INSTALLATION GUIDELINES FOR MIRAFI® H_2R_i WICKING GEOSYNTHETIC

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March, 2018

General

This document is prepared to help ensure the geosynthetic wicking/soil reinforcement, once installed, will perform its intended design functions. To do so, the geosynthetic must be identified, handled, stored and installed in such a way that its physical property values are not affected and the design conditions are ultimately met as intended. This document does not account for every possible construction or installation scenario. However, this document contains information consistent with generally accepted practices of identifying, handling, storing and installing geosynthetic materials for most roadway applications

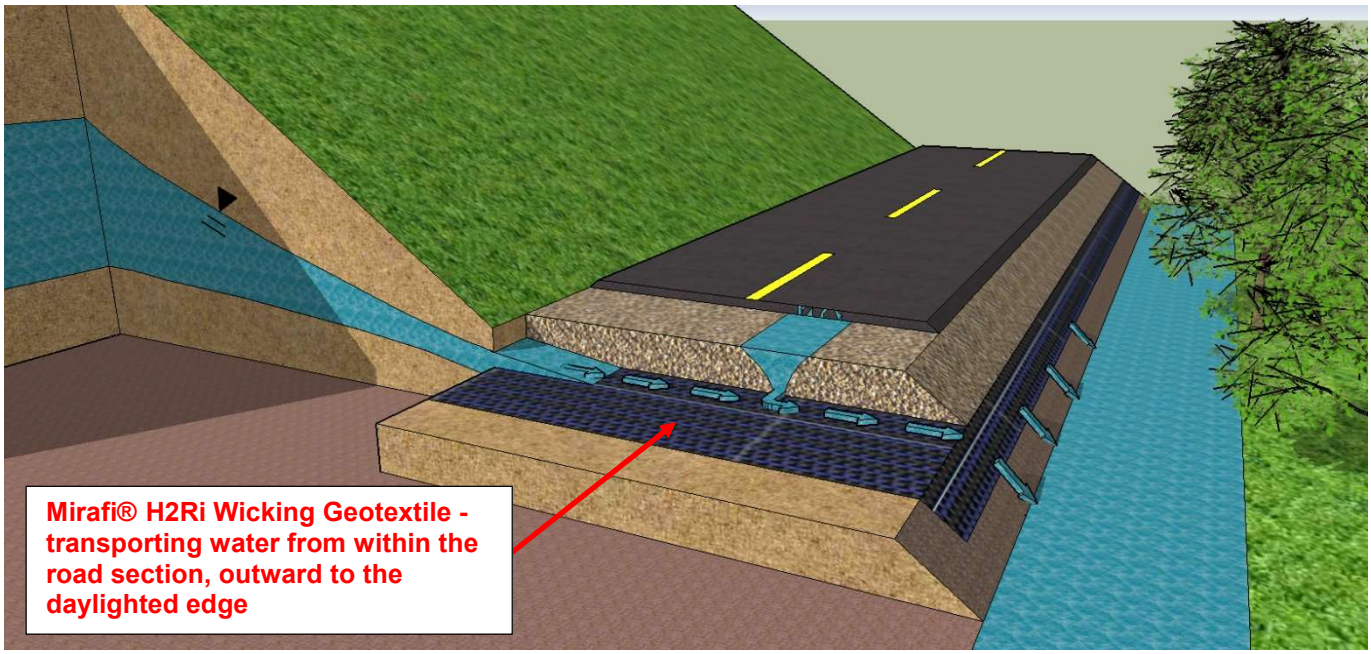
This document is intended as an installation guideline only and should not be construed as engineering advice. Final decision regarding proper installation details shall be written into the project plans and specifications and is the responsibility of the project engineer. If you have questions regarding a specific project or encounter conditions other than those described herein, call our support number at 888-795-0808. Failure to follow these guidelines may result in reduced performance or an unnecessary failure of the geosynthetic in a properly designed application.

Material Identification, Storage and Handling

The geosynthetic shall be rolled on cores having strength sufficient to avoid collapse or other damage from normal use. Each roll shall be wrapped with a plastic covering to protect the geosynthetic from damage during shipping and handling. Each roll shall be identified with a durable gummed label or the equivalent, clearly legible on the outside of the roll wrapping. The label shall indicate the manufacturer's name, the style number and the roll number. Upon delivery, check the Mirafi® H_2Ri roll labels to verify the correct product has been received.

Immediately inspect the geosynthetic to ensure it is free of any flaws or damage that might have occurred during shipping or handling. While unloading or transferring the geosynthetic from one location to another, prevent damage to the protective wrapping, core, label or the geosynthetic itself. If the geosynthetic is to be stored for an extended period of time, the geosynthetic shall be located and placed in a manner that ensures the integrity of the wrapping, core and label as well as the physical properties of the geosynthetic.

The product is shipped in a heavy plastic bag or covering to help prevent moisture absorption before installation. Mirafi® H_2Ri has an affinity for water, making roll weights increase drastically if left out in the rain, making installation more difficult. The geosynthetic should be stored indoors or elevated off the ground on dunnage, while ensuring that it is adequately covered and protected from precipitation or other moisture, ultraviolet radiation, chemicals that are strong acids or strong bases, fire or flames including welding sparks, temperatures in excess of 140° F (60° C), and human or animal destruction.



Overview

TenCate introduced the Mirafi® H_2Ri wicking geosynthetic in February 2012 as a solution to address frost heave problems in roadways identified by the Alaska Department of Transportation. It has the unique ability to wick water laterally out of fine-grained unsaturated soils through capillary action (suction) in its fibers. Since its introduction, engineers have sought this wicking capability to solve a myriad of problems, such as reducing the moisture content in soils related to capillary rise, high water tables, and surficial water intrusion.

Currently, projects related to frost heave amount to approximately 20% of the installed projects as engineers identify new issues that can be solved using the Mirafi® H_2Ri wicking geosynthetic. Examples of recently identified solutions are permeable pavements, differential soil expansion, and reducing liquefaction potential in seismic events. Several universities are conducting research in different areas. To stay abreast of new information, engineers should stay in contact with their local Mirafi® representative.

Placement Location(s)

Placing the Mirafi® H_2Ri layer(s) at the appropriate elevation(s) within the structural cross section is project specific and depends on site conditions. The most common location is at the subgrade/base interface within a pavement structure.

Mirafi® H_2Ri moves water by capillary action. The geosynthetic can wick water uphill approximately 8" (200 mm), depending on temperature, pressure, and humidity. Reliance on uphill wicking should be avoided but can occur as a result of inconsistencies in construction and/or as allowance result of low spots in the subgrade surface.

Generally, the Mirafi® H_2Ri should be placed at least 12" (300 mm) above the adjacent ground water table or free water surface outside the installation. However, sites that experience flood events may locate the wicking geosynthetic below the water line to allow faster drying of an aggregate and/or facilitate the opening of a road or airfield after water levels recede.

Some example application installations:

1. Frost Heave: The Mirafi® H_2Ri should be placed as low as possible in the cross section (see Figure 1). Several projects have been installed with H_2Ri above the frost line and are performing very well without heaves. Local design guidelines may not allow for a reduced design depth from a traditional structural cross section, so designers should check with their approving office prior to planning a material/layer thickness reduction.

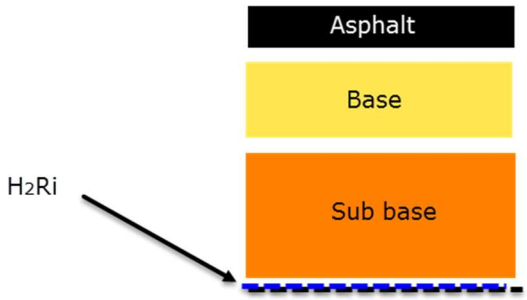


Figure 1 - Subgrade interface

2. Enhanced Lateral Drainage: Place the Mirafi® H_2Ri under the aggregate base course of a pavement structure as shown in Figure 2. This solution increases the drainage coefficient for the aggregate base, significantly improving the service-life of a roadway.

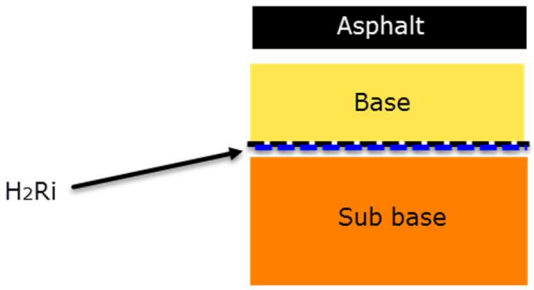


Figure 2 - Aggregate base and sub base

3. Surficial Flow: Placement should be as high in the structural section as possible as shown in Figure 3. The Mirafi® H_2Ri wicking geosynthetic should have a minimum of 6" (150 mm) compacted aggregate coverage. It is not possible to pave directly on H_2Ri as an AC tack coat will clog the wicking yarns. For one project, a nonwoven geotextile was placed over the Mirafi® H_2Ri and a concrete surface was constructed directly on the nonwoven geotextile. Further research into this procedure is needed.

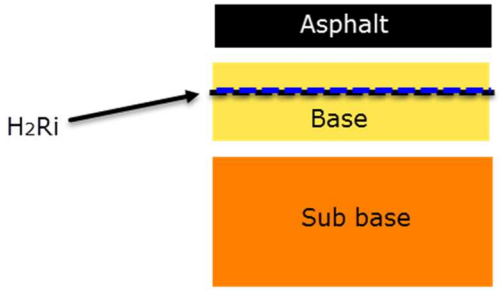


Figure 3 - Close to the pavement structure as possible

Geosynthetic Placement

Clear, grub and excavate (as required) to the planned subgrade or undercut elevations, stripping topsoil, deleterious debris and unsuitable material from the site. Cut stumps and other projecting vegetation as close and even to the ground surface as practical. Specialized equipment with low ground pressure, as directed by the Engineer, may be required for very soft soils (CBR ≤ 1.5%) or on "sensitive" subgrade soils to minimize disturbance. In addition, it may also be beneficial to leave root mats in place in such instances. The surface of the subgrade should be relatively smooth and level, and depressions or humps greater than 6 inches (150 mm) should be graded level (i.e., back bladed/back dragged).

The geosynthetic reinforcement shall be placed directly on the prepared subgrade, as shown in Image 1. The geosynthetic shall be rolled out flat and pulled tight, with no folds or wrinkles. Unroll the geosynthetic in the direction of travel, so that the machine direction (i.e., long axis) of the roll is parallel with planned traffic flow.

Image 1 - H2Ri Installed Parallel to Planned Traffic Flow Over a Prepared Subgrade

Directional Overlap

Mirafi® H_2R*i* must be designed into a structural cross section with the appropriate flow direction of H_2R*i* being indicated for installers to follow. Most geosynthetics do not require flow direction orientation and overlap details, leaving the installation up to the contractor's discretion. For a wicking product like Mirafi® H_2R*i*, it is important to provide a detailed cross-section that clearly shows the overlaps and required gradients of the geosynthetic, to establish correct installation and optimize performance. Overlapped layers of Mirafi® H_2R*i* should be shingled in a similar manner to roof tiles, in order to allow water to shed onto the adjacent lower layer(s). Adjacent rolls should be overlapped a minimum 12" (300 mm) and a maximum 36" (900 mm) along their sides and ends as a function of subgrade strength as shown in the following table (after AASHTO M288-xx):

CBR ≥ 3%	12" to 18" (30-45 cm) overlap
1% ≤ CBR < 3%	24" to 36" (60-90 cm) overlap
0.5% ≤ CBR < 1%	36" (90 cm+) or Sewn*
CBR < 0.5%	Sewn*

** Please contact a Mirafi representative for recommended sewing practices.*

Mirafi® H_2Ri is marked with “flow direction” on the packaging to promote proper installation and placement orientation, as shown in Image 2.

Image 2 - Packaging to Aid Installation Orientation

Mirafi® H_2Ri is manufactured with wicking fibers that create flow channels to wick water laterally along the cross-machine direction. Water enters these flow channels and moves laterally to the edge of the Mirafi® H_2Ri panel, and then releases onto the shingled layer below at the overlap. Image 3 shows a typical center-crowned subgrade, with planned water movement outward from the center, to the left and to the right.

Image 3 - Center Roll at the High Point Moving Water to the Left and Right.

Image 4 shows a super elevation on the right, with planned water flow from right to left.

Image 4 - Installation Through Super-Elevation on Right, Moving Water from Right to Left

Obstacles

The product can be re-oriented and pieced-in to promote water flow around obstacles such as bridge approaches and driveways, as shown in Images 5 and 6.

Image 5 - Bridge Approach, Routing Water Away from Structure.

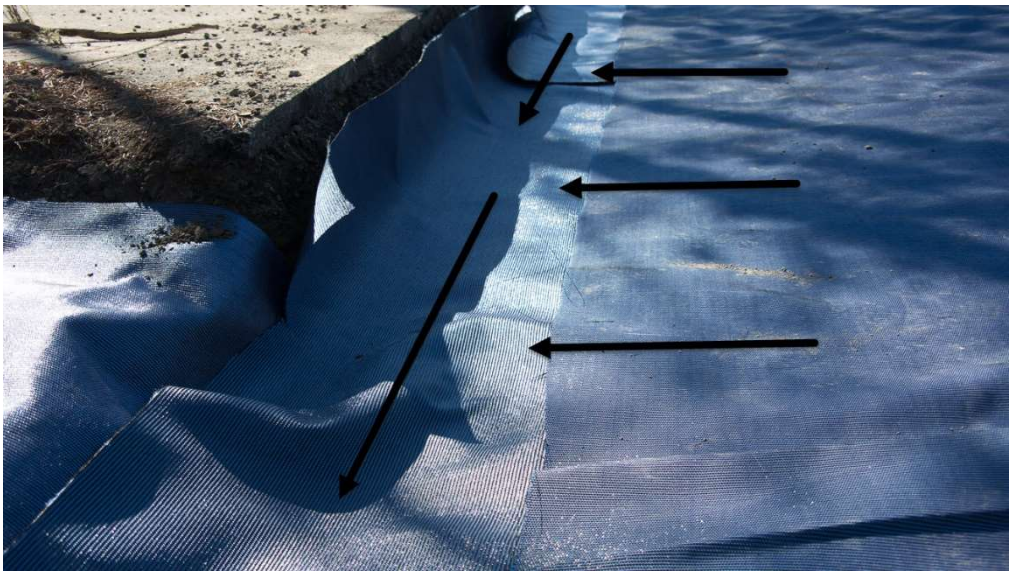


Image 6 - Routing Around Residential Driveway Entrance

Terminations to Promote Water Removal

1. Traditional – No Outlet: This approach is useful when the moisture content needs to be maintained and distributed evenly across the site, but not necessarily removed from the pavement cross section. The Mirafi® H_2R_i is installed like a traditional roadway geosynthetic ,without leading into any drainage systems or daylighted areas. Designers can use the directional component of the Mirafi® H_2R_i to spread out the moisture content uniformly, as shown in Image 7. A clay subgrade is a good candidate for this approach.

Image 7 - Traditional Installation with No Outlet

2. Edge Termination - This approach is good for roadway embankments that can allow water to flow out of H2Ri at the edge, as shown in Image 8.

Image 8 - Edge Termination on Side of Embankment into Ditch Line (Right Side)

A directional gradient that drains water laterally and down towards the shoulder into large drainage rock (ballast or small riprap) should be incorporated with this approach, as shown in Figure 4a and 4b. Please note that the Mirafi 600X separation geotextile shown in Figure 4b is best used with small rip rap stone or very large ballast/drainage aggregate.

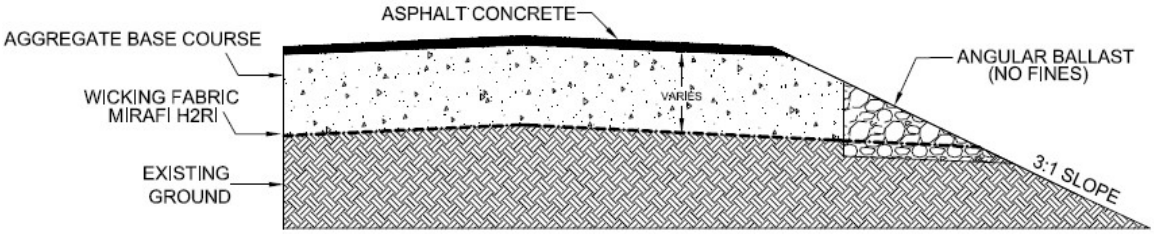


Figure 4a - Detail of Angular Ballast Protection for Day Lighted Installation

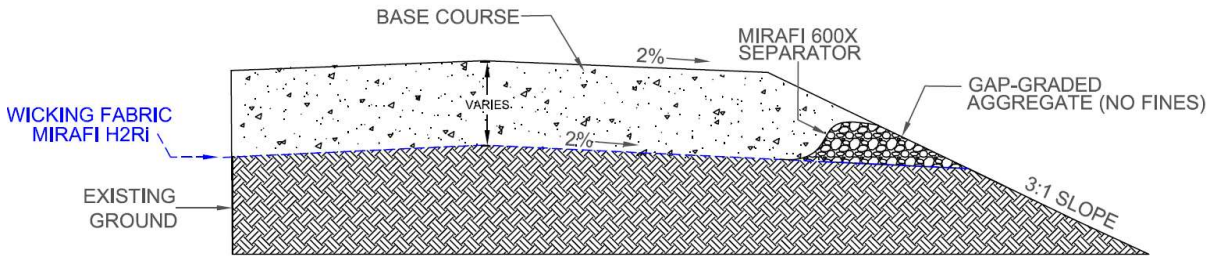


Figure 4 - Detail of Rip Rap Protection for Daylighted Installation

3. Daylighting - This approach has been shown to be the best for maximum water removal from a cross section. Evaporation at the exterior drives water movement outward from the interior. A directional gradient should be incorporated with this approach in combination with a minimum 12" (300 mm) draped exposure of Mirafi® H_2Ri at the exterior, as shown in Figure 5.

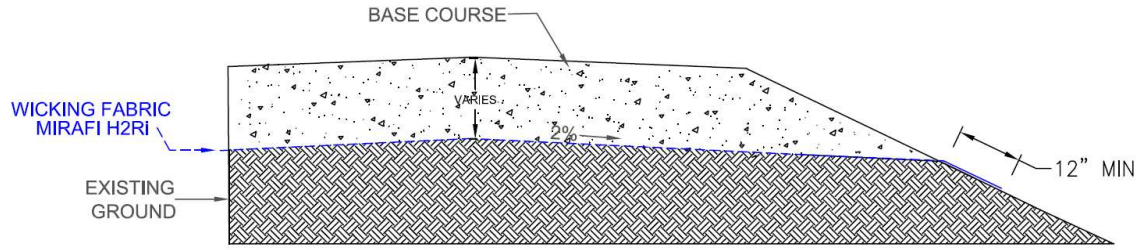


Figure 5 - Detail for Edge Termination into Ditch

A gap-graded or open graded drainage rock, ballast, or rip rap covering may be used to protect the material from UV degradation, as shown in Figures 6 and Images 9 and 10. However, this will increase the difficulty in mowing and other maintenance operations. This approach may not be the most effective in environments with very high or constant humidity.

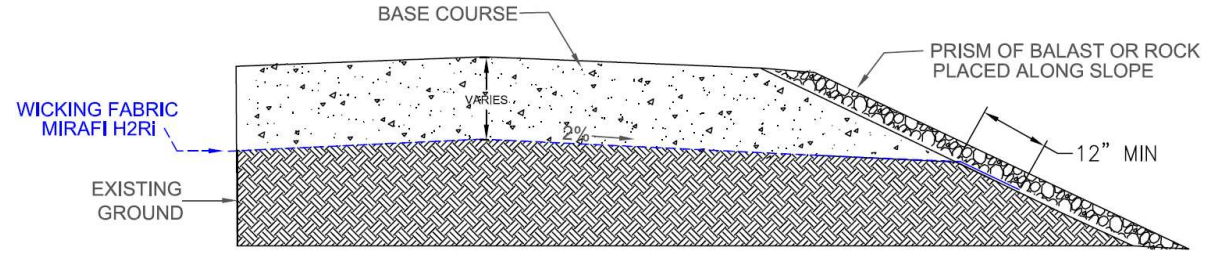


Figure 6 - Detail of Rock Protection for Daylighted Installation

Image 9 - Daylighted Installation Using Rip Rap to Cover the Exposed Edge of Mirafi® H$_2$R*i*.

Image 10 - Water Wicking with Edge Termination

4. Bio-wicking - This approach relies on local vegetation to draw water from the system through their roots, away from the exposed edge of Mirafi® H$_2$R*i*. Vegetation can be selectively planted on the sides of the road, as shown in Figure 6, to enable evapotranspiration. Local riparian based plants with a shallow root structures can be selected and planted after construction, or the use of existing on-site topsoil for native species plant growth, as demonstrated in Image 11.

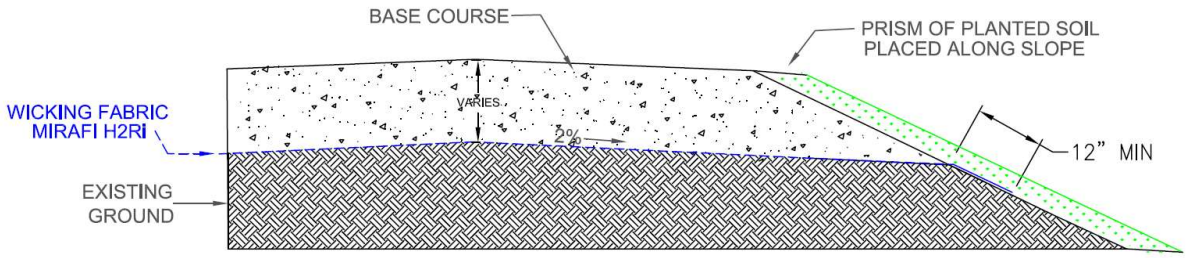


Figure 6 - Bio-Wicking Application Using Plants for Evapotranspiration

Image 11 - Native Plants Establishing the First Season after Installation

5. Piping – This approach should be used for designs with existing curb and gutter, or where the shoulder elevation is flat, piping is required to daylight water. In this approach the H2Ri is terminated into either a traditional trench drain with a perforated pipe (Figure 7b) or into a non-perforated, saw-cut pipe (Figure 7a). A minimum 4" (100 mm) diameter HDPE drain pipe is recommended for use in these applications. A vertical drop of 10" (250 mm) between the elevation of the geotextile and the top of pipe is recommended to initiate a siphon effect in the wicking channels, as shown in Figure 7a and 7b and Image 12. This amount of vertical gradient inhibits inward wicking back into the cross section, as the estimated maximum uphill wicking capability of H_2Ri is approximately 8" (200 mm). When using a sawcut pipe, the Mirafi® H_2Ri should be inserted into slot at the top of the pipe. Mirafi® 600X separation geotextile may be used to cover the sawcut interface, to shield soil from entering the pipe, as shown in Figure 7a.

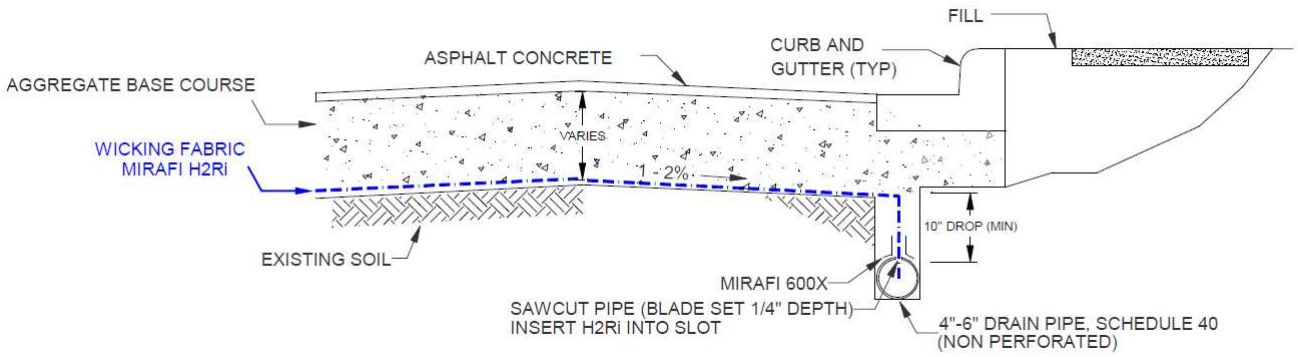


Figure 7a: Piping Detail

Image 12 - Pipe Installation

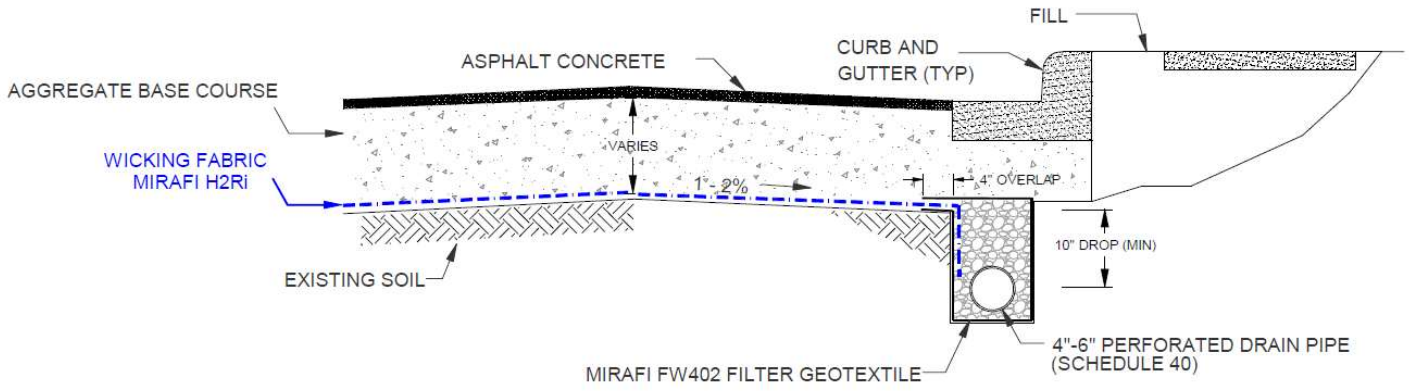


Figure 7b: Alternate Piping Detail

Fill Placement

Trafficking vehicles directly on or over the Mirafi® H_2Ri is not recommended. Aggregate fill, as specified, should be placed directly over the geosynthetic in 8 - 12 (200 – 300 mm) inch loose lifts. Typically, if the design lift thickness is less than or equal to 16 inches (400 mm), the entire lift should be placed and compacted in one single layer to minimize further weakening of soft, wet subgrade soils.

Aggregate fill should be end-dumped from the edge of the previously placed material spreading from the middle outward. Standard compaction methods may be used unless the soils are very soft (CBR ≤ 1.5%). In such cases, static compaction with a light smooth drum roller is considered prudent (Image 5). Once a stable working platform has been achieved, compact aggregate fill to project specifications, after it has been graded smooth and before it is subjected to accumulated traffic.

Image 13 – Small Smooth Drum Roller

The use of a forklift or front-end loader to unroll the geosynthetic using chains and end holders as show in Image 14, is a common installation practice.

Image - 14. Fence Posts Used as End Holders for Unrolling

At the end of the roll, utilize clamps to secure the material to the core as shown in Image 15.

Image 15 - Clamps Used to Secure the Material to the Core

Once the rolls are clamped, the rolls can be pulled taut by construction equipment, as shown in Image 16.

Image 16 - Forklift Pulling the Material Taut as Truck Begins its End Dump.

A small 1” (25 mm) lift can be utilized if the subgrade is competent, as shown in Image 17. The contents of standard dump truck will cover a 300 ft (91.44 m) roll, allowing the rest of the lifts to be placed with belly dumps or “Sidump’r”. Sudden braking, sudden starting and sharp turning during these processes should be avoided.

Photo 17. Gate Set to Spread 1” (25 mm) Lift Allowing a Full Spread Over One Roll.

A minimum aggregate fill thickness of 6 inches (150 mm) is required prior to operation of tracked equipment on the geosynthetic. In addition, turning of tracked equipment should be prevented, or kept to a minimum to prevent tracks from displacing the fill and damaging the geosynthetic.

Aggregate Fill Considerations

A preferred (not required) fill gradation for roadway applications is well-graded, crushed aggregate fill with a maximum particle size of 1½ inches (40 mm) and less than 10% fines (passing #200 sieve). For unpaved road applications, most clean granular fills, including sands are acceptable, but may affect the performance of the roadway.