

National Park Service DEWA

Watergate Wetlands Restoration Project:

Restoration for Today and the Future

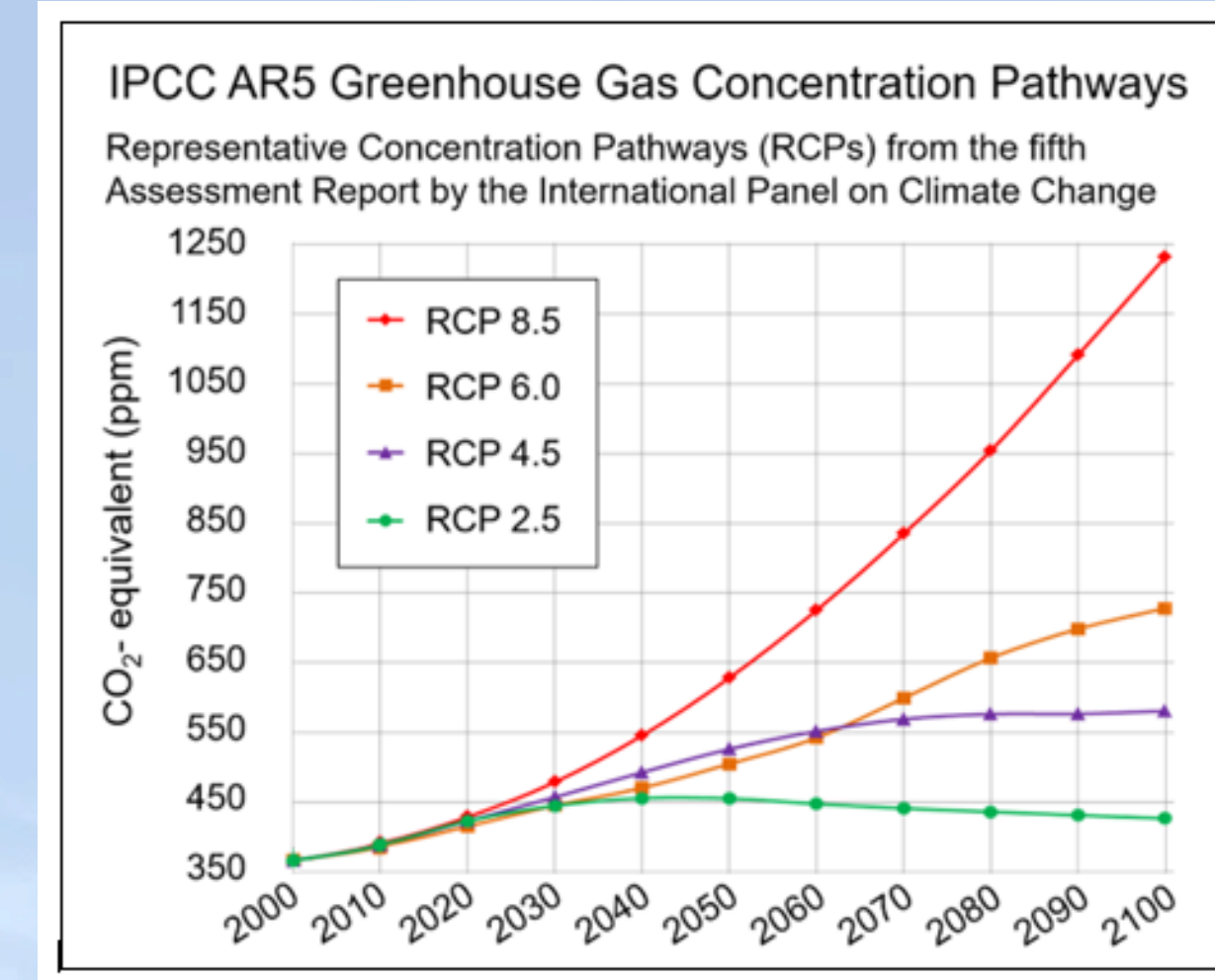
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The National Park Service (NPS) proposed to restore wetlands and the natural function of Van Campens Brook at the 114-acre Watergate Recreation Site to generate the required 33-credit acres of internal mitigation at the Delaware Water Gap National Recreation Area and offset environmental impacts associated with the construction of a transmission line in the area. This was achieved through restoring 20 acres of wetland habitat, 7.6 acres of upland habitat and enhanced over 55 acres of wetland and upland forest habitat. The restoration included removal of artificial dams and human-made ponds, re-establishing palustrine wetland habitat, reconstructing and enhancing sections of the Van Campens Brook, relocating 1.6 miles of an energy distribution line and restoring the connection between Van Campens Brook and its natural floodplain.

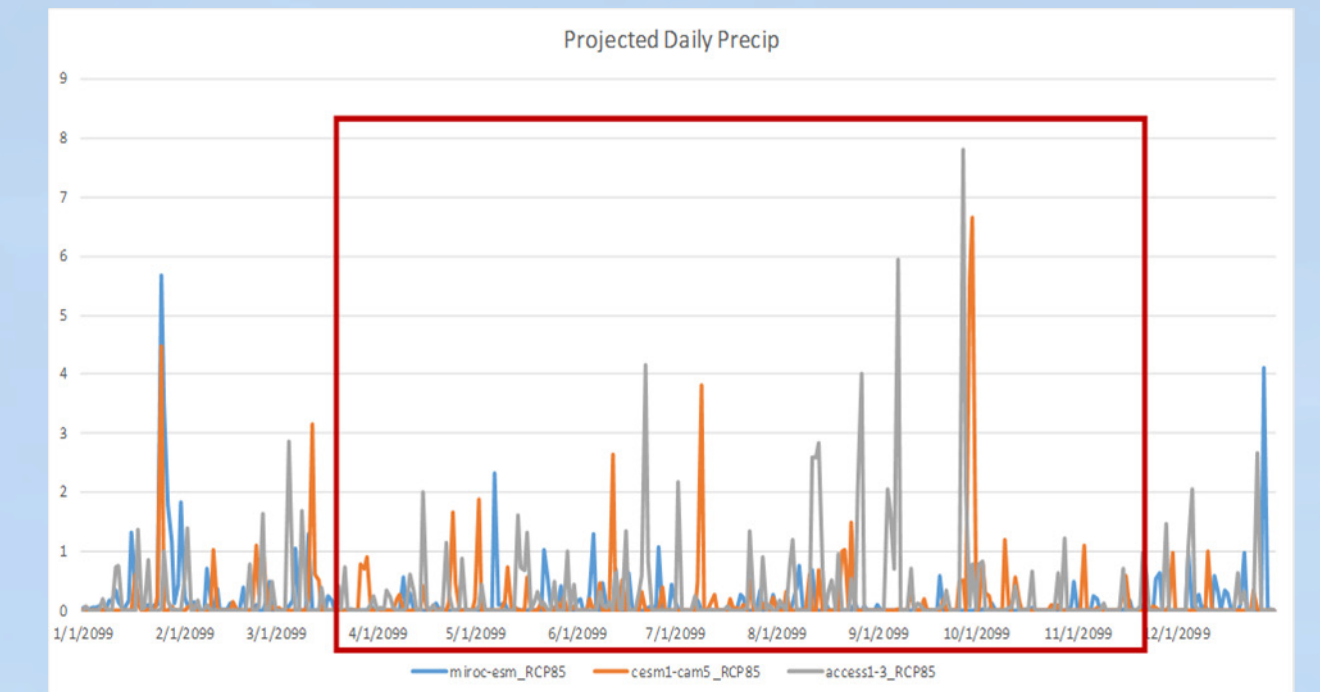
WSP performed multiple pre-design studies to understand the ecological, biological and physical processes of the project area and regional landscape. WSP and NPS engaged in a collaborative design process that integrated the results of the pre-design studies along with the project goals and feedback received from NPS expert advisors.

The resulting design maximized the ecological and functional uplift of the project area and avoided adverse impacts on known rare and threatened species in the project. Additionally, WSP developed a resilient based design, evaluating for and refining design considerations for habitat elevations and planting plans to accommodate future climate stressors, including increases in precipitation and temperature extremes.

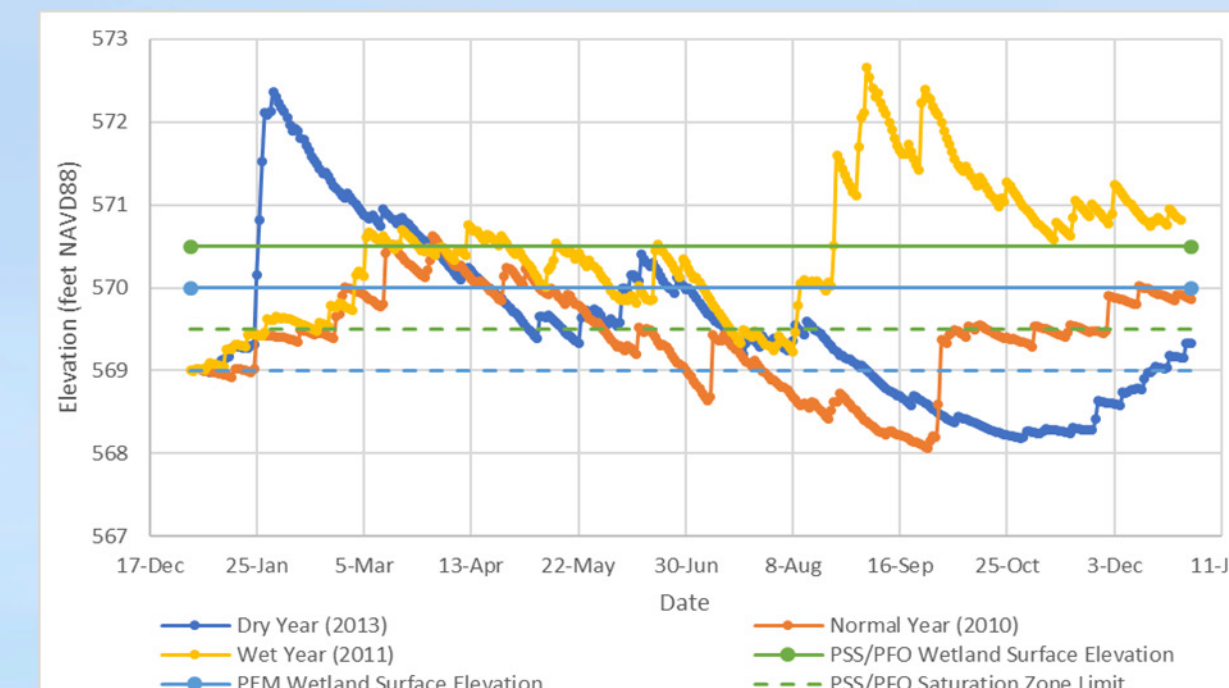
WSP utilized over 20 climate models to develop a regionalized temporal model, daily precipitation, evapotranspiration and storm frequency rainfall depths were projected to 2100. The impact of these projected future climate conditions were used to evaluate the adaptability of the design. Adjustments were then incorporated into the restoration design to allow for the natural lateral migration of wetland habitats predicted within Van Campens Brook floodplain.



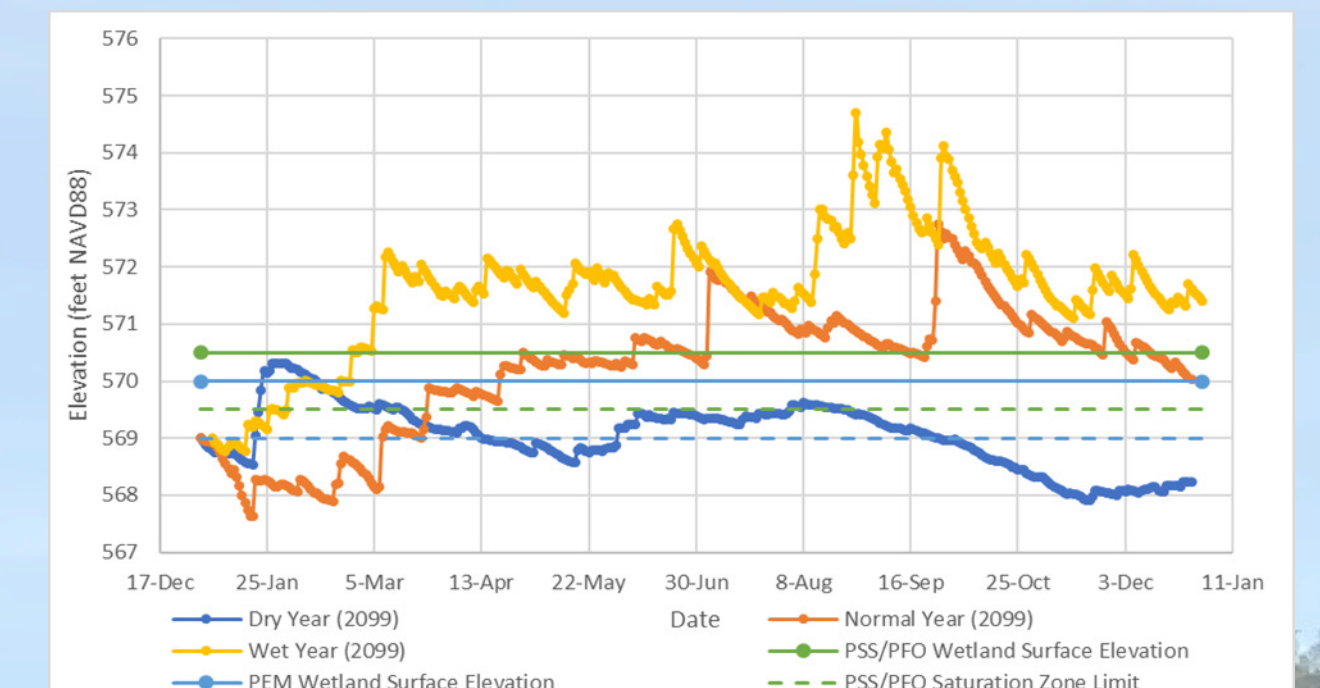
Pathways 4.5 and 8.5 utilized in evaluation



Projected 2100 normal wet and dry precipitation years



Modeled groundwater elevations for present day conditions



Modeled groundwater elevations for projected 2100 conditions

TABLE 24. SATURATION AND FLOODING LEVEL BY HABITAT TYPE DURING THE GROWING SEASON (APRIL 22 TO OCTOBER 18) FOR THE SIMULATED NORMAL YEAR (2010)

Well	Habitat Type	Design Elevation	Percent of Growing Season Saturated	Percent of Growing Season Flooded	USACE Criteria - 12.5% Saturation During Growing Season Met	USACE Criteria - 7 Days of Consecutive Saturation During Growing Season Met
1	PEM	576.50	24.02%	0.00%	Yes	Yes
1	PSS/PFO	577.00	14.53%	0.00%	Yes	Yes
3	PEM	555.00	49.72%	0.56%	Yes	Yes
3	PSS/PFO	555.50	24.02%	0.00%	Yes	Yes
4	PEM	567.50	38.55%	1.68%	Yes	Yes
4	PSS/PFO	568.00	15.08%	0.00%	Yes	Yes
6	PEM	570.00	59.22%	7.26%	Yes	Yes
6	PSS/PFO	570.50	26.26%	0.00%	Yes	Yes
7	PEM	573.00	65.36%	5.59%	Yes	Yes
7	PSS/PFO	573.50	26.26%	0.00%	Yes	Yes
11	PEM	582.00	100.00%	5.59%	Yes	Yes
11	PSS/PFO	582.50	65.92%	1.68%	Yes	Yes
13	PEM	596.50	24.02%	5.59%	Yes	Yes
13	PSS/PFO	597.00	14.53%	0.56%	Yes	Yes
14	PEM	594.25	22.35%	10.06%	Yes	Yes
14	PSS/PFO	594.75	16.20%	8.38%	Yes	Yes
18	PEM	603.50	34.08%	8.94%	Yes	Yes
18	PSS/PFO	604.00	21.79%	2.79%	Yes	Yes
19	PEM	611.50	20.11%	6.70%	Yes	Yes
19	PSS/PFO	612.00	16.20%	0.00%	Yes	Yes

NOTES: PEM = PALUSTRINE EMERGENT WETLAND; PSS = PALUSTRINE SCIRP-SHURK; PFO = PALUSTRINE FORESTED WETLAND
ALL ELEVATIONS PROVIDED IN FEET NAVD83

Proposed wetland design grades for present day saturation and flood conditions

TABLE 24. SATURATION AND FLOODING LEVEL BY HABITAT TYPE DURING THE GROWING SEASON (APRIL 22 TO OCTOBER 18) FOR THE SIMULATED FUTURE CONDITION NORMAL YEAR (2099)

Well	Habitat Type	Design Elevation	Percent of Growing Season Saturated	Percent of Growing Season Flooded
1	PEM	576.50	100.00%	88.59%
1	PSS/PFO	577.00	98.38%	1.12%
3	PEM	555.00	97.21%	1.68%
3	PSS/PFO	555.50	59.78%	0.56%
4	PEM	567.50	100.00%	8.94%
4	PSS/PFO	568.00	55.87%	1.12%
6	PEM	570.00	100.00%	99.94%
6	PSS/PFO	570.50	100.00%	64.80%
7	PEM	573.00	100.00%	95.53%
7	PSS/PFO	573.50	100.00%	55.87%
11	PEM	582.00	99.64%	20.67%
11	PSS/PFO	582.50	99.64%	3.35%
13	PEM	596.50	97.77%	27.27%
13	PSS/PFO	597.00	64.80%	6.15%
14	PEM	594.25	100.00%	83.80%
14	PSS/PFO	594.75	100.00%	43.58%
18	PEM	603.50	100.00%	37.99%
18	PSS/PFO	604.00	92.18%	11.73%
19	PEM	611.50	94.97%	70.39%
19	PSS/PFO	612.00	72.07%	56.98%

NOTES: PEM = PALUSTRINE EMERGENT WETLAND; PSS = PALUSTRINE SCIRP-SHURK; PFO = PALUSTRINE FORESTED WETLAND
ALL ELEVATIONS PROVIDED IN FEET NAVD83

Proposed wetland design grades for future degree of saturation and flood conditions



Van Campens Brook Post Restoration
Profile restoration and floodplain connection



Van Campens Brook and Pond 10 (with dam)
Pre-removal and floodplain



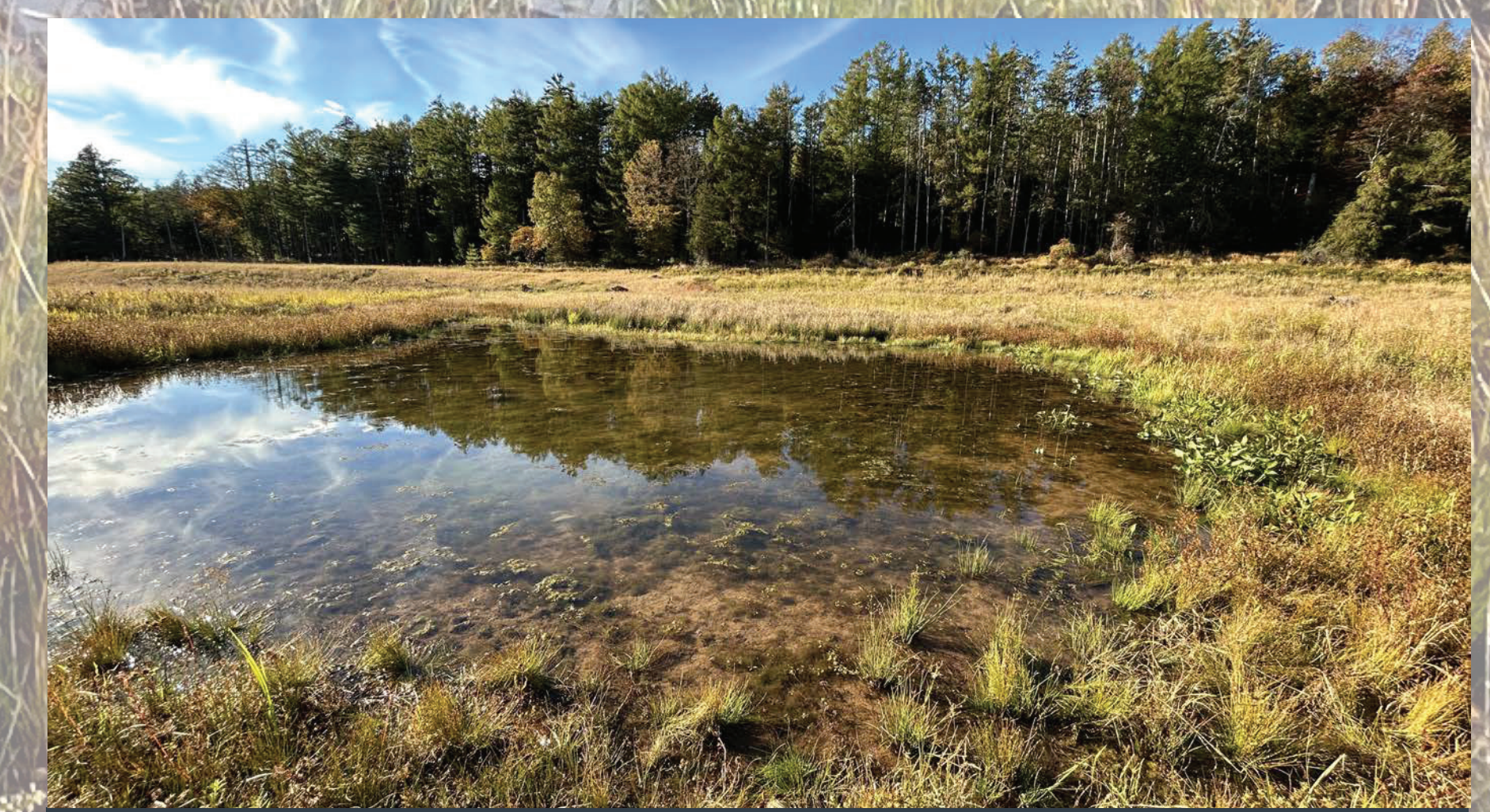
Restored floodplain at Garris Barn



Pond 2 post restoration
Restored emergent wetland with wildlife structures



Pond 10 post restoration
Wetland and stream overlook



Pond 10 post removal
Vernal pool habitat