



Added Exhibit M on 4/13/21

**CITY OF GLENDALE, CALIFORNIA
REPORT TO THE PARKS, RECREATION AND COMMUNITY SERVICES
COMMISSION**

AGENDA ITEM

Report: A comparative analysis on surface types for soccer and multi-purpose fields

1. Motion to provide feedback to staff and making a recommendation for City Council's consideration on the preferred surface type for the soccer and multi-purpose field projects at Fremont Park, Pacific Park, Sports Complex, Cerritos Elementary, and Wilson Middle School.

COMMISSION/COMMITTEE ACTION

Item Type: Action Item

Approved for April 19, 2021 **Calendar**

ADMINISTRATIVE ACTION

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RECOMMENDATION

Staff is seeking direction from Commission to make a recommendation for City Council's consideration on the preferred surface type for the soccer and multi-purpose field projects at Fremont Park, Pacific Park, Sports Complex, Cerritos Elementary, and Wilson Middle School.

BACKGROUND/ANALYSIS

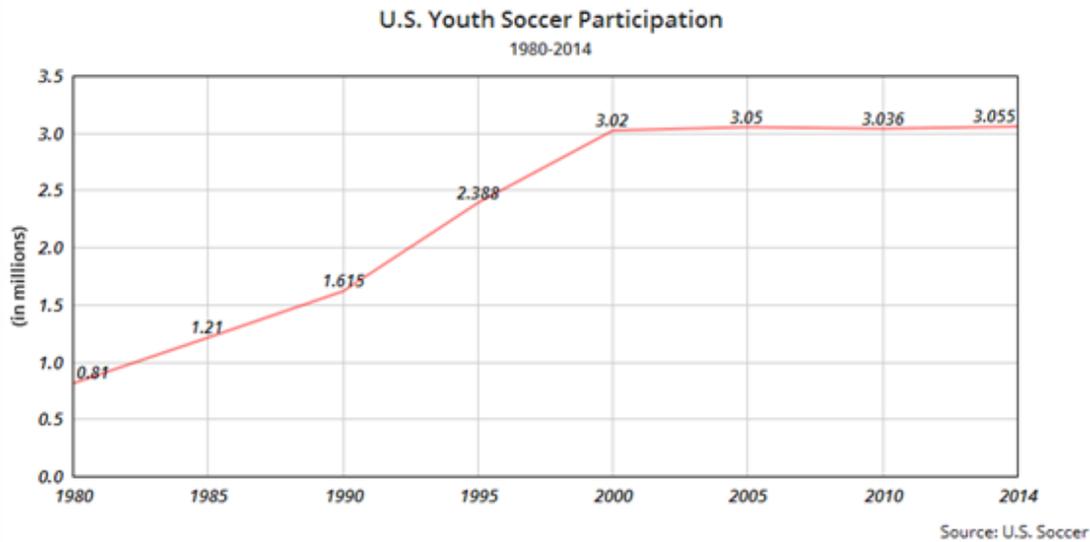
At the request of the Parks, Recreation and Community Services Commission during the October 2020 meeting, as well as in response to a February 8, 2021 letter from the Glendale Environmental Coalition (GEC) submitted to City Council suggesting the use of Environmental Passive Integrated Chamber (EPIC) System with natural grass for the five soccer / multi-purpose field projects (Fremont Park, Pacific Park, Sports Complex, Cerritos Elementary, and Wilson Middle School), CSP has prepared this report to compare natural grass, the use of EPIC system, and artificial turf.

Demand for Soccer Fields

According to the National Park and Recreation Association (NRPA), a community should have one soccer field for each 10,000 occupants. With over 200,000 residents, Glendale should have a minimum of 20 soccer fields. The City's Recreation Element of the General Plan, adopted by the City Council in April 1996, identified a standard of 1 field per 5,000 population. In addition, findings in the Recreation Element highlight "extreme shortage of athletic fields" in the City. Glendale currently has three official soccer fields in its inventory: two at the Sports Complex and one at Pacific Park – a joint use soccer field at Edison Elementary under a Joint Use Agreement with the Glendale Unified School District. A fourth soccer field has been created in the outfield of the newly installed multi-purpose artificial turf field at the Sports Complex Baseball Field #1. The latter was a joint effort with St. Francis High School and has proven to be an innovative approach to addressing field demand, enhanced player safety, reduced maintenance cost, as well as eliminated water and fertilizer use for the field.

The demand for soccer field usage has significantly increased over the past three decades as the sport saw a popularity increase after the 1994 World Cup, which was held in the United States. Multiple soccer associations have reported an escalating need for soccer fields and continually compete for available field time. Due to this growing need, CSP staff reserves soccer practices and games on its sixteen baseball / softball fields, further complicating logistical and maintenance challenges while impacting baseball and softball leagues. The Department also experiences unauthorized soccer play at a number of non-dedicated open turf areas such as at Brand Park, Carr Park, Fremont Park, Glorietta Park, Maple Park, Pelanconi Park, and Verdugo Park, to name a few.

Below is a chart of youth soccer participants in the United States created by U.S. Soccer. The chart indicates that from 1984 to 2014, the youth soccer participation almost quadrupled, from 800,000 participants to over 3 million. This data is 7 years old, yet the trend for increased participation continues to escalate.



— M. Alex Johnson — NBC News

This trend in demand is also evident in Glendale, both for soccer and baseball / softball fields. Annually, there are 156 groups / organizations that utilize Glendale’s fields including private and non-profit adult and youth groups and clubs, and schools (college and high schools). These groups serve an estimated 12,000 youth participants. There are 19 fields in Glendale, 4 of which are currently artificial turf, which are used by 104 of the groups. The artificial turf fields are reserved between 360-365 days per year and are closed on select holidays only when no one requests to rent the fields. This translates to 5,475 hours of available time per field for reservations. The grass fields are reserved between 275-325 days per year, depending on field maintenance and rain closures. This equates to approximately 4,100 hours of available field time, a reduction of 1,375 hours per field, and 20,625 hours annually across all 15 grass fields. Field demand continues to be a challenge as staff turns away approximately 50 groups per year; moreover, staff is unable to fill the requests of the existing groups thus reserving less time than requested or scheduling at other fields than those that are desired.

It is imperative to note that while a typical field can be available for 5,475 hours per year for an average of 15 hours per day (park hours 7am-10pm), most of the use on the field reservations are made during prime time hours: 4pm-10pm weekdays, and 7am-10pm weekends. As such, prime time available hours per lit field is 3,126 hours. As an example, Sports Complex soccer fields are reserved on average 2,500 hours per year. Three (3) of the nineteen (19) fields (Brand Little League, Brand T-ball, and Verdugo softball) do not have lights; thus are available 1,850 hours during prime time use. During

the week while school is in session, the fields (if not reserved) are open to the general public to use from 7am-4pm (9 hours).

Generally speaking, baseball fields are reserved primarily for little league use during the months of January through July, including all-stars. These same fields are then booked from August through December primarily for soccer use. Hence, the department operates the fields between two seasons and prioritizes use of the field based on the season: baseball from January through July and soccer from August through December. The fields are further utilized for flag football, lacrosse, and CSP recreational programs such as One Glendale. As such, time allotted for maintenance of the fields is a challenge.

Natural grass baseball / softball fields are rotated every 4-5 years for overall maintenance, requiring a 3-month closure; while the former natural grass soccer fields were closed for 3-months annually for maintenance.

The requested use for soccer, baseball and softball fields has significantly increased over the past twenty years, showing tremendous growth in the popularity of recreational and club sports. As such, park management requires a balancing act that takes into account access to fields to meet the high demand, resource availability and management, cost of maintenance, environmental impacts, sustainability, and community / user input as elements of the equation to solve the demand / maintenance challenges presented by playing fields.

City's Response to Meet the Demand

The Community Services & Parks Department's (CSP) mission is to enhance the quality of life of residents by providing a safe, well maintained parks and public places; preserving open space and historic resources; providing services that address the physical, recreational, social and economic needs of the community; and creating opportunities for renewal, growth, and enrichment.

In its continued effort to achieve its mission and meet the demand highlighted above, CSP (under direction and approval of the City Council) is working on five artificial turf soccer / multi-purpose field projects at the following sites:

1. Fremont Park: an artificial turf soccer field to be constructed in the open turf area currently used by patrons for unauthorized soccer play
2. Pacific Park: a reconstruction of the existing natural grass ballfield into a multi-purpose artificial turf baseball and soccer field
3. Sports Complex: a reconstruction of existing softball field into a multi-purpose artificial turf softball, baseball, and soccer field
4. Cerritos Elementary: a joint use multi-purpose artificial turf field project with the Glendale Unified School District (GUSD) approved by City Council and the GUSD Board
5. Wilson Middle School: a joint use multi-purpose artificial turf game field and practice field project with GUSD approved by City Council and the GUSD Board

These projects were a result of community demand for more soccer fields as identified in the 1996 Recreation Element, attached hereto as **Exhibit A**, as well as during the development impact fee strategic planning and the County-wide Needs Assessment meetings in 2016 which resulted in the Measure A Funding. In addition, there has been a significant increase in ongoing requests for field time by local non-profit youth sport organizations, American Youth Soccer Organization (AYSO), Homenetmen, Levon Ishtoyan Soccer Academy, Sporting So-Cal Soccer Academy, Farwest United FC, LA International FC, Little League, CV United Softball, Crescenta Sports Association, and Glendale/La Crescenta Babe Ruth, to name a few.

Impact of Soccer Play on Natural Grass Fields

Soccer is a sport that is played year round including during cool, wet weather when turf experiences stunted growth rates and is not as resilient as during the spring and summer months. In the fall and winter, turf does not recover from intense use nor respond to renovation treatment. Soccer is played at a consistently higher rate of speed and generally in a narrow band toward the middle of the pitch from goal to goal. The speed of play, frequent directional changes, and starts and stops create a mechanical action that is destructive to the turf blades and root structure and creates intense soil compaction. As a result, natural grass soccer fields are in constant need of major maintenance further restricting field availability by being closed three months during the summer for renovation, closed during rainy days, as well as several days after the rains secede to allow the field to dry for safe play. It further requires continued reseeding, fertilizing, and aerating as the turf is destroyed from soccer play.

Such was CSP's experience with the soccer fields at the Glendale Sports Complex and at Pacific Park. The Sports Complex fields are reserved daily for an average of 8 hours per weekday and 15 hours per day on weekends (7am-10pm). This heavy demand for field time continually resulted in dirt soccer fields.

In a report prepared for Parks, Recreation and Community Services Commission on December 28, 2001, CSP highlighted three options to resolve soccer field challenges at the Sports Complex. Those options were:

1. Create and maintain a dirt soccer field
2. Rebuild the fields and reduce play
3. Replace natural grass with artificial turf

The first two options would have resulted in significant drawbacks. Soccer players prefer playing on turf rather than dirt for safety and playability. Dirt fields result in unsafe and unhealthy conditions for the athletes, as well as have a negative aesthetic overall effect that does not produce the image the city desires.

The second option, rebuilding the fields, required installing a drainage system, upgrading the irrigation system, and replacing the top 6 to 8 inches of soil, laser

grading, and sod. The project at that time was estimated to cost in excess of \$350,000. In addition, the reduction of play on the fields would have further impacted the lack of adequate soccer fields. Even complete rebuild of the soccer fields would have only marginally improved the quality of the fields and would not have eliminated the need for major renovation on an annual basis.

It was determined by the Commission and City Council that the best option would be to replace the natural grass with artificial turf. This option increased the quality of the game for players, significantly reduced maintenance costs, significantly reduced water consumption, increased the number of events held on the field, eliminated field "down time" due to turf repair and replacement, and minimized injuries by providing a flat, even, consistent surface that is neither too hard nor too soft and had proper traction.

Conversion of Sports Complex and Pacific Park Soccer Fields to Artificial Turf

With a limited budget, an increasingly diminished staff, along with a heavily used park system, Glendale faced a challenge in keeping up with the natural grass soccer field maintenance at the Sports Complex. Prior to converting the Sports Complex soccer fields to artificial turf, the fields were closed during the summer months (July through September) for renovation. Below are pictures from 2003-04 of the Sports Complex natural grass soccer fields 4 and 5. As evident, these fields were primarily dirt fields due to the heavy use.



Photo: 2003-04 Sports Complex Soccer Fields taken from Mt. Zebo



Photo: 2003-04 Sports Complex Soccer Fields taken from Mt. Zebo

These fields were closed annually from July-September for annual turf renovation (seed/sod). At that time, turf restoration cost the City between \$25-45 thousand a year to replant seed or sod the soccer fields. Generally, replanting grass seeds requires 3 months (slightly less time for sod, yet at higher costs) after installation to allow for full maturity of turf. However, the heavy demand on Sports Complex soccer fields limited turf maturity time to only one month. As a result, the turf failed to recover from intense use or respond to renovation treatment in winter. If these fields were natural grass today, the annual renovation costs per field (excluding general turf maintenance) is estimated at \$36-80 thousand, for seed and sod respectively.

Prior to installing the artificial turf, Sports Complex was staffed by a Sr. Groundskeeper, 2 Groundskeeper IIs, a Groundskeeper I, and hourly staff support for during the week, as well as one hourly employee for weekend coverage. Between 2010 through 2014, the City reduced its full time work force from 1,904 employees to just under 1,520. This resulted in the loss of 25 full time personnel in the Park Services Section, a 35% reduction. As such, the Section adapted and found more efficient ways to manage park maintenance needs. One of those adjustments included assigning more facilities to all remaining staff. Currently, CSP has only 2 Groundskeeper IIs assigned to maintain the Sports Complex during the week (50% reduction in full time staffing), plus weekend

hourly staff. The same Groundskeeper IIs also maintain the Dunsmore Park and Glorietta Park Ballfields. If the two soccer fields and the baseball field #1 were natural grass today, we would need two additional full time staff at Sports Complex to manage the daily routine maintenance and provide safe playing fields at the Complex and the other sites the same staff maintain.

Similarly, when Pacific Park first opened in 2003, it had a Sr. Groundskeeper, a Groundskeeper II, and a Maintenance Worker assigned to its maintenance. Currently, we only have one Groundskeeper II with the occasional minimal hourly staff support (when available) to maintain the entire park as well as the perimeter of Edison elementary and some areas inside the school as per our Joint Use Agreement. From 2003 to November of 2013, Pacific Park's multi-purpose field was natural grass. Every year the department would invest time and resources during the summer months between June and August to restore the dirt field into usable, playable grass. Once the school year started, the combined impact of the school using the field as its yard along with the fully booked field for rentals in the afternoon/evenings and weekends, within 2 months, the grass would die and the field would turn back into hard compacted dirt.

The department proceeded with converting the field into artificial turf and after a 2.5-month renovation, the field reopened. Almost immediately, the field was rented for use by youth and adults alike on weekdays and on Saturdays. One year after the field was renovated, the only available time the field was not reserved was on Sundays between noon and 5pm. During youth soccer season, the field was booked during this time frame as well. Currently, this field is reserved weekly 102 out of 105 hours available.

Availability of fields enhance CSP's ability to run more efficient operations and programming as well. A great example of a CSP program that benefits from the fields at Pacific Park is the One Glendale program. It uses the fields during two seasons: flag football and soccer. Flag football is played September through October on both the natural grass ballfield and artificial turf field. Recreation staff spend approximately 4 hours to line and prep the field for play. During this time, no other private reservations are scheduled on the field until the program season is done.

During soccer season (March through May), the baseball field is used to hold practices for the Edison Elementary team as the artificial turf is being used (simultaneously) to hold games for the other schools. The ballfield is used for Edison's practices even if there are no games scheduled on the artificial turf to curtail any issues associated with "home court/home field" advantage for Edison. The season is concurrent with the little league's baseball season. As such, little league's permit is granted after One Glendale program ends for the day at 5pm.

Pictures below show the destructive impact of these program on the natural grass ballfield.



Field Surface Alternatives

At the request of the Parks, Recreation and Community Services Commission and in response to a February 8, 2021 letter from the Glendale Environmental Coalition (GEC), CSP has prepared this report to examine the use of natural grass, the use of EPIC system, and artificial turf.

I. Natural Grass

A well-maintained natural grass field is an ideal surface for soccer play. Grass benefits the environment by reducing the urban heat island effect, filtering rainwater and pollution, and providing habitats for birds and insects. Natural grass reduces temperatures even on hot days, with the temperature rarely rising above 85 degrees Fahrenheit, regardless of air temperature.

As mentioned previously, soccer play is destructive to turf blades and its root structure creating intense soil compaction. As such, park and turf managers agree that a natural grass field must be closed to the public at regular intervals in order to keep the grass healthy and allow for regular maintenance / renovations. Grass fields that are open to the public year-round for sports—particularly soccer—are virtually guaranteed to wear out. Thus, the debate of access to fields vs. safe / green fields presents a challenge for the City, as we are unable to close fields as necessary due to the extremely high demand for play time. Along with the growing popularity of soccer, a particularly punishing sport when it comes to grass, it has intensified the need for regular maintenance of natural grass fields.

Maintenance Requirements

All natural grass fields are living, breathing organisms that require regular maintenance including mowing, edging, lining, watering, fertilizing, time off from play, and the application of plant herbicides and pesticides to control weeds and pests. To help ease compaction from heavy play, fields require aerification multiple times a year. *High sand* content fields require more attention to watering, fertilization, seeding, and top dressing due to leeching, essentially requiring an increase of maintenance frequencies. These maintenance requirements do have an impact to the carbon footprint.

Generally, natural grass maintenance falls into the following categories and tasks:

- **Daily Maintenance:**
 - Walk the field to look for and remove hazardous materials and conditions such as litter, broken glass, metals, any other objects that can be harmful to users, broken sprinklers, holes in the turf, and turf diseases
 - Repair broken sprinklers

- Fill-in the holes with top soil to avoid injuries (gopher, ground squirrel, or holes resulting from play)
 - Check the turf conditions and to see if the turf is too dry / wet and adjust the irrigation accordingly
 - On average, a field takes about 2-2.5 hours to complete the daily tasks above
 - Baseball would have additional maintenance requirements such as dragging, lining the field, placing the bases, and walking the infield to ensure there are no lips that will cause a ball to “hop” into a player’s face while trying to catch the ball. In addition, there are approximately \$20,000 in staff fees annually to prep the fields, 1 hour per field / per game for high school and adult leagues.
- **Weekly Maintenance:**
 - Mowing, edging, and weeding once per week
 - In the summer months, the mowing frequency for athletic fields may increase to twice per week or as requested for special events by the users. Mowing requires 2.5 hours per wk. in fall/winter, and approximately 5.5 hours during the summer when turf grows rapidly. Edging will require an additional 2.5 hours on soccer fields.
 - For baseball, if infield is wet, prep time can increase by 2-3 hours per week. As for edging and detailing, it requires stringing up base pads, the infield diamond, and the warning track before edging. Including the outfield arc, edging can take 4.5 hours.
- **Other Maintenance:**
 - Conduct an irrigation test (monthly), spot seed (4 hours per occurrence), and verticut the turf (8 hours per occurrence). Spot seeding and verti-cutting is contingent upon available resources and are generally conducted twice per year or as needed.
 - Turf repairs for vandalism: CSP has experienced numerous occasions where individuals drive on the grass fields and leave tire marks that require minimal to major repairs.
- **Aerating and Fertilization:** Natural grass fields require periodic aerification and fertilization, as well as skilled staff with the ability to operate heavy equipment. Depending on the use of the field and conditions, the turf is aerated and fertilized at a minimum of 2 times a year. Core aerating includes coring, dragging, and sweeping. At each frequency, a Park Maintenance Supervisor, a Sr. Groundskeeper, and a Groundskeeper II are assigned to complete this task for an average of 9 hours (about a full day). Fertilizing will require two staff at an average of 4 hours. In order to see positive results, the turf should be allowed to rest at least a day or two after the aeration and fertilization is completed. This is challenging with the city’s heavily used fields.

- **Turf Renovations:** Park Services Section conducts turf renovations as part of the overall field renovation projects. Given that the best growing season for grass is summer / fall, the Section conducts full renovation of pre-selected 3-4 fields annually, while other fields experience minor renovations. The scheduling of these renovations are closely coordinated with the Recreation Section to ensure field availability for leagues and avoid scheduling challenges. These tasks do not include unanticipated challenges such as soil profiles (small rocks that need to be removed) to continue with scope of work.
 - Full renovations include stripping existing turf, addressing drainage issues, lasergrading, sod installation. For baseball, this would include infield and outfield sod installation, as well as infield base standard and pitching mound installation
 - Minor renovations include aerating, overseeding, topdressing, and fertilizing the infield and outfield, as well as placing / adjusting bases and cutting down the lips.

Below are estimated annual maintenance and renovation costs (sod / seed) for natural grass soccer fields (90,000 sq. ft.). The details on these costs are attached as **Exhibit B**.

Annual Maintenance Costs	
Materials	\$5,233
Labor	\$23,585
Fuel (mower use only)	\$585
Water	\$15,000
Total Cost	\$44,404

Annual Renovation Costs (Sod)	
Materials	\$5,647
Equipment Rentals	\$4,600
Contract Work (grading / sod)	\$58,800
Labor	\$11,099
Total Cost	\$80,146

Annual Renovation Costs (Seed)	
Materials	\$13,507
Equipment Rentals	\$4,600
Contract Work (grading)	\$6,000
Labor	\$8,801
Total Cost	\$32,909

An Example of a Field Renovation Cost

The recent Glorietta Park Baseball Field renovation (summer of 2020) project can be used as an example of current natural grass field renovation costs. The scope of work included stripping the existing turf, installation of drain pipes to assist with field drainage, laser grading the field, and installation of new sod. This project, as in most field renovation projects, was a combination of using in house staff for preparation, drainage installation, irrigation etc., and contract work for laser grading and sod installation. The total project cost, excluding overhead costs, was \$107,432.15.

Category	Cost
Materials (Sand, gravel, top soil, brick dust)	\$7,375.14
Equipment Rental	\$4,720.86
Drainage Materials	\$3,389.97
In House Staff Labor (excluding overhead)	\$38,546.18
Lasergrading (contractor)	\$14,900
Sod Purchase and Installation (contractor)	\$38,500
Total Cost	\$107,432.15

If a new natural grass soccer field is to be constructed, it would cost an estimated \$175-\$225 thousand (excluding soft costs). It may require the removal of the top 3-6 inches of soil, installation of drainage system, installation of new irrigation system, importing of new top soil, grading, and sod installation.

II. Natural Grass with EPIC System

The Environmental Passive Integrated Conveyance (EPIC) system is a subsurface non-pressurized irrigation system installed under natural grass. It is an environmentally safe system that combines irrigation and storm water capture / use on fields. Rainfall is collected from the field surface and is moved to storage. The captured stormwater is then used for irrigation of the field. According to the vendor, given that EPIC is a subsurface irrigation system, it has 100% capture and use capability and utilizes 50-70% less water usage than conventional irrigation systems. It further has the capability of using greywater and condensation, with the ability to store more water in additional storage tanks. Being a subsurface system, it eliminates exposed sprinklers and valve boxes and has less moving parts with few simple control points.

Installation of EPIC system requires the removal of natural soil, installation of the EPIC chambers / tanks, importing 12" of proprietary sand, then the installation of sand based sod or seed. The cost of materials alone for a typical soccer field is estimated at \$800-\$850,000. With tax, at midpoint range of \$825,000, the total cost of materials would be \$910,000, excluding labor for demo and installation. Although the vendor did not have installation costs, they informed staff that the estimate for labor would mimic that of the material cost; thus a full conversion of a field to an EPIC system natural grass field would cost approximately \$1.75-\$1.85 million, excluding soft costs.

While the maintenance on the EPIC System is minimal, the sand and turf installed on it require rigid maintenance. The routine lawn care needs listed above under natural grass such as mowing and edging must be conducted at regular intervals. According to a document provided by the vendor "Fertilization and Management of EPIC Turf Areas and Athletic Fields" by Jonas Z. Sipaila, attached to this report as **Exhibit C**, the fields must undergo monthly fertilization and aeration. In addition, because sand cannot hold nutrients, it is recommended that the following eight inorganic elements be added to the field to see positive results: Calcium, Iron, Magnesium, Manganese, Nitrogen, Potassium, Phosphorous, Sulfur.

The document states that if plants are to do their best, "they must be supplied with a proper balance of all the essential inorganic substances. If any one of the inorganic substances is deficient, its lack will soon be manifested in the growth of the plant regardless of how much of all the other substances may be available."

The document further highlights the maintenance needs on pages 3-5. It shows rigid maintenance from March through November, and field closure in the winter months December through February. Further, it highlights the need for increased aeration, fertilization, and mowing requirements as compared to natural grass fields without the EPIC system. Another document, attached as **Exhibit D**, is a chart prepared by EPIC on recommended management guidelines for fields.

Although in some scenarios the EPIC system may save on water usage, the amount of chemical leaching into storm drains and the groundwater supply from the required fertilization schedule does not outweigh the benefit of limited water savings. Even with a sub-irrigation system (where groundwater runoff is captured in tanks and recycled), the water being used to maintain the water table in the soil profile would become saturated with fertilizers and salts to the point where it could be toxic to the turf. Similar to natural grass, there are also impacts to the carbon footprint that come from the regular maintenance schedule of this turf as well. The amount of staff, equipment, and time necessary to follow the recommendations for mowing, monthly aerating, fertilizing, overseeding and top dressing would mean more equipment running for longer periods of time. Moreover, once aerated and fertilized, the fields should remain closed for a day or two further reducing field availability and impacting team practices and games.

Pest management is yet another consideration with this system. The level of recommended fertilizer application may result in turf diseases and possibly require fungicide application. Given CSP's Integrated Pest Management (IPM) policy manual, CSP is limited to non-pesticide solutions first (mechanical, biological) to control or possibly prevent diseases, and apply fungicides only if the cultural and mechanical techniques don't provide a sufficient level of control. The IPM manual also requires staying away from any products which have a Warning or Danger Label. The only products allowed under the IPM are those which have a Caution signal on the label. This will limit staffs' ability to control and/prevent diseases from getting a foothold on the fields.

III. Artificial Turf

Artificial turf products were first introduced in the late 1970's. The early systems were typically filled with sand only and had a tendency to compact over time resulting in very hard fields. There have been a number of refinements in the technology over the last 50 years designed to alleviate that problem, including the addition of rubber pellets to the infill mixture, natural infill products, and the addition of shock pads.

The artificial turf systems have vastly improved since their original inception. Traditional turf systems were "carpet-like" systems installed on an asphalt base. Their pile surfaces were tightly knitted or tufted nylon or polypropylene fibers, resulting in a tough, durable, yet highly abrasive playing surface. The new artificial turf systems consist of 2" to 2-1/2" long synthetic fibers tufted to a polypropylene backing, with secondary coating of polyurethane. The fibers are filled to a depth of 1- 2" with sand, rubber pellets, a mixture of sand and rubber, or more environmentally friendly options such as cork, coconut husks, etc.

They are installed over a gravel base, with some designs incorporating a shock pad for added safety. They are vertically draining; water drains vertically through the artificial turf backing and the gravel base. The sub-base is sloped to direct the water to a perimeter drainpipe that leads into the storm drain system. Many new field constructions in California incorporate stormwater capture into their designs.

The durability of artificial turf is far superior to natural grass. These systems are constructed to withstand year-round daily activity – football, soccer, field hockey, lacrosse, etc. – in all types of weather. Free of puddles, muddy conditions, or worn areas, the field remains safe, usable and ready at all times. Because there is no winter dormancy, summer dry or brown patches, the synthetic surface provides a quality look and a consistent level of play.

There are thousands of artificial turf field installations nationwide. A heightened sense of environmental awareness prompts interest in its ability to conserve billions of gallons of water each year. Increased user requirements and intense competition have given rise to a new generation of artificial turf systems that replicate the look and playability of natural, lush grass. Athletes enjoy significantly more playing time without the need for resource-intensive maintenance.

Cost to install an artificial turf field ranges between \$12-\$15 per sq. ft. including demolition, earthwork & grading, drainage, shock pads, the turf and infill. For Pacific Park, the estimate for the field portion of the construction is \$842,000 for a 54,500 sq. ft. field. A 90,000 sq. ft. soccer field would be estimated at \$1.2-\$1.3 million, excluding soft costs.

Maintenance Requirements

Artificial turf requires significantly less maintenance than natural grass. General safety walk-through and litter pickup is the same for both fields. Every other week, the turf would require grooming and brushing for optimum play and longevity. Annually, the field would need a de-compaction / rejuvenation treatment, and adding infill, which is currently contracted with a vendor for about \$3,500 per field. Adding more infill material to the turf is done on an as needed basis; materials for this is provided by the vendor during construction. To date, the city has not purchased any additional fill material for the current artificial turf fields since 2005.

Benefits of Artificial Turf

Artificial turf offers many advantages for both the user and the City, particularly for such heavily used fields. These advantages are:

1. It looks, feels, and plays like natural grass
2. It can withstand significantly higher levels of use than natural grass, without the need for periodic closure for regeneration.

3. It eliminates field down time due to turf repair and renovation, thus increases field availability by 25% or approximately 1,375 hours annually.
4. It saves money because it requires minimal maintenance (labor and materials)
5. It increases revenue generated which in return pays for field replacement
6. It is made with resilient materials for safety and provides a uniform and consistent playing surface
7. It reduces carbon footprint and utility uses: no water, no fertilizer, no pesticides, no mowing or other landscaping
8. It eliminates contaminated storm water runoff from pesticide and fertilizer use
9. It provides a 'cushioned' stable surface for users that reduces the likelihood of head and lower extremity injuries
10. It has superior drainage capacity and can be used in wet weather; thus increasing field availability for AYSO and other soccer leagues

Despite the significant advantages, there are some disadvantages to installing artificial turf. They include:

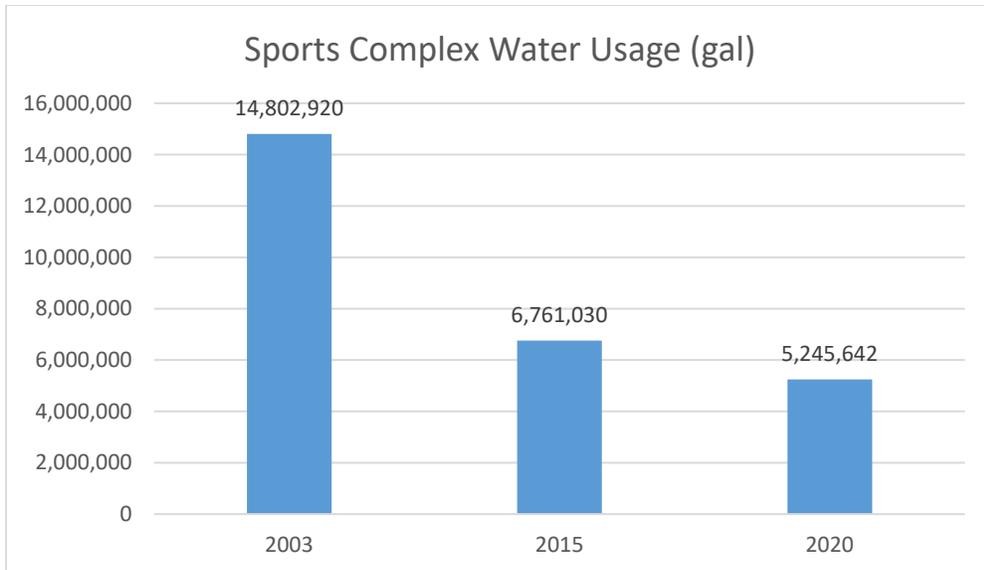
- High initial cost of installation and replacement
- Higher temperatures on field: rubber fill fields are typically 30-40 degrees warmer than the air temperature off the field.
- Contributes to the heat island effect
- Requires virgin plastic to make the turf product
- Certain items such as seeds and gum on the field cause great difficulties for maintaining the aesthetics of the field.
- Fibers break down over time and create a mess

However, numerous studies and analysis indicate that artificial turf dominates in all areas of maintenance, long range cost, revenue generation, and general soccer related issues.

Environmental Impacts:

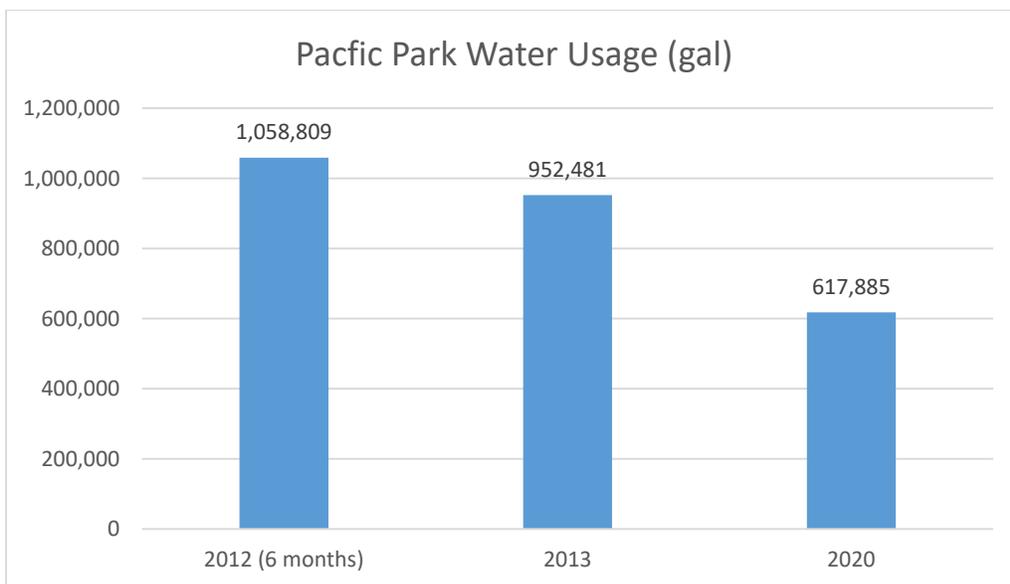
Artificial turf fields do not require pesticides, herbicides or fertilizers that natural grass needs to stay healthy; additional resources are conserved by the avoidance of mowing (use of fossil fuels) and watering. This elimination of heavy equipment use also reduces carbon emissions and benefits the environment. The attached **Exhibit E** “Synthetic Turf vs. Natural Grass” prepared by the Synthetic Turf Council highlights the environmental benefits of artificial turf.

Eliminating costly water and irrigation bills provides the opportunity to enjoy substantial savings and benefit the environment by reducing water consumption. For example, CSP compared water consumption at the Sports Complex and Pacific Park before and after artificial turf installation. The following tables (**T1** and **T2**) provide the water usage for both facilities. It is imperative to note that both of these facilities use recycled / gray water for field and park irrigation.



T1: Sports Complex Water Usage

The Sports Complex soccer fields (Fields 4 and 5) were converted to artificial turf in 2005; followed by Field One (baseball field converted to multi-purpose baseball / soccer) in 2018. In 2003, the Sports Complex irrigation related water use was 14.8 million gallons. In 2015, the usage was reduced to 6.7 million gallons; and post field one's conversion, the total usage was reduced to 5.2 million gallons of water. While there are numerous factors that led to over 9 million gallons of water savings annually, such as CSP's policy on timely irrigation repairs, efficient systems and materials, centralized irrigation controllers, and an overall change in staff attitude to be water wise, staff believes the conversion to artificial turf is the largest proponent of water savings. The 9.5 million gallons of water reduction at Sports Complex annually translates to tens of thousands of dollars in reduced utility consumption.



T2: Pacific Park Water Usage

Similarly, Pacific Park realized water use reduction as well. In 2012, before conversion to artificial turf, our available data for a 6-month period showed 1.05 million gallons used, doubled for an annual total at approximately 2 million gallons. Data from 2013 when the soccer field was being constructed shows usage at 952,000 gallons, and the most current year usage (2020) shows 617,000 gallons used. In all, the conversion to artificial turf resulted in approximately 1.2-1.4 million gallons of water reduction, translating to approximately \$8-\$9,000 savings.

Moreover, by reducing fertilizer, maintenance and renovation labor / supplies, and other pesticide / chemical bills from the operating budgets, CSP is able to shift those resources to other park maintenance improvements. The resultant elimination of chemical run-off assists with the City's efforts to stay in compliance with the City's sustainability efforts as well as environmental laws of local, state, and federal governments.

Removing natural grass, no matter how deteriorated, can have a negative impact to the environment. Though artificial fields have drainage systems, they do not contain microorganisms that can break down pollutants. Traditionally, rainwater is not absorbed - it simply drains through the field and runs into storm sewers. Artificial turf also contributes to the urban heat island effect by absorbing sunlight and emitting heat. Additionally, removing grass takes away habitats that serve birds and plant life in the city.

However, there are mitigation measures that can be introduced to alleviate the impacts of natural grass removal. Planting trees, creating additional green space, and new vegetation will help filter air pollutants and contribute to the cooling of the city, decreasing the effects of the urban heat island. Using natural infill material, such as Geofill, will also assist in keeping the artificial turf cooler. New trees and landscapes will also mitigate the removal of wildlife habitats. In addition, creating bioswales and designing the field to allow for stormwater capture into their designs will further mitigate these issues. For example, a soils test conducted for the current Pacific Park multi-purpose artificial turf project indicated that the soil was not expansive, thus the water will infiltrate the soil without the need for a dry well. As such, the design incorporates the installation of 6 concrete catch basins that will collect and further infiltrate water into the soil, allowing only excess water to make it to the storm drains.

If playing on an artificial turf field on a hot day, watering the turf before a game or practice can help reduce surface temperature. However, based on our experience and available data, this is only effective for a short period of time. Temperatures rebound after only about 20 minutes (less time than it takes to play a regulation half game of soccer). Adding irrigation to and watering this type of sports field could cost thousands of dollars and be ineffective as water could simply roll off the surface and not really soak in to provide that small window of temperature relief. As a result, this is not as cost effective or as safe as scheduling games around peak high-heat times. As such, at

extreme high temperatures, leagues and coaches cancel practices and games (regardless of artificial turf or natural grass), on average about five (5) times per year. For City run leagues, when there is a high heat advisory for the county of 100 degrees or higher forecasted at the start of the game – the game is postponed/rescheduled (regardless of artificial or natural grass). Additionally, City staff monitor air quality reports and will postpone/reschedule games in the event the area is experiencing poor air quality.

G-Max Rating

The American Society for Testing and Materials (ASTM) has established a testing protocol for determining the shock absorbency of artificial turf fields. G-Max is a measurement, in part, of both safety and performance. G-Max measures the shock attenuation (hardness) of a surface. The G-Max rating for artificial turf ranges between 105-165; whereas the G-Max of natural grass in pristine condition ranges between 100 and 125. Since field hardness is related to the frequency of injuries from deceleration impact, the United States Consumer Product Safety Commission has issued guidelines on the appropriate G-max ratings for artificial turf/infill systems. A G-max rating of 200 is considered the maximum safe rating for shock absorbency, with the optimum G-Max being 155-165. As a practical matter, most owners require that the artificial turf fields must not exceed a G-max of 165 at any location on the field for the life of the warranty (usually 8 years).

Player safety is of the utmost importance. After conducting site visits to see the quality of the product, CSP and GUSD staff proposed to use Shawgrass Legion Turf with GeoFill/Natural Play infill as the option for the aforementioned projects in this report. The proposed product addresses safety in regards to G-Max and Head Impact Criteria (HIC) as well as a player's potential for lower extremity injuries (ankle and knee injuries). Shaw Sports Turf goes further with the development and use of GeoFill/NaturalPlay infill. These infills give the field a firmer, stable, cooler, and safer playing surface than that of a crumb rubber system. These natural infills allows for better footing and player performance since it best replicates a natural grass system. These are systems used by Major League Baseball and Major League Soccer teams: Arizona Diamondbacks, Florida Marlins, and Texas Rangers, and FC Dallas, to name a few. **Exhibit F** highlights the cooling effects of the GeoFill product.

Artificial Turf Related Studies

There are hundreds of articles and studies related to artificial turf installation and use worldwide. One such article by the Synthetic Turf Council titled “Synthetic Turf 360 – A Guide for Today’s Synthetic Turf 2011” highlights use, environmental, and safety issues related to artificial turf. It states that at the beginning of 2011, more than “6,000 artificial turf fields were being used in North America by a growing number of high school and

collegiate athletes playing and practicing football, soccer, hockey, baseball, rugby, lacrosse and many other sports”.

It further states that a full-size artificial turf sports field saves 500,000 to 1,000,000 gallons of water each year depending on location and estimated that in 2010, “between 3 billion and 6 billion gallons of water were conserved”. This article is attached hereto as **Exhibit G**.

As for the use of pesticides and fertilizers, a July 7, 2007, article entitled “Grass Warfare,” in the Wall Street Journal states: “The pesticides used in lawn-care products found on shelves nationwide are considered legal by government standards. But broader research on health risks from such chemicals has prompted general warnings. The EPA, which regulates pesticide use, notes on its own website that kids are at greater peril from pesticides because their internal organs and immune systems are developing.”

- Gwendolyn Bounds, “Grass Warfare” (Wall Street Journal, July 7, 2007)

According to the North Carolina Department of Environment and Natural Resources polluted storm water run-off is the No. 1 cause of water pollution in their state, with common examples including over-fertilizing lawns and excessive pesticide use.

- Stormwater FAQs, (North Carolina Department of Environment and Natural Resources website)

It is estimated that the amount of artificial turf currently installed across the nations has eliminated the need for nearly a billion pounds of harmful pesticides and fertilizers, which could have significant health and environmental implications.

A recent study titled “Life Cycle Assessment of Artificial and Natural Turf Sports Fields” prepared by the Institute of Natural Resource Sciences, Zurich University of Applied Sciences, conducted a Life Cycle Assessment of natural grass and artificial turf fields. The study identifies annual usage hours as the most important factor for environmental impact. The study states that artificial turf can be played on for much longer per year than natural grass, and concludes that “at optimal capacity utilization, artificial turf sports fields have significantly lower environmental impacts per hour of use”. It further recommends that when an agency is planning a new sports turf, “the number of hours of use should be estimated as accurately as possible so that the optimum type of turf can be selected for the sports field”. It further concludes, that for “high intensity of use, artificial turf is more environmentally sustainable, and for less intensive use, a form of natural grass is”. The Executive Summary of this study is attached to this report as **Exhibit H**.

Glendale Environmental Coalition Letter

As previously stated, the Glendale Environmental Coalition sent a letter to the City Council and the Parks, Recreation and Community Services Commission, dated February 8, 2021, recommending the use of Environmental Passive Integrated Conveyance (EPIC) System with natural grass in lieu of artificial turf for the five projects reflected in this report. The letter highlights the benefits of the EPIC system and lists concerns with the proposed artificial turf product. Below a brief summary of the points raised in the letter and staff analysis in response.

EPIC System:

The GEC letter takes the position that “an alternate natural grass system, such as the Environmental Passive Integrated [Conveyance] System (EPIC) could be a viable alternative.” The letter states that the EPIC system is efficient, economical and long lasting, combining subsurface irrigation with water storage and filtration. It further states that the system encourages long root systems, thus upgrading grass health to withstand heavier use. The letter also highlights the following as benefits of the EPIC system: “excellent drainage, absorbs stormwater, allows for below-surface greywater usage, uses water economically, supports healthy soil, and demonstrates cooler surface temperatures and safer conditions for athletes than artificial turf”.

The GEC letter suggests that Franklin Elementary is considering this system for their multi-purpose field. Staff reached out to GUSD Facilities and Operations Management team to ask their opinion. Although the District has not taken an official position on the EPIC system at Franklin Elementary, the maintenance team’s initial investigation on the associated costs of installation and maintenance challenges has them leaning towards not recommending this alternative.

Fields with EPIC System

Staff connected with the EPIC System representative to inquire about system installations. There are only a handful of EPIC system athletic fields installed throughout the nation. The representative identified the following facilities as having installed the EPIC System: Paradise High School in Paradise, CA; Vista Del Lago High School in Folsom, CA; and on Westcott Field at Southern Methodist University (SMU), in Dallas, Texas. Staff reached out to the maintenance management teams at these three facilities to inquire about their experience with the system.

Paradise High School:

Staff spoke with the Director of Facilities, Maintenance, and Operations at the Paradise Unified School District (PUSD). The district installed the EPIC System at their Paradise

High School soccer field in 2013. This field is comparable to Glendale's heavily used fields as it is used by the school for soccer, track / field, football, as well as it is open for public use on nights and weekends. The system drains well once the root system is established. The system only required one repair in 2020: a pump replacement that cost about \$1,400 for parts, plus labor.

Given that it is a sand base system, PUSD experienced challenges with its maintenance. Growing the root system posed significant challenges for the initial 5 years after installation. The heavy use created low spots and tore the turf much easier because it is sand base. This required the use of the proprietary sand that must be used for an EPIC system. The district further experienced increases in their overall maintenance efforts: overseeding 3-5 times per year, aerating monthly January through June and bi-monthly from June to December. Overseeding the field required above ground sprinklers as seed must be maintained in moist condition. While the District did not have actual water use figures, it did not experience measurable water savings as trans-evaporation was still a challenge, the sand must be kept moist, and required topical watering while seeding. The District dedicated a full time groundskeeper for the field's maintenance, and experienced \$17-\$18,000 increase in cost for seed and fertilizers, for an annual maintenance cost of approximately \$120,000..

The Director of Operations did not recommend this system for heavily used municipal fields. Furthermore, PUSD's Long Term Master Planning has approved replacing this field with an artificial turf field.

Vista Del Lago High School

Staff spoke with the Director of Operations at Folsom Unified School District (FUSD), which is responsible for the maintenance of Vista Del Lago High School. This field is also comparable to the heavily used soccer fields in Glendale as it is used by the school as well as is open to the public. The field drains well allowing for soccer play soon after rains. The EPIC system did not require major repairs, just minor maintenance costs.

FUSD experienced similar challenges to PUSD, resulting in poor field conditions in the summer months, thus requiring increased maintenance. One such challenge was the root system, which only grew down to 2 inches. Another challenge was the need to increase aerification, fertilization, overseeding, and topical watering to keep seeds moist.

Although the field is doing better now, the Director of Operation did not recommend this system, would not chose this option again, and prefers the installation of artificial turf for heavily used fields.

Westcott Field, Southern Methodist University, TX

Staff connected with the Athletic Department of Westcott Field, at SMU. This field's use is not comparable to Glendale's municipal field. It is primarily used by the college men's and women's soccer teams at an average of 25 hours per week. They have an alternate field on campus that is used for practice / games as well. Although the use is not comparable, it has similar challenges as it relates to field conditions and maintenance.

The field is shut down in the winter to allow the field to rest as there is not much activity during that time period. The field undergoes major maintenance in May to prepare for the heaviest use in June – summer camps when the field is scheduled 6 days per week, for an average of 6-8 hours per day. The field also had drainage problems due to the wrong sand / soil content effecting infiltration rates. SMU experienced challenges with root generation as well; finding it necessary to flood the field to soak it. The school had to install above ground irrigation to keep seeds moist, similar to the high schools. This level of watering did not corroborate the claims for water savings by the system.

The field uses fine sand that leeches out all the nutrients, thus requiring increased frequencies of fertilizer application. The school further replaces the turf in heavy wear areas regularly, such as the penalty box. It is estimated that the field increased general turf maintenance costs by 20%. Thus, he believed that the field would not be feasible for heavy use and that artificial turf would be more ideal for such use.

“Netlon” Mesh Installation with EPIC

The GEC letter further suggests consideration of a synthetic product called “Netlon” to be integrated into the EPIC system natural grass to increase durability. Netlon is a plastic mesh material that is installed in the sand / soil to reinforce the top layer and resist compaction, increase load bearing capacity, and enhance infiltration properties of the soil. If installed, it would introduce synthetic plastic into the soil composition of the field. Netlon is a unique product which can be useful in many different applications, with best utilization in areas where surface support is necessary (i.e. for vehicles parking, construction) and/or for moisture control in the soil profile (as in clay soils or areas with poor drainage).

There is concern for player safety regarding impact attenuation on the surface of the Netlon product. Heavily used municipal fields experience the Netlon product surfacing to the top of the turf, requiring staff to pick it up prior to games and after aeration, thus increasing maintenance needs of the field.

Exhibit J is a study that highlights how Netlon increases the surface hardness and escalates the potential for athlete injury in the event of a fall. The safety of park patrons in a municipal setting is a top priority. Combined with the increased maintenance frequencies and costs for labor, materials, and equipment, the installation of Netlon as part of a heavily used municipal athletic field is not a sustainable solution.

Artificial Turf:

In relation to the artificial turf fields, the letter states the following:

1. GEC: It requires synthetic shock pads, which will eventually require landfilling.

Staff Response: The NXTPlay shock pad that is proposed for this field is recyclable. NXTPlay pad is certified Cradle to Cradle by the Products Innovation Institute. Turf repurposing and recycling plays a role in our sustainability efforts.

2. GEC: It requires virgin plastic to manufacture (top layer).

Staff Response: In an effort to have turf fields avoid ending up in landfills, Shaw Sports Turf has developed a process to reclaim turf to be recycled into a shock pad called NXTPlay. While new turf requires virgin plastic to manufacture, it is constructed with the intent it can be recycled or repurposed at the end of their lifecycle.

3. GEC: It does not promote effective stormwater capture.

Staff Response: Stormwater capture is a function of a turf field's base design and many new field constructions in California incorporate stormwater capture into their designs. CSP will incorporate this design element in the current proposed fields, where feasible, similar to Pacific Park.

4. GEC: It does not promote effective greywater use.

Staff Response: Greywater/Reclaimed water usage is not needed nor recommended for artificial turf. As the GEC letter indicated, of the proposed projects, Pacific Park and Sports Complex currently utilize reclaimed water to irrigate the park, excluding the artificial turf fields. Fremont does not currently have reclaimed water source at the park, however it is possible to link to a source on Glenoaks Blvd. Regardless of the final decision to use natural grass or artificial turf for the projects, connecting a reclaimed water line to Fremont Park will be beneficial and promote greywater use. As such, CSP will work with Glendale Water and Power to look at the feasibility of this project in the coming years. Moreover, any opportunity to connect reclaimed water to parks for irrigation use will be analyzed and considered on future park projects.

5. GEC: It requires extra maintenance including watering.

Staff Response: Watering is not required or critical to an artificial turf field's maintenance, safety, or for its warranty. Although the presence of moisture in the infill is beneficial and enhances the field's performance and assists with playability, it is not required nor does it require the installation of sprinklers. The climate in Glendale

provides the presence of moisture passively from relative humidity, rainfall, and dew that often settles on surfaces in the mornings and evenings. The average relative humidity in Glendale is high enough, and the average temperatures are mild enough that heat will not be a concern for the majority of the year. Given the infill material is made up of natural products (sand and coconut husks), they maintain the field at much lower temperatures as compared to the rubberized pellets that absorb heat. As for maintenance, artificial turf significantly reduces maintenance requirements as compared with natural grass and the EPIC system as highlighted in their respective sections in this report.

6. GEC Claim: It sheds plastic fragments into storm drains.

Staff Response: Fiber shedding is mitigated with regular brushing and sweeping. The materials collected from this sweeping will be stored at the site and recycled. The natural Geofill infill that may come off the field due to foot traffic is plant-based and as such not harmful to the environment.

Program impacts:

As it relates to programmatic impacts, the letter states that artificial turf “may not increase days of use in Glendale as it produces its own heat island effect, becoming as hot as 160 °F on a 90 °F day. When that happens, it needs to be watered in order to cool, with temporary (and not always effective) impact”.

Staff Response: The current rubber fill fields do experience high temperatures in intense summer heat. At the Sports Complex, on approximately 10 days per year during summer camp rentals, the sprinklers are turned on to help cool the fields, albeit temporarily. Given its ineffectiveness, the City opted not to install these sprayers at the Pacific Park multi-purpose field. The City cancels its Adult League games approximately 3-5 days per year when temperatures exceed 100 degrees at 6pm. Coaches and private leagues choose to cancel their own games for the children’s safety and City refunds their rates given extreme temperatures.

Despite closures for excessive heat, the artificial turf fields by far provide more playing time as compared to natural grass. They are reserved 360-365 days out of the year as compared to 275-325 days for natural grass fields. The difference is due to having the natural grass soccer fields being closed 3 months out of the year for renovations. In addition, when it rains, the fields are closed for approximately 3 days per field, translating to over 6,300 children being impacted (3 days * 15 fields * 7 groups * 20 kids per group).

The GEC letter states that the EPIC installation would mitigate the soggy field issues and grass refurbishment/rest time. “The system is designed to drain rapidly through a

layer of sand while capturing that stormwater for later use and, thanks to this design, grows much healthier and stronger grass. Rain would pose no problem for this system.” The letter further claims that EPIC fields regenerate “significantly quicker” and only portions of damaged areas can be replaced and that overseeding can help with field maintenance allowing more play days.

Staff Response: While sand base fields have a tendency to drain faster, they do not alleviate the need to close the fields for maintenance. Our inquiries with existing users of the EPIC system found that the significant increase in routine maintenance of the fields impact operations (aeration and overseeding) and require significantly higher levels / frequencies of fertilizers and chemicals due to leeching (monthly applications). As stated earlier, each time this practice is applied, the fields should remain closed for a day or two – further impacting field availability. Moreover, all three EPIC system users contacted experienced significant challenges in growing grass, especially root generation. As for overseeding, all EPIC fields experienced the need for topical watering due to overseeding, which in turn increased the field watering and maintenance needs.

The GEC letter states that “many studies on artificial turf have shown a greater number of player injuries than natural grass, including anterior cruciate ligament (ACL) tears, concussions, and ankle sprains, and longer recovery times needed between games”.

Staff Response: Traction, rotation and slip resistance, surface abrasion and stability of artificial turf fields meet the rigorous requirements of the most respected sports leagues and federations. Some of the published studies of the comparative safety of artificial turf include:

- A 2004 NCAA study among schools nationwide comparing injury rates between natural grass and artificial turf found that the injury rate during practice was 4.4% on natural grass, and 3.5% on artificial turf.
- An analysis was conducted by FIFA’s Medical Assessment and Research Centre of the incidence and severity of injuries sustained on grass and artificial turf during two FIFA U-17 World Championships. According to FIFA, “The research showed that there was very little difference in the incidence, nature and causes of injuries observed during games played on artificial turf compared with those played on grass.”
 - “Very Positive Medical Research on Artificial Turf” (Turf Roots Magazine 01, pp. 8-10, FIFA)
- Three 2010 long-term studies published by researchers from Norway and Sweden comparing acute injuries on artificial turf and natural grass. The studies examined the type, location and severity of injuries sustained by hundreds of

players during thousands of hours of matches and training over a four-to-five-year period. Many types of acute injuries to men and women soccer players, particularly knee injury, ankle sprain, muscle strains, concussions, MCL tears and fractures were evaluated. The researchers concluded that the injury risk of playing on artificial turf is no greater than playing on natural grass.

- Bjørneboe J, Bahr R, Andersen TE (2010) Risk of injury on third generation artificial turf in Norwegian professional football. *British Journal of Sports Medicine*, 44: 794-798.
- Ekstrand J, Hägglund M, Fuler CW (2010) Comparison of injuries sustained on artificial turf and grass by male and female elite football players. *Scandinavian Journal of Medicine and Science in Sports*, DOI: 10.1111/j.1600-0838.2010.01118.
- Soligard T, Bahr R, Andersen TE (2010) Injury risk on artificial turf and grass in youth tournament football. *Scandinavian Journal of Medicine and Science in Sports*, DOI: 10.1111/j.1600-0838.2010.01174.

CSP conducted a survey of Glendale field users and inquires about injuries sustained while playing on natural grass and artificial turf. The survey results, highlighted later in this report, show no significant difference between the two surface types.

Maintenance:

The GEC letter claims that the proposed Shawgrass Legion Turf with GeoFill/Natural Play “(1) ... will only last 8 years, (2) replacing that surface requires the manufacturing of new product with virgin plastic, and (3) the shock pad will eventually need to be landfilled at the end of its life. We contend that there is ultimately no safe, environmentally sound manufacturing or disposal of artificial turf and shock pads.”

While the manufacturer warranty is only 8 years, the turf will last at minimum 10 years, possibly 12 with the proper maintenance. The soccer fields at the Sports Complex were first installed in 2005 and replaced 10 years later in 2015. Replacing the surface does require the manufacturing of new product with virgin plastic, however that old surface is recycled into the shock pad, which in turn is recyclable itself.

The letter further claims that the “maintenance costs for EPIC fields are lower than for artificial fields” and that the system would require 60% less watering. The letter further highlights maintenance requirements for the artificial turf, identifying the need to sweep once per week, groomed every 4-5 days, patching damaged areas, and sanitizing after spills.

As highlighted in the cost comparison, maintenance of turf with EPIC system costs more than the other alternatives of natural grass and artificial turf. Moreover, the current users

of EPIC system have not experienced water savings as intended, and have resorted to above ground irrigation to continue growing seed.

The artificial turf system proposed for the aforementioned projects is Legion Turf with GeoFill/Natural Play infill by Shaw Sports Turf, including a NXTPlay shock pad. This system does not require any watering to perform its intended design purpose: to be a safe, durable, reliable sports field that is available year-round for field users. A field with no moisture does not create any adverse effect on its overall safety or performance.

Maintenance requirements for artificial turf fields are far less than that of a natural grass system or its variants. Turf with an EPIC system will still need periodic closure for aerating, fertilizing, reseeding, rain, or grass regrowth from heavy usage. The use of lawn care equipment also creates more air and noise pollution. Moreover, CSP continues to experience burrowing on fields by gophers and ground squirrels, requiring constant and immediate attention to hazardous situations. An artificial turf field is less likely to be damaged by wildlife that may root or burrow into the field which can cause hazards to the players. Natural grass fields, with or without EPIC system, also need consistent watering, with warmer and drier times of the year requiring more watering and maintenance.

Artificial turf fields require routine maintenance such as walking the field daily to look for unsafe conditions, tears, as well as conduct litter control. Grooming is necessary after every 80-100 hours of field use or once per month minimum to redistribute the infill levels. Weekly grooming is not required, yet given their heavy use, staff groom the current artificial turf fields once every two weeks. Brushing and sweeping is conducted to pick up small particles on the field. This task is done as needed, after every 80-100 hours of use, or at a minimum of once every month. An annual de-compaction / rejuvenation is needed for high-use fields using field grooming equipment. The City contracts with vendors to conduct this annual de-compaction and field rejuvenation service for approximately \$3,500 per field.

As in natural grass, there are high wear areas on artificial turf that would require replacement or patching, if torn. We have experienced the need to conduct such a repair once at Pacific Park since 2014; and two times at the Sports Complex since 2005. Since 2014, Pacific Park has needed repair primarily in areas where the turf has seams due to line stitches. Those repairs have been conducted by facility staff as necessary or are conducted under warranty by the manufacturer. As stated previously, the areas on an artificial turf field that need additional attention and possible maintenance are the high use areas which include the corners, the goalie area, and the penalty kick area where the shooter plants his/her non-shooting foot. In relation to sanitizing, Sports Complex experiences one spill per year that requires sanitization, while Pacific Park has had two clean ups since 2014. Staff is also looking into a product

called PROKURE that is designed to disinfect and sanitize artificial turf fields which can be applied as part of the contract maintenance annually.

GeoFill infill also provides an additional passive cooling benefit by absorbing moisture present in the environment: rainfall, relative humidity, and dew points. The climate of Glendale is mild enough with relative humidity, allowing for moisture to be trapped in the infill early in the days and evenings and evaporates as the field warms up, thus keeping it cooler than compared to a crumb rubber system. Moisture in the infill provides an added benefit to the playability and cooling, but is not a requirement for its day-to-day usage even during the hotter times of the year.

A study conducted by Penn State University tested for specific types of bacteria in artificial and natural grass, including *S. aureus*. This study was captured in the Sports Turf Managers Association (STMA) paper titled: "A Guide to Synthetic and Natural Turfgrass for Sports Fields" 3rd Edition. The 20 fields studied included natural grass fields, artificial turf fields, both indoor and outdoor, and high and low use areas on fields. The study found no *S. aureus* at any test location. Another test conducted to evaluate how long staph bacteria can survive on artificial turf. "Results found that levels of bacteria on outdoor fields quickly dropped to very low levels. The bacteria survival rate on natural turfgrass fields was comparable. Sunlight reduces bacterial survival rate. On indoor fields, bacteria survived on artificial turf and natural grass for multiple days. The population [of bacteria] decreased significantly with time."

Field User Survey

CSP staff conducted a brief survey of Glendale field users in February 2021. The survey ran from February 23 through March 1, 2021, and included questions such as: the type of organization and clients served (youth / adult), fields generally reserved, number of years they used City fields, the type of field reserved (artificial / natural), injuries, and type of field surfacing preferred. Given that CSP fields are generally used for baseball and soccer, as well as two of the current approved projects are multi-purpose fields (baseball and soccer), this survey was sent to all users including little leagues, adult leagues, baseball, softball, and soccer groups. CSP received a total of sixty (60) responses to the survey. Below is a summary of the survey results. The full survey results are attached as **Exhibit K**.

Field Users

Of the sixty (60) groups, eleven (11) reserve fields for high school, college or university athletics programs, fifteen (15) user groups are adults 18 to 59 years old, and thirty-four (34) groups serve the youth.

Purpose for Field Usage

All groups were asked what is the primary purpose for their reservations. Sixty (60) groups responded as follows:

To create a time and space for participants to socialize	7
To hold training and practices	35
To hold training and practices; To hold tournaments (short time-span, 6 weeks or less)	2
To hold training and practices; To run a league (longer-term time span, 7 to 12 weeks based on seasons)	3
To run a league (longer-term time span, 7 to 12 weeks based on seasons)	13
Grand Total	60

Reservation Frequency

When asked how frequently they reserve a field from the City in a week, the responses were as follows:

1 Day / Week	22
2 Days / Week	7
3 Days / Week	8
4 Days / Week	7
5 Days / Week	4
6 Days / Week	5
7 Days / Week	7

Type of Field Preferred by Respondent's Participants

Users were asked what type of field surface do their users prefer to play on. Forty-four (44) or 73% chose Artificial Turf, and fifteen (15) or 25% chose natural grass; and one response was blank. All fifteen respondents that chose natural grass are baseball / softball groups.

Demand

The survey asked what are the reasons why the specific user doesn't rent more field time.

Lack of field availability based on my schedule	30
I am satisfied with the amount of time I currently have	25
It doesn't make financial sense	5

Finally, forty-one (41) respondents said the majority of the fields they reserve are for artificial turf while nineteen (19) respondents typically reserve natural grass.

Artificial Turf renters primarily rent the for the following sport:

Baseball	3
LaCrosse	2
Soccer	35

Natural Grass renters primarily rent the field for the following sport:

Baseball/Softball	16
Soccer	3

Injuries Experienced on Artificial Turf

CSP was also interested in the number of injuries recorded by the users that were a result of playing on the artificial turf playing surface. Over the past 16 years of artificial turf reservations in the City of Glendale, (16 years at Sports Complex Soccer Fields 4 and 5; approximately 7-8 years at the Pacific Park Multi-Purpose Field; and 2 years at Sports Complex Multi-Purpose Field #1), reported injuries were minimal in relation to the number of hours over the length of time the fields have been reserved.

Across 41 respondents and an average of 7.1 years of rental history per artificial turf user; twenty-nine (29) respondents (71%) reported no injuries in a calendar year; nine (9) respondents (22%) had 2 or fewer injuries in a calendar year; two (2) respondents (5%) had 3-4 injuries; and one (1) respondent (2.5%) had 5 or more injuries.

The most common injuries reported were ankle sprains (12) and slide burns (11); knee injuries (9) such as ACL, MCL, and PCL; and concussion from hitting the surface (3).

Injuries Experienced on Natural Grass

In comparison, across the nineteen (19) respondents who said they rent natural grass fields from the City, these users have rented fields from the City on an average of 14 years. Given that natural grass has been the primary playing surface for decades, eight (8) out of nineteen (19) respondents have experience renting fields dating back 15-45 years, while eleven (11) respondents have rented fields between a few months up to seven years.

One respondent has recorded 3 or 4 injuries per calendar year, eleven (11) respondents experienced 2 or fewer injuries, and seven (7) respondents did not experience any injuries.

The most common injuries include ankle sprains (11) and slide burns (6); while 6 respondents said the type of injuries they experience were not those listed.

Survey of CA Park Agencies

CSP staff conducted a survey of California Park and Recreation Society (CPRS) Park Agencies across California to see what type of fields they have in their parks. Founded in 1946, CPRS is a nonprofit, professional and public interest organization with over 4,000 park and recreation professional members; with 86 percent of park and recreation agencies in California having at least one CPRS member.

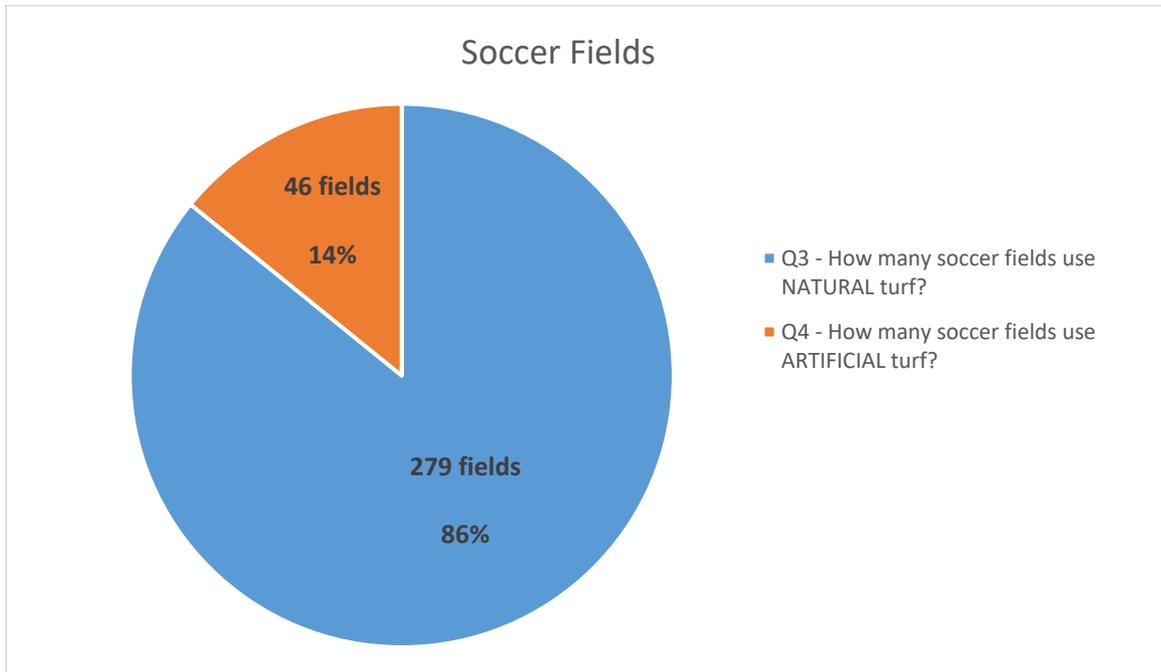
The questions for this survey focused on the number of baseball and soccer fields agencies have in their inventory, how many are natural grass or artificial turf, type of fill material, and if the agency has future plans for artificial turf fields. In addition, staff wanted to find out if any of these park agencies have any fields with the EPIC system.

Twenty-nine (29) Park and Recreation agencies across California responded to the survey. Below is a summary of the results. Full survey answers are attached to this report as **Exhibit L**.

Soccer Fields:

Of the twenty-nine (29) respondents, twenty-seven (27) agencies responded to having soccer fields in their parks ranging from one (1) field to fifty-seven (57) fields, for a total

of three hundred twenty-five (325) soccer fields. Two agencies listed having no soccer fields (Burbank and City of Lakewood). As Table 4 (T4) below illustrates, of the 325 soccer fields reported, two hundred seventy-nine (279) or eighty-six percent (86%) are natural grass fields and forty-six (46) or fourteen percent (14%) are artificial turf fields. The infill used on the artificial soccer fields vary from crumb rubber, rubber / sand mix, cork, cork / sand mix, pumis, and ground olive pits.



T(4): Survey responses on the number of artificial / natural grass fields

Ballfields:

Similarly, we inquired about the number of ballfields. The respondents reported having five hundred twenty four (524) ballfields, with only twelve fields (12) or 2% being artificial turf. The remaining five-hundred-twelve fields (512) or 98% are natural grass fields.

Fields with EPIC System:

None of the responding agencies have fields constructed with the EPIC System. This confirms the information received by the EPIC representative in that no municipal fields are constructed with this system.

Future Artificial Turf Fields:

The survey further inquired whether the agencies had future plans for artificial turf fields. Twelve (12) responding agencies (41%) said yes, five (5) agencies (18%) said maybe, and the remaining twelve (12) agencies (41%) said they had no current plans for additional artificial turf fields.

CSP also received a response from the City of Los Angeles. Given that a lot of their fields are multipurpose fields and a lot of open space areas are used for soccer play, they could not provide an actual inventory of ballfield vs soccer field. Their response claimed to have 256 ballfields, 2 of which are artificial diamond fields designed as ADA accessible fields. The City has 62 artificial multipurpose fields of varying size and configuration, most of which are used for soccer, but not expressly for that purpose. The City confirmed they did not have any fields with the EPIC system.

Summary

After considering the three alternative turf options for the projects, here are some summary findings.

There are numerous studies and documentation that show active participation in sports are critical to youth development in fitness, mental health, self-esteem and leadership. The true debate over natural grass (with or without EPIC system) or artificial turf lies with the issue of community access to fields, available resources, a sustainable maintenance approach, and fiscal responsibility. Glendale residents deserve athletic fields that are green, clean and safe, and available for optimum use to maximize utility. It is imperative to note that the purpose of the five soccer / multi-purpose field projects previously approved by City Council was to meet the increased public demand for soccer fields, alleviating field availability challenges and allowing over 12,000 youth to have uninterrupted recreational ability.

Under the right circumstances, natural grass fields would be an ideal option if the fields are allowed to rest and have the necessary resourced to maintain it at safe / playable levels. Glendale's continually growing demand for athletic fields far exceeds availability, and closure of fields for 3 months for maintenance will impact play for thousands of users. Natural turf soccer fields are more difficult to maintain due to the nature of the sport; thus making it a more appropriate venue for artificial turf.

Epic system is a great concept in capturing and reusing stormwater. There may be some applicable uses for future green infrastructure projects. With the proper field down time and additional resources, it can play a role in stormwater capture and reuse. Of all three options considered, it has the highest initial cost for construction as well as annual maintenance. Yet it doesn't seem to solve challenges of having natural grass soccer

fields. The three schools that have EPIC system installed on their fields experienced similar challenges in managing the turf: hard to grow the roots to the desired length, increased aeration and fertilization, as well as seeding.

Artificial turf offers significant advantages and provides some solutions to the challenges of grass fields: maintenance costs are lower and fields are available for play in all weather. While there is always room for improvement and manufacturers are making significant advances in environmentally friendly approaches, artificial turf is a creative solution to expand our options for meeting the recreation needs of Glendale. Artificial turf has come a long way since its inception. Given the high demand for artificial turf fields, manufacturers have continued to address the physical, fiscal, and environmental concerns. They are safer, more environmentally friendly, product is recyclable, the infill is natural and not harmful to the environment, shock pad is recycled and recyclable, and given the current market, are at competitive prices.

The following Table **(T5)** summarizes all three alternatives:

Evaluative Criteria	Artificial Turf	Natural Grass	Natural Grass with EPIC System
Availability	Available for play 365 days per year, even right after a heavy rainstorm	Available 9 months; with 3-month closure for renovations. Further closed 2-3 days after rains.	Available 9 months; with 3-month closure for renovations. Further closed 2-3 days after rains.
Durability	Withstands heavy and repetitive use, even during the heavy rain. No recovery time necessary between events/uses.	Needs ongoing maintenance and repairs; especially after wet rainy weather.	Needs ongoing maintenance and repairs; especially after wet rainy weather.
Ball Action	Balls react, bounce and play similar to well-maintained natural grass.	Imperfections such as weed patches, exposed dirt, mud spots, and sprinkler heads can cause inconsistent ball action.	Imperfections such as weed patches, exposed dirt and mud spots can cause inconsistent ball action.
Safety	Studies show no significant difference between surface types	Studies show no significant difference between surface types	Studies show no significant difference between surface types
Environmental Impacts	Eliminate chemical, fertilizer, pesticide use; Reduce water consumption 1.5-2 million gallons; LCA shows least environmental impact when used over 1,600 hours per year	Reduces urban heat island effect, filters rainwater and pollution, provides wildlife habitat; maint. adds to carbon footprint, use of fertilizers and pesticides	Reduces urban heat island effect, captures and reuses rainwater and pollution; maint. adds to carbon footprint, increased use of fertilizers, chemicals and pesticides
Appearance	Always maintains a look of a freshly mowed lawn.	Won't maintain that new lawn look over time. Areas of heavy use wear down creating bare areas, and weeds move in.	Won't maintain that new lawn look over time. Areas of heavy use wear down, creating bare areas, and weeds move in.

Surface Temperature	Geofill natural infill temperature tends to be 40 degrees cooler than traditional artificial turf fields.	Temperature would be equivalent or slightly cooler than the air temperature off the field.	Temperature would be equivalent or slightly cooler than the air temperature off the field.
Replacement / Rejuvenation	Lasts up to and possibly beyond 10 years Replacement of turf layer at year 10	Annual reseeding / sod required which leads to downtime for re-growth. Excessive compaction typically requires complete reconstruction.	Monthly overseeding, aerating, fertilizing required; leading to downtime for re-growth. Excessive compaction typically requires complete reconstruction.
Construction and Maintenance Costs, and Revenue Generated (Over 20 Years)	Construction: \$1.66 million Maintenance: \$2.74 million Revenue: \$3.2 million	Construction: \$200,000 Maintenance: \$3.2 million Revenue: \$600 thousand	Construction: \$1.8 million Maintenance: \$4.97 million Revenue: \$600 thousand
Overall Cost / (Revenue) Over 20 Years	(\$456,351.55)	\$2,626,213.11	\$4,375,763.42

T5: A Summary Table of Natural Grass, EPIC System, and Artificial Turf Field

FISCAL IMPACT

One of the disadvantages of artificial turf is the initial cost associated with its installation along with the drainage system that helps keep the field free of puddles even during heavy rain season. Similarly, the EPIC System has a very high initial cost for materials and installation. However, as this section will illustrate, in the long run, natural grass maintenance costs (with or without EPIC system) will surpass the cost associated with the installation, maintenance, and replacement of artificial turf. The costs highlighted in this section reflect a typical size soccer field at 90,000 sq. ft.

Natural Grass Costs

Initial cost of constructing a natural grass soccer field is estimated at \$175-\$225 thousand. Revitalization and maintenance of a natural grass soccer field costs \$44,404 for regular maintenance and \$80,146 for sodded renovation, for a total cost of \$124,550 per year. Fields renovated with seed would cost \$77,312 for annual maintenance and renovation, yet require an additional month of closure (4 months instead of 3) to allow for seed germination and proper rooting. This increased rest time will negatively affect revenue generation for the field as well as impact field availability. As such, it is more feasible to use sod during renovations. **See Exhibit B for details.**

Natural Grass with EPIC System Costs

The initial cost of constructing a natural grass field with the EPIC System is estimated at \$1.75-\$1.85 million, plus project management and soft costs. This type of field has a higher annual maintenance cost due to the increased maintenance requirements for aerating and fertilizing. Regular maintenance of a natural grass soccer field with EPIC system is estimated at \$49,153 and \$81,551 for sodded renovation, for a total annual cost of \$130,704. The same field, if renovated with seed, would cost \$83,467, yet require an additional month of closure (4 months instead of 3) to allow for seed germination and proper rooting. **See Exhibit B for Details.**

Artificial Turf Costs

The initial cost of installing artificial turf field ranges from \$10-\$14 per sq. ft. for site preparation, drainage, aggregate replacement, shock pads, and the turf surface. For a typical 90,000 sq. ft. soccer field, the cost is estimated at \$1.2-\$1.3 million, plus project management and soft costs, totaling approximately \$1.6 million.

Artificial turf has an anticipated lifespan of ten (10) years at which time the playing surface will need replacing while the drainage system will remain intact. The cost for the replacement is roughly 50% of the initial installation cost. For example, the replacement of the top layer turf at the two soccer fields at Sports Complex in 2015 cost \$877,705, excluding project management.

The estimated cost for maintaining artificial turf is \$10,285 per year. **See Exhibit B for details.**

Revenue Generated

Average annual revenue from rentals on multi-purpose artificial turf fields is \$160,000, while average revenue on natural grass fields is \$30,000, currently with the natural turf ball fields (at sports complex) and before the soccer fields were converted to artificial turf at the Sports Complex. CSP currently doesn't have natural grass multi-purpose/soccer fields, thus the revenue listed is from rental of natural grass ball fields, which are sometimes used as multi-purpose field to rent to soccer users when it is not used for baseball/softball and what the revenue used to be at the Sports Complex

before the soccer fields (2004) were converted to artificial turf. It is important to note that the rental fees vary depending on the size/type of field, thus the fee rate for rentals for artificial turf fields is not the same as natural grass fields. The fees charged for the use of the fields vary according to the time of day: there is an additional fee for the use of lights for games played at night. Moreover, non-profit and approved community youth groups pay a reduced fee for the use of the fields as compared to adult leagues.

Comparison

In comparison with natural grass, or natural grass with EPIC system, artificial turf costs significantly less to maintain. For this cost comparison, given our experience with seeded renovations on soccer fields, the renovation costs with sod are being utilized. In addition, initial construction cost estimates for all surface types is incorporated to show the costs over a 20-year period. The comparison further includes a 2% CPI applied to the maintenance costs, yet the revenue has been presented as a constant as increase to hourly reservation costs have not been approved. See **Exhibit I** for details.

Table 3 (**T3**) presents a 20-year cost / revenue comparison matrix of natural grass, EPIC System, and artificial turf. The artificial turf field material costs also include the replacement cost at year 10.

Category	Natural Grass	Natural Grass w/ EPIC System	Artificial Turf
Starting Cost	\$200,000	\$1,800,000	\$1,662,500
20 Year Cost	\$3,226,213.11	\$4,975,763.42	\$2,743,648.45
20 Year Revenue	\$600,000	\$600,000	\$3,200,000
Total Overall Cost / Revenue	\$2,626,213.11	\$4,375,763.42	(\$456,351.55)

T3: Cost/Revenue Comparison of Natural grass, Epic, and Artificial Turf Matrix

As the comparison shows, after a twenty-year period the natural grass soccer fields are estimated to cost the City in excess of \$2.6 million dollars; the natural grass field with

EPIC System is estimated at \$4.37 million, while the artificial turf field would generate \$456 thousand in revenue, including the turf replacement cost at 10 years.

ALTERNATIVES

N/A

EXHIBITS

Exhibit A – City of Glendale Recreation Element

Exhibit B – Turf Maintenance Cost Estimates

Exhibit C – EPIC Turf Management

Exhibit D – EPIC Turf Football Field Specifics

Exhibit E – Synthetic Turf vs. Natural Grass 2020

Exhibit F – Geofill Cooling

Exhibit G – Synthetic Turf 360

Exhibit H – Life Cycle Assessment Study – Executive Summary

Exhibit I – Cost-Revenue Comparison of Natural Grass, EPIC System, and Artificial Turf

Exhibit J – Effects of Soil Reinforcing Study

Exhibit K – Field Users' Survey

Exhibit L – Fields Survey Results

Exhibit M – Letter from Glendale Environmental Coalition dated February 8, 2021