

AVIATION LANDSCAPE AND SUSTAINABLE DESIGN CRITERIA

Engineering Department
Port Authority of NY & NJ

Prepared by Ilonka Angalet

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INTRODUCTION

Landscape architecture provides the Port Authority of NY & NJ aviation facilities with a number of design criteria strategies : 1) Airport Redevelopment Site Planning, 2) Landscape Operational Upgrades that target landscape and irrigation installations, 3) Runway Safety Area Programs, 4) Wetland Mitigation, 5) Landscape Plants and Design Criteria that provide minimal attractants to birds and other undesirable pests, and 6) Sustainable Design Practices: Best Management Practices for Storm Water Management Practices, and Alternative Pavement Treatments and 7) Review of Tenant Landscape Applications.

- 1) Airport Redevelopment Programs – Landscape Architectural efforts have historically been an integral member of the design team commencing with conceptual design, site design development, through contract development, implementation and on-going maintenance. The landscape contract is prepared separately but in tandem with the roadways, traffic requirements and infrastructure contract development program. The landscape contract installation and minimum two-year maintenance contract follows the completion of the road ways, buildings, and infrastructure contract.
- 2) Landscape Operational Upgrade Programs – Landscape Architectural efforts include rehabilitation strategies for neglected, underutilized or reclaimed areas.
- 3) Runway Safety Areas – Landscape Architectural efforts include tree crown reduction on public and private property, working with operational and wildlife staff to greatly reduce avian and other wildlife hazards and create safer runway safety areas for planes and emergency vehicles.
- 4) Wetland Mitigation – Landscape Architectural efforts work with regulatory agencies and local interest groups to create tidal wetland habitats when required by permit.
- 5) Landscape Plants and Design Criteria that provide minimal attractants to birds and other undesirable pests (i.e. Asian Longhorned beetle), offer sustainable characteristics and reliable performance under variable soil and climate conditions.
- 6) Sustainable Design Practices – Sustainable design seeks to reduce environmental impacts and improve the maintenance and operations of new and renovated facilities.
 - Best Management Practices for Storm Water Management Practices
 - Alternative Pavement Treatments – Impervious and Pervious Treatments
 - Locally reduce carbon emissions during the seasonal growth period

- Locally reduce surface temperatures.

- 7) Review of Tenant Landscape Applications – Landscape Architectural staff work with the TAA-QAD staff by reviewing applications and providing the tenants with the current FAA and PA guidelines in regard to landscaping at our airports.

GOALS

The goal of the Landscape staff has been to provide a quality landscape environment that complements the facilities design, meets functional requirements (roadways, signage, exists and entrances to frontages, parking facilities and residual open space) and incorporates sustainable practices wherever permissible.

In order to achieve these goals, a successful landscape must satisfy these objectives:

1. Select a palate of plants suitable to the facilities environment, while providing maximum seasonal interest and minimal pest problems.
2. A design that is incorporated into an area suitable for vigorous plant growth and considers the impacts with and without permanent maintenance.
3. A design that considers the impacts with and without permanent irrigation.
4. A design that considers the significance of sustainable design practices. The goal of the Port Authority of NY & NJ Sustainable Design Guidelines is: (1) energy conservation and efficiency; (2) conservation of water and other natural resources; (3) waste reduction; and (4) healthy indoor environments.
5. A design that is installed under a separate, stand alone landscape installation contract that requires a minimum two year maintenance follow up by the installing Contractor, who shall have as his superintendent over the entire installation and maintenance a State Certified Arborist knowledgeable and experienced in this type of Work.

THE ENVIRONMENT AND IT'S IMPACT ON LANDSCAPING

The area provided for landscaping at Port Authority facilities are primarily infertile sandy soils, compacted urban fill, or without soil altogether, having either low moisture capacity or excessive moisture retention, alkaline, and high in soluble salts. Such conditions are not suitable for

establishing healthy and vigorously growing plants. Additionally the locations of these areas are subject to constant winds and cyclic periods of excessive heat, drought and de-icing salts.

The Port Authority of NY/NJ has gone a long way to improving the environmental conditions required to support healthy and vigorously growing plants and turf in all contracts let in the last ten years. The basic elements including screened loam soil, planting mixes, structural soils, subsurface drainage, introduction of permanent irrigation, introduction of biostimulants, hydrogels, use of certified arborists, stringent Nursery inspections, avoidance of bird attractants, mandatory 2-year maintenance following a capital installation and follow up on-going maintenance has made this difference.

Landscape plants also require adequate root growing space to stay healthy, thrive and provide a positive, pleasing image. However, the demands for traffic improvements, parking (patron, tenant, taxi, limo, HOV, trailer trucks), elevated guideway, roadways (public, restricted service), train stations and connectors, terminal growth, control towers, heating and cooling plants and additional above ground and underground utilities are eroding away the limited available space at an alarming rate.

The major impediments to establishing trees in paved, urban areas is the lack of adequate volume of soil for tree root growth, adequate water, nutrients, oxygen, construction injury due to lack of or improper tree protection during construction, improper tree handling and planting at installation and lack of reasonable maintenance.

Research studies on urban tree plantings have established for some time that the rule-of-thumb requirement for a street tree pit should be to provide "1 cubic yard of soil volume for every 5 cubic yards of crown volume".

DESIGN PARAMETERS / RECOMMENDATIONS

Landscaped areas can be broken down into five areas: 1) Building Site, 2) Primary Entrance/Exit Roadways, 3) Secondary Roadways, 4) Airside and 5) Tenanted spaces.

BUILDING SITE

1. Opportunities for large scale landscaping are rarely available. However opportunities for creative hardscape elements exist, such as decorative pavement treatments, environmental/art fence, bollards, canopies, and lighting.
2. The side and rear parking lot edges should have a 30 foot wide median consisting of a single row of trees, low hedge and security fence. This design element is now almost nearly impossible to implement with the requirement of parking structures and roadway improvements to meet the patrons demand for adequate daily parking availability.

3. A median 50-foot wide or more may provide an opportunity for introducing Best Management Practices including; bio-filtration, infiltration trenches and swales.
4. Small irregular islands occurring at the extreme ends of the entrance and exist to terminal frontage islands offer opportunities to provide seasonal flowering displays and masses of evergreen and deciduous groundcover. This design element actively competes with hand holes, manholes, electrical, equipment boxes, sign foundations, traffic lights and guide rail. Where this area is unsuitable for planting then a decorative hardscape pavement will be introduced.
5. Larger irregular islands provide an opportunity for ornamental trees as well as a few specimen canopy trees in order to add a sense of maturity and to soften the scale of the buildings, overpasses and wide expansive roads. This design element competes with electrical vaults, pump stations and off road parking of service vehicles.
6. Salt splash pavements at curb lines and fence lines are attractive hardscape elements as well as a means to reduce maintenance at guide rails, fence lines and roadway edges. Salt splash consisting of eight-inch hexagonal asphalt pavers laid out in a random pattern composed of two different color aggregates is evident at JFK. At EWR, the salt splash pavement is composed of three different colored concrete eco-stone pavers and allows for the water permeability. At LGA, the salt splash hardscape treatment is a simple pre-cast concrete Unilock paver. Wherever possible the saltsplash pavement should be composed of a permeable pavement system.
7. Select a standard or custom fence element and use it consistently throughout the facility. An art/environmental fence element should be used at the frontages.
8. Green roofs are an option that offer a number of sustainable attributes: a) reduces storm water runoff, b) reduces the heat island effect, c) provides thermal insulation, and d) prolong the life of the water proof membrane.
9. Street trees cannot survive the limited below grade volumes provided by the traditional 5' X5' tree pit. Structural soils have been introduced that span under paved surfaces which satisfy both tree and pavement requirement.

PRIMARY ENTRANCE/EXIT ROADWAYS

1. Small irregular islands should be paved with the same decorative permeable hardscape pavement used in the salt splash treated areas.
2. Larger irregular islands will provide opportunities for seasonal displays and ground cover plants as well as a few specimen canopy trees in order to add a sense of maturity and to

soften the scale of the overpasses and wide expansive roads. Seasonal displays and groundcover will be especially evident at entrance/exit ramps.

4. Medians between the roadway and the adjacent use should consist of a 30-foot wide buffer, which includes a double row of trees, low hedge, seasonal displays and groundcover and security fence. Seasonal displays and groundcover will be especially evident at the base of directory signs located on the inbound roadways.
5. Medians may also contain infiltration / filtration trenches that support vegetation while treating stormwater runoff. These bio-infiltration systems reduce downstream stormwater runoff, reduce total suspended solids, mitigate heavy metals and remove excessive nutrients.
5. Salt splash consisting of a permeable pavement system that allows stormwater infiltration and filtration. Salt splash pavement maybe introduced along roadway edges and under fences and guide rails to reduce maintenance, while providing positive year-round image.
6. A standard custom picket fence element has been identified at JFK and EWR. The fence should be used for all Port Authority and Tenanted spaces that face onto the primary entrance/exit roadways.
7. Select Tall Fescue seed cultivars that can thrive on low nutrient, low water availability and that ar“90% endophyte enhanced” variety.

SECONDARY ROADWAYS

1. Small irregular islands should be treated with hardscape, such as colored asphalt or concrete pavers.
2. Larger irregular islands will contain ornamental trees as well as a few specimen canopy trees in order to add a sense of maturity and to match the scale of the overpasses and wide expansive roads.
3. Depending on topography the area between the roadway and the adjacent use should consist of a 30-foot wide buffer, which includes a double row of trees, low hedge, seasonal displays and groundcover and security fence or a bio-infiltration / filtration trench.
4. Seasonal displays and groundcover could be evident at the base of any inbound directory signs.
5. Salt splash consisting of eight-inch hexagonal asphalt pavers laid out in a random pattern composed of two different color aggregates is evident at JFK. At EWR, the salt splash paver is composed of three different colored concrete pavers.

6. Embankments will be solidly planted with an appropriate groundcover.
7. Select Tall Fescue lawn seed cultivars that can thrive on low nutrient, low water availability and that are “90% endophyte enhanced” variety.
8. Grade conditions beneath overpasses, guide ways, guide rails will have gravel mulch or stabilized crushed stone screenings, which reduce maintenance while providing an attractive appearance.
9. Port Authority and Tenanted spaces requiring fencing should have a uniform fencing system.

AIRSIDE

1. Select Tall Fescue seed cultivars that can thrive on low nutrient, low water availability and that are “90% endophyte enhanced” variety.
2. Incorporate 2” – 6” of compost into the existing soil to increase the water holding capacity of the soil.
3. Follow the maintenance routine prescribed by Wildlife Biologist.
4. Areas likely to experience emergency vehicles and/or jet engine thrusting should have polypropylene fibers incorporated into the soil to reinforce root/soil contact.
5. Avoid surface water ponding.

DESIGN CRITERIA

A LANDSCAPE DESIGN LEAST LIKELY TO ATTRACT BIRDS SHOULD HAVE THE FOLLOWING QUALITIES:

1. Avoid plant material and design features that provide birds with a source of FOOD, WATER, COVER and SPATIAL DOMAIN.
2. Canopy trees should be planted in linear rows, canopies spaced 15-20 feet apart at maturity. (Adjacent canopies should never be touching)
3. Shrubs and small trees should be used moderately and not be planted under or directly adjacent to canopy trees. (Avoid creating eco-diversity)
4. Shrub beds should be small in size and discontinuous.
5. Flowering ornamental trees should be limited in quantity.
6. Groundcover should be well manicured, healthy, dense , moderately tall lawn, a fruitless low growing groundcover, gravel or bark mulch.
7. All plants should be planted at the same size and time.

PLANT MATERIAL

TREES

Trees shall be selected that meet the following criteria:

- * To withstand pollution and tough urban environments,
- * To tolerate wind and drought.
- * To tolerate excessive road de-icing salts and salt-laced prevailing winds.
- * To be unattractive to birds as a food source and meet FAA approval.
- * To be unattractive to birds as a roosting site and meet FAA approval.
- * To be primarily deciduous, since evergreen trees are an ideal bird habitat.
- * To have interesting flowers, fall color, size, shape or habit.
- * To be obtainable on the commercial market.
- * To be not listed on any quarantine or invasive plant list

| | |
|-------------------------------|----------------------------|
| Carpinus betulus 'Fastigiata' | Columnar European Hornbeam |
| Gleditsia triacanthos 'Halka' | Moraine Honeylocust |
| Quercus phellos | Willow Oak |
| Quercus robur 'Fastigiata' | Fastigate English Oak |
| Quercus robur 'Crimschmidt' | Crimson Spire Oak |
| Quercus robur 'Regal Prince' | Regal Prince Fast. Oak |
| Zelkova serrata 'Green Vase' | Green Vase Zelkova |

ORNAMENTAL TREES

Ornamental trees shall meet the same criteria as trees.

| | |
|---------------------------------|-----------------------------------|
| Chioanthus virginicus | Fringe Tree |
| Cornus x Ruth Ellen | Stellar White Dogwood (Fruitless) |
| Koelreuteria paniculata | Golden Rain Tree |
| Manolia stellata 'Varieites' | Star Magnolia |
| Malus 'Coralburst' | Coralburst Crabapple (Fruitless) |
| Malus 'Spring Snow' | Spring Snow Crabapple (Fruitless) |
| Parrotia persica | Persian Parrotia |
| Syringa reticulata 'Ivory Silk' | Ivory Silk Lilac |

EVERGREEN TREES

| | |
|------------------|---------------------|
| Pinus flexilis | Limber Pine |
| Pinus parviflora | Japanese White Pine |

SHRUBS AND GROUNDCOVER

Shrubs and groundcovers shall meet the same criteria as trees.

| | |
|---|------------------------------|
| Abelia x grandiflora 'Edward Goucher' | Edward Goucher Abelia |
| Clethera alnifolia 'Hummingbird' | Summersweet |
| Clethera alnifolia 'Sixteen Candles' | |
| Cotinus coggygria 'Young Lady' | |
| Diervilla lonicera 'Copper' | |
| Diervilla sessilifolia 'Cool Splash' | |
| Fothergilla gardenii | Dwarf Fothergilla |
| Hamamelis x intermedia 'Arnold Promise' | Arnold Promise Witchhazel |
| Heptacodium mconoides | Seven-Son |
| Hydrangea paniculata 'Limelight' | Limelight Hydrangea |
| Hydrangea paniculata 'Tardiva' | Tardiva Hydrangea |
| Hydrangea quercifolia 'SnowQueen' | Snow Queen Oakleaf Hydrangea |
| Hydrangea 'Little Lamb' | |
| Hydrangea 'Samantha' | |
| Hypericum 'Hidcote' | Hidcote |
| Juniperus chinensis sargentii | Sargent's Chinese Juniper |
| Juniperus procumbens 'Nana' | Japanese Garden Juniper |
| Juniperus Sabina tamariscifolia | Tam Juniper |
| Itea japonica 'Henry's Garnet' | Henry's Garnet Sweetspire |
| Spiraea x bumalda 'Froebelii' | Spirea Froebelii |
| Spiraea x media 'Snowstorm' | Spirea Snowstorm |
| Spiraea nipponica 'Snowmound' | Snowmound Spirea |
| Spiraea 'Pink Parasols' | |
| Spiraea 'Lemon Princess' | |
| Stephanandra incisa 'Crispa' | Lace Shrub |
| Syringa meyeri 'Palibin' | Dwarf Korean Lilac |
| Syringa 'Tinkerbelle' | |
| Syringa x Bloomerang | |
| Taxus x media 'Greenwave' | Greenwave Yew |
| Taxus x media 'Tauntonii' | Taunton Spreading Yew |
| Taxus x media 'Wardii' | Ward's Yew |
| Weigela florida 'Carnaval' | Carnaval Weigela |
| Weigela florida 'Alexandra' | Wine & Roses Weigela |
| Weigela florida 'Variegata Nana' | Dwarf Variegated Weigela |

SEASONAL DISPLAY PERENNIALS

| | |
|---|------------------------|
| Caryopteris x clandonensis 'First Choice' | Blue Mist Caryopteris |
| Coreopsis grandiflora 'Moonbeam' | Tickseed |
| Eupatorium dubium 'Baby Joe' | |
| Eupatorium purpureum 'Gateway' | Gateway Joe Pye Weed |
| Hemerocallis 'Happy Returns' | Happy returns Daylily |
| Hemerocallis 'Stella de Oro' | Stella de Oro Daylily |
| Hosta species | Hosta |
| Liriope muscari 'Big Blue' | Big Blue Lily Turf |
| Nepeta faassenii 'Walkers Low' | Walkers Low Catmint |
| Pennisetum alopecuroides 'Cassian' | Cassian Fountain Grass |
| Perovskia atriplicifolia | Russian Sage |
| Pycnanthemum muticum | Mountain Mint |
| Salvia nemorosa 'Cardonna' | Meadow Sage |
| Sedum x 'Autumn Joy' | Autumn Joy Sedum |
| Sedum 'Mini Joy' | Mini Joy Sedum |
| Stachys byzantina 'Helene von Stein' | Lambs Ears |

SEASONAL DISPLAY ANNUALS

| | |
|---|---------------------|
| Begonia 'Cocktail Series' | Begonia |
| Catharanthus roseus | Periwinkle |
| Coleus species | Coleus |
| Chrysanthemum species | Chrysanthemum |
| Helichrysum petiolare | Licorice plant |
| Lantana camara cultivars | Lantana |
| Petunia 'Purple Wave' | Wave Series Petunia |
| Portulaca grandiflora 'Margarita Fruit' | Rose Moss |
| Tithonia rotundifolia 'Fiesta Del Sol' | Mexican Sunflower |
| Viola x wittrockiana cultivars | Pansy |

SEASONAL DISPLAY BULBS

| | |
|--------------------------|----------------------|
| Daffodil x 'Ice Follies' | Ice Follies Daffodil |
| Daffodil x 'King Alfred' | King Alfred Daffodil |

PLANTS SUITABLE FOR STORM WATER MANAGEMENT

| | OBL | FACW | FAC |
|---|-----|------|-----|
| Trees & Shrubs | | | |
| Clethera alnifolia / Sweet pepperbush | | | X |
| Diervilla lonicera / Bushhoneysuckle | | | X |
| Hamamelis virginia / Witch hazel | | | X |
| Itea virginica / Sweetspire | X | | |
| Grasses | | | |
| Calamagrostis canadensis | | X | |
| Fescue var. Bullseye or Spider LSTall Fescue* | | | X |
| Puccinella distans / Alkali Grass | | | X |
| Perennials | | | |
| Acorus calamus / Sweet Flag | | X | |
| Anemone canadensis / Canadian Anemone | | | X |
| Asclepias incarnata – Swamp Milkweed | X | | |
| Eupatorium purpureum – Joe Pye Weed | | | X |
| Hibiscus moscheutos / Swamp rose-mallow | X | | |
| Iris vericolor / Blue Flag | X | | |
| Osmunda cinnamome / Cinnamon Fern | | X | |

* >90% Endophyte Infection
 OBL Obligate Wetland species: Occur almost always in wetlands
 FACW Facultative Wetland species: Usually occur in wetlands, but occasionally found in non-wetlands.
 FAC Facultative species: Equally likely to occur in wetlands or non-wetlands.

LAWN

Select Tall Fescue cultivars that can thrive on low nutrient, low water availability and that are "90% endophyte enhanced" variety. NO exceptions.

IRRIGATION

1. Seasonal display areas and landscaped areas adjacent to pedestrian nodes should be irrigated with automatic sprinklers that are controlled by computerized controllers connects to weather stations and soil sensors.
2. Trees, shrubs and groundcover may be irrigated with automatic sprinklers. Trees not handled by automatic sprinklers should be irrigated with TreeGaters for the first two years after installation.
3. Lawn and mature grass may not necessarily be irrigated after the initial six months after germination.
4. Water supply will be from connections to the existing water mains. The water will be metered and supplied with a backflow preventer.
5. Water supply should consider alternative sources such as roof storm water runoff and gray water.
6. Roofwater runoff may be collected in cisterns and used as a non-potable source of irrigation water.
7. Planted swales and infiltration trenches located in landscape areas carrying roadway storm water runoff.

HARDSCAPE

1. Salt splash paver - Salt splash consisting of eight-inch hexagonal asphalt pavers laid out in a random pattern composed of two different color aggregates as is evident at JFK. At EWR, the salt splash paver is composed of three different custom-blend colored precast concrete pavers. EWR pavers are Uni Eco and Super Décor by Unilock.
2. Gravel mulch is a blend of red, white and brown washed river stone., such a the Delaware River Blend.
3. Stabilized crushed stone screenings is beige, gray or a blend of crushed stone screenings treated with a stabilizer to create a semi-solid pavement.
4. Permeable concrete, asphalt pavement systems should be considered.

MAINTENANCE - THE IPM APPROACH

The goal of the Integrated Pest Management (IPM) approach is to manage pests and the environment to balance costs, benefits, public health and environmental quality. The Contractor shall employ as supervisor for the installation and maintenance a New York State Certified Arborist (represented by an individual certified and qualified to evaluate horticulture requirements). Additionally the Landscape Architect, the Facility Maintenance staff and the Contractor shall take periodic and regular walk-throughs to access the Contractor's performance and workmanship.

REDUCING CONSTRUCTION IMPACTS

Airspade – An airspade is a tool that uses compressed air to alleviate soil compaction without causing any damage to the tree roots. This method calls for the use of an air spade to loosen the soil around the tree roots and fortifying the existing soil with compost and bio-stimulants, adding no more than two inches of mulch to the surface and irrigating.

Micro-tunneling – Tunneling equipment involves a cutting tool, connecting rods and/or hoses, a unit that provides thrust or torque, and a field power unit. Tunneling can provide holes in diameter of 47 inches. Many communities now have provisions in their ordinance that address the use of tunneling rather than trenching when trees in excess of 5” DBH in public areas are encountered.

Structural Soil – Structural soil is a medium composed primarily of crushed stone, clay loam and a hydrogel stabilizing agent. The material can be compacted to meet all relevant pavement design requirements yet allow for sustainable root growth.

Tree Protection – Tree protection measures must be implemented during construction. This means that prior to construction a suitable barrier must be erected around the existing tree zone as determined by the certified arborist. Tree protection measures include but are not limited to protecting the entire tree from mechanical damage and the roots from mechanical damage and compaction. Trees must be irrigated regularly and biostimulants and IPM practices must be conducted on a regular basis throughout the construction period. Roots must never be left exposed and allowed to desiccate.

REFERENCES

JFK Redevelopment Program Investigational Studies: Bird Hazards, Soils, Irrigation, Hanna/Olin, Ltd. December 1988

JFK International Airport Central Terminal Area: Parking Lot Perimeter, Port Authority Engineering Dept., February 1993

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Federal Aviation Administration – Advisory Circular No. 150/5200-33B, Hazardous Wildlife Attractants On or Near Airports, August 28, 2007

Tree Planting Guidelines, New York City Parks & Recreation, February 2003

Alternative Stormwater Management Practices, New York State Department of Environmental Conservation, 2006

Stormwater Management Practices, New Jersey Department of Environmental Protection, 2005

New York State Stormwater Management Design Manual

02920 – Soil Testing

02921 – Screened Loam Soil

02930 – Seeding

02940 – Trees, Shrubs and Ground cover (NY)

02954 – Trees, Shrubs and Ground cover (NJ)

02958 – Tree Pruning and Removal

02959 – Tree Protection During Construction

02960 – Adding Compost

02961 – Air- Spading

02971 – Maintenance of Permanent Landscaping

PORT AUTHORITY SPECIFICATIONS