Toronto and Region Conservation Authority

Guideline for Determining Ecosystem Compensation (After the decision to compensate has been made)

Updated June 2023

ACKNOWLEDGEMENTS

This document was prepared by the Toronto and Region Conservation Authority and was made possible by the generous funding and in-kind support provided by the Regional Municipality of Peel, the Regional Municipality of York, the City of Toronto, and the Regional Municipality of Durham.

Toronto and Region Conservation Authority formally adopted the Guideline for Determining Ecosystem Compensation (the Guideline) in **June 2018** (RES.#A85/18). This update was adopted in June 2023 (RES.#A 110/23), following a review of the early application successes and challenges of the Guideline.

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This document should be referenced as:
Guideline for Determining Ecosystem Compensation, Toronto and Region Conservation Authority, June 2023.

HOW TO READ THIS DOCUMENT

The Guideline for Determining Ecosystem Compensation (referred to as the "Guideline") presents an approach for replacing natural features lost through the development and/or infrastructure planning processes after the decision to *compensate* has been made. This Guideline consists of four sections, a glossary, references, and four appendices.

Section 1: An introduction provides an overview of the context, rationale, and outlines principles that establish the intent of the Guideline.

Section 2: Outlines an approach for determining compensation requirements that attempts to replicate, to the extent possible and without significant delay or *lag time*, the same *ecosystem structure* and associated level of *ecosystem functions* that are to be lost.

Section 3: Lists and describes important considerations in planning and implementing a compensation project.

Section 4: Explains the TRCA habitat restoration planning and implementation approach.

Glossary: Provides definitions of terms used in the Guideline.

References: Lists documents sourced in the development of the Guideline

Appendix A: Lists and illustrates typical restoration plans and details by ecosystem type.

Appendix B: Describes the method of calculating *basal area*.

Appendix C: Provides information on individual tree replacement ratios for when the *basal area* approach is not suitable for determining compensation.

Appendix D: Illustrates and describes examples of compensation options.

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1.0 INTRODUCTION

As the *Toronto region* continues to grow, increased stress is placed on natural heritage systems and on their ability to provide the same benefits to the population. Conservation in an urban context is challenging because of the finite space available to fit all basic needs of communities, including homes, workplaces, amenities, infrastructure and natural features and areas. Issues at the larger scale, such as global climate change, add to the complexity of addressing the local challenges. These pressures should result in increased support for conservation, however, despite a strong protective policy and regulatory regime, natural features and the functions and services they provide continue to decline within the *Toronto region*.

Within this context, ecosystem compensation becomes an important tool to help ensure that the critical *ecosystem functions* and *services* lost through development and infrastructure are restored back on the landscape for the betterment of communities.

Toronto and Region Conservation Authority (TRCA) and our municipal partners are dedicated to the protection, restoration and enhancement of the *natural system,* its features and functions, and the valuable *ecosystem services* that the system provides to the *Toronto region*. Our agency's ecological restoration programs, and the strong environmental objectives and policies contained in municipal official plans clearly demonstrate this commitment.

To help replace losses to the *natural system* that are determined in the planning or environmental assessment processes to be unavoidable*,* TRCA, municipalities and landowners, have used ecosystem compensation. This has typically occurred when the natural features in question are not protected by federal, provincial or municipal policy, or when draft approvals to remove features have remained in place from previous policy regimes. *Impacts* to the *natural system* can be even more pronounced in the case of infrastructure, as the need for linear alignments often limits the ability to avoid natural features.

Compensation Should Not Be the "Default"

The use of the Guideline does not negate the need to apply the *mitigation hierarchy* when development and infrastructure planning affects natural features. In other words, protection through avoidance, minimization and mitigation should be pursued to its fullest before compensation scenarios are proposed. The following figure (Figure 1) outlines the typical compensation review process including where to apply the *mitigation hierarchy.*

Setting Principles and Standards

To date, the application of compensation has resulted in some success at replacing lost natural features and the *ecosystem functions* they provide. However, there are challenges, such as the limited availability of land for restoration, the *risk* and complexity associated with restoration, lengthy negotiations, lack of transparency, inconsistent results and, in many instances, an inability to fully replace the lost *ecosystem functions* and land base. Some of these challenges are difficult, if not impossible to fully address,

however, establishing a Guideline that sets principles and standards should help to address many of them. The principles and standards established herein are intended to ensure that compensation remains a last resort and that all efforts for protection on site are exhausted prior to contemplating removals. Standards of practice can also help ensure that compensation restoration projects are adequately financed and successfully implemented for the long term.

Municipal and Other Public Agency Adaptation

It is recognized that each municipality may have their own unique objectives and approaches to ecosystem compensation. This Guideline outlines the important principles and methods needed for successful compensation outcomes, while also recognizing that municipalities or other public agencies may wish to adapt these to their own needs.

As indicated by the box on the lower left in Figure 1, the Guideline has been organized to address each technical aspect of the compensation approach, from determining what is required to replace the impacted ecosystem, to strategic application of compensation, to monitoring and documenting outcomes.

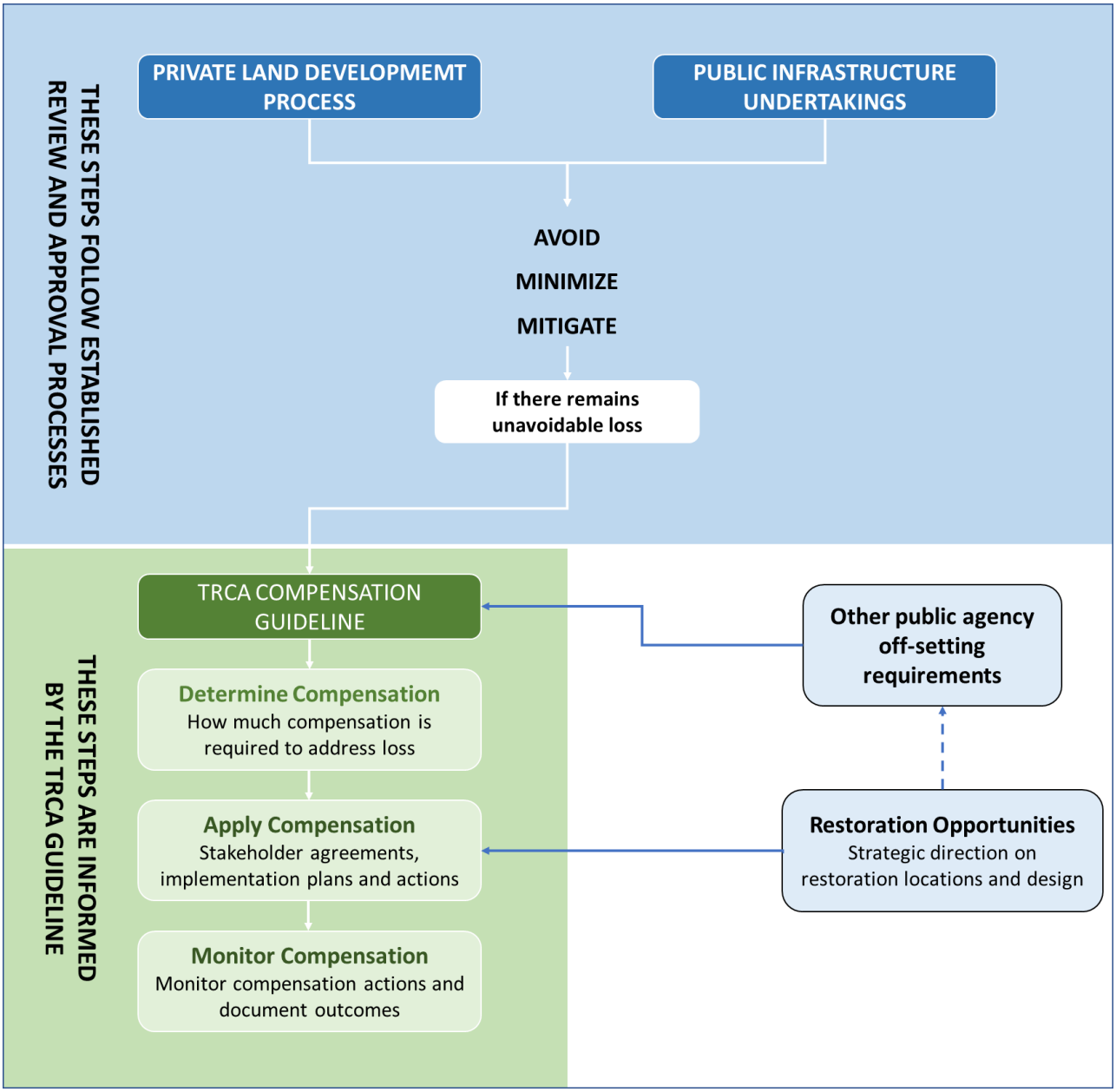

Figure 1: Typical Compensation and Review and Approval Processes.

1.1 Purpose and Scope of the Guideline

The purpose of this Guideline is to provide guidance on how to determine the total amount of compensation required to replace lost or altered ecosystems in a repeatable and transparent manner, after it has been decided that compensation is required. The Guideline is written to assist planners, ecologists, other practitioners, and stakeholders in understanding how compensation for ecosystem losses can be implemented. Promoting strategic and effective implementation of compensation

restoration, the Guideline attempts to provide a standard and consistent approach, informed by scientific expertise and experience in the application of natural heritage management and ecological restoration.

Ecosystem Structure, Functions and Services

This Guideline determines requirements for replacing the structure and the land base of a natural feature lost to development or infrastructure. Once established and over time, the restored *ecosystem structure* provides renewed *ecosystem functions*, which provides the foundation for the provision of *ecosystem services*. There are several *risks* and uncertainties associated with attempting to replace complex ecosystems. The re-establishment of similar *ecosystem functions* and associated services is far from certain and can take a significant amount of time. Adhering to the standards in this Guideline (along with long term protection, management, and the passage of time) can lead to the replacement of similar *ecosystem functions* and *services*. In some instances, over a longer time frame, there may be the opportunity to realize a gain in these functions and services.

What the Guideline Is Not

The Guideline does not provide guidance on when removals are appropriate with associated compensation. Rather, this determination is made through the planning, environmental assessment or permit processes, and guided by policy addressing compensation, where such policy exists.

This Guideline does not replace, or in any way negate the requirements of other legislation applicable to *impacts* to species or ecosystems at the municipal, provincial, or federal levels. Protection, and ideally enhancement of the existing *natural system* should remain a primary goal of natural heritage systems planning. The intent of this Guideline is not to weaken this goal or diminish the ability to protect ecosystems *in situ*.

The Guideline is not suggesting any modifications to the existing planning, environmental assessment or permitting processes leading up to the decision to allow ecological *impacts* with compensation. However, the decision will be better informed by the information in the Guideline given that it articulates what is warranted when the decision is made.

The Guideline cannot be used to determine compensation requirements for built types of *green infrastructure* such as low impact development stormwater management facilities.

1.2 Applicability of the Guideline

The Guideline can be applied to any natural feature (e.g., forests, woodlands, wetlands, thickets and meadows) that has been determined through review of applications and undertakings for development planning, infrastructure, or TRCA permits to require compensation.

Buffers or Vegetation Protection Zones

While the Guideline can apply to natural features or restoration and enhancement areas, it does not apply to *buffers* or vegetation protection zones. *Buffers* are not addressed within the Guideline at this time due to the complexity and difficultly in replacing their intended functions.

The primary role of *buffers* is to help safeguard natural features from negative effects associated with adjacent land use. Attempting to *compensate* for loss of a *buffer* by restoring an ecosystem elsewhere on the landscape does not address this primary function and would leave the subject natural feature susceptible to degradation. Further, a restored natural feature, such as a woodland or a wetland, would have a *buffer* applied to it once the lands adjacent to the feature are proposed for development.

Green Infrastructure

Compensation requirements determined using this Guideline should be applied to the re-establishment of natural ecosystems and not used to install or otherwise improve engineered *green infrastructure* or community amenities. Nor does the Guideline apply to individual trees located in parks or along roadsides not associated with natural features.

Other Compensation/Off-Setting Programs

For *impacts* to individual park, yard or street trees, municipalities may have by-laws containing provisions for tree replacements, or other natural feature compensation polices or by-laws. It is important to continue to support the application of these municipal mechanisms by providing technical guidance in their application, coordinating with municipal staff to avoid duplication, and assist in the development of new or updated by-laws as needed. In this way, the two separate processes of the Guideline and individual tree replacement programs work together for a comprehensive approach to restoring losses.

Where municipalities have official plan policies for compensation, the Guideline can be used as technical guidance in meeting those policies, however, it is recognized that each municipality may have their own unique objectives and approaches to ecosystem compensation. This Guideline outlines the important principles and methods needed for successful compensation outcomes, while also recognizing that municipalities may wish to adapt these to their own needs, e.g., application of the Guideline to *buffers*.

Another mechanism for restoring lost habitat is the Ministry of Environment, Conservation, and Parks (MECP) Overall Benefit Permit (OBP) process under the *Endangered Species Act*. Where an OBP is required, TRCA defers to MECP for their requirements under their species-specific permit process. However, there may be cases where a portion of the *impact* to habitat is compensated through one mechanism while the remaining *impact* is compensated through a different mechanism. For example, off-setting required through the *Endangered Species Act* may address *impacts* to one species but may not *compensate* for all of the lost structure and function provided by the impacted ecosystem. In these cases, determining what is required to *compensate* for the remaining *impact* can be accomplished through the Guideline.

This Guideline does not contain provisions for determining compensation requirements for the loss of fish habitat and defers to provincial and federal ministries (e.g., Fisheries and Oceans Canada) that direct compensation for *impacts* to aquatic species and their habitat. For direction on addressing any type of alteration, restoration, or removal of a *headwater drainage feature*, the Evaluation, Classification and Management of *Headwater Drainage Features* Guideline (TRCA and CVC, 2014) should be used.

1.3 Principles of the Guideline

The following principles represent the intent of the Guideline.

1. Compensation must be considered only as a last resort within the established *mitigation hierarchy* of: Avoid, Minimize, *Mitigate*, *Compensate*.

2. The compensation process should be transparent helping to ensure accountability of all parties involved.

3. The compensation process should strive to be consistent and replicable.

4. Compensation outcomes should strive to fully replace the same level of lost *ecosystem structure* and *function* in proximity to where the loss occurs and, where possible, achieve an overall gain.

5. Compensation should be directed to on-the-ground ecosystem restoration and be informed by strategic watershed and restoration planning.

6. Implementation of compensation should be completed promptly so that *ecosystem functions* are re-established as soon as possible after (or even before) losses occur.

7. The compensation process should use an adaptive management approach incorporating monitoring, tracking and evaluation to gauge success and inform program improvements.

2.0 COMPONENTS OF A COMPENSATION PROJECT

In determining what will be required to *compensate* for an *impact*, some important components that must be considered are the location of the compensation project, and who will undertake the project. For example, the project may be located:

- On-site - compensation occurs on the same site that the ecosystem *impact* is taking place
- Off-site - compensation occurs in a different location from where the *impact* is taking place

Similarly, the compensation may be installed by:

- the Proponent - contractors hired by the proponent to plan, design, prepare the site, undertake the restoration work, and monitor and maintain the restored ecosystem, in accordance with sections 3.2 and 3.3
- TRCA - TRCA's restoration staff plan, design, prepare the site, undertake the restoration work, and monitor and maintain the restored ecosystem, in accordance with sections 3.2 and 3.3
- a public agency other than TRCA - the municipality or other public body may choose to plan, design, prepare the site, undertake the restoration work, and monitor and maintain the restored ecosystem, in accordance with Sections 3.2 and 3.3. The applicable Restoration Typical(s) in Appendix A can be a useful reference when designing and implementing restoration works.

Cash-in-Lieu and Land Base Calculations

In the instances that TRCA or another public agency implements a compensation project, private proponents provide funds to TRCA or the public agency in lieu of undertaking the compensation project themselves. The amount of the cash-in-lieu is based on the cost to restore the impacted ecosystem's structure as outlined in Section 2.1 and the cost of replacing its land base as outlined in Section 2.2.

Public Infrastructure and Land Base

Where the proponent is a municipality undertaking a public infrastructure project with compensation, Section 2.2.1 should be referenced. Section 2.2.1 describes that for public infrastructure projects there may be special circumstances where the application of the land base portion of compensation is considered in a different way.

Combining Approaches

There may also be a combination of two or more of the options outlined above, e.g., partial restoration off-site by TRCA, and partial restoration on-site by private proponent. Whichever approach is decided

upon, the approach should meet the intent of this Guideline including the principles in section 1.4, the implementation guidance outlined in Section 3.0, and the detailed preparation, design, and monitoring in the applicable Restoration Typical(s) in Appendix A.

On-site Compensation Preferred

In most cases, on-site compensation is the preferred option as it is in proximity to where the loss occurs; it also removes the complexity of finding new lands in proximity to the loss. On-site compensation should be explored as a priority option prior to contemplating off-site options. Ideally, the implementation guidance in Section 3.0 should be adhered to when determining the appropriateness of on-site compensation.

2.1 Replicating Ecosystem Structure

Ecosystems are complex and dynamic systems. Regardless of the approach to determining the level of compensation required, attempts to replace lost *ecosystem structure* and *functions* will fall short in many instances, at least in the short term. Understanding this limitation, the Guideline establishes an approach that attempts to replicate, to the extent possible and without significant delay or *lag time*, the same *ecosystem structure* and associated level of *ecosystem functions* that are to be lost.

The ability to re-establish generally the same structure in a reasonable time frame is in part dependent on the type of ecosystem being restored. Some functions of some ecosystem types such as cultural meadows can be established relatively quickly since their rate of vegetation growth does not have a significant *lag time*. This is not to suggest that these ecosystem types are less complex or less important than others, or that restoration of these ecosystems is without *risk* and uncertainty. It simply recognizes that the vegetation in some ecosystem types can be established relatively quickly.

It takes much longer to re-establish treed ecosystems due to their long developmental periods and the inability to plant fully grown trees. This Guideline attempts to partially address this issue by prescribing that the loss of a mature forest requires replacement with a larger, young forest.

Vegetation and Soil
Using *vegetation type* to guide compensation requirements does not fully account for other ecosystem components such as soil structure. TRCA recognizes this gap and will work to modify the Guideline as new knowledge is gained.

This Guideline uses *basal area* to establish ecosystem restoration replacement ratios (in hectares). *Basal area* is a standard forestry measurement, is included in the *Ecological Land Classification for Southern*

Ontario and is a widely used standard practice easily determined using simple equipment (See Appendix B: Calculating Basal Area). *Basal area* is the common term used to describe the cross-sectional area occupied by tree stems. Stand *basal area* is defined as the total cross-sectional area of all stems in an ecosystem measured at breast height (1.3 m) and expressed as a unit of land area (m^2/ha). In general terms, older and higher functioning treed ecosystems will have a greater *basal area*. *Basal area* also loosely equates to, and can be used as a surrogate for, above ground *biomass* within a treed ecosystem. *Biomass* in turn correlates to some of the *ecosystem functions* that a treed ecosystem can provide. Therefore, attempting to re-establish the same *basal area* in the newly restored treed ecosystem as was lost, helps, in part, to ensure that the same level of some *ecosystem functions* is maintained.

Dead Trees
For the purposes of the Compensation Guideline, dead trees are included in the *basal area* tally but not the calculations. Dead trees contribute to the function of forested ecosystems and therefore should be considered in assessing the feature that is being lost. This in turn informs the restoration requirements to replace the lost feature.

The objective for treed ecosystems is to re-establish the same level of *basal area* within 10 years of implementing the compensation restoration. Based on the survival and growth rates of previous TRCA restoration projects, it is typical to achieve a *basal area* of 5 m^2/ha at the 10-year mark. Based on these growth rates Table 1 (below) will be used to determine the compensation ratios for various *basal area* categories.

As an example, to achieve *basal area* equivalency at the 10-year mark (5m^2/ha) for an impacted site with a *basal area* of 18 m^2/ha, a 4:1 restoration ratio must be used. In other words, 4 hectares of new habitat must be restored for every one hectare removed.

As stated earlier, some ecosystems and their associated functions can typically be re-established relatively quickly upon restoration. Due to a lack of trees, these types of features will have a low *basal area* (less than 5m^2/ha) and would therefore have a compensation ratio of 1:1 as follows from the first row of Table 1. Points A to E that follow outline the procedure for calculating replacement ratios. The intent of Table 1 is to lay out the general forest successional steps or ranges so that the ecosystem structure (*basal area*) and function of the impact site can be replicated elsewhere. Basal area in this way is not the critical element but a proxy to determining the amount of above ground biomass to be restored.

Table 1: Compensation ratios based on basal area of impacted site.

Basal area range (m^2/ha)	Average basal area (m^2/ha)	Lag time factor – Basal area of 10-year-old restoration site (m^2/ha)	Compensation Ratio (ha: ha)
0 – 5	5	5	1:1
5.1 – 10	10	5	2:1
10.1 – 15	15	5	3:1
15.1 –20	20	5	4:1
20.1 – 25+	25	5	5:1

2.1.1 Procedure for Determining Replacement Ratios with Basal Area

A. Determine the *vegetation type*(s) for the area being impacted using the *Ecological Land Classification for Southern Ontario* (ELC) system. If more than one ecosystem type is being impacted, then the *vegetation type* must be determined for each.

B. Determine the amount (in hectares) of each *vegetation type* being removed.

C. Determine the *basal area* for each *vegetation type* being impacted. (See Appendix B: Calculating Basal Area). If only a portion of the feature is being removed, the average *basal area* should be calculated based on the entire feature, and not just the portion being removed. This average will then be used in D below.

D. Using Table 1, determine the compensation ratio for each *vegetation type* being removed. If the *vegetation community* has few or no trees, it will have a *basal area* of 5m²/ha or less and can therefore be replaced at a 1:1 ratio.

E. Based on the amount of each *vegetation type* being removed and the compensation ratio for each, determine the total size of the restoration required for each *vegetation type*.

In some instances, there may be specific *ecosystem functions* provided by the impacted ecosystem that are identified and required through the planning or infrastructure review process to be addressed as part of the restoration implementation. These conditions may influence the ecosystem restoration requirements. Additional information is provided in Section 3.2 regarding project-specific requirements.

Hydrologic Function
The compensation direction outlined in this Guideline may not account for all the hydrological functions the impacted ecosystem may have been providing. Additional measures, either on-site or off-site, may be required to address implications to hydrology and/or stormwater management and to satisfy applicable water resource management policies.

Land Area Required for Restoration

In some cases, the size of the required ecosystem restoration to re-establish similar levels of functions will be larger than the area that was removed. In cases where ecosystem restoration requirements are greater than the required land base compensation, additional restoration can occur on other lands previously identified and protected for restoration purposes as part of the *natural system* (see illustrative examples of on-site and off-site compensation in Appendix D).

Scattered Mature Trees within a Natural Feature

There may be circumstances that warrant quantifying *impacts* to individual trees located within an ecosystem. An example of this is a temporary *impact* to a cultural meadow with scattered mature trees. In these situations, the meadow habitat can be re-established relatively quickly post- *impact*. However, it may also be deemed necessary to *compensate* for the loss of the mature trees. In these circumstances, an alternative to the *basal area* approach is warranted for calculating compensation requirements. Appendix C provides information that can be used to guide tree replacement ratios for individual trees where municipal tree by-laws do not apply.

Wetlands

Wetlands are a very important, yet scarce, ecosystem type within TRCA's watersheds. It is critical that wetland loss due to land and infrastructure development be eliminated. Several studies on wetland offsetting programs have demonstrated that it can take several years, and even up to several decades, for some restored wetlands to achieve similar function as the wetlands removed (Pezzati et al. 2018, Moreno-Mateos et al. 2012)

One of the most successful approaches to addressing this issue is to require the restoration of a larger wetland than the wetland impacted (zu Ermgassen et al. 2019). The approach to requiring higher replacement ratios for wetland loss is a widely used approach across Canada and the world. Several wetland offsetting programs exist within Canada that require greater than 1:1 for many different wetland types (Navigating the Swamp, Ontario Nature, 2017).

TRCA will continue to explore the science and practice of wetland offsetting and may develop a more comprehensive approach to establishing wetland replacement ratios to be incorporated into future updates to this Guideline.

2.2 Replicating the Land Base

TRCA's Terrestrial Natural Heritage System Strategy (2007) identified the need for the *Toronto region* to not only protect natural features and areas, but to expand on them through restoration and connect them within the landscape. The Natural Heritage System was updated in 2022 to ensure it accurately reflects current land use and to incorporate the latest science. The overall size of *natural systems* plays

an important role in determining the *ecosystem functions* they provide. Larger *natural systems* are more biodiverse, provide greater levels of *ecosystem functions* and are better able to withstand the stresses of urbanization and climate change. It is therefore critical to ensure that any losses to the land area of the *natural system* due to removals of forests, wetlands or other ecosystems be addressed by adding new lands to the *natural system* such that the overall physical extent of the *natural system* is not reduced.

Loss of land removed from the *natural system* can be compensated at a 1:1 ratio. In other words, one hectare of land base removed can be compensated for by adding one hectare of land back into the *natural system*, either on the same site or off-site. Lands identified for addition into the *natural system*, either on the development site or elsewhere on the landscape, must be configured in such a way as to improve the overall ecological function of the *natural system*. Additional direction on land base configuration is provided in Section 3.0.

When replicating land base for off-site compensation projects, there are two important considerations:

- The new lands should be located as close to the original location as possible (see section 3.2. for more discussion on this) to help ensure the restored *ecosystem functions* and *services* remain accessible to the local community.
- Secondly, lands secured for compensation should be located outside of (but connected to) the identified *natural system* of the municipality so that they can ultimately be added to the system to make up the loss. Securing or purchasing land for compensation that is already identified as part of the *natural system* would result in a net loss to the overall area of the *natural system*.

Cash-in-lieu

When an impacted feature cannot be compensated for on-site and another parcel of land is not readily available off-site, in order to *compensate* for the lost land base associated with the *impact*, the proponent provides cash-in-lieu that reflects the *market value* of the developable land being gained. The *market value* of the development site should be determined by an appraisal.

Other methods of calculating land costs could be supported, subject to the satisfaction of approval authorities. In any case, fair *market value* of the development site must be determined using generally *accepted appraisal principles*.

Appraisal costs and other fees associated with determining land base replacement costs will be the responsibility of the proponent. If there is a disagreement on values, the approval authority may, at its discretion, procure its own appraisal with the costs borne by the proponent.

2.2.1 Land Base and Municipal Infrastructure Projects

Infrastructure projects are completed by a number of different agencies/proponents making a standard approach to land base compensation difficult. Approval authorities should work with proponents within

the various planning processes to help ensure land base compensation is appropriately considered and that the principles of the Guideline are addressed.

Both investment in infrastructure and the protection of *natural systems* contribute to the public good. The environmental assessment process for public projects helps to ensure investments in infrastructure minimize *impacts* to natural features and the functions they provide. When *impacts* cannot be eliminated, however, compensation action should be taken to ensure the public benefits provided by the *natural system* are not diminished.

The requirements for a compensation project as outlined in the Guideline represent the best available practice for restoration of lost features and for "adding back" to the *natural system*.

The Guideline provides guidance to further aid in the review and approval processes by detailing the costs to restore features and providing a rationale as to why the land base of the *natural system* is critical to its continued function. The full land base requirements determined by the Guideline for a feature lost to infrastructure may not be achievable given that municipalities typically own right-of-way lands sized only to accommodate the infrastructure itself with little surplus land remaining, (see Municipal Infrastructure diagrammatic example in Appendix D). In these cases, the land area removed from the *natural system* from all infrastructure projects can be tracked and compiled together so that cumulative losses to the land base of the *natural system* can be quantified. Tracking losses allows for the understanding of how these cumulative losses are impacting the function of the *natural system* and exploration of avenues to offset these losses through existing municipal land acquisition and ecological restoration programs or other means.

Single infrastructure projects that involve the removal of large portions (multiple hectares) of the *natural system,* or when TRCA-owned lands are impacted, may warrant discussions regarding compensating land base on a case-by-case basis.

3.0 APPLICATION OF COMPENSATION

Typically, once the specifics of the compensation project have been agreed to, the final decision is documented, the need for legal agreements is determined, and a land securement (if applicable) and ecosystem restoration implementation plan are established.

3.1 Agreements

Agreements will differ from situation to situation, dependent on the compensation approach applied and on which party will undertake the implementation. Examples of agreements may be within: the conditions of draft plan approval for a subdivision, a site plan agreement, or the commitments of an Environmental Assessment. Alternatively, there may be a stand-alone agreement for the compensation

plan signed by all the parties (proponent, landowner(s), approval authority(ies), as applicable). The parties involved in compensation decisions will ultimately determine the terms and conditions of any subsequent legal agreements. The following are factors to be considered when contemplating agreements:

- Agreements of conditional approval should cite that current costs to restore and current land values (at the time of receipt of the funds) should be used in calculating the compensation funds.
- Compensation funds transferred to a public agency must be applied to installation of the agreed upon ecosystem type, including land acquisition (when applicable), helping to ensure the funds are directed to the replacement of lost *ecosystem function*s and *services*.
- Funds (when being transferred to a public agency) should be received prior to removal of features.
- A timeline for implementation may be determined to ensure the ecosystem is replaced as soon as possible and ideally before the *impact* occurs.
- If the proponent implements compensation actions, a security should be held until the warranty's expiration. Warranty periods will vary but should be consistent with the determined monitoring period. Security amounts will also vary depending on perceived *risks* and complexity of restoration actions. Phased release of securities may be negotiated depending on the nature of the project to ensure development applicants undertake the required compensation work.
- If upon review by senior leadership at TRCA it is found that an agreement is not being followed, the proponent will be advised in writing and TRCA staff may cash the security and use the funds to undertake the necessary work. This ensures that the appropriate funding is available should the applicant fail to undertake or complete the agreed upon compensation.

In addition to the considerations listed above, there may be circumstances that warrant additional measures to help reduce *risk* to an acceptable level. The following provide some possible actions:

- Requiring greater financial securities to support possible mitigation measures and contingencies
- Requiring financial securities to be held for longer periods of time to ensure establishment of newly restored ecosystems
- Increasing the size of the ecosystem required to be restored

3.1.1 Agreements and Public Agencies as Proponents

Securities/letters of credit are generally not applied where the proponent is another public agency such as a municipality. As per current practice, TRCA and the public proponent will work together, in a transparent and consistent manner, to agree on the best approach to implementing compensation that meets the principles of the Guideline. Nonetheless, if implementation is being undertaken by a public agency, that agency (municipality, TRCA or other) accepts responsibility for the effective

implementation and monitoring of the compensation works, unless otherwise arranged between agencies. For example, in the case of public-private partnerships, securities may be required.

3.2 Implementation of the Compensation Project

Once the appropriate amount of compensation has been determined and agreed to by the parties involved, the next step is the development and execution of a land securement (if applicable) and ecosystem restoration implementation plan. The execution of the plan will be dependent on the location of the compensation and who will complete the works. However, regardless of these, some fundamental considerations apply, including project-specific information, ecosystem restoration principles, and broader TRCA or municipal program direction. In addition to the guidance outlined here in section 3.2, TRCA has developed several tools to help identify restoration sites and guide ecosystem restoration decision making, as referenced in section 4.0 of the Guideline.

Compensation actions should result in a reinvestment into local ecosystem restoration and the lands required for those works, and should be guided by strategic watershed management and restoration planning documents and priorities. Compensation actions should be directed to new projects (or extensions of existing projects) that require investment and resources.

3.2.1 Project-Specific Requirements

Some compensation projects may have specific requirements and deliverables associated with them as part of the compensation agreement. These could include restoration of a particular ecosystem type or the need to re-use soil or woody material or perform a plant rescue from the lost ecosystem. In addition, the impacted ecosystem may have been providing a particular function that warrants consideration in the design and implementation of the restoration works. For example, habitat for a particular species or group of species may need to be incorporated into restoration projects to help address the loss of this habitat because of the ecosystem removal. These requirements must be adhered to, planned for, and documented through implementation.

3.2.2 Ecosystem Type

In most instances, it will be appropriate to restore the same ecosystem type as was lost, e.g., restoring a forest for losing a forest. However, there may be other cases where this is not achievable due to the specific site conditions of the restoration location, or not desirable based on strategic restoration priorities. Site conditions including soil type, drainage, exposure, and aspect will dictate which ecosystem types are suitable for a particular location. Additional guidance to help refine the restoration goals and ecosystem type to be restored can be based on the type of restoration that best achieves the *natural system* strategies and municipal objectives. There may also be site-specific/file-specific circumstances that dictate special technical direction that deviates from a typical “like for like”

approach. Nevertheless, in all cases, the type of feature to be restored will be guided by TRCA, provincial and municipal natural heritage objectives, restoration programs, and strategic ecosystem management priorities.

3.2.3 Considerations for Location and Siting

Proximity to Loss

The location of the compensation project (both land securement and ecosystem restoration) should be within the same geographic area as the ecosystem that was removed (same neighbourhood, subwatershed, or municipality). This helps to ensure that the restored *ecosystem functions* and *services* contribute to the same area. For those circumstances where land acquisition is part of the required compensation, the lands to be acquired and the land to be restored do not need to be on the same site. There may be instances where previously identified and secured lands can be restored to address the ecosystem restoration component of the compensation and separate lands acquired to address the land base compensation component. However, they should both be located within the same geographic area as the impacted site. The appropriateness of the location for ecosystem restoration may also be influenced by the requirement to restore a particular ecosystem type or to achieve a specific natural heritage objective.

There may be instances where restoration or land securement cannot practically occur in proximity to the impact. In these instances, it may be necessary and acceptable for the restoration and land securement to be in a different portion of the TRCA jurisdiction than where the impact occurred. For example, it may be acceptable in limited instances for the restoration or land securement to occur within the Greenbelt (outside the Natural Heritage System), even if the impact has occurred outside the Greenbelt.

Contiguous to the Natural System

In addition, the newly acquired land must be located outside of, but generally proximate to, the currently protected *natural system*. This is required to ensure that lands acquired add new area to the system to *compensate* for the lands removed, helping to maintain the overall size of the *natural system*.

Land Ownership and Designation

Lands secured for compensation should be placed in public ownership and designated and zoned in an environmental protection category. They should also be in proximity and preferably contiguous to currently held public lands and be accessible, enabling their effective long-term protection and management.

Land Availability

In highly urbanized watersheds adding lands to the *natural system* may not always be feasible due to the limited availability of land. In these cases, the municipality, TRCA, and the proponent can work together

to find lands that are perhaps within the *natural system* but need restoration to *compensate* for permitted losses. However, this should be the exception to the rule, given that this scenario would result in a net loss in the amount of land within the *natural system*. Alternatively, lands can be secured outside of the impacted municipality but within the upper portion of the same watershed, helping to ensure that the downstream municipality will benefit from many of the *ecosystem services* in the long term.

Ecosystem Connectivity

When determining the location of restoration areas and land securement, *ecosystem connectivity* must be considered and maximized to the extent possible, for example where east-west connectivity could enhance cross-watershed functions.

Ecosystem Configuration

Ecosystem restoration should be configured in such a way as to improve the size and shape of the natural heritage system, improving both the local *ecosystem function* and the larger *natural system* as a whole. Newly restored ecosystems must also be situated to help ensure they are protected from the effects of adjacent land uses.

3.2.4 Considerations for Assessments, Monitoring, and Maintenance

Assessing and monitoring outcomes is a critical component of the compensation process. Regardless of who is implementing the work it is the responsibility of the implementer to undertake assessments and monitoring to determine any required remedial actions. Key to achieving the goals of the agreed upon compensation plan, is ensuring the success of the individual project, which in turn will help guide improvement of the overall compensation program over time.

Site assessments should be undertaken at the 1, 3, and 5-year points after construction and or planting is complete, to allow for early detection and correction of any planting or construction failures.

In addition to site assessments, monitoring of flora and fauna should be undertaken r for the more complex restoration projects to assess whether the restored sites are providing the anticipated ecosystem functions. This monitoring should consist of collecting baseline data as well as data once the newly restored ecosystem has become established. Ideally sites should be monitored 10 years after implementation, and this should be strived for when feasible. However, this may not be practical in all situations. The monitoring timeframe will be determined based on project specific opportunities and constraints. This monitoring is particularly important for wetland projects. Planting sites alone may not provide sufficient change in data collected over 10 years to warrant monitoring data collection. Documentation should be uploaded into the TRCA compensation database, if implemented by TRCA, or provided to the public agency overseeing proponent-led implementation for review.

Assessment, monitoring, and maintenance will typically be the responsibility of those undertaking the restoration work. This responsibility will be confirmed and documented as part of the agreements outlined in section 3.1. Monitoring reports will be written to document project results. Where projects are not functioning as designed and approved, investigations will be undertaken to understand why. Further, modifications may be required to ensure that the project is successful; the need for these can be stipulated in an agreement and assured through securities held by the public agencies (see also section 3.1 Agreements). Monitoring and maintenance often constitute a learning process that can inform future compensation decisions and implementation plans.

As a standard best management practice, a 25% planting replacement cost should be built into all project budgets regardless of who is implementing the work. This planting replacement contingency is informed by the experience of TRCA and reflects typical restoration replanting rates. This cost is listed in the budget items for all planting typicals as outlined in Appendix A.

3.3 Documenting the Compensation Project

For each compensation project, the specific actions proposed to address the required compensation must be documented in a report by those implementing the work (or an agent acting on their behalf). The report must document how:

- Principles in section 1.4 have been adhered to,
- Required compensation has been determined in accordance with section 2.0,
- Direction in section 3.0 has been followed.

In addition, the report must document the following:

- A description of the impacted ecosystem,
- A brief description of the proposed compensation location(s) and a rationale for their selection,
- A proposed work plan,
- Detailed design drawings,
- Construction phasing plan,
- Monitoring plan,
- Any other relevant details as required through agreements between the proponent and the approval authority based on site-specific/file-specific circumstances.

Ultimately, the documentation must show that projects are designed to take advantage of existing site conditions and will provide the agreed to deliverables.

4.0 TRCA STRATEGIC RESTORATION IMPLEMENTATION

TRCA has developed a comprehensive ecological restoration program and has been successfully implementing restoration projects across the TRCA jurisdiction for many years.

The Guideline recognizes and supports others' approaches to implementing compensation if the intent of the Guideline is met. In many circumstances, TRCA will be well suited to manage compensation implementation actions due to expertise in ecological restoration and the established restoration program. This has proven to be the case for many compensation projects over the last several years.

For those cases where the parties involved have identified TRCA as the most effective agency to undertake compensation restoration and/or land securement actions, TRCA will follow a transparent and consistent approach, ensuring accountability and ultimately successful outcomes. This approach will employ several tools and processes including strategic site selection tools, a Restoration Opportunities Database, watershed planning documents, **TRCA's Greenlands Acquisition Project 2021-2030** (where applicable), a project tracking database, and project implementation expertise.

Additional details on TRCA's approach to identifying priority restoration projects can be found in the **Integrated Restoration Prioritization: A Multiple Benefit Approach to Restoration Planning** document and on TRCA's **website**.

In addition to scenarios where TRCA undertakes compensation restoration, these tools are available to help inform restoration actions by municipalities, other public agencies, as well as private proponents and their consultants.

GLOSSARY

Accepted appraisal principles	Refers to the Canadian Uniform Standards of Professional Appraisal Practice, 2018 (as amended) by the Appraisal Institute of Canada.
Basal area	Basal area is the common term used to describe the cross-sectional area of a tree measured 1.3 metres above the ground. Stand Basal Area is the total cross-sectional area of all stems in an ecosystem typically expressed in m^2 per hectare.
Biomass	Biomass is biological material derived from living, or recently living organisms; the accumulation of living or recently living matter within an ecosystem.
Buffer	A strip of permanent vegetation that helps alleviate the negative effects of development on natural features and functions and can include a non-vegetated erosion access allowance (also see definition for erosion access allowance in The Living City Policies) required to manage a natural hazard. *Buffers* may also be referred to as vegetation protection zones.
Compensate	The replacement of a lost/altered natural feature or area and its functions.
Ecological Land Classification System for Southern Ontario	The Ministry of Natural Resources and Forestry's Southern Ontario system of classification of lands from an ecological perspective; an approach that attempts to identify and classify ecologically similar areas; published in 1998, and as may be updated from time to time.
Ecosystem functions	The natural processes, products or services that living and non-living environments provide or perform within or between species, ecosystems, and landscapes. These may include biological, physical, and socio-economic interactions.
Ecosystem services	The benefits to humans and other species, provided by nature.
Ecosystem structure	The biotic (living) and abiotic (non-living) form and composition (e.g. dominant plant species, size of vegetation, soil type and topography) of ecosystems that give each ecosystem its own definition and function.

Green infrastructure	Natural vegetation, vegetative technologies, soil in volumes and qualities adequate to sustain vegetation and absorb water, and supportive green technologies that replicate *ecosystem functions* and that collectively provide society with a multitude of environmental, social and economic benefits.
Headwater Drainage Features	Ill-defined, non-permanently flowing drainage features that may not have defined bed or banks; they are zero-order intermittent and ephemeral channels, swales and rivulets, but do not include rills or furrows.
Impact(s)	Removal or partial removal of a component of the *Natural System*.
In Situ	In the context of ecosystem compensation, in situ refers to maintaining the subject ecosystem and its associated functions and services in its current location.
Lag Time	In the context of this Guideline, lag time refers to the time required for a newly restored ecosystem to reach a similar level of function as the impacted ecosystem it is attempting to replace.
Market Value	The most probable price, as of a specified date, in cash, or in terms equivalent to cash, or in other precisely revealed terms, for which the specified property rights should sell after reasonable exposure in a competitive market under all conditions requisite to a fair sale, with the buyer and seller each acting prudently, knowledgeably, and for self-interest, and assuming that neither is under undue duress. (Appraisal Institute of Canada)
Mitigate	The prevention, modification, or alleviation of negative effects on the environment. It also includes any action with the intent to enhance beneficial effects.
Mitigation Hierarchy	Avoid, minimize, *mitigate*, *compensate*.
Natural Cover	Land occupied by naturally and culturally occurring native or non-native vegetation that is not characterized as agricultural or urban land uses.
Natural System	The natural system is comprised of water resources, natural features and areas, natural hazards, and restoration areas of potential natural cover and/or *buffers* (The Living City Policies, 2014).

Risk	In compensation, the potential for the replication of *ecosystem structure* or *function* to fail. Risk increases with ecosystem complexity or specific conditions difficult to reproduce.
Toronto region	TRCA's watershed-based jurisdiction, made up of nine watersheds and the Lake Ontario shoreline, from Etobicoke Creek watershed in the west, to Carruthers Creek watershed in the east, and made up of all or parts of the following municipalities: Toronto, Durham, York, Peel, Mono, Adjala-Tosorontio, Caledon, Brampton, Mississauga, Aurora, King, Vaughan, Richmond Hill, Markham, Whitchurch-Stouffville, Uxbridge, Pickering, and Ajax.
Vegetation Type/ Vegetation Community	An ecosystem as described by its vegetation composition and form. For example, an oak-maple forest. The level of mapping detail for the "Vegetation Type" is defined by the *Ecological Land Classification System for Southern Ontario*.

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APPENDIX A: RESTORATION TYPICALS

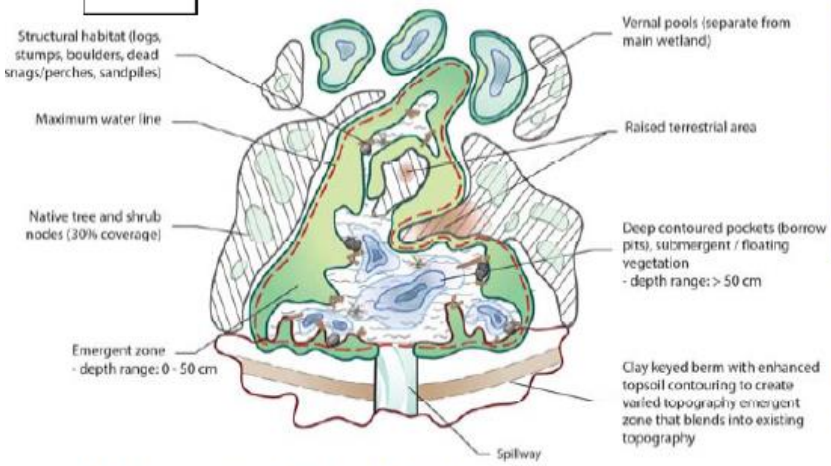
The following information provides typical project design details for the planning, implementation, maintenance, and monitoring of restoration projects. Standard planting densities are also included for the relevant ecosystem types. The information in this appendix can be a useful reference when designing and implementing restoration works. These are typical restoration design standards and will need to be adapted for site-specific conditions and agreements.

Each typical is identified with a capital letter to indicate it is part of a Wetland (W), Forest (F), Riparian (R), or Meadow (M) ecosystem type.

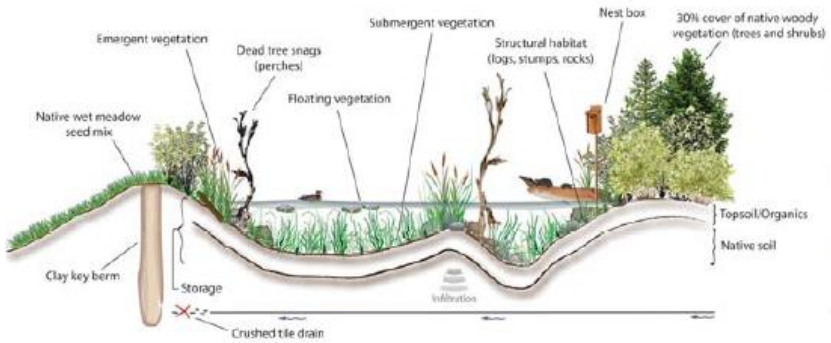
*Typical Budget Items and Costs – although typical budget items are listed for each restoration type, the costs for each item are not. The costs are subject to market price changes (e.g., for fuel, materials, etc.), and are therefore not listed. For the most current costs, please contact TRCA staff.

W

MARSH WETLAND RESTORATION



MARSH WETLAND TYPICAL PLAN



MARSH WETLAND TYPICAL CROSS SECTION

Details:

Project planning and development (permits, survey, detailed design and project management), site preparation (staging, access, layout, sediment & erosion control, etc.), berm and spillway construction, wetland contouring and grading, habitat structure installation, planting and seed application.

Restored marsh wetland, post implementation monitoring.

Features to include inDesign:

- Reversal of altered hydrology (crushed tile drains, decommissioning straightened ditches)
- Varying topography including shallow water (0 - 50 cm depth) and open water/deep pockets (50 - 200 cm depth)
- Proper and stable water level control
- Proper erosion and sediment control methods
- 10 - 20 Habitat structures (dead trees, snags, basking logs, log perches, sand piles, nest box, etc.)
- Site preparation for planting and removal of invasive species
- 0.7 ha aquatic (50% of wetland footprint planted with aquatic plugs (2,250 plugs at 6 inch spacing)
  - 0.28 ha open water/submergent plantings (225 plugs)
  - 0.42 ha emergent vegetation plantings (2,025 plugs)
- 0.3 ha terrestrial (100% planted with trees & shrubs (1,000 stems)
  - Shrubs planted in 50 groups of 10 at 1 m spacing
  - Trees planted in 50 groups of 10 at 2.25 m spacing
- 6 kg Native wetland/wet meadow seed for disturbed soils
- 46 kg erosion and sediment control cover crop
- 800 m of deer fencing to mitigate or prevent predation of, and damage to, terrestrial plantings by wildlife

Project Goals:

- Restore ecosystem form and function
- Restore soil and soil processes
- Restore natural hydrologic processes
- Enhance and restore natural cover and essential habitat

Suggested plant species:

Plant native early successional riparian tree and shrub species and wet tolerant conifer species. Based on specific site conditions and existing vegetation, species might include:

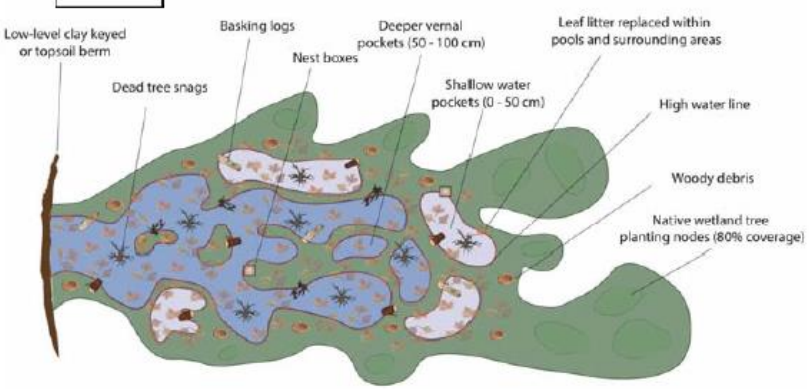
- Red osier dogwood
- Nannyberry
- Cottonwood
- Birch
- Balsam poplar
- Tamarack
- Eastern white cedar

Marsh Wetland Typical Construction Cost Estimate (1 ha)		2023 Cost Year
Project Management	**Notes**	**Cost ($)**
Project Management	Initiating, planning, executing, controlling, and closing	$
	Subtotal	**$**
Contingency	10%	$
	Total	**$**
Construction		
Planning and Design	Permits, survey, archaeology, engineering, and project design	$
Equipment	2 days of site preparation and 8 days of construction (Truck, trailer, excavator, loader, water pump)	$
Materials	Herbicide application, aggregate, erosion and sediment control, filter cloth, round stone, (10 loads) wood/logs, (46 kg) cover crop, (6 kg) native seed, and habitat structures	$
Labour	2 days of site prep, 8 days of construction (1 day each for mobilization and demobilization) for 3 staff	$
	Subtotal	**$**
Contingency	10%	$
	Total	**$**
Deer Fence		
Equipment	Truck, trailer, ATV	$
Materials	8 rolls of fencing (100m rolls), 360 T-bars (2.3 m), staples and flagging tape	$
Labour	4 days for installation, maintenance and removal for 4 staff	$
	Subtotal	**$**
Contingency	10%	$
	Total	**$**
Edge Planting		
Equipment	Truck, trailer, ATV	$
Materials	300 potted (2 gal) coniferous, 160 potted (2 gal) deciduous, 40 bareroot deciduous, 400 potted (2 gal) shrubs, 100 bareroot shrubs, and (1 load) mulch	$
Labour	3 days implementation for 5 staff	$
	Subtotal	**$**
Contingency	10%	$
Plant Replacement	25% replacement of material	$
	Total	**$**
Aquatic Planting		
Equipment	Truck, trailer	$
Materials	2,250 plugs planted	$
Labour	2 days implementation for 5 staff	$
	Subtotal	**$**
Contingency	10%	$
Plant Replacement	25% replacement of material	$
	Total	**$**
Habitat Installation		
Equipment	Truck	$
Materials	2 Wood duck boxes	$
Labour	1 day implementation for 2 staff	$
	Subtotal	**$**
Contingency	10%	$
	Total	**$**
Monitoring and Assessment	Pre (year 0) /Post (year 10) Monitoring for Flora and Fauna 3 Rapid Restoration Assessment visits (year 1, 3 and 5) with reporting	$
	Total	**$**
	Project Management Subtotal	**$**
	Construction and Planting Subtotal	**$**
	Contingency and Replacement Subtotal	**$**
	Monitoring and Assessment Subtotal	**$**
	GRAND TOTAL	$

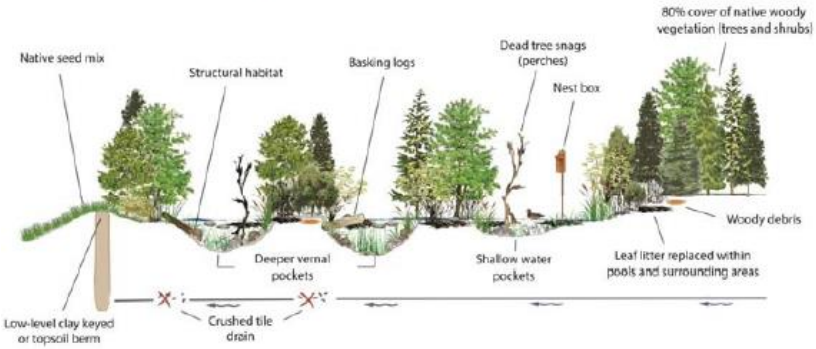
**Typical Budget Items and Costs – although typical budget items are listed for each restoration type, the costs for each item are not. The costs are subject to market price changes (e.g., for fuel, materials, etc.), and are therefore not listed. For the most current costs, please contact TRCA staff.*

W

FORESTED WETLAND RESTORATION



FORESTED WETLAND TYPICAL PLAN



FORESTED WETLAND TYPICAL CROSS SECTION

Details:

Project planning and development (permits, survey, detailed design and project management), site preparation (staging, access, layout, sediment & erosion control, etc.), subtle regrading to create low level control berm and spillway, wetland contouring and grading, enhanced wildlife habitat and/or bird box installation, planting and seed application.

Newly planted trees and shrubs in forested wetland site

Features to include in Design:

- Reversal of altered hydrology (crushed tile drains, decommissioning straightened ditches)
- Proper and stable water level control
- Proper erosion and sediment control methods
- Varying topography including shallow water (0 - 50 cm depth) deeper vernal pockets (50 - 100 cm depth)
- 20 - 30 Habitat structures (basking logs, log perches, 2 wood duck boxes)
- Site preparation for planting and removal of invasive species
- Terrestrial area planted with 80% woody vegetation (native trees and shrub pots)
  - Trees planted in groups of 10 at 2.4 m spacing (1,240 stems)
  - Shrubs planted in groups of 10 at 1 m spacing (1,200 stems)
- 6 kg native wetland/wet meadow seed mix for disturbed soils
- 46 kg erosion and sediment control cover crop
- 1,800 m of deer fencing to mitigate or prevent predation of, and damage to, terrestrial plantings by wildlife

Project Goals:

- Restore ecosystem form and function
- Restore soil and soil processes
- Restore natural hydrologic processes
- Enhance and restore natural cover and essential habitat

Suggested plant species:

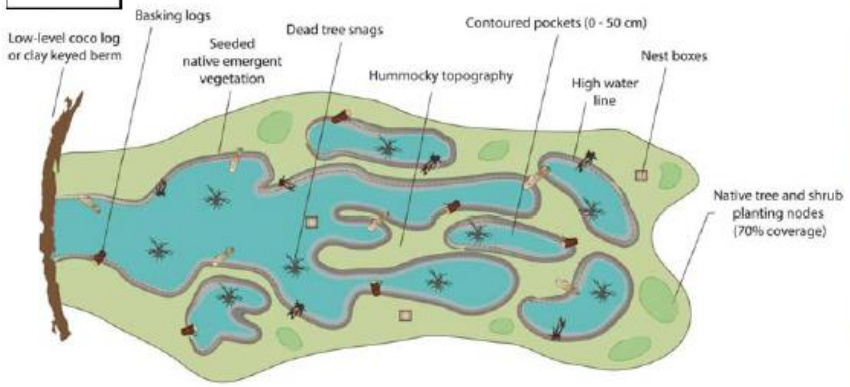
Plant native early successional riparian tree and shrub species and wet tolerant conifers. Based on specific site conditions and existing vegetation, species might include:

- Red osier dogwood
- Alder
- Silver maple
- Birch
- Eastern white cedar
- Tamarack
- White spruce

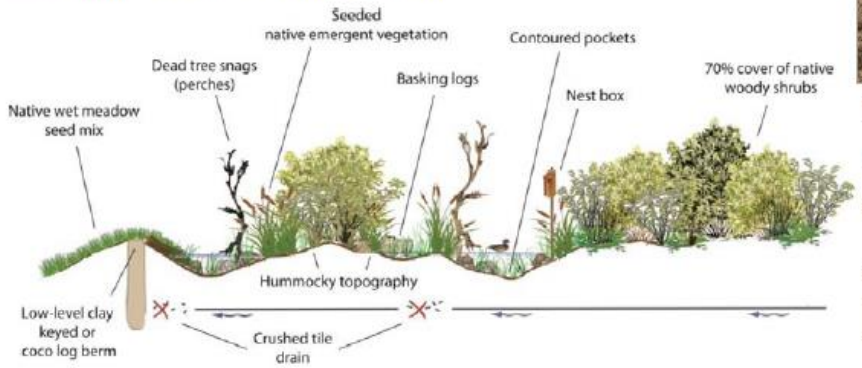
Forested Wetland Typical Construction Cost Estimate (1 ha)		2023 Cost Year
Project Management	**Notes**	**Cost ($)**
Project Management	Initiating, planning, executing, controlling, and closing	$
	Subtotal	$
Contingency	10%	$
	Total	$
Construction		
Planning and Design	Permits, survey, archaeology, engineering, and project design	$
Equipment	2 days of site preparation and 6 days of construction (Truck, trailer, excavator, loader)	$
Materials	Herbicide application, aggregate, erosion and sediment control, filter cloth, round stone, (10 loads) wood/logs, (46 kg) cover crop, (6 kg) native seed, and habitat structures	$
Labour	2 days of site prep, 6 days of construction (1 day each for mobilization and demobilization) for 3 staff	$
	Subtotal	$
Contingency	10%	$
	Total	$
Deer Fence		
Equipment	Truck, trailer, ATV	$
Materials	18 rolls of fencing (100m rolls), 810 T-bars (2.3 m), staples and flagging tape	$
Labour	8 days for installation, maintenance and removal for 4 staff	$
	Subtotal	$
Contingency	10%	$
	Total	$
Tree and Shrub Planting		
Equipment	Truck, trailer, ATV	$
Materials	640 potted (2 gal) coniferous, 480 potted (2 gal) deciduous, 120 bareroot deciduous, 960 potted (2 gal) shrubs, 240 bareroot shrubs, and (4 loads) mulch	$
Labour	9 days implementation for 5 staff	$
	Subtotal	$
Contingency	10%	$
Plant Replacement	25% replacement of material	$
	Total	$
Habitat Installation		
Equipment	Truck	$
Materials	2 Wood duck boxes	$
Labour	1 day Implementation for 2 staff	$
	Subtotal	$
Contingency	10%	$
	Total	$
Monitoring and Assessment	Pre (year 0) /Post (year 10) Monitoring for Flora and Fauna 3 Rapid Restoration Assessment visits (year 1, 3 and 5) with reporting	$
	Total	$
	Project Management Subtotal	$
	Construction and Planting Subtotal	$
	Contingency and Replacement Subtotal	$
	Monitoring and Assessment Subtotal	$
	GRAND TOTAL	$

**Typical Budget Items and Costs – although typical budget items are listed for each restoration type, the costs for each item are not. The costs are subject to market price changes (e.g., for fuel, materials, etc.), and are therefore not listed. For the most current costs, please contact TRCA staff.*

WET SHRUB THICKET RESTORATION



WET SHRUB THICKET TYPICAL PLAN



WET SHRUB THICKET TYPICAL CROSS SECTION

Details:

Project planning and development (permits, survey, detailed design and project management), site preparation (staging, access, layout, sediment & erosion control, etc.), berm and spillway construction, wetland contouring and grading, habitat structure installation, planting and seed application.

Restored wet shrub thicket, post construction, prior planting

Red osier dogwood shrub node on wet shrub thicket site

Project Goals:

- Restore ecosystem form and function
- Restore soil and soil processes
- Restore natural hydrologic processes
- Enhance and restore natural cover and essential habitat

Suggested plant species:

Plant native early successional riparian shrub species, such as:

- Willow
- Red osier dogwood
- High bush cranberry
- Buttonbush

Features to include in Design:

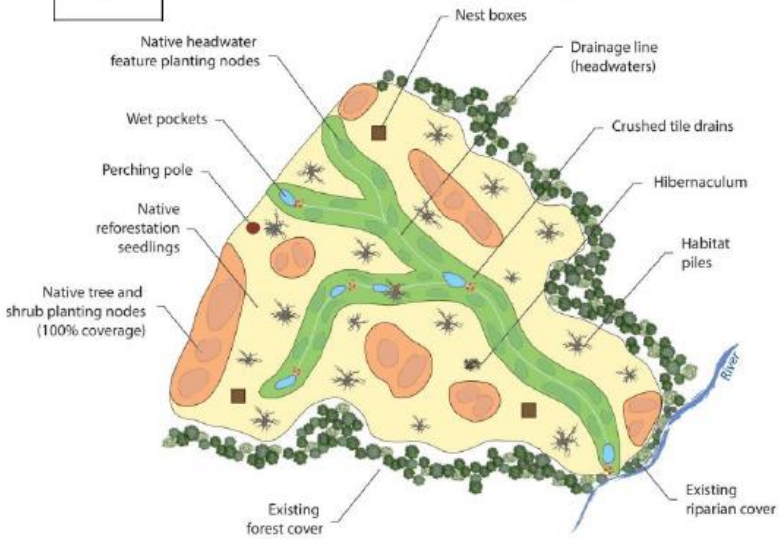
- Reversal of altered hydrology (crushed tile drains, decommissioning straightened ditches)
- Proper and stable water level control
- Proper erosion and sediment control methods
- Varying/hummocky topography including shallow open water (0 - 50 cm depth)
- 20 - 30 Habitat structures (dead trees, snags, basking logs, log perches, nest boxes, etc.)
- Site preparation for planting and removal of invasive species
- Native terrestrial and emergent vegetation
  - 0.7 ha terrestrial (50% planted with shrubs (4,200 stems)
  - 0.3 ha aquatic
- 6 kg native wetland/wet meadow seed mix for disturbed soils
- 46 kg erosion and sediment control cover crop
- 900 m of deer fencing to mitigate or prevent predation of, and damage to, terrestrial plantings by wildlife

Wet Shrub Thicket Typical Construction Cost Estimate (1 ha)		2023 Cost Year
Project Management	**Notes**	**Cost ($)**
Project Management	Initiating, planning, executing, controlling, and closing	$
	Subtotal	$
Contingency	10%	$
	Total	$
Construction		
Planning and Design	Permits, survey, archaeology, engineering, and project design	
Equipment	2 days of site preparation and 6 days of construction (Truck, trailer, excavator, loader)	$
Materials	Herbicide application, aggregate, erosion and sediment control, filter cloth, round stone, (5 loads) wood/logs, (46 kg) cover crop, (6 kg) native seed, and habitat structures	$
Labour	2 days of site prep, 6 days of construction (1 day each for mobilization and demobilization) for 3 staff	$
	Subtotal	$
Contingency	10%	$
	Total	$
Deer Fence		
Equipment	Truck, trailer, ATV	$
Materials	9 rolls of fencing (100m rolls), 405 T-bars (2.3 m), staples and flagging tape	$
Labour	6 days for installation, maintenance and removal for 4 staff	$
	Subtotal	$
Contingency	10%	$
	Total	$
Tree and Shrub Planting		
Equipment	Truck, trailer, ATV	$
Materials	2,000 potted (2 gal) shrubs, 1000 bareroot shrubs, 1,200 units bioengineering, and (4 loads) mulch	$
Labour	10 days implementation for 5 staff	$
	Subtotal	$
Contingency	10%	$
Plant Replacement	25% replacement of material	$
	Total	$
Habitat Installation		
Equipment	Truck	$
Materials	2 Wood duck boxes	$
Labour	1 day implementation for 2 staff	$
	Subtotal	$
Contingency	10%	$
	Total	$
Monitoring and Assessment	Pre (year 0) /Post (year 10) Monitoring for Flora and Fauna 3 Rapid Restoration Assessment visits (year 1, 3 and 5) with reporting	$
	Total	$
	Project Management Subtotal	$
	Construction and Planting Subtotal	$
	Contingency and Replacement Subtotal	$
	Monitoring and Assessment Subtotal	$
	GRAND TOTAL	$

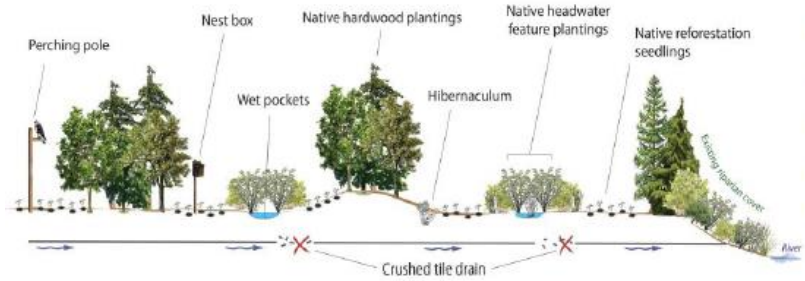
**Typical Budget Items and Costs – although typical budget items are listed for each restoration type, the costs for each item are not. The costs are subject to market price changes (e.g., for fuel, materials, etc.), and are therefore not listed. For the most current costs, please contact TRCA staff.*

F

ENHANCED REFORESTATION



ENHANCED REFORESTATION TYPICAL PLAN



ENHANCED REFORESTATION TYPICAL CROSS SECTION

Details:

Project planning and development (detailed design and project management), site preparation, wildlife structures and/or bird box installation

Reforestation monitoring, year 1

Reforestation monitoring year 1

Reforestation monitoring year 5

Features to include in Design:

- Reversal of altered hydrology (crushed tile drains, decommissioning straightened ditches)
- Proper erosion and sediment control methods
- 20 - 30 Habitat structures (log perches, large woody debris, hibernacula, nest boxes)
- Site preparation and removal of invasive species
- 100% woody vegetation (native trees and shrubs, including bareroot seedlings) planted.
  - Shrubs planted in groups of 10 at 1 m spacing (1,000 pieces)
  - Bareroot trees scatter planted at 1.7 m spacing (1,000 seedlings)
  - Potted trees planted in groups of 10 at 2.45 m spacing (1,000 pots)
- 4 kg native meadow seed mix for disturbed soils
- 46 kg erosion and sediment control cover crop
- 1,500 m of deer fencing to mitigate or prevent predation of, and damage to, terrestrial plantings by wildlife

Project Goals:

- Restore ecosystem form and function
- Restore soil and soil processes
- Restore natural hydrologic processes
- Enhance and restore natural cover and essential habitat

Suggested plant species:

Planting early to mid-successional tree and shrub species based on specific site conditions and existing vegetation, species might include:

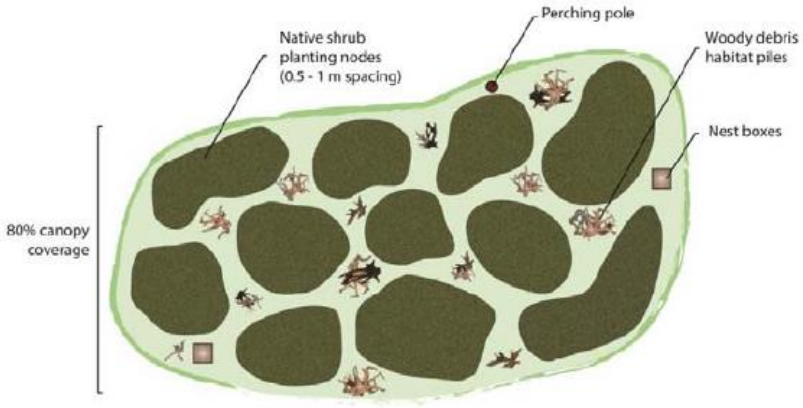
- Elderberry
- Sumac
- Dogwood
- Birch
- Eastern white cedar
- White pine
- Poplar
- Spruce

Enhanced Reforestation Planting Typical Cost Estimate (1 ha)		2023 Cost Year
Project Management	**Notes**	**Cost ($)**
Project Management	Initiating, planning, executing, controlling, and closing	$
	Subtotal	**$**
Contingency	10%	$
	Total	**$**
Site Preparation		
Equipment	4 days of equipment time for minor grading, tilling, seeding. (Truck, trailer, tractor, tractor Implements, ATV)	$
Materials	Herbicide application, (46 kg) cover crop, (4 kg) native seed	$
Labour	4 days of implementation for 2 staff	$
	Subtotal	**$**
Contingency	10%	$
	Total	**$**
Deer Fence		
Equipment	Truck, trailer, ATV	$
Materials	15 rolls of fencing (100m rolls), 675 T-bars (2.3 m), staples and flagging tape	$
Labour	7 days for installation, maintenance and removal for 4 staff	$
	Subtotal	**$**
Contingency	10%	$
	Total	**$**
Planting		
Equipment	Truck, trailer, ATV	$
Materials	1,000 tree seedlings, 1,000 potted (2 gal) shrubs, 500 potted (2 gal) coniferous, 500 potted (2 gal) deciduous, and (3 loads) mulch	$
Labour	8 days implementation for 5 staff	$
	Subtotal	**$**
Contingency	10%	$
Plant Replacement	25% replacement of material	$
	Total	**$**
Habitat Installation		
Equipment	4 days of equipment time for minor grading and structure installation. (Truck, trailer, tractor, tractor Implements, ATV)	$
Materials	4 bird boxes and (5 loads) wood/logs	$
Labour	4 days implementation for 2 staff	$
	Subtotal	**$**
Contingency	10%	$
	Total	**$**
Site Assessment	3 Rapid Restoration Assessment visits (year 1, 3 and 5) with reporting	$
	Total	$
	Project Management Subtotal	**$**
	Site Preparation and Planting Subtotal	**$**
	Contingency and Replacement Subtotal	**$**
	Monitoring and Assessment Subtotal	**$**
	GRAND TOTAL	**$**

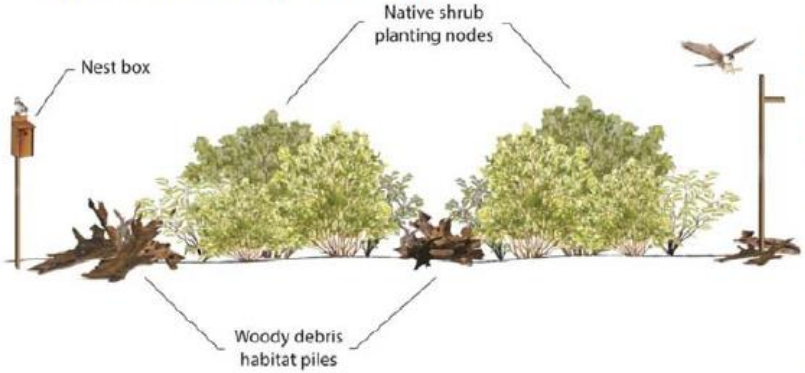
**Typical Budget Items and Costs – although typical budget items are listed for each restoration type, the costs for each item are not. The costs are subject to market price changes (e.g., for fuel, materials, etc.), and are therefore not listed. For the most current costs, please contact TRCA staff.*

F

SHRUB THICKET PLANTING



SHRUB THICKET TYPICAL PLAN



SHRUB THICKET TYPICAL CROSS SECTION

Details:

Project planning and development (detailed design and project management), site preparation, essential wildlife structures and/or bird box installation.

Recently mulched shrub node in shrub thicket restoration

Features to include in Design:

- Reversal of altered hydrology (crushed tile drains, decommissioning straightened ditches, culvert removal)
- Proper erosion and sediment control methods
- 10-20 Habitat structures (log perches, large woody debris, 4 nest boxes)
- Site preparation for planting and removal of invasive species
- 0.8 ha, (50% planted with shrubs (4,000 stems)
- Mulch application around plants
- 4 kg native wetland/ wet meadow seed for disturbed soils
- 46 kg erosion and sediment control cover crop
- 1,000 m of deer fencing to mitigate or prevent predation of, and damage to, terrestrial plantings by wildlife

Project Goals:

- Restore ecosystem form and function
- Restore soil and soil processes
- Restore natural hydrologic processes
- Enhance and restore natural cover and essential habitat

Suggested plant species:

Plant native early succession shrub species, based on specific site conditions and existing vegetation, species might include:

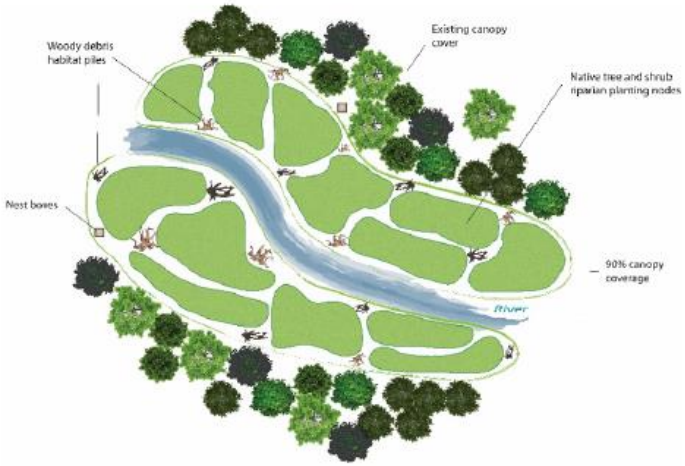
- Grey dogwood
- Alder
- Flowering raspberry
- Serviceberry
- Elderberry

Shrub Thicket Planting Typical Cost Estimate (1 ha)		2023 Cost Year
Project Management	**Notes**	**Cost ($)**
Project Management	Initiating, planning, executing, controlling, and closing	$
	Subtotal	**$**
Contingency	10%	$
	Total	**$**
Site Preparation		
Equipment	4 days of equipment time for minor grading, tilling, seeding	$
Materials	Herbicide application, (46 kg) cover crop, (4 kg) of native seed	$
Labour	4 days implementation for 2 staff	$
	Subtotal	**$**
Contingency	10%	$
	Total	**$**
Deer Fence		
Equipment	Truck, trailer, ATV	$
Materials	10 rolls of fencing (100m rolls), 450 T-bars (2.3 m), staples and flagging tape	$
Labour	6 days for installation, maintenance and removal for 4 staff	$
	Subtotal	**$**
Contingency	10%	$
	Total	**$**
Planting		
Equipment	Truck, trailer, ATV	$
Materials	3,000 potted (2 gal) shrubs, 1000 bareroot shrubs, and (4 loads) mulch	$
Labour	11 days implementation for 5 staff	$
	Subtotal	**$**
Contingency	10%	$
Plant Replacement	25% replacement of material	$
	Total	**$**
Habitat Installation		
Equipment	4 days of equipment time for minor grading and structure installation. (Tractor, tractor Implements, ATV)	$
Materials	4 bird boxes and (5 loads) wood/logs	$
Labour	4 days of implementation for 2 staff	$
	Subtotal	**$**
Contingency	10%	$
	Total	**$**
Site Assessment	3 Rapid Restoration Assessment visits (year 1, 3 and 5) with reporting	$
	Total	**$**
	Project Management Subtotal	**$**
	Site Preparation and Planting Subtotal	**$**
	Contingency and Replacement Subtotal	**$**
	Monitoring and Assessment Subtotal	**$**
	GRAND TOTAL	**$**

**Typical Budget Items and Costs – although typical budget items are listed for each restoration type, the costs for each item are not. The costs are subject to market price changes (e.g., for fuel, materials, etc.), and are therefore not listed. For the most current costs, please contact TRCA staff.*

R

RIPARIAN PLANTING



RIPARIAN PLANTING TYPICAL PLAN

RIPARIAN PLANTING TYPICAL CROSS SECTION

Details:

Project planning and development (permits, detailed design and project mgmt.), site preparation, essential wildlife structures and/or bird boxes installation, 90% of riparian area planted with trees and shrubs (2,650 stems), and mulch application.

Recently planted riparian area

Riparian planting post implementation

Features to include in Design:

- Reversal of altered hydrology (crushed tile drains, decommissioning straightened ditches)
- Proper water level control
- Proper erosion and sediment control methods
- 20 - 30 Habitat structures (basking logs, log perches, turtle nesting piles, 4 nest boxes)
- Site preparation for planting and removal of invasive species
- 90% woody vegetation (native trees and shrub pots)
  - Trees planted in groups of 10 at 2.4 m spacing (1,350 stems)
  - Shrubs planted in groups of 10 at 1 m spacing (1,300 stems)
- 4 kg native riparian/wet meadow seed for disturbed soils
- 46 kg erosion and sediment control cover crop
- 2,000 m of deer fencing to mitigate or prevent predation of, and damage to, terrestrial plantings by wildlife

Project Goals:

- Restore ecosystem form and function
- Restore soil and soil processes
- Restore natural hydrologic processes
- Enhance and restore natural cover and essential habitat

Suggested plant species:

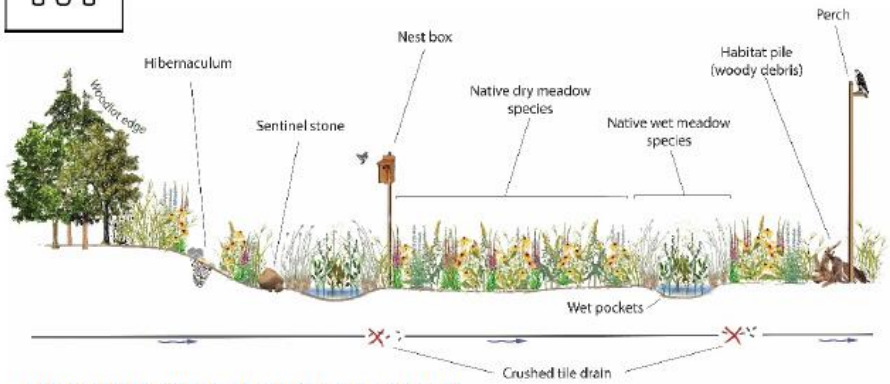
Plant native early successional riparian tree and shrub species, to increase stabilization of soils adjacent to a watercourse or drainline, reducing sediment transport into receiving waters. Species selection based on specific site conditions and existing vegetation; species might include:

- Sandbar willow
- Speckled alder
- Red osier dogwood
- Silky dogwood
- Meadowsweet
- Buttonbush
- Silver maple
- Trembling aspen
- Eastern white cedar

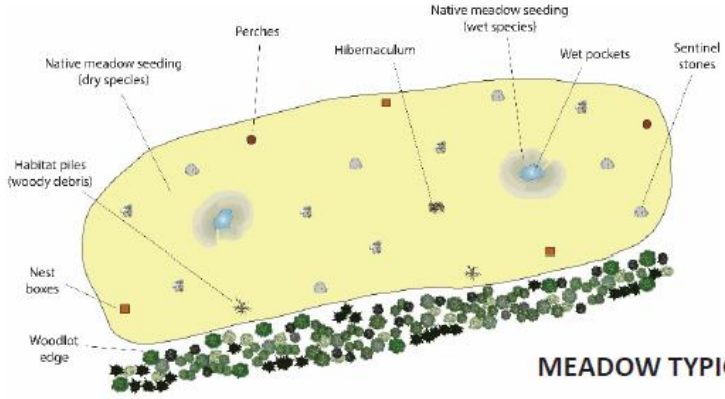
Riparian Planting Typical Cost Estimate (1 ha)		2023 Cost Year
Project Management	**Notes**	**Cost ($)**
Project Management	Initiating, planning, executing, controlling, and closing	$
	Subtotal	**$**
Contingency	10%	$
	Total	**$**
Site Preparation		
Equipment	4 days of equipment time for minor grading, tilling, seeding. (Truck, trailer, tractor, tractor implements, ATV)	$
Materials	Herbicide application, (46 kg) cover crop, and (4 kg) native seed	$
Labour	4 days implementation for 2 staff	$
	Subtotal	**$**
Contingency	10%	$
	Total	**$**
Deer Fence		
Equipment	Truck, trailer, ATV	$
Materials	20 rolls of fencing (100m rolls), 900 T-bars (2.3 m), staples and flagging tape	$
Labour	8 days for installation, maintenance and removal for 4 staff	$
	Subtotal	**$**
Contingency	10%	$
	Total	**$**
Planting		
Equipment	Truck, trailer, ATV	$
Materials	650 potted (2 gal) coniferous, 560 potted (2 gal) deciduous, 140 bareroot deciduous, 1,000 potted (2 gal) shrubs, 300 bareroot shrubs, and (3 loads) mulch	$
Labour	8 days implementation for 5 staff	$
	Subtotal	**$**
Contingency	10%	$
Plant Replacement	25% replacement of material	$
	Total	**$**
Habitat Installation		
Equipment	4 days of equipment time for minor grading and structure installation. (Truck, trailer, tractor, tractor Implements)	$
Materials	4 bird boxes and (5 loads) wood/logs	$
Labour	4 days implementation for 2 staff	$
	Subtotal	**$**
Contingency	10%	$
	Total	**$**
Site Assessment	3 Rapid Restoration Assessment visits (year 1, 3 and 5) with reporting	$
	Total	**$**
	Project Management Subtotal	**$**
	Site Preparation, Planting and Habitat Subtotal	**$**
	Contingency and Replacement Subtotal	**$**
	Monitoring and Assessment Subtotal	**$**
	GRAND TOTAL	**$**

**Typical Budget Items and Costs – although typical budget items are listed for each restoration type, the costs for each item are not. The costs are subject to market price changes (e.g., for fuel, materials, etc.), and are therefore not listed. For the most current costs, please contact TRCA staff.*

M NATIVE MEADOW RESTORATION



MEADOW TYPICAL CROSS SECTION



MEADOW TYPICAL PLAN

Meadow restoration, 5 years post implementation

Project Goals:

- Restore ecosystem form and function
- Restore soil and soil processes
- Restore natural hydrologic processes
- Enhance and restore natural cover and essential habitat
- Enhanced natural corridor connections
- New model for managing hydro corridors

Suggested Plant Species:

Plant native forbes and grasses to increase biodiversity and natural cover. Recommended:

- 20% flowers
- 80% grasses
- (percentages can be adjusted based on specific restoration goals).

Details:

Planning and development (permits, detailed design and project management), site preparation that includes tilling, herbicide application, mowing, planting a nurse crop, to be followed with a fall native seeding. In the spring, mow and spray area, plant seeds and monitor.
Assess, maintain, and adaptively manage over a 10 year period.
Three monitoring events for flora/fauna occur in years 1, 5 and 10 of the project period.

Features to include in Design:

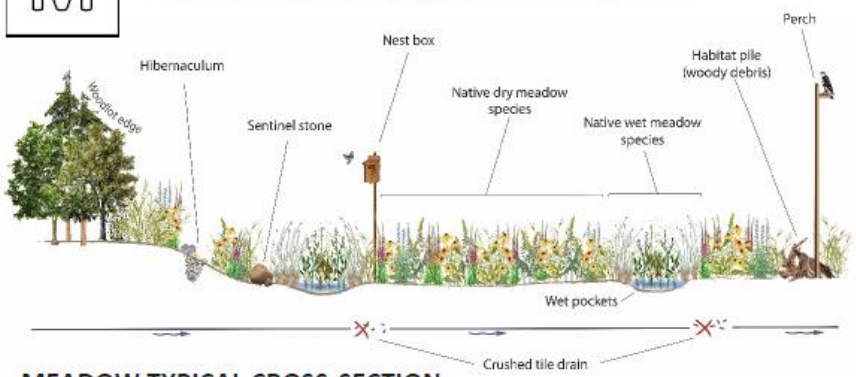
- One year site preparation for native meadow seeding with removal of invasive species
- Site grading and reversal of altered hydrology (crushed tile drains, decommissioning straightened ditches)
- 20 - 30 Habitat structures (Large woody debris piles, log perches, sentinel stones, hibernacula, nest boxes)
- Native meadow seed mix planted into prepared area.
- Maintain with a mow and spot herbicide treatment to reduce invasive and/or woody species competition

Native Meadow Typical Cost Estimate (1 ha)		2023 Cost Year
Project Management	**Years 1-10**	**Costs ($)**
	Initiating, planning, executing, controlling, and closing	$
	Subtotal	$
Contingency	10%	$
	Total	$
Site Preparation and Seeding	**Year 1**	
Equipment	12 days of equipment time for initial mow, tilling 3x, spraying 2x, seeding cover crop (truck, trailer, tractor, tractor implements)	$
Materials	90 kg oats cover crop, 6 signs & posts, contractor broadcast spray 2x, contractor drill native seed (14 kg) in the fall	$
Labour	Implementation	$
	Subtotal	$
Contingency	10%	$
	Total	$
Planting	**Year 2 & 5**	
Equipment	4 days of equipment time for seeding nurse crop, maintenance high cut mow in August (truck, trailer, tractor, tractor implements)	$
Materials	Nurse crop of oats or millet (30 kg), Contractor spot spray invasives	$
Labour	Implementation	$
	Subtotal	$
Contingency	10%	$
	Total	$
Maintenance Mowing	**Years 3, 6, and 9**	
Equipment	3 days of equipment time for low maintenance mow in fall (truck, trailer, tractor, tractor implements)	$
Materials	None	$
Labour	Implementation	$
	Subtotal	$
Contingency	10%	$
	Total	$
Adaptive Management	**Years 3-10**	
Equipment	5 days of equipment time to monitor for invasive species and spot spray where needed (truck)	$
Materials	Herbaceous spot spray application years 3,4,6 & 9 Woody herbicide	$
Labour	Implementation	$
	Subtotal	$
Contingency	10%	$
	Total	$
Monitoring	**Year 1, 5 and 10**	
	Year 1 (Pre implementation) set up and reporting	$
	Year 5 visit with reporting	$
	Year 10 (Post implementaiton) visit with reporting	$
	Subtotal	$
Contingency	10%	$
	Total	$
	Project Management Subtotal	$
	Site Preparation and Planting Subtotal	$
	Maintenance Mowing and Adaptive Management Subtotal	$
	Monitoring Subtotal	$
	Contingency Subtotal	$
	GRAND TOTAL	$

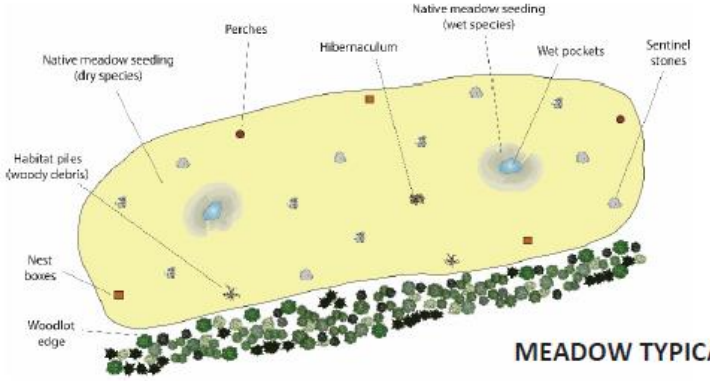
**Typical Budget Items and Costs – although typical budget items are listed for each restoration type, the costs for each item are not. The costs are subject to market price changes (e.g., for fuel, materials, etc.), and are therefore not listed. For the most current costs, please contact TRCA staff.*

M

NATIVE SAR MEADOW RESTORATION



MEADOW TYPICAL CROSS SECTION



MEADOW TYPICAL PLAN

Meadow restoration, 5 years post implementation

Project Goals:

- Restore ecosystem form and function
- Restore soil and soil processes
- Restore natural hydrologic processes
- Enhance and restore natural cover and essential habitat
- Enhanced natural corridor connections
- Restore ecosystem specifically utilized by SAR

Suggested Plant Species:

Plant native forbes and grasses to increase biodiversity and natural cover. Recommended:

- 20% flowers
- 80% grasses
- at least 3 grass species, one of which grows 50cm or taller
- (percentages can be adjusted based on specific restoration goals)

Details:

Planning and development (permits, detailed design and project management), site preparation that includes tilling, herbicide application, planting a nurse crop, and fall native seeding. Native seeding is followed with herbicide spot spray and fall mow for 5 years. Subsequent maintenance for 15 years to include herbicide spot spray or prescribed burn and fall mow every 3 to 4 years.

Restoration area to be at least 200 meters by 200 meters (4 hectares).
Implementation, maintenance and adaptive management occur over a 20 year period.
Bird monitoring to occur through implementation to year 5, at least 3 times a year when SAR birds are likely to be present.

Features to Include in Design:

- One year site preparation for native meadow seeding with removal of invasive species
- Site grading and reversal of altered hydrology (crushed tile drains, decommissioning straightened ditches)
- 20 - 30 Habitat structures (Large woody debris piles, log perches, sentinel stones, hibernacula, nest boxes)
- Native meadow seed mix planted into prepared area.

Native SAR Meadow Typical Cost Estimate (4 ha)		2023 Cost Year
Project Management	**Years 1-20**	
	Initiating, planning, executing, controlling, and closing	
	Subtotal	
Contingency	10%	
	Total	
Site Prep and Planting	**Implementation (Year 1) Mow, Herbicide, Till, Seed**	
Equipment	28 days of equipment time for mow, tilling 3x, spraying 3x, seeding cover crop (truck, trailer, tractor, tractor Implements)	
Materials	3 applications of herbicide, 10 signs & posts, 248 kg cover crop, seeding contractor to drill native (56 kg) in fall	
Labour	Implementation	
	Subtotal	
Contingency	10%	
	Total	
Maintenance Mowing	**Years 1-20**	
Equipment	3 days of equipment time for fall mow (truck, trailer, tractor, tractor implements); once/yr (yrs 1-5); once every 3-4 yrs (yrs 6-20)	
Materials	Yr 1 - Oats or millet Nurse crop (120 kg), Contractor spot spray invasives	
Labour	Implementation	
	Subtotal	
Labour	10%	
	Total	
Adaptive Management	**Years 1-20**	
Equipment	Work trucks/Sprayers	
Materials	Blanket herbicide spray yr 1, woody herbicide yr 1, (2/yr) herbaceous spot spray yrs 1-5, 9, 13	
Labour	Implementation	
	Subtotal	
Contingency	10%	
	Total	
Monitoring	**Years 1-5**	
	Year 1 visit with reporting	
	Year 2 visit with reporting	
	Year 3 visit with reporting	
	Year 4 visit with reporting	
	Year 5 visit with reporting	
	Subtotal	
Contingency	10%	
	Total	
	Project Management Subtotal	
	Site Preparation and Planting Subtotal	
	Maintenance Mowing and Adaptive Management Subtotal	
	Monitoring Subtotal	
	Contingency Subtotal	
	GRAND TOTAL	

**Typical Budget Items and Costs – although typical budget items are listed for each restoration type, the costs for each item are not. The costs are subject to market price changes (e.g., for fuel, materials, etc.), and are therefore not listed. For the most current costs, please contact TRCA staff.*

APPENDIX B: CALCULATING BASAL AREA

General guidance on how to perform the *basal area* calculation can be sought from the Ecological Land Classification for Southern Ontario Field Guide or the Ontario Tree Marking Guide. The following recommendations are provided in order to standardize the collection and submission of *basal area* calculations related to TRCA Ecosystem Compensation.

Please consult with TRCA staff prior to deviating from the ideal data collection recommendations.

- *Basal area* should be collected from the contiguous ecosystem type (Ecological Land Classification polygon) from which the unavoidable loss or *impact* to natural feature has been identified.
- Use a BAF 2 metric prism.
- Use fixed area plots in circumstances where the prism provides less accuracy (such as in young plantations or dense hardwood stands where it is not possible to distinguish individual stems).
    - In these circumstances circular plots are recommended; for a 200 m^2 plot the plot radius is 7.99 m.
- A minimum of 3 plots (either prism sweeps or fixed area plots) should be taken within the ecosystem type impacted, with a minimum sample size of 10% coverage.
- Ideally plots are to be located 40 meters from an edge of the polygon to avoid edge bias. At minimum plots should be located so that they do not solely include the edge of the ecosystem type.
- Ideally there should be a minimum of 80 meters between sweeps/plots.
- Where appropriate a grid pattern should be used and marked in the office prior to field data collection.
- The centre of each sweep/plot should be marked on the ground and recorded with GPS, for staff verification, if necessary. This information should be mapped and provided with the data collection sheets to TRCA staff.
- *Basal area* to be recorded by tree species. All dead trees should be tallied but should not be used in the *basal area* calculation.
- Diameter measurements are to be recorded for all borderline trees. A plot radius table can be used to determine whether the tree is in a plot. A Plot Radius Factor Table can be found in Appendix D of the Ontario Tree Marking Guide.

References:

Lee, H.T., W.D. Bakawsky, J.Reily, J. Bowles, M. Puddister, P. Uhlig and S. McMurray. 1998. Ecological Land Classification for Southern Ontario: First Approximation and Its Application. Ontario Ministry of Natural Resources, Southcentral science Section, Science Development and Transfer Branch. SCSS Field Guide FG-02.

OMNR. 2004. Ontario Tree Marking Guide, Version 1.1. Ont. Min. Nat. Resour. Queen's Printer for Ontario. Toronto. p. 252

Basal Area Collection Form

Adapted from the ELC for Southern Ontario Field Guide for use with TRCA Guideline for Determining Ecosystem Compensation

Table B-1. Ecosystem Compensation BA Collection Form.

ECOSYSTEM TYPE CHARACTERISTICS	SITE:
	ECOSYSTEM TYPE:
	DATE:
	SURVEYOR(S):

TREE TALLY BY SPECIES:

PRISM FACTOR:

SPECIES	TALLY 1	TALLY 2	TALLY 3	TALLY 4	TALLY 5	TOTAL	REL. AVG

TOTAL							100
BASAL AREA (BA)							
DEAD							

STAND COMPOSITION:

COMMUNITY PROFILE DIAGRAM

NOTES:

APPENDIX C: INDIVIDUAL TREE REPLACEMENT TABLE

When the *basal area* approach is not suitable for determining compensation, as may be the case with individual trees where no municipal tree by-laws apply, tree replacement ratios can be a helpful tool. The following provides information on tree replacement ratios as well as typical costing when planting individual trees.

The data collected as part of municipal Urban Forest Studies conducted by TRCA and the i-Tree-Eco analysis model developed by the U.S.D.A. Forestry Service help to provide TRCA-relevant, empirical values for some *ecosystem services* based on tree diameter; these include carbon sequestration and pollution removal. The i-Tree-Eco data, the *basal area* information used for natural feature compensation as well as current municipal tree by-law requirements were all used to inform the suggested tree replacement ratios outlined in Table C-1 below. In general, older or more significant trees are replaced at higher ratios than smaller ones.

Table C-1. Replication Tree (Planting) Ratio by Diameter at Breast Height (DBH)

	DBH Range (cm)	Replication Ratio
1	0 – 10	1:1
2	10.1 – 20	1:3
3	20.1 – 30	1:10
4	30.1 – 40	1:15
5	40.1 – 50	1:20
6	50.1 – 60	1:30
7	60.1 – 70	1:40
8	70.1 +	1:50

Improved efficiency would be achieved if many trees would be implemented under one contract. For this Guideline, the following assumptions were made:

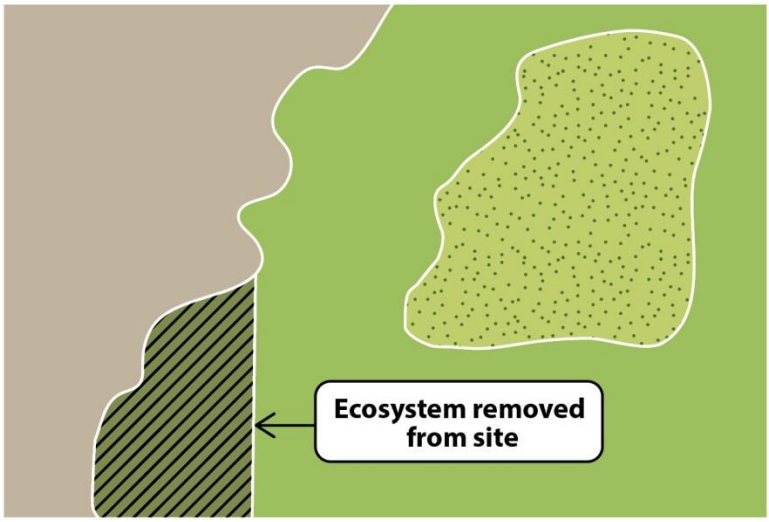
1. Replacement of individual trees will have a replacement requirement of minimum 60 mm wire basket caliper tree
2. Costing will include maintenance and monitoring with a minimum 2-year warranty
3. Costing is based on typical industry standards and planting within parkland settings

Costs associated with these plantings are subject to market changes for fuel, materials, etc., and are therefore not listed. For the most current costs, please contact TRCA staff.

APPENDIX D: COMPENSATION EXAMPLES

Simple examples are provided in this appendix that help to illustrate application of the compensation approaches described within the Guideline. The examples are not meant to exclude other options of compensation but to demonstrate some of the more common scenarios.

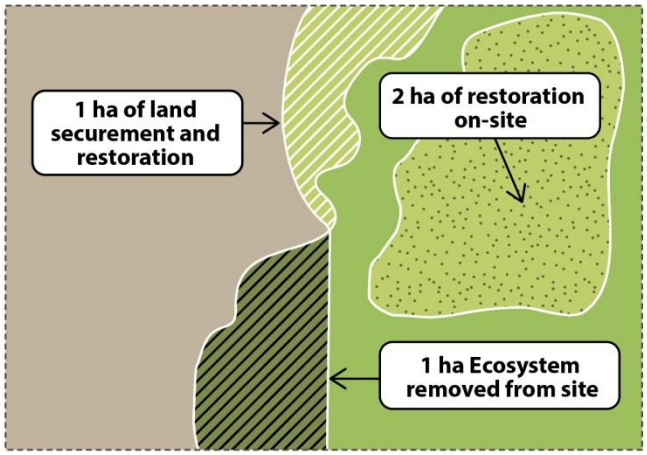
DESCRIPTION OF THE IMPACTED SITE AND ECOSYSTEM PROPOSED TO BE REMOVED



ECOSYSTEM REMOVED
Ecosystem type: Forest
Size of habitat: 1 hectare (ha)
Basal area: 15 m^2/ha

LEGEND
- Natural system
- Developable area
- Ecosystem removal
- Potential restoration area

OPTION 1 - ON-SITE COMPENSATION



ECOSYSTEM STRUCTURE

Basal area of 15 m^2/ha equates to a replacement ratio of 1:3. Total size of ecosystem restoration required = 1 ha x 3 = 3 ha

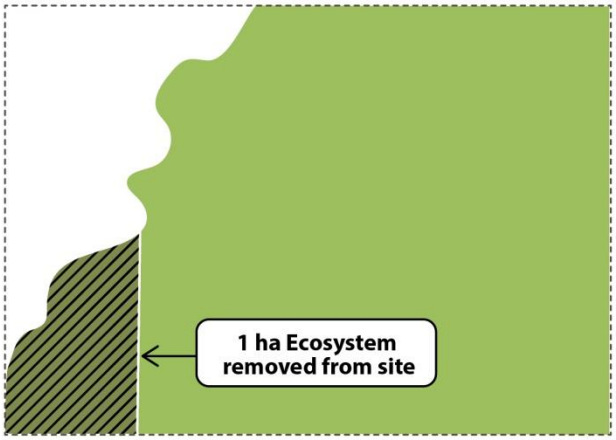
One hectare of restoration can occur on site within the area required to compensate for the lost land base. The remaining two hectares of restoration can occur within the potential restoration area on site.

LAND BASE

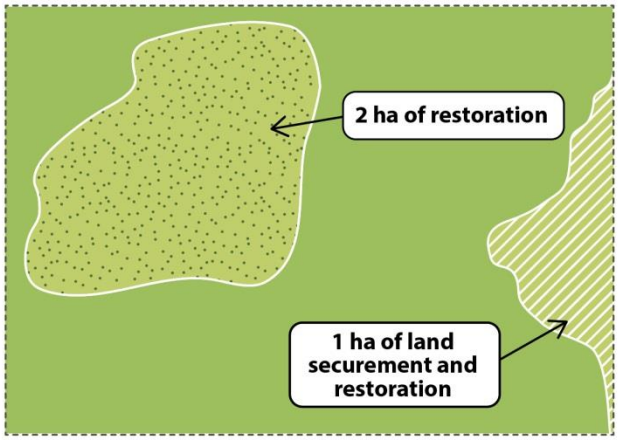
Ratio = 1:1 = one ha removed from the natural system = one hectare added back on the same site
(as illustrated in light green hatching)

OPTION 2 - OFF-SITE COMPENSATION WITH AGENCY-LED IMPLEMENTATION

DEVELOPMENT SITE



OFF-SITE LOCATION



ECOSYSTEM STRUCTURE

Basal area of 15 m^2/ha equates to a replacement ratio of 1:3. Total size of ecosystem restoration required = 1 ha x 3 = 3 ha. If cash-in-lieu option is being used, funds transferred to implementation agency depends on the cost to restore 3 ha of habitat. Cost to restore can be obtained on request.

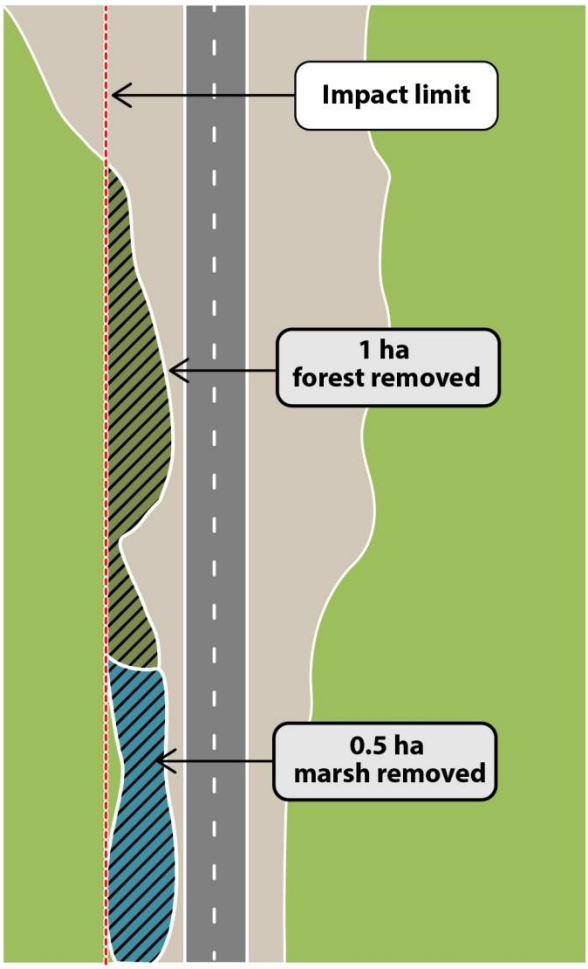
LAND BASE

Ratio = 1:1 = one ha removed from the natural system = one hectare added back off-site. If cash-in-lieu option is being used, land value of one ha determined using guidance from Section 2.2.

TOTAL COST UNDER CASH-IN-LIEU

The total funds to be transferred is the sum of the cost to restore three hectares of habitat and land value for one hectare of land.

MUNICIPAL INFRASTRUCTURE EXAMPLE



ECOSYSTEM REMOVED

Ecosystem type: Forest
Size of habitat: 1 hectare (ha)
Basal area: 15 m^2/hectare

Ecosystem type: Marsh
Size of habitat: 0.5 ha

ECOSYSTEM STRUCTURE

Forest
Assuming a forest basal area of 15 m2/ha, a 3ha:1ha replacement ratio is required. One ha of forest removed requires restoration of three ha.

Marsh
Marsh habitat is restored at a 1ha:1ha ratio. Therefore, 0.5 ha of marsh habitat must be restored to address the removal.

Restoration can occur on site to the extent possible with the remaining restoration being implemented elsewhere in proximity to the impact

LAND BASE

Land base compensation does not need to be addressed on an individual project basis. TRCA and the Municipality can track the land area removed from the natural system from all infrastructure projects and work together to explore avenues to off-set these losses through existing municipal land acquisition and ecological restoration programs or other means.