RECREATIONAL FACILITIES

TYPAR GEOTEXTILES

TOUGH OVER TIME

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1.0 FEATURES OF RECREATIONAL FACILITIES

Recreational facilities are used for a variety of purposes, including:

- Sports fields
- Tennis courts
- Swimming pools
- Horse training tracks
- Walking, jogging and bike trails
- Golf course sand traps and greens

Most of these facilities require a specified surface that is not waterproof. Therefore, quick recovery from a rain depends on adequate drainage. In addition, highly specialized surfaces such as sand traps, clay or grass tennis courts, wood chip trails, arena floors, race tracks, etc., must be free from contamination. This calls for both a separation layer and a subgrade drainage system.

Subgrade drainage systems require a properly designed protective filter (usually sand) that prevents the piping of the subgrade soil in the drain and the possible clogging of the drain. Traditionally, graded aggregate filters have been used as protective filters to prevent piping and clogging. These filters are expensive and very difficult to install, making them impractical for all but the most elite recreational facilities.

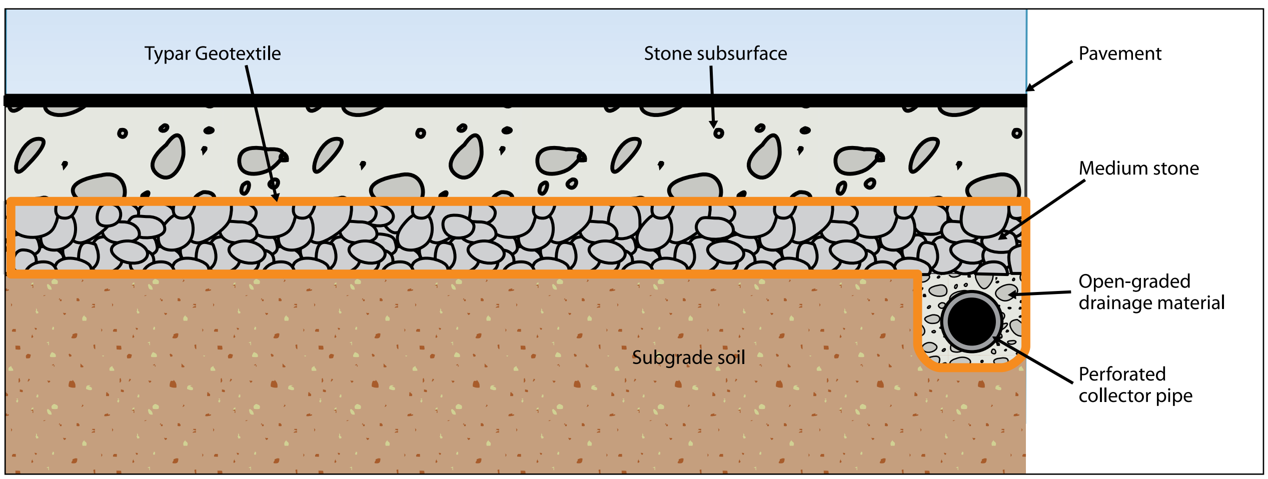

Figure 1: Blanket drain for paved system.

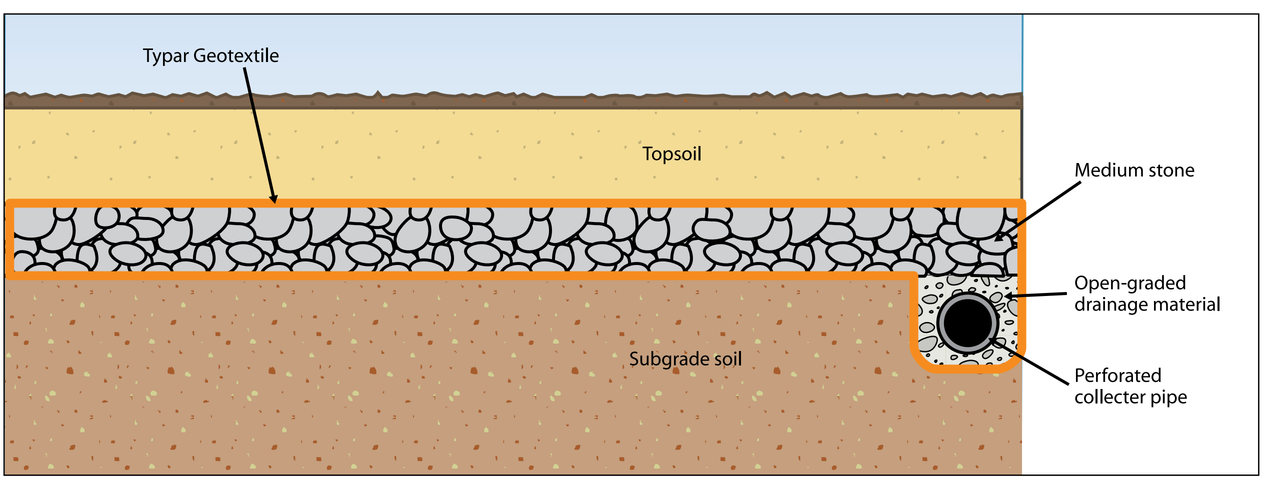

Figure 2: Blanket drain for unpaved system.

SOIL NAME	DIAMETER		US STANDARD SIEVE SIZE	FAMILIAR EXAMPLE
	mm	inches		
Boulders	Over 300	Over 12	> 12”	Larger than basketball
Cobbles (rounded)	76-300	3-12	3-12”	Grapefruit
Coarse gravel	19-76	0.75-3.0	0.75-3”	Orange or lemon
Fine gravel	4.75-19	0.19-0.75	No. 4-0.75	Grape or pea
Coarse sand	2.0-4.75	0.08-0.19	No. 10-No. 4	Rock salt
Medium sand	0.42-2.0	0.016-0.08	No. 40-No. 10	Sugar or table salt
Fine sand	0.074-0.42	0.003-0.016	No. 200-No. 40	Powdered sugar
Silt sizes	0.002-0.074	0.0008-0.003	Rock flour and finer; particles cannot be distinguished with naked eye at distances of 20cm (8”).	
Clay sizes	< 0.002	< 0.00008		

Figure 3: Soil description based on typical grain size.

Typar geotextiles offer many advantages over graded aggregate filters:

- Eliminate the need for costly, well-graded sands and aggregate
- Add long-term stability
- Permit faster, simpler and more economical construction
- Eliminate the need for drain pipes in some cases
- Minimize soil piping and the potential for drain clogging
- Preserve the integrity of the surface material, reducing maintenance costs
- Are permeable, tough, durable and chemical resistant

2.0 HOW TYPAR GEOTEXTILES WORK

Typar geotextiles stabilize and strengthen the surface and drain materials of recreational facilities by providing a separation layer between the surface material, aggregate base and subgrade. This prevents intermixing and maintains the integrity of the aggregate base and surface material over the long-term.

In addition to separation, Typar geotextiles create a permeable layer that promotes subgrade soil drainage, and preserves the drainage capability of the aggregate base layer. Yet while Typar’s high water permeability lets water through, it restrains fine subgrade soil particles due to the small size of its openings. This protects the drainage system from clogging and prevents the surface material from being lost into the subgrade or the drainage system.

3.0 DESIGN CONSIDERATIONS AND SELECTION OF GEOTEXTILES

The primary function of the geotextile in recreational facilities is filtration. The design of recreational facilities using geotextile separators requires the evaluation of two criteria:

- Retention criteria that ensures the geotextile openings are small enough to prevent migration of soil particles (piping).
- Permeability criteria that ensures the geotextile is permeable enough to allow liquids to pass freely though. “Permeability” of a geotextile is measured by way of its permittivity (or cross-plane flow rate).

3.1 RETENTION STANDARD

Soil identification based on grain size is a useful indicator of the soil behavior when filtered by a geotextile. The selection of a geotextile is normally based on the percent of the in-site-specific soil passing through a 0.075 mm sieve (No. 200 sieve). Figure 6 describes the different types of soil based on typical grain size.

3.2 PERMEABILITY STANDARD

The default geotextile selection is based on the simple premise that permeability of the geotextile is greater than permeability of the soil based on the predominant particle size of the soil. All grades of Typar geotextiles are more permeable than clean well-graded sand and gravel (Figure 5 and Figure 6).

3.3 SELECT THE GEOTEXTILE

AASHTO M288 is the applicable specification for the use of geotextiles for subsurface drainage, allowing for the long-term passage of water into a subsurface drain system while retaining the soil. Selection of the appropriate geotextile or Typar style is dependent on the subgrade soil.

MAJOR DIVISIONS	SUBDIVISIONS	TYPICAL NAMES	LABORATORY CLASSIFICATION CRITERIA
Coarse-grained soil (More than 50% retained on No. 200 sieve)	Gravel (More than 50% of coarse fraction retained on No. 4 sieve)	Well-graded gravel or gravel-sand mixture, little or no fines	Less than 5% fines*
		Poorly-graded gravel or gravelly sand, little or no fines	Less than 5% fines*
		Silty gravel, gravel-sand-salt mixtures	More than 12% fines*
		Clay-like gravel, gravel-sand-clay mixtures	More than 12% fines*
	Sand (50% or more of coarse fraction passes through No. 1 sieve)	Well-graded gravel or gravelly sand, little or no fines	Less than 5% fines*
		Poorly-graded sand or gravelly sand, little or no fines	Less than 5% fines*
		Silty sand, sand-silt mixtures	More than 12% fines*
		Clay-like sand, sand-clay mixtures	More than 12% fines*
Fine-grained soil (50% or more passes No. 200 sieve)	Silt and clay (Liquid limit less than 50)	Inorganic silt, rock flour, silt of low plasticity	Inorganic soil
		Inorganic clay or low plasticity, gravelly clay, sandy clay	Inorganic soil
		Organic silt and organic clay or low plasticity	Organic soil
	Silt and clay (Liquid limit 50 or more)	Inorganic silt, micaceous silt, silt of high plasticity	Inorganic soil
		Inorganic, highly plastic clay, fat clay, silty clay	Inorganic soil
		Organic silt and organic clay or high plasticity	Organic soil
Peat	Highly organic	Peat and other highly organic soil	Primarily organic matter, dark in color and organic color

Figure 4: Unified soil classification system sieve.
Courtesy of McGraw Hill and Robert W. Day, Soil Testing Manual, pg. 81.

*Fines are those soil particles that pass the No. 200

SOIL TYPE	PERMEABILITY COEFFICIENT K (CM/SEC)
Uniform coarse sand	0.4
Uniform medium sand	0.1
Clean, well-graded sand and gravel	0.01
Uniform fine sand	0.004
Well-graded silty sand and gravel	0.0004
Silty sand	0.0001
Uniform silt	0.00005
Sandy clay	0.000005
Silty clay	0.000001
Clay	0.0000001
Colloidal clay	0.000000001

Figure 5: Typical permeability of soil types.

Use Figure 7 as a guide to select the appropriate Typar geotextile. The engineer should always refer to the full AASHTO M288 specification for final selection of the geotextile.

4.0 INSTALLATION GUIDE

Successful use of geotextiles in recreational facilities requires proper installation. Follow the sequence of installation in Figure 8 for general construction guidelines for trench drains. See Sections 4.1 – 4.4 for more in-depth application instructions.

	PERMITTIVITY (D4491) sec^{-1}	PERMEABILITY (D4491) cm/sec	WATER FLOW (D4491) gal/min ft^2	APPARENT OPENING SIZE (MAX) (D4751)	
				mm	US Sieve
TYPAR 3801	0.1	0.01	8	0.09	170
TYPAR 3631	0.2	0.01	20	0.10	140
TYPAR 3601	0.1	0.01	15	0.10	140
TYPAR 3501	0.5	0.03	50	0.20	70
TYPAR 3401	0.7	0.03	60	0.21	70
TYPAR 3341	0.7	0.03	85	0.25	60
TYPAR 3301	0.8	0.03	95	0.30	50
TYPAR 3201	1.0	0.03	190	0.59	30
TYPAR 3151	1.5	0.04	235	0.84	20
Note: The ability of a geotextile to pass water is indicated by the permittivity–therefore it should be used to compare the ability of various types (needlepunched, SRW, and heatbonded), NOT PERMEABILITY. For comparisons, permittivity of fabrics should be measured UNDER_LOAD. See ASTMD-4491. To get permeability, you multiply permittivity by the fabric thickness. Therefore, if the fabrics pass the same amount of water and one is twice as thick, it will appear to pass water twice as fast which could be misleading.					

Figure 6: Hydraulic properties of Typar Geotextiles (Minimum average roll values except AOS).

IN SITU SOIL PASSING .075 mm (No. 200 sieve)	MINIMUM PERMITTIVITY sec^{-1}	MAXIMUM AOS mm	TYPAR GEOTEXTILE SELECTION AASHTO M288 CLASS						
			-	-	3	2	1	1	1
<15%	0.5	0.43	3301	3341	3401	3501			
15% - 50%	0.2	0.25		3341	3401	3501		3631	
>50%	0.1	0.22			3401	3501	3601	3631	3801

Figure 7: Selection of TYPAR Geotextiles (Adopted from AASHTO M288).

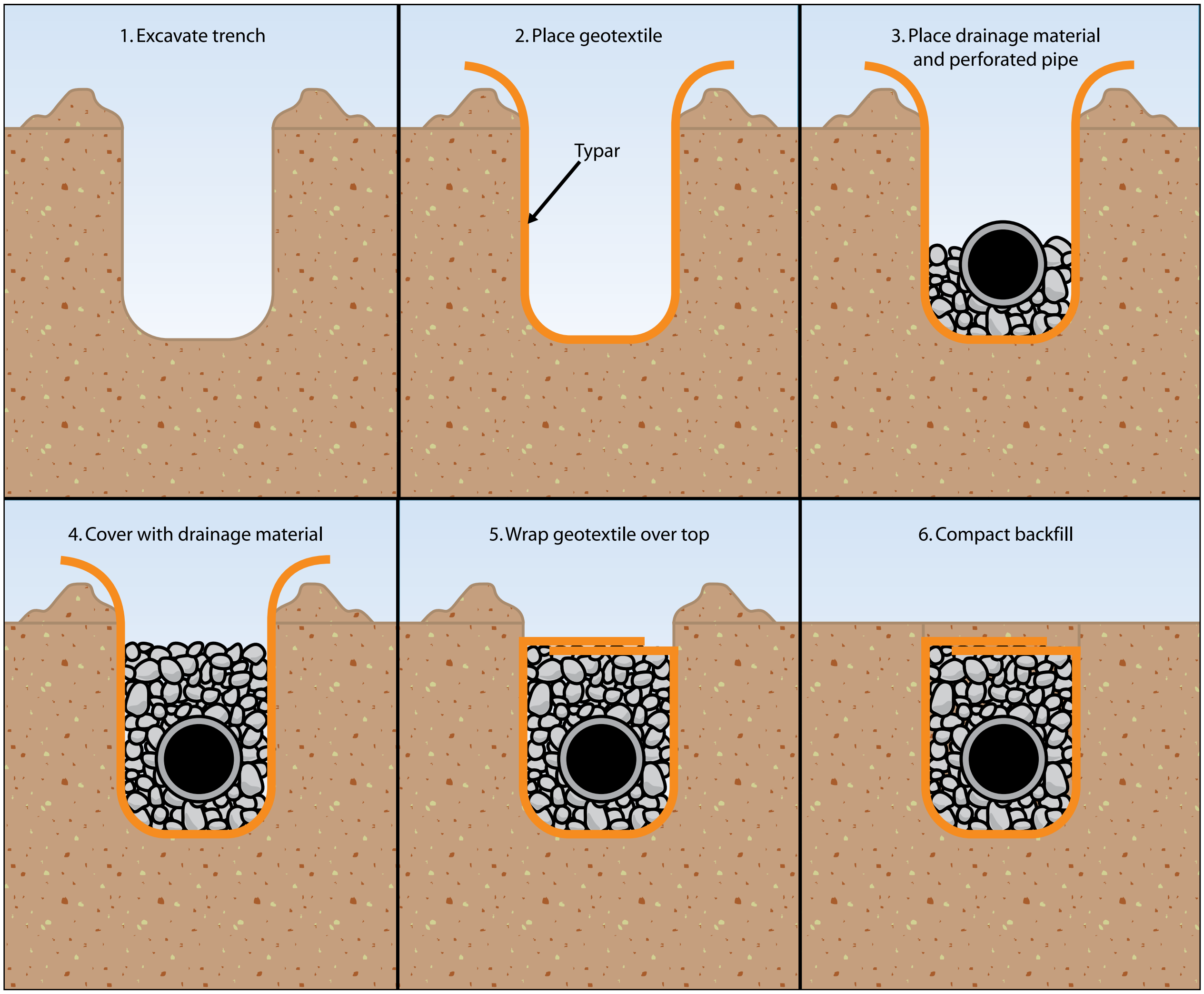

Figure 8: Installation guide for underdrain construction.

4.1 SWIMMING POOLS

Swimming pools can float out of the ground as the ground becomes saturated with water. The primary design consideration for these facilities is that the blanket drains shown in Figures 1 and 2 are sized to cope with maximum rainfall. The steps in constructing a typical drain for pools are as follows:

1. Excavate to the dimensions of the pool plus three feet deeper.
2. Line the walls and bottom of the excavation with a Typar geotextile.
3. Place and compact 6 inches of drainage stone.
4. Place perforated pipe on 2-foot centers and connect it to the gravity drain.
5. Place and compact remaining 30 inches of drain stone.
6. Lay Typar over entire area. This separation layer prevents the concrete at the base of the pool from entering the drain stone.
7. Construct pool.
8. Fill space between the pool walls and Typar with at least 3 inches of drain stone.
9. Pour access pad around pool.

Specific details must be verified for a specific installation by a qualified designer.

4.2 TRAINING TRACKS AND RACE TRACKS

Many horse training tracks and race tracks use the blanket drain construction concept. (This blanket drain concept can also be applied to tennis courts). A collector drain (Figure 9) runs around the margin of the infield, while the base of the blanket drain slopes a minimum of 3 degrees toward the infield as shown in Figure 10. This type of facility requires a two-fold consideration. You must size the drain capacity for a 20-year storm, and size the depth of the stone to support the running surface plus the wheel loads of maintenance vehicles.

Typar has been found to be an ideal material for this application. One construction tip for placing the drain stone is to first construct a temporary haul road around the outside edge of the track, which allows the passage of heavy rock trucks. Lighter equipment then uses the haul road as a stockpile and spreads the stone.

4.3 BASEBALL DIAMONDS

Generally, all baseball diamonds have the same problems: compaction, drainage, turf quality, and footing. The majority of the problems occur in the infield section, the main area of play. A subgrade blanket and trench drain system as shown in Figure 5 will provide fast drainage after heavy rainfalls and permit quicker use.

4.4 SAND TRAPS

The contamination of the imported sand in traps or bunkers by the surrounding subgrade soil represents a major problem for the golf course greens keeper. Another problem is that traps and bunkers retain water after heavy rains, requiring the greens crew to pump out the water.

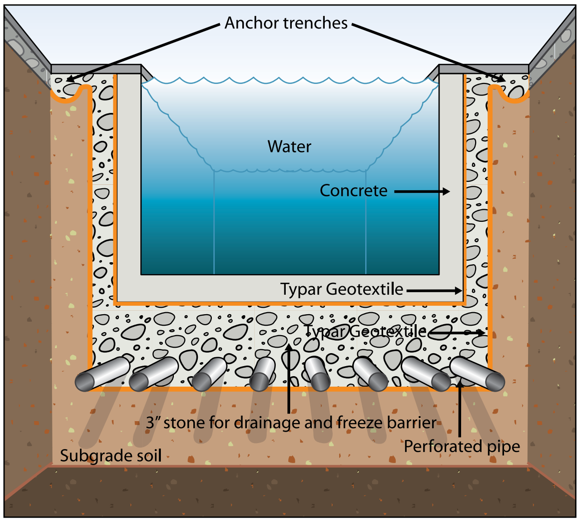

Figure 9: Swimming pool application.

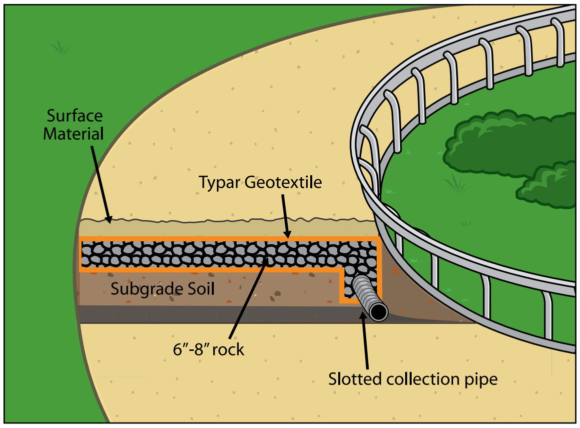

Figure 10: Blanket drain application for horse training tracks and race tracks.

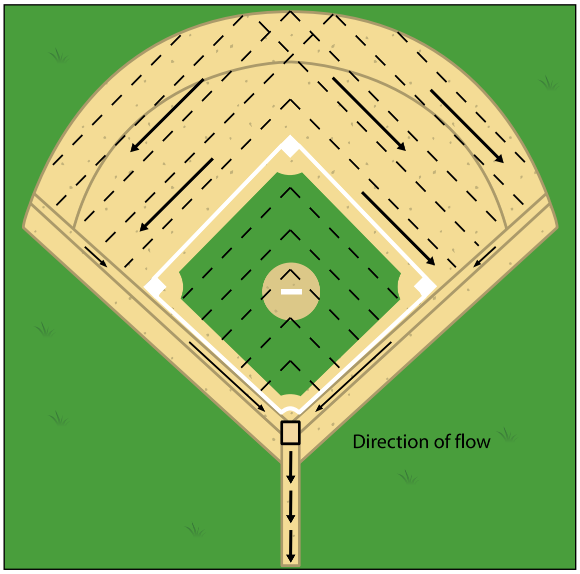

Figure 11: Subgrade drain system for baseball diamond.

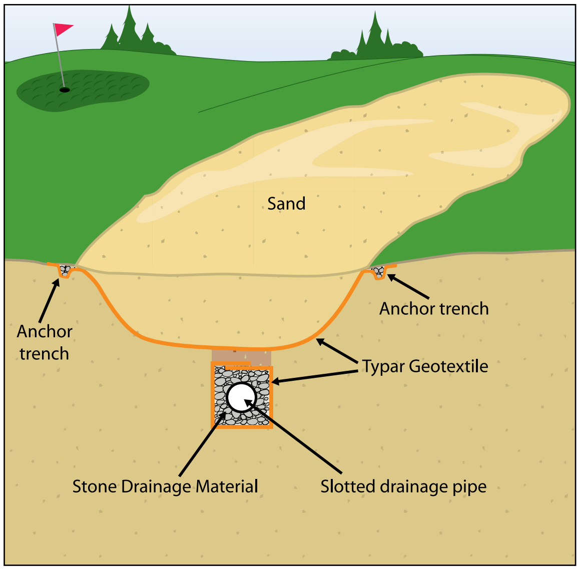

Figure 12: Combination underdrain and liner system for sand traps.

Using Typar to separate the sand from the subgrade soil and constructing a trench drain system solves these problems. Figure 12 illustrates how this is accomplished.

5.0 OVERLAP AND JOINING

Overlaps provide continuity between adjacent geotextile rolls. Sufficient overlap is required to prevent fabric separation during backfilling. A minimum overlap of 12 inches is recommended.

Pins or piles of stone or sand may be used to maintain geotextile overlaps during installation. Geotextile overlaps at the end of rolls should be in the direction of the aggregate placement with the previous roll on top.

6.0 SETTING SPECIFICATIONS

Specifications should generally follow the design considerations in sections 3.0 to 3.3. Primary considerations include the minimum geotextile requirements for design retention, filtration and survivability.

For subsurface drains, the engineer should specify an AASHTO M288 Class of geotextile as follows:

AASHTO M288 Class 1 or TYPAR 3631,
AASHTO M288 Class 2 or TYPAR 3501, or
AASHTO M288 Class 3 or TYPAR 3401.

Additional requirements should reference the AASHTO M288; i.e. "for certification, sampling, testing and acceptance, shipment and storage requirements of AASHTO M288."

When specifying Typar geotextiles for recreational facilities, specify the appropriate Typar grade with the confidence that all Typar geotextiles are manufactured to the high quality standards required by the recreational facilities industry.