

## **Rainstore<sup>3</sup> Installation Instructions Water Harvesting For Stormwater Drainage Containment & Reuse with Geomembrane Liner**

(A separate install guide for stormwater retention or detention/exfiltration, is available - call 303-233-8383 or visit [www.invisiblestructures.com](http://www.invisiblestructures.com))

### **1) Introduction**

- A. This document describes how to properly install the Rainstore<sup>3</sup> water storage system with geomembrane for stormwater containment and reuse.
- B. **Containment** allows for on site subsurface water storage for many non-potable applications such as irrigation.
- C. **Contractors:** Only licensed contractors should install the Rainstore<sup>3</sup> system. The contractor should have a good performance record with similar construction projects. Homeowners should not install the Rainstore<sup>3</sup> units themselves.
- D. **Landscaping:** Plant only grass, flowers, or shrubs with shallow root systems over the installed product. Trees should be planned for and CANNOT be planted directly above a complete Rainstore<sup>3</sup> system. The deep tree roots can damage the water storage capacity of the system by tearing the geotextile fabric and clogging Rainstore<sup>3</sup> cells with root growth. Trees can be planted around the system, or planted in an island of a parking lot devoid of Rainstore<sup>3</sup> cells. Recommended distance from Rainstore<sup>3</sup> system is 10 meters with a root barrier on the edge next to tree.
- E. **Warning:** Do NOT drive motorized equipment on any portion of the Rainstore<sup>3</sup> area until installation is 100% complete. Driving over any part of the partial installation could damage the geogrid, fabric, or Rainstore<sup>3</sup> cells, thus compromising the integrity of the entire installation. Walking on the Rainstore<sup>3</sup> units is acceptable.
- F. **Warranty:** Invisible Structures, Inc. is not responsible for careless installations that do not follow the technical specifications. The ISI warranty only covers Rainstore<sup>3</sup> material defects. Please see the separate warranty sheet in the Rainstore<sup>3</sup> brochure, or call ISI at 303-233-8383.

### **2) Material Requirements**

- A. **Rainstore<sup>3</sup>:** The cells arrive preassembled to the desired height. They will arrive in a box truck on pallets. When multiple cells are stacked on one pallet, white paper will divide each stack. Do not assemble, re-stack, or disassemble any units onsite as this will void the product warranty. **DO NOT** cut Rainstore<sup>3</sup> units. Units must be installed whole. Cutting is only permitted for maintenance port installations (see our Rainstore<sup>3</sup> maintenance port design details). **DO NOT** disassemble, reassemble, or reconfigure the height (stacks) of Rainstore<sup>3</sup>. Stacks must be assembled at Invisible Structures manufacturing facility.

- B. Geogrid: Acceptable examples are Tensar TriX 160, Tenax MS 330, or Huesker Fornit 30 or equivalent. Geogrid is available in 2 rolls sizes: 9.84 ft x 164 ft roll that weighs 102 lbs, or 13.1 ft x 264 ft that weighs 138 lbs. This product is not supplied by Invisible Structures.
- C. Geotextile: Non-woven PP or PET of at least 8-ounce per square yard. The geotextile fabric is available in rolls measuring 12.5 ft x 360 feet or 15 ft x 300 feet. Both roll sizes weigh 240 lbs. This product is not supplied by Invisible Structures.
- D. Geomembrane liner: for harvesting application. Minimum 40 mil PVC, or thicker.
- E. Silver or metallic tape: the corners of the completed installation should be marked with metallic tape for future utility detection.
- F. Pipe Boot: to properly secure inlet, outlet, and maintenance ports to the Rainstore<sup>3</sup> system. Please view section 5.12 for installation instructions.

### **3) Equipment Requirements**

- A. A powered lift to move stacked Rainstore<sup>3</sup> cells into the excavated area. A backhoe can have a fork or hanging chain attachment for lowering Rainstore<sup>3</sup> units into the excavated area.
- B. A walk behind roller for backfill compaction. For installations with an area of 1,000 square feet or more, a light drivable roller such as the Bomag 125 D-4 that weighs 3,125 kg (6890 lbs) or a compacter of similar weight may be used for compaction after the first six inches of fill material have been installed.

### **4) Shipping, Handling & Storage**

#### **4.1 Unloading:**

- A. Rainstore<sup>3</sup> cells arrive stacked to the desire height in a box truck on wooden pallet. Two or more workers per stacked unit can unload the cells. The Rainstore<sup>3</sup> can also be removed from the truck with a powered lift.
  - **Powered lift:** Rainstore<sup>3</sup> can be unloaded by a bobcat machine with a fork attachment or a larger bobcat with a scoop attachment. To unload the units with a powered lift, slide a pallet of Rainstore<sup>3</sup> to the rear of the truck using workers or a pallet jack. Position the cells onto the fork or scoop attachment.
- B. Depending upon the height of the cells, a powered lift may be required for removal from the truck. This could be a bobcat, forklift, or back hoe.

- C. If a cell stack has a few cylinders that have become partially dislodged in transit or offloading, simply apply even pressure onto the top of the cell to re-connect the units – each cylinder top ribs should touch adjacent cylinder’s bottom rib. If there are more than twelve (12) cylinders disconnected in a cell stack, replacement cells are needed.

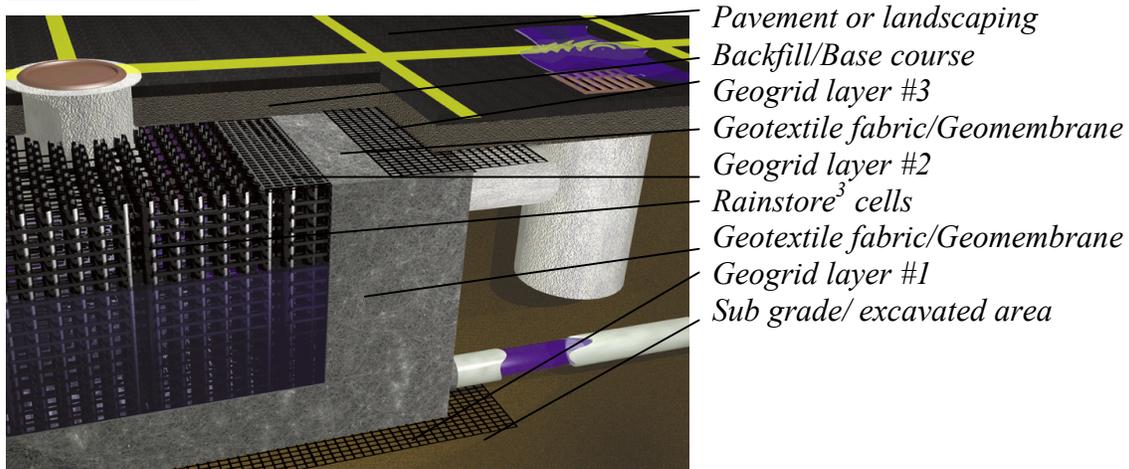
**4.2 Sun exposure:**

- A. If the product is not to be installed for five or more days after delivery, the Rainstore<sup>3</sup> cells MUST be stored out of the sun. Rainstore<sup>3</sup> should be stored in a shed or covered with a UV resistant tarp. Too much exposure to UV rays from the sun will weaken the plastic of the Rainstore<sup>3</sup> cells. Failure to comply with appropriate storage requirements could result in breach of the product warranty.

**4.3 Inclement weather:**

- A. Install Rainstore<sup>3</sup> only if the outside air temperature is 55 degrees Fahrenheit or above. The plastic becomes brittle below 40 degrees F.
- B. Rainstore<sup>3</sup> should not be installed on muddy soil or in standing water. The excavated area should be dry before installation.

**5) Installation**



**5.1 Excavation Preparation**

- A. Excavate the area to the desired depth for the Rainstore<sup>3</sup> system, as shown on site plans. Allow proper depth for the height of the Rainstore<sup>3</sup> cells and the cover material.
- B. The excavated area must be dry, smooth, level, and devoid of rocks, lumps or debris. Before installing the Rainstore<sup>3</sup>, test the area with a 3 meter (10 feet) straight edge or laser level. The surface of the excavated area should not differ in elevation more than 6mm (0.25 inches). All irregularities must be corrected and re-leveled.

- C. Excavation must extend at least three feet beyond all sides of the Rainstore<sup>3</sup> placement area to allow ample room for product installation and sidefill compaction.
- D. All inlet pipes and filtering systems should be installed to the edge of the excavated area per manufacturer's recommendation. Please see section 5.12, for installation of connecting pipes from these devices
- E. Typically, inlet pipes are located near or at the top of the Rainstore<sup>3</sup> chamber/cells and outlet pipes (if necessary) are located along the bottom of the system. An overflow pipe should be located at the top of the system.

### **5.2 Geogrid – First Layer:**

- A. Three separate layers of geogrid are required for the Rainstore<sup>3</sup> system. Geogrid arrives in rolls and can be shipped on a flatbed truck. Rolls are available in two sizes: 9.84 ft x 164 ft roll that weighs 102 lbs, or 13.1 ft x 264 ft that weighs 138 lbs. This product is not supplied by Invisible Structures. Two or more workers should carry the geogrid roll into the excavated area.



- B. Spread the first layer of geogrid at the base of the excavated area. The geogrid will quickly unroll across the excavation area. Seams of the geogrid should overlap at least 12 inches. The first layer provides a stable and even surface for Rainstore<sup>3</sup> cell installation.
- C. The geogrid layers may be temporarily anchored with rocks or adequate debris, to prevent it from rolling up before other system components can be installed.

### **5.3 Geotextile Fabric – First Layer:**

- A. A layer of geotextile fabric is installed on top of the first layer of geogrid. The geotextile encompasses all of the Rainstore<sup>3</sup> cells. Water exits from the system through an outlet pipe.
- B. The geotextile arrives in two rolls that measure 12.5 ft x 360 feet or 15 ft x 300 feet. Both roll sizes weigh 240 lbs. Two or more workers can lift and quickly install the geotextile by unrolling it over the geogrid material. Seams should

overlap 12 inches. Seams can be joined with duct tape or a similar material to prevent shifting of the geotextile fabric.

- C. Be sure to leave excess fabric on all sides of excavated area. The excess fabric will later be brought up and around to encompass the sides and top of the Rainstore<sup>3</sup> cells. The geotextile can be temporarily anchored at the sides of the excavated area with rocks, bricks, or boards during installation.

#### **5.4 Water Harvesting Liner**



*Geogrid layer #3*  
*Geotextile outside (encases Rainstore3)*  
*Geomembrane (encases Rainstore3)*  
*Geotextile inside (encases Rainstore3)*  
*Geogrid layer #2*  
*Rainstore3 units*  
*Geotextile inside (encases Rainstore3)*  
*Geomembrane (encases Rainstore3)*  
*Geotextile outside (encases Rainstore3)*  
*Geogrid layer #1*

- A. An impermeable 40 mil PVC liner is placed over the first geotextile layer. This makes the Rainstore<sup>3</sup> unit impermeable. The excess liner will later be brought up and around to encompass the sides and top of the Rainstore<sup>3</sup> cells
- B. Seams should overlap a minimum of 12 inches or per manufacturer's recommendations. The seams of the PVC liner should be chemically sealed to ensure impermeability. A MEK cleaner (methyl ethyl ketone) and PVC Seam Adhesive should be used. It is recommended a liner expert seal the seams.
- D. Install the liner only if the outside air temperature is 55 degrees Fahrenheit or above. The plastic becomes brittle below 40 degrees F. The area should be dry before installation.

#### **5.5 Geotextile Fabric – Second Layer:**

- A. A second layer of geotextile fabric is installed on top of the PVC liner.
- B. Two or more workers can lift and quickly install the geotextile by unrolling it over the PVC liner. Seams should overlap 12 inches. Seams can be joined with duct tape or a similar material to prevent shifting of the geotextile fabric.
- C. Be sure to leave excess fabric on all sides of excavated area. The excess fabric will later be brought up and around to encompass the sides and top of the Rainstore<sup>3</sup> cells. The geotextile can be temporarily anchored at the sides of the excavated area with rocks, bricks, or boards during installation.

### 5.6 Marking Rainstore<sup>3</sup> Placement:

- A. The Rainstore<sup>3</sup> installation area can be outlined on the geotextile using spray paint, chalk line, or even rope. If using rope, make sure to remove all rope after the Rainstore<sup>3</sup> cells are in place.

### 5.7 Position the Cells:

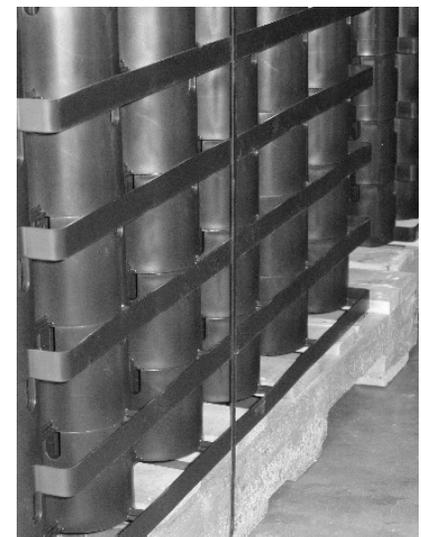
- A. Depending upon the height of the Rainstore<sup>3</sup> cells, two to four workers can carry the cells and place them on the geotextile fabric.

- B. Workers can also use a dolly to roll the stacked Rainstore<sup>3</sup> cells into place. Take care not to allow the Rainstore<sup>3</sup> to tip over to prevent stacked cells from being damaged. **Damaged units CANNOT be installed and must be discarded. Call ISI for replacement pieces at 303-233-8383.** Rainstore<sup>3</sup> units **CANNOT BE CUT** to fit the hole. Each unit must be installed whole. No Partial unit is allowed unless making room for a maintenance port (see 5.8).



- C. A powered lift can be used as a small crane to lower Rainstore<sup>3</sup> cells into place. The powered lift should use wide strapping around the Rainstore<sup>3</sup> cells. The strapping should be placed under the pallet the Rainstore<sup>3</sup> cells are on to avoid damage to the bottom of the Rainstore<sup>3</sup> units. To avoid product damage or replacement, make sure the strapping isn't too tight around the top, bottom or sides of the stacked cells.

- D. There are two sets of banding surrounding the Rainstore<sup>3</sup> cells and pallet. Only cut the metal banding that attaches the cells to the pallet, **BUT NOT** the banding that holds the cell stacks together. Remove and discard the pallet from under the Rainstore<sup>3</sup> cells. If white paper divides the stacked cells, remove and discard that as well.



- E. Final positioning of cells should be done by hand by at least two workers. The cells are placed side by side, **with the grid side down** on the geotextile fabric layer. Align bumpers on each side of all stacked cells to ensure square placement.

### 5.8 Maintenance Ports:

- A. Depending on the size of the maintenance port, one or four Rainstore<sup>3</sup> columns can be removed to install a maintenance port. The Rainstore<sup>3</sup> units can ONLY be cut for maintenance port installation – no other cutting is permitted. The Rainstore<sup>3</sup> cells can be cut using a powered cutter, such as a chain saw or a reciprocating saw. **NOTE: Cut ONLY the GRID between the cylinders, NOT the cylinders themselves.** The location of the maintenance port should be clearly marked with tape or paint before Rainstore<sup>3</sup> cells are cut.

### **5.9 Geogrid - Second Layer:**

- A. The second geogrid layer is applied directly over the installed Rainstore<sup>3</sup> cells and provides a walking surface for workers. The layer also prevents the geotextile fabric from being penetrated.
- B. The geogrid easily unrolls with two workers. The seams should overlap at least 12 inches.

### **5.10 Wrap the Rainstore3 Cells:**

- A. After the second layer of geogrid is installed, the anchored geotextile fabric surrounding the Rainstore<sup>3</sup> installation can be wrapped around all sides and the top of the Rainstore<sup>3</sup> chamber.
- B. Remove anchor material from the geotextile fabric. Enclose the Rainstore<sup>3</sup> cells with the inner layer of geotextile by bringing the fabric around the sides to the top of the cells. Seams should be sealed according to manufacturer recommendations.
- C. After encompassing the Rainstore<sup>3</sup> units in geotextile, wrap the chamber with the PVC liner in a similar fashion. The impermeable liner must be chemically sealed per manufacturer recommendations.
- D. Finally, wrap the outer layer of geotextile fabric around the chamber. Seams should be sealed according to manufacturer's recommendations.

### **5.11 Add Maintenance Ports/ Connect Inlet & Outlet Pipes:**

- A. Prefabricated boots are available to provide a water tight connection between the Rainstore3 chamber and any maintenance port or inlet and outlet pipes. This replaces securing the geotextile fabric around a pipe using a hose clamp. The prefabricated boots are available from any geotextile manufacturer.
- B. Boot Pipe Installation (from Environment Protection, Inc. [www.geomembrane.com](http://www.geomembrane.com))
  - a. Prepare the sub grade around the area of the pipe. The sub grade must be smooth, uniform, and free of any protrusions.
  - b. Clean the surface of the liner around the penetration where the boot will be welded in place. Wipe away any dirt or dust particles. The surfaces of the liner, boot, and the pipe must be completely clean and dry.

- c. Slide the boot sleeve on the pipe, making sure the boot is aligned and all surfaces are smooth. It may be necessary to trim the excess tapered portion of the boot sleeve.
  - d. Weld the boot apron to the liner using adhesive. Apply the adhesive to the liner and the boot apron. Let the adhesive setup for several seconds before pressing the boot apron and the liner together using a roller. Make sure to smooth out any bubbles or wrinkles.
  - e. Seal the boot sleeve to the pipe using the stainless steel hose clamp. The clamp around the pipe will form a watertight seal to the pipe.
- C. Maintenance ports/boots and pipes should be completely sealed to the impermeable PVC liner per manufacturer's requirements.

#### **5.12 Side Backfill & Compaction:**

- A. The area around the installed Rainstore<sup>3</sup> structure must be backfilled with self containing structural aggregate. The fill material should be applied gradually. The fill should be compacted in a maximum of 12-inch high lifts to 95% proctor density. Backfill to the top of the geotextile wrapped Rainstore<sup>3</sup> structure.
- B. To ensure the backfill is properly compacted, have a Geotechnical Engineer test the fill density on site.

#### **5.13 Geogrid - Third Layer:**

- A. When the side backfill compaction is complete, the third layer of geogrid is ready for installation. The final layer of geogrid must extend beyond all sides of the Rainstore<sup>3</sup> installation at least three feet. The third layer helps dissipate the load of traffic. Have two workers unroll the geogrid. Make sure the seams overlap at least 12 inches.

#### **5.14 Top Backfill:**

- A. Add the top layer of backfill material over the geogrid material. The backfill must be compacted in six inch high lifts to 95% proctor density. Use a walk behind roller for small installations.
- B. For installations with an area of 1,000 square feet or more, a light drivable roller such as the Bomag 125 D-4 that weighs 3,125 kg (6890 lbs) or a compacter of similar weight may be used for compaction after the first six inches of fill material have been installed.
- C. Fill material should measure 12 inches minimum and 36 inches maximum. To ensure the backfill is properly compacted, have a Geotechnical Engineer test the fill density on site.

#### **5.15 Surface Material:**

- A. Once compaction is complete, cover material may be placed. Landscaping materials such as grass, or shallow root shrubs may be planted. For parking lot applications: Grasspave<sup>2</sup>, Gravelpave<sup>2</sup>, asphalt, concrete or other pavement may be installed.

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