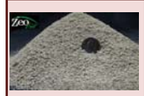
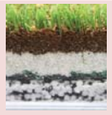
Appendix B - Rt. 33 Recreation Field, Portsmouth, NH

Synthetic Turf Infill Options

Weston & Sampson

	Infill Type	Examples	Material Description	Facts and Advantages	Disadvantages	Life Span	Maintenance	End of Life Cycle	Cost / S.F. *Carpet and Infill system only	Irrigation System	Estimated Rt. 33 Field Synthetic Turf Cost (Soccer Field - 89,805 s.f.) * Carpet, infill, shock pad (if required) and irrigation system (if required) only.	Annual Maintenance Cost
	**Crumb Rubber Infill**	1. Gillette Stadium, MA 2. Hoover High School, CA 3. Ames High School, IA	Crumb rubber infill is derived from recycled tires. There are two types: Ambient and Cryogenic. Ambient crumb rubber is created through a process where the tires are kept at room temperature during the crumbling process. Cryogenic crumb rubber is created by freezing the tires prior to granulation. This process avoids heat degradation. Crumb rubber infill is the most widely used infill material for synthetic sports fields.	This is currently the most inexpensive and widely used infill material on the market. Crumb rubber is metal free and does not contain liberated fibers in an amount that exceeds .01% of the total weight of the crumb rubber. The metal and liberated fibers are materials used in the tire manufacturing process. According to the Sports Turf Council (STC) crumb rubber meets the European Union EN 73-1 Standards which are the standards for compliance of chemicals in children's toys. Most used, tested and proven infill in the industry.	Although numerous studies have proven crumb rubber to be non - toxic to the field users, many safety concerns have risen in the media. Because of its black colour SBR has high surface temperatures caused by sunlight.Crumb rubber gives off odors at high temperatures and can not be recycled, only re-used.	Life of the carpet	- Grooming per 100 hours - Decompaction every 3-4 years - Top dressing every 2-3 years - Annual G-MAX monitoring	Can be reused (not recycled) ex: Field infill, asphalt, acoustic barriers, ADA compliant playground surfacing, natural turf soil amendments, etc.	$4.00 - $4.50	Not required	$404,123	$5,000 - $10,000 (Plus 300 hours of labor)
	**Coated Crumb Rubber Infill**	1. Mary E. Grogan Community Park, CA 2. Randall Island Sport Complex, NY 3. Buckingham Browne & Nichols School, MA	Both the ambient and cryogenic rubber can be coated with colorants, sealers, and anti-microbial substances. Similar to crumb rubber infill, coated crumb rubber also does not contain metal and lose fibers used during the tire manufacturing process as well meets the EN 73-1 standards.	Coated crumb rubber provides additional aesthetics appeal, reduction of dust by product during the manufacturing process and complete encapsulation of the rubber particle.	High cost, same chemical make-up as SBR rubber, and limited availability.	Life of the carpet	- Grooming per 100 hours - Decompaction every 3-4 years - Top dressing every 2-3 years - Annual G-MAX monitoring	Select products can be recovered, cleaned and recoated for reuse as infill. Can also be recycled into rubberized asphalt or molded products.	$4.75 - $5.25	Not required	$471,476	$5,000 - $10,000 (Plus 300 hours of labor)
	**EPDM Infill**	1. Los Prados Park, CA	EPDM (Ethylene Propylene Diene Monomer) is a polymer elastomer with high resistance to abrasion and wear. Available in a variety of colors and has similar physical characteristics to crumb rubber infill.	EPDM has proven its durability as an infill product in all types of climates. Its excellent elasticity properties and resistance to atmospheric and chemical agents provide a stable, high performance infill product.	Over time EPDM can harden because the cross-linking reaction used to make the product continues. This has a negative impact on playing characteristics and can affect the fibre characteristics.Recycling is not possible.	8-10 years	- Grooming per 100 hours - Decompaction every 3-4 years - Top dressing every 2-3 years - Annual G-MAX monitoring	Can be reused as infill and recycled into new infill or other products.	$6.75 - $7.00 (Includes $2.00 Shock Pad)	Not required	$628,635	$5,000 - $10,000 (Plus 300 hours of labor)
	**TPE Infill**	1. Sprague School, MA	Thermo Plastic Elastomer (TPE) infill is a non-toxic elastomer, available in variety of colors, very long lasting and 100% recyclable and reusable as infill when the field is replaced. TPE has a similar feeling as it relates to play characteristics to crumb rubber.	TPE infill, when used with virgin-based resins, will offer consistent performance and excellent g-max over a wide temperature range. It is used in combination with a shock pad.	High cost, must use proven, proprietary formulas for quality, and limited availability. Has been known to get sticky in hot climates in proper formula is not used.	8-10 years	- Grooming per 100 hours - Decompaction every 3-4 years - Top dressing every 2-3 years - Annual G-MAX monitoring	Can be reused as infill and recycled into new infill or other products.	$7.50 - $7.75 (Includes $2.00 Shock Pad)	Not required	$695,989	$5,000 - $10,000 (Plus 300 hours of labor)
	**Nike Grind**	1. Lincoln High School, OR 2. Lafayette Park, CA 3. Glassel Park, CA	Nike Grind includes three types of raw materials made from recycled athletic shoes and manufacturing byproducts: rubber from the outsole, foam from the midsole and fabric from the upper. These materials are ground up and used by select companies in sport and playground surfaces, as well as in numerous Nike apparel, footwear and equipment products.	Nike Grind Reduces water consumption by hundreds of thousands of gallons each year over natural grass fields. It's optimized construction is rigorously tested for impact performance, and is virtually odorless and won't mark balls, shoes or players.Nike Grind can use a lighter color profile to reflect sunlight and generate 10–15-percent less heat build up, helping to sustain athletic performance.	It take 50,000 - 75,000 pairs of shoes to make a full size soccer field, which limits that availablity of this prodect. The demand tends to be higher then can be supplied, making annual infill replacement difficult and unreliable.	10 years of play at 40 hours a week.	- Grooming per 100 hours - Decompaction every 3-4 years - Top dressing every 2-3 years - Annual G-MAX monitoring	Can be reused (not recycled) ex: Field infill, asphalt, acoustic barriers, ADA compliant playground surfacing, natural turf soil amendments, etc.	$5.75 - $6.00	Not required	$538,830	$5,000 - $10,000 (Plus 300 hours of labor)
	**EcoMax**	1. Bellarmin College Preparatory , CA	This infill is comprised of an extruded composite of recycled turf and thermoplastic elastomer (TPE). The EcoMax granules deliver a new, impact absorbing infill that offers safe and comfortable performance.	EcoMax offers great playability characteristics (plays close to high end cryogenic rubber/sand infill system), good compression/compaction characteristics, slight heat reduction, and is Tested rigorously for mechanical wear and weathering.	High cost, limited availability, and limited installation and long term use history.	8 years	- Grooming per 100 hours - Decompaction every 3-4 years - Top dressing every 2-3 years - Annual G-MAX monitoring	Can be returned to select manufacturers to be cleaned and recycled. Can also be reused as infill in synthetic turf field.	$7.00 - $7.50 (Includes $2.00 Shock Pad)	Not required	$673,538	$5,000 - $10,000 (Plus 300 hours of labor)
	**Sand (Silica)**	Used as a ballast in all rubber systems	Pure silica sand is one of the original infill materials utilized in synthetic turf system. This product is a natural infill that is non-toxic chemically stable and fracture resistant. Typically tan or white in color. As a natural product there is no heavy material within the silica. It is important the silica have a high purity (greater than 90%) to resist deterioration and absorption of bacteria.	It can be used in conjunction with many other infills on the market to provide safe and more realistic playing surface. Silica can be mixed with rubber products. Silica sand can either be coated with different materials as a standalone product or can be used to firm up a combination of traditional infill systems. It is used in combination with a shock pad.	The relative hardness of the material is very high, high abrasive quality, high cost due to required shock pad, high transportation costs due to weight, and more infill needed due to small particle size and heavy compaction.	Life of carpet	- Grooming per 100 hours - Top dressing every 2-3 years - Annual G-MAX monitoring	Can be reused as infill on new field, in landscape installations, and for natural turf soil amendments.	$6.75 - $7.00 (Includes $2.00 Shock Pad)	Not required	$628,635	$5,000 - $10,000 (Plus 300 hours of labor)
	**Coated Silica Sand Infill**	1. Newburyport High School, MA 2. South Windsor High School, CT	This class of infill consists of coated, high-purity silica sand with either a soft or rigid coating specifically engineered for synthetic turf. These coatings are either elastomeric or acrylic in nature (non-toxic) and form a bond with the sand grain sealing it from bacteria to provide superior performance and durability. Coated sand is available in various sizes.	This material is typically used in a homogenous infill which provides both ballast and shock absorbing qualities in combination with a shock pad.	The relative hardness of the material is very high, high cost due to required shock pad, high transportation costs due to weight, and more infill needed due to small particle size and heavy compaction.	16 year maximum	- Grooming per 100 hours - Top dressing every 2-3 years - Annual G-MAX monitoring	Can be returned to select manufacturers to be cleaned and recoated. Can also be reused as top dressing on natural turf fields.	$6.75 - $7.00 (Includes $2.00 Shock Pad)	Not required	$628,635	$5,000 - $10,000 (Plus 300 hours of labor)
	**ZeoFill**	1. Jesuit High School, CA 2. John Ferraro Athletic Fields, CA 3. Van Nuys - Sherman Oaks Complex, CA	Zeolites are naturally occurring minerals found in specific types of sedimentary rocks. Due to their natural absorbent/adsorbent qualities, zeolites have been used for many different applications. The use of ZeoFill was of particular interest to the synthetic grass industry since it is certified organic and therefore poses no safety concerns.	ZeoFill provides a cooler surface, less pungent rubber smell, no harmful silica sand dust which increase chances of silicosis and helps clean waste water run-off.	The Synthetic Turf industry has adopted zeolite as an alternative infill but most companies don't realize the potential harm if they use the wrong type of zeolite. Also due to the relative hardness of ZeoFill, a shock pad is required.	8 years	- Grooming per 100 hours - Top dressing every 2-3 years - Annual G-MAX monitoring	Can be re-used as a soil amendment, cat litter or even storm water filtration	$6.25 - $6.50 (Includes $2.00 Shock Pad)	Not required	$583,733	$5,000 - $10,000 (Plus 300 hours of labor)
	**CoolPlay**	1. University of Tulsa, OK 2. Saratoga High School, CA 3. University of Maryland, MD	FieldTurf's exclusive and innovative Extruded Cork Composite (ECC) top dressing allows the CoolPlay system to deliver the same behavior and overall stability as FieldTurf's Elite system fields found in the world's most famous stadiums. CoolPlay takes nothing away from performance... exept the heat.	The special ECC top dressing could replace the top layer of crumb rubber on the three-layer infill system - which is proven to offer better performance and safety. The ECC granule is durable, shock absorbing and absorbs far less heat than other alternatives. No irrigation needed. CoolPlay has higher resiliency than other organics.	Still uses crumb rubber in the infill system which comes with all of the same concerns as having a regular crumb rubber infill and the top cork layer will breakdown over time.	8 years	- Grooming per 100 hours of play - Replace 10% of infill every 2-3 years - Decompaction 2 times a year - Annual G-MAX Monitoring	Can be used to topdress natural turf fields.	$4.75 - $5.00	Not required	$449,025	$12,000 - $18,000
	**Cork & Coconut Fibers (GreenPlay)**	1. St. Timothy's School, MD	A select, high tensile strength coconut fiber matrix blended with ground virgin cork. No chemicals are added and it comes in a variety of browns and earth tone colors.	This environmentally sustainable, highly permeable,100% recyclable infill has proven to reduce turf temperatures up to 65 degrees, reduce G-Max levels, increase foot stability and reduce energy restitution with proven durability for the life of the field. These materials have a natural resistance to mold & fungus. Irrigation and a shock pad are required.	Requires irrigation to avoid hardening, requires annual additional infill, unproven longterm performance, increased cost per square foot, and higher maintenance costs.	8 years	- Grooming per 100 hours of play - Replace 10% of infill every 2-3 years - Decompaction 2 times a year - Annual G-MAX Monitoring - Monitor moisture content twice a week	Top layer (40%) can be reused as infill, the remaining 60% can be used to topdress a natural turf field.	$6.75 - $7.00 (Includes $2.00 Shock Pad)	$40,000.00	$668,635	$12,000 - $18,000 (Does not include cost of water. 12,000 gallons twice a week is the recommended average)

	Infill Type	Examples	Material Description	Facts and Advantages	Disadvantages	Life Span	Maintenance	End of Life Cycle	Cost / S.F. *Carpet and Infill system only	Irrigation System	Estimated Rt. 33 Field Synthetic Turf Cost (Soccer Field - 89,805 s.f.) * Carpet, infill, shock pad (if required) and irrigation system (if required) only.	Annual Maintenance Cost
	**Cork (PureFill)**	1. Santa Flavia- Palermo, Italy 2. SV Wateringseveld- The Netherlands 3. Signal Iduna Park- Dortmund, Germany	Cork infill is a natural infill that is 100% environment friendly and non-toxic. It is an organic, recyclable and sustainable product that is harvested from the cork oak tree every nine years, without harming the trees.	Cork is considered an unalterable and unperishable material. It has a low thermal conductivity due to its natural structure which will reduce the surface temperature significantly. The suberin component of cork is anti-microbial and anti-allergenic and will repel pests, mold, and prevent the cork from rotting. No water is required, but a shock pad is necessary.	Moderate resiliance, low density allows materials to float, cling to fibers with static charge, may require irrigation to remove static charge, and limited availability.	8 years	- Groom after heavy rain - Replace 10% of infill every 2-3 years - Decompaction 3 times a year/ every 4-6 weeks - Annual G-MAX Monitoring	Can be used to topdress natural turf fields or recycled directly into the environment.	$6.25 - $7.50 (Includes $2.00 Shock Pad)	Not required	$673,538	$14,000 - $20,000
	**Coconut Fibers (GeoFill)**	1. Google Corporate Campus Soccer Field, CA 2. Pleasantville High School and Middle School Fields, NY	Coconut fibers allows for clean water runoff, is 100% recyclable and is naturally resistant to mold and fungus. These fiber's unique organic properties, gives the entire system synthetic grass an amazing touch of naturalness	Coconut fibers are layered with sand and a shock pad to provide a stable surface that prevent infill shifts and flyouts. Naturally cooler because the composition of the fibers holds moister and is resistant to mold and fungus. This infill system will require irrigation and annual top dressing and decompaction.	Requires irrigation to avoid hardening, requires annual top dressing and decompaction, unproven longterm performance, increased cost per square foot, and higher maintenance costs.	8 years	- Grooming per 100 hours of play - Replace 10% of infill every 2-3 years - Decompaction 2 times a year - Annual G-MAX Monitoring - Monitor moisture content twice a week	Can be used to topdress natural turf fields or recycled directly into the environment.	$6.75 - $7.00 (Includes $2.00 Shock Pad)	$40,000.00	$668,635	$12,000 - $18,000 (Does not include cost of water. 12,000 gallons twice a week is the recommended average)
	**Coconut Husk, Rice Husk and Cork (Infill-Pro Geo)**	1. The Fessenden School, MA 2. Virginia Soccer Training Center, VA 3. Highlands Field, CA	This unique natural infill is composed by selected organic fibres that guarantee better technical and sporting performances, provide better conditions for athletes, the environment and safety. Provides a natural grass-like look	Excellent UV resistance Due to the fibre nature and the plant origin, it has a high UV resistance making deterioration very slow over a very long time. This infill can be recycled for agricultural use therefore when the artificial turf comes to the end of its life, it is easy and economical to remove.	Requires irrigation to avoid hardening, requires annual additional infill, unproven longterm performance, increased cost per square foot, and higher maintenance costs.	8 years	- Grooming per 100 hours of play - Replace 10% of infill every 2-3 years - Decompaction 2 times a year - Annual G-MAX Monitoring - Monitor moisture content twice a week	Can be used to topdress natural turf fields or recycled directly into the environment.	$6.75 - $7.00 (Includes $2.00 Shock Pad)	$40,000.00	$668,635	$14,000 - $20,000 (Does not include cost of water. 12,000 gallons twice a week is the recommended average)
	**Walnut Shells (SafeShell)**	1. Baseball Field, Cincinnati, OH	Safeshell is made of 100% USA grown walnut shells.Safeshell teamed up with a leading biotechnology firm to develop a unique process that virtually eliminates residual protein allergens which remain on the shell after processing. SafeShell is a blend of Black and English walnut shells. Black walnut shells are more rounded than English walnut shells. The result of this proprietary mix is the perfect balance of firm, fast and player friendly.	Safeshell excels at evaporative cooling. Safeshell absorbs water with minimal expansion and then releases it slowly over time to help keep surfaces from heating up too quickly. Even dry, Safeshell plays cooler than crumb rubber. Safeshell is made from one of the hardest nut shells on the planet. It doesn't float and plays the same wet or dry. 100% organic.	Safeshell is a made from walnut shells because they are the hardest nut in the world. The trade-off is the abrasion factor.Also SafeShell has only been around for a little over two years so there is limited installation and long term use history.	Life of carpet	- Grooming per 100 hours - Decompaction every 3-4 years - Top dressing every 2-3 years - Annual G-MAX monitoring	Can be used to topdress natural turf fields or recycled directly into the environment.	$6.50 - $6.75 (Includes $2.00 Shock Pad)	Not required	$606,184	$5,000 - $10,000 (Plus 300 hours of labor)

City of

Portsmouth

New Hampshire

Artificial Turf at the Route 33 Athletic Complex

May 15, 2017

Presentation Outline

How did we get to where we are today?

- City-wide Field Shortage | Critical Needs
- Portsmouth High School Field as a Case Study
- Design Process | Multiple Field Design Options
- Recognizing + Addressing Community Concerns
- The Recommended Improvement Program

City-wide Field Shortage | Critical Needs

From – City of Portsmouth Comprehensive Recreation Needs 2010 Study

Field Demand Summary

- 17 total fields, 7 fields are lit, 5 lit fields are at Portsmouth HS.
- Organizations limit participation.
- Organizations play on fields in Newington and Greenland.
- Most fields are multi-use. No capacity for rotation of fields or resting to allow recovery.
- Middle and elementary schools lack adequate fields.
- Tournament play limited due to lack of appropriate venues.

City-wide Field Shortage | Critical Needs

From – City of Portsmouth Comprehensive Recreation Needs 2010 Study

Study Conclusion:

- Needed: 3-4 New Rectangular **Synthetic Turf Fields** with Lighting
- Needed: 2-3 New Adult Softball Fields

Status Quo Until New Fields are Developed, Organizations:

- Cannot practice (due to the availability of fields)
- Cannot play competition games (due to under sizing)
- Cannot play at all (seasonal limitations, weather + poor drainage)
- Play on substandard fields (due to turf condition)

Portsmouth HS Field as a Case Study

- **PHS Field Capacity (prior to artificial turf)**

  15 football games (5 freshman, 5 J.V. 5 varsity) = 30 hours

  16 boys lacrosse games (8 J.V. and 8 varsity) = 24 hours

- No other uses to allow for turf regeneration. Even with limited use field impacts 20 yard line to the 20 yard line.

- **TOTAL use per year = 54 hours**

- **PHS Field Capacity (after artificial turf)**

  Use 7 days/week x 9 months/year

  TOTAL use per year = 3,920 hours

High School Field
September 2009

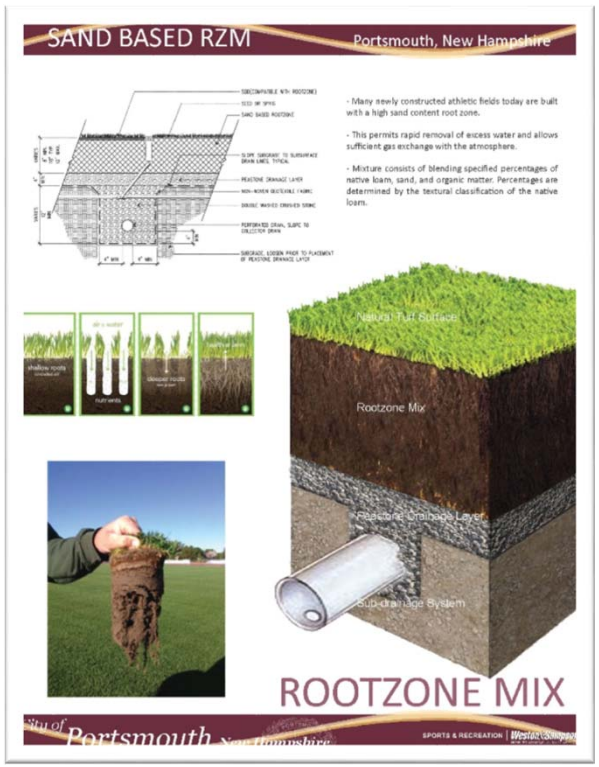
Portsmouth HS Field as a Case Study

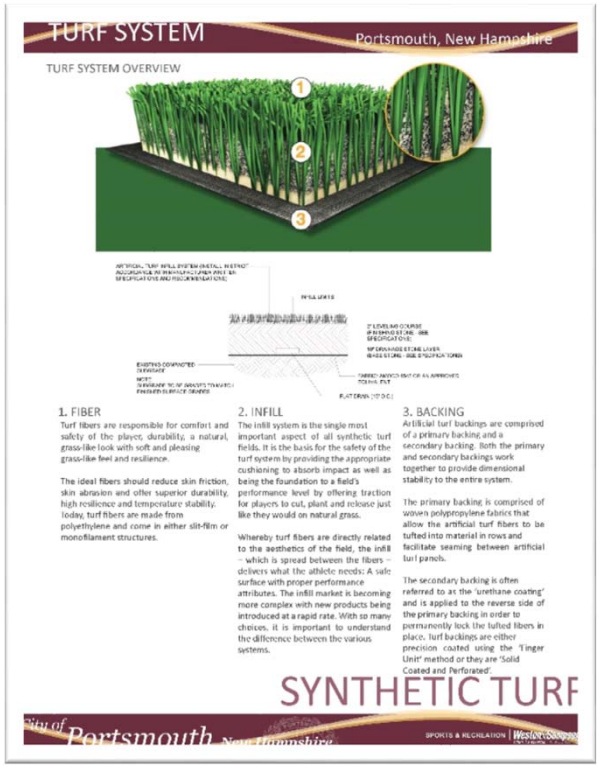
Current Field Users

- PHS phys. ed. classes
- PHS boys soccer
- PHS girls soccer
- PHS field hockey
- PHS boys lacrosse
- PHS girls lacrosse
- PHS baseball
- PHS softball
- PHS track
- PHS band
- PHS frisbee club
- PHS special events
- Portsmouth City Soccer Club
- Seacoast United Soccer
- Portsmouth Youth Football
- Lighthouse Lacrosse
- Seacoast Lacrosse
- Portsmouth elementary track
- PMS boys soccer
- PMS girls soccer
- PMS field hockey
- PMS boys lacrosse
- PMS girls lacrosse
- Great Bay United Soccer
- Fusion Soccer
- Chad Soccer
- NHIAA boys soccer
- Girls soccer
- Boys lacrosse
- Girls lacrosse
- Field hockey
- Seacoast Phantoms (soccer)
- Seacoast Vipers (football)

Needs are still great and youth sports participation is growing.

Design Process | Multiple Field Design Options





City of Portsmouth, New Hampshire

Design Process | Multiple Field Design Options

	Native Soil Natural	Sand Based Natural	Synthetic Turf
Initial Construction Cost	$405,000	$670,000	$980,000
Annual Maintenance Cost	$25,000	$30,000	$10,000
Replacement Cost After 12 Years	$85,000	$85,000	$400,000
Life-Cycle Cost over 12 Years	$790,000	$1,360,000	$1,500,000
Hours of Recommended use per Year	100 to 200	350 to 600	3,000+
Average Cost per Hour of Use	$250	$112	$26

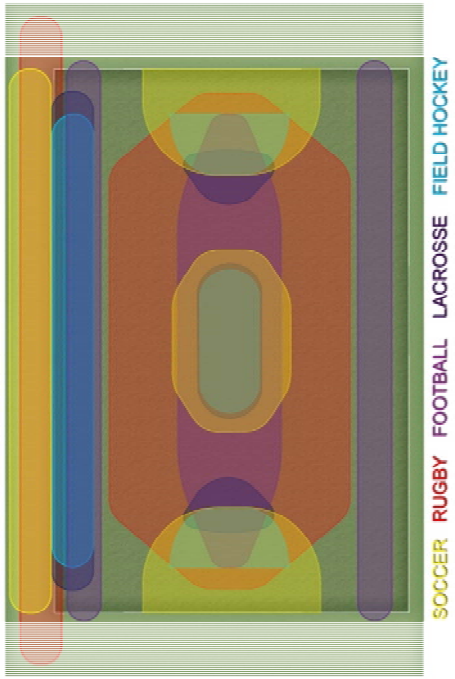
Conclusions:

-Native Soil Field – Not viable due to amount of playing time available
-Sand Based Natural Field – Not viable due to amount of playing time available
-Synthetic Turf Field – Best choice to BEGIN alleviating critical field shortages

Design Process | Multiple Field Design Options

Natural Turf Wear

- Left
  be deemed
  play



Average Multi-Use Field (240'x360') | Field Wear & Tear Zone: 62% | Sideline Wear & Tear Zone: 32,300 SF

Design Process | Multiple Field Design Options

Pro's and Cons for Natural Turf Fields:

- Initial Cost - Cheaper to construct and replace/re-sod.
- Playability can be limited by weather.
- Limited Playing Time - It is recommended that higher performing natural fields are only played on for
- Higher maintenance costs
- Environment impacts

Pro's and Cons for Synthetic Turf Fields:

- Higher Initial Cost – More expensive to build, repair and replace.
- More Playing Time - Can support higher intensity of use and can extend the playing season.
- Less intensive maintenance program
- Fewer Injuries due to even playing surface and consistent G-max performance
- Potential heat hazards

Conclusion: For this project a synthetic turf system best meets City needs

Design Process | Multiple Field Design Options

Synthetic Turf Field Infill Options

Rubber | Plastic	Natural | Organic	Minerals/Coated Minerals
Wide use, best performance + resiliency	Organic	Longest life before replacement
Some recycled	Prone to migrating, more maintenance	Less resiliency, harder surface
Perception of risk	Requires shock pad, higher cost	Requires shock pad, higher cost
Heavy metals in trace amounts, not releasable	Moisture required to retain resiliency, can freeze	Can be abrasive
Shock pad required with some products	May contain pesticides, heavy metals in trace amounts that are releasable	

Conclusion: For this project a synthetic turf system with rubber infill best meets City needs

Addressing Community Concerns

Public comments have included

- Use of crumb rubber introduces more chemicals into the environment
- Have not accounted for the different physiology of young children
- Science is inadequate
- Have not considered all of the vectors of exposure
- Project team has a bias toward synthetic turf

Addressing Community Concerns

Marie Rudiman (Weston & Sampson)

Human Health Risk Assessor, Toxicologist

- Northeastern University |Toxicology
- Experience: 23 Years
- Focus: Human and ecological risk assessment, air quality

Dr. Stephen Clough, Ph.D., DABT (Haley & Aldrich) (Peer Reviewer)

Environmental Toxicologist, Risk Assessor

- University of Michigan, MS, Ph.D. Water Quality + Env. Toxicology
- Experience: 30 Years
- Focus: Water quality, human and ecological risk assessment

Addressing Community Concerns

What is a toxicologist?

- Toxicologists study the adverse effects of chemicals on living organisms
- Mix of chemistry, biology, and pharmacology

What do they do?

- Evaluate chemicals to determine if they cause an environmental health using Federal (EPA) and State (NH DES/state)

Who uses toxicological data?

- Human Health and Environmental Risk Assessors
- Epidemiologists
- Public Health Officials
- Regulators – EPA, NH DES and other state environmental departments

Addressing Community Concerns

Bioavailability vs. Risk

- Bioavailability of the constituents of synthetic turf fields
  - Amount of constituent that is available to be absorbed into the body
  - Constituents are generally tied up within the polymer of the rubber

- Risk Assessment is a way to estimate potential health risks from exposure to to chemicals
  - Risk = Exposure x Toxicity

Addressing Community Concerns

- Ways we looked at available data to determine if the risks are acceptable
  - Comparison to applicable standards
  - Ingestion of crumb rubber particles (CRP)
  - Dermal contact with CRP and turf bed
  - Breathing in constituents that may volatilize from the synthetic field
  - Leaching of constituents into groundwater
- Analyze proposed crumb rubber prior to installation
  - Inorganics - Metals
  - Organics
    - Polycyclic aromatic hydrocarbons (PAHs)
    - Semi-Volatile Organic Compounds (SVOCs)
    - Volatile Organic Compounds (VOCs)
- We will evaluate data we collect from proposed fields in the same manner

Addressing Community Concerns

Constituent	Maximum Detected Concentration mg/kg	ASTM (American Society for Testing and Materials) F3188-16 Safety of Toys mg/kg		European Standard EN 71-3 Category III Safety of Toys mg/kg	
Metals					
Antimony	4	60	Pass	560	Pass
Arsenic	0.4	25	Pass	47	Pass
Barium	6	1,000	Pass	18,750	Pass
Beryllium	0.2	NA		NA	
Cadmium	0.5	75	Pass	17	Pass
Chromium(VI)	ND	60	Pass	0.2	Pass
Chromium(III)	2	60	Pass	460	Pass
Cobalt	120	NA		130	Pass
Copper	27	NA		7,700	Pass
Lead	26	90	Pass	160	Pass
Mercury	0.1	60	Pass	94	Pass
Molybdnum	2	NA		NA	
Nickel	34	NA		930	Pass
Selenium	2	500	Pass	460	Pass
Silver	0.4	NA		NA	
Thallium	2	NA		NA	
Vanadium	0.8	NA		NA	
Zinc	14000	NA		46,000	Pass

Addressing Community Concerns

Comparison to Soil Background

Constituent	Maximum Detected Concentration in Crumb Rubber mg/kg	Soil Background Concentrations from New Hampshire and Massachusetts 90th Percentile mg/kg	
Metals			
Aluminum	68	10,000	
Antimony	4	1	
Arsenic	0	11	
Barium	6	50	
Beryllium	0.2	0.4	
Boron	9	Not Determined	
Cadmium	0.53	1.9	
Chromium(III)	1.7	33	
Cobalt	120	4	*
Copper	27	31	
Lead	26	51	
Manganese	8	300	
Mercury	0.065	0.31	
Molybdnum	2	Not Determined	
Nickel	34	23	*
Selenium	2	5	
Strontium	10	Not Determined	
Silver	0.4	0.6	
Thallium	2	5	
Titanium	5	Not Determined	
Vanadium	0.84	30	
Zinc	14,000	98	*

Addressing Community Concerns

Risk Assessment: Conservative Assumptions

- Maximum detected concentrations were used
- Subchronic exposure (1 yr old) 2 days/wk/30 weeks (48 hr/wk)
- Chronic exposure 3 days/wk/30 weeks (72 hr/wk)
- Exposure through ingestion and dermal contact
- Ingest 100 mg/kg crumb rubber on each day of exposure
- Crumb rubber sticking to face, forearms, hands, lower legs and feet
- Assumes crumb rubber can be ingested like soil and adheres to skin like soil. Reality: far less exposure!

Addressing Community Concerns

Risk Assessment

Risk = Exposure x Toxicity

Conclusion: Potential Risks are an Acceptable Exposure/Negligible Exposure

- Residential Receptor
- Age 1 through 31 years
- 30 year exposure

Forthcoming Study: US EPA due Summer 2017

Addressing Community Concerns

Recent Review Article Evaluating Human Exposure Pathways (Cheng, 2013):

ENVIRONMENTAL Science & Technology

Critical Review

pubs.acs.org/est

Environmental and Health Impacts of Artificial Turf: A Review

Hefa Cheng,*,† Yuanan Hu,† and Martin Reinhard‡

- Many risk assessment studies have been conducted to characterize the health risk of tire rubber crumb in artificial turf fields via these exposure routes, with the *results consistently showing that no significant health risk was associated with being on or playing on such fields*.
  - Oral: "…there is no indication that the exposure to hazardous substances (PAHs and Pb) in tire rubber crumb via hand-to-mouth contact could cause adverse health effects".
  - Dermal: "…risk assessment studies have shown that the doses of toxic chemicals exposed through dermal absorption were too low to cause any adverse health effects, including allergic response or indicated sensitization, for children and adults playing on artificial turf fields"
  - Inhalation: "Field monitoring showed that the levels of PAHs and VOCs detected in the air above outdoor artificial turf fields were not high enough to threaten human health and that the health risk from indoor artificial turf was also below the level of concern with adequate facility ventilation."

Addressing Community Concerns

Experience Addressing Artificial Issues

- **Fenn Prep School**
  - H&A and MA DEP supported safety of artificial turf to Massachusetts Adjudicatory Court (decision to develop upheld)
  - 5 years of groundwater monitoring show metal concentrations similar to background and below human health and wildlife criteria

- **Concord/Carlisle High School**
  - Served on expert panel, two new fields using crumb rubber infill successfully developed based on majority vote at Town Meeting

Addressing Community Concerns

Experience Addressing Artificial Issues

- **Town of Weymouth**
  - Provided expert testimony to Conservation Commission to replace natural grass field with artificial turf field (protective of downgradient alewife run)

- **Town of Weston**
  - Provided expert support for the municipality that requested upgrade of Proctor Field (natural turf) with smaller but more efficient artificial turf field (year round play)

Addressing Community Concerns

"Long Term Groundwater Monitoring of an Artificial Turf Field"

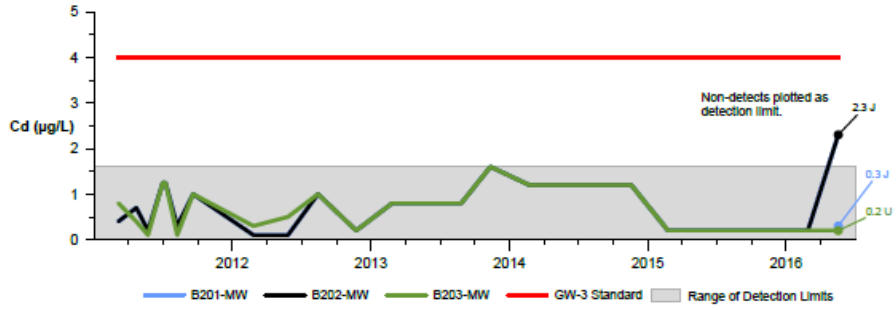
Clough, S.R., Miles, O., M., and Kastrinos, J.

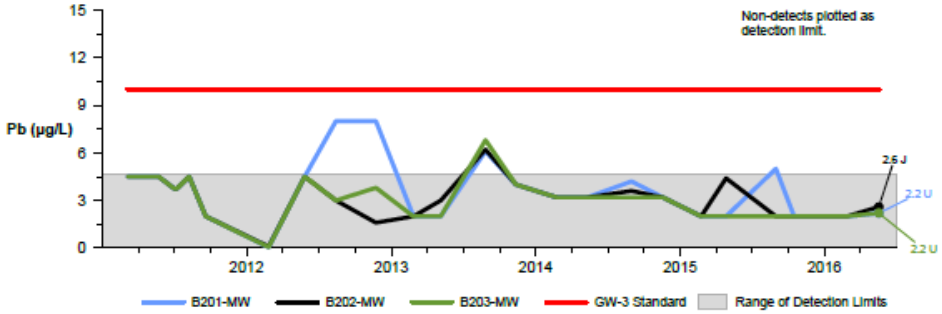
Groundwater Monitoring and Remediation (In Press)

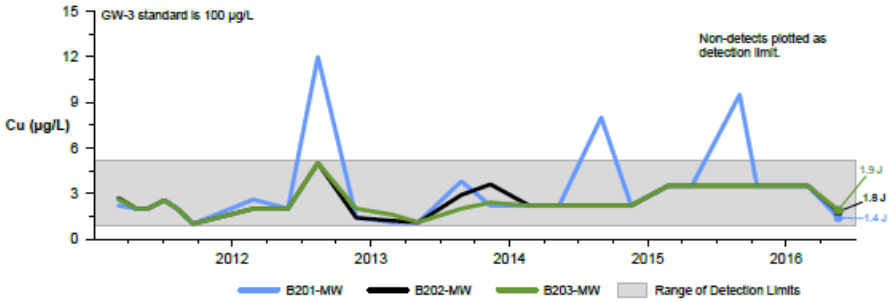
City of Portsmouth, New Hampshire

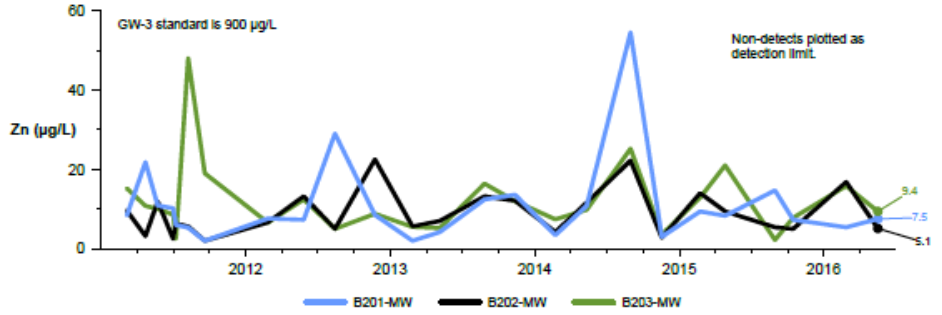
Addressing Community Concerns

Five Years of Groundwater Monitoring at Fenn School: Results









City of Portsmouth, New Hampshire

The Recommended Improvement Program

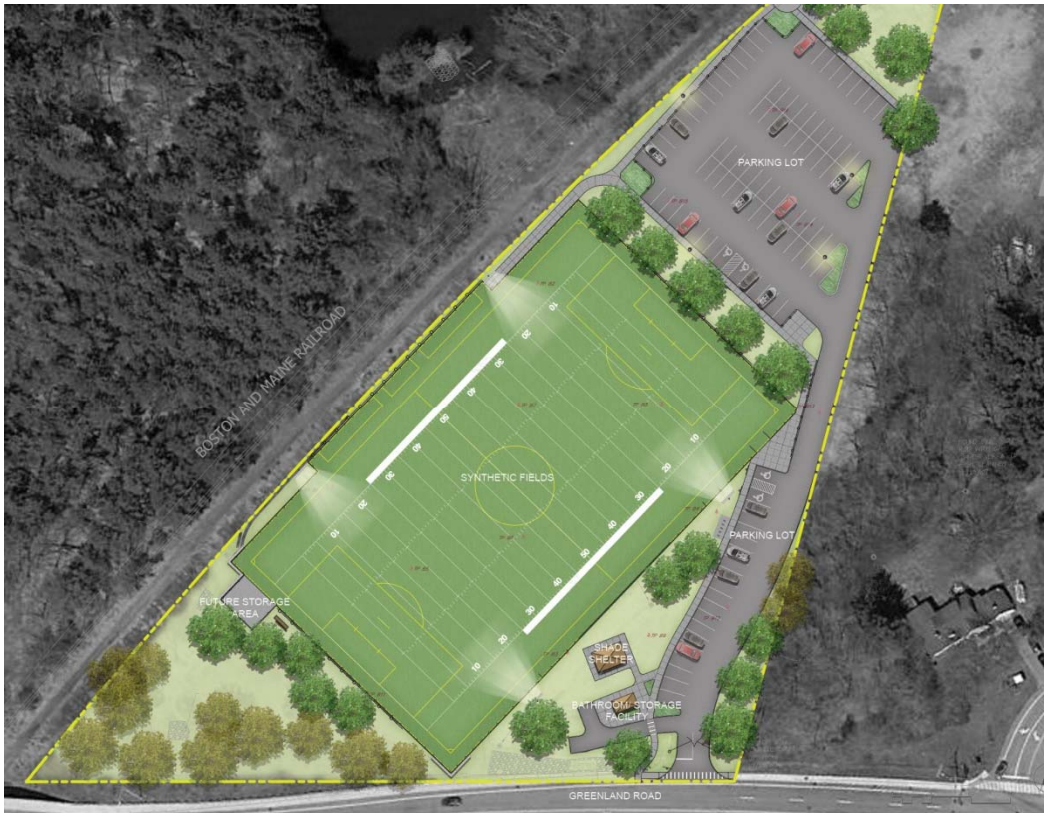
The Existing Property

- Roughly 5 acres
- Located on Rt. 33 near Plains Park
- Single Rectangular Footprint

The Recommended Improvement Program

Total Improvement Program

- Synthetic turf sports field
- Sports lighting
- Parking area w/ lighting
- Bathroom facilities
- Connection to future multi-use path
- Shade shelter
- Bike parking
- Play area



City of Portsmouth, New Hampshire

The Recommended Improvement Program

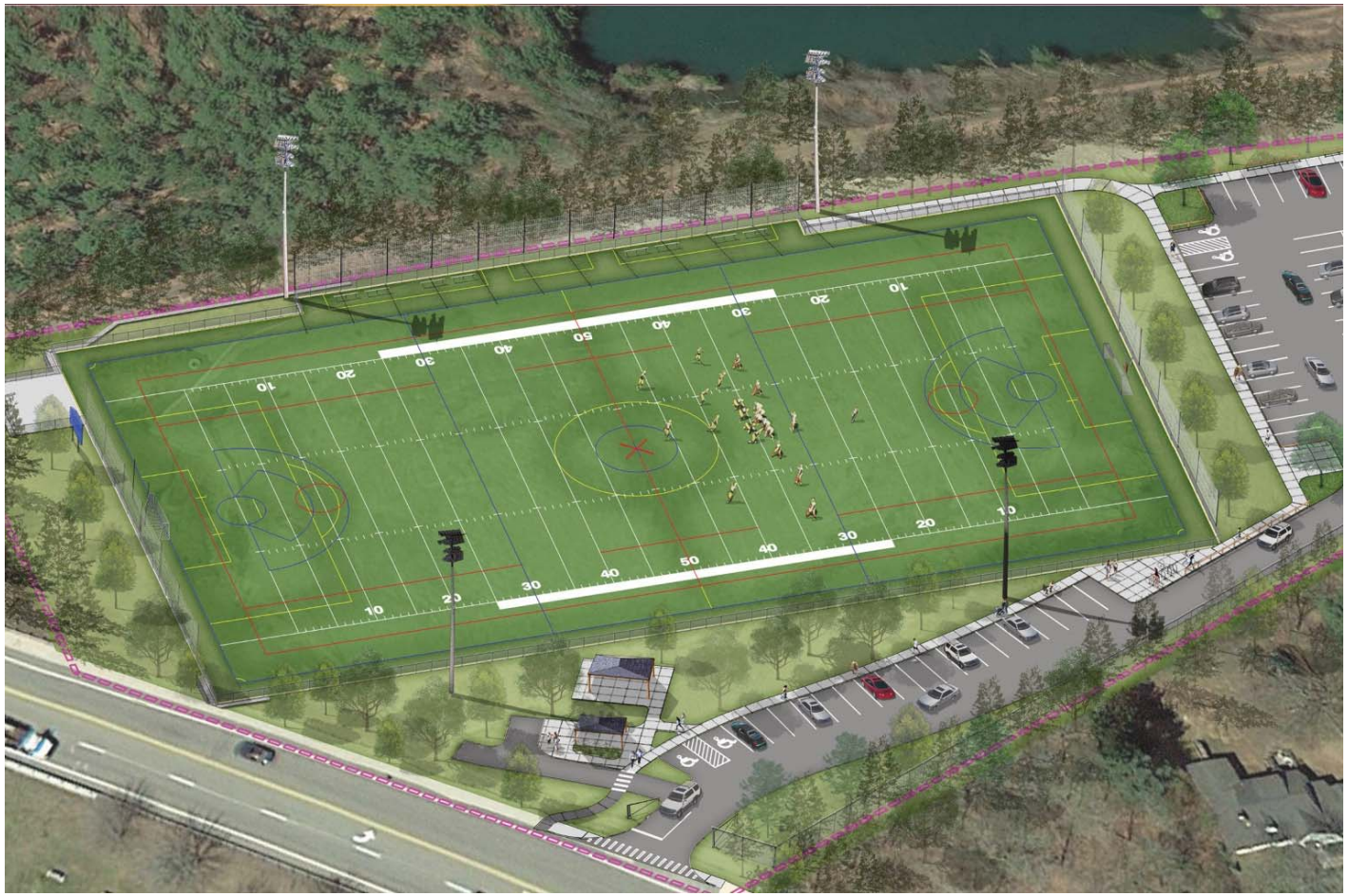
Project Benefits

- Eases critical rectangular shortages
- Provides great playability
- Reduces impacts to other fields
- Supports high impact sports competitive levels
- Accommodates school and uses
- Maximizes periods of usage, weather disruptions

City of Portsmouth, New Hampshire

Thank You

Questions + Comments



City of Portsmouth, New Hampshire