



CARAVELLE

by Cardinal Systems



Construction Guide

For Polymer Wall Pools

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Introduction

We thank you for your purchase of our polymer wall pool. We think you will find it quite simple to install. We would like, however, to impress upon you the importance of reading these instructions carefully in order to acquaint yourself thoroughly with the drawings, and acquire an understanding of what building a swimming pool involves.

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Getting Ready

Planning the Layout

The location of the pool on your lot is a very important decision, and time should be taken to plan it carefully. Try to select a sunny part of the yard, not only to maximize enjoyment of the pool, but to avoid annoyances such as leaves and other debris falling into the pool. Exposure to the sun will also help warm the water and enhance enjoyment.

It can be helpful in planning the pool if the proposed size and location is staked out with some string lines in order to help visualize the finished project. Keep in mind extra room may be required for extra features desired. Most pools will have a walkway of 3 to 4 feet around the entire pool. Will there be a bathhouse, dressing area, or patio area? Will there be a door to the house near the pool? Where will the pump and filter be placed? Answering such questions early avoids problems later on.

If the prospective site contains low spots that may experience periodic flooding at certain times of the year or a high water table, proper drainage will be necessary to remove excess ground water. In addition, check for hidden obstacles such as sewer or septic systems, buried pipes, or wiring. Finally, for safety reasons, the pool must never be installed underneath telephone or electrical wires.

Preparing the Paperwork

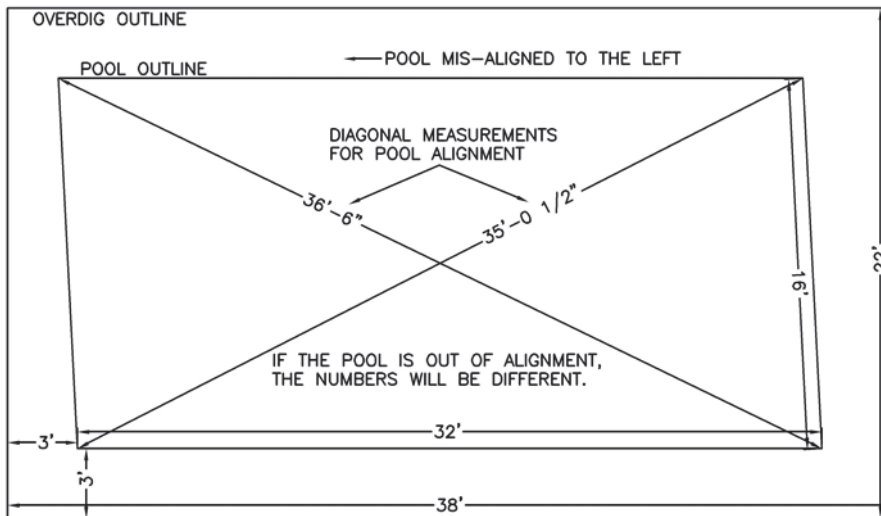
Check building codes in the area where the installation will take place, and any regulations governing residential pools. Regulations vary widely between communities, but a building permit is generally required. **ALL SWIMMING POOLS MUST BE INSTALLED IN ACCORDANCE WITH THE AMERICAN NATIONAL STANDARD FOR INGROUND SWIMMING POOLS ANSI/NSPI-5 2003 OR LATEST VERSION.**

Pool Layout

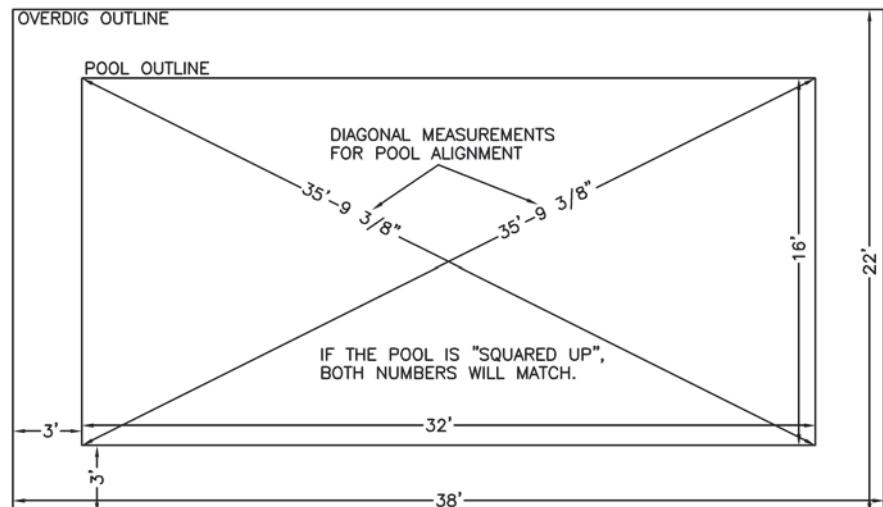
Rectangular Pool Example

The layout of simple shapes such as a rectangle is easy if a few basic concepts are followed. After deciding on the size and orientation of the pool, and allowing for proper spacing away from property lines, fences, houses, and any other obstructions, stake out the pool outline. This can be done with a variety of methods; stakes and strings, chalk lines, or spray paint. This will enable you to get a better idea for the actual space required by the pool, and may be easily adjusted in case the initial size or placement of the pool is unsatisfactory. Once excavation has begun, changes are much more difficult.

Aligning the pool shape is done by measuring across opposite corners. This is referred to as the diagonal of the pool. A simple method for figuring diagonals is provided in the section at the end of this guide. In the case of a rectangle, the pool may be aligned without even knowing the actual measurement number; simply adjust the pool so both opposite corner measurements are the same.



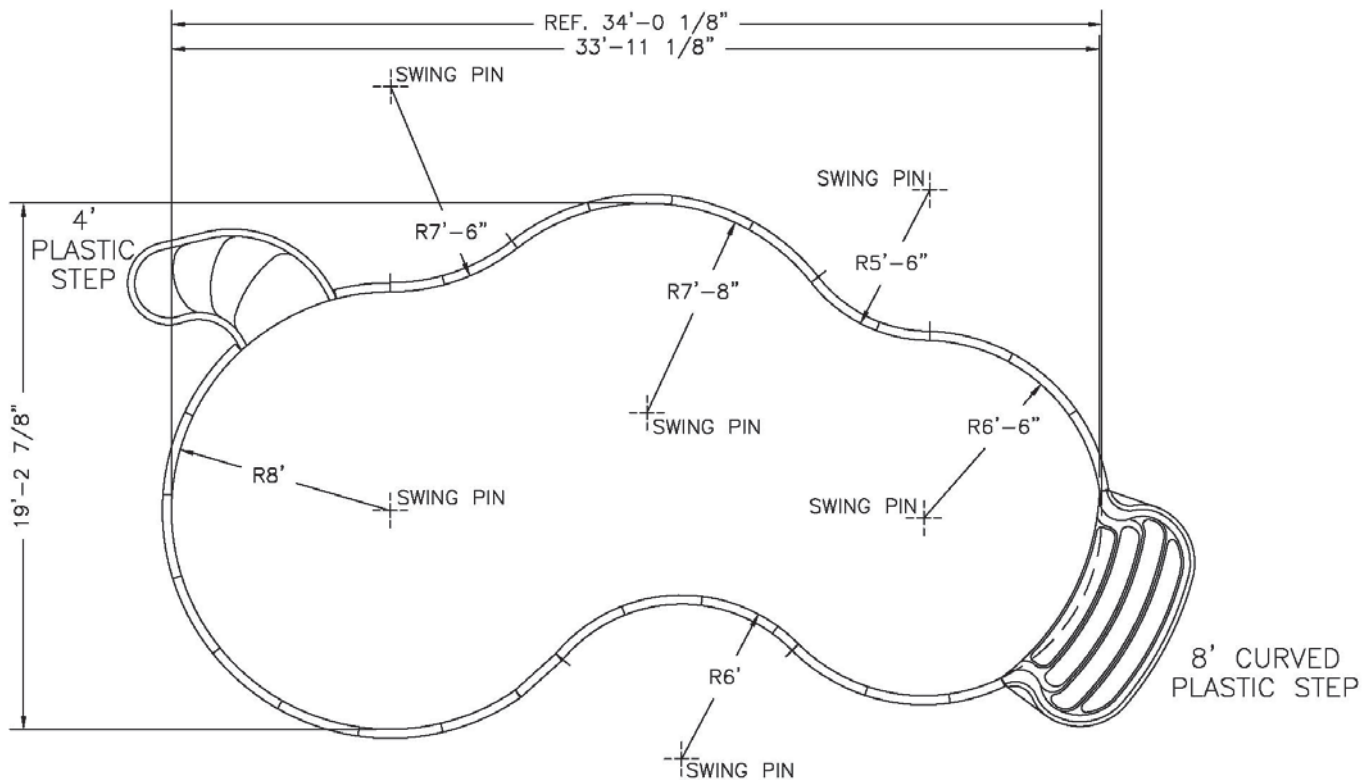
Pool Prior To Squaring



Pool After Squaring

Free Form Pool Example

There are many custom shapes available from **CARAVELLE**, and we classify a lot of them under the general heading of “Free Form”. Alignment of these Free Form pools is no more difficult than aligning a rectangular pool. The same considerations regarding size, orientation, and obstacle clearance still apply, and the same methods for staking are used. This time, a rectangular box which would enclose the pool is laid out, and measurements are taken from the corners of the box to locations on the pool. Let’s look at a 16’ x 34’ Free Form with radius steps.

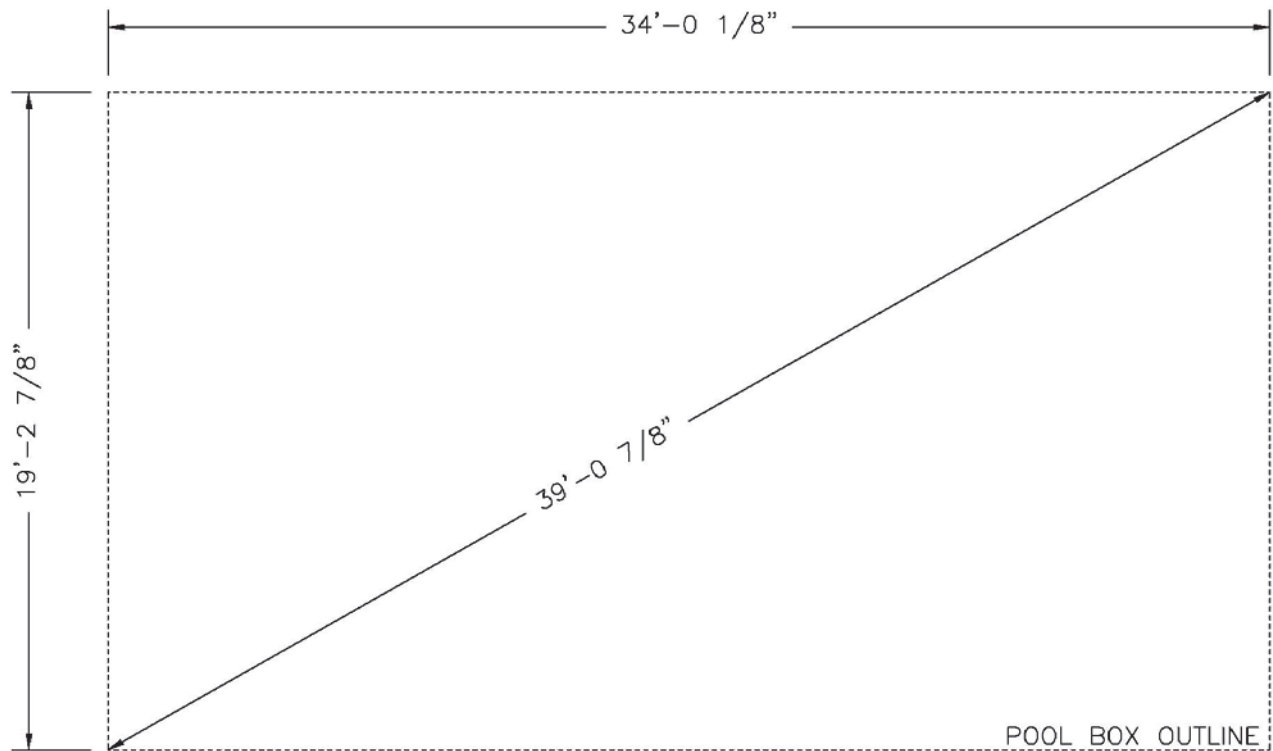


Squaring dimensions and other alignment information for pool installations are not normally provided until an order is actually placed for the pool. The reason for this is the time involved, which can be significant on unusually shaped pools. Should you require such information, the time to request it is when you place the order. The assumption is made that all changes to the size or shape will be completed before you order the pool. When requested, we supply a list of measurements which includes the distance from both deep and shallow swing pins to all other swing pins to lay out the excavation. The list also has triangulation measurements from both sides of the step to panel joints for aligning the panels during assembly. A copy of a typical print with the related list of measurements is provided in Appendix C.

Pool Layout

Free Form Pool Example

First, stake out the pool box outline shown below as was done previously for the rectangle pool (Refer to the Rectangular Pool section on page 2 for squaring the pool box). This particular installation is for a 16' x 34' free form but the overall stake dimensions are 19'-2 7/8" x 34'-0 1/8".



Free Form Pool Example

Let's see how this layout develops:

Finding Radius Swing Pins

Step #1

Measure from Point 1 out $13'-9\frac{5}{8}"$ and from Point 4 out $11'-3\frac{3}{4}"$. At the intersection of these (2) measurement drive a rebar stake to mark 8' radius swing pin (A).

Step #2

Measure from Point 1 out $19'$ and from Point 2 out $18'-3\frac{5}{8}"$. At the intersection of these (2) measurement drive a rebar stake to mark 7'-8" radius swing pin (B).

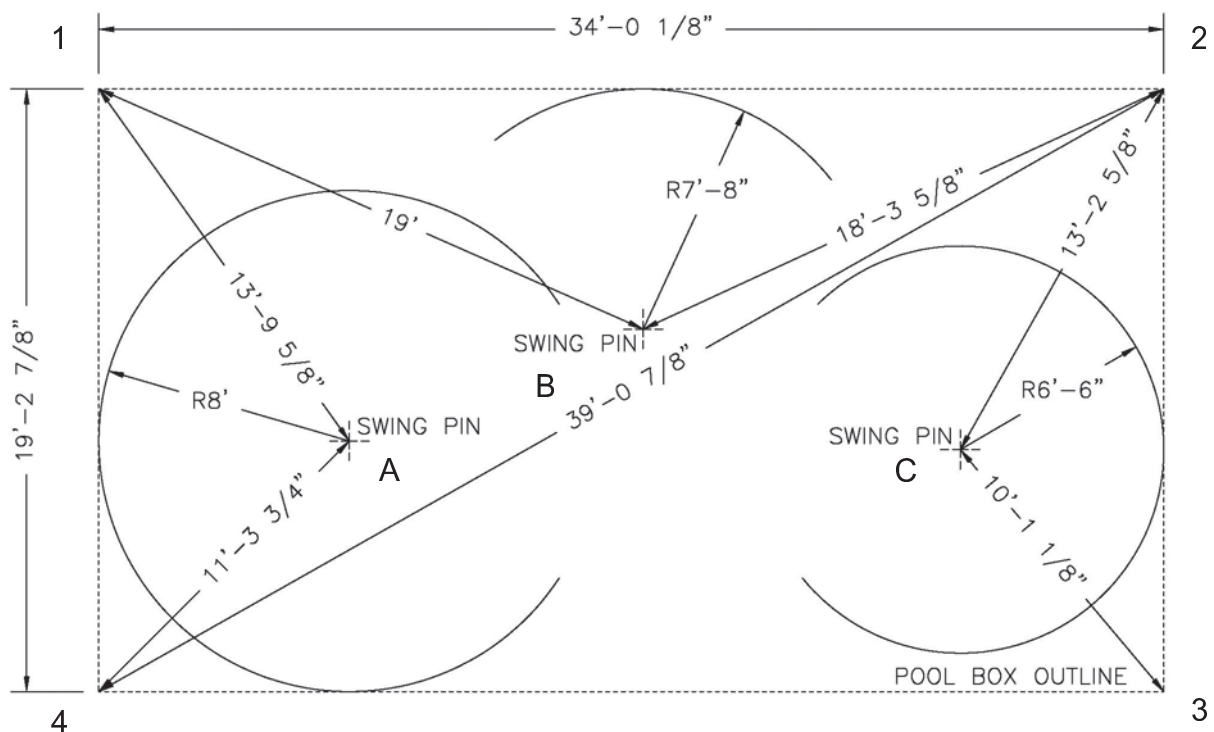
Step #3

Measure from Point 2 out $13'-2\frac{5}{8}"$ and from Point 3 out $10'-1\frac{1}{8}"$. At the intersection of these (2) measurement drive a rebar stake to mark 6'-6" radius swing pin (C).

Now that the pins are determined for the radii, we can swing and mark.

Step #4

Attach your tape measure on swing pin "A" and measure out 8'. Keeping the tape measure pulled tight, use marking paint to swing your 8' radius. Repeat this step for swing pins "B" & "C" using the appropriate radius measurement.



Pool Layout

Free Form Pool Example

Finding Reverse Radius Swing Pins

Step #1

Measure from Point 1 out $9'-0\frac{7}{8}"$ and from Point 4 out $24'-10"$. At the intersection of these (2) measurements drive a rebar stake to mark the $7'-6"$ reverse radius swing pin (D).

Step #2

Measure from Point 2 out $6'-3\frac{5}{8}"$ and from Point 3 out $20'-8\frac{3}{8}"$. At the intersection of these (2) measurements drive a rebar stake to mark $5'-6"$ reverse radius swing pin (E).

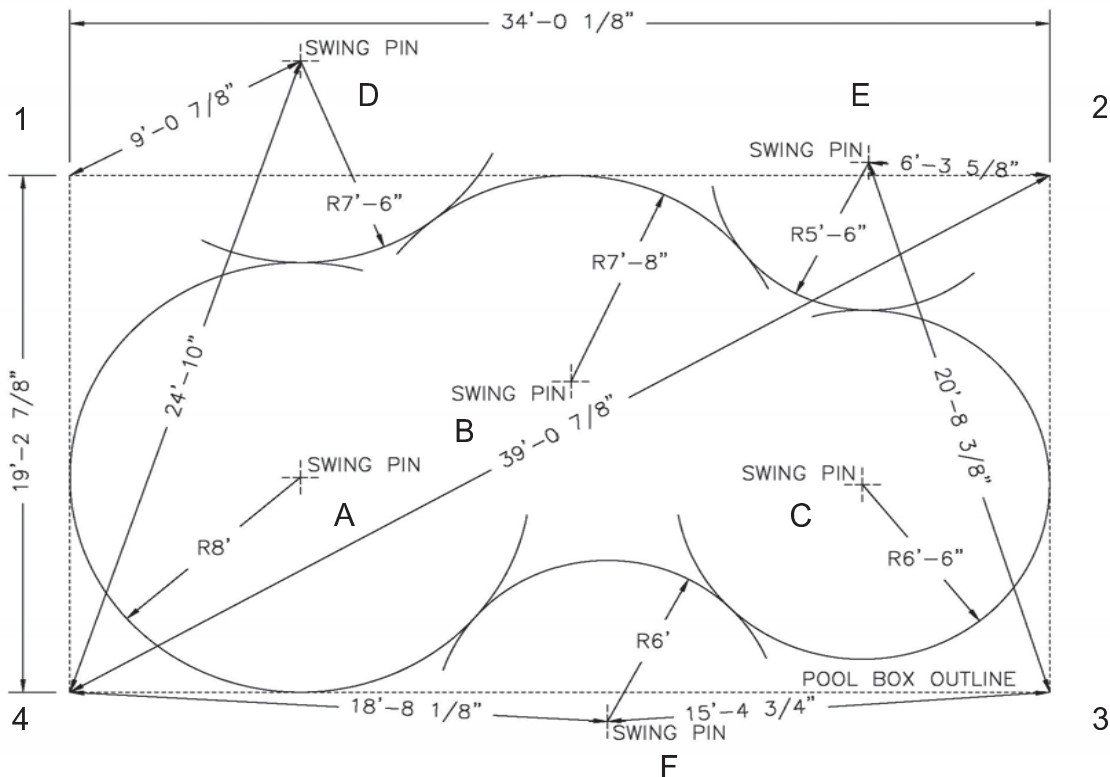
Step #3

Measure from Point 4 out $18'-8\frac{1}{8}"$ and from Point 3 out $15'-4\frac{3}{4}"$. At the intersection of these (2) measurements drive a rebar stake to mark $6'$ reverse radius swing pin (F).

Now that the pins are determined for the reverse radii, we can swing and mark.

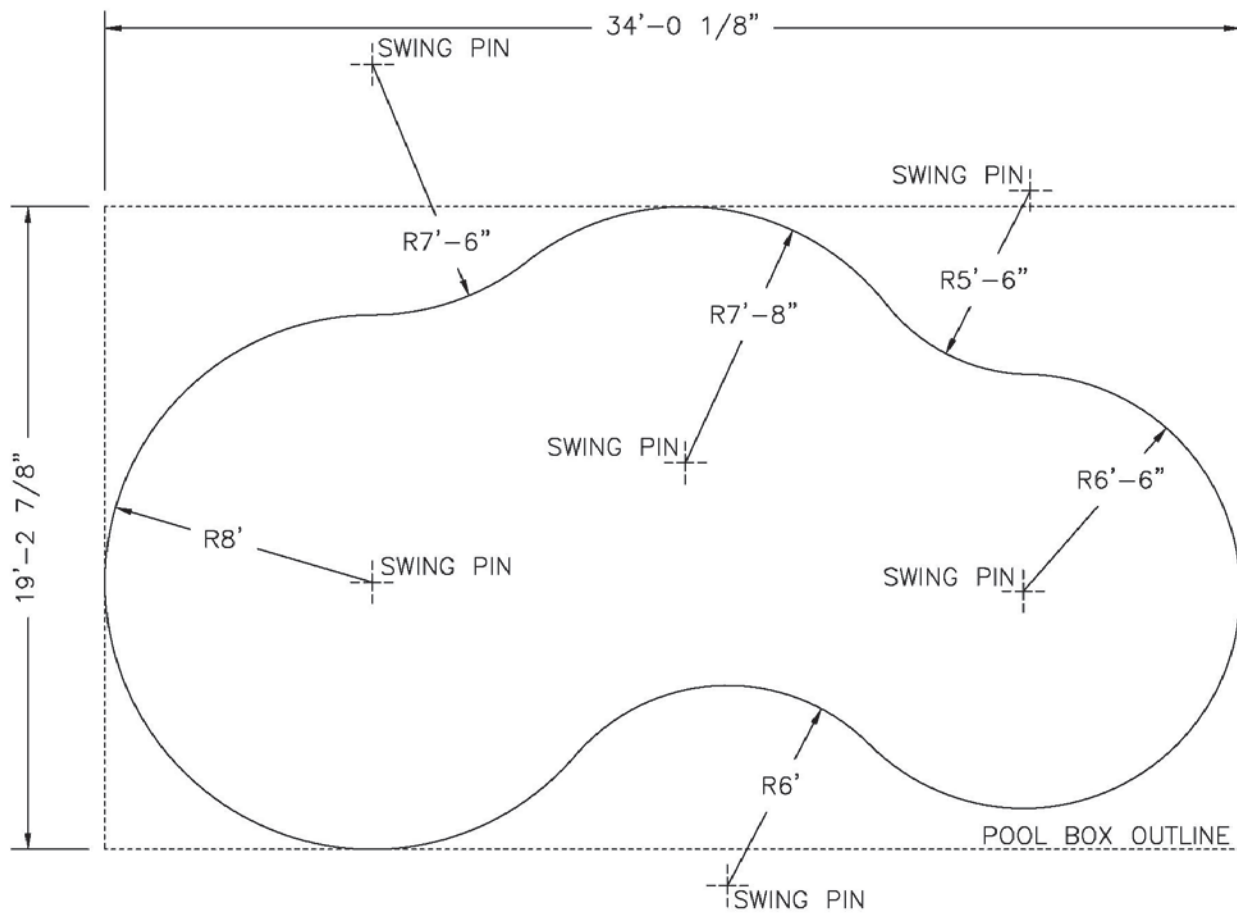
Step #4

Attach your tape measure to swing pin "D" and measure out $7'-6"$. Keeping the tape measure pulled tight, use marking paint to swing your $7'-6"$ reverse radius. Repeat this step for swing pins "E" & "F" using the appropriate radius measurement.



Free Form Pool Example

The finished outline showing the measurements used.



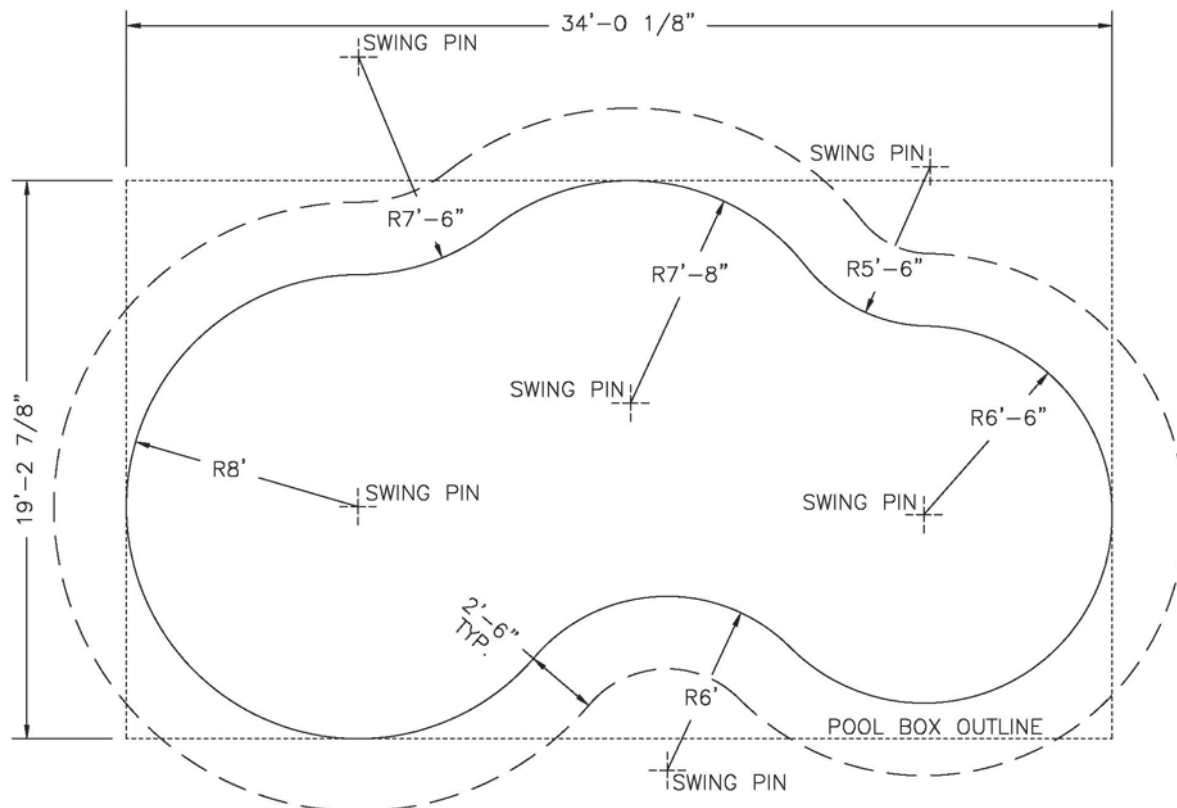
Pool Layout

Free Form Pool Example

Once the pool outline is laid out, the over-dig can also be laid out. A typical over-dig is 2'-6" to 3' beyond the pool perimeter outline. In this example we used a 2'-6" over-dig.

To determine the radius over-dig outline of the example pool, begin by adding 2'-6" to each radius measurement. For example, the 8' radius plus the 2'-6" over-dig will now become a 10'-6" radius. Follow Step #4 as described on pages 5 to mark the radius over-dig.

To determine the reverse radius over-dig outline, begin by subtracting 2'-6" from each reverse measurement. For example, the 7'-6" reverse radius will now become a 5' reverse radius. Follow Step #4 as described on page 6 to mark the reverse radius over-dig.



Undisturbed Ground

Have the excavator operator study the drawing of your particular size pool and stress the importance of the fairly close tolerances for the walls and inside finish. In particular, ensure that the width and length of the deep part of the excavation is not too great, since it is better to have to do a little extra hand trimming after the walls are firmly in position, than to find that you are trying to install the walls on thin air. The excavator should have access to a dump site to dispose of the removed earth.

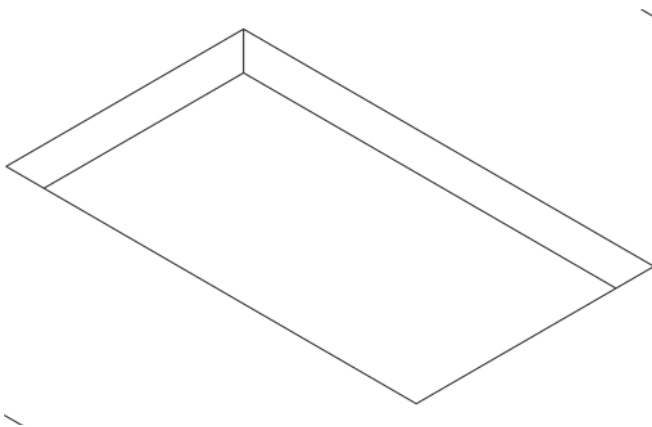
Next choose the elevation for the top surface of the pool. (Height of standard pool wall is 42" plus the height of the selected coping). Normally the surface will correlate with a surrounding walk, patio deck, or highest ground elevation of the pool site. The top surface of the pool must be three to four inches (3"-4") above the highest ground elevation of surrounding deck when finished.

Locate a permanent reference point on the pool site to decide the depth of the initial excavation. If this point is not in the way of excavation and dirt removal, mark it conspicuously for future reference during the pool construction. If it is in the way of excavation, transpose this elevation to a deck, sidewalk, mortar joint on a block basement wall or driving a stake in an out of the way place.

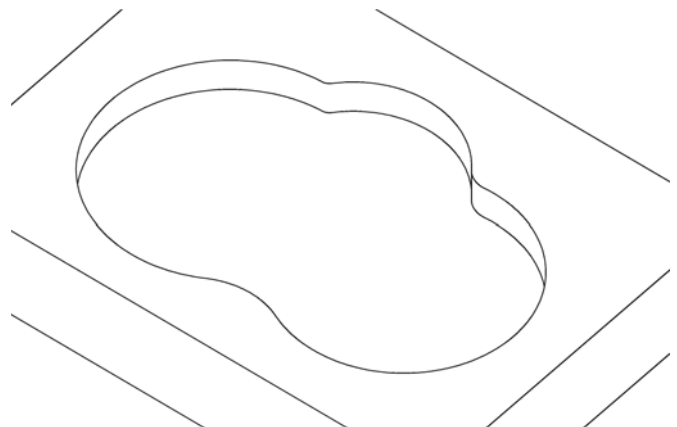
NOTE: The height of the selected coping must be added to the wall height for the total wall height.

The finished elevation depth, measured from the top of the coping, will be maintained in shallow end and on the 2'-6" over-dig around the pool wall perimeter.

The first operation is to dig the over-dig to a uniformed finished elevation depth below the reference point.



Rectangular pool shape plus over-dig.



Free-form pool shape plus over-dig.

Excavation

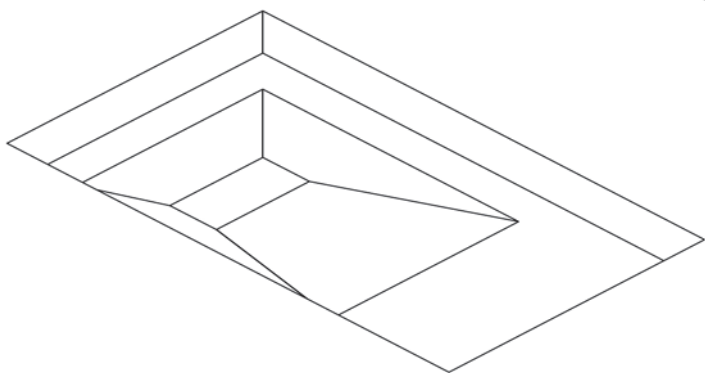
Undisturbed Ground

After the first part of the excavation is done, the next step is to layout the exact pool size on the floor of the finished elevation excavation. Remember to leave the 2'-6" over-dig as a working ledge. This layout should be accurate because it will decide the exact position of the pool.

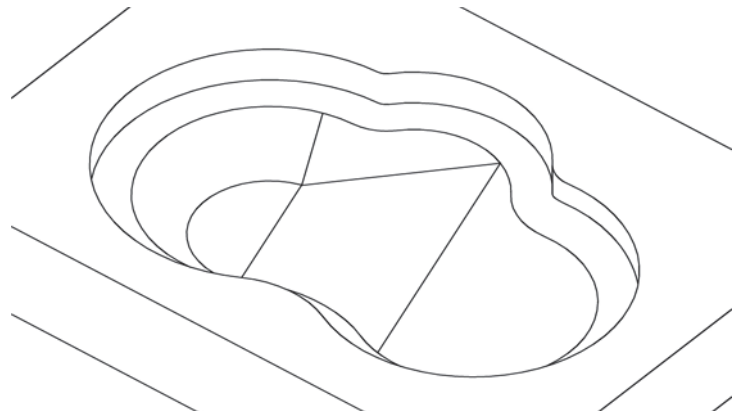
Repeat Step #1—Step #4 on pages 5 and 6 to recreate the pool layout. This will provide you with location of the pool panels.

After the final position of the pool is decided, layout the hopper of the pool as noted on your pool construction prints for excavation (Reference appendix C for this example).. The top edge of the hopper slopes (deep end) should be marked with string. Using the strings as a guide, spray a line along the strings. Simultaneously, the termination of the deep end slope should be marked along the strings with rebar. While digging the hopper, the excavator can sight across to the opposite side of the pool and trim the hopper walls to the proper slope as the final depth of the hole is reached. The excavated depth of the hopper is two inches (2") deeper than the finished dimensions.

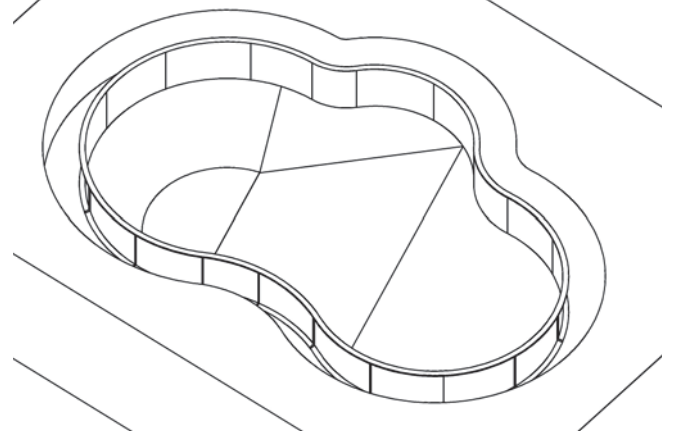
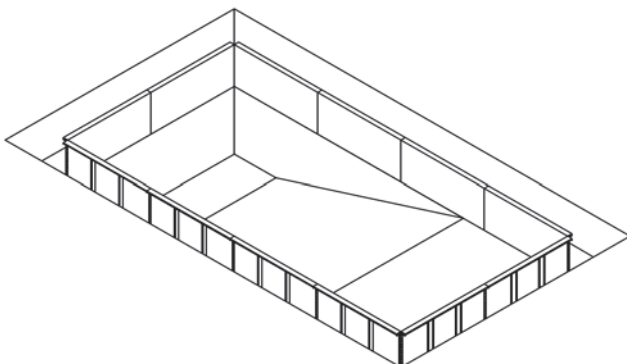
IMPORTANT: Be careful not to dig into the area outside the paint to avoid and undercut of the over-dig. Doing so will remove supporting ledge for panels. **The working ledge must be absolutely level and even for the assembly of panels to go smoothly! An uneven ledge will make it difficult to join the panels together because the flanges will be difficult to align.**



Rectangular pool shape with hopper.



Free-form pool shape with hopper.

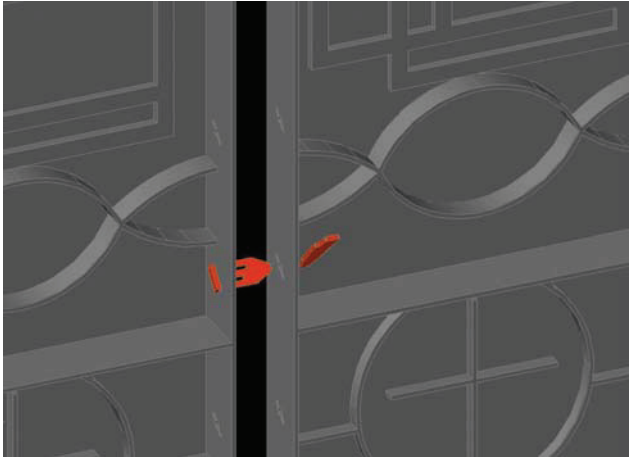


Excavation finished and pool wall panels installed. Buttress braces are required at every panel joint but are not shown here in order to illustrate the relation of panels, hopper, and over-dig.

Pool Wall Erection

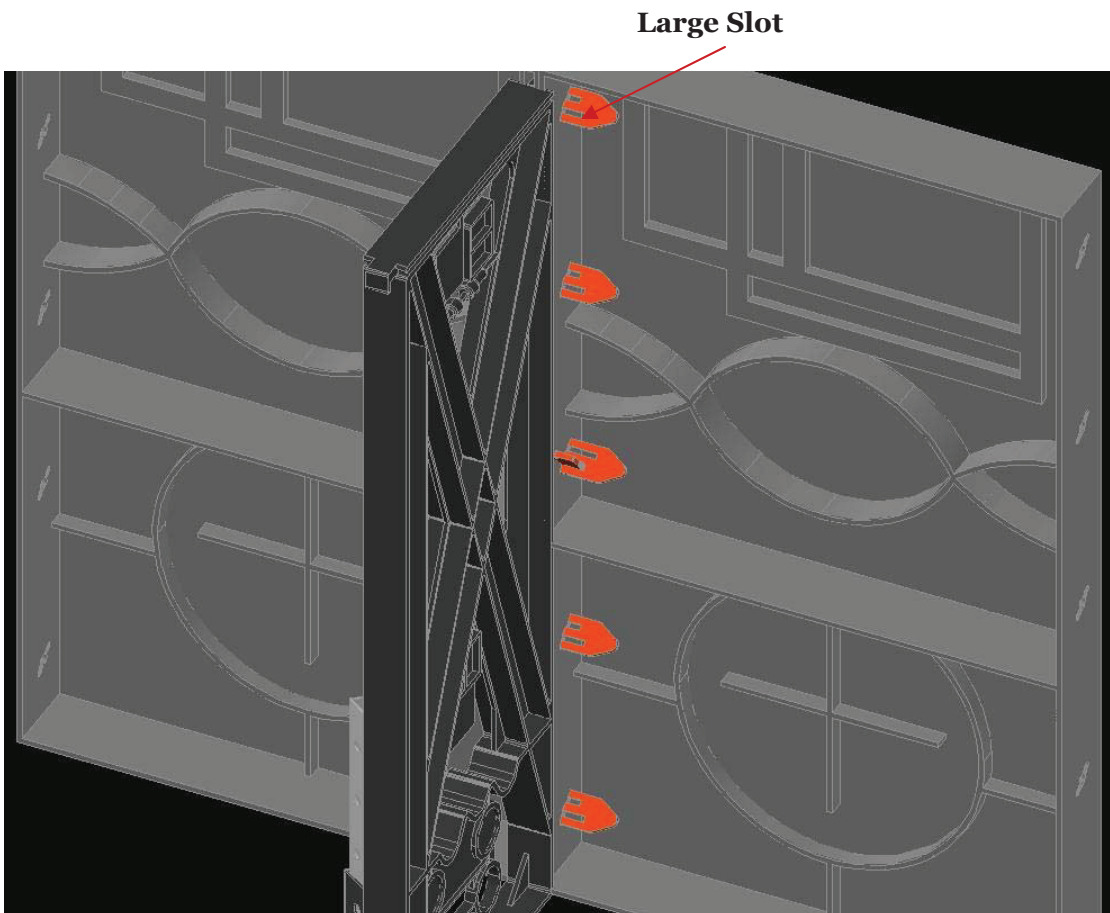
Assembly of Components

Set the **CARAVELLE** swimming pool wall panels on the over-dig ledge against the side of the excavation according to the panel diagram provided by CARAVELLE. Begin at any corner panel, assemble the first wall panel to the corner panel using the **Speedlock** fastening system.



Begin by installing the peg, with the small slot facing down, into the center keyway hole of the panel. Align the panel face and flange and insert the wedge with serrations facing away from the panel side flange (See Illustration 1).

Illustration 1



Place buttress on the left side of the panel seam. Insert pegs into the keyway holes on the buttress tabs with the large slot facing down (See Illustration 2).

Note: Buttresses can be positioned on either side of the panel seam. The pegs must be inserted so that the slots are on the opposite side of the buttress tabs.

Illustration 2

Pool Wall Erection

Assembly of Components

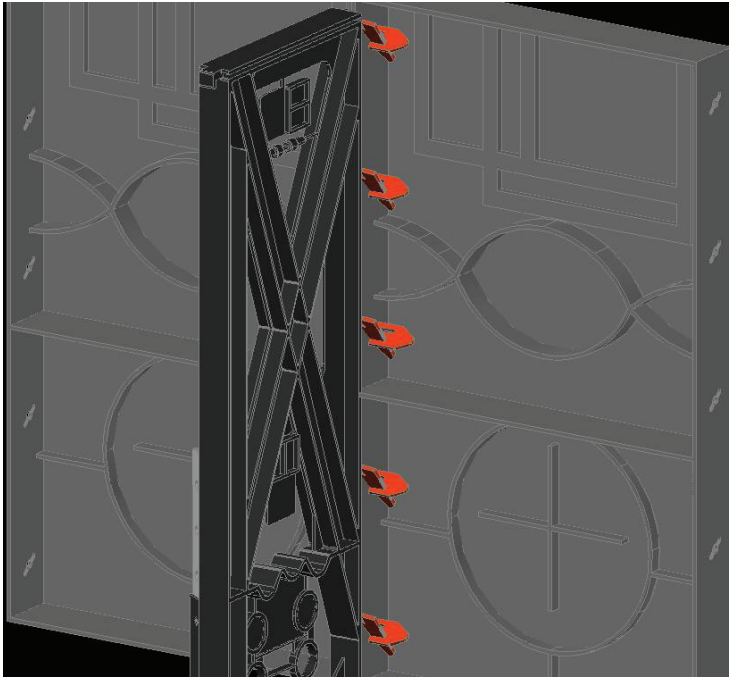


Illustration 3

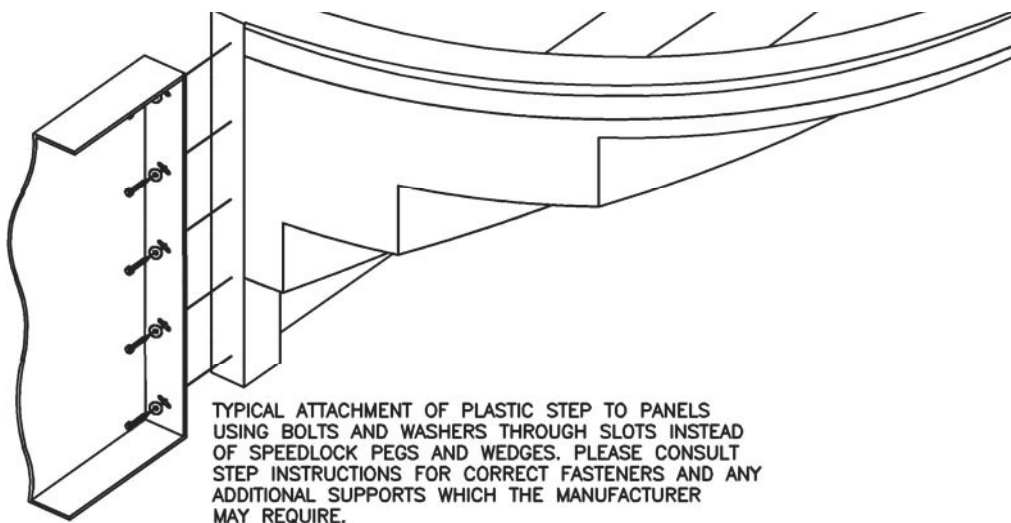
Illustration 3 shows the finished buttress assembly with all peg and wedges installed.

The wedges can now be tapped into place with a hammer. A light tap is all that is needed.

Step Installation

Plastic or fiberglass steps from other manufacturers may also be used with **CARAVELLE** polymer wall panels. A typical plastic step installation is shown below.

The **Speedlock** peg and wedge slots in the panels are used, but the **Speedlocks** are replaced with our bolt and washer kit to fasten the sides of the step. This method of attachment gives the most reliable connection between **CARAVELLE** panel and plastic step, while leaving the maximum access for any additional step support recommended by the step manufacturer.



TYPICAL ATTACHMENT OF PLASTIC STEP TO PANELS USING BOLTS AND WASHERS THROUGH SLOTS INSTEAD OF SPEEDLOCK PEGS AND WEDGES. PLEASE CONSULT STEP INSTRUCTIONS FOR CORRECT FASTENERS AND ANY ADDITIONAL SUPPORTS WHICH THE MANUFACTURER MAY REQUIRE.

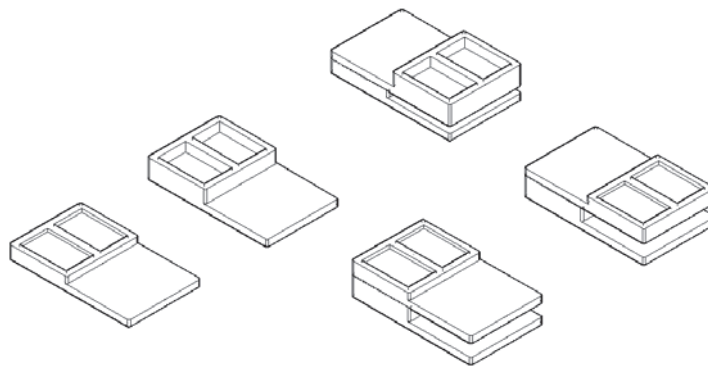
Shim Configuration

When the wall assemblies are straight, square and parallel and match the supplied measurements on the construction print, drive rebar pieces into holes located in the bottom flange of the pool wall panels along the entire pool perimeter. Leave approximately 6" of rebar extending above bottom flange. Check supplied measurements periodically as staking and pinning progresses.

Level the assembled pool walls by taking elevation measurements (with transit or laser level) at each panel joint and step (if installed). Leveling shims are a part of every patented **CARAVELLE** buttress. Simply cut off the necessary shims and stack as needed. Shims have been designed to allow for shimming from a 1/4" to 1-1/4". This procedure is very important and enough time should be devoted to the leveling procedure to assure an absolutely level pool.

When entire perimeter wall sections are pinned with rebar, begin plumbing the panels using a 4' level held to the face of the panel. Drive the stakes in the stake pockets on buttresses to adjust the plumb of the wall. Check plumb and level as you proceed with this process. Now, the pins that are attached to the buttress can be cut off with diagonal cutters and inserted in the appropriate holes in the stake pocket and passed through the stake.

Shim Configurations



Optional Plastic Support Tube

The buttress includes plastic support tube attachment tab for placement of concrete tube forms for those on-site situations that require reinforced pilasters.

Pool Wall Erection

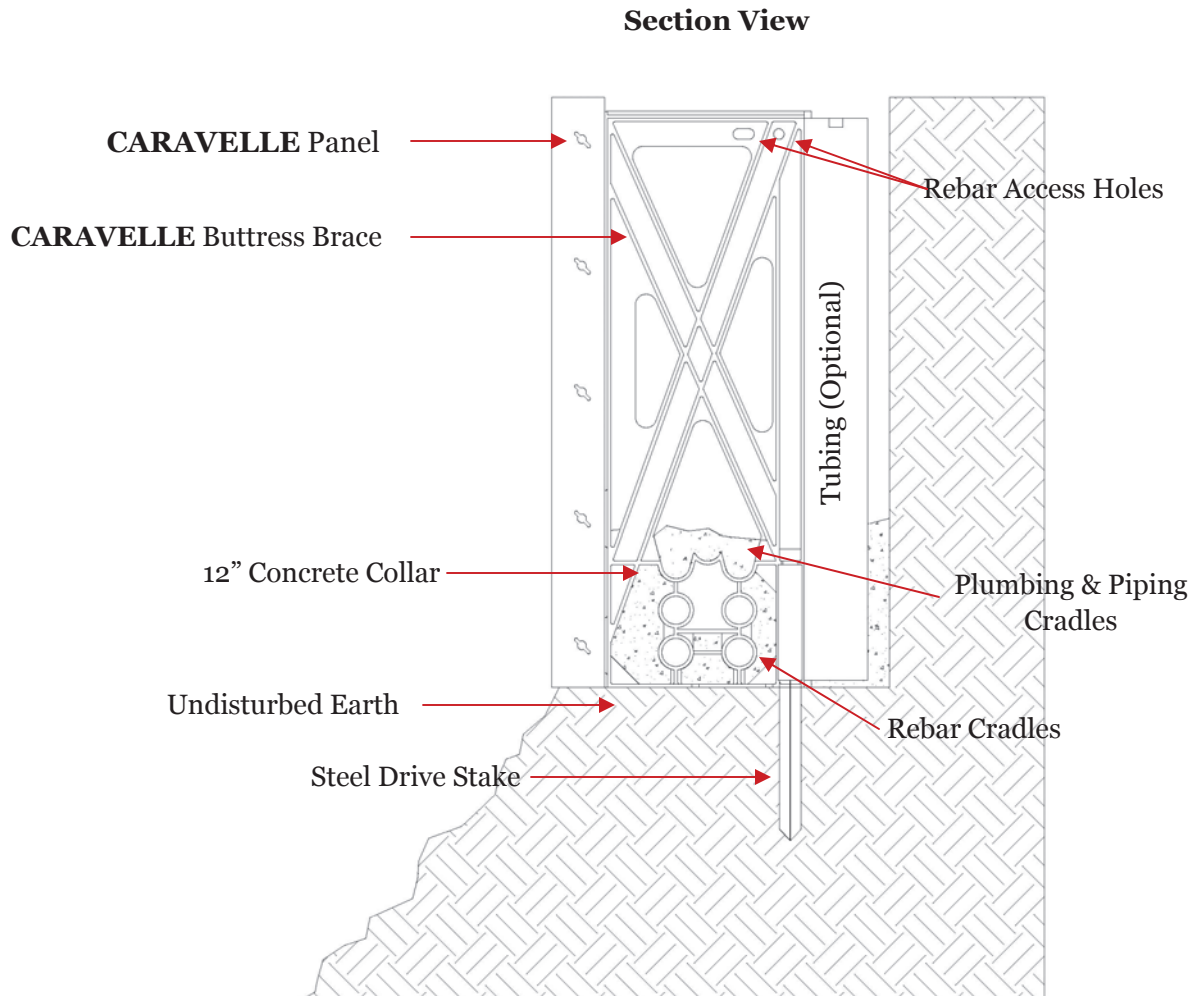
Pouring the Concrete Collar

To avoid the concrete footing from running under wall sections and protruding into pool excavation, be sure to fill any voids under the wall with dirt. Be careful to place the concrete behind the wall gently to avoid disturbing the straight wall or level. A little extra patience and care at this stage is recommended. Also, tamping out footing with a rake or shovel will ensure the structural integrity of the footing.

Plumbing or electrical items which would be affected by the concrete collar should be in place at this time, but this is optional and will differ with installers. The pool is now ready to have the concrete reinforcing collar installed. If optional tubing is used, they would be filled with concrete at the same time.

Pour concrete around the entire perimeter of the pool, including areas behind stairs or benches. The concrete should be a minimum of 12" deep by 24" wide and should enclose both the bottom panel edge and the buttress frame bases.

Recheck plumb and level immediately after concrete is poured to make sure measurements are correct.

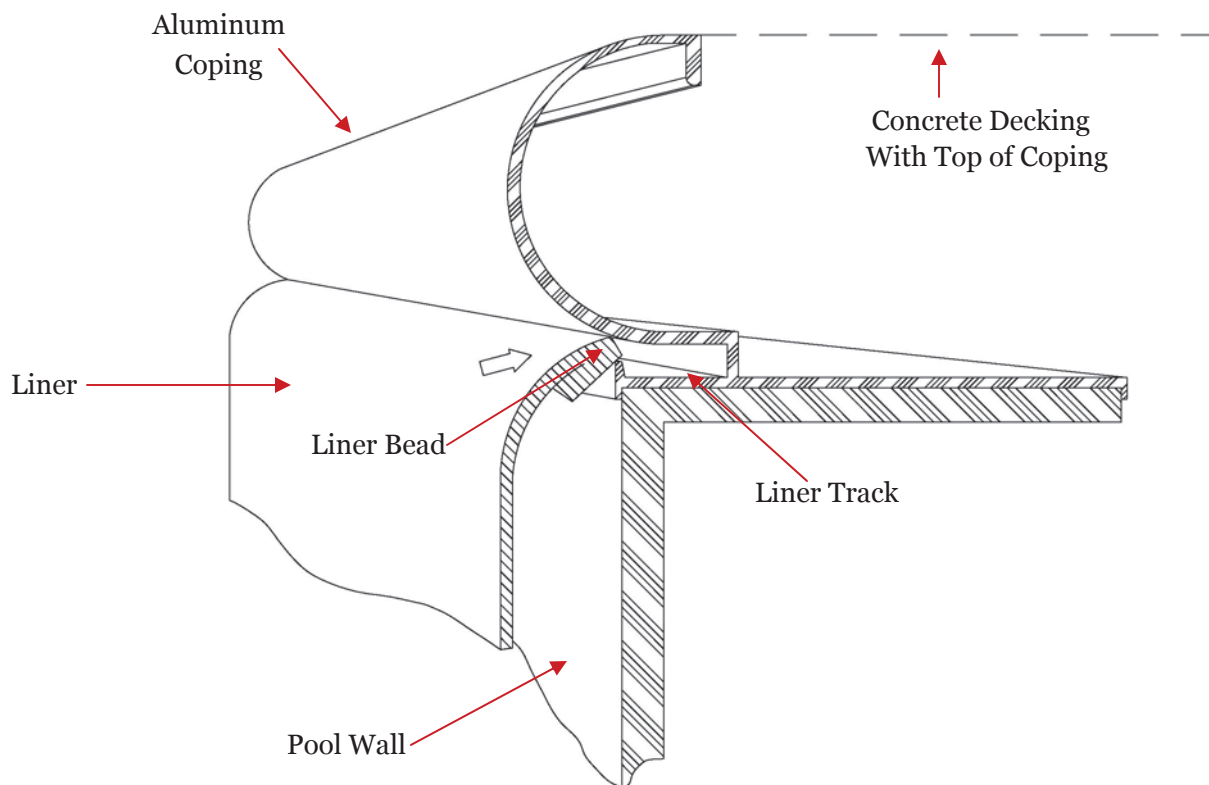


A typical side view showing panel and buttress frame with concrete collar.

Installation of Coping

Install all corner sections first with the self-taping screws provided. Coping sections next to a step may have to be cut and hand trimmed to fit snug next to the step. A drill with a 5/16" hex head bit works best for installing these screws. After the corners are secured, screw the long lengths of coping with drive screws in the same manner. Make sure the liner receptacle on the lower edge of the coping is flush with the top inside edge of the pool walls. Screws should be installed at one foot (1') intervals. When cutting the straight pieces of coping and fitting them into place, avoid coping joints that correspond to the pool wall joints. Cover each coping joint with a coping cover clip or other suitable method. These coping cover clips must be placed on the coping before concrete deck is poured.

The coping has a dual purpose of: Acting as a receptacle (liner track) for retaining the liner bead and serving as an attractive edging against which concrete is poured.



Bonding

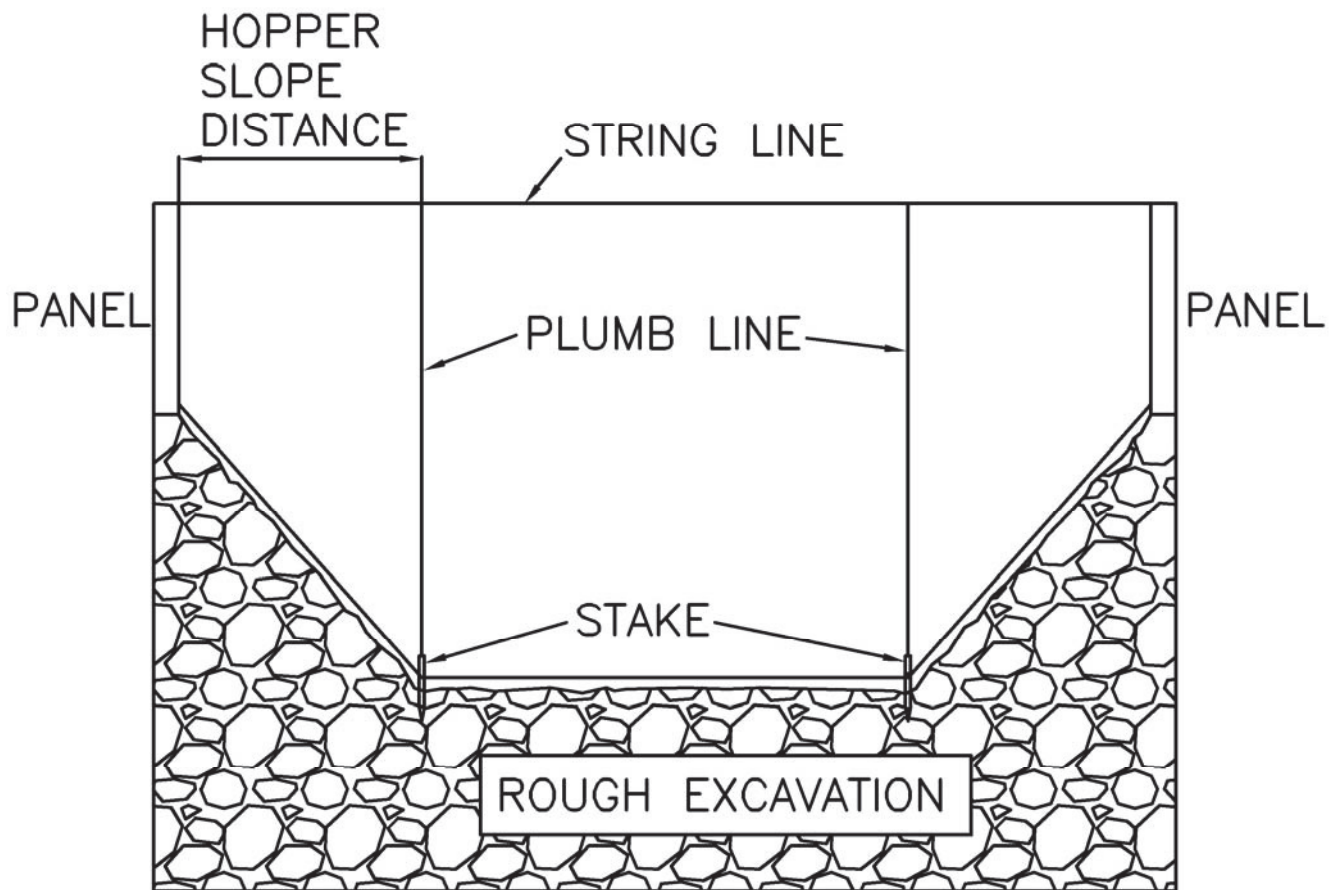
Check all federal, state, and local codes for bonding requirements. Your local inspector must be contacted for approval before the pool is backfilled and the deck installed.

Pool Bottom Preparation

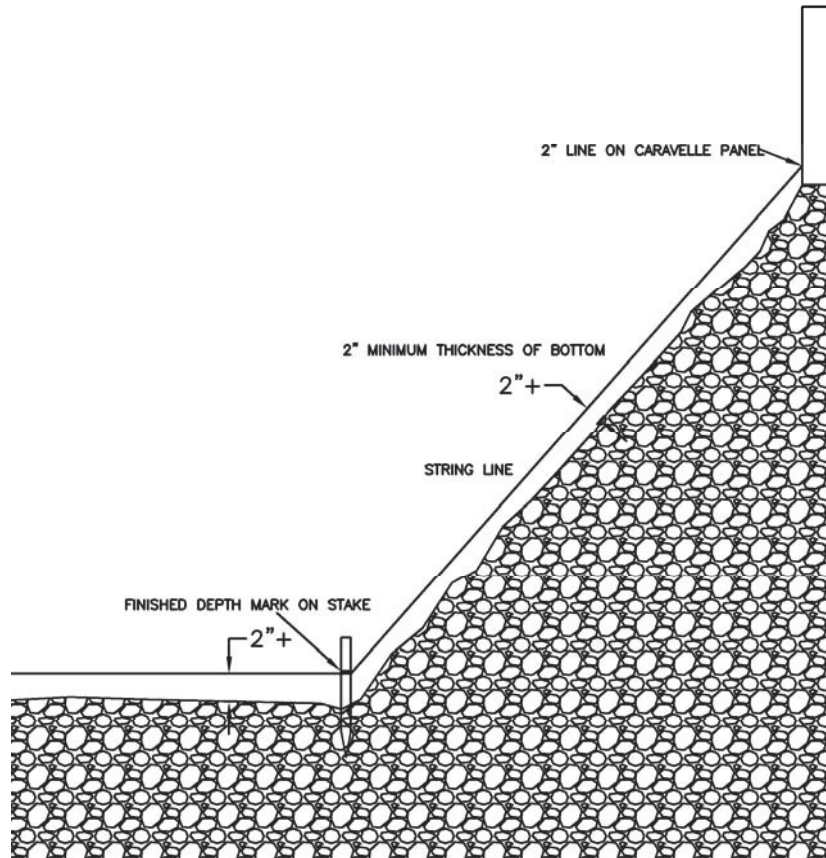
If you have worked carefully with the excavator, the pool bottom and hopper should be roughly to size. For finishing accurately, hand trimming is most likely necessary. Refer to the drawings of the pool you are installing for information regarding hopper dimensions.

The corners of the hopper may be located by stretching string lines across the top of the pool at the appropriate locations and measuring down from the string lines.

After locating the relevant points for the hopper, drive a stake in the ground at each point and mark each stake at the finished depth of the pool. Your excavation should be at least 2 inches below the mark on the stakes.



Using a string line from the mark on the stake to the grout line mark which is found 2 inches above the bottom edge of your **CARAVELLE, INC.** panels will give you the finished grade of your bottom material.



Installing the Pool Bottom

Bottom finishing can be done by progressing either from shallow to deep end or deep to shallow end. When trowelling the pool base, a minimum thickness of 2" inches must be maintained throughout. Spread the pool base out with a flat shovel into roughly 2' x 6' sections. Use a 30" magnesium darby to spread and flatten the pool base. Get the pool base as flat as possible by working the darby in several different directions. Use the 16" pool trowel to "slick" the pool base, close the surface and finish as smooth and flat as possible. This section is now finished and another can be started.

As the deep end slopes are completed and the hopper bottom is trowelled, strings and pins should be removed and trowelled smooth. Be careful to trowel out any crumbs as work progresses. These will show through liner if they are not taken out. If the bottom is trowelled from deep to shallow it will be extremely difficult to keep crumbs out of finished bottom. Debris cannot be swept out until bottom is cured. Check with pool base manufacturer for curing time.

Liner Installation

Preparation for Installation of Liner

Before installing the liner, wipe down the pool walls with a rag to remove any dirt or pool base that may be stuck to the walls. Next, tape the pool wall joints with duct tape to create an air seal and prevent air from leaking through wall joints while the liner is vacuumed into place. Tape should extend from the bottom edge of coping down to the top edge of the pool base bottom material. Some installers prefer to tape the joints before the installation of the pool bottom. This is a matter of preference. It is also recommended to tape the back side edge of the coping on the top of the pool panel to improve air seal for fitting of liner, or seal the coping.

Installation of Liner

Follow manufacturers instructions for installation of liner.

Backfilling

Be sure all skimmers, returns, plumbing and electrical lines are run according to manufacturers instructions before backfilling occurs.

When backfilling the over-dig it is useful to have a string set up along the coping of the long side of the pool to help maintain straight walls.

The water level in the pool should be at least one half the way up the vertical walls to help offset the pressure of the backfill. Do not fill the pool any higher than one to two inches (1"-2") below the bottom of the skimmer without backfilling to the water height.

When using earthmoving equipment such as a backhoe or a front-end loader, machinery must be kept a minimum of three feet (3') away from the pool walls at all times. This means extra hand work but the extra effort will more than offset the risk of damaging the pool walls.

Backfilling the pool may be done with any non-expansive material such as clean sand, river run, pea gravel or small grade limestone.

Backfill the over-dig up to the top of the pool wall panel, not to the top of the coping. This allows for some settling and the thickness of the concrete decking. The fill should not be packed too heavily, as this may cause the panels to bulge inward. Once the pool is completely backfilled, fill the pool with water to the middle of the skimmer opening.

Completing the Job

After the main installation is done, any additional related equipment should be installed. Filter installation, connections to any possible above-ground water features or decorative lighting, and safety equipment should be done at this time. Placement of the filter system is of utmost importance. Bear in mind that the closer it is to the pool, the more efficiently it will operate. The filter can be hidden behind bushes, or placed in a filter house, which also diminishes the noise in the swimming area. In all cases, manufacturer's recommendations should be followed to ensure proper operation.

CAUTION:

Under no circumstances should the electrical installation be done by anyone but a licensed electrician. Every locality has an electrical code spelling out all the requirements needed for safe pool operation. A local, licensed electrician is familiar with the code and will obtain approval from the proper authorities before the pool is put into use.

Deck Area Installation

Due to the fact that a large area around the pool has been excavated and backfilled, a condition has been created which is not conducive to the placement of concrete. We do not advise construction of concrete walks or patios without the use of optional support tubes and properly prepared site. Contact a local masonry firm or landscaping professional for deck installation.

If using a bullnose coping, top edge should be taped with masking tape or painters tape to protect the surface from scratches when finishing concrete. **DO NOT USE DUCT TAPE.**

Final Clean Up

Be sure to remove the coping masking tape from the coping within the first 12 hours after finishing concrete. Any concrete splatters remaining on the coping, vinyl liner, handrails and ladders should also be cleaned at this time. Vacuum the pool as soon as possible to remove any cement and stones from the pool floor. Failure to do so will result in more difficult cleaning later.

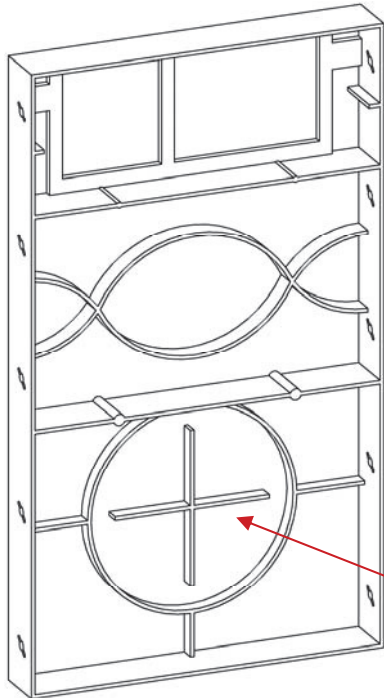
Safety Signage

Refer to the American National Standards for Residential Inground Swimming pools ANSI/NSPI-5 2003 or latest version for detailed descriptions and illustrations regarding the use and location of warning signs to be permanently affixed within the pool area and clearly visible to all users!

Pool Wall Components

Pre-molded Straight Pool Panels

CARAVELLE pre-molded straight panels are made from High-Impact Polystyrene (HIPS) and incorporate high-strength reinforcing ribs and guide templates for lights and skimmers.



CARAVELLE straight panels come in (clockwise from lower left) 1 ft., 2 ft., 4 ft., and 6 ft. lengths.

Reinforced skimmer and light mounting areas are supplied on all panels larger than 1 ft.

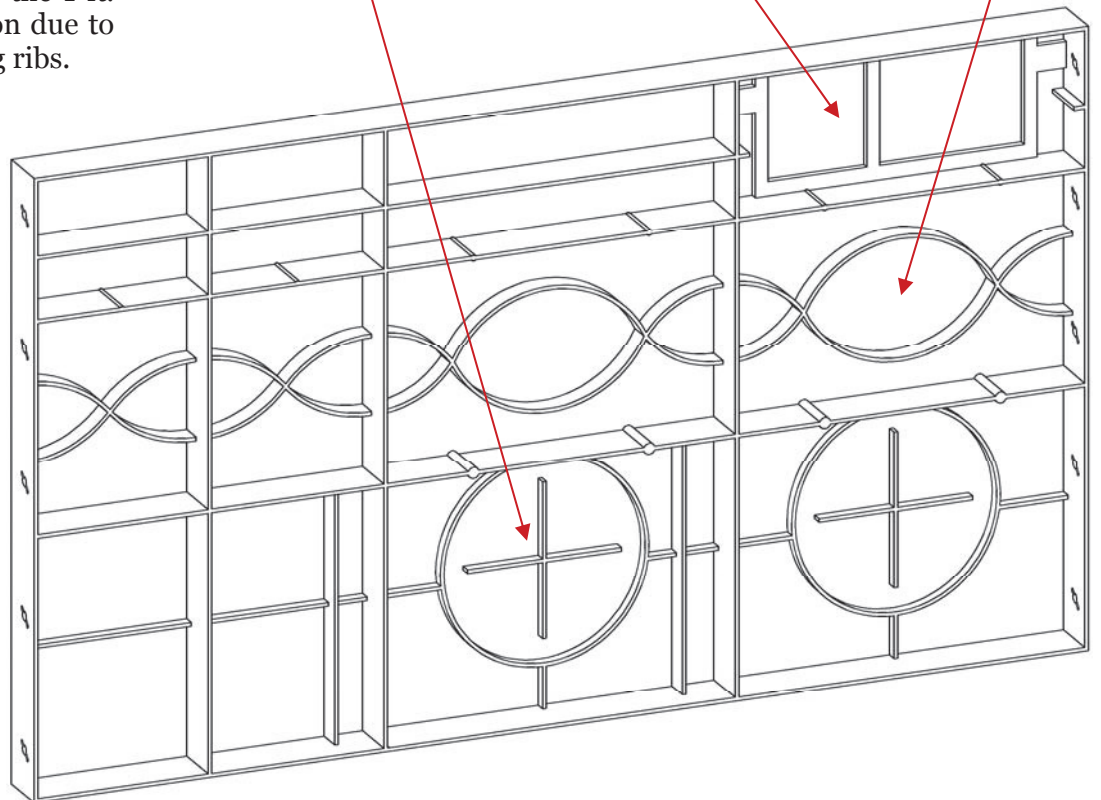
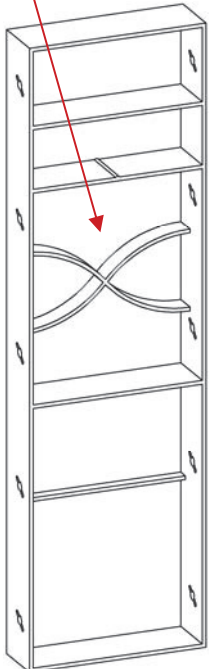
Typical mounting locations are shown for:

Lights

Skimmers

Returns

A return may be installed in the 1 ft. panel at the indicated location due to the position of the reinforcing ribs.



Curved Pool Panels

CARAVELLE'S pre-molded 2 ft. radius corner panel and bendable 1 ft., 2 ft., or 3 ft. long (3 ft. long shown here) panels also incorporate high-strength reinforcing ribs.

The bendable panels are available in a full range of regular or reverse radii.

The pre-molded 2 ft. radius corner is shown at right.

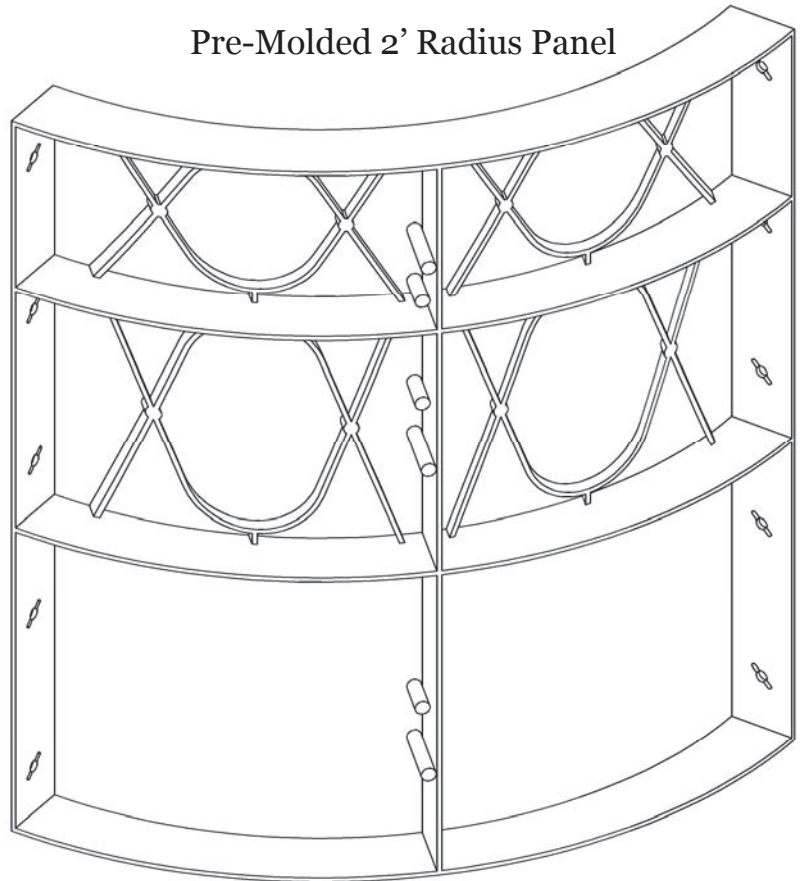
The 3 ft. bendable panel is shown below left as a regular 8 ft. radius, and below right as a 6 ft. reverse radius.

All **CARAVELLE** straight and radius panels use our **Speedlock** peg and wedge fastening system for ease of installation.

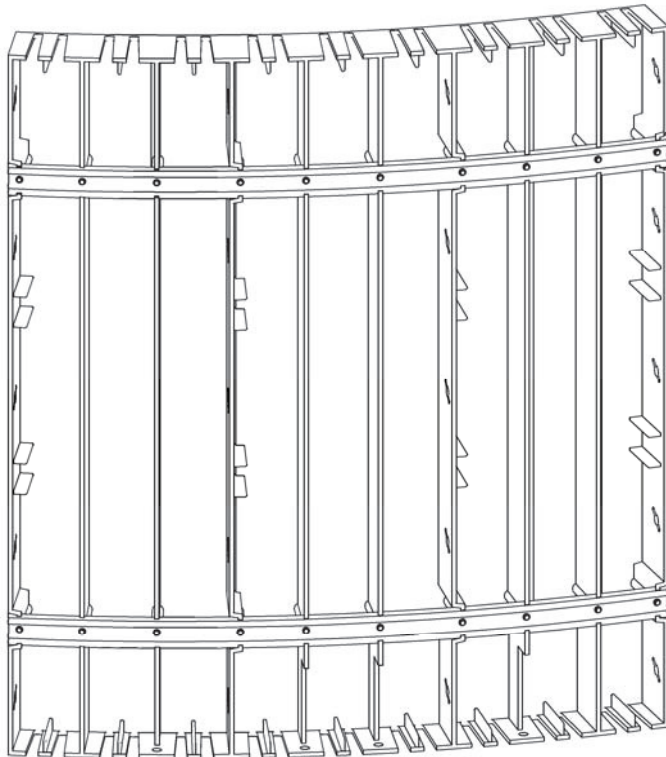
CARAVELLE pre-molded 2 ft. radius corner panels are made from High-Impact Polystyrene (HIPS).

CARAVELLE bendable panels are made from Polypropylene.

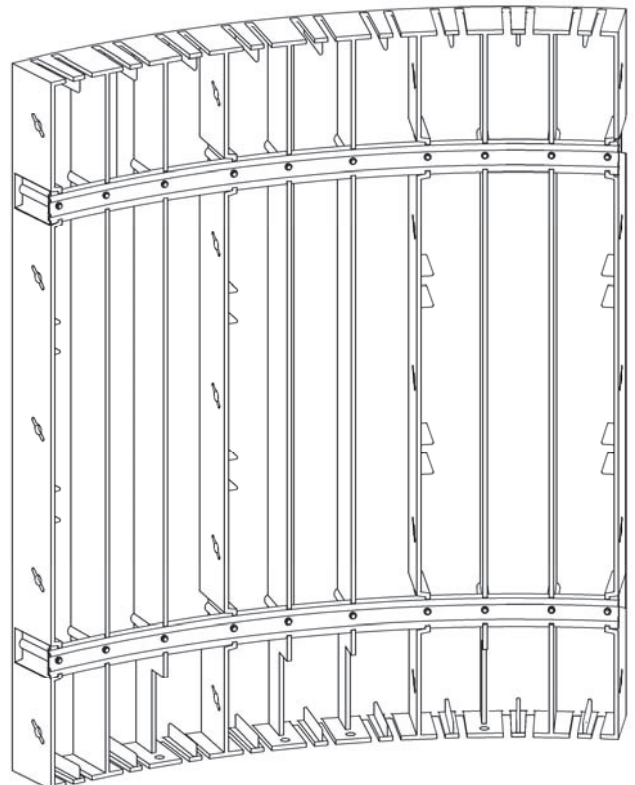
Pre-Molded 2' Radius Panel



8' Radius Panel

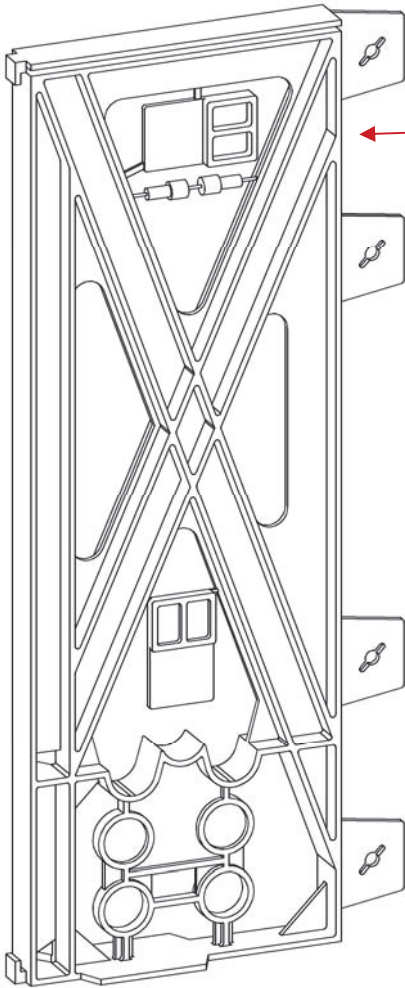


6' Reverse Radius Panel



Pool Wall Components

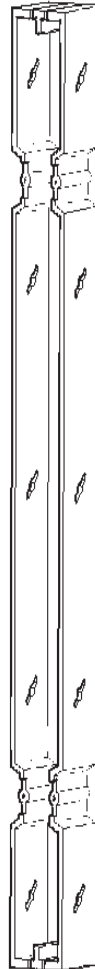
Pre-molded Accessories



CARAVELLE uses a high-strength High Density Polyethylene molded buttress brace for a solid installation.

A 45 degree corner angle is available to create the popular Grecian and Rectangle pool shapes. (2) 45° corner angles attach to make a 90° corner.

A 1 inch spacer can be used in lieu of the 3 3/8" flex radius panel to create a 4' radius and reverse radius corners. Note: Peg & Wedges can not be used in this application.

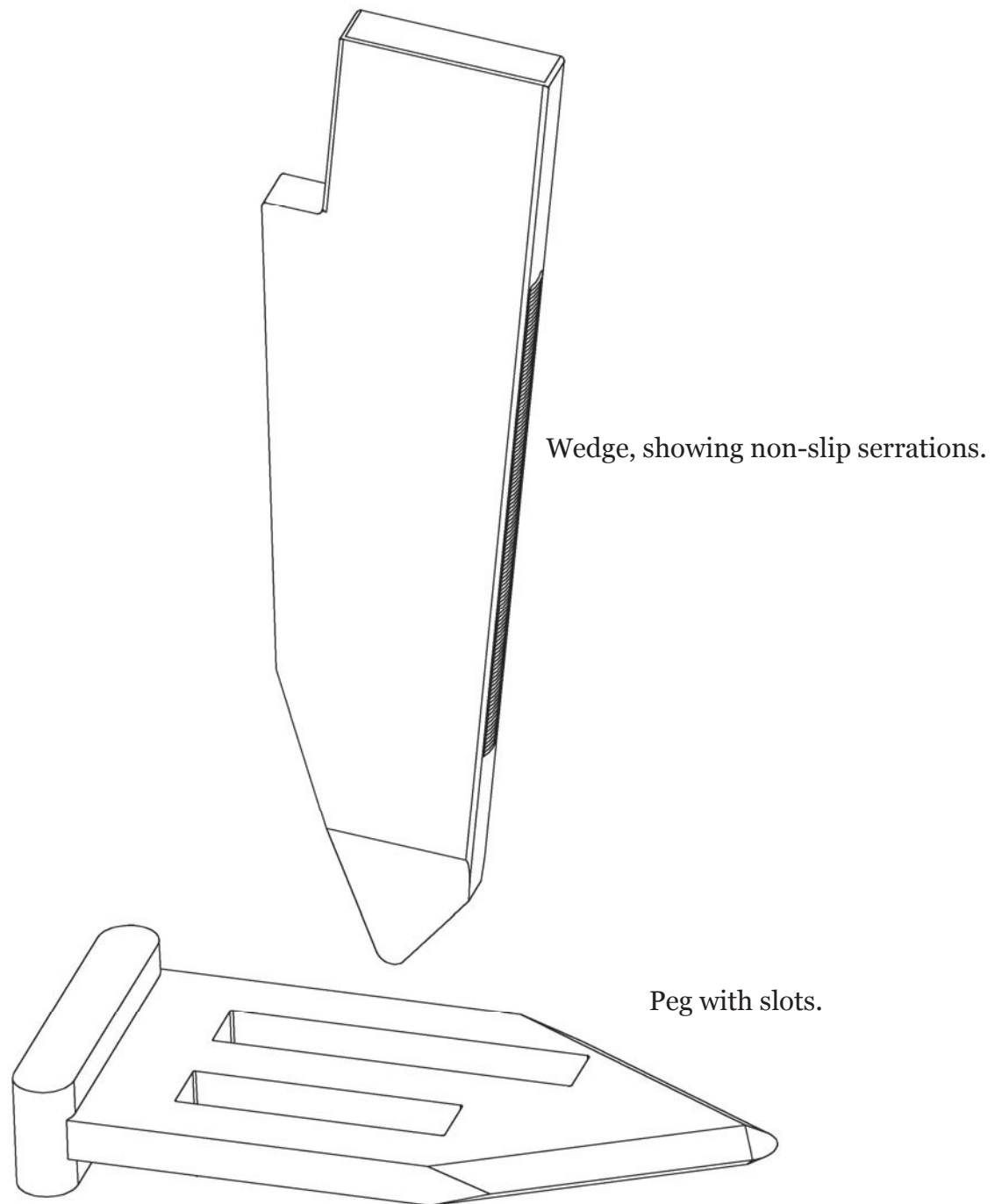


A 3 3/8" flex radius panel is used to create a true 4' radius and reverse radius corner.

Detailed information on the entire **CARAVELLE** family of components is shown on subsequent pages.

Speedlock

CARAVELLE panels are fastened together using our **Speedlock** peg and wedge system for a quick and secure joint between panels. The serrations on the straight edge of the wedge are placed away from the panel, and interlock with the slot to prevent slippage. The shorter slot in the peg is used when fastening two panels together, and the longer slot is used for fastening two panels and a buttress frame. Illustrations are provided on the following pages. 5 pegs and 5 wedges are required per panel joint.



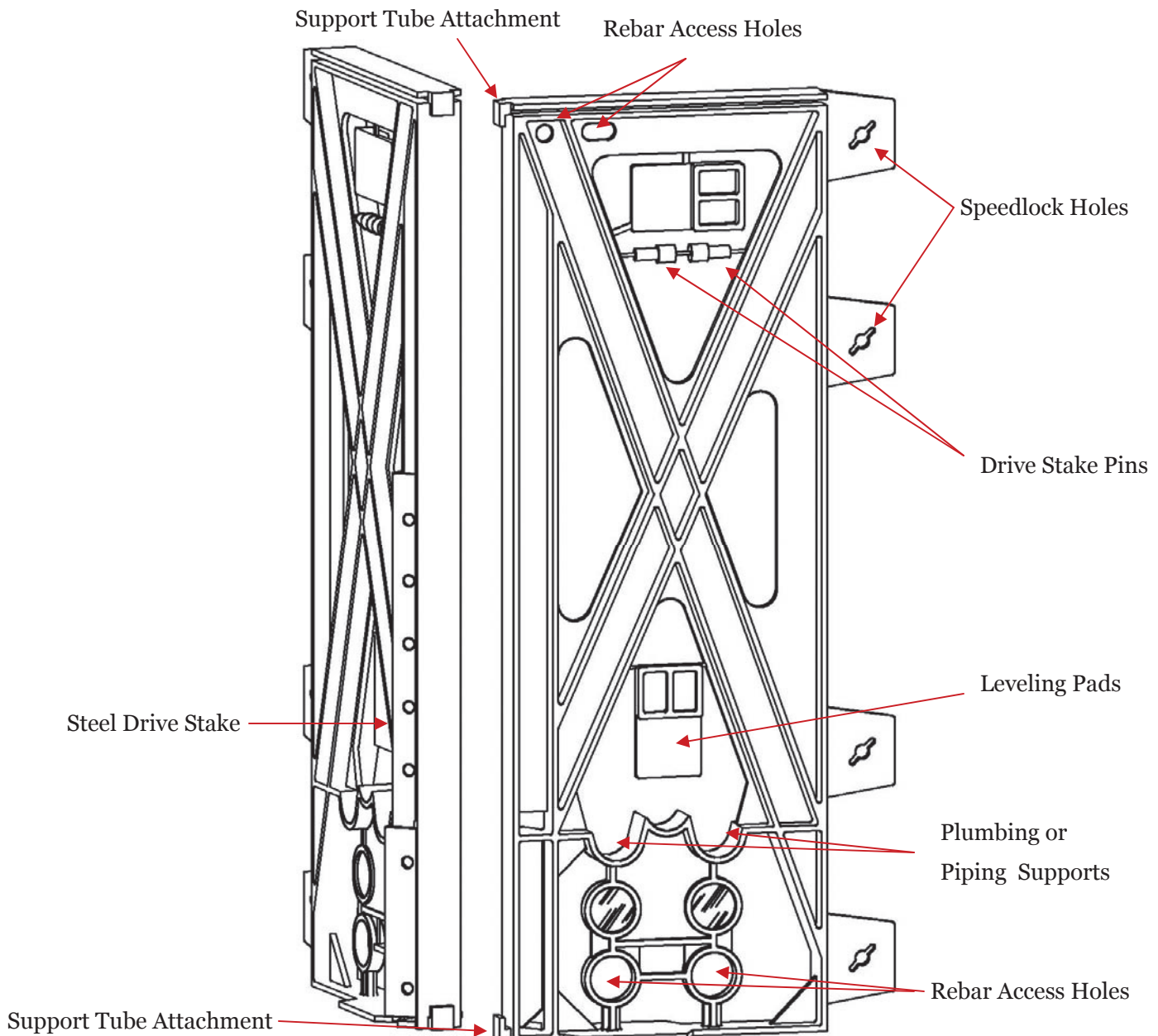
Pool Wall Components

Buttress Features

CARAVELLE panels are supported using our buttress brace. **CARAVELLE** buttress braces are a complete bracing system, with all needed components packaged as a complete unit. An illustration is shown on the following page.

Supports and guides for plumbing and other components are integrally molded into the structure of the brace for extra rigidity. Leveling pads of varying thickness are attached to the framework with small runners, and are easily detached and used as needed. A heavy-duty, 11 gauge Galvanized steel drive stake comes in its own integrally molded guide channel, and pins for securing the drive stake to the buttress are supplied on runners.

If additional support is required for the pool deck, hooked tabs are supplied at the rear of the brace to hold optional tubing which would be filled with concrete at the same time the concrete collar is poured.

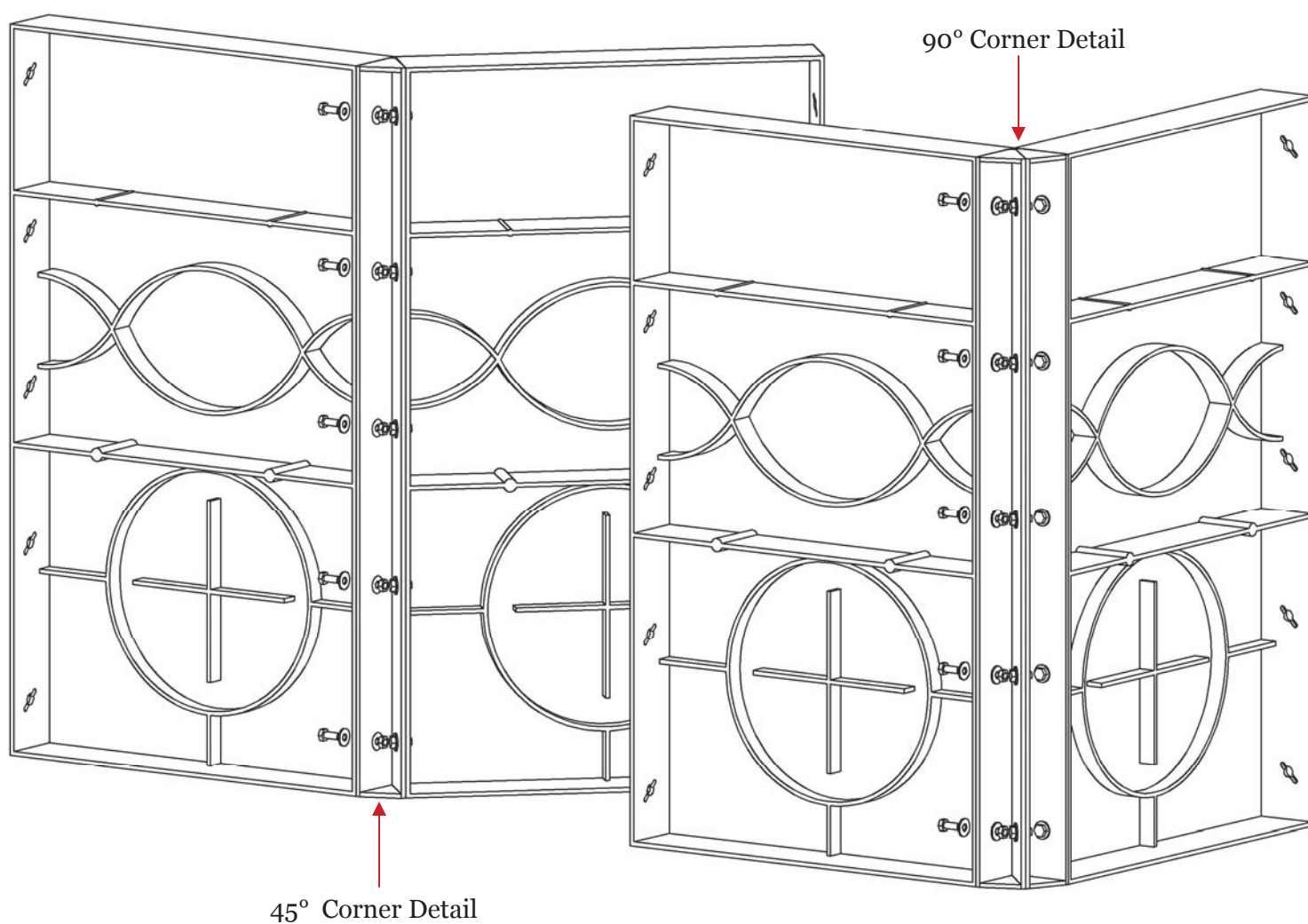


Corner Treatments

Corner angles are used to create the popular Grecian or Rectangle pool shapes by adding one 45° corner angle between panels, or two 45° corner angles to form a 90° corner for a Rectangle.

Bolts and washers are substituted for our Speedlock peg and wedge fasteners using the same slots.

As illustrated below, our Speedlock fasteners are replaced by bolts and washers supplied with the corner angles.

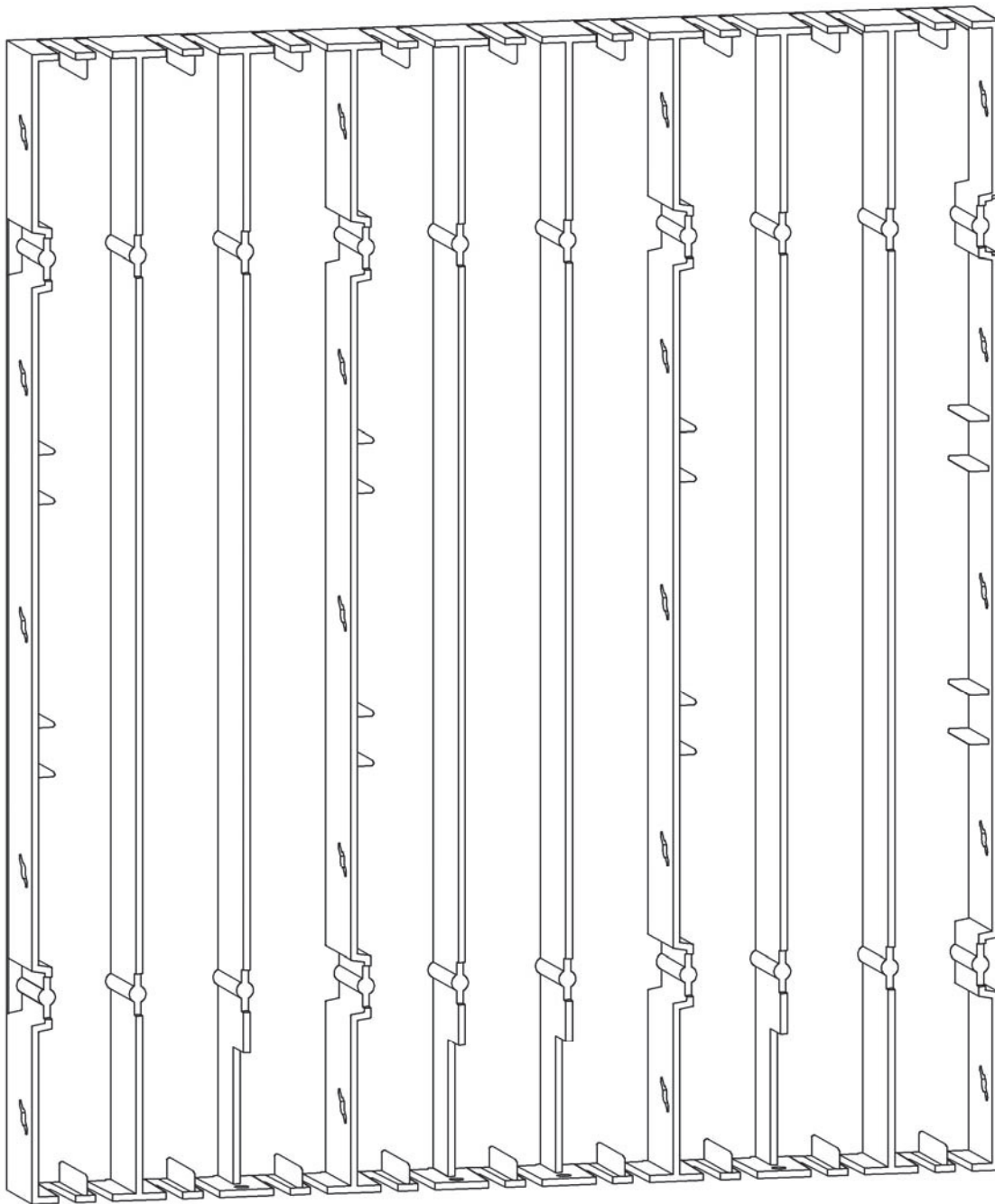


Pool Wall Components

Curved Shapes

CARAVELLE'S flex panel is used to create a wide variety of curved or "Free Form" pool shapes. Our bendable panel is furnished in 1', 2' & 3' lengths. Regular (toward the outside of the pool) or Reverse (toward the inside of the pool) curves may be formed, as well as compound curves formed on the same panel. Integral reinforcing ribs, staking holes, and precision extruded forming bands are all part of the **CARAVELLE** bendable panel product.

Both straight and bendable panels may be used to create a unique pool design since our buttress frames and **Speedlock** fasteners are used on all **CARAVELLE** polymer wall products.

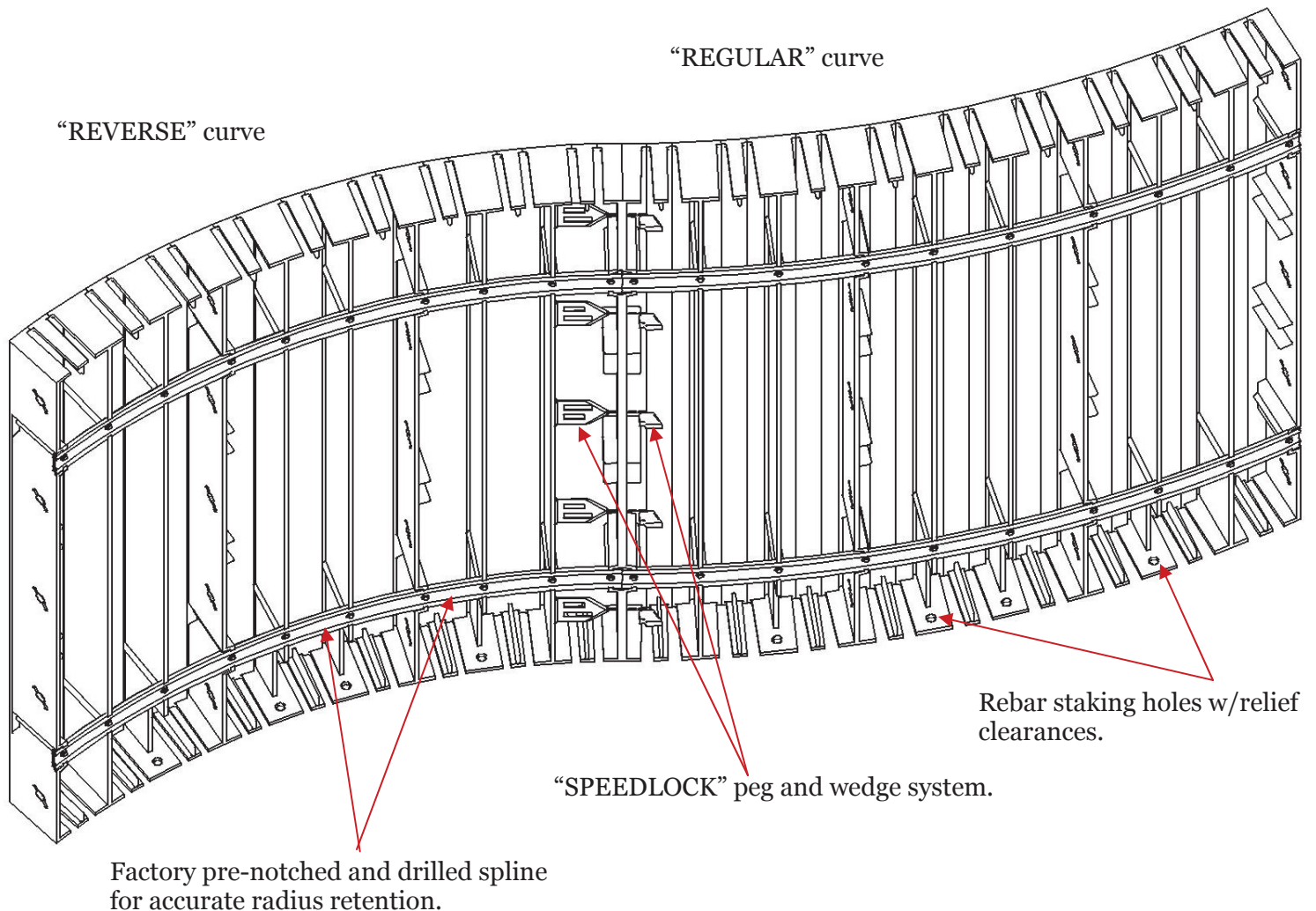


Curved Shapes

CARAVELLE panels may be used in any combination to create the ideal pool shape for your personal pool requirements. Shown below is an example of combined curved panels; a 4' "REVERSE" radius curved panel connected to a 6' "REGULAR" radius curved panel.

CARAVELLE curved panels are supplied pre-radiused with a precision notched and punched spline attached at the factory for accurate radius forming.

CARAVELLE panels require a buttress brace at each joint. In the picture below, the brace is not shown in order to more clearly illustrate the use of the pre-notched spline, and **Speedlock** peg and wedge system.

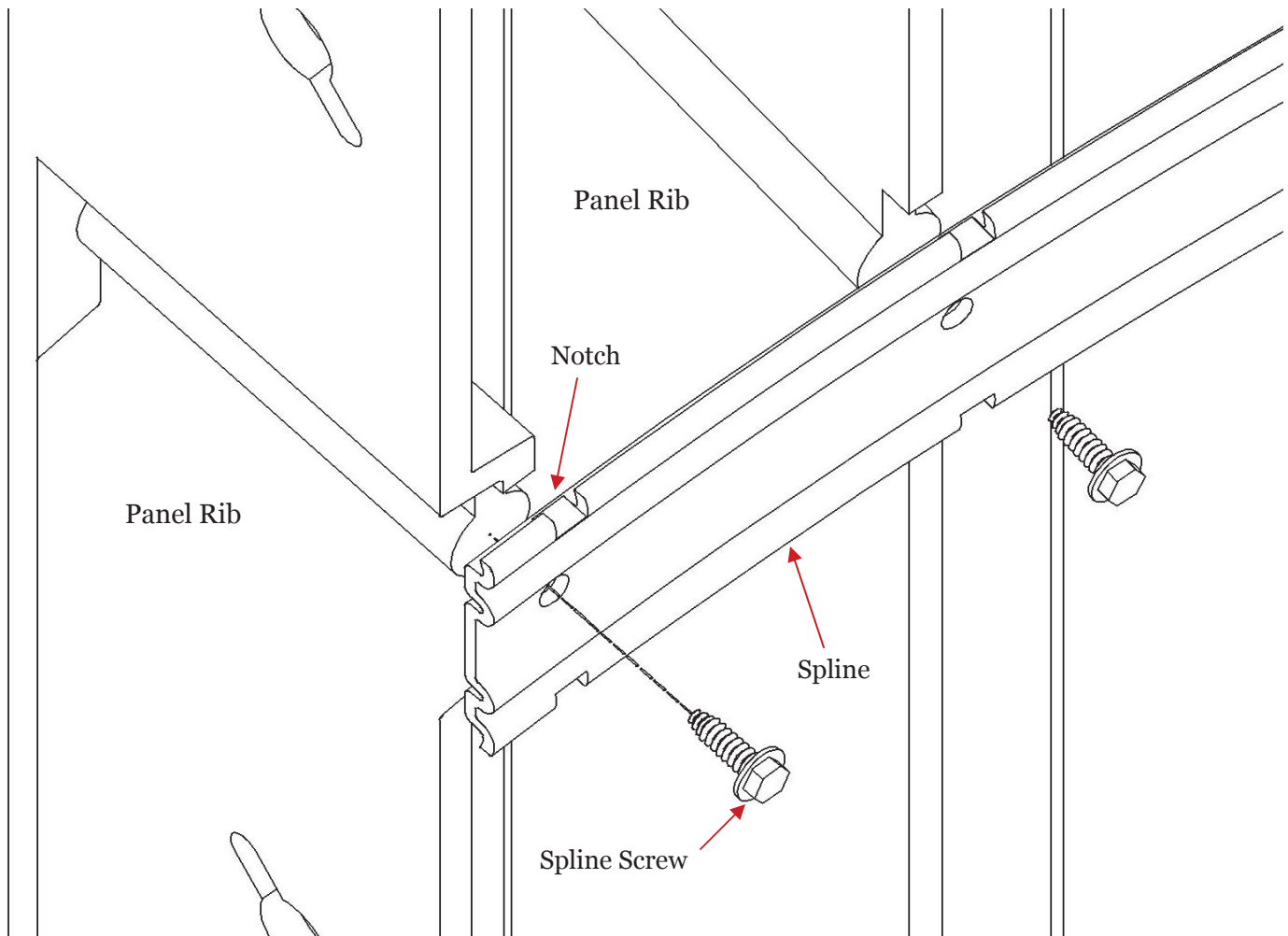


Pool Wall Components

Spline Attachment

If desired, **CARAVELLE** curved panels may be shipped flat with the splines packaged separately for field installation. This method allows more cost-effective shipping. Each panel will require (2) splines for complete assembly.

To attach the splines, lay the panel on a flat stable surface. Each spline will be predrilled and notched for required radius. The spline should be installed with “This side up” toward the top of the panel. Attach spline to the rib of the panel one notch at a time until all holes are filled with screws (purchased separately). Repeat this step for the 2nd spline to complete required radius.



Appendix A

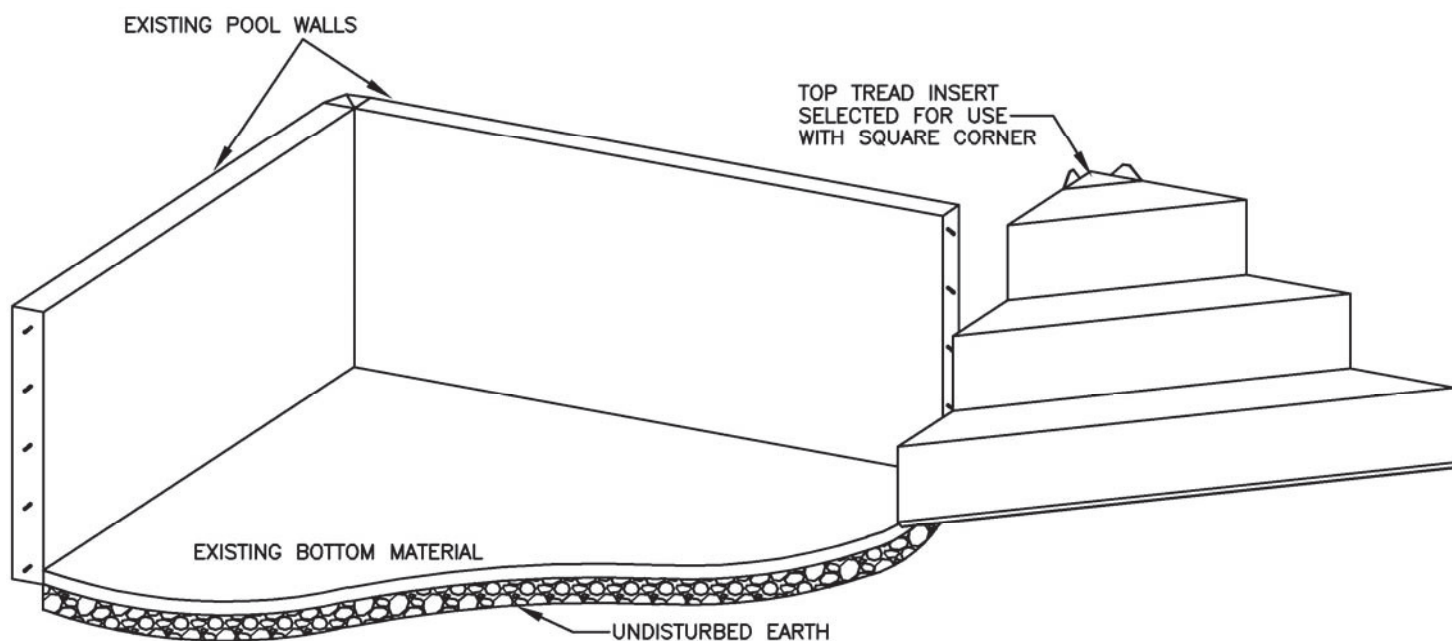
Additional Pool Enhancements

Enhance a New Pool or Upgrade an Existing Pool

In addition to our line of new-construction panels, **CARAVELLE** offers “drop-in” steps and benches manufactured by Cardinal Systems to add value and functionality to a new pool, or when refurbishing an existing swimming pool. “Drop-in” steps and benches can be installed in polymer-walled pools to provide an aesthetically pleasing means of entry to a pool where none may have existed previously, or to provide a bench for lounging.

“Drop-in” steps and benches are manufactured with high quality and structural integrity. **CARAVELLE** can offer an optional polyurethane based coating on the “drop-in” steps and benches to help continue the advantages of polymer. They are completely self-supporting and require minimal effort to install. This also makes them ideal for a pool upgrades when replacing a liner.

The steps shown here for upgrading an existing pool are the same as for new construction, except for the removal of existing bottom material.

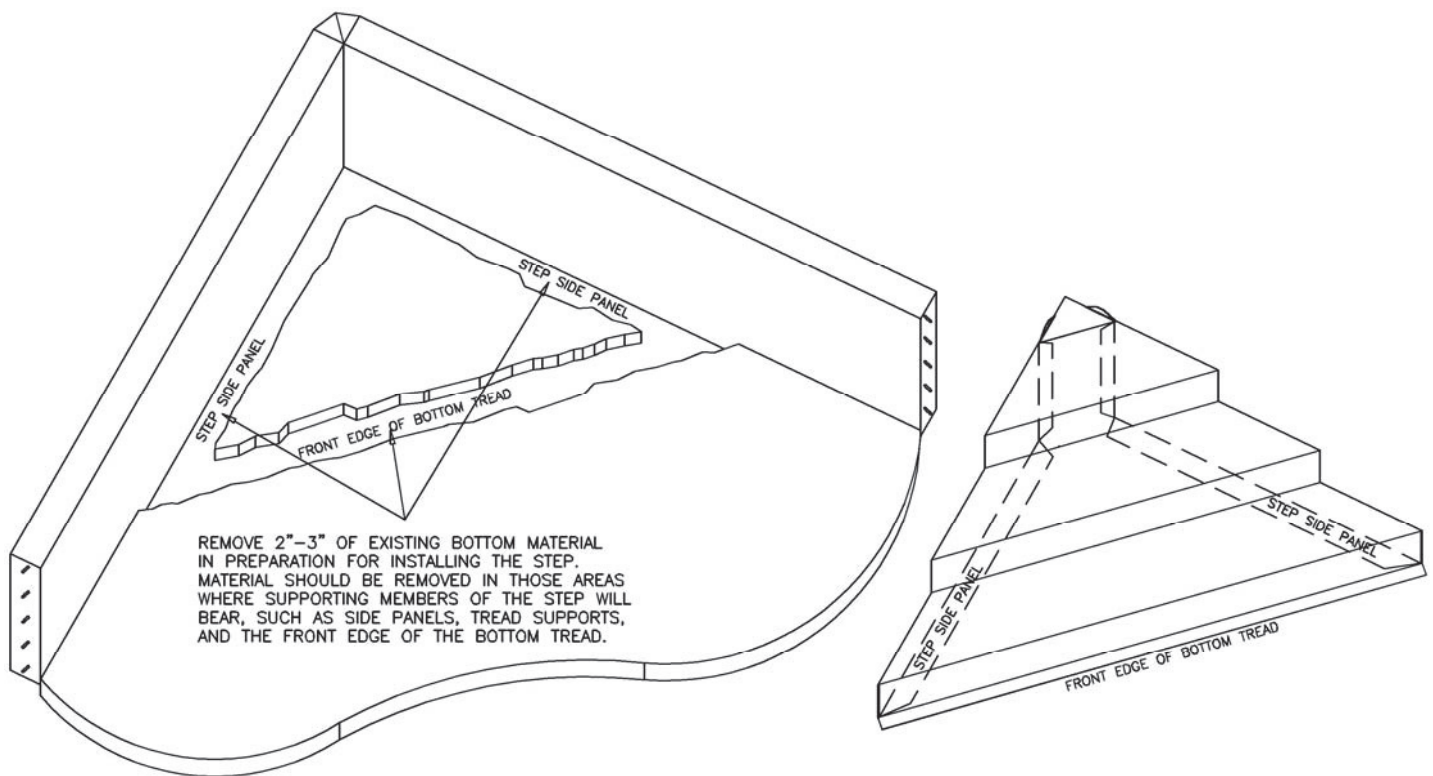


Appendix A

Enhance a New Pool or Upgrade an Existing Pool

A typical installation using a 7' "drop-in" step is shown below.

Once the old liner is removed, a minimal amount of existing bottom material is removed down to the level of the bottom of the panels against which the step will rest. The steps are designed to have the same amount of bottom material contacting the bottom of the step as is normally used on panels, usually 2 inches.

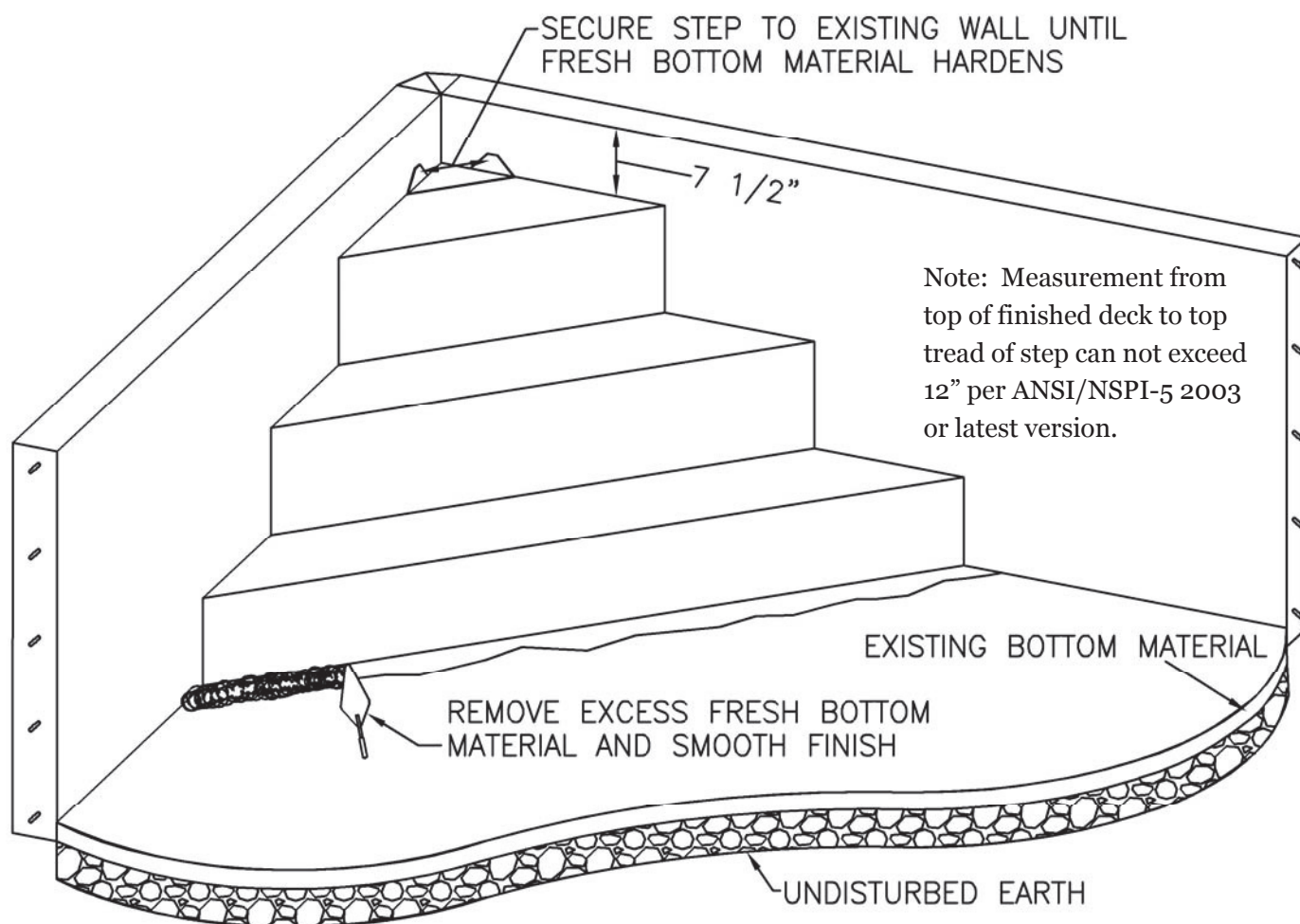


Appendix A

Additional Pool Enhancement

Enhance a New Pool or Upgrade an Existing Pool

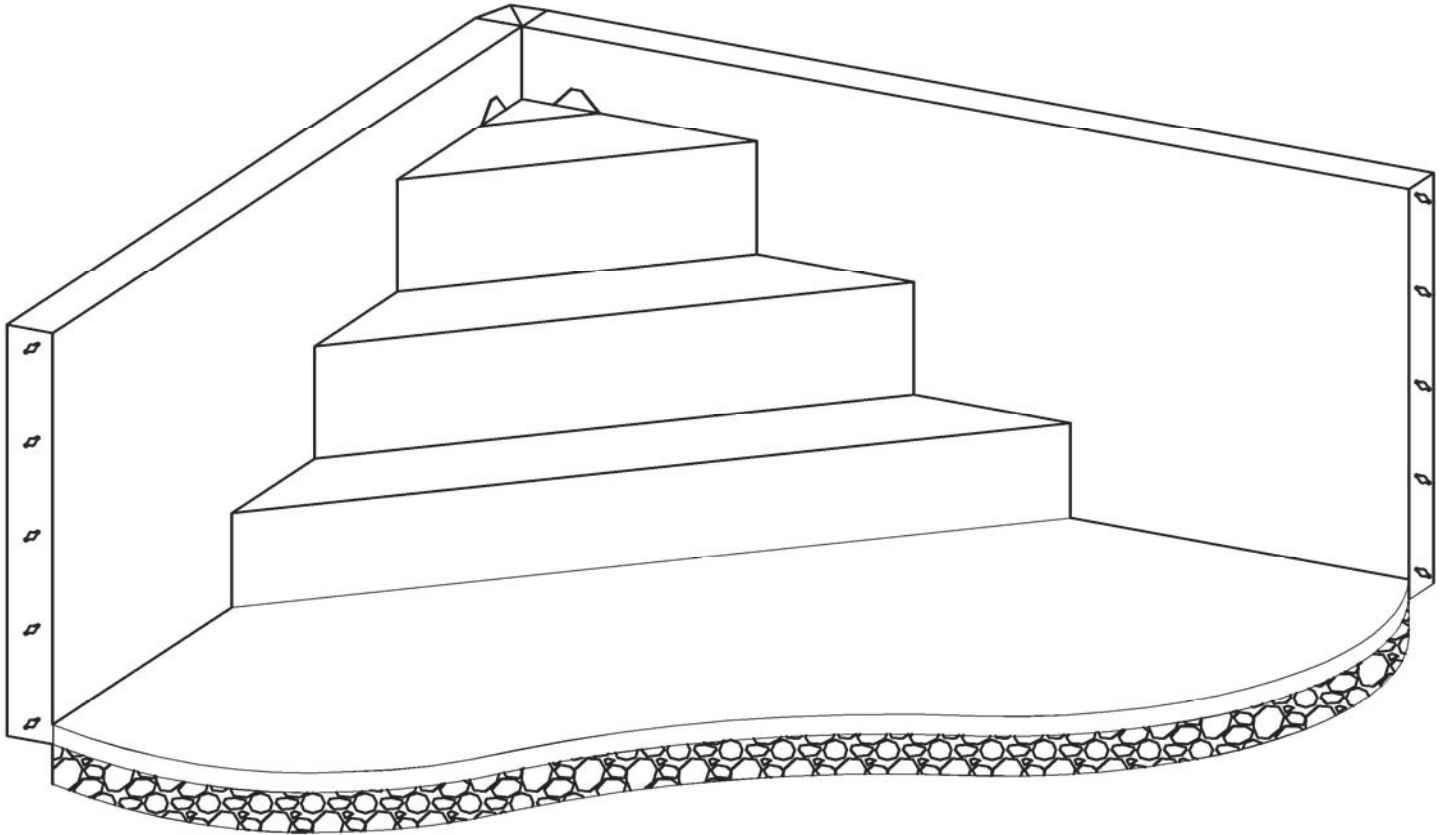
All drop-in steps are provided with one or more tabs turned upward. These tabs allow the installer to secure the step to the pool walls. The step is held at the correct height for the top tread using Tek screws or Pop rivets, and new material is installed along the front edge of the bottom tread and smoothed to match the existing bottom. Once the new material has hardened, the new liner is installed.



Appendix A

Enhance a New Pool or Upgrade an Existing Pool

The finished installation, ready for the liner.



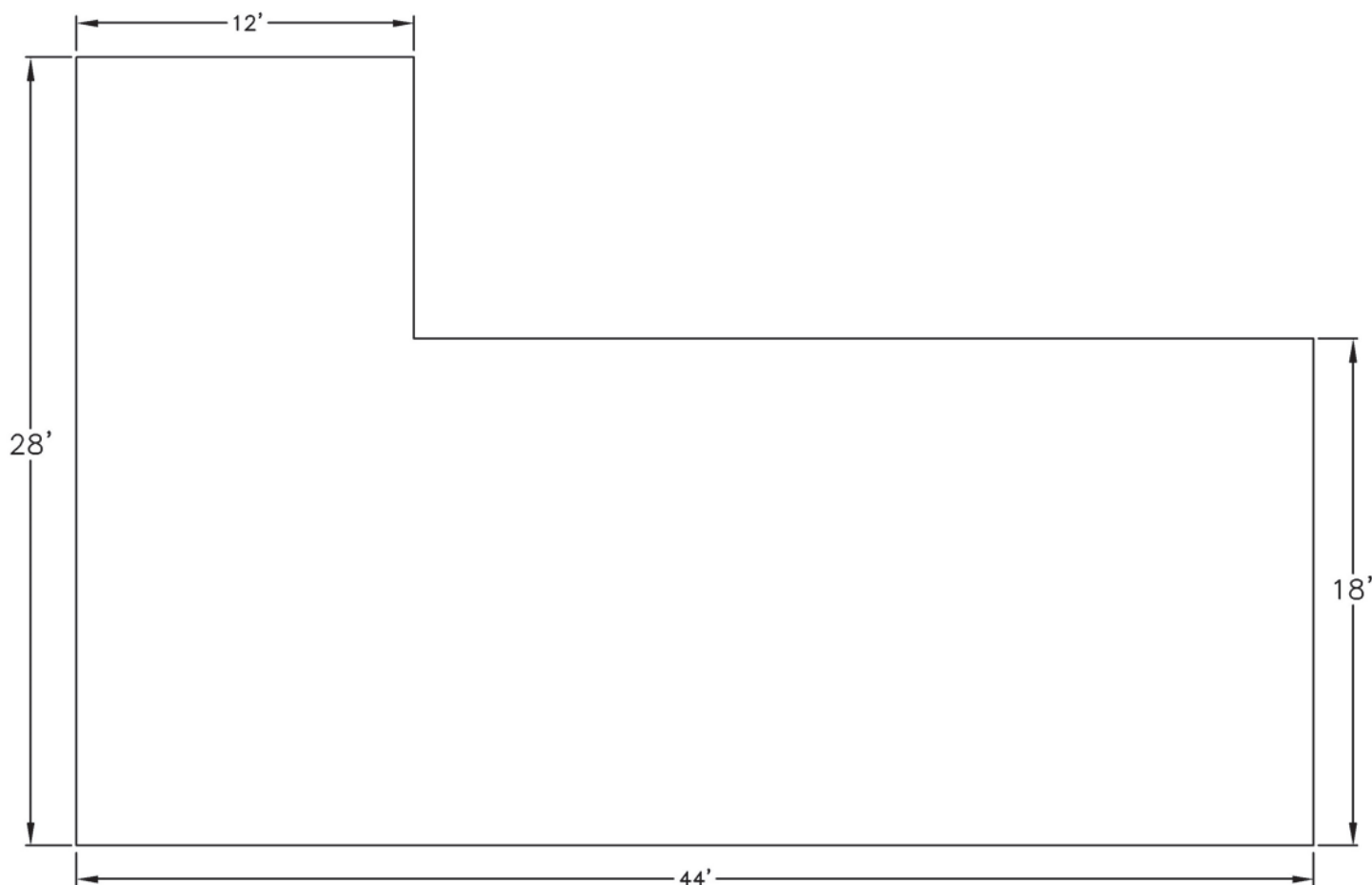
Appendix B

Helpful Formulas & Calculations

Finding a Diagonal

Using a tape measure, you can “square up” any rectangular or ell-shaped pool, or any size box to help you layout a free-form pool. You can also locate “swing pins”. The basic formula is $A^2+B^2=C^2$. That is, “A squared plus B squared equals C squared.” Here is how it works, with a simple diagram to illustrate the steps. When you “square” a number, you multiply the number by itself.

Your pool may be an 18' x 44' True Ell with a 12' x 28' ell for the shallow end. Let's take a look at how to square up your 18' x 44' True Ell.



Appendix B

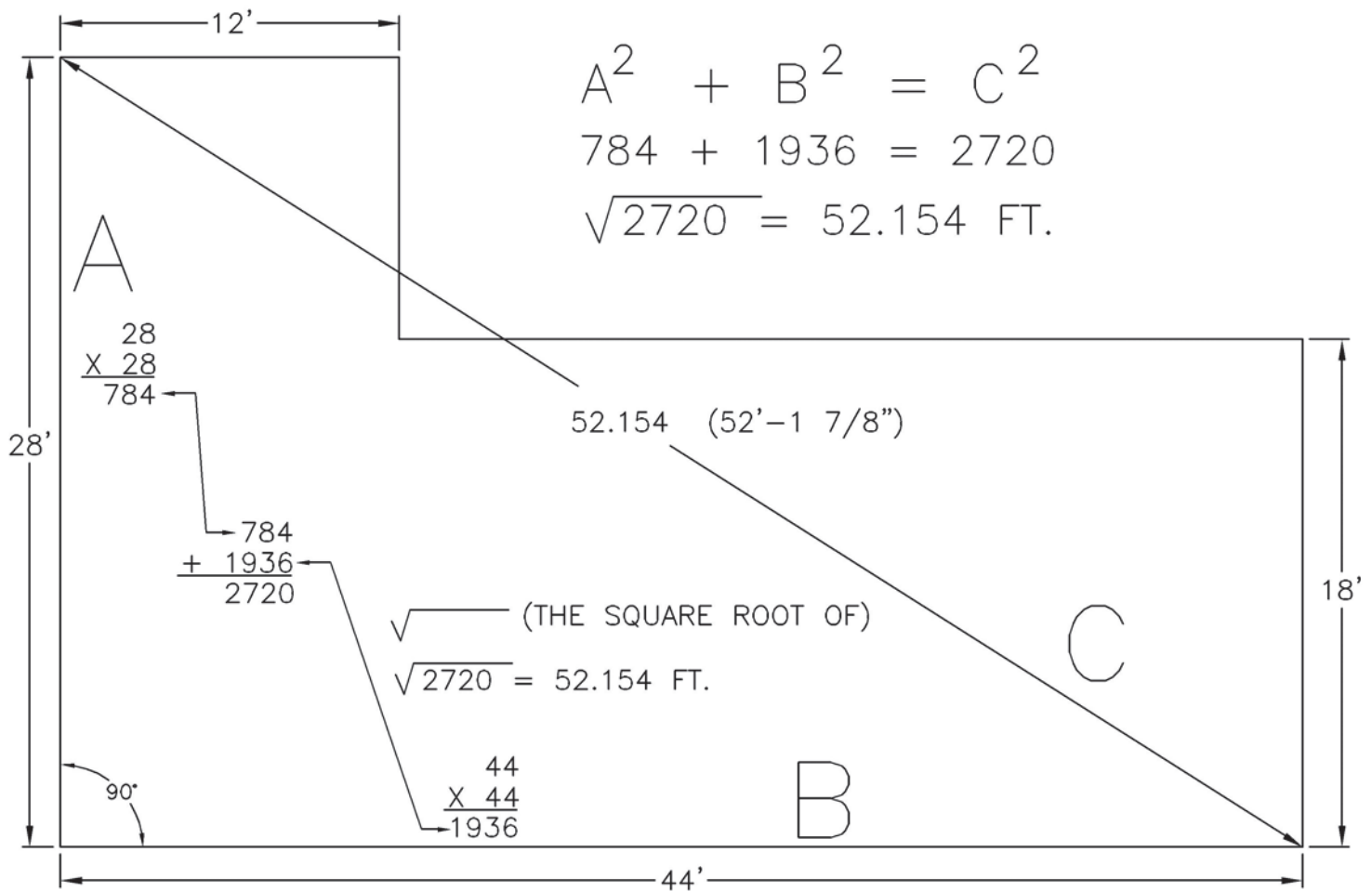
Finding a Diagonal

We'll square up the two long walls, 44' from the deep end to the shallow, 28' along the shallow ell.

First, 44 squared (44 x 44) is 1936. Then, 28 squared (28 x 28) is 784. Add 1936 and 784 and you get 2720. Now you "un-square" it. The square root of 2720 is 52.154 ft.

Naturally, 52 ft. is 52 ft. To find out how many inches and fractions of an inch are in .154 ft., use the conversion table at the end of this section.

Look in the second row down, over on the right, and you see 1-3/4" equals .146 ft., and .156 ft. equals 1-7/8". Your number, .154 ft., is clearly closer to 1 7/8" than to 1 3/4". Square within 1/8" in 52' is more than acceptable.

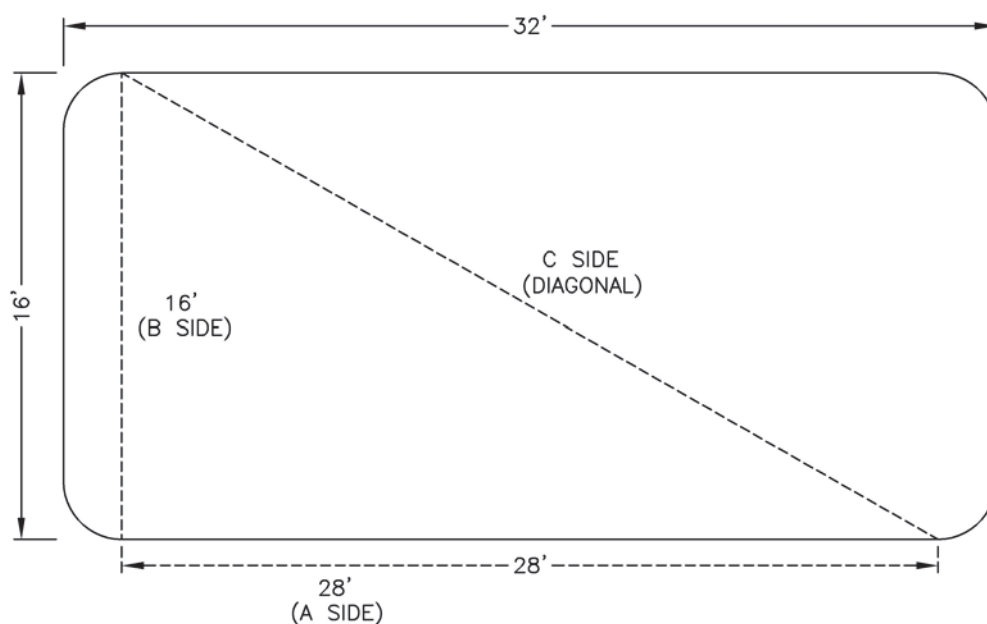


Appendix B

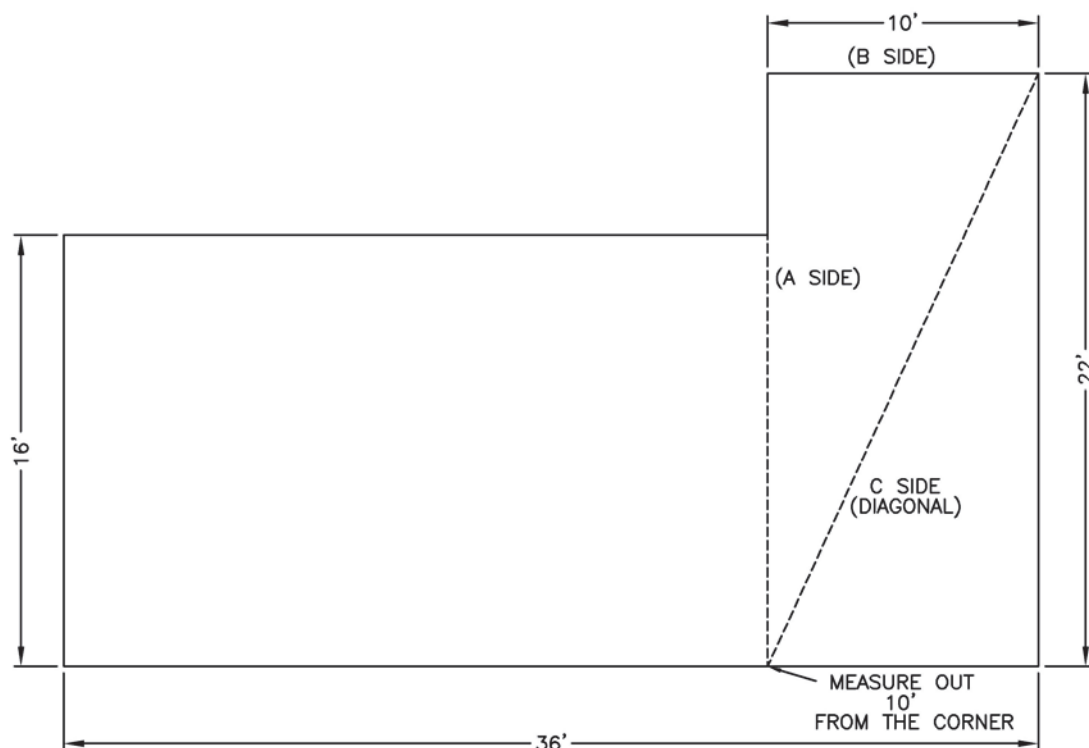
Helpful Formulas & Calculations

Finding a Diagonal

Squaring up nearly any other ell or rectangle can be done using the above method. The 16' x 32' rectangle below can be squared by using the panel joints at the ends of the long walls. These form a 16' x 28' rectangle.



Any ell can also be considered as two rectangles; one 16' x 36' by measuring 16' up the 22' wall, and one 10' x 22' by measuring 10' along the 36' wall as shown.



Appendix B

Decimal Feet to Inches & Fractions Conversion

WHOLE INCHES	FRACTIONS X (1/8's)							
	0	1/8	1/4	3/8	1/2	5/8	3/4	7/8
	0	0.010	0.021	0.031	0.042	0.052	0.062	0.073
	1	0.094	0.104	0.115	0.125	0.135	0.146	0.156
	2	0.177	0.187	0.198	0.208	0.219	0.229	0.240
	3	0.260	0.271	0.281	0.292	0.302	0.312	0.323
	4	0.344	0.354	0.365	0.375	0.385	0.396	0.406
	5	0.427	0.437	0.448	0.458	0.469	0.479	0.490
	6	0.510	0.521	0.531	0.542	0.552	0.562	0.573
	7	0.594	0.604	0.615	0.625	0.635	0.646	0.656
	8	0.677	0.687	0.698	0.708	0.719	0.729	0.740
	9	0.760	0.771	0.781	0.792	0.802	0.812	0.823
	10	0.844	0.854	0.865	0.875	0.885	0.896	0.906
	11	0.927	0.937	0.948	0.958	0.969	0.979	0.990

Finding How Many Gallons Your Pool Holds

CARAVELLE, INC. does not include volume information on pool drawings. In order to find the approximate capacity of your pool, you need only the area of the pool (found in the title block on all **CARAVELLE, INC.** pool drawings) and the average depth of your pool. The average depth is mostly an educated guess based on how much of the pool is play area, slope, and deep end. The area number, which is the number of SQUARE feet that the pool occupies, is multiplied by the average depth to get the number of CUBIC feet of water that the pool holds. There are 7.48 gallons in every CUBIC foot, so:

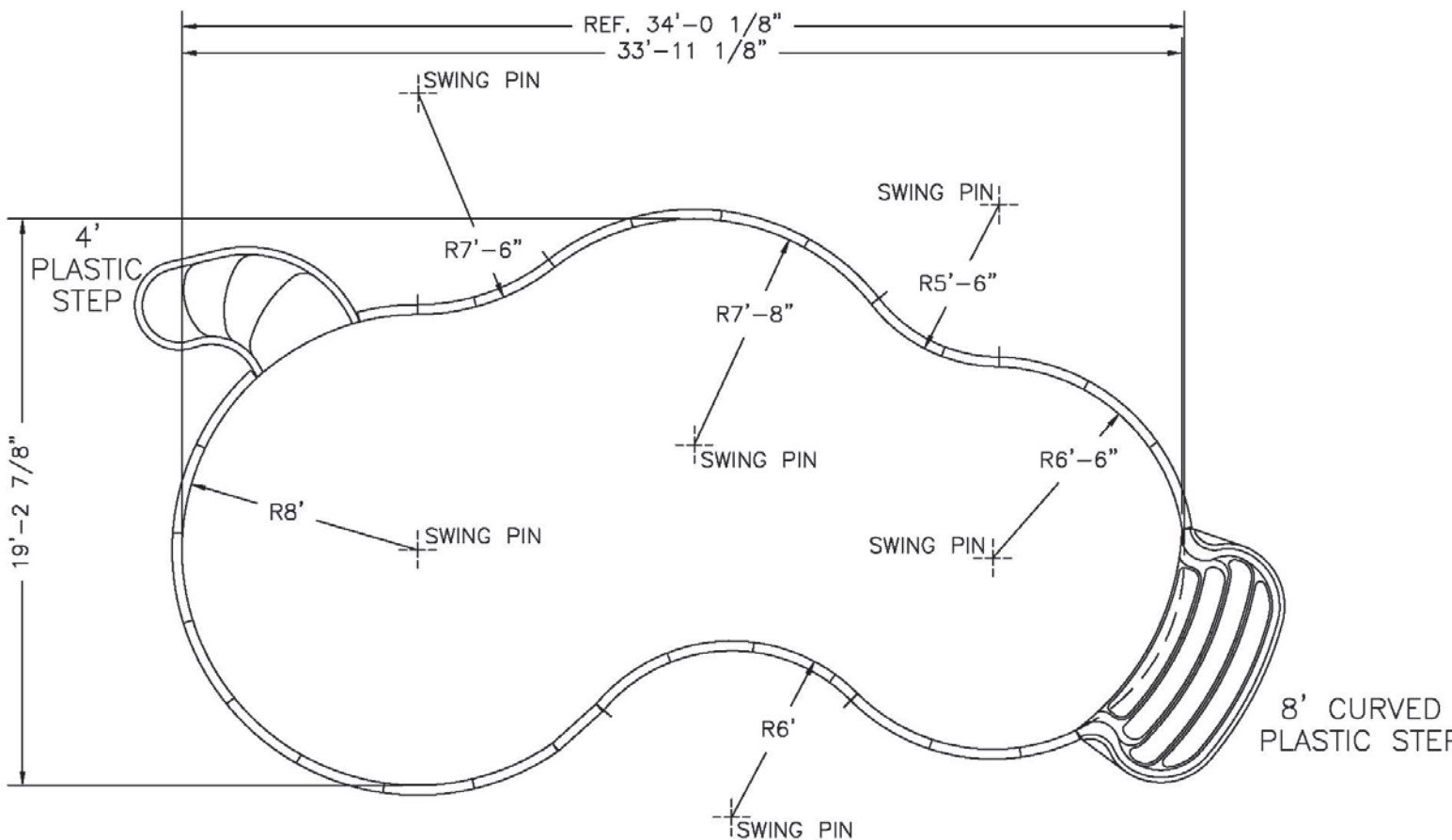
A 16' x 36' (16 x 36 = 576 SQUARE ft.) rectangle with an average depth of 6' (576 x 6 = 3456 CUBIC ft.) holds 25,850 (3456 x 7.48) gallons.

Appendix C

Pool Layout Drawing

Construction Plan Detail

Once a final decision is made regarding the size, shape, and depth of the new swimming pool, **CARAVELLE** can provide a wide range of information to assist in the installation process. The 16' x 34' Free Form pool mentioned previously is shown here, with the plastic step selected and oriented in the center of the shallow end. A 4' plastic step is used in the opposite end of the pool as well.

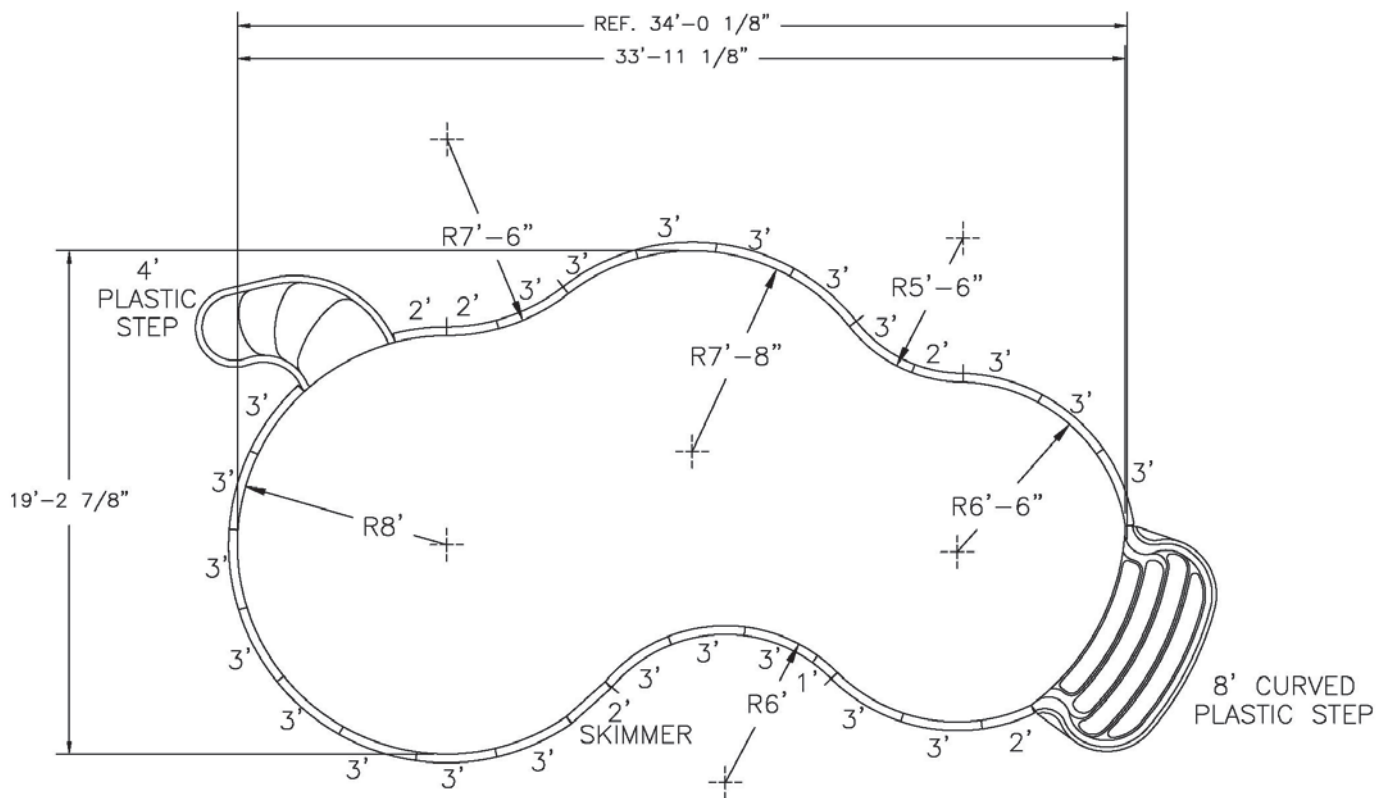


Final shape and step location.

Appendix C

Construction Plan Detail

CARAVELLE provides the panels lengths and step information so that the correct parts may be ordered to complete the pool kit. Panel length numbers are shown as close to each panel as we can, but leaders are sometimes necessary to indicate which panel is which in some areas of the pool. Other information is also provided but has been removed from the following drawing for clarity and will be discussed further on.



Panel lengths and step information shown with radius information.

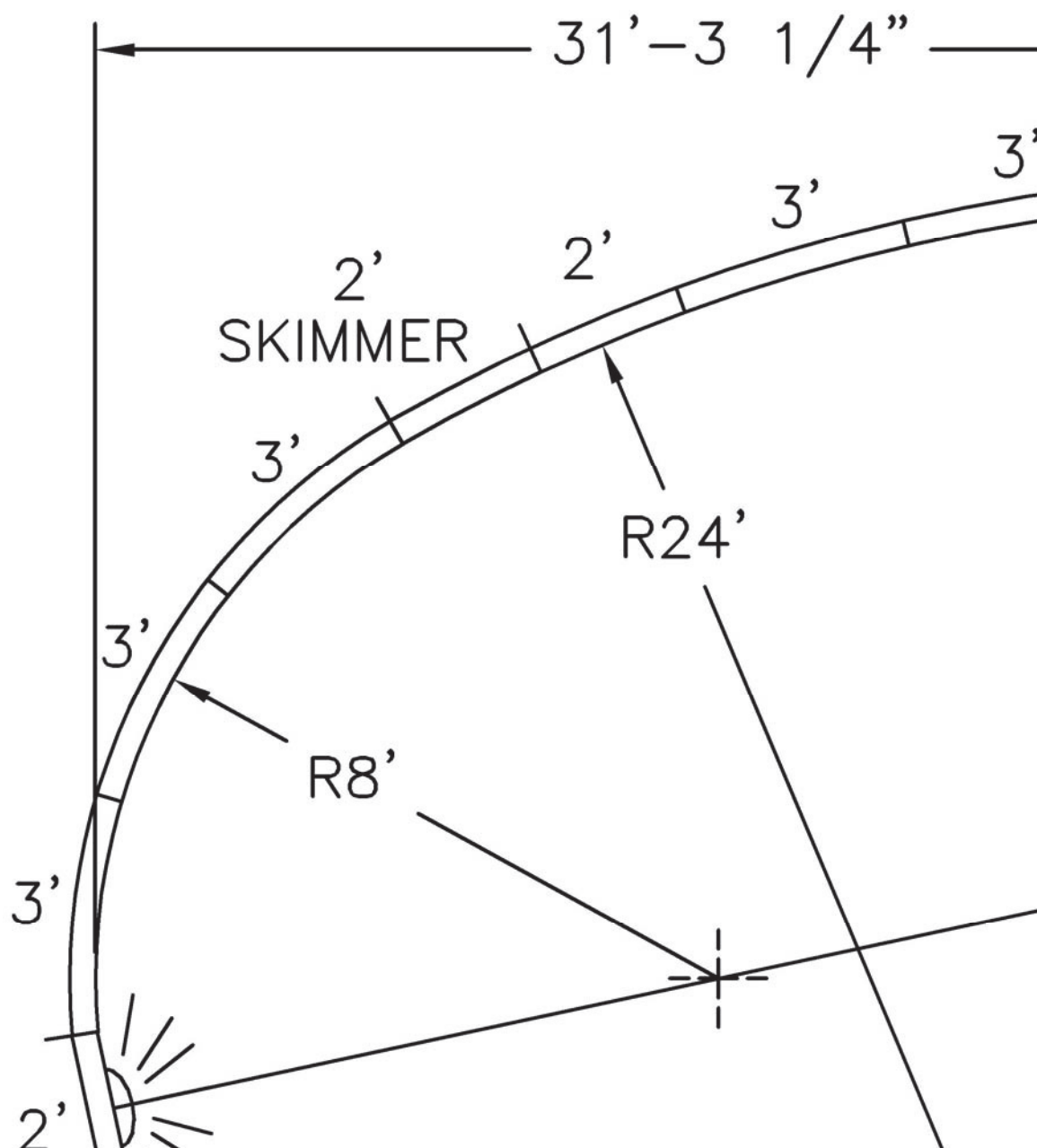
Appendix C

Pool Layout Drawing

Construction Plan Detail

Another feature of **CARAVELLE** drawings are the “tick” marks. Whenever a straight panel meets a radius, or one radius meets a different radius, the panel joint marker is extended out side the pool outline. By using the “tick” marks and information already on the drawing, layouts can be done easily.

In the case where two tangent radii meet, the tick mark occurs directly on a line between the radius centers, or “swing points” and can be used to help lay the pool out.



Appendix C

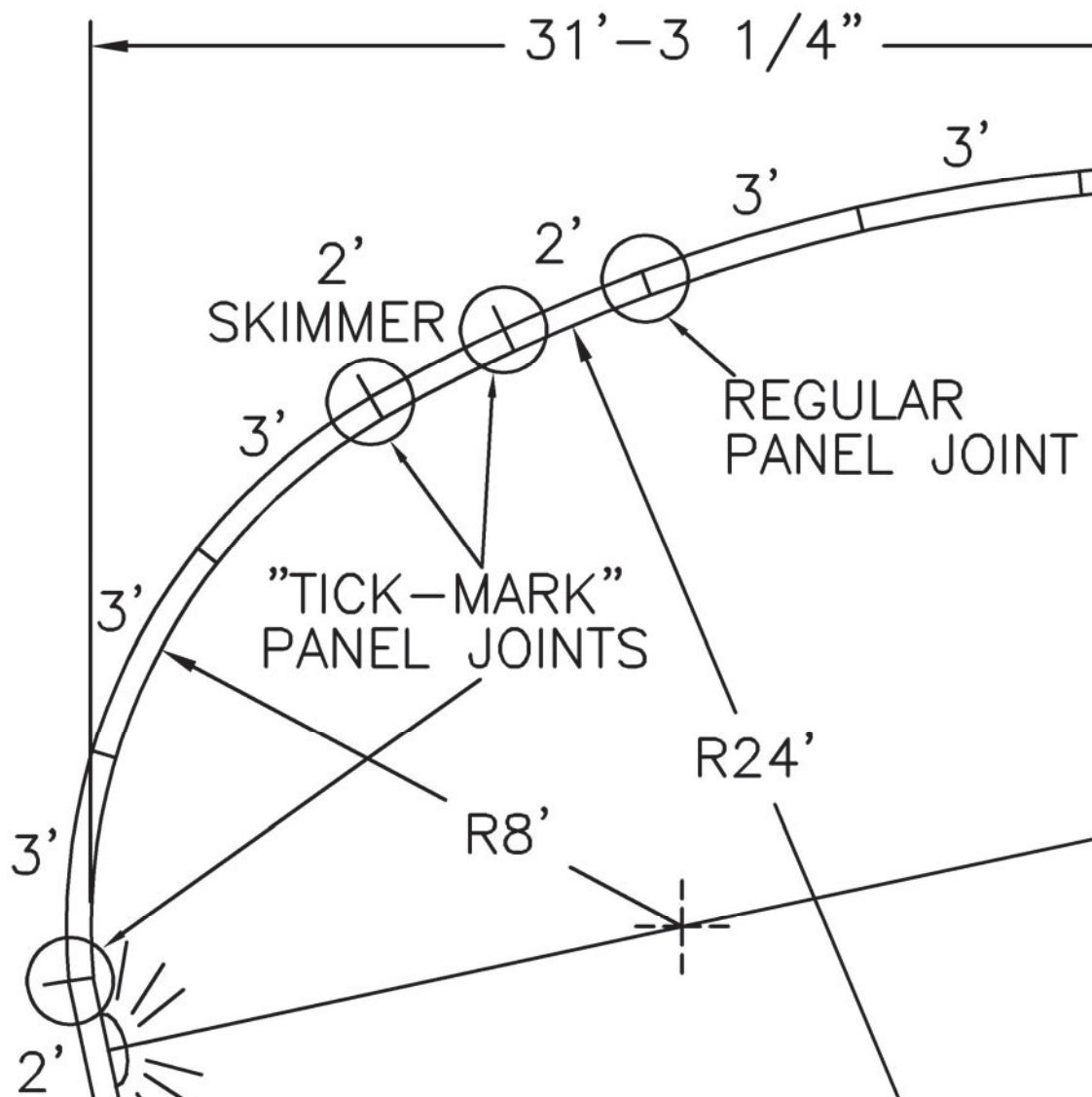
Construction Plan Detail

In the example shown below, there is a 2' light panel at the lower left, going into 3' x 8' radius panels, then a 2' skimmer panel, a 2' x 24' radius panel and finally a pair of 3' x 24' radius panels.

Since the light panel is straight and the first 3' x 8' radius panel is curved, the panel joint marker is shown as a "tick mark" meaning it is extended twice the thickness of the pool wall to give a visual indication that there is a change. The remaining 2 panels are the same 8' radius, so those joints are shown as "regular" or starting at the panel face and stopping at rear of the panel.

The next panel is a 2' skimmer panel which is straight, so the panel joint marker is another "tick mark". The other end of the skimmer panel meets a 2' x 24' radius panel so that joint marker is also a "tick mark".

The next two 3' panels are the same 24' radius as the 2' x 24' radius so the joint marker is "regular".



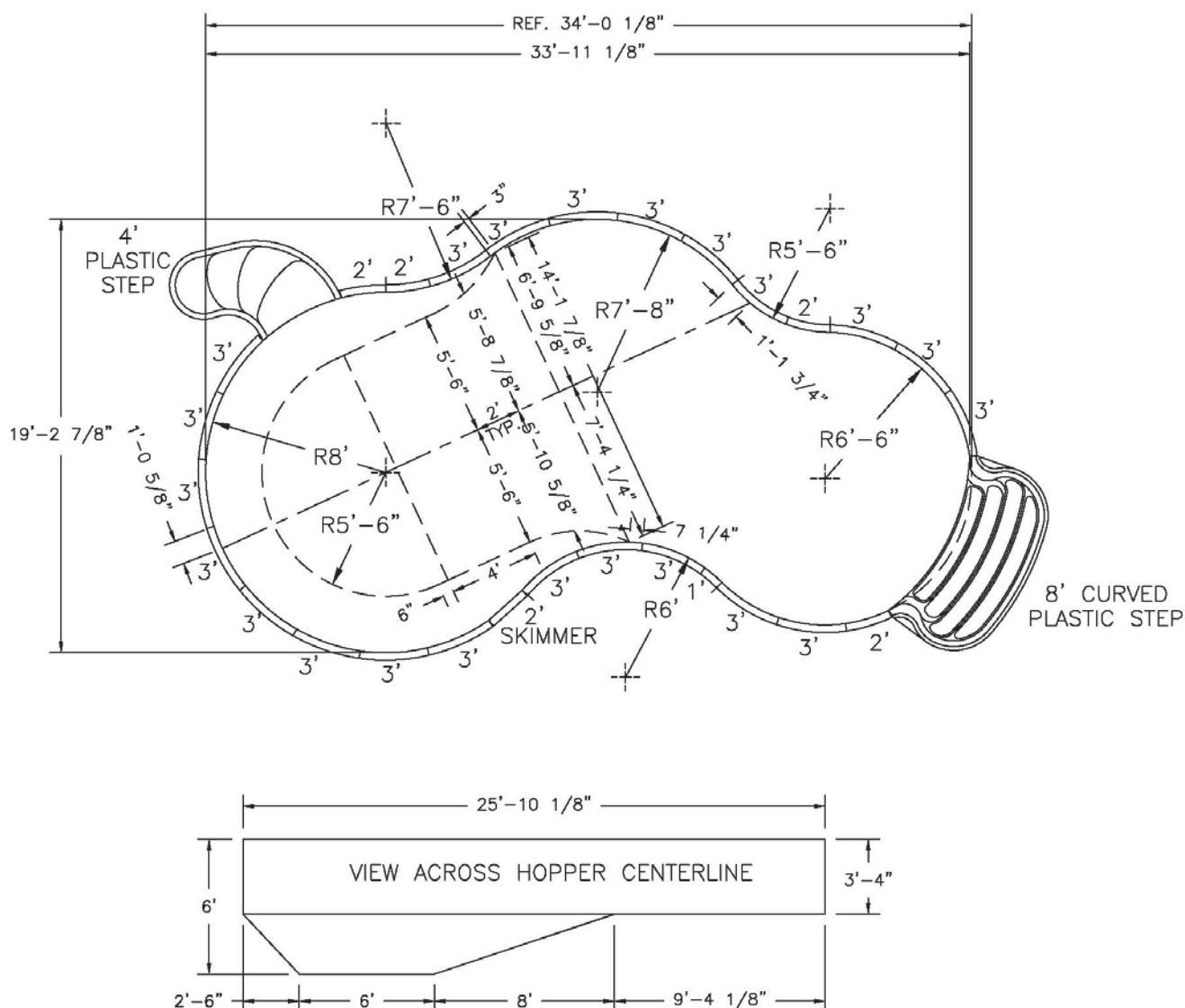
Pool Layout Drawing

Construction Plan Detail

Depth information, or “hopper” dimensions are shown in the following drawing. This is normally shown with panel lengths, but is shown separately here. In some cases, as illustrated here, the centerline of the hopper is not the same as the centerline used to layout the pool. This may be for either diving clearance or aesthetics and information is provided to layout this centerline.

The dimensions outside the panels are used to locate centerline and shallow end break lines referenced from the nearest panel joint. Dimensions from the centerline are used to lay out the slope. Additional information can be provided as necessary.

The side view in this case is a section view shown along the centerline of the hopper and is therefore shorter than the overall length of the pool.



Hopper dimensions and cross-section.

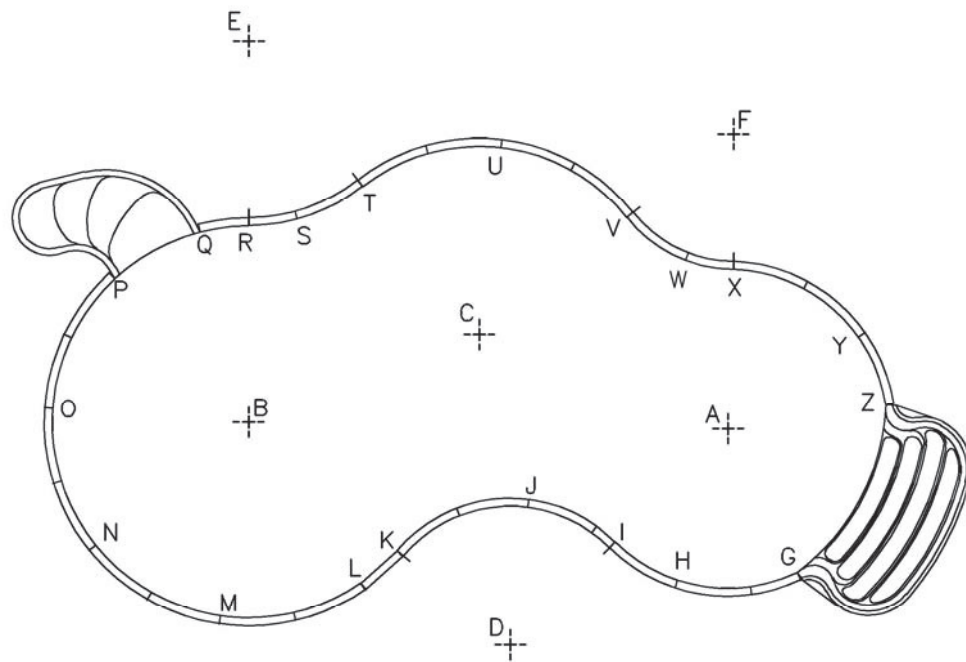
Appendix C

Construction Plan A-B Option

Additional layout information can be provided upon request to assist installation. The proper time to request such information is at the time the pool size and shape is finalized and the **CARAVELLE** panels ordered. There is a lead time necessary to generate the layout information, so it is not provided generally for every pool, but on an as-needed basis. Several of the most popular methods are shown below.

“A-B’s” or “POINT-TO-POINTS”

This is a table of measurements from the shallow and deep end radius pins to all other radius pins, and from both sides of the step to panel joints for triangulation.



POINTS	DISTANCE	POINTS	DISTANCE	POINTS	DISTANCE
A-B	19'-6 1/8"	G-H	4'-10 1/2"	Z-H	11'-1 1/8"
A-C	10'-10"	G-I	7'-6"	Z-I	12'-4 1/4"
A-D	12'-6"	G-J	11'-3 7/8"	Z-J	15'-0 3/8"
A-E	25'-0 7/8"	G-K	16'-3 5/8"	Z-K	20'-9"
A-F	12'	G-L	17'-9 1/8"	Z-L	22'-6 7/8"
B-C	10'-0 1/2"	G-M	23'-6 3/8"	Z-M	28'-5"
B-D	14'	G-N	28'-6 7/8"	Z-N	32'-8"
B-E	15'-6"	G-O	31'-0 1/2"	Z-O	33'-11"
B-F	22'-11 3/8"	G-P	30'-3"	Z-P	31'-9 5/8"
		G-Q	27'-11 3/4"	Z-Q	28'-9 1/4"
		G-R	26'-5"	Z-R	26'-11 1/8"
		C-S	24'-11"	Z-S	25'-1 1/4"
		G-T	23'-8"	Z-T	23'-0 3/4"
		G-U	21'-1 1/8"	Z-U	18'-10"
		G-V	16'-0 5/8"	Z-V	13'-0 1/4"
		G-W	13'-6 1/8"	Z-W	10'-0 5/8"
		G-X	12'-7 1/2"	Z-X	8'-3 5/8"
		G-Y	9'-11 1/8"	Z-Y	2'-11 5/8"
		G-Z	7'-8 7/8"		

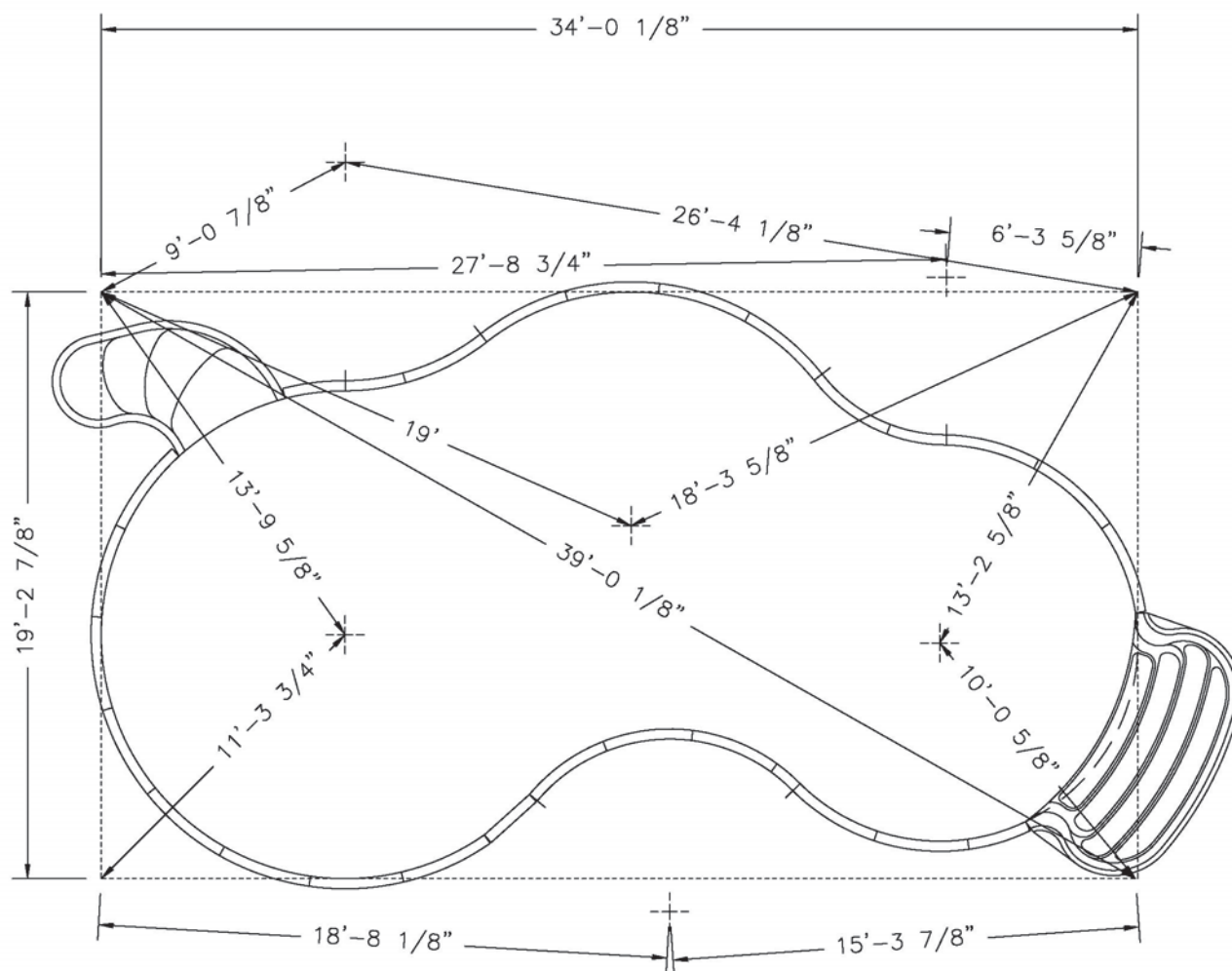
This type of chart is not provided for rectangular or ell-shaped pools. Diagonal cross-measurements are substituted instead as a better method for pools with mostly straight or angular configurations.

Appendix C

Pool Layout Drawing

Construction Plan Box Method Option

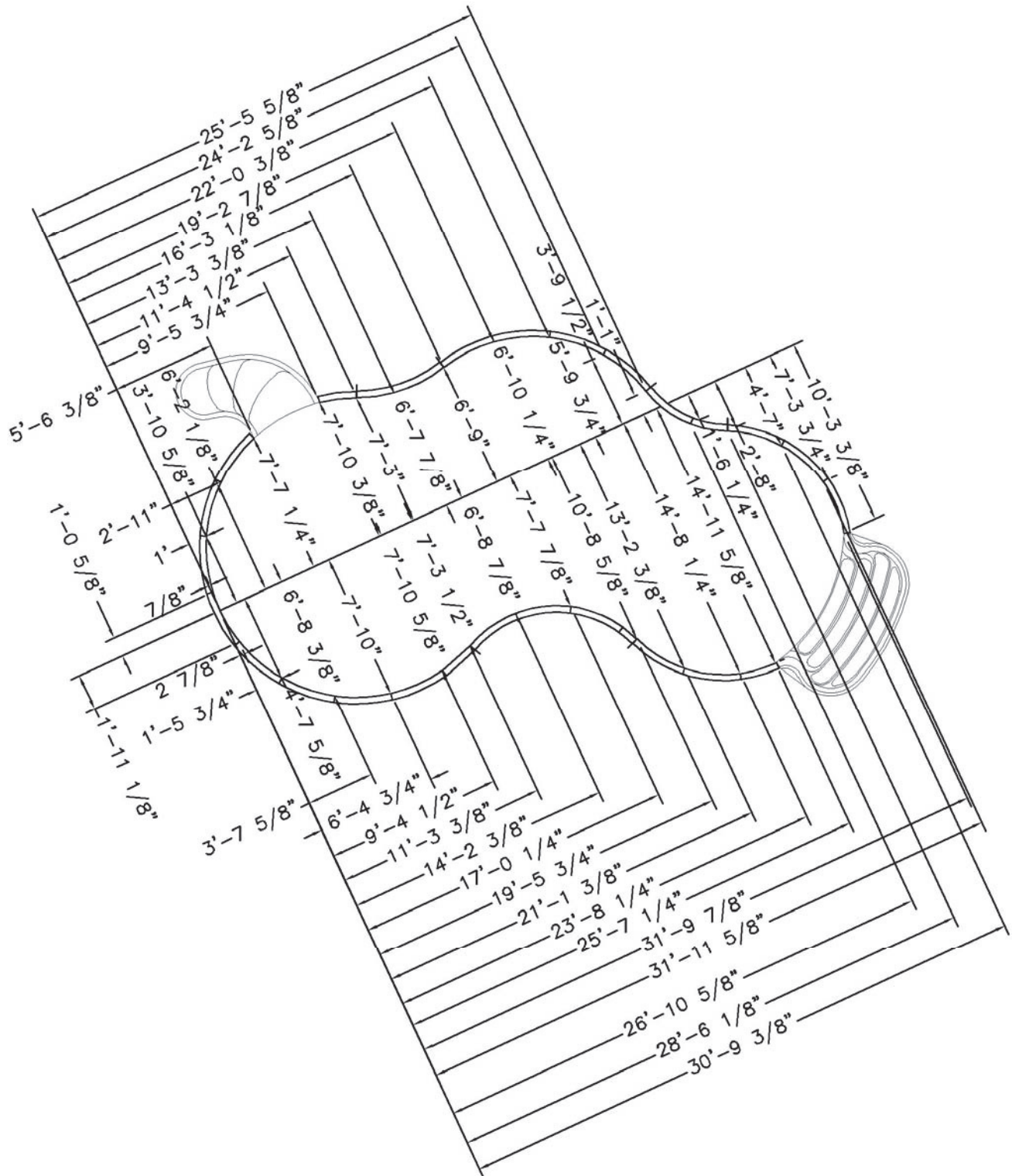
This method uses the box from the layout example above as a reference to set all radius swing pins.



Appendix C

Construction Plan Center Line Option

This is a way to set panels by referencing the centerline of the pool instead of the step.



Pool Layout Drawing

The drawing as sent to the customer.



CARAVELLE
by Caravel Systems

DRAWN BY:	BH
DATE:	3/2/07
SCALE:	1/8" = 1'
DRAWING NUMBER:	

SAMPLE POOL

Revisions			PER.1	89' - 0"
1			S.A.1	449, 9 ft ³
2			VOL.1	
			APPROVED:	