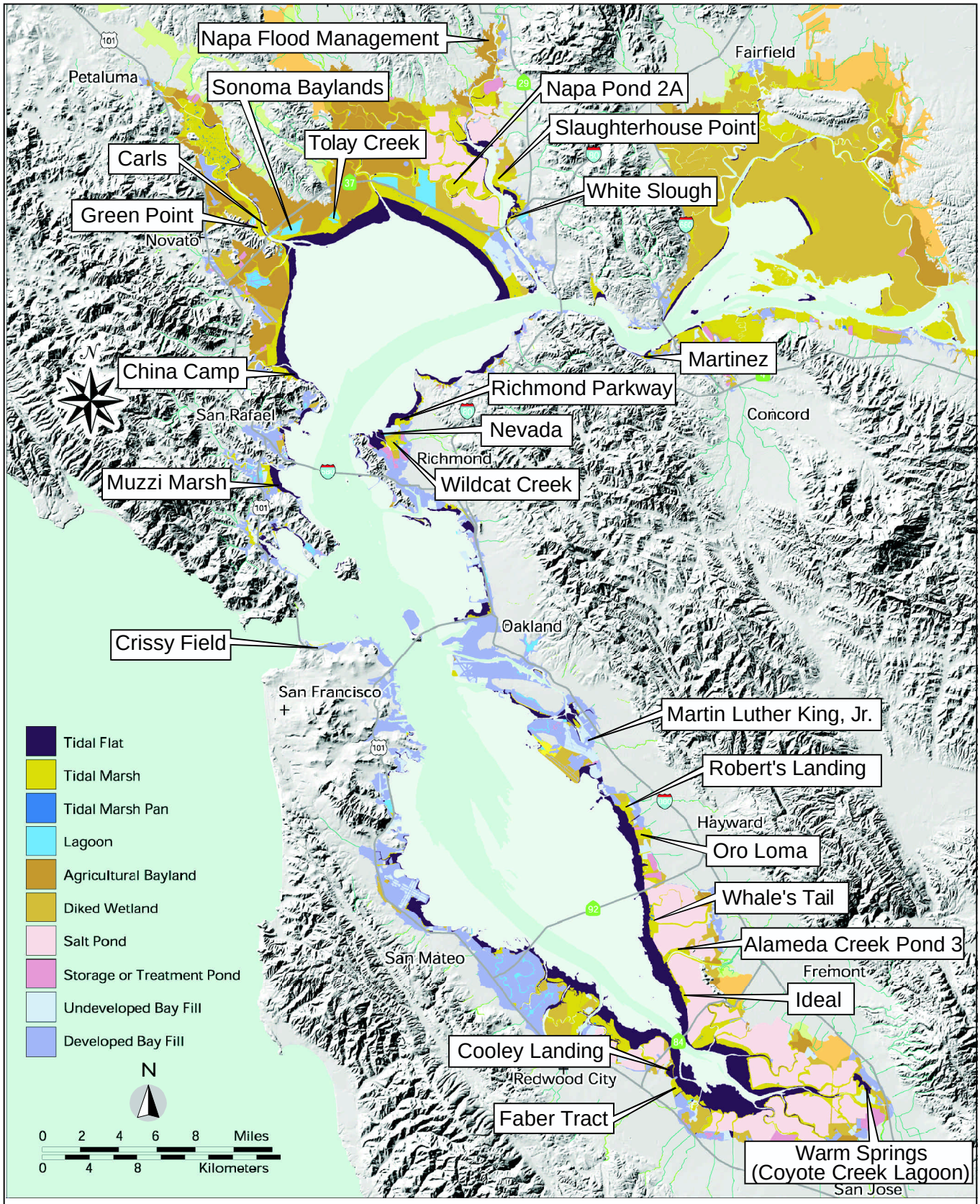


map source: EcoAtlas (SFEI 1999)

figure 1

Tidal Wetland Restoration Handbook

Wetland Restoration Site Locations

PWA

1632 Fig_WetlndRestSiteLoc.cdr

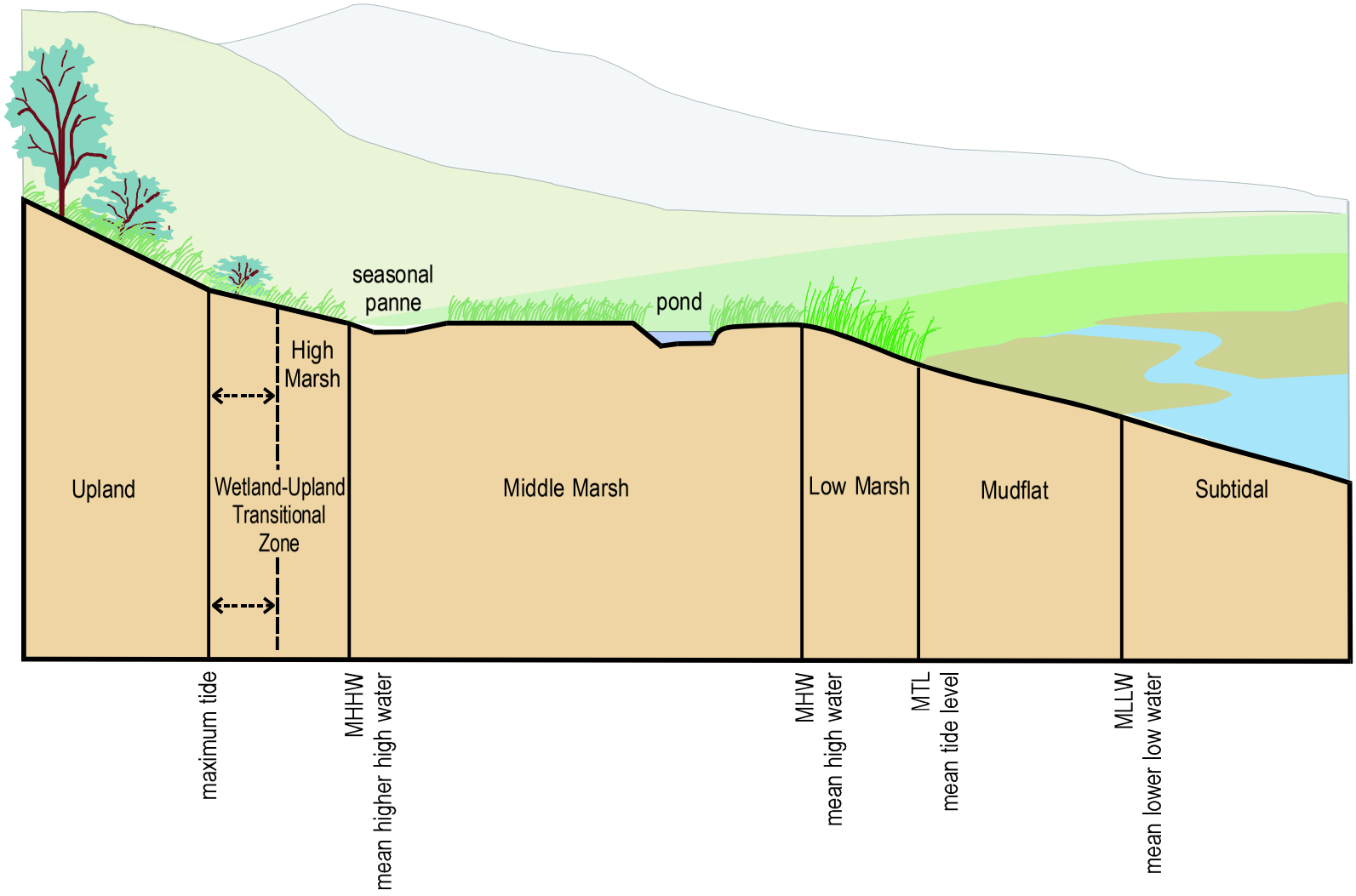


figure 2

Note:
The landward boundary of the high marsh shifts from year to year within the wetland-upland transition zone.

Tidal Wetland Restoration Handbook

Vertical Profile of Tidal Marsh

1632/VertProfileTdlMrsh.cdr

PWA

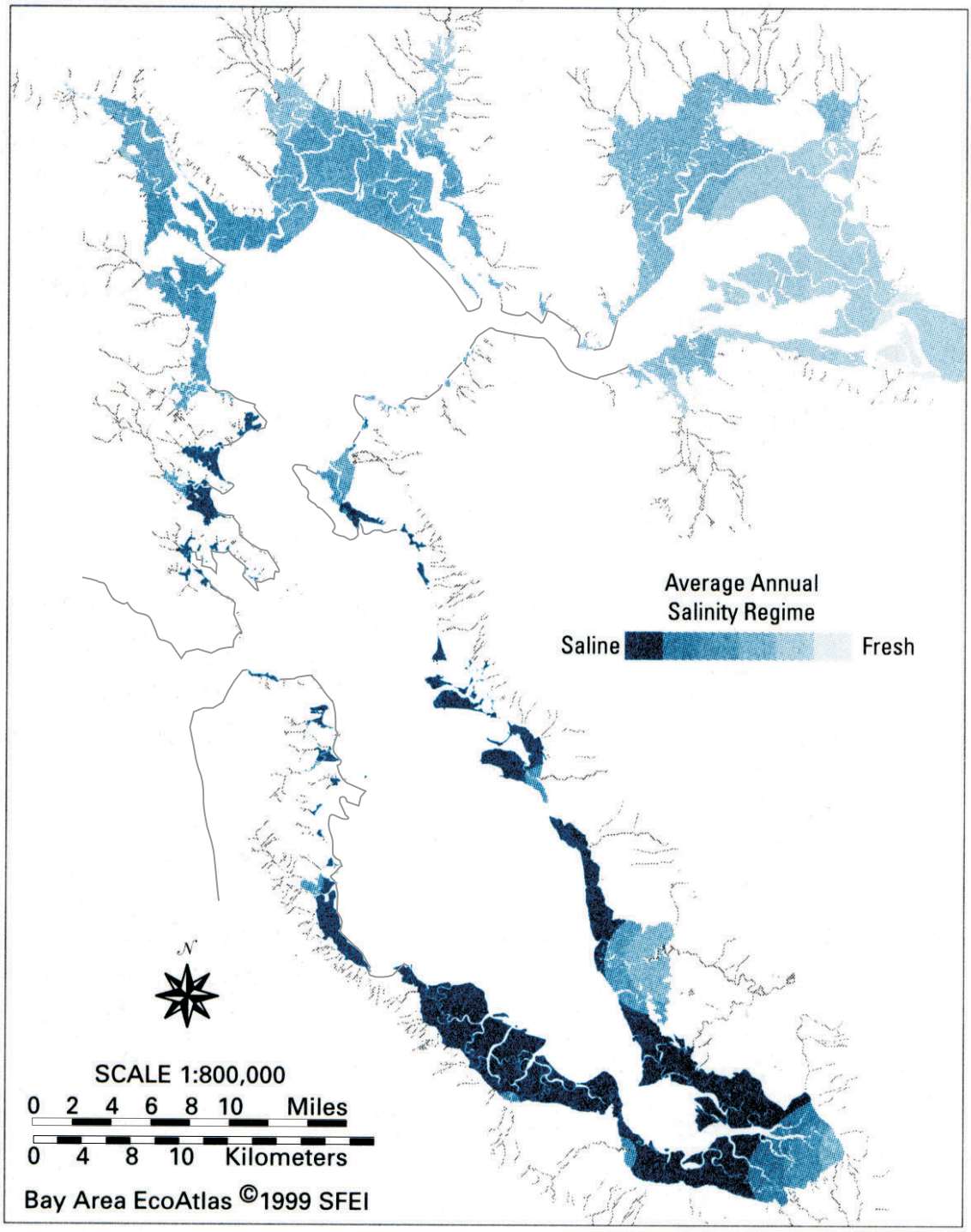


figure 3

Source:
Habitat Goals Project (1999)

Tidal Wetland Restoration Handbook

Regional Map of Salinity Gradients

PWA

1632/report/MainFigs/RegMapSalGrdnts.cdr 5.18.04

figure 4

Tidal Wetland Restoration Handbook

China Camp Marsh

PWA

1632/fig_ChinCamMarsh.cdr aug2004

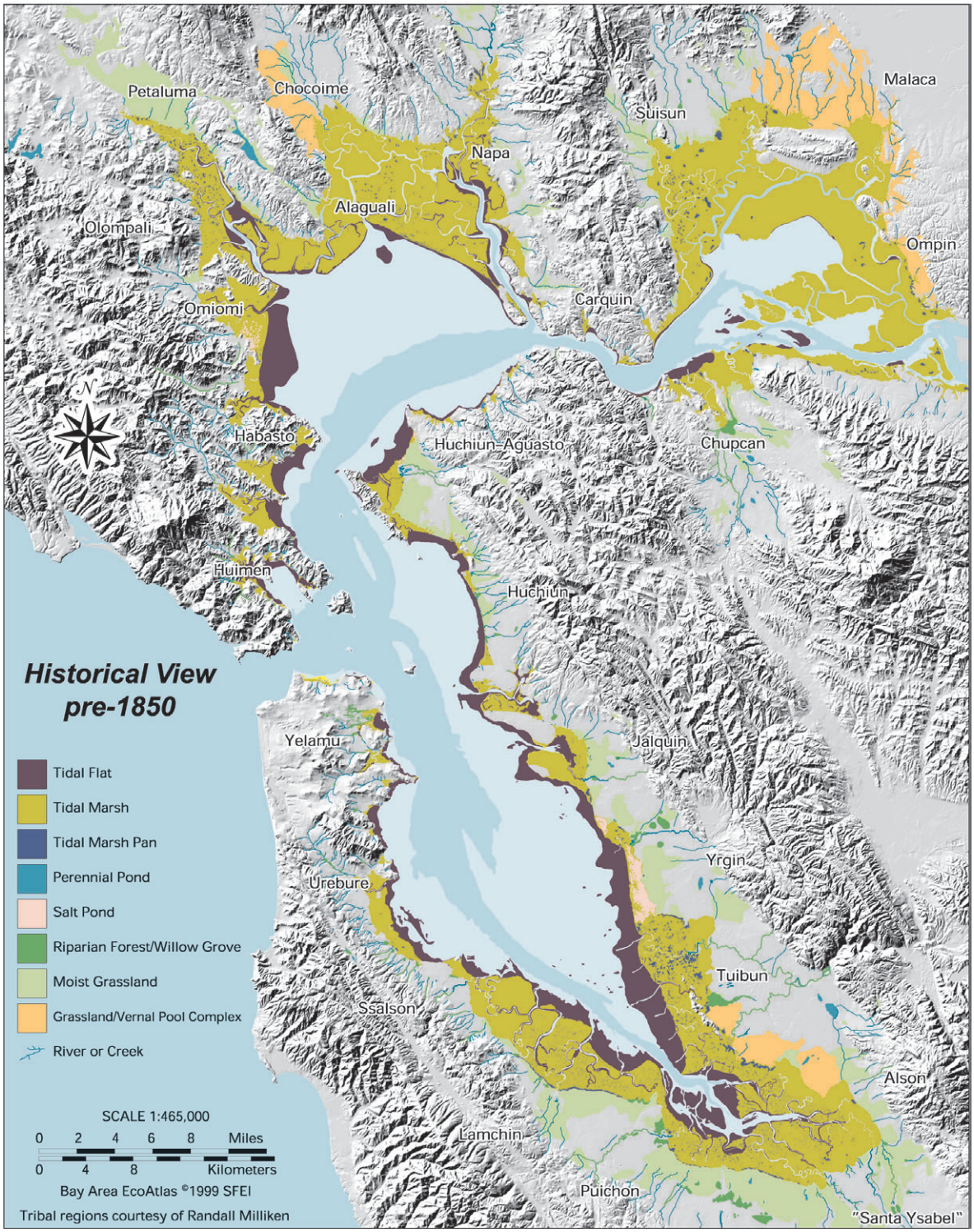


figure 5

Source:
Habitat Goals Project (1999)

Tidal Wetland Restoration Handbook

Past Distribution of Bayland Habitat

PWA

1632/report/MainFigs/PastDistBaylndHab.cdr aug2004

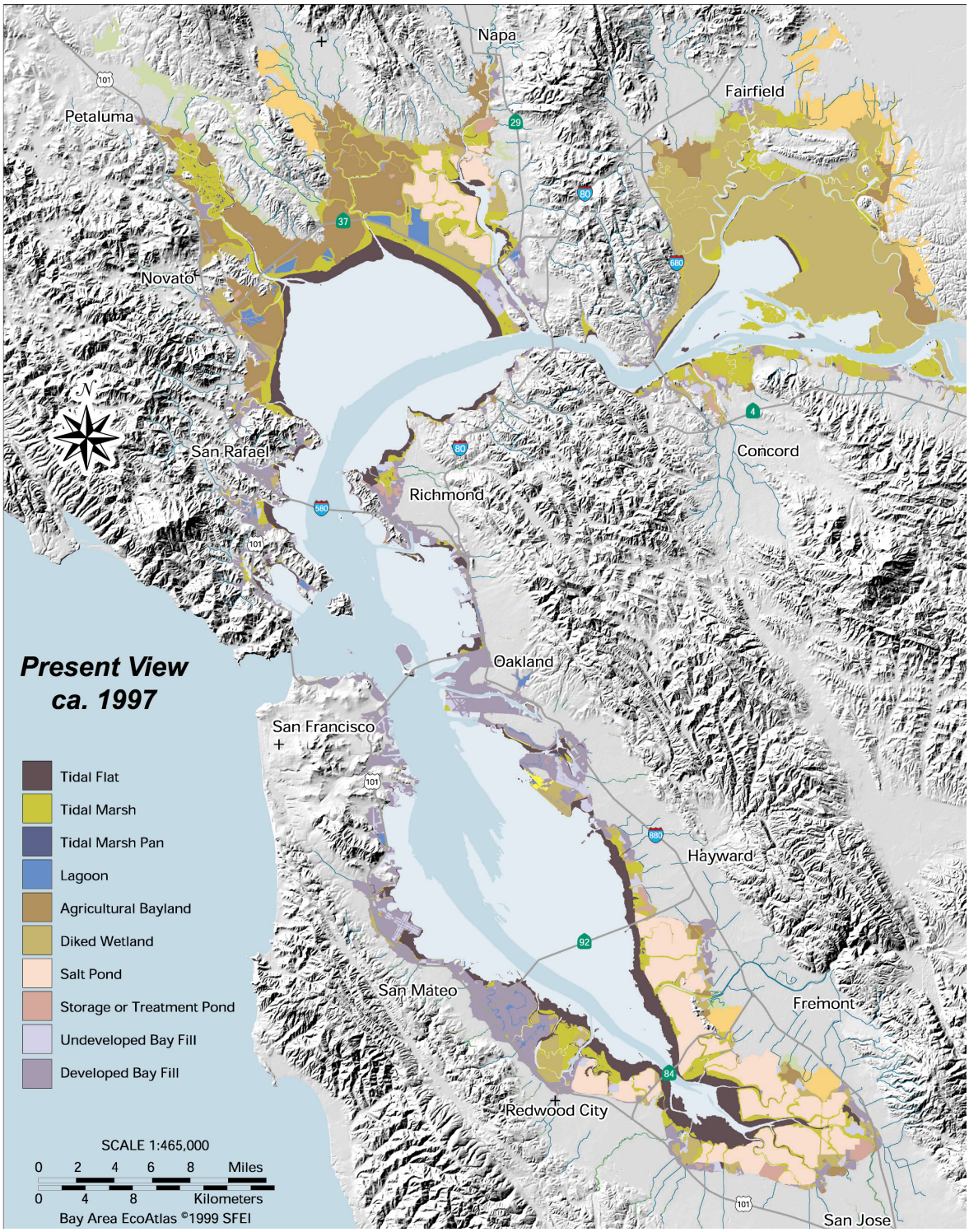


figure 6

Source:
Habitat Goals Report (1999)

Tidal Wetland Restoration Handbook

Present Distribution of Bayland Habitat

PWA

1632/report/MainFigs/PsntDistBaylndHab.cdr aug2004

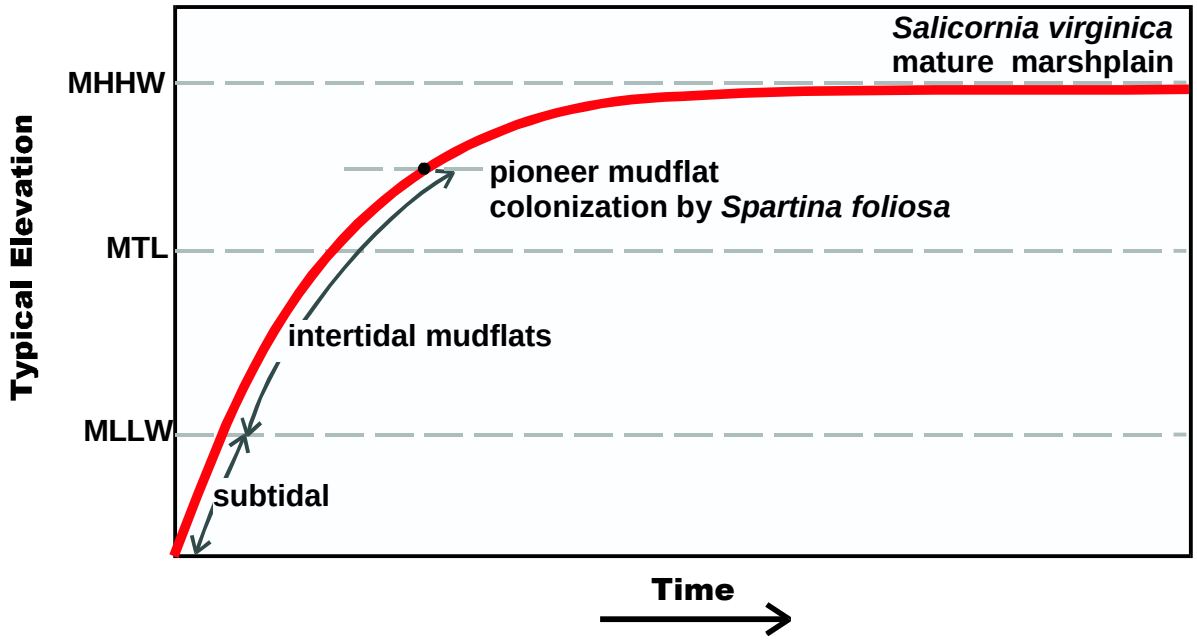


figure 7

Tidal Wetland Restoration Handbook

Evolutionary Trajectory of Restoring Tidal Marsh

PWA

evol_traget.cdr 8.17.04

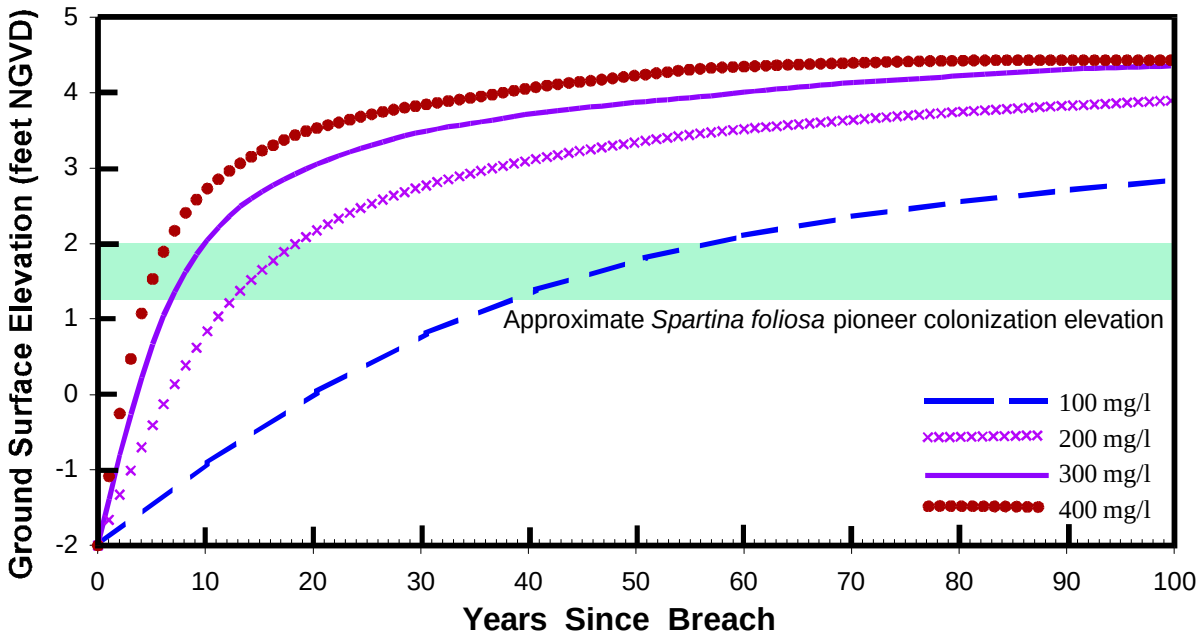


figure 8

Shaded bar identifies the approximate *Spartina foliosa* colonization elevation. Prediction is based on tides at the Presidio, no sea level rise, and 550 kg/m^3 dry density of inorganics, typical for San Francisco Bay.

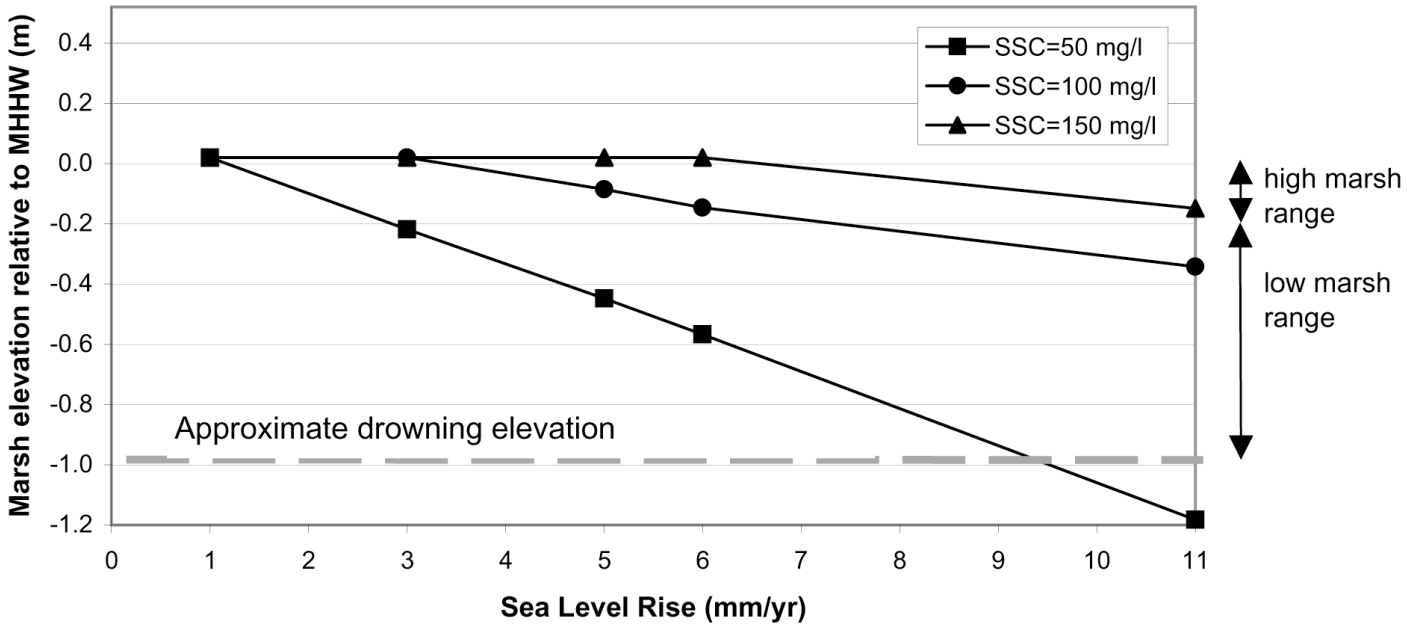
Source: Williams and Orr (2002)

Tidal Wetland Restoration Handbook

Effect of Suspended Sediment Concentration on Marshplain Evolution

PWA

1632/fig_EffectSuspSedConMrshpln.cdr Aug2004



San Pablo Bay equilibrium marsh elevation as a function of sea level rise and suspended sediment concentration (SSC). Note that marsh elevations for the low suspended sediment scenario may be overestimated because the marsh did not reach an equilibrium elevation within the 500 years modeled.

figure 9

Tidal Wetland Restoration Handbook

Effect of Relative Sea Level Rise on Marshplain Evolution

Source:
Orr et al.pdf(2003)\(Fig6.xls)

PWA

1632/fig_effectRelSeaLvlR.cdr

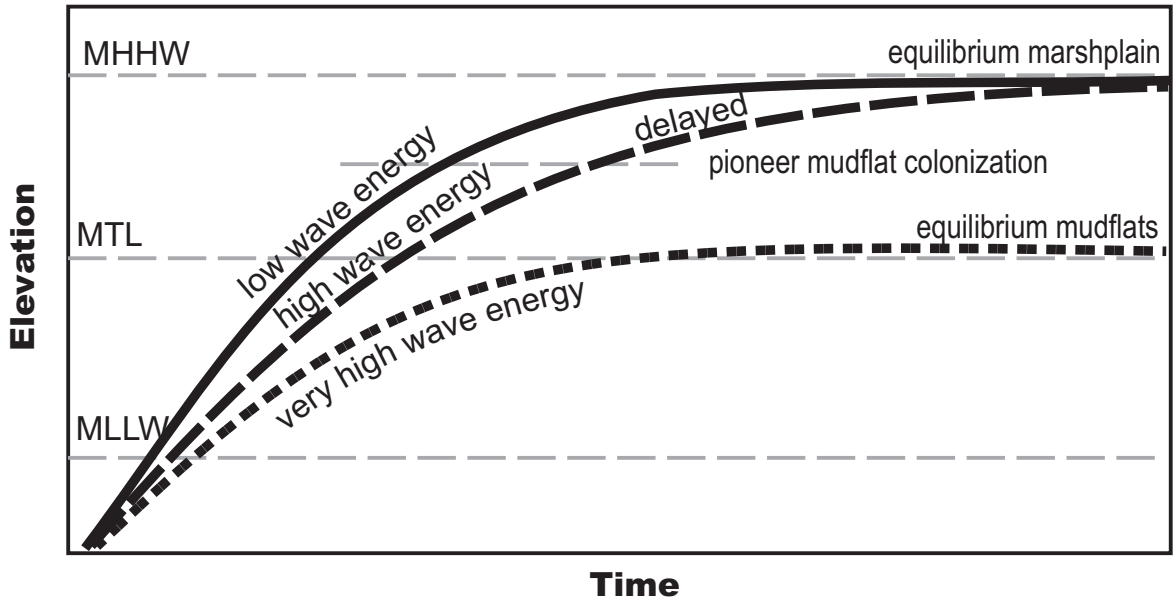


figure 10

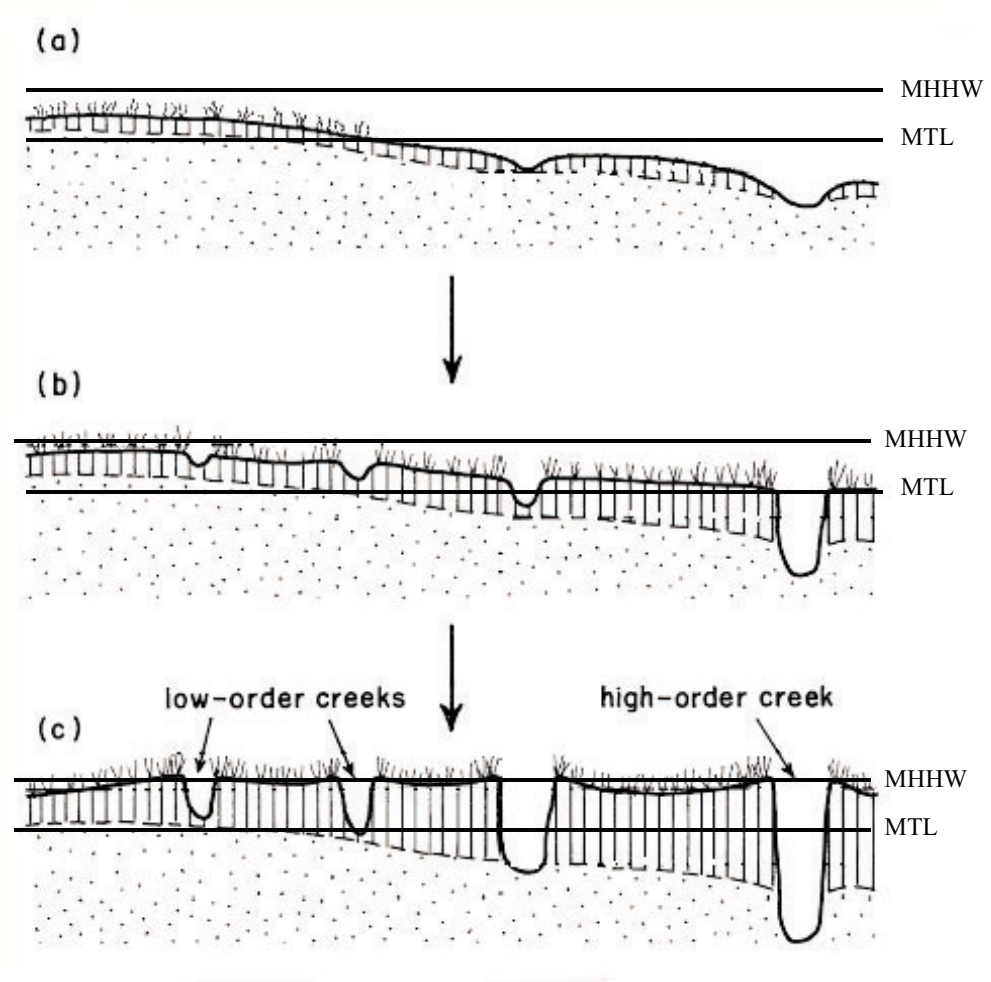
Tidal Wetland Restoration Handbook

Conceptual Effect of Wind Waves on Tidal Marsh Evolution

Source: Williams and Orr 2002 Fig 14

PWA

fig13_wind waves.cdr 5.17.04



Schematic of youthful marsh development.
(a) Young marsh low in the tidal frame with precursor mudflat and incipient channels.
(b) Developing marsh showing more extensive vegetation colonization and channel formation.
(c) Mature marsh with fully vegetated marsh plain and channel drainage system.

MHHW = mean higher high water.
MTL = mean tide level.
Speckled fill is mud;
hatched fill is marsh soil.

figure 11

Tidal Wetland Restoration Handbook

Tidal Marshplain Evolution with Time

Source: Adapted from French (1993) and Allen (2000).

PWA

1632_Fig_Tid_marshp_evol.cdr

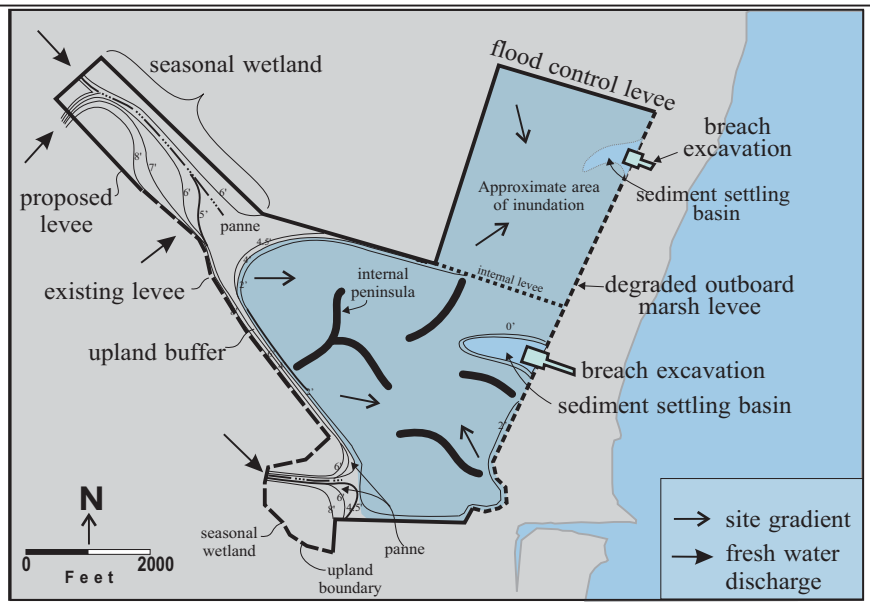
figure 12

Tidal Wetland Restoration Handbook

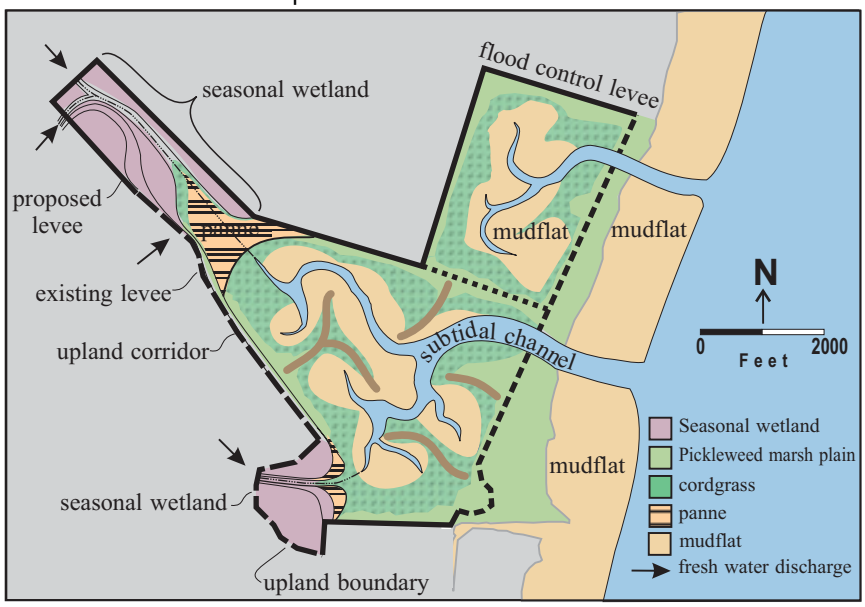
Hamilton Restoration Site Template & Expected Evolution

1632/fig/hamiltonRest.cdr

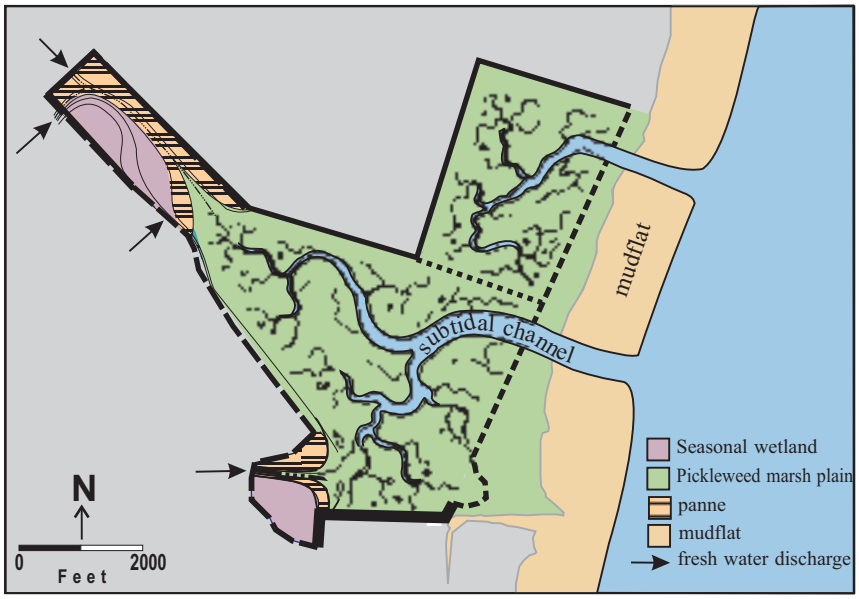
PWA



Initial Conditions Site Template.



Expected Site Conditions Approximately 10 Years After Construction



Expected Site Conditions Approximately 50 Years After Construction.

figure 13

Tidal Wetland Restoration Handbook

Muzzi Marsh 1990

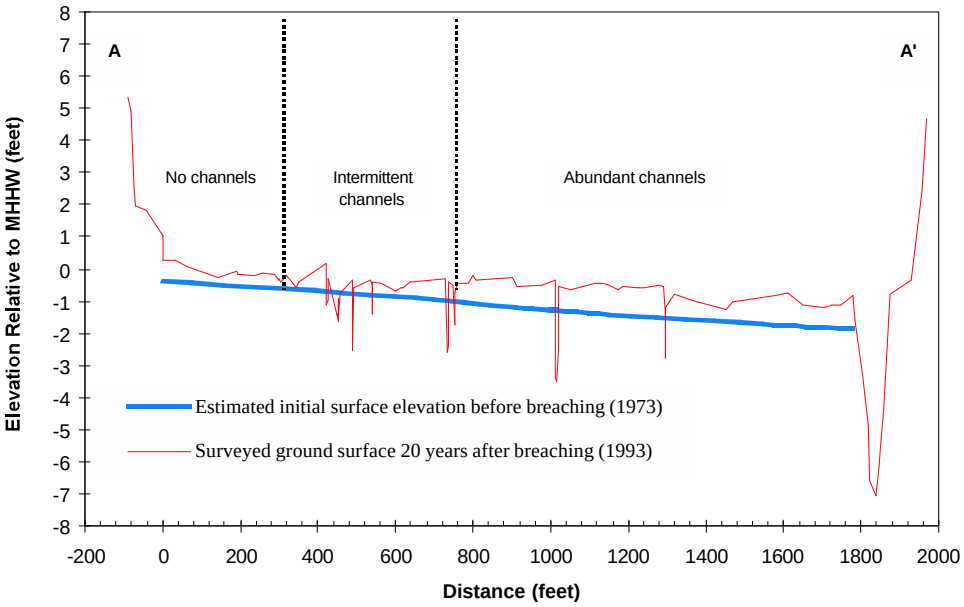
date of photo: 3/15/90
scale shown: 1:6,000
original scale: 1:12,000

N

0 250 500
feet

PWA

Muzzi1990.cdr



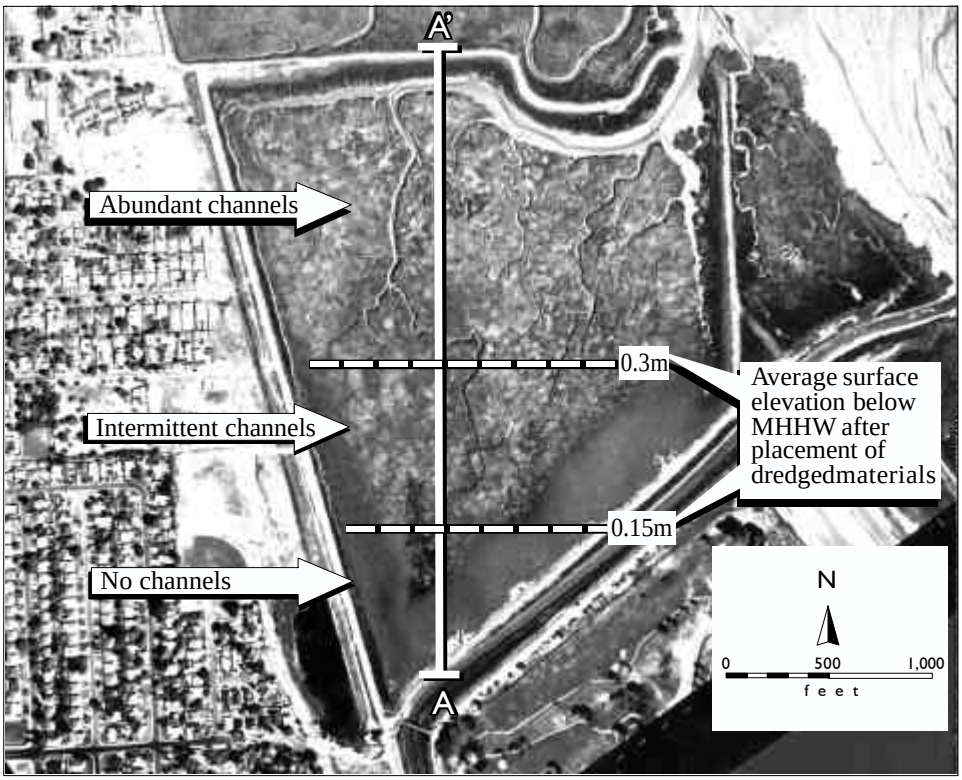


figure 14

Tidal Wetland Restoration Handbook

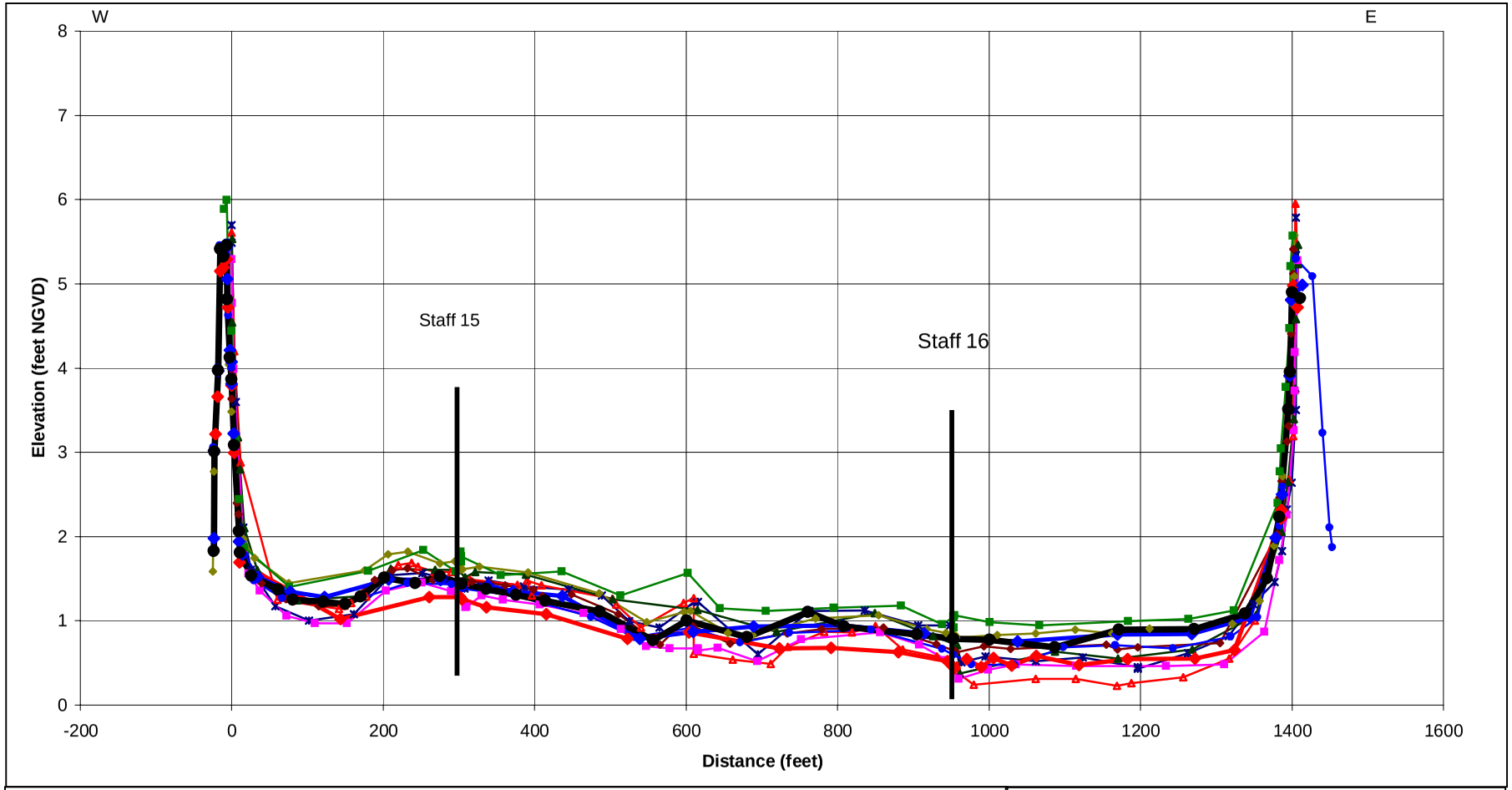
Pre Breach Ground Surface Elevation and Slough Channel Abundance at Faber Tract

Elevation profile at top shows estimated initial ground elevations before breaching in 1973. Dotted lines in the cross-section and photograph indicate zones of channel abundance

Source: Williams and Orr 2002

PWA

1632/fig/PreBrechGrdSurf.cdr



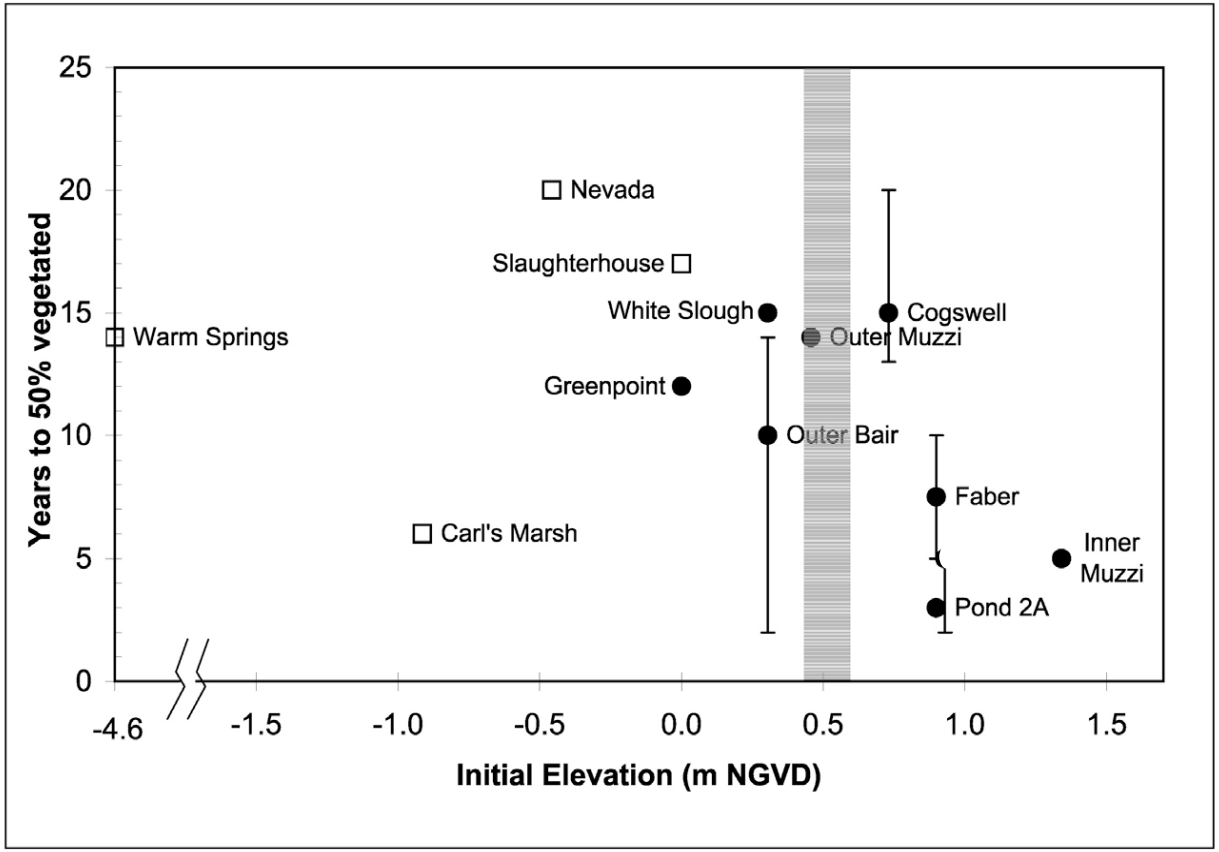
Sept-97
Mar-98
Oct-98
Apr-99
Oct-99
Mar-00
Oct-00
June-01
Oct-01
Apr-02
Sep-02

Figure 15

Tidal Wetland Restoration Handbook
Sonoma Baylands 2002 Monitoring - Interior Transect 16

PWA

PWA#: 1174



Number of years for marshplain vegetation to establish versus initial elevation. Shaded bar identifies the approximate Spartina colonization elevation. Error bars represent the range of uncertainty based on the data available to bracket the time frame. Damped tidal sites excluded.

● Age when 50% vegetated

□ Current age if not vegetated (as of Year 2000)

figure 16

Tidal Wetland Restoration Handbook

Colonization Elevation

Source:
Williams&Orr2002.pdf\(Fig5-6-10.xls)

PWA Ref # 1632-Aug2004

PWA

pwa/TechPapers/Williams&Orr2002.pdf/figure5

figure 17

Tidal Wetland Restoration Handbook

Muzzi Marsh Vegetation 1980

PWA

1632/fig/Muzzi_marsh1980

1984

2003

figure 18

Tidal Wetland Restoration Handbook

Muzzi Marsh South Channel

PWA

1632/fig/MuzMrshSuthChl.cdr

N

0 500

feet

figure 19

Tidal Wetland Restoration Handbook

Martinez Marsh 2003

1632/fig/mrtnz_03cdr

PWA

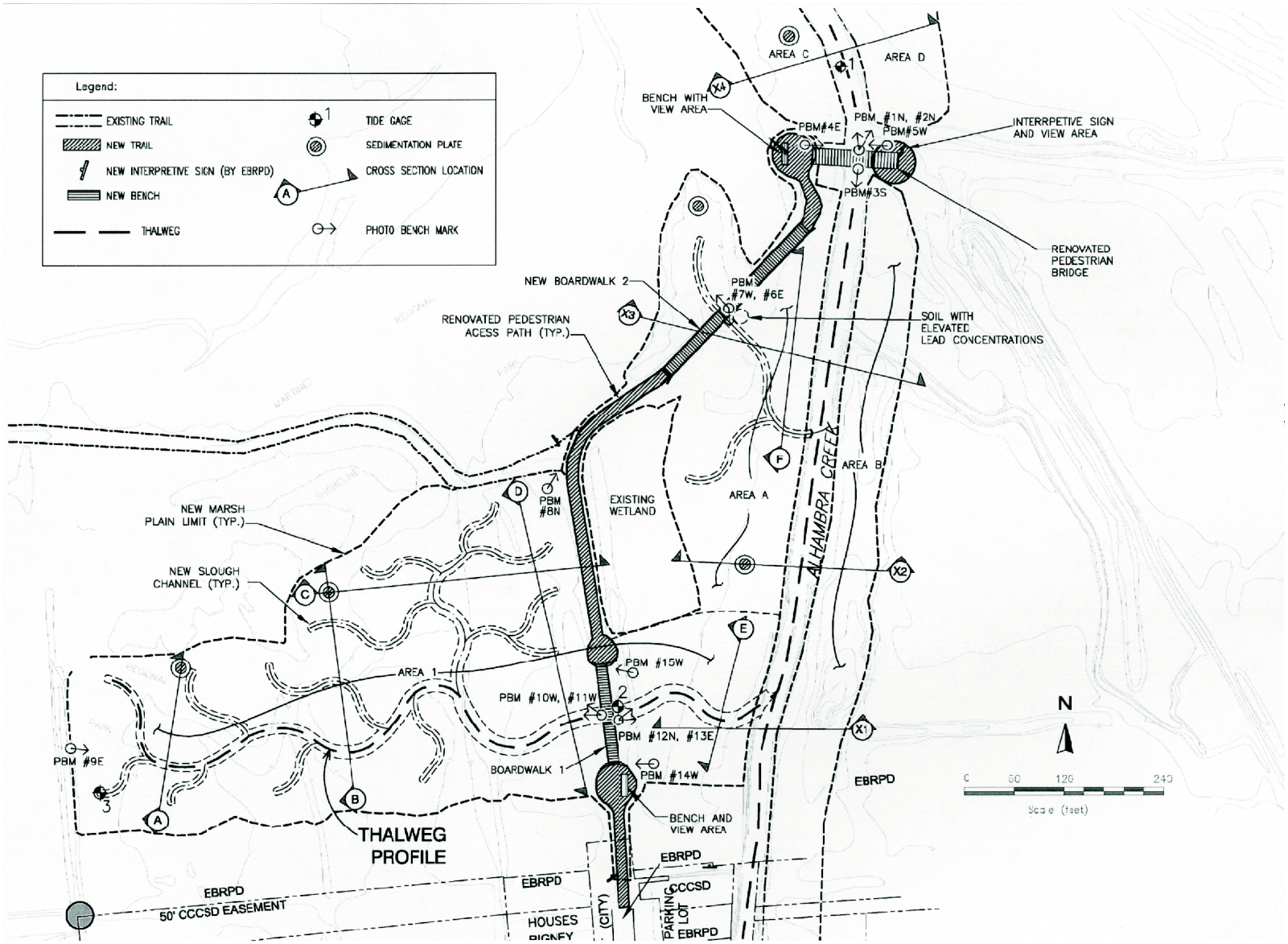


figure 20

Tidal Wetland Restoration Handbook

Martinez Marsh Design 2003

PWA

1632/fig MartinzDesign.cdr

PBM 12N
On bridge rail over thalweg looking Northeast
7/17/2003 12:00 pm (-0.2 feet MLLW @ Crockett)

PBM 13E
On bridge rail over thalweg looking East
7/17/2003 12:00 pm (-0.2 feet MLLW @ Crockett)

figure 21

Tidal Wetland Restoration Handbook

Martinez Marsh Vegetation 2003

PWA

1632 /fig/MrtxMrshVeg03.cdr

figure 22

Warm Springs Marsh

date of photo: 8/11/98
scale shown: 1:12,000
original scale: 1:16,800

WarmSprings1998_fig22.cdr

PWA

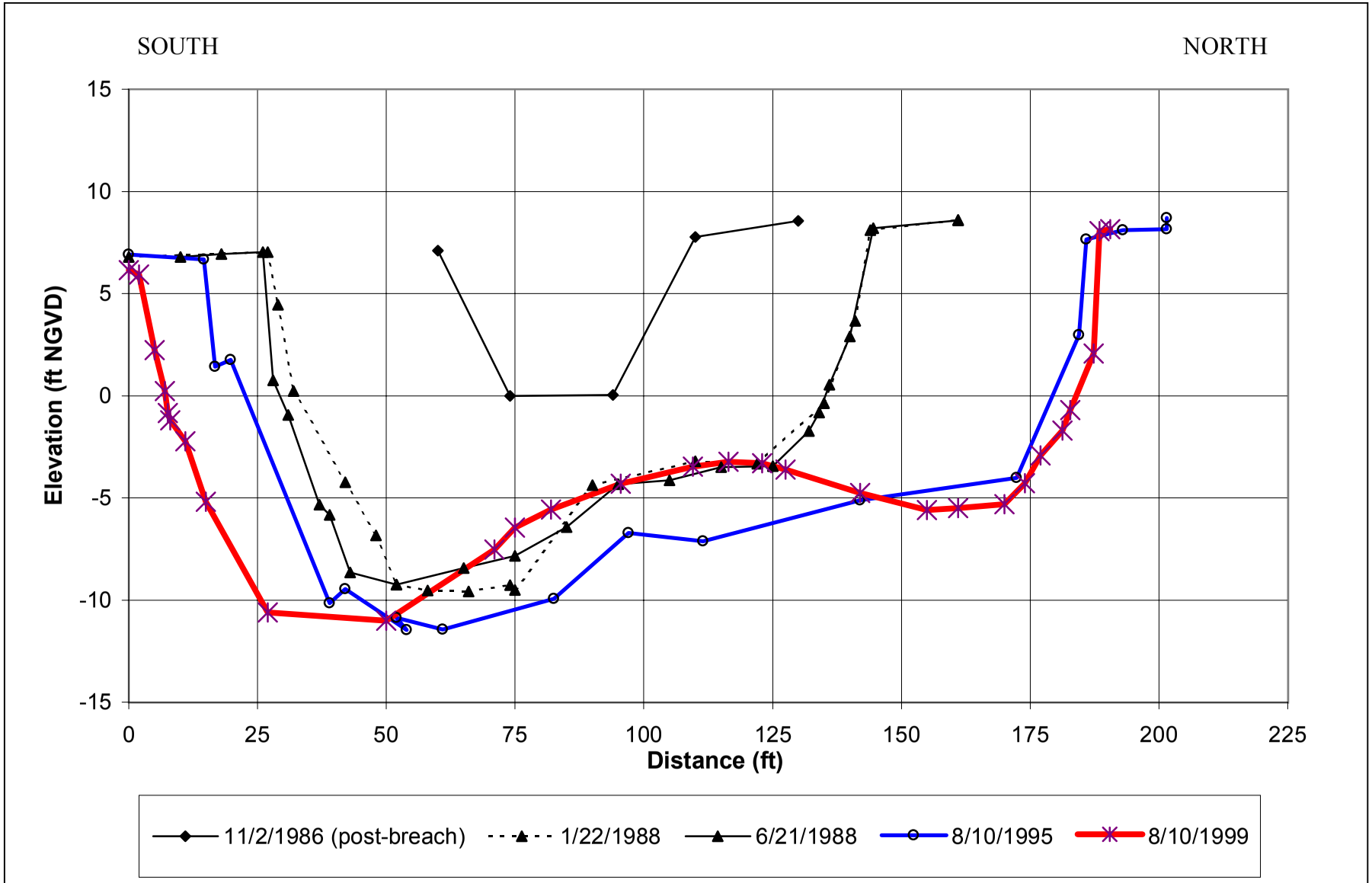


figure 23	*Tidal Wetland Restoration Handbook*: **Warm Springs Marsh - South Breach Cross Section**	PWA	PWA#: 1575

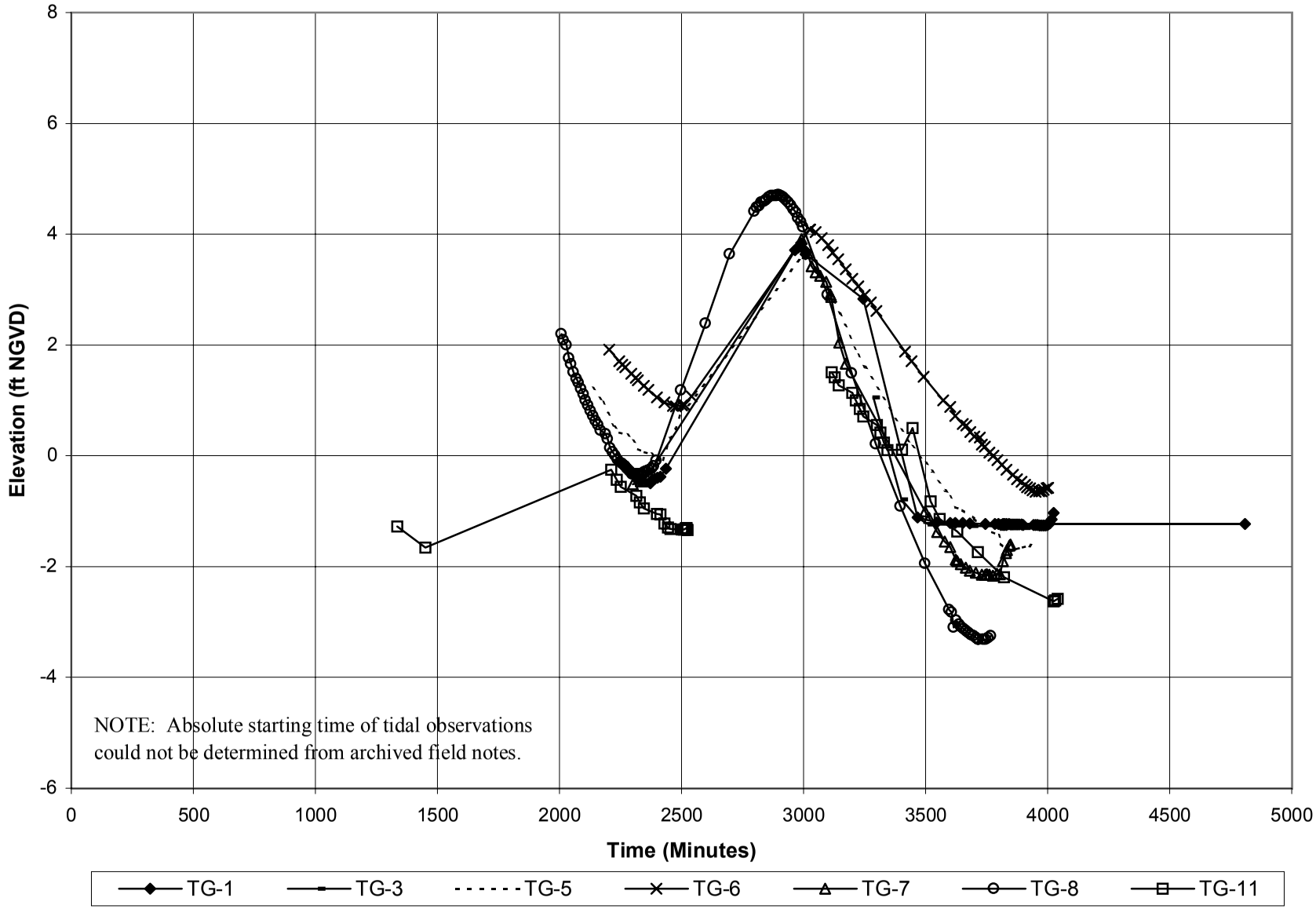


figure 24	*Tidal Wetland Restoration Handbook* **Warm Springs Marsh - Tides March 21-22, 1987**	**PWA**	PWA#: 1575

PWA/1575MarshMon/FigureA7.2_WarmSprings1987.xls

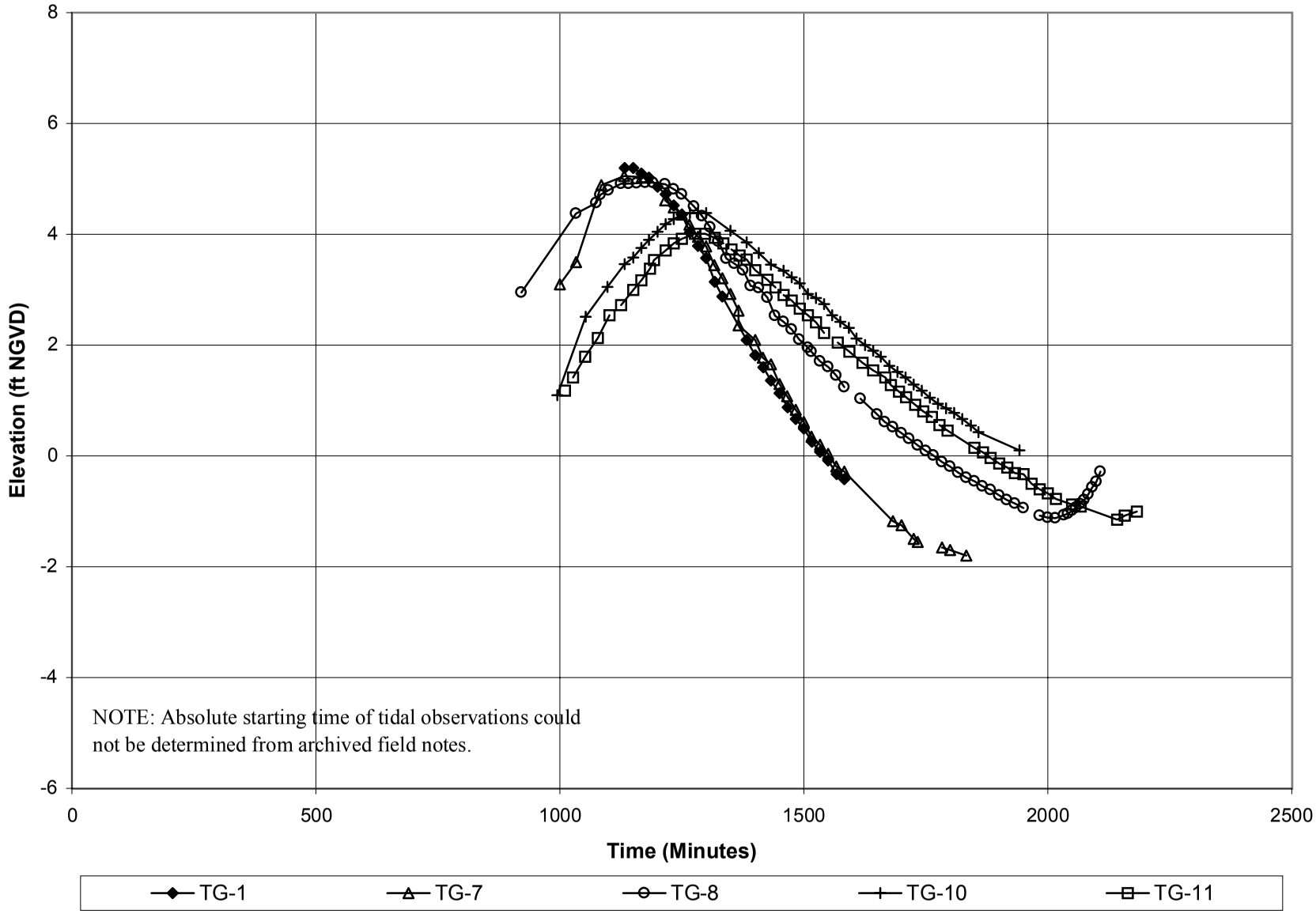


figure 25 | *Tidal Wetland Restoration Handbook* | **Warm Springs Marsh - Tides** **March 16, 1988** | PWA | PWA#: 1575

PWA/1575MarshMon/FigureA7.3_WarmSprings1988.xls

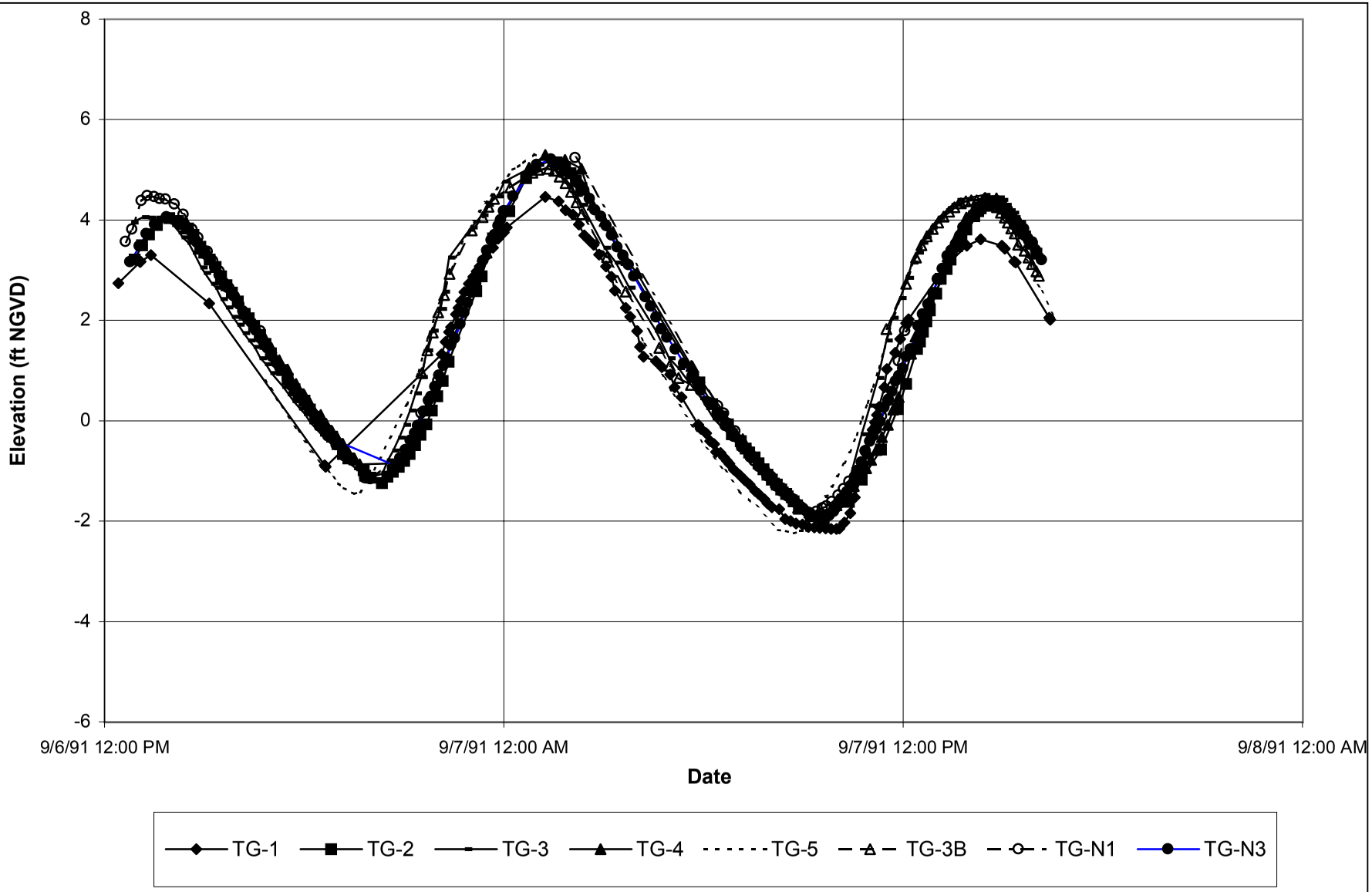


figure **26** | *Tidal Wetland Restoration Handbook:* **Warm Springs Marsh - Tides Sept 6-Sept 8, 1991** | **PWA** | PWA#: 1575

PWA/1575MarshMon2003/FigureA7.4_WarmSprings1991.xls

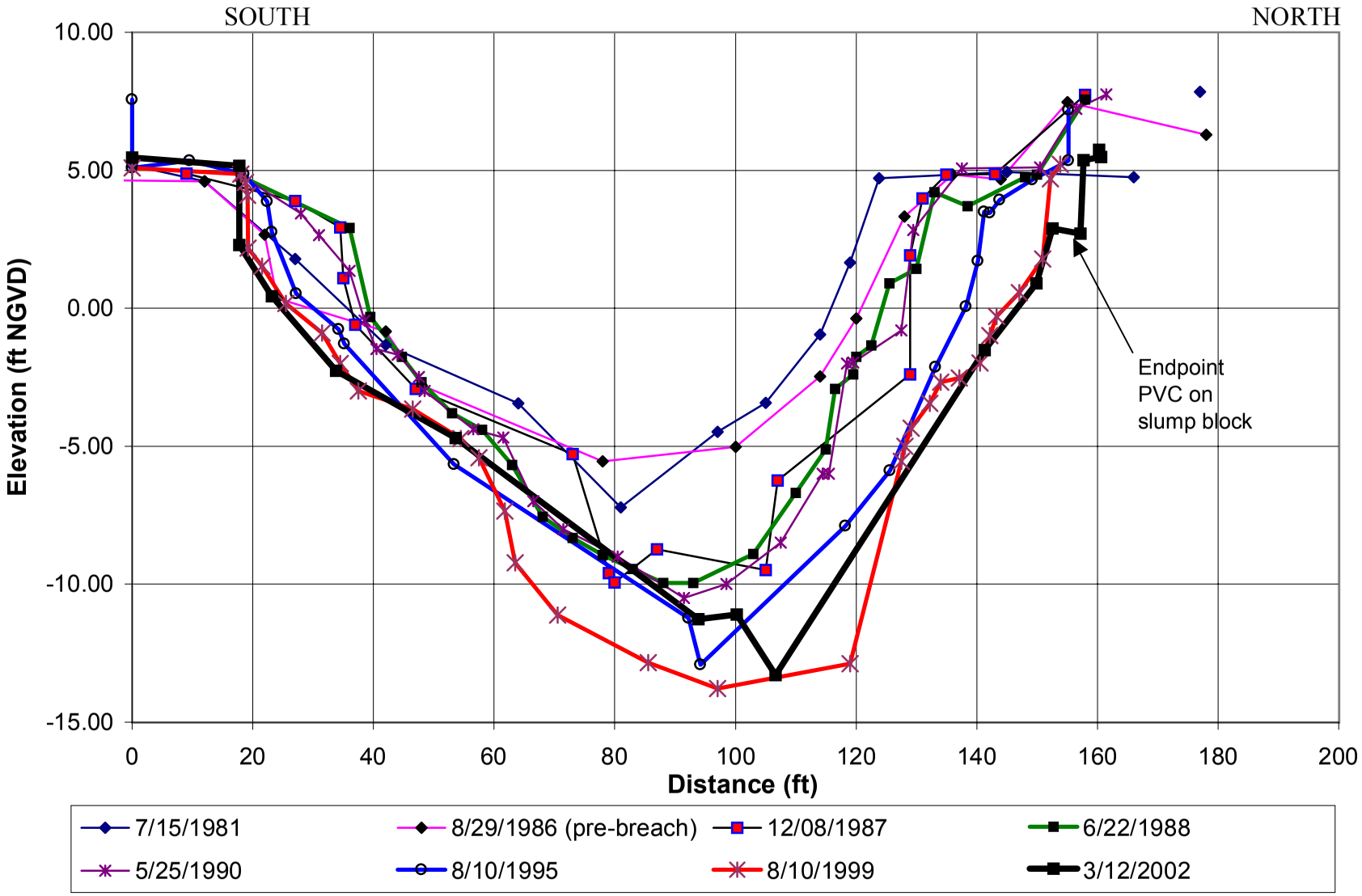


figure 27 | *Tidal Wetland Restoration Handbook* **Warm Springs Marsh - X-S 71, Coyote Slough nr Connector Slough 1981-2002** | PWA | PWA#: 1575

PWA/1575MarshMon2003/FigureA6.6_WarmSpringsXS71.xls

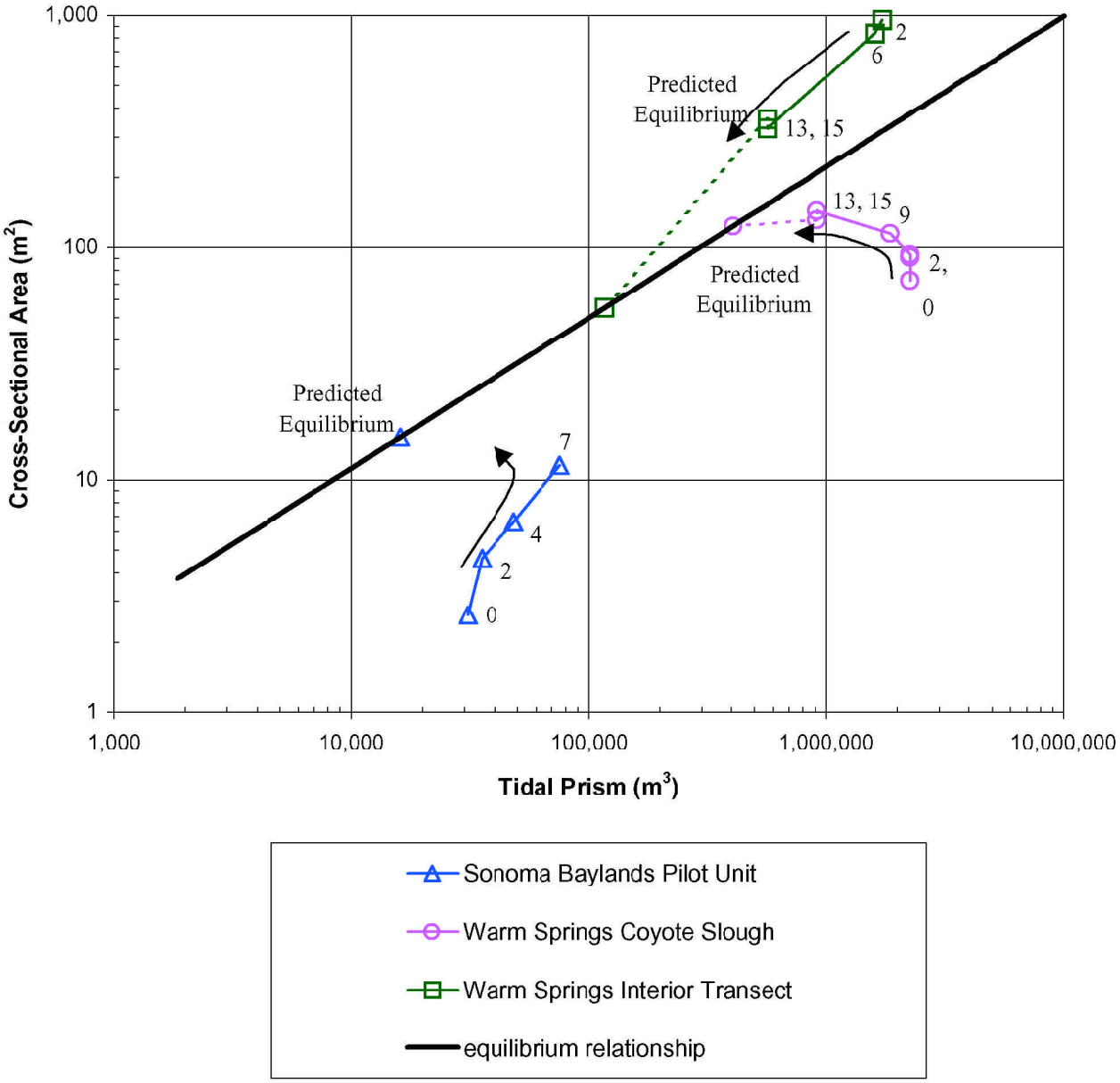


figure 28

Tidal Wetland Restoration Handbook

Evolutionary Trajectory of Tidal Prism and Channel Cross-Sectional Area

PWA

1632/fig/EvlTrjTidPrism.cdr

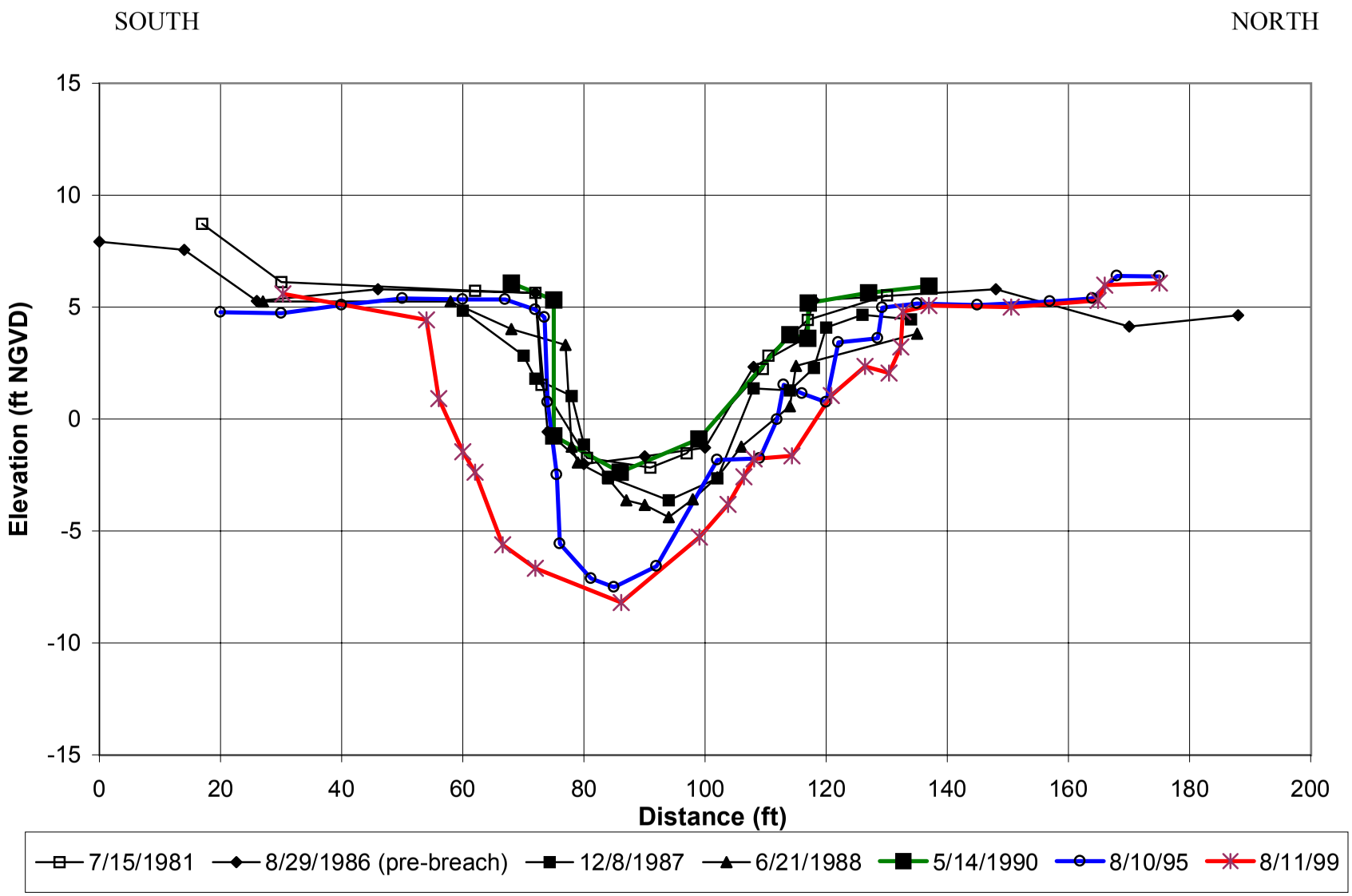
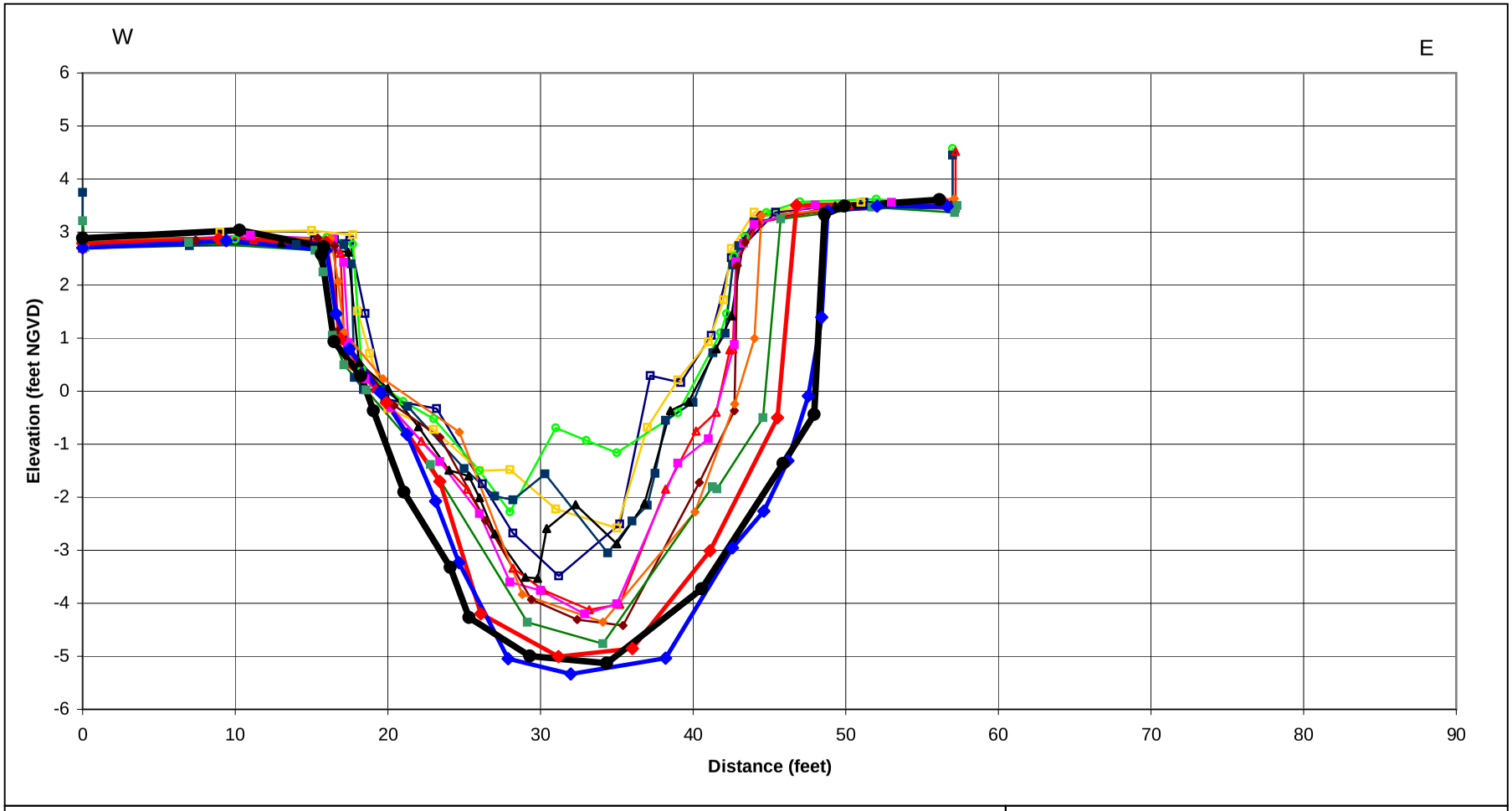


figure 29 | *Tidal Wetland Restoration Handbook* | **Warm Springs Marsh - Cross Section 41, Mud Slough 1981-1999** | **PWA** | PWA#: 1575

PWA/ 1575MarshMon2003/ FigureA6.5_WarmSpringsXS41.xls



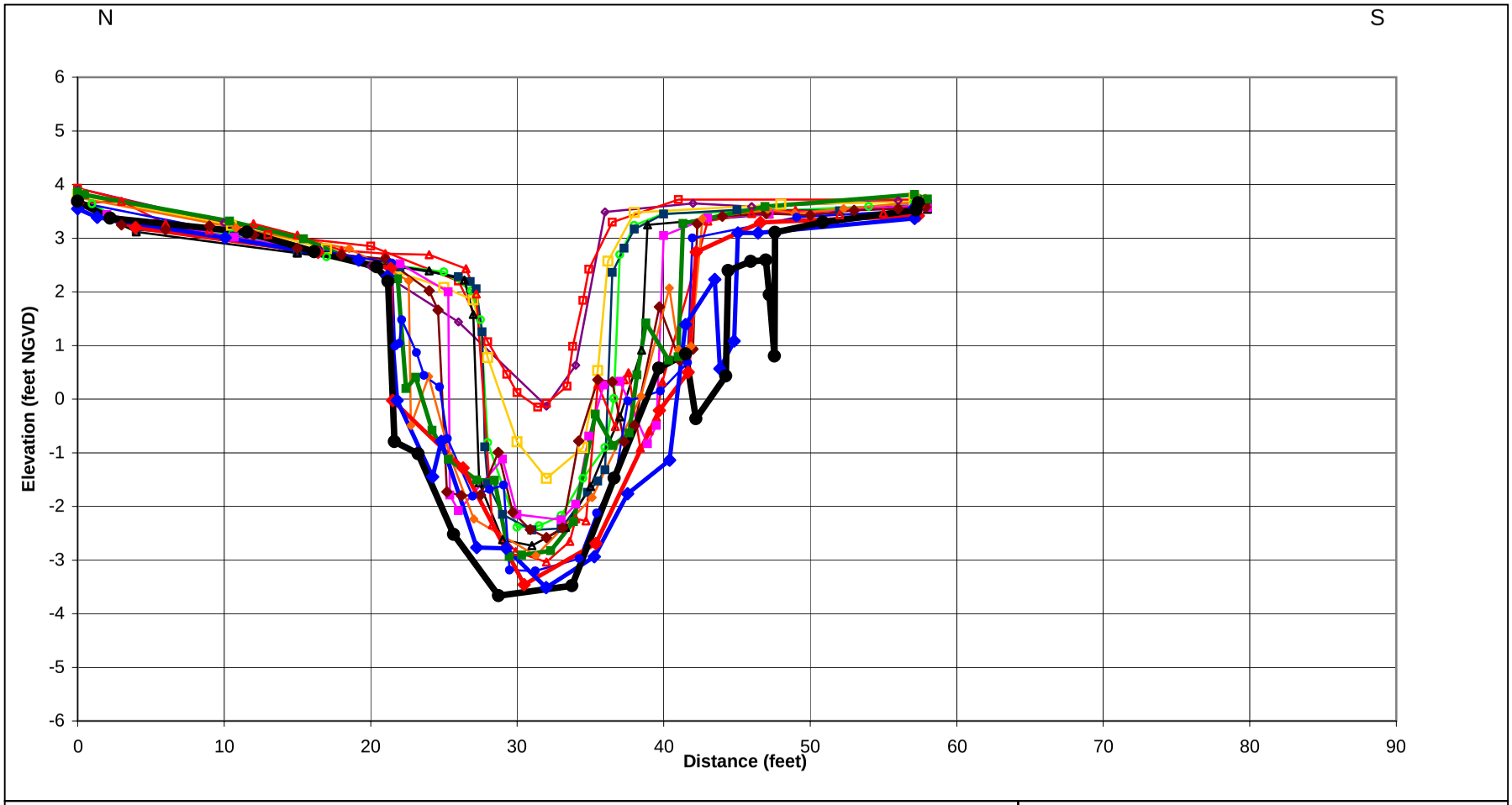
Mar-96 Aug-96 Jun-97 Sep-97 Mar-98
Oct-98 Apr-99 Oct-99 Mar-00 Oct-00
Oct-01 May-02 Sep-02

Figure 30

Tidal Wetlands Restoration Handbook
Sonoma Baylands Pilot Unit: Breach Cross Section 11

PWA

PWA#: 2002SonBay 1174 - FigA8



Oct-94 | Feb-96 | Aug-96 | Jun-97 | Sep-97
Mar-98 | Oct-98 | Apr-99 | Sep-99 | Mar-00
Oct-00 | Apr-01 | Oct-01 | Apr-02 | Sep-02

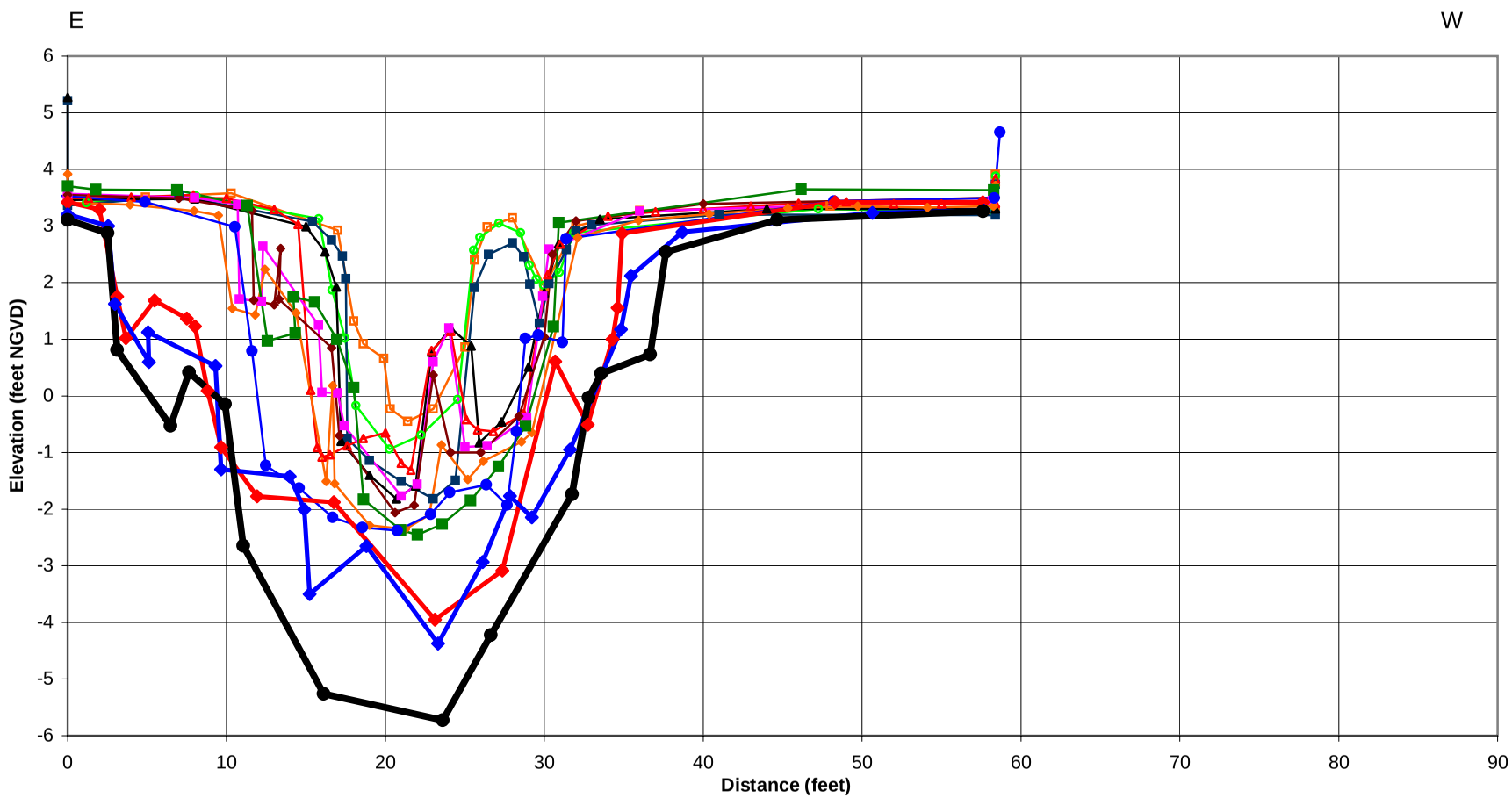
Figure 31

Tidal Wetlands Rest. Hdbk

Son. Bay 2002 Monitoring - Slough Channel Cross Section 1

PWA

PWA#: SonBay2002-1174 FigA1



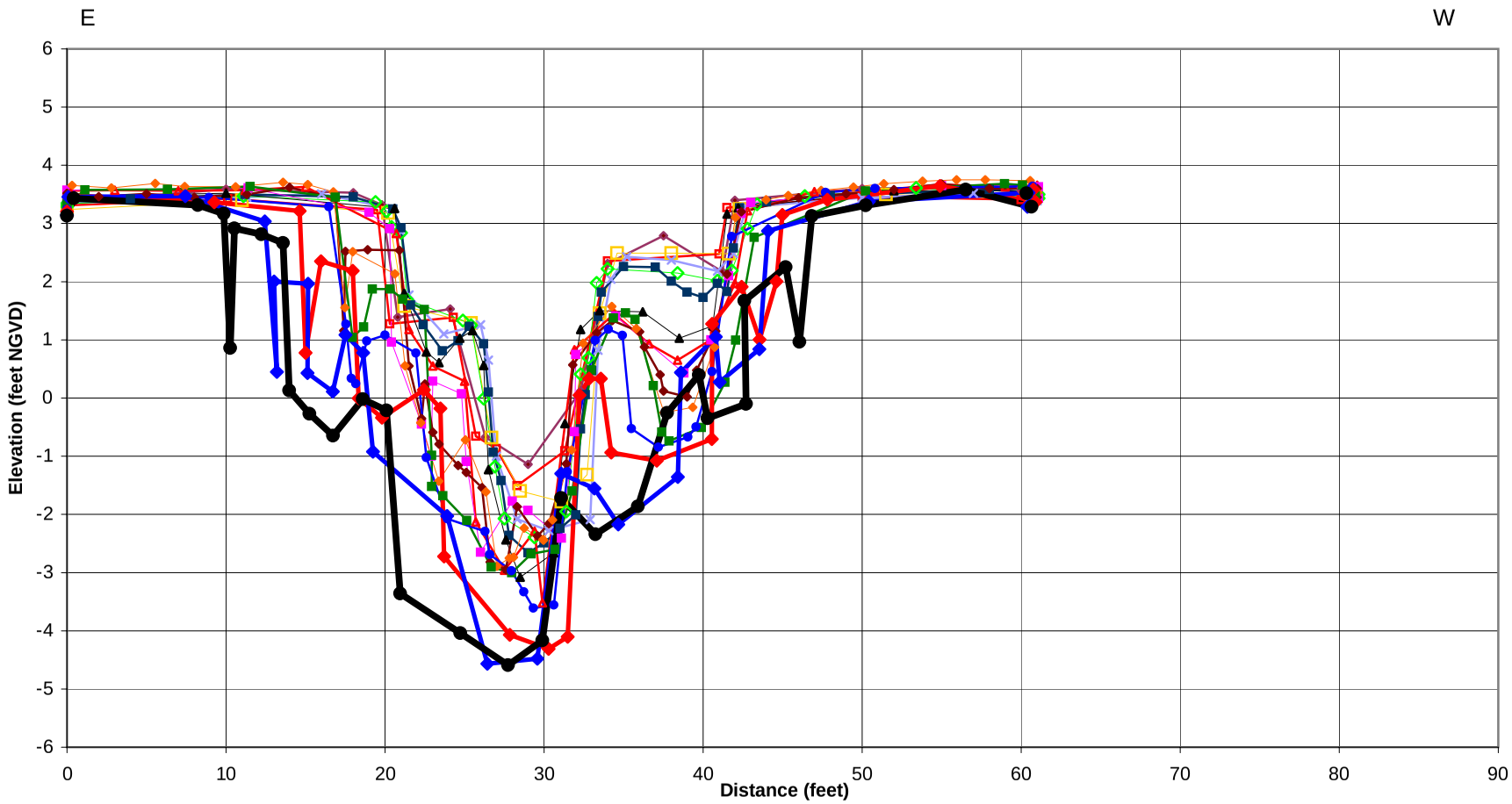
Aug-96 Mar-97 Sep-97 Mar-98 Oct-98
Apr-99 Oct-99 Mar-00 Oct-00 Apr-01
Oct-01 Apr-02 Oct-02

Figure 32

Tidal Wetlands Restoration Handbook
Son. Bay. Main Unit - Slough Channel Cross Section 15

PWA

PWA#: SonBay2002-1174FigA14



Oct-94 Feb-96 Jul-96 Feb-97 Jun-97 Sep-97
Mar-98 Oct-98 Apr-99 Sep-99 Mar-00 Oct-00
Apr-01 Oct-01 Apr-02 Sep-02

Figure 33

Sonoma Baylands Pilot Unit

Son. Bay. Pilot Unit - Slough Channel Cross Section 6

PWA

PWA#: SonBay2002 -1174FigA5

figure 34

2001 - 1 year after breaching

Tidal Wetland Restoration Handbook

Cooley Landing Outboard Mudflat Channels

1632/fig/CooleyLndOtbrdMdflt/chnl.cdr

PWA

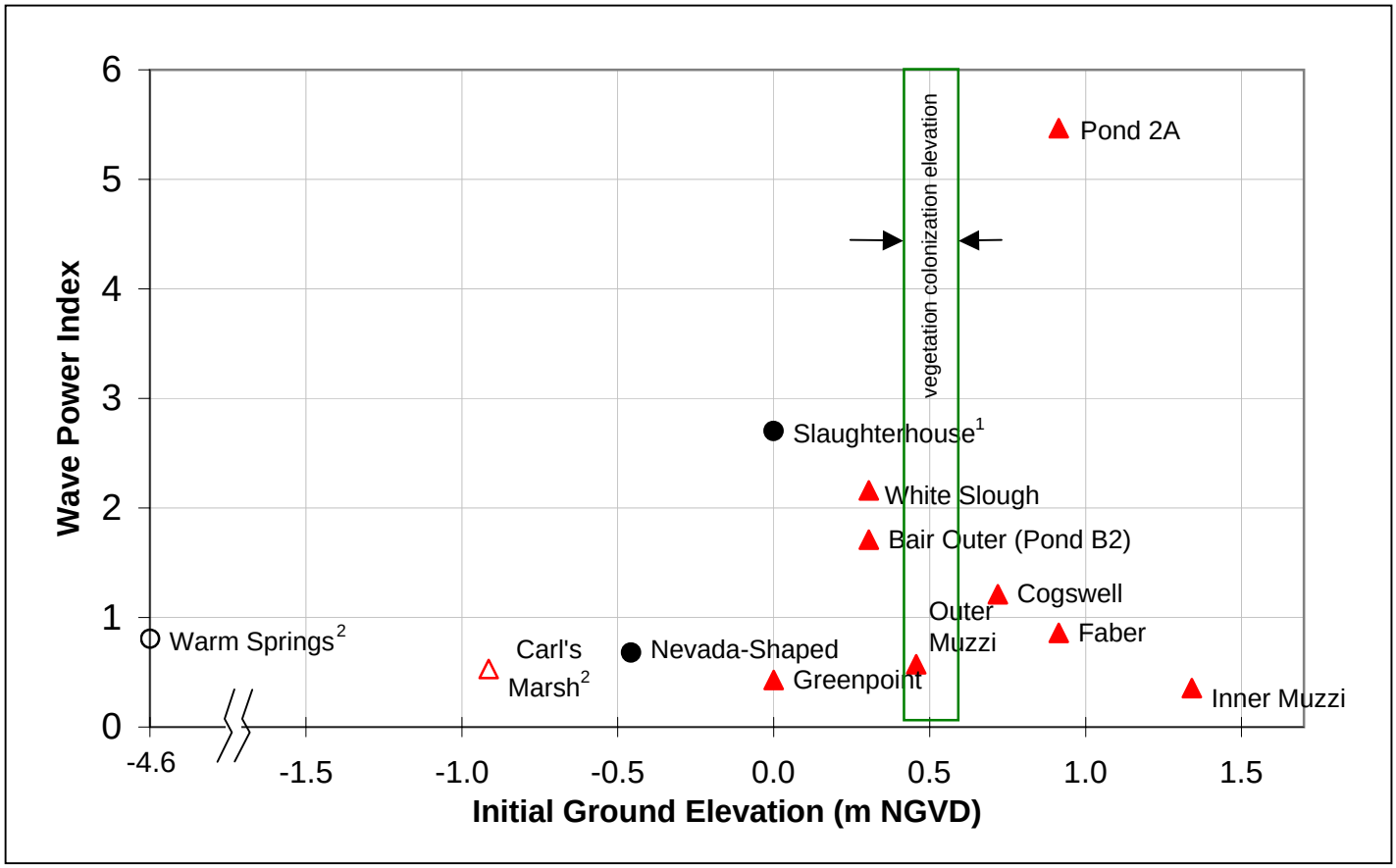


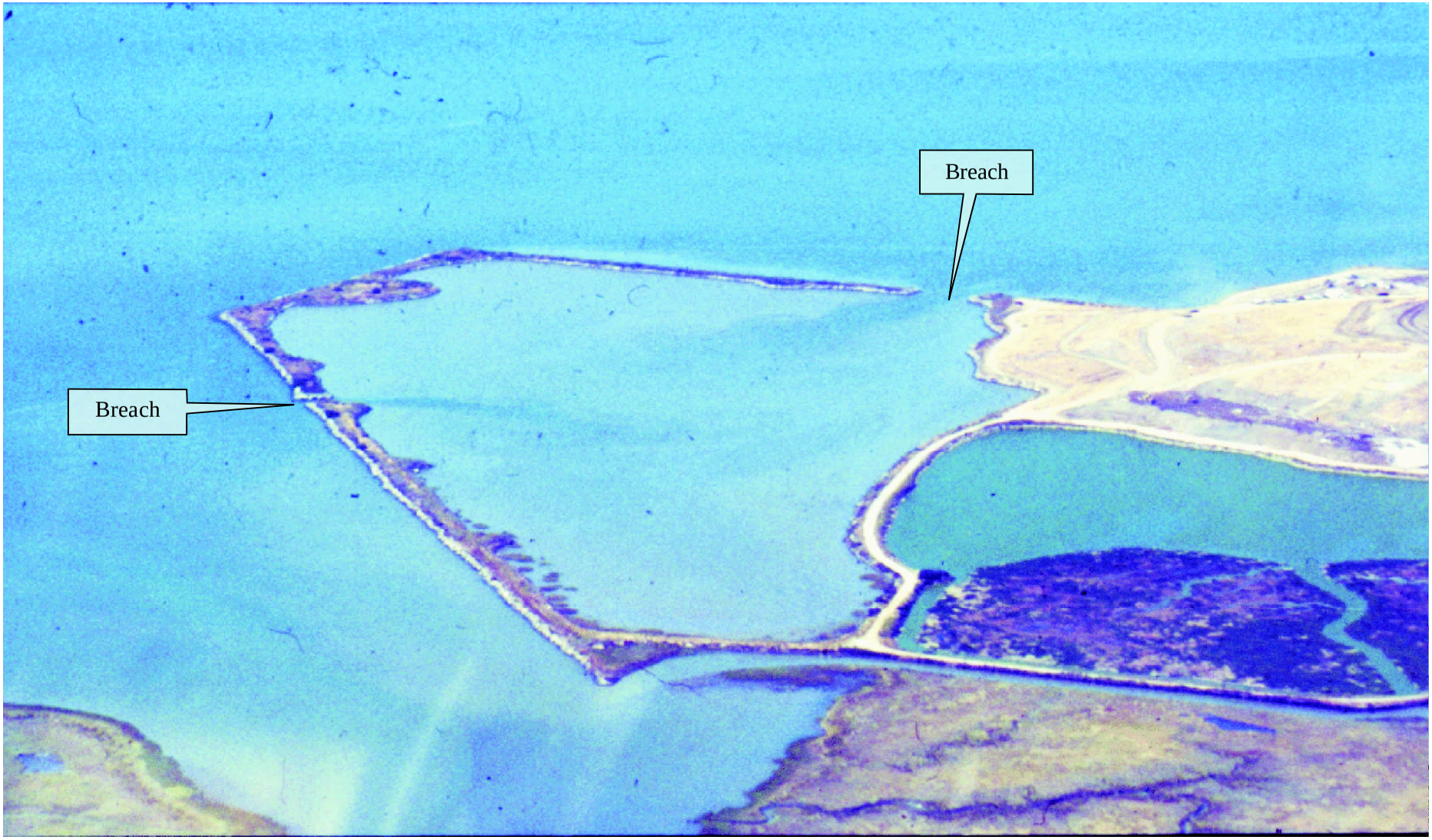
figure 35

Tidal Wetlands Restoration Handbook

Initial Ground Elevation, Wave Power Index, & Vegetation Status of Study Sites

PWA

Fig35-Williams&Orr_fig14.xls Fig 14 8/23/2004



1995, approximately 15 years after breaching.

figure 36

As of 2004, the site has not changed significantly since it was breached between 1978 and 1981. Vegetation has not colonized the site, apparently due to the inhibition of sediment deposition by wind-waves.

Tidal Wetland Restoration Handbook

Nevada Shaped Parcel, Richmond Shoreline at Wildcat Creek

1632_FIG_Nevada.cdr

PWA

August 1996

Thirteen years after breaching, site remains mainly intertidal mudflat.

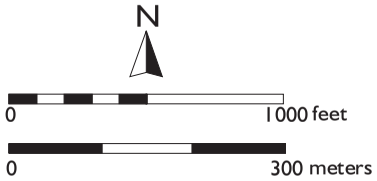


figure 37

Tidal Wetland Restoration Handbook

Slaughterhouse Point, Napa River

1632_FIG_slaughter.cdr

PWA

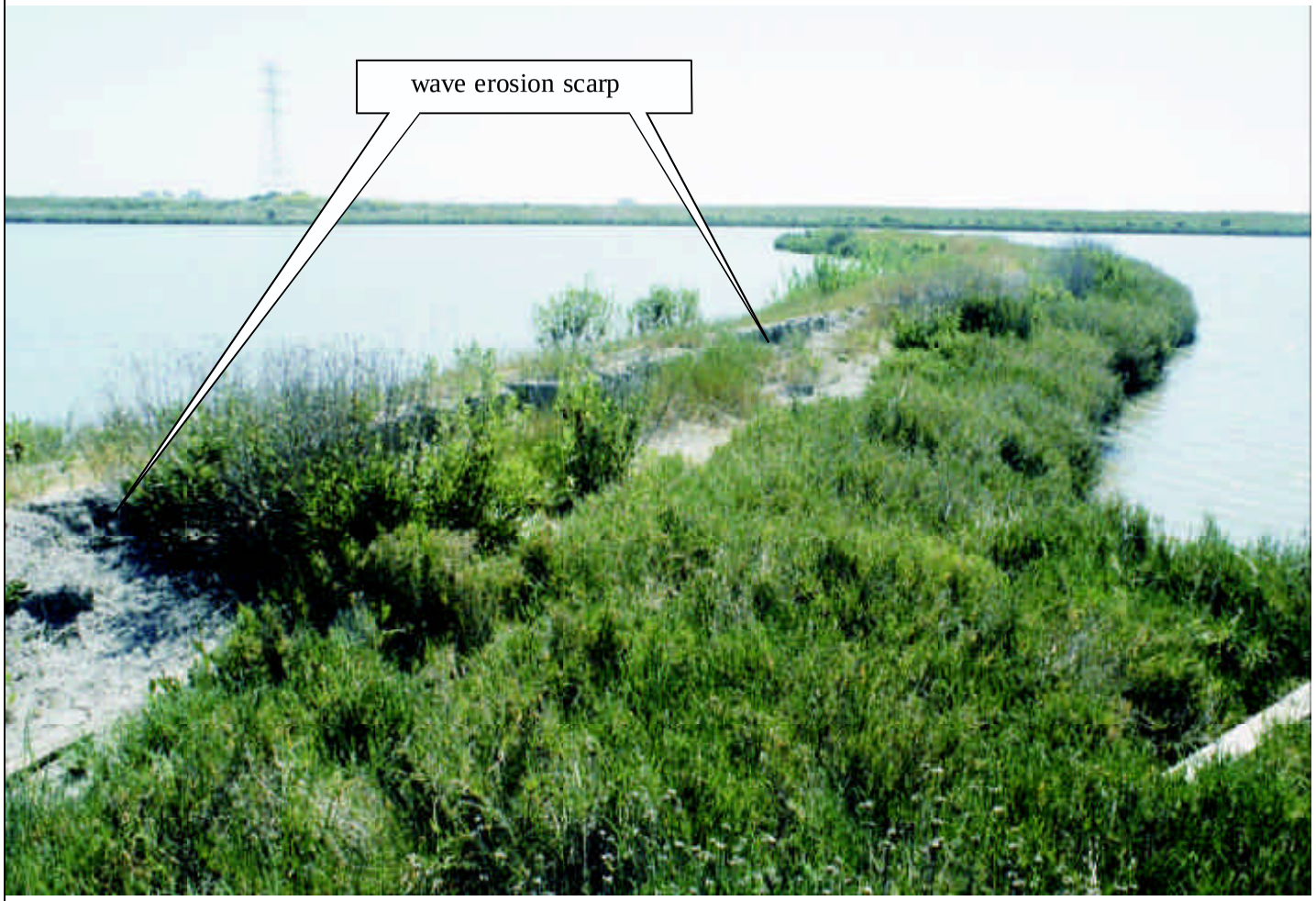


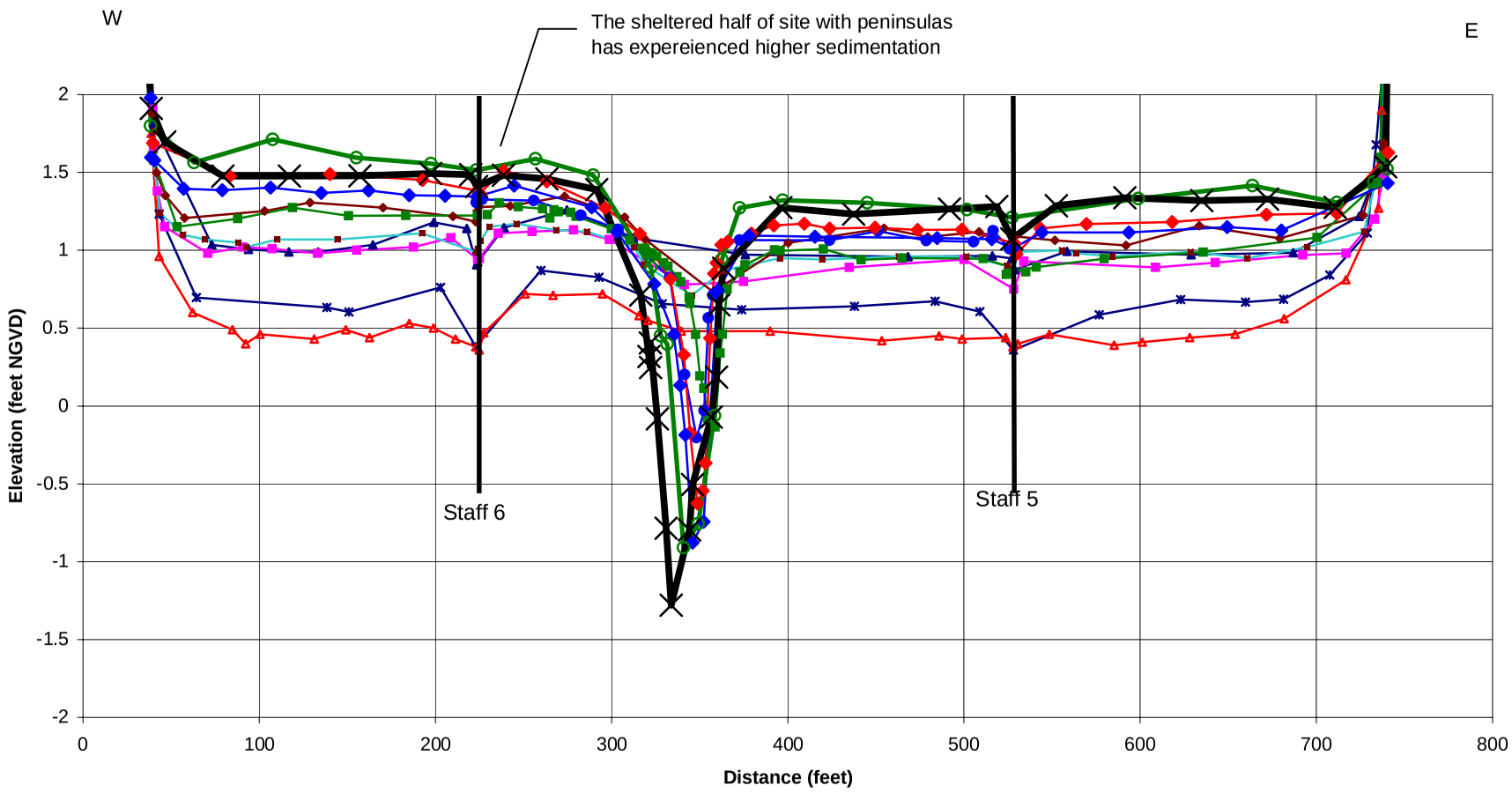
figure 38

Tidal Wetland Restoration Handbook

Wave Erosion of Sonoma Baylands Pilot Unit Peninsula

1632_FIG/WaveErosion.cdr

PWA



Sept-97
Mar-98
Oct-98
Apr-99
Sep-99
Mar-00
Oct-00
Oct-00-Detail
Apr-01
Oct-01
Apr-02
Sep-02
Sep-03

Figure 39

Tidal Wetland Restoration Handbook

Sonoma Baylands Pilot Unit Cross-Section

PWA

PWA#: 1174

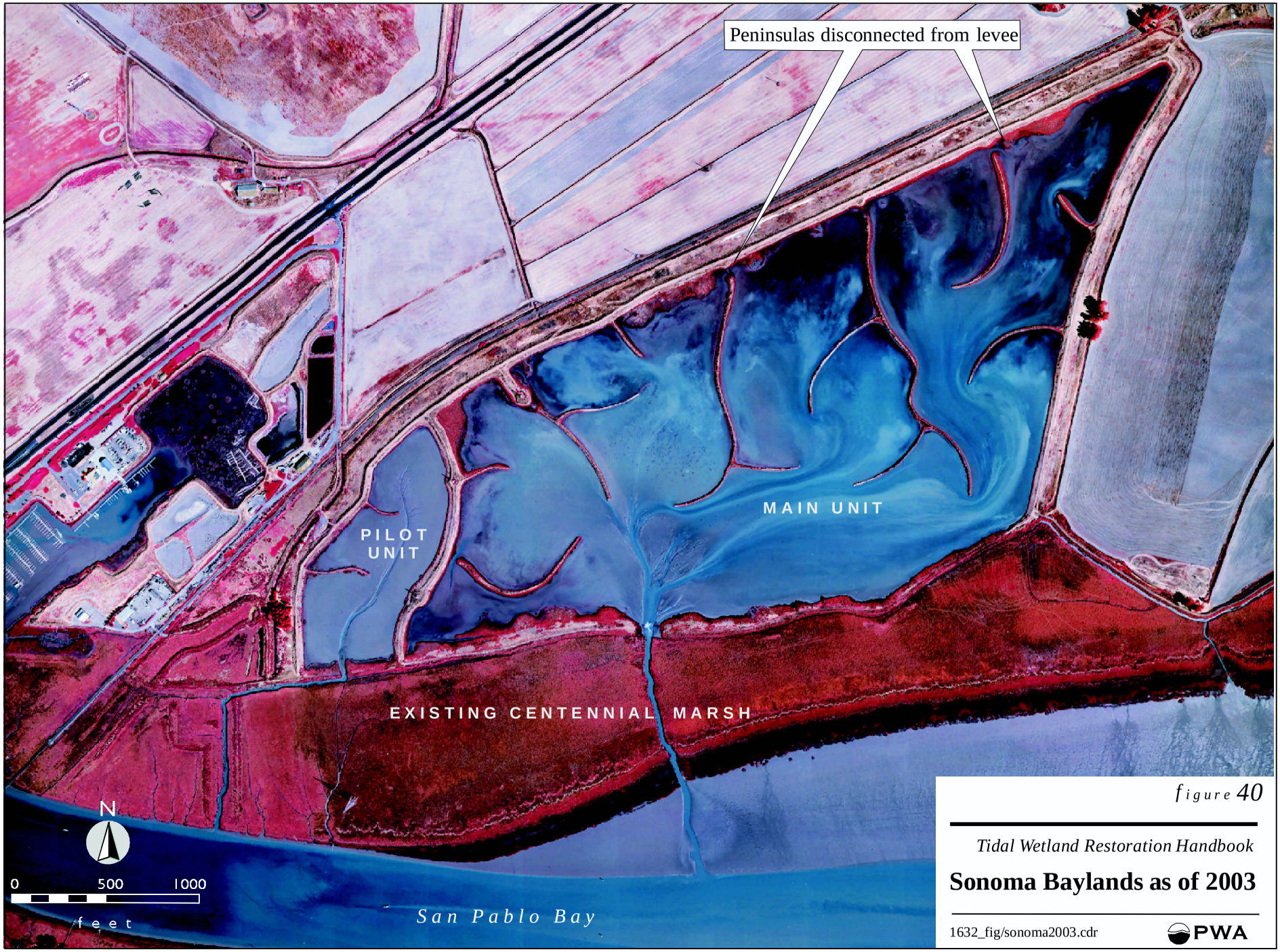


figure 40

Tidal Wetland Restoration Handbook

Sonoma Baylands as of 2003

1632_fig/sonoma2003.cdr

PWA

figure 41

Tidal Wetland Restoration Handbook

Muzzi Marsh Training Dike 2003

PWA

1632/fig/MuziMrshTrnDk03.cdr

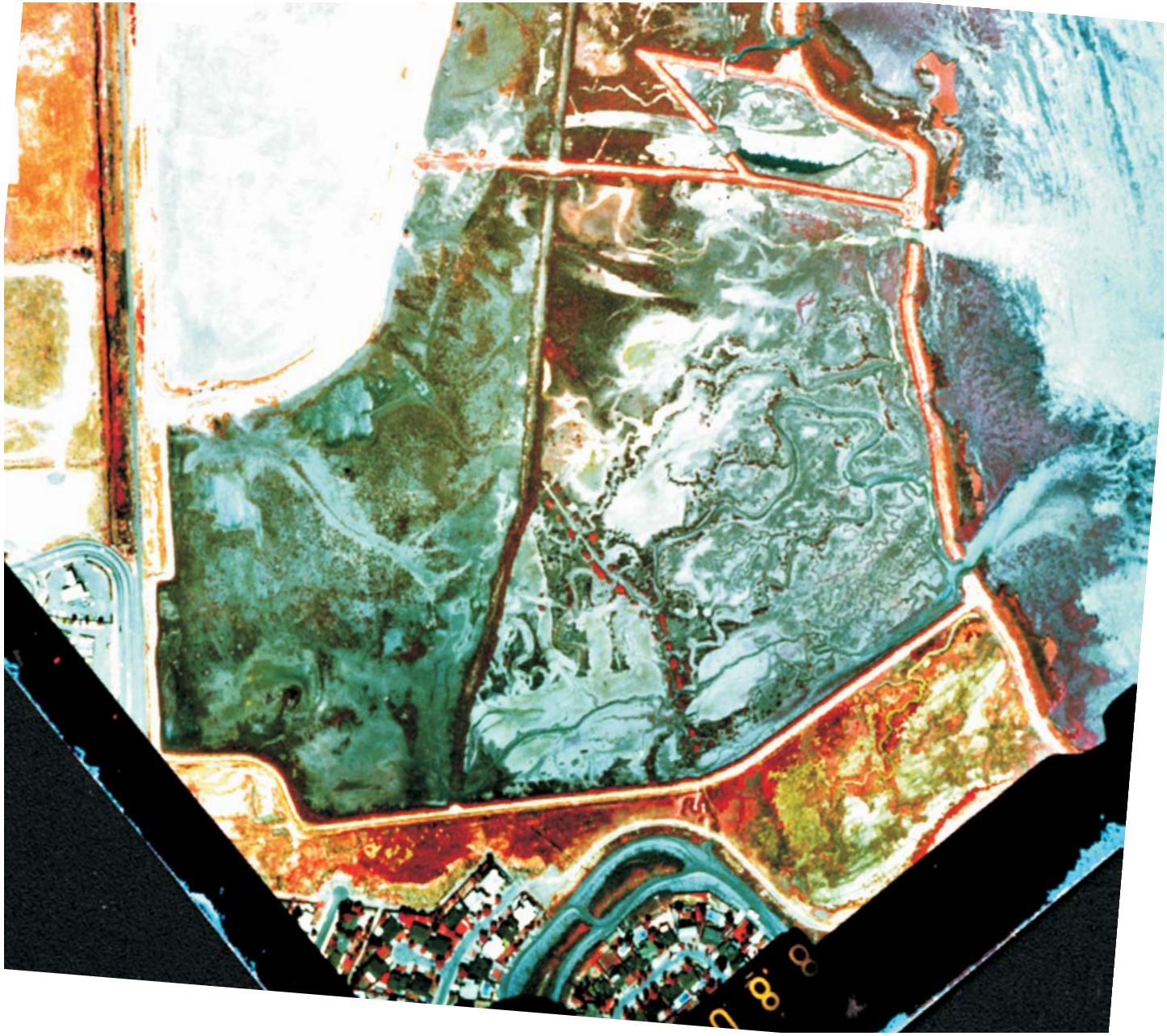


figure 42

Tidal Wetlands Restoration Handbook

date of photo: 5/17/80
scale shown: 1:6,000
original scale: unknown

N

0 250 500

feet

PWA

pdf made from 1575-2003MarshMon/FigureB1.5_Muzzi1980.pdf

figure 43

Tidal Wetland Restoration Handbook

Muzzi Marsh 1990

date of photo: 3/15/90
scale shown: 1:6,000
original scale: 1:12,000

N

0 250 500
feet

PWA

Muzzi1990_fig43.cdr

figure 44

Tidal Wetlands Restoration Handbook

date of photo: 8/11/98
scale shown: 1:6,000
original scale: 1:9,600

N

0 250 500
feet

PWA

pdf made from 1575-2003MarshMon/FigureB1.15_Muzzi1998b.pdf

1/17/01 (post breach)

9/27/03

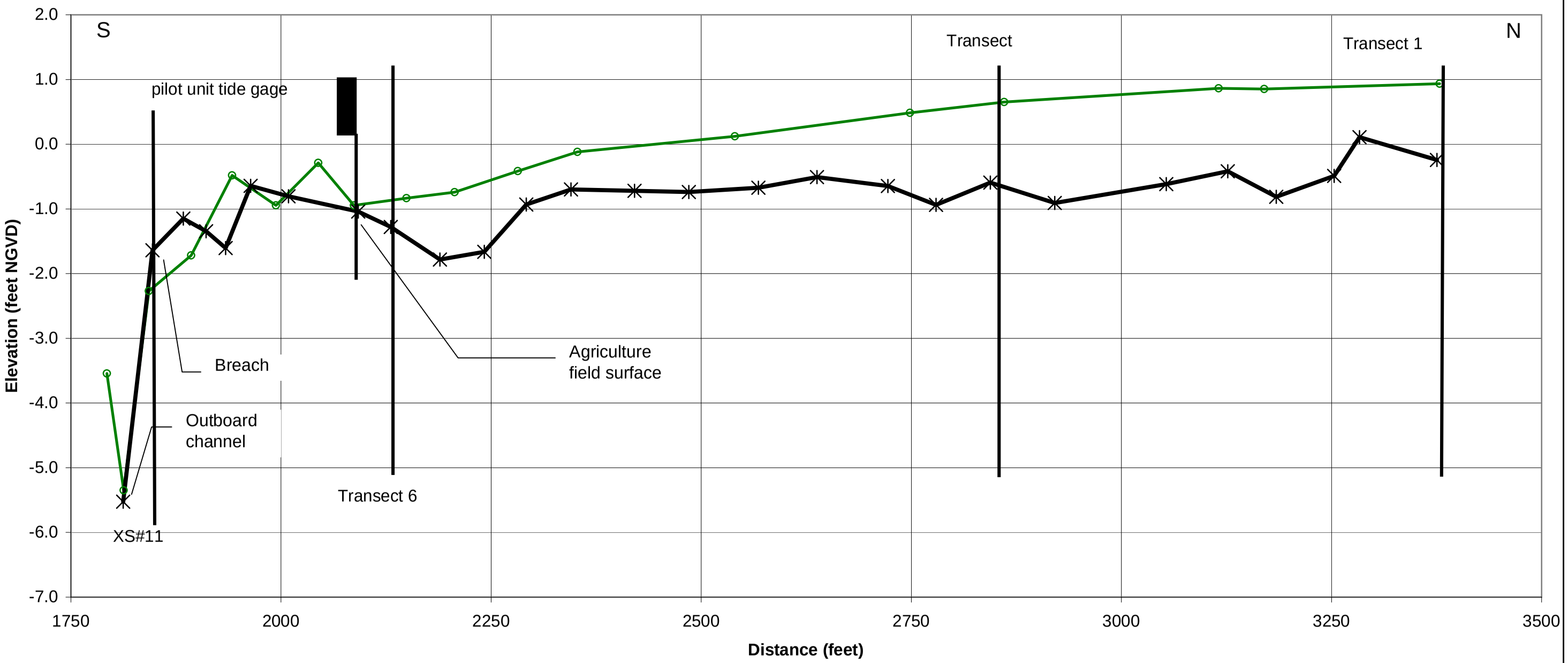
figure 45

Tidal Wetland Restoration Handbook

Cooley Landing Bayfront Levee

1632_FIG_cooleyLdgBayft.cdr

PWA



Sep-02 Sep-03

Figure 46

Tidal Wetland Restoration Handbook

Sonoma Baylands Pilot Unit Thalweg Profile

PWA

PWA#: 1174

a

5/19/86

Three months after accidental breaching of managed marsh - site is mainly subtidal due to constricted channel.

b

10/15/99

Predominantly *Scirpus maritimus* colonized marshplain. Channel has eroded to allow full tidal action.

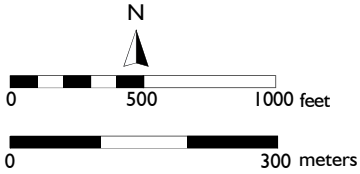


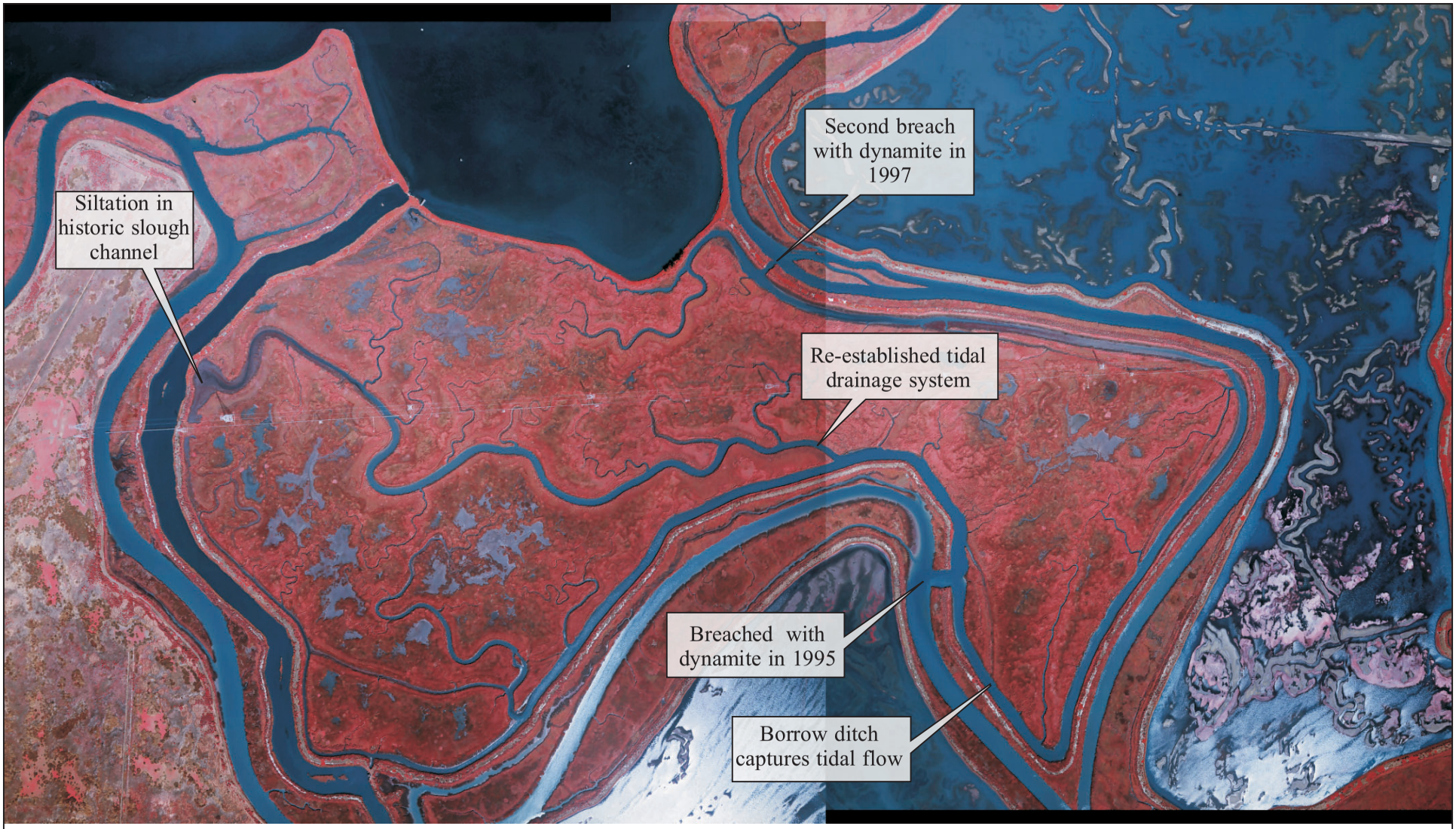
figure 47

Tidal Wetland Restoration Handbook

Green Point Marsh, Petaluma River

PWA

1632/fig/GreenPointMrsh.cdr



9/23/03, Nine years after breaching

N

0 1000 feet

0 300 meters

figure 48

Tidal Wetland Restoration Handbook

Napa Pond 2A, Napa River Salt Marsh

1632/NapaPond2a .cdr - 082004

PWA

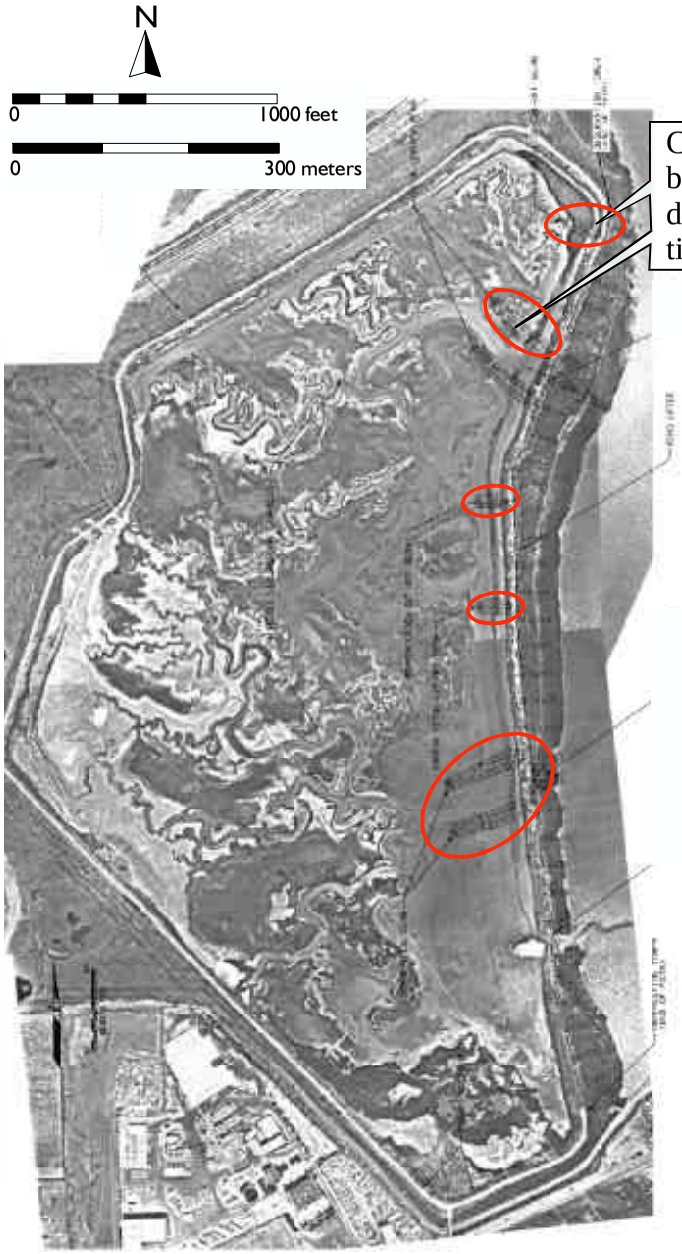
figure 49

Tidal Wetland Restoration Handbook

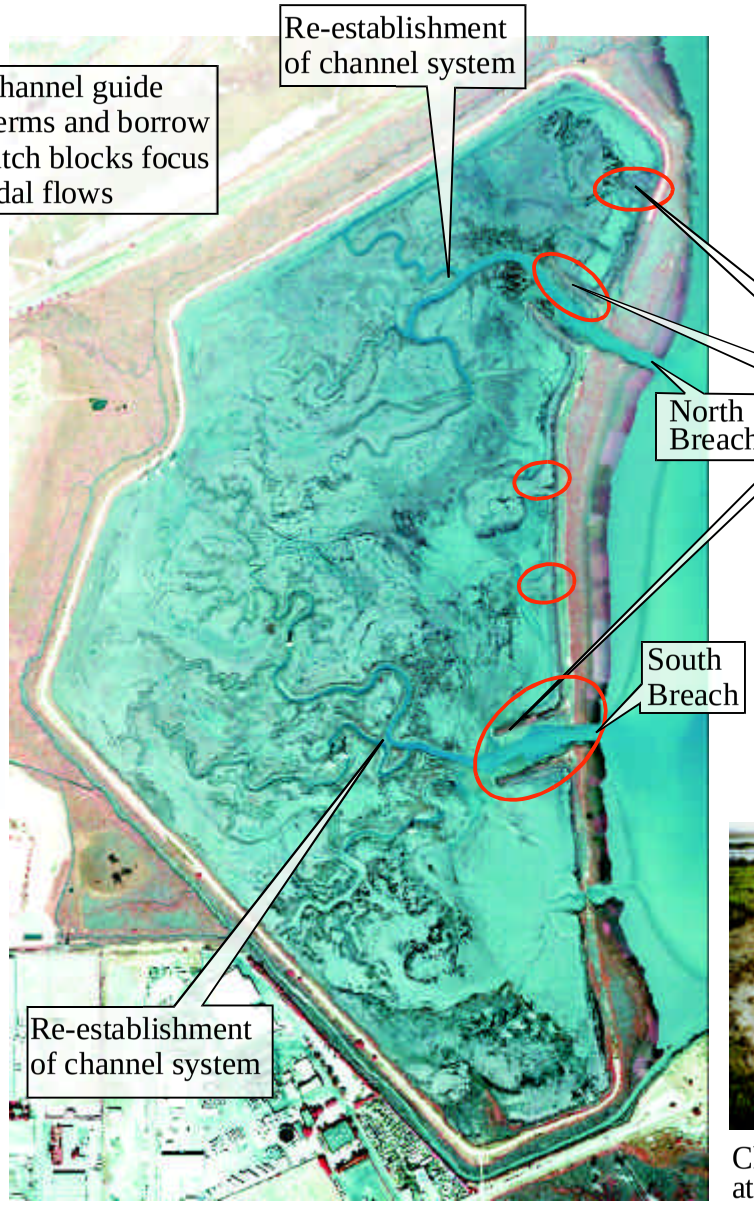
Cooley Landing
Palo Alto Shoreline

1632/fig/CooleyPA.cdr

PWA



a) Abandoned saltpond showing design of ditch blocks and breaches, prior to 2000



b) **9/22/03**, 3 years after breaching

Channel guide berms and borrow ditch blocks focus tidal flows

Channel bed erosion and side slumping at Cooley Landing (September 2001)

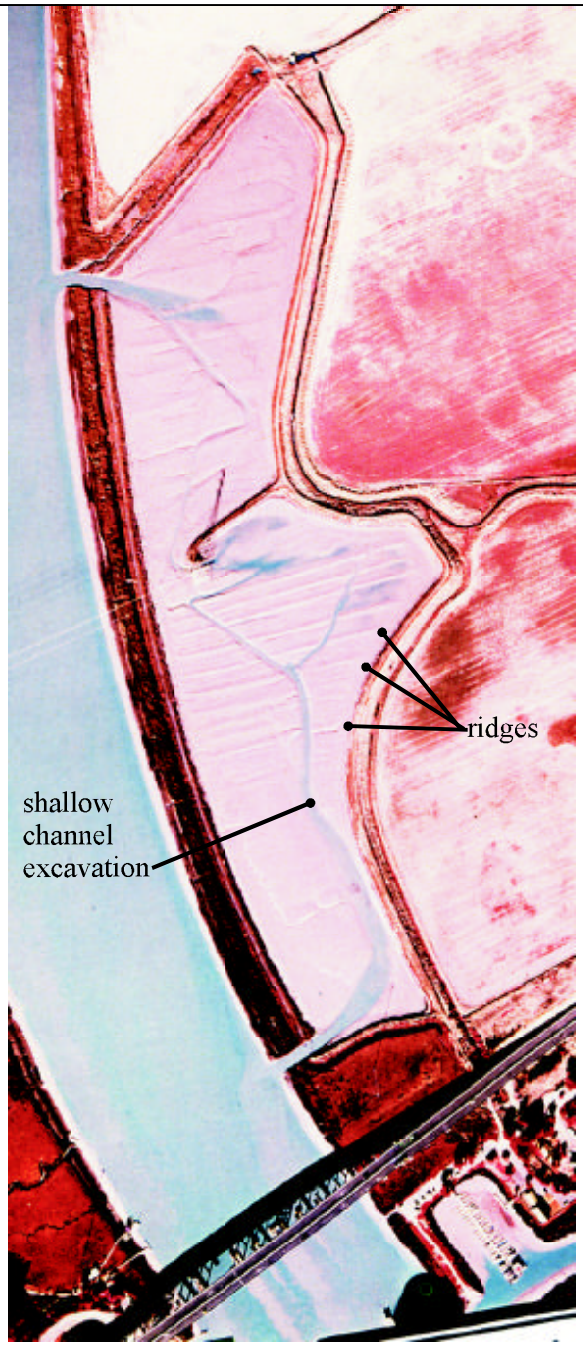
figure 50

Tidal Wetland Restoration Handbook

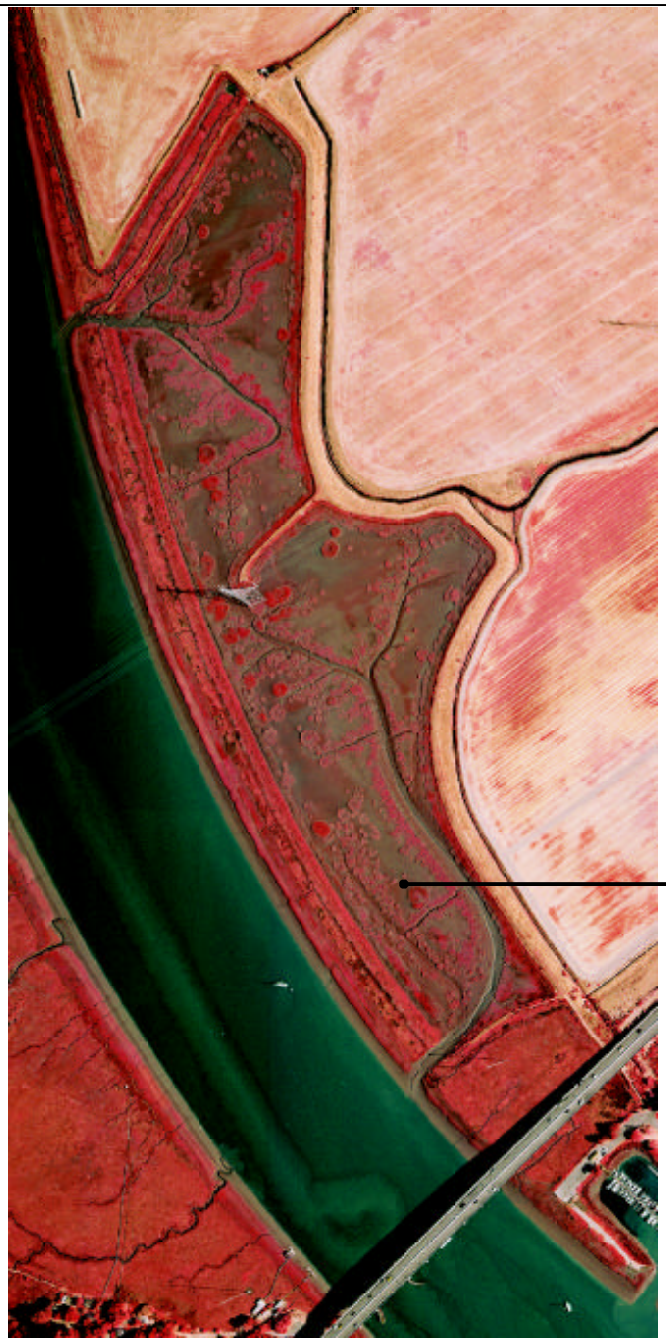
Carl's Marsh
Petaluma River

1632_Carl's.cdr

PWA



11/29/95, 5 years after breaching



9/22/03, 9 years after breaching

Spartina foliosa, Scripus maritimus, & pickleweed have colonized. The imprint of the original grading is still evident.

N

0 500 1000 feet

0 300 meters

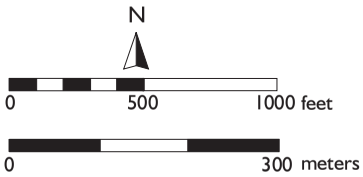


figure 51

Tidal Wetland Restoration Handbook

Wildcat Creek Marsh Ponds

1632_FIG_WildcatCkMrshPnd.cdr

PWA

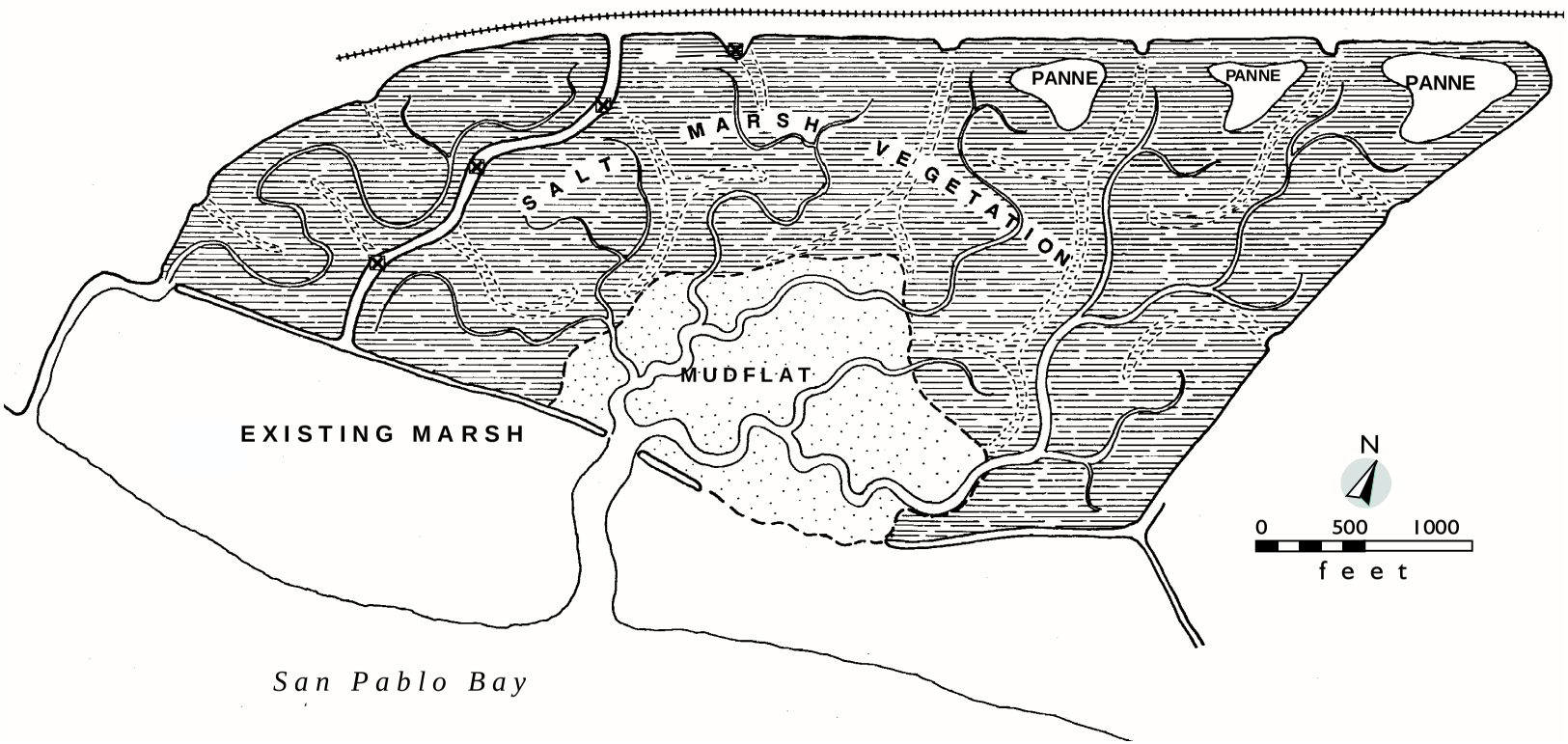


figure 52

Tidal Wetland Restoration Handbook

Expected Evolution of Sonoma Baylands (After approximately 10 years of evolution as specified in design plan)

1632_FIG_ExpEvolSono.cdr

PWA

1992

2003

figure 53

Tidal Wetland Restoration Handbook

Warm Springs Viewing Platform

1632 Fig_warm springs.cdr

PWA

figure 54

Tidal Wetland Restoration Handbook

Crissy Field Public Access

1632_FIG _Crissy.cdr

PWA

figure 55

Tidal Wetland Restoration Handbook

Tolay Creek

1632 Fig_Tolay.cdr

PWA