# SHERWOOD FOREST STREAM REHABILITATION BUCKINGHAM GREEN DEVELOPMENT, ARDEN, DE

Sherwood Forest

Buckingham Green

approximate location of proposed work

Perkins Run

# PROJECT CONTEXT

SHERWOOD FOREST STREAM REHABILITATION : BUCKINGHAM GREEN DEVELOPMENT, ARDEN DE

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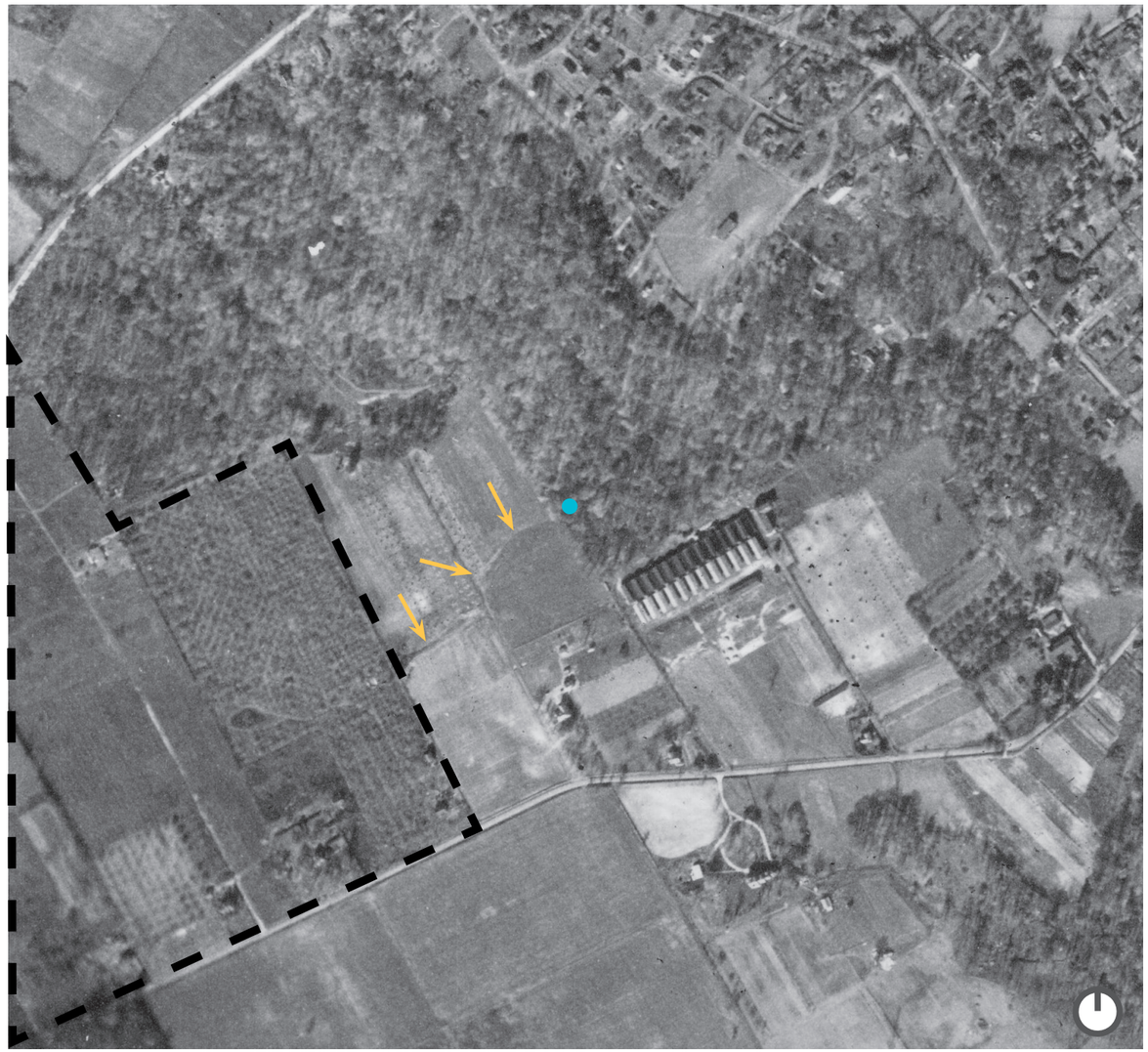
## 1937 aerial image



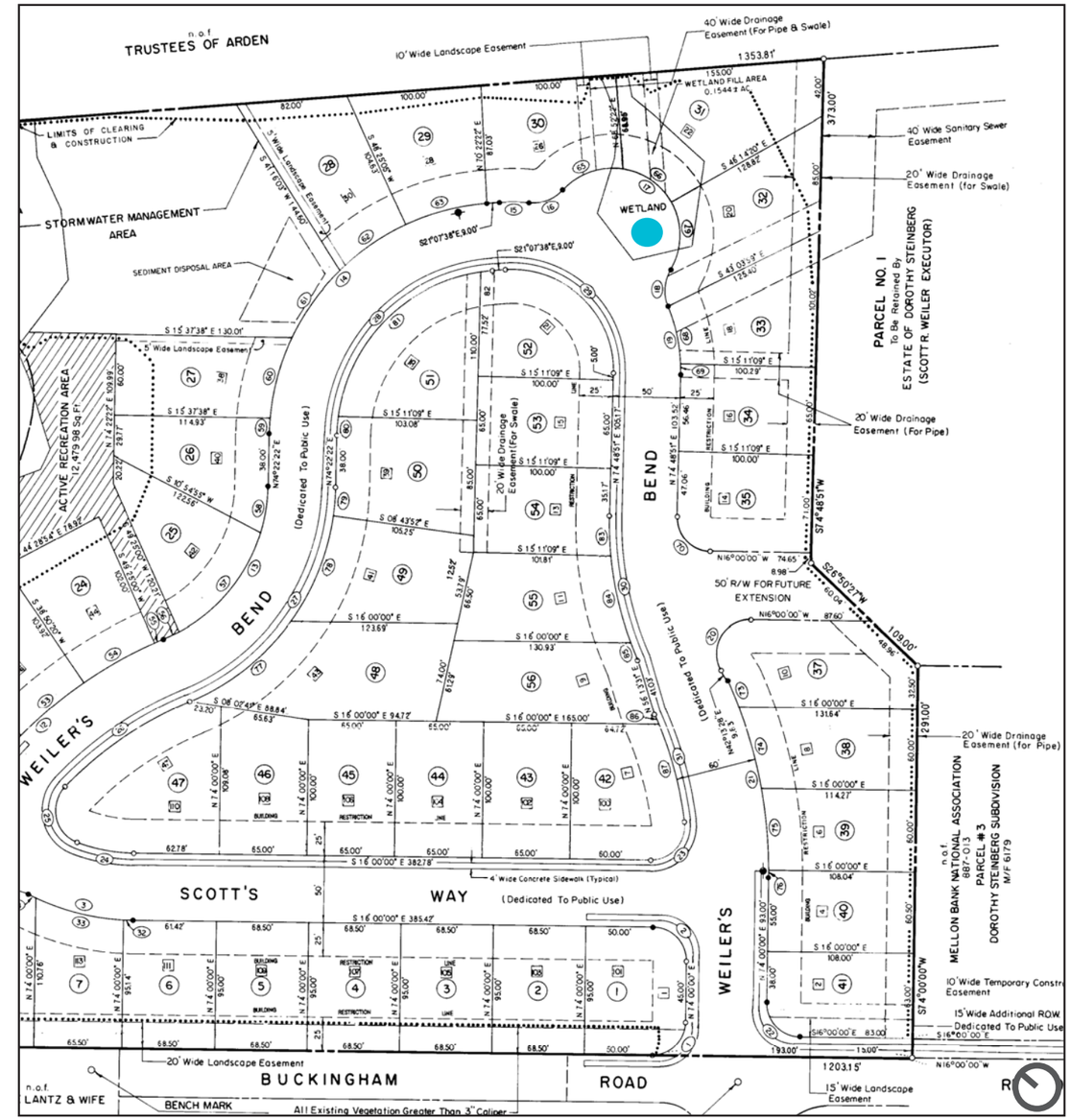
## 1992 aerial image

watershed characteristic changes

approximate location of start of erosion problems

probable historic channel

# WATERSHED CHARACTERISTICS

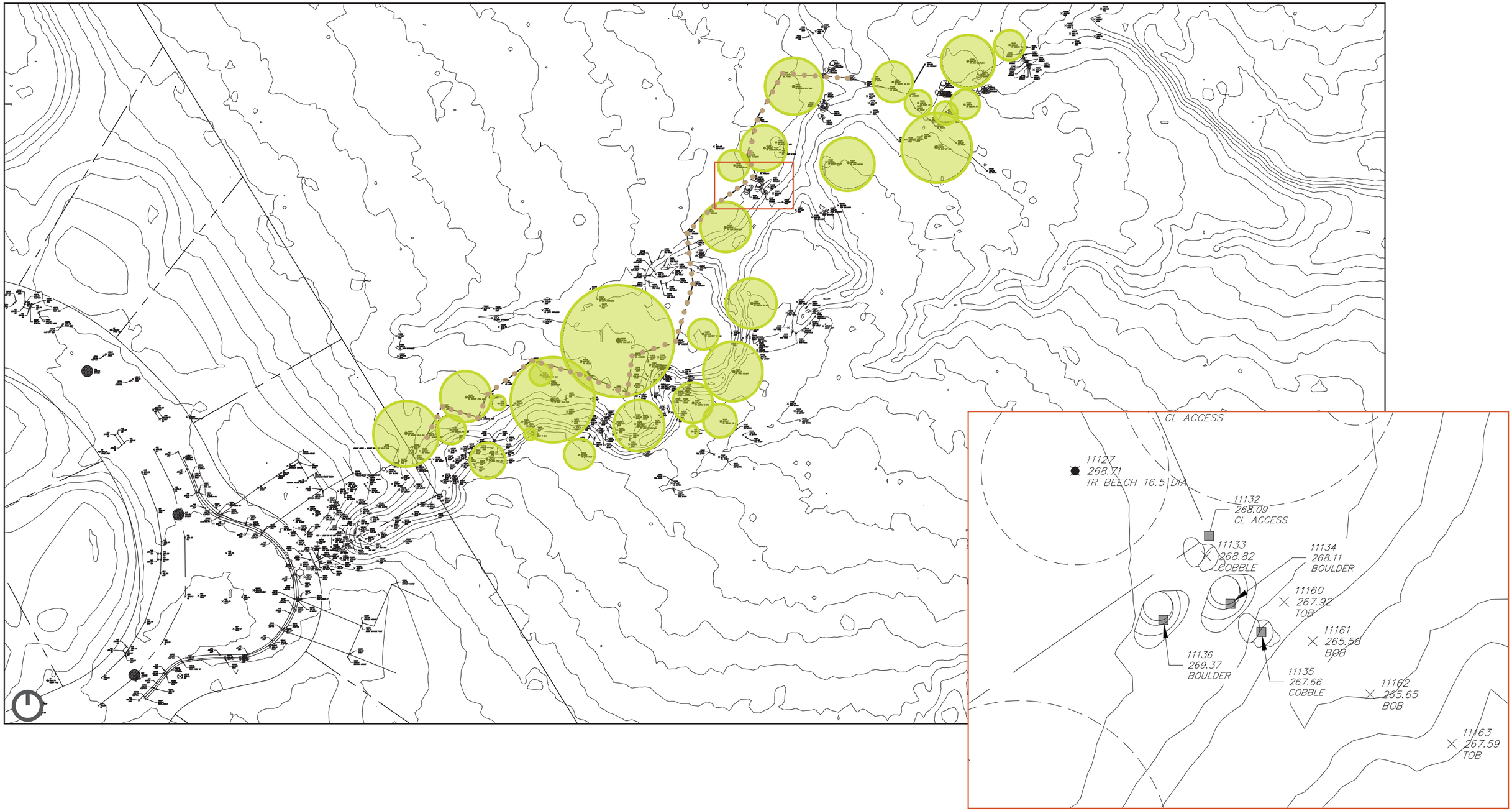



**Storm Sewer Plan per LBG Site Plan**

storm line bypassing Buckingham Green

**Buckingham Green Record Plan**

wetlands filled per plan design




# PROJECT SURVEY

SHERWOOD FOREST STREAM REHABILITATION : BUCKINGHAM GREEN DEVELOPMENT, ARDEN DE

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# 2002 - Plot 3

SHERWOOD FOREST SQUARES

| | |
|---|---|
| Lindera benzoin | Spicebush |
| Fagus grandifolia | American beech |
| Smilacina racemosa | False solomon's-seal |
| Parthenocissus quinquefolia | Virginia creeper |
| Euonymus americanus | Running strawberry bush |
| Podophyllum peltatum | Mayapple |
| Carya ovata | Shagbark hickory |
| Prunus serotina | Black cherry |
| Viburnum dentatum | Arrowwood viburnum |
| Acer rubrum | Red maple |
| Viburnum acerifolium | Maple-leaved viburnum |
| Collinsonia canadensis | Horse-balm |
| Arisaema triphyllum | Jack-in-the-pulpit |
| Smilax rotundifolia | Round-leaved greenbrier |
| Toxicodendron radicans | Poison ivy |
| Vitis vulpina | Frost grape |
| Liquidambar styraciflua | Sweet-gum |
| Rubus allegheniensis | Blackberry |

Species over 25% in 10 m. square:
Canopy: Fagus - 4, Liriodendron - 3
Subcanopy: -
Tall shrub: Fagus - 3
Short shrub-

Surveyed: 22 July, 2002

# Other References

University of Delaware
Flora of Delaware Online Database
Forested Floodplains and Riparian Swamps (Piedmont)
William McAvoy

Guide to Delaware Vegetation Communities 2009
Northern Piedmont Mesic Oak-Beech Forest
CEGL006921
Robert Coxe

http://www.pnwplants.wsu.edu/PlantDisplay.aspx?PlantID=166

Photo (c)2006 Derek Ramsey - Wikipedia

Dan Busemeyer - Illinois Historical Society

# US National Vegetation Classification

## Association Detail Report: CEGL006921

***Fagus grandifolia - Betula lenta - Quercus (alba, rubra) / Carpinus caroliniana* Forest**

The U.S. National Vegetation Classification

| | |
|---|---|
| **Translated Name:** | American Beech - Sweet Birch - (White Oak, Northern Red Oak) / American Hornbeam Forest |
| **Colloquial Name:** | Northern Piedmont Mesic Oak - Beech Forest |

**-Type Concept**

This mesic hardwood forest occurs in the northern Piedmont of New Jersey, Delaware, and is likely to occur in Maryland. This association occurs on gently sloping sites, and soils may be rocky. The canopy is characterized by *Fagus grandifolia, Liriodendron tulipifera*, and *Betula lenta*, with associated species including *Quercus alba, Quercus rubra, Nyssa sylvatica, Fraxinus americana*, and *Carya* spp. The shrub layer is dominated by *Carpinus caroliniana*, with lesser amounts of *Cornus florida, Hamamelis virginiana*, and *Lindera benzoin*. Other shrub associates include *Viburnum acerifolium, Vaccinium pallidum, Viburnum dentatum*, and *Hamamelis virginiana*. The herbaceous layer is characterized by *Polystichum acrostichoides, Arisaema triphyllum, Thelypteris noveboracensis, Mitchella repens, Medeola virginiana, Polystichum acrostichoides, Parthenocissus quinquefolia, Polygonatum biflorum, Galium circaezans, Botrychium virginianum*, and *Amphicarpaea bracteata*. This association is similar to *~Fagus grandifolia - Quercus (alba, rubra) - Liriodendron tulipifera / (Ilex opaca var. opaca)* Forest (CEGL006075)$$ but is characterized by the presence of *Betula lenta* and the lack or negligible presence of Coastal Plain species such as *Ilex opaca* or *Liquidambar styraciflua*.

**-Classification**

| Vegetation Hierarchy | |
|---|---|
| **Class** | 1 Mesomorphic Tree Vegetation Class |
| **Subclass** | 1.B Temperate & Boreal Forest & Woodland Subclass |
| **Formation** | 1.B.2 Cool Temperate Forest & Woodland Formation |
| **Division** | 1.B.2.Na *Acer saccharum - Fagus grandifolia - Quercus rubra* Forest & Woodland Division |
| **Macrogroup** | 1.B.2.Na.2 Appalachian-Northeastern Oak - Hardwood - Pine Forest & Woodland Macrogroup |
| **Group** | 1.B.2.Na.2.c *Quercus alba - Quercus prinus - Carya glabra* Forest & Woodland Group |
| **Alliance** | 1.B.2.Na.2.c *Fagus grandifolia - Quercus rubra / Cornus florida* Forest Alliance |
| **Association** | 1.B.2.Na.2.c *Fagus grandifolia - Betula lenta - Quercus (alba, rubra) / Carpinus caroliniana* Forest |

**-Related Concepts from Other Classifications**

**Synonomy: =** Mesic Oak - Beech Forest (Sneddon 2008)
**=** Mesic Piedmont Mixed Hardwood Forest (Bowman 2000)
**><** Mixed Hardwoods community (Ehrenfeld 1977)
**><** Mixed Oak - Beech community (Ehrenfeld 1977)

## Bringhurst Woods

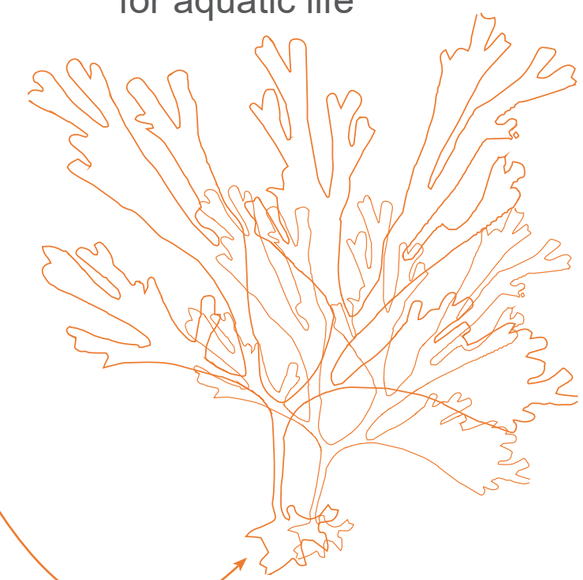
## Sherwood Forest

REFERENCE SITE

temperature : in a stable stream bed sunlight is equally absorbed and reflected

## Bringhurst Woods

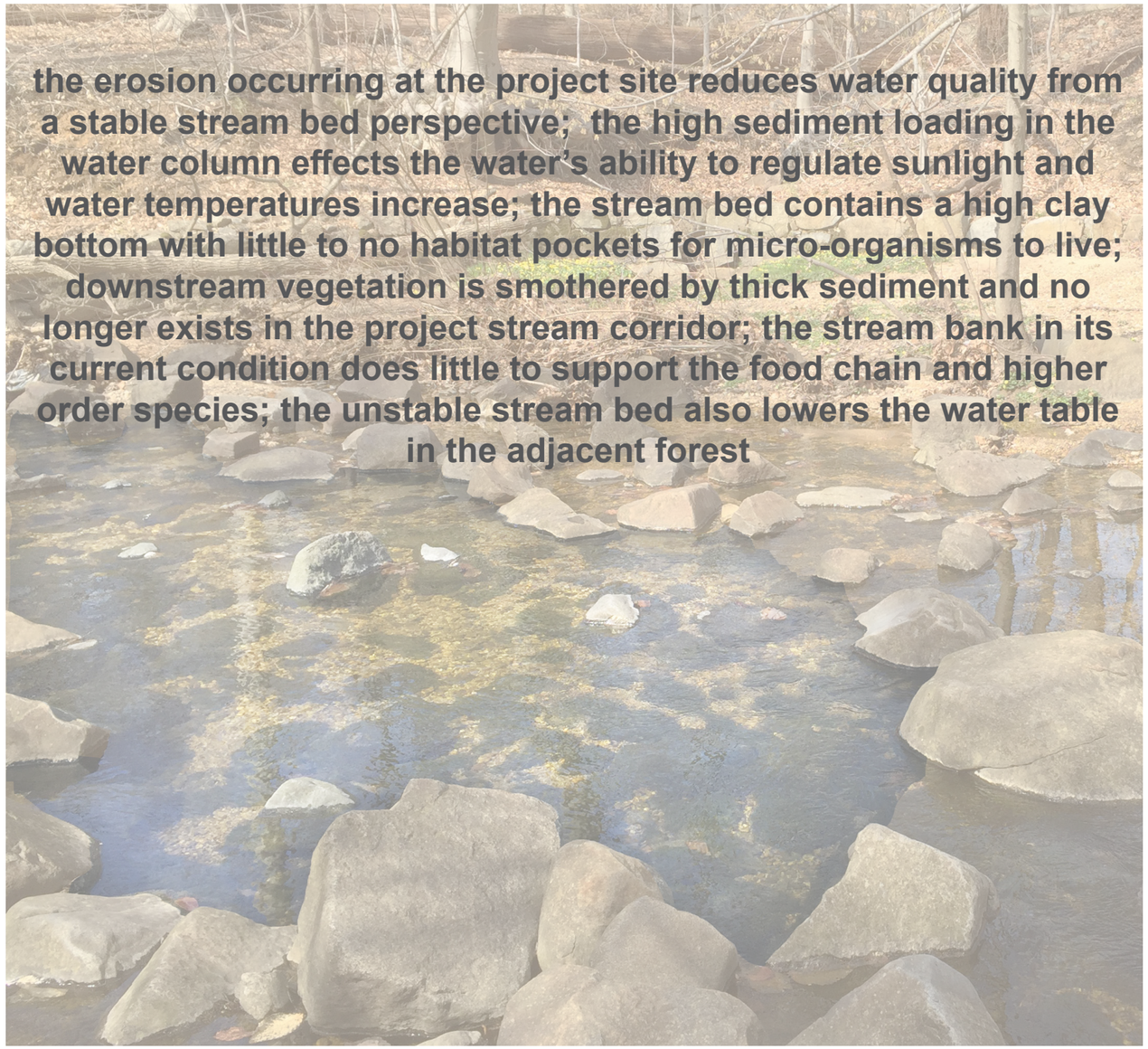
micro-organisms: in a stable stream bed there is varying sizes of debris, cobble and/or gravel supporting areas of habitat for aquatic life



vegetation: a healthy stream bed supports vegetation, in the Lower Piedmont streams, typically in the form of algae

a stable stream bed promotes the ecological interactions between higher order species

# LANDSCAPE RELATIONSHIPS : WATER QUALITY - STABLE STREAM BED



# LANDSCAPE RELATIONSHIPS : WATER QUALITY - STABLE STREAM BED

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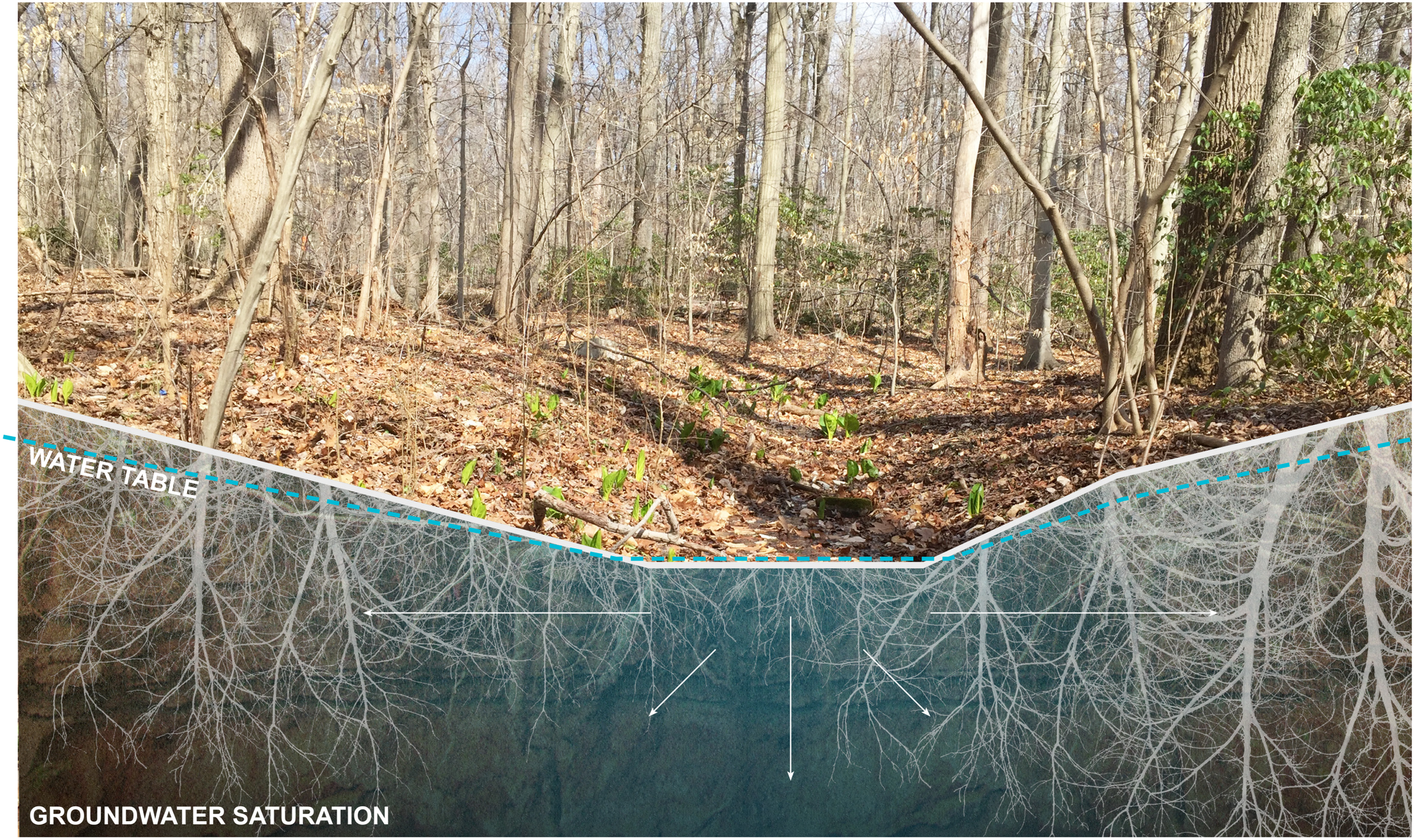


# LANDSCAPE RELATIONSHIPS : FOREST HYDROLOGY - BRINGHURST WOODS

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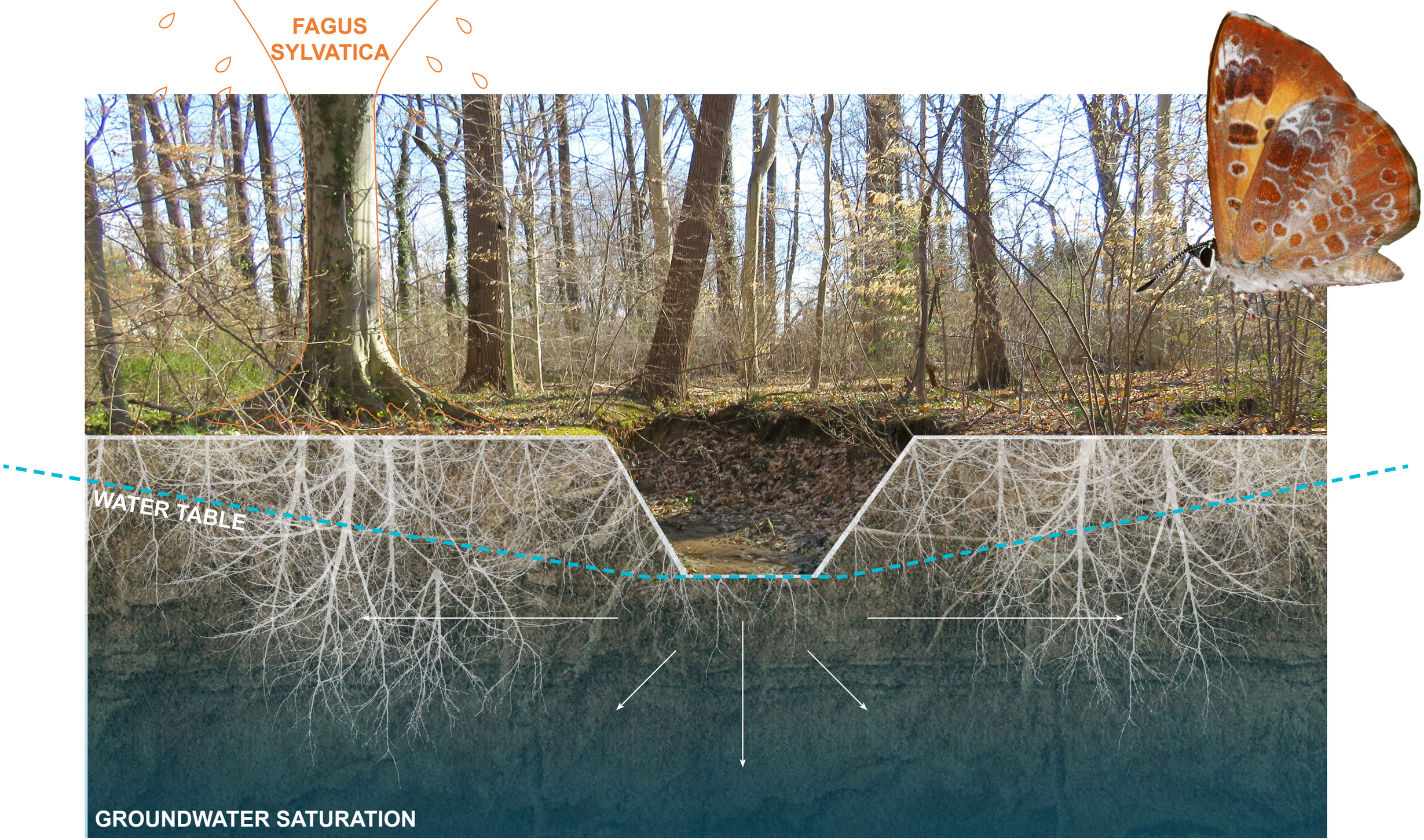


LANDSCAPE RELATIONSHIPS : FOREST HYDROLOGY - SHERWOOD FOREST , PROJECT AREA

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## Bringhurst Woods

## Q (discharge) = V (velocity) * A (area)

## Sherwood Forest

10 YR = 4.8 IN

2 YR = 3.2 IN

1 YR = 2.7 IN

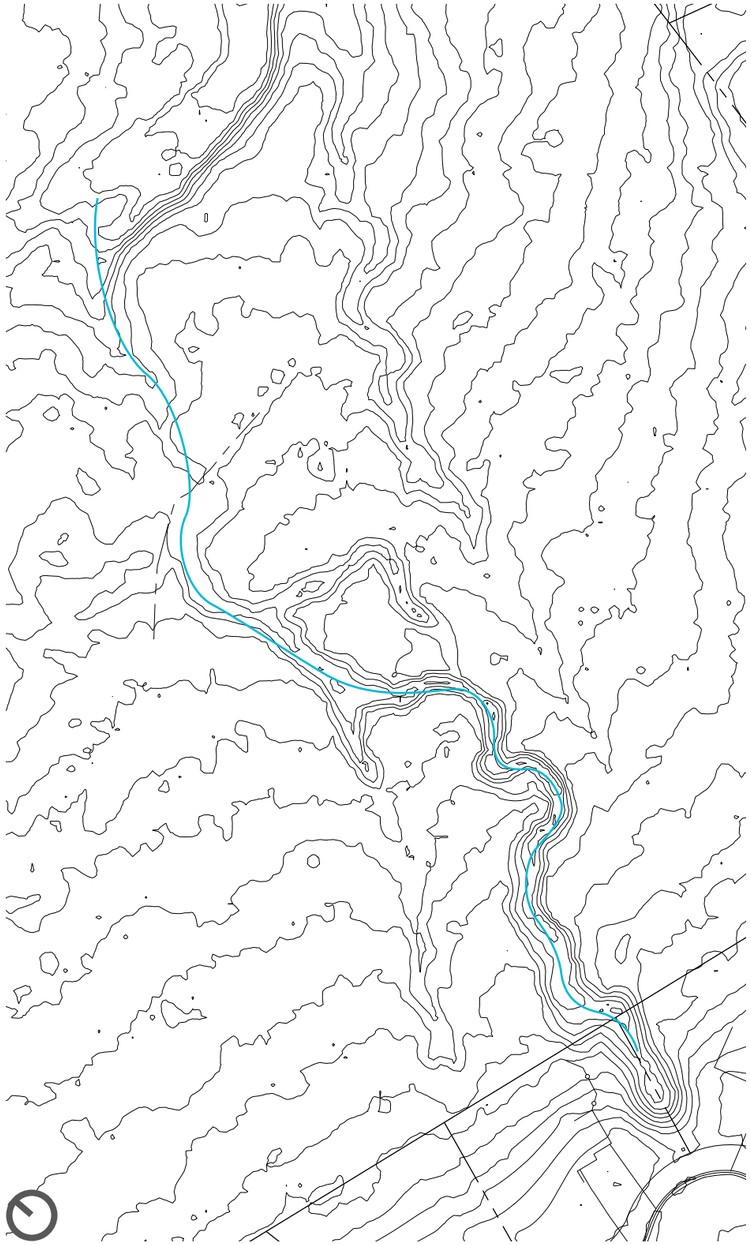
6 MO = 2.0 IN

**stable channel = V↑ = A↑**

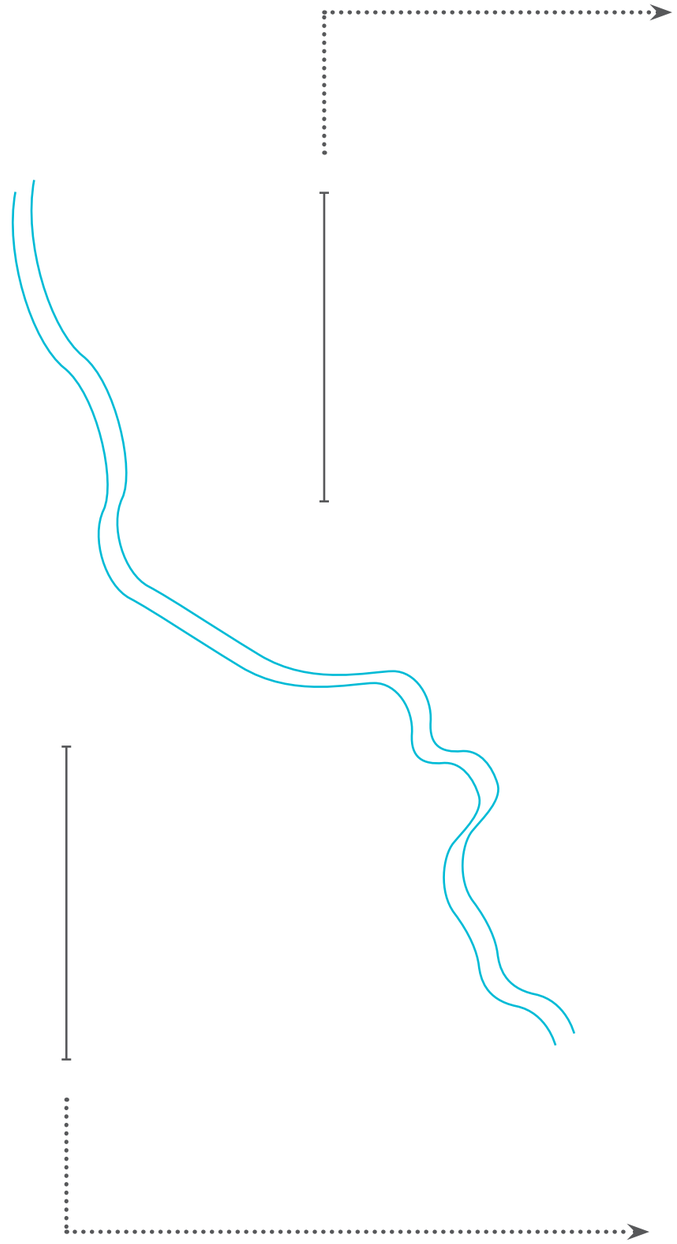
**non-stable channel = V↑ ≠ A↑**

LANDSCAPE RELATIONSHIPS : Q = V * A

## 2015 LiDAR contours



## blue line stream course



## stable downstream bed

## non-stable upstream bed / project site

# LANDSCAPE RELATIONSHIPS : FLOW TO SURFACE COVER TYPE - SHERWOOD FOREST, PROJECT STREAM CORRIDOR

SHERWOOD FOREST STREAM REHABILITATION : BUCKINGHAM GREEN DEVELOPMENT, ARDEN DE

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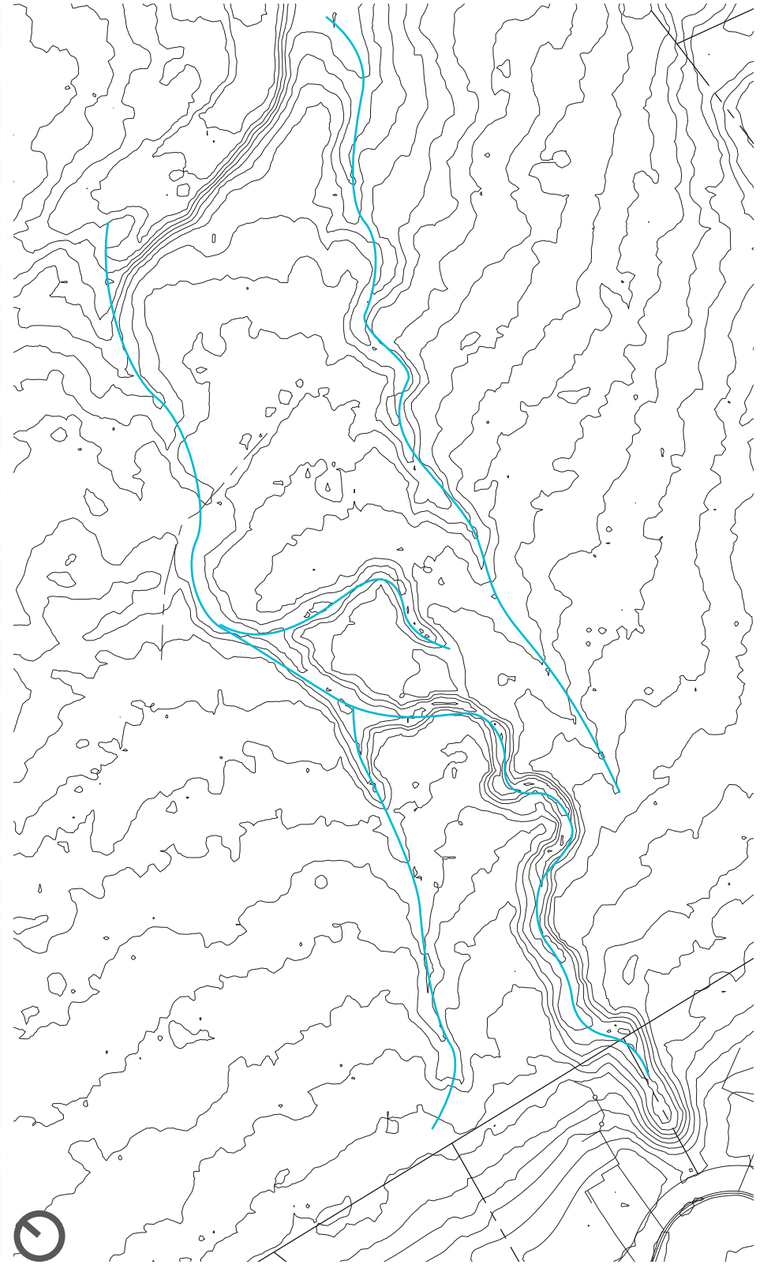
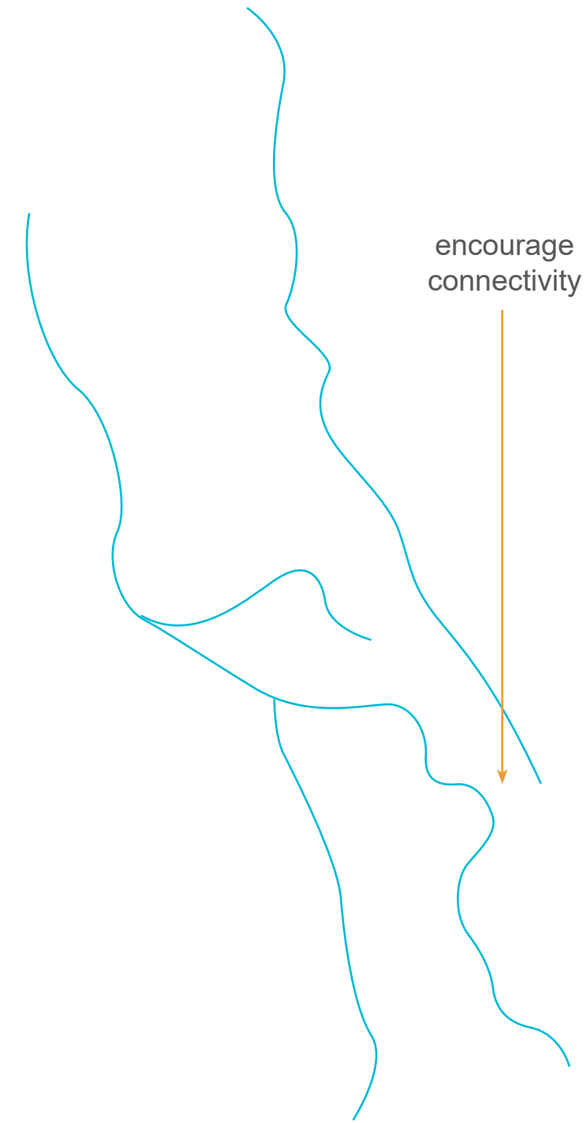
**1992 aerial imagery -** braiding visible in winter aerial

**2015 LiDAR contours**



**braided channel pattern**




research indicates braided channels, hydrologic flows meandering through vegetated islands, supports dynamic stability in channel form, during flooding events many channels receive flow

# LANDSCAPE RELATIONSHIPS : CHANNEL PATTERN - VERTICAL RESTORATION

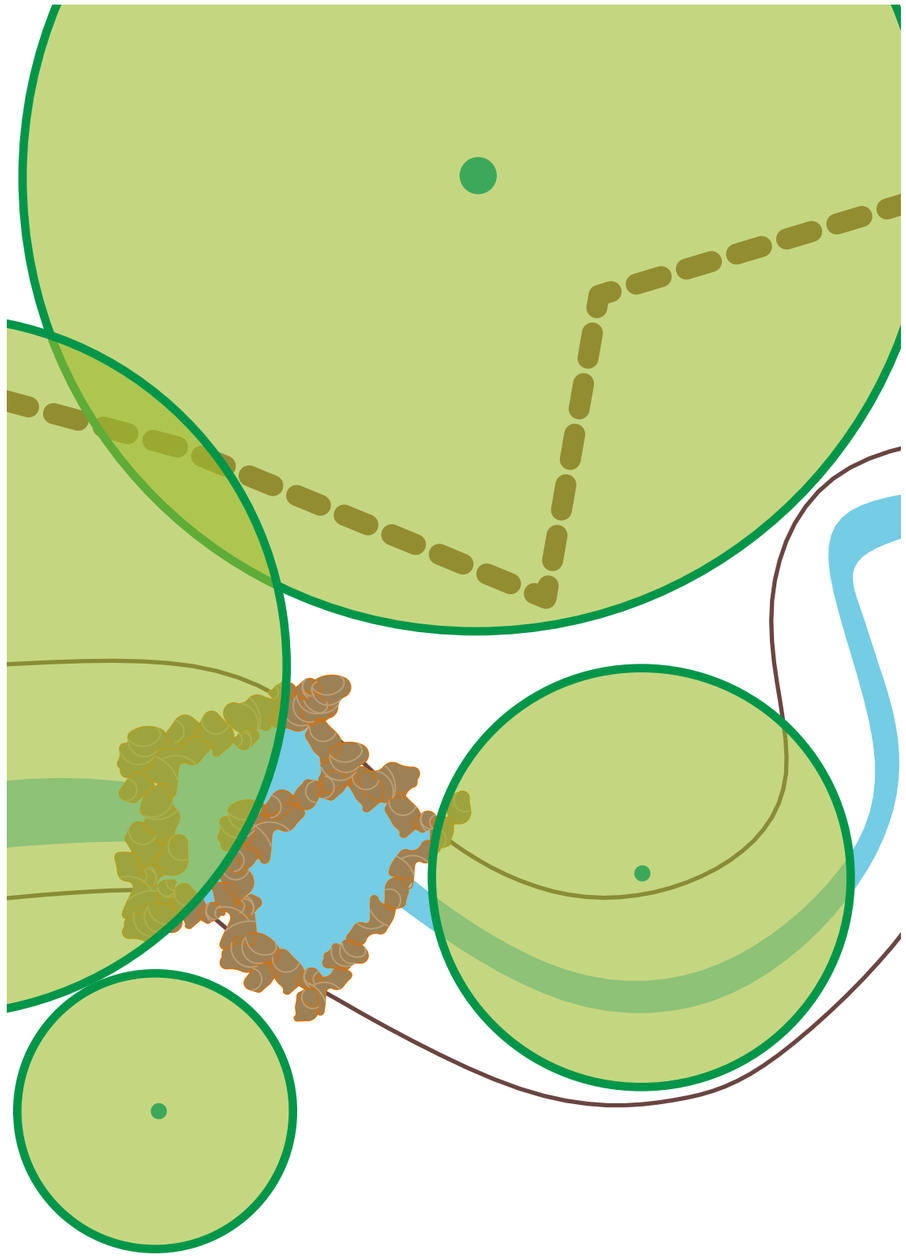
## Bringhurst Woods

## Sherwood Forest - Project Area

the design strategy to repair the eroded channel will include the use of stone structures to slow down flow velocities, reduce erosion, and accrete sediment; which overtime will naturally raise the stream bed to a level that provides increased connectivity to the surrounding forest hydrology and vegetation. The Bringhurst Woods site shows the formation of a natural stone check dam that slows down stream velocities.

# CONCEPT DESIGN : CHANNEL SURFACE - COVER TYPE

## PLAN VIEW



## DIGITAL RENDERING

CONCEPT DESIGN

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