A Report on

THE GREAT LAWN

ITS PUBLIC USE, MAINTENANCE, AND REPAIR

Presented to the
City of New York and
The Central Park Conservancy
July 16, 2009

By the Great Lawn Study Committee

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INTRODUCTION AND COMMITTEE CHARGE

The Great Lawn study committee was formed by members of the Central Park Conservancy from January - March, 2008. The committee was first introduced to the issues surrounding the use and care of the Great Lawn during a teleconference call on May 1, 2008. A PowerPoint presentation and study committee mission statement (page 11) was sent prior to the call to each participant so they could follow the presentation.

From the study committee mission statement, the group was asked to form our opinion around the following six focus areas.

1. Are numeric or frequency limitations necessary for the use of the Great Lawn for large events?
2. If so, what are number and/or frequency of large events that can reasonably be accommodated by the Great Lawn each year (or season) without causing unacceptable damage?
3. What is the maximum crowd size that can reasonably be accommodated at Great Lawn events without causing unacceptable damage or threatening the safety of event participants?
4. Are there times of the year when the Great Lawn cannot accommodate a large event without risking unacceptable damage?
5. What measures must be undertaken at large events to prevent unacceptable damage and to ensure the safety of event participants? And
6. What additional measures can be taken to maximize, within the foregoing parameters, the availability of the Great Lawn for large events, including rallies and demonstrations?

The committee primarily addressed these six focus areas but did not limit our comments or opinions.

After some discussion, the committee decided that the Bon Jovi concert offered an excellent opportunity to observe a large event on the Great Lawn and plans were made to visit Central Park during July 11 – 13, 2008. During this visit, members of the study committee met with key staff/leadership of NYC's Department of Parks and Recreation and the Central Park Conservancy to review the park's detailed event planning documents (including crowd counting procedures) and completed a comprehensive multi-day assessment of the Great Lawn prior to, during and following the Bon Jovi concert to include the crowd's access and egress to the event. A large cherry picker (boom lift) was used by members of the study committee for observation and photo's (images 30-32).

Before departing, the committee met to share our opinions, issues, and conclusions. A Philharmonic event followed the Bon Jovi concert on July 15, 2009 and Mr. Richard Bussert continued to observe and document the condition of the Turfgrass over the next several weeks (images attached).

GENERAL OBSERVATIONS AND OPINIONS

The committee found the health of the turfgrass system in the Great Lawn area to be in good condition. We requested and received copies of soil physical and chemical test results that are completed on an ongoing basis (Page 14). We had one formal and several informal meetings with Mr. Douglas Blonsky, Mr. Russell Fredericks, Mr. Alessandro Olivieri and others to discuss turfgrass pest control, horticultural and agronomic maintenance and repair practices and schedules.

After gathering the information and discussing horticultural and agronomic issues with the staff, the committee is satisfied that the expertise of the staff and the decision making processes related to horticultural and agronomic practices are exemplary, especially when compared to similar public park situations with which the committee has familiarity.

The committee appreciates with the degree possible, the varied functions this open space provides to the residents of the city and the citizens of the nation and the difficulty in equitably balancing these sometimes competing functions. It is not the role of this committee to weigh the value of those functions but simply to assess the impact that varying activities will likely have on the condition of the Great Lawn.

SPECIFIC FOCUS QUESTIONS

Focus Question 1 - Are numeric or frequency limitations necessary for the use of the Great Lawn for large events?

In the extremes, there are both numeric and frequency limitations for almost any type of event on any turfgrass area. Although three outfielders moving about during a softball game will cause limited damage to the turfgrass, players are creatures of habit and they are typically attracted to the small wear area that develops as 'their spot'. With constant games, this area continues to receive more wear and at some point the turfgrass must be allowed to rest and recover and some turfgrass renovation or repair procedures may be required. For these reasons, the softball fields on the Great Lawn are periodically rested (typically at least one field is being rested at all times). In the case of a softball game, the damage caused by an individual event is small but if the event has a high frequency, a limitation must be placed on the number or frequency of the event in order to allow the turfgrass to recover and/or for the staff to implement repair procedures. Obviously, for a significant portion of the year the turfgrass must be mowed and it would be impractical to try to hold a softball game at the same time. So there are always limitations of some kind.

Focus Question 2 - If so, what is number and/or frequency of large events that can reasonably be accommodated by the Great Lawn each year (or season) without causing unacceptable damage?

And,

Focus Question 4 - Are there times of the year when the Great Lawn cannot accommodate a large event without risking unacceptable damage?

Unacceptable damage has been defined as damage requiring some type of major shutdown of the area for repairs. Currently, the park schedules the closing of one or typically two fields after a large event. Large being defined as any event with over 5,000 participants. The two fields in and around the stage area for major events are scheduled to be the closed fields in the two weeks after a large event as these areas typically receive the most traffic and are in need of the most rest and repair. This field rotation is scheduled in advance and thus there is little disruption in the use schedule for the park.

There is no set lower number of large events that can be held without the potential for unacceptable damage. Each and every large event holds the possibility of causing severe damage to the entire turfgrass area. Any large event held during a period where the soil is saturated with water is likely to cause unacceptable damage. In fact, any large event, similar in size to the Bon Jovi concert, held during a period of saturated soil conditions would likely render all of the softball fields unusable and in need of major repair including the installation of new sod. During this period of major repair, most if not all of the Great Lawn would be unavailable for recreational or spontaneous use by the public and the repair would be a significant expense.

The repaired turfgrass may be able to handle a reasonable amount of softball events in two to three weeks after installation; however, it would certainly not be adequately established to withstand another large event within a month. The immature turf would be more prone to suffer damage from additional events (even those held under ideal conditions) and the cycle of damage/repair would likely continue to repeat itself throughout the remainder of the season. In addition, the immature grass would also be much more susceptible to insect, weed, and disease infestation resulting in an increased reliance on pesticides, fertilizers, and irrigation to manage these areas. The increased use of pesticide may itself necessitate a limited use of these areas out of a concern for public safety.

Agronomically, the park has taken steps to limit the possibility of high soil moisture contents resulting in significant damage during an event. A rapidly draining sand-based rootzone was installed in the main lawn area in 1996. This advanced high-sand rootzone provides a compaction-resistant, rapidly-draining growing-medium that still provides ample moisture and nutrients for the turfgrass. A map of the area of the Great Lawn that contains this advanced rootzone is enclosed (Image 33).

Even with this advanced rootzone, a very large event held during inclement weather would likely result in significant unacceptable damage. It is thus the opinion of this committee that considering all uses of the Great Lawn throughout the season, the Department of Parks and Recreation should have the authority to cancel, with relatively short notice, a large event due to inclement conditions. The committee understands the pressure brought to bear on both the Department of Parks and Recreation and event organizers to allow an event to take place and because of this, recommends the development of a 'policy matrix' that would guide decisions regarding event cancellations. This decision tree would be in place and agreed to prior to an event and would likely include information about existing turfgrass conditions, soil moisture content measurements, and input from a professional meteorological consultant.

Weather history during specific time periods could be used to predict the likelihood of event cancellation. It is apparent why the Parks Department suggests large event use periods as two major events in June, two in July and two from the second week of August through the second week in September. During these time periods the likelihood of cancellation due to weather conditions that will result in unacceptable turfgrass damage is reduced.

In lieu of some agreement on a cancellation policy matrix for events in spring and fall, these summer months are appropriate time periods for large events for the following reasons.

- The chance of significant damage is certainly lessened due to lower likelihood of precipitation.

- Soil moisture can be controlled to a greater degree in summer compared to spring and fall. Drying takes place faster after precipitation events. The rootzone can be 'dried down' in preparation for the large event to limit damage. In the spring and fall, the rootzone will not dry quickly so a rain event occurring 5 days prior to the large event, could result in a high rootzone moisture content thus increasing the likelihood of unacceptable damage.

- Spring and fall weather conditions allow the turfgrass to heal and recover from damage. The cool season turfgrass species adapted to New York such as Kentucky bluegrass, tall fescue, and perennial ryegrass amass the majority of their roots during the fall and spring of the year. The committee believes that a main reason why the Great Lawn withstands the foot traffic it receives is due to the lessened traffic stress during the periods of active turfgrass recovery in the spring and fall. Effectively, the turfgrass can recover all fall and all spring before encountering the stressful large events during the summer months.

The committee believes that one additional large event could be held during either fall or spring (<u>not both</u>) each year; however, the committee warns that there will be a very high likelihood of cancellation and event organizers must be willing to accept that risk.

Focus Question 3 - What is the maximum crowd size that can reasonably be accommodated at Great Lawn events without causing unacceptable damage or threatening the safety of event participants?

And,

Focus Question 5 - What measures must be undertaken at large events to prevent unacceptable damage and to ensure the safety of event participants?

The findings and opinions that follow are related primarily to the safety and security of the attendees at a large event on the Great Lawn in Central Park. The conclusions are based upon observations at and surrounding the recent Bon Jovi concert (July 12, 2008) as well as upon years of experience with hundreds of outdoor and indoor events.

Safety and security of all participants at a large outdoor event requires consideration of a number of variables that could have an effect on crowd management including size of crowd, duration of event, weather, age of audience, time of day, nature of event, potential use of alcohol/drugs, etc.

Once these variables are known, adjustments can be made in a well-designed operations plan. Several of these variables, however, are common to most large outdoor events and were present at the Bon Jovi concert:

- Early arriving crowd;
- Large number of attendees waiting for multiple hours;
- Need for food, drink and restrooms within easy access; and
- Need for sufficient space for attendees to stand, sit, or recline on blankets during long waiting periods.

Those in charge of operations must also anticipate the potential for emergencies including evacuation in a timely manner. A safe emergency exit is a function of the size and demeanor of the audience, a sufficient uniformed presence, an adequate public address system, sufficient lighting, etc.

Responding reasonably and intelligently to the question of maximum crowd size is not merely a mathematical consideration. The maximum crowd size is also a function, for example, of the amount of space required for people who are not all standing but sitting and lying down. It is also a function of how much time is acceptable or necessary to evacuate an audience due to an actual or impending emergency.

The maximum size of a crowd that can safely use the Great Lawn is conditioned by the dimensions of the space, and by the posture of the participants, which has a lot to do with the wait time that seems to be common to all major outdoor events. While there may be some ability to ratchet up the numbers slightly by fully filling the rearmost sections of the lawn that would only account for several thousand additional people. Extending the crowd beyond the perimeter of the Great Lawn to the east, west or south would be problematic and likely dangerous due to the heavily wooded, uneven nature of the terrain, especially in the evening. The area below the drip line of the trees does not contain the compaction resistant rootzone and if these areas are extensively used damage to the trees may occur. The impact of soil compaction on tree health (both root and overall) has been extensively documented in the scientific literature and applies to the mature ring of trees surrounding the Great Lawn. These mature trees are very valuable and the replacement expense significant. The importance and value of New York City's urban forest, of which approximately 50% is under the jurisdiction of NYC's Department of Parks and Recreation, has been determined to be ~$5.2 billion (Fiona Watt, Chief of Forestry & Horticulture, City of New York Parks and Recreation; http://treesmatter.osu.edu/Trees_ppt/NYC%20Urban%20Forest.ppt#683,1,It Really Does Grow On Trees). Mulch is spread over these areas to help reduce the impact of random foot traffic but these areas should be avoided as seating areas for a dense crowd. Also these areas generally provide a poor sight line to the stage. Expanding to the south would be hampered by the presence of Turtle Pond. Additionally, in those areas there would be no visibility of the event nor would the sound carry very well.

The baseball infields could be covered to provide some additional space but that would require people to be located near or under show equipment including stacked speakers, rigged sound and lighting equipment, generators and a web of electrical cables. These items could prove to be annoying, undesirable and unsafe. Besides, the baseball infield areas offer an excellent space for movement and storage of performance related equipment and staging. By utilizing some of the infields for these purposes, an equal area of turfgrass is protected from these activities.

As a mathematical calculation and using the Bon Jovi concert as an ideal situation (good weather, friendly crowd) there are 10 acres of space available inside the oval once the space for the stage, emergency lanes, and sound towers and other equipment placed on the baseball infields were excluded. If the often cited average standing space of 5 - 7 ft^2 per person were used, the 10 acres inside the oval theoretically could accommodate 60,000-80,000 standing individuals. If the tree lined ring on the inside of the oval is excluded as audience 'seating' as we believe it should be to protect the health of the trees, the effective 'seating' capacity of the Great Lawn is approximately 8.4 acres. Using the same 5 – 7 ft^2 per standing person average and assuming 8.4 acres of available space, this calculates to a capacity of 52,000 to 73,000 persons. Because people tend to arrive well in advance of major events (as was the case in the Bon Jovi concert) and sit and/or recline, sometimes in small groups all day long, we recommend using the 7 ft^2 per person minimum when developing a realistic 'seating capacity' for the Great Lawn. Thus if the area under the drip line of the trees is excluded, 52,000 could theoretically be accommodated. If all persons attending are expected to recline during part or all of their time on the Great Lawn, a more appropriate number to use may be 10 ft^2 per person. In this case, when the area under the trees is excluded the number the Great Lawn could theoretically accommodate 36,600 persons. If the Turtle Pond overflow area is used for audience 'seating', the committee's finding is that the Great Lawn could safely accommodate 55,000 attendees with a mixed standing and reclining audience.

Approximately 48,000 attended the Bon Jovi concert. Observation of the audience, throughout the event, from the ground and from high above the lawn revealed a dense but not overly compressed crowd with only portions of the 6 infields and a small amount of the 2 rearmost sections with some visible space (Images 27-32). The Bon Jovi crowd required approximately 20 minutes to clear the Great Lawn and an additional 20-30 minutes for people to reach the east and west perimeters of the park.

All indoor event facilities have maximum attendance caps that are imposed by code. These caps are primarily in place to provide safe and expeditious exiting in both normal and emergency situations. Indoor facilities are also subject to frequent and thorough inspection by government authorities. While it is perhaps more difficult to establish a maximum crowd number in an outdoor setting, it is just as important. Given the conditions that have been described above for a large event staged on the Great Lawn in Central Park the maximum number of attendees who could be safely and expeditiously exited (assuming the Turtle Pond overflow area is used) is approximately 55,000.

Focus Question 6 - What additional measures can be taken to maximize, within the foregoing parameters, the availability of the Great Lawn for large events, including rallies and demonstrations?

The Department of Parks and Recreation has already installed a quickly draining advanced rootzone system to the majority of the Great Lawn. They have established traffic tolerant turfgrass species and cultivars. Their maintenance procedures are exemplary. Plywood roadways are constructed and used to protect the turfgrass during loading in and out, respectively, of equipment (Images 11-17) and the non-grass infields are used smartly for sound towers and other heavy equipment. This attention to detail and forethought has allowed the Great Lawn to withstand the amount of traffic it currently receives without causing significant unacceptable damage or a disruption of this area for public use.

The use of TerraPlass (a protective covering system) to cover the turfgrass and allow a greater density of attendees is not practical. We estimate that it would take a 50 person crew a minimum of 36 hours of constant labor to install (and a similar amount of time to remove) over the 10 acres of the Great Lawn. The cost to rent TerraPlass is approximately $35,000 per acre (not including labor). The installation and removal of the system would severely limit use of the entire area during this time. TerraPlass while protecting the turfgrass from physical damage increases the likelihood of the turf developing disease and would require the use of preventative (applied prior to laying down the TerraPlass) fungicide sprays. While TerraPlass may allow for a greater density of persons, damage is likely to occur under high soil moisture conditions.

Resodding of the Great Lawn after unacceptable damage has occurred will cost at least $100,000 per acre, probably higher. Thick-cut sod, similar to what is installed in-season on NFL stadium fields would be required if the surface is to be playable shortly after installation. Sodding of a significant portion of the Great Lawn would require a minimum of two weeks to complete during which time the area would not be useable for recreation or spontaneous use. Sod with a sandy soil resembling the existing rootzone is recommended and may not be available locally. The use of non-sand thick-cut sod over the high-sand drainage system is not recommended as it would reduce the effectiveness of the advanced rootzone and necessitate significant changes in the long-term agronomic management of the Great Lawn.

SUMMARY AND COMMITTEE OPINIONS

The Great Lawn is an asset to the citizens of New York and the millions that visit the City. The safety of persons enjoying this area is of utmost concern. The many and varied uses of this area create a difficult balancing act for park and Conservancy employees and administrators. The City and Conservancy has been able to hold numerous large events while not significantly limiting the recreational or spontaneous use of the Great Lawn. The grounds managers are using state of the art construction and management procedures to ensure a safe, playable, and attractive park setting for the visitors to the Great Lawn.

- It is the committee's finding that to ensure the personal safety of attendees and to limit the amount of unacceptable damage to the turfgrass and/or mature trees that a 55,000 person upper limit be set on large events held on the Great Lawn. The 55,000 person upper limit assumes the Turtle Pond area will also be open to attendees.

- If the lawn area is to be enjoyed for both spontaneous and organized recreation close to the large event, it is imperative that Department of Parks and Recreation and/or Central Park Conservancy administrators have the ability to cancel an event due to inclement weather.

- The committee recommends the establishment of a policy matrix for the cancellation of events. This decision tree would include the existing condition of the turfgrass, soil moisture measurements, and a professional meteorological consultant. The committee believes that if event planners agree to the cancellation policy, one additional large event could be held during either fall or spring (not both) each year. The committee warns that there will be a high likelihood of cancellation during these times of the year that and event organizers must be willing to accept this risk.

It must be emphasized that one poorly planned or executed large event may result in unacceptable damage to a majority of the Great Lawn and/or jeopardize the safety of participants. Significant and rapid repair of the turfgrass and/or mature trees would require a shutdown of the Great Lawn as well as significant expenditures in labor and materials.

The committee is available and willing to provide additional clarification on any of the information provided in this document.

Respectfully Submitted,

Michael J. Boehm	Richard G. Bussert	Andrew McNitt	Robert Russo
Michael Jan Boehm	Richard Bussert		Robert Russo

ADDENDUM

Addendum A. Great Lawn Study Committee mission statement provided by the City of New York and the Central Park Conservancy.

STUDY COMMITTEE MISSION STATEMENT

In 2004, a federal lawsuit was commenced against the City of New York and the Central Park Conservancy by two groups that sought a permit to demonstrate together on the Great Lawn just prior to the start of the 2004 Republican National Convention. The suit challenged the denial of a permit to the groups, as well as the Parks Department's regulations imposing limits on the use of New York City parks. These regulations were subsequently amended so as to set forth specific conditions for the use of the Great Lawn.

Adopted in January 2006, the Parks Department's Great Lawn regulations sought to codify the Parks Department's management practices with respect to the Great Lawn which had evolved since its restoration in 1997 (copy attached). The regulations set forth certain conditions for the conduct of special events and demonstrations on the Great Lawn.[1]

The regulations provide as follows:

- **Large and small events:** The regulations govern large and small events on the Great Lawn. A "large event" is defined as "a special event or demonstration with anticipated attendance between 5,000 and 50,000 participants, which requires the use of the ball fields on the Great Lawn. In contrast, a "small event" is defined as "a special event or demonstration with anticipated attendance of less than 5,000 participants, which does not require the use of any of the Great Lawn ball fields during the hours that the Department permits the ball fields for athletic uses, and does not displace any athletic use on the Great Lawn"

- **Number and timing of large events:** A maximum of six large events can be permitted on the Great Lawn each year. Large events may "take place only during the months of June and July and during the period from the third week of August through the second week of September," with a maximum of up to two large events in June, two in July, and two during the latter period.

- **Event size:** Attendance at large events on the Great Lawn may not exceed 50,000 persons.

- **Rain cancellation:** Both large and small events on the Great Lawn "are subject to cancellation by the [Parks] Commissioner at any time in the event wet conditions exist that will increase the likelihood of damage" to the Great Lawn.

- **Load-in plan:** A load-in plan for large and small events "must be approved by the Commissioner in order to assure that: (A) the flow of persons through park landscapes on appropriately designated paths for that purpose shall be orderly: and (B) the attendees will not damage adjacent landscapes." In addition, in the case of large events, the approved load-in plan must "assure that maximum number of persons attending does not exceed 50,000."

As part of the settlement of the lawsuit, the Parks Department agreed to undertake a feasibility study to obtain a recommendation as to the optimum and sustainable use of the Great Lawn for large events including rallies, demonstrations and cultural events from a committee of experts consisting of three experts in turf management and one expert in crowd control. The Parks Commissioner will use the study committee's recommendation to determine whether the Parks Department's regulations governing large events on the Great Lawn should be modified.

Under terms of the settlement, the Parks Department must "provide to the study committee information regarding the physical characteristics of the Great Lawn and the day-to-day use of the Great Lawn for active and passive recreation, including but not limited to the use of its eight softball fields." That information has been presented to the study committee members in a power point presentation. Should study committee members seek additional information, they should request such information by way of a written request. A site visit for members of the study committee will be scheduled in late May or early June. In addition, notice regarding the scheduling of all large events during the 2008 season will also be provided to study committee members in the event that committee members would like to observe any scheduled events.

Under the terms of the stipulation, the Parks Department must also provide to the study committee "a non-binding recommendation with objective criteria that define the nature and extent of the damage to the Great Lawn that the Parks Department deems unacceptable insofar as it would significantly impede the day-to-day use of the Great Lawn or significantly damage the grass or surrounding landscapes ("unacceptable damage"). Using its expertise, the committee is to then "determine whether and to what extent large events on the Great Lawn should be limited to prevent unacceptable damage."

The Parks Department's recommendation as to what constitutes unacceptable damage is as follows: Damage from any event should be limited to the extent that necessary repairs can be made by aerating and overseeding and/or would not necessitate the closing of more than one ball field (in addition to the field closed for routine maintenance) for more than two weeks. The Parks Department deems unacceptable any event damage that would require removal of damaged lawn, re-grading, adding topsoil, reseeding or sodding an/or any other damage that would require the closing of one ball field for more than two weeks or more than one ball field for any period of time.

Under the terms of the settlement, the study committee must issue a report at the conclusion of the study setting forth its findings, conclusions and recommendations as to the following:

- Whether there are numeric or frequency limitations that are necessary for the use of the Great Lawn for large events;

- If so, the number and frequency of large events that can reasonably be accommodated by the Great Lawn each year without causing unacceptable damage;

- The maximum crowd size that can reasonably be accommodated at the Great Lawn events without causing unacceptable damage or threatening the safety of event participants;

- Whether there are any times of the year when the Great Lawn cannot accommodate a large event without risking unacceptable damage;

- What measures must be undertaken at large events to prevent unacceptable damage and to ensure the safety of event participants; and

- What additional measures can be undertaken to maximize, with the foregoing parameters, the availability of the Great Lawn for large events, including rallies and demonstrations?

The current regulations regarding the use of the Great Lawn will remain in effect during the study period except that enforcement of the 50,000 person limit for large events is stayed by court order and the Parks Department is required to use a 75,000-person limit during the study period. (The study committee is not bound by either the 50,000 or the 75,000-person limit as is to make its own independent recommendation regarding the maximum crowd size that can reasonably be accommodated at Great Lawn events, as noted above.)

Under the terms of the settlement, the Parks Department will, at the conclusion of the study, make public the names and credentials of the study committee members, the study report, findings, and all other records generated or maintained by the study committee or by the Parks Department with regard to the study committee. Study committee members must maintain all written and electronic records generated in connection with the study, including personal notes, and turn them over to the Parks Department at the conclusion of the study.

Under the terms of the settlement, the study must be completed, and the report issued, by October 7, 2009. However, the Parks Department requests that, if at all possible, the study be completed and the report issued by May, 2009.

[1] A "special event" is defined in the Parks Department regulations as "any group activity including, but not limited to, a performance, meeting assembly, contest, exhibit, ceremony, parade, athletic competition, reading, or picnic involving more than 20 people or a group activity involving less than 20 people for which specific space is reserved"; it does not include casual park use by visitors or tourists." A "demonstration" is defined as "a group activity including but not limited to, a meeting assembly, protest, rally, march or vigil which involves the expression of view or grievances involving more than 20 people."

Addendum B. Record of turfgrass and rootzone physical and chemical properties.

Comments: The root zone mix sample (Lab ID No. 20163-1) was tested as received. It is my understanding that you want a specification written based on these results. The mix had moderate amount of silt and clay present. The sand fraction was uniform in particle size, most of the sand falling into the medium and coarse size fractions. The uniformity of the sand particle size is illustrated by the uniformity coefficient (Cu), this value falling into the optimum range of 2.5 to 3.5 for sports field construction mixes. The lower the Cu and gradation index, the more uniform the particle size and the greater the compaction resistance.

The sand particle shape is mixed. The pH was low enough to justify lime.

The physical properties of the mix, as determined on compacted cores, are found in the table on page 2. The mix had a saturated hydraulic conductivity (infiltration) rate that was low. The original mix used in the Great Lawn had infiltration rates that were higher than this. The reduction in the infiltration rate likely reflects changes in the organic matter over these past few years.

The total porosity was acceptable, as was the distribution of pore space. The aeration porosity is made up of relatively large pores that conduct water under saturated conditions. When drained, they are filled with air providing the oxygen that is necessary for root growth. The capillary porosity is made up of small pores that hold water against the force of gravity, retaining much of it for plant use. Ideally, a root zone mix would contain a nearly equal distribution of air and water filled pore space after free drainage.

You can see from the results that the aeration porosity was low, but acceptable. The water retention, as reflected in the capillary porosity, was acceptable as well. The results suggest that fields built with this mix would have low drainage, and after free drainage would have good aeration and water retention.

Based on these results and knowing what we started with in this project, I would suggest the following specifications.

Root Zone mix: The root zone will be defined in this section and shall be selected as such. The root zone mixture will consist of a sand, biosolid compost, and a topsoil. The root zone mix will be evaluated using the ASTM Test Methods as specified by the Owners Testing Agent. A sand sample, compost, and a topsoil shall be submitted to the Owners Testing agent, and tested for adherence to the specifications.

The final root zone mix shall be a meet the following particle size criteria, as determined by ASTM F1632:

	Sieve Mesh	Diameter of sieve (mm)	Allowable range % retained
Gravel	10	2.00	0 - 5%
Very coarse sand	18	1.00	0 - 15% combined with gravel
Coarse	35	0.50	25 - 35%
Medium	60	0.25	35 – 45%

Fine	100	0.15	15% maximum
Very fine	270	0.05	4% maximum
Silt		0.002	3 - 5%
Clay		< 0.002	1 - 3%

In addition, there should be 100% passing the No.5 screen (4 mm), and 5 to 8% combined silt and clay. The organic matter content on the mix shall be 0.8 to 1.3% by weight, as determined by ASTM F1647.

Topsoil: The topsoil used in this blend shall be a screened natural loam or sandy loam soil free from stones or soil clumps 1/4" or larger, and free of rhizomes of quackgrass or any other noxious weeds, and shall be free of any herbicide residue.

Compost: A biosolid compost may be used as the organic component provided it meets the following criteria:

An organic matter content of no less than 60% as determined by ASTM D2974.
A moisture content of 35 – 70%, as determined by ASTM D2974.
A carbon/nitrogen ratio of 15:1 to 30:1.
A Solvita Index of 6 to 8.
95 – 100% passing a 3/8" screen.
A pH of 6 to 8.
Non-phytotoxic
Meet all state and federal standards for land application of biosolids

Root Zone Mixture Performance Testing: ASTM F-1815 shall be used for the performance testing. Water retention shall be done at 30 cm tension. Tests shall determine compliance with specified mixing ratio and provide calibration data for the quality control program. Tests shall comply with the following criteria on a core compacted at 14.3 ft-lbs/square inch.

Saturated hydraulic conductivity (inches per hour)	8 to 16 inches per hour
Bulk density (gm/cc)	1.3 to 1.65
Total Porosity (percent)	35 - 55%
Aeration porosity*	15 - 30%
Capillary porosity*	15 - 25%
Saturation percentage*	40 - 60%

* determined @ 30 cm tension

The sand-soil-peat or compost shall be mixed off site to a uniform consistency.

The original mix was a 7-2-1 (sand-soil-compost), but I believe that East Coast Mines had to make adjustments to the soil content during production. Please let me know if you have any questions on these results or specifications. Thank you.

Norman W. Hummel Jr.
President

Great Lawn Topdressing Specifications

PART 1 GENERAL

1.1

A. Central Park Great Lawn Topdressing

1.2 REFERENCES

A. American Society of Agronomy's Methods of Soil Analysis, Part 1, Chapter 43, Sec. 43-5, "Particle Fractionation and Particle-size Analysis"

B. ASTM Standards F-1815-97; D-421; D-4318; F-1632; F-1647

1.3 SUBMITTALS FOR REVIEW

A. Submittals: Procedures for submittals

B. Samples: Submit 2 lb sample of the topdressing mixture to the Central Park Conservancy.

C. Product data: Physical analysis of the proportions of sand, clay and silt, from accredited soil testing laboratory.

1.4 DELIVERY, STORAGE AND HANDLING

A. Do not deliver material in wet or muddy condition. These materials will be rejected.

B. Protect all materials from weather and contamination.

C. **The Central Park Conservancy retains right to reject unsatisfactory or defective material at any time during progress of work. Removal of unsatisfactory or defective materials from Central Park will be the sole responsibility of The Vendor within 48 hours of notification.**

1.5 COORDINATION

A. Coordinate trucking with Central Park Conservancy to meet work schedule. All trucks must arrive at Central Park, New York City no later than **7:00** am, unless specified. Trucks not arriving within specified time frame will be rejected. Trucks must be a tandem, tri-axle dump truck. Trailer trucks will not be accepted unless agreed upon in advance with the Conservancy.

B. The vendor must be able to provide multiple trucks with topdressing on any given day within 24 to 48 hours as requested by the Conservancy. The size of the trucks entering Central Park must be approved in advance of delivery.

No trucks shall drive on lawns or unpaved surface unless directed.

C. Each truck must be accompanied by a delivery ticket, stating point of origin of the material, quantity and weight contained therein, name of contractor, and the purchase order number.

PART 2

2.1 MATERIALS

A. Sand based topdressing mix with the following particle size analysis and components;

1. Sand: 100% by volume with the following breakdown.

Material	Sieve Mesh	Diameter of Sieve (mm)	Percent Retained
Gravel	10	2.00	0-5%
Very Coarse Sand	18	1.00	0-15% (gravel incl.)
Coarse Sand	35	0.50	25-35%
Medium Sand	60	0.25	35-45%
Fine Sand	100	0.15	15% maximum
Very Fine Sand	270	0.05	4% maximum
Silt		0.002	3-5%
Clay		<0.002	1-3%

TURFGRASS TISSUE ANALYSIS

BY

DAVID W. YORK, Ph.D.
TOURNAMENT TURF LABORATORIES, INC.
405 GLADE MILL ROAD
VALENCIA, PA 16059

TELEPHONE (724)898-2329

Date: 06-11-2008

Client name: Matthew Brown
Client address: Central Park Conservancy
Soil Lab
830 Fifth Avenue
New York, New York 10021

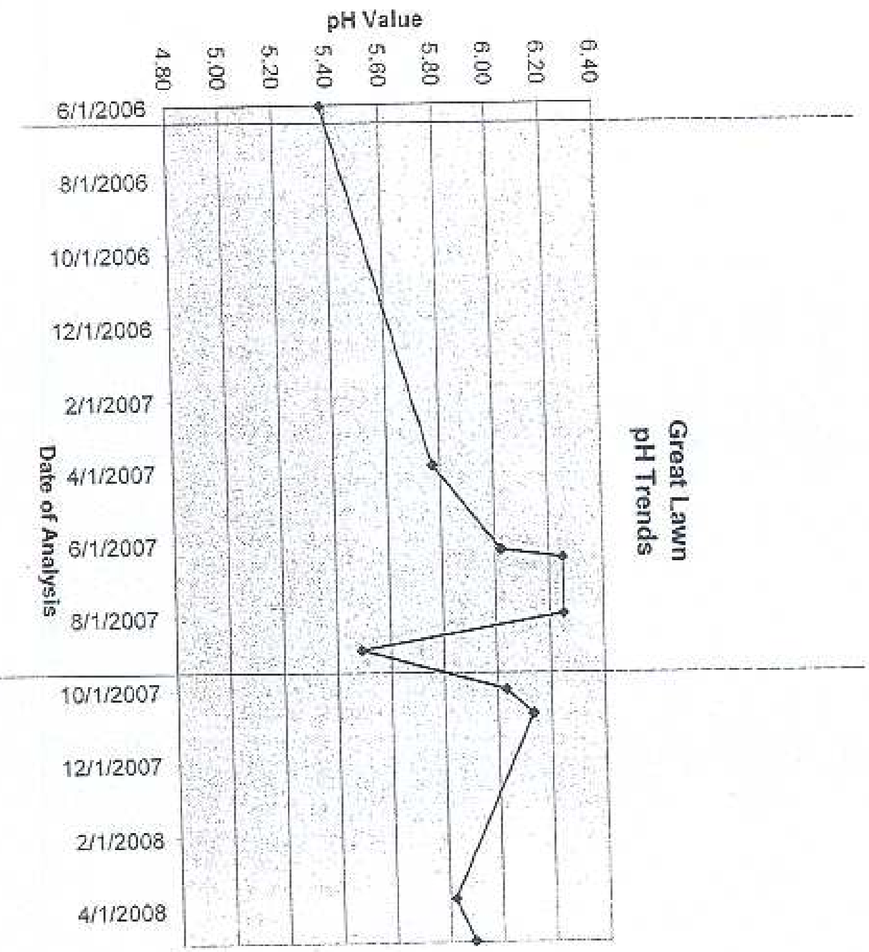
Client number: M-45
Sample ID: Central Park Conservancy Great Lawn
Sample number: 103

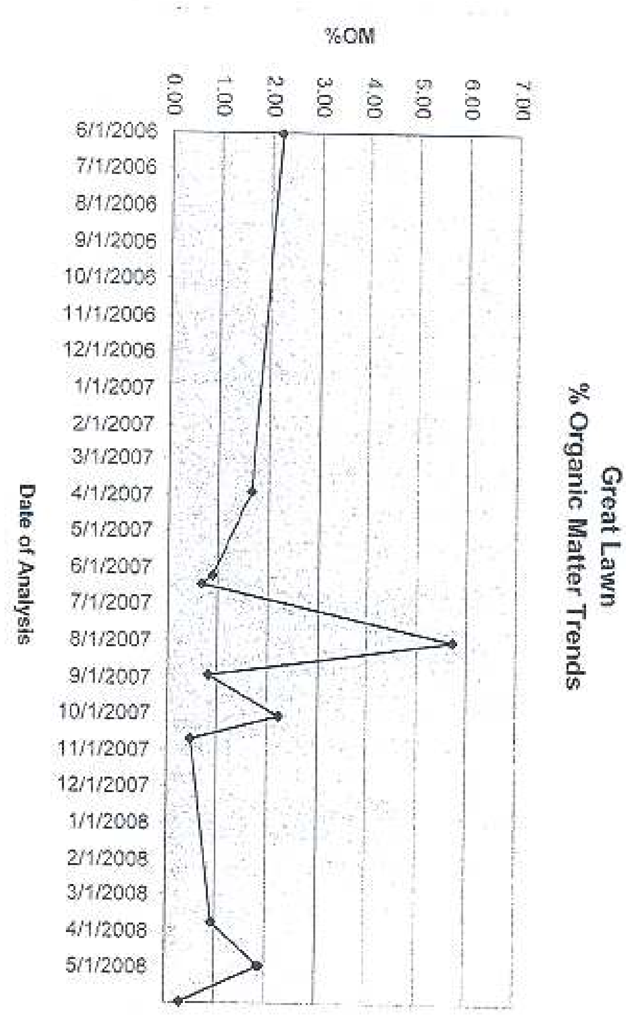
Turfgrass Type: Kentucky bluegrass sports field

Constituent		100 % Dry Matter Corrected Lab Analysis Results	Target Values For Turfgrass Maintenance
Nitrogen,	%	4.19	5.00 - 5.50
Phosphorus,	%	0.50	0.40 - 0.60
Potassium,	%	2.50	2.50 - 3.50
Calcium,	%	0.51	0.45 - 0.60
Magnesium,	%	0.24	0.25 - 0.35
Sulfur,	%	0.49	0.25 - 0.40
Zinc,	ppm *	50.23	45.00 - 65.00
Copper,	ppm	14.77	10.00 - 20.00
Iron,	ppm	305.44	200.00 - 400.00
Manganese,	ppm	103.98	80.00 - 150.00
Boron,	ppm	8.89	10.00 - 15.00
Sodium,	%	0.02	0.01 - 0.04

Dry Matter % (Acceptable Range 92.00 - 98.00) 93.60%

* ppm = parts per million


Great Lawn
pH Trends
pH Value
4.80
5.00
5.20
5.40
5.60
5.80
6.00
6.20
6.40
Date of Analysis
6/1/2006
8/1/2006
10/1/2006
12/1/2006
2/1/2007
4/1/2007
6/1/2007
8/1/2007
10/1/2007
12/1/2007
2/1/2008
4/1/2008

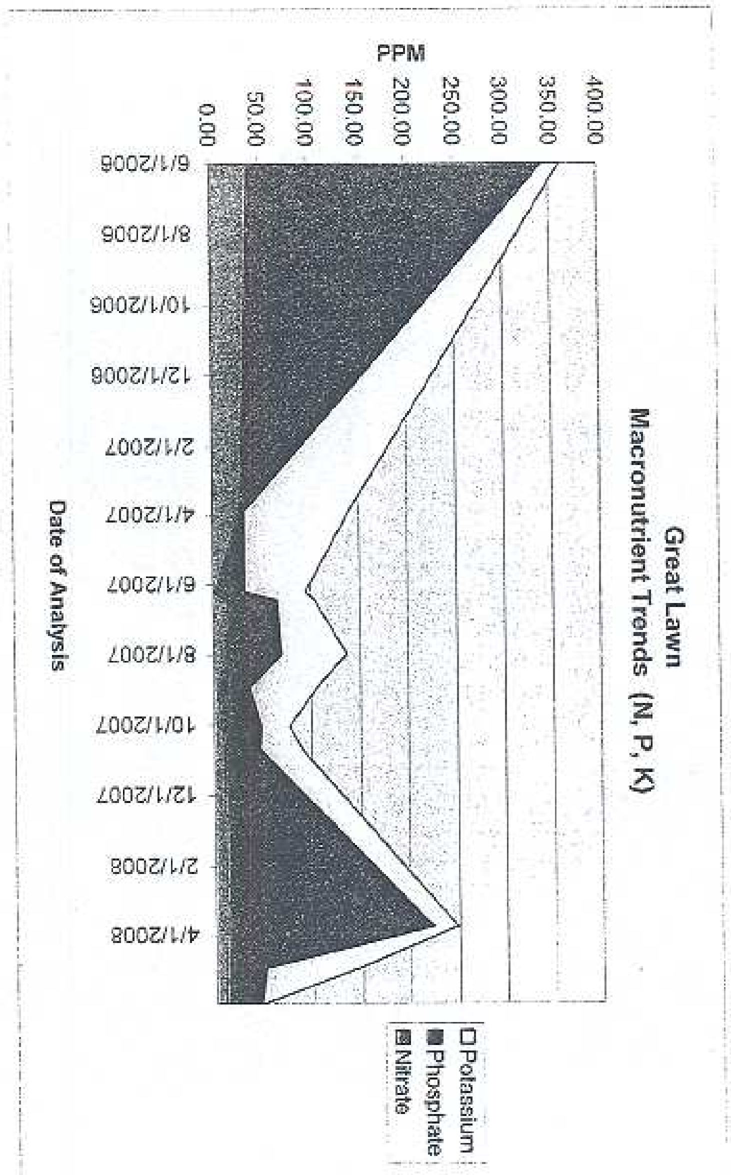

Great Lawn
% Organic Matter Trends
%OM
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
6/1/2006
7/1/2006
8/1/2006
9/1/2006
10/1/2006
11/1/2006
12/1/2006
1/1/2007
2/1/2007
3/1/2007
4/1/2007
5/1/2007
6/1/2007
7/1/2007
8/1/2007
9/1/2007
10/1/2007
11/1/2007
12/1/2007
1/1/2008
2/1/2008
3/1/2008
4/1/2008
5/1/2008
Date of Analysis

Date - Analysis Completed	Sample ID - Description	Laboratory ID	Nitrate (0-20 ppm)	Phosphate (40-60 ppm)	Potassium (100-180 ppm)	Copper (0.4-2.0 ppm)	Iron (5-20 ppm)	Manganese (19-50 ppm)
		na						
		na						
6/1/06	13 - Great Lawn 6/1/06	na	39.62	303.24	18.03	1.09	72.66	14.78
3/28/2007	Great Lawn	032807-003	28.30	4.86	106.89	1.95	60.65	28.98
6/7/07	Great Lawn	052407-001	1.91	30.99	62.00	1.53	49.12	8.64
6/14/2007	Great Lawn	061407-003	14.47	51.13	38.48	1.17	47.52	19.66
7/31/2007	Great Lawn	073007-001	12.98	57.05	66.27	1.01	36.69	36.10
8/29/2007	Great Lawn	082807-001	3.40	33.48	68.88	0.38	56.04	2.37
10/2/2007	Great Lawn	092507-001	8.51	39.99	28.74	0.50	33.08	8.14
10/22/2007	Great Lawn	102207-001	10.85	36.33	42.90	0.48	0.56	9.66
3/24/08	Great Lawn	032408-003	12.34	210.71	25.18	0.00	0.00	0.00
4/29/08	Great Lawn	040908-002	10.43	40.97	95.25	0.52	2.46	8.47
5/30/08	Great Lawn	053008-001	10.00	36.29	3.09	na	na	na

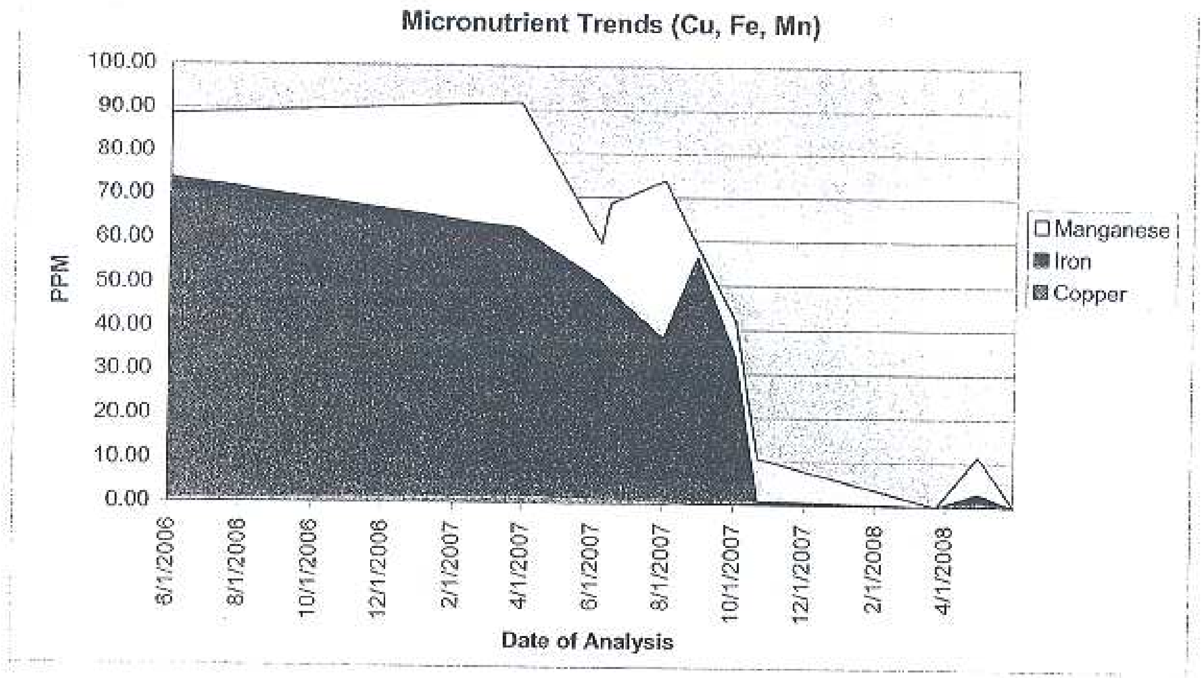
Date of Analysis	Sample ID - Description	Bulk Density (g/cc)	Avg Bulk Density (g/cc)
9/19/03	Great Lawn - NE	1.58	1.48
9/19/03	Great Lawn - NW	1.38	
9/19/03	Great Lawn - Fields 7 & 8	1.48	1.48
9/25/03	Great Lawn - NE	1.63	1.60
9/25/03	Great Lawn - NW	1.56	
9/25/03	Great Lawn - Fields 7 & 8	1.78	1.78
4/9/08	Great Lawn - North Oval	1.47	1.40
4/9/08	Great Lawn - Mid-Oval	1.55	
4/9/08	Great Lawn - South Oval	1.17	
5/30/08	Great Lawn - North-Oval	1.66	1.53
5/30/08	Great Lawn - Mid-Oval	1.58	
5/30/08	Great Lawn - South Oval	1.33	
6/30/08	Great Lawn - Mid-Oval	1.24	1.24

*Note - Cell values in red denote concentrations out of the ideal range for the parameter. The ideal ranges can be found in the column header.

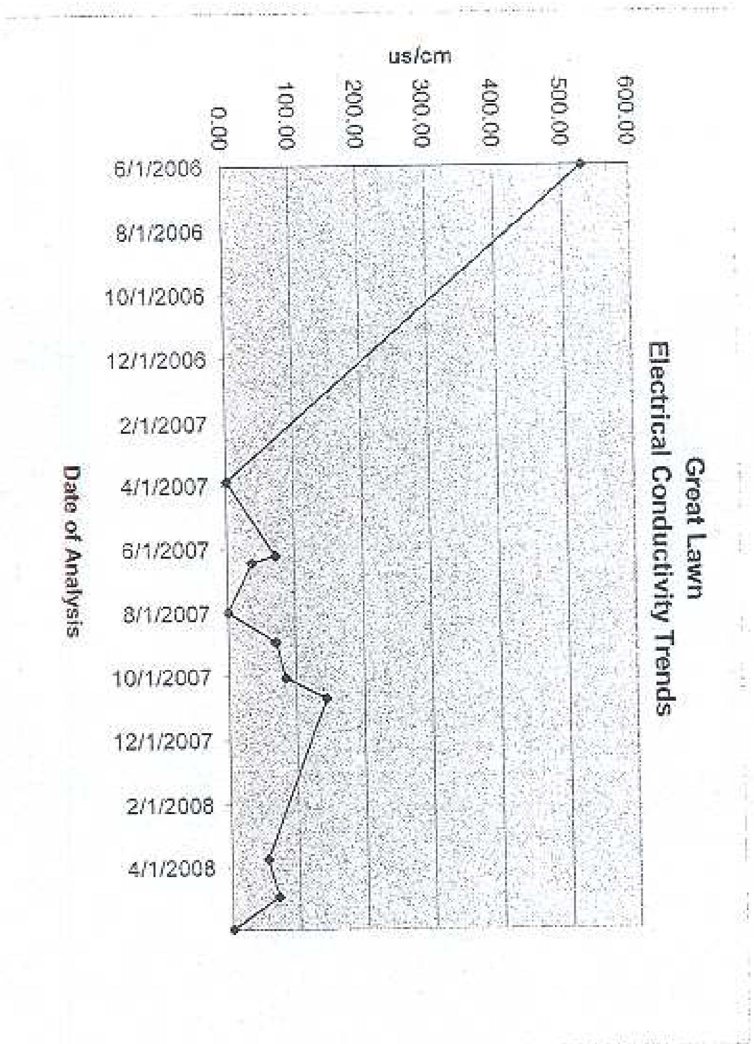
Calcium (1000-2000ppm)	Magnesium (60-180ppm)	CECe (variable per soil)	pH (6.0~6.8)	EC (uS)	%OM
na	na	na	5.38	530.40	2.20
na	na	na	5.77	0.55	1.66
na	na	na	6.02	71.40	0.90
1,150	475	9.81	6.25	36.62	0.67
1,225	600	11.29	6.25	na	5.72
600	1,075	12.13	5.49	70.02	0.82
1,150	500	9.99	6.03	84.16	2.22
1,375	625	12.19	6.13	143.30	0.48
800	575	8.86	5.82	53.07	0.92
1,150	725	12.04	5.89	68.01	1.86
na	na	na	6.0-6.5	na	0.30



Great Lawn
Micronutrient Trends (Cu, Fe, Mn)



Micronutrient Trends (Cu, Fe, Mn)
PPM
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
6/1/2006
8/1/2006
10/1/2006
12/1/2006
2/1/2007
4/1/2007
6/1/2007
8/1/2007
10/1/2007
12/1/2007
2/1/2008
4/1/2008
Date of Analysis
Manganese
Iron
Copper


Great Lawn
Electrical Conductivity Trends
us/cm
0.00
100.00
200.00
300.00
400.00
500.00
600.00
6/1/2006
8/1/2006
10/1/2006
12/1/2006
2/1/2007
4/1/2007
6/1/2007
8/1/2007
10/1/2007
12/1/2007
2/1/2008
4/1/2008
Date of Analysis

HUMMEL & CO., INC

Hummel & Co., Inc. • 35 King Street • P.O. Box 606 • Trumansburg, New York 14886 • Phone: (607) 387-5694 • Fax: (607) 387-9499 • Email: soildr1@zoom-DSL.com • Web Site: www.turfdoctor.com

00775-01

MATERIALS TEST REPORT FOR
Central Park Conservancy

REPORT TO: Matthew Brown
Central Park Conservancy
830 5th Avenue
New York, NY 10021

DATE RECEIVED: December 29, 2005
TEST DATES: December 29 - January 3
REPORT DATE: January 3, 2006
CONDITION OF SAMPLE: Small

PARTICLE SIZE ANALYSIS (ASTM F-1632)

		Soil Separate %				Sieve Size/Sand Fraction Sand Particle Diameter % Retained					
Lab ID No.	Sample	Sand	Silt	Clay	No. 10 Gravel 2 mm	No. 18 V. coarse 1 mm	No. 35 Coarse 0.5 mm	No. 60 Medium 0.25 mm	No. 100 Fine 0.15 mm	No. 140 V. fine 0.10 mm	No. 270 V. fine 0.05 mm
20163-1	Mix sample	89.7	4.9	1.9	3.5	9.4	28.2	38.8	9.9	1.9	1.5

PARTICLE SHAPE/PARTICLE SIZE PARAMETERS/pH

Lab ID No.	Sample	Sphericity/Angularity	pH*	D85	Cu	Grad. Index
20163-1	Mix sample	Low to high/sub-angular to rounded	5.8	0.92	3.49	7.60

*ASTM D4972

Turfgrass Soil Consulting and Testing Services

00775-01

PHYSICAL PROPERTIES (ASTM F-1815-97)

Lab ID No.	Sample	Particle Density (g/cc)	Bulk Density (g/cc)	Ksat Infiltration Rate (in/hr)	Total Porosity %	Aeration Porosity %	Capillary Porosity* %	Organic Matter+ %
20163-1	Mix sample	2.64	1.64	1.9	37.7	16.6	21.1	0.97
	USGA Values			> 6	35 - 55	15 - 30	15 – 25	

* Determined at 30 cm tension
\+ ASTM F-1647, loss on ignition method

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ACCREDITED

QUALITY CONTROL TEST REPORT FOR
Great Lawn of Central Park

REPORT TO: Russell Frederick
Central Park, Attn: 79 St. Yard
830 5th Street
New York, NY 10021

DATE RECEIVED: April 16, 1998
TEST DATE: April 16 - 17
REPORT DATE: April 30, 1998
Condition of sample: Normal

QUALITY CONTROL ANALYSIS

Lab ID No.	Sample	Soil Separate %		% Organic	Perc Rate (in/hr)	Sand Size Class/Sand Particle Diameter % Retained					
		Sand	Silt & Clay			Gravel 2 mm	V. coarse 1 mm	Coarse 0.5 mm	Medium 0.25 mm	Fine 0.15 mm	V. fine 0.05 mm
3546-1	Great Lawn	92.9	7.1	4.21	4.95	4.0	8.8	26.8	39.0	10.4	2.9
	Original submittal (May 31, 1996)	93.8	6.2	1.94		2.9	7.3	26.6	42.1	11.2	3.7

Central Park Conservancy Seed Blend Specification 2008-2009

Custom Bluegrass 80/20 (50 lb bags)6,000 lbs	
17%	Nuglade Kentucky Bluegrass
12%	Total Eclipse Kentucky Bluegrass
12%	Everest Kentucky Bluegrass
12%	Rugby II Kentucky Bluegrass
10%	Washington Kentucky Bluegrass
7%	Rambo Kentucky Bluegrass
10%	Touchdown Kentucky Bluegrass
10%	Manhattan 4 Perennial Ryegrass
10%	Extreme Perennial Ryegrass
Custom Shade Mix (50 lb bags) 11,000 lbs	
30%	Ambrose Chewing Fescue
15%	Nuglade Kentucky Bluegrass
15%	Quest Tall Fescue
15%	Arid III Tall Fescue
15%	Aruba Creeping Red Fescue
10%	Manhattan 4 Ryegrass
Custom Bluegrass 90/10 Mix (50 lb bags) 2,000 lbs	
18%	Nuglade Kentucky Bluegrass
15%	Total Eclipse Kentucky Bluegrass
15%	Unique Kentucky Bluegrass
15%	Rugby II Kentucky Bluegrass
10%	Washington Kentucky Bluegrass
7%	Rambo Kentucky Bluegrass
10%	Extreme Kentucky Bluegrass
10%	Manhattan 4 Perennial Ryegrass
Custom Tall Fescue 85/15Mix (50 lb bags) 9,000 lbs	
60%	Quest Tall Fescue
20%	Arid III Tall Fescue
5%	Titan Ltd
15%	Blue Chip Kentucky Bluegrass

Image 1

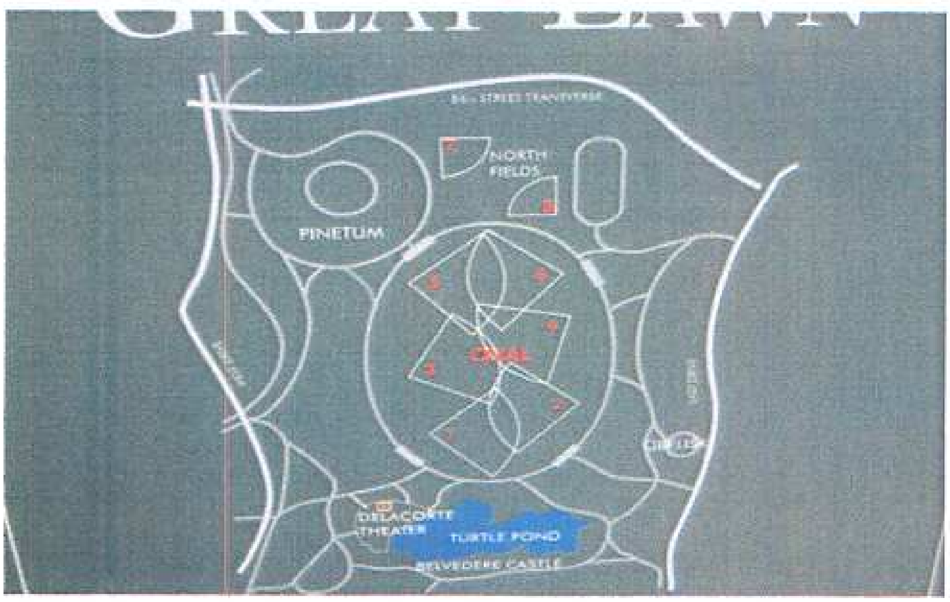
Central Park Turf- The Great Lawn Study

Andrew McNitt, Michael Boehm, Robert Russo & Richard Bussert

1

Image 2

The Great Lawn was restored in the 1995 and re-opened in 1997. The main oval consists of approximately 13 of the total 55 acres.



2

Image 3

Over 25,000 cubic yards of a sand based mix was spread across the area

3

Image 4

The combination of special events, event support, daily use and routine maintenance can stress both modified and native soils. Excessively wet or dry soils and high air and soil temperatures can also challenge the best turf care strategies and programs.

4

Image 5

Many of the following pictures represent a chronological snapshot of the changing conditions of the Great Lawn area from late June through late July 2008. This picture shows the lawn the day after a New York Philharmonic performance on June 25. The Great Lawn hosted a series of events in early July, including a concert by Bon Jovi followed several days later by another concert by the New York Philharmonic.

5

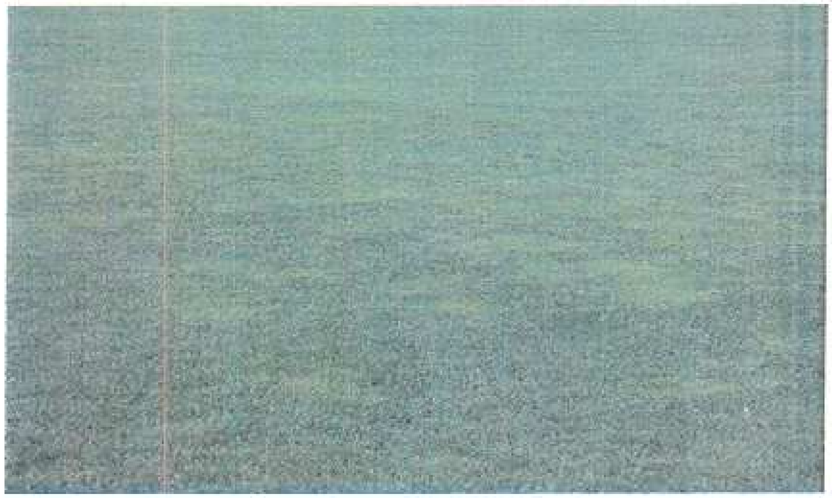
Image 6

Signage was posted in early July announcing a "large ticketed event."

6

Image 7

During the restoration of 1995, the Great Lawn was sodded with Kentucky bluegrass and perennial ryegrass. The Great Lawn turf appears healthy and relatively weed free, a testament to the proactive maintenance regime of it's caretakers.



7

Image 8

Crowd Control and Walking Ailes

8

Image 9

An extensive array of equipment and machinery are used during setup and breakdown of large events.

9

Image 10

Hundreds of barricades are stockpiled beneath the canopy of the trees at the edge of the Great Lawn. Notice how much mulch is spread in this area. This aids in minimizing damage not only from equipment, but helps to spread out foot traffic wear patterns, as well.

10

Image 11

Matting and decking help to distribute weight from the delivery, setup, breakdown and removal of generators, speakers, and audio visual towers.

11

Image 12

The matting is stockpiled and ready for use

12

Image 13

The size of the audio visual setup depends on the performance. The Philharmonic setup was smaller than Bon Jovi's.

13

Image 14

Pre-Bon Jovi, notice sound tower and generator on 'skinned' portion of softball fields.

14

Image 15

15

Image 16

16

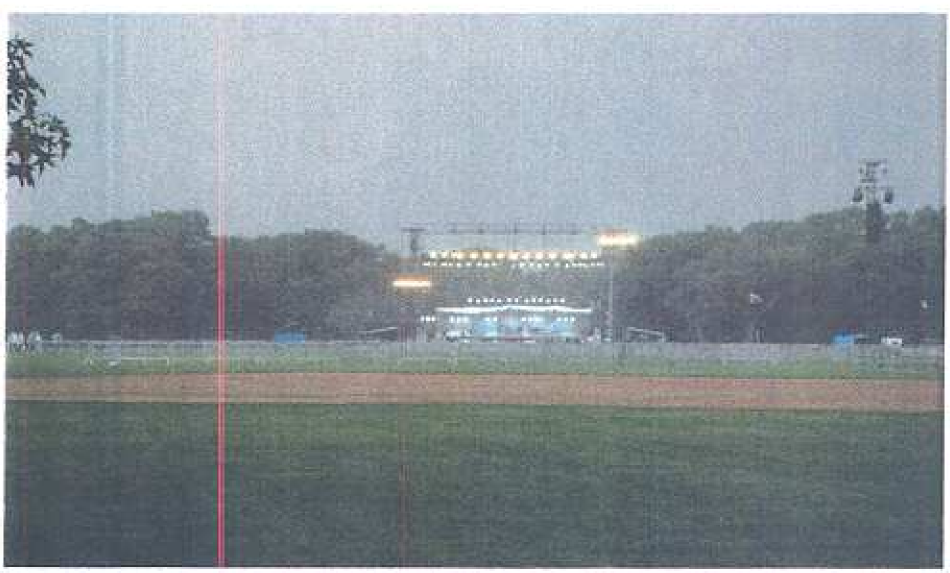
Image 17

Roadway constructed to reduce

17

Image 18

View from Great Lawn oval looking north toward stage.



18

Image 19

Bon Jovi stage preparations

19

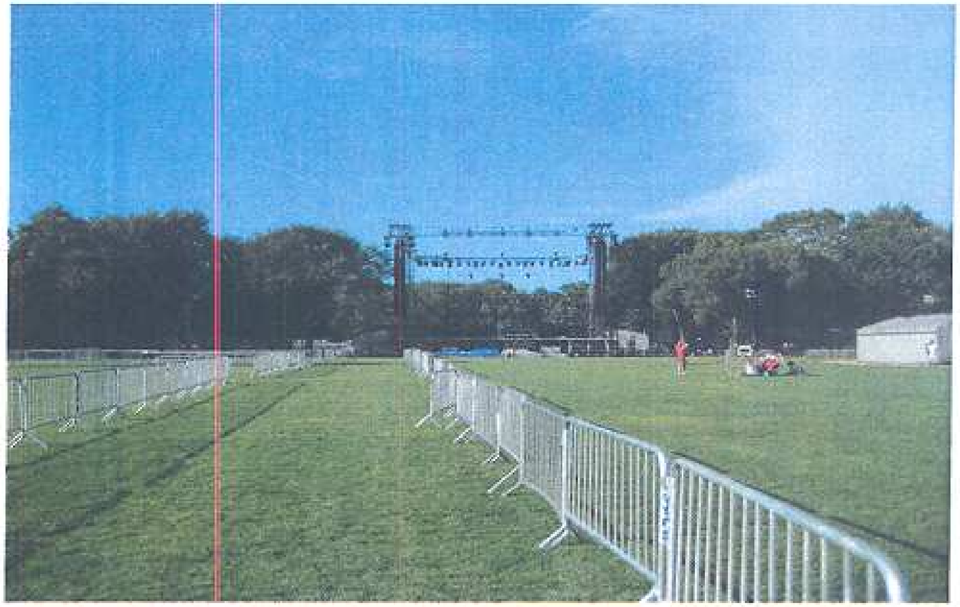
Image 20

This stage was at the north end of the Great Lawn

20

Image 21

7/11 day before concert-note the size of the egress corridors



21

Image 22

In determining how many events the lawn can support, crowd size may be less a determinant than is the time it takes the crowd to exit the area. These corridors help in directing the flow of foot traffic.

22

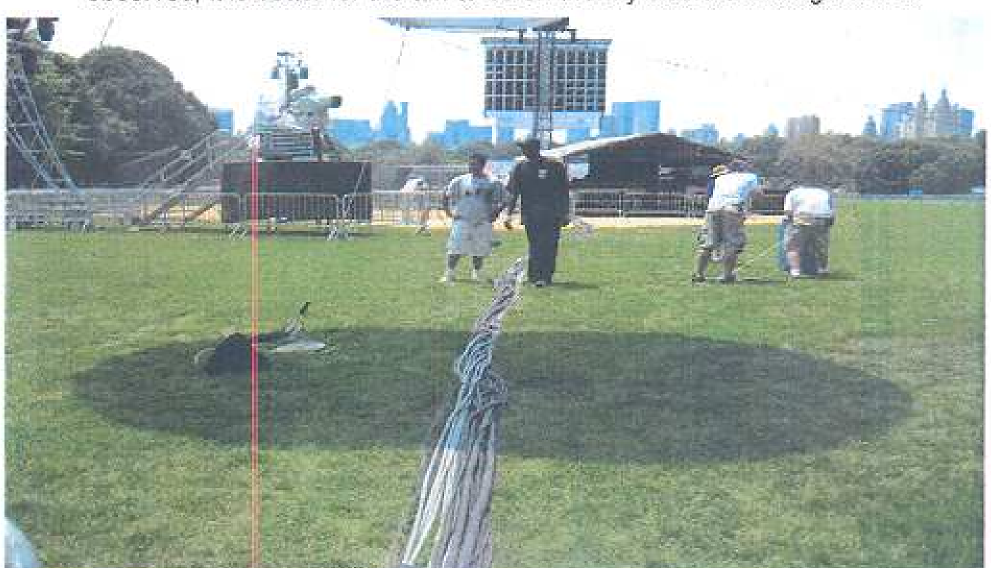
Image 23

Passive recreational use 7/11

23

Image 24

On July 11, you will note footprinting and loss of turgor. Prior to the Bon Jovi concert, the lawns were allowed to dry down. Although some wilting turf was observed, it is better for the turf to be on the dry side than being too wet.



24

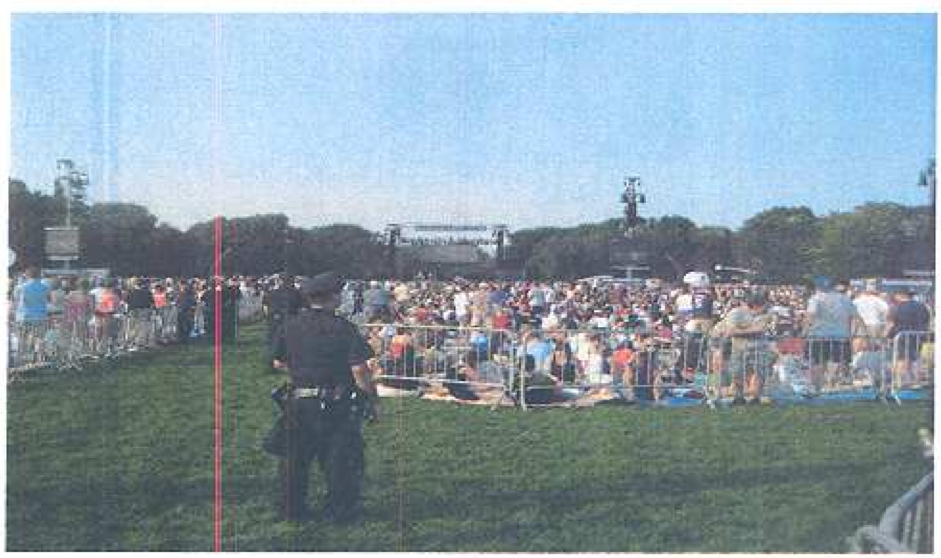
Image 25

Day of concert-July 12

25

Image 26

7/12



26

Image 27

7/12

Note: Polypropylene tarp

27

Image 28

Crowd count determined to be 48,538, based on count by park employees

28

Image 29

Image 30

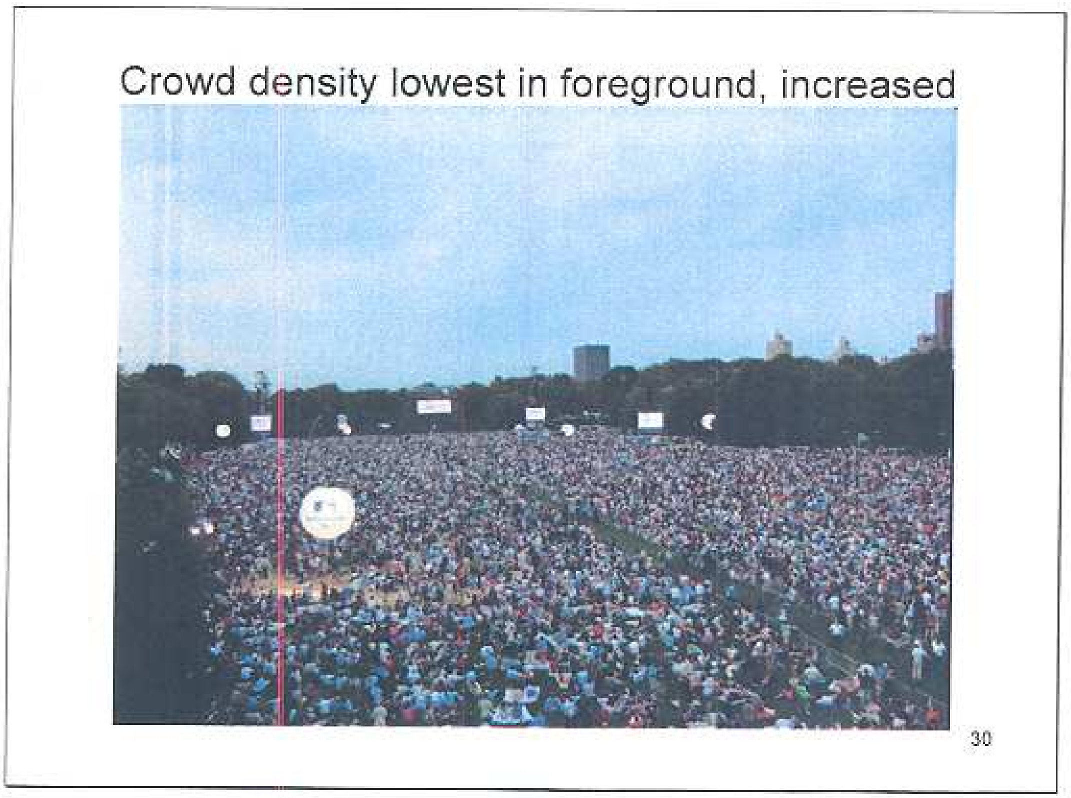


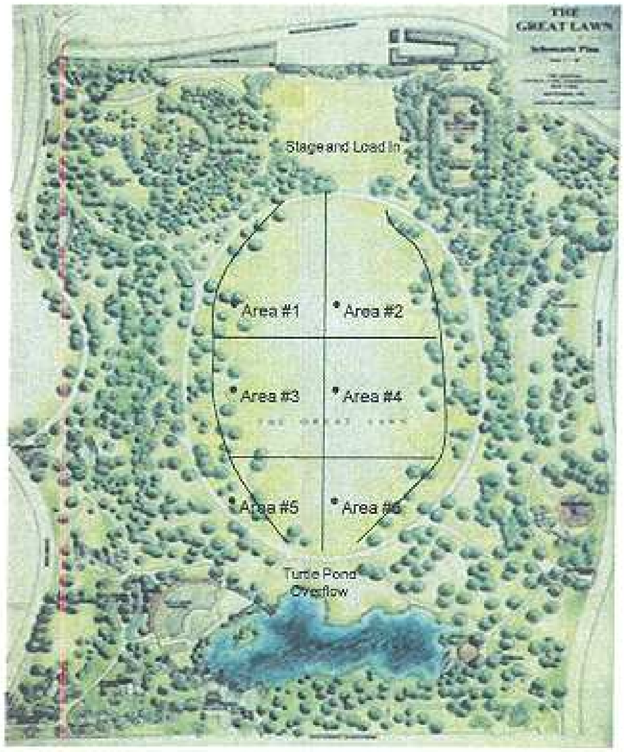
Image 31

31

Image 32

32

Image 33

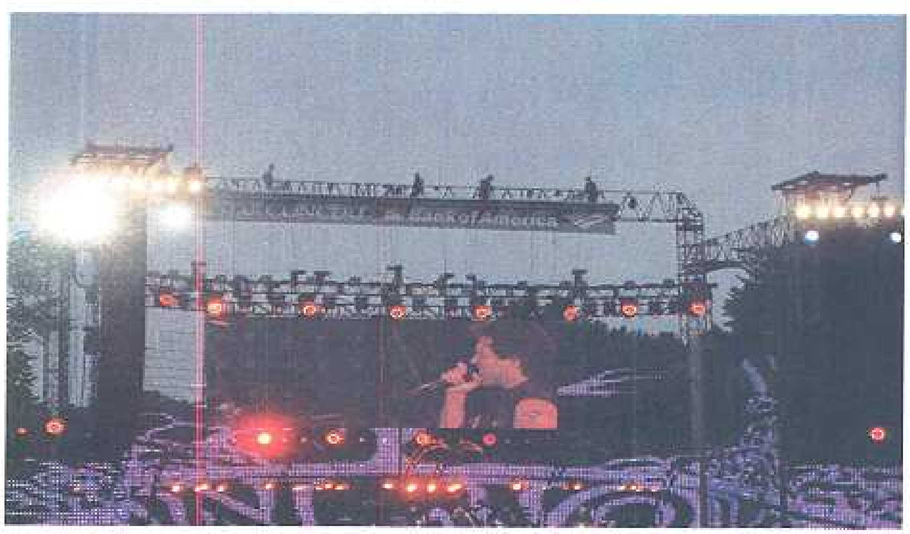


33

Restoration began in 1995.

Image 34

Showtime



34

Image 35

Post event observations

35

Image 36

This recycling container and utility vehicle are creating pinchpoints that constrict the outflow of concertgoers.

36

Image 37

Post-event debris is manually removed

37

Image 38

Stressed turf can be seen even at night

38

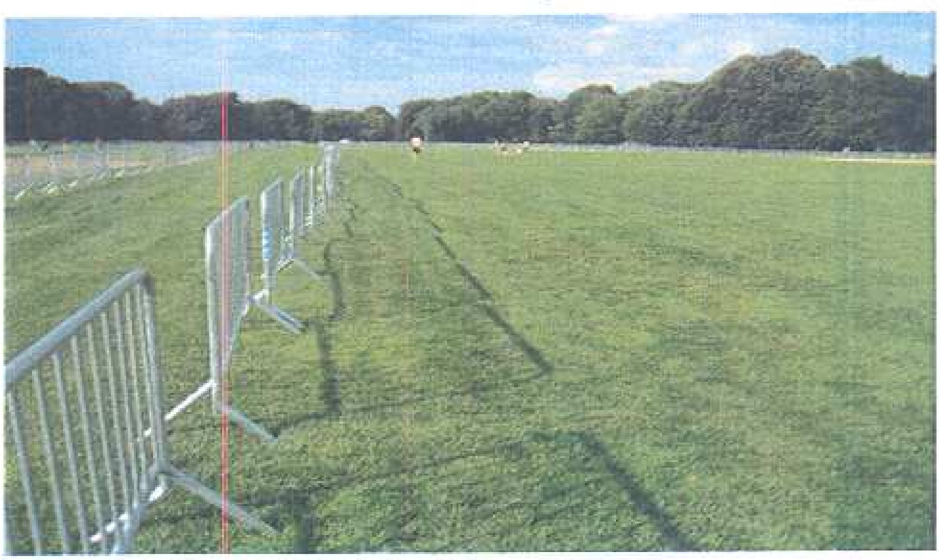
Image 39

7/13 load out

39

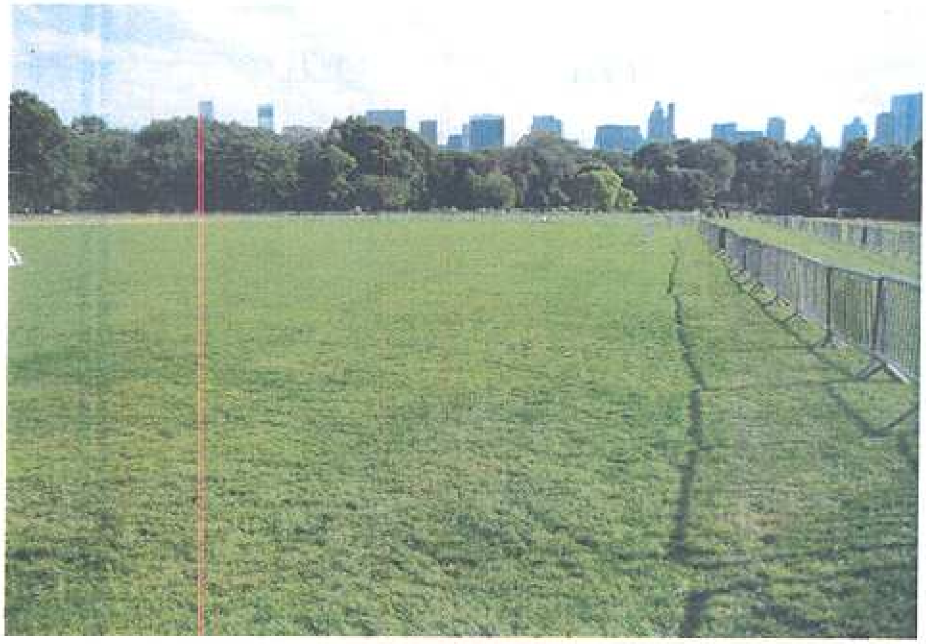
Image 40

7/14 the good



40

Image 41



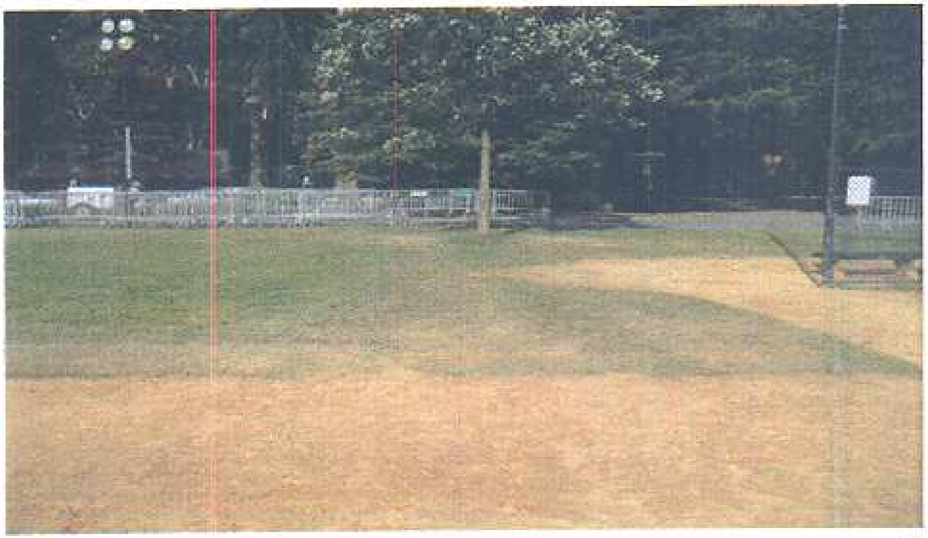
41

Image 42

42

Image 43

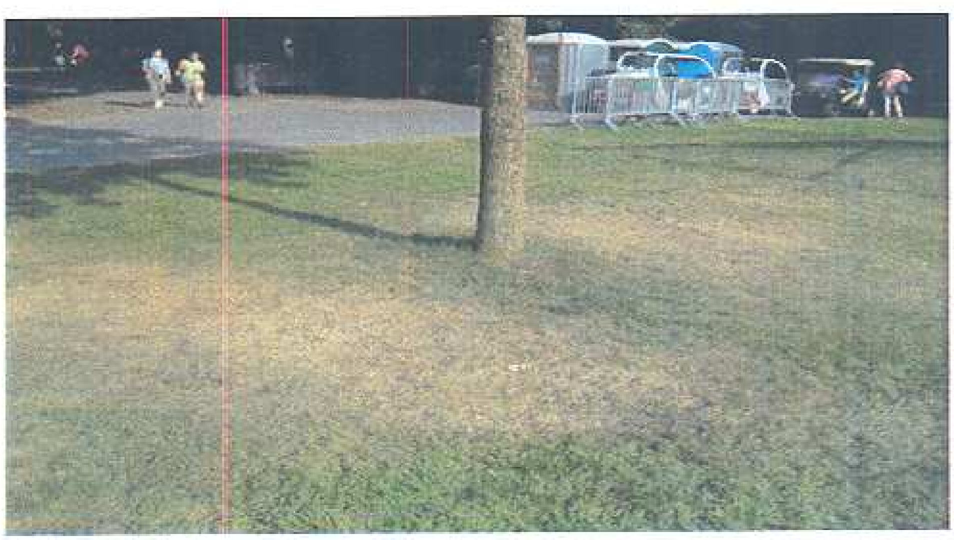
The bad



43

Image 44

Traffic stresses



44

Image 45

45

Image 46

46

Image 47

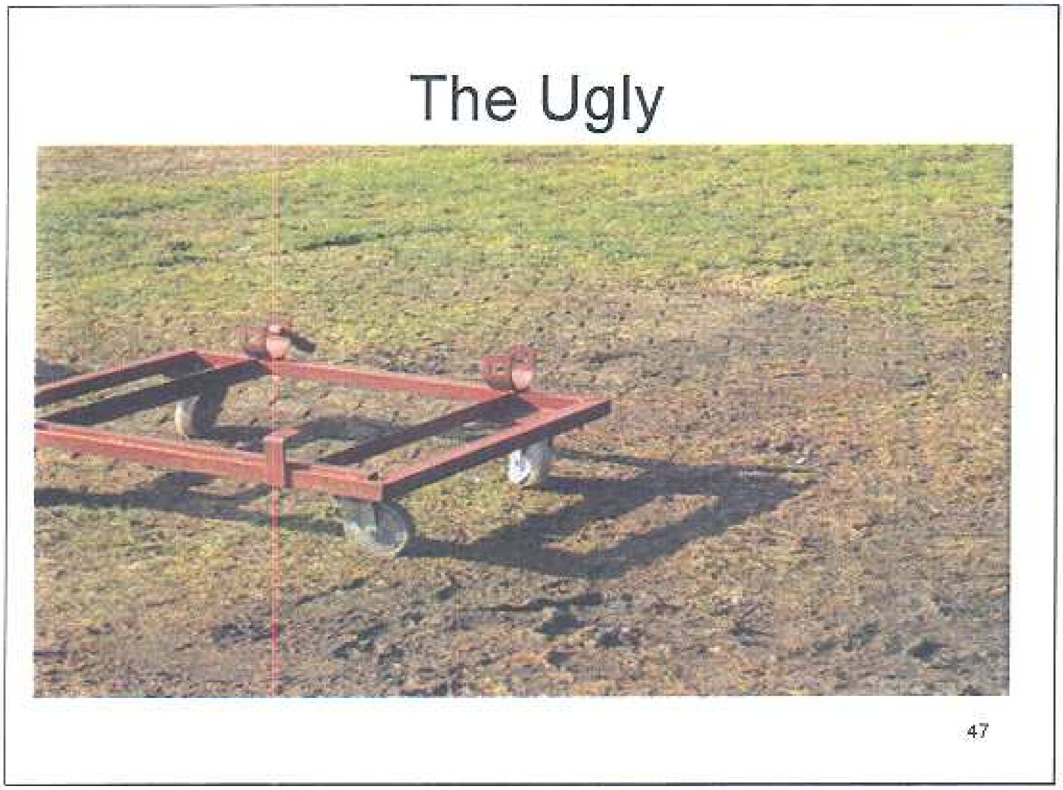


Image 48

Image 49

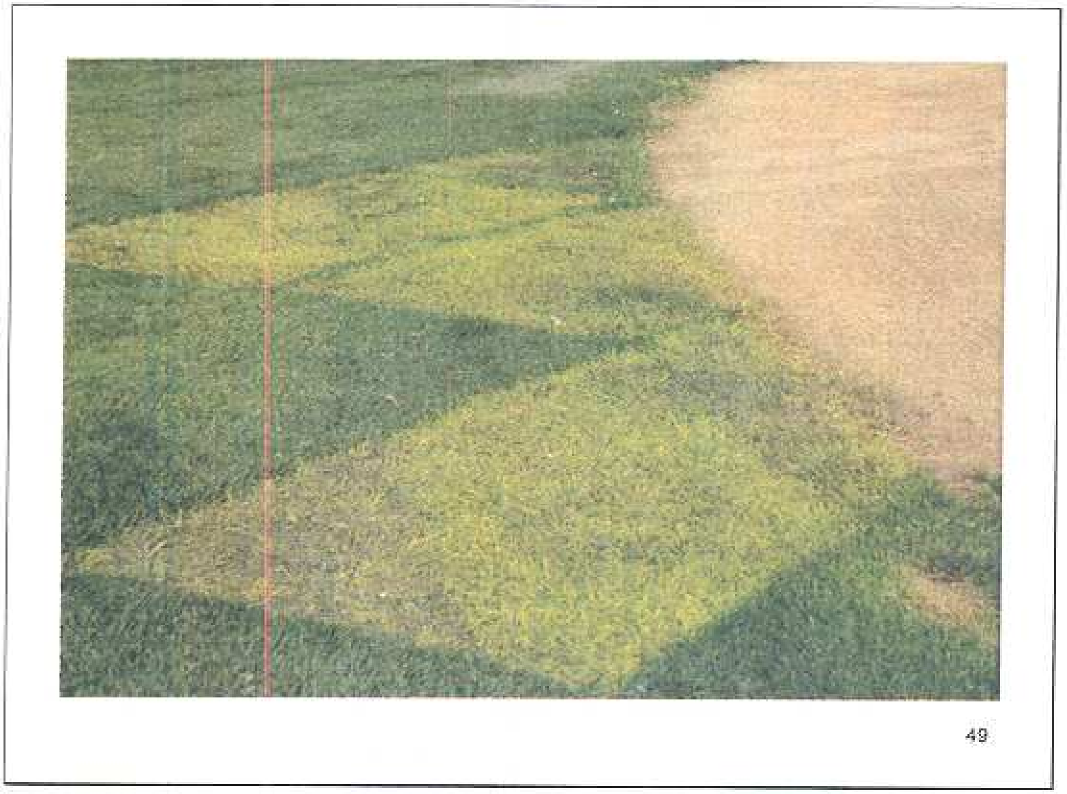


Image 50

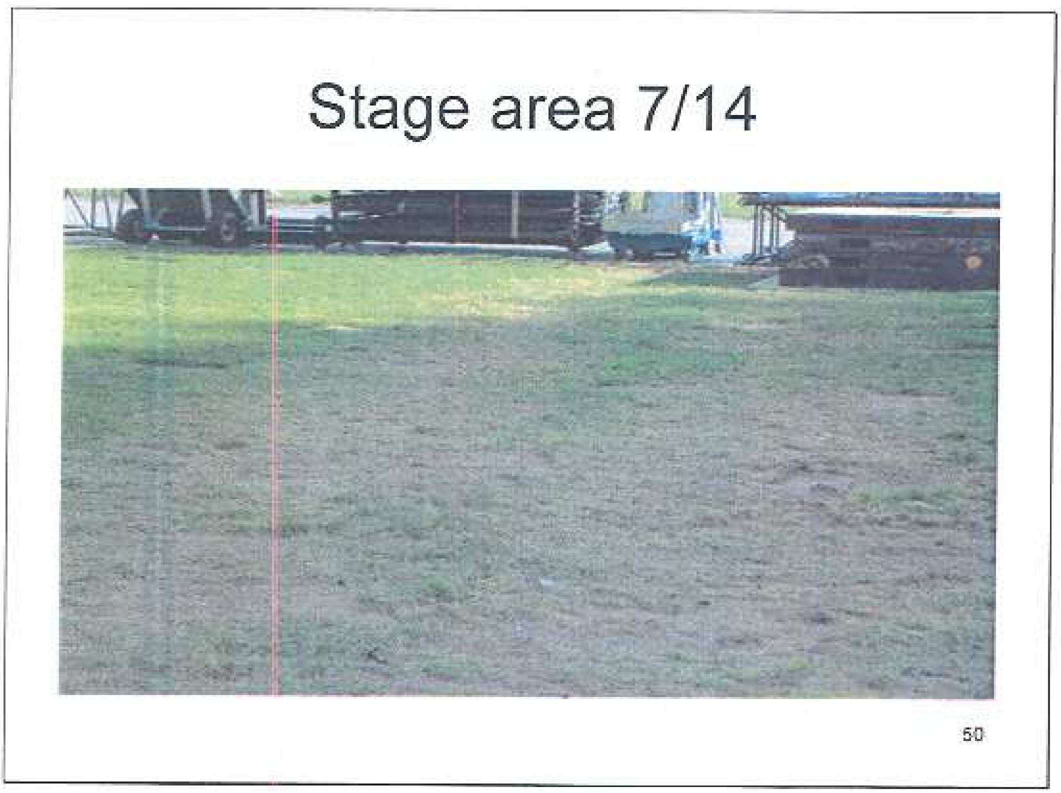
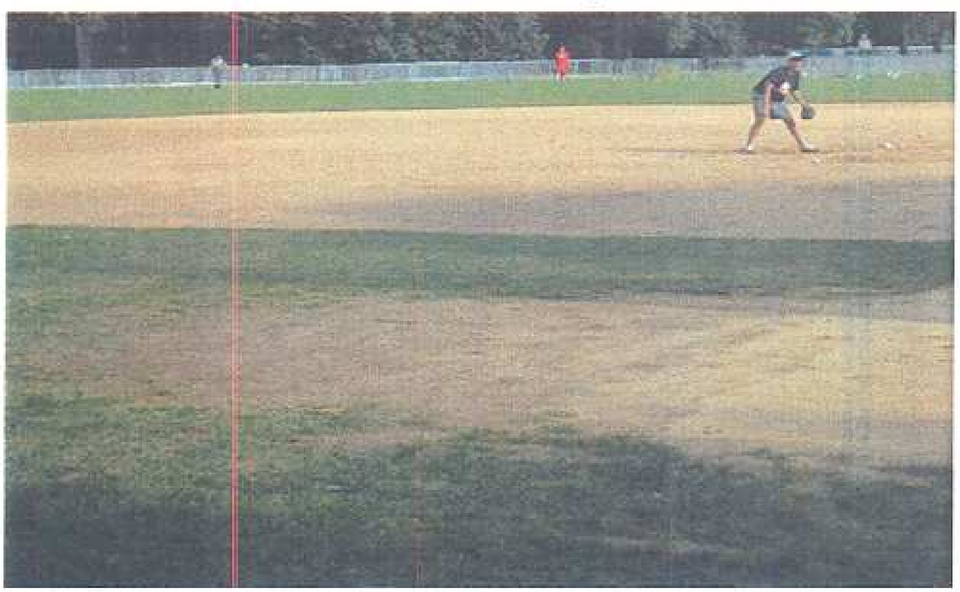


Image 51

51

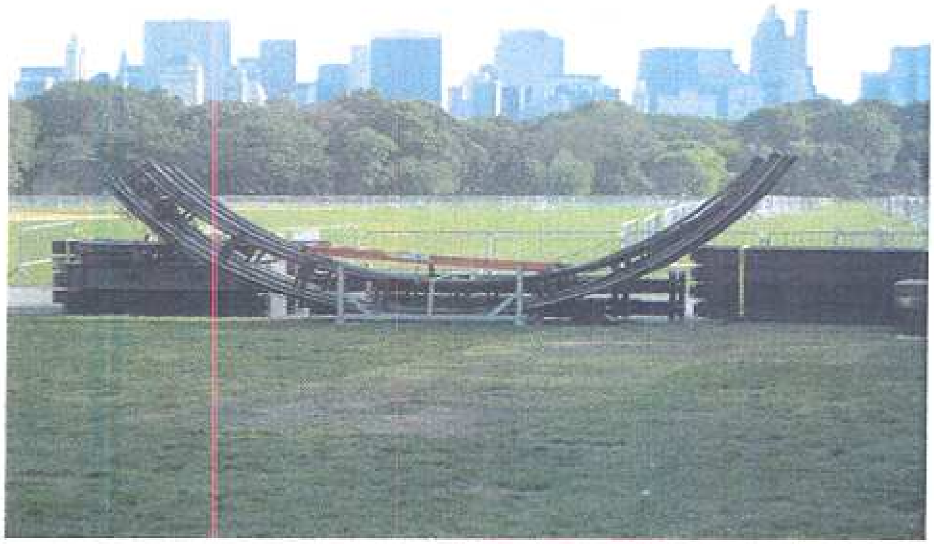
Image 52

Softball Use one day after event



52

Image 53



53

Image 54

Hardscape being utilized to minimize turfgrass damage

54

Image 55

7/14 .47 inches rain

55

Image 56

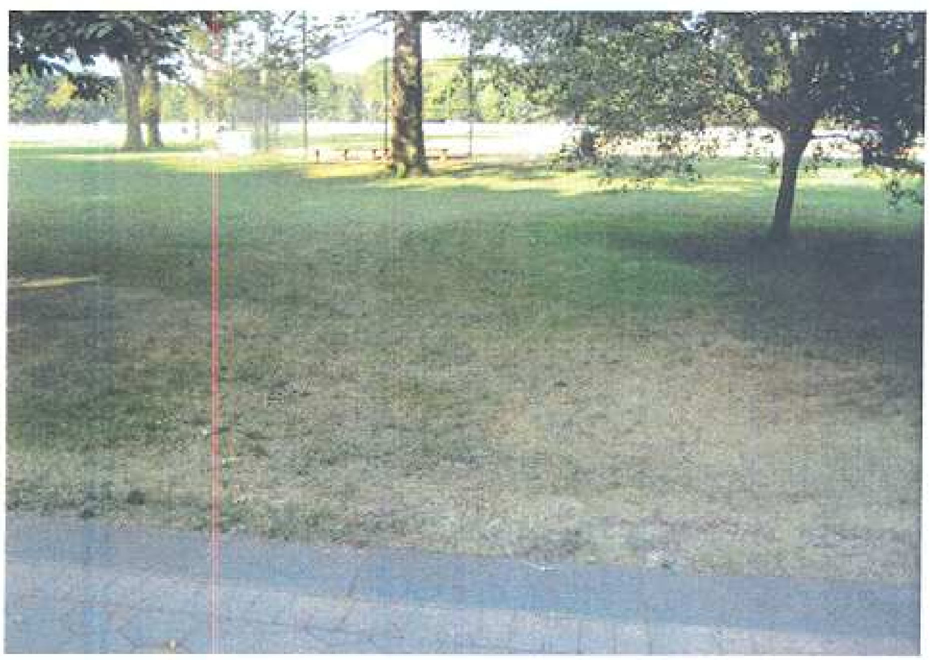
56

Image 57

Transition areas ie. Not seating just wear caused by access to seating areas on shaded nonadvanced rootzone. This turfgrass is less tolerant to traffic

57

Image 58



58

Image 59

7/15 PrePhilharmonic

59

Image 60

60

Image 61

Sea of sheets and blankets

61

Image 62

62

Image 63

Image 64

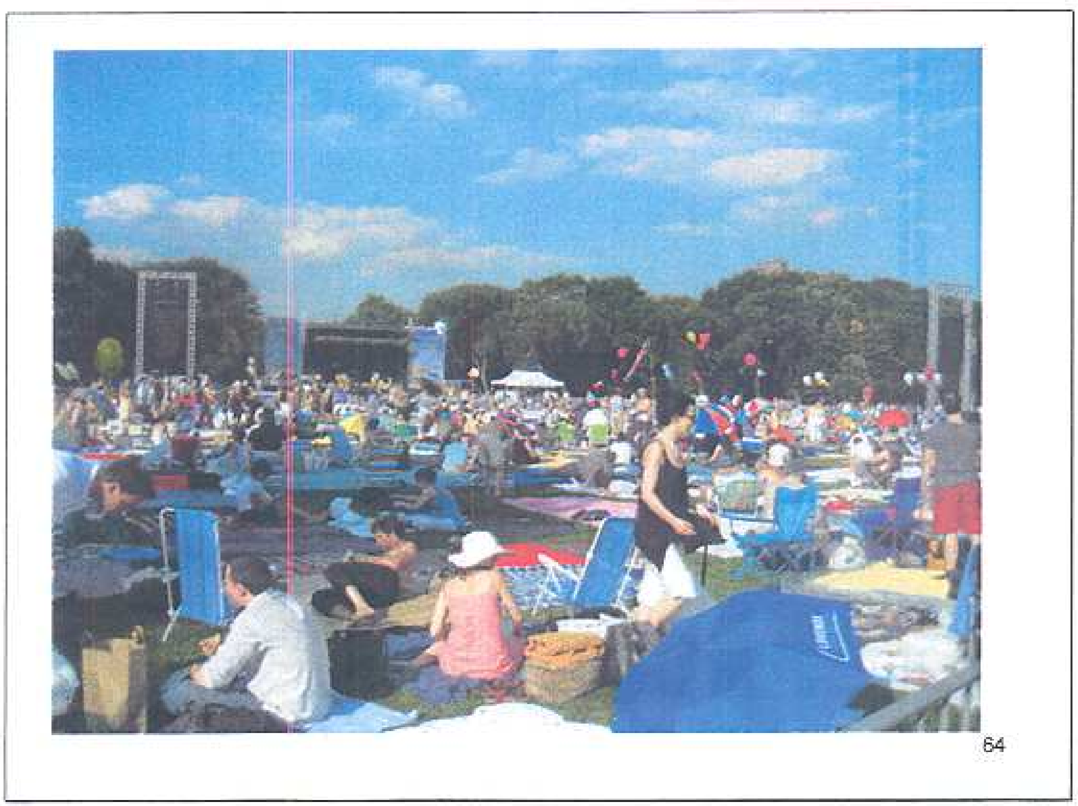
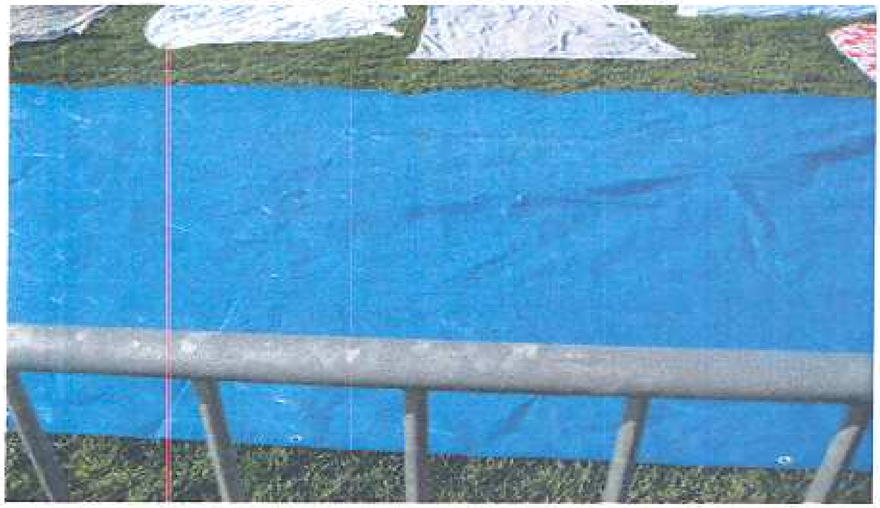


Image 65

Polypropylene-coated fabric tarps can damage turf depending on weather conditions



65

Image 66

AV equipment area

66

Image 67

7/16 post philharmonic

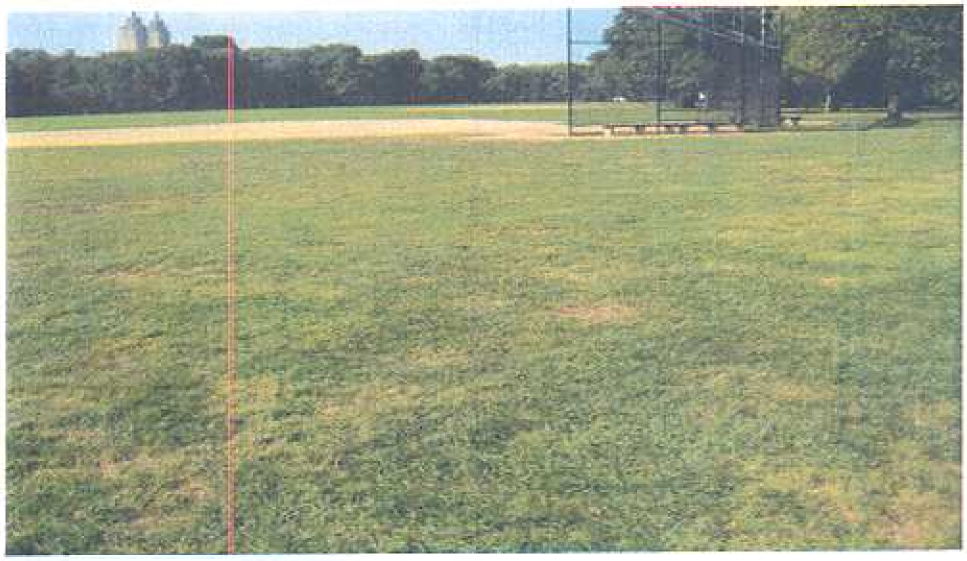


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Image 68

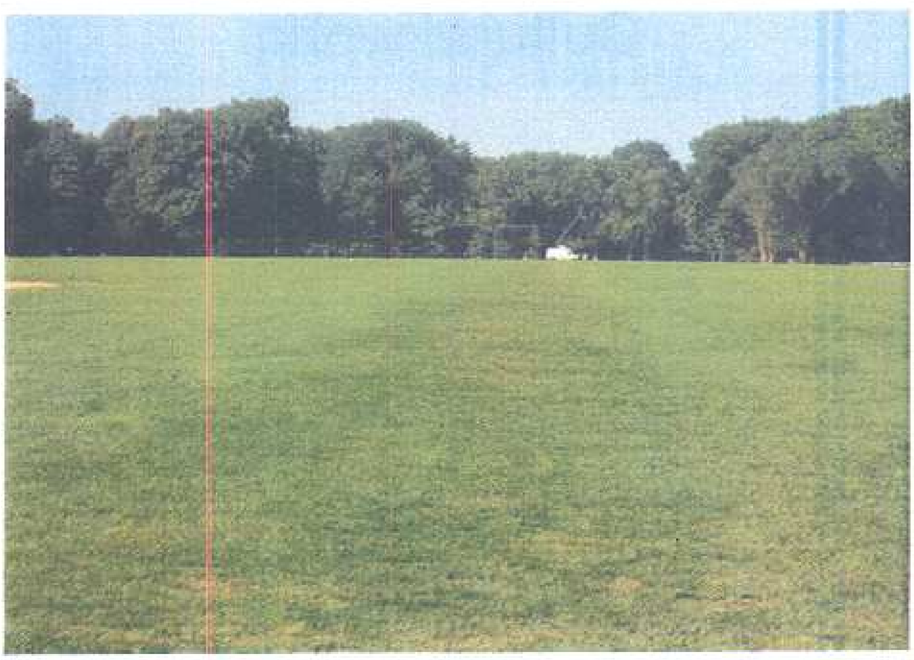

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Image 69

Image 70

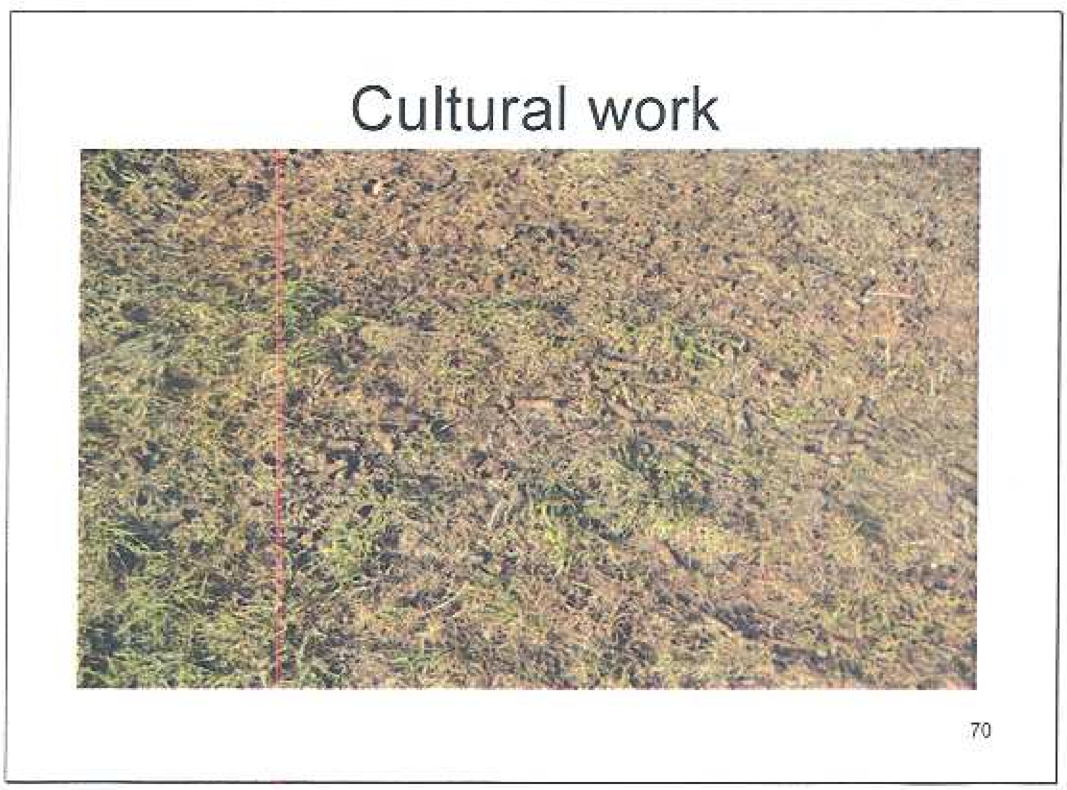

Image 71

Aerification to relieve compaction and overseeding

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Image 72

Good quality cultural equipment

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Image 73

High capacity topdressers and spreaders

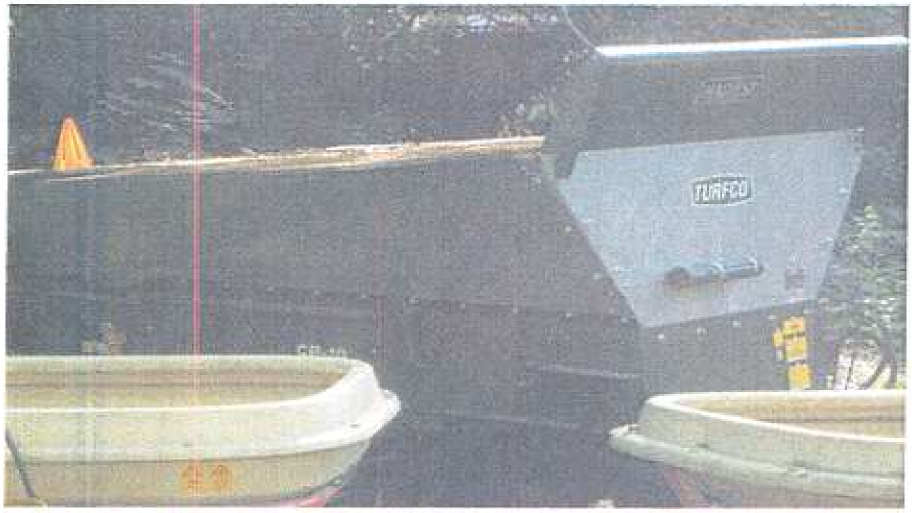

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Image 74

Low pressure, wide-track tires

74

Image 75

Aeration near stage area

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Image 76

Dead and damaged areas

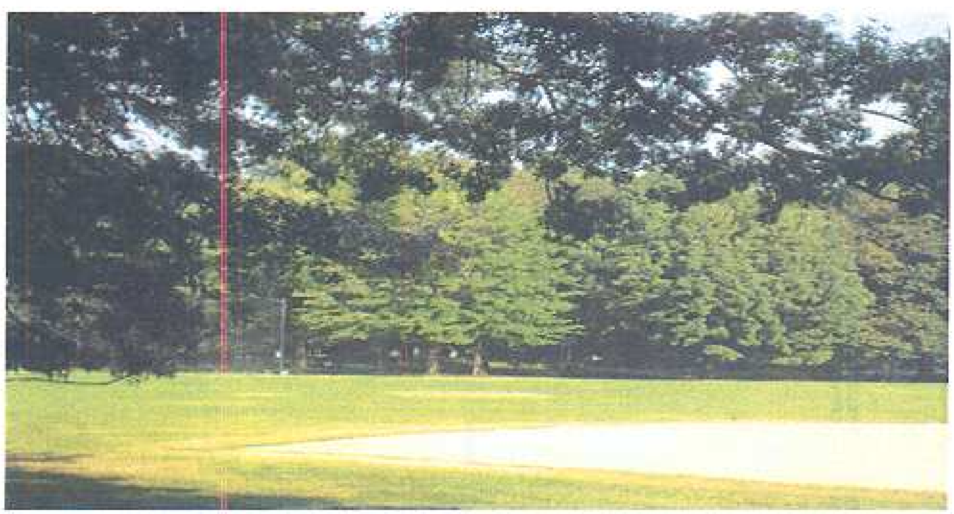

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Image 77

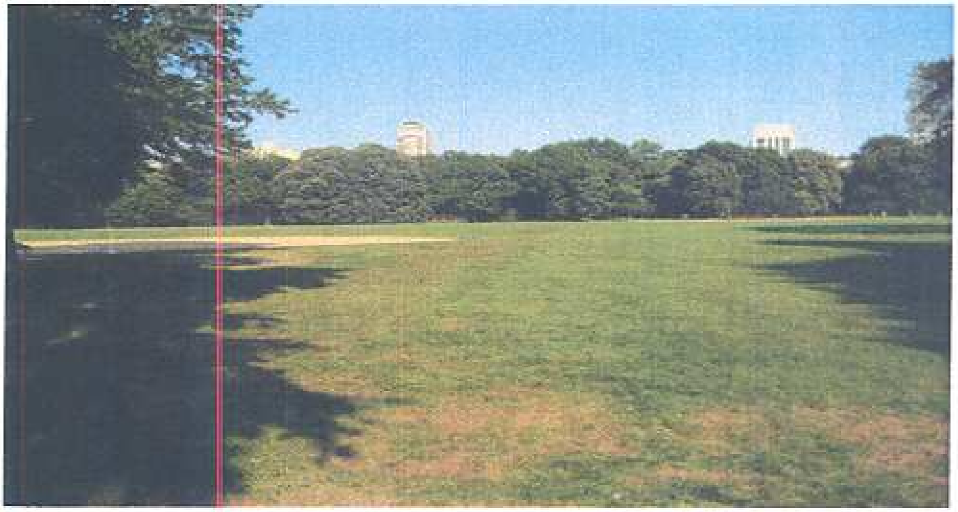

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Image 78

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Image 79

Egress corridors

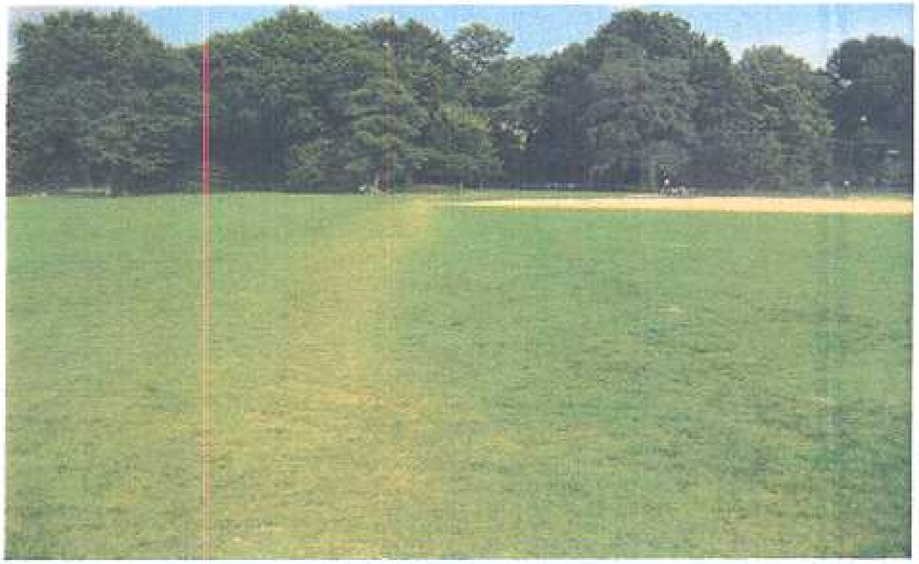

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Image 80

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Image 81

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Image 82

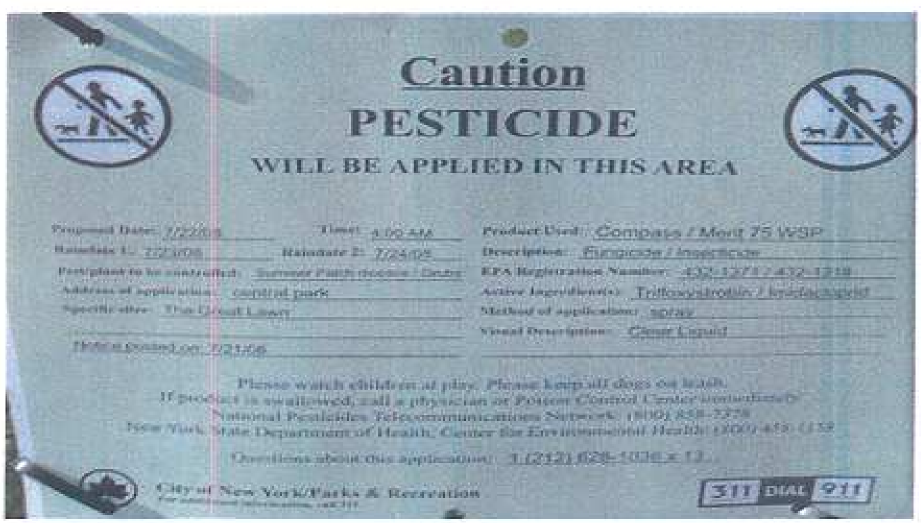
82

Image 83

83

Image 84

7/21 lawn application



84

Image 85

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Image 86

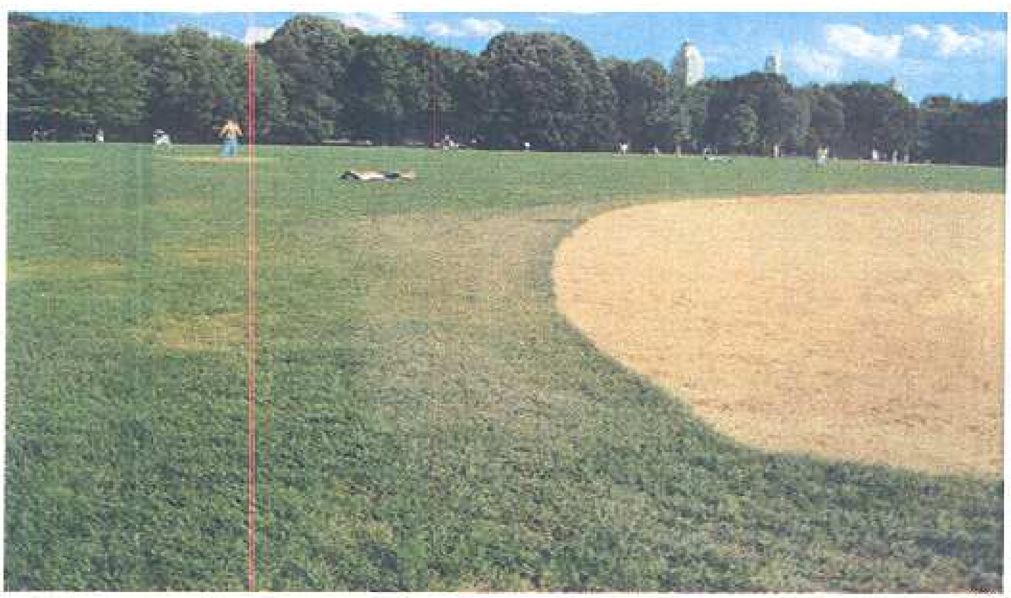

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Image 87

Time Line-AV area damage

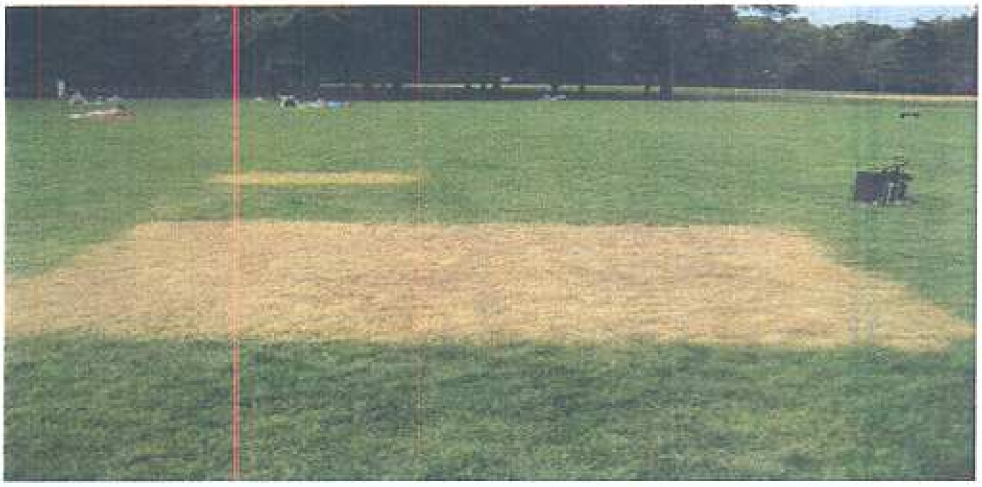

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Image 88

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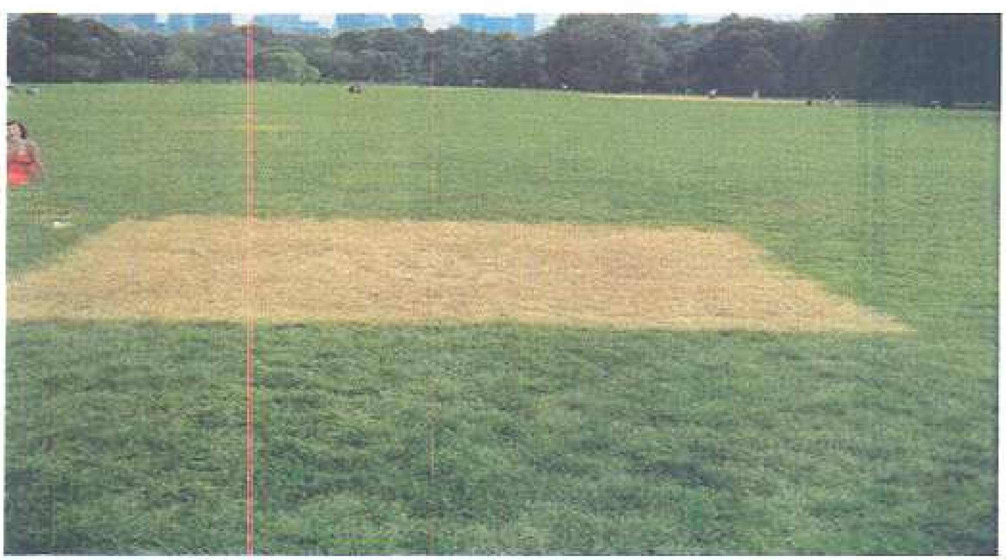

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Image 89

7/21

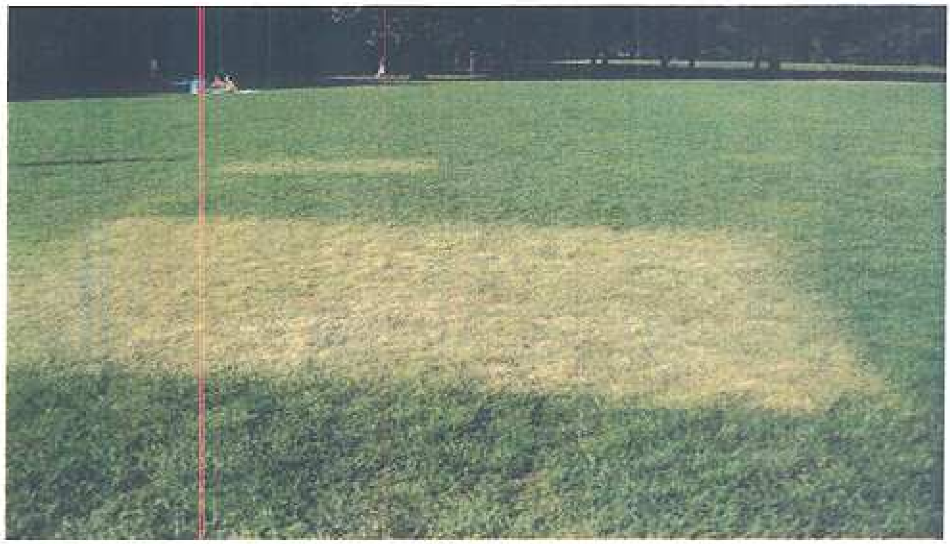

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Image 90

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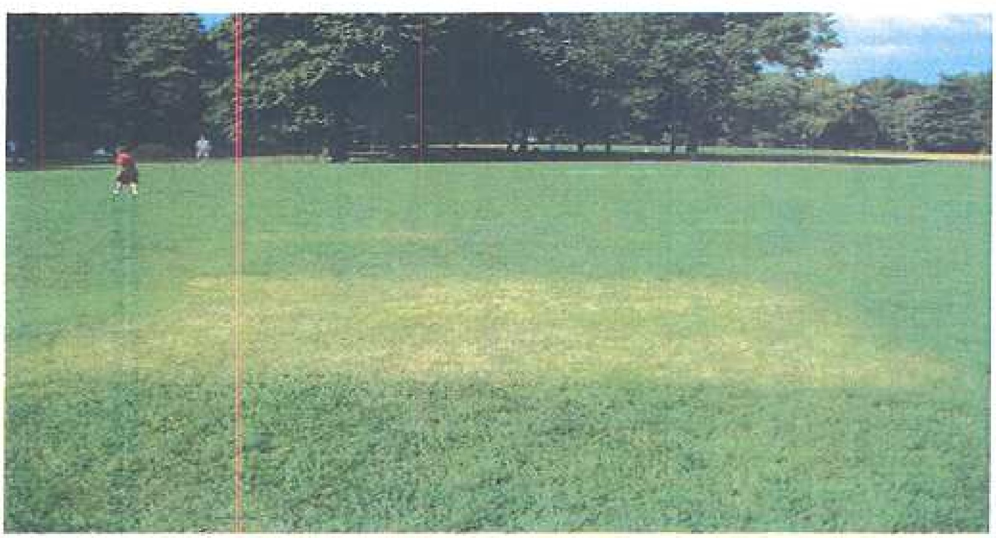

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Image 91

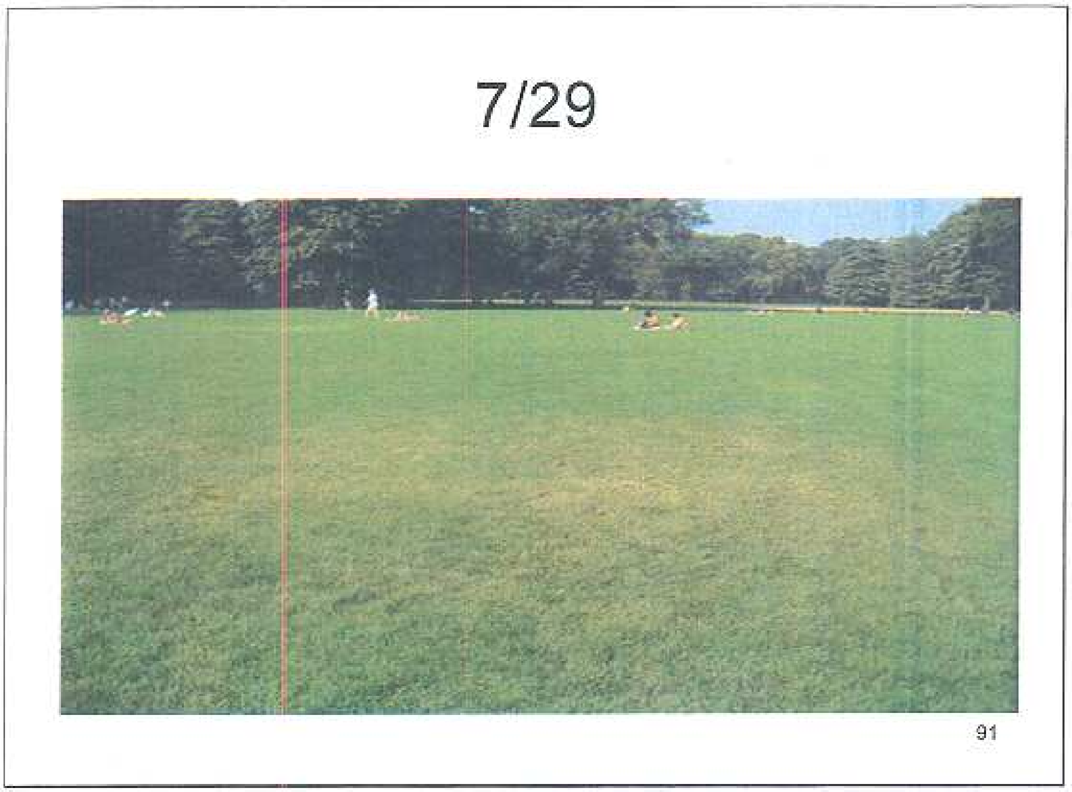

Image 92

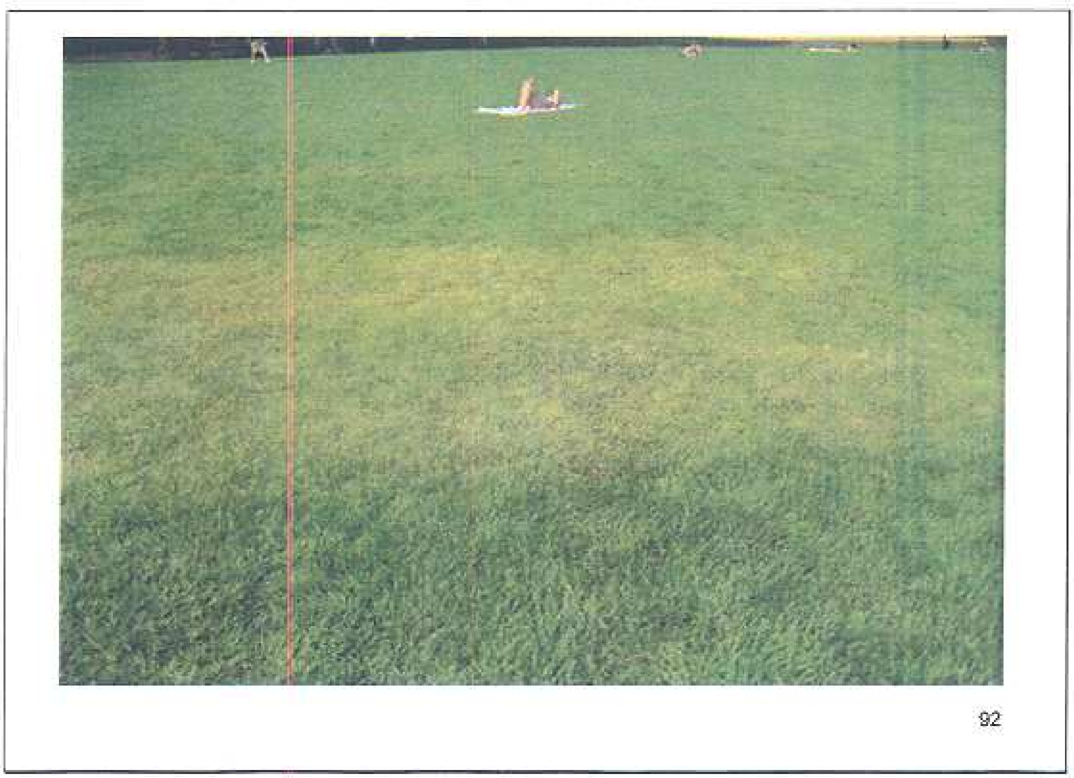

Image 93

Transition area drainage

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Image 94

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Image 95

North end wear

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Image 96

Traffic wear

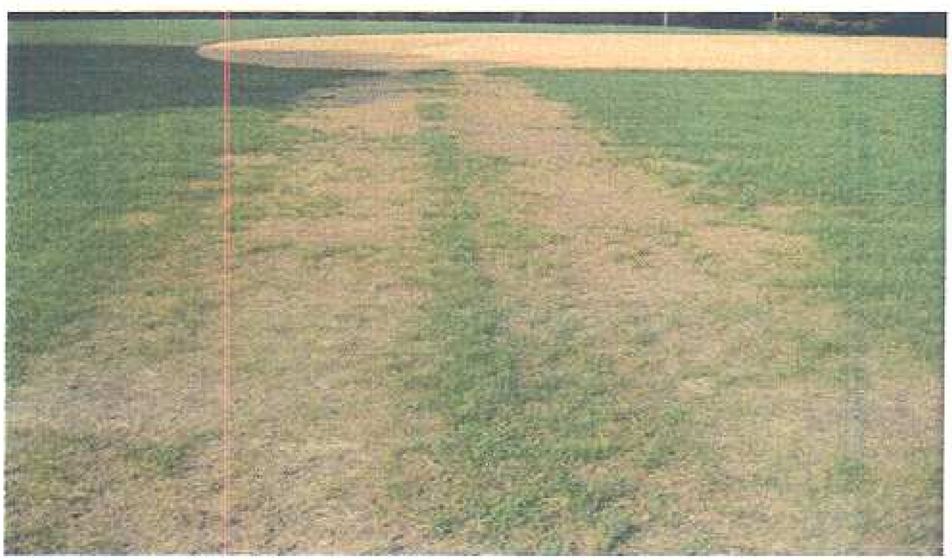

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Image 97

Non advanced rootzone

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Image 98

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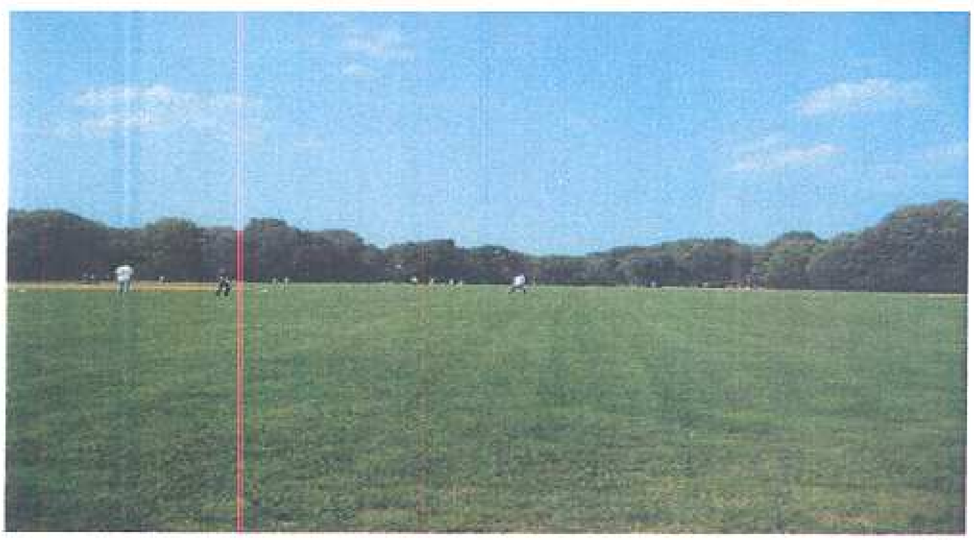

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