

TREGARON CULTURAL LANDSCAPE REPORT

Chapter VI: Landscape Preservation Treatment Recommendations

Shipman prepared plans for shaping the small, level space around the entrance and the surrounding slopes. The plans, however, were not carried out in full. A few decades later, aerial photographs revealed that entrance plantings with residential character were thriving in the mottled shade of the surrounding woodland canopy. Beyond the perimeter fence, tall evergreens and loose clusters of deciduous shrubs created a border along the entrance drive.

Today, the Macomb frontage area consists of level turf, a steep ravine, and a wooded slope along the sides of the entry drive. Referenced as Landscape Unit 6, it includes the remaining historic Japanese maple trees and a small wooded area to the south that frames the Tregaron entry, abuts the TLP lots to the north, and the wooded slopes and hillside up to the WIS facilities to the east. The drive skirts the ravine and creek as it climbs towards the hilltop and WIS. The roadside frontage of Tregaron interfaces with the domestic landscapes of the Queen Anne, Shingle, Classical Revival, and Mission homes along Macomb Street. The entry area reflects a degree of disturbance although some historical landscape features persist. Recent work by the local sewer authority has significantly disrupted soils, grades and the stream source arrangement between the drive and the street. Remaining historic built elements in this area include the entry drive, partially obscured cobblestone gutters, and several stone retaining walls on the downhill side between this landscape unit and the adjacent woodland. The frontage fence does not appear to be original. Contemporary stone and wood steps snake down the steep hillside for pedestrian access to the far corner of WIS. However, the eroding path dangerously drops walkers onto the entrance drive without a dedicated route to reach Macomb Street.

The current woodland overstory of the area is characterized by a mixture of American beech and red, white, and chestnut oaks. A small number of tulip trees are also present. A range of remnant ornamental species characterizes the entryway including rhododendron, flowering dogwood, Japanese maple, euonymus shrubs, Japanese andromeda, barberry, and leucothoe. The framing Japanese maple trees at the entry are the green-leaved form and are relatively old but may be from either the Parmelee or Davies-Post ownership periods. With the exception of numerous rhododendron, individual plants and small groups populate the area rather than large stands. Most of these are ground plane plants including pachysandra, English ivy, and Christmas fern. Little regeneration of canopy trees is present in the understory. Invasive species found on the wooded slopes of the area include ornamental groundcovers such as English ivy and pachysandra.

6b. Macomb Entry & Woodland Slope Preservation Approach

The mission of the Tregaron Conservancy for this area is to draw on historical antecedents and recapture the beauty and dignity of the Macomb entrance and drive. The area is a principal entryway for the school. A clean and simple approach to this area is recommended in order to bring together both sides of the drive to form a more visually apparent entry. Circulation should be enhanced to preserve historic retaining wall features and allow pedestrians to access the hilltop. Today a confusing combination of older trees and volunteer species on the wooded hillside obscure the impression of passage into the historic landscape of the estate. This situation should be amended; however, precise historic designs cannot be restored. Although Ellen Biddle Shipman created garden designs for the area no strong evidence exists that they were carried out. The designs suggest a clear intent to develop a more formal entryway stretching from the street

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along the drive by using selected plantings including undulating drifts of perennial plants, shrubs, and small trees. This design concept should be followed in a rehabilitation treatment.

The entry area can be framed with more intensive plantings with reference to the Shipman plans. The heavy application of shrubs complemented with small trees and smaller perennial plants dominate Shipman's designs for this area. Plans call for a shrub border to be planted along Macomb Street frontage. A separate drawing also calls for shrubs to be planted along sections of the entrance drive. Upon entering the estate, a small garden is shown adjacent to the drive as a special feature. These historic design plans are housed in the Shipman Archive at the Cornell University Library and can be consulted to inspire the specific planting palette and spatial arrangement for the entrance drive and Macomb frontage.

The wooded hillside lies between the drive and the newer WIS facilities. Treatment of this area should begin with removal of invasive plants and hazardous trees and removal of the winding wooden staircase. Following these actions, a dedicated pedestrian pathway would also be developed to allow students to safely use the entrance drive for access to the hilltop. With new circulation established for pedestrians, the hillside could be replanted as a backdrop for the entry experience.

Removal of undesirable woody plants should commence by using the "cut and paint" method as outlined in the Appendix. This cut and paint method is safe and effective because it focuses on the undesirable plants, kills roots through absorption into plant tissue, and limits any migration of herbicide into the broader landscape. Another method for the uprooting of small trees is the use of a Weed Wrench or similar tool.

Maintenance is also important for the long term success of renewal and recapture efforts. In order to reestablish the mixed hardwood forest of oak, beech, and tulip tree, a reliable watering system will need to be improvised for the slope. For minor watering a mobile watering system can be used with a water tank on a truck filled at a spigot. A gravity fed system is possible since the hilltop is accessible by vehicle. A hose connection also may be possible from the adjacent WIS facilities.

Woodland renewal would continue with the selective pruning and replanting of flowering dogwoods and broadleaf evergreen shrubs such as rhododendrons and azaleas. In order to maintain the character of the hillside into the future, a few areas would be planted with young oak and beech trees to eventually replace the existing mature trees. The invasive ground covers of English ivy and pachysandra should be replaced with other ground covers such as eastern teaberry and ferns.

Circulation concerns will be addressed in the rehabilitation treatment of the Macomb Entry area. The drive exhibits multiple layers of asphalt patching, over-paving and deterioration of cobble gutters, failure of drainage, and drive edge deterioration from erosion. After resolving drainage issues, the sections of original stone retaining walls to the east side of the drive require inspection and repair. This would entail cleaning and mortar repointing and selected stone resetting. In general Heritage Landscapes recommends milling the drive asphalt, repairing and

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reconstructing cobble gutters, cleaning and repairing original drains including pipes and outflows, and stabilizing and repairing stone walls as required. Improvements in pedestrian circulation would occur concurrently with the improvement in the gutter system. A new path would be constructed between Macomb Street and the hilltop along the edge of the drive. This path could be paved with brick to match the historic paving in locations on the hilltop. The path would also connect to trails on the other side of the drive near the meadow. A fork in the path will lead toward the new structures built by WIS.

This entrance area is adjacent to the relatively intensive hilltop development of WIS and the residences along Macomb Street. The unit can be considered for development extending from and contiguous with the existing Macomb streetscape. A small portion of the area closest to existing homes is suitable for additional houses that fit with the character of the neighborhood. These homes would be screened by using evergreen and deciduous plants from the entrance drive.

Creation of planting plans to screen adjacent homes, management of the wooded hillside, and removal of invasive plants and failing specimens can begin at anytime. Long term issues including irrigation and maintenance should be determined prior to carrying out new plantings in the area. Irrigation could be of the hose bib approach, as was used historically on the property—remnants of which are found today throughout the site. Since the Macomb entry is an important front door to the school and larger estate property, design decisions and maintenance responsibility should be discussed between the Tregaron Conservancy and WIS.

B. TREGARON LANDSCAPE PRESERVATION RECOMMENDATIONS SUMMARY

Several commonalities exist as the range of landscape preservation interventions is explored above. Remaining historic landscape features should be preserved, stabilized, repaired, with more extreme interventions of restoration and reconstruction applied to severely deteriorated and degraded features. Invasive species suppression and woodland management is also another critical piece in the recapture of the historic character and appearance of Tregaron. Initial work in the woodlands removing hazardous and felled trees has begun the process of greater access. While some efforts can be undertaken with volunteers, ongoing consistent work on landscape renewal will require either staff or contracted services. Opportunities to engage volunteers yield three aspects of potential volunteer efforts:

- Weed Team- Invasive Species suppression
- Trail Team- Trail upgrades and maintenance
- Planting Team- New trees, shrubs and herbaceous planting

The organization and effectiveness of ideal levels volunteer efforts and contractual efforts can be understood by relating the Tregaron landscape types to standard staffing levels. Based on management practices at other public institutions, including the Indianapolis Museum of Art, The New York Botanical Garden, and Heritage Landscapes experience, the following chart has

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been developed with regard to landscape type and full time employees (FTE) per acre. One FTE has been calculated based on a person working 1920 hours per year, or 48 weeks per year at 40 hours per week. This does not take into consideration construction projects that may be overseen by staff or irregular volunteer efforts. These are general guidelines that provide an order of magnitude approximation of the needed staffing levels if all areas of the Tregaron landscape are maintained effectively. The general staffing estimates are:

Landscape Type	FTE / Acre
High Care Annual & Perennial Gardens with Small Fine Lawn	3/1
Propagation House and Nurseries	2/1
Medium-High Care Perennial & Shrub Gardens	1/1
Medium Intensity Shrub, Tree & Herbaceous Collections	1/3
Low Intensity Tree & Shrub Collections with Some Lawn	1/5
Fine Lawn	1/9
General Lawn	1/18
Gravel Roads and Parking	1/25
Meadows	1/30
Managed Woodlands in Good Condition	1/30

These levels should be targeted within the Tregaron landscape over time. However, initial efforts should continue to move forward with respect to preservation, restoration, and reconstruction of historic landscape character. The Tregaron Conservancy should be commended on efforts to begin renewal and recapture of the former Tregaron estate landscape. Recognizing that areas will be brought forward sequentially, projects should target areas where work has already been done.

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1 – COW PASTURE & TWIN OAK



Figure V1.1. A historic image of the cow pasture at Tregaron showing the formerly open character of pasture edged with deciduous trees.

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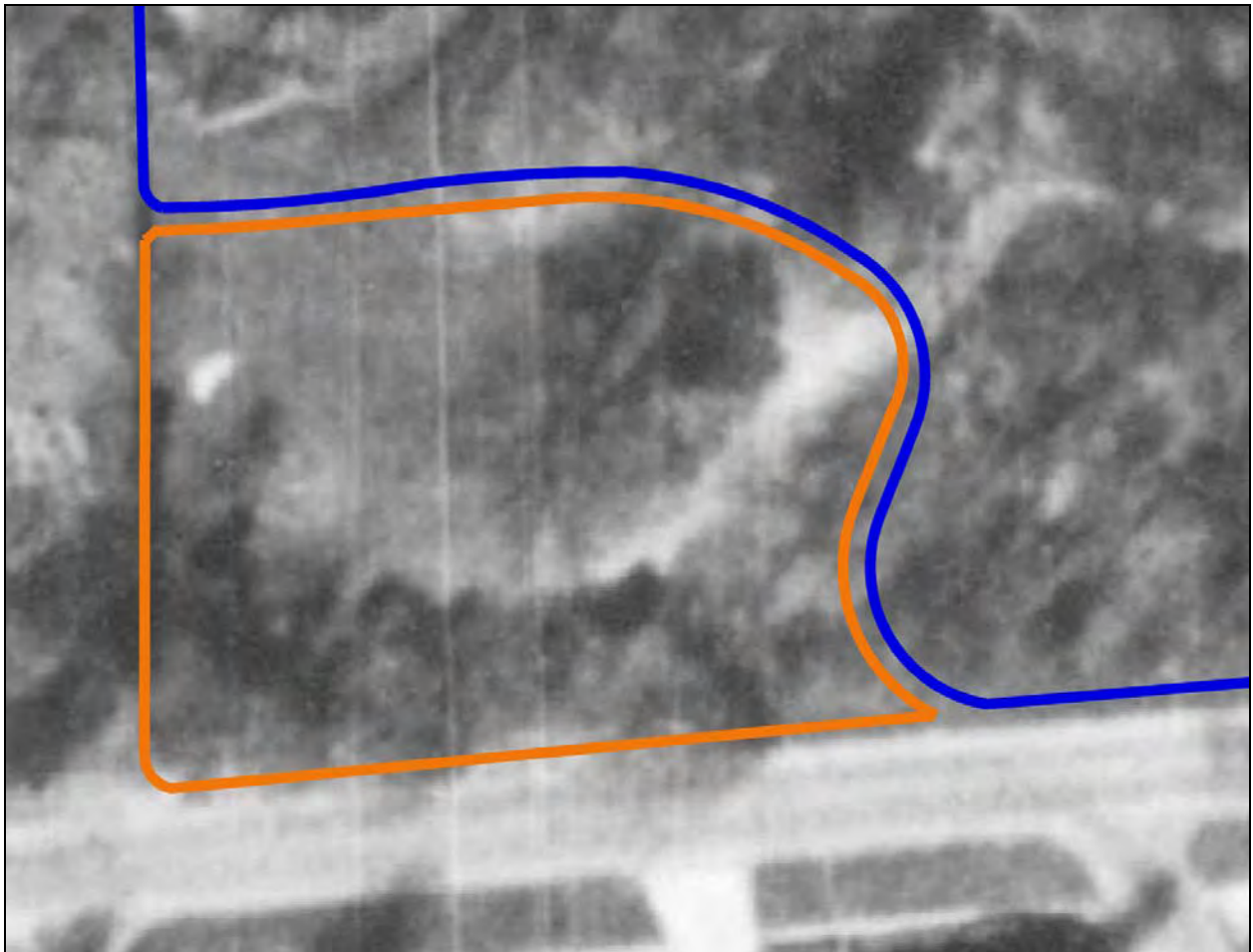


Figure VI.2. A detail area of the cow pasture outlined in orange over a historic aerial. Note the relationship between the open areas shown in lighter gray hues and more dense areas of trees shown in darker gray hues.

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Figure VI.3. A 2005 view of the twin oak surrounded by young invasive forest understory and regenerated oaks.

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Figure V1.4. Work underway clearing the Twin Oak Meadow in 2007 after removal of the dead Twin Oak. Note the large stump with the hollow center. in the foreground. Efforts to continue the removal of invasive vegetation should continue.

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Figure V1.5. Woodland clearing work session using a Weed Wrench fulcrum tool to remove invasive woody vegetation. Courtesy Louisville Olmsted Parks Conservancy and Andropogon Associates.

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Figure V1.6. Removing invasive vegetation and replanting the Twin Oak will aid in the recapture of the open pasture character at Tregaron, like this similarly situated oak in a meadow. Courtesy Heritage Landscapes.

2 – CAUSEWAY & POND VALLEY



Figure V1.7. A historic view of the Causeway area with open views framed by large deciduous trees and shrubs.

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Figure VI.8. The historic character at the Causeway was shady and enclosed by woodland vegetation.

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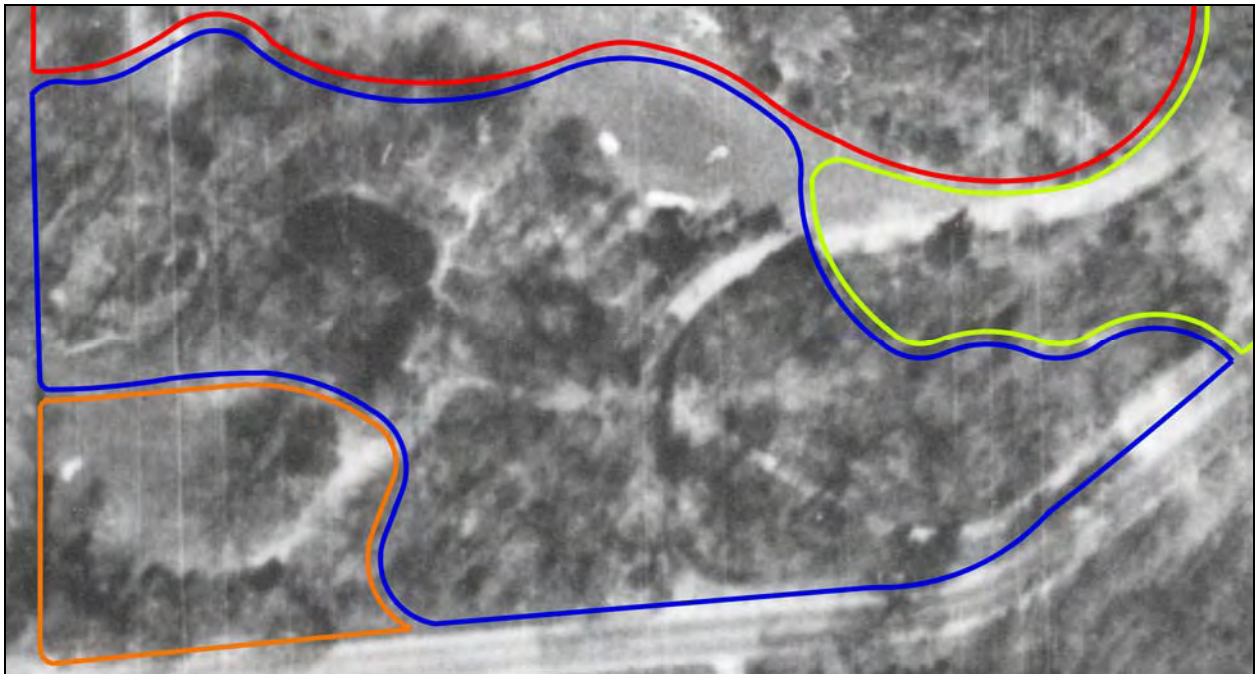


Figure V1.9. A detail of the Causeway and Pond Valley landscape area outlined in blue over a historic aerial. Circulation routes are visible through the tree cover.

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Figure V1.10. Existing condition of pond and surrounding landscape in 2005 prior to dead tree removal and tree care work.

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Figure VI.11. View of brackish pond with stone edge visible through dense invasive vegetation. Removal of invasive species will make the historic pond edge more evident.

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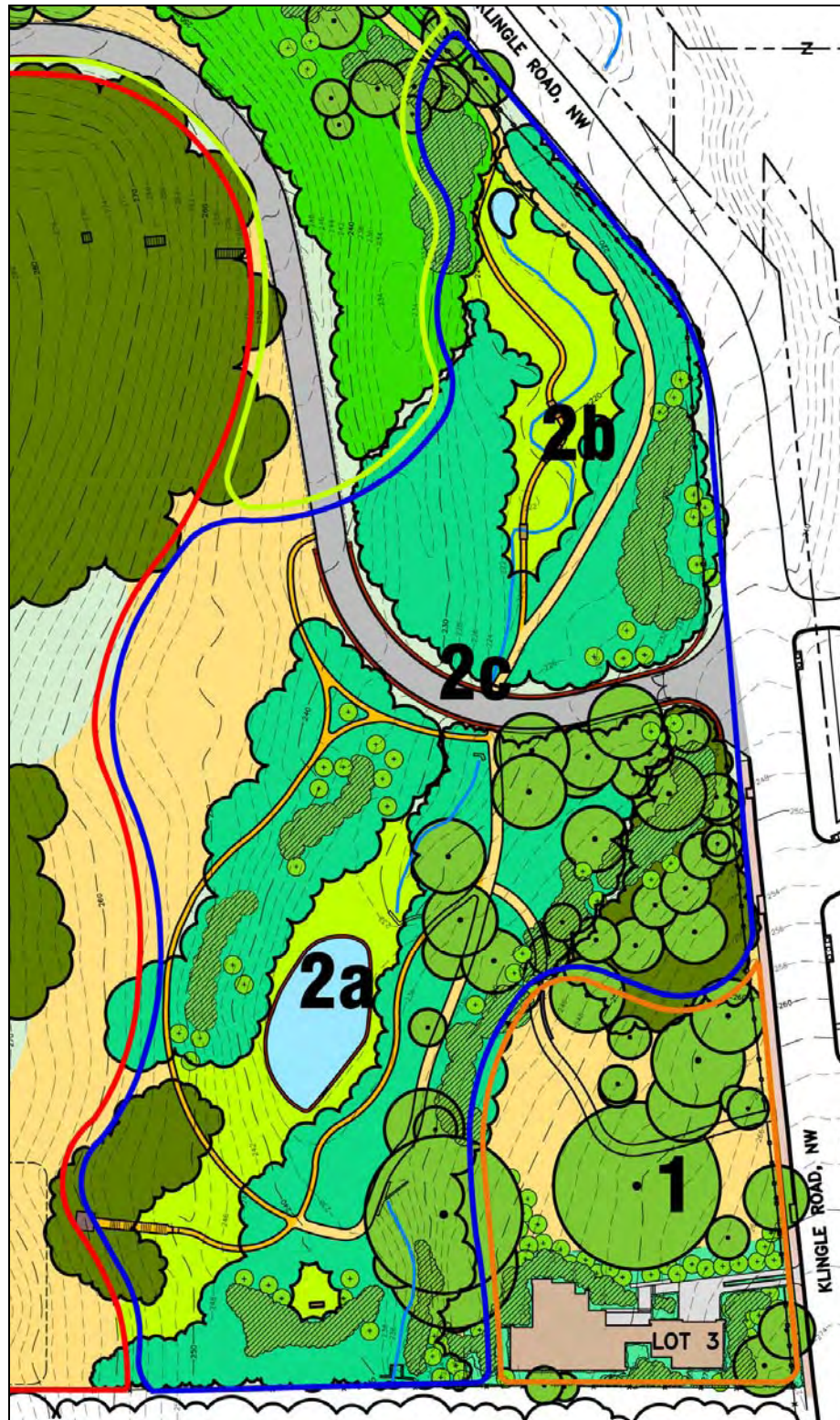


Figure V1.12. A detail of the Vegetation Management Plan showing the proposed vegetation typologies for the Causeway and Pond Valley for recapture of the historic character.

3 – DRIVE & MEADOW



Figure V1.13. A historic view of the Drive & Meadow area shows sloping topography and an open ground plane surrounded by deciduous trees and shrubs.

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Figure V1.14. The Drive & Meadow landscape area outlined in yellow over a historic aerial shows the generally open historic character of the area.

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Figure V1.15. View of the Drive & Meadow area in 2005 with open turf grass lawn areas with clear views bordered by trees and shrubs.

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Figure VI.16. A view across the Drive & Meadow area to adjacent houses abutting the Tregaron property. A woodland edge helps screen houses from view; however, renewal in the woodland edge is needed.

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Figure V1.17. The replacement of turf grass with meadow grasses in some areas at Tregaron landscape will reduce maintenance and improve sustainability measures across the property. Courtesy Valley Forge National Historical Park and Heritage Landscapes.

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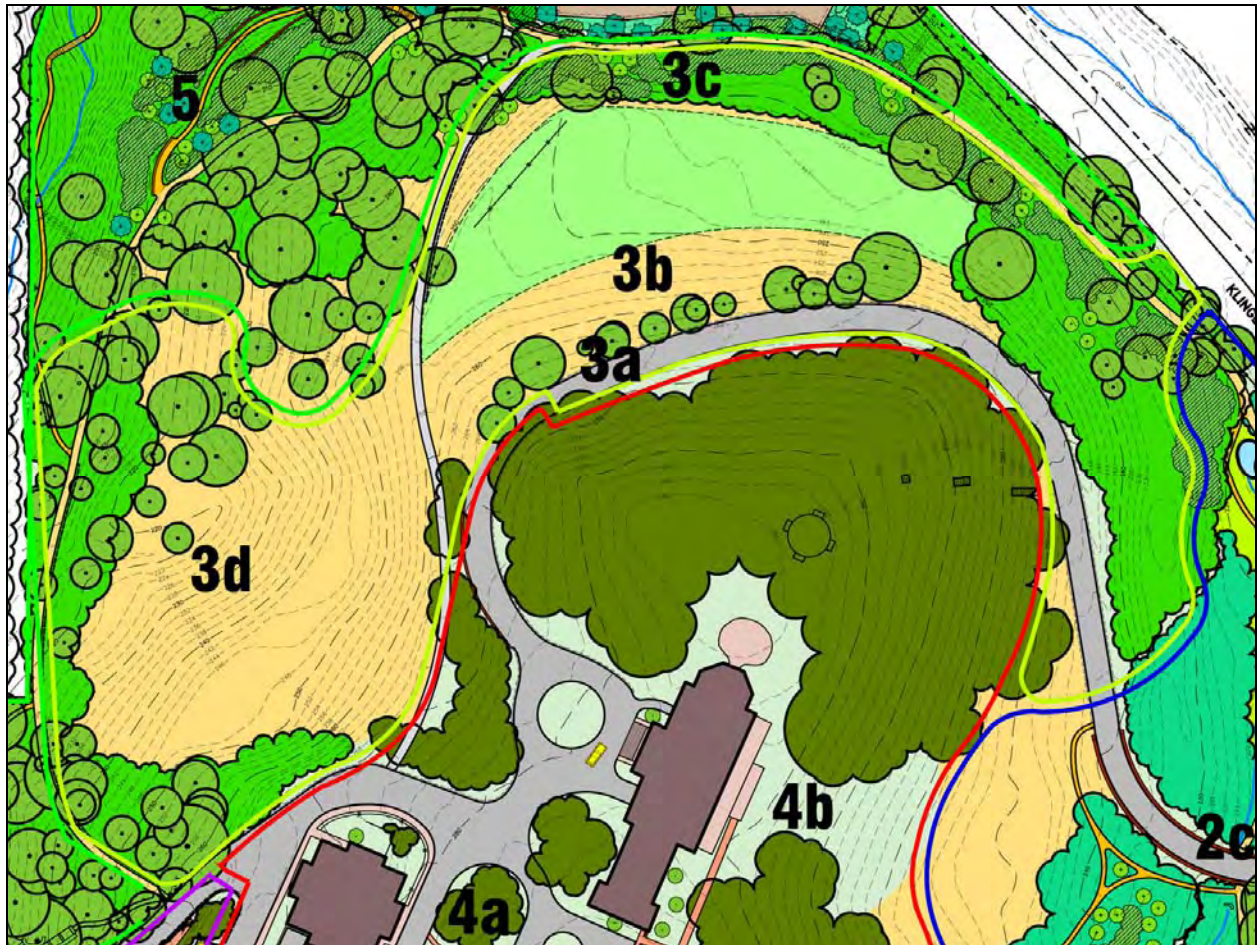


Figure V1.18. A detail of the Vegetation Management Plan showing the proposed vegetation typologies for the Drive & Meadow with meadow and recreational turf as well as woodland renewal.

4 – HILLTOP, GARDENS & HOUSE



Figure V1.19. A historic view of the Hilltop, Gardens & House area with expansive views across open lawns framed by overstory trees and beds of shrubs and groundcovers.

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Figure V1.20. A historic image showing the former character of the area adjacent to the main house with layers of understory and overstory vegetation to create shady and more enclosed areas.

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Figure V1.21. A historic view of the formal garden west of the main house at Tregaron. Character-defining features include the brick wall, entrance gate, water feature, and various shapes of manicured planting beds.

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Figure V1.22. The Hilltop, Gardens & House landscape area outlined in red over a historic aerial, shows the historic character and spatial organization of the buildings and adjacent landscape.

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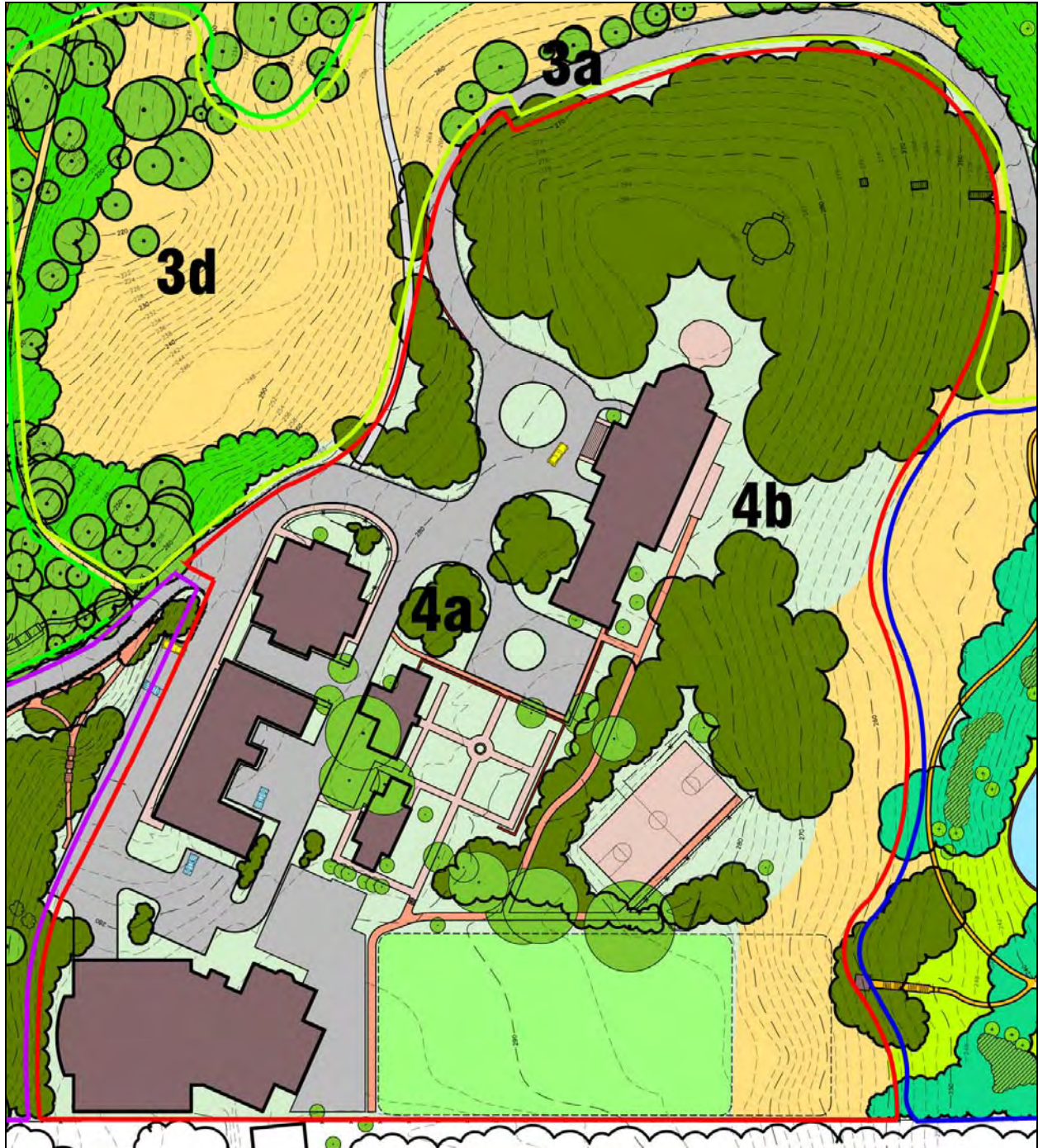


Figure V1.23. A detail of the Vegetation Management Plan showing the proposed vegetation typologies for the Hilltop, Gardens & House area with turf and mixed oak upland woodland.

5 – NORTHEAST WOODLAND, STREAM & TRAILS



Figure V1.24. View of the conditions of the northeast woodland area in 2005 with invasive plant cover and some woodland regeneration.

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Figure V1.25. Remaining historic landscape features include these stone steps and path in the northeast woodland.

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Figure V1.26. Example of historic concrete drainage gutter at the edge of a path now partially obscured with leaf litter and volunteer herbaceous groundcover.

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Figure V1.27. A modern concrete wall installed to alleviate erosion is proposed for removal to be followed by slope regrading, planting, and erosion control.

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Figure V1.28. Shipman era woodland overlook stone walls with dentil style vertical capstones require inspection and masonry repair.

6 – MACOMB ENTRY & WOODLAND SLOPE



Figure V1.29. A detail of the Macomb Entry & Woodland Slope outlined in purple over a historic aerial shows the density of woodland during the period of significance.

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Figure V1.30. This 2005 view of the Macomb entrance shows the adjacent urban neighborhood along Macomb Street in the background and the curving entry drive with cobble gutters.



Figure V1.31. Some historic landscape features remain at the entrance such as this segment of stone wall, the broken end requires replacement while inspection, repair and repointing should be carried out on the remaining wall.

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Figure V1.32. Character-defining landscape features to preserve include the cobble drive gutter, and the character of the woodland understory with ferns and rhododendron.

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Figure V1.33. A detail of the Vegetation Management Plan shows the proposed vegetation typology for the Macomb Entry & Woodland slope with meadow, mixed oak upland woodland, and screening plantings around the houses on Lots 1 and 2.

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Figure VI.34. This computer altered image of a pond area shows the character of dappled light, mature canopy trees, flowering native understory trees and herbaceous plantings of wetland primrose and wild geranium that depict the intended character of the Tregaron pond valley.

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Figure VI.35. This computer altered view shows a spring scene along a meandering stream that characterizes the lower pond valley landscape intended for Tregaron with wildflowers like tiarella, trilliums, mayapple and spring beauties cover the ground plane with the display of white blossoms of native dogwood trees.

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Figure VI.36. A woodland walk image, computer altered, envisions the rich plantings of the healthy Tregaron woodlands of the future with an understory of ferns and native shrubs below a mixed native tree canopy.

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Appendix: Landscape Renewal Guidelines

As cultural landscapes are renewed there are a number of factors to consider in terms of implementation approach. There is, for example, a concern for limitation of adjacent damage within the landscape as implementation works proceed. While in many cases degraded aspects of the landscape are replaced in-kind with historic materials, there is also the opportunity to apply new technologies and consider green design and construction approaches. In response to the needs of cultural landscapes for thoughtful implementation through contractor, staff and volunteer project initiatives, Heritage Landscapes has developed useful protocols to address the construction of stabilized aggregate trails, soil management, exotic species suppression, meadow establishment and tree planting.

As preservation landscapes architects our overall objective is to ensure a vibrant future for valued heritage landscapes. An increasingly important component of preserving and sustaining heritage places is the application of green principles and decreasing project carbon footprint. In principle as a baseline, preservation seeks to safeguard a valued place and limits site disturbance in any undertaking. In assessing sustainability, the effective transformation of an historic landscape into a more useful, safe, aesthetically pleasing place is a more sustainable and green practice than building anew. Conceptually the reuse of a heritage place yields a smaller carbon footprint than shaping an entirely new landscape. As the practice of carbon footprinting progresses Heritage Landscapes will be testing the application of this concept to historic landscape preservation and reporting on project impacts.

These Landscape Renewal Guidelines developed by our office are included here for reference. They are office protocols and are constantly updated as techniques are tested and results gathered.ⁱ All of them are relevant to the planned work at Tregaron.

TRAIL DEVELOPMENT GUIDELINES

The walking trails at Tregaron are intended for strolling, walking, jogging and dog walking use by pedestrians. They are not intended for mountain biking or any motorized scooters or all terrain vehicles. Trails also provide service access to care for the landscape, preferably using lightweight golf carts with pneumatic tires. Recognizing these clear purposes, paths within the Tregaron landscape do not need to be very wide. Paths and trails are proposed for a 54 to 60-inch width which is sufficient for single file passing. Path layout is an important task to provide the gently curving, graceful alignments seen in historic images and indicated by the remaining concrete path gutters. Not all

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historic paths were edged with gutters. Those paths without gutters should be laid out with care to achieve the alignment indicated by the historic documentation to achieve the desired character.

A 54 to 60-inch path width is also a good for relatively low impact construction. Using small machinery and extreme care, former paths can be constructed along historic alignments with a few stockpiling locations for excavated soil and gravel fill materials. Construction with limited adjacent impact is desired. Layout is field staked using offset stakes that can remain in place and be outside of the construction zone but still highly visible. A small backhoe with a 48 inch bucket can excavate the path base into the soil about 8 inches in depth. This type of machinery can work essentially within the proposed path cutting, placing gravel fill then driving on the base course to cut the next portion.

Heritage Landscapes prefers to use gravel and bound aggregate paths whenever appropriate. They are less costly to construct and are often more in keeping with the historic character of the property. The additional impetus to use a gravel and stabilized aggregate path construction is carbon footprint and fossil fuel use. Concrete has a high carbon footprint from the preparation of Portland cement at high temperatures using fossil fuels. Asphalt products are also fossil fuel intensive. Gravel and aggregate paths have a considerably lower carbon footprint and are therefore more sustainable.

After approval of the excavated path layout the base is cut and a 4 inch gravel base should be compacted in the excavated portion of the path alignment. On top of the gravel, a 4 inch layer of decomposed granite or crushed 3/8" or 1/4" aggregate with StaLok should comprise the path surface. StaLok is a patented, non-toxic, colorless and odorless organic binder that comes in concentrated powder form that binds stone dust and fines to form a durable low maintenance path. StaLok® Paving Material for aggregate path surfacing is obtained from Stabilizer Solutions, Inc. 33 South 28th St., Phoenix, AZ 85034; phone (602) 225-5900, (800) 336-2468; fax (602) 225-5902; website www.stabilizersolutions.com; email info@stabilizersolutions.com. Mixing of the patented binder with the gravel is a specified technique that can be carried out at the gravel supply location and brought to the site. Once at the site, the approved aggregate and StaLok mixture is placed on the compacted gravel subgrade, raked smooth, wet down, allowed to stand and compacted to provide the desired 4 to 5 inch depth. This gravel bound path hardens as it dries and resists erosion.

Where the path gradient exceeds 5 percent and where paths intersect, water bars should be placed at not more than 15 foot intervals to shunt surface water flows to the side of the path. Doing so redirects surface water flows and limits the amount of path erosion over time. Water bars are constructed of cobblestone, "V" or "U" shaped formed steel or other durable materials. They are placed at an angle with one end farther downhill creating a break in the path that catches moving water and shunts it to the side.

SOIL MANAGEMENT GUIDELINES

During any future undertaking at Tregaron, management of soils is imperative to controlling soil quality and limiting negative impacts from projects such as compaction from heavy machinery. If projects require special machinery, maximum sizes and weights should be specified to limit soil disturbance. Heritage Landscapes specifies pneumatic tires or wide track light weight machinery on

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previous projects to limit soil compaction. Post-construction deep tilling and addition of appropriate soil amendments, such as sands, small gravels and compost, can also aid in increasing soil fertility after construction.

Native soil is a combination of sand and gravels, clay silt and organic matter. When excavation is required separation of topsoil and subsoil is specified. The principal difference between topsoil and subsoil is the % of organic matter although subsoils may contain different percentages of the mineral soil components: sand and gravel; clay; and silt. With the scarcity of native soils and the impacts on other landscapes of soil stripping for construction projects, Heritage Landscapes has developed specifications for testing excavated and on-site soil stockpiles and amending these soils for reuse at the construction site. This is a sustainable construction practice that again limits carbon footprint by reducing transportation costs and not requiring the degradation of another site to remove the topsoil. What is more readily available today is compost. While garden guidance touts the annual addition of compost to garden soils, recent studies indicate that composted material in excess of 20% by volume of soil reduces plant growth rates. It is thought that this is due to the decomposition process that is continuing to a degree to breakdown the humic material in the compost and that process robs nutrients from the plants. Excavated soils can be effectively reused on site with appropriate amendments. Often an increase in sand and small gravel can aid in soil percolation and enhance aerobic conditions. Compost is generally added to enhance plant nutrient availability. The key elements to successful reuse of on site soil is careful construction practices, controlled stockpiling, thorough testing for all soil factors, addition of appropriate amendments, thorough mixing and proper placement of subgrade soil fills and finely graded surface topsoil.

Soil erosion is also a factor to consider and limit within the Tregaron property. Steeply sloping topography with limited ground plane vegetation covers makes soils susceptible to erosion during even light rainfall events. Slopes beyond the mowable limits of 1:3 or 33% should be stabilized with densely rooted meadow grasses or woodland understory plantings, not maintained in frequently mown turf. Improved stormwater management will also aid in soil stability. High velocity water scours the edges of the ravines, removing topsoil and exposing tree roots. Stormwater, soil management and erosion control should be considered together in landscape renewal implementation at Tregaron.

EXOTIC INVASIVE SPECIES SUPPRESSION GUIDELINES

The limited focused care given to the Tregaron landscape over recent decades has resulted in an obvious, widespread problem of exotic invasive species invasion. Colonization of invasive exotic species from both historic and contemporary sources is noted at property edges, in woodlands and in the Pond Valley. Exotic invasive plants are aggressive, tending to increase in number while effectively competing against native plants while limiting native plant growth and reproduction and degrading the habitat value of the area. Exotic, fast growing species are considered bully plants, offering no positive benefits that limit growth of plants that do offer positive environmental benefits. In a designed landscape, historic exotic plants that are well-behaved, staying where planted, have a place in the overall composition. In contrast invasive non-native plants that migrate and proliferate throughout the landscape are not welcome as their growth tactics out-compete other plants and alter the landscape character. In recent years active suppression of invasive plants has been undertaken in

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many public landscapes and considerable technical literature addressing testing, tools, techniques, safety issues and effective control has been developed.

Invasive species suppression will be an ongoing effort throughout the Tregaron landscape. With a planned suppression program, colonized areas of invasive plants can be removed although seed sources will remain in areas adjacent to Tregaron. Inspection and removals should be an annual effort that will suppress dense patches of undesirable plants within a few years of intensive effort. Planning the program of invasive species suppression is an initial step. One approach to the effort is targeting species suppression by applying tested protocols. An effective strategy for control of invasive plants is the Bradley Method, a perimeter approach that moves from landscape edges to center sequentially. Locations of infestations are identified and plants are eradicated at the perimeter and removal continues working toward the densely populated areas. The Bradley Method “has great promise on nature reserves with low budgets and with sensitive plant populations” as noted in a useful overview publication.ⁱⁱ

Exotic, invasive trees and shrubs, vines and groundcovers each have effective means of control. The principal invasive species at Tregaron are Norway maple, vine honeysuckle, garlic mustard and petasites a wetland plant, while other species are also present to a lesser degree in specific areas. In order to completely suppress undesirable woody and herbaceous plants, manual removal, targeted burning, mowing, herbicide and biological controls may all be potentially effective control means. Manual removal is a tried and true method of suppression. Plants and roots are removed by hand without toxins. This technique is often used for vines and groundcovers and is more successful with some species than others. Some plants can be suppressed through mowing at target times, like early spring when top growth absorbs most of the plant nutrients. Repeating mowing is an effective control in areas where the ground plane is readily mown and woody plants are not in the way of mowing activity. Plants with brittle roots and vigorous re-growth, like garlic mustard, require a variety of techniques and a degree of persistence with hand pulling, herbicide treatments, and propane torch burning.

Young woody plants of ½ inch to 1 ½ inch caliper can be removed with Weed Wrench or Talon tools made for this purpose. These tools allow manual removal of plant and root mass while limiting disturbance to the root zones of the nearby plants. An effective protocol for invasive exotic tree and shrub suppression for plants larger than Weed Wrench size is a double cutting method, where the plant is cut with the second cut as close to grade as possible, followed by painting herbicide, typically Glyphosphate or Triclopyr, directly on the cut trunks. Stems wet from cutting absorb the herbicide as they dry out, effectively killing the plant. Without herbicide, trees will continue to resprout vigorously. Coordination between tree cutting crews and licensed pesticide/herbicide applicator should be scheduled for best results. Herbicide should be applied to the cut trunks within six hours. This cut and paint method limits herbicide migration into other areas of the landscape and is safer and more effective because it focuses only on undesirable plants, kills roots through absorption into plant tissue.

Selection of an invasive species removal technique is dependent on available personnel, funding, and proximity of non-target species. The control of specific target species needs to be carried out by researching best practices to obtain data on successful control, planning the effort and persisting with the suppression until the species is under control. Invasive species control should address target

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species and rely on best practices and field tests to refine the most suitable approach. Hand removal of target plants using teams of people on volunteer work days has been effective in public parks and preserves. The Tregaron Conservancy could establish a “Weed Team” that works on suppression efforts several times a year. Within five years, control of target species should be well along and ongoing efforts will require a lesser level of effort.

MEADOW ESTABLISHMENT GUIDELINES

The meadow, turf and recreational turf areas at Tregaron are all in herbaceous cover managed with a mowing regime. The difference in these categories is the frequency of mowing and the control of broadleaf species. The meadow areas are proposed in order to reduce the amount of mowing required and focus mowing and broadleaf control in turf areas. There is a degree of increase in meadow areas particularly at the edges of the woodlands to reverse the trend toward reduction of open areas and to manage the woodland-edge invasive species by mowing. The intersection of different landscape types also requires careful consideration. In terms of landscape management the establishment of mowing along woodland edges and the reinforcement of positive, sustainable woodland edge plantings beyond that mowing line is a process that will take time to initialize and will require conscious management over time.

Seeding or planting desired meadow areas can begin with planting plugs of preferred grasses and wildflowers. By choosing and establishing the right plants, meadow areas will contribute to habitat value drawing field and woodland edge birds and butterflies. Initial meadow inspection and care will involve suppressing undesirable weed species for a period of three years. Meadow care, once established will be light with inspection and species control as needed and mowing once every two years. Mowing is used to suppress woody species which sprout from seed annually. Recent research indicates that to support butterflies biannual mowing is preferred so that cocoons remain on standing stems overwintering and opening the following spring. The final meadow management inspection and care will be determined by the target species and habitat conditions desired. The proposed meadow grasses and wildflower species are recommended as a mixture.

Native Grass Seed: Fresh, clean, dry, new seed, mixed species potentially the following list:

- 50 percent *Schizachyrium scoparium* (Little Bluestem)
- 30 percent *Sorghastrum nutans* (Indiangrass)
- 20 percent *Panicum virgatum* (Switchgrass)
- Use 60 percent Native Grass Seed

A typical listing of native wildflowers of the mid-Atlantic region is noted here. This list or one more fine-tuned to the Tregaron soil and climatic conditions can be developed. Obtaining seed from local and regional sources is desired. The objective is to mix native grasses and wildflowers for the Tregaron meadows. All listed wildflowers are perennials, though often annuals are used in the initial seeding and over-seeded for the first few years to provide bloom and more importantly to fill gaps in bare soil that could be targets for undesirable species.

Wildflower Seed: clean, dry, new seed, mixed species potentially the following list:

- 20 percent *Asclepias tuberosa* (Butterfly weed)

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- 15 percent *Aster laevis* (Smooth Blue Aster)
- 15 percent *Echinacea purpurea* (Purple coneflower)
- 15 percent *Eupatorium coelestinum* (Mist Flower)
- 15 percent *Monarda fistulosa* (Wild Bergamont)
- 10 percent *Rudbeckia hirta* (Black Eyed Susan)
- 10 percent *Solidago nemoralis* (Gray Goldenrod)
- Use 40 percent Wildflower Seed

As planting projects are scoped, scheduled seed availability needs to be arranged. A good source for seeds and plant plugs for meadow areas is Ernst Conservation Seeds, LLP, 9006 Mercer Pike, Meadville, PA 16335; phone 800-873-3321 or 814-336-2404; fax 814-336-5191, website <http://www.ernstseed.com>. If areas to be planted need a quick cover, it may be desirable to substitute seeds for some native grass plugs. Plugs have an advantage in quicker growth, but are more costly and require hand planting. There are several sources that could supply the needed seed or young plugs of preferred meadow plant materials. Plants can be contract grown in three to four months. If the use of plugs is chosen contract growing can be arranged with a conservation plant grower to ensure plant availability when the project goes forward.

TREE PLANTING GUIDELINES

The condition of the Tregaron woodland, with many mature trees and limited regeneration, means that intensive tree planting will need to take place in the future to renew woodland character. To ensure that the newly planted trees thrive and that the desired effect is achieved, it is essential that trees are chosen carefully. Trees should be selected according to woodland area, species type, and soil type. Trees should also be obtained in full health, planted appropriately and be provided care for the first three years. This tree planting guidance spells out the preferred protocols for tree planting. Observance of the recommended guidelines during selection, installation, and maintenance will aid in tree planting success.

Trees should be chosen for specific projects by contractors, staff, or volunteers to meet the project objectives. The species chosen for planting in each public landscape should conform to the list of existing trees inventoried and the soils and conditions where they are to be planted. Tree size for a park planting should be fairly substantial; 1 inch to 3 inches in caliper is a good range for public landscape use. Very small trees are more vulnerable to mowing, vandalism, weed growth, improper depth of planting and other potential failure causes. Although larger trees tend to cost more initially, they offer advantages in a public setting. While a smaller-sized tree may be desirable in home setting, a public setting calls for a tree with more presence. If a tree is staked and mulched appropriately, it is less likely to be stepped on or knocked down. Maintenance staff will have an easier time recognizing the trees while mowing, and they will be less likely to unintentionally damage the tree. Additionally, the slightly larger trees will more quickly become a noticeable and valued part of the improved landscape.

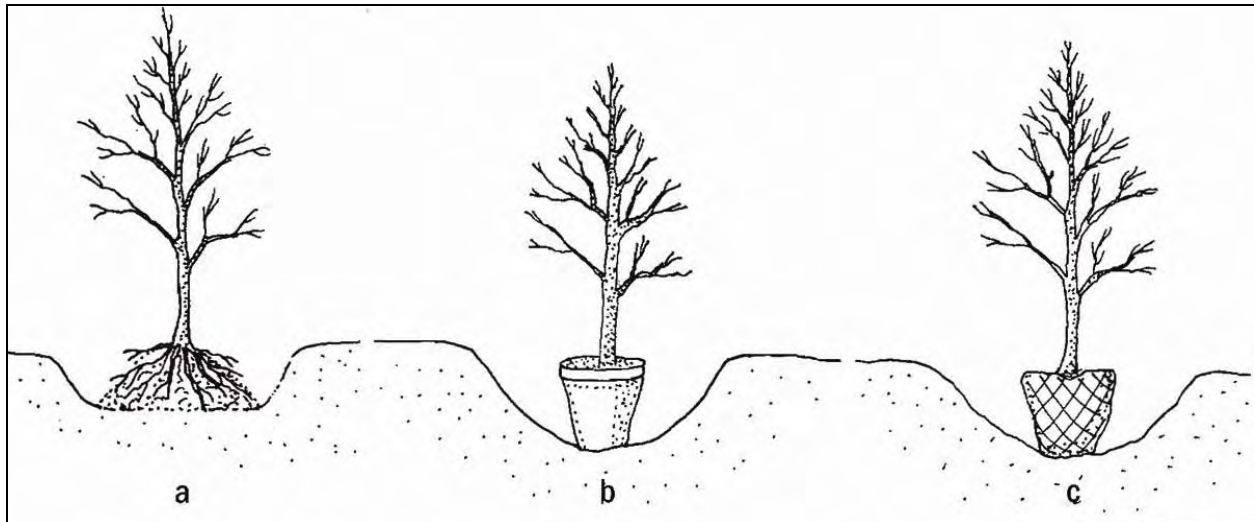
Tree Types, Similarities & Differences

Trees can be purchased as three different ways—bare root, container grown, or ball and burlap. Bare roots trees are shipped from the nursery with bare roots dipped in gel to retain root moisture during

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transport. As no earth ball encloses the roots, gel-dipping must be specified when ordering bare root trees or significant tree loss will occur. Typically, bare root trees are less expensive to purchase and ship, but demand greater planting care. Container grown trees are trees that have been grown in fabric or plastic containers that enclose the root mass. These trees are typically transplanted from container to container as the tree grows. However, containers can cause circling and limiting root systems as trees are not often upgraded to larger containers when their root systems need more space to grow. Ball and burlap trees (also known as B&B) are typically grown in the ground. When the tree is ready for sale, the root ball is dug and wrapped in burlap. Typically, these trees are the heaviest with a substantial earth ball surrounding the roots that requires substantial effort to plant. Each also requires slightly different planting techniques.



Trees can be purchased as (a) bare root, (b) container grown, and (c) ball and burlap for planting. All types require slightly different planting techniques, and each should be inspected for trunk, and root damage upon planting. Courtesy The Cornell Guide for Planting and Maintaining Trees and Shrubs.

Though container grown and ball and burlap trees are prevalent throughout the nursery industry, planting bare root trees is becoming more common, as bare root trees have several advantages. A 1 ½ inch bareroot tree is about 10 feet high and weighs about 30 pounds, which can be easily moved and carried by volunteers or staff for simple planting operations. Because of the reduced weight, reduced shipping charges and damages occurs, as damage to nursery growing stock nearly always happens during digging and transporting the trees. Once bare root trees arrive on site, trees are completely open to view and damage to trunks, branches and root masses can be readily seen. When planted, bare root trees adjust immediately to the planting soil rather than forming a root barrier at the edge of the container or ball and burlap soil. Additionally, trees have increasing availability at 1 inch to 1 ¾ inch caliper size for early spring planting before leaves break out.

Tree Inspection

Healthy trees should be obtained from reputable growers. Inspection of trees upon purchase should examine many factors including trunk form, branch patterns, root vigor and lack of damage. If the caliper of the tree is greater than 2", the trunk should taper some as it extends upward.ⁱⁱⁱ The trunk should also flare as it reaches the soil indicating the presence of lateral roots. This area of the plant,

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referred to as the “root collar,” will be mentioned again in the section outlining good planting practices. It is imperative that soil not be piled on the trunk. Additionally, for grafted trees the notched section where the trees have been grafted together should not be included in the root section. This grafted area must remain above soil level. The visible union will disappear (or be significantly reduced) as the tree ages.

The branching patterns of the tree should have adequate spacing between the branch layers, allowing the limbs to grow without crowding. Generally, the tree should emerge from a single main trunk, although some trees have natural multiple trunk clump forms. For single trunk trees well spaced branching should develop high up the trunk. While young trees may branch at 3 to 4 feet above the root flares most park trees should be trimmed up as they mature to allow people to walk underneath. Trunks that split into multiple trunks in a cluster near each other are more likely to be damaged by ice or high winds.^{iv}



Courtesy Planting Trees and Shrubs for Long-Term Health.

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Depending on the type of tree, the root system may appear either coarse with few thick roots or fibrous with a dense root mass. The texture varies but the roots should be directed outward and slightly downward. Circling roots indicate that a plant has either been container-bound for too long or that it was planted too deeply. If a plant has too much soil above its top layer of roots, it will tend to send new roots in an upward, circling direction seeking oxygen and water. This “dysfunctional” root system can create serious problems for the tree as it disrupts the tree’s ability to send nutrients and water through the trunk to the branches and leaves. Circling roots should generally be avoided, or at the very least removed. Trees with evidence of trunk damage, insect and disease infestation, or poor root form with girdling, or circling root forms should be rejected.

General Planting Guidelines

Ideally, the planting site should be prepared prior to delivery. Preparation will allow the delivery driver or staff to place the trees as close to the planting location as possible and minimize machinery for transport. Each time machinery is used for transport, the plant is subject to mechanical and handling damage. Planning for the delivery ahead of time can help minimize these risks. Prepare the planting hole and soil for tree planting following these steps:

- In the selected locations, cut a circle six-feet in diameter centered on the tree trunk position. Remove all sod and take to a compost location away from the planting site.
- Prepare a flat-bottomed hole for the trees about 3 to 3 ½-feet wide and 2 feet deep. Use a tarp for piling soil next to the hole for a cleaner planting operation.
- Use a soil probe to determine soil pH. Understand what pH levels the incoming trees prefer. This will vary according to species type. Adjust pH downward (increasing acidity) with aluminum or iron sulfate, or adjust it upward (decreasing acidity) with lime. Mix the chosen supplement into the soil that is waiting on the tarp next to the hole.
- If desired, use *Roots* fertilizer to ensure that the soil contains adequate trace minerals and microbial elements. An organic, slow-release granular fertilizer (i.e. 4-4-4 balanced formula) is also recommended. Quick-release fertilizer should be avoided, as it can burn the roots of the tree if it comes into direct contact with it. Add a pint of each fertilizer type to the soil (the same soil that is temporarily located on the tarp), and mix thoroughly into the pile. Be sure to break up any large clumps of soil so that fertilizer distribution is even. Nutrients may also be added once the plant is established. However, the process of being transplanted is highly stressful for trees and plants. Additional support is often beneficial, especially in areas with nutrient poor soils.

Once the planting holes are prepared, the trees may be delivered. While lightweight bare root and container grown trees can be hand carried with ease, ball and burlap trees of 1 ½ to 3 inch caliper trees are heavy. These heavy trees should be delivered on a small truck, unloaded on a ramp or lift and positioned near their planting locations. A ball cart can be used to move the trees without damaging root ball or trunk. Avoid carrying container grown and ball and burlap trees by the trunk as root breakage can occur and damage the trees.

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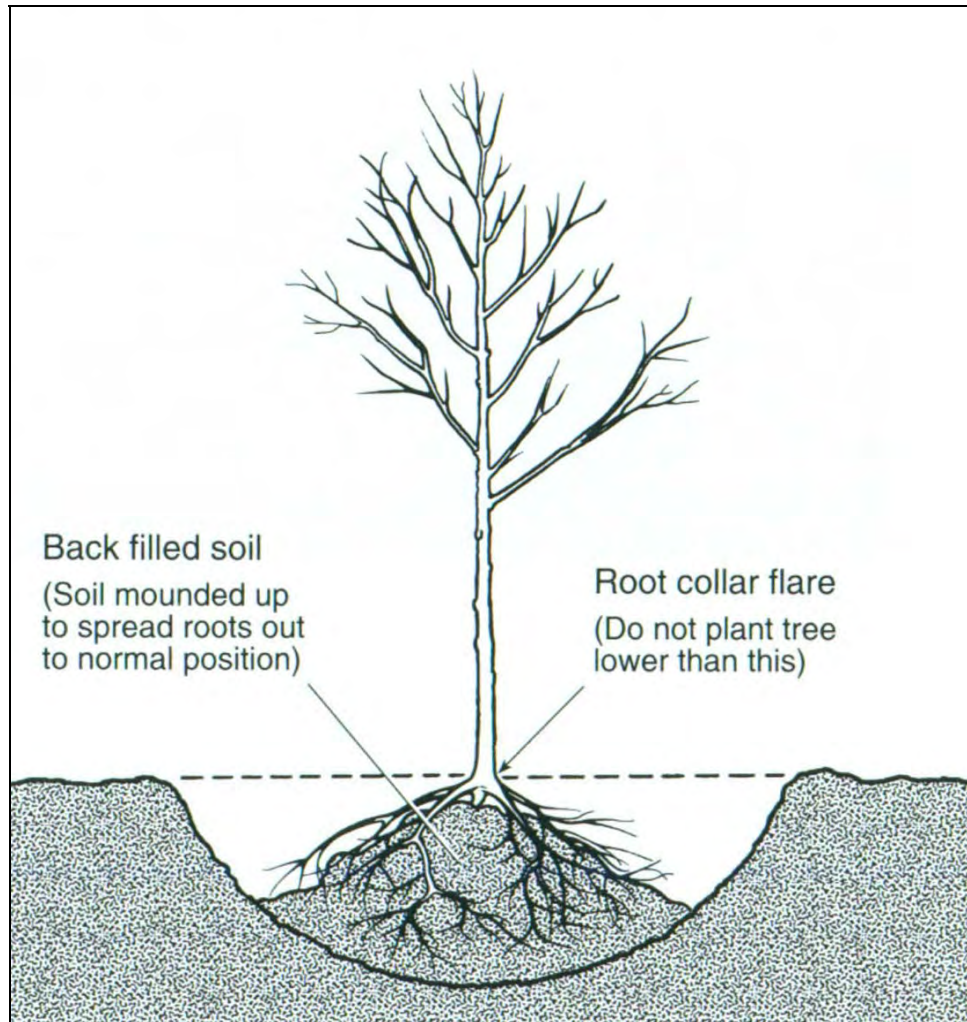


Bare root trees weigh about 30 pounds per tree and are approximately 10-15 feet tall. Trees are lightweight, easy to handle, and can be moved by one person. Courtesy Heritage Landscapes.

Upon delivery, determine the root ball height and width. Locating the root flares, the location where the roots flare away from the trunk, help establish the correct planting depth. If using ball and burlap trees, the burlap should be peeled back to locate the root flares. From the top of the root flare, go down about 2" and use this point as the top reference point for depth measurement. The tree will be planted 2 inches above the surrounding grade. Use this reference point to plant the tree at the correct depth. Do not plant the tree too deep with soil above root flares. The root flare will show above the soil when correctly planted. In contrast, a tree planted too high with too much of the root flares showing can survive although it may dry out. A tree planted too low will fail to thrive and may die. To insure correct soil depth:

- Dig hole to match root mass or soil ball size adjust width of hole to allow a minimum of 6-inches around the tree on all sides.
- Check hole depth against the roots or soil ball and the dug hole for accuracy before placing plants
- If hole is too deep, replace soil and firmly tamp into bottom of hole to compact at proper depth to avoid tree sinking after planting.
- Place the tree in its prepared hole.

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When planting bare root trees, the hole should be about 3 to 3 ½-feet wide and 2 feet deep, and the root collar should be located above the soil. Courtesy Planting Trees and Shrubs for Long-Term Health.

Planting should be carried out in teams of two so that one person mounds and packs the soil while checking tree planting depth and the other holds the tree upright. The backfill soil is placed and tamped halfway full. Fill the hole with water and allow it to be absorbed, then continue to fill and tamp again to reach final soil depth. This will help guarantee good root to soil connection and eliminate air pockets.

When planting bare root trees, care should be taken to schedule planting promptly after tree delivery. Bare root trees cannot be held long but if necessary can be place in a refrigerated space with the roots kept moist by packing into mulch material and wetting down with a fine mist. Upon arrival inspect and selectively prune damaged roots before planting. A portion of the root mass showing evidence of disease, damage, or girdling should be removed.

If you receive bare root trees for spring planting, observe the trees in bud condition. Buds should be swollen and ready to break into leaf but not be leafed out. In the case of oaks, birch, and hawthorn,

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these species may require sweating, a special watering and heating treatment that helps tree growth buds to swell and break dormancy. The grower may carry out this process which requires that the trees be placed on layer of wood chips, burlap, or other material and doused with water. When ordering, check with the grower to see if this is the case. The wet saplings are then covered with moist burlap and a sheet of thick plastic to retain moisture. Placed in a warm location (45-70 degrees Fahrenheit) out of the direct sunlight, the tree buds will swell. When the buds swell but before the leaves open, carry out the planting.

For bare root trees fill the hole with a mound in the center that will accommodate the specific root mass to the actual tree to be planted. Tamp the soil mound lightly by hand so that it functions as a support for the loose roots. Position the roots around the tree, and ensure that the tree remains upright. Fill in around the tree using the soil on the tarp. Ensure that the trunk at the point of the root flares is positioned 2 inches above the surrounding soil height beyond the planting hole.



For container grown trees, carefully remove the tree from the container and loosen roots. If pot-bound slit all four sides and bottom of root ball. Courtesy Planting Trees and Shrubs for Long-Term Health.

Planting container trees requires special attention to removing the container and opening the root ball. First, check if the trees arrive dry and water them before removing the containers. Trees may be removed from containers by gently pushing on the container and if needed pulling on the trunk.

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If there are roots coming out of the bottom loosen or trim these roots before attempting to remove the container. Once the root ball has been removed, inspect the root mass for encircling roots and tease them loose. If root circling is a problem, create 1" slits from top to bottom on each quarter of the container soil mass. These slits continued across the bottom of the soil and root mass, forming an X. This root and soil mass slitting will reopen the root mass so that it can grow more readily into the soil at the planting location. The tree may then be placed in a hole at the proper depth or adjusted to the root flare level on the trunk and then back-filled.

To plant a large, heavy ball and burlap tree, use a wire-cutter to clip away wire baskets or rope. Remove the entire top half of the basket. Cut away as much of the burlap or protective wrap as possible without damaging the root ball. If the tree is heavy and the burlap and wire portion under the tree is not removable, it may be trimmed and tucked down into the soil. Remove as much of the burlap and wire as possible without harming the tree. Material and wires left wrapped around the root ball may inhibit root growth and hinder tree performance. Backfill roughly half of the soil and tamp all the way around the root ball. Finish filling to grade and check that the soil meets the root flare of the trunk and slopes gently away from the tree.



For ball and burlap trees, move the tree using a tree cart, place in hold, and remove twine, burlap, and wire basket holding the root ball together. As much of the burlap and wire should be removed as possible.. Courtesy Planting Trees and Shrubs for Long-Term Health.

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Once the bare root, container grown or ball and burlap tree is planted, form a five inch high watering saucer at the outside diameter of the prepared hole using extra soil. Compact this watering saucer by hand tamping so that it will not break when water is added. Water each tree twice allowing the filled saucer to percolate down once between watering. Adjust soil as needed to address watering related settlement. Double-check that the tree is at the proper elevation with the flared root collar visible at soil surface.

Place wood chip mulch to depth of 2 to 3 inches within the water saucer and firm into place by hand so that no soil is showing. Taper the mulch down to ½ inch depth at the tree trunk. The purposes of mulch are to retain soil moisture and suppress weed growth. If desired, distribute Treflan, a weed seed sprouting inhibitor, on the surface of the mulch and watering saucer so that the newly planted tree has limited weed competition.

In order to establish young replanted trees, a watering system will need to be devised. Watering of newly planted trees should take place on two week intervals during the first year and in dry conditions in the subsequent two years. After three years, young trees should be watered in drought conditions. This can be carried out using a mobile watering system can be used with a water tank on a truck or a 55 gallon drum pulled behind a golf cart. This type of tank can be filled at a spigot and moved where needed. Initially, a hose connection to a street-front fire hydrant also may be used with permission of local authorities. Emergency watering may be necessary in times of drought. Volunteer labor can be effective for forming bucket brigades if the situation warrants this approach.

The issue of tree staking has been under some scrutiny in recent years. While stakes can hold a tree level for the first year after growth, allowing trees to resist the wind has been shown to aid root development. The objective is to allow trees not more than ten degrees of movement from vertical as they begin to grow. After planting, place two 5-foot high hardwood stakes opposing the prevailing winds to either side, or place three stakes in a triangle. Position stakes upright and firm by sledging into the soil, Place stakes just inside the watering saucer. To support trees at stakes use wire with wide hose or flat webbing fabric covering, never use bare wire that will damage tree trunks. The webbing or hose should be attached to the tree no higher than 1/3 of the way up the young tree trunk.

In high traffic areas wrap hardware cloth completely around the watering saucer and stakes to provide a movement barrier and an animal and mower guard. In areas where pedestrian traffic is not an issue, a hardware cloth trunk protector wrapped about 2 feet high by 8-10 inches in diameter. This galvanized wire mesh material is preferred for tree guards because it allows light and air on the tree trunk not holding moisture as tree wraps do, and it does not provide space for pests to nest that plastic tree guards do. Secure the hardware cloth slightly into the grade. This hardware cloth barrier will safeguard the tree trunk against mower or weed whacker damage, winter cold and animals.

Tree Establishment Care

Trees require an intensive level of establishment care for the first three years after plantings. A program of inspection, watering, corrective pruning, fertilization, weeding and mulch renewal should be planned and carried out. There are several steps that can be taken to ensure tree health and longevity.

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- Supplemental watering is needed at two week intervals for the full growing season after planting and in dry conditions thereafter
- Surface broadcast of fertilizer should be carried out each spring as mulch is renewed and weeds are removed
- Weed tree mulch circle and renew mulch annually by removing old mulch, checking soil depth, exposed to bright sun for several hours to reduce mold and pathogens and replacing with fresh mulch. Too much or too little mulch is detrimental. With an overall depth of 2 to 3 inches, ensure that the mulch is light at the trunk reducing depth to ½ inch
- Stakes should be used for the first year and can be used as support for trees in windy areas for two more years. When the new tree is stable, remove the stakes, wires and hose or webbing guards so that the tree will continue to develop strong anchoring roots.

For at least three years after planting young trees should be inspected and evaluated twice each year, in early spring and mid-summer. If problems become apparent, corrective action should be taken. As additional guidance, a one page summary planting instruction provides for ball and burlap elm trees at Shelburne Farms is included at the end of this document.

Trees are one of the antidotes to global-warming. Planting trees is a visible effort to decrease carbon footprint that can be undertaken by staff and volunteers. Planting trees is a rewarding experience, and seeing planted trees thrive and mature is a joy. The meadows and woodlands of Tregaron deserve an ongoing and effective tree planting effort.

APPENDIX ENDNOTES

ⁱ Heritage Landscapes retains authorship and all rights of these guidelines as developed by our office from research and direct project experience.

ⁱⁱ *Weed Control Methods Handbook Tools and Techniques for Use in Natural Areas*, by authors Mandy Tu, Callie Hurd, and John M. Randall, April 2001, available on the web at tncweeds.ucdavis.edu.

ⁱⁱⁱ *The Cornell Guide for Planting and Maintaining Trees and Shrubs*, by authors George L. Good and Richard Weir III, Cornell University Cooperative Extension, n.d.

^{iv} *Planting Trees and Shrubs for Long-Term Health*, by authors Rebecca Hargrave, Gary Johnson, Michael Zins, University of Minnesota Extension Service, 2002.

Elm Planting & Protection Guidelines

For establishing new elm trees, and other trees at Shelburne Farms, Heritage Landscapes suggests the following sequence and details:

1. In the selected locations, cut a circle six-feet in diameter centered on the tree trunk position. Remove all sod and take to a compost location, away from the planting site.
2. Use a soil probe to determine soil pH. Elms prefer a slightly acid soil say 6.5 pH, although they will tolerate both mildly acid and mildly alkaline pH levels of about 6.1 to 8.0. Adjust pH downward with aluminum or iron sulfate or upward with lime. Distribute on the planting soil surface and mix in.
3. Prepare a flat-bottomed hole for the elm trees about 3 to 3 1/2-feet wide and 2-feet deep. Use a tarp for piling soil next to the hole for a cleaner planting operation.
4. Have 2 to 2 1/2-inch caliper trees delivered and placed near their respective planting locations or use a ball cart to move them by hand without damage to the root ball.
5. Peel back burlap to see root flares for planting height. Check the ball depth and width with a tape measure and adjust holes. Tamp bottom of hole firm and adjust depth as needed to position root flares 2-inches above surrounding grades. Adjust width of hole as required to allow a minimum of 6-inches around the tree on all sides.
6. Get *Roots* fertilizer for trace minerals and microbial elements and an organic slow release granular fertilizer (i.e. 4-4-4 balanced formula). Use both mixed together at specified rates at the time of planting. Using about a pint of each fertilizer type, broadcast into soil pile and mix-in, breaking up soil to blend before filling planting hole.
7. Place each tree in its hole. With a wire cutter, clip away the wire basket and remove the entire top half of the basket and as much of balance as possible without breaking the root ball.
8. Peel back burlap on top of ball and cut away.
9. Position trunk upright with branching as desired.
10. Begin backfill of soil filling and tamp all the way around the ball. Fill to halfway, tamp and water in, filling hole with water. Allow water to seep in and complete filling to grade to meet root flare and slope gently away from tree.
11. Form 5-inch high watering saucer at about 36 to 42-inches in diameter. Use soil mix and tamp to firm up soil within saucer and around edge out to the six-foot diameter circle edge. Tamp edge of circle to be about 2-inches below grade at surrounding turf.
12. Place wood chip mulch to depth of 2 inches and tamp in place. Distribute weed seed inhibitor over mulch to discourage weed growth around new tree.
13. Water in again filling saucer and firming soil as needed to contain water.
14. Place four 5-foot high stakes around the tree 6-inches beyond the water saucer.
15. Wrap around all the stakes with chicken wire or hardware cloth about 2-feet high to provide a movement barrier in areas of heavy pedestrian traffic.
16. For winter protection from mice bark damage place a hardware cloth tube around the tree trunk with on overlapping joint bent together.