HABITAT RESTORATION USING DREDGED MATERIAL PLACEMENT

WITHIN THE LOWER COLUMBIA RIVER AT WOODLAND ISLANDS, WA

Hans Moritz
Matt Fraver
Logan Negherbon
Mike Turaski
Kate Wells
Valerie Ringold
Louis Landre
Jon Gornick
Jarod Norton
Jessica Stokke
Ann Hodgson
US Army Corps of Engineers - Portland District

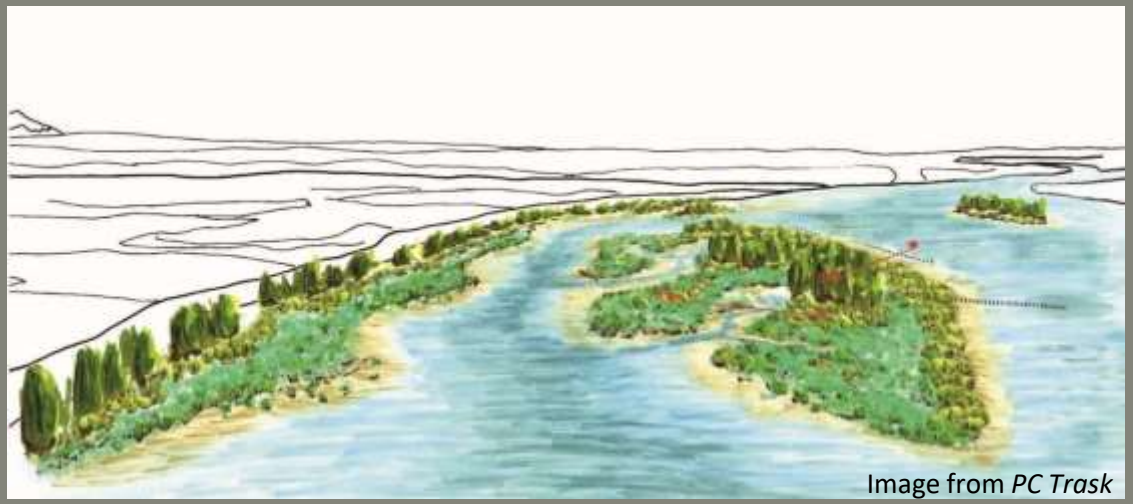

Image from *PC Trask*

COLUMBIA RIVER ESTUARY CONFERENCE
Resilience within a Shifting Environment 10-12 APRIL 2018

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BACKGROUND & MOTIVATION

77% of the intertidal and riparian areas of Columbia River estuary have been lost from the pre-settlement condition due to: diking, filling, and hydrology modification.

LCR NAVIGATION CHANNEL

Each Year, 6 to 8 million CY of sand is dredged from the LCR deep draft navigation channel (RM 6 to 105).

Distribution of Dredged Material Placement during 2014-2016:

Upland = 12-19% *

Shoreline = 9-14%

Inwater = 69-80 %

** UPLAND placement could increase to 50% (2003 CRCD EIS)*

CHALLENGE: Provide Reliable Navigation within the LCR while sustaining…..

- ***Sediment Resources***
- ***Morphology***
- ***Ecology***
- ***Fisheries***

…and other river functions that depend on sediment

SOLUTION = Judicious Placement of Dredged Sediment

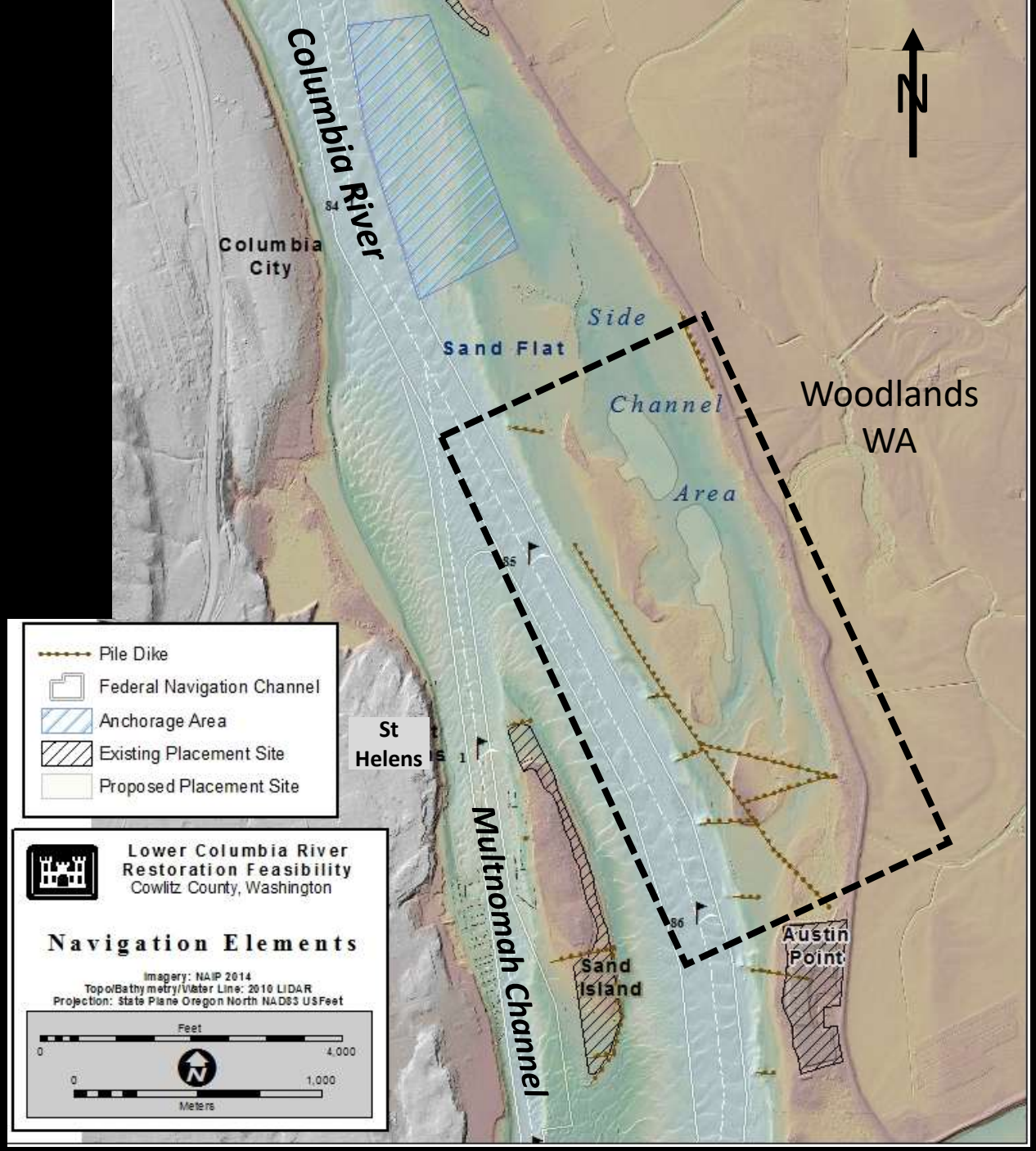
2017/10/26

CONSIDER THE PAST

at

Woodland Islands

CRM 85-86

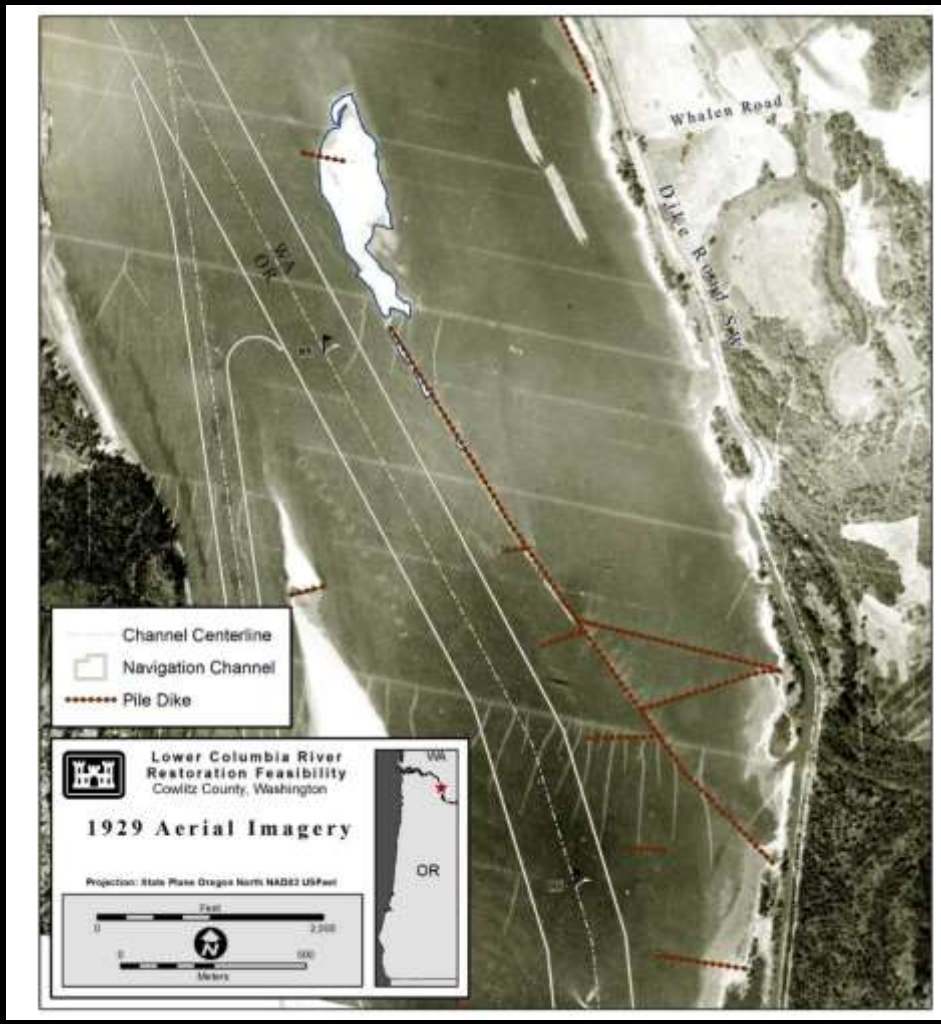


Woodland Islands
WA
CRM 85

Across river from St. Helens, OR

An area of continuous navigation improvement since 1870s.

Evolution of the Woodland Islands (1929-1957)



Pile Dike Construction

Dredged Material Placement

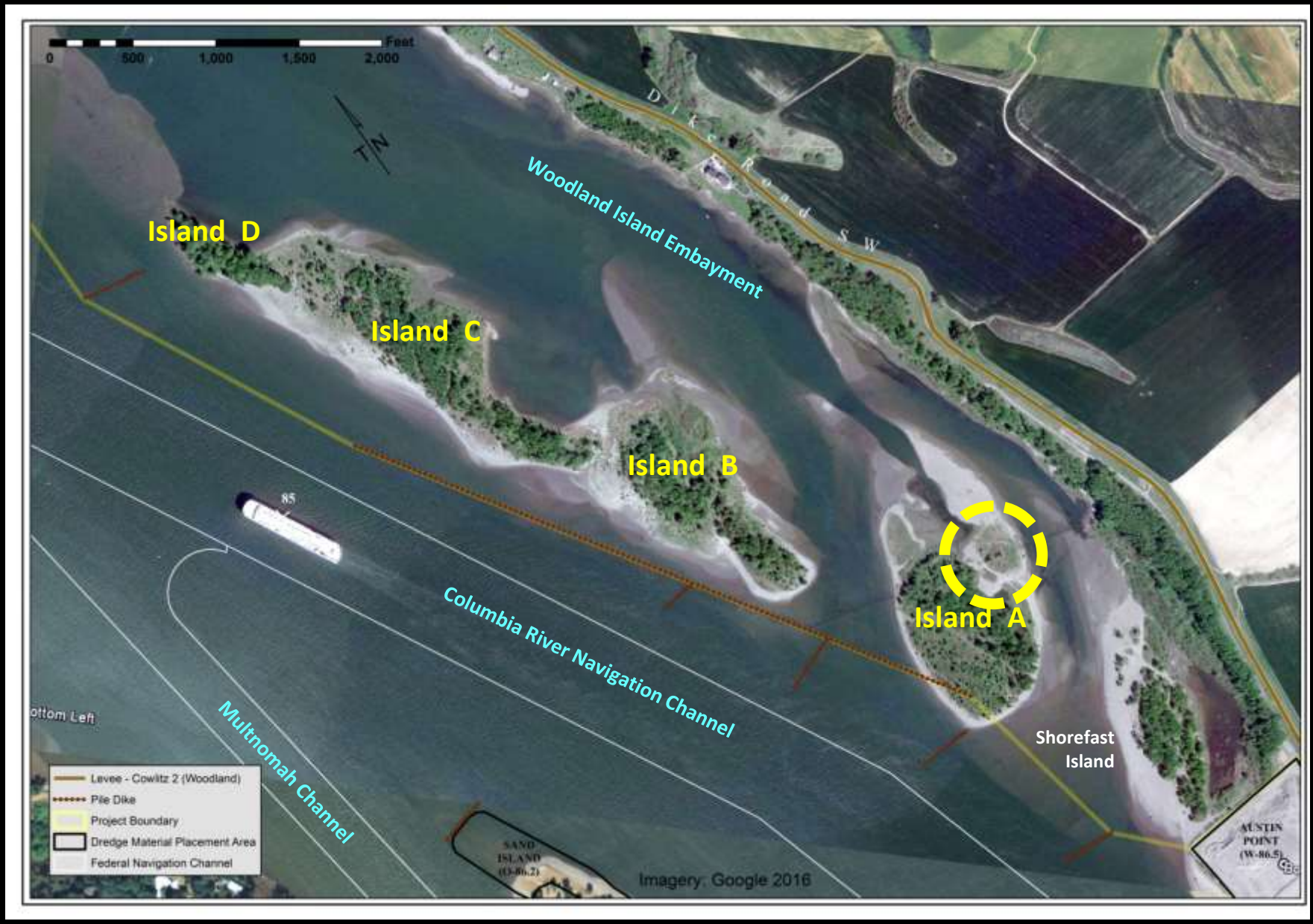
Evolution of the Woodland Islands (1973-1983)

Dredged Material Placement

Evolution of Placed Dredged Material

Evolution of the Woodland Islands (1989-2011)

Evolution of Placed Dredged Material



WOODLAND ISLANDS, WA CRM 85 Present Condition

Core #4 near Big Cottonwood tree. Top 6 inches of core was brown loose river overwash sand. Below 6 inches, material is progressively more grey coarse sand (dredged material).

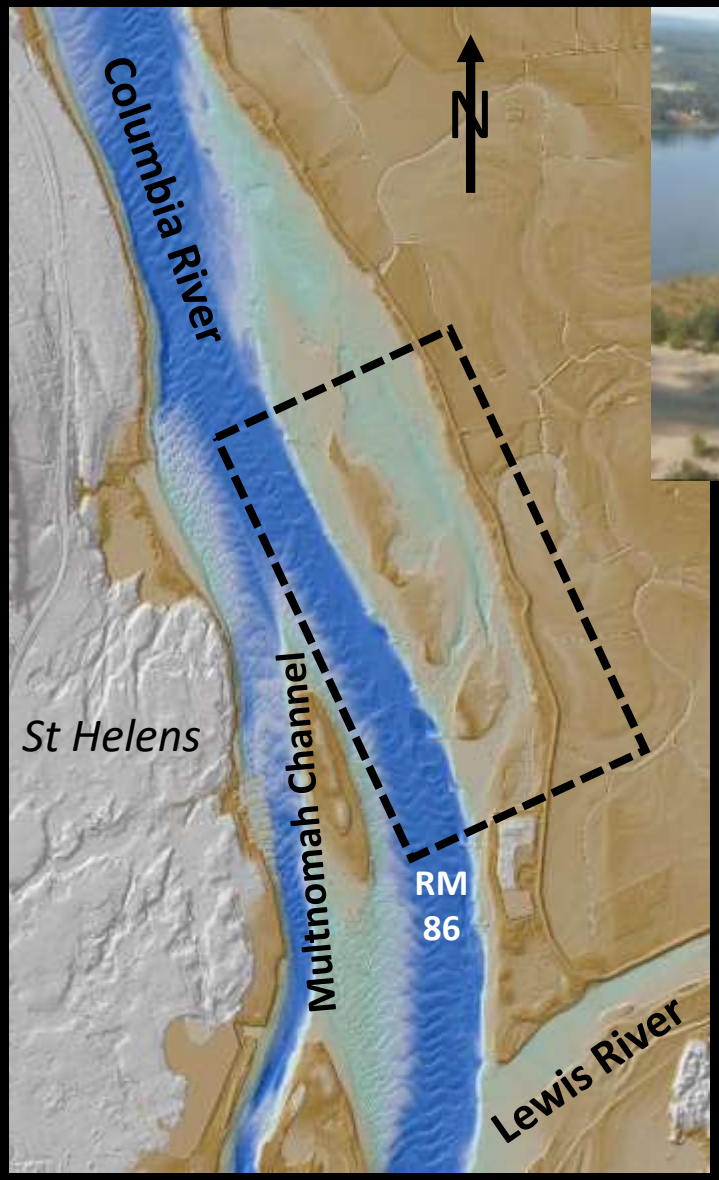
Core #4 – Island A

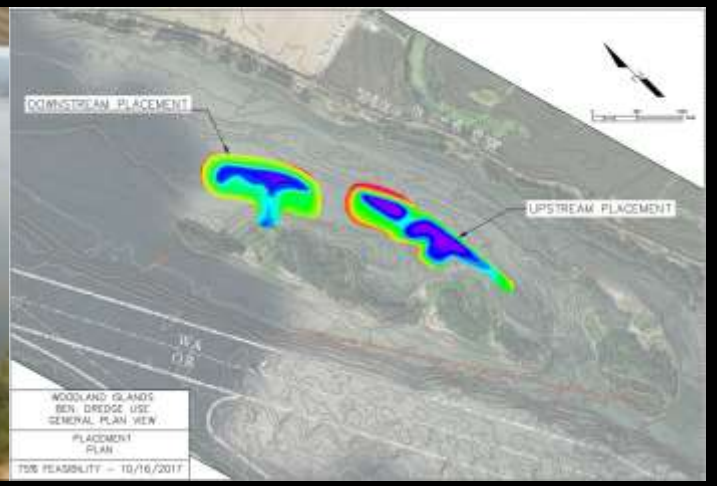
Core #3 Below first inch, material becomes progressively more brown sand-based. At 24 inches below surface; material is grey coarse sand (dredged material).

Core #3 – Island A

Core #3 taken on "Island A", near tidal slough. Top 1 inch of core was fines-sandy material mix.

Proposed Project: Woodland Islands *Habitat Restoration*





- Located near CRM 85 along WA shore
- Proximity to major confluences
- Moderate area for restoration (~30 ac)
- Close to productive shoal
- Relatively protected
  - Existing islands provide shelter from river thalweg
  - Existing pile dike network adds sheltering effect
  - Area is aggrading
- Existing habitats on site demonstrate potential
- Lack of major real estate obstacles

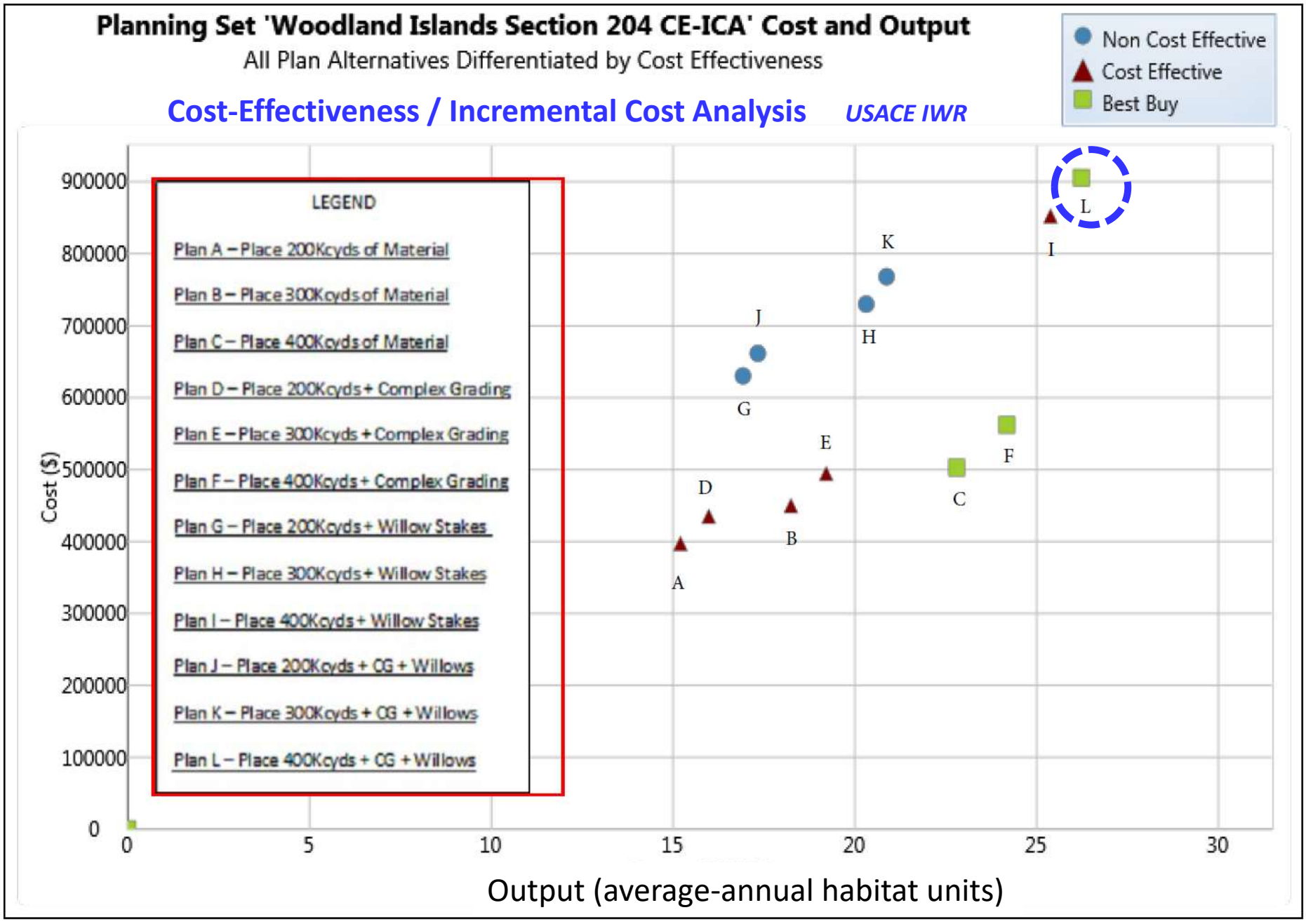
Planning Objectives for the Woodland Islands

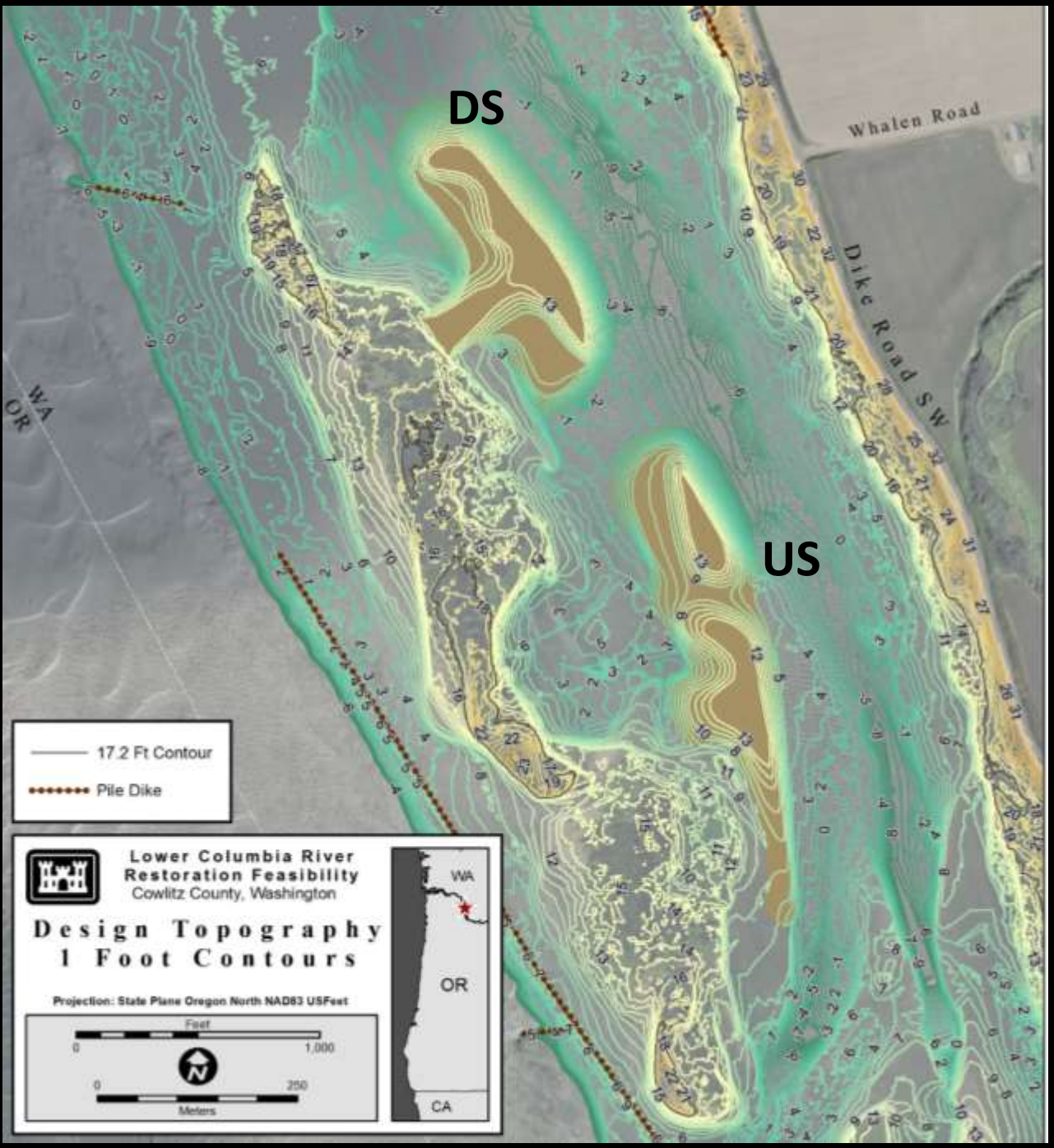
Conduct CAP Section 204 study (beneficial use of dredged material). Apply a 50-year planning horizon:

- ***Increase habitat for juvenile salmonids at Woodland Islands site***
- ***Increase habitat for yellow warblers***
- *Increase flood refugia for juvenile and adult salmon at the Woodland Islands site*
- *Increase floodplain habitat complexity at the Woodland Islands site*
- *Increase the extent of quality riparian habitat at the Woodland Islands site*

Yellow warblers migrate through and nest within the LCR floodplains. Managing yellow warbler habitat to increase the regional population represents a significant habitat restoration objective.

Alternatives Optimized using CE/ICA with HEP = Construct 2 Futures within Woodland Bay using 400,000 cy of sand dredged from St. Helens Bar. Project features will add terrain within elevation zone 0 ft to 14 ft NAVD. Features will be graded and planted.


Planning Set 'Woodland Islands Section 204 CE-ICA' Cost and Output
All Plan Alternatives Differentiated by Cost Effectiveness
Cost-Effectiveness / Incremental Cost Analysis
USACE IWR
Non Cost Effective
Cost Effective
Best Buy
LEGEND
Plan A – Place 200Kcyds of Material
Plan B – Place 300Kcyds of Material
Plan C – Place 400Kcyds of Material
Plan D – Place 200Kcyds + Complex Grading
Plan E – Place 300Kcyds + Complex Grading
Plan F – Place 400Kcyds + Complex Grading
Plan G – Place 200Kcyds + Willow Stakes
Plan H – Place 300Kcyds + Willow Stakes
Plan I – Place 400Kcyds + Willow Stakes
Plan J – Place 200Kcyds + CG + Willows
Plan K – Place 300Kcyds + CG + Willows
Plan L – Place 400Kcyds + CG + Willows
Cost ($)
900000
800000
700000
600000
500000
400000
300000
200000
100000
0
0
5
10
15
20
25
30
Output (average-annual habitat units)
A
B
C
D
E
F
G
H
I
J
K
L



Alternative L (Preferred)

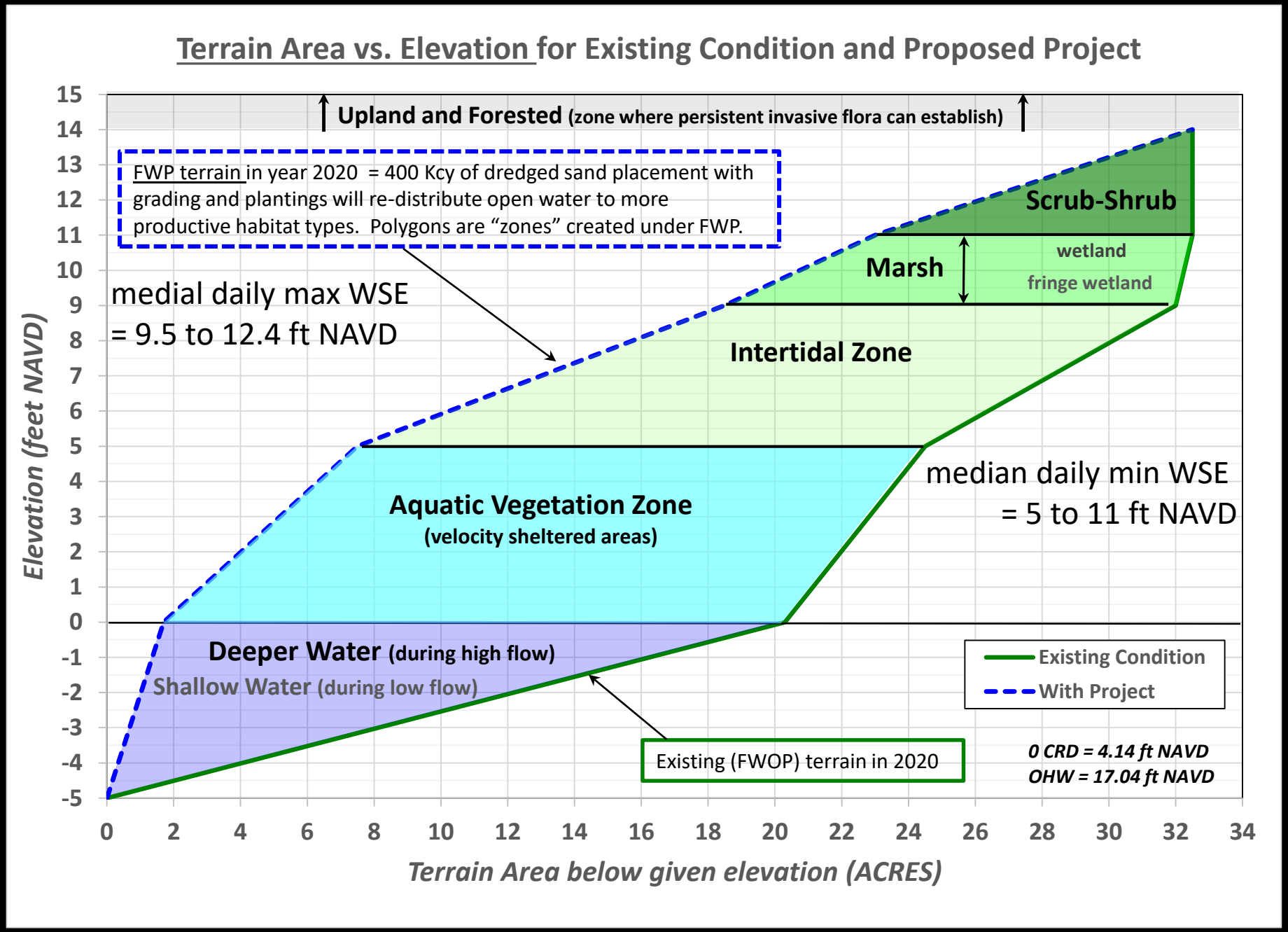
Base Measure: placement of 400 kcy dredged material.

Downstream Feature (DS) = 250 Kcy

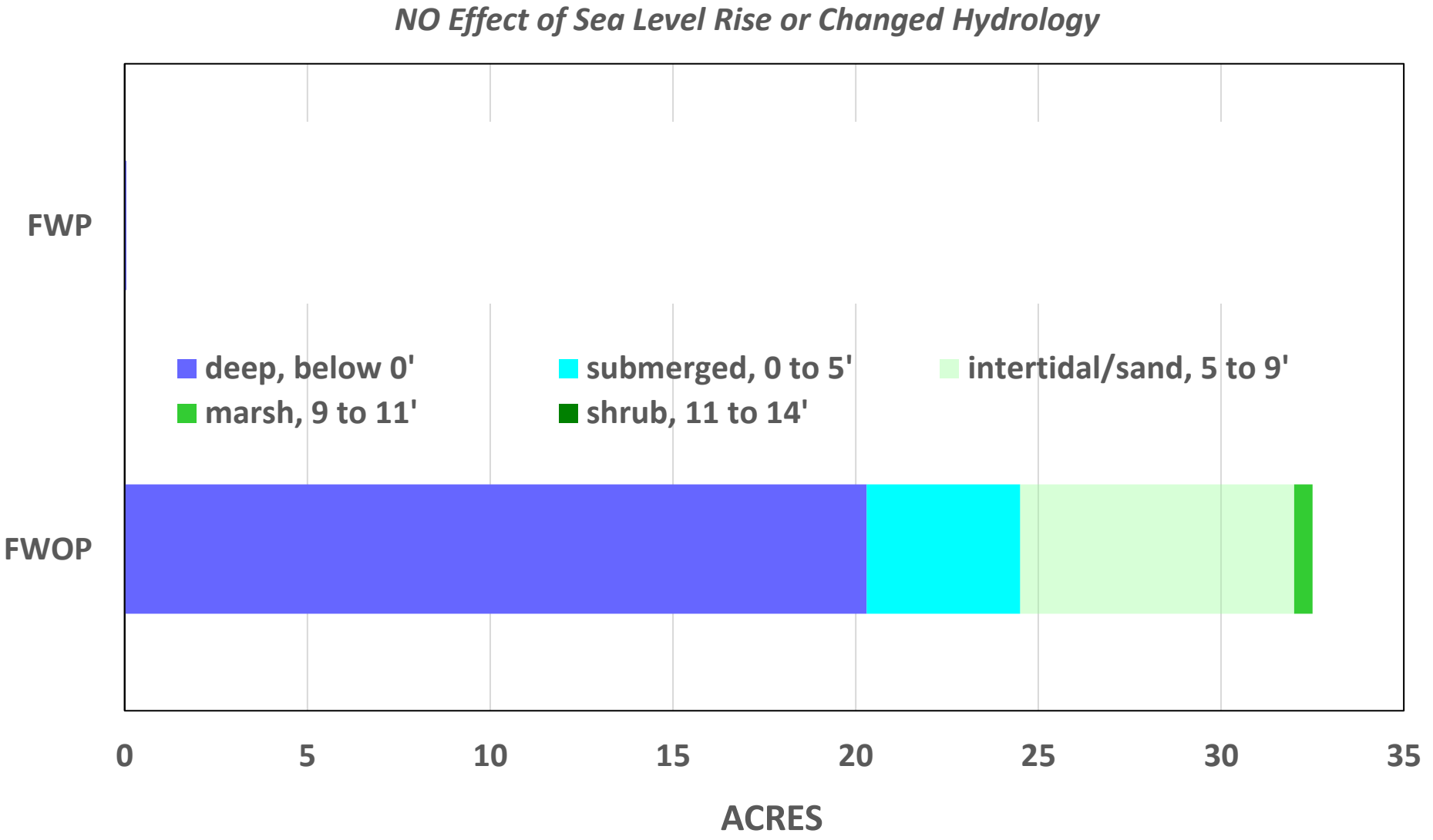
Upstream Feature (US) = 150 Kcy

Additional Measures

Implement complex grading and additional planting of vegetation.


Terrain Area vs. Elevation for Existing Condition and Proposed Project
Upland and Forested (zone where persistent invasive flora can establish)
FWP terrain in year 2020 = 400 Kcy of dredged sand placement with grading and plantings will re-distribute open water to more productive habitat types. Polygons are "zones" created under FWP.
Scrub-Shrub
wetland
Marsh
fringe wetland
medial daily max WSE
= 9.5 to 12.4 ft NAVD
Intertidal Zone
median daily min WSE
= 5 to 11 ft NAVD
Aquatic Vegetation Zone
(velocity sheltered areas)
Deeper Water (during high flow)
Shallow Water (during low flow)
Existing Condition
With Project
Existing (FWOP) terrain in 2020
0 CRD = 4.14 ft NAVD
OHW = 17.04 ft NAVD
Elevation (feet NAVD)
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
Terrain Area below given elevation (ACRES)

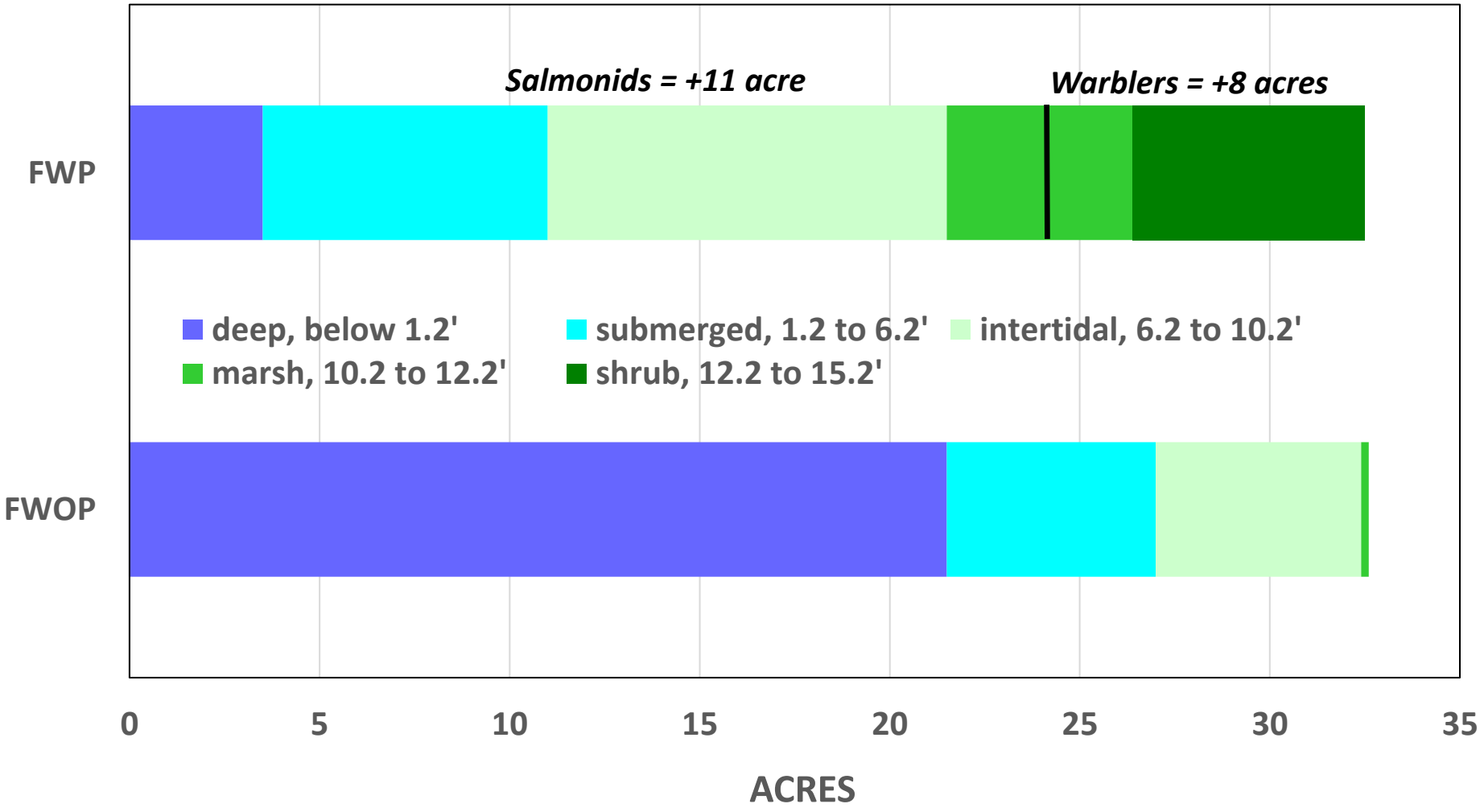
Acreage Distribution of Habitat Types: With-Project vs. Existing Condition



FWOP = future without project, FWP = future with project

Acreage Distribution of Habitat Types: With-Project vs. Existing Condition

2 ft Sea Level Rise at MCR = 1.2 ft Stage Increase at RM 86



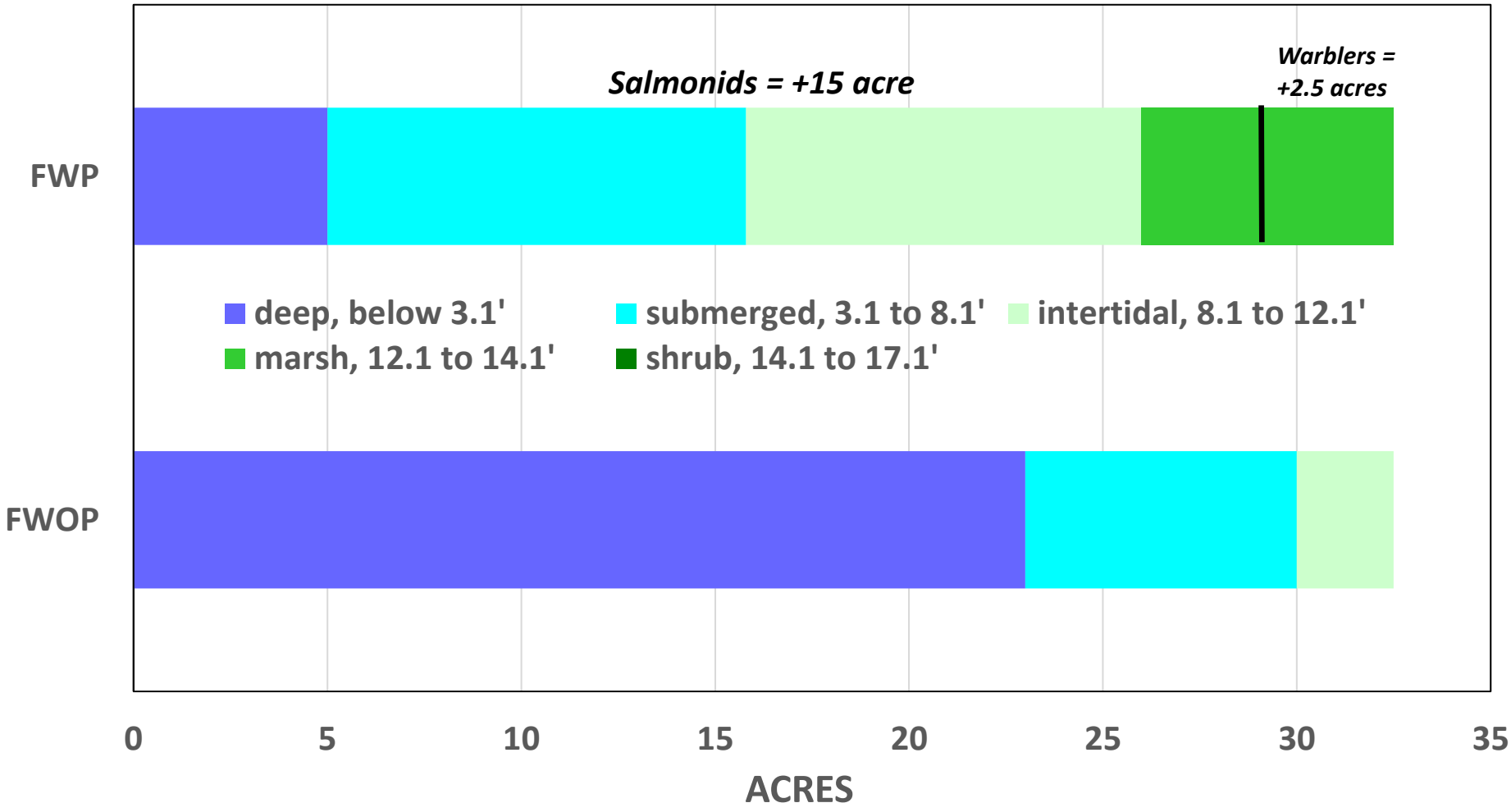
FWOP = future without project, FWP = future with project

Acreage Distribution of Habitat Types: With-Project vs. Existing Condition

15% Flow Increase for 0.5 AEP = 1.9 ft Stage Increase at RM 86

and

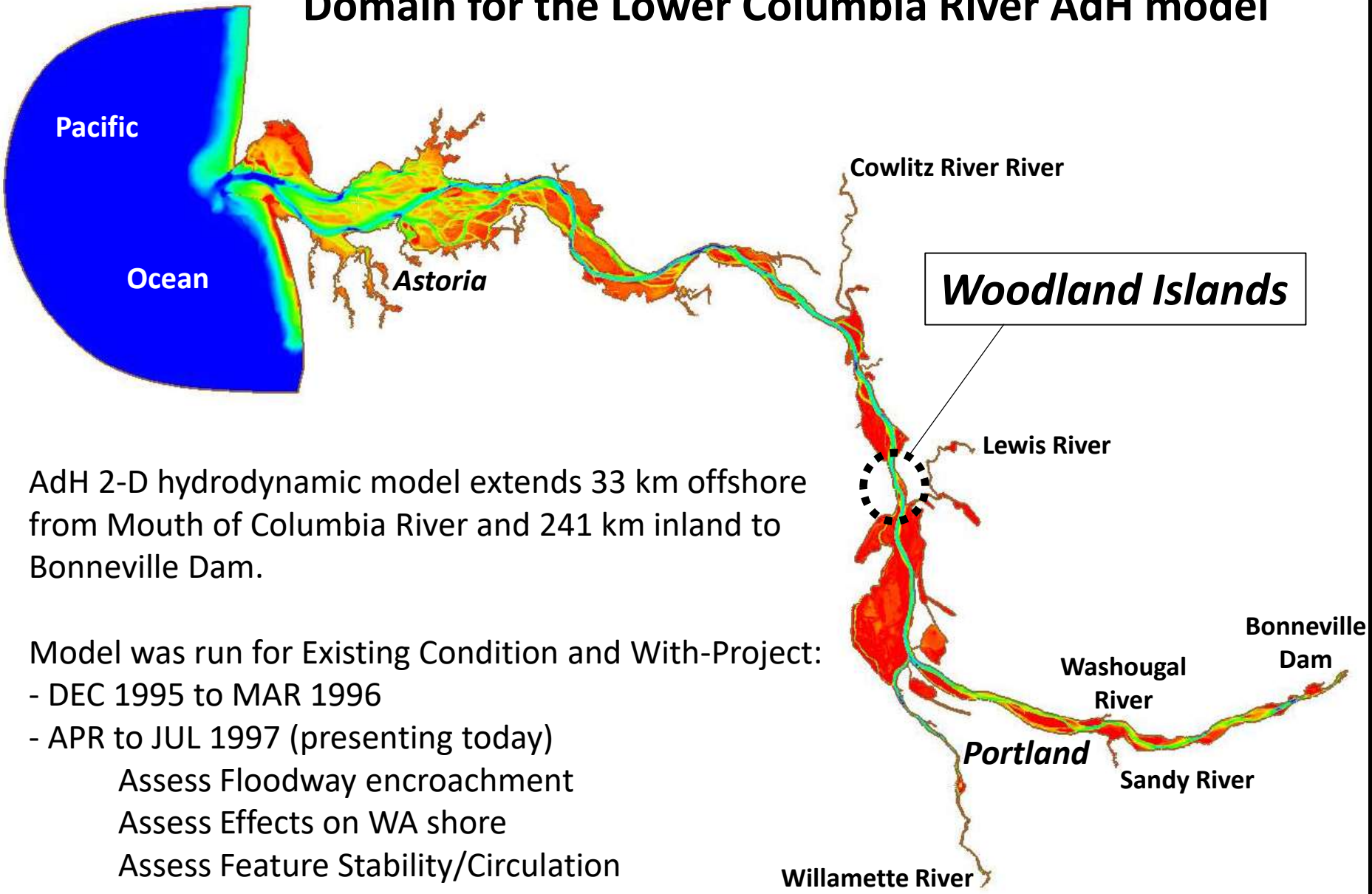
2 ft Sea Level Rise at MCR = 1.2 ft Stage Increase at RM 86



HYDRAULIC RESPONSE

present climate

Domain for the Lower Columbia River AdH model



AdH 2-D hydrodynamic model extends 33 km offshore from Mouth of Columbia River and 241 km inland to Bonneville Dam.

Model was run for Existing Condition and With-Project:

- DEC 1995 to MAR 1996
- APR to JUL 1997 (presenting today)
  - Assess Floodway encroachment
  - Assess Effects on WA shore
  - Assess Feature Stability/Circulation

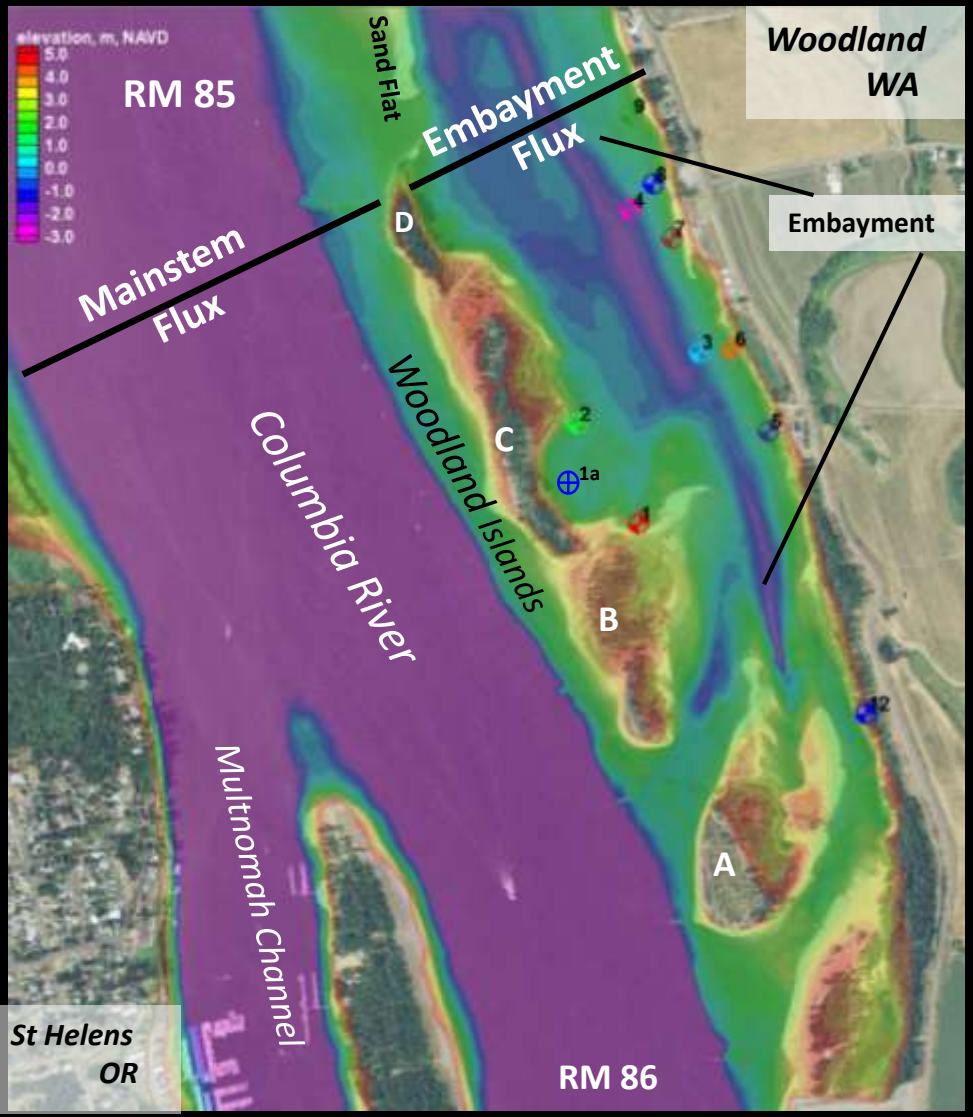


Figure H2a. Existing Condition Terrain elevation, background image obtained with river stage at 3.4 m NAVD (11 ft NAVD or 7 ft CRD). Islands are individual denoted as A to D. 1 ft = 0.3048 meter. River bed elevations < -3 m (-9.8 ft) NAVD are shown as "purple".

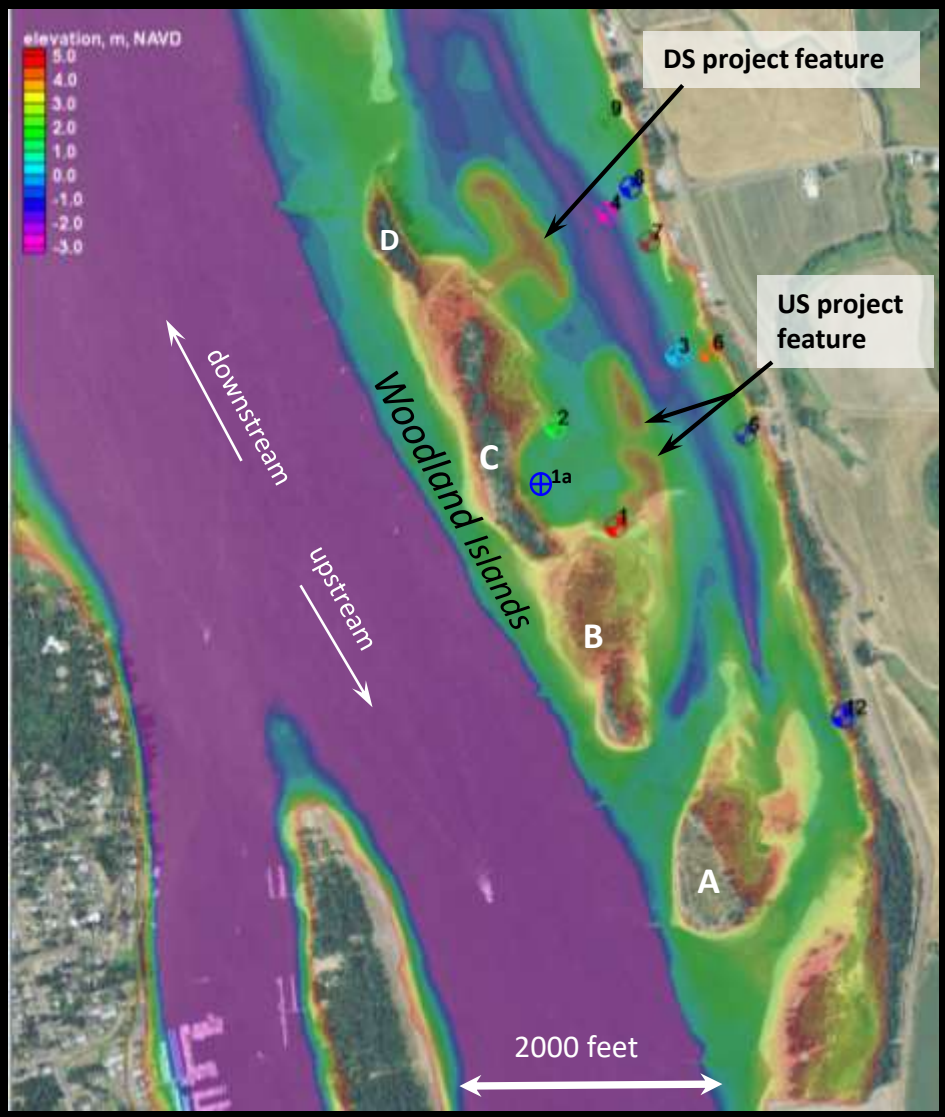
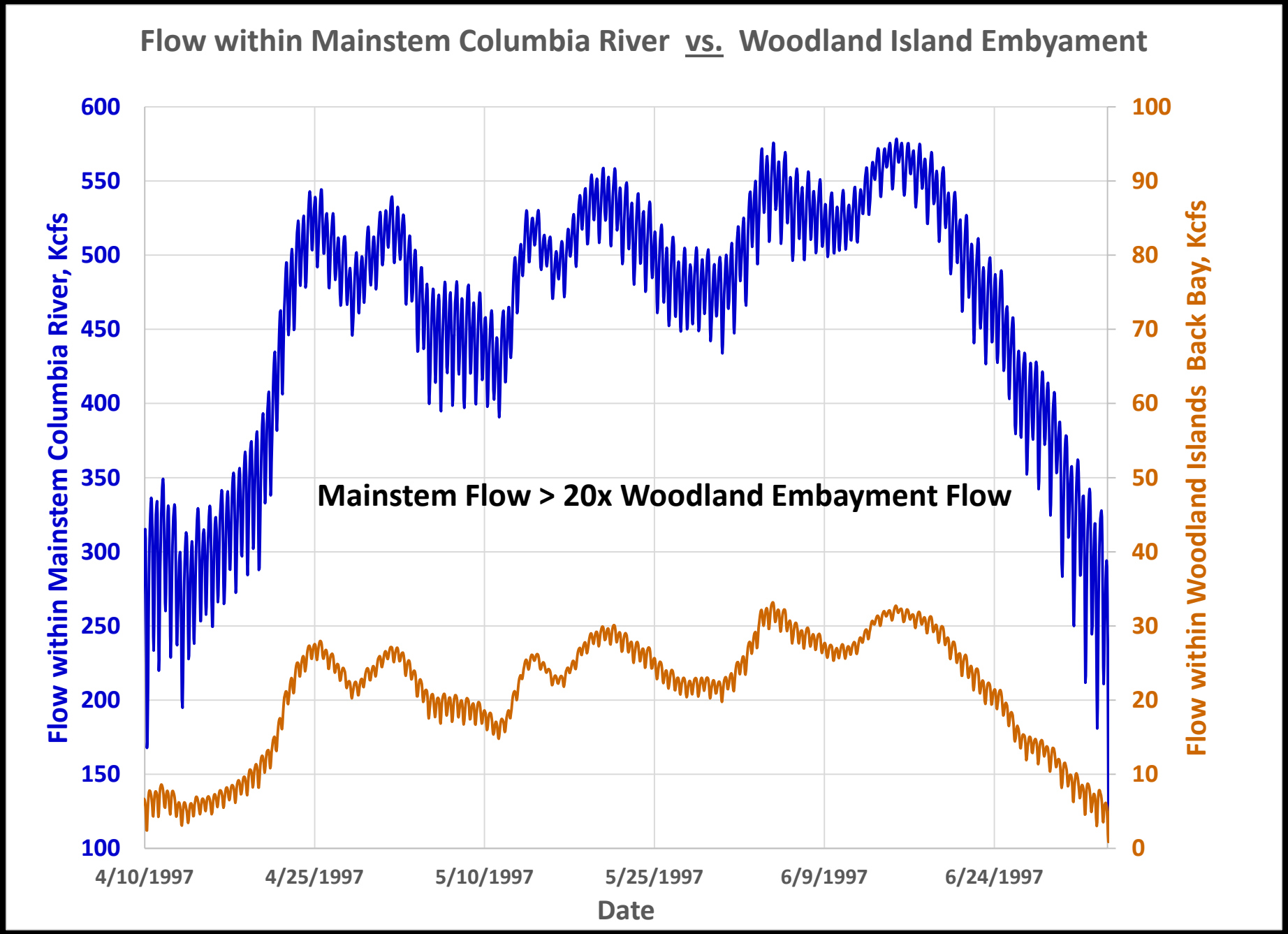
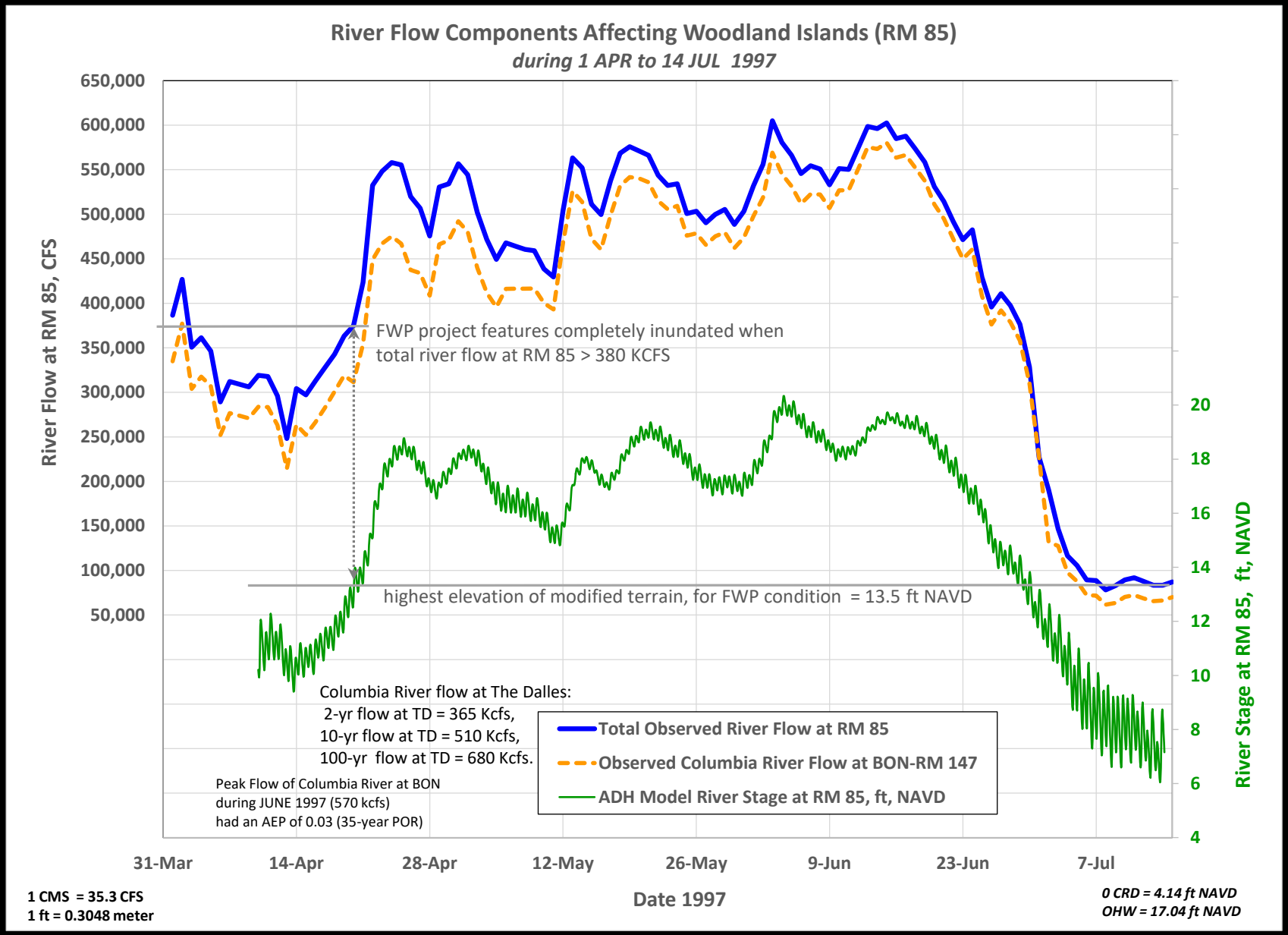


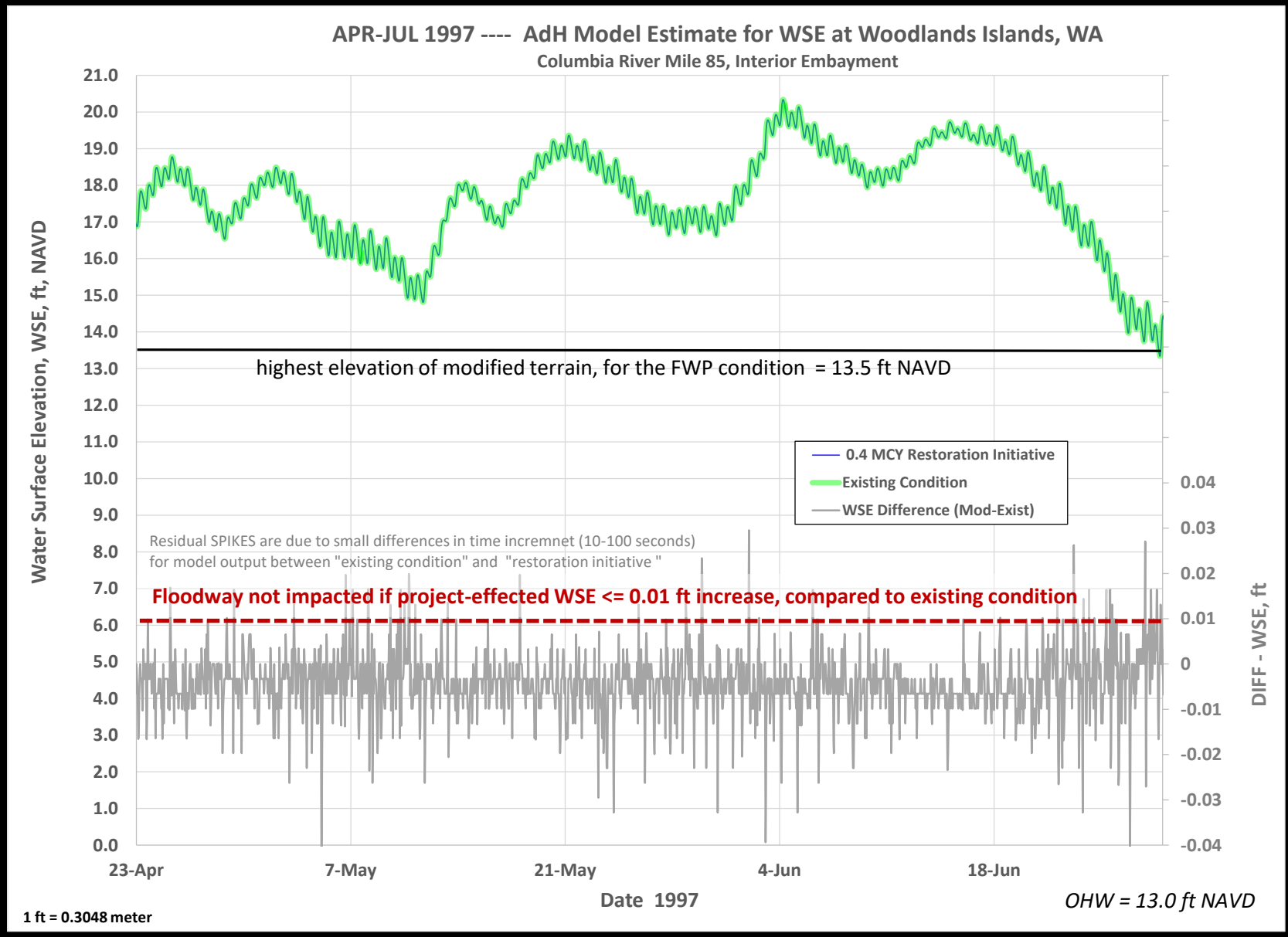
Figure H2b. Proposed With-Project Terrain Modification, spanning -1.8 to 4.1 m NAVD (-5.9 to +13.5 ft NAVD). Project features shown as upstream (US) and downstream (DS), to be created using controlled placement of sand dredged from the FNC near RM 86.5.

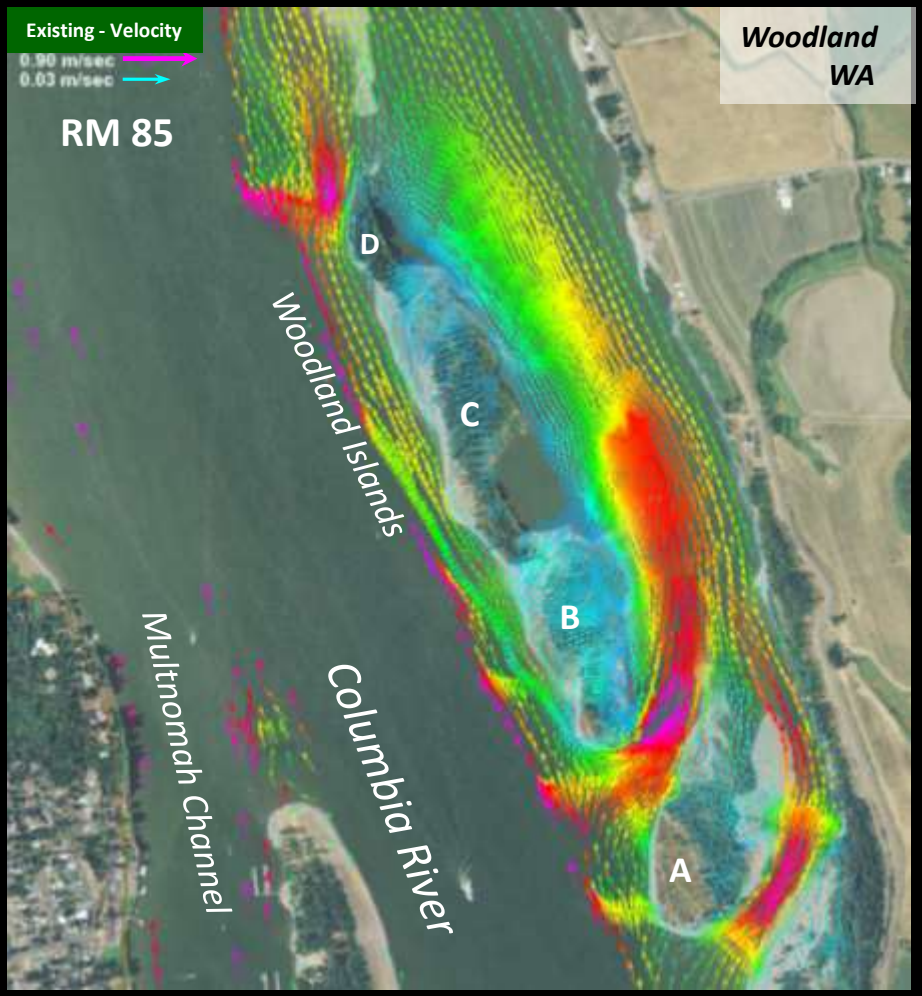

Flow within Mainstem Columbia River vs. Woodland Island Embyament
Flow within Mainstem Columbia River, Kcfs
Flow within Woodland Islands Back Bay, Kcfs
Mainstem Flow > 20x Woodland Embayment Flow
600
550
500
450
400
350
300
250
200
150
100
100
90
80
70
60
50
40
30
20
10
0
4/10/1997
4/25/1997
5/10/1997
5/25/1997
6/9/1997
6/24/1997
Date

River FLOW and STAGE Affecting Woodland Islands During APR-JUL 1997



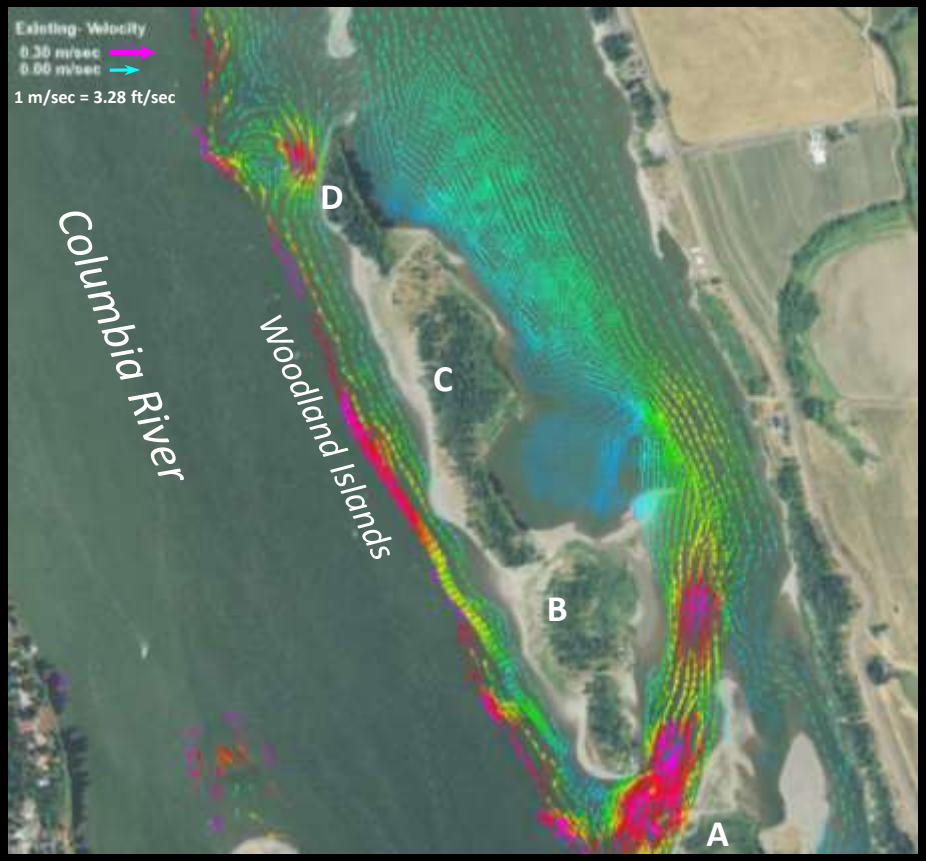
Verification that Woodland Island Project Does NOT Affect Increase in River Stage



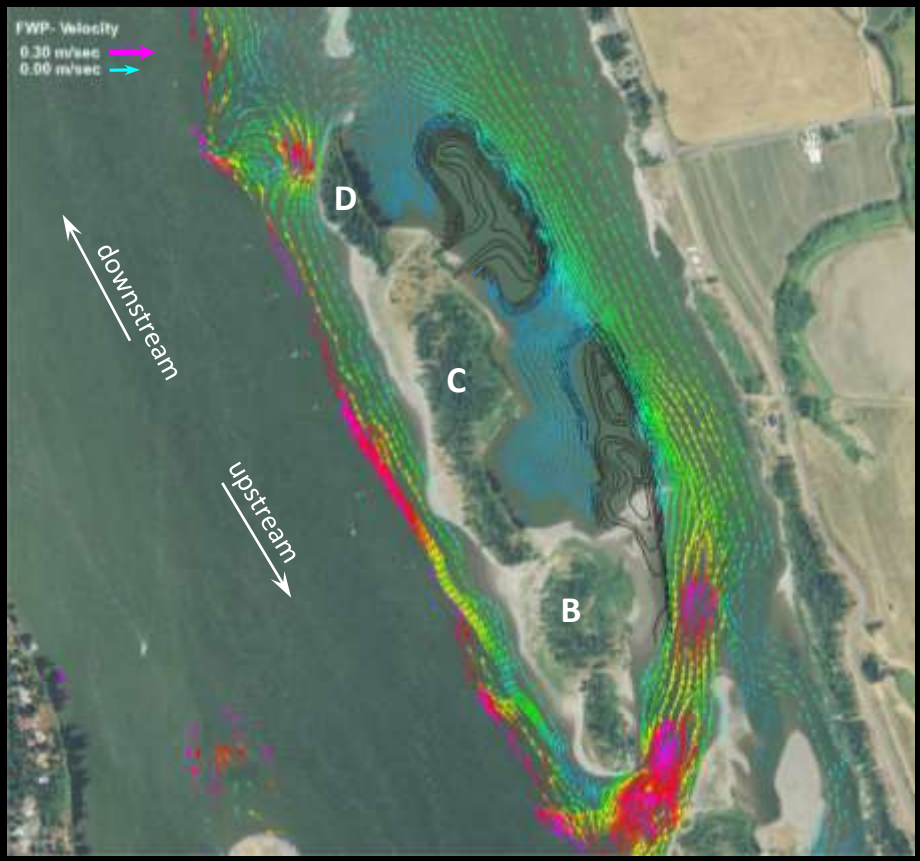


LEFT. Existing Condition Currents – HIGH River Flow Event, with Columbia River flow at RM 85 reaching 610 kcfs (17.3 kcms). Current speed within the mainstem Columbia River > 0.90 m/sec. Both figures are a "snapshot" of river current vectors simulated by AdH model for 1200 on 15 JUN 1997 (model TS=1812 hrs).

PEAK of 1997 Flood Event (610 Kcfs)

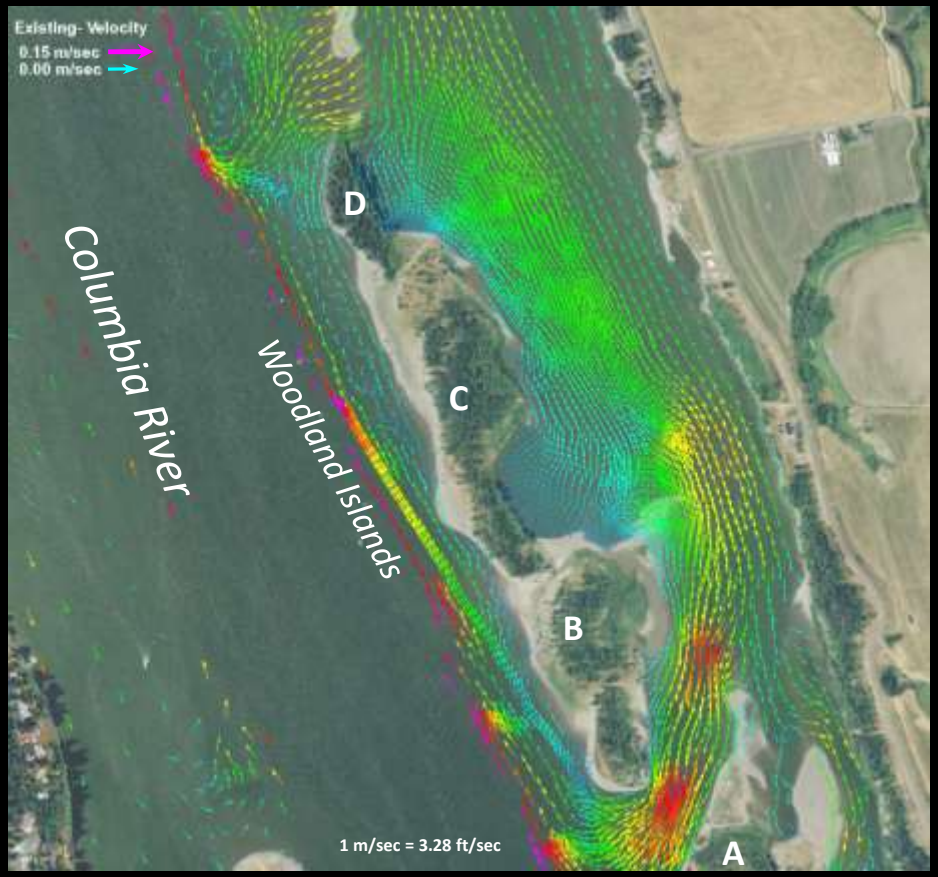


LEFT. Existing Condition Currents – Ebb Tide during LOW riverine flow. Columbia River flow at RM 85 was about 100 Kcfs (2.8 kcms). Current speed within the mainstem Columbia River > 0.30 m/sec. River stage was at 6.7 ft and falling to 6.0 ft NAVD.

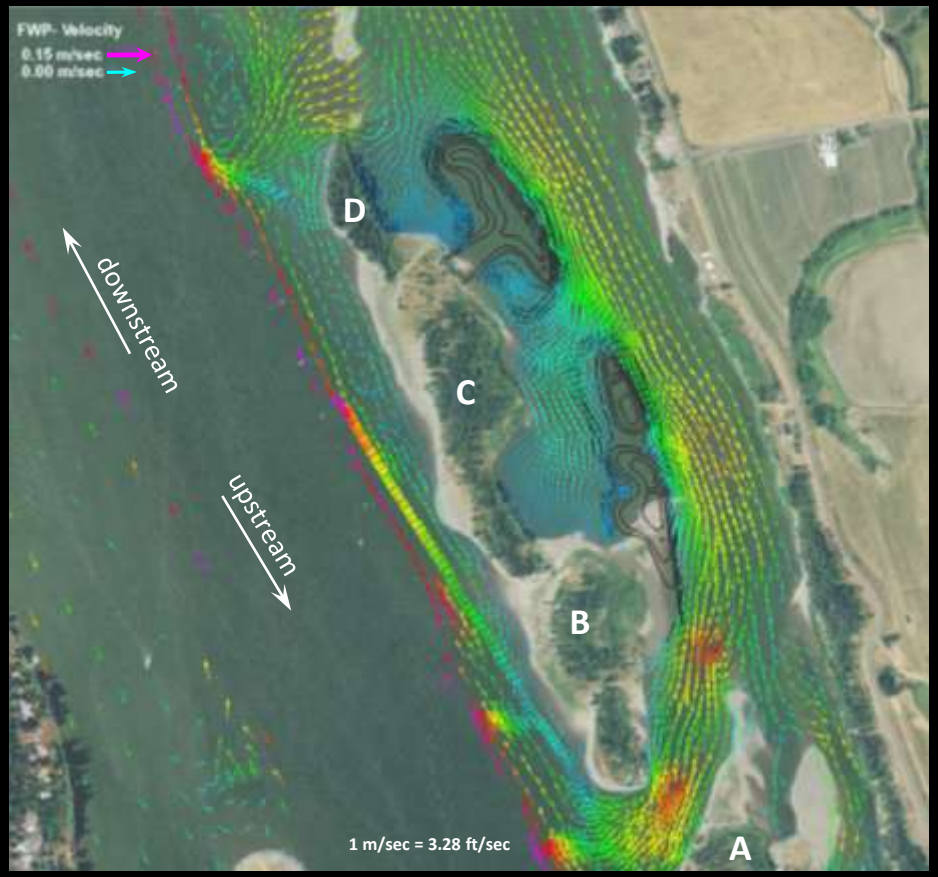


RIGHT. FWP River Currents – Ebb Tide during LOW riverine flow. Both figure H3a and H3b are "snapshots" of river current vectors simulated by AdH model for 1400 on 13 JUL 1997 (model TS=2486 hrs).

EBB TIDE during Summer Low Flow (100 Kcfs)

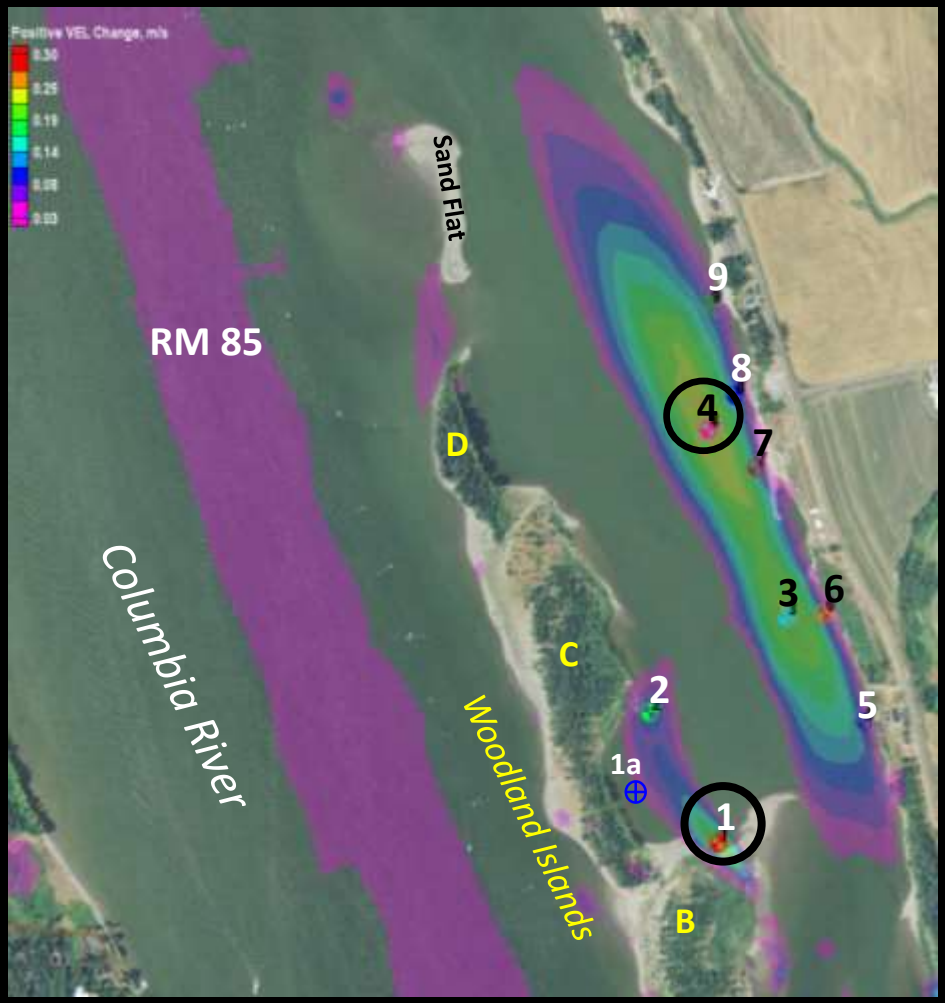


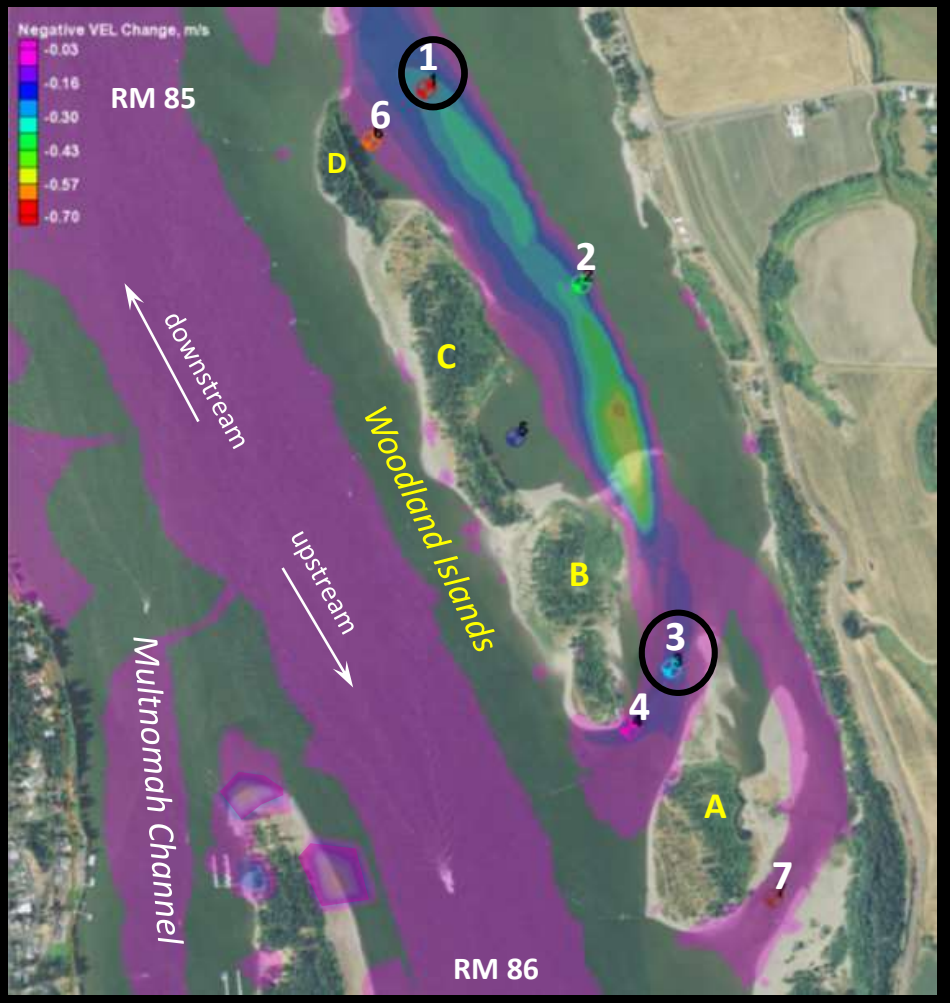
LEFT. Existing Condition Currents – Flood Tide during LOW riverine flow. Columbia River flow at RM 85 was about 100 Kcfs (2.8 kcms). Current speed within the mainstem Columbia River > 0.15 m/sec. River stage was at 8.1 ft and rising to 8.7 ft NAVD.



RIGHT. FWP River Currents – Flood Tide during LOW riverine flow. Both figure H3a and H3b are "snapshots" of river current vectors simulated by AdH model for 2000 on 12 JUL 1997 (model TS=2468 hrs).

FLOOD TIDE during Summer Low Flow (100 Kcfs)

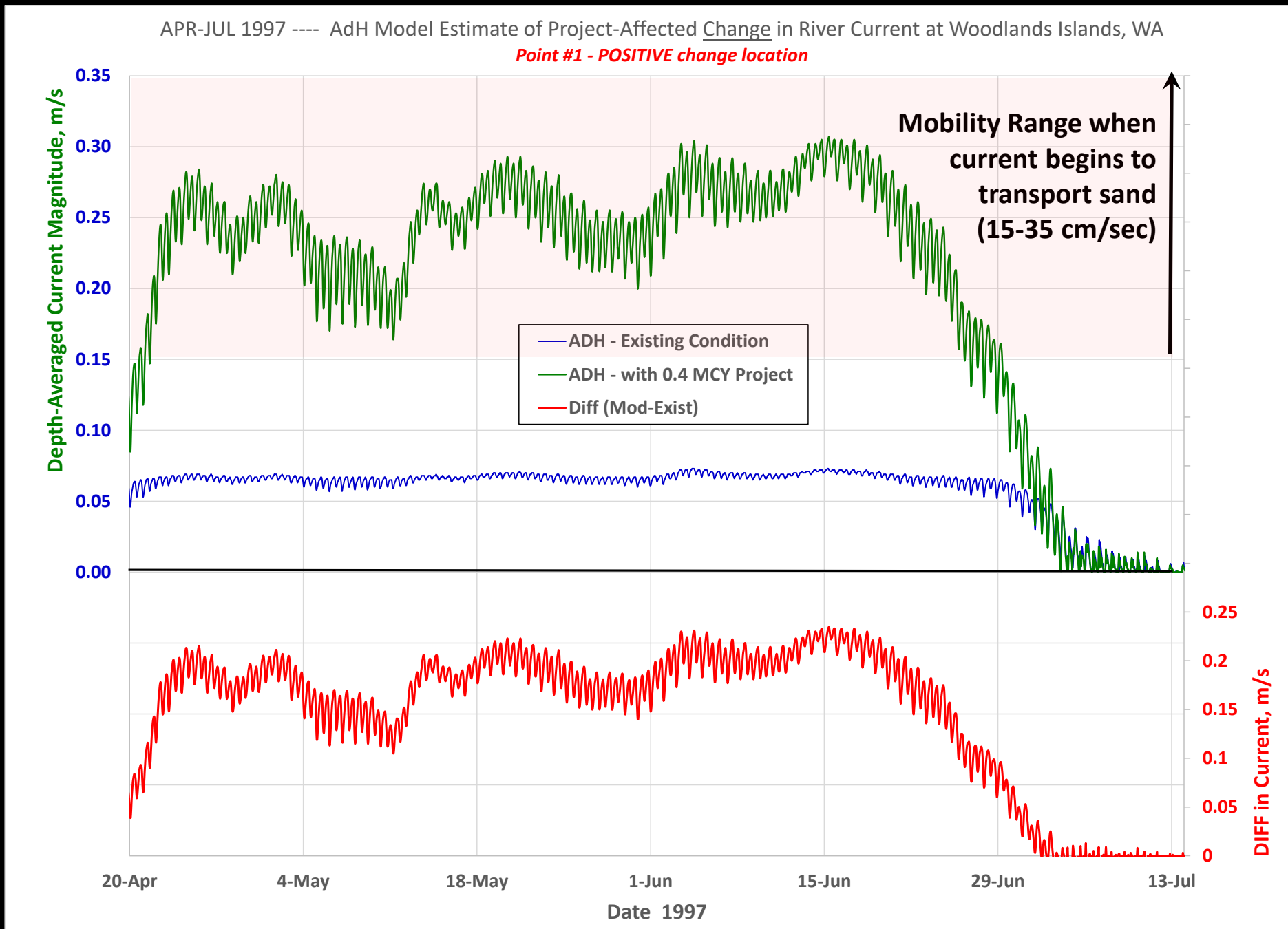


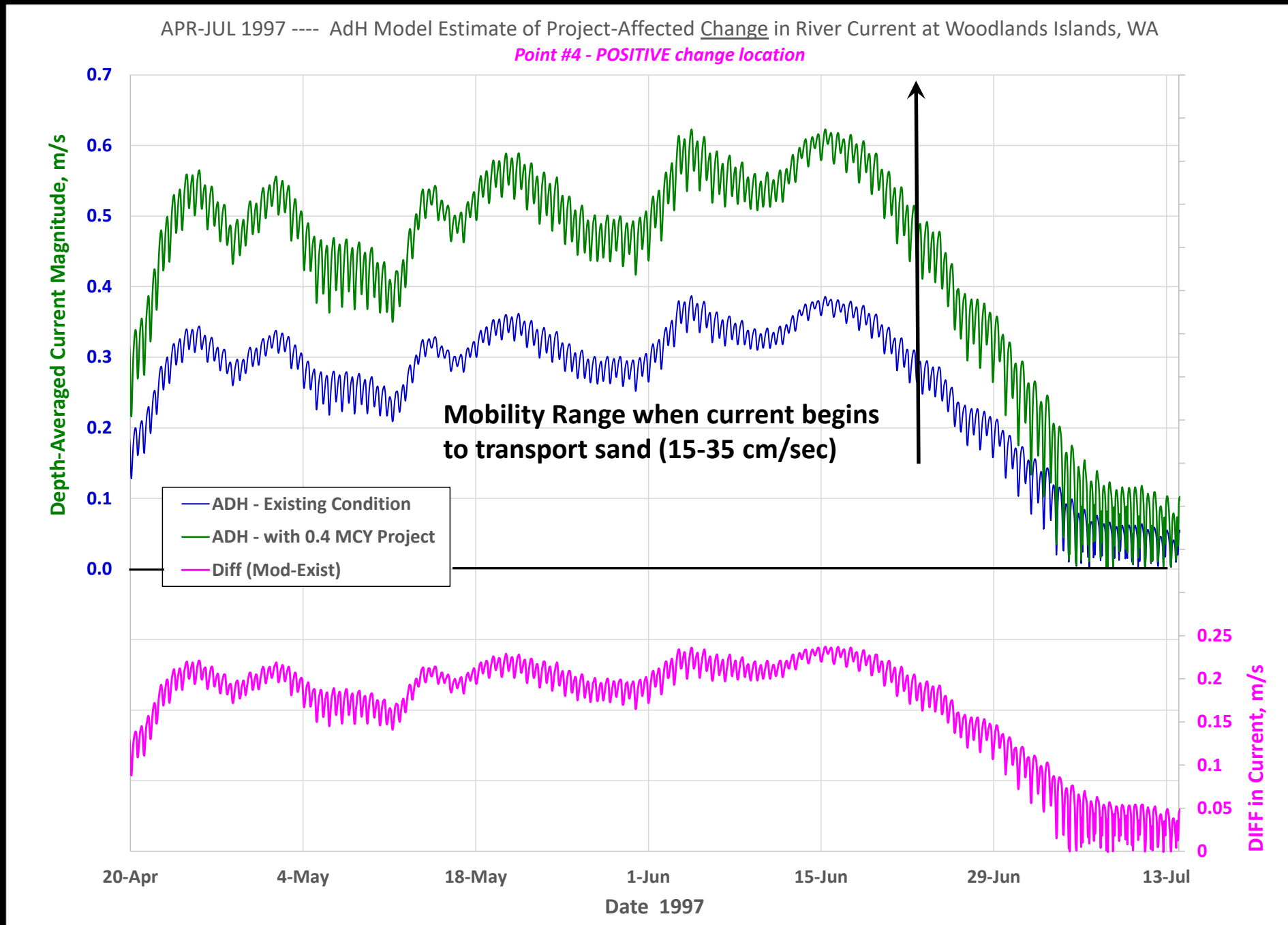


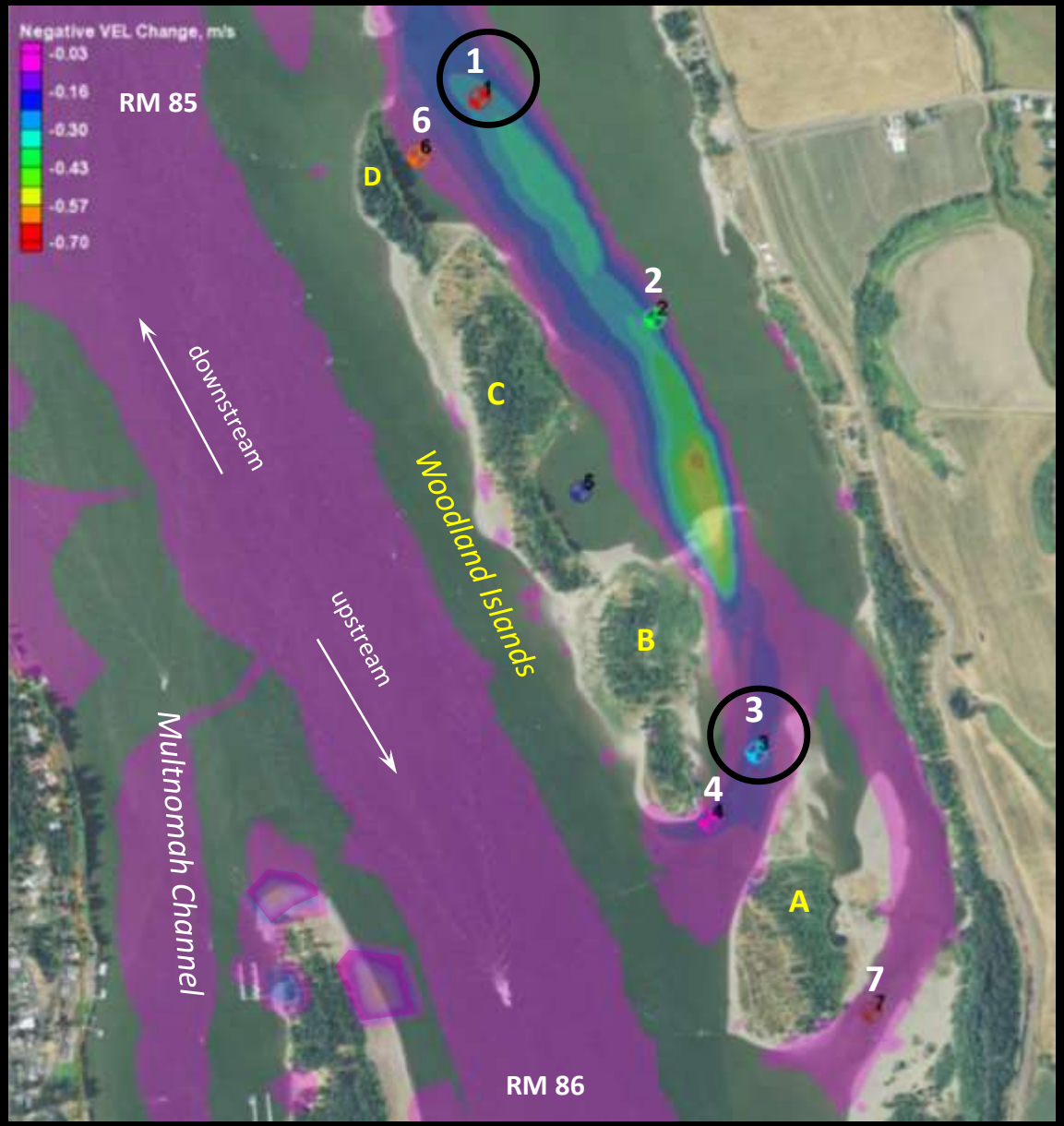
LEFT. Areas affected by an <u>INCREASE</u> in river current magnitude due to project implementation, as compared to existing condition. 1 m/s = 3.28 ft/s. This graphic shows the maximum increase in current between existing condition and FWP.

RIGHT. Areas affected by <u>REDUCTION</u> in river current magnitude due to project implementation, as compared to present condition. This graphic shows the maximum decrease in current between existing condition and FWP.

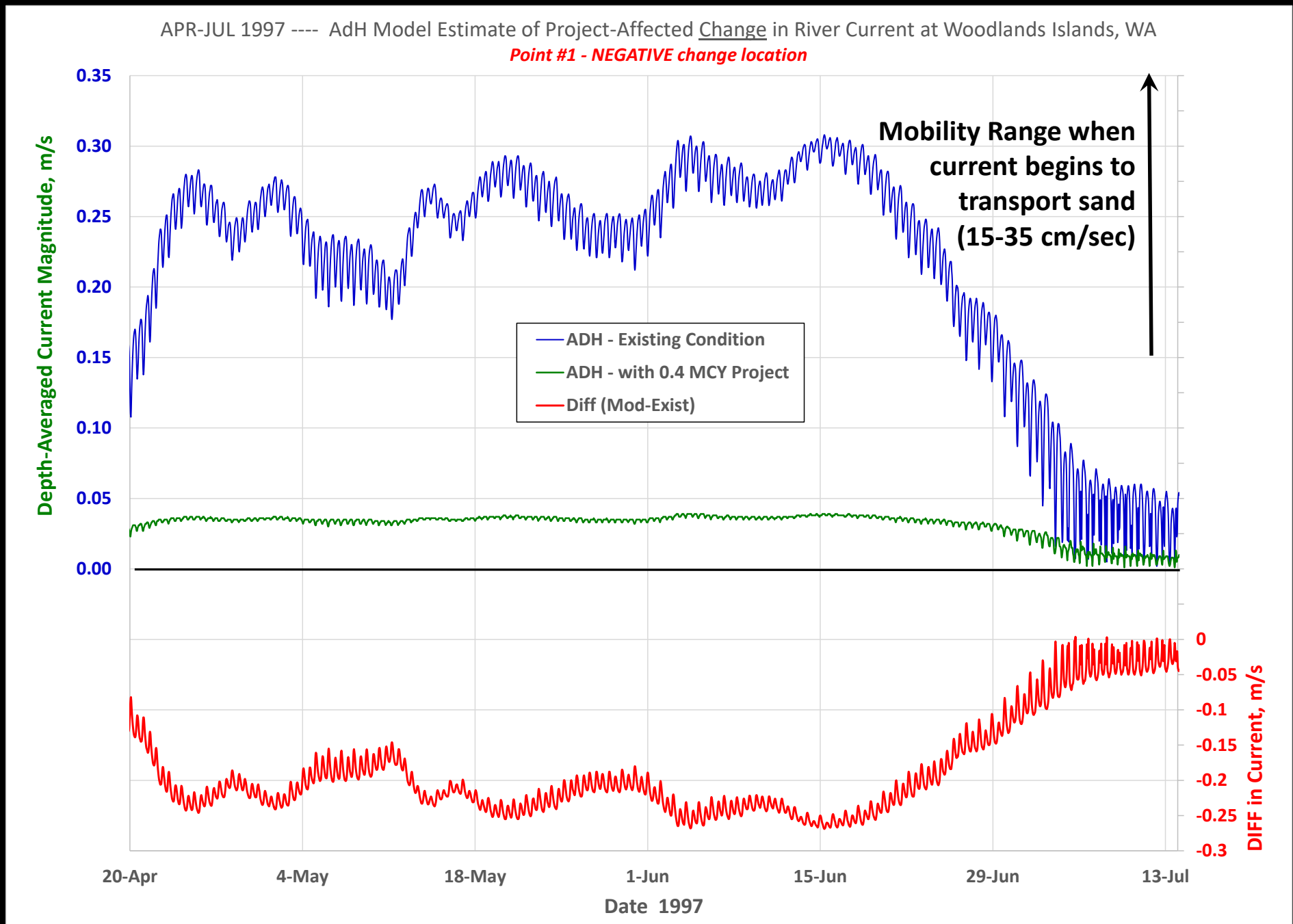
AREAS OF MAXIMUM VELOCTY CHANGE APR-JUL 1997

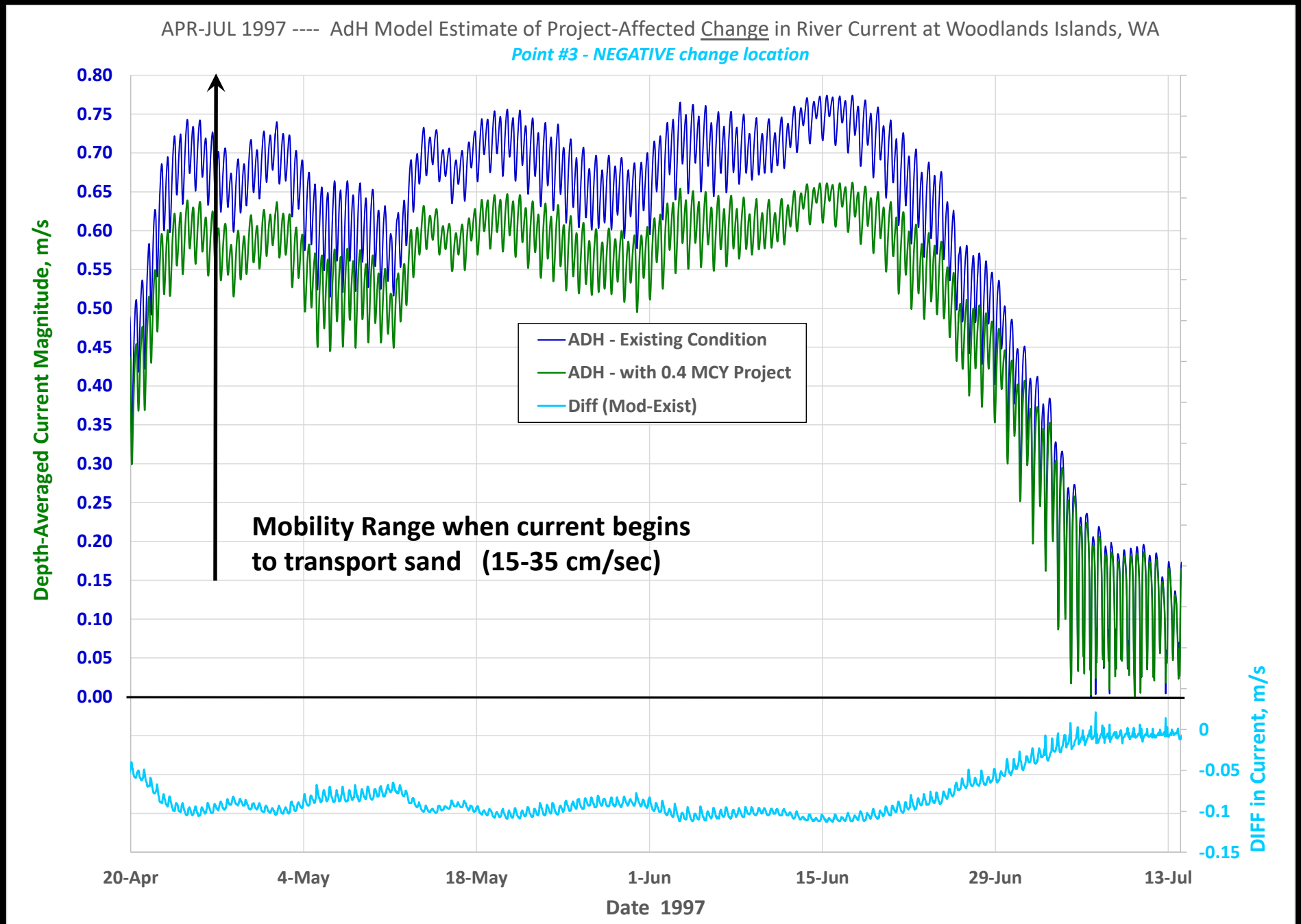

APR-JUL 1997 ---- AdH Model Estimate of Project-Affected Change in River Current at Woodlands Islands, WA
Point #1 - POSITIVE change location
Depth-Averaged Current Magnitude, m/s
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Mobility Range when current begins to transport sand (15-35 cm/sec)
ADH - Existing Condition
ADH - with 0.4 MCY Project
Diff (Mod-Exist)
0.25
0.2
0.15
0.1
0.05
0
DIFF in Current, m/s
20-Apr
4-May
18-May
1-Jun
15-Jun
29-Jun
13-Jul
Date 1997


APR-JUL 1997 ---- AdH Model Estimate of Project-Affected Change in River Current at Woodlands Islands, WA
Point #4 - POSITIVE change location
Depth-Averaged Current Magnitude, m/s
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Mobility Range when current begins to transport sand (15-35 cm/sec)
ADH - Existing Condition
ADH - with 0.4 MCY Project
Diff (Mod-Exist)
0.25
0.2
0.15
0.1
0.05
0
DIFF in Current, m/s
20-Apr
4-May
18-May
1-Jun
15-Jun
29-Jun
13-Jul
Date 1997



Areas affected by <u>REDUCTION</u> in river current magnitude due to project implementation, as compared to present condition. This graphic shows the maximum decrease in current between existing condition and FWP.


APR-JUL 1997 ---- AdH Model Estimate of Project-Affected Change in River Current at Woodlands Islands, WA
Point #1 - NEGATIVE change location
Depth-Averaged Current Magnitude, m/s
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Mobility Range when current begins to transport sand (15-35 cm/sec)
ADH - Existing Condition
ADH - with 0.4 MCY Project
Diff (Mod-Exist)
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
DIFF in Current, m/s
20-Apr
4-May
18-May
1-Jun
15-Jun
29-Jun
13-Jul
Date 1997


APR-JUL 1997 ---- AdH Model Estimate of Project-Affected Change in River Current at Woodlands Islands, WA
Point #3 - NEGATIVE change location
Depth-Averaged Current Magnitude, m/s
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
ADH - Existing Condition
ADH - with 0.4 MCY Project
Diff (Mod-Exist)
Mobility Range when current begins
to transport sand (15-35 cm/sec)
DIFF in Current, m/s
0
-0.05
-0.1
-0.15
20-Apr
4-May
18-May
1-Jun
15-Jun
29-Jun
13-Jul
Date 1997

HABITAT RESTORATION
USING DREDGED MATERIAL PLACEMENT

WITHIN THE LOWER COLUMBIA RIVER
AT WOODLAND ISLANDS, WA

Conclusions

Proposed Action is Based on Previous Experiences - RIDM

Optimized Plan Restores Salmonid and Avian Habitats

Moderate Scale Project Occurs within a Diverse LCR Reach

Project is Resilient to Potential Climate Change Effects

Project Not Expected to Negatively Affect Adjacent Properties

Project Expected to Provide Added Ecological Function

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IMPLEMENTATION

Targeted placement of 400,000 CY of sand dredged from the St. Helens Bar using the hydraulic dredge Oregon.

pumping capacity 30,000-40,000 gallons/day = 20,000-60,000 cy sand/day


temporary berm (will become new shoreline)
discharge of dredged material
return water to river
existing shoreline (from past placement)

Low pressure discharge of dredged material-water mixture at shore interface: Traditional shoreline placement – best for making low relief features (sand bars) with high enough elevation that shore equipment can grade