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December 25, 2013

Mr. Jeff Piette
Kahler Slater Inc
111 W. Wisconsin Avenue
Milwaukee, WI 53203

SUBJECT: University of Wisconsin - Madison Campus
Recreational Sports Master Plan Study
Environmental and Historic Concerns Responses

Dear Mr. Piette:

Below is the list of potential environmental impacts and historical concerns related to the development of a facilities master plan for UW-Madison Recreational Sports as submitted by Gary Brown, PLA, FASLA – FP&M Campus Planning & Landscape Architecture. Our responses to each are provided.

1. Stormwater management should strive to meet the campus policy on returning all sites to pre-settlement runoff conditions.

   Response:

   The master plan report and cost estimate include storm water storage in accordance with campus policy for runoff quantity control. Proposed building and parking improvements should also include best management practices (BMPs) for sediment control (green roofs, bio-swales, rain gardens, porous asphalt, etc.)

2. Stormwater management as it relates to artificial turf fields needs to be studied, not only from a quantity standpoint, but a quality standpoint. If the artificial turf fields are to be an in-fill type turf, what are the chemical properties of the fill, does it breakdown over time, can it wash out of the turf and into the drainage system and on into the lake, are there runoff temperature issues, etc.

   Response:

   Recycled used car tires are used to make the crumb rubber infill. The recycled rubber has the potential to carry the following chemicals: polynuclear aromatic hydrocarbons (PAHs), phthalates, volatile organic compounds (VOCs), zinc, iron, manganese, nickel, PCB, copper, mercury, lead, cadmium, volatile nitrosamines, benzothiazole, isononylphenol, and more. As stated in a study by the University of California Berkeley, "the mere presence of a substance is not necessarily cause for concern. For the most part, when these chemicals are present in tires,

they occur in very small concentrations. Also, their presence does not automatically equal exposure. Tires are relatively, though not entirely, inert and the vulcanization process that they undergo to prepare them for their second life as artificial turf renders them more, rather than less, stable. Further, many of the chemicals of concern are already present at relatively high levels in urban environments, as a result of numerous human activities which are not presently considered controversial: driving, heating and cooling systems, and regular production of household and industrial waste."
http://c.ymcdn.com/sites/www.syntheticturfcouncil.org/resource/resmgr/docs/manex-uc_berkeley_crumb_rubb.pdf

The synthetic turf backing system holds the infill material in place while allowing the surface runoff to infiltrate through to the drainage system below. The only condition where the infill material could wash out of the turf is during an intense rainfall event that exceeds the turf system infiltration rate resulting in overland surface flow and potential floating of infill. The inclusion of additional BMPs around the fields will prevent floating of rubber infill material into downstream water bodies during a rare high intensity rainfall occurrence.

3. Do you have to water the in-fill type fields to keep the fill in place and from dispersing dust into the air? If so, that water use needs to be calculated into the overall cost-benefit analysis of these types of fields.

   Response:

   No water is required for maintenance of the field infill.

4. Are there ecologically friendly in-fill type turf fields (rather than ground up used tires for the fill materials)?

   Response:

   The most common type of infill material is the styrene-butadiene rubber (SBR), recycled tire rubber, granule as it offers a cost-efficient and durable playing surface. Alternative types include:
   - *Thermoplastic Elastomer (TPE) which is produced by using prime raw materials which offer a stable shock absorption for synthetic turf fields. The infill pellets are harder but more durable than the standard SBR granules. This material can be recycled after its use as infill. This material comes at a higher price, often three to five times higher than that of SBR.*
   - *Recycled athletic shoes can be used as an infill product through the Nike Grind program. This product is the most cost-efficient environmentally-friendly infill material other than SBR.*

- *<u>Cork infill</u> is a natural infill that is 100% environment-friendly and non-toxic as it is organic, recyclable, and sustainable. This infill option has recently attained high results for athletic performance and field durability when tested as infill for sports fields. Testing has also demonstrated that surface temperature is lower when using cork as infill, rather than any type of rubber.*

5. Environmental impacts related to the loss of natural turf to artificial turf fields, ie. Stormwater infiltration rates, mitigating urban heat island effects, etc.

   Response:

   - *The synthetic turf's engineered drainage system with a detention layer provides temporary storage and facilitates infiltration. Rainfall that would otherwise runoff of the grass field is instead retained on site for a longer period of time, thus allowing more water to be infiltrated during small storm events. During larger storm events the area will act as a small detention basin and will discharge to the existing storm water collection system upon reaching saturation, in a manner similar to the existing grassed field.*
   - *In general, the environmental impacts of natural grass are more complex than those of synthetic turf. This is due in large part to the fact that natural grass requires the continual addition of inputs to sustain a field's health. The EPA says, "methods used to maintain turf grass…applying fertilizers and pesticides and mowing frequently… can negate any benefits gained in water quality and cost effectiveness. Excess soluble pesticides and fertilizers can mix with storm water runoff and be carried into receiving waters. Excess chemicals can leach into underground aquifers."*
     http://www.epa.gov/owow/nps/Section319I/NJ.html

6. Environmental impacts of artificial turf fields:
   a) <u>Contamination of the local groundwater</u>

   Response:

   Multiple studies have been conducted in recent years on the environmental impacts, a few of which are summarized below.
   - *Studies conducted by the NY State Departments of Environmental Conservation in 2008 to assess the safety of crumb rubber in synthetic turf fields concluded that "crumb rubber may be used as an infill without significant impact on groundwater quality."*
     http://www.dec.ny.gov/docs/materials_minerals_pdf/tirestudy.pdf

- *A study from the spring to fall of 2008 by the NY State Department of Environmental Conservation found that "analysis of crumb rubber samples digested in acid revealed that the lead concentration in crumb rubber samples was well below the federal hazard standard for lead in soil and indicated that the crumb rubber from which the samples were obtained would not be a significant source of lead exposure if used as an infill material in synthetic turf fields."*
  http://www.dec.ny.gov/docs/materials_minerals_pdf/crumbrubfr.pdf

- *A 2-year study in January 2009 by Milone & MacBroom, a firm specializing in environmental science completed their own year-long study on water quality, air quality and temperature of three synthetic fields in CT. Their findings were conclusive that leaching of organic compounds and heavy metals should "be of no concern with regard to the safety of synthetic fields." The study concluded that eight water samples from three different fields "indicate that the actual storm water drainage from the fields allows for complete survival of the test species call 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."*
  http://www.miloneandmacbroom.com/Libraries/Documents/Evalutation_of_the_Environmental_Effects_of_Synthetic_Turf_Athletic.sflb.ashx

- *Further analysis following EPA methods "indicates that metals will leach from crumb rubber but in concentrations that are within ranges that could be expected to leach from native soil."*
  http://www.epa.gov/nerl/download_files/documents/tire_crumbs.pdf

b) Production contributes to greenhouse gas emissions

Response:

- *The impacts associated with the production of synthetic turf components increase the total greenhouse gas emissions when considering the entire life cycle, due to related increases in processing and transportation needs.*
- *Natural grass athletic fields in good condition are essentially carbon neutral. They absorb CO2 in their root system, but only for the short term since they are frequently mowed and the CO2 is released at decomposition of the grass clippings. Synthetic turf fields are not carbon neutral in nature and would require complimentary landscaping to offset the loss of the natural grass.*

c) On-going costs of having to replace the turf after 8 to 10 years

Response:

The warranty of synthetic turf systems is currently at 8 to 10 years duration, however the usable lifespan of the surface is expected to be 12 to 15 years. The cost for the replacement turf is dependent on petroleum prices at the time of purchase. Historically, turf prices have risen 2% to 3% per year.

d) Recycling costs of old/replacement turf

Response:

The recycling of the old turf is typically handled as a deduct on the purchase of the replacement turf, which is dependent on the size of the field.

e) Heat gain on the field and impact to users

Response:

Surface temperatures on crumb-rubber infilled synthetic turf fields can be elevated from natural turf and may contribute to heat stress. Wind, clouds and precipitation all have a significant impact on the surface temperature, as with any surface. The most pronounced temperatures are at the fiber and decrease dramatically within a few inches above the surface. Watering the synthetic turf field may briefly reduce the surface temperatures when needed in warm climates. Awareness of the potential for heat illness and how to recognize and prevent heat illness needs to be raised among users.

f) Increase in injuries to users

Response:

- *A 2-year study published in the British Journal of Sports Medicine in 2007 found no significant difference in the frequency or severity of injuries in men's and women's NCAA soccer between natural grass and the latest generation of synthetic turf fields.*
  http://bjsm.bmj.com/content/41/suppl_1/i20.abstract
- A 3-year study published in the American Journal of Sports Medicine in 2010, Vol. 38, No. 4, found significant differences in injury incidence, mechanism and severity. Although similarities did exist between FieldTurf

and natural grass over a 3-year period of competitive play, the findings showed significant differences in injury incidence, severity of injury, injury time loss, injury situation, grade of injury, injuries under various field conditions, and temperature between playing surfaces – with FieldTurf markedly the safer playing surface.
http://www.ncbi.nlm.nih.gov/pubmed/20075177

g) Human health issues related to artificial turf field use

Response:

- *A review of available information by the California Office of Environmental Health Hazard Assessment (OEHHA) evaluated the risk of cancer from breathing the air above a synthetic turf infilled field over 70 years. The lifetime cancer risk was determined to be one in one million. The review states that the "lifetime cancer risks of one cancer in a population of one million are considered a negligible risk level. Many common human activities result in cancer risks that are higher than one in one million."*
  http://www.calrecycle.ca.gov/tires/products/bizassist/health/turfstudy/LitReview.doc

- *In a study by Penn State's College of Agricultural Sciences, 20 "infill" design synthetic fields at various locations in PA were studied and found no trace of staphylococcus aureus bacterium in any of the fields. The study concluded that "the infill systems are not a hospitable environment for microbial activity… they tend to be dry and exposed to outdoor temperatures, which fluctuate rapidly."*
  http://plantscience.psu.edu/research/centers/ssrc/research/microbial

7. Impacts to utilities from an operating budget standpoint for lighting the fields.

   Response:

   Annual operating costs for typical field lighting is estimated at $3,000 per field per year assuming 40 light fixtures used 200 hours/year with an energy cost of 0.10/kW. Annual operating costs for green generation lighting are estimated at $1,250 per field per year to achieve the same assumed target light levels for the field. This information is based on data available from Musco Sports Lighting, LLC.

8. Historic – impacts to the mapped archaeological sites to the north of the existing Natatorium must be avoided.

   Response:

Will comply.

To compile the responses above, documents from the following sources were used:

American Journal of Sports Medicine - Incidence, mechanisms, and severity of game-related college football injuries on FieldTurf versus natural grass: a 3-year prospective study, 2010.
British Journal of Sports Medicine - 2-Year NCAA Soccer Study, 2007
CA Office of Environmental Health Hazard Assessment (CA EPA), July 2009
FieldTurf - Independent Testing Data
Milone & MacBroom - Evaluation of the Environmental Effects of Synthetic Turf Athletic Fields, 2009
NJ Dept. of Environmental Protection
NY State Dept. of Environmental Conservation - An Assessment of Chemical Leaching, Releases to Air and Temperature at Crumb Rubber Infilled Synthetic Turf Fields, May 2009
NY State Dept. of Health – Fact Sheet on Rubber Infilled fields, August 2012
Penn State University Center for Sports Surface Research – MRSA Study, 2011
Ridgewood Environmental Advisory Committee - Assessment of Environmental, Health, and Human Safety Concerns Related to the Synthetic Turf Surface at Maple Park in Ridgewood, NJ, December 2009
Synthetic Turf Council Website – Independent Research
University of California, Berkeley Laboratory for Manufacturing and Sustainability - Review of the Impacts of Crumb Rubber in Artificial Turf Applications, February 2010
U.S. Environmental Protection Agency Website - Sources of Nonpoint Pollution

Sincerely,

Brent T. Pitcher, P.E., LEED AP
Principal

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December 25, 2013

Mr. Jeff Piette
Kahler Slater Inc
111 W. Wisconsin Avenue
Milwaukee, WI 53203

SUBJECT: University of Wisconsin - Madison Campus
Recreational Sports Master Plan Study
Civil Engineering Summary Report

Dear Mr. Piette:

We have completed our scope of civil engineering services for the UW-Madison Recreational Sports Master Plan Study project. We have summarized our findings in this letter report for inclusion in your final report.

South East Recreational Facility (SERF)

Existing Infrastructure Issues and Utility Systems Review

The planned building renovation and expansion will have a minimal impact to the surrounding site infrastructure. Only a few site improvements will be incorporated to address the need for additional moped parking and associated building entry connections to the surrounding pedestrian walkways. The building utility connections will continue to utilize the City of Madison Water Utility sanitary sewer and water main located on the west, north, and east faces of the building. The loading to these existing utilities will not change dramatically with the building renovation and expansion due to the efficiencies realized with upgraded building equipment.

Storm Water Management

Any additional impervious area associated with this building renovation and expansion should be mitigated with the incorporation of a green roof system. This system will reduce the amount of storm water runoff and also delay the time at which runoff occurs, resulting in decreased stress on sewer systems at peak flow periods. This is achieved by storing water in the substrate which will be taken up by the plants from where it is returned to the atmosphere through transpiration and evaporation. This system will also improve the runoff water quality by filtering the rainwater through the soil and root uptake zone.

Natatorium Facility (NAT)

Existing Infrastructure Issues and Utility Systems Review

The planned building expansion will utilize all of the existing grass area to the east. Some minor pavement improvements will be included for the planned service drive on the north face of the building. The building utility connections will continue to utilize the private sanitary sewer and water main located in Observatory Drive. These utilities were sized to accommodate the planned NAT building expansion with the utility upgrade project completed in 2011.

Storm Water Management

Storm water detention will be required to adhere to campus policy for returning all sites to pre-settlement runoff conditions for the 10-year rainfall event for this project. The storm water detention for this building renovation and expansion is planned to be addressed with the underground storm water storage planned for the Near East Athletic Field improvements discussed later in this report. Additional best management practices (BMPs) such as green roofs, bioswales, and rain gardens should also indorporated into the project.

Nielsen Tennis Center Facility

Existing Site Description

The Nielsen Tennis Center Facility was constructed in 1967 southeast of the Class of 1918 Marsh, a former wetland that is now part of an urban storm water management system for the west campus. The building is located just above the 100-year floodplain elevation.

Existing Infrastructure Issues and Utility Systems Review

The planned minor building expansion will utilize a part of the existing grass area to the east and west of the existing entrance. Some minor pavement improvements will be included for the associated pedestrian walkways. No change will be required for the building utility connections in Marsh Drive as loadings for these utilities will not increase with the building expansion.

Storm Water Management

The additional impervious area associated with this building renovation and expansion should be mitigated with the incorporation of best management practices (BMPs) designed to filter pollutants, enhance infiltration runoff, and decrease runoff peak flow rates and volumes. Examples include porous pavement, rain gardens, bioswales, and/or bioretention basins.

Near East Fields

Existing Infrastructure Issues and Utility Systems Review

Geotechnical investigations in this area were performed in 2005 for the Central Campus Utility Improvements project, in 2007 for the Lakeshore Residence Hall and Food Service Facility project, and in 2009 for the Cole Beach Tennis Courts project. This site has been filled with approximately 4-feet or more of excavated materials from surrounding project sites. It was determined in the 2009 Tennis Court project, east of the project site, that the existing fill soils were suitable for support of the tennis courts. However, a layer of clear stone below the pavement section was incorporated for drainage and stabilization.

The surrounding infrastructure will be able to support the proposed athletic field improvements project. An existing water main is located north of the proposed field, south of Dejope Residence Hall for supply to the proposed drinking fountains. An existing 36" storm sewer main is located on the south edge of the proposed field which can be used for the proposed field drainage and storm water management system connection. Four existing field light poles located at the corners of the proposed field limits can remain in place, but will need additional light fixtures to provide sufficient light levels. Two existing field light poles will need to be relocated to the center of the proposed field and will also need additional light fixtures. Four total additional new light poles will be needed along the field sidelines.

Proposed Field Development Summary

The proposed field development will include the following elements as shown on the Near East Fields Exhibit:

Synthetic Turf Field installation incorporating field markings for:

- 4 total north/south soccer fields (115'x230')
- 1 total east/west tournament field for soccer (225'x360'), lacrosse(195'x360'), and rugby (225'x400')

Additional site improvements desired include the following:

- Perimeter decorative fence (6' height)
- Decorative gateway/access Point
- 4 scoreboards
- 2 drinking fountains
- 4 new light poles
- Relocation of 2 existing light poles
- Additional light fixtures for the six existing light poles

Storm Water Management
Storm water detention is required to adhere to campus policy for returning all sites to pre-settlement runoff conditions for the 10-year rainfall event. A 24-inch deep stone storage layer with 30% minimum void ratio below the entire field area is proposed to address the storm water management requirements for the site. Additional storm water management for the proposed natatorium expansion may also be incorporated into this storm water detention system.

Near West Fields

Existing Infrastructure Issues and Utility Systems Review
Geotechnical investigations in this area were performed in 2003 for the West Recreation Fields project, in 2004 for the West Campus Cogeneration Facility project, and in 2009 for the Marching Band Practice Fields Replacement project. The project area has been filled with up to 8-feet of excavation materials from the Cogeneration Facility project. An existing underground infiltration system is located just north of the project area which needs to remain in place.

The surrounding infrastructure will be able to support the proposed athletic field improvements project. An existing 4-inch water irrigation service line runs through the center of the proposed field which, if deep enough, can remain in place for non-potable water supply for the field. A new water service will need to be extended to supply the proposed drinking fountains. An existing 12" storm sewer is located in the northeast corner of the proposed field which will need to remain in place with the field construction. The existing dry detention basins located south and east of the proposed field area are to remain. The proposed field drainage and storm water management system will need to discharge to these basins. Eight existing field light poles located around the proposed field limits can remain in place, but will need additional light fixtures to provide sufficient light levels. Two existing field light poles will need to be relocated closer to the proposed field sideline and will also need additional light fixtures. Three total additional new light poles will be needed along the field sidelines.

Proposed Field Development Summary
The proposed field development will include the following elements as shown on the Near West Fields Exhibit:

Synthetic Turf Field installation incorporating field markings for:
- 5 total north/south flag football fields (120'x300')

- 1 total east/west tournament field for soccer (225'x360'), lacrosse(195'x360'), and rugby (225'x400')

Additional site improvements desired include the following:
- Perimeter decorative fence (6' height)
- Decorative gateway/access Point
- 5 scoreboards
- 2 drinking fountains
- 3 new light poles
- Relocation of 2 existing light poles
- Additional light fixtures for the ten existing light poles

Storm Water Management
Storm water detention is required to adhere to campus policy for returning all sites to pre-settlement runoff conditions for the 10-year rainfall event. An 18-inch deep stone storage layer with 30% minimum void ratio below the entire field area is proposed to address the storm water management requirements for the site.

University Bay Fields (UBay)

Existing Site Description
This site is located immediately west of the Class of 1918 Marsh, a former wetland that is now part of an urban storm water management system for the west campus. In the early 1900's, this area became the site of a College of Agriculture engineering project which included the installation of a complex network of drainage pipes and pumps for converting "low value" marsh to cropland. This system failed by the early 1960's and the area was then being used as a campus landfill until the marsh was restored in the late 1960's. Portions of the east side of the site are located within the 100-year floodplain elevation.

Existing Infrastructure Issues and Utility Systems Review
Geotechnical investigations in this area were performed in 2004 for the West Campus Storm Water Management Plan and in 2009 for the UW Soccer Field project. Four total test pits were excavated throughout the central and south portions of the site. In general it was verified that the majority of the fill material observed appeared to be construction type debris and much of this waste appears to be below the groundwater table. Groundwater was observed to be between 5 and 10 feet below ground surface at the time of this investigation.

The surrounding infrastructure will be able to support the proposed athletic field improvements project. An existing 6-inch water service line runs through the center of the proposed field which, if deep enough, can remain in place for non-potable water

supply for the fields. A new water service will need to be extended to supply the proposed drinking fountains and any buildings. An existing 24" sanitary sewer is located in the southwest corner of the site in an area of proposed synthetic turf which will need to remain in place with the field construction.

Proposed Field Development Summary
The proposed field development will include the following elements as shown on the University Bay Fields Exhibit:

Synthetic Turf Field installation incorporating field markings for:
- 1 total north/south women's lacrosse field (195'x360')
- 1 total north/south men's lacrosse field (180'x330')
- 2 total north/south soccer tournament fields (225'x360') with additional markings for ultimate frisbee

Natural Turf Field installations for:
- 2 total rugby fields (225'x400')
- 2 total softball fields
- 1 total baseball field

Additional site improvements desired include
- 2 total Sand Volleyball Courts
- 2 total Basketball Courts
- 2 total Porous Pavement Parking Lots
- Crushed limestone pathway around the site (10' wide)
- Pedestrian spine pathway through the site (12' wide)
- 2 total Concession/Restroom buildings with storage and covered picnic areas
- 9 total scoreboards (2 softball, 1 baseball, 2 rugby, 2 lacrosse, 2 soccer)
- 2 total drinking fountains
- 32 total light poles

Storm Water Management
Storm water management is required to adhere to campus policy for returning all sites to pre-settlement runoff conditions for the 10-year rainfall event. An 18-inch deep stone storage layer with 30% minimum void ratio below the entire synthetic field area is proposed address the storm water management requirements for the site. In addition, porous pavement systems and other BMPS should be utilized to mitigate the addition of associated buildings and paving for the site.

Sincerely,

Brent T. Pitcher, P.E., LEED AP
Principal

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Exhibit 1 – Near East Fields
Exhibit 2 – Near West Fields
Exhibit 3 – University Bay Fields