

Permaculture Design

7338 East Clovis Avenue, Mesa, Arizona

January 2016 -updated February 2017

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Introduction to this Design

This Design is an overview for all the designs at 7338 East Clovis Avenue, Mesa. It provides an overall design framework and ethical analysis, as well as all the base maps and initial observation of the site between 2012 and 2015, leading to a placement of the elements which form the substance of a series of related more detailed designs.

Site and Client Overview December 2013

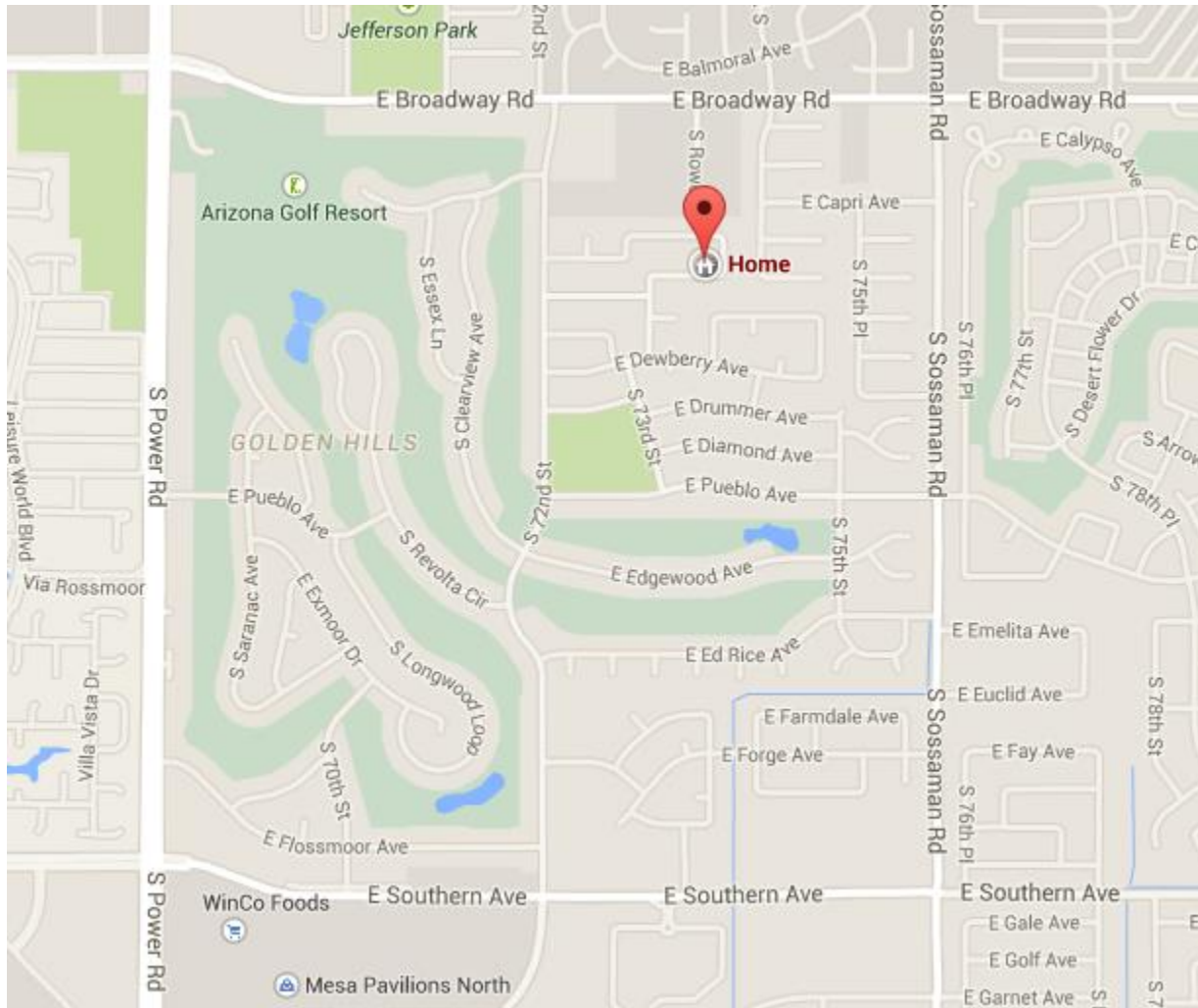
7338 East Clovis Avenue is the house and gardens of Simon Reboul, a 50 year old Techie, who lives in East Mesa, Arizona, which is part of the area around Phoenix. Phoenix is on the edge of the Sonoran Desert in the South West of the USA and in the catchment area of the Colorado River.



His two children spend alternate weekends at the house and I (Sam) spend as much time there as possible but otherwise he lives alone. He works full-time.

The house is situated in Mesa, with an average rainfall of 9 inches per annum. Much of this falls as Monsoon rainstorms) and the house, as is typical for the area, has no guttering or existing rainwater

harvesting. The house is situated in a quiet neighbourhood close to a golf resort with a high proportion of retired people living close by. The house is of modest size and cost compared to the average American home but is relatively large by UK standards.



Simon drives to work at SRP and for most other purposes a car is necessary either due to the distance to be travelled or due to the need for air conditioning during the hotter months. Sam walks or bikes to Winco, the local employee owned Supermarket and other shops in that area but this is only possible during the cooler hours of the day.

The house, is aligned North- South, was formerly owned by an elderly couple. It has good insulation and some double glazing but suffers from excess solar gain in the Summer especially via the small, West-facing window in the Dining Area.

In the Winter, the low sun can be harnessed to warm the front of the house via solar gain in the front bedroom.

Simon spent some time over his first year in the house decorating the internal space and had the heating/cooling system repaired. He has had new flooring installed throughout and hand-made beds for himself and his children. He is planning a number of projects for the next year or so to improve the aesthetics and comfort of the house, including making new shutters. He spent the first year in the property observing the existing landscaping and started composting kitchen and garden waste but otherwise the garden stayed largely untouched.

To the Front of the Property is a typical Desert-style front garden with rocks and gravel and a range of desert plants, including some full grown cacti. To the rear of the property is a 40 by 70 foot garden with lawn, gravelled area and a range of mature trees, plants and shrubs.

This will be an incremental design, with a high level of input from the client. The overall design will eventually cover the whole house and garden as single integrated system. However, some elements require detailed designs in their own right (e.g. rainwater harvesting, compost toilet and chicken house) and these will be created and woven into the overall design as time and other resources allow.

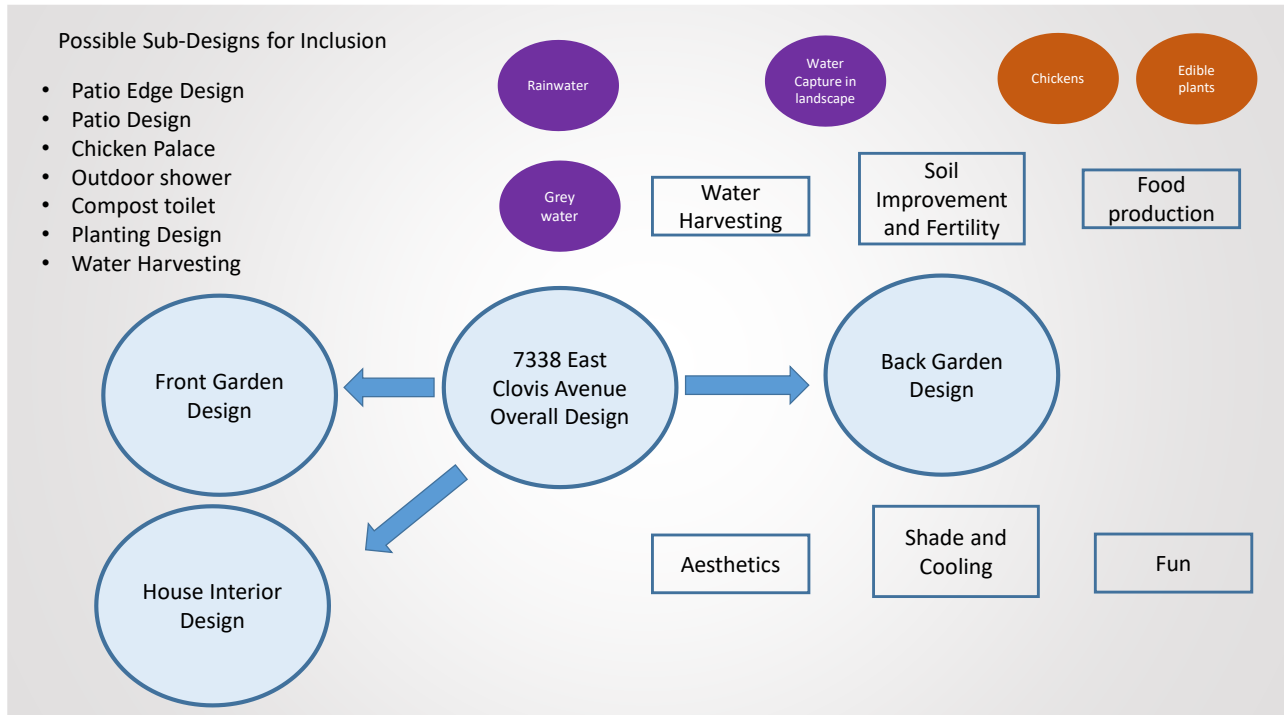
The Design has been evolving over a period of time. The original Client Interview and Sketched base map, were done in England in Summer 2013, and the design for the first compost bin was done by Simon, with some advice from myself during 2013. Also in 2013, Simon had solar panels installed on the house and attended a permaculture chicken-keeping course.

Design Process

For this design, I will be using OBREDIMET (Observation, Boundaries, Resources, Evaluation, Design Decisions, Implementation, Maintenance, Evaluation, Tweak).

As the Overall Design includes a number of smaller designs, I will be using this as a Design *cycle* rather than a linear process. Each of the smaller designs making up the larger design will include its own version of the Design Process.

An overview of some of the potential future sub-designs is shown here:



The decision on which sub-designs will eventually be included will form part of the EVALUATION and DESIGN (DECISIONS) stages of the overall design.

Summary of Design Process

Process Stage	Overview
OBSERVATION	Based on Simon’s initial year at the house in which the garden was untouched and ongoing observations over the intervening time period and in response to implemented stages of the incremental design. At the time of writing, this amounts to almost a full two years of observations.
BOUNDARIES	Physical, emotional and resource limitations.
RESOURCES	Physical, emotional, financial and time.
EVALUATION	Analysing the desired functions and elements and weighing up the identified options.
DESIGN	Identification of the Decisions made.
IMPLEMENTATION	Plan of time-frame and allocation of resources.
MAINTENANCE	Plan for maintenance of the design over time.
EVALUATION (2)	Review of implemented elements over time and plan for further improvements/ revisions.
TWEAK	Implementing the planned revisions.

Design Tools and Sources of Information- Initial Client Interview and Initial Observations

- Client Interview/ Dialogue

From England in July 2013 the following were done as part of an overall Client Interview:-

- Sketched base map
- Discussion of desired functions and some potential elements
- PMI (initial analysis)
- PASTE (initial analysis) Or PASTA (where the E for Events is replaced by A for activities)

Simon relayed observations from the site over the course of the year and we have both done some work on identifying the plants already in his garden and researching suitable additional plants and structures.

Simon also attended a Permaculture Chicken Keeping Course in Tucson to learn about suitable breeds and welfare for chickens kept in the desert climate.

Design Tools and Sources of Information –Overall Design Stage 1

On site continuation from December 2013 and January 2014:

- Client Interview
- Scale Base Map with Overlays
- Planning for Real
- Analysis of functions and elements
- Zones/ Sector analysis
- Simon attended a class given by Brad Lancaster, local water conservation/harvesting expert and permaculturist.

Design Tools and Sources of Information – Overall Design Stage 2

April 2014 Visit:

- Review and evaluation of elements implemented on previous visit
- Client Interview
- Analysis of functions and elements
- Research – plants/ resources available locally/ support networks
- Further Experimental planting and observations
- Visit to Singh's farm – demonstration site/ inspiration and compost source
- Sam and Simon attended a herb growing course run by the Valley Permaculture Association, of which we are members.

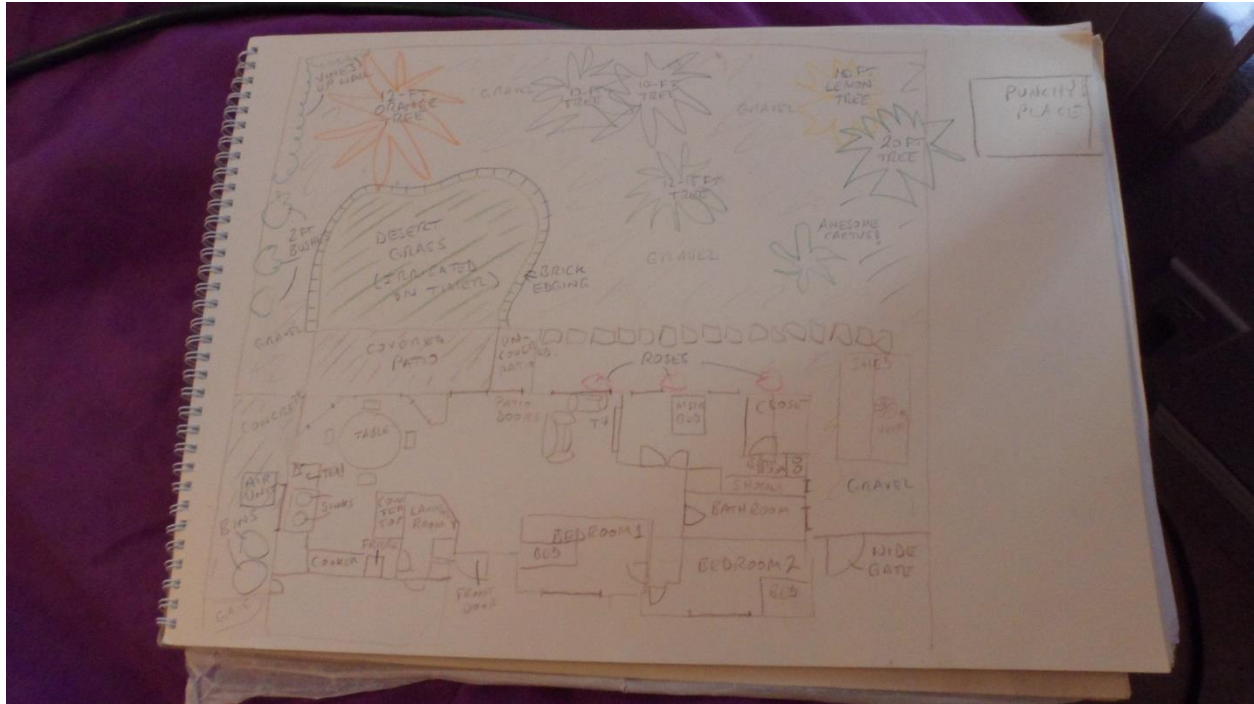
Design Tools and Sources of Information – Overall Design Stage 3

Before and during November 2014- December 2014 Visit:

- Simon attended Shade tree class run by SRP (a local utility company) and the Valley Permaculture Association (VPA). We received two free trees from this programme. The class was given by Ryan Wood of the local Water Management Group, which advises on water harvesting and conservation.
- Tour de Coops – we attended the VPA's Tour de Coops. This gave us the opportunity to see and compare six different types of garden/chicken –keeping arrangements. See Chickens Design.
- Sketch Map overlay of base map showing rough plan for growing and chicken areas
- Base map of veg beds.
- Ethics and Principles analysis for the Overall Design
- Planning for Real with bricks on the vegetable beds

OBSERVATION STAGE 1

Sketch Map 1 – see A3 portfolio for original



This is the original sketch map drawn by Simon in July 2013 whilst he was visiting the UK, which shows the layout of the house and back garden as it was when he first moved in. The back garden faces North.

The existing plants in the garden (see also PASTA below) included the citrus trees (orange and lemon), Monstruoso cactus and a Rosemary bush. The garden was split into a brick-edged lawn and areas of gravel.

This Sketch map and Simon's description of the garden, based on his having been there for six months but not having spent much time outdoors was used as the focus for the client interview and initial discussion of potential functions and elements that follows.

Client Interview from July 2013

In this initial Client interview, Simon and I talked through the existing features of the site and also the functions that he would like to be fulfilled. I have also added in some additional material from our ongoing discussions. For the purposes of this interview, we were looking at the Back Garden primarily, although where relevant we have also considered the Front Garden and the Interior of the House.

At the time of the interview, Simon had only been in the house 6 months, so he hadn't been doing a lot in the garden but was mainly settling into the house and making observations.

His desired functions for the Back Garden were:-

- Creation of a private outdoor space
- Provide shade
- An area for the children to play and be involved in food production and harvesting
- Food production
- Work area (e.g. for wood working)
- Attract wildlife especially hummingbirds and other bird species

At the time, Simon wasn't really using the garden but he felt that fulfilment of these functions would allow him to use the garden more.

Desired Function - Private Outdoor Space

This function did not feature very highly in the original client interview but was a talking point once I arrived on site in December 2013, especially with regard to the neighbours. Having then been at the house for a further six months, Simon was more aware of noise disturbance from his neighbours and also had identified lines of sight where he felt overlooked. Privacy is an important element for Simon.

Desired Function – Provide Shade

The existing trees (see Base map) do provide some shade but a major issue that Simon identified was the west facing window into the Dining area, which catches too much solar energy leading to internal heating within the house to uncomfortable levels. This was therefore identified as a priority to come up with a solution to shade the window.

In subsequent discussions and research, Simon has begun to look at options for shade providing trees, which could also assist in providing more privacy if planted in the lines of site discussed above.

Desired Function – area for children to play and be involved in Food Production

Simon has two children who visit on alternate weekends. He would like to encourage them to play in the garden and be involved in garden activities such as food growing and composting. We talked about

creating a “ Jungle” feel to the garden, creating hidden play space, possibilities such as a tree house or den and keeping the lawn area for play.

Desired Function – Food Production

At this initial discussion, Simon, who has no previous gardening experience expressed the desire that any food production area be low maintenance. He didn't feel that it was worth growing greens as these are cheap at the local supermarkets but he would like to grow the ingredients for Salsa (tomatoes, onions, garlic, chilli) as well as sweet pepper, aubergines, avocado and courgettes, preferably from heirloom seeds. At this stage neither of us knew very much about gardening in the desert or what would be possible. He also liked the idea of strawberries and raspberries /blackberries but not currants.

Desired Function – Woodworking area

In the December 2013 initial design for the area around the Patio allowance was made for a workspace on the patio but as the Design has progressed, Simon decided that he would rather keep the patio as a recreational space and have his woodworking in the garage.

Desired Function - Attract Wildlife

Simon was keen to have a variety of birds and beneficial insects, especially hummingbirds, visit the garden. We discussed our need to research local species which could also potentially have either a food growing and/ or shade function in addition to attracting wildlife.

Other Comments and Observations from the Client Interview July 2013

- Simon wanted to make a moveable compost bin. He was somewhat wary of the potential for composting to attract vermin, so we discussed this in detail.
- The area under the problematic West facing window is made of concrete but a potential option could be to plant a grapevine to shade the window.
- Garden also contains a charcoal grill for entertainment – currently no fire pit.
- Currently there is no patio furniture or other seating – Simon wasn't sure where there would be room for this.
- Chickens – no predators so could free range in a shady area but the main problem is who would look after them if Simon was in UK or elsewhere.
- Arizona climate only allows outside activity from November to Mid-June – the rest of the time it is too hot.
- Simon would like to be able to walk across the garden barefoot but most of the garden is currently gravelled. The gravel is providing a mulch over the soil (there is no membrane underneath and weeds grow freely if left) but also acts as a thermal store.

Initial PMI

This was the initial PMI from the client interview in July 2013

Positive	Minus	Interesting
Garden shed	Lack of shade	Cactus
Covered patio	Ants and mosquitos	
Existing trees especially the Lemon tree	Gravel –can’t walk on it barefoot	
Cactus		
Lawn – but how could it function better		

Other features which have emerged over time:

Positive	Minus	Interesting
Large rosemary bush	Damp edges around patio which attract mosquitos	Potential to attract hummingbirds
Cat’s Claw vine covering back wall	Bourgainvillea plants around the walls – spiky and hard to get rid of.	
Space available for new features		

Initial and Desired PASTA

	Existing as at December 2013	Desired
PLANTS	Various weeds including dandelions/ thistles and wild rocket, groundsel and something resembling camomile and others we haven’t identified. Weeds appear in most areas of the garden but are concentrated in the shadier and damper areas.	Mosquito repellent plants especially edible and fragrant herbs
	Trees and Shrubs – Lemon, Orange 2 X Bottlebrush, Indian Rosewood, cat’s claw vine, Bourgainvilleas x3, Rosemary	Herbs for culinary purposes
	Grass lawn	Plants to attract birds, especially hummingbirds and beneficial insects.
	Front garden contains cacti and flowering shrubs	More shade trees

Animals	Wild birds and various insects	Chickens, more wildlife
Structures	2 side access gates/passageways, garden walls, brick outline to lawn, path to shed, Shed	Chicken house Compost toilet Rainwater harvesting system Fire pit Compost bin (s) Hose reel
Tools	Some basic garden tools, woodworking tools in garage.	Wheelbarrow, loppers, other hand tools
Activities	Not used much to date	Entertaining friends, play for kids, relaxing, enjoying wildlife, food production

OBSERVATION STAGE 2 UP TO AND INCLUDING VISIT DECEMBER 2013

Observations December 26th 2013

- Existing brick path delimits garden area into gravel and lawn. Possibility to turn this into a feature such as a herb spiral or keyhole bed.
- The children do not use the lawn to play on and it creates a breeding ground for mosquitos.
- Front of the House has a lot of solar gain (especially Melody's bedroom) – possibility to add awnings to deflect Summer sun but allow solar gain in Winter.
- Glazing is the main heat transmitter, walls are relatively well insulated.

Photos of rainstorm December 2013



This photo is of the existing irrigation control system as at December 2013 and also indicates the underlying clay soil which can be seen holding the rainstorm water.



This photo shows the pool of water under the lemon tree during the rainstorm, indicating some original creation of basins around the existing trees.

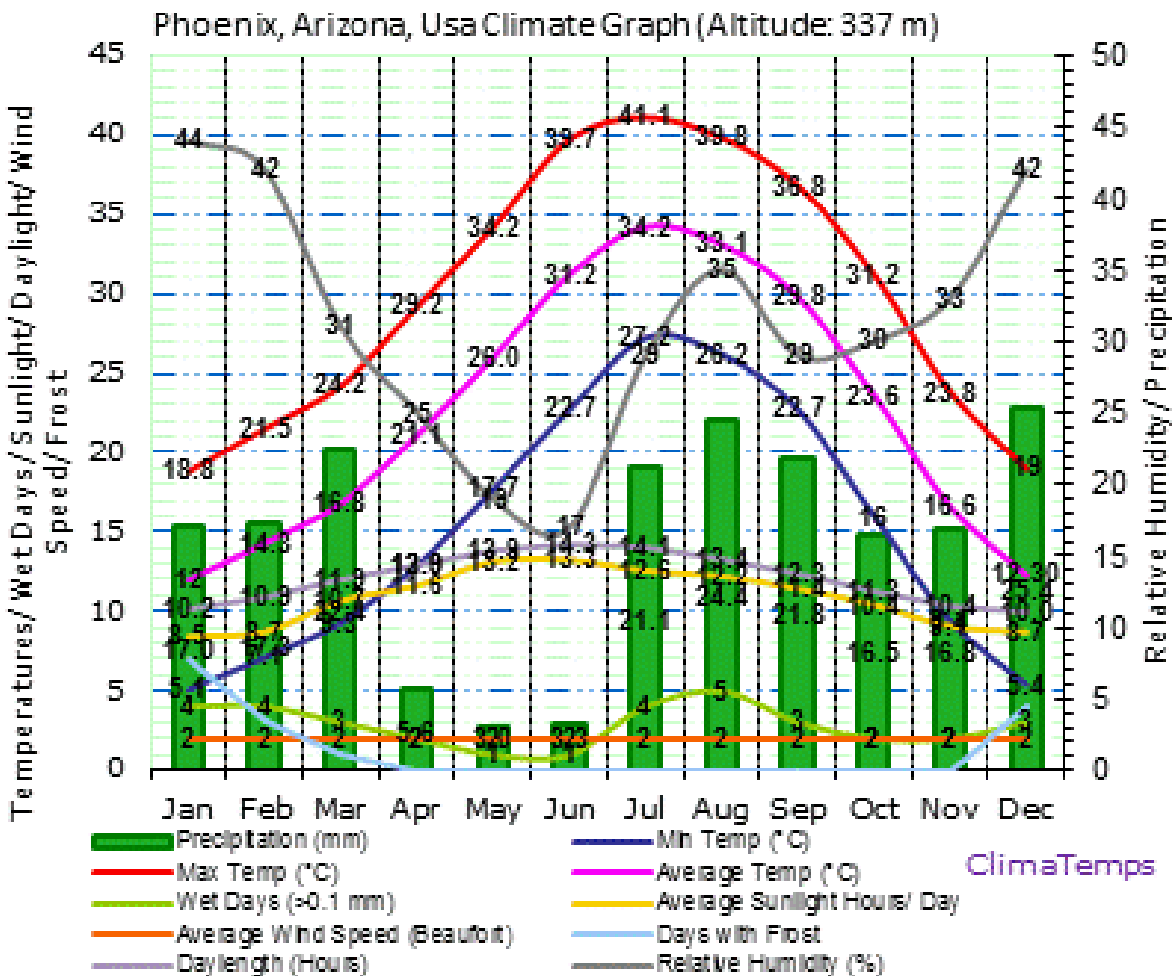


This photo shows water pooling during a rainstorm on the edge of the patio area

Water Sector Analysis for 7338 East Clovis Avenue

Observations

Below is a summary of Average Climatic Conditions for Phoenix. Average rainfall in Mesa is roughly 9 inches per annum.



Scale Back Garden Base Map as at 29th December 2013 – see portfolio A3 folder for Map.

Scale Base Map of the back garden showing existing planting, orientation, Winter shade line (from covered patio) and area in front of patio receiving additional drip water. The back garden measures 70 ft by 40ft and the scale used was 1ft: 0.2 inches.

This Base map was then used as the bottom layer for a range of overlays and also as the starting map for a Planning for Real Exercise, related to the analysis of elements and functions. See below.

Soil and Indicator Plant Observations

The strangest thing about the soil in Arizona, from an English perspective, is the complete lack of earthworms. It makes the soil seem less alive! Whilst digging in front of the patio on 19th November 2014 I found one earthworm, which was a complete surprise but the soil in that area is damp and also had compost applied the previous year, which may have contained eggs. So far this is the only worm that I have seen.

Generally the soil is viewed as poor and requiring twice yearly amendment (in the form of compost, mulch etc) to allow growth of any annual vegetables. However, there are many desert adapted species which can survive in the unamended soil, such as local trees like Mesquite, Palo Verde and Desert Willow or shrubs like Creosote.

Generally soils in the Phoenix area are alkaline clay and may have an impenetrable calcite layer close to the surface in some areas (according to the Maricopa County Master Gardener Manual).

Despite the lack of nutrients, low rainfall and high temperature variations, the soil at 7338 Clovis Avenue in the back garden supports a range of pioneer plants/weeds, which are particularly abundant in areas where there is some irrigation where they can opportunistically take up water planned for other plants. Where the trees are planted in shallow basins there is also weed growth, indicating that it both wetter and cooler due to the basin structure and shade provided by the tree canopy.

In open areas of the garden, where there is no irrigation, there is still sufficient soil moisture to support species such as California Poppy, which have blown in from neighbouring gardens.

Anywhere that there is water will quickly grow a surface layer of native plants or windblown migrants from local gardens and we have a policy of leaving everything at present, as plant growth is a good indicator of where the moisture is retained

Recognisable weeds (from my perspective) include groundsel (*Senecio Vulgaris*), which is an indicator of cultivation and high fertility. There are no deep accumulators (dock etc). Close to the patio, which is the wettest part of the garden, chickweed and groundsel are now growing in amongst the Bermuda grass. This has only happened since I started adding compost to the area around the patio. See Patio Design 1.

Also around the compost bin, there is a thick growth of unplanned squash, melon and a single tomato plant, which may have been grown from inadvertent seeds in the compost bin. This is providing much needed ground cover, which further helps to retain moisture in the soil.



View of Soil dug out in front of Patio, showing typical sandy clay texture, compacted by footfall and recently dug to remove Bermuda grass.

Soil Texture

A classic soil texture test reveals the back garden soil to be a sandy clay:



Shaking a sample up in water in a jar reveals that there is very little natural organic matter in the soil and pH test gives a pH of 7.5-8 in the area which will be the main growing area.

This alkalinity is typical in Arizona.



Soil pH Test from lawn area just beyond patio

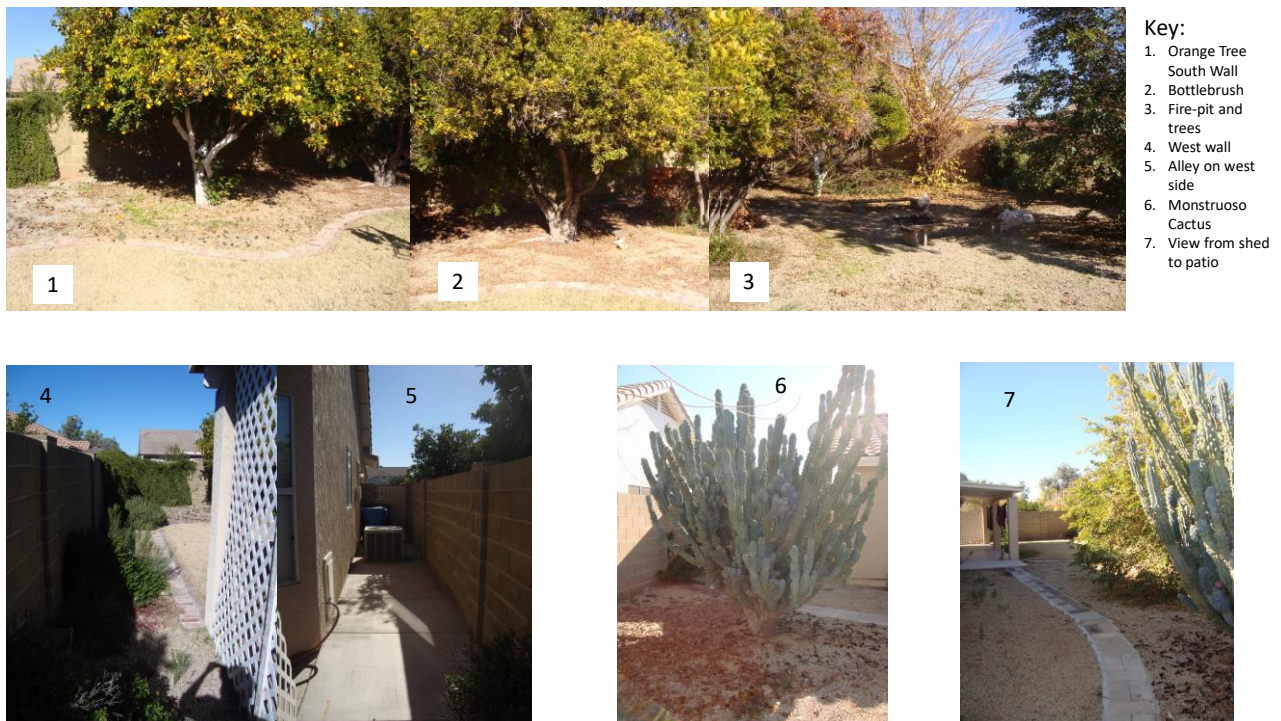
Sun Sector Analysis

Arizona has two growing seasons, Spring and Autumn. Not much can survive over the hot Summer period. In the Winter, night temperatures can drop to below freezing, so plants need to be frost hardy or complete their growing season before the frosts. However, orientation is less of an issue than in a temperate climate. Day length does not vary massively compared to England. Shade provision is major issue, especially with respect to trying to cool the built environment. The sunniest part of the garden is the area at the back of the lawn, which receives sunlight almost all day.

By contrast the area nearest the patio is shaded in the Winter, although it does receive some sun earlier in the year.

Zones

Overview of the Back Garden as at December 2013 –All Zone 1



These pictures were taken prior to any changes being made to the back garden. All of the back garden is in frequent use and so I have taken it as all being Zone 1. The patio almost consists of a tighter Zone (Zone 1A perhaps?) which we visit many times a day with other areas of the back garden being more of a Zone 1B – still visited but less time spent there on a daily basis. We rarely visit the Front Garden, so this is perhaps Zone 3, although we access the house through either the Front Door or Garage and Simon picks up mail and takes the bins in and out via the Front.

Overview of Back Garden December 2013 – All Zone 1



- Key:
- 1. Back gate and side of shed
 - 2. Rosewood tree
 - 3. Bed under Bedroom windows
 - 4. East wall near Mulberry
 - 5. View of Patio
 - 6. Winter shade line on lawn



Overview of Front Garden December 2014 – Zone 1-3



- Key
- 1. Front garden west side with gully and cactus
 - 2. Front garden gully and river rocks
 - 3. Front door and solar panels
 - 4. Front Garden east side
 - 5. Solar panel controls



OBSERVATION STAGE 2 UP TO AND INCLUDING VISIT April 2014

By this time Simon had been in the house for nearly a year and a half and it was clear that some of the original thoughts he had back in the Client Interview of July 2013 were starting to evolve and change. This is examined more fully in the analysis of Elements and Functions in the Design Section of this document. Some clear changes of function had already begun to emerge:

- Wood-working area – Simon shifted this from the patio to the garage where he can keep his tools and also leave the patio area free for outdoor living and relaxation.
- Lawn – the children do not use it as a play area and it harbours mosquitos. It also takes up space which could be more productively used.

We spent a lot of time in April discussing ways forward and I also created a **Planning for Real** type approach with key elements on post its, which I could move around the Scale Base Map. We didn't at this point reach any firm conclusions on the final placement of elements but Simon continued to make observations on how well the experimental planting was going. For example:

- Pumpkins planted under Rosewood – Simon felt that watering them lead to overwatering of the tree and so removed them.
- By contrast, plants planted under the Orange tree thrived.
- Plants in pots got dehydrated very easily and some did not survive.
- Some of the plants, including those in pots, did well and we had some yield (e..g. Basil, chilli, aubergine).

Client Interview 2 – April 2014

During this interview, we talked about creating water retaining features in the garden and how to reduce ambient temperature and also possible placing of features such as a chicken run and compost toilet and the possibility for a rainwater harvesting system. We also talked about converting the lawn area to predominantly vegetable production – following the success of the aubergines and tomatoes planted in pots in December. We also talked about tree positions and creating shade and privacy.

- 1) Additional tree planting for shade and privacy is a priority but quite expensive so will have to be done over time.
- 2) We talked about different options for the chicken house and Sam also expressed an interest in looking into whether we could keep ducks.

Option 1 – Chickens under the orange tree – good as it is already shady in a line of sight from the backdoor but creates issues of where and how to fence them in to stop them eating veggies.

Option 2 – Under the bedroom window – this is another shady area and has the advantage that it doesn't have another obvious use and lots of weeds grow there. It would be easier to fence and the chucks could have additional access to the area behind the shed for clearing weeds and having more foraging space. Also then a composter for chicken poo could go at the back of the shed which is close by.

Option 3 – have a moveable run in addition to either 1 or 2 above – this would help with weeding and getting organic matter into the garden.

3) Possible locations for a compost toilet –

Option 1 - back of the shed but this is right near the neighbour's kitchen window.

Option 2 – behind the lemon tree – this is close to the fire pit so handy for social gatherings

4) Rainwater tank – discussed various options but the problem is the roof slopes E/W so easiest place to channel water to which has space for a tank without it being unsightly is on the west side passage between the kitchen and dining room windows. Need to investigate this more.

OBSERVATION STAGE 3: UP TO AND INCLUDING VISIT November 2014

I arrived back in Arizona on 3rd November 2014. Simon had visited the UK in August and in the run up to that visit, he had prioritised installation of a new irrigation system. This was vital to keep the garden alive in the searing Summer heat, especially during his absence. In the process, he had been working in the early mornings and noticed that he was not getting mosquito bites on the patio but was getting them out on the lawn. Since arriving, I have been badly bitten and so eradication of the mosquitos by natural means has become a major priority for us both.

The new irrigation system is working well and has capacity for very focused and localised irrigation. Simon has a new controller, which has not been installed yet but hopefully will be shortly.

In my absence, Simon had the opportunity to get two free desert adapted shade trees via a programme run by the Valley Permaculture Alliance and SRP (which happens to be the company that Simon works for but here was acting as part of its corporate social responsibility programme). The Shade Tree programme allows householders to get free trees provided they attend a class on how to look after them. Simon attended the class and after looking the available options for trees, we chose a Desert Willow and a Mesquite and Simon planted them in locations previously identified by the Planning for Real exercise. This is discussed more fully in the Design section.

Between Simon's UK visit and my arrival in AZ, Simon was preoccupied with work on the house as it was too hot to work outside. Instead he carried out a full redecoration of the living room and kitchen areas. However, he continued to observe the impacts of the experimental plantings (see Design section) and confirmed some of the observations made earlier. Some of his observations were:

- Plants in the ground do better than those in pots
- Both lemongrass plants have grown but one is bigger than the other
- Everything has done better since the irrigation lines went in
- One Cape Honeysuckle died – possibly due to waterlogging during a rainstorm. Both the others seem to be thriving, so it doesn't look as if it was a disease.
- Lemon tree lost a branch but seems otherwise healthy
- Pumpkins got eaten through the stem behind the fruit, so no yield there but the foliage has done well and so has production of male flowers
- Herbs have generally done well except the mint, which died due to lack of water while Simon was in the UK. Basil is doing well.
- French lavender did better than the English lavender
- Best yields have been Aubergines (especially the Thai aubergines) and chillis. We also have two lovely melons growing.
- Pots under the Orange tree were happier than when on the patio
- Mequite and Desert Willow both settled in well

Tour de Coops

On November 8th 2014, Simon and I spent the day on a tour of local chicken coops arranged by the Valley Permaculture Association. This allowed us to make detailed observations of how other people keep chickens in Arizona and to expand our own ideas.

This concludes the Observations made to date. These have informed the Design Decisions made for the overall design. Reference to key observations is also made in the Sub-designs.

Boundaries

Boundary Type	Boundary	Comment
Physical	Walls and fences	The back garden has breeze block walls and two access gates, one on the east side and one on the west side of the house. The front garden is open to the pavement/ road and has a small gully running through it.
Physical	Rainfall and Hot Summers	Rainfall is about 9 inches per year but falls as storm rains during the Monsoons. See rainwater harvesting design. Not much can happen outside during the long Summer months as it is too hot to work outdoors and nothing much reaches fruition at this time.
Physical	Soil	Alkaline clay soil
Time	Simon works full time and Sam only visits once every few months for a period of weeks.	All of our designs have to factor this in. This means we have to decide on priorities and Simon has to implement some elements alone.
Time	Dual planting season	Related to the above –Sam has to leave specific instructions for planting whilst she is away as she cannot always be on site at the most appropriate planting times.
Emotional	Difficulty of separation/ Communication over long distance.	We miss each other when Sam is away and it can be hard to maintain momentum and communicate clearly.
Financial	Limited funds available	See resources below.

Legal	Local laws.	See sub-designs for details. There are some stipulations relating to activities on private property (such as chicken keeping and rainwater harvesting), although nothing we wish to do is prohibited.
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Resources

Resource Type	Resource	Location/ Abundance/ Other Comment
Financial	Primary – Simon’s Income Secondary – Contributions from Sam	<p>Simon’s job is fairly secure and well paid. However, cost of living is high and Simon continues to support his former wife and children, so each part of the Design has to conform to a budget. Simon prefers to use high quality materials with a long lifetime rather than cheaper materials, although we will be using recycled/re-used materials wherever possible.</p> <p>Sam’s income is limited and she also has to cover expenses in the UK and both of us have to budget for airfares, which takes up chunks of money which could otherwise be dedicated to implementing design features. Nevertheless we are blessed with enough funds to be able to implement the full design albeit over a long period of time.</p>
Emotional	Each Other	We love each other and we communicate well. We are both dedicated to making each other happy and working as a team.
Support from Organisations	Valley Permaculture Association (VPA) Water Management Group (WMG) Arizona State University (ASU) Desert Botanical Gardens Maricopa Master Gardeners programme	<p>There are a lot of sources of information and support locally in the Phoenix area and lots of knowledgeable people. The VPA and WMG both run a variety of classes and events, which provide information and training on various aspects of Permaculture in the Sonoran desert. VPA also publishes a planting calendar specific to Arizona, which is essential to identify which things to plant in the split planting seasons.</p> <p>The ASU has lots of botanical information, as does the Desert Botanical Gardens and they have been helpful in assisting us to identify the existing plants at the property.</p> <p>The Maricopa Master Gardener programme publishes a manual on line and runs classes, which contains locally specific information on growing edible plants.</p>

Supplies	Singh Farms – Compost/Farmers Market	Fantastic compost available from very lovely site.
Supplies Continued	<p>Mesa Feed Barn</p> <p>Organic Feed Buying group</p> <p>Peaceful Valley Farm (online)</p> <p>Home Depot/ Lowes</p> <p>Valley Transport</p>	<p>Straw and chicken Feed Supplies. Also possible source of cheap pallets.</p> <p>We are not part of this yet but we will join when we have the chickens.</p> <p>Based in California runs the Grow Organic website – we have used them as a seed supplier and we may buy the fruit bushes (raspberry, blackberry and grape) from them.</p> <p>We have got all our garden tools from Home Depot or Lowes locally. We have tried to go for reputable makes and solid tools which will last. American tools tend to be a different design to UK tools but are generally very nice to work with and well suited to the conditions here.</p> <p>Generally we are very car dependent here but Sam does use the bus or bike where possible and the light rail system is being extended towards Mesa, although it won't come quite as far east as where we live.</p>
Natural	<p>Trees and plants in Garden</p> <p>Climate</p> <p>Wildlife</p>	<p>Already provide some shade, habitat and wood for construction and fires. Also a few culinary plants (such as the Rosemary)</p> <p>The hot dry climate provides ample sunshine for growing vegetables and powers the solar panels.</p> <p>Geckos and birds in the garden eat bugs and provide entertainment.</p>

Evaluate

The following will be used to Evaluate the Design Options available:

- 1) Analysis of Ethics and Principles related to this Design
- 2) Analysis of Elements and Functions to arrive at placements where possible, based on Client Interview and Observations so far and the Planning for Real.

Ethics and Principles

1.1 Ethics

Earth Care

We will be caring for the Earth by:

- Improving the soil quality by adding organic matter and growing vegetation which help to retain water in the landscape, thereby preventing further soil erosion and deterioration.
- Supporting wildlife and increasing biodiversity in the area by providing habitat and food, for geckos, birds and insects (as well as ourselves)
- Reducing our reliance on fossil fuels by planting to increase shade and cooling (reducing the cooling demand on the house), using renewable energy wherever possible and changing our behaviour gradually to reduce our transport and other fossil fuel demands.(e.g using more second hand materials, re-using bags and other materials). Also reducing food miles and our reliance on shop bought commodities (such as cleaning products or medicines which we hope to at least partially produce at home). As far as possible, we will work towards off-setting some of the impacts of flying across continents, although we recognise that this is a major drawback of our current way of living.

People Care

We will be caring for ourselves and others by:

- Loving each other, talking and valuing each other's contributions. Also valuing the diversity between ourselves.
- Providing a safe and happy, environmentally positive space for our children.

- Building networks of local people with similar interest – this is a long term goal. There are some networks of permaculturists in Phoenix but we feel that we could be drivers of a stronger network in Mesa itself.
- Providing a space that others can learn from in a safe and comfortable environment – perhaps holding small courses here in the future.

Fair Shares

We will try to act responsibly and limit our impacts, so that others may live and share the Earth by:

- Gradual changes in our behaviour and looking more deeply at where we buy food and goods – trying to buy the most ethical option available.
- Supporting local business and other permaculturists locally.
- Providing habitat and food for wildlife.
- Providing a beautiful and well adapted space for those who live here after we have gone.

1.2 Key Principles

Throughout the Design (s) I will be trying to integrate the Holmgren and other Principles and reference will be made to these as appropriate in the sub-designs. The key principles used in this overall Design are:-

- Multiple elements/ functions – wherever appropriate. See functional analysis.
- Observe and Interact- this Design is based on a long continuous process of observation and we expect that it will be continually re-evaluated and tweaked over the coming years as our understanding of the site and our own needs deepens.
- Maximise Edge/ Use and Value Diversity – both in terms of planting and increasing our edge into the local community.
- Produce No Waste – Simon and I have different views on what constitutes waste and this leads to very productive and lively discussions. We are gradually introducing more re-use and although Simon has a complete aversion to keeping anything for which he can see no immediate purpose, we are starting to identify purposes for materials that he might previously have regarded as useless.
- Use slow and sustainable solutions – due to our time boundaries and being required to live apart for long periods, we have to use this Principle. We will also be responding creatively to the changes that occur over the lifetime of the Design.

2. Analysis of Functions and Elements

An initial set of desired functions /elements was listed from the first Client Interview in July 2013. Over subsequent discussions and based on site observations so far, this has now been refined and some conclusions drawn. The Table below explains the decision- making process:

Function Identified in Client Interview 2013			
Function	Potential Elements	Chosen Elements	Reasons
Create a Private Outdoor space	More trees and vines Trellis Arbours	Mesquite planted to block view to neighbour	Multi-function tree, also provides shade and pods can be used to make mesquite flour.
		Trellis to be added to all shared garden walls	Reuse of old trellis from West side of Patio – creates height above the wall and more vertical growing space
		Vines to be grown up all trellis - grapevines	Vines will increase privacy and create habitat and food. Grapes are deciduous so in some areas we may plant an evergreen vine. Final decision not taken yet.
		Moringa planted on South-east corner	This is an experiment. Moringa grows fast and has highly nutritious leaves and is adapted to hot climates. Recommended by the VPA. Remains to be seen whether it will survive here.
		Planting planned behind shed	We decided it would be great to have an outdoor shower – see below so planting in this area would be to make the shower private and make it more pleasant.

Provide Shade	<p>Trees – possibilities included: Desert Willow Palo Verde Mesquite (thorned or thornless varieties) Citrus – lime Moringa Mulberry Ironwood Rosewood</p>	<p>Chosen trees (back garden): Mequite Desert Willow Moringa (Lime in the future)</p>	<p>Chosen for their desert adaptation (except the lime, which is a little frivolous and may end up being a pot plant on the patio). All provide good habitat and have low water requirements as well as providing shade. Simon got the Mesquite and the Desert willow for free through the Shade Tree Programme and they have been place to provide both privacy and shade/cooling.</p>
	<p>Vines – possibilities Grapevines Other fruiting vines Cats Claw Cape Honeysuckle Ocotillo Other flowering desert adapted vines</p> <p>Window shades and overhangs</p> <p>Curtains/shutters</p>	<p>Chosen Vines: (back garden) Cape Honeysuckle Bower Vine</p> <p>Grapevines</p> <p>Window shades added to kitchen windows</p> <p>Temporary curtains hung throughout pending Simon making wooden shutters.</p>	<p>Both chosen for their desert adaptations and the fact that they attract hummingbirds and are pretty.</p> <p>Simon was initially hesitant about having fruiting vines as he felt they would attract too many insects and drop fruit, making a mess. Having seen them at other properties and also having realised that he might enjoy the harvest of fruit, he is now more open to this and we are planning to put some vines (probably a mixture of Flame and Thompson seedless, which grow well here) around the walls in January 2015. See Patio Design 1 - this was to cool the West facing window in the kitchen.</p> <p>Simon wants to make shutters to his own design and so this is a longer term project with the current light curtains just providing some cooling/shade.</p>

<p>Play area/activities for children</p>	<p>Lawn for ball games Dens Treehouse Chickens Fire pit</p>	<p>Chickens Lawn replaced with vegetable garden Fire pit</p>	<p>Simon’s children don’t particularly like outdoor play and there is a local play park, which Matthew can ride to on his bike. Also the lawn harbours mosquitos, so we decided to get rid of it completely. We put the Fire pit in in December 2013 and the children do enjoy nights around the fire. We are hoping that they will also get involved with the chickens.</p>
<p>Food production</p>	<p>Edible trees and shrubs Vegetables Herbs Chicken forage plants Food for wildlife Chickens</p>	<p>See Planting Design. See Chickens Design.</p>	<p>Simon has become much more enthusiastic about producing food over the last two years, having sampled some early yields from our experimental plantings.</p>
<p>Woodworking</p>	<p>On the patio In the garage</p>	<p>Garage</p>	<p>Patio is now available as a potential outdoor living space.</p>
<p>Attract wildlife</p>	<p>Leave areas untouched – stop removing weeds Plant vines and flowers which attract hummingbirds Plant calendula and other marigolds to attract beneficial insects.</p>	<p>Weeds only removed when areas turned over to other production Lawn is being removed See planting Design.</p>	<p>We choose every plant to be multi-function including having a benefit to wildlife (except mosquitos!). We also have areas which provide habitat to insects, geckos and birds. The tree cover is full of different birds and we regularly</p>

Additional Elements and their Planned Functions

Over the course of our discussions a number of other potential Elements have been identified, which we would like to incorporate but which were not part of the original client interview:

Element	Function
Rainwater Tank	Irrigation – reduce reliance on Municipal supply and increase resilience to drought.
Guttering and Rain barrels (water butts)	Irrigation/ water conservation
Outdoor shower	Fun! Use rainwater and recycle grey water for irrigation.
Compost toilet	Reduce waste and water use. Create soil fertility.
Fire Pit	Fun ! Also a means of disposing of slow to compost woody material.
Clay oven	Reduce need for indoor cooking and be able to live more outside. Reuse old bricks.
Rocket stove	Reduce need for indoor cooking and be able to live more outside.
Seating and tables	Comfort - be able to use the patio and garden as a living space.
Lighting	Safety and aesthetics.
Decorations	Aesthetics.
Outdoor storage	Be able to live outside more easily by having everything we need to hand.
Chickens plus house/ run	Meat, eggs, compost, entertainment.

Placement of Elements and Planned Implementation Dates

To date (November 2014) , we have arrived at the following placement of Elements:

Element w Functions	Placement	Planned implementation	Sub-Design for more detail
Cape Honeysuckle (Shade/ Wildlife)	Shading west-facing kitchen window	Completed December 2013	Patio Design 1
Bower Vine (Wildlife)	Patio Edge	Completed December 2013	Patio Design 1
Herbs (Food/ wildlife)	Patio Edge	Completed December 2013	Patio Design 1
Herbs (Food/ wildlife)	Pots	Completed December 2013	Patio Design 1
Experimental Planting (Aubergines, tomatoes, chilli, sweet peppers) (Food)	Pots	Completed December 2013	Patio Design 1
Pumpkins (Food)	Under Rosewood tree	Completed April 2014	Planting Design
Melon, aubergine, chilli (Food)	Under Orange tree	Completed April 2014	Planting Design
Basil/ Mint/oregano (Food/wildlife)	Pots	Completed April 2014	Planting Design
Shade Trees (Shade/wildlife/food)	Mesquite -- South west in between Bottlebrush and Lemon. Desert Willow -- South west in between Bottlebrush and Lemon. East border near patio edge	Completed September 2014 Completed September 2014	Planting Design Planting Design
Pomegranate (Food/wildlife)	East border in between Willow and Rosemary	Completed April 2014	Planting Design

Aloe Vera (medicine)	East Border	Completed April 2014	Planting Design
Element w Functions	Placement	Planned implementation	Sub-Design for more detail
Lemongrass (Mosquito repellent)	East Border	Completed April 2014	Planting Design
Vegetable Beds (Food)	Former Lawn	December 2014-June 2015	Planting Design
Chicken Forage plants (Food for chucks and wild birds)	Under trees and in the former gravelled area	December 2014 – December 2015	Planting Design/ Chickens Design
Fruit hedges and Fruiting vines (Food/ shade/ privacy)	Around the whole perimeter wherever there is available space	January 2015	Planting Design
Trellis on walls	Around the perimeter and especially where the shower is planned to be	January 2015	Planting Design/ Shower Design
Outdoor Shower	Behind the shed/opposite the bathrooms	TBC – possibly 2016	Shower Design
Chicken House/run	North East corner – exact dimensions not yet determined	By end of 2016	Chickens Design
Rainwater Harvesting system	Tank at back of shed next to outdoor shower. Smaller barrels and guttering under bedroom window.	By end of 2017	Rainwater Harvesting Design
Outdoor living room	Patio	By end 2015	Outdoor Living Design

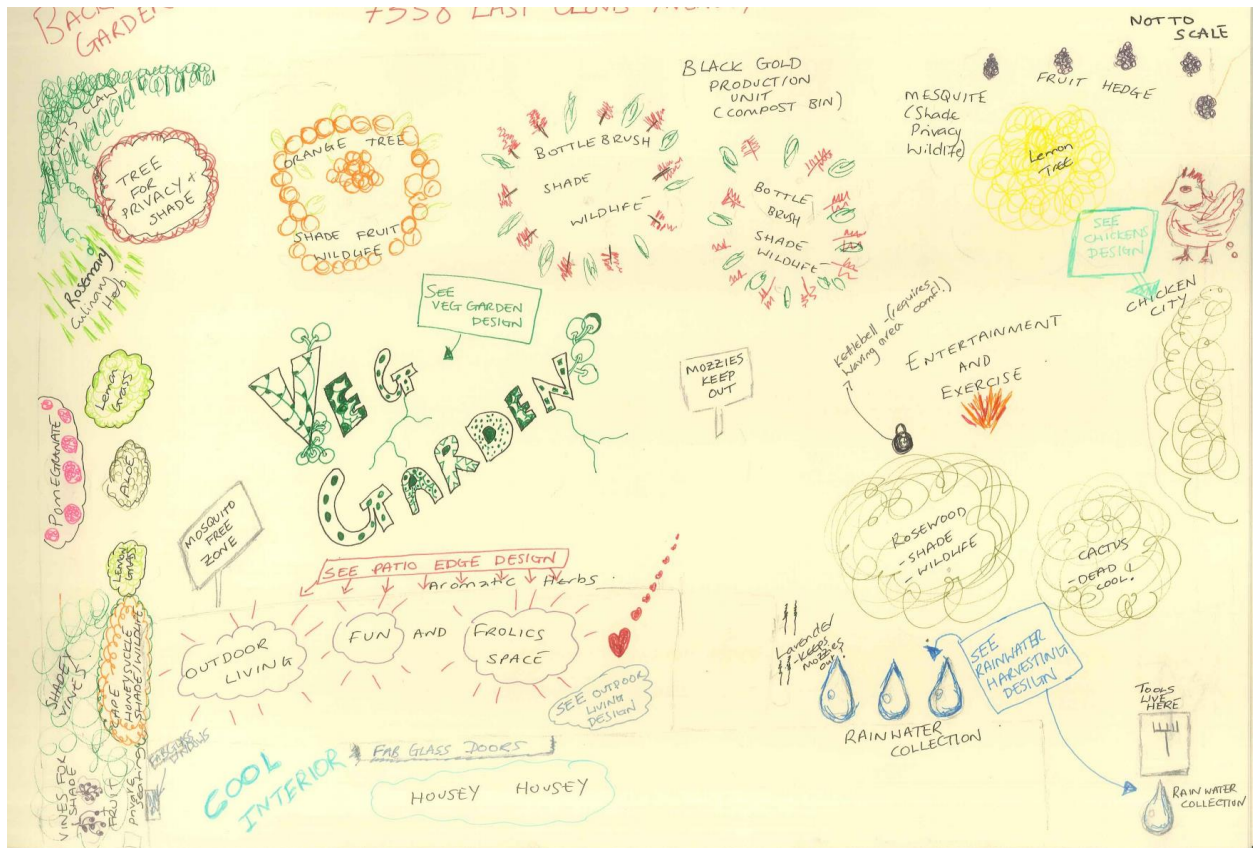
Clay oven /rocket Stove	Not yet determined.	By end of 2018	Outdoor Living Design
Element w Functions	Placement	Planned implementation	Sub-Design for more detail
Compost Toilet	Not yet determined.	By end 2018	Outdoor living design.

Design

Taking into account all of the above, the following sub-designs will be created and these will form an integrated whole for 7338 E Clovis Avenue:

- House Interior – this is mostly in Simon’s hands and will not be fully documented except where it crosses over with documented designs.
- Front Garden – this is not a priority area for us at present, although we are discussing how the front garden can be integrated into the overall design.
- Patio Design 1 - the Planting Design for Patio Edge carried out in advance of the main design
- Outdoor Living – use of the gardens as a living space for relaxation, eating, love-making and entertainment.
- Planting Design – will incorporate food production, as well as planting for shade/wildlife and will cover primarily the back garden but may include the front garden.
- Chickens Design – the house itself will be designed by Simon primarily, as will the regime of keeping/culling the chickens. Sam will document the design of the run and foraging areas.
- Rainwater Harvesting Design
- Outdoor Shower Design – linked to the Outdoor Living Design
- Compost Toilet – linked to the Outdoor Living Design

Diagram of Relative Placements of Elements(Back garden) – see A3 Portfolio for original



Implementation, Maintenance and Tweaks

Broad timeframes for Implementation are given in the Evaluation section above for each Sub-Design. The Designs themselves will contain the detailed Implementation and Maintenance Plans.

Progress on Implementation at January 2016

Overall the plant elements which have worked well have been the perennial plantings, especially Mediterranean herbs, grapevines and trees planted for shade. Elements which have not worked so well are annual vegetables, for which we still haven't constructed the raised beds and which have had to compete with free-ranging chickens.

Simon installed an irrigation system in the garden which on further observation, is not fully suited to purpose and has resulted in under-watering of annual plants and over-watering of trees and perennials. We are currently re-designing this system.

Impact of the Chickens

The chickens arrived in 2015 and we have been observing their behaviour and impact on the garden ever since. Two were lost to a predator and the remaining two have generally thrived on free-ranging, having access to a small coop but choosing to roost in the Ironwood tree. We are now considering a major tweaking process to be able to allow for them to continue to free range but still be able to grow some annual vegetables. To achieve this we will need to create natural barriers to them moving into certain areas and also create incentives in the form of foraging plants in the areas we would like them to frequent.

Element w Functions	Placement	Planned implementation	Progress On Implementation
Cape Honeysuckle (Shade/ Wildlife)	Shading west-facing kitchen window	Completed December 2013	Complete and fulfilling its designed function of shading the West Window.
Bower Vine (Wildlife)	Patio Edge	Completed December 2013	Complete and the plant is thriving and attracts hummingbirds when in flower.
Herbs (Food/ wildlife)	Patio Edge	Completed December 2013	Mediterranean herbs and curry plant thriving. Thyme and lemon balm have not spread as originally planned due to chicken damage.
Herbs (Food/ wildlife)	Pots	Completed December 2013	Worked well for one season but then died due to chicken damage and lack of irrigation.

Experimental Planting (Aubergines, tomatoes, chilli, sweet peppers) (Food)	Pots	Completed December 2013	Worked well for one season but still awaiting construction of beds for a more permanent planting design.
Pumpkins (Food)	Under Rosewood tree	Completed April 2014	Only lasted the season
Melon, aubergine, chilli (Food)	Under Orange tree	Completed April 2014	Only lasted the season
Basil/ Mint/oregano (Food/wildlife)	Pots	Completed April 2014	Only lasted the season
Shade Trees (Shade/wildlife/food)	Mesquite – East border near patio edge Desert Willow - at back of garden between lemon and bottlebrush	Completed September 2014 Completed September 2014	Mequite transplanted in January 2016 as it was growing too close to the house. Thriving.
Pomegranate (Food/wildlife)	East border in between Willow and Rosemary	Completed April 2014	Thriving.
Aloe Vera (medicine)	East Border	Completed April 2014	Thriving
Lemongrass (Mosquito repellent)	East Border	Completed April 2014	Thriving
Vegetable Beds (Food)	Former Lawn	December 2014-June 2015	Sunken beds flooded and suffered damage by the free-ranging chickens. We are considering creating wicking beds but need to create a chicken enclosure first.
Chicken Forage plants (Food for chucks and wild birds)	Under trees and in the former gravelled area	December 2014 – December 2015	Not implemented but still intended

Fruit hedges and Fruiting vines (Food/ shade/ privacy)	Around the whole perimeter wherever there is available space	January 2015	Grapevines have done well but blackcurrants and raspberries died due to insufficient irrigation.
Trellis on walls	Around the perimeter and especially where the shower is planned to be	January 2015	Not implemented yet but still intended.
Outdoor Shower	Behind the shed/opposite the bathrooms	TBC – possibly 2016	Unlikely to be completed until 2017 or later.
Chicken House/run	North East corner – exact dimensions not yet determined	By end of 2016	Chickens arrived in 2015 and have been free ranging to date. This has delayed implementation of veg garden elements.
Rainwater Harvesting system	Tank at back of shed next to outdoor shower. Smaller barrels and guttering under bedroom window.	By end of 2017	Rainwater Harvesting Design
Outdoor living room	Patio	By end 2015	Not much progress on this to date.
Clay oven /rocket Stove	Not yet determined.	By end of 2018	No progress on this to date
Compost Toilet	Not yet determined.	By end 2018	No progress on this to date.

Maintenance Plan 2016-2017

Action	Intended Result	Timeframe	Cost
Remove Mulberry which is undermining west wall	Stop the wall collapsing. Will also clear space for new fruiting/forage plants.	February 2016	\$250
Remove lemon tree	This is very sad but the trunk has split.	Winter 2016	None
Improve Irrigation	Allow deep infrequent watering of trees and more frequent watering of annuals, herbs and vines.	Spring 2016	Negligible as the kit is already here it just needs re-laying
Dig berms/ basins around the trees	Improve water retention and make beds for groundcover	Spring 2016	None
Mulch over the former lawn area	Prevent regrowth of Bermuda grass	Spring 2016	Approx. \$100
Train Pomegranate	Grow as a wide cordon along the east wall	Spring 2016	None
Trim Monstruoso cactus	Improve access	Spring 2016	None
Burn or compost dead wood	Add fertility. Decrease habitat for insect pests.	Spring 2016	None
Mulch Mesquite	Help it to recover from transplanting	February 2016	None

Tweaks to Ongoing Implementation

Tweaks to the overall design will actually form the basis of the next, more detailed designed stage for the chicken foraging and vegetable garden areas.

Main tweaks are:

- 1) Stronger focus on native, adapted perennial plants going forward.
- 2) Creating natural water collection but also having better focused irrigation systems
- 3) Allowing the chickens to free range rather than having them in a fenced enclosure

Evaluation 2016

What has gone well?

1. We have achieved many of our original aims, particularly with creating more shade and privacy around the house.
2. Perennial herbs and trees have flourished.
3. The chickens are happy and laying eggs for us!
4. The amount of wildlife in the garden has significantly increased.
5. We have raised the soil fertility and improved water retention through native planting and the creation of berms and basins.
6. We have removed most of the Bermuda grass and decreased the mosquito population.

What has been Challenging?

1. Working on the design from across the Atlantic and intermittently in Arizona has been quite emotionally traumatic. It has been difficult to follow through on the elements that I put in place on different visits and the failure of the veg garden has been frustrating for me as I feel it could have worked had I been here to maintain it.
2. Having to apply my knowledge in a different climate has also been challenging, although it has also been a rewarding experience.
3. Competition between the chickens and potential veg growing has been challenging and we will need to address this in the more detailed designs for the Chicken foraging and veg growing areas- these designs will need to overlap and be integrated.

Long Term Goals

1. To have a garden which is as near self-sufficient as possible in terms of water use and retention
2. To have a productive veg garden
3. To make the garden a comfortable outdoor living space
4. To continue to progress all the design elements identified above

Next achievable Steps

1. Remove the Mulberry and replant the area around the west wall

2. Create designated areas for the chickens to free range with available forage and natural barriers to discourage them from coming into the areas where veg will be growing
3. Design the veg garden
4. Re-design the irrigation system

Reflection 2016

Due to the scale in both space and time of this project and my lack of previous experience of designing in a desert climate, the most useful design tool has been trial and error, backed in places by observation of the surroundings and use of research. I started this design in 2013 and three years later, I feel that I am really still observing for the most part.

During this time, I have learned a lot about desert plants and the eco-system here but it remains a painful process to be intermittently involved in the actual implementation of the Design.

The true design for this site is constantly evolving and constantly being tweaked as every year Simon and myself learn a little more about ourselves, the garden and our surroundings.

I haven't found any of the Design tools particularly useful. In fact they have mostly felt like an imposition on a more natural way of approaching a project of this nature, which requires a high degree of experimentation and continual observation. Nevertheless documenting the process has been really interesting. In terms of my Diploma, I am not now sure whether I will include other designs from Arizona in my portfolio.

Evaluation 2017

Stop Press! Simon and I split up in July 2016, six months after writing this design, which has halted any further implementation (as far as I know).

This is design number 2 in my portfolio and it was very complex due to the circumstances (both emotional and physical). In terms of doing things differently in the future, I would choose a simpler scope and a more clearly defined client relationship. Designing for a partner didn't prove to be straightforward.

Reflection 2017

I learnt a lot doing this design and I'm really grateful that I had the opportunity of trying to make something work in a totally different climate. I am very tempted to do the chickens and rainwater sub-designs as fantasy elements – possibly only at sketch level because I think my ideas are valid even though I won't get to implement them in practice.