Chapter 5: Landscaping Alternatives

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5.1 Introduction

The physical appearance of the Chapman campus is very important as it acts as an introduction to the school and plays a role in creating an attractive and positive learning environment that draws students to the school. In 2012, Newsweek Magazine recognized Chapman as the third most beautiful school in the nation (Newsweek/Daily Beast, 2012). It follows, then, that the landscaping of Chapman University is well regarded and attractive to current and potential students.

Maintaining the landscaping of a 78-acre campus is costly. Yearly costs include the repair of Bert C. Williams Mall lawn due to damage from campus events and foot traffic, and replacing seasonal plants around campus to meet aesthetic standards. The frequent replacement of seasonal plants also produces a large volume of plant waste, which is removed by an independent organization for recycling. With the rising cost of water and frequent periods of drought in the state of California, it will not be practical in the long term to continue to spend increasing amounts of money on non-native, non-drought resistant plants, which require more water to maintain and frequent replacement in order to meet aesthetic standards.

The mission of Chapman University has been to provide a distinctive education and to foster "inquiring, ethical and productive" global citizens (Chapman Facts & History). As one of California's "oldest and most respected universities" (Chapman Facts & History), Chapman should seek to be an innovative leader as citizens of California face longer-lasting drought conditions, and find alternatives to reduce the university's own resource use and avoid foreseeable increases in landscaping costs.

This chapter will identify cost-effective and water-saving alternatives to Chapman's current landscaping practices, including:

- Native plant incorporation
- Plant waste mulching
- Lawn cover alternatives

5.2 History of Landscaping at Chapman

5.2.1 Past accomplishments

Chapman University contracts with ValleyCrest Landscape Maintenance for the installation and maintenance of landscaping features on campus. A native plant garden existed in front of Hashinger Science Center from 2000-2005, but was replaced with iceberg roses. Native plants (mound grass) were planted around the Fish Interfaith Center in 2004. Chapman replaced the grass athletic field with athletic turf in 2006 and incorporated native grasses into the rooftop patio of Argyros Forum in 2011. Chapman also began converting the Rainbird sprinkler system to a drip system in feasible areas in 2011. The Cypress Street Schoolhouse, which reopened in 2013 as The Early Human and Lifespan Development

Figure 5.1. *Native landscaping at Cypress Street Schoolhouse.*

Research Facility, incorporates many native plants into its landscaping (**Figure 5.1**).

5.3 Current Status and Alternatives

The Chapman University 2013 Environmental Audit recommended that Chapman decrease the number of times seasonal flowers are planted and replaced, and add more native plants to the landscaping. It was also predicted that the university's growth, coupled with "limited water resources" and water's increasing price (as a result of the latter), would make water "a more significant concern" in the years to come (2013 Audit).

5.3.1 Plants on Campus

The physical appearance of the Chapman campus represents the university's ideals and culture, but also its "relationship with nature and the contributions the University is making toward a more sustainable future" (2013 Audit). The plant species found on campus are used to embody those qualities and goals with an aesthetic beauty that complements and enhances the regional setting. Chapman University's Master Landscape Plan, adopted in 2003, recommends species of "trees, hedges, shrubs, and ground cover" for the campus, but only 3 of its 44 recommended species (7%) are California native plants (2013 Audit). The Recommended Plant Palette also allows for the use of unlisted species with the approval of the landscaping architect (Master Landscape Plan). Seasonal flowers located in prominent positions around the campus, such as the Bert. C. Williams Mall sign and Charles C. Chapman statue (**Figure 5.2**) are replaced four times a year, costing on average $29,400 (2013 Audit). According to ValleyCrest, a flat containing 16 flowers costs between $12-30; the low estimate represents the cheapest variety the university purchases, while the high estimate is the most expensive variety. Each time seasonal flowers are replaced, 350 flats are purchased, totaling 1,400 flats per year. Considering the range of estimates, the replacement cost can range between $16,800 and $42,000, averaging $29,400. To move toward more sustainable landscaping while reducing spending, one alternative is to increase the incorporation of native and drought-tolerant plants.

Figure 5.2. *Charles C. Chapman statue with seasonal flowers.*

Native vs. Non-native

Annual plants are plants that live for one year. Chapman replaces annual plants approximately every three months to maximize flowering time in key areas around the campus. In Southern California, non-native plants generally require more water because the climate is typically drier than their natural habitat. Most of the annual plant species found at Chapman are non-native. In contrast, native plants occur naturally in a given area. Southern California native plants are typically drought-resistant, small in size, and require less maintenance than non-native species.

There is a common misconception that when a plant is "native," it does not flower or look nice, neither of which is true.

Figure 5.3. *Common Yarrow.*

Both native and non-native plants possess flowering and non-flowering species. Common Yarrow is a native flowering plant with white disk flowers (**Figure 5.3**). Woolly Blue Curls is a native shrub with blue and purple blooms.

Figure 5.4. *Iceberg Roses.*

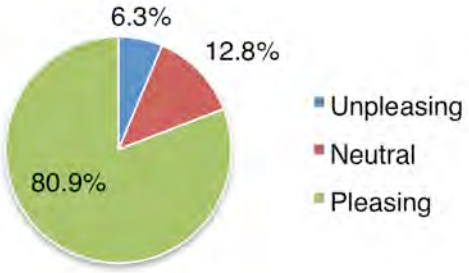

Figure 5.5. *"On a scale of 1 to 5 (1 being least and 5 being most) how aesthetically pleasing do you find Iceberg Roses?" (n=1421)*

Figure 5.6. *Purplehead.*

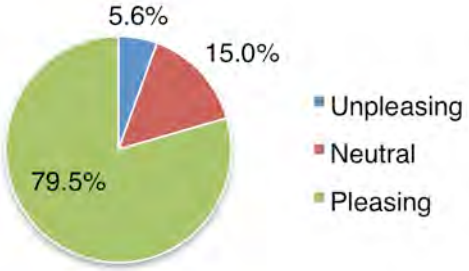

Figure 5.7. *"On a scale of 1 to 5 (1 being least and 5 being most) how aesthetically pleasing do you find Purplehead?" (n=1421)*

Figure 5.8. *Woolly Blue Curls.*

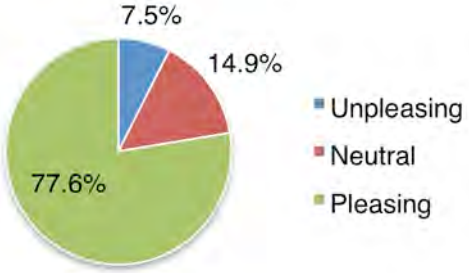

Figure 5.9. *"On a scale of 1 to 5 (1 being least and 5 being most) how aesthetically pleasing do you find Woolly Blue Curls?" (n=1421)*

Chapman is located between the coastal and inland regions of California at an elevation below 500 feet and approximately 20 miles inland from the ocean. These geographical characteristics, as well as monthly average temperature and sun/shade availability, should ideally be considered when choosing plant species to maximize aesthetics and minimize resource use and plant cost.

In the 2014 Chapman Environmental Audit Survey: Water Use and Landscaping, students, faculty, and staff were asked to rate on a scale of 1 to 5 the aesthetic beauty of a list of ten non-native, annual plants currently found on campus and ten native, drought-resistant plants. The top

three aesthetically pleasing plants were Iceberg Roses with 80.9% finding it pleasing and 6.3% unpleasing (**Figure 5.4, 5.5**), Purplehead with 79.5% finding it pleasing and 5.6% unpleasing (**Figure 5.6, 5.7**), and Woolly Blue Curls with 77.6% finding it pleasing and 7.5% unpleasing (**Figure 5.8, 5.9**). **Table 5.1** (see **Appendix 5.8.1**) lists the survey results from all 20 plants and their estimated costs.

A majority of respondents found many non-native plants to be aesthetically pleasing, but not every non-native plant was regarded this way. Pansies, which are displayed prominently before the Charles C. Chapman statue, were only found to be aesthetically pleasing by 54.9% of respondents, while 21.5% found them unpleasing (**Figure 5.10, 5.11**). Only 31.1% found Mock Orange to be pleasing, while 37.7% found it unpleasing (**Figure 5.12, 5.13**). Support for using native plants in campus landscaping was largely positive, with 65.4% supporting and only 5.1% not supporting the practice (**Figure 5.14**).

Figure 5.10. *Pansies.*

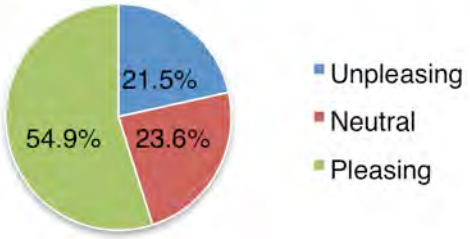

Figure 5.11. *"On a scale of 1 to 5 (1 being least and 5 being most) how aesthetically pleasing do you find Pansies?" (n=1421)*

Figure 5.12. *Mock orange.*

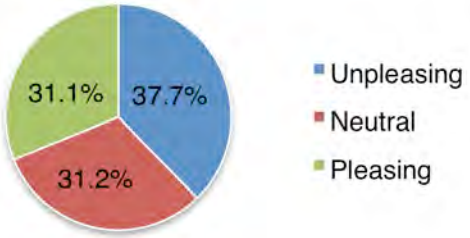

Figure 5.13. *"On a scale of 1 to 5 (1 being least and 5 being most) how aesthetically pleasing do you find Mock orange?" (n=1421)*

Quotes have been obtained from RECON Native Plants, Inc. in San Diego and Tree of Life Nursery in San Juan Capistrano, for the unit price of several native plant species used in the 2014 Survey (**Appendix 5.8.3, 5.8.4**). These quotes can be used to compare the cost of the surveyed plants with the cost of plants currently found on campus, especially those replaced frequently throughout the year.

To redesign existing gardens to incorporate native plants while meeting the aesthetic needs of the campus, Chapman can consult with Orange County Coastkeeper. The

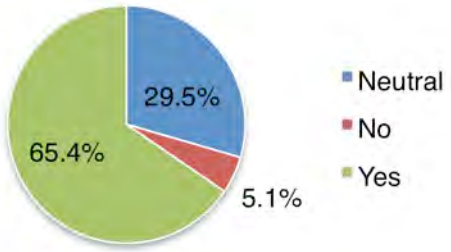

Figure 5.14. *"Do you support the use of native plants in Chapman's landscaping?" (n=1421)*

Coastkeeper Garden, located at Santiago Community College, displays several vignette gardens of varying design, using only native and "California Friendly" plants: plants that are low water use and either indigenous or naturalized without being invasive or damaging to the local environment (**Figure 5.15**). The organization also provides blueprints for homeowners and businesses trying to design their own unique garden (**Appendix 5.8.2**).

5.3.2 Plant Waste

In an average week, Chapman's landscaping produces about 40 cubic yards of plant waste, primarily a combination of tree leaves, shrub clippings, and turf waste. The plant waste is taken away by Agromin to a facility approximately 14 miles from the campus to be turned into mulch and resold to the public. Agromin makes an average of three trips to Chapman each month, costing $250 for each trip, or $9,000 a year. Red-bark mulch can be found around the campus, which Chapman purchases from Tierra Verde for $28 per cubic yard. Chapman purchases 75 cubic yards of bark three times a year. Each shipment costs $2,200 (including a minimum shipping cost of $200), or $6,600 a year.

Figure 5.15. *The Italian themed vignette at Coastkeeper Garden, with citrus trees, decomposed granite paving, and an entry trellis.*

Mulching

Mulch is a protective layer of material that is spread on top of soil. It protects soil from erosion, provides nutrients to plants as it decomposes, controls weeds, and improves the water retention of soil, keeping it moist. Mulch can be made from plant materials found on campus, such as leaves, grass clippings, and wood chips. The breakdown of organic material occurs over a period of time; plant waste can be turned into usable mulch in as little as three weeks, but a more realistic turnover period is two months. The time needed is dependent on how often the plant waste pile is mixed and watered and the temperature of the pile. Two local colleges have incorporated mulching facilities into their campuses for landscaping. Chapman could benefit from a similar practice to save money otherwise spent on Agromin and Tierra Verde services.

Mulching at Other Colleges

California State University, Fullerton, and Orange Coast College are known to mulch plant waste. The Fullerton Arboretum at CSU Fullerton maintains a compost pile that is used for gardens at the arboretum and lawns "surrounding the Titan Student Union, Student Recreation Center, and Children's Center" on the college campus (Environmental Advocacy). Its practice is similar to typical mulching (utilizing the green waste generated by the campus) but also includes the use of donated barley grain and horse manure, so it is referred to as a compost pile. The composting area is open to the air and approximately 17,424 square feet and produces 650 cubic yards of compost per year (**Figure 5.16**).

Figure 5.16. *Composting site at Fullerton Arboretum.*

Jonathan Davis, a biologist at the Fullerton Arboretum, manages the compost pile along with one or two student volunteers. One person spends approximately two hours each week maintaining the pile, which requires turning and watering a few times per week. Fullerton's facility uses a small, $32,000 tractor for turning the pile and a normal gardening hose for watering. Although not necessary, Davis recommended the use of a wood chipper to help speed up the turnover process.

Similarly, Orange Coast College collects and disposes all of its grass clippings, brush, tree pruning waste, and wood waste by mulching it in a 21,780 square foot area of the campus. Once a year a mobile grinding service is brought to campus to grind the plant waste and sort it into four desired textures from coarse to very fine.

5.3.3 Lawn Cover

Chapman University's Bert C. Williams Mall, the iconic grass lawn located in front of Memorial Hall, is one example of landscaping that requires continuous investments to maintain. In Southern California's Mediterranean climate, grass lawns require significantly more water. In addition to excessive water usage, the grass must be repaired at least once a year due to damage from foot traffic and campus events held on the lawn. The conversion of natural grass areas to an alternative lawn cover will reduce water usage and maintenance costs.

Based on its condition, Bert C. Williams Mall lawn is either re-sod or repaired, costing the university extra maintenance expenses excluded from basic maintenance practices. During years that it is re-sod, the extra maintenance of Bert C. Williams Mall costs $40,406 (2013 Audit). In the past 15 years, Bert C. Williams Mall lawn has been re-sod twice, costing approximately $80,812. Most years the lawn is repaired rather than re-sod and the maintenance per year ranges from $2,500-$7,500. This range depends on how much and what type of maintenance needs to be done based on a variety of factors, including weather, amount of use, damage to the lawn, etc. Excluded are the basic maintenance and labor costs associated with the lawn, as they are part of the university's overall landscape contract rather than a separate bid. Over the course of 15 years, Chapman has spent between $113,312 and $178,312 on Bert C. Williams Mall's extra maintenance alone, averaging $7,554-$11,887 per year.

Artificial Turf

One potential alternative to grass lawn cover is artificial turf replacement. Artificial turf requires periodic maintenance such as infill replacement, brushing of the turf, and removal of loose debris such as leaves and twigs. Smart Turf, a LEED qualified product of Catalina Home, is a type of artificial turf manufactured solely in the United States and has a lifetime warranty of 15 years. Compared to natural grass, minimal maintenance is required for Smart Turf. Currently, Bert C. Williams Mall is mowed on a weekly basis and treated with fertilizer and herbicide every six months. Artificial turf replacement would eliminate the need for mowing and fertilizer and herbicide application, thereby reducing maintenance and labor costs, plant waste, and chemical runoff.

The lawn's Rainbird sprinkler system is turned on for two 10-minute intervals every day, bringing Bert C. Williams Mall's estimated total water usage to 282,240 gallons per year, costing about $850 (See **Appendix 5.8.9** for calculation). Unlike other types of artificial turf, Smart Turf does not need to be watered. However, the turf is susceptible to stains, which can be easily removed with household detergent and water. Amy Word, a representative at Catalina Home, explained that rainfall is the easiest way to clean the turf, but due to the general lack of rain in Southern California, Smart Turf can be cleaned by "keeping a few sprinkler heads working and [running] them periodically" (SmartTurf).

A quote from INSTALL-IT-DIRECT from 2013 (**Appendix 5.8.5**) lists the installation and labor of artificial turf replacement cost as $128,122 (2013 Audit). The total cost of labor and installation of Smart Turf through Catalina Home and their installation partner Turf & Sport amounts to $113,851

(**Appendix 5.8.6, 5.8.7**). In addition, Chapman would be eligible for a two dollar per square foot rebate through the Municipal Water District of Orange County's Turf Removal Program. This program would save the university $36,864 (2013 Audit).

Although the installation of artificial turf requires large initial investment, the long-term savings offset the short-term expense. Two payback periods were calculated using a low savings estimate and a high savings estimate to give an average payback period of 6.6 years (**Table 5.2**). Year 1 of both low and high estimate savings factor in the one-time rebate of $36,864. For each following year, the low estimate savings for Bert C. Williams Mall is $8,404 and the high estimate savings is $12,737. Factored into the savings estimates are extra maintenance and water savings. (See **Appendix 5.8.10** for detailed savings calculation). The payback calculations exclude basic maintenance costs that would contribute to additional savings and further lower the payback period. This is because it is difficult to obtain Bert C. Williams Mall's exact basic maintenance expenses, as they are included in the university's overall landscaping maintenance contract. Additionally, the basic maintenance and water usage for Smart Turf were not calculated into the payback, as the exact costs could not be obtained. Smart Turf's product, however, requires very little maintenance and uses minimal water, so the values were assumed to be insignificant.

Table 5.2. *Payback period for artificial turf.*

	Low savings	High savings
Initial investment	$113,851	$113,851
Savings (year 1)	$45,250	$49,583
Savings (after year 1)	$8,404	$12,737
Payback (yrs)	**8.20**	**5.00**

In the 2014 Survey, students and faculty were asked, "If [Bert C. Williams Mall] were replaced with artificial turf, would this have a negative impact on the aesthetic beauty of campus?" (**Figure 5.17**). 42.9% of the respondents said "yes," 26.4% said "no," and the remaining 30.7% were "neutral." Those who responded "Yes, it would have a negative impact on the beauty of campus" were given the option to provide written feedback. Of the 610 students, faculty, and staff that opposed artificial turf replacement, 564 people provided reasons for their opposition. **Figure 5.18** shows the most common explanations against artificial turf. 36.3% were concerned with its fake look and feel, 27.3%

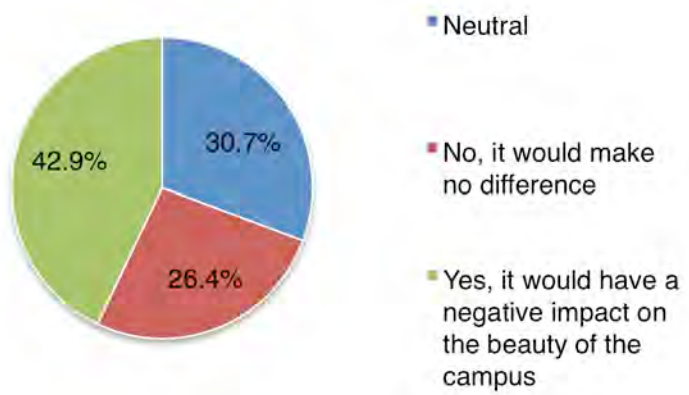

Figure 5.17. *"If [Bert C. Williams Mall] were replaced with artificial turf, would this have a negative impact on the aesthetic beauty of the campus?" (n=1421).*

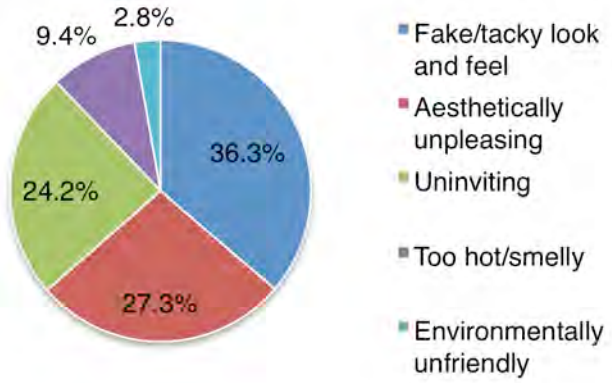

Figure 5.18. *The most common answers to "Yes, it would have a negative impact on the beauty of campus—Why?" (n=564)*

considered it aesthetically unpleasing, 24.2% considered it uninviting, 9.4% were concerned it would become too hot and smelly, and 2.8% considered it environmentally unfriendly. Given the nature of the responses, it appears that many complaints against artificial turf were more applicable to athletic fields that use synthetic turf.

Figure 5.19. *Sample of Smart Turf next to Bert C. Williams Mall's natural grass.*

Figure 5.20. *Sample of Smart Turf next to Wilson Field's athletic turf.*

A common misconception about artificial turf as a lawn cover is that it is comparable to the synthetic turf used on athletic fields. However, the materials that go into the production of Smart Turf versus the production of athletic turf are very different. Depending on the manufacturer, artificial turf can have different inputs. The main concern the Chapman community has with artificial turf is the fake look and feel, however, Smart Turf's products are designed to resemble a natural grass lawn. **Figure 5.19** shows a sample of Smart Turf next to Bert C. Williams Mall's natural grass, and **Figure 5.20** shows the same sample next to Wilson Field's athletic turf. The look and feel of the sample closely resembles the natural grass on Bert C. Williams Mall, rather than the turf on Wilson Field.

Wilson Field's artificial turf was manufactured and installed by Field Turf, a company that specializes in artificial turf for sports. Field Turf's product uses cryogenic rubber and silica sand. Cryogenic rubber is the "highest and rarest grade of rubber granule" and is "not easily obtainable" (Field Turf). Roughly 4% of a ground up rubber tire is "suitable for cryogenic rubber processing," and the production of "creating a cryogenic rubber granule requires a substantial amount of time and technical manipulation" (Field Turf).

Odor comes from the rubber infill that is used on athletic field turf. When exposed to the sun, rubber infill heats up and becomes susceptible to bacterial growth, which contributes to the noticeable odor some synthetic turf fields give off. Smart Turf uses Envirofill, an infill made of rounded sand grains rather than rubber. The sand used in Smart Turf's Envirofill is recycled content; it is "a byproduct from a process that mines sand for the oil industry" and can be recycled and reused after its lifetime on an artificial lawn (Smart Turf). Envirofill is Microban-infused, which means that it has "built-in antimicrobial protection that gives [the infill] an added level of protection against microbes such as stain and odor causing bacteria, mold, and mildew" (Smart Turf). Because Smart Turf's infill has antimicrobial protection and excludes rubber content, it is odorless.

2.8% of the written feedback expressed opposition to artificial turf because it is environmentally harmful. Smart Turf is environmentally friendly; it eliminates the use of lead and other hazardous waste heavy materials in its manufacturing. The turf itself is made from PE monofilament, and the backing uses both recycled materials from old fields and virgin materials made from woven polypropylene and polyurethane (Smart Turf). As previously mentioned, the infill is manufactured from recycled content, and should be recycled rather than dumped in the landfill.

Another common argument against artificial turf is that it can get very hot when the weather is warm. To get an idea of how hot artificial turf gets in the sun, a Smart Turf sample was placed in

direct sunlight on a day of 70°F for 1 hour. The temperature of the sample was taken every 15 minutes until it reached an equilibrium temperature of 127°F. The average temperature of grass lawn in the same area was 90°F.

Other Alternatives

5.7% of students, faculty, and staff who provided written responses in opposition to artificial turf provided constructive feedback. 100% of these responses expressed that, while they did not like the idea of replacing Bert C. Williams Mall lawn with artificial turf, they would support an alternative, organic ground cover.

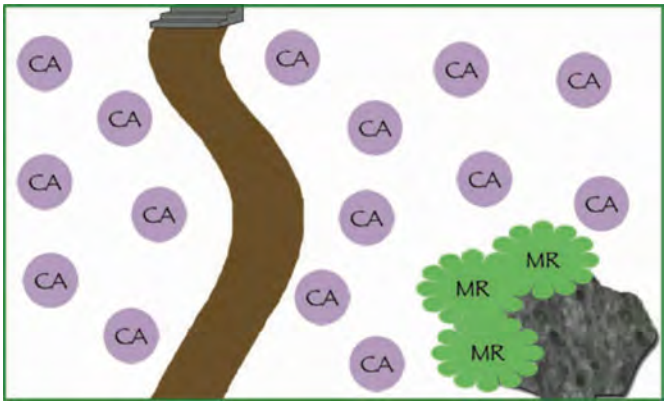

Figure 5.21. *"Lawn Replacement #1: Ground Covers and Grasses," from Yerbabuenanursery. CA - Ceanothus gloriosus 'Anchor Bay,' MR - Muhlenbergia rigens.*

Figure 5.22. *Bishops weed.*

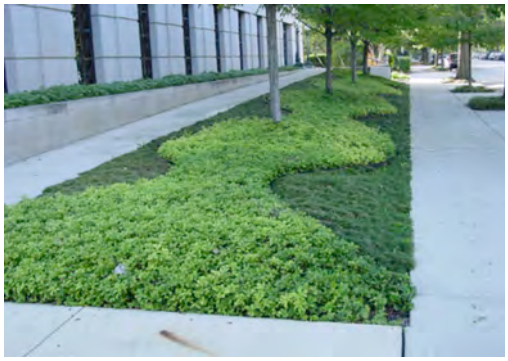

Figure 5.23. *Juniper.*

The Yerba Buena Nursery provides lawn replacement layouts using plants that are native to California. One option is "planting [the] broad area with one or two varieties of groundcover" (**Figure 5.21**) (Lawn Alternatives Used). Perennial groundcovers, once established, require minimal maintenance. Due to the nature in which they spread outwards rather than upwards, groundcovers eliminate the need for mowing. To prevent the groundcovers from growing beyond the boundary, a low brick edge barrier can be used to contain them. Furthermore, they act as mulch for the soil and drive out weeds, rendering fertilizer and herbicide application unnecessary (Lawn Alternatives 2012). It is important to note that groundcovers only require weeding and mulching maintenance within the first year of planting (Lawn Alternatives 2012). Common perennial groundcover species include: alyssum, tapien, cotoneaster, bishops weed (**Figure 5.22**), and juniper (**Figure 5.23**).

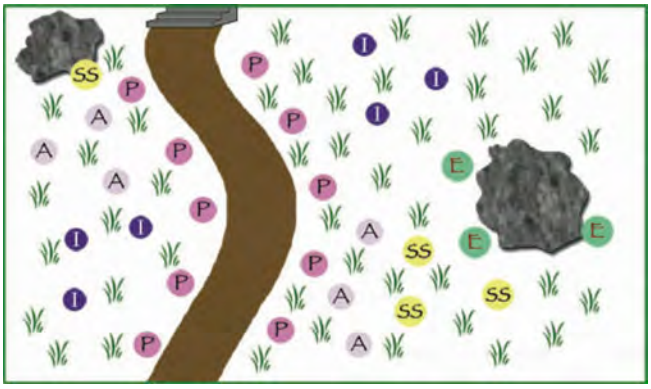

Figure 5.24. *"Lawn Replacement #2: Meadow with Small Grasses and Colorful Perennials," from Yerbabuenanursery. A - Achillea millefolium, E - Epilobium canum (grass) - Festuca 'Siskiyou Blue,' I - Iris douglasiana, P - Penstemon heterophyllus 'Margarita BOP', SS - Solidago sp.*

Another popular alternative is planting a native meadow garden, a combination of native grasses and perennial flowers (**Figure 5.24**). Warren Wilson College's Landscaping Crew in South Carolina conducted the Native Grass and Wildflower Project, with a goal to "replace campus turf grass with low-input, aesthetically beautiful and biologically diverse meadows that create important native wildlife habitat and demonstrate a sustainable solution to turf management" (Warren 2011). WWC has successfully replaced turf areas

with native grass meadows and wildflowers. Although WWC is located in South Carolina and alternatives are somewhat dependent on geographical climate, the project demonstrates the feasibility of incorporating lawn alternatives in college campus landscaping. Converting Bert C. Williams Mall lawn to a native meadow garden, however, would pose complications for Chapman events that take place in that area.

Figure 5.25. *Native sedge grass.*

The City of Santa Monica's Office of Sustainability and the Environment compiled a list of climate-appropriate ground covers that would reduce water usage by 50-70% (Ackerman). Native sedge grasses (**Figure 5.25**) require little water and only need to be mowed one or two times per year, while yarrow species (**Figure 5.26**) can be mowed every six weeks. Moreover, ornamental grass species (**Figure 5.27**) are drought-resistant and rarely require fertilizer and herbicides (Ackerman).

5.4 Concluding Assessment

5.4.1 Areas of progress

A few areas on campus, such as the Cypress Street Schoolhouse and the Fish Interfaith Chapel, have incorporated native plants into the existing landscape. Chapman University switched from Rainbird sprinkler systems to more efficient drip sprinkler systems in select areas. Additionally, the installation of a weather-based sprinkler system is anticipated in Summer 2014.

Figure 5.26. *Yarrow grass species.*

5.4.2 Areas in which to improve

Plants on Campus

8,582,652 gallons of water were used in 2013 for landscaping around academic buildings, costing $27,145 (See Chapter 1). Watering of non-native plants on campus must occur on a daily basis, which contributes to the high water usage. The majority of students, faculty, and staff would support greater integration of native plants (**Figure 5.14**) and found many of the species quoted to be aesthetically pleasing (**Table 5.1** in **Appendix 5.8.1**). **Table 5.1** also shows the costs of each native and non-native plant rated in the 2014 Survey.

Figure 5.27. *Ornamental grass.*

Mulching

Although the current disposal practice recycles Chapman's plant waste into mulch, the frequent trips to and from the campus to Agromin's mulching facility contribute to carbon dioxide emissions. Additionally, Chapman buys red-bark mulch, which must be shipped to the campus. Creating an on-campus mulching facility could eliminate both the monetary and environmental costs of these practices.

Lawn Alternatives

The repair of Bert C. Williams Mall lawn is a continuous investment. Grass lawns require more water in an environment prone to drought conditions. Events and foot traffic also cause damage to the lawn, demanding yearly repair and contributing to extra maintenance fees.

5.4.3 Existing gaps in knowledge

The exact basic maintenance costs for Bert C. Williams Mall are unknown because they are included in Chapman's overall landscaping maintenance contract. In addition, the exact amount of money spent on existing plants on campus was unobtainable.

5.5 Recommendations

5.5.1 Low cost/effort

Seasonal Color Changes

- Reduce plant replacement from four times a year to three.

Annual plant replacement occurs four times a year and costs approximately $29,400, not including watering and fertilizing costs, so reducing plant replacement frequency would cut plant and maintenance costs by approximately a fourth, or $7,350. Only 30.2% of people surveyed found annual plant replacement to be an important use of Chapman's resources (**Figure 5.28**) (2014 Survey). If there was concern over the aesthetic look of the seasonal plant species after three months, different plant species could be used in place of the existing plants. Stakeholders in this decision would include the Marketing Department, Facilities Management, and Campus Planning, who would have to approve the policy change.

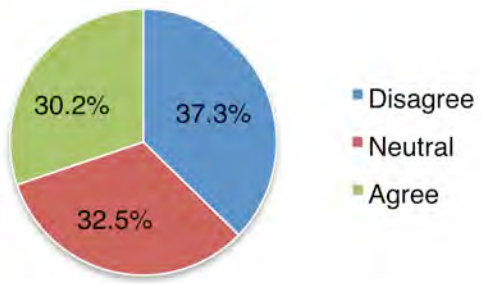

Figure 5.28. *"The replacement of annual plants is an important use of Chapman's resources." (n=1421)*

Educate the Chapman Community

- Education of alternative practices.

Considering the feedback regarding the replacement of Bert C. Williams Mall with artificial turf, education on the functions, benefits, and costs of artificial turf and the differences between artificial and athletic turf is needed to help the community make well-informed decisions on the matter. The community would also benefit from information regarding proper and improper gardening practices and the environmental, resource, and monetary costs associated. Student organizations on campus, such as Student Government Association and Mission Environment, should hold a series of seminars to educate students, faculty, and staff about landscaping alternatives and practices.

5.5.2 Moderate cost/effort

Recommended Plant Palette

- Revise the Recommended Plant Palette so that at least 50% of its recommended species are Southern California native.

Of the 44 species listed in the Recommended Plant Palette of the Master Landscape Plan, only 3 (7%) are native to California. The remaining species possess varying levels of drought resistance. Phasing out non-native and drought intolerant species would help reduce yearly maintenance, watering, and replacement costs, as native species generally produce less plant waste, require less water to grow and, due to their adaptation to California's climate, live longer. See **Appendix 5.8.8** for a list of current plant palette species, recommended native species, and their estimated costs.

Chapman's geographical location, average fluctuations in temperature, and average sunlight availability should also be taken into consideration when selecting species to maximize growth potential and lifespan. Each new species would have to be approved by a landscaping architect, Campus Planning, and the Marketing Department to ensure that it meets cost and asethetic standards. The campus plant-watering schedule would have to be adjusted in areas with native plants, as they do not require daily watering after establishment. Designing specific gardens that use only native plants would simplify the schedule change to specific areas. Orange County Coastkeeper has several garden layouts from which to draw design and planning ideas (**Appendix 5.8.2**).

5.5.3 High cost/effort

Lawn Replacement

- Replace area(s) of lawn with artificial turf or an alternative lawn cover.

The replacement of Bert C. Williams Mall would reduce water usage, plant waste, and damage due to foot traffic, which would reduce the overall yearly maintenance costs for this area. Based on survey feedback and the need for a large location for hosting special events, replacement is unlikely. The area is used for special events such as commencement ceremonies and American Celebration, an annual fundraising event. It would be difficult to find an area of equivalent size and slope to relocate these events to, given the limited size of the campus. However, smaller parcels of lawn located throughout the campus that serve only an aesthetic purpose would be viable for conversion using one or more of the lawn alternatives discussed in **Section 5.3.3**. A survey of campus landscaping was conducted and ideal conversion areas are shown in **Appendix 5.8.12**. Maintenance costs of these areas would become insignificant. Replacing smaller, less inhabited areas of lawn first

can act as a proving ground for artificial turf use in larger areas of campus. During this conversion, the Student Government Association could provide outreach to the Chapman community regarding artificial turf and its associated benefits.

- Relocate Chapman events that are held on Bert C. Williams Mall.

This would reduce the foot traffic damage, thereby lowering the rate of repair and maintenance costs associated. American Celebration, commencement ceremonies, and other campus events could potentially be relocated to the Attallah Piazza, which is of comparable size to Bert C. Williams Mall. Alternatively, the Musco Center for the Arts, currently under construction, will have a large area in front that could serve as a new location. Stakeholders in this decision would include key individuals involved with event planning and the Board of Trustees.

Mulching

- Construct a Chapman facility dedicated to mulching.

Based on the observed practices and benefits of mulching at Orange Coast College and the Fullerton Arboretum at CSU Fullerton, Chapman could eliminate the costs of transporting plant waste off campus and purchasing fertilizer and mulch for use in landscaping by mulching its own plant waste.

It was more feasible for Fullerton to integrate mulching and composting into their facilities because the arboretum was preexisting with space readily available. Chapman would have to locate a 22,000 square foot area to contain its plant waste. Approval of the mulching site would have to be gained from the City of Orange, but the university's Specific Plan would allow for it. There is concern about disrupting Chapman's neighbors, but mulching plant waste does not have the sanitation, vermin, and odor problems that food composting does.

Based on Fullerton's practices, the weekly maintenance required would be minimal. The purchase of a $32,000 tractor would be paid back in 2.1 years, assuming the elimination of Agromin and Tierra Verde services. (See **Appendix 5.8.11** for calculation). Further costs such as a wood chipper are optional. Someone would also need to be designated to maintain the mulching pile each week, but student volunteers could assist with this.

5.5.4 Future areas of research

Future research should include an evaluation of the costs and characteristics of each individual plant species currently listed in the Master Landscape Plan. This will enable a comparison of costs, including water resources required, with native and drought-resistant plant species.

It would also be beneficial to research additional lawn cover alternatives. Aside from those mentioned in this chapter, there are many alternatives that could potentially work on Chapman's campus.

5.6 Contacts

Dr. Christopher Kim, School of Earth and Environmental Sciences, Chapman University (cskim@chapman.edu, 714-628-7363)
Mackenzie Crigger, Energy Conservation and Sustainability Manager, Chapman University (crigger@chapman.edu, 714-628-7370)
Dr. Jennifer Funk, School of Earth and Environmental Sciences, Chapman University (jlfunk@chapman.edu, 714-744-7953)

Ken Murai, Director of Campus Design, Chapman University (murai@chapman.edu)
David Contreras Jr., Associate Account Manager, Valley Crest (dcontreras@valleycrest.com, 714-546-7843)
Joe Cotroneo, Operations Manager, Valley Crest (jcotroneo@valleycrest.com, 949-939-4392)
Ed Blatchford, Associate Director of Facilites, Chapman University (blatchfo@chapman.edu, 714-628-6658)
Cindy Graves, Facilities Business Manager, Chapman University (cgraves@chapman.edu, 714-628-6575)
Behrooz Esfandiari, Campus Planner, Chapman University (esfandia@chapman.edu, (714) 744-7838)
Austin Brown, Project Manager, Orange County Coastkeeper (austin@coastkeeper.org, 562-502-0846)
Amy Word, Sales Manager, Catalina Home (aword@catalinahome.com, 800-421-6723)
Mike Alexander, Installer, Turf and Sport (mike@foreverlawnaz.com, 480-726-2411)
Jeff Sholk, INSTALL-IT-DIRECT (jeff@installitdirect.com, 760-212-6577)
Jonathan Duffy Davis, California State University, Fullerton (jdavis@fullerton.edu, 657-278-3407)
Gregory T. Dyment, Director of Fullerton Arboretum, Cal State University, Fullerton (gdyment@fullerton.edu, 657-278-3250)
Anne Krieghoff, Facilities Manager, University of California, Irvine (akriegho@uci.edu, 949-824-9097)
Jennifer Le, Senior Planner & Environmental Review Coordinator, City of Orange Community Development Department (jle@cityoforange.org, 714-744-7238)

5.7 References

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5.8 Appendices

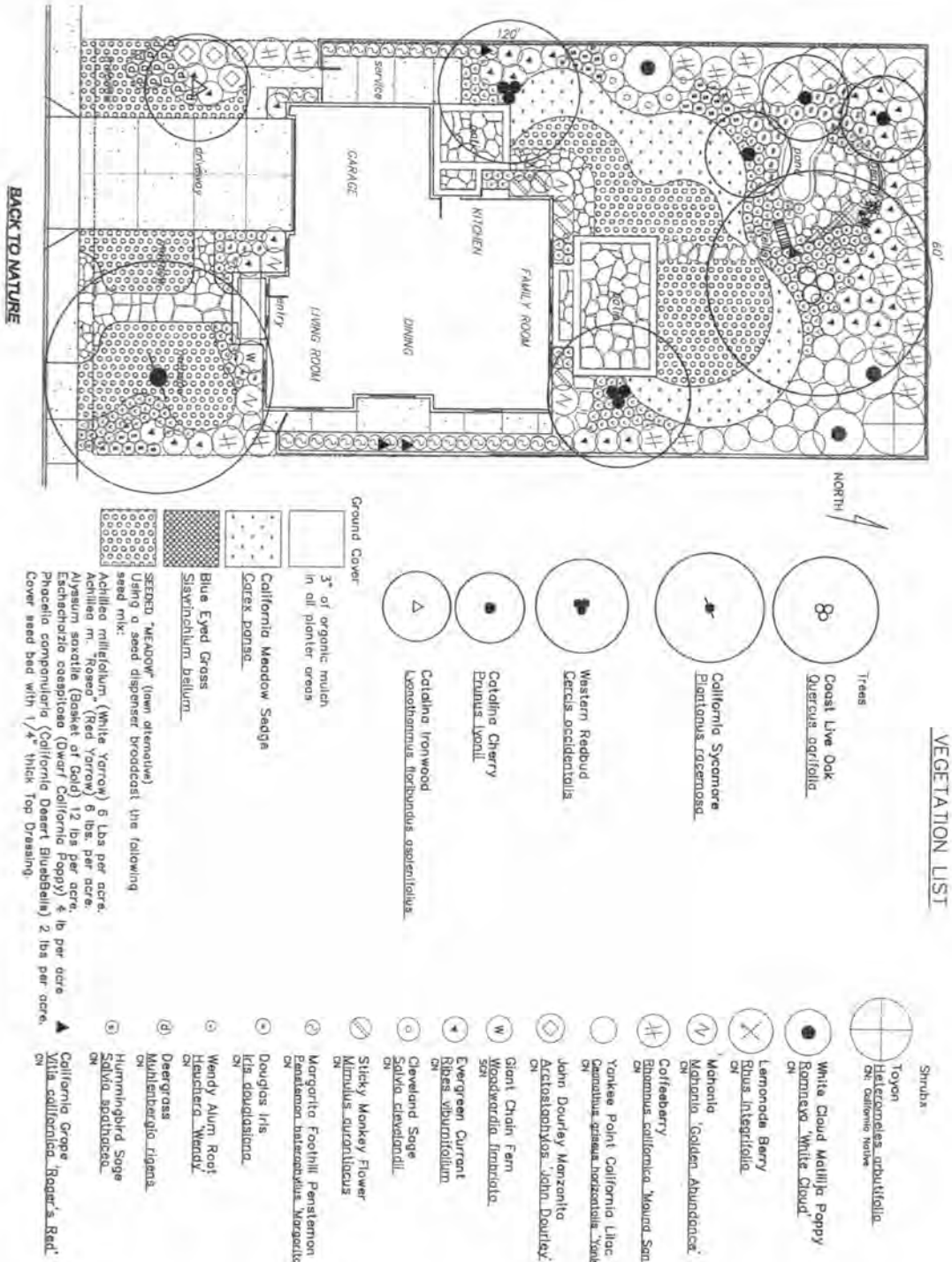
5.8.1 Plant Aesthetic Survey Results

Table 5.1. *The 2014 Survey queried students, faculty, and staff about the aesthetic beauty of 10 non-native plants found on campus and 10 native plants that could be incorporated into campus landscaping. Included is the estimated price for each plant. (n=1421)*

Plant	Native/Non-native	Pleasing	Neutral	Unpleasing	Price (per 1 gallon container)
Iceberg Roses	Non-native	80.9%	12.8%	6.3%	$9.98
Purplehead	Native	79.5%	15.0%	5.6%	$3.80
Woolly Blue Curls	Native	77.6%	14.9%	7.5%	$6.05
Bougainvillea	Non-native	70.9%	17.2%	11.9%	$4.65
Common Yarrow	Native	70.9%	20.8%	8.4%	$3.25
Tulip Poppy	Native	69.6%	19.2%	11.2%	$4.55
Ivy geraniums	Non-native	68.5%	20.0%	11.5%	$4.65
Bluehead Gilia	Native	66.5%	22.0%	11.5%	$8.00
Indian Hawthorn	Non-native	65.7%	21.5%	12.9%	$11.15*
Western Redbud	Native	61.4%	21.3%	17.2%	$4.10
Pansies	Non-native	54.9%	23.6%	21.5%	$2.35
Birds of Paradise	Non-native	54.1%	23.9%	22.0%	$4.65
Hong Kong Orchid tree	Non-native	53.9%	26.3%	19.8%	$15.00
Primrose	Non-native	53.8%	26.5%	19.7%	$10.60*
Toyon	Native	51.4%	25.7%	22.9%	$3.25
Autumn Sage	Native	46.0%	28.2%	25.8%	$3.45
Desert Marigold	Native	41.7%	24.8%	33.6%	$4.95
Golden Yarrow	Native	38.6%	31.0%	30.3%	$3.80
Mock Orange	Non-native	31.1%	31.2%	37.7%	$4.30
English Holly	Non-native	22.4%	27.2%	50.5%	$5.15

*Price per 5 gallon container

5.8.2 Orange County Coastkeeper Sample Native Garden Blueprint



5.8.3 RECON Native Plants, Inc. Quote

Chapman University

One University Dr.
Orange, CA 92866

REQUEST FOR QUOTE

TO:
SALES
RECON Native Plants
1755 Saturn Blvd.
San Diego, CA 92154
P (619) 423-2284
F (619) 423-0632

SHIP TO:
Chapman University
One University Dr.
Orange, CA 92866

DATE	CONTACT	SHIPPED VIA	NEEDED BY	JOB #
March 27, 2014	Nicholas Marino			

QTY	UNIT	DESCRIPTION	UNIT PRICE	NOTES
50	1 gallon	Achillea millefolium	3.25	
50	1 gallon	Cercis occidentalis	4.25	
25	FT	Dichelostemma capitatum	N/A	
50	1 gallon	Eriophyllum confertiflorum	5.25	
50	1 gallon	Heteromeles arbutifolia	3.25	
50	1 gallon	Salvia greggii	N/A sub. Gambelia speciosa	
25	FT	Trichostema lanatum	4.25	
			N/A sub Salvia clevelandii 'Winifred Gilman' 4.25	
			SUBTOTAL	
			SALES TAX	
			SHIPPING & HANDLING	125$
			OTHER	
			TOTAL	

5.8.4 Tree of Life Nursery Quote

TREE OF LIFE NURSERY
P.O. Box 635, San Juan Capistrano, CA
Tel (949) 728-0685 Fax (949)
CaliforniaNativePlants.com

QUOTE # 30236

Attn: **Nicholas Marino**

Sold To: **Chapman University**
One University Drive
Orange, CA 92866

Ship To: **Chapman University**
33201 Ortega Highway
San Juan Capistrano, CA 92675

Phone: **714/744/7953** Fax:

Account Number	Quote Date	Ship Via	Job Name	Page
CHAUNI	**03/28/14**		**Chapman ES&P RFQ**	**1/1**

Date Expires	Salesperson	Terms
04/27/14	**Junior Rodriguez**	**C.O.D.**

Qty	Item # /Size	Description	Unit Price	Ext. Price
50	ACHI_MILL.-.1G	Achillea millefolium, -, 01 Gal	3.80	190.00
50	BAIL_MULT.-.1G	Baileya multiradiata, -, 01 Gal	4.95	247.50
50	CERC_OCCI.-.1G	Cercis occidentalis, -, 01 Gal	4.10	205.00
25	DICH_CAPI.-.RP	Dichelostemma capitatum, -, Liner/Rose Pot	1.15	28.75
50	ERIO_CONF.-.1G	Eriophyllum confertiflorum, -, 01 Gal	3.80	190.00
50	HETE_ARBU.-.1G	Heteromeles arbutifolia, -, 01 Gal	4.25	212.50
50	HUNN_FUMA.-.1G	Hunnemannia fumariifolia, -, 01 Gal	4.55	227.50
50	SALV_GREG_RED.-.1G	Salvia greggii (red), -, 01 Gal	3.45	172.50
25	TRIC_LANA.-.1G	Trichostema lanatum, -, 01 Gal	6.05	151.25

Notes

Sale Amount	1,625.00
Sales Tax	130.01
Total	1,755.01

CHAPMAN UNIVERSITY

Re: Availability Request No. VDP0KW / Chapman University

1 message

TOLN Quotes IMAP <quotes@californianativeplants.com> Mon, May 5, 2014 at 8:18 AM

Nicholas,

Thank you for your inquiry, from your list we can only have for the Dichelostemma capitatum 1 gallons $3.80

Junior Rodriguez

Tree of Life Nursery
33201 Ortega Highway
San Juan Capistrano, CA 92675
949/728/0685

UPCOMING Events & Speakers

http://www.californianativeplants.com/index.php/retail/event-calendar/calendars/1-3-4

On May 4, 2014, at 3:49 PM, Nicholas Marino wrote:

> Nicholas Marino has requested plant availability information.
>
> **Submission ID:** VDP0KW
>
> ---
>
> **Customer Information:**
>
> **Nicholas Marino**
> **Chapman University**
> **One University Drive**
> **Orange, CA 92866**
> **Phone: | Fax: | Mobile:**
>
> **Existing Customer:** No
>
> ---
>
> **Job/Plant Information:**
>
> **Job location:**
>
> Chapman University
> One University Drive
> Orange, CA 92866
>
> **Job Number:** Chapman ES&P RFQ

5.8.5 Bert C. Williams Mall Lawn Artificial Turf Quote (2013)

INSTALL IT DIRECT

Estimate

DATE: 4/10/2013

CUSTOMER:

Kellie Stump / Ph: (925) 323-3149 / stumo102@mail.chapman.edu
333 Glassell Street, Orange, CA.

DESCRIPTION	INVESTMENT
Remove grass, grade dirt, compact sand and install 19,263 square feet of Sierra or Everglade Fescue Light	$165,750.00

OTHER COMMENTS

Hi Kellie...I reviewed the install location at the college twice, and I pushed to give you the lowest possible price and I included every discount that we offer. After reviewing the bid...call me with any questions that you might have. [the synthetic turf that I selected has the specific qualities that the location will require...the blades have a "W" shape with spines at every angle...this will allow the turf to spring back up as the grass gets walked on. We also use green sand instead of the black rubber that heats up the grass and sticks to everything!] The lawn area will look amazing as the turf I selected looks "very natural". Best Regards...Jeff

SUBTOTAL	$165,750.00
20% Discount	$33,150.00
Cash/Check Discount	
Referral Discount	$3,978.00
Avail. Dates Offer(500-999 Pavers)	$0.00
Avail. Dates Offer (1000+ Pavers)	$500.00
INVESTMENT	**$128,122.00**

Make all checks payable to:
INSTALL-IT-DIRECT, INC.

This is not a contract. INSTALL-IT-DIRECT reserves the right to withdraw this estimate at any time.
Should you choose to accept this estimate, please sign below and return via email or fax (858-270-0788)
A formal contract will be sent.

If you have any questions about this estimate, please contact
your design consultant or our office at 858-925-3000

Thank You For Your Consideration and We Look Forward To Working With You!

Accepted:		Date:	4/10/2013

INSTALL-IT-DIRECT, INC. | 5580 La Jolla Blvd. #188 La Jolla, Ca 92037

Office: 858-925-3000 | Fax: 858-270-0788
www.installitdirect.com

5.8.6 Bert C. Williams Mall Lawn Artificial Turf Quote (2014)

CATALINA HOME

14418 Best Avenue * Santa Fe Springs, CA 90670
Phone (800) 421-6723 FAX (562) 404-3925

Pro-Forma **INVOICE** Page 1 of 1

Account No.	Sales Rep.	Invoice Date	Invoice No.
27933	02	4/03/14	514135-01

SOLD TO:
CHAMPMAN UNIVERSITY
QUOTE-MEMORIAL LAWN
CA 90670

SHIP TO:
CHAPMAN UNIVERSITY
MEMORIAL LAWN
CA 90670

Please Remit to:
CATALINA HOME
14418 BEST AVENUE
SANTA FE SPRINGS, CA 90670

Terms	Customer P.O.	Side Mark	Shipped VIA
NET CBD CASHIER'S			PPD & ADD OT - L.A./SAN GABR.V

Roll Number	Description Style Name/Color Name	Dyelot No.	Length Feet Inches	Square Ft./Each/Yd.	Unit Price Ft./Each/Yd.	$ Amount
99999-99-99	BAYSI BAYSIDE-TURF		1536' 0"	18,432.00	1.99	36,679.68
ID#	001 LIME			2,048.00	17.91	
	Sub Total					36,679.68
	*** Made in U.S.A. ***					
	Freight Amount					130.00
	Tax Amount 9.000%					3,312.87
	Invoice Total					40,122.55

Purchaser agrees to pay any and all costs which may reasonably be incurred in the collection of this invoice, including but not limited to attorney's fees. Prices are subject to change without notice. Any claims for return, replacements, credits or allowances must be made not later than 10 days after receipt of merchandise by purchaser, and in no event will be allowed without prior authorization. Dealer waives all claim rights if cutting or installation is made on goods with visible defects.

5.8.7 Bert C. Williams Mall Lawn Artificial Turf Installation Quote (2014)

TURF & SPORT

2223 W. Pecos Rd. #2
Chandler, AZ 85224
ROC205797

Phone 480-726-2411
Fax # 480-726-2468

Quote

Date	Quote #
4/9/2014	4272

Name / Address	Job Site
Chapman University Sophie Gantz One University Drive ORANGE, CA 92866	Bert Williams Mall Lawn

____Reflections from tinted windows/glass top tables, etc. can create a magnifying affect and melt grass and is NOT covered under the Manufacturer's Warranty.

Rep	Job
MA	

Qty	Item	Description	Price	Total
18,432	installation	Installation of customer supplied SmartTurf *Pricing includes sod removal, grass kill, capping irrigation valves, compacted base material, 2.5lbs sqft of sand/rubber infill, professional installation with glued seems*	4.00	73,728.00

Subtotal	$73,728.00
Sales Tax (0.0%)	$0.00
Total	$73,728.00

Due to pricing considerations, the quote can only be guaranteed for 60 days. T & S is not responsible for damage to any electrical/ irrigation systems not installed to code. Signature changes this quote into a binding agreement.50% DEPOSIT IS REQUIRED PRIOR TO SCHEDULING. Any unpaid balance is subject to 18% finance charge monthly. Disclaimer:T & S would like to disclose that in this climate the grass does get hot in direct sunlight, although is does not retain or radiate any heat. Although we pretreat the ground prior to installation, we can not guarantee that natural grass/weeds will not work their way through the base. *There is going to be maintenance on the homeowners part to keep grass washed when there are pets involved to eliminate any possibility of odors. Reflections from tinted windows/glass top tables can create a magnifying affect and melt Grass.Laying Down or Matting of Fibers and Discoloration due to material build up on fibers is considered normal wear and tear.

_____

Customer Signature

5.8.8 Current Palette Species and Recommended Native Plant Replacements

Plant Species	Native/Non-native	Price (per 1 gallon container)
Pansies***	Non-native	$2.35
Achillea millefolium (Common Yarrow)	Native	$3.25
Heteromeles arbutifolia (Toyon)	Native	$3.25
Salvia greggii (Autumn Sage)	Native	$3.45
Erigeron glaucus 'Sea Breeze'	Native	$3.50
Hedera helix ‘Hahnii’ (“Hahn’s Ivy”)	Non-native	$3.75
Dichelostemma capitatum (Purplehead)	Native	$3.80
Eriophyllum confertiflorum (Golden Yarrow)	Native	$3.80
Cercis occidentalis (Western Redbud)	Native	$4.10
Buxus microphylla japonica (Green Beauty Boxwood)	Non-native	$4.30
Ligustrum japonicum 'Texanum'	Non-native	$4.30
Mock Orange***	Non-native	$4.30
Salvia clevelandii "Winnifred Gillman"	Native	$4.30
Salvia microphylla	Native	$4.30
Sambucus mexicana	Native	$4.30
Hunnemannia fumariifolia (Tulip Poppy)	Native	$4.55
Xylosma congestum (“Xylosma”)	Non-native	$4.65
Osmanthus fragrans	Non-native	$4.65
Prunus caroliniana (“Carolina Cherry”)	Non-native	$4.65
Baileya multiradiata (Desert Marigold)	Native	$4.95
Ceanothus griseus horizontalis 'Yankee Point'	Native	$5.00
English Holly***	Non-native	$5.15
Ophiopogon spp.	Non-native	$5.15
Rhamnus californica (Coffeeberry)	Native	$5.15
Vinca major (Periwinkle)	Non-native	$5.75
Trichostema lanatum (Woolly Blue Curls)	Native	$6.05
Epilobium canum	Native	$6.50
Encelia californica	Native	$7.99
Lupinus bicolor	Native	$7.99
Phacelia campanularia	Native	$7.99
Gilia capitata (Bluehead Gilia)	Native	$8.00
Iceberg Roses***	Non-native	$9.98
Primrose***	Non-native	$10.60*
Rhus integrifolia (Lemonadeberry)	Native	$14.00*
Hedera helix (English Ivy)	Non-native	$15.50*
Rosa minutifolia	Native	$19.50
Camellia japonica (“Camellia”)	Non-native	$34.25*
Pinus canariensis (“Canary Island Pine Tree”)	Non-native	$47.00**
Jacaranda mimosifolia	Non-native	$49.50**
Koelreuteria paniculata (“Golden Rain Tree”)	Non-native	$49.50**

Schinus molle (Peruvian Peppertree)	Non-native	$49.50**
Magnolia grandiflora ("Southern Magnolia")	Non-native	$51.25**
Pyrus kawakamii ("Evergreen Pear")	Non-native	$54.15**
Liquidambar styraciflua 'Burgundy' ("Sweet Gum")	Non-native	$57.00**

*Price for 5 gallon container
**Price for 15 gallon container
***Not officially listed in plant palette but found on campus

5.8.9 Water Usage of Bert C. Williams Mall

$$14 \text{ sprinklers} \times \frac{3 \text{ gal}}{\text{min}} \times \frac{20 \text{ min}}{\text{day}} \times \frac{7 \text{ days}}{\text{week}} \times \frac{4 \text{ weeks}}{\text{month}} \times \frac{12 \text{ months}}{\text{year}} = \mathbf{282{,}240 \text{ gal/year}}$$

$$\frac{282{,}240 \text{ gal}}{\text{year}} \times \frac{\text{hcf}}{748 \text{ gal}} \times \frac{\$2.25}{\text{hcf}} = \mathbf{\$848.98}$$

5.8.10 Savings for Artificial Turf

Calculation for low and high estimate savings for first year of artificial turf payback period.

	Low estimate	**High estimate**
Extra maintenance	$7,554.13	$11,887.47
Water savings	$850	$850
Rebate ($2/ft^2)	$36,846	$36,846
Savings	**$45,250.13**	**$49,583.47**

Calculation for annual low and high estimate savings after first year.

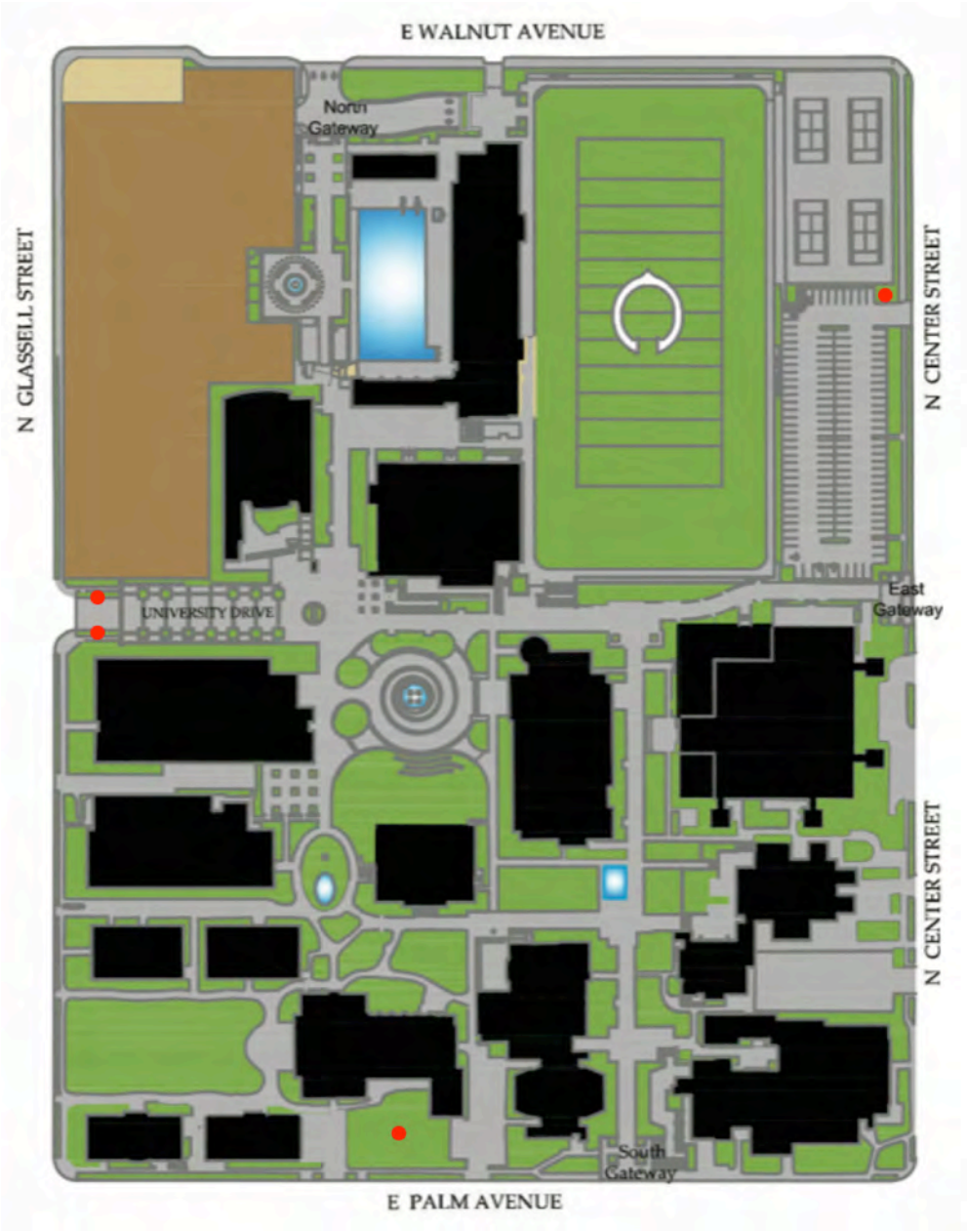
	Low estimate	**High estimate**
Extra maintenance	$7,554.13	$11,887.47
Water savings	$850	$850
Savings	**$8,404.13**	**$12,737.47**

5.8.11 Payback for Tractor

Agromin savings	$9,000
Tierra Verde savings	$6,600

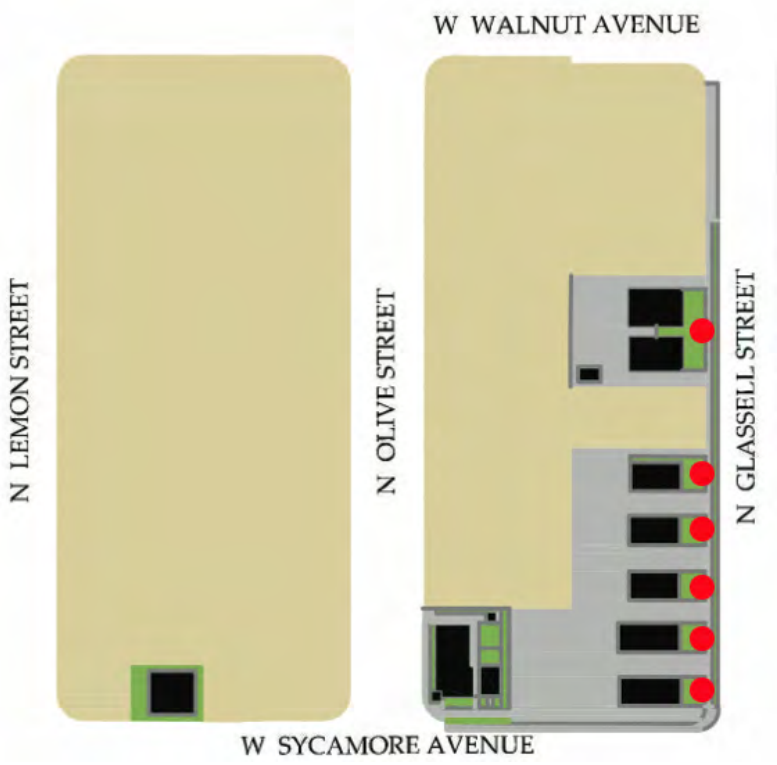
Initial investment	$32,000
Total yearly savings	$15,600
Payback (yrs)	**2.1**

5.8.12 Areas of Lawn Ideal for Conversion



Lawns on the main Chapman campus that could be replaced with artificial turf or an organic lawn cover.

Lawns around the Residence Halls on the Chapman campus that could be replaced with artificial turf or an organic lawn cover.



Chapman offices with lawns that could be replaced with artificial turf or an organic lawn cover.

Lawns at Dale E. Fowler School of Law and Leatherby Entrepreneurship Village that could be replaced with artificial turf or an organic lawn cover.

About the Authors

Tyler Anthony, ES&P Class of 2014 (Residential Buildings) is in the Earth Systems track with a minor in Sociology. His interests in the field include Environmental Geology and the anthropogenic effects on the variety of Earth's systems. Given his previous research in Environmental Geochemistry and Earth Systems background, he plans to narrow down his interests as he looks to apply to graduate school in the near future.
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