Explaining the Impaired Water Contributing Areas and Sub-Watershed Wetland Profile Reports

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Tutorial Purpose

This short tutorial is designed to explain the process and rational behind the development of the impaired water contributing area and sub-watershed wetland profile reports.

It will also explain how each of these reports can be used to help us develop preliminary wetland specific goals and objectives in a watershed restoration plan. And, how they can be used to help identify which wetland types and specific wetland functions should be targeted to address identified water quality and quantity impairments.

These reports are meant to be used in conjugation with the “Exploring your Aquatic Resources” interactive web application.

Part 1: Impaired Water Contributing Areas (IWCA) Reports

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Impaired Waters CA Overview

The Impaired Water Contributing Areas (IMCA) reports have been developed to allow the user to quickly identify wetlands that should be targeted based on their predicted functions to help address identified water quality and quantity impairments. These are brief 2-page reports that provide information about the pollutants and pollution, and their sources within a contributing area, proportion of wetland and riparian areas within a IWCA, and recommendations as to which wetland type should address water quality/quantity impairments within an IWCA.

The intended purpose of the IWCA reports is to:

1. Help watershed groups set preliminary wetland specific watershed goals and objectives that address identified water quality impairments in waters with water quality assessments that may have 303d listed waters;
2. Provide an initial starting point for targeting specific wetland sites for restoration or protection based on the functions they are predicted to provide; and,
3. Educate users about current wetland resources in each IWCA and how their functions impact other aquatic resources in the contributing area.

Impaired Waters CA Overview

Definitions

Impaired water contributing areas – are the upstream/up-gradient areas that drain into a stream or river on that MDEQ has conducted a water quality assessment on . These waters may be on the 303d impaired stream list thus requiring the development of a TMDL. IWCAs have been delineated only for streams and rivers that have been assessed by the Montana Department of Environmental Quality.

Wetland functions – in general, are the effects that wetlands have on other aquatic resources, ecosystem processes, or biota. For example attenuation of nutrients or maintaining late season stream flows.

Wetland profiles – these describe the proportion of each wetland or riparian hydrogeomorphic type within a IWCA, usually expressed as a bar graph.

Hydrologically modified – These are wetlands in the National Wetland Inventory that have been ditched, drained, excavated, farmed, or diked. These are considered as “impacted” wetlands.

Impaired Waters CA Methods

IWCA and the reports were developed in several steps. Spatial datasets used were: 2008 303d listed stream segments (MDEQ Dataset) and provisional wetland maps (MTNHP)

Step 1: Water quality assessed stream segments were combined, including pollutants, pollution and impairment sources for each like named stream segment (i.e. Wise River).

Step 2: Using the lowest downstream point on each combined like named stream segment the contributing area was mapped, this is the impaired water contributing area.

Step 3: Targeted wetland functions that should address the known pollutants, pollution, and impairment sources within the impaired Water contributing area were added.

Step 4: Wetland profiles were run on each impaired water contributing area using provisional wetland maps obtained from the Montana Natural Heritage Program.

Step 5: Wetland profiles were related to IWCAs and targeted wetland functions to develop impaired water contributing area reports.

Parts of each IWCA Report (Page 1)

- Title –Impaired water contributing area name (stream name), unique ID.
- Known pollutants and pollution
- Impairment sources
- Wetland functions that will address known pollutants, pollution and impairment sources (marked with an **X**, i.e. sediment retention)
- Percent of each wetland type that is predicted to display a high capacity to provide an associated wetland function (i.e. 41.2% of slope wetlands have a high capacity to provide sediment retention)

Identifying wetland and riparian areas to improve water quality and quantity
Divide Creek Impaired Waters Contributing Area, Big Hole Watershed

GIS ID: Big Hole 18

This brief report sumarizes the types of wetland and riparian areas in Divide Creek Impaired Waters Contributing Area. And, identifies which wetland types or riparian areas can be targeted for restoration or protection based on their contribution to water quality and quantity. Divide Creek watershed has had a water quality assessment conducted and may be listed as a 303d stream under the Clean Water Act thus requiring the development of a TMDL (Total Maximum Daily Load). Specific information on the water quality assessment for Divide Creek can be found at: http://cwaic.mt.gov/

Impairment Cause(s) - Pollutants:	Phosphorus (Total) [CFL 2006], Sedimentation/Siltation [CFL 1990], Temperature, water [CFL 2006], Total Kjehldahl Nitrogen (TKN) [CFL 2006]
Impairment Cause(s) - Pollution:	Alteration in stream-side or littoral vegetative covers, Low flow alterations

Source: MDEQ 2008 305b GIS Layer

MDEQ identified the following as potential causes of impairement of the observed pollutants and pollution:

Agriculture, Flow Alterations from Water Diversions

Targeting wetlands for restoration and protection based on their capacity to provide water quality and quantity functions can be an effective means of reducing the amount of pollutants entering streams and rivers. In the Divide Creek impaired waters contributing area, restoring and protecting wetland and riparian areas that have a high capacity to provide the functions marked with an X in the chart below can help moderate the negative impacts from the identified causes of impairement and improve water quality and/or water quantity.

Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
	X	X	X	X	X

Each wetland type has the ability to perform all of the identified water quality/quantity functions to a degree. Some wetlands, though, are better at providing these functions then others. For Example, in the Divide Creek impaired waters contributing area 56.6% of Slope wetlands display a high capacity to attenuate nutrients. The proportion of each wetland type and riparian area within this impaired water contributing area that displays a high capacity to perform an identified water quality/quantity function is listed below. The wetland type and riparian areas that are in bold italics have the greatest capacity to moderate the negative impacts from the identified pollutant sources. Values of 0.0% in the chart means that these wetland types or riparian areas have only a medium to low capacity to moderate the negative impacts from identified pollutant sources.

Type	Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*
Fringe	0.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*
Riparian	85.6%	*0.0%*	*0.0%*	*0.0%*	*15.8%*	*0.0%*
Riverine	0.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*
Slope	17.8%	*41.2%*	*56.6%*	*0.0%*	*0.0%*	*0.0%*
Depressional	27.6%	*9.4%*	*16.0%*	*0.0%*	*0.0%*	*0.5%*

Page 1 of 2 Report Generated: 9/28/2011

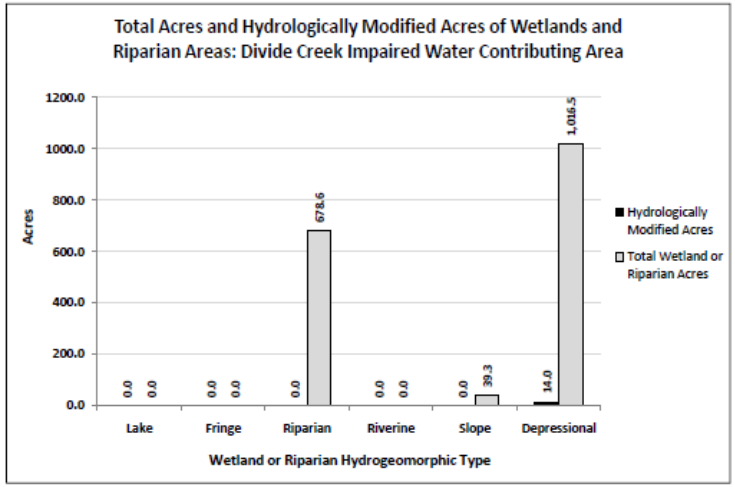
Parts of each IWCA Report (Page 2)

- Total acres of wetland and riparian areas, including hydrologically modified, and majority wetland types.
- Recommendation on which wetland types to target to address water quality and quantity impairments.
- Wetland profile of impaired water contributing area showing acreage of each wetland type and acres of each wetland type that is hydrologically modified.

Divide Creek has a total of 1734 wetland and riparian acres within its impaired waters Contributing Area, with 14 acres (1%) considered as hydrologically modified in the National Wetland Inventory database. The majority of wetlands or riparian areas are Depressional (58.6%), followed by Riparian (39.1%), and Slope (2.3%).

Using Divide Creek impaired waters contributing area's wetland and riparian areas profile and associated hydrogeomorphic (HGM) functions. Restoring and/or protecting the following wetland types and riparian areas in Divide Creek impaired water contributing area should help to moderate the negative impacts from the identified causes of impairement and provide the following water quality and/or water quantity benefits:

Improve stream temperatures for aquatic life:	Depressional Wetlands
Reduce flood peaks and desynchronize flood flows:	
Stabilize the banks along watercourses:	Riparian Areas,
Retain sediments and reduce siltation:	Riparian Areas, Slope Wetlands, Depressional Wetlands
Increase attenuation of nutrients:	Slope Wetlands, Depressional Wetlands
Maintain late season streamflows:	



Page 2 of 2

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Using the Impaired Water Contributing Area Reports to set goals and objectives

! Note: as this is a pilot project the processes described as to how to use the impaired water contributing area reports are only recommendations and intended to get you started.

Using the Impaired Water Contributing Area Reports to set goals and objectives

The information in each IWCA report will help us to make some general wetland goals and objectives that can be then be prioritized and finalized as more information is gathered. Using Divide Creek in the Big Hole as an example the first step uses the information on the known pollutants, pollution and impairment sources:

- Based on the pollutants, pollution and impairment sources we can see that restoring or protecting wetlands that have a capacity for sediment retention and bank stabilization could potentially address sediment/siltation issues that are in part caused by alteration in stream-side or littoral vegetative covers from agricultural practices.

Impairment Cause(s) - Pollutants:	Phosphorus (Total) [CFL 2006], Sedimentation/Siltation [CFL 1990], Temperature, water [CFL 2006], Total Kjehldahl Nitrogen (TKN) [CFL 2006]
Impairment Cause(s) - Pollution:	Alteration in stream-side or littoral vegetative covers, Low flow alterations

Agriculture, Flow Alterations from Water Diversions

Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
	X	X	X	X	X

Using the Impaired Water Contributing Area Reports to set goals and objectives

- Also, based on the pollutants, pollution, and impairment sources we see that restoring or protecting wetlands that have a capacity to maintain late season stream flows and moderating temperature could address the known temperature impairment and moderate the effects from flow alterations.

Impairment Cause(s) - Pollutants:	Phosphorus (Total) [CFL 2006], Sedimentation/Siltation [CFL 1996], Temperature, water [CFL 2006], Total Kjehldahl Nitrogen (TKN) [CFL 2006]
Impairment Cause(s) - Pollution:	Alteration in stream-side or littoral vegetative covers, Low flow alterations

Agriculture, Flow Alterations from Water Diversions

Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
	X	X	X	X	X

Using the Impaired Water Contributing Area Reports to set goals and objectives

- Finally, we can see that nutrients are also a problem in Divide Creek. So we may want to look also at wetlands that have a high capacity to attenuate nutrients.

Impairment Cause(s) - Pollutants:	Phosphorus (Total) [CFL 2006], Sedimentation/Siltation [CFL 1990], Temperature, water [CFL 2006], Total Kjehldahl Nitrogen (TKN) [CFL 2006]
Impairment Cause(s) - Pollution:	Alteration in stream-side or littoral vegetative covers, Low flow alterations

Agriculture, Flow Alterations from Water Diversions

Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
	X	X	X	X	X

Using the Impaired Water Contributing Area Reports to set goals and objectives

In summary what we learned from the first step is that we may want to consider wetland specific goals and objectives that target wetlands with the following wetland functions to address identified water quality and quantity impairments:

- Sediment retention;
- Bank stabilization;
- Streamflow maintenance;
- Temperature regulation; and,
- Nutrient attenuation.

Using the Impaired Water Contributing Area Reports to set goals and objectives

But what type of wetlands should we target to address the known pollutants and their sources.

In the second step we look at the table on page two of each report. This table provides general recommendation on which wetland types address identified water quality and quantity impairments. Using this information, if one of our preliminary wetland specific goals is to target restoration and protection of wetlands that may reduce sedimentation/siltation. The wetland types we should target are:

- Riparian areas, slope wetlands, and depressional wetlands.

Improve stream temperatures for aquatic	Depressional Wetlands
Reduce flood peaks and desynchronize flood flows:	
Stabilize the banks along watercourses:	Riparian Areas,
Retain sediments and reduce siltation:	Riparian Areas, Slope Wetlands, Depressional Wetlands
Increase attenuation of nutrients:	Slope Wetlands, Depressional Wetlands
Maintain late season streamflows:	

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Using the Impaired Water Contributing Area Reports to set goals and objectives

In the third step, we can then go back to the table at the bottom of page one, which describes the percent of each wetland type that is predicted to display a high capacity to provide an associated wetland function. And look at the percent of riparian areas, slope wetland and depressional wetlands that have a high capacity to retain sediments and reduce siltation.

In this example we see that 41.2% of slope wetlands have a high capacity to address this water quality impairment, while only 9.4% of depressional wetlands display a high capacity to reduce sediments.

Oddly enough in this example, it shows that there are no riparian areas with a high capacity to retain sediments. This does not mean that they do not perform this function, only that they do not display a **high** capacity to perform this function.

Type	Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.0%	***0.0%***	***0.0%***	***0.0%***	***0.0%***	***0.0%***
Fringe	0.0%	***0.0%***	***0.0%***	***0.0%***	***0.0%***	***0.0%***
Riparian	85.6%	***0.0%***	***0.0%***	***0.0%***	***15.8%***	***0.0%***
Riverine	0.0%	***0.0%***	***0.0%***	***0.0%***	***0.0%***	***0.0%***
Slope	17.8%	***41.2%***	***56.6%***	***0.0%***	***0.0%***	***0.0%***
Depressional	27.6%	***9.4%***	***16.0%***	***0.0%***	***0.0%***	***0.5%***

Using the Impaired Water Contributing Area Reports to set goals and objectives

We can then go through each of the wetland types identified in step two and the percent that function at a high capacity to come up with a list of preliminary wetland specific goals or objectives describing the wetland types we should evaluate to address the water quality and quantity impairments in a impaired water contributing area.

In this example our preliminary wetland specific goals and objectives for Divide Creek may be:

- Riparian areas will be evaluated for restoration or protection to help stabilize the banks along water courses.
- Slope and depressional wetlands will be evaluated for restoration or protection to help retain sediments and reduce siltation.
- Slope and depressional wetlands will be evaluated for restoration or protection to increase the attenuation of nutrients. And,
- Depressional wetlands will be evaluated for restoration or protection to help regulate the temperatures in the stream.

Using the Impaired Water Contributing Area Reports to set goals and objectives

You will notice that in step one we stated maintaining late season stream flows as a potential goal or objective. Yet in the third step we do not identify any wetland type that will address this water quantity impairment.

This is because the chart on the bottom of page one shows that there are no wetlands that have a high capacity to maintain late season stream flows. Thus, while restoring or protecting wetland and riparian areas will have some effect on stream flows, other means for addressing late season streams flows may be more effective. Such as irrigation efficiency projects, or working with a water right holder to convert an existing consumptive use to instream use.

Increase attenuation of nutrients:	Slope Wetlands, Depressional Wetlands
Maintain late season streamflows:	

Type	Flood Abatement	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.0%	***0.0%***	***0.0%***	***0.0%***	***0.0%***	***0.0%***
Fringe	0.0%	***0.0%***	***0.0%***	***0.0%***	***0.0%***	***0.0%***
Riparian	85.6%	***0.0%***	***0.0%***	***0.0%***	***15.8%***	***0.0%***
Riverine	0.0%	***0.0%***	***0.0%***	***0.0%***	***0.0%***	***0.0%***
Slope	17.8%	***41.2%***	***56.6%***	***0.0%***	***0.0%***	***0.0%***
Depressional	27.6%	***9.4%***	***16.0%***	***0.0%***	***0.0%***	***0.5%***

The next step:

The information taken from the impaired water CA reports, and the preliminary wetland specific goals and objectives are then used in the interactive web application to identify wetlands and riparian areas to evaluate based on their capacity to address identified water quality and quantity impairments.

Another short tutorial describes how the interactive web application "Exploring your aquatic resources" works. This tutorial can be found at the top of the interactive web application that is found at:

http://test.svc.mt.gov/deq/wmaAquaticResources

Part 2: Sub-Watershed Wetland Profile Reports

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Sub-watershed Wetland Profile Overview

The sub-watershed wetland profiles were developed to “fill in” the gaps in areas that are not covered by the impacted water contributing areas. The sub-watershed wetland profiles are intended to give the user a general target for wetland and riparian restoration and protection goals. This work is based on identifying sub-watersheds that display similar characteristics and lumping them into regions. These regions are then further broken down into impacted and “reference” sub-watersheds depending on the extent of development, impacts to wetlands and other information.

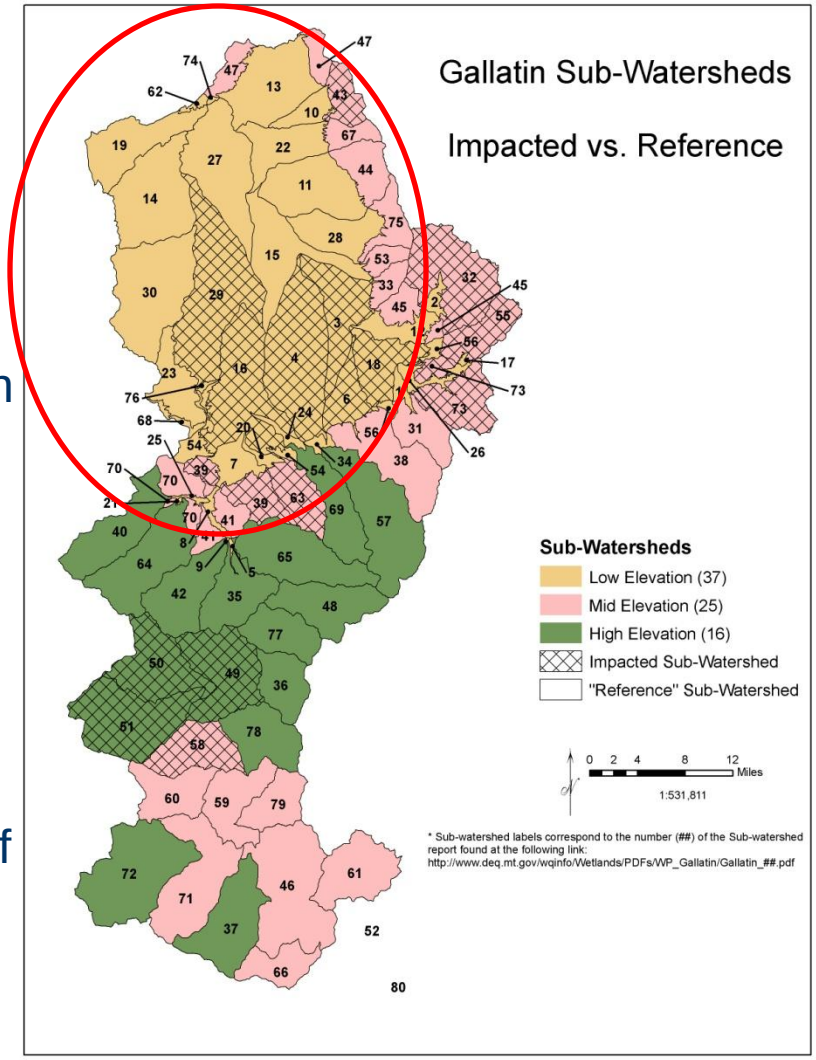
The intended purpose is to use the general “reference” wetland profile that is developed for each region as a general target for restoring wetland and riparian areas to similar proportions.

Explanation of Regions and “Reference”

Sub-watersheds were created using the HUC 6 boundaries from the National Hydrography Dataset. Some sub-watersheds were then split on a topology profile based on expert opinion.

Analysis on the sub-watersheds were run comparing the elevation, slope, relief, mean precipitation, geology and hydrography characteristics. Regions, based on this analysis, were created by minimizing the within group variance while maximizing the variance between groups. By doing this we ended up with sub-watersheds that are similar in nature and we should be able to compare wetland profiles with a measure of confidence.

For example the low elevation sub-watersheds are more similar to each other, then to the mid elevation sub-watersheds.

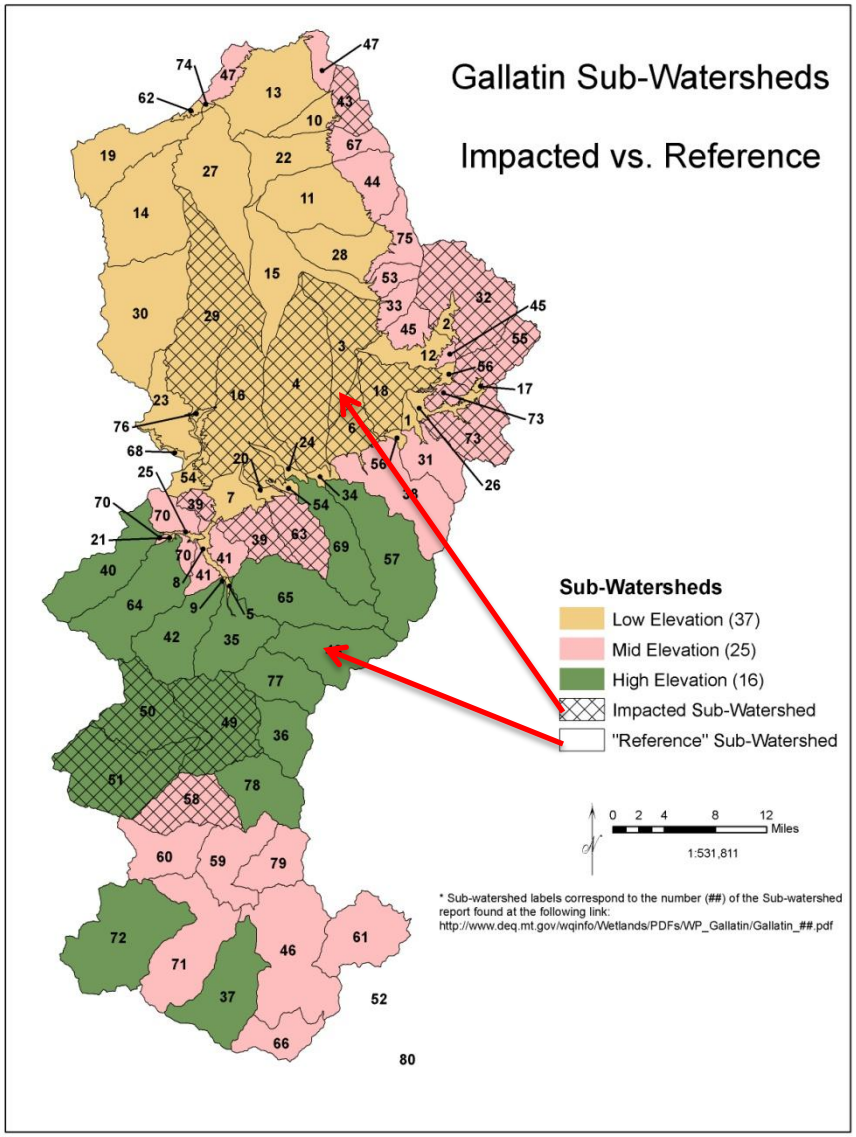


Explanation of Regions and “Reference”

Each sub-watershed was then further characterized for the impacts within the sub-watershed. Based on analysis of road density, septic density, ground water withdrawals, agriculture, forestry, impacted wetlands, number of flow diversions, and % of water quality impaired streams sub-watersheds were either classified as impacted or “reference”

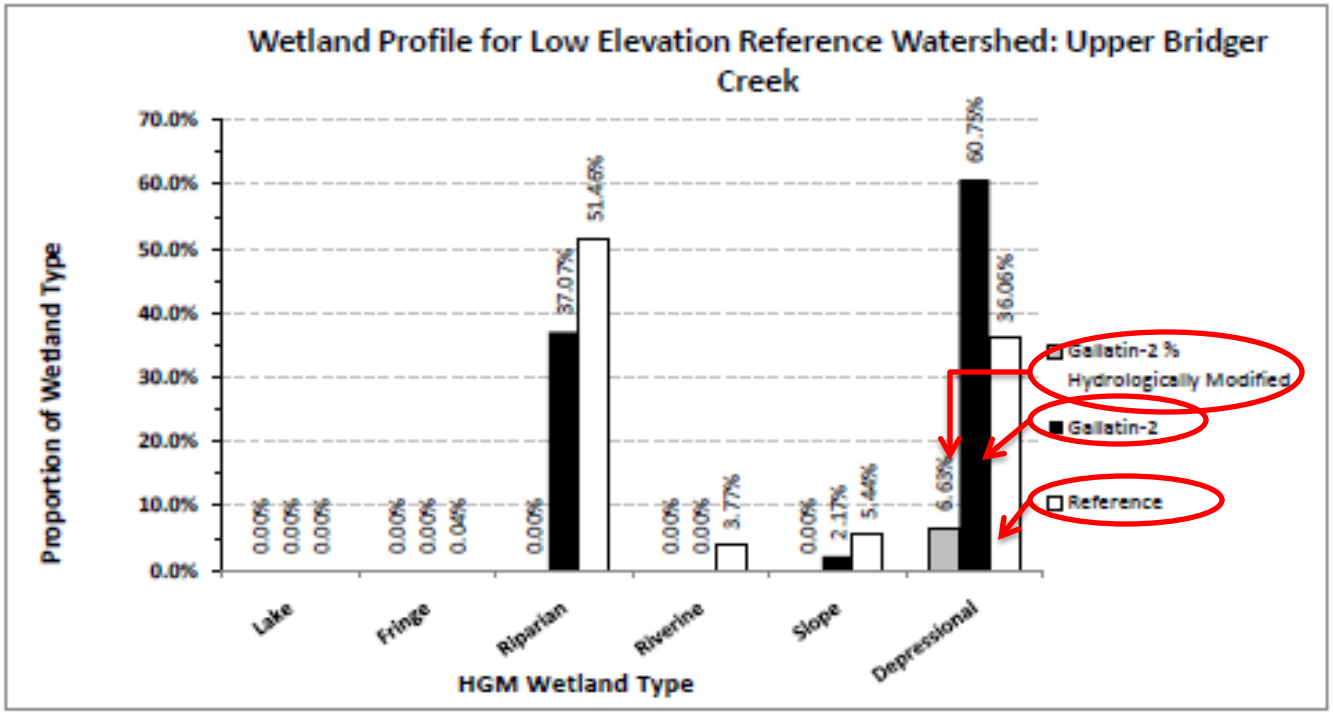
Impacted or “reference” grouping was determined by minimizing the within group variance while maximizing the variance between groups.

“Reference” is in quotes as they still show impacts, they are just less impacted then the impacted sub-watersheds.



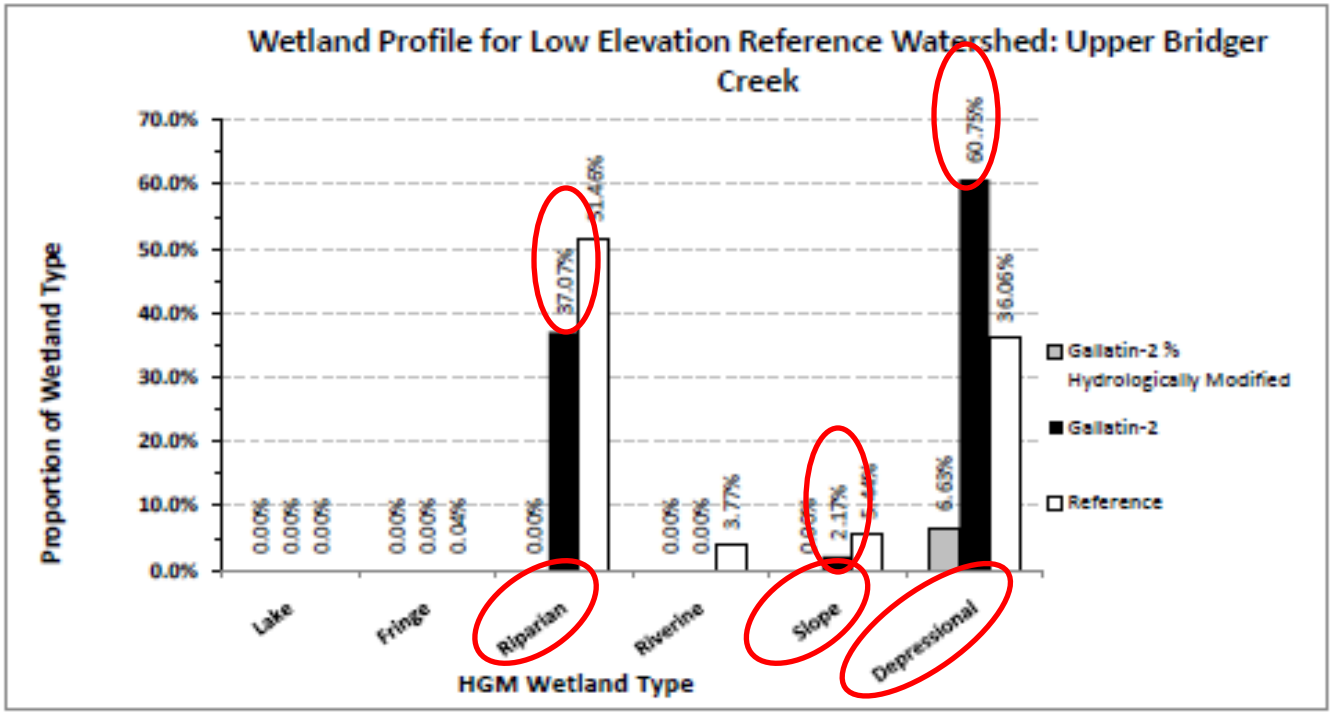
Creating Wetland Profiles

Wetland profiles were then created for each sub-watershed and a general "reference" wetland profile for each region group. This was calculated using provisional NWI data obtained from the Montana Natural Heritage Program with wetland hydrogeomorphic (HGM)-types identified. The percentage of each wetland HGM-type that is classified as hydrologically modified was also calculated.



Creating Wetland Profiles

Wetland profiles show the proportion of wetland HGM-types in relation to the other wetland HGM-types and riparian areas within a sub-watershed. For example, the proportion of wetland types and riparian areas for Upper Bridger Creek in the low elevation region of the Gallatin Watershed is: 37.07% riparian, 60.75% depressional wetlands, and 2.17% slope wetlands.



Wetland Profile Reports Explained

Each sub-watershed has a one page wetland profile report associated with it. This report contains the following:

- Watershed name, impacted or “reference”, and unique ID.
- Brief description of topographic and hydrological characteristics.
- Brief description of impacts observed in the sub-watershed.
- Acres of wetlands and hydrologically modified wetlands within the sub-watershed.
- Percent of each wetland type that is predicted to display a high capacity to provide an associated wetland function.
- Wetland profile showing the proportion of wetland types of each sub-watershed and its comparable general “reference” wetland profile.

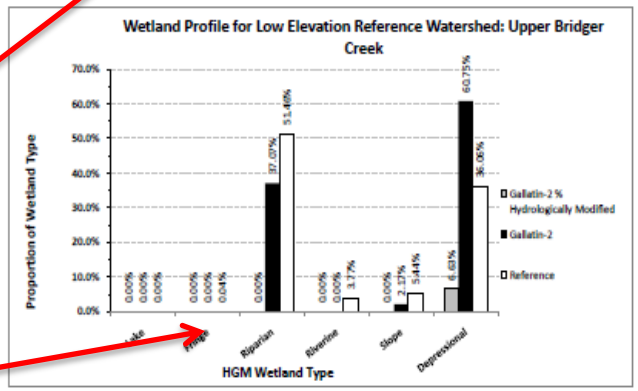
Wetland Profile: Reference Watershed Gallatin-2, Upper Bridger Creek

This brief report summarizes the wetland profiles for the Upper Bridger Creek Sub-Watershed: Gallatin-2. This sub-wateshed is grouped into the Low elevation sub-watershed group. It has a mean elevation of 1945.17 m, a mean slope of 6.28 degrees, a total relief of 113 m, with the majority of stream segments having a Strahler stream order of 3.

Based on the meters of roads per acre (12.37), percent of altered land cover (31), percent of intensive agriculture (18.72), number of groundwater wells (65), and density of septic systems per acre (0.03062) within the sub-watershed. Upper Bridger Creek watershed is considered as a/an Reference sub-watershed in the Low elevation sub-watershed group for the Gallatin Watershed.

Upper Bridger Creek sub-watershed contains 166 acres of wetlands. Of which, 7 acres are considered as being modified in the National Wetlands Inventory database. The percent of wetlands in each HGM wetland type that have a high capacity to provide functions that may target water quality and quantiy impairements in Upper Bridger Creek are listed below.

	Flood Attenuation	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Fringe	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Riparian	99.91%	0.00%	0.00%	0.00%	50.30%	0.00%
Riverine	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Slope	100.00%	0.00%	58.22%	0.00%	0.00%	0.00%
Depressional	80.97%	67.20%	71.63%	0.00%	0.00%	0.71%



** Note: Gallatin-2 % Hydrologically Modified denotes the percentage of wetlands within that HGM Wetland type that are considered as modified in the NWI Database. Percentages of HGM Wetland Types in the Reference and Gallatin-2 watersheds are proportions of the total. For example, as the proportion of wetlands in one HGM Type increases, the other wetlands types will decrease.*

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Using the Wetland Profile Reports to set goals and objectives

! Note: as this is a pilot project the processes described as to how to use the wetland profile reports are only recommendations and intended to get you started.

Using the Wetland Profile Reports to set goals and objectives

Wetland profile reports can be used in two different ways to develop preliminary wetland specific goals and objectives. The first way is similar to the impaired water contributing areas reports where we may want to identify restoration opportunities to address a known water quality or quantity impairment. Using Lower Hyalite creek as an example, from past studies, local knowledge, and other sources we know that Lower Hyalite Creek has an issue with increased nutrients.

Looking at the table in the wetland profile report we see that both slope and depressional wetlands with a high capacity to attenuate nutrients are present in this sub-watershed.

	Flood Attenuation	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Fringe	0.00%	81.56%	0.00%	0.00%	0.00%	71.34%
Riparian	96.41%	0.00%	0.00%	0.00%	72.56%	0.00%
Riverine	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Slope	4.53%	70.53%	18.42%	0.00%	0.00%	0.00%
Depressional	25.46%	6.03%	10.99%	0.48%	0.00%	0.73%

Using the Wetland Profile Reports to set goals and objectives

Thus one of our wetland specific goals and objectives may be:

- Slope and depressional wetlands will be evaluated for restoration or protection to increase the attenuation of nutrients in Lower Hyalite Creek.

And we can use this wetland specific goal or objective in the interactive web application to identify specific slope and depressional wetlands that have a high capacity to attenuate nutrients for further evaluation in the field.

Using the Wetland Profile Reports to set goals and objectives

Let's add a little complexity and say that we also have an issue with flooding on Lower Hyalite Creek. Looking at the chart in the report we see that 96.41% of riparian areas in Lower Hyalite Creek have a high capacity to attenuate floods and reduce peak flows. Thus, making them a good target for restoration or protection.

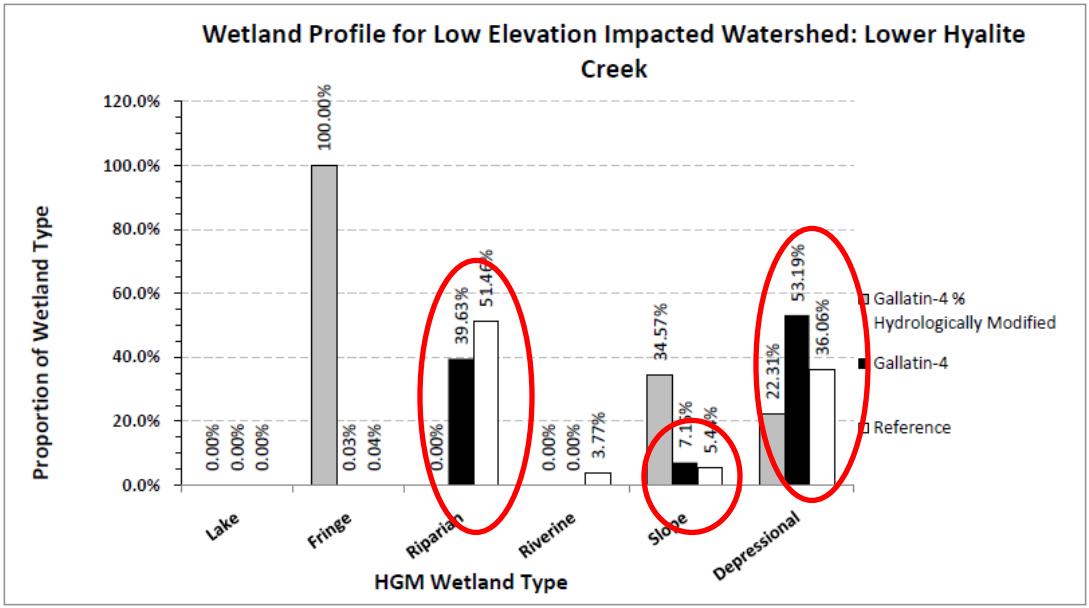
We now can add a second wetland or riparian specific goal or objective:

- Riparian areas will be evaluated for restoration or protection for flood attenuation and peak flow reductions in Lower Hyalite Creek.

	Flood Attenuation	Sediment Retention	Nutrient Attenuation	Streamflow Maintenance	Bank Stabilization	Temperature
Lake	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Fringe	0.00%	81.56%	0.00%	0.00%	0.00%	71.34%
Riparian	96.41%	0.00%	0.00%	0.00%	72.56%	0.00%
Riverine	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Slope	4.53%	70.53%	18.42%	0.00%	0.00%	0.00%
Depressional	25.46%	6.03%	10.99%	0.48%	0.00%	0.73%

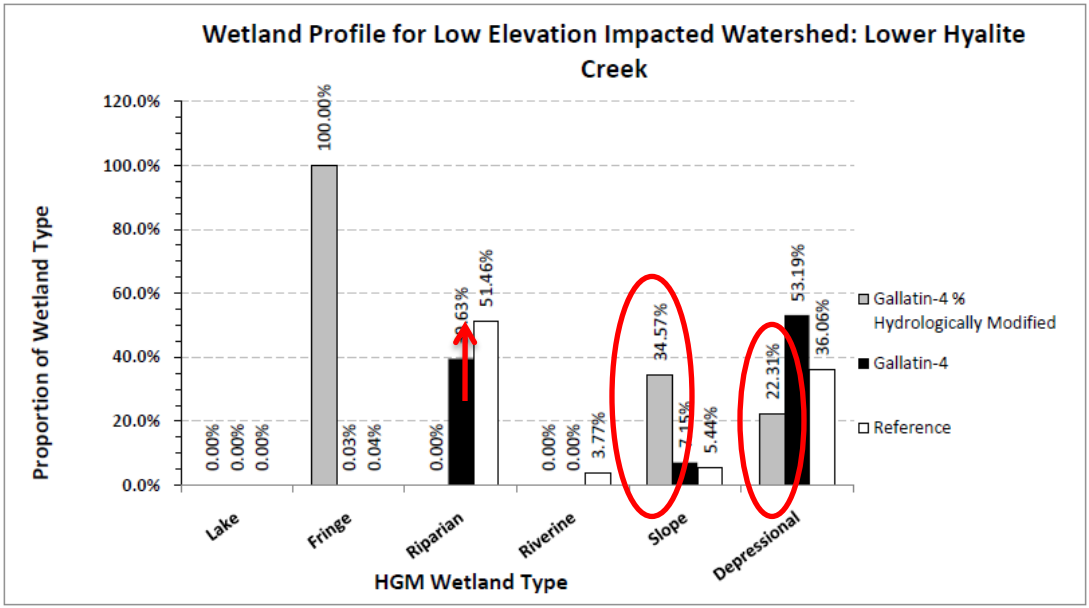
Using the Wetland Profile Reports to set goals and objectives

The second way of using the wetland profile reports is to evaluate restoring wetland types to proportions similar to the general “reference” wetland profile. For example, looking at the chart and comparing the proportions of wetland types we see that in this sub-watershed the proportion of slope and depressional wetlands is actually <u>greater</u> than the general “reference” wetland profile. While the proportion of riparian areas is <u>less</u>.



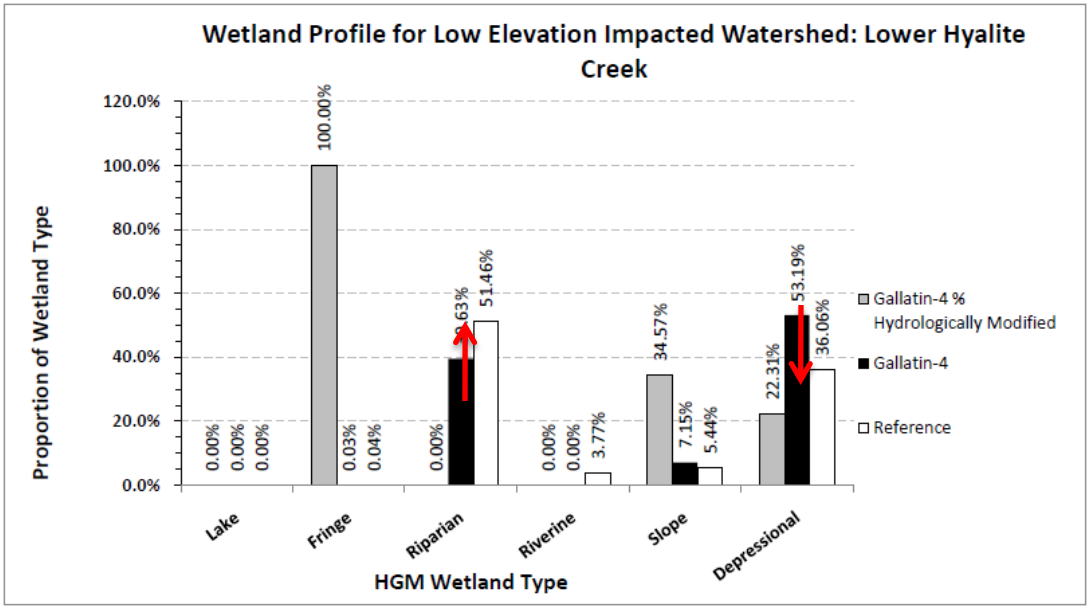
Using the Wetland Profile Reports to set goals and objectives

Thus for slope and depressional wetlands we may want to restore and protect existing wetlands because a high percentage are hydrologically modified. And look for opportunities to restore riparian areas where they have been lost to increase their proportion within the watershed to reflect the general "reference" wetland profile.



Using the Wetland Profile Reports to set goals and objectives

Restoring riparian areas where they have been lost will <u>increase</u> their proportion in the sub-watershed and <u>decrease</u> the proportion of slope and depressional wetlands. Bringing Lower Hyalite Creeks wetland profile closer to the general "reference" wetland profile for low elevation sub-watersheds.



Using the Wetland Profile Reports to set goals and objectives

We can now either modify our preliminary wetland specific goals and objectives with information learned from the wetland profile reports.

For example:

- Existing hydrologically modified slope and depressional wetlands will be evaluated for restoration or protection to increase the attenuation of nutrients in Lower Hyalite Creek.
- Opportunities to restore riparian areas where they have been previously removed will be evaluated for flood attenuation and peak flow reductions in Lower Hyalite Creek.

Using the Wetland Profile Reports to set goals and objectives

Or, add a third wetland specific goal and objective that includes looking for slope and depressional wetland restoration opportunities and areas to "create" new riparian areas.

For Example:

- Opportunities to restore riparian areas where they have been previously removed, and to restore and protect existing hydrologically modified slope and depressional wetlands will be evaluated to create a wetland profile for Lower Hyalite Creek that is similar to the general "reference" wetland profile for the low elevation region for the Gallatin Watershed.

The next step:

The information taken from the wetland profile reports, and the preliminary wetland specific goals and objectives are then used in the interactive web application to identify specific wetlands and riparian areas to evaluate based on their capacity to address identified water quality and quantity impairments or based on their HGM-type to restore wetlands and riparian areas to proportions similar to the general “reference” wetland profile for their respective region group.

Another short tutorial describes how the interactive web application “Exploring your aquatic resources” works. This tutorial can be found at the top of the interactive web application that is found at:

http://test.svc.mt.gov/deq/wmaAquaticResources

QUESTIONS OR SUGGESTIONS?

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