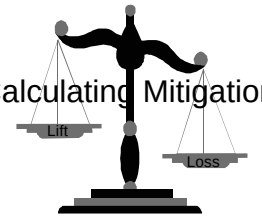
US Army Corps
of Engineers
Jacksonville District

version 4.0

Calculating Mitigation



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Under the U.S. Army Corps of Engineers Regulatory Program, mitigation is necessary to offset wetland impacts and/or to secondary or cumulative impacts.

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This presentation describes a method that has been developed to be used during a permit review to determine if a proposed mitigation plan is sufficient to offset impacts.

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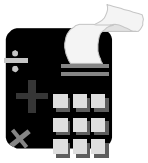

This method uses a mathematical process to supplement

but not to supplant

use of professional judgement during a project review.

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The formula will be placed below.

Each variable will be added as it it is explained during this presentation.

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I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances

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We will discuss:

I. Unavoidable Impact

II. Compensatory Mitigation

III. Special Circumstances

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I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances

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I. Unavoidable Impact

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I. Unavoidable Impact
A. Defined
1. Concerns
II. Compensatory Mitigation
III. Special Circumstances

Concerns

version 4.0

What are our concerns with this mathematical process to calculate mitigation?

?

- Does this process apply to all mitigation?
- Does this make it easier to permit impacts?
- Will greater impacts be allowed since now can more easily calculate compensation?
- Others?

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I. Unavoidable Impact
A. Defined
1. Concerns
II. Compensatory Mitigation
III. Special Circumstances

Concerns
(Continued)

version 4.0

!

The mathematical process is for unavoidable impacts. This is only one component of the review of a permit.

Following is a brief review of the three documents that describe mitigation is more than just compensation.

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I. Unavoidable Impact
A. Defined
2. Permit Regulation
II. Compensatory Mitigation
III. Special Circumstances

33 CFR 320.4(r)

version 4.0

Corps permits include mitigation to:

- Minimize adverse effects
- Satisfy legal requirements
- Tip the public interest balance.

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I. Unavoidable Impact
A. Defined
3. 404(b)(1)
II. Compensatory Mitigation
III. Special Circumstances

404(b)(1) Guidelines

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40CFR230.10(a) "...no discharge...shall be permitted if there is a practicable alternative...which would have less adverse impact on the aquatic ecosystem..."

40CFR230.12(a)(3)(iii) The proposed discharge must "include all appropriate and practicable measures to minimize potential harm to the aquatic ecosystem"

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I. Unavoidable Impact
A. Defined
4. MOA
II. Compensatory Mitigation
III. Special Circumstances

Corps/EPA MOA

version 4.0

Goal of NO NET LOSS
- "no overall net loss of values and functions"
- recognizes losses will occur in some cases

Goal of "functional value replacement"
- Prefer on-site, in-kind
- Adequate safety margin (prefer restoration)
- One-to-One Acreage replacement may be a "reasonable surrogate"

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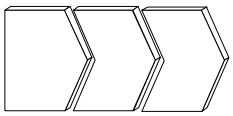
I. Unavoidable Impact
A. Defined
4. MOA (continued)
II. Compensatory Mitigation
III. Special Circumstances

Corps/EPA MOA
(Continued)

version 4.0

Mitigation Sequencing
- Avoidance
- Minimization
- Compensation



Disallows the use of compensatory mitigation to satisfy the alternatives test

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I. Unavoidable Impact
B. Concerns
(Discussion)
II. Compensatory Mitigation
III. Special Circumstances

Concerns

version 4.0

After the applicant and the Corps have finished discussing the avoidance and minimization aspects of the project, then they are ready to discuss the compensation of unavoidable project impacts . . .

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I. Unavoidable Impact
B. Concerns
(Discussion)
II. Compensatory Mitigation
III. Special Circumstances

Concerns
(Continued)

version 4.0

What are our concerns with project impacts?

?

- Aquatic environment degradation
- Loss of benefits wetland provides
- Difference between “good” & “poor” wetland
- Many functions present in a wetland
- Some functions important in watershed
- Others?

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I. Unavoidable Impact
B. Concerns
(Discussion)
II. Compensatory Mitigation
III. Special Circumstances

Concerns
(Continued)

version 4.0

These concerns are incorporated into the following variables.

! "Δ" is the Greek symbol "Delta" and is the abbreviation for change. Here, it will mean a change in a wetland function

Weight, " Weighting Factor", will express the relative importance of wetland functions

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I. Unavoidable Impact
C. Assessment
1. Components
II. Compensatory Mitigation
III. Special Circumstances

Wetland Components

version 4.0

There are many components to a wetland, which when looked at, can help classify a wetlands health.

These are . . .

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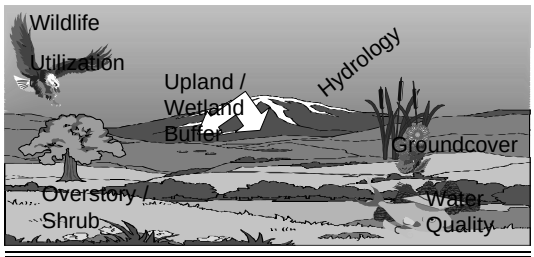
I. Unavoidable Impact
C. Assessment
1. Components
II. Compensatory Mitigation
III. Special Circumstances

Wetland Components
(Continued)

version 4.0



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I. Unavoidable Impact
C. Assessment
2. Method
II. Compensatory Mitigation
III. Special Circumstances

METHOD

version 4.0

Numeric Functional Assessment

- Purpose: To determine, in a systematic way, the presence or absence of a given wetland component.

- Assumption: Wetlands can be measured by assessing a given set of variables.

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I. Unavoidable Impact
C. Assessment
2. Method
II. Compensatory Mitigation
III. Special Circumstances

METHOD
(Continued)

version 4.0

Many methods of assessing the presence of function have been developed, including:

- Habitat Evaluation Procedure (HEP)
- Wetland Evaluation Technique (WET)
- Hydrogeomorphic Methodology (HGM)
- Wetland Rapid Assessment Procedure (WRAP)

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I. Unavoidable Impact
C. Assessment
2. Method
II. Compensatory Mitigation
III. Special Circumstances

METHOD
(Continued)

version 4.0

Any numeric assessment method can be used in calculating mitigation, if:

- the method is technically appropriate for the location and type of impact; and,

- the same method is used for both the impact and mitigation sites.

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I. Unavoidable Impact
C. Assessment
2. Method
II. Compensatory Mitigation
III. Special Circumstances

METHOD
(Continued)

version 4.0

Federal Agencies are developing HGM for use throughout United States. In interim, Jacksonville District has adopted WRAP.

An applicant is not required to perform WRAP, but inclusion of WRAP or another assessment would expedite the Corps' evaluation of an application.

Now, we will use WRAP to assess the impact site . .

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I. Unavoidable Impact
C. Assessment
3. WRAP
II. Compensatory Mitigation
III. Special Circumstances

WRAP

version 4.0

The existing condition: Use WRAP to assign a score from 0 to 3 for each of the six components at the impact site as it exists today.

- Wildlife Utilization - Overstory - Ground Cover
- Buffer - Hydrology - Water Quality Input

The with-project condition: For a typical impact, the wetland components are eliminated. Therefore the WRAP scores for each component will be 0.

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I. Unavoidable Impact
C. Assessment
3. WRAP
II. Compensatory Mitigation
III. Special Circumstances

WRAP
(Continued)

version 4.0

Now calculate the impact site's change in functions.

	Wildlife Utilization	Overstory	Ground Cover	Buffer	Hydrology	Water Quality
Existing Condition	0 to 3	0 to 3	0 to 3	0 to 3	0 to 3	0 to 3
With-Project	0	0	0	0	0	0
Difference	Δ	Δ	Δ	Δ	Δ	Δ

This defines the first variable of the equation.

Δ

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I. Unavoidable Impact
C. Assessment
3. WRAP
II. Compensatory Mitigation
III. Special Circumstances

WRAP
(Continued)

version 4.0

We have six separate “accounts” to keep track of!

Wildlife Utilization	Overstory	Ground Cover	Buffer	Hydrology	Water Quality
Δ	Δ	Δ	Δ	Δ	Δ

WRAP scores vary from 0 to 3. We must divide each Δ by 3 so that the numbers range from 0 to 1. This is so they can be multiplied by the other factors.

Δ / 3	Δ / 3	Δ / 3	Δ / 3	Δ / 3	Δ / 3
Δ	Δ	Δ	Δ	Δ	Δ

Δ

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I. Unavoidable Impact
D. Weighting Factor
1. How Combine?
II. Compensatory Mitigation
III. Special Circumstances

How Combine?

version 4.0

Wildlife Utilization	Overstory	Ground Cover	Buffer	Hydrology	Water Quality
Δ	Δ	Δ	Δ	Δ	Δ

We will combine the six “accounts” into a single score by multiplying each by a Weighting Factor.

Δ	Δ	Δ	Δ	Δ	Δ
x Weight1	x Weight2	x Weight3	x Weight4	x Weight5	x Weight6
Δ1	Δ2	Δ3	Δ4	Δ5	Δ6

Δ x Weight

26

I. Unavoidable Impact
D. Weighting Factor
2. Assigning Weight
II. Compensatory Mitigation
III. Special Circumstances

Assigning Weight

version 4.0

- Purpose: To apply value judgement to individual functions. For example, wildlife utilization may be more important to society than other components.

- Assumption: All functions may not be equal importance.

Δ x Weight

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I. Unavoidable Impact
D. Weighting Factor
2. Assigning Weight
II. Compensatory Mitigation
III. Special Circumstances

Assigning Weight

version 4.0

How?

- Start with equal weighting.
- Change to unequal weighting if specific information warrants.
- Develop and apply on watershed basis.

Prefer to develop weighting as part of interagency team permitting or other watershed efforts.

I. Unavoidable Impact
D. Weighting Factor
2. Assigning Weight
II. Compensatory Mitigation
III. Special Circumstances

Assigning Weight
(Continued)

version 4.0

Five questions used to assign weight.

1. Does project result in identifiable ecological benefits to established watershed issues? (i.e., does an increase or decrease of a function or functions affect an issue listed in a watershed plan or other similar effort?)

continued . . .

I. Unavoidable Impact
D. Weighting Factor
2. Assigning Weight
II. Compensatory Mitigation
III. Special Circumstances

Assigning Weight
(Continued)

version 4.0

2. Does project result in identifiable benefits to adjacent lands/waters of regional importance? (e.g., is any function particularly important to regionally important downstream waters?)

3. Improves status of Federal and/or State listed threatened, endangered or candidate species?

continued . . .

I. Unavoidable Impact
D. Weighting Factor
2. Assigning Weight
II. Compensatory Mitigation
III. Special Circumstances

Assigning Weight
(Continued)

version 4.0

4. Restores or creates ecological features considered to be unusual, unique or rare in region? (e.g., will restoration or impact affect certain habitats/functions that have been largely removed in the past.)

5. Special Considerations?

I. Unavoidable Impact
D. Weighting Factor
3. Calculation
II. Compensatory Mitigation
III. Special Circumstances

Calculation
(Continued)

version 4.0

The sum of the weighting factors will equal 1.

Weight1 + Weight2 + Weight3 + Weight4 + Weight5 + Weight6 = 1

If each of the components are equally important, then each will have 1/6th of the total weight.

Δ	Δ	Δ	Δ	Δ	Δ
x 1/6	x 1/6	x 1/6	x 1/6	x 1/6	x 1/6
---	---	---	---	---	---
Δ1	Δ2	Δ3	Δ4	Δ5	Δ6

I. Unavoidable Impact
D. Weighting Factor
3. Calculation
II. Compensatory Mitigation
III. Special Circumstances

Calculation
(Continued)

version 4.0

Components can be unequally weighted, but the minimum weight for any component is 1/12.

Δ	Δ	Δ	Δ	Δ	Δ
x 1/3	x 1/3	x 1/12	X 1/12	x 1/12	x 1/12
---	---	---	---	---	---
Δ1	Δ2	Δ3	Δ4	Δ5	Δ6

The single score = $\Delta 1 + \Delta 2 + \Delta 3 + \Delta 4 + \Delta 5 + \Delta 6$
$= \sum (\Delta \times \text{Weight})$
This defines the second variable of the equation.

I. Unavoidable Impact
E. Units
1. Units per Acre
II. Compensatory Mitigation
III. Special Circumstances

Units per Acre

version 4.0

- The use of this equation at this point will result in the calculation of the “Units per Acre”

- These units relate to presence of function

- This represents the change, per acre, of the presence of function resulting from the mitigation or impact activities.

Σ (Δ x Weight) = Units per Acre

34

I. Unavoidable Impact
E. Units
1. Units per Acre
II. Compensatory Mitigation
III. Special Circumstances

Units per Acre
(Continued)

version 4.0

Here is an example calculation for an impact site.

	Wildlife Utilization	Overstory	Ground Cover	Buffer	Hydrology	Water Quality
Existing Condition	1.5	1.5	2.5	2.5	3.0	2.5
With-project	0	0	0	0	0	0
Δ	1.5	1.5	2.5	2.5	3.0	2.5
Δ divided by 3	1.5 / 3	1.5 / 3	2.5 / 3	2.5 / 3	3.0 / 3	2.5 / 3
X Weight Factor	x 1/3	X 1/ 3	x 1/12	x1/12	x 1/12	x 1/12
(Δ x Weight) =	1.5 / 9	1.5 / 9	2.5 / 36	2.5 / 36	3.0 / 36	2.5 / 36

Σ (Δ x Weight) = 22.5 / 36 = 0.625 Units per Acre

Σ (Δ x Weight) = Units per Acre

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I. Unavoidable Impact
E. Units
2. Calculation
II. Compensatory Mitigation
III. Special Circumstances

Units

version 4.0

Multiplying the Units per Acre by the number of acres over which the activity occurs results in the total number of units of “loss” in the presence of functions resulting from the proposed impact.

0.625 units/acre X 10 acres = 6.25 units “loss”

[Σ (Δ x Weight)] x Acres = Units

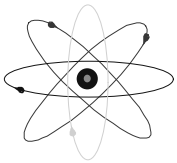
36

I. Unavoidable Impact
E. Units
3. Round Off
II. Compensatory Mitigation
III. Special Circumstances

Round Off

version 4.0

0.625 units/acre X 10 acres = 6.25 units "loss"



We do not know the presence of functions down to two decimal places!!

[Σ (Δ x Weight)] x Acres = Units

37

I. Unavoidable Impact
E. Units
3. Round Off
II. Compensatory Mitigation
III. Special Circumstances

Round Off

version 4.0

Retain three decimal places to preserve accuracy as the Δ is multiplied several times within the formula.

Round the resulting number of units to the nearest integer, except for special circumstances (such as for an exceptionally large or small acreage project)

0.625 units/acre X 10 acres = ~~6.25~~ 6 units "loss"

[Σ (Δ x Weight)] x Acres = Units

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I. Unavoidable Impact

II. Compensatory Mitigation
III. Special Circumstances

Next

version 4.0

Compensatory mitigation must be designed and implemented to replace these 6 units of loss.

[Σ (Δ x Weight)] x Acres = Units

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I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances

version 4.0

II. Compensatory Mitigation

I. Unavoidable Impact

II. Compensatory Mitigation
III. Special Circumstances

Next

version 4.0

There are many ways to provide compensatory mitigation.

One way is to create a replacement wetland.

Now we will calculate the number of units provided by this newly created wetland . . .

I. Unavoidable Impact
II. Compensatory Mitigation
A. On-Site Creation
1. Assessment
III. Special Circumstances

On-Site Creation

version 4.0

Assessment of On-Site Creation uses the same formula but is mathematically the reverse of the impact calculation.

<u>The existing condition</u>: Creation starts with an upland and so the WRAP scores for each component will be 0.

I. Unavoidable Impact
II. Compensatory Mitigation
A. On-Site Creation
1. Assessment
III. Special Circumstances

On-Site Creation
(Continued)

version 4.0

The with-project condition: Next, use WRAP to assign a score from 0 to 3 for each of the six components at the creation site as it is expected to be at full maturity.

Note that for forested systems, the permit may require a final monitoring report at year 5 while full maturity may not occur until long after that!

[Σ (Δ x Weight)] x Acres = Units

43

I. Unavoidable Impact
II. Compensatory Mitigation
A. On-Site Creation
1. Assessment
III. Special Circumstances

On-Site Creation
(Continued)

version 4.0

Full Maturity: The plant community when it has the maximum presence of functions given its landscape position. Forested canopy may not reach full maturity until 40 years or more.

Success Criteria: The plant community at the point it has "proven" the success of the construction and is expected to continue maturing. This is the final permit monitoring report, usually at 3 to 5 years.

[Σ (Δ x Weight)] x Acres = Units

44

I. Unavoidable Impact
II. Compensatory Mitigation
A. On-Site Creation
1. Assessment
III. Special Circumstances

On-Site Creation
(Continued)

version 4.0

Now calculate the increase in functions created.

	Wildlife Utilization	Overstory	Ground Cover	Buffer	Hydrology	Water Quality
Existing Condition	0	0	0	0	0	0
With-Project	0 to 3	0 to 3	0 to 3	0 to 3	0 to 3	0 to 3
Difference	Δ	Δ	Δ	Δ	Δ	Δ
Adjust WRAP	Δ / 3	Δ / 3	Δ / 3	Δ / 3	Δ / 3	Δ / 3
	Δ	Δ	Δ	Δ	Δ	Δ

[Σ (Δ x Weight)] x Acres = Units

45

I. Unavoidable Impact
II. Compensatory Mitigation
A. On-Site Creation
1. Assessment
III. Special Circumstances

On-Site Creation
(Continued)

version 4.0

We combine the six scores into a single number by multiplying each by the Weighting Factor.

Δ	Δ	Δ	Δ	Δ	Δ
x Weight1	x Weight2	x Weight3	x Weight4	x Weight5	x Weight6
---	---	---	---	---	---
Δ1	Δ2	Δ3	Δ4	Δ5	Δ6

The single score = $\Delta 1 + \Delta 2 + \Delta 3 + \Delta 4 + \Delta 5 + \Delta 6$
$= \sum (\Delta \times \text{Weight})$
So far, the same equation as for impact.

[Σ (Δ x Weight)] x Acres = Units

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I. Unavoidable Impact
II. Compensatory Mitigation
A. On-Site Creation
2. Units per Acre
III. Special Circumstances

Units per Acre

version 4.0

Here is an example calculation for the creation site.

	Wildlife Utilization	Overstory	Ground Cover	Buffer	Hydrology	Water Quality
Existing Condition	0	0	0	0	0	0
With-project	2.5	2.5	2.5	0.5	2.0	2.0
Δ	2.5	2.5	2.5	0.5	2.0	2.0
Δ divided by 3	2.5 / 3	2.5 / 3	2.5 / 3	0.5 / 3	2.0 / 3	2.0 / 3
X Weight Factor	x 1/3	X 1/ 3	x 1/12	x1/12	x 1/12	x 1/12
(Δ x Weight) =	2.5 / 9	2.5 / 9	2.5 / 36	0.5 / 36	2.0 / 36	2.0 / 36

Σ (Δ x Weight) = 27.0 / 36 = 0.750 Units per Acre

[Σ (Δ x Weight)] = Units per Acre

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I. Unavoidable Impact
II. Compensatory Mitigation
A. On-Site Creation
3. Units (unadjusted)
III. Special Circumstances

Units (unadjusted)

version 4.0

Multiplying the Units per Acre by the number of acres that will be created will provide the number of units of "lift" representing the increase in the presence of functions resulting from the creation of the wetland.

0.750 units/acre X 20 acres = 15 units "lift"
(unadjusted) (unadjusted)

The equation is still the same as for impact. But . . .

[Σ (Δ x Weight)] x Acres = Units

48

I. Unavoidable Impact
II. Compensatory Mitigation
A. On-Site Creation
3. Units (unadjusted)
III. Special Circumstances

Units (unadjusted)
(Continued)

version 4.0

While an impact activity is relatively straightforward,

There are additional concerns before agreeing to the number of units of "lift" just calculated.

[Σ (Δ x Weight)] x Acres = Units

I. Unavoidable Impact
II. Compensatory Mitigation
A. On-Site Creation
4. Concerns.
III. Special Circumstances

Concerns

version 4.0

What are our concerns with on-site creation?

?

- Time between impact and full maturity
- Some functions mature sooner than others.
- Events outside of control of manager could affect full maturity
- Not every square foot of the created wetland reaches full maturity.
- Others?

[Σ (Δ x Weight)] x Acres = Units

I. Unavoidable Impact
II. Compensatory Mitigation
A. On-Site Creation
4. Concerns.
III. Special Circumstances

Concerns
(Continued)

version 4.0

!

These concerns are incorporated into the following variables.

Temp = Temporal Loss Factor
= Adjustment for time

Risk = Risk Factor
= Adjustment for uncontrollable events

[Σ (Δ x Weight)] x Acres = Units

I. Unavoidable Impact
II. Compensatory Mitigation
B. Temporal Loss
1. Defined
III. Special Circumstances

Temporal Loss

version 4.0

- Purpose: To take into account the time lag between impact and when mitigation reaches maturity.

- Assumption: There is a time lag between when mitigation is completed and when it is fully replaces lost functions or structure.

[Σ (Δ x Weight)] x Acres = Units

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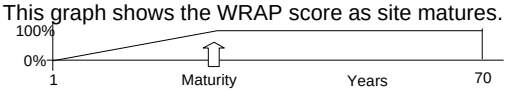
I. Unavoidable Impact
II. Compensatory Mitigation
B. Temporal Loss
2. Calculation
III. Special Circumstances

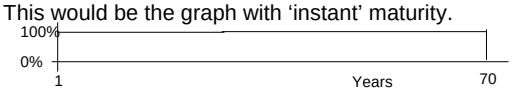
Temporal Loss
(Continued)

version 4.0

This graph shows the WRAP score as site matures.



This would be the graph with 'instant' maturity.



The Temporal Factor is area of the top graph divided by the bottom graph. This is third variable.

[Σ (Δ x Weight x Temp)] x Acres = Units

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I. Unavoidable Impact
II. Compensatory Mitigation
B. Temporal Loss
3. Comments
III. Special Circumstances

Temporal Loss
(Continued)

version 4.0

- The Temporal Loss Factor allows mitigation that occurs after impact to be counted as compensation.

- The number of years for a plant community to reach maturity is based on local experience and literature. Also varies depending on climate, planting techniques & etc. Will generally be standardized within a region.

[Σ (Δ x Weight x Temp)] x Acres = Units

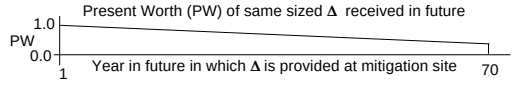
54

I. Unavoidable Impact
II. Compensatory Mitigation
B. Temporal Loss
3. Comments
III. Special Circumstances

Temporal Loss
(Continued)

version 4.0

Temporal Loss Factor is adjusted for "Present Worth" since a Δ "received" in the future is less valuable than if the Δ was "received" today.



The calculation is complicated, but a lookup table is available for day to day use.

[Σ (Δ x Weight x Temp)] x Acres = Units

55

I. Unavoidable Impact
II. Compensatory Mitigation
C. Risk
1. Defined
III. Special Circumstances

Risk

version 4.0

- Purpose: To account for mitigation not being successful.

- Assumption: Mitigation is rarely performed under ideal conditions.

[Σ (Δ x Weight x Temp x Risk)] x Acres = Units

56

I. Unavoidable Impact
II. Compensatory Mitigation
C. Risk
2. Calculation
III. Special Circumstances

Risk
(Continued)

version 4.0

These considerations are used to estimate risk.
- Mitigation type (creation, restoration, preserve)
- Size of and/or landscape context of the site
- Maintenance requirements
- Maintenance plan

A draft worksheet is available to "score" these.

The Risk Factor = 1.0 if the mitigation is expected to be 100% successful. This is fourth variable.

[Σ (Δ x Weight x Temp x Risk)] x Acres = Units

57

I. Unavoidable Impact
II. Compensatory Mitigation
C. Risk
3. Comments
III. Special Circumstances

Risk
(Continued)

version 4.0

- The Risk Factor is related to the Temporal Loss Factor as the type of mitigation is varied.

	Temporal	Risk
Creation	Long	High
Restoration	Short	Moderate
Preservation	n.a.	Low

- The administrative constraints on mitigation banks tend to reduce risk to nil (that is, 100% success).

[∑ (Δ x Weight x Temp x Risk)] x Acres = Units

58

I. Unavoidable Impact
II. Compensatory Mitigation
D. Temp & Risk
1. Calculation
III. Special Circumstances

Temp & Risk

version 4.0

Note that Temp and Risk Factors are applied to each wetland "account" individually.

- Some wetland functions mature earlier than others, e.g., hydrology could be fully established sooner than full maturity of the tree saplings.

- Some types of work is less affected then others by outside influences, e.g., hydrology restored from installing a ditch block has less risk than restoration of wildlife habitat adjacent to houses.

[∑ (Δ x Weight x Temp x Risk)] x Acres = Units

59

I. Unavoidable Impact
II. Compensatory Mitigation
D. Temp & Risk
2. Units per Acre
III. Special Circumstances

Units per Acre

version 4.0

Here are the units per acre for each account that we calculated earlier for the example creation site. Now we will modify these with <u>sample</u> Temps and Risks

	Wildlife Utilization	Overstory	Ground Cover	Buffer	Hydrology	Water Quality
(Δ x Weight) =	2.5 / 9	2.5 / 9	2.5 / 36	0.5 / 36	2.0 / 36	2.0 / 36
X Temp Factor	x 0.4137	x 0.3312	x0.9324	x 0.9624	x0.9624	x0.9624
X Risk Factor	x 0.67	x 0.67	x0.73	x 0.67	x0.67	x0.67
units per acre =	0.077	0.061	0.047	0.009	0.036	0.036

[∑ (Δ x Weight x Temp x Risk)] = 0.266 Units per Acre

[∑ (Δ x Weight x Temp x Risk)] = Units per acre

60

I. Unavoidable Impact
II. Compensatory Mitigation
D. Temp & Risk
2. Units per Acre
III. Special Circumstances

Units per Acre
(Continued)

version 4.0

The Temp Factor for three of the accounts is 0.9654.
- 0.9654 read from the lookup table for 3 years
- 3 years based on estimate when the hydrology, buffer, and water quality functions will mature.

The Temp Factor for overstory is 0.3312.
- 0.3312 read from the lookup table for 41 years.
- 41 years is estimated maturity of saplings.

[Σ (Δ x Weight x Temp x Risk)] = Units per acre

61

I. Unavoidable Impact
II. Compensatory Mitigation
D. Temp & Risk
2. Units per Acre
III. Special Circumstances

Units per Acre
(Continued)

version 4.0

The Risk Factors were all high because:
- This example creation site is small
- The example site will be surrounded by homes
- Natural sheetflow is replaced by drainage system

A worksheet could be used to mathematically score the risk or could use experience from other sites.

[Σ (Δ x Weight x Temp x Risk)] = Units per acre

62

I. Unavoidable Impact
II. Compensatory Mitigation
D. Temp & Risk
3. Units
III. Special Circumstances

Units

version 4.0

Multiplying the Units per Acre by the number of acres that will be created will provide the number of units of "lift". This is the increase in the presence of functions resulting from the creation of the wetland.

0.266 units/acre X 20 acres = ~~5.32~~ 5 units "lift"

Now we will compare this to impact site . . .

[Σ (Δ x Weight x Temp x Risk)] x Acres = Units

63

I. Unavoidable Impact
II. Compensatory Mitigation
E. Project Total
1. Compare
III. Special Circumstances

Project Total

version 4.0

For the impact site:
0.625 units/acre X 10 acres = ~~6.25~~ 6 units "loss"

For the creation site:
0.266 units/acre X 20 acres = ~~5.32~~ 5 units "lift"

The proposed project will result in a net change in the presence of functions:
Net = (6 units "loss") - (5 units "lift") = 1 unit "loss"

[Σ (Δ x Weight x Temp x Risk)] x Acres = Units

64

I. Unavoidable Impact
II. Compensatory Mitigation
E. Project Total
2. Adjust
III. Special Circumstances

Project Total
(Continued)

version 4.0

Impact: 0.625 units/acreX10 acres=~~6.25~~ 6 units "loss"
Created: 0.266 units/acreX20 acres=~~5.32~~ 5 units "lift"
Net = (6 units "loss") - (5 units "lift") = 1 unit "loss"

If the quantity of lift equals the loss, then the project is assumed to provide sufficient compensatory mitigation, subject to common sense (for example, creation of mangrove does not compensate for impacts to cypress).

[Σ (Δ x Weight x Temp x Risk)] x Acres = Units

65

I. Unavoidable Impact
II. Compensatory Mitigation
E. Project Total
2. Adjust
III. Special Circumstances

Project Total
(Continued)

version 4.0

Impact: 0.625 units/acreX10 acres=~~6.25~~ 6 units "loss"
Created: 0.266 units/acreX20 acres=~~5.32~~ 5 units "lift"
Net = (6 units "loss") - (5 units "lift") = 1 unit "loss"

Options to bring the Net to zero:
- Adjust number of acres
- Change management of work to reduce risk or other variable
- Add another mitigation location

[Σ (Δ x Weight x Temp x Risk)] x Acres = Units

66

I. Unavoidable Impact
II. Compensatory Mitigation
E. Project Total
2. Adjust
III. Special Circumstances

Project Total
(Continued)

version 4.0

Impact: 0.625 units/acreX10 acres=~~6.25~~ 6 units "loss"
Created: 0.266 units/acreX20 acres=~~5.32~~ 5 units "lift"
Net = (6 units "loss") - (5 units "lift") = 1 unit "loss"

For our example, we will add another mitigation location to the project. However, instead of creating a wetland, we will restore an existing wetland.

[Σ (Δ x Weight x Temp x Risk)] x Acres = Units

67

I. Unavoidable Impact
II. Compensatory Mitigation
F. Restoration
1. WRAP
III. Special Circumstances

Restoration
(Continued)

version 4.0

The existing condition: Use WRAP to assign a score from 0 to 3 for each of the six components at the impact site as it exists today.

The with-project condition: Next, use WRAP to assign a score from 0 to 3 for each of the six components at the creation site as it is expected to be at full maturity.

[Σ (Δ x Weight x Temp x Risk)] x Acres = Units

68

I. Unavoidable Impact
II. Compensatory Mitigation
F. Restoration
1. WRAP
III. Special Circumstances

Restoration
(Continued)

version 4.0

Note the WRAP scores to calculate Δ vary depending on the type of activity.

	Existing Condition	With-Project
Impact	0 to 3	0
Creation	0	0 to 3
Restoration	0 to 3	larger 0 to 3

Δ

The formula is the same for each type of activity!

[Σ (Δ x Weight x Temp x Risk)] x Acres = Units

69

I. Unavoidable Impact
II. Compensatory Mitigation
F. Restoration
2. Units
III. Special Circumstances

Units

version 4.0

Sample calculation for our restoration site.

	Wildlife Utilization	Overstory	Ground Cover	Buffer	Hydrology	Water Quality
Existing Condition	1.0	0.5	1.0	0.5	2.0	2.0
With-project	2.5	2.5	2.5	2.0	2.5	2.5
Δ	1.5	2.0	1.5	1.5	0.5	0.5
Δ divided by 3	1.5 / 3	2.0 / 3	1.5 / 3	1.5 / 3	0.5 / 3	0.5 / 3
X Weight Factor	x 1/3	X 1/ 3	x 1/12	x1/12	x 1/12	x 1/12
(Δ x Weight) =	1.5 / 9	2.0 / 9	1.5 / 36	1.5 / 36	0.5 / 36	0.5 / 36

Continued next page . . .

[Σ (Δ x Weight x Temp x Risk)] x Acres = Units

I. Unavoidable Impact
II. Compensatory Mitigation
F. Restoration
2. Units
III. Special Circumstances

Units

(Continued)

version 4.0

Continued . . .

	Wildlife Utilization	Overstory	Ground Cover	Buffer	Hydrology	Water Quality
(Δ x Weight) =	1.5 / 9	2.0 / 9	1.5 / 36	1.5 / 36	0.5 / 36	0.5 / 36
X Temp Factor	x 0.4137	x 0.3312	x0.9324	x 0.9624	x0.9624	x0.9624
X Risk Factor	x 0.67	x 0.67	x0.73	x 0.67	x0.67	x0.67
units per acre =	0.046	0.049	0.028	0.027	0.009	0.009

[Σ (Δ x Weight x Temp x Risk)] = 0.168 Units per Acre

0.168 units/acre X 6 acres = 1.01 units “lift”

[Σ (Δ x Weight x Temp x Risk)] x Acres = Units

I. Unavoidable Impact
II. Compensatory Mitigation
G. Revised Project
1. Calculation
III. Special Circumstances

Revised Project

version 4.0

Impact: 0.625 units/acreX10 acres=~~6.25~~ 6 units “loss”
Created: 0.266 units/acreX20 acres=~~5.32~~ 5 units “lift”
Restore: 0.168 units/acreX 6 acres=~~1.01~~ 1 unit “lift”

Net = (5 units + 1 unit) “lift” - 6 units “loss” = 0 units

The compensatory mitigation provides replacement functions essentially equal to the functions lost.

[Σ (Δ x Weight x Temp x Risk)] x Acres = Units

I. Unavoidable Impact
II. Compensatory Mitigation
G. Revised Project
2. Ratio
III. Special Circumstances

Ratio

version 4.0

Impact: 0.625 units/acreX10 acres=~~6.25~~ 6 units "loss"
Created: 0.266 units/acreX20 acres=~~5.32~~ 5 units "lift"
Restore: 0.168 units/acreX 6 acres=~~1.01~~ 1 unit "lift"
Net = (5 units + 1 unit) "lift" - 6 units "loss" = 0 units

How does one compare this to the mitigation "ratio"? The mitigation ratio is based on acres.

Ratio = (20acres+6acres) "lift" / 10acres "loss" = 2.6:1

[Σ (Δ x Weight x Temp x Risk)] x Acres = Units

I. Unavoidable Impact
II. Compensatory Mitigation
G. Revised Project
3. Tally Polygon
III. Special Circumstances

Tally Polygon

version 4.0

Each activity and its acreage is called a "Polygon"
A project is subdivided into polygons.
The mitigation plan will include a tally of the polygons.

Polygon	Description	units/acre	X acres	= units	type
1	Impact	0.625	10	~~6.25~~ 6	"loss"
2	Creation	0.266	20	~~5.32~~ 5	"lift"
3	Restore	0.168	6	~~1.01~~ 1	"lift"

Net = (5 units + 1 unit) "lift" - 6 units "loss" = 0 units

[Σ (Δ x Weight x Temp x Risk)] x Acres = Units

I. Unavoidable Impact
II. Compensatory Mitigation

III. Special Circumstances

version 4.0

These are the fundamentals common to all projects.

Now for some of the special circumstances . . .

[Σ (Δ x Weight x Temp x Risk)] x Acres = Units

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances

version 4.0

III. Special Circumstances

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances

version 4.0

The special circumstances are:

- Off-site mitigation (proximity factor)
- Secondary Impact (and Large Preserves)
- Preservation

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances
A. Off-Site mitigation
1. introduction

Off-Site Mitigation

version 4.0

What if the mitigation is off-site?

- Off-site location that is contiguous with other natural areas is more appropriate than on-site “postage stamp”

- This may better address watershed issues

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances
A. Off-Site mitigation
2. Concerns

Concerns

version 4.0

What are our concerns with off-site mitigation?

?

- Wildlife different?
- Different receiving water bodies (especially for water quality function)?
- If impact is large % of small watershed, will it be fully compensated by mitigation in another watershed?
- Others?

[Σ (Δ x Weight x Temp x Risk)] x Acres = Units

79

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances
A. Off-Site mitigation
2. Concerns

Concerns
(Continued)

version 4.0

!

These concerns are incorporated into the Proximity Factor variable.

[Σ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

80

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances
A. Off-Site mitigation
3. Proximity Factor

Proximity Factor

version 4.0

- Purpose: To take into account distance between the impact and mitigation sites.

- Assumption: Mitigation in the same watershed as the impact is optimal.

[Σ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

81

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances
A. Off-Site mitigation
3. Proximity Factor

Proximity Factor
(Continued)

version 4.0

This factor has two components.

- Fish and Wildlife
  (based on number of guilds at sites)

- Diminishing Relevance
  (based on watersheds)

[Σ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

82

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances
A. Off-Site mitigation
4. Fish & Wildlife

Fish & Wildlife

version 4.0

The Fish & Wildlife component is based on two questions.

Question A: Is the guild represented at the impact site? Answer either yes or no for each guild.

Neotropical Migrants	Reptiles
Wading Birds	Freshwater Fish
Raptors	Small Mammals
Waterfowl	Large Mammals
Amphibians	Invertebrates

[Σ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

83

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances
A. Off-Site mitigation
4. Fish & Wildlife

Fish & Wildlife
(Continued)

version 4.0

Question B: Does location of the mitigation relative to impact **reduce** the ability to mitigate that guild?

	A	B		A	B
Neotropicals	no	---	Reptiles	yes	no
Wading Birds	yes	yes	Freshwater Fish	yes	no
Raptors	no	---	Small Mammals	yes	yes
Waterfowl	yes	no	Large Mammals	no	---
Amphibians	yes	no	Invertebrates	yes	no

Fish & Wildlife Score = B yes's ÷ A yes's = 2 / 7

[Σ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

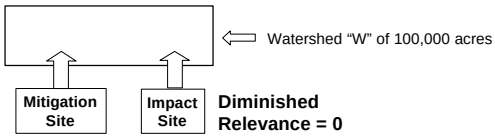
84

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances
A. Off-Site mitigation
5. Diminish Relevance

Diminished Relevance

version 4.0

If the impact site is in the same watershed as the mitigation site, the Diminishing Relevance score = 0



Diminished Relevance = 0

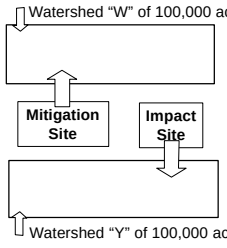
[∑ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances
A. Off-Site mitigation
5. Diminish Relevance

Diminished Relevance

(Continued)

version 4.0



If the impact site is in another watershed, then the math is more complicated.

First, one must define the "Service Area" for the mitigation site . . .

[∑ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances
A. Off-Site mitigation
5. Diminish Relevance

Diminished Relevance

(Continued)

version 4.0

The Service Area is the watershed or watersheds within which impacts can be appropriately compensated at the mitigation site.

For a Mitigation Bank, this will be defined in the Mitigation Bank Instrument.

For other mitigation, this must be determined at the time the application is reviewed.

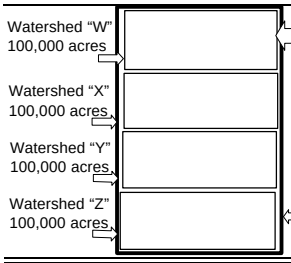
[∑ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances
A. Off-Site mitigation
5. Diminish Relevance

Diminished Relevance

(Continued)

version 4.0



Here, the Service Area was determined to encompass these four watersheds.

[∑ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

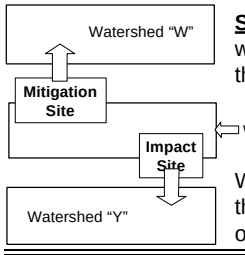
88

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances
A. Off-Site mitigation
5. Diminish Relevance

Diminished Relevance

(Continued)

version 4.0



Second,find the watershed or watersheds that are between the impact and mitigation sites.

We found one watershed in this example. Now mark this on the Service Area map . . .

[∑ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

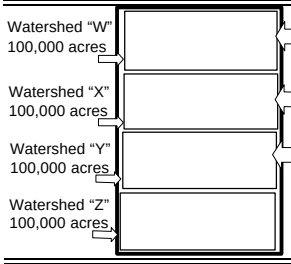
89

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances
A. Off-Site mitigation
5. Diminish Relevance

Diminished Relevance

(Continued)

version 4.0



Third, calculate the Diminished Relevance score . . .

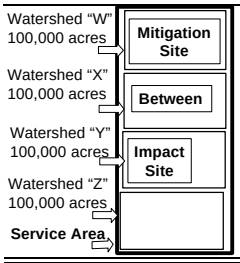
[∑ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

90

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances
A. Off-Site mitigation
5. Diminish Relevance

Diminished Relevance
(Continued)

version 4.0



$$= \left[\frac{(W+X+Y)}{(W)} - 1 \right] \div \left[\frac{(\textbf{Service Area})}{(W)} - 1 \right]$$

$$= \left[\frac{(300{,}000)}{(100{,}000)} - 1 \right] \div \left[\frac{(\textbf{400,000})}{(100{,}000)} - 1 \right]$$

= 2/3 = score for impact site in "Y"

Score is based on a ratio of the acres of the watersheds.

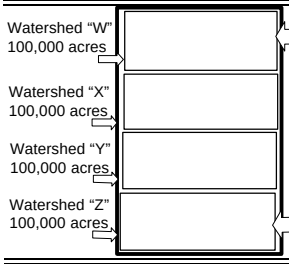
[Σ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

91

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances
A. Off-Site mitigation
5. Diminish Relevance

Diminished Relevance
(Continued)

version 4.0



Diminished Relevance Score = 1.0 if the Impact site is in the furthest watershed

Diminished Relevance = 1

[Σ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

92

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances
A. Off-Site mitigation
6. Calculation

Calculation

version 4.0

At last! The Proximity Factor is calculated by finding the average of the two component scores.

$$1 \div \left[\frac{(\text{Fish\&Wildlife Score}) + (\text{Diminishing Relevance})}{2} + 1 \right]$$

This is the fifth variable in the formula. Note that if the mitigation and impact is in the same watershed, the Proximity Factor = 1

[Σ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

93

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances
B. Secondary Impact
1. introduction

Secondary Impact

version 4.0

Wetlands can be impacted even if fill is not placed directly on them.

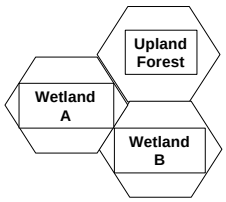
Wetlands are affected by activities adjacent to it.

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances
B. Secondary Impact
2. Illustration

Secondary Impact
(Continued)

version 4.0

We will assess the impact on Wetland A.



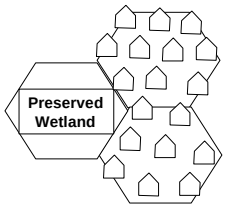
Existing Condition. The wetland has surrounding natural vegetation. It receives clean runoff, is connected to a larger area of habitat, and is buffered from other uses.

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances
B. Secondary Impact
2. Illustration

Secondary Impact
(Continued)

version 4.0

We then build houses but preserve Wetland A.



With Project Condition. The wetland is now smaller and is impacted by the houses. The numeric functional assessment will be lower than the existing but not zero.

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances
B. Secondary Impact
3. Comparison

Types of Activities

version 4.0

We add one more type of activity to our comparison table.

	Existing Condition	With-Project
Impact	0 to 3	0
Creation	0	0 to 3
Restoration	0 to 3	larger 0 to 3
Secondary Impact	0 to 3	smaller 0 to 3

Δ

[Σ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

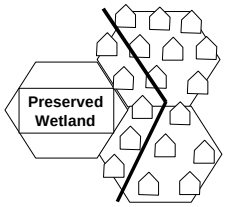
97

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances
B. Secondary Impact
4. Buffer

Buffer

version 4.0

We then provide a buffer to Wetland A.



With Project Condition. Is still an impact but not the same as the last example.

A buffer is one product/goal of the the minimization aspect of mitigation.

[Σ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

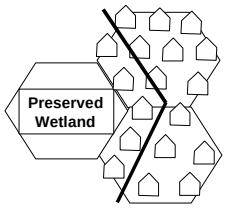
98

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances
B. Secondary Impact
4. Buffer

Buffer
(Continued)

version 4.0

A “preserved wetland” is an impact?!



Adjacent work can degrade a preserved wetland.

The activity may be on an upland.

[Σ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

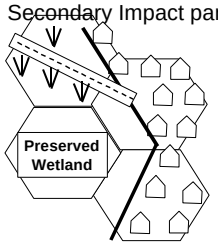
99

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances
B. Secondary Impact
4. Buffer

Buffer
(Continued)

version 4.0

Secondary Impact part of Corps permit review?



No, if all activity is on upland. No Corps permit!

Yes, if some portion of activity requires a Corps permit (for example, if requires fill in wetland for an access road)

[Σ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

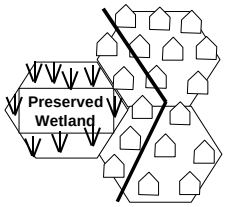
100

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances
B. Secondary Impact
4. Buffer

Buffer
(Continued)

version 4.0

How can mitigate for secondary impact?



The degradation resulting from change in adjacent land use can be sometimes be countered by performing restoration or other work within the Preserved Wetland.

[Σ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

101

I. Unavoidable Impact
II. Compensatory Mitigation
III. Special Circumstances
B. Secondary Impact
5. Large Preserves

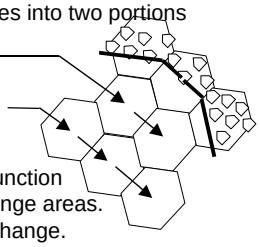
Large Preserves

version 4.0

Note: divide large preserves into two portions

1- The “fringe” areas

2 - The “core” areas are not affected by the work



Calculate the change in function (impact) for each of the fringe areas. The core areas have no change.

[Σ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

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C. Preservation
1. Introduction

Preservation

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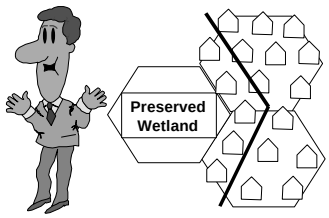

Lets agree that this represents a project that has "passed" the avoidance, minimization, and mitigation requirements . . .

[Σ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

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Preservation

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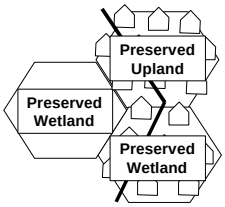
. . . But instead of building, we place an easement or transfer title that prevents the houses being built.

We now calculate the number of units of "lift" based on removing this development threat . . .



[Σ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

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I. Unavoidable Impact
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2. Calculation

Preservation

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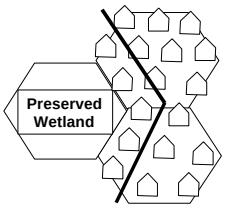
<u>Without Project Condition</u>. This is condition of the site that is likely to occur. Is the result of "..a demonstrable threat of aquatic function degradation due to human activities that might not otherwise be expected to be restricted." (Joint State/Federal Mitigation Bank Review Team Process, Operational Draft, October 1998)



[Σ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

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2. Calculation

Preservation
(Continued)

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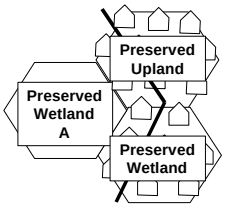
Existing Condition. Is the condition "today." The only change from the "Without Project" condition is the placement of a conservation easement, change in ownership, etc., that restricts use of site.



[Σ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

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I. Unavoidable Impact
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2. Calculation

Preservation
(Continued)

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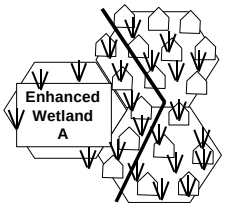
With Project Condition. Is the condition the result of physical work within the wetland itself and/or work in adjacent areas that then benefit the wetland.



[Σ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

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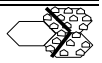
The calculation has three steps.



Step 1 Without Project → Δ ← Existing Condition

Calculate difference in function due to preservation

Step 2 Existing → Δ ← With Project Condition

Calculate difference due to physical enhancement/restoration

Step 3 Total units of "lift" = Step 1 + Step 2

[Σ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

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I. Unavoidable Impact
II. Compensatory Mitigation
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3. Comparison

Types of Activities

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Now add this to our comparison table.

	Without Project	Existing	With-Project
Impact	Not applicable	0 to 3	0
Creation	Not applicable	0	0 to 3
Restoration	Not applicable	0 to 3	larger 0 to 3
Secondary Impact	Not applicable	0 to 3	smaller 0 to 3
Preservation	smaller 0 to 3	0 to 3	larger 0 to 3

Δ

[Σ (Δ x Weight x Temp x Risk)] x Acres x Proximity = Units

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I. Unavoidable Impact
II. Compensatory Mitigation
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C. Preservation
3. Comparison

Types of Activities

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	Without Project	Existing	With-Project
Impact	Not applicable	0 to 3	0
Creation	Not applicable	0	0 to 3
Restoration	Not applicable	0 to 3	larger 0 to 3
Secondary Impact	Not applicable	0 to 3	smaller 0 to 3
Preservation	smaller 0 to 3	0 to 3	larger 0 to 3

A preservation polygon will have two Δ's

Δ Preserve

Δ Enhance / Restore

[Σ (Δ x Weight x Temp x Risk)] x Acres x Proximity = Units

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Jacksonville District

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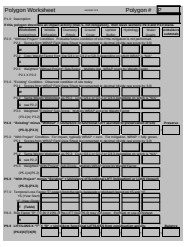
Fill-in-the-blank worksheets are available. Their use is optional. They record and present the calculations for permit review.



[Σ (Δ x Weight x Temp x Risk)] x Acres X Proximity = Units

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of Engineers
Jacksonville District

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Details on this topic are found in the Joint State/Federal Mitigation Bank Review Team Process, Operational Draft, October 1998

Questions?

http://www.saj.usace.army.mil/permit