Wetlands by Design: Wetland Restoration Feasibility

Data description and guidance for use

December 2020

Wetlands by Design is the first watershed-based analysis to guide wetland conservation efforts throughout Wisconsin. It involves extensive Geographic Information System (GIS) analysis of land and water features to identify both wetlands and potentially restorable wetlands that are most likely to provide ecosystem services.

Potentially Restorable Wetland (PRW) is the name given to areas that are likely to have had wetland features but are no longer mapped as wetland and, as a result, have the potential to be restored. In the 2017 release of *Wetlands by Design*, and the *Wetlands and Watershed Explorer*, PRW attributes included size and the extent of ecosystem services the PRW might provide based on its soil type, landscape position, and land use context. Otherwise, all PRWs were considered equal.

Wetlands by Design 2021 enhances the PRW layer by adding attributes that relate to how feasible a PRW's restoration to wetland may be. Within the *Explorer* this expanded PRW layer is available as "Feasibility" along with the original "Ecosystem Services."

The Feasibility attributes, like the Services attributes, are derived from existing geospatial data. Consequently, they are subject to similar limitations such as spatial accuracy and changing conditions on the ground. As with any tool based on remotely sensed data, the PRW Feasibility layer is a coarse screen that informs but does not eliminate the need for additional site-specific considerations.

Finding restoration sites or comparing multiple sites is time consuming and costly. Assessing restoration feasibility typically begins with a desktop review of the area in relation to existing plans and datasets. This identifies some of the red flags or advantages that help to distinguish which PRWs have fewer obstacles to restoration and merit further assessment. A second step is to examine the actual soil conditions, water sources, and boundary limitations on-site, and to determine landowner willingness.

The *Explorer's* enhanced PRW layer with feasibility factors identifies the potential obstacles to restoration typically found in a GIS or desktop analysis. Using the *Explorer* to find obstacles or red flags reduces the need for routine GIS analyses, cuts pre-planning time, and leaves more resources for the restoration effort.

The *Explorer's* Feasibility tool is intended for land use planners, restorationists, and private landowners without additional GIS capability. For more in-depth analyses, the underlying data are available for download.

Wetlands by Design 2021 encourages the same functional approach to wetland protection and restoration, and the watershed focus of the initial Wetlands by Design, especially for wetland compensatory mitigation or voluntary wetland restoration where objectives include meeting watershed scale goals. Where watersheds are the focus, we recommend using the *Explorer's* watershed and functional aspects first, followed by feasibility.

The service and feasibility aspects are fundamentally different in two ways that affect using the data and interpreting the results:

- The service attributes are based on soil, water, and landscape conditions, or hydrogeomorphic features. The feasibility attributes are based on human land use, and social and political influences. Consequently, many of the feasibility factors are easier to apply and results require less interpretation, e.g. either a PRW is within an urban area, or near an airport, or owned by a single landowner, or it isn't.

- The magnitude of the service attributes is relative to those of other wetlands and PRWs within the same watershed. Feasibility, however, is considered statewide. Restoration obstacles due to the presence of an airport or the number of landowners are independent of the watershed where a PRW occurs. Consequently, in some watersheds, especially those in more developed areas, most PRWs will have restoration obstacles. This doesn't argue against restoration here. Rather, where watershed specific restoration is the goal, the Feasibility tool identifies these obstacles and which ones, with more site-specific information, may be manageable.

In fact, no single feasibility factor here precludes wetland restoration. Any PRW can be restored, given enough resources and landowner cooperation. Some feasibility factors are red flags that site-specific information may influence greatly one way or the other. Within the *Explorer*, Feasibility means a collective estimate of the relative probability of restoration success. The higher the feasibility score, the greater is the preponderance of evidence that a restoration will face fewer obstacles. The factors that reduce a PRW's score from the maximum value indicate what obstacles to expect.

Many features contribute to make some PRWs easier to restore than others and affect restoration success. Are nearby land uses compatible with wetland restoration? Are invasive species likely to be a problem? For a given PRW not all factors are equally important and not all factors are relevant to every user.

The feasibility factors are in two categories: Land Use, and Invasive Plant Species. The *Explorer* ranks each PRW's feasibility for each of these two categories individually, and for both factors combined. **Table A** shows the feasibility factors and the criterion used to weight each factor's relative feasibility. The next section explains the rationale for including each factor and more detail on each criterion for the two broad feasibility categories.

Land Use Considerations

These factors combine land use and land cover data. The land cover data are based on Wiscland 2.0 with subsequent modifications made by WDNR.

Land Cover Factors

Agricultural lands in crop production within an agricultural landscape are the most feasible for wetland restoration due to the absence of investment in structures. PRWs on or near pastureland are considered less feasible due to the presence of long-established non-native plant species. Proximity to urban areas further reduces feasibility. We distinguish "Heavy" urban areas with a high percentage of impervious cover from "Light" urban areas within a less developed landscape and in relation to municipal boundaries. PRWs in these light urban areas that also occur beyond a municipal boundary have greater feasibility than PRWs of other urban types.

PRWs near natural land cover such as woods or wetlands are considered more feasible due to the added value natural cover affords plant and animal migration. Similarly, PRWs near surface water or with a

contributing drainage of sufficient area to support a wetland are also considered more feasible. The surface water flow criterion is based on the Water Flow Path used in Wetlands by Design. This feasibility factor *does not* consider the presence of drain tile or shallow groundwater flow.

Airports

Wetland restoration near airports must consider potential conflicts between increased wildlife, especially waterfowl, and air traffic. PRWs that occur within five miles of a public use airport require a review by the local airport authority and WisDOT Bureau of Aeronautics for compliance with FAA guidelines. The outcome of the review, which depends on the configuration of airport runways and air traffic patterns, *may* restrict wetland restoration type or extent. Consequently, these PRWs are ranked less feasible. Once a PRW is cleared of airport related restrictions, however, this factor will no longer apply.

Drainage Districts

About a third of Wisconsin farms depend on constructed drains to remove excess water from their land. Most of these are operated by a single landowner or by voluntary cooperation among neighbors. However, about 10 percent of these drains are organized as drainage districts, governed by county drainage boards. The Wisconsin Department of Agriculture, Trade and Consumer Protection regulates drainage districts under Wisconsin law. PRWs within these districts are generally not feasible to restore. The presence of drains outside drainage districts may be available from local governments but is not included as a feasibility factor.

Based on these land use considerations a PRW's restoration feasibility may rank from a high of 4 to a low of -3 (Table A). Figure 1 shows how PRWs are distributed among these relative ranks for all PRWs and for those at least 10 acres in extent. Note the frequency scale is logarithmic. In the *Explorer*, these ranks are shown in 4 categories (0 to -3, 1, 2, and 3-4), representing lowest to highest feasibility, respectively.

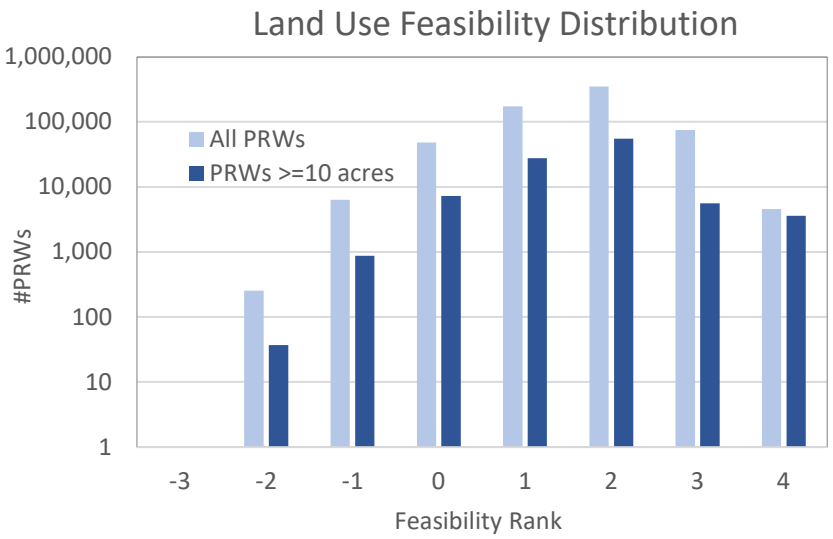

Figure 1. Distribution of composite ranks for feasibility factors related to Land Use.

Invasive Plant Species Considerations

This section considers susceptibility of a restoration to four common wetland invaders – reed canary grass, giant reed grass (*Phragmites australis subsp. australis*), cattails, and buckthorn or honeysuckle. None of these plants prevent restoration but the likelihood of their occurrence indicates a need for subsequent management, an important consideration for long-term restoration success.

The occurrence of reed canary grass is based on WDNR's 2008 mapping after a favorable comparison with that provided by the later WiscLand 2.0. The occurrence of cattails and buckthorn/honeysuckle is based on WiscLand 2.0. Occurrence of giant reed grass (Phragmites) is based on ground surveys conducted by WDNR. For reed canary grass and cattails using satellite imagery provides statewide data, but limits data accuracy to occurrences where the plant populations are large and dense. For Phragmites, ground surveys may document smaller populations, but they are limited in geographic coverage and far from complete. Consequently, the species occurrence data indicate species presence, but the absence of occurrence data *does not* imply species absence.

For each invasive taxon lower ranks are assigned to PRWs where the taxon occurs within or near a PRW as described in Table A. For taxa whose propagules are often water borne, their occurrence upstream from a PRW has the same effect on feasibility as horizontal proximity.

Based on these invasive plant species considerations a PRW's restoration feasibility may rank from a high of 0 to a low of -8 (Table A). Figure 2 shows how PRWs are distributed among these relative ranks for all PRWs and for those at least 10 acres in extent. Note the frequency scale is logarithmic. In the *Explorer*, these ranks are shown in 4 categories (<= -3, -2, -1, and 0), representing lowest to highest feasibility, respectively.

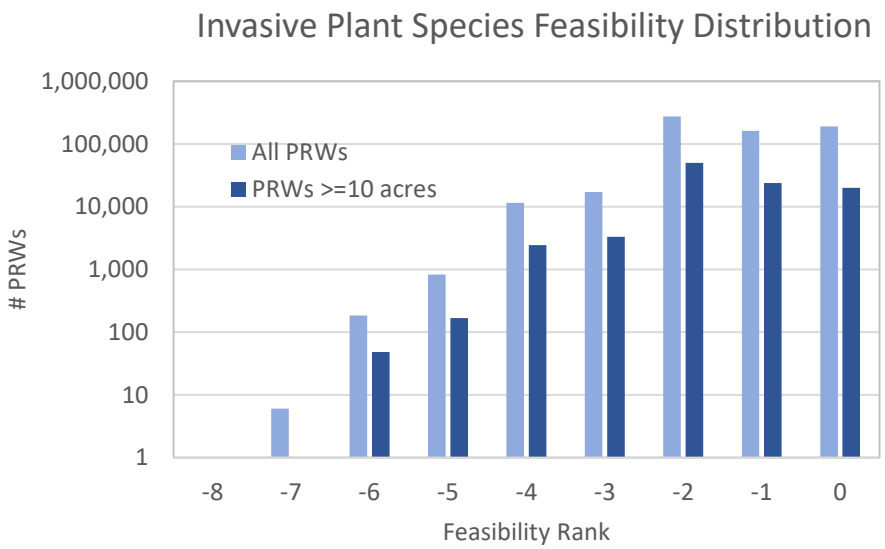

Figure 2. Distribution of composite ranks for feasibility factors related to Invasive Plant Species.

Overall Feasibility

Each PRW was also ranked for overall restoration feasibility by adding feasibility ranks for land use considerations and invasive plant species considerations. A PRW's overall restoration feasibility may rank from a high of 4 to a low of -11. Figure 3 shows how PRWs are distributed among these relative ranks for all PRWs and for those at least 10 acres in extent. Note the frequency scale is logarithmic. In the *Explorer*, these ranks are shown in 5 categories (<= -3, -2, -1, 0-1, and >= 2), representing lowest to highest feasibility, respectively

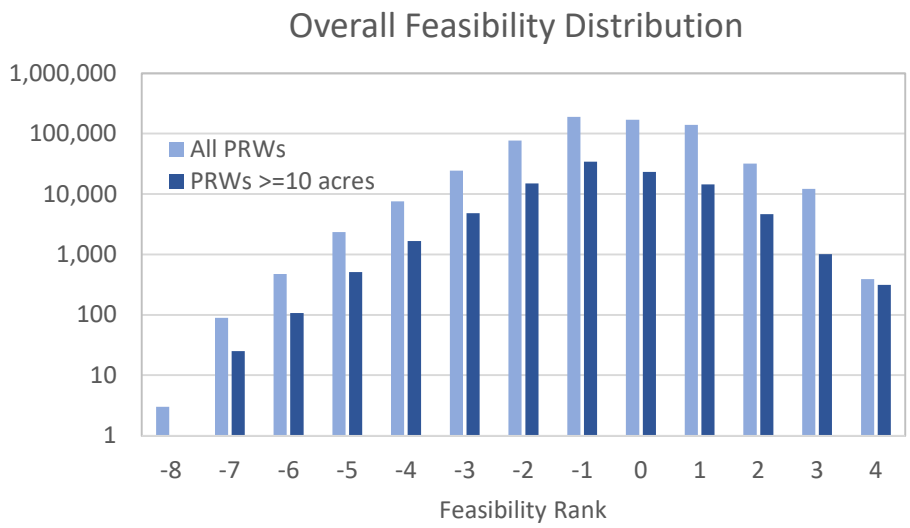

Figure 3. Distribution of composite ranks for Overall Feasibility, combining factors related to Land Use and Invasive Plant Species.

Table A -- PRW Restoration Feasibility Factors

Feasibility Category	Feasibility Factor	Criterion	Additive Score	Category Score Range
Land Use Considerations	Agriculture (Row Crops & Fallow Land)	PRW is at least 100 m from Agriculture (Pasture) or Urban land cover types.	2	-3 to 4
	Agriculture (Pasture)	PRW is at least 100 m from Urban land cover types.	1	
	Urban "Light"	PRW is within a Light Urban cover type and outside a municipal boundary.	0	
	Urban "Heavy"	PRW is within any Urban land cover type and also within a municipal boundary.	-1	
	Proximity to Natural Cover	PRW is within 100 m of any natural cover type that exceeds 10 acres = 1, otherwise 0.	1 or 0	
	Local Surface Water Flow	PRW has a Water Flowpath indicating surface water outfow or throughflow = 1, otherwise 0.	1 or 0	
	Airport Buffer Zones	PRW is within 5-miles of a public use airport operaton zone = -1, otherwise 0.	-1 or 0	
	Drainage Districts	PRW is within an established active drainage district = -1, otherwise 0.	-1 or 0	
Invasive Plant Species Considerations	No Invasives	PRW does not meet any of the following criteria.	0	-8 to 0
	Reed Canary Grass	Reed Canary Grass is mapped within the PRW.	-2	
	Reed Canary Grass Nearby	Reed Canary Grass is mapped within 100 m of the PRW or within 100 m of 1-mile upstream waterway.	-1	
	Cattails	Cattail is mapped within the PRW	-2	
	Cattails Nearby	Cattail is mapped within 100 m of the PRW or within 100 m of 1-mile upstream waterway.	-1	
	Phragmites	Giant Reed Grass is mapped within the PRW.	-2	
	Phragmites Nearby	Giant Reed Grass is mapped within 100 m of the PRW or within 100 m of 1-mile upstream waterway.	-1	
	Buckthorn	Buckthorn is mapped within the PRW	-2	
	Buckthorn Nearby	Buckthorn is mapped within 100 m of the PRW.	-1	

Table A -- PRW Restoration Feasibility - continued

Feasibility Category	Feasibility Factor	Additive Numeric Score	Numeric Score Range	Score Criteriia	Feasibility Rationale	Layer Name	Field Name In Woking LO_Feasiblity
Size & Land Owner Feasibility	PRW is Adjacent to DNR Land	1 or 0	-2 to 10	PRW is within 100 m of DNR owned land = 1, otherwise 0.	Proximity to DNR owned land is an ILF Program facor	EnhancedPRW_9_7_19	LO_PubProp_Num (Short)
	PRW is Adjacent to Other Conserved Land with Public Access	1 or 0		PRW is withinb 100 m of USFWS WPAs, Tribal Lands, Parcels owned by NCO's = 1, otherwise 0.	Proximity to other conserved lands recognizes WDNR's conservation partners. Source data is the best avaialble as of 12/2021 and may be incomplete.	EnhancedPRW_9_7_19	LO_OthPub_Num (Short)
	Size of PRW	0 to 2		PRW extent > 40 acres = 2, 10 to 40 acres = 1, <10 acres = 0	Larger PRWs score higher than smaller PRWs	EnhancedPRW_9_7_19	LO_PRWSize_Num (Short)
	Size of Complex that contains the PRW	0 to 2		PRW Complex extent > 40 acres = 2, 10 to 40 acres = 1, <10 acres = 0	PRWs within larger Complexes score higher than PRWs within in smaller Complexes	EnhancedPRW_9_7_19	LO_ComplexSize_Num (Short)
	Core Habitat Indicator	-2 or 0		PRWs within a Complex perimeter that exceeds 10x the Complex area, AND the Complex centroid is external to it, AND the Complex is less than 10 acres = -2, otherwise 0. Centroids that are near the complex edge are considered internal.	PRW Complexes that are likely to result in mostly edge habitat are devalued compared to those likely to have core habitat.	LO_Complex_ID_MtS	LO_CoreHab_Num (Short)
	% PRW of PRW Complex	0 to 2		PRW comprises > 95% of the Complex = 2; 80 to 95% = 1; < 80 % = 0	Dominant PRWs within a Complex score higher than PRWs that make less contribution to a Complex	EnhancedPRW_9_7_19	LO_PerPRWCmplx (Double)
	% PRW Complex owned by a landowner	0 to 2		PRW with at least 90% of its Complex owned by one landowner = 2; PRW with at least 90% of its Complex owned by two landowners = 1; otherwise 0	PRWs with fewer landowners within the same Complex score higher than those with more landowners.	LO_Complex_ID_MtS	LO_PerOwnerCplx (Short)