A Review of Benefits and Issues Associated with Natural Grass and Artificial Turf Rectangular Stadium Fields

Prepared by a Staff Work Group from Montgomery County Public Schools, Montgomery County Department of Parks, Montgomery County Council, Montgomery County Department of Environmental Protection, and Montgomery County Department of Health and Human Services

September 15, 2011

Final Report

Appendices A through M

Appendices

A. Summary of Artificial Turf Fields (ATF) Located at Maryland and Neighboring Public School Systems

B. Warranty for Montgomery Blair High School artificial turf field.

C. Life-Cycle Cost Maintenance Assumptions

D. Life-Cycle Cost Analysis Detail and Assumptions

   1. MCPS high school stadium fields

   2. Montgomery County Parks fields

E. Excerpt from MCPS Athletic Handbook on Heat and Air Quality

F. Montgomery County Department of Environmental Protection attachment to the July 1, 2010, Montgomery County Transportation, Infrastructure, Energy, and Environment Committee meeting packet

G. Results from ongoing synthetic turf monitoring plan being managed by the San Francisco Public Utilities Commission (SFWater).

H. Sampling Results from SFWater

I. Letters from Montgomery County Citizens Advisory Boards

   1. Western Montgomery County CAB Letter to The Honorable Nancy Floreen, President Montgomery County Council, September 30, 2010

   2. Mid-County CAB Letter to the Honorable Isiah Leggett, County Executive and Ms. Mary Bradford, Director Montgomery County Parks, June 17, 2010

J. Resolution from the Montgomery County Storm Water Partners Network, undated

K. Solid Waste Advisory Committee (SWAC) – Annual Meeting with the County Executive, February 10, 2011

L. City of San Francisco Specification for Artificial Turf Fields

M. Memo from Dan Mauer dated July 8, 2009, to the San Francisco Recreation and Park Commission on provisions to reduce the environmental footprint of artificial turf fields

N. All Comments Received on the Draft Report During the Public Comment Period (April 13, 2011 through June 7, 2011)
   - NOTE: Appendix N is packaged separately from Appendices A through M

Appendix A: Summary of Artificial Turf Fields (ATF) Located at Maryland and Neighboring Public School Systems

Jurisdiction	Number of High Schools	Number of ATF Stadium Fields	Considering one or an additional ATF	Vendor(s)	Satisfaction level				Heat Issues	Hot Weather Practice Guidelines
					Extremely	Very	Satisfied	Not Satisfied		
Maryland										
Allegany	3	2	no	Field Turf Tarkett	X				no	Heat index card to determine type of practice - Heavy,light, not at all (for band, drill team etc also)
Anne Arundel	12	11	includes two under construction	Field Turf Tarkett one field, Sunny Acres for other eight					no	no special guidelines
Baltimore City	21	2	1	Sportexe	X				none	none
Baltimore County	24	5	yes	Field Turf Tarkett		X			no	no
Calvert	4	0	not yet							
Caroline	2	0	not yet							
Carroll	8	0	yes - new high school							
Cecil	5									
Charles	6	1	?	?		X			no	athletic trainers determine heat factors;
Dorchester	2	0	no							
Frederick	10	4	not at this time	Sprint Turf		X				Found 8-10º ambient temp difference with natural grass - same
Garrett	2									
Harford	10	5	yes	3 Field Turf Tarkett, 2 Geo Sport, 1 Astroturf	with Field Turf Tarkett			with Geo Sport	no	practice early, coaches check temps (1 coach thought natural grass area was hotter)
Howard	12	0	yes							All Bermuda Fields
Kent	1	0	no							
Montgomery	25	3	yes	Field Turf Tarkett	X				no	
Prince George's	22	0	yes							
Queen Anne	2	0	yes							
St. Mary's	3	0	no							
Somerset	2	0	no							
Talbot	2	0								
Washington	7	1	maybe						no	none
Wicomico	4	0	no							
Worcester	3	1								
Maryland Total	**192**	**35**	**18.2%**							
Neighboring										
Fairfax	26	6	yes						no	none
Washington DC	11	10								
Arlington	5	3								
Neighboring Total	42	19	**45.2%**							
Total All Schools	**234**	**54**	**23.1%**							

Appendix B: Montgomery Blair High School FieldTurf Warranty

Manufacturer's Limited Warranty

FieldTurf warrants that if **FieldTurf FTOM 1F** for football/soccer/lacrosse/field hockey synthetic turf proves to be defective in material or workmanship, resulting in premature wear, during normal and ordinary use of the Product for the sporting activities set out below or for any other uses for which **FieldTurf** gives its written authorization, within 8 years from the date of completion of installation, **FieldTurf** will, at **FieldTurf's** option, either repair or replace the affected area without charge, to the extent required to meet the warranty period (but no cash refunds will be made). This warranty does not come into effect unless the Certificate of Completion is sent for validation to the head office of **FieldTurf** indicated below within 30 days of installation or customer use, whichever occurs first. This warranty is limited to the remedies of repair or replacement, which shall constitute the exclusive remedies available under this warranty, and all other remedies or recourses which might otherwise be available are hereby waived by the Buyer. **FieldTurf** will have no other obligations or liability for damages arising out of or in connection with the use or performance of the product including but without limitation, damages for personal injury or economic losses.

Other Exclusions

This limited warranty does not cover:

1. Damage resulting from accident, force majeure, misuse, intentional and unintentional abuse, infill displacement, and neglect or from other than normal and ordinary use of the Product. Normal and ordinary use is considered as usage up to 3,000 hours per year of regular play and utilization for the sporting activities set out in the warranty. Normal play and ordinary use includes a reasonable number of users or participants and does not include repetitive marching, repetitive training or high-intensity drills on the same part of the field, in particular to, but not limited to white or yellow lines, goal areas, and sideline areas, or the area around the bases, home plate and the pitcher's mound.
2. Damage resulting from failure to maintain the Product in accordance with the maintenance and use instructions provided to the buyer. Buyer shall produce maintenance logs.
3. Damage resulting from repair, attempted repair or maintenance by anyone other than **FieldTurf** or an authorized distributor or authorized third party serviceman.
4. Damage due to causes which include but are not limited to the application of chemicals or cleaning agents, adhesive backing, dirt, traffic, normal matting, negligence, vandalism, fire, flood, windstorm, animals and improper care.
5. Failure or improper design of the base. Depression of the soil or matter upon which the base or Product rests.
6. Use of improper footwear such as long spiked track shoes and regular use of steel cleats. Standard soccer or football cleats are recommended. Flat soled shoes such as work boots should be avoided.

We disclaim liability for incidental and consequential damages for breach of any express or implied warranty, including any implied warranty of merchantability, with respect to the Product. In the event that the Product is used for purposes other than the specific sporting activities set out herein or any other uses for which **FieldTurf** gives its written authorization, it being understood that **FieldTurf** has tested the Product for use in connection with these sporting activities and may not have tested it for other uses, **FieldTurf** shall not be responsible for any and all damages incurred and this limited warranty as well as all legal warranties shall become null and void. Any product repairs or replacements performed under the terms of this guarantee shall not lead to any extension whatsoever of the guarantee.

Name of purchaser: ***Montgomery County Department of Parks, 9500 Brunett Ave., Silver Spring, MD 20901***

Date of completion: *August 10th, 2009*

Sporting Activities: *Multi Sport use*

Location: *Montgomery Blair High School*

Installed by: *FieldTurf USA*

Address: *51 University Boulevard*

City: *Silver Spring*

State: *Maryland*

Zip: *20901*

Tel: *(301) 649-2451*

Fax:

Signature:

(Please Print Name) *Michael MacNeil*

Date: *August 14th, 2009*

Reference: *061749*

This warranty is insured by a third party. For more information please contact Costumer Service at FieldTurf at the number listed below.
FieldTurf 8088 Montview Road, Montreal, Quebec, Canada, H4P 2L7 Toll Free: 1-800-724-2969

FieldTurf Tarkett
UNITED IN SPORT

Appendix C:

Major Lifecycle Cost Assumptions

Turf Selection	Artificial Turf	Bermuda Grass	Kentucky Blue Grass	Bermuda Grass	Cool Season
Base	**Stone**	**Sand Base**	**Sand Base**	**Native Soil**	**Native Soil**
Size	75,000 to 95,000 square feet	75,000 to 95,000 square feet	75,000 to 95,000 square feet	75,000 to 95,000 square feet	75,000 to 95,000 square feet
Irrigation	No	Yes	Yes	Yes	Yes
Stormwater Management Goal	**Detain, infiltrate, or treat excess runoff to mimic the natural hydrology of woods in good condition.** Natural turf is treated as pervious so a portion of the one-year storm requirement is assumed to be met via natural drainage. Artificial Turf is considered impervous and therefore more treatment is assumed to be needed to meet the same requirement.				
Equipment	Groomer, Utility Cart, Sweeper	Leased Mower, Sprayer, Tractor, Topdresser, Aerator, Verticutter	Leased Mower, Sprayer, Tractor, Topdresser, Aerator, Seeder	Leased Mower, Tractor, Aerator, Verticutter	Z-Mower
Typical Annual Maintenance Practices					
Fertilizer	n/a	10 liquid and 10 granular applications	15 liquid and 10 granular applications	5 liquid and 7 granular applications	4 granular applications
Seed	n/a	1 split overseeding application with rye grass for color in the fall	1 fall and 1 spring seeding	1 split overseeding application with rye grass for color in the fall	1 fall and 1 spring seeding
Water	n/a	Summer months: ½ inch of water 3 times per week, Other months: ½ inch 2 times per week. Irrigation estimate = 1 million gallons per year	Summer months: daily watering up to ¼ inch depending on heat, Other months: ½ inch 2 times per week.	2/3 the requirement of sand base fields	2/3 the requirement of sand base fields
Fungicide	n/a	n/a	Preventative program: 4 applications during the summer	n/a	n/a
Pesticide	n/a	n/a	grub treatment as needed	n/a	grub treatment as needed
Mowing	n/a	36 to 40 week cutting season:5 times a week for 20 weeks, then 2 times a week for the other 16-20 weeks, use energy efficient Fairway mowers (diesel engine/hybrid)	36 to 40 week cutting season:3 times a week for 20 weeks, then 1 time a week for the other 16 to 20 weeks, use Z mower (gasoline engine)	4 times a week for 20 weeks then 2 times a week for the other 16-20 weeks, bluegrass 3 times a week, 1 time a week (36 to 40 weeks) Fairway mowers (diesel engine spinning electric alternator) hybrid versus Z mower (gas) burns more fuel.	36 to 40 week cutting season:1 time a week for 40 weeks, use Z mower (gasoline engine)
Grooming	2 times per month	n/a	n/a	n/a	n/a
Sweeping	every 3 weeks	n/a	n/a	n/a	n/a
Paint	Permanent lines assumed for all sports.	Once per week painting of each sport as needed.	Once per week painting of each sport as needed.	Once per week painting of each sport as needed.	Once per week painting of each sport as needed.
Top Dressing	n/a	6 times per year	4 times per year	n/a	n/a
Sod/Resprigging	n/a	once per year after heavy use in the spring	resod heavily used areas twice per year	once per year after heavy use in the spring	resod heavily used areas twice per year
Other Costs					
Add Infill	once during life of carpet	n/a	n/a	n/a	n/a
Renovation	replace carpet after 8 years	strip off, grade, and sod every 10 to 12 years	strip off, grade, and sod every 10 to 12 years	strip off, grade, and sprig every 10 to 12 years	strip off, grade, and seed every 10 to 12 years
Disposal	require replacement field contractor to recycle old field	n/a	n/a	n/a	n/a

Lifecycle Comparison of Artificial Turf and Natural Grass Fields at MCPS High School Stadiums

	Artificial Turf (w Crumb Rubber Infill)				Bermuda Grass (w Sand Base)			Kentucky Bluegrass (w Sand Base)			Bermuda Grass (w Native Soil Base)			Cool Season Grass (w Natural Soil Base)		
Year	Capital	Maintenance	Revenue	Net Cost	Capital	Maintenance	Cost				Capital	Maintenance	Cost	Capital	Maintenance	Cost
1	1,125,000	10,000	(80,000)	1,055,000	530,000	50,000	580,000	580,000	50,000	630,000	150,000	45,000	195,000	75,000	25,000	100,000
2		10,000	(80,000)	(70,000)		50,000	50,000		50,000	50,000		45,000	45,000		25,000	25,000
3		10,000	(80,000)	(70,000)		50,000	50,000		50,000	50,000		45,000	45,000		25,000	25,000
4		10,000	(80,000)	(70,000)		50,000	50,000		50,000	50,000		45,000	45,000		25,000	25,000
5		13,000	(80,000)	(67,000)		50,000	50,000		50,000	50,000		45,000	45,000		25,000	25,000
6		10,000	(80,000)	(70,000)		50,000	50,000		50,000	50,000		45,000	45,000		25,000	25,000
7		10,000	(80,000)	(70,000)		50,000	50,000		50,000	50,000		45,000	45,000		25,000	25,000
8		10,000	(80,000)	(70,000)		50,000	50,000		50,000	50,000		45,000	45,000		25,000	25,000
9	640,000	10,000	(80,000)	570,000		50,000	50,000		50,000	50,000		45,000	45,000		25,000	25,000
10		10,000	(80,000)	(70,000)		50,000	50,000		50,000	50,000		45,000	45,000		25,000	25,000
11		10,000	(80,000)	(70,000)		50,000	50,000		50,000	50,000		45,000	45,000		25,000	25,000
12		10,000	(80,000)	(70,000)	150,000	50,000	200,000	175,000	50,000	225,000	100,000	45,000	145,000	60,000	25,000	85,000
13		13,000	(80,000)	(67,000)		50,000	50,000		50,000	50,000		45,000	45,000		25,000	25,000
14		10,000	(80,000)	(70,000)		50,000	50,000		50,000	50,000		45,000	45,000		25,000	25,000
15		10,000	(80,000)	(70,000)		50,000	50,000		50,000	50,000		45,000	45,000		25,000	25,000
16		10,000	(80,000)	(70,000)		50,000	50,000		50,000	50,000		45,000	45,000		25,000	25,000
17	640,000	10,000	(80,000)	570,000		50,000	50,000		50,000	50,000		45,000	45,000		25,000	25,000
18		10,000	(80,000)	(70,000)		50,000	50,000		50,000	50,000		45,000	45,000		25,000	25,000
19		10,000	(80,000)	(70,000)		50,000	50,000		50,000	50,000		45,000	45,000		25,000	25,000
20		10,000	(80,000)	(70,000)		50,000	50,000		50,000	50,000		45,000	45,000		25,000	25,000
Total	**2,405,000**	**206,000**	**(1,600,000)**	**1,011,000**	**680,000**	**1,000,000**	**1,680,000**	**755,000**	**1,000,000**	**1,755,000**	**250,000**	**900,000**	**1,150,000**	**135,000**	**500,000**	**635,000**

Cost Per Hour Calculation

Artificial Turf (with Crumb Rubber Infill)			Bermuda Grass (Sand Base)			Kentucky Bluegrass (Sand Base)			Bermuda Grass (Native Soil Base)			Cool Season Grass (Native Soil)		
Annual Hours of Use (see separate chart for details) =		2,300	**Annual Hours of Use =**		600	**Annual Hours of Use =**		500	**Annual Hours of Use =**		400	**Annual Hours of Use =**		300
Net Cost Per Hour of Use =		**21.98**	**Net Cost Per Hour of Use =**		**140.00**	**Net Cost Per Hour of Use =**		**175.50**	**Net Cost Per Hour of Use =**		**143.75**	**Net Cost Per Hour of Use =**		**105.83**
Net Present Value (17 Year Cost) at Various Discount Rates		**Cost Per hour**	**Discount Rate**	**NPV**	**Cost Per hour**	**Discount Rate**	**NPV**	**Cost Per hour**	**Discount Rate**	**NPV**	**Cost Per hour**	**Discount Rate**	**NPV**	**Cost Per hour**
3%	$933,158	20.29	3%	1,363,644	113.64	3%	1,429,722	142.97	3%	885,255	110.66	3%	486,835	81.14
5%	$894,795	19.45	5%	1,211,398	100.95	5%	1,272,938	127.29	5%	759,340	94.92	5%	416,394	69.40
7%	$863,930	18.78	7%	1,091,630	90.97	7%	1,149,459	114.95	7%	661,319	82.66	7%	361,585	60.26

Assumptions

	Artificial Turf	Bermuda (Sand Base)	Bermuda (Native Soil)	KBG (Sand Base)	Cool Season G (Native Soil)	
Capital Cost Detail						
Sitework	235,000	450,000	100,000	500,000	60,000	Sitework costs only occur in initial construction
Turf Field Installation/Replacement	565,000	n/a	n/a	n/a	n/a	8 year AT replacement based on typical warranty length
Stormwater Management	300,000					Stormwater Management costs only occur in initial construction. AT swm could be lower when swm is part of overall school modernization.
Equipment	25,000	80,000	50,000	80,000	15,000	
Total - Initial Construction	**1,125,000**	**530,000**	**150,000**	**580,000**	**75,000**	AT, and sand base costs will be less if done as part of a high school modernization
Recycling/Disposal of Turf Field	75,000	n/a	n/a	n/a	n/a	Assumes recycling of old carpet (at a cost of $.75 per square foot with 100,000 square feet of carpet) is required as part of contract for replacement field.
Total - Replacement	640,000	-	-	-	-	8 year AT replacement of carpet based on typical warranty length. Current recycling cost assumed as well.
Maintenance Costs						
Annual Maintenance Costs	**10,000**	**50,000**	**45,000**	**50,000**	**25,000**	See Appendix C for Maintenance Assumptions
Other Maintenance Costs						
Add infill material after 3 years	3,000	n/a	n/a			
Resodding or major renovation	n/a	150,000	100,000	175,000	60,000	
Revenue						
CUPF Field Rentals/Parternship Revenue	80,000	-	-	-	-	MCPS - Artificial Turf: Based on actual revenue experience at Richard Montgomery, Walter Johnson, and Blair HS fields. MCPS - Natural Grass: No community use assumed. Hours reserved for team games and some practices only.

Appendix D-1

Lifecycle Comparison of Artificial Turf and Natural Grass Fields for Parks

	Artificial Turf (w Crumb Rubber Infill)				Bermuda Grass (w Sand Base)				Kentucky Bluegrass (w Sand Base)				Bermuda Grass (w Native Soil Base)				Cool Season Grass (w Natural Soil Base)			
Year	Capital	Maintenance	Revenue	Net Cost	Capital	Maintenance	Revenue	Net Cost	Capital	Maintenance	Revenue	Net Cost	Capital	Maintenance	Revenue	Net Cost	Capital	Maintenance	Revenue	Net Cost
1	1,125,000	10,000	(80,000)	1,055,000	530,000	50,000	(48,000)	532,000	580,000	50,000	(40,000)	590,000	150,000	45,000	(14,000)	181,000	75,000	25,000	(11,000)	89,000
2		10,000	(80,000)	(70,000)		50,000	(48,000)	2,000		50,000	(40,000)	10,000		45,000	(14,000)	31,000		25,000	(11,000)	14,000
3		10,000	(80,000)	(70,000)		50,000	(48,000)	2,000		50,000	(40,000)	10,000		45,000	(14,000)	31,000		25,000	(11,000)	14,000
4		10,000	(80,000)	(70,000)		50,000	(48,000)	2,000		50,000	(40,000)	10,000		45,000	(14,000)	31,000		25,000	(11,000)	14,000
5		13,000	(80,000)	(67,000)		50,000	(48,000)	2,000		50,000	(40,000)	10,000		45,000	(14,000)	31,000		25,000	(11,000)	14,000
6		10,000	(80,000)	(70,000)		50,000	(48,000)	2,000		50,000	(40,000)	10,000		45,000	(14,000)	31,000		25,000	(11,000)	14,000
7		10,000	(80,000)	(70,000)		50,000	(48,000)	2,000		50,000	(40,000)	10,000		45,000	(14,000)	31,000		25,000	(11,000)	14,000
8		10,000	(80,000)	(70,000)		50,000	(48,000)	2,000		50,000	(40,000)	10,000		45,000	(14,000)	31,000		25,000	(11,000)	14,000
9	640,000	10,000	(80,000)	570,000		50,000	(48,000)	2,000		50,000	(40,000)	10,000		45,000	(14,000)	31,000		25,000	(11,000)	14,000
10		10,000	(80,000)	(70,000)		50,000	(48,000)	2,000		50,000	(40,000)	10,000		45,000	(14,000)	31,000		25,000	(11,000)	14,000
11		10,000	(80,000)	(70,000)		50,000	(48,000)	2,000		50,000	(40,000)	10,000		45,000	(14,000)	31,000		25,000	(11,000)	14,000
12		10,000	(80,000)	(70,000)	150,000	50,000	(48,000)	152,000	175,000	50,000	(40,000)	185,000	100,000	45,000	(14,000)	131,000	60,000	25,000	(11,000)	74,000
13		13,000	(80,000)	(67,000)		50,000	(48,000)	2,000		50,000	(40,000)	10,000		45,000	(14,000)	31,000		25,000	(11,000)	14,000
14		10,000	(80,000)	(70,000)		50,000	(48,000)	2,000		50,000	(40,000)	10,000		45,000	(14,000)	31,000		25,000	(11,000)	14,000
15		10,000	(80,000)	(70,000)		50,000	(48,000)	2,000		50,000	(40,000)	10,000		45,000	(14,000)	31,000		25,000	(11,000)	14,000
16		10,000	(80,000)	(70,000)		50,000	(48,000)	2,000		50,000	(40,000)	10,000		45,000	(14,000)	31,000		25,000	(11,000)	14,000
17	640,000	10,000	(80,000)	570,000		50,000	(48,000)	2,000		50,000	(40,000)	10,000		45,000	(14,000)	31,000		25,000	(11,000)	14,000
18		10,000	(80,000)	(70,000)		50,000	(48,000)	2,000		50,000	(40,000)	10,000		45,000	(14,000)	31,000		25,000	(11,000)	14,000
19		10,000	(80,000)	(70,000)		50,000	(48,000)	2,000		50,000	(40,000)	10,000		45,000	(14,000)	31,000		25,000	(11,000)	14,000
20		10,000	(80,000)	(70,000)		50,000	(48,000)	2,000		50,000	(40,000)	10,000		45,000	(14,000)	31,000		25,000	(11,000)	14,000
Total	**2,405,000**	**206,000**	**(1,600,000)**	**1,011,000**	**680,000**	**1,000,000**	**(960,000)**	**720,000**	**755,000**	**1,000,000**	**(800,000)**	**955,000**	**250,000**	**900,000**	**(280,000)**	**870,000**	**135,000**	**500,000**	**(220,000)**	**415,000**

Cost Per Hour Calculation

Artificial Turf (with Crumb Rubber Infill)			Bermuda Grass (Sand Base)			Kentucky Bluegrass (Sand Base)			Bermuda Grass (Native Soil Base)			Cool Season Grass (Native Soil)		
Annual Hours of Use (see separate chart for details) =		1,000	**Annual Hours of Use =**		600	**Annual Hours of Use =**		500	**Annual Hours of Use =**		500	**Annual Hours of Use =**		500
Net Cost Per Hour of Use =		**50.55**	**Cost Per Hour of Use =**		**60.00**	**Cost Per Hour of Use =**		**95.50**	**Cost Per Hour of Use =**		**87.00**	**Cost Per Hour of Use =**		**41.50**
Net Present Value (NPV) at Various Discount Rates		**Cost Per hour**	**Discount Rate**	**NPV**	**Cost Per hour**	**Discount Rate**	**NPV**	**Cost Per hour**	**Discount Rate**	**NPV**	**Cost Per hour**	**Discount Rate**	**NPV**	**Cost Per hour**
3%	$933,158	46.66	3%	649,525	54.13	3%	834,623	83.46	3%	676,971	67.70	3%	323,183	32.32
5%	$894,795	44.74	5%	613,212	51.10	5%	774,450	77.44	5%	584,869	58.49	5%	279,310	27.93
7%	$863,930	43.20	7%	583,117	48.59	7%	725,698	72.57	7%	513,003	51.30	7%	245,050	24.51

Assumptions

	Artificial Turf	Bermuda (Sand Base)	Bermuda (Native Soil)	KBG (Sand Base)	Cool Season G (Native Soil)	
Capital Cost Detail						
Sitework	235,000	450,000	100,000	500,000	60,000	Sitework costs only occur in initial construction
Turf Field Installation/Replacement	565,000	n/a	n/a	n/a	n/a	8 year AT replacement based on typical warranty length
Stormwater Management	300,000					AT swm could be lower when swm is part of overall school modernization. Natural grass fields assumed to have sufficient drainage already in place
Equipment	25,000	80,000	50,000	80,000	15,000	
Total - Initial Construction	**1,125,000**	**530,000**	**150,000**	**580,000**	**75,000**	AT, and sand based natural turf field costs could be less if done as part of a high school modernization
Recycling/Disposal of Turf Field	75,000	n/a	n/a	n/a	n/a	Assumes recycling of old carpet (at a cost of $.75 per square foot with 100,000 square feet of carpet) is required as part of contract for replacement field
Total - Replacement	640,000	-	-	-	-	8 year AT replacement based on typical warranty length
Maintenance Costs						
Annual Maintenance Costs	**10,000**	**50,000**	**45,000**	**50,000**	**25,000**	See Appendix C for Maintenance Assumptions
Other Maintenance Costs						
Add infill (once during life of carpet)	3,000	n/a	n/a			
Resodding or major renovation	n/a	150,000	100,000	175,000	60,000	
Revenue						
Annual CUPF Field Rentals - Parks	80,000	48,000	14,000	40,000	11,000	Parks - Art Turf fields permitted by CUPF, same revenue as for MCPS AT fields. Natural Grass Revenue = same $ rate as AT for sand-based fields, current avg rates ($22/hr) assumed for native soil fields. 20% hourly rate discount assumed (similar to discount assumed for partnership agreements at AT fields)

APPENDIX E: EXCERPT FROM THE MCPS ATHLETIC HANDBOOK WEATHER

WEATHER GUIDELINES

Temperature	*Air Quality Index*	*Activity*
Mid 70s – Low 80s° F	Code Green 0-50 Good Air Quality	No restrictions.
Upper 70s – Mid 80s° F	Code Yellow 51-100 Moderate Air Quality	Watch carefully, appropriate water breaks.
Upper 80s – Low 90s° F	Code Orange 101-150 Unhealthy for sensitive groups Air Quality	Observe carefully (especially at risk individuals) frequent water breaks.
Mid 90s – 100° F	Code Red 151-200 Unhealthy Air Quality	Hold one morning non-school day practice, or one school day practice of one hour, with mandatory water breaks every 20 minutes. Games cancelled.
Mid 90s – 100+° F	Code Purple 201-300 Very Unhealthy Air Quality	Afternoon practices cancelled. Games cancelled.

Source: Montgomery County Government, Department of Environmental Protection

It is the coach's responsibility to call for air quality color codes and respond appropriately. The forecast and color code can be obtained by calling 202-962-3299 and/or visit their website at http://www.mwcog.org/environment/air/data.

Air quality (ground level ozone or smog) deteriorates when temperatures are in excess of 90°, with low or no winds and clear skies. When such conditions are anticipated, a Code Orange, Red or Purple forecast is issued. Under such conditions at-risk individuals, who are heavily exercising, should be closely watched and if experiencing any breathing difficulties, immediately required to cease exercising and move indoors. At-risk individuals include those who responded "yes" on the Medical Evaluation Form to being asthmatic or having heart and lung function problems (Part I), and individuals who responded "yes" to having experienced chest pains, shortness of breath, weakness when exposed to high temperatures, or impaired lung function (Part 3).

In hot, humid weather, coaches are expected to use good judgment in determining the length and type of outdoor practice. Frequent practice breaks and drinking water must be provided. Coaches must be aware of signs of heat exhaustion. Players who exhibit these signs are to cease practicing. Salt tablets are not to be issued. Players should be counseled to continue proper hydration at home and after practices.

When schools are dismissed early because of heat, no practices, meetings, or contests are allowed.

In extremely cold weather coaches are expected to use good judgment in determining the length and type of practice. Athletic events may be rescheduled by mutual agreement of the athletic directors of the opposing schools if the wind-chill factor could be detrimental to the health and safety of the athletes.

THUNDER AND LIGHTNING

1. Procedures for suspending outdoor athletic events because of lightning/thunder.
   a. If thunder and/or lightning can be heard or seen, stop the activity and have players and spectators seek protective shelter immediately.
   b. Inform players that in situations where thunder and/or lightning may or may not be present, if they feel their hair stand on end and skin tingle, immediately assume the following crouched position: drop to their knees, place their hands/arms on their legs, and lower their head. They should not lie flat.
2. In the event that either thunder or lightning should occur, allow 30 minutes to pass after the last occurrence of thunder and/or lightning before resuming play.
3. In case of thunder or lightning during an athletic practice, scrimmage, or contest, the activity will be suspended immediately. Players and officials should seek shelter. Spectators will be directed to leave. All coaches are expected to have an alternate plan for seeking shelter and/or expedient departure in case of thunder or lightning or other severe inclement weather.
4. The principal has the final authority to delay or postpone events because of thunder or lightning. If the principal is not present, the host athletic director has the responsibility; if the athletic director or designee is not present, coaches have the responsibility.
5. If a game is suspended because of thunder or lightning, it shall be resumed the same day, if possible, at the discretion of the officials and host athletic director.
6. When a contest has been suspended for more than 1 1/2 hours (cumulative time) due to inclement weather, the contest shall be ended. The game will be rescheduled at a later date or continued from the point of suspension, in accordance with the rules governing that sport.

Unless a county-wide decision is announced, the decision to postpone outdoor athletic events because of adverse field conditions or inclement weather is the responsibility of the host athletic director or designee.

FIELD CONDITIONS

Elementary and middle school facilities shall not be used for practices or games when the following conditions exist:

1. Water is standing on the field.
2. One-half inch or more of rain has fallen within the previous 24 hours.
3. Turf and mud can be displaced or dislodged from the ground.
4. The ground cakes or clings to shoes.
5. A steady rain is falling.
6. Bare areas are muddy

Appendix F: Montgomery County Department of Environmental Protection attachment to the July1, 2010 Montgomery County Council Transportation, Infrastructure, Energy, and Environment Committee

Artificial Turf
Department of Environmental Protection
June 28, 2010

1. Environmental Benefits and Disadvantages of Artificial Turf Fields

Stormwater Management

Although grass fields are considered pervious surfaces, the County Department of Permitting Services (DPS) requires treatment of the first ¼ inch of runoff for stormwater management for newly established fields. DPS considers artificial turf to be an impervious surface for stormwater management purposes. This construction is similar to the design of stormwater management BMPs intended to promote infiltration such as pervious pavement. DPS requires an additional depth of gravel under County artificial turf fields to meet statewide infiltration design standards or requires underdrains to direct flows to adjacent stormwater management structures. A study of a field in France (Moretto, 2007) found that only 12% of rainfall percolated through the field over an 11 month period. They attributed the lost volume of water to evaporation and water flowing along the carpet fabric to the periphery of the field rather than through the fabric into the matrix below the field.

Pesticides and Fertilizers

Artificial turf fields do not require pesticides or fertilizers. Natural grass fields are often maintained with pesticides and fertilizers

Mowing

While artificial turf fields do not require mowing, some field operators regularly groom the surface using a rake pulled by a small tractor. This is similar to mowing but somewhat faster and is not an essential practice. Some local fields receive minimal grooming (Table 3). In all cases, grooming is done at a lower frequency than mowing.

Irrigation

Natural grass fields generally require irrigation. Artificial turf fields do not require irrigation. Although some operators recommend watering artificial turf fields during very hot weather to reduce temperature impacts, most local artificial turf field operators do not water their fields (Table 3).

Other Issues

Artificial turf fields are made of synthetic materials that require energy and other inputs including petroleum. Natural grass fields are laid down as sod or seeded and grown in place. Both sod and seed are produced using fertilizer, energy and other inputs. It is difficult to say which of these processes are preferable from an environmental standpoint.

Artificial turf fields are generally projected to have life spans of approximately 10 to 15 years, depending on usage. During that time span they can tolerate a much higher level of usage than natural grass fields.

Table 3. Survey of Montgomery County and Fairfax County

Artificial Turf Maintenance Practices

		Age of Field	Regular Grooming	Watering	Disinfect Whole Field
Private Schools in Mont. Co.	6 Schools	3 Years Avg.	4 Schools Monthly	2 Schools Rarely	1 School
Fairfax County Park Authority	20+ Fields	10 Years Max.	No	No	No

2. Government Findings and Other Applicable Studies

Most governmental studies have focused on the potential for human health impacts from used tire products. There have been far fewer governmental studies focusing on water quality or other environmental impacts from used tire products. This review focuses on potential water quality impacts from artificial turf runoff.

Some studies have concluded that used tire products and artificial turf fields are unlikely to generate pollutants at a level above water quality limits (Lim and Walker 2009, Moretto 2007, Vidair, Haas and Schlag 2007, Ledoux, 2007, Lim, 2010, Bristol and McDermott 2008, Chemrisk 2008, Hofstra 2008, and Johns and Goodlin, 2008). Studies generally have found that fields have the potential to release low levels of pollutants when first installed, but that levels drop off very quickly to background levels. Only four of the studies listed above directly sampled runoff from actual artificial turf fields (Bristol andMcDermott, 2008, Hofstra, 2008, Lim and Walker, 2009 and Moretto, 2007.)

Studies done in other settings indicate that used tire products clearly have the potential to release toxic substances (Brown, 2007, Denly, Rutkowski and Vetrano, 2008, USEPA, 2009). Polycyclic aromatic hydrocarbons, zinc and other metals are the principal substances of concern produced by used tires although many other substances have been identified in small concentrations. It is difficult to relate these results to actual environmental conditions. Many of the identified substances are in low concentrations and may not be released under field conditions. Little information exists on the impacts of many of these substances. Most of them have no relevant government regulatory standards. However, it is also possible that synergistic impacts could occur when these substances exist in combination.

Some studies have found toxicity to aquatic organisms from tire leachate or relatively high concentrations of pollutants. For instance, Sheehan, et. al. (2006) found that leachate from tire shreds installed below the water table reduced survival of aquatic organisms. The design of artificial turf fields places the rubber above the water table. Lim and Walker (2009) found that crumb rubber produced an average zinc concentration of 1947.4 ug/L in a Synthetic Precipitation Leaching Procedure (SPLP) test. This is much higher than the Maryland freshwater criterion for aquatic life of 120 ug/L. Their SPLP results also found relatively high concentrations of many other substances. However, Lim and Walker (2009) characterize this test as an, "Aggressive laboratory testing method ... which may overestimate releases from the samples as compared to releases in the ambient setting." Less aggressive laboratory procedures found lower concentrations of pollutants.

Some studies have identified rare instances of lead on older artificial turf fields (NJDHHS 2008, NYCDPR Undated). The U.S. Consumer Product Safety Commission (CPSC 2008) has tied the lead in these fields to pigments used in the carpeting material and recommended that lead not be used in the manufacture of new fields.

Summary of Studies Reviewed

Bristol, Scott G. and Vincent C. McDermott. 2008. *Evaluation of Stormwater Drainage Quality From Synthetic Turf Athletic Fields*. Milone & MacBroom, Inc. Cheshire, Conn. 10 pp.

"The results of the study indicate that the actual stormwater drainage from the fields allows for the complete survival of the test species *Daphnia pulex*. An analysis of the concentration of metals in the actual drainage water indicates that metals do not leach in amounts that would be considered a risk to aquatic life as compared to existing water quality standards. Analysis of the laboratory based leaching potential of metals in accordance with acceptable EPA methods indicates that metals will leach from the crumb rubber but in concentrations that are within ranges that could be expected to leach from native soil."

Brown, David R. 2007. *Artificial Turf – Exposures to Ground-Up Rubber Tires – Athletic Fields – Playgrounds – Gardening Mulch*. EHHI. North Haven, CT. 37 pp.

This literature review includes a laboratory study of tire crumb leaching and volatilization done by the Connecticut Agricultural Experiment Station. Brown concludes that crumb rubber has the potential to release a variety of hazardous substances.

ChemRisk, Inc. 2008. *Review of the Human Health & Ecological Safety of Exposure to Recycled Tire Rubber found at Playgrounds and Synthetic Turf Fields*. Pittsburgh, PA. 57pp

This literature review of crumb rubber studies found that no adverse ecological effects are likely. They recommended that additional studies be done.

CPSC (U.S. Consumer Product Safety Commission). 2008. *CPSC Staff Finds Synthetic Turf Fields OK to Install, OK to Play On*. Press Release #08-348.

R:\Programs\NPDES\Projects\Artificial Turf Evaluation\Papers\CPSC Release.mht

"Although small amounts of lead were detected on the surface of some older fields, none of these tested fields released amounts of lead that would be harmful to children. ... Lead is present in the pigments of some synthetic turf products to give the turf its various colors. ... Although this evaluation found no harmful lead levels, CPSC staff is asking that voluntary standards be developed for synthetic turf to preclude the use of lead in future products."

Denly, Elizabeth, Katarina Rutkowski and Karen M. Vetrano. 2008. A Review of the Potential Health and Safety Risks from Synthetic Turf Fields Containing Crumb Rubber Infill. TRC. Windsor, Conn. / New York City Department of Health and Mental Hygiene 200 pp.

COPC (concentration of potential concern) from the crumb rubber vary depending on the type of crumb rubber, the method of extraction used for analysis, and the media measured (crumb rubber, air, leachate).

Hofstra, U. 2008. *Follow-up Study of the Environmental Aspects of Rubber Infill*. Intron. Sittard, Netherlands. 5 pp.

Hofstra found the contribution of zinc leaching from fields over relevant time periods to have insignificant environmental impacts. "The zinc concentration in the drainage water from 5- to 6-year-old fields is lower than the concentration in rainwater. ... The impact of weathering of the rubber crumb for the technical lifetime of an artificial turf field (approx. 10 to 15 years) does not cause the leaching of zinc from the rubber crumb made from recycled car tyres to exceed the threshold values for dissolved zinc in surface water or the derived threshold value from the Decree on Soil Quality for the emission of zinc into the soil."

Johns, D. Michael and Tom Goodlin. 2008. *Evaluation of Potential Environmental Risks Associated with Installing Synthetic Turf Fields on Bainbridge Island*. Windward Environmental. Seattle, WA. 14 pp.

Literature review by Johns and Goodlin (2008) found that fields are unlikely to produce toxicity in surface waters or pollute groundwater.

Ledoux, Thomas. 2007. *Preliminary Assessment of the Toxicity from Exposure to Crumb Rubber: its use in Playgrounds and Artificial Turf Playing Fields*. New Jersey Department of Environmental Protection.

NJDEP literature review concluded that there was insufficient information to perform a complete risk characterization for crumb rubber.

Lim, Ly. 2010. Personal Communication. NY Department of Environmental Conservation.

Ten additional water samples not included in Lim and Walker (2009) had results similar the one sample discussed in that report (actual test results not available). Funding has not been available for further study.

Lim, Ly and Randi Walker. 2009. *Assessment of Chemical Leaching, Releases to Air and Temperature at Crumb-Rubber Infilled Synthetic Turf Fields*. New York State Department of Environmental Conservation, New York State Department of Health. 140 pp.

This NY State study was mainly laboratory based, but limited field sampling resulted in 32 groundwater samples and one runoff sample. These samples were analyzed chemically and impacts estimated. SPLP laboratory analysis of crumb rubber found relatively high levels of some pollutants, the less aggressive laboratory column test found lower levels of pollutants. The study found little likelihood of impacts to groundwater, surface water or air quality from artificial turf fields.

Moretto, Robert. 2007. *Environmental and Health Assessment of the Use of Elastomer Granulates (Virgin and from Used Tyres) as Filling in Third-Generation Artificial Turf.* ADEME/ALIAPUR/Fieldturf Tarkett. 27 pp.

Equipment was set up to obtain samples draining through an actual outdoor artificial turf field as well as four laboratory systems containing artificial turf. A surprisingly small amount of water was collected from the actual field relative to rainfall totals. Chemical analysis indicated an initial release of some pollutants followed by lower levels in subsequent samples. The results of the laboratory and field samples were similar. No environmental impacts would be anticipated based on the concentrations of pollutants observed or toxicology testing which was done.

NJDHHS (New Jersey Department of Health and Senior Services). 2008. Update: New Jersey Investigation of Artificial Turf and Human Health Concerns. Trenton, NJ.

NJDHHS 2008.pdf

This is a fact sheet on lead found at several New Jersey artificial turf fields made with nylon fibers. Most fields were found to have little or no lead.

NYCDPR (New York City Department of Parks and Recreation). Undated Web Page. http://www.nycgovparks.org/sub_things_to_do/facilities/synthetic_turf_test_results.html.

R:\Programs\NPDES\Projects\Artificial Turf Evaluation\Papers\NYC Turf Flyer.mht

This web page summarizes issues related to artificial turf fields including the finding of lead in one city field.

Sheehan, P.J., et al., *Evaluating the risk to aquatic ecosystems posed by leachate from tire shred fill in roads using toxicity tests, toxicity identification evaluations, and groundwater modeling*. Environ Toxicol Chem, 2006. 25(2): p. 400-11.

Sheehan, et. al. (2006) found no toxicity to two species of aquatic organisms from exposure to leachate from shredded tire fill placed above the water table. Exposure to leachates collected from tire shreds installed below the water table reduced survival. Modeling predicted that impact would disappear over a distance of 3 to 11 meters depending on local conditions.

U.S. Environmental Protection Agency. 2009. *A Scoping-Level Field Monitoring Study of Synthetic Turf Fields and Playgrounds*. 105 pp.

This study collected air, dust, carpet fiber and rubber infill samples. They found average lead levels in the turf to be under EPA standards for lead in soil or floor dust.

Vidair, Charles, Robert Haas and Robert Schlag. 2007. *Evaluation of Health Effects of Recycled Waste Tires in Playground and Track Products*. California Environmental Protection Agency for the California Integrated Waste Management Board. Sacramento, CA. 147 pp.

This evaluation of human health impacts also included a literature review of environmental impacts. A low likelihood of soil or groundwater contamination was predicted. They also concluded that, "Considering all the data, it seems doubtful that recycled tire rubber in outdoor applications such as playground surfaces releases high enough levels of chemicals to cause toxicity to animals and plants living in the vicinity."

Synthetic Turf Stormwater Quality Monitoring and Sampling Plan

February 2, 2010

Project Description and Background

The San Francisco Recreation and Park Department (RPD) has recently installed synthetic turf at playfields around San Francisco. Public concern about the health and safety of the synthetic turf products has arisen. One area of concern is the material chemical composition, in part due to the use of used tires for the rubber infill. In 2008, RPD established the Synthetic Playfields Task Force to review existing data and research and develop recommendations, which included the following:

- The Department should conduct or participate in tests of field stormwater runoff to determine the presence and potential levels of zinc and other possible contaminants.
- If the stormwater runoff meets drinking water standards, the Department should recharge it into groundwater, if feasible. If the water does not meet drinking water standards, the Department should collect runoff for discharge into the sewer system, where it will be treated appropriately.

The San Francisco Public Utilities Commission (SFPUC) and RPD are working together to complete the above recommendations. The Synthetic Turf Stormwater Quality Monitoring and Sampling Plan described herein outlines how these recommendations will be achieved.

Monitoring Goals and Objectives

The objectives of the Synthetic Turf Stormwater Quality Monitoring and Sampling Plan are:

- To collect stormwater quality data;
- To determine the potential impact of synthetic playfields on groundwater; and
- To assist with the planning and design of San Francisco playfields.

Sampling Locations

The sampling locations will be at two playfields where RPD has installed synthetic turf. Site plans of both locations are attached. The two locations are as follows:

- South Sunset Playground, which is located on 40th Avenue between Wawona Street and Vicente Street; and
- Garfield Square, which is located between 25th Street and 26th Street and Treat Avenue and Harrison Street.

Sampling Schedule

Data collection will start as soon as possible and will extend through the 2010/2011 rainy season. Sampling will be performed twice during 2009/2010 winter storm events and

twice during the 2010/2011 winter storm events. Ideally, samples should not be collected less than two weeks apart and should be collected as early as possible after the beginning of each storm, when there is sufficient flow available to allow sampling. The first sample collected during the 2010/2011 winter should be collected at the beginning of the first storm of that rainy season. The goal of the first 2010/2011 winter sampling event is to characterize the "first flush" stormwater quality characteristics.

Sampling Methods

At each sampling location, grab samples will be collected and sent to the SFPUC Water Quality Division Laboratory for analysis. These grab sample locations are shown on the attached figures and were discussed at a field visit that occurred on January 27, 2010.

Constituents and Methods

The physical parameters, chemical constituents, laboratory methods and laboratory reporting limits, where applicable, are as follows:

- pH (0.1 pH unit), temperature (0.1°C), specific conductance, turbidity (0.1 NTU), total dissolved solids (TDS), and total suspended solids (TSS)
- The following metals (total and dissolved), methods, and detection limits:

Metal	Method	MDL[1]		ML[2]	
AG	SEM_200.8_WW	0.003	UG/L	0.25	UG/L
AS	SEM_200.8_WW	0.07	UG/L	2	UG/L
BA	SEM_200.8_WW	0.02	UG/L	Not listed	
BE	SEM_200.8_WW	0.04	UG/L	0.5	UG/L
CD	SEM_200.8_WW	0.006	UG/L	0.25	UG/L
CO	SEM_200.8_WW	0.005	UG/L	Not listed	
CR	SEM_200.8_WW	0.004	UG/L	0.5	UG/L
CU	SEM_200.8_WW	0.03	UG/L	0.5	UG/L
FE	SEM_200.8_WW (modified)	3	UG/L	20	UG/L
MN	SEM_200.8_WW	0.03	UG/L	Not listed	
MO	SEM_200.8_WW	0.07	UG/L	Not listed	
NI	SEM_200.8_WW	0.02	UG/L	1	UG/L
PB	SEM_200.8_WW	0.02	UG/L	0.5	UG/L
SB	SEM_200.8_WW	0.03	UG/L	0.5	UG/L
SE	SEM_200.8_WW	0.03	UG/L	2	UG/L
TL	SEM_200.8_WW	0.01	UG/L	1	UG/L
V	SEM_200.8_WW	0.007	UG/L	Not listed	
ZN	SEM_200.8_WW	0.2	UG/L	1	UG/L
HG	SEM_245.1_WW	0.2	UG/L	2	UG/L

[1] Minimum Detection Limit
[2] Method Limit as per the State Implementation Policy. (Method limit applies to the wastewater method and is similar to the reporting limit that applies to drinking water methods.)

- Volatile organic compounds (VOCs) by US EPA Method 624
- Semi-volatile organic compounds by US EPA Method 625

QA/QC

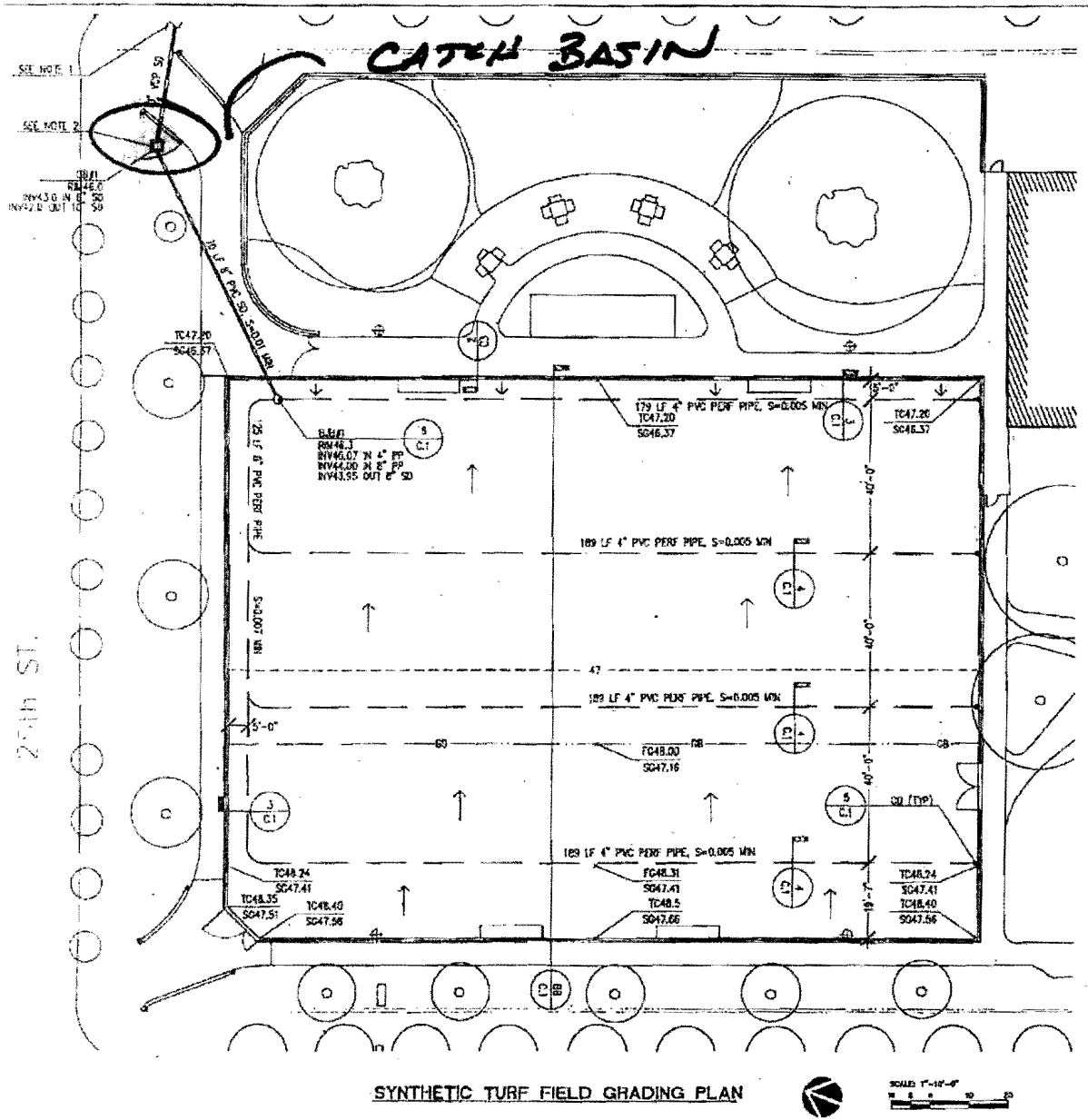
Field: A field duplicate sample for all constituents will be collected at the South Sunset sampling location. In addition, one trip blank will be analyzed for VOCs.

Laboratory: The laboratory(ies) shall follow all standard laboratory quality control procedures, including analyzing a matrix spike (MS) and matrix spike duplicate (MSD) for each constituent.

Data and Reporting

Once the samples are collected and analyzed at the lab, the data will be entered into LIMS under a new project entitled, "Synthetic Turf" and the two locations should be entitled, "SSPG" and "GarSq," for South Sunset Playground and Garfield Square, respectively. The sample identifications, SDG numbers and a copy of the COC will be provided to Betsey Eagon, who will be coordinating the synthetic turf stormwater monitoring and sampling.

After the first two sampling events, the data will be summarized and reported in an Excel spreadsheet to RPD for review. After all four sampling events have been performed, the Excel spreadsheet will be updated and a brief memorandum will be prepared.



SYNTHETIC TURF FIELD GRADING PLAN

SCALE 1"=10'-0"

SAN FRANCISCO
FIELDS PROJECT

GARFIELD SQ.

R | H | A | A

NOTES

1. SEE MEP STORM DRAIN, SEE SHEET C3.1.1.
2. NEW CATCH BASIN, SEE SHEET C3.1.2.
3. SEE SHEET C1.2.1 FOR CHANNEL OF REST OF SITE.

Miller Pacific

Call Two Working Days Before You Dig!

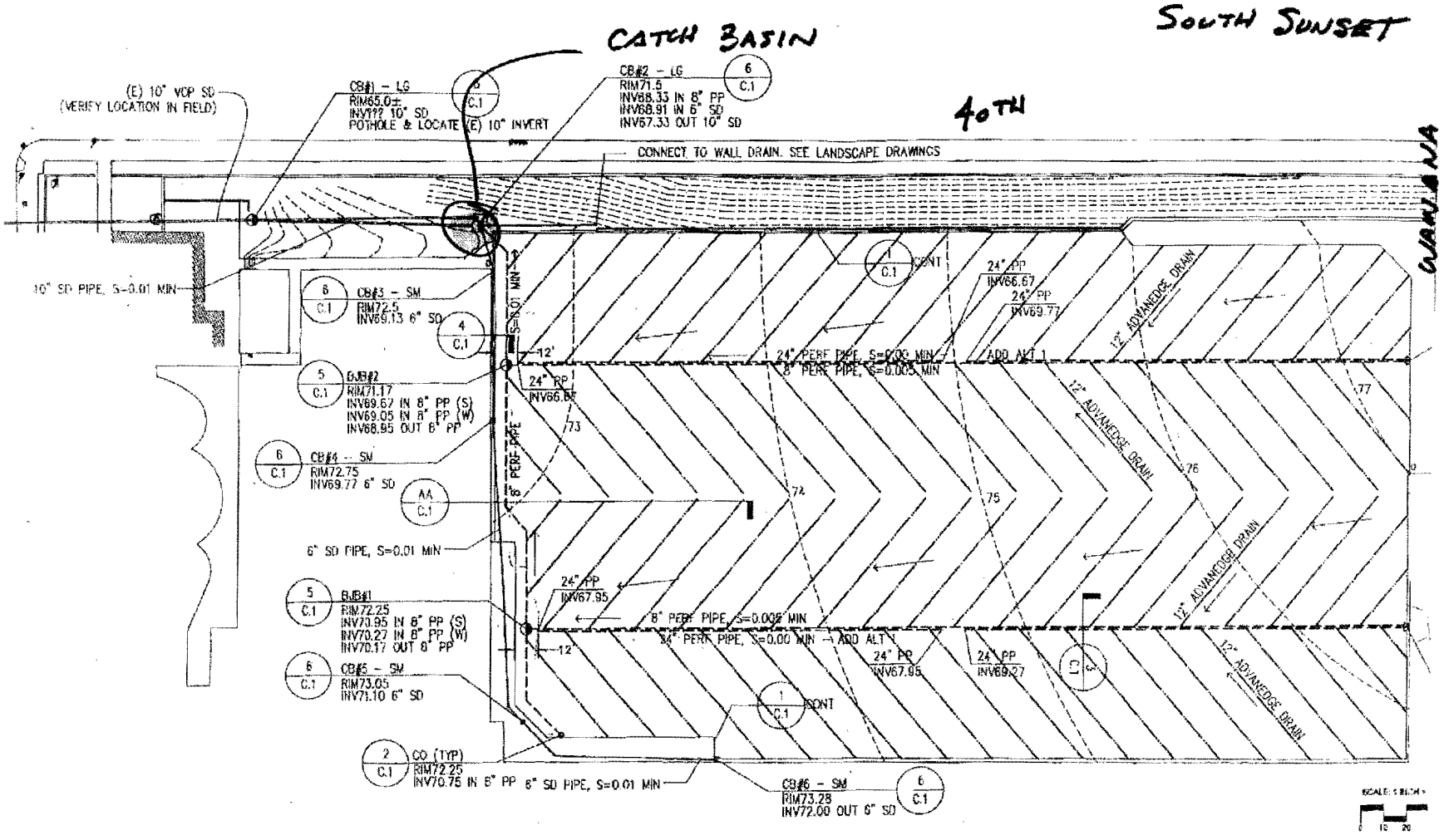
1-800-227-2600

LEGEND

SYNTHETIC TURF FIELD GRADING & DRAINAGE PLAN

GC2.1

Sampling location



Sampling location

Synthetic Turf Stormwater Quality Monitoring

2009/2010 Monitoring Results [1]

4/28/2010

		South Sunset Playground		*Garfield Square*		MCL[3]
	Units	2/23/2010	3/2/2010	2/24/2010	3/2/2010	
pH		6.3[2]	6.6	7.2	7.1	
Temperature	°F	52[2]	56	56	58	
Specific Conductance	UMHOS/CM	237[2]	224	382	390	
Turbidity	NTU	49[2]	117	1	43	
Total Dissolved Solids	MG/L	102	62	212	152	
Total Suspended Solids	MG/L	25	45	<7	28.5	
Silver	UG/L	<0.25	<0.25	<0.25	<0.25	100[4]
Dissolved Silver	UG/L	<0.25	<0.25	<0.25	<0.25	
Arsenic	UG/L	<2	<2	<2	<2	10
Dissolved Arsenic	UG/L	<2	<2	<2	<2	
Barium	UG/L	70.00	107.79	56.66	137.50	1000
Dissolved Barium	UG/L	50.08	61.06	54.60	68.83	
Beryllium	UG/L	<0.5	<0.5	<0.5	<0.5	4
Dissolved Beryllium	UG/L	<0.5	<0.5	<0.5	<0.5	
Cadmium	UG/L	<0.25	<0.25	<0.25	<0.25	5
Dissolved Cadmium	UG/L	<0.25	<0.25	<0.25	<0.25	
Cobalt	UG/L	1.10	2.64	0.22	1.72	-
Dissolved Cobalt	UG/L	0.16	0.08	0.22	0.18	
Chromium	UG/L	5.13	12.25	<0.5	1.81	50
Dissolved Chromium	UG/L	1.54	0.84	<0.5	0.54	
Copper	UG/L	4.39	8.99	5.48	8.91	1000[4]
Dissolved Copper	UG/L	4.32	2.40	5.90	4.67	
Iron	UG/L	1386.80	3624.30	14.40	1741.50	300[4]
Dissolved Iron	UG/L	15.11	5.50	<2.5	<2.5	
Manganese	UG/L	51.21	144.25	0.87	35.00	50[4]
Dissolved Manganese	UG/L	2.36	0.37	1.87	0.53	
Molybdenum	UG/L	0.46	0.34	8.69	8.26	-
Dissolved Molybdenum	UG/L	0.57	0.42	8.44	7.37	
Nickel	UG/L	7.57	18.54	3.80	7.34	100
Dissolved Nickel	UG/L	<1	<1	3.64	3.89	
Lead	UG/L	0.64	1.59	<0.5	1.69	15
Dissolved Lead	UG/L	<0.5	<0.5	<0.5	<0.5	
Antimony	UG/L	<0.5	<0.5	0.67	0.70	6
Dissolved Antimony	UG/L	<0.5	<0.5	0.61	0.62	
Selenium	UG/L	<2	<2	<2	<2	50
Dissolved Selenium	UG/L	<2	<2	<2	<2	
Thallium	UG/L	<1	<1	<1	<1	2
Dissolved Thallium	UG/L	<1	<1	<1	<1	
Vanadium	UG/L	3.70	8.83	1.60	6.52	50[5]
Dissolved Vanadium	UG/L	1.33	1.31	1.49	2.14	
Zinc	UG/L	31.43	32.29	58.50	136.75	5000[4]
Dissolved Zinc	UG/L	6.40	3.72	42.16	72.79	
Mercury	UG/L	<0.2	<0.2	<0.2	0.2	2
Dissolved Mercury	UG/L	<0.2	<0.2	<0.2	<0.2	
Volatile Organic Compounds		ND	ND	ND	ND	
Semi Volatile Organic Compounds		ND	ND	ND	ND	

(1) Two additional sampling events will be conducted during the 2010/2011 winter season as per the Synthetic Turf Stormwater Quality Monitoring and Sampling Plan (2/2/10).
(2) Used field duplicate value
(3) California Maximum Contaminant Levels (MCL)
(4) Secondary MCL
(5) California Department of Public Health notification level

Appendix I-1:

WESTERN MONTGOMERY COUNTY CITIZENS ADVISORY BOARD
Serving the areas of Bethesda, Cabin John, Chevy Chase, Friendship Heights Garrett Park, Glen Echo, North Bethesda and Potomac

September 30, 2010

The Honorable Nancy Floreen, President
Montgomery County Council
Council Office Building
100 Maryland Avenue
Rockville, Maryland 20850

Dear Council President Floreen,

The Western Montgomery County Citizens Advisory Board (the "CAB") examined the issues and concerns raised by members of the community at our June 21, 2010 meeting regarding the installation of artificial turf fields at Montgomery County high schools and public parks. The concerns raised by the community centered on the impact artificial turf fields may have on the environment, student health, and County finances.

Based on the concerns raised by the community members, the full CAB deliberated on this issue at its July 19, 2010 meeting and recommends that the Montgomery County Council address the following key points:

1) A full life cycle cost analysis of artificial turf field installation should be undertaken by the County, which should include an analysis of all costs associated with maintenance, replacement, and disposal. This analysis will assist the County in determining the true future financial commitment that artificial turf fields will entail.

2) The County, with partners like the Environmental Protection Agency, Montgomery County Public Schools, and the Montgomery County Department of Parks, should embark on a rigorous collection and review of existing scientific data, and new studies, if necessary, to fully understand the effects of artificial turf fields on:

    a) the safety and health of students and athletes using the fields; specifically problems associated with excessively high temperatures during summer months and increases in the rate and severity of sport injuries.

    b) the environment; specifically toxic chemicals in stormwater runoff and toxic particulates in the air.

We are grateful to the County Council's Transportation, Infrastructure, Energy and Environment (T&E) Committee for initiating a dialogue about the risks posed by the installation of artificial turfs in the County high schools and parks. As the County continues to study the effects of artificial turf fields, we encourage them to keep in mind specific concerns raised by members of the community to the CAB.

Please contact us should you have any questions or like any additional information.

Sincerely,

Sue F. Knapp
Chair

SFK/kpt

cc: Montgomery County Councilmembers

Appendix I-2

MID-COUNTY CITIZENS ADVISORY BOARD

June 17, 2010

The Honorable Isiah Leggett
Montgomery County Executive
101 Monroe Street
Rockville, Maryland 20850

Ms. Mary Bradford, Director
Montgomery County Department of Parks
9500 Brunett Avenue
Silver Spring, Maryland 20901

Dear Mr. Leggett and Ms. Bradford:

I am writing on behalf of the Mid-County Citizens Advisory Board (MCCAB) to express our concerns about the proposed use of artificial turf fields by Montgomery County Public Schools and the Montgomery County Department of Parks. At its April 20, 2010 meeting, we heard from members of the community about their concerns about the proposed installation of artificial turf football fields at Wheaton High School, other public schools, and parks. Among the concerns expressed were negative impacts on the environment, student health, and County finances.

I asked the MCCAB's Quality of Life Committee to examine these issues. Based on these deliberations, and a final discussion at our June 15th meeting, the MCCAB recommends the following actions be taken:

The Montgomery County Government (MCG) should place a moratorium on further construction of artificial turf fields in parks, schools and recreational areas until the environmental, health and financial impacts of these fields are better understood.

Although research on the environmental impacts of artificial turf fields is limited, there appears to be reason for concern. Artificial turf fields being installed in Montgomery County include the use of old tires. A single field installation includes the depositing of 120 tons of pulverized automobile tires and hundreds of tons of rock on County land. As a result phthalates and other harmful materials may be contaminating the ground and water. Additional concerns have been raised in the sports medicine community with high air temperatures on artificial turf fields. Again, research appears to be inconclusive, but the lack of conclusive research bolsters the need for caution before exposing young athletes and others to potential risk.

As you are well aware the County is facing unprecedented fiscal challenges. Although apparent savings on field maintenance may make artificial turf fields an attractive option, we urge the County to exercise caution. A review of literature indicates that the environmental and public health impacts of artificial turf fields are poorly understood, with many questions left unanswered. With such questions unanswered, it would seem difficult to determine exactly what future financial commitments the County is making with further artificial turf field construction.

A moratorium on construction would allow the County more time to deliberate and allow time for the science to "catch up". Therefore the MCCAB urges a moratorium on further artificial turf field construction on all MCG owned properties.

As always, thank you for your consideration and continued leadership.

Sincerely,

Sheldon Fishman
Chair

cc: Montgomery County Council
Gabriel Albornoz, Department of Recreation

Appendix J:

Montgomery County Stormwater Partners Network
Resolution on Sustainable Athletic Field Construction and Maintenance

Whereas the **problem** that athletic field directors and managers seek to address is the poor condition of many of our rectangular grass fields and their degradation after extensive hours of play in all weather conditions;

Whereas typically such fields have been composed of sod laid on native clay soil and maintained with chemical fertilizers.

Whereas one **"solution"** being aggressively promoted, artificial turf, is a rug of plastic blades attached to a coated plastic mat and infilled with a couple of inches of pulverized used tires .

Whereas both the plastic rug and synthetic rubber infill pose documented water pollution problems and other environmental and public health hazards;

Whereas grass is the safer, healthier, environmentally beneficial, more cost-effective option preferred by professional and amateur athletes and coaches; and

Whereas grass provides oxygen, absorbs carbon dioxide, is sustainable and renewable;

Whereas grass fields can always be converted to artificial turf but artificial turf, with its parking lot-like base--tons of dirt removed and tons of rocks trucked in-- cannot be easily or cost effectively converted back to grass.

Whereas greater durability, drainage, and water pollution prevention can be achieved by installing a sand-cap grass field and maintaining it organically, as we know from the experience of others,[1] and irrigation as needed may be done with water collected in cisterns from stormwater run-off,

Be it therefore resolved that the Stormwater Partners asks Montgomery County Department of Parks, Montgomery County Public Schools, and other County land management agencies, to:

- **Pilot one or more grass fields using the best 21st century techniques for installation and organic maintenance that have been documented to work;**
- **Install no additional rubber and plastic fields while the natural grass fields are being fully piloted using best available practices, and thereafter only where grass cannot grow, e.g., indoors, in full shade, or a temporary surface on asphalt, and using safer, biodegradable alternatives to rubber infill.**

---

[1] Branford, CT, Alex Palluzzi, in 30 years' experience with athletic fields has perfected organic maintenance. E-mail correspondence. Also see http://zip06.theday.com/blogs/the_sound/archive/2008/11/20/hammer-time.aspx and http://www.beyondpesticides.org/lawn/activist/BranfordCTpolicy.pdf in *Shore Publishing.*

- **Compare full life cycle cost of organically-maintained natural turf fields versus artificial turf fields, to include disposal costs of artificial turf.**
- **Create financing mechanisms that include annual maintenance costs in the budget so as not to artificially select for expensive plastic fields.**
- **Include testing of field leachate and runoff discharges for zinc, phthalates, and lead.**
- **Publish on the County's web site the results of the organic and artificial turf water pollution discharge tests and life cycle costing studies.**

Further Be It Known that:

Plastic artificial turf can become hot enough to burn players and to contribute to "heat island" effect,[2] while a grass field remains cooler than air because of transpiration;

Used tire crumbs are documented to contain carcinogens, mutagens, neurotoxins, liver, kidney, and endocrine disruptors, phthalates, and may contain the neurotoxin lead.[3]

Water beads up and rolls off the crumbs and plastic backing rather than percolating into the ground,[4] creating a polluted runoff problem and potentially carrying toxins leached from the tire crumb and plastic into streams;

Zinc from the pulverized truck tires when discharged or leached from artificial turf fields is particularly harmful to plants and aquatic life;[5]

Antimicrobial rinses used to decontaminate the field and fabric softener to fluff up the blades (if used) are also potential contaminates in our waterways;

In as few as 8 years, artificial turf fields experiencing the heavy use intended will face disposal as hazardous waste at significant cost;[6]

Contact: Anne Ambler: anambler@gmail.com or Kathy Michels: Kathleen.Michels@verizon.net 7.1.2010

Additional resources:
www.athenasmi.org/projects/docs/UCC_project_ATHENA_technical_paper.pdf (report with methodology for determining that 1861 trees must be planted to offset the carbon footprint of one 9,000 sq. m artificial turf playing field.)

---

2 Brigham Young University study, http://aces.nmsu.edu/programs/turf/documents/brigham-young-study.pdf.

3 *See* The Connecticut Agricultural Experiment Station, Examination of Crumb Rubber Produced from Recycled Tires, August 2007.

4 Brigham Young University study, http://aces.nmsu.edu/programs/turf/documents/brigham-young-study.pdf and Penn State University, http://www.cropsoil.psu.edu/mcnitt/infill8.cfm, in Item No. 5.

5 Marine Resources Conservation Center, www.synturf.org/images/Crumb_Rubber_Final.pdf ; see also T.Kallqvist, Norwegian Institute for Water Research (NIVA), Environmental Risk Assessment of Artificial Turf Systems, December 2005, p. 6.

6 University of Arkansas, http://turf.uark.edu/turfhelp/archives/021109.html.

Appendix K:

Solid Waste Advisory Committee (SWAC)

Annual Meeting with the County Executive

February 10, 2011

We appreciate the opportunity to share the concerns of the Solid Waste Advisory Committee and are grateful for the emphasis that the County Executive continues to place on reducing the impact of solid waste on the environment. While not immune from fiscal challenges, DSWS provides critical public services: reliable, safe and timely waste collection and responsible disposal is a key component of our way of life here in Montgomery County. We understand the extreme budget pressures that the County is currently facing, but strongly support sustaining DSWS funding for the FY12 budget.

For many years Montgomery County has provided a leadership role in the areas of recycling, reclamation and disposal of solid waste materials. This leadership role has positioned the county to take on four new solid waste challenges:

1. Artificial Turf
2. Food Recycling
3. Re-development of the Gude Landfill
4. Collaboration/Efficiency/Money Saving Opportunities

Each of these areas are addressed in more detail in Attachment A. We welcome the potential to engage with the County Council or other entities to further these visionary ideas.

All the opportunities discussed in the Attachment A are focused on the same result – reducing the amount of solid waste that enters the waste stream and reducing the impact at our landfills – the result being reduced costs, longer landfill life, and reduced need to send the effluent of Montgomery County to other areas. This will help us enhance the sense of stewardship that we should have for the land, water, and air that makes up our county.

We continue to rely on, and believe in, the continued mission of the DEP's community education, focusing in 2012 on multiple family housing complexes in an effort to bring them up to the same standards and expectations placed and enforced upon owners of single family homes.

We appreciate the continued support of our efforts, and look forward to continued opportunity to serve our county.

Solid Waste Advisory Committee (SWAC)

Annual Meeting with the County Executive

February 10, 2011

Attachment A

Opportunity 1 –**Artificial Turf** –This is a major solid waste issue facing the county today, and one on which Montgomery County has an opportunity to take a leadership role. SWAC has identified 24 football-sized artificial turf installations in Montgomery County (most comprised of private school athletic fields and private athletic businesses) and an additional 150 installations of 4-5,000 square feet installed on private property. As the warranted life of the large fields is only 8 years, and each is comprised of roughly 350,000 pounds of turf and rubber material that cannot be recycled or incinerated, the impact on the County's landfills could be enormous. (Please refer to accompanying charts for additional detail.)

SWAC is looking to the Executive and County Council for support in collaborative efforts with other County organizations and agencies to:

1. Identify and inventory all artificial turf fields currently installed and those with outstanding permits. This will allow SWAC to size the challenge and forecast removal of materials.
2. Manage the ongoing installation and removal of artificial fields, including creating a process for handling the component materials at the Transfer Station. The county needs to capture the opportunity at the entry and exit point.
3. Work with industry experts to stay apprised of latest developments and recommendations in installation, removal and recyclability of these materials.
4. Develop true life cycle models (financial and environmental) for artificial turf fields in order to develop recommendations for County-owned fields.
5. Work with DEP to create community education plan.

Opportunity 2 – **Food Recycling** – SWAC will be exploring the potential for a food recycling plan, similar to that recently announced in Los Angeles, wherein excess edible food is diverted from the waste stream to homeless shelters and food banks. This opportunity can address two pressing problems – alleviating hunger amongst disadvantaged Montgomery County residents, and reducing the amount of material sent to the waste transfer station.

SWAC is looking to the Executive and County Council for support in collaborative efforts with other County organizations and agencies to:

1. Identify potential sources of excess food (e.g., schools, restaurants, grocery stores).
2. Identify potential recipients of excess food.
3. Work with business, community and county organizations to develop a plan for food redistribution, acknowledging and compensating for, in law and code, the contributions of the businesses and private organizations toward this voluntary effort.
4. Work with partner organizations to help create community education plan.
5. Make the necessary changes to health codes and safety laws allowing private and business organizations to cooperate with government in a mutually advantageous arrangement.

Solid Waste Advisory Committee (SWAC)

Annual Meeting with the County Executive

February 10, 2011

Opportunity 3 – **Redevelopment of the Gude Landfill.** SWAC will continue to work with DSWS in developing a comprehensive approach to the Gude Landfill Property Remediation and Re-use plan.

SWAC is looking to the Executive and County Council for support in collaborative efforts with other County organizations and agencies to:

1. Identify potential for valuable resources within the landfill
2. Determine feasibility of 'harvesting' resources.
3. Determine potential for 'selling' property with requirement for remediation prior to development.
4. Create a "ball park" cost estimate for different remediation scenarios.

Opportunity 4 – **Collaboration/Efficiencies/Money Saving Opportunities**

SWAC believes there are efficiencies that can be gained from teaming the efforts of DEP, MNNCP and MCPS to maximize the potential for recycling retrieval from county, park and school public areas by aggregating resources from all three organizations.

SWAC is looking to the Executive and County Council for support in collaborative efforts with other County organizations and agencies to:

1. Identify potential areas for collaboration; e.g., . mapping existing recycling pickup routes and destinations for parks and schools
2. determining additional recycling contributions from expanded programs.

Thank you for your continued support of our efforts. SWAC believes that these four key initiatives will allow Montgomery County to continue to play a leadership role in saving our planet.

Solid Waste Advisory Committee (SWAC)

Annual Meeting with the County Executive

February 10, 2011

Additional Information related to Artificial Turf

(Fields are football or soccer sized – 1.2 acres)

Facility	Status	Designation	Number of Fields
Bullis School	Constructed	Private School	1
Church of the Little Flower	Constructed	Private School	1
Georgetown Prep (?)	Constructed	Private School	1
Good Counsel	Constructed	Private School	1
Holton Arms	Constructed	Private School	1
Landon School	Constructed	Private School	1
Montgomery Blair	Constructed	MCPS	1
Our Lady of Lourdes	Constructed	Private School	1
Richard Montgomery	Constructed	MCPS	1
Soccer Plex	Constructed	Public/Private Partner	3
St Andrew	Constructed	Private School	1
Walter Johnson	Constructed	MCPS	1
Holy Child	Under Construction	Private School	1
The German School	Plan in Review	Private School	1
Fairland Regional Park	Constructed	MNNCP	1
Holy Redeemer Church	Under Construction	Private	1
Mater Dei	Under Construction	Private	1
Champions Field House	Constructed	Private Business	3
Rockville Soccer Plex	Constructed	Private Business	3
		Total Identified	24

List is considered accurate but not complete.

Interesting Statistics for Each Field

Per Joe Murphy – On Deck Sports 1/10/2011

Removal costs = 50 cents per square foot
3- 10 pounds of infill per square foot
80,000 square feet of turf – pulverized used tires
Turf weight and rubber = 350,000 pounds
Sand + Turf + rubber = almost 1,000,000 pounds

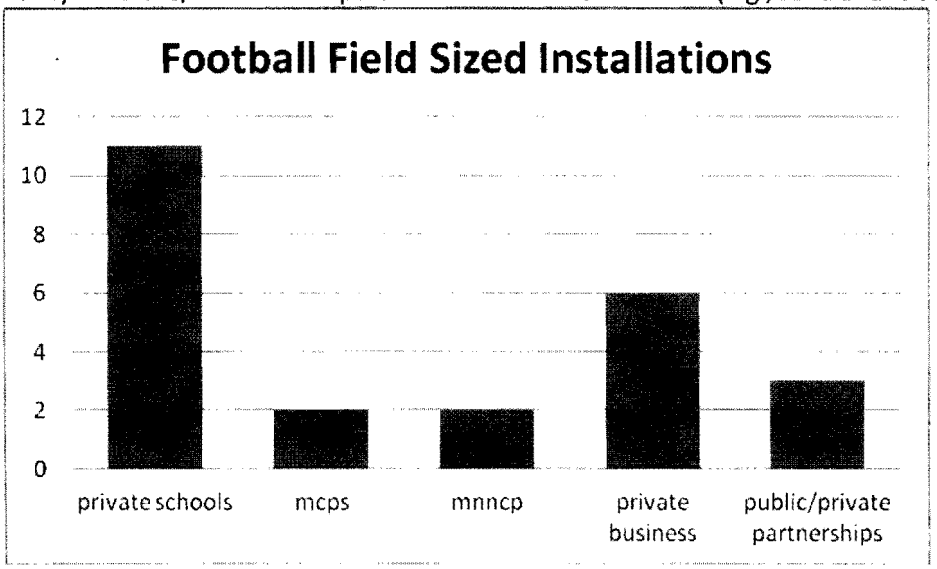
While we are still researching the age of the current installations, the warranted life of these fields is only 8 years. Within the next five years, it is anticipated that at least 5 of the football sized fields will be replaced, yielding a minimum of 1,750,000 pounds of rubber.

Solid Waste Advisory Committee (SWAC)

Annual Meeting with the County Executive

February 10, 2011

Artificial turf has the potential to be re-used, but currently cannot be recycled or incinerated. Contractors will have the ability to re-use/re-sell some portion of the removed material (e.g., sand and rubber crumb)



Montgomery County owned property is a small percentage of the total installed base. Montgomery County numbers confirmed with CUPF 1/20/2011.

Private homeowner Artificial Turf Installations

Reference sites per truegreensports.com

Potomac, MD	14
Bethesda	7
Rockville	5
N. Potomac	1
Germantown	1
Silver Spring	1
Gaithersburg	1

- Per Bob Speinke (True Green Sports) – 1/10/2011 We have approximately 150 installations in Montgomery County. The average size is 4-5000 square feet.
- Truegreen replaces, on average, 3 fields per year, resulting in a minimum of 15,000 square feet sent to landfill. All materials are transferred to the Waste Transfer Station.

List does not include private/commercial indoor putting greens, tennis courts and batting cages.

Research has not been completed for in-line skating facilities and retirement communities.

SECTION 02540

SYNTHETIC TURF PLAYING FIELD

PART 1 GENERAL

1.01 SCOPE OF WORK

A. It shall be the responsibility of the successful turf contractor to provide all labor, materials, equipment and tools necessary for the complete installation of a synthetic grass material, The system shall consist of, but not necessarily be limited to, the following:
   1. A complete synthetic grass system consisting of a minimum height 2-1/4 inch tall fiber.
   2. A resilient infill system, consisting of sand and rubber as specified in this section. The infill shall be filled so that there is a void of no greater than ¾" to the top of the fiber.

B. The Turf Contractor shall coordinate all activities with the City Contractor. The City Contractor will provide temporary fencing, access to potable water, sanitary facilities, and unimpeded access to the work site. The turf contractor shall be responsible for all other applicable General Condition requirements identified in the drawings and specifications referenced in paragraph 1.04B of this Document.

1.02 DEFINITIONS

For the purposes of this specification section, the following definitions shall apply:

A. "Turf Contractor" means the Turf Company awarded this Contract or its subcontractor(s) who will furnish and install the Synthetic Grass System in conformance with the terms and conditions of this Contract.

B. "City Contractor" means a separate contractor, under separate agreement, hired by the City, who shall be performing work at the project site contemporaneously with the Turf Contractor.

C. "The Turf Company" shall mean the Synthetic Grass System manufacturer and/or supplier awarded this contract.

D. "Synthetic Grass System" means the turf infill material, backing material, turf fibers, and field striping specified in this Contract Document and resulting in a synthetic turf field suitable for recreational sports in a heavily-used, urban environment.

E. "Owner" shall mean the City Fields Foundation.

F. "City" shall be City and County of San Francisco.

1.03 JOB CONDITIONS

A. The Turf Contractor shall be responsible for reviewing the base and ensuring it conforms to the project requirements prior to placement of the synthetic turf. Turf Contractor shall provide written verification to the Owner's Representative that the base installation is acceptable and meets their requirements prior to installing their turf.

B. Playing field subgrade preparation shall be completed and accepted by the Owner's representative prior to commencement of work under this section.

1.04 REFERENCES

A. ASTM Standard Test Methods:

1. [redacted]
2. D1577 - Standard Test Method for Linear Density of Textile Fiber
3. D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering
4. D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity
5. D5034 - Standard Test Method of Breaking Strength and Elongation of Textile Fabrics (Grab Test)
6. D5848 - Standard Test Method for Mass per Unit Area of Pile Yarn Floor Covering
7. F355 - Standard Test Method for Shock-Absorbing Properties of Playing Surfaces.
8. F1015 - Standard Test Method for Relative Abrasiveness of Synthetic Turf Playing Surfaces
9. F1936 - Standard Test Method for Shock-Absorbing Properties of North American Football Field Playing Systems as Measured in the Field

B. Specifications/Drawings:
City Fields Project Kimbell Playground- 1398J(R): plans dated 4/28/2009 and specifications dated June3, 2009.

C. Current National Federation of High School (NFHS) Soccer, Football, Men's and Women's Lacrosse, Baseball, Softball rules, as applicable.

1.05 TURF QUALIFICATIONS

A. The Turf Contractor shall be required to submit information from the synthetic turf installer and/or manufacturer as required in Section 01300 that complies with the following:

1. The Turf Contractor and/or the Turf Company must be experienced in **both** the manufacturing and installation of the specified type of synthetic in-filled turf system.
2. For the purpose of meeting these qualifications, the type of rubber and sand are determining factors in meeting these installation qualifications. No alternative in-fills will be allowed.
3. The Turf Contractor must provide competent workmen skilled in this specific type of synthetic turf installation. The designated Supervisory personnel on the project must be certified as competent in the installation of this material, including sewing seams and proper installation of the infill mixture. The manufacturer shall have a representative on site to certify the installation and warranty compliance.
4. All designs, markings, layouts, and materials shall conform to all current NFHS standards as specified that may apply to this type of synthetic turf installation.
5. The foreman installing the synthetic turf must have installed at least twenty (20) fields in the last three (3) years.
6. The Turf Company must provide competent workmen, skilled in this specific type of in-filled synthetic grass installation. The designated supervisory personnel on the project must be certified in writing by the turf manufacturer as competent in the installation of this material, including sewing seams and proper installation of the infill mixture. The manufacturer shall have a representative on site to certify the installation and warranty compliance.
7. The Turf Company must have certified crews and may not use outside, independent contractors for the installation.
8. The Turf Company must possess an active California D-12 Synthetic Products license in good standing, and have never had a license revoked.
9. The Turf Company must not have had a Surety or Bonding Company finish work on any contract within the last five (5) years.
10. The Turf Contractor shall provide written certification from the Turf Contractor and/or the Manufacturer that the proposed Synthetic Grass System does not violate any patent and that the Turf Contractor and/or the Manufacturer will indemnify, defend, and hold the City harmless from any claims arising out of or relating to patent, trademark, or copyright

infringement for the use of any proposed Synthetic Grass System installed by the Turf Contractor.

11. The terms and conditions of this Contract and applicable law mandate the payment of a prevailing rate of wage to all workers, including those engaged in the installation of the Synthetic Grass System. The Owner shall enforce the prevailing wage for each appropriate trade based on the type of work performed. Prevailing wage rates shall comply with the rules and regulations established by both state and local contracting law.
12. The Turf Company must not have been disqualified or barred from performing work for any public owner or other contracting entity in the U.S.

1.06 SUBMITTALS

A. Submit two complete samples, a minimum of 8" x 11" inch size, consisting of the exact proposed product. In addition, submit two loose samples (one foot squares) of the turf backing and tufted fibers and two sets of one quart samples of the following:
   1. Specified Sand Infill
   2. Specified Rubber Infill

B. Submit manufacturer's installation instructions.

C. The turf manufacturer shall submit a project specific letter on the company letterhead certifying that the products of this section meet or exceed all specified requirements, and state that the installer has complied with the qualifications above and is certified by the manufacturer to install this type of synthetic turf.

D. Submit Drawings for:
   1. Seaming plan.
   2. Installation details; edge detail, utility box detail, etc.
   3. Field Layout and Striping Plan (including field colors), including field line layouts (including colors), etc.
   4. The Turf Manufacturer shall submit color samples for approval for all color and/or logo work, including final electronic versions of artwork.

E. Certified copies of independent (third-party) laboratory reports on ASTM tests as follows:
   1. Pile Height, Face Width & Total Fabric Weight, ASTM D5848
   2. Primary & Secondary Backing Weights, ASTM D5848
   3. Tuft Bind, ASTM D1335
   4. Grab Tear Strength, ASTM D5034
   5. Water Permeability, ASTM D1551
   6. Flame Resistance, ASTM F1551
   7. Tuft Yarn Tensile Strength and Elongation, ASTM D2256

F. Submit a copy of the 8-year (minimum), prepaid, non-prorated, third-party insured warranty and insurance policy information.

G. Submit a list providing project name, date the field installation was approved, size of field, contact names and telephone numbers for each project that meets the experience requirements identified in 1.05-A.1 above.

H. At time of bid, Turf Contractor and /or Turf Manufacturer shall submit the following corporate information:
   1. Audited Financial Statement
   2. Proof of liability insurance including the amount of coverage and expiration date. Information shall be provided directly from Turf Contractor and /or Turf Manufacturer insurance company.
   3. List of Majority Owners (If privately held) and Board of Directors

4. Provide proof of EPLI

1.07 WARRANTY

A. The Turf Company shall submit its Manufacturer's Warranty which guarantees the usability and playability of the synthetic turf system for its intended uses for a minimum eight (8) year period commencing with the date of Substantial Completion. The warranty coverage shall not be prorated nor limited to the amount of the usage.

B. The warranty submitted must have the following characteristics:
1. A non-prorated, non-cancellable, up-front, pre-paid, third-party insured warranty. Warranty shall be covered by a third party insurance policy, non-cancelable and pre-paid, and is in effect covering this installation, and underwritten by a Best "A" Rated (or better) Insurance Carrier listed in the A.M. Best Key Rating Guide.
2. Insurance carrier must confirm that the policy is in force and premiums prepaid for entire warranty duration in full.
3. The policy must include a minimum annual aggregate of $5,000,000 per year and be based on claims arising from fields installed and completed only during the policy year.
4. The policy must provide full coverage for eight (8) years (minimum) from the date of Notice of Completion.
5. The policy shall cover all costs associated with full field replacement with new equal or better turf material, including labor, materials and any other costs to repair or replace the field.
6. Owner shall not be responsible for any deductible.
7. Warranty shall have no restrictions on hourly use limitations as long as the primary athletic use on the field is as anticipated in the original design. Turf Contractor shall include in the cost of the turf replacement of high use areas such as but not limited to home plate, batter's box, pitcher's mound, first, second, third, base areas, goal mouth's of soccer pitch's, etc. up to two times during the warranty period at a time of the warranty holder's discretion.
8. Must warrant materials and workmanship, and that the materials installed meet or exceed the product specifications, including general wear and damage caused from UV degradation.
9. Must have a provision to either make a cash refund or repair or replace such portions of the installed materials that are no longer serviceable to maintain a serviceable and playable surface.
10. Must be a warranty from a single source covering workmanship and all self-manufactured or procured materials.
11. Guarantee the availability of replacement material for the synthetic turf system installed for the full warranty period.
12. Turf must maintain an ASTM F355 G-Max of less than 170 for the life of the warranty.
13. The name on the warranty shall be made out to the City and County of San Francisco.
14. The Turf Company must verify that its onsite representative has inspected the installation and that the work conforms to the Manufacturer's requirements. The Manufacturer will submit written certification that the policy is in effect, fully funded and that the installation is added to the policy upon completion and acceptance.

1.08 BURDEN OF PROOF

A. Within this section, burden of proof of compliance with all requirements rests solely with the submitting Turf Company and or Turf Contractor, not with the City, Owner, Designer, or City Contractor.

PART 2 MATERIALS

2.01 INFILL SYNTHETIC TURF

A. The carpet shall be delivered in 15-foot wide rolls. The perimeter white and yellow lines can be tufted into the individual sideline rolls. The rolls shall be of sufficient length to extend from sideline to sideline. Head seams, between the sidelines, will not be acceptable.

B. All field of play lines for soccer, including soccer penalty kick circle, shall be inlaid or tufted. The lines for soccer, including soccer penalty kick circle, shall be yellow.

C. All field of play lines for Men's Lacrosse, including team and official areas, shall be inlaid or tufted. The lines shall be light blue.

D. All field of play lines for Women's Lacrosse, including team and official areas, shall be inlaid or tufted. The lines shall be red.

E. All field of play lines for football (except hash marks, which can be painted) shall be inlaid or tufted. The lines for football shall be maroon.

F. All field of play lines for baseball, shall be inlaid or tufted. The lines, bases, pitchers rubber shall be white. All infield areas as designated on plan are terra cotta in color.

G. All field of play lines for softball, shall be inlaid or tufted. The lines shall be white.

H. Rubber shall be provided per product specification, and shall be cryogenically processed SBR rubber. All rubber shall be a homogeneous black color and uniform size, and shall be clean of any impurities or material other than approved rubber.

I. All SBR rubber shall come from California recycled tires. The Turf Company shall provide documentation certifying the SBR source and the calculation of how many tires were recycled.

Sand shall be rounded silica sand and dust free. Coarse jagged sand will not be accepted. Sand shall consist of 60-70% of the total infill material as defined by weight. The sand shall have the following gradation:

Sieves (US Mesh Size)	% Retained
16	0
25	10-30
30	30-50
35	15-35
40	5-15
50	<5
70	<1

J. The specified infill shall be no less than a uniform ¾" depth below the top of fibers.

K. Thread for sewing seams of turf shall be as recommended by the Synthetic Turf Manufacturer.

L. Glue for inlaying lines and markings shall be as recommended by the Synthetic Turf Manufacturer.

2.02 SYNTHETIC TURF MAINTENANCE EQUIPMENT (GROOMER AND SWEEPER)

A. Turf Contractor shall supply one field groomer (min. 12' wide model) and one sweeper (3 piece gang unit). Sweeper to have a debris collection attachment that shall pick up ¼" diameter (and

larger) material, but leave infill material (i.e. sand and rubber). The groomer shall have plastic brushes and metal tines that are adjustable.

B. Acceptable grooming product is Synthetic Turf Groomer w/ Greens Slicer Spring Tine Rake, as manufactured by Greens Groomer Worldwide, Ph: (888) 298-8852, or acceptable equivalent product.

C. The field sweeper shall be the Agrifab sweeper as available from the manufacturer, (phone 1-800-724-2969) or acceptable equivalent product.

2.03 END-OF-LIFE RECYCLING PLANS

A. The Turf Company , with their bid proposal, shall provide detailed plans for the management of all turf product components at the end of their useful life, including:
1) Manner of reuse/recycling for each product component
2) Identification of parties responsible for the removal and disposal of the field products.
3) A detailed description of the reuse or recycling process.
4) A signed commitment from the winning proposal's signatory guaranteeing implementation of the plan within seven (7) years of the contract ratification.
5) These plans shall not include incineration, or any other type of high temperature conversion technology.
6) These plans shall not include the use of synthetic turf as Alternate Daily Cover.
7) Using the discarded synthetic turf in either of these methods may impact a firm's future opportunities for the contracting of synthetic turf fields.

2.04 POST CONSUMER RECYCLED CONTENT

A. All synthetic turf purchased for installation and use on San Francisco City property will include recycled content to the maximum extent feasible.
1) The Turf Company will provide the amount and type of recycled content in the turf product.
2) Proposals that do not include recycled content must provide an explanation as to why it was omitted and describe plans and timeline for inclusion of recycled content in the future.

2.05 HEAVY METALS AND MATERIAL CONTENT

A. The Turf Company will conduct and submit product analysis with the project bid. Analysis will be processed in the form of current, certified laboratory results using specified standards and processes.

B. Analytical Methodology: All representative samples of the turf fibers, turf backing, infill material shall be analyzed for lead, cadmium, and semi-volatile organic compounds (SVOCs), as well as select analyses for leachable metals concentrations.

1) Total Metals Analysis: All samples (fibers, infill, backing and backfill) shall be analyzed for the California [illegible] by the laboratory for analysis of total recoverable metals by USEPA [illegible]. The samples shall then be analyzed for total metals concentrations by USEPA method 6010B/7400.

2) Leachable Metals Analysis: [illegible] shall be analyzed for leachable concentrations of selected metals using the California [illegible] WET for lead, zinc, and cadmium. [illegible] from the total metals analysis [illegible] threshold limit Concentration (TTLC) value, as shown on attached Table B, the WET shall be conducted for those individual metals as well.

3) Analysis for SVOCs: All samples (fibers, infill, backing and backfill) shall be analyzed for the SW-846 list of SVOCs. The submitted samples shall be prepared by the laboratory for

analysis by USEPA method 3540 or 3550. The samples shall then be analyzed for SVOC concentrations by USEPA method 8270B or 8270C. Results shall include, at a minimum, data for aniline (CAS #62-53-3), phenol (108-95-2) and Benzothiazole (95-16-9). Concentrations of SVOCs are to be provided for reference purposes only and are not being evaluated against any particular criteria.

C. Evaluation Criteria: The detected concentrations of lead, chromium and zinc in the samples of the turf infill material shall not exceed the threshold values listed in Table A & B for total metals and leachable metals analyses. In no case shall the total metal concentration of any sample be equal to or exceeding TTLC values. In addition, concentrations of metals detected in any leachate test shall not exceed the STLC value (for threshold values, see California Code of Regulations, Title 22, Chapter 11, Article 3.)

TABLE A. Maximum levels of metals permitted for San Francisco synthetic turf products – recycled styrene butadiene rubber (SBR) infill materials

Metal	Total metals analysis (mg/kg)	Leachable metals analysis (ug/L)
Chromium	750[ii]	50[iv]
Lead	50	2.5[iv]
Zinc	23,000[iii]	250,000[iv]

i. San Francisco Regional Water Quality Control Board (SFRWQCB) Environmental Screening Level (ESL) for residential land use for compounds detected in shallow soils where groundwater is a current or potential source of drinking water.
See: http://www.swrcb.ca.gov/rwqcb2/esl.shtml

ii. No total chromium value promulgated in ESLs; chromium III value indicated instead.

iii. California Human Health Screening Levels (CHHSLs) for soil for residential land use.

iv. Selected soluble threshold limit concentration (STLC).

TABLE B. Maximum levels of total metals permitted for San Francisco synthetic turf products – fibers, underlayment, and backing

Metal	Total metals analysis (mg/kg)
Chromium	25
Lead	50

2.06 BROMINATED FLAME RETARDANTS

A. The Turf Company shall provide verification that brominated flame retardants have not been intentionally added in the manufacture of the turf fibers, backing/underlayment or infill materials. Verification can take the form of a signed letter from the manufacturer, or appropriate laboratory analyses of the product proving that levels of elemental bromine are lower than 1% by weight.

PART 3 EXECUTION

3.01 INSTALLING THE SYNTHETIC TURF

A. The installation shall be performed in full compliance with the reviewed and accepted product submittal.

B. Only trained technicians, skilled in the installation of athletic caliber synthetic turf systems working under the direct supervision of the approved installer/manufacturer supervisors, shall undertake any cutting, sewing, gluing, shearing, topdressing or brushing operations.

C. The Turf Contractor shall strictly adhere to the installation procedures outlined in this section. Any

D. The turf manufacturer and installation subcontractor shall inspect and accept in writing the field base section and drainage, and provide documentation to that effect, prior to the installation of the synthetic grass system. The surface must be perfectly clean as installation commences and shall be maintained in that condition throughout the process.

E. Brock to be installed by the City Contractor timing to be coordinated between City Contractor and Turf Contractor. The carpet rolls are to be installed directly over the properly installed manufactured base material. Refer to the synthetic turf base specification section. No equipment with loads greater than 35 pounds per square inch (35 psi) shall be allowed on the field. As required, Turf Contractor is responsible for altering operations in order to adhere to this requirement. Turf Contractor and synthetic turf installer shall strictly adhere to the written instructions provided by the Brock manufacturer for installing turf on top of their product. Turf Contractor shall always make sure that those vehicles being used on Brock bases are equipped with pneumatic (air-filled) tires, preferably turf tires. These tires are designed to spread loads and minimize damage to surface. Foam Filled or solid tires as well as tires with aggressive lug patterns should not be used on the Brock base, without synthetic turf installed. *If possible, use of an A-frame for unrolling of the synthetic turf is* ***strongly recommended.***

F. The carpet rolls are to be installed directly over the properly prepared base. Extreme care should be taken to avoid disturbing the base, both in regard to compaction and planarity. It is suggested that a 2-5 ton static roller is on site and available to repair and properly compact any disturbed areas of the prepared base. If repairs are required, they shall be coordinated with the City Contractor prior to repair.

G. The full width rolls shall be laid out across the width of the field. Utilizing standard state of the art sewing procedures each roll shall be attached to the next. When all of the rolls of the playing surface have been installed, the sideline areas shall be installed at right angles to the playing field turf. *GLUING OF ROLLS SHALL NOT BE ACCEPTABLE.*

H. Seams shall not be visible and shall be flat, tight and permanent with no separation or fraying. Seams that show after installation shall be repaired prior to final project completion at no cost to the Owner.

I. The synthetic turf field shall utilize sewn seams. Minimum gluing will only be permitted to repair problem areas, corner completions, and to cut in any logos or inlaid lines as required by the specifications. Seams between turf panels must be sewn. Inlaid markings may not be installed by means of cutting through the fabric and adhering the colored turf to a separate reinforcing tape or cloth. Rather, inlaid markings (that cannot be tufted into the fabric), shall be installed by means of shearing out the existing green fiber and laying in a new piece of colored fabric into a bed of suitable "hot melt" adhesive placed directly on the original turf backing material. Systems that cut through the turf fabric for inlaid lines are not acceptable due to the fact that such a procedure shall weaken the structural integrity of the turf fabric backing. All seams shall be sewn using double bagger stitches and polyester thread or adhered using seaming tape and high grade adhesive (per the manufacturer's standard procedures). Seams shall be flat, tight, and permanent with no separation or fraying.

J. Connections of the perimeter synthetic turf edges shall be completed by one of the following two methods (refer to drawings for applicable details):
   1) Connection to perimeter concrete edges (with recessed edge) with the manufacturer-approved adhesive.
   2) Connection to the recycled plastic header boards shall be done with industrial staples (min. depth embedment is one inch (1") at maximum 2 inch (2") on center staple spacing. Header board will be installed by the City Contractor.

K. Infill materials shall be applied in thin lifts. The turf shall be brushed as the mixture is applied. The infill material shall be installed to a depth as specified in this section. The mix shall be uniform and even in thickness to assure proper playing characteristics. The infill material shall not be installed during wet conditions.

L. The infill materials shall be installed to fill the voids between the fibers and allow the fibers to remain vertical and non-directional. The infill shall be placed so that there is a void of ¾" to the top of the fibers.

M. At near Substantial Completion of the synthetic turf fields, the Turf Contractor shall test for shock absorbency. The turf contractor and/or manufacturer shall pay for an independent testing laboratory accredited for such tests (who shall be pre-approved by the Owner's Representative). All testing and analysis of findings shall be completed by qualified persons utilizing correct techniques. The laboratory shall provide the necessary testing data to the Owner's Representative that verifies the finished field meets or exceeds the required shock attenuation. The G-max range shall be between 95 and 170 for the life of the warranty, as determined by the ASTM F355A and F1936 test procedures. Any test results that do not meet the requirements of this specification or if any one test value is greater than ten percent (10%) greater in variance as specified in1.07B-12, then the Turf Contractor's field installer shall address the failed test area, be required to retest the entire field as stated above, and conform to these requirements prior to the issuance of the Certificate of Substantial Completion.

PROTECTION AND CLEANING

A. Protect installed synthetic turf from subsequent construction operations and the public until Substantial Completion.

B. Do not permit traffic over unprotected turf surface.

C. Turf Contractor shall provide the labor, supplies, and equipment as necessary for final cleaning of surfaces and installed items.

D. All usable remnants of new material shall become the property of the City.

E. The Turf Contractor shall keep the area clean throughout the project and clear of debris.

3.02 MAINTENANCE & WARRANTY

A. The turf installer and/or the turf manufacturer must provide the following prior to Final Acceptance and the Owner's Representative filing the Project Notice of Completion:
   1. The turf manufacturer shall provide the written warranty for the project per the minimum requirements identified in this specification section. Submit Manufacturer Warranty and ensure that forms have been completed in Owner's name and registered with Manufacturer and Insurance Carrier. Submit information confirming that the third party

insurance policy, non-cancelable and pre-paid, is in effect covering this installation, and underwritten by a Best "A" Rated Insurance Carrier. Insurance carrier must confirm that the policy is in force and premiums paid.

2. Three (3) copies of Maintenance Manuals, which will include all necessary instructions for the proper care and preventive maintenance of the turf system, including painting and markings.
3. Project Record Documents: Record actual locations of seams and other pertinent information.
4. Upon completion of the field installation, the turf installation contractor shall have a supervisory personnel provide a minimum three (3) hour field training seminar with the Owner's Representative on how to care for the field. At a minimum, seminar shall include a demonstration of how to care for the field with the provided groomer / sweeper address use of the sweeper and groomer, review the entire provided maintenance manual (including the proper procedure for removal of gum and other debris) and answer any questions.
5. Supply a field groomer and/or sweeper as specified.
6. The Contractor shall achieve Substantial Completion for the work under this Contract when the Project is ready and available for use as a playfield.
7. Provide surplus materials of 500 lbs of rubber infill material. Rubber material shall be delivered in 90 gallon wheeled totes.

B. Turf Manufacturer shall be responsible for the testing of the G-max levels of the installed synthetic turf at the completion of years two, four, six, and one month prior to the completion of year eight. If any of these tests do not fall within the G-max range as specified in this specification section, the Manufacturer will be required to modify the field composition to the sole satisfaction of the Owner's Representative so that it falls within the target G-max range. All costs associated with such work shall be borne solely by the Manufacturer and/or installer. Any failed test shall be retested to verify that the field meets the specifications. All testing shall be paid by the Manufacturer and/or installer. All testing shall be completed by an independent testing laboratory accredited for such tests, and shall be pre-approved by the Owner's Representative. All testing and analysis of findings shall be completed by qualified persons utilizing the required techniques outlined in the ASTM F355 test standard.

END OF SECTION

Appendix M:

MEMORANDUM

To: **Recreation and Park Commission**

Thru: **Phil Ginsberg, General Manager**

From: **Dan Mauer, Capital Division**

Cc: **Chris Geiger, Ph.D, Department of the Environment**

Paul Ledesma, Department of the Environment

Patrick Hannan, City Fields Foundation

Date: **7/8/09**

Re: **Synthetic Turf Standards – Information Only**

On October 2, 2008, the San Francisco Recreation and Park Commission approved the recommendations in the Synthetic Playfield Task Force Report. As part of Recreation and Parks' ongoing implementation of those recommendations, we've collaborated with the Department of the Environment and the City Fields Foundation to develop standards for synthetic turf purchases for San Francisco Recreation and Parks athletic fields being renovated with synthetic turf.

This memo is for information only. The Department of the Environment is the agency issuing the synthetic turf standards and there is no action for the commission to take today. The Kimbell Playground athletic field renovation will be the first project to use the new synthetic turf standards.

Background

The Department of the Environment's Chris Geiger, Ph.D - the Municipal Toxics Reduction Coordinator, and Paul Ledesma – the City Government Zero Waste Coordinator, were instrumental in developing heavy metal, recycling and recycled content standards for synthetic turf. These standards include general purchasing requirements previously established by resolution at the Board of Supervisors.

In issuing these standards, San Francisco will become the first known municipality in the nation to require recyclability as well as recycled content in synthetic turf purchases. The high amount of recycled content in styrene butadiene rubber (SBR) infill is a primary factor in the SF Department of the Environment's ongoing support for using SBR rubber in local synthetic turf fields.

Lead is the primary heavy metal to be addressed by the heavy metal standards, with Chromium a distant second. The primary goal is to filter out products that have purposely added lead chromate or other lead compounds to the turf components.

Zinc is the primary concern in the recycled tire SBR infill. Zinc oxide is purposefully added to tires at rates of up to 2% or more. It is not a major human health hazard but can be an aquatic toxicity hazard if the tires sit in water for a long time. In 2008, the Synthetic Playfields Task Force reviewed the existing scientific literature and fully discussed this hazard with regard to synthetic turf. The task force determined that there is no imminent risk of aquatic toxicity but, as a precautionary measure, the SF Public Utilities Commission staff will test runoff levels at a representative field. We are initiating those tests. The task force also recommended installing synthetic turf fields above the water table and using a criteria based site selection process to determine the potential public health benefits of an installation.

San Francisco Synthetic Turf Standards

The synthetic turf standards fall into three general categories: end-of-life recycling plans, post-consumer recycled content and heavy metal and material content. Potential vendors will be required to provide the information when submitting project bids. Any bids with incomplete information or insufficient data will be rejected.

<u>End-of-Life Recycling Plans</u>

Potential vendors will be required to provide detailed plans for the management of all turf product components at the end of their useful life, including:

a. Manner of reuse/recycling for each product component
b. Identification of parties responsible for the removal and disposal of the field products.
c. A description of the reuse or recycling process.
d. A signed commitment from the winning proposal's signatory guaranteeing implementation of the plan within seven (7) years of the contract ratification.
e. These plans shall not include incineration, or any other type of high temperature conversion technology.
f. These plans shall not include the use of synthetic turf as Alternate Daily Cover.

g. Using the discarded synthetic turf in either of these methods may impact a firm's future opportunities for the contracting of synthetic turf fields.

Post Consumer Recycled Content

All synthetic turf purchased by San Francisco will include recycled content to the maximum extent feasible.

a. Potential vendors will provide the amount and type of recycled content in the turf product.
b. Proposals that do not include recycled content must provide an explanation as to why it was omitted and describe plans for inclusion of recycled content in the future.

Heavy Metals and Material Content

Potential vendors will conduct and submit product analysis with the project bid. Analysis will be presented in the form of certified laboratory results using specified standards and processes.

Analytical Methodologies: Representative samples of the turf fibers, turf backing, and infill material shall be analyzed for total metals content and semi-volatile organic compounds (SVOCs), as well as select analyses for leachable metals concentrations.

1) Total Metals Analysis: *All samples* (fibers, infill, underlayment and backing) shall be analyzed for the California Assessment Manual 17/Title 26 list of metals (CAM 17 metals). The submitted samples shall be prepared by the laboratory for analysis of total recoverable metals by USEPA method 3050B. The samples shall then be analyzed for total metals concentrations by USEPA method 6010B/7400.

2) Leachable Metals Analysis: *Infill samples only* shall be analyzed for leachability of selected metals using the California Waste Extraction Test (WET). All samples shall be analyzed by the WET for lead, zinc, and total chromium. For other constituents, if the detected concentrations from the total metals analysis above are greater than or equal to ten times the Soluble Threshold Limit Concentration (STLC) value, as shown on attached Table B, the WET shall be conducted for those individual metals as well.

3) Analysis for SVOCs: *All samples* (fibers, infill, underlayment, backing.) shall be analyzed for the SW-846 list of SVOCs. The submitted samples shall be prepared by the laboratory for analysis by USEPA method 3540 or 3550. The samples shall then be analyzed for SVOC concentrations by USEPA method 8270B or 8270C. Results shall at a minimum include data for aniline (CAS #62-53-3), phenol (108-95-2) and benzothiazole (95-16-9). Concentrations of SVOCs are to be provided for reference purposes only and are not being evaluated against any particular criteria.

Evaluation Criteria: The detected concentrations of lead, chromium, and zinc in the samples of the turf and the cushioning material shall not exceed the threshold values listed in Table A-C for total metals and leachable metals analyses. In no case shall the total metal concentration of any metal equal or exceed the TTLC values. In addition, concentrations of metals detected in any leachate tests shall not exceed the STLC value (for threshold values, see California Code of Regulations, Title 22, Chapter 11, Article 3.)

Brominated flame retardants

Vendor shall provide verification that brominated flame retardants have not been intentionally added in the manufacture of the turf fiber, backing, underlayment or infill materials. Verification can take the form of a signed letter from the manufacturer, or appropriate laboratory analyses of the product proving that levels of elemental bromine are lower than 1% by weight.

TABLE A. Maximum levels of metals permitted for San Francisco synthetic turf products – recycled styrene butadiene rubber (SBR) infill materials

Metal	**Total metals analysis (mg/kg)**	**Leachable metals analysis (ug/L)**
Chromium	750[i,ii]	50[i]
Lead	50	2.5[i]
Zinc	23,000[iii]	250,000[iv]

i. San Francisco Regional Water Quality Control Board (SFRWQCB) Environmental Screening Level (ESL) for residential land use for compounds detected in shallow soils where groundwater is a current or potential source of drinking water. See: http://www.swrcb.ca.gov/rwqcb2/esl.shtml

ii. No total chromium value promulgated in ESLs; chromium III value indicated instead.

iii. California Human Health Screening Levels (CHHSLs) for soil for residential land use.

iv. Selected soluble threshold limit concentration (STLC).

TABLE B. Maximum levels of metals permitted for San Francisco synthetic turf products – non-SBR infill materials

Metal	Total metals analysis (mg/kg)	Leachable metals analysis (ug/L)
Chromium	750[i,ii]	50[i]
Lead	50	2.5[i]
Zinc	23,000[iii]	81[i]

i. San Francisco Regional Water Quality Control Board (SFRWQCB) Environmental Screening Level (ESL) for residential land use for compounds detected in shallow soils where groundwater is a current or potential source of drinking water. See: http://www.swrcb.ca.gov/rwqcb2/esl.shtml

ii. No total chromium value promulgated in ESLs; chromium III value indicated instead.

iii. California Human Health Screening Levels (CHHSLs) for soil for residential land use.

TABLE C. Maximum levels of total metals permitted for San Francisco synthetic turf products – fibers, underlayment, and backing

Metal	Total metals analysis (mg/kg)
Chromium	25
Lead	50