

# INSTALLATION GUIDELINES FOR MIRAFI<sup>®</sup> H<sub>2</sub>R/ MOISTURE MANAGEMENT SYSTEM

Prepared by:

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## **General**

This document is intended as a general installation guideline only and should not be construed as engineering advice. Final decision regarding proper installation details shall be written into the project 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, contact TenCate Geosynthetics.

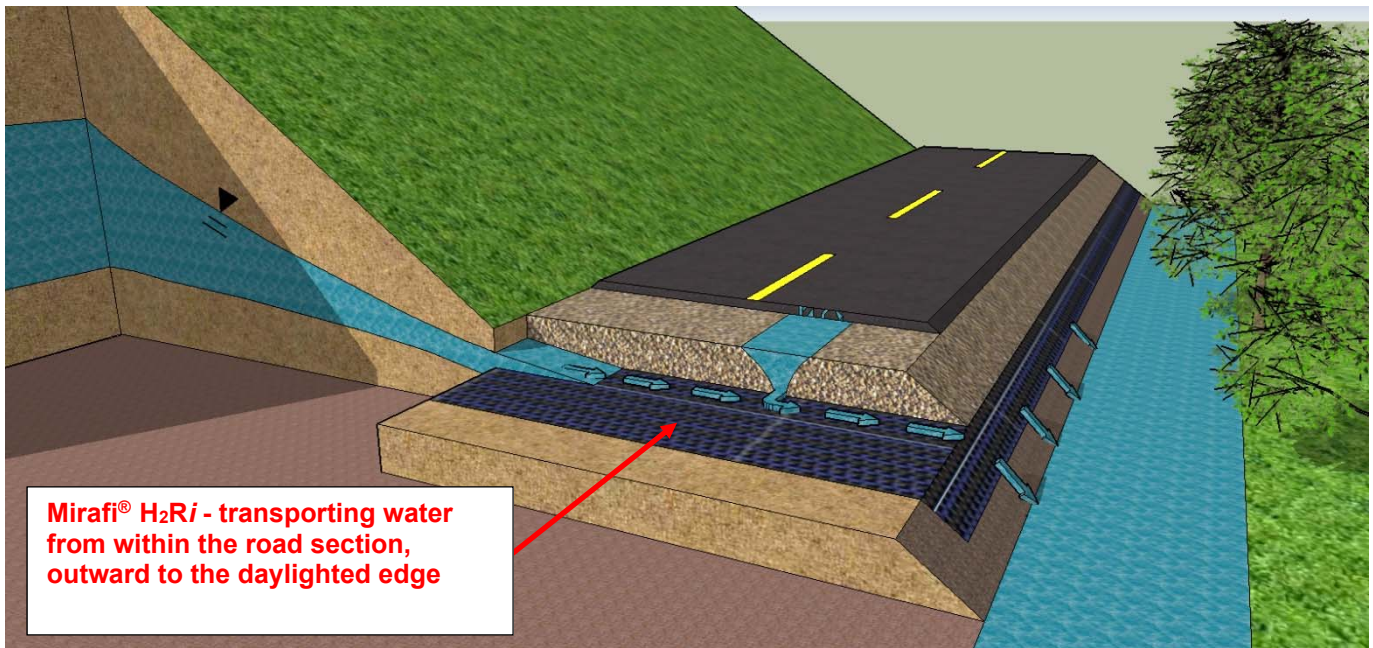
Geosynthetics must be identified, handled, stored and installed in such a way that its physical property values are not affected, and the design conditions are ultimately met as intended. This document does not account for every possible construction scenario. However, this document contains information consistent with generally accepted practices of identifying, handling, storing and installing geosynthetic materials for most roadway applications

## **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<sub>2</sub>Ri 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, 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, in accordance with ASTM 4873.

The product is shipped in a heavy plastic bag or covering to help prevent moisture adsorption before installation. Mirafi® H<sub>2</sub>Ri has an affinity for water, making roll weights increase drastically if the plastic wrap is compromised and exposed to rain or moisture, 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, fire or flames including welding sparks, temperatures in excess of 140° F (60° C), and human or animal destruction.



## Overview

TenCate introduced Mirafi® H<sub>2</sub>Ri continuous moisture management system in February 2012. It has the unique ability to wick water laterally out of unsaturated soils through capillary action (suction) in its fibers. Since its introduction, engineers have sought this moisture movement capability to solve a myriad of problems, such as reducing the moisture content in soils related to capillary rise, high moisture conditions, and surficial water intrusion.

To stay abreast of new information, engineers should stay in contact with their local TenCate representative.

## Placement Location(s)

Placing Mirafi® H<sub>2</sub>Ri layer(s) at the appropriate elevation(s) within the structural cross section is project specific and depends on individual site conditions. The most common location is at the subgrade/base interface within a pavement structure.

Mirafi® H<sub>2</sub>Ri moves water by capillary action. The geosynthetic can wick water without the assistance of gravity approximately 8" (200 mm), depending on temperature, pressure, and humidity. Reliance on uphill moisture movement should be avoided but may occur because of inconsistencies in construction and/or as allowance result of low spots in the subgrade surface.

Generally, Mirafi® H2Ri 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 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. Enhanced Lateral Drainage/Pavement Reinforcement: Place Mirafi® H2Ri 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 modulus and service-life of the roadway.

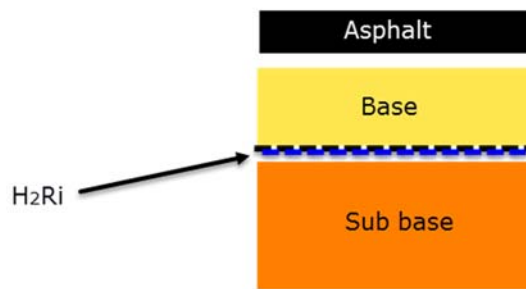


Figure 1 - Aggregate base and sub base

2. Frost Heave: Mirafi® H2Ri should be placed as lower in the cross section (see Figure 1) to reduce the moisture content. In some instances, multiple layers may be warranted. Several projects have been installed with Mirafi® H2Ri 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.

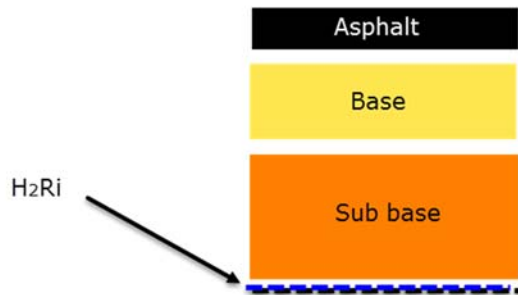


Figure 1 - Subgrade interface

3. Surficial Intrusion: Placement should be as high in the structural section as possible as shown in Figure 3. The Mirafi® H<sub>2</sub>Ri wicking geosynthetic should have a minimum of 6” (150 mm) compacted aggregate coverage. It is not possible to pave directly on Mirafi® H<sub>2</sub>Ri.

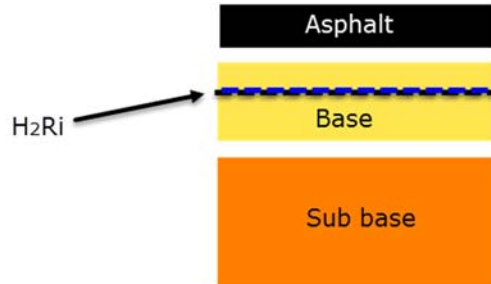


Figure 3 - Close to the pavement structure as possible

### **Geosynthetic Installation/Placement**

Clear, grub and excavate (as required) to the planned subgrade or undercut elevations, stripping topsoil, deleterious debris and unsuitable material from the site. Specialized equipment with low ground pressure, as directed by the Engineer, may be required for very soft soils (CBR  $\leq 1.0$ ) or on “sensitive” subgrade soils to minimize disturbance. 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 – Mirafi® H2Ri Installed Parallel to Planned Traffic Flow Over a Prepared Subgrade

### **Directional Overlap**

Mirafi® H2Ri must be designed into a structural cross section with the appropriate flow direction of the system 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 system that move moisture like Mirafi® H2Ri, it is important to provide a detailed cross-section that clearly shows the overlaps and required gradients of the geosynthetic, to ensure proper installation and optimize performance. Overlapped layers of Mirafi® H2Ri should be shingled in a similar manner to roof tiles, 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 M288-17):

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+)
CBR < 0.5%	Contact your TenCate Representative

*\* Please contact a TenCate representative for recommended sewing practices.*

Mirafi® H<sub>2</sub>Ri is marked with “flow direction” on the packaging to aid in proper installation and placement orientation, as shown in Image 2.

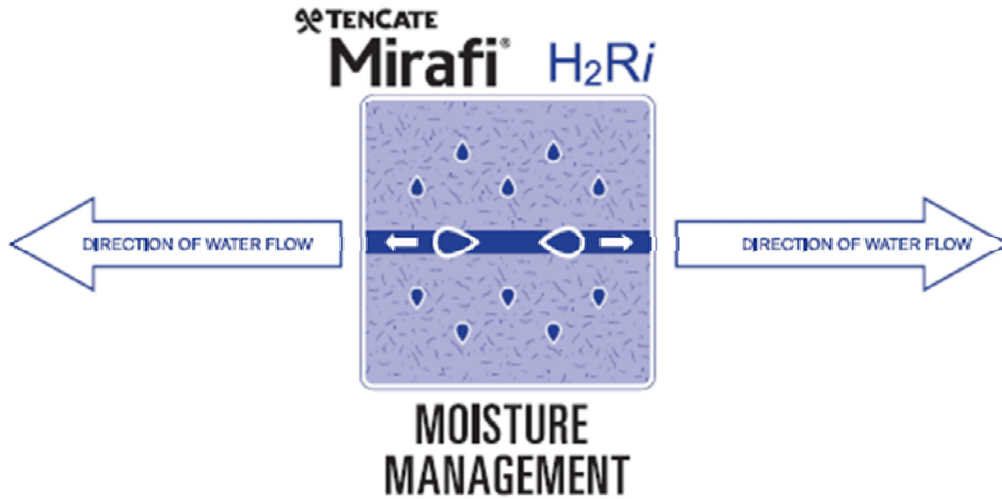


Image 2 - Packaging to Aid Installation Orientation

Mirafi® H<sub>2</sub>Ri is manufactured with laterally oriented wicking fibers that create flow channels to wick water along the cross-machine direction. Water enters these flow channels and moves laterally to the edge of the Mirafi® H<sub>2</sub>Ri 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.

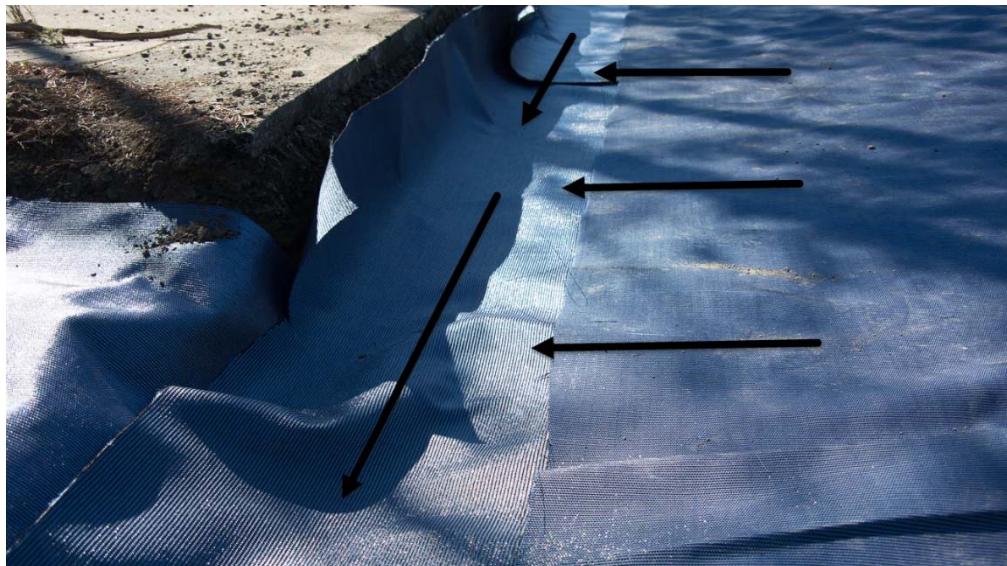


Image 6 - Routing Around Residential Driveway Entrance

### Terminations to Promote Water Removal

**IMPORTANT!** The termination details of Mirafi® H<sub>2</sub>R*i* are critical to the performance of the system. Mirafi® H<sub>2</sub>R*i* is a unique material that will wick water from high moisture conditions to low moisture conditions. If not properly detailed and installed, it is possible for Mirafi® H<sub>2</sub>R*i* to draw moisture into the system creating a negative effect.

1. Traditional – No Outlet: This approach is useful when the moisture content needs to be maintained and distributed evenly across the site subgrade, but not necessarily removed from the pavement cross section. The Mirafi® H<sub>2</sub>Ri is installed like a traditional roadway geosynthetic, without leading into any drainage systems or day lighted areas. Designers can use the directional component of the Mirafi® H<sub>2</sub>Ri to spread out the moisture content uniformly, as shown in Image 7. Typically, moisture sensitive clay subgrade soils can be good candidates for this type of termination.



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 the system 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. If Mirafi® H2R*i* is terminated above a shoulder drainage ditch, care and maintenance of the ditch should be maintained to ensure water does not back up to the level of the Mirafi® H2R*i*. This could include clearing and cleaning of the ditch to ensure proper drainage.

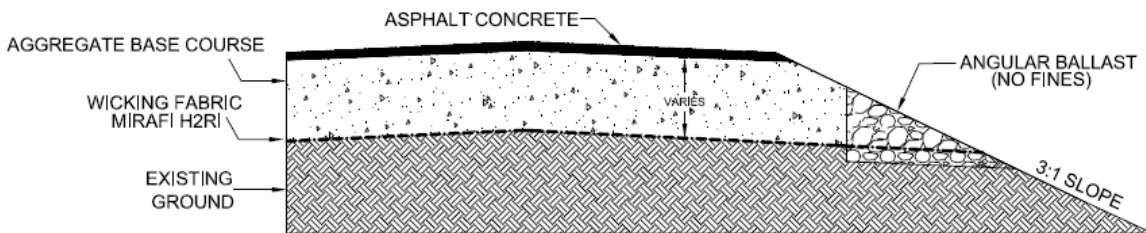


Figure 4a - Detail of Angular Ballast Protection for Day Lighted Installation

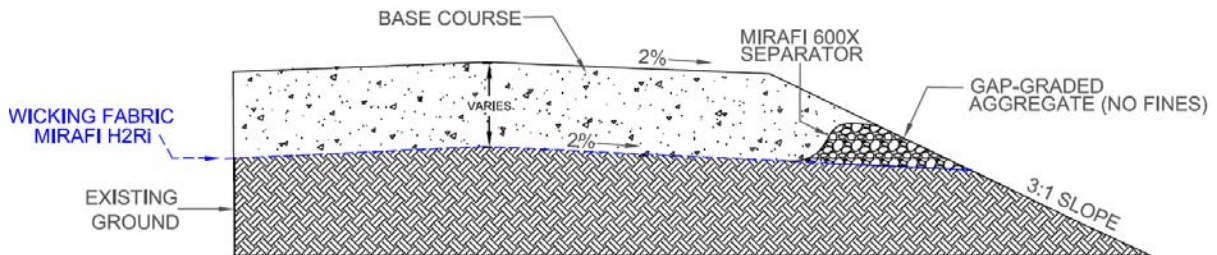


Figure 4 - Detail of Rip Rap Protection for Daylighted Installation

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® H2R*i* at the exterior (along the ditch), as shown in Figure 5. If Mirafi® H2R*i* is terminated above a shoulder drainage ditch, care and maintenance of the ditch should be maintained to ensure water does not back up to the level of the system. This could include clearing and cleaning of the ditch to ensure proper drainage.

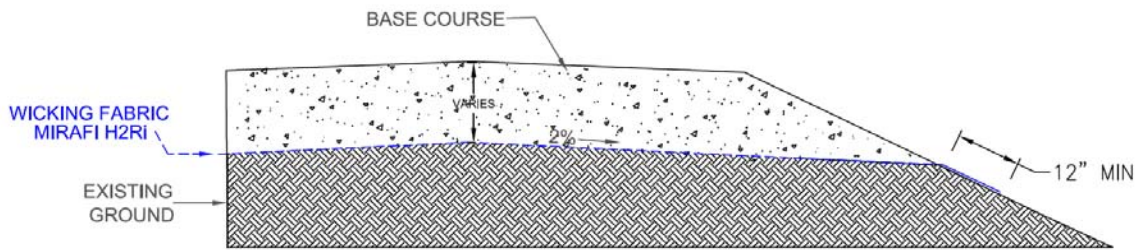


Figure 5 - Detail for Edge Termination into Ditch

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.

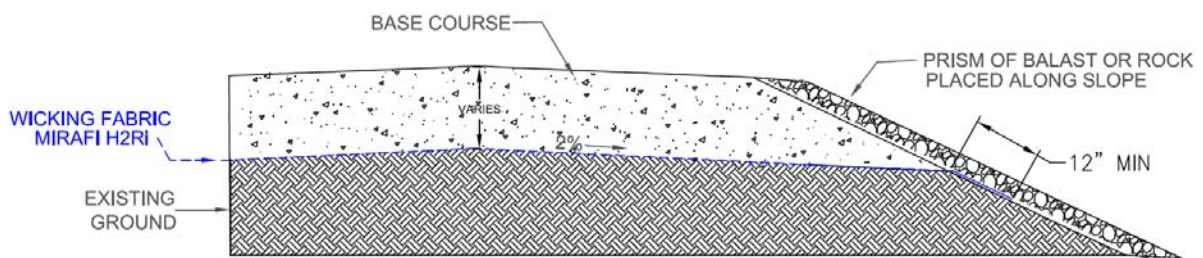


Figure 6 - Detail of Rock Protection for Daylighted Installation



Image 9 - Daylighted Installation Using Rip Rap to Cover the Exposed Edge of Mirafi<sup>®</sup> H<sub>2</sub>Ri.





Image 10 – Moisture Movement 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<sub>2</sub>Ri. 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.

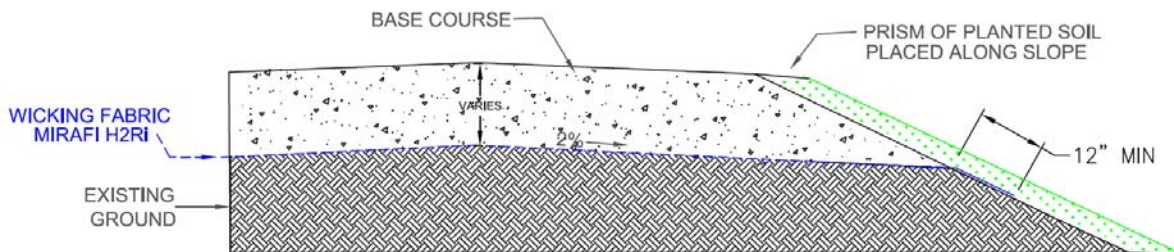


Figure 6 - Bio-Wicking Application Using Plants for Evapotranspiration



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, edge drains are required to daylight water. In this approach the Mirafi® H<sub>2</sub>Ri 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 moisture movement capability of Mirafi® H<sub>2</sub>Ri is approximately 8" (200 mm). When using a sawcut pipe, the Mirafi® H<sub>2</sub>Ri 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.



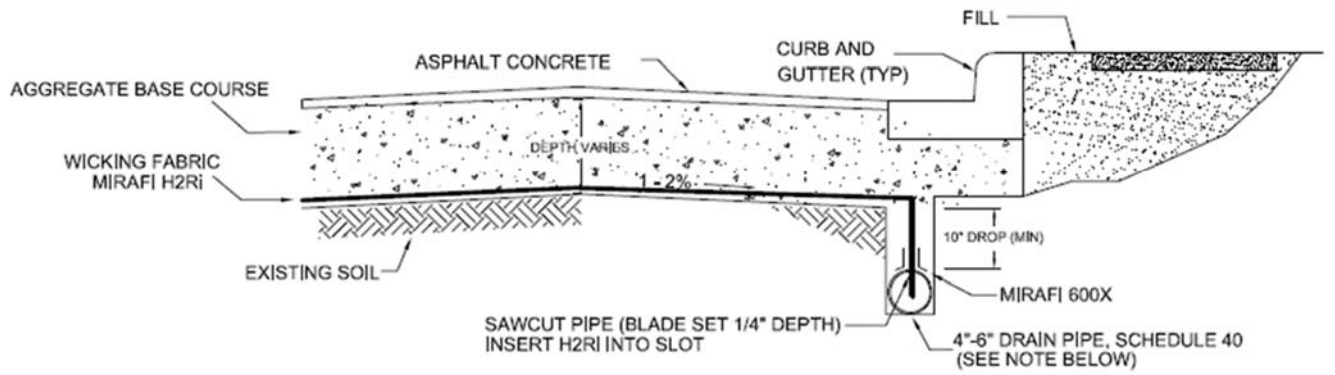


Figure 7a: Piping Detail



Image 12 - Pipe Installation with Separation Geotextile

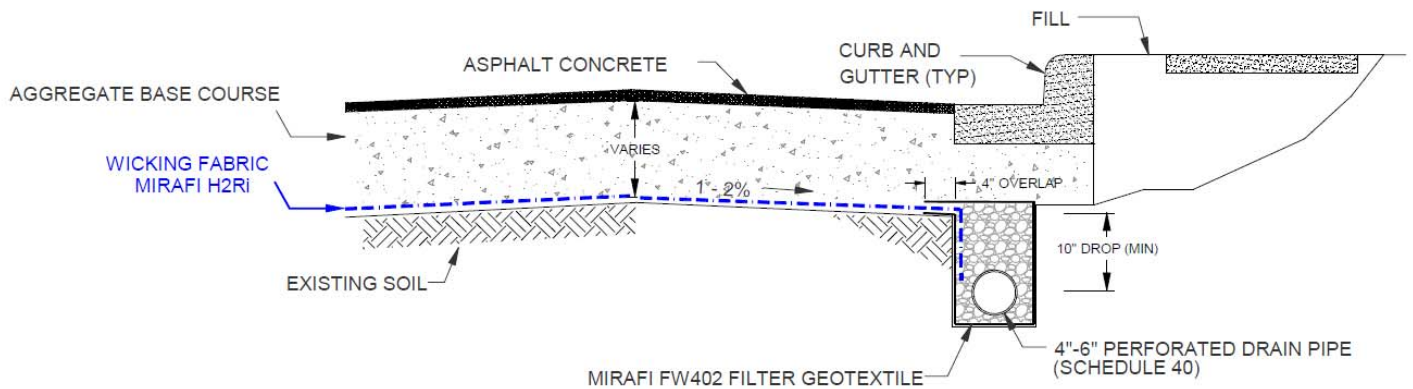


Figure 7b: Alternate Piping Detail

### Fill Placement

Trafficking vehicles directly on or over the Mirafi® H<sub>2</sub>R<sub>i</sub> 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 taught by construction equipment, as shown in Image 16.



Image 16 - Forklift Pulling the Material Taught 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.

### **Installation and Repairs for Utility Cuts or Damaged Areas**

Repairs to the system can be made in the field by placing a repair panel or patch over the damaged area. If the area of the patch is sloping, the patch should be placed under the existing fabric on the upslope side and over the existing fabric on the downslope side to shingle the waterflow down slope. The repair panel should extend a 1 - 3 ft. (0.3m - 0.9 m) beyond the edges of the damaged geosynthetic. Pullout and/or direct sliding calculations should be performed by the project engineer to verify the minimum required overlap length to meet a specific project's requirements.

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