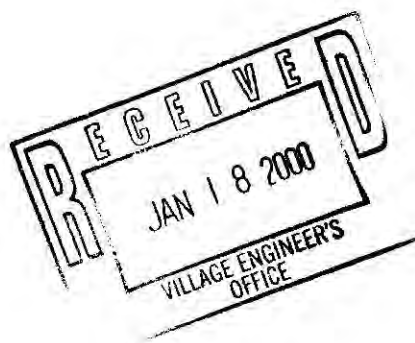




Environmental Management Plan

**Hudson National Golf Club
Croton-on-Hudson, New York**

Prepared for:

National Fairways, Inc
71 Arch Street
Greenwich, CT 06830

Prepared by:

The Turf Science Group
Raleigh, NC

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GOLF COURSE CULTURAL PRACTICES

The primary cultural practices that produce and sustain a healthy turf are mowing, irrigation and fertilization. These three operations, alone or in combination, often cause changes in the root and canopy micro-environment which can have either a positive or negative result. Thus, it is essential that these practices are executed in a proper and timely manner to ensure turfgrass quality and playability. The best deterrent to weed, insect and disease infestation is a healthy turf. Thus, maintaining hearty grasses will minimize the need to apply fertilizers and pesticides.

Recommendations for cultural programs include information adapted from a report prepared for a golf course development previously proposed for this location (Petrovic, 1991). However, these have been updated and expanded for the Hudson National Golf Club plan.

MOWING

Mowing is the most basic maintenance operation on a golf course. Without regular mowing at the appropriate heights of cut, the course would become unplayable. With good mowing practices, density, texture, color, root development, wear tolerance and other aspects of turf quality are enhanced. Proper mowing practices also can reduce the amount of irrigation needed. Taller grasses have a significantly higher evapotranspiration rate and thus a greater need for water. Mowing grass too short stresses the turf which not only produces a need for more water, but can cause the weakened turf to be more susceptible to weed, insect and disease infestation. Recommended mowing practices are presented in Table 1.

Table 1. Recommended mowing for the turf areas.					
Mowing	Greens	Tees	Fairways	Intermediate Rough	Rough
Height (inches)	5/32 - 1/4 (0.156 - 0.250)	3/8 - 5/8 (0.375 - 0.625)	1/2 - 1.0 (0.5 - 1.0)	3/4 - 1 (0.75 - 1.0)	1 1/2 - 2 (1.5 - 2)
Frequency	Daily	2 to 4 times per week	2 to 3 times per week	1 to 2 times per week	7 to 14 days
Clippings	Remove ¹	Remove ¹	Return or Remove ²	Return	Return
¹ Clippings are not to be disposed of in or within 25 feet of wetlands. ² Depends upon equipment and overall management objectives.					

Grass variety and turf use have the greatest influence on mowing height. Each turfgrass has a mowing tolerance range within which it can be expected to provide outstanding turf. The best approach is to use the highest mowing height acceptable for the various playing surfaces. However, if fast greens are required for tournament play, mowing can be lowered below recommended minimums for a short period of time. Another option is to continue mowing at the higher height and double cut twice, as frequently this operation will produce the same green speed as the lower cut. In addition, during the summer months when stress is likely to occur, if the membership is satisfied with the green speed, do not lower the height of cut. If the membership demands faster green speeds, begin by double cutting once or twice per week before lowering the height of cut. Additionally, rolling several times per week can improve speed without lowering the height of cut.

Mowing height and growth rate have the most influence on mowing frequency. As a "rule of thumb," mowing should be done often enough that no more than one-third of the leaf is removed at any cutting. Frequent mowing is best because it minimizes the effect on

photosynthesis and helps maintain a high percentage of leaf surface which is necessary for healthy root development.

If mowing is scheduled at appropriate intervals and the grass clippings are dispersed uniformly, the clippings may be left on the fairways and roughs. Research has indicated that returning clippings to the surface does not greatly increase thatch buildup on turf that is properly managed otherwise. Clippings decompose rapidly, thus returning some fertilizer and organic matter to the soil. Clippings also help conserve moisture and insulate the soil.

Clippings are always removed from greens and tees to prevent interference with play. Collected clippings can either be combined with a high carbon source (such as leaves) and composted or disposed of by broadcasting in natural waste areas. No clippings are to be disposed in or within 25 feet of wetlands.

FERTILIZING

The most important aspect of a sound fertilizer program is to ensure that the nutrients applied do not end up in surface and/or ground water and do not drift off-site. Nitrogen and phosphorus are the elements most often associated with eutrophication of lakes and streams. Other nutrients do not seem to pose a problem to surface waters.

Excessive nitrate concentrations in ground water represent a health hazard where ground water is tapped for drinking water supplies. Much of the nitrogen applied to golf courses is in the ammonium and nitrate forms. The results of research on nitrogen fertilizers applied to turfgrasses (Petrovic, 1990) reveal that nitrate-nitrogen concentrations in soil water leaching through the surface soil exceeds drinking water standards of 10 ppm only where soils are sandy

and one of the following conditions exist: 1) high levels of soluble nitrogen are applied, greater than 3 lbs. N/1000 sq.ft. at one time; or 2) very frequent (daily) irrigation is practiced coupled with application of water soluble nitrogen sources. Accordingly, nitrate movement may be minimized by addressing efficiency in rate and timing of nitrogen inputs, through choice of materials, and efficiency in rate and timing of irrigation. Reports by Walker and Branham (1992) concluded that several management actions effectively minimize or eliminate nitrate movement: 1) limit irrigation to replacement of soil moisture; 2) use slow release nitrogen sources; 3) time fertilizer applications in relation to active uptake; and 4) use realistic nitrogen application rates.

When a fertilizer is applied in excess of what the plant can use or when the turf is not actively growing due to temperature, water, light, lack of an individual nutrient, etc., much of the application could be lost. For these reasons, before a fertilizer is applied, the limiting growth factors must be considered. In addition, only a fertilizer containing the nutrients in the right form needed by the plant should be used and applied at the appropriate rate and frequency. Plants will respond favorably to fertilizer applications only if the application contains a nutrient that is deficient.

To ensure that fertilizer applications address actual deficiencies, soils must be analyzed to determine pH, calcium, magnesium, phosphorus and potassium availability and balance. From this information a valid lime and fertilizer program can be developed with the assurance that excess nutrients will not be applied. Soils are to be sampled at all greens, tees, and fairway areas. Data from these analyses will be used to adjust fertilizer rates based on soil residual levels, thereby avoiding excess application of materials which could become nonpoint sources of pollution.

Nitrogen is the nutrient used by grasses in the largest quantities. Its function is to stimulate vegetative growth and provide the grass with green color. Nitrogen fertilization needs are to be determined by color, density and rate of growth (clipping yields) of grass, and plant tissue analysis. Plant tissue analysis is to be conducted on selected locations every three to four weeks during the growing season. This will serve as a guide for determining if nutrients are in a sufficiency range or if fertilization is needed to balance the nutrition. Freshly harvested tissue is to be collected and dried in a microwave oven. The dried plant material is to be sent to a lab and analyzed for a standard compliment of analytes, including nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, and manganese.

Leaching of nitrate nitrogen can be minimized by making controlled applications (spoon feeding), by using controlled materials (slow-release) or by using a combination of these approaches. The superintendent will personally control applications by either using soluble fertilizers and applying the materials with a sprayer that has been calibrated to put out an accurate amount of material per acre or through fertigation. Under either approach, the superintendent can personally control the rate and frequency of fertilizer application; thereby reducing the tendency to apply excessive amounts of nitrate and ammonium forms of nitrogen on an infrequent basis.

Controlled materials, such as natural organic sources (Milorgranite, Ringer, Sustane, etc.), isobutylidene diurea (IBDU), methylene ureas (MU) and coated ureas (SCU, Polyon, Poly-S, Sulfurkote-II and others) are all slow-release (SR) nitrogen sources. They have the advantage of supplying a longer more uniform source of nitrogen, a lower salt index and reduced nitrogen leaching.

By combining soluble nitrogen sources with the slow-release nitrogen products, availability can be extended to the grass without prompting nitrogen leaching into the groundwater. Also, the use of fertigation will allow the superintendent to apply small amounts of fertilizer to locations where it is needed and thus reduce the likelihood of off-site contamination.

BASIC FERTILIZER PROGRAM

Creeping bentgrass and Kentucky bluegrass grow within a wide soil pH range. However, for optimum soil microbial activity and improved nutrient availability it is preferred to keep the pH in the 5.5 to 6.5 range. Also important is the maintenance of a calcium to magnesium ratio of 10:1.

The basic turfgrass fertilization program for the Hudson National Golf Club is presented in Tables 2 through 5. Additional, location specific provisions are presented below.

Greens. If soil test results indicate that either dolomite for soil pH correction and/or phosphorus are needed, they shall be applied during aerifying operations so that they can be worked into the root zone. The addition of potassium shall be made in three to four applications per year and applied at the rate of $\frac{1}{2}$ to 1 pound per 1000 square feet. Slow release sources of nitrogen shall be applied at the rate of 0.5 to 1.0 pound per 1000 square feet.

Tees. If phosphorus and dolomite are needed, the tee surfaces shall be treated the same as the greens. Nitrogen and potassium are to be applied at about the same rate as for the putting greens.

Table 2. General Fertilizer Applications on Greens and Tees (Pounds per 1000 square feet per year).†			
Area	Nitrogen	Phosphorus	Potassium
Greens	3.5 to 5	1 to 3	4 to 6
Tees	3.5 to 5	1 to 3	4 to 6
† Adjustments are to be made based upon testing results and turf response.			

Table 3. Fertilizer Schedule for Greens and Tees (Pounds per 1000 square feet per application).†									
Greens & Tees	Apr*	May	June	July	Aug	Sep*	Oct	Nov	Total
Nitrogen	WS 0.25	WS 0.25	NO 0.5	NO 0.5	NO 0.5	SR 0.5	WS 0.5	SR 0.5-2	4.0-5.5
	SR 0.25	SR 0.25							
Phosphorus	0.25		0.4	0.4	0.4				1.45
Potassium	0.5	0.5	0.8	0.8	0.8	0.5	0.5	0.5-1	4.9-5.4
† Adjustments are to be made based upon testing results and turf response. May be modified by the fertigation schedule.									
* application may be reduced or eliminated after first several years.									
WS = Water soluble; SR = Slow release; NO = Natural organic.									

Fairways. Dolomite and phosphorus applications are to be based on soil test results. No individual application of nitrogen or potassium is to exceed 40 pounds per acre and ½ the nitrogen is to be from a slow release source.

Roughs. Roughs are to be fertilized two times per year. Dolomite and phosphorus applications are to be based on soil test results. Individual applications of nitrogen and potassium are not to exceed 40 pounds per acre and ½ the nitrogen is to be from a slow release source.

Area	Nitrogen	Phosphorus	Potassium
Fairways	90 to 180	45 to 135	90 to 225
Intermediate Rough	60 to 120	22 to 66	60 to 120
Rough	40 to 80	0 to 45	40 to 80
Vegetative Filter Strip	40	20	40

†Adjustments are to be made based upon testing results and turf response. May be modified by the fertigation schedule.

Fairways	May	June	July	Aug	Sep	Total
Nitrogen	WS 22.5	NO 45		NO 45	WS 22.5	180
	SR 22.5				SR 22.5	
Phosphorus	22.5	18		18		58.5
Potassium	45	36		36	45	162
Roughs	May	June	July	Aug	Sep	Total
Nitrogen	WS 20				WS 20	80
	SR 20				SR 20	
Phosphorus	22.5					22.5
Potassium	40				40	80
Intermediate Roughs	May	June	July	Aug	Sep	Total
Nitrogen	WS 20	WS 10			WS 20	100
	SR 20	SR 10			SR 20	
Phosphorus	22				22	44
Potassium	20	20			20	60
Vegetative Filter Strip						
Complete N-P-K	40-20-40					40-20-40

† Adjustments are to be made based upon testing results and turf response.
WS = Water soluble; SR = Slow release; NO = Natural organic

FERTIGATION SYSTEM

Fertigation is the process of fertilizing at low rates through the irrigation system. Reporting on the results of a recent study, Snyder et al. (1989) concluded that turfgrass nitrogen uptake and subsequent plant growth was more uniform and the potential for leaching was greatly reduced by fertigation compared to conventional fertilizer application.

The type of fertilizer that will initially be used in the fertigation system will be CoRoN 28-0-0. It is a controlled-release liquid nitrogen fertilizer with 70% of nitrogen coming from controlled release and 30% from water soluble urea. Other brands of fertilizer with similar slow-release nitrogen characteristics as CoRoN 28-0-0 may be used in the fertigation system, depending on the turf needs and site conditions.

Hudson National Golf Course may use biostimulants, humates, or soil conditioners to improve the health of the soil, increase microbial activity, and improve the cation exchange capacity. These materials may be distributed via the fertigation system. The net result of using these natural products is that the soil is better able to store nutrients, filter pesticides, and make the plants more proficient in assimilating fertilizers and water. These materials will be used to reduce and eliminate pesticides whenever practical.

A state-of-the-art Toro irrigation system has been installed at Hudson National Golf Club. It is a computerized system that has individual head control for each of the approximately 1200 sprinklers. It is integrated with the weather station located on site, data from which is used to estimate irrigation demand based on the evapotranspiration of the turf (see below). A PlantStar fertigation system has been incorporated into the irrigation system. The locations of sprinkler head adjustment are indicated on the plan entitled Limited Activities (see Appendix VI).

Fertigation is not to occur when prevailing wind speeds exceed 15 miles per hour. Pesticides are not to be applied via the fertigation system.

Irrigation System. Irrigation system design and operational strategy must fulfill all environmental requirements for protecting wetlands, surface water and ground water on and around the golf course. In addition, the irrigation system must meet the water requirements of the turf by supplementing natural rainfall. Even though annual rainfall for the Croton-on-Hudson area is over 45 inches, a deficit does occur during the summer months when Evapotranspiration (ET) exceeds rainfall (Table 6). Given historic precipitation patterns, it is anticipated that supplemental irrigation will be needed five months a year with the maximum in June, July and August. Irrigation will be managed with a computer controlled system. Irrigation is to be based on measurements of weather conditions, as described in the following section entitled 'Water Management.'

Table 6. Turfgrass irrigation requirements for Croton-on-Hudson, New York based on average rainfall and moisture availability.						
Month	Precipitation (a)	Available Moisture (b)	Est. ET (c)	Deficit	Irrigation (d)	Total Moisture Applied
Inches per Week						
Jan	0.87	0.44	0.03			0.87
Feb	0.73	0.37	0.03			0.73
Mar	0.84	0.42	0.17			0.84
Apr	0.84	0.42	0.44	0.02		0.84
May	0.85	0.43	0.89	0.46	0.61	1.46

Table 6. Turfgrass irrigation requirements for Croton-on-Hudson, New York based on average rainfall and moisture availability.

Month	Precipitation (a)	Available Moisture (b)	Est. ET (c)	Deficit	Irrigation (d)	Total Moisture Applied
Jun	0.97	0.49	1.29	0.8	1.07	2.04
Jul	1.06	0.53	1.55	1.02	1.36	2.42
Aug	1.09	0.55	1.34	0.79	1.05	2.14
Sep	1	0.5	0.89	0.39	0.52	1.52
Oct	0.83	0.42	0.49	0.07		0.83
Nov	0.69	0.35	0.2			0.69
Dec	0.82	0.41	0.04			0.82

(a) Based on weather records from Bedford Hills, Westchester County, NY over a 36 year average.

(b) Assuming replacing soil moisture at 50% depletion.

(c) From "Toro Rainfall-Evapotranspiration Data" for New York.

(d) Based on 75% Application Efficiency.

WATER MANAGEMENT

Because of the many variables to consider (i.e., slope, soil types, rooting depth, etc.), even with the most sophisticated irrigation system available, daily fine-tuning of the irrigation program by the golf course superintendent and irrigation technician is essential.

Knowledge of the water reserve in the root zone is a key input required for determining irrigation needs. On greens, approximately seventy-five percent of the root system may occur in the top four inches of soil. On tees, fairways and roughs the depth of rooting can vary from six to twelve inches, depending on how these surfaces are managed. Knowledge of soil water storage, actual daily rainfall, and calculated daily evapotranspiration (ET) information makes it possible to determine when the available soil moisture is depleted and irrigation required. Guidance can be obtained through the use of a US Weather Bureau Class A evaporation pan and rain gauge.

A weather station located at the maintenance facility records rainfall and ET. The amount of irrigation plus rainfall necessary to sustain the turf in an actively growing condition is approximately 70% of pan evaporation.

There are more sophisticated soil moisture sensor devices and weather stations which record a wide array of environmental parameters. These could be employed if desired, however, they will not substitute for the superintendent and irrigation technician paying careful attention to detail over the differing soil and turf conditions on the course.

To insure there is always adequate moisture for growth and development, the amount of water to apply at each irrigation is to be the depth required to replace that extracted by the turf since the last irrigation or rainfall (normally at 50% depletion of the soil water holding capacity in the irrigated zone), plus an amount to offset losses due to irrigation system inefficiencies. Irrigation beyond this level is a waste of water and could result in movement of nutrients and pesticides past the grass root zone.

Given the imperfect nature of any irrigation system, there is the possibility of different areas of the course being over-watered, correctly watered, and under-watered. Therefore, only through careful study and trial and error can the superintendent and irrigation technician achieve the most appropriate balance, one which focuses on the drier side.

The best method of determining whether the proper amount of water has been applied is to determine the depth of water penetration following irrigation by coring with a soils tube. If water has not penetrated to the desired depth by six to eight hours after an irrigation, then the irrigation time will be increased. If water has moved well beyond the desired irrigation depth, then the irrigation time will be decreased.

To avoid runoff, the application rate must not exceed the soil infiltration rate. If runoff is likely to occur, the irrigation system is to be cycled to ensure proper infiltration. In addition, one of the primary responsibilities of the golf course superintendent and irrigation technician is to monitor the heads frequently to be sure all heads are operating properly and that no head is inadvertently applying water to an environmentally sensitive area (e.g., wetlands).

SUPPLEMENTARY CULTURAL PRACTICES

To help develop and sustain quality turf, spiking, vertical mowing, aerifying, topdressing and rolling are to be used. These operations physically alter the plant's environment by removing and or relocating soil and organic materials or altering turf growth habit. Only when turfgrasses are actively growing are these cultural practices to be performed.

Spiking. Spiking is most useful in breaking up surface compaction and improving moisture infiltration and gas exchange. In addition, it is useful in lifting the blades of grass before mowing to aid in preventing the turf from thatching.

Vertical Mowing. When done on a timely basis, vertical mowing can be used to remove mower induced grain on greens and reduce thatch. In addition, vertical mowing can be used to thin turf so that a better job of reel mowing can be done. Also, vertical mowing is used to separate the soil from aerifier cores and mix it with the sand used to fill the aerifier holes and topdress the playing surface.

Aerifying. The main purpose of aerification is to relieve surface compaction which in turn improves surface water infiltration, allows for good root penetration, provides for easier air exchange in the soil, improves nutrient uptake, removes excess thatch and increases turfgrass vigor.

Aerification on putting greens is commonly followed with topdressing. If aerifying is done without topdressing with proper materials and developing a good turf cover, the soils could return to their original compacted state.

Aerification plugs are to be disposed of in nonplay or rough areas. No plugs are to be disposed of in or within 120 feet of wetlands .

Topdressing. Topdressing aids in thatch decomposition, lessens grain development, stimulates new shoot growth, encourages stolon rooting, and makes the ball roll true and faster. Although a small amount of thatch (1/4 - 1/2 inch thick) is desirable to provide a certain amount of resiliency, thatch is the greatest single limiting factor in the development of fast, uniform greens. Although topdressing does not prevent the development of stems and roots which contribute to that buildup, it does keep the thatch separated to prevent dense, compacted mats from forming. By mixing suitable topdressing materials with the organic material, thatch layers, as such, will not develop and will decompose faster.

Rolling. New light-weight, self propelled rolling equipment has made rolling a viable practice for smoothing the turf surface and improving green speed. It is frequently used in the summer months to allow a higher height of cut for improved stress tolerance while increasing green

speeds. However, recent research has shown it can be overdone. Rolling more often than several times a week can lead to excess wear and compaction.

BASIC ANNUAL MAINTENANCE GUIDE

The following guidance supplements the Basic Annual Maintenance Guide on the following pages. The numbers of the following items correspond to the numbers in the Remarks column in the Basic Annual Maintenance Guide Chart. This basic program is to be adjusted and fine tuned by the superintendent based on specific situations. In all cases the restrictions specified on the plan entitled Limited Activities (see Appendix VI) shall apply.

1. **Soil Analysis and Tissue Analysis.** Sample representative greens, tees, fairways and roughs for analysis and recommendations. Soils analyses are to occur in April, May, June, July, and August on greens, tees and fairways for three years. Tissue analyses are to occur periodically during the year as determined by the superintendent. The primary purpose of soil and tissue testing is to ensure a sound lime and fertilizer program based on nutrient availability and balance for good growth of the grass. A healthy plant is less susceptible to disease and other pests.
2. **Calibration of Equipment.** All spreaders and sprayers must be repaired, if needed, and calibrated for proper distribution of fertilizers and pesticides.
3. **Mowing.** Following irrigation, mowing is the most important and most time consuming maintenance operation on a golf course. Without regular mowing at the appropriate heights of cut, the course would become unplayable. With good mowing practices, density, texture, color, root development, wear tolerance and other aspects of turf quality are enhanced.
4. **Fertilizing.** The fertilizer program will be based on soil test results for pH, calcium, magnesium, phosphorus and potassium and on tissue analysis for nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron and manganese. Nitrogen fertilization will be determined by color, density and the rate of growth (clipping yields) of the grass as well as soil nitrogen reserves (as determined from testing) and tissue testing. Interpretation of soil nitrogen analyses to exact amounts which are available to the plant is difficult. For this reason, nitrogen rates are not to be based solely on soil testing.

5. **Irrigation Program.** Each time water is applied, operate the system long enough to wet the soil to the depth of rooting. When greens are stressed, hand water or syringe during the heat of the day in addition to regular night irrigation.
6. **Spiking.** This procedure is needed to relieve surface compaction and insure good gas exchange (oxygen and carbon dioxide).
7. **Vertical Mowing.** During the growing season, this operation is needed to reduce mower induced grain and thatch buildup, and to provide a smoother, faster putting surface.
8. **Aerifying.** Aerifying surfaces relieves compaction, increases soil and surface air exchange and improves fertilizer and water movement into the soil.
9. **Topdressing.** In addition to following aerification, apply topdressing once or twice per month during the growing season at the rate of one-quarter cubic yard per 1000 square feet. This practice not only helps control thatch, but also helps provide a smooth, true surface for mowing and accurate ball roll.
10. **Liming.** Apply dolomitic limestone where soil test results indicate a need.
11. **Nematode Control.** May be needed infrequently. Use soil nematode analysis to determine population levels and suggest treatment.
12. **Wetting Agent Applications.** If localized dry spots appear on the greens, apply a good quality wetting agent and water immediately to prevent yellowing of the grass. Use a wetting agent when applying a liquid fertilizer or pesticide unless the label states otherwise.
13. **Raking and Edging Bunkers.** Rake bunkers daily and edge at least once per month. Edging waste is to be composted.
14. **Weed Control.** Monitor for the presence of weeds. If the population becomes so large that it affects the playing surface, use the appropriate herbicide. Also see Section on weed control in 'Specific Local Problems'.
15. **Insect Control.** Monitor daily for beetles, grubs, caterpillars and other insect pests. Do not treat unless the pest is found, identified and present in damaging numbers. Also see Section on insect control in 'Specific Local Problems'.
16. **Disease Control.** During periods when disease or conditions favoring a disease outbreak are prevalent, inspect the surfaces daily and treat only as necessary. Also see Section on disease control in 'Specific Local Problems'.

- 17. Native Grass.** Native grass areas shall be left in a natural herbaceous meadow condition. These areas shall be mowed to a height of six (6) inches once a year only. Clippings shall be mulched in place unless otherwise specified.
- 18. 25-foot Vegetated Filter Strip.** Native grasses within the 25-foot vegetated filter strip shall be mowed no more often than two times per year. All clippings shall be removed for disposal at a location more than 25 feet from a wetland area. No fertilizers, including organic fertilizers, shall be applied to native grasses within this filter strip. Turf grass roughs located within the 25-foot vegetated filter strip may be fertilized once per year if necessary to maintain a healthy, dense vegetative growth. No pesticides shall be applied within the 25-foot vegetated filter strip except as required for the control of *Phragmites communis* (see maintenance activity #23). All activities to be conducted within the 25-foot vegetated filter strips are subject to the limitations and restrictions specified on the plan entitled Limited Activities provided as Appendix VI.
- 19. 20-foot Prohibited Buffer.** Mowing of herbaceous vegetation within 20 feet of wetlands shall occur no more frequently than twice per year. No fertilizers, including organic fertilizers, shall be applied within this buffer. No pesticides shall be applied within the 20-foot prohibited buffer except as required for the control of *Phragmites communis* (see maintenance activity #23). No grass clippings, leaves, or other organic materials shall be deposited in or disposed of within 25 feet of a wetland boundary. No aeration plugs shall be deposited in or disposed of within 120 feet of a wetland boundary. All activities to be conducted within the 20-foot Prohibited Buffer are subject to the limitations and restrictions specified on the plan entitled Limited Activities provided as Appendix VI.
- 20. Wetland Play-over.** Wetland Play-over areas are to be left in a natural state. No mowing, fertilizer applications, and/or pesticide applications are to be made within the play-over areas except as required for the control of *Phragmites communis* (see maintenance activity #23). Play-over areas are to be pruned as specified on the plan entitled Limited Activities, a copy of which is posted in the golf course superintendent's office and provided in Appendix VI. Such pruning is to be done no more frequently than once per year and is to be conducted only during the months of December, January, and February. The objective of pruning in play-over areas is to ensure visibility of the edges of fairways and bunkers from tees.
- 21. Debris Removal from Wetlands and 20-foot Prohibited Buffer.** Debris interfering with surface drainage, trash, litter, and golf balls shall be removed from wetlands and the 20-foot prohibited buffer as a single event no more frequently than twice per year: once in January and once in August. All such removal of debris, trash, and golf balls shall be conducted by hand. No mechanized equipment shall be used in either the wetlands or the 20-foot prohibited buffer.

- 22. Bird boxes.** All bird boxes shall be cleaned out each December and inspected for soundness and use. Unsound boxes shall be repaired or replaced. Boxes not used for three consecutive years shall be relocated to a more appropriate site. The golf club will consult with the staff of the Brinton Brook Wildlife Sanctuary concerning types and appropriate sites for the relocation of the bird boxes.
- 23. Control of *Phragmites communis*.** The growth of common reedgrass (*Phragmites communis*) in wetland areas W-12A and W-12B, Water Quality Basins #8 and #16, the stream channel discharging from wetland area W-12C, and all other locations is to be controlled at all times so as to prevent the spread of this plant to adjacent properties. Control is to be accomplished through the application of the herbicide Rodeo® (Monsanto Corporation) by wicking to the above-ground portion of the plant in accordance with label instructions.

BASIC ANNUAL MAINTENANCE GUIDE Hudson National Golf Club													
Location and Operation	J	F	M	A	M	J	J	A	S	O	N	D	Remarks
General													
Soil Analysis				X	X	X	X	X					1
Calibrate Equipment			X										2
Greens:													
Mowing	X	X	X	X	X	X	X	X	X	X	X	X	3
Fertilizing				X	X	X	X	X	X	X	X	X	4
Irrigating					X	X	X	X	X				5
Spiking				X	X	X	X	X	X				6
Vertical Mowing				X	X	X			X	X			7
Aerifying			X		X		X		X	X			8
Topdressing			X	X	X	X		X	X	X		X	9
Liming					X								10
Disease Control			X	X	X	X	X	X	X	X	X	X	16
Weed Control				X	X	X	X	X	X				14
Insect Control						X	X	X	X				15, 11
Wetting Agents						X	X	X	X				12
Tees													
Mowing			X	X	X	X	X	X	X	X	X		3
Fertilizing				X	X	X	X	X	X	X	X	X	4
Irrigating					X	X	X	X	X				5
Spiking				X	X	X	X	X	X				6
Vertical Mowing					X	X			X				7
Aerifying			X		X				X				8
Topdressing					X	X			X				9
Disease Control			X	X	X	X	X	X	X	X	X	X	16
Weed Control				X	X	X	X	X	X				14
Insect Control							X	X	X				15

BASIC ANNUAL MAINTENANCE GUIDE Hudson National Golf Club													
Location and Operation	J	F	M	A	M	J	J	A	S	O	N	D	Remarks
Liming				X									10
Fairways:													
Mowing			X	X	X	X	X	X	X	X	X		3
Fertilizing					X	X	X	X	X	X	X	X	4
Irrigating					X	X	X	X	X				5
Aerifying						X							8
Disease Control						X	X	X	X	X	X	X	16
Weed Control				X	X	X	X	X	X				14
Insect Control					X	X	X	X	X				15
Liming					X								10
Roughs													
Mowing				X	X	X	X	X	X	X	X		3
Fertilizing					X				X				4
Irrigating					X	X	X	X	X				5
Liming						X							10
Bunkers													
Raking & Edging			X	X	X	X	X	X	X	X	X		13
Native Grass													17
Mowing							X				X		
Fertilizing													
Liming						X							
25-ft Vegetated Filter Strip													18
Mowing							X				X		
Fertilization					X								

BASIC ANNUAL MAINTENANCE GUIDE Hudson National Golf Club													
Location and Operation	J	F	M	A	M	J	J	A	S	O	N	D	Remarks
20-ft Prohibited Buffer													19
Mowing							X*				X		
Fertilizing													
Wetland Playover													20
Pruning	X	X										X	
Drainage Clearing	X							X					
Ball Removal	X							X					
Bird Boxes													22
Clean out	X											X	
Repair/Replace	X											X	
Relocate	X											X	
Wetland Weed Control													20, 23
<i>P. Communis</i>							X	X					
Snow Mold Prevention		X									X	X	
Intermediate Rough													
Mowing			X	X	X	X	X	X	X				3
Fertilizing					X	X			X				4
Irrigating				X	X	X	X	X	X				5
Aerifying						X							8
Disease Control						X	X	X	X	X	X	X	16
Weed Control				X	X	X	X	X	X				14
Insect Control					X	X	X	X	X				15
Liming					X								10

* Mowing of the 20-foot Prohibited Buffer in July is an optional activity.

INTEGRATED PEST MANAGEMENT

Integrated Pest Management (IPM) programs rely on six basic approaches for plant protection. These include the following: 1) **Regulatory** - using certified seed and sod to prevent unwanted weed contamination; 2) **Genetic** - selecting improved grasses which perform well in specific areas and show a resistance to pest problems; 3) **Cultural** - following recommendations made for proper primary and secondary cultural practices which will maintain the turf in the most healthy condition and influence its susceptibility and recovery from pest problems; 4) **Physical** - cleaning equipment to prevent spreading of diseases and weeds from infected areas; 5) **Biological** - for a limited number of pest problems biological control can be used whereby natural enemies are introduced to effectively compete with the pest; 6) **Chemical** - pesticides are a necessary and beneficial approach to turf pest problems, but use can be restricted in many cases to curative rather than preventive applications, thus reducing environmental exposure.

PESTICIDE SELECTION

Background Considerations. Pesticide selection must be based on effectiveness, toxicity to non-target species, solubility and persistence. Few pesticide applications are to be made on a regularly scheduled basis. Exceptions may include preemergence herbicides and fungicides used to control *Pythium* and patch diseases. Additionally, materials must be applied strictly in accordance with label instructions, at labeled rates, under appropriate environmental conditions (i.e. no spraying on days when winds exceed 10 knots or when rain is forecast), with a low-

volume sprayer to reduce the possibility of drift. Also, materials must be rotated as to use in order to deter the development of resistant strains of pests which may require more frequent and/or higher rates of pesticide applications.

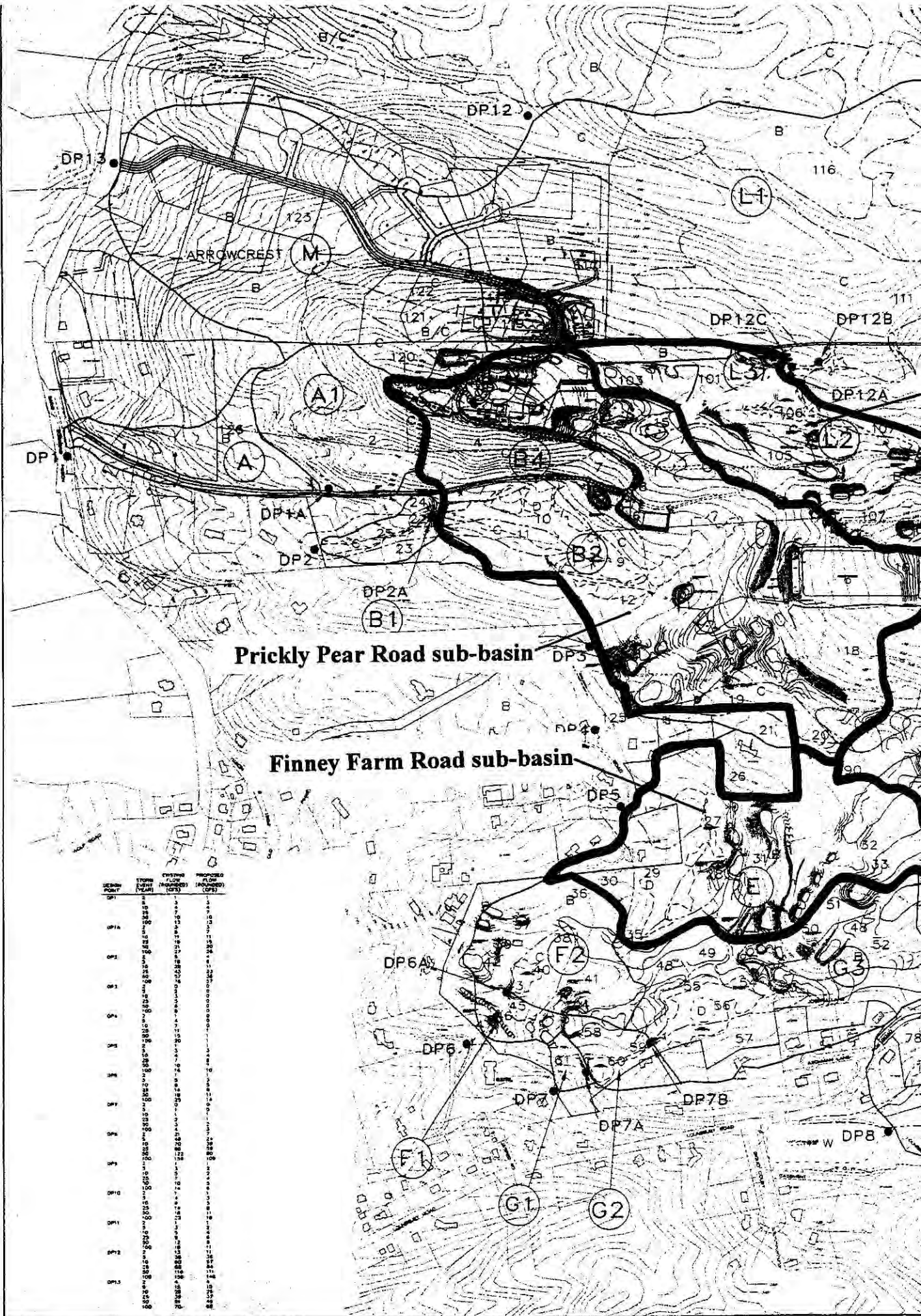
The greatest potential for contamination of both surface and subsurface waters from pesticide application is the movement of materials with water. A number of factors determine the potential for pesticide movement and ground water contamination. Pesticide factors include reactivity with the soil, half-life, and time and rate of application. Soil factors also influence vulnerability, with sandy soils low in organic matter having a greater tendency for problems. Soil pH and the presence of channels which may provide macropore flow also are factors influencing movement. The application site is more vulnerable if it has a shallow depth to the ground water table, and/or is in a particularly wet climate. Excessive irrigation also increases site vulnerability, as does pesticide injection into the soil through the turf canopy (Anonymous, 1989). As part of the overall interaction of management practices, Weber (1989) has shown that plant water use will slow the leaching of pesticides and allow for more interaction within the root zone where material degradation is faster.

Balogh and Anderson (1992) summarized in an exhaustive literature review that the rate and timing of pesticide application in relation to precipitation/irrigation that produces runoff or leaching episodes is a critical management consideration. No pesticide applications are to be made when the possibility of rain is imminent. Materials which require water for activation are best watered into the soil with controlled irrigation.

Screening of Materials for Use at Hudson National Golf Club. Several models have been used in assessment of pesticides for use at Hudson National Golf Club. The objective of this modeling was to determine if any U.S. EPA and State of New York registered pesticides should be either excluded from use at the golf course or carefully monitored given consideration of critical site conditions specific to the Hudson National Golf Club. The first model employed was NPURG as used in Petrovic's report on pesticide use for the Prickly Pear Hill Golf Club. Additional models were used to further assess pesticides. They included Deubert (1990), a model developed by the University of Florida (Augustijn-Beckers et al, 1991), and Weber (1990). Specifics regarding each of these models, including model results, are presented in Appendix III. Based on the results of these models, a list of specific pesticides approved for use at the Hudson National Golf Club has been developed. This list is presented in Appendix I.

Pesticide Restrictions. In addition to modeling, pesticides were further evaluated by examining HALs (Health Advisory Limits, EPA) and LC_{50} or MACs, a measure of aquatic toxicity. If HALs were less than or equal to 100 ppb and less than or equal to 50 ppb for MAC/ LC_{50} then additional analyses were conducted. As a result of this assessment, specific restrictions on the use of bentazon, chlorpyrifos, ethoprop, fenamiphos, isofenphos, and trichlorfon have been developed for the following drainage areas [See Limited Activities Map in Appendix VI for locations (Figure 1)]: 1) The Brinton Brook drainage, sub-basins L1, L2 & L3; 2) Finney Farm Road drainage, sub-basin E; and 3) Prickly Pear drainage, sub-basin B2.

The specific restrictions placed on the use of bentazon, chlorpyrifos, ethoprop, fenamiphos, isofenphos, and trichlorfon in the three drainage areas are presented in Table 7.



Prickly Pear Road sub-basin

Finney Farm Road sub-basin

POINT	STORM FLOW (CFS)	CWATER FLOW (CFS)	PROPOSED FLOW (CFS)
DP1	100	100	100
DP1A	100	100	100
DP2	100	100	100
DP3	100	100	100
DP4	100	100	100
DP5	100	100	100
DP6	100	100	100
DP6A	100	100	100
DP7	100	100	100
DP7A	100	100	100
DP7B	100	100	100
DP8	100	100	100
DP9	100	100	100
DP10	100	100	100
DP11	100	100	100
DP12	100	100	100
DP13	100	100	100

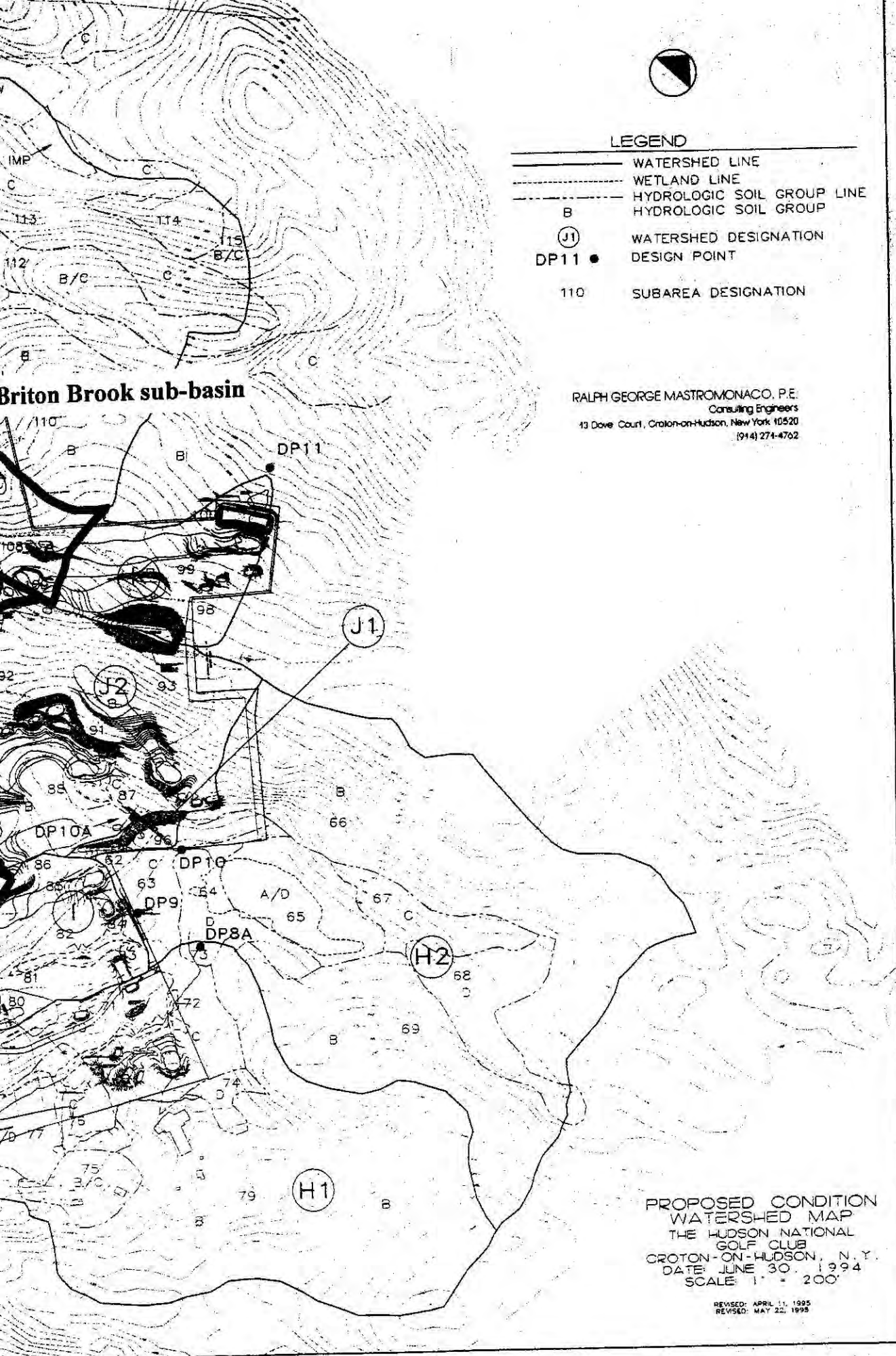


Figure 1. Location of drainage sub-basins for which there are restrictions of certain pesticides.

In addition to the restrictions specified in Table 7, the use of trifluralin, benefin, and fenamiphos is prohibited within the Jane E. Lytle Memorial Arboretum drainage basin (see basin boundaries on the plan entitled Limited Activities in Appendix VI); the use of PCNB is prohibited at the Hudson National Golf Club; no pesticide which cannot be appropriately analyzed in water monitoring efforts may be applied to the golf course unless it can be demonstrated to the satisfaction of the Village Planning Board that it is an intrinsically low risk pesticide in terms of its mobility, persistence, and toxicity; and no pesticides are to be applied via the fertigation system.

Table 7. Restrictions for use of pesticides at four areas (Brinton Brook Pond, Finney Farm Road, Prickly Pear Road, and Arboretum drainage sub-basins).†

Pesticide	Applications ^a	Rate ^b	Restrictions ^c
Insecticides			
Chlorpyrifos	2	2	No more than 20% treated at any one time. A 30 day waiting period between applications.
Ethoprop	1	5	Not used on greens and tees. No more than 20% treated at any one time.
Isofenphos	2	2	No more than 50% treated annually. A 90 day waiting period between applications.
Trichlorfon	1	8	Not used on greens and tees. No more than 50% treated at any one time.
Herbicides			
Bentazon	Application to no more than 25 acres	1	Spot treatment.
Nematicides			
Fenamiphos	1	10	Used on greens only.
† Acreage is given as the percent of total area of greens, tees, fairways and roughs in the three areas. Spot treatment will be used when possible. ^a Applications per year ^b rate per application in pounds active ingredient per acre. ^c Restrictions: percent of area treated refers to total restricted areas on the golf course; thus no more than 20% of the restricted area may be treated at one time. The number of days between applications is the number days between actual applications, thus if green X were in a restricted area, and was treated, it could not be treated until the waiting period had expired.			

PEST CONTROL RECOMMENDATIONS

As a component of IPM, the golf course superintendent must make decisions about pest problems and develop control recommendations including the judicious use of pesticides. Figure 2 is a suggested flow chart for decision making based on IPM strategies. Strategies include identifying an anticipated pest complex, assessing the interrelationship of disease infection and expression of symptoms, noting temperature ranges when diseases most prevalent on cool-season grasses are active, and identifying timing for optimum insect and weed control. As part of the strategy, pesticides approved for use based on the screening previously noted in this plan are suggested for use with each specific pest.

DISEASE CONTROL

Disease incidence is closely linked to environmental factors, primarily temperature, humidity, and amount of sunshine. The temperature ranges which favor development and growth of turfgrass pathogens are given in Figure 3. As part of the IPM strategies, logging of daily temperature information will be critical to note when disease development is favored. While this approach is helpful for many diseases, there are several in which infection and expression of symptoms are distinctly different (Figure 4). For these specific pests, preventative treatments will be made. Fungicides which are recommended and approved for use on the golf course are listed in Table 8.

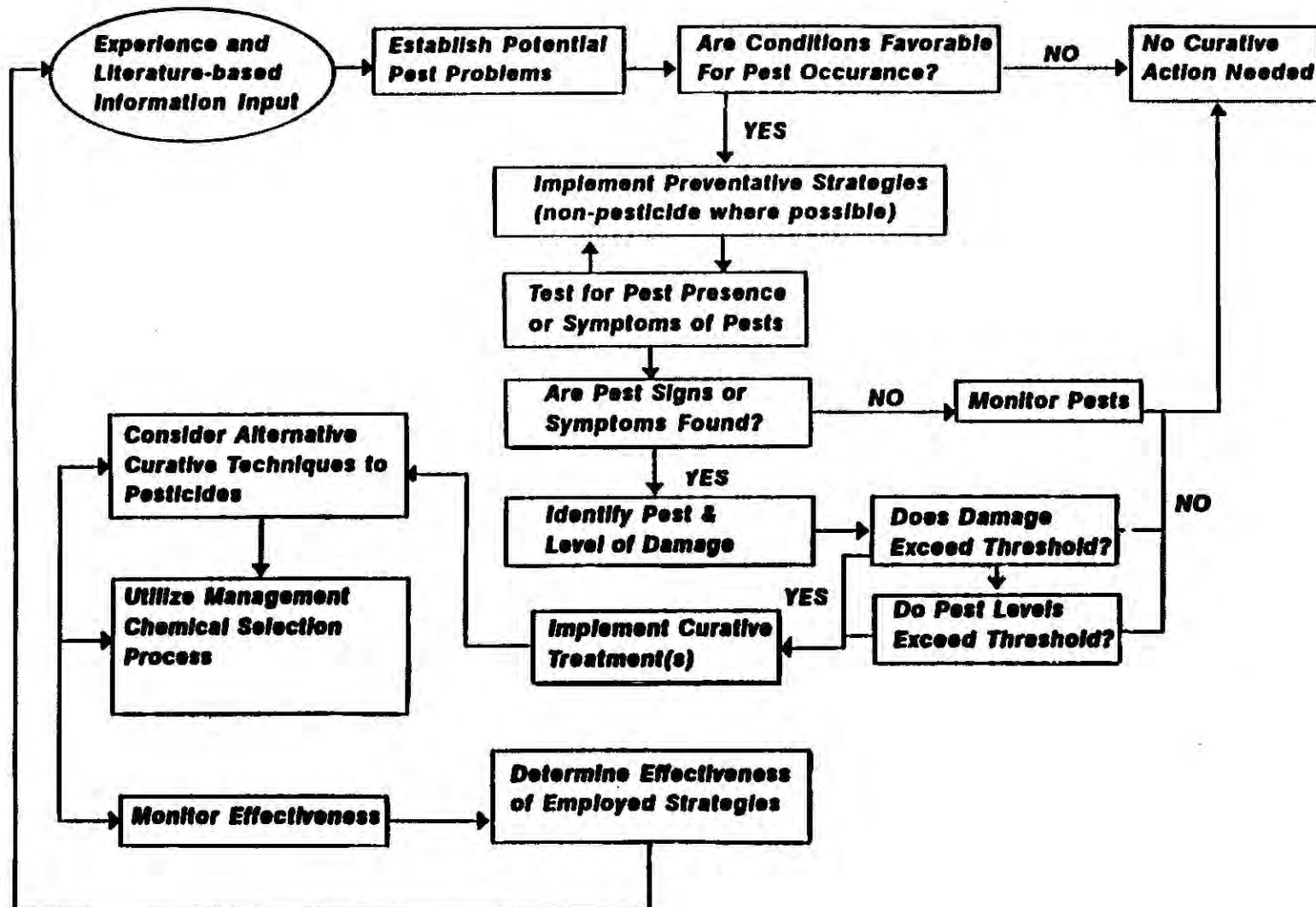
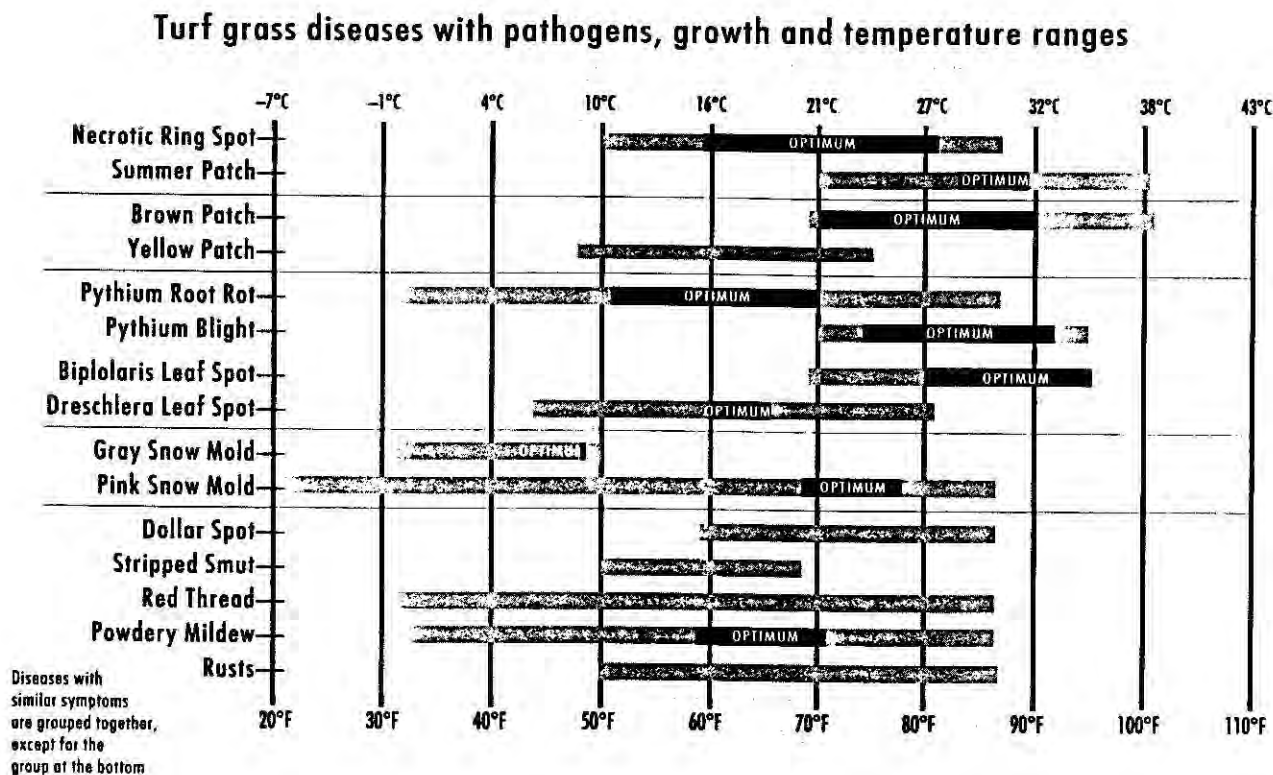


Figure 2. Integrated Pest Management Plan Decision Flow Chart.

Figure 3. Temperature Ranges for Turfgrass Disease Development.

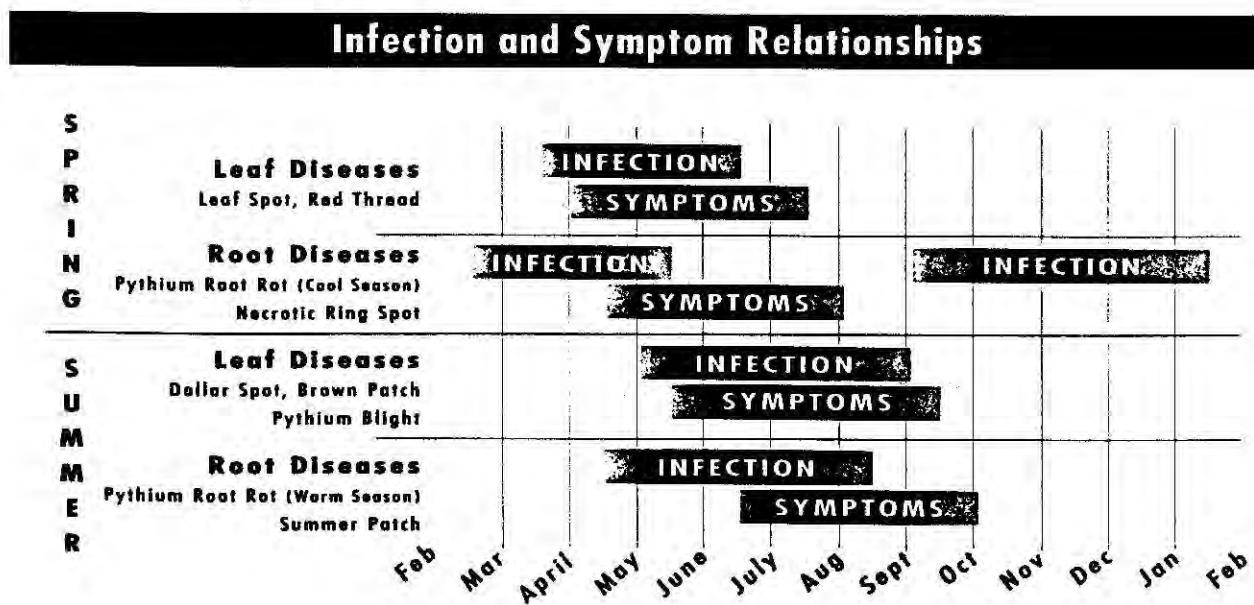


DISEASE	PATHOGEN	TEMP. RANGE OF GROWTH	TEMP. OPTIMUM GROWTH
Necrotic Ring Spot	<i>Leptosphaeria korrae</i>	50-86 °F (10-30°C)	59-82 °F (15-28°C)
Summer Patch	<i>Magnaporthe poae</i>	70-105 °F (21-41°C)	83-87 °F (28-31°C)
Brown Patch	<i>Rhizoctonia</i> spp.	68-105°F (20-41°C)	70-90 °F (21-32°C)
Yellow Patch	<i>Rhizoctonia cerealis</i>	47-75 °F (8-24°C)	Not determined
Pythium Root Rot	<i>Pythium</i> spp.	32-86 °F (0-30°C)	52-70 °F (11-21°C)
Pythium Blight	<i>Pythium</i> spp.	70-95 °F (21-35°C)	74-93 °F (23-2°C)
Bipolaris Leaf Spot	<i>Bipolaris sorokiniana</i>	68-95 °F (20-35°C)	>80 °F (>27°C)
Dreischlera Leaf Spot	<i>Dreischlera</i> spp.	43-81 °F (6-27°C)	59-65 °F (15-18°C)
Gray Snow Mold	<i>Typhula</i> spp.	32-50 °F (0-10°C)	48 °F (8°C)
Pink Snow Mold	<i>Microdochium nivale</i>	22-86 °F (5-30°C)	68-77 °F (20-25°C)
Dollar Spot	<i>Sclerotinia homoeocarpa</i>	59-86 °F (15-30°C)	Not determined
Stripped Smut	<i>Ustilago</i> spp.	50-68 °F (10-20°C)	Not determined
Red Thread	<i>Laetisaria fuciformis</i>	32-86 °F (0-30°C)	Not determined
Powdery Mildew	<i>Erysiphe graminis</i>	34-86 °F (1-30°C)	59-72 °F (15-22°C)
Rusts	<i>Puccinia</i> spp.	50-86 °F (10-30°C)	Not determined

AS YOU CAN SEE FROM THE ABOVE TABLE AND CHART, temperature ranges can be, in some cases, a definitive diagnostic tool when identifying fungal pathogen damage in turf and in others case at least helpful. But in order to use temperature ranges as a diagnostic tool it is necessary that precise data on air or soil temperatures be kept on a systematic basis.

spp. = species

Figure 4. Interrelationship Between Turfgrass Disease Infection and Symptom Development.



No annual fungicide program can, nor should, be developed for this golf course, although several disease problems previously identified can only be treated by a preventative approach. Following sound cultural programs, and practicing routine scouting and monitoring of turf and environmental conditions will minimize the need for excessive preventative and curative applications.

Table 8. Fungicides† recommended for control of specific turfgrass diseases at Hudson National Golf Club.		
Disease	Greens/Tees	Fairways/Roughs
Brown Patch	azoxystrobin, chlorothalonil, iprodione, mancozeb, propiconazole, thiram, triadimefon, vinclozalin	iprodione, propiconazole, thiram, triadimefon
Dollar Spot	chlorothalonil, iprodione, propiconazole, thiram, triadimefon, vinclozalin	iprodione, propiconazole, thiram, triadimefon
Leaf Spots	chlorothalonil, iprodione, mancozeb, vinclozalin	iprodione
Necrotic Ringspot	fenarimol, iprodione	iprodione
Pink Snow Mold	azoxystrobin, iprodione, thiophanate, triadimefon, vinclozalin	iprodione, triadimefon
Pythium Blight	etridiazole, fosetyl-Al	fosetyl-Al, metalaxyl
Pythium Root Rot	fosetyl-Al	fosetyl-Al
Summer Patch	iprodione, propiconazole, triadimefon	iprodione, propiconazole, triadimefon
Typhula Blight	azoxystrobin, chlorothalonil, iprodione, thiram, triadimefon	iprodione, thiram, triadimefon
† All materials must be applied at rates and under conditions prescribed by the label.		

Brown Patch. Controlling thatch levels and avoiding excess nitrogen will aid in controlling disease incidence. Use of several natural organic fertilizer/composts in the fertilization/topdressing programs have been shown to reduce the incidence of brown patch by up

to 75% (Nelson, 1990). Daily scouting is reported during periods of warm weather. On greens and tees, apply curative treatment upon detection of any incidence. On fairways, apply treatment upon detection of 2 to 3 incidences which are 2 to 4 inches in diameter per 100 sq.ft. of area. In roughs, treatment is to be applied only when incidences exceed 4 to 6 per 100 sq.ft. and are 4 to 6 inches in diameter and weather conditions are favorable for further disease development per Figure 3.

Dollar Spot. This disease is favored by low nitrogen levels. Use of several natural organic fertilizers/composts has been shown to reduce incidence by up to 45% (Nelson, 1990). This disease is slow to develop and cause damage; therefore, daily scouting during the months which favor disease development should preclude treatment except on a curative basis. On greens and tees, apply curative treatment upon detection of any incidence. On fairways, apply treatment upon detection of 2 or more incidences which are greater than 0.5 inch diameter per square foot. In roughs, apply only when incidences with a diameter greater than 0.75 inch exceed 4 to 6 per sq.ft. and weather conditions are favorable for further disease development per Figure 3.

Leaf Spots. Cooler temperatures favor development, primarily during April and May. Avoiding heavy spring fertilization can reduce the damage. On greens and tees, apply curative treatment upon detection of any incidence which is forming patches or thinning the turf. On fairways, apply when incidences of patches exceed 2 to 3 per sq.ft. or when the turf appears to be thinning. In roughs, apply only when incidences appear to be thinning the turf.

Necrotic Ringspot. This disease occurs in cool-wet weather and is most severe with excessive nitrogen fertilization and over- or under-watering. A preventative strategy must be employed on areas with a history of disease development. Preventative treatments must be applied to greens and tees which have a previous history of infection when cool-wet weather occurs. On fairways and roughs, treatment should occur upon detection of any incidence.

Pink Snow Mold. This is most prevalent during cold temperatures (32 to 40 F) and wet conditions. Avoiding late fall nitrogen applications can reduce the severity. On all areas, curative applications should be made upon detection of any incidence prior to any snowfall. Preventative applications should be made prior to snowfall which will provide prolonged cover.

Pythium Root Rot and Blight. This is a rapidly developing and devastating disease. It is favored by excessive nitrogen fertilization and very wet and hot weather. An attack can result in the death of an entire green, tee or fairway in a matter of hours. This disease is easily spread if in the blight stage. The root rot form is exceptionally damaging since it requires long recovery periods, often during summer months when temperature conditions are not favorable for root growth. Because of the severity of damage, a preventative approach is taken during weather conditions which favor disease development. Also, apply pesticide upon detection of any incidence on any area.

Summer Patch. Over fertilization with nitrogen and excessive irrigation increase the likelihood of disease development. Damage to the plant occurs in April and May, prior to

symptom development (Figure 4). Curative treatments are to be made on any area where incidence is noted. Preventative treatments are to be made in April and May, prior to symptom development, on areas which have a previous history (see Figure 4).

Typhula Blight or Gray Snow Mold. This disease requires snow cover to develop. Winters with little or no snow fall usually have a low incidence of disease. Avoiding over fertilization with nitrogen in the mid-fall reduces the severity. A preventative fungicide program is used to ensure minimal turf damage since long term weather predictions are imprecise. A preventative fungicide application is to be made prior to snowfall.

INSECT CONTROL

Insect problems at this course will be minimal, primarily root feeding grubs. Routine scouting and sampling of turf for adults and grubs will isolate areas of concern and target control measures. While nonchemical treatments such as parasitic nematodes and bacteria for insect control are available, they do not give the degree of consistency, reliability and versatility required and have proven to be ineffective in many circumstances (Potter, 1993). Suggested thresholds for chemical treatment adapted from Hellman (1992), Bhowmik et al. (1991) and Villani (1992) are given in Table 9.

Table 9. Suggested thresholds for treatment of insect problems at Hudson National Golf Club.	
Insects	#/sq.ft.
Grubs	
Japanese beetle	4 to 10
European chafer	4 to 6
Asiatic garden beetle	5 to 18
Oriental beetle	5 to 7
Hyperodes weevil	30 to 50
Sod webworm	no estimate

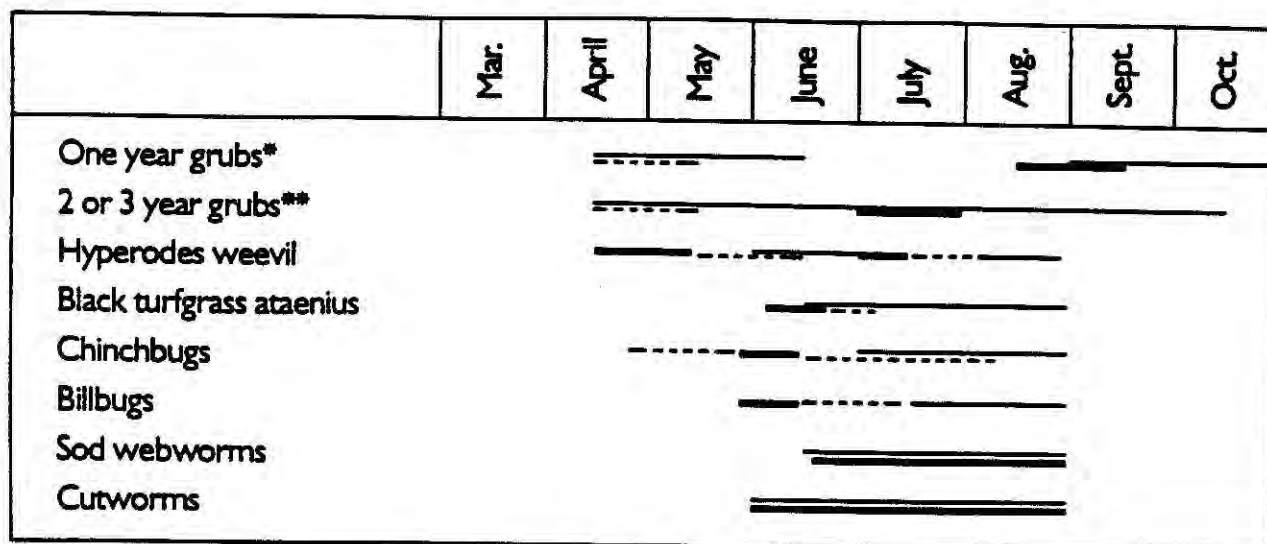
Insecticides which are recommended and approved for use at the Hudson National Golf Club are listed in Table 10.

Table 10. Insecticides† recommended for control of specific turfgrass insects at Hudson National Golf Club.		
Insect	Greens/Tees	Fairways/Roughs
Hyperodes weevil	chlorpyrifos, isofenphos	chlorpyrifos, isofenphos
White grubs	bendiocarb, carbaryl, chlorpyrifos, isofenphos	bendiocarb, carbaryl, ethoprop, trichlorfon
Sod webworms	carbaryl, chlorpyrifos	carbaryl, chlorpyrifos
† All materials must be applied at rates and under conditions prescribed by the label.		

Hyperodes weevil. This insect attacks only the annual bluegrass plant. Therefore, if the annual bluegrass weed control program is effective, a minimum of damage will occur with this insect. Sampling of the adult population in the spring will determine if selected areas need to be treated.

White grubs. Several species of insect have larval forms as white grubs that feed on the turfgrass roots at the soil/thatch interface. They can be extremely destructive, especially in the advanced larval stage. The key to successful control is identifying threshold levels and treating when larvae are in the earliest stages, July for May or June beetles, and August or September for most others (Figure 5). Insecticide applications will be made when larvae are still active at the soil surface.

Figure 5. Recommended Timing of Insecticide Applications for Optimum Efficacy.



----- periods when damage most likely to occur
 ===== best time to treat
 ----- second best time to treat

* Japanese beetles, European chafer, Masked chafer, Oriental beetle, Asiatic garden beetle

** May or June beetles

Sod Webworms. These are caterpillar larvae of several species of moths. They can be very destructive if not diagnosed and treated early. The adult moths are inactive in the daytime and can be observed resting on the turfgrass, weeds, or on the leaves and stems of trees or shrubs. Likewise, the larvae are night feeders on the leaves of the grass. Scouting for both adults and larvae burrowed down in the grass can determine if damaging numbers are present. While summer months are when the moth activity is greatest, several species have 2 or 3 life cycles per year. Monitoring is critical to ensuring timely treatment. Evening treatment is required since that is when the larvae are active.

WEED CONTROL

The most effective weed control is a dense healthy turf. Paying strict attention to optimum cultural practices to maintain an aggressive turf is the first requisite in weed control. Herbicides which are recommended and approved based on the selection guidelines previously noted are listed in Table 11.

Annual bluegrass. While the common name implies this is an annual weed problem, the sub-species (*Poa annua* spp. *reptans*) of this pest problem is actually a perennial. Growth and persistence of annual bluegrass is favored by compacted and/or wet soils, high soil pH, and high soil phosphorus levels. Keeping cultural practices current to prevent these conditions and favor the growth of the preferred grasses will minimize the competition from annual bluegrass.

Table 11. Herbicides† and Plant Growth Regulators† recommended for control of specific turfgrass weeds at Hudson National Golf Club.			
Weed	Greens/Tees	Fairways	Roughs
Annual bluegrass	ethofumesate, cimectacarb, paclobutrazol	ethofumesate, cimectacarb, paclobutrazol	ethofumesate, cimectacarb, paclobutrazol
Clover	None suitable	MCPP	MCPP
Broadleafs	2,4-D	2,4-D, dicamba, MCPP	2,4-D, dicamba, MCPP
Crabgrass	bensulide, DCPA, bensulide + oxadiazon	bensulide, DCPA	benefin, DCPA, bensulide, MSMA, pendimethalin, trifluralin
† All materials must be applied at rates and under conditions prescribed by the label.			

Clover and other broadleaf weeds. Clover is likely to be found only in non-irrigated areas since it persists only under dry conditions. Other broadleaf weeds will invade weakened or thin turf.

Crabgrass. This is an annual grassy weed that invades thin turf. Crabgrass seeds require light for germination; thus, an effective control is to maintain a dense stand of grass. Crabgrass seed is known to germinate when soil temperatures reach 53 to 58° F at a 4-inch depth.

Necessary herbicide applications are to be made just prior to soil temperatures reaching this range.

The following are guidelines under which turf weed management, by use of herbicides, is to be initiated.

% Weeds Tolerated		
	Grassy Weeds	Broadleaf Weeds
Greens	0 – 1	0 – 1
Tees	2 – 6	1 – 4
Fairways	3 – 8	2 – 7
Roughs	7 – 12	8 – 13

Common Reedgrass (*Phragmites communis*). The growth of the common reed, *Phragmites communis*, in Wetland Areas W-12A and W-12B, Water Quality Basins #8 and #16, and the stream channel discharging from Wetland Area W-12C is to be controlled at all times so as to prevent the spread of this plant to adjacent properties. Control is to be accomplished either through the hand removal of individual plants or through the application of Rodeo® (Monsanto Corporation) by wick to the above-ground portion of the plant during the active growing season and in accordance with label instructions. Control of this plant is to be conducted annually, as necessary, during the peak period of inflorescence. Application of the herbicide Rodeo must be done by a NYS-licensed aquatic pesticide applicator.

Pond Weeds. Pond weeds within the irrigation pond are to be controlled through either hand removal or drawdown of the pond water level during the period of December through February. Drawdown of pond water levels is to be conducted in accordance with the protocol specified herein under the section entitled **WETLAND MANAGEMENT PLAN - Irrigation Pond Management Plan**.

Grass carp may be used to control aquatic weed infestations in the irrigation pond. The use of the grass carp will follow NY Department of Conservation guidelines. Grass carp are used as a form of biological control in ponds and lakes. Normally only the triploid (sterile) form of this fish used. Non-reproducing populations are maintained so that the grass carp numbers don't exceed the number needed to control the weed infestation; and, non-reproducing populations are maintained so that in the event fish escape to another water body they do not destroy the balance of naturally-occurring aquatic vegetation.

Moss Control. Hudson National Golf Course will utilize an integrated approach against the spread of moss on putting green surfaces. Practices to combat this problem will include: light and frequent sand topdressing applications, vertical mowing, spiking, surface drying via Sub-Air treatments, hand watering of localized dry spots and lastly, dishwashing soap combined with iron sulfate to desiccate moss colonies.

Purple Loosestrife. The growth of purple loosestrife (*Lythrum salicaria*) on the golf course property is to be controlled at all times so as to prevent the spread of this plant to adjacent properties. Control is to be accomplished through the hand removal of plants upon detection.

PESTICIDE SAFETY

STORAGE

Pesticides are to be stored in a separate room designated for these materials only. The room must be kept locked and posted as required by law. The Club's 'Hazard Communication Program and Emergency Response Plan' also will be posted. Good ventilation is to be provided and chemicals are to be kept away from direct contact with the concrete floor. All pesticides are to be stored in their original containers with visible labels (See Appendix X).

To be prepared for spills and/or leaks, absorbent floor-sweep materials, sawdust or cat litter and activated charcoal must be kept on hand.

An inventory of pesticides and other chemicals is to be kept, and MSDS and labels for each pesticide used must be readily accessible.

A fire extinguisher, protective clothing, respirator and first aid supplies are to be kept in an attainable place and in ready condition.

Water is to be available for both routine and emergency chemical removal, including showers and eye wash facilities.

HANDLING AND APPLICATION

When handling pesticides, special attention must be given to warnings and precautions on the label. Applicators must follow the directions on the label, and adhere to label requirements regarding personal protective gear that is to be worn when mixing and applying pesticides.

Chemicals are to be measured out below eye level; and applicators must not stand directly over the tank when adding chemicals, as they frequently splash and emit dusts.

Mixing and loading must be done in a designated area so that any spills can be handled effectively.

Before mixing chemicals together, their compatibility is to be checked, as chemical incompatibility could result in reduced effectiveness, increased toxicity to the applicator, or phytotoxicity to the turfgrass. The "quart jar method" is to be used to determine compatibility. Spray adjuvants (such as wetting agents, emulsifiers, foaming agents and stickers) are to be used in accordance with label recommendations.

Care must be taken to mix only the amount of pesticide needed for the application. A "large batch" pesticide mixing tank, 300 gallons in size, is located in the pesticide storage facility in the maintenance area of the golf course. This tank is to be used for the mixing of larger quantities of pesticide when such quantities are needed for a given application (e.g., when all greens are treated for Snow Mold). This tank is to be used only for the mixing of a pesticide to be applied in a single application: pesticide is not to be stored in this tank.

In the event that there is excess, the excess material will be disposed of according to label directions.

As soon as pesticides are loaded, all equipment and apparel used is to be washed, rinsed and air dried. Water used in the cleaning process is added into the spray tank as make-up water, or it is pumped to a holding tank and used as mixing water for a future spray application.

Cleaning water from herbicides, insecticides and fungicides is stored in separate storage tanks and is pumped to the storage tanks within the self-contained pesticide building.

After the pesticide is applied, the sprayer tank, boom and nozzles must be washed in the hazardous material storage and washdown area, and the water held (in the holding tanks as described in the paragraph above) to be used as mixing water for the next spray application.

Pesticides are to be sprayed with a sprayer shroud when wind speed is greater than 10 knots. A weather station has been installed at the site so that wind speed may be monitored. Further, a sprayer shroud is to be used in locations near homes, including number 8 green; number 9 tees, fairway, and green number 10 green; number 11 tees and green; number 12 tees; number 13 tees; number 16 green; and number 17 tees.

DISPOSAL

Empty bottles, drums or cans will be disposed of according to the label, which usually states to triple rinse and recycle, recondition or puncture, and dispose. Containers are to be rinsed before spraying so that the rinsate can be put into the spray tank.

When a container has an expired shelf life or is damaged, the manufacturer, supplier or local state agency is to be contacted for assistance in disposal.

EQUIPMENT WASHING SYSTEMS

A CLP Water Maze® has been installed at the general washdown facility. The Water Maze is a closed, wash water recycling system that is used to wash golf course equipment; but not pesticide application equipment. The Water Maze uses a series of separators, skimmers and filters to cleanse water. A description of the system and the general maintenance and service guidelines are presented in Appendix XI.

All sludges and clippings from the Water Maze are applied to rough and native greens via top-dressing equipment.

Pesticide mixing and application equipment is washed in a different location, using a different system than the Water Maze. Pesticide equipment is mixed and washed in a self-contained building. Water used in the cleaning process is added into the spray tank as make-up water, or it is pumped to a holding tank and used as mixing water for a future spray application. Cleaning water from herbicides, insecticides and fungicides is stored in separate storage tanks and is pumped to the storage tanks within the self-contained pesticide building.

PESTICIDE RECORD KEEPING

Proper records of all pesticide applications will be kept according to all village, state, and federal requirements. These records will help establish proof of proper use, facilitate comparison of results of different applications and/or find cause of an error. Records are to include the following information:

1. Date and time of application.
2. Name of applicator.
3. Person directing or authorizing the application.
4. Weather conditions.
5. Target pest.
6. Pesticide Used (trade name, active ingredient, amount of formulation, amount of water).
7. Adjuvant/Surfactant and amount applied, if used.
8. The area of golf course ornamental plantings number of acres or square feet treated.
9. Total amount of pesticide used.
10. Application equipment.
11. Additional remarks, such as severity of the infestation.

In addition to the records specified above, the New York State Department of Environmental Conservation Form entitled "Certified Commercial Applicator or Registered Business Record of Pesticide Purchase and Use" shall be maintained by the Club. A copy of this form is provided on the next page.

Certified Commercial Applicator or Registered Business Record of Pesticide Purchase and Use

PAGE

NAME OF CERTIFIED APPLICATOR OR REGISTERED BUSINESS

ADDRESS

CERTIFICATION/BUSINESS REGISTRATION ID NUMBER

LIST SEPARATELY BELOW ALL PESTICIDES USED.

[illegible]

SPILL PREVENTION AND RESPONSE

PREVENTION

- Mixing of chemicals is to occur only at the designated chemical mixing area that is designed to contain any spillage until it is properly treated with the filtration unit.
- Chemicals are to be transported along prescribed routes chosen to minimize the likelihood of spills (e.g., steep slopes are avoided) and avoid sensitive areas (e.g., wetlands).
- Chemicals applied to the course are to be dilute. Concentrated chemicals are to be stored in a locked storage facility, and mixed only in the specially designed mixing area.
- The least toxic materials, with the shortest half-lives and greatest affinity for soils, are to be used on the course.

TRAINING

- Current pesticide operators licenses are to be maintained by the Golf Course Superintendent, Assistant Superintendent, and Pesticide Spray Technician.
- Safety plans including proper handling and storage as indicated on Material Safety Data Sheets (MSDS) are to be followed.
- Training in proper storage, handling, mixing and containment of spills of chemicals is to be conducted. The golf course superintendent shall maintain records defining who has received training, the date(s) of training, and the subject of the training.

- These training records will be included in the golf course superintendent's Annual Report to the Village.

CONTAINMENT

- Spill containment materials are readily available. Commercially available spill containment kits (containing for example, foam pillows and absorbent material) are to be kept readily available in the chemical mixing area and in the chemical storage area. Any used kits are to be correctly disposed of based on the type of chemical.
- A spill or hose leak on the site will result in the following actions.
 - spray technician is to contact the superintendent or assistant superintendent.
 - appropriate containment measures are to be immediately instituted (e.g., use of containment kit, creation of a berm with a shovel, and isolation of the area).
 - The superintendent or assistant superintendent will immediately notify by telephone the Village engineer, fire department, and environmental monitoring consultant. The NY Department of Environmental Conservation will be contacted when quantities trigger State involvement. The Village's Environmental Monitoring Consultant, in consultation with the Hudson National Golf Club, will establish the appropriate response to be taken..
- Based on the amount of dilute (mixed) chemical released, the following will occur:
 - <10 gallons. Follow actions as listed above.
 - 10-50 gallons. Follow actions as listed above. Additional actions will depend on the chemical's toxicity and location of release.

- >50 gallons. Follow actions listed above. Monitor down-gradient and in potentially affected waters. Monitoring duration will depend on the degradation properties of the chemical, but will include sampling at the time of release, and at appropriate intervals, as determined by the Village's Environmental Monitoring Consultant. Results of the monitoring will be reported to all involved agencies and monitoring will continue until the situation is satisfactorily mitigated. The results of the monitoring will dictate future actions.

WATER QUALITY MONITORING

The Water Quality Monitoring Program at Hudson National Golf Club includes monitoring of surface water, pond sediments, and ground water. The monitoring plan is designed to:

1. Establish a baseline of water and sediment quality prior to construction,
2. Provide data that will establish environmental conditions, thus providing a basis for measuring compliance with environmental regulations, and
3. Ensure that Integrated Pest Management is functioning properly and that no health hazards have developed.

The Water Quality Monitoring Program consists of three phases that coincide with golf course development. Phase I defined pre-development water and sediment quality conditions, Phase II occurred during the construction and development phase and immediate post-development time-frame, and Phase III monitors the post-development, operational golf course condition. Phase III began with golf course grow-in of turf. The results of the Phase I monitoring program are presented in Appendix VII, and the results from Phase II are presented in Appendix VIII.

Tables 12, 13, and 14 in this section will be revised if new analytes are introduced.

SURFACE WATER MONITORING

Phase I: Background Surface Water Quality. The goal of Phase I was to establish background surface water quality at the Hudson National Golf Club. Results of the Phase I surface water quality monitoring are included in Appendix VII.

Phase II: Surface Water Quality during Construction and Immediate Post-Construction Period. The goal of Phase II was to assess construction and immediate post-construction activities on surface water, groundwater and sediment quality. Pesticides and fertilizers were not applied to the course during this Phase of monitoring. The Phase II data are presented in Appendix VIII. As per the previously approved Environmental Management Plan (EMP, July 21, 1997), a report of Phase II data was not generated. Phase II data were transmitted to the appropriate entities within the prescribed timeframe of the EMP. During the Phase II time period the Village and consultants changed the location of sample stations, added sample stations and changed variables to be analyzed. The decision was made by the Village that the data for this time period would be transmitted to the appropriate entities, but that a report was not warranted.

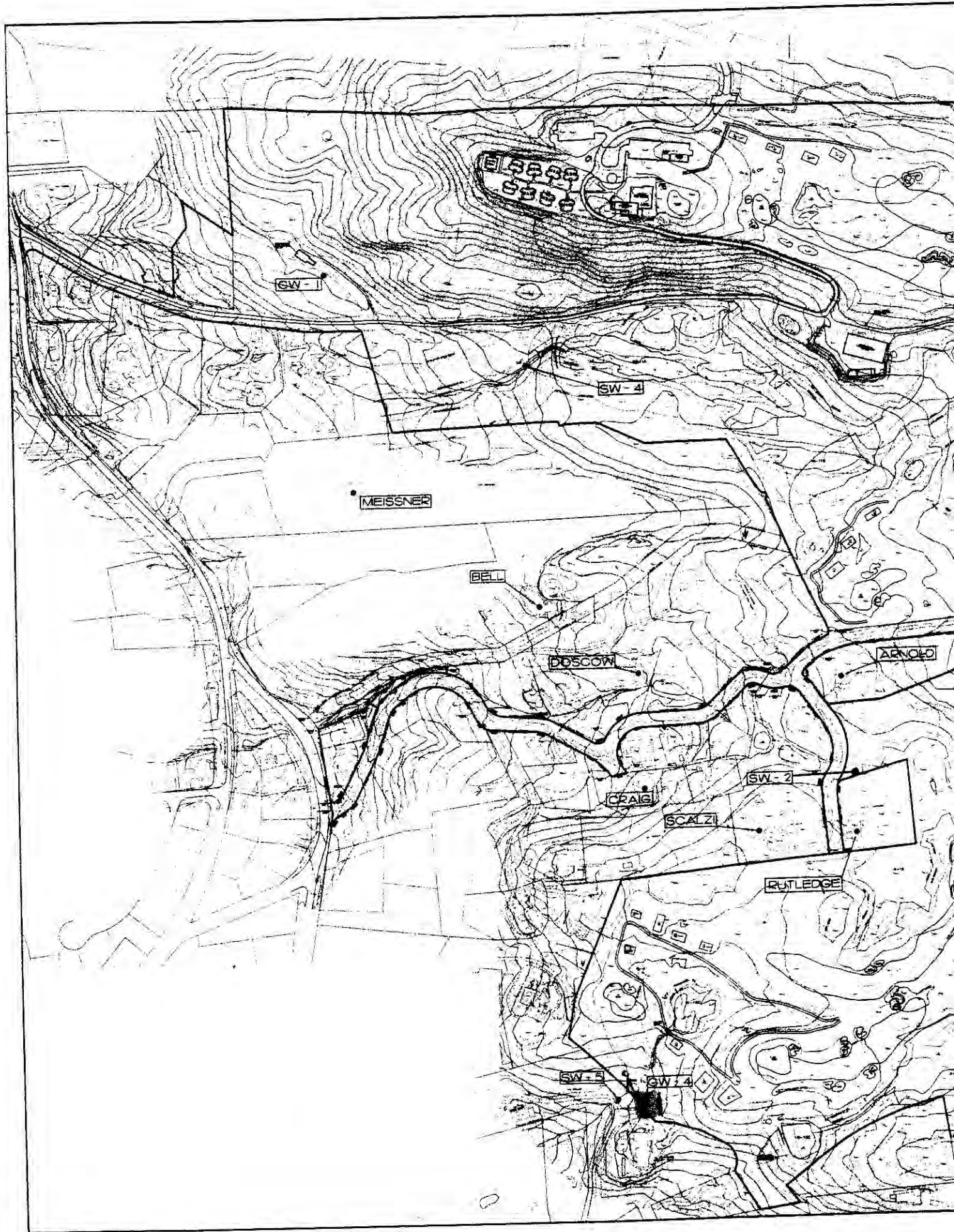
Phase III: Surface Water Quality during Golf Course Operations. The goal of Phase III is to monitor surface water, groundwater and sediment quality during the operation of the Hudson National Golf Club. Phase III began in November 1995. The five (5) year period for testing will start following satisfactory completion of all drainage systems and water quality basins. The period of surface water quality monitoring will be extended beyond the above-stated basic five - year period should specific conditions warrant. The definition of specific conditions warranting

an extension of the monitoring period together with the terms of such an extension(s) are presented herein under the section entitled **Extensions of Monitoring Periods**.

Sample Locations. Surface water is to be sampled at the seven locations that are shown on Figure 6. Sample stations have been located and permanently marked in the field with metal rods of sufficient depth so that they are not easily removed. The sample stations have been photographed (see Appendix IX for photographs of sample locations). Data from these sample stations will allow an assessment of the quality of the surface water leaving the site.

Sample Frequency. Surface water samples are to be collected six times per year: Three non-stormwater surface samples (one each in Spring, Summer and Fall) and three stormwater surface samples (one each in Spring, Summer and Fall) are to be collected. Reasonable efforts should be made to collect the fall stormwater runoff samples after a snow mold fungicide has been applied, if it is a target analyte. Non-stormwater surface water samples are to be collected during periods when it has not rained for at least 48 hours preceding the sampling. Stormwater surface samples are to be collected in accordance with the protocols in Appendix XII (Stormwater Surface Water Sample Protocols).

Sampling will be conducted by representatives of the Village who have been appropriately trained to collect surface water samples. Weather data will be taken from the onsite weather station.





LEGEND

	EXISTING		PROPOSED
			CATCH BASIN
			DRAIN MANHOLE
			SAN. SEWER MANHOLE
			HYDRANT
			DRAIN INLET
			WATER VALVE
			HEADWALL
			DRY WELL
			STREET LIGHT
			MONUMENT
			OFF-SITE WELL
			OFF-SITE S.D.A.
			CONTOUR LINE
			WETLAND LINE
			20 FT. PROHIBITED BUFFER LINE
			100 FT. MINIMUM ACTIVITY SET
			RETAINING WALL
			RUBBLE RETAINING WALL
			CARPATH BRIDGE
			RIP RAP SWALE
			WATER QUALITY CONTROL STRUCTURE SYMBOLS WITH MANHOLE COVER
			WITH INLET COVER
			METAL OUTLET STRUCTURE

THE HUDSON NATIONAL GOLF CLUB, INC.
 Applied
 70 Seaview Ave.
 Stamford, Connecticut 06905

MCCULLOUGH GOLDBERGER & STAU
 Attorneys at L
 550 Momaroneck Ave.
 Harrison, New York 10529

FAZIO GOLF COURSE DESIGNERS, INC.
 Golf Course Design
 109 South Main Str.
 Hendersonville, North Carolina 28637

SASAKI ASSOCIATES, INC.
 Master Planner
 64 Pleasant Str.
 Watertown, Massachusetts 02157

RALPH GEORGE MASTROMONACO, P.E.
 Consulting Engineer
 13 Dove Court, Croton-on-Hudson, New York 10519
 (914) 271-4747

SAMPLING MAP
THE HUDSON NATIONAL
GOLF CLUB
 VILLAGE OF CROTON-ON-HUDSON
 WESTCHESTER COUNTY, N.Y.
 DATE: MARCH 15, 1996
 SCALE: 1" = 200'
 SHEET OF SHEETS

REVISED: OCTOBER 3, 1996

Figure 6. Locations of surface water (SW), groundwater (GW), pond sediment (PS), and domestic drinking

The first sample of the year will be taken after pesticides have been applied to the course at least once. Should water not be available on a given sample date, two additional attempts will be made to obtain a sample within the time period (Spring, Summer, Autumn).

Sample Analytes. Surface water samples are to be analyzed for the analytes listed in Table 12. The pesticide/residues included in Table 12 are to be analyzed only if they have been applied to the golf course within three (3) years preceding the sampling event.

Field Methods. Variables, container type, preservation and holding times for surface water samples are given in Table 13.

A number of variables are to be measured on-site including pH, water temperature, specific conductance, and turbidity. pH is to be measured with a pH probe that has been calibrated just prior to use. Specific conductance is to be measured with a calibrated specific conductance meter. Water discharge in the streams is to be measured at the time of water sampling by standard USGS techniques that involve measuring flow with a current meter and calculating cross-sectional areas of each sample site (USGS, 1968). The three-point method, using a calibrated current meter to measure flow and a standard tape measure to determine wetted area in the cross-section, is to be employed to determine instantaneous discharge measures.

The stream water is to be sampled by obtaining 'discrete' grab samples of water. Discrete grab samples are taken at a selected location, depth and time, and then analyzed for the constituents of interest. Stream water is to be obtained from the center of flow—and for non-stormwater samples at mid-depth—and analyzed for the variables in Table 12. Water is to be

collected in sample bottles that face upstream, and transferred to sample containers that include proper preservatives and labels. The sample containers are to be immediately placed in a cooler with ice and sent to a laboratory for analysis.

A chain-of-custody program is followed to assure that proper transportation and storage practices are documented and that the appropriate analyses are conducted.

A field sampling log of surface water sampling and observations is to be maintained and all log sheets are to be initialed in ink by the person conducting the sampling. The field log documents site conditions, including water depth, observations, weather conditions, and field measurements. Specific notations to be made will include the visual observations of discoloration of the water, the presence of sediment deposition, algae growth, and any other unusual circumstances. An example of a field data sheet for surface water sample collection is given in Appendix V.

Laboratory Methods. Sample analyses are to follow accepted, standard methods as defined in the laboratories accreditation and detailed in their Quality Assurance and Quality Control procedures. Sample containers, properly cleaned and containing the proper preservative, are to be supplied by the analytical laboratory.

In cases where standard methods are not available, the Laboratory is to follow closely related standard practices, and demonstrate accuracy and precision of the method with at least a 5-point standard curve, sample spikes, and duplicate analyses. No pesticide which cannot be appropriately analyzed in water monitoring efforts may be applied to the golf course unless it can

be demonstrated to the satisfaction of the Village Planning Board that it is an intrinsically low risk pesticide in terms of its mobility, persistence, and toxicity.

GROUND WATER MONITORING

Phase I: Background Groundwater Quality. Results of the Phase I groundwater quality monitoring are presented in Appendix VII. Note that during the Phase I ground water monitoring period no monitoring of domestic drinking water wells was conducted because discussions with the Village were ongoing as to domestic water supply. Once it was determined that wells would remain, sampling was conducted. The first sampling was conducted on July 20, 1995.

Subsequent sampling of the domestic drinking water wells occurred in December 1995; May 1996; July 1996; October 1996; and December/January 1997. Because no pre-construction baseline of water quality conditions in these wells was developed, the Hudson National Golf Club has agreed to accept responsibility for any detected exceedences that might be attributable to chemical applications on the golf course.

Phase II: Groundwater Quality during Construction and Immediate Post-Construction Period. Results of the Phase II monitoring are presented in Appendix VIII.

Phase III: Groundwater Quality during Golf Course Operations. The goal of Phase III is to monitor surface water, groundwater and sediment quality during the operation of Hudson National Golf Course. Phase III began in November 1995. The five (5) year period for testing will start following satisfactory completion of all drainage systems and water quality basins.

The period of groundwater quality monitoring will be extended beyond the above-stated five-year period should specific conditions warrant. The definition of specific conditions warranting an extension of the monitoring period together with the terms of such an extension(s) are presented herein under the section entitled **Extensions of Monitoring Periods**. The monitoring of a specific, off-site drinking water well will be extended for an additional two-year period if the results of sampling said well, at any time during the preceding two years, has revealed potential contamination by the operation of the golf course.

Sample Locations. Groundwater is to be sampled at the twelve locations including seven existing offsite private domestic wells shown on Figure 6. Groundwater sample stations have been field marked and photographed (Appendix IX). Data from these sample stations will allow an assessment of the quality of the groundwater on the site.

Sample Frequency. Groundwater samples are to be collected quarterly with at least 30 days between samples. The Spring sampling event will not occur until after the first application of pesticides and/or nutrients.

Sample Analytes. Groundwater samples are to be analyzed for the analytes listed in Table 12.

The pesticide/residues included in Table 12 are to be analyzed only if they have been applied to the golf course within three (3) years preceding the sampling event.

Table 12. Variables to be Analyzed (x) in Surface- and Ground- Water and Pond Sediments at Hudson National Golf Club, Westchester County, New York.

Variable	PHASE I and III Water Quality Monitoring Program			PHASE II Water Quality Monitoring Program		
	Surface Water	Ground Water	Pond Sediment	Surface Water	Ground Water	Pond Sediment
Field Analyses						
pH	X	X		X	X	
Water Temperature	X	X		X	X	
Specific Conductance	X	X		X	X	
Turbidity	X			X		
Laboratory Analyses						
Nitrate-Nitrite Nitrogen	X	X				
Total Phosphorus	X	X		X		
Chloride	X	X		X		
Total Dissolved Solids	X	X		X		
Particle size			X			X
2,4-D	X	X				
Dicamba	X	X				
Mecoprop	X	X				
PCNB	X		X			
Chlorothalonil	X	X	X			
Trichlorfon/DDVP	X	X				
Trifluralin			X			
Thiram	X	X				
Ethylene Thiourea		X				
Chlorpyrifos	X		X			
Bensulide	X					
Fenarimol	X ^a					
Mancozeb	X ^a					

^a fenarimol and mancozeb will be monitored at SW-3A only, and only if these pesticides have been applied in the the SW-3A drainage basin within three years preceding the sampling event.

Table 13. Variables, container type, preservation, and holding times for water samples.

Variable	Container Type	Preservation	Holding Time	Analytical Method ^a
pH	not applicable	not applicable	not applicable	EPA 150.1
Water Temperature	not applicable	not applicable	not applicable	EPA 170.1
Specific Conductance	not applicable	not applicable	not applicable	EPA 120.1
Turbidity	not applicable	not applicable	not applicable	EPA 180.1
Nitrate-Nitrite Nitrogen	P,G	Cool, 4°C H ₂ SO ₄ to pH <2	48 h	EPA 353.3
Total Phosphorus	P,G	Cool, 4° C, H ₂ SO ₄ to pH <2	28 d	EPA 365.4
Chloride	P,G	Cool, 4° C	28 d or	EPA 325.3
Total Dissolved Solids	P,G	Cool, 4° C	7 d	EPA 160.1
2,4-D	G	Cool, 4° C	7 d	EPA 8150, GC with ECD Target detection limit= 0.05µg/ℓ
Dicamba	G	Cool, 4° C	7 d	EPA 8150, GC with ECD Target detection limit= 0.05µg/ℓ
Mecoprop	G	Cool, 4° C	7 d	EPA 8150, GC with ECD Target detection limit= 2.50µg/ℓ
PCNB	G	Cool, 4° C	7 d	extraction: EPA 3510 liquid/liquid analysis: EPA 8080 GC ECD Target detection limit= 0.05µg/ℓ
Trichlorfon/DDVP	G	Cool, 4° C	7 d	GC with ECD, Target detection limit= 1.50µg/ℓ
Trifluralin	G	Cool, 4° C	7 d	extraction: EPA 3510 liquid/liquid analysis: EPA 8080 GC ECD Target detection limit= 0.4µg/ℓ
Thiram/ETU	G	Cool, 4° C	7 d	EPA 507, GC with NPD Target detection limit= 1.30µg/ℓ

Table 13. Variables, container type, preservation, and holding times for water samples.

Variable	Container Type	Preservation	Holding Time	Analytical Method ^a
Chlorpyrifos	G	Cool, 4 ° C	7 d	extraction: EPA 3510 liquid/liquid analysis: EPA 8080 GC ECD Target detection limit= 0.05µg/l
Bensulide	G	Cool, 4 ° C	7 d	Target detection limit= 7µg/l
Chlorothalonil	G	Cool, 4 ° C	7 d	extraction: EPA 3510 liquid/liquid analysis: EPA 8080 GC ECD Target detection limit= 0.05µg/l
Fenarimol	G	HCl to pH <2	14d	EPA 525, Target detection limit = 0.1µg/l
Mancozeb ^b /ETU	G	Cool, 4 ° C	14 d	EPA 509, Target detection limit = 5.0 ppb

^a Alternatives to these methods are acceptable as long as they have been validated, accepted by EPA and/or met EPA's performance criteria, and have similar or lower target detection limits.

^b Laboratory detection limits are currently 5.0 ppb. This is greater than the calculated HAL of 0.2 ppb.

From: USEPA, Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, updated 1983.

USEPA, Analytical Support Branch, Operations and Quality Control Manual, June 1985.

USEPA, Test Methods for Evaluating Solid Waste, SW-846, 1986, updated in 1987.

USGS. Laboratory Theory and Methods for Sediment Analysis.

40 CFR Part 136 Table II: Required Containers, Preservation Techniques and Holding Times (Water/Wastewater Samples), 1988.

Proprietary methodology supplied by manufacturers.

Field Methods. Variables, container type, preservation and holding times for groundwater samples are given in Table 13. Drinking water wells are to be sampled from the spigot or faucet located closest to the well or before any water treatment system. Drinking water well spigots or faucets will be opened and allowed to run for at least three to five minutes to ensure that stagnant water from the water lines has been flushed from the system.

At all non-drinking water wells, ground water elevation is to be determined on each sampling date. After measuring water elevation, the standing water in the well is removed and replaced by fresh water. The quantity of water from one well casing volume is to be determined from the casing size and the amount of water in casing. In general, high-yield wells are to be purged of three well casing volumes of water and low-yield wells are to be purged to dryness. Each well is to be purged using disposable bailers or a portable pump that is cleaned between wells. Water from high-yield wells is suitable for sampling when three consecutive well volumes have stable pH, temperature, and specific conductance readings. Low-yield wells are suitable for sampling when water in the well recovers to within 0.2 feet of the original level. If the water level does not recover to within 0.2 feet of the original level, then the well will be left to recover until the end of the day or sampling event, whichever is longer. If the well still does not recover to within 0.2 feet of the original water level, the well will be sampled only if there is enough water to fill the sample bottles.

Wells are allowed to recharge after purging to allow the system to equilibrate. Depth to the water table is to be remeasured. Once the well is purged, it should be allowed to recover to within 0.2 feet of the original level. Water level is to be recorded and water samples are to be extracted. Extraction is to occur with a pump, or a dedicated bailer. Water temperature, pH, and specific conductance are to be measured in water that will not be used for laboratory analyses. Water samples are to be taken and decanted or drained into an appropriate sample container that has the proper preservatives and is to be labeled. Samples are to be transferred from the sample device to the sample container in a manner that will minimize turbulence and the loss of volatile

compounds. Samples are to be immediately placed in a cooler with ice and sent to the analytical laboratory.

A chain-of-custody program is to be followed to assure that proper transportation and storage practices are documented and that the appropriate analyses are conducted.

A field sampling log on groundwater sampling and observations will be maintained. The log book documents site conditions, including water depth, observations, weather conditions, and field measurements. All log entry sheets are to be initialed in ink. An example of a page from a field log is given in Appendix V.

Laboratory Methods. Sample analyses are to follow accepted, standard methods as defined in the laboratories accreditation and detailed in their Quality Assurance and Quality Control procedures. Sample containers, properly cleaned and containing the proper preservative, are to be supplied by the analytical laboratory.

In cases where standard methods are not available, the Laboratory is to follow closely related standard practices, and demonstrate accuracy and precision of the method with at least a 5-point standard curve, sample spikes, and duplicate analyses. Pesticides are not to be applied to the course if they can not be analyzed in water.

SEDIMENT MONITORING

Phase I: Background Sediment Quality Analysis. Results of the Phase I sediment quality monitoring are included in Appendix VII.

Phase II: Sediment Quality during Construction and Immediate Post-Construction Period.

Results of the Phase II sediment quality monitoring are included in Appendix VIII.

Phase III: Sediment Quality during Golf Course Operations. The goal of Phase III is to monitor surface water, groundwater and sediment quality during the operation of Hudson National Golf Course. Phase III began in November 1995 and will continue until a basic period of five (5) years has elapsed following satisfactory completion of all drainage systems and water quality basins. The period of sediment quality monitoring will be extended beyond the above-stated five-year period should specific conditions warrant. The definition of specific conditions warranting an extension of the monitoring period together with the terms of such an extension(s) are presented herein under the section entitled **Extensions of Monitoring Periods.**

Sample Location. Pond sediment is to be sampled from the Brinton Brook Pond (i.e., Farm Pond) at three locations and composited into one sample in the field. The three samples are to be collected from three different locations within the pond, at discharge points of inflowing drainage channels, where sediments are deposited. Sample location is shown on Figure 6 and is the same location as used in Phase I monitoring (PS means pond sediments). Sample location has been photographed. Data from this sample station will allow an assessment of the quality of the sediment in the pond.

Sample Frequency. Pond sediment samples are to be collected three times per year at the time of surface water sampling in the Spring, Summer, and Autumn.

Sample Analytes. Pond sediment samples are to be analyzed for the analytes listed in Table 12. The pesticide/residues included in Table 12 will be analyzed only if they have been applied to the golf course within three (3) years preceding the sampling event.

Field Methods. Variables, container type, preservation and holding times for sediment samples are given in Table 14.

Table 14. Variables, container type, preservation, and holding times for sediment samples.				
Variable	Container Type	Preservation	Holding Time	Analytical Method
Nitrate-Nitrite Nitrogen	Polyethylene or Polypropylene bag, Glass jar	Cool, 4°C,	28 d	EPA 353.1, 353.2, after extraction
Total Phosphorus	Polyethylene or Polypropylene bag, Glass jar	Cool, 4°C,	28 d	EPA 365.4, after extraction
Particle Size	Polyethylene or Polypropylene bag, Glass jar	Cool, 4° C	28 d	Sieve Analysis, USGS
PCNB	Glass jar	Cool, 4 °C	14 d	extraction: EPA 3510 liquid/liquid analysis: EPA 8080 GC ECD
Chlorothalonil	Glass Jar	Cool, 4 °C	14 d	extraction: EPA 3510 liquid/liquid analysis: EPA 8080 GC ECD
Chlorpyrifos	Glass Jar	Cool, 4 °C	14 d	extraction: EPA 3510 liquid/liquid analysis: EPA 8080 GC ECD
Trifluralin	Glass Jar	Cool, 4 °C	14 d	extraction: EPA 3510 liquid/liquid analysis: EPA 8080 GC ECD

Table 14. Variables, container type, preservation, and holding times for sediment samples.				
Variable	Container Type	Preservation	Holding Time	Analytical Method
From: USEPA, Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, updated 1983. USEPA, Analytical Support Branch, Operations and Quality Control Manual, June 1985. USEPA, Test Methods for Evaluating Solid Waste, SW-846, 1986, updated in 1987. USGS. Laboratory Theory and Methods for Sediment Analysis. 40 CFR Part 136 Table II: Required Containers, Preservation Techniques and Holding Times (Water/Wastewater Samples), 1988.				

Pond sediment is to be collected with a gravity type sediment coring device or by hand. Three cores or grab samples are to be taken and composited to yield one sample on which analyses will be performed. The approximate top 10-cm of the sediment will be retained and analyzed. Grain-size effects from the sediments will be reduced by analyzing the <125 μm sediment fraction.

A chain-of-custody program is to be followed to assure that proper transportation and storage practices are documented and that the appropriate analyses are conducted.

A field sampling log on sediment sampling and observations is to be maintained. The log book documents site conditions, including the water depth, sediment texture, observations and weather conditions. All log entry sheets are to be initialed in ink. An example of a page from a field log is given in Appendix V.

Laboratory Methods. Sample analyses are to follow accepted, standard methods as defined in the laboratories accreditation and detailed in their Quality Assurance and Quality

Control procedures. Sample containers, properly cleaned and containing the proper preservative, are to be supplied by the analytical laboratory.

In cases where standard methods are not available, the Laboratory is to follow closely related standard practices, and demonstrate accuracy and precision of the method with at least a 5-point standard curve, sample spikes, and duplicate analyses. Pesticides are not to be applied to the course if they can not be analyzed in water.

Site Specific Quality Control and General Water and Sediment Sampling Considerations.

The field quality assurance program is a systematic process which, together with the laboratory quality assurance programs, ensures a specified degree of confidence in the data collected for an environmental survey. The field quality assurance program involves a series of steps, procedures and practices which are described below.

General Measures.

- a. All equipment, apparatus and instruments should be kept clean and in good working condition.
- b. Records should be kept of all repairs to the instruments and apparatus and of any irregular incidents or experiences which may affect the measures taken.
- c. It is essential that standardized and approved methodologies be used by field personnel.
- d. Photographs of all permanent sampling locations are included in Appendix X.

Prevention of Sample Contamination. The quality of data generated in a laboratory depends primarily on the integrity of the samples that arrive at the laboratory. Consequently, the field personnel must take appropriate measures to protect samples from deterioration and contamination.

- a. Field measurements should always be made on a separate sub-sample, which is then discarded once the measurements have been made. They should never be made on the same water sample which is returned to the analytical laboratory for chemical analysis.
- b. Sample bottles, new or used, must be cleaned according to recommended procedures.
- c. Only the recommended type of sample bottle for each parameter should be used.
- d. Water sample bottles should be employed for water samples only.
- e. Recommended preservation methods must be used. All preservatives must be of an analytical grade.
- f. Solvent-rinsed Teflon liners can be used to prevent contamination from the bottle caps of water samples which are to be analyzed for organic compounds.
- g. The inner portion of sample bottles and caps should not be touched with bare hands, gloves, mitts, etc.
- h. Sample bottles must be kept in a clean environment, away from dust, dirt, fumes, and grime. Vehicle cleanliness is important.
- i. All foreign and especially metal objects must be kept out of contact with acids and water samples. Petroleum products and exhaust fumes should be kept away from samples.

- j. Specific conductance should never be measured in sample water that was first used for pH measurements. Potassium chloride diffusing from the pH probe alters the conductivity of the sample.
- k. Samples must never be permitted to stand in the sun; they should be stored in an ice chest.
- l. Samples must be shipped to the laboratory without delay.
- m. The sample collector should keep their hands clean and refrain from smoking while working with water samples.

Field Quality Control. In addition to standardized field procedures, field quality control requires the submission of blank and duplicate samples to check contamination, sample containers, or any equipment that is used in sample collection or handling, and to detect other systematic and random errors occurring from the time of sampling to the

time of analysis. One (1) trip blank and one (1) duplicate for every 10 to 12 groundwater samples will be collected. Replicate samples must also be collected to check the reproducibility of the sampling. The timing and the frequency of blank, duplicate, and replicate samples are listed in Table 15. All field notes are to be initialed in ink by the person conducting the sampling.

Table 15. Number and types of samples taken for field quality control.

Trip Blank	1* per each event
Sampler Blank	1* per day of each ground water sampling event - unless disposable bailers are used, then none required
Field Blank	1* per day of each ground water sampling event
Duplicates	1* per 10 to 12 samples
* Complete set for all analytical parameters.	

Trip Blanks. Prior to a field sampling trip, one complete set of sample bottles for all analytical parameters required for the sampling event will be filled with ultrapure distilled water in the laboratory, preserved in the same manner as field samples, and labeled as the "trip blank". This sample set will be included with the clean bottle shipment to the field sampling contractor and at no time are the trip blank containers to be opened until returned to the laboratory. When the sampling event is completed, the trip blank sample will be included with the shipment back to the laboratory and the trip blank will be analyzed for the same parameters as prescribed for the field samples. The trip blank sample is designed to detect any potential source of contamination outside of the field sample collection activities, such as bottle washing procedures and bottle shipment preparation at the laboratory.

Sampler Blanks. One "sampler blank" consisting of ultrapure distilled water poured into, or permitted to pass through the sampler is prepared and analyzed in the laboratory for the groundwater variables of interest. When one-time use disposable bailers are used for ground water sample collection, the sampler blank is not required.

Field Blanks. A daily "field blank" is prepared in the field at the end of each day's sampling. One blank is prepared for every 10 water samples. A field blank is prepared by filling appropriate sample bottles with ultrapure distilled water, adding preservative in the same manner as it was added to the water samples, capping the bottles tightly, and transporting them to the laboratory in the same manner as the water samples.

Duplicates. Duplicate samples (splits) are obtained by dividing one sample into two sub-samples. One sample in every ten water samples is split. Splits are done periodically to obtain the magnitude of errors owing to contamination, random and systematic errors, and any other variabilities which are introduced from the time of sampling until the samples arrive at the laboratory.

Laboratory Quality Control Measures. The laboratory contracted by the Village to conduct the analyses specified in this monitoring program shall be selected by the Village's Environmental Monitoring Consultant. The Hudson National Golf Club will be notified and consulted if any changes in laboratory services are considered by the village. The Laboratory used for sample analysis must retain certification by the Environmental Protection Agency (EPA) or its designated State Agency to conduct chemical analyses on surface water and drinking water. Certification of the laboratory is maintained by successful performance of the EPA Water Pollution Study and EPA Water Supply Study, and the NY ELAP program. The laboratory must have a Good Laboratory Practices or equivalent (e.g., NY ELAP) in place under FIFRA. Sample analyses will follow accepted, standard methods as defined in the laboratories accreditation and detailed in their Quality Assurance and Quality Control procedures.

The results from each sampling event shall be accompanied by the following QC results: matrix spikes (MS) conducted at five (5) or less times the detection limit for the analyte, MS duplicates, reference blanks/method blanks, lab batch duplicates, and surrogate recoveries. In addition, the laboratory director or QA Unit head should note whether there were any QC problems.

Data Storage. Data generated in the field sampling and from laboratory analyses is to be entered into a computer spreadsheet (e.g., QuattroPro, Lotus 1,2,3). Data analyses is to be performed with this data set. The data set is to be printed after each update and the printed data will be stored in a notebook. A backup of the computer spreadsheet data is to be maintained. Field data sheets are to be maintained in a notebook.

Criteria for Management Response.

Non Pesticide Analytes. If concentrations of non-pesticide analytes (variables) exceed State Water Quality Criteria applicable to site waters, or if trends indicate a steady and significant increasing concentration, then the media will be resampled and a review of management practices, site conditions and weather conditions will be implemented to determine reasons for increased concentrations. The laboratory must report results within 15 days of sampling. In addition, the following exceedances of total phosphorus and nitrate-nitrogen concentrations in either criterion will trigger immediate action:

- concentrations exceeding two standard deviations above the baseline mean, or
- concentrations exceeding the 10 ppm nitrate nitrogen MCL in ground water; or
- concentrations exceeding the State Water Quality Criteria applicable to site waters for nitrate nitrogen and total phosphorus in surface water.

All non-pesticide analyte response thresholds are summarized in Table 16.

The immediate action will be an immediate reduction in fertilizer use and/or an increased proportion of slow-release fertilizers. Following the review cited above, these immediate

restrictions may be lifted or modified, as appropriate and as determined by the Village's Environmental Monitoring Consultant in consultation with the Village Engineer and the Hudson National Golf Club. Actions taken will be detailed in the report for the sampling event and in the annual report (See reporting of results and notification procedures).

Table 16. Response thresholds for analytes.		
Variable	Surface Water	Groundwater
pH	Outside of 6.5 to 8.5	Outside of 6.5 to 8.5
Nitrate-Nitrogen	Two standard deviations above the baseline mean. ^a	10 ppm or two standard deviations above the baseline mean, whichever is lower.
Total Phosphorus	Two standard deviations above the baseline mean. ^a	New York State Class GA standard or two standard deviations above the baseline mean, whichever is lower.
Chloride	250 ppm	250 ppm
Total Dissolved Solids	500 ppm	500 ppm
Turbidity	no increase from baseline	NA
2,4-D	MAC = 11.1 ppb	NYSDEC = 4.4 ppb
Dicamba	HAL x 0.5 = 100 ppb	NYSDEC = 0.44 ppb
Mecoprop	HAL x 0.1 = 3.5 ppb	NYSDEC = 0.44 ppb
PCNB	HAL x 0.1 = 2.1 ppb	HAL x 0.1 = 2.1 ppb
Chlorothalonil	LC ₅₀ x 0.01 = 0.49 ppb	HAL = 2 ppb
ETU	0.2 ppb	0.2 ppb
Thiram	LC ₅₀ x 0.01 = 1.3 ppb	NYSDEC = 1.8 ppb
Trichlorfon	MAC = 1.6 ppb	HAL x 0.5 = 625 ppb
Chlorpyrifos	LC ₅₀ x 0.01 = 0.071 ppb	HAL x 0.5 = 52 ppb
Bensulide	LC ₅₀ x 0.01 = 7 ppb	HAL x 0.5 = 25 ppb
Fenarimol	LC ₅₀ x 0.01 = 1.4 ppb	NA

Table 16. Response thresholds for analytes.		
Variable	Surface Water	Groundwater
Mancozeb	$LC_{50} \times 0.01 = 4.6 \text{ ppb}$	NA
^a baseline mean is given in Table 5 of the Baseline Monitoring Report, Dec. 1996. NA means not applicable because the variables are not analyzed as per the Environmental Management Plan. The response threshold data (HAL, LC_{50}, and MAC) are taken from Appendix III. Water quality standards have been established by NYSDEC for certain compounds and water classifications. The most recent standards for each of these compounds will be used.		

Pesticide Analytes. If a pesticide listed in Table 12 is detected in samples at concentrations **below** the specified response thresholds indicated in Table 16, the following responses are to occur:

1. The sample station from which the detection sample was obtained will be resampled and reanalyzed for the detected analyte within one (1) week following the receipt of laboratory results. The laboratory must report results from the re-testing within 15 days of sampling.
2. A review of the use, weather conditions after its application, and possible alternative control measures will be conducted and a decision will be made by the Village's Environmental Monitoring Consultant in consultation with the Village Engineer and the Hudson National Golf Course as to the continued use of the detected pesticide on the golf course.

If a pesticide listed in Table 12 is detected in samples at a concentration **above** the specified response thresholds indicated in Table 16, the following responses are to occur:

1. The detected pesticide will be immediately removed from the list of recommended pesticides for use on the golf course and its use on the golf course will be terminated.
2. The sample station from which the detection sample was obtained will be resampled and reanalyzed for the detected analyte within one (1) week following the receipt of laboratory results. The laboratory must report results from the re-testing within 15 days of sampling. Should the results of such resampling indicate concentrations of the detected analyte below the specified response threshold indicated in Table 16, the golf course may apply to the Village of Croton-on-Hudson planning board for permission to reinstate the detected pesticide on the list of recommended pesticides.

The application for reinstatement of a pesticide shall be submitted by the golf course superintendent. The application shall define the circumstances which led to the removal of the pesticide from the list of recommended pesticides and the reasons why the superintendent believes the pesticide should be reinstated. The planning board shall consider such an application for reinstatement at its next regularly scheduled meeting following its receipt of the application. The planning board may seek the advise of an expert in the use of chemical materials on golf courses to assist it in the review of the application. The Hudson National Golf Club shall reimburse the Village for the reasonable and appropriate costs associated with the review of an application. The planning board shall either approve or deny the application within 60 days of receipt. If the planning board approves the application, its resolution of approval shall specify any additional restrictions it deems appropriate concerning the use of this pesticide on the golf course.

DATA ANALYSIS

Data generated in the field sampling and from laboratory analyses are to be assessed with descriptive statistics and graphic presentation to determine spatial and temporal distribution of the water variables at the site. Sediment data are to be analyzed to determine temporal patterns. Much of the information collected is to be associated with a particular spatial location, and the spatial relationship of the points will be important in interpreting the data. Point plots, scatter plots, bar charts and pie charts are examples of graphic presentations that may be useful in interpreting data. Data at each water and sediment station are to be analyzed to determine trends over time.

Data is to be compared with State water quality criteria (surface water and drinking water) and the USEPA pesticide Health Advisories Limits (HAL's, given in Appendix I, Table 3). In Phase III, concentrations of water and sediment variables will be compared with background concentrations to determine changes from background conditions. There are two exceptions to this protocol, involving Station SW-5 and SW-3A. SW-5 was added as a sample station in July, 1994 at the request of the Village. The location of station SW-3A was changed on November 28, 1995 to provide a sample station at the base of the irrigation pond flume, as requested by the Village planning board. The station was relocated for the November 28, 1995 sample event. Baseline data from SW-3A was taken from the old SW-3A (at the property inflow location near hole number 8). The data from the new SW-3A (at the flume from the irrigation lake) will be compared with the regional reference location as described above. And, water quality will also be compared with the new background surface water sampling location.

The location of SW-5 has always been between the 11th green and tees and sampling at this station began in July 1994 and has continued to the present time. During sample events in the baseline period, this stream was dry. Thus, a baseline was not established. Data for this station will be analyzed by: 1) comparing temporal changes and 2) comparing to a regional reference location. The regional reference location for this station will be the baseline data for the other streams in the monitoring program. Thus, the water quality data from SW-5 will be compared to the mean and standard deviation of like analytes from the other SW stations collected during Phase I.

Concentrations protection of aquatic life will be evaluated by comparing measured concentrations against LC_{50} or MAC data (Appendix I, Table 3). The MAC data are used when available. When MAC data are not available for a pesticide, LC_{50} data is used. LC_{50} data exist for most of the chemicals, and the lowest LC_{50} obtained for the pesticide was divided by a correction factor of 100 to obtain a screening criteria (Suter et al. 1989; Warren-Hicks et al. 1989). This is a conservative factor in that most measured chronic values would be higher than those estimated from this factor (Suter et al. 1983).

Reporting of Results and Notification Procedures. Data transmittal is to be accomplished through written reports (Table 17). All reports are to include both laboratory and field quality control data, copies of all original field notes and forms, and a summary table comparing analysis results to relevant response thresholds for each analyte.

A Report of Each Sampling Event. Reports showing the results of each sampling effort are to be submitted by the Village's Environmental Monitoring Consultant to the Village and Hudson National Golf Club as soon as possible following the receipt of the analytical data from the laboratory. The reports are to be sent to the Village Engineer and the Hudson National Golf Club superintendent within 30 days following the date of the sampling event. The report of each sampling event shall be accompanied by the following QC results: matrix spikes (MS) conducted at five (5) or less times the detection limit for the analyte, MS duplicates, reference blanks/method blanks, lab batch duplicates, and surrogate recoveries. In addition, the laboratory director or QA Unit head should note whether there were any QC problems. The report is to include a brief identification/discussion of any significant results.

In the event that a monitored parameter/substance is detected within a private drinking water well (i.e., now or formerly belonging to Arnold, Bell, Craig, Doscow, Meissner, Rutledge, and Scalzi) at a level equal to or greater than a response threshold specified under Groundwater in Table 16, the Village's environmental monitoring consultant shall make reasonable efforts to immediately notify, by telephone, the owner of the well as to the detection. Said notice also shall be sent to the owner immediately by Certified Mail. A copy of the Certified Mail notification shall be sent concurrently to the Village Engineer of the Village of Croton-on-Hudson and the Hudson National Golf Club Superintendent.

In the event that a monitored parameter/substance is detected at a surface water sampling location at a level equal to or greater than a response threshold specified under Surface Water in Table 16, the Village's Environmental Monitoring Consultant shall immediately notify the Village Engineer. The Village Engineer shall then notify the designated representative(s) of

owners of land (e.g., Jane E. Lytle Memorial Arboretum, Brinton Brook Sanctuary, residents of Finney Farm Road and Prickly Pear Hill Road, etc.) located immediately downgradient of the location of the detection.

Annual Report. An annual report will be submitted by the Village's Environmental Monitoring Consultant to the Village of Croton-on-Hudson Engineer and Hudson National Golf Club by January 15 of each year of Phase III sampling. The full annual report, including the appended data package (e.g., laboratory results data and field data sheets) is to be sent to the Village Engineer (2 copies) and the Hudson National Golf Club superintendent (1 copy). Additional copies of the report, without the appended data package, are to be sent to the Chairman of the Village Planning Board (1 copy) and the Chairman of the Village Water Control Commission (1 copy). The report is to include:

- Application schedule of all pesticides and fertilizers applied to the golf course. The date of application, weather conditions, rate of application, product used, and specific location where the material was applied will be reported.
- A summary of the results of the surface and well water samples, with a list of any remedial actions that were taken.
- Recommended modifications to the fertilizer and pesticide application program for Village approval that will encourage use of safer material, if they become available. These recommendations for modifications will include recommendations for any associated modifications to the monitoring program (see section titled Amending the Environmental Management Plan).

Table 17. Summary of reporting and notification procedures.		
Notification/Report Trigger	Notification/Report Due Date	Notification/Report Recipient
Water Quality Sampling Event	30 days after sampling	Village Engineer, Croton-on-Hudson, and Hudson National Golf Club Superintendent
Annual Water Quality Sampling Summary Report	January 30 of the year following the sampling	Village of Croton-on-Hudson Village Engineer, Chairman of the Water Control Commission, and Chairman of the Planning Board, and Hudson National Golf Club Superintendent
Detection of Analyte in Private Drinking Water Well At or Above Groundwater Response Threshold specified in Table 16.	Immediately upon receipt of results from laboratory	Owner of the well, Village Engineer, and Hudson National Golf Club Superintendent

EXTENSIONS OF MONITORING PERIODS

The monitoring of surface waters, ground waters, and sediments shall continue for a period of five (5) years from the date of any sampling event during which an analyte was found to occur at a concentration exceeding a response threshold specified in Table 16. Whenever monitoring is continued due to the exceedance of a response threshold specified in Table 16, the continuation of monitoring beyond the basic five-year monitoring period specified for Phase III monitoring shall be limited to the sampling location and analyte associated with the exceedance.

STORMWATER MANAGEMENT PLAN

The construction of the Hudson National Golf Course converted approximately 123 acres of forest, to turf and related developed areas. Copies of all monitoring reports and records specified in this section are to be submitted each January by the Golf Course Superintendent to the Village of Croton-on-Hudson, Village Engineer, the Chairman of the Water Control Commission, the Chairman of the Planning Board, and the Village's environmental monitoring consultant. To maintain the quality of stormwater runoff after development, the site engineering plans provide a variety of measures to treat runoff prior to its discharge to wetlands and water courses. This stormwater management plan was developed by Ralph Mastromonaco, PE and describes the various stormwater management features that have been incorporated into the plans for the project.

HYDROLOGIC BASED CONTROLS

The control of peak flow is a primary measure to minimize erosion and sedimentation problems in runoff. To this end the project employs two (2) main stormwater retention basins and seven (7) smaller retention basins to capture stormwater and limit release rates. A description of the hydraulic details of these basins is contained in the Drainage and Hydrology Report for the project. The stormwater storage provided on site will reduce or maintain peak flow levels to the rates at the pre-construction conditions. The project has been designed so as to

maintain the pre-construction total quantity of stormwater exiting the site via ground water recharge and surface runoff.

Essentially, reducing and/or maintaining the release rates will prevent scouring of stream beds and banks and reduce the introduction of sediments into the surface water system. The provision of velocity dissipaters at head wall outlets will provide long lasting protection against scouring, as well.

TREATMENT

Water Quality Basins (Infiltration Basins). The site engineering plans provide for 18 Water Quality Basins located throughout the site. These are designed to retain, at a minimum, the first one inch of runoff from tees and greens and the first $\frac{1}{2}$ inch of runoff from other areas. Studies have shown that 70% to 95% of contaminants in stormwater can be removed by retaining the first $\frac{1}{2}$ inch of runoff. Tees and greens on the golf course have been designed to discharge into a water quality basin or the irrigation pond. These areas are most heavily treated with lawn chemicals and fertilizers. Accordingly, the first one (1) inch of runoff from these areas will be retained in water quality basins.

The water quality basins operate by use of a specially designed control structure in the flow path. the first $\frac{1}{2}$ or 1 inch of the runoff enters the control structure and is diverted to a side-oriented infiltration basin. When the basin fills to a volume equivalent to the designed first flush volume (first 0.5 inch or 1.0 inch of runoff from the tributary areas), the remaining flows from

the site are permitted to pass through the control structure to the receiving water course. At the 3rd green, the water quality basin functions as both a retention system and a water quality basin, but is designed to retain more than the first ½ inch to account for the mixing of flow through the system. This was done to account for the diffuse nature of runoff in this watershed and to avoid having to concentrate and collect the flows for the purpose of separating the first ½ inch. Water quality Basin #13 (located to the east of the fairway of hole #12) also functions as a stormwater detention basin.

The runoff water that is captured is allowed to infiltrate into the soils, evaporate, or filter through soil and gravel layers to an underdrain piping system as shown on the details for the site. The contaminants within the basin are reduced by vaporization, plant uptake, or chemical and biological processes.

Vegetative Swales. The site plans provide for vegetated swales to permit filtering and infiltration of stormwater. These swales have been sodded with Kentucky Bluegrass and are used on gentle slopes where slower velocities enhance the filtering and infiltration processes and to convey outflows from water quality basins.

25-Foot Vegetated Filter Strips. Filter strips are used to a great degree on the Hudson National Golf Course. These areas are at least 25 feet wide and are intended to treat stormwater runoff from the developed fairway areas. Enhancing the effects of the filter strips are the preferred

wooded area strips that surround the fairways. Each of these provides a method to disperse runoff and limit velocities.

Vegetative Cover for Filter Strips. Orchard Grass is 25%, Sweet Vernal Grass is 25%, Tall Fescue is 35%, and Creeping Fescue is 15%.

Rip-Rap Swales. In certain areas, where runoff collects, rip-rap swales are used to convey stormwater. These provide a safe, permanent method of conveying stormwater through the site, and are preferable to a closed piping system. In fact, the site has been designed with a minimal number of closed drainage systems. Rip-rap swales are constructed in areas where volumes are expected to be great and where slopes are too steep to permit grassed swales. Generally, swales in excess of 10 per cent should be rip-rapped.

Rip-rap swales provide for some settling of sediments, and further allow for infiltration of stormwater. Rip-rap stone sizes are 150 lbs., generally. Details and locations of these are indicated on the site engineering plans.

Hooded Outlets. Catch basins subject to pavement runoff shall be equipped with hooded outlets.

Special Management Procedures for Water Quality Basins

1. The yard drain within water quality basin #13 (i.e., adjacent to the green of hole #13) is to be capped immediately prior to forecasted storm events. This cap is to be removed after 48 hours have elapsed following the completion of the storm.
2. The valve located on the underdrain of water quality basin #17 (i.e., adjacent to the green of hole #3) is to be adjusted as necessary to ensure that the basin drains dry within 48 to 72 hours following a storm event of at least 1-inch of rainfall. If adjustments to this valve fail to achieve this standard, appropriate soil improvements shall be implemented immediately. See section entitled *Water Quality Basin Monitoring and Restoration Protocol* for definitions of "draining dry" and appropriate soil improvements.

INSPECTIONS AND MAINTENANCE SCHEDULE

Water Quality Basins (Infiltration types). To assure the long-term operation of the water quality basins, the following schedule of inspections and maintenance shall be implemented. The Water Control Commission will be notified at least 48 hours in advance of the monitoring of the water quality basins, so that they may witness the activity.

1. All Water Quality Basins shall be inspected annually for signs of differential settling of the embankment, cracking, erosion, seepage through the embankment, tree growth on the embankment, and sediment accumulation, and to determine the condition of

vegetative cover lining the basins (turf and herbaceous wetland plants) and the condition of outlet structures (including bypass and underdrain discharge channels). Appropriate maintenance is to occur immediately following an inspection during which a need was found to exist. Appropriate maintenance includes the repair of embankments, bypass and discharge channels, and other structural repairs; annual mowing to prevent tree and heavy shrub growth in the basins and on the embankments; debris and litter removal; and sediment removal when sediment has accumulated to a depth of five inches. All clippings generated during mowing of the basins are to be removed for disposal outside of the basin and outside of any wetlands and lands located within 120 feet of wetlands.

2. Water Quality Basins (with the exception of Basin #6, a wet pond) shall be monitored quarterly during the first full year following completion of their construction and annually thereafter to determine if they are draining dry within a period of 48 to 72 hours following a storm. Monitoring shall consist of visual inspections following a storm of at least one inch of precipitation. For the purposes of this protocol, a water quality basin will be considered to have drained dry if there is no free water sitting on the surface of the basin bottom other than small, isolated pockets holding less than 10 cubic feet of water. Prior to the initiation of this monitoring, the golf course superintendent, or designated representative, shall notify the village engineer.

- All records of monitoring activities are to be maintained at the superintendent's office and submitted to the village, as specified in this Stormwater Management Plan under the heading of Record Keeping.
- In the event that monitoring indicates that a basin is not draining within 48 to 72 hours following a one-inch storm event, improvements to the soils in the basin shall be implemented immediately so as to achieve this drainage standard.
- Soil improvements shall consist of the addition of organic matter and fine-textured soils if the monitoring indicates that the basin is draining dry less than 48 hours following the conclusion of a storm.
 - Soil improvements shall consist of the removal of fine-textured soils (e.g., sediments), tilling of soils, and/or the addition of sand if the monitoring indicates that the basin is not draining dry within 72 hours following the conclusion of a storm.
 - All soil improvement work shall be reviewed and approved by the Village Engineer. Accordingly, should the results of monitoring indicate the need for soil improvements, the Village Engineer shall be notified immediately.
 - Following the completion of soil improvement work within a water quality basin, the affected basin shall be monitored quarterly after rainfall of 1" or more for a period of one (1) year to verify compliance with the 48 to 72-hour drainage standard. Thereafter, the basin shall be monitored on an annual

basis. These inspections shall include the Village Engineer or the Village Monitor.

- The Village may appoint a representative to monitor post-storm water quality basin performance periodically with prior notification to the golf course superintendent.

Catch Basins. All site catch basins should be inspected regularly. Hooded outlets are especially prone to collection of debris and should be inspected every six months. Sumps in any catch basin or other structure should be cleaned when the debris has filled the sump to $\frac{1}{2}$ its capacity.

Wetland Drain. The surface field drain in wetland area W-18 (located north of Finney Farm Road) is to be monitored semi-annually in spring and fall and all accumulated debris is to be removed.

25-Foot Vegetated Filter Strips, Rolled Edges, Vegetated Swales, and Rip Rap Channels.

The 25' vegetated filter strips are to be mowed two times per year. Vegetated swales and rip rap swales will be maintained by normal golf course maintenance. The normal maintenance schedule should be sufficient to maintain these areas in proper condition.

Swales should be inspected and repaired when obvious attention is needed. The golf course is anticipated to have an unusually high degree of normal maintenance, including a full time staff of maintenance workers, and these features will be included as a part of the normal maintenance by the golf course superintendent.

All grass clippings are to be removed from these areas. No clippings, aeration plugs, or leaves shall be deposited in these areas.

The vegetated filter strips, rolled edges, and vegetated swales are to be monitored annually. Monitoring shall include a review of the integrity of vegetation cover; maintenance practices; presence/absence of aeration plugs, grass clippings, blown leaves; structural integrity of the rolled edges; and the general species composition of vegetative cover. Rip rap swales are to be monitored annually as to their structural condition and the presence/absence of erosion.

Record Keeping. Records of all water quality basin, catch basin, and buffer and swale inspection and maintenance activities are to be maintained by the golf course superintendent. Records shall include the date of inspections, inspection findings, and a description and dates of remedial actions taken. Copies of all monitoring reports and records specified in this section are to be submitted each January to the Village of Croton-on-Hudson, Village Engineer, the Chairman of the Water Control Commission, the Chairman of the Planning Board, and the Village's environmental monitoring consultant.

WETLAND MANAGEMENT PLAN

The management of the Hudson National Golf Club will implement an active wetland management program for as long as the club exists. This management program will be incorporated into the overall maintenance program for the golf course to ensure that course maintenance activities focus not only on maintaining golf turf quality and course playability but also on maintaining the health and functional characteristics of the existing wetland areas, the new vernal pool habitat, the wetland enhancement plantings, and the wetland buffer filter strips. Critical elements of the wetland management plan include periodic monitoring, maintenance of proposed vegetative conditions, restoration or repair of damaged areas, and record keeping. Descriptions of wetlands are given in Appendix IV. Results of all inspections will be sent to the Village Engineer. Copies of all monitoring reports and records specified in this Wetland Management Plan to be submitted to the village are to be submitted each January 15 to the Village of Croton-on-Hudson Village Engineer, the Chairman of the Water Control Commission, and the Chairman of the Planning Board.

MAINTENANCE OF WETLAND PLAY OVER AREAS

Wetland Play over areas exist where portions of the golf course cross existing wetland areas. These areas include portions of wetlands W12-A, W12-B, W12-C, W13-B, W15, W-17, and W-18. Vegetation in these wetland areas is to be maintained as specified on the plan entitled

"Limited Activities", a copy of which is to be posted on the wall of the golf course superintendent's office and provided herein as Appendix VI.

20-FOOT PROHIBITED BUFFER

Activities to be conducted within 20 feet of a boundary of a wetland shall be limited to those specified on the plan entitled *Limited Activities* (see Appendix VI). All such activities shall be conducted in strict conformance with the conditions specified on the said plan entitled *Limited Activities*.

DRAINAGE VALVE AT WETLAND 17

A drainage valve is located at the outlet of Wetland Area 17 adjacent to the fairway of hole #10. This drainage valve controls the surface flow of water from Wetland Area 17 to Wetland Area 18 (located adjacent to and west of the fairway of hole #12). This valve is to remain open at all times except during storm events. Accordingly, the golf course superintendent is to close this valve immediately prior to a forecasted storm event and reopen the valve following the storm. The valve is to be opened once water levels in wetland W-18 have subsided. The opening of the valve is not to result in increased flooding of properties downstream of wetland W-18.

MONITORING OF EPHEMERAL POND

Purpose and Frequency. The constructed ephemeral pond (see Figure 7) is to be monitored twice annually by the Village's Environmental Consultant to determine the success of this construction. "Success" is defined as survival, over a three-year period, of at least 80% of each type of plant (e.g., 80% of the trees, 80% of the shrubs, etc) installed during the construction and the retention of surface waters at an average depth of at least four (4) inches from April 1 through May 20 of each year. Monitoring is to begin in May following the end of the first full annual growing season (i.e., spring, summer, and fall) after completion of the plantings, as specified on Plan L-O (as approved by the Village planning board on March 2, 1999), and continue for a period of three (3) years thereafter, unless "success" has not been achieved. If at any time during the three-year monitoring period the area is found not to meet the standards of the definition of "success", all plants which have not survived shall be replaced during the immediately following planting season to 100% of the planting provisionally accepted at the beginning of the monitoring period. In the event that the Ephemeral Pond planting falls below 80% survival, all failed plants will be replaced and the 3-year monitoring period restarted. At the final third year inspection there will at least 80% survival of each of the three groups of woody plants, trees, and small trees and shrubs. There will also be at least 80% herbaceous cover at the ground level.

Baseline Monitoring. At the conclusion of construction of the ephemeral pond, the following conditions must be recorded for use as baseline information for subsequent monitoring activities:

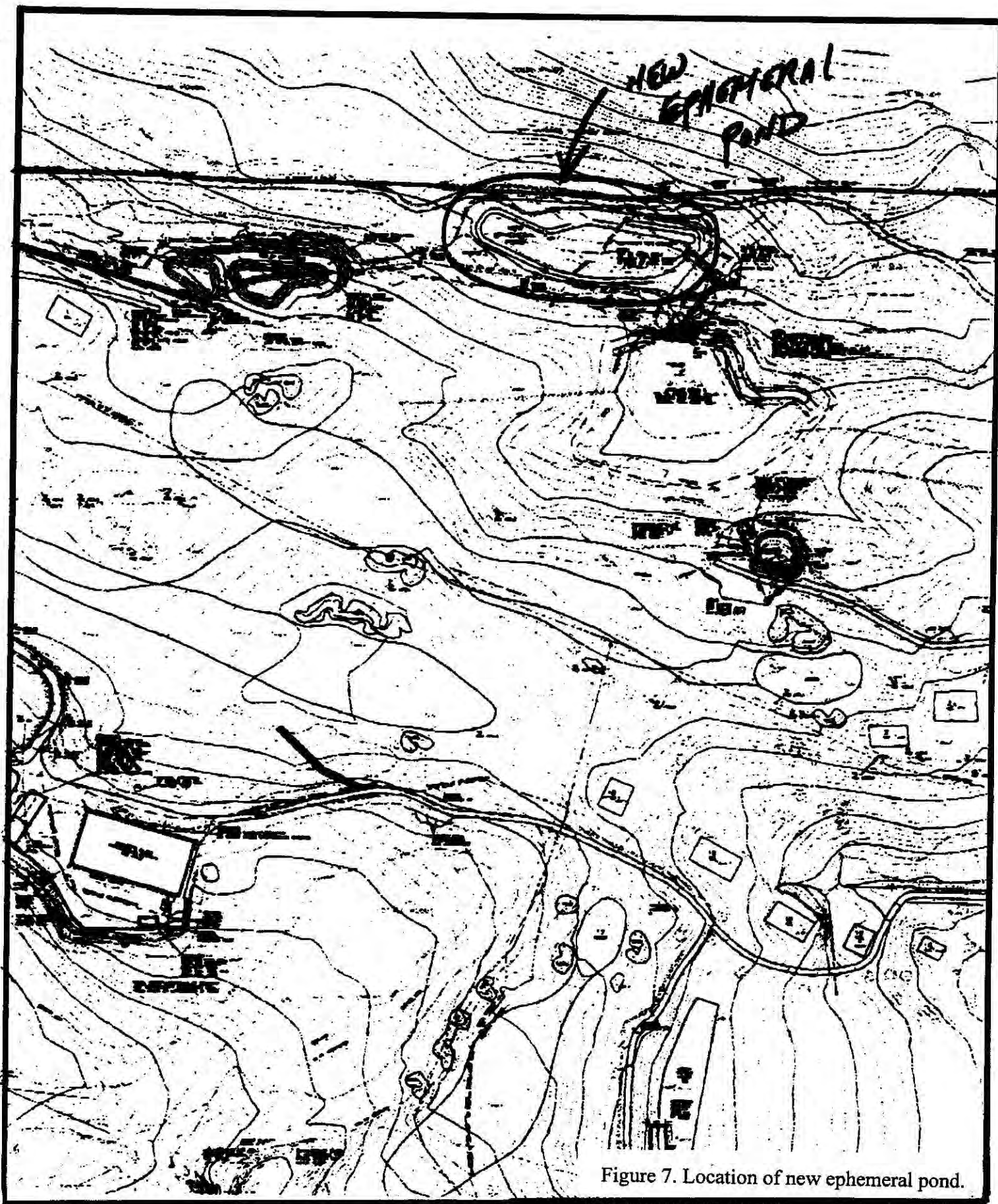


Figure 7. Location of new ephemeral pond.

- a. "as-built" plan indicating final grades with bottom spot elevations, percent slope, and shrub plantings by species;
- b. established permeability of the subgrade; and
- c. any results of soil tests of the installed top soil.

Post-Construction Monitoring Program. Post-construction monitoring of the ephemeral pond shall consist of an annual visual inspection of the pond and recording of the following data:

- presence of vigorous new shoots on planted vegetation;
- color of foliage on planted vegetation;
- size of planted woody vegetation;
- aerial coverage of seeded vegetation;
- percent survival of planted vegetation; and
- the average depth of water in the pond.

Record Keeping. A report on all ephemeral pond plant monitoring activities is to be provided annually by the Village Environmental Consultant to the Village Engineer, the Water Control Commission, and the golf course superintendent. The report is to include all records of the inspections conducted during the preceding year. Records shall include the date of inspections, inspection findings, and, if success has not been achieved, a description of remedial actions taken.

Remedial Actions. In the event that the monitoring of the ephemeral pond reveals that “success” has not been achieved, appropriate and approved remedial measures shall be implemented. To assist in determining appropriate remedial measures, the following actions/data shall be reviewed by the Water Control Commission and the Village’s Environmental Consultant:

- visual inspection of surface hydrologic conditions;
- soil test data;
- visual inspection of plants for indications of damage by insects, disease, chemical contamination, predation, and competition; and
- regional and local climatic data.

The following remedial actions shall be reviewed by the Water Control Commission for implementation in the event that the actions/data collected indicate the given condition. Other actions shall be taken if conditions indicate them to be appropriate.

Condition	Potential Remedial Action
Insufficient Surface Water	Excavate, regrade, decrease the permeability of the subsoil.
Excessive Surface Water	Regrade to establish positive drainage, replant with more water tolerant species, increase the permeability of the subsoil
Soil Toxicity	Replace soil with uncontaminated top soil and replant, identify source of toxin and eliminate it.
Plant Infestations/Predation	Apply appropriate treatments, remove destroyed plants, and replace with healthy stock.

All remedial actions shall be completed within one year of the monitoring event during which the need for remediation is first detected.

MONITORING OF WETLAND AREAS

Purpose and Frequency. All wetlands and watercourses are to be inspected twice annually: once in the spring and once in the fall. Inspections are to focus on the condition of vegetation, the color and clarity of surface waters, the condition of ground cover, and the condition of vegetated buffer strips.

Notification of Water Control Commission. The golf course superintendent shall notify the Water Control Commission of the Village of Croton-on-Hudson of his intention to conduct a wetland inspection at least thirty (30) days prior to conducting the inspection. The Water Control Commission and/or other Village representative may attend these inspections.

Monitoring and Maintenance of Vegetative Conditions. Vegetation planted in and within twenty-five (25) feet of Wetland Areas W-12A, W-12B, W-12C, W-13A, W-13B, W-15 (between the tees and fairway of hole #9), W-17, and W-18 shall be monitored by the Village's Environmental Consultant to determine the survival of the planted material. Monitoring by the Village's Environmental Consultant begins when a planting area, as shown on plan L-O, is

complete and is to continue on a twice-annual basis for three (3) years. Any failed plantings must be replaced during the next planting season. If at any time during the three-year monitoring period a planting area has less than 80% survival of the planted material, all failed plantings within that planting area shall be replaced during the immediately following planting season to 100% of the planting provisionally accepted at the beginning of the monitoring period. At the final three year inspection, there will be at least 80% survival of each of the three groups of woody plants, trees, and small trees and shrubs. The herbaceous marsh vegetation established in Wetland Areas W-12A and W-12B shall be maintained in an herbaceous condition through the hand removal of any woody plant material which may become established in the area. Hand removal shall include hand cutting of stems and the carrying of cut material out of the wetland. No woody plant material planted in the wetland areas as part of the approved planting plans shall be removed as part of this maintenance activity.

Restoration and Repair of Damaged Areas. Observed damage to existing topography and ground cover conditions in and within twenty (20) feet of wetlands shall be remedied immediately. Such damage may include, but is not limited to, siltation, erosion, and compaction or trampling by golfers. Accumulated silts shall be removed, eroded channels shall be filled and either seeded or sodded, and compacted areas shall be raked. All such repairs are to be conducted using hand tools only. Damaged ground cover vegetation will be restored by seeding, sodding, or planting, depending on the vegetation damaged. Channels, with the exception of

rolled edges and vegetated swales, which form within 20 feet of a wetland shall be filled and seeded or sodded so as to restore sheet flow conditions.

Record Keeping. Records of all wetland inspection activities are to be maintained by the golf course superintendent. Records shall include the date of inspections, inspection findings, and a description and dates of remedial actions taken. Records also shall include a description of any activities which have been conducted within the wetlands and/or within 120 feet of the wetlands which constitute neither "normal maintenance" nor "normal repair of observed damage" as such terms are defined below under the heading of Review by Water Control Commission. A copy of these records shall be submitted to the Village Engineer as part of the Golf Course Superintendent's Annual Report.

Review by Water Control Commission. Normal maintenance of wetlands and areas within 120 feet of wetlands and normal repairs of observed damage to such areas may be undertaken without prior additional review by and approval from the Water Control Commission of the Village of Croton-on-Hudson. All other activities to be conducted within such areas shall require prior review by and approval from the Water Control Commission pursuant to Chapter 227 of the Village Code. For the purposes of this provision, normal maintenance of the above-specified areas shall include the maintenance of herbaceous marsh vegetation in Wetland Areas W-12A and W-12B and the maintenance of vegetation conditions in wetlands W-12C, W-15, W-17, W-

18, and W-13B (as described herein under Monitoring and Maintenance of Vegetative Conditions and as specified on the plan entitled *Limited Activities*, a copy of which is provided as Appendix VI), and the removal of trash, debris, and golf balls from wetland areas twice annually (as a single removal event each time) during the months of January and August. Normal repairs of observed damage to the above-specified areas shall include all activities necessary to restore the affected areas to their pre-damaged condition, provided all such activities are conducted using hand tools only and they do not result in changing the pre-damage physical, chemical, or biological conditions of the areas.

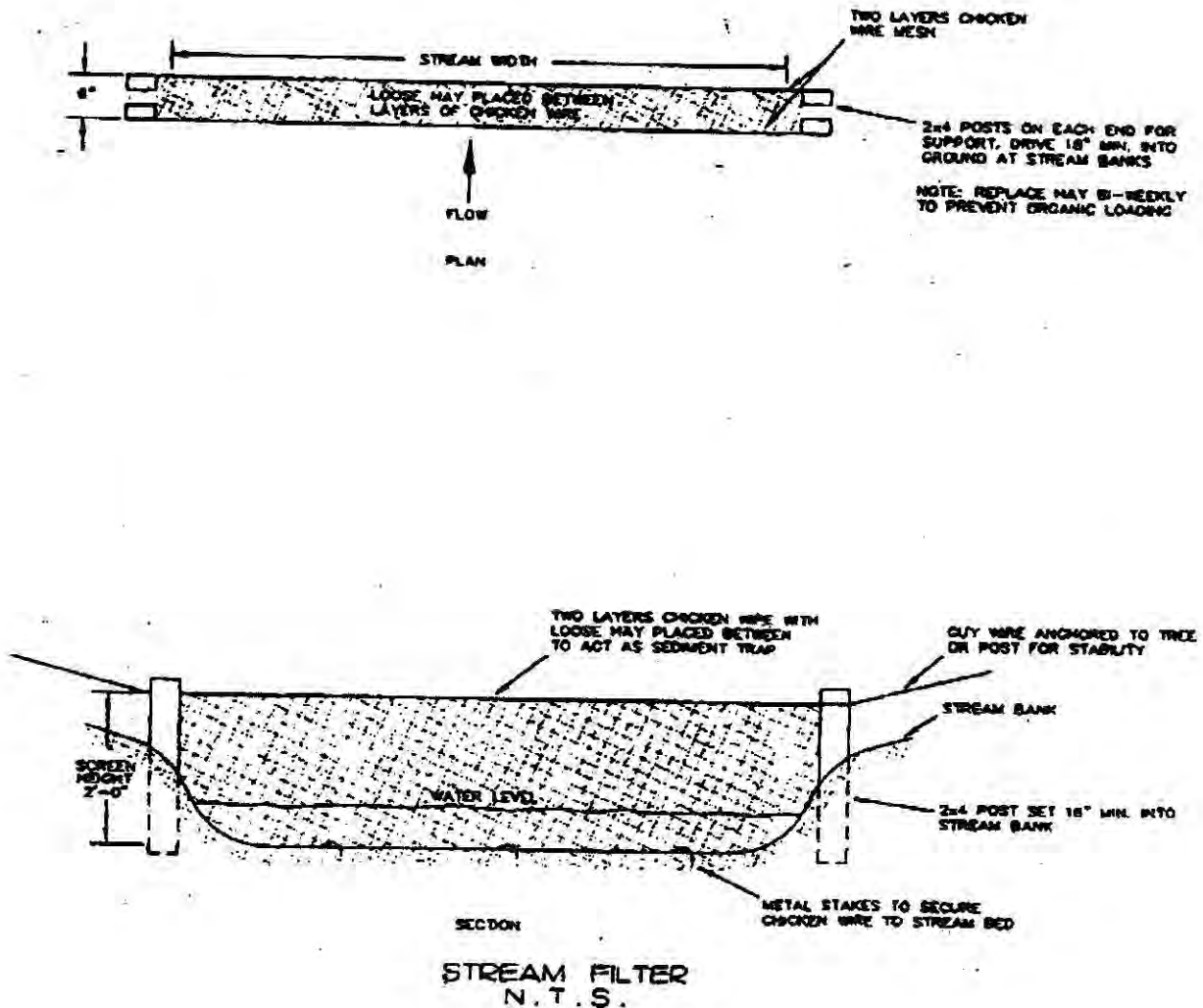
IRRIGATION POND MANAGEMENT PLAN

Aquatic vegetative growth within and along the banks of the irrigation pond may be controlled through the drawdown of water from the pond. Drawdown of the pond is achieved through 'opening the drain' from the irrigation pond, and references made to drawdown mean that water is released from the irrigation pond through the drain. Water also may be drawn down within the pond when necessary to service/maintain equipment and structures located within the pond. Drawdown of the pond is to occur no more than once each year and only during the period of December through February. All water draw-downs from the irrigation pond shall be conducted in accordance with the following protocol.

- The golf course superintendent shall notify the Water Control Commission of the Village of Croton-on-Hudson and the president of The Jane E. Lytle Memorial

Arboretum of his intention to initiate a drawdown at least 48 hours in advance of initiating the drawdown.

- Prior to initiation of drawdown, a water sample from the irrigation pond will be taken and analyzed for the variables listed in Table 12 and for surface water sample station SW-3A. The results of the analysis of this water sample shall be included with the notification submitted to the Water Control Commission and the Arboretum specified above. Once the sample has been obtained from the pond, no pesticide or fertilizer applications are to be made within the watershed of the pond until after the drawdown has been completed and the pond drain has been closed. Should the results of the sample analysis reveal that the water in the pond contains concentrations of an analyte exceeding the response thresholds specified in Table 16, no drawdown of the pond shall occur. If the Hudson National Golf Club still desires to drawdown the pond, an additional water sample may be taken and analyzed. Again, the Water Control Commission and the Arboretum shall be notified of the intention to conduct the drawdown and the results of the additional sampling shall be included as part of the notification. No drawdown of the pond shall occur as long as the sample analysis results indicate an exceeding of a response threshold specified in Table 16.
- Prior to releasing water from the pond during a drawdown, a stream filter (see Figure 8) shall be installed across the stream which enters the Arboretum property. This filter is to be installed on the golf course property. The stream filter will be constructed of straw or salt hay.



Prior to installing the stream filter all rip rap, stones, and organic debris in the immediate location of the installation shall be removed such that the filter may be secured to the stream bed as indicated. Upon removal of the stream filter, all removed rip rap shall be reinstalled.

Figure 8. Schematic of the irrigation pond filter.

- Prior to initiation of drawdown, photographs of the existing stream channel and adjacent area within the Arboretum shall be taken and retained by the golf course superintendent.
- Water shall be released from the pond at a rate which does not cause scouring of the receiving stream channel. This rate shall be established at the time of the initiation of drawdown in consultation with a representative of the Water Control Commission and the president of The Jane E. Lytle Memorial Arboretum (i.e., the valve on the drawdown pipe will be opened only to the extent acceptable to the Water Control Commission and the Arboretum.
- Upon completion of the drawdown and pond maintenance activities, the valve on the drawdown pipe shall be closed, and the key to the valve should be removed. All sediments/debris which accumulates in the stream channel during the drawdown shall be removed for disposal in the "natural waste disposal area" located off Prickly Pear Hill Road, and the stream filter shall be removed should any damage to the arboretum property occur as a result of the drawdown.
- The Hudson National Golf Club shall restore, at its cost, the damaged property to its pre-drawdown condition.

MISCELLANEOUS MONITORING ACTIVITIES

The results and records of the following miscellaneous monitoring activities are to be maintained at the site by the golf course superintendent and reported to the Village of Croton-on-Hudson Village Engineer and Water Control Commission.

Irrigation Pond Recycling System. The irrigation pond recycling system consists of a manhole and a pump and is designed to operate continuously to return water seeping from the base of the irrigation pond dam to the pond and prevent the discharge of such water to the Jane E. Lytle Memorial Arboretum. This system shall be inspected on a monthly basis, and the pump and appurtenant works shall be repaired/replaced immediately upon detection of a malfunction. The results of these inspections shall be reported to the Village Engineer.

Arboretum Water Supply. In compliance with the terms of an Agreement (the Agreement) between the Hudson National Golf Club and Village of Croton-on-Hudson board of trustees (dated May 5, 1999), the Hudson National Golf Club is to provide a continuous flow of water to the Jane E. Lytle Memorial Arboretum. The continuous flow rate is to be at least 32 gallons per minute, as measured at a v-notched weir located in the stream channel below the irrigation pond dam and approximately 20 feet west of the Hudson National Golf Club/Jane E. Lytle Memorial Arboretum property boundary. To ensure that this minimum flow rate is maintained, an Arboretum water supply system has been installed on the golf club property. The Arboretum

water supply system consists of two wells located adjacent to the Arboretum access drive, a PVC feed line which connects the wells to a discharge point in the south bank of the stream channel below the irrigation pond dam, and a hose connected to the bleed-off valve from the municipal water meter associated with the irrigation pond feed line. The hose from the bleed-off valve discharges to the stream channel located below the irrigation pond dam at roughly the same location as the PVC feed line from the wells. According to the Agreement, the flow at the v-notched weir is to be monitored by an appointee of the Village board of trustees. In the event that flows from the wells and all other sources tributary to the stream channel do not produce the minimum flow rate to the v-notched weir, the golf club is to supplement the flows, as necessary, to maintain the minimum flow rate. The supplemented flows may be obtained by opening the bleed-off valve from the municipal water meter or by siphoning water directly from the irrigation pond. If this Arboretum water supply system fails at any time to maintain the minimum flow rate, necessary repairs to system components are to be made by the Hudson National Golf Club within two (2) weeks of acquiring knowledge of the failure.

Monitoring of Dams. The golf course property includes three water impoundment "dams": at the irrigation pond, southeast of Prickly Pear Hill Road, and the small pond northwest of the fairway of hole #1. The dam at the irrigation pond is to be monitored on a quarterly basis and the other two "dams" are to be monitored annually. Monitoring is to consist of a visual inspection to determine if any seepage begins to show traces of soil particles and/or sloughing or sinkholes develop on the dam. Should either of these conditions be detected during the monitoring, a

geotechnical engineer must be consulted to determine appropriate improvements/remediation measures. In addition to the monitoring of seepage for soil particles, the seepage from the irrigation pond dam is to be visually monitored for the discharge of iron. Monitoring of dams shall be conducted by the golf course superintendent or assistant superintendent in conjunction with the Village Engineer. Should consultation with a geotechnical engineer be necessary, the Hudson National Golf Club shall diligently pursue implementation of the geotechnical engineer's recommendations in conjunction with the Village Engineer. The results of all dam inspections shall be reported to the Village Engineer.

Fertigation System Pressure Testing. The fertigation system is to be pressure tested annually prior to the initiation of use in the spring for the purpose of detecting any leaks. If the results of such testing reveal the presence of a leak, the use of the fertigation system will be suspended until the leak is sealed.

The 'no play' Environmentally Sensitive Areas. Environmentally sensitive areas on the golf course that are designated as 'no play' areas are identified in the plan entitled *Limited Activities*, a copy of which is provided as Appendix VI. These "no play" areas are designated on the Golf Course by wooden stakes with green colored tops.

AMENDING THE ENVIRONMENTAL MANAGEMENT PLAN

This Environmental Management Plan may be amended by the Village planning board from time to time so as to permit appropriate modifications to its provisions.

The golf course superintendent, Village board of trustees, Village Water Control Commission, Village Engineer, or Village planning board may request an amendment. An amendment request shall specify what the proposed change is, the reason for the change, and any site-specific restrictions to be considered in reviewing the proposed change. If the proposed change involves the addition of a pesticide to the List of Pesticides for Possible Use at Hudson National Golf Club (contained herein in Appendix I), the request shall include the results of a site-specific risk assessment (based on NPURG or other appropriate model(s)); the Health Advisory Limit and LC_{50} /MAC data; and the sorption coefficient, leaching and runoff characteristics, and toxicity data for the proposed new pesticide. The request also shall define any modifications to the water quality monitoring program specified in the Environmental Management Plan which are appropriate should the proposed amendment be implemented. Unless the request is initiated by the golf course superintendent, a copy of the request shall be provided to the golf course superintendent at the time it is submitted to the planning board.

The village planning board shall consider a request within thirty (30) days following the receipt of the request. The planning board may seek the advise of an expert to assist it in the review of the request. The Hudson National Golf Club shall reimburse the Village for the

reasonable and appropriate costs associated with the review of a request initiated by the superintendent of the golf course.

The planning board shall either approve or deny the request within a reasonable period of time following the receipt of the request. If the planning board approves the request, its resolution of approval shall specify any restrictions it deems appropriate concerning the amendment and any modifications to the water quality monitoring program it deems appropriate.

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Appendix I

List of Pesticides for Use at Hudson National Golf Club

Table 1. List of Pesticides for Possible use at Hudson National Golf Club.

Table 2. Recommendations for Fungicide, Insecticide, and Herbicide Use at Hudson National Golf Club.

Table 3. Health Advisory Limits and LC50/MAC data for Pesticides at Hudson National Golf Club.

Table 4. Sorption Coefficients, leaching and runoff characteristics and toxicity data for pesticides considered for use at Hudson National Golf Club.

Appendix I

Table 1. List of Pesticides for Possible Use at Hudson National Golf Club

azoxystrobin	iprodione
bendiocarb	isofenphos
benefin	mancozeb
bensulide	mecoprop (MCP)
bentazon	metalaxyl
carbaryl	MSMA
chlorpyrifos	oxadiazon
chlorothalonil	pendimethalin
DCPA	propiconazole
dicamba	siduron
ethofumesate	thiram
ethoprop	triadimefon
etridiazole	trichlorfon
fenamiphos	trifluralin
fenarimol	vinclozalin
fosetyl-Al	2,4-D amine
glyphosate	

Appendix I

Table 2. Recommendations for Fungicide, Insecticide, and Herbicide Use at Hudson National Golf Club.

Fungicides† recommended for control of specific turfgrass diseases at Hudson National Golf Club. (TABLE 8 in text.)		
Disease	Greens/Tees	Fairways/Roughs
Brown Patch	azoxystrobin, chlorothalonil, iprodione, mancozeb, propiconazole, thiram, triadimefon, vinclozalin	iprodione, propiconazole, thiram, triadimefon
Dollar Spot	chlorothalonil, iprodione, propiconazole, thiram, triadimefon, vinclozalin	iprodione, propiconazole, thiram, triadimefon
Leaf Spots	chlorothalonil, iprodione, mancozeb, vinclozalin	iprodione
Necrotic Ringspot	fenarimol, iprodione	iprodione
Pink Snow Mold	azoxystrobin, iprodione, thiophanate, triadimefon, vinclozalin	iprodione, triadimefon
Pythium Blight	etridiazole, fosetyl-Al	fosetyl-Al, metalaxyl
Pythium Root Rot	fosetyl-Al	fosetyl-Al
Summer Patch	iprodione, propiconazole, triadimefon	iprodione, propiconazole, triadimefon
Typhula Blight	azoxystrobin, chlorothalonil, iprodione, thiram, triadimefon	iprodione, thiram, triadimefon
† All materials must be applied at rates and under conditions prescribed by the label.		

Insecticides† recommended for control of specific turfgrass insects at Hudson National Golf Club. (TABLE 10 in text.)		
Insect	Greens/Tees	Fairways/Roughs
Hyperodes weevil	chlorpyrifos, isofenphos	chlorpyrifos, isofenphos
White grubs	bendiocarb, carbaryl, chlorpyrifos, isofenphos	bendiocarb, carbaryl, ethoprop, trichlorfon
Sod webworms	carbaryl, chlorpyrifos	carbaryl, chlorpyrifos
† All materials must be applied at rates and under conditions prescribed by the label.		

Herbicides† and Plant Growth Regulators† recommended for control of specific turfgrass weeds at Hudson National Golf Club. (TABLE 11 in text.)			
Weed	Greens/Tees	Fairways	Roughs
Annual bluegrass	ethofumesate, cimectacarb, paclobutrazol	ethofumesate, cimectacarb, paclobutrazol	ethofumesate, cimectacarb, paclobutrazol
Clover	None suitable	MCP	MCP
Broadleafs	2,4-D	2,4-D, dicamba, MCP	2,4-D, dicamba, MCP
Crabgrass	bensulide, DCPA, bensulide + oxadiazon	bensulide, DCPA	benefin, DCPA, bensulide, MSMA, pendimethalin, trifluralin
† All materials must be applied at rates and under conditions prescribed by the label			

Appendix I**Table 3. Health Advisory Limits and LC₅₀/MAC data for Pesticides at Hudson National Golf Club.**

Pesticide	HAL (ppb)	LC₅₀ (ppb)^a	MAC (ppb)
azoxystrobin	no data	25.9	
bendiocarb	40	15.5	7
benefin	2100	3.7	
bensulide	50	7	
bentazon	20	6350	
carbaryl	700	1140	1.4
chlorpyrifos	105	0.071	
chlorothalonil	2	0.49	
DCPA	3500	1000	
dicamba	200	280	420
ethofumesate	8750	150	12.5
ethoprop	0.1	138	
etridiazole	no data	40	
fenamiphos	2	1.1	
fenarimol	500	18	12
fosetyl-Al	21000	4280	1135
glyphosate	700	83	796
iprodione	280	67	
isofenphos	35	20	0.059
mancozeb	21	10	
mecoprop (MCP)	35	1500	1860

Pesticide	HAL (ppb)	LC₅₀ (ppb)^a	MAC (ppb)
metalaxyl	420	>1000	280
MSMA	700	120	
oxadiazon	40	3200	
PCNB	21	10	
pendimethalin	280	1.99	
propiconazole	91	>1000	810
siduron	8750	180	
thiram	40	1.3	
triadimefon	210	140	24
trichlorfon	1250	4	1.6
trifluralin	5	0.41	
vinclozalin	200	5250	
2,4-D amine	70	1000	11.1
Cimectacarb	8750		3800
Paclobutrazol	460		360

Notes:

^a the numbers in this column have been calculated by $LC_{50} \times 0.01 = \text{number in column.}$

The Lifetime Health Advisory Level or Equivalent (HALEQ) provides a measure of pesticide toxicity to humans. The lifetime health advisory level as defined by EPA is the concentration of a chemical in drinking water that is not expected to cause any adverse health effects over a lifetime of exposure (70 yrs), with a margin of safety. The values we used in the table are the EPA lifetime health advisory level, HAL, or an equivalent value, HALEQ (denoted by a superscripted asterisk), calculated using the same formula used by the EPA ($HALEQ = RfD \times 7000$), where RfD is the reference dose determined by the EPA.

The aquatic toxicity provides a measure of pesticide toxicity to aquatic species. The values given in the table are the lethal concentrations at which 50% of the test species dies (LC_{50}) divided by a conservative safety factor of 100 (Suter et al 1989; Warren-Hicks et al. 1989). This is a conservative factor in that most measured chronic values would be higher than those estimated from this factor (Suter et al. 1983).

Appendix I

Table 4. Sorption Coefficients, leaching and runoff characteristics and toxicity data for pesticides considered for use at Hudson National Golf Club.

Table 1. Turf-Golf Courses-Pesticide Parameter Matrix for Selecting Pesticides to Minimize Water Quality Problems.

06/05/91

Trade-Name ¹	Common Name	Application Timing ²		Sorption Coefficient ³ K _{oc} (ml/g)		Relative Losses		Toxicity	
		Pre	Post			Leaching RLPI ⁴	Runoff RRPI ⁵	HAL or HALEQ ⁶ (ppb)	Aquatic LC ₅₀ ⁷ (ppm)
Herbicide									
2 Plus 2(M)	2,4-D amine		x	20		20	20	70	100
2 Plus 2(M)	mecoprop (MCPP)		x	20	E(pH7)	10	10	7 *	low toxicity
AAtrex	atrazine	x	x	100		17	17	3	4.5
Ace Lawn Weed Killer(M)	dicamba		x	2		1	1	200	28
Ace Lawn Weed Killer(M)	2,4-D		x	20		20	20	70	1.1
Ace Lawn Weed Killer(M)	mecoprop (MCPP)		x	20	E(pH7)	10	10	7 *	low toxicity
Asulox	asulam		x	40		57	57	400 *	>5,000
Balan	benefin	x		9,000		>2,000	3	2,000	0.37b
Benvel	dicamba		x	2		1	1	200	28
Basagran	bentazon		x	34		17	17	20	635
Benefin Granular	benefin	x		9,000		>2,000	3	2,000 *	0.37b
Betamec	bensulide	x		1,000	E	83	8	50 *	0.7
Betasan	bensulide	x		1,000	E	83	8	50 *	0.7
Bueno	MSMA		x	10,000	E	1,000	1	nd	12b
Calar	CAMA		x	nd		nd	nd	nd	nd
Chickweed Spurge(M)	2,4-D		x	20		20	20	70	1.1
Chickweed Spurge(M)	dicamba		x	2		1	1	200	28
Chickweed Spurge(M)	dichlorprop		x	1,000	E	1,000	100	40 *	1.3
Chipco Turf Herbicide	2,4-D amine		x	20		20	20	70	100
Clout	DSMA		x	nd		nd	nd	nd	nd
Crabgrass Preventer	benefin	x		9,000		>2,000	3	2,000 *	0.37b
Dacamine	2,4-D amine		x	20		20	20	70	100
Daconate	MSMA		x	10,000	E	1,000	1	nd	12b
Dacthal	DCPA	x		5,000		500	2	4,000	100a
Devrinol	napropamide	x		700		100	20	700 *	30b
Dimension	dithiopyr	x		nd		nd	nd	nd	0.5
DMA	2,4-D amine		x	20		20	20	70	100
DHC Weed Control	metsulfuron		x	35	(pH7)	3	3	2,000 *	1,000d
Formula	2,4-D amine		x	20		20	20	70	100
Gallery	isoxaben	x		nd		nd	nd	nd	nd
Gramoxone Super	paraquat		x	1,000,000	E	>2,000	1	30	15
Halt	pendimethalin	x		5000		556	2	300 *	0.199b
Halts	bensulide	x		1,000	E	83	8	50 *	0.7

HAL or HALEQ⁶: Lifetime Health Advisory Level or Lifetime Health Advisory Level Equivalent.

Continued---

TABLE 1. Turf-Golf Courses-Pesticide Parameter Matrix---Continued:

Trade-Name ¹	Common Name	Application Timing ²		Sorption Coefficient ³ K _{ow} (ml/g)	Relative Losses		Toxicity		
		Pre	Post		Leaching RLPI ⁴	Runoff RRPI ⁵	HAL or MALEQ ⁶ (ppb)	Aquatic LC ₅₀ ⁷ (ppm)	
Herbicide									
Noelion	diclofop-methyl		x	16,000		>2,000	2	10 *	0.35
Illoxan	diclofop-methyl		x	16,000		>2,000	2	10 *	0.35
Image	imazaquin		x	20	E(pH7)	3	3	2,000 *	>100
Kerb	pronamide	x	x	200		33	33	50	72
Kleenup	glyphosate		x	24,000	E	>2,000	1	700	8.3
Laddok (M)	atrazine	x	x	100		17	17	3	4.5
Laddok (M)	bentazon	x	x	34		17	17	20	635
Lesco	2,4-D amine		x	20		20	20	70	100
Lesco Eight-One(M)	dicamba		x	2		1	1	200	28
Lesco Eight-One(M)	2,4-D amine		x	20		20	20	70	100
Lesco Three-Way(M)	mecoprop (MCPP)		x	20	E(pH7)	10	10	7 *	low toxicity
Lesco Three-Way(M)	dicamba		x	2		1	1	200	28
Lesco Three-Way(M)	2,4-D		x	20		20	20	70	1.1
Lescoper(M)	mecoprop (MCPP)		x	20	E(pH7)	10	10	7 *	low toxicity
Lescoper(M)	2,4-D amine		x	20		20	20	70	100
Lescopex	mecoprop (MCPP)		x	20	E(pH7)	10	10	7 *	low toxicity
Lescosan	bensulide	x		1,000	E	83	8	50 *	0.7
Mecomec	mecoprop (MCPP)		x	20	E(pH7)	10	10	7 *	low toxicity
Mecoprop	mecoprop (MCPP)		x	20	E(pH7)	10	10	7 *	low toxicity
MSMA	MSMA		x	10,000	E	1,000	1	nd	12b
Pennant	metolachlor	x		200		22	22	100	2
Phenaben(M)	dicamba		x	2		1	1	200	28
Phenaben(M)	2,4-D amine		x	20		20	20	70	100
Poast	sethoxydim		x	100	E(pH7)	200	200	600 *	170
Pre-M	pendimethalin	x		5,000		556	2	300 *	0.199b
Prefar	bensulide	x		1,000	E	83	8	50 *	0.7
Presan	bensulide	x		1,000	E	83	8	50 *	0.7
Princep	simsazine	x	x	130		22	22	1	2.8
Prograss	ethofumesate		x	340		133	98	nd	>180
Proturf Goosegrass(M)	oxadiazon	x		3,200		533	5	40 *	>320
Proturf Goosegrass(M)	bensulide	x		1,000	E	83	8	50 *	0.7
Proturf	bensulide	x		1,000	E	83	8	50 *	0.7
Proturf	dicamba		x	2		1	1	200	28

HAL or MALEQ⁶: Lifetime Health Advisory Level or Lifetime Health Advisory Level Equivalent.

Continued---

TABLE 1. Turf-Golf Courses-Pesticide Parameter Matrix---Continued:

Trade-Name ¹	Common Name	Application Timing ²		Sorption Coefficient ³ K _{oc} (ml/g)	Relative Losses		Toxicity		
		Pre	Post		Leaching RLPI ⁴	Runoff RRPI ⁵	HAL or HALEQ ⁶ (ppb)	Aquatic LC ₅₀ ⁷ (ppm)	
Herbicide									
Purge	atrazine	x	x	100		17	17	3	4.5
Quadmec(M)	mecoprop (MCP)		x	20	E(pH7)	10	10	7 *	low toxicity
Quadmec(M)	dicamba		x	2		1	1	200	28
Quadmec(M)	2,4-D		x	20		20	20	70	1.1
Ronstar	oxadiazon	x		3,200		533	5	40 *	>320
Round-Up	glyphosate		x	24,000	E	>2,000	1	700	8.3
Rubigan	fenarimol	x		600		17	5	500 *	1.8
Sencor	metribuzin	x	x	60		15	15	200	76
Super Trimec(M)	dichlorprop		x	1,000	E	1,000	100	40 *	1.3
Super Trimec(M)	2,4-D		x	20		20	20	70 *	1.1
Super Trimec(M)	dicamba		x	2		1	1	200	28
Super D II Weedone(M)	dicamba		x	2		1	1	200	28
Super D II Weedone(M)	2,4-D amine		x	20		20	20	70	100
Surflan	oryzalin	x		600		300	83	400 *	3.26
Team(M)	trifluralin	x		8,000		1,330	2	5	0.041
Team(M)	oryzalin	x		600		300	83	400 *	3.26
Team(M)	benefin	x		9,000		>2,000	3	2000 *	0.37b
Treflan	trifluralin	x		8,000		1,330	2	5	0.041
TrexSan(M)	2,4-D		x	20		20	20	70 *	1.1
TrexSan(M)	dicamba		x	2		1	1	200	28
TrexSan(M)	mecoprop (MCP)		x	20	E(pH7)	10	10	7 *	low toxicity
Trimec Encore(M)	dicamba		x	2		1	1	200	28
Trimec Encore(M)	mecoprop (MCP)		x	20	E(pH7)	10	10	7 *	low toxicity
Trimec Encore(M)	MCPA		x	20	E(pH7)	14	14	11	232
Trimec(M)	mecoprop (MCP)		x	20	E(pH7)	10	10	7 *	low toxicity
Trimec(M)	2,4-D		x	20		20	20	70 *	1.1
Trimec(M)	dicamba		x	2		1	1	200	28
Turf Kleen(M)	2,4-D amine		x	20		20	20	70	100
Turf Kleen(M)	mecoprop (MCP)		x	20	E(pH7)	10	10	7 *	low toxicity
Turfion II Amine(M)	trichlopyr		x	20	E	4	4	200 *	117
Turfion II Amine(M)	2,4-D		x	20		20	20	70 *	1.1

HAL or HALEQ⁶: Lifetime Health Advisory Level or Lifetime Health Advisory Level Equivalent.

Continued---

TABLE 1. Turf-Golf Courses-Pesticide Parameter Matrix---Continued:

Trade-Name ¹	Common Name	Application Timing ²		Sorption Coefficient ³ K _{ow} (ml/g)	Relative Losses		Toxicity		
		Pre	Post		Leaching RLPI ⁴	Runoff RRPI ⁴	HAL or HALEQ ⁵ (ppb)	Aquatic LC ₅₀ ⁷ (ppm)	
<u>Herbicide</u>									
Turfion(M)	2,4-D		x	20	20	20	70 *	1.1	
Turfion(M)	trichlopyr		x	20 E	4	4	200 *	117	
Versar	MSMA		x	10,000 E	1,000	1	nd	12b	
Weed-B-Gon(M)	2,4-D amine		x	20	20	20	70	100	
Weed-B-Gon(M)	mecoprop (MCP)		x	20 E(pH7)	10	10	7 *	low toxicity	
Weedar	2,4-D amine		x	20	20	20	70	100	
Weedestroy Triamine(M)	MCPA		x	20 E(pH7)	8	8	11	232	
Weedestroy Triamine(M)	mecoprop (MCP)		x	20 E(pH7)	10	10	7 *	low toxicity	
Weedestroy Triamine(M)	dicamba		x	2	1	1	200	28	
Weedestroy Tri-ester(M)	2,4-D		x	20	20	20	70 *	1.1	
Weedestroy Tri-ester(M)	mecoprop (MCP)		x	20 E(pH7)	10	10	7 *	low toxicity	
Weedmaster(M)	2,4-D amine		x	20	20	20	70	100	
Weedmaster(M)	dicamba		x	2	1	1	200	28	
Weedone	2,4-D amine		x	20	20	20	70	100	
Weedone DPC Herbicide(M)	2,4-D		x	20	20	20	70	1.1	
Weedone DPC Herbicide(M)	dichlorprop		x	1,000 E	1,000	100	40 *	1.3	
Weedstroy	mecoprop (MCP)		x	20 E(pH7)	10	10	7 *	low toxicity	
XL(M)	benflin	x		9,000	>2,000	3	2,000 *	0.37b	
XL(M)	oryzalin	x		600	300	83	400 *	3.26	

Trade-Name ¹	Common Name	Application Type ²		Sorption Coefficient ³ K _{oc} (ml/g)	Relative Losses		Toxicity	
		Soil	Foliar		Leaching RLPI ⁴	Runoff RRPI ⁴	HAL or HALEQ ⁵ (ppb)	Aquatic LC ₅₀ ⁷ (ppm)
<u>Insecticide/Miticide</u>								
Andro Belt	hydramethylnon	x		730,000	>2,000	1	nd	nd
Crusade	fonofos	x	x	870	218	29	10	0.02
Cythion	malathion		x	1,800	>2,000	556	200	0.2

HAL or HALEQ⁵: Lifetime Health Advisory Level or Lifetime Health Advisory Level Equivalent.

Continued---

TABLE 1. Turf-Golf Courses-Pesticide Parameter Matrix---Continued:

Trade-Name ¹	Common Name	Application Type ²		Sorption Coefficient ³ K _{oc} (ml/g)		Relative Losses		Toxicity	
		Soil	Foliar			Leaching RLPI ⁴	Runoff RRPI ⁵	HAL or HALEQ ⁶ (ppb)	Aquatic LG ₅₀ ⁷ (ppm)
<u>Insecticide/Miticide</u>									
Diazinon	diazinon		x	1,000	E	250	25	0.6	0.09
Dipel	bacillus thuringiensis		x	nd		nd	nd	nd	95b
Dursban	chlorpyrifos		x	6,070		>2,000	5	20 *	0.0071
Dylox	trichlorfon		x	10		10	10	900 *	0.4
Ethion	ethion		x	10,000		667	1	4 *	0.5
Lannate	methomyl		x	72		24	24	200	3.4
Logic Bait	fenoxycarb	x		1,000	E	>2,000	1,000	nd	nd
Mavrik Aquaflo	fluvalinate		x	1,000,000	E	>2,000	1	70 *	0.0029
Mocap	ethoprop	x		70		28	28	0.1 *	13.8
Mudrin	methomyl		x	72		24	24	200	3.4
Oftanol	isofenphos	x	x	600		40	11	7 *	2d
Orthene	acephate	x	x	2		7	7	30 *	730
Pounce	permethrin		x	100,000		>2,000	1	400 *	0.0041
Proxol	trichlorfon	x		10		10	10	900 *	0.4
Pydrin	fenvalerate		x	5,300		1,510	5	200 *	0.0006
Sevin	carbaryl	x	x	300		300	300	700	114
Talstar	bifenthrin		x	240,000		>2,000	1	100 *	0.00015
Trithion	carbophenothion		x	46,000		>2,000	1	nd	nd
Triumph	isazophos	x	x	100		29	29	0.1 *	0.008
Turcam	bendiocarb	x	x	570		1,140	351	40 *	1.55
<u>Nematicide</u>									
Mocap	ethoprop	INC		70		28	28	0.1 *	13.8
Nemacur	fenamiphos	INC		100		20	20	2	0.11
<u>Fungicide</u>									
Aliette	fosetyl aluminum		x	20		2,000	>1,000	20,000 *	428
Apron	metalaxyl	x		50		7	7	400 *	>100
Banner	propiconazol		x	1,000	E	91	9	100 *	1.3b

HAL or HALEQ⁶: Lifetime Health Advisory Level or Lifetime Health Advisory Level Equivalent.

Continued---

TABLE 1. Turf-Golf Courses-Pesticide Parameter Matrix---Continued:

Trade-Name ¹	Common Name	Application Type ²		Sorption Coefficient ³ K _{oc} (ml/g)		Relative Losses		Toxicity		
		Soil	Foliar			Leaching RLPI ⁴	Runoff RRPI ⁴	HAL or NAL ⁵ (ppb)	Aquatic LC ₅₀ ⁶ (ppm)	
Fungicide										
Benol	propamocarb-hydro.	x	x	1,000,000	E	>2,000	1	700	*	410
Bayleton	triadimefon		x	300		115	115	200	*	14
Bromosan (M)	thiram		x	670		447	100	40	*	0.13
Bromosan (M)	thiophanate		x	nd		nd	nd	nd		20d
Chipco	iprodione		x	700		500	102	300	*	6.7
Clearys 3336	thiophanate		x	nd		nd	nd	nd		20d
Daconil	chlorothalonil		x	1,380		460	24	2		0.049
Dithane M-45	mancozeb		x	2,000		286	7	20	*	1b
Dow Elanco Broadway (M)	chlorothalonil		x	1,380		460	24	2		0.049
Dow Elanco Broadway (M)	fenarimol		x	600		17	5	500	*	1.8
Duosan (M)	mancozeb		x	2,000		286	7	20	*	1b
Duosan (M)	thiophanate methyl		x	1,830		1,830	55	600	*	11d
Dyrene	anilazine		x	1,000	E	>2,000	1,000	3	*	0.15
Fore	mancozeb		x	2,000		286	7	40	*	1.9
Fungo	thiophanate-methyl	x	x	1,830		1,830	55	600	*	11d
Griffen Manex	maneb		x	2,000	E	286	7	40	*	1.9
Kincaid Terraneb	chloroneb		x	1,650		127	5	90	*	>4,200b
Koben	etridiazol	x	x	1,000	E	97	10	nd		4
Lanco Captan	captan		x	200		800	800	900	*	0.0732
Lesco	thiram		x	670		447	100	40	*	0.13
Lesco	PCNB		x	5,000	E	>2,000	10	20	*	low toxicity
Lesco Twosome (M)	chlorothalonil		x	1,380		460	24	2		0.049
Lesco Twosome (M)	fenarimol		x	600		17	5	500	*	1.8
Maneb Plus Zinc(M)	zinc		x	nd		nd	nd	nd		nd
Maneb Plus Zinc(M)	maneb		x	2,000	E	286	17	40	*	1.9
Manex II	mancozeb		x	2,000		286	7	20	*	1b
Manzate 200	mancozeb		x	2,000		286	7	20	*	1b
Manzi(M)	maneb		x	2,000	E	286	17	40	*	1.9
Manzi(M)	zinc		x	nd		nd	nd	nd		nd
Pace (M)	metalaxyl		x	50		7	7	400	*	>100
Pace (M)	mancozeb		x	2,000		286	7	20	*	1b
Penncozeb	mancozeb		x	2,000		286	7	20	*	1b

HAL or NAL⁵: Lifetime Health Advisory Level or Lifetime Health Advisory Level Equivalent.

Continued---

TABLE 1. Turf-Golf Courses-Pesticide Parameter Matrix---Continued:

Trade-Name ¹	Common Name	Application Type ²		Sorption Coefficient ³ K _{oc} (ml/g)		Relative Losses		Toxicity	
		Soil	Foliar			Leaching RLPI ⁴	Runoff RRPI ⁴	HAL or HALEQ ⁵ (ppb)	Aquatic LC ₅₀ ⁶ (ppm)
<u>Fungicide</u>									
Pennwalt Maneb Plus(M)	zinc salt		x	nd		nd	nd	nd	nd
Pennwalt Maneb Plus(M)	maneb		x	2,000	E	286	17	40 *	1.9
Rubigen	fenarimol		x	600		17	5	500 *	1.8
SMCP Thiram	thiram		x	670		447	100	40 *	0.13
Spotrete	thiram		x	670		447	100	40 *	0.13
Subdue	metalaxyl	x	x	50		7	7	400 *	>100
Terraclor	PCNB	x	x	5,000	E	>2,000	10	20 *	low toxicity
Terramec	chloroneb		x	1,650		127	5	90 *	>4,200b
Terraneb	chloroneb		x	1,650		127	5	90 *	>4,200b
Terrazole	etridiazole	x	x	1,000	E	97	10	nd	4
Tersan 1991	benomyl		x	1,900		79	2	400 *	0.17
Thiramid	thiram	x		670		447	100	40 *	0.13
Topain M	thiophanate-methyl		x	1,830		1,830	55	600 *	11d
Turfside	PCNB	x		5,000	E	>2,000	10	20 *	low toxicity
Vorlan	vinclozalin		x	98	E	49	49	200 *	52.5
<u>Fumigants for Control of Soil Fungi</u>									
Brom-O-Gas	methyl bromide	INJ		22		4	4	7 *	2.5
Busan 1020	metam-sodium	INJ		10	E	14	14	nd	toxic
Terr-O-Gas (M)	methyl bromide	INJ		22		4	4	7 *	2.3
Terr-O-Gas (M)	chloropicrin	INJ		62		620	620	nd	nd
Vapam	metam-sodium	INC, INJ		10	E	14	14	nd	toxic
Vorlex(M)	1,3-dichloropropene	INJ		32		32	32	0.2	5.5
Vorlex(M)	N.I.T.	INJ		6		9	9	nd	0.37

HAL or HALEQ⁵: Lifetime Health Advisory Level or Lifetime Health Advisory Level Equivalent.

Continued---

TABLE 1. Turf-Golf Courses-Pesticide Parameter Matrix---Continued:

¹ Trade-Name:	(M) indicates that the product is a mixture of two or more active ingredients.
² Application Timing:	x: applied pre emergence or post emergence
³ Application Type:	INC: Incorporated INJ: Injected x: applied to soil surface or foliage
⁴ Sorption Coefficient:	E: estimated G: educated guess
⁵ Relative Leaching Potential Index (RLPI):	Smaller number indicates greater leaching hazard.
⁶ Relative Runoff Potential Index (RRPI):	Smaller number indicates greater runoff hazard.
⁷ HAL or HALEQ:	Lifetime Health Advisory Level or Lifetime Health Advisory Level Equivalent.
	*: Lifetime Health Advisory Equivalent
	value is for rainbow trout, 48 or 96 hr exposure time, unless otherwise specified
	a=channel catfish b=bluegill d=gold fish.

nd: no data available.

Appendix II

Restricted Use Pesticides

Restricted Use Pesticides	
Trade Name	Common Name
Dursban	Chlorpyrifos
Mocap	Ethoprop
Nemacur	Fenamiphos
Turcam	Bendiocarb

Appendix III

Report on Pesticides for Prickly Pear Golf Club Text and Data From Model Analysis

REPORT TO THE LEGACY GROUP
ON
THE PROPOSED PEST MANAGEMENT PLAN AND FERTILIZER PROGRAM FOR THE
PRICKLY PEAR HILL GOLF COURSE, CROTON ON THE HUDSON, NEW YORK
BY

A. MARTIN PETROVIC, PH.D

62 East Seneca Road
Trumansburg, NY 14886

Presently employed as an
Associate Professor of Turfgrass Science, Cornell University

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**PROPOSED PEST MANAGEMENT PLAN AND FERTILIZER PROGRAM FOR THE
PRICKLY PEAR HILL GOLF COURSE**

by

A. Martin Petrovic, Ph.D.

April 24, 1991

I. INTRODUCTION

This report was compiled from the following inputs: site inspection of the property on 10 September, 1990, results for representative soil samples taken from the site by Jay Fain (Tables I.1, I.2), review of the site plans, environmental fate assessment of the currently registered pesticides by model simulation, determination of the anticipated pest complex, and extensive literature search on the environment fate of fertilizers and pesticides, integrated pest management programs and fertility requirements for golf course turf. The outcome of this analysis will provide a basis for development of an environmentally sound fertilizer and pest management program to be followed by the golf course management personnel.

II. PEST MANAGEMENT PROGRAM

The components of pest management program will include: pest biology information, anticipated pest complex (Table II.1), control options (biological, cultural, plant resistance, and pesticidal) and pesticide environmental fate assessment for the selection of pesticide(s) for each anticipated major golf course pest. There has been much interest in the development of an "Organic Program" or an Integrated Pest Management (IPM) program for golf courses as a way to provide for good pest control while eliminating unnecessary pesticide application. There are some natural organic techniques available and where appropriate will be suggested for control of specific pests.

While IPM practices have been successfully used in other agricultural operations, a scientifically proven IPM program for golf courses has not yet been developed. This report will interject IPM practices that can be followed to provide for good pest control. The use of pesticides will still be necessary on this golf course; however, the one(s) suggested are not expected to have a negative impact on either surface or groundwater.

1. Anticipated Pest Complex.

It is anticipated that the Prickly Pear Hill Golf Course will have the pests shown in Table II.1. This information was derived from the pest management records for 1990 from the Sleepy Hollow Golf Course (see attached records). This golf course is in a close proximity to this site, is at a similar elevation, and has similar soils, grasses and mesoclimate. The list contains the most frequently encountered pests of golf courses in southeastern New

York.

2. Pesticide Fate Assessment

The assessment of the leaching and runoff potential of each registered pesticide for each soil found on the site was preformed by using the National Pesticide/soil database and User decision support system for Risk assessment of Ground and surface water contamination (NPURG). NPURG is a computerized information delivery system developed by the US Department of Agriculture and the Soil Conservation Service based on the GLEAMS model (Leonard et al. 1987). It was developed to be used for screening pesticides for their potential for leaching and runoff on a site specific basis (by soil type).

NOTE, this model was developed for row crop agricultural applications and has not been evaluated under turfgrass condition. Based on research on the leaching of pesticides applied to turfgrass (Petrovic et al., 1990) the NPURG simulation was found to correctly predict the probability of leaching in 11 out of 12 cases. In only one case did it over predict the leaching of pesticides applied to turfgrass (dicamba). A comparison of actual field results and the NPURG simulation are shown in Table II.10 and Figures II.1-3. Therefore, when the model predicts a low probability for leaching, then in fact leaching is highly unlikely. However, when the model predicts a high probability for leaching, this may not be the case. It is recommended to err on the conservative side for environmental protection. Thus, any pesticide that is predicted to have a high probability for leaching has been removed from the list of suggested pesticides for a given pest.

It is also very likely that NPURG will substantially over predict the runoff of pesticides applied to turfgrass based on the results of several studies on pesticide runoff from turfgrass (Watschke et al, 1989, and Morton et al, 1988). These results clearly showed that once turfgrasses are established there is little water leaving a turfgrass site (approximately 1% of the water that comes in contact with the turf) even when irrigated at a 5 inch/hr. NPURG ranks runoff from bare soil which reflects the erosion potential of a given soil. Once this site has been established with turfgrass, then it is unlikely that there should be significant runoff of water that might contain a pesticide. The water infiltration rates shown in Table I.1 for the surface layer (A soil horizon) of each soil was found to range from 0.53 to 14 inches/hr. This was measured on compacted samples reflecting the state of the soil during the construction phase. It is expected that the infiltration rates should substantially increase as the turfgrass becomes established as observed by Watschke et al., 1989. The one exception should be the greens/tee soil that should decrease rapidly over time. The change in infiltration rate should reduce the potential for runoff from the native soils and have not effect on the greens and tees.

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The following are the conditions under which the pesticide/soil fate was determined:

- * The pesticide was applied to the surface of a fallow (bare) soil 16, 8, 4, and 2 days before and on the day of the first major rainfall event.
- * A 3.5 inch precipitation event was generated every second day for five events, and then a 1.0 inch event every other day for at least four times during the half life period of the pesticide. Total precipitation was 21.5 inches.
- * The site had a four per cent slope and a rooting depth of 36 inches. This site has several soils with a greater than 4 % slope. As indicated on the detailed NPURG evaluation sheets found in Section V of this report, the results reported here are valid for soils with a greater than 15 % slope.

The conditions that these simulations are run under are considered to be the "worst case scenario". The frequency of a rainfall event in excess of 3.5 inch per day in Westchester County, NY (irrigation will be less than 1 inch per day) is once every two years. The likelihood of 5 such events over a 10 day period (normal precipitation for the growing season for Croton, NY is 22 inches) is quite small.

A summary of the pesticide fate as determined by the NPURG analysis for greens/tees and fairways/roughs are shown in Tables II.2 to II.9. Any pesticide that had a high probability for either leaching or runoff was removed from the list of suggested pesticides for a given pest. When a pesticide was rejected from the suggested list due to a high probability of runoff, a question mark (?) was placed next to the rejection in Tables II.2-II.9. In only two cases (Hyperodes weevil and crabgrass) were all registered pesticides rejected for use, however, pesticide use was still suggested for the reasons given above. The detailed evaluation sheets for each pest-pesticide-soil combination are as contained in Section V of this report.

3. Management Plan by Pest

DISEASES

The greens, tees and fairways are to be seeded with creeping bentgrass (Agrostis palustris Huds.). Creeping bentgrass is adapted to both wet and dry soil conditions (typical of what is found on this site). The disease control options available for creeping bentgrass are cultural, biological and with the use of pesticides. The following is a detailed program of disease management for the anticipated diseases on the Prickly Pear Hill Golf Course:

Brown Patch

This disease occurs under conditions of warm (>85 F) and very humid weather. It is expected that Brown patch will occur in June, July and August during most years. Cultural conditions that can reduce the severity of this disease are to avoid over Nitrogen fertilization (which is recommended in the Fertilizer Program), to water minimally and provide for good air movement and water drainage. There are no direct biological control agents at this time but there are several natural organic fertilizer/composts (Sustain and Ringer Compost Plus and Greens Restore) that have been shown to reduce the incidence of Brown patch by 75 % (Nelson, 1990). Thus, these material are suggested to be used to reduced the need for fungicides and as part the Fertilizer Program. The presence of Brown patch can be confirmed by laboratory analysis or by disease detection kits. It is highly recommended that the golf course superintendent use one of the diagnostic techniques to determine the need for addition control, namely fungicides. Daily scouting during periods of warm weather is highly recommended.

If the severity of the disease warrants the use of a fungicide, the following list of fungicides, if used, are not expected to have a negative impact on either surface or groundwater:

Greens/tees (Table II.2): anilazine, chlorothalonil, iprodione, mancozeb, PCNB, propiconazole, thiophanate, thiram, triadimefon, and vinclozalin

Fairways/roughs (Table II.6): anilazine, iprodione, propiconazole, thiophanate, thiram and triadimefon

Dollar Spot

Dollar spot is a foliar disease that is favored by temperatures of at least 75 F and by too low a level of nitrogen fertilization. It will probability occur on this site from May through October. Dollar spot is easily recognizable, slow to develop and to cause damage. Ringer Compost Plus and Greens Restore have been shown to reduce Dollar incidence by 45 % (Nelson, 1990). Damage from this disease may exceed the level acceptable on modern golf courses, thus, fungicide application are very likely to be needed. The following list of fungicides, if used, are not expected to have a negative impact on either surface or groundwater:

Greens/tees (Table II.2): anilazine, chlorothalonil, iprodione, propiconazole, thiophanates, thiram, triadimefon and vinclozolin

Fairways/roughs (Table II.6): anilazine, iprodione, propiconazole, thiophanates, thiram and triadimefon

Leaf Spots

There are several fungi that cause the disease known as leaf spot. The symptoms of leaf spot are most often observed in the cool weather of spring months of April and May. Avoiding heavy early spring nitrogen applications can reduced the damage caused by this disease (as noted in the Fertilizer Program, heavy early spring nitrogen fertilization will be avoided). The following list of fungicides, if used, are not expected to have a negative impact on either surface or groundwater:

Greens/tee (Table II.3): anilazine, chlorothalonil, iprodione, mancozeb, and vinclozolin

Fairways/roughs (Table II.7): anilazine and iprodione

Necrotic Ringspot

This disease's infection occurs in cool-wet weather of spring (April-May) and is most severe with excessive nitrogen fertilization and over/underwatering. Symptoms don't often appear until summer. Therefore, on areas with a history of Necrotic ringspot, fungicides must be applied in a preventative manner. At this point no other control options are available. The following list of fungicides, if used, are not expected to have a negative impact on either surface or groundwater:

Greens/tees (Table II.3): fenarimol and iprodione

Fairways/roughs (Table II.7): iprodione

Pink Snow Mold

Pink snow mold is a fungal disease that is favored by temperatures in the range of 32 to 40 F and wet weather. It is likely to occur on this site from November to March. Avoiding late fall nitrogen applications can reduce the severity of Pink snow mold (no late nitrogen applications will be made). However, fungicides are the only control method available at this time. The following list of fungicides, if used, are not expected to have a negative impact on either surface or groundwater:

Greens/tees (Table II.3): iprodione, PCNB, thiophanates, triadimefon and vinclozalin

Fairways/roughs (Table II.7): iprodione, thiophanates and triadimefon

Pythium Blight

This disease is the most rapidly developing and devastating disease to attack golf courses. It is favored by excessive nitrogen

fertilization and very wet and hot weather (>90 F). Death of an entire green, tee or fairway can be in hours once the pathogen becomes active. Thus, quite often a preventative fungicide program is utilized to reduce the risk of catastrophic damage to the golf course. If preventative measures are not taken, then very frequent scouting of the golf course is required to determine if the disease organisms are active. Weather has a large effect, thus, climatological models have been used to predict an outbreak. Environmental monitoring and disease forecasting technology has been commercially developed for Pythium Blight and should be used on this site to determine when of if a fungicide should be applied. The following list of fungicides, if used, are not expected to have a negative impact on either surface or groundwater:

Greens/tees (Table II.3): etridiazole and fosetyl-Al

Fairways/roughs (Table II.7): fosetyl-Al and metalaxyl

Pythium Root Rot

This disease is related to Pythium blight, however, it occurs in cooler weather and is found in the root system. Results from sample cultures are necessary to confirm the presence of Pythium Root Rot. This is necessary before treatment since the Pythium fungi are not controlled by other fungicides. If not properly diagnosed the result could be a misapplication of a fungicide. The following list of fungicides, if used, are not expected to have a negative impact on either surface or groundwater:

Greens/tees (Table II.3): fosetyl-Al

Summer Patch

This disease will most likely be found on this site from June to September. Over fertilization with nitrogen and extremes in water will increase the likelihood of the disease. The damage to the turfgrass plant occurs in April-May, well in advance of the symptoms. Thus, a preventative fungicide program is necessary on sites that have had a history of Summer Patch problems. A fungicide application needs to be made in the spring before June. The following list of fungicides, if used, are not expected to have a negative impact on either surface or groundwater:

Greens/tees (Table II.4): iprodione, propiconazole,
Fairways/roughs thiophanates, and triadimefon

Typhula Blight

Typhula blight or Gray snow mold is winter disease that requires snow cover to develop. During open or winters with low snowfall, Gray snow mold is seldom a problem. Avoiding over nitrogen fertilization in the mid-fall period reduces the severity

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of this disease. Preventative fungicide program is often used to insure minimal turf damage from this disease since long term weather predictions are unreliable. The following list of fungicides, if used, are not expected to have a negative impact on either surface or groundwater:

Greens/tees (Table II.4): anilazine, chlorothalonil, iprodione, PCNB, thiram and triadimefon

Fairways/roughs (Table II.8): anilazine, iprodione, thiram and triadimefon

Disease Control Program (Fungicides)

It is impossible and environmentally irresponsible to develop a fungicide application schedule in advance of the building of a golf course. The major premise of an IPM program to use all options in controlling a pest and when it is necessary to apply a fungicide it must be applied at the right time for optimal control. Only a preventative fungicide program could be developed in advance of operating a golf course. Preventative programs are only necessary for a few turfgrass diseases. Thus, it would be very likely that an all preventative program would lead to applying fungicides when it was not necessary, increasing the risk of environmental damage and greater likelihood of developing fungi resistant to fungicides. The best way to reduce the reliance on pesticides is to follow proper fertilizer practices, allow for good surface drainage, control irrigation to only replace what the plant has used, scout and monitor pest population to determine if an economic/aesthetics threshold has been reached and then use the most effective method available for control.

WEEDS

It is anticipated that after the first year of establishment of this golf course that weed problems will tend to be minimal. This is a result of sound golf course cultural/pest control practices that will produce a dense-competitive environment against weed encroachment. Thus, the anticipated weeds will be limited to annual bluegrass, broadleaf weeds especially clover and crabgrass.

Annual Bluegrass

Annual bluegrass (Poa annua spp. Reptans) is a very common weed that invades golf courses. It is well adapted to short mowing, heavily trafficked site, soils with a high pH and phosphorus level, and wet soil conditions. Thus, a cultural program to reduce it's competitiveness must include: keeping soil pH at 6 or below, provide for good drainage, keep irrigation to a minimum, use soils that are not too high in phosphorus and are resistant to compaction (such as the sandy soils to be used on the greens and tees). Even

after doing all of this annual bluegrass can still persist. Thus, some other control measures must be followed. There are experimental biological control agents for annual bluegrass that may some day be commercially available. Chemical control is limited. The following list of herbicides, if used, are not expected to have a negative impact on either surface and groundwater:

Greens/tees and Fairways/roughs (Table II.4,8): ethofumesate

Clover and other Broadleaf Weeds

Clover is often the only broadleaf weed commonly found on golf courses. It is favored by soil pH around 7 and by dry soils. Thus, on this golf course it would be anticipated that clover would be found on the unirrigated site (roughs) and dry areas like the sandy greens/tees. If other broadleaf weeds do invade, then it is common to use a broad spectrum herbicide cocktail for control. The following list of herbicides, if used, are not expected to have a negative impact on either surface or groundwater:

Greens/tees (Table II.4): Clover, None found suitable
Broadleaf weeds, 2,4-D

Fairways/roughs (Table II.8): Clover, MCPP
Broadleaf weeds, 2,4-D,
dicamba
and MCPP

Crabgrass

Crabgrass is an annual grassy weed that invades thin turf. Thus, any other practices that encourage a dense stand of turf reduce the incidence of crabgrass. Practices such as fertilization, irrigation and pest control that produce a dense turf restrict light from reaching the soil surface. Crabgrass seeds require light for germination. These management practices help significantly, however, when a golfer takes a divot the soil is exposed to light and crabgrass can invade. There are two herbicidal control programs, preemergence and postemergence. These terms refer to before or after the crabgrass seeds germinate, respectively. The preemergent herbicides must be put down in advance of the period of germination of crabgrass, usually in April. The problem with this approach is that you are not sure that crabgrass will be present or not. If not present then the application has been wasted. Postemergent herbicides are few and require careful timing for good control. The following list of herbicides, if used, are not expected to have a negative impact on surface or groundwater:

Greens/tees (Table II.5): benefin, bensulide, DCPA,
methanearsonate, pendimethalin and

trifluralin
Note, only bensulide and DCPA will not injure
bentgrass

Fairways/roughs (Table II.9): None were found suitable

It should be noted that NPURG predicted a high probability for surface runoff with all of these herbicides on fairways/roughs. Based on the research results of Watschke et al.(1989) with one of the herbicides (pendimethalin), runoff from up to 12% slopes with a turf cover even when irrigated at an intensity of 5 inches/hr, was non-detectable. Thus, it is suggested that the list selected for greens/tees would also be suitable on the fairways/roughs.

INSECTS

Insect problems anticipated on this golf course are restricted to just a few insects. There are nonchemical approaches to insect control available commercially. Many however have been proven to be ineffective. These include biocontrols such as milky spore and nematodes for white grub control. There are grasses resistant to certain surface feeding insects; however, the grasses found on golf courses are not in this type. This is not to say that some day nonchemical approaches will place in a pest control program on golf courses. There is substantial research being done in this area and the findings to date are very exciting.

One of the best practices to follow in an insect control program is to implement a systematic sampling/monitoring scheme. It has been found that insect pests of turf like white grubs do not uniformly cover the entire golf course. In fact it has been shown that grubs are confine to certain parts of the golf course and even a small section of a fairway. Therefore, it is highly recommended that the prior to any insecticide application that a sampling protocol be followed and treatment be confined to only the areas where insects are found in sufficient numbers to be causing damage. The Turfgrass Science/IPM Program at Cornell University is developing sampling/monitoring protocols for insects and should be consulted for details on development of such a program.

Hyperodes Weevil

This insect attacks only the annual bluegrass plant. Therefore, if the annual bluegrass control program is effective then insecticidal controls will be unnecessary. In the unlikely event that annual bluegrass is not eradicated, Hyperodes Weevil can be a serious pest and insecticidal control measures must be taken. Sampling of the adult population can be made in spring and the selected areas for treatment determined. The following list of insecticides, if used, are not expected to have a negative impact on either surface or groundwater:

Greens/tees (Table II.4): chlorpyrifos and isofenphos

Fairways/roughs (Table II.8): None were found suitable

Note, as before with herbicides, Watschke et al.(1989) found no runoff of chlorpyrifos, thus, these two insecticides should pose little problem in runoff, and are suggested for use on fairways.

White Grubs

There are several species of insects that have a destructive larval stage known as white grubs. These include Japanese beetle, Oriental Beetle, Asiatic Garden Beetle and European Chafer. The population of these insect should also be determined as described above before any insecticidal treatment be made. Treatments are most effective in early August when the grubs are very small. The following list of insecticides, if used, are not expected to have a negative impact on surface and groundwater:

Greens/tees (Table II.5): bendiocarb, carbaryl, chlorpyrifos and isofenphos

Fairways/roughs (Table II.9): bendiocarb, carbaryl, ethoprop and trichlorfon

III. FERTILIZATION PROGRAM

Unlike pesticide programs, it is possible to develop in advance a fertilization schedule. Factors important in the development of such a program include the site specific soil properties, nutrient requirements of grass species/cultivar, irrigation plan, desired level of quality, interaction with pest populations and environmental considerations. The fertilizer nutrients of concern from an environmental perspective are nitrogen (as nitrate) and phosphorus (phosphates). Nitrate can cause a reduction in the quality of water in terms of either as a drinking water source or it's impact on eutrophication of streams, ponds or lakes. Phosphorus on the other hand is mostly a concern of surface water eutrophication.

There has been considerable research on the fate of nitrogen applied to turfgrass as summarized by Petrovic (1990, see attached reference). Factors that influence the degree of nitrate leaching are the source of nitrogen, the rate of application, the timing of the application and irrigation practices. These factors will be interjected into the fertilization program to produce a good quality golf course with a low probability of any negative impact on the surrounding environment.

The following fertilization program was developed based on: the needs of the creeping bentgrass plant, site specific soil

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conditions (Table III.1), the desire for a good level of quality, interaction with pest populations and with special emphases on the environmental consideration of nitrogen fertilization. The creeping bentgrass plant is very efficient at utilizing fertilizer nitrogen. The amount and type of fertilizer nitrogen to be applied on this golf course are in line with the plant requirement for nitrogen.

An environmentally sound fertilization program for this golf course is presented in Tables III.2 and III.3. This program incorporates a balanced approach to fertilization: the amount of each of the nutrient applied will provide for adequate plant growth, will not over or under stimulate growth at the expense disease resistance or weed encroachment, will act in a disease suppressive manner by the use of natural organic fertilizer (Ringer or Sustane) and will not lead to the potential for either a significant amount runoff or leaching by not having a large pool of water soluble nitrogen available at one time. This program will avoid several of the major factors that encourage nitrate leaching: there is no late fall fertilization, the nitrogen sources have not been shown to leach from golf course type turf (Petrovic, 1990 and Petrovic, 1991) and the rates of application are low, thus resulting in little soluble nitrogen available for off site transport.

The range of reported of nitrate leaching values from field studies for IBDU fertilization (the other nitrogen source suggested for use on this golf course) are 0.1 to 0.9 % of the amount of nitrogen applied. Leaching from applications of Ringer or Sustane has been shown to be zero (Petrovic, 1991). Thus, an estimated nitrate loading rate from the approximately 90 acres of greens, tees, roughs and fairways at the maximum rate of 0.9 % of the applied fertilizer nitrogen is 47 lbs. of nitrate-N in initial years and 45 lbs. of nitrate-N in subsequent years. Assuming the average rainfall in a similar location (Croton Lake) to Prickly Pear Hill is 50 inches per year and that half the annual rainfall will leach into groundwater, then the average concentration of nitrate-N leaching into the groundwater is 0.75 mg/l, well below the 10 mg/l federal drinking water standard. Thus, the groundwater associated with this golf course would be considered potable.

It has been assumed that phosphorus leaching from turfgrass site is small, especially on non-sandy soils. From pure sand putting greens, phosphorus leaching was found to be as high as 8 % of the phosphorus applied (Sheard and Beauchamp, 1985). Using the figure of 8 %, the anticipated phosphorus loading rate from the 10 acres of greens and tees would from 17 lbs (if Ringer were used) to 42 lbs (if Sustane were used). Assuming the same rainfall and groundwater recharge rates as described above for nitrates, then the average concentration of phosphate leaching into the groundwater ranged from 0.27 to 0.67 mg/l from the 10 acres. If put in to context of the total acres of the golf course (90 acres) with a dilution effect from the other areas (fairways and roughs), the

the concentration of phosphate would be estimated to range from 0.03 to 0.07 mg/l. There are no numerical standards for phosphorus for ground water or in surface waters at this time for New York.

Irrigation management is an extremely important in terms of nutrient leaching (Petrovic, 1990). Following proper irrigation procedures can reduce disease problems and avoid the waste of water. The objective of a sound irrigation program is to have healthy turf, which in most cases relates to irrigating just to replace the amount of water used by the plant. Watering in this manner has been shown to dramatically reduce the potential for nitrate leaching (Morton, 1988). Irrigating to only replace what has been used by the plant and evaporated from the soil (referred to as evapotranspiration) has been successfully done for years in the western part of the United States. Such methods are available for use on this golf course. These include a soil moisture control system and an irrigation rate based on an estimated value for evapotranspiration. The irrigation system can be attached to and controlled by soil moisture sensors to determine the need for irrigation. Snyder et al.(1984) found that sensor controlled irrigation drastically reduced nitrate leaching from sand.

Another method of determining the need and amount of irrigation is the use of pan evaporation rate. The Prickly Pear Hill Golf Course should install US Weather Bureau class A evaporation pan and rain gauge on the golf course. The amount of irrigation to be applied to the golf course should be equal to 70 % amount of water lost by the evaporation pan minus the amount of rainfall from the last time the site was irrigated. The period between measurements should reflect the interval between irrigation events. If the golf course is only going to irrigation once per week, then the weekly amount of rainfall and pan evaporation must be measured and the amount of irrigation calculated. If irrigation is to be done daily, then the measurements and calculation must be made daily.

SECTION IV. COMPARISON OF ALTERNATIVE PLANS

The alternative plans center around the addition of housing, modification of the proposed golf course layout or down sizing the proposed golf course. The alternative plan(s) could pose a greater risk to the environment and to the wetlands than the proposed golf course. Residential lawns are often fertilized at a higher annual rate and with sources that have a much higher probability of leaching (Table IV.1) than this golf course. Pesticide use on residential lawns should be less than on the golf course. However, homeowners very often over apply pesticides, apply them at the wrong time and don't store them in a safe manner. The result of such activity could certainly have a much greater negative impact than this golf course which will be managed by a well educated, and highly trained golf course professional. Down sizing would do little to reduce the impact of the proposed golf course on the Page

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surrounding environment. It has been clearly shown in this report that applying fertilizers or pesticides to proposed golf course would not reduce the quality of either groundwater or surface water. Down sizing is therefore not necessary.

SECTION V. ATTACHMENTS

1. Complete NPURG work sheets by pest/soil/pesticide combination.
2. 1991 Pest Management Recommendations for Commercial Turfgrass, Cornell University.
3. Article entitled "The fate of nitrogenous fertilizers applied to turfgrass" by A.M. Petrovic.
4. NPURG explanation sheet.

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Table I.1. Selected Soil Chemical and Physical Properties-Prickly Pear Hill Project

Site Number	Soil Series Name	Soil Horizon	Infiltration Rate	Organic Carbon	pH
			inches/hr	%	
1	Charlton loam	A	1.01	4.76	4.6
		B	0.28	0.88	
		C	0.29	0.64	
2	Ridgebury loam	A	1.19	4.97	5.0
		B	0.22	1.83	
		C	0.03	0.57	
3	Sutton loam	A	1.39	5.85	4.5
		B	0.07	0.70	
		C	0.04	0.38	
4	Charlton loam	A	1.58	0.70	
		B	0.41	0.71	
5	Sun loam	A	1.62	5.66	6.1
		B	0.10	2.17	
6	Charlton loam	A	1.53	3.97	5.0
		B	0.58	0.78	
		C	0.37	0.44	
7	Ridgebury loam	A	0.53	3.52	5.2
		B	0.32	1.10	
		C	0.08	0.47	
8	Charlton-Chatfield loam	A	0.84	3.2	5.0
		B	0.18	1.40	
		C	0.34	0.29	
Greens Mix	Blue Ridge 80/20. Sand/peat		14.0	3.90	4.3

Samples taken by Jay Fain; Analysis done by the Soil Testing Laboratory, Cornell University, complete results attached. The samples were compacted prior to running the infiltration rate to reflect what would be expected following the construction phase.

Table I.2 Selected Soil Chemical Properties-Prickly Pear Hill Project

Site Number	Soil Series Name	Nutrient Level			
		Phosphorus	Potassium	Calcium	Magnesium
		----- lbs/acre-----			
1	Charlton loam	4	154	140	44
2	Ridgebury loam	6	108	788	190
3	Sutton loam	3	186	1470	188
4	Charlton loam	3	160	2294	360
5	Sun loam	2	248	1638	381
6	Charlton loam	1	104	766	184
7	Ridgebury loam	2	299	1448	142
8	Charlton/ Chatfield loam	10	130	186	40

Samples taken by Jay Fain; Samples analyzed at the Soil Testing Laboratory, Cornell University, complete results attached.

Table II.1. The Typical Pest Complex' for the Proposed Prickly Pear Hill Golf Course

Month of Occurrence	Site		
	Greens	Tees	Fairways
Jan.-Feb.	Snow mold		
March			
April	Necrotic Ring Spot Leaf Spot Crabgrass	Necrotic Ring Spot Leaf Spot Crabgrass	Annual Bluegrass Crabgrass
May	Necrotic Ring Spot White Grubs Leaf Spot Summer Patch Pythium Root Rot	Leaf Spot White Grubs Summer Patch Necrotic Ring Spot	Crabgrass White Grubs Summer Patch Necrotic Ring-Spot, Leaf Spot Dollar Spot Hyperodes Weevil
June	Necrotic Ring Spot Dollar Spot Pythium Root Rot Crabgrass Summer Patch Pythium Blight	Leaf Spot White Grubs Dollar Spot Pythium Root Rot Crabgrass Brown Patch Clover	White Grubs Necrotic Ring-Spot Dollar Spot Crabgrass Pythium Blight
July	Dollar Spot Hyperodes Weevil Brown Patch Pythium Blight Summer Patch	Dollar Spot Hyperodes Weevil Brown Patch Pythium Blight	Dollar Spot Hyperodes Weevil Brown Patch Pythium Blight
August	Dollar Spot Pythium Blight Brown Patch Annual Bluegrass Pythium Root Rot Algae	Dollar spot Pythium Blight Brown Patch	Dollar Spot Pythium Blight Brown Patch Annual Bluegrass
September	White Grubs	Dollar Spot	White Grubs Dollar Spot
October	Dollar Spot Pythium Root Rot	Dollar Spot	Dollar Spot
November	Snow Mold (pink,gray)	Snow Mold (pink,gray)	Dollar Spot Clover
December	Snow Molds	Snow Molds	Snow Molds

This list was derived from pest control records (1990) for Sleepy Hollow Country Club, a golf course with similar climatic and soil conditions.

Table II.2. Summary of pesticide-soil environmental fate for putting greens/tees, Prickly Pear Hill Project

Pest	Registered Pesticide	Potential*		Acceptable	Reject
		Leaching	Runoff		
<u>Brown Patch (Rhizoctonia)</u>	anilazine	3	3	yes	
	benomyl	1	3		yes
	chlorothalonil	3	3	yes	
	fenarimol	1	3		yes
	iprodione	3	3	yes	
	mancozeb	3	3	yes	
	PCNB	3	3	yes	
	propiconazole	3	3	yes	
	thiophanate	3	3	yes	
	thiram	3	3	yes	
	triadimefon	3	3	yes	
	vinclozalin	3	3	yes	
<u>Dollar Spot (Lanzia, Moellerodiscus)</u>	anilazine	3	3	yes	
	benomyl	1	3		yes
	chlorothalonil	3	3	yes	
	fenarimol	1	3		yes
	iprodione	3	3	yes	
	propiconazole	3	3	yes	
	thiophanates	3	3	yes	
	thiram	3	3	yes	
	triadimefon	3	3	yes	
	vinclozolin	3	3	yes	

* 1= high probability of runoff or leaching past the root zone; 2=possibility of runoff or leaching past the root zone; 3= low probability of runoff or leaching past the root zone.

Table II.3. Summary of pesticide-soil environmental fate for putting greens/tees, Prickly Pear Hill Project.

Pest	Registered Pesticide	Potential [*]		Acceptable	Reject
		Leaching	Runoff		
Leaf Spots	anilazine	3	3	yes	
	chlorothalonil	3	3	yes	
	iprodione	3	3	yes	
	mancozeb	3	3	yes	
	vinclozolin	3	3	yes	
Nectrotic Ring Spot (<u>Leptosphaeria</u>)	benomyl	1	3		yes
	fenarimol	3	3	yes	
	iprodione	3	3	yes	
Pink Snow Mold (<u>Microdochum</u>)	benomyl	1	3		yes
	fenarimol	1	3		yes
	iprodione	3	3	yes	
	PCNB	3	3	yes	
	thiophanate	3	3	yes	
	triadimefon	3	3	yes	
	vinclozalin	3	3	yes	
Pythium Blight (<u>Pythium</u>)	etridiazole	3	3	yes	
	fosetyl-Al	3	3	yes	
	metalaxyl	1	3		yes
	propamocarb	no data			
Pythium Root Rot	fosetyl-Al	3	3	yes	
	metalaxyl	1	3		yes
	propamocarb	no data			

* 1=high probability; 2=possibility; 3= low probability of runoff or leaching past the root zone.

Table II.4. Summary of the pesticide-soil environmental fate for putting greens/tees, Prickly Pear Hill Project.

Pest	Registered Pesticide	Potential*		Acceptable	Reject
		Leaching	Runoff		
Summer Patch (<u>Magnaporthe</u>)	benomyl	1	3		yes
	fenarimol	1	3		yes
	iprodione	3	3	yes	
	propiconazole	3	3	yes	
	thiophanate	3	3	yes	
	triadimefon	3	3	yes	
Typhula Blight (<u>Typhula</u>)	anilazine	3	3	yes	
	chlorothalonil	3	3	yes	
	fenarimol	1	3		yes
	iprodione	3	3	yes	
	PCNB	3	3	yes	
	thiram	3	3	yes	
Broad Leaf Weeds	triadimefon	3	3	yes	
	2,4-D	3	3	yes	
	dicamba	1	3		yes
Clover	MCPP	1	3		yes
	MCPP	1	3		yes
Annual Bluegrass	ethofumesate	1	3		yes
	paclobutrizol	no data			
Hyperodes Weevil	chlorpyrifos	3	3	yes	
	isofenphos	3	3	yes	

* 1=high probability; 2=possibility; 3=low probability of runoff or leaching past the root zone.

Table II.5. Summary of the pesticide-soil environmental fate for putting greens/tees, Prickly Pear Hill Project.

Pest	Registered Pesticide	Potential*		Acceptable	Reject
		Leaching	Runoff		
White Grubs	bendiocarb	3	3	yes	
	carbaryl	3	3	yes	
	chlorpyrifos	3	3	yes	
	ethoprop	1	3		yes
	isofenphos	3	3	yes	
	trichlorfon	1	3		yes
Crabgrass	benefin	3	3	yes	
	bensulide	3	3	yes	
	DCPA	3	3	yes	
	methanearsonate	3	3	yes	
	pendi-methalin	3	3	yes	
	siduron	1	3		yes
	trifluralin	3	3	yes	

* 1=high probability; 2=possibility; 3=low probability of runoff or leaching past the root zone.

Table II.6. Summary of pesticide-soil environmental fate for fairways, Prickly Pear Hill Project

Pest	Registered Pesticide	Potential*		Acceptable	Reject
		Leaching	Runoff		
<u>Brown Patch (Rhizoctonia)</u>	anilazine	3	3	yes	
	benomyl	1	3		yes
	chlorothalonil	3	1		yes?
	fenarimol	3	1		yes?
	iprodione	3	3	yes	
	mancozeb	3	1		yes?
	PCNB	3	1		yes?
	propiconazole	3	3	yes	
	thiophanate	3	3	yes	
	thiram	3	3	yes	
	triadimefon	3	3	yes	
	vinclozalin	3	1		yes?
<u>Dollar Spot (Lanzia, Moellerodiscus)</u>	anilazine	3	3	yes	
	benomyl	3	1		yes?
	chlorothalonil	3	1		yes?
	fenarimol	3	1		yes?
	iprodione	3	3	yes	
	propiconazole	3	3	yes	
	thiophanates	3	3	yes	
	thiram	3	3	yes	
	triadimefon	3	3	yes	
	vinclozolin	3	1		yes?

* 1= high probability of runoff or leaching past the root zone; 2=possibility of runoff or leaching past the root zone; 3= low probability of runoff or leaching past the root zone.

Table II.7. Summary of pesticide-soil environmental fate for fairways, Prickly Pear Hill Project.

Pest	Registered Pesticide	Potential [*]		Acceptable	Reject
		Leaching	Runoff		
Leaf Spots	anilazine	3	3	yes	
	chlorothalonil	3	1		yes?
	iprodione	3	3	yes	
	mancozeb	3	1		yes?
	vinclozolin	3	1		yes?
Nectrotic Ring Spot (<u>Leptosphaeria</u>)	benomyl	3	1		yes?
	fenarimol	3	1		yes?
	iprodione	3	3	yes	
Pink Snow Mold (<u>Microdochum</u>)	benomyl	3	1		yes?
	fenarimol	3	1		yes?
	iprodione	3	3	yes	
	PCNB	3	1		yes?
	thiophanate	3	3	yes	
	triadimefon	3	3	yes	
	vinclozalin	3	1		yes?
Pythium Blight (<u>Pythium</u>)	etridiazole	3	1		yes?
	fosetyl-Al	3	3	yes	
	metalaxyl	3	3	yes	
	propamocarb	no data			

* 1=high probability; 2=possibility; 3= low probability of runoff or leaching past the root zone.

Table II.8. Summary of the pesticide-soil environmental fate for fairways, Prickly Pear Hill Project.

Pest	Registered Pesticide	Potential*		Acceptable	Reject
		Leaching	Runoff		
Summer Patch (<u>Magneporthe</u>)	benomyl	3	1		yes?
	fenarimol	3	1		yes?
	iprodione	3	3	yes	
	propiconazole	3	3	yes	
	thiophanate	3	3	yes	
	triadimefon	3	3	yes	
Typhula Blight (<u>Typhula</u>)	anilazine	3	3	yes	
	chlorothalonil	3	1		yes?
	fenarimol	3	1		yes?
	iprodione	3	3	yes	
	PCNB	3	1		yes?
	thiram	3	3	yes	
Broad Leaf Weeds	triadimefon	3	3	yes	
	2,4-D	3	3	yes	
	dicamba	3	3	yes	
Clover	MCPP	3	3	yes	
	MCPP	3	3	yes	
Annual Bluegrass	ethofumesate	3	3	yes	
	paclobutrizol	no data			
Hyperodes Weevil	chlorpyrifos	3	1		yes?
	isofenphos	3	1		yes?

* 1=high probability; 2=possibility; 3=low probability of runoff or leaching past the root zone.

Table II.9. Summary of the pesticide-soil environmental fate for fairways, Prickly Pear Hill Project.

Pest	Registered Pesticide	Potential		Acceptable	Reject
		Leaching	Runoff		
White Grubs	bendiocarb	3	3	yes	
	carbaryl	3	3	yes	
	chlorpyrifos	3	1		yes?
	ethoprop	3	3	yes	
	isofenphos	3	1		yes?
	trichlorfon	3	3	yes	
Crabgrass	benefin	3	1		yes?
	bensulide	3	1		yes?
	DCPA	3	1		yes?
	methanearsonate	3	1		yes?
	pendi-methalin	3	1		yes?
	siduron	3	1		yes?
	trifluralin	3	1		yes?

* 1=high probability; 2=possibility; 3=low probability of runoff or leaching past the root zone.

Table II.10 NPURG simulation used for validation.

NPURG
Pesticide/Soil Interaction Ratings for
Ground and Surface Water Protection.

Chemical database name: USDA1_09.dbf Date of issue: Fri Jan 11 14:00:22 1991

Soil database name: USsoils.dbf Date of issue: Wed Apr 03 09:15:38 1991

Pesticide User: _____ Date: Wed Apr 03 11:13:17 1991

Address: _____ Crop: _____

Location: _____ Target: _____

Soil Type #1: _____ % of field Ave. Slope: _____ % pH: _____ Drained: _____

Soil Type #2: _____ % of field Ave. Slope: _____ % pH: _____ Drained: _____

Soil Type #3: _____ % of field Ave. Slope: _____ % pH: _____ Drained: _____

Water Resource: Ground / Surface Type: _____ Distance: _____

Soil/Pesticide Leaching Potential (SPLP)

NPURG 9.100
Database 1.900

Soil
Series: U_ARKPORT
Texture: FSL
Hydro - B

U_BLUE RIDGE S
sand
Hydro - A

U_HUDSON
SIL
Hydro - C

Pesticide:
=====

2,4-D DIMETHYLAMINE SALT
F - Foliar application
CARBARYL

F 3 *

1 &

3 * &

3 *

2 &

3 * &

CHLOROTHALONIL
F - Foliar application
DICAMBA SALT

3 *

F 3 &

3 * &

1 * E

1 & E

2 * & E

* max slope is > 15%, & depth to seasonal high water table < 6 ft., + ponded
G (guessed) / E (estimated) database values used in the computations.

These ratings are relative rankings of pesticide/soil interactions. They are intended for use by SCS and CES personnel as one component of an environmental risk analysis. Pest management includes the assessment of all potential risks.

Pesticide selected: _____ Formulation: _____

Rate/Timing: _____ Method: _____

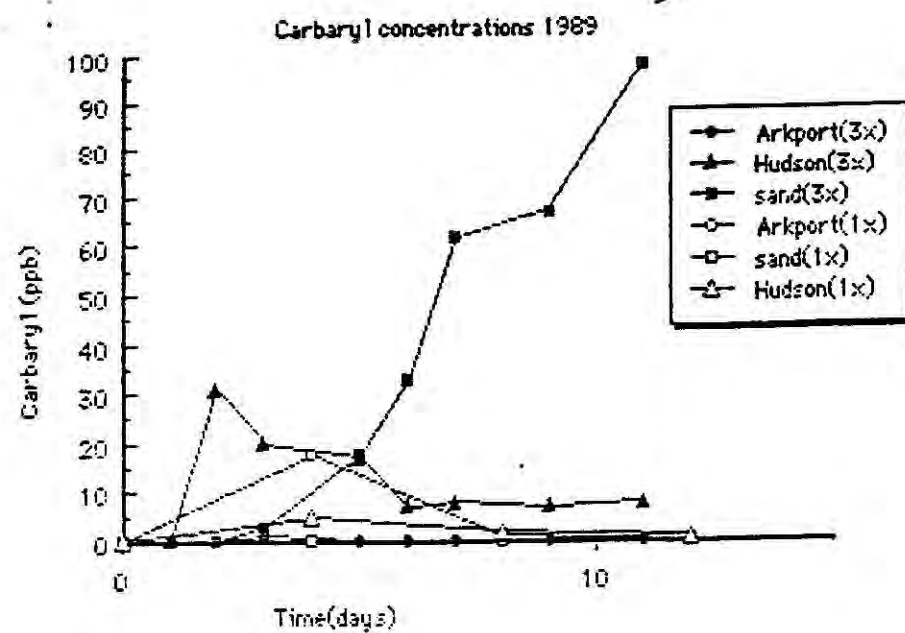
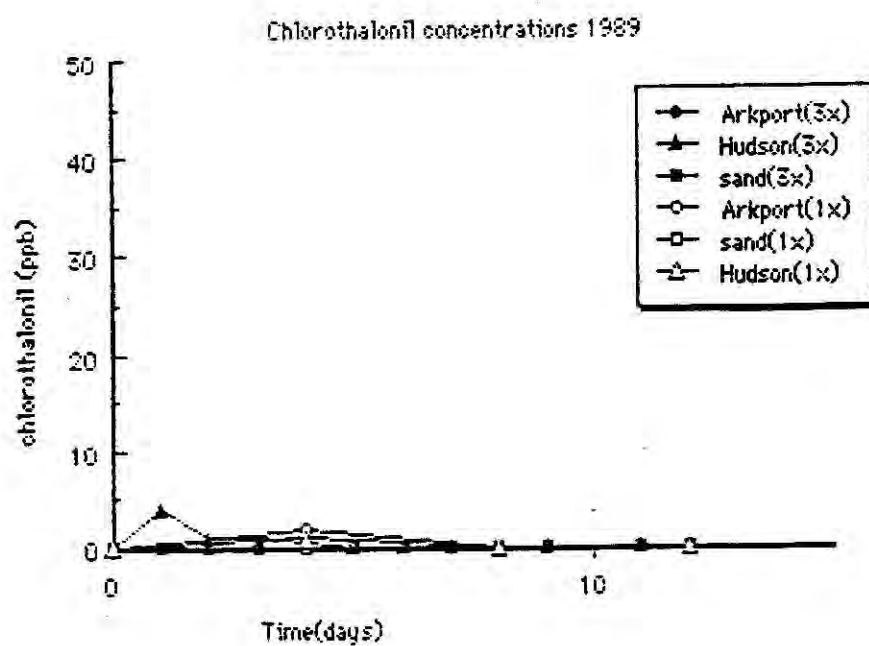


Fig. II.1 Actual pesticide leaching data. 1X= 1 leaching event/wk. 3X= 3 leaching events/wk.



**Fig. II.2 Actual
pesticide leaching
data. 1X= 1
leaching event/wk.
3X= 3 leaching
events/wk.**

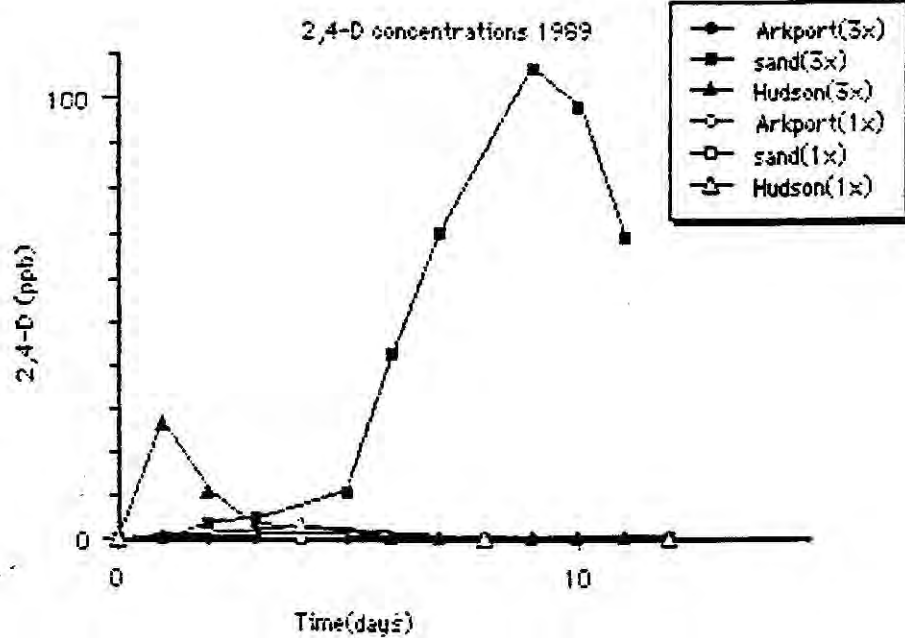
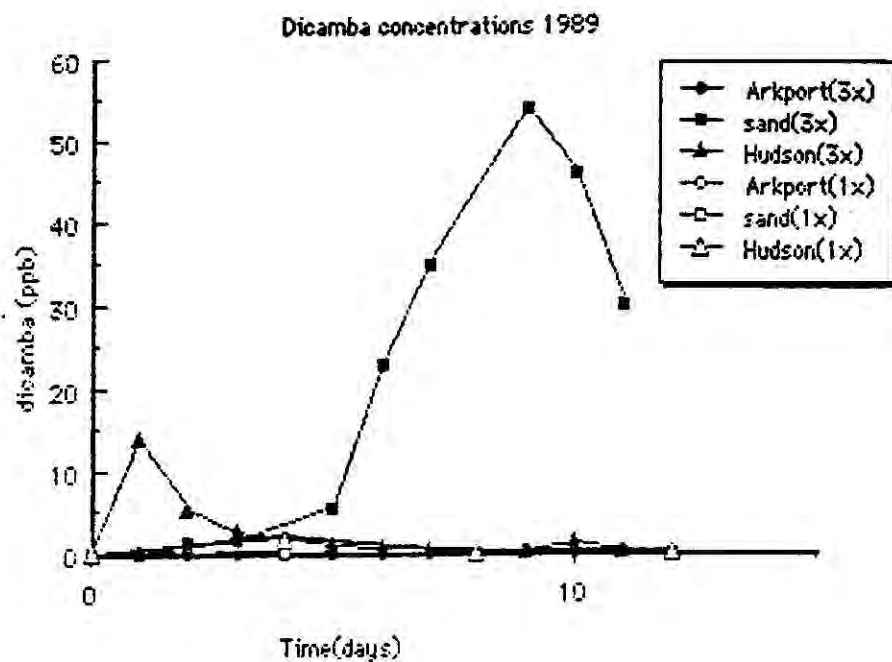


Fig. II.3 Actual pesticide leaching data. 1X= 1 leaching event/wk. 3X= 3 leaching events/wk.

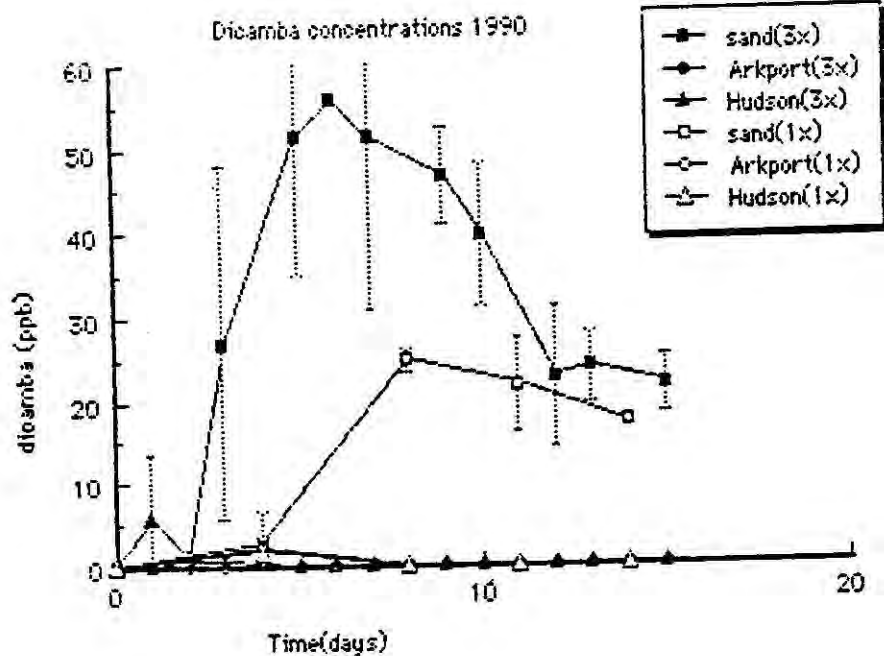
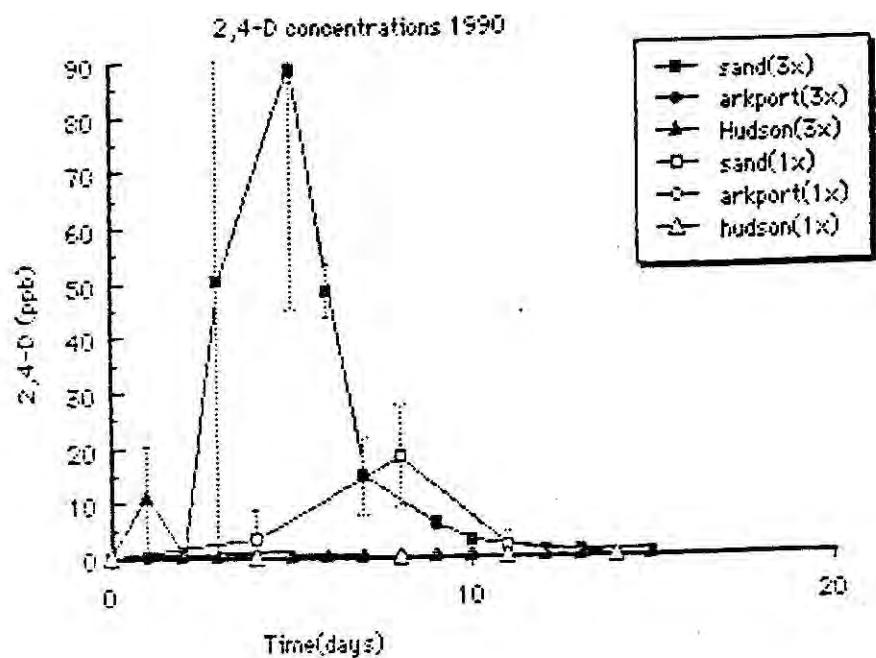


Table III.1. The amount of pure limestone, phosphorus, potassium and magnesium needed during establishment of Prickly Pear Hill Golf Course.

<u>Hole</u>	<u>Soil</u>	<u>Limestone</u>	<u>Phosphorus(P₂O₅)</u>	<u>Potassium(K₂O)</u>	<u>Magnesium</u>
-----lbs/1000sq.ft.-----					
1,3,4 5,6,7 8,11,12 14,15 16,18	Charlton/ Chatfield loam	471	0(0)	4(3.5)	yes
2,9 12,16	Sutton loam	556	2(1)	3(2)	none
2,4,10 16,17	Sun loam	225	3(2)	2(2)	none
9,13	Chatfield/ Hollis Rock Outcrop				
16	Ridgebury loam	218	2(2)	2(1)	none
5	Charlton loam	196	3(2)	4(3.5)	none

The amounts shown above are to be incorporated into the surface 6 inches prior to seeding to raise the pH to 6.5 and to obtain an optimum nutrient level. When magnesium is needed, then a dolomitic limestone should be used to supply both calcium and magnesium. Values in () refer to maintenance levels for both phosphorus and potassium fertilization. All rates are for the areas that will be using the nature soil which is assumed to be fairways and roughs.

Table III.2. Recommended fertilization program for the greens/tees at the Prickly Pear Hill Golf Course.

<u>First several years</u>						
<u>April</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>
<u>lbs/1000 sq.ft.</u>						
IBDU	IBDU	Ringer or Sustane	Ringer or Sustane	Ringer or Sustane	IBDU	Yr. Tot.
0.5	0.5	1.0	1.0	1.0	0.5	4.5 N
		0.4	0.4	0.4	(Sustane)	1.2 P ₂ O ₅
		0.16	0.16	0.16	(Ringer)	0.48 "
		0.8	0.8	0.8	(Sustane)	2.4 K ₂ O
		0.5	0.5	0.5	(Ringer)	1.5 "
<u>Future years</u>						
	IBDU	Ringer or Sustane	Ringer or Sustane	Ringer or Sustane	IBDU	
	0.5	1.0	1.0	1.0	0.5	4.0 N
Sustane	0	0.4	0.4	0.4	0	1.2 P ₂ O ₅
or						
Ringer	0	0.16	0.16	0.16	0	0.48 "
Sustane	0	0.8	0.8	0.8	0	2.4 K ₂ O
or						
Ringer		0.16	0.16	0.16		0.48 "

Table III.3. Recommended fertilization program for fairways and roughs for the Prickly Pear Hill Golf Course.

	May	June	July	Aug.	Sept.	Yearly Total
	----- lbs/1000 sq.ft. -----					
Fairways						
	IBDU	Sustane or Ringer	Sustane or Ringer	Sustane or Ringer	IBDU	
	0.5	1.0	1.0	1.0	0.5	4.0 N
Sustane or Ringer		0.4	0.4	0.4		1.2 P ₂ O ₅
		0.16	0.16	0.16		0.48 "
Sustane or Ringer		0.8	0.8	0.8		2.4 K ₂ O
		0.5	0.5	0.5		1.5 "
Roughs						
	IBDU, Monoammonium phosphate (MAP) Potassium sulfate				IBDU MAP Potassium sulfate	
	1				1	2.0 N
	0.25				0.25	0.5 P ₂ O ₅
	0.75				0.75	1.5 K ₂ O

Table IV.1. A typical fertilization and pesticide program for well maintained lawn.

	<u>Yearly total</u>
Nitrogen application source is usually urea	5 lbs N/1000s.f.
Herbicides	
Trimec (2,4-D, MCPP, dicamba)	1.5 oz AI/1000s.f.
pendimethalin	1 oz AI/1000s.f.
Insecticides	
chlorpyrifos	1.5 oz AI/1000s.f.
isofenphos	.75 oz AI/1000s.f.

Additional Model Analysis

A model developed at the University of Massachusetts (Deubert, 1990) allows for assessing pesticide applications on specific sites on a more qualitative basis using a minimum of quantitative information. This model requires an assessment of pesticide solubility, half-life and Koc values; and site specific information more qualitative including soil texture, topography, water table depth, application method and ground water recharge rates. Using a numerical index which ranks from 8 to 17 where 8 = ground water contamination improbable, to 17 = ground water contamination possible, the Hudson National Golf Club site was evaluated for specific pesticide use. Deubert suggests that if the sum of the indices approaches 15 or 16, then a more quantitative assessment of the situation is needed. A list of pesticides which may be included in an Integrated Pest Management Plan were evaluated and are listed in Table 7. These materials were selected for evaluation based on their known performance under field situations. All are currently registered in New York and listed in the Cornell University Recommendations for Commercial Turfgrass Management.

Evaluation of pesticides† for Hudson National Golf Club using the model of Deubert (1990).	
Insecticides:	Rating
<i>Bacillus thuringiensis</i>	Biological, not evaluated
acephate	14
bendiocarb	13
carbaryl	12
chlorpyrifos	13
ethoprop	15*
isazofos	15*
isofenphos	13
trichlorfon	15*
Nematicides:	
ethoprop	15*
fenamiphos	15*

Evaluation of pesticides† for Hudson National Golf Club using the model of Deubert (1990).	
Insecticides:	Rating
Fungicides:	
anilazine	12
chlorothalonil	13
etridiazole	13
fenarimol	14
fosetyl-Al	15*
iprodione	13
mancozeb	13
metalaxyl	14
PCNB	12
propiconazole	13
thiophanate	14
thiram	13
triadimefon	15*
vinclozalin	12
Herbicides:	
benefin	13
bensulide	14
bentazon	14
DCPA	13
dicamba	15*
ethofumesate	15*
glyphosate	13
mecoprop (MCP)	15*

Evaluation of pesticides† for Hudson National Golf Club using the model of Deubert (1990).	
Insecticides:	Rating
MSMA	15*
oxadiazon	13
pendimethalin	14
siduron	15*
trifluralin	14
2,4-D amine	14
† Table information denotes chemical names.	
* Needs further evaluation to determine suitability for use at this site.	

Based on Deubert's assessment, twelve materials which have a rating of 15 have been further evaluated in order to determine their suitability for use on this site. Seven of the materials were evaluated by Petrovic in 1991 using the National Pesticide/Soil database and User decision support system for Risk assessment of Ground and surface water contamination (NPURG) which is based on the GLEAMS model. This model was developed for row crop agricultural and has not been fully evaluated for turf situations. However, research has found that the model over predicts actual field observations for leaching of pesticides. Therefore any error would be conservative in comparison. Recommendations for use of dicamba, ethofumesate, ethoprop, fosetyl-Al, MCPP, triadimefon and trichlorfon listed under the specific local problems for disease, insect and weed control have been taken from this previous study.

Another model developed by the University of Florida (Augustijn-Beckers et al, 1991) bases pesticide selection on soils characterization and two indices: 1) Relative Leaching Potential Index (RLPI) and the 2) Relative Runoff Potential Index (RRPI). These indices are also based on the organic carbon sorption coefficient (K_{oc}) and degradation half-life values of each pesticide. Secondly it is also suggested that the Lifetime Health Advisory Level or Equivalent (HALEQ) and Aquatic Toxicity be considered in the pesticide selection procedure. The HALEQ provides a measure of pesticide toxicity to humans. This is listed as the concentration of a chemical in drinking water (parts per billion, ppb) which is not expected to cause any adverse health effects over a lifetime of exposure. Aquatic toxicity values are given as LC_{50} for rainbow trout. Higher values are desired for both of these parameters. Based on selected soil chemical and physical properties, the site would have a leaching potential rating of low, and a soil runoff rating of medium (Brown et al., 1991).

Evaluation of selected pesticides for leaching and runoff potential based on the model of Augustijn-Beckers et al., 1991.						
Pesticide	K_{oc} Value	RLPI	RRPI	HALEQ	Aquatic Toxicity	Comments
isazofos	100	29	29	0.1	0.008	Not recommended
siduron	890	NA	NA	NA	NA	Needs further evaluation
fenamiphos	200	20	20	2	0.11	Needs further evaluation
MSMA	10000	1000	1	ND	12	High K _{oc} *
If the K _{oc} value is 100 or less or if the RLPI value is 10 or less and the soil leaching rating is high, then the pesticide has a high potential for leaching and should be used with extreme caution.						
* K _{oc} and RLPI values indicate material is safe for use with caution.						

Two materials from the above table are of concern for potential environmental impact based on these models (fenamiphos and siduron). Further evaluation used a model developed by Weber (1990) which determines Ground Water Contamination Potential (GWCP). Four key parameters including K_{oc}, T-1/2, rate of application (R) and fraction of pesticide hitting the soil (0.5 for turf) are used in the following equation:

$$\text{GWCP Index} = K_{oc}/(T-1/2)(R)(F).$$

A ranking of the GWCP Indices as classified by Weber is as follows:

GWCP Index	Descriptive Ranking
101 to 1,000,000	Extremely Low
11 to 100	Very Low
1.1 to 10	Low
0.11 to 1.0	Moderate
0.01 to 0.10	High
< 0.01	Very High

Based on reported K_{oc} and half-life values for these two materials (Deubert, 1990) and recommended application rates, GWCP values have been calculated and descriptive rankings given as follows:

fenamiphos = 2.0, low;

siduron = 1.2, low;

Fenamiphos is used only on putting greens and any leachate would be filtered through drainage into fairways or other grassed areas before moving into an aquatic environment. Therefore retention would allow degradation and negate any potential threat to non-target organisms. Additionally, nematode problems for which fenamiphos is used, while they do exist in the northeastern US, are rare and treatment would not occur on an annual basis.

Siduron should be used with caution and preferably only as a spot treatment for crabgrass control where spring seeding is necessary for turf renovation.

Appendix IV

Wetlands and Watercourses

Appendix V

Field Sampling Sheets

SURFACE WATER FIELD SAMPLING SHEET

Station Number: _____ Samplers: _____

Description: _____

Date of Sampling: _____

Time of Sampling: _____

Weather: _____

Field Measurements:

Water Temp (°C): _____

Air Temp (°C): _____

pH: _____

Specific Cond(μ S): _____

Depth of Water (m): _____

Depth at which Sample taken (m): _____

Wetted Area (m): _____

Water Flow (m/sec): _____

Calibration of Instruments:

Specific Conductance: Meter: _____

Reading in KCl soln: _____

pH Meter Model: _____ Calibration Buffers used: _____

Sample Apparatus: _____

Mode of Transport: _____

Shipping Date: _____

For Surface Runoff Sampling Events

Rain event begins: _____ Total amount of rainfall: _____

Rain event ends : _____ Time sample collected: _____

Duration of event: _____

POND SEDIMENT FIELD SAMPLING SHEET

Station Number: _____ Samplers: _____

Description: _____

Date of Sampling: Day: _____ Month: _____ Year: _____

Time of Sampling: Hour: _____ Minute: _____

Field Measurements:

Water Temp (°C): _____

Air Temp (°C): _____

pH: _____

Specific Cond(μ S): _____

Depth of Water at which sample taken(m): _____

Calibration of Instruments

Specific Conductance: Meter: _____ Meter Reading in KCl soln: _____

pH Meter Model: _____ Calibration Buffers used: _____

Sample Apparatus: _____

Mode of Transport: _____

Shipping Date: _____

Remarks:

GROUND WATER FIELD SAMPLING SHEET

Well Number: _____ Samplers: _____

Description: _____

Weather: _____

Date of Sampling: Day: _____ Month: _____ Year: _____

Time of Sampling: Hour: _____ Minute: _____

EVACUATION:

Static Water Level (TOC): _____ Static Water Volume:(TOC): _____

Pump Start Time: _____ Pump End Time: _____

Total Pump Time: _____ Volume Evacuated: _____

Conductivity, pH, Temperature1. _____ μS ; _____ $^{\circ}\text{C}$; _____ s.u.2. _____ μS ; _____ $^{\circ}\text{C}$; _____ s.u.3. _____ μS ; _____ $^{\circ}\text{C}$; _____ s.u.**SAMPLE:**

Sample Water Level (FT): _____

Water Temp ($^{\circ}\text{C}$): _____Air Temp ($^{\circ}\text{C}$): _____

pH: _____

Specific Cond (μS): _____**Calibration of Instruments**

Specific Conductance: Meter: _____ Meter Reading in KCl soln: _____

pH Meter Model: _____ Calibration Buffers used: _____

Sample Apparatus: _____

Mode of Transport: _____

Shipping Date: _____

Appendix VI

Limited Activities Map

Appendix VII

Phase I Monitoring Report

Changes made to the original Baseline Monitoring Report.

The first draft of the Baseline Monitoring Report was written in July 1995 and it addressed the baseline water and sediment quality at Hudson National Golf Course.

The final version of the Baseline Monitoring Report was issued in December 1996. Changes between the two versions were the result of the Villages request to 1) change the monitoring program in September 1994, and 2) update the Baseline Report to reflect these changes.

Changes in the monitoring program were made in September 1994 at the request of the Village, and included the following: 1) relocation of sample station SW-3A; addition of sample station SW-5; and 2) the pesticides in the Tier I and II sample regimes were substantially changed. Even though these changes came after the baseline monitoring was complete, the Village wanted the Baseline Report updated to reflect the changes.

The final version of the Baseline Monitoring Report reflects the requested changes as follows:

1. The pesticides included in Tier I and II were identified in Table 2, and discussed on pages 6 and 8. The data tables were also updated to reflect the newly included pesticides.
2. Regional Water Quality References were determined. In Section 3.4, page 22, regional water quality references were established. These regional references were established for stations that did not have a site specific reference, and included the relocated SW-3A and the added station SW-5 for surface water. A groundwater regional reference site was also established for the groundwater wells because they were installed at different times, and several were dry and had to be reinstalled.
3. Reference Station Locations (Section 3.5, page 24) were also added in June 1996 and included a surface reference station SW-6 and a groundwater reference GW-6.

Baseline Monitoring Report
Hudson National Golf Club
Croton-on-Hudson, New York

Prepared for:
National Fairways, Inc.
71 Arch Street
Greenwich, Ct 06830

Prepared by:
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

July 1995, December 1996

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1.0 INTRODUCTION

An Environmental Monitoring Program was established at Hudson National Golf Club, Croton-on-Hudson, Westchester County, NY. The monitoring program included monitoring of surface water, pond sediments, and ground water. The environmental monitoring program is described on pages 95 through 127 of the Environmental Management Plan for Hudson National Golf Course, August 1994 and revised October 4, 1996.

The goals of the monitoring program include:

1. Establish a baseline of water and sediment quality prior to construction,
2. Provide data that will establish environmental conditions, thus providing a basis for measuring compliance with environmental regulations, and
3. Ensure that Integrated Pest Management is functioning properly and that no health hazards have developed.

The environmental monitoring program is coupled with the agronomic practices on the golf course. An adaptation from a model proposed by Madhun and Freed (1990) notes that there are four basic types of monitoring which can occur: 1) *Reconnaissance* - periodic observation to disclose changes or trends; 2) *Surveillance* - to comply with an enforcement program. Pesticide application licensing programs require record-keeping which may be monitored at any time; 3) *Subjective* - spot-checking for broad or open-ended exploration of problems; and 4) *Objective* - to provide data for use in developing or confirming the results of ongoing programs.

Monitoring operations at Hudson National Golf Club includes all of these types of monitoring. The focus of environmental monitoring programs is to maintain environmental quality and obtain information on which to make adjustments in cultural programs using all of these approaches. Results of the environmental monitoring program provide feedback to the golf course superintendent, and thus provide a useful management tool.

The Environmental Monitoring Program is established in three phases that coincide with golf

course development. Phase I defines pre-development water and sediment quality conditions, Phase II is the construction and development phase and immediate post-development time-frame, and Phase III is the post-development, operational golf course. Phase III begins with golf course grow-in of turf. This report describes the results of Phase I of the monitoring plan which established a baseline of water and sediment quality

2.0 METHODS AND MATERIALS

2.1 Sample Locations

Surface Water. Surface water was sampled at seven locations that are described below and shown on Figure 1 (SW means surface water):

Sample Station SW 1. The stream flowing into the Brinton Brook Sanctuary;

Sample Station SW 2. The catch basin that drains into the swimming pool (Southwest of Finney Farm Rd).

Sample Station SW 3. The flow that feeds Kaplans Pond (the stream locations are labeled 3a (stream enters property) and 3b (stream leaves property));

Sample Station SW 4. The intermittent stream that flows along the southerly side of Prickly Pear Hill Road;

Sample Station SW 5. A stream that leaves the property near green number 11.

Sample Station SW 6. A background station located off the property. The station was added in June 1996 at the request of the Village. The station is located in a stream that is formed by discharges from ponds on Foster Court and Upland Lane. The site was marked and a trail leading to the site was constructed by the Croton Arboretum (as per June 27, 1996 letter from Arboretum president). This station will be marked by the Arboretum.

Sample stations were located and marked in the field with striped flagging and identified on maps. SW-5 was added in July after a site visit with the Village consultant, and it was dry on the two subsequent sample efforts.

Figure 1. Locations of surface water (SW), groundwater (GW), and pond sediment (PS) sample stations, Hudson National Golf Course, Westchester, County, NY.

The map is located at the back of the report.

Groundwater. Groundwater was sampled at three locations in 1994 that are described below and shown on Figure 1 (GW means groundwater):

Sample Station GW 1. Existing well site located to the southwest of Prickly Pear Hill Road.

Sample Station GW 2. Existing well site located to the west of Finney Farm Road.

Sample Station GW 3. Existing well site located to the east of the Cortlandt Conservation Association Easement.

Sample Station GW 4. Monitor well located on the southeast part of the property.

Sample Station GW 5. Monitor well located near the Brinton Brook Sanctuary.

Sample Station GW 6. Background monitor well located near the northern boundary of the property.

New 2" monitor wells were installed at GW-1, GW-2 and GW-3. The wells were constructed according to New York regulations, under the direction of a geologist. Because the drill rig could not get to the locations of GW-4, GW-5, and GW-6 these wells were not installed until after clearing. These wells were installed in July 1995. A spring was sampled in the vicinity of GW-5. This was done to get an estimate of surficial groundwater even though a well could not be installed. Groundwater sample stations were field marked and identified on maps. In June 1996 GW-3, GW-4, and GW-6 were reinstalled because they were dry most of the time.

Sediment. Pond sediment was sampled from the Brinton Brook Pond at three locations and composited into one sample in the field. The three samples were collected in a triangular pattern around the center of the pond. The sample location is described below and shown on Figure 1 (PS means pond sediments):

Sample Station PS 1. The sediments at the middle of the Brinton Brook Pond.

2.2 Sample Frequency

The goal of Phase I is to define the baseline conditions at the site. Surface water samples were collected four times during the baseline period. Two surface water samples were taken after rainfall events of $\frac{1}{2}$ " or more in a 24 hr period and two surface water samples were taken during non-rainfall periods (no rain for previous 5 days; see Table 1). Groundwater was collected two times prior to the beginning of construction, and sediment was collected three times prior to construction.

Table 1. Sample dates, weather conditions, and environmental media sampled. Blanks indicate no samples.

Date	Weather conditions	Surface Water sample station	Ground Water sample station	Pond Sediment sample
5-30-94	clear, 70°F, approx 1.5 to 2 inches of rain over 48hrs	1, 2, 3A, 3B, 4		
6-5-94	clear, 70°F,			1
6-26-94	clear, 80°F, 2.2 inches of rain over 48 hrs	1, 2, 3A, 3B, 4	spring	1
7-27-94	clear, 90°F, dry period	1, 2, 3A, 3B, 4	1,2,3, spring	1
9-6-94	clear, 78°F, dry period	1,2	2,3, spring	

2.3 Sample Analytes

Surface water, groundwater and pond sediments were analyzed for the analytes listed in Table 2. Additionally, during Phase I, surface water, ground water, and sediment were analyzed for the "second tier" pesticides so that background levels of those pesticides could be set.

In August 1994 the Village consultant recommended that a change be made to the second tier

Table 2. Variables to be Analyzed (x) in Surface- and Ground- Water and Pond Sediments at Hudson National Golf Club, Westchester County, New York.

Variable	Surface Water	Ground Water	Pond Sediment
Field Analyses			
pH	x	x	
Water Temperature	x	x	
Specific Conductance	x	x	
Laboratory Analyses			
Nitrate Nitrogen	x	x	
Total Phosphorus	x	x	
Chloride	x	x	
Total Dissolved Solids	x	x	
Turbidity	x		
Particle size			x
2,4-D	x	x	
Dicamba	x	x	
Mecoprop	x	x	
PCNB	x		x
Chlorothalonil			x
Tier II Analytes			
Bensulide	x		
Chlorpyrifos	x		x
Chlorothalonil	x	x	
Dichlorvos (DDVP, metabolite of Trichlorfon)	x	x	
Ethylene thiourea (ETU)		x	
Thiram	x	x	
Trichlorfon	x	x	
Trifluralin			x

pesticides (see the August 16, 1994, Environmental Monitoring Program for Hudson National Golf Course). These changes are summarized in Appendix D. Additional changes were made by the Village consultant in 1996. Changes included adding PCNB and chlorothalonil to the list of routine analytes. Because the background sampling was completed prior to the time changes were approved, the new list of pesticides and those in the "second tier" are assumed to be below detection limits in surface water, ground water and sediments. Table 2 has information relevant to the latest revisions in the sampling program.

2.4 Field Methods

Variables, container type, preservation and holding times for water samples are given in Table 3. Variables, container type, preservation and holding times for sediment samples are given in Table 4.

Surface Water. A number of variables were measured on-site, including pH, water temperature, and specific conductance. pH was measured with a pH probe that had been calibrated just prior to use. Specific conductance was measured with a calibrated specific conductance meter. Water temperature was measured with a thermometer. Because flow in the streams was so small, water discharge in the streams was measured at the time of water sampling by using a 2" polyethylene tube to divert water.

The stream water was sampled by obtaining 'discrete' grab samples of water. Discrete grab samples were taken at the selected location, with a 2" polyethylene tube. The tube was placed in the stream and water was diverted to the sample containers. Stream water was obtained from the center of flow at mid-depth and analyzed for the variables listed in Table 2. The sample containers were immediately placed in a cooler with ice and taken to a laboratory for analysis. A chain-of-custody program was followed to assure that proper transportation and storage practices were documented and that the appropriate analyses were being conducted. Chain of custody forms are in Appendix C.

Table 3. Variables, container type, preservation, and suggested holding times for water samples. Tier II analytes were handled as given below and were analyzed with EPA or standardized methods.

Variable	Container Type	Preservation	Analytical Method	Suggested Holding Time
pH	not applicable	not applicable	EPA 150.1	not applicable
Water Temperature	not applicable	not applicable	EPA 170.1	not applicable
Specific Conductance	not applicable	not applicable	EPA 120.1	not applicable
Nitrate Nitrogen, mg/L	P,G	Cool, 4°C, acidify	EPA 353.2	48 hr
Total Phosphorus, mg/L	P,G	Cool, 4°C, H ₂ SO ₄ to pH <2	EPA 365.4	28 d
Chloride, mg/L	P,G	Cool, 4°C	EPA 325.3	28 d
Total Dissolved Solids, mg/L	P,G	Cool, 4°C	EPA 160.1	7 d
Turbidity, NTU	P,G	Cool, 4°C	EPA 180.1	48 hr
2,4-D, µg/L	G	Cool, 4°C	EPA 8150, GC with ECD Target detection limit= 0.05µg/l	7 d
Dicamba, µg/L	G	Cool, 4°C	EPA 8150, GC with ECD Target detection limit= 0.05µg/l	7 d
Mecoprop, µg/L	G	Cool, 4°C	EPA 8150, GC with ECD Target detection limit= 2.50µg/l	7 d
PCNB	G	Cool, 4°C	extraction: EPA 3510 liquid/liquid analysis: EPA 8080 GC/ ECD Target detection limit= 0.05µg/l	7 d

Variable	Container Type	Preservation	Analytical Method	Suggested Holding Time
Bensulide	G	Cool, 4 °C	Method 636 via HPLC, Target detection limit= 7 µg/l	7 d
Chlorpyrifos	G	Cool, 4 °C	extraction: EPA 3510 liquid/liquid analysis: EPA 8080 GC/ ECD Target detection limit= 0.05 µg/l	7 d
Chlorothalonil	G	Cool, 4 °C	extraction: EPA 3510 liquid/liquid analysis: EPA 8080 GC/ ECD Target detection limit= 0.05 µg/l	7 d
Dichlorvos	G	Cool, 4 °C	extraction: EPA 3510 liquid/liquid analysis: EPA 8080 GC/ ECD Target detection limit= 0.05 µg/l	7 d
Ethylene thiourea (ETU)	G	Cool, 4 °C	Method 509 via HPLC, Target detection limit= 5 µg/l	7 d
Thiram	G	Cool, 4 °C	Convert to ETU	7 d
Trichlorfon	G	Cool, 4 °C	Convert to Dichlorvos	7 d

From:

USEPA, Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, updated 1983.

USEPA, Analytical Support Branch, Operations and Quality Control Manual, June 1985.

USEPA, Test Methods for Evaluating Solid Waste, SW-846, 1986, updated in 1987.

USGS. Laboratory Theory and Methods for Sediment Analysis.

40 CFR Part 136 Table II: Required Containers, Preservation Techniques and Holding Times
(Water/Wastewater Samples), 1988.

Table 4. Variables, container type, preservation, and holding times for sediment samples. Tier II analytes were handled as given below and were analyzed with EPA or standardized methods.

Variable	Container Type	Preservation	Analytical Method	Suggested Holding Times
Particle Size	Polyethylene or Polypropylene bag, Glass jar	Cool, 4 ° C	Sieve Analysis, USGS	-
PCNB	Glass jar	Cool, 4 ° C	extraction: EPA 3550 sonication; analysis: EPA 8080 GC/ ECD; Target detection limit= 1.7µg/kg	14 days
Chlorothalonil	Glass Jar	Cool, 4 ° C	extraction:EPA 3550 sonication; analysis analysis: EPA 8080 GC ECD, Target detection limit= 1.7µg/kg	14 days
Chlorpyrifos	Glass Jar	Cool, 4 ° C	extraction:EPA 3550 sonication; analysis analysis: EPA 8080 GC ECD, Target detection limit= 1.7µg/kg	14 days
Trifluralin	Glass Jar	Cool, 4 ° C	extraction:EPA 3550 sonication; analysis analysis: EPA 8080 GC ECD, Target detection limit= 1.7µg/kg	14 days

From:

USEPA, Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, updated 983.

USEPA, Analytical Support Branch, Operations and Quality Control Manual, June 1985.

USEPA, Test Methods for Evaluating Solid Waste, SW-846, 1986, updated in 1987.

USGS. Laboratory Theory and Methods for Sediment Analysis.

40 CFR Part 136 Table II: Required Containers, Preservation Techniques and Holding Times (Water/Wastewater Samples), 1988.

Field sampling notes of surface water sampling and observations were maintained. The log book documents site conditions, including stream water depth, observations, weather conditions, and field measurements. Field notes are given in Appendix B.

Groundwater. Groundwater samples were obtained from 2-inch monitor wells. Each well was pumped to dryness and allowed to recover before sampling. The well recharge rate is given in the field notes found in Appendix B. Water was considered suitable for sampling when three consecutive measures of water had stable pH, temperature and specific conductance readings.

Wells were allowed to recharge after purging to allow the system to equilibrate. Samples were extracted with a polyethylene bailer. Water temperature, pH, and specific conductance were measured in water that was not be used for laboratory analyses; that is, the water was discarded. Water samples were drained into an appropriate sample container that had the proper preservatives and labels. Samples were transferred from the sample device to the sample container in a manner that minimized turbulence and the loss of volatile compounds. Samples were immediately placed in a cooler with ice and transported to the analytical laboratory. A chain-of-custody program was followed to assure that proper transportation and storage practices were documented and that the appropriate analyses were being conducted.

A field sampling log on groundwater sampling and observations was maintained. The log book documents site conditions, including observations, weather conditions, and field measurements. Field notes are given in Appendix B.

Sediment. Pond sediment was collected by driving an open ended polyethylene tube into the sediment and capping the upper end to create a seal. The tube was then pulled out, extracting the core. Three grab samples were taken and composited to yield one sample on which analyses were performed. The approximate top 10-cm of the sediment was retained and analyzed. Samples were immediately placed in a cooler with ice and transported to the analytical laboratory. A chain-of-custody program was followed to assure that proper transportation and storage practices were

documented and that the appropriate analyses were being conducted.

A field sampling log on sediment sampling and observations was maintained. The log book documents site conditions, including water depth, sediment texture, observations, and weather conditions. Field notes are given in Appendix B.

2.5 Laboratory Methods

Analytes and analytical methods are given in Tables 2, 3, and 4. Analytical procedures followed standard methods for measurement of analytes, including EPA (1990, 1983), Standard Methods 18th edition (1992), and ASTM. Laboratories are certified by the State to conduct chemical analyses on surface water and drinking water. Certification of the laboratory has been maintained by successful performance of the EPA Water Pollution Study and EPA Water Supply Study. Sample analyses will follow accepted, standard methods as defined in the laboratories accreditation and detailed in their Quality Assurance and Quality Control procedures. Sample containers, properly cleaned and containing the proper preservative, were supplied by the analytical laboratory.

In cases where standard methods were not available, the laboratory followed closely related standard practices, and demonstrated accuracy and precision of the method with at least a 5-point standard curve, sample spikes, and duplicate analyses.

3.0 RESULTS AND DISCUSSION

A summary of the results of the sampling for the baseline period is given in Table 5. Data for each sample date are given in Appendix A, and field notes are given in Appendix B.

3.1 Surface water

Surface water was sampled at the locations identified in Table 1. Sample station's SW-1 and SW-2 had water during all sample events; SW-3A, SW-3B, and SW-4 had water during three sample events; and SW-5 was dry on its two scheduled sample events.

Pesticides were sampled and analyzed. The pesticides 2,4-D, dicamba, and mecoprop were sampled and were less than detection limits (Table 5). PCNB and the tier II pesticide analytes were added or changed after the baseline monitoring program was completed. Hudson National Golf Club has agreed with the Village that the existing sample stations had concentrations that were less than detection limits for PCNB and the tier II pesticide analytes. The tier II pesticides include chlorothalonil, thiram, chlorpyrifos, bensulide, trichlorfon, and DDVP, a metabolite of trichlorfon (as given in Table 20 of the Environmental Management Plan). Detection limits are given in Table 3, 4 and 5.

Surface waters were circum-neutral (pH range from 6.5 to 7.2) with moderate specific conductance values. pH of surface waters is typically between 6.5 and 8.5 units which is also the State water quality standard. Specific conductance is a measure of the ability of a water sample to conduct an electrical current and is dependent on the total concentration of ionized substances in water. The mean specific conductance ranged from 80 $\mu\text{S}/\text{cm}$ at SW-4 to 206 $\mu\text{S}/\text{cm}$ at SW-2 (Table 5). Water temperatures reflected the range and influence of late spring, summer, and early autumn solar radiation.

Table 5. Summary of the results of the baseline monitoring for surface water, ground water, and pond sediments for Hudson National Golf Club, Croton-on-Hudson, NY, May 30, 1994 through September 6, 1995. The mean, range and sample size (in parentheses) are given for each variable, except pH. pH is a log based measure, thus means are not meaningful. Note that the Tier II analytes for both surface and groundwater were changed by the Village in September 1994, and that the analyte PCNB in surface water was added as a variable in 1996.

Variable	Surface Water						Ground Water			
	SW-1	SW-2	SW-3A	SW-3B	SW-4	SW-5	GW-1	GW-2	GW-3	GW-Spring
pH	6.9 - 7.1 (4)	6.7 - 7.1 (4)	6.5 (3)	6.8 (3)	7.2 (3)	Dry	7.0 (1)	6.9 - 7.1 (2)	6.8 (2)	6.9 (3)
Water Temperature, °C	20 16 - 24 (4)	21 14 - 28 (4)	25.3 22 - 29 (3)	22.7 17 - 27 (3)	22.3 17 - 26 (3)		12 (1)	13 12 - 14 (2)	13 12 - 14 (2)	12 11 - 14 (3)
Specific Conductance, µS/cm	117 72 - 1800 (4)	206 72 - 300 (4)	84 38 - 175 (3)	88 42 - 180 (3)	80 25 - 190 (3)		75 (1)	80 50 - 110 (2)	75 50 - 100 (2)	58 25 - 125 (3)
Nitrate Nitrogen, mg/l	0.27 0.05 - 0.73 (4)	0.22 0.15 - 0.17 (4)	0.08 0.06 - 1.9 (3)	0.24 0.09 - 0.52 (3)	0.18 0.11 - 0.29 (3)		1.76 (1)	0.36 0.22 - 0.52 (2)	1.11 0.23 - 1.99 (2)	0.19 0.15 - 0.24 (3)
Total Phosphorus, mg/l	0.11 <0.05 - 0.18 (4)	0.06 <0.05 - 0.10 (4)	0.11 <0.05 - 2.4 (3)	0.12 <0.05 - 0.09 (3)	0.14 <0.05 - 0.25 (3)		16.7 (1)	1.37 0.65 - 2.1 (2)	31.1 21.8 - 40.3 (2)	0.08 <0.05 - 0.12 (3)
Chloride, mg/l	6.5 5 - 9 (4)	19.8 12 - 38 (4)	8 5 - 11 (3)	14 13 - 16 (3)	9.3 9 - 10 (3)		8 (1)	8.5 7 - 10 (2)	28 11 - 45 (2)	7 <5 - 10 (3)
Total Dissolved Solids, mg/l	66.7 64 - 70 (3)	190.3 155 - 218 (3)	121 117 - 125 (2)	122.5 116 - 129 (2)	96.5 86 - 107 (2)		91 (1)	183 170 - 196 (2)	310 208 - 413 (2)	44 9 - 78 (2)
Turbidity, NTU	9.8 2.4 - 17.3 (2)	2.1 (1)	ND	ND	6.8 (1)		- ^c	- ^c	- ^c	- ^c
2,4-D, µg/l (detection limit = 0.05 µg/l)	<detect ^c (4)	<detect ^c (4)	<detect ^c (3)	<detect ^c (3)	<detect ^c (3)		<detect ^c (1)	<detect ^c (2)	<detect ^c (2)	<detect ^c (2)

Variable	Surface Water						Ground Water			
	SW-1	SW-2	SW-3A	SW-3B	SW-4	SW-5	GW-1	GW-2	GW-3	GW-Spring
Dicamba, $\mu\text{g/l}$ (detection limit = 0.05 $\mu\text{g/l}$)	<detect ^c (4)	<detect ^c (4)	<detect ^c (3)	<detect ^c (3)	<detect ^c (3)		<detect (1)	<detect (2)	<detect (2)	<detect (2)
Mecoprop, $\mu\text{g/l}$ (detection limit = 2.5 $\mu\text{g/l}$)	<detect ^c (4)	<detect ^c (4)	<detect ^c (3)	<detect ^c (3)	<detect ^c (3)		<detect (1)	<detect (2)	<detect (2)	<detect (2)
PCNB, $\mu\text{g/l}$ (detection limit = 0.05 $\mu\text{g/l}$)	<detect ^c	<detect ^c	<detect ^c	<detect ^c	<detect ^c		<detect ^c	<detect ^c	<detect ^c	<detect ^c
Tier II Analytes^b										
Bensulide, $\mu\text{g/l}$ (detection limit = 7 $\mu\text{g/l}$)	<detect ^c	<detect ^c	<detect ^c	<detect ^c	<detect ^c		-e	-e	-e	-e
Chlorpyrifos, $\mu\text{g/l}$ (detection limit = 0.05 $\mu\text{g/l}$)	<detect ^c	<detect ^c	<detect ^c	<detect ^c	<detect ^c		-e	-e	-e	-e
Chlorothalonil, $\mu\text{g/l}$ (detection limit = 0.05 $\mu\text{g/l}$)	<detect ^c	<detect ^c	<detect ^c	<detect ^c	<detect ^c		<detect ^c	<detect ^c	<detect ^c	<detect ^c
Dichlorvos (trichlorfon), $\mu\text{g/l}$ (detection limit = 0.05 $\mu\text{g/l}$)	<detect ^c	<detect ^c	<detect ^c	<detect ^c	<detect ^c		<detect ^c	<detect ^c	<detect ^c	<detect ^c
Ethylene thiourea (ETU, thiram) (detection limit = 5 $\mu\text{g/l}$)	<detect ^c	<detect ^c	<detect ^c	<detect ^c	<detect ^c		<detect ^c	<detect ^c	<detect ^c	<detect ^c

^a when obtaining mean values for variables that had measurements that were less than detection limits, the less than numbers are treated as equal to the detection limit. This provides a conservative approach to data interpretation.

^b Tier II analytes were changed by the Village in September. These Tier II analytes were not sampled during this time period. However, Hudson National Golf Club assumes that concentrations were less than detection limits. This was based on sampling and analyses that was conducted in subsequent phases of the project.

^c < detect means less than detection limits; that is, the analyte was not detected. The target detection limit is also given for each analyte.

^d Specific conductance of 1800 $\mu\text{S/cm}$ for SW-1 is considered an outlier and not included in calculation of the mean.

^e not analyzed according to the monitoring plan.

An apparent outlier of 1,800 $\mu\text{S}/\text{cm}$ was measured at SW-1 on 6-26-94. This measurement was six times greater than any other surface water specific conductance measurement and it was not used in the determination of the mean for SW-1.

Total dissolved solids are a measure of the dissolved material in waters. In surface waters at Hudson National, mean total dissolved solids ranged in concentration from 66.7 mg/L at SW-1 to 190.3 mg/L at SW-2. The State water quality standard for total dissolved solids is 500 mg/L. Typically, dissolved solids parallel specific conductance measurements unless organic constituents are present. Mean concentrations of total dissolved solids in surface waters at Hudson National parallel specific conductance measurements. Comparison of total dissolved solids and specific conductance also provides additional evidence that the 1,800 $\mu\text{S}/\text{cm}$ measurement at SW-1 was an outlier.

The lowest total dissolved solids measurements were at stations that drained ponds. This was not unexpected because ponds tend to allow suspended material to settle. Suspended sediment particles that can be easily carried by rivers and streams settle out once they reach the relatively quiescent pond environment. As a consequence of this trapping ability, particle associated nutrients, organic matter, and chemicals are retained in impoundments (Heinemann 1984, Nielsen et al. 1984, EPA 1988a, Morgui et al. 1993).

Another indication of the generally low suspended solid loads in surface waters was turbidity (range of mean values: 2.1 to 9.8 NTU).

Nitrogen and phosphorus in surface waters were within generally expected ranges associated with streams (Table 5). During sample events, there were no observations of unusual growths of periphyton or macrophytes that would indicate excessive nutrients in the water. These important nutrients in surface water are subject to many different types of influences, including chemical changes (e.g., adsorption, volatilization, flocculation, denitrification, nitrification), biotic changes (e.g., uptake and release) and seasonal changes (e.g., stratification in lakes; metabolic

activity)(Wetzel 1983, Fontaine and Bartell 1983). The wide ranges of concentrations that were measured were expected and the wide range is commonly observed (Vollenweider 1968, Jones and Bachmann 1976). For example, total phosphorus ranged from less than detection levels to 0.18 mg/L at SW-1.

At station SW-3A, the station that drains the conservation area and flows onto the Hudson National property, nitrate nitrogen and total phosphorus were very high on 7-27-94. Concentrations were 1.9 and 2.44 mg/L for nitrate nitrogen and total phosphorus, respectively. These concentrations, although possible, were 3⁷ and 49 times greater than the lowest measured concentration for nitrate nitrogen and total phosphorus, respectively. Because background concentrations are being defined, a conservative approach is appropriate. Therefore, these measured concentrations should be considered outliers and the means given in Table 5 reflect this assumption.

Chloride is a relatively conservative anion; that is, it undergoes relatively minor changes from biotic utilization or biotically mediated changes in the environment (Wetzel 1983). Mean chloride concentrations ranged from 6.5 to 19.8 mg/L across all sample stations.

3.2 Ground water

Three ground water monitoring wells were installed and sampled. A spring that represents the local ground water conditions near the mansion was sampled. This spring was sampled because installation of the ground water wells in this area was not feasible until after clearing. The spring was sampled three times; GW-2 and GW-3 had water during two sample events; and GW-1 had water during one sample event. During sample events, there were no unusual odors or staining of the water.

Domestic drinking water supplies were to be sampled. Due to ongoing discussions with the domestic drinking water well owners and the Village with respect to installation of a water main

in lieu of monitoring, the wells have not yet been sampled. In 1995 it was determined that the water main will not be installed, and thus seven homes will have their domestic drinking water supplies sampled and analyzed. Results of these analyses will be forwarded to the Village in subsequent reports, and baseline data will be collected in 1995.

Pesticides were sampled and analyzed. The pesticides 2,4-D, dicamba, and mecoprop were sampled and were less than detection limits (Table 5). The tier II pesticide analytes were added or changed after the baseline monitoring program was completed. Hudson National Golf Club has agreed with the Village that the existing sample stations had concentrations that were less than detection limits for the tier II pesticide analytes. The tier II pesticides include chlorothalonil, ethylene thiourea (ETU), thiram, trichlorfon, and DDVP, a metabolite of trichlorfon (as given in Table 20 of the Environmental Management Plan). Detection limits are given in Table 3, 4 and 5.

Ground waters were circum-neutral (pH range from 6.8 to 7.0) with moderate specific conductance values. pH is normally between 6.5 and 8.5 units which is also the State water quality standard. Specific conductance values ranged from a mean of 58 $\mu\text{S}/\text{cm}$ in the spring water sample to 80 $\mu\text{S}/\text{cm}$ in sample GW-2 (Table 5). Water temperatures reflected the relatively consistent and cool waters associated with ground water.

Total dissolved solids are a measure of the dissolved material in waters and mean values ranged from 44 mg/l in the spring water to 310 mg/L in GW-3. Typically, dissolved solids are less than 500 mg/L which is also the State water quality standard.

Mean nitrate nitrogen concentrations in ground water was 1.76, 0.36, 1.11 and 0.19 mg/L for GW-1, GW-2, GW-3 and GW-spring. The greatest concentration, 1.99 mg/L $\text{NO}_3\text{-N}$, was measured in GW-3 and the lowest concentration, 0.15 mg/L $\text{NO}_3\text{-N}$, was measured in GW-spring (Table 5). The State drinking water standard for nitrate nitrogen is 10 mg/L.

Mean total phosphorus concentrations were 16.7, 1.37, 31.1 and 0.08 mg/L for GW-1, GW-2, GW-3 and GW-spring (Table 5). The greatest concentration was 40.3 mg/L in GW-3 and the lowest concentration was less than detection limits (<0.05 mg/L). These concentrations were relatively high, and may indicate that some silts and clays were analyzed with the water. Thus, these concentrations may reflect phosphorus in the water fraction plus phosphorous associated with the solids fraction.

Chloride concentrations were relatively uniform with mean concentrations of 7 to 28 mg/L. All concentrations were less than 11 mg/L with the exception of the sample from GW-3 on 9-6-94, which was 45 mg/L. The State water quality standard for chloride is 250 mg/L.

3.3 Pond Sediments

Pond sediments were composed of medium sand (3.6%), fine sand (4.5%), very fine sand (9%), and silts and clays (66.9%). Pond sediments were analyzed for pesticides 2,4-D, dicamba, and mecoprop and none were detected (Table 6). These analytes were changed by the Village to PCNB and Chlorothalonil. PCNB and Chlorothalonil and the tier II pesticide analytes were added or changed after the baseline monitoring program was completed. Hudson National Golf Club has agreed with the Village that the existing sample stations had concentrations that were less than detection limits for the tier II pesticide analytes. The tier II pesticides include chlorpyrifos and trifluralin (as given in Table 20 of the Environmental Management Plan). Detection limits are given in Table 4.

Table 6. Data from pond sediment sampling and analyses of the Hudson National Golf Club.

Variable ^a	Sample Dates			Mean
	6-5-94	6-26-94	7-27-94	
Laboratory Analyses				
2,4-D, mg/kg	<detect ^b	<detect	<detect	- ^c
Dicamba, mg/kg	<detect	<detect	<detect	- ^c
Mecoprop, mg/kg	<detect	<detect	<detect	- ^c
PCNB detection limit, 1.7 µg/kg				<detect (<1.7 µg/kg)
Chlorothalonil detection limit, 1.7 µg/kg				<detect (<1.7 µg/kg)
Tier II Analytes				
Chlorpyrifos, mg/kg detection limit, 1.7 µg/kg				<detect (<1.7 µg/kg)
Trifluralin, mg/kg detection limit, 1.7 µg/kg				<detect (<1.7 µg/kg)
Particle size(% passing) ^d				
Medium sand (%)		-	86	86
Fine sand (%)		78	83	80.5
Very fine sand (%)		81	71	76
Silts and clays (%)		74	60	67

^a PCNB and Chlorothalonil and the tier II analytes were changed by the Village.

^b < detect means less than detection limits; that is, the analyte was not detected.

^c These analytes were removed by the Village from the list of pesticides that are to be measured.

^d data for the medium sands on June 26 are inconsistent with method results and are not used.

3.4 Regional Water Quality References

Regional references were established for surface water and groundwater. Regional references are established for monitoring stations that do not have a site specific reference for direct comparisons with natural or pre-existing conditions.

Surface water. At Hudson National Golf Course, regional references were established for surface water by calculating the mean and standard deviation for each variable across surface water stations (Table 7). Thus, water quality at stations that do not have a site specific reference will be compared to the mean and standard deviation of like analytes from the other SW stations collected during Phase I of the monitoring program.

Surface water stations SW-3A and SW-5 will be compared with data for the regional reference site. These stations do not have an established baseline. SW-3A does not have a baseline because the Village requested that the sample location be moved from the position established during baseline (inflow to the golf course from the Arboretum) to the discharge point from the irrigation lake. SW-3A was relocated for the November 28, 1995 sample event.

Surface water station SW-5 was added as a sample station in July 1994 at the request of the Village consultant. Sampling began in July 1994 and has continued. During the baseline period the stream was dry, thus samples were not obtained and a baseline could not be established.

Ground water. A regional reference for groundwater was also established by calculating the mean and standard deviation for each variable across ground water stations in 1994 and 1995. Data from 1995 was included in the reference station calculation because data from 1994 and 1995 were not statistically significantly different. Thus, water quality at stations that do not have a site specific reference will be compared to the mean and standard deviation of like analytes from the other GW stations collected during Phase I of the monitoring program.

Table 7. Surface water and ground water regional reference site mean, standard deviation and sample size.

	Surface water	Ground water
pH	6.9±0.2 (17)	6.5±0.8 (9)
Water Temperature, °C	22±5 (17)	11±3 (9)
Specific Conductance, µS/cm	121±86 (16)	1213±77 (9)
Nitrate Nitrogen, mg/L	0.31±0.43 (17)	0.92±0.7 (9)
Total Phosphorus, mg/L	0.24±0.55 (17)	10.44±12.88 (9)
Chloride, mg/L	11.7±7.4 (17)	28.6±34.1 (9)
Total Dissolved Solids, mg/L	120.9±47.4 (12)	196±88 (9)
Turbidity, NTU	7.2±6.1 (4)	- ^a
2,4-D, µg/l (detection limit 0.05 µg/l)	<detect	<detect
Dicamba, µg/l (detection limit 0.05 µg/l)	<detect	<detect
Mecoprop, µg/l (detection limit 2.5 µg/l)	<detect	<detect
PCNB, µg/l (detection limit 0.05 µg/l)	<detect	- ^a

a indicates that analyte is not to be analyzed according to the Environmental Management Plan

The regional reference, as well as the reference well (GW-6), will be used to assess ground water data at stations GW-1, GW-3, and GW-4; GW-2 has continual data with which to assess concentrations. The regional reference is required because ground water monitoring wells have been installed at different times throughout the project. Ground water monitoring wells 1,2 and 3 were installed in July of 1994. Well numbers 4, 5 and 6 were installed in July 1995. These wells were installed in 1995 because a drill rig could not reach the areas where the wells were to be located until the land had been partially cleared. Well numbers 3,4 and 6 were reinstalled in June 1996 and well number 5 was abandoned in June 1996 as per instructions from the Village Consultant. GW-3 was reinstalled because it had been dry since the drought in 1995. GW-4 and GW-6 were reinstalled because they had been dry since original installation in July 1995.

3.5 Reference Station Locations

Surface water and ground water sample stations were established to provide a reference for the water quality determinations at other sample stations. SW-6, the surface water reference station, was established in July 1996 and GW-6, the ground water reference station, was originally established in July 1994 and was reinstalled in June 1996. SW-6 is a stream located on Arboretum property, and GW-6 is located near a high point on the north edge of the property.

4.0 SUMMARY

An environmental monitoring program was initiated in May 1994 at the Hudson National Golf Course in Croton-on-Hudson, NY. Sample dates were May 30, June 26, July 27, and September 6, 1994. Sample events in May and June were conducted after rain events and sample events in June and July were conducted during dry periods. Surface water sampling was conducted at six stations on four different dates. Ground water sampling was conducted at three groundwater monitoring wells on two different dates, and at a spring that represents groundwater, on three different dates. Depending on the date, some sample stations were dry. Pond sediment was collected on June 5, June 26 and July 27, 1994.

Baseline data have been established for surface water, ground water and pond sediment. For all pesticides that were analyzed, none were detected in the samples. For the pesticides added the plan by the Village after the baseline period, including the tier II pesticides requested by the Village, concentrations are assumed to be less than detection limits as defined in the Tables of this document. For sample stations that do not have an established baseline (due to inclusion in the monitoring program after the baseline period) a regional reference has been established. Additionally, reference sites, SW-6 and GW-6 were established in 1996 to also provide a means of evaluating the data.

5.0 REFERENCES

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APPENDIX A

DATA BY SAMPLE DATE FROM SURFACE WATER, GROUND WATER,
AND SEDIMENT SAMPLING AND ANALYSES

Appendix A, Table 1. Data from surface and ground water sampling and analyses of the Hudson National Golf Club.

[illegible]

Variable	Sample Station SW-1				Sample Station SW-2			
	5-30-94	6-26-94	7-27-94	9-6-94	5-30-94	6-26-94	7-27-94	9-6-94
Chlorothalonil, $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$
Dichlorvos (trichlorfon), $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$
Thiram, $\mu\text{g}/\ell$	<detect ^c , 5 $\mu\text{g}/\ell$	<detect ^c , 5 $\mu\text{g}/\ell$	<detect ^c , 5 $\mu\text{g}/\ell$	<detect ^c , 5 $\mu\text{g}/\ell$	<detect ^c , 5 $\mu\text{g}/\ell$	<detect ^c , 5 $\mu\text{g}/\ell$	<detect ^c , 5 $\mu\text{g}/\ell$	<detect ^c , 5 $\mu\text{g}/\ell$

^a see Table 6 for particle size determinations.

^b Tier 2 analytes were changed by the Village in September. These Tier II analytes were not sampled during this time period. However, Hudson National Golf Club assumes that concentrations were less than detection limits. This was based on sampling and analyses that was conducted in subsequent phases of the project.

^c < detect means less than detection limits; that is, the analyte was not detected. The target detection limit is also given for each analyte.

^d data removed from the data set because holding times were exceeded.

Appendix A, Table 1 (continued). Data from surface and ground water sampling and analyses of the Hudson National Golf Club.

Variable	Sample Station SW-3A				Sample Station SW-3B			
	5-30-94	6-26-94	7-27-94	9-6-94	5-30-94	6-26-94	7-27-94	9-6-94
Field Analyses								
pH	6.5	6.5	6.5	Dry	6.8	6.8	6.8	Dry
Water Temperature, °C	22	25	29	Dry	17	24	27	Dry
Specific Conductance, $\mu\text{S}/\text{cm}$	175	38	38	Dry	180	42	42	Dry
Laboratory Analyses								
Nitrate Nitrogen, mg/ℓ	0.06	0.09	1.90	Dry	0.09	0.09	0.52	Dry
Total Phosphorus, mg/ℓ	0.17	<0.05	2.44	Dry	<0.05	0.22	0.09	Dry
Chloride, mg/ℓ	8	5	11	Dry	13	13	16	Dry
Total Dissolved Solids, mg/ℓ	-d	117	125	Dry	-d	116	129	Dry
Turbidity, NTU	-d	-d	-d	Dry	-d	-d	-d	Dry
Particle size ^a								
2,4-D, $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	Dry	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	Dry
Dicamba, $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	Dry	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	Dry
Mecoprop, $\mu\text{g}/\ell$	<detect ^c , 2.5 $\mu\text{g}/\ell$	<detect ^c , 2.5 $\mu\text{g}/\ell$	<detect ^c , 2.5 $\mu\text{g}/\ell$	Dry	<detect ^c , 2.5 $\mu\text{g}/\ell$	<detect ^c , 2.5 $\mu\text{g}/\ell$	<detect ^c , 2.5 $\mu\text{g}/\ell$	Dry
PCNB, $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	Dry	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	Dry
Tier II Analytes^b								
Bensulide, $\mu\text{g}/\ell$	<detect ^c , 7 $\mu\text{g}/\ell$	<detect ^c , 7 $\mu\text{g}/\ell$	<detect ^c , 7 $\mu\text{g}/\ell$	Dry	<detect ^c , 7 $\mu\text{g}/\ell$	<detect ^c , 7 $\mu\text{g}/\ell$	<detect ^c , 7 $\mu\text{g}/\ell$	Dry

Variable	Sample Station SW-3A				Sample Station SW-3B			
	5-30-94	6-26-94	7-27-94	9-6-94	5-30-94	6-26-94	7-27-94	9-6-94
Chlorpyrifos, $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	Dry	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	Dry
Chlorothalonil, $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	Dry	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	Dry
Dichlorvos (trichlorfon), $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	Dry	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	Dry
Thiram, $\mu\text{g}/\ell$	<detect ^c , 5 $\mu\text{g}/\ell$	<detect ^c , 5 $\mu\text{g}/\ell$	<detect ^c , 5 $\mu\text{g}/\ell$	Dry	<detect ^c , 5 $\mu\text{g}/\ell$	<detect ^c , 5 $\mu\text{g}/\ell$	<detect ^c , 5 $\mu\text{g}/\ell$	Dry

^a see Table 6 for particle size determinations.

^b Tier 2 analytes were changed by the Village in September: These Tier II analytes were not sampled during this time period. However, Hudson National Golf Club assumes that concentrations were less than detection limits. This was based on sampling and analyses that was conducted in subsequent phases of the project.

^c < detect means less than detection limits; that is, the analyte was not detected. The target detection limit is also given for each analyte.

^d data removed from the data set because holding times were exceeded.

Appendix A, Table 1 (continued). Data from surface and ground water sampling and analyses of the Hudson National Golf Club.

Variable	Sample Station SW-4				Sample Station SW-5 ^c			
	5-30-94	6-26-94	7-27-94	9-6-94	5-30-94	6-26-94	7-27-94	9-6-94
Field Analyses								
pH	7.2	7.2	7.2	Dry			Dry	Dry
Water Temperature, °C	17	24	26	Dry			Dry	Dry
Specific Conductance, µS/cm	190	25	25	Dry			Dry	Dry
Laboratory Analyses								
Nitrate Nitrogen, mg/l	0.14	0.11	0.29	Dry			Dry	Dry
Total Phosphorus, mg/l	<0.05	0.25	0.112	Dry			Dry	Dry
Chloride, mg/l	9	9	10	Dry			Dry	Dry
Total Dissolved Solids, mg/l	-d	86	107	Dry			Dry	Dry
Turbidity, NTU	-d	-d	6.8	Dry			Dry	Dry
Particle size ^a								
2,4-D, µg/l	<detect ^c , 0.05 µg/l	<detect ^c , 0.05 µg/l	<detect ^c , 0.05 µg/l	Dry			Dry	Dry
Dicamba, µg/l	<detect ^c , 0.05 µg/l	<detect ^c , 0.05 µg/l	<detect ^c , 0.05 µg/l	Dry			Dry	Dry
Mecoprop, µg/l	<detect ^c , 2.5 µg/l	<detect ^c , 2.5 µg/l	<detect ^c , 2.5 µg/l	Dry			Dry	Dry
PCNB, µg/l	<detect ^c , 0.05 µg/l	<detect ^c , 0.05 µg/l	<detect ^c , 0.05 µg/l	Dry			Dry	Dry
Tier II Analytes^b								
Bensulide, µg/l	<detect ^c , 7 µg/l	<detect ^c , 7 µg/l	<detect ^c , 7 µg/l	Dry			Dry	Dry
Chlorpyrifos, µg/l	<detect ^c , 0.05 µg/l	<detect ^c , 0.05 µg/l	<detect ^c , 0.05 µg/l	Dry			Dry	Dry
Chlorothalonil, µg/l	<detect ^c , 0.05 µg/l	<detect ^c , 0.05 µg/l	<detect ^c , 0.05 µg/l	Dry			Dry	Dry

Variable	Sample Station SW-4				Sample Station SW-5 ^c			
	5-30-94	6-26-94	7-27-94	9-6-94	5-30-94	6-26-94	7-27-94	9-6-94
Dichlorvos (trichlorfon), $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	<detect ^c , 0.05 $\mu\text{g}/\ell$	Dry			Dry	Dry
Thiram, $\mu\text{g}/\ell$	<detect ^c , 5 $\mu\text{g}/\ell$	<detect ^c , 5 $\mu\text{g}/\ell$	<detect ^c , 5 $\mu\text{g}/\ell$	Dry			Dry	Dry

^a see Table 6 for particle size determinations.

^b Tier 2 analytes were changed by the Village in September. These Tier II analytes were not sampled during this time period. However, Hudson National Golf Club assumes that concentrations were less than detection limits. This was based on sampling and analyses that was conducted in subsequent phases of the project.

^c < detect means less than detection limits; that is, the analyte was not detected. The target detection limit is also given for each analyte.

^d data removed from the data set because holding times were exceeded.

^e Sample station SW-5 was added in July.

Appendix A, Table 1 (continued). Data from surface and ground water sampling and analyses of the Hudson National Golf Club.

Variable	Sample Station GW-1 ^f				Sample Station GW-2 ^f			
	5-30-94	6-26-94	7-27-94	9-6-94	5-30-94	6-26-94	7-27-94	9-6-94
Field Analyses								
pH			7.0	Dry			6.9	7.1
Water Temperature, °C			12	Dry			12	14
Specific Conductance, µS/cm			75	Dry			50	110
Laboratory Analyses								
Nitrate Nitrogen, mg/l			1.76	Dry			0.52	0.22
Total Phosphorus, mg/l			16.7	Dry			2.1	0.65
Chloride, mg/l			8	Dry			10	7
Total Dissolved Solids, mg/l			91	Dry			196	170
Turbidity, NTU								
Particle size ^a								
2,4-D, µg/L			<detect ^c , 0.05 µg/l	Dry			<detect ^c , 0.05 µg/l	<detect ^c , 0.05 µg/l
Dicamba, µg/L			<detect ^c , 0.05 µg/l	Dry			<detect ^c , 0.05 µg/l	<detect ^c , 0.05 µg/l
Mecoprop, µg/L			<detect ^c , 2.5 µg/l	Dry			<detect ^c , 2.5 µg/l	<detect ^c , 2.5 µg/l
Tier II Analytes^b								
Chlorothalonil, µg/l			<detect ^c , 0.05 µg/l	Dry			<detect ^c , 0.05 µg/l	<detect ^c , 0.05 µg/l
Dichlorvos (trichlorfon), µg/l			<detect ^c , 0.05 µg/l	Dry			<detect ^c , 0.05 µg/l	<detect ^c , 0.05 µg/l
Ethylene thiourea (ETU), µg/l			<detect ^c , 5 µg/l				<detect ^c , 5 µg/l	<detect ^c , 5 µg/l
Thiram, µg/l			<detect ^c , 5 µg/l	Dry			<detect ^c , 5 µg/l	<detect ^c , 5 µg/l

^a see Table 6 for particle size determinations.

^b Tier 2 analytes were changed by the Village in September. These Tier II analytes were not sampled during this time period. However, Hudson National Golf Club assumes that concentrations were less than detection limits. This was based on sampling and analyses that was conducted in subsequent phases of the project.

^c < detect means less than detection limits; that is, the analyte was not detected. The target detection limit is also given for each analyte.

^d data removed from the data set because holding times were exceeded.

^e Sample station SW-5 was added in July

^f Ground water wells were installed in July.

Appendix A, Table 1 (continued). Data from surface and ground water sampling and analyses of the Hudson National Golf Club.

Variable	Sample Station GW-3 ^f				Sample Station GW-Spring ^f			
	5-30-94	6-26-94	7-27-94	9-6-94	5-30-94	6-26-94	7-27-94	9-6-94
Field Analyses								
pH			6.8	6.8		6.9	6.9	6.9
Water Temperature, °C			12	14		11	12	14
Specific Conductance, µS/cm			50	100		25	25	125
Laboratory Analyses								
Nitrate Nitrogen, mg/l			1.99	0.23		0.24	0.15	0.19
Total Phosphorus, mg/l			21.8	40.3		0.12	<0.05	0.06
Chloride, mg/l			11	45		6	10	<5
Total Dissolved Solids, mg /l			208	413		9	78	
Turbidity, NTU							<0.1	
Particle size ^a								
2,4-D, µg/l			<detect ^c , 0.05 µg/l	<detect ^c , 0.05 µg/l		<detect ^c , 0.05 µg/l	<detect ^c , 0.05 µg/l	<detect ^c , 0.05 µg/l
Dicamba, µg/l			<detect ^c , 0.05 µg/l	<detect ^c , 0.05 µg/l		<detect ^c , 0.05 µg/l	<detect ^c , 0.05 µg/l	<detect ^c , 0.05 µg/l
Mecoprop, µg/l			<detect ^c , 2.5 µg/l	<detect ^c , 2.5 µg/l		<detect ^c , 2.5 µg/l	<detect ^c , 2.5 µg/l	<detect ^c , 2.5 µg/l
Tier II Analytes^b								
Chlorothalonil, µg/l			<detect ^c , 0.05 µg/l	<detect ^c , 0.05 µg/l		<detect ^c , 0.05 µg/l	<detect ^c , 0.05 µg/l	<detect ^c , 0.05 µg/l
Dichlorvos (trichlorfon), µg/l			<detect ^c , 0.05 µg/l	<detect ^c , 0.05 µg/l		<detect ^c , 0.05 µg/l	<detect ^c , 0.05 µg/l	<detect ^c , 0.05 µg/l
Ethylene thiourea (ETU), µg/l			<detect ^c , 5 µg/l	<detect ^c , 5 µg/l		<detect ^c , 5 µg/l	<detect ^c , 5 µg/l	<detect ^c , 5 µg/l
Thiram, µg/l			<detect ^c , 5 µg/l	<detect ^c , 5 µg/l		<detect ^c , 5 µg/l	<detect ^c , 5 µg/l	<detect ^c , 5 µg/l

^a see Table 6 for particle size determinations.

^b Tier 2 analytes were changed by the Village in September. These Tier II analytes were not sampled during

this time period. However, Hudson National Golf Club assumes that concentrations were less than detection limits. This was based on sampling and analyses that was conducted in subsequent phases of the project.

^c < detect means less than detection limits; that is, the analyte was not detected. The target detection limit is also given for each analyte.

^d data removed from the data set because holding times were exceeded.

^e Sample station SW-5 was added in July

^f Ground water wells were installed in July; Ground water -Spring was sampled in lieu of GW-5 because GW-5 could not be installed until after clearing.

APPENDIX B

FIELD NOTES

Tim Miller Associates, Inc.

7H calibration @ 80 A
PH 4, 7, 10 used

[illegible]

Date 6-5-94

Weather *Clear 70*

[illegible]

Tim Miller Associates, Inc.

Weather (LWR 80)

PH CALIBRATION @ 9am
PH 4,7 USED

[illegible]

Tim Miller Associates, Inc.

Weather *clear* 90

PH CALIF. WTN @ 9:40
4, 7, 10, USSD

[illegible]

Tim Miller Associates, Inc.

74 CATERPILLAR @ 9.2m
4,7,10 USED

[illegible]

APPENDIX C

LAB DATA AND CHAIN-OF-CUSTODY FORMS



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO.(s) : 7733C1-4 of: 5

Date Received: 94/06/01

Sample(s) of : SURFACE WATER

Date Reported: 95/01/17

NAM : MILES SMART

ORG : TURF SCIENCE GROUP, INC.

ADD : 106 BRUCE DRIVE

CSZ : CARY, NC 27511

Telephone : 919-380-8565

PO/Job No. :

Marked A: SW-1 05/30/94

B: SW-2 05/30/94

C: SW-3A 05/30/94

D: SW-3B 5/30/94

Lab Sample No.=> A: 7733C1 B: 7733C2 C: 7733C3 D: 7733C4

CAT. NO.	ANALYSES	UNITS	A: 7733C1	B: 7733C2	C: 7733C3	D: 7733C4
: EW-10	: CHLORIDE	(mg/L) :	6	13	8	13
: EW-30.2	: NITROGEN:KJELDAHL (AS N)	(mg/L) :	<0.01	<0.01	0.14	<0.01
: EW-30.4	: NITROGEN:NITRATE (AS N)	(mg/L) :	0.05	0.201	0.056	0.089
: EW-30.6	: NITROGEN:NITRITE (AS N)	(mg/L) :	<0.005	<0.005	<0.005	<0.005
: EW-30.7	: NITROGEN:TOTAL (AS N)	(mg/L) :	0.05	0.201	0.196	0.089
: EW-38.2	: PHOSPHORUS:TOTAL (AS P)	(mg/L) :	<0.05	<0.05	0.168	<0.05
: EW-40	: SOLIDS:TOT DISSOLVED	(mg/L) :	60	151	95	116
: EW-50	: TURBIDITY	(ntu) :	2.3	1.4	5.7	2.7
:	:	:	:	:	:	:
:	:	:	:	:	:	:
:	:	:	:	:	:	:
:	:	:	:	:	:	:
:	:	:	:	:	:	:
:	:	:	:	:	:	:
:	:	:	:	:	:	:
:	:	:	:	:	:	:
:	:	:	:	:	:	:
:	:	:	:	:	:	:

Comments:

Laboratory Contact For Above Report

Name : Jeff Whaley, B.S.

Title: Section Head, Organics

Reviewed and Approved

: James B. Cox, III

: Manager, Environmental Dept.

-----SUBMISSION INFO-----

Analyst(s) : JW

No. Containers:

Sample Submission:

C-O-C:

Samp Admin:

Pickup:

Time:

Miles:

RUSH :



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO. (s) : 7733C5

of: 5

Date Received: 94/06/01

Sample(s) of : SURFACE WATER

Date Reported: 95/01/17

NAM : MILES SMART

ORG : TURF SCIENCE GROUP, INC.

ADD : 106 BRUCE DRIVE

CSZ : CARY, NC 27511

Telephone : 919-380-8565

PO/Job No. :

Marked A: SW-4 05/30/94

B:

C:

D:

Lab Sample No. => A: 7733C5 B: C: D:

CAT. NO.	ANALYSES	UNITS	A	B	C	D
: EW-10	: CHLORIDE	(mg/L)	9	:	:	:
: EW-30.2	: NITROGEN: KJELDAHL (AS N)	(mg/L)	<0.01	:	:	:
: EW-30.4	: NITROGEN: NITRATE (AS N)	(mg/L)	0.138	:	:	:
: EW-30.6	: NITROGEN: NITRITE (AS N)	(mg/L)	<0.005	:	:	:
: EW-30.7	: NITROGEN: TOTAL (AS N)	(mg/L)	0.138	:	:	:
: EW-38.2	: PHOSPHORUS (TOTAL (AS P)	(mg/L)	<0.05	:	:	:
: EW-40	: SOLIDS: TOT DISSOLVED	(mg/L)	93	:	:	:
: EW-50	: TURBIDITY	(ntu)	2.5	:	:	:
:	:	:	:	:	:	:
:	:	:	:	:	:	:
:	:	:	:	:	:	:
:	:	:	:	:	:	:
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:	:	:	:	:	:	:
:	:	:	:	:	:	:
:	:	:	:	:	:	:
:	:	:	:	:	:	:

Comments:

Laboratory Contact For Above Report

Name : Jeff Whaley, B.S.

Title: Section Head, Organics

Reviewed and Approved

: James B. Cox, III

: Manager, Environmental Dept.

SUBMISSION INFO

Analyst(s): JW

No. Containers:

Sample Submission:

C-O-C:

Samp Admin:

Pickup:

Time:

Miles:

RUSH :



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3809 Airport Drive

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Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO.(s): 7733C3-4 of: 5

Date Received: 06/01/94

Sample(s) of : SURFACE WATER

Date Reported: 01/17/95

NAM : MILES SMART

ORG : TURF SCIENCE GROUP, INC.

ADD : 106 BRUCE DRIVE

CSZ : CARY, NC 27511

Telephone : 919-380-8565

PO/Job No. :

Marked A: SW-3A 05/30/94

B: SW-3B 05/30/94

C. Preparation Date (Prep.)

D: Analysis Date (Analysis)

Lab Sample No.=> A: 7733C3 B: 7733C4 C: Prep. D: Analysis

CAT. NO.	ANALYSES	UNITS	A: 7733C3	B: 7733C4	C: Prep.	D: Analysis
EO-99	Acid Herbicides -					
	2,4 D	(mg/L)	<0.010	<0.010	06/06/94	06/14/94
	Dicamba	(mg/L)	<0.010	<0.010	06/06/94	06/14/94
	Mecoprop	(mg/L)	<0.050	<0.050	06/06/94	06/14/94
EO-99	Organophos Compounds -					
	Fenamiphos	(mg/L)	<0.005	<0.005	06/06/94	07/07/94
	Ethoprop	(mg/L)	<0.005	<0.005	06/06/94	07/07/94
	Trichlorfon		NA	NA	06/06/94	08/04/94
EO-99	Organosulfur Compound -					
	Ethofumesate	(mg/L)	<0.025	<0.025	06/06/94	07/11/94
EO-99	Organonitrogen Compounds -					
	Triadimefon	(mg/L)	<0.001	<0.001	06/06/94	08/04/94
	Siduron	(mg/L)	<0.2	<0.2	06/22/94	06/22/94

Comments: Samples were prepared and analyzed utilizing in-house and/or modified EPA procedures. Please refer to the enclosed letter dated 8/11/94.
: NA - Not analyzed; procedure unavailable for this analyte.

Laboratory Contact For Above Report

Reviewed and Approved

Name : Jeff Whaley, B.S.

: James B. Cox, III

Title: Section Head, Organics/GCMS

: Manager, Environmental Dept.

SUBMISSION INFO

Analyst(s): No. Containers: Sample Submission: C-O-C:
Samp Admin: Pickup: Time: Miles: RUSH :



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO. (s): 7733C5 of: 5 Date Received: 06/01/94

Sample(s) of : SURFACE WATER Date Reported: 01/17/95

NAM : MILES SMART

ORG : TURF SCIENCE GROUP, INC.

ADD : 106 BRUCE DRIVE

CSZ : CARY, NC 27511

Telephone : 919-380-8565

PO/Job No. :

Marked A: SW-4 05/30/94

B:

C: Preparation Date (Prep.)

D: Analysis Date (Analysis)

Lab Sample No. => A: 7733C5 B: C: Prep. D: Analysis

CAT. NO.	ANALYSES	UNITS				
EO-99	Acid Herbicides -					
	2,4 D	(mg/L)	<0.010		06/06/94	06/14/94
	Dicamba	(mg/L)	<0.010		06/06/94	06/14/94
	Mecoprop	(mg/L)	<0.050		06/06/94	06/14/94
EO-99	Organophos Compounds -					
	Fenamiphos	(mg/L)	<0.005		06/06/94	07/07/94
	Ethoprop	(mg/L)	<0.005		06/06/94	07/07/94
	Trichlorfon		NA		06/06/94	08/04/94
EO-99	Organosulfur Compound -					
	Ethofumesate	(mg/L)	<0.025		06/06/94	07/11/94
EO-99	Organonitrogen Compounds -					
	Triadimefon	(mg/L)	<0.001		06/06/94	08/04/94
	Siduron	(mg/L)	<0.2		06/22/94	06/22/94

Comments: Samples were prepared and analyzed utilizing in-house and/or modified EPA procedures. Please refer to the enclosed letter dated 8/11/94.
NA - Not analyzed; procedure unavailable for this analyte.

Laboratory Contact For Above Report

Name : Jeff Whaley, B.S.

Title: Section Head, Organics/GCMS

Reviewed and Approved

James B. Cox, III

Manager, Environmental Dept.

-----SUBMISSION INFO-----

Analyst(s): No. Containers: Sample Submission: C-O-C:
Samp Admin: Pickup: Time: Miles: RUSH :



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REPORT OF ANALYSIS

LAB SAMPLE NO.(s): 7733C1-2 of: 5

Date Received: 06/01/94

Sample(s) of : SURFACE WATER

Date Reported: 01/17/95

NAM : MILES SMART
ORG : TURF SCIENCE GROUP, INC.
ADD : 106 BRUCE DRIVE
CSZ : CARY, NC 27511

Telephone : 919-380-8565

PO/Job No. :

Marked A: SW-1 05/30/94

B: SW-2 05/30/94

C: Preparation Date (Prep.)

D: Analysis Date (Analysis)

Lab Sample No.=> A: 7733C1 B: 7733C2 C: Prep. D: Analysis

CAT. NO.	ANALYSES	UNITS				
EO-99	Acid Herbicides -					
	2,4 D	(mg/L)	<0.010	<0.010	06/06/94	06/14/94
	Dicamba	(mg/L)	<0.010	<0.010	06/06/94	06/14/94
	Mecoprop	(mg/L)	<0.050	<0.050	06/06/94	06/14/94
EO-99	Organophos Compounds -					
	Fenamiphos	(mg/L)	<0.005	<0.005	06/06/94	07/07/94
	Ethoprop	(mg/L)	<0.005	<0.005	06/06/94	07/07/94
	Trichlorfon		NA	NA	06/06/94	08/04/94
EO-99	Organosulfur Compound -					
	Ethofumesate	(mg/L)	<0.025	<0.025	06/06/94	07/11/94
EO-99	Organonitrogen Compounds -					
	Triadimefon	(mg/L)	<0.001	<0.001	06/06/94	08/04/94
	Siduron	(mg/L)	<0.2	<0.2	06/22/94	06/22/94

Comments: Samples were prepared and analyzed utilizing in-house and/or modified EPA procedures. Please refer to the enclosed letter dated 8/11/94.
: NA - Not analyzed; procedure unavailable for this analyte.

Laboratory Contact For Above Report

Reviewed and Approved

Name : Jeff Whaley, B.S.
Title: Section Head, Organics/GCMS

James B. Cox, III
Manager, Environmental Dept.

-----SUBMISSION INFO-----
Analyst(s): No. Containers: Sample Submission: C-O-C:
Samp Admin: Pickup: Time: Miles: RUSH :



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Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO.(s): 7878C1

of: 1

Date Received: 06/07/94

Sample(s) of: SEDIMENT

Date Reported: 01/17/95

NAM: MILES SMART

ORG: TURF SCIENCE GROUP, INC.

ADD: 106 BRUCE DRIVE

CSZ: CARY, NC 27511

Telephone: 919-380-8565

PO/Job No.:

Marked A: SEDIMENT 06/05/94

B:

C: Preparation Date (Prep.)

D: Analysis Date (Analysis)

Lab Sample No. => A: 7878C1 B:

C: Prep. D: Analysis

CAT. NO.	ANALYSES	UNITS				
: EO-99	: Acid Herbicides -					
:	: 2,4 D	(mg/kg)	: <10	:	: 06/17/94:	07/12/94
:	: Dicamba	(mg/kg)	: <10	:	: 06/17/94:	07/12/94
:	: Mecoprop	(mg/kg)	: <100	:	: 06/17/94:	07/12/94
: EO-99	: Organophos Compounds -					
:	: Fenamiphos		: OV	:	: 06/17/94:	
:	: Ethoprop		: OV	:	: 06/17/94:	
:	: Trichlorfon		: OV	:	: 06/17/94:	
: EO-99	: Organosulfur Compound -					
:	: Ethofumesate		: NR	:	: 06/17/94:	07/11/94
: EO-99	: Organonitrogen Compounds -					
:	: Triadimefon		: OV	:	: 06/17/94:	
:	: Siduron	(mg/kg)	: <1.0	:	: 06/22/94:	06/22/94

Comments: Samples were prepared and analyzed utilizing in-house and/or modified EPA procedures. Please refer to the enclosed letter dated 8/11/94.
: OV - Not analyzed; laboratory oversight. NR - Not reported; matrix interference.

Laboratory Contact For Above Report

Name: Jeff Whaley, B.S.

Title: Section Head, Organics/GCMS

Reviewed and Approved

: James B. Cox, III

: Manager, Environmental Dept.

SUBMISSION INFO

Analyst(s):

No. Containers:

Sample Submission:

C-O-C:

Samp Admin:

Pickup:

Time:

Miles:

RUSH:

Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO. (s): 8457C1-3 of: 3

Date Received: 94/06/29

Sample(s) of : SURFACE WATER

Date Reported: 95/01/17

NAM : MILES SMART

ORG : TURF SCIENCE GROUP, INC.

Telephone : 919-380-8565

ADD : 106 BRUCE DRIVE

CSZ : CARY, NC 27511

PO/Job No. :

Marked A: SW-2 06/26/94

B: SW-3A 06/26/94

C: SW-3B 06/26/94

L:

Lab Sample No.=> A: 8457C1 B: 8457C2 C: 8457C3 D:

[illegible]

-Comments:

Laboratory Contact For Above Report

Name : Jeff Whaley, B.S.

Title: Section Head, Organics

Reviewed and Approved

: James B. Cox, III

: Manager, Environmental Dept.

SUBMISSION INFO			
Analyst(s): JW	No. Containers:	Sample Submission:	C-O-C:
Samp Admin:	Pickup:	Time: Miles:	RUSH :

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3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO.(s): 8456C1-4 of: 4 Date Received: 94/06/29

Sample(s) of : POND SEDIMENT/SPRING WATER/ SURFACE WATER Date Reported: 95/01/17

NAM : MILES SMART
ORG : TURF SCIENCE GROUP, INC.
ADD : 106 BRUCE DRIVE
CSZ : CARY, NC 27511

Telephone : 919-380-8565

PO/Job No. :

Marked A: POND SEDIMENT 06/26/94

B: SPRING WATER 06/26/94

C: SW-4 06/26/94

D: SW-1 06/26/94

Lab Sample No.=> A: 8456C1 B: 8456C2 C: 8456C3 D: 8456C4

[illegible]

Comments: * ANALYSIS SUBCONTRACTED TO MICROBAC ENVIRONMENTAL LABORATORY.
: SEE ACCOMPANYING FORM.

Laboratory Contact For Above Report

Name : Jeff Whaley, B.S.
Title: Section Head, Organics

Reviewed and Approved

: James B. Cox, III
: Manager, Environmental Dept.

SUBMISSION INFO

Analyst(s): JW
Samp Admin:

No. Containers:..
Pickup:

Sample Submission:
Time: Miles:

C-O-C:
RUSH :



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

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Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO.(s): 8456C1 of: 4

Date Received: 06/29/94

Sample(s) of : POND SEDIMENT

Date Reported: 01/17/94

NAM : MILES SMART

ORG : TURF SCIENCE GROUP, INC.

ADD : 106 BRUCE DRIVE

CSZ : CARY, NC 27511

Telephone : 919-380-8565

PO/Job No. :

Marked A: POND SEDIMENT 06/26/94

B:

C: Preparation Date (Prep.)

D: Analysis Date (Analysis)

		Lab Sample No.=> A: 8456C1		B:	C: Prep.	D: Analysis
CAT. NO.	ANALYSES	UNITS				
EO-99	Acid Herbicides -					
	2,4 D	(mg/kg)	<10		06/30/94	07/14/94
	Dicamba	(mg/kg)	<10		06/30/94	07/14/94
	Mecoprop	(mg/kg)	<100		06/30/94	07/14/94
EO-99	Organophos Compounds -					
	Fenamiphos		OV		06/30/94	
	Ethoprop		OV		06/30/94	
	Trichlorfon		NA		06/30/94	08/04/94
EO-99	Organosulfur Compound -					
	Ethofumesate		NR		06/30/94	07/11/94
EO-99	Organonitrogen Compounds -					
	Triadimefon	(mg/kg)	<1.0		06/30/94	08/04/94
	Siduron	(mg/kg)	<1.0		07/06/94	07/06/94

Comments: Samples were prepared and analyzed utilizing in-house and/or modified EPA procedures. Please refer to the enclosed letter dated 8/11/94.
: NA - Not analyzed; procedure unavailable for this analyte.
: OV - Not analyzed; laboratory oversight. NR - Not reported; matrix interference.

Laboratory Contact For Above Report

Reviewed and Approved

Name : Jeff Whaley, B.S.

Title: Section Head, Organics/GCMS

: James B. Cox, III

: Manager, Environmental Dept.

SUBMISSION INFO

Analyst(s):

No. Containers:

Sample Submission:

C-O-C:

Samp Admin:

Pickup:

Time:

Miles:

RUSH :



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

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Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO. (s) : 8457C3 of: 3 Date Received: 06/29/94

Sample(s) of : SURFACE WATER

Date Reported:

NAM : MILES SMART
ORG : TURF SCIENCE GROUP, INC.
ADD : 106 BRUCE DRIVE
CSZ : CARY, NC 27511

Telephone : 919-380-8565

PO/Job No. :

Marked A: SW-3B 06/26/94

B:

C: Preparation Date (Prep.)

D: Analysis Date (Analysis)

Lab Sample No. => A: 8457C3 B: C: Prep. D: Analysis

CAT. NO.	ANALYSES	UNITS				
: EO-99	: Acid Herbicides -					
:	: 2,4 D	(mg/L)	: <0.010	:	: 06/30/94:	07/14/94
:	: Dicamba	(mg/L)	: <0.010	:	: 06/30/94:	07/14/94
:	: Mecoprop	(mg/L)	: <0.050	:	: 06/30/94:	07/14/94
: EO-99	: Organophos Compounds -					
:	: Fenamiphos	(mg/L)	: <0.005	:	: 06/30/94:	07/08/94
:	: Ethoprop	(mg/L)	: <0.005	:	: 06/30/94:	07/08/94
:	: Trichlorfon		: NA	:	: 06/30/94:	08/04/94
: EO-99	: Organosulfur Compound -					
:	: Ethofumesate	(mg/L)	: <0.025	:	: 06/30/94:	07/11/94
: EO-99	: Organonitrogen Compounds -					
:	: Triadimefon	(mg/L)	: <0.001	:	: 06/30/94:	08/04/94
:	: Siduron	(mg/L)	: <1.0	:	: 07/06/94:	07/06/94

Comments: Samples were prepared and analyzed utilizing in-house and/or modified EPA procedures. Please refer to the enclosed letter dated 8/11/94.
: NA - Not analyzed; procedure unavailable for this analyte.

Laboratory Contact For Above Report

Reviewed and Approved

Name : Jeff Whaley, B.S.

: James B. Cox, III

Title: Section Head, Organics/GCMS

: Manager, Environmental Dept.

SUBMISSION INFO

Analyst(s) : No. Containers: Sample Submission: C-O-C:
Samp Admin: Pickup: Time: Miles: RUSH :



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO.(s): 8457C1-2 of: 3

Date Received: 06/29/94

Sample(s) of : SURFACE WATER

Date Reported: 01/17/94

NAM : MILES SMART

ORG : TURF SCIENCE GROUP, INC.

ADD : 106 BRUCE DRIVE

CSZ : CARY, NC 27511

Telephone : 919-380-8565

PO/Job No. :

Marked A: SW-2 06/26/94

B: SW-3A 06/26/94

C: Preparation Date (Prep.)

D: Analysis Date (Analysis)

Lab Sample No.=> A: 8457C1 B: 8457C2 C: Prep. D: Analysis

CAT. NO.	ANALYSES	UNITS	A: 8457C1	B: 8457C2	C: Prep.	D: Analysis
EO-99	Acid Herbicides -					
	2,4 D	(mg/L)	<0.010	<0.010	06/30/94	07/14/94
	Dicamba	(mg/L)	<0.010	<0.010	06/30/94	07/14/94
	Mecoprop	(mg/L)	<0.050	<0.050	06/30/94	07/14/94
EO-99	Organophos Compounds -					
	Fenamiphos	(mg/L)	<0.005	<0.005	06/30/94	07/08/94
	Ethoprop	(mg/L)	<0.005	<0.005	06/30/94	07/08/94
	Trichlorfon		NA	NA	06/30/94	08/04/94
EO-99	Organosulfur Compound -					
	Ethofumesate	(mg/L)	<0.025	<0.025	06/30/94	07/11/94
EO-99	Organonitrogen Compounds -					
	Triadimefon	(mg/L)	<0.001	<0.001	06/30/94	08/04/94
	Siduron	(mg/L)	<1.0	<1.0	07/06/94	07/06/94

Comments: Samples were prepared and analyzed utilizing in-house and/or modified EPA procedures. Please refer to the enclosed letter dated 8/11/94.
NA - Not analyzed; procedure unavailable for this analyte.

Laboratory Contact For Above Report

Name : Jeff Whaley, B.S.

Title: Section Head, Organics/GCMS

Reviewed and Approved

: James B. Cox, III

: Manager, Environmental Dept.

SUBMISSION INFO

Analyst(s):

No. Containers:

Sample Submission:

C-O-C:

Samp Admin:

Pickup:

Time:

Miles:

RUSH :



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Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO. (s): 8456C2-3 of: 4

Date Received: 06/29/94

Sample(s) of: SPRING/SURFACE WATER

Date Reported: 01/17/94

NAM: MILES SMART

ORG: TURF SCIENCE GROUP, INC.

ADD: 106 BRUCE DRIVE

CSZ: CARY, NC 27511

Telephone: 919-380-8565

PO/Job No.:

Marked A: SPRING WATER 06/26/94

B: SW-4 06/26/94

C: Preparation Date (Prep.)

D: Analysis Date (Analysis)

Lab Sample No. => A: 8456C2 B: 8456C3 C: Prep. D: Analysis

CAT. NO.	ANALYSES	UNITS				
: EO-99	: Acid Herbicides -					
:	: 2,4 D	(mg/L)	: <0.010	: <0.010	: 06/30/94:	07/14/94
:	: Dicamba	(mg/L)	: <0.010	: <0.010	: 06/30/94:	07/14/94
:	: Mecoprop	(mg/L)	: <0.050	: <0.050	: 06/30/94:	07/14/94
: EO-99	: Organophos Compounds -					
:	: Fenamiphos	(mg/L)	: <0.005	: <0.005	: 06/30/94:	07/7-8/94
:	: Ethoprop	(mg/L)	: <0.005	: <0.005	: 06/30/94:	07/7-8/94
:	: Trichlorfon	(mg/L)	: NA	: NA	: 06/30/94:	08/04/94
: EO-99	: Organosulfur Compound -					
:	: Ethofumesate	(mg/L)	: <0.025	: <0.025	: 06/30/94:	07/11/94
: EO-99	: Organonitrogen Compounds -					
:	: Triadimefon	(mg/L)	: <0.001	: <0.001	: 06/30/94:	08/04/94
:	: Siduron	(mg/L)	: <1.0	: <1.0	: 07/06/94:	07/06/94

Comments: Samples were prepared and analyzed utilizing in-house and/or modified EPA procedures. Please refer to the enclosed letter dated 8/11/94.
: NA - Not analyzed; procedure unavailable for this analyte.

Laboratory Contact For Above Report

Name: Jeff Whaley, B.S.

Title: Section Head, Organics/GCMS

Reviewed and Approved

: James B. Cox, III

: Manager, Environmental Dept.

SUBMISSION INFO

Analyst(s): No. Containers: Sample Submission: C-O-C:
Samp Admin: Pickup: Time: Miles: RUSH:



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(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO. (s): 8456C4 of: 4

Date Received: 06/29/94

Sample(s) of : SURFACE WATER

Date Reported: 01/17/95

NAM : MILES SMART

ORG : TURF SCIENCE GROUP, INC.

ADD : 106 BRUCE DRIVE

CSZ : CARY, NC 27511

Telephone : 919-380-8565

PO/Job No. :

Marked A: SW-1 06/26/94

B:

C: Preparation Date (Prep.)

D: Analysis Date (Analysis)

		Lab Sample No. => A: 8456C4		B:	C: Prep.	D: Analysis
CAT. NO.	ANALYSES	UNITS				
EO-99	Acid Herbicides -					
	2,4 D	(mg/L)	<0.010		06/30/94	07/14/94
	Dicamba	(mg/L)	<0.010		06/30/94	07/14/94
	Mecoprop	(mg/L)	<0.050		06/30/94	07/14/94
EO-99	Organophos Compounds -					
	Fenamiphos	(mg/L)	<0.005		06/30/94	07/08/94
	Ethoprop	(mg/L)	<0.005		06/30/94	07/08/94
	Trichlorfon	(mg/L)	NA		06/30/94	08/04/94
EO-99	Organosulfur Compound -					
	Ethofumesate	(mg/L)	<0.025		06/30/94	07/11/94
EO-99	Organonitrogen Compounds -					
	Triadimefon	(mg/L)	<0.001		06/30/94	08/04/94
	Siduron	(mg/L)	<1.0		07/06/94	07/06/94

Comments: Samples were prepared and analyzed utilizing in-house and/or modified EPA procedures. Please refer to the enclosed letter dated 8/11/94.
NA - Not analyzed; procedure unavailable for this analyte.

Laboratory Contact For Above Report

Name : Jeff Whaley, B.S.

Title: Section Head, Organics/GCMS

Reviewed and Approved

James B. Cox, III

Manager, Environmental Dept.

Analyst(s):	No. Containers:	Sample Submission:	C-O-C:
Samp Admin:	Pickup:	Time:	Miles:
			RUSH :



MICROBAC ENVIRONMENTAL LABORATORY, INC.



817 Castle Hayne St., Fayetteville, North Carolina 28303
Phone (910) 864-1920 - Fax (910) 864-8774

ANALYSIS REPORT

CLIENT: Southern Testing & Research Lab
ADDRESS: 3809 Airport Drive
Wilson, NC 27896
TELEPHONE: (919) 237-4175
CONTACT PERSON: Mr. Jeff Whaley
ACCOUNT NUMBER: #KM008

DATE REC'D: 07/06/94 SAMPLED: 07/05/94
SAMPLE: Pond Sediment
SAMPLED BY: Client
DELIVERED BY: UPS
SAMPLE CODE: ID #94MX73791
REFERENCE: #8456C1

ANALYSIS UNIT RESULTS

PARTICLE SIZE (um)

4000 < x	%	
3000 < x < 4000	%	
2000 < x < 3000	%	
1600 < x < 2000	%	
420 < x < 1600	%	
x < 420	%	
300 < x	%	13.8
150 < x < 300	%	17.4
75 < x < 100	%	28.8
x < 75	%	40.0

COMMENTS: < = LESS THAN

METHOD: ASTM D410/D413

RESPECTFULLY SUBMITTED,

R. W. Sanders

RONALD W. SANDERS *for*
MANAGING DIRECTOR

Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO. (s) : 9170C1-3 of: 3

Date Received: 94/07/29

Sample(s) of : GROUND WATER/SURFACE WATER

Date Reported: 95/01/17

NAM : MILES SMART

ORG : TURF SCIENCE GROUP, INC.

ADD : 106 BRUCE DRIVE

CSZ : CARY, NC 27511

Telephone : 919-380-8565

PO/Job No. :

Marked A: GW-2 07/27/94

B: GW-3 07/27/94

FC: SW-4 07/27/94

D:

Lab Sample No.=> A: 9170C1 B: 9170C2 C: 9170C3 D:

~~NAME~~ CAT. NO.

ANALYSES

UNITS

Sample	Parameter	Unit	Value	Unit	Value	Unit	Value
EW-10	CHLORIDE	(mg/L)	10		11		10
EW-30.4	NITROGEN:NITRATE (AS N)	(mg/L)	0.515		1.99		0.294
EW-30.6	NITROGEN:NITRITE (AS N)	(mg/L)	0.062		0.034		0.008
EW-38.2	PHOSPHORUS:TOTAL (AS P)	(mg/L)	2.09		21.8		0.112
EW-40	SOLIDS:TOT DISSOLVED	(mg/L)	196		208		107
EW-50	TURBIDITY	(ntu)					6.8

Comments:

Laboratory Contact For Above Report

Name : Jeff Whaley, B.S.

Title: Section Head, Organics

Reviewed and Approved

: James B. Cox, III

: Manager, Environmental Dept.

-----SUBMISSION INFO

Analyst(s) : JW

No. Containers:

Sample Submission:

 $C-O-C:$

Samp Admin:

Pickup:

Time:

Miles:

RUSH :



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Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO.(s): 9170C1-2 of: 3

Date Received: 07/29/94

Sample(s) of : GROUND WATER

Date Reported:

NAM : MILES SMART

ORG : TURF SCIENCE GROUP, INC.

ADD : 106 BRUCE DRIVE

CSZ : CARY, NC 27511

Telephone : 919-380-8565

PO/Job No. :

Marked A: GW-2 07/27/94

B: GW-3 07/27/94

C: Preparation Date (Prep.)

D: Analysis Date (Analysis)

Lab Sample No.=> A: 9170C1 B: 9170C2 C: Prep. D: Analysis

CAT. NO.	ANALYSES	UNITS				
: EO-99	: Acid Herbicides -	:	:	:	:	:
:	: 2,4 D	(mg/L):	<0.010	: <0.010	: 08/02/94:	09/22/94
:	: Dicamba	(mg/L):	<0.010	: <0.010	: 08/02/94:	09/22/94
:	: Mecoprop	(mg/L):	<0.050	: <0.010	: 08/02/94:	09/22/94
: EO-99	: Organophos Compounds -	:	:	:	:	:
:	: Fenamiphos	(mg/L):	<0.005	: <0.005	: 08/02/94:	09/12/94
:	: Ethoprop	(mg/L):	<0.005	: <0.005	: 08/02/94:	09/12/94
:	: Trichlorfon	:	NA	: NA	: 08/02/94:	09/14/94
: EO-99	: Organosulfur Compound -	:	:	:	:	:
:	: Ethofumesate	(mg/L):	<0.025	: <0.025	: 08/02/94:	09/13/94
: EO-99	: Organonitrogen Compounds -	:	:	:	:	:
:	: Triadimefon	(mg/L):	<0.001	: <0.001	: 08/02/94:	09/14/94
:	: Siduron	(mg/L):	<0.3	: <0.3	: 08/16/94:	08/16/94

Comments: Samples were prepared and analyzed utilizing in-house and/or modified EPA procedures. Please refer to the enclosed letter dated 8/11/94.
: NA - Not analyzed; procedure unavailable for this analyte.

Laboratory Contact For Above Report

Name : Jeff Whaley, B.S.

Title: Section Head, Organics/GCMS

Reviewed and Approved

: James B. Cox, III

: Manager, Environmental Dept.

SUBMISSION INFO

Analyst(s): No. Containers: Sample Submission: C-O-C:
Samp Admin: Pickup: Time: Miles: RUSH :



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Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO. (s): 9170C3

of: 3

Date Received: 07/29/94

Sample(s) of: SURFACE WATER

Date Reported: 01/17/95

NAM: MILES SMART

ORG: TURF SCIENCE GROUP, INC.

ADD: 106 BRUCE DRIVE

CSZ: CARY, NC 27511

Telephone: 919-380-8565

PO/Job No.:

Marked A: SW-4 07/27/94

B:

C: Preparation Date (Prep.)

D: Analysis Date (Analysis)

Lab Sample No. => A: 9170C3 B:

C: Prep. D: Analysis

CAT. NO.	ANALYSES	UNITS				
EO-99	Acid Herbicides -					
	2,4 D	(mg/L)	<0.010		08/02/94	09/22/94
	Dicamba	(mg/L)	<0.010		08/02/94	09/22/94
	Mecoprop	(mg/L)	<0.050		08/02/94	09/22/94
EO-99	Organophos Compounds -					
	Fenamiphos	(mg/L)	<0.005		08/02/94	09/12/94
	Ethoprop	(mg/L)	<0.005		08/02/94	09/12/94
	Trichlorfon		NA		08/02/94	09/14/94
EO-99	Organosulfur Compound -					
	Ethofumesate	(mg/L)	<0.025		08/02/94	09/13/94
EO-99	Organonitrogen Compounds -					
	Triadimefon	(mg/L)	<0.001		08/02/94	09/14/94
	Siduron	(mg/L)	<0.3		08/16/94	08/16/94

Comments: Samples were prepared and analyzed utilizing in-house and/or modified EPA procedures. Please refer to the enclosed letter dated 8/11/94.
NA - Not analyzed; procedure unavailable for this analyte.

Laboratory Contact For Above Report

Name: Jeff Whaley, B.S.

Title: Section Head, Organics/GCMS

Reviewed and Approved

James B. Cox, III

Manager, Environmental Dept.

SUBMISSION INFO

Analyst(s):

No. Containers:

Sample Submission:

C-O-C:

Samp Admin:

Pickup:

Time:

Miles:

RUSH:



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Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO.(s): 9171C1-4 of: 4 Date Received: 94/07/29

Sample(s) of : POND SEDIMENT/SURFACE WATER Date Reported: 95/01/17

NAM : MILES SMART

ORG : TURF SCIENCE GROUP, INC.

ADD : 106 BRUCE DRIVE

CSZ : CARY, NC 27511

Telephone : 919-380-8565

PO/Job No. :

Marked A: POND 07/27/94

B: SW-3A 07/27/94

C: SW-3B 07/27/94

D: SW-2 07/27/94

Lab Sample No.=> A: 9171C1 B: 9171C2 C: 9171C3 D: 9171C4

CAT. NO.	ANALYSES	UNITS	A: 9171C1	B: 9171C2	C: 9171C3	D: 9171C4
: EW-10	: CHLORIDE	(mg/L):	: 11	: 16	: 16	
: EW-30.4	: NITROGEN:NITRATE (AS N)	(mg/L):	: 1.90	: 0.524	: 0.240	
: EW-30.6	: NITROGEN:NITRITE (AS N)	(mg/L):	: 0.011	: <0.005	: <0.005	
: EW-38.2	: PHOSPHORUS:TOTAL (AS P)	(mg/L):	: 2.44	: 0.092	: 0.050	
: EW-40	: SOLIDS:TOT DISSOLVED	(mg/L):	: 125	: 129	: 198	
: EW-50	: TURBIDITY	(ntu):	: 32	: 3.3	: 1.8	
: EW-99	: PARTICLE SIZE	:MEL FORM*				
:	:	:	:	:	:	
:	:	:	:	:	:	
:	:	:	:	:	:	
:	:	:	:	:	:	
:	:	:	:	:	:	
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:	:	:	:	:	:	

Comments: * ANALYSIS SUBCONTRACTED TO MICROBAC ENVIRONMENTAL LABORATORY.
SEE ACCOMPANYING FORM.

Laboratory Contact For Above Report

Name : Jeff Whaley, B.S.

Title: Section Head, Organics

Reviewed and Approved

: James B. Cox, III

: Manager, Environmental Dept.

-----SUBMISSION INFO-----
Analyst(s): JW No. Containers: 14 Sample Submission: C-O-C: Y
Samp Admin: Pickup: N Time: Miles: RUSH : N



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Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO. (s): 9171C1 of: 4

Date Received: 07/29/94

Sample(s) of: POND SEDIMENT

Date Reported: 01/17/95

NAM: MILES SMART

ORG: TURF SCIENCE GROUP, INC.

ADD: 106 BRUCE DRIVE

CSZ: CARY, NC 27511

Telephone: 919-380-8565

PO/Job No.:

Marked A: POND 07/27/94

B:

C: Preparation Date (Prep.)

D: Analysis Date (Analysis)

		Lab Sample No. => A: 9171C1		B:	C: Prep.	D: Analysis
CAT. NO.	ANALYSES	UNITS				
EO-99	Acid Herbicides -					
	2,4 D	(mg/kg)	<10		08/08/94	09/22/94
	Dicamba	(mg/kg)	<10		08/08/94	09/22/94
	Mecoprop	(mg/kg)	<100		08/08/94	09/22/94
EO-99	Organophos Compounds -					
	Fenamiphos		OV		09/12/94	
	Ethoprop		OV		09/12/94	
	Trichlorfon		NA		09/12/94	09/19/94
EO-99	Organosulfur Compound -					
	Ethofumesate	(mg/kg)	<0.150		09/12/94	10/14/94
EO-99	Organonitrogen Compounds -					
	Triadimefon	(mg/kg)	<0.025		09/12/94	09/19/94
	Siduron	(mg/kg)	<0.3		08/16/94	08/16/94

Comments: Samples were prepared and analyzed utilizing in-house and/or modified EPA procedures. Please refer to the enclosed letter dated 8/11/94.
: NA - Not analyzed; procedure unavailable for this analyte.
: OV - Not analyzed; laboratory oversight.

Laboratory Contact For Above Report

Reviewed and Approved

Name: Jeff Whaley, B.S.

: James B. Cox, III

Title: Section Head, Organics/GCMS

: Manager, Environmental Dept.

SUBMISSION INFO

Analyst(s):

No. Containers:

Sample Submission:

C-O-C:

Samp Admin:

Pickup:

Time:

Miles:

RUSH:



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Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO.(s) : 9171C2-3 of: 4

Date Received: 07/29/94

Sample(s) of : SURFACE WATER

Date Reported: 01/17/95

NAM : MILES SMART

ORG : TURF SCIENCE GROUP, INC.

ADD : 106 BRUCE DRIVE

CSZ : CARY, NC 27511

Telephone : 919-380-8565

PO/Job No. :

Marked A: SW-3A 07/27/94

B: SW-3B 07/27/94

C: Preparation Date (Prep.)

D: Analysis Date (Analysis)

Lab Sample No.=> A: 9171C2 B: 9171C3 C: Prep. D: Analysis:

CAT. NO.	ANALYSES	UNITS	A	B	C	D
EO-99	Acid Herbicides -					
	2,4 D	(mg/L)	<0.010	<0.010	08/02/94	09/22/94
	Dicamba	(mg/L)	<0.010	<0.010	08/02/94	09/22/94
	Mecoprop	(mg/L)	<0.050	<0.050	08/02/94	09/22/94
EO-99	Organophos Compounds -					
	Fenamiphos	(mg/L)	<0.005	<0.005	09/12/94	09/12/94
	Ethoprop	(mg/L)	<0.005	<0.005	09/12/94	09/12/94
	Trichlorfon	(mg/L)	NA	NA	09/12/94	09/14/94
EO-99	Organosulfur Compound -					
	Ethofumesate	(mg/L)	<0.025	<0.025	09/12/94	09/13/94
EO-99	Organonitrogen Compounds -					
	Triadimefon	(mg/L)	<0.001	<0.001	09/12/94	09/14/94
	Siduron	(mg/L)	<0.3	<0.3	08/16/94	08/16/94

Comments: Samples were prepared and analyzed utilizing in-house and/or modified EPA procedures. Please refer to the enclosed letter dated 8/11/94.
: NA - Not analyzed; procedure unavailable for this analyte.

Laboratory Contact For Above Report

Name : Jeff Whaley, B.S.

Title: Section Head, Organics/GCMS

Reviewed and Approved

: James B. Cox, III

: Manager, Environmental Dept.

SUBMISSION INFO

Analyst(s) :

No. Containers:

Sample Submission:

C-O-C:

Samp Admin:

Pickup:

Time:

Miles:

RUSH :



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Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO.(s): 9171C4 of: 4

Date Received: 07/29/94 *

Sample(s) of : SURFACE WATER

Date Reported: 01/17/95

NAM : MILES SMART
ORG : TURF SCIENCE GROUP, INC.
ADD : 106 BRUCE DRIVE
CSZ : CARY, NC 27511

Telephone : 919-380-8565

PO/Job No. :

Marked A: SW-2 07/27/94

B:

C: Preparation Date (Prep.)

D: Analysis Date (Analysis)

		Lab Sample No.=> A: 9171C4		B:	C: Prep.	D: Analysis
CAT. NO.	ANALYSES	UNITS				
EO-99	Acid Herbicides -					
	2,4 D	(mg/L)	<0.010		08/02/94	09/22/94
	Dicamba	(mg/L)	<0.010		08/02/94	09/22/94
	Mecoprop	(mg/L)	<0.050		08/02/94	09/22/94
EO-99	Organophos Compounds -					
	Fenamiphos	(mg/L)	<0.005		09/12/94	09/12/94
	Ethoprop	(mg/L)	<0.005		09/12/94	09/12/94
	Trichlorfon	(mg/L)	NA		09/12/94	09/14/94
EO-99	Organosulfur Compound -					
	Ethofumesate	(mg/L)	<0.025		09/12/94	09/13/94
EO-99	Organonitrogen Compounds -					
	Triadimefon	(mg/L)	<0.001		09/12/94	09/14/94
	Siduron	(mg/L)	<0.3		08/16/94	08/16/94

Comments: Samples were prepared and analyzed utilizing in-house and/or modified EPA procedures. Please refer to the enclosed letter dated 8/11/94.
NA - Not analyzed; procedure unavailable for this analyte.

Laboratory Contact For Above Report

Name : Jeff Whaley, B.S.
Title: Section Head, Organics/GCMS

Reviewed and Approved

James B. Cox, III
Manager, Environmental Dept.

SUBMISSION INFO			
Analyst(s):	No. Containers:	Sample Submission:	C-O-C:
Samp Admin:	Pickup:	Time:	Miles: RUSH :

Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO. (s): 9172C1-3 of: 3 Date Received: 94/07/29

Sample(s) of : SURFACE WATER, GROUND WATER Date Reported: 95/01/17
SPRING WATER

NAM : MILES SMART

ORG : TURF SCIENCE GROUP, INC.

ADD : 106 BRUCE DRIVE

CSZ : CARY, NC 27511

Telephone : 919-380-8565

PO/Job No. :

Marked A: SW-1 07/27/94

B: GW-1 07/27/94

C: SPRING 07/27/94

D:

Lab Sample No.=> A: 9172C1 B: 9172C2 C: 9172C3 D:

CAT. NO.

ANALYSES

UNITS

[illegible]

Comments:

Laboratory Contact For Above Report

Name : Jeff Whaley, B.S.

Title: Section Head, Organics

Reviewed and Approved

: James B. Cox, III

: Manager, Environmental Dept.

-----SUBMISSION INFO-----

Analyst(s) : JW

No. Containers:

Sample Submission:

$$\text{C}-\text{O}-\text{C}:$$

Samp Admin:

Pickup:

Time:

Miles:

RUSH :



Southern Testing & Research Laboratories, Inc.

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Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO.(s) : 9172C1-2 of: 3

Date Received: 07/29/94

Sample(s) of : SURFACE/GROUND WATER

Date Reported: 01/17/95

NAM : MILES SMART

ORG : TURF SCIENCE GROUP, INC.

ADD : 106 BRUCE DRIVE

CSZ : CARY, NC 27511

Telephone : 919-380-8565

PO/Job No. :

Marked A: SW-1 07/27/94

B: GW-1 07/27/94

C: Preparation Date (Prep.)

D: Analysis Date (Analysis)

Lab Sample No.=> A: 9171C1 B: 9171C2 C: Prep. D: Analysis

CAT. NO.	ANALYSES	UNITS				
EO-99	Acid Herbicides -					
	2,4 D	(mg/L)	<0.010	<0.010	08/02/94	09/22/94
	Dicamba	(mg/L)	<0.010	<0.010	08/02/94	09/22/94
	Mecoprop	(mg/L)	<0.050	<0.050	08/02/94	09/22/94
EO-99	Organophos Compounds -					
	Fenamiphos	(mg/L)	<0.005	<0.005	08/02/94	09/12/94
	Ethoprop	(mg/L)	<0.005	<0.005	08/02/94	09/12/94
	Trichlorfon		NA	NA	08/02/94	09/14/94
EO-99	Organosulfur Compound -					
	Ethofumesate	(mg/L)	<0.025	<0.025	08/02/94	09/13/94
EO-99	Organonitrogen Compounds -					
	Triadimefon	(mg/L)	<0.001	<0.001	08/02/94	09/14/94
	Siduron	(mg/L)	<0.3	<0.3	08/16/94	08/16/94

Comments: Samples were prepared and analyzed utilizing in-house and/or modified EPA procedures. Please refer to the enclosed letter dated 8/11/94.
: NA - Not analyzed; procedure unavailable for this analyte.

Laboratory Contact For Above Report

Name : Jeff Whaley, B.S.

Title: Section Head, Organics/GCMS

Reviewed and Approved

James B. Cox, III

Manager, Environmental Dept.

SUBMISSION INFO

Analyst(s) :

No. Containers:

Sample Submission:

C-O-C:

Samp Admin:

Pickup:

Time:

Miles:

RUSH :



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO.(s): 9172C3

of: 3

Date Received: 07/29/94

Sample(s) of : SPRING WATER

Date Reported: 01/17/95

NAM : MILES SMART

ORG : TURF SCIENCE GROUP, INC.

ADD : 106 BRUCE DRIVE

CSZ : CARY, NC 27511

Telephone : 919-380-8565

PO/Job No. :

Marked A: SPRING 07/27/94

B:

C: Preparation Date (Prep.)

D: Analysis Date (Analysis)

Lab Sample No.=> A: 9171C3 B:

C: Prep. D: Analysis

CAT. NO.	ANALYSES	UNITS				
: EO-99	: Acid Herbicides -		:	:	:	:
:	: 2,4 D	(mg/L)	: <0.010	:	: 08/02/94:	09/22/94
:	: Dicamba	(mg/L)	: <0.010	:	: 08/02/94:	09/22/94
:	: Mecoprop	(mg/L)	: <0.050	:	: 08/02/94:	09/22/94
: EO-99	: Organophos Compounds -		:	:	:	:
:	: Fenamiphos	(mg/L)	: <0.005	:	: 08/02/94:	09/12/94
:	: Ethoprop	(mg/L)	: <0.005	:	: 08/02/94:	09/12/94
:	: Trichlorfon		: NA	:	: 08/02/94:	09/14/94
: EO-99	: Organosulfur Compound -		:	:	:	:
:	: Ethofumesate	(mg/L)	: <0.025	:	: 08/02/94:	09/13/94
: EO-99	: Organonitrogen Compounds -		:	:	:	:
:	: Triadimefon	(mg/L)	: <0.001	:	: 08/02/94:	09/14/94
:	: Siduron	(mg/L)	: <0.3	:	: 08/16/94:	08/16/94

Comments: Samples were prepared and analyzed utilizing in-house and/or modified EPA procedures. Please refer to the enclosed letter dated 8/11/94.
: NA - Not analyzed; procedure unavailable for this analyte.

Laboratory Contact For Above Report

Name : Jeff Whaley, B.S.

Title: Section Head, Organics/GCMS

Reviewed and Approved

: James B. Cox, III

: Manager, Environmental Dept.

SUBMISSION INFO

Analyst(s):

No. Containers:

Sample Submission:

C-O-C:

Samp Admin:

Pickup:

Time:

Miles:

RUSH :



817 Castle Hayne St., Fayetteville, North Carolina 28303
Phone (910) 864-1920 - Fax (910) 864-8774

ANALYSIS REPORT

CLIENT: Southern Testing & Research Lab
ADDRESS: 3809 Airport Drive
Wilson, NC 27896
TELEPHONE: (919) 237-4175
CONTACT PERSON: Mr. Jeff Whaley
ACCOUNT NUMBER: #KM008

DATE REC'D: 08/02/94 SAMPLED: 07/29/94
SAMPLE: Pond Sediment
SAMPLED BY: Client
DELIVERED BY: UPS
SAMPLE CODE: ID #94MX84359
REFERENCE: #9171C1

ANALYSIS UNIT RESULTS

PARTICLE SIZE (um)

4000 < x	%	
3000 < x < 4000	%	
2000 < x < 3000	%	
1600 < x < 2000	%	
420 < x < 1600	%	
x < 420	%	
300 < x	%	32.6
150 < x < 300	%	21.7
75 < x < 100	%	19.4
x < 75	%	26.2

COMMENTS: < = LESS THAN

METHOD: ASTM D410/D413

RESPECTFULLY SUBMITTED,

R. W. Sanders

RONALD W. SANDERS ^{SR}
MANAGING DIRECTOR



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO.(s): 1193D1-2 of: 2

Date Received: 94/09/07

Sample(s) of : GROUND WATER

Date Reported: 95/01/17

NAM : MILES SMART

ORG : TURF SCIENCE GROUP, INC.

ADD : 106 BRUCE DRIVE

CSZ : CARY, NC 27511

Telephone : 919-380-8565

PO/Job No. :

Marked A: GW-2 09/06/94

B: GW-3 09/06/94

C:

D:

Lab Sample No.=> A: 1193D1 B: 1193D2 C: D:

CAT. NO.	ANALYSES	UNITS	A: 1193D1	B: 1193D2	C:	D:
: EW-10	: CHLORIDE	(mg/L) :	7	: 45	:	:
: EW-30.4	: NITROGEN:NITRATE (AS N)	(mg/L) :	0.215	: 0.226	:	:
: EW-30.6	: NITROGEN:NITRITE (AS N)	(mg/L) :	0.012	: <0.005	:	:
: EW-38.2	: PHOSPHORUS:TOTAL (AS P)	(mg/L) :	0.654	: 40.3	:	:
: EW-40	: SOLIDS:TOTAL DISSOLVED	(mg/L) :	170	: 413	:	:
:	:	:	:	:	:	:
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Comments:

Laboratory Contact For Above Report

Name : Jeff Whaley, B.S.

Title: Section Head, Organics

Reviewed and Approved

: James B. Cox, III

Manager, Environmental Dept.

SUBMISSION INFO

Analyst(s): JW

No. Containers:

Sample Submission:

C-O-C:

Sample Admin:

Pickup:

Time:

Miles:

RUSH :

Southern Testing & Research Laboratories, Inc.

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Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO. (s) : 1194D1-3 of: 3

Date Received: 94/09/07

Sample(s) of : SPRING WATER/SURFACE WATER

Date Reported: 95/01/17

NAM : MILES SMART

ORG : TURF SCIENCE GROUP, INC.

Telephone : 919-380-8565

ADD : 106 BRUCE DRIVE

CSZ : CARY, NC 27511

PO/Job No. :

Marked A: SPRING WATER 09/06/94

B: SW-2 09/06/94

C: SW-1 09/06/94

D:

Lab Sample No.=> A: 1194D1 B: 1194D2 C: 1194D3 D:

[illegible]

Comments:

Laboratory Contact For Above Report

Name : Jeff Whaley, B.S.

Title: Section Head, Organics

Reviewed and Approved

: James B. Cox, III

: Manager, Environmental Dept.

-----SUBMISSION INFO-----

Analyst(s): JW

No. Containers:

Sample Submission:

$$\text{C}-\text{O}-\text{C}:$$

Samp Admin:

Pickup:

Time:

Miles:

RUSH :



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Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO.(s) : 1193D1-2 of: 2

Date Received: 09/07/94

Sample(s) of : GROUND WATER

Date Reported: 01/17/95

NAM : MILES SMART
ORG : TURF SCIENCE GROUP, INC.
ADD : 106 BRUCE DRIVE
CSZ : CARY, NC 27511

Telephone : 919-380-8565

PO/Job No. :

Marked A: GW-2 09/06/94

B: GW-3 09/06/94

C: Preparation Date (Prep.)

D: Analysis Date (Analysis)

Lab Sample No.=> A: 1193D1 B: 1193D2 C: Prep. D: Analysis

CAT. NO.	ANALYSES	UNITS				
: EO-99	: Acid Herbicides -	:	:	:	:	:
:	: 2,4 D	(mg/L):	<0.010	: <0.010	: 09/16/94:	10/14/94
:	: Dicamba	(mg/L):	<0.010	: <0.010	: 09/16/94:	10/14/94
:	: Mecoprop	(mg/L):	<0.050	: <0.050	: 09/16/94:	10/14/94
: EO-99	: Organophos Compounds -	:	:	:	:	:
:	: Fenamiphos	(mg/L):	<0.005	: <0.005	: 09/16/94:	10/13/94
:	: Ethoprop	(mg/L):	<0.005	: <0.005	: 09/16/94:	10/13/94
:	: Trichlorfon	:	NA	: NA	: 09/16/94:	10/07/94
: EO-99	: Organosulfur Compound -	:	:	:	:	:
:	: Ethofumesate	(mg/L):	<0.025	: <0.025	: 09/16/94:	10/14/94
: EO-99	: Organonitrogen Compounds -	:	:	:	:	:
:	: Triadimefon	(mg/L):	<0.001	: <0.001	: 09/16/94:	10/07/94
:	: Siduron	(mg/L):	<0.3	: <0.3	: 09/19/94:	09/19/94

Comments: Samples were prepared and analyzed utilizing in-house and/or modified EPA procedures. Please refer to the enclosed letter dated 8/11/94.
: NA - Not analyzed; procedure unavailable for this analyte.

Laboratory Contact For Above Report

Name : Jeff Whaley, B.S.
Title: Section Head, Organics/GCMS

Reviewed and Approved

: James B. Cox, III
: Manager, Environmental Dept.

-----SUBMISSION INFO-----
Analyst(s): No. Containers: Sample Submission: C-O-C:
Samp Admin: Pickup: Time: Miles: RUSH :



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3809 Airport Drive

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Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO.(s) : 1194D1-2 of: 3 Date Received: 09/07/94

Sample(s) of : SPRING WATER/SURFACE WATER Date Reported: 01/17/95

NAM : MILES SMART
ORG : TURF SCIENCE GROUP, INC.
ADD : 106 BRUCE DRIVE
CSZ : CARY, NC 27511

Telephone : 919-380-8565

PO/Job No. :

Marked A: SPRING 09/06/94

B: SW-2 09/06/94

C: Preparation Date (Prep.)

D: Analysis Date (Analysis)

Lab Sample No.=> A: 1194D1 B: 1194D2 C: Prep. D: Analysis

CAT. NO.	ANALYSES	UNITS				
EO-99	Acid Herbicides -					
	2,4 D	(mg/L)	<0.010	<0.010	09/16/94	10/14/94
	Dicamba	(mg/L)	<0.010	<0.010	09/16/94	10/14/94
	Mecoprop	(mg/L)	<0.050	<0.050	09/16/94	10/14/94
EO-99	Organophos Compounds -					
	Fenamiphos	(mg/L)	<0.005	<0.005	09/16/94	10/13/94
	Ethoprop	(mg/L)	<0.005	<0.005	09/16/94	10/13/94
	Trichlorfon		NA	NA	09/16/94	10/07/94
EO-99	Organosulfur Compound -					
	Ethofumesate	(mg/L)	<0.025	<0.025	09/16/94	10/14/94
EO-99	Organonitrogen Compounds -					
	Triadimefon	(mg/L)	<0.001	<0.001	09/16/94	10/07/94
	Siduron	(mg/L)	<0.3	<0.3	09/19/94	09/19/94

Comments: Samples were prepared and analyzed utilizing in-house and/or modified EPA procedures. Please refer to the enclosed letter dated 8/11/94.
NA - Not analyzed; procedure unavailable for this analyte.

Laboratory Contact For Above Report

Name : Jeff Whaley, B.S.
Title: Section Head, Organics/GCMS

Reviewed and Approved

James B. Cox, III
Manager, Environmental Dept.

SUBMISSION INFO

Analyst(s) : No. Containers: Sample Submission: C-O-C:
Samp Admin: Pickup: Time: Miles: RUSH :



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Wilson, NC 27896

REPORT OF ANALYSIS

LAB SAMPLE NO.(s): 1194D3

of: 3

Date Received: 09/07/94

Sample(s) of : SURFACE WATER

Date Reported: 01/17/95

NAM : MILES SMART

ORG : TURF SCIENCE GROUP, INC.

ADD : 106 BRUCE DRIVE

CSZ : CARY, NC 27511

Telephone : 919-380-8565

PO/Job No. :

Marked A: SW1 09/06/94

B:

C: Preparation Date (Prep.)

D: Analysis Date (Analysis)

Lab Sample No.=> A: 1194D3 B:

C: Prep. D: Analysis

CAT. NO.	ANALYSES	UNITS				
: EO-99	: Acid Herbicides -					
:	: 2,4 D	(mg/L)	: <0.010	:	: 09/16/94:	10/14/94
:	: Dicamba	(mg/L)	: <0.010	:	: 09/16/94:	10/14/94
:	: Mecoprop	(mg/L)	: <0.050	:	: 09/16/94:	10/14/94
: EO-99	: Organophos Compounds -					
:	: Fenamiphos	(mg/L)	: <0.005	:	: 09/16/94:	10/13/94
:	: Ethoprop	(mg/L)	: <0.005	:	: 09/16/94:	10/13/94
:	: Trichlorfon		: NA	:	: 09/16/94:	10/07/94
: EO-99	: Organosulfur Compound -					
:	: Ethofumesate	(mg/L)	: <0.025	:	: 09/16/94:	10/14/94
: EO-99	: Organonitrogen Compounds -					
:	: Triadimefon	(mg/L)	: <0.001	:	: 09/16/94:	10/07/94
:	: Siduron	(mg/L)	: <0.3	:	: 09/19/94:	09/19/94

Comments: Samples were prepared and analyzed utilizing in-house and/or modified EPA procedures. Please refer to the enclosed letter dated 8/11/94.
: NA - Not analyzed; procedure unavailable for this analyte.

Laboratory Contact For Above Report

Name : Jeff Whaley, B.S.

Title: Section Head, Organics/GCMS

Reviewed and Approved

: James B. Cox, III

: Manager, Environmental Dept.

SUBMISSION INFO

Analyst(s):

No. Containers:

Sample Submission:

C-O-C:

Samp Admin:

Pickup:

Time:

Miles:

RUSH :



CHAIN OF CUSTODY & ANALYSIS REQUEST

PAGE _____ of _____

1 ORIGINAL REPORT TO (Company and Individual) TURF SCIENCE GROUP (Address) 106 BRUCE DR, CARY NC 27511				2 CONTACT PERSON (Report) MILES SMITH				LAB USE LOGGED IN BY (INITIAL) ME SAMPLE # 773301-45			
3 ADDITIONAL ADDRESS (Invoice or Report)				3 PHONE # (Report)				DATE 6/19/94			
4 REQUESTED TURNAROUND TIME: ☐ Normal (2 weeks) ☐ Rush (1 week)* ☐ Emergency Rush (ASAP)*				7 PROJECT NAME HUDSON NATIONAL				TIME 10:00			
5 PROJECT # / PO #				6 QUOTE #				ACCOUNT #			
8 CONTACT PERSON/PHONE # (Add'n)				9 ANALYSES REQUESTED (Please Use Catalog #'s)				TRANSPORT Fed Ex			
10 Sample Container Info				11				12			
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SOUTHERN TESTING & RESEARCH LABORATORIES, INC.

3809 Airport Drive • Wilson, NC 27896
919-237-4175 • Fax: 919-237-9341

CHAIN OF CUSTODY & ANALYSIS REQUEST

PAGE _____ of _____

1 ORIGINAL REPORT TO (Company and Individual) TURF SCIENCE GROUP (Address) 106 Bruce Dr, Cary NC 27511				2 CONTACT PERSON (Report) MILES SMART 3 PHONE # (Report) 919-380-8565 FAX #				LAB USE LOGGED IN BY (INITIAL) ME DATE 6-1-94 REC'D ON ICE? ☒ YES ☐ NO Temp. <u>COOL</u> SAMPLING CHARGES Time Mileage Other TRANSPORT FedEx				4 ADDITIONAL ADDRESS (Invoice or Report)				5 CONTACT PERSON/PHONE # (Add'n)											
6 Requested Turnaround Time: ☐ Normal (2 weeks) ☐ Rush (1 week)* ☐ Emergency Rush (ASAP)*				7 PROJECT NAME HUDSON NATIONAL 8 PROJECT # / PO # 11 9 QUOTE # 11				Sample Container Info Container Type Size (Vol./Wt.) # of Containers Preservation				Analyses Requested (Please Use Catalog #'s)															
10 Start 11 End Comp Grab Sample Type Description												14															
Item # Date Time Date Time 12 13 14 Sample Marks												15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000															
20 TRANSFER # 1 2 3				21 RELINQUISHED BY SERGIO SMIRNOV				22 DATE / TIME 5/31 10A				23 RECEIVED BY Margo Engel				24 DATE / TIME 6-1-94 10:00				25 SAMPLER SIGNATURE: 				26 COMMENTS: ANALYSES AS PER TURF SCIENCE INSTR 7020			



CHAIN OF CUSTODY & ANALYSIS REQUEST

PAGE _____ of _____

1 ORIGINAL REPORT TO: (Company and Individual) TURF SCIENCE GROUP (Address) 106 BRUCE DR, CARY NC 27511				2 CONTACT PERSON (Report) Miles SMART				LOGGED IN BY (INITIAL) ME				SAMPLE # 787801											
3 PHONE # (Report) 919 380-8565				5 CONTACT PERSON/PHONE # (Add'n)				DATE 6-7-94				TIME											
4 ADDITIONAL ADDRESS (Invoice or Report)				6 CONTACT PERSON/PHONE # (Add'n)				REC'D ON ICE? YES NO Temp				ACCOUNT #											
7 PROJECT NAME				8 PROJECT # / PO #				9 QUOTE #				SAMPLING CHARGES Time Mileage Other				TRANSPORT UPS							
10 Requested Turnaround Time: ☐ Normal (2 weeks) ☐ Rush (1 week)* ☐ Emergency Rush (ASAP)*				11 Sample Type				12 Description				13 Sample Container Info				14 Analyses Requested (Please Use Catalog #'s)							
15 Item #				16 Date Time				17 Date Time				18 Comp				19 Grab				20 Sample Marks			
21 SS				22 6-5 3 PM				23				24				25				26			
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CHAIN OF CUSTODY & ANALYSIS REQUEST

PAGE _____ of _____

1 ORIGINAL REPORT TO (Company and Individual) USE Service Group (Address)				2 CONTACT PERSON (Report) Miles Smith				LAB USE LOGGED IN BY (INITIAL) me				SAMPLE # 917001-3			
3 ADDITIONAL ADDRESS (Invoice or Report)				3 PHONE # (Report) 919 381 8565 FAX #				DATE 7-29-94 TIME 11:00 AM				ACCOUNT #			
4 REQUESTED TURNAROUND TIME: ☐ Normal (2 weeks) ☐ Rush (1 week)* ☐ Emergency Rush (ASAP)*				5 PROJECT NAME				6 PROJECT # / PO #				7 QUOTE #			
8 CONTACT PERSON/PHONE # (Add'n)				9 ANALYSES REQUESTED (Please Use Catalog #'s) SEE TOP SHEET FOR GROUP				10 SAMPLING CHARGES Time Mileage Other				11 TRANSPORT Fed X			
12 Sample Container Info				13				14				15			
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CHAIN OF CUSTODY & ANALYSIS REQUEST

PAGE _____ of _____

(1) ORIGINAL REPORT TO: (Company and Individual) <i>TRF SERVICE GROUP</i> (Address) <i>100 BORNE DR CARY NC 27511</i>				(2) CONTACT PERSON (Report) <i>MILES SMART</i>				LAB USE			
(4) ADDITIONAL ADDRESS (Invoice or Report)				(3) PHONE # (Report) <i>919 380-8565</i> FAX #				LOGGED IN BY (INITIAL) <i>JB</i>			
(5) Requested Turnaround Time: ☐ Normal (2 weeks) ☐ Rush (1 week)* ☐ Emergency Rush (ASAP)*				(7) PROJECT NAME				SAMPLE # <i>917101-4</i>			
(6) PROJECT # / PO #				(8) QUOTE #				DATE <i>7/29/94</i>			
(9) CONTACT PERSON/PHONE # (Add'n)				(10) ANALYSES REQUESTED (Please Use Catalog #'s) <i>SEE TRF SERVICE GROUP</i>				TIME			
(11) PROJECT # / PO #				(12) QUOTE #				REC'D ON ICE? <i>ICE PACK</i> ☐ YES ☐ NO Temp <i>Cool</i>			
(13) CONTAINER TYPE				(14) SIZE (Vol/Lit)				SAMPLING CHARGES Time Mileage Other			
(15) # of Containers				(16) PRESERVATION				TRANSPORT <i>FDX</i>			
(17) ANALYSES REQUESTED (Please Use Catalog #'s)				(18) ANALYSES REQUESTED (Please Use Catalog #'s)				(19) ANALYSES REQUESTED (Please Use Catalog #'s)			
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TRANSFER #		(20) RELINQUISHED BY		DATE / TIME		(21) RECEIVED BY		DATE / TIME		(22) SAMPLER SIGNATURE:	
1		<i>SRGIO SMITH</i>		<i>7/28/94</i>		<i>Mary Eng</i>		<i>7/29/94 1:00</i>		<i>[Signature]</i>	
2										(23) COMMENTS:	
3											



CHAIN OF CUSTODY & ANALYSIS REQUEST

PAGE _____ of _____

1 ORIGINAL REPORT TO (Company and Individual) TERRA Services Group (Address) 100 Bruce Dr, Cary NC 27511				2 CONTACT PERSON (Report) Allies Smart				LOGGED IN BY (INITIAL) ZB				SAMPLE # 11-14 DI-3											
3 PHONE # (Report) 919 360-8565				5 CONTACT PERSON/PHONE # (Add'n)				DATE 9/7/91				TIME 11:00											
4 ADDITIONAL ADDRESS (Invoice or Report)				6 PROJECT NAME Pecan 13-12				REC'D ON ICE? ☒ YES ☐ NO Temp (C) 100				ACCOUNT #											
7 PROJECT # / PO #				8 QUOTE #				SAMPLING CHARGES Time Mileage Other				TRANSPORT LIPS											
9 Requested Turnaround Time: ☐ Normal (2 weeks) ☐ Rush (1 week)* ☐ Emergency Rush (ASAP)*				10 Sample Container Info				Analyses Requested (Please Use Catalog #'s)															
11 Start 12 End Comp Grab Sample Type Description				13 Container Type 14 Size (Vol./Wt.) 15 # of Containers 16 Preservation 17				18															
19 Item # 20 Date Time 21 Date Time 22 23 Sample Marks				24 LP 25 LP 26 L 27 L 28 4 29 11/50				20															
TRIN6 9-6-91 9 AM 10 A				(1)				PA LA P L				Sic Allies Smart											
SW-2 10 A 11 A				(2)				" " " "				" " "											
SW-1 11 A 12 A				(3)				" " " "				" " "											
SW-2 12 A 1 P				WATER - GROUND				" " " "				" " "											
TRANSFER # 20 RELINQUISHED BY				DATE / TIME 21 RECEIVED BY				DATE / TIME				22 SAMPLER SIGNATURE											
1 SERGIO SMITH 16110				9-6-91/4PM Kwia Baka				9-7-91 11:00				23 COMMENTS:											
2																							
3																							

APPENDIX D

SECOND TIER ANALYTES

Original Tier II analytes:

Ethofumesate

Ethoprop

Fenamiphos

Fosetyl-Aluminum

Siduron

Triadimefon

Trichlorfon

Revised Tier II analytes

Ground Water	Surface Water	Pond Sediments
Ethylene thiourea (ETU)	Chlorothalonil	Chlorpyrifos
Chlorothalonil	Thiram	Trifluralin
Thiram	DDVP	Trichlorfon
DDVP (metabolite of Trichlorfon)	Chlorpyrifos	
Trichlorfon	Bensulide	
	Trichlorfon	

Appendix VIII

Phase II Data



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

REPORT of ANALYSIS

SAMPLE No.: D5803-001

Miles Smart
Turf Science Group, Inc.
106 Bruce Dr.
Cary

NC 27511

Phone: (919) 380-8565 X
Fax: () -

P. O.:

Client Sample ID: HUDSON GOLF
Marks: Spring

Collected: 01/30/95 09:30
Received: 01/31/95 10:00

Matrix: SPRING WATER
Classification: ENV

CAT No.	ANALYSES	MDL	RESULT	UNITS
EW-10	Chloride	0.25	8.08	mg/L
EW-30.4	Nitrogen: Nitrate (as N)	1.0	4.03	mg/L
W-38.2	Phosphorus: Total (as P)	0.25	0.523	mg/L
N-40	Solids: Total Dissolved	1.00	92	mg/L
EW-50	Turbidity	1	23	NTU

COMMENTS:

Laboratory Contact(s):

Reviewed and Approved by:

James B. Cox, III
James B. Cox, III, B.S.
Manager, Environmental Dept.



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

R E P O R T o f A N A L Y S I S

SAMPLE No.: D5803-002

Miles Smart
Turf Science Group, Inc.
106 Bruce Dr.
Cary

NC 27511

Phone: (919) 380-8565 X

Fax: () -

P. O.:

Client Sample ID: HUDSON GOLF
Marks: SW- 2

Collected: 01/30/95 15:30

Received: 01/31/95 10:00

Matrix: SPRING WATER

Classification: ENV

IAT No. ANALYSES		MDL	RESULT	UNITS
EW-10	Chloride	0.25	15.5	mg/L
EW-30.4	Nitrogen: Nitrate (as N)	0.1	0.151	mg/L
EW-38.2	Phosphorus: Total (as P)	0.050	0.462	mg/L
EW-40	Solids: Total Dissolved	1.00	231	mg/L
EW-50	Turbidity	1	5.1	NTU

COMMENTS:

Laboratory Contact (s):

Reviewed and Approved by:

James B. Cox, III
James B. Cox, III, B.S.
Manager, Environmental Dept.



**SOUTHERN TESTING
& RESEARCH LABORATORIES, INC.**
3809 Airport Drive • Wilson, NC 27896
919-237-4175 • Fax: 919-237-9341

CHAIN OF CUSTODY & ANALYSIS REQUEST

PAGE _____ of _____

① ORIGINAL REPORT TO: (Company and Individual)

TURF SCIENCE GROUP (SMART ASSOC)
(Address)
106 BRUCE DR CARY NC 27511

② CONTACT PERSON (Report)

MIKE SMART

③ PHONE # (Report) 919 380-8565

FAX #

④ CONTACT PERSON/PHONE # (Add'n)

⑤ ADDITIONAL ADDRESS (Invoice or Report)

⑥ Requested Turnaround Time:

- ☐ Normal (2 weeks)
☐ Rush (1 week)*
☐ Emergency Rush (ASAP)*

⑦ PROJECT NAME

HUDSON GOLF

⑧ PROJECT # / PO #

⑨ QUOTE #

LAB USE

LOGGED IN BY (INITIAL)

SAMPLE #

DATE

TIME

REC'D ON ICE?

☐ YES ☐ NO Temp

ACCOUNT #

SAMPLING CHARGES

Time

Mileage

Other

TRANSPORT

Analyses Requested (Please Use Catalog #'s)

Sample Container Info

Container Type
Size (Vol./Wt.)
of Containers
Preservation

⑩ Start ⑪ End Comp Grab Sample Type Description

Item #	Date Time	Date Time	⑫	⑬	⑭ Sample Marks	⑮	⑯	⑰	⑱	⑲A	Comments
1	1/30/95	9:30 AM	✓		SPRING	G	L	2	N		
2	1/30/95	"	✓		SPRING	P	L	1	H ₂ SO ₄		
3	1/30/95	"	✓		SPRING	P	L	1	N		
4	1/30/95	"	✓		GW-2	G	L	1	N		
5	1/30/95	"	✓		GW-2	P	L	1	H ₂ SO ₄		
6	1/30/95	"	✓		GW-2	P	L	1	N		
7	1/30/95	3:30 P	✓		SW-2	G	L	1	N		
8	1/30/95	"	✓		SW-2	P	L	1	H ₂ SO ₄		
9	1/30/95	"	✓		SW-2	P	L	1	N		
10	1/30/95	"				G	L	1			

TRANSFER #

⑳

RELINQUISHED BY

DATE / TIME

㉑

RECEIVED BY

DATE / TIME

㉒ SAMPLER SIGNATURE:

㉓ COMMENTS:



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

R E P O R T o f A N A L Y S I S

SAMPLE No.: D5802-003

Miles Smart
Turf Science Group, Inc.
106 Bruce Dr.
Cary

NC 27511

Phone: (919) 380-8565 X

Fax: () -

P. O.:

Client Sample ID: HUDSON GOLF
Marks: SW-1

Collected: 01/30/95 10:30
Received: 01/31/95 10:00

Matrix: SURFACE WATER
Classification: ENV

CAT No.	ANALYSES	MDL	RESULT	UNITS
EW-10	Chloride	0.25	8.08	mg/L
EW-30.4	Nitrogen: Nitrate (as N)	0.1	3.02	mg/L
EW-38.2	Phosphorus: Total (as P)	0.25	0.407	mg/L
EW-40	Solids: Total Dissolved	1.00	93	mg/L
EW-50	Turbidity	1	25	NTU

COMMENTS:

Laboratory Contact(s):

Jeff Whaley, B.S.
Section Head, Organics/GCMS

Reviewed and Approved by:

James B. Cox, III, B.S.
Manager, Environmental Dept.

page 3 of 3

D5802.897

(DC1:RE001.0) 02/17/95 17:14



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3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

REPORT of ANALYSIS

SAMPLE No.: D5802-001

Miles Smart
Turf Science Group, Inc.
106 Bruce Dr.
Cary

NC 27511

Phone: (919) 380-8565 X
Fax: () -

P. O.:

Client Sample ID: HUDSON GOLF
Marks: GW-1

Collected: 01/30/95 11:30
Received: 01/31/95 10:00

Matrix: GROUNDWATER
Classification: ENV

CAT No.	ANALYSES	MDL	RESULT	UNITS
7-10	Chloride	0.5	11.9	mg/L
EW-30.4	Nitrogen: Nitrate (as N)	0.1	0.180	mg/L
EW-38.2	Phosphorus: Total (as P)	0.25	0.859	mg/L
7-40	Solids: Total Dissolved	1.00	101	mg/L

COMMENTS:

Laboratory Contact(s):

Reviewed and Approved by:

Jeff Whaley, B.S.
Section Head, Organics/GCMS

James B. Cox, III, B.S.
Manager, Environmental Dept.

page 1 of 3

D5802.897

(DC1:RE001.0) 02/17/95 17:14



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Wilson, NC 27896

R E P O R T o f A N A L Y S I S

SAMPLE No.: D5802-002

Miles Smart
Turf Science Group, Inc.
106 Bruce Dr.
Cary

NC 27511

Phone: (919) 380-8565 X
Fax: () -

P. O.:

Client Sample ID: HUDSON GOLF
Marks: GW-2

Collected: 01/30/95 13:30
Received: 01/31/95 10:00

Matrix: GROUNDWATER
Classification: ENV

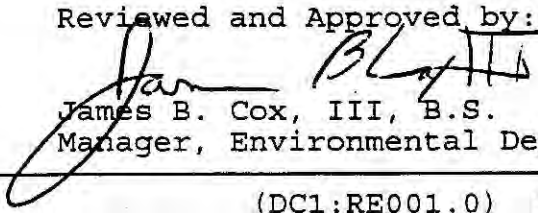
CAT No.	ANALYSES	MDL	RESULT	UNITS
EW-10	Chloride	0.25	9.68	mg/L
EW-30.4	Nitrogen: Nitrate (as N)	0.1	0.344	mg/L
EW-38.2	Phosphorus: Total (as P)	0.25	1.11	mg/L
EW-40	Solids: Total Dissolved	1.00	177	mg/L

COMMENTS:

Laboratory Contact(s):

Jeff Whaley, B.S.
Section Head, Organics/GCMS

Reviewed and Approved by:


James B. Cox, III, B.S.
Manager, Environmental Dept.

page 2 of 3

D5802.897

(DC1:RE001.0) 02/17/95 17:14



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& RESEARCH LABORATORIES, INC.**
3809 Airport Drive • Wilson, NC 27896
919-237-4175 • Fax: 919-237-9341

CHAIN OF CUSTODY & ANALYSIS REQUEST

PAGE _____ of _____

① ORIGINAL REPORT TO: (Company and Individual)

TURN SCIENCE GROUP (SMART + ASSOC)

(Address)

106 BRUCE DR CARY NC 27511

④ ADDITIONAL ADDRESS (Invoice or Report)

⑥ Requested Turnaround Time:

- ☐ Normal (2 weeks)
☐ Rush (1 week)*
☐ Emergency Rush (ASAP)*

⑦ PROJECT NAME

HUDSON GOLF

⑧ PROJECT # / PO #

⑨ QUOTE #

② CONTACT PERSON (Report)

MILES SMART

③ PHONE # (Report) 919 380-8565

FAX #

⑥ CONTACT PERSON/PHONE # (Add'n)

LAB USE

LOGGED IN BY (INITIAL)

SAMPLE #

5-8024

DATE

TIME

1-31-95 10:00

REC'D ON ICE?

☐ YES ☒ NO Temp

ACCOUNT #

SAMPLING CHARGES

Time

Mileage

Other

TRANSPORT

FedEx

Sample Container Info

Container Type

Size (Vol/Wt.)

of Containers

Preservation

Analyses Requested (Please Use Catalog #'s)

⑩ Start ⑪ End Comp Grab Sample Description

Item #	Date Time	Date Time	⑫	⑬	⑭ Sample Marks	⑮	⑯	⑰	⑱	⑲	⑳	㉑	㉒	㉓	㉔	㉕	㉖	㉗	㉘	㉙	㉚	㉛	㉜	㉝	㉞	㉟	Comments
	1-30	11:30 A		✓	GW-1 ①	B	L	2	N																		
	"	"		✓	GW-1 ①	P	L	1	H ₂ SO ₄																		
	"	"		✓	GW-1 ①	P	L	1	N																		
	1 PM	1:30 P		✓	GW-2 ②	G	L	2	N																		
	"	"		✓	GW-2 ②	P	L	1	H ₂ SO ₄																		
	"	"		✓	GW-2 ②	P	L	1	N																		
	10 A	10:30 A		✓	SW-1 ③	G	L	2	N																		
	"	"		✓	SW-1 ③	P	L	1	H ₂ SO ₄																		
	"	"		✓	SW-1 ③	P	L	1	N																		

TRANSFER #

⑳

RELINQUISHED BY

DATE / TIME

㉑

RECEIVED BY

DATE / TIME

㉒ SAMPLER SIGNATURE:

㉓ COMMENTS:

Hudson National Golf Course Monitoring Field Sheets

Tim Miller Associates, Inc.

Date 7-30-95

Weather 6692 350

CALIFORNIA @ 8:30 AM

PH 9710

[illegible]



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

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Wilson, NC 27896

REPORT of ANALYSIS

SAMPLE No.: E1434-001

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Dr.
Cary

NC 27511

Phone: (919) 380-8565 X
Fax: (919) 380-7415

P. O.:

Client Sample ID: Sergio
Marks: GW-2

Collected: 07/31/95 11:00
Received: 08/01/95 10:00

Matrix: GROUNDWATER
Classification: ENV

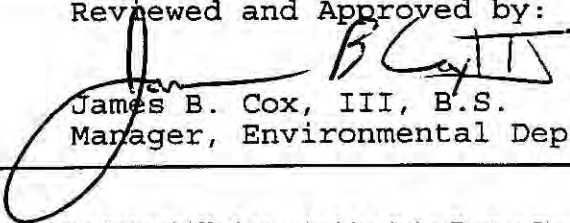
AT No.	ANALYSES	MDL	RESULT	UNITS
EW-10	Chloride	1.25	35.7	mg/L
W-30.4	Nitrogen: Nitrate (as N)	0.100	1.23	mg/L
W-38.2	Phosphorus: Total (as P)	0.500	9.33	mg/L
EW-40	Solids: Total Dissolved	1	230	mg/L
EP-6	TDPHos Filtration		Yes	
W-99	Phosphorus: Total Dissolved	0.050	0.139	mg/L
EO-99	Chlorothalonil		FORM A	
EO-99	Herbicides		FORM B	
O-99	DDVP		FORM C	
O-99	Thiram		FORM D	

COMMENTS:

Laboratory Contact(s):

Jeff Whaley, B.S.
Section Head, Organics/GCMS

Reviewed and Approved by:


James B. Cox, III, B.S.
Manager, Environmental Department



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

Form A Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1434E1

Date Received: 08/01/95

Project Name: Sergio

Date Reported: 10/27/95

Results specific to: 1434E1

Client marks: GW-2

Date Sampled: 07/31/95

Matrix: Groundwater

Date Prepared: 08/03/95

Date Analyzed: 08/11/95

Parameter/Sample I.D.

Results
(ug/L)

Comments

Chlorothalonil /

1434E1

-

Failed injection.

1434E1 Duplicate

< 0.5

Quality Control

Chlorothalonil /

MB080395

< 0.5

Method Blank

MBS080395, 10 ug/L Spike

10.8

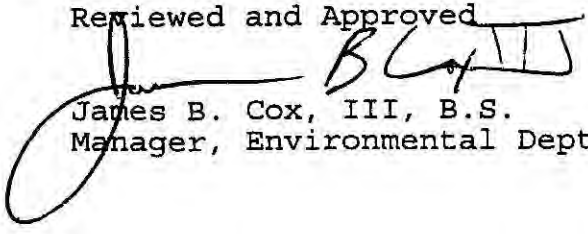
Method Blank Spike
108% Recovery

Method: Microextraction, GC/ECD, Southern Testing.

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\el434e

Reviewed and Approved


James B. Cox, III, B.S.
Manager, Environmental Dept.



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

Form B Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1434E1

Date Received: 08/01/95

Project Name: Sergio

Date Reported: 10/27/95

Results specific to: 1434E1

Client marks: GW-2

Date Sampled: 07/31/95

Matrix: Groundwater

Date Prepared: 08/03/95

Date Analyzed: 08/09/95

<u>Parameter/Sample I.D.</u>	<u>Results</u> <u>(ug/L)</u>	<u>Comments</u>
2,4 D /		
1434E1	< 10.0	
1434E1 Duplicate	< 10.0	
Dicamba /		
1434E1	< 10.0	
1434E1 Duplicate	< 10.0	
MCPP /		
1434E1	<100.0	
1434E1 Duplicate	<100.0	
<u>Quality Control</u>		
2,4 D /		
MB072695	< 10.0	Method Blank
MBS072695, 50.0 ug/L Spike	38.8	Method Blank Spike 78% Recovery
Dicamba /		
MB072695	< 10.0	Method Blank
MBS072695, 50.0 ug/L Spike	41.7	Method Blank Spike 83% Recovery
MCPP /		
MB072695	< 10.0	Method Blank
MBS072695, 500 ug/L Spike	373	Method Blank Spike 75% Recovery

Method: Microextraction, GC/MS, Southern Testing.

Laboratory Contact

Reviewed and Approved

Jeff Whaley, B.S.
Section Head, Organics/GCMS
P:\jwhaley\budsmart\el1434m

James B. Cox, III, B.S.
Manager, Environmental Dept.



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

Form C Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1434E1

Date Received: 08/01/95

Date Reported: 10/27/95

Project Name: Sergio

Results specific to: 1434E1

Client marks: GW-2

Date Sampled: 07/31/95

Matrix: Groundwater

Date Prepared: 09/12/95

Date Analyzed: 09/13/95

<u>Parameter/Sample I.D.</u>	<u>Results</u> <u>(ug/L)</u>	<u>Comments</u>
DDVP /		
1434E1	< 1.0	
<u>Quality Control</u>		
DDVP /		
MB091295	< 1.0	Method Blank
MBS091295, 25 ug/L Spike	19.9	Method Blank Spike 80% Recovery

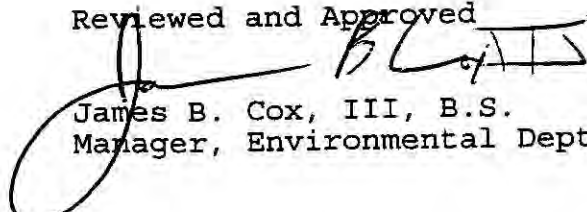
Method: Microextraction, GC/FPD (Phosphorus mode), Southern Testing.

Comment: In method development trials it was discovered that trichlorfon degraded appreciably to DDVP during chromatography. The rate of degradation was determined to be random therefore, samples were analyzed for DDVP only, not for both trichlorfon and DDVP as requested.

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\01434c

Reviewed and Approved


James B. Cox, III, B.S.
Manager, Environmental Dept.



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

Form D Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1434E1

Date Received: 08/01/95

Project Name: Sergio

Date Reported: 10/27/95

Results specific to: 1434E1

Client marks: GW-2

Date Sampled: 07/31/95

Matrix: Groundwater

Date Prepared: 09/21/95

Date Analyzed: 09/27/95

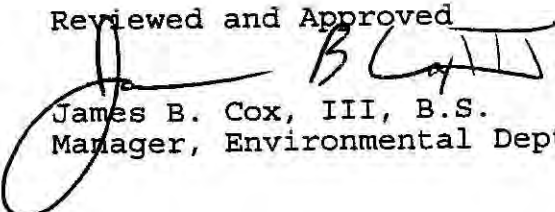
<u>Parameter/Sample I.D.</u>	<u>Results</u> <u>(ug/L)</u>	<u>Comments</u>
Thiram /		
1434E1	< 25.0	
<u>Quality Control</u>		
Thiram /		
MB092195	< 25.0	Method Blank
MBS092195, 500 ug/L Spike	452	Method Blank Spike 90% Recovery

Method: Modified EPA 630.1, GC/FPD(Sulfur mode).

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\el434a

Reviewed and Approved


James B. Cox, III, B.S.
Manager, Environmental Dept.



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

R E P O R T o f A N A L Y S I S

SAMPLE No.: E1434-002

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Dr.
Cary

NC 27511

Phone: (919) 380-8565 X
Fax: (919) 380-7415

P. O.:

Client Sample ID: Sergio
Marks: PS1

Collected: 07/31/95 13:30
Received: 08/01/95 10:00

Matrix: SEDIMENT
Classification: ENV

CAT No.	ANALYSES	MDL	RESULT	UNITS
EW-99	Particle Size			*
EO-99	Chlorothalonil		FORM A	
EO-99	Chloropyrifos		FORM B	
EO-99	PCNB		FORM C	
EO-99	Trifluralin		FORM D	

COMMENTS: * Analysis performed by Microbac Laboratories, Inc.
of Fayetteville, N.C. See Microbac report for results.

Laboratory Contact(s):

Reviewed and Approved by:

Jeff Whaley, B.S.
Section Head, Organics/GCMS

James B. Cox, III, B.S.
Manager, Environmental Department

Microbac

Microbac Laboratories, Inc.

MICROBAC ENVIRONMENTAL LABORATORY
817 CASTLE HAYNE STREET
FAYETTEVILLE, NC 28303
(910) 864-1920 / (910) 864-8774 (FAX)

NC #11
NC #37714
USDA #3787

AIR • FUEL • WATER • FOOD • WASTES

CERTIFICATE OF ANALYSIS

CERT #14792

CLIENT: Southern Testing & Research Lab

DATE REC'D: 08/02/95 SAMPLED: 07/31/95

ADDRESS: 3809 Airport Drive

SAMPLED BY: Client

Wilson, NC 27896

DELIVERED BY: UPS

CONTACT PERSON: Mr. Joe Raythers

SAMPLE CODE: Pond Sediment, Grab

ACCOUNT NUMBER: #KS005

REFERENCE:

SAMPLE ID: 1. Pond Sediment - ID #95MX84498

2

DATA REVIEWED BY: _____

3.

DATE REPORTED: 08/21/95

4.

ANALYSIS

UNIT

1

2

3

4

PARTICLE SIZE (um)

METHOD: ASTM D410/D13

4000 < x

3000 < x < 4000

2000 < x < 3000

1600 < x < 2000

420 < x < 1600

300 x < 420

%

43.9*

150 < x < 300

%

16.2*

75 < x < 100

%

39.4*

x < 75

%

0.5*

COMMENTS: < = Less than

> = Greater Than

* = THIS SAMPLE WAS DRIED @ 70°C PRIOR TO SIZING. THE SAMPLE HARDENED AND REQUIRED SOME MANUAL BREAK-UP BEFORE SIEVING. THIS COULD INTRODUCE SIGNIFICANT ERROR INTO THE ANALYSIS.





Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

Form A Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1434E2

Date Received: 08/01/95

Project Name: Sergio

Date Reported: 10/27/95

Results specific to: 1434E2

Client marks: PS-1

Date Sampled: 07/31/95

Matrix: Sediment

Date Prepared: 10/19/95

Date Analyzed: 10/20/95

Parameter/Sample I.D.

Results
(ug/kg)

Comments

Chlorothalonil /

1434E2

< 48.4

1434E2 Duplicate

< 48.9

Quality Control

Chlorothalonil /

MB101895

< 50.1

Method Blank

MBS101895, 49.6 ug/kg Spike

47.7

Method Blank Spike

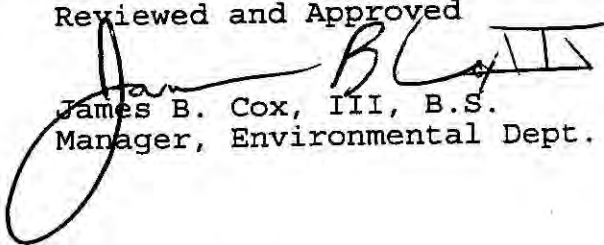
96% Recovery

Method: Sonication extraction, GC/ECD, Southern Testing.

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
P:\jwhaley\budsmart\el434g

Reviewed and Approved


James B. Cox, III, B.S.
Manager, Environmental Dept.



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Wilson, NC 27896

Form B Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1434E2

Date Received: 08/01/95

Project Name: Sergio

Date Reported: 10/27/95

Results specific to: 1434E2

Client marks: PS-1

Date Sampled: 07/31/95

Matrix: Sediment

Date Prepared: 10/19/95

Date Analyzed: 10/20/95

Parameter/Sample I.D.
Chlorpyrifos /

Results
(ug/kg)

Comments

1434E2

< 48.4

1434E2 Duplicate

< 48.9

Quality Control
Chlorpyrifos /

MB101895

< 50.1

Method Blank

MBS101895, 49.6 ug/kg Spike

49.7

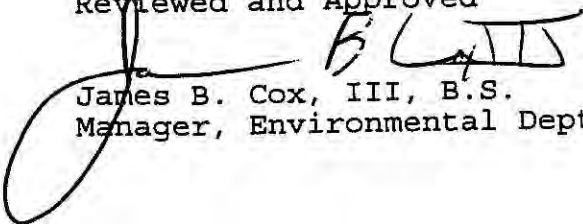
Method Blank Spike
100% Recovery

Method: Sonication extraction, GC/ECD, Southern Testing.

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
P:\jwhaley\budsmart\el14341

Reviewed and Approved


James B. Cox, III, B.S.
Manager, Environmental Dept.



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

Form C Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1434E2

Date Received: 08/01/95

Project Name: Sergio

Date Reported: 10/27/95

Results specific to: 1434E2

Client marks: PS-1

Date Sampled: 07/31/95

Matrix: Sediment

Date Prepared: 10/12/95

Date Analyzed: 10/13/95

<u>Parameter/Sample I.D.</u>	<u>Results</u> <u>(ug/kg)</u>	<u>Comments</u>
PCNB /		

1434E2	< 49.7	
--------	--------	--

1434E2 Duplicate	< 49.5	
------------------	--------	--

Quality Control

PCNB /

1434E2, 52.6 ug/kg Spike	76.9	146% Recovery*
MB080895	< 50.1	Method Blank
MBS080895, 52.3 ug/kg Spike	43.4	Method Blank Spike
		83% Recovery

Method: Sonication extraction, GC/ECD, Southern Testing.

Comment: Re-extraction of spike for study not possible. Last of sample used for simultaneous reanalysis of Trifluralin, Chlorothalonil, and Chlorpyrifos.

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\el434j

Reviewed and Approved

James B. Cox, III, B.S.
Manager, Environmental Dept.



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

Form D Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1434E2

Date Received: 08/01/95

Project Name: Sergio

Date Reported: 10/27/95

Results specific to: 1434E2

Client marks: PS-1

Date Sampled: 07/31/95

Matrix: Sediment

Date Prepared: 10/19/95

Date Analyzed: 10/20/95

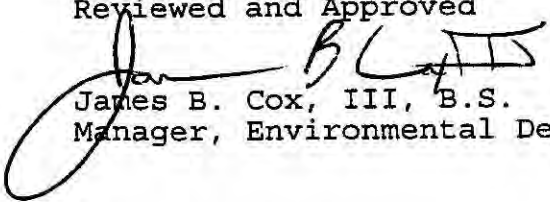
<u>Parameter/Sample I.D.</u>	<u>Results</u> <u>(ug/kg)</u>	<u>Comments</u>
Trifluralin /		
1434E2	< 48.4	
1434E2 Duplicate	< 48.9	
 <u>Quality Control</u>		
Trifluralin /		
MB101895	< 50.1	Method Blank
MBS101895, 49.6 ug/kg Spike	43.9	Method Blank Spike 89% Recovery

Method: Sonication extraction, GC/ECD, Southern Testing.

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\el1434h

Reviewed and Approved


James B. Cox, III, B.S.
Manager, Environmental Dept.



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

REPORT of ANALYSIS

SAMPLE No.: E1434-003

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Dr.
Cary

NC 27511

Phone: (919) 380-8565 X
Fax: (919) 380-7415

P. O.:

Client Sample ID: Sergio
Marks: SW-1

Collected: 07/31/95 14:20
Received: 08/01/95 10:00

Matrix: SURFACE WATER
Classification: ENV

CAT No.	ANALYSES	MDL	RESULT	UNITS
EW-10	Chloride	0.25	5.61	mg/L
EW-30.4	Nitrogen: Nitrate (as N)	0.100	0.338	mg/L
EW-38.2	Phosphorus: Total (as P)	0.050	0.421	mg/L
EW-40	Solids: Total Dissolved	1	109	mg/L
EW-50	Turbidity	3.1	109	NTU
EP-6	TDPHos Filtration		Yes	
EW-99	Phosphorus: Total Dissolved	0.050	0.270	mg/L
EO-99	Bensulide		FORM A	
EO-99	Chlorothalonil		FORM B	
EO-99	Chlorpyrifos		FORM C	
EO-99	DDVP		FORM D	
EO-99	Herbicides		FORM E	
EO-99	Thiram		FORM F	

COMMENTS:

Laboratory Contact(s):

Reviewed and Approved by:

Jeff Whaley, B.S.
Section Head, Organics/GCMS

James B. Cox, III, B.S.
Manager, Environmental Department



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

Form A Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1434E3

Date Received: 08/01/95

Project Name: Sergio

Date Reported: 10/27/95

Results specific to: 1434E3

Client marks: SW-1

Date Sampled: 07/31/95

Matrix: Surface water

Date Prepared: 10/30/95

Date Analyzed: 10/30/95

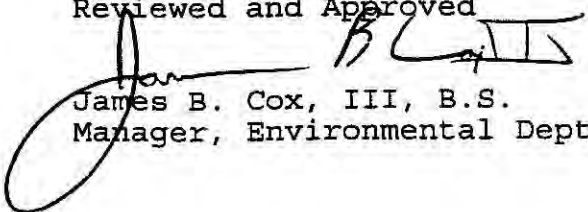
<u>Parameter/Sample I.D.</u>	<u>Results</u> <u>(ug/L)</u>	<u>Comments</u>
Bensulide /		
1434E3	< 2.0	
<u>Quality Control</u>		
Bensulide /		
1434E3, 100 ug/L Spike	108	108% Recovery
MB103095	< 2.0	Method Blank
MBS103095-1, 20 ug/L Spike	6.9	Method Blank Spike
		138% Recovery
MBS103095-2, 200 ug/L Spike	42.1	Method Blank Spike
		84% Recovery

Method: EPA 636, HPLC/UV Vis

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\e1434n

Reviewed and Approved


James B. Cox, III, B.S.
Manager, Environmental Dept.



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

Form B Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1434E3

Date Received: 08/01/95

Project Name: Sergio

Date Reported: 10/27/95

Results specific to: 1434E3

Client marks: SW-1

Date Sampled: 07/31/95

Matrix: Surface water

Date Prepared: 08/03/95

Date Analyzed: 08/11/95

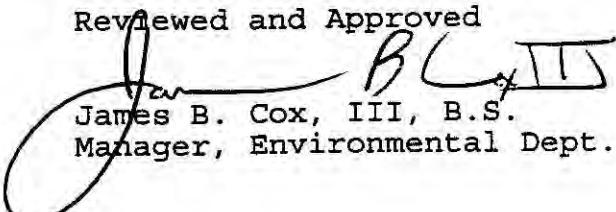
<u>Parameter/Sample I.D.</u>	<u>Results</u> <u>(ug/L)</u>	<u>Comments</u>
Chlorothalonil /		
1434E3	< 0.5	
1434E3 Duplicate	< 0.5	
<u>Quality Control</u>		
Chlorothalonil /		
MB080395	< 0.5	Method Blank
MBS080395, 10 ug/L Spike	10.8	Method Blank Spike 108% Recovery

Method: Microextraction, GC/ECD, Southern Testing.

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\el434f

Reviewed and Approved


James B. Cox, III, B.S.
Manager, Environmental Dept.



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

Form C Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1434E3

Date Received: 08/01/95

Project Name: Sergio

Date Reported: 10/27/95

Results specific to: 1434E3

Client marks: SW-1

Date Sampled: 07/31/95

Matrix: Surface water

Date Prepared: 08/08/95

Date Analyzed: 08/10/95

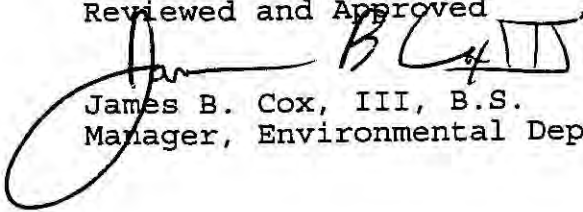
<u>Parameter/Sample I.D.</u>	<u>Results</u> <u>(ug/L)</u>	<u>Comments</u>
Chlorpyrifos /		
1434E3	< 0.5	
1434E3 Duplicate	< 0.5	
<u>Quality Control</u>		
Chlorpyrifos /		
1434E3, 5.0 ug/L Spike	4.9	98% Recovery
MB080895	< 0.5	Method Blank
MBS080895, 5.0 ug/L Spike	5.0	Method Blank Spike
		100% Recovery

Method: Microextraction, GC/ECD, Southern Testing.

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\e1434k

Reviewed and Approved


James B. Cox, III, B.S.
Manager, Environmental Dept.



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

Form D Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1434E3

Date Received: 08/01/95

Project Name: Sergio

Date Reported: 10/27/95

Results specific to: 1434E3

Client marks: SW-1

Date Sampled: 07/31/95

Matrix: Surface water

Date Prepared: 09/12/95

Date Analyzed: 09/13/95

<u>Parameter/Sample I.D.</u>	<u>Results</u> <u>(ug/L)</u>	<u>Comments</u>
DDVP /		
1434E3	< 1.0	
<u>Quality Control</u>		
DDVP /		
MB091295	< 1.0	Method Blank
MBS091295, 25 ug/L Spike	19.9	Method Blank Spike 80% Recovery

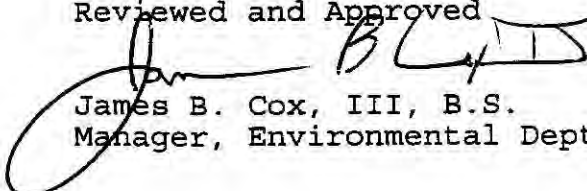
Method: Microextraction, GC/FPD(Phosphorus mode), Southern Testing.

Comment: In method development trials it was discovered that trichlorfon degraded appreciably to DDVP during chromatography. The rate of degradation was determined to be random therefore, samples were analyzed for DDVP only, not for both trichlorfon and DDVP as requested.

Laboratory Contact

Reviewed and Approved

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\el434d


James B. Cox, III, B.S.
Manager, Environmental Dept.



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3809 Airport Drive

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Form E Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1434E3

Date Received: 08/01/95

Project Name: Sergio

Date Reported: 10/27/95

Results specific to: 1434E3

Client marks: SW-1

Date Sampled: 07/31/95

Matrix: Surface water

Date Prepared: 08/03/95

Date Analyzed: 08/09/95

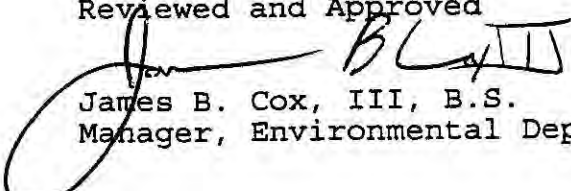
<u>Parameter/Sample I.D.</u>	<u>Results</u> <u>(ug/L)</u>	<u>Comments</u>
2,4 D /		
1434E3	< 10.0	
1434E3 Duplicate	< 10.0	
Dicamba /		
1434E3	< 10.0	
1434E3 Duplicate	< 10.0	
MCP /		
1434E3	<100.0	
1434E3 Duplicate	<100.0	
<u>Quality Control</u>		
2,4 D /		
MB072695	< 10.0	Method Blank
MBS072695, 50.0 ug/L Spike	38.8	Method Blank Spike 78% Recovery
Dicamba /		
MB072695	< 10.0	Method Blank
MBS072695, 50.0 ug/L Spike	41.7	Method Blank Spike 83% Recovery
MCP /		
MB072695	< 10.0	Method Blank
MBS072695, 500 ug/L Spike	373	Method Blank Spike 75% Recovery

Method: Microextraction, GC/MS, Southern Testing.

Laboratory Contact

Reviewed and Approved

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\el4341


James B. Cox, III, B.S.
Manager, Environmental Dept.



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

Form F

Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1434E3

Date Received: 08/01/95

Project Name: Sergio

Date Reported: 10/27/95

Results specific to: 1434E3

Client marks: SW-1

Date Sampled: 07/31/95

Matrix: Surface water

Date Prepared: 09/20/95

Date Analyzed: 09/27/95

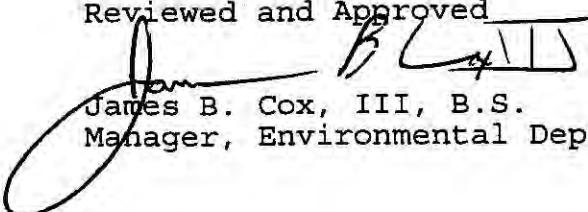
<u>Parameter/Sample I.D.</u>	<u>Results</u> <u>(ug/L)</u>	<u>Comments</u>
Thiram /		
1434E3	< 25.0	
1434E3 Duplicate	< 25.0	
<u>Quality Control</u>		
Thiram /		
1434E3, 100 ug/L Spike	99.7	100% Recovery
MB092095	< 25.0	Method Blank
MBS092095, 100 ug/L Spike	81.6	Method Blank Spike 82% Recovery

Method: Modified EPA 630.1, GC/FPD(Sulfur mode).

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\1434b

Reviewed and Approved


James B. Cox, III, B.S.
Manager, Environmental Dept.



SEE REVERSE FOR INSTRUCTIONS

LAB USE

SAM - F001 (1/95)

***ADDITIONAL CHARGES WILL APPLY.**

COPY



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Wilson, NC 27896

REPORT of ANALYSIS

SAMPLE No.: E1217-001

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Dr.
Cary

NC 27511

Phone: (919) 380-8565 X
Fax: (919) 380-7415

P. O.:

Client Sample ID: HUDSON NATIONAL
Marks: RUTLEDGE 7/20 GRAB

Collected: 07/20/95 14:30
Received: 07/22/95 13:15

Matrix: DRINKING WATER
Classification: ENV

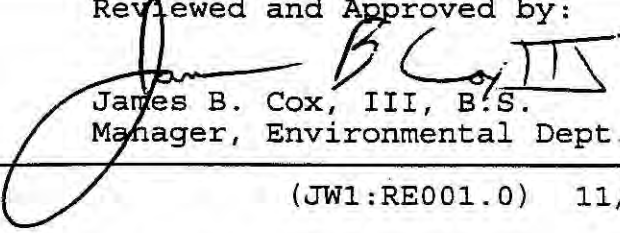
CAT No.	ANALYSES	MDL	RESULT	UNITS
EW-10	Chloride	1.25	219	mg/L
EW-16	Conductivity	14.1	1,470	umhos/cm
EW-30.4	Nitrate (as N)	0.010	0.983	mg/L
EW-30.6	Nitrite (as N)	0.005	0.006	mg/L
EW-34	pH (Laboratory)		6.22	SU
EW-38.2	Phosphorus: Total (as P)	0.050	0.100	mg/L
EW-40	Solids: Total Dissolved	1	784	mg/L
EO-99	Chlorothalonil		FORM A	
EO-99	DDVP		FORM B	
EO-99	Herbicides		FORM C	
EO-99	Thiram		FORM D	

COMMENTS:

Laboratory Contact(s):

Jeff Whaley, B.S.
Section Head, Organics/GCMS

Reviewed and Approved by:


James B. Cox, III, B.S.
Manager, Environmental Dept.



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

REPORT of ANALYSIS

SAMPLE No.: E1217-002

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Dr.
Cary NC 27511

Phone: (919) 380-8565 X
Fax: (919) 380-7415

P. O.:

Client Sample ID: HUDSON NATIONAL
Marks: BELL 7/20 GRAB

Collected: 07/20/95 14:50
Received: 07/22/95 13:15

Matrix: DRINKING WATER
Classification: ENV

TEST No.	ANALYSES	MDL	RESULT	UNITS
EW-10	Chloride	0.25	9.69	mg/L
EW-16	Conductivity	14.1	379	umhos/cm
N-30.4	Nitrate (as N)	0.010	0.179	mg/L
EW-30.6	Nitrite (as N)	0.005	ND	mg/L
EW-34	pH (Laboratory)		6.40	SU
N-38.2	Phosphorus: Total (as P)	0.050	0.085	mg/L
EW-40	Solids: Total Dissolved	1	222	mg/L
EO-99	Chlorothalonil		FORM A	
EO-99	DDVP		FORM B	
EO-99	Herbicides		FORM C	
EO-99	Thiram		FORM D	

COMMENTS: ND - Not Detected.

Laboratory Contact(s):

Reviewed and Approved by:

Jeff Whaley, B.S.
Section Head, Organics/GCMS

James B. Cox, III, B.S.
Manager, Environmental Dept.



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

R E P O R T o f A N A L Y S I S

SAMPLE No.: E1217-003

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Dr.
Cary

NC 27511

Phone: (919) 380-8565 X
Fax: (919) 380-7415

P. O.:

Client Sample ID: HUDSON NATIONAL
Marks: ARNOLD 7/20 GRAB

Collected: 07/20/95 15:30
Received: 07/22/95 13:15

Matrix: DRINKING WATER
Classification: ENV

CAT No.	ANALYSES	MDL	RESULT	UNITS
EW-10	Chloride	0.25	8.16	mg/L
EW-16	Conductivity	14.1	297	umhos/cm
EW-30.4	Nitrate (as N)	0.050	0.185	mg/L
EW-30.6	Nitrite (as N)	0.005	ND	mg/L
EW-34	pH (Laboratory)		6.81	SU
EW-38.2	Phosphorus: Total (as P)	0.050	0.092	mg/L
EW-40	Solids: Total Dissolved	1	177	mg/L
EO-99	Chlorothalonil		FORM A	
EO-99	DDVP		FORM B	
EO-99	Herbicides		FORM C	
EO-99	Thiram		FORM D	

COMMENTS: ND - Not Detected.

Laboratory Contact(s):

Reviewed and Approved by:

Jeff Whaley, B.S.
Section Head, Organics/GCMS

James B. Cox, III, B.S.
Manager, Environmental Department



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

REPORT of ANALYSIS

SAMPLE No.: E1217-004

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Dr.
Cary

NC 27511

Phone: (919) 380-8565 X
Fax: (919) 380-7415

P. O.:

Client Sample ID: HUDSON NATIONAL
Marks: MEISSNER 7/20 GRAB

Collected: 07/20/95 15:15
Received: 07/22/95 13:15

Matrix: DRINKING WATER
Classification: ENV

AT No.	ANALYSES	MDL	RESULT	UNITS
EW-10	Chloride	0.25	8.33	mg/L
W-16	Conductivity	14.1	348	umhos/cm
W-30.4	Nitrate (as N)	0.050	ND	mg/L
EW-30.6	Nitrite (as N)	0.005	ND	mg/L
W-34	pH (Laboratory)		7.48	SU
W-38.2	Phosphorus: Total (as P)	0.050	ND	mg/L
EW-40	Solids: Total Dissolved	1	208	mg/L
EO-99	Chlorothalonil		FORM A	
O-99	DDVP		FORM B	
EO-99	Herbicides		FORM C	
EO-99	Thiram		FORM D	

COMMENTS: ND - Not Detected.

Laboratory Contact(s):

Jeff Whaley, B.S.
Section Head, Organics/GCMS

Reviewed and Approved by:

James B. Cox, III, B.S.
Manager, Environmental Department



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

Form A Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1217E1-4

Date Received: 07/22/95

Project Name: Hudson National

Date Reported: 10/27/95

Date Sampled: 07/20/95

Matrix: Drinking water

Date Prepared: 07/27/95

Date Analyzed: 08/03/95

<u>Parameter/</u>	<u>Laboratory</u>	<u>Client</u>
<u>Sample I.D./</u>	<u>Sample I.D./</u>	<u>Marks</u>
Chlorothalonil /		

<u>Results</u>	<u>Comments</u>
<u>(ug/L)</u>	

1217E1/ Rutledge 7-20 Grab	< 0.5
1217E2/ Bell 7-20 Grab	< 0.5
1217E3/ Arnold 7-20 Grab	< 0.5
1217E3 Duplicate	< 0.5
1217E4/ Meissner 7-20 Grab	< 0.5

Quality Control
Chlorothalonil /

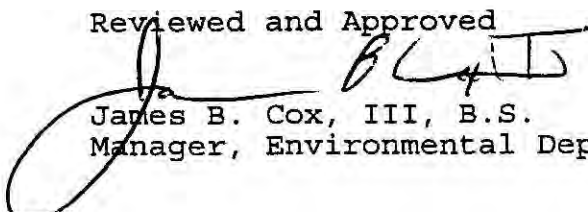
1217E1, 10 ug/L Spike	12.5	125% Recovery
1217E1, 10 ug/L Spike Duplicate	11.2	112% Recovery
MB072795	< 0.5	Method Blank
MBS072795, 10 ug/L Spike	11.5	Method Blank Spike
		115% Recovery

Method: Microextraction, GC/ECD, Southern Testing.

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\el217g

Reviewed and Approved


James B. Cox, III, B.S.
Manager, Environmental Dept.



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

Form B Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1217E1-4

Date Received: 07/22/95

Project Name: Hudson National

Date Reported: 10/27/95

Date Sampled: 07/20/95

Matrix: Drinking water

Date Prepared: 09/12/95

Date Analyzed: 09/13/95

<u>Parameter/</u>	<u>Laboratory</u>	<u>Client</u>
<u>DDVP /</u>	<u>Sample I.D./</u>	<u>Marks</u>

<u>Results</u>	<u>Comments</u>
<u>(ug/L)</u>	

1217E1/ Rutledge 7-20 Grab	< 1.0	
1217E2/ Bell 7-20 Grab	< 1.0	
1217E2 Duplicate	< 1.0	
1217E3/ Arnold 7-20 Grab	< 1.0	
1217E4/ Meissner 7-20 Grab	< 1.0	

Quality Control
DDVP /

1217E3, 25 ug/L Spike

24.5

98% Recovery

MB091295

< 1.0

Method Blank

MBS091295, 25 ug/L Spike

19.9

Method Blank Spike
80% Recovery

Method: Microextraction, GC/FPD(Phosphorus mode), Southern Testing.

Comment: In method development trials it was discovered that trichlorfon degraded appreciably to DDVP during chromatography. The rate of degradation was determined to be random therefore, samples were analyzed for DDVP only, not for both trichlorfon and DDVP as requested.

Laboratory Contact

Reviewed and Approved

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\e1217b

James B. Cox, III, B.S.
Manager, Environmental Dept.



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Form C Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1217E1

Date Received: 07/22/95

Project Name: Hudson National

Date Reported: 10/27/95

Results specific to: 1217E1

Client marks: Rutledge 7/20 Grab

Date Sampled: 07/20/95

Matrix: Drinking water

Date Prepared: 07/26/95

Date Analyzed: 08/09/95

<u>Parameter/Sample I.D.</u>	<u>Results</u> <u>(ug/L)</u>	<u>Comments</u>
2,4 D /		
1217E1	< 10.0	
1217E1 Duplicate	< 10.0	
Dicamba /		
1217E1	< 10.0	
1217E1 Duplicate	< 10.0	
MCP P /		
1217E1	<100.0	
1217E1 Duplicate	<100.0	
<u>Quality Control</u>		
2,4 D /		
MB072695	< 10.0	Method Blank
MBS072695, 50.0 ug/L Spike	38.8	Method Blank Spike 78% Recovery
Dicamba /		
MB072695	< 10.0	Method Blank
MBS072695, 50.0 ug/L Spike	41.7	Method Blank Spike 83% Recovery
MCP P /		
MB072695	< 10.0	Method Blank
MBS072695, 500 ug/L Spike	373	Method Blank Spike 75% Recovery

Method: Microextraction, GC/MS, Southern Testing.

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\e1217c

Reviewed and Approved

James B. Cox, III, B.S.
Manager, Environmental Dept.



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Wilson, NC 27896

Form C Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1217E2

Date Received: 07/22/95

Project Name: Hudson National

Date Reported: 10/27/95

Results specific to: 1217E2

Client marks: Bell 7/20 Grab

Date Sampled: 07/20/95

Matrix: Drinking water

Date Prepared: 07/26/95

Date Analyzed: 08/09/95

<u>Parameter/Sample I.D.</u>	<u>Results</u> <u>(ug/L)</u>	<u>Comments</u>
2,4 D / 1217E2	< 10.0	
Dicamba / 1217E2	< 10.0	
MCP P / 1217E2	<100.0	

Quality Control

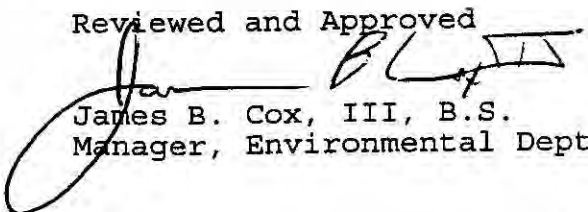
2,4 D / MB072695	< 10.0	Method Blank
MBS072695, 50.0 ug/L Spike	38.8	Method Blank Spike 78% Recovery
Dicamba / MB072695	< 10.0	Method Blank
MBS072695, 50.0 ug/L Spike	41.7	Method Blank Spike 83% Recovery
MCP P / MB072695	< 10.0	Method Blank
MBS072695, 500 ug/L Spike	373	Method Blank Spike 75% Recovery

Method: Microextraction, GC/MS, Southern Testing.

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\el217d

Reviewed and Approved


James B. Cox, III, B.S.
Manager, Environmental Dept.



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Form C Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1217E3

Date Received: 07/22/95

Project Name: Hudson National

Date Reported: 10/27/95

Results specific to: 1217E3

Client marks: Arnold 7/20 Grab

Date Sampled: 07/20/95

Matrix: Drinking water

Date Prepared: 07/26/95

Date Analyzed: 08/09/95

<u>Parameter/Sample I.D.</u>	<u>Results</u> <u>(ug/L)</u>	<u>Comments</u>
2,4 D / 1217E3	< 10.0	
Dicamba / 1217E3	< 10.0	
MCPD / 1217E3	<100.0	

Quality Control

2,4 D /		
1217E3, 50 ug/L Spike	31.2	62% Recovery
1217E3, 50 ug/L Spike Dup	26.8	54% Recovery
MB072695	< 10.0	Method Blank
MBS072695, 50.0 ug/L Spike	38.8	Method Blank Spike 78% Recovery
Dicamba /		
1217E3, 50 ug/L Spike	39.4	79% Recovery
1217E3, 50 ug/L Spike Dup	33.2	66% Recovery
MB072695	< 10.0	Method Blank
MBS072695, 50.0 ug/L Spike	41.7	Method Blank Spike 83% Recovery
MCPD /		
1217E3, 50 ug/L Spike	313	63% Recovery
1217E3, 50 ug/L Spike Dup	262	52% Recovery
MB072695	< 10.0	Method Blank
MBS072695, 500 ug/L Spike	373	Method Blank Spike 75% Recovery

Method: Microextraction, GC/MS, Southern Testing.

Laboratory Contact

Reviewed and Approved

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\el217e

James B. Cox, III, B.S.
Manager, Environmental Dept.



**SOUTHERN TESTING
& RESEARCH LABORATORIES, INC.**

3809 Airport Drive • Wilson, NC 27896
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**CHAIN OF CUSTODY
& ANALYSIS REQUEST**

SEE REVERSE FOR INSTRUCTIONS

PAGE 1 of 1

1 ORIGINAL REPORT TO: (Company and Individual) <u>THE TURF SCIENCE GROUP INC</u> (Address) <u>106 BRUCE DR. CARY N.C. 27511</u>				2 CONTACT PERSON (Report) <u>BUD SMART</u>				LAB USE			
3 ADDITIONAL ADDRESS (Invoice or Report)				3 PHONE (Report) <u>919 380 8565</u> FAX # <u>919 380 7415</u>				LOGGED IN BY (INITIAL) <u>1217E144</u>			
4 REQUESTED TURNAROUND TIME: ☐ Normal (2 weeks) ☐ Rush (1 week)* ☒ Emergency Rush (ASAP)*				5 PROJECT NAME <u>HUDSON NATIONAL GOLF CLUB</u>				DATE <u>7/12/95</u>			
6 PROJECT# / PO #				7 QUOTE #				TIME <u>1:15 PM</u>			
8 CONTACT PERSON/PHONE # (Add'n) <u>Allen Hicks 914 271 7600</u>				9 ANALYSES REQUESTED (Please Use Catalog #'s) <u>70XED BY client for analysis 7/12/95</u>				ACCOUNT #			
10 SAMPLE CONTAINER INFO				11 SAMPLING CHARGES				TRANSPORT			
Container Type				Size (Vol./Wt.)				Time			
# of Containers				Preservation				Mileage			
12				13				Other			
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Wilson, NC 27896

Form C Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1217E4

Date Received: 07/22/95

Project Name: Hudson National

Date Reported: 10/27/95

Results specific to: 1217E4

Client marks: Meissner 7/20 Grab

Date Sampled: 07/20/95

Matrix: Drinking water

Date Prepared: 07/26/95

Date Analyzed: 08/09/95

Parameter/Sample I.D.

Results

Comments

2,4 D /

1217E4

< 10.0

Dicamba /

1217E4

< 10.0

MCPP /

1217E4

<100.0

Quality Control

2,4 D /

MB072695

< 10.0

Method Blank

MBS072695, 50.0 ug/L Spike

38.8

Method Blank Spike
78% Recovery

Dicamba /

MB072695

< 10.0

Method Blank

MBS072695, 50.0 ug/L Spike

41.7

Method Blank Spike
83% Recovery

MCPP /

MB072695

< 10.0

Method Blank

MBS072695, 500 ug/L Spike

373

Method Blank Spike
75% Recovery

Method: Microextraction, GC/MS, Southern Testing.

Laboratory Contact

Reviewed and Approved

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\1217f

James B. Cox, III, B.S.
Manager, Environmental Dept.



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Form D Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1217E1-4

Date Received: 07/22/95

Project Name: Hudson National

Date Reported: 10/27/95

Date Sampled: 07/20/95

Matrix: Drinking water

Date Prepared: 09/21/95

Date Analyzed: 09/27/95

<u>Parameter/</u>	<u>Laboratory</u>	<u>Client</u>	<u>Results</u>	<u>Comments</u>
<u>Thiram /</u>	<u>Sample I.D./</u>	<u>Marks</u>	<u>(ug/L)</u>	

1217E1/ Rutledge 7-20 Grab	< 25.0
1217E2/ Bell 7-20 Grab	< 25.0
1217E2 Duplicate	< 25.0
1217E3/ Arnold 7-20 Grab	< 25.0
1217E4/ Meissner 7-20 Grab	< 25.0

Quality Control

Thiram /

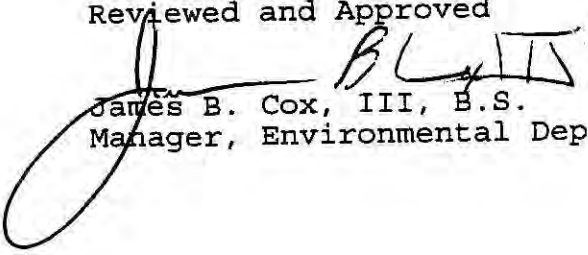
1217E4, 500 ug/L Spike	496	99% Recovery
MB092195	< 1.0	Method Blank
MBS092195, 500 ug/L Spike	452	Method Blank Spike
		90% Recovery

Method: Modified EPA 630.1, GC/FPD(Sulfur mode).

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\1217a

Reviewed and Approved


James B. Cox, III, B.S.
Manager, Environmental Dept.



SEE REVERSE FOR INSTRUCTIONS

① ORIGINAL REPORT TO: (Company and Individual) THE TURF SCIENCE GROUP INC. (Address) 106 BRUCE DR CHRY N.C. 27511				② CONTACT PERSON (Report) BUD SMART				LOGGED IN BY (INITIAL) gms		SAMPLE # 121782 of 4	
④ ADDITIONAL ADDRESS (Invoice or Report)				③ PHONE # (Report) 919-380-8565 FAX # 919-380-7415				DATE 7/22/95		TIME 1:15 PM	
⑥ REQUESTED TURNAROUND TIME: ☐ Normal (2 weeks) ☐ Rush (1 week)* ☒ Emergency Rush (ASAP)*				⑦ PROJECT NAME Highway National Golf Club				REC'D ON ICE ☒ YES ☐ NO Temp Calcd		ACCOUNT #	
⑧ PROJECT # / PO #				⑨ QUOTE #				SAMPLING CHARGES Time Mileage Other		TRANSPORT UPS	
⑩ Start ⑪ End Comp Grab				⑫ Sample Type				⑬ Description			
⑭ Item #				⑮ Date Time				⑯ Date Time			
⑰ Sample Marks				⑱ Container Type				⑲ Size (Vol./Wt.)			
⑳ # of Containers				㉑ Preservation				㉒ Analyses Requested (Please Use Catalog #'s)			
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CHAIN OF CUSTODY & ANALYSIS REQUEST

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PAGE 1 of 1

SAM - F001 (1/95)

ADDITIONAL CHARGES WITH FORFEITURE:



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513

[illegible]



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REPORT of ANALYSIS

SAMPLE No.: E1437-001

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Dr.
Cary NC 27511

Phone: (919) 380-8565 X
Fax: (919) 380-7415

P. O.:

Client Sample ID: HUDSON NATIONAL
Marks: Craig 7/29 Grab

Collected: 07/29/95 16:00
Received: 08/01/95 10:00

Matrix: DRINKING WATER
Classification: ENV

AT No.	ANALYSES	MDL	RESULT	UNITS
EW-10	Chloride	0.25	8.67	mg/L
W-16	Conductivity	14.1	291	umhos/cm
W-30.4	Nitrate (as N)	0.025	ND	mg/L
EW-30.6	Nitrite (as N)	0.005	ND	mg/L
W-34	pH (Laboratory)		7.64	SU
W-38.2	Phosphorus: Total (as P)	0.050	0.060	mg/L
EW-40	Solids: Total Dissolved	1	211	mg/L
EP-6	TDPHos Filtration		Yes	
W-99	Phosphorus: Total Dissolved (as P)	0.050	0.069	mg/L
LO-99	Chlorothalonil		FORM A	
EO-99	DDVP		FORM B	
TO-99	Herbicides		FORM C	
O-99	Thiram		FORM D	

COMMENTS: ND - Not Detected.

Laboratory Contact(s):

Reviewed and Approved by:

Jeff Whaley, B.S.
Section Head, Organics/GCMS

James B. Cox, III, B.S.
Manager, Environmental Dept.



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Wilson, NC 27896

Form A Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1437E1

Date Received: 08/01/95

Project Name: Hudson National

Date Reported: 10/27/95

Results specific to: 1437E1

Client marks: Craig 7/29 Grab

Date Sampled: 07/29/95

Matrix: Drinking water

Date Prepared: 08/03/95

Date Analyzed: 08/11/95

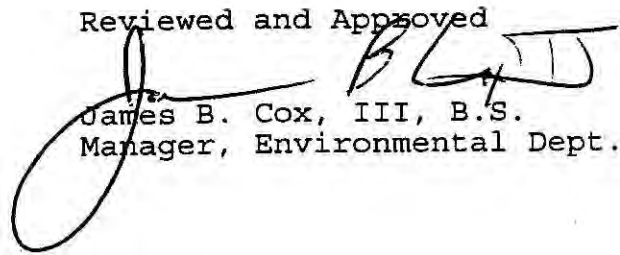
<u>Parameter/Sample I.D.</u>	<u>Results</u> <u>(ug/L)</u>	<u>Comments</u>
Chlorothalonil /		
1437E1	< 0.5	
<u>Quality Control</u>		
Chlorothalonil /		
1437E1, 10 ug/L Spike	11.1	111% Recovery
1437E1, 10 ug/L Spike Dup.	10.8	108% Recovery
MB080395	< 0.5	Method Blank
MBS080395, 10 ug/L Spike	10.8	Method Blank Spike
		108% Recovery

Method: Microextraction, GC/ECD, Southern Testing.

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\el1437c

Reviewed and Approved


James B. Cox, III, B.S.
Manager, Environmental Dept.



Southern Testing & Research Laboratories, Inc.

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Form B Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1437E1

Date Received: 08/01/95

Project Name: Hudson National

Date Reported: 10/27/95

Results specific to: 1437E1

Client marks: Craig 7/29 Grab

Date Sampled: 07/29/95

Matrix: Drinking water

Date Prepared: 09/12/95

Date Analyzed: 09/13/95

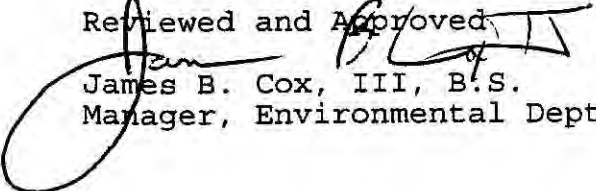
<u>Parameter/Sample I.D.</u>	<u>Results</u> <u>(ug/L)</u>	<u>Comments</u>
DDVP /		
1437E1	< 1.0	
<u>Quality Control</u>		
DDVP /		
MB091295	< 1.0	Method Blank
MBS091295, 25 ug/L Spike	19.9	Method Blank Spike 80% Recovery

Method: Microextraction, GC/FPD (Phosphorus mode), Southern Testing.

Comment: In method development trials it was discovered that trichlorfon degraded appreciably to DDVP during chromatography. The rate of degradation was determined to be random therefore, samples were analyzed for DDVP only, not for both trichlorfon and DDVP as requested.

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\el1437b

Reviewed and Approved

James B. Cox, III, B.S.
Manager, Environmental Dept.



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

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Wilson, NC 27896

Form C Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1437E1

Date Received: 08/01/95

Project Name: Hudson National

Date Reported: 10/27/95

Results specific to: 1437E1

Client marks: Craig 7/29 Grab

Date Sampled: 07/29/95

Matrix: Drinking water

Date Prepared: 08/03/95

Date Analyzed: 08/09/95

<u>Parameter/Sample I.D.</u>	<u>Results</u> <u>(ug/L)</u>	<u>Comments</u>
2,4 D /		
1437E1	< 10.0	Estimated MDL*
1437E1 Duplicate	< 10.0	
Dicamba /		
1437E1	< 10.0	Estimated MDL*
1437E1 Duplicate	< 10.0	
MCPP /		
1437E1	<100.0	Estimated MDL*
1437E1 Duplicate	<100.0	

Quality Control

2,4 D /		
MB072695	< 10.0	Method Blank
MBS072695, 50.0 ug/L Spike	38.8	Method Blank Spike 78% Recovery
Dicamba /		
MB072695	< 10.0	Method Blank
MBS072695, 50.0 ug/L Spike	41.7	Method Blank Spike 83% Recovery
MCPP /		
MB072695	< 10.0	Method Blank
MBS072695, 500 ug/L Spike	373	Method Blank Spike 75% Recovery

Method: Microextraction, GC/MS, Southern Testing.

Comments: *Method detection limit estimated due to poor surrogate recovery.

Laboratory Contact

Reviewed and Approved

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\el1437d

James B. Cox, III, B.S.
Manager, Environmental Dept.



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

Form D Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1437E1

Date Received: 08/01/95

Project Name: Hudson National

Date Reported: 10/27/95

Results specific to: 1435E1

Client marks: Craig 7/29 Grab

Date Sampled: 07/29/95

Matrix: Drinking water

Date Prepared: 09/21/95

Date Analyzed: 09/27/95

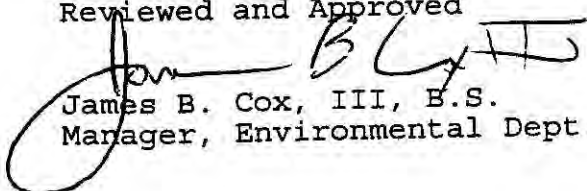
<u>Parameter/Sample I.D.</u>	<u>Results</u> <u>(ug/L)</u>	<u>Comments</u>
Thiram /		
1437E1	< 25.0	
<u>Quality Control</u>		
Thiram /		
MB092195	< 25.0	Method Blank
MBS092195, 500 ug/L Spike	452	Method Blank Spike 90% Recovery

Method: Modified EPA 630.1, GC/FPD(Sulfur mode).

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\1437a

Reviewed and Approved


James B. Cox, III, B.S.
Manager, Environmental Dept.



SEE REVERSE FOR INSTRUCTIONS

[illegible]



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Wilson, NC 27896

REPORT of ANALYSIS

SAMPLE No.: E1436-001

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Dr.
Cary

NC 27511

Phone: (919) 380-8565 X
Fax: (919) 380-7415

P. O.:

Client Sample ID: HUDSON NATIONAL
Marks: Scalzi 7/28 Grab

Collected: 07/28/95 14:00
Received: 08/01/95 10:00

Matrix: DRINKING WATER
Classification: ENV

CAT No.	ANALYSES	MDL	RESULT	UNITS
LW-10	Chloride	0.25	19.4	mg/L
EW-16	Conductivity	14.1	384	umhos/cm
W-30.4	Nitrate (as N)	0.025	0.191	mg/L
W-30.6	Nitrite (as N)	0.005	ND	mg/L
EW-34	pH (Laboratory)		6.97	SU
EW-38.2	Phosphorus: Total (as P)	0.050	0.079	mg/L
W-40	Solids: Total Dissolved	1	237	mg/L
EP-6	TDPHos Filtration		Yes	
EW-99	Phosphorus: Total Dissolved	0.050	0.069	mg/L
O-99	Chlorothalonil		FORM A	
O-99	DDVP		FORM B	
EO-99	Herbicides		FORM C	
O-99	Thiram		FORM D	

COMMENTS: ND - Not Detected.

Laboratory Contact (s):

Reviewed and Approved by:

Jeff Whaley, B.S.
Section Head, Organics/GCMS

James B. Cox, III, B.S.
Manager, Environmental Dept.

page 1 of 1

E1436.887



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Form A Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1436E1

Date Received: 08/01/95

Project Name: Hudson National

Date Reported: 10/27/95

Results specific to: 1436E1

Client marks: Scalzi 7/28 Grab

Date Sampled: 07/28/95

Matrix: Drinking water

Date Prepared: 08/03/95

Date Analyzed: 08/11/95

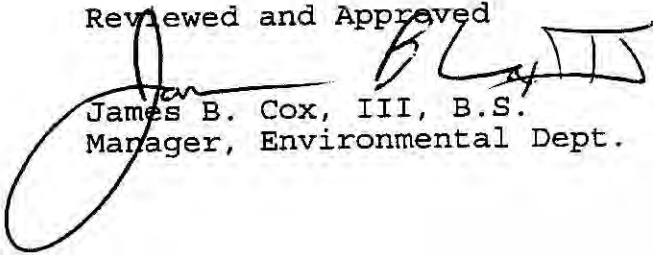
<u>Parameter/Sample I.D.</u>	<u>Results</u> <u>(ug/L)</u>	<u>Comments</u>
Chlorothalonil /		
1436E1	< 0.5	
1436E1 Duplicate	< 0.5	
<u>Quality Control</u>		
Chlorothalonil /		
MB080395	< 0.5	Method Blank
MBS080395, 10 ug/L Spike	10.8	Method Blank Spike 108% Recovery

Method: Microextraction, GC/ECD, Southern Testing.

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\ei436c

Reviewed and Approved


James B. Cox, III, B.S.
Manager, Environmental Dept.



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Wilson, NC 27896

Form B

Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1436E1

Date Received: 08/01/95

Date Reported: 10/27/95

Project Name: Hudson National

Results specific to: 1436E1

Client marks: Scalzi 7/28 Grab

Date Sampled: 07/28/95

Matrix: Drinking water

Date Prepared: 09/12/95

Date Analyzed: 09/13/95

Parameter/Sample I.D.
DDVP /

Results
(ug/L)

Comments

1436E1

< 1.0

Quality Control
DDVP /

MB091295
MBS091295, 25 ug/L Spike

< 1.0
19.9

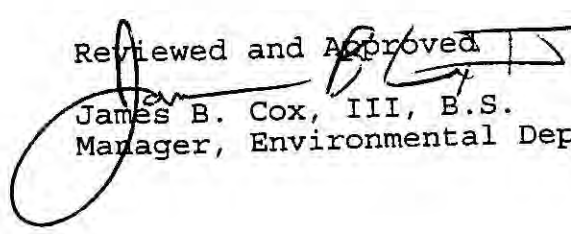
Method Blank
Method Blank Spike
80% Recovery

Method: Microextraction, GC/FPD (Phosphorus mode), Southern Testing.

Comment: In method development trials it was discovered that trichlorfon degraded appreciably to DDVP during chromatography. The rate of degradation was determined to be random therefore, samples were analyzed for DDVP only, not for both trichlorfon and DDVP as requested.

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\1436b

Reviewed and Approved

James B. Cox, III, B.S.
Manager, Environmental Dept.



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Form C Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1436E1

Date Received: 08/01/95

Project Name: Hudson National

Date Reported: 10/27/95

Results specific to: 1436E1

Client marks: Scalzi 7/28 Grab

Date Sampled: 07/28/95

Matrix: Drinking water

Date Prepared: 08/03/95

Date Analyzed: 08/09/95

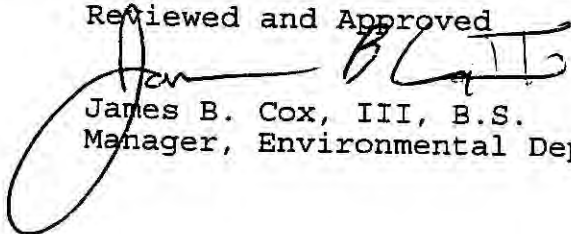
<u>Parameter/Sample I.D.</u>	<u>Results</u> <u>(ug/L)</u>	<u>Comments</u>
2,4 D / 1436E1	< 10.0	
Dicamba / 1436E1	< 10.0	
MCP P / 1436E1	<100.0	
<u>Quality Control</u>		
2,4 D / MB072695	< 10.0	Method Blank
MBS072695, 50.0 ug/L Spike	38.8	Method Blank Spike 78% Recovery
Dicamba / MB072695	< 10.0	Method Blank
MBS072695, 50.0 ug/L Spike	41.7	Method Blank Spike 83% Recovery
MCP P / MB072695	< 10.0	Method Blank
MBS072695, 500 ug/L Spike	373	Method Blank Spike 75% Recovery

Method: Microextraction, GC/MS, Southern Testing.

Laboratory Contact

Reviewed and Approved

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\01436d


James B. Cox, III, B.S.
Manager, Environmental Dept.



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Form D Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1436E1

Date Received: 08/01/95

Project Name: Hudson National

Date Reported: 10/27/95

Results specific to: 1436E1

Client marks: Scalzi 7/28 Grab

Date Sampled: 07/28/95

Matrix: Drinking water

Date Prepared: 09/21/95

Date Analyzed: 09/27/95

Parameter/Sample I.D.
Thiram /

Results
(ug/L)

Comments

1436E1

< 25.0

Quality Control
Thiram /

MB092195

< 25.0

Method Blank

MBS092195, 500 ug/L Spike

452

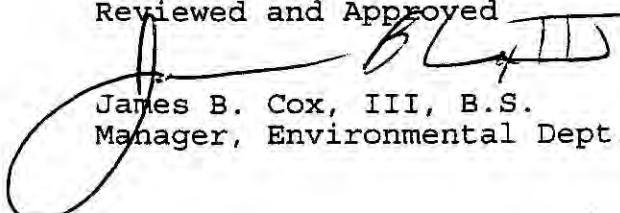
Method Blank Spike
90% Recovery

Method: Modified EPA 630.1, GC/FPD(Sulfur mode).

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\el436a

Reviewed and Approved


James B. Cox, III, B.S.
Manager, Environmental Dept.



SEE REVERSE FOR INSTRUCTIONS

[illegible]



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Wilson, NC 27896

R E P O R T o f A N A L Y S I S

SAMPLE No.: E1435-001

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Dr.
Cary NC 27511

Phone: (919) 380-8565 X
Fax: (919) 380-7415

P. O.:

Client Sample ID: HUDSON NATIONAL
Marks: Doskow 7/28 Grab

Collected: 07/28/95 14:15
Received: 08/01/95 10:00

Matrix: DRINKING WATER
Classification: ENV

TEST No.	ANALYSES	MDL	RESULT	UNITS
EW-10	Chloride	0.25	32.1	mg/L
EW-16	Conductivity	14.1	499	umhos/cm
N-30.4	Nitrate (as N)	0.025	0.113	mg/L
EW-30.6	Nitrite (as N)	0.005	ND	mg/L
EW-34	pH (Laboratory)		7.16	SU
N-38.2	Phosphorus: Total (as P)	0.050	0.050	mg/L
N-40	Solids: Total Dissolved	1	310	mg/L
EP-6	TDPHos Filtration		Yes	
N-99	Phosphorus: Total Dissolved	0.050	0.060	mg/L
O-99	Chlorothalonil		FORM A	
EO-99	DDVP		FORM B	
EO-99	Herbicides		FORM C	
O-99	Thiram		FORM D	

COMMENTS: ND - Not Detected.

Laboratory Contact(s):

Reviewed and Approved by:

Jeff Whaley, B.S.
Section Head, Organics/GCMS

James B. Cox, III, B.S.
Manager, Environmental Dept.



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Form A Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1435E1

Date Received: 08/01/95

Project Name: Hudson National

Date Reported: 10/31/95

Results specific to: 1435E1

Client marks: Daskow 7/28 Grab

Date Sampled: 07/28/95

Matrix: Drinking water

Date Prepared: 09/12/95

Date Analyzed: 09/13/95

Parameter/Sample I.D.
Chlorothalonil /

Results
(ug/L)

Comments

1435E1

< 0.5

Quality Control
Chlorothalonil /

MB080395

< 0.5

Method Blank

MBS080395, 10 ug/L Spike

10.8

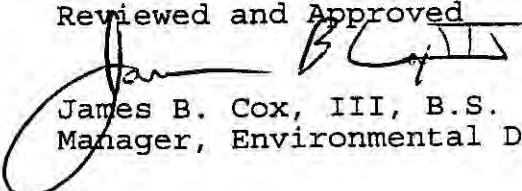
Method Blank Spike
108% Recovery

Method: Microextraction, GC/ECD, Southern Testing.

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\e1435c

Reviewed and Approved


James B. Cox, III, B.S.
Manager, Environmental Dept.



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Form B Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1435E1

Date Received: 08/01/95

Project Name: Hudson National

Date Reported: 10/31/95

Results specific to: 1435E1

Client marks: Doskow 7/28 Grab

Date Sampled: 07/28/95

Matrix: Drinking water

Date Prepared: 09/12/95

Date Analyzed: 09/13/95

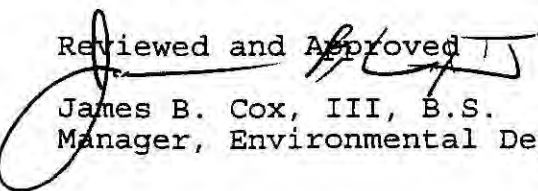
<u>Parameter/Sample I.D.</u>	<u>Results</u> <u>(ug/L)</u>	<u>Comments</u>
DDVP /		
1435E1	< 1.0	
<u>Quality Control</u>		
DDVP /		
MB091295	< 1.0	Method Blank
MBS091295, 25 ug/L Spike	19.9	Method Blank Spike 80% Recovery

Method: Microextraction, GC/FPD (Phosphorus mode), Southern Testing.

Comment: In method development trials it was discovered that trichlorfon degraded appreciably to DDVP during chromatography. The rate of degradation was determined to be random therefore, samples were analyzed for DDVP only, not for both trichlorfon and DDVP as requested.

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\el1435b

Reviewed and Approved 
James B. Cox, III, B.S.
Manager, Environmental Dept.



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Form C

Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1435E1

Date Received: 08/01/95

Project Name: Hudson National

Date Reported: 10/31/95

Results specific to: 1435E1

Client marks: Doskow 7/28 Grab

Date Sampled: 07/28/95

Matrix: Drinking water

Date Prepared: 08/03/95

Date Analyzed: 08/09/95

<u>Parameter/Sample I.D.</u>	<u>Results</u> <u>(ug/L)</u>	<u>Comments</u>
2,4 D / 1435E1	< 10.0	Estimated MDL*
Dicamba / 1435E1	< 10.0	Estimated MDL*
MCP / 1435E1	<100.0	Estimated MDL*
<u>Quality Control</u>		
2,4 D / 1435E1, 50 ug/L Spike	19.0	38% Recovery
1435E1, 50 ug/L Spike Dup	19.4	39% Recovery
MB072695	< 10.0	Method Blank
MBS072695, 50.0 ug/L Spike	38.8	Method Blank Spike 78% Recovery
Dicamba / 1435E1, 50 ug/L Spike	18.5	38% Recovery
1435E1, 50 ug/L Spike Dup	16.3	33% Recovery
MB072695	< 10.0	Method Blank
MBS072695, 50.0 ug/L Spike	41.7	Method Blank Spike 83% Recovery
MCP / 1435E1, 500 ug/L Spike	198	40% Recovery
1435E1, 500 ug/L Spike Dup	184	37% Recovery
MB072695	< 10.0	Method Blank
MBS072695, 500 ug/L Spike	373	Method Blank Spike 75% Recovery

Method: Microextraction, GC/MS, Southern Testing.

Comments: *Method detection limit estimated due to poor surrogate recovery.

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\el435d

Reviewed and Approved

James B. Cox, III, B.S.
Manager, Environmental Dept.



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Form D Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 1435E1

Date Received: 08/01/95

Project Name: Hudson National

Date Reported: 10/31/95

Results specific to: 1435E1

Client marks: Doskow 7/28 Grab

Date Sampled: 07/28/95

Matrix: Drinking water

Date Prepared: 09/21/95

Date Analyzed: 09/27/95

Parameter/Sample I.D.
Thiram /

Results
(ug/L)

Comments

1435E1

< 25.0

Quality Control
Thiram /

1435E1, 500 ug/L Spike

511

102% Recovery

MB092195

< 25.0

Method Blank

MBS092195, 500 ug/L Spike

452

Method Blank Spike

90% Recovery

Method: Modified EPA 630.1, GC/FPD(Sulfur mode).

Laboratory Contact

Reviewed and Approved

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\c1435a

James B. Cox, III, B.S.
Manager, Environmental Dept.



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Wilson, NC 27896

REPORT of ANALYSIS

SAMPLE No.: E3049-001

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Dr.
Cary

NC 27511

Phone: (919) 380-8565 X

Fax: (919) 380-7415

P. O.:

Client Sample ID: HUDSON NATIONAL
Marks: SW-1

Collected: 10/02/95 09:15
Received: 10/03/95 11:00

Matrix: SURFACE WATER
Classification: ENV

CAT No.	ANALYSES	MDL	RESULT	UNITS
EW-10	Chloride	0.10	17.6	mg/L
EW-30.4	Nitrogen: Nitrate (as N)	0.500	0.919	mg/L
EW-38.2	Phosphorus: Total (as P)	0.625	1.73	mg/L
EW-40	Solids: Total Dissolved	1	118	mg/L
EO-99	Herbicides		FORM A	

COMMENTS:

Laboratory Contact(s):

Reviewed and Approved by:

Jeff Whaley, B.S.
Section Head, Organics/GCMS

James B. Cox, III, B.S.
Manager, Environmental Dept.



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Wilson, NC 27896

Form A Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 3049E1

Date Received: 10/03/95

Project Name: Hudson National

Date Reported: 10/31/95

Results specific to: 3049E1

Client marks: SW-1

Date Sampled: 10/02/95

Matrix: Surface Water

Date Prepared: 10/05/95

Date Analyzed: 10/24/95

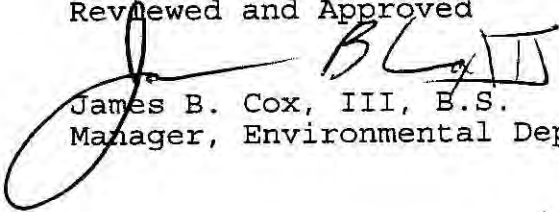
<u>Parameter/Sample I.D.</u>	<u>Results</u> <u>(ug/L)</u>	<u>Comments</u>
2,4 D / 3049E1	< 25.0	
Dicamba / 3049E1	< 25.0	
MCP P / 3049E1	<100	
<u>Quality Control</u>		
2,4 D / MB100595	< 25.0	Method Blank
MBS100595, 50 ug/L Spike	54.5	Method Blank Spike 109% Recovery
Dicamba / MB100595	< 25.0	Method Blank
MBS100595, 50 ug/L Spike	67.4	Method Blank Spike 135% Recovery
MCP P / MB100595	<100	Method Blank
MBS100595, 500 ug/L Spike	545	Method Blank Spike 109% Recovery

Method: Sonication extraction, GC/ECD, Southern Testing.

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\3049c

Reviewed and Approved


James B. Cox, III, B.S.
Manager, Environmental Dept.



Southern Testing & Research Laboratories, Inc.

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REPORT of ANALYSIS

SAMPLE No.: E3049-002

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Dr.
Cary NC 27511

Phone: (919) 380-8565 X
Fax: (919) 380-7415

P. O.:

Client Sample ID: HUDSON NATIONAL
Marks: GW-2

Collected: 10/02/95 14:15
Received: 10/03/95 11:00

Matrix: GROUNDWATER
Classification: ENV

CAT No.	ANALYSES	MDL	RESULT	UNITS
EW-10	Chloride	0.10	118	mg/L
EW-30.4	Nitrogen: Nitrate (as N)	0.100	1.77	mg/L
EW-38.2	Phosphorus: Total (as P)	0.625	1.09	mg/L
EW-40	Solids: Total Dissolved	1	181	mg/L
EO-99	Herbicides		FORM A	

COMMENTS:

Laboratory Contact(s):

Reviewed and Approved by:

Jeff Whaley, B.S.
Section Head, Organics/GCMS

James B. Cox, III, B.S.
Manager, Environmental Dept.



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Wilson, NC 27896

Form A

Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 3049E2

Date Received: 10/03/95

Project Name: Hudson National

Date Reported: 10/31/95

Results specific to: 3049E2

Client marks: GW-2

Date Sampled: 10/02/95

Matrix: Groundwater

Date Prepared: 10/05/95

Date Analyzed: 10/24/95

<u>Parameter/Sample I.D.</u>	<u>Results</u> <u>(ug/L)</u>	<u>Comments</u>
2,4 D /		
3049E2	< 25.0	
3049E2 Duplicate	< 25.0	
Dicamba /		
3049E2	< 25.0	
3049E2 Duplicate	< 25.0	
MCPD /		
3049E2	<100	
3049E2 Duplicate	<100	
<u>Quality Control</u>		
2,4 D /		
MB100595	< 25.0	Method Blank
MBS100595, 50 ug/L Spike	54.5	Method Blank Spike 109% Recovery
Dicamba /		
MB100595	< 25.0	Method Blank
MBS100595, 50 ug/L Spike	67.4	Method Blank Spike 135% Recovery
MCPD /		
MB100595	<100	Method Blank
MBS100595, 500 ug/L Spike	545	Method Blank Spike 109% Recovery

Method: Sonication extraction, GC/ECD, Southern Testing.

Laboratory Contact

Reviewed and Approved

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\3049d

James B. Cox, III, B.S.
Manager, Environmental Dept.



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Wilson, NC 27896

REPORT of ANALYSIS

SAMPLE No.: E3049-003

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Dr.
Cary NC 27511

Phone: (919) 380-8565 X
Fax: (919) 380-7415

P. O.:

Client Sample ID: HUDSON NATIONAL
Marks: SW-3b

Collected: 10/02/95 12:30
Received: 10/03/95 11:00

Matrix: SURFACE WATER
Classification: ENV

CAT No.	ANALYSES	MDL	RESULT	UNITS
EW-10	Chloride	1.00	30.4	mg/L
EW-30.4	Nitrogen: Nitrate (as N)	0.100	2.19	mg/L
EW-38.2	Phosphorus: Total (as P)	0.050	0.055	mg/L
EW-40	Solids: Total Dissolved	1	1,580	mg/L
EO-99	Herbicides		FORM A	

COMMENTS:

Laboratory Contact(s):

Reviewed and Approved by:

Jeff Whaley, B.S.
Section Head, Organics/GCMS

James B. Cox, III, B.S.
Manager, Environmental Dept.



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

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Wilson, NC 27896

Form A Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 3049E3

Date Received: 10/03/95

Project Name: Hudson National

Date Reported: 10/31/95

Results specific to: 3049E3

Client marks: SW-3b

Date Sampled: 10/02/95

Matrix: Surface Water

Date Prepared: 10/05/95

Date Analyzed: 10/24/95

<u>Parameter/Sample I.D.</u>	<u>Results</u> <u>(ug/L)</u>	<u>Comments</u>
2,4 D / 3049E3	< 25.0	
Dicamba / 3049E3	< 25.0	
MCPD / 3049E3	<100	
<u>Quality Control</u>		
2,4 D / 3049E3, 50 ug/L Spike	47.9	96% Recovery
MB100595	< 25.0	Method Blank
MBS100595, 50 ug/L Spike	54.5	Method Blank Spike 109% Recovery
Dicamba / 3049E3, 50 ug/L Spike	56.5	113% Recovery
MB100595	< 25.0	Method Blank
MBS100595, 50 ug/L Spike	67.4	Method Blank Spike 135% Recovery
MCPD / 3049E3, 500 ug/L Spike	478	96% Recovery
MB100595	<100	Method Blank
MBS100595, 500 ug/L Spike	545	Method Blank Spike 109% Recovery

Method: Sonication extraction, GC/ECD, Southern Testing.

Laboratory Contact

Reviewed and Approved

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\3049e

James B. Cox, III, B.S.
Manager, Environmental Dept.



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

(919) 237-4175 • Fax: (919) 237-9341

Wilson, NC 27896

REPORT of ANALYSIS

SAMPLE No.: E3049-004

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Dr.
Cary NC 27511

Phone: (919) 380-8565 X
Fax: (919) 380-7415

P. O.:

Client Sample ID: HUDSON NATIONAL
Marks: Pond Sediment

Collected: 10/02/95 10:15
Received: 10/03/95 11:00

Matrix: SEDIMENT
Classification: ENV

CAT No.	ANALYSES	MDL	RESULT	UNITS
EO-99	Chlorothalonil		FORM A	
EO-99	Particle size		Attachment*	
EO-99	PCNB		FORM B	

COMMENTS: * Analysis subcontracted to Microbac Laboratories, Inc. of Fayetteville, N.C. See Microbac report for results.

Laboratory Contact(s):

Reviewed and Approved by:

Jeff Whaley, B.S.
Section Head, Organics/GCMS

James B. Cox, III, B.S.
Manager, Environmental Dept.



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

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Wilson, NC 27896

Form B Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 3049E4

Date Recieved: 10/03/95

Project Name: Hudson National

Date Reported: 10/31/95

Results specific to: 3049E4

Client marks: Pond Sediment

Date Sampled: 10/02/95

Matrix: Sediment

Date Prepared: 10/12/95

Date Analyzed: 10/13/95

<u>Parameter/Sample I.D.</u>	<u>Results</u> <u>(ug/kg)</u>	<u>Comments</u>
PCNB /		

3049E4	<49.5	
3049E4 Duplicate	<49.8	

Quality Control
PCNB /

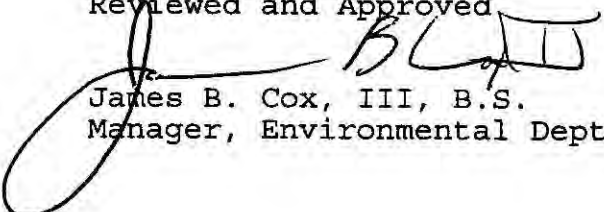
3049E4, 49.8 ug/kg Spike	65.5	132% Recovery
MB101295	<50.0	Method Blank
MBS101295, 50 ug/kg Spike	44.9	Method Blank Spike
		90% Recovery

Method: Sonication extraction, GC/ECD, Southern Testing.

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\3049b

Reviewed and Approved


James B. Cox, III, B.S.
Manager, Environmental Dept.



Southern Testing & Research Laboratories, Inc.

3809 Airport Drive

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Wilson, NC 27896

Form 0_1 Miscellaneous Environmental Organics

Miles M. (Bud) Smart, Ph.D.
The Turf Science Group, Inc.
106 Bruce Drive
Cary, NC 27511

Lab I.D.: 3049E4

Date Recieved: 10/03/95

Project Name: Hudson National

Date Reported: 10/24/95

Results specific to: 3049E4

Client marks: Pond Sediment

Date Sampled: 10/02/95

Matrix: Sediment

Date Prepared: 10/12/95

Date Analyzed: 10/13/95

Parameter/Sample I.D.
Chlorothalonil /

Results
(ug/kg)

Comments

3049E4

<49.5

Estimated MDL due

3049E4 Duplicate

<49.8

to spike recovery.

Quality Control
Chlorothalonil /

3049E4, 49.8 ug/kg Spike

0

0% Recovery

MB101295

<50.0

Method Blank

MBS101295, 50 ug/kg Spike

52.2

Method Blank Spike
104% Recovery

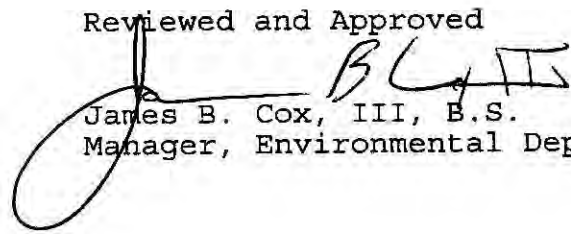
Method: Sonication extraction, GC/ECD, Southern Testing.

Comments: Method blank spike results indicate successful
application of procedure.

Laboratory Contact

Jeff Whaley, B.S.
Section Head, Organics/GCMS
F:\jwhaley\budsmart\3049a

Reviewed and Approved


James B. Cox, III, B.S.
Manager, Environmental Dept.

Microbac

Microbac Laboratories, Inc.

MICROBAC ENVIRONMENTAL LABORATORY
817 CASTLE HAYNE STREET
FAYETTEVILLE, NC 28303
(910) 864-1920 / (910) 864-8774 (FAX)

NC #11
NC #37714
USDA #3787

AIR • FUEL • WATER • FOOD • WASTES

CERTIFICATE OF ANALYSIS

CERT #15294

CLIENT: Southern Testing & Research Lab

ADDRESS: 3809 Airport Drive

Wilson, NC 27896

CONTACT PERSON: Mr. Joe Raythers

ACCOUNT NUMBER: #KS005

SAMPLE ID: 1. 3049-R4 - ID #95MK106009

2

3.

4.

DATE REC'D: 10/06/95 SAMPLED: 10/02/95

SAMPLED BY: Client

DELIVERED BY: UPS

SAMPLE CODE: Pond Sediment, Grab

REFERENCE:

DATA REVIEWED BY: *RW Sander*

DATE REPORTED: 11/15/95

ANALYSIS

UNIT

1

2

3

4

PARTICLE SIZE (um)

METHOD: ASTM D410/D13

4000 < x

3000 < x < 4000

2000 < x < 3000

1600 < x < 2000

420 < x < 1600

300 x < 420

150 < x < 300

75 < x < 100

x < 75

1

10.48

1

7.15

1

12.58

1

69.79

COMMENTS: < = Less than

> = Greater Than



**SOUTHERN TESTING
& RESEARCH LABORATORIES, INC.**
3809 Airport Drive • Wilson, NC 27896
919-237-4175 • Fax: 919-237-9341

CHAIN OF CUSTODY & ANALYSIS REQUEST

SEE REVERSE FOR INSTRUCTIONS

PAGE _____ of _____

① ORIGINAL REPORT TO: (Company and Individual)
Turf Science Group (SMART Assoc)
(Address)
106 BRUCE DR, CARY NC 27511

④ ADDITIONAL ADDRESS (Invoice or Report)

⑥ Requested Turnaround Time:

- ☐ Normal (2 weeks)
☐ Rush (1 week)*
☐ Emergency Rush (ASAP)*

⑦ PROJECT NAME

HUDSON NATIONAL

⑧ PROJECT # / PO #

⑨ QUOTE #

② CONTACT PERSON (Report)

MILES SMART

③ PHONE # (Report) **919 380-8565**

FAX #

⑤ CONTACT PERSON/PHONE # (Add'n)

LAB USE

LOGGED IN BY (INITIALS)	SAMPLE #
ME	30491-4
DATE	TIME
10-3-95	
REC'D ON 10/3/95	ACCOUNT #
☒ YES ☐ NO	
SAMPLING CHARGES	TRANSPORT
Time Mileage Other	UPS

Sample Container Info

Container Type	Size (Vol./Wt.)	# of Containers	Preservation
16	17	18	19

Analyses Requested (Please Use Catalog #'s)

⑩	⑪	⑫	⑬	⑭	⑮	⑯	⑰	⑱	⑲	⑳
Start	End	Comp	Grab	Sample Type	Description	16	17	18	19	20
Item #	Date Time	Date Time								Comments
	10-2-95 915 A	S	✓	SURFACE WATER	SW-1	①	PLAST 2 LITR	2	REF/NONE	
	10-2-95 215 P	S	✓	GROUND WATER	GW-2	②	GLASS 1 LIT	2	REF/N	
	10-2-95 1230 P	S	✓	SURFACE WATER	SW-3b	③	PLASTIC 2 LIT	2	REF/N	
	10-2-95 1015 A	S	✓	SEDIMENT	POND	④	GLASS 1/2 LIT	2	N	

SEE MILES SMART

TRANSFER #	⑳	RELINQUISHED BY	DATE / TIME	㉑	RECEIVED BY	DATE / TIME	㉒	SAMPLE SIGNATURE	㉓	COMMENTS
1		BRAD SMITH	10-2-95/900		Margo English	10-3-95 11:00				
2										
3										

Appendix IX

Photographs of Permanent Groundwater and Surface Water Sampling Locations



Photograph 1. Groundwater sample station, GW-1.



Photograph 2. Groundwater sample station, GW-2.



Photograph 3. Groundwater sample station, GW-3.



Photograph 4. Groundwater sample station, GW-4.



Photograph 5. Groundwater sample station, GW-6.



Photograph 6. Sediment sample station, PS-1.



Photograph 7. Surface water sample station SW-1.



Photograph 8. Surface water sample station SW-2.



Photograph 9. Surface water sample station, SW-3A.



Photograph 10. Surface water sample station, SW-3B.



Photograph 11. Surface water sample station, SW-4.



Photograph 12. Surface water sample station, SW-5.



Photograph 13. Surface water sample station SW-6.

Appendix X

Hazard Communication Program

HAZARD COMMUNICATION PROGRAM

(NAME OR COMPANY)

(LOCATION-DIVISION)

It is the intent of _____,
(Name of Company) (Address-Location-Division)

to comply with the requirements of the Hazard Communication Standard in our continuing effort to provide a healthy and safe workplace for our employees.

This program is designed to provide employee information and training (1) the hazardous chemicals known to be in the workplace, (2) the methods that will be employed to protect workers, (3) the precautionary methods employees must follow to protect themselves from hazardous chemicals, (4) the detection of a release of hazardous chemicals and (5) emergency procedures to follow should there be a release of hazardous chemicals and/or employee exposure to them.

WRITTEN HAZARD COMMUNICATION PROGRAM: Copies of the written Hazard Communication Program are available from the office of _____
(Name of Office or Person)

Program is reviewed annually and is updated as needed. All present or new employees will be given a copy of the program. Employees and/or their authorized representative may obtain an additional copy of the program during normal working ours at a cost of \$1.00 per page.

MATERIAL SAFETY DATA SHEETS: Following is a listing of all hazardous chemicals known to be in the workplace; the location(s) of the chemical are also provided:

<u>HAZARDOUS CHEMICAL</u>	<u>LOCATION</u>	<u>USE</u>
---------------------------	-----------------	------------

- 1.
2. (List all known or suspected hazardous chemicals.)
3. (If you do not have copies or all MSDS's, you will need to contact your suppliers for the necessary copies).

A Material Safety Data Sheet (MSDS) and/or label of each hazardous chemical is filed in the office of _____ Employees

(Name of Office or Person)

and/or their representative may obtain a single copy of an MSDS and/or label during normal working hours at a cost of \$1.00 per page. The relevant information on the MSDS will be shared with employees during the hazard communication training program. The MSDS will be available in the workplace to all employees who are urged to review them whenever they have a question regarding the chemical.

NOTIFICATION OF OTHER EMPLOYERS: When other employers bring a work crew onto our property they will be supplied with a copy of the Hazard Communication Program and with copies of the MSDS for hazardous chemicals which could be encountered in their work area. It shall be their responsibility to train their employees, provide personal protective equipment and handle employee emergencies. Any releases or spills of hazardous chemicals shall within minutes, be brought to the immediate attention of _____

(Name of Office, Person or Position Title)

USE OF LABELS: Whenever possible hazardous chemicals will be kept in their original containers. Should an original container ever become defective (leak) the chemical will be transferred to a similar type container. The label will be transferred to the replacement container and be securely attached. If the label is non-transferrable, a replacement label with all significant information will be prepared and be securely and prominently placed on the new container. This container of a chemical will be used for its intended use as soon as possible.

Placards will be placed on all containers in which hazardous chemicals are used, such as storage tanks for chemicals, solvent tanks for cleaning parts, etc.

EMPLOYEE INFORMATION AND TRAINING: All employees will be provided with information and training on hazardous chemicals in their workplace:

- ✓ At the time of their initial employment.
- ✓ Whenever a new hazardous chemical is brought into their workplace.
- ✓ At least annually.

All affected employees are required to participate in this training. The training will be provided or arranged by _____

(Name of Office or Person or Position Title)

The employees will be provided with the following information:

- ✓ The requirements of the Hazard Communication Standard.
- ✓ Operations in their work area where hazardous chemicals are present, used or stored.
- ✓ Location and availability of the written Hazard Communication Program and MSDS files.

Employee training will include:

- ✓ Methods and observations that may be used to detect the presence or release of a hazardous chemical in the work area (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.)
- ✓ The physical and health hazards of the chemicals in the work area.
- ✓ The measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used and
- ✓ The details of the hazard communication program developed by the employer, including an explanation of the labeling system and the Material Safety Data Sheet, and how employees can obtain and use the appropriate hazard information.

HAZARD CHEMICAL RELEASE, SPILL OR EXPOSURE

Employees will immediately, within minutes, notify their immediate supervisor of any release, spill or human exposure to a hazardous chemical. If it is a significant release into the atmosphere, a spill on non-owned property or into a surface or ground water supply, notify the local emergency service agency and/or fire department (telephone 911) and/or the State Emergency Response Commission.

If a person or persons are exposed to a hazardous chemical, emergency treatment as specified by the MSDS or label will be immediately applied and whenever a question of further medical treatment may be required, the individual(s) will be transported to

(Name of Doctor or Emergency Treatment Center)

A copy of the MSDS and/or label will be transmitted with the exposed individual(s).

The supervisor of an area in which a hazardous chemical release, spill or exposure occurs will, immediately after emergency action, notify _____ of the event.

(Name of Office or Person)

EMPLOYEE REQUIREMENTS: Employees are required to follow all standard operating procedures in the handling of hazardous chemicals, including the use of protective equipment. Failure to do so shall provide sufficient reason for reprimands, suspension or termination of employment.

INFORMING OUTSIDE CONTRACTORS

There may be instances where tasks will be performed by contractors that are not company employees. Should there be a hazardous substance in the work area, it is the obligation of our company to make the contractor aware of the situation. This may be accomplished by:

1. A list hazardous substances in the work area.
2. A diagram of the work area with the locations designated where hazardous substances are used and/or stored.

The contractor will be advised that MSDS are on file and available upon request. The contractor will sign an acknowledgment of receipt of information.

ACKNOWLEDGMENT OF RECEIPT

DATE: _____

ON THE ABOVE DATE, I _____

(CONTRACTOR'S NAME)

RECEIVED A LIST OF HAZARDOUS SUBSTANCES USED AND/OR STORED IN THE
WORK AREA FROM _____

I UNDERSTAND THAT MSDS ARE AVAILABLE FOR ALL SUBSTANCES
LISTED, UPON REQUEST. I ALSO MAY OBTAIN A DIAGRAM OF THE WORK AREA
DESIGNATION USE AND/OR STORAGE OF HAZARDOUS SUBSTANCES.

(CONTRACTOR'S SIGNATURE)

HAZARDS OF NON-ROUTINE TASKS

A non-routine task is defined as one or more of the following:

1. A task not done frequently
2. A task not listed on your job description
3. A task for which you are not trained

Should your Supervisor/Foreman call upon you to perform a non-routine task involving hazardous chemical handling or working in an area where hazardous chemicals are used or stored, the following steps will be taken by the him/her:

1. Give the employee a complete description of the task
2. Brief on hazardous chemicals in the work place
3. Brief on the effects the chemicals may have on the person
4. Determine if the employee is allergic to the chemicals present
5. Brief on proper handling of the chemicals
6. Brief an first aid procedures to take concerning the chemicals
7. State that there will be mandatory use of safety equipment
8. The Supervisor/Foremen will closely monitor the employee while working in the area of hazardous chemicals

**RECOMMENDED POSTERS AND RECORDS
IN MAINTENANCE AREA**

1. OSHA JOB SAFETY AND PROTECTION POSTER
U.S. Department of Labor
Occupational Safety and Health Administration
2. EQUAL EMPLOYMENT OPPORTUNITY POSTER
Equal Employment Opportunity Commission
3. WORKERS' COMPENSATION POSTER
Obtain from Insurance carrier
4. BE SAGE WITH PESTICIDES POSTER
Environmental Protection Agency
5. RIGHT-TO-KNOW LAW POSTER
Toxic Substances Information Center
6. MATERIAL SAFETY DATA SHEETS (MSDS)
Obtain from distributor for each hazardous chemical used and/or stored.
7. PESTICIDE LABELS
Obtain from distributor of each pesticide used and/or stored.
8. HAZARD COMMUNICATION PROGRAM
A written program prepared by the course.
9. RESTRICTED USE PESTICIDE APPLICATION RECORD
Date and location of application.
Product name and quantity (pounds or gallons) of pesticide applied
Area treated and application rate method of application
10. RESTRICTED PESTICIDE CERTIFICATION LICENSE
Test is given at the Orange County Cooperative Extension service.
Required only for individuals purchasing and using restricted pesticides.

Appendix XI

CLP Water Maze Wash Water Recycling System

CLP OPERATOR'S MANUAL

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3. Begin adjusting the metering valve until 40 SCFH flow for the Series 400 and 20 SCFH flow for Series 200 is achieved on the SCFH gauge.

4. Reconnect the tubing to the ozone check valve.

GENERAL MAINTENANCE AND SERVICE**Periodic Maintenance:**♦ **Oil Skimmer Collection Drum**

Monitor the level of oil in the collection drum. Empty it as required.

♦ **Solids Removal**

Settled solids are collected in the bottom of the cone of the CLP. The solids must be removed periodically as dictated by the dirt load coming into the unit. The procedure for removal is as follows.

- ♦ Open Valve #5. Fill up the bag, then shut the valve. Repeat as needed.
- ♦ Check the electrical cords to ensure they are safe, no damage or cracking.
- ♦ Check inlet and outlet pipes for leaks or damage.

Cartridge Filter:

The Water Maze Cartridge Filter is a high performance industrial filter. Manufactured from durable, corrosion-proof materials, it is designed for continuous or intermittent operation. The Cartridge Filter utilizes a reusable, reinforced polyester filter cartridge element to provide a high degree of water clarity and long filter cycles with absolute minimum care.

Filtering:

Filtration starts as soon as flow is steady through the filter. As the filter cartridge removes dirt from the water, the accumulated dirt causes a resistance to flow. As a result, the gauge pressure will rise and the flow will decrease. When the pressure rises 6 - 10 psi above the starting pressure, or when flow decreases below the desired rate, clean or replace the filter cartridges. **Note:** There is an alarm on the system that will sound when a pressure of 15 psi is reached. Clean the filters before the alarm sounds.

Remove/Replace Cartridges:**Removing Cartridge Elements**

1. Shut off the pump.
2. Open the drain valve and allow water to drain from filter. **NOTE:** To assist draining process, open air vent a few turns. (Optional on CLP-5023)
3. Disassembly:
 - a. Unscrew the lock-ring from the top of the filter and lift off.

- b. To remove filter cover, tap it on the side to break the seal.

4. To Remove Cartridge

- a. Grasp the handles on the Dirt Catcher assembly and lift out, using a slight rocking motion.
- b. Slide the cartridge element off the Dirt Catcher assembly.
- c. Clean cartridge (see section on Cleaning Cartridges).

Reinstalling Cartridges:

1. Flush and drain any dirt or debris from the bottom of the filter tank.
2. Carefully replace cartridge element back over the Dirt Catcher assembly. Make sure "This Side Up" is visible on cartridge element.
3. Replace the cartridge element and the Dirt Catcher back in the filter tank, making sure the Dirt Catcher assembly is fully seated.
4. Make sure the Filter Head flanged sealing surface is clean and the o-ring is in place. **NOTE:** The O-ring will need to be lubricated periodically.
5. Replace the filter cover, making sure it is fully seated.
6. Replace the lock-ring and secure hand tight.
7. Close the drain valve, set valves and follow instructions for "Filling System with Water".

Cleaning Cartridges:

The cartridge filter element can be cleaned by pressure washing inside and out with no more than 1000 psi of pressure, or use a garden hose. After hosing the cartridge, for best results, allow the cartridge to dry and carefully brush pleated surface areas to remove fine particles.

Algae, dirt and oils can form a coating on the cartridge pleats which may not be thoroughly removed by hosing. To remove such materials, soak the cartridge in a solution of filter element cleaner (available from your dealer). Follow directions for use and allow an hour for soaking. Hose thoroughly before reinstalling in filter.

If calcium or mineral deposits are excessive, the cartridge may be restored to "like new" condition by soaking in muriatic acid. Use commercially available 20% muriatic acid added to water in a 1 to 1 ratio. Use a plastic container and take extreme care when handling cleaning agents as they are harmful to eyes, skin and clothing.

Safety glasses and protective gloves must be worn during this cleaning operation. After cleaning, flush with water. NOTE: SEE ITEM 6 UNDER SAFETY INSTRUCTIONS.

CLP OPERATOR'S MANUAL

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A spare "standby" cartridge filter element is an excellent investment. It provides convenience and assures that your filter will always be ready to operate at peak efficiency. For best results, use only genuine Water Maze cartridges in your filter.

Winterizing:

If a heated area is not provided in areas where subfreezing temperatures can be expected, the entire machine must be drained.

Testing Carbon:

Remove the valve from the Carbasorb Filter and extract a carbon sample. Place carbon sample in the 4 oz. plastic bottle. (Fill the bottle 1/4 full of carbon, about 1 inch.)

Fill the 2 oz. bottle with water and add 1 drop of chlorine. Dip the chlorine test paper into the solution to ensure you have at least 100 parts per million of chlorine in the mixture. Add this solution to the carbon in the 4 oz. bottle. Cap and shake it periodically over a period of three minutes. After three minutes, dip a new piece of chlorine test paper into the solution. Compare the color with the color chart that comes with the test paper. If you get a reading, order new carbon. *There may be some dark discoloration from the carbon. Do not confuse this with the color caused by the chlorine.*

OZONE GENERATOR

Ozone...Nature's Purification Agent:

Ozone is produced in nature or artificially by man. In the earth's atmosphere, ozone is formed when oxygen is exposed to ultraviolet light or an electrical charge as during thunderstorms. Ozone's primary function in nature is to purify the air we breathe and screen us from harmful rays of the sun. In a similar fashion, the CLP system uses ozone to disinfect water because Ozone has a number of characteristics that make it ideal for water treatment.

History of Ozone for Water Treatment:

Ozone was first used to disinfect drinking water in Europe in 1893, and since the early 1950's for use in swimming pools and spas. Ozone's unique characteristics make it ideally suited for a variety of water treatment applications. For this reason, over 2,000 municipal water treatment facilities throughout the world use ozone as the primary disinfectant agent.

Ozone's Characteristics:

Ozone is well suited for water treatment, and its unique characteristics are described below:

- Ozone works up to 3,000 times faster than chlorine to kill bacteria and destroy harmful micro-organisms.

- Ozone is a more powerful oxidizing agent than chlorine and bromine, having a better ability to remove water contamination.
- Ozone will not form harmful by-products, like THM's (a problem in drinking water), or chloramines, (by-products of chlorine that are responsible for odors, skin irritations and burning eyes.)
- Ozone will not alter the water's pH, reducing pH fluctuations.
- Ozone coagulates small particles in water so clarity is dramatically improved.
- Ozone acts as a deodorizer removing unpleasant odors from water.

How the CLP Ozone System Works:

Because ozone is unstable, it cannot be packaged and used at a later date. For this reason, ozone is always produced where it is utilized.

Point-of-use ozone generation is simple. This powerful disinfectant is produced from ambient air surrounding the generator using special ultraviolet lamps located inside the system's cabinet. To generate the ozone, air movement is created through the use of an air compressor or water venturi. As air passes over these unique lamps, the oxygen contained in the air is converted. The resulting ozone gas is subsequently introduced to the water in the inlet pipeline, where oxidation and disinfection immediately takes place.

Ozone Generator Maintenance:

Caution: Never look at the unshielded ozone lamp while operating the unit. This lamp can cause severe eye and skin damage. The indicator light will be a dim red or not lit at all when operating properly. The light goes a bright red when there is a failure. See product description for location of the indicator light.

Testing the Lamp: (See page 15.)

To test the ozone lamp, use a voltmeter set on ohms. First remove the ozone cover and unplug the lamp plug from the ozone lamp. NOTE: There are two filaments - an upper and a lower - inside the lamp. Place one of the voltmeter leads on one of the lamp prongs and, with the other lead, touch all of the three remaining prongs. If continuity is not achieved on both upper and lower filaments, replace the ozone lamp (Part #6-0534) (See figure 14).

To test the power pack, use a voltmeter set on the correct voltage (120V or 240V). Place one of the voltmeter leads into the lamp plug where the white wire goes into it and plug the other voltmeter lead into the lamp plug where the blue wire goes into it. If no voltage is present replace the ozone ballast (Part #6-05231 - 120V, Part #6-05232 - 240V). When ordering an ozone ballast, you also need the 4-pin connector (Part #6-05233).

CLP OPERATOR'S MANUAL

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Replacing the lamp: (See Page 16.)

Lamp replacements are available from your Water Maze Dealer should they need to be replaced. Simply turn off the power to the Clarifier at the breaker, remove the screws on the power pack cover and remove the cover. Disconnect the plug on the end of the ozone lamp. Now, loosen the lamp holder locking ring from around the end of the lamp by turning it counter clockwise and remove it. Remove the lamp by grabbing the rubber bushing around the end of the lamp and pulling it straight out. Remove the rubber bushing from the lamp and install it on your new lamp, making sure the outer edge of the bushing is flush with the outer edge of the silver end cap on the lamp. Now, slide the lamp back into the reaction chamber. The lamp holder may now be reinstalled and tightened. Reinstall the plug onto the lamp and replace the power pack cover. **Caution:** Keep the lamp free of fingerprints and dust particles by only handling the metal end caps on the lamp. You can clean the lamp with rubbing alcohol and a soft cloth. A dirty lamp will not allow maximum ozone output.

SPECIFICATIONS:

Energy required 110V: 105VAC MIN., 125VAC MAX., .800 AMP/Ballast

Energy required 220V: 210VAC MIN., 230V MAX., .450AMP/Ballast

Power Consumption: 20Watts

Average Lamp Life: 9,000 Hours

Lamp Wavelength: 185 nm

CHEMICAL MAINTENANCE PROGRAM**Owner Chemical Maintenance Program to Maintain Recycled Water Quality:**

Daily monitoring and adjustment of Water Maze recycled water chemistry is essential. If not monitored and controlled, the recycled water will become chemically unbalanced resulting in a host of problems such as algae and bacteria growth, obnoxious odors, iron discoloration and ultimately it will be unfit for reuse and must be disposed of.

The daily monitoring and adjustment maintenance program presented herein will, if followed, provide suitable recyclable wash water. The proper maintenance of the water is not complicated and depends upon a few basic principles which are:

1. Physical - effective filtration and recirculation of the water

Effective recirculation of the water through the catch basin, and the CLP is achieved only if the system is utilized often (daily 6-8 hours or more) or if the system is set to recirculate the water throughout the total system. The CLP has controls and procedures to achieve continuous effective

water recirculation throughout the process. Therefore, if the CLP is operated properly, it will achieve the required need of effective filtration and recirculation.

2. Chemical - proper adjustment of alkalinity and pH

The most important factor to control and maintain is the pH of the water (i.e. the acidity or alkalinity). If the recycled water is acidic (low pH) it will dissolve iron into solution. The presence of iron of more than 0.2 ppm will result in rusty staining of virtually anything the water comes in contact with. Alkaline water can cause cloudiness and greatly reduces the effectiveness of chlorination. Many of the cleaning detergents are alkaline and will make the recycled water too alkaline. Also, high alkaline water is difficult to filter and decreases filter media life. The proper pH range to maintain is 6.8 - 7.2.

Alkalinity refers to the soluble salts in the water. These include bicarbonates, carbonates, hydroxides and other alkali compounds. The water's total alkalinity controls its resistance (buffering ability) to large fluctuations in pH levels.

Another factor which should be monitored for proper water chemistry balancing is calcium hardness. The presence of too much calcium can lead to the formulation of scale in the filters.

3. Biological - adequate disinfection, algae, bacteria, and odor control

Chlorination and ozonation are used to control bacteria, odor and algae formation. For chlorine to be effective, it must be available as free chlorine. If the proper pH and alkalinity is not maintained, or if the water contains dirt particles, the chlorine will be combined chlorine and not be effective in the control of algae and bacteria growth. Combined chlorine has only 1/15th the strength of free chlorine. Ozonation is used in the CLP system. Chlorine can be added to help with control if needed.

Inadequate or improper addition of chlorine could result in algae and bacteria growth. Once algae and a bacterial growth starts, the system must be shock treated. It is best to minimize the chances of algae and bacteria problem.

The killing of bacteria by chlorine exists in two phases:

1. The penetration of the active germicidal principal (hypochlorous acid) into the bacterial cell.
2. The chemical combination of this ingredient with the protoplasm (the complex composition which forms the essential part of plant and animal cells). This combining is directly responsible for the death of the organism.

CLP OPERATOR'S MANUAL

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The activity of this germicidal effect is reduced in alkaline solutions (those with a pH* greater than 7.5) and expressed as follows:

pH	% of Effectiveness
4.0	100.0
5.0	99.6
6.0	95.8
7.0	69.7
8.0	18.7
9.0	2.2
10.0	0.2

Hypochlorite when added to solutions with a pH lower than 6.0 can produce oxide which is toxic. In vehicle washing, almost all cleaning compounds are alkaline in nature. Hypochlorite will still control bacterial growth and thus smell at higher alkaline ranges, but as the table indicates, its effectiveness is reduced.

To compensate for this inhibited activity, a larger quantity of hypochlorite is used. This will control bacterial growth but will increase operational costs.

Typical hypochlorite has a pH of approximately 11.6. This high pH will only increase the pH of holding tank water making pH adjustment more difficult.

Trichloro-S-Triazine Trione is a chlorine compound which has a pH of 3.0 and when added to holding tanks will aid in the reduction of tank pH levels.

Unlike hypochlorite, which is usually 15 percent chlorine and will produce sodium or calcium salts in holding tanks, these new products are 99 percent chlorine which means that if a solid "puck" of chlorine is used, the total effectiveness of the puck is superior to that of hypochlorite and no negative by-products are produced.

DAILY CHEMICAL MAINTENANCE

Step 1. Collect a water sample from tank #1. **NOTE:** Be sure that the water is circulating from the sump through the CLP system and back to the catch basin.

Step 2. Using the test strips supplied, measure:

- The pH.
- The total chlorine (if using chlorine).
- The free chlorine (if using chlorine).
- The alkalinity (if needed).
- The calcium hardness (if needed).

Step 3. If the pH is 6.8-7.2 go to Step 4, if not, adjust the pH in the water being recycled between the oil water separator and the pit to pH 6.8-7.2. Muriatic acid or liquid Alum can be used to lower the pH. Soda ash (sodium carbonate) or caustic soda (sodium hydroxide) can be used to raise the pH.

Adjust the pH gradually allowing complete mixing after adding chemical. Take a new sample, read the pH and continue to adjust gradually until the desired pH is achieved.

Step 4. The total alkalinity should be between 50-150 ppm. If the total alkalinity is too low add sodium bicarbonate to raise it. If total alkalinity is too high, add muriatic acid to bring it within acceptable range. This will also decrease the pH. If the pH goes below 7.0, add sodium bicarbonate to increase the pH. This procedure may have to be repeated several times to get the pH and a total alkalinity into the proper range.

Step 5. The calcium hardness should not exceed 25 grains. If it is too high, some water must be removed from the system and fresh makeup water added. Alternatively, an ion exchange water softener or an ionizer may have to be added to the system to reduce and maintain lower calcium hardness levels.

Step 6. Free chlorine levels should be 1-2 ppm. If chlorine is added for additional control. A 10-50% concentrated liquid chlorine is available at pool supply outlets. Household bleach can be used, but contains only 5% chlorine. Chlorine continually dissipates and becomes used up and the chlorine level must be adjusted daily. Remember chlorine is most effective when the pH level is correct (6.8-7.2).

Initially, in order to achieve proper water chemistry balance, extra time is needed. However, once achieved, it can be easily maintained in a minimum amount of time by daily monitoring and adjustment.

The CLP unit has an ORP/pH Controller which automatically maintains the ORP and pH levels. Total alkalinity and hardness must be checked manually.

ORP MEASUREMENT SYSTEM

Measuring ORP is similar to measuring pH. Platinum is sensitive to electron activity in the same manner as pH-sensitive glass is sensitive to the presence of (activity) the hydrogen ion. In a typical ORP sensor, the electrode is nearly identical to the pH electrode, with the platinum surface (usually a platinum rod or band) serving as the measuring half of the electrode, and a silver/silver chloride reference wire in a potassium chloride (KCl) reference electrolyte serving as the reference half (Figure 16). Several manufacturers offer ORP sensors.

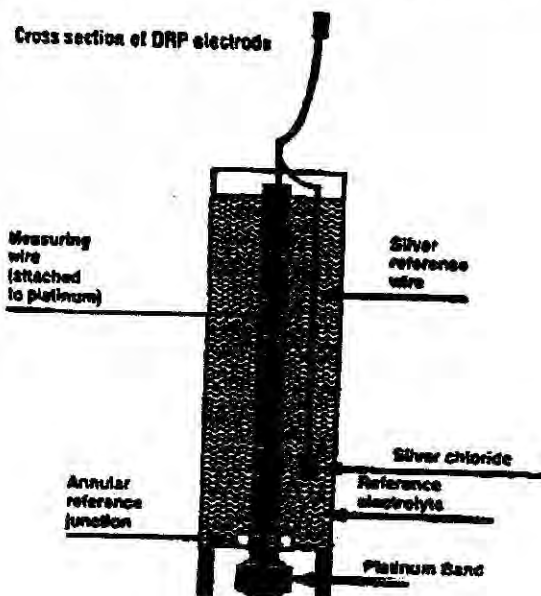
The electrode can be looked on as a battery where voltage flows from the measuring side to the reference side. The reference electrolyte completes the circuit by providing an electrical connection back to the solution being measured. For this reason, the reference junction must remain clean and free flowing.

Care of the ORP electrode also mimics that of pH instrumentation. For instance, the electrode must remain in the solution at all times, and the system will require routine cleaning and calibration to compensate for electrode deg-

CLP OPERATOR'S MANUAL

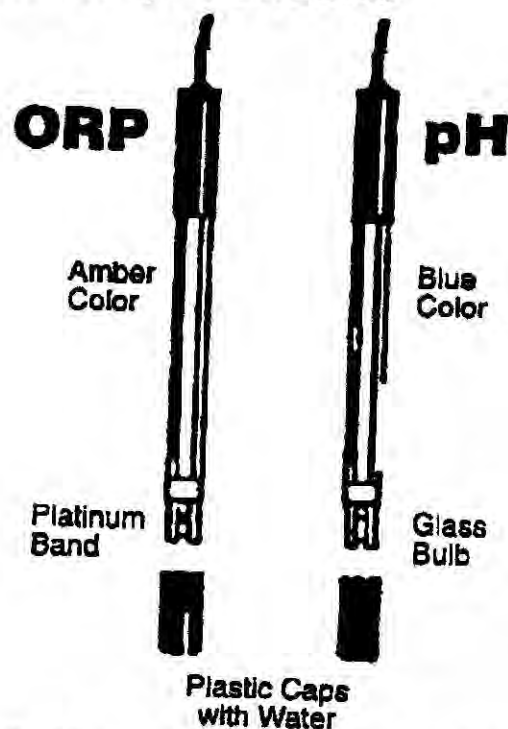
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radiation. It is likely that the electrode will require replacement every one to two years, depending on the application.



Cleaning the ORP electrode is best done with a five percent hydrochloric acid solution. This solution is most effective for solubilizing hard-water deposits that may occur in the reference junction. It is important to keep the reference junction free flowing to enable the reference electrolyte to carry the reference voltage back to the solution.

Calibration should be a regular maintenance task. A monthly frequency is typical in many disinfection situations. Calibration is best accomplished in freshly made solutions of quinhydrone saturated into pH 4.0 and 7.0 buffer solutions. Quinhydrone is a weak reducing agent whose activity changes with pH. By adding it to solutions of known pH, standard ORP solutions of 87 mV (7.0 pH) and 284 mV (4.0 pH) can be produced. These solutions are used to monitor the offset (standard) and slope (slope) of the electrode as it degrades over time. Quinhydrone should be stored cool, and fresh solutions employed for each calibration.

ORP and pH SENSORS

How should I clean the sensors? The cleaning of the ORP/pH sensors must be done on a weekly maintenance schedule if used in a moderate to heavy oil and dirt load; on a monthly maintenance schedule if used in a low oil and dirt level.

To clean the sensors, do the following: Loosen the sensor from the compression tee. With a Q-Tip and any household degreaser (i.e. 409) spray and wipe the sensor probe clean. Rinse with clean water. Dip the sensors in muriatic acid to remove hard water deposits. Rinse with clean water.

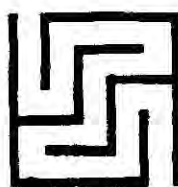
To check sensor for proper operation place a small amount of white vinegar, muriatic or hydrochloric acid into a cup and place sensor probe into solution. For the pH sensor, flip controller switch to pH reading. The needle should drop. For the ORP sensor, flip controller switch to ORP reading. The needle should rise.

Note: Only clean one sensor at a time. Sensors must stay in some kind of liquid at all times.

CENTRIFUGAL PUMP

Your centrifugal pump has been quality-built and engineered to give you efficient, dependable service. It is equipped with union connectors to make installation and future service easier.

The advanced design uses a single speed motor which reduces operation and maintenance to simple, common-sense procedures.



WATER MAZE®

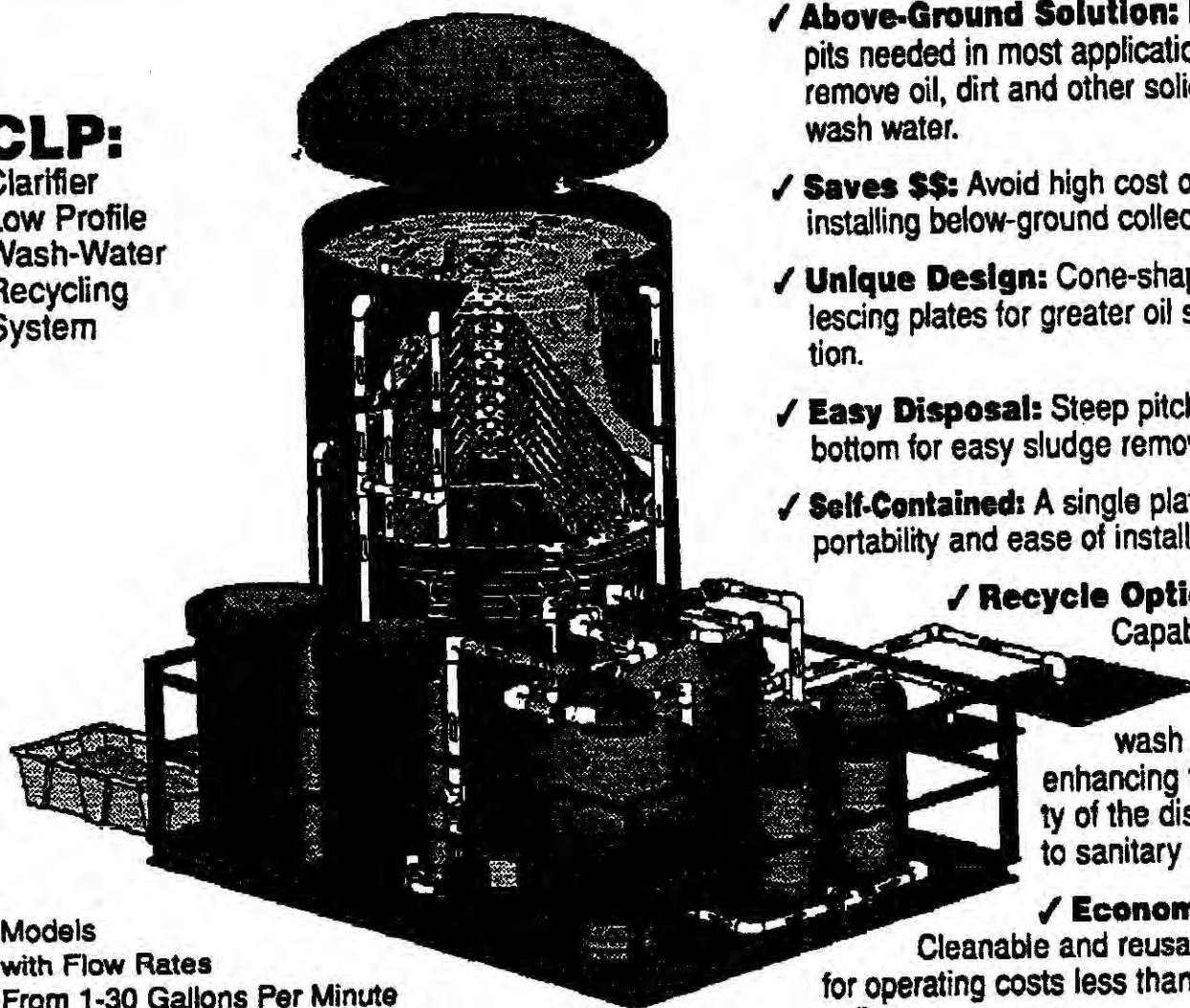
CLP

WASH-WATER RECYCLING SYSTEMS

FAX FACTS FROM LANDA

CLP:

Clarifier
Low Profile
Wash-Water
Recycling
System



Models
with Flow Rates
From 1-30 Gallons Per Minute

- ✓ **Above-Ground Solution:** No large pits needed in most applications to remove oil, dirt and other solids from wash water.
- ✓ **Saves \$\$:** Avoid high cost of installing below-ground collection pits.
- ✓ **Unique Design:** Cone-shaped coalescing plates for greater oil separation.
- ✓ **Easy Disposal:** Steep pitched cone bottom for easy sludge removal.
- ✓ **Self-Contained:** A single platform for portability and ease of installation.

✓ **Recycle Option:**

Capable of recycling wash water or enhancing the quality of the discharge to sanitary sewer.

✓ **Economical:**

Cleanable and reusable filters for operating costs less than 1/4¢ per gallon.

MODELS:

CLP systems are a blend of the benefits found in LANDA's self-contained Delta systems and above-ground Clarifier systems:

CLP-7021A: Most basic system; flow rate: flow 1-15 GPM

CLP-7022A: Includes upgraded carbon filtration; flow 1-15 GPM

CLP-7023A: Provides additional media filtration; flow 1-15 GPM

CLP-7032A: Includes upgraded carbon filtration; flow 1-30 GPM

CLP-7033A: Provides additional media filtration; flow 1-30 GPM

CLP wash-water recycling systems are ETL tested to meet all UL and OSHA standards.

J&D SALES AND SERVICE

Joseph D. Farino
195 Blau Road
Hackettstown, NJ 07840
(908) 852-1526

LANDA
WATER CLEANING SYSTEMS

Updated 4/98

CL 7023

0.0 GENERAL

The wash water treatment/reclaim system will include a level activated sump pump, a coalescing oil/dirt/water separator, a skimmer to remove free floating oil, and an ozone generator for bacteria control. All of the equipment in this section shall be supplied by one supplier as a package system. The equipment shall be a Water Maze CLP 7023, as manufactured by Landa, Inc., 13705 NE Airport Way, Portland, OR, 97230-1048, Phone 1-800-547-8672.

1.0 WASH WATER TREATMENT/ RECLAIM SYSTEM

This section of the specification covers the performance and specifications for the wash water treatment, oil water clarifier system.

1.1 PERFORMANCE

The wash water treatment system shall be capable of treating waste water generated from the cleaning of machinery and equipment, separating free oil and dirt from the water. The processes used in providing water suitable for sanitary discharge or reuse are: aeration, gravity separation, incline plate oil attraction, static solids separation, coalescing separation, ozone disinfection, oxidation and solids bag collection. NOTE: "Suitable for sanitary discharge" is defined as the allowable discharge limits in your area. The wash water treatment system will:

Remove all physical particles down to 20 microns (5 microns optional).

Remove all free oil droplets 1 micron and larger. (When detergents are not used).

Remove trace quantities of chemicals and solvents, such as those in common degreasing agents, which may periodically be used in vehicle and equipment cleaning.

Sterilize the treated water before storage and reuse with ozone.

Be capable of processing up to 15 gpm of waste water.

Recirculation for added bacterial control.

As the water is recirculated it will be electronically monitored to determine the ORP/pH adjustment necessary and in turn, automatically add the pH adjusting and the ORP adjusting chemicals called for by the monitor.

1.2 GENERAL DESCRIPTION

The system shall be a module requiring a suitable base pad and minimal assembly. The system supplied will include the following:

1.2.0 This unit will be a self-contained unit mounted on a base with side rails measuring 96" L x 72" W. This unit will have a maximum height of 110".

1.2.1 A float level activated 1/2 hp, 230V single phase, 60Hz, sump pump. A float switch is provided to keep the sump pump from running dry of water.

1.2.2 A corrosion resistant, cone shaped, polyethylene oil/solids/water coalescing separator with the following features:

An automatic timer controls a pump for continuous recirculation of the four tube ozone generator with an injector which gives 97% contact with the water for bacteria and odor control, a cone bottom tank containing ten polypropylene vertical corrugated solids settling plates, and an isolated solids collection chamber which can be drained and cleaned by opening a drain valve. The solids will collect in a bag for easy handling.

A coalescing separation chamber containing a corrugated coalescing pack constructed of oleophillic (oil loving) polypropylene material with a minimum of 340 sq. ft. of coalescing surface area.

An adjustable oil skimmer capable of removing free oil floating to the top. The oil is then directed to an oil decanter for further separation.

The oil/water separator shall come equipped with an automatic ozone generator for circulation and bacteria control.

Waste stream must change flow path and travel up angled polypropylene plates for maximum oil/solids/water separation.

A transfer pump used to push processed water back to the pressure washer or to discharge in case of an over filling of the sump pit. The system will be designed as a zero discharge system to provide wash quality water.

A 65 gallon vertical holding tank containing a n/o float switch which turns the filter pump on and off as the water level raises and lowers. A n/o float switch shall be provided to turn the filter pump off if the tank water level becomes abnormally low.

A filtration pack (Filter Pac III) shall be provided which pre-filters through a 350 lb. corrosion-resistant, ultra-violet resistant, precision molded one-piece media filter that is capable of pressurized backwashing. The water is then filtered to 20 microns, 5 microns optional, through two 200 sq. ft. non-corrosive thermoplastic cartridge filters and 200 lbs. of degassed virgin activated carbon to adsorb various contaminants in a corrosion-resistant, ultra-violet resistant, precision molded one piece pressurized

backwashing tank.

An additional 65 gallon tank will be provided to hold processed water and a n/c float switch to open the rain water overflow solenoid if the tank level becomes too high. A n/o float switch will turn the transfer pump off and opens the fresh water make up solenoid if the tank level becomes too low. A n/c float switch which turns the filter pump on and off.

1.3 INSTALLATION/START-UP SERVICE

A representative from LANDA will provide two days of installation training of owner personnel and start-up service.

1.4 MAINTENANCE CONTRACT

The supplier of the equipment in this section shall offer with this proposal a monthly preventative maintenance contract, covering all the equipment and a price list for any consumable items.

1.5 QUALITY CONTROL

All equipment in this section will be pre-tested at the factory prior to shipment. The manufacturer shall provide a written warranty that the products provided will be free from defects in material or workmanship for a period of 12 months from date of purchase, 90 days on electrical components, when used in accordance with written instructions and guidelines provided by the manufacturer. See warranty for exact details.

1.6 PAINT

The CLP shall be, except for the tank, painted with an epoxy powder coating and baked on at 400° Fahrenheit.

1.7 OPERATION AND MAINTENANCE MANUAL

One copy of the Operating and Maintenance Manual and video will be furnished with the equipment. The manual will contain all pertinent information on the equipment and parts in the equipment.

1.8 EXECUTION

The complete system shall be installed in accordance with manufacturer's instructions and recommended cleaning chemicals for proper operation.

Appendix XII
Stormwater Surface Water Sample Protocols

SAMPLE COLLECTION TIMING

Stormwater runoff samples will be collected from the six on-site surface water monitoring stations and one off-site station (see Figure 6) three times per year, once each in the spring, summer, and fall. The rainfall events during which these samples will be collected must be no less than one quarter inch, measured at the Hudson National Golf Club. Reasonable efforts will be made to sample the runoff close to the time of first flush, i.e., at the beginning of the runoff event. The appropriate timing of the sampling is discussed below.

Spring and Fall Sample Collection. During spring and fall, stormwater runoff samples will be collected by the grab method (see collection method discussion below) between 4 hours to 10 hours following the accumulation of one quarter (1/4) inch of rainfall. The office of Hudson National's golf course superintendent (Gregg Stanley, CGCS) may be contacted at (914) 271-1468 for the purpose of obtaining real-time rainfall information recorded at the Hudson National Golf Club's weather station. If it is not possible to determine when one quarter inch of rainfall has occurred on the golf course, then sampling will occur within 10 hours to 18 hours following the start of rainfall.

The first sample in the spring of each year will be taken after the first pesticide application has been made on the golf course. Should no water be available at the sampling locations during the monitoring event, i.e., the storm event did not produce sufficient runoff, two additional attempts will be made to obtain a sample within the same season. If after three attempts in one season a storm event sample cannot be successfully obtained, then no further attempts will be made until the next season.

Summer Sample Collection. During the summer, stormwater runoff samples will be collected by the grab method 2-8 hours following the accumulation of one quarter inch of rainfall. If the real-time rainfall accumulation data are not available, then sampling will occur within 6 hours to 14 hours following the start of rainfall. The shorter response time is due to the nature of rainfall occurring during the summer, which is generally more intense and of shorter duration than during the spring and autumn.

COLLECTION METHODS

Grab Sample Collection. The samples will be collected by hand in laboratory-prepared bottles. The bottles will be placed into the surface water flow facing upstream. Proper care will be taken not to disturb the stream channel substrate before or during the grab sampling so as not to stir up sediments into the water column and potentially into the sample. When the flow is deep enough, the lid will remain on the bottle until it is submerged, then the lid will be removed to obtain the sample from the vertical mid-point of flow.

After the sample is obtained, the water will be transferred to laboratory-prepared sample containers that include proper preservatives and labels. The filled sample containers will

immediately be placed in a cooler and packed with ice. The analytes, proper container types, preservatives, and holding times for surface water samples are given in Tables 12 and 13 of the EMP. The only pesticide analytes from Table 12 that are to be analyzed for a particular sampling event are those that have been applied to the golf course.

The samples will be shipped to the analytical laboratory by priority overnight express delivery after proper packaging and completion of the chain-of-custody record.

In stream Passive Samplers. Alternatively, In stream passive samplers may be used to collect water samples on rising stream flows during a storm event. An In stream passive sampler is essentially a bottle (glass or plastic, depending on the analytes) fitted with a special rubber stopper on the opening. Two glass tubes are positioned parallel to each other through two holes in the stopper. Each tube extends into the glass bottle. One tube is shorter than the other. This is the sampling tube. The longer tube is a vent, allowing air in the bottle to escape as the bottle fills with water. The bottle is positioned in the stream channel just before a storm event so that the shorter tube, the sampling tube, extends slightly above the surface water flow. If no flow is present, then the water intake tube must be set so that the first flow of water in the channel will pass into the bottle. The installation of a V-notched weir in conjunction with the In stream samplers at some or all of the monitoring stations may be necessary to assure the collection of the rising water in the streams in response to storm runoff. The In stream passive sampler provides for the collection of water without the need for a sampling technician to be present at the time of the first flush of the storm event. The concept for this In stream passive sampler collection method was introduced for this project by ENSR, Northborough, MA. A schematic drawing of the In stream passive sampler is attached.

The In stream passive samplers are deployed into the stream channel at each monitoring station not more than 24 hours in advance of an anticipated storm event. This is a necessary step to establish the proper position of each sampler's water intake tube. The samplers are promptly removed following each sampling event. The sampler bottles are properly cleaned and sealed prior to each deployment. Each sampling station will require at least two samplers; one for inorganic analytes and one for pesticide analytes.

The sampler bottles should be retrieved from their In stream locations within six hours of the sampling event; at a minimum, the bottles must be retrieved within 24 hours and prior to the next storm event. Subsamples are poured into individual sample containers, each properly labeled and including the appropriate preservative. The sample containers are sealed and immediately place into a cooler packed with ice. The analytes, proper container types, preservatives, and holding times for surface water samples are given in Tables 12 and 13 of the EMP. The only pesticide analytes from Table 12 that are to be analyzed for a particular sampling event are those that have been applied to the golf course.

The samples are shipped to the analytical laboratory by priority overnight express delivery after proper packaging and completion of the chain-of-custody record.

This sample collection method is preferred for several reasons. It provides for improved sampling consistency, more reliable collection of the storm runoff first flush, and the sample is more representative of an extended time period during the start of a runoff event compared to the instantaneous grab sample. However, this sample collection strategy is more complicated logistically and requires the proper design and installation of the passive In stream samplers and related structures at each surface water monitoring station.

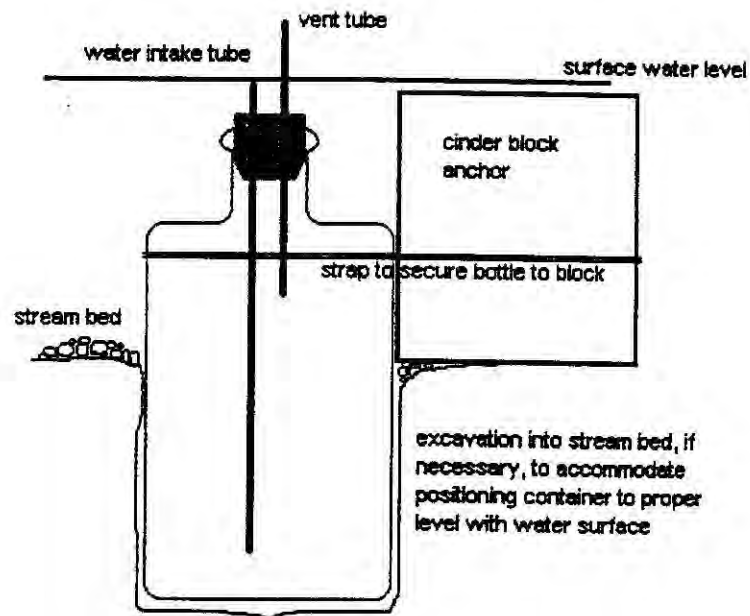
FIELD PARAMETER MEASUREMENT

The following parameters will be measured in the field at the time of sampling: pH, temperature, specific conductivity, turbidity, and the rate of flow. All readings, measurements, and observations will be recorded on appropriate field sampling data sheets, an example of which is provided in Appendix V of the EMP. Field analysis SOPs must be approved by the Study Director in advance.

When In stream passive samplers are used for sample collection, the field parameter measurements will be made from subsamples of the water collected in the samplers. For this reason, it is critical that the samplers are retrieved as soon as possible following sample collection.

ADDITIONAL INFORMATION

Refer to the main Water Quality Monitoring discussion in the EMP starting on page 48 for additional information about the monitoring program at the Hudson National Golf Club.



In Stream Passive Sampler