

Performance Measures and Habitat Units

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One of the Last Old Growth Cypress Floodplains in
the SE Florida




Last Large Freshwater Wetland Corridor in
Project Area



U.S. ARMY



US Army Corps
of Engineers



Vulnerable estuarine habitats

Introduction

- Performance Measures Overview
- Other Environmental Considerations
- Performance Measure 9 Results – Connectivity
- Performance Measure 4 Examples and Key Points – Watershed Plant Communities
- Performance Measure 1 Flows and Key Points – Loxahatchee River Flows and Salinity Zones
- Habitat Units



Objectives and PM Table

| LRWRP Objective (Abbreviated) | PM 1 – Flow and Salinity | PM 4 – Watershed Hydrology | PM 9 - Connectivity |
|--|--------------------------|----------------------------|---------------------|
| 1. Restore wet and dry season flows to Northwest Fork of Loxahatchee River | √ | | |
| 2. Restore and/or maintain estuarine communities (oysters, fish, seagrass) | √ | | |
| 3. Increase natural area extent of wetlands | √ | √ | |
| 4. Restore connections between natural areas | √ | √ | √ |
| 5. Restore native plant and animal species abundance and diversity | √ | √ | √ |



Ecosystem Focus Areas and PMs

| Ecosystem Zones | PM 1 | PM 4 | PM 9 |
|---|------|------|------|
| Watershed Wetlands – Freshwater Flora and Fauna | | √ | √ |
| Cypress Swamp-River Floodplain - Freshwater Flora and Fauna | √ | | √ |
| Tidal River Floodplain - | √ | | |
| Oligohaline with Vallisneria americana and Fish Larvae | √ | | |
| Mesohaline - Oysters | √ | | |
| Polyhaline - Seagrass | √ | | |



Other Environmental Considerations

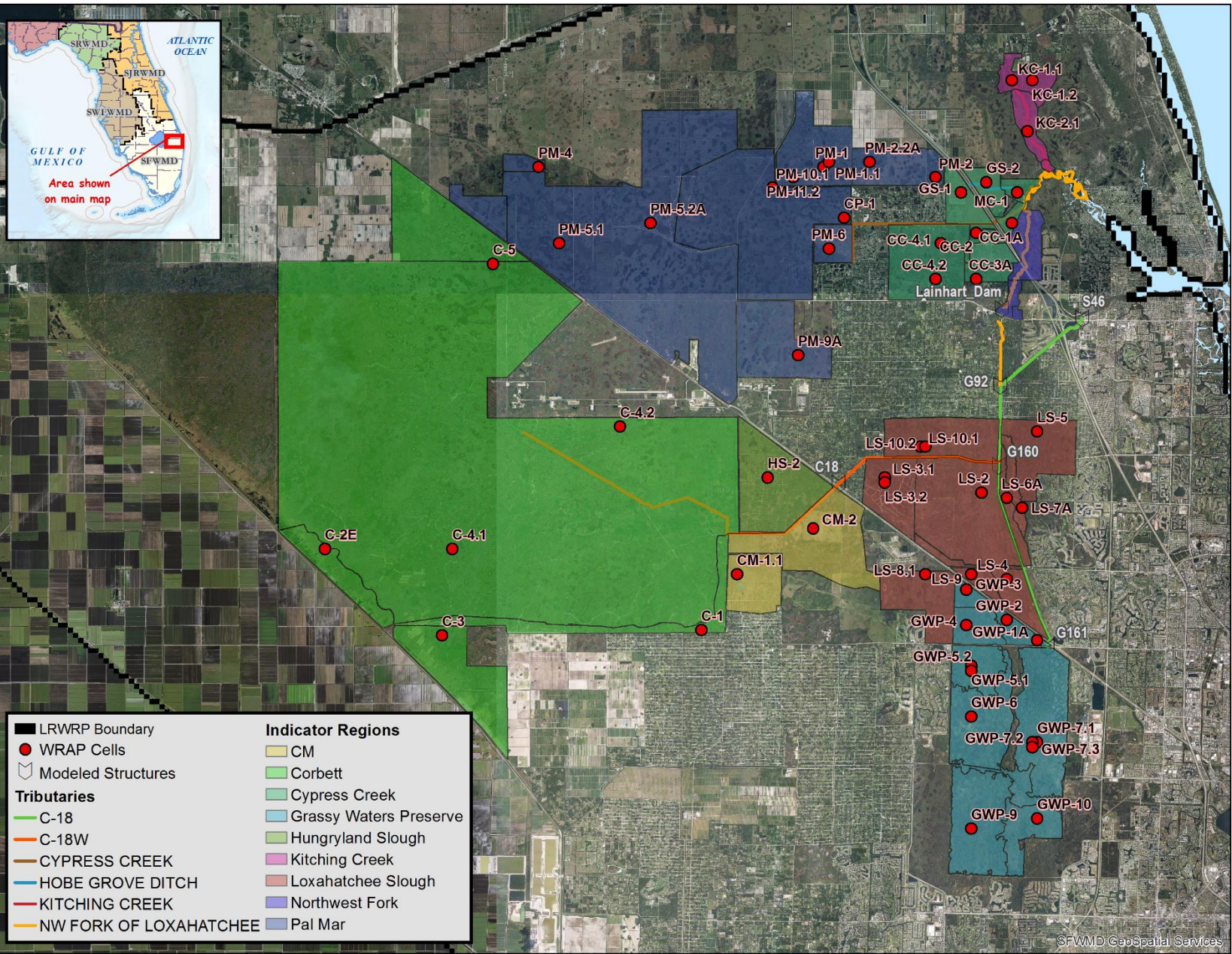
- Water Quality
- Fish and Wildlife
- Essential Fish Habitat
- Endangered Species
- Hazardous, Toxic, Radioactive Waste
- Cultural Resources
- Mitigation Sites
- Socioeconomics
- Water Supply
- Flood Control
- Farm Land



Performance Measure 9

| Alternative | 2 | 5 | 10 | 12 | 13 |
|---------------------------------|-------------|-------------|-------------|-------------|-------------|
| Hydrology – Flow close to River | 12.5 | 12.5 | 8.3 | 16.7 | 16.7 |
| Greenway – Existing Greenways | 16.7 | 16.7 | 12.5 | 25.0 | 25.0 |
| Water Quality – Overland Flow | 20.8 | 20.8 | 12.5 | 12.5 | 20.8 |
| F&W – Forage, Breeding, Nursery | 16.7 | 16.7 | 11.1 | 18.1 | 20.8 |
| PM 9 Score | 66.7 | 66.7 | 44.4 | 72.2 | 83.3 |





PM 4 – Indicator Regions and WRAP Cell locations



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Major Plant Communities and Inundation Duration

| Plant Community Type | Annual Avg. Water Depth (inches) | Inundation Duration* (days/yr) | Target - Median Inundation Duration (days/yr) | Target Inundation Duration 41 Year |
|----------------------------|----------------------------------|--------------------------------|---|------------------------------------|
| Mesic Flatwood | Below ground | ≤30 | 15 | 615 |
| Mesic (Oak) Hammock | Below ground | 0-60 | 30 | 1230 |
| Hydric Flatwood | 0-6 | 30-60 | 45 | 1845 |
| Hydric Hammock | 0-6 | 30-60 | 45 | 1845 |
| Depression Marsh | 12-24 | 180-300 | 240 | 9840 |
| Wet Prairie | 6-16 | 60-180 | 120 | 4920 |
| Strand Swamp | 18-36 | 210-300 | 255 | 10455 |
| Floodplain Swamp | 12-30 | 120-240 | 180 | 7380 |
| Dome Swamp | 12-24 | 210-300 | 255 | 10455 |

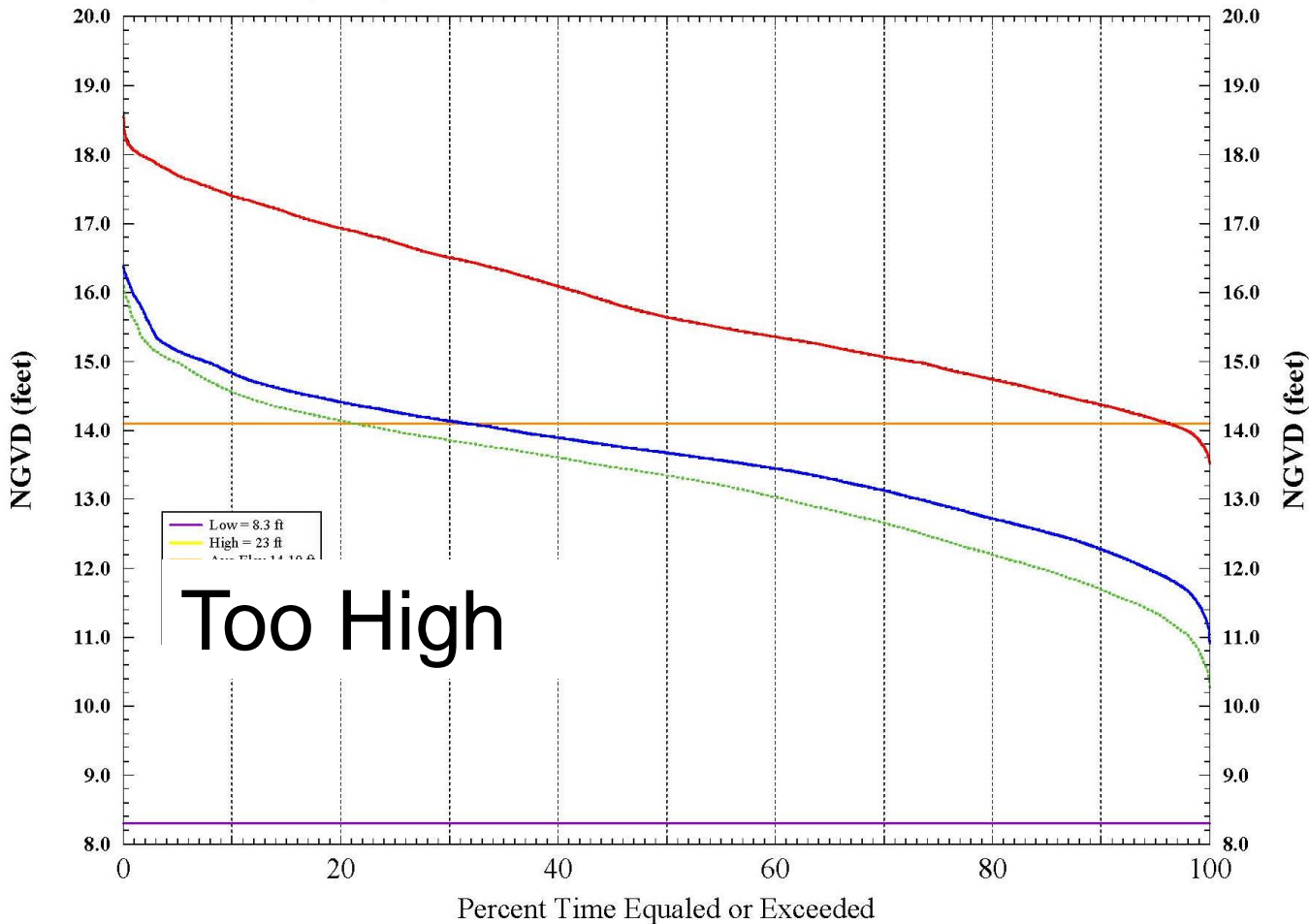
* Frequency coincides with wet weather patterns and existing groundwater conditions

| IR | Acres | Dominant Vegetation | Topo for Inundation | Target Inundation | ECB WRAP Hydro score | ECB Inundation (est.) | 2014B # of Days Inundated | PM 4 Initial Score | Functional Scaling Score | PM4 Score Scaled | ECB Habitat Units | 2070FWO # Days Inundated | ALT2 # of Days Inundated | ALT5 # of Days Inundated | ALT10 # of Days Inundated | ALT12 # of Days Inundated | ALT13 # of Days Inundated |
|--------|-------|---------------------|---------------------|-------------------|----------------------|-----------------------|---------------------------|--------------------|--------------------------|------------------|-------------------|--------------------------|--------------------------|--------------------------|---------------------------|---------------------------|---------------------------|
| C-1 | 1642 | DM | 21.8 | 9840 | 2 | 6560 | 6649 | 0.68 | 0.5 | 0.34 | 554.76 | 6650 | 2871 | 3706 | 1381 | 6904 | 6048 |
| C-2 | 1226 | DM | 18.1 | 9840 | 2 | 6560 | 8461 | 0.86 | 1 | 0.86 | 1054.19 | 8439 | 8384 | 8433 | 8442 | 8476 | 8464 |
| C-3 | 2806 | DS | 18.5 | 10455 | 1 | 3485 | 4581 | 0.44 | 0.25 | 0.11 | 307.37 | 4567 | 4722 | 4544 | 4539 | 4749 | 4711 |
| C-4 | 54871 | DM | 22.4 | 9840 | 2.5 | 8200 | 7200 | 0.73 | 0.75 | 0.55 | 30112.13 | 7197 | 7199 | 7202 | 7193 | 7190 | 7193 |
| C-5 | 3170 | DM | 24.8 | 9840 | 2.5 | 8200 | 7914 | 0.80 | 0.75 | 0.60 | 1912.15 | 7914 | 7913 | 7909 | 7912 | 7911 | 7913 |
| CC-1 | 202 | FS | 4.9 | 7380 | 1 | 2460 | 1245 | 0.17 | 0.1 | 0.02 | 3.41 | 1232 | 2715 | 510 | 1789 | 2726 | 505 |
| CC-2 | 557 | FS | 11 | 7380 | 0.5 | 1230 | 1957 | 0.27 | 0.1 | 0.03 | 14.77 | 1956 | 14669 | 14254 | 10597 | 14669 | 14262 |
| CC-4 | 2542 | DM | 15 | 9840 | 1.5 | 4920 | 3461 | 0.35 | 0.1 | 0.04 | 89.41 | 3462 | 14522 | 14648 | 13029 | 14522 | 14650 |
| GS-1 | 1411 | DM | 14.2 | 9840 | 0.5 | 1640 | 0 | 0.00 | | 0.00 | 0.00 | 0 | 14967 | 14967 | 0 | 14967 | 14967 |
| GWP-10 | 1107 | DS | 18.2 | 10455 | 3 | 10455 | 13362 | 1.28 | 0.75 | 0.96 | 1061.10 | 12800 | 12954 | 13120 | 10170 | 12765 | 13119 |
| GWP-1 | 42 | DS | 18.1 | 10455 | 1.5 | 5227.5 | 6955 | 0.67 | 0.5 | 0.33 | 13.97 | 5966 | 4629 | 4800 | 4072 | 3579 | 5834 |
| GWP-2 | 397 | DS | 17.2 | 10455 | 2 | 6970 | 8145 | 0.78 | 0.75 | 0.58 | 231.96 | 7117 | 7277 | 7528 | 6129 | 6207 | 9057 |
| GWP-3 | 308 | DS | 17.5 | 10455 | 2 | 6970 | 10338 | 0.99 | 1 | 0.99 | 304.55 | 9487 | 9320 | 9621 | 8201 | 8694 | 13685 |
| GWP-4 | 755 | DS | 18 | 10455 | 3 | 10455 | 11056 | 1.06 | 1 | 1.06 | 798.40 | 10253 | 9767 | 10032 | 8419 | 8990 | 11145 |
| GWP-9 | 2518 | DS | 17.5 | 10455 | 3 | 10455 | 14723 | 1.41 | 0.5 | 0.70 | 1772.96 | 14566 | 14602 | 14649 | 13417 | 14560 | 14649 |
| LS-2 | 3849 | DM | 16.8 | 9840 | 2 | 6560 | 189 | 0.02 | 0.1 | 0.00 | 7.39 | 131 | 9288 | 9442 | 8890 | 9430 | 12108 |
| LS-3.1 | 1451 | DM | 18.1 | 9840 | 1.5 | 4920 | 4347 | 0.44 | 0.25 | 0.11 | 160.25 | 4331 | 5746 | 5744 | 4973 | 5590 | 8966 |
| LS-4 | 772 | DM | 16.9 | 9840 | 1.5 | 4920 | 3438 | 0.35 | 0.1 | 0.03 | 26.97 | 3084 | 9098 | 9324 | 8667 | 9398 | 12283 |
| LS-5 | 1782 | DM | 16.1 | 9840 | 1.5 | 4920 | 5963 | 0.61 | 0.5 | 0.30 | 539.94 | 5536 | 6490 | 6494 | 6096 | 6560 | 6357 |
| LS-6 | 405 | DM | 15.5 | 9840 | 2 | 6560 | 10123 | 1.03 | 1 | 1.03 | 416.65 | 10095 | 12304 | 12348 | 13035 | 13755 | 12561 |
| LS-7 | 426 | SS | 15.5 | 10455 | 2 | 6970 | 8885 | 0.85 | 1 | 0.85 | 362.03 | 8846 | 11315 | 11341 | 11925 | 12647 | 11553 |
| MC-1 | 266 | FS | 1.4 | 7380 | 0.5 | 1230 | 1408 | 0.19 | 0.1 | 0.02 | 5.07 | 1407 | 14975 | 14975 | 14975 | 14975 | 14975 |
| PM-1 | 2177 | DM | 18.5 | 9840 | 1.5 | 4920 | 4617 | 0.47 | 0.25 | 0.12 | 255.37 | 4618 | 13225 | 13222 | 4724 | 13223 | 13221 |
| PM-2 | 1452 | DM | 14.1 | 9840 | 1 | 3280 | 3162 | 0.32 | 0.1 | 0.03 | 46.66 | 3162 | 14416 | 14384 | 4671 | 14416 | 14384 |
| PM-4 | 284 | DM | 24.8 | 9840 | 2.5 | 8200 | 7798 | 0.79 | 0.75 | 0.59 | 168.80 | 7801 | 7801 | 7799 | 7798 | 7799 | 7799 |
| PM-5 | 19672 | DM | 25.1 | 9840 | 2.5 | 8200 | 8438 | 0.86 | 1 | 0.86 | 16869.14 | 8438 | 8439 | 8439 | 8438 | 8440 | 8438 |
| PM-10 | 7181 | DM | 18.6 | 9840 | 2.5 | 8200 | 8712 | 0.89 | 1 | 0.89 | 6357.81 | 8712 | 14975 | 14975 | 8694 | 14975 | 14975 |
| KC-1 | 658 | FS | 12.5 | 7380 | 1.5 | 3690 | 3773 | 0.51 | 0.25 | 0.13 | 84.10 | 3646 | 5701 | 5700 | 5701 | 5700 | 5700 |
| KC-2 | 585 | FS | 6.5 | 7380 | 2 | 4920 | 5972 | 0.81 | 0.75 | 0.61 | 355.04 | 5950 | 6437 | 6435 | 6424 | 6435 | 6436 |
| CM-1 | 1381 | DM | 21.5 | 9840 | 0 | 0 | 1 | 0.00 | 0.1 | 0.00 | 0.01 | 1 | 14780 | 14975 | 12852 | 14584 | 14002 |
| HS-2 | 2867 | DM | 22.5 | 9840 | 1 | 3280 | 2904 | 0.30 | 0.1 | 0.03 | 84.61 | 2905 | 2558 | 2613 | 2591 | 2291 | 2137 |
| CM-2 | 3191 | DM | 20.7 | 9840 | 0.5 | 1640 | 3133 | 0.32 | 0.1 | 0.03 | 101.60 | 3133 | 3407 | 3461 | 2965 | 4842 | 14479 |
| LS-8 | 1670 | DM | 18.5 | 9840 | 2 | 6560 | 6452 | 0.66 | 0.5 | 0.33 | 547.50 | 6287 | 6741 | 6808 | 6328 | 6841 | 14844 |

PM 4 Performance Questions

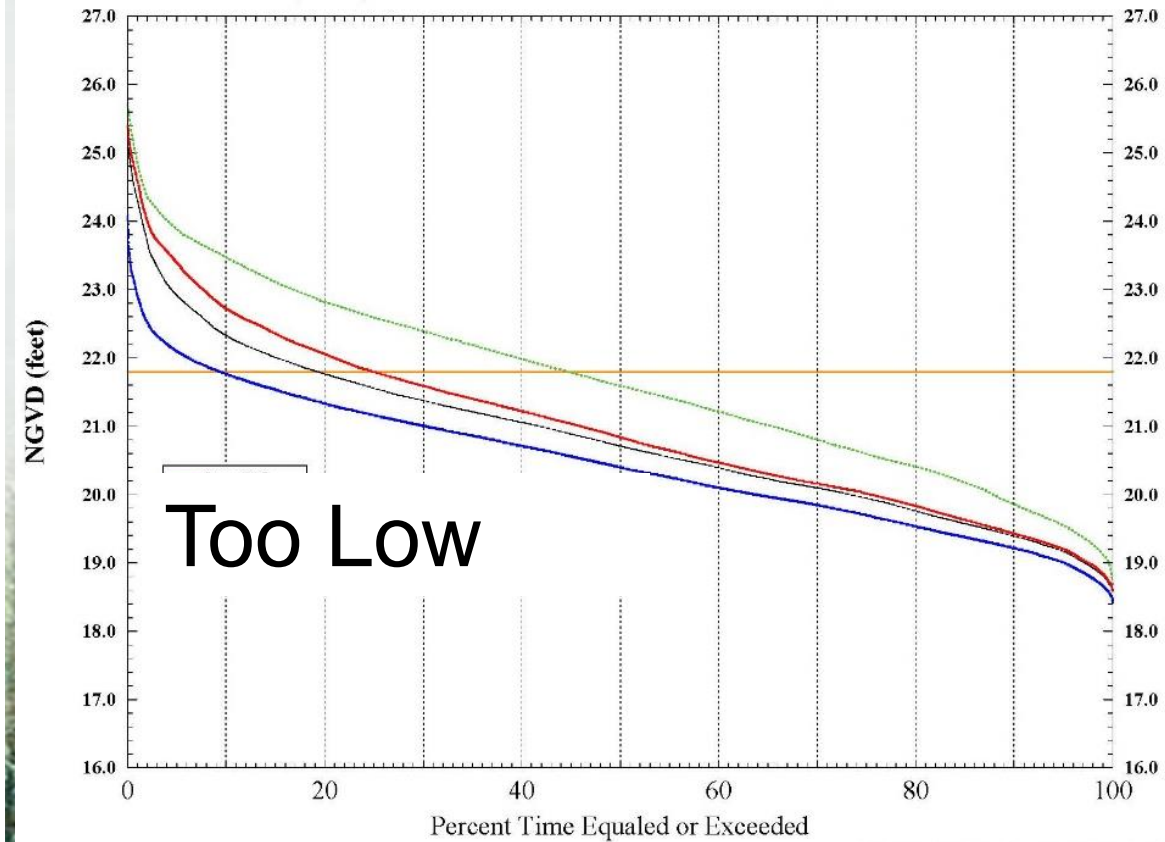
PM-2

Daily Stage Duration Curves for Period of Record 1965 – 2005



C-1

Daily Stage Duration Curves for Period of Record 1965 – 2005



PM 4 Habitat Units (EXAMPLE TO BE UPDATED)

| | ecb | fwo | 2 | 5 | 10 | 12 | 13 |
|-------|------------|------------|----------|----------|-----------|-----------|-----------|
| FW1 | 11263 | 11387 | 16020 | 16292 | 13570 | 14807 | 16655 |
| FW2 | 34842 | 34809 | 38762 | 38857 | 38645 | 40163 | 41593 |
| FW3 | 24473 | 24726 | 24457 | 24408 | 27000 | 24458 | 24451 |
| total | 70578 | 70923 | 79239 | 79557 | 79216 | 79428 | 82699 |

PM 1 - Lainhart Flow Targets

Percentage of Time rolling 30 day Average dry season Flow Exceeds 68 cfs During Dry Season and Percentage of time wet season flows exceed 110 cfs for >120 days

| Alternative | Dry Season (December 1 – May 31) | Wet Season (June 1 to November 30) |
|-------------|--|--|
| 2014 ECB | 46% (65, 66, 67-68, 69, 71, 72, 73, 74, 75-78, 79, 80-82, 84, 85, 86-87, 88-90, 91-92, 95-96, 97, 99, 00, 01, 02, 03-05) | 49% (65, 70-73, 75-77, 79-81, 84-85, 87-90, 00, 02-04) |
| 2070 FWO | 45% (65, 66, 67-68, 69, 71, 72, 73-78, 79, 80-82, 84, 85, 86-87, 88-90, 91-92, 94, 95-97,, 99, 00, 01, 02, 03-05) | 49%(65, 70-73, 75-77, 79-81, 84-85, 87-90, 00, 02-04) |
| Alt.2 | 83% (65, 67, 68, 71, 73-75, 76-77, 78-79, 81-82, 85, 89, 90, 99, 01, 03, 04, 05) | 93% (00, 02, 04) |
| Alt5 | 92% (65, 68, 71, 73, 76-78, 81, 90-91, 01, 03, 05) | 93% (00, 02, 04) |
| Alt 10 | 67% (65, 67, 68, 71, 72, 73-74, 75-77, 78, 79, 80, 81, 85, 86-87, 88, 89, 90, 92, 96, 99, 00, 01, 02, 03-05) | 63% (65, 71, 77, 79-81, 87-90, 00, 02-04) |
| Alt 12 | 94% (67, 68, 71, 73, 75-77, 81, 89, 01, 03-04) | 93% (77, 00, 02) |
| Alt 13 | 78% (65, 67-68, 71, 74-75, 76-77, 78-79, 81-82, 85, 89-90, 96, 99-00, 01, 03, 04, 05) | 85% (77, 81, 87, 00, 02, 04) |

()Years when flow target was not met
 Green: less than 10 cfs below target
 Purple: 10 to 20 cfs below target
 Red: more than 20 cfs below target



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PM 1 – Flows = Inundation and Salinity for Valued Ecosystem Components

- Floodplain swamp and hydric hammock in the freshwater riverine floodplain – 0 practical salinity units (psu), 4 to 8 months inundation per year during the months of June - November (RM 16 to RM 9.5)
- Floodplain swamp in the tidal floodplain – < 2 psu (RM 9.5 to RM 8.1)
- *Vallisneria americana* – < 5 psu (RM 10.5 to RM 6.5)
- Fish larvae in the oligohaline zone – preferred salinity range of 2 to 8 psu (RM 10 to RM 5.5)
- Oysters in the mesohaline zone – preferred salinity range of 10 to 20 psu (RM 6.0 to RM 3.5)
- Seagrasses in the polyhaline zone – preferred salinity range of > 20 psu (RM 4.0 to RM 0.0)

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Water Quality

