



Marana Farm

Revisioning, Participatory Process and Design



Marana Heritage Farm

Credits



The information in this report is intended as guidance for the Community Food Bank and the Marana Farm, in informing decisions related to this project. The research, evaluation, and recommendations were achieved to the best knowledge and judgment of Drachman Institute staff, students, and faculty, and are subject to verification by the Community Food Bank and the Marana Farm or other parties prior to implementation of any action.

All photos, renderings, drawings, charts or other content were taken or generated by Drachman Institute staff unless otherwise cited.

The Drachman Institute is the research-based outreach arm of the College of Architecture and Landscape Architecture (CALA) at The University of Arizona dedicated to environmentally-sensitive and resource-conscious planning and design with a focus on underserved and vulnerable communities. We engage students, staff, faculty, and citizens as an interdisciplinary collaborative striving to make our communities healthier, safer, more equitable, and more beautiful places to live. We embrace a service-learning model of education serving the needs of communities while providing an outreach experience for students as a fundamental educational goal consistent with the mission of CALA and The University of Arizona.

Drachman Institute

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Communities Putting Prevention to Work (CPPW) is a national initiative of the Centers for Disease Control and Prevention (CDC), funded by the the American Recovery and Reinvestment Act of 2009 and the U.S. Department of Health and Human Services.

The goal of CPPW is to prevent or reduce the spread of obesity and related diseases by increasing opportunities for improved nutrition and active living, via policy, systems and environmental change.

Pima County was one of 44 communities nationwide that received funding for the CPPW grant. CPPW is being developed and administered by the Pima County Health Department, in partnership with Activate Tucson, a coalition advocating healthy eating & active living.

The Drachman Institute, serving as the Built Environment Team, is one of seven partner organizations. Other partners include:

- The YMCA of Tucson and Southern Arizona;
- The Community Food Bank;
- PRO Neighborhoods;
- The United Way of Tucson & Southern Arizona;
- The Carondelet Health Network;
- Drachman Institute (College of Architecture and Landscape Architecture);
- College of Public Health, and the Center for Physical Activity and Nutrition.

Made possible by funding from the Pima County Health Department via the U.S. Department of Health and Human Services.

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Introduction



Introduction

Project Context & Summary

In August 2010, the Marana Farm approached the Drachman Institute about updating its master plan to reflect the current mission to increase educational, outreach, and demonstration opportunities at the farm, becoming a “flagship” center and destination for the surrounding community and entire county.

The goal of the Communities Putting Prevention to Work grant (CPPW) is to prevent and reduce the spread of obesity and related chronic diseases by increasing opportunities for improved nutrition and active living via policy, systems and environmental change.

Drachman Institute, as the Built Environment Team for CPPW, is working together with other partners to implement sustainable change. The goal of the Built Environment Team is to engage public officials, staff and community leaders in urban planning, development and community design practices that support health, nutrition and physical activity. Design planning projects, like this one at the Marana Farm, will support this goal of bringing together organizations and individuals to create health-enhancing systems.

Based on site constraints, existing plans, research of principles and case studies, coordination with the Marana Farm management team, and feedback from Community Food Bank representatives, Marana Farm workers, and other CPPW team members, the Drachman Institute developed a series of schematic site plans and conceptual designs. The alternate site plans and architectural designs included plans for existing farm features, new entrances, gardens, storage

spaces, work areas, outdoor venues, shade structures, community facilities, and farm facilities.

The research, plans, and designs were presented and discussed with Community Food Bank representatives, Marana Farm workers, and other CPPW team members through a series of presentations and design charrettes. These meetings were usually held on site at the Marana Farm. Their feedback was the basis for a final recommended master site plan, designs for outdoor spaces and plantings, and architectural designs for a new farm building, shade/tool shed structures, and gateway entrances. A primary focus of the plan was to develop a community farming destination that provides education, outreach activities, and sustainable farming demonstration for local neighborhood residents, the regional food bank community, and for the farm workers in a way that exemplifies the best of community interaction/connectivity and sustainable living, building, and farming practices.

The research and design recommendations that were developed through this iterative and interactive process address the needs and mission of the Marana Farm and its community connections within the Town of Marana. The goal of this document is to provide the Marana Farm and their partners with the information, knowledge, exhibits, and momentum to move this project forward in developing a sustainable farm and iconic community destination.

Introduction

Project Timeline

March 2010	Pima County was awarded Community Putting Prevention to Work grant (CPPW).
June 2010	Under the CPPW grant, the Town of Marana was chosen as one of 15 target communities within Pima County where grant partners would be focusing their efforts.
July 2010	Community Food Bank approached Drachman Institute, the Built Environment Team on the CPPW grant, with the idea of developing a master plan for the Marana Farm.
August 18, 2010	A team from Drachman Institute toured the Marana Farm and met with workers from the Farm for an initial project discussion and overview.
September 3, 2010	A preliminary presentation was held with Drachman Institute and the Marana Farm team at the Marana Farm to review overall goals, programs, and ideas.
September 15, 2010	A meeting was held with representatives from Forest City, real estate developer of Gladden Farms, a housing development directly north of the Marana Farm site. The purpose of meeting was to discuss the possibility of the farm capturing water run off from the planned development.
September 28, 2010	A second meeting was held at the Marana Farm. A participatory design charrette followed a presentation of site analysis and initial concepts to the Marana Farm team.
November 9, 2010	The third meeting was held at the Marana Farm. Based on previous feedback, a master site plan and architectural designs were presented and discussed.
March 2011	Master plan and final book, <i>Marana Farm: Revisioning, Participatory Process and Design</i> was presented to the Marana Farm and the Community Food Bank.

Analysis



Analysis: Background

Community Food Bank

Mission: Community Food Bank

According to the Community Food Bank of Tucson's website, the mission of CFB states: "through education, advocacy, and the acquisition, storage, and distribution of food, we will anticipate and meet the food needs of the hungry in our community."

The Community Food Bank of Tucson (CFB) is a 501 (c)(3) not-for-profit corporation. It has served the people of Tucson and Pima County since 1976. It currently provides enough food for 48,000 meals per day which are distributed through about 300 local human service agency partners. Every month, over 215,000 people receive assistance. In 2007, over 22 million pounds of food were distributed through the Food Bank's programs.

The CFB offers a variety of services and programs such as the Community Food Resource Center, SNAP Government Nutrition; and Food Assistance Programs. Of the services they offer, the Community Food Resource Center represents many of the programs that have a food growing and local food emphasis to specifically empower individuals and communities. These include: the Youth Farm Project; the Marana Farm; the Home Garden Program; the Nuestra Tierra Demonstration Garden; and Child Nutrition Programs.

<http://communityfoodbank.com>



Marana Heritage Farm History

The Marana Heritage Farm (Marana Farm) is part of a larger Town of Marana plan called the Marana Heritage Park. The Marana Farm serves a vital function in fulfilling the park's purpose to tell a story of Marana's past and celebrate the history and culture.

The Farm is a partnership between the Community Food Bank Community Food Resource Center, the Town of Marana Parks and Recreation Department, and many community members. The main objectives of the Marana Farm are to improve access to healthy, locally-grown produce, educating people about food system issues, and serve as a demonstration center by providing hands-on learning opportunities. Visitors to the farm will:

- Learn about the important role that agriculture plays in the history and future of Marana and southern Arizona
- Learn to grow food in the Sonora Desert through workshops and events for youth and adults
- Learn about community food security and food bank programs
- Experience a diverse farming system

Since the Community Food Resource Center started managing the Marana Farm in 2007, a number of opportunities have already been made available for the local community to participate on the farm, including:

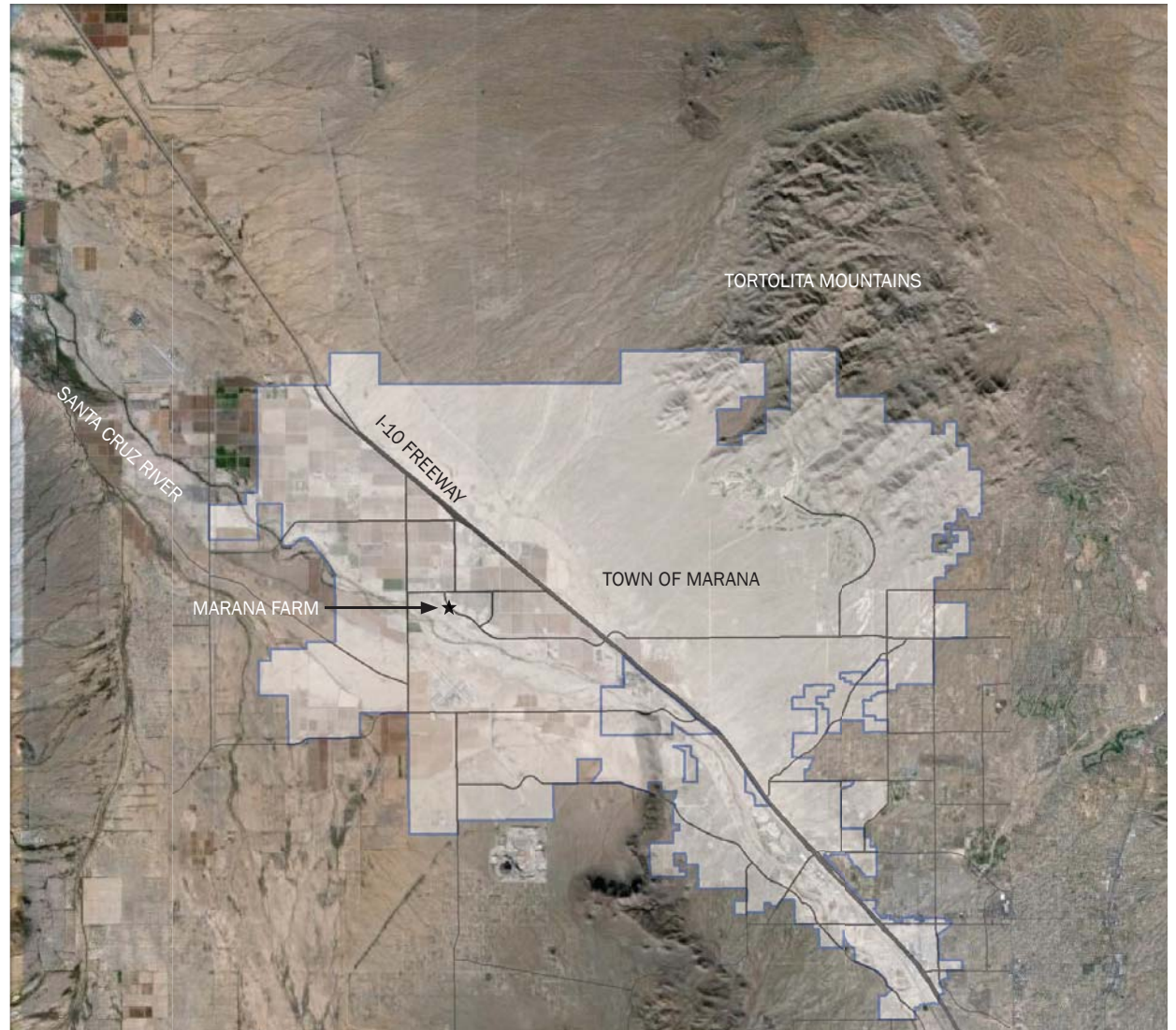
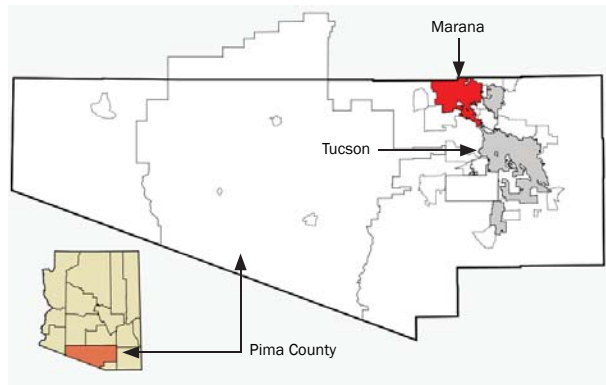
- the Youth Farm Project, which is a program where young people are given the opportunity to develop a relationship with the food they eat and to consider how what they eat affects their health, community, and the planet.
- Volunteer activities, which include planting, watering, harvesting, weeding, poultry care, greenhouse production, structure maintenance, and natural building.

Analysis: Background

Location

The Town of Marana, located within Pima County, Arizona, northwest of the city of Tucson, is home to the Marana Farm site.

The Santa Cruz River, the predominant watercourse in Marana, is a riparian habitat that supports a diversity of wildlife and plant species. Nearby are the Tortolita Mountains to the northeast and Saguaro National Monument to the southwest.



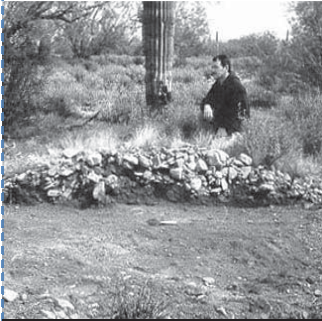
Analysis: Background

Marana History Timeline

Pre-history

2200BC - 1450AD

Excavated rock pile for large scale agave harvest



Ancient canal used by the Hohokam to irrigate crops



Turning Point

1450 - 1690

Spanish influence in the form of soldier and monk



Spanish Period

1690 - 1821

Statue of Father Eusebio Kino in Phoenix, AZ



Mexican Period

1821 - 1854

Early New Republic of Mexico Flag



Corn arrives from Mexico.

Domestic or wild cotton from Mexico cultivated.

On the slopes of Tortolita Mountains, wild agave was cultivated by clearing rocks and building rock piles, terraces, and check dams to slow storm runoff.

550-1450AD — Marana inhabited by the Hohokam — ancestors of the present day Tohono O'odham. Hohokam developed extensive canal systems from the Santa Cruz River to irrigate crops.

Spanish from the south and Apache from the north move into the area of Marana, forever influencing the local indigenous culture.

Father Eusebio Francisco Kino from the north Cruz (1691-1711) founding a series of Jesuit missions. Imports a number of Mediterranean food plants.

With independence from Spanish colonial rule, the area of Marana falls under the control of the New Republic of Mexico.

1854 - 1912

1912 - Present

[illegible]

All images: <http://www.marana.org>

1980s — Decade marks the decline of farming in Marana as farms begin to be converted into housing developments.

1930s — Chinese immigrants arrive on Southern Pacific Railroad and some become known as truck farmers, providing an extensive amount of vegetables.

Post World War — Marana economy shifts from ranching to mainly agriculture, specializing in cotton.

Ranching is the central livelihood.

February 14, 1912 — Arizona becomes the 48th state.

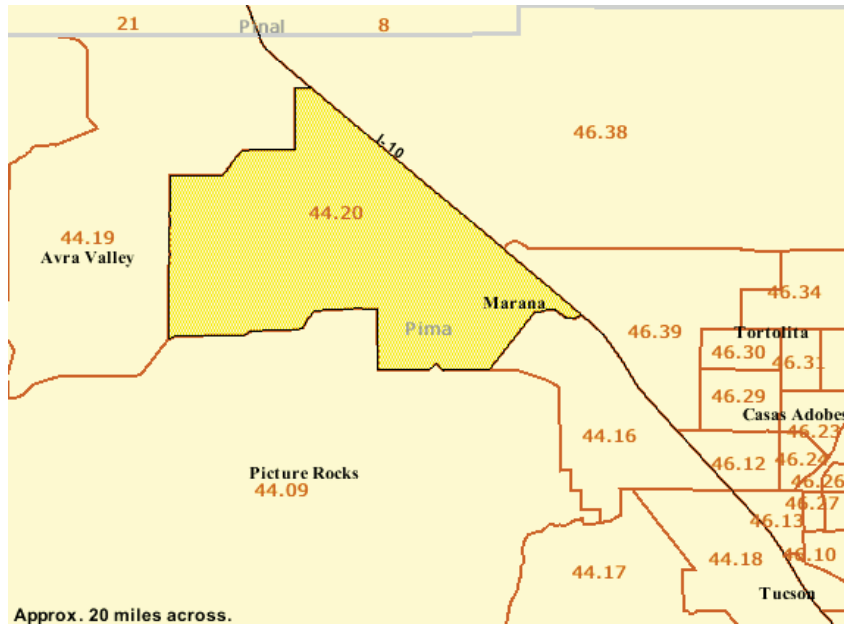
1880 — Railroad arrives in Marana.

1860s — Copper mining boom.

Mexican ranchers establish large cattle ranches.

1854 — the Gadsden Purchase transfers 29,640 square miles of New Mexico and Arizona south of the Gila River from Mexico to the United States of America.

Analysis: Town Demographics



Marana

The incorporated Town of Marana is a small, growing city, with a land area of about 118 square miles. Its current population is approximately 33,000, but that number is expected to grow to 100,000 by the year 2030.

www.marana.com

The Marana Farm is located within Census Tract 44.20, shown above.

Percent below poverty level, 1999			
	Marana	Pima County	U.S.
Individuals	15.0%	14.7%	12.4%
18 years and over	15.9%	12.9%	10.9%
65 years and over	9.5%	8.2%	9.9%
Related children under 18 years	12.6%	19.4%	16.1%
Related children 5 to 17 years	9.4%	18.4%	15.4%
Families	14.3%	10.5%	9.2%
With related children under 18 years	13.7%	16.4%	13.6%
With related children under 5 years	11.9%	20.6%	17.0%
Families with female householder, no husband present	31.5%	28.1%	26.5%
With related children under 18 years	35.6%	35.2%	34.3%
With related children under 5 years	16.3%	46.9%	46.4%

SOURCES: U.S. Census Bureau – Census 2000. Available at <http://factfinder.census.gov>.

Census Data

The statistics discussed in this section are based upon information from the U.S. Census Bureau, from the census conducted in the year 2000. In the last ten years, the Town of Marana has experienced high growth, and much of this data may not reflect current conditions. When the 2010 Census data becomes available, it is recommended that this section be updated.

Poverty Statistics

In Marana, the percentage of individuals and families living below the poverty level are slightly greater than in Pima County.

In 1999, 14.3% of families and 15.0% of individuals in Marana were below the poverty level, a difference of less than 4% from the corresponding national percentage in each case. The percentage of families with children below the poverty level were in many cases lower than national figures.

Population: 2,642
Land area:
Location: Northwest of Tucson, alongside I-10 from the Tucson City line to the Pinal County border
Colonia: Yes
Incorporated: Yes
Congressional District: 8
Board of Supervisors District: 3
Target Area Boundaries: W Marana Rd N, W Tangerine Rd S, N Sanders Rd W, N Postvale Rd E
Census Tract: 44.20

POPULATION

The population of Marana is similar in age to the U.S. population, with a median age about one year less than the country as a whole. Average household size and family size are both comparable in Marana to the country as a whole.

Income is significantly less in Marana as compared to national figures. Median household income is a little more than two-thirds that for the U.S. as a whole, and median family income and per capita income are roughly two-thirds those for the U.S. In the case of median family income, this amounts to a difference of nearly \$20,000.

The population of Marana more than half non-Hispanic white and about one-third Hispanic. Proportions of non-Hispanic White, Black, and Asian Marana residents are less than those for the U.S., while the proportion of American Indian and Alaska Natives in Marana is greater.

About one-quarter of those in Marana speak a language other than English at home, compared to less than one-fifth of the U.S. population. The proportion of foreign born Marana residents is nearly identical to the national figure.

SOURCE: Govtrack.us. Arizona's 8th Congressional District & Map. Available at: <http://www.govtrack.us/congress/findyourreps.xpd?state=AZ&district=8>.
 Pima County Board of Supervisors. District Map. Available at: <http://www.pima.gov/bos/distmap/images/bos17.pdf>.
 U.S. Census Bureau – Census 2000. Available at <http://factfinder.census.gov>.
 U.S. Department of Housing & Urban Development. Designated Colonias in Arizona. Available at: <http://www.hud.gov/local/az/groups/coloniasaz.cfm>.

Demographics (Census 2000)

	MARANA	U.S.
GENDER		
Male	53.9%	49.1%
Female	46.1%	50.9%
AGE		
Median age	34.5 years	35.3 years
Under 5 years	6.0%	6.8%
18 years and over	76.8%	74.3%
65 years and over	11.1%	12.4%
HOUSEHOLDS AND FAMILIES		
Average household size	2.81 people	2.59 people
Average family size	3.20 people	3.14 people
Median household income	\$30,000	\$41,994
Median family income	\$31,744	\$50,046
Per capita income	\$14,231	\$21,587
RACE AND ETHNICITY		
Not Hispanic or Latino:		
White alone	53.5%	69.1%
Black or African American alone	5.4%	12.1%
American Indian and Alaska Native alone	5.1%	0.7%
Asian alone	0.8%	3.6%
Native Hawaiian and Other Pacific Islander alone	0.2%	0.1%
Some other race alone	0.0%	0.2%
Two or more races	1.5%	1.6%
Hispanic or Latino (of any race)	33.6%	12.5%
NATIVITY / LANGUAGE		
Foreign born	11.2%	11.1%
Speak a language other than English at home (population 5 years and over)	26.3%	17.9%

Analysis: Town

Zoning & Land Use

Zoning

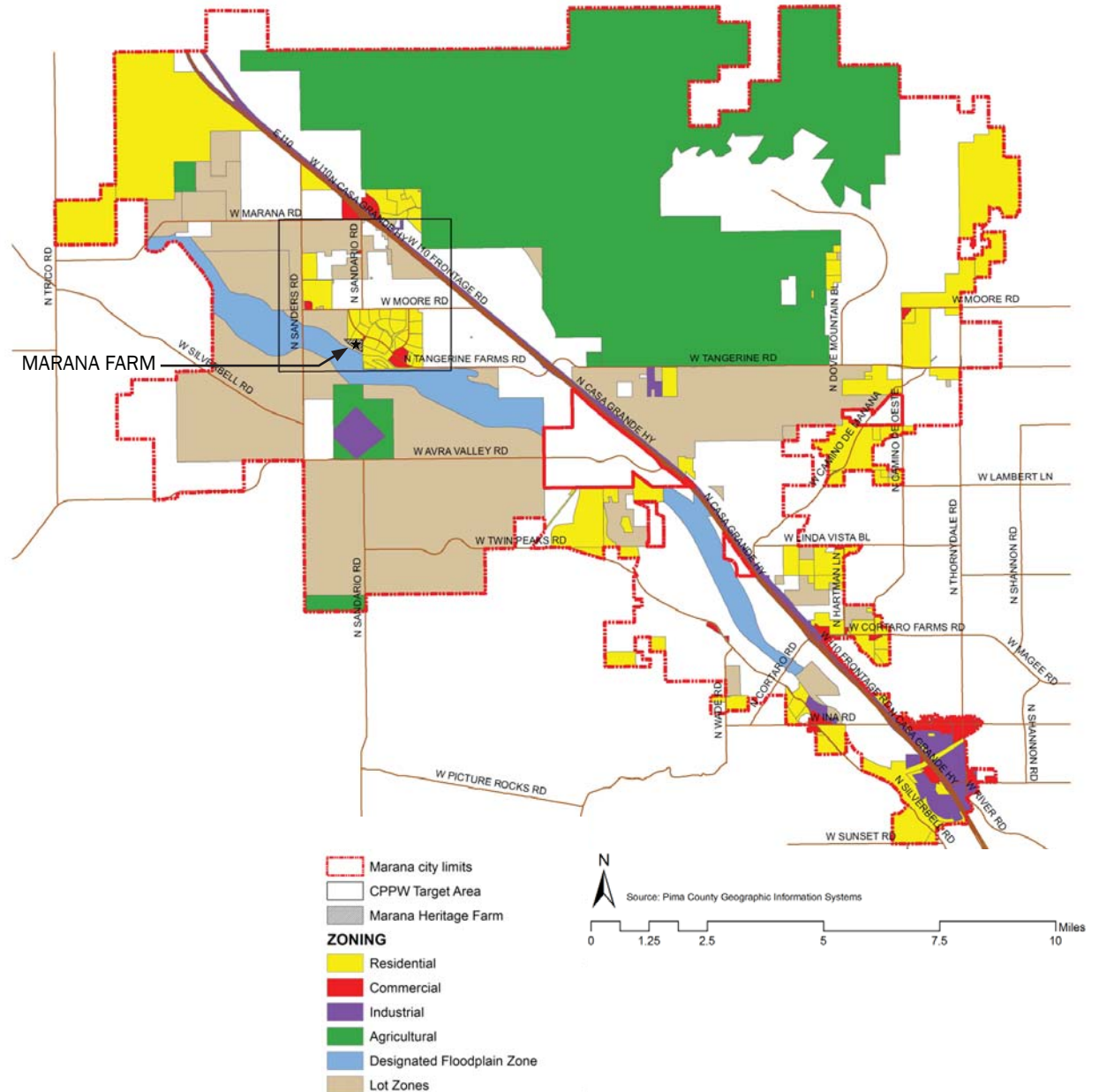
The Marana Farm is located just north of a Flood Plain Zone (the Santa Cruz River) and is surrounded by Residential Zones and Lot Zones. Within the classification of Lot Zone, there are Small, Medium and Large Lot Zones.

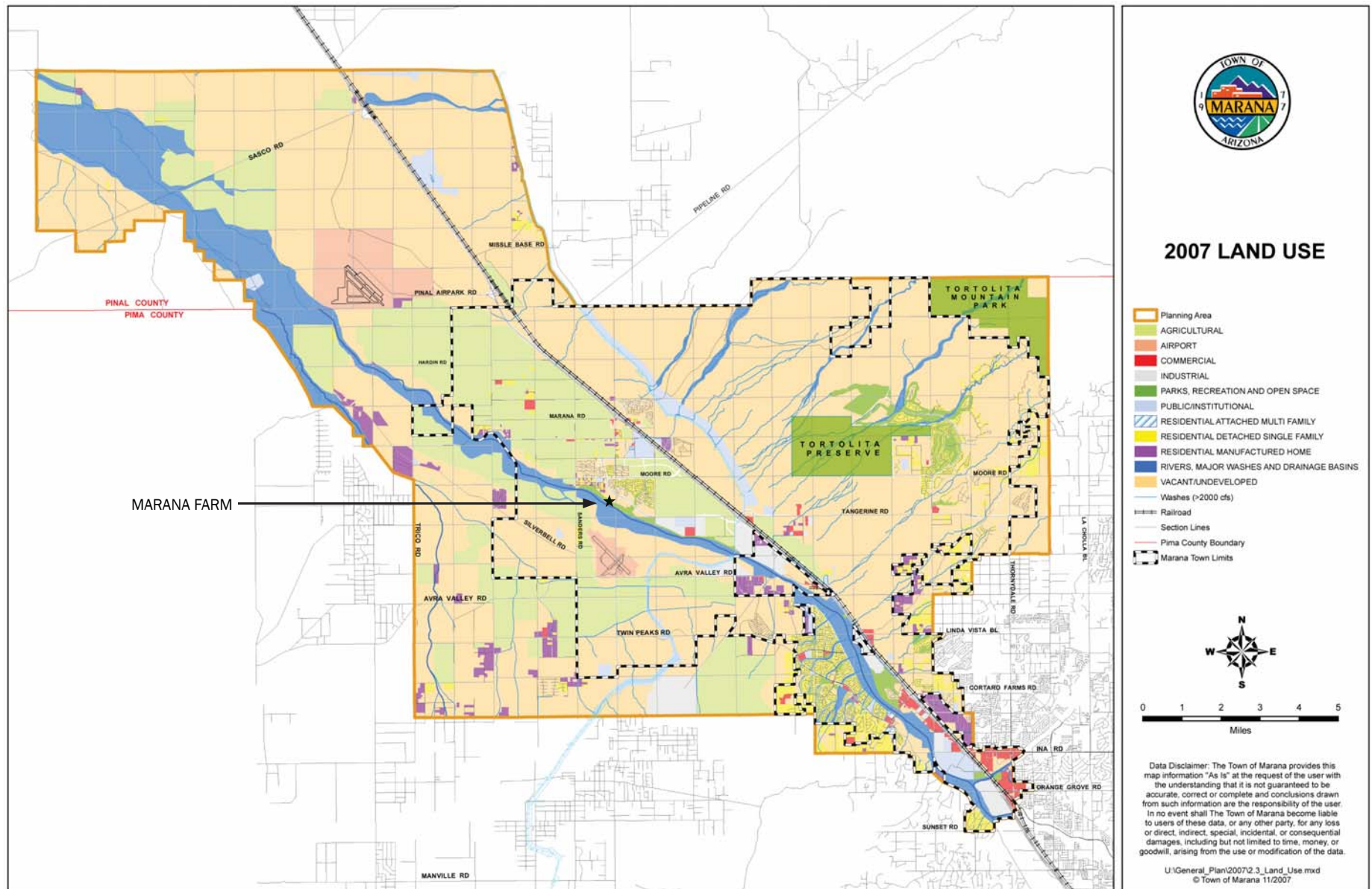
According to the Town of Marana Land Development Code, “within [Lot Zones], any residential, commercial, industrial or quasi-public land use is permitted...” The Future Development Map (on page 20) shows the potential use of these zones.

Land Use

The Marana Farm is surrounded by older, new, and planned residential communities, bounded by the Santa Cruz River to the south. Currently, agricultural uses are adjacent to these residential neighborhoods.

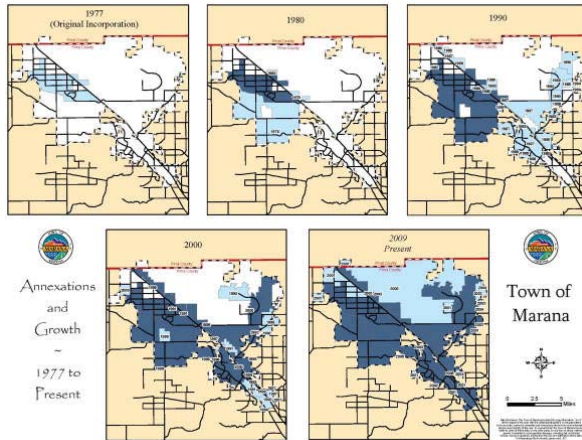
Planned residential communities are being developed in what was historically traditional farmland. The remaining farms in Marana primarily grow short staple cotton and durum wheat for export to Italy.





Annexation & Future Growth

The grouping of small maps below shows Marana's annexation and growth by decade.



FUTURE DEVELOPMENT

- Master Planning Area
- Rural Density Residential
- Low Density Residential
- Medium Density Residential
- Commercial
- Mixed Rural
- Industrial
- Town Center Planning Area
- Park/Open Space
- Santa Cruz Buffer
- Airport
- Planning Area
- Pinal County Planning Area
- Marana Town Limits
- Pima County Boundary
- Washes (>2000 cfs)

0 1 2 3 4 5
Miles

Scale: 0 to 5 Miles

North Arrow

Data Disclaimer: The Town of Marana provides this map information "as is" at the request of the user with the understanding that it is not guaranteed to be accurate, correct or complete and disclaims any liability from such information are the responsibility of the user. In no event shall the Town of Marana become liable to users of these data, or any other party, for any loss or direct, indirect, special, incidental, or consequential damages, including but not limited to time, money, or goodwill, arising from the use or modification of the data.

U:\General_Plan\200703_2_Future_Land_Use.mxd
© Town of Marana 4/2008

All images: <http://www.marana.com/>

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Analysis: Town

Healthy Food in Marana

According to the Centers for Disease Control, a food desert is “an area that lacks access to affordable fruits, vegetables, whole grains, low-fat milk, and other foods that make up the full range of a healthy diet.”

www.cdc.org

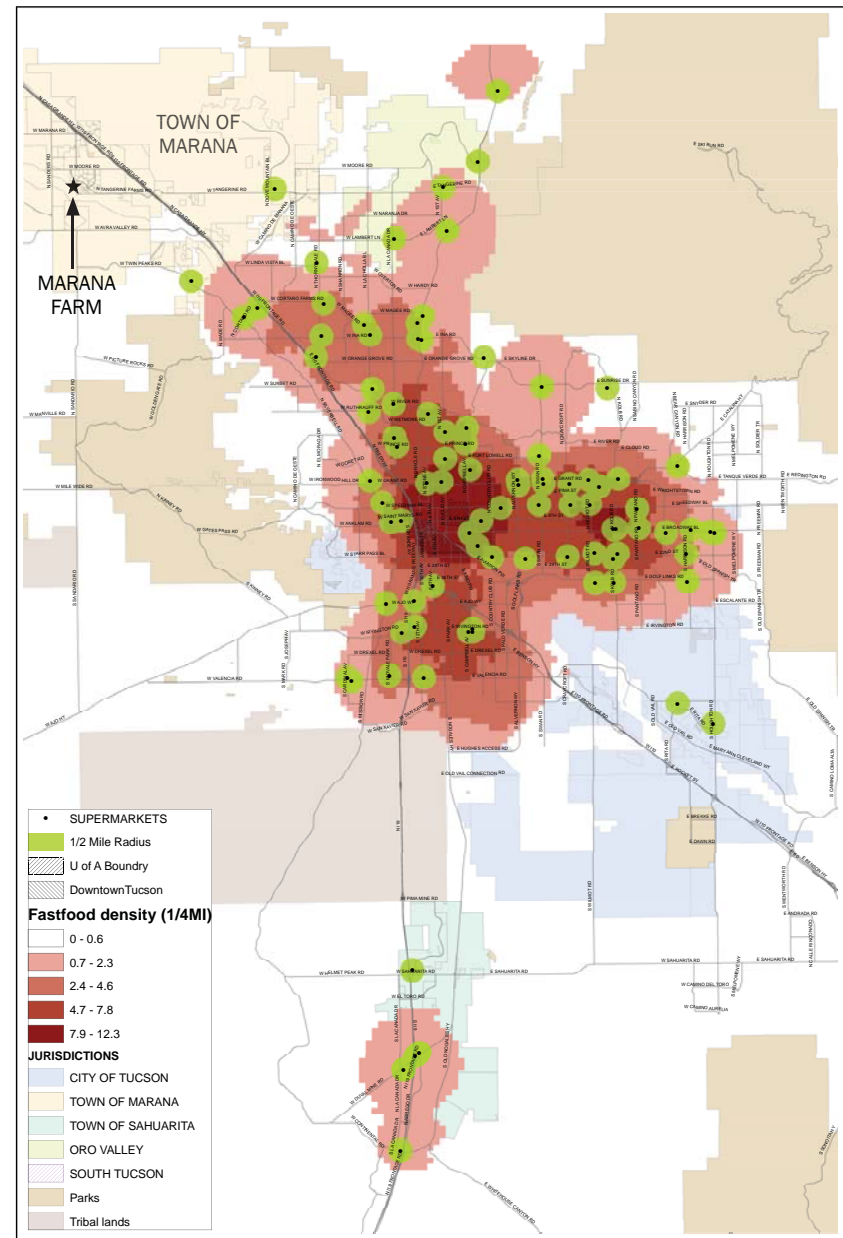
A food imbalance is when an area has poor access to healthy food (and full-service supermarkets), and convenient access to unhealthy food (usually fast food chains).

While areas of Tucson would be considered to have food imbalance, Marana appears to meet the definition for a food desert, with its lack of supermarkets, and very low fast food density (using data provided by the Pima County Health Department).

With its growing population, there is a need for more food sources in Marana. The Marana Farm continues to serve as a source of healthy, fresh food, distributed through the Community Food Bank and weekly farm stand.

Marana

The partial map of Pima County at right shows the locations of full-service supermarkets with 1/2 mile walking radius (black dot surrounded by green circle) and the density of fast food outlets per 1/4 mile (with the darkest red areas indicating highest density of fast food restaurants).



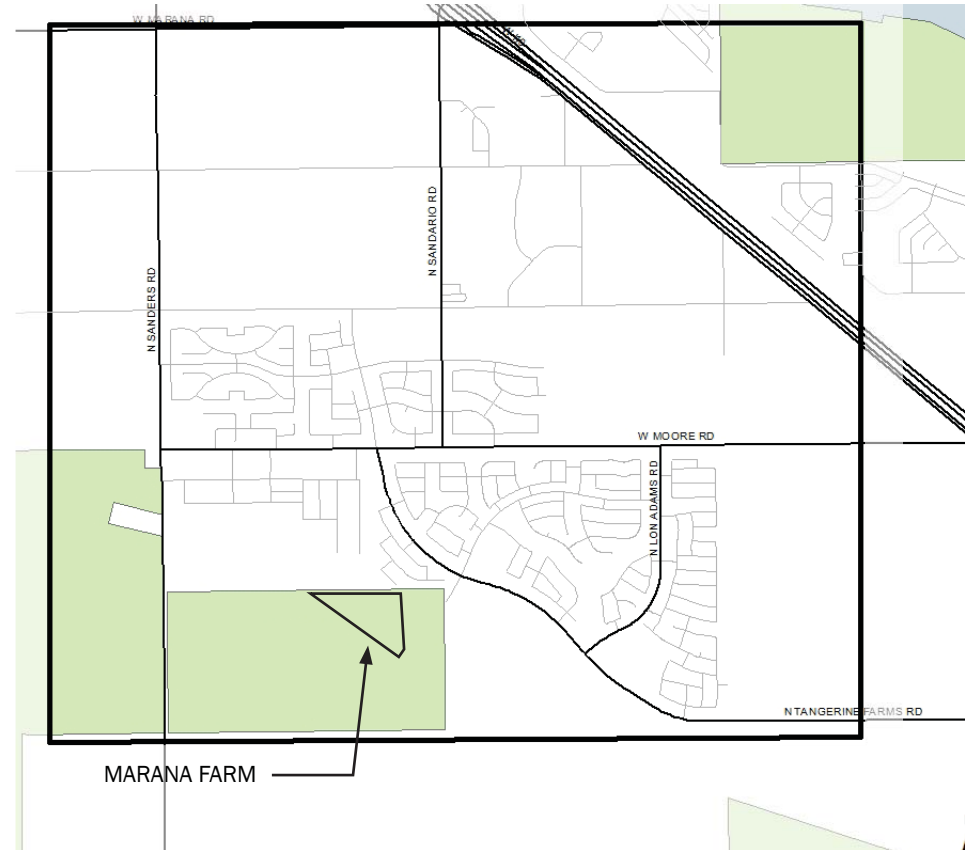
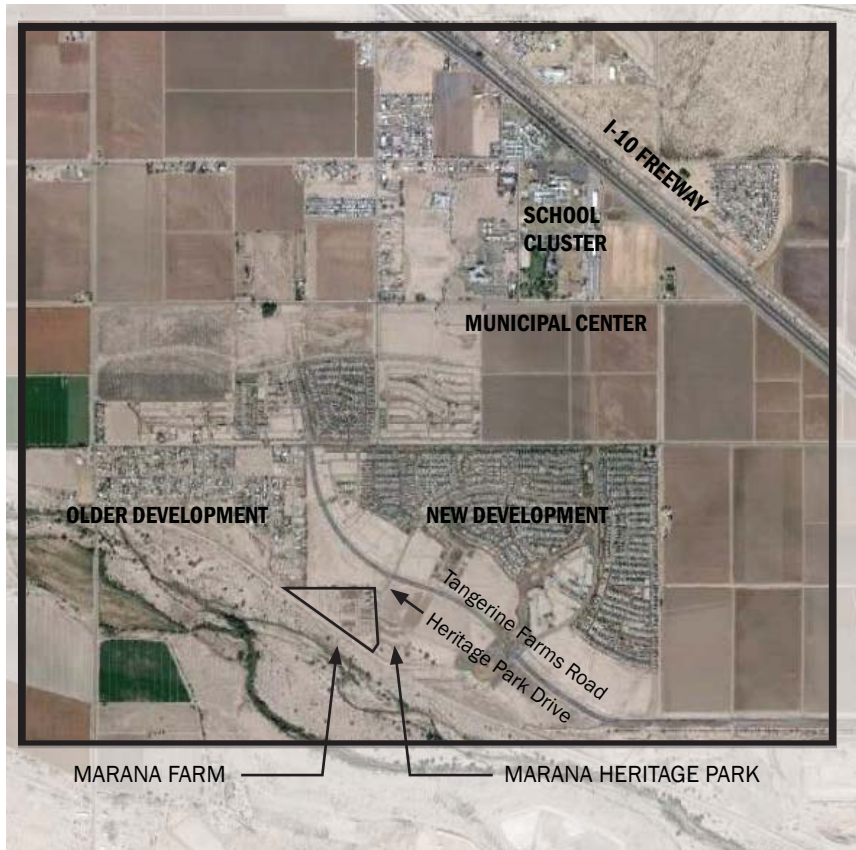
Source: Pima County Health Department

THE DRACHMAN INSTITUTE
INSTITUTE OF PUBLIC HEALTH AND ENVIRONMENTAL SCIENCE
UNIVERSITY OF ARIZONA, TUCSON, ARIZONA

0 1.25 2.5 5 7.5 10 Miles

Analysis: Study Area

Location of Marana Farm



Source: Pima County Geographic Information Systems

Legend

- BUREAU OF RECLAMATION
- PRIVATE LAND
- STATE TRUST LAND
- Marana Farm
- Streets
- Major Roads
- CPPW Marana Farm Context Study Area

Location

The Marana Farm site is situated directly north of the Santa Cruz River, on State Trust land. It is located just south of the corner of Tangerine Farms Road and Heritage Park Drive in Marana, Arizona.

Drachman Institute chose the CPPW Marana Farm Context Study Area (indicated by solid black line in diagrams above) because a goal of CPPW grant projects is to make connections between important community sites and areas. The Context Study Area is approximately 3 miles square, and includes the Marana School cluster, the Town of Marana's municipal center, and different types and ages of neighborhoods and housing developments.

Site Analysis: Study Area

Future Development

New Neighbors

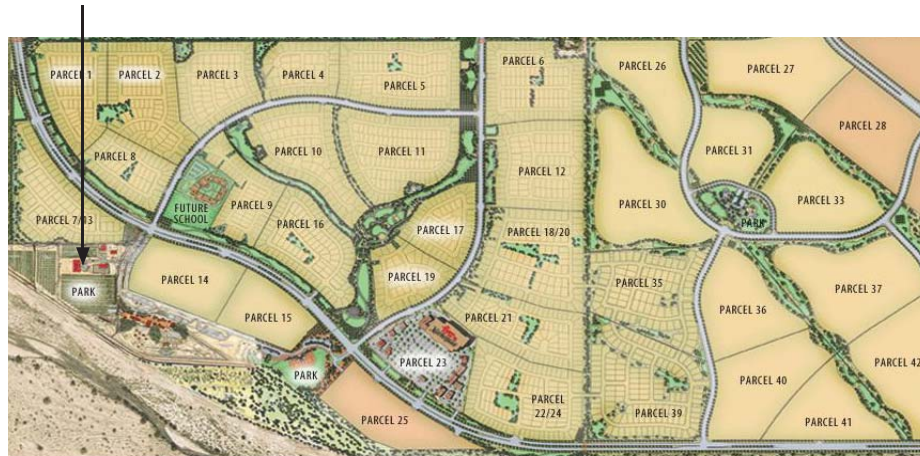
As Marana's population continues to grow, housing developments will replace the agricultural land surrounding the Marana Farm. To the northwest, 90 units will be constructed as the Honea Heights III development. To the north, 75 units will make up the Gladden Farms Parcel 7/13. To the west, Gladden Farms Parcel 14 is platted for more residential development.

In this context, being located in the center of a very populated residential area, the farm can offer many benefits to the community, beyond serving as open space and a natural area. The farm is a node of activity for many types of gatherings, such as educational workshops and classes, work parties, harvest festivals, and youth-oriented activities. It is also a gateway through which surrounding residents can pass to access the Santa Cruz River Walk and the Marana Heritage Park. Additionally, the farm can offer an architectural and landscape form that represents the cultural and agricultural character of the community's past.



A map showing the existing and proposed developments adjacent to the farm.

MARANA FARM



<http://www.gladdenfarms.com>

This map shows the density of proposed residential housing surrounding the farm, as well as the location of a future elementary school northeast of the farm and a future supermarket east on E. Tangerine Farms Road.



<http://www.bing.com>

This aerial image shows the type of development pattern of the housing subdivisions that may surround the farm in the future.

Analysis: Study Area

Public Amenities

There are many public amenities located within the CPPW Marana Farm Context Study Area.

To the north, adjacent to the I-10 freeway, there is a school cluster, which includes an elementary, middle, and two alternative high schools.

Town government is located in the new Marana Municipal Complex which was dedicated in May, 2005. This 110,000 square foot building serves the Town's administrative, law enforcement, and judicial services.

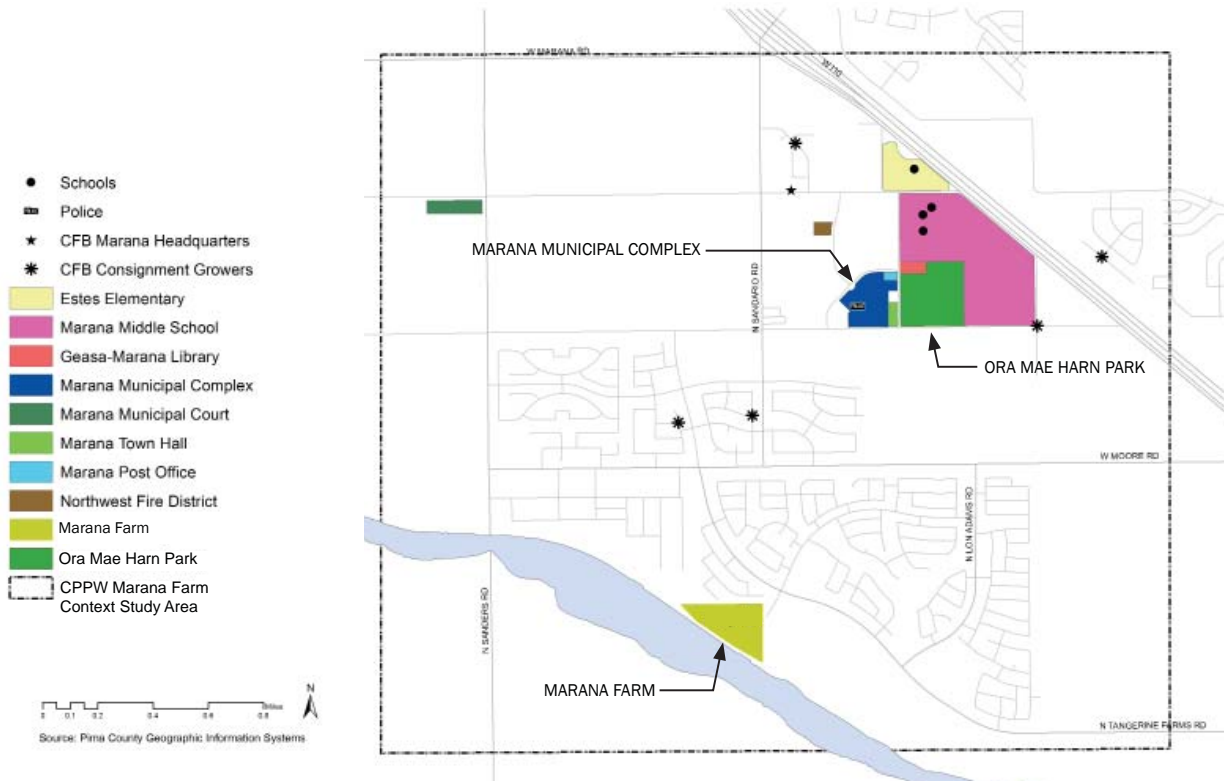
A new health facility is currently under construction near the municipal complex. Ora Mae Harn Park is a well-used community space, located near one of the public libraries. The Marana headquarters for the Community Food Bank (CFB) is nearby, and is an important resource in the community.

The Marana Farm should also be included in this list. It will continue to serve the community as an important and necessary amenity. An expansion of its mission and outreach will increase its role as a community partner.



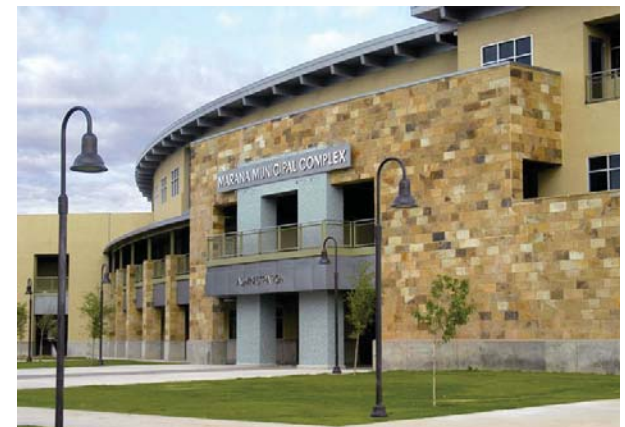
<http://www.publichealth.arizona.edu/news/2011/public-health-work-tucson>

Volunteers and staff processing vegetables at the Marana Farm.



<http://www.lloydconstruction.com/portfolio-k-12-education.php>

The Media Center was part of an extensive renovation at Marana Middle School.



<http://kwmech.com/projects/marana.asp>

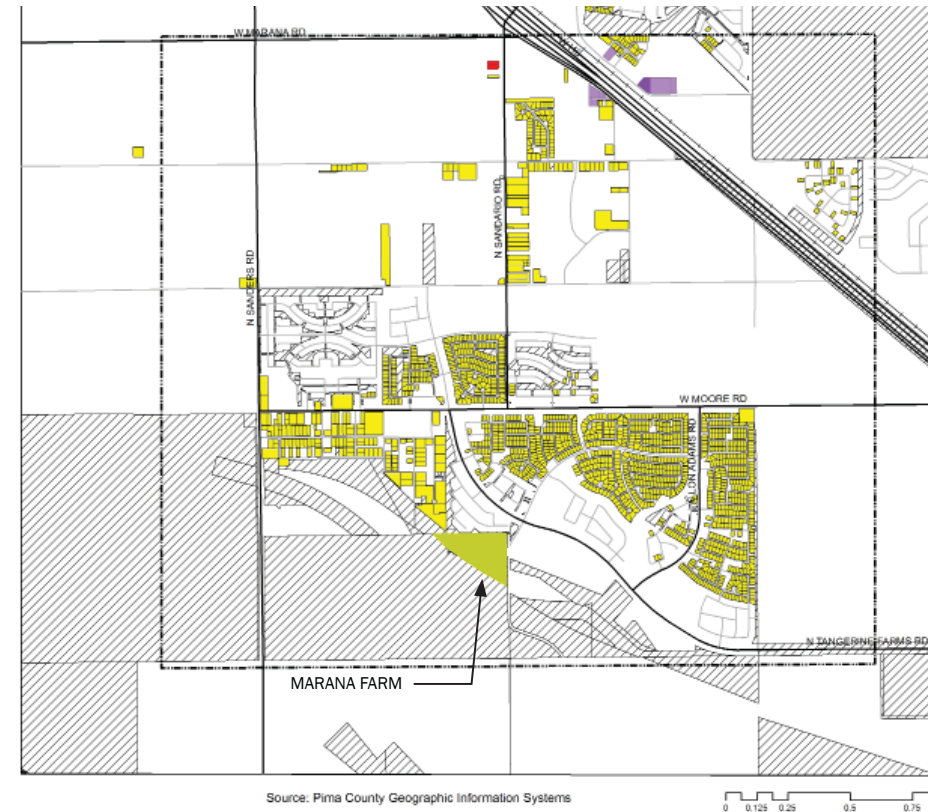
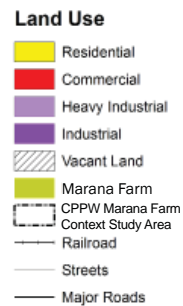
The Marana Municipal Complex.

Analysis: Study Area

Land Use

The Santa Cruz River serves as a natural boundary for development. Directly south of the river, development is sparse, except for the Marana Regional Airport and the Marana High School, which may be an indicator of future development. To the north of the river, the area is characterized by residential development.

Within a two-mile radius of the Marana Farm site, land use is almost exclusively residential. There is some commercial and industrial use near the I-10 freeway, located just over 2 miles away to the northeast, however, most of the commercial activity is found in the north and south ends of Marana's town limits.



Analysis: Study Area

Hydrology & Climate

The topography map at right shows the land sloping down toward the northwest, directing rainwater and runoff, as part of the Santa Cruz River watershed.

Based on information from the Western Regional Climate Center website, data was collected from the closest climate station. Marana’s average temperatures range from 66.5 degrees Fahrenheit in December to 102.9 in July (from 1961-1990 monthly climate summary), with the average annual temperature being 85.3 degrees Fahrenheit.

Marana receives rainfall during the winter and summer, or monsoon, season. Annual rainfall is 11.61 inches.

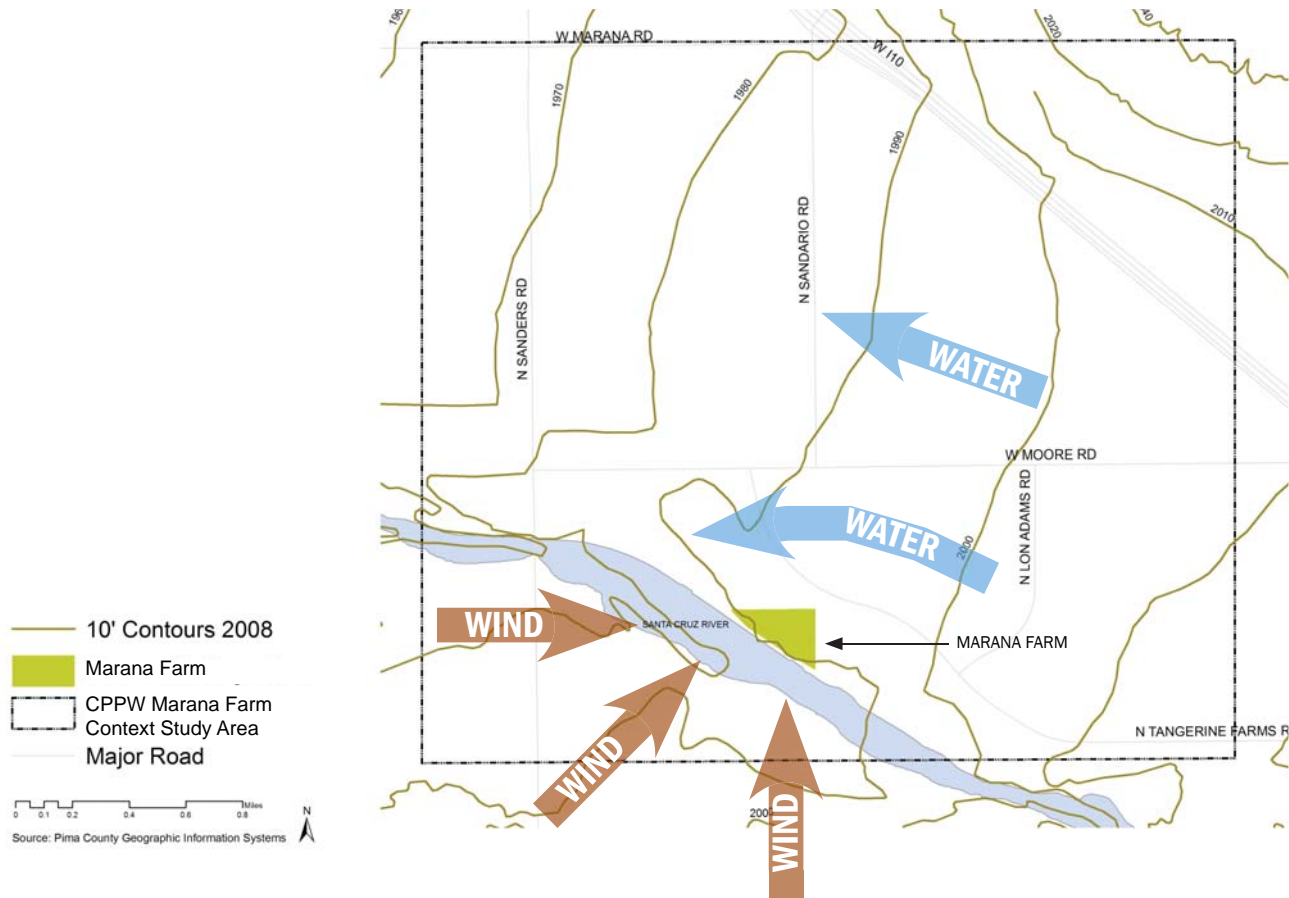
Because Marana’s elevation is lower than Tucson to the southwest, average temperatures are slightly higher and precipitation is slightly lower than in Tucson. (See data below.)

According to anecdotal data provided by Marana Farm workers, prevailing winds are from the south and west.

CORTARO 3 SW, ARIZONA (022159)

1961-1990 Monthly Climate Summary

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	67.7	71.2	76.1	84.2	93.2	101.7	102.9	100.2	96.2	87.6	73.2	66.5	85.3
Average Min. Temperature (F)	34.7	37.4	41.6	47.1	54.6	65.7	73.3	71.4	65.3	52.9	41.8	35.7	51.9
Average Total Precipitation (in.)	0.59	0.83	0.67	0.39	0.11	0.27	1.55	2.26	1.45	1.07	0.90	1.53	11.61



TUCSON UNIV OF ARIZONA, ARIZONA (028815)

1961-1990 Monthly Climate Summary

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	66.6	70.5	75.5	82.9	91.1	99.9	100.9	98.6	94.9	86.1	72.4	67.1	84.1
Average Min. Temperature (F)	39.9	42.5	46.2	52.3	59.8	69.0	74.7	73.4	68.5	57.4	45.2	40.6	55.9
Average Total Precipitation (in.)	1.00	0.91	0.74	0.41	0.17	0.32	2.17	2.10	1.28	1.00	0.70	1.06	11.85

Unofficial values based on averages/sums of smoothed daily data. Information is computed from available daily data during the 1961-1990 period. Smoothing, missing data and observation-time changes may cause these 1961-1990 values to differ from official NCDC values. This table is presented for use at locations that don't have official NCDC data. No adjustments are made for missing data or time of observation. Check [NCDC normals](#) table for official data.

Western Regional Climate Center
<http://www.wrcc.dri.edu/summary/climsaz.html>

Analysis: Study Area

Alternative Transportation

The new growth in Marana includes many subdivisions and planned communities, many of which have made it a priority to include pedestrian pathways, greenways, and connectivity routes to nearby amenities. There is a bike pathway as part of the Santa Cruz River Walk and bike routes have been planned within the housing development to the north.

Currently, a commuter bus runs along the I-10 corridor to Tucson, and a proposed circulator bus is part of the Transit Project 2040 plan.

Marana could increase the number of bike pathways, further connecting Marana Farm to the surrounding community and local schools. As well, in order to serve well the new residents moving in to the area, more bus routes may be necessary. Bus service could include stops at the Marana Farm, the Marana Municipal Complex, the elementary and middle schools to the north, and the high school to the south, creating a localized public transportation system which would also help to build community connections.



Images showing the infrastructure already in place to support walking and biking near the Gladden Farms area.

Analysis: Existing Conditions

Map of Site

A recent aerial photograph of the Marana Farm site shows the current configuration of the existing elements.

The farm buildings and structures are located in the northeast corner of the site, near the main entrance from N. Heritage Park Rd.

The western half of the site has been designated for diverse row crops, and includes plans for a grape vineyard and fruit orchard.



Analysis: Existing Conditions

Topography/Hydrology

The topography diagrams below illustrate that water flows to the west on the Marana Farm site, and is directed to the Santa Cruz River. From east to west, there is an approximate 10-foot elevation drop across the site.

On the western half of the site, the land is graded into three terraces, with a two-foot elevation change between each.

These terraces create an opportunity to distribute water on the site, especially since they are currently connected by an irrigation ditch (orange line on map at right) which runs along the northern edge of the farm. This ditch could serve as the distribution channel for water runoff from the development to the north.

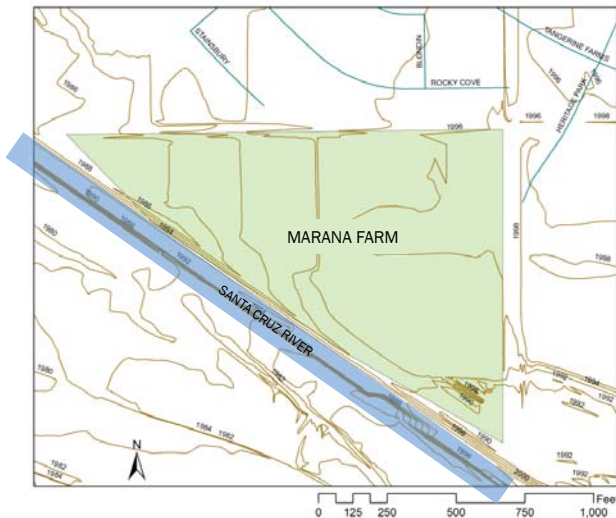
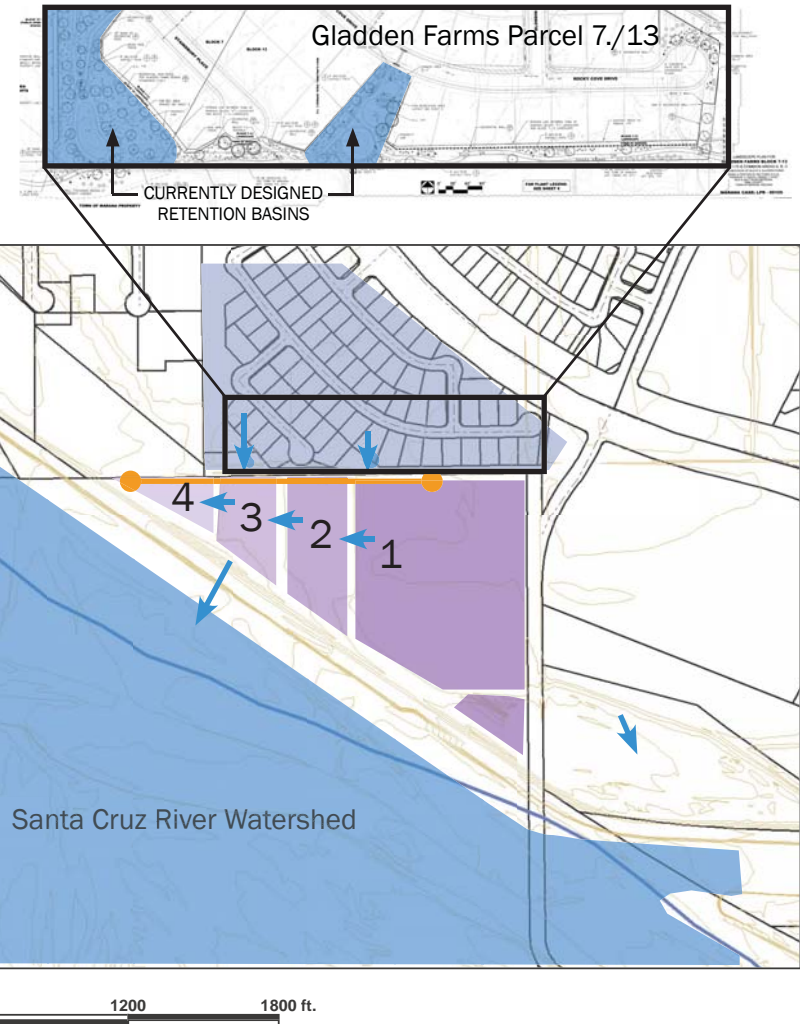


Diagram showing topography of the Marana Farm and its close proximity to the Santa Cruz River.

The Drachman Institute team spoke with the developers of Gladden Farms about altering their plans to allow Marana Farm access to the water run off from Parcel 7/13. They acknowledged that they would be willing to make adjustments, so that the water that would have wound diverted to the Santa Cruz River could instead be used for irrigation of vegetated basins on the farm.



Hydrology of Marana Farm

Analysis: Existing Conditions

Food Production Areas



1 Arrow head points toward direction of view



The Marana Farm serves as an educational resource showcasing the production of local food (2, 3), food forestry with the use of Father Kino Heritage Trees (1), often using passive rainwater harvesting techniques.

Analysis: Existing Conditions

Food Production Areas



The Marana Farm currently features a Youth Garden, approximately 1/8 acre in size, which affords local youth and visiting school children a place to volunteer and learn about farming. The site includes a sunken “pizza garden”, chickens, an outdoor classroom, an earth oven made from materials found on-site, and fruit trees. This site is a testament to Marana Farm’s dedication to education, recreation and community participation.



- 1 The youth garden is centrally located near the main entrance, to the west of the parking lot, and is an important node near the existing barn and central work area.



The ramada and outdoor classroom



The storage shed

Analysis: Existing Conditions

Composting Operations



The compost operations of the Marana Farm are critical to the production of organic food. The current one-acre composting area, will be able to provide all of the nutrients to grow food crops in a sustainable manner. Compost input material is dropped off by local community organizations (like the Tucson Zoo, contributor of “Zoo Doo”), and placed in piles in the designated compost area (1, 2).

Vermiculture, or worm composting, is another way to create high quality compost. The worm crates can be moved around the farm, depending on the season (3).



Analysis: Existing Conditions

Buildings



- 1** An historic, adobe building is currently being used as an office for the Gladden Farms Home Owners Association.



- 2** The barn houses office space for the farm workers and serves as an area to store historic tractors. This space has the potential to serve other purposes.
- 3** Photo at left gives a view of the barn from the west.



- 4** From top to bottom: The nursery house (or green house), tool storage shed and cooler are clustered together to the west of the barn.

Analysis: Existing Conditions

Shade Structures



A few shade structures for storage and other farm activities are located on the farm.

Increasing opportunities for shade would provide protection and rest areas for farm workers and visitors on the lengthy walks across the farm site. These shade structures could serve many functions at once – storage/tool shed, ramada space, rainwater catchment and support for vertical crops.



- 1** The vegetable washing station is centrally located, west of the barn.
- 2** This shade structure was built by a local Boy Scout troop, and provides storage for straw bales.
- 3** The large ramada is an excellent site for large gatherings of people, like the weekly Marana Farm Stand.



Analysis: Existing Conditions

Vehicular Infrastructure



2 The current parking lot.



1 Tractors require clearance to drive around, and between, farm plots.

Current truck paths on the farm have been created where they are needed, and are, in some places, very silty during dry times and muddy in the rainy season. These conditions create ruts which can make navigation difficult.

Installing a supportive, permeable road material which could bear the heavy weight of delivery trucks would reduce the amount of labor and cost needed for maintaining and regrading the roads.



Large vehicles, like this box truck, need to have clear access to buildings and other structures for loading and delivering supplies and produce.

Analysis: Existing Conditions

Other Features



The deactivated irrigation ditch (1) runs along the northern edge of the farm. This canal could direct water to a series of basins which contain native trees and shrubs, which would provide wind protection for food crops, shade houses and hoop structures. In the summer of 2010, severe microburst winds from the south destroyed a few of the shade houses.

As well, native trees (2) were planted in basins around the perimeter of the property, creating a buffer zone which will provide a windbreak and shade for crops.

Different types of entry points can be found at different locations around the farm. The main entrance (4) opens for vehicles and people, and a minor entrance at the north is for pedestrians only. (5)

Analysis: Existing Conditions

Lack of Shade



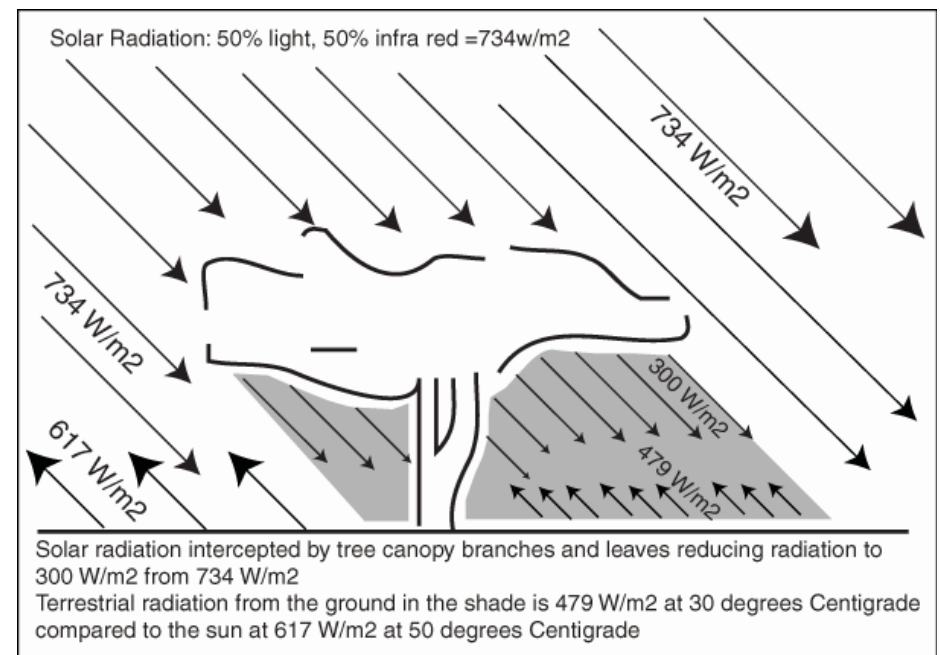
Walking distances at the farm

The aerial image of the Marana Farm above shows distances of typical routes current farm workers take. Farm workers may walk more than 1,400 feet round-trip along these paths without shade from either tree or structure.

As noted earlier in this book, the springs, summers, and falls (typical farm working seasons) in Marana are very hot, sunny, and dry. Shade becomes a necessity when working outdoors.

Benefits of trees:

- Decreases temperature extremes between hot and cold.
- Decreases reflected heat from exposed ground.
- Increases evapotranspiration rates, effectively cooling temperatures and improving climate around trees.
- Lowers desiccation rates of tender plant species.
- Reduces harmful effects of winds. Without trees, sheet flows of wind pick up dust and increase potential for destructive capacities.
- Slows wind and air movement beneath tree canopies, providing insulative capacities.



Grey, Gene. "Tree Microclimate." Scanned Image. 1978. Urban Forestry. Wiley. September 21, 2010.

Literature Review



Literature Review

Permaculture Design



Permaculture Design Process

The permaculture design process offers design solutions that emphasize the assemblage of components by modeling or placing elements that amplify the natural processes.

Zonation

Zones can be thought of as concentric circles classified according to intensity of human intervention, on-site energy and resources management or physical characteristics (slopes, temperature variations etc). (Wikipedia, December 7, 2010).

What is instructive about the Drylands Permaculture Research Farm is organization of the its elements. In the site plan above, Zone 1 contains elements that are visited most frequently, minimizing the distance traveled by the farmer to complete daily tasks. Zone 2 requires less frequent maintenance, such as the occasional weeding or pruning needed

for an orchard. Zone 3 is often where the main crops and animals are grown for domestic and commercial purposes and requires less care than Zones 1 and 2. Zone 4 is a semi-wild area that may be actively harvested for native resources like fire wood. Finally, Zone 5 is a wild area where nature's processes can benefit the farm through its healthy ecosystem.

Design

- Zone 1: Nursery, Display Gardens, Food & Seed Gardens, Chickens
- Zone 2: Bulk Storage, Orchard Plantings, Fire Preventing Shelter
- Zone 3: Major crop plantings
- Zone 4: Semi-wild, endemic bee forage plants
- Zone 5: Remnant vegetation where natural processes are fully intact

Vision

The vision of the Drylands Permaculture Farm was to demonstrate the potential of a “practical design system for creating sustainable human cultures and economies founded upon ecological principles and an ethic of personal responsibility to make it happen.” It serves as a means to prove that even in difficult climates, farming, agriculture and human ecology are not diametrically opposed to natural ecology.

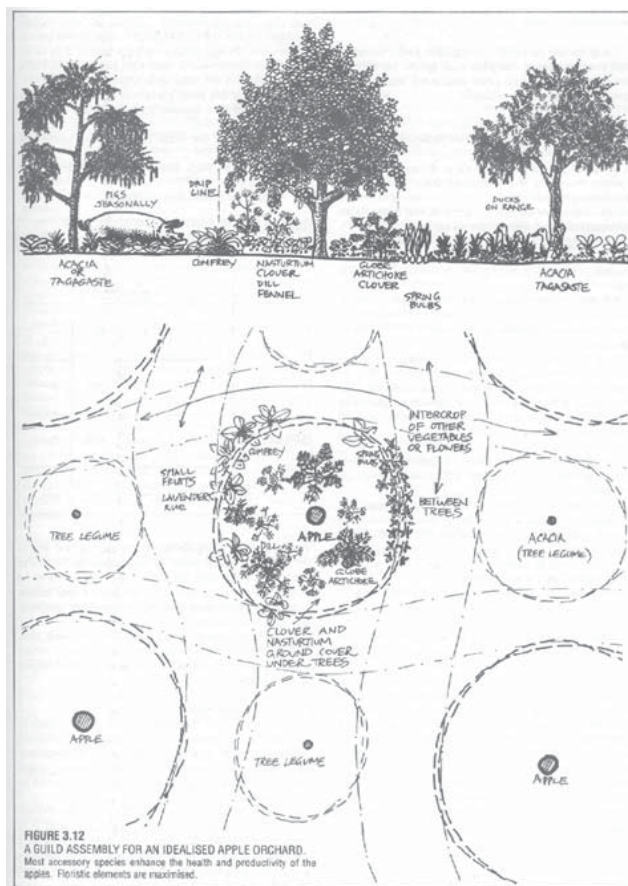
Literature Review

Planting Guilds & Relationships

Planting Guilds

Planting guilds refer to an assemblage of plant materials that have beneficial interactions amongst each other. Indigenous agriculture has long revealed the beneficial relationship among the “Three Sisters” — beans, corn and squash. Beans fix atmospheric nitrogen into the soil, corn provides a shady microclimate, and the squash offers a green mulch.

These same principles can be applied to larger scale perennial and woody plants. For example, mesquites and acacias — species in the nitrogen-fixing pea family — fix atmospheric nitrogen into the soil to support understory vegetation and surrounding tree species, like fruiting plants, that are beneficial to humans. The microclimate created by trees increases crop diversity, allowing for a wider variety of crops.



Scanned image: [Permaculture: A Designer's Manual](http://www.permaculture.com.au/)

Trees in the Farm

Another farm-related benefit of trees to crops is the creation of microclimates. The graphic to the right summarizes the body of research that shows that temperature is lower and humidity is higher beneath the tree canopy. At night, the tree canopy creates a warmer microclimate than the colder exposed air above.

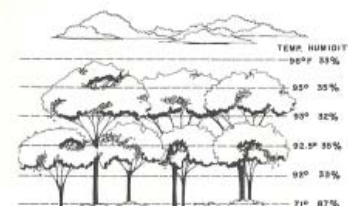
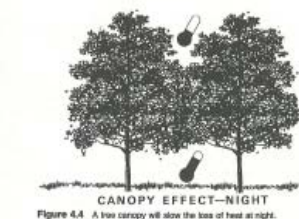


Figure 4.3 Temperature decreases and humidity increases downward through a forest canopy.



<http://www.foodforest.com.au/>

Benefiting from Nature

In the photo, below right, mesquite trees protect tender row crops from Jordan's intense summer heat. The biomass of the trees also serve as a temperature moderating thermal mass that tends to keep the surrounding area relatively warmer in the winter and cooler in the summer. Without the trees, the row crops would be exposed to the extreme effects of wind and sun.

In the photo below left, deciduous fruit trees provide a protected and moderated microclimate for row crops in the summer months, and allow them to benefit from sun and warmth in the winter.



<http://www.foodforest.com.au/>



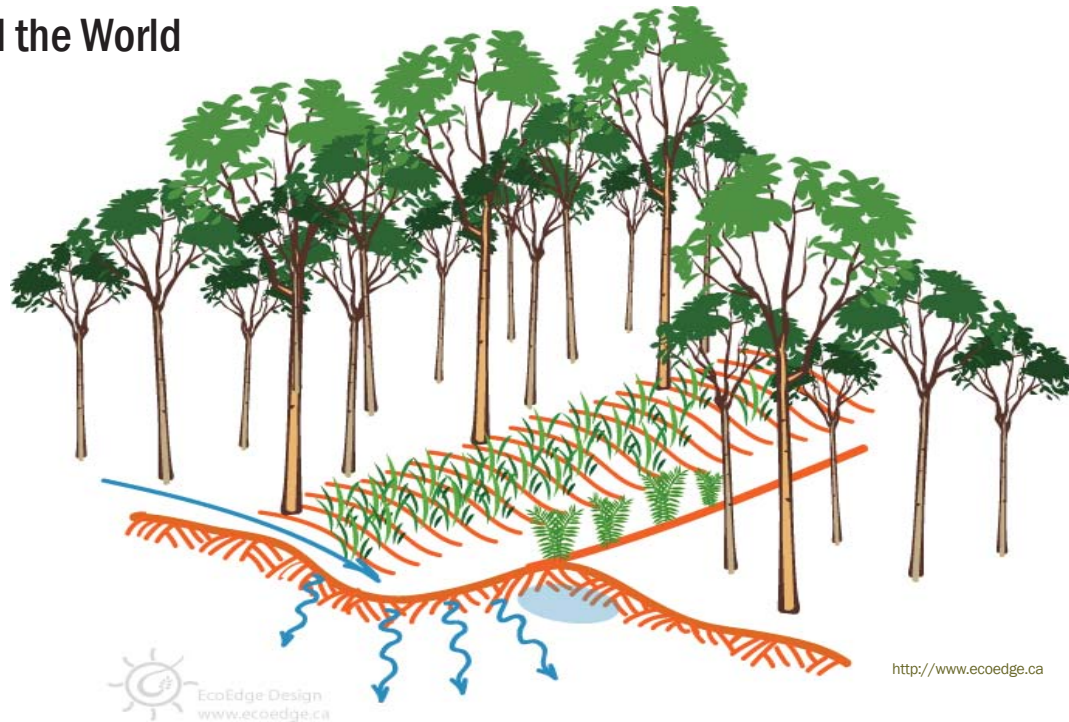
<http://ecolocalizer.com/2009/11/14/turning-desert-into-a-garden/>

Literature Review

Sustainable Farming Practices Around the World

Rainwater harvesting

The common thread between all of these farms: the rainwater harvesting earthwork.



<http://permaculturenursery.com.au/design/design.html/>

Australia

Swales placed on contour serve as the foundation of many permaculture, or sustainable, farms found in dryland regions, such as Africa, the Middle East and Australia. A swale on contour captures uphill runoff and allows for infiltration into the ground. The downhill effects of the earthworks have proven to be very useful for growing food forests and native revegetation buffers to improve crop quality and yield.



<http://www.guardian.co.uk/lifeandstyle/gardening-blog/2009/mar/04/gardens1>

Palestine

'The Tortoise Garden' project is a permaculture farm in Bustan Quraaqa, West Bank, Palestine. By reactivating the ancestral practices of dryland farming in the area — terrace farming, microclimate, and companion planting — the project is proving that ancient practices and farming systems offer practical solutions for sustainable farming.

before



after



<http://permaculture.org.au/>



<http://www.treehugger.com/files/2009/12/greening-the-desert-permaculture-revisited.php/>

Jordan

Permaculture designer Geoff Lawton's project is a successful demonstration of how systems which are ordered in harmony with the patterns of nature can create an oasis in hyperarid deserts, like those found in Jordan. This site receives an average of four inches of rain per year, mostly in the winter, and has scorching summertime temperatures. Two to three years after the completion of the site construction, *Prosopis* species are already thriving along the swale on contour. The swale

captures about 265,000 gallons of water per average rain event.

The before and after photos above show the effect of rainwater harvesting on a parched land. The *Prosopis* on the right are 10 years old and create a microclimate for row crops that are grown on contour. Not easily seen are the interplantings of pomegranate, fig and date palms amongst the *Prosopis* species.

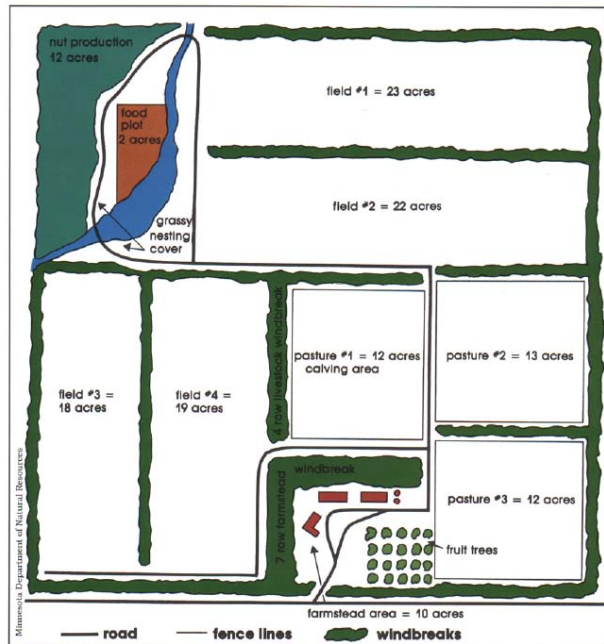
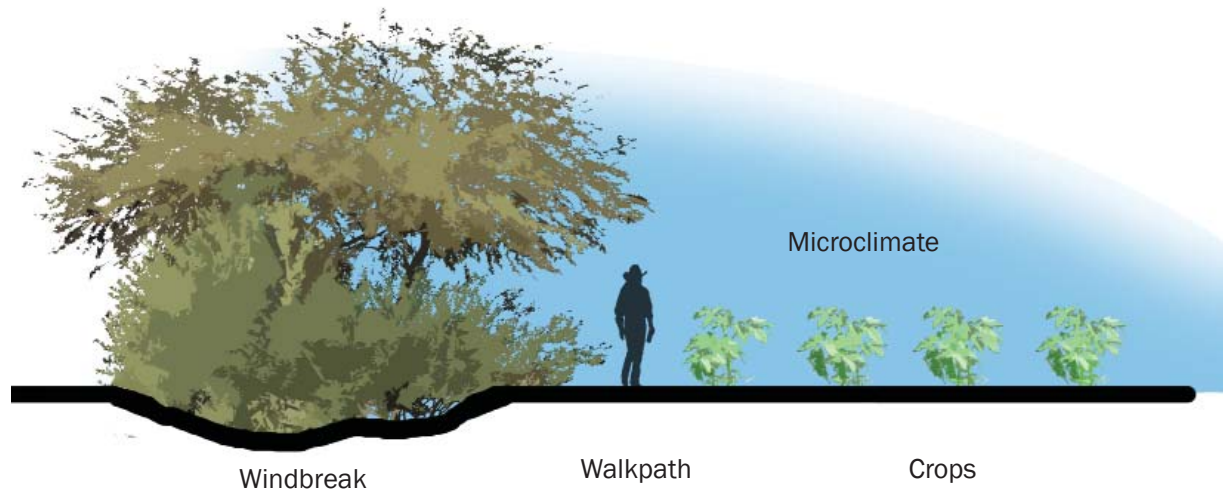
Literature Review

Sustainable Agriculture & Windbreaks

Windbreaks

Windbreaks help protect cropland by reducing wind velocities for a distance approximately 15 times the height of the tallest trees. Decreasing soil loss, plant abrasion and dessication due to evapotranspiration are just some of the benefits that they provide.

The diagram above shows how a windbreak, rainwater harvesting basin and crops interact. The windbreak provides a zone of protection for plants to increase a crop's quality and yield.



A well-designed farm incorporates many types of windbreaks to protect fields, crops and buildings.

Scanned image:
Windbreaks in Sustainable Agriculture Systems, University of Nebraska-Lincoln

Benefits of Windbreaks

Windbreaks provide protection for people, animals, buildings, crops and natural resources. The benefits of windbreaks are multifold, as they:

- reduce soil erosion by wind;
- control runoff from agricultural lands;
- provide food and shelter for wildlife species;
- can be harvested for timber and fuelwood;



This photograph shows the layout plan of a farm effectively using windbreaks.

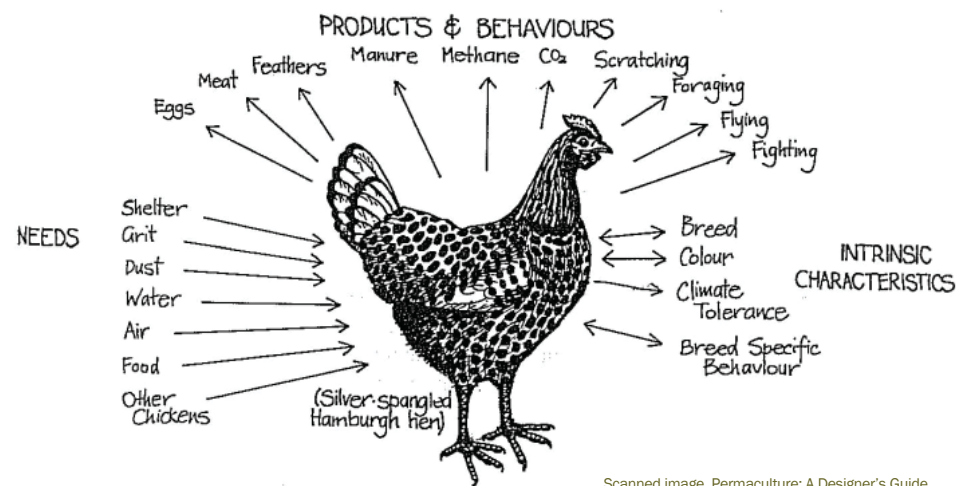
Scanned image:
Windbreaks in Sustainable Agriculture Systems, University of Nebraska-Lincoln

- can be harvested (specialized tree crops, such as fruits and nuts).
- improve crop yield by between 5-45%, in the long term;
- improve quality of wind-sensitive crops;
- enhance natural controls of insects and increase biological diversity;
- reduce stress on livestock;
- reduce mortality of young animals;
- add beauty to the landscape;
- aid in the deposition of wind-borne soil, building fertility and storing moisture;
- decrease plant abrasion and dessication;
- moderate surrounding temperature and humidity to lower evaporation rates;
- increase crop water use efficiency and photosynthesis rates;
- result in a net increase in crop quality and crop diversity.

Windbreaks in Sustainable Agriculture Systems, University of Nebraska-Lincoln

Literature Review

Beneficial Animals in the Garden



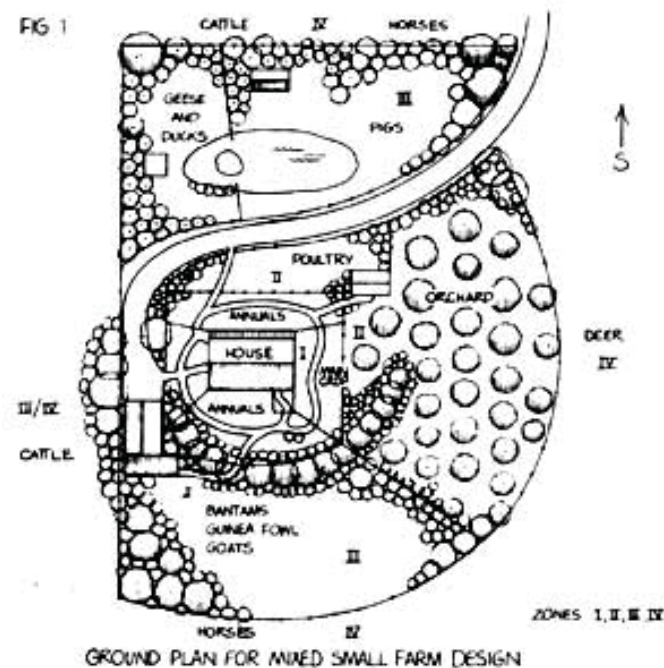
Scanned image, [Permaculture: A Designer's Guide](#)

Placing Animals within the Farm

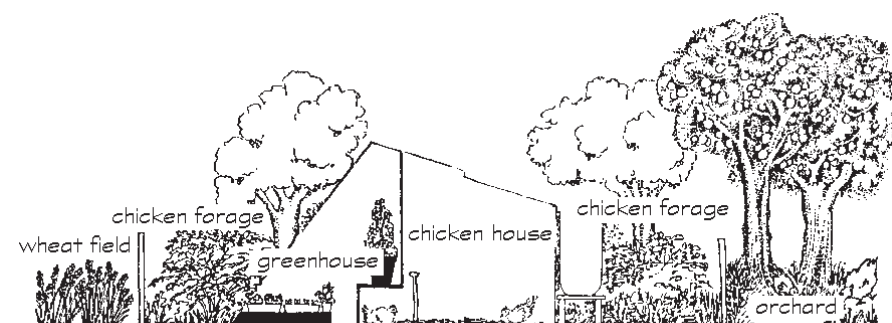
Optimal placement of animals within the farm can effectively integrate the use of an animal's products and behavior, which serve to reduce human labor, decrease the need for additional nutrient inputs, and grow healthy animals.

For example, chickens provide a farm with the following benefits: eggs, meat, feathers, manure, and certain behavioral characteristics like scratching and foraging. Other livestock animals have similar beneficial characteristics.

In terms of agroforestry, placing animals within, or near, an orchard and garden can support and improve relationships between humans, animals and the orchard system. Animals devour the grubs and root-eating insects found under the orchard canopy. Through the foraging process, the soil is aerated at its topmost layer where most decomposition takes place. The tree roots receive a supply of fertilizer in the form of manure produced by the animal. Finally, humans benefit from a reduced work load and are able to enjoy products from both the animals and the orchard.



Scanned image, [Permaculture: A Designer's Guide](#)



<http://www.transitionculture.org/2008/10/20/in-search-of-the-fabled-permaculture-chickengreenhouse/>

Literature Review

Inspiring Design Examples



<http://www.desert-museum.org/>

AZ Sonoran Desert Museum

The Arizona Sonoran Desert Museum exemplifies a place-based human relationship to the Sonoran desert. As a museum, zoo and a botanical garden, it offers important insights on how vernacular architecture and design may be applied. The photo at left shows desert trees shading a decomposed granite patio, used for seating and small gatherings.

For more information, see <http://www.desert-museum.org/>

Corn Mazes

Corn mazes around Tucson are seasonal attractions for local residents, and serve as places for the entire family. Such an attraction provides the opportunity to connect visitors with the other aspects of a farm, such as a restaurant, local goods and produce.



Schnepf Farms, Mesa, AZ

<http://www.azcentral.com/members/Blog/JaimeeRose/t125178840>

Vernacular Building

The use of local materials is a sustainable way to connect people to place where they live.

This simple chicken coop was designed using a locally-available reed in Burkina Faso, Africa.



Steven Davies, Voice in the Desert

http://www.voiceinthedesert.org.uk/weblog/archives/2008/06/african_chicken.html/



<http://www.rowesproducefarm.com>

Rowe's Produce Farm

Rowe's Produce Farm has been serving the Ypsilanti area of Michigan for over 40 years. This farm offers visitors an interactive opportunity for consumers to pick their own strawberries and raspberries. Located in a modified barnhouse, the image above shows the setting in which their customers can buy their food.

For consumers, the experience of buying food can build a sense of trust, community and uniqueness. An indoor market that is protected from the elements can also retain an openness similar to being outside.

The "U-pick" concept helps to activate the consumers awareness of where food comes from and how it is grown.

For more information, see <http://www.rowesproducefarm.org/>



<http://www.regionalfoodbank.org/>

Regional Food Bank of Oklahoma

In 1980, the Oklahoma City Food Bank was founded, the first in the region. In 2000, the organization changed its name to the Regional Food Bank of Oklahoma to better describe the area served.

In its first year of operation, the Regional Food Bank (RFB) distributed 280,000 pounds of food, which is now distributed in about three days. The nonprofit provides enough food to feed 77,000 people every week with administrative and fundraising costs of less than four percent.

The RFB has developed many programs over the years, like gardening classes, an aquaponic and greenhouse system, a composting operation, and an orchard.

The Urban Harvest program at the RFB works to assist in the development, establishment and ongoing support of community gardens in Oklahoma City.

The demonstration garden at the RFB, maintained by staff or volunteer Master Gardeners, serves as a teaching area for new gardeners.

Also at the RFB, Plant-A-Row is a program for people who want to help feed the hungry in their community by growing food themselves, and donating the produce to people in need.

For more information, see <http://www.regionalfoodbank.org/>



<http://www.avalongardens.org>

- | | | |
|--|--|---|
| ● Community | ● Pond | ● Residence |
| ● Crop Fields | ● Animals | ● Storage |

Avalon Organic Gardens

Avalon Organic Gardens, Farm and Ranch is a 165-acre community and a sustainable living experimentation site located south of Tucson in Tumacacori, Arizona.

The farm and ranch includes many earth homes, greywater structures, rainwater earthworks, a food forest harvesting basin, sustainable farming design, and animals – ducks, chickens, goats, horses, and cattle. Community amenities include a community house, gathering building, and a series of barns for the farm activities, as well as arts and crafts, music, food processing, storage, and preparation.

The farm also employs innovative farming methods, which address the arid desert climate.

For more information, see <http://www.avalongardens.org>



<http://www.desertraincafe.com/>

Desert Rain Café

Desert Rain Café opened in March 2009 in Sells, Arizona. The café is a project of Tohono O'odham Community Action (TOCA), a non-profit organization dedicated to creating a healthy, culturally vital, and sustainable Tohono O'odham community. 100% of all proceeds support TOCA's programs in traditional O'odham foods, community wellness, and native arts.

The cafe supports TOCA's mission – to reinvigorate culture and health on the Tohono O'odham Nation – by providing healthy food choices to community members.

The menu showcases the bounty of the Sonoran Desert and the many indigenous foods that have been used by the Tohono O'odham people for centuries.

Food grown and cooked locally can be an educational experience that makes seasonal and local food more accessible to the public.

A restaurant can also serve as a community kitchen to strengthen local economies.

For more information, see <http://www.desertraincafe.com/>

Conceptual Development



Conceptual Development

Participatory Process

When working with a neighborhood or community, Drachman Institute takes a strength-based approach to community planning, design, and development.

The components of the community process are:

- Asset mapping
- Building Relationships and Community Capacity
- Creating a Community Vision
- Mobilizing Resources
- Implementation

Through discussions, presentations, and a design charrette, conducted in the fall and winter of 2010-2011, the Drachman Institute and the Marana Farm team worked together to define existing strengths, identify areas of need, articulate priorities, and envision potential future improvements.

The final book presented here, *Marana Farm: Visioning, Participatory Planning and Design* incorporates and recognizes this essential and valuable feedback. Meetings with the Town of Marana, housing developers, and other partners working on the CPPW grant also informed the final design solutions.



Visits to the farm during the participatory process provided the Drachman Institute team with different views of the Marana Farm at different times of day and year, broadening and understanding of the complex system behind a working farm.

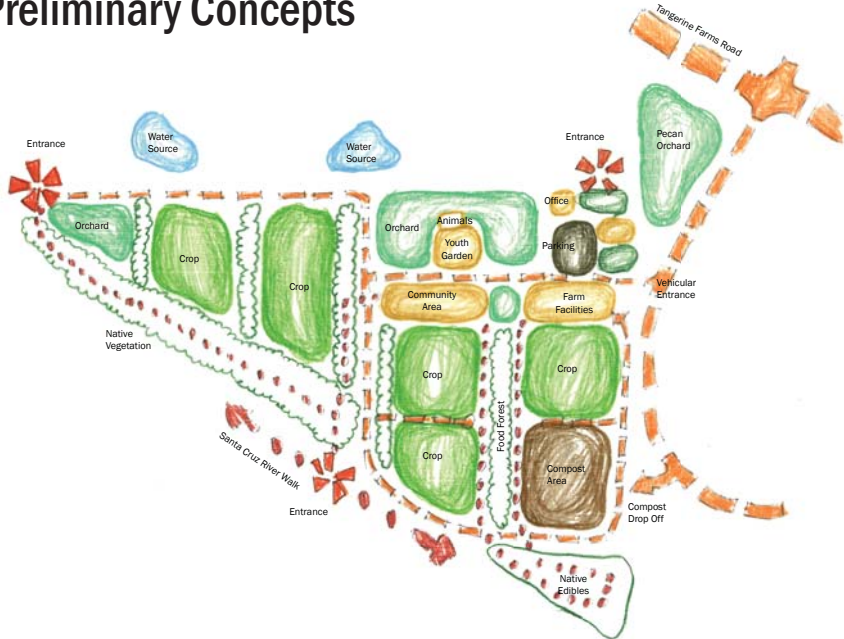
Conceptual Development

Vision & Program

	Education	Outreach	Sustainable Farm
Participants	~GARDENER – weekly neighbor Elementary, middle, high & college students Local residents Neighborhood associations Youth organizations: 4H, Future Farmers of America, Boy & Girl Scouts, etc.	~NATURALIST – occasional visitor Local farmers Donors/partners Regional or local residents Customers Event attendees	~GROWER – daily farm worker Farm staff Volunteers, students, interns Community leaders
Activities	Classes: sustainability, permaculture, rainwater harvesting, cooking/food preparation, etc. School activities: youth training, competitions, apprentice programs, internships, etc. Community workshops: medicinal herbs, native edibles, backyard gardening, food preparation, organic farming, beekeeping, composting, vermiculture, etc. Entrepreneurship training	Farm tours Farmer's market Festivals Fundraising events: Dinners, celebrity chefs, auctions, etc. Retreats/board meetings Weddings/parties	Administration/meetings Food production Harvesting events Fundraising events Planting events Weeding events Food processing
Elements	Commercial kitchen Multi-purpose building Outdoor classroom Youth gardens Demonstration gardens Eating areas Food preparation & processing areas Food storage areas: root cellar, walk-in cooler, etc. Parking Restrooms	Commercial kitchen Multi-purpose building Outdoor classroom Information area Community/gathering area Demonstration gardens Petting zoo Paths, trails, connections Accessible shade Attractive & clear entrance Signage Bus access options Parking Restrooms	Fields: orchards, row crops, etc. Natural Areas/buffers/windbreaks Offices & administration areas Multi-purpose building Outdoor classroom Youth gardens Demonstration gardens Animal barn Beekeeping area Compost area: Compost drop-off, office, vermiculture Seed starting areas Residences (temp workers, residencies) Loading zones Restrooms Tool storage & tractor maintenance

Conceptual Development

Preliminary Concepts



Two concepts were generated after an initial discussion with the Farm Team and site visit.

Concept 1

This concept places the community area at the central “heart” of the farm. Farm facilities and storage are located near the main entrance.

An orchard surrounds the youth orchard, creating a shady, cool microclimate for youth, and for the animals housed here.

Pedestrian and vehicle circulation routes are distinct, reducing potential conflicts.

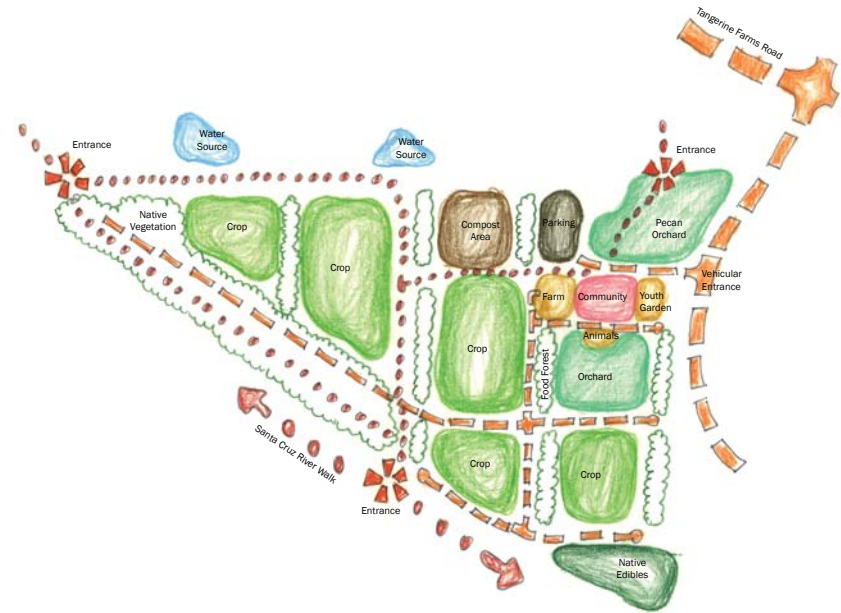
A separate entrance has been added for compost drop-off.

PROS

- Circulation between people and vehicles is free of conflict

CONS

- Vehicular circulation would require tractor to make frequent stops and turn-arounds
- Youth garden may seem “hemmed in” by the orchard; this layout doesn’t allow for any expansion



Concept 2

Concept 2 consolidates the education, community and farm facilities together, in a very visible location near the main entrance.

An orchard extends out from the community facility, allowing for a shady, gathering area and a space to view the animals.

The compost area is relocated to the north, resulting in closer access to the farm plots to the west.

PROS

- Community area and farm facilities are in close proximity, allowing for “blending” of functions
- Few opportunities for pedestrian and vehicle conflict
- Orchard located south of community area serves as wind break and shaded space
- Compost area is more centrally located; shorter distance to transport
- Animals can easily be integrated into the community and farm areas

CONS

- Compost area is in clear view from the neighborhood to the north
- Vehicular circulation would require tractor to make frequent stops and turn-arounds

Conceptual Development

Preliminary Concepts

Following a presentation of initial concepts, and a participatory design charrette, a third concept was created.

Concept 3

Concept 3 draws from the first two concepts, creating an integrated hub of farm and community activity at the center of the site.

This arrangement creates a central axis, with the pedestrian circulation connecting the Santa Cruz River Walk to the Youth Garden. Visitors have the opportunity to move from the community area to parts of the farm facilities, increasing understanding of the workings of the farm.

Both tractor (pink dashed line) and truck circulation (orange dashed line) was considered, and truck access was limited to a loop around the compost area and a route from the main entrance to the farm facilities. Tractor paths allow for continuous movement throughout the farm, without needing to turn around.

The western corner serves as an entrance for the three surrounding neighborhoods, and includes a community orchard and garden.



PROS

- Community and farm facility arrangement allow for flexibility with regard to public/private functions and events
- Compost area remains in current location; drop-off is convenient via truck loop
- Animals can easily be integrated into the community and farm areas
- Pedestrian entrances afford excellent access to neighbors from north, and grant a direct path south to the Santa Cruz River Walk
- Few opportunities for pedestrian and vehicle conflict

CONS

- With so many entrances to the public, some will need to be controlled
- These entrances will need to accommodate tractor width
- May want to alter northeast pedestrian entrance, to reduce conflict near more private office building

Design Principles



Design Principles

Design Principles

Mission

The design and construction of any facilities or landscape modifications should reflect the three-fold mission of the Marana Farm: sustainable farming, education, and community outreach.

This three-fold mission can be demonstrated throughout the design in the types of programs that are facilitated or the types of buildings that are built or reused (Program), through the materials that are used (Materiality), and through the building systems and energy and water resources that are utilized (Energy and Water).

Design decisions within these categories can visibly and physically demonstrate to the community how to build, live, and farm sustainably. The Marana Farm can be a living laboratory and example of the best of energy and water conservation methods, re-used, recycled, and appropriately selected and applied materials, and building type designs that are best suited for this community, culture, and climate.

Program

Sustainability should not only be thought of in terms of the environment, but, especially with regard to the Marana Farm, in terms of a thriving and productive community and farm.

Elements such as a community commercial kitchen and a community classroom and multi-purpose room provide opportunities for social and economic development and growth within Marana and throughout the

region. A commercial kitchen can provide the appropriate facility for groups, clubs, non-profits, and individuals to prepare healthy foods for public use, dining, and sale. It may become an incubator for struggling entrepreneurs. The community classroom/dining room/multi-purpose room can provide the venue for training and demonstrations for healthy food preparation, cooking, and growing, or become the site of a fund-raising event or dinner. Parts of the program supporting the farm such as a root cellar, food preparation and washing area, a tractor and equipment maintenance shop, compost facilities, vermiculture areas, and satellite tool sheds/toilets (that can be located as necessary throughout the farm) will sustain the growth and evolution of the farm.

Other programmatic elements such as demonstration gardens, the youth garden, and outdoor classrooms will support the educational aspect of Marana Farm's mission.

Materiality

The facilities on the sustainable farm should reflect, through their construction and materials, the inherent notions of the farm, including sustainability, agricultural methods, natural aesthetic, resource management/preservation, recyclability, durability, and re-usability. Materials used will stand as a physical expression of the values, priorities, and practices of the Marana Farm. They will serve the mission of the Marana Farm as an educational tool expressing again how to build, live, and farm sustainably.



The Santa Fe Railyard, completed in 2010, is an example of how materials can be selected as part of a design to to evoke historical meaning and cultural memory, in this case, how the railroad is an integral part of Santa Fe's past.



<http://www.westernskycommunications.com/blog/tag/bike-to-ography/page/3/>

BICAS (Bicycle Inter-Community Action and Salvage), located in Tucson, AZ, is a non-profit community education and recycling center for bicycles, whose mission is to promote education, art, and a healthy environment while providing service and opportunity for those in need. The entrance to the facility, constructed completely from bicycle parts, signals to visitors what they might encounter inside and introduces them to the mission and sensibility of the organization.

Priority should be made to re-use existing buildings appropriately wherever possible before new construction is necessary. Where new construction is needed, local, recycled, and/or reused materials should be used where possible. By reusing materials and buildings, raw material extraction is limited, reducing the negative impacts of the energy used during the extraction, production, and transportation of new materials. Additionally, this reduces the amount of materials going to a landfill.

Most structural steel manufactured today can contain more than 80% recycled content. Along with its durability, this emphasizes steel's role as a sustainable building material. Steel is readily available (or found) and can be reused in many different ways - structural framing, window and door framing, siding, roofing, trim, signage, etc. Additionally, even when allowed to rust, steel can add to an earthen or agricultural aesthetic.

Adobe block and rammed earth are materials that can be extracted, produced, and constructed all directly on-site. Soil from the site can be used to make the adobe blocks or as the main component of walls made of rammed earth. Reducing costs more, they also do not require additional finish materials. Additionally, rammed earth and adobe block both act as a thermal mass, a valued characteristic of desert architecture because of its ability to absorb heat during the day and release it at night which helps keep the interiors warm in the winter and cool in the summer.

Other alternative and sustainable building materials should also be explored such as

“earthbag,” “papercrete,” or strawbale - all earthen and natural materials that can demonstrate both cost and energy efficiency.

Energy and Water

While passive systems should be an integral part of the design of any new or retrofit construction, active systems that control thermal comfort, or distribute power and water will likely be an important part of the building. The design should strategically take advantage of existing site conditions that can reduce energy and water consumption. The design should also be expressive of this and act as a physical demonstration of energy and water conservation, serving the mission of the Marana Farm.

Appropriate solar orientation is a critical aspect of any design in the desert. Buildings on the farm should be designed to keep out heat in the summer and to take advantage of the sun's heat in the winter. Ideally, buildings should be oriented with their longest walls facing north and south. Windows on west or east facing walls should be avoided while glazing on the south can provide strong solar gain in the winter if protected by well designed horizontal shade structures in the summer.

While proper solar orientation and window placement make a significant impact in energy consumption and thermal comfort, additional active strategies such as the installation of photovoltaic panels and solar water heaters can increase the sustainability of farm facilities.

Natural lighting and natural ventilation are also

important aspects of a healthy and sustainable building. Natural lighting can reduce the need for artificial light and energy consumption while providing farm workers or visitors with quality working light and a visible connection to the farm. Natural ventilation can also reduce energy consumption and allow the user to control her own indoor environment. Especially considering the moderate climate of the Marana desert, operable elements such as sliding doors, windows, screens, and skylights can take advantage of the comfortable outdoor temperatures and breezes.

Water, especially in the desert, is a precious resource and essential to the sustainability of the Marana Farm. Water should be conserved and reused wherever possible, through the use of rainwater harvesting, greywater reuse, and the use of water-conserving plumbing fixtures. Roofs are designed to shed water and are thus a great source of water collection. Gutters and cisterns can be a visible design expression of the sustainable practice of water conservation. Greywater, or waste water from lavatories, showers, or laundry, can be reused (and even plumbed separately) for irrigation or other non-potable uses. Additionally, low-flow faucets and waterless urinals and toilets can be used where appropriate in new or updated buildings reducing the consumption of water and the waste associated with it.

Again, these design principles will not only sustain the farm, but can actively demonstrate to the community how they can build, live, and farm sustainably.

Design Principles

Materials

Fly-ash Concrete

“Fly ash is a fine, glass-like powder recovered from gases created by coal-fired electric power generation. U.S. power plants produce millions of tons of fly ash annually, which is usually dumped in landfills. Fly ash is an inexpensive replacement for portland cement used in concrete, while it actually improves strength, segregation, and ease of pumping of the concrete. Fly ash is also used as an ingredient in brick, block, paving, and structural fills.”

<http://www.toolbase.org/Technology-Inventory/Foundations/fly-ash-concrete>



http://woodburydb.files.wordpress.com/2010/01/flyash_concrete.gif

Wood & Steel

Wood, or timber, is a traditional building material found on many farms, and the Marana Farm is no exception. It creates a warm and traditional feel on the interior, and, if treated or protected properly, emphasizes the place and culture when used as an exterior feature or material.

Most structural steel manufactured today contains more than 80% recycled content. Along

with its durability, this emphasizes steel's role as a sustainable building material. Additionally, when allowed to rust, or sealed in its rusted state, the steel adds to the natural and earthen aesthetic and blends with the colors of the land.



Adobe Block

Made from locally obtained dirt, adobe can be long-lasting and aesthetically beautiful while providing thermal mass that helps to keep the space cool in the summer and warm in the winter. Additionally, this material has cultural significance in the southwest and has been used locally for centuries.



http://www.aznativeproperties.com/RooPho_new/Featured_Listings/10620_W_Montecito/10620_W_Montecito.htm

Papercrete

Papercrete is a generic term used to describe a “do-it-yourself” material that consists of usually 50-80% recycled paper mixed with either portland cement, clay, soils, other additives or some combination of them. Papercrete can be formed into any shape or pressed into blocks to be used in a masonry format. It's light weight, high insulation value, and ease of construction make it an ideal material for small “unskilled labor” constructed projects. However, because it has not been adopted by many building codes or jurisdictions as a standardized building material, it may pose a road block for larger projects.



A prototype of a papercrete house, built by graduate students at the John C. Lyle Center for Regenerative Studies, Cal Poly Pomona.

Rammed Earth

“Rammed earth is a structural wall system built of natural mineral soils compacted in thin layers within sturdy formwork. The strength and durability of the wall results from the densification of a clay, sand, and gravel matrix. The mass of the wall provides superior thermal and acoustic properties.

To build a rammed earth wall, moist soil is compacted layer at a time inside of a strong mold or form. The forms can be removed immediately and the fresh wall is capable of supporting loads. It continues to cure and gain strength slowly over time.

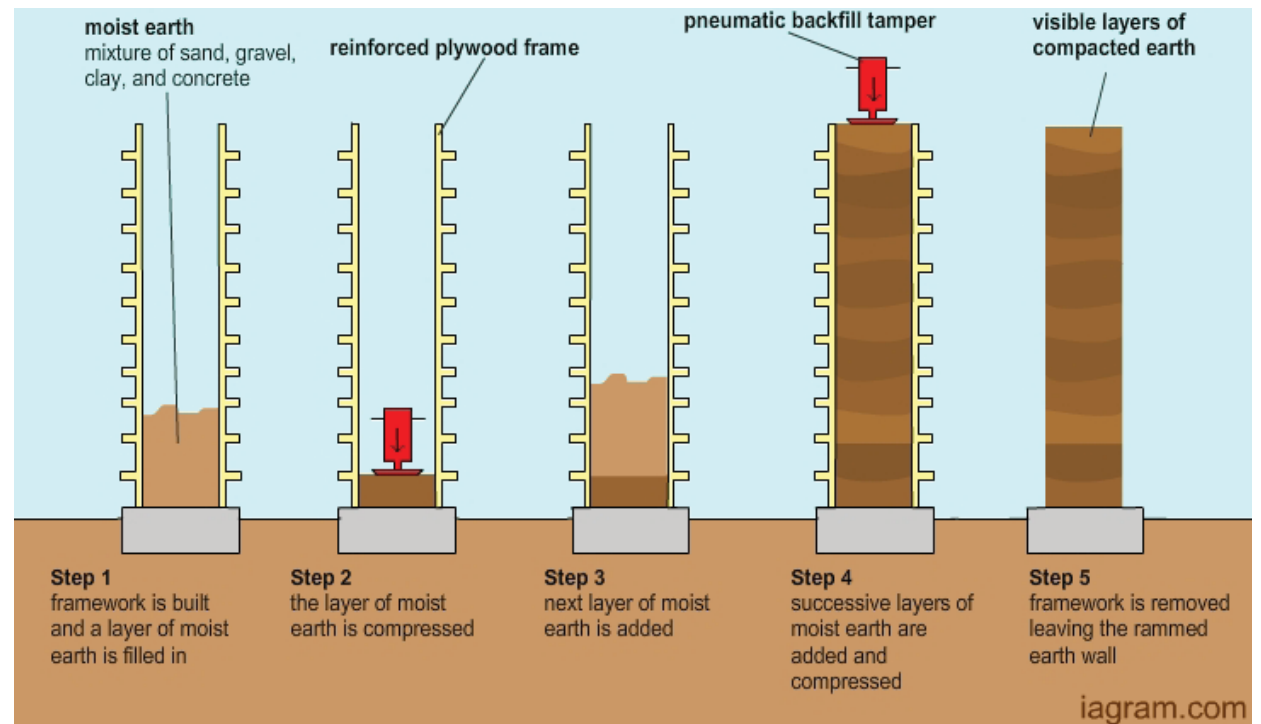
Although rammed earth can serve as simply a resource -conserving thermal flywheel, in other applications it is celebrated as functional art.”

<http://rammedearthworks.com/page/FAQs>

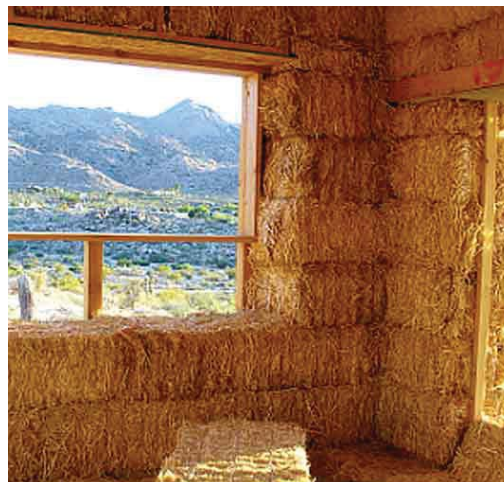
Rammed earth technology not only maintains a certain aesthetic that is linked to the land, but would be an excellent material for showcasing the principles and intensions of this sustainable farm. While the technology of building structures from the earth dates back to prehistory, the use of this material in a modern application embraces it as a heritage to be built upon, similar to the way that sustainable farming practices borrow knowledge from the past.

Strawbale

The bales used in construction are made from a waste-product of the farming industry. Strawbale homes and buildings have high insulation values, are simple to build, and their thick walls are a valued design feature.



<http://engeyedesignteam.files.wordpress.com/2010/09/rammedearth1.jpg>



<http://www.inhabitat.com/2007/12/29/sacred-sands-a-strawbale-bb-guest-retreat>



http://www.treehugger.com/files/2007/04/nkmip_desert_cu.php

Design Principles

Windbreaks

At the Marana Farm, a native vegetation buffer act would gently diffuse and reroute the prevailing southwesterly winds.

New studies recommend that windbreaks include three to eight rows of plant material. This contrasts with an older design which included only a single row of trees or shrubs, demonstrated to be ineffective at decreasing wind speed.

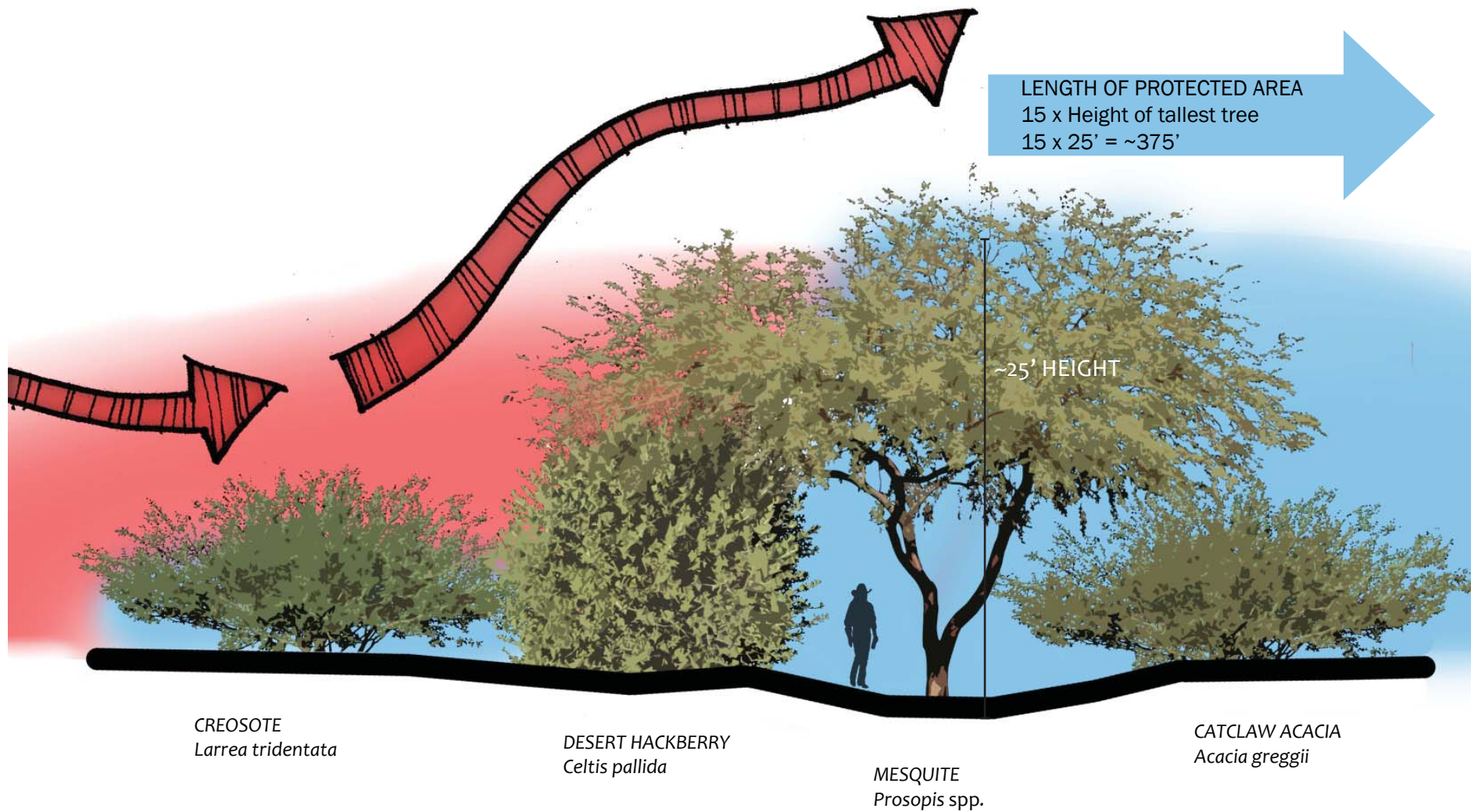
A windbreak for the Marana Farm could be composed of the following layers:

First layer: smaller, hardy vegetation, such as creosote (*Larrea tridentata*)

Second layer: larger shrub vegetation, like desert hackberry (*Celtis pallida*) or catclaw acacia (*Acacia greggii*)

Third layer: largest tree species, like mesquite (*Prosopis* spp.) or palo verde (*Cercidium* spp.).

The layered effect of trees forces air to ramp gently upward, prevents wind from abruptly hitting the tallest tree and damaging branches, and creates a protected area with a distance of about 15 times the height of the tree on the leeward side. Shrub vegetation prevents wind from funneling underneath the tree canopy, which would compromise the effectiveness of the windbreak. The buffer can be planted in a basins designed to catch rainwater, increasing energy efficiency and overall sustainability.



Design Recommendations



Design Recommendations

Master Plan

Feedback from Community Food Bank representatives, Marana Farm workers, and other CPPW team members during meetings and presentations of conceptual designs was the basis for this final recommended master site plan.

The relationships between the existing features and the new proposed program are designed to support and reflect **the three-fold mission of the Marana Farm: sustainable farming, education, and community outreach**, while serving as a venue for a variety of activities by the three user groups: **Growers, Gardeners, and Naturalists**. The plan provides the appropriate interaction and accessibility between users while maintaining privacy and security as needed.

This plan places the community-focused spaces both conceptually and geographically at the center of the farm, with more farm-work spaces radiating from there. The indoor/outdoor Farmer's Market and the community spaces of the New Farm Building create an entry court directly south of the Main Entrance Gateway. This gateway (labeled as '1' on the map) acts as an iconic threshold between the parking lot and the farm. To the north of that space remains the Youth Garden, while a demonstration fruit orchard, planter garden, and herb garden bookend the space to the south.

The **New Farm Building** is designed and located to serve as a central transition space, work space, and educational space that promotes activities and interaction by the three user groups while providing both visual and physical connection to the other areas of the farm. The community-serving spaces (multi-purpose/classroom and community commercial kitchen) are located

toward the center, while the farm offices and work spaces move away toward the west end of the building. These work spaces are served by a loading zone, farm equipment and worker parking, shade and green houses, and equipment storage west of the New Farm Building. The building is designed to mirror the footprint of the existing building to the east and is situated with the multi-purpose room views aligning with the Food Forest trail to the south and the Youth Garden to the north.

The **existing buildings on the site** will be modified or reused. The existing metal building east of the New Farm Building will serve as the Farmer's Market space and could be used for storage or as flexible community space. Because of its location at the edge of the property away from community spaces, the existing building at the north end of the property (currently used as offices by local home owners associations) will be modified to serve as a residence for traveling workers (ex: WWOOFeRs — World Wide Opportunities on Organic Farms).

Satellite tool sheds are strategically located throughout the farm to provide efficient access to tools and toilets while providing a shaded outdoor class or work space.

While larger fields of row crops are the main land use on the farm, south of, and adjacent to, the community spaces is a **field that is divided into quadrants** representing and demonstrating different types of agricultural activities: gardens, pasture, animal barn, and orchard. An **outdoor classroom space** is defined by shade trees at the center of that field. Each field is lined by native trees planted in basins designed to collect

rainwater. These trees, specifically lining the southern and western edges to block prevailing winds, help to protect the fields, crops, and shade structures from wind damage or erosion while also providing shaded paths for the farm workers.

The **compost area** is located directly south of this field. The outdoor office/tool shed/toilet for the composting operation is aligned with the outdoor classroom space in the field to the north and is also located along the truck route for community compost delivery.

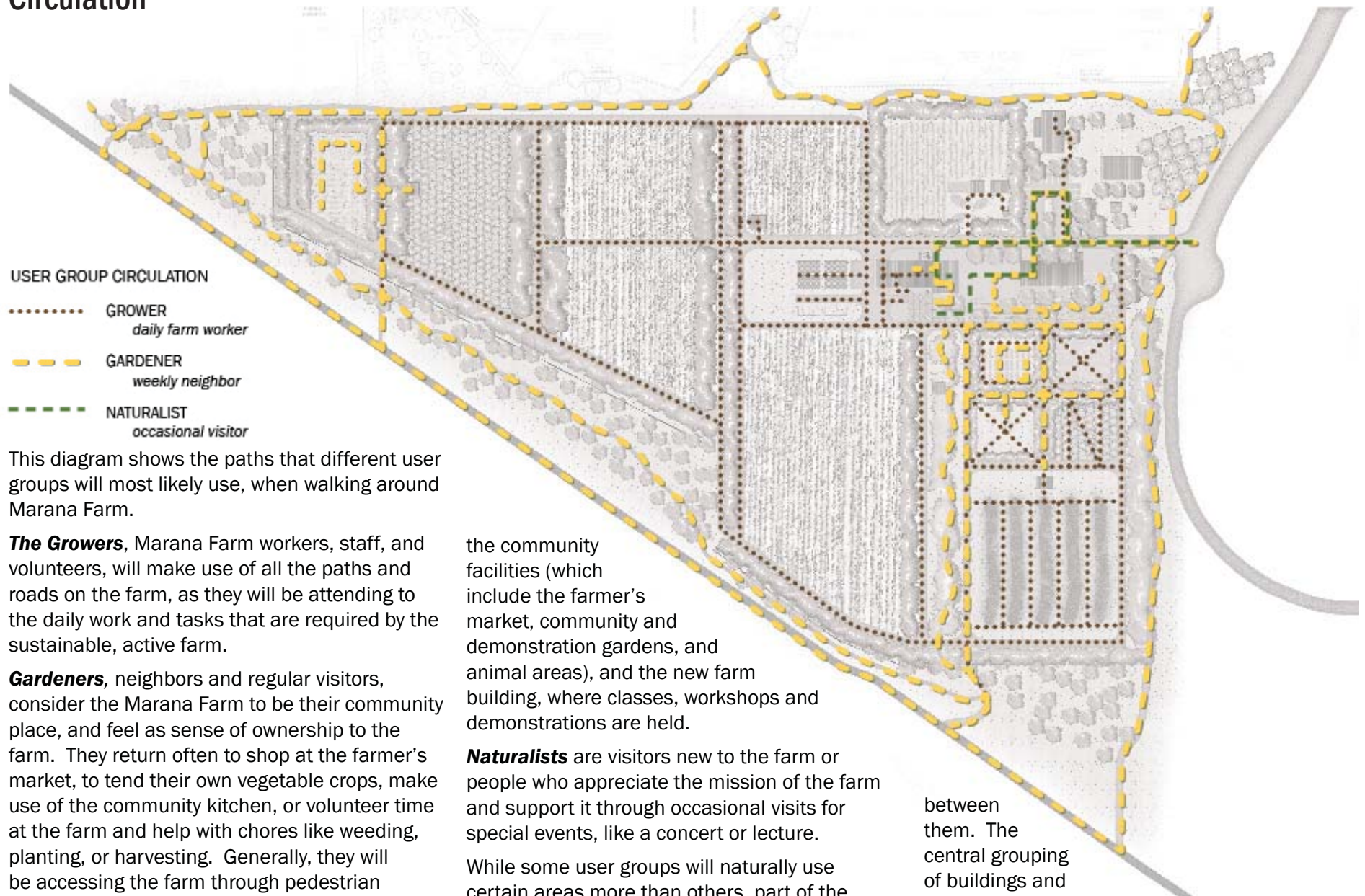
With existing and soon-to-be-completed community trails located along the north and south property boundaries of the farm, **pedestrian entrances and gateways** were designed and placed in strategic locations along these trails in order to maintain appropriate pedestrian access and control circulation. The entrances at the west corner and at the north along the neighborhood pedestrian trail (labeled as '3' on the map) allow local residents of the Honea Heights and Gladden Farms neighborhoods access to the Community Garden and also to the farm during certain hours. Entrances along the Santa Cruz River Walk (labeled as '2' on the map) provide access to the farm and interpretive native vegetation paths along the south. The entrance along that trail at the southeast corner provides a gateway to the community-focused areas of the farm that visitors can access by using the food forest pathway.

Native plantings along the southern boundary of the farm help to revitalize and stabilize the silty, dusty soil near the river while demonstrating rehabilitation strategies for disturbed land, using native and appropriate landscape along interpretive trails.



Design Recommendations

Circulation



This diagram shows the paths that different user groups will most likely use, when walking around Marana Farm.

The Growers, Marana Farm workers, staff, and volunteers, will make use of all the paths and roads on the farm, as they will be attending to the daily work and tasks that are required by the sustainable, active farm.

Gardeners, neighbors and regular visitors, consider the Marana Farm to be their community place, and feel a sense of ownership to the farm. They return often to shop at the farmer's market, to tend their own vegetable crops, make use of the community kitchen, or volunteer time at the farm and help with chores like weeding, planting, or harvesting. Generally, they will be accessing the farm through pedestrian entrances and pathways, and will spend their time in the community areas, such as the orchard and garden at the western edge,

the community facilities (which include the farmer's market, community and demonstration gardens, and animal areas), and the new farm building, where classes, workshops and demonstrations are held.

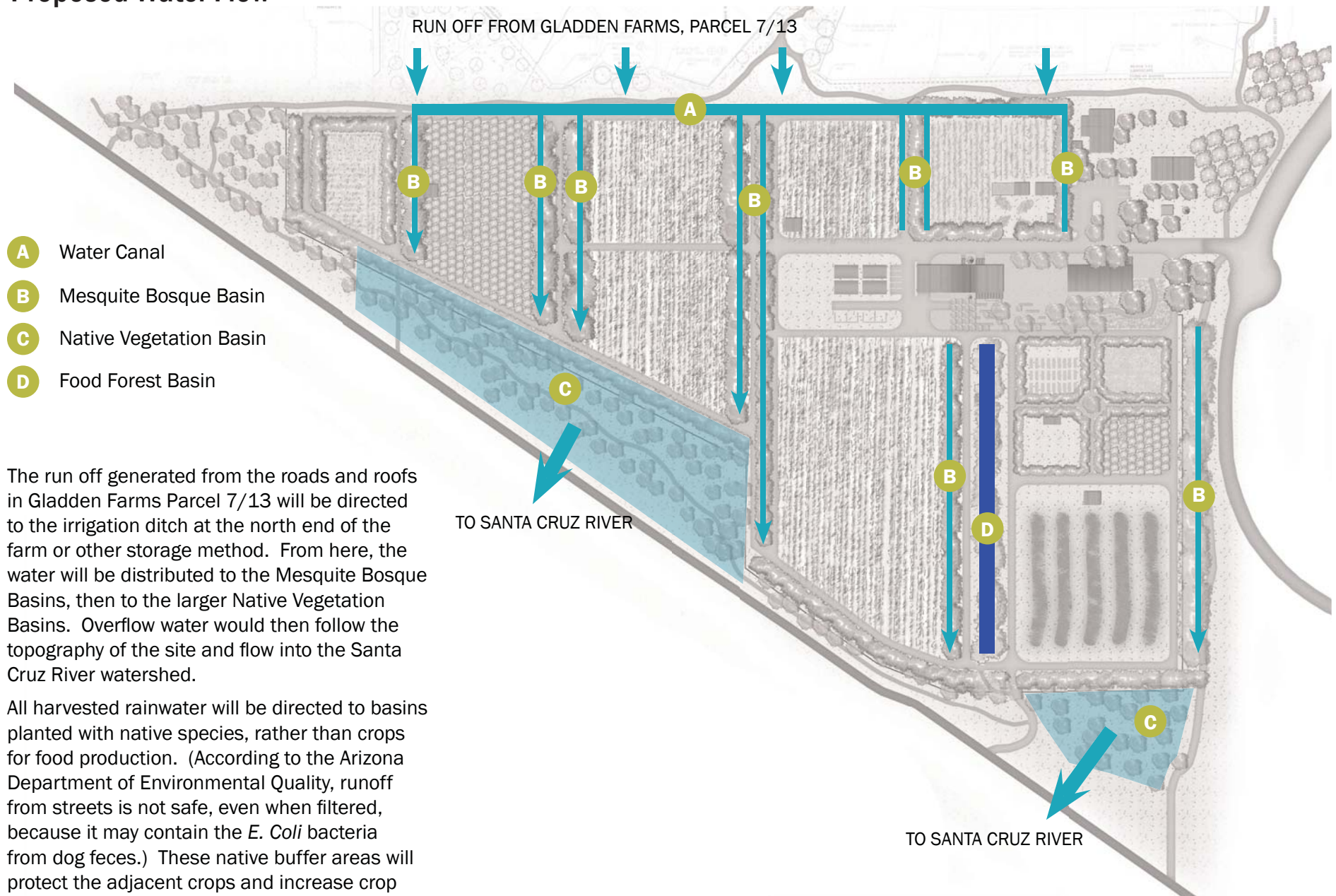
Naturalists are visitors new to the farm or people who appreciate the mission of the farm and support it through occasional visits for special events, like a concert or lecture.

While some user groups will naturally use certain areas more than others, part of the mission of the farm is to reach a diverse audience of people, and encourage interaction

between them. The central grouping of buildings and gardens composes an area of high activity which all three user groups will frequent.

Design Recommendations

Proposed Water Flow

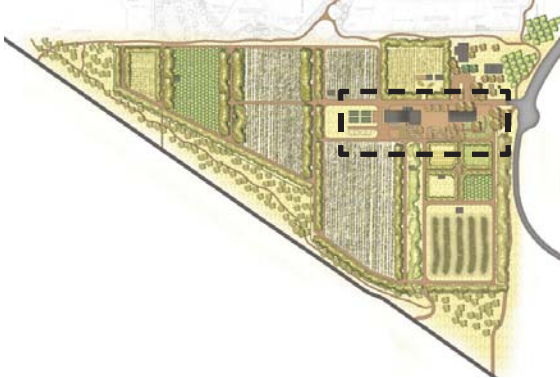


The run off generated from the roads and roofs in Gladden Farms Parcel 7/13 will be directed to the irrigation ditch at the north end of the farm or other storage method. From here, the water will be distributed to the Mesquite Bosque Basins, then to the larger Native Vegetation Basins. Overflow water would then follow the topography of the site and flow into the Santa Cruz River watershed.

All harvested rainwater will be directed to basins planted with native species, rather than crops for food production. (According to the Arizona Department of Environmental Quality, runoff from streets is not safe, even when filtered, because it may contain the *E. Coli* bacteria from dog feces.) These native buffer areas will protect the adjacent crops and increase crop yield.

Design Recommendations

Central Core



- 1 Main pedestrian entrance
- 2 Farmers market
- 3 New farm building
- 4 Fruit orchard
- 5 Demonstration gardens
Outdoor seating area
- 6 Herb garden
- 7 Shade houses &
green houses
- 8 Farm equipment
storage area
- 9 Farm truck &
worker parking



Design Recommendations

Main Entrance to Farm

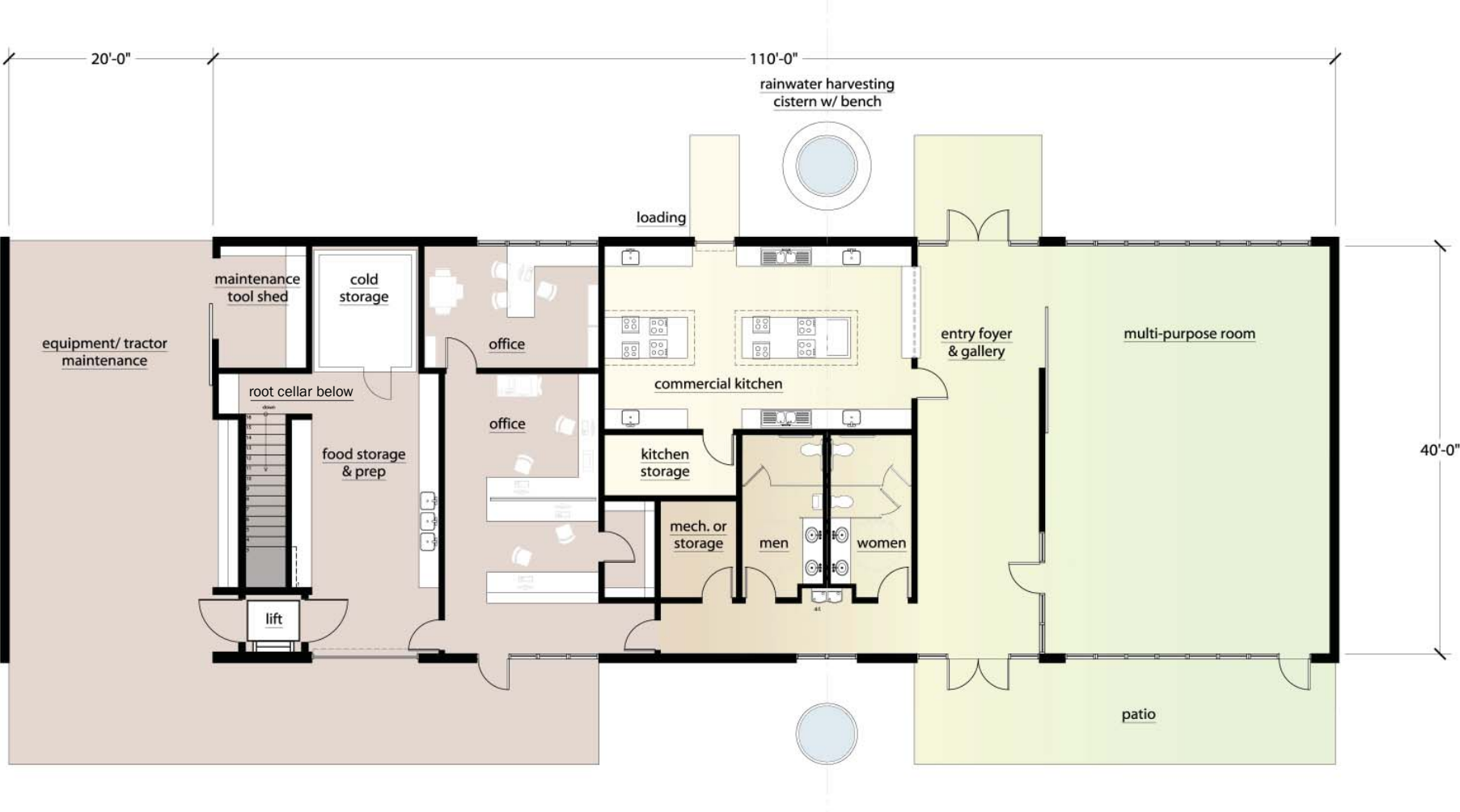


Looking towards the southwest, this view of the main pedestrian entrance to the Marana Farm shows the indoor and outdoor areas of the farmers market as well as the formal pedestrian (or even small vehicular) gateway to the farm. From this entrance, the visitor already begins to understand and see the different aspects and features of the farm.

The framed entryway serves as a clear threshold for visitors. The materials – wood and steel – are reflective of those found within the farm, the form is similar to the agricultural feel of some of the existing architecture on site, and the structure is a consistent element found at each main entrance. Signage could include a

locator map for orientation, as well as special event announcements, while the sign over the entryway features the Marana Farm logo laser-cut from plate steel.

Design Recommendations New Farm Building, Plan



- Growers (daily farm worker)
- Gardeners (weekly neighbor)
- Naturalists (occasional visitor)

Areas (in square feet — s.f.):			
total (excluding tractor maintenance):		4,400 s.f.	
multi-purpose room:	1,120 s.f.	office area:	715 s.f.
commercial kitchen:	630 s.f.	food storage & prep area:	660 s.f.
entry foyer & gallery space:	480 s.f.	root cellar:	820 s.f.
restrooms/storage:	350 s.f.	tractor maintenance area:	900 s.f.

Design Recommendations

New Farm Building, Program

This new farm building was designed to serve a number of uses and provide the venue for a variety of activities by the three user groups: *Growers, Gardeners, and Naturalists*. Because it serves three different user types, it had to be designed to provide privacy and security while feeling open, accessible, and connected.

The **entry** serves as a **central gallery**, designed to not only control access and circulation between the outdoor programs, the multi-purpose room, the commercial kitchen, and services such as restrooms, but also to serve as a gallery that could be used as an educational space or to exhibit work of local artisans, chefs, gardeners, schools, etc.

The **multi-purpose room** was designed to be a flexible space with lots of natural daylight and visual connection to the farm. Two large window walls on the north and south provide protected natural light as well as views of the youth garden to the north and the demonstration gardens, seating area, and food forest to the south. This room has direct access to the outdoor patio on the south and also opens up into the gallery directly across from the commercial kitchen which features a serving counter into this space. This space could be the venue for classes, dinners, fund-raising events, culinary demonstrations, presentations, etc.

The **commercial kitchen** is intended to serve as a fully equipped community facility, certified by the county health department, where individuals, community organizations, vendors, or special event coordinators can rent or borrow the facilities where they can safely and legally

produce, package, or prepare food. The kitchen was designed with ample counter space, sinks, stoves, ovens, and other equipment for multiple users. It also features a walk-in cold or dry storage room as well as a separate loading entrance directly into the kitchen from the exterior loading area.

The **office area** designed for the farm managers and workers features an open office space that includes up to five work stations, a walk-in storage closet, and space for a common copier or printer. Additionally, there is a private “director’s” office adjacent to the open offices. This office provides room for a large work station as well as space for a small conference table. Large window walls on the north and south of the office area provide quality ambient light throughout the entire office space, reducing the dependence on artificial light and energy use.

To accommodate the need for a covered **food storage and preparation area**, adjacent to the farm offices and the back loading area is an indoor work area that provides extensive counter work space, sinks, and a walk-in refrigerator. Directly below that space, and accessed via a wide stairwell and industrial lift, is a root cellar for food storage. This space is secured (or opened) by a large sliding or overhead door.

At the west end of the building is a covered **equipment and tractor maintenance** space that is open on the north and south. This “drive-through” shop has a secured walk-in tool shed/equipment room as well as over 16 feet of built-in cabinet space.

The **overall building** was designed to mirror the footprint of the existing metal structure on the east end of the farm. The base material of the new building is proposed as rammed earth to emphasize the connection with the land, the use of local and simple earthen materials, and the technology of thermal mass in the desert to control thermal comfort. In contrast to this traditional earthen material, a modern corrugated steel siding is used to transition from the base to the roof plane. Large glass walls also help to emphasize the contrast between hand-made earthen and modern industrial technology similar to the agricultural balance on the farm. The roof is aesthetically designed to create a visual movement and diagram that emphasizes the practicality of capturing rainwater. Located near the main and rear entrances, the rainwater harvesting cisterns, which feature a circular bench, help to create iconic entryways.

Ultimately, this building is designed and located to serve as a central transition space, work space, and educational space that promotes activities and interaction by the three user groups while providing both visual and physical connection to the other areas of the farm. This design provides a venue for these interactions and activities and also serves as a living and working model and visual example of appropriate and sustainable agricultural development and architecture in the desert southwest.

Design Recommendations

New Farm Building



Looking towards the southwest, the rainwater harvesting cistern with the bench, the suspended canopy cover, the red double doors, and indigenous shade trees help to denote and emphasize the main entrance.

This view of the north and east elevations shows the rammed earth base with the large window wall that provides excellent natural light and frames views of the youth garden from the multi-purpose room. The solid walls on the east

and west with the large window walls on the north and south provide the best orientation for natural light and heat gain in the winter while being protected from the harsh summer sun.

The roof rafter tails and the high placement of the corrugated rusted steel siding help to showcase the roof slope towards the center of the building where the rainwater harvesting occurs.

Loading zones on the other side of the cistern allow for easy access to the commercial kitchen.

Design Recommendations

New Farm Building



Looking towards the northeast, this view of the south and west elevations shows the rammed earth base with the rusted corrugated steel siding above emphasizing the contrast and compliment of earth and industry found on the farm. The continuation of the roof rafters and roof plane over the “drive-through” maintenance area and down along the west elevation into the ground strengthens the notion of a continuous, folded plane that unifies the programmatic elements within the building.

The open maintenance area promotes appropriate natural ventilation while providing protection from the sun, wind, or rain. The tool shed and cabinets are secured independently but easily accessible from within that space.

On the south elevation, the large doorway allows ample access, natural light, and ventilation to the enclosed food preparation and storage space adjacent to the back loading area.

The window wall on the south near the loading zone provides an entry to the farm offices while providing protected natural light into the open office area.

Again, the south elevation continues to emphasize the intent and importance of harvesting and appropriate use of rainwater.

Design Recommendations

Demonstration Gardens



Looking towards the northwest, this view of the south and east elevations shows the rammed earth base with the large window wall that provides excellent natural light in and views of the demonstration gardens and seating area, as well as the food forest beyond, from the multi-purpose room. The suspended canopy over the south window wall provides protection for the multi-purpose room from the summer sun, while providing a transition patio space between the

indoor and outdoor multi-use areas. A raised planter area along the south edge of this patio provides a counter or demonstration planter for different types of events or trainings.

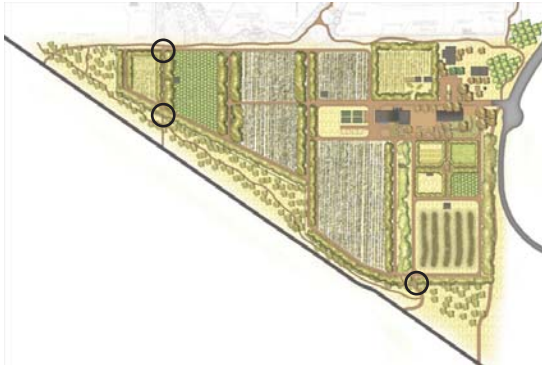
The demonstration gardens on the south side of the new farm building integrate seating and raised planters built from rammed earth, concrete, and steel. The accessible planters and benches are arranged to create multiple paths and to slow movement which emphasizes

the design of the area as a quiet, transitional space between the educational program of the building and the work aspects of the farm itself. The fruit orchard on the western boundary of the demonstration gardens is fed by the rainwater cisterns on the south side of the new building.

As one moves east toward the farmers market, larger trees are planted near the seating and planters, providing a shaded venue for outdoor events, entertainment, or classes.

Design Recommendations

Neighborhood Entrances



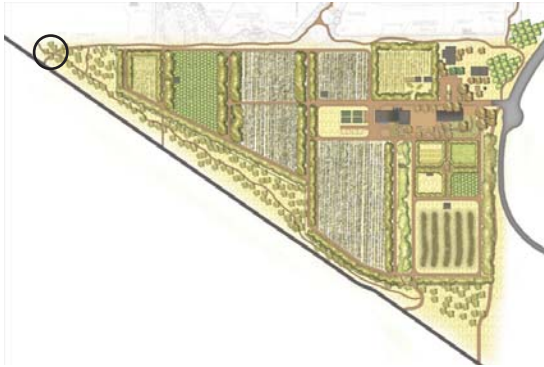
This image shows one of the southern entrances to the Marana Farm, from the Santa Cruz River Walk. The approach brings visitors through an area planted with creosote bush and other native plants, allowing people to make a gradual transition from paved pathway to desert environment to farm. The structural diversity of native plantings strengthens the web of nature by creating habitat for pollinators and wildlife.

The framed entryway serves as a clear threshold for visitors. The materials – wood and steel – are reflective of those found within the farm, and the structure is a consistent element found at each main entrance. Signage could include a locator map for orientation, as well as special event announcements, while the sign over the entryway features the Marana Farm logo laser-cut from plate steel.



Design Recommendations

Other Entrances & Spaces



West Entry

This entry could combine the use of raised or sunken planters, signage, and shade trees to create an inviting entrance that showcases examples for homeowners of the various climatically-appropriate planting methods. This would also act as a defining threshold between the adjacent neighborhoods and the Marana Farm. The neighborhoods could potentially take ownership and maintain these planters that would serve as a gateway to their community gardens in the northwest corner of the farm property.

Design Recommendations

Other Entrances & Spaces

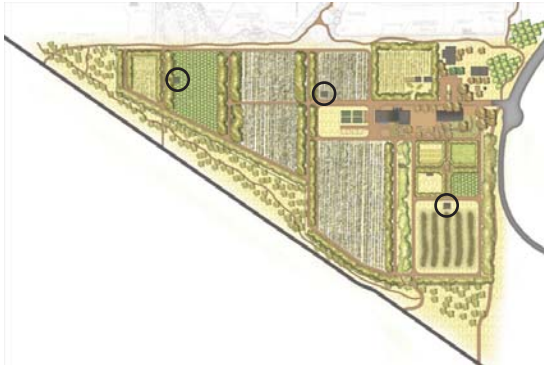


Cafe

A regional and natural cafe/restaurant that features local ingredients and indigenous foods may be part of the program of the farm. This image shows some of the characteristics that could help define this type of space. Outdoor eating areas adjacent to demonstration gardens and water harvesting systems could be shaded with fabric structures and indigenous shade trees.

Design Recommendations

Satellite Tool Shed



The satellite tool shed serves the needs of the farm workers by providing access to commonly used tools throughout the farm. The added efficiency of having tools accessible where they work is complimented by the combination of a composting toilet, sink, work station/counter, and shade. The architecture continues to uphold the expression of play between earth and industry while celebrating the sustainability in form and function.

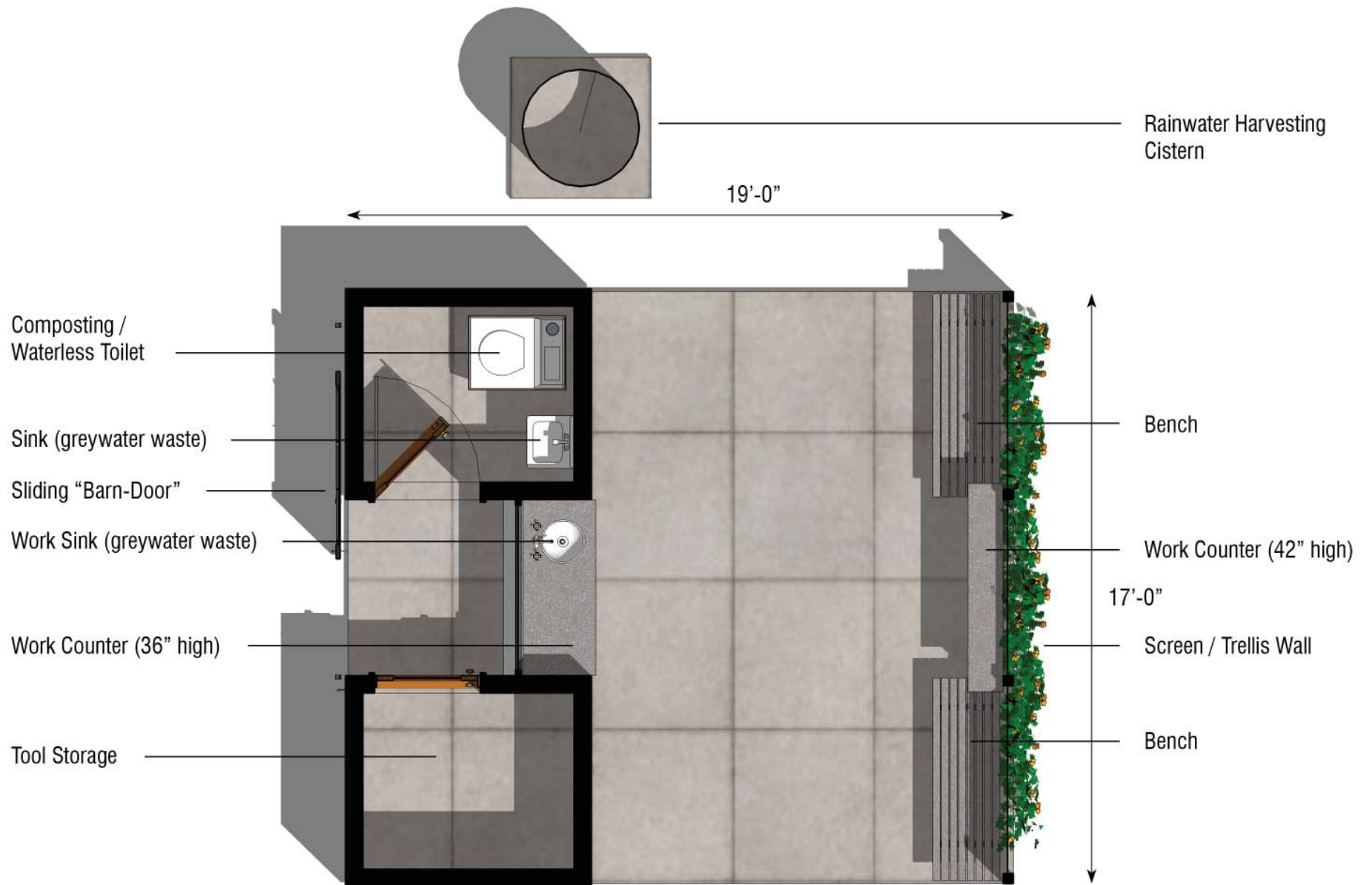


The open space can act as a classroom, outdoor office, or just a well-needed respite from the sun. The space is shaded from above with a metal roof on exposed framing and is protected on the west by the solid adobe or rammed-earth walls and a planter screen on the east. The tool shed and toilet room are lit with clerestory ambient light through translucent polycarbonate panels eliminating the need for artificial light or electrical wiring. Their entries are secured with

a single sliding "barn door," emphasizing the agricultural vernacular of the farm architecture. The roof form not only allows for natural light, but is designed to capture rainwater, diverting it to a cistern on the north that would help to water the 'green' screen on the east or other plantings nearby, or providing water for the sinks if filtered properly.

Design Recommendations

Satellite Tool Shed, Plan



Appendix



Appendix

Plant List for Windbreaks

Choices of windbreak species must take into account rate of growth, density, and deep root systems.

Trees for Windbreak

Cercidium floridum, blue palo verde
Chilopsis linearis, desert willow
Olneya tesota, desert ironwood
Prosopis glandulosa, Texas honey mesquite
Prosopis juliflora, velvet mesquite
Prosopis pubescens, screwbean mesquite

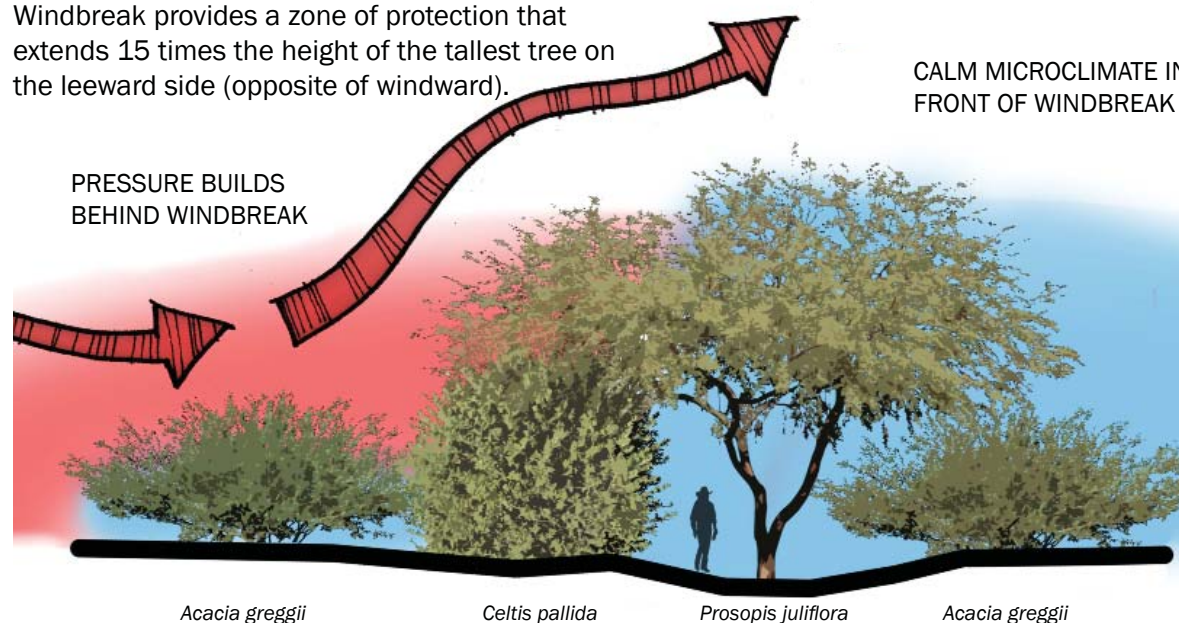
Shrubs for Windbreak

Acacia greggii, catclaw acacia
Celtis pallida, desert hackberry
Dodonea viscosa, hopseed bush
Lycium spp., wolfberry
Vauquelinia californica, Arizona rosewood

Shrubs for Wildlife

Celtis pallida, desert hackberry
Condalia globosa, bitter condalia
Condalia werneri, Mexican crucillo
Lycium spp., wolfberry
Ziziphys obtusifolia, gray thorn

Windbreak provides a zone of protection that extends 15 times the height of the tallest tree on the leeward side (opposite of windward).



Stacking a windbreak to deflect wind creates microclimates that create less turbulent pockets so that other important farm activities to take place. In general, the effects of a windbreak are creation of cooler temperatures and decreased loss of water to evaporation in the summer, and the warmer temperatures

because an environment with less turbulent air conditions reduces the replacement of warm air. Research shows that windbreaks contribute to conservation of soil moisture, improvement of crop water use efficiency and increase in crop yields in the protected zones.



Chilopsis linearis



Prosopis pubescens



Prosopis juliflora



Celtis pallida



Acacia greggii

Appendix

Cost Estimates



This cost estimate is for preliminary planning purposes only and may not necessarily reflect actual current prices. Additionally, it does not include labor costs. Any pricing or bids should be obtained by a licensed and bonded general contractor.

Marana Farm Satellite Tool Shed/ Outdoor Classroom/ Toilet
Cost Estimate - Materials Only

Cost Estimate - Materials Only			RSMean	Other	
Item		Quantity or area	Cost per Item		Total Cost
Foundation (3000 psi conc.)					
Footings	I.f.	52	7.07		\$367.64
Slab	s.f.	320	2.14		\$684.80
Walls (Adobe Block)					
blocks	ea	940		1.5	\$1,410.00
mortar	50# bag	4		15	\$60.00
Roof					
Roof Framing System	s.f.	396	1.47		\$582.12
Beams		1		40	\$40.00
Waterproof Membrane	s.f.	396	0.07		\$27.72
Steel Roofing	s.f.	1		430	\$430.00
Roofing Screws	box of 100	3		14	\$42.00
Gutter	custom				\$200.00
Skylight Walls					
Framing	s.f.	40	0.68		\$27.20
Polycarbonate	min. order	1		550	\$550.00
Upper corner-Flashing	10' lengths	4		4.82	\$19.28
Lower z-Flashing	10' lengths	4		9.3	\$37.20
Columns	ea	4		11.97	\$47.88
Benches		2		125	\$250.00
Work Counter - 12"	I.f.	4.833		5	\$24.17
Screen	s.f.	135		2	\$270.00
Countertop	I.f.	4.833	28.5		\$137.74
Work Sink		1		139	\$139.00
Composting Toilet		1		2099	\$2,099.00
Lavatory		1		78.96	\$78.96
Plumbing (lav & sink)	per lav.	2	47.5		\$95.00
Doors		2	284.17		\$568.34
Sliding Barn Door		1		510	\$510.00
Rainwater Harvesting Cistern					
Concrete Base	ea	1		300	\$300.00
Steel Culvert	4' Dia.	1		220	\$220.00
Lid & seal	ea	1		85	\$85.00
Hose Bib	ea	1		5	\$5.00
Sub-Total					\$9,308.05
Contingency					10% \$930.80
Total					\$10,238.85

Appendix

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