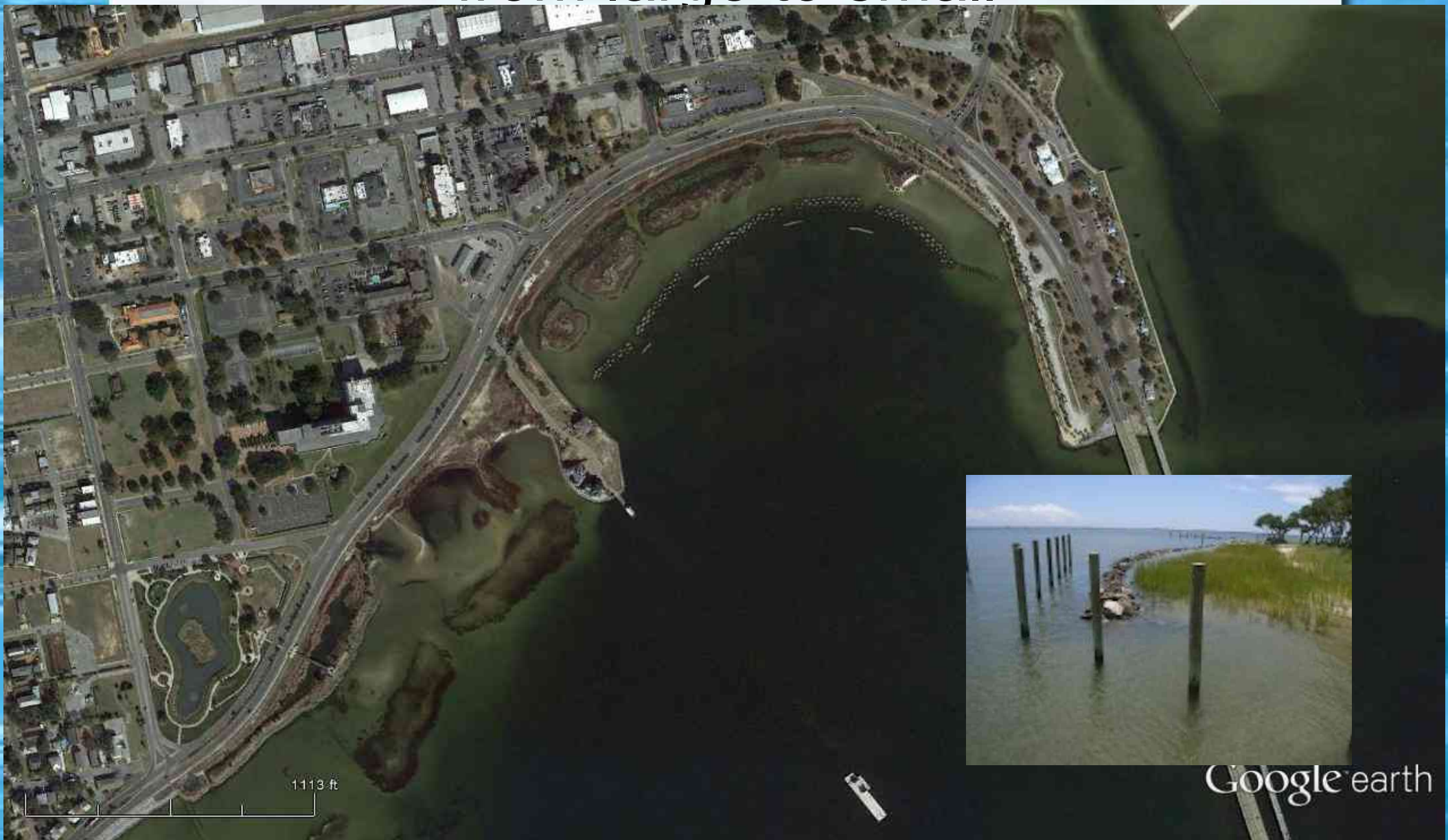
Living Shorelines Types
from large to small



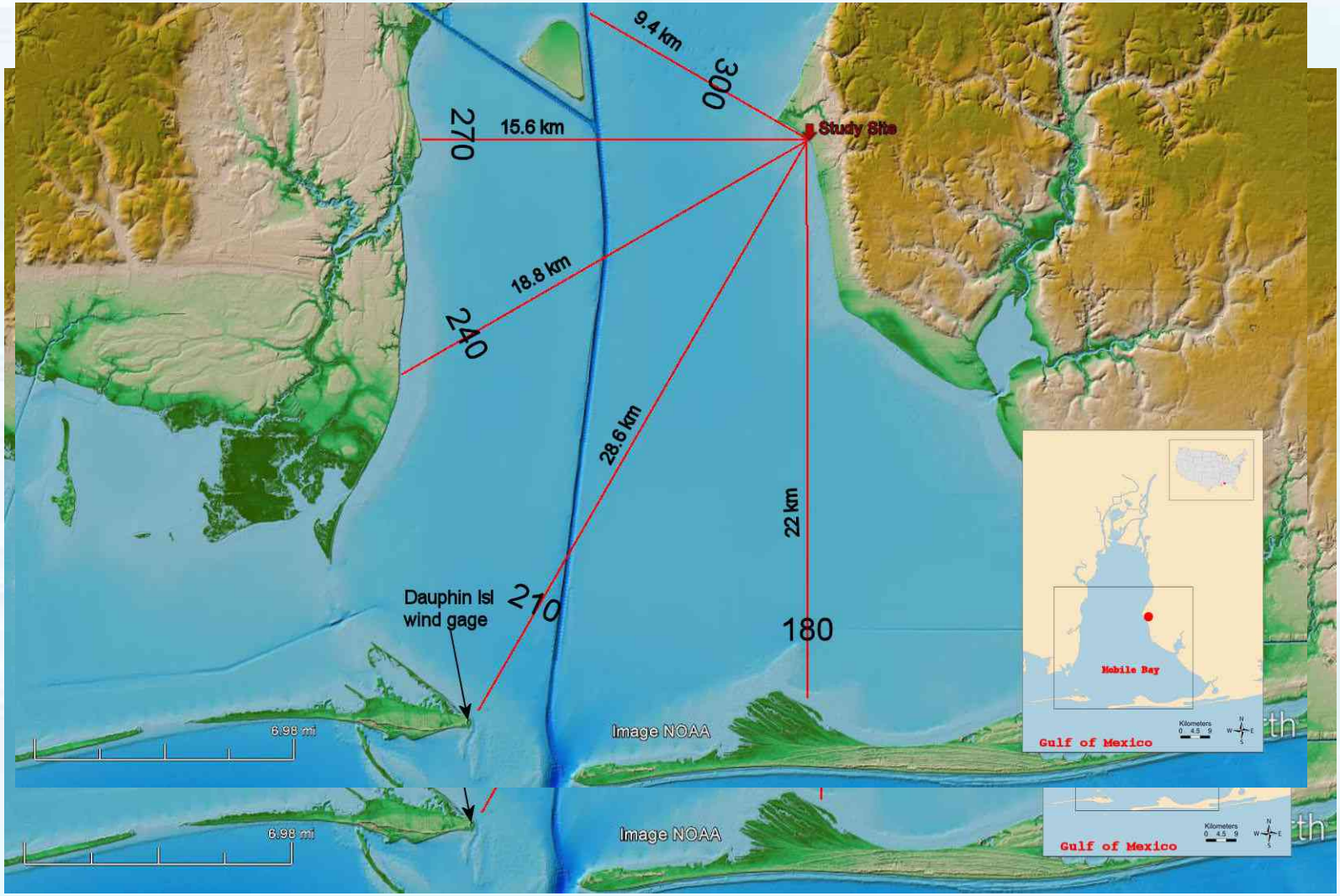
Downsizing a Living Shoreline; Retail-scale Options for Private Properties on Exposed, Rapidly-Eroding Coasts

David d. McGehee, P.E., D.CE
Emerald Ocean Engineering LLC

and

Taylor “Chips” Kirschenfeld
Environmental Consultant

Project Location



Existing Conditions

Owner's Mission

Reduce Upland/Shoreline Erosion

Maintain Recreational Beach

Be a Good Neighbor

Utilize a Living Shoreline
(“. . . like Project Greenshores”)

Average Erosion @ Project 1997 - 2013 ~ 2 ft/yr
Over 1 ft/mo from 2008 - 2010

Site Analysis

Calculated Net LST Potential (cu yd / yr)

LST potential shows accumulation:

Why isn't the project accreting?

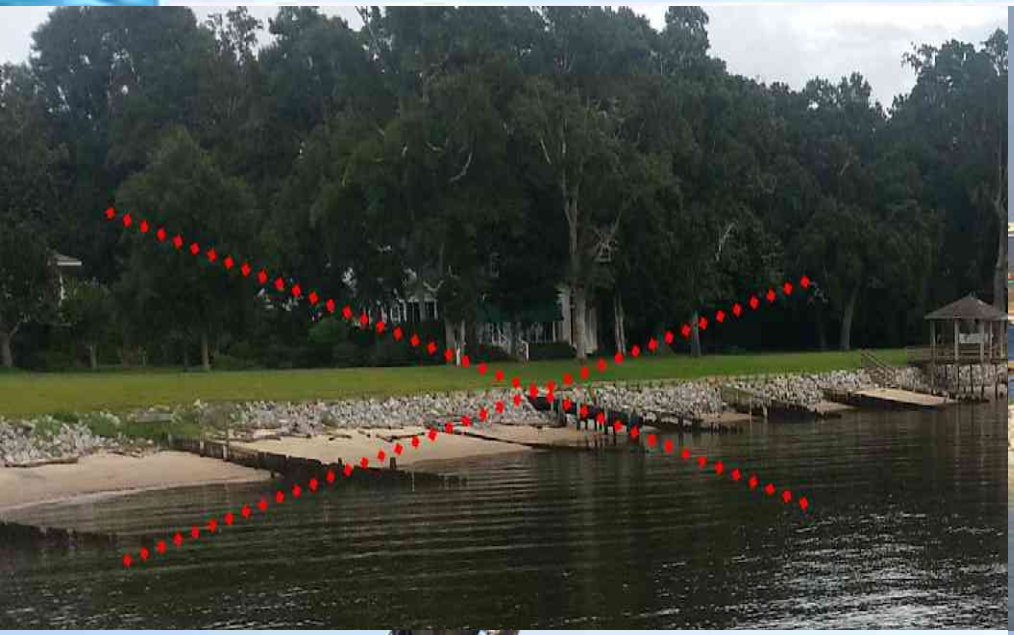
No southern sediment supply

If shorelines are retreating, where is all that eroded sand going?

Offshore

(see offshore profiles)

CONCEPTS



Design Challenges/Design Strategies

Optimize reef bw performance to:

Eliminate/reduce upland erosion & offshore transport

Sill; dissipate high steep waves; pass low long waves

Maintain the saltmarsh

Average $H_s < H_{th}$ (Douglas & Stout, 2004)

Permit adequate longshore transport

Salient good; tombolo bad; bobcat OK

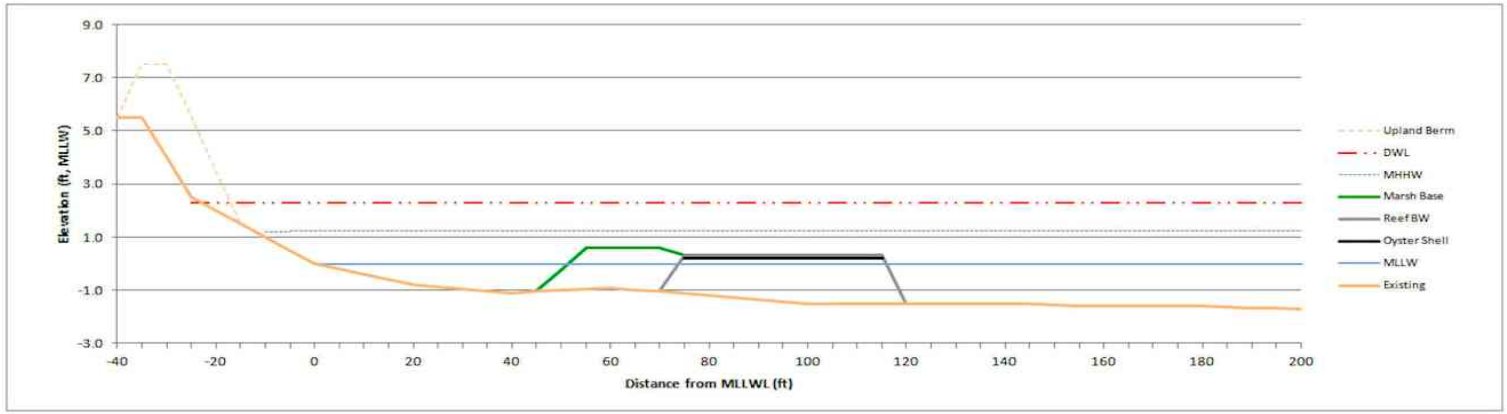
Adapt to sea level rise

Rise with it: 1) maintenance {cheap}; 2) oysters {free}

Survive extreme events

Stay low; stay flat

Design profile



Dimension	Alongshore	Crosshore	Crest Elevation	Area	Volume	Volume
Project Component	(ft)	(ft)	(ft, MLLW)	(ft^2)	(ft^3)	(yd^3)
Reef Breakwater	135	50	0.33	6,213	9,533	353
Oyster Shell Layer	135	50	0 – 0.2	4,970	391	14
Marsh	85	25	0.6	2,125	2,996	111
Upland Berm	155	25	7.5	3,875	7,750	287
SUMS				17,183	20,671	766
Submerged Land Area Covered				8338 (0.2 acres)		

Reimer - Moore Living Shoreline Project

Dwg. No: RM-3	**Project Cross Section**	Date: 10/18/2013
BY: ddm		Rev. No:

Emerald Ocean Engineering LLC
107 Ariola Drive
Pensacola Beach, FL 32561
850.232.4111
www.EmeraldOe.com

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Dwg. No: RM-3 | Project Cross Section | Date: 10/18/2013
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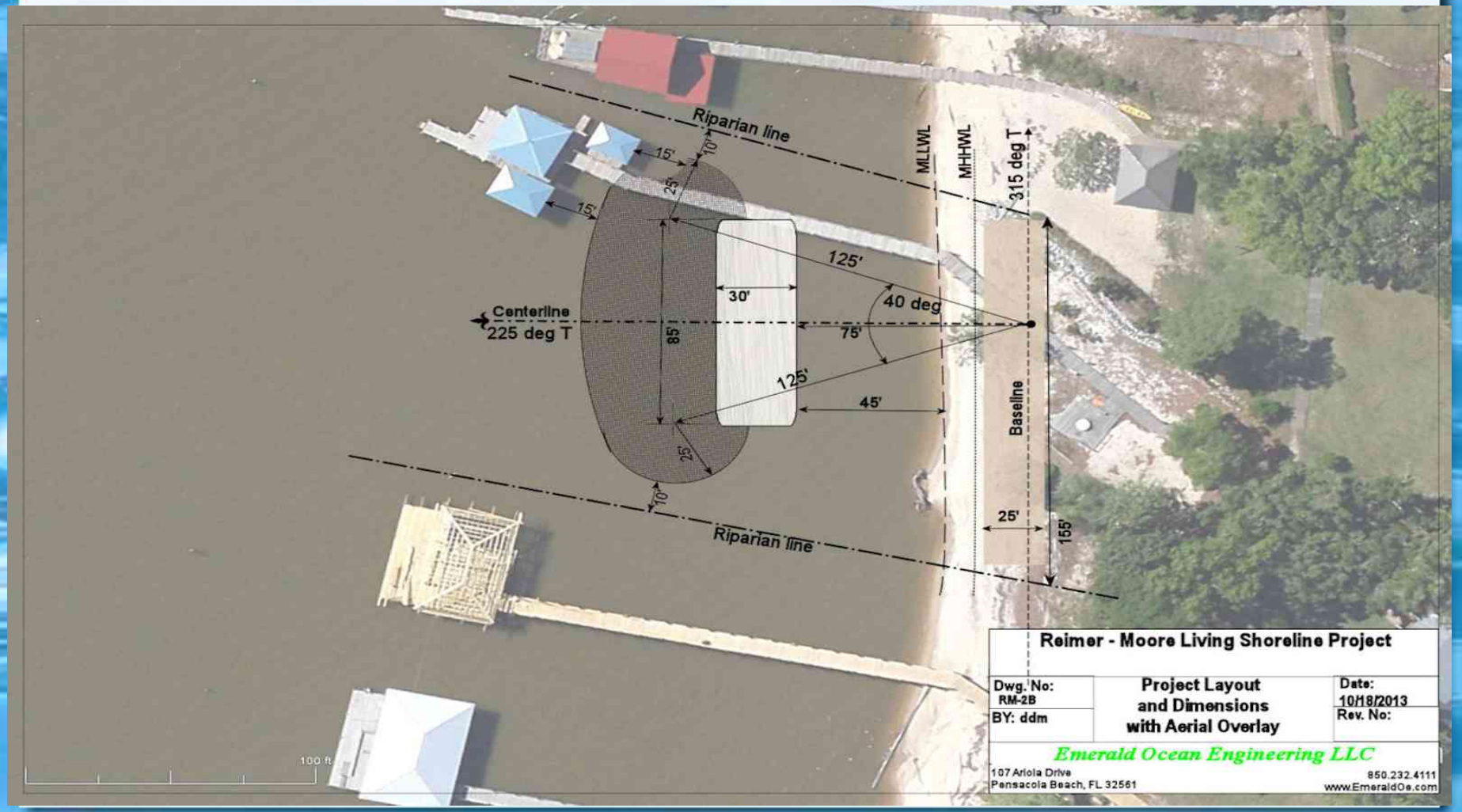
DESIGN PLAN


Riparian line
MLLWL
MHHWL
315 deg T
15'
10'
25'
15'
125'
30'
40 deg
Centerline
225 deg T
85'
75'
125'
45'
Baseline
25'
10'
25'
155'
Riparian line
100 ft
Reimer - Moore Living Shoreline Project
Dwg. No: RM-2B
Project Layout and Dimensions with Aerial Overlay
Date: 10/18/2013
BY: ddm
Rev. No:
Emerald Ocean Engineering LLC
107 Ariola Drive
Pensacola Beach, FL 32561
850.232.4111
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Voluntary Adaptive Management Plan

CONSTRUCTION

Cost Comparison

For 155 ft of shoreline protection:

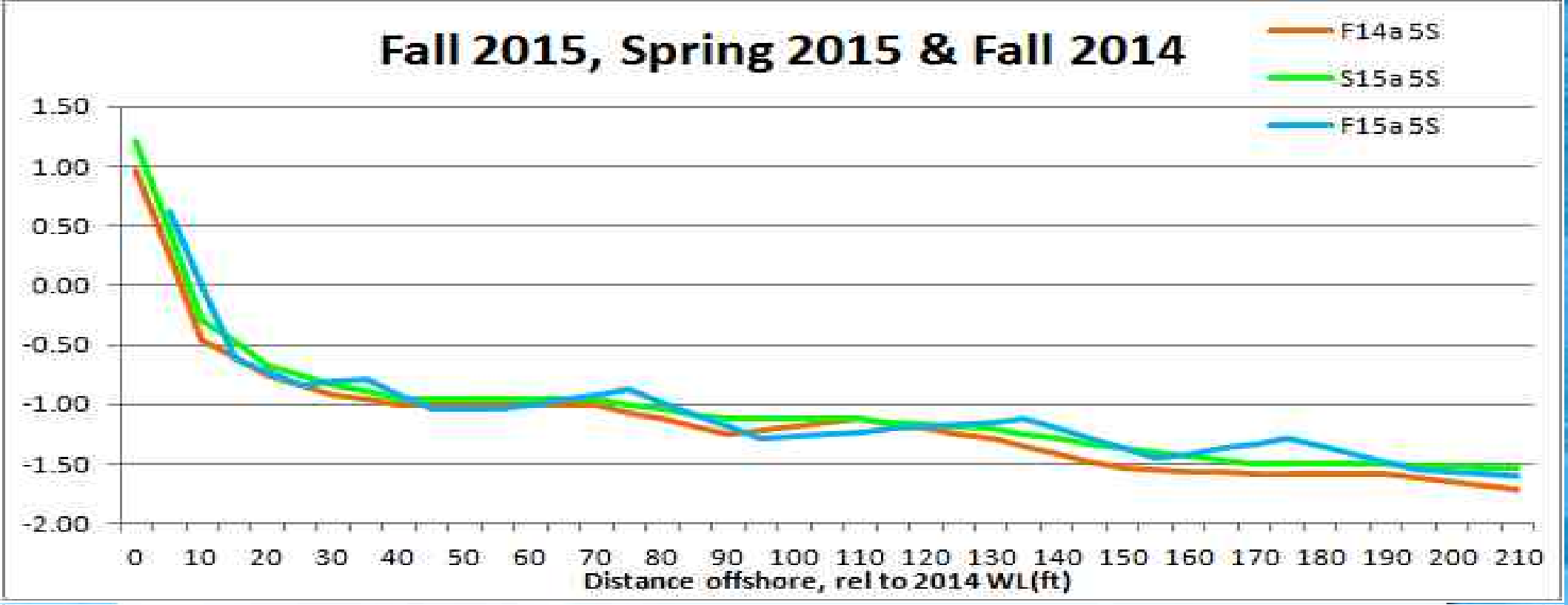
Traditional Bulkhead - $40-60 K

Living Shoreline – $ 70 K

Offshore Emergent Breakwater > $100 K

State-mandated Monitoring

- 11 Profiles extending ~200' offshore
- 250' N & S of project bounds
- Neighborhood seminars
- Semi-annually, 3 yrs


Fall 2015, Spring 2015 & Fall 2014
F14a 5S
S15a 5S
F15a 5S
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1.00
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-0.50
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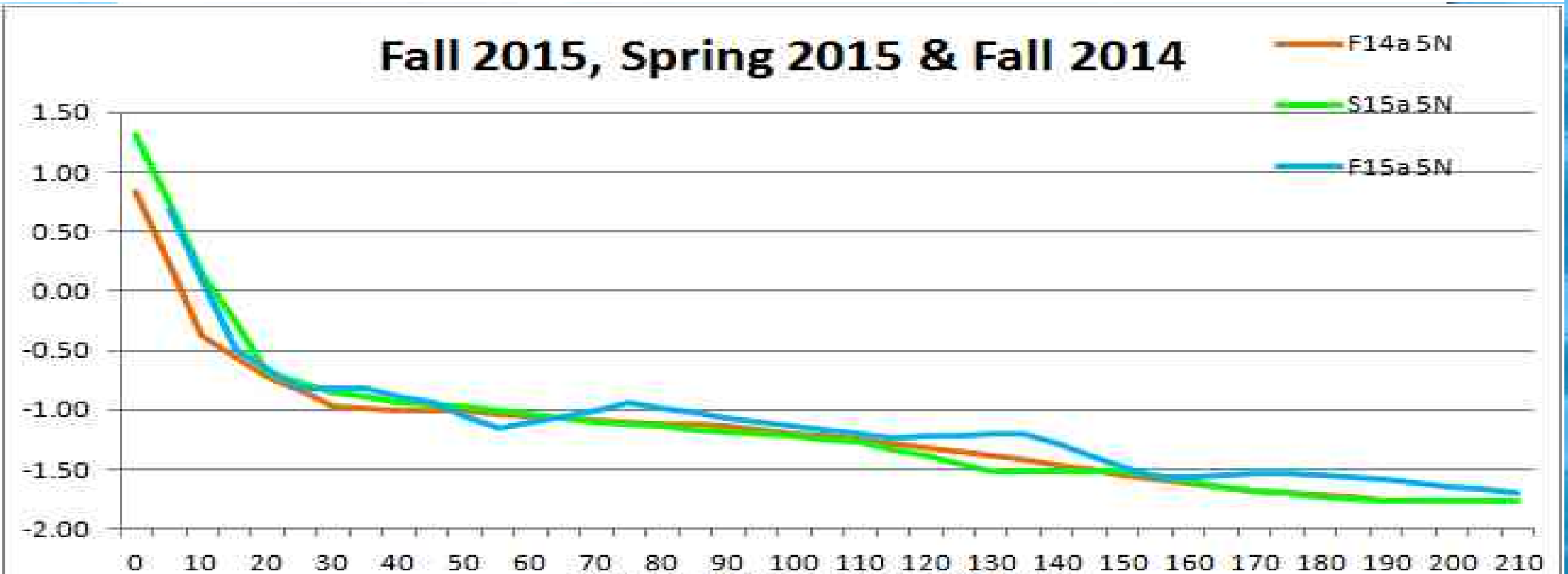
Distance offshore, rel to 2014 WL(ft)


Fall 2015, Spring 2015 & Fall 2014
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F15a 5N
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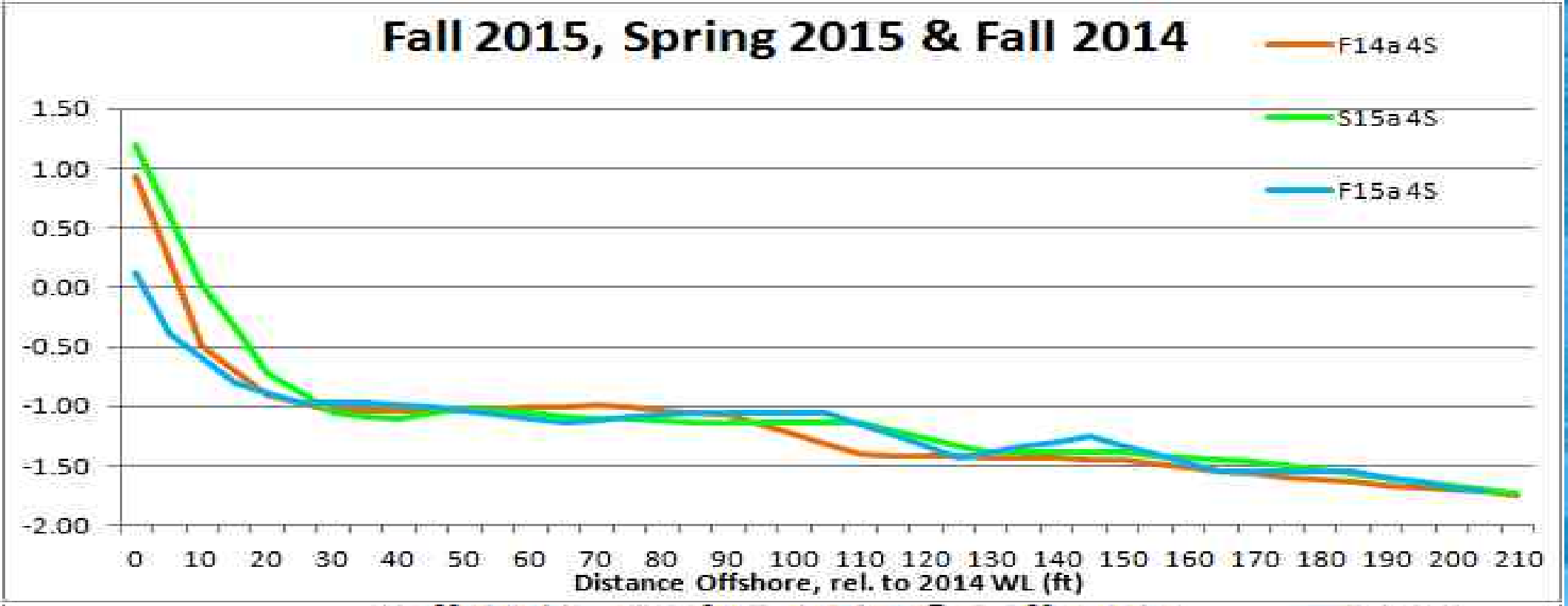
Fall 2015, Spring 2015 & Fall 2014
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S15a4S
F15a4S
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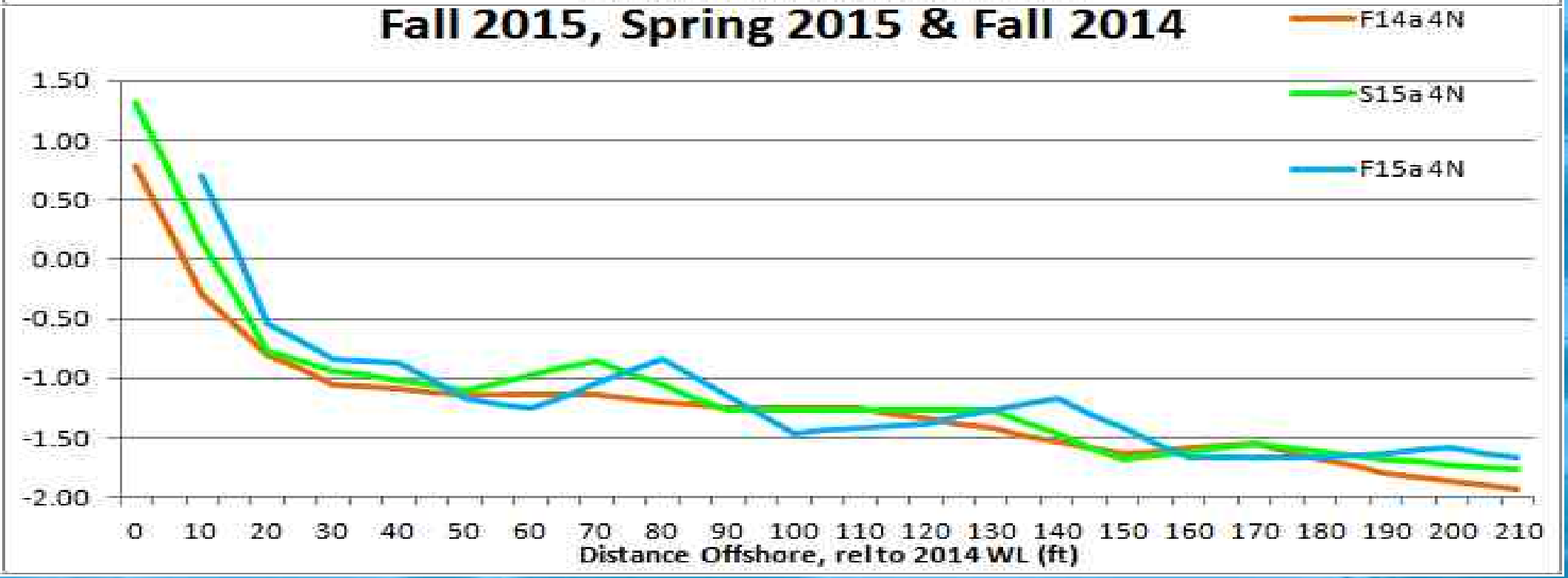
Distance Offshore, rel. to 2014 WL (ft)


Fall 2015, Spring 2015 & Fall 2014
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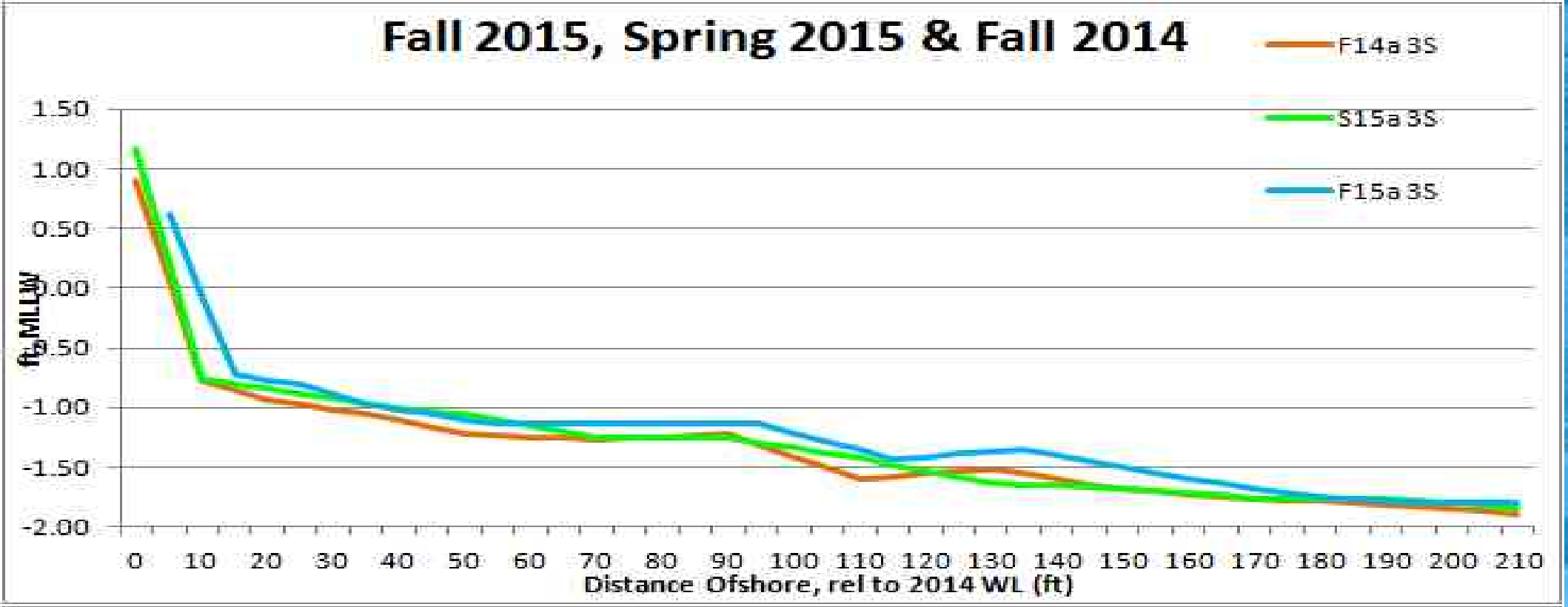
Distance Offshore, relto 2014 WL (ft)


Fall 2015, Spring 2015 & Fall 2014
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S15a 3S
F15a 3S
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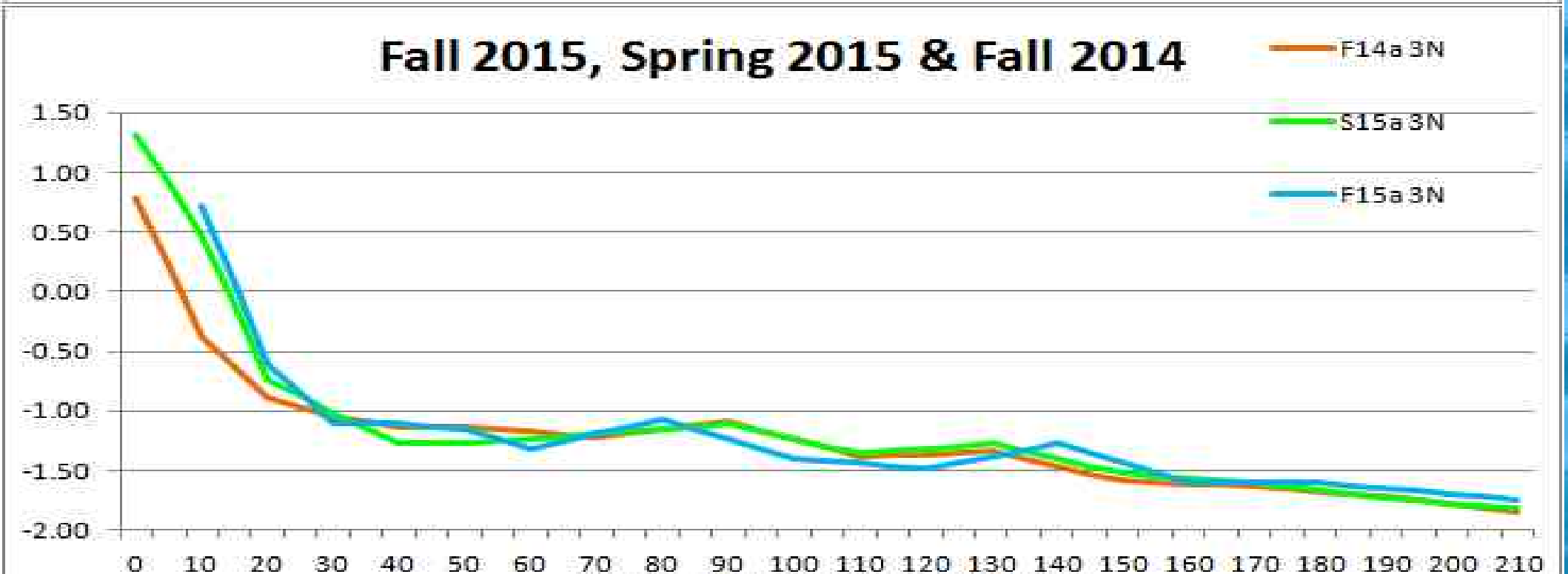
ft, MLLW
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210
Distance Ofshore, rel to 2014 WL (ft)


Fall 2015, Spring 2015 & Fall 2014
F14a 3N
S15a 3N
F15a 3N
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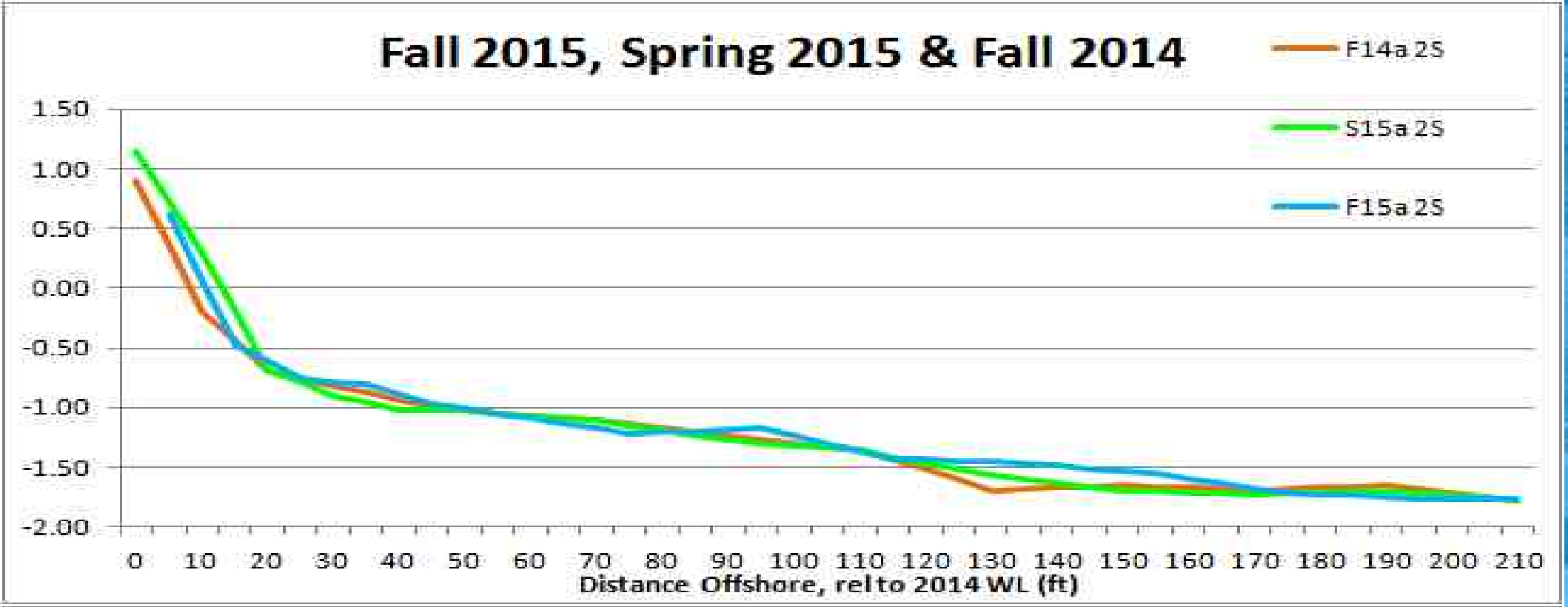
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210


Fall 2015, Spring 2015 & Fall 2014
F14a 2S
S15a 2S
F15a 2S
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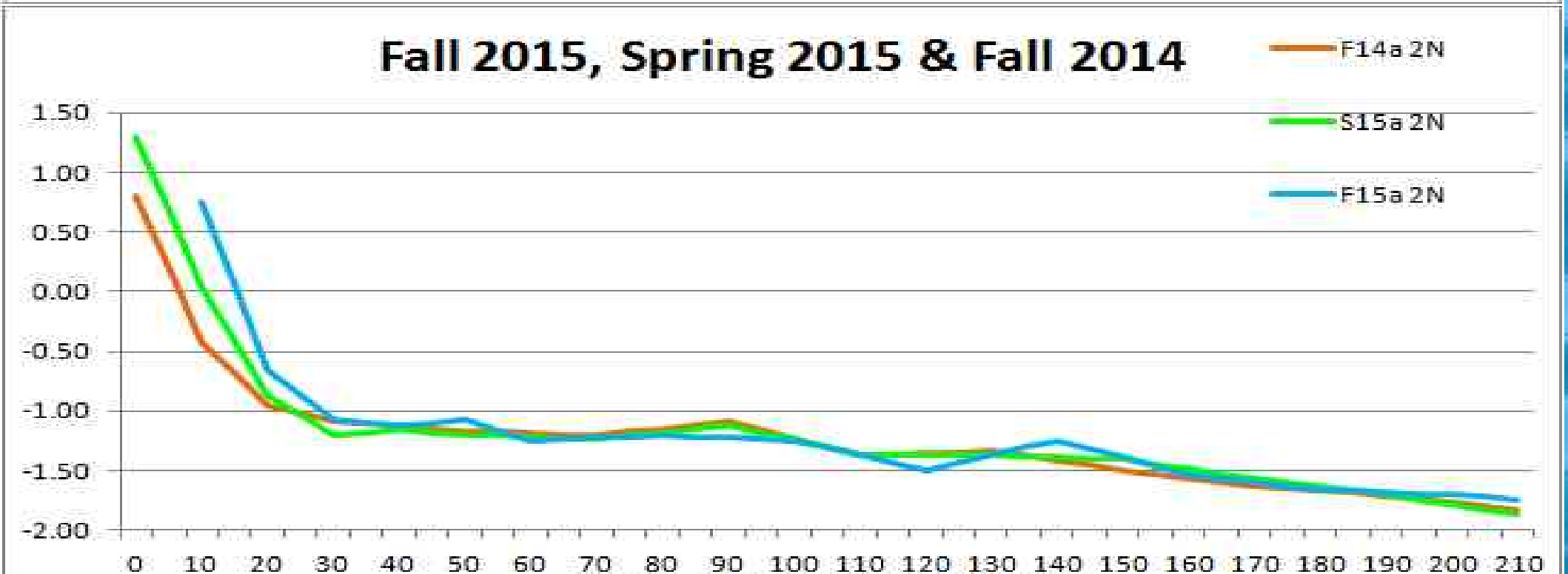
Distance Offshore, rel to 2014 WL (ft)


Fall 2015, Spring 2015 & Fall 2014
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S15a 2N
F15a 2N
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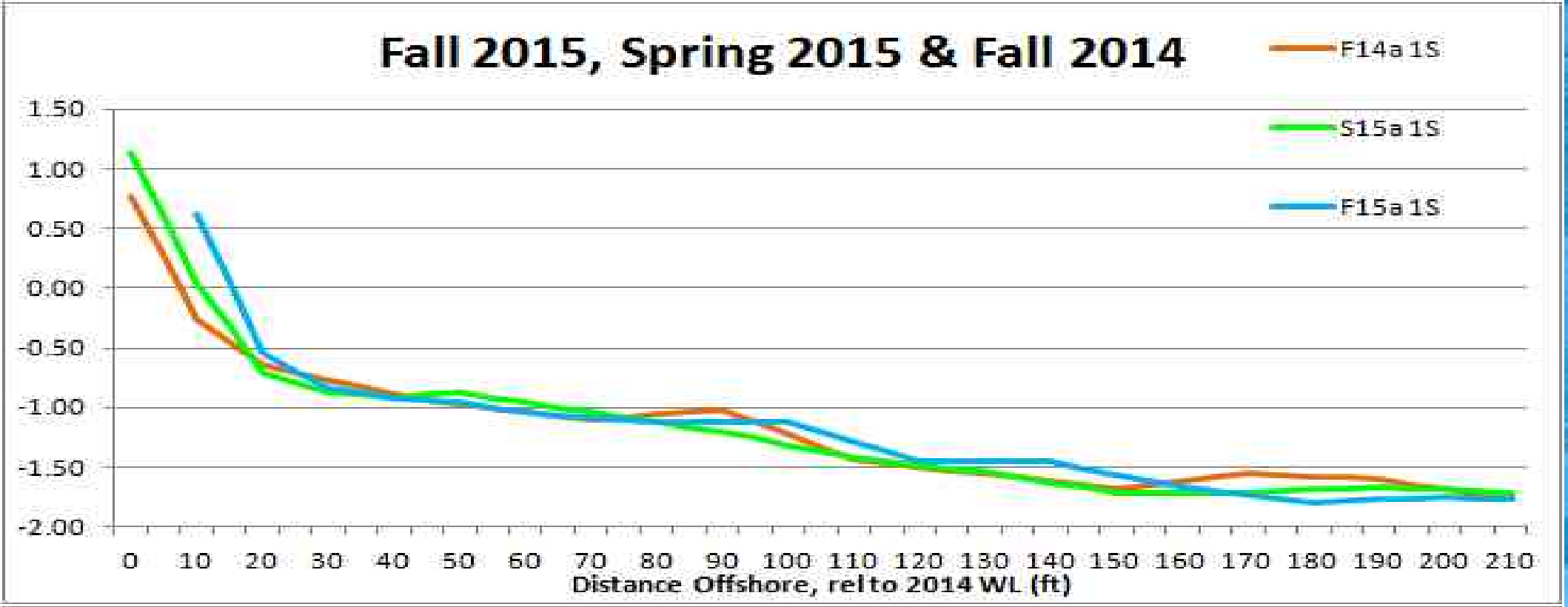
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210


Fall 2015, Spring 2015 & Fall 2014
F14a1S
S15a1S
F15a1S
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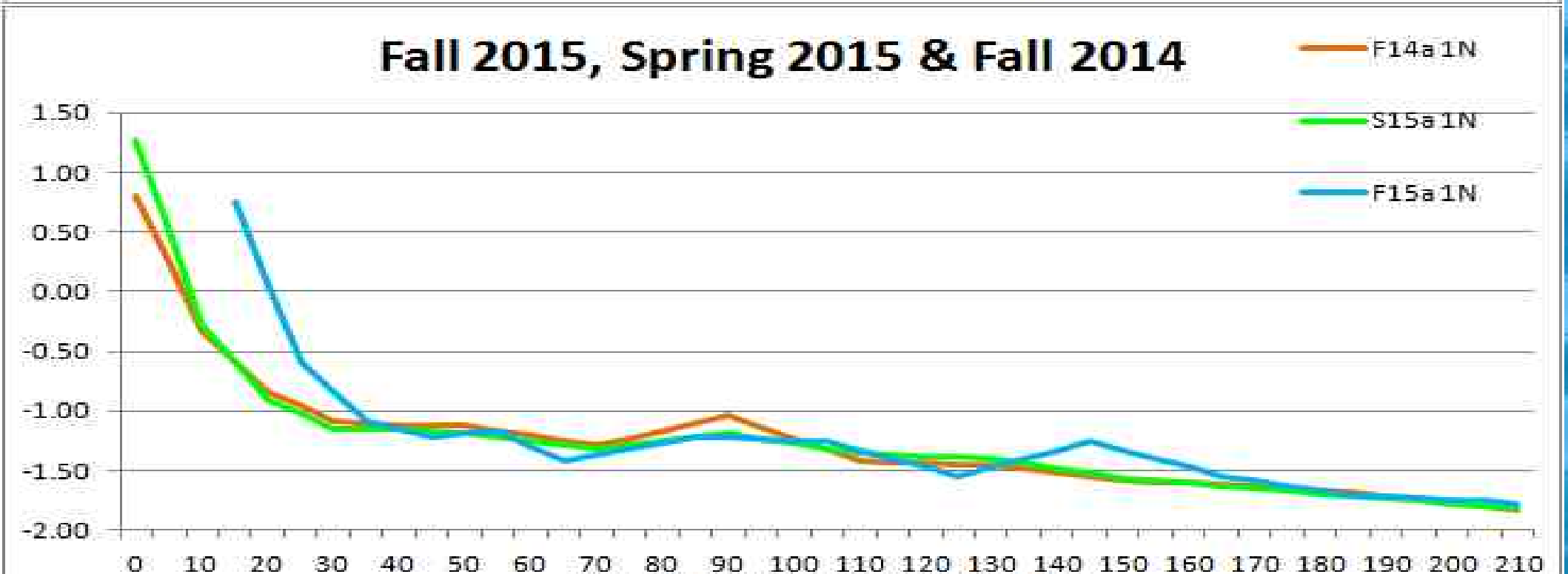
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210
Distance Offshore, rel to 2014 WL (ft)


Fall 2015, Spring 2015 & Fall 2014
F14a1N
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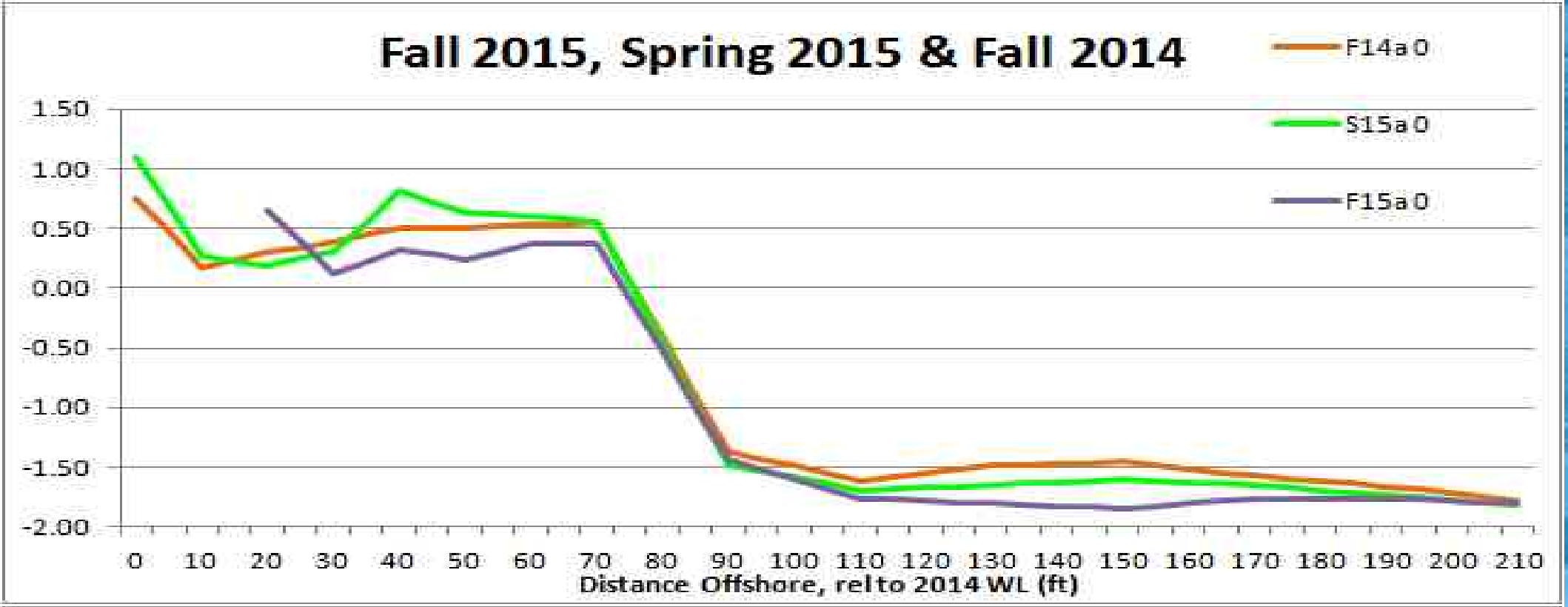
Fall 2015, Spring 2015 & Fall 2014
F14a 0
S15a 0
F15a 0
1.50
1.00
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-0.50
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-1.50
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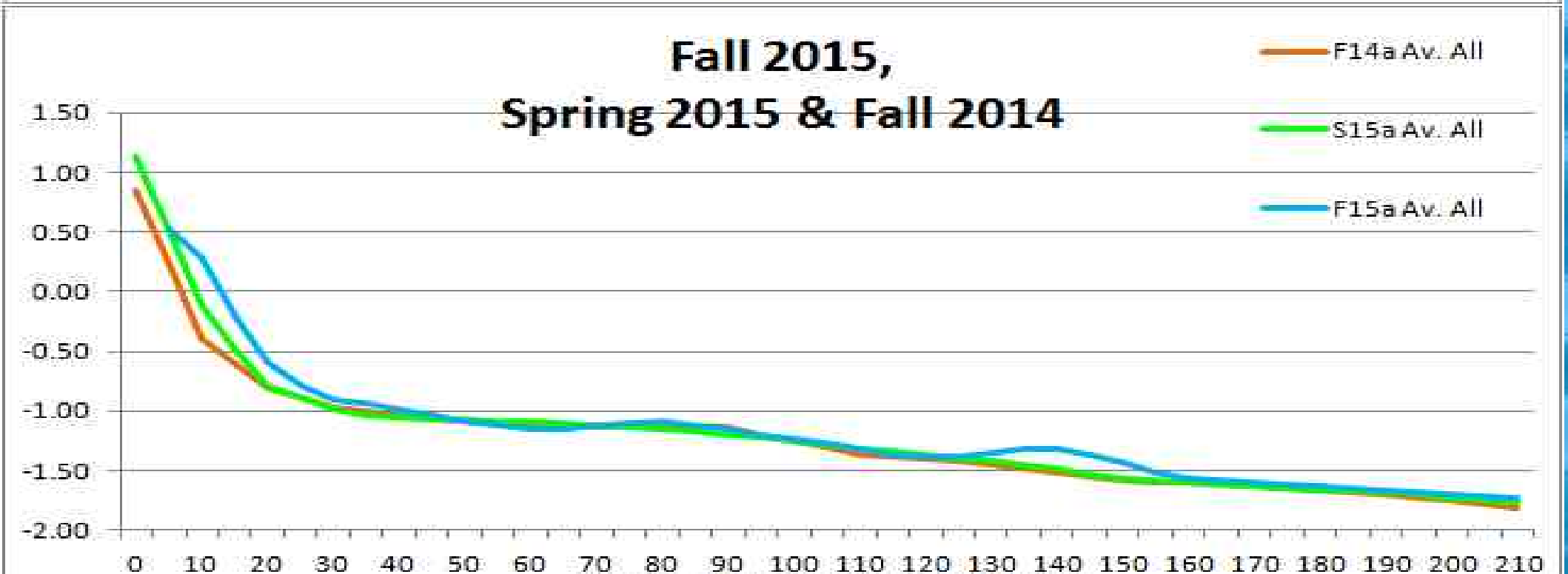
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210
Distance Offshore, rel to 2014 WL (ft)


Fall 2015,
Spring 2015 & Fall 2014
F14a Av. All
S15a Av. All
F15a Av. All
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-1.50
-2.00
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210

1Week Post Construction

I Week Post Construction

1 Year Post Construction

1 Year Post Construction

Missions Accomplished ! (?)

OWNER'S

- Reduce erosion √
- Recreational beach √
- Neighborly √√
- Living Shoreline √√√

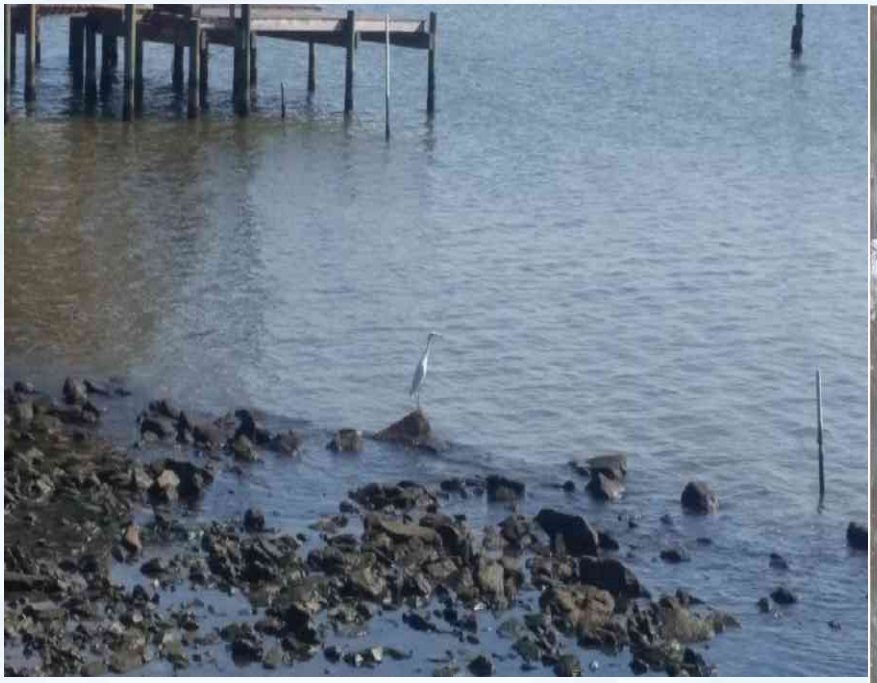
DESIGNER'S

- Reduce erosion A
- Maintain saltmarsh A
- Allow LST C ??
- Survive Incomplete
- Adapt to SLR
  - Cheap A
  - Free D

LESSONS

- Saltmarsh vegetation can thrive on exposed bay shorelines
- Submerged Reef BW perform well in ***X-shore dominated*** shorelines
- Submerged reef BW can be:
  - ***Reef habitat*** as valuable as marsh
  - ***Breakwaters*** as effective as emergent bw

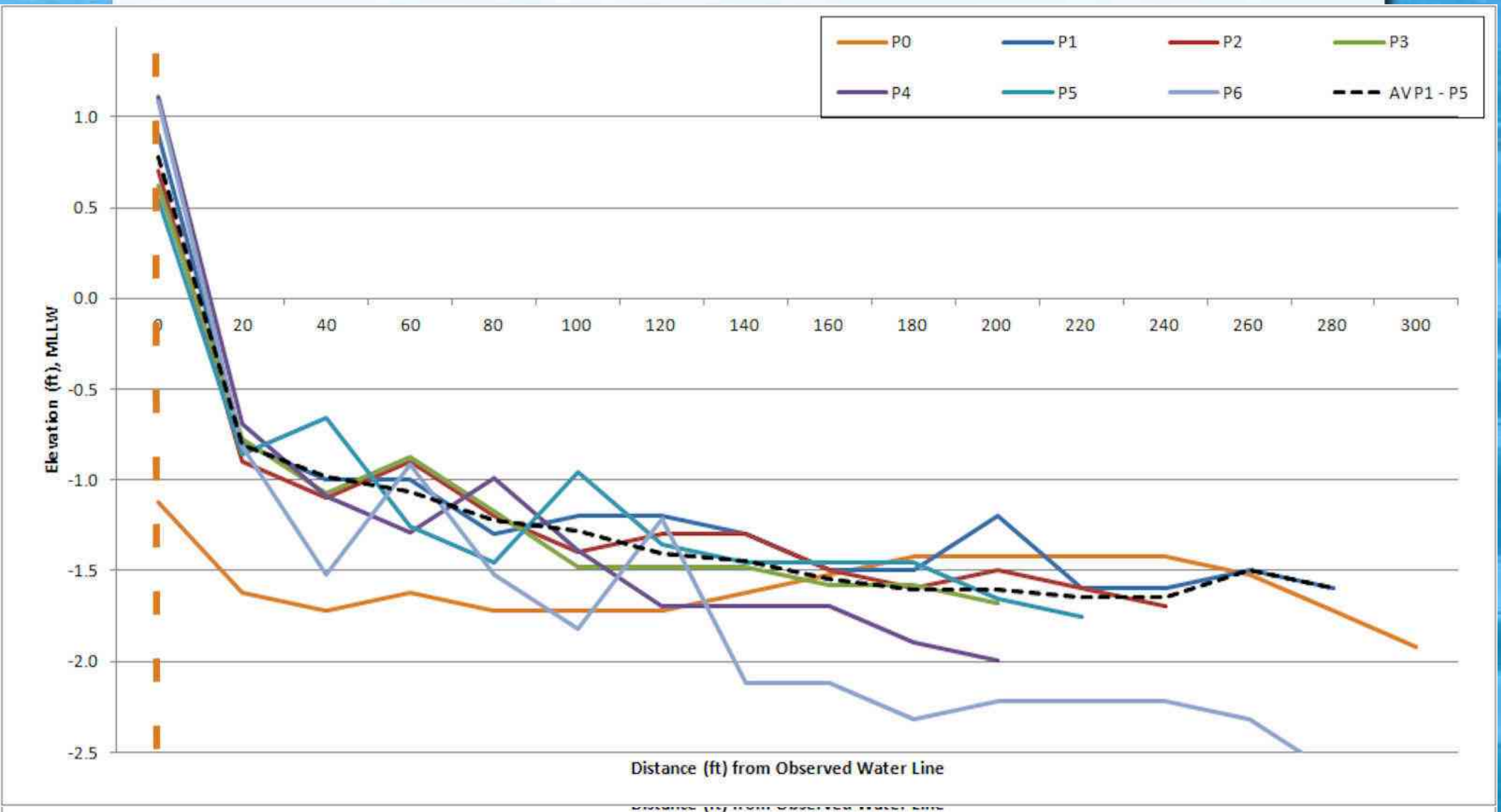
??Questions??



Low tide visitor ↑

High tide visitor →

Offshore Profiles => Offshore Trx.
15 yrs upland erosion ~ Vol. > P0



Profile 4S – Local Effects (LST-o-meter)

As Built


REEF BREAKWATER
MARSH BASE
UPLAND BERM
C
© 2015 Google
100 ft
100 ft
Google earth
Reimer - Moore Living Shoreline Project
Dwg. No: RM-1
Project Components
Date: 10/18/2013
BY: ddm
Rev. No:
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