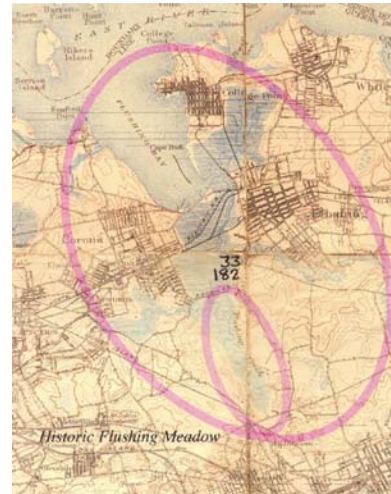


EXECUTIVE SUMMARY

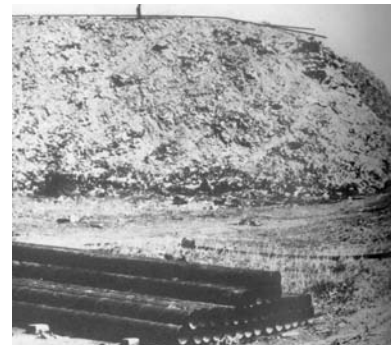
Meadow and Willow Lakes today are the product of human intervention in the natural environment. Sculpted by glaciers thousands of years ago, Flushing Meadows has been substantially altered over the last hundred years – first by its use as a city dump and then by Robert Moses as part of an aggressive park and highway building campaign. The resulting landscape reflects the predominant construction and design philosophies of the early 20th century, not a process of natural development.

The twin lakes were conceived as a stormwater retention basin and ornamental centerpiece for the 1939 World’s Fair. As a result, the topography and contours are a byproduct of the bulldozer, not the forces of nature. Driven by aesthetic rather than environmental concerns, the physical structure of the lakes works against the emergence of a diverse ecological system, and towards one of monoculture and dominance by invasive species.

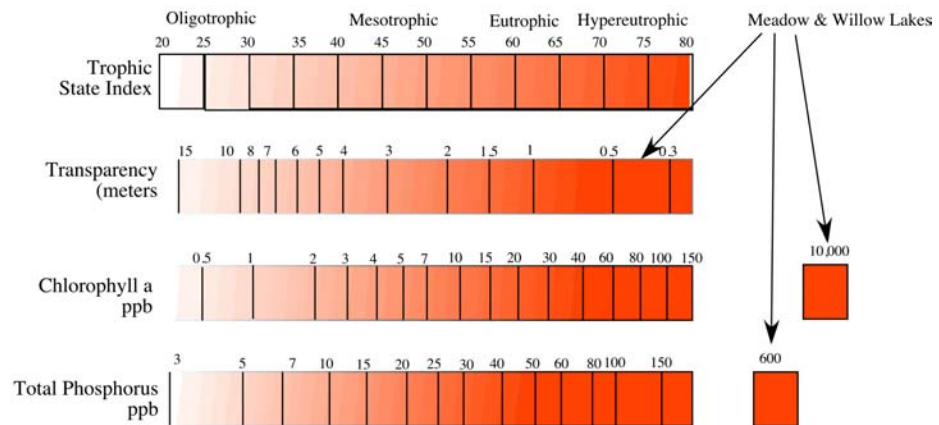
The lakes further suffer from pollution that is, ironically, a result of their very creation. For thousands of years, Flushing Meadows was a tidal marsh drained twice a day by the natural action of the tides, which served to keep nutrient levels in balance. Damming Flushing Creek to create the lakes has eliminated tidal action, and the resulting unchecked release of phosphorus from the former marsh bed has caused the lakes to become “eutrophic” – or super-saturated with algae in warm weather. Eutrophication is not only unpleasant – causing bad odors and pea-green water – but is also destructive to natural habitats and to fish, which are killed in large numbers in summer by the depletion of oxygen in the water.



The tidal marsh in Flushing Meadow (above) became one of the largest garbage dumps in New York City (below). Mount Corona, as photographed in the 1900’s, was nearly 100 feet high.

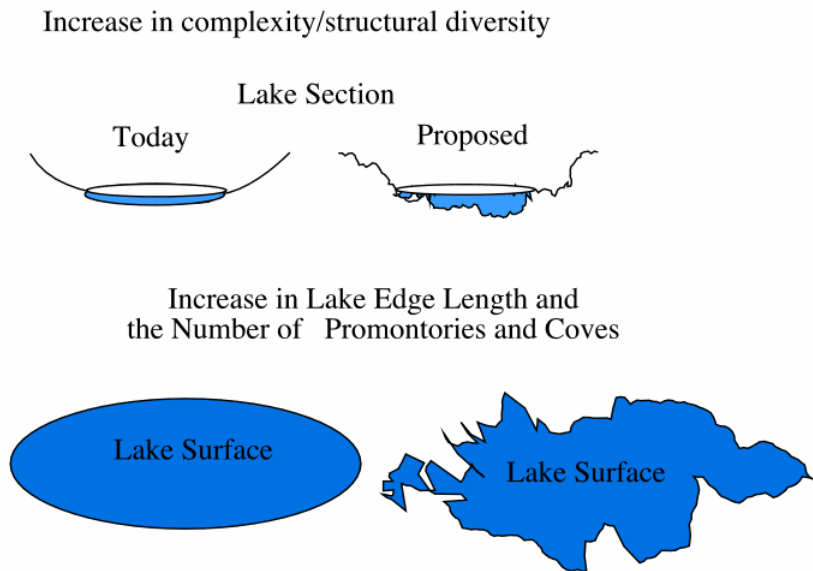


The Trophic State Index is a measure of the “health” of lakes. As can be seen, measures of Meadow and Willow Lakes, reported in the Lawler, Matusky & Skelly Report, indicate values far into the hypereutrophic, or polluted, zone (from Carlson’s Trophic State Index, modified from the Lake and Reservoir Restoration Guidance Manual, 1990).



Only human intervention can remedy this situation. Without it, the lakes are likely to look and function as they do today for the next several hundred years. The smooth curves and even depths of the lakes do not provide the varied habitats needed for biodiversity. The graphic at right represents the form of the lakes today compared to the more varied lake edge and bottom structures needed to sustain a more varied ecological system.

The Geometry of Ecological Enhancement



This uniform structure has led to a virtual monoculture of the invasive reed *Phragmites*. This aggressive plant has invaded almost the entire perimeter of Willow Lake, occupying and eliminating this habitat for almost all other species. In fact, the Gaia Institute has noted only about 37 species around Willow Lake – an area which could support an estimated 300 to 400 species. This limited plant diversity is mirrored in limited aquatic life, with only six species of fish counted in the waters of the two lakes – whereas water bodies of this size should be capable of sustaining twice this number.



The common reed, *Phragmites* has dominated the edges of Willow Lake, as can be seen in the photograph at left.

No plan has emerged – prior to the NYC2012 proposal – for the comprehensive ecological restoration and enhancement necessary to make the lakes truly healthy for human and non-human use. With the proper techniques, the NYC2012 proposal "... could provide the integration of infrastructure and natural systems essential for the improvement of the lake environment and the protection of human and ecological health." In fact, not only is this an environmental enhancement opportunity, but from the Olympic point of view, it is a necessity. Clean water, a healthy landscape, and improved facilities are all prerequisites for Olympic use, and through major modifications by the Gaia Institute, the plan now incorporates systems that will provide a permanent, largely self-sustaining lake and upland environment by 2012 and for centuries beyond.

The 2,000-meter rowing course proposed for the 2012 Olympic Games has been ecologically engineered by the Gaia Institute to more than quadruple the acreage of productive wetlands and dramatically expand natural habitats. In order to be used for competition, the lakes must also be deepened below the racing lanes to a depth of 3.5 meters, and the necessary dredging will remove many if not all of the phosphorus-rich sediments that contribute to the poor water quality of the lakes today.



The techniques recommended are neither new nor untested. The Gaia Institute, as well as City, state, and federal agencies, and a number of engineering and construction companies have successfully implemented similar measures at many other locations throughout New York City and the surrounding metropolitan region. Post construction monitoring indicates that where these techniques are properly designed and carried out, they have substantial environmental benefit at relatively modest cost. Furthermore, these systems are largely self-sustaining, eliminating the need for costly mechanical systems, chemicals, infrastructure, or on-going maintenance crews. Among the most important steps proposed by the Gaia Institute and included in the Olympic rowing program are the following:

- **Dredging the lake bottom** is one of the most important steps to improving water quality, and one that has been advocated by the Parks Department at the recommendation of its consultants for decades. Only by removing the deep, nutrient-rich peat and sediment layers left over from the historic salt marsh will the lakes be able to sustain a diverse and healthy fish and invertebrate populations. Today, only six species of fish populate

Meadow and Willow Lakes, compared to twice this number seen in water bodies of similar size. Dredging the lakes to at least 12 feet deep in the middle is required for Olympic rowing. Preliminary coring samples suggest that a harder, low phosphorus sandy layer may underlie the top two meters of soft sediments.



Core samples taken by the Gaia Institute in 2001 show a nutrient-rich peat layer at least 2 meters deep, which is an ongoing source of pollutants in Meadow and Willow Lakes.

Two separate cores are pictured at left. The brown peat layer is the top of each core, and the bottom segment of the core is to the left. The cores are approximately 2 1/2 inches in diameter.

- **“Daylighting” of stormwater**, recreating streams and creeks by removing pipes which now discharge highway runoff into the lakes without any natural filtration by sun or soil, would help remove the heavy metals and suspended solids that now accumulate on the lake bottom. Replacing these underground culverts with open wetland holding ponds would further aid the natural filtration process and provide beautiful landscape features around the lakes. The NYC2012 proposal would daylight all of the stormwater pipes around the lakes while maintaining continuous pedestrian access and all existing playing areas.



The Olympic Rowing proposal includes daylighting of stormwater pipes (above), much like the enhancements being implemented in Conference House Park, Staten Island (right).

- Reintroduction of native wetland plant species** is essential to recreating a balanced ecosystem. The invasive, common reed *Phragmites* has virtually taken over the entire perimeter of Willow Lake. While providing habitat for certain birds and other organisms, the contribution of this narrow wetland filter is limited. A more diverse and expanded native shrub and herbaceous wetland plant community would provide habitat for a much greater number of birds, fish, and invertebrates, while providing more filtration capacity because of the increased area of the enhanced wetland surrounding the lake edges. The NYC2012 plan proposes large-scale reintroduction of native plant communities well in advance of the 2012 Games. The lead time is necessary to ensure sufficient time for the



The difference between urban runoff problems and habitat lies in sustainable natural structures. A mallard and her ducklings can just be seen in the photo at left, well hidden in the dark right center of the picture, under a grassy overhang. Eighteen months ago, this wetland was a blacktopped path. Constructed by the Gaia Institute, this former asphalt surface now contains a coverage of 22 native species, with about 300 individual shoots and 170 colonies.

growth and development of the biomass required to power the natural filtration which will bring water quality up to Olympic standards.

- Wetlands in series** – or a terraced sequence of wetlands and uplands – would exponentially increase the natural filtration ability uplands and wetlands taken separately. Studies indicate that efficiency goes up dramatically when water alternatively moves through wetland pools, soil buffers, wetland pools, soils, and so on. By creating as many as four wetlands in series, it would be possible to virtually eliminate pollutant inputs and bring the water quality to swimmable – theoretically even to drinkable – levels. The NYC2012 plan proposes installation of wetlands in series around the entire perimeter of Willow Lake, as both a natural filter and an environmental education asset.



The enhanced wetland, island, and soil buffer system pictured at right would dramatically improve biodiversity and water treatment capacity in the twin lakes. By filtering stormwater through an alternating series of soils-wetlands-soils-wetlands, the removal capacity of these systems is increased exponentially. Water passing through a single wetland prior to entering lakes and ponds removes approximately 50 –90% of nitrogen, heavy metals, and pathogens, whereas the wetland series proposed in the NYC2012 plan would remove approximately 90 to 99% of nitrogen, phosphorus, heavy metals, and pathogens.

- Expanding wetland acreage to match runoff inputs** is also critical. To meet water quality goals, the area of wetlands must be sized to handle the volume of water flowing from impervious surfaces in the surrounding watershed. Today, the two lakes are rimmed by about 15 acres of low-diversity wetland, which is inadequate given an estimated watershed area of 4-6 square miles. The NYC2012 plan calls for approximately 90 acres of diverse, high-productivity wetlands – an increase of ~500% in wetland acreage. This area would be sufficient to handle runoff from 1,250 acres of paved surface – an area equal to at least 50% of the entire watershed.



Increasing wetland area six-fold, the 90 acres of wetland proposed in the NYC2012 plan, as pictured at left, would be sufficient to filter runoff from 1,250 acres of paved surface, approximately 50% of the entire Flushing Meadows watershed.



By adding an 18” rich humus layer over construction and demolition debris and urban landfill, as can be seen in the photographs above and at left, transformed a ragweed-covered, abandoned lot in Brooklyn into a stormwater capture park. Presently covered with blueberries and other native plants, natural infiltration processes have been restored and enhanced by the action of plant roots, worms, and burrowing insects.

- **Improving the water infiltration rate of existing soil** is also critical, not only to natural filtration processes but also to eliminating flooding. The substratum beneath the park is composed of cinder ash, which can become compacted, thus behaving like a paved surface. Adding a fresh, humic soil layer 12” to 18” deep will dramatically enhance the ability of the land to absorb rain – eliminating “ponding,” making it possible to maintain healthy turf, and reducing damage to park infrastructure caused by the freeze-thaw cycle. Past studies by the Gaia Institute have shown that the addition of such a layer increases infiltration rates up to as much as 1 to 2 feet per hour of water – an amount equal to or greater than the total rainfall dropped by Hurricane Floyd. The NYC2012 proposal includes a plan to regrade the lakes area with at least 12” of humus-rich topsoil, the essential prerequisite for the growth and development of diverse and aesthetically appealing plant communities.
- **Ongoing public access and education** is perhaps most important of all to the success of these efforts. Experience at State and National parks has shown that people are most willing to protect and promote landscapes that they can experience and enjoy. The NYC2012 plan proposes a nature sanctuary around Willow Lake which features an elevated boardwalk which passes along the periphery of the wetlands, allowing for bird watching, strolling, and contemplation, while preventing direct access to fragile, natural habitats by people.



Public appreciation of natural areas through direct experience is becoming the new approach to conservation at the Department of the Interior. To deepen public appreciation of the protected watershed in Government Canyon, the formerly off-limits park land will be opened for recreational use.



The Olympic rowing proposal would incorporate six new boathouses for recreational use by the public, high schools, colleges and universities. At the same time, the natural areas to the south will be accessible only by a raised boardwalk, allowing public access, while limiting disturbance to wildlife.



Conclusion

Given the intrinsic aim of producing an ecologically sustainable, low nutrient water body surrounded by a mosaic of native plant communities, soil buffers, and biologically diverse, productive wetlands, there is no essential conflict between the goals of NYC2012 and environmental quality. In fact, given the history of the landfill and ash dumping together with the high phosphorus sediments of the lake bottom left from thousands of years of marsh growth, environmental quality improvements without the restoration and enhancement steps described here are not possible. Increases in biological diversity and ecosystem services are only likely to occur with the kinds of investment necessary for developing the park for Olympic use.