土手と湿地帯の植生はファイバーロールによって修復されたリトルシダークリーク。クリエイティブ ハビタッツ スベン ホイガー社＆ベストマン グリーン システム ロサー ベストマンが技術を提供した
The streambanks were regraded and stabilized with "fiberolls" and wetland plantings.
Sven Hoeger of Creative Habitats and Lothar Bestmann of Bestmann Green Systems provided plant materials and technical expertise.

アメリカのランドスケープ・レストレーション（景観の修復）とエコロジカルプランニング

アンドロポゴンのケース

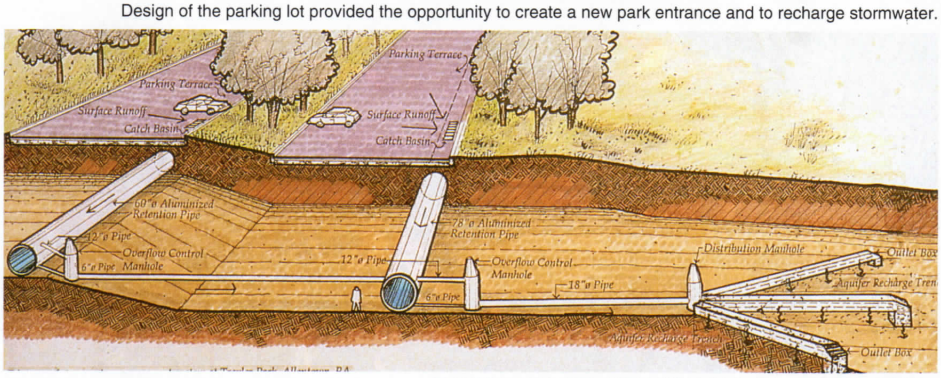
資料・写真提供／アンドロポゴン・アソシエーツ
構成・翻訳／岩田明子

Ecological Landscape Planning, Design, and Restoration

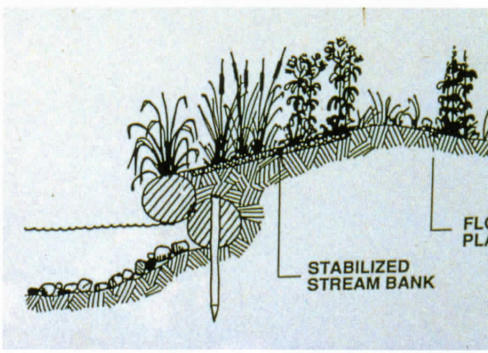
Presented by Andropogon Associates,Ltd.
Plan & Japanese Translation by Akiko Iwata

駐車場のデザインが、新しい公園のエントランスと雨水管理の両方の機能を果たす
Design of the parking lot provided the opportunity to create a new park entrance and to recharge stormwater.

貯水溝のパイプへの排水溝のディテール
Detail of inlet to storage pipes.



雨水管理システムの図。地下の岩盤は水に溶けやすい石灰岩に配慮し、
パイプとトレンチのネットワークが雨水を徐々に土壌に放出する
Diagram of stormwater management system. The bedrock geology is soft limestone easily dissolved in water.
Therefore, a network of pipes stores stormwater and slowly disperses it into the soil.



ファイバーロールとカーペットによる土手の安定化。
ファイバーカーペットによるマスの生息しやすいポケットを作る土手
Stabilized bank with fiberoll and fibercarpet.Undercut bank
with fibercarpet.

トレクスラー・メモリアルパーク

地域の住民に親しまれ人々の利用度の高いこの公園は、都市にある多くの公園が直面している問題、公園周辺地域の土地利用の変化、公園利用自体の変化、都市化の影響を受ける水域からの公害物質を含んだ雨水の流入による水質や植物生態への大きなダーメジなど、様々な問題を抱えていた。1988年にアンドロポゴンは公園のマスタープランをアレンタウン市から受けた。このプランの焦点は、各種の環境問題の解決の他、地元のランドスケープアーキテクト、J. フランクリン・ミーアンが1920年代にデザインした英国田園調デザインの歴史的価値の評価と修復であった。

マスタープランには、新しい公園のエントランス、駐車場、湖のリニューアルと新しい橋の導入が含まれた。これらのデザイン一つひとつが公園内の雨水管理、河川の管理、動植物の生態の改善を導くよう配慮された。

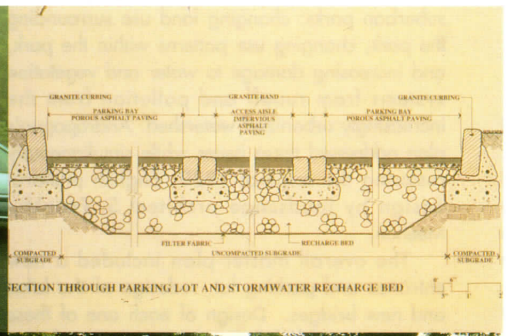
アレンタウン市がつくった排水溝は、市内に降る雨のほとんどを小川に流出させていた。都市からの雨水がパイプを通り小川の下流にすばやく大量に流し込まれるため、上流から流れ込む自然の雨水が下流にいく手前でダムのように溜まってしまっていた。流れきれない水は土手を越えてそのあたりは洪水状態になっていたのである。その状態が長引くにつれて土手の浸食は進み、沈殿物が水路をふさぎ、小川の幅は広がり、深さはどんどん浅くなっていったのである。

この公園内のリトルシダークリークには、野生のブラウントラウト（マス）が多く生息し、水質を保全するようAクラスに指定されている。激しい浸食を受けた土手と沈殿物により幅広く浅くなった小川の水温は上がり、マスの生息が激減していた。このプロジェクトの水環境の修復の目標は以下に挙げると、①土手の強化と安定化、②マスのための水環境の改善、③水管理の不足によりみすぼらしくなった水路の田園的風景とともに平穏な雰囲気を持つランドスケープへの修復、④増水域内に生息する動植物の種類の増加、⑤下流の水環境悪化を防止するための増水時の貯水の管理。

これらの目的を果たすためにアンドロポゴンでは既存の3つのゾーンを見直すため、増水域に重点を置いた。①水路と土手、②増水域の段丘、③逆流水路と窪地である。

逆流した水が流れる水路の突端部分には貯水用の水たまりをつくり、増水を素早く吸収するように漏斗型にした。これらのゾーンを安定すべく植栽がなされ、表面に凹凸を増やし、走る水の早さを弱めるように考えた。

土手の浸食の問題を解決するため、アンドロポゴンはSven Hoeger of Creative Habitats, Inc. And Lothar Bestmann of



左：雨は中央の通路の通常のアスファルトを流れ、両側の駐車エリアの多孔性アスファルトに吸い込まれる
Rain runs off the regular asphalt in the center aisle and disappears into the porous asphalt parking bays on either side.

右：図2 駐車場の地下の基礎構造
Diagram of recharge bed in the parking lot.

左：水は格子状に穴のあいた面を流れるので、この小さな橋の上では水があふれたり溜まったりすることはない
Because water washes over and through its grate-like road bed and open sides, this small bridge does not impede the flow of floodwaters.

右：新しい道路のデザインのポイントは、この地域特有の丘陵と広々とした谷間の空間的体験の演出であった。芝生のオープンスペースをカーブしていくこの道路の眺めは、この樹木園のもっとも美しいシーンの一つである
The key to the design of the new road was an alignment which would dramatize the topography and spatial experience of the broad, open valley. The view of the road curving across the meadow has become one of the Arboretum's most beloved vistas.

左：この小道の優雅なラインが散策する人々にランドスケープをより楽しませる
The graceful lines of this path complement the landscape through which it travels.

右：利用者はビジターセンターでリラックスし、案内図を見る
Visitors can relax and plan their journey at the Visitor Center.

って人々の気持ちを準備させ、ドラマティックな状況を提供する。道路は入場者を様々な樹木園のランドスケープに触れさせ、その新しいシークエンスは広々とした芝地と森林の歴史的な文脈を再認識させる。

新しいビジターセンターとなるワイドナー教育センターは、自然景観のエリア、ヴィクトリアンガーデン、エステイトパーク、田園的ランドスケープなどの様々なタイプのランドスケープの交差点として機能する。それはちょうど樹木園のすべての建物が丘の峰に沿って存在しているようにである。昔のコンプトンマンション（Compton mansion）の馬車小屋であったこの建物は、以前の入場玄関とともにビクトリア朝風のコンサバトリーのアイデアの一つとして既存の建物から建築的な統一感を持ってデザインされたものである。

この建物のように、新しい駐車場はメインの丘の上に計画され、樹木園のワイドナー教育センターと管理事務所ビルの主な2つの建物をつないでいる。新しい駐車場は昔のコンプトンマンションに向かう正式なエントランスでもあり、ちょうど回り込んだところに設置された。丘の頂上に位置する駐車場は、丘の上からそれぞれの側の低い部分にはめ込まれており、公園の利用者からガーデンに向っては駐車場が隠れ、視野に入らないよう配慮された。

新しい駐車場の設計は既存の丘陵と樹木園のコレクションである樹木を注意深く考慮したうえでなされた。排水の管理のため、駐車場はテラスのようにデザインされた。このテラスの間の歩道は駐車場から入場者を主な施設へ導く機能を果たしている。駐車場は雨水が多孔性のアスファルトとその下の基礎地盤を通して自然に地下に吸収されるようにデザインされた。図2は駐車場の下の基礎構造を示している。

この雨水管理のプランでは多孔性舗装は単に一つの製品として使用されているわけではなく、大きなシステムの一部である。アンドロポゴンはケイヒルアソシエーツとともにこのシステムをデザインした。この2つの事務所は20年以上もともに新しい雨水管理の技術を開発してきている。車やバスが通行する交通量の多いアクセス道路は通常のアスファルトである。車が止められるだけの駐車場の場所は荒い材料を使った多孔性のアスファルトを使用する。多孔性アスファルトと不浸透のアスファルトのつなぎ目のラインには2列のストーンブロックを使った。激しい雨のとき、駐車場の水は多孔性の舗装に吸い込まれる。通常のアスファルトでは水たまりができるのに比べて、雨が降って水が地面に吸収されていくプロセスは美しいものである。

この駐車場は、雨水が吸収されていく自然のサイクルをモデルとして技術的にデザインされた。雨水を集める機能を果たすテラス状の駐車場は、見た目にもエレガントなデザインとして実現され、同時に雨水を吸収する多孔性の舗装はサスティナブルデザインの視覚化にも成功したといえよう。

Ecological Landscape Planning, Design, and Restoration

Andropogon Associates, Ltd. in Philadelphia, Pennsylvania, USA is a landscape architectural first practicing ecological planning and design. As a first their philosophy is to effect fundamental change in the treatment of landscapes by demonstrating ecologically sound alternatives to conventional practices. Andropogon makes a habit of restoration in its work and has extensive experience in the adaptive reuse and renewal of natural, urban and derelict landscapes in a wide range of contexts. Throughout their 25 years in practice Andropogon has had a particular interest in integrative water management into their designs. Increased runoff from development is one of the most pervasive problems in the landscape today. The engineering paradigm for drainage is to concentrate flow and velocity and carry water away from the place where it falls as quickly as possible. Conventional stormwater management relies heavily on curbs, pipes, inlets, dams, riprap, dete tion basins, and other "hard" engineering solutions.

Sustainable design solutions do not deal with single-focus goals, such as flood control or erosion control, but rather looks at the management of the whole resource. For example, all water, including wastewater, is treated as a resource - not as a problem - and is managed as a crucial component of the larger water system and is integrated into the whole site design. This approach finds solutions based on models that replicate the natural hydrology of a site.

Drainage solutions will then reduce runoff and maximize infiltration in the uplands, restore or maintain stream baseflow, provide groundwater recharge, and reestablish stream channel stability, regardless of the strength of the storm event.

Technologies such as "porous paving," which Andropogon has used in one of the foster infiltration and the reduction of contaminants, reinforcing natural functions.

Andropogon also has pioneered a participatory process that builds consensus among the many disparate individuals who impact the landscape and promotes a creative partnership between people and their environment. As each environment is different, so are the needs of each client. Their approach seeks to clarify critical issues to produce appropriate solutions that successfully integrate the needs of the client with those of the community and larger environment. Andropogon's goal in ecological planning and design is to weave together the landscape of man and nature for the benefit of both. Committed to environmental education, Andropogon's partners and staff also teach at the university level and are involved in public forums, workshops and conferences.

Trexler Memorial Park
Allentown, Pennsylvania

In 1988 Andropogon Associates was retained by the city of Allentown to develop a master plan for Trexler Memorial Park. The park, a heavily used and much appreciated regional amenity, faced problems that are typical of many urban and suburban parks: changing land use surrounding the park, changing use patterns within the park, and increasing damage to water and vegetation systems from runoff and pollution from the increasingly urbanized watershed. Andropogon's plan addressed these issues while simultaneously restoring the original 1920s English pastoral design by landscape architect S. Franklin Meehan.

The overall master plan included a new entrance and parking lot, redesign of the lake, and new bridges. Design of each one of these elements provided the opportunity to recharge stormwater, control flood damage, and enrich the plant and animal habitats in the park.

A stormwater outfall built by the city channeled precipitation from much of the urban portions of Allentown into the stream.

This water moved rapidly through pipes into the lower stream, arriving before water from the rest of the watershed swelled the upper part of the stream. As a result, water from the outlet formed an "hydrolic dam," trapping the floodwaters moving downstream. Floodwater eventually jumped the stream banks and flooded the valley. Over time, as the stream banks eroded and sediment filled the channel, creating a wider and shallower stream channel.

This stream, called Little Cedar Creek, is a class "A" front stream with a significant population of wild brown trout. With severely eroded banks and a wider and shallower channel, the stream had warmed and the trout habitat was rapidly disappearing. The goal of the stream restoration project was:

1. To reinforce and stabilize the stream bank.
2. To upgrade the aquatic environment for trout.
3. To restore this degraded and unsightly stream corridor to a sense of pastoral tranquility
4. To provide a much richer variety of habitats within the floodplain.
5. To provide additional flood storage in the floodplain to prevent further degradation of the channel downstream.

To achieve these goals, Andropogon Associates regraded the floodplain to accentuate the natural features of the stream corridor.

1. Stream channel and banks.
2. Floodplain terrace.
3. Backwater channels and depressions within the floodplain.

The backwater channels with retention puddles at their head exaggerate the path of the floodwaters and were created to funnel stormwater from the stream into the floodplain where it would be absorbed. Planting reinforces the geometry of these zones and decreases the coefficient of runoff by increasing "roughness." How do the back channels connect with the stream?

To solve the problems of streambank erosion, Andropogon Associates worked with Sven Hoeger of Creative Habitats, Inc. and Lothar Bestmann of Bestmann Green Systems. Bestmann, a German engineer, invented a system of herbaceous bioengineering. At Trexler, Bestmann and Hoeger designed two solutions to stabilize the streambanks with two products that Bestmann designs and produces - "fiberolls" and "fibercarpets."

Fiberolls are 20 foot long sections of rolled coconut fiber matting that look like giant sausages and are held together by nylon netting. They provide a flexible, stable medium for plants to grow in. The coconut matting deteriorates slowly, providing an interim substrate for the young herbaceous plants. The fiberoll holds the stream bank and traps sediment until the plants are mature enough to root into the bank. Fiberolls are installed half submerged in the water at the bottom of the bank and staked. In Little Cedar Creek, the fiberolls were undulated one above the other to create small shady pockets for trout within the banks. These pockets formed protective niches for trout to lurk in and created eddies which trapped their prey.

Fibercarpets are custom grown wetland sods on a coconut fiber substrate - 3feet wide and 20 feet long. These fibercarpets are unrolled onto a prepared planting surface and butted right up against the fiberolls to prevent erosion at the top of the bank. The carpets are staked and tied with sisal cord on a crisscross pattern.

The rebuilt banks returned the channel to a section closer to its original configuration. To further narrow the channel, local rocks placed on coconut fiber matting were carefully placed in a waffle pattern. The result is a colder, more swiftly flowing stream with ample habitat for caddis and mayflies.

Sustaining a healthy stream and diverse native plant communities over the long term required retrofitting current park drainage systems as well as streambank stabilization. Andropogon's design for the parking lot also incorporates a new system for managing stormwater runoff. Runoff drains into a network of underground retention pipes and recharge trenches which slowly release the water into the soil mantle. This greatly reduces erosion and flooding of adjacent park landscapes and recharges the runoff into the aquifer. The recharge also sustains the base flow in Little Cedar Creek, a trout stream that runs through the park.

Nikko Kirifuri Resort Master Plan
The Ministry of Posts and Telecommunication
Nikko City, Tochigi Prefecture, Japan

Andropogon Associates was the landscape architect and site designer for a new resort hotel and spa complex, located in a mountainous area of Japan, adjacent to Nikko National Park. Although spectacular in its beauty, the natural site posed serious environmental challenges - complex land forms, steep slopes, highly erodible soils, and sensitive woodlands.

Andropogon worked closely with a Japanese and American team, including architects and engineers, to develop an ecological site plan that balanced site development with conservation. Andoropogon's role as landscape architect included siting the buildings, designing a storm water management system which utilized a series of ornamental ponds, designing pedestrian and vehicular circulation, replanting the site with rescued trees and shrubs, and restoring the woodlands and the stream disturbed during construction.

Nikko Kirifuri Resort was designed to suggest a

rural Japanese village within a misty forested setting. The intent of the site plan was to reinforce this theme by fitting the new facilities to the site in a sympathetic manner, minimizing intrusion in the landscape, and setting the buildings in a context of natural woodlands.

Stormwater Management

At this Japanese resort complex Andropogon Associates designed a series of three ornamental ponds to hold stormwater runoff from the access road, parking lots, and hotel roof. A small rocky upper basin filled with willows dissipates the intensity of the water discharged from pipes, settles out silt, and filters other pollutants. A lower basin provides storage for a twenty-five-year flood. The water from this lower basin is used to supply a third pond, closest to the hotel. This pond is connected to the hotel by a series of steps and terraces which take guests down to the water.

All three ponds are deep, a minimum of four feet, and are conceived of as "balanced life ponds" - interdependent communities of aquatic plants, animals, insects and microorganisms in a balanced condition. Although they store stormwater, the ponds are also designed to be attractive water features.

Nikko Kirifuri Resort Vehicular Circulation

Andropogon Associates, working closely with architects, designed vehicular and pedestrian routes on the site to dramatize the natural beauty of the landscape.

Guests enter the site on an elegant bridge which spans a forested ravine more than 30 meters deep and 150 meters wide. Curving and rising to fit the contours of the hillside, the bridge is supported by a single central column that minimizes its impact on the steep ravine slopes.

The impression of a village in the woods is heightened by the winding entrance drive, giving visitors intimate views of the hotel and enclosing forest, and distant views of the mountains. Arriving at the hotel, the drive changes character to evoke a village street. To minimize damage to the surrounding forest along the entrance road, retaining walls were used instead of earth banks. Earth banks would have enlarged the cut and fill area as the minimum slope in these fragile soils would be 3:1. Constructed as series of terraces, these walls provide planting areas which help to "seal the forest edge."

Nikko Kirifuri Resort Pedestrian Circulation

Andropogon designed a variety of trails at this new Japanese resort facility so that guests could enjoy the surrounding natural landscape. The primary path links the two buildings by a covered walkway which crosses the ravine, providing spectacular views into the stream valley below and out to the mountains. A loop trail for hiking and nature exploration takes the more adventurous guest through the forest and along the stream valley. A portion of this trail follows the alignment of the original construction access road which was installed and later removed - with forest, stream and hillside terrain fully restored after construction was completed.

Morris Arboretum of the University of Pennsylvania
Chestnut Hill, Philadelphia, PA.

In 1978, Andropogon Associates developed a master plan for the Morris Arboretum of the University of Pennsylvania in Philadelphia. A guiding principal of this project was that the design of the Arboretum should be a response to the character of Chestnut Hill, its distinctive surrounding community. The master plan and all the designs for the new facilities derived their aesthetic from both the natural landscape and cultural landscape - complex topography and the rich deciduous woods of the Wissahickon Valley, the broad roleing farmlands of the limestone valley and the former Victorian estate of John and Lydia Morris, brother and sister who collected Victorian garden plants from all over the world.

The purpose of the master plan was to guide the evolution of this private estate - which had been deteriorating since the death of its founders - into a beautiful, well- used, modern public institution. The original Victorian mansion was torn down in 1976, due to neglect and a lack of foresight. A small new visitor entrance was built in the same year, in a new location on a busy residential street. The traffic generated and the general unattractiveness of the building soon became a thorn in the side of the neighbors.

Andropogon analyzed the Arboretum landscape in a number of ways. A series of historical plans of the Arboretum illustrates its evolution and shows most that extensive waterworks and the mansion on the hill were the major organizing features of the historical property. A spatial analysis of the landscape "rooms" of the Arboretum in 1978 shows how the integrity of the historian design had been compromised. The Morrises created a collection of Victorian gardens which included a Japanese tea garden, and an English park. The park, which should have been retained as a broad, uncluttered, meadow bounded by woodlands, had become a rabbit warren of horticultural exhibits.

The key to the development of the master plan was to understand the Arboretum as a series of landscapes. Andropogon illustrated four different landscape types in a diagram which showed 1. The symbolic landscape with its formal gardens 2. An estate park 3. Natural woodlands along the Wissahickon Creek 4. A working landscape - an 18th century farm that also existed on the property.

An expanding institution requires more than restoration. To create a living and growing public facility, the plan needed to provide an extensive network of pedestrian paths, an orientation center, entrance road, parking and maintenance facilities. The illustrative plan shows the revised path system integrated with renovated historical elements, a new visitor center, and the design of a new entry sequence which incorporates a new entrance, entry drive, and parking lots. The new entrance road and parking lots were the first major projects realized at the Arboretum.

The new entrance road solved a number of different problems for the Arboretum, opening up a previously inaccessible area and connecting the Victorian garden with the farm property to facilitate access and service. The new road now brings visitors to the former site of the historic mansion on the ridge top so they can begin their tour of the gardens at the original entrance.

The road was designed to show off the landscape. The key to its design was an alignment which would reflect the scale and character of the broad, open, limestone valley, and dramatize the topography and spatial experience of the place. Each curve of the road frames and reveals specific views as the visitor climbs the hill. The road brings the visitor through all the Arboretum's landscape types and the new sequence of experience reestablishes the historical natural context of meadow and forest.

Widener Education Center, also the new visitor orientation center, occurs at the conjunction of all the landscape types - natural area, Victorian garden, estate park and pastoral landscape, and like all the buildings in the Arboretum, is sited along the ridge. Adaptive reuse of this building, formerly the carriage house to the mansion, included designing a new entrance porch which blended architectural themes from the existing structure with the idea of a "Victorian conservatory."

The new parking lots, like the buildings, are also sited along the major ridge that links the Arboretum's two main buildings - the Widener Education Center and the administrative building at Gates Hall. The location of these lots on either side of the ridge, tucked into the brow of the hill, hides the lots from visitors in the gardens below.

In the stormwater management plan for the parking lots, the porous paving is not merely a product but part of a larger system. Andoropogon designed this system in concert with Cahill Associates, in West Chester, PA. These two firms have worked together for over 20 years to develop innovative stormwater management techniques. The parking lot is an important demonstration exhibit of sustainable design. The parking bays are engineered to model the natural cycle of stormwater. When it rains, water rapidly percolates through the porous paving into an underground basin and then seeps into the ground. The central section of the parking lots, which receive heavy traffic from cars and buses, is conventional asphalt. The parking bays on either side, which receive standing vehicles only, are of porous asphalt, which is an asphalt made without fine particles. The dividing line between porous and non-porous asphalt is marked by a double line of cobbles. During a thunderstorm, water in the parking bays disappears into the porous paving while rain puddles on the regular asphalt. The process of water recharging into the ground where it falls is made part of the aesthetic while rain puddles on the regular asphalt. To collect stormwater, the parking lots are designed as a series of level terraces which also gives them an elegant visual quality.