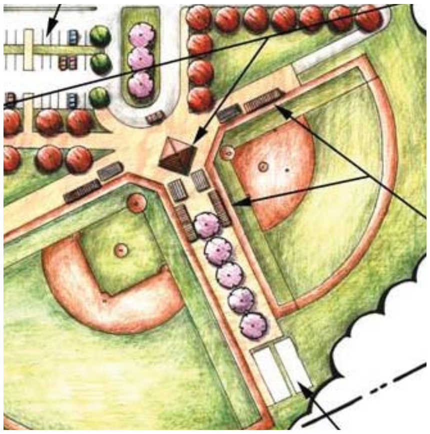

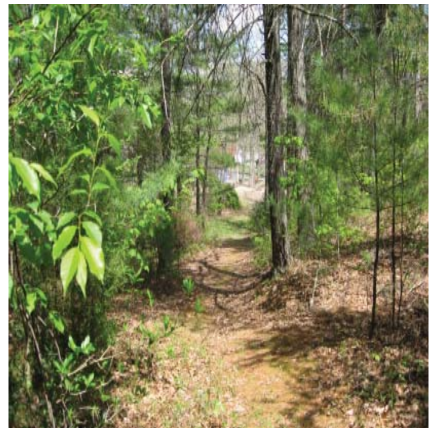

Sharon Park | Colonel Tom Dotson Sports Complex

Prepared for Alleghany County Parks and Recreation
September 2007

Prepared by:

cd community design
ac assistance center
College of Architecture and Urban Studies
Virginia Polytechnic Institute and State University

c d a c

The Community Design Assistance Center (CDAC) is an outreach center of the College of Architecture and Urban Studies and Virginia Tech that assists communities, neighborhood groups and non-profit organizations in improving the natural and built environments through design, planning, and research. Through the integration of the learning and working environment, the Center will execute projects that link instruction and research and share its knowledge base with the general public.

Community Design Assistance Center

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Project Design Team

The CDAC design team for this project was comprised of the following members:

Kim Steika	Landscape Architecture Project Coordinator, Community Design Assistance Center
Michael Blake	Undergraduate student, Landscape Architecture
Brad Milne	Graduate student, Landscape Architecture

The CDAC design team with County staff and volunteers.

Acknowledgements

The CDAC design team would like to recognize and thank the following individuals for their assistance throughout the course of this project:

Lacy Broughman	Volunteer Coordinator, Clifton Forge Little League
Shelly Dudley	Planner & Zoning Administrator, Alleghany County
John McGee	Geo-spatial Extension Specialist, Forestry, Virginia Tech
Eric Simpson	Interim Parks and Recreation Director and Maintenance Supervisor
J.R. Simpson	Principal, Sharon Elementary School
Ms. Shawn Truett	Teacher, Sharon Elementary School

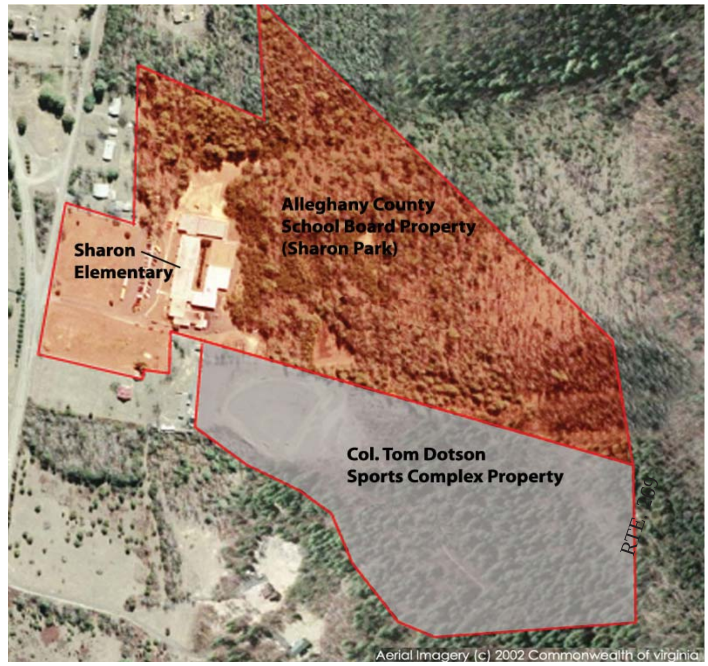
Table of Contents

Project Description

Alleghany County is working in conjunction with the Clifton Forge Little League to develop a 14.66 acre property in the Sharon area of Alleghany County, approximately 5 miles east of the Town of Clifton Forge. The property is conveniently located only 5 minutes away from I-64 and 10 minutes east of US 220, making regional scale events a possibility. The property currently has one 200' radius playing field that is used by about 375 local baseball and softball players as well as hundreds of players from outside locations. This will be called the Colonel Tom Dotson Sports Complex, named in honor of the land donor and is to be used for children and youth sports solely.

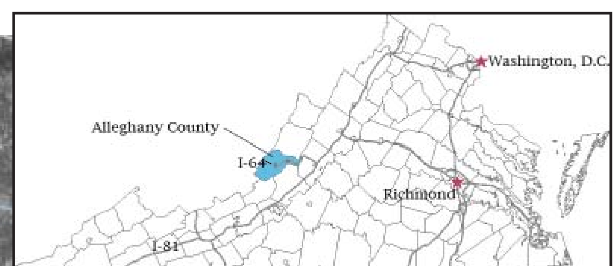
Adjacent to the future Col. Tom Dotson Sports Complex, and directly behind Sharon Elementary School are approximately 15 acres of wooded terrain owned by the Alleghany County School Board. The County desires to create a master plan for this wooded property as well, providing students, teachers, and community members with easy access to outdoor activities, learning opportunities, and other recreational options. This site will be called Sharon Park.

The County has expressed a strong desire to make these two areas an exemplary park complex that will serve the recreational interests of many of its residents. The park is intended to benefit "the County, the schools, the community, and promote wellness.[1]" To help achieve this goal, the Community Design Assistance Center was hired to assist in the development of conceptual master plans for these two areas.

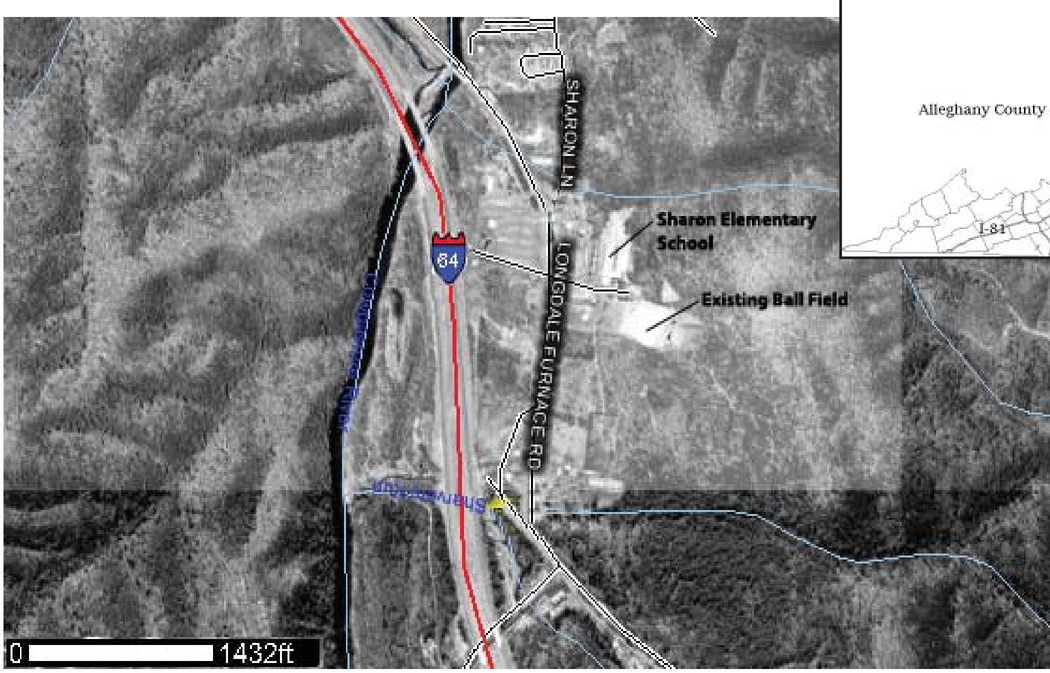


(Top, gray) Colonel Tom Dotson Sports Complex
(Aerial Imagery (c) 2002 Commonwealth of Virginia)

(Bottom, red) Sharon Elementary School and Park context map.
(Aerial Imagery (c) 2002 Commonwealth of Virginia)



State context map



[1] George "Chip" Snead, Interim County Administrator

Vision Statement

The proposed parks will serve as a showpiece for Alleghany County residents, students, little leaguers, and all other users. The properties will serve needs of a broad range age groups residing within and outside the community. The parks will offer a variety of both active and passive recreational opportunities that will be accompanied by multiple modes of formal and informal learning opportunities focused on the environment.

The programming of the parks will provide the community with an array of ball fields varying in size to accommodate the different age groups and skill levels of those using the facilities. The combined sites will also contain pavilions for spectating and picnicking, restrooms in multiple locations, concessions, walking trails, outdoor classrooms with interpretative signage, soccer fields, accessible handicap parking and seating, and four areas of centrally located parking allowing access to both park areas.

An interpretative play structure built by students of Sharon Elementary.

Image of a little ball field. Photo taken from http://images.google.com.
Image by Steve Keller.

Design Process

Public participation was an important component of the design process in order to meet the needs of the community. During the initial site visit in February of 2007 the CDAC design team first met with Eric Simpson, Interim Director of Parks and Recreation for Alleghany County and Lacy Broughman, Volunteer Coordinator of the Clifton Forge Little League, to discuss the desired programming needs of the two properties. While on the visit, the CDAC team gathered valuable information through the means of photographs and field notes to aid in the documentation of the properties' existing conditions. The team also analyzed the sites' existing soil conditions, vegetative species, erosion and sediment issues, site access, and potential areas of design implementation.

The CDAC team prepared initial conceptual ideas for the sites based on information gathered from the site analysis and the feedback of the project stakeholders. These concepts were presented to County staff, Sharon Elementary school teachers and faculty, and members of the community for review and comment at a community meeting. The meeting was intended to afford all interested community members an opportunity to influence the park design with their ideas and suggestions.

Based on comments received at the community meeting, the CDAC team returned to Blacksburg to further refine the concepts. Final conceptual plans were developed and presented at Sharon Elementary School in June of 2007 to the community and its stakeholders.

This supporting report was prepared to document the overall design process.

CDAC design team members Brad Milne (left center) and Michael Blake (right) tour the project site with Lacy Broughman (left) and Eric Simpson (right center).

CDAC design team members Michael Blake and Brad Milne explore existing site conditions.

Public meeting at the Sharon Elementary School.

Site Description / Analysis

The two adjacent project sites are located in the Appalachian Plateau region of Virginia. Both possess a south to southwest facing aspect and contain a mix of native Virginia species of evergreen and deciduous canopy trees. In past years the properties have been forested lending to a mix of established and early successional growth, with is accompanied by a variety of tree heights and diameters. The forest floor of the future Sharon Park contains an array of woody and herbaceous ground-cover plant species. The proposed area for the Col. Tom Dotson Sports Complex contains no visible plant growth except along its edges. This site was previously been cleared and graded prior to the CDAC design team's initial visit in February of 2007.

During the site analysis process, the CDAC team looked at existing and adjacent site features as well as the sites' soils, topography, hydrology, and other physical elements. These elements are described individually on the following pages.

Site of proposed Col. Tom Dotson Sports Complex.

Forest floor evergreen species.
(May, 2007)

Photo taken of forest floor herbaceous plant species.
(May, 2007)

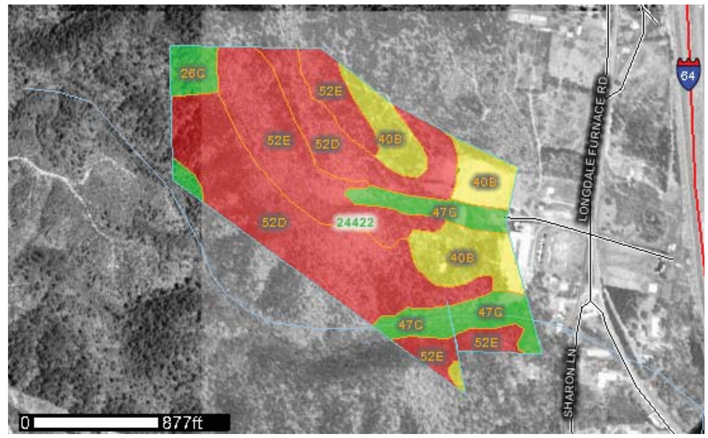
Photos taken on project property indicating varying heights of forest species, canopy, understory and ground cover species. (May, 2007)

Site Analysis (cont.)

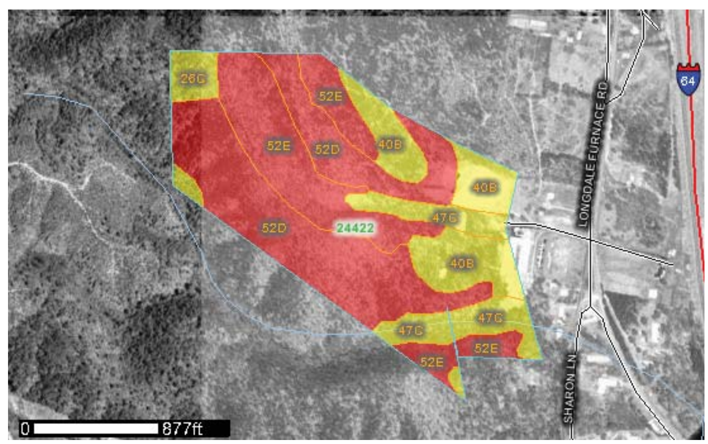
Soils:

The CDAC team utilized the Natural Resources Conservation Service's (NRCS) web soil survey resource to examine the soils found on site and in the surrounding areas. A detailed soil report can be found in Appendix E. In summary, the project area contains Escatawba loam, Gilpin silt loam, Nicelytown silt loam, Shelocta-Berks complex, and Weikert-Berks rough complex soils. Based on the information provided from NRCS' web soil survey analysis of the soils, there is, in general, a high chance of corrosion of concrete on site, a low to moderate chance of corrosion of steel, somewhat limited landscaping opportunities without amendments, somewhat limited opportunities to site picnic facilities and playgrounds, and some good opportunities to site trails. A key and detailed descriptions of these limitations or lack thereof can be found in Appendix E. The maps below and to the right illustrate areas of opportunity and constraint. The colors correspond to the aforementioned ratings: green represents that it is not limited by the soil, yellow means it is somewhat limited, and red signifies it is very limited because of the soil.

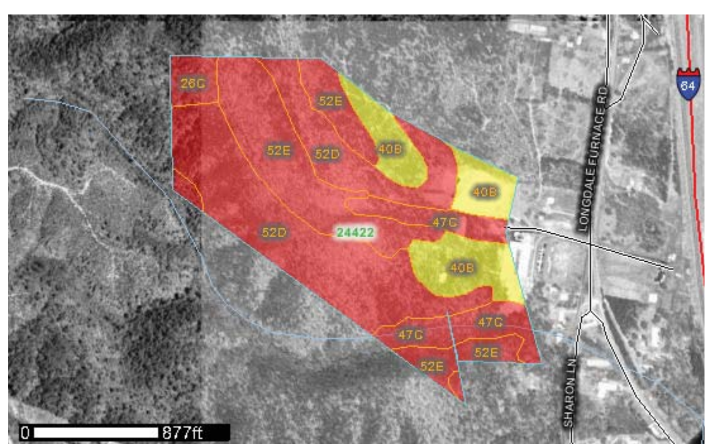
Map indicating the likelihood that the soil will have a corrosive effect on concrete. In this map, red represents highly likely.



Map indicating the suitability of the soil to support paths and trails on site and in the surrounding areas.



Map indicating the suitability of the soil to support picnic areas on site and in the surrounding areas.



Map indicating the suitability of the soil to support playgrounds on site and in the surrounding areas.

Site Analysis (cont.)

Topography:

The CDAC team was unable to acquire a topographic map of the site more detailed than a USGS Quad Map at 20 foot contour intervals that is dated. The site's topography has recently been altered through grading to prepare for ball fields. The USGS topography was used in the site analysis process to identify ridges and drainage patterns. The CDAC team met with County staff and project volunteers on site several times to determine areas where the topography was most suitable to support active recreational activities that require level playing services. Field notes were taking and used during the design process to guide the team. The project area offers magnificent views of the mountainous surrounding topography.

Interim Parks and Recreation Director Eric Simpson (left) and CDAC team member Brad Milne record the dimensions of several flatter portions of land within the project study area.

Site photo of the proposed Colo. Tom Dotson Sports Complex' view of northwest facing topography. (February, 2007)

Hydrology:

Current hydrological features and issues of concern were documented through a site analysis with the use field notes and photographs taken during site visits. The areas identified include the project area's existing water and drainage features, areas of erosion and runoff, areas of deforestation, and existing parking lots, ball fields, and roadway access.

Hydrological features play a major role in the development of a site. With potential increased amounts of water runoff during the construction phase of the project and with the implementation of proposed parking lots, roadways, and other paved surfaces, an analysis of these conditions was needed in order to aid in the finalization of a conceptual master plan that would address water management practices.

Existing stream corridor located between the proposed Sharon Park and Col. Tom Dotson Sports Complex.

Located between the two project park sites is a meandering stream corridor. The stream varies in width and surrounding vegetation throughout different portions of the site. With the presence of a stream between the two parks, on site water management will be incorporated in the design to-help alleviate potential runoff issues that could disturb the function, form, an aesthetic of the stream corridor.

Currently, an existing detention pond is used to collect stormwater runoff from the Col. Tom Dotson Sports Complex site. With the implementation of the additional facilities and parking, the pond may need to be expanded in order to accommodate a greater amount of runoff.

Site Analysis (cont.)


The steam on site enters a drainage pipe and is channeled underground as it approaches Sharon Elementary School.

Disturbance of the soils from prior grading and land clearing on the Col. Tom Dotson Sports Complex site has left the ground unstable causing the structure and cohesion of the soil to loosen, increasing erosion, particularly in sloping areas.

Some measures have already been implemented to address storm water. A swale and drainage culvert were constructed to ideally eliminate any storm water impact to surrounding property owners from the project site. The culvert allows runoff from the existing parking lot and upper portions of the Col. Tom Dotson Sports Complex site to drain into a small swale leading to the detention pond. With the implementation of the proposed sports complex, the culvert may need to be enlarged to accommodate greater amounts of runoff. A professional engineer should be consulted to conduct drainage calculations and make recommendations prior to making any changes to the existing culvert.


Existing detention pond and surrounding vegetation.


An examples of an area of soil erosion adjacent the Col. Tom Dotson Sports Complex.


Existing culvert and drainage swale installed to move storm water from the Col. Tom Dotson Sports Complex into the existing detention pond.

Site Analysis (cont.)

Although the terrain behind Sharon Elementary School is sloped there are two level locations that have been previously graded in past years to accommodate outdoor playing regions that have never been utilized. These sites are excellent potential areas for soccer and football fields for Sharon Park based on their topography. Soils in these areas pose a potential problem though. The image to the right illustrates the current crusting on the soil that is an indication of compaction and poor drainage. A soil and percolation test should be conducted prior to planting turf or any other vegetation type. Soil amendments may need to be made and a core aeration should be conducted also prior to planting. If these areas are developed as athletic fields, or become areas of high usage, the ground should be aerated at least once a year to relieve the constant compaction from foot traffic.[1]

Cracked soil indicates poor soil conditions at one of the cleared, flat areas behind Sharon Elementary School.

Existing clearing behind Sharon Elementary School.

[1] Barry Robinson, Montgomery County Extension Agent.

Site Analysis (cont.)

Existing Site Features:

1. Existing gravel parking lot and 200' radius ball field.

2. Existing entry road and view of terraced upper level.

3. Existing access road and concession stand at the Col. Tom Dotson Sports Complex .

4. Depressed and eroded area at the edge of the Col. Tom Dotson Complex.

5. Existing edge conditions adjacent to the current and proposed sports complex.

6. Existing pathway leading to property behind Sharon Elementary.

Site Analysis (cont.)

Existing Site Features:

7. Lack of dense understory makes it easy to walk on School Board land.

8. Existing classroom garden behind Sharon Elementary.

9. The mounded hill, nearby stream, and otherwise flat topography near the school provide a great spot for an outdoor classroom/adventure play area.

10. Existing stairway behind Sharon Elementary leading to unused space.

11. One of the flat areas behind Sharon Elementary.

12. Existing pathways behind Sharon Elementary.

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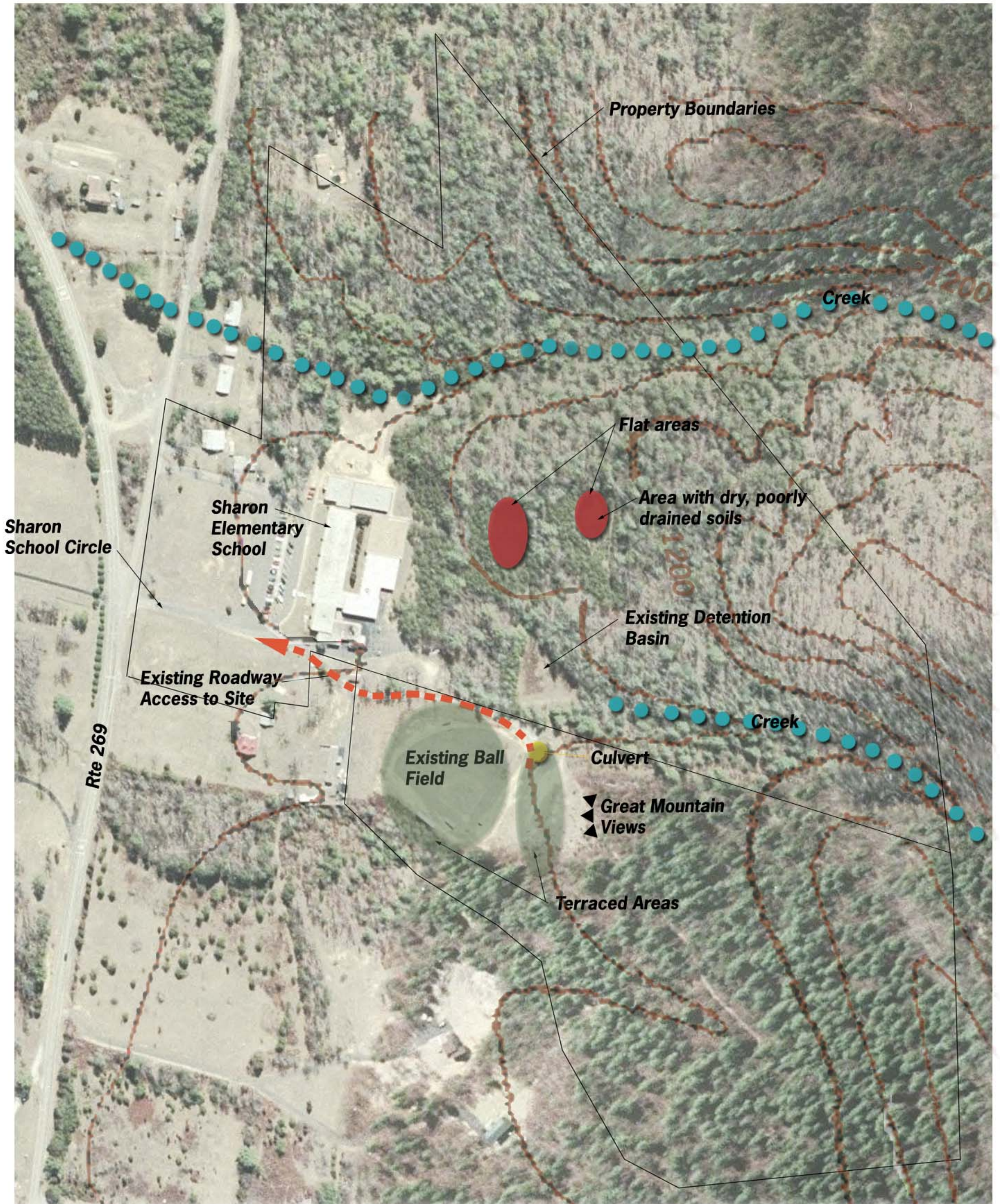
Existing Site Features Context Map

Sharon Park & Colonel Tom Dotson Sports Complex



Not to Scale

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Col. Tom Dotson Sports Complex & Sharon Park - Site Analysis
Alleghany County, Virginia

Design Recommendations

The conceptual design phase allowed the design team to explore various ideas, potential layouts and circulation patterns for the two park sites. The CDAC team sought to develop design recommendations that would maximize the space available and the favorable attributes of the site, and would allow for a multitude of functions and activities to be met through the site design.

An understanding of potential usage throughout the various seasons, including times of peak use and special events, and the relationship between proposed site activities and the overall circulation of the site helped create a successful design that can be appreciated by all.

Preliminary design work for Col. Tom Dotson Sports Complex was prepared and presented to Alleghany County staff in February 2007. This work was revised and expanded based on the feedback of County staff members.

The CDAC design team presented two preliminary conceptual design for Col. Tom Dotson Sports Complex and ideas for walking trails and outdoor classrooms behind Sharon Elementary School to Alleghany County officials, Sharon Elementary School faculty and staff, and interested community members in April 2007. At this meeting, the CDAC team was informed that the Col. Tom Dotson Sports Complex was to be used by children and youth only and devoted primarily to Little League. The team also saw, based on public comments, that there was a strong desire to develop multipurpose fields behind Sharon Elementary for use by the broader community.

As a result, the CDAC team returned to refine and develop distinct master plans for both Col. Tom Dotson Sports Complex and Sharon Park. These adjacent parks connect to each other via trails systems and offer complimentary uses to residents and visitors alike. The CDAC team incorporated expressed desires of community members into final conceptual master plan for each park site and presented the plans to the community in June 2007.

Preliminary Conceptual Designs

Preliminary conceptual designs were presented at a community meeting at Sharon Elementary School in April 2007. The CDAC design team received several recommendations by the public which included the desire for ample parking, seating, restrooms, and shelter facilities that can be easily accessed by handicapped visitors throughout both parks. Other recommendations focused on stormwater management practices that would help to alleviate existing site runoff. Some suggestions for the Sharon Park site included the need for an outdoor classroom setting to introduce and build a relationship between the students and the local environment, and the need for an open play space that could double as a youth soccer field during non school hours.

Comments from participants at the meetings regarding the two sites helped to shape the final conceptual design for each park. Descriptions and 11x17 drawings of the Preliminary Conceptual Designs for Col. Tom Dotson Sports Complex and Sharon Park can be found on the following pages.

CDAC team member Brad Milne the preliminary design concept for Sharon Park.

Preliminary Conceptual Designs

Col. Tom Dotson Sports Complex:
Preliminary Design Concept A

Preliminary Design Concept A strove to maximize the number of activities feasible on the site. In this design the location of the main entry road and existing topography played a major role in the formation of the initial site design. With the use of these two features the design team was able to maximize the use of the site allowing for the addition of two new ball fields, pavilions with concessions, restrooms, picnicking areas, handicap seating, a playground, open green spaces for alternative play, and multiple parking lots.

A central roadway between the two properties allows for both sites to be connected through a central access point, therefore minimizing the amount of parking lots and focusing on concentrating stormwater runoff to a central bio-retention area where it can be collected, filtered, and slowly released back into the site. Swales were incorporated in the site design to help alleviate higher amounts of runoff that will accumulate from the proposed sports complex and parking lot surfaces.

The existing topography influenced the siting of the parking lots, concession facilities, and ball fields. The design team was able to take advantage of the existing terraces on site, therefore minimizing the amount of grading that would need to be done prior to the construction of the proposed sports complex.

The Preliminary Design Concept A developed a central axis to divide uses. Tree were used to define edge conditions and to separate the recreational and pedestrian areas from vehicular activity.

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Colonel Tom Dotson Sports Complex - Preliminary Concept A
Alleghany County, Virginia

Preliminary Conceptual Designs

Col. Tom Dotson Sports Complex:
Preliminary Design Concept B

Preliminary Design Concept B shares some of the design features seen in Design Concept A: bio-rention swales along the entry drive, centrally located concession stand, restrooms, and parking, as well and a concession stand and restroom facility to service the upper ball field.

Concept B changes the configuration of the two western ball fields, providing more open space along the northern wooded edge of the site.

Mounded seating provides an opportunity for parents and other fans to sit and enjoy the games, while simultaneously serving as a mounded grassy area for spontaneous play for children who are not playing baseball.

Near the mounded seating is a trail head and path providing access to a series of nature trails that would connect with Sharon Park.

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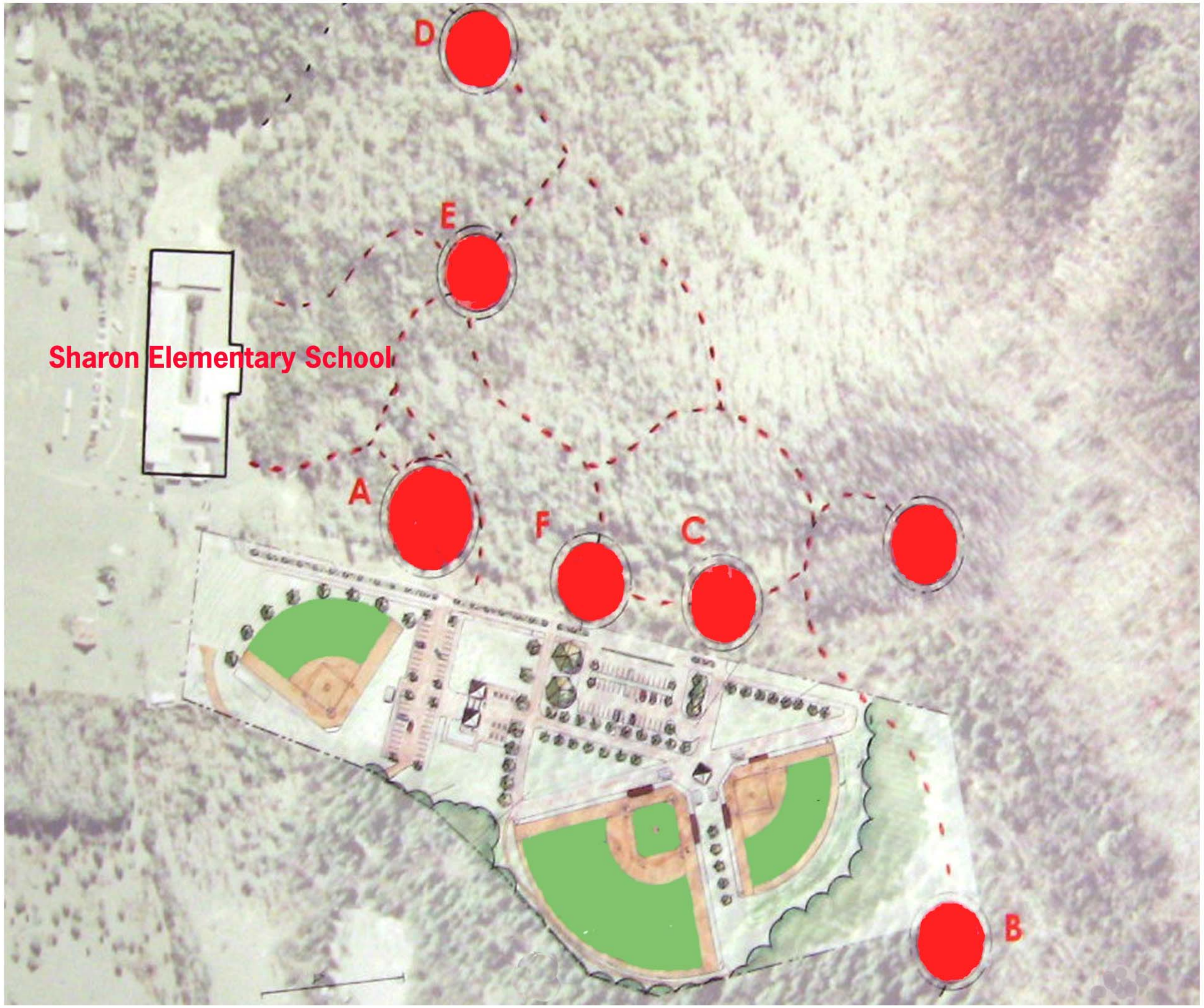
Colonel Tom Dotson Sports Complex - Preliminary Concept B
Alleghany County, Virginia

Preliminary Conceptual Designs

Sharon Park - Preliminary Design Concept:

The preliminary design concept for Sharon Park aimed to create a series of outdoor classroom spaces connected by a trail system. The classroom areas are sited around existing features of interest, such as the detention pond and creek. The majority of the trail system is ADA accessible and serves as a classroom in and of itself, with interpretative signage calling attention to species of trees and native plant and bird species inhabiting the region. A pavilion for picnicking or larger class gatherings is sited directly behind the school. The design proposes that two overland footbridges be incorporated on site to aid in the crossing of existing stream bed corridors, allowing the trail system to be accessible from the parking areas of the proposed Col. Tom Dotson Sports Complex.

Sharon Park & Colonel Tom Dotson Sports Complex



A

Detention Pond Trail

B

Nature Trail

C

Nature Trail

D

Footbridge

E

Pavilion

F

Footbridge Crossing Creek

Not to Scale

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Sharon Park - Preliminary Design Concept
Alleghany County, Virginia

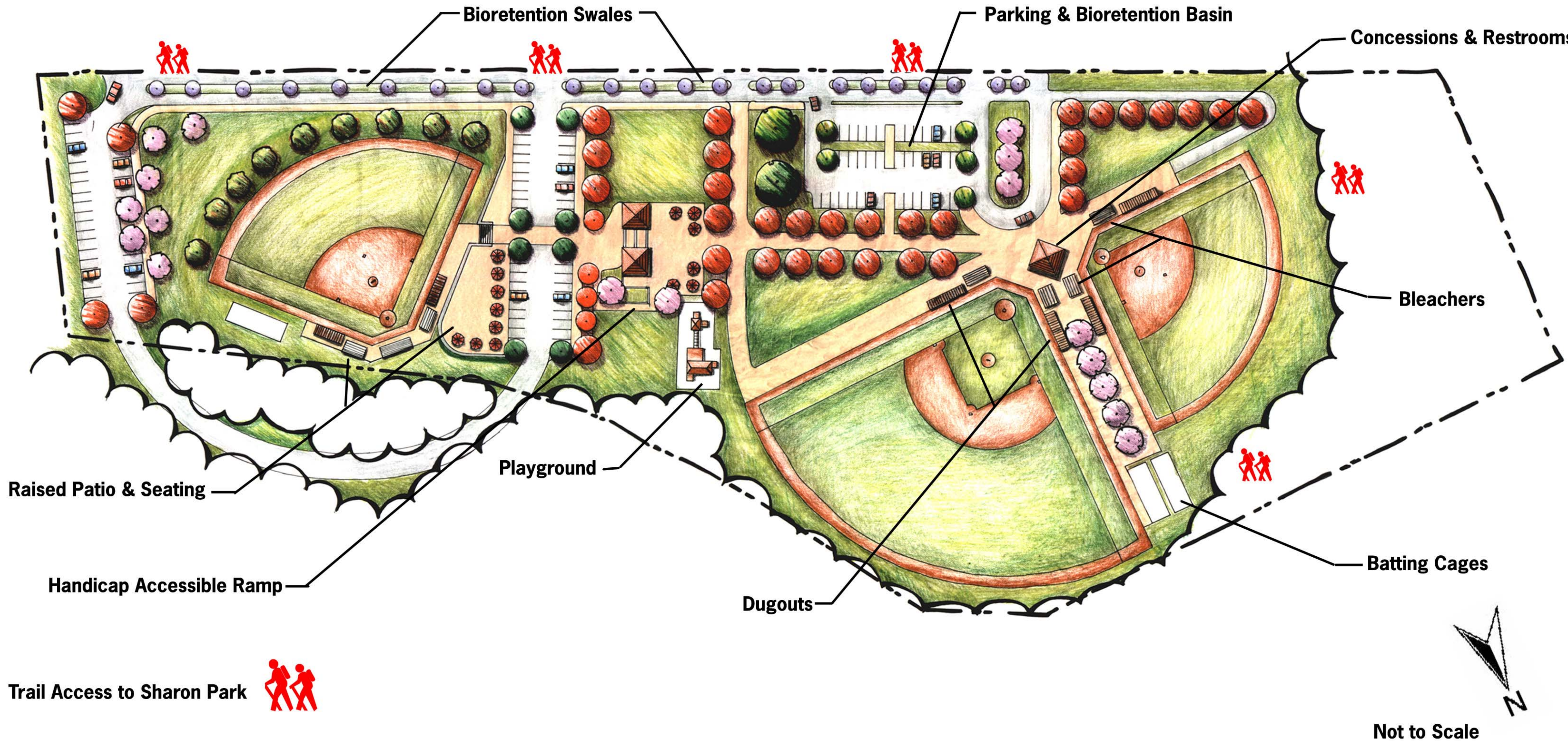
Final Conceptual Master Plan

Col. Tom Dotson Sports Complex:

Comments from the preliminary design presentation were used to refine the design concept for Col. Tom Dotson Sports Complex into a final conceptual master plan.

The final conceptual master plan incorporates site amenities including an additional parking lot at the base of the existing ball field, two additional batting cages, a playground, a raised patio with covered seating, and multiple access points to Sharon Park.

Sharon Park & Colonel Tom Dotson Sports Complex



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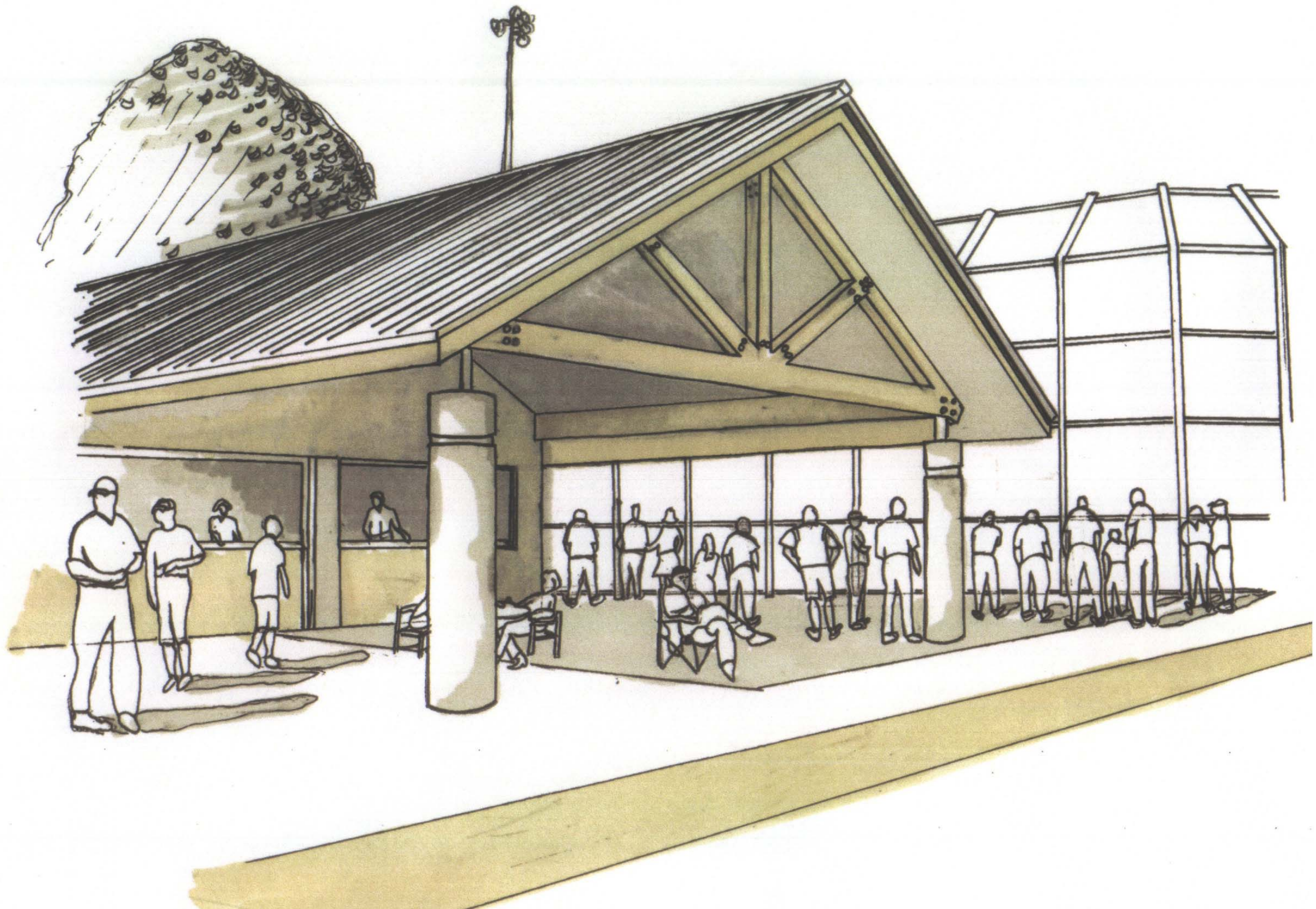
Colonel Tom Dotson Sports Complex - Final Conceptual Master Plan
Alleghany County, Virginia

Sharon Park & Colonel Tom Dotson Sports Complex



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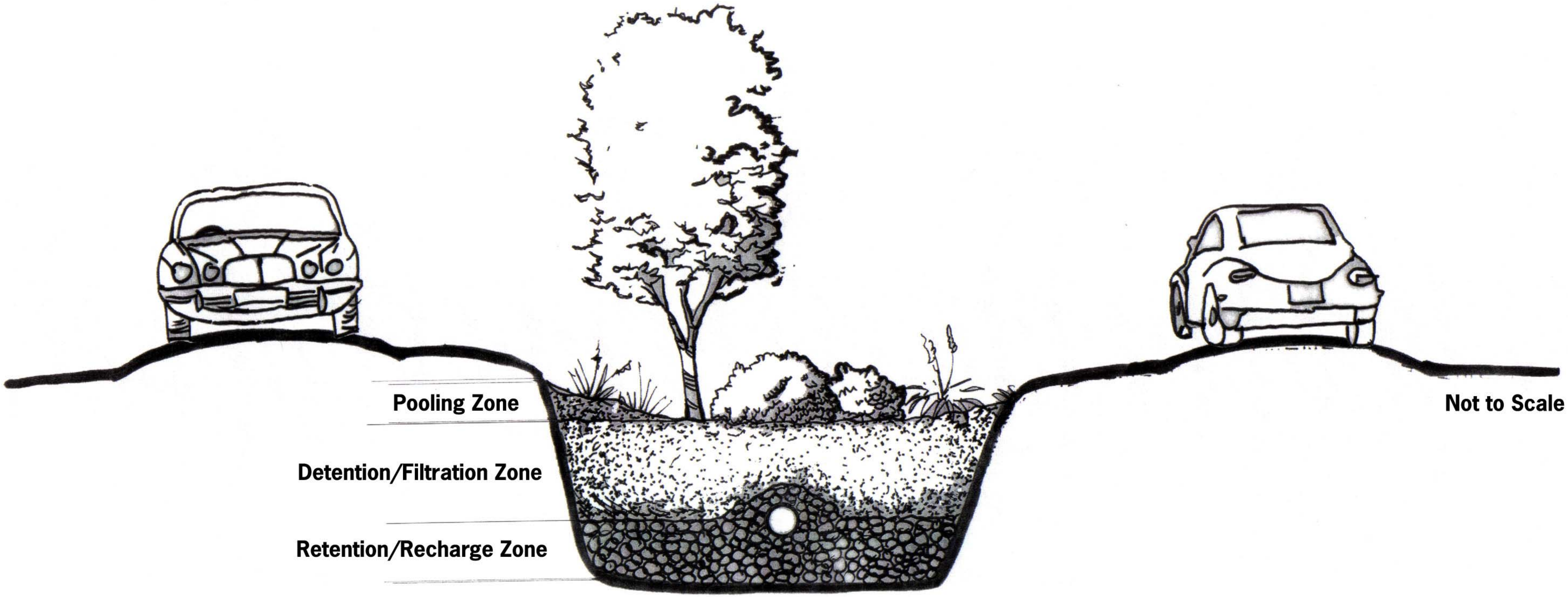
Col. Tom Dotson Sports Complex Sketch - Concessions & Restrooms
Alleghany County, Virginia



Col. Tom Dotson Sports Complex Cross-Section - Biorentention Swale
Alleghany County, Virginia

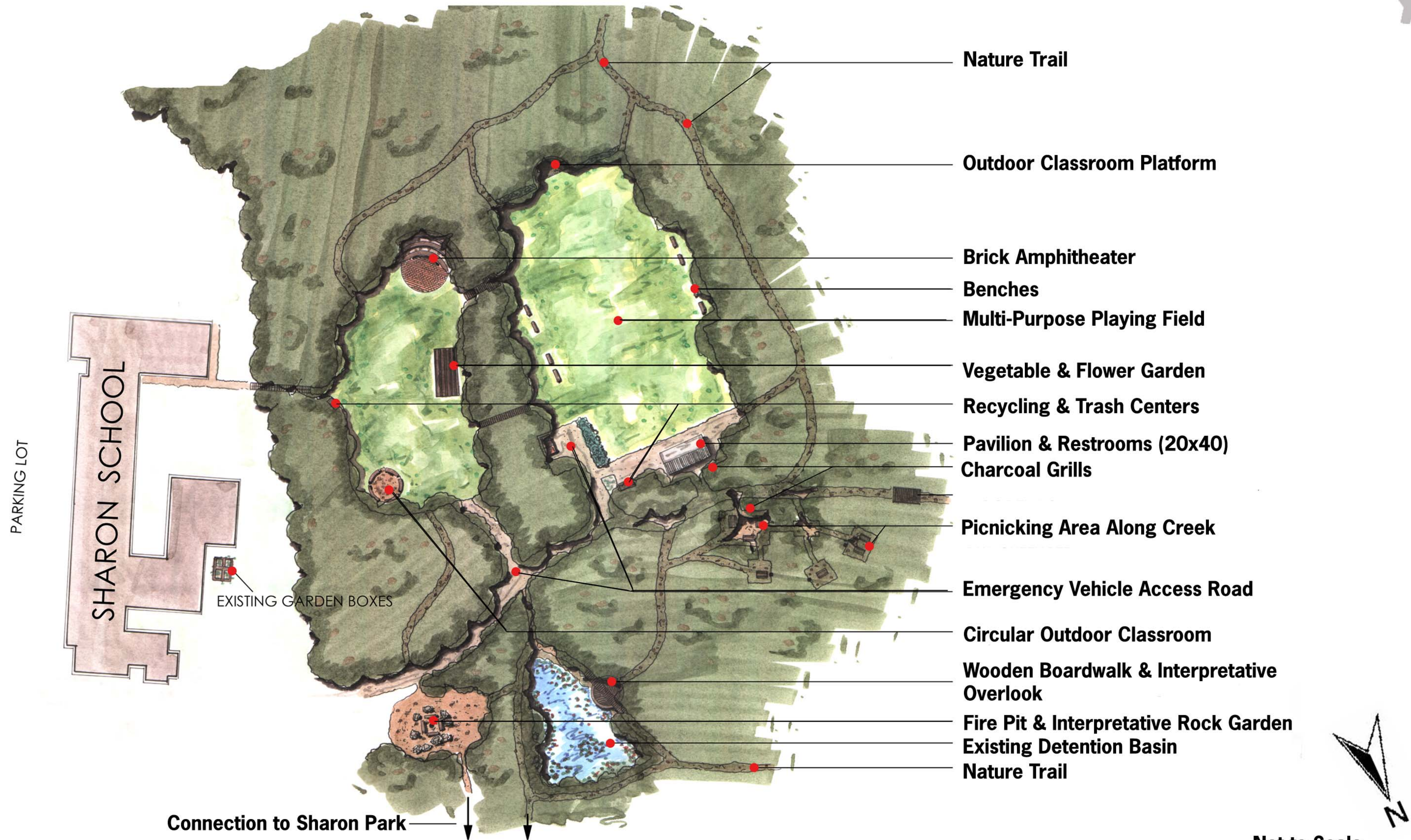
Final Conceptual Master Plan

Sharon Park:

The CDAC team used the input from the April community meeting to shape the final conceptual master plan for Sharon Park.

In the final conceptual master plan, the network of trails was reconfigured to connect two open green spaces to additional site features such as covered picnicking areas, a school vegetable and flower garden, four outdoor classrooms, a rock garden with a fire pit to provide a space for possible night time school activities or local scout troop camp-outs, footbridges crossing natural stream bed corridors, and an emergency and maintenance access drive.

Sharon Park & Colonel Tom Dotson Sports Complex



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Sharon Park - Final Conceptual Master Plan
Alleghany County, Virginia

Sharon Park & Colonel Tom Dotson Sports Complex

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Sharon Park Sketch - ADA Accessible Nature Trail
Alleghany County, Virginia

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Sharon Park Sketch - Fire Pit & Rock Garden
Alleghany County, Virginia

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Sharon Park Sketch - Picnicking Pavilion
Alleghany County, Virginia

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Sharon Park Sketch - Detention Pond Footbridge
Alleghany County, Virginia

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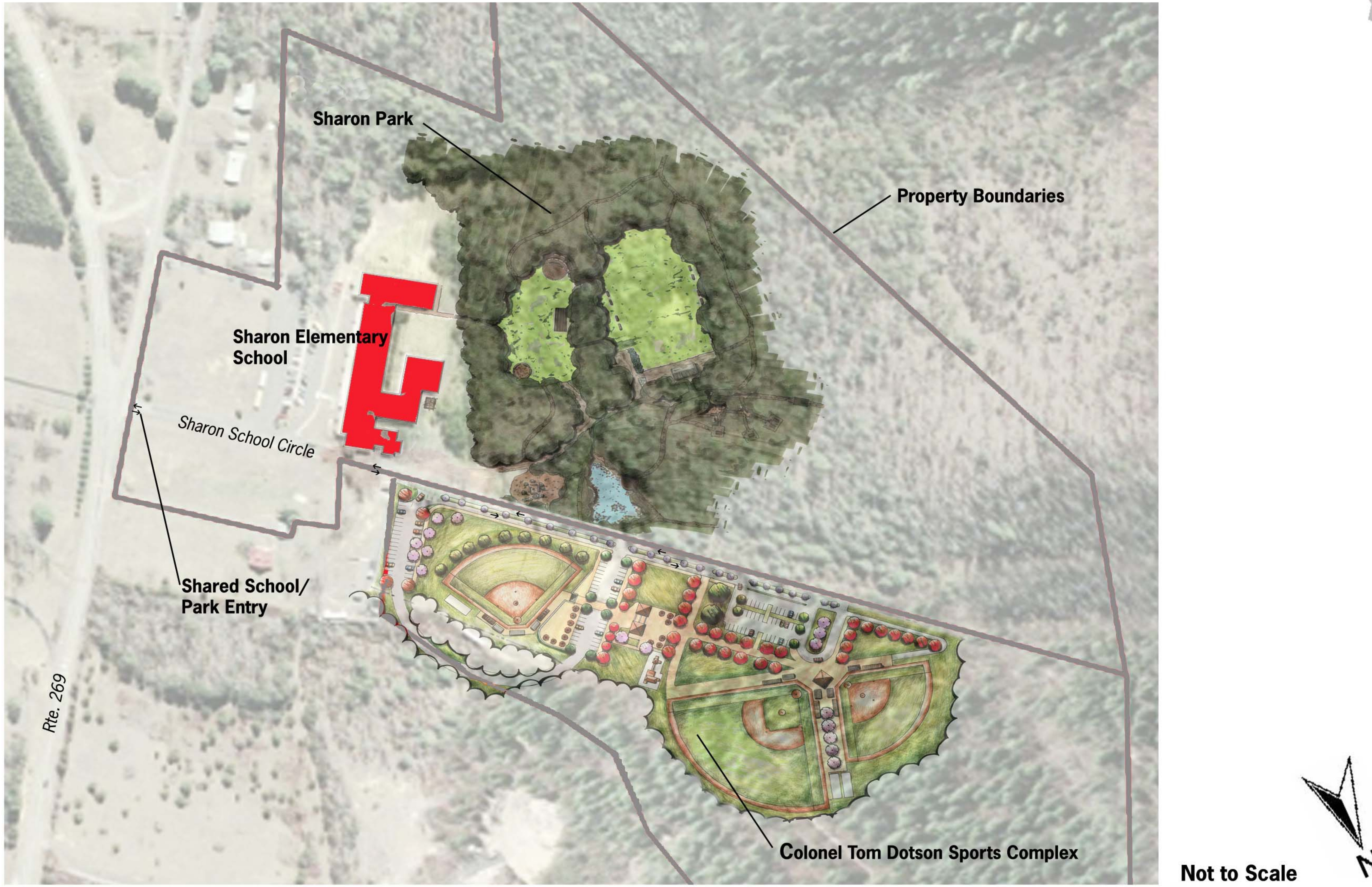
Sharon Park Sketch - Detention Pond Footbridge
Alleghany County, Virginia

Sharon Park & Colonel Tom Dotson Sports Complex



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Appendix A : LID / Bio-retention

INTRODUCTION TO LID AND MANUAL OVERVIEW

DEFINITION OF LID. Low Impact Development (LID) is a stormwater management strategy concerned with maintaining or restoring the natural hydrologic functions of a site to achieve natural resource protection objectives and fulfill environmental regulatory requirements. LID employs a variety of natural and built features that reduce the rate of runoff, filter out its pollutants, and facilitate the infiltration of water into the ground. By reducing water pollution and increasing groundwater recharge, LID helps to improve the quality of receiving surface waters and stabilize the flow rates of nearby streams.

LID incorporates a set of overall site design strategies as well as highly localized, small-scale, decentralized source control techniques known as Integrated Management Practices (IMPs). IMPs may be integrated into buildings, infrastructure, or landscape design. Rather than collecting runoff in piped or channelized networks and controlling the flow downstream in a large stormwater management facility, LID takes a decentralized approach that disperses flows and manages runoff closer to where it originates. Because LID embraces a variety of useful techniques for controlling runoff, designs can be customized according to local regulatory and resource protection requirements, as well as site constraints. New projects, redevelopment projects, and capital improvement projects can all be viewed as candidates for implementation of LID.

LID Elements

Information taken from http://www.wbdg.org/ccb/DOD/UFC/ufc_3_210_10.pdf

BACKGROUND ON THE USE OF LID. The use of LID was pioneered in the 1990s by the Prince George's County, Maryland Department of Environmental Resources (PGDER). Prince George's County has a population of over 800,000, and land uses within the County are very diverse, ranging from sparsely populated natural and agricultural areas to densely populated urban centers. The LID effort in Prince George's County began with the development and use of bioretention cells. A bioretention cell is created by replacing existing soil with a highly porous soil mixture, grading the area to form a shallow depression, and replanting the area with specially selected vegetation. The vegetation must be able to tolerate temporarily saturated soil conditions as well as the pollutants contained in the local runoff. When it rains, bioretention areas collect the runoff and then filter out the pollutants as the water passes down through the soil.

The County's initial experience with bioretention led to a full-scale effort to incorporate LID into the County's resource protection program. In 1998, the County produced the first municipal LID manual. This was later expanded into a nationally distributed LID manual published in 2000. A feasibility study was prepared by the Low Impact Development Center in 2002 that provided guidance on how LID could be used to retrofit urban areas. Numerous municipalities, including Portland, Oregon, are incorporating LID techniques into their urban resource protection programs. Although LID concepts and techniques are new to many planners in the United States, many of these techniques have been successfully used in Europe and Asia for many years.

Several successful pilot projects have been constructed by the Navy and other Department of Defense (DoD) agencies during the last several years. The effectiveness of these projects in managing runoff, reducing construction and maintenance costs, and creating ancillary benefits such as community involvement has created significant interest in LID. The challenge is to adapt these approaches and techniques to the unique requirements of DoD facilities on a wider scale.

LID SITE DESIGN STRATEGIES. The goal of LID site design is to reduce the hydrologic impact of development and to incorporate techniques that maintain or restore the site's hydrologic and hydraulic functions. The optimal LID site design minimizes runoff volume and preserves existing flow paths. This minimizes infrastructural requirements. By contrast, in conventional site design, runoff volume and energy may increase, which results in concentrated flows that require larger and more extensive stormwater infrastructure.

Generally, site design strategies for any project will address the arrangement of buildings, roads, parking areas, and other features, and the conveyance of runoff across the site. LID site design strategies achieve all of the basic objectives of site design while also minimizing the generation of runoff. Some examples of LID site design strategies discussed in this UFC include:

- Grade to encourages heat flow and lengthen flow paths.
- Maintain natural drainage divides to keep flow paths dispersed.
- Disconnect impervious areas such as pavement and roofs from the storm drain network, allowing runoff to be conveyed over pervious areas instead.

- Preserve the naturally vegetated areas and soil types that slow runoff, filter out pollutants, and facilitate infiltration.
- Direct runoff into or across vegetated areas to help filter runoff and encourage recharge.
- Provide small-scale distributed features and devices that help meet regulatory and resource objectives.
- Treat pollutant loads where they are generated, or prevent their generation.

LID Devices. Reevaluate the site design once all of the appropriate site design strategies are considered and proposed to determine whether the stormwater management objectives have been met. Stormwater management controls, if required, should be located as close as possible to the sources of potential impacts. The management of water quality from pavement runoff, for example, should utilize devices that are installed at the edge of the pavement. These types of controls are generally small-scale (because the site planning strategies have created small-scale drainage areas and runoff volumes) and can be designed to address very specific management issues. The objective is to consider the potential of every part of the landscape, building(s), and infrastructure to contribute to the site stormwater management goals. When selecting LID devices, preference should be given to those that use natural systems, processes, and materials. The following list briefly defines the LID devices (or IMPs) described in this UFC.

BASIC LIST OF IMPs. :

Bioretention: Vegetated depressions that collect runoff and facilitate its infiltration into the ground.

Grassed Swales: Shallow channels lined with grass and used to convey and store runoff.

Permeable Pavement: Asphalt or concrete rendered porous by the aggregate structure.

Permeable Pavers: Manufactured paving stones containing spaces where water can penetrate into the porous media placed underneath.

Soil amendments: Minerals and organic material added to soil to increase its capacity for absorbing moisture and sustaining vegetation.

Example photo of a bio-retention swale.
Photo taken from www.wsud.org

Example photo of a bio-retention parking lot swale.
Photo taken from www.waterresearch.com

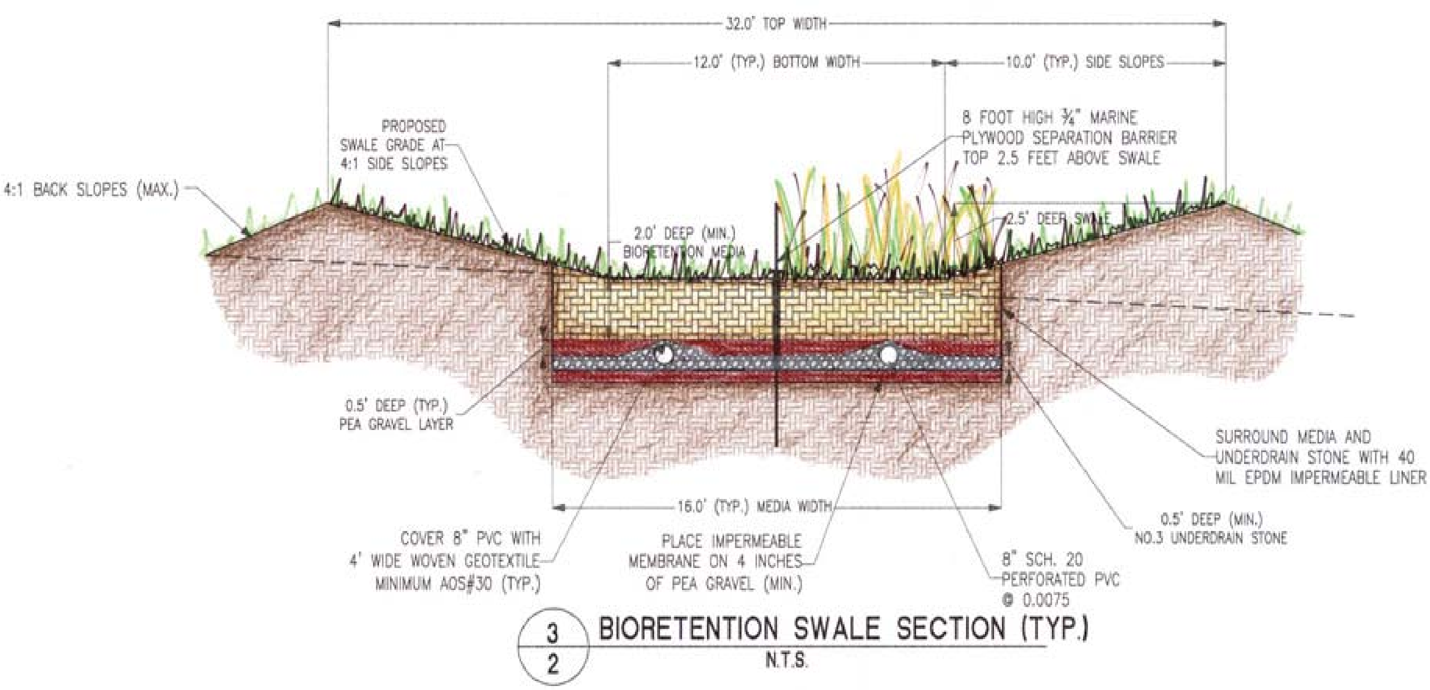


Photo taken from www.esc.rutgers.edu

Appendix B : Porous Paver Suggestions

Pervious Paving Reccomendation | Cast in place allowing water to pass through

Pervious concrete is made from carefully controlled amounts of water and cementitious materials used to create a paste that forms a thick coating around aggregate particles. Unlike conventional concrete, the mixture contains little or no sand, creating a substantial void content – between 15% to 25%.

Using sufficient paste to coat and bind the aggregate particles together creates a system of highly permeable, interconnected voids which drain quickly. Both the low mortar content and the high porosity reduce strength compared to conventional concrete, but sufficient strength is readily achieved for many applications.

Pervious concrete allows 3 to 8 gallons of water per minute to pass through each square foot of the material. By allowing rainwater to seep into the ground, pervious concrete can be instrumental in recharging groundwater and reducing stormwater runoff. This capability can reduce the need for retention ponds, swales, and other stormwater management devices. Pervious pavement integrates hardscape surfaces with stormwater management.

Uses:

Applications for pervious concrete include:

Hardscape
Low-volume pavements
Residential roads, alleys, and driveways
Low-water crossings
Parking lots
Sidewalks and pathways
Patios
Tennis courts
Swimming pool decks
Pavement edge drains

Floors
Foundations/floors for greenhouses, fish hatcheries, aquatic amusement centers, and zoos

Walls
Load bearing and other walls
Sound barriers

Other
Subbase for conventional concrete pavement
Slope stabilization
Artificial reefs
Well linings
Hydraulic structures
Tree grates in sidewalks
Groins and seawalls

Why:

Use of pervious concrete is among the Best Management Practices (BMP) recommended by the EPA and other agencies for the management of stormwater runoff on a regional and local basis. By eliminating the need for retention ponds, swales, and other stormwater devices, pervious concrete can lower overall project costs on a first-cost basis, and makes more efficient use of the land.

Information taken from http://www.concretethinker.com/Papers.aspx?DocId=10

Sustainabilty:

Pervious concrete has many environmental benefits. See associated sustainability solutions and technical briefs (right) for more detail.

Stormwater Management. By allowing water to soak through and infiltrate, pervious paving reduces stormwater flow and pollutant loads. Can contribute to LEED Credit 6.

Minimize Site Distrubance. By integrating paving and drainage, less site area may need to be used to manage stormwater, allowing a more compact site development footprint. May contribute to LEED Credit SS 5.

Local. Materials are usually extracted and manufactured locally. May contribute to LEED Credit M 5.

Recycled content. Fly ash, slag cement, or silica fume can substitute partially for cement, and recycled aggregates can replace newly mined gravel. Recycled content can contribute to LEED Credit M 4.

Cool. The voids reduce mass reducing the heat build up associated with heat islands. Lighter colored cements can increase reflectivity. Not specifically approved for achieving LEED Credit SS 7.

Considerations:

The properties of pervious concrete vary with design and depend on the materials used and the compaction procedures. General guidelines for specifications are provided below.

Permeability. Typical flow rates for water through pervious concrete are 3 to 8 gallons per sq foot per minute, but can be double that amount if desired.

Compressive Strength. Pervious concretes can develop compressive strengths in the range of 500 to 4000 psi – suitable for a wide range of applications.

Flexural Strength. Flexural strength of pervious concrete ranges between 150 and 550 psi.

Shrinkage. Drying shrinkage of pervious concrete is faster but much less than that experienced with conventional concrete. Many pervious concretes are made without control joints and are allowed to crack randomly.

Freeze-Thaw Resistance. Freeze-thaw resistance depends on the saturation level of the voids in the concrete at the time of freezing. In the field, it appears that the rapid draining characteristics of pervious concrete prevent saturation from occurring. Where substantial moisture and freeze-thaw conditions are anticipated, pervious concrete should be placed on a 6 to 18-in.-thick layer of drainable rock base such as 1-in. crushed stone.

Abrasion resistance. Because of the rougher surface texture and open structure of pervious concrete, abrasion and raveling of aggregate particles can be a problem, particularly where snowplows are used to clear pavements. Surface raveling in new pervious concrete can occur when rocks loosely bound to the surface pop out under traffic loads. This raveling is considerably reduced after the first few weeks.

Photo of porous pavement.
Photo taken from www.concretenetwork.com

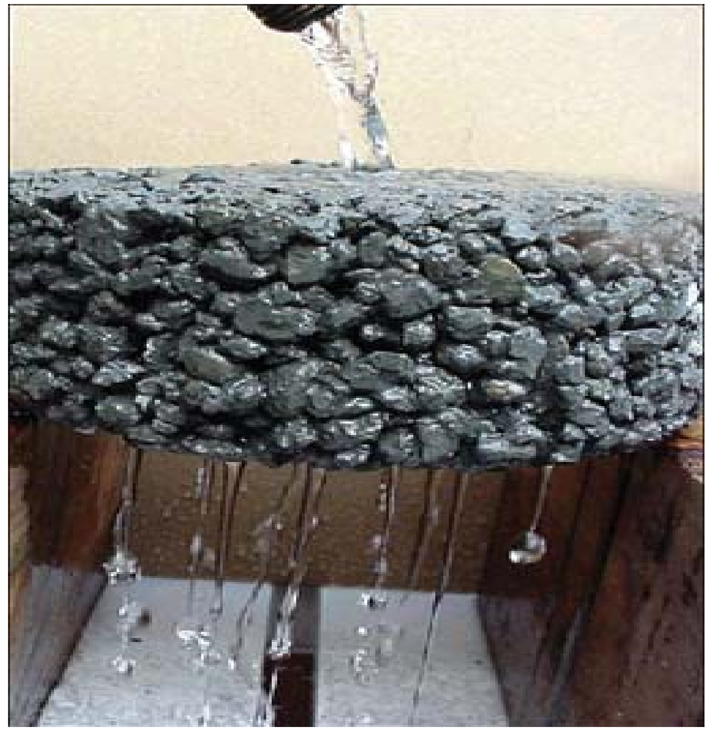
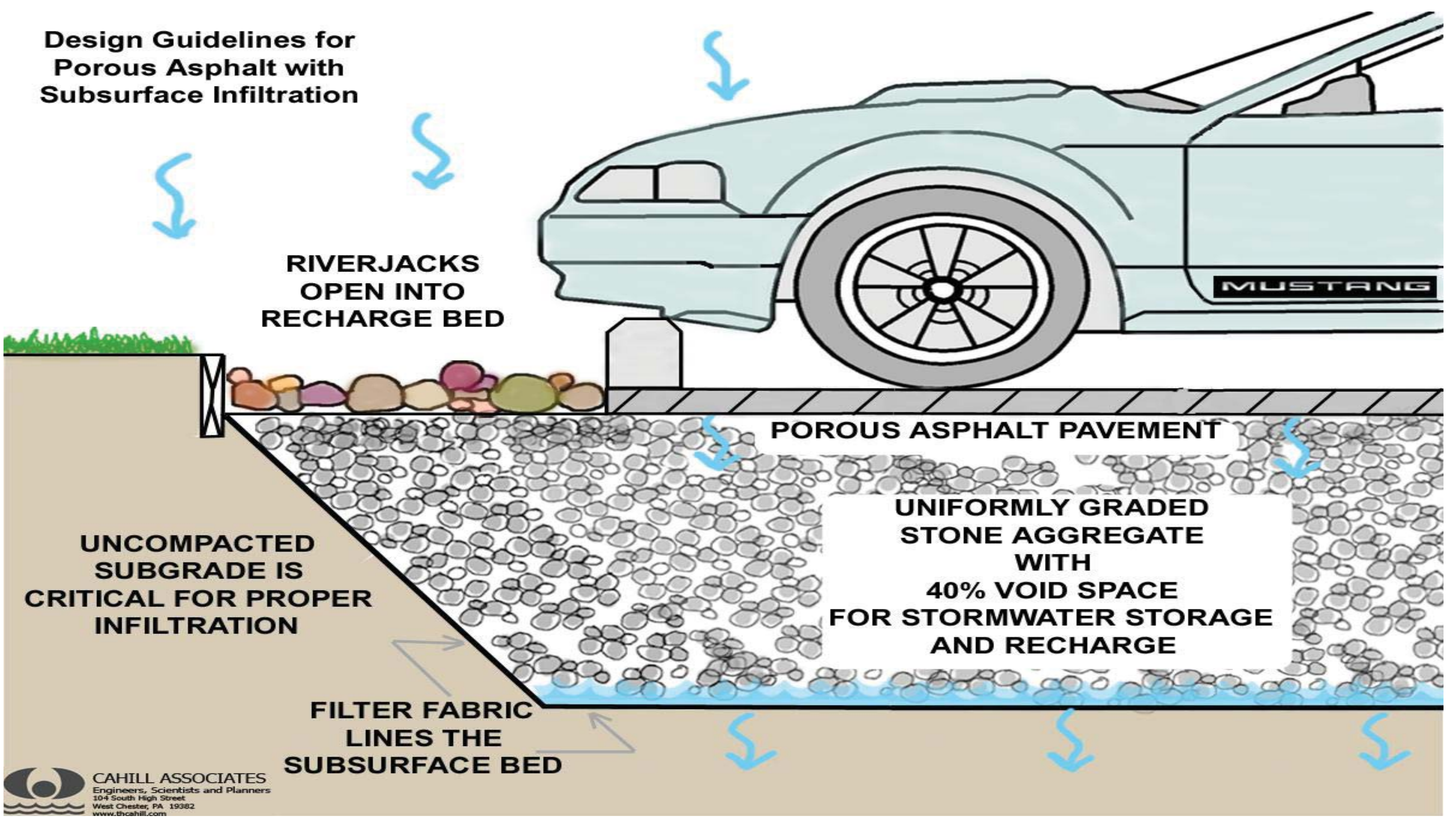


Photo of porous pavement
Photo taken from www.centralconcrete.com



Section drawing of porous pavement parking space.
Photo taken from www.mapc.com

Appendix C : Site Amenities

Green Playground Solutions

BigToys Playground Equipment Offers You a Choice

BigToys has been known for producing the highest quality wooden playground equipment available for over 35 years. Now, BigToys unique structural system is available in your choice of conditioned wood or 100% recycled steel and plastic.

BigToys Recycled Steel and Plastic System Features:

- We don't downgrade our materials for lower prices. Our 6" diameter tubing is standard on all BigToys school-age and EarlyWorks™ preschool playground equipment. These critical structural supports, produced from U.S. made, reclaimed steel offer incredible strength and durability for all children.
- Unlike most metal playground equipment, BigToys' galvanized steel tubing is first primed and then powder-coated for superior rust resistance. This "triple-coating" greatly reduces the likelihood of rust "traveling" under the outer paint layer if metal components are scratched down to the raw steel underneath.
- Our plastic decks, enclosures and roofs are made from 100% post-consumer, recycled High Density Polyethylene (HDPE). Internal fiberglass-reinforcing is added to deck and enclosure supports for maximum strength and no sagging!
- We pre-drill every hole needed at the factory to assemble your BigToys so there is no need for on-site fabrication. This keeps the integrity of our triple-coating protection intact so our pipe won't rust around connection points.
- Textured HDPE deck surfaces exceed the ADA requirement for slip-resistance in both wet and dry conditions.
- Each BigToys internal connector can hold up to 5,000 pounds. This simple but sturdy connection allows you to spend more of your budget on fun activities and not expensive clamps that are easily mis-installed.
- A rugged, cast aluminum end cap tops each steel upright, providing a finished look and connection point for attachments.
- Our unique textured powder coating helps keep pipe surfaces cooler in hot weather and gives children a tactile experience different from common glossy coatings.

Information taken from http://www.bigtoys.com/

BigToys Conditioned Wood System Features:

- BigToys child-friendly conditioned wood is EPA approved and contains NO CCA. Our conditioning preservative won't leach out, won't stain, doesn't pollute the environment and won't harm children.
- Our unique milling process results in a smooth furniture-grade finish. In addition to sanding every exposed surface, we also take the time to remove all corners from our dimensional lumber on enclosures and decks.
- Wood is a natural material that offers children beauty, warmth and a connection to nature. This connection adds to a child's experience on the playground.
- BigToys' patented, internal "Eagle" fastener expands for a secure connection that won't loosen as a result of expansion and contraction of the surrounding wood.
- All BigToys decks and enclosures are factory assembled eliminating on-site fabrication. You don't need any specialized carpentry skills to build your BigToys.

We believe in wood

Many people feel we are moving away from our connection to the natural world around us. Wood based BigToys playground equipment connects children to nature. Children can stimulate their natural instincts by reinforcing a connection to the natural materials of BigToys. This connection adds to a child's experience on our playground equipment and gives children an opportunity to relate to BigToys which will change naturally as they change.

We use only conditioned wood that is arsenate-free and contains no heavy metals to build our BigToys playground equipment. We believe that wood offers a natural, warm beauty that is not available in most man-made materials. Perfectly suited to commercial playground equipment; our conditioned wood has a smooth finish that delivers exceptional durability for generations of use. Many BigToys sold decades ago are still in use today on playgrounds throughout the world.

Wood is durable

We have been building BigToys playground equipment for over 30 years. We have an annual warranty
rate of 0.3% and our warranty for our wood columns is 15 years. In many areas you will find children playing on the same wooden BigToys playground equipment their parents played on.

BigToys quickFacts : Metal Column

Tubing

- 6" outside diameter tubing (20% larger than competitor's 5" diameter)
- .109" / 12 gauge wall thickness
- Contains 100% recycled scrap steel
- Tubing is roll-formed from pre-galvanized sheet steel
- Welded seam is "metalized" with a zinc coating
- Connection holes are plasma-cut in a modular pattern allowing for easy volunteer installation
- Tubing is cleaned by sand-blasting to a "near-white finish". Tubing is then coated and baked with an epoxy primer and then coated and baked again with a semi-gloss, textured polyester based powder coat finish in Cardinal brand Metallic Light Bronze color. This results in a Triple-coated BigToys "column".
- Textured powder coating results in lower surface temperature compared to gloss finishes
- 50 Year Warranty from the tubing manufacturer
- Made in Wallbridge, Ohio, USA

Column end fitting

- Heavy-duty, 100% recycled cast aluminum column end fitting is coated and baked with an epoxy primer and then coated and baked again with a semi-gloss, textured polyester based powder coat finish in Cardinal brand Metallic Light Bronze color.
- Cap connection to roof purlin bracket. Ease of assembly based on cap installation

Steel footing plate

- 3/16" galvanized steel footing plate allows for easier in-ground installation
- Footing plate is secured to base of column with coated drive screws

BigToys quickFacts : Recycled Plastic

Recycled Plastic Decks, Enclosures and Roofs

- 100% recycled High Density Polyethylene (HDPE) from recycled post-consumer plastics
- One BigToys 9 board platform contains 1,015 milk jugs, keeping them out of landfills
- Contains no saw dust or organic material as found in Trex® – 100% HDPE material won't absorb moisture
- Low-pressure injected molding vs. extruding provides improved slip-resistant surface texture (meets ADA requirements)
- 50 Year Warranty provided by manufacturer
- Contains UV inhibitors for color stability
- Load bearing components (i.e. deck support members) are fiber-reinforced
- Won't support a flame without an accelerant
- Used successfully in a wide range of environments from Alaska to Puerto Rico
- Graffiti can be easily removed with standard non-toxic cleaners

BigToys® quickFacts : Copper Azol

The facts on why BigToys® uses Copper Azol preservative on our wood based play equipment.

BigToys applauds and encourages the overall discussion on treated wooden playgrounds that is currently ongoing across North America. We feel however, that much of it is based on incorrect information. As a responsible leading manufacturer of wood based play equipment, BigToys would like to help inform interested parties on some of the issues and offer factual answers to aid in their understating of this complex topic.

- Why treat wood at all?
  - Like metal, plastic and other materials, most wood is subject to deterioration when exposed to continual soaking or when in contact with the soil.
  - Wood treated with Copper Azol lasts up to five times longer than untreated wood.
  - The longer wood lasts, the fewer trees need to be cut to replace it.
  - Treated wood components ensure the usability of BigToys for many years, helping to protect the investment of our customers and the safety of children.

- When did BigToys start using Copper Azol?
  - As of September, 2001 BigToys play equipment has been produced using Copper Azol as the exclusive preservative for treating our wood components. At that time all CCA (chromated copper arsenate) treated material was removed completely from our products.

- Why did BigToys change to Copper Azol from CCA?
  - BigToys decision to replace CCA treatment with Copper Azol was based on our commitment to the safety of children who play on our equipment. While we agree with the Environmental Protection Agency (EPA) that there is no inherent risk in CCA treated wood playgrounds we feel that Copper Azol offers a natural solution for wood preservation without diminishing its effectiveness.

- What is Copper Azol?
  - Copper, derived from recycled sources, is the principal active ingredient, protecting against termites and fungal decay. Protection against copper-tolerant fungi is provided by an organic azol that is also used to protect many of the foods we eat such as fruit, peanuts and wheat.
  - This copper azol formulation has been registered by the EPA as a safe and acceptable preservative for pressure-treating wood in consumer applications including playgrounds.
  - The EPA classifies CCA as a restricted use pesticide, but Copper Azol preservative is not restricted by the EPA. In addition, there are no special EPA precautions for handling wood treated with Copper Azol as there are with CCA treated wood.
  - Copper Azol, has been used effectively in 20 countries around the world since 1992.
  - WolmanE® is a commercially produced wood treatment made from Copper Azol.

- What are the benefits of using Copper Azol on BigToys?
  - Copper Azol renders wood useless as a food source for termites and fungi while keeping the wood attractive, clean and odorless.
  - Copper Azol is now recognized as the most effective and successful alternative to CCA treated wood throughout the world. It is an ideal choice for playground equipment, outdoor furniture, decks, patios, garden and landscape structures.

- Are there any risks in using Copper Azol?

- Based on an independent human health risk assessment by Gradient Corporation, a noted environmental and toxicological consulting firm, the highest potential risk from exposure to copper azol-treated wood was estimated to be 17 times lower than the level that the EPA uses as a safety benchmark. This comprehensive study of occupational, residential, and playground uses of wood pressure-treated with copper azol preservative has concluded, "no adverse health effects are expected."

- How do I dispose of wood treated with Copper Azol?
  - There is no actual on-site wood fabrication in the installation of BigToys play equipment that will result in wood waste such as scraps or sawdust. This eliminates concerns about site clean-up related to wood treated with Copper Azol.
  - In general, Copper Azol treated wood can be disposed of with ordinary trash collection. It should not be burned.

- A few misconceptions that we would like to correct:
  - Pressure treated wood is bad…
    - In fact, "pressure treating" refers only to the process of applying a liquid solution to wood within a vacuum, not to the materials that are being applied. This process is regularly used by manufacturers in the wood industry to apply various stains, water repellants, wood treatments and other materials not considered harmful. Pressure treated wood does not always contain CCA.

  - A greenish wood color means it is treated with CCA…
    - The greenish tint found on some treated wood results naturally from the use of copper as a preservative agent to reduce decay from fungi. It does not indicate the presence of CCA since other non-CCA treatments also appear green. Copper is not considered a heavy metal or a health risk.

  - CCA-treated wooden play equipment must be removed from public play areas…
    - Neither the EPA nor the Consumer Products Safety Commission (CPSC) has suggested that existing wooden play equipment should be removed from public playgrounds.
    - The EPA suggest that applying certain penetrating coatings, for example, oil-based semitransparent stains, on a regular basis can aid in keeping these structures safe and usable.

  - CCA is transferred by touching wood playground equipment…
    - Unlike CCA treated wood used in most backyard decks, fences and other residential wood products, existing BigToys equipment previously treated with CCA is free of surface residue, eliminating excess exposure to CCA. Specifically, the wood that was used on our equipment underwent a special manufacturing process as required by the CPSC in accordance with the specifications of the American Wood Preservers Association C17 standard.

  - Wood playgrounds are illegal…
    - There are currently no known written or pending laws at the Provincial, State or Federal level that prohibit the purchase of wooden play equipment for use on public playgrounds. A pending bill in the U.S. Congress is written to prohibit "the use of arsenic treated wood" in the manufacture of various residential and commercial products including fences, walkways, boat docks, playgrounds, etc.

  - Wood playgrounds are not durable or require extra maintenance…
    - All wood play equipment is not equal. Much of the wood equipment built in the last two decades was constructed from typical lumber produced for general construction. BigToys wood components feature highly finished materials, fabricated for use only on BigToys play equipment. The difference results in a BigToys product that lasts many years and requires no more maintenance than equipment made of metal and plastic. We know of BigToys equipment installed 30 years ago that is still being used daily in parks and schools in the U.S.

Green Playground Solutions

BigToys Community Built Playground Equipment

Frequently, building a playground for a park or school is a community effort. Thousands of school and community groups have installed BigToys playground equipment as volunteer projects throughout North America. And they ended up with more than just wonderful, long-lasting playground equipment. They also built pride in their schools and parks and a sense of community while having fun doing it. Studies indicate that public spaces that are built and supported in this way often have a lower incidence of vandalism too.

BigToys' simple, straight-forward system of modular components and pre-drilled holes make it possible for volunteers without previous experience to install BigToys playground equipment. Even kids can help, because only common, everyday tools are necessary. And there's no on-site manufacturing required which reduces the risk of injury associated with constructing playgrounds from standard building materials.

BigToys supplies easy to follow instructions with every order that detail the simple assembly and installation process. And if you do have questions there's a toll-free number direct to the factory for immediate advice. Our industry first **SATURDAY SERVICE, (360) 556-2668,** can provide lost or damaged parts overnight to most areas of the U.S. so your weekend project can still be completed on schedule. For a nominal fee a BigToys installation supervisor can guide your group through the project and still save you as much as 30% of the total cost of your project, or if you prefer you can contract the entire installation for a "turn-key" project.

100% Recycled Plastic Bench

Park Equipment Pro's 100% recycled plastic bench features a black recycled plastic frame and stainless steel fasteners. The 2"x4" slats are 100% recycled plastic. One can choose between a 6 foot (185 lb.) and 8 foot (205 lb.) model.

Economy Park Grill

This grill has a 300 square inch cooking surface and dimensions of 20"W x 15" D x 10" H. Made of 3/16" steel with a continuous weld type construction, this is Park Equipment Pro's most vandal resistant pedestal grill. Total weight is 29lbs. The grill can be shipped via UPS.

Information taken from http://www.parkequipmentpro.com

Round Vinylast Plastisol Table

This table has #9 expanded metal top and seats and is available in a variety of colors (red, blue, brown, and yellow). The table top is 48" in diameter and the frame is hot-dipped galvanized after fabrication.

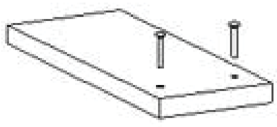
55 Gallon Plastisol Litter Receptacle

This litter receptacle neatly hides a 55 gallon drum. It is constructed with A 3/4" No. 9 expanded metal with heavy PVC coating, which is both UV and mildew resistant. Park Equipment Pro gives customers the choice of purchasing a free-standing receptacle, an in-ground receptacle, or a surface-mounted receptacle. Available in seven different colors.

Information taken from http://www.parkequipmentpro.com

200-1002 5-Row x 12'L Bleacher Understructure

For those with a tight budget and can't afford aluminum bleachers, or just do not like them, this bleacher frame offers an excellent alternative. Easy to use and assemble, you just need to supply the wood planks for seats. The fasteners attach them to the frame, and you have an easy-to-use low-cost bleacher system. (Check local codes for rail requirements on any bleacher system you use).



Weight: 186 LB

Dimensions: 12' long x 5 rows

Warranty: 5 year limited

Information taken from http://www.highlandproductsgroup.com/itemdesc.asp?ic=200%2D1002&eq=&Tp=

Appendix D : Outdoor Learning Opportunities

China School Forest Learning Guide

Introduction:
The China School Forest is a town-owned tract of land located behind the China Primary and Middle Schools. The town has set aside this land for educational and recreational purposes.

The total lot is approximately 70 acres and is comprised of school grounds, outdoor classrooms, and a working wood lot. This property has been sustainably managed for forest products since the early 1980's and was recognized as a Maine Tree Farm in 1985. The forest received the 1997 Outstanding Maine Tree Farm Award for it's exemplary stewardship and educational practices.

The purpose of our demonstration forest is to provide a complete picture of the forest as a dynamic ecosystem, as a source of valuable natural products, and as a recreational resource. As an educational resource, we feel that it's location and design will make it readily accessible to students in the central Maine area for a "hands-on" experience.

There are many resources available including Project Learning Tree, Project WILD, Project Aquatic WILD, and Project WET, which can be used to help teach concepts about the natural world. Both schools have "Tree Trunk" boxes containing teacher resources, trade books, forestry tools, and other items that can be used in the forest. These may be checked out of the library. All subject areas including language arts, social science, math, science, allied arts, and physical education can be integrated into the outdoor classroom. Many resource books, people, and programs are also listed in the appendix of this guide and can be used as a starting point. You do not have to teach just environmental education here. We encourage creative uses of our forest and would love to hear about how you use this area as an educational resource.

Using the Guide:
This guide will provide you with information on where to locate resource materials and activities to use in the forest. We have included maps, charts, a description of each learning station, suggested learning activities, and tree identification information.

http://www.china-ms.u52.k12.me.us/~schoolforest/index.html

Learning Station 1 - Forest Choices

Concepts:
Students can learn about -
- Four different methods of forest management: single tree harvest, clear-cutting, high grading, and inactive management
- Forest succession and disturbance
- What wildlife needs to survive, and what different forest types supply those needs
- The concept of stewardship
- The differences between preservation, conservation, utilization, and exploitation
- How a compass works
- How to find your way with a compass
- How to read a map

Definition of Station:
Few issues, if any, have simple solutions, and resolving them usually involves compromise. At this station your students will learn about some of the effects that human activities can have on the forest.

From this viewing platform, you can look at four different sections of forest that have been treated by four different management methods. Before these treatments took place in the winter of 1991 - 1992, the entire stand looked similar.

Area A: Untouched
No forest management activity took place in this section. No human activity took place on this site, and all forest manipulation is left to the whims of Mother Nature.

Area B: Clear-cut:
This type of harvest removes all trees over 20 feet tall from the site. This allows the stand to regenerate to species that do not tolerate shade. These species include: white and gray birch, popple, cherry, and tamarack. These trees are fast growing and short-lived, so that the entire stand can often be harvested again, in a similar manner, in 25 to 30 years.

This type of disturbance sets the stand back to an early state of forest succession, where it is utilized by a great variety of animals including: fox, partridge, woodcock, moose, and deer.

Area C: Single Tree Selection, Improvement Harvest
This type of selective harvesting removes individual trees that are sick, badly formed, or undesirable. It leaves behind a well-

http://www.china-ms.u52.k12.me.us/~schoolforest/sta1.html

distributed stand of healthy trees that are expected to grow well. Enough sun can now reach the forest floor so that the stand begins to regenerate. The young trees will be of species that are moderately shade tolerant such as: yellow birch, red and sugar maple, spruces, fir, pine, and cedar. The stand will be harvested again in 10 to 15 years, and there may be large, good quality trees whose growth has slowed due to old age that can be removed along with undesirable trees. This type of uneven age management can provide a continuous supply of a variety of wood products.

This type of disturbance sets the stand back to the middle stages of forest succession. It will be used by many animals including: deer, partridge, squirrel, and turkey.

Area D: High Grade
Depending on how much of the stand was removed, regeneration may begin to appear. While this type of harvest will produce the largest amount of money now, it does not take into account what will happen in the future. A properly managed forest will produce a continuous supply of wood and money, but an improperly managed forest will only sometimes produce wood and money.

A great variety of animals will use this area, including: deer, partridge, squirrel, and woodpeckers.

Active forest management based on sound scientific principles is called silviculture. It can be compared to agriculture or gardening, and the major difference is time. A garden crop is planted, tended, and harvested in one season. A forest takes many years to be naturally or artificially planted, tended, and harvested.

The timing of silvicultural activities is based on the growing condition of the forest and on the landowner's goals. The forest is made up of many biological systems (the life cycle of tree species, wildlife needs and utilization, soil limitations, water resources, etc.) and these should all be considered, along with a consideration of its social values (economic needs, aesthetic beauty, recreation, a refuge from humanity, etc.).

Remember that there are no black and white, right or wrong answers in forest and wildlife management, but there are sound decisions that can be made. You will make better decisions if you are armed with as much knowledge as possible. A forest cannot be all things to all people at any one time, but it

http://www.china-ms.u52.k12.me.us/~schoolforest/sta1.html

Learning Station 3 - Riparian Area

Concepts:
Students can learn about -
- What a watershed is
- How land use of an entire watershed affects water resources
- What non-point source pollution is
- How an undisturbed vegetated area protects water resources from pollution
- Benefits provided by strips of trees or shrubs

Definition of Station:
Riparian areas are areas along the edges of water resources such as streams, rivers, ponds, and lakes. Undisturbed riparian areas buffer the effects of land use activities further up in the watershed and protect the quality of water. This strip of trees or shrubs also provides a windbreak, can shield undesirable views, and provides travel corridors for wildlife.

A watershed is all of the land area that drains into a water resource. Everything that happens in that land area can affect the quality and quantity of the water resource.

In an undisturbed forested watershed, the force of raindrops is slowed by striking vegetation, running across uneven ground, being absorbed by the duff, and being taken up by plants. Only a small percentage leaves the site as runoff. When vegetation is removed, the rain strikes the ground with more force, and more runs off. This increase in the amount and velocity of water causes soil erosion and sometimes flooding. Erosion causes soil and the nutrients that are naturally attached to the soil particles to be carried into nearby water bodies. Soil particles, or sediment, can build up in streams, smothering fish eggs, clogging fish gills, and killing small animals and insects that fish or larger animals feed on. Nutrients carried into the water can cause algae blooms or other changes in the ecosystem. Because more water runs off an unvegetated site, the affected streams and rivers may rise higher than they did before the land clearing took place.

Leaving an undisturbed buffer strip along water resources will help lessen the effects of non-point source pollution such as soil erosion and sedimentation. Notice that an undisturbed forest floor is uneven and covered with a layer of duff that remains damp when the ground in cleared areas dry out. This slows the water running through the area, allowing some of the sediment to drop out and giving plants time to take up the water and the nutrients in it. The roots of the vegetation also help stabilize the banks of the streams or lakes.

The vegetation often shades the water, providing cool resting places and shelter for fish in deadfalls and root systems. These are excellent hatching and staging areas for aquatic and terrestrial insects, attracting birds and wildlife to this food source. Also, seeds and insects fall from the vegetation to feed animals in the water.

An undisturbed buffer strip also provides benefits to land animals. It gives them cover when they go to drink, and provides them with a travel corridor that connects with other areas they use. Often the relatively wet soils along the waters edge allow a greater variety of plants to grow, providing food for wildlife.

http://www.china-ms.u52.k12.me.us/~schoolforest/sta3.html

Learning Station 5 - Geology

Concepts:
Students can learn about -
- Rock outcrops and form relationships about other outcrops in the China region
- Bedrock geology in China and Maine
- Geologic processes that helped to form the surficial and bedrock geology of the area
- How soil is made of small pieces of rock and decomposing organic matter

Definition of Station:
This rock sticking out of the ground (a rock outcrop) is a small part of the rock that forms the geologic base for the state of Maine, our continent, and our planet. The rock under the soil you are standing on is called bedrock. The bedrock for the state of Maine has been affected by many different geologic processes including:

1. metamorphic changes (heating and intense pressure)

2. continental collisions (with Africa and Europe)

3. igneous intrusions (domes of magma)

4. glacial pressure at the surface from several ice ages.

The soils in this area can also be studied. Is the soil high in organic matter? Is there a lot of clay in the soil? How does the nearby wetland affect the soils? What organic matter has been used to create the soils? How does the type of soil affect the trees growing in this area? There are many questions to explore in the area of soils.

During the last Ice Age, large sand and gravel deposits were left behind by the retreating icecap. These deposits are called eskers. There are many gravel pits in our local towns; in fact, the gravel used in our access roads came from locally mined gravel pits. What else do we use this sand and gravel for? In many places, water flows between the sand particles below the ground's surface. In our area, we often drill down into the sand deposits and pump out the water to use in our homes. Water in these sand and gravel deposits is called a sand and gravel aquifer. The water in these aquifers are often interconnected from one place to the next beneath the surface of the ground. We can see this water at the surface in ponds, lakes, and wetland areas. The water level underground is sometimes called the water table. The aquifers are replenished or recharged when it rains or when snow melts.

Water can also be trapped in large cracks in the bedrock. In Maine, water is also present in bedrock aquifers. Ground water in the bedrock moves in thin cracks or openings in the rocks. The cracks in the rocks extend beneath the land surface to depths greater than 300 feet. Most wells in Maine are drilled into the bedrock aquifers. The wells intersect the water-filled cracks which yield water to the well. Well pumps push or pull water from the wells into our homes, schools, and businesses.

This geology station can be a starting point for many lessons on geology, soils, and aquifers.

Appendix E : Soils Report

United States Department of Agriculture

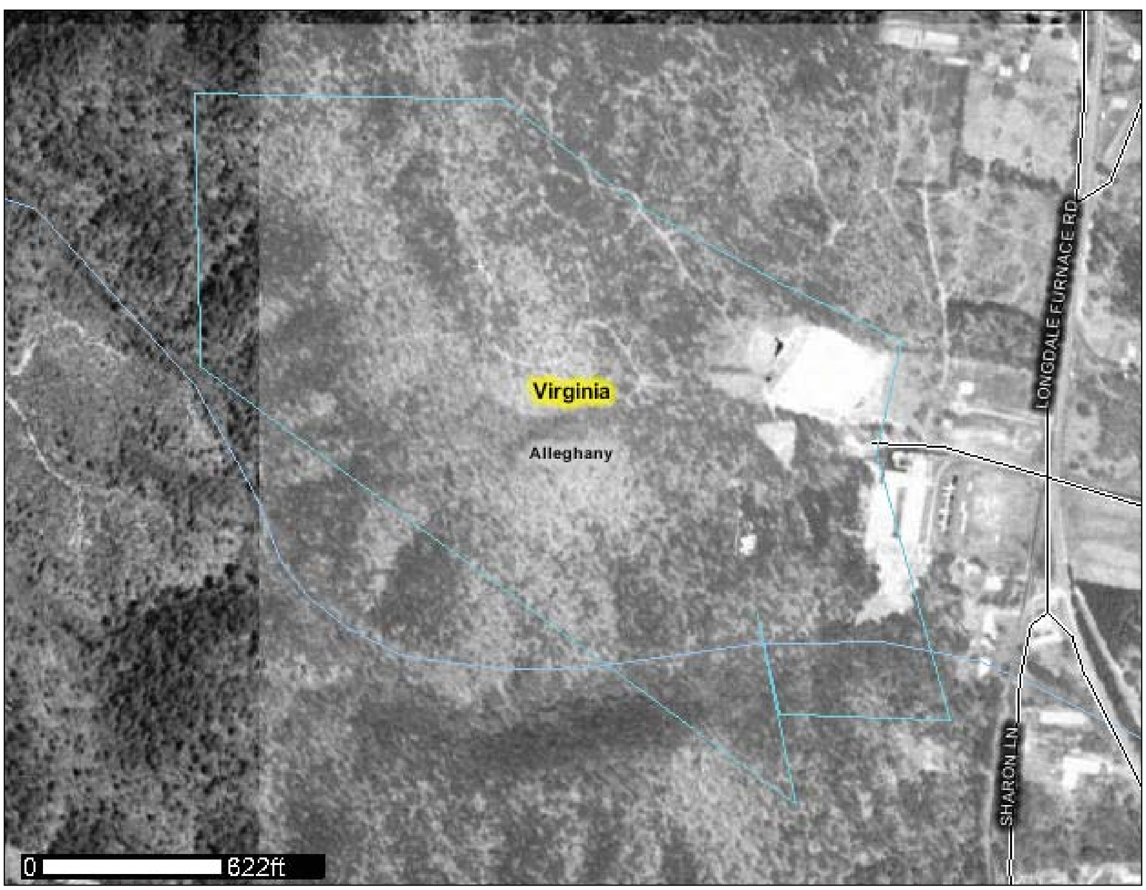
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Alleghany County, Virginia



Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/ accessed 09/26/07.

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

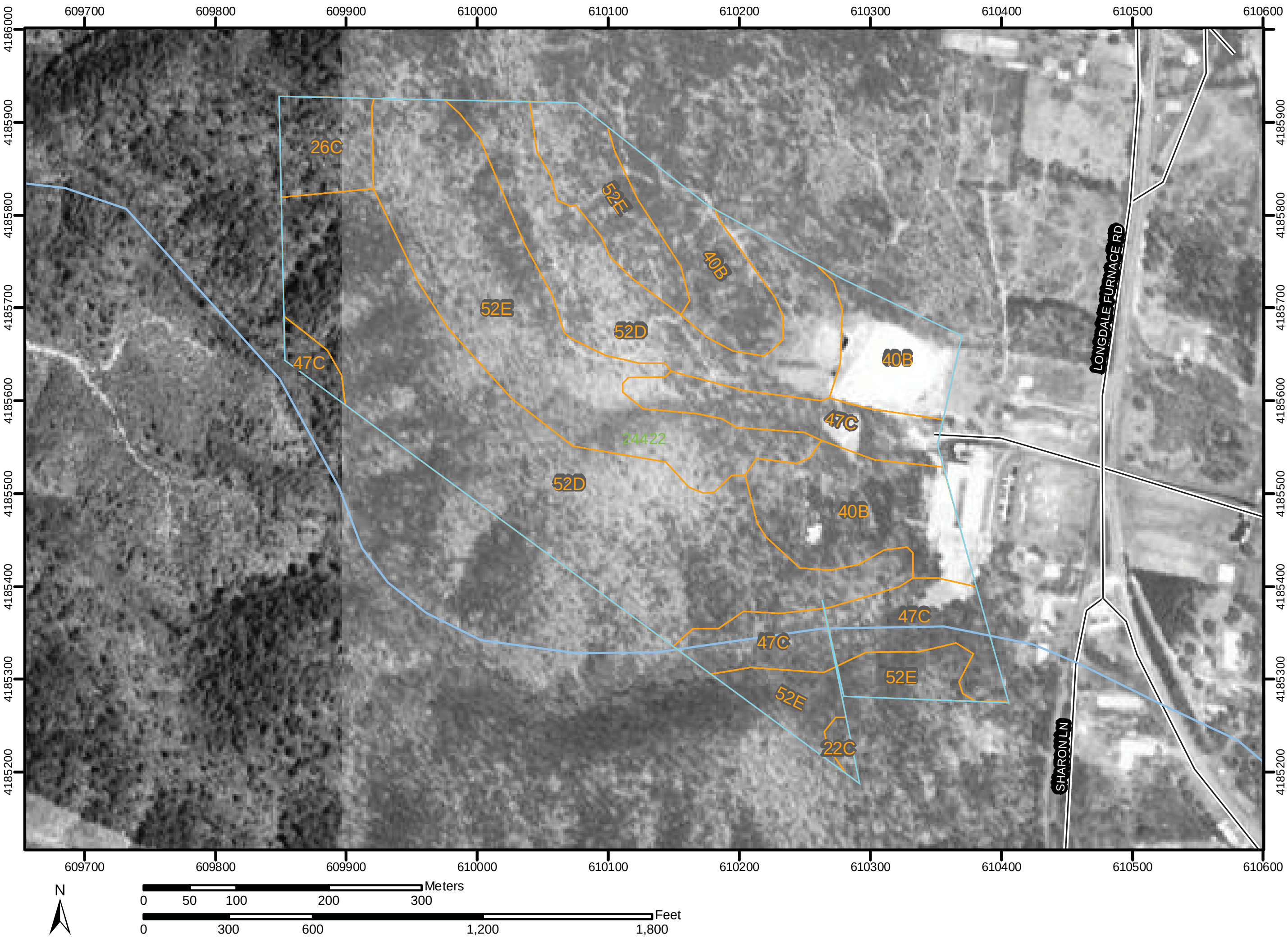
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Legend

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Postal Code

Municipalities
- Cities
- Urban Areas

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails

Roads
- Interstate Highways
- US Routes
- State Highways
- Local Roads
- Other Roads

MAP INFORMATION

Original soil survey map sheets were prepared at publication scale. Viewing scale and printing scale, however, may vary from the original. Please rely on the bar scale on each map sheet for proper map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 17N

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Alleghany County, Virginia
Survey Area Data: Version 9, Aug 23, 2007

Date(s) aerial images were photographed: 4/18/1996

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Alleghany County, Virginia (VA005)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
22C	Escatawba loam, 8 to 15 percent slopes, very stony	0.3	0.4%
26C	Gilpin silt loam, 8 to 15 percent slopes	2.5	3.1%
40B	Nicelytown silt loam, 3 to 8 percent slopes	13.7	16.9%
47C	Shelocta-Berks complex, 8 to 15 percent slopes	9.8	12.1%
52D	Weikert-Berks-Rough complex, 15 to 35 percent slopes	33.2	40.9%
52E	Weikert-Berks-Rough complex, 35 to 55 percent slopes	21.6	26.6%
Totals for Area of Interest (AOI)		81.3	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Alleghany County, Virginia

22C—Escatawba loam, 8 to 15 percent slopes, very stony

Map Unit Setting

Mean annual precipitation: 29 to 41 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 125 to 180 days

Map Unit Composition

Escatawba and similar soils: 80 percent
Minor components: 1 percent

Description of Escatawba

Setting

Landform: Fans, fans, fans
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Mountainbase, base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Colluvium derived from sandstone and shale

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with stones and boulders: 2.5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 30 to 48 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.3 inches)

Interpretive groups

Land capability (nonirrigated): 6s

Typical profile

0 to 3 inches: Loam
3 to 17 inches: Loam
17 to 30 inches: Loam
30 to 50 inches: Clay loam
50 to 60 inches: Cobbly clay loam

Minor Components

Purdy, silty clay loam

Percent of map unit: 1 percent
Landform: Stream terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear

26C—Gilpin silt loam, 8 to 15 percent slopes

Map Unit Setting

Mean annual precipitation: 29 to 41 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 125 to 180 days

Map Unit Composition

Gilpin and similar soils: 80 percent

Description of Gilpin

Setting

Landform: Hillsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from shale and siltstone

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.6 inches)

Interpretive groups

Land capability (nonirrigated): 3e

Typical profile

0 to 2 inches: Silt loam
2 to 7 inches: Channery silt loam
7 to 26 inches: Channery silty clay loam
26 to 32 inches: Very channery silty clay loam
32 to 42 inches: Bedrock

40B—Nicelytown silt loam, 3 to 8 percent slopes

Map Unit Setting

Mean annual precipitation: 29 to 41 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 125 to 180 days

Map Unit Composition

Nicelytown and similar soils: 80 percent
Minor components: 1 percent

Description of Nicelytown

Setting

Landform: Stream terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sandstone and shale

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.2 inches)

Interpretive groups

Land capability (nonirrigated): 2e

Typical profile

0 to 5 inches: Silt loam
5 to 8 inches: Silt loam
8 to 34 inches: Clay loam
34 to 65 inches: Silty clay loam

Minor Components

Purdy, silty clay loam

Percent of map unit: 1 percent
Landform: Stream terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear

47C—Shelocta-Berks complex, 8 to 15 percent slopes

Map Unit Setting

Mean annual precipitation: 29 to 41 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 125 to 180 days

Map Unit Composition

Shelocta and similar soils: 60 percent
Berks and similar soils: 20 percent

Description of Shelocta

Setting

Landform: Fans, fans, fans
Landform position (two-dimensional): Footslope, toeslope

Landform position (three-dimensional): Lower third of mountainflank, mountainbase, base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Colluvium derived from shale, siltstone, and some fine-grained sandstone

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 9.0 inches)

Interpretive groups

Land capability (nonirrigated): 3e

Typical profile

0 to 2 inches: Silt loam
2 to 7 inches: Channery silt loam
7 to 60 inches: Channery silt loam
60 to 65 inches: Channery silt loam

Description of Berks

Setting

Landform: Hillsides, mountainsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Mountaintop, mountainflank, interfluve, nose slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from shale and siltstone

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.7 inches)

Interpretive groups

Land capability (nonirrigated): 3e

Typical profile

0 to 4 inches: Channery silt loam
4 to 11 inches: Channery silt loam
11 to 22 inches: Very channery silt loam
22 to 27 inches: Very channery loam
27 to 37 inches: Bedrock

52D—Weikert-Berks-Rough complex, 15 to 35 percent slopes

Map Unit Setting

Mean annual precipitation: 29 to 41 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 125 to 180 days

Map Unit Composition

Weikert and similar soils: 35 percent
Berks and similar soils: 34 percent
Rough and similar soils: 10 percent

Description of Weikert

Setting

Landform: Hillsides, mountainsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Mountaintop, upper third of mountainflank, interfluve, nose slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from shale and siltstone

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 1.6 inches)

Interpretive groups

Land capability (nonirrigated): 6e

Typical profile

0 to 4 inches: Channery silt loam
4 to 16 inches: Very channery silt loam
16 to 26 inches: Bedrock

Description of Berks

Setting

Landform: Hillsides, mountainsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Upper third of mountainflank, mountaintop, interfluve, nose slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from shale and siltstone

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock

Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.7 inches)

Interpretive groups

Land capability (nonirrigated): 6e

Typical profile

0 to 4 inches: Channery silt loam
4 to 11 inches: Channery silt loam
11 to 22 inches: Very channery silt loam
22 to 27 inches: Very channery loam
27 to 37 inches: Bedrock

Description of Rough

Setting

Landform: Hillsides, mountainsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Upper third of mountainflank, mountaintop, interfluve, nose slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from shale and siltstone

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: 4 to 10 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 0.3 inches)

Interpretive groups

Land capability (nonirrigated): 7e

Typical profile

0 to 1 inches: Very channery silt loam
1 to 5 inches: Extremely channery silt loam
5 to 7 inches: Extremely channery silt loam
7 to 17 inches: Bedrock

52E—Weikert-Berks-Rough complex, 35 to 55 percent slopes

Map Unit Setting

Mean annual precipitation: 29 to 41 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 125 to 180 days

Map Unit Composition

Weikert and similar soils: 40 percent
Berks and similar soils: 30 percent
Rough and similar soils: 15 percent

Description of Weikert

Setting

Landform: Hillsides, mountainsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Mountaintop, mountainflank, interfluve, nose slope, side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum weathered from shale and siltstone

Properties and qualities

Slope: 35 to 55 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 1.6 inches)

Interpretive groups

Land capability (nonirrigated): 7e

Typical profile

0 to 4 inches: Channery silt loam
4 to 16 inches: Very channery silt loam
16 to 26 inches: Bedrock

Description of Berks

Setting

Landform: Hillsides, mountainsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Mountainflank, mountaintop, interfluve, nose slope, side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum weathered from shale and siltstone

Properties and qualities

Slope: 35 to 55 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.7 inches)

Interpretive groups

Land capability (nonirrigated): 7e

Typical profile

0 to 4 inches: Channery silt loam
4 to 11 inches: Channery silt loam
11 to 22 inches: Very channery silt loam
22 to 27 inches: Very channery loam
27 to 37 inches: Bedrock

Description of Rough

Setting

Landform: Hillsides, mountainsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Mountainflank, mountaintop, interfluve, nose slope, side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum weathered from shale and siltstone

Properties and qualities

Slope: 35 to 55 percent
Depth to restrictive feature: 4 to 10 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 0.3 inches)

Interpretive groups

Land capability (nonirrigated): 7e

Typical profile

0 to 1 inches: Very channery silt loam
1 to 5 inches: Extremely channery silt loam
5 to 7 inches: Extremely channery silt loam
7 to 17 inches: Bedrock

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://soils.usda.gov/

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://soils.usda.gov/

Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://soils.usda.gov/

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://soils.usda.gov/

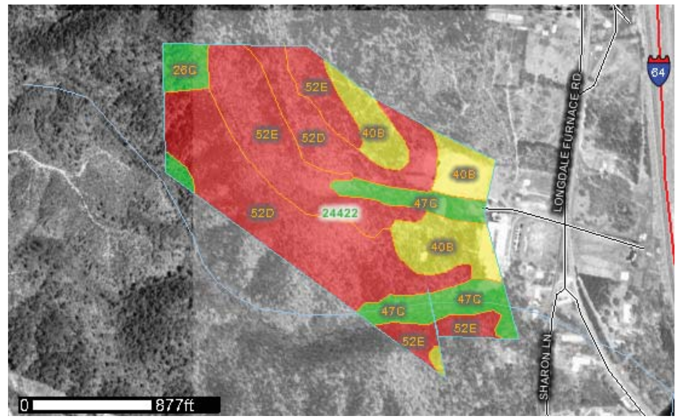
United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.glti.nrcs.usda.gov/

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://soils.usda.gov/

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://soils.usda.gov/

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210.

The Nature Resources Conservation Center's Web Soil Survey provides evaluations soils ability to support certain activities and support or negatively effect certain building materials or other processes. The soils on the project site were examined in terms of their potential corrosive effect on concrete and steel and their ability to support path and trails, picnicking, and playgrounds. Descriptions of how the ratings are determined and what they imply are listed below for landscaping, trails, and picnicking areas.



Map indicating the suitability of the soil to support paths and trails on site and in the surrounding areas.

PATHS:

Paths and trails for hiking and horseback riding should require little or no slope modification through cutting and filling.

The ratings are based on the soil properties that affect traffic-ability and erodibility. These properties are stoniness, depth to a water table, ponding, flooding, slope, and texture of the surface layer.

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the specified use. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

PICNICKING:
Picnic areas are natural or landscaped tracts used primarily for preparing meals and eating outdoors. These areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas.

The ratings are based on the soil properties that affect the ease of developing picnic areas and that influence traffic-ability and the growth of vegetation after development. Slope and stoniness are the main concerns affecting the development of picnic areas. For good traffic-ability, the surface of picnic areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence traffic-ability are texture of the surface layer, depth to a water table, ponding, flooding, saturated hydraulic conductivity (Ksat), and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, saturated hydraulic conductivity (Ksat), and toxic substances in the soil.

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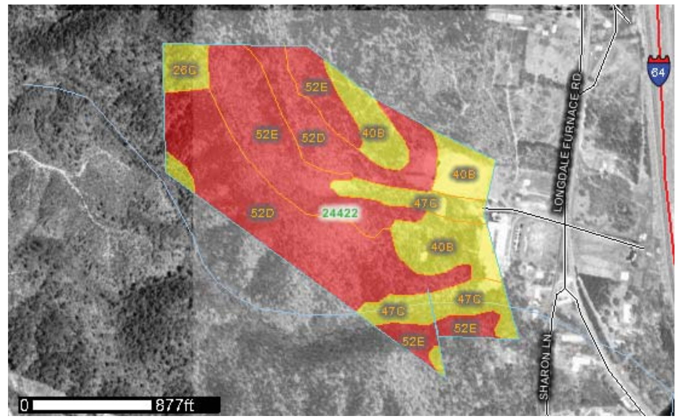

Map indicating the suitability of the soil to support picnicking on site and in the surrounding areas.

Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

PLAYGROUNDS

Playgrounds are areas used intensively for games, such as baseball and football, and similar activities. Playgrounds require soils that are nearly level, are free of stones, and can withstand intensive foot traffic.

The ratings are based on the soil properties that affect the ease of developing playgrounds and that influence traffic-ability and the growth of vegetation after development. Slope and stoniness are the main concerns affecting the development of playgrounds. For good traffic-ability, the surface of the playgrounds should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence traffic-ability are texture of the surface layer, depth to a water table, ponding, flooding, saturated hydraulic conductivity (Ksat), and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, saturated hydraulic conductivity (Ksat), and toxic substances in the soil.

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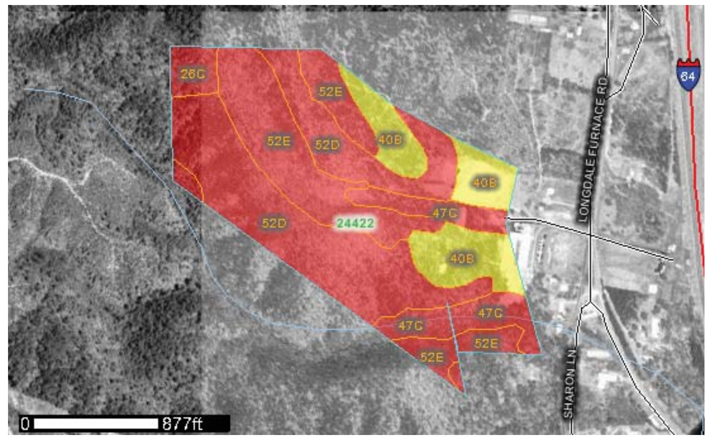

Map indicating the suitability of the soil to support playgrounds on site and in the surrounding areas.

Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).