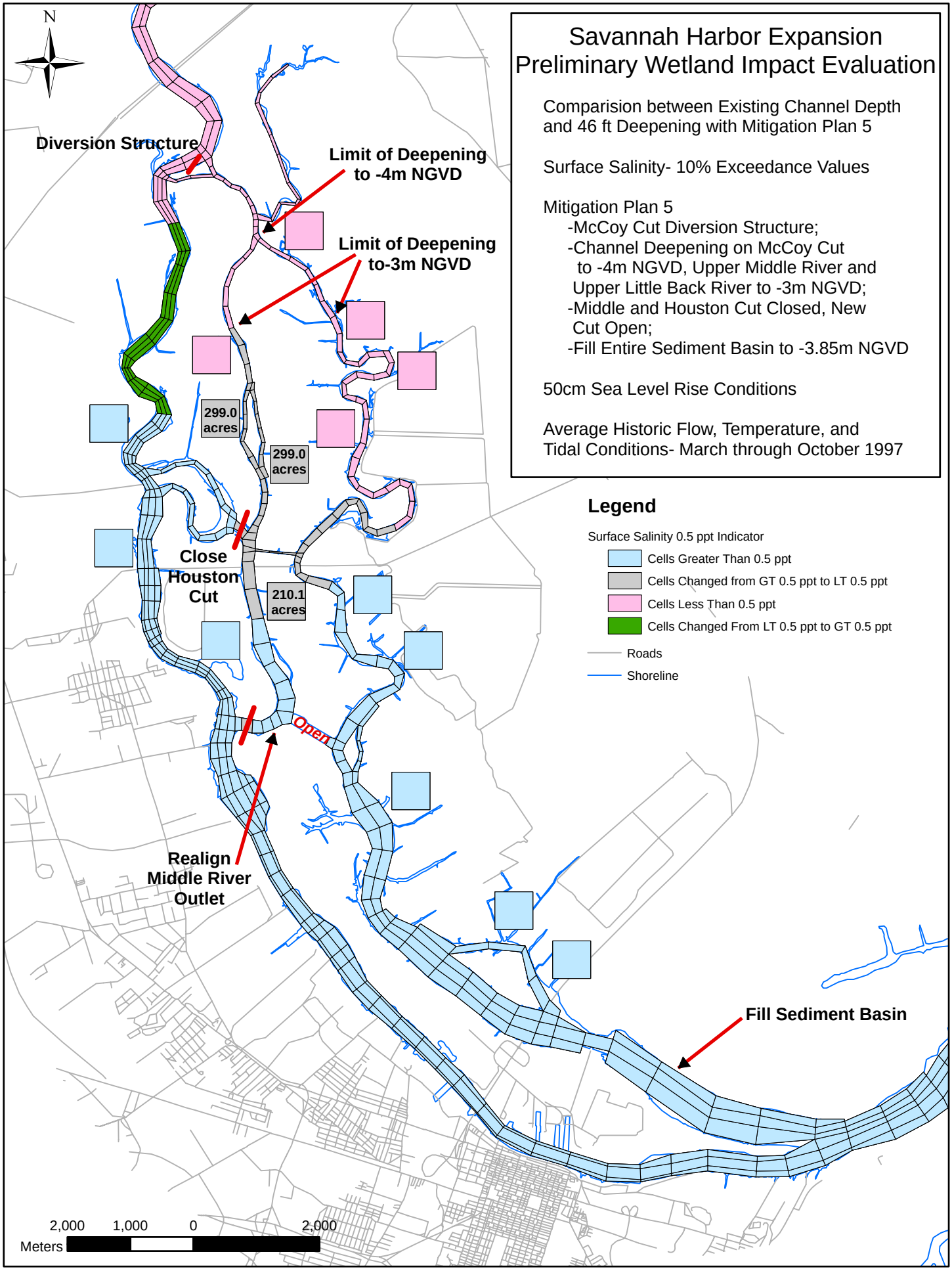
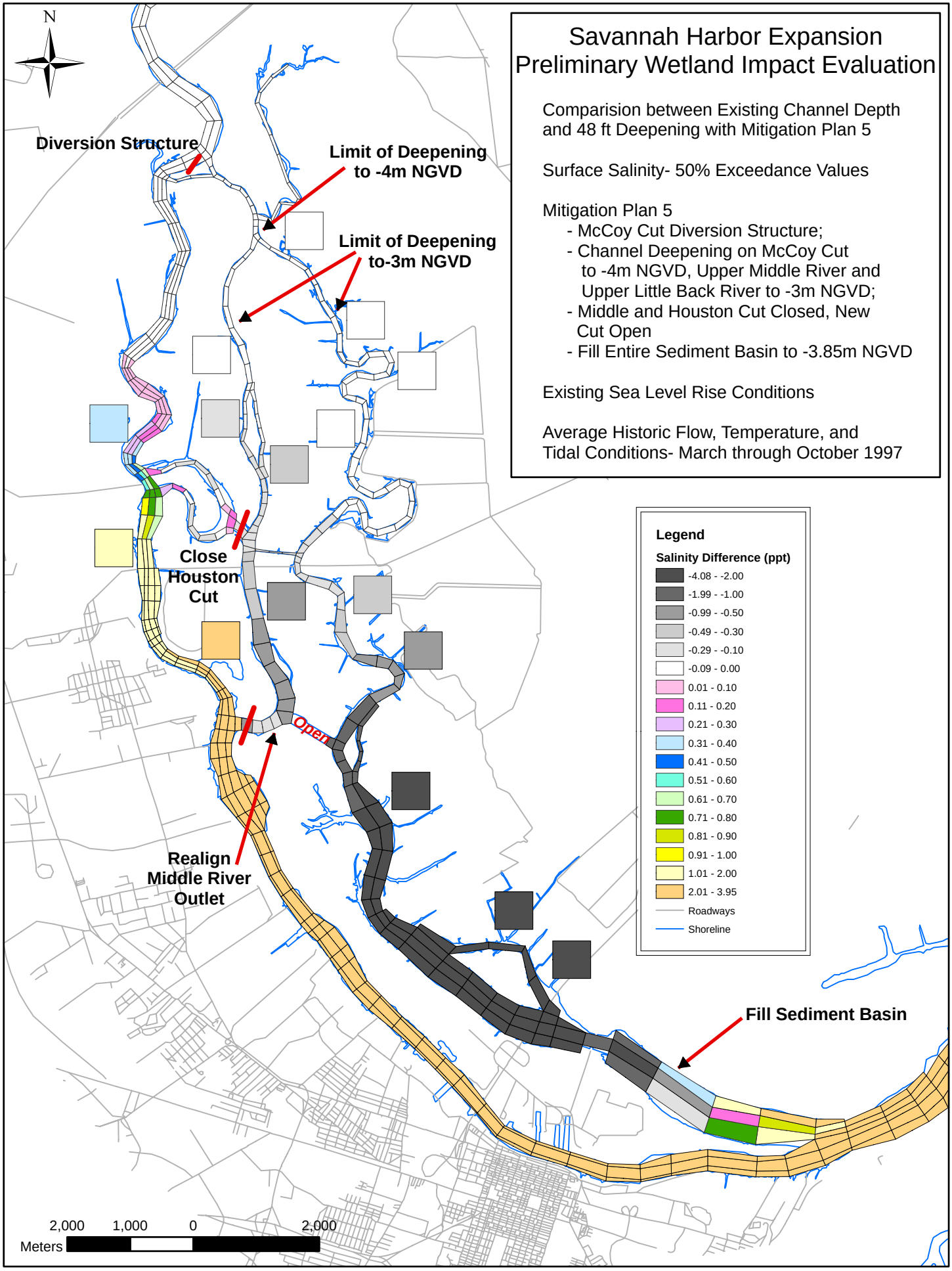


January 2007

48-ft Deepening

Basic Evaluation



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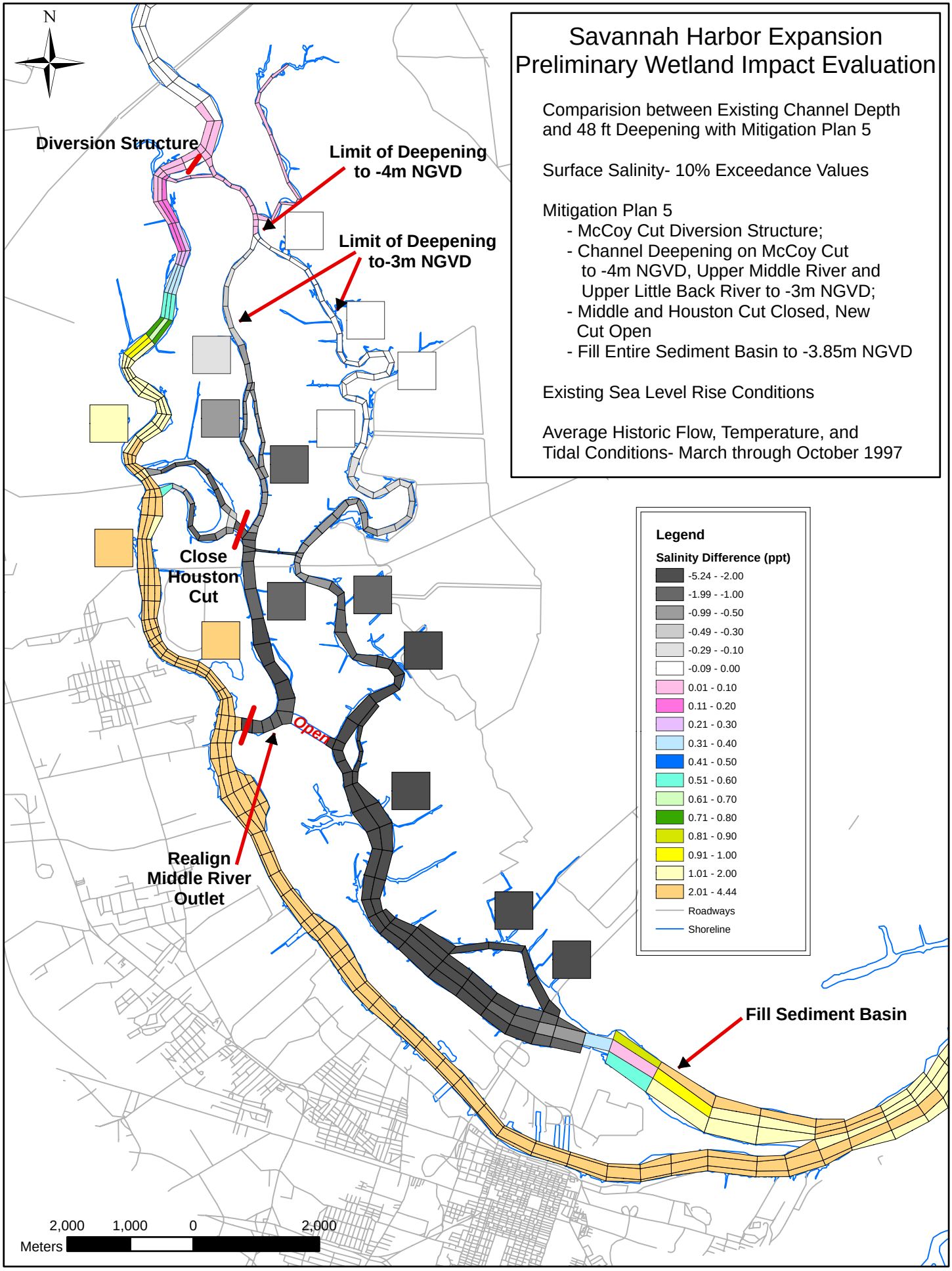

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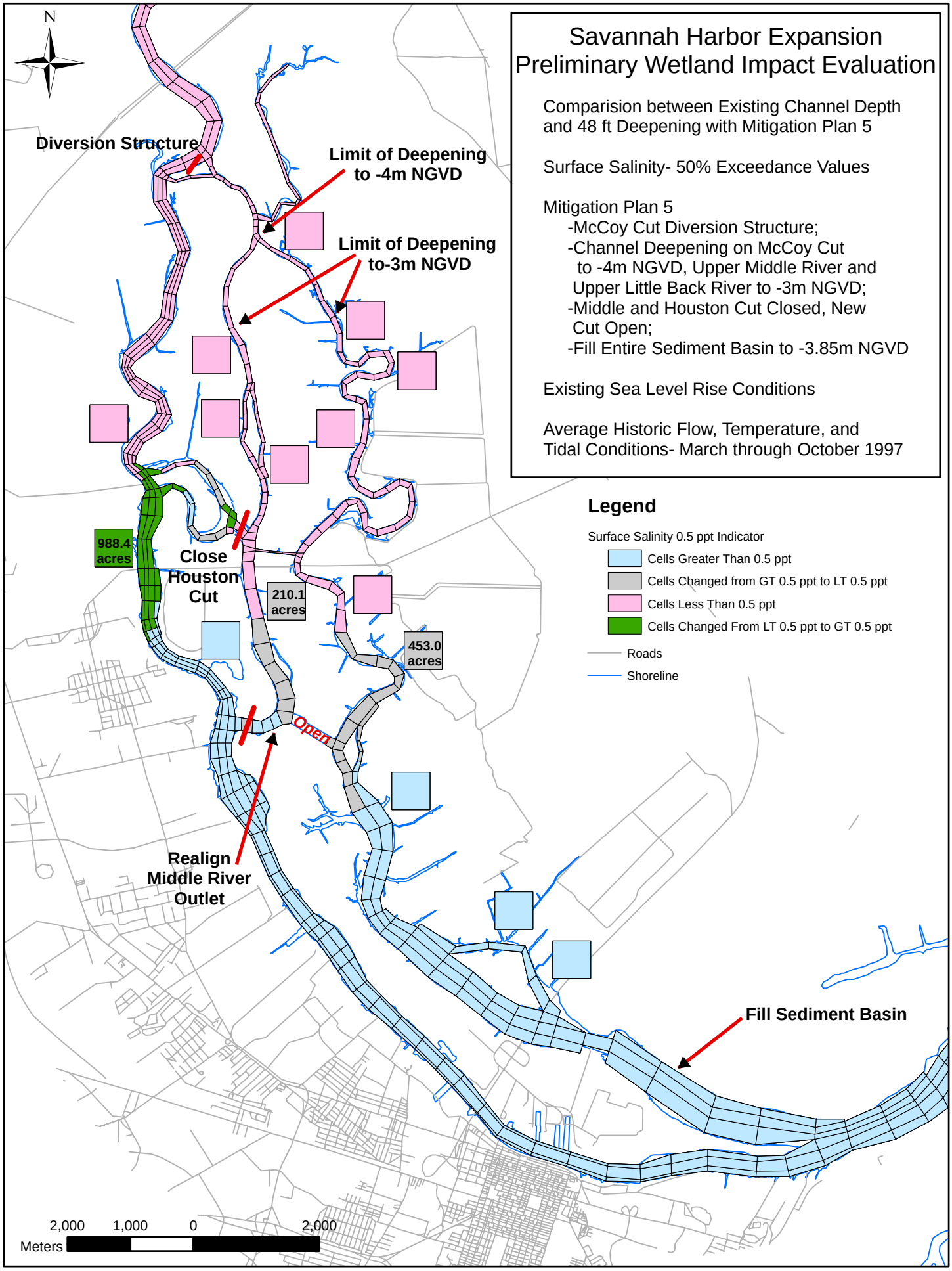

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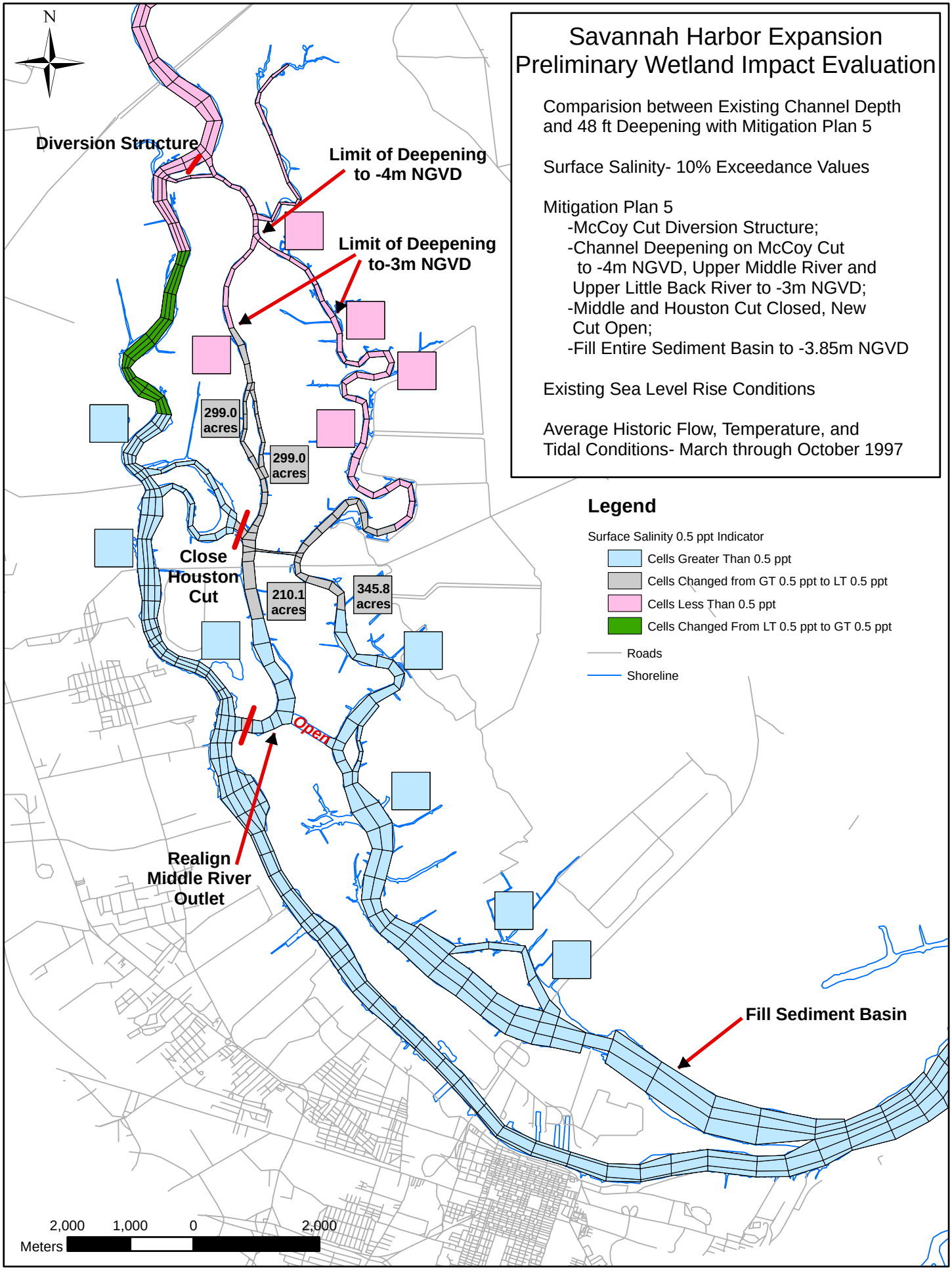
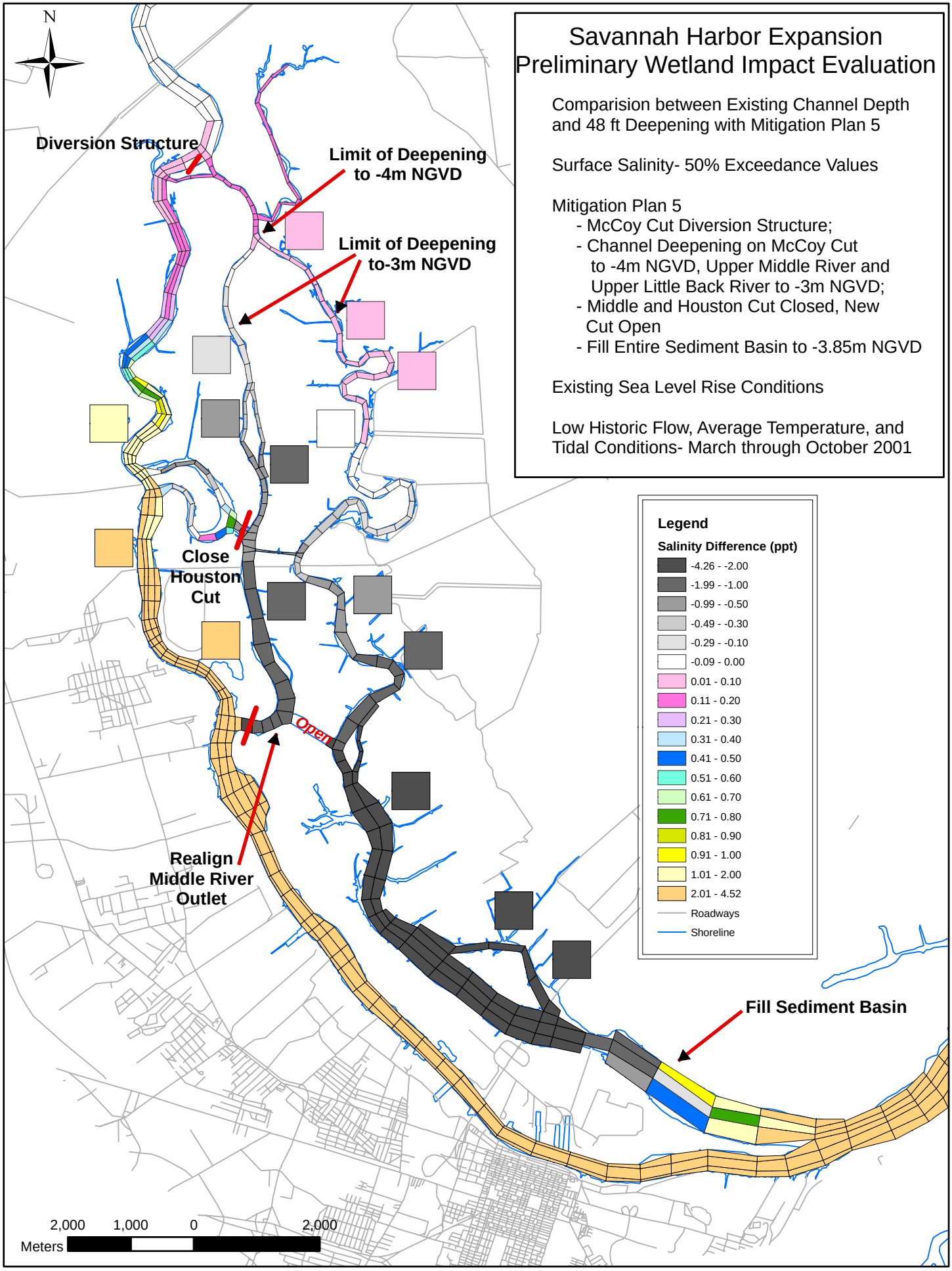


January 2007

Sensitivity Analysis #1



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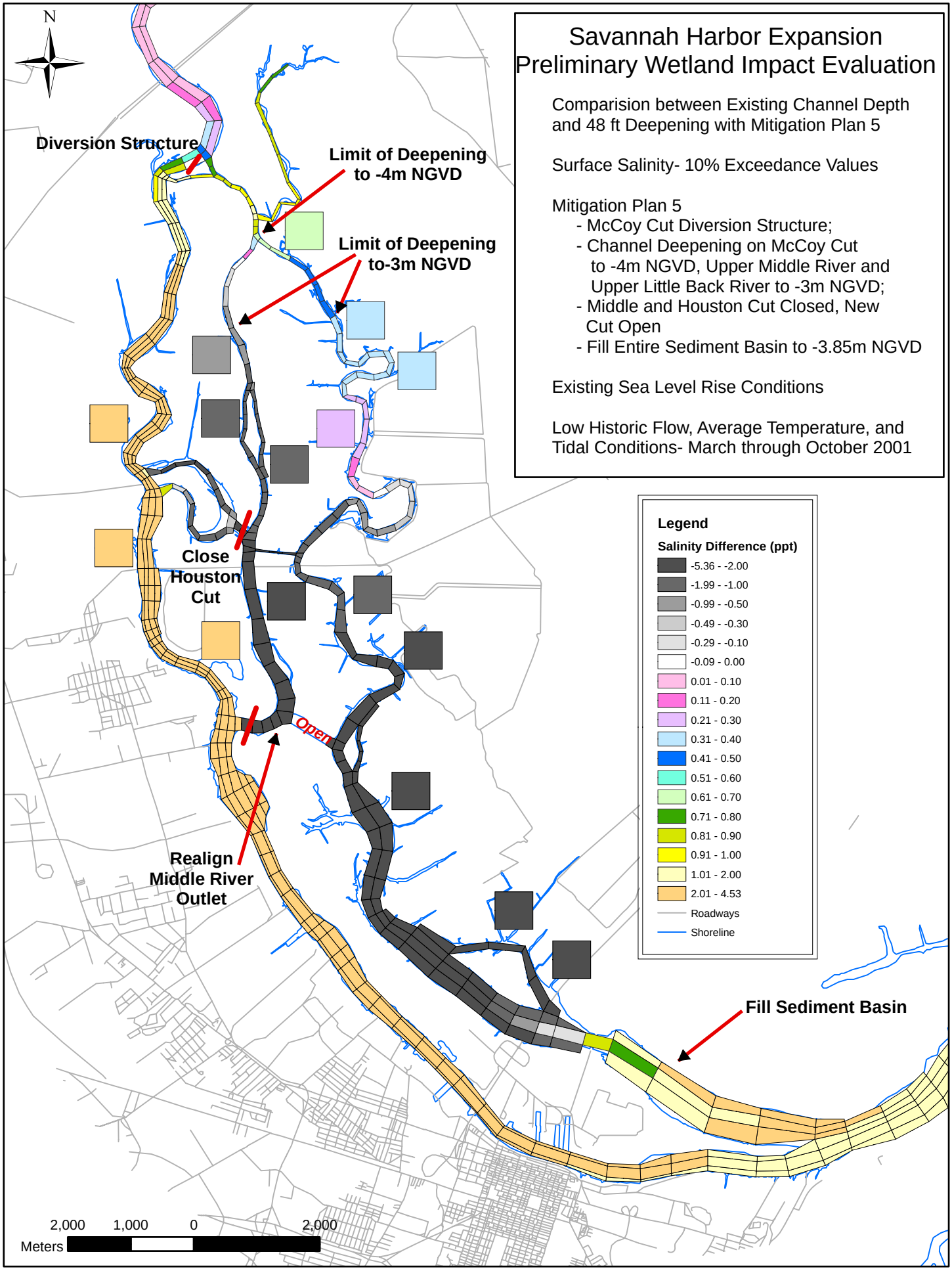

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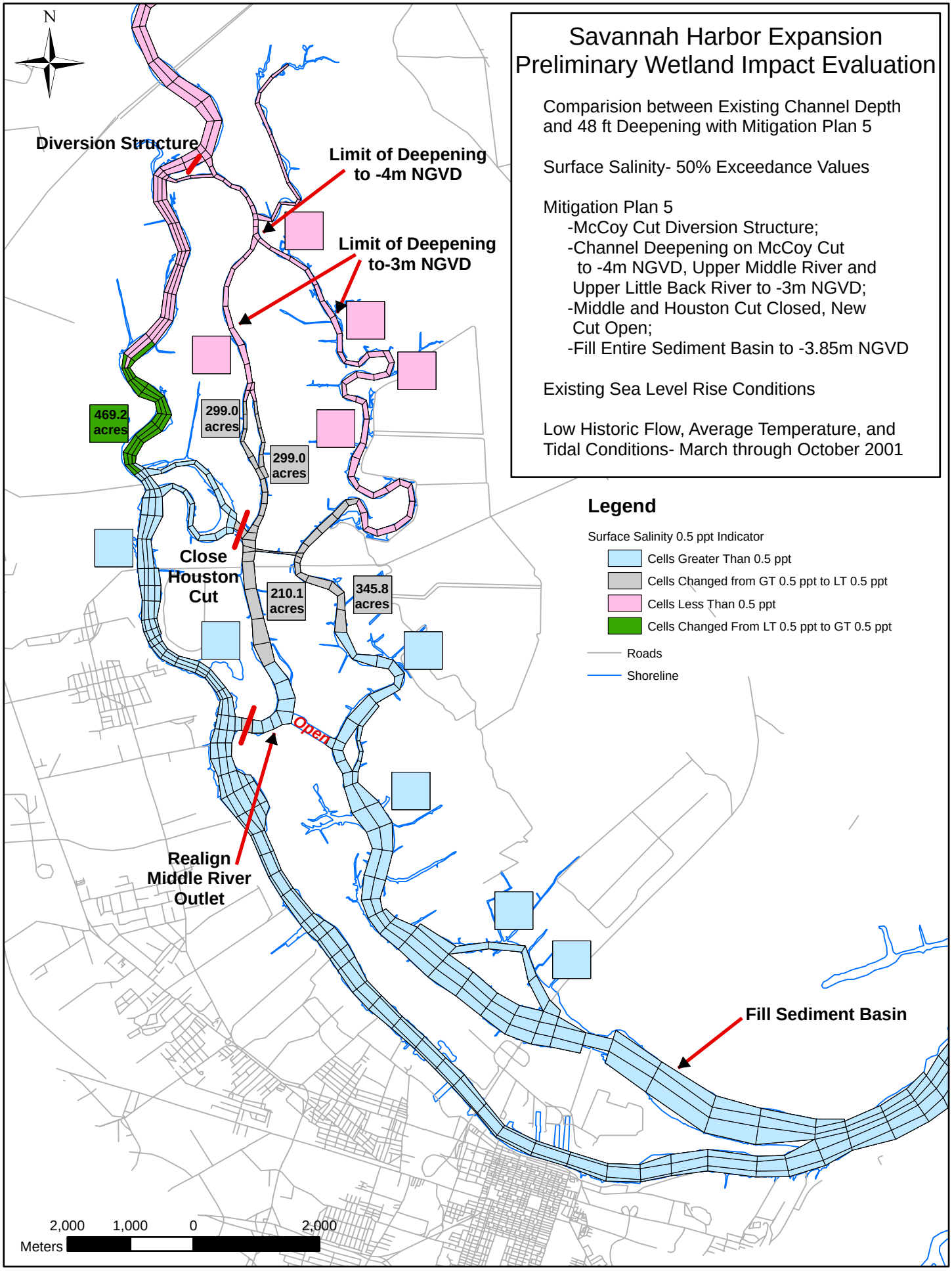

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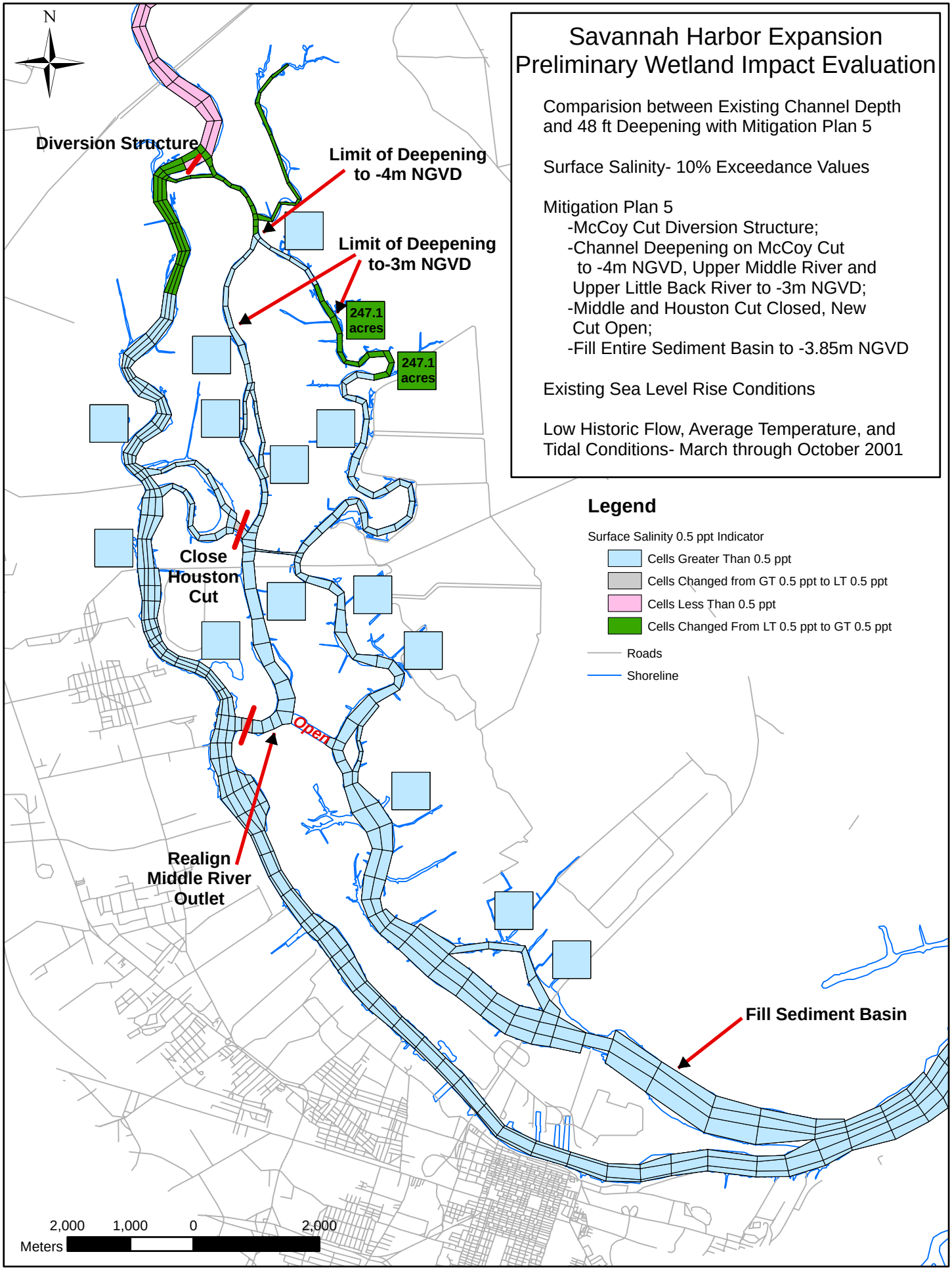


Savannah Harbor Expansion
Preliminary Wetland Impact Evaluation

Comparision between Existing Channel Depth and 48 ft Deepening with Mitigation Plan 5

Surface Salinity- 10% Exceedance Values

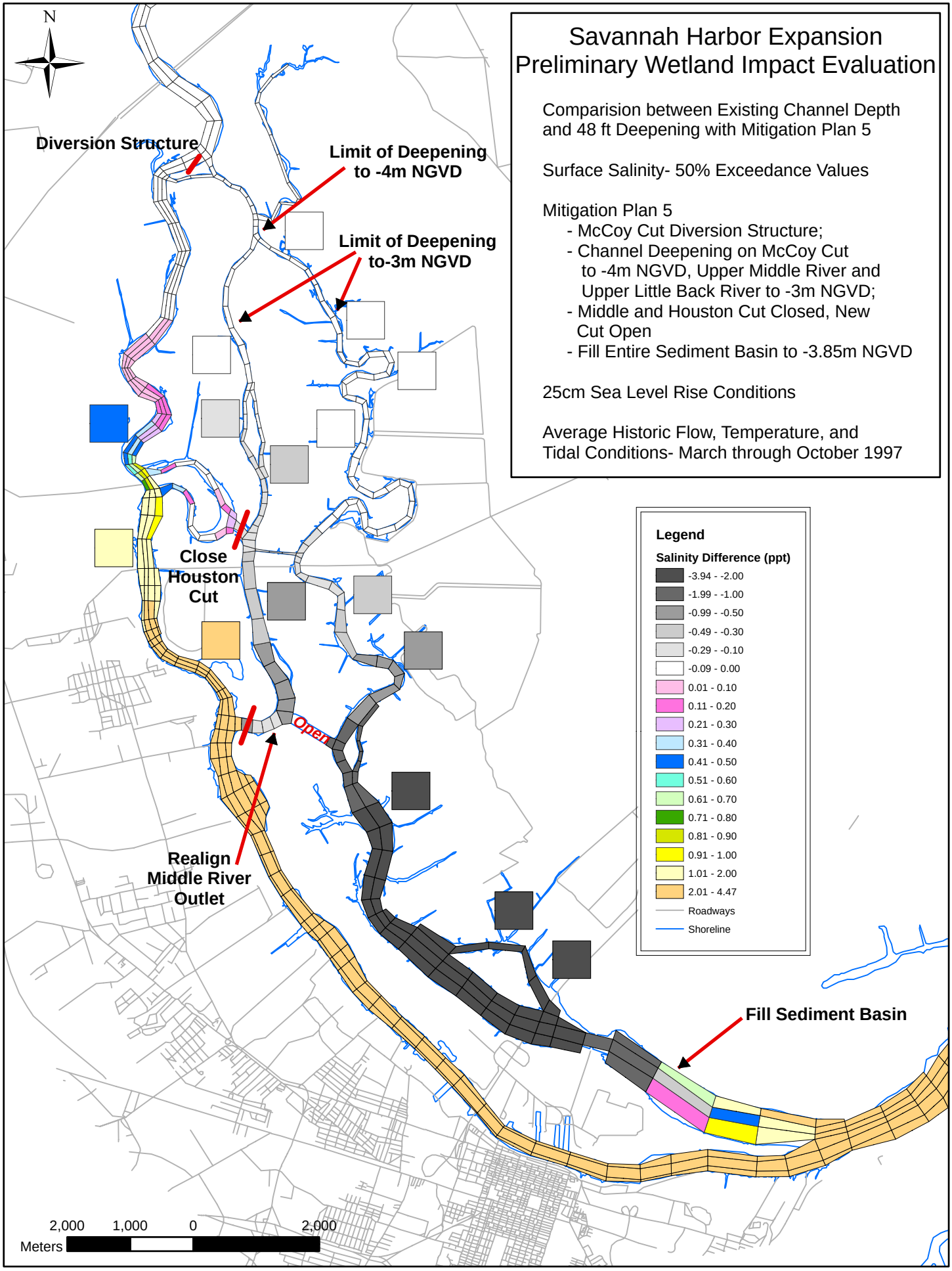
Mitigation Plan 5
- -McCoy Cut Diversion Structure;
- -Channel Deepening on McCoy Cut to -4m NGVD, Upper Middle River and Upper Little Back River to -3m NGVD;
- -Middle and Houston Cut Closed, New Cut Open;
- -Fill Entire Sediment Basin to -3.85m NGVD

Existing Sea Level Rise Conditions

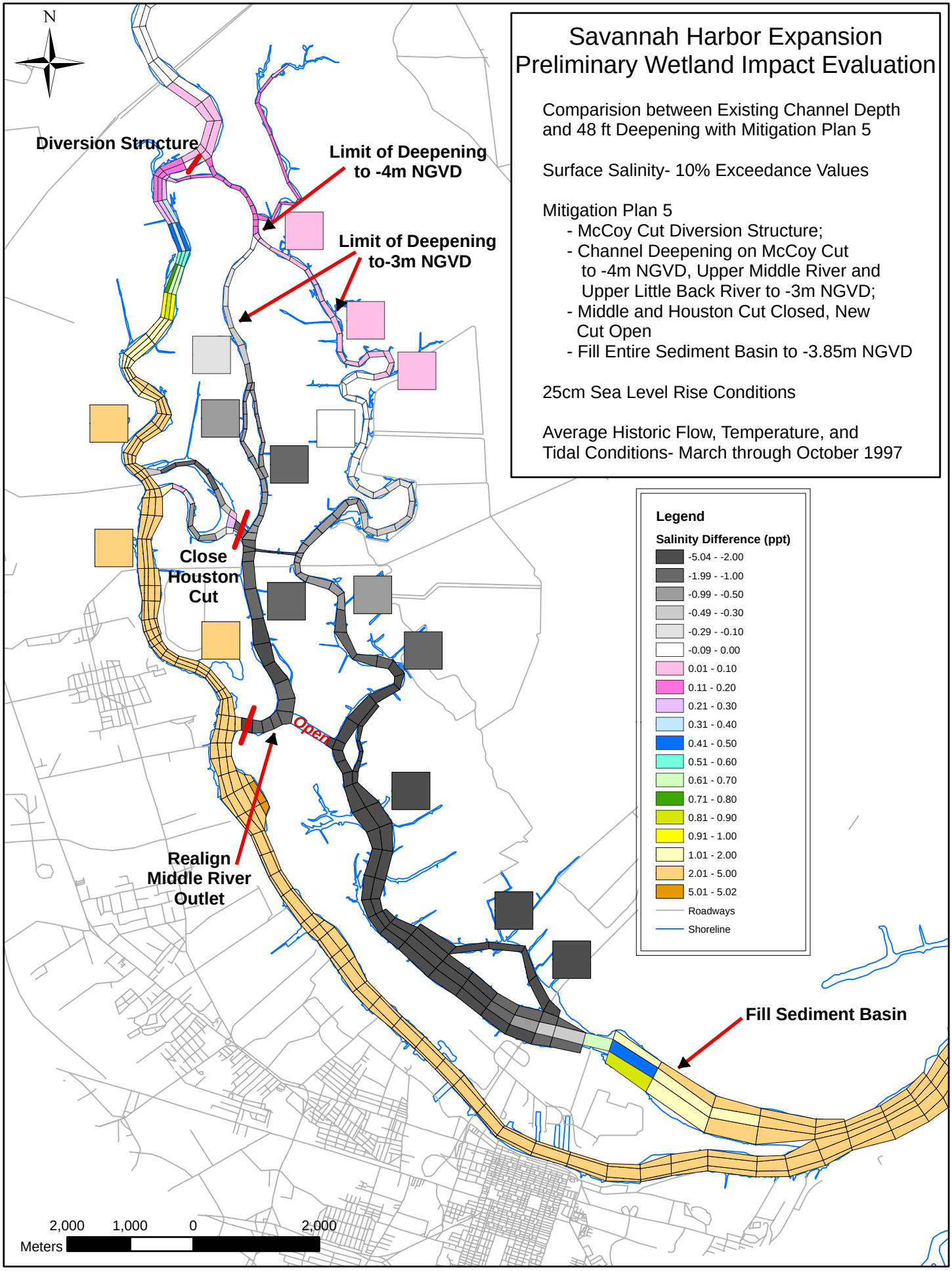
Low Historic Flow, Average Temperature, and Tidal Conditions- March through October 2001

January 2007

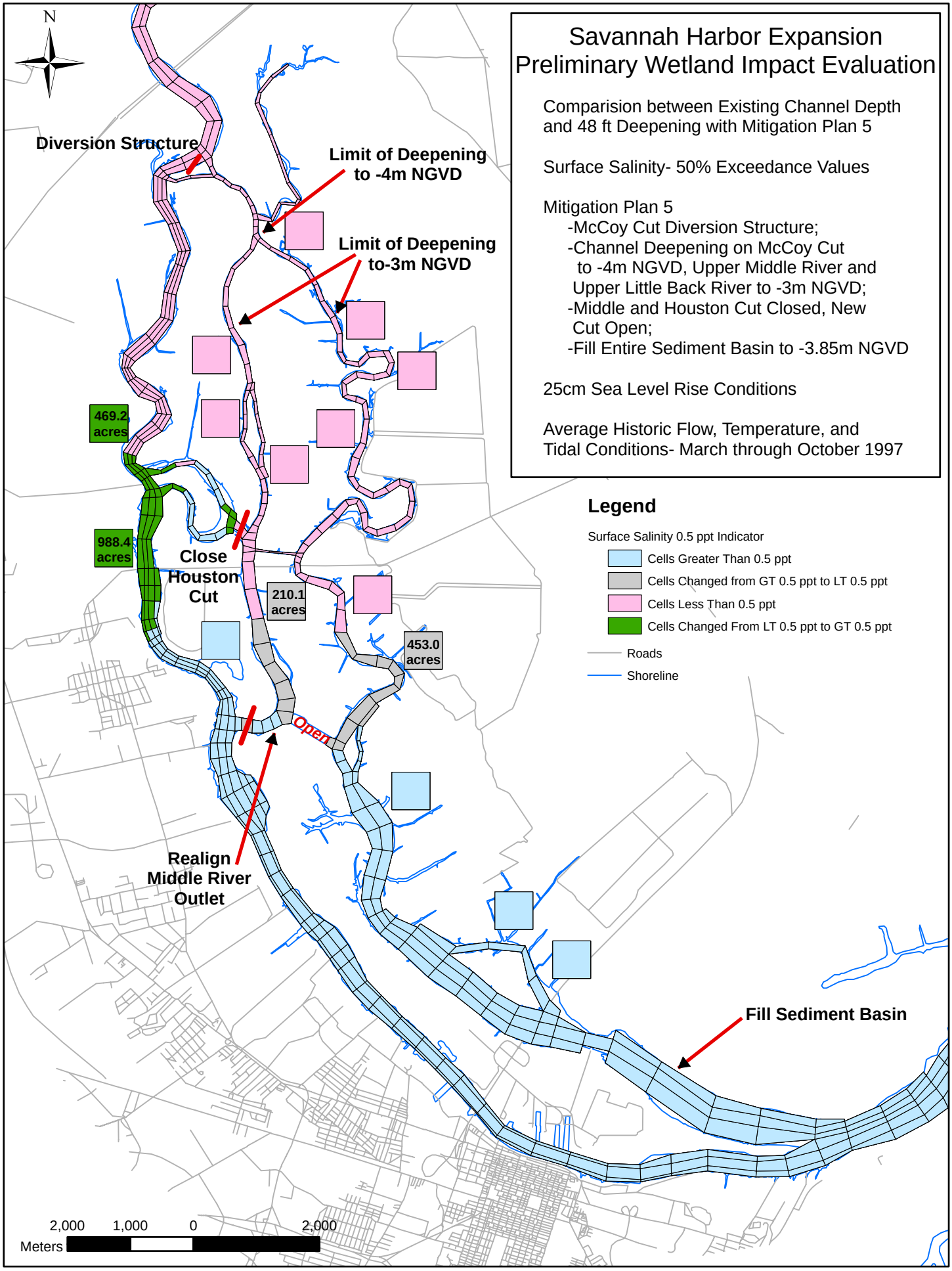
Sensitivity Analysis #2A



January 2007



January 2007



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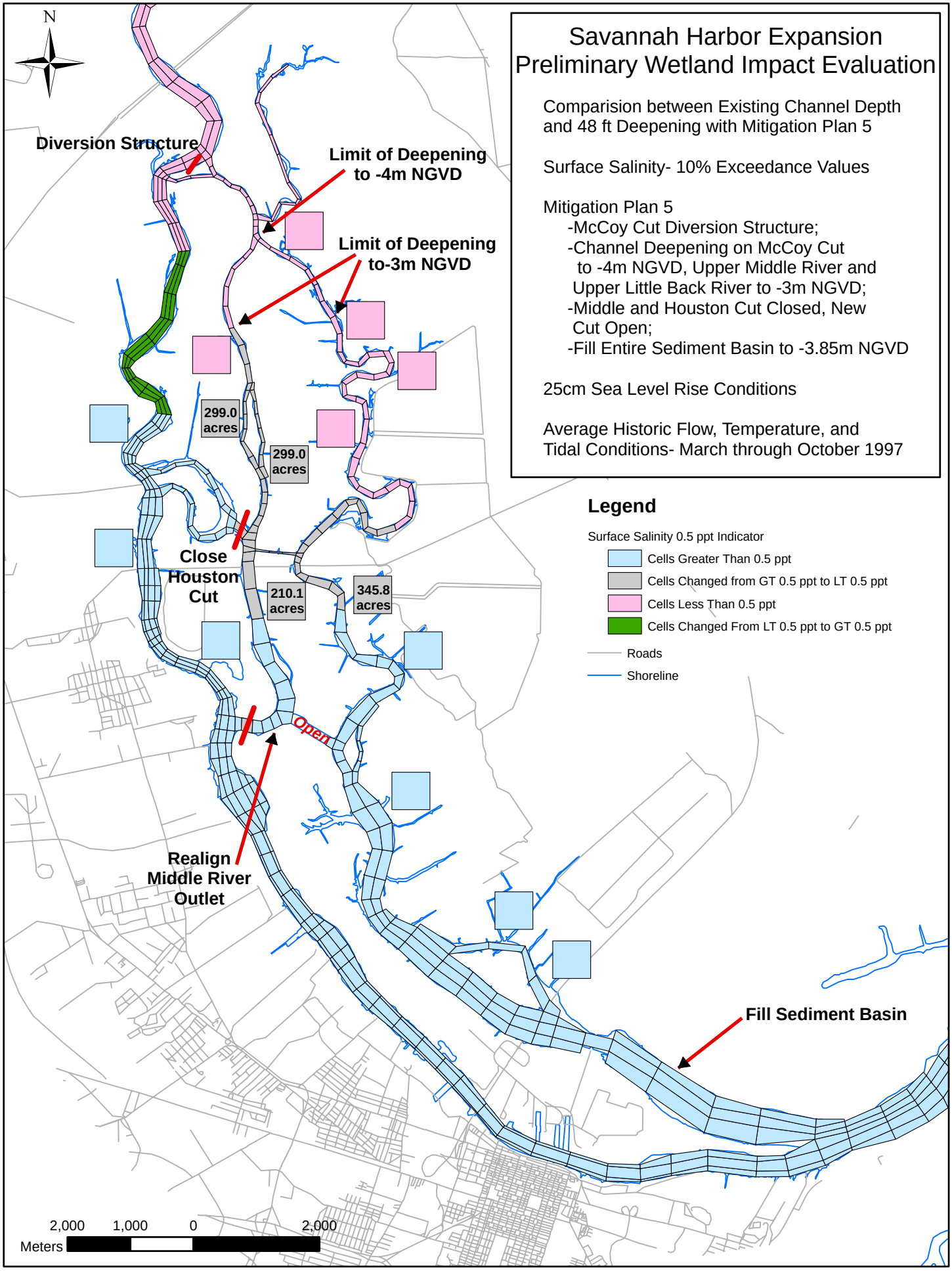
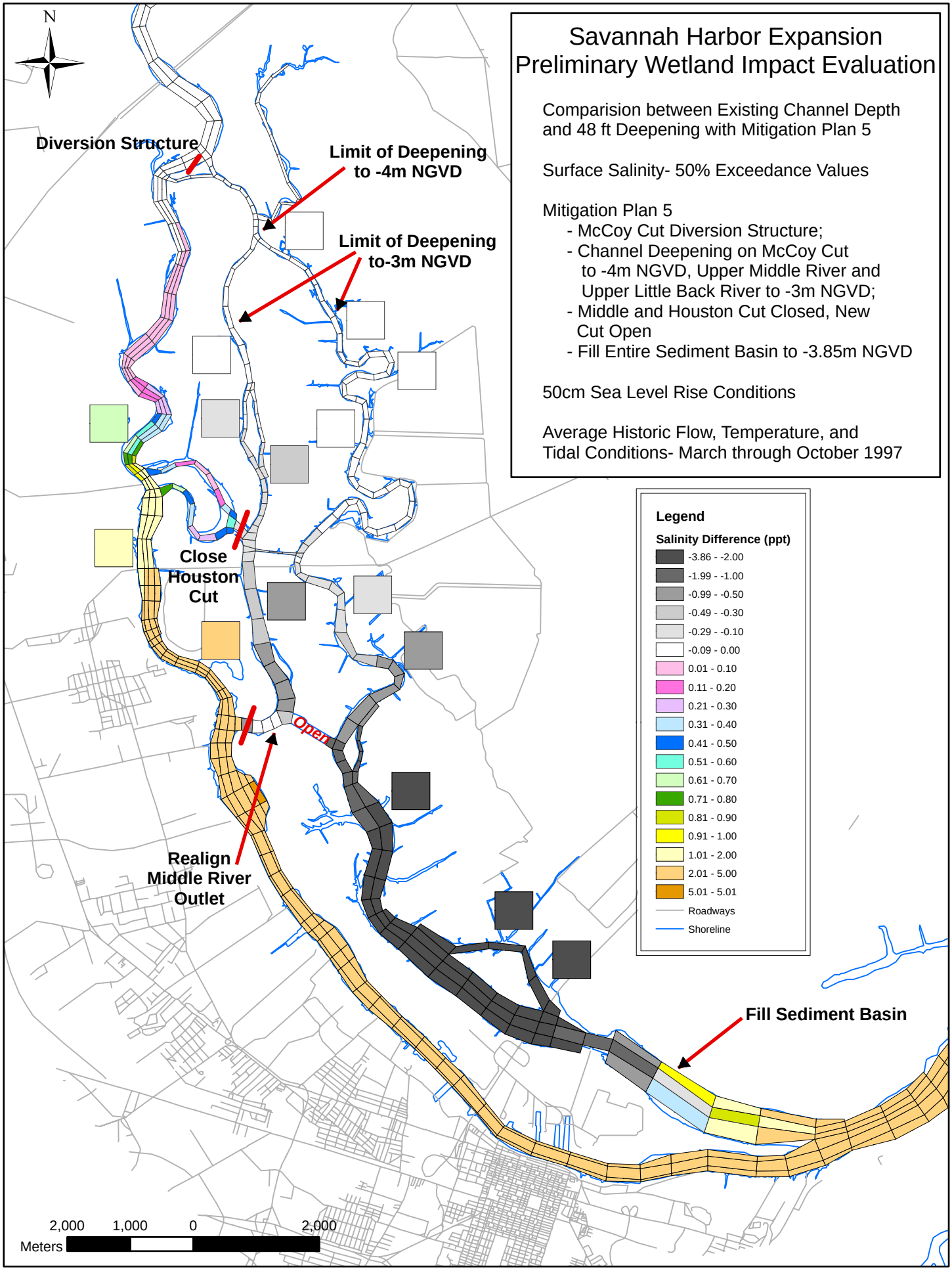
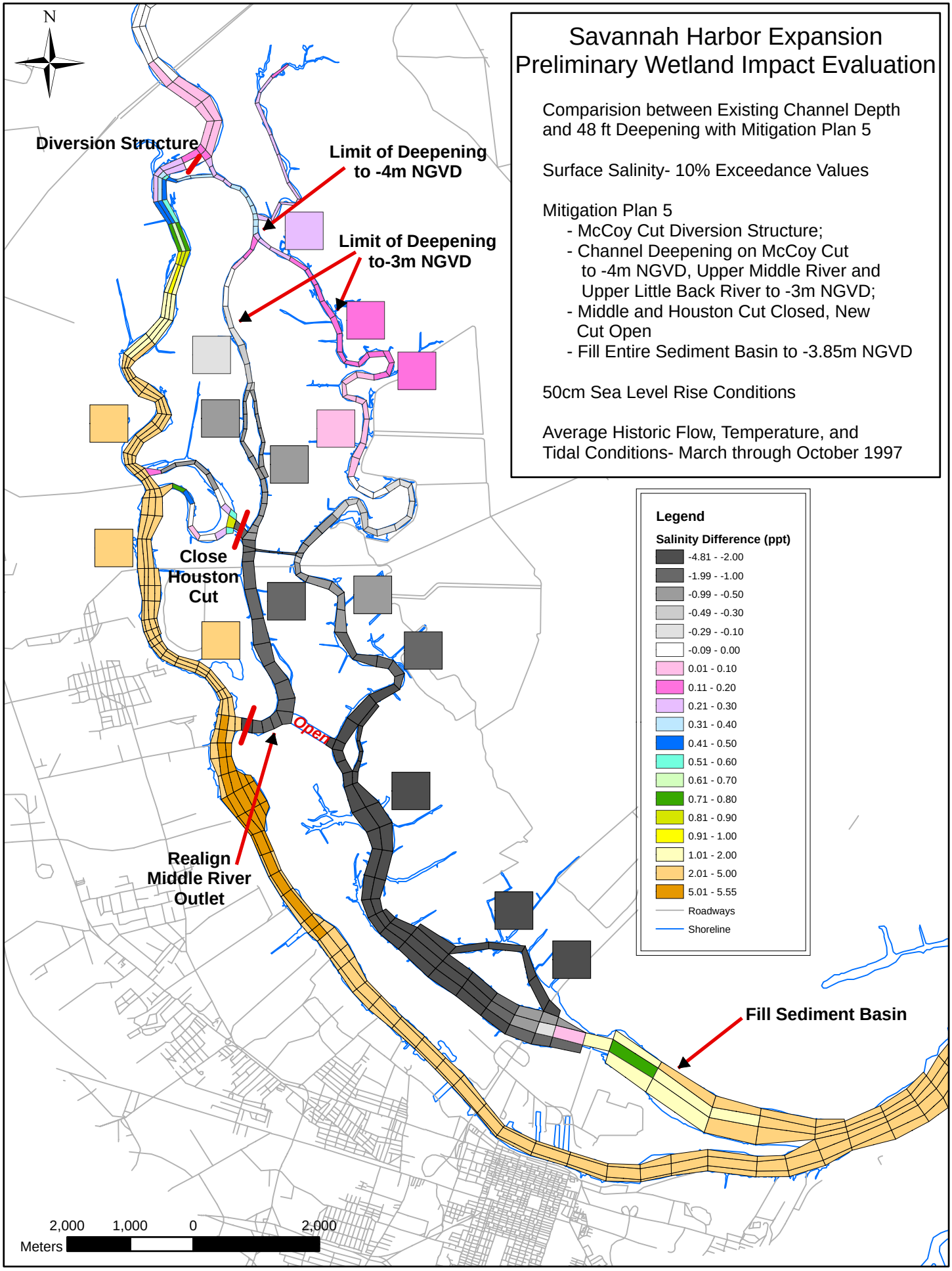


January 2007

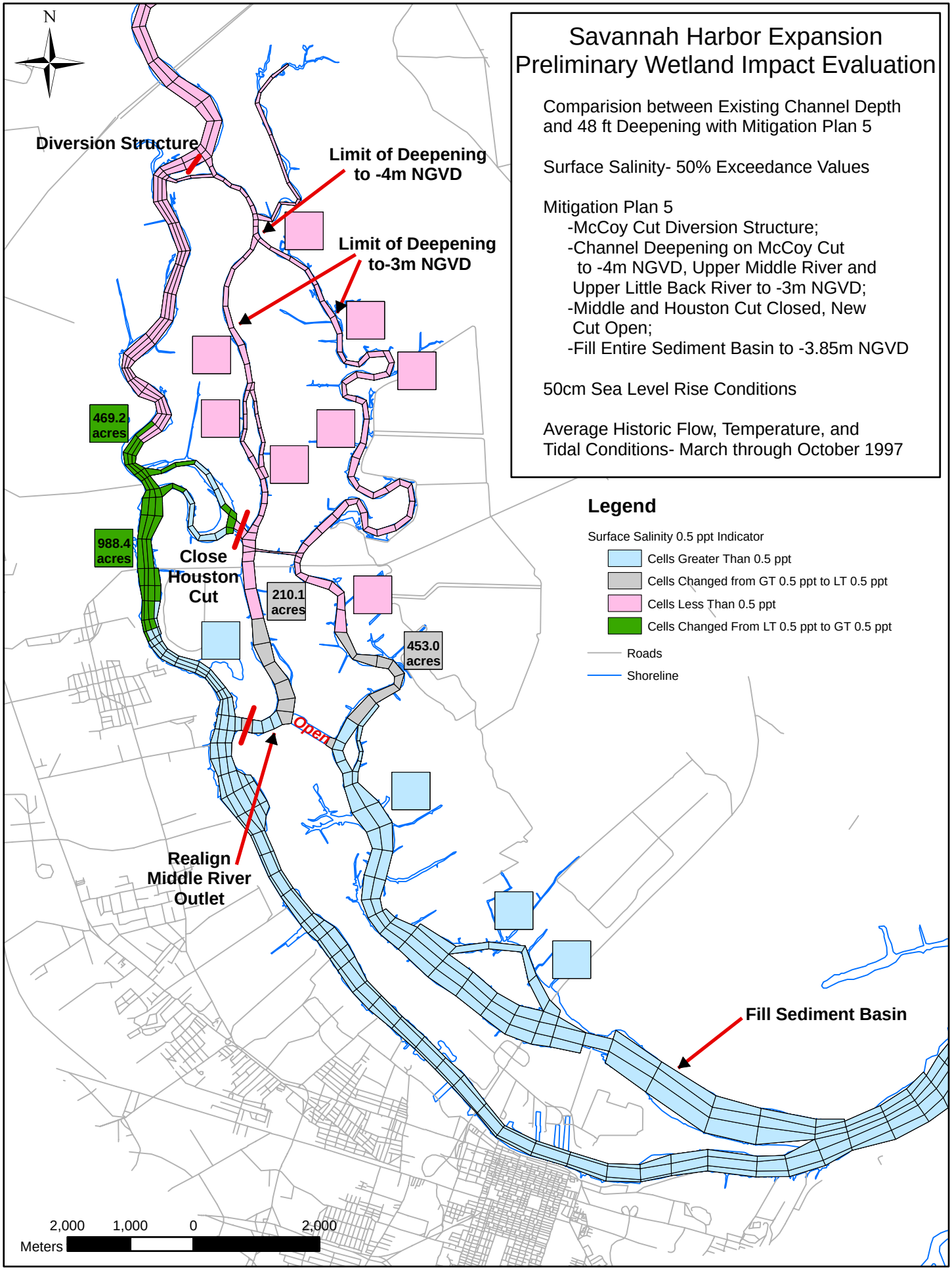
Sensitivity Analysis #2B



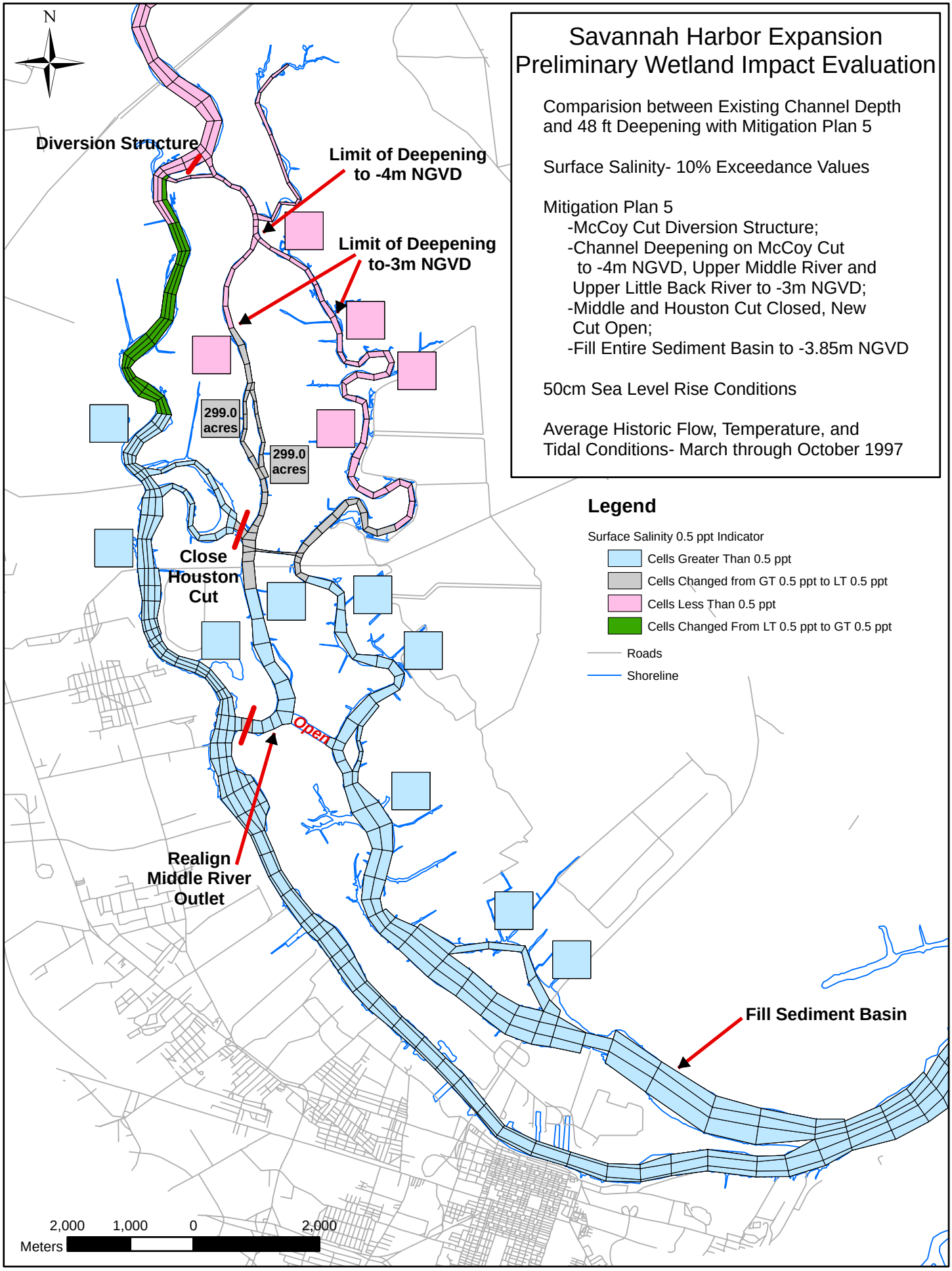
January 2007



January 2007



January 2007



January 2007

Savannah Harbor Expansion Project

Evaluation of Marsh/Wetland Impacts with Additional Mitigation Plans

August 2007

Introduction

This report summarizes the results of marsh impacts with implementation of mitigation alternatives and navigation channel deepening. Five additional mitigation alternatives are presented and have been evaluated under three possible navigation channel depths (48 ft, 46 ft, and 45 ft).

Each of the mitigation plans were evaluated using the 3D hydrodynamic model EFDC. The run period for each plan is March through October 1997. This time period is representative of average historic flow, temperature, and tidal conditions. The effects of sea level rise have *NOT* been evaluated in this report. The parameter evaluated is the 50 % exceedance surface salinity value throughout the model grid. The run period and parameters were specified by the Interagency Coordination Team.

Plan Description

Five additional mitigation plans were modeled to determine their effectiveness in reducing salinity impacts to freshwater marsh due to deepening the navigation channel. Mitigation Plans 1-5 were evaluated prior to the plans presented here. Evaluation of Plans 1-5 determined that Plan 3 showed the most potential at reducing impacts from harbor deepening. The additional mitigation plans presented here use Plan 3 as a basis for evaluation. Below is a brief description of Plan 3 and each of the five additional plans presented in this report. Also, on the following page is a graphic showing the features associated with each of the mitigation plans.

Plan 3 - *McCoys Cut Diversion Structure* - *Channel Deepening on McCoys, Upper Middle and Little Back River* - *Fill Entire Sediment Basin* - *Close Rifle Cut*	**Plan 3c** - *McCoys Cut Diversion Structure* - *Fill Entire Sediment Basin* - *Close Rifle Cut* - *Close Lower (western) Arm at McCoys Cut*
Plan 3a - *McCoys Cut Diversion Structure* - *Channel Deepening on McCoys, Upper Middle and Little Back River* - *Fill Entire Sediment Basin* - *Close Rifle Cut* - *Close Lower (western) Arm at McCoys Cut*	**Plan 6** - *McCoys Cut Diversion Structure* - *Channel Deepening on McCoys, Upper Middle and Little Back River* - *Fill Entire Sediment Basin* - *Close Rifle Cut* - *Remove Tidegate Abutments and Piers*
Plan 3b - *McCoys Cut Diversion Structure* - *Fill Entire Sediment Basin* - *Close Rifle Cut*	**Plan 6b** - *McCoys Cut Diversion Structure* - *Fill Entire Sediment Basin to -3.85m NGVD* - *Close Rifle Cut* - *Remove Tidegate Abutments and Piers* - *Close Lower (western) Arm at McCoys Cut*

	McCoy Cut Diversion Structure	Channel Deepening on McCoy, Upper Middle and Little Back River	Fill Entire Sediment Basin	Close Rifle Cut	Close Lower (western) Arm at McCoy Cut	Remove Tidegate Abutments and Piers	
Plan 3	x	x	x	x			Plan 3
Plan 3a	x	x	x	x	x		Plan 3a
Plan 3b	x		x	x			Plan 3b
Plan 3c	x		x	x	x		Plan 3c
Plan 6	x	x	x	x		x	Plan 6
Plan 6b	x		x	x	x	x	Plan 6b

Output Presented

There are three types of maps presented in this report:

1- ***Predicted River Salinity from the Hydrodynamic Model (EFDC)-*** The EFDC model grid is shown with 50% exceedance surface salinities broken into 5 categories: 0-0.5 ppt, 0.6-1.0 ppt, 1.1-2.0 ppt, 2.1-4.0 ppt, 4.0-32.5 ppt. Modeling is based on average historic flow, temperature, and tidal conditions- March through October 1997. The effects of sea level rise have *NOT* been evaluated in this report.

2- ***Estimated Marsh Salinity Contour Lines-*** Marsh salinity contour lines are shown that break the marsh into 5 categories: 0-0.5 ppt, 0.6-1.0 ppt, 1.1-2.0 ppt, 2.1-4.0 ppt, > 4.0 ppt. The first category 0-0.5 ppt represents freshwater marsh. The contour lines were extrapolated into the marsh from the riverine hydrodynamic model results shown in the maps described above *1- Predicted River Salinity from the Hydrodynamic Model*.

   Because of the subjectivity of developing the contour lines for this set of maps, two measures were taken to ensure the results are valid. First, all of the maps were developed by the same person to eliminate bias due to the possibility of different perspectives. Second, verification was done to determine a level of confidence in comparing the results. The verification was done by testing the repeatability of drawing the contour line for the freshwater zone (0-0.5 ppt) for three randomly selected maps. For the repeatability test, first the same person redrew the freshwater zone. Second a different person redrew the freshwater zone. Both of these tests produced acreages with less than a 2% difference from the original acreages. From this test, the results are considered valid within +/- 50 acres.

3- ***Surface Salinity Difference Maps-*** Maps show the change in riverine salinity at each EFDC grid cell between the existing condition and each mitigation plan. Salinity values are predicted using the hydrodynamic model (EFDC). The grid cells are color coded to show the salinity differences. The grey shading is used to show cells that have lower salinity values than the existing condition (i.e. deepening impacts have been reduced to 0, and, in fact, show improvement over the existing condition).

Results

Results from the modeling are presented in the following two tables. The two tables show estimated marsh salinity impacts based on the mapping described in 2-***Estimated Marsh Salinity Contour Lines*** above. The contour line verification described in the previous section suggests the acreages are valid within +/- 50 acres.

Table 1- *Estimated Marsh Salinity Impacts- Plans 3, 3a, 3b and 3c*

48 ft Depth

Estimated Marsh Salinity	Existing (*acres*)	Deepened Only --No Mitigation— (*acres*)	Plan 3 (*acres*)	Plan 3a (*acres*)	Plan 3b (*acres*)	Plan 3c (*acres*)
0.0 – 0.5	4072	2860	3584	3531	3406	3383
0.6 – 1.0	864	830	766	949	871	784
1.1 – 2.0	555	1215	1587	1489	1221	1368
2.1 – 4.0	834	739	682	673	938	892
> 4	2506	3188	2213	2190	2396	2405

46 ft Depth

Estimated Marsh Salinity	Existing (*acres*)	Deepened Only --No Mitigation— (*acres*)	Plan 3 (*acres*)	Plan 3a (*acres*)	Plan 3b (*acres*)	Plan 3c (*acres*)
0.0 – 0.5	4072	3015	3753	3840	3521	3599
0.6 – 1.0	864	1050	1298	1535	1195	1070
1.1 – 2.0	555	921	991	892	952	1066
2.1 – 4.0	834	789	616	774	860	762
> 4	2506	3057	2174	1790	2304	2335

45 ft Depth

Estimated Marsh Salinity	Existing (*acres*)	Deepened Only --No Mitigation— (*acres*)	Plan 3 (*acres*)	Plan 3a (*acres*)	Plan 3b (*acres*)	Plan 3c (*acres*)
0.0 – 0.5	4072	3105	3718	3798	3572	3626
0.6 – 1.0	864	1319	1827	1733	1368	1347
1.1 – 2.0	555	630	732	726	816	783
2.1 – 4.0	834	906	763	780	855	856
> 4	2506	2873	1792	1794	2221	2219

Table 2- *Estimated Marsh Salinity Impacts- Plans 3, 6 and 6b*

48 ft Depth

Estimated Marsh Salinity	Existing (*acres*)	Deepened Only --No Mitigation— (*acres*)	Plan 3 (*acres*)	Plan 6 (*acres*)	Plan 6b (*acres*)
0.0 – 0.5	4072	2860	3584	3715	3610
0.6 – 1.0	864	830	766	1419	885
1.1 – 2.0	555	1215	1587	1141	1384
2.1 – 4.0	834	739	682	793	770
> 4	2506	3188	2213	1764	2183

46 ft Depth

Estimated Marsh Salinity	Existing (*acres*)	Deepened Only --No Mitigation— (*acres*)	Plan 3 (*acres*)	Plan 6 (*acres*)	Plan 6b (*acres*)
0.0 – 0.5	4072	3015	3753	3817	3610
0.6 – 1.0	864	1050	1298	1677	1512
1.1 – 2.0	555	921	991	893	891
2.1 – 4.0	834	789	616	703	642
> 4	2506	3057	2174	1743	2177

45 ft Depth

Estimated Marsh Salinity	Existing (*acres*)	Deepened Only --No Mitigation— (*acres*)	Plan 3 (*acres*)	Plan 6 (*acres*)	Plan 6b (*acres*)
0.0 – 0.5	4072	3105	3718	4038	3865
0.6 – 1.0	864	1319	1827	1835	1459
1.1 – 2.0	555	630	732	559	774
2.1 – 4.0	834	906	763	712	589
> 4	2506	2873	1792	1689	2145

Summary

In viewing and discussing the results of the mitigation plans it is important to remember the following:

1- The marsh impacts are evaluated by looking at the ***net*** acreage. This is especially important when discussing the impacts to freshwater marshes. The net acreage value is based on the conditions of the marsh after the project is in place. It does not take into consideration what the marsh salinity is under current conditions. For example, a mitigation plan may gain freshwater marsh on Back River and lose freshwater marsh on Front River. The net acreage may meet the impact criteria, but in reality, it may take some time for a marsh to convert from a brackish marsh to a freshwater marsh.

2- The model has a limited ability to evaluate specific design parameters of a true diversion structure. The diversion structure described in each of the plans was modeled by altering the Front River width just downstream of McCoys Cut. By narrowing the passage on Front River the water surface elevation at the mouth of McCoys Cut was increased. The rise in elevation encourages more water to go down McCoys Cut. EFDC does not have options for inserting a defined diversion structure but narrowing the River channel in this area is essentially what a diversion structure will do.

   Several different “sizes” of diversion structures were evaluated during the development of the mitigation plans by varying the widths of the narrow passage on Front River. This allowed us to vary the amount of flow diverted down McCoys Cut. The structure modeled in Mitigation Plan 3, and each of the additional plans in this report, was found to be the most effective at diverting freshwater

flows through McCoys Cut of the several different “sizes” evaluated. A future design task will be required to develop specifications for a diversion structure that performs as in the model simulation.

The evaluation of each of the mitigation plans included review of the effects the plan has on the tide range and velocities. It was concluded that each of the additional plans do not reduce the tide range significantly in Back River, Little Back River, or Middle River. Velocities for all the additional plans are close to existing conditions. However, as expected, removing the abutments and piers in Plans 6 and 6b do increase velocities in Back River and Little Back River slightly above the existing condition.

Plan 3a

The results for Plan 3a are very similar to Plan 3. Little value to reducing salinity impacts seem to be added with the additional mitigation feature of closing the lower arm at McCoys Cut, although it does provide modest gains for some depths. Despite the limited mitigation potential for freshwater marshes, this feature does have the potential to provide fish habitat benefits and should be evaluated in that model framework. Another possible benefit to closing the lower arm at McCoys Cut is that it could provide a cost savings to the dredged material disposal cost for deepening McCoys Cut and the upper portions of Middle and Little Back Rivers by providing a nearby disposal area. Also,

Plan 3b

Plan 3b appears to have less benefits compared to Plan 3. Deepening the upper reaches of McCoys Cut, Middle River and Little Back River are critical in allowing more freshwater to flow down the Back River system.

Plan 3c

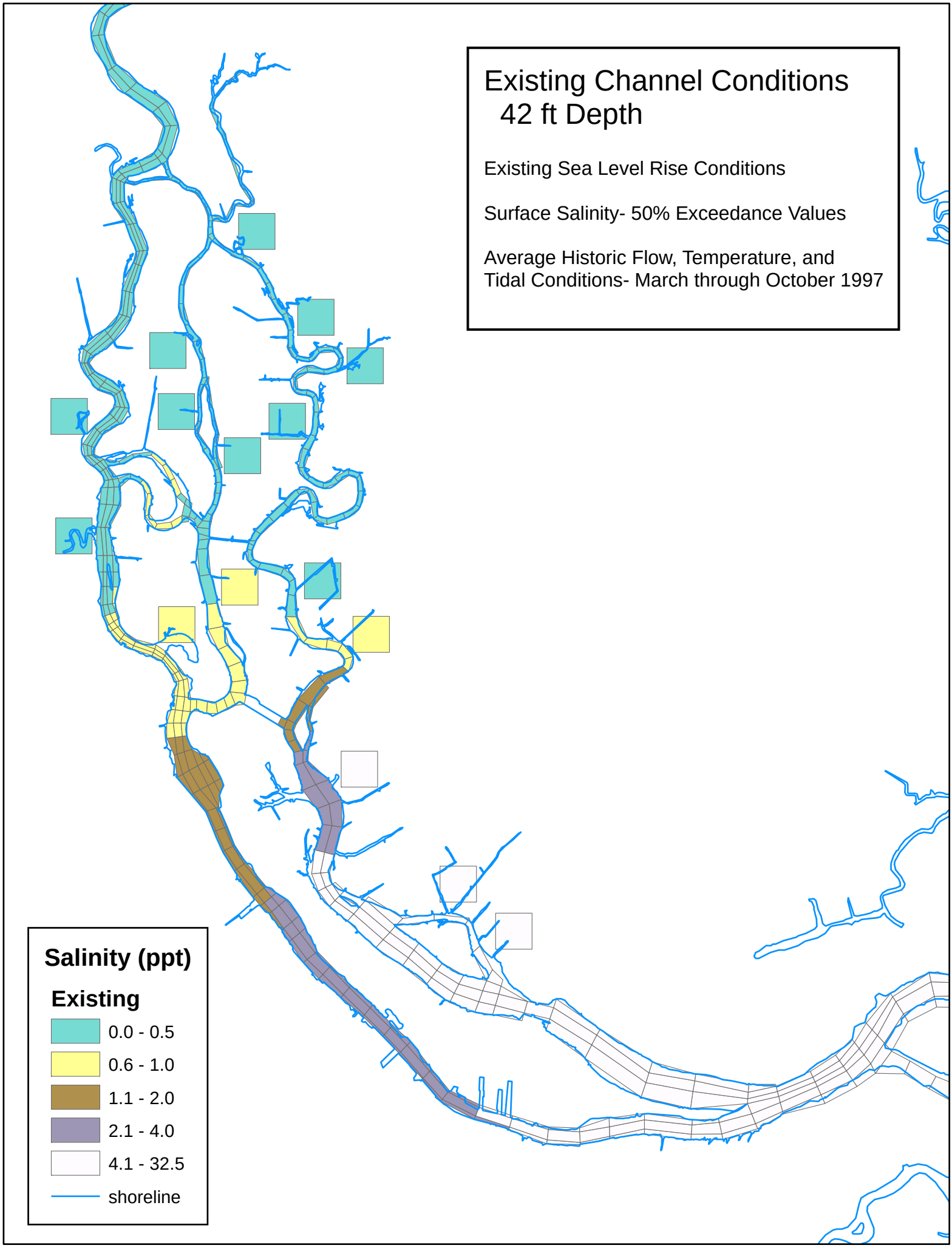
Plan 3c combines the two additional features of Plan a and b. The combination plan does not appear to have reduced salinity impacts greater than that of Plan 3 without the two additional features. These two combinations seem to add little value in reducing salinity impacts along the freshwater reaches of Front, Middle, Back and Little Back Rivers.

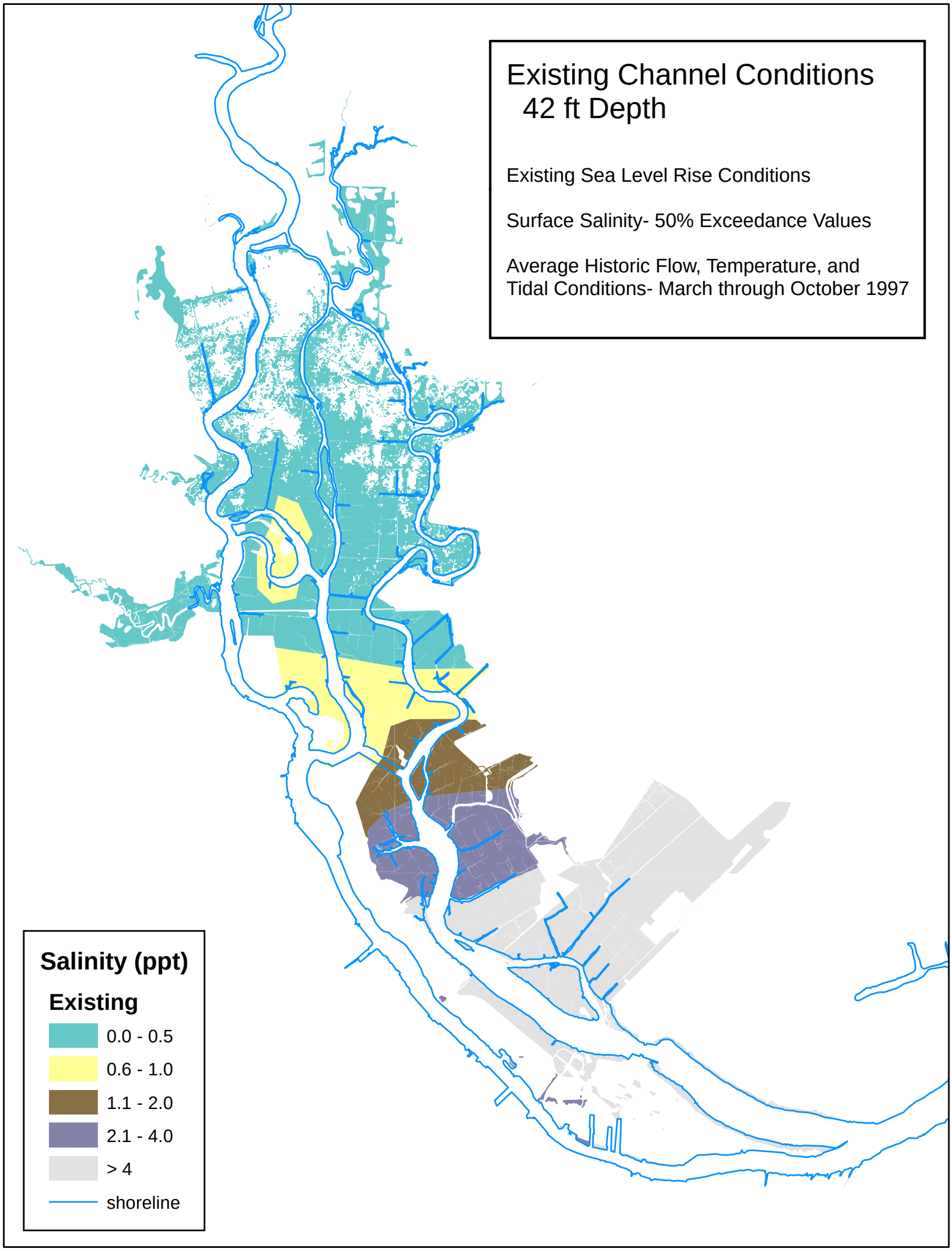
Plan 6

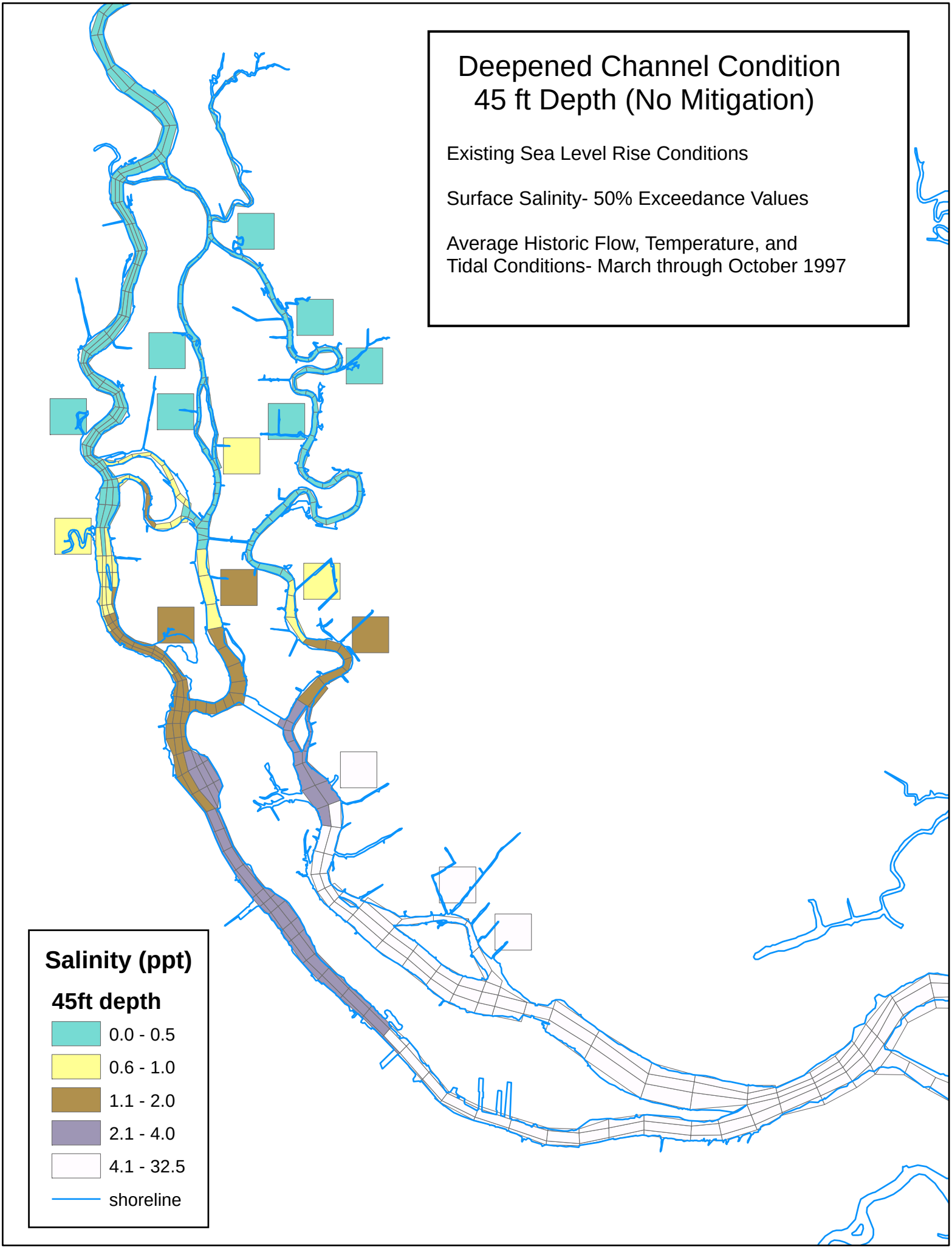
The results from Plan 6 appear to further reduce salinity impacts as compared to Plan 3. In all deepening scenarios the additional mitigation features provides more freshwater marsh area than that of Plan 3.

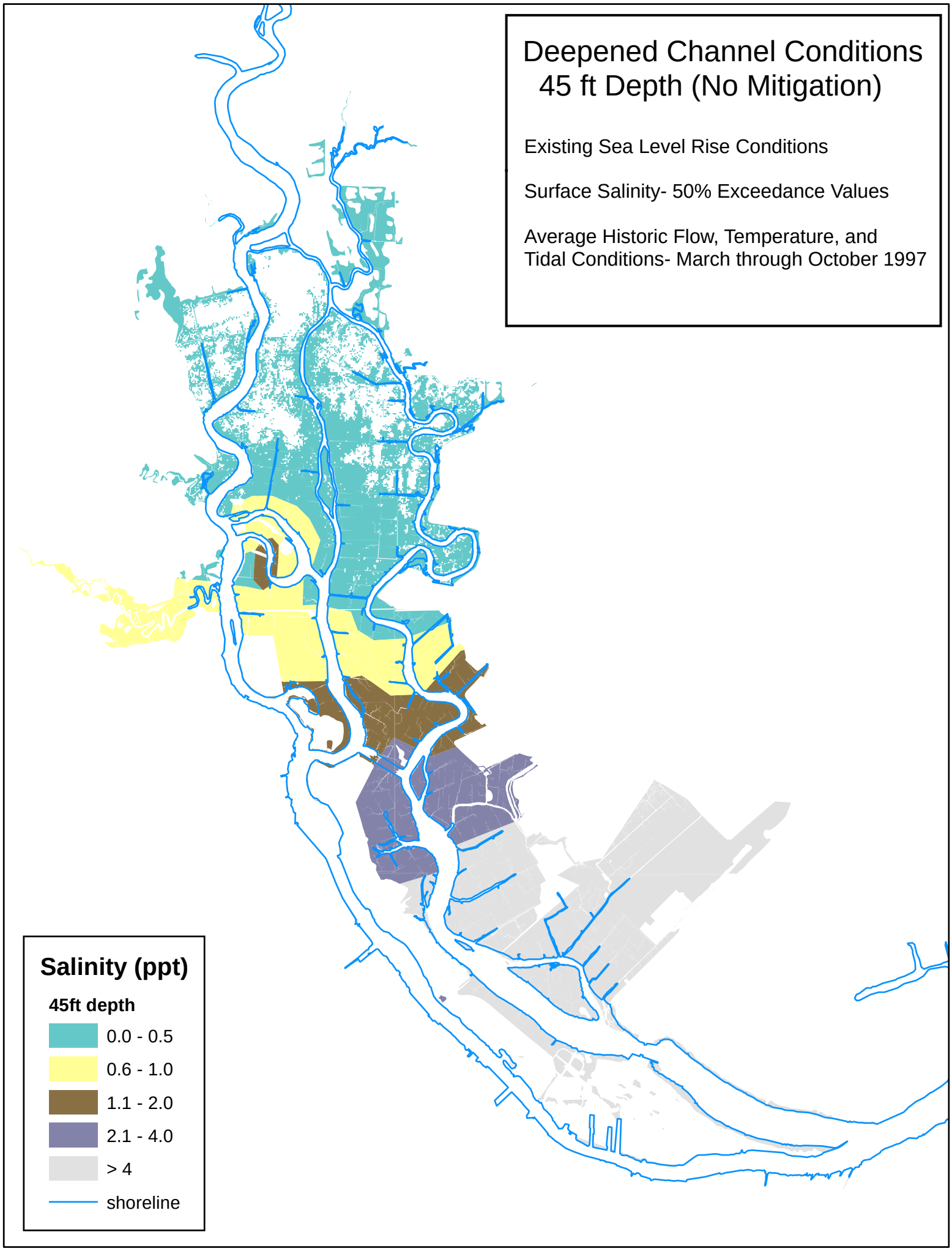
Plan 6b

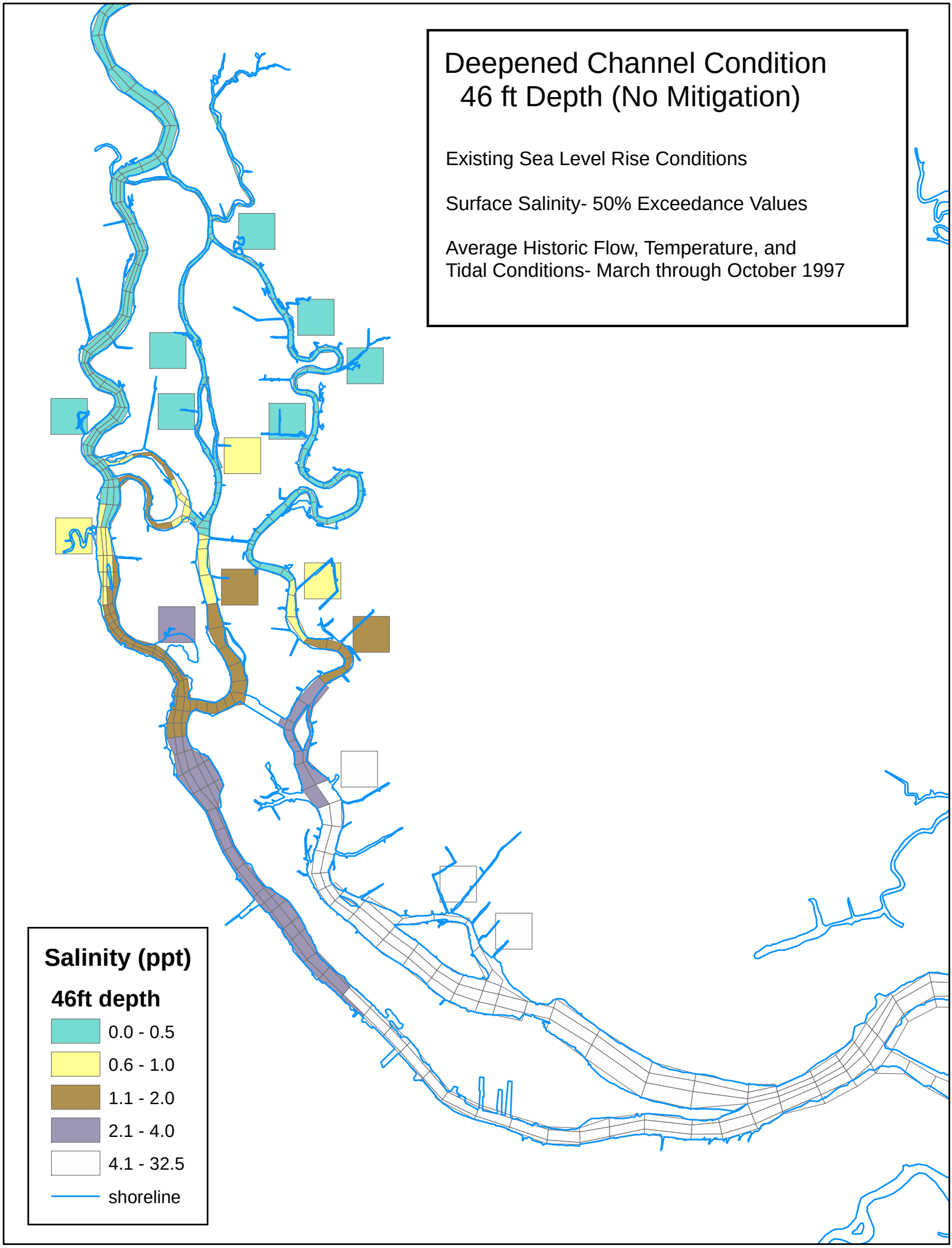
Plan 6b appears to further reduce salinity impacts on Front River over that of Plan 3. The increased flushing capacity due to opening the area at the tidegate in combination with closing the lower arm at McCoys Cut appears to combat salinity pushing further upstream due to deepening the navigation channel. Salinity impacts on Back, Little Back and Middle Rivers are similar to what they were in Plan 3.

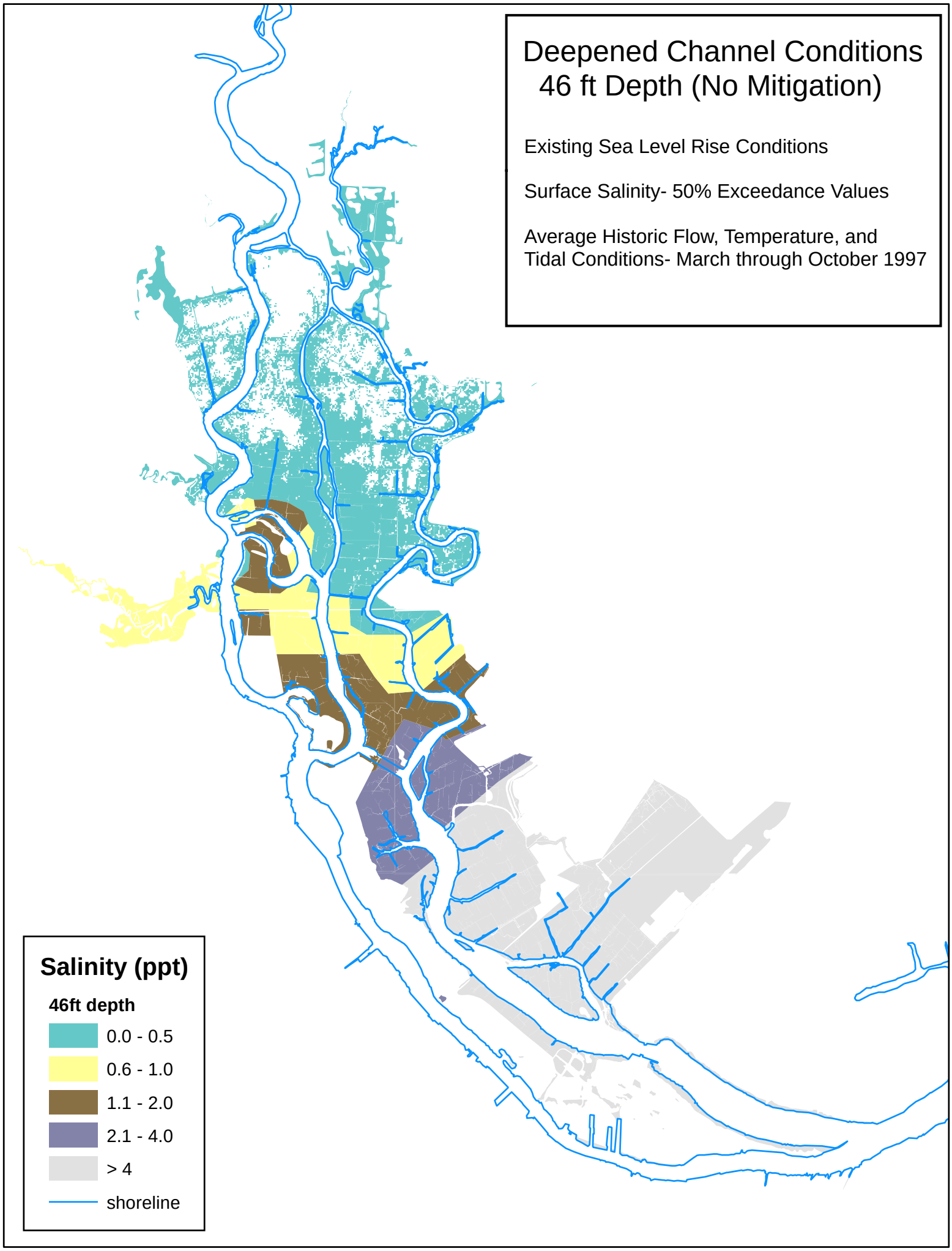

Existing Channel Conditions
42 ft Depth
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and
Tidal Conditions- March through October 1997
Salinity (ppt)
Existing
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5
shoreline

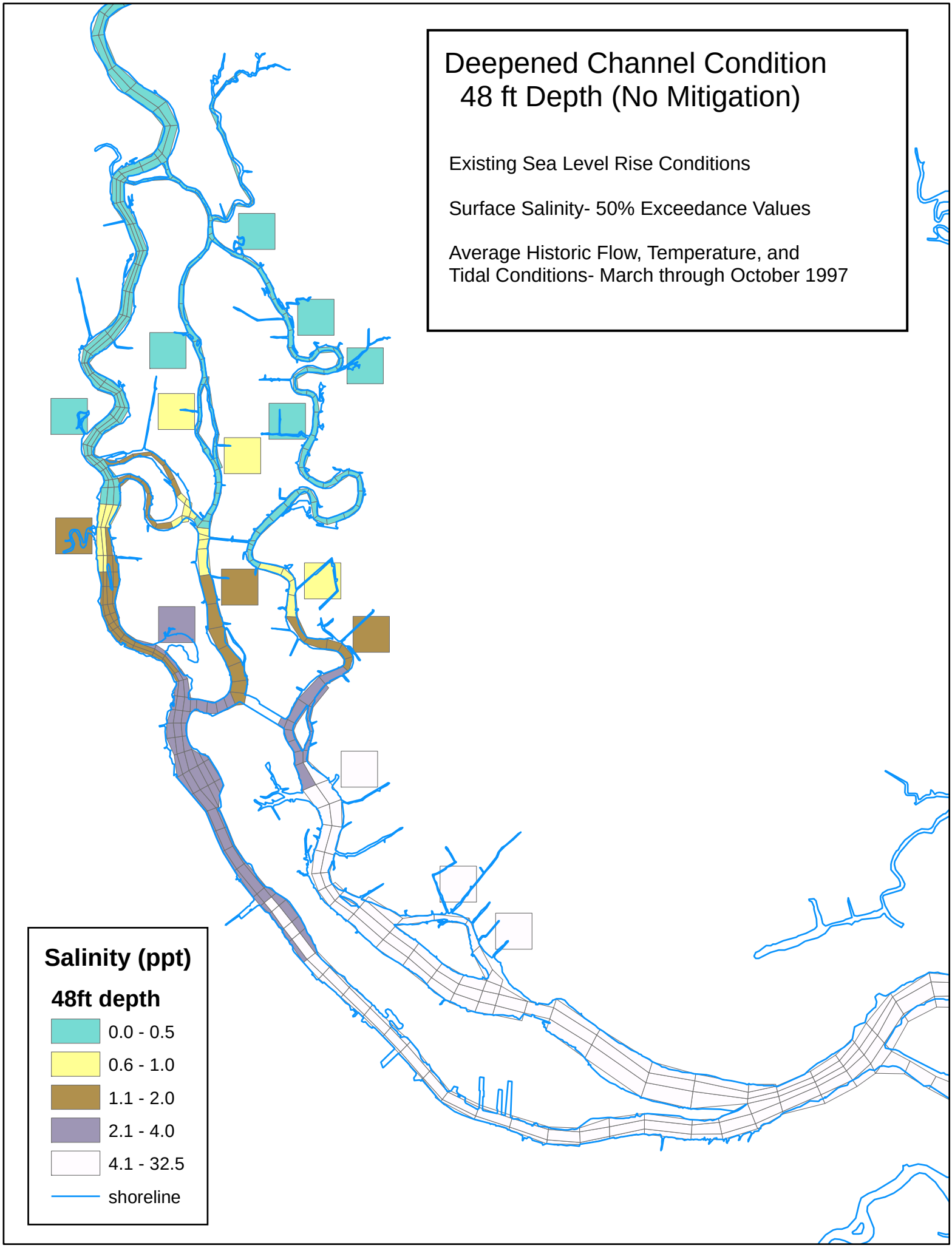

Existing Channel Conditions
42 ft Depth
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and
Tidal Conditions- March through October 1997
Salinity (ppt)
Existing
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline

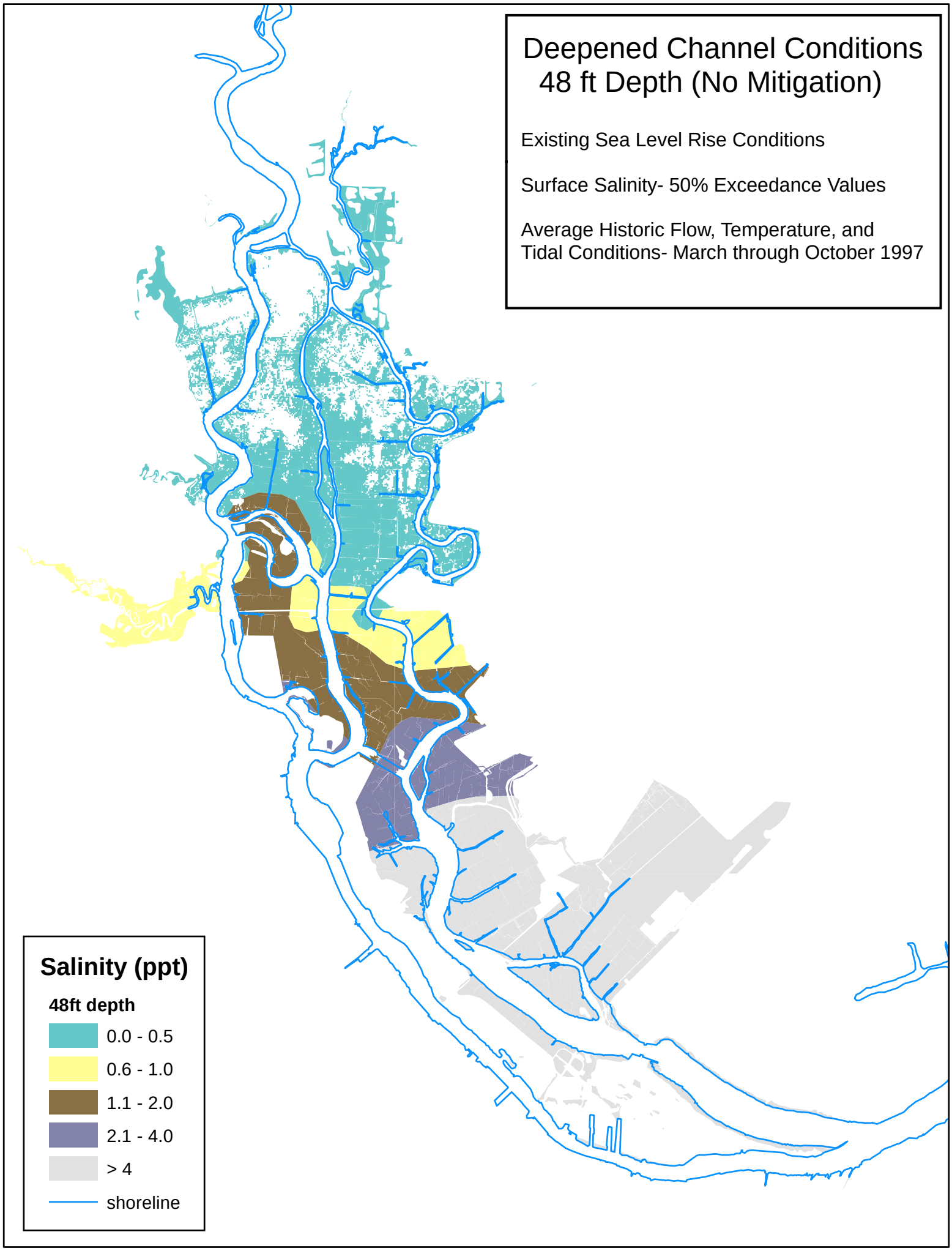

Deepened Channel Condition
45 ft Depth (No Mitigation)
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and
Tidal Conditions- March through October 1997
Salinity (ppt)
45ft depth
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5
shoreline

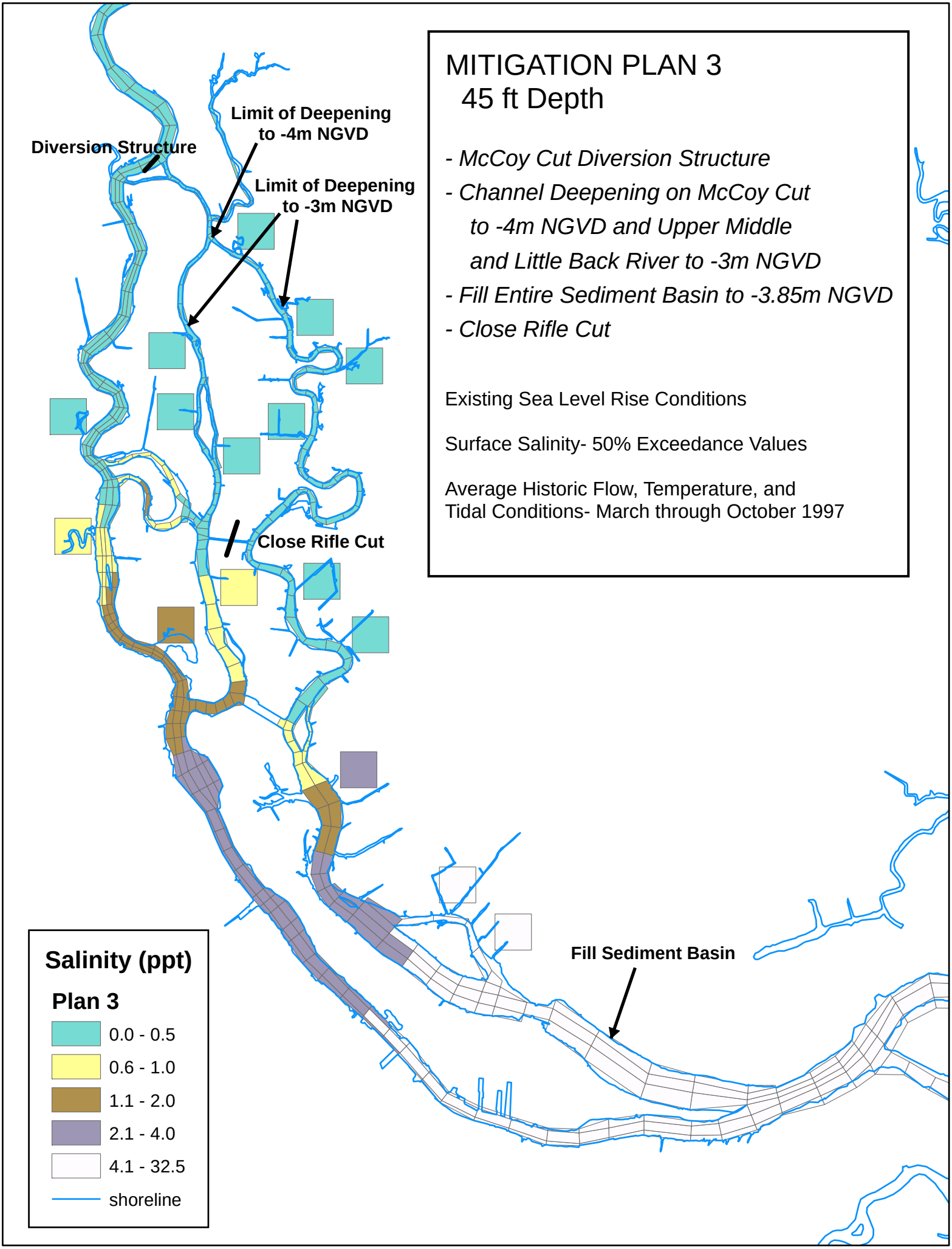

Deepened Channel Conditions
45 ft Depth (No Mitigation)
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and
Tidal Conditions- March through October 1997
Salinity (ppt)
45ft depth
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline

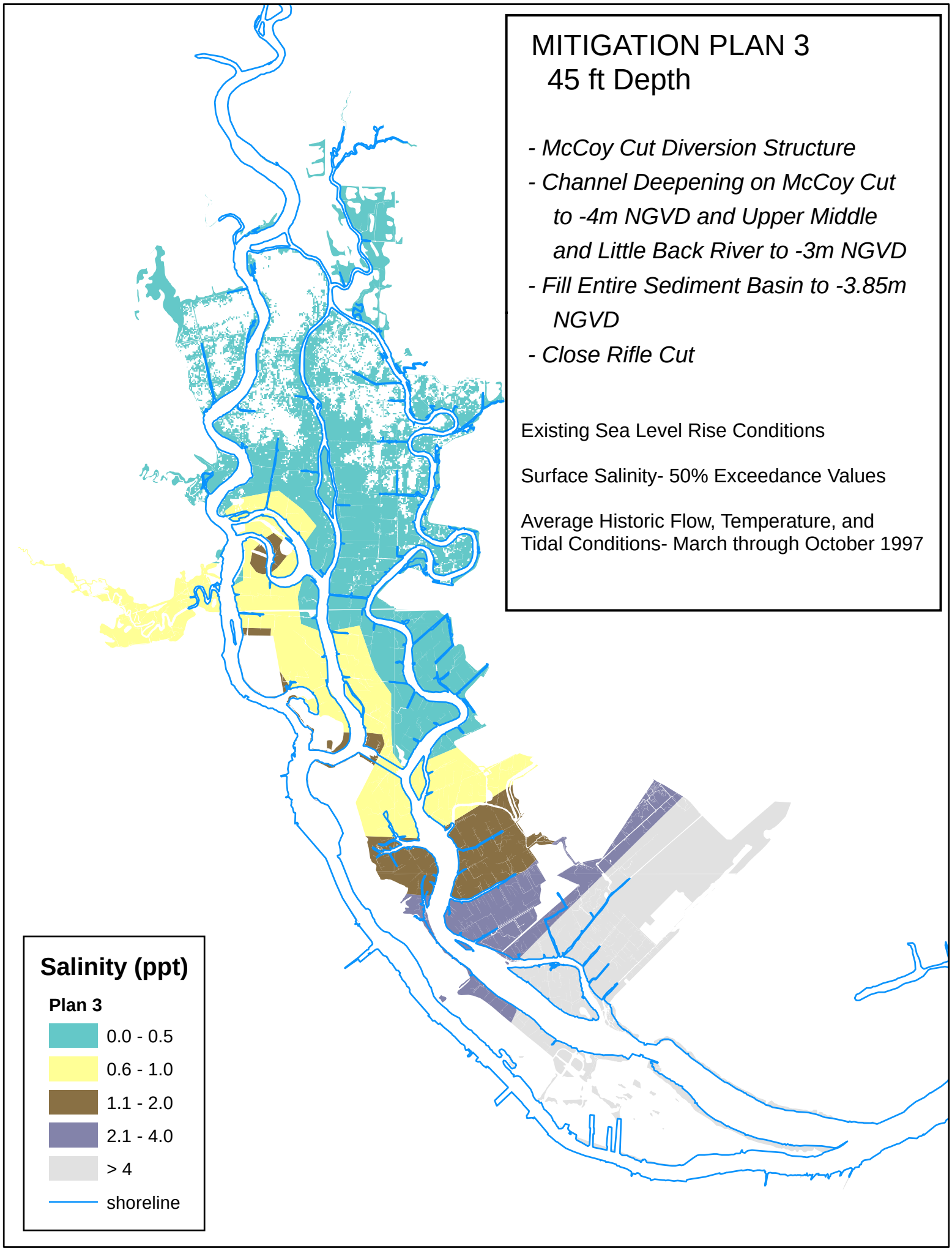

Deepened Channel Condition
46 ft Depth (No Mitigation)
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and
Tidal Conditions- March through October 1997
Salinity (ppt)
46ft depth
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5
shoreline

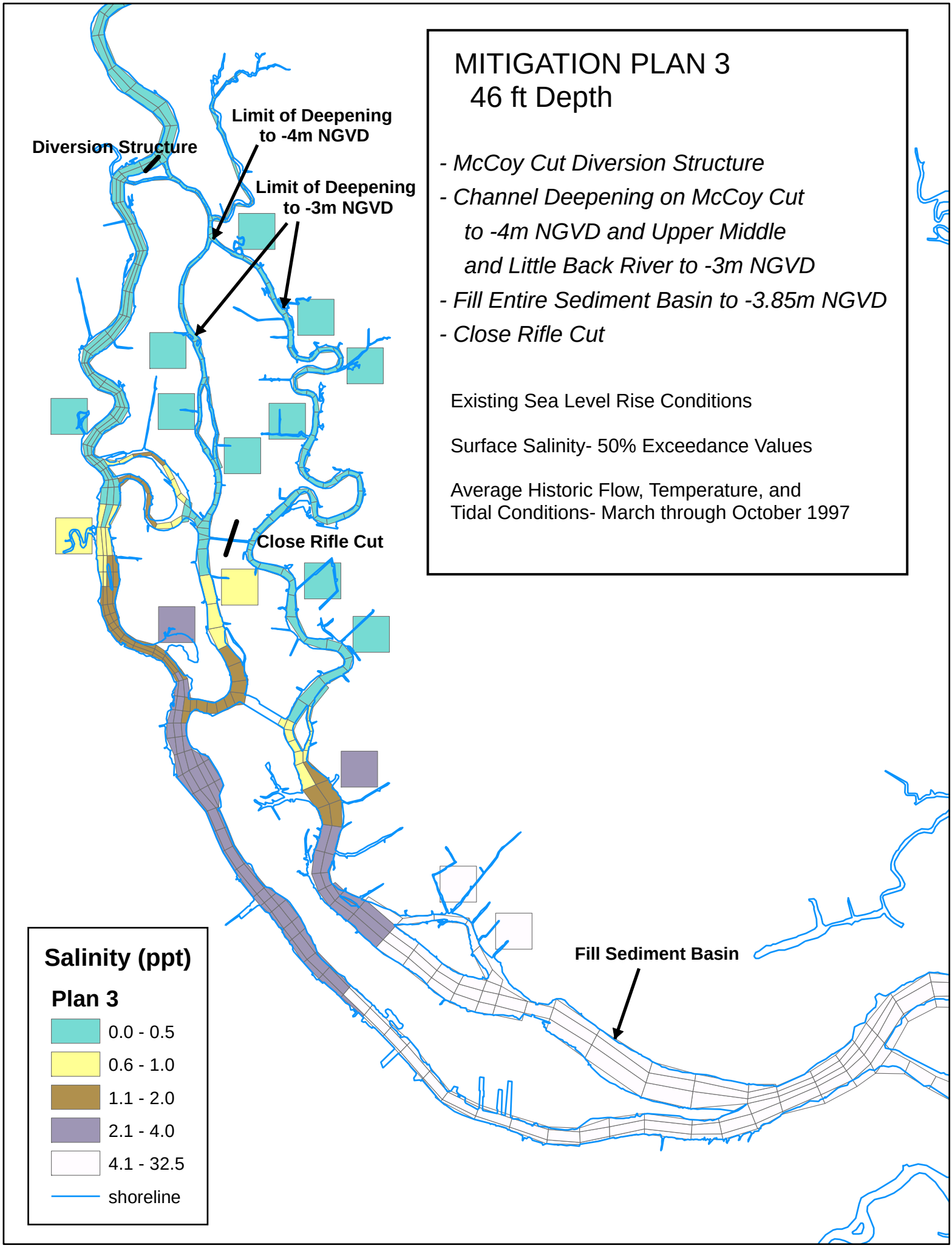

Deepened Channel Conditions
46 ft Depth (No Mitigation)
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and
Tidal Conditions- March through October 1997
Salinity (ppt)
46ft depth
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline

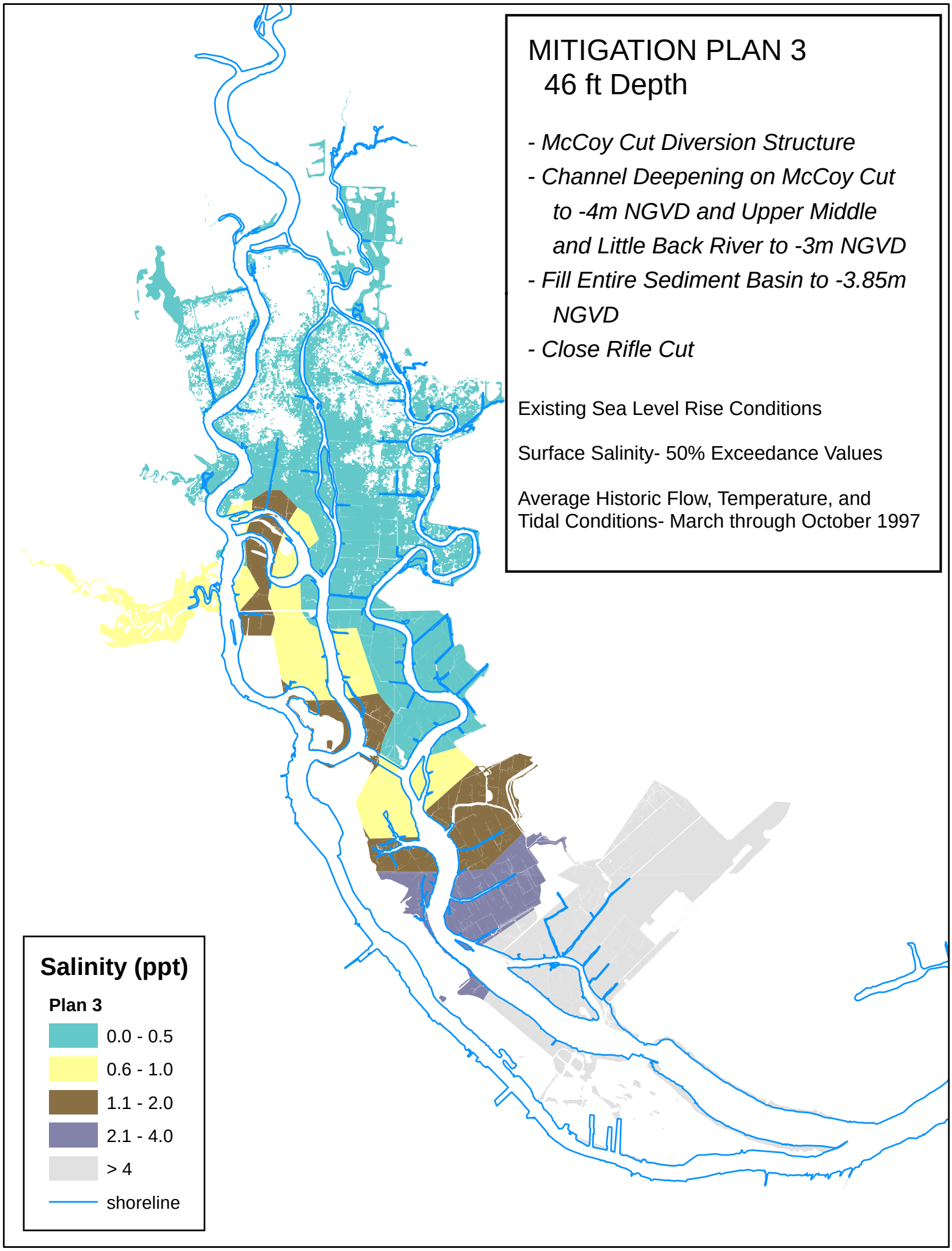

Deepened Channel Condition
48 ft Depth (No Mitigation)
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and
Tidal Conditions- March through October 1997
Salinity (ppt)
48ft depth
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5
shoreline

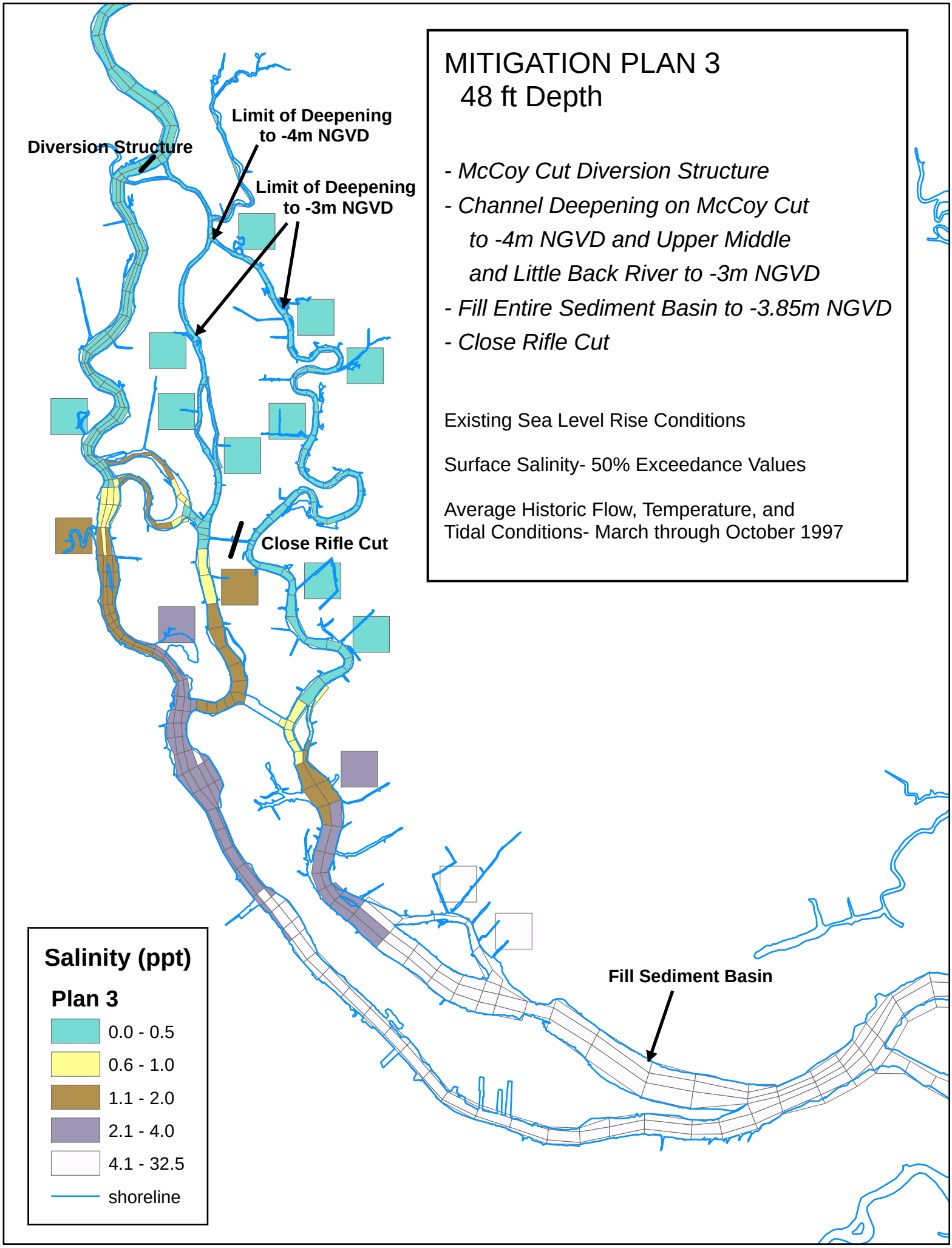

Deepened Channel Conditions
48 ft Depth (No Mitigation)
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and
Tidal Conditions- March through October 1997
Salinity (ppt)
48ft depth
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline

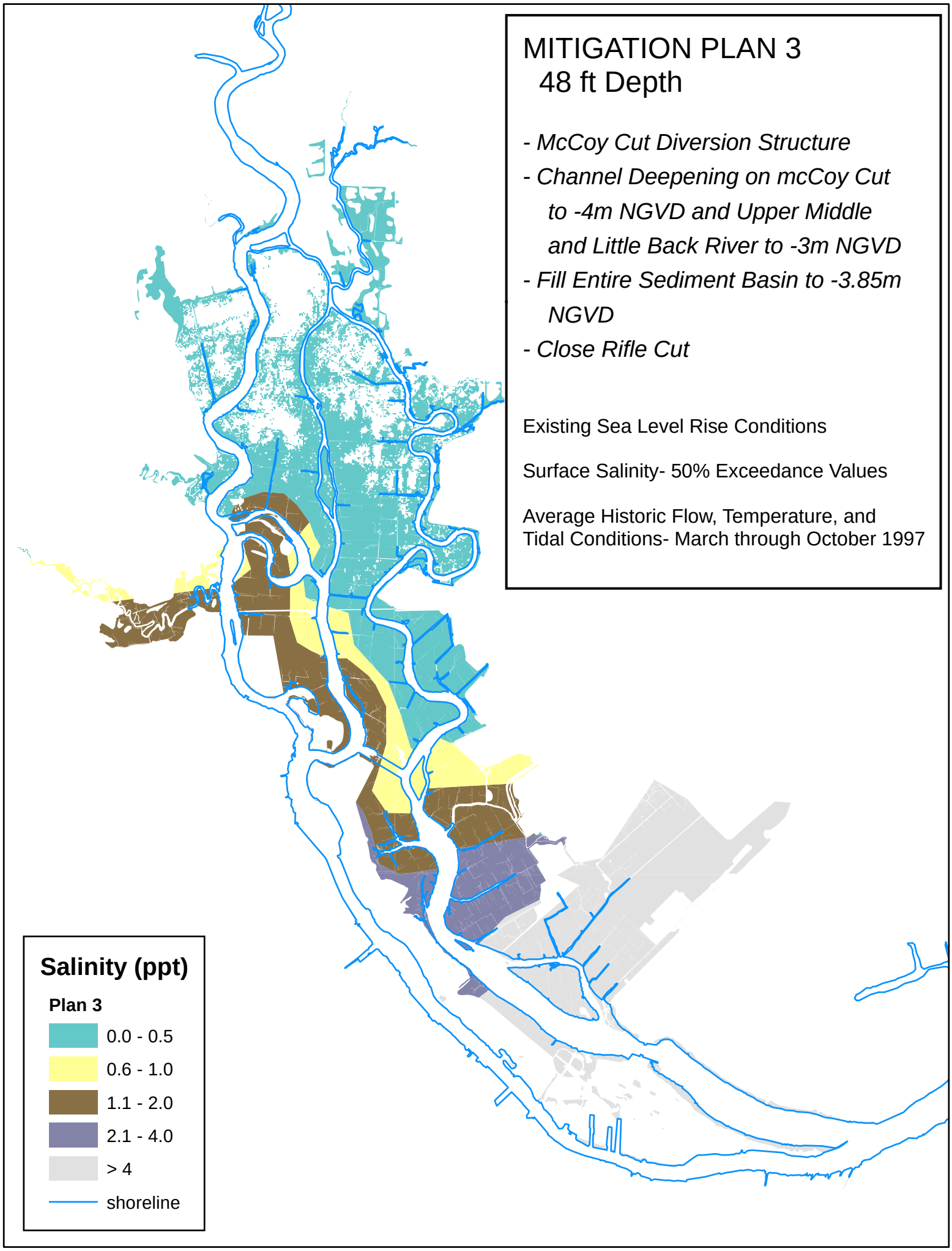

MITIGATION PLAN 3
45 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Diversion Structure
Limit of Deepening to -4m NGVD
Limit of Deepening to -3m NGVD
Close Rifle Cut
Fill Sediment Basin
Salinity (ppt)
Plan 3
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5
shoreline

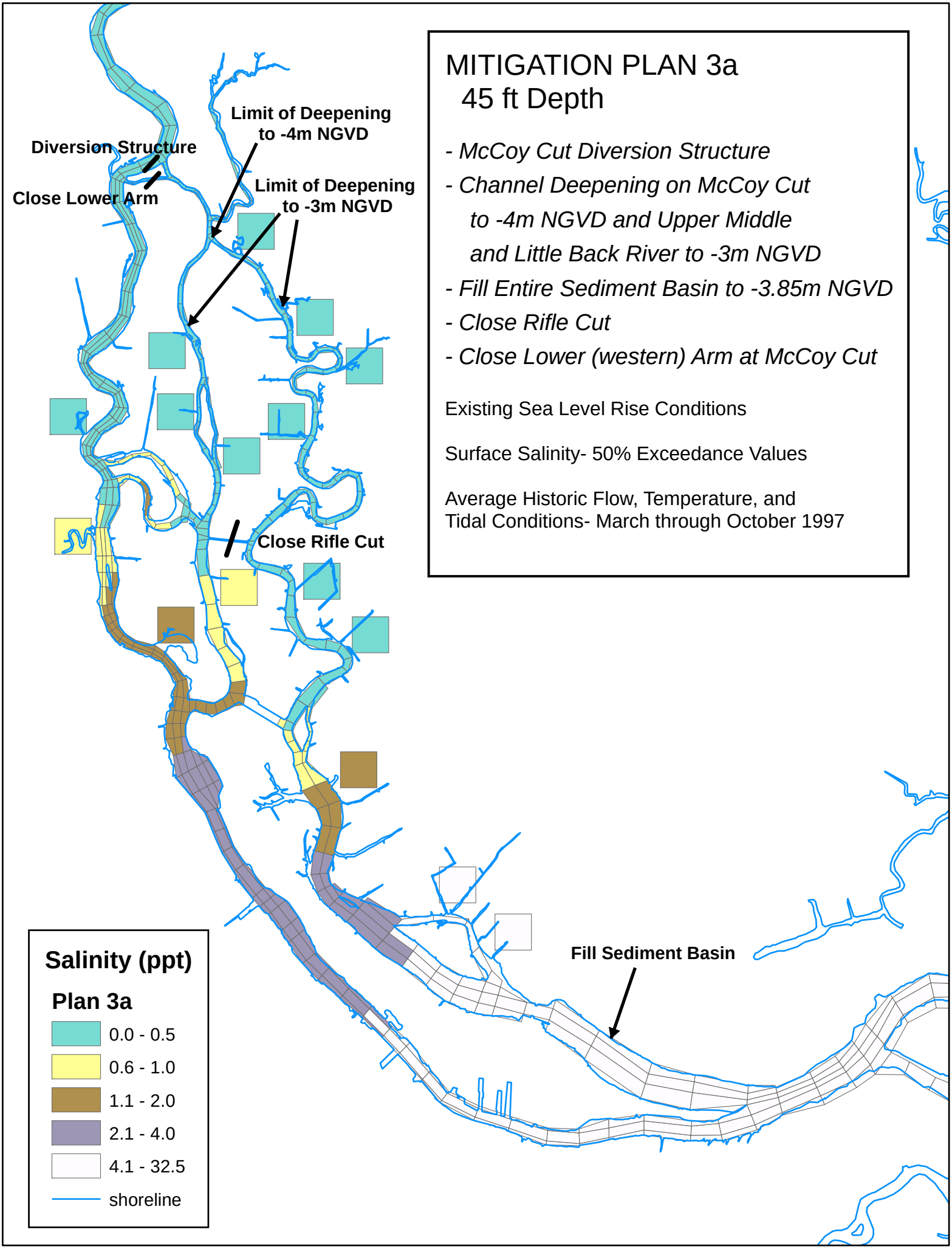

MITIGATION PLAN 3
45 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Salinity (ppt)
Plan 3
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline

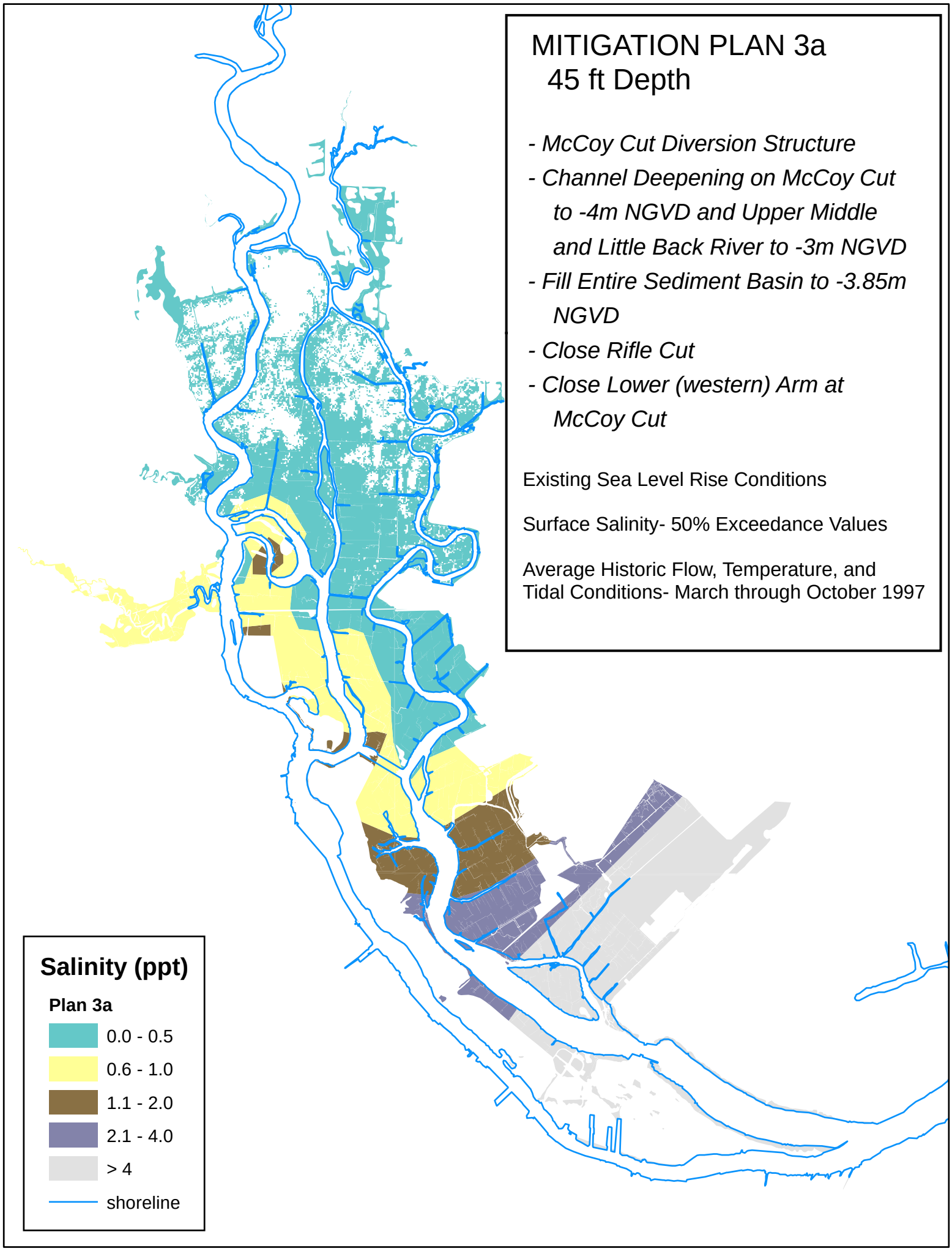

MITIGATION PLAN 3
46 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Diversion Structure
Limit of Deepening to -4m NGVD
Limit of Deepening to -3m NGVD
Close Rifle Cut
Fill Sediment Basin
Salinity (ppt)
Plan 3
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5
shoreline

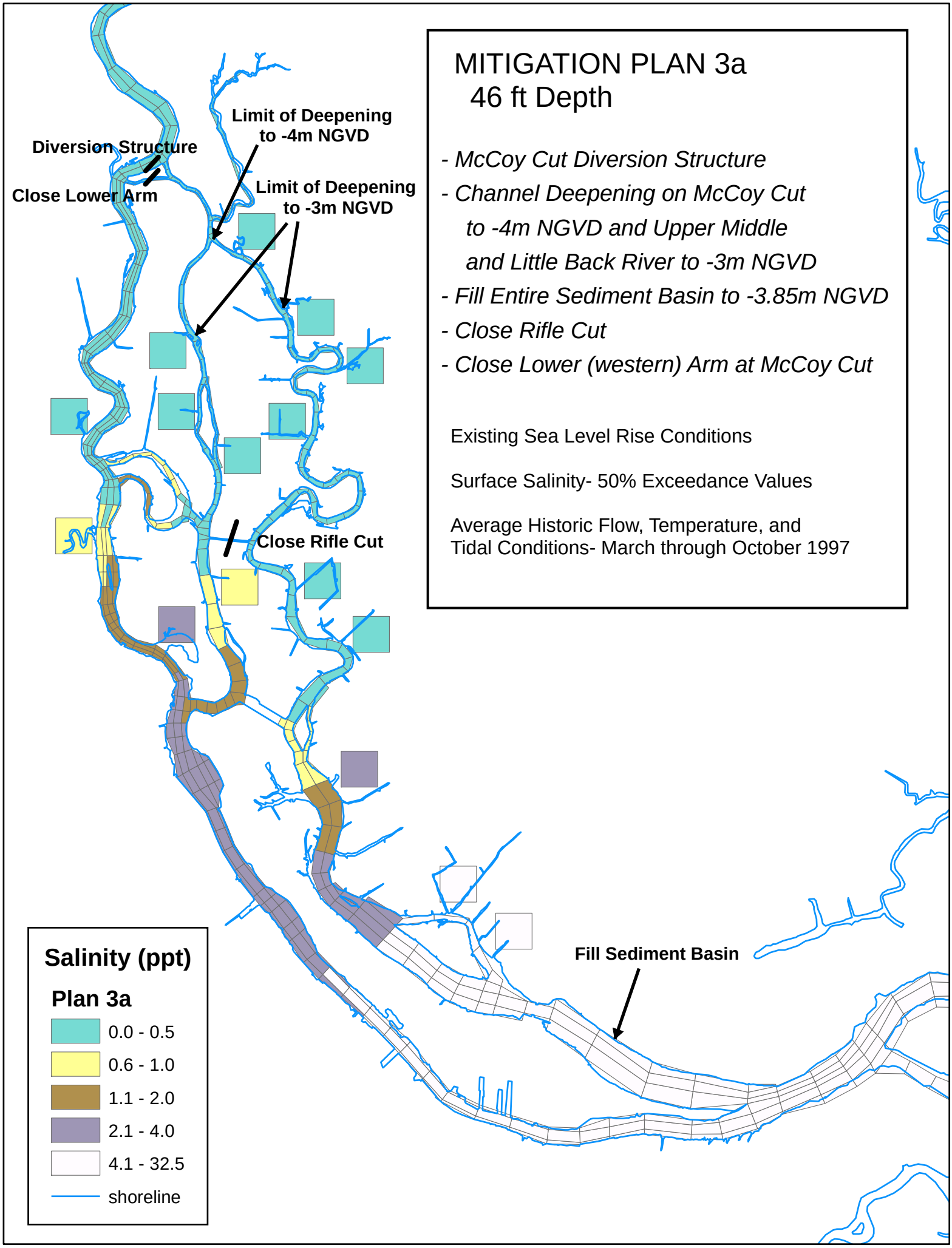

MITIGATION PLAN 3
46 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Salinity (ppt)
Plan 3
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline

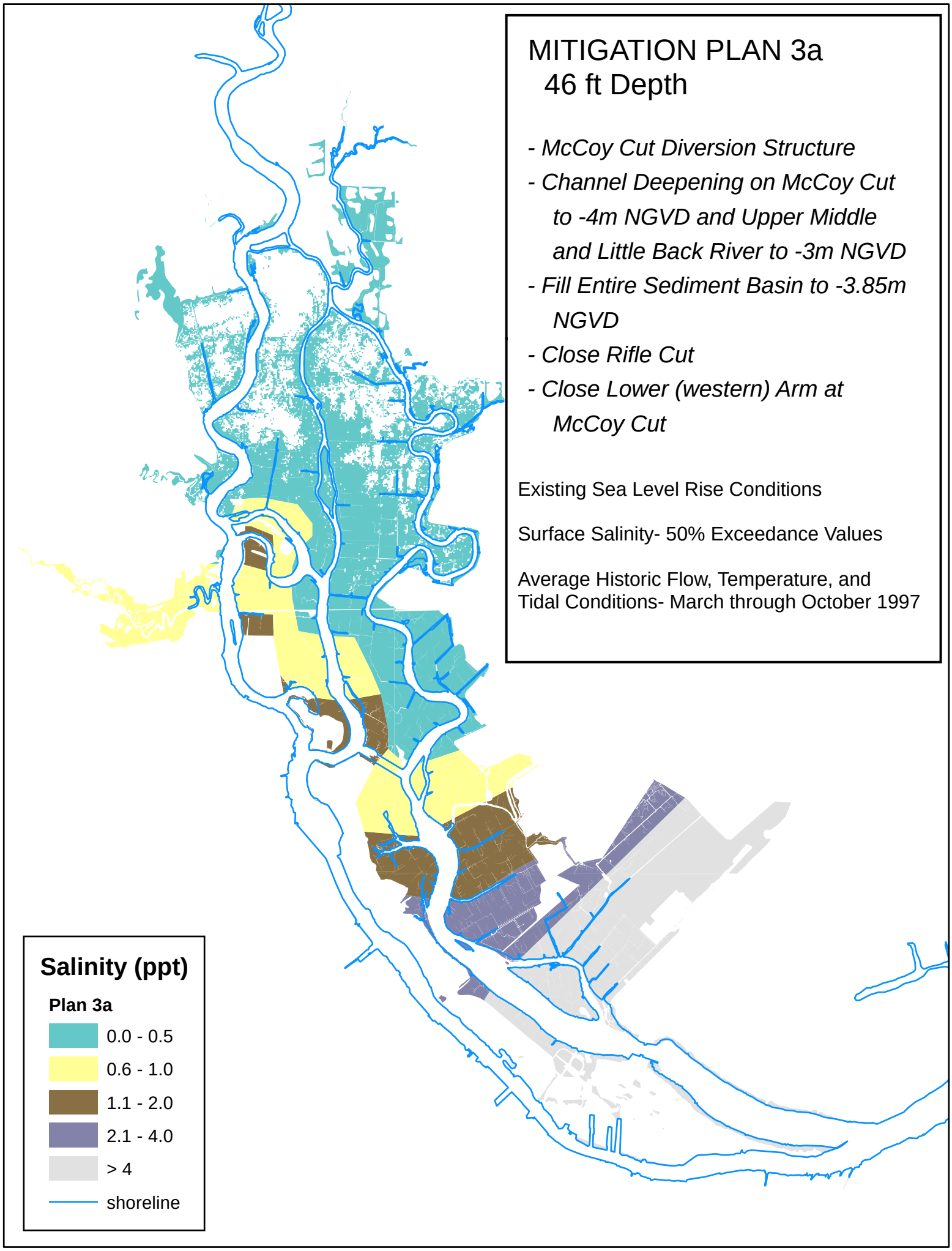

MITIGATION PLAN 3
48 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Diversion Structure
Limit of Deepening to -4m NGVD
Limit of Deepening to -3m NGVD
Close Rifle Cut
Fill Sediment Basin
Salinity (ppt)
Plan 3
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5
shoreline

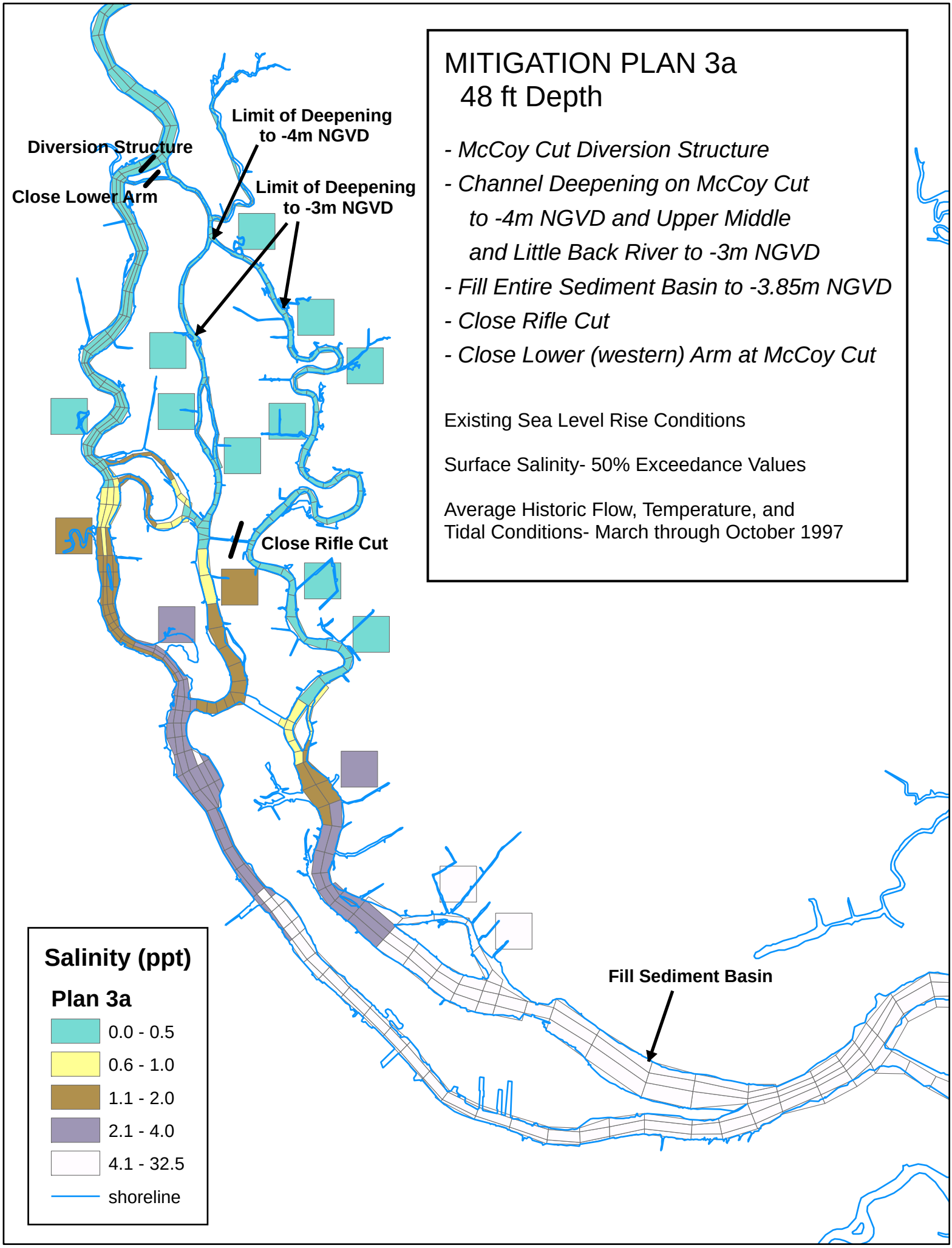

MITIGATION PLAN 3
48 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on mcCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Salinity (ppt)
Plan 3
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline

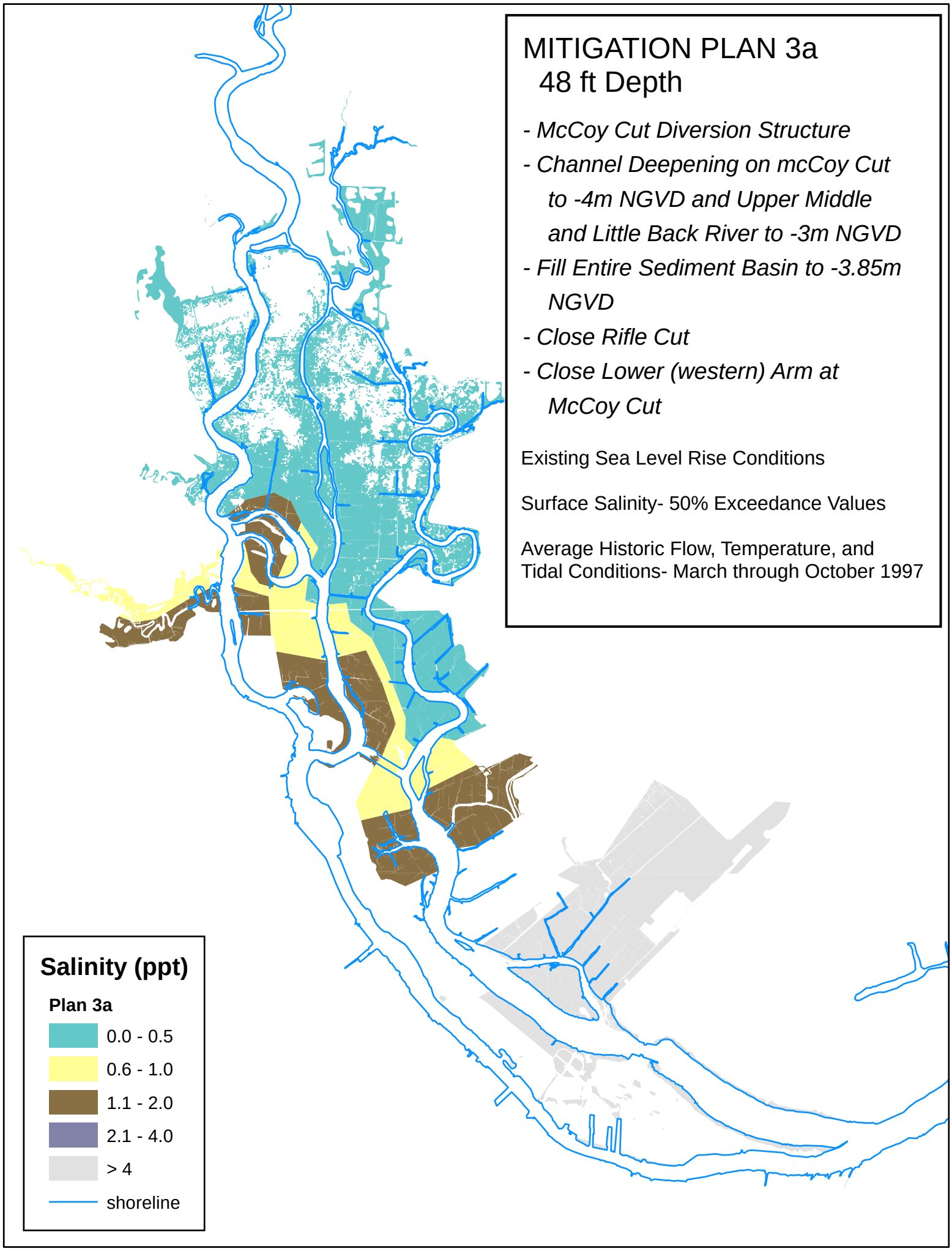

MITIGATION PLAN 3a
45 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Close Lower (western) Arm at McCoy Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Limit of Deepening to -4m NGVD
Limit of Deepening to -3m NGVD
Diversion Structure
Close Lower Arm
Close Rifle Cut
Fill Sediment Basin
Salinity (ppt)
Plan 3a
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5
shoreline

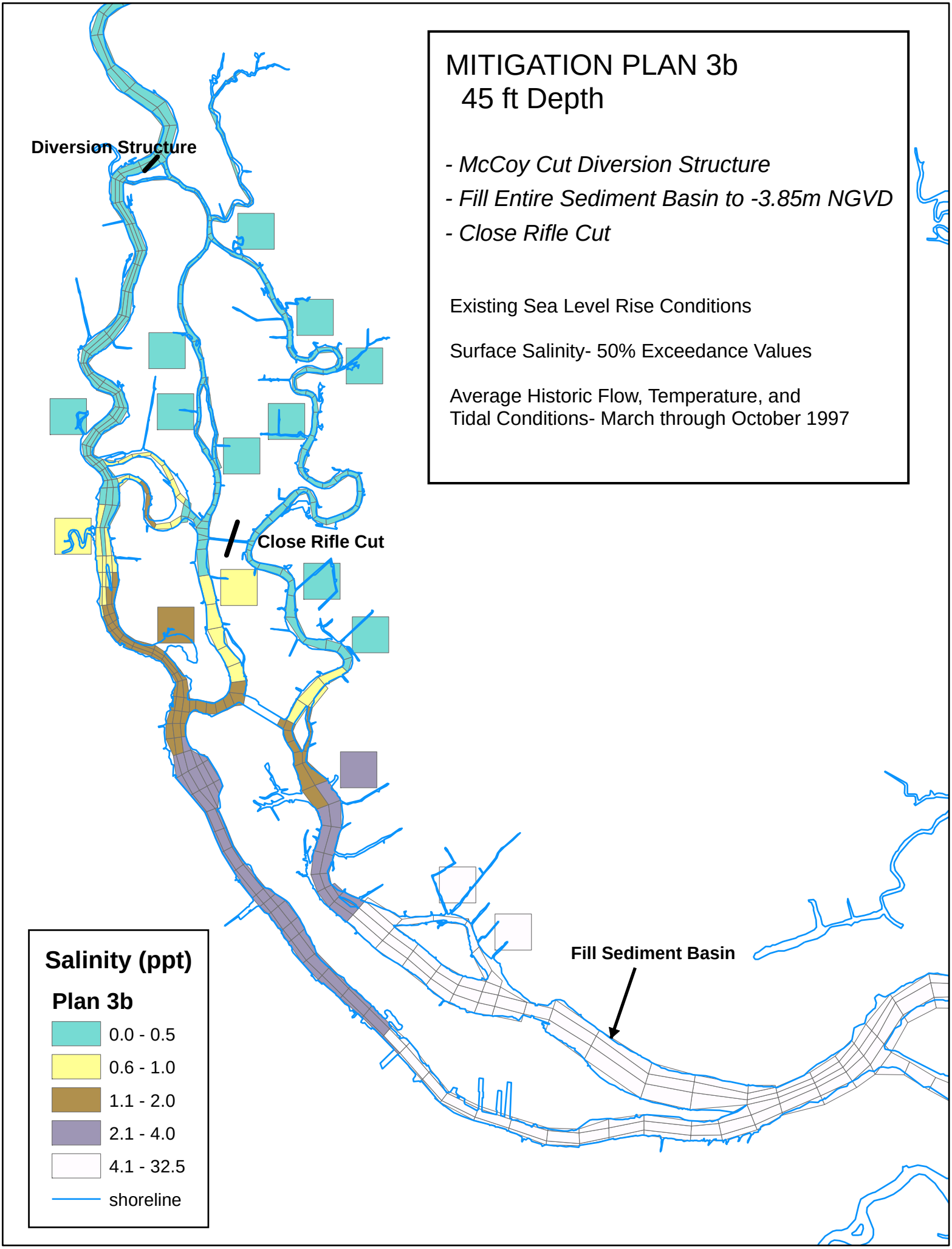

MITIGATION PLAN 3a
45 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Close Lower (western) Arm at McCoy Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Salinity (ppt)
Plan 3a
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline

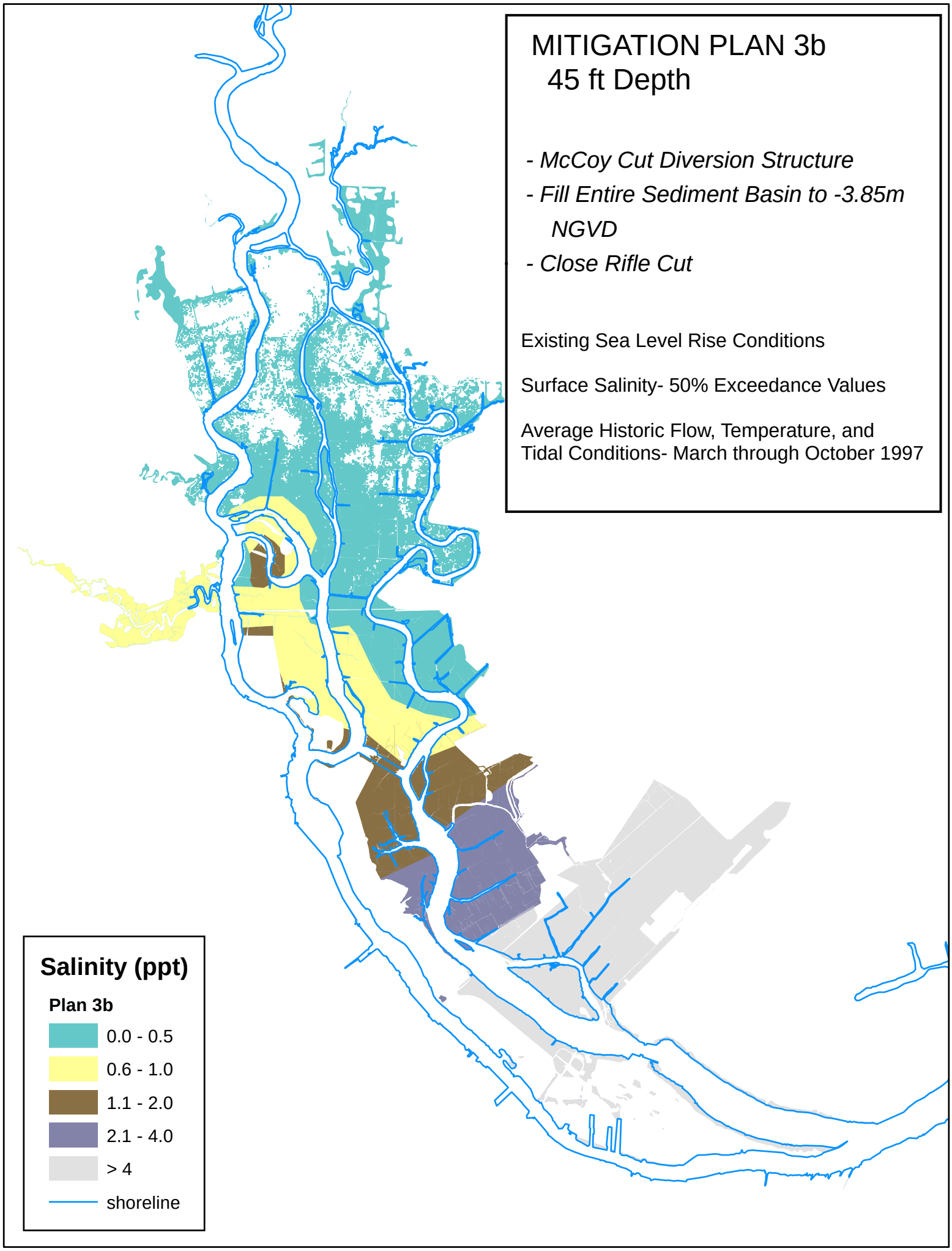

MITIGATION PLAN 3a
46 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Close Lower (western) Arm at McCoy Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Limit of Deepening to -4m NGVD
Limit of Deepening to -3m NGVD
Diversion Structure
Close Lower Arm
Close Rifle Cut
Fill Sediment Basin
Salinity (ppt)
Plan 3a
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5
shoreline

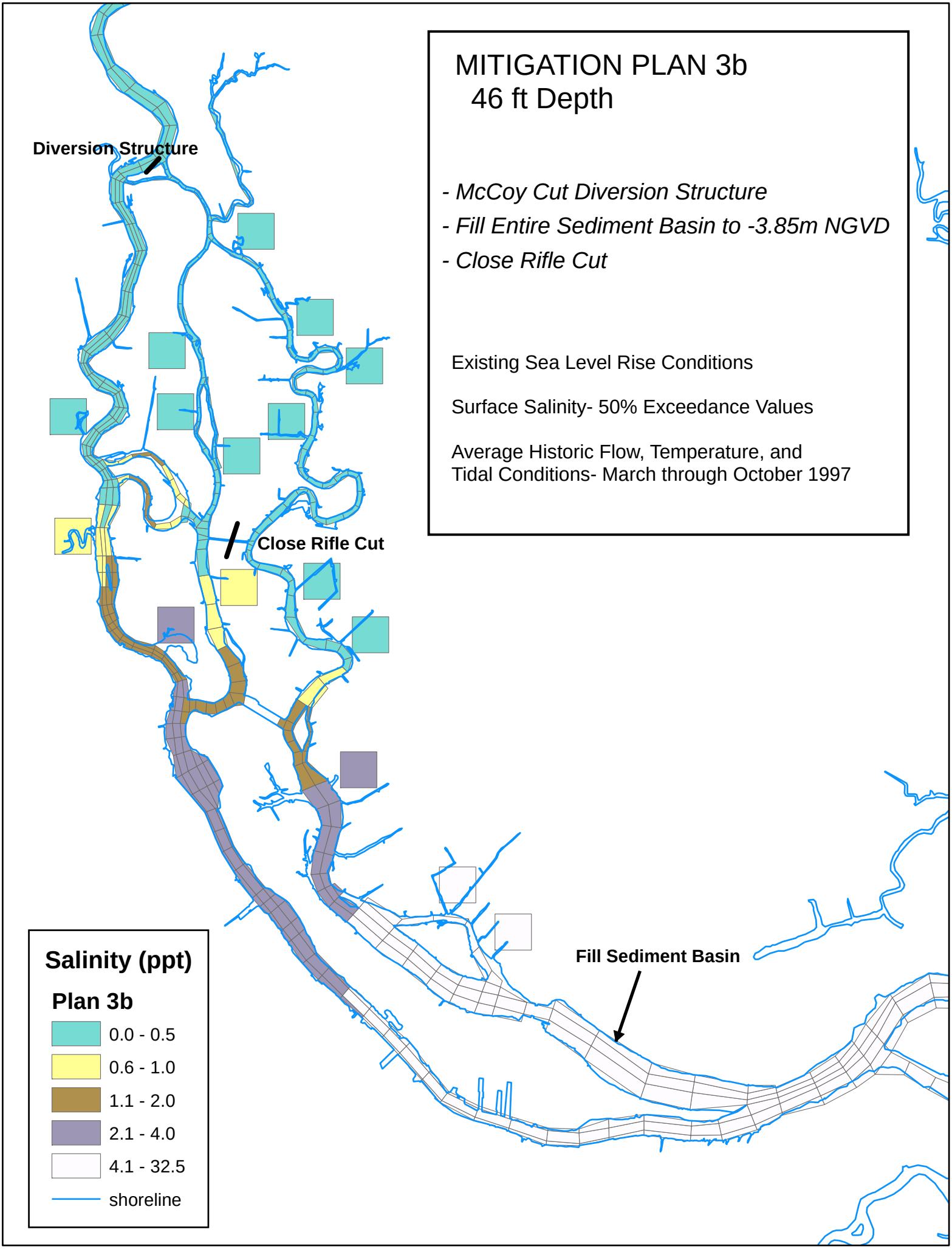

MITIGATION PLAN 3a
46 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Close Lower (western) Arm at McCoy Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Salinity (ppt)
Plan 3a
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline

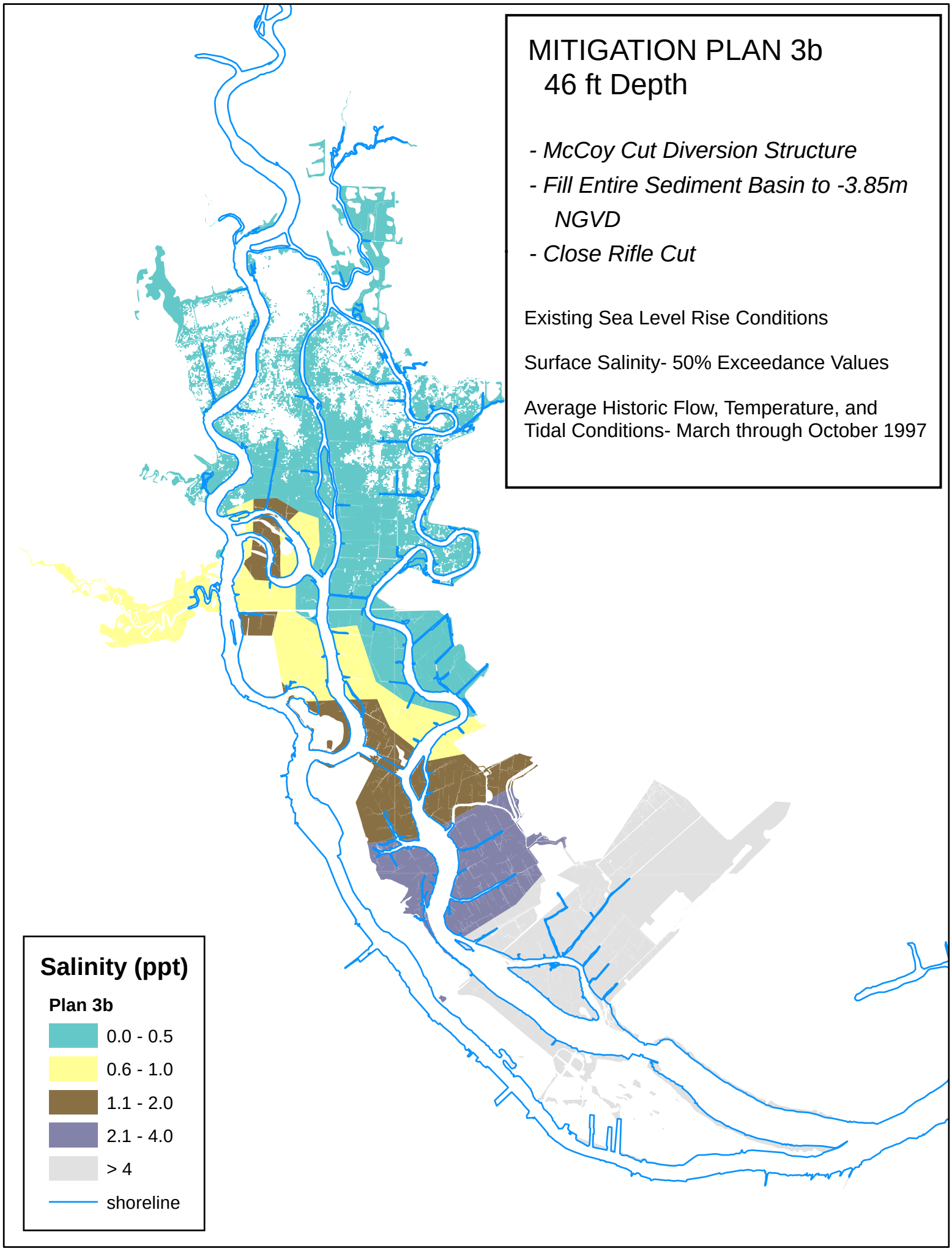

MITIGATION PLAN 3a
48 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Close Lower (western) Arm at McCoy Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Diversion Structure
Close Lower Arm
Limit of Deepening to -4m NGVD
Limit of Deepening to -3m NGVD
Close Rifle Cut
Fill Sediment Basin
Salinity (ppt)
Plan 3a
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5
shoreline

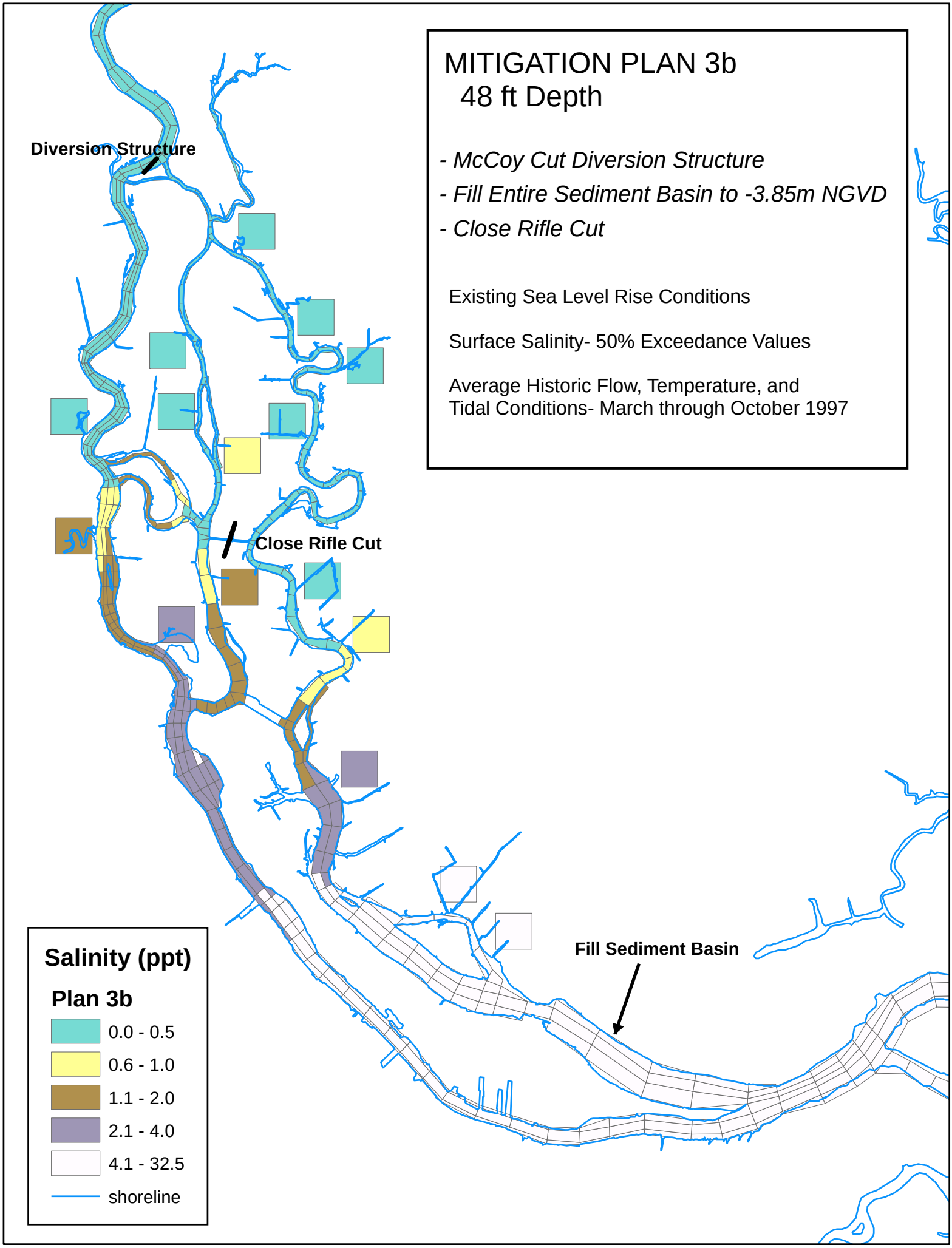

MITIGATION PLAN 3a
48 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on mcCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Close Lower (western) Arm at McCoy Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Salinity (ppt)
Plan 3a
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline

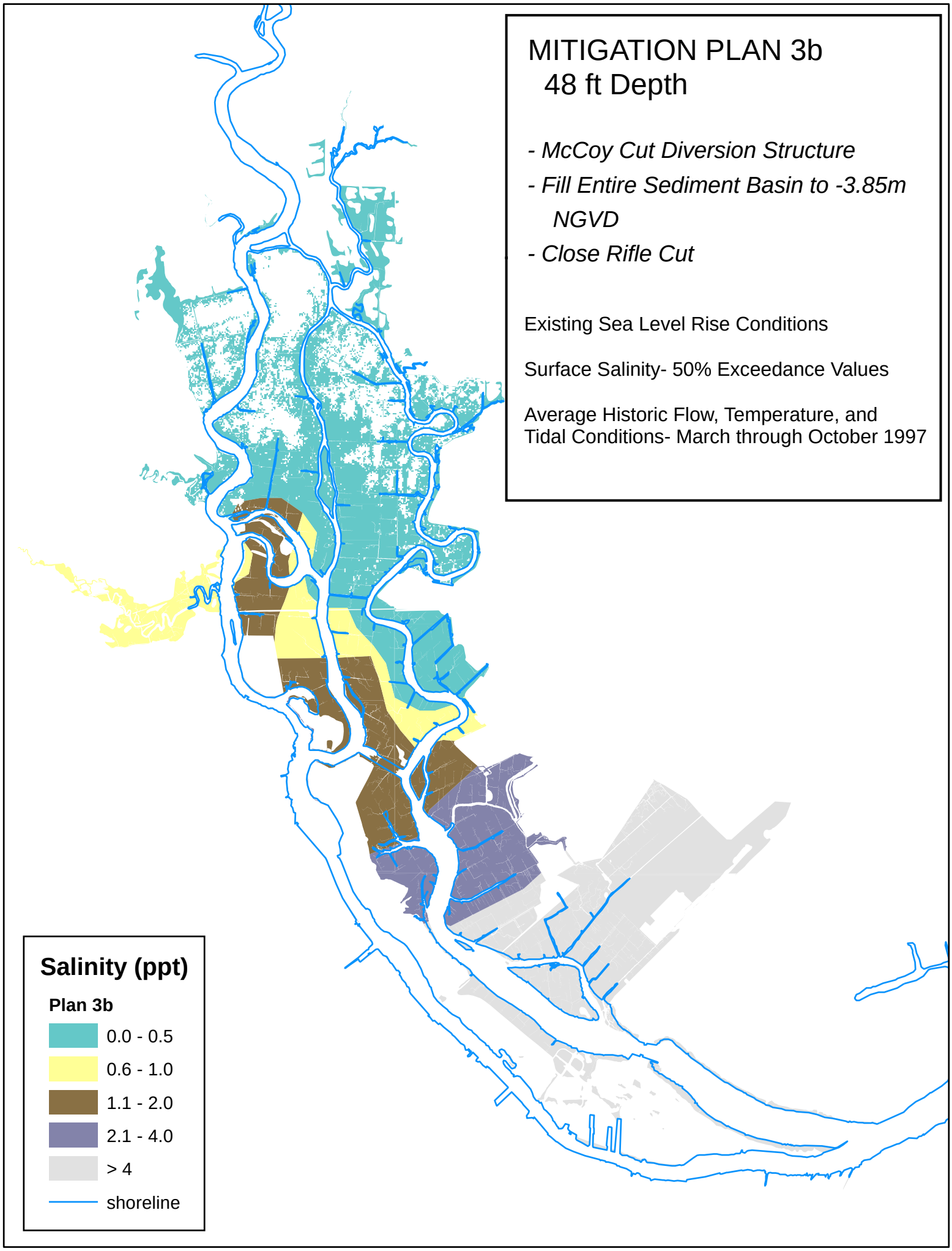

MITIGATION PLAN 3b
45 ft Depth
- McCoy Cut Diversion Structure
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and
Tidal Conditions- March through October 1997
Diversion Structure
Close Rifle Cut
Fill Sediment Basin
Salinity (ppt)
Plan 3b
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5
shoreline

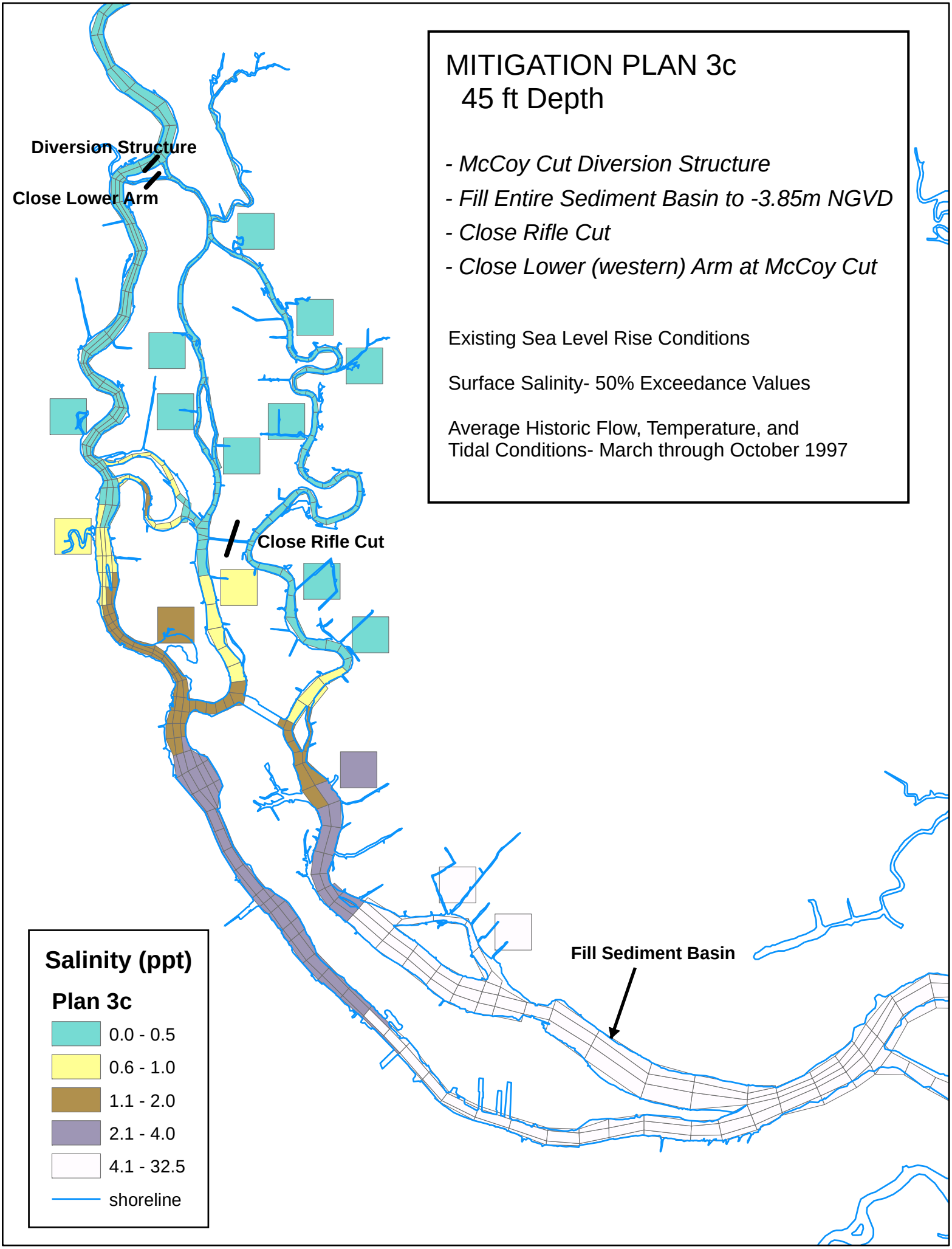

MITIGATION PLAN 3b
45 ft Depth
- McCoy Cut Diversion Structure
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Salinity (ppt)
Plan 3b
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline

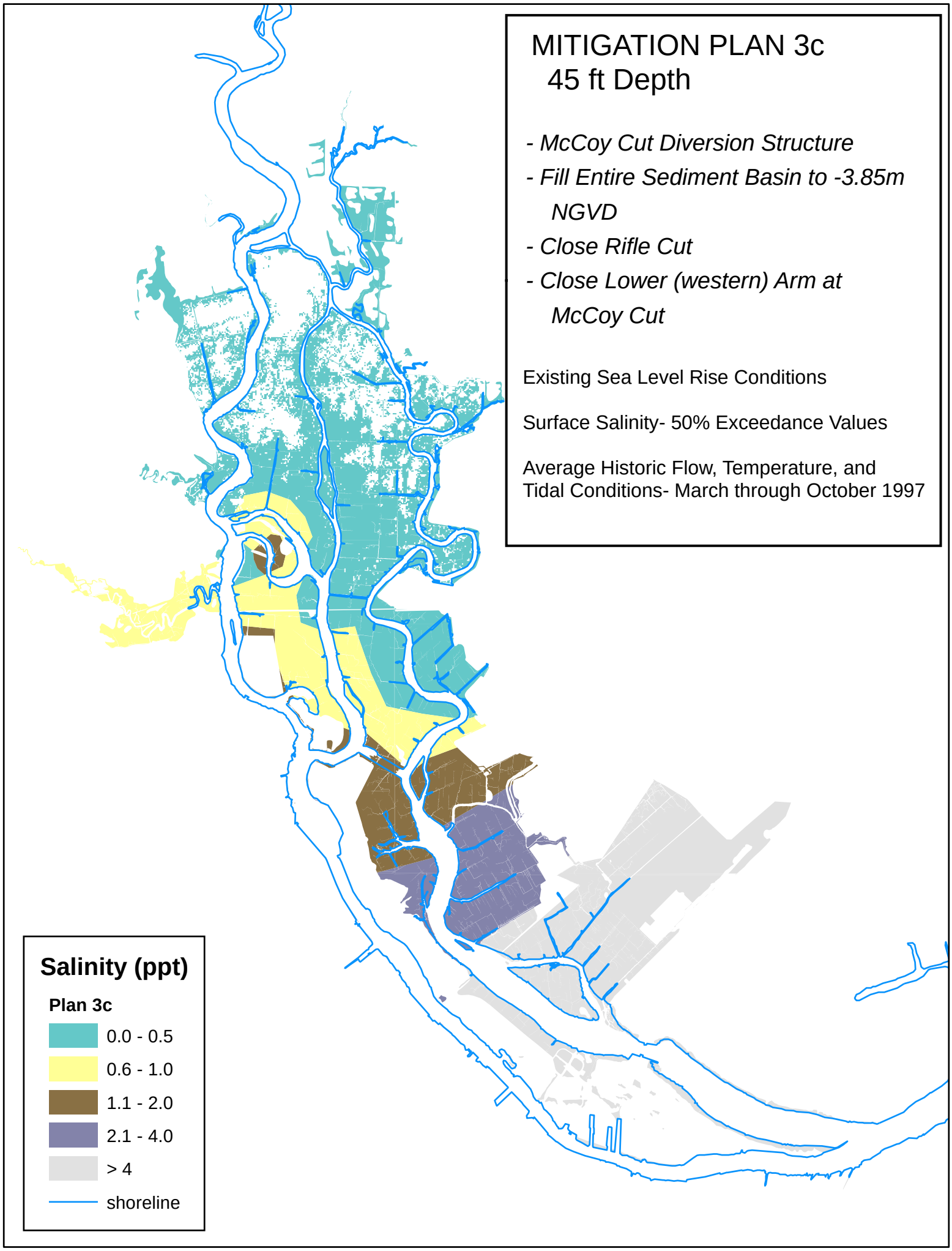

MITIGATION PLAN 3b
46 ft Depth
- McCoy Cut Diversion Structure
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and
Tidal Conditions- March through October 1997
Diversion Structure
Close Rifle Cut
Fill Sediment Basin
Salinity (ppt)
Plan 3b
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5
shoreline

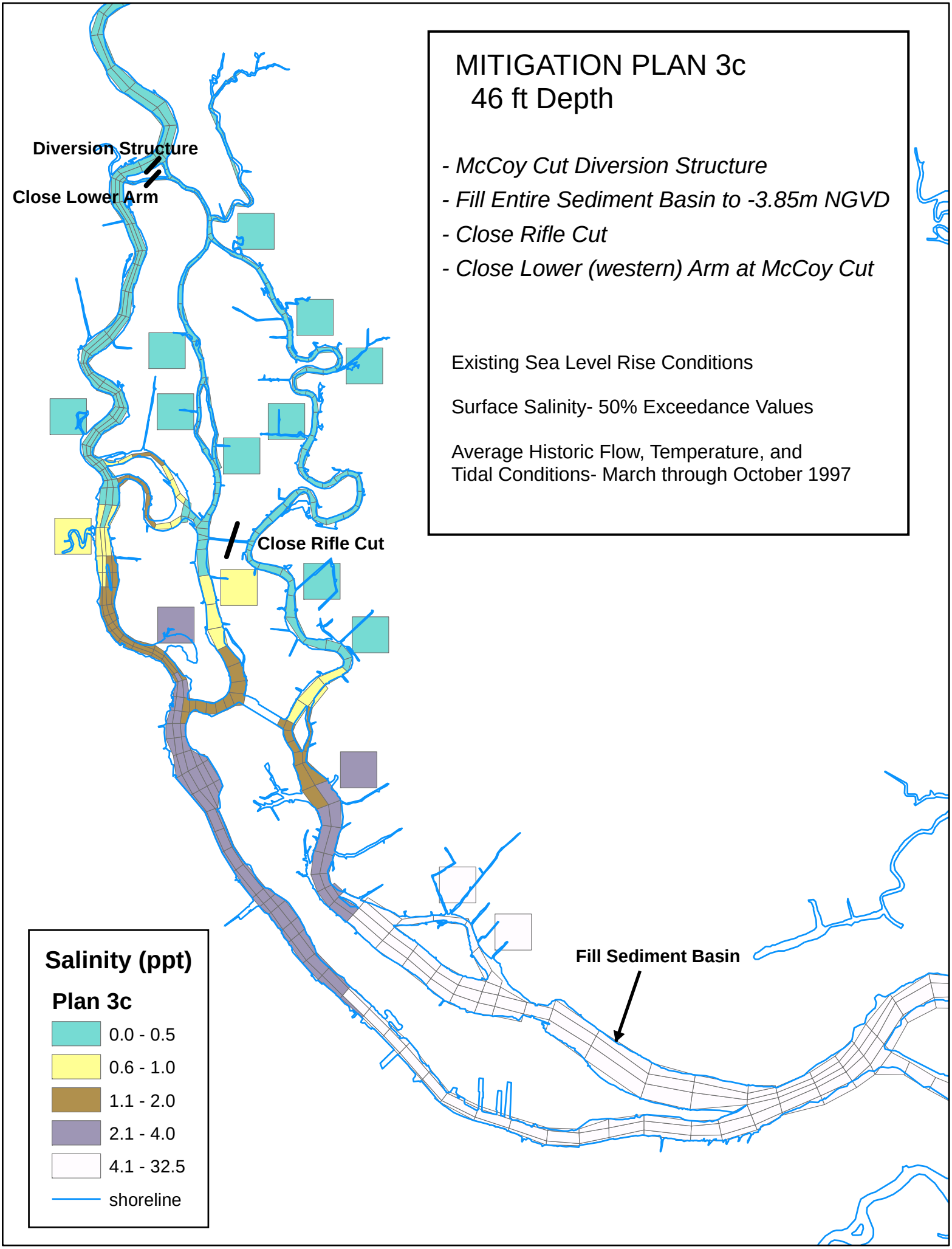

MITIGATION PLAN 3b
46 ft Depth
- McCoy Cut Diversion Structure
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Salinity (ppt)
Plan 3b
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline

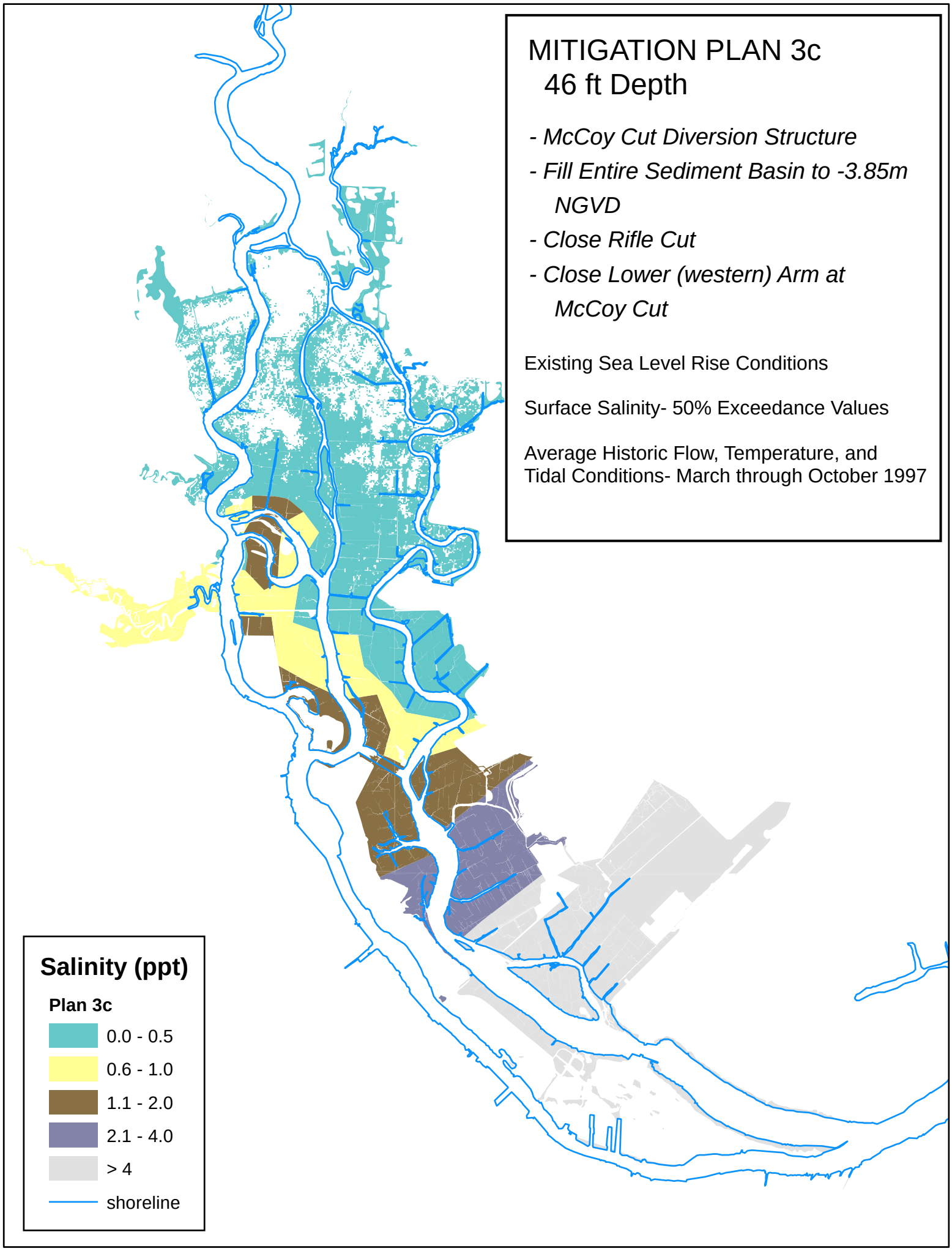

MITIGATION PLAN 3b
48 ft Depth
- McCoy Cut Diversion Structure
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and
Tidal Conditions- March through October 1997
Diversion Structure
Close Rifle Cut
Fill Sediment Basin
Salinity (ppt)
Plan 3b
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5
shoreline

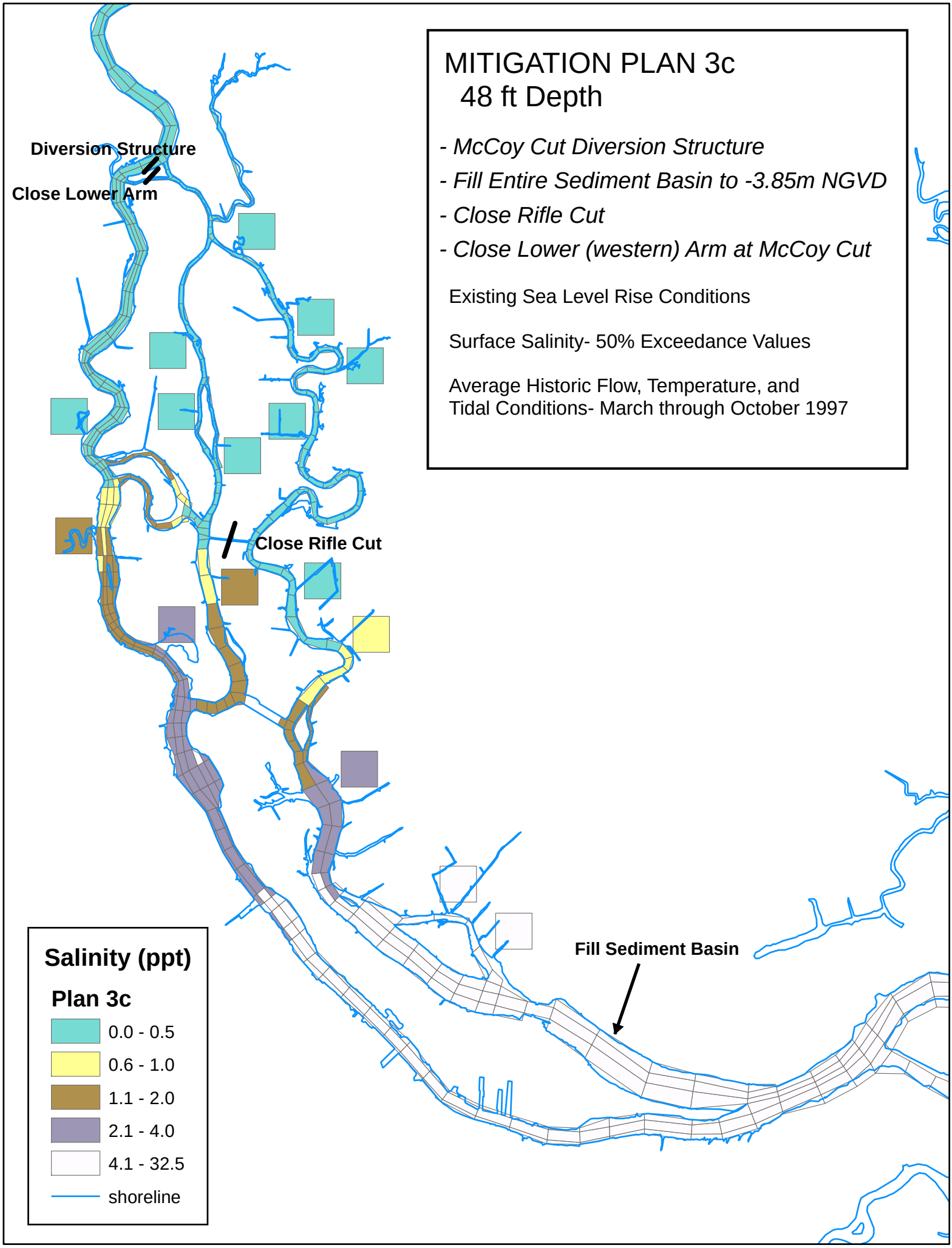

MITIGATION PLAN 3b
48 ft Depth
- McCoy Cut Diversion Structure
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Salinity (ppt)
Plan 3b
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline

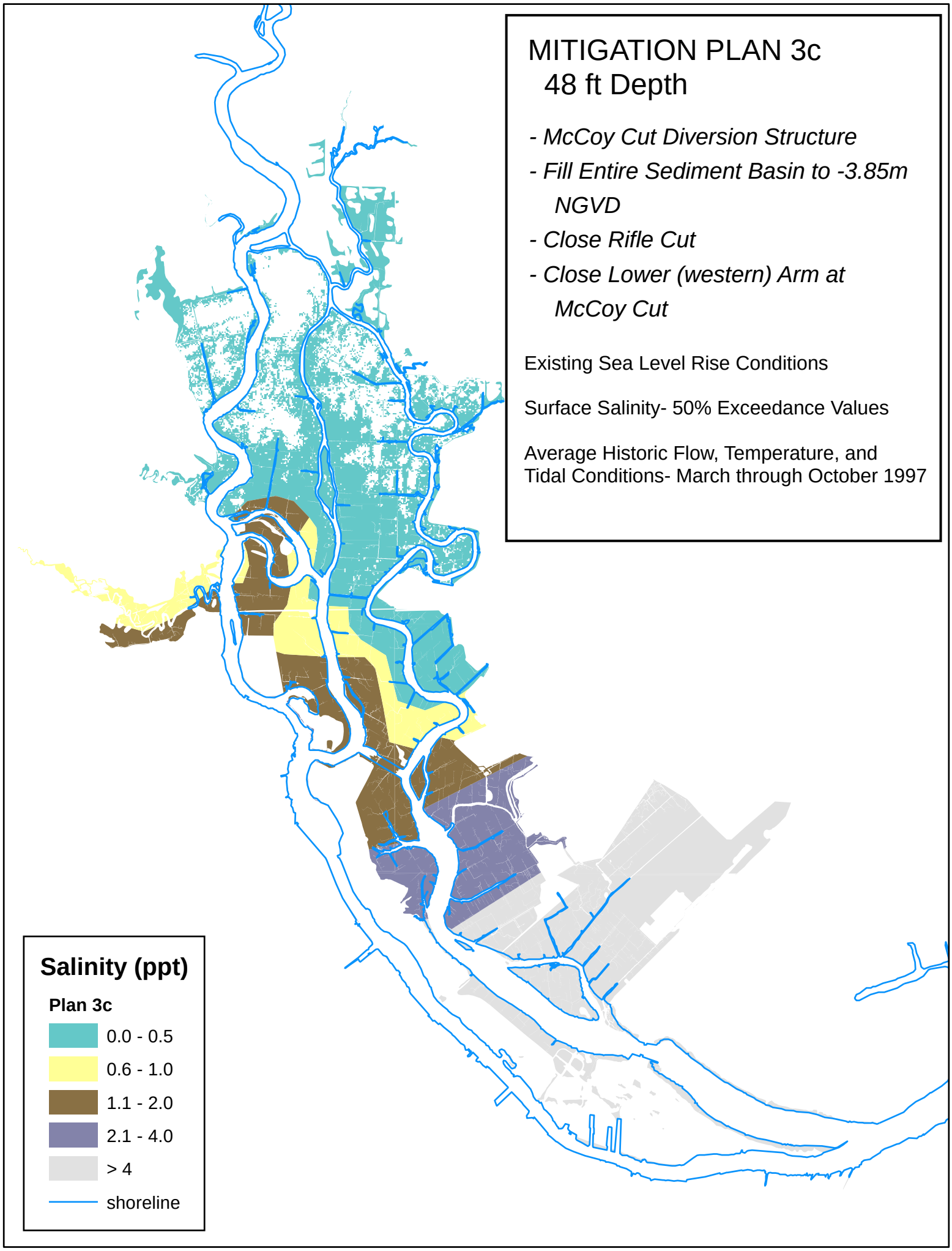

MITIGATION PLAN 3c
45 ft Depth
- McCoy Cut Diversion Structure
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Close Lower (western) Arm at McCoy Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and
Tidal Conditions- March through October 1997
Diversion Structure
Close Lower Arm
Close Rifle Cut
Fill Sediment Basin
Salinity (ppt)
Plan 3c
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5
shoreline

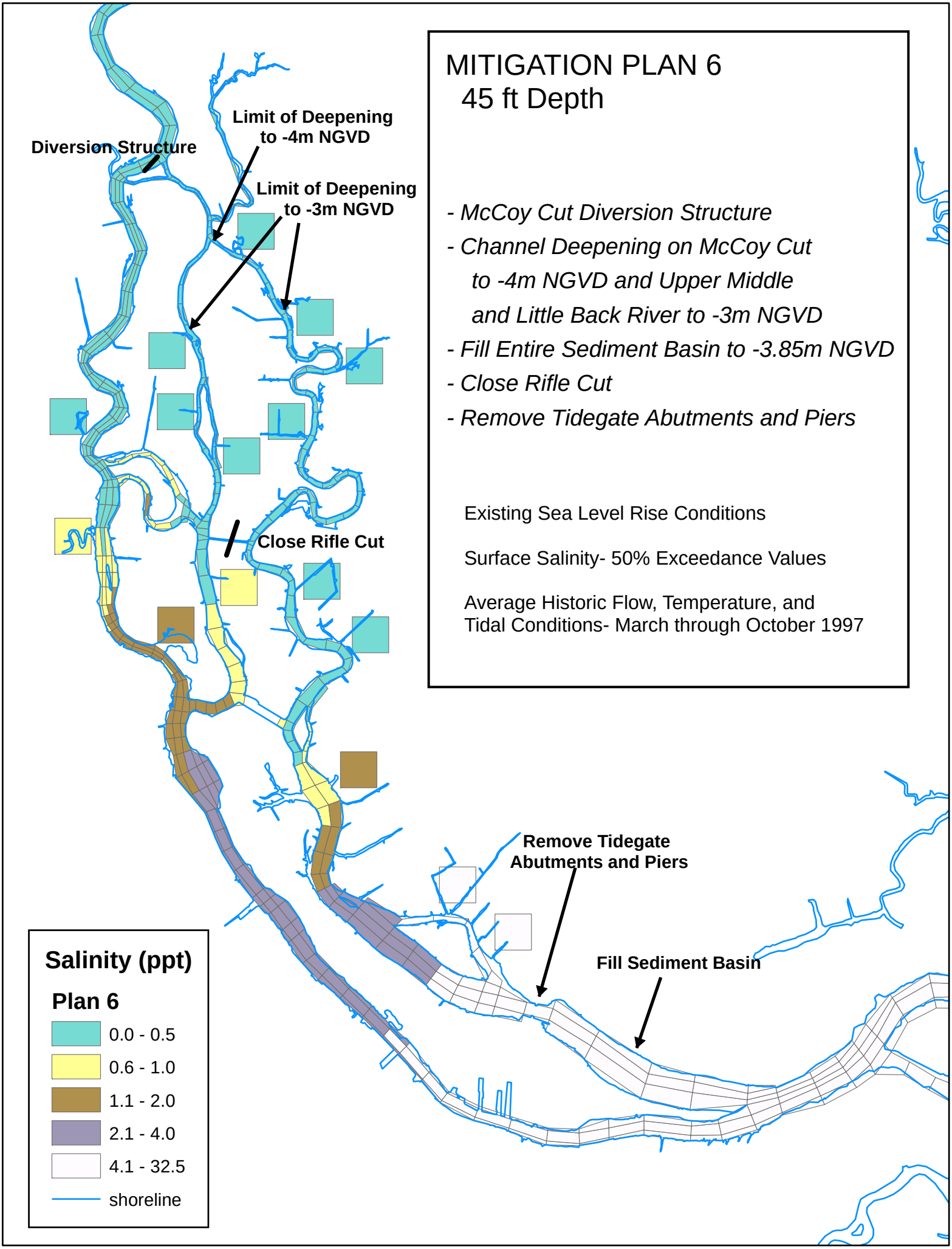

MITIGATION PLAN 3c
45 ft Depth
- McCoy Cut Diversion Structure
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Close Lower (western) Arm at McCoy Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Salinity (ppt)
Plan 3c
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline

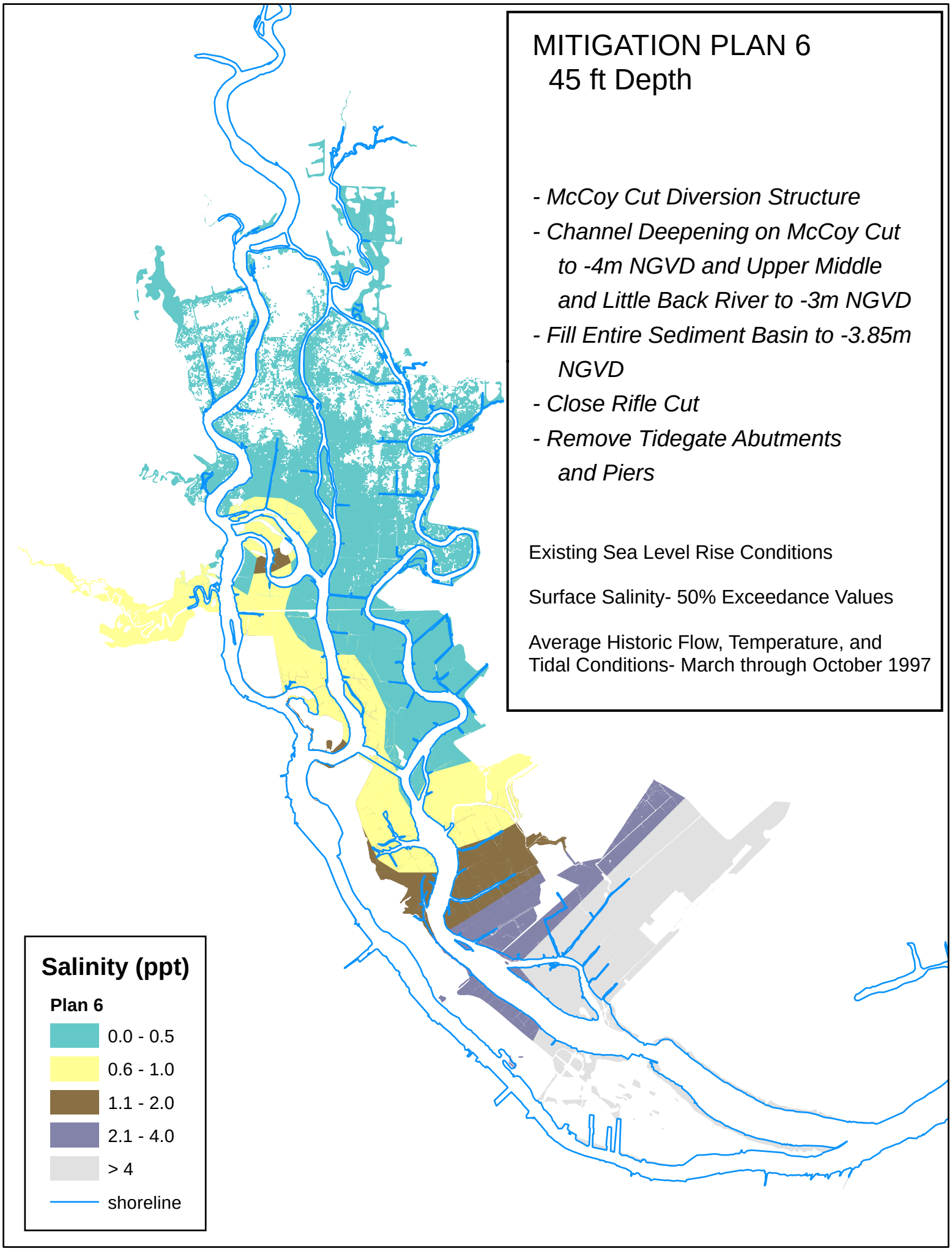

MITIGATION PLAN 3c
46 ft Depth
- McCoy Cut Diversion Structure
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Close Lower (western) Arm at McCoy Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and
Tidal Conditions- March through October 1997
Diversion Structure
Close Lower Arm
Close Rifle Cut
Fill Sediment Basin
Salinity (ppt)
Plan 3c
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5
shoreline

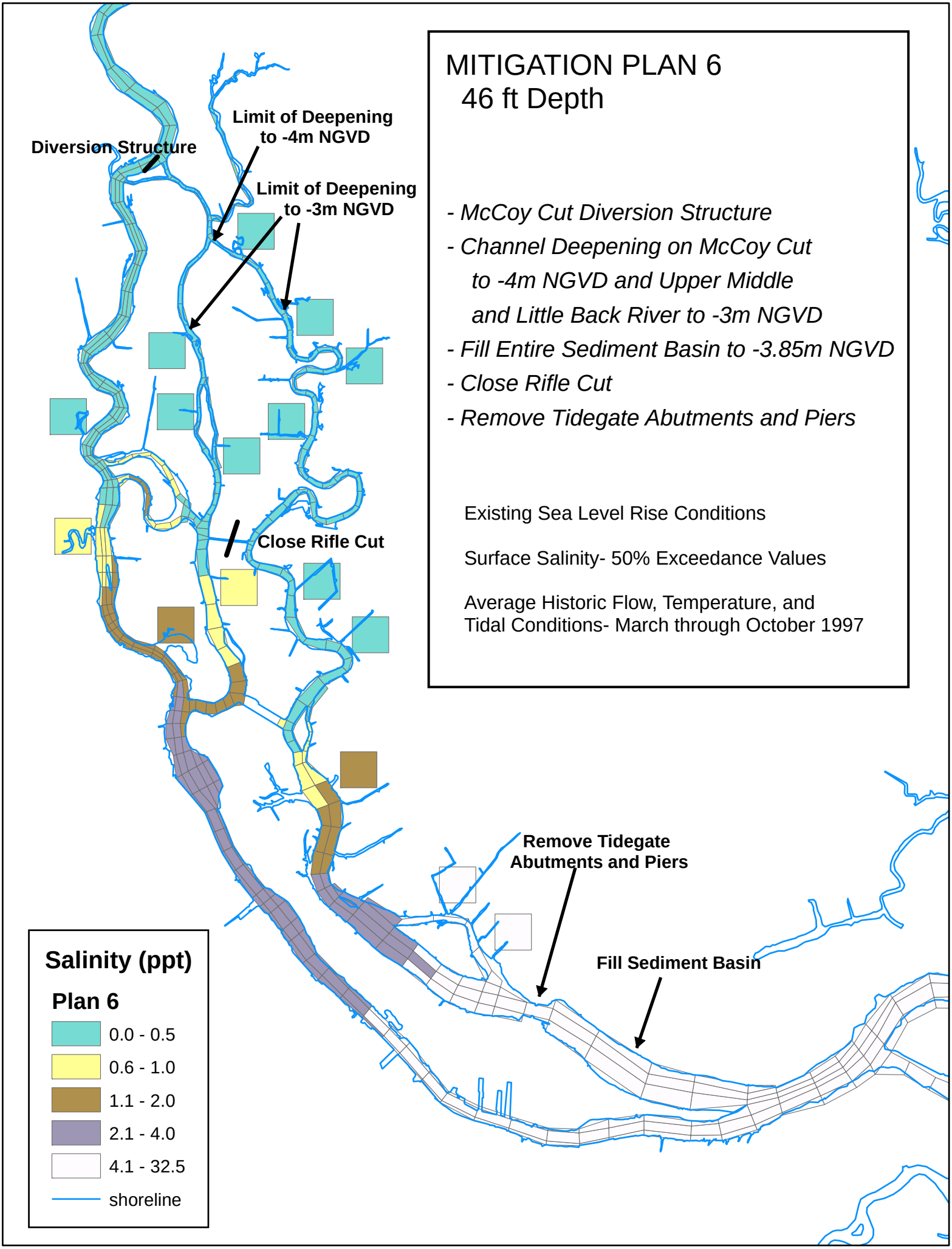

MITIGATION PLAN 3c
46 ft Depth
- McCoy Cut Diversion Structure
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Close Lower (western) Arm at McCoy Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Salinity (ppt)
Plan 3c
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline

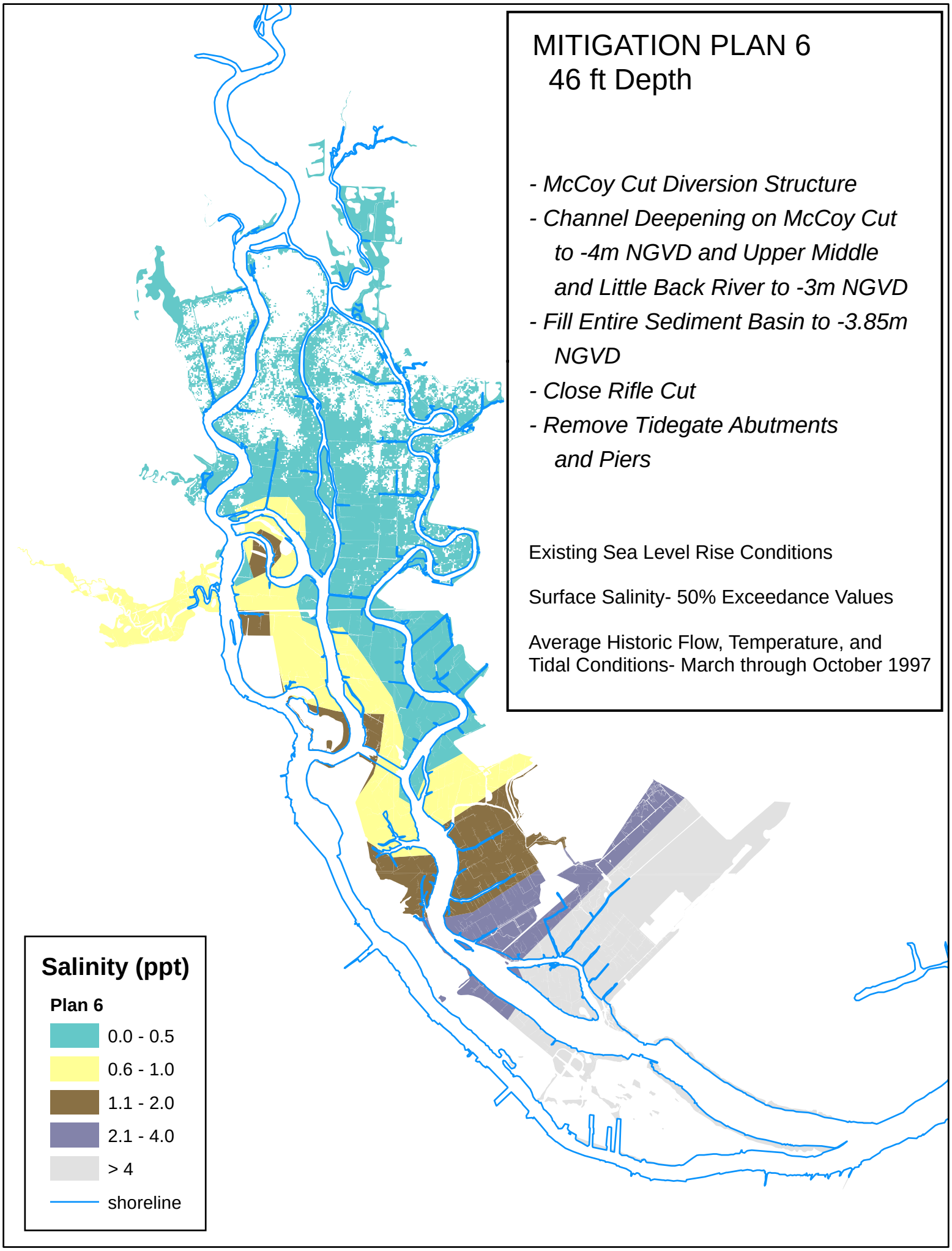

MITIGATION PLAN 3c
48 ft Depth
- McCoy Cut Diversion Structure
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Close Lower (western) Arm at McCoy Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and
Tidal Conditions- March through October 1997
Diversion Structure
Close Lower Arm
Close Rifle Cut
Fill Sediment Basin
Salinity (ppt)
Plan 3c
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5
shoreline

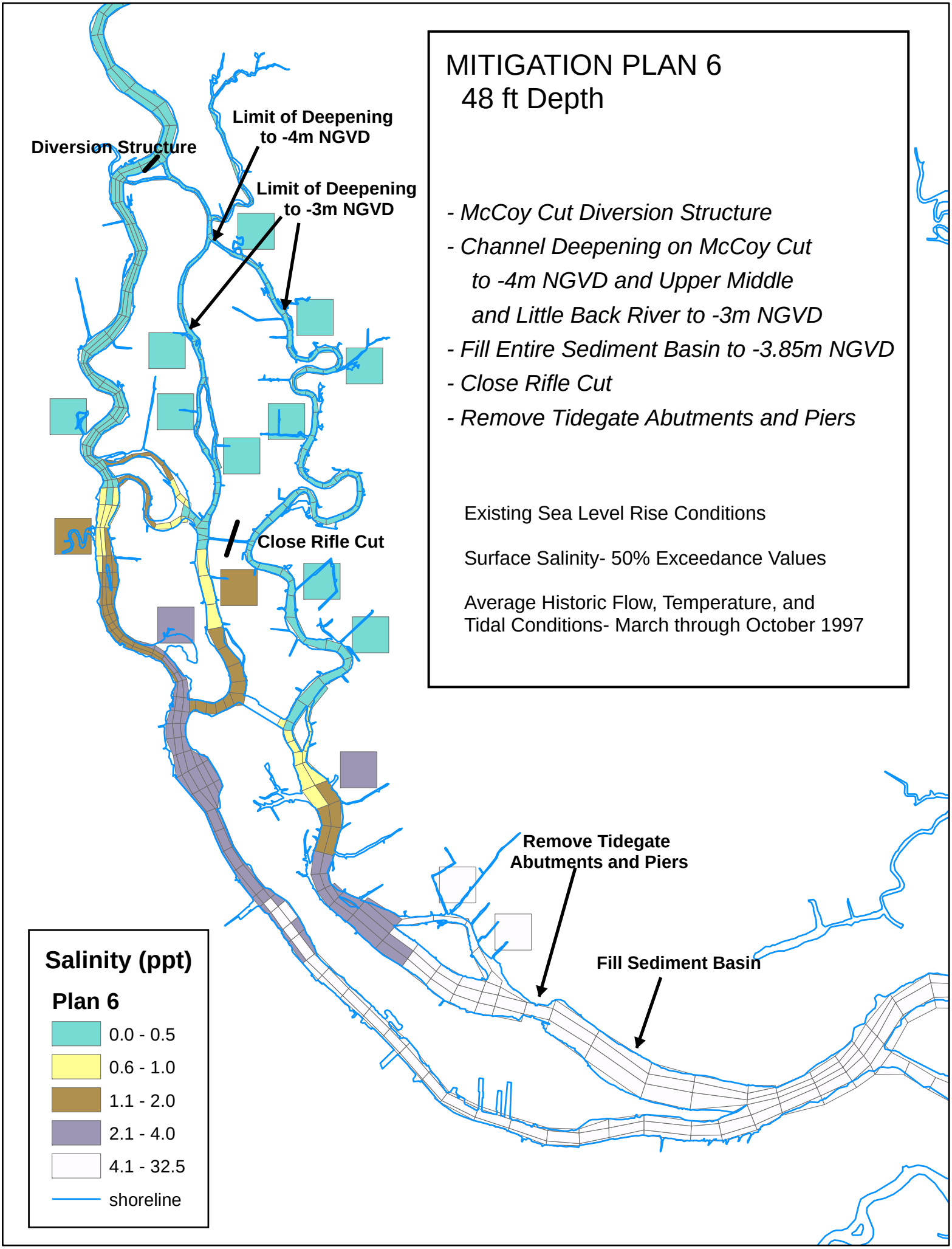

MITIGATION PLAN 3c
48 ft Depth
- McCoy Cut Diversion Structure
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Close Lower (western) Arm at McCoy Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Salinity (ppt)
Plan 3c
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline

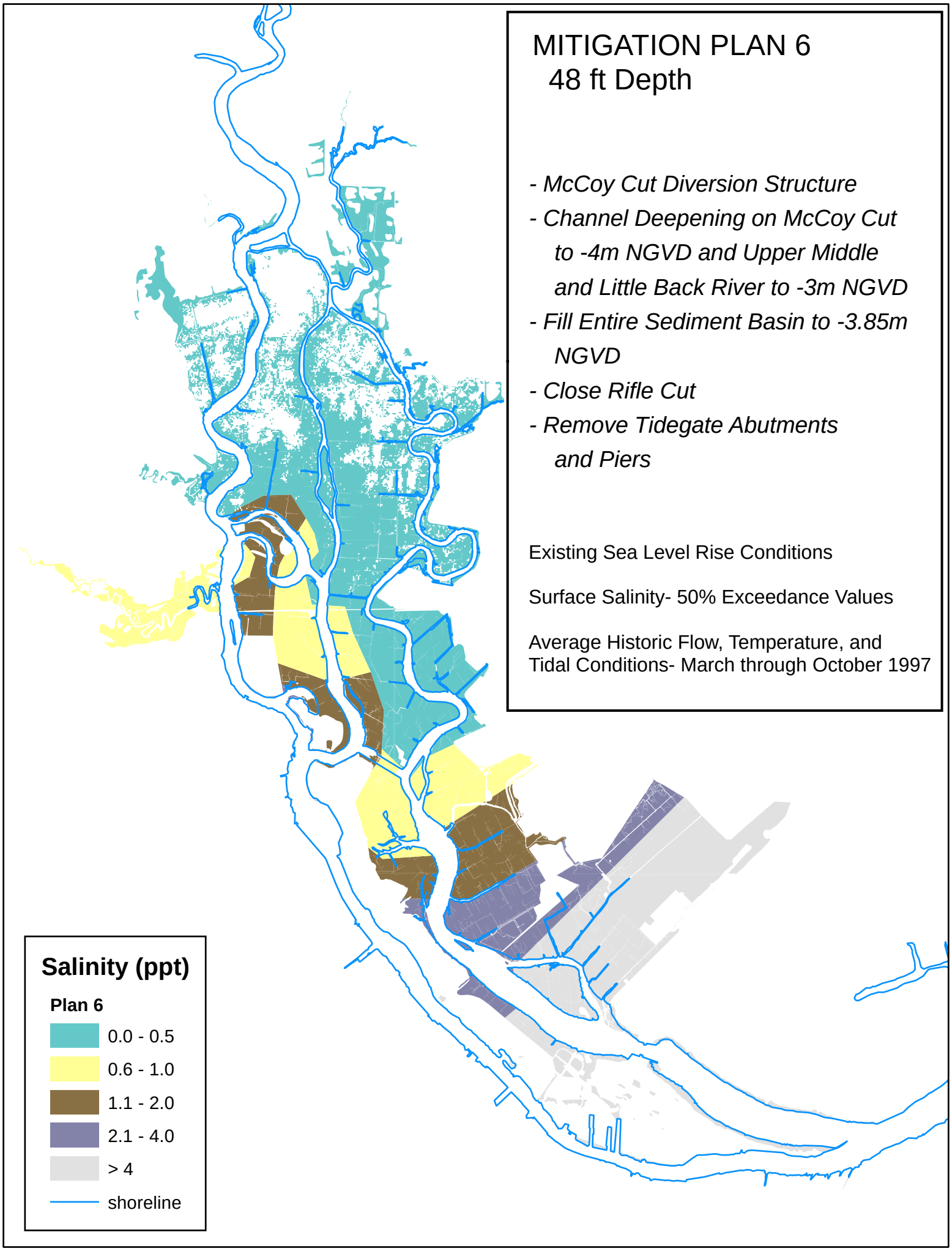

MITIGATION PLAN 6
45 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Remove Tidegate Abutments and Piers
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Diversion Structure
Limit of Deepening to -4m NGVD
Limit of Deepening to -3m NGVD
Close Rifle Cut
Remove Tidegate Abutments and Piers
Fill Sediment Basin
Salinity (ppt)
Plan 6
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5
shoreline

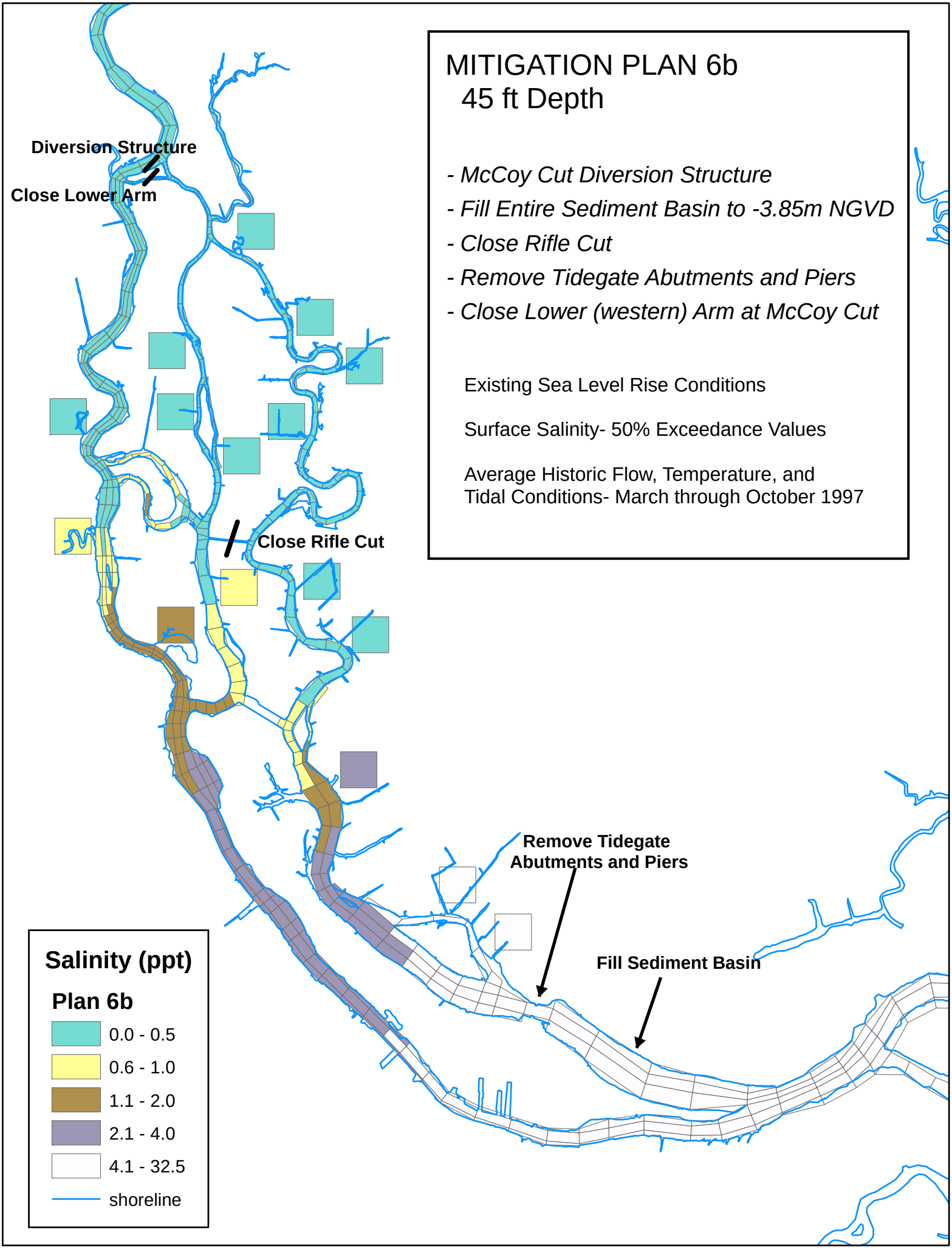

MITIGATION PLAN 6
45 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Remove Tidegate Abutments and Piers
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Salinity (ppt)
Plan 6
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline

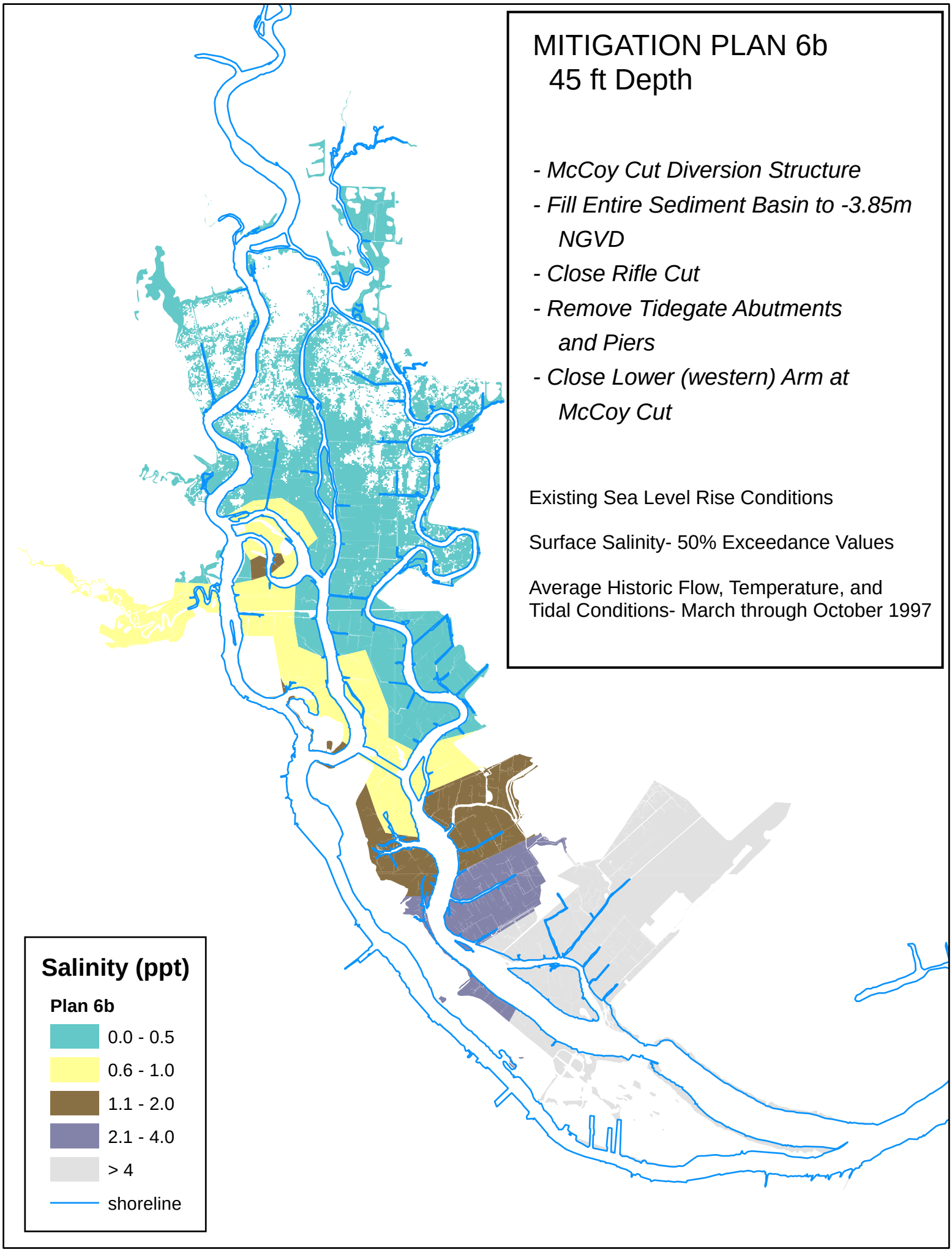

MITIGATION PLAN 6
46 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Remove Tidegate Abutments and Piers
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Diversion Structure
Limit of Deepening to -4m NGVD
Limit of Deepening to -3m NGVD
Close Rifle Cut
Remove Tidegate Abutments and Piers
Fill Sediment Basin
Salinity (ppt)
Plan 6
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5
shoreline

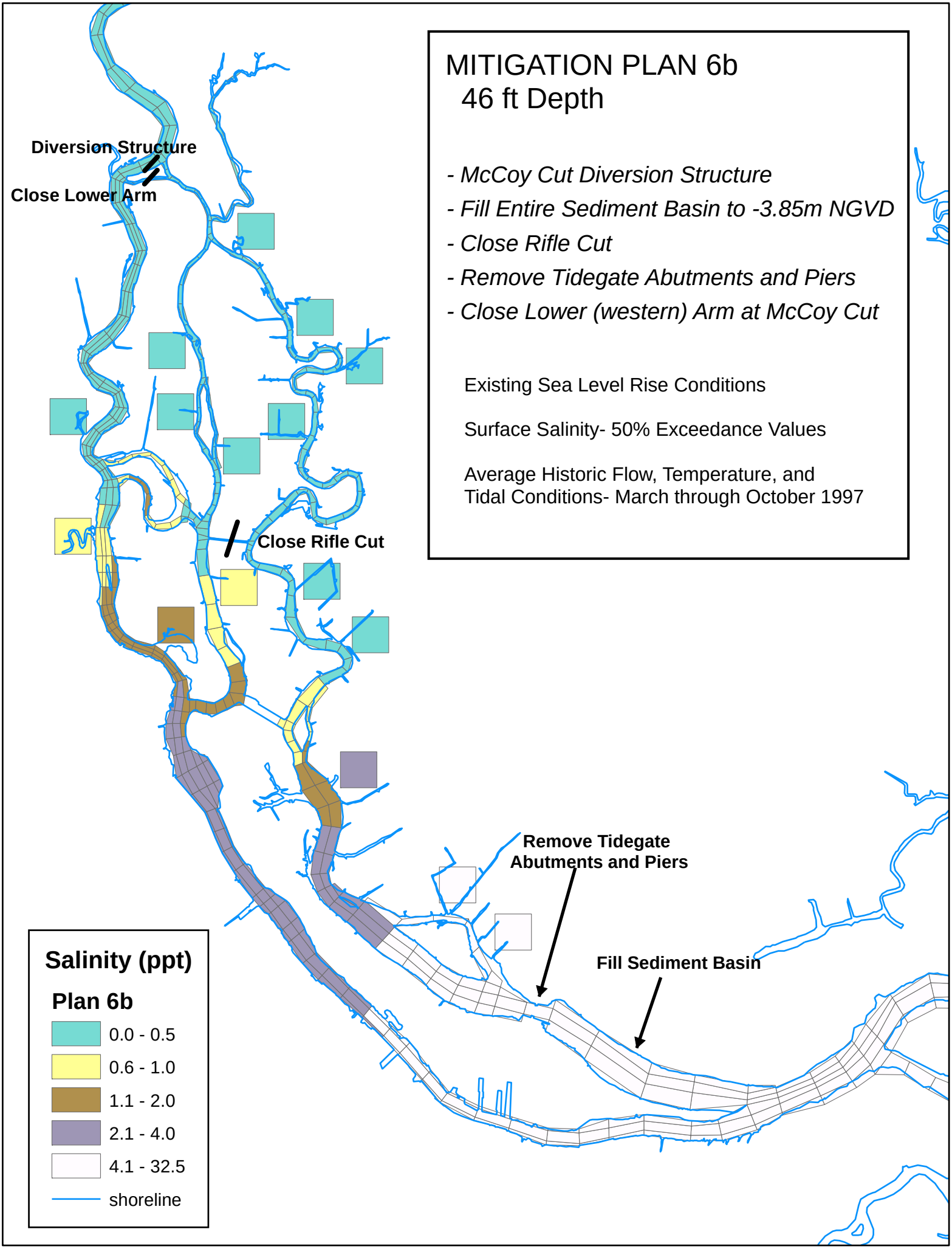

MITIGATION PLAN 6
46 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Remove Tidegate Abutments and Piers
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Salinity (ppt)
Plan 6
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline

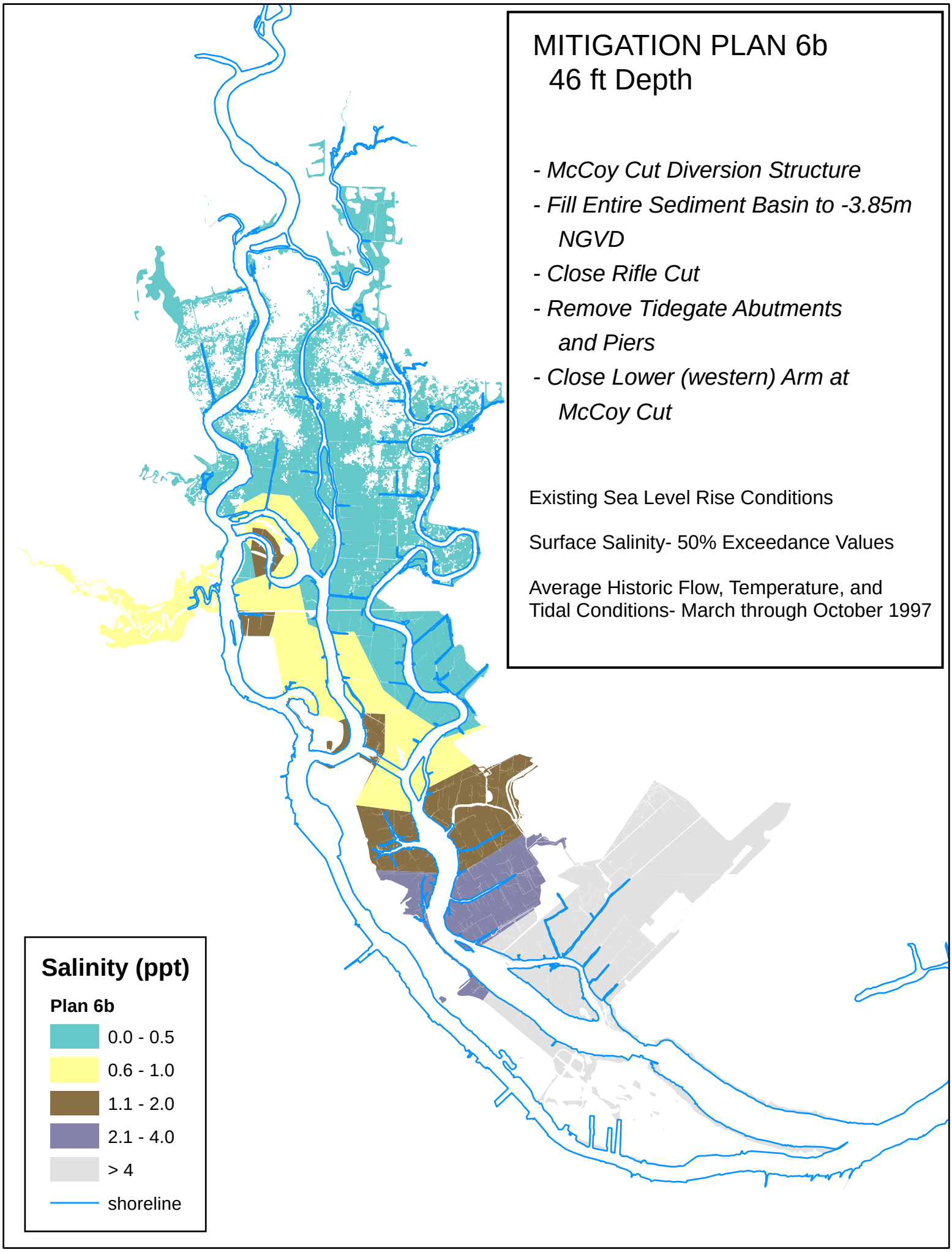

MITIGATION PLAN 6
48 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Remove Tidegate Abutments and Piers
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Diversion Structure
Limit of Deepening to -4m NGVD
Limit of Deepening to -3m NGVD
Close Rifle Cut
Remove Tidegate Abutments and Piers
Fill Sediment Basin
Salinity (ppt)
Plan 6
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5
shoreline

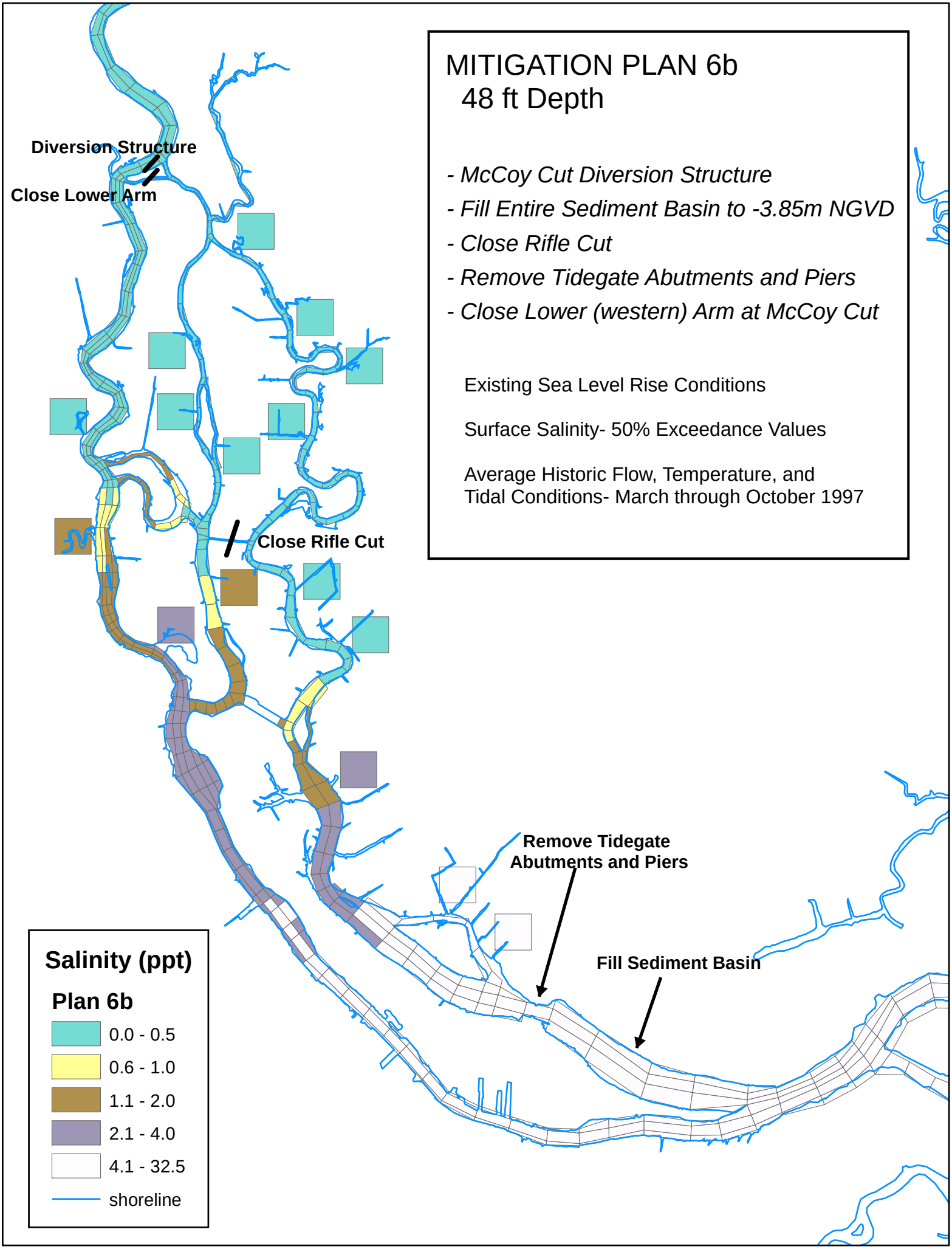

MITIGATION PLAN 6
48 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Remove Tidegate Abutments and Piers
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Salinity (ppt)
Plan 6
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline

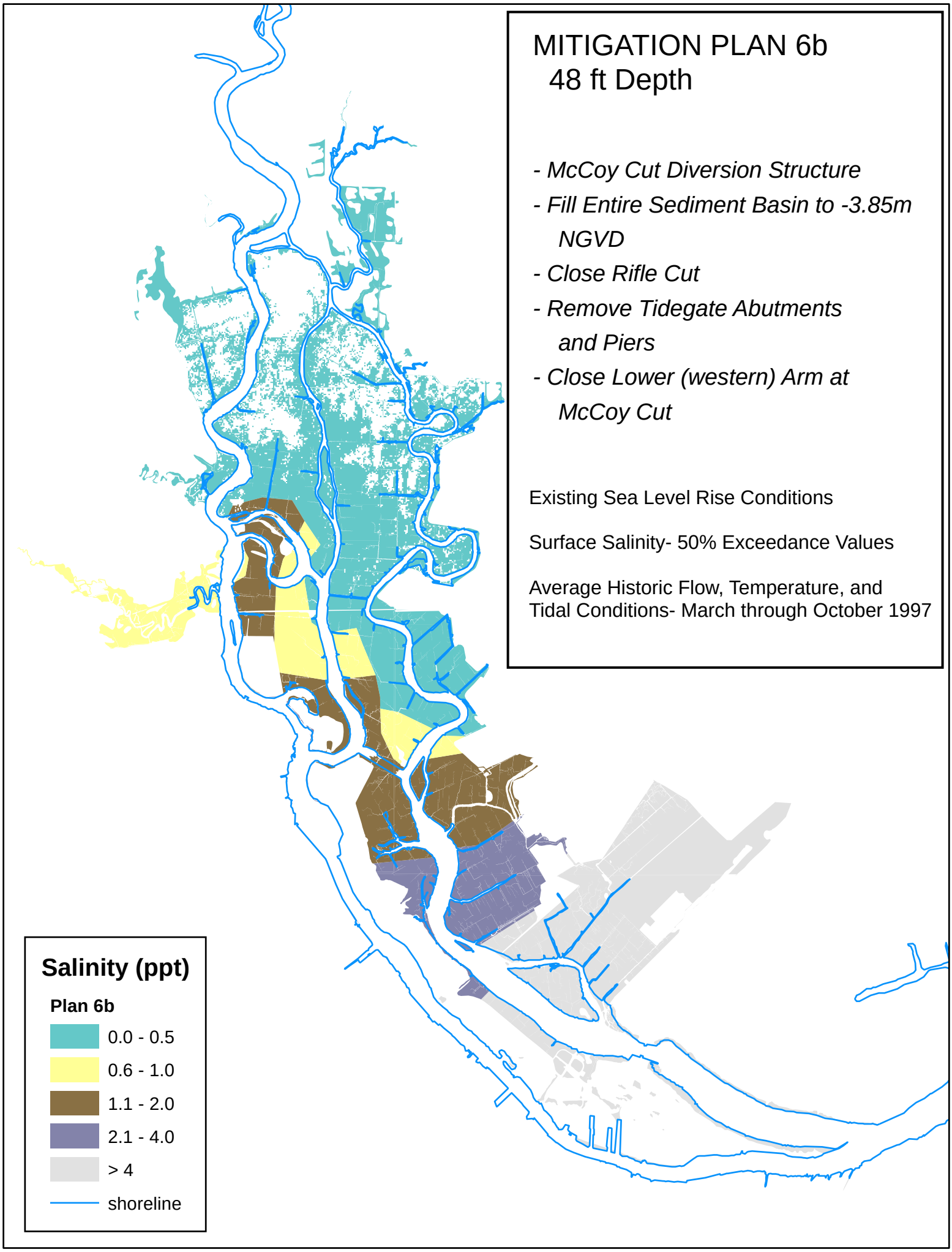

MITIGATION PLAN 6b
45 ft Depth
- McCoy Cut Diversion Structure
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Remove Tidegate Abutments and Piers
- Close Lower (western) Arm at McCoy Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Diversion Structure
Close Lower Arm
Close Rifle Cut
Remove Tidegate Abutments and Piers
Fill Sediment Basin
Salinity (ppt)
Plan 6b
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5
shoreline

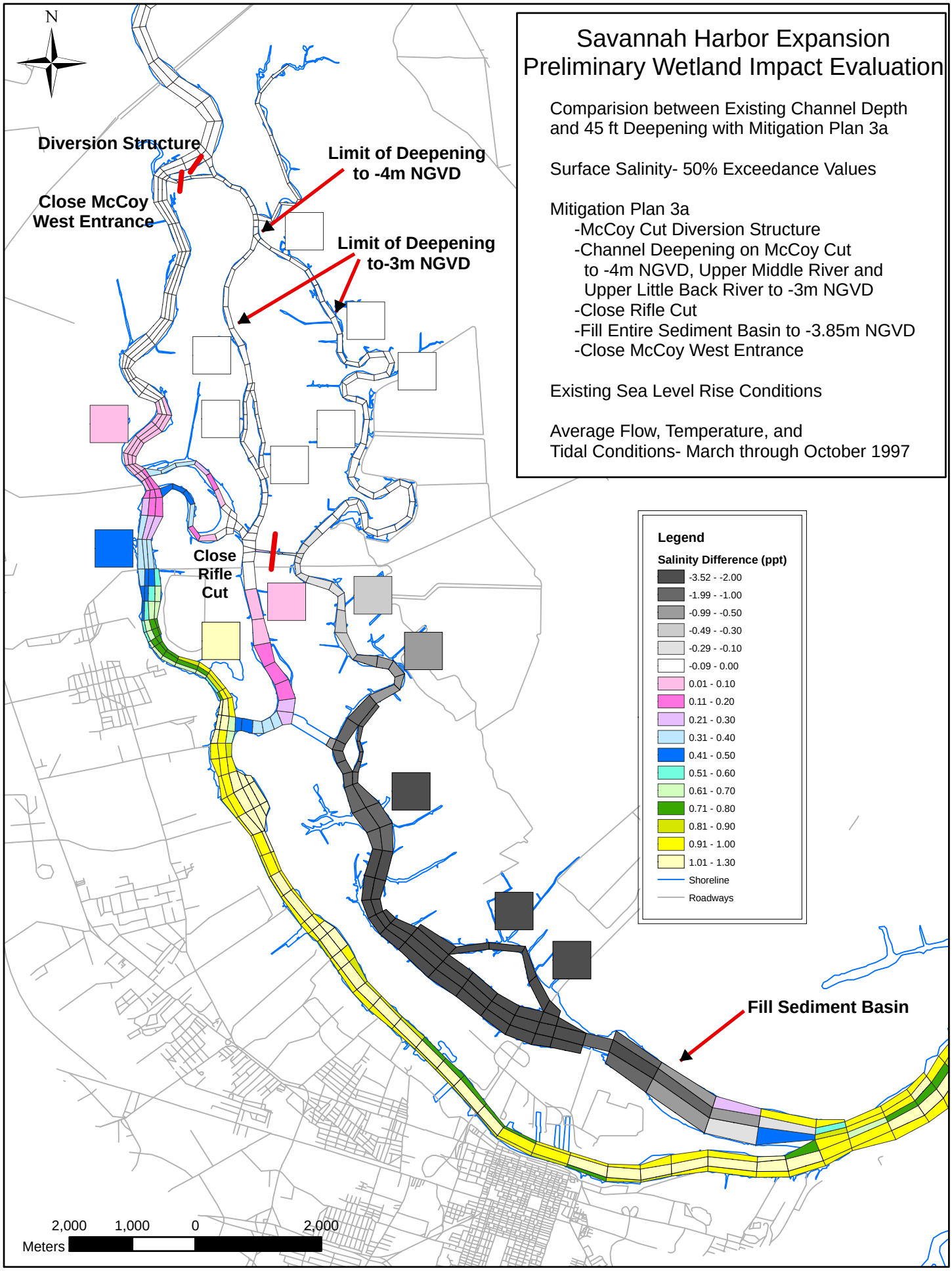

MITIGATION PLAN 6b
45 ft Depth
- McCoy Cut Diversion Structure
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Remove Tidegate Abutments and Piers
- Close Lower (western) Arm at McCoy Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Salinity (ppt)
Plan 6b
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline


MITIGATION PLAN 6b
46 ft Depth
- McCoy Cut Diversion Structure
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Remove Tidegate Abutments and Piers
- Close Lower (western) Arm at McCoy Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Diversion Structure
Close Lower Arm
Close Rifle Cut
Remove Tidegate Abutments and Piers
Fill Sediment Basin
Salinity (ppt)
Plan 6b
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5
shoreline

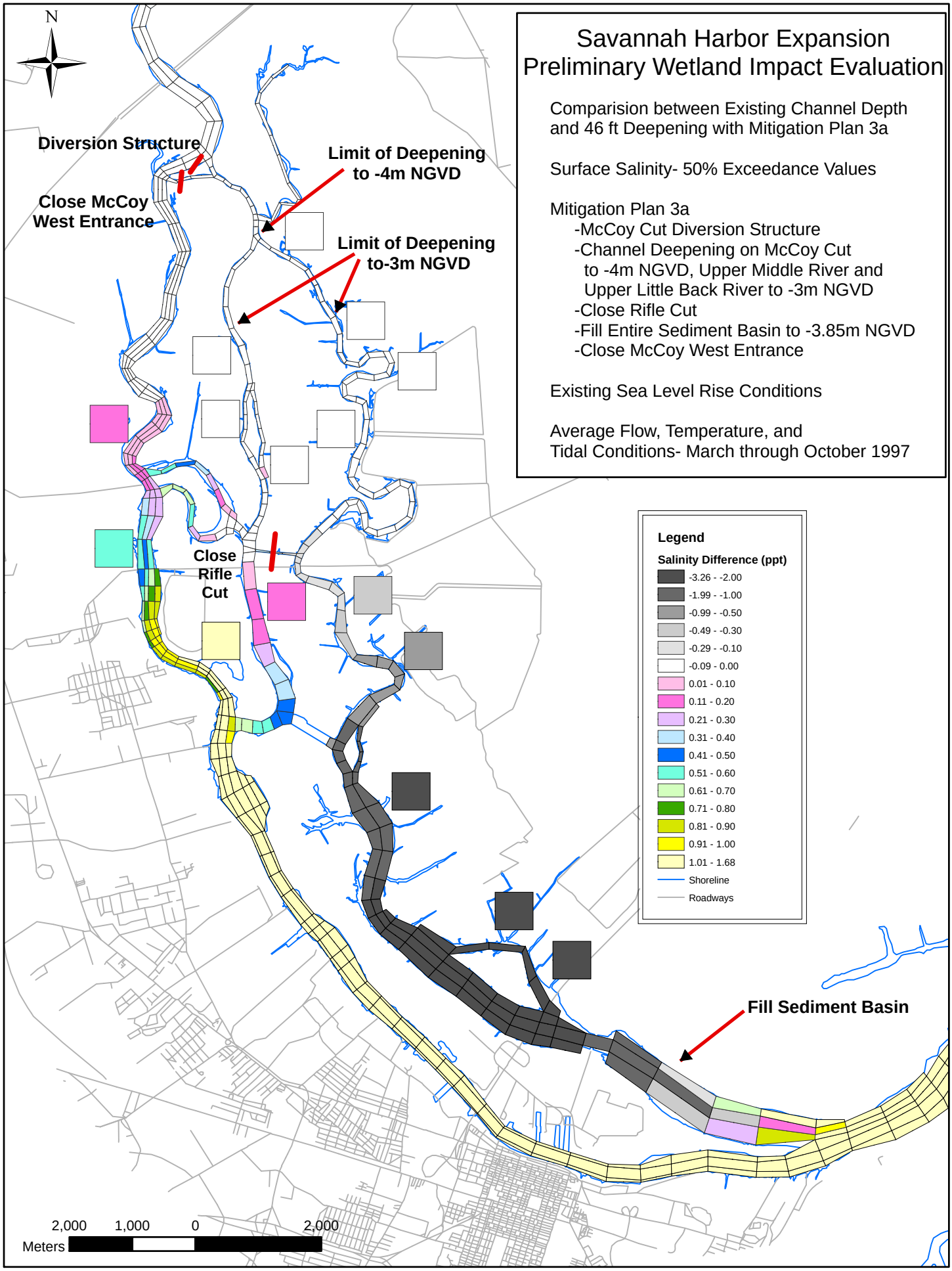

MITIGATION PLAN 6b
46 ft Depth
- McCoy Cut Diversion Structure
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Remove Tidegate Abutments and Piers
- Close Lower (western) Arm at McCoy Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Salinity (ppt)
Plan 6b
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline


MITIGATION PLAN 6b
48 ft Depth
- McCoy Cut Diversion Structure
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Remove Tidegate Abutments and Piers
- Close Lower (western) Arm at McCoy Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Diversion Structure
Close Lower Arm
Close Rifle Cut
Remove Tidegate Abutments and Piers
Fill Sediment Basin
Salinity (ppt)
Plan 6b
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5
shoreline

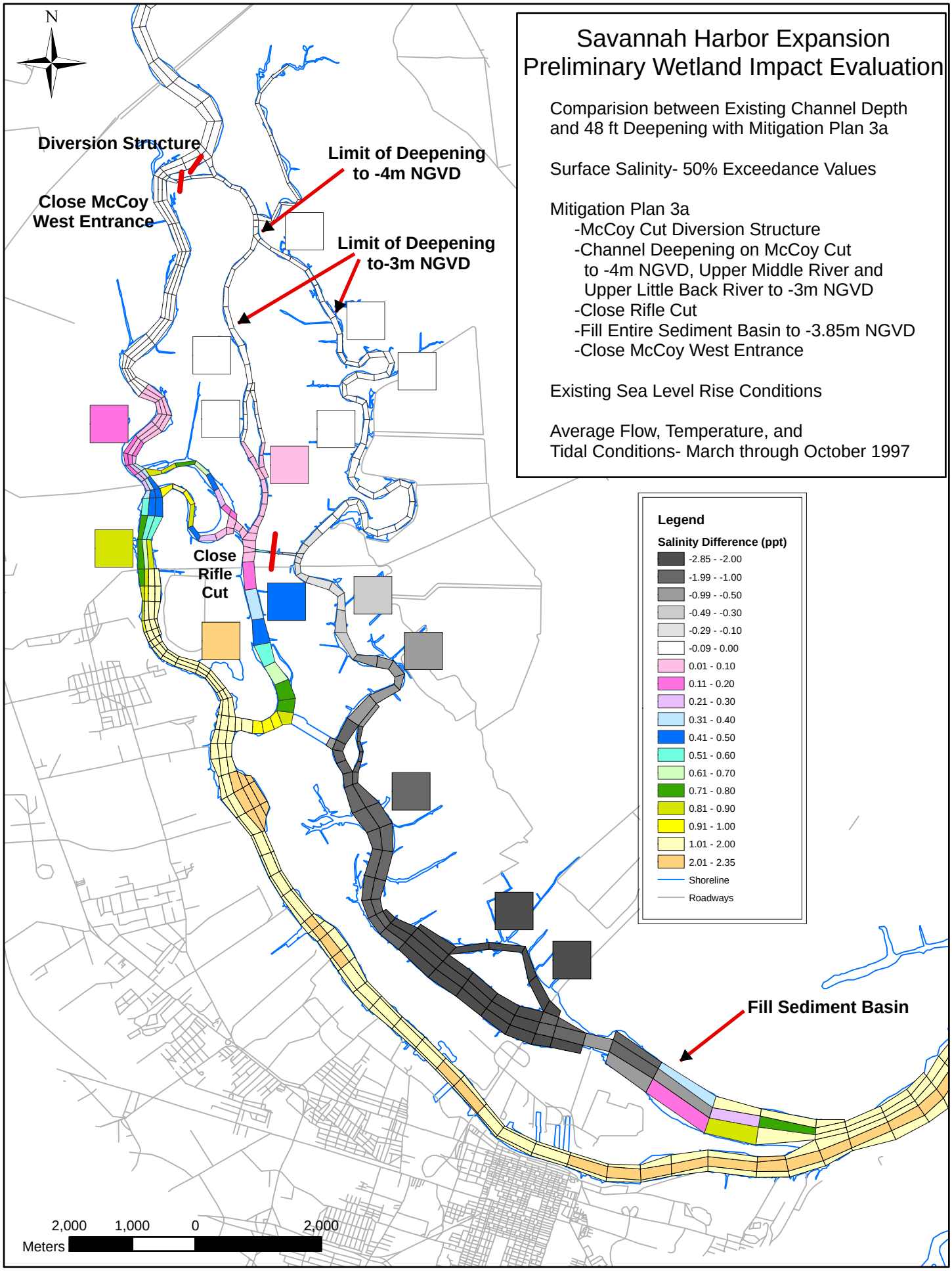

MITIGATION PLAN 6b
48 ft Depth
- McCoy Cut Diversion Structure
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Remove Tidegate Abutments and Piers
- Close Lower (western) Arm at McCoy Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Salinity (ppt)
Plan 6b
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline


Savannah Harbor Expansion
Preliminary Wetland Impact Evaluation
Comparision between Existing Channel Depth and 45 ft Deepening with Mitigation Plan 3a
Surface Salinity- 50% Exceedance Values
Mitigation Plan 3a
-McCoy Cut Diversion Structure
-Channel Deepening on McCoy Cut to -4m NGVD, Upper Middle River and Upper Little Back River to -3m NGVD
-Close Rifle Cut
-Fill Entire Sediment Basin to -3.85m NGVD
-Close McCoy West Entrance
Existing Sea Level Rise Conditions
Average Flow, Temperature, and Tidal Conditions- March through October 1997
N
Diversion Structure
Close McCoy West Entrance
Limit of Deepening to -4m NGVD
Limit of Deepening to-3m NGVD
Close Rifle Cut
Fill Sediment Basin
Legend
Salinity Difference (ppt)
-3.52 - -2.00
-1.99 - -1.00
-0.99 - -0.50
-0.49 - -0.30
-0.29 - -0.10
-0.09 - 0.00
0.01 - 0.10
0.11 - 0.20
0.21 - 0.30
0.31 - 0.40
0.41 - 0.50
0.51 - 0.60
0.61 - 0.70
0.71 - 0.80
0.81 - 0.90
0.91 - 1.00
1.01 - 1.30
Shoreline
Roadways
2,000 1,000 0 2,000
Meters

July 2007


Savannah Harbor Expansion
Preliminary Wetland Impact Evaluation
Comparision between Existing Channel Depth and 46 ft Deepening with Mitigation Plan 3a
Surface Salinity- 50% Exceedance Values
Mitigation Plan 3a
-McCoy Cut Diversion Structure
-Channel Deepening on McCoy Cut to -4m NGVD, Upper Middle River and Upper Little Back River to -3m NGVD
-Close Rifle Cut
-Fill Entire Sediment Basin to -3.85m NGVD
-Close McCoy West Entrance
Existing Sea Level Rise Conditions
Average Flow, Temperature, and Tidal Conditions- March through October 1997
N
Diversion Structure
Close McCoy West Entrance
Limit of Deepening to -4m NGVD
Limit of Deepening to-3m NGVD
Close Rifle Cut
Fill Sediment Basin
Legend
Salinity Difference (ppt)
-3.26 - -2.00
-1.99 - -1.00
-0.99 - -0.50
-0.49 - -0.30
-0.29 - -0.10
-0.09 - 0.00
0.01 - 0.10
0.11 - 0.20
0.21 - 0.30
0.31 - 0.40
0.41 - 0.50
0.51 - 0.60
0.61 - 0.70
0.71 - 0.80
0.81 - 0.90
0.91 - 1.00
1.01 - 1.68
Shoreline
Roadways
2,000 1,000 0 2,000
Meters

July 2007


Savannah Harbor Expansion
Preliminary Wetland Impact Evaluation
Comparision between Existing Channel Depth and 48 ft Deepening with Mitigation Plan 3a
Surface Salinity- 50% Exceedance Values
Mitigation Plan 3a
-McCoy Cut Diversion Structure
-Channel Deepening on McCoy Cut to -4m NGVD, Upper Middle River and Upper Little Back River to -3m NGVD
-Close Rifle Cut
-Fill Entire Sediment Basin to -3.85m NGVD
-Close McCoy West Entrance
Existing Sea Level Rise Conditions
Average Flow, Temperature, and Tidal Conditions- March through October 1997
N
Diversion Structure
Close McCoy West Entrance
Limit of Deepening to -4m NGVD
Limit of Deepening to-3m NGVD
Close Rifle Cut
Fill Sediment Basin
Legend
Salinity Difference (ppt)
-2.85 - -2.00
-1.99 - -1.00
-0.99 - -0.50
-0.49 - -0.30
-0.29 - -0.10
-0.09 - 0.00
0.01 - 0.10
0.11 - 0.20
0.21 - 0.30
0.31 - 0.40
0.41 - 0.50
0.51 - 0.60
0.61 - 0.70
0.71 - 0.80
0.81 - 0.90
0.91 - 1.00
1.01 - 2.00
2.01 - 2.35
Shoreline
Roadways
2,000 1,000 0 2,000
Meters

July 2007

oy
nce

Savannah Harbor Expansion
Preliminary Wetland Impact Evaluation

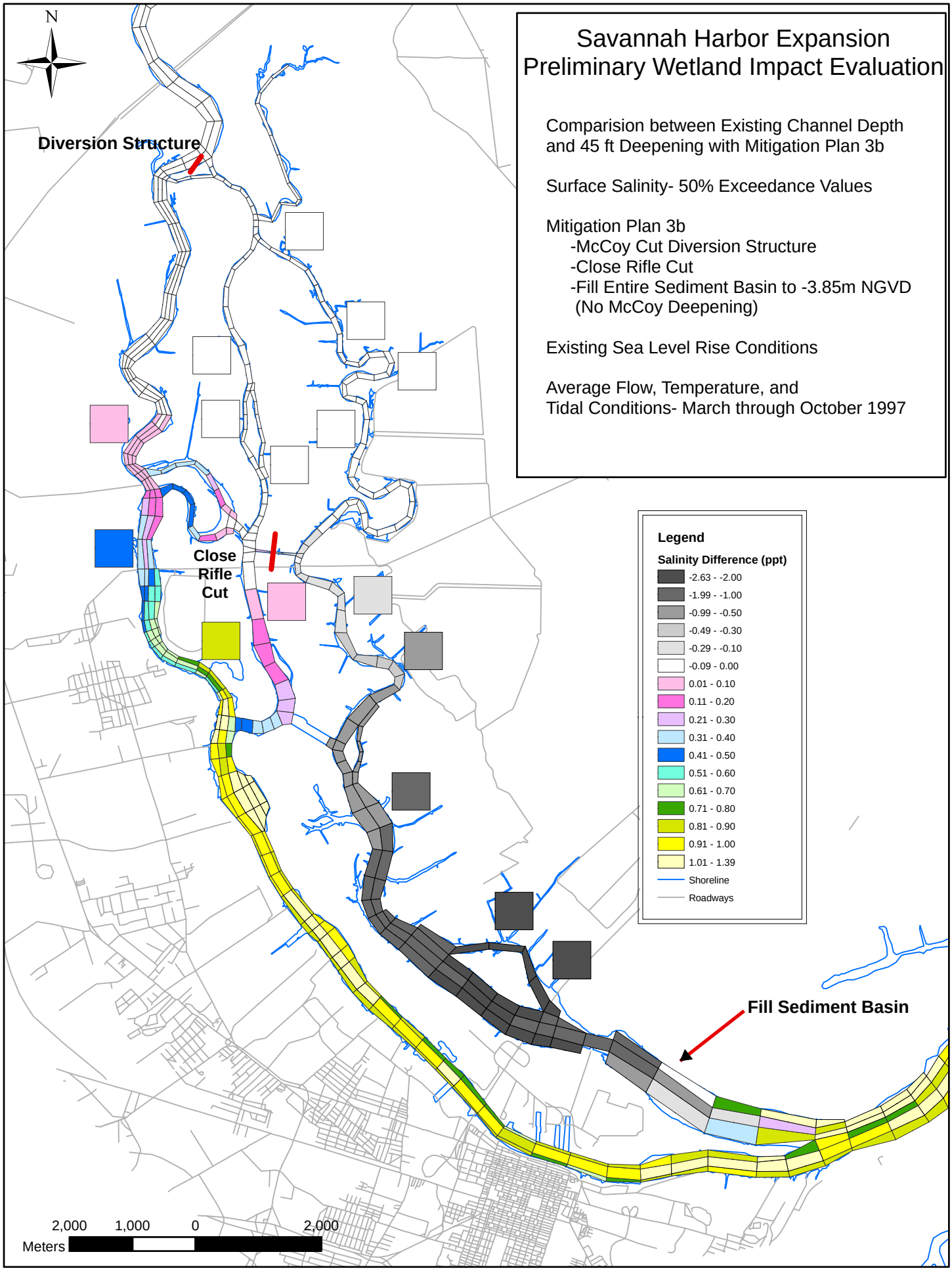
Comparision between Existing Channel Depth and 45 ft Deepening with Mitigation Plan 3b

Surface Salinity- 50% Exceedance Values

Mitigation Plan 3b
- -McCoy Cut Diversion Structure
- -Close Rifle Cut
- -Fill Entire Sediment Basin to -3.85m NGVD (No McCoy Deepening)

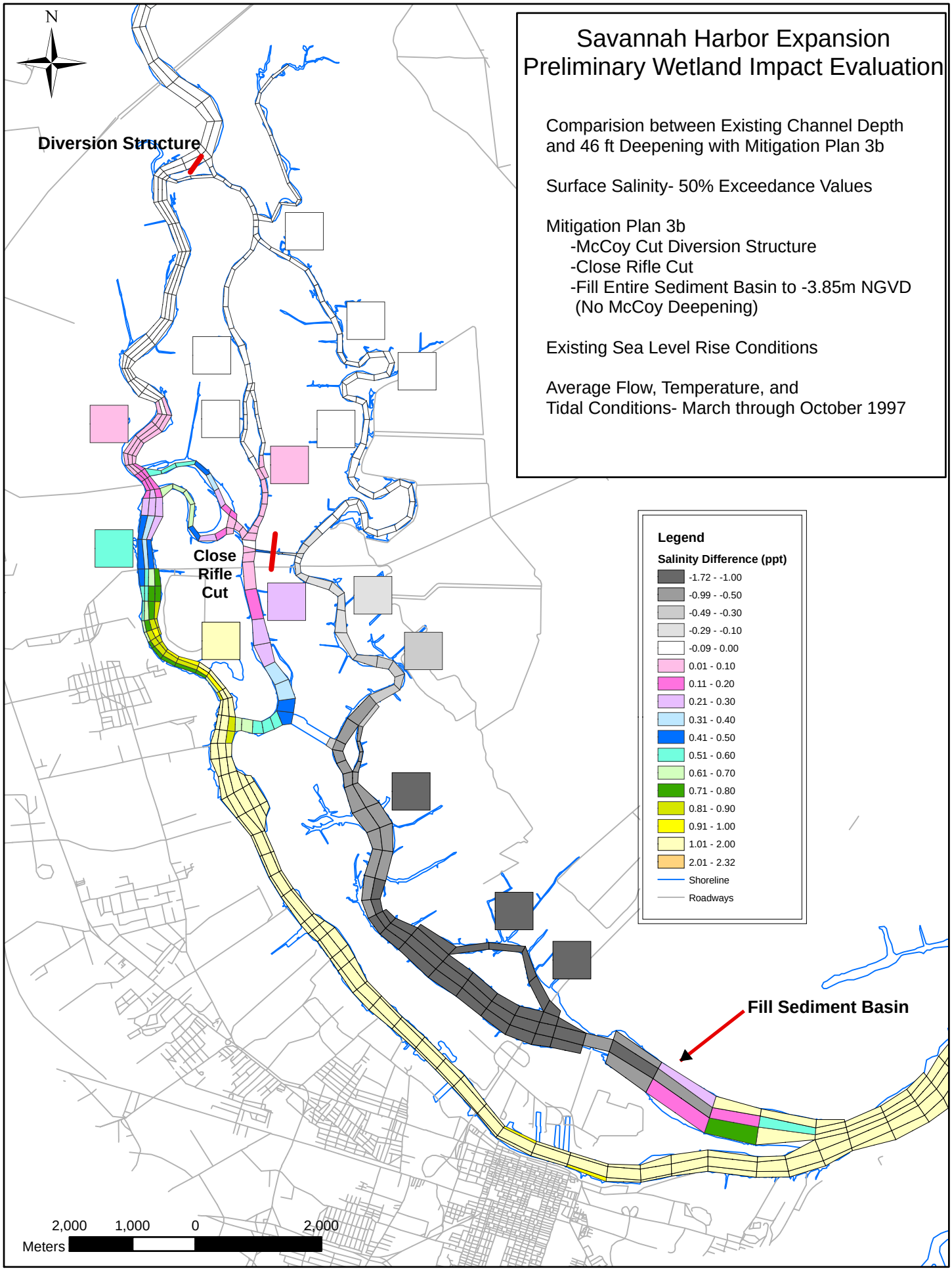
Existing Sea Level Rise Conditions

Average Flow, Temperature, and Tidal Conditions- March through October 1997

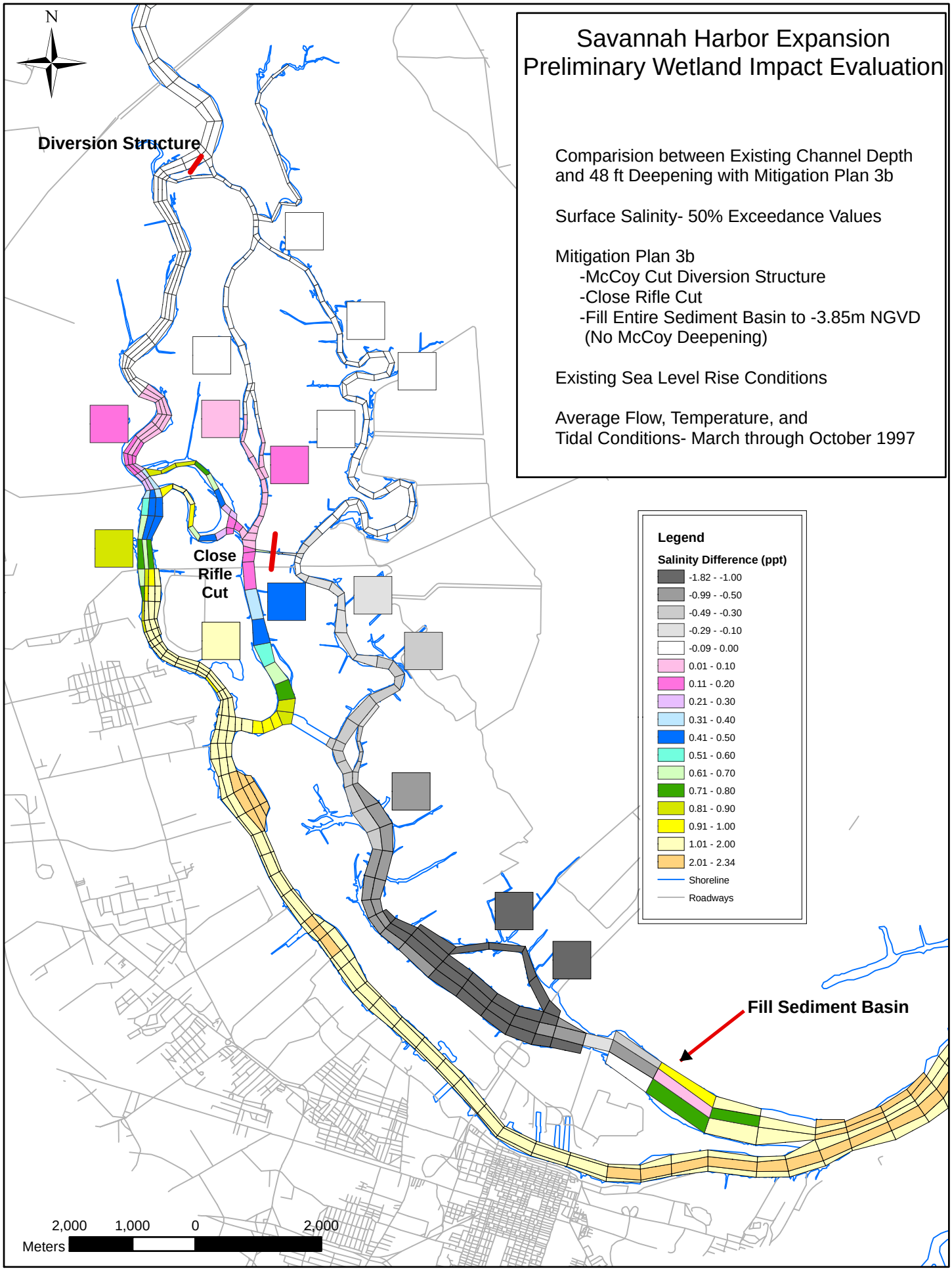


July 2007

oy
nce



July 2007



Savannah Harbor Expansion
Preliminary Wetland Impact Evaluation

Comparision between Existing Channel Depth and 48 ft Deepening with Mitigation Plan 3b

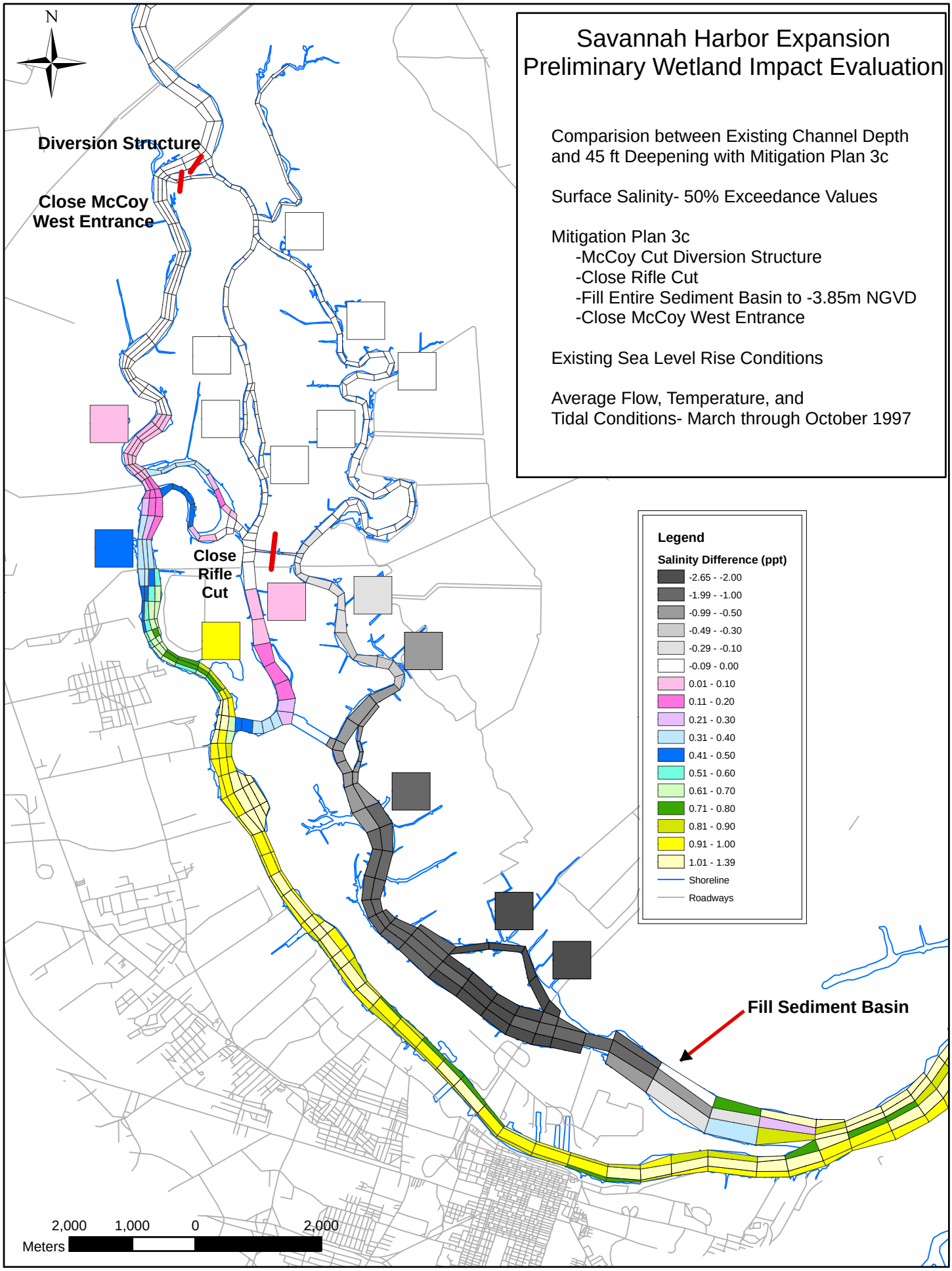
Surface Salinity- 50% Exceedance Values

Mitigation Plan 3b
- -McCoy Cut Diversion Structure
- -Close Rifle Cut
- -Fill Entire Sediment Basin to -3.85m NGVD (No McCoy Deepening)

Existing Sea Level Rise Conditions

Average Flow, Temperature, and Tidal Conditions- March through October 1997

July 2007



Savannah Harbor Expansion
Preliminary Wetland Impact Evaluation

Comparision between Existing Channel Depth and 45 ft Deepening with Mitigation Plan 3c

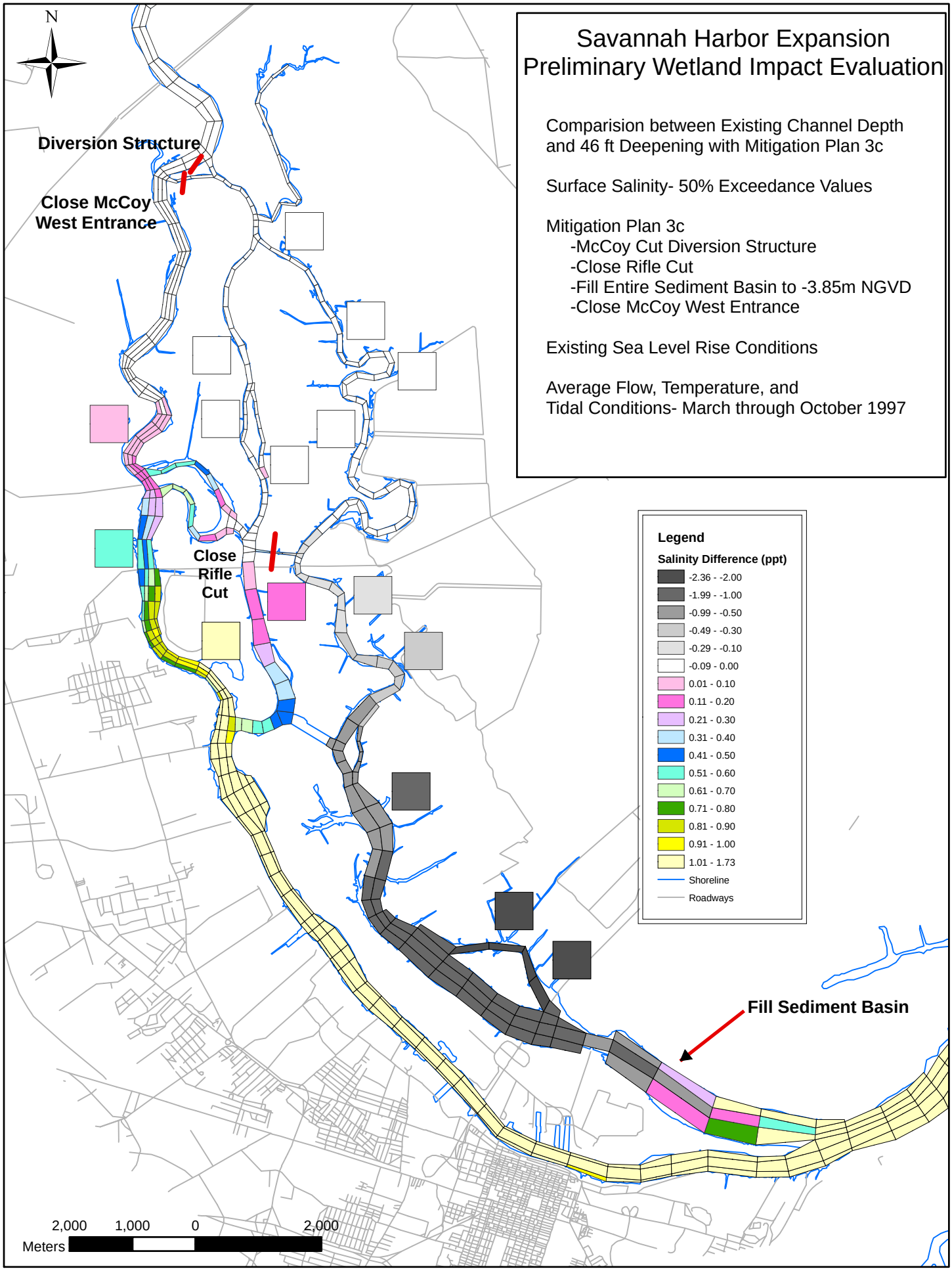
Surface Salinity- 50% Exceedance Values

Mitigation Plan 3c
- -McCoy Cut Diversion Structure
- -Close Rifle Cut
- -Fill Entire Sediment Basin to -3.85m NGVD
- -Close McCoy West Entrance

Existing Sea Level Rise Conditions

Average Flow, Temperature, and Tidal Conditions- March through October 1997

July 2007



Savannah Harbor Expansion
Preliminary Wetland Impact Evaluation

Comparision between Existing Channel Depth and 46 ft Deepening with Mitigation Plan 3c

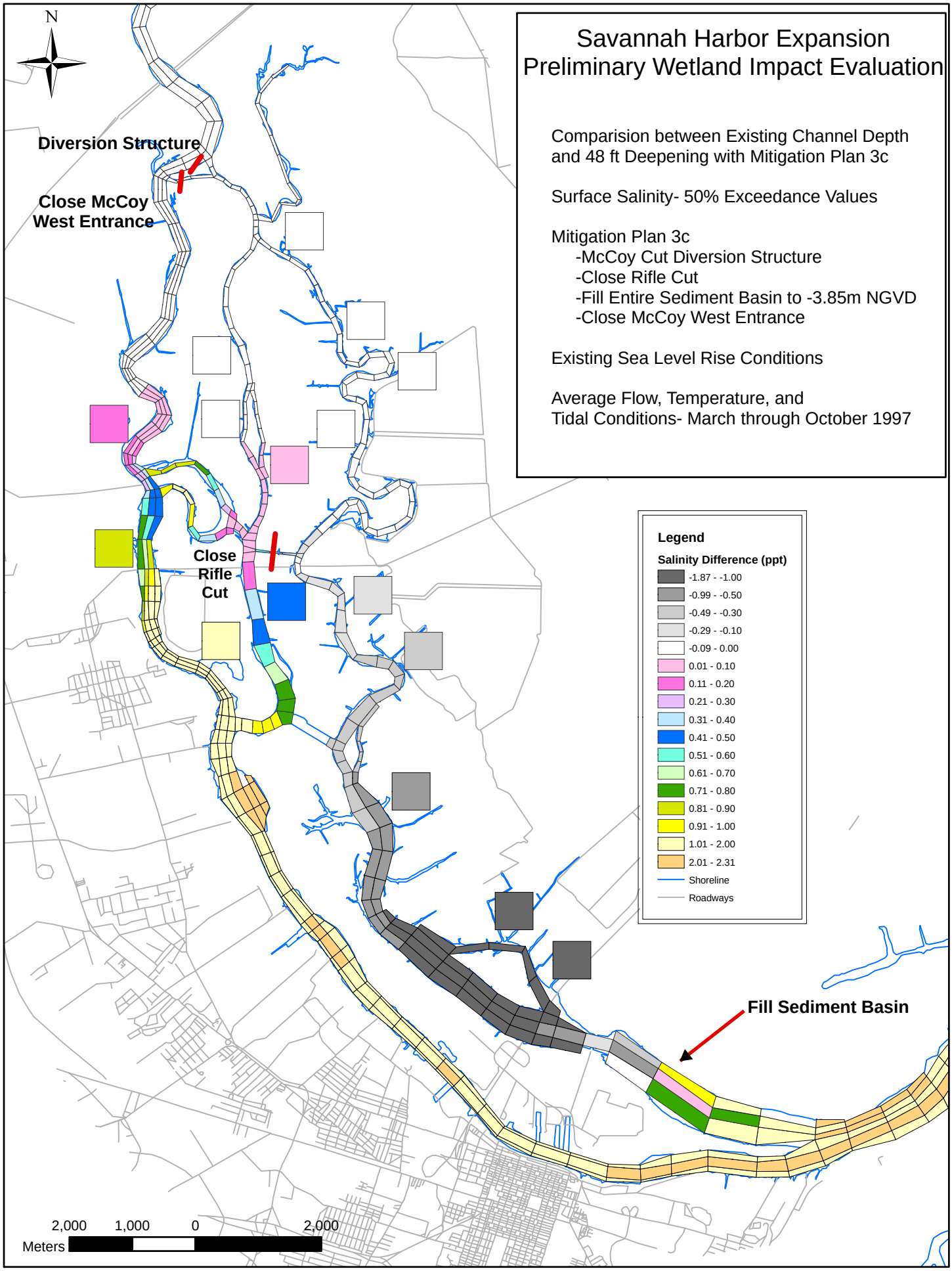
Surface Salinity- 50% Exceedance Values

Mitigation Plan 3c
- -McCoy Cut Diversion Structure
- -Close Rifle Cut
- -Fill Entire Sediment Basin to -3.85m NGVD
- -Close McCoy West Entrance

Existing Sea Level Rise Conditions

Average Flow, Temperature, and Tidal Conditions- March through October 1997

July 2007



Savannah Harbor Expansion
Preliminary Wetland Impact Evaluation

Comparision between Existing Channel Depth and 48 ft Deepening with Mitigation Plan 3c

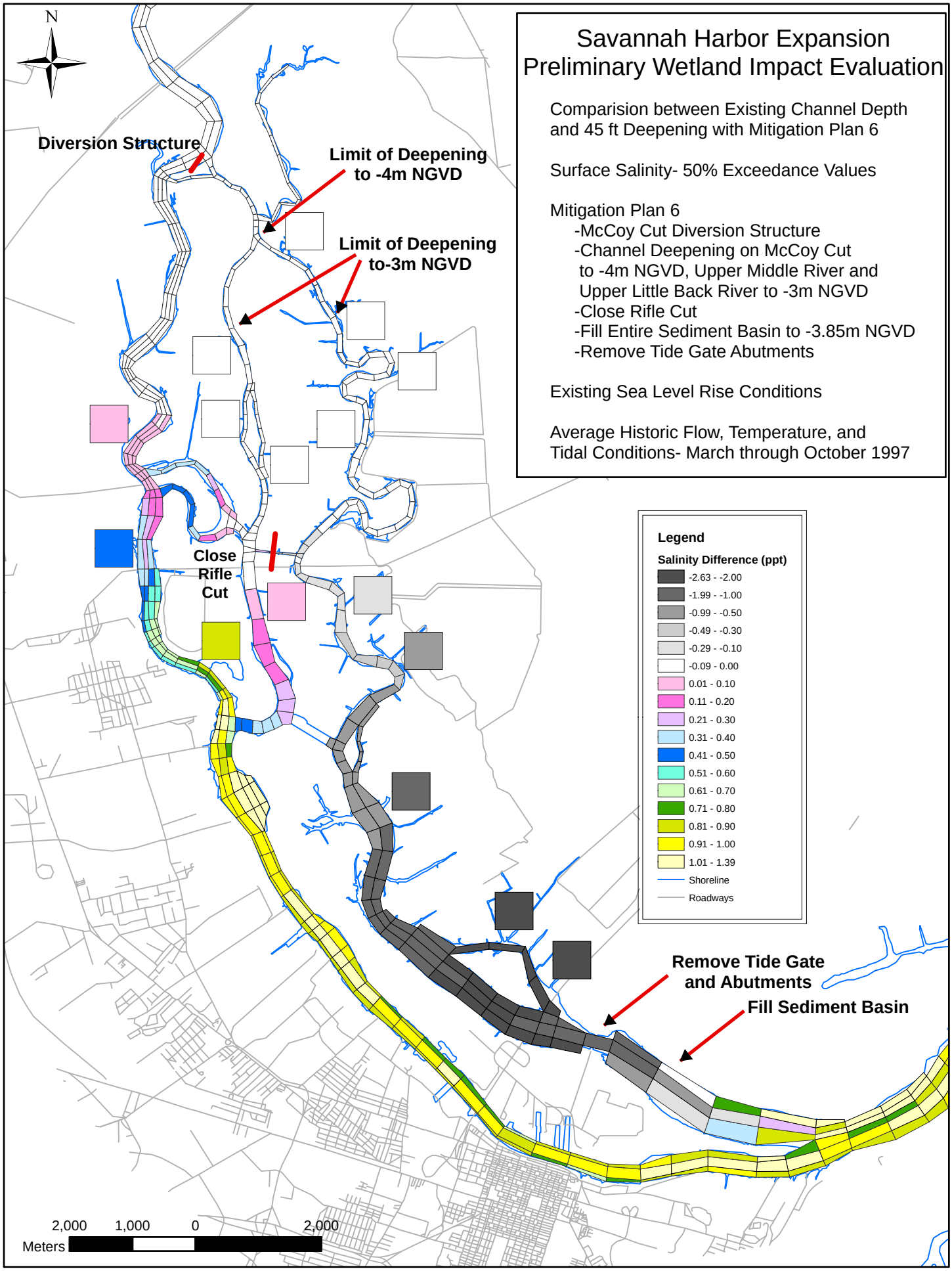
Surface Salinity- 50% Exceedance Values

Mitigation Plan 3c
- -McCoy Cut Diversion Structure
- -Close Rifle Cut
- -Fill Entire Sediment Basin to -3.85m NGVD
- -Close McCoy West Entrance

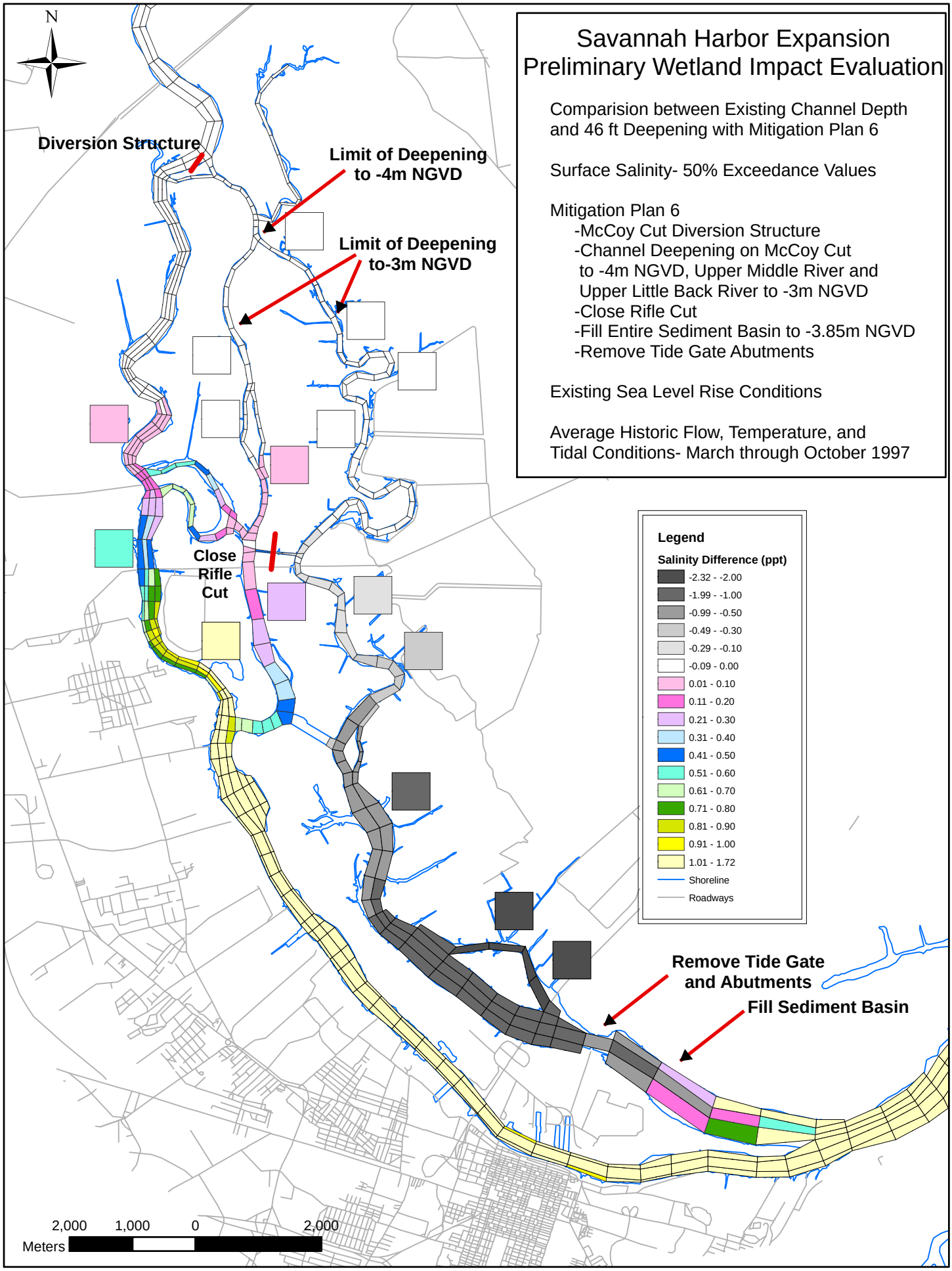
Existing Sea Level Rise Conditions

Average Flow, Temperature, and Tidal Conditions- March through October 1997

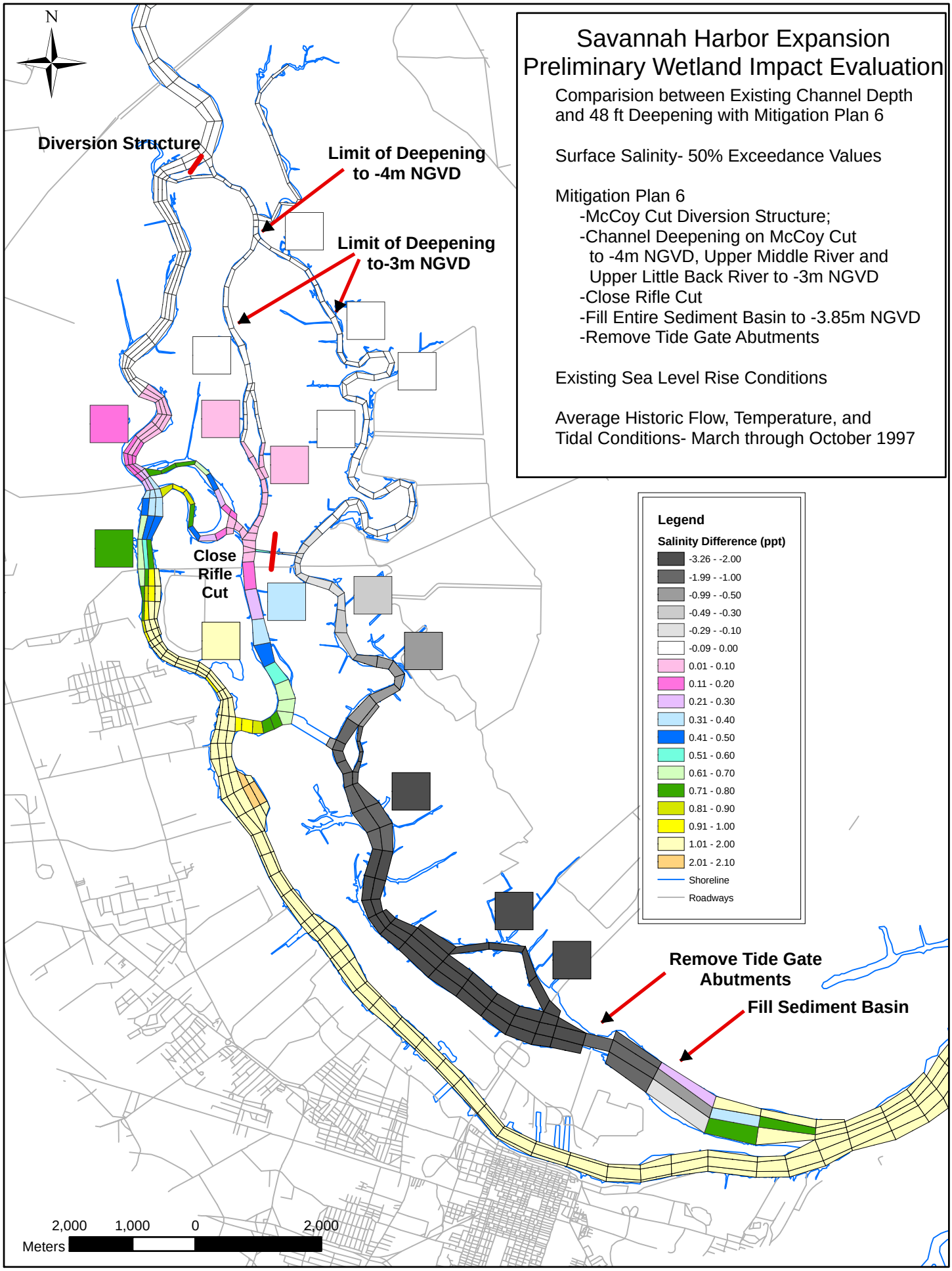
July 2007


Savannah Harbor Expansion
Preliminary Wetland Impact Evaluation
Comparision between Existing Channel Depth and 45 ft Deepening with Mitigation Plan 6
Surface Salinity- 50% Exceedance Values
Mitigation Plan 6
-McCoy Cut Diversion Structure
-Channel Deepening on McCoy Cut to -4m NGVD, Upper Middle River and Upper Little Back River to -3m NGVD
-Close Rifle Cut
-Fill Entire Sediment Basin to -3.85m NGVD
-Remove Tide Gate Abutments
Existing Sea Level Rise Conditions
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
N
Diversion Structure
Limit of Deepening to -4m NGVD
Limit of Deepening to-3m NGVD
Close Rifle Cut
Remove Tide Gate and Abutments
Fill Sediment Basin
Legend
Salinity Difference (ppt)
-2.63 - -2.00
-1.99 - -1.00
-0.99 - -0.50
-0.49 - -0.30
-0.29 - -0.10
-0.09 - 0.00
0.01 - 0.10
0.11 - 0.20
0.21 - 0.30
0.31 - 0.40
0.41 - 0.50
0.51 - 0.60
0.61 - 0.70
0.71 - 0.80
0.81 - 0.90
0.91 - 1.00
1.01 - 1.39
Shoreline
Roadways
2,000 1,000 0 2,000
Meters

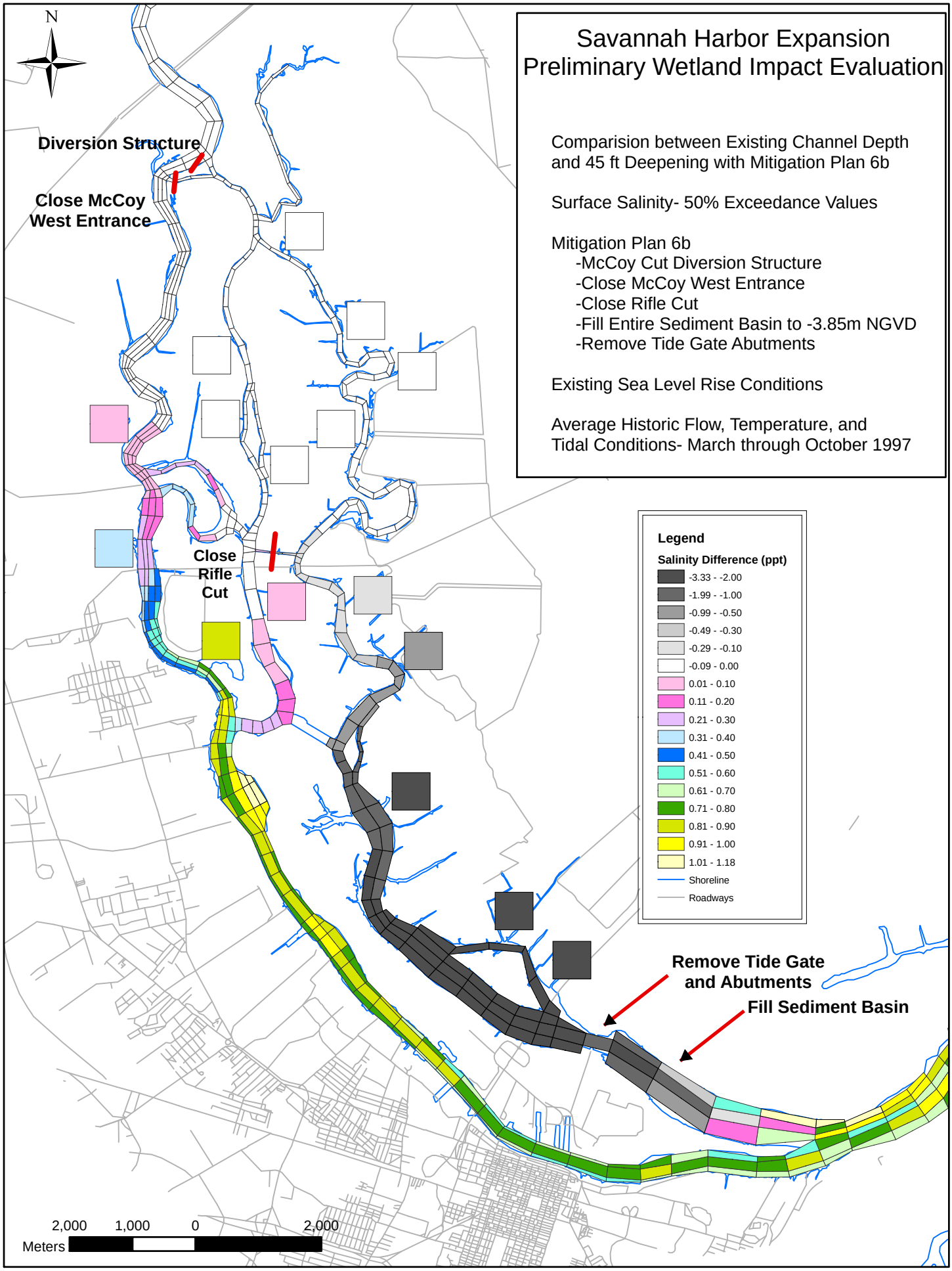
July 2007


Savannah Harbor Expansion
Preliminary Wetland Impact Evaluation
Comparision between Existing Channel Depth and 46 ft Deepening with Mitigation Plan 6
Surface Salinity- 50% Exceedance Values
Mitigation Plan 6
-McCoy Cut Diversion Structure
-Channel Deepening on McCoy Cut to -4m NGVD, Upper Middle River and Upper Little Back River to -3m NGVD
-Close Rifle Cut
-Fill Entire Sediment Basin to -3.85m NGVD
-Remove Tide Gate Abutments
Existing Sea Level Rise Conditions
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
N
Diversion Structure
Limit of Deepening to -4m NGVD
Limit of Deepening to-3m NGVD
Close Rifle Cut
Remove Tide Gate and Abutments
Fill Sediment Basin
Legend
Salinity Difference (ppt)
-2.32 - -2.00
-1.99 - -1.00
-0.99 - -0.50
-0.49 - -0.30
-0.29 - -0.10
-0.09 - 0.00
0.01 - 0.10
0.11 - 0.20
0.21 - 0.30
0.31 - 0.40
0.41 - 0.50
0.51 - 0.60
0.61 - 0.70
0.71 - 0.80
0.81 - 0.90
0.91 - 1.00
1.01 - 1.72
Shoreline
Roadways
2,000 1,000 0 2,000
Meters

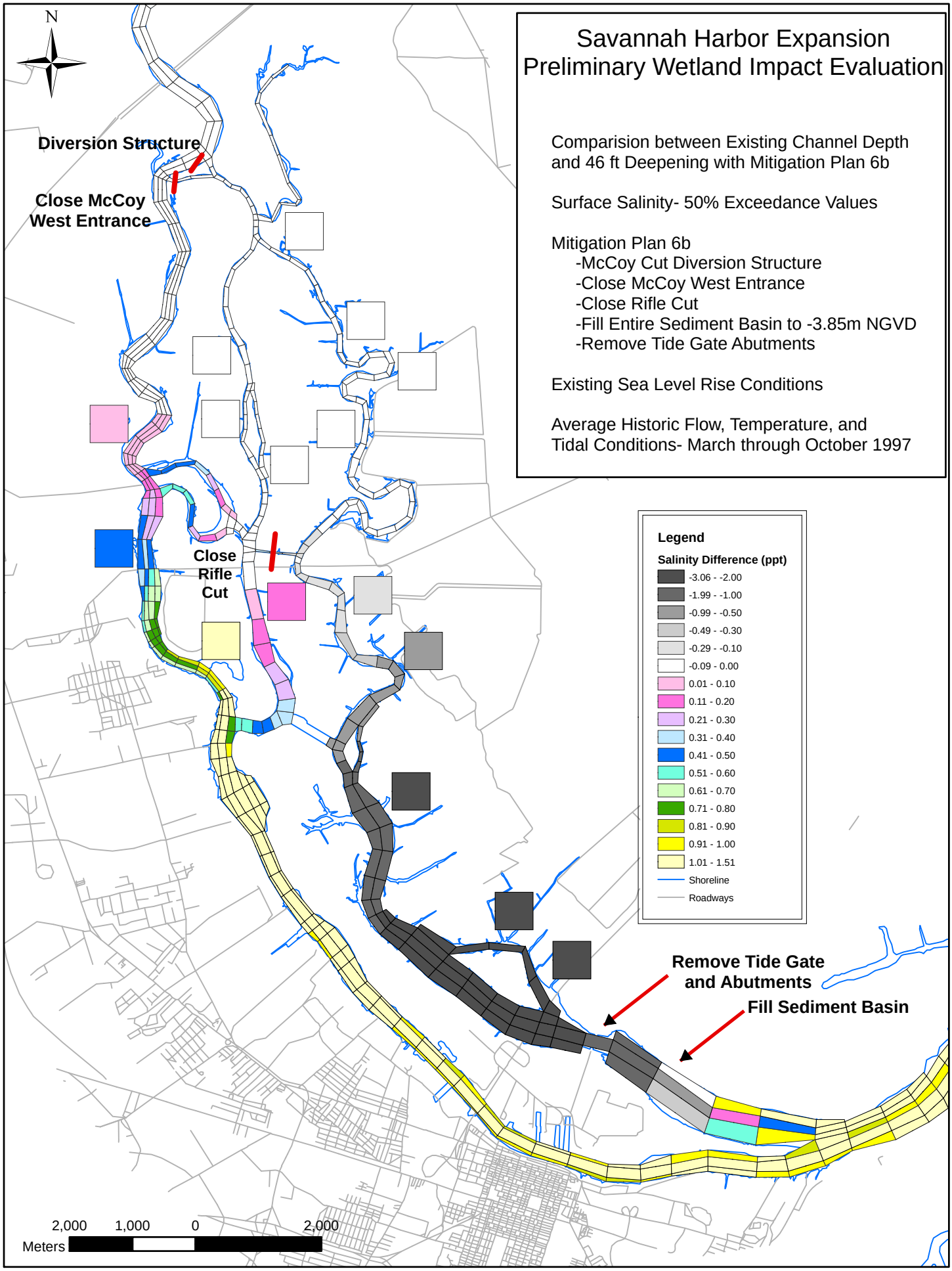
July 2007


Savannah Harbor Expansion
Preliminary Wetland Impact Evaluation
Comparision between Existing Channel Depth and 48 ft Deepening with Mitigation Plan 6
Surface Salinity- 50% Exceedance Values
Mitigation Plan 6
-McCoy Cut Diversion Structure;
-Channel Deepening on McCoy Cut to -4m NGVD, Upper Middle River and Upper Little Back River to -3m NGVD
-Close Rifle Cut
-Fill Entire Sediment Basin to -3.85m NGVD
-Remove Tide Gate Abutments
Existing Sea Level Rise Conditions
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
N
Diversion Structure
Limit of Deepening to -4m NGVD
Limit of Deepening to-3m NGVD
Close Rifle Cut
Remove Tide Gate Abutments
Fill Sediment Basin
Legend
Salinity Difference (ppt)
-3.26 - -2.00
-1.99 - -1.00
-0.99 - -0.50
-0.49 - -0.30
-0.29 - -0.10
-0.09 - 0.00
0.01 - 0.10
0.11 - 0.20
0.21 - 0.30
0.31 - 0.40
0.41 - 0.50
0.51 - 0.60
0.61 - 0.70
0.71 - 0.80
0.81 - 0.90
0.91 - 1.00
1.01 - 2.00
2.01 - 2.10
Shoreline
Roadways
2,000 1,000 0 2,000
Meters

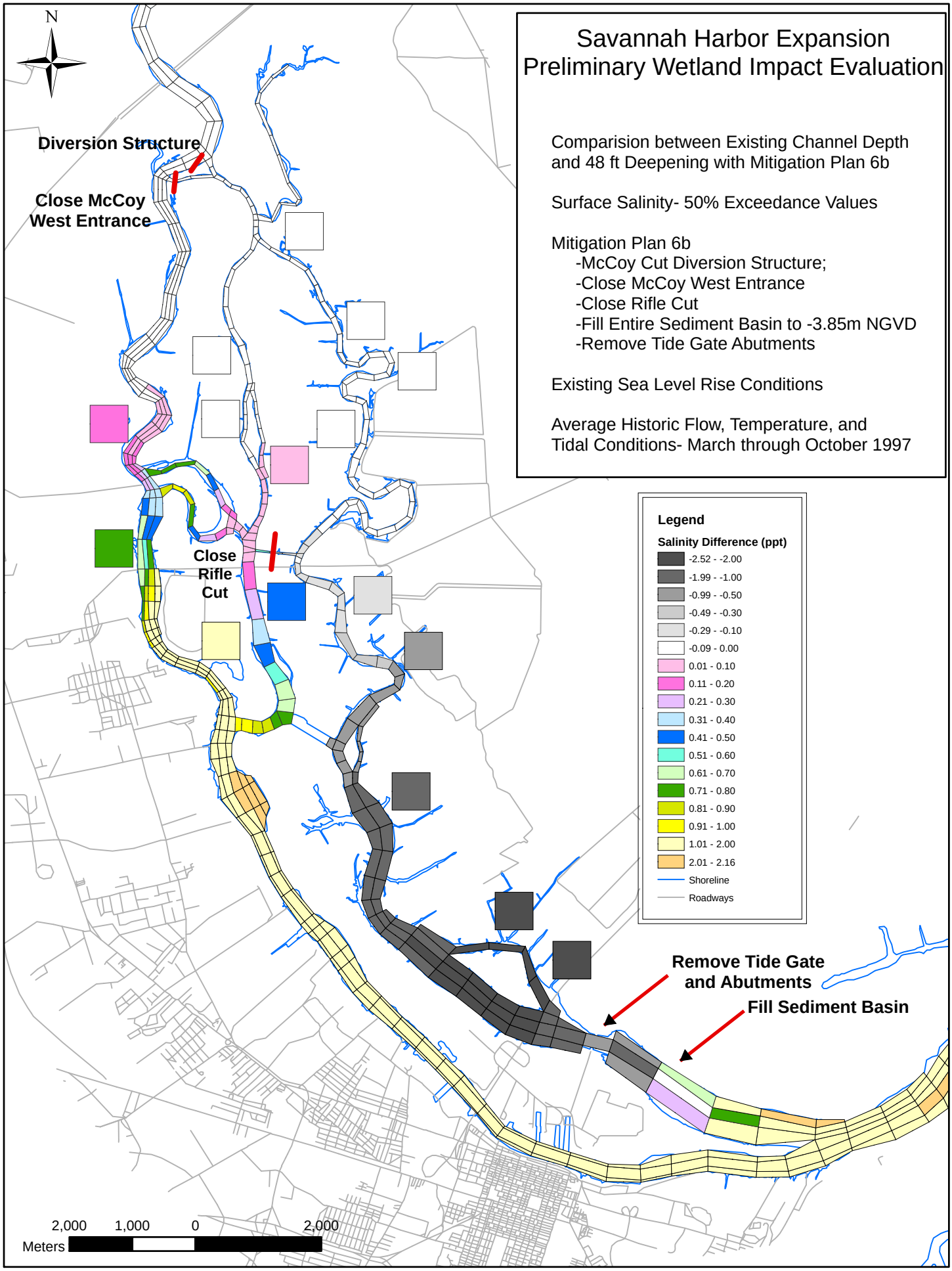
July 2007


Savannah Harbor Expansion
Preliminary Wetland Impact Evaluation
Comparision between Existing Channel Depth and 45 ft Deepening with Mitigation Plan 6b
Surface Salinity- 50% Exceedance Values
Mitigation Plan 6b
-McCoy Cut Diversion Structure
-Close McCoy West Entrance
-Close Rifle Cut
-Fill Entire Sediment Basin to -3.85m NGVD
-Remove Tide Gate Abutments
Existing Sea Level Rise Conditions
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
N
Diversion Structure
Close McCoy West Entrance
Close Rifle Cut
Remove Tide Gate and Abutments
Fill Sediment Basin
Legend
Salinity Difference (ppt)
-3.33 - -2.00
-1.99 - -1.00
-0.99 - -0.50
-0.49 - -0.30
-0.29 - -0.10
-0.09 - 0.00
0.01 - 0.10
0.11 - 0.20
0.21 - 0.30
0.31 - 0.40
0.41 - 0.50
0.51 - 0.60
0.61 - 0.70
0.71 - 0.80
0.81 - 0.90
0.91 - 1.00
1.01 - 1.18
Shoreline
Roadways
2,000 1,000 0 2,000
Meters

July 2007


Savannah Harbor Expansion
Preliminary Wetland Impact Evaluation
Comparision between Existing Channel Depth and 46 ft Deepening with Mitigation Plan 6b
Surface Salinity- 50% Exceedance Values
Mitigation Plan 6b
-McCoy Cut Diversion Structure
-Close McCoy West Entrance
-Close Rifle Cut
-Fill Entire Sediment Basin to -3.85m NGVD
-Remove Tide Gate Abutments
Existing Sea Level Rise Conditions
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
N
Diversion Structure
Close McCoy West Entrance
Close Rifle Cut
Remove Tide Gate and Abutments
Fill Sediment Basin
Legend
Salinity Difference (ppt)
-3.06 - -2.00
-1.99 - -1.00
-0.99 - -0.50
-0.49 - -0.30
-0.29 - -0.10
-0.09 - 0.00
0.01 - 0.10
0.11 - 0.20
0.21 - 0.30
0.31 - 0.40
0.41 - 0.50
0.51 - 0.60
0.61 - 0.70
0.71 - 0.80
0.81 - 0.90
0.91 - 1.00
1.01 - 1.51
Shoreline
Roadways
2,000 1,000 0 2,000
Meters

July 2007


Savannah Harbor Expansion
Preliminary Wetland Impact Evaluation
Comparision between Existing Channel Depth and 48 ft Deepening with Mitigation Plan 6b
Surface Salinity- 50% Exceedance Values
Mitigation Plan 6b
-McCoy Cut Diversion Structure;
-Close McCoy West Entrance
-Close Rifle Cut
-Fill Entire Sediment Basin to -3.85m NGVD
-Remove Tide Gate Abutments
Existing Sea Level Rise Conditions
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
N
Diversion Structure
Close McCoy West Entrance
Close Rifle Cut
Remove Tide Gate and Abutments
Fill Sediment Basin
Legend
Salinity Difference (ppt)
-2.52 - -2.00
-1.99 - -1.00
-0.99 - -0.50
-0.49 - -0.30
-0.29 - -0.10
-0.09 - 0.00
0.01 - 0.10
0.11 - 0.20
0.21 - 0.30
0.31 - 0.40
0.41 - 0.50
0.51 - 0.60
0.61 - 0.70
0.71 - 0.80
0.81 - 0.90
0.91 - 1.00
1.01 - 2.00
2.01 - 2.16
Shoreline
Roadways
2,000 1,000 0 2,000
Meters

July 2007

Savannah Harbor Expansion Project

Evaluation of Marsh/Wetland Impacts
Plan 6a ONLY

August 2007

Introduction

This report summarizes the results of marsh impacts with implementation of one mitigation alternative and navigation channel deepening. One additional mitigation alternative is presented and has been evaluated under three possible navigation channel depths (48 ft, 46 ft, and 45 ft).

The mitigation plan was evaluated using the 3D hydrodynamic model EFDC. The run period is March through October 1997. This time period is representative of average historic flow, temperature, and tidal conditions. The effects of sea level rise have *NOT* been evaluated in this report. The parameter evaluated is the 50 % exceedance surface salinity value throughout the model grid. The run period and parameters were specified by the Interagency Coordination Team.

Plan Description

One additional mitigation plan was modeled to determine the effectiveness in reducing salinity impacts to freshwater marsh due to deepening the navigation channel. Mitigation Plans 1-6b were evaluated prior to the plan presented here. The additional mitigation plan presented here is Plan 6a. Below is a brief description of Plan 6a and a graphic showing the features of Plan 6a and several other mitigation plans evaluated prior to this report.

Plan 6a

- *McCoys Cut Diversion Structure*
- *Channel Deepening on McCoys, Upper Middle and Little Back River*
- *Fill Entire Sediment Basin*
- *Close Rifle Cut*
- *Remove Tidegate Abutments and Piers*
- *Close Lower (western) Arm at McCoy Cut*

	McCoy Cut Diversion Structure	Channel Deepening on McCoy, Upper Middle and Little Back River	Fill Entire Sediment Basin	Close Rifle Cut	Close Lower (western) Arm at McCoy Cut	Remove Tidegate Abutments and Piers	
Plan 3	x	x	x	x			Plan 3
Plan 3a	x	x	x	x	x		Plan 3a
Plan 3b	x		x	x			Plan 3b
Plan 3c	x		x	x	x		Plan 3c
Plan 6	x	x	x	x		x	Plan 6
Plan 6a	**x**	**x**	**x**	**x**	**x**	**x**	**Plan 6a**
Plan 6b	x		x	x	x	x	Plan 6b

*For additional details about Plans 3a, 3b, 3c, 6 & 6b please refer to report *Savannah Harbor Expansion Project Evaluation of Marsh/Wetland Impacts with Additional Mitigation Plans* dated August 2007

Output Presented

There are three types of maps presented in this report:

1- ***Predicted River Salinity from the Hydrodynamic Model (EFDC)-*** The EFDC model grid is shown with 50% exceedance surface salinities broken into 5 categories: 0-0.5 ppt, 0.6-1.0 ppt, 1.1-2.0 ppt, 2.1-4.0 ppt, 4.0-32.5 ppt. Modeling is based on average historic flow, temperature, and tidal conditions- March through October 1997. The effects of sea level rise have *NOT* been evaluated in this report.

2- ***Estimated Marsh Salinity Contour Lines-*** Marsh salinity contour lines are shown that break the marsh into 5 categories: 0-0.5 ppt, 0.6-1.0 ppt, 1.1-2.0 ppt, 2.1-4.0 ppt, > 4.0 ppt. The first category 0-0.5 ppt represents freshwater marsh. The contour lines were extrapolated into the marsh from the riverine hydrodynamic model results shown in the maps described above *1- Predicted River Salinity from the Hydrodynamic Model*.

3- ***Surface Salinity Difference Maps-*** Maps show the change in riverine salinity at each EFDC grid cell between the existing condition and each mitigation plan. Salinity values are predicted using the hydrodynamic model (EFDC). The grid cells are color coded to show the salinity differences. The grey shading is used to show cells that have lower salinity values than the existing condition (i.e. deepening impacts have been reduced to 0, and, in fact, show improvement over the existing condition).

Results

Results from the modeling are presented in the following table. The table shows estimated marsh salinity impacts based on the mapping described in 2-***Estimated Marsh Salinity Contour Lines*** above. The acreages are valid within +/- 50 acres.

Table 1- *Estimated Marsh Salinity Impacts- Plans 3, 6, **6a**, and 6b*

48 ft Depth

Estimated Marsh Salinity	Existing (*acres*)	Deepened Only --No Mitigation— (*acres*)	Plan 3 (*acres*)	Plan 6 (*acres*)	**Plan 6a (*acres*)**	Plan 6b (*acres*)
0.0 – 0.5	4072	2860	3584	3715	**3735**	3610
0.6 – 1.0	864	830	766	1419	**1340**	885
1.1 – 2.0	555	1215	1587	1141	**1191**	1384
2.1 – 4.0	834	739	682	793	**790**	770
> 4	2506	3188	2213	1764	**1776**	2183

46 ft Depth

Estimated Marsh Salinity	Existing (*acres*)	Deepened Only --No Mitigation— (*acres*)	Plan 3 (*acres*)	Plan 6 (*acres*)	**Plan 6a (*acres*)**	Plan 6b (*acres*)
0.0 – 0.5	4072	3015	3753	3817	**3871**	3610
0.6 – 1.0	864	1050	1298	1677	**1650**	1512
1.1 – 2.0	555	921	991	893	**862**	891
2.1 – 4.0	834	789	616	703	**700**	642
> 4	2506	3057	2174	1743	**1749**	2177

Table 1 (continued)- *Estimated Marsh Salinity Impacts- Plans 3, 6, **6a**, and 6b*

45 ft Depth

Estimated Marsh Salinity	Existing (*acres*)	Deepened Only --No Mitigation— (*acres*)	Plan 3 (*acres*)	Plan 6 (*acres*)	**Plan 6a (*acres*)**	Plan 6b (*acres*)
0.0 – 0.5	4072	3105	3718	4038	**4040**	3865
0.6 – 1.0	864	1319	1827	1835	**1781**	1459
1.1 – 2.0	555	630	732	559	**588**	774
2.1 – 4.0	834	906	763	712	**745**	589
> 4	2506	2873	1792	1689	**1678**	2145

Summary

In viewing and discussing the results of the mitigation plans it is important to remember the following:

1- The marsh impacts are evaluated by looking at the ***net*** acreage. This is especially important when discussing the impacts to freshwater marshes. The net acreage value is based on the conditions of the marsh after the project is in place. It does not take into consideration what the marsh salinity is under current conditions. For example, a mitigation plan may gain freshwater marsh on Back River and lose freshwater marsh on Front River. The net acreage may meet the impact criteria, but in reality, it may take some time for a marsh to convert from a brackish marsh to a freshwater marsh.

2- The model has a limited ability to evaluate specific design parameters of a true diversion structure. The diversion structure described in each of the plans was modeled by altering the Front River width just downstream of McCoys Cut. By narrowing the passage on Front River the water surface elevation at the mouth of McCoys Cut was increased. The rise in elevation encourages more water to go down McCoys Cut. EFDC does not have options for inserting a defined diversion structure but narrowing the River channel in this area is essentially what a diversion structure will do.

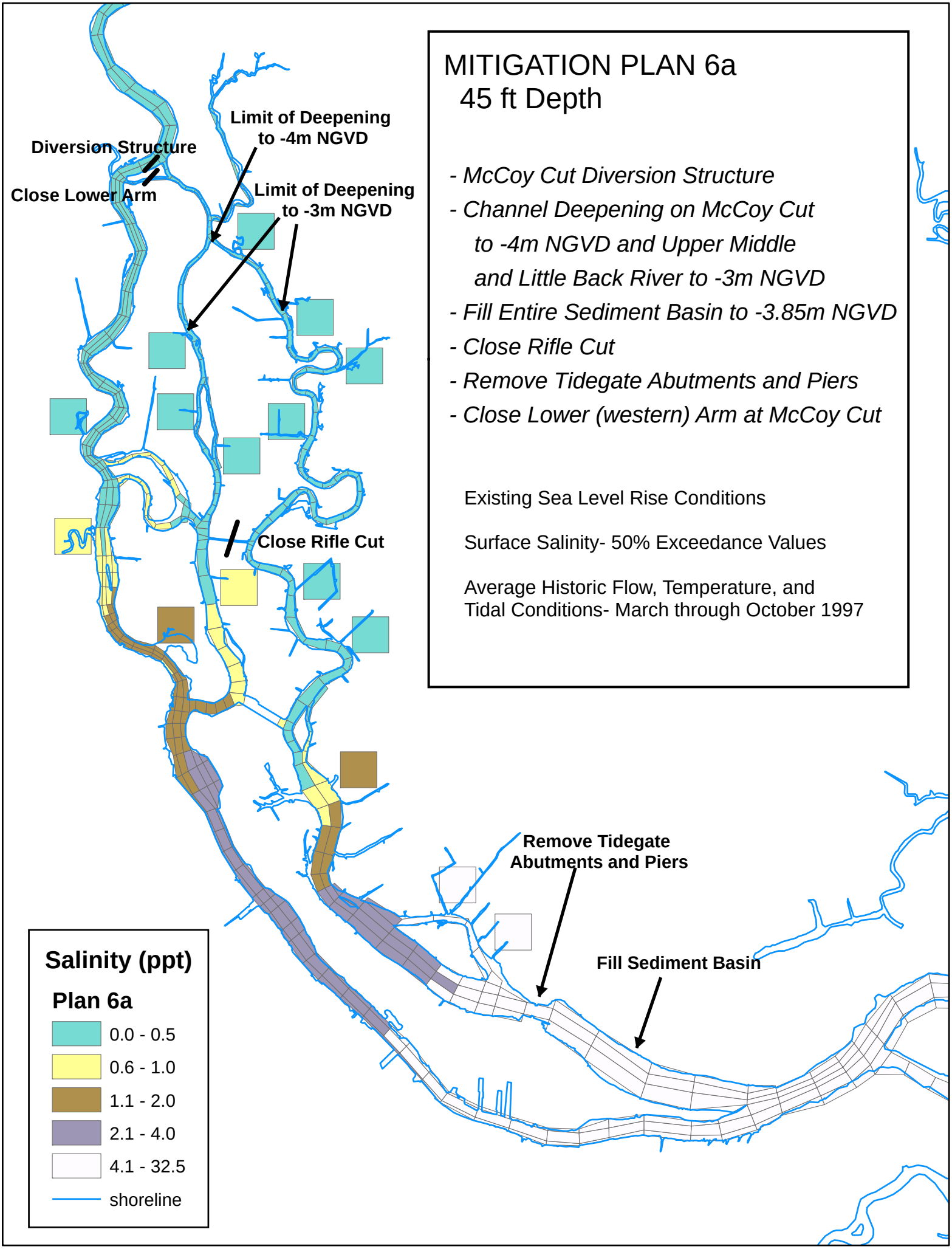
   Several different “sizes” of diversion structures were evaluated during the development of the mitigation plans by varying the widths of the narrow passage on Front River. This allowed us to vary the amount of flow diverted down McCoys Cut. The structure modeled in Mitigation Plan 3, and each of the additional plans in this report, was found to be the most effective at diverting freshwater flows through McCoys Cut of the several different “sizes” evaluated. A future design task will be required to develop specifications for a diversion structure that performs as in the model simulation.

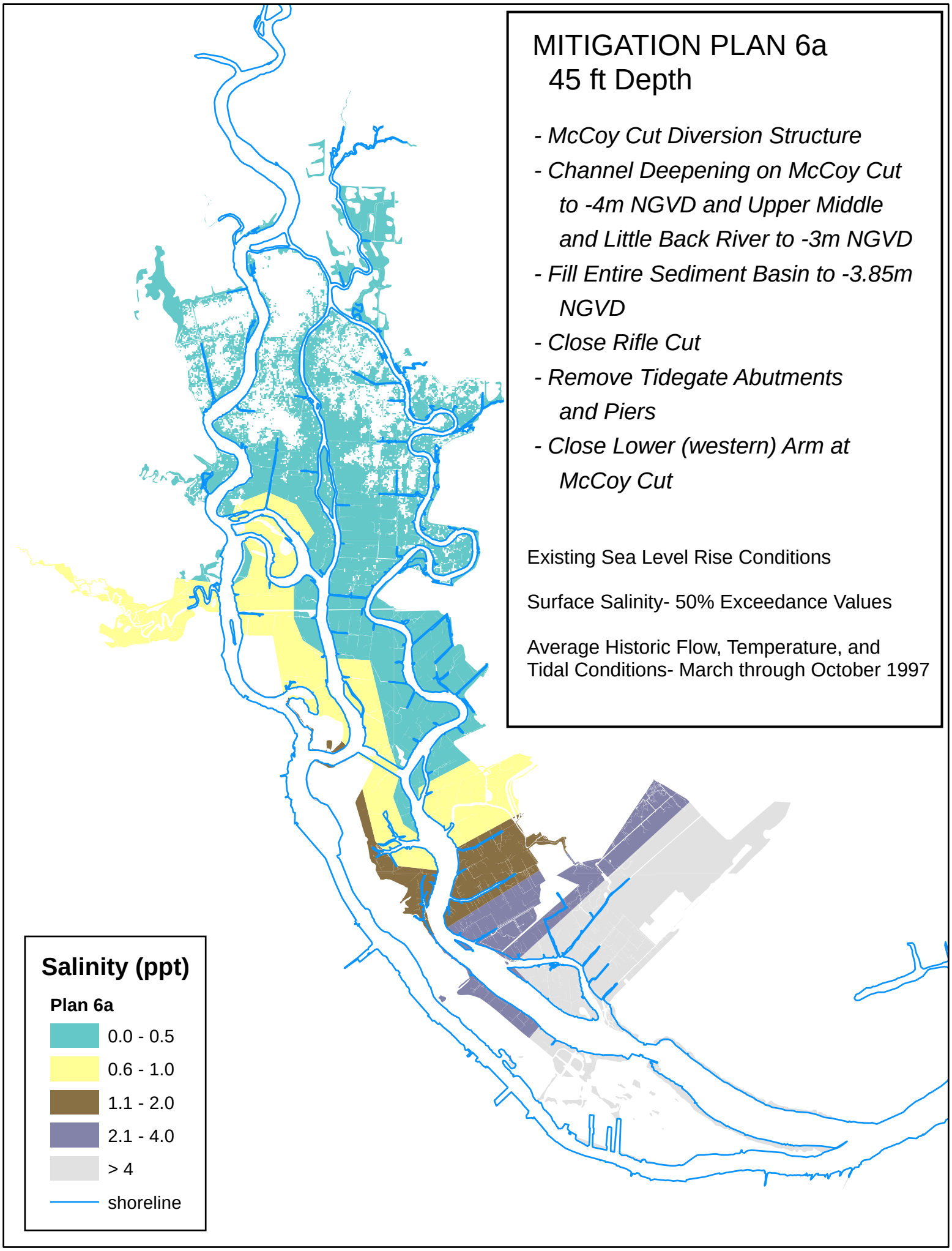
The evaluation of the mitigation plan included review of the effects the plan has on the tide range and velocities. It was concluded that each of the additional plan does not reduce the tide range significantly in Back River, Little Back River, or Middle River. Velocities for all the additional plans are close to existing conditions. However, as expected, removing the abutments and piers in Plans 6, 6a and 6b do increase velocities in Back River and Little Back River slightly above the existing condition.

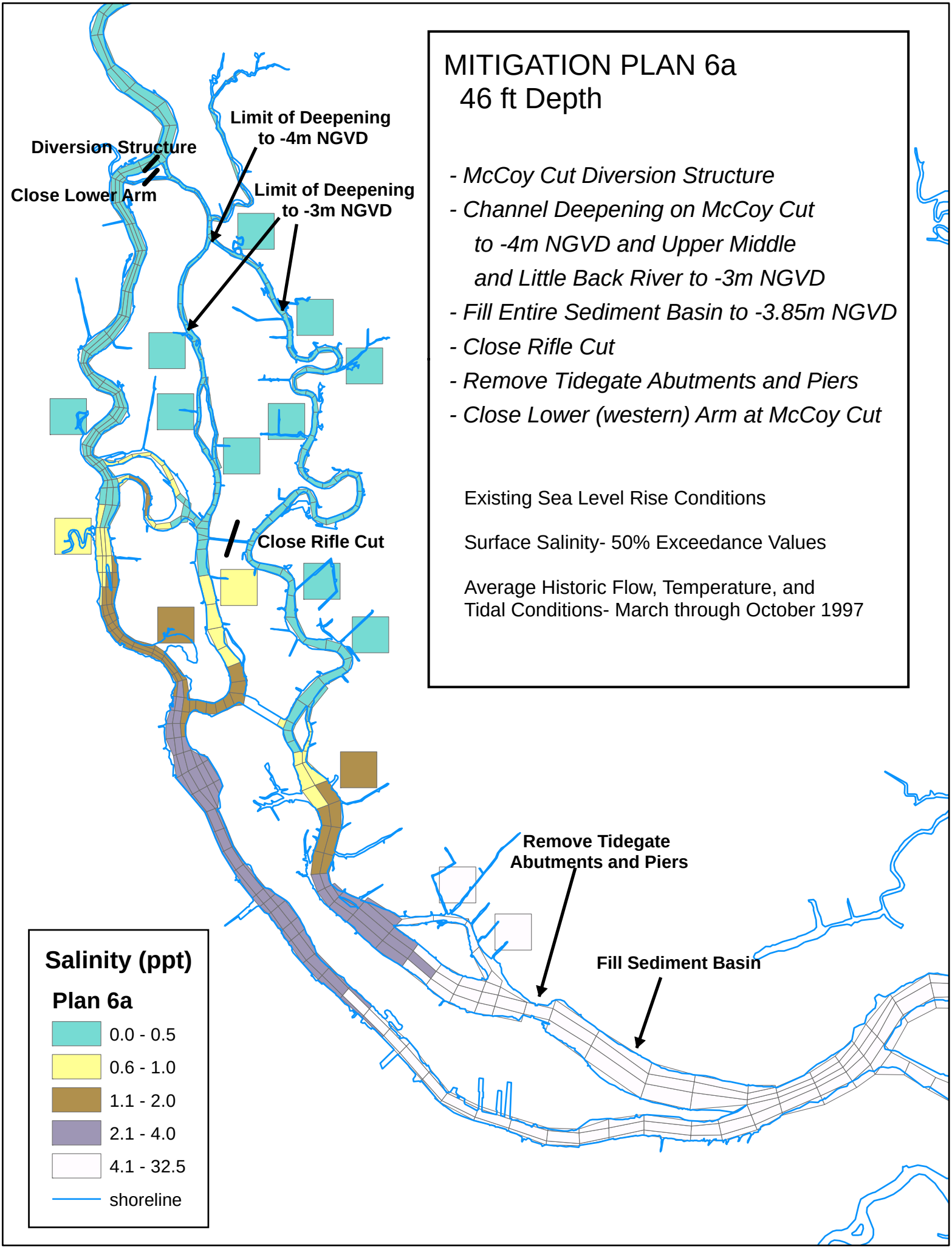
Plan 6a

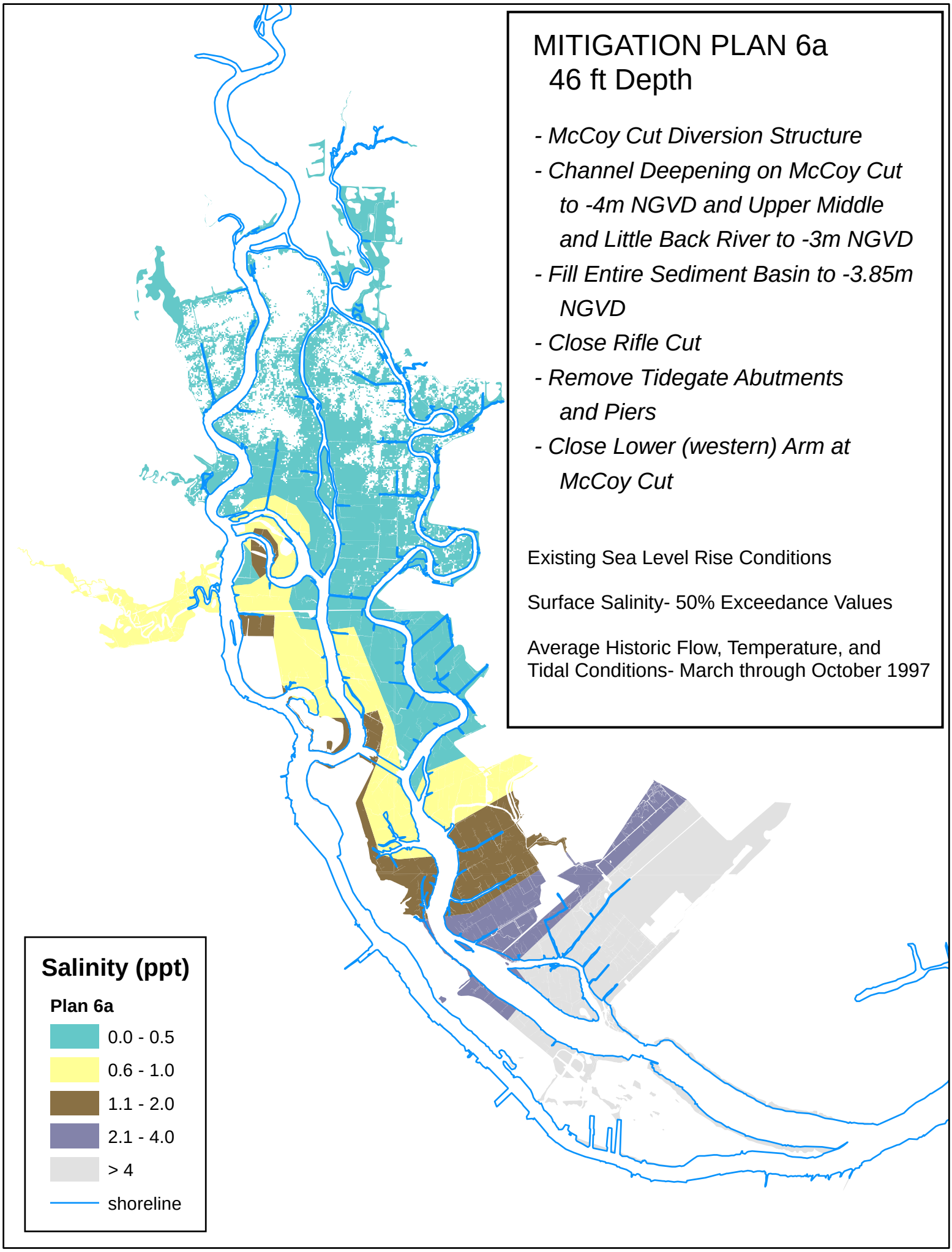
The results of Plan 6a are comparable to Plan 6. Salinity impacts are slightly reduced further than that of Plan 6. Closing the Lower (western) Arm at McCoy Cut does provided added benefits on Middle River, Back River and Little Back Rivers.

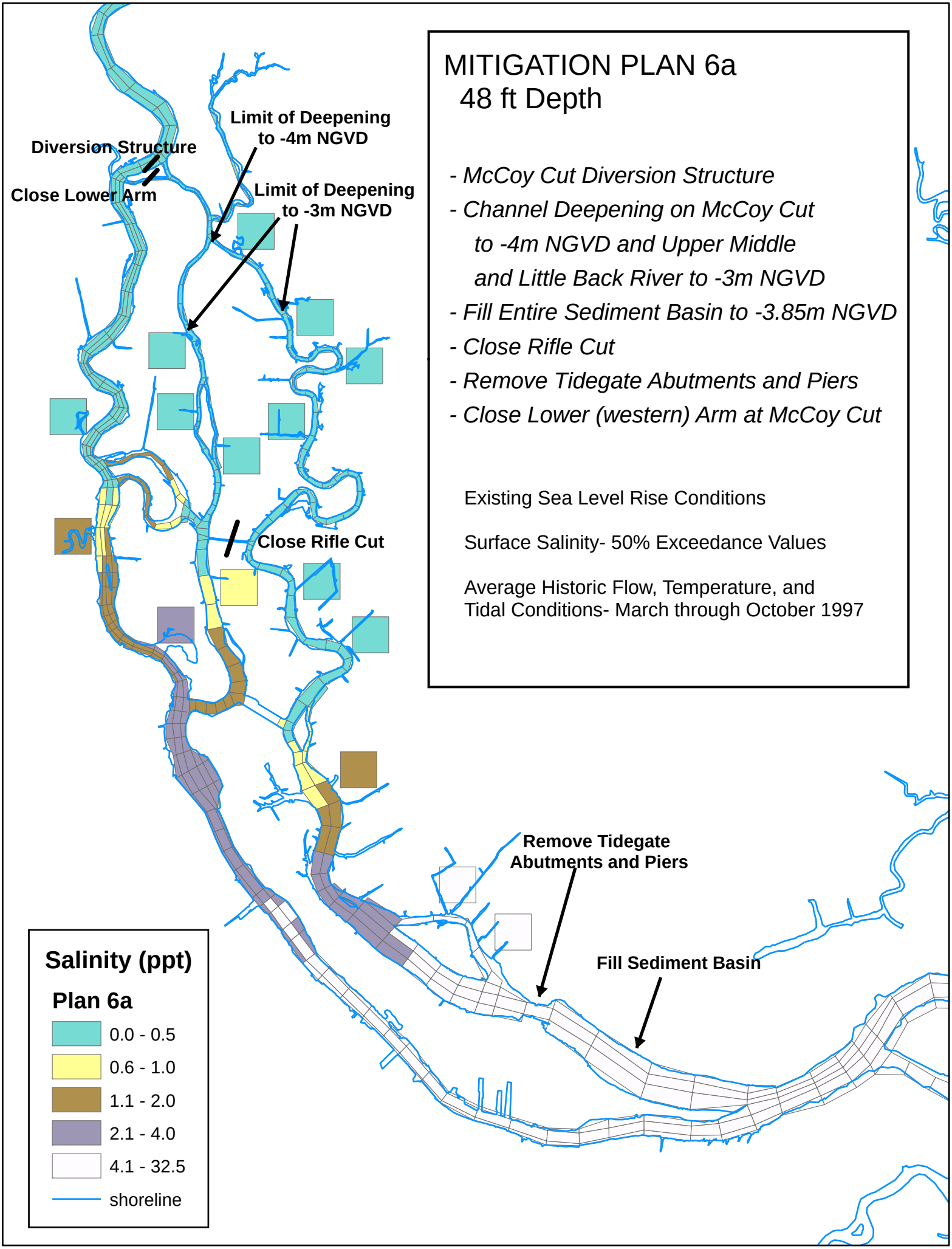
For additional details about Plans 3a, 3b, 3c, 6 & 6b please refer to report *Savannah Harbor Expansion Project Evaluation of Marsh/Wetland Impacts with Additional Mitigation Plans* dated August 2007.

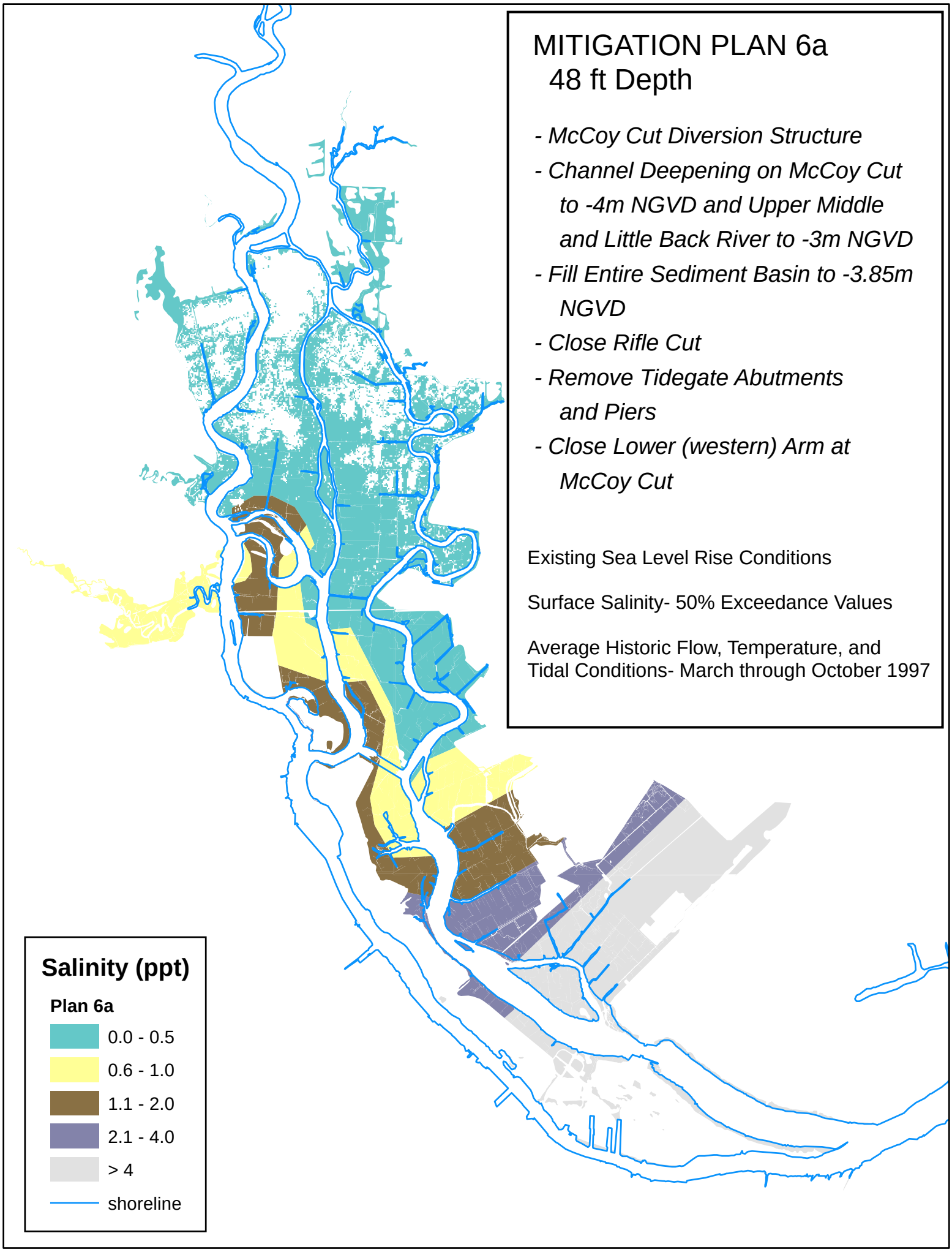

MITIGATION PLAN 6a
45 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Remove Tidegate Abutments and Piers
- Close Lower (western) Arm at McCoy Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Diversion Structure
Close Lower Arm
Limit of Deepening to -4m NGVD
Limit of Deepening to -3m NGVD
Close Rifle Cut
Remove Tidegate Abutments and Piers
Fill Sediment Basin
Salinity (ppt)
Plan 6a
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5
shoreline

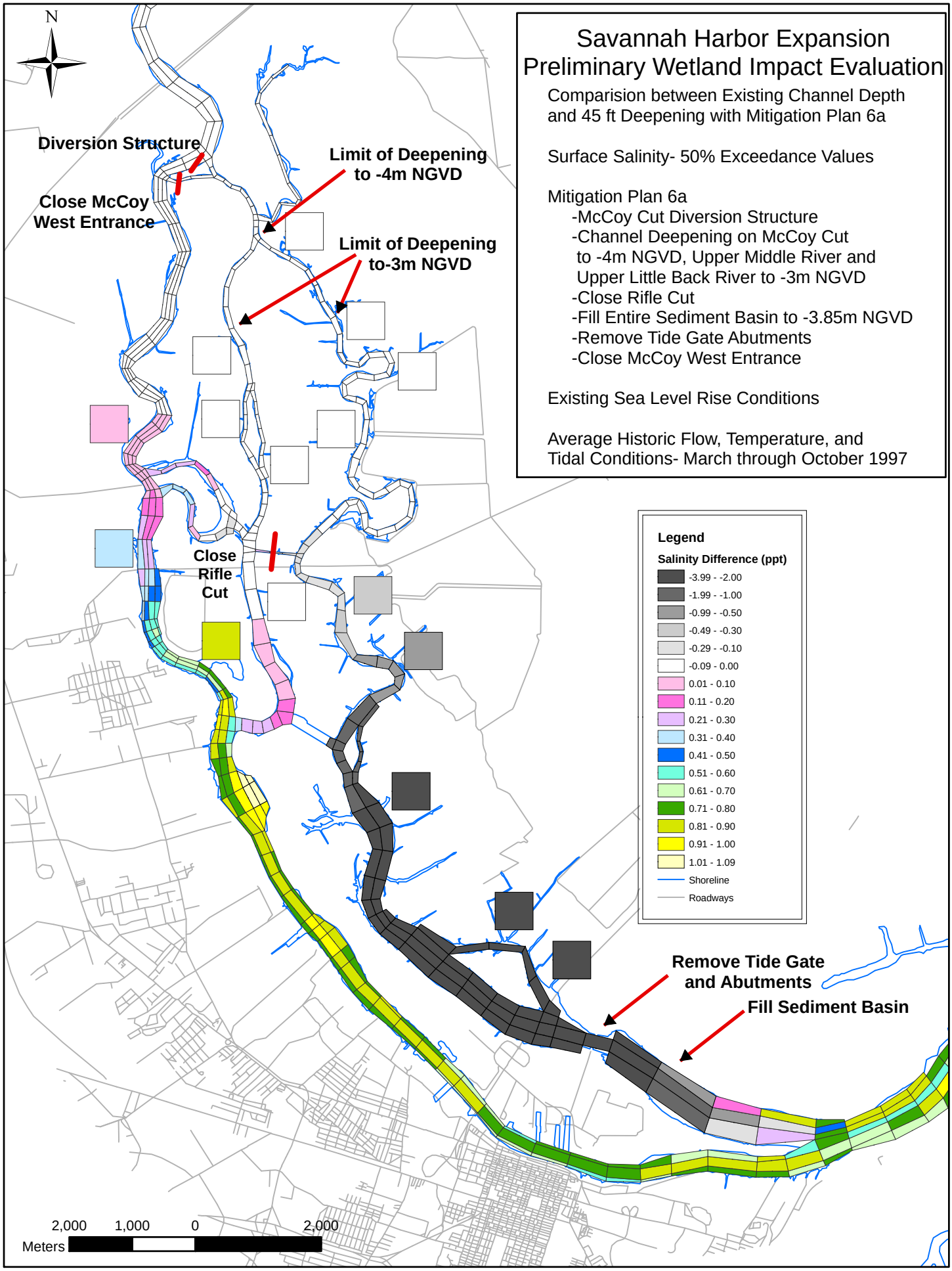

MITIGATION PLAN 6a
45 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Remove Tidegate Abutments and Piers
- Close Lower (western) Arm at McCoy Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Salinity (ppt)
Plan 6a
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline


MITIGATION PLAN 6a
46 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Remove Tidegate Abutments and Piers
- Close Lower (western) Arm at McCoy Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Diversion Structure
Close Lower Arm
Limit of Deepening to -4m NGVD
Limit of Deepening to -3m NGVD
Close Rifle Cut
Remove Tidegate Abutments and Piers
Fill Sediment Basin
Salinity (ppt)
Plan 6a
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5
shoreline

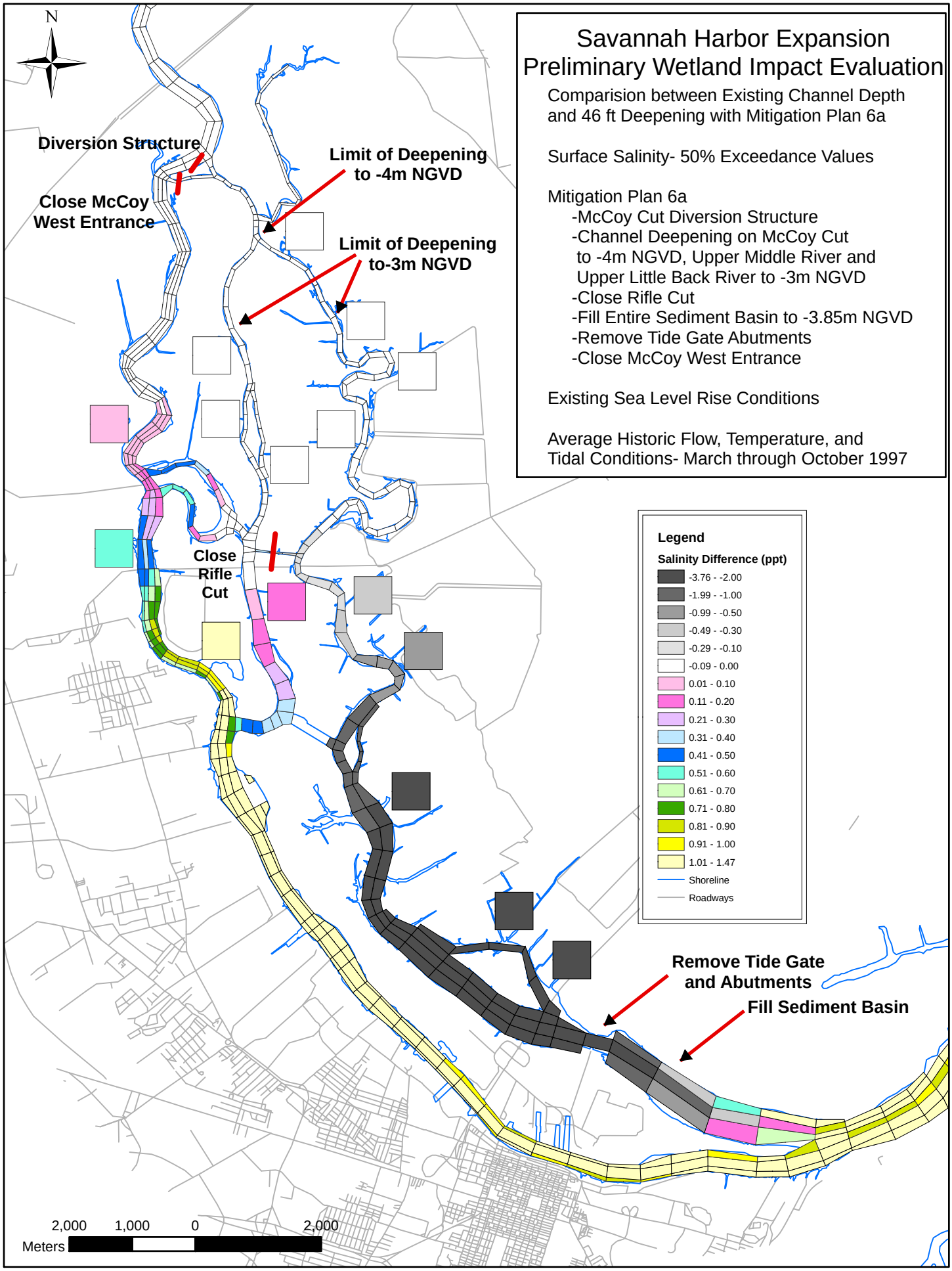

MITIGATION PLAN 6a
46 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Remove Tidegate Abutments and Piers
- Close Lower (western) Arm at McCoy Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Salinity (ppt)
Plan 6a
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline


MITIGATION PLAN 6a
48 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Remove Tidegate Abutments and Piers
- Close Lower (western) Arm at McCoy Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Diversion Structure
Close Lower Arm
Limit of Deepening to -4m NGVD
Limit of Deepening to -3m NGVD
Close Rifle Cut
Remove Tidegate Abutments and Piers
Fill Sediment Basin
Salinity (ppt)
Plan 6a
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5
shoreline

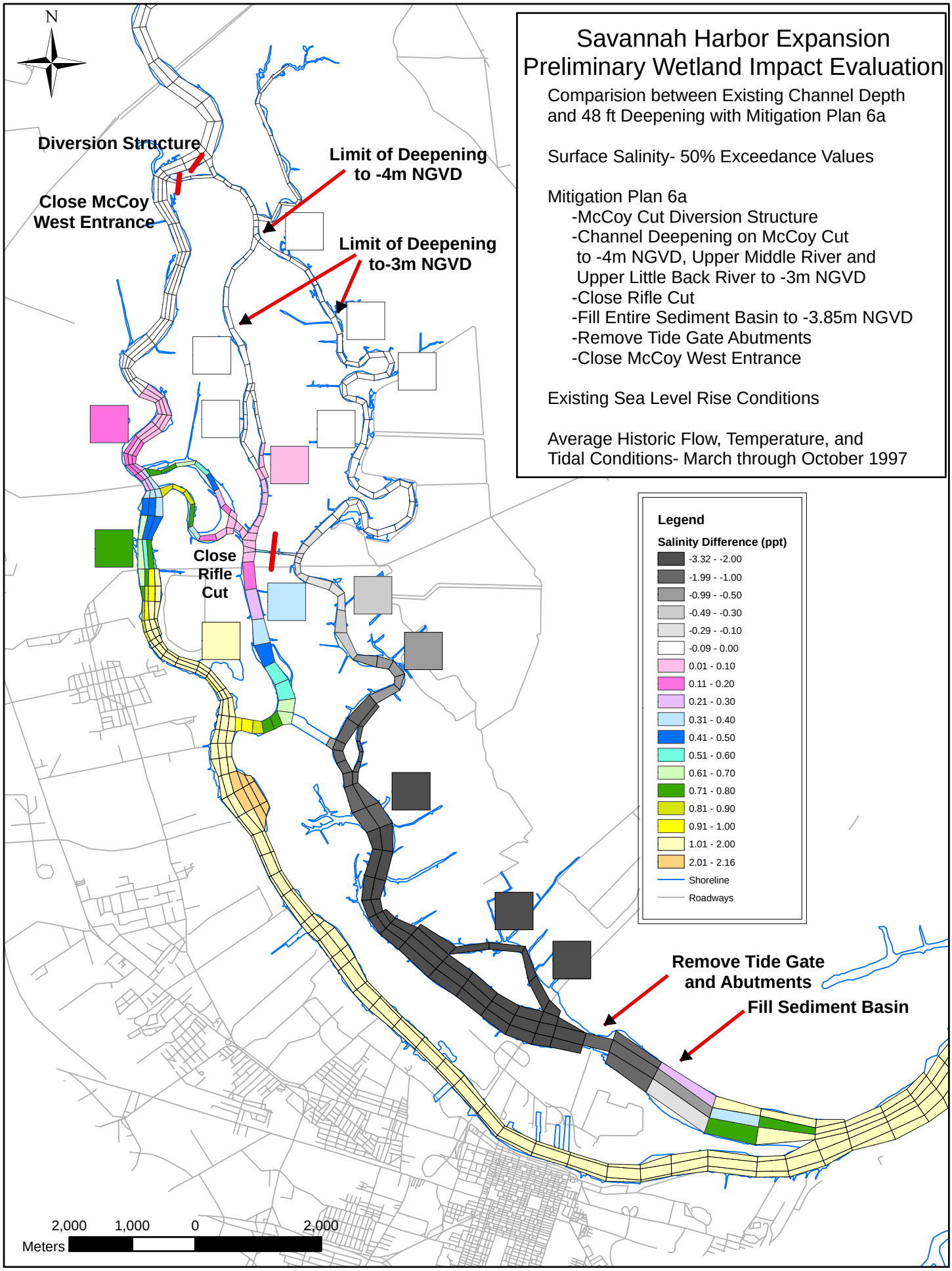

MITIGATION PLAN 6a
48 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Remove Tidegate Abutments and Piers
- Close Lower (western) Arm at McCoy Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Salinity (ppt)
Plan 6a
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline


Savannah Harbor Expansion
Preliminary Wetland Impact Evaluation
Comparision between Existing Channel Depth and 45 ft Deepening with Mitigation Plan 6a
Surface Salinity- 50% Exceedance Values
Mitigation Plan 6a
-McCoy Cut Diversion Structure
-Channel Deepening on McCoy Cut to -4m NGVD, Upper Middle River and Upper Little Back River to -3m NGVD
-Close Rifle Cut
-Fill Entire Sediment Basin to -3.85m NGVD
-Remove Tide Gate Abutments
-Close McCoy West Entrance
Existing Sea Level Rise Conditions
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
N
Diversion Structure
Close McCoy West Entrance
Limit of Deepening to -4m NGVD
Limit of Deepening to-3m NGVD
Close Rifle Cut
Remove Tide Gate and Abutments
Fill Sediment Basin
Legend
Salinity Difference (ppt)
-3.99 - -2.00
-1.99 - -1.00
-0.99 - -0.50
-0.49 - -0.30
-0.29 - -0.10
-0.09 - 0.00
0.01 - 0.10
0.11 - 0.20
0.21 - 0.30
0.31 - 0.40
0.41 - 0.50
0.51 - 0.60
0.61 - 0.70
0.71 - 0.80
0.81 - 0.90
0.91 - 1.00
1.01 - 1.09
Shoreline
Roadways
2,000 1,000 0 2,000
Meters

July 2007


Savannah Harbor Expansion
Preliminary Wetland Impact Evaluation
Comparision between Existing Channel Depth and 46 ft Deepening with Mitigation Plan 6a
Surface Salinity- 50% Exceedance Values
Mitigation Plan 6a
-McCoy Cut Diversion Structure
-Channel Deepening on McCoy Cut to -4m NGVD, Upper Middle River and Upper Little Back River to -3m NGVD
-Close Rifle Cut
-Fill Entire Sediment Basin to -3.85m NGVD
-Remove Tide Gate Abutments
-Close McCoy West Entrance
Existing Sea Level Rise Conditions
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
N
Diversion Structure
Close McCoy West Entrance
Limit of Deepening to -4m NGVD
Limit of Deepening to-3m NGVD
Close Rifle Cut
Remove Tide Gate and Abutments
Fill Sediment Basin
Legend
Salinity Difference (ppt)
-3.76 - -2.00
-1.99 - -1.00
-0.99 - -0.50
-0.49 - -0.30
-0.29 - -0.10
-0.09 - 0.00
0.01 - 0.10
0.11 - 0.20
0.21 - 0.30
0.31 - 0.40
0.41 - 0.50
0.51 - 0.60
0.61 - 0.70
0.71 - 0.80
0.81 - 0.90
0.91 - 1.00
1.01 - 1.47
Shoreline
Roadways
2,000 1,000 0 2,000
Meters

July 2007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Savannah Harbor Expansion
Preliminary Wetland Impact Evaluation
Comparision between Existing Channel Depth and 48 ft Deepening with Mitigation Plan 6a
Surface Salinity- 50% Exceedance Values
Mitigation Plan 6a
-McCoy Cut Diversion Structure
-Channel Deepening on McCoy Cut to -4m NGVD, Upper Middle River and Upper Little Back River to -3m NGVD
-Close Rifle Cut
-Fill Entire Sediment Basin to -3.85m NGVD
-Remove Tide Gate Abutments
-Close McCoy West Entrance
Existing Sea Level Rise Conditions
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Diversion Structure
Close McCoy West Entrance
Limit of Deepening to -4m NGVD
Limit of Deepening to-3m NGVD
Close Rifle Cut
Remove Tide Gate and Abutments
Fill Sediment Basin
Legend
Salinity Difference (ppt)
-3.32 - -2.00
-1.99 - -1.00
-0.99 - -0.50
-0.49 - -0.30
-0.29 - -0.10
-0.09 - 0.00
0.01 - 0.10
0.11 - 0.20
0.21 - 0.30
0.31 - 0.40
0.41 - 0.50
0.51 - 0.60
0.61 - 0.70
0.71 - 0.80
0.81 - 0.90
0.91 - 1.00
1.01 - 2.00
2.01 - 2.16
Shoreline
Roadways
2,000 1,000 0 2,000
Meters

July 2007

Savannah Harbor Expansion Project

Evaluation of Marsh/Wetland Impacts
Plan 7 ONLY

October 2007

Introduction

This report summarizes the results of marsh impacts with implementation of Mitigation Plan 7 and its effects on reducing salinity impacts to marshes/wetlands due to navigation channel deepening. Plan 7 has been evaluated under two possible navigation channel depths (48 ft and 46 ft).

The mitigation plan was evaluated using the 3D hydrodynamic model EFDC. The run period is March through October 1997. This time period is representative of average historic flow, temperature, and tidal conditions. The effects of sea level rise have *NOT* been evaluated in this report. The parameter evaluated is the 50% exceedance surface salinity value throughout the model grid. The run period and parameters were specified by the Interagency Coordination Team.

Plan Description

One additional mitigation plan was modeled to determine the effectiveness in reducing salinity impacts to freshwater marsh due to deepening the navigation channel. Mitigation Plans 1-6b were evaluated prior to the plan presented here. Detailed results for Plans 1-6b can be found in the following reports:

Wetland/Marsh Mitigation Plan Evaluation dated April 2007

Savannah Harbor Expansion Project Evaluation of Marsh/Wetland Impacts with Additional Mitigation Plans dated August 2007

Savannah Harbor Expansion Project Evaluation of Marsh/Wetland Impacts Plan 6a Only dated August 2007

The additional mitigation plan presented here is Plan 7 which incorporates the mitigation features of Plan 3 plus rerouting Front River through Steamboat River. Below is a brief description.

Plan7
- *McCoys Cut Diversion Structure*
- *Channel Deepening on McCoys, Upper Middle and Little Back River*
- *Fill Entire Sediment Basin*
- *Close Rifle Cut*
- *Reroute Front River through Steamboat River by Closing Drakies Cut*

The adjustments made to the model to predict results of Plan 7 were complex and required close scrutiny to ensure the additional mitigation feature was modeled accurately. Front River was rerouted through Steamboat by closing off Drakies Cut, cells 13_100, 14_100 and 15_100, and widening and deepening the 17 cells along Steamboat River to represent the equivalent flow area currently found in Front River. Cells 24_100 and 25_100 represent Houstown Cut, the linkage between Steamboat and Middle River. These cells were not deepened or widened, their depths remained the same as they are in the existing channel conditions model. The sill at this cut is at elevation -2.2 m NGVD. See Figures 1 & 2.

Figure 1- *EFDC Model Grid*

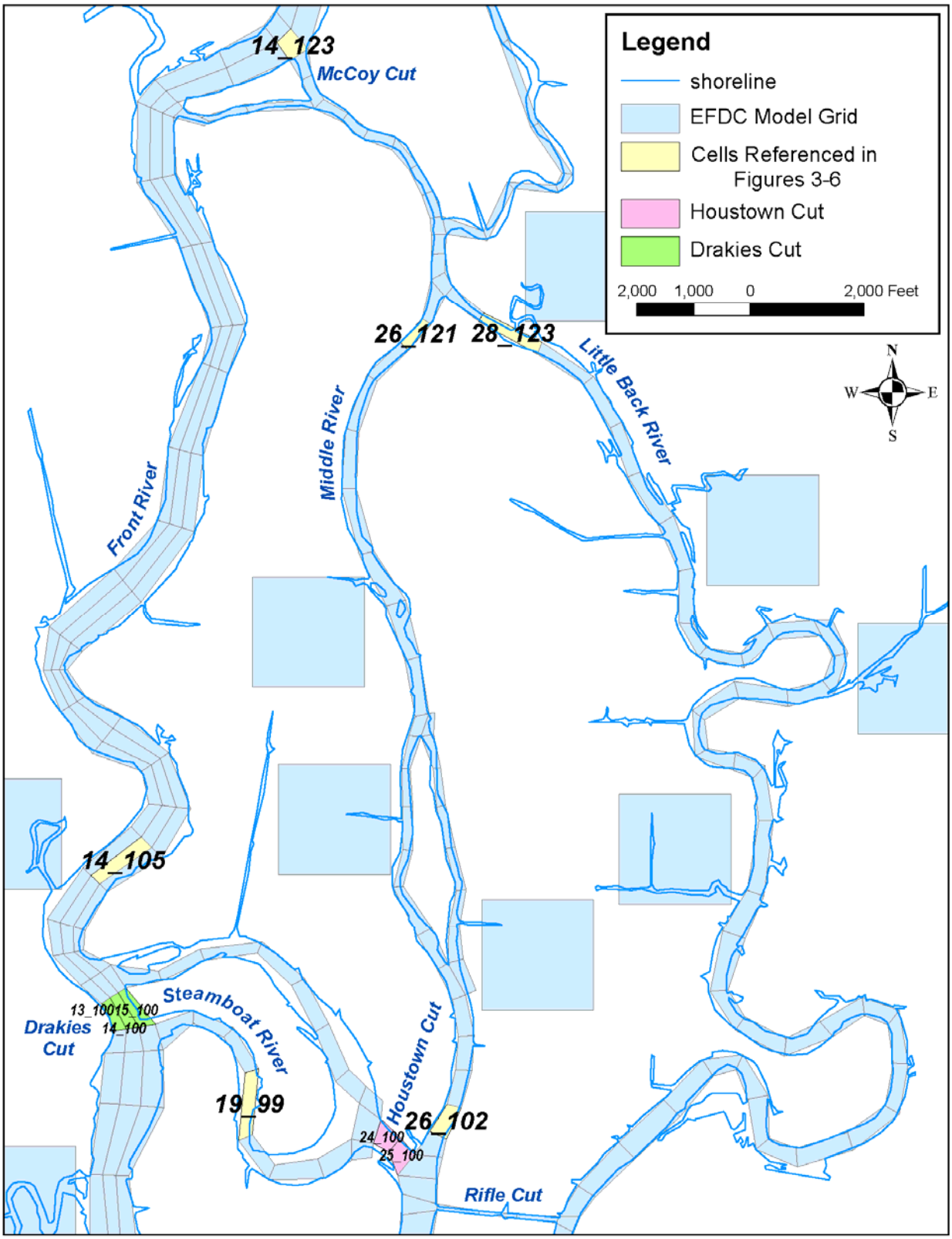


Figure 2- *Steamboat River- Aerial View*

Output Presented

There are three types of maps presented in this report:

1- ***Predicted River Salinity from the Hydrodynamic Model (EFDC)-*** The EFDC model grid is shown with 50% exceedance surface salinities broken into 5 categories: 0-0.5 ppt, 0.6-1.0 ppt, 1.1-2.0 ppt, 2.1-4.0 ppt, 4.0-32.5 ppt. Modeling is based on average historic flow, temperature, and tidal conditions- March through October 1997. The effects of sea level rise have *NOT* been evaluated in this report.

2- ***Estimated Marsh Salinity Contour Lines-*** Marsh salinity contour lines are shown that break the marsh into 5 categories: 0-0.5 ppt, 0.6-1.0 ppt, 1.1-2.0 ppt, 2.1-4.0 ppt, > 4.0 ppt. The first category 0-0.5 ppt represents freshwater marsh. The contour lines were extrapolated into the marsh from the riverine hydrodynamic model results shown in the maps described above *1- Predicted River Salinity from the Hydrodynamic Model*.

3- ***Surface Salinity Difference Maps-*** Maps show the change in riverine salinity at each EFDC grid cell between the existing condition and each mitigation plan. Salinity values are predicted using the hydrodynamic model (EFDC). The grid cells are color coded to show the salinity differences. The grey shading is used to show cells that have lower salinity values than the existing condition (i.e.

deepening impacts have been reduced to 0, and, in fact, show improvement over the existing condition).

Results

Results from the modeling are presented in the following table. The table shows estimated marsh salinity impacts based on the mapping described in 2-***Estimated Marsh Salinity Contour Lines*** above. The acreages are valid within +/- 50 acres. The numbers in Table 1 reflect all marsh acreages minus acreages that will be lost due to construction of Plan 7. Plan 7 construction will consist of both widening and deepening Steamboat River, which will impact approximately 100 acres of the adjacent marsh area.

Table 1- *Estimated Marsh Salinity Impacts- Plans 3 and 7*

48 ft Depth

Estimated Marsh Salinity	Existing (*acres*)	Deepened Only --No Mitigation— (*acres*)	Plan 3 (*acres*)	Plan 7* (*acres*)
0.0 – 0.5	4072	2860	3584	3772
0.6 – 1.0	864	830	766	1145
1.1 – 2.0	555	1215	1587	1024
2.1 – 4.0	834	739	682	605
> 4	2506	3188	2213	2186

46 ft Depth

Estimated Marsh Salinity	Existing (*acres*)	Deepened Only --No Mitigation— (*acres*)	Plan 3 (*acres*)	Plan 7* (*acres*)
0.0 – 0.5	4072	3015	3753	4285
0.6 – 1.0	864	1050	1298	1054
1.1 – 2.0	555	921	991	866
2.1 – 4.0	834	789	616	739
> 4	2506	3057	2174	1788

** acreages incorporate marsh loss due to construction of Plan 7 mitigation features*

The model predictions for Plan 7 show that the additional mitigation feature, routing Front River through Steamboat, does provide additional mitigation benefits. For the 48 ft deepening, the mapping shows that the freshwater zone ends just below Steamboat as compared to Plan 3 where the freshwater zone ends above Steamboat. It may be counterintuitive to think that the freshwater zone around Steamboat would remain fresh with the Front River routed through it. However, what the modeling shows is that when Steamboat is widened and deepened the salinity becomes more stratified and the velocities increase. This change in geometry allows the less dense freshwater to stay on top of the water column and flush through the bend while providing freshwater to the marshes (See Figure 3). In Plan 3 and under existing conditions Steamboat is smaller and more shallow. Velocities are low and the water column is less stratified. This allows more saline water to be available in the surface layer of the water column, for a longer period of time, to interact with the marsh; thus causing the freshwater zone to move above Steamboat.

Despite the shallow depth of the sill at Houstown Cut (-2.2 m NGVD) saline water moves from Steamboat through Houstown Cut to Middle River and causes increases in surface salinity on Middle River (See Figure 4 and Table 2). However, surface salinities on Front River above Steamboat are greatly reduced by lengthening the path that the saline water has to travel during each tidal cycle (See Figure 5). Figure 6 shows that the predominate path for surface salinity to move through the upper portion of the river system is Middle River. Near McCoy's Cut the surface salinities on Middle River are much higher than that of Front River. The salinity movement on Middle River appears to supply salinity to the upper portion of Little Back River.

Figure 3- *Salinity Comparison- Steamboat River*

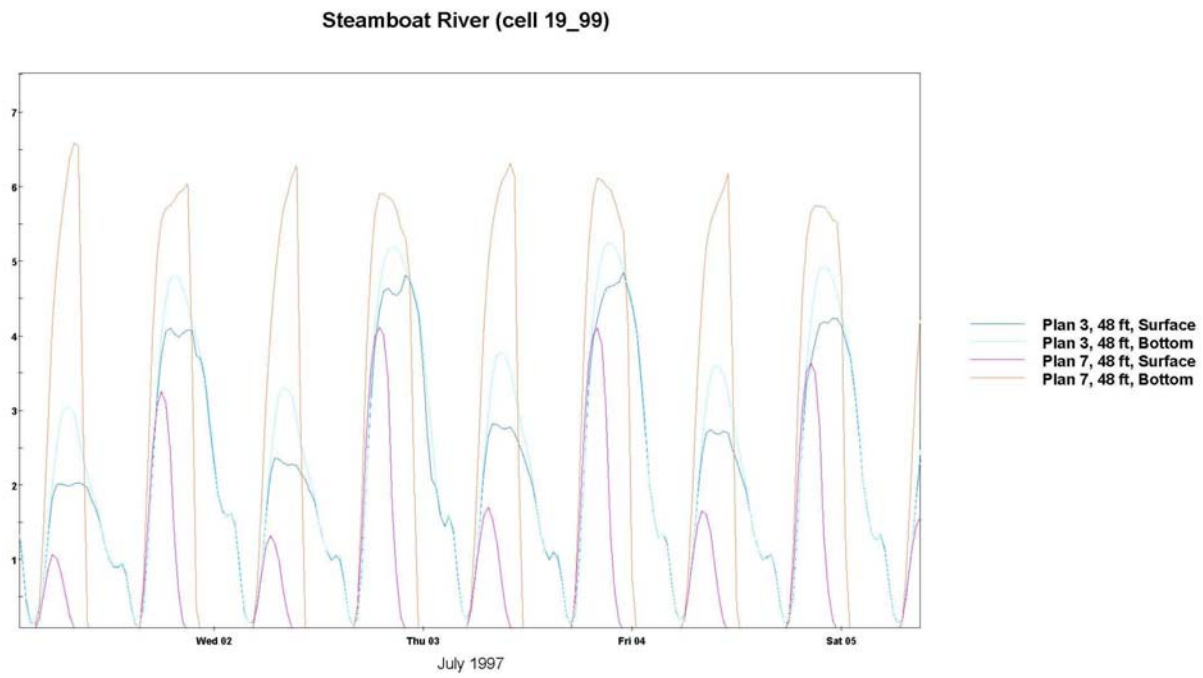


Figure 4- *Surface Salinity Comparison- Middle River*

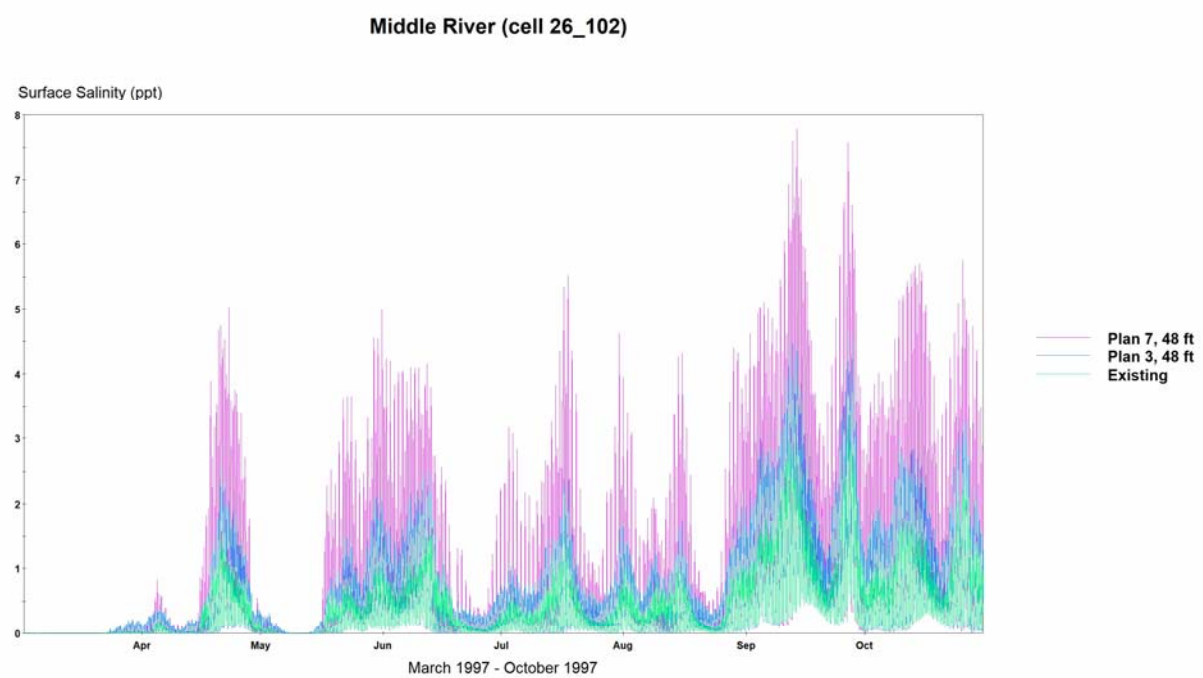


Table 2- *Surface Salinity Percentile Value Comparison- Middle River (Cell 26_102)*

Percentile*	Existing Conditions	Plan 3 48 ft	Plan 7 48 ft
10	0.00	0.00	0.00
20	0.01	0.02	0.01
30	0.05	0.06	0.04
40	0.11	0.14	0.11
50	0.20	0.27	0.24
60	0.33	0.45	0.48
70	0.48	0.68	0.82
80	0.68	1.06	1.42
90	1.00	1.63	2.54

*The percentile values were computed from the same datasets used to develop Figure 4.

Figure 5- *Surface Salinity Comparison- Front River*

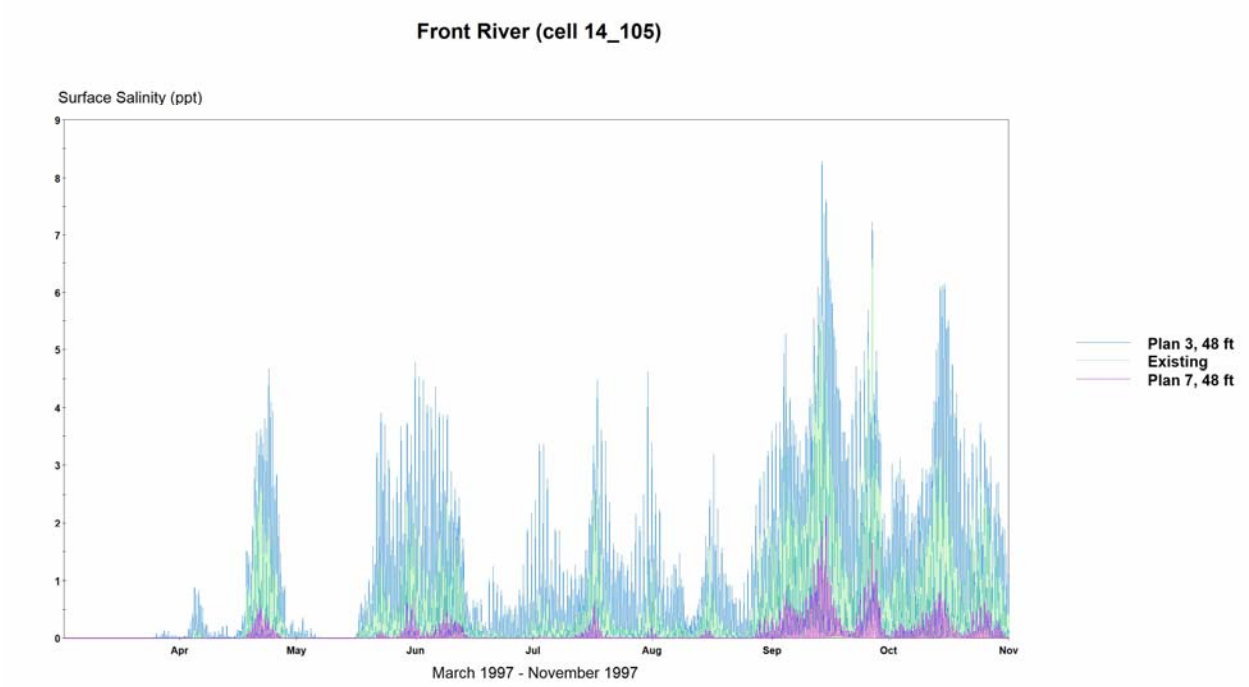
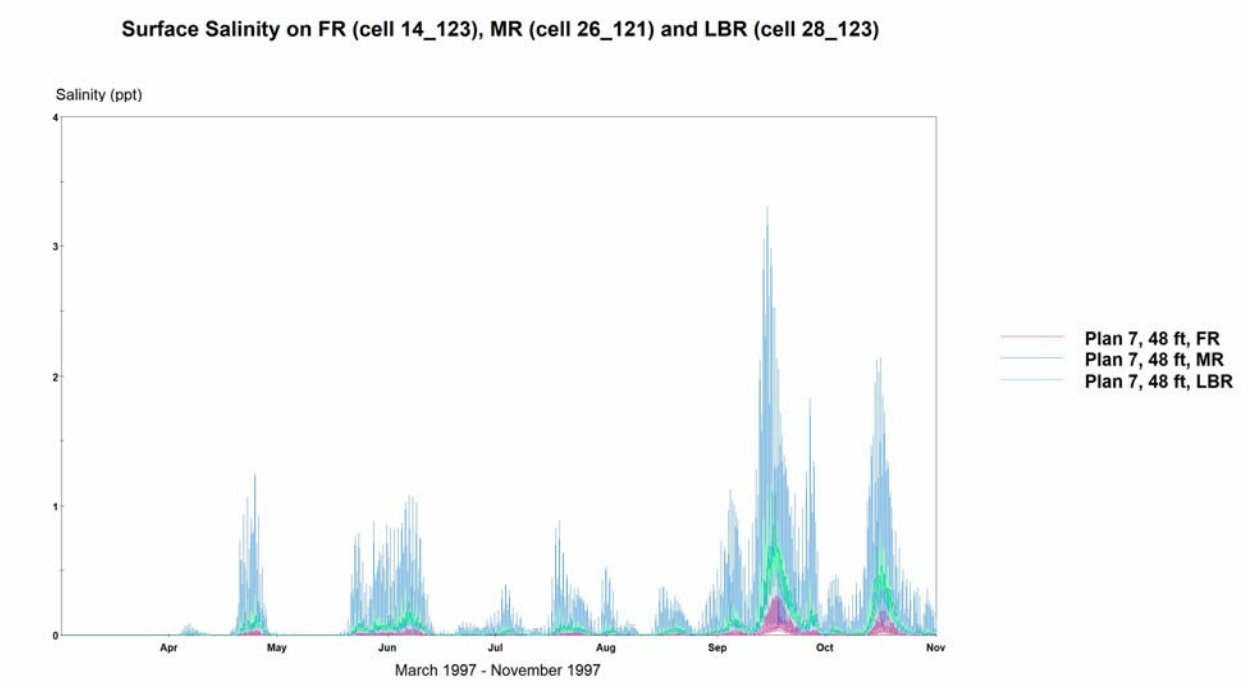


Figure 6- *Surface Salinity Comparison- Front, Middle, and Little Back River*



Summary

In viewing and discussing the results of the mitigation plans it is important to remember the following:

1- The marsh impacts are evaluated by looking at the ***net*** acreage. This is especially important when discussing the impacts to freshwater marshes. The net acreage value is based on the conditions of the marsh after the project is in place. It does not take into consideration what the marsh salinity is under current conditions. For example, a mitigation plan may gain freshwater marsh on Back River and lose freshwater marsh on Front River. The net acreage may meet the impact criteria, but in reality, it may take some time for a marsh to convert from a brackish marsh to a freshwater marsh.

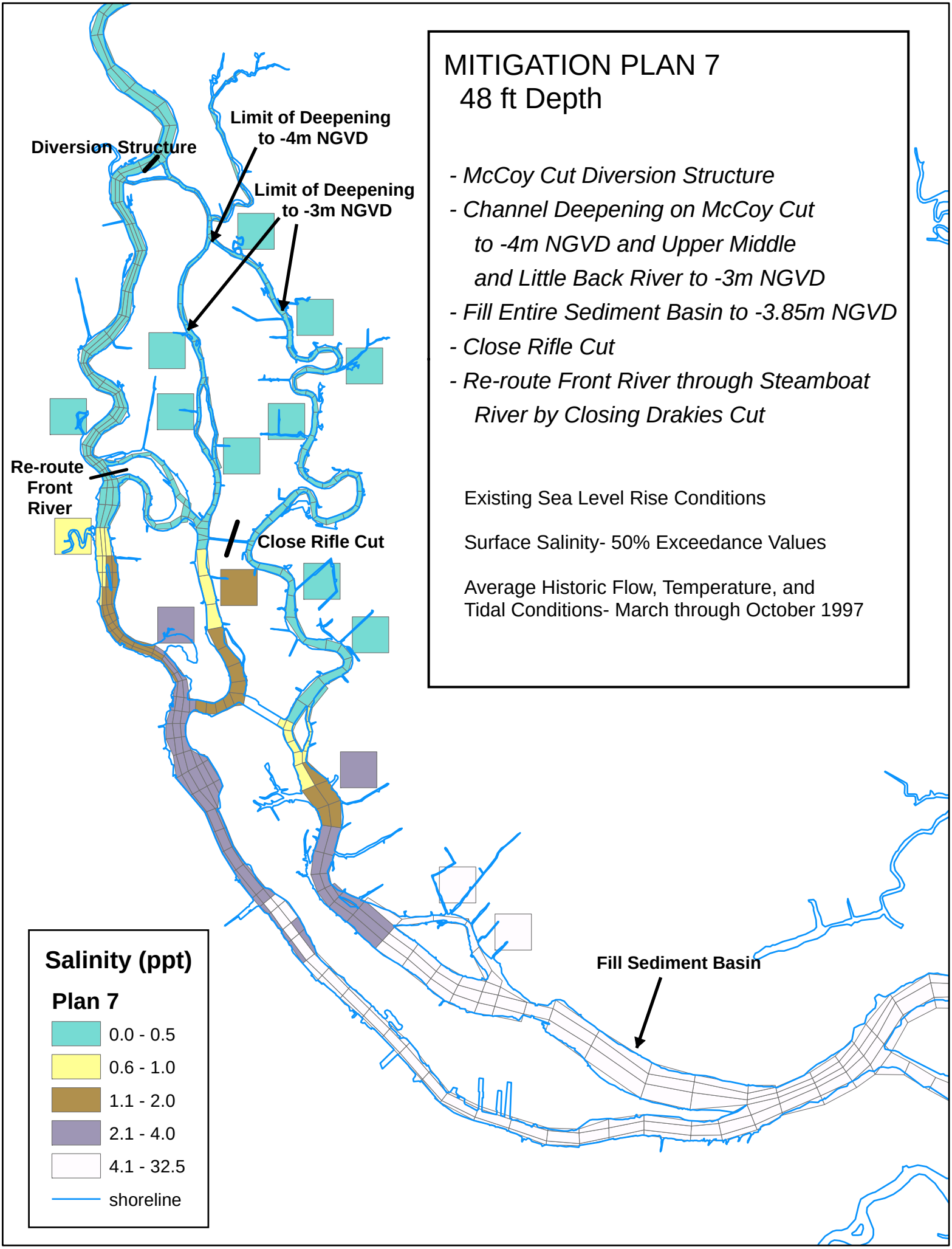
2- The model has a limited ability to evaluate specific design parameters of a true diversion structure. The diversion structure described in each of the plans was modeled by altering the Front River width just downstream of McCoys Cut. By narrowing the passage on Front River the water surface elevation at the mouth of McCoys Cut was increased. The rise in elevation encourages more water to go down McCoys Cut. EFDC does not have options for inserting a defined diversion structure but narrowing the River channel in this area is essentially what a diversion structure will do.

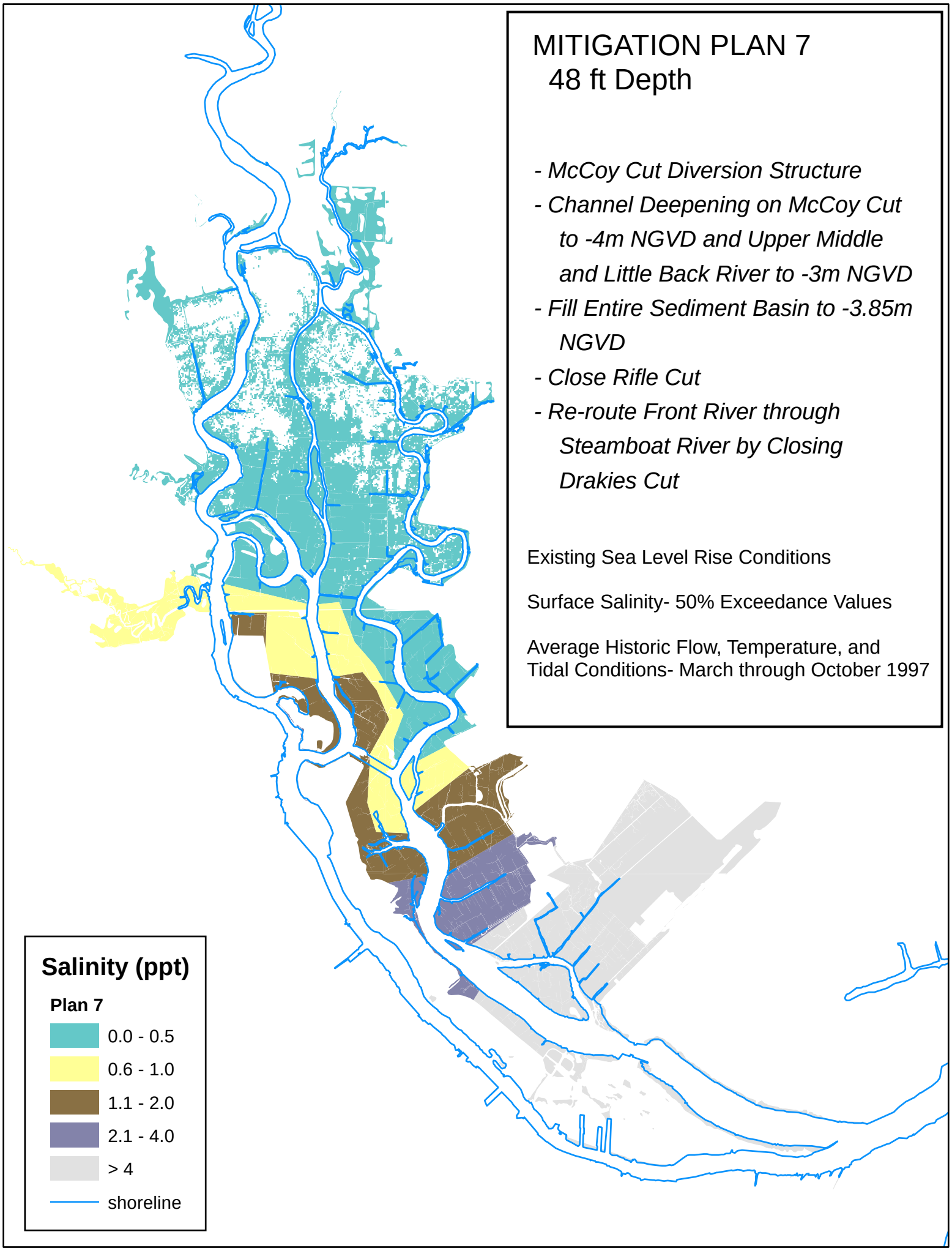
   Several different “sizes” of diversion structures were evaluated during the development of the mitigation plans by varying the widths of the narrow passage on Front River. This allowed us to vary the amount of flow diverted down McCoys Cut. The structure modeled in Mitigation Plan 3 and Plan 7, was found to be the most effective at diverting freshwater flows through McCoys Cut of the several different “sizes” evaluated. A future design task will be required to develop specifications for a diversion structure that performs as in the model simulation.

The evaluation of the mitigation plan included review of the effects the plan has on the tide range. It was concluded that Plan 7 does not reduce the tide range significantly in Front River, Back River, Little Back River, or Middle River. The maximum high tide range reduction on Front River is less than 3 inches.

Plan 7 does appear to be more effective in mitigating the impacts due to deepening than Plan 3 when viewing the acreage impacts based on the 50th percentile salinity contours. For the 48 ft depth there is approximately 180 more freshwater marsh/wetland acres available. However, at the 48 ft depth, Plan 7 does not fully mitigate the impacts to freshwater marsh/wetlands and additional mitigation measures would likely be required.

Despite the benefits shown by computing the 50th percentile surface salinities and subsequent marsh/wetland acreages impacted, Plan 7 does appear to increase surface salinity on Middle River. As shown in Figures 3 & 4 and Table 2, surface salinity on Middle River increases significantly for percentiles greater than 50. The increases on Middle River are more pronounced with drought flows. During those high tide periods Plan 7 has the potential to provide more saline water to wetlands than that of Plan 3.


MITIGATION PLAN 7
48 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Re-route Front River through Steamboat River by Closing Drakies Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Diversion Structure
Limit of Deepening to -4m NGVD
Limit of Deepening to -3m NGVD
Re-route Front River
Close Rifle Cut
Fill Sediment Basin
Salinity (ppt)
Plan 7
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5
shoreline


MITIGATION PLAN 7
48 ft Depth
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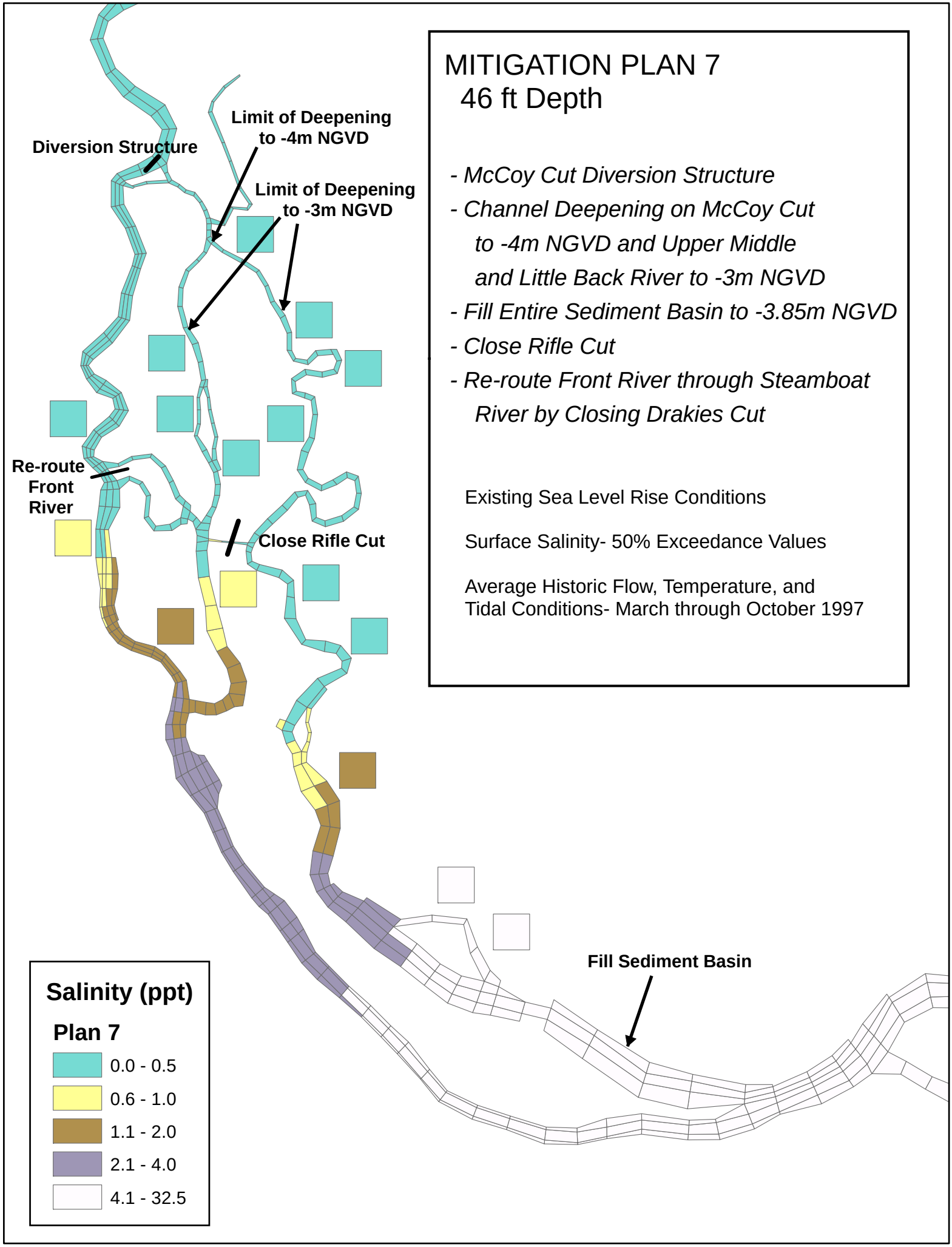
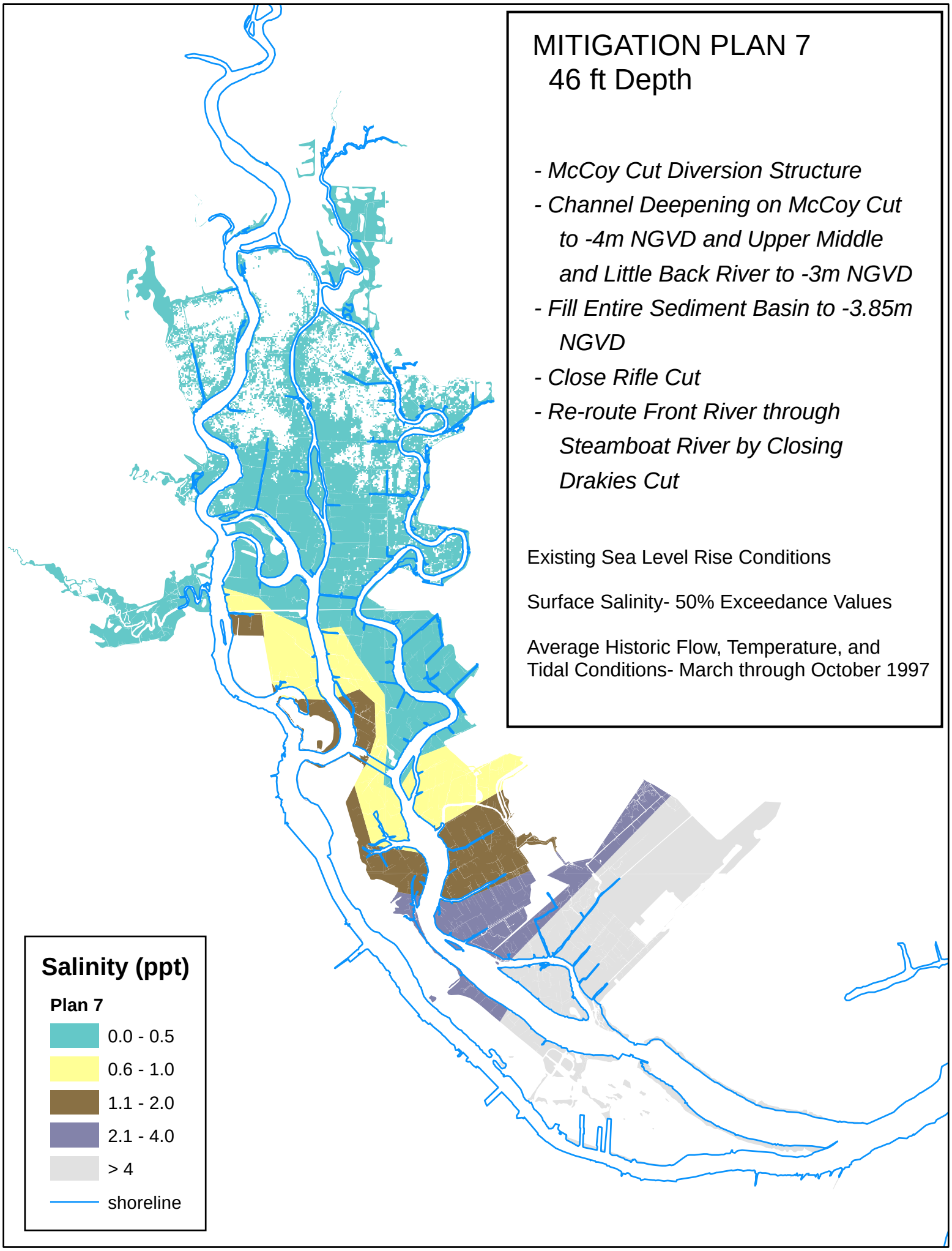
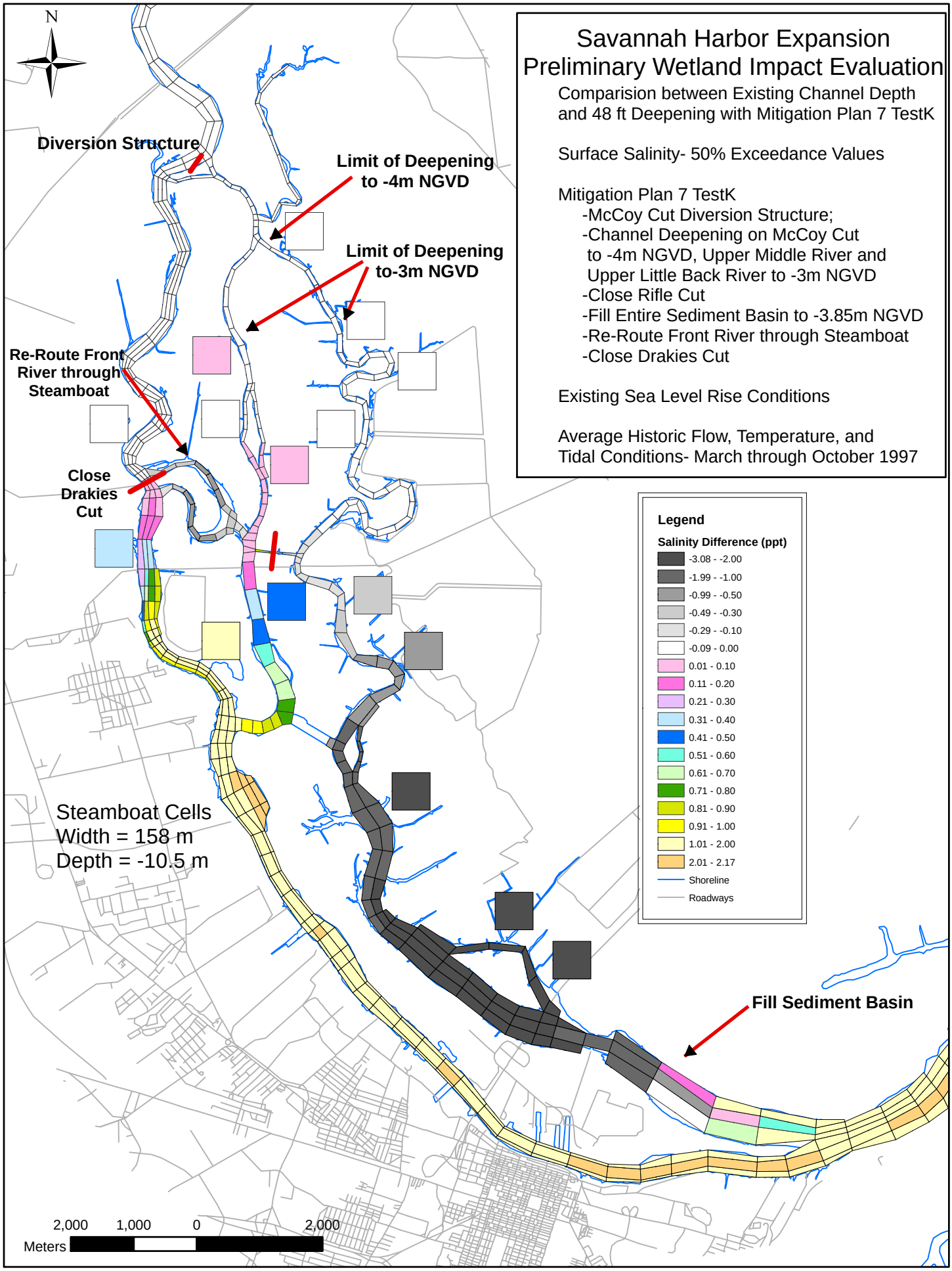
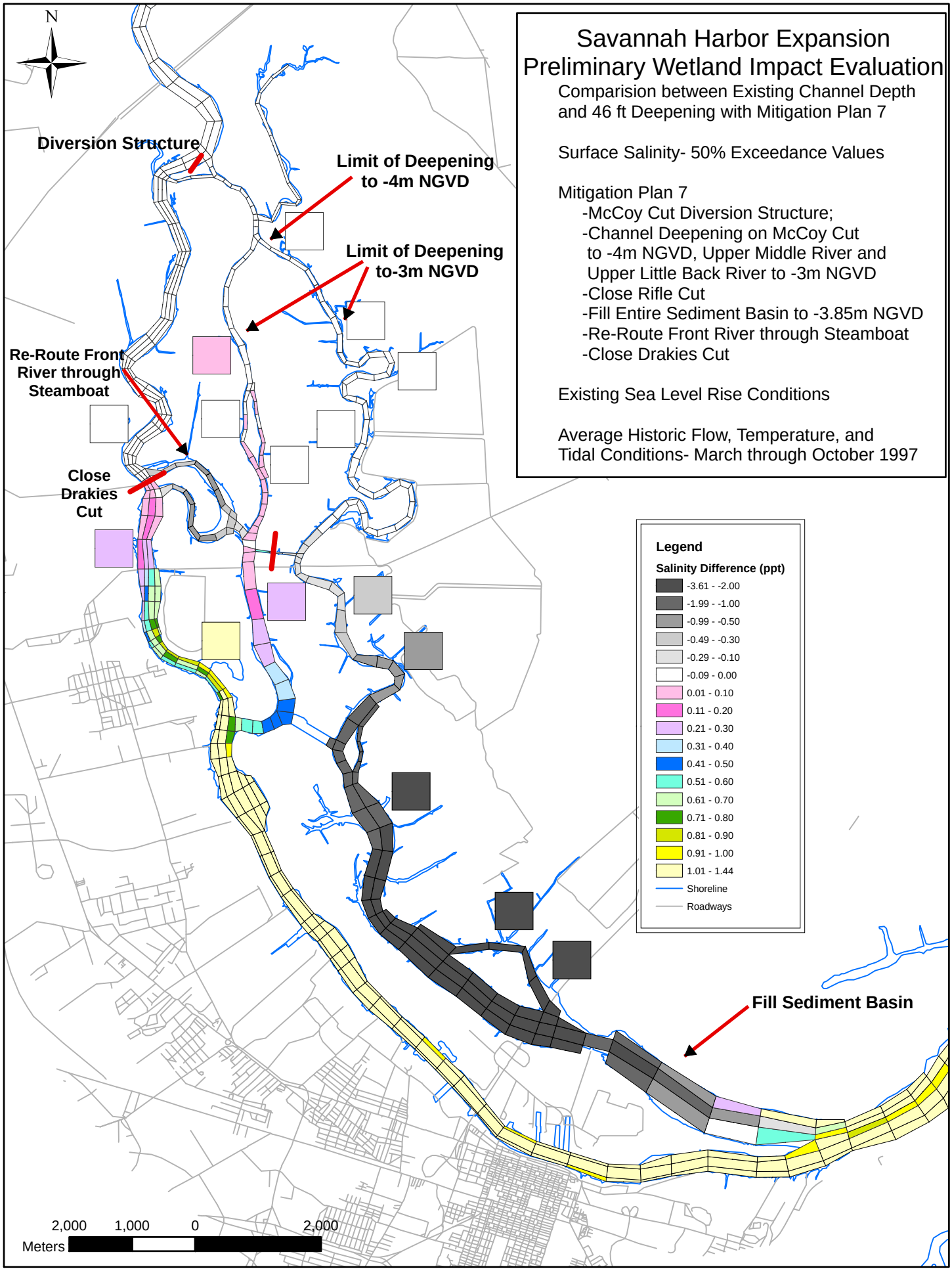
- Close Rifle Cut
- Re-route Front River through Steamboat River by Closing Drakies Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Salinity (ppt)
Plan 7
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline


MITIGATION PLAN 7
46 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Re-route Front River through Steamboat River by Closing Drakies Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Diversion Structure
Limit of Deepening to -4m NGVD
Limit of Deepening to -3m NGVD
Re-route Front River
Close Rifle Cut
Fill Sediment Basin
Salinity (ppt)
Plan 7
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
4.1 - 32.5


MITIGATION PLAN 7
46 ft Depth
- McCoy Cut Diversion Structure
- Channel Deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back River to -3m NGVD
- Fill Entire Sediment Basin to -3.85m NGVD
- Close Rifle Cut
- Re-route Front River through Steamboat River by Closing Drakies Cut
Existing Sea Level Rise Conditions
Surface Salinity- 50% Exceedance Values
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
Salinity (ppt)
Plan 7
0.0 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 4.0
> 4
shoreline


Savannah Harbor Expansion
Preliminary Wetland Impact Evaluation
Comparision between Existing Channel Depth and 48 ft Deepening with Mitigation Plan 7 TestK
Surface Salinity- 50% Exceedance Values
Mitigation Plan 7 TestK
-McCoy Cut Diversion Structure;
-Channel Deepening on McCoy Cut to -4m NGVD, Upper Middle River and Upper Little Back River to -3m NGVD
-Close Rifle Cut
-Fill Entire Sediment Basin to -3.85m NGVD
-Re-Route Front River through Steamboat
-Close Drakies Cut
Existing Sea Level Rise Conditions
Average Historic Flow, Temperature, and Tidal Conditions- March through October 1997
N
Diversion Structure
Limit of Deepening to -4m NGVD
Limit of Deepening to-3m NGVD
Re-Route Front River through Steamboat
Close Drakies Cut
Fill Sediment Basin
Steamboat Cells
Width = 158 m
Depth = -10.5 m
Legend
Salinity Difference (ppt)
-3.08 - -2.00
-1.99 - -1.00
-0.99 - -0.50
-0.49 - -0.30
-0.29 - -0.10
-0.09 - 0.00
0.01 - 0.10
0.11 - 0.20
0.21 - 0.30
0.31 - 0.40
0.41 - 0.50
0.51 - 0.60
0.61 - 0.70
0.71 - 0.80
0.81 - 0.90
0.91 - 1.00
1.01 - 2.00
2.01 - 2.17
Shoreline
Roadways
2,000 1,000 0 2,000
Meters

Sep18 2007



October 2007