TIDAL SURGE PROTECTION FOR A COASTAL FRESH WATER IRRIGATION SUPPLY AS SEA LEVELS RISE

Robert L. Horner, PE
Weston & Sampson Engineers, Inc.

CHARLESTON NATIONAL COMMUNITY

- Approx. 800 Residential Units

- Approx. 800 Acres (Overall)

- 18 Hole Golf Course

- Freshwater Pond System for Storm Drainage

  & Irrigation Storage

- Outfall to Saltwater Canal (Isaac German Canal)

Tidal Surge Protection For A Coastal Fresh Water Irrigation Supply As Sea Levels Rise

US Highway 17

Charleston National

Copahee Sound

Weston & Sampson

Tidal Surge Protection For A Coastal Fresh Water Irrigation Supply As Sea Levels Rise

PROBLEM

• During extremely high tidal events (King Tides & Storm Surge) Saltwater would flow upstream into the stormwater & irrigation storage pond system

• High Chlorides in the irrigation water had begun killing the turf and landscaping on the golf course

• Stormwater storage was typically not available for runoff during severe weather events leading to increased flooding concerns

Weston & Sampson

Tidal Surge Protection For A Coastal Fresh Water Irrigation Supply As Sea Levels Rise

CAUSES

- Failed flap Gates due to changes in the receiving creek bottom elevation

- Increased frequency & elevation of tidal events & storm surge

Weston & Sampson

Tidal Surge Protection For A Coastal Fresh Water Irrigation Supply As Sea Levels Rise

Stuck in open Position

3 x 36" Flap Gates
(Invert below Creek Bottom)

Discharge/Saltwater Side

Isaac German
Canal Bottom

Weston & Sampson

Tidal Surge Protection For A Coastal Fresh Water Irrigation Supply As Sea Levels Rise

3 x 48" Overflow Weir
Riser Structure
Freshwater
Inlet Side

Weston & Sampson

Tidal Surge Protection For A Coastal Fresh Water Irrigation Supply As Sea Levels Rise

PROJECT GOALS

- Prevent Saltwater intrusion into irrigation supply
- Protect stormwater system storage capacity for rainfall & runoff vs storm or tidal surge
- Provide redundancy to prevent failures and mitigate risk to golf course and help prevent flooding

Weston & Sampson

Tidal Surge Protection For A Coastal Fresh Water Irrigation Supply As Sea Levels Rise

48" Connector Pipes
Invert El. = -1.6

National Dr.
Elevation 7.0 (NGVD 29)

36" Outfall
Invert El. = -1.3

Overflow Weirs
El. = 3.8 (Normal Water Surface)

Pond CN-11

SECTION FROM RECORD DRAWING DATED APRIL 2000

Weston & Sampson

Tidal Surge Protection For A Coastal Fresh Water Irrigation Supply As Sea Levels Rise

SOLUTION

- Install Overflow Weirs on 48" Connecting pipes into CN-11 (Last Pond before outfall)
- Install Buoyancy Controlled Covers on Weirs
- Replace & Improve Outfall Flap Gates
- Protect pond system from surge up to road and adjacent topography elevations (7)

Weston & Sampson

Tidal Surge Protection For A Coastal Fresh Water Irrigation Supply As Sea Levels Rise

48" Connector Pipes
Invert El. -1.6

Weston & Sampson

Tidal Surge Protection For A Coastal Fresh Water Irrigation Supply As Sea Levels Rise

New Overflow Weirs
7' x 7'

Weston & Sampson

Tidal Surge Protection For A Coastal Fresh Water Irrigation Supply As Sea Levels Rise

Testing Prototype Buoyancy Controlled Covers on 7x7 Boxes

Covered by Tidal Event

Weston & Sampson

Tidal Surge Protection For A Coastal Fresh Water Irrigation Supply As Sea Levels Rise

Full Scale Buoyancy Controlled Surge Prevention Device

Buoyant Cell 6 CF

Alignment Guide

Neoprene Gasket
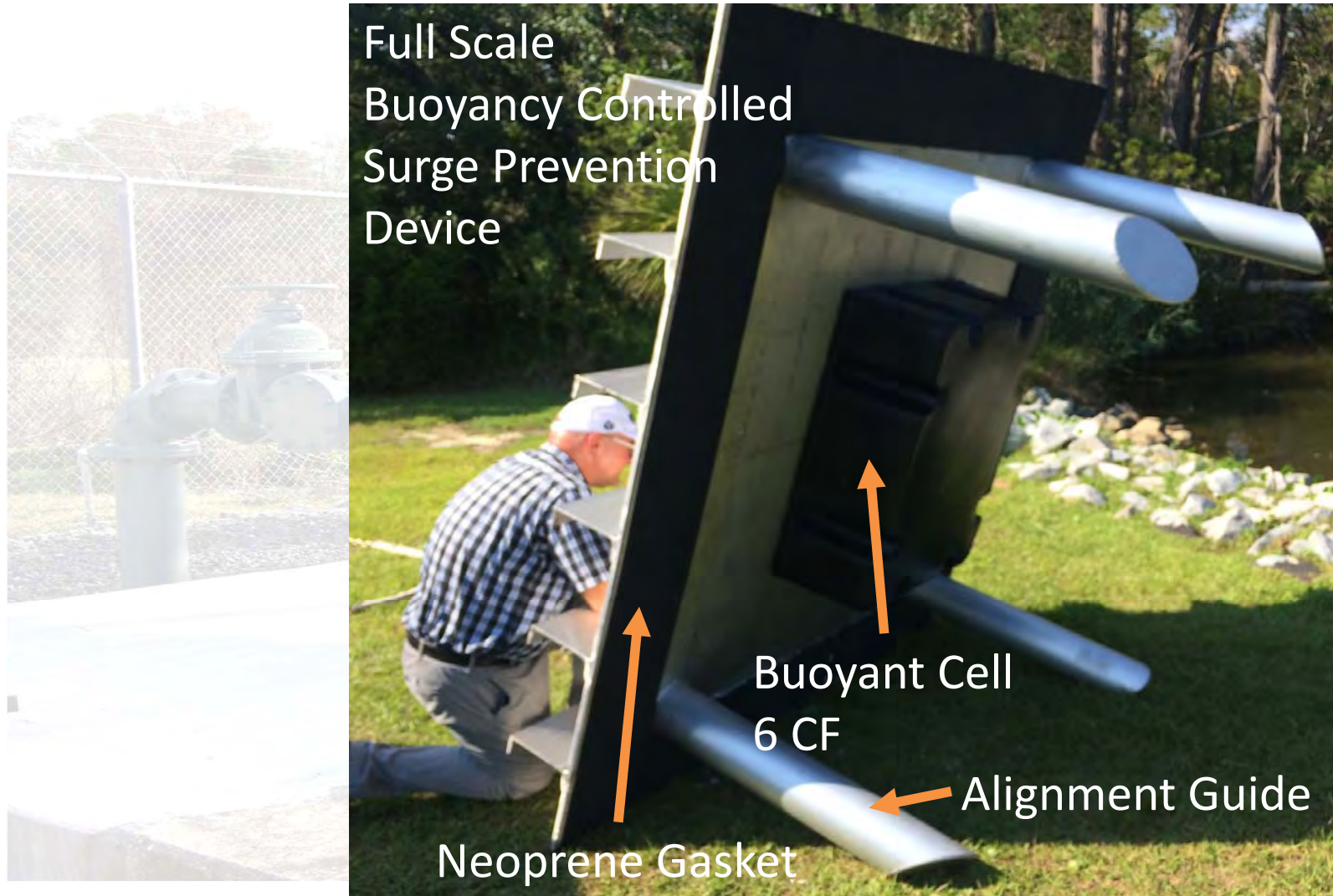
Weston & Sampson

Tidal Surge Protection For A Coastal Fresh Water Irrigation Supply As Sea Levels Rise

Installation

Weston & Sampson℠

Tidal Surge Protection For A Coastal Fresh Water Irrigation Supply As Sea Levels Rise

Pond CN-11   Outfall

Installed & Operating

Tidal Surge Protection For A Coastal Fresh Water Irrigation Supply As Sea Levels Rise

Pond CN-11

Gates Closed & Seated
During Recent King Tide

Weston & Sampson

Tidal Surge Protection For A Coastal Fresh Water Irrigation Supply As Sea Levels Rise

Flap Gates Modified & Raised
Above Mud Line

Weston & Sampson

Tidal Surge Protection For A Coastal Fresh Water Irrigation Supply As Sea Levels Rise

Summary

- Buoyancy Controlled Box Covers Installed
- No Saltwater Intrusion into Irrigation Storage has occurred since installation
- Flap Gates replaced and raised above Mud Line
- Chloride Levels returned to "normal" in irrigation supply
- Stormwater storage capacity above weirs, below emergency overflow reserved for stormwater runoff

Weston & Sampson

Tidal Surge Protection For A Coastal Fresh Water Irrigation Supply As Sea Levels Rise