

THE PENNSYLVANIA STATE UNIVERSITY

# Landscape Maintenance Manual

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The Arboretum at Penn State

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## INTRODUCTION

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### Statement of Purpose

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This Landscape Maintenance Manual outlines standards of care and management for the Arboretum's grounds, gardens, and natural landscapes. Our Core Values statement dedicates us to strive for "excellence, emphasizing the quality of collections, materials, function, and design." By maintaining exemplary standards of horticultural care, we reflect this commitment to excellence, ensure the optimal health of our living collections, and create a landscape of enduring beauty.

### Organization of this Manual

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This manual is divided into sections, each of which addresses standards, protocols, and deadlines for care of a specific area or asset. Sections will be added as the Arboretum grows, and existing content will be modified to reflect changes in or refinements to maintenance practices.

## TURF CARE

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### Lawn Areas

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1. **Mowing Frequency**

Conventional lawn areas will be cut at least once every 3 working days. Exceptions may be made if turfgrass is under stress due to lack of soil moisture, conditions are too wet to cut, or turfgrass and soils have been treated with chemical control products and are not able to be cut for a certain amount of time. Low-mow fescue lawns in the Children's Garden will be cut every 2 weeks or as needed, based on weekly assessment of lawn height and condition.

2. **Height of Cut**

Default mowing height for conventional lawn areas will be 3". Low-mow fescue lawns in the Children's Garden will be cut to a height of 6".

3. **Fertility**

All lawn areas will be evaluated annually to establish a yearly fertility management prescription. Soil samples will be taken at this time and fertility will be adjusted accordingly and as needed. Individual lawn areas (Event Lawn, Esplanade, Pollinators' Garden lawn, Children's Garden Gathering Lawn, and Children's Garden low-mow fescue lawns) will be evaluated individually, and separate fertility management regimens established for each area as required. Soil fertility in lawn areas may be enhanced via use of compost, organic fertilizers/supplements, or synthetic fertilizers.

4. **Pest and Disease Management**

The application of insecticides, fungicides, and other control products may be pursued if IPM scouting reveals a population of, or damage caused by, a pest or disease, and if the population or damage exceeds a threshold set by the Arboretum's horticulture team. If chemical control is indicated, care will be taken to select the shortest-residual product that best controls the target pest/disease without affecting other organisms. Finally, care will be taken to ensure that application is completed at the optimal time to control the target pest/disease.

5. **Herbicides**

The application of herbicides may be pursued if IPM scouting reveals an infestation of weedy plants, and if the population or damage exceeds a threshold set by the Arboretum's horticulture team (in lawn areas, a 95% weed-free turfgrass stand will be maintained). If chemical control is indicated, care will be taken to select the shortest-residual product that best controls the target species without affecting other organisms. Finally, care will be taken to ensure that application is completed at the optimal time to control the target species.

6. **Irrigation**

Lawn areas will be evaluated individually for irrigation requirements. Irrigation volume and frequency will be determined by rainfall, temperature, season length, demands of plant material, and event schedules; and to water in fertilizers, herbicides, or other products. In the case of a state-declared drought watch, warning, or emergency, Penn State's Landscape Drought Contingency Plan (attached as Appendix I) will be implemented.

7. **Aeration**

All turfgrass areas will be aerated at least 1 time per year. Some areas may require more frequent aeration to help minimize or reduce thatch, maintain and/or rebuild soil structure, and reduce compaction. All aeration should be done either in the late spring/early summer or late summer/early fall. These times may vary depending on factors such as the weather and Arboretum event schedule.

8. **Seeding, Sodding, or Re-grassing**

Areas that require seeding, sodding, or re-grassing will be addressed before bare spots are evident. Turfgrass along sidewalk edges damaged from snow removal and anti-skid control products will be addressed prior to spring commencement each year. Other areas will be addressed throughout the growing season on a priority basis. Turfgrass edges along sidewalks will be monitored for unevenness along sidewalks and will be graded to no less than 1" below the edge of the sidewalk.

9. **Leaf Removal**

Leaves will be fully mulch-mowed into, or removed from, lawns before winter break if weather allows. Should leaf care not be possible prior to winter break, leaves will be removed at the first available opportunity during the winter season.

## Field Areas

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1. **Mowing**

a. **Frequency and Height** - Field areas will be cut at most once every month from April through October. Exceptions may be made if turfgrass is under stress due to lack of soil moisture, conditions are too wet to cut, or turfgrass and soils have been treated with chemical control products and are not able to be cut for a certain amount of time. All fields will be cut at a height of 5", which is the maximum deck height of OPP's standard Toro mower.

b. **Mowed Pathways –**

i. **Frequency, Height, and Width** - Mowed pathways in fields will be cut at least once every 5 working days. Exceptions may be made if turfgrass is under stress due to lack of soil moisture, conditions are too wet to cut, or turfgrass and soils have been treated with chemical control products and are not able to be cut for a certain amount of time. All pathways will be cut at a height of 3". Unless otherwise specified, mowed pathways will be width of two passes with OPP's standard Toro mower.

ii. **Location Rotation** – The locations of all mowed pathways will be reviewed every April to determine whether heavy pedestrian use has damaged the turf. If necessary, mowed paths will be relocated to adjacent undamaged areas to preserve general pedestrian flow while permitting turf restoration. Heavily-impacted areas will be evaluated for need of additional aeration and overseeding.

2. **Fertility**

All field areas will be evaluated annually to establish a yearly fertility management prescription. Soil samples will be taken at this time and fertility will be adjusted accordingly and as needed. Compost and organic fertilizers/supplements will be used preferentially in enhancing fertility in field areas, though synthetic fertilizers may be used if deemed necessary.

3. **Pest and Disease Management**

The application of insecticides, fungicides, and other control products may be pursued if IPM scouting reveals a population of, or damage caused by, a pest or disease, and if the population or damage exceeds a threshold set by the Arboretum's horticulture team. If chemical control is indicated, care will be taken to select the shortest-residual product that best controls the target pest/disease without affecting other organisms. Finally, care will be taken to ensure that application is completed at the optimal time to control the target pest/disease.

4. **Herbicides**

The application of herbicides may be pursued if IPM scouting reveals an infestation of weedy plants, and if the population or damage exceeds a threshold set by the Arboretum's horticulture team (in field areas, an 80% weed-free stand will be maintained). If chemical control is indicated, care will be taken to select the shortest-residual product that best controls the target species without affecting other organisms. Finally, care will be taken to ensure that application is completed at the optimal time to control the target species.

5. **Irrigation**

Field areas shall be maintained without the use of supplemental irrigation, except in cases where short-term irrigation is required to establish newly-seeded or sodded areas.

6. **Aeration**

- a. **Field Areas** - All field areas will be aerated at least 1 time per year. All aeration should be done either in the late spring/early summer or late summer/early fall.
- b. **Mowed Pathways** – Mowed pathways will be aerated twice per year.

7. **Seeding, Sodding, or Re-Grassing**

Areas that require seeding, sodding, or re-grassing will be addressed before bare spots are evident. Other areas will be addressed throughout the growing season on a priority basis.

8. **Leaf Removal**

Leaves will be fully mulch-mowed into, or removed from, fields before winter break if weather allows. Should leaf care not be possible prior to winter break, leaves will be removed at the first available opportunity during the winter season.

## LANDSCAPE CARE

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### Tree Rings

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1. Tree rings should be mulched when bare soil is apparent.
2. Mulch should be of a depth of 4" and not touch the trunk of the tree. A 1" buffer should be maintained around the base of the tree trunk.
3. Tree rings should be edged on a 2-year rotation.
4. Rings should be of a uniform circular shape. Tree ring radius should be 12" for every 1" of trunk diameter with a minimum radius of 28" and maximum of 4ft.
5. For large trees underplanted with turf, a 3-5" ring of bare soil should be maintained around the base of the trunk. If herbicide is required to control weeds in this area, special care should be taken not to apply spray to trunk of tree.

### Bed Maintenance: Woody and Perennial Plant Beds

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#### 1. General Service Level

- a. **Weeds** - Beds and ground cover shall be maintained weed-free to the fullest extent possible. Weeds are removed manually, except in cases where growth form or extent of infestation render manual control impractical (e.g., infestations of Canada thistle).
- b. **Dead Plants** - All dead plants will be removed immediately and replaced during the next planting season (spring or fall). For plants considered a fall planting risk, replacements will be installed during the next spring planting season.
- c. **Edging and Mulching** - Beds should be evaluated annually to assess need for edging and mulching. Typically, beds will be edged and mulched on a 2-year rotation. Mulch should be 2 - 4" in depth, and a 1" buffer should be maintained around trunks of trees or shrubs.
- d. **Leaf Removal** - Leaves will be fully removed from beds before Penn State's winter break, if weather allows. At the very latest, leaves will be fully removed from beds by the end of the winter season.

#### 2. Woody Shrub Pruning

- a. All woody shrubs will be evaluated annually to assess need for pruning. Pruning should be undertaken to maintain design intent and promote optimal plant growth and health. Cutback shrubs, roses, and shrub dogwoods will typically be pruned annually. Most other shrubs and trees will be pruned for structure and vigor on a 2-3 year rotation. Some plants (e.g., roses) may need to be pruned multiple times during the growing season. Most pruning will be accomplished during the winter and early spring.
- b. Plants should be pruned in a manner that preserves access to sidewalks, ramps, entrances, signs and lights.
- c. Dead wood should be removed as soon as it becomes apparent.
- d. Hedges will be evaluated annually for pruning needs. The arborvitae hedge surrounding the Strolling Gardens will be sheared at least every 2 years, and will be maintained at a maximum height of 14'. The Cornelian cherry hedges on either side of the Esplanade will be pruned by hand every 2-3 years, and will be maintained at a maximum height of 9'. The shrub dogwood hedge in the Rose and Fragrance Garden will be pruned by hand at least twice during the growing season, and will be maintained at a maximum height of 7'.



### 3. Perennial Plant Maintenance

Perennial plants, including broadleaf perennials, grasses, bulbs, and groundcovers, will be maintained to promote optimal health, vigor, and display value. Deciduous broadleaf perennials will usually be cut back to the ground in late autumn or early winter, though some may be left standing until late winter to provide seasonal interest. Ornamental grasses will usually be cut back in late winter. Evergreen perennials and groundcovers will typically be cut back in late winter or early spring. To promote bulb naturalization, perennial bulb foliage will be retained after flowering and will be cut back only after yellowing has become evident.

### 4. Fertility

In general, supplemental fertilizers will not be applied to woody and perennial plant beds. Plant health will be monitored on an ongoing basis, and should plants display evidence of nutrient deficiency, soil samples will be taken and fertility adjusted accordingly.

### 5. Pest and Disease Management

The application of insecticides, fungicides, and other control products may be pursued if IPM scouting reveals a population of, or damage caused by, a pest or disease, and if the population or damage exceeds a threshold set by the Arboretum's horticulture team. If chemical control is indicated, care will be taken to select the shortest-residual product that best controls the target pest/disease without affecting other organisms. Finally, care will be taken to ensure that application is completed at the optimal time to control the target pest/disease. For annually recurrent problems (e.g., viburnum crown borer) an IPM prescription will be developed each year prior to pest emergence, and treatment will be applied at optimal time following regular scouting.

### 6. Herbicides

In general, herbicides will be used as a means of last resort in woody and perennial plant beds, and will typically be applied only in cases where noxious weeds have become established and cannot be controlled or eradicated via manual removal. If chemical control is indicated, care will be taken to select the shortest-residual product that best controls the target species without affecting other organisms. Finally, care will be taken to ensure that application is completed at the optimal time to control the target species.

### 7. Irrigation

Woody and perennial plant beds will be evaluated individually for irrigation requirements. Irrigation volume and frequency will be determined by rainfall, temperature, season length, demands of plant material, and event schedules; and to water in fertilizers, herbicides, or other products. In the case of a state-declared drought watch, warning, or emergency, Penn State's Landscape Drought Contingency Plan (attached as Appendix I) will be implemented.

## Bed Maintenance: Annual and Seasonal Displays

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### 1. General Service Level

- a. **Weeds** - Beds shall be maintained weed-free to the fullest extent possible. Weeds are removed manually, except in cases where growth form or extent of infestation render manual control impractical (e.g., infestations of Canada thistle).
- b. **Dead Plants** - All dead plants will be removed immediately and replaced as soon as possible within one working week.
- c. **Edging and Mulching** - Beds should be evaluated annually to assess need for edging and mulching. Typically, beds will be mulched following installation of seasonal plant displays, and mulch may be re-applied "cosmetically" multiple times during the growing season if plant change-outs cause large amounts of soil to become visible. Mulch should

be 1-2" in depth, and a 1" buffer should be maintained around trunks of trees or shrubs. Annual and seasonal display beds will typically be edged on a 2-3 year rotation.

- d. **Leaf Removal** - Leaves will be fully removed from beds before Penn State's winter break, if weather allows. At the very latest, leaves will be fully removed from beds by the end of the winter season.

## 2. **Fertility**

In general, supplemental fertilization will not be required for spring and fall displays in garden beds, or for edible plant displays in the Children's Garden. In contrast, summer ornamental displays will typically require applications of liquid fertilizer to promote growth, flowering, and healthy plant development. Liquid fertilizer with an appropriate formulation (such as Jack's 20-3-19 Petunia Feed) should be applied every two weeks via Dosatron or other injector system at a rate of 150 ppm.

## 3. **Pest and Disease Management**

Chemicals to control insect pests or diseases will typically not be applied to plants in annual or seasonal displays. Rather, plants will be monitored on an ongoing basis and will be removed and replaced if damage exceeds an aesthetic threshold set by gardeners and garden supervisors.

## 4. **Herbicides**

In general, herbicides will be used as a means of last resort in annual and seasonal display beds, and will typically be applied only in cases where noxious weeds have become established and cannot be controlled or eradicated via manual removal. If chemical control is indicated, care will be taken to select the shortest-residual product that best controls the target species without affecting other organisms. Finally, care will be taken to ensure that application is completed at the optimal time to control the target species.

## 5. **Irrigation**

Annual and seasonal display beds will be evaluated individually for irrigation requirements. Irrigation volume and frequency will be determined by rainfall, temperature, season length, demands of plant material, and event schedules; and to water in fertilizers or other products. In the case of a state-declared drought watch, warning, or emergency, Penn State's Landscape Drought Contingency Plan (attached as Appendix I) will be implemented.

## Marsh Meadow

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### 1. **Annual Biomass Removal**

- a. **Mowing and Baling** – Switchgrass in the Marsh Meadow is to be mowed and baled once per year between early February and mid-March, while ground is frozen and before new growth emerges.
- b. **Thatch** - Following annual mowing and baling, any remaining thatch in meadow is to be raked and collected via vacuum.

### 2. **Sinkhole Remediation**

At the time of annual mowing, the Marsh Meadow is to be inspected for the condition of existing sinkholes and the appearance of any new depressions. Sinkholes will be excavated, filled with gravel, topdressed with 12-18" of soil, and seeded with switchgrass (*Panicum virgatum* 'Shelter').

### 3. **Pest & Disease Management**

Because the Marsh Meadow is a rainwater infiltration area, all pest and disease control products will be evaluated for their potential adverse effects to hydrological systems prior to application. Nevertheless, the application of insecticides, fungicides, and other control products may be pursued if deemed necessary by the Arboretum's horticulture team. If chemical control is

indicated, care will be taken to select the shortest-residual product that best controls the target pest/disease without affecting other organisms. Finally, care will be taken to ensure that application is completed at the optimal time to control the target pest/disease.

4. **Herbicides**

Because the Marsh Meadow is a rainwater infiltration area draining to Penn State's drinking water supply, extreme care will be taken to avoid groundwater contamination. For this reason, all herbicides will be evaluated for their potential adverse effects prior to application, and manual removal of weeds will be the preferred means of eradication. In cases where chemical control of weeds is required (e.g., persistent crown vetch infestation) herbicide will be applied via spot treatment on target plants.

## Walkways & Pathways

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1. **Paved Walkways**

- a. **Maintenance** – At no time should an accumulation of sand, dirt, leaves, graffiti, mold, or mildew detract from the appearance or safety of paved walkways. Walkways should be scouted daily, and a leaf blower should be used to blow off surfaces once daily and following other activities, such as lawn mowing or bed mulching, in adjacent areas. Walkways should be scouted regularly for emergence of weeds between cracks.
- b. **Refurbishment** – Paved walkways will be inspected annually in the spring for spalling, cracking, or other damage caused by winter conditions. The need for repairs will be evaluated following inspection, and any necessary repairs will be conducted within the same calendar year.

2. **Trail Mix / Grit Walkways**

- a. **Maintenance** – All trail mix and grit walkways will be evaluated seasonally, as well as following significant rain events, for erosion of surface material, formation of gullies and potholes, and other issues. Special attention should also be paid to transition zones between loose walkways and other surfaces, such as paved sidewalks, where a change in grade level can hamper ADA accessibility or cause a tripping hazard. Trail mix and grit walkways should be kept weed-free, and should be scouted regularly for emergence of weeds within the trail bed. Any deficiencies in trail surface should be mitigated as soon as possible, or within one working week of discovery.
- b. **Refurbishment** – Trail mix and grit walkways will be evaluated annually to assess the need for resurfacing or major refurbishment, and will typically be refurbished every 3-5 years.

3. **Mulch / Wood Chip Paths**

- a. **Maintenance** – All mulch and wood chip paths will be evaluated seasonally, as well as following significant rain events, for erosion of surface material, formation of gullies and potholes, and other issues. Special attention should also be paid to transition zones between loose walkways and other surfaces, such as paved sidewalks, where a change in grade level can hamper ADA accessibility or cause a tripping hazard. Mulch and wood chip paths should be kept weed-free, and should be scouted regularly for emergence of weeds within the trail bed. Any deficiencies in trail surface should be mitigated as soon as possible, or within one working week of discovery.
- b. **Refurbishment** – Mulch and wood chip trails will be evaluated annually to assess the need for resurfacing or major refurbishment, and will be refurbished as needed.

#### 4. **Mown Paths**

These areas will be cut at least once every (5) working days. Exceptions may be made if turfgrass is under stress due to lack of soil moisture, conditions are too wet to cut, or turfgrass and soils have been treated with chemical control products and are not able to be cut for a certain amount of time. All pathways will be cut at a height of 3”.

### Botanic Gardens and Children’s Garden – Weekend Cover Procedure

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During the growing season (roughly mid-April through early November), hort techs will be scheduled for weekend cover in the Botanic Gardens and Children’s Garden. Weekend cover may not be deemed necessary if weather is predicted to be poor and low visitation is expected. Typically 1 employee will be assigned for each weekend day, and will complete the following work in the early morning:

#### 1. **Botanic Gardens and Children’s Garden**

- a. Check grounds and parking lot for trash.
- b. Blow off all paved surfaces.
- c. Replace furniture if moved.

#### 2. **Water Features**

- a. Check all water features for proper functioning:
  - i. Main Arboretum Fountain
  - ii. Lotus Pool
  - iii. Children’s Garden entrance pools and spring basin
  - iv. Children’s Garden In & Out Creek
  - v. Children’s Garden farm pump and trough (may need to be dumped, cleaned of sediment, and refilled)
- b. Skim off and remove debris as needed.
- c. If not working properly, troubleshoot and then call OPP work reception desk to request a plumber.

#### 3. **Children’s Garden Additional Tasks**

- a. Clean up sand in cave.
- b. Clean off any chalk not on chalkboard.
- c. Move stones back to dry stream bed.
- d. Close all gates.

## TREE CARE

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### 1. Pruning Schedule

- a. Trees less than 7 years old should be assessed yearly, and if necessary receive structural pruning on an annual basis.
- b. Trees 7-20 years old should be assessed for structural pruning needs every 3-5 years.
- c. Trees 20 years old and older should receive maintenance pruning every 7-10 years to clean diseased, dying, dead, and defective branches from the crown.
- d. Trees adjacent to roadways, walkways, signs, and streetlights should be inspected annually for safety and clearance issues, and maintenance-pruned if necessary.

### 2. Pruning Practices

#### a. General:

- i. Pruning shall not be conducted without a clear objective or outcome.
- ii. Pruning should support human safety, optimize tree health, and support aesthetics and design intent.
- iii. When removing branches, the pruning cut shall not damage the branch bark ridge and branch collar.
- iv. Heading cuts should not be used except in storm response and crown restoration procedures.
- v. Branch reduction or thinning should be used to achieve pruning objectives rather than making large (>8" diameter) branch removal cuts.

#### b. Cleaning:

- i. Thinning shall be performed to remove dead, diseased, dying, and defective branches, which reduces hazards, promotes, health, and improves appearance.
- ii. Large branches should be removed with the aid of ropes and rigging equipment to minimize the risk of tree injury from falling debris.

#### c. Thinning:

- i. Thinning shall be performed to reduce the density of branches, which increases light penetration, improves visibility, and decreases wind load.
- ii. Assess how a tree will be pruned from the top down.
- iii. Favor branches with strong, U-shaped angles of attachment. Remove branches with weak, V-shaped angles of attachment and/or included bark.
- iv. Ideally, lateral branches should be evenly spaced on the main stem of young trees.
- v. Remove any branches that rub or cross another branch.
- vi. Make sure that lateral branches are no more than one-half to three-quarters of the diameter of the main stem to discourage the development of co-dominant stems.
- vii. Do not remove more than one-quarter of the living crown of a tree at one time. If it is necessary to remove more, do so over successive years.

#### d. Raising:

- i. Raising shall be performed to provide vertical clearance from thoroughfares, signs, street lights, structures and surveillance cameras.
- ii. Always maintain live branches on at least two-thirds of a tree's total height. Removing too many lower branches will hinder the development of a strong main stem.
- iii. Remove basal sprouts and vigorous water sprouts.

**e. Reduction:**

- i. Reduction shall be performed to decrease the overall height of a tree or to decrease the length of an individual branch.
- ii. Use reduction pruning only when absolutely necessary. Make the pruning cut at a lateral branch that is a least one-third the diameter of the stem to be removed.
- iii. If it is necessary to remove more than half of the foliage from a branch, remove the entire branch.

**3. Irrigation**

**a. Establishment**

Newly-planted trees will be watered at the time of installation, and will be provided with weekly supplemental water over the course of their first growing season. Should it be necessary, supplemental irrigation may be continued during the second growing season following installation.

**b. Trees in Garden Beds**

Trees located in irrigated, mixed garden beds with other types of plants will be assessed regularly for irrigation requirements. Irrigation volume and frequency will be determined by rainfall, temperature, season length, demands of plant material, and event schedules; and to water in fertilizers, herbicides, or other products. In the case of a state-declared drought watch, warning, or emergency, Penn State's Landscape Drought Contingency Plan (attached as Appendix I) will be implemented.

**c. Trees in Fields and Natural Areas**

In general, trees located in non-garden settings such as fields and natural areas will not be provided with supplemental irrigation. However, exceptions may be made in the case of high-value specimens exposed to severe drought conditions.

**4. Fertility**

In general, trees will receive no regular fertilization treatment. However, specimen or high-value trees may receive prescription fertilization when severe nutrient deficiencies are diagnosed.

**5. Pest & Disease Management**

The application of insecticides, fungicides, and other control products may be pursued if IPM scouting reveals a population of, or damage caused by, a pest or disease, and if the population or damage exceeds a threshold set by the horticulture and arboriculture teams. If chemical control is indicated, care will be taken to select the shortest-residual product that best controls the target pest/disease without affecting other organisms. Finally, care will be taken to ensure that application is completed at the optimal time to control the target pest/disease. For annually recurrent problems (e.g., bronze birch borer, fire blight) an IPM prescription will be developed each year prior to pest emergence, and treatment will be applied at optimal time following regular scouting.

## WATER FEATURES

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### Main Fountain

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#### 1. Operation Dates

Main fountain will be tested and filled early to mid-April (weather-dependent), and will operate until drained and winterized in early November. Fountain basin should be thoroughly cleaned of debris at these times.

#### 2. Routine Maintenance

Weekly checks should include water sampling and bromine addition (if indicated by sample), checking and cleaning of canister filter, checking of automatic water level control, checking of reservoir for debris, and checking operation of all lights. Should any light bulbs be non-operational or should significant operational issues be discovered, corrective maintenance should be performed immediately.

#### 3. Painting

Fountain basin will be evaluated annually for need of repainting. Repainting may be required every 4-5 years.

### Lotus Pool

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#### 1. Operation Dates

The Lotus Pool is to remain filled year-round, and hardy plants may remain in place throughout the year. Seasonal aquatic plants should be installed by June, and remain in place through October.

#### 2. Routine Maintenance

During the growing season, Lotus Pool should be skimmed daily. At least once every two weeks, aquatic plants should be groomed to remove any dead, diseased, or unsightly foliage. At this time, pond dye may be added if necessary to maintain water opacity.

#### 3. Fertility

Plants in the Lotus Pool will typically require applications of granular fertilizer to promote growth, flowering, and healthy plant development. Slow-release granular fertilizer should be applied directly to pots, and will typically be applied twice during the growing season, in June and August/September.

#### 4. Algae Control

Algaecides, flocculants, or other additives may be required in order to prevent or control algae blooms. Liquid barley extract should be applied every two weeks or as required to prevent algae from proliferating. Should algae develop, chemical algaecides non-toxic to desirable aquatic plants and fish may be applied. Following application of algaecide, flocculant may be required to facilitate cleanup of algae debris.

### Children's Garden Entrance Pools

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#### 1. Operation Dates

Entrance pools will be tested and filled early to mid-April (weather-dependent), and will operate until drained and winterized in November. Basins should be thoroughly cleaned of debris prior to spring activation and at time of winterization.

#### 2. Routine Maintenance

During the growing season, Entrance Pools should be skimmed daily. At least once every two weeks, aquatic plants should be groomed to remove any dead, diseased, or unsightly foliage.

### **3. Pump Maintenance**

Weekly checks should include checking and cleaning of main pump and checking of automatic water level control.

### **4. Filter Maintenance**

Weekly checks should include checking (and, if necessary, cleaning) of sand filter, UV filtration system, and ionization system.

### **5. Fertility**

Plants in the Entrance Pools may require applications of granular fertilizer to promote growth, flowering, and healthy plant development. Slow-release granular fertilizer should be applied directly to pots, and will typically be applied twice during the growing season, in June and August/September.

### **6. Algae Control**

Algaecides, flocculants, or other additives may be required in order to prevent or control algae blooms. Liquid barley extract should be applied every two weeks or as required to prevent algae from proliferating. Should algae develop, chemical algaecides non-toxic to desirable aquatic plants may be applied. Following application of algaecide, flocculant may be required to enable cleanup of algae debris. In order to prevent algae buildup on stones or sides of basins, basins may need to be drained and cleaned monthly during the summer.

## **In and Out Creek**

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### **1. Operation Dates**

In and Out Creek will be tested and filled early to mid-April (weather-dependent),, and will operate until drained and winterized in November. Watercourses should be thoroughly cleaned of debris prior to spring activation and at time of winterization.

### **2. Routine Maintenance**

During the growing season, the creek should be skimmed of surface debris daily. On a weekly basis, the return sump should be cleaned of accumulated sediment and other debris.

### **3. Pump Maintenance**

Weekly checks should include checking and cleaning of main pump and checking of automatic water level control.

### **4. Filter Maintenance**

Weekly checks should include checking (and, if necessary, cleaning) of sand filter, UV filtration system, and ionization system.

### **5. Water Testing**

Water should be tested weekly, and bromine levels adjusted as needed to maintain water safety.

## **Farm Pump & Trough**

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### **1. Operation Dates**

Pump and trough will be tested and brought on-line early to mid-April (weather-dependent),, and will operate until drained and winterized in November.

### **2. Routine Maintenance**

Pump and trough should be inspected daily, and trough emptied and cleaned as needed to remove debris and sediment. Every two weeks during the summer, the trough will be assessed for algae accumulation, and if necessary, will be scrubbed thoroughly and treated with a 10% bleach water solution to remove algae, mold, and mildew.



## IRRIGATION SYSTEM

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### 1. **Operation Dates**

Activation of the irrigation system should take place the week following spring commencement. Irrigation blow-out and winterization should be conducted in early November, following Pumpkin Festival and prior to winter display installation. At time of activation and winterization, all zones and individual heads should be inspected for correct operation. All deficiencies or leaks should be repaired at this time.

### 2. **Preventive and Corrective Maintenance**

Irrigation system should be scouted on an ongoing basis, while active, for correct operation. Minor malfunctions should be fixed immediately upon discovery if possible, but within a maximum timeframe of one working week. If a major leak or issue is discovered, it should be stabilized / contained as soon as possible, and OPP plumbing crew called to address the situation.

## OVERLOOK PAVILION CANOPY

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### 1. **Side Curtains**

- a. **Installation and Removal Dates** - Side panels will be installed during the first work week following May 15, and will be removed the first work week following the Pumpkin Festival (typically, the first work week following October 15). All panels will be inspected for damage prior to spring installation and following removal in the fall. Following autumn removal, side panels should be folded and stored in an organized fashion.
- b. **Maintenance** – While installed, panels should be inspected weekly to ensure that all points of attachment to canopy roof are sound. Any broken attachments should be replaced as soon as possible, within one working week. Any panels with ripped or frayed canvas or broken zippers should be uninstalled immediately and brought in for repair.

### 2. **Canopy Snow Removal** – See Snow Removal section on page 17 below.

## PARKING LOTS

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### 1. **General Service Level**

Parking lot should be maintained so as to remain free of trash, accumulated sediment or debris, leaves, and weeds.

### 2. **Daily Maintenance**

Parking lot should be scouted daily for trash and debris. A leaf blower should be used to blow off surfaces following activities such as lawn mowing or bed mulching in adjacent areas.

### 3. **Preventive and Corrective Maintenance**

At no time should an accumulation of sand, dirt, leaves, graffiti, mold, or mildew detract from the appearance or safety of parking lots. Sweeping and cleaning should be performed as necessary to address these issues. Lot should be scouted regularly for emergence of weeds between cracks.

### 4. **Line Striping**

Parking lot will be evaluated annually to assess the need for re-striping. Striping will be applied to designated turf area adjacent to parking lot to accommodate peak parking demand during summer months.

## TRASH AND DEBRIS REMOVAL

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### 1. Daily Maintenance

All trash and recycling containers should be checked and emptied daily. During peak visitation or in conjunction with special events, some receptacles may have to be emptied twice daily.

### 2. Preventive and Corrective Maintenance

Stickers and posters are to be removed from trees, light poles, signs, etc. All graffiti should be treated as vandalism and reported to Campus Police prior to being cleaned. Paint graffiti may need to be referred to the OPP masonry crew.

### 3. Football and Event Cleanup

On the Sunday following a Saturday home football game or other major weekend event, all trash and accumulated debris will be removed from Arboretum grounds, gardens, trash and recycling receptacles, and parking lots.

## FURNISHINGS

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### 1. Teak Benches and Chairs

Benches and chairs are to be repositioned as necessary to maintain garden aesthetics and ease of public use. Repair and graffiti removal needs should be addressed immediately upon discovery. Teak furnishings will be evaluated every other year to address need for power washing. If deemed necessary, power washing will be completed over the winter.

### 2. Teak and Metal Trash Receptacles

Repair and graffiti removal needs should be addressed immediately upon discovery. Trash receptacles will be evaluated every year to address need for power washing, which will be completed over the winter.

### 3. Landscape Lighting

Garden footlights and specimen tree uprights should be checked for proper operation a minimum of two weeks prior to any evening Arboretum event, and once monthly during the May – October event rental season. Any necessary bulb replacements and minor adjustments should be made at time of inspection. Larger issues should be referred to OPP electricians for investigation and repair.

## SNOW REMOVAL

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### 1. General Service Level

- a. Snow removal will commence on the day of any snowfall event equaling or exceeding 0.5" snow depth.
- b. At no time will snow be permitted to cover transportation or parking surfaces longer than noon of the day following conclusion of snowfall.

### 2. Extent of Snow Removal in Gardens

The following areas are to be cleared of snow:

- a. Strolling Gardens sidewalk and patios
- b. Overlook Pavilion sidewalk and patios
- c. Esplanade sidewalks
- d. Bamboo Allee sidewalk and Main Fountain patio
- e. Oasis Garden – patio cleared around Lotus Pool
- f. Rose & Fragrance Garden – perimeter sidewalk cleared

- g. Conservatory Terrace patio – pathway cleared to Poplar Court
- h. Children’s Garden – paved sidewalk cleared to front of cave and glass house
- i. Benches will be cleared within 2-3 days following snowfall.

**3. Use of Snow-Melting Compounds**

- a. **Parking Lot** – Snow-melting compounds may be used in parking lot to prevent ice buildup and reduce the danger of injury due to falls.
- b. **Botanic Gardens** – Under normal circumstances, sodium-based snow-melting compounds are not to be used in the Botanic Gardens due to the potential for injury to plants. When de-icer use is required, products with a calcium or magnesium base, or sand, may be used. In an ice emergency scenario, sodium-based de-icers may be used to reduce the risk of injury resulting from slips and falls. Overuse of any de-icer product should be avoided in the Botanic Gardens.

**4. Overlook Pavilion Canopy**

- a. Following a winter storm warning, the PSU Snow Marshal will confer with OPP Landscape Supervision in the Snow Planning Meeting to determine the operational plan for the current storm. The PSU Snow Marshal will forward a notification, weather forecast, and action plan to Arboretum at Penn State Director and Director of Horticulture.
- b. For expected snow accumulations < 4 inches, no immediate action will be taken.
- c. For expected snow accumulations of 4 inches of wet snow, 12 inches of dry snow, or any combination of snow, freezing rain, or ice equivalent, Snow roof rakes will be used to manually remove snow from canopy roof. Action will be repeated as necessary to maintain canopy snow depth below 4”, and final raking will be performed following conclusion of snowfall.

## NATURAL AREAS

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### Bellefonte Central Rail Trail

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**1. Right-of-Way Mowing**

Herbaceous growth alongside the rail trail will be mown to a height of 4" three times per year, typically in June, August, and October. Woody growth alongside trail will be cut back every 2 -3 years to maintain trail clearances and sightlines.

**2. Surface Maintenance**

Trail surface will be evaluated seasonally, as well as following significant rain events, for erosion of surface material, formation of gullies and potholes, and other issues. Any deficiencies in trail surface should be mitigated as soon as possible, or within one working week of discovery.

**3. Surface Refurbishment**

Trail surface will be evaluated annually to assess the need for resurfacing or major refurbishment, and will typically be refurbished every 3-5 years.

**4. Hazard Tree Inspection**

The entirety of the rail trail will be inspected twice yearly, in spring and autumn, by the campus arborist crew for evidence of hazard trees. Should potentially hazardous trees be identified, mitigation pruning will be performed as soon as possible to reduce risk to trail users.

### Prairie Restoration Site

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**1. Controlled Burns**

The prairie restoration site will be evaluated annually to assess the need for a prescribed fire. Controlled burns may be implemented on a 2-5 year rotation. Should fire be prescribed, planning and execution will follow the Arboretum's Burn Plan.

**2. Invasive Weed Control**

The prairie restoration site will be evaluated seasonally to assess the need for control of nonnative invasive weed species. Should chemical control of weeds be indicated, herbicide will be applied via spot treatment on target plants.

**3. Pathway Mowing**

These areas will be cut at least once every (5) working days. Exceptions may be made if turfgrass is under stress due to lack of soil moisture, conditions are too wet to cut, or turfgrass and soils have been treated with chemical control products and are not able to be cut for a certain amount of time. All pathways will be cut at a height of 3".

### Hartley Wood and the Gerhold Wildflower Trail

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**1. General Oversight**

Day-to-day maintenance of Hartley Wood and the Gerhold Wildflower Trail is to be accomplished by the Arboretum's Natural Areas Program Assistant in accordance with goals established by the project's management plan.

**2. Trail Maintenance**

The Gerhold Wildflower Trail and other marked walking trails are to be maintained at a width of 3 to 4'. A 6' layer of coarse wood chips is to be applied to trail surfaces on an as-needed basis, annually for the Gerhold Wildflower Trail and usually every other year for other trails. Encroaching tree branches and woody undergrowth are to be cut back from trail edges annually.

**3. Invasive Plant Control**

Invasive plant removal and subsequent control is to proceed in accordance with the phasing plan established by the overall project management plan. In most cases, invasive woody shrubs will first be treated with a chemical herbicide. Chemical treatment will be followed by physical removal of standing dead shrubs. Removal of invasive herbaceous plants will be accomplished either via chemical herbicide or manual weeding, to be determined by severity and extent of the invasion and growth characteristics of the target plant.

**4. Native Plant Restoration**

Reintroduction of native plant species is to proceed in accordance with the species list and phasing plan established by the overall project management plan.

**5. Tree Tubes and Stakes**

Woody plants installed outside the deer enclosure and recognized as preferred browse species are to be outfitted with tree tubes and stakes at time of installation. The condition of tubes and stakes is to be monitored on an ongoing basis by the project assistant, and repairs/replacements are to be made promptly. Tubes and stakes are to be permanently removed when plants are sufficiently mature to withstand moderate damage from deer browse and/or buck rub.

**6. Deer Enclosure Fence**

The fence will be monitored on an ongoing basis for damage to posts, mesh, or signage. Any necessary repairs or replacements are to be made promptly, either by the project assistant or a qualified contractor.

**7. Hazard Tree Inspection**

The entirety of the trail network will be inspected twice yearly, in spring and autumn, by the project assistant for evidence of hazard trees. Should potentially hazardous trees be identified, they will be identified for follow-up by the campus arborist crew. Mitigation pruning will be performed as soon as possible to reduce risk to trail users.

## **IMPORTANT DATES AND ASSOCIATED MAINTENANCE MILESTONES**

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- 1. Blue and White Weekend** (mid-April)
  - a. Main fountain deck removed and stored
  - b. Water features cleaned, filled, and turned on (Main Fountain, Lotus Pool, Children's Garden entrance pools, In and Out Creek, farm pump and trough)
  - c. Drinking fountains turned on
  - d. Spring container displays installed
  - e. Weather permitting, some spring bedding displays installed
  - f. Spring leaf clean-up completed
- 2. Commencement** (early-mid May)
  - a. Spring containers refreshed if necessary
  - b. All spring bedding displays installed
  - c. Woody pruning completed
  - d. Necessary spring mulching completed
  - e. Irrigation system turned on
- 3. First Day of Summer** (June 21)
  - a. Summer container displays installed
  - b. Summer bedding displays installed
- 4. Student Return** (mid-August)
- 5. Pumpkin Festival / Parents & Families Weekend** (first non-home football game in October)
  - a. Fall displays installed during last week of September / first week of October
  - b. Canopy side curtains removed the week following event
  - c. Water features drained, cleaned, and winterized by end of month
  - d. Drinking fountains turned off and winterized by end of month
- 6. Thanksgiving Holiday** (November 24)
  - a. Tulip installation completed
  - b. Irrigation system winterized
  - c. Main fountain deck inspected, repaired (if necessary), and installed
  - d. Winter display installation begun
- 7. Winter Celebration** (last day of classes – mid-December)
  - a. Winter display completed during first week of December
- 8. Penn State Winter Break** (December 24)
  - a. Spring and summer garden design completed

## **APPENDIX I: OPP DROUGHT CONTINGENCY PLAN – LANDSCAPE**

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### **Drought Watch**

1. Conduct drought awareness meeting with OPP Landscape crew members
  - a. Discuss water conservation measures and techniques
  - b. Discuss Drought Contingency Plan
2. Identify water leaks
  - a. Leaking hose bibs
  - b. Wet spots on ground
  - c. Look for continuous water flow in storm drains – possible underground water leak
  - d. Identify sink holes – possible underground water leak
3. Minimize equipment washing to only that necessary to insure the safe operation and proper functioning of equipment
4. Install water shutoffs on all water hoses

### **Drought Warning**

1. Mandatory reduction of water consumption by 15%
  - a. Hintz irrigation zones
  - b. Schreyer House turf areas
  - c. Beaver Stadium north parking area
2. Water consumption reduction at The Arboretum at Penn State
  - a. Cease irrigation of Event Lawn and Esplanade Lawn
  - b. Program all irrigation of garden beds to occur between 7:00 pm – 9:00 am
  - c. Reduce irrigation of living collections as much as possible without compromising plant survival
  - d. Turn off main Arboretum fountain, In and Out Creek, and Farm Pump water features
3. Restrict equipment washing
4. Restrict water use on paved surfaces
  - a. Street sweeping - Minimize use of water for dust control
5. Restrict cleaning of landscape shop areas
  - a. Shop yard
  - b. Shop interior floor areas
6. Restrict pressure washing of outside spaces
7. Restrict watering at nursery, except between the hours of 5:00 pm – 9:00 am
8. Restrict the watering of plant material, except between the hours of 5:00 pm – 9:00 am
9. Shut off landscape water features
  - a. Hub Plaza water wall
  - b. Walter Walters Courtyard water sphere
  - c. Chambers water sculpture
  - d. Hub ornamental pond

### **Drought Emergency**

1. Water consumption reduction at The Arboretum at Penn State
  - a. Cease irrigation of Display Garden and Harvest Garden beds, as well as any other planting beds containing primarily non-collections plant material
  - b. Turn off children’s garden Entrance Pools and relocate plant material
  - c. Cease irrigation of ornamental container displays

2. Cease equipment washing with potable water – Wash only at recycled water/washing facility
3. Restrict watering at nursery and greenhouse, except between the hours of 5:00 pm – 9:00 am
4. Restrict the watering of newly established plant material between the hours of 5:00 pm – 9:00 am
5. Cease watering of all established plant material (flowers, turf, trees, and shrubs) in general campus areas
6. Cease unnecessary water usage



## APPENDIX II: PA ONE CALL PROCEDURE

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1. Mark the perimeter of the intended work site with white flags and / or paint.
2. Call **1-800-242-1776**. Whoever answers the call will first ask you a couple of questions regarding identification.
  - a. Give your own name, BUT **confirm that the phone number is 814-865-2701** – this is the phone number for Brian Phiel, the Tower Rd. Landscape Facility supervisor, who coordinates and maintains records of all PA One Calls in our area of campus.
  - b. The person will ask you to verify that you are calling on behalf of PENN STATE UNIVERSITY. (YES)
  - c. **The email address to confirm is [bgp103@psu.edu](mailto:bgp103@psu.edu)**. If the person asks you to confirm the fax number, it should be 814-865-2797. The address to confirm is the Office of Physical Plant, University Park, PA.
3. Design or Construction?
  - a. The operator will ask if the utility marking is for purposes of design or construction. In nearly all cases, the answer is CONSTRUCTION.
  - b. Next, they will ask if the work is excavation or demolition. In nearly all cases, the answer is EXCAVATION.
4. Location Questions
  - a. County? CENTRE
  - b. Municipality? STATE COLLEGE BOROUGH and / or COLLEGE TOWNSHIP (depending on work location within the Arboretum).
  - c. Location: THE ARBORETUM AT PENN STATE.
  - d. Closest intersection: **Services Road and Bigler Road** (this is the intersection closest to the Arboretum parking lot).
  - e. Next closest intersection: **Bigler Road and Park Avenue**
  - f. You will be asked to explain the exact location. Always provide GPS lat. and long. coordinates, easily obtained from Google Maps / Google Earth.
  - g. Size of the area?
  - h. On public property? YES
  - i. Has the area been marked with white paint and/or flags? YES
5. Type of Work
  - a. Specify tent installation, plant installation / removal, etc.
  - b. Describe the means of accomplishing the work (for tent stakes, this is “driving in”)
6. Additional Information
  - a. Ask the operator to make a note that within the gardens, all utilities should be marked with colored paint, NOT flags (small children pull the flags out, which causes problems).
7. Serial Numbers
  - a. When the PA One Call person is satisfied that all of the necessary questions have been answered, he or she will assign a serial number (job number) for each municipality. For jobs straddling municipal boundaries, you will have two numbers (one for State College Borough site and one for the College Township site). **KEEP THESE NUMBERS HANDY.**
8. Legal Start Date
  - a. There is a legal window when our work can be done. The operator will provide the dates for this window, which is between the third and tenth day after making the call.

9. Mark Serial Number(s) on Site

- a. Once the call has concluded, return to the work site and write the serial number(s) on at least 1 flag and / or on the ground with marking paint.

10. Columbia Gas Pipeline – Notification Procedure

- a. There is a 12" high-pressure natural gas line running across Arboretum property. It is located on the Park Ave. frontage between Park Ave. and the Marsh Meadow, and the 50'-wide right-of-way associated with it is marked with yellow posts.
- b. If the work area lies near or within the line or its right-of-way, we must also contact Columbia Gas to notify them of the work. Our direct contact at Columbia Gas is:

Mark Bressler

Field Operations Leader

Office: 814-278-5842 / Cell: 814-404-7890

Email: [mbressl@nisource.com](mailto:mbressl@nisource.com)

- c. When calling Columbia Gas to inform them of the work, have the PA One Call serial number(s) handy, and provide these to Mark Bressler.

## **APPENDIX III: HORTICULTURE AND MAINTENANCE TIMELINE**

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# HORTICULTURE AND MAINTENANCE TIMELINE - 2018

MONTH DATE	JANUARY					FEBRUARY				MARCH				APRIL					MAY					JUNE					JULY					AUGUST				SEPTEMBER				OCTOBER					NOVEMBER				DECEMBER				
WEEK NUMBER	1	8	15	22	29	5	12	19	26	5	12	19	26	2	9	16	23	30	7	14	21	28	4	11	18	25	2	9	16	23	30	6	13	20	27	3	10	17	24	1	8	15	22	29	5	12	19	26	3	10	17	24	31		
<b>HORT TASKS</b>	Perennial cutbacks																															Perennial cutbacks																							
	Leaf removal																															Leaf removal																							
	Winter woody pruning																																																						
						Ornamental grass cutbacks																																																	
						Marsh Meadow mowing / sinkhole inspection																																																	
										Spring mulching																																													
														Spring plantout																																									
														Ongoing garden maint - weeding, deadheading, watering, etc.																																									
																			Summer changeout																																				
																												Fall changeout																											
																												Pumpkin Festival Prep																											
																																Eub install																							
																																Winter changeout																							
<b>TURF MAINT</b>														Twice-weekly lawn mowing																																									
														Weekly hrt pathway mowing																																									
														Monthly field mowing																																									
														Aeration - spring option														Aeration - fall option																											
																																leaf removal																							
<b>WATER FEATURES &amp; IRRIGATION SYSTEM</b>										Main fire deck removal																																													
														Water feature boot-up																																									
														Dinking fire boot-up																																									
														Weekly water feature maint																																									
														Irrigation boot-up																							Irrigation waterization																		
<b>RAIL TRAIL</b>						Right-of-way brush mowing (every 2-3 yrs)																																																	
														Hazard tree inspection																							Hazard tree inspection																		
																			Edge mowing																		Edge mowing																		
																																					Edge mowing																		



