Submission
Regarding the

Proposal to Install Synthetic Turf on Arlington Reserve

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Submission on Arlington Reserve

I am writing to express my objections to, and grave reservations about, the proposal to refurbish and resurface Arlington Reserve with synthetic turf.

I am a Senior Lecturer in the School of Chemistry at a major Australian University (UNSW). My qualifications [BSc. (Hons), PhD Monash] are in the areas of organic and medicinal chemistry. In addition, I have, for almost 10 years, taught senior level environmental toxicology at UNSW. For many years I was a member of the NSW Wildlife Information and Rescue Service Inc. (WIRES), serving for several years on the State Management Committee of that organisation – its equivalent of a Board of Directors. I am also a resident of the Dulwich Hill area, living in Abergeldie St near Arlington Reserve.

My reasons for opposing the proposal are explained more extensively in the following pages, however in summary:

Artificial or synthetic turf is inherently unsafe: There are four interwoven issues –

- the extreme temperatures that develop on hot days on artificial surfaces, with potential to cause dehydration, heat stress, heat exhaustion, and even heat stroke;
- the risk of injury or infection to players on artificial surfaces;
- toxicity of components used in manufacture of the synthetic turf and the effect on players and users; and
- the overall environmental impact.

Parking, noise, traffic, litter and safety: Parking around Arlington Reserve becomes almost impossible on soccer days, with the result that cars park illegally, and dangerously. Driving in the area becomes hazardous, and pedestrians crossing roads in the vicinity of illegally parked cars are put in jeopardy. The installation of an artificial surface is intended to allow ***even greater use***, and these problems will escalate. My concern is that nothing is being done – or has been done – to address these concerns; use of the reserve at even the present levels is unsustainable in terms of traffic, noise, safety, and litter. Increased use – and that ***is*** Council's stated objective – will result in an unbearable increase in all of these problems.

Reduction in useable open space: Increased use of Arlington Reserve will reduce the access for passive / informal recreation, and the installation of an artificial surface will reduce the types of activities for which the Reserve can be used, creating a "sporting monoculture".

Heritage: Arlington Reserve is a heritage focal point in the area, and a synthetic surface will destroy the setting.

Economics: Maintenance of an artificial surface is ***not*** necessarily any cheaper than natural grass.

In coming to my conclusions I have taken into account authoritative and reliable evidence, from primary, peer-reviewed scientific literature, and formal Government and other scientific reports. Many earlier papers also support my conclusions, however I am cognisant of the fact that newer generation artificial

surfaces have different characteristics compared to older surfaces such as AstroTurf. As a result, I have generally focussed on very recent research.

I am not opposed to the redevelopment of Arlington Reserve. The surface urgently needs work. Replacement of the current surface with a quality natural grass surface – using modern, drought tolerant, hardy grass – is the only viable option. A ***proper, regularly maintained*** natural grass surface should see many years of use – for soccer clubs, and local residents alike. This is the outcome for which we should all hope.

If you need any further information, I am happy to discuss this submission with you further. I can be contacted by post, phone, or e-mail on g.edwards@unsw.edu.au

Yours sincerely,

Summary of aspects considered in this submission:

Section A: Health and Safety - Injuries and other ill effects possible from playing on synthetic *versus* natural surfaces

- Heat stress and injuries for players
- Watering the pitch can reduce heat stress: a satisfactory solution?
- Risk of injury and infection on artificial turf surfaces

Section B: Toxic chemicals emitted from synthetic surfaces

- The composition of the artificial surface
- Recycled tyres provide in-fill: are they good or bad?
- Effect of the artificial turf surface on the local environment
- But Council plans to install an Australian-made product, so overseas studies are irrelevant.
- FIFA (the Fédération Internationale de Football Association) has approved artificial surfaces
- And what does FIFA actually *say* about artificial surfaces?
- Artificial Surfaces are everywhere – they must be safe or Councils and other organisations would never have used them??
- And artificial turf actually changes the game.

Section C: Environmental Concerns

- Artificial turf provides no photosynthetic oxygen
- Heritage value
- Is the installation of the artificial turf consistent with a ground surrounded by trees?
- The future of trees surrounding the ground cannot be guaranteed
- The effect on native wildlife
- Which is "greener" – natural grass, or artificial turf?

Section D: Community concerns

- Arlington Reserve will not be available for alternative uses.
- Traffic, parking and noise
- Litter
- Local communities have been sworn at and abused by the soccer fraternity in the past
- It has been suggested that soccer clubs could be asked to "take ownership" of the ground and self-police the area for problems
- Use will increase dramatically in the future

Section E: The economics

- Are artificial turf surfaces really cheaper to maintain?
- There is a significant initial cost, but are replacement costs really less?

Section F: Conclusion

Section A: Health and Safety - Injuries and other ill effects possible from playing on synthetic *versus* natural surfaces

The proposal to resurface Arlington Reserve with artificial turf raises significant questions regarding the risks *versus* the benefits. One of the main benefits of artificial turf is its all-weather usefulness. However at what cost? In assessing the merits of this proposal, the complexity of the issue demands that all of the relevant concerns should be addressed. A review of the scientific evidence from the primary, peer-reviewed scientific literature, is telling.

The issue of health and safety with regard to synthetic turf surfaces was highlighted recently in an editorial in the ***Journal of Exposure Science and Environmental Epidemiology*** in **2008**. This journal is part of the esteemed ***Nature*** publishing group. In the editorial, the authors – two of the editors of the journal – highlighted dangers with lead contamination especially in weathered and worn pitches, as well as a series of problems with more modern pitches, including the toxic profile of in-fill rubber, and elevated surface temperatures experienced on all pitches. Their conclusion is that there is a need for a **"much more thorough understanding of the environmental impacts, human exposure and health risk implications associated with all synthetic turf products available on the market."** This prestigious scientific journal (editorial published in 2008) believes that more ***unbiased*** research is needed before synthetic surfaces can be considered safe.

(**Reference:** Lioy, P.J. and Weisel, C.P., *Journal of Exposure Science and Environmental Epidemiology*, **2008**, 18(6), 533-534.)

There are three main areas of concern that will be considered separately in this section: the higher temperature profiles on artificial surfaces, injuries to players, and the potential toxic hazards associated with synthetic materials.

Heat stress and injuries for players

Artificial turf and natural grass are very different surfaces. While it is true that there have been improvements to artificial surfaces in terms of their ability to replicate the feel underfoot compared with grass, there is ***one aspect that is undisputed, and remains unresolved***: the **temperatures** that players will be exposed to, especially in the height of summer. Every summer we hear in the popular media about the high temperatures that are generated in playing arenas with artificial surfaces. In 2007, Sports Illustrated reported the case of six Peruvian soccer players who **actually suffered burns and blisters** to the soles of their feet from playing on artificial turf in Piura on a sunny day. These players were unable to train or play as a result. The temperatures experienced in Piura, Peru, in early February 2007 when the game was played, were a maximum 35 °C (mean temp. 28 °C) – not dissimilar to a typical summer's day in Sydney.

(**References:** http://sportsillustrated.cnn.com/2007/soccer/02/07/bc.soccer.latam.peru.pitches/index.html Sports Illustrated online 7 February 2007; accessed 8 September 2009;
climate in Piura, Peru: http://www.tutiempo.net/en/Climate/Piura/02-2007/844010.htm accessed 8 September 2009)

Anecdotal evidence such as this is backed up with solid research. Studies on synthetic turf at Brigham Young University, Utah, in 2002, showed that the average surface temperature on an artificial soccer field – measured at the surface, and in the air above the surface – was consistently and significantly higher than that measured on natural turf (see **Table 1**, below). The hottest temperature that was recorded was 93.3 °C, measured on a day when the mean temperature was just 37 °C. ***Even an asphalt surface was cooler!*** In the Brigham Young University study, it was reported that one coach actually developed blisters on his feet (through tennis shoes) as a result of the extreme temperatures.

Table 1: Brigham Young University study

	Average temp (°C)	Maximum temp (°C)
Artificial turf - soccer field (on surface)	47.4	**69.4**
Artificial turf (shade: air temp)	24.4	**37.2**
Natural turf (on surface)	25.7	**31.4**
Natural turf (shade: air temp)	19.1	**23.9**

(**Reference**: Williams, C.F., and Pulley, G.E., Brigham Young University, "Synthetic Surface Heat Studies", http://aces.nmsu.edu/programs/turf/documents/brigham-young-study.pdf accessed 27 August 2009)

The Brigham Young University study showed extremes of temperature, however this is not the only study to show that artificial surfaces produce much hotter playing environments. McNitt and co-authors (2008) from Pennsylvania State University conducted a comprehensive study of numerous synthetic surfaces, and the effect of watering. In all cases, even though the tested surfaces were only 4.5 metres square (not much bigger than six queen-sized beds put together), it was shown that synthetic turf surfaces had ***significantly higher*** surface temperatures compared to natural grass. On days when the air temperature was 25 to 30 °C, the surface temperatures of the **ten** different surfaces tested varied from 45.4 °C (19 °C higher than the air temperature) to 71.5 °C (41 °C higher than the air temperature). These substantially elevated surface temperatures would result in greater heat transfer directly to the feet of players, with subsequent physiological stress and injury.

McNitt and co-authors also showed that watering the surfaces resulted in immediate drops in temperatures, ***but that this was not sustained***, rebounding significantly within 30 minutes. While watering of the artificial surfaces produced a desired drop in temperature, **"these low temperatures could not be maintained for periods of time equal to the length of standard sporting events."**

(**Reference**: McNitt, A.S., Petrunak, D.M. and Serensits, T.J. "Temperature Amelioration Of Synthetic Turf Surfaces Through Irrigation." *Acta Hort. (ISHS)* **2008**, 783, 573-582 http://www.actahort.org/books/783/783_59.htm accessed 20 August 2009)

The combination of higher temperatures, and added water in an attempt to reduce the temperature, would create an extremely humid and unpleasant environment. Grass, on the other hand, is naturally cooling as a result of the transpiration process resulting in an effect termed "the oasis phenomenon".

(**References:** Queensland Department of Employment, Economic Development and Innovation website http://www.dpi.qld.gov.au/cps/rde/dpi/hs.xsl/26_13315_ENA_HTML.htm accessed 6 September 2009.
M Santamouris, *"The role of green spaces"* pp. 145-159, in "Energy and Climate in the Built Environment", by M. Santamouris and D.N. Asimakopoulos, published by James & James London, 2001 ISBN 1 87936 90 7)

Extreme temperatures such as those generated on artificial surfaces can pose serious health risks to susceptible individuals in addition to the potential burns mentioned above. The increased heat gained by a player's feet would need to be dissipated by blood flow; McNitt and coworkers (2008, above) reviewed earlier literature where the conclusion was that the heat transferred from the synthetic surface to a player's feet would in itself be **"significant enough to contribute to greater physiological stress that may result in serious heat related health problems regardless of… air temperatures."**

It is recognised widely by the medical and general community that children are especially vulnerable to the effects of heat: these are the same school aged children who will be wanting to use the playing field during and after school times, including the hot summer and early autumn months (see **Table 2**, below). Heat

stress, dehydration, heat exhaustion and heat stroke are all probable effects of extreme heat exposure. Artificial surfaces will only increase the likelihood of these devastating effects on children and young adults for whom this ground is supposed to provide a venue for healthy and safe exercise.

But how much of the year could be affected? The closest weather station to Dulwich Hill is located at Canterbury Racecourse. (Similar temperature profiles were reported at other weather stations surrounding the local area.) If we take Pennsylvania State University's research, showing that ambient temperatures in the range 25 to 30 °C could produce surface temperatures in excess of 70 °C, then it is clear that high to *extreme surface temperatures could be experienced in 9 months of the past year*.

Table 2: Climate in the local municipality – Canterbury racecourse weather station

Month and year	Number of days with maximum temperature 25 °C and above	Number of days with maximum temperature 30 °C and above
September 2008	8	4
October 2008	12	7
November 2008	10	1
December 2008	22	9
January 2009	25	14 (2 days above 40 °C)
February 2009	16	8
March 2009	21	2
April 2009	7	0
August 2009	4 (incomplete data)	0

(**Reference:** Bureau of Meteorology http://www.bom.gov.au/climate/dwo/IDCJDW2025.latest.shtml accessed 8 September 2009)

If the soccer season does not encompass the height of summer, this even further highlights the folly of this proposal: the ground will be essentially useless during summer, and could lay idle in the hottest times of the year. The resultant **reduction** in the use of the ground is contrary to the Council's obligations to facilitate informal recreation for the community at large. If children **did** use the ground on hot days for informal recreation, they could suffer severe heat-related effects, which could deteriorate rapidly, as the medical or first-aid support that would normally accompany an organised soccer match, or practice would not be available. A well maintained grass surface would enable both organised and informal recreation all year round.

Watering the pitch can reduce heat stress: a satisfactory solution?

The studies quoted above by Williams and Pulley, and by McNitt and co-authors, clearly demonstrated that irrigation of artificial turf resulted in a dramatic **but transient** drop in temperature (in the Brigham Young University study the surface temperature dropped from 78.9 °C to 29.4 °C, but quickly heated up to 48.8 °C within **five minutes**; after 10 minutes the surface had already reached 73.3 °C). The effect is clearly temporary, and both groups have clearly demonstrated that the cool temperatures cannot be maintained for the duration of any sporting match. Nonetheless, irrigation is the only solution suggested in any publication.

There is another serious concern: the waste of precious water. Watering natural grass could conceivably use recovered water or bore water or rainwater, where the water would quickly be absorbed and become part of the environment. Minerals in bore water would be returned to the soil. Watering the artificial turf would require potable (town) water to minimise the growth of algal slime on the polymer surfaces. Use of bore water for irrigation of artificial turf would see a rapid buildup of minerals and dirt on the polymer

surface. The lack of natural soil microorganisms to biodegrade any pollutants would see them build up on the artificial turf, requiring even greater usage of clean water to cleanse the synthetic surface. This use of scarce potable water for nothing more than cooling an artificial surface is a serious concern in a time of climate change and long-term drought in eastern Australia.

Despite the inadequate and imperfect way in which it addresses the problem, the installation of an artificial surface **must** be accompanied by a complete irrigation system to ensure that the surface can be watered on warm and hot days, as needed. The additional cost will need to be taken into account – it is my belief that Council's budget allocation for this project does not include these essential works.

Risk of injury and infection on artificial turf surfaces

In assessing the injury rates reported on various surfaces, caution needs to be exercised. Some analyses exclude injuries that do not result in loss of playing time; these statistics would completely ignore injuries such as turf burns, for example. (The study of Ekstrand and co-workers 2006 is such publication. Ekstrand actually states that "Wounds, burns and friction injuries have been reported to be more common on artificial turf. Injuries that did not result in absence from full training or matches were not included in this study, and ***we may therefore have underestimated this problem***.") It is tempting to ignore reports that focus on sports other than soccer, but comparisons between the surfaces can be instructive, regardless of the sport.

(**Reference**: Ekstrand, J., Timpka, T., and Hägglund, M., *British Journal of Sports Medicine*, **2006**, 40, 975-980.)

Many reports **have** shown that artificial turf surfaces are less forgiving than properly maintained natural grass. As a result, **more injuries** are often reported on artificial surfaces. Orchard and Powell (2003) provided a good review of the higher injury rates on artificial turf *versus* grass, and in their 10 year study concluded that there is a greater incidence of knee and ankle sprains in American footballers who played on artificial turf, compared to natural grass. Sprains to the big toe – resulting in a condition known as Turf Toe (a metatarsalphalangeal joint sprain) – are especially common on artificial surfaces compared with natural grass (Childs, 2006); in fact, Turf Toe was virtually unknown before the introduction of artificial turf surfaces, and the increase in incidence of this condition tracks well with the increasing use of synthetic playing fields.

(**References:** Orchard, J.W. and Powell, J.W. "Risk of Knee and Ankle Sprains under Various Weather Conditions in American Football", *Medicine and Science in Sports & Exercise*, **2003**, 35(7), 1118-1123;
Childs, S.G., "The Pathogenesis and Biomechanics of Turf Toe", *Orthopaedic Nursing*, **2006**, 25(4), 276-280;
Ohlson, B., and O'Connor, P.L., "Turf Toe", http://emedicine.medscape.com/article/1236962-overview accessed 6 September 2009).

Recent literature has also demonstrated that the rate and severity of head injuries in American footballers can be higher when they play on artificial turf, compared with natural grass. Guskiewicz and co-authors (2000), in a study of college and high school level American football players, noted that **more severe concussions** were observed on contact with artificial turf compared with natural grass; similar patterns were observed in University level Canadian football where head and neck injury rates were 1.59 times higher on artificial turf (Hagel *et al.* 2003). This is extremely pertinent, as these young non-professional players would likely be at a similar level of physical and skill development compared with the soccer players who would be using Arlington Reserve. Ramirez and co-authors (2006), in a study of high school American football players (16 & 17 year old) also reported higher incidences of injuries on artificial surfaces (1.6 times greater incidence). Even reports showing that overall injury rates are similar (Meyers and Barnhill, 2004) point to very different injury patterns on the different surfaces. The Meyers and

Barnhill study showed higher incidences of epidermal and muscle injuries were reported on FieldTurf compared to grass; higher incidences of concussion were reported on grass, but the overall numbers of these injuries seen in the Meyers and Barnhill study were low. While American football is obviously very different to soccer, the fact that higher injury rates have generally been determined on artificial surfaces cannot be disputed.

(**References**: Naunheim, R., McGurren, M, Standeven, J., Fucetola, R., Lauryssen, C., and Deibert, E., "Does the Use of Artificial Turf Contribute to Head Injuries?" *The Journal of TRAUMA: Injury, Infection, and Critical Care*, **2002**, 53(4), 691-694;
Guskiewicz KM, Weaver NL, Padua DA, Garrett WE., "Epidemiology of concussion in collegiate and high school football players." *Am J Sports Med.* **2000**, 28, 643–650;
Hagel, B.E., Fick, G.H., and Meeuwisse, W.H., *American Journal of Epidemiology*, **2003**, 157(9), 825-833;
Ramirez, M., Brown Schaffer, K., Shen, H., Kashani, S., and Kraus, J.F., *American Journal of Sports Medicine*, **2006**, 34(7), 1147-1158.
Meyers, M.C. and Barnhill, B.S., *The American Journal of Sports Medicine*, **2004**, 32(7), 1626-1638.)

Most modern artificial surfaces have impact attenuating features; one main way in which impact injuries are supposed to be minimised is by the use of (often recycled) tyre rubber. While new surfaces might initially have good cushioning properties, the cushioning layers rapidly become compacted in high traffic areas of a playing surface, resulting in a much harder surface (Naunheim and coworkers, 2004). Even attempts to stir up the material to reactivate its cushioning potential were only partly successful.

(**Reference:** Naunheim, R., Parrott, H., and Standeven, J., , "A Comparison of Artificial Turf" *The Journal of TRAUMA: Injury, Infection, and Critical Care*, **2004**, 57(6), 1311-1314.)

Hockey players also experience injuries on artificial surfaces, where Eggers-Ströder and Hermann report that ***"Severe injuries are mostly due to the playing surface; especially Astroturf seems to be dangerous."*** In a much more recent study, the faster pace of hockey on artificial surfaces compared with natural grass was believed to contribute to a significantly higher incidence of ankle injuries (Peters-Futre and co-authors, 2007).

(**References:** Eggers-Ströder, G. and Hermann, B., *Sportverletz Sportschaden* **1994**; 8: 93-97;
Naicker, M., McLean, M., Esterhuizen, T.M., and Peters-Futre, E.M., *Journal of Science and Medicine in Sport*, **2007**, 10, 363-371.

Injuries that occur most often are abrasions referred to as turf burns, resulting from the abrasive nature of the polymers used to make the synthetic turf. A report in the prestigious *New England Journal of Medicine* (2005) detailed the occurrence and transmission of an extremely serious skin infection that caused large abscesses requiring surgical intervention. This study of professional football players in the US showed that turf burns provided a ready point of entry for infectious agents; the particular infection that was the object of this study was methicillin-resistant *Staphylococcus aureus* (MRSA). **All of the infections** occurred at turf burn sites, and players reported that turf burns were **more frequent and severe** on artificial surfaces. These skin injuries ***"place players at increased risk for infection"***. This study provides unequivocal evidence that these injuries provide a readily accessible site for entry of infection from a range of dangerous microorganisms.

(**Reference:** Kazakova, S.V., Hageman, J.C., Matava, M., Srinivasan, A., Phelan, L., Garfinkel, B., Boo, T., McAllister, S., Anderson, J., Jensen, B., Dodson, D., Lonsway, D., McDougal, L.K., Arduino, M., Fraser, V.J., Killgore, G., Tenover, F.C., Cody, S., and Jernigan, D.B., *New England Journal of Medicine*, **2005**, 352(5), 468-475.)

Council's proposal specifically relates to soccer and it has been shown that artificial turf likewise causes an increase in injuries. Steffen and coauthors (2007) have shown that, for young female soccer players, **the rate of serious injury on artificial turf was significantly higher**. In a review of sports, injuries, and playing surfaces by Stiles *et al.* (2009), the results of a number of studies by various authors were compiled. In general, higher injury rates (especially for men) were reported on artificial surfaces. There was a reduced tendency for severe injuries to occur on natural grass. **Players preferred natural grass** for several

reasons: player impact on the surface (falls) was lower and leg and muscle problems were less frequent, the ball rolled more slowly on grass, and grass was more comfortable to play on (it retained moisture better, and was cooler in hot weather).

(**References:** Steffen, K., Andersen, T.E., and Bahr, R., *British Journal of Sports Medicine*, **2007**, 41(Suppl 1) i33-i37; Stiles, V.H., James, I.T., Dixon, S.J., and Guisasola, I.N., *Sports Med.*, **2009**, 39(1), 65-84.)

Most telling, however, is research commissioned by one of soccer's main bodies – the Union of European Football Associations (UEFA). Professor Jan Ekstrand, who carried out 6 years' research ***on behalf of UEFA*** into cases of injuries on artificial turf *versus* natural grass, concluded that there are no more injuries on artificial turf compared to natural grass, **but**:

1. the nature of the injuries differed: muscular injuries are greater on grass, but ligament damage is more likely on artificial surfaces (in particular, ankle injuries)
2. changing from artificial turf to natural grass, and *vice versa*, DOES carry an increased injury risk. Problems can arise if players train on one surface, and compete on another.

Hence players who train or play on synthetic turf, and then play other games on natural grass, will be at risk of greater injury. This will include all players who would call Arlington reserve their home ground: they would practise and play their home games on synthetic turf, and then play their away games on natural grass, where their incidence of injury would be expected to increase. Visiting teams who practise at home on grass, and then play on an artificial surface at Arlington Reserve, would be at a greater risk of injury. Even home players who "warm up" on natural grass (Laxton or Johnson, against Council policy), and then play on synthetic turf on Arlington Reserve, will be at greater risk of injury.

[**Reference:** http://www.fifpro.org/index.php?mod=one&id=17022 (the Fédération International Des Associations de Footballeurs Professionels website) accessed 27 August 2009]

Section B: Toxic chemicals emitted from synthetic surfaces

The composition of the artificial surface

When considering the potential toxicity of an artificial surface, there is much more to take into account than just the nature of the polymers that are used for the fibres, the backing, and the support. In addition to the polymer molecules themselves, the surfaces will contain:

- plasticisers (to reduce their rigidity and make them softer);
- stabilisers (to increase their lifespan especially when exposed to oxygen, and ultraviolet radiation from the sun);
- colouring agents (to make the "grass" look green, and the line markings distinct);
- fungicides (and one example on display at the information session on 16 August had a fungicide-coated sand base, where the fungicide was supposed to remain active, and therefore toxic, for the life of the artificial surface);
- numerous other chemicals, such as bonding agents (glues).

If recycled tyres are used to produce granular in-fill, the potential for absorbed toxic materials must also be taken into account.

Many of these chemicals are toxic; that is beyond dispute. The important issues are the **level** and **frequency** of exposure. Low-level exposure for a brief period ***may*** be below the threshold level needed to produce **acute** toxic effects. Low level ***repeated*** exposure introduces another element: these materials may not be toxic in a single, low level exposure, but repeated exposure (as would be the case with weekly

matches and training) may eventually produce **chronic** effects; these effects can sometimes take years to manifest themselves, long after exposure has ceased (a well-known example is asbestos-related mesothelioma). Chronic effects typically require ***much lower doses*** than acute toxic effects. Chronic toxic effects are much harder to study, and much less is known about them. However it is known that safe exposure limits to a variety of chemicals are regularly reviewed, and they are occasionally amended – to lower and lower levels, as more evidence comes to light (For instance, while occupational levels of benzene exposure are currently set at 5 parts *per* million, it is likely that they will be revised to 1 p.p.m. or even 0.5 p.p.m.). Levels that are considered safe today, may be revised and declared unsafe in the future, with more research and information. Levels that are considered safe for the general population, can often be unsafe for more sensitive groups, such as children.

Scientific reports often have large amounts of data – but what does it tell us? Papers will frequently discuss test results of samples obtained from a number of sites (*e.g.*, the amount of lead or other toxins found on several grounds), and report that the **mean** or **average** concentration of lead is a certain value. If this mean or average is below the mandated exposure level, it could be tempting to think that the grounds are safe. But is this necessarily so? Sometimes it is more informative to look at the spread of results, either by looking at all of the data, or by considering the standard deviation (SD). (The SD gives a measure of the dispersion or spread of values – the larger the SD, the larger the spread of data around the mean. If the data conforms to what is known as a normal distribution, then approximately 68% of the data comes within one SD of the mean, and 95% of the data comes within two SDs of the mean.)

> In a hypothetical example, a series of tests on hypothetical sports grounds could give an average concentration of a toxin of 5.2 parts per million (p.p.m.). If the exposure limit was set by the Government at 6.0 p.p.m., then the average is below the limit. However if there was a large spread of values in the data set – some areas would likely have concentrations above the limit. If the SD was 0.8 p.p.m., then ≈68% of concentrations would be expected to fall in the range 4.4-6.0 p.p.m. (mean ± 1 SD). Thirty-two percent fall outside this range, and 16% (about *one in six*) of grounds would exceed the limit, even though the mean appears to be comfortably under the danger level. So the average, while interesting, is perhaps less informative than the spread of data which might show that some sports grounds actually exceeded the imposed limit. After all, at Arlington Reserve we won't care about averages across other grounds. We will care about the toxicant levels at our own ground.

Another important issue in consideration of toxicity is bioavailability, or bio-accessibility. These terms refer to the relative ease by which chemicals can be absorbed by the human body, and potentially cause harm. If a toxic material is not actually absorbed, it cannot cause harm.

A ***thorough and responsible assessment*** of the toxic profile of any artificial turf surfaces to be used at Arlington Reserve should incorporate a consideration of **all** of these factors as they relate to **all** of the chemical components, from the fibres to the colours to the infill agents. As Council, at the information day, presented two different examples as possible artificial surfaces, the full profile of each surface should be considered.

There is much conflicting information on the chemicals involved, and their toxicity. Some studies and reports claim that toxic components are present in levels that are too high to be considered safe, and others claim that levels are below the threshold. However even reports that conclude that these surfaces are safe for play, often have qualifying statements. The Connecticut Department of Public Health in a Technical Fact Sheet, qualified their conclusions by stating that "the ***uncertainties warranted further investigation***" and the potential exposures and risks ***have not been fully characterised***." In a review of synthetic turf safety prepared for the Somerset Hills School District in 2008, it is stated that (my emphasis):

> "No significant threats to human health and no increased carcinogenicity have been found in studies of third generation artificial turf, with the exception of a slight potential risk to latex-sensitive individuals. …..***Very little epidemiological work*** has been performed on the effect of crumb rubber and human health……It is important to understand that ***gaps exist in the research*** on artificial turf. While studies have been run on rubber granules and playground surfaces, ***very few studies have actually monitored the chemistry of synthetic turf***, and particularly rubber crumb infill in a working environment. Researchers suspect that the leaching/outgassing of crumb rubber changes dramatically over time: volatile materials turn to gases in a few months or years, metals become more bioavailable as materials deteriorate with use and exposure to sunlight….actual numbers studying the ***lifetime potential for chemical contamination (up to 10 years) do not exist***."

(**References:** Connecticut Department of Public Health Technical Fact Sheet October 2007 http://www.ct.gov/dph/lib/dph/environmental_health/eoha/pdf/artificial_turf_tech_fs_10-07.pdf accessed 12 Sept. 2009; Whitlock, C.E.A., "Review of Synthetic Turf Safety" published date 20 September 2008, Somerset Hills School District, New Jersey, http://www.shsd.org/NewSite/district_info/BulletinBoard/TurfReport092208.pdf accessed 30 August 2009)

One example of toxicity, concerning lead, is instructive. Older pitches have used lead chromate extensively as a pigment. Newer pitches, that use recycled tyres for in-fill, have also been shown to have lead contamination. Manufacturers claim that the lead chromate is not soluble, is encapsulated within the fibres, and is essentially non-toxic. However the Material Safety Data Sheet – the official documents provided by chemical companies to allow people to assess risk – for lead chromate says that it is a neurotoxin, and a potential cancer hazard. Lead has also been detected in rubber crumb in-fill (see below). The US Centre for Disease Control recently called for testing of older fields, and on June 1 2009 updated their site to report that some fields actually had "unhealthy levels of lead dust." It has been recommended that the synthetic turf industry limit or phase out the use of lead. Interestingly, most concerns focus on the lead. Chromate – a form of hexavalent chromium – is a Type 1 Carcinogen (**known** to cause cancer in humans) as listed by the International Agency for Research on Cancer.

(**Reference:** http://www.cdc.gov/nceh/lead/tips/artificialturf.htm accessed 28 August 2009
http://www.jtbaker.com/msds/englishhtml/l2869.htm for the MSDS for lead chromate; accessed 28 August 2009
http://monographs.iarc.fr/ENG/Classification/crthgr01.php the IARC list of Type 1 carcinogens; accessed 31 August 2009)

Recycled tyres provide in-fill: are they good or bad?

Rubber tyres – and hence, any products made from recycled tyres – are much more than just rubber. A number of metals are used in their manufacture. Zinc, magnesium, and calcium are all used in the process, and lead is a frequent contaminant of the zinc oxide used in vulcanisation. Antimony pentasulfide is often used as a colourant. Many other substances including trace metals are absorbed as the tyres contact the road surface during their lifetime.

(**Reference:** Bocca, B., Forte, G., Petrucci, F., Costantini, S., and Izzo, P., *Science of the Total Environment*, **2009**, 407, 2183-2090.)

Recycling: Some types of artificial surfaces use either recycled rubber underlays, or recycled tyres as a crumb rubber infill. The potential benefits and environmental credentials of the proposal have been touted in some quarters because some tyres are recycled rather than disposed in landfill. However the small contribution to the recycling effort does not necessarily offset the potential toxic consequences. The

supposed benefit from recycling some tyres now will be completely offset if the entire surface of the artificial turf field cannot be recycled – because of pigments, stabilisers, or other additives – when it needs to be replaced.

Crumb rubber from tyres: The crumb rubber produced from old tyres has been shown to have a complex chemical profile. This rubber is composed of a large number of organic compounds. Some are relatively volatile organic compounds, such as benzothiazole, phthalates, alkylated benzenes, and alkylated phenols. The Department of Analytical Chemistry at the Connecticut Agricultural Experiment Station performed a series of analyses on crumb rubber and determined that these volatile components not only become airborne, but they also can be leached into runoff. Other compounds that are normally less volatile will become volatile – and hence, capable of being inhaled – by the greatly increased surface area of the crumb rubber, and the high on-field surface temperatures. Their tests also identified a series of toxic metals in runoff, including selenium, cadmium and lead. A Danish report, which also provides a review of other investigations, highlights the lack of long-term data. Despite the paucity of data, recommendations consistently call for the phasing out of recycled tyre in-fills as the risks are seen as unacceptable.

(**References:**
Incorvia Mattina, MJ, Isleyen, M., William Berger, B., and Saim Ozdemir, S., *"Examination Of Crumb Rubber Produced From Recycled Tires"*, Connecticut Agricultural Experiment Station, http://www.ct.gov/caes/lib/caes/documents/publications/fact_sheets/examinationofcrumbrubberac005.pdf accessed 30 August 2009)
Nilsson, N.H., Malmgren-Hansen, B., and Thomsen, U.S., Mapping, emissions and environmental and health assessment of chemical substances in artificial turf, Danish Ministry of the Environment report, Survey of Chemical Substances in Consumer Products, No. 100, 2008.
http://www2.mst.dk/udgiv/publications/2008/978-87-7052-866-5/pdf/978-87-7052-867-2.pdf accessed 29 August 2009)

A significant concern is the presence of **polycyclic aromatic hydrocarbons (PAHs)** in the rubber. Polycyclic aromatic hydrocarbons are a class of compounds that include potent carcinogens such as benzo[*a*]pyrene. A study reported in the *Journal of Exposure Science and Environmental Epidemiology* in 2008 has shown that crumb rubber used as infill in synthetic surfaces contains a cocktail of compounds including heavy metals and PAHs, with benzo[*a*]pyrene (a Type 1 Carcinogen according to the International Agency for Research on Cancer) among them. Zhang and co-authors sampled rubber granules from new (installed in 2006) and older fields for analysis, and determined that ***all samples*** contained PAHs, with levels as high as 38.15 parts per million. Samples taken from older fields had lower amounts, demonstrating that these toxic compounds are lost to the environment over time. However rubber in-fill needs to be replaced, meaning that the supply of these toxic materials will be periodically renewed. While bioavailability by ingestion is considered to be minimal, absorption through the skin, or by inhalation, are more likely. Zhang and co-authors concluded that "considering children and athletes have frequent skin contact with the surface and rubber infill of synthetic turf field, exposure through dermal contact **cannot be ignored**…. [their results suggest] **a potential for inhalation exposure** to occur when children and athletes are close to the turf surface and especially when respiration rate is high during heavy exercise activities."

Zhang and co-authors (2008) also demonstrated that the rubber in-fill in artificial surfaces has significant levels of zinc, lead, chromium, arsenic and cadmium, and that the lead was **highly bioaccessible** in gastric fluids (stomach). Runoff from synthetic surfaces with a high zinc content could pose a risk to plant and aquatic life. Levels of chromium in a new grass fibre were at a level to cause concern.

(**Reference:** Zhang, J., Han, I.-K., Zhang, L., and Crain, W., *Journal of Exposure Science and Environmental Epidemiology,* **2008**, 18, 600-607.)

Effect of the artificial turf surface on the local environment

When considering the installation of artificial surfaces, there is an undisputed fact: there will, especially in the immediate pre-construction period, be significant runoff from the new surface that is contaminated with at least some of these chemicals. The runoff will then either pass into stormwater, or groundwater. (It is worth noting that the piped enclosure of the watercourse that runs to Hawthorne Canal under Arlington Reserve is irrelevant: if chemicals are washed into the soil they will have the capacity to pollute the local environment and enter the local groundwater.)

A report prepared for the Danish EPA has assessed that it is likely that at least some of the chemicals could be present in amounts in excess of the official No Adverse Affect Level. In particular, significant quantities of zinc, phthalates, and nonylphenol would be expected to leach into groundwater. While these levels would reduce over time, the periodic replacement of crumb infill would see the levels increase again. Bocca and coworkers (2009) have also examined leachates; while many metals were leached at low levels, zinc levels were leached at the highest concentrations, and other metals such as aluminium, iron and magnesium were also leached. While lead was generally leached in small amounts, when the spread of results is considered, in some of their tests its concentrations did approach the (German) statutory limits. Bocca and coworkers also note that "more investigation is needed to look at the use of tyre crumb and the potential for release of inhalable particles, as well as the contamination of soil and groundwater".

(**Reference:** Nilsson, N.H., Malmgren-Hansen, B., and Thomsen, U.S., Mapping, emissions and environmental and health assessment of chemical substances in artificial turf, Danish Ministry of the Environment report, Survey of Chemical Substances in Consumer Products, No. 100, 2008.
http://www2.mst.dk/udgiv/publications/2008/978-87-7052-866-5/pdf/978-87-7052-867-2.pdf accessed 29 August 2009;
Bocca, B., Forte, G., Petrucci, F., Costantini, S., and Izzo, P., *Science of the Total Environment*, **2009**, 407, 2183-2090.)

But Council plans to install an Australian-made product, so overseas studies are irrelevant.

This is not true. The chemical compounds involved, and their behaviour under various environmental / climatic conditions are the key. Toxicology does not respect international boundaries – if a chemical is toxic in Europe or the US, it is toxic worldwide. The question is the chemical make-up of the artificial surface, the underlying layers, the bonding agents, the colouring agents, the plasticisers, the stabilisers, and other components of the surface. Additionally, if a synthetic surface absorbs solar radiation on warm days and results in a hot playing surface, it will happen in any country, on any hot day.

FIFA (the Fédération Internationale de Football Association) has approved artificial surfaces

This may be so but there are several pertinent issues:

- Many FIFA controlled matches are in the northern hemisphere, in countries with much colder climates than ours, in some cases where grass is more difficult to grow to a suitable standard.
- Artificial turf ***does*** have significant advantages regarding injury rates when compared with snow-covered or frozen natural grass surfaces.
- Many northern hemisphere countries have cooler summers and hence the longevity of the polymer will be extended, and problems with heat stress will be minimised.

While UEFA has stated that artificial pitches are needed under some circumstances, such as in countries that experience bad winters where artificial turf can be better than frozen ground, the UEFA CEO is on

record as saying that "A good natural pitch is always the best - that is also the view of the players and everybody else involved…"

(**Reference:** http://www.uefa.com/uefa/keytopics/kind=1048576/newsid=256667.html accessed 13 September 2009)

And what does FIFA actually *say* about artificial surfaces?

FIFA has recently published recommendations and guidelines regarding artificial turf. While the document principally deals with the behaviour of the surface during play, several aspects are instructive. In the May 2009 Handbook of Requirements, they state that they **do not endorse** the use of sprinklers within the playing area (but do acknowledge that they are sometimes included, but additional requirements are included to ensure that the sprinklers do not prove hazardous to players *i.e.*, they retract fully). There is also the following statement regarding toxicology (my emphasis):

> "The manufacturer should be asked to supply to the purchaser an assurance that the sports surface together with its supporting layers, **does not contain** in its finished state any substance which is **known** to be **toxic, mutagenic, teratogenic or carcinogenic** when in contact with the skin. Furthermore that **no substances** will be released as a **vapour or dust** during normal use."

(**Reference:** "FIFA Quality Concept – Handbook of requirements for Football Turf" May 2009. http://www.fifa.com/mm/document/afdeveloping/pitch&equipment/68/52/08/fqcrequirementsmanual(may2009)specimen.pdf accessed 6 September 2009)

While manufacturers might be reluctant to state that their products do not measure up to FIFA's own recommendations, scientific evidence clearly shows that there are real and serious concerns.

And, at the consultation meeting at Arlington Reserve, if you put your nose close to the two samples on display, you could smell something unnatural. Both surfaces were emitting volatile organic compounds into the atmosphere.

Artificial Surfaces are everywhere – they must be safe or Councils and other organisations would never have used them??

History is littered with examples of previously-safe materials that were universally accepted, but are now considered dangerous and have either been phased out, or restricted. In fact, the US Environmental Protection Agency has recently announced that the ***rubber surfaces used in children's playgrounds*** – made from recycled tyres – need to be reviewed because of concerns over lead levels.

(**Reference:** USAToday online http://articles.latimes.com/2008/sep/04/business/fi-turf4 accessed 30 August 2009)

Little is known about the long-term effects of artificial surfaces, and the chemicals within them (either alone, or acting in synergy). In a study produced by the Office of Environmental Health Hazard Assessment for the Integrated Waste Management Board of the Californian EPA, extensive testing has revealed that recycled tyres that were used for playgrounds did contain a mixture of many chemicals. While the conclusion was that exposure of a child was likely to be insignificant in many cases, the carcinogenic risk resulting from hand-to-mouth transmission of toxicants was evaluated as slightly above the *di minimis* level of 1 per 1,000,000, taken as a generally accepted risk level. Concerns over safety are

resulting in lawsuits. In late 2008, Californian Attorney-General Jerry Brown filed a suit against three manufacturers of artificial turf over the lead content.
(**References: "**Evaluation of Health Effects of Recycled Waste Tires in Playground and Track Products" California EPA / OEHHA Jan 2007 http://www.ciwmb.ca.gov/Publications/Tires/62206013.pdf accessed 12 September 2009;
LA Times Online http://articles.latimes.com/2008/sep/04/business/fi-turf4 accessed 30 August 2009)

Whether Australian surfaces have significant lead concentrations – or not – is irrelevant. Until all of the health concerns – heat illnesses, injuries, infections, and toxicity – can be satisfactorily answered, Council is potentially opening itself to litigation if it replaces the natural grass surface with artificial turf.

And artificial turf actually changes the game.

In a series of tests conducted on a ***recently installed, third generation surface***, players developed much higher lactate levels and significantly higher heart rates when running on modern synthetic surfaces compared with natural grass (di Michele *et al.*, 2009). Different playing surfaces affect the force distributions in players' feet during running; there are a substantially different maximum peak pressures in key regions of feet on artificial turf – the central forefoot experiences 25% greater pressure, for example (Ford and coworkers, 2006). Elite Swedish players actually performed differently when playing on artificial turf: they attempted more short passes in the midfield zone, executed fewer successful long, low passes and performed fewer sliding tackles on artificial turf resulting in less aggressive defensive play. The reduction in the number of sliding tackles was explained by a fear of turf burns from synthetic surfaces. These Swedish players reported poorer ball control, greater physical effort, and a general negative perception of artificial turf (Andersson and coworkers, 2008). The Swedish players reported that artificial turf was physically harder than natural grass, and that it was more difficult to run without the ball.

The different behaviour of the artificial surface compared with natural grass means that players behave differently when playing on it. More importantly, players who play on one type of surface, and train on another type, are at a distinct disadvantage, as discussed above. Rather than becoming more useful and popular with the soccer fraternity, Council risks developing a venue that is less popular, less useful, and ultimately a white elephant. International studies have shown that soccer **players** actually prefer playing on grass!

(**References:** diMichele, R., di Renzo, A.M., Ammazzalorso, S., and Merni, F., *Journal of Strength and Conditioning Research*, **2009**, 23(3), 939-945;
Ford, K.R., Manson, N.A., Evans, B.J., Myer, G.D., Gwin, R.C., Heidt Jnr., R.S., and Hewett, T.E., *Journal of Science and Medicine in Sport*, **2006**, 9(6), 433-440;
Andersson, H., Ekblom, B., and Krustrup, P., *Journal of Sports Sciences*, **2008**, 26(2), 113-122.)

Section C: Environmental Concerns

Artificial turf provides no photosynthetic oxygen

Even a small patch of well-tended grass such as Arlington Reserve does provide significant oxygen for the local area – the photosynthetic process also results in the absorption of significant carbon dioxide (the major greenhouse gas). While the grass clippings will eventually degrade and return at least some CO_2 to the atmosphere, they will not generate more greenhouse gas than they consume.

Heritage value

Arlington Reserve is a beautiful ground. Its grandstand, in particular, has substantial heritage value. Conservation of high value heritage items such as Arlington Reserve involves more than just the immediate items of concern – it involves setting and context as well. Examples abound where the façade of an historically important building is preserved, only to be overwhelmed by a multistorey modern complex built behind it. A heritage house loses its soul when surrounded by a modern shopping complex. Likewise, the beauty of Arlington Reserve will be considerably diminished if the natural grass is replaced with synthetic turf. The heritage preservation of Arlington Reserve should include not just the grandstand, but also the natural turf, to provide maximum context for this historical jewel in the crown.

Is the installation of the artificial turf consistent with a ground surrounded by trees? The future of trees surrounding the ground cannot be guaranteed

One of the key recommendations of a Cranfield University report is that artificial surfaces need to be clear of any **overhanging** trees, or trees which may allow leaf litter to blow onto the surface. The removal of trees is considered necessary to prevent the accumulation of litter, and the deposits of sap on the grounds, which will (at the very least) stain the surface.

At the information session on 16 August 2009, Council staff gave a **categorical assurance** that none of the trees would be removed. Indeed, given the significance of the large eucalypts near the change rooms, any such removal would not only be contrary to this advice, but would further destroy the heritage setting of the ground. The **Amended Marrickville Tree Strategy Issues Paper (Draft) 2007** clearly states that trees such as the ones at Arlington Reserve are significant, and must be preserved. Apart from their environmental impact (absorbing carbon dioxide, providing oxygen, through photosynthesis, and cooling through the "oasis phenomenon" *vide supra*), their improvement to the park (providing shelter and shade, and acting as a wind break), and their beauty, they provide a partial but significant visual screen and a noise screen for neighbours when matches or practice are occurring. Removal of the trees – as recommended by Cranfield University – would transform a beautiful heritage ground into an artificial eyesore.

(**Reference:** http://www.cranfield.ac.uk/sas/pdf/cranfieldmaintainingsyntheticturfguidelinesv1_1.pdf and http://www.sportsurf.org/workshops/7/IJ.pdf Accessed 30 August 2009)

The effect on native wildlife

The Inner West is a long-established urban area where remnant bushland has been all but eradicated. Nonetheless, over time trees and other vegetation have become established, and native animals have either returned to the area, or adapted. We have seen our native wildlife able to survive and adopt our new urban environment as their home. At Arlington Reserve we frequently see native birds: kookaburras, New Holland honeyeaters, willie wagtails, crested pigeons, masked lapwings ("plovers"), rainbow lorikeets and red wattlebirds are just some examples seen regularly on the Reserve. While many birds spend much of their time in trees, some (such as the masked lapwings) are essentially ground dwelling, and many others rely on open ground for food - catching insects among grass, or foraging for seed. Removal of the grass from Arlington Reserve would drastically reduce the open grassland on which our bird population relies.

The greatest concern however is not the birdlife, but a ground-dwelling marsupial. The Long-nosed Bandicoot *Perameles nasuta* Geoffroy, 1804 (family Peramelidae) has been identified in the area, and the NSW Department of Environment, Climate Change and Water has made a determination (2008) under the Threatened Species Conservation Act that the local inner west population is endangered. The distribution

of the animals is quite wide within the municipality, with live animals being trapped or seen in the Lewisham and Dulwich Hill areas, and dead specimens being found in Lewisham, Dulwich Hill, Marrickville and Five Dock. This population is extremely significant because it is the only population south of the Parramatta River, and north of the Royal / Heathcote National Parks to the south of Sydney. For the purposes of the determination, the population includes both the Marrickville and Canada Bay LGAs, with the likelihood that it extended into neighbouring areas as well. The determination indicates that further research is likely to define an even wider distribution for this small population.

While the animals generally shelter under old buildings, they "**forage in parkland** and back yards". The mobility of the animals means that even if they do not live permanently on Arlington Reserve, it is extremely likely that the Reserve is within their range.

The population already faces extreme threats of extinction from road trauma, predation by introduced species (most notably cats, but also dogs and foxes), and loss of habitat – either the areas in which they shelter, or the ground on which they forage. Loss of the natural surface from Arlington Reserve would reduce their habitat, and place just one more pressure on this significant and endangered population.

It is interesting that Section 91 of the Threatened Species Conservation Act 1995 states that, while the Director General may grant a licence to damage habitat of a threatened species such as this one, such a licence can only be issued: (a) for the welfare of the animals, or (b) if there is a threat to life or property. Other special reasons may be allowed, but the Act implies that these reasons must be exceptional – such as an Aboriginal person exercising his or her culture. It is clear that the resurfacing of Arlington Reserve with synthetic turf does not fall under these guidelines. Any application to disturb the habitat must be accompanied by a proper Species Impact Statement (Section 92 of The Act). This is the Council's statutory obligation. The determination of endangered status under the Act has clearly indicated that Dulwich Hill is part of the domain of these animals. It is not our obligation to prove that Arlington Reserve is part of the bandicoot's habitat and range – the determination has done that. It is Council's obligation to prove that Arlington Reserve is NOT part of the habitat.

(**References:** http://www.environment.nsw.gov.au/determinations/longnosedbandicootfd.htm accessed 7 September 2009; Threatened Species Conservation Act 1995 http://www.austlii.edu.au/au/legis/nsw/consol_act/tsca1995323/ accessed 7 September 2009)

Which is "greener" – natural grass, or artificial turf?

There is considerable debate about the relative merits of natural grass *versus* the synthetic alternative. Natural grass requires mowing, and this process does result in some greenhouse gases and pollution from the mower. However the Athena Institute has estimated that **1861** coniferous trees would need to be planted – ***and grow for ten years*** – to offset the carbon footprint of an artificial turf field.

(**Reference:** http://www.athenasmi.ca/projects/docs/UCC_project_ATHENA_technical_paper.pdf accessed 30 August 2009)

And what can be said of the merits of each surface with regard to chemical application? Natural grass requires fertiliser, and occasional application of pesticides and herbicides. An experienced groundskeeper could assess whether pesticides or herbicides needed to be applied in any given season, and their application could be targeted to problem areas only. Artificial turf requires the application of fungicides, algicides, and disinfectants / antiseptics **on a regular basis** (one local manufacturer says that quarterly application **"is a must**"). Algal treatments in particular are recommended ***every three months***, and failure to do so could void the warranty. Any statement that synthetic turf is greener or more environmentally acceptable than natural grass is a distortion of the facts.

(**Reference:** http://www.teamsports.com.au/a/21.html accessed 30 August 2009)

Section D: Community concerns

Arlington Reserve will not be available for alternative uses.

While is has been stated that Arlington Reserve will be available for informal recreation, the reality will be quite different. Many residents in the immediate area work Monday to Friday, 9 am to 5 pm. On returning home, attempts to use Arlington Reserve will be stymied by soccer practice (which we were informed at the information day could occur up to 4 evenings per week, in addition to weekends); instead, residents will have to "relax" at home to the sound of soccer practice long into the evening.

Even if soccer practice does not interfere totally with informal recreation, the synthetic surface will restrict any alternative sports. In past years people have used the ground for informal cricket matches – a central wicket was mown, and people played in cricketing whites indicating a serious, if informal, match. Schools have marked running tracks and used Arlington Reserve for athletics meets. Activities such as these will be impossible on an artificial surface. The use of Arlington Reserve will become more of a sporting monoculture.

Also, in the recent past, Arlington Reserve was used for the Christmas carols and fireworks. While this event is usually held at Johnson Park, Arlington Reserve is an excellent stand-by venue. The potential for damage to an artificial surface, not only from fireworks but also from people setting up picnic areas, means that this venue will never be available for such activities again.

At a time when we are seeing greater urban consolidation, and the redevelopment of the Dulwich Hill shopping precinct with additional dwellings, Council should be setting aside *MORE* open space for general recreation, not less. The diversity of the community should allow for diverse sporting and recreational pursuits – not force people to play any sport they want, as long as it is soccer.

There is an obesity epidemic in Australia, especially among the young. The conversion of Arlington Reserve to a more soccer-friendly ground, with greater use, will see it essentially monopolized by a few clubs. Young people who are already quite fit will reap the benefits. Those members of the community who most need access to the ground will be less able to use the ground for any sporting pursuits – unless they wish, and are able, to join a soccer team. It may sound trite, but the fit will become fitter, and the fat will become fatter.

Traffic, parking and noise

The proposal has one very simple aim: to increase the usage of Arlington Reserve. This was plainly admitted by Council staff at the briefing day: the expectation is that the ground will be used continuously all year round – for approximately 60 hours per week. For half of the year, matches would be played on both days on the weekend and, for the rest of the year, matches could be played on one day on the weekend. For at least 80% of the year is it also expected that training could occur four nights of the week.

Dulwich Hill – especially the area around Arlington Reserve – is now a built-up, residential area. The increased traffic, lawless parking, swearing, and general noise resulting from this change and the increased usage would be unbearable for anyone living in the vicinity. Already, on "soccer days", parking within several blocks of Arlington Reserve is a nightmare. Cars park in No Standing zones, on footpaths, and in driveways. Parking very close to the roundabout on Constitution Rd / William Pde is a significant hazard,

to traffic and for pedestrians trying to cross in the vicinity. No Standing and other traffic control signs may have been erected, but people ignore them. Increased usage of the Reserve, as has been proposed to result from installation of an *all-weather* surface, will only exacerbate the problem. Council clearly does not have the resources – or the willpower – to enforce the restrictions around the area when the soccer games and practice are in progress, for a single day, not to mention for 60+ hours per week, 48 weeks of the year, for the next 10 years. The local Police have indicated that the usage – ***even at current levels*** – is unsustainable. Any additional usage will only increase the noise resulting from the venue – something that can be heard, even as far away as Abergeldie St. Council either cannot or will not manage effectively the problems at the current level of usage. Until Council provides the community with more than promises and empty rhetoric, **no increase** in usage patterns should **ever** be contemplated.

To alleviate the parking nightmare, introduction of residents' parking schemes and one hour parking zones is no solution. This may mean that residents will have to pay annual charges for parking permits in addition to their rates (to support something that the majority of residents in the area do not want!), the parking problem may move further away, and any people trying to visit residents will find parking extremely problematic.

Litter

Soccer days result in a dramatic increase in litter both within the park itself, and in the surrounds. Residents of Dulwich Hill are rightly proud of their suburb, and the additional litter is unacceptable. It is not just unsightly: food scraps attract rats with the attendant disease hazards; litter washes into drains, clogging them and resulting in localised flooding in the event of heavy rains; and the litter can wash further into the stormwater increasing pollution in our waterways.

Local communities have been sworn at and abused by the soccer fraternity in the past

This is a major problem, and one that has not been – and cannot be – denied. Soccer clubs act as though they own the area when they are using it. At the Council meeting of 18 August 2009, Clr. Macri called for consultation in the hope of achieving a ***"win-win"*** solution. While this would seem desirable, the evidence suggests that procuring such an outcome is fraught. At that same Council meeting:

- Before the formal start of the meeting, an elder member of the soccer community went around the room and told everyone to be quiet and respectful, not to yell out or boo when people spoke with contrary views, and to allow everyone to speak. With such warnings, one can assume that the soccer community would be on its best behaviour.
- Despite these warnings, when people spoke in opposition to the proposal, members of the soccer community became very vocal – they booed, jeered, yelled insults, and were generally derisive. Even when Mayor Iskandar called for calm, the mayhem continued. Despite the presence of Councillors, security, Council staff, and the media, the soccer community could not restrain itself. This begs the question: how can we trust them to show restraint and be respectful of residents when they are away from officialdom and the public gaze?
- The vocal outbursts were particularly intense when female speakers were attempting to be heard, in particular Suzanne Marks and Clr. Kontellis. The intensity of the interjections, and the nature of some of the comments made by members of the gallery, suggest a particularly misogynist attitude among the almost exclusively male community.

- The younger children were – largely – quiet and respectful. However the example set by elder members of the community must cause great concern that this standard of behaviour will be instilled in these impressionable juniors as an acceptable way to behave, and treat others.

Increased use of the ground, as an artificial surface will allow, can only lead to an increase in the frequency of unpleasant confrontations when residents attempt to go about their normal lives.

It has been suggested that soccer clubs could be asked to "take ownership" of the ground and self-police the area for problems

Even if the local soccer clubs ***can*** ensure that their own players abide by a code of conduct that ensures peaceful coexistence with residents, it is unlikely that their influence will extend to visiting teams who could come from areas across Sydney.

Use will increase dramatically in the future

At the Council meeting on 18 August 2009, it was indicated that the Marrickville Red Devils would at least train at the ground. This will place additional time strain on the ground.

The representations at Council on 18 August were from male soccer teams. If Council is serious about the health of children – and not just the health of boys – then girls' teams will start to use the ground as well and the usage will skyrocket.

Section E: The economics

Are artificial turf surfaces really cheaper to maintain?

In a comprehensive paper published by Cranfield University in the UK, it is demonstrated very clearly that:

1. artificial turf pitches need to be maintained strictly according to the manufacturer's specifications to safeguard the warranty period, and
2. artificial turf pitches are as expensive to maintain as natural grass. There is no cost saving at all. (In fact, in a survey of groundskeepers of independent schools, natural grass was actually £500 *per annum* cheaper, *per* playing field.)

The only saving is that artificial turf is cheaper to maintain on a £ (or $) *per* hour of use basis – and as Council is not planning to develop **more** playing surfaces, this is irrelevant. There is one Arlington Oval, and the same amount of money will need to be spent on its upkeep, regardless of whether it is natural grass, or artificial turf.

One example of the need for extensive maintenance is the recommendation that the artificial surface have a use : maintenance ratio of 10:1 and be completely swept **every 1-2 days** ***(not weekly).*** There are also the costs of algicides, antiseptics, disinfectants, and other chemicals.

(**Reference:** http://www.cranfield.ac.uk/sas/pdf/cranfieldmaintainingsyntheticturfguidelinesv1_1.pdf and http://www.sportsurf.org/workshops/7/IJ.pdf Accessed 30 August 2009)

There is a significant initial cost, but are replacement costs really less?

This may be so. However the same arguments no doubt were used 10 years ago. In ten years' time, when Council may be looking to replace the surface, technology will have moved on. Newer surfaces will be available, which may require different preparation, underlay, *etc.* Restricting choice to a surface that suits the preparation and subsurface padding of a chosen technology in 2009 may condemn Council to old or redundant technologies; people who installed "state of the art" surfaces 10 years ago now have the choice of re-installing second generation surfaces, or starting anew with the third generation technologies. The currently available surface technologies may even have been phased out, in which case Council will have no choice but to opt for a full-cost replacement. Currently, the artificial surface is unlikely to be recyclable. In ten years it may be, but there may be considerable additional costs to recycle the old synthetic materials – if they can be recycled at that time. If not, there may be significant waste disposal charges and penalties to pay. When it is time to replace the pitch, there will be considerable pressure from clubs to adopt the latest technology, especially if it is touted as a safer or superior product.

Section F: Conclusion

The installation of an artificial turf pitch at Arlington Reserve is not warranted. There are significant health and safety concerns that mitigate against it; in particular, the extreme heat that can develop on the surface in hot weather with the very real possibility of heat-related illnesses, especially in young children. Sufficient concerns exist about other issues: the rate and type of injuries that are sustained on artificial turf, and the potential toxic hazards from the numerous chemicals involved. Even reports that give the green light for the use of artificial surfaces are compromised by the inclusion of qualifying statements that point to the lack of proper long-term studies on the effects of these surfaces.

Heritage and Environmental factors also argue against the installation of an artificial surface. Arlington Reserve is a ground of true heritage beauty, and a properly maintained natural grass surface enhances the setting. There is the very real likelihood that installation of an artificial surface will destroy the habitat of the declared endangered population of the long-nosed bandicoot. Grass provides a cooler, friendlier surface for rest and play, and also provides photosynthetic oxygen for the local environment. Synthetic turf requires three-monthly chemical application, and provides nothing but polluted runoff.

The sole reason for the recommendation to install artificial turf is to provide an all-weather surface, to allow greater use of the ground, regardless of the effect on the quality of life for residents in the area. This will reduce, or completely extinguish, the availability of the ground for local residents for informal recreation. Other activities will become impossible, and Arlington reserve will become a soccer-only venue. While I am in favour of the Reserve being locked after hours – regardless of the surface – to reduce vandalism, I am not in favour of the sporting monoculture that will inevitably develop. And with regard to the "all weather" nature of the surface: will parents ***really*** want their children playing in driving rain?

The increased use leads to many other community concerns: extended parking problems over the entire week, more litter, noise, and traffic. Confrontation between soccer clubs and local residents have occurred when soccer clubs also take over Johnson and Laxton parks for warm ups, and our fear is that these will increase as well.

And what of the game itself? It is recognised that players prefer to train and compete on natural grass. This is not just because competition on natural grass is embedded within the history of the game – players regularly state that natural grass pitches are superior. Modern studies, looking at player behaviour and stress on the artificial surfaces, show that there are differences. Players experience more physiological stress on artificial turf (even third generation surfaces) and, as a result, their play is modified. "The game" actually changes. Tradition is lost.

The solution is the replacement of the existing natural grass surface with a new, natural grass surface. Technology has moved on. Much of the focus of this debate has been on the technology of artificial turf, however significant – and serious – questions remain over its use. The technology of natural grass has also advanced; there are hardier, more drought-tolerant turfs available. A commitment to proper maintenance of a well-chosen natural grass is the key to a decent surface that can be enjoyed by all.