

Life Lab's Educational Garden

Bed Design Guide

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About Life Lab



Since 1979 Life Lab has been a national leader of the garden-based learning movement.

Through workshops and consultations, we have provided tens of thousands of educators across the country with the inspiration and information necessary to engage young people in gardens and on farms. Our workshops and award-winning publications are the go-to resource for educators and families interested in engaging young people in gardens. At the Life Lab Garden Classroom educational center in Santa Cruz, CA and the Blooming Classroom in Watsonville, CA we promote experiential learning for people of all ages through field trips, children's camps, and teacher workshops.

www.lifelab.org

[@lifelabtweets](https://twitter.com/lifelabtweets)

www.facebook.com/lifelabscienceprogram

About This Project

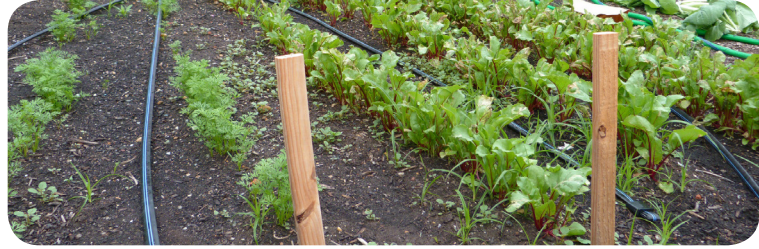
Life Lab's 2-acre Garden Classroom is full of fun, whimsical, and educational elements. Since our site serves as a model outdoor classroom site for thousands of educators every year, we are excited to demonstrate different types of garden beds at this location.

In 2013, with the help of a grant from the Captain Planet Foundation, and donations from our local lumber company, Big Creek Lumber, and from DripWorks Irrigation Supply, we reconstructed our kitchen garden to be a model of many different types of garden beds. While we recognize that this is far from an exhaustive list of all types of garden beds, we selected a handful of designs that we know are tried and true with sizes, shapes, and materials that are particularly suited for a school or teaching garden environment.

We hope you will use this guide as useful inspiration for starting or expanding your educational garden. For further inspiration and ideas about educational garden design elements, view our photo albums. We have compiled photos from educational gardens all over the nation (including our own) that have had some pretty neat ideas: www.lifelab.org/gardenphotos

General Bed Types

1. In-Ground



In-ground garden beds are prepared directly in the native soil found at your garden site. For sites with fertile, weed free soil these beds may be ideal. The width of your garden bed should not be much wider than 4 ft. Ideally your students can reach to the middle of the bed without having to step in the the bed.

PROS

- No additional supplies needed to build borders or containers.
- Easy to change the layout of your garden space.
- Quick to establish garden beds.

CONS

- No defined border, and may result in errant feet trampling plants and compacting soil.
- Difficult to install gopher wire.
- Native soil may lack nutrients or host many weeds.

2. Raised Beds



We define raised beds as open-bottom garden beds with physical borders/edges that contain soil. Raised beds may be ideal for you if you are seeking beds with a more significant border and are needing to import better soil. Raised beds can be built with an array of materials such as cinder blocks, redwood or cedar lumber, straw bales, composite timber, or found resources.

The width of your garden bed should not be much wider than 4 ft. Ideally your students can reach to the middle of the bed without having to step in the bed.



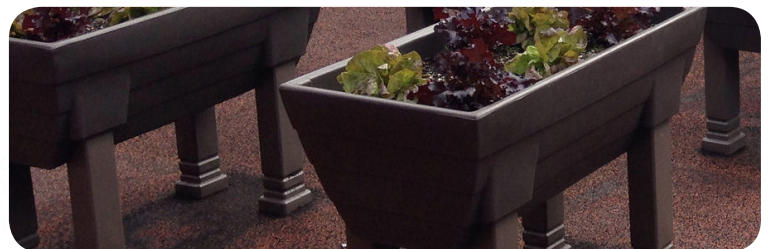
PROS

- Creates defined border that deters trampling plants and compacting soil.
- Can be filled with more fertile soil.
- Can be placed on top of weed cloth, concrete, or non-arable soil.
- Easier to install gopher wire.

CONS

- Creating bed edges requires more materials and can be costly.
- More time consuming to construct.
- Importing soil can be costly.
- May inhibit deep-rooted plant growth.
- Bed frames may degrade over time.

3. Container Beds



We define container beds as beds fully contained with bottoms. Garden containers are well suited for smaller plantings and shallow rooted plants. These beds are often used to grow lettuce, other greens, flowers, and herbs. Container gardens are ideal to place on top of concrete and can be placed on dollies to move indoors to protect from weather or vandalism. Half wine barrels, EarthBoxes, and redwood planter boxes are common container beds.



PROS

- May be portable and requires limited space.
- Gardens can be placed on concrete and beautify non-planting areas.
- Purchased soil is weed free.

CONS

- Beds may dry down faster and require more fertile soil than in-ground beds.
- Small containers limit root growth.



Raised Bed Garden Designs

Wooden Raised Beds



Our tall and short wooden raised beds are made of locally sourced redwood, a naturally rot-resistant material, and is an excellent material for a raised garden bed. Rot-resistant woods typically last for 15 - 20 years, but will eventually need to be replaced. Other rot-resistant wood materials that you can find locally may include, but are not limited to: cedar, juniper, and oak.

For both of our redwood beds, gopher wire (or use hardware cloth) was easily stapled to the bottom of the bed frames. Designing your beds exterior widths to be the same width as your gopher wire makes for easy gopher wire installation. Measure gopher wire to fit your dimensions, and using a staple gun or roofing nails, affix the wire to the bed frame. Then flip frame over so the wire is on the bottom of your bed.

Suggested Tools for Building a Wooden Bed

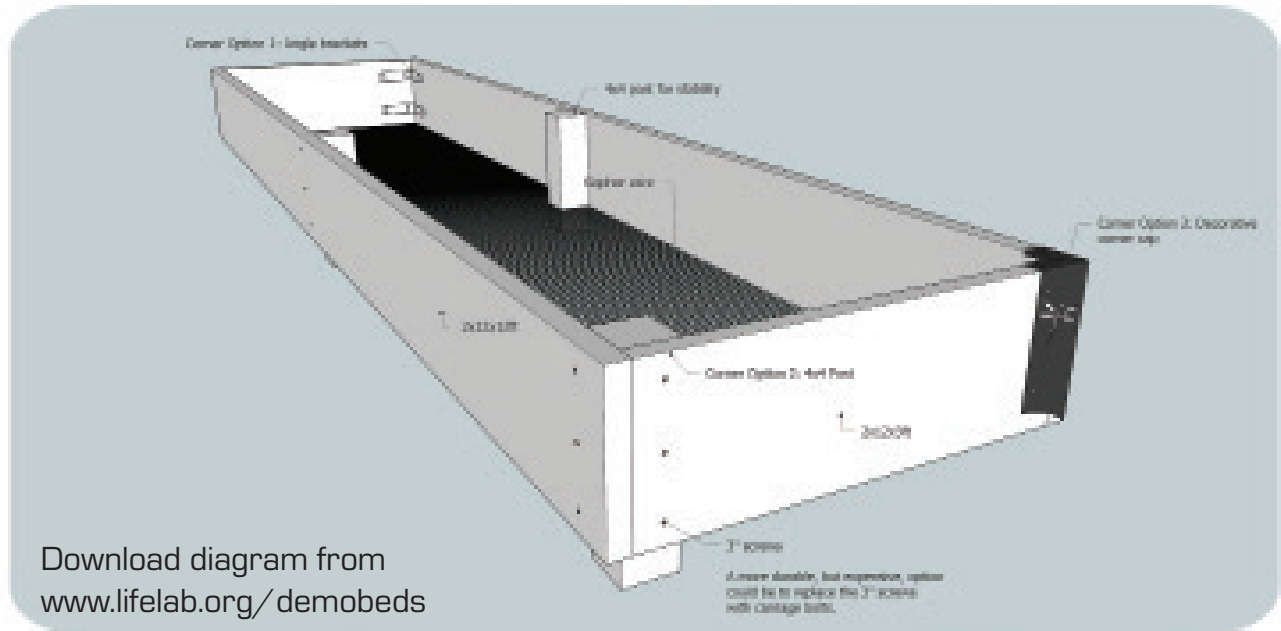
- Hammer
- Square Angle (for straight cuts)
- Carpenter Clamps
- Power Drill & Saw
- Long Nose Tip Snips
(for cutting gopher wire)
- Staple Gun

Construction and Assembly Tips:

- Measure twice, cut once.
-
- Pre-drill pilot holes before screwing or inserting carriage bolts.
- If possible, assemble and build on a flat surface.
- Gopher wire and hardware cloth usually comes in 3, 4, or 5 ft. widths - it is good idea to design your exterior bed width to be the width of of the gopher wire you are using. This will eliminate the need to cut your gopher wire to the proper width.

Short Raised Bed: 3 ft. x 12 ft. - \$244.37

The short raised bed is more ideal to be placed on top of existing soil. This is often found in schools gardens, and uses less materials than the tall raised bed, thus is less costly to build and fill with soil.



Materials:

Lumber

2 - 2 in. x 12 in. x 12 ft
 (2 in. x 2 in./ ft. = \$4.70 ft.
 \$4.70 x 12 ft. = \$56.40 x 2 = \$112.80)

2 - 2 in. x 12 in. x 6 ft
 (2 in. x 2 in./ ft. = \$4.70 ft.
 \$4.70 x 6 ft. = \$28.20 x 2 = \$56.40)

1 - 4 in. x 4 in. x 8 ft.
 (4 in. x 4 in. / ft. = \$2.90
 \$2.90 x 8 ft. = \$23.20)
 *cut in 6 -16 in. posts to be used as corner unions and mid bed supports. Dig holes in the ground where 4 in.x 4 in. posts will be placed to help secure the bed in place and to keep the long boards from splaying.

Hardware

40 - 3 in. decking screws
 (1 lb. box (70 pieces) = \$8.49)

1 ½ in. screws, if using metal bracket to join corners
 (1 lb. box (70 pieces) = \$8.49)

3 ft. x 12 ft. hardware cloth or gopher wire.
 (3 ft. x 25 ft. = \$34.99; 4 ft. x 25 ft. = \$44.99)

Staples to a fix gopher wire.

Total bed cost: \$244.37 +tax

Corner Union Options

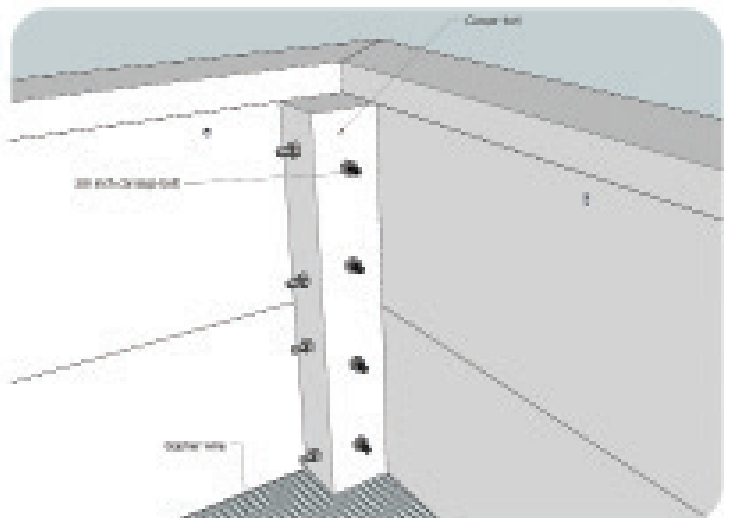
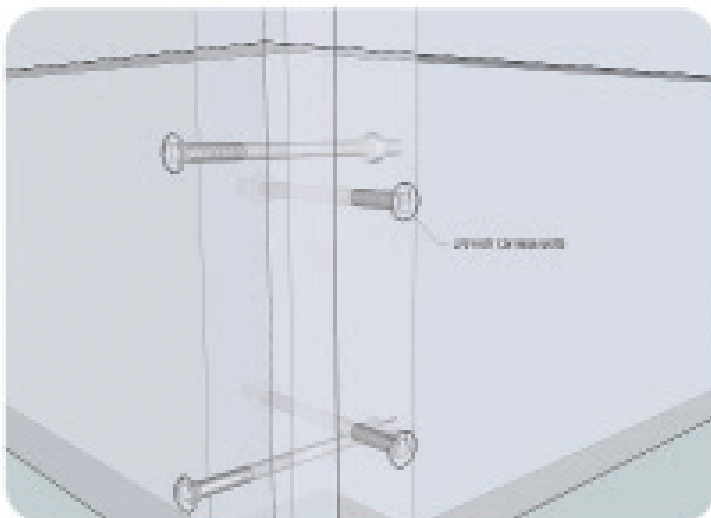
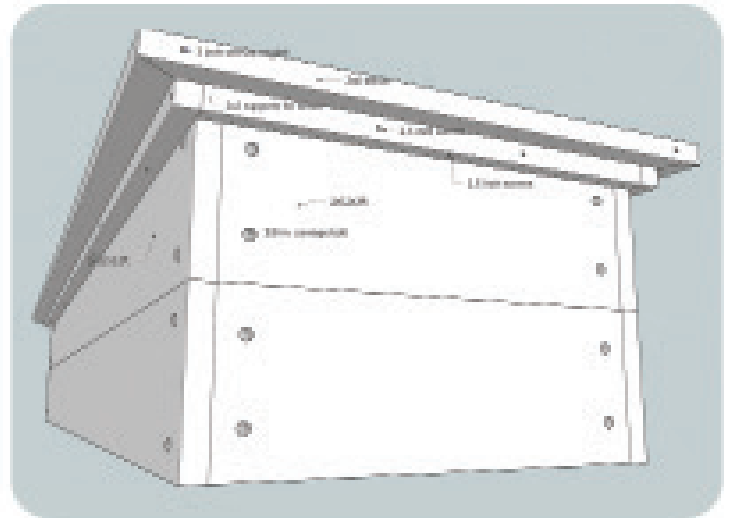
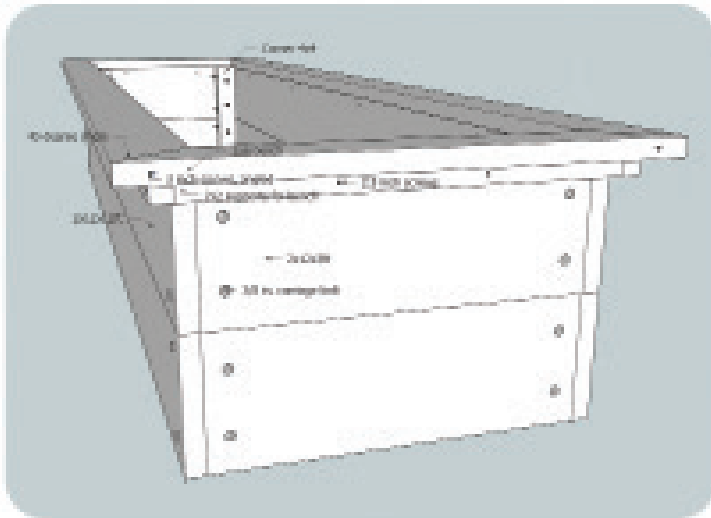
It is advisable to join corners using a 4 in. x 4 in. post (option 1) or some sort of metal bracket (options 2 and 3).

There are various metal brackets that can be purchased to join corners together. Consult your hardware store or read on for decorative corner bed options.



Tall Raised Bed: 3ft. x 12 ft. - \$518.50

The tall raised bed is ideal for deep-rooted plants even when placed on top of concrete or other surfaces. Due to its height, the edge of this bed makes a nice seating area for students.



Materials:

Lumber

5 - 2 in. x 12 in. x 12 ft.
 (2 in. x 12 in./ ft. = \$4.70
 $\$4.70 \times 12 \text{ ft.} = \$56.40 \times 5 = \$282$)

* 4 - 12 ft. lengths
 * 1 - 12 ft. length cut
 in 4 - 3 ft. lengths

4 in. x 4 in. x 12 ft.
 (4 in. x 4 in./ ft. = \$2.90
 $\$2.90 \times 12 \text{ ft.} = \34.80)
 *cut into 6 - 2 ft. lengths

75 - 3 in. decking screws (for use to
 secure benchtop.
 (1 lb. box (70 pieces) = \$8.49)

40 - 6 1/2 in. 3/8 carriage bolts with
 washers and nuts
 (3/8 bolt = \$1.29/ ea. 3/8 washer = \$.23/ ea.
 3/8 nut = \$.33/ ea.
 $\$1.29 + \$.23 + \$.33 = \$1.85 \times 40 = \$74$)

1 - 3 ft. x 12 ft. gopher wire or
 hardware cloth
 (3 ft. x 25 ft. = \$34.99)

Staples to a fix gopher wire

Wood Benchtop (optional)

2 - 2 in. x 6 in. x 14 ft.
 (2 in. x 6 in./ ft. = \$1.64
 $\$1.64 \times 14 \text{ ft.} = \$22.96 \times 2 = \$45.92$)

*cut into 2 - 12+ ft. lengths (to fit
 bed top with 45 degree ends)

1 - 2 in. x 6 in. x 10 ft.
 (2 in. x 6 in./ ft. = \$1.64
 $\$1.64 \times 10 \text{ ft.} = \16.40)
 *cut into 2 - 3+ ft. lengths (to fit
 bed top with 45 degree ends)

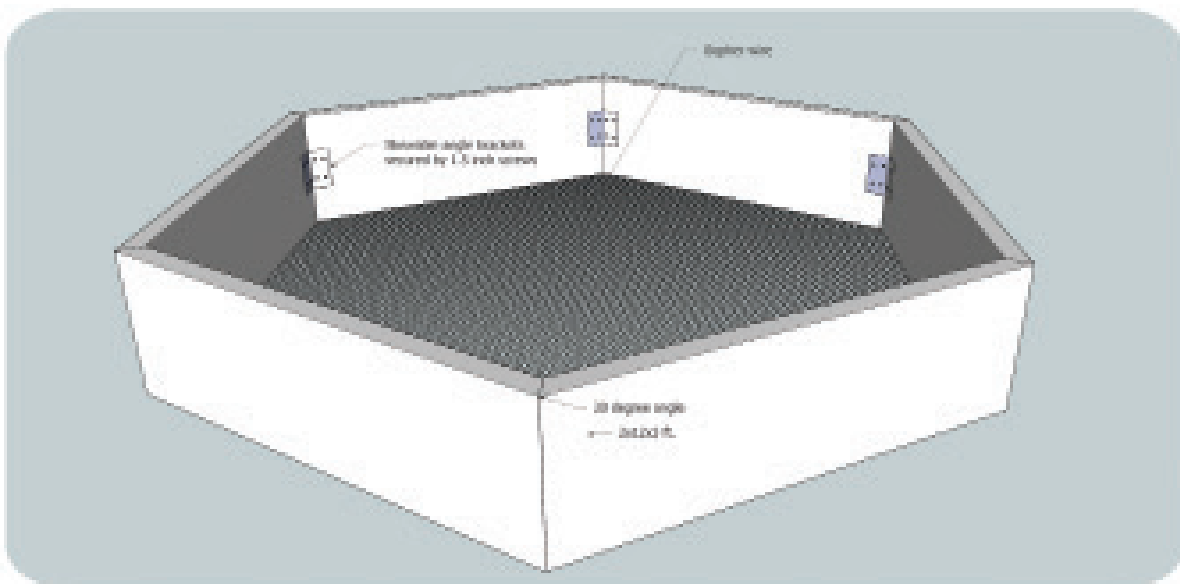
2 - 2 in. x 2 in. x 12 ft. (used as
 support under bench top)
 (2 in. x 2 in./ ft. = \$.73
 $\$.73 \times 12 \text{ ft.} = \$8.76 \times 2 = \$17.52$)

1 - 2 in. x 2 in. x 6 ft.
 (2 in. x 2 in./ ft. = \$.73
 $\$.73 \times 6 \text{ ft.} = \4.38)
 *cut into 2 - 3 ft. pieces (used as
 support under bench top)

Total bed cost: \$518.50 +tax

Hexagonal Bed: 6 ft. x 6 ft. - \$89.50

A hexagon-shaped bed is another raised garden bed which is perfect for students to gather around as a group. Ideally, your hexagon bed would be the right dimension for students to attend to plants that are growing in the center.



Materials (for a 6 ft. wide bed):

Lumber

2 in. x 2 in. x 18 ft. (\$27)*
 (2 in. x 2 in./ ft. = \$.73
 \$.73 x 18 = \$13.14 x 2 = \$26.28)
 *cut into six three-foot pieces

Hardware

6 - skewable angle brackets.
 (1 bracket = \$3.29/ ea. \$3.29 x 6 = \$19.74)

60 - 1.5 in. deck screws.
 (1 lb. box (70 pieces) = \$8.49)

1 - 3 ft. x 12 ft. gopher wire or
 hardware cloth.
 (3 ft. x 25 ft. = \$34.99)
 *cut into 2 - 3 ft. x 6 ft. pieces, overlap
 and mend gopher wire pieces.

Wood Benchtop (optional)

Skill Saw
 Power Drill
 Clamps

Total bed price: \$ 89.50

Construction and Assembly Tips:

Use the following equation to determine your bed dimensions with **s** being the side length: **Area = $(3\sqrt{3} s^2) / 2$**

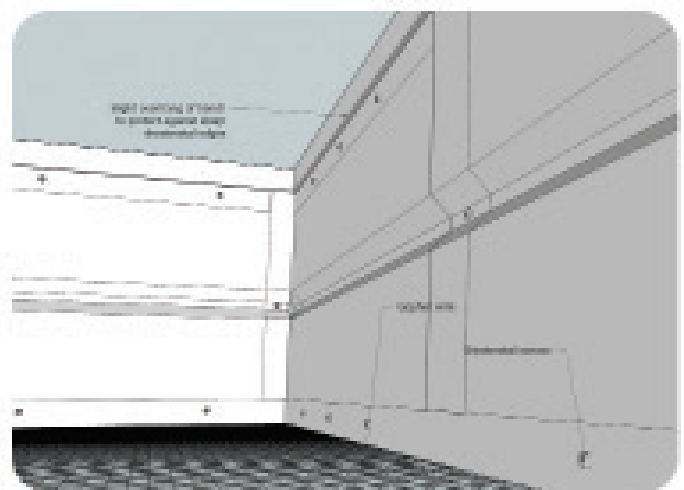
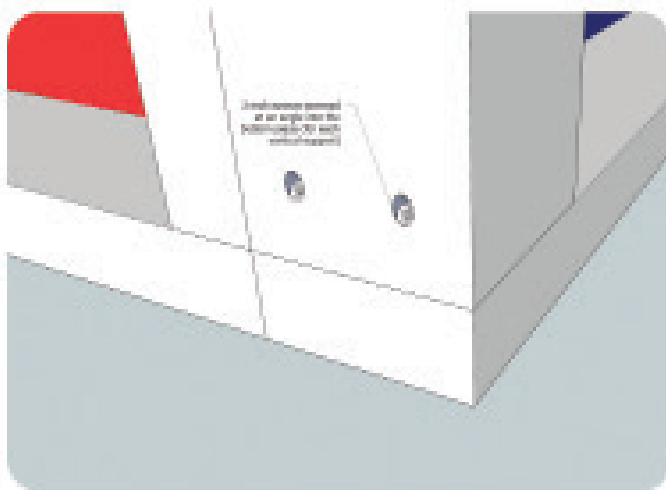
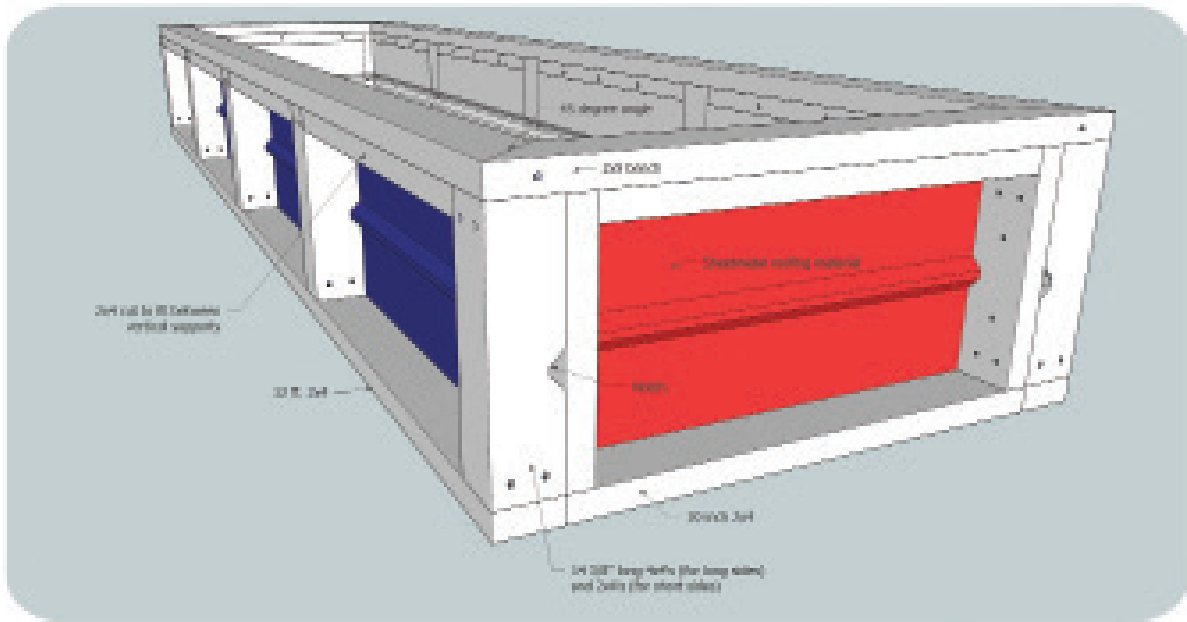
Cut each edge of the boards at a 30 degree angle and arrange accordingly to create a hexagon.

Every 2 boards should create a 120 degree angle.

Width of the completed hexagon bed (from opposite corners) will be twice as long as each board.

Metal Beds

Metal Bed: 3ft. x 12 ft. - \$264.91



Materials:

Lumber

4- 2 in. x 4 in. x 12 ft.
 (2 in. x 4 in./ ft. = \$1.47
 $\$1.47 \times 12 \text{ ft.} = \$17.64 \times 4 = \$70.56$)
 (for top and bottom pieces on the
 long sides)

1- 2 in. x 4 in. x 10 ft.
 (2 in. x 4 in./ ft. = \$1.47
 $\$1.47 \times 10 \text{ ft.} = \14.70)
 (for short side vertical supports
 and short side top pieces)

1- 2 in. x 4 in. x 8 ft.
 (2 in. x 4 in./ ft. = \$1.47
 $\$1.47 \times 8 \text{ ft.} = \11.76)
 (for short side top pieces)

2- 4 in. x 4 in. x 8 ft.
 (4 in. x 4 in./ ft. = \$2.90
 $\$2.90 \times 8 \text{ ft.} = \$23.20 \times 2 = \$46.40$)
 (for long side vertical supports)

1- 2 in. x 12 in. x 12 ft.
 (2 in. x 12 in./ ft. = \$4.70 \$
 $4.70 \times 12 \text{ ft.} = \56.40)
 (for bench, ripped to be exactly 4
 inches wide-just enough to cover
 up the sheetmetal edge)

1- 2 in. x 6 in. x 8 ft.
 (2 in. x 6 in./ ft. = \$1.64
 $\$1.64 \times 8 \text{ ft.} = \13.12)
 (for bench, ripped to be 4 inches
 wide as above)

Wood Benchtop (optional)

1- 12 ft. x 3 ft. sheet metal roofing
 or siding panel (for the long sides)
 1- 8 ft. x 3 ft. sheet metal roofing
 or siding panel (for short sides or
 shorter than 8 ft., but at least
 3 ft. x 3 ft.)

Hardware

3 in. screws
 (1 lb. box (70 pieces) = \$8.49)

2.5 in. screws
 (1 lb. box (86 pieces) = \$8.49)

1 - 3 ft. x 12 ft. gopher wire or
 hardware cloth
 (3 ft. x 25 ft. = \$34.99)

Construction and Assembly Tips

Skill saw/circular saw

Handsaw

Drill and drill bits

Clamps

Angle grinder for cutting the sheet
 metal (wear heavy duty gloves and
 safety goggles)

Total bed cost: \$264.91

Construction and Assembly Tips

Design bed based on size of the sheet metal provided and build each side separately.

Cut the bottom piece of each section and then the vertical supports for each section using 3 in. screws

Cut 2 in. x 4 in. pieces to fit in between each pair of vertical supports

When cutting, keep in mind to cut a notch in each vertical support or flip the sheet metal over so the protrusion of the metal is inside of the bed

Cut sheet metal to size and secure each side with clamps and 3 in. screws

(Optional) It is recommended to add a bench to the top of the bed that hangs $\frac{1}{4}$ in. to $\frac{1}{2}$ in. of the inside of the bed. This will protect garden visitors from being cut by sharp sheet metal edges.

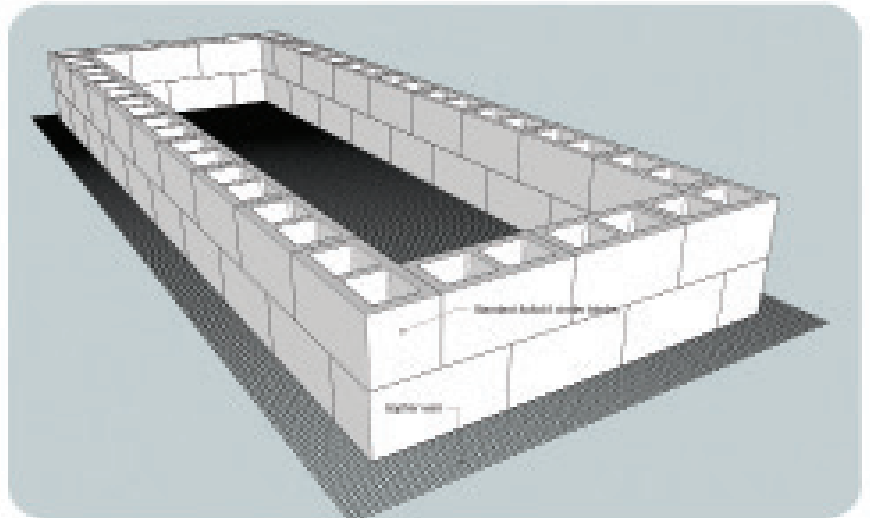


Cinderblock



Cinderblock: 4 ft. x 12.5 ft. - \$259.07

Cinder blocks are an easy and cost effective material for building a raised bed. Although these are basic, you can easily give it some character by allowing students to paint or create mosaics along each cinder block.



There are different styles for cinder blocks which include adobe, thin, split, structural or fireplace and many others. For a standard cinder block bed, please see the following information. Please also note that cinder blocks may vary in price depending on your style and local hardware store. For our sourcing we used Central Home Supply in Santa Cruz, CA; however, the pricing materials below are for the standard cinder block which is not demonstrated in the Kitchen Garden.

Materials (for a 4 ft. x 12. ft. bed)

92 - 8 in. x 8 in. x 16 in. standard cinder block.... (\$234.60)
3 - 10 fl. oz. construction adhesive....(\$14.48)
1 - 4 ft. x 13 ft. gopher wire or hardware cloth
Landscape staples to secure gopher wire to ground...(\$9.99)

Total price: \$259.07

Construction and Assembly Tips

Level and till soil before place cinder blocks or gopher wire.

Lay out enough gopher wire with your desired dimensions, leaving an additional $\frac{1}{2}$ ft. for all sides. If necessary, weave gopher wire together if it does not fit your bed size.

Gently arrange cinder blocks on top of gopher wire to create your bed.

For a second layer, use construction adhesive or mortar to adhere cinder blocks together. Place adhesive closer to the inside of each block to prevent it from spilling from the sides.

Gently place second layer of cinder blocks and let it dry for 24 hours. See adhesive details for further instructions as directions may vary.



Kit Beds



PROS

- Easy to assemble and may not require additional hardware.
- Already comes with a set dimension for your garden space and can be easily readjusted.

CONS

- May not be sustainable and need to be replaced sooner rather than later.
- Can be costly.

Composite Kit Bed: 4 ft. x 8 ft. - \$239.82

Kit beds may be available online or at your local hardware store. We selected Frame it All as our kit bed demonstration. Frame it All beds can be customized to fit your garden space and is easy to assemble and adjust accordingly. Your needs may vary for using kit beds, but we suggest the 2 levels of the 2 in. timber for more depth and stability.



Source: Frame it All (www.frameitall.com)

Metal Kit Bed: (Modular 4 - in - 1) \$189.95



Source: Metal Kit Bed (www.raisedbeds.com)

Frame it All Kit Costs:

Raised Beds Modular Metal Trough Garden Bed (4-in-1): \$189.95

Frame it All Raised Garden Curved Ends 2 in. 4 ft. x 8 ft. 2 level: \$239.82

*Note: To accommodate our dimensions (3 ft. x 12 ft.), we ordered additional boards and cut our end boards to just under 3 ft. For beds longer than 8 ft., Frame it All recommends purchasing extra boards and 4-way joint pieces to add stability to the middle of the bed.

Kit Bed Retailers

www.frameitall.com
www.raisedbeds.com

www.greenesfence.com
www.eartheasy.com

Corners and Brackets

To add more decorative flair to your garden beds, particularly your raised wooden beds, browse raised bed corner options at www.raisedbeds.com/corners/ or Plow & Hearth Insect Design.

Many of these decorative brackets act as structural unions and can make for easy bed assembly.



Pest Protection

There are many types of pests that can intrude your garden, and it may be necessary to invest in pest protection for your beds.

Burrowing Pests

In areas with burrowing pests like gophers attaching “gopher wire” to the bottom of the bed is much easier done during the bed construction process. Galvanized poultry fencing with $\frac{3}{4}$ in. or less holes affixed to the bottom of a garden bed frame is often used as gopher exclusion wire, but there are more durable and preferable options.

Some stores carry gopher wire that is made from thicker gauge wire than normal poultry wire. Half inch hardware cloth is another recommended option to use for gopher exclusion. If it is necessary to join two pieces of gopher wire together make sure to overlap the pieces by at least 3 inches and weave the two sides together so that gophers cannot penetrate the barrier.



Flying and Crawling Pests

In addition to gopher wire, it may be necessary to cover your beds with remay (floating row cover) or bird netting to prevent critters from eating your plants. An alternative to bird netting products, which often tangle and tear easily, is to source a roll of Plastic/Polyresin netting. These thicker plastic netting products last longer and are easier to store. Row cover and netting protection can be supported over your bed with inverted “U” supports made from heavy gauged wire or ½ PVC pipe.

To make it easier to create PVC pipe supports you can affix 1 in. wide PVC tubes with pipe clamps on the inside of your garden bed to serve as collars for the ½ in. pipe to slide into.

Materials

50 ft. 9 gauge netting.....	\$5.99/ ea.
½ in. 20 ft. PVC pipe.....	\$4.29/ ea.
1 in. 10 ft. PVC pipe.....	\$3.79/ ea.
1 in. 20 ft. PVC pipe.....	\$7.49/ ea.

Soil Calculator Links

Gardener's Supply Company:

<https://www.gardeners.com/how-to/soil-calculator/7558.html>

Soil Buildings Systems (adjusts for settling):

<http://www.soilbuildingsystems.com>

Soil Direct (for different sized and shaped beds)

Convert from cubic feet to cubic yards:

<https://www.soildirect.com/calculator/cubic-yard-calculator/>



Irrigation

California School Garden Network – Maintaining Your Garden

<http://www.csgn.org/maintaining-your-garden>

Drip Depot: <http://www.dripdepot.com/>

Drip Works: <http://www.dripworks.com/>

Saving Water Partnership – Drip Irrigation and Soaker Hoses:

<http://www.savingwater.org/lawngarden/wateringirrigation/dripirrigationsoakerhoses/>

UCSC Farm and Garden (Center for Agroecology and Sustainable Food Systems)

-For the Gardener : Water Conservation Tips

http://63.249.122.224/wp-content/uploads/2010/05/water_saving_handout.pdf

Other useful resources

Annie's Homegrown – Creating Gardens of Goodness

<http://www.annies.com/wp-content/uploads/2012/09/>

Creating-Gardens-of-Goodness_Annies-Homegrown.pdf

California School Garden Network – Creating and Sustaining School Gardens

<http://www.csgn.org/csystg>

Louisiana State University 4H – School Gardening: Best Practices

http://www.ext.colostate.edu/4_h/school-garden.pdf

University of Georgia Cooperative Extension – Raised Beds vs. In-Ground Gardens

http://www.caes.uga.edu/applications/publications/files/pdf/C%201027-3_2.PDF

<http://www.sunset.com/garden/backyard-projects/ultimate-raised-bed-how-to>



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