White Clay Creek State Park
Trail Plan

Table of Contents

Acknowledgements 3
Executive Summary 4
Public Participation 6
Regional and Local Trail Context 6
Trail Users & Uses 7
Park Setting 8
2018 Trail System Condition Assessment 8
Trail Descriptions 10
Trail Infrastructure 13
Trail Plan 14
Assessment Process 14
Objectives 15
Planned Trail System 17
Trail Characteristics, Accessibility, Safety, and Infrastructure 18
Plan Implementation 21
Priority Project List 23

Appendices

Appendix A: Existing and Planned Conditions Maps 24
Appendix B: Tables 41
Appendix C: Sustainable Trail Best Management Practices 49
Appendix D: Natural and Cultural Resources 51
Appendix E: Public Demand for Trail Opportunities 52
Appendix F: Minimizing Resource Impacts with Sustainable Trail Design 53
Appendix G: Public Comment Questions and Analysis 55
Appendix H: Accomplishments 64
Appendix I: Glossary of Terms 65

Maps

Map 1. Current Trail System 10, 24
Map 2. Current Trail Sustainability 25
Map 3. Current Trail Uses 26
Map 4. Current Trail Widths 27
Map 5. Current Trail Surfaces 28
Map 6. Current Trail Accessibility 29
Map 7. Current Trail Infrastructure 30
Map 8. Regional Context 31
Map 9. White Clay Creek State Park 32
Map 10. Planned Trail System 18, 33
Map 11. Planned Trail Sustainability 34
Map 12. Planned Trail Uses 35
Map 13. Planned Trail Widths 36
Map 14. Planned Trail Surfaces 37
Map 15. Planned Accessibility 19, 38
Map 16. Planned Trail Infrastructure 39
Map 17. Planned Trail Naming 40

Tables

Table 1. State Park Trail Distribution Analysis 41
Table 2. Current Existing Trail Uses 8, 42
Table 3. Current Trail Characteristics 9, 42
Table 4. Current Existing Trails, Miles & Uses 12, 43
Table 5. Planned Trail Characteristics and Accessibility 18, 44
Table 6. Planned Trail Changes 21, 45
Table 7. Bridge Conditions 46

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Public participation was a core component in developing this plan. A Stakeholder Working Group, representative of trail and park user groups, was assembled to participate in open discussions regarding the trail plan. Thanks to all the folks on the Working Group that participated in learning about the park's natural and cultural assets and recreational trail uses; learning about the Division's evaluation and planning process; and engaging in discussions that led to changes in the 2011 trail plan. The Working Group provided key input for current and future alignments, surfaces, and uses represented in this plan. The Working Group members were State Representative Paul Baumbach and staff Sean Dwyer, Fred Conkey, Heather Dunigan, Joe Spadafino, Greg Johnson, Lauri Webber, Bill Johnston, Dick Carroll, Gary Kirk, James Ireland, Jason Sparklin, Mary Everhart, Mike Monagle, Mike Ott, Ricardo Gomez, Jim White, Dave Pro, Linda Stapleford, Andy Urquhart, Tim Gorzynsky, and Walt Leipold.

Participation, engagement, and constructive dialogue contributed to a successful planning process and shaped this trail plan. We extend our sincere appreciation to the Stakeholder Working Group who provided input. The future of trails in White Clay Creek State Park is bright because of your participation.

Executive Summary

White Clay Creek State Park and the associated recreational opportunities play a substantial role in creating a community that promotes exercise and makes access to the natural environment easier. The adjacent protected park lands in Delaware and Pennsylvania almost doubles the size of available public land for recreation highlighting the importance of the state park as an integral component to an expanding regional equestrian, pedestrian, and bicycle trail network that will change how the greater Newark community and visitors to the region spend time and live better lifestyles.

During the trail planning process for the 2019 plan, existing natural and cultural resources were reassessed and continue to play an integral part in modifying best trail locations resulting in alignments that achieve the following:

- Minimize impact to high quality habitats;
- Reduce habitat fragmentation;
- Reduce erosion;
- Protect cultural resources;
- Enhance and/or expand the trail system;
- Create trail links between park management units;
- Build community connections where none exist today and;
- Enhance diverse recreational experiences for all non-motorized trail visitors.
- Consider the essential experiences for the park.

Appendix A, Maps 1-7 highlight the existing conditions for the park in 2018. Based on the existing natural and cultural resources, including areas with wet soil conditions, and social science data, changes to the existing trail system are needed to address trail objectives. Making recommendations for updating trail alignments, the DNREC Trail and Stakeholders Teams considered the following variables and conditions; trail safety; community connections; soil types; topography; hydrology; plant and animal distribution; current and future use; habitat fragmentation; erosion; accessibility; experience; trail use trends; anticipated regional land use growth; park staffing levels; maintenance practices; challenge; and trail sustainability. The planned trail system changes are highlighted in Appendix A on Maps 10-16.

White Clay Creek State Park's trails currently fall short of an acceptable threshold of the sustainability assessment criteria (see Appendix C). Analysis shows that of the current 39.8 total trail miles, about 23% (9.0 miles) fall into the "Poor" Sustainability category and need some degree of change or enhancement to achieve a higher level of sustainability (see Map 2).

Planned Trail changes will increase over-all park mileages from the current 39.8 miles to 45.7 miles. This change will result in an increase in mileage for pedestrians, bikers, and equestrians. The change in mileage for all users is related to modifications of some current single use designated trails (pedestrian only) to shared-use, realignments, road to trail conversions, and some new trails. Reconstruction of trails in perennially wet soil zones or high erosion areas will provide for the highest resource protection and sustainability. Current alignments that fall within hydric soil zones will be reviewed for rerouting, hardening, or the construction of boardwalks. These methods will avoid long-term impacts on natural and cultural resources and eliminate costly on-going trail maintenance. Overall, alignment changes will account for an increase of 5.9 miles of trail.

A Summary of the planned trail changes are as follows:

- Existing 39.8 mile trail system will be increase by 15% or 5.9 miles to 45.7 miles
- Existing 24.9 miles of single track trail will be increased by 20% to 30.0 miles through the addition of new trail segments
- Double track will increase from 14.9 miles to 15.7 miles or 5% through the addition of realignments, road to trail conversions, and some new trails
- Realignments, enhancements, and new construction techniques of the existing 14.3 trail miles categorized as poor or fair sustainability will be reduced by 60% or 8.6 miles
- All-weather hardened surface trails will be increased by 40% or 5.2 miles

- 2.3 miles or 27% of designated Pedestrian Only trails will be re-designated as biking/pedestrian
- Accessible trails will increase of 64% from 10.1 to 16.6 miles

Based on ranking criteria utilized for Master Plan project ranking, there are nine priority trail construction projects that stand out. Below is a summary of those trail construction projects and the project priority ranking.

- Pomeroy Trail surface upgrade: pave trail to protect the stability of the trail, accessibility, minimize maintenance, and prevent sediment loss -23
- Wells Lane Connector: create biking connection between Creek Road and Carpenter Recreational Area – 26
- Kranz Farm Connector: new connector trail for future camping facilities within Carpenter Recreation Area – 32
- Chestnut Hill Connectors: community trail connectors for the Judge Morris Area - 38
- Possum Hill and David English Trail Areas: improve natural surface trails to increase sustainability – 39
- Skills Trail: improve safety and enhance features design – 53
- Pomeroy Trail Extension: improve access on the eastern side of the White Clay Creek from Hopkins to Chamber Road – 60
- Carpenter Accessible Loop: create an accessible paved loop within the Carpenter Recreational Area – 61
- Deerfield Connector: improve access between Possum Hill and Carpenter Recreational Area by constructing a link through the Deerfield Area - 64

Public Participation

The Division conducted a series of trail stakeholder meetings in 2016-2017. In addition, during the White Clay Creek State Park Master Planning process the Division gathered additional comments from the user community that were valuable in shaping this 2019 trail plan. See Appendix G for a review of 2018 master planning survey and analysis.

Regional and Local Trail Context

White Clay Creek State Park (WCCSP) is located in northwest Delaware adjacent to the Pennsylvania boundary. See Map 8 in Appendix A for regional context. It falls within the Piedmont Ecoregion – a region covering five percent of the State. Piedmont geomorphology is characterized by rolling hill topography, rocky soils, and steep stream valleys. WCCSP hosts a variety of ecosystems including wooded uplands, freshwater wetlands, riparian, and open meadows. Northwest of the park is the White Clay Creek Preserve in Pennsylvania. To the east is Middle Run Valley Natural Area owned by New Castle County and managed by Delaware Nature Society. Areas north and south of the park are densely populated and in character with suburban and urban development.

White Clay Creek State Park's location places it close to major urban and suburban populations of the Philadelphia metropolitan region-3.8 million people live within 30 miles of the park. The park's current 39.8 mile trail system combined with other local trails (50+ miles) make these public lands key recreational trail sites both locally and regionally.

Trail Users and Uses

There was an estimated 164,000 visitors to White Clay Creek State Park in 2018. Evidence shows that trail related recreation is one of the most popular activities in the park. From 2000 to 2010, the population of New Castle County grew from 538,170 to 554,405 residents, an increase of 3.0%. This increase and population projections for the next 30 years, place a high demand on Park resources in the future.

Below is a summary of the trail users observed in the Park.

- Pedestrians

  The term pedestrian includes walkers, hikers, nature watchers, cross-country skiers, geo-cashers, and trail runners.

- Bicycle Riders

  There are a number of sub groups that fall into this category. A few examples are road riders, commuters, competitors, mountain bikers, and general bicyclists who cruise paved pathway through town or at the beach.

- Equestrians

  Equestrians include trail riding, mounted orienteering, endurance riding, carriage rides, and cross country jumping to name a few.

- Special Needs Populations

  The Americans with Disabilities Act is a 1990 federal law that helps people with a disability gain equal access to public facilities. Presently there is guidance available for recreation facilities including trail widths of 3 feet or greater, grades of 10% and less, limited obstacles (no staircases or steps, or large roots or rocks), firm stable surfaces, and cross slopes 5% or less. Federal agencies (Forest Service and Park Service) are required to use these guidelines. The Delaware Division of Parks and Recreation has adopted and uses the outdoor recreational accessible guidance. The guideline can be referenced at http://www.fs.fed.us/recreation/programs/accessibility/

Park Setting

The 3,522 acres of White Clay Creek State Park contain a variety of landscapes, from river and stream valleys to meadows and hardwood forests (see Appendix A to view existing park conditions). Historically, the forests of the Piedmont were home to Native Americans, who harvested various foods from the forests and waterways and hunted game in the surrounding forests. After the European settlers arrived, agriculture developed slowly in the areas. The property that is now White Clay Creek State Park has a long recorded history of small family farms highlighting typical meadow and forested landscapes that have changed little over the last century.

2018 Trail System Condition Assessment

In the park today there are a variety of activities that impact trails and trail corridors. Trail location and park activities such as trail maintenance, ranger patrol activities, or trail users on foot, bike, or horse will impact the landscape and soils. Soil disturbance is expected in the development and use of trails, however better trail design and management can drastically reduce widespread trail impacts and erosion.

Today, the trail system at White Clay Creek State Park is comprised of 39.8 miles of trail that serve hikers, walkers, runners, mountain bikers, bicyclists, equestrians, and other non-motorized trail users. This represents 24% of the total miles across the Delaware State Park trail system (see Appendix B, Table 1). Of those 39.8 trail miles in White Clay Creek, 8.6 are designated as pedestrian-only, 31.2 miles are designated for equestrians, pedestrians and bikers (see Table 2 below). Table 3 below outlines trail characteristic by categories –surface, widths, permitted uses, and accessibility and the percent that each characteristic represents in the trail system as assessed in 2018. All existing conditions assessments are depicted in Maps 1 through 7 (see Appendix A).

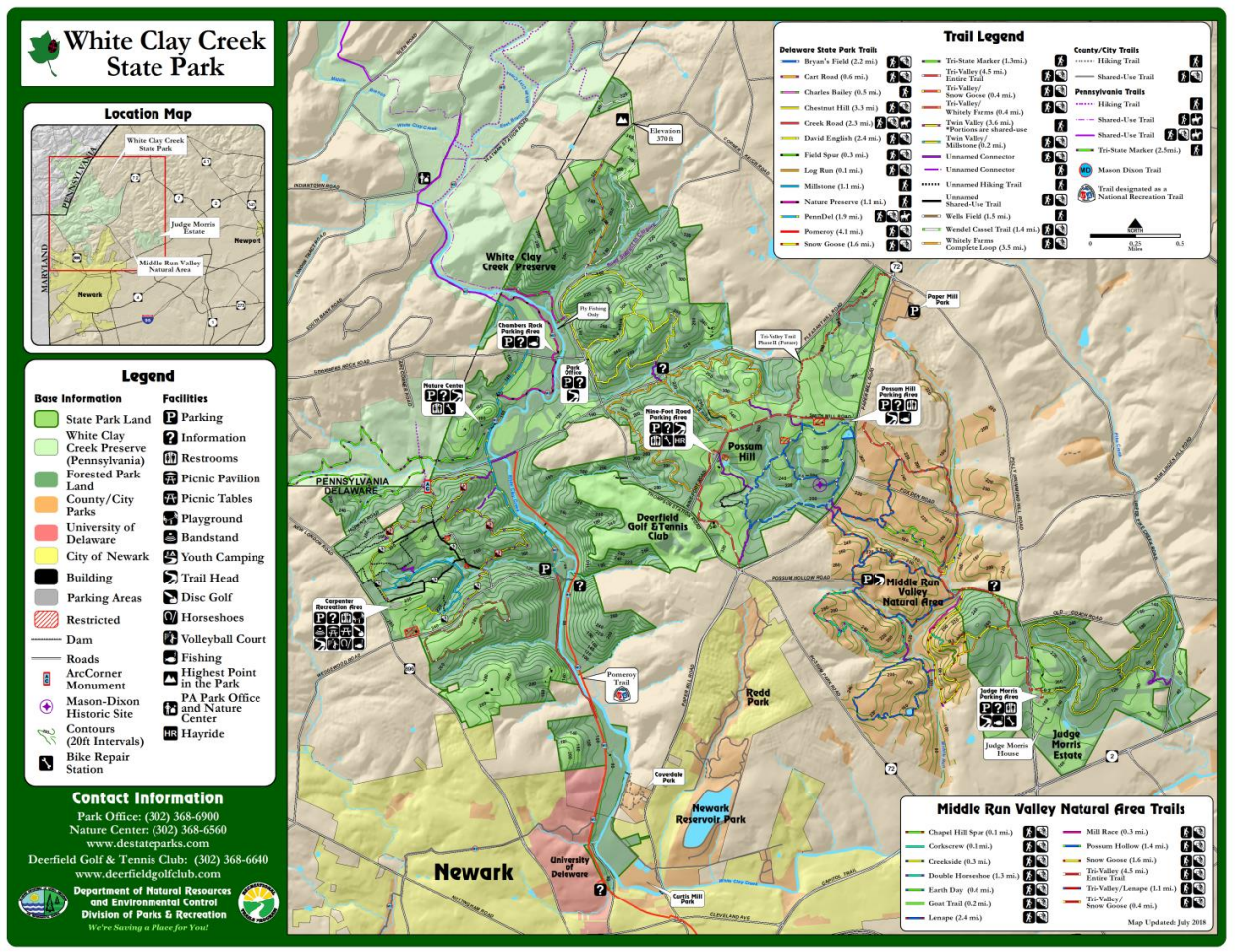
Table 2 - 2018 Trail Uses

2018 Trail Uses	Mileage
Total Trails	39.8
Pedestrian	39.8
Pedestrian Only	8.6
Pedestrian/Bike	28.4
Pedestrian/Bike/Equestrian	2.8

Table 3 - Current Trail Characteristics

Trail Characteristics	2018 Trail Mileage	Percentage of Park System
Total Mileage	39.8	100%
Sustainability		
Good	25.5	64
Fair	5.3	13
Poor	9.0	23
Surface		
Natural	26.9	68
Hardened	12.9	32
Width		
Single Track	24.9	63
Double Track	14.9	37
Permitted Use		
Pedestrian Only	8.6	22
Pedestrian/ Bike	28.4	70
Pedestrian/ Bike/Equestrian	2.8	8
Accessibility		
Accessible	10.1	25
Not Accessible	29.7	75

Map 1 - 2018 Trail System On-line Map



Trail Descriptions

Access to the trail system is available from several trailhead parking areas and nearby communities. There are 21 named trails in the park – the main trails are highlighted below.

- Bryan's Field Trail
  The 2.2 mile loop trail begins at the Bryan's Field parking lot crossing meadow and passing through mature hardwood forest of maple, oak, and popular over a packed earth surface. The grade is moderate throughout and has connectors to Thompson Station Road, Nine Foot Road, and Middle Run Natural Area. Post Mark Trail cut-off traverses near the Mason-Dixon Historic Monument and cuts the outer loop in half.

- Charles Bailey Trail
  The trail begins off Thompson Station Road a half mile north of the park office (where there is trailhead parking). Newly upgraded, the 0.5 mile (portion in DE) is accessible from Thompson Station Road for 0.25 mile. The creek-side trail then continues to hug the eastern bank of the White Clay Creek and cross the park and state boundary into Pennsylvania and the White Clay Preserve.

Chestnut Hill Trail
The 3.3 mile single track trail winds through mature forest behind the Judge Morris Estate on a packed earth surface. The trail begins at the Judge Morris Estate parking lot. There are two community connections to the trail.

- David English Trail
  The 2.4 mile trail begins at the White Clay Creek park office. One of the more challenging trails in the park, this single-track loop trail passes through hardwood forest and hayfields over a packed earth surface. Twin Ponds cut-off trail is located at the approximate midpoint along the trail and returns to the trailhead and cuts the outer loop in half. A connecting trail links to the trails within the Possum Hill Area.

- Millstone Trail
  The Millstone Trail begins at the main parking area in the Carpenter Area. It is a 1.1 mile trail that follows an easy to moderate grade over grass and packed earth through meadows and forested areas. The trail traverses alongside Millstone Pond below a geological feature of rock outcropping. The trail intersects with the Twin Valley Trail, the longest loop trail within the Carpenter Area of the park.

- Nature Preserve Trail
  The 1.1 mile single track trail for pedestrians, meanders within the western floodplain of the White Clay Creek from near the nature center, crosses Chambers Rock Road and continues to the Pennsylvania border and the White Clay Preserve.

- Pomeroy Trail
  The 4.1 mile long double track trail links to Creek Road and the City of Newark to the core of the park on the eastern side of the White Clay Creek and terminates at Hopkins Road. Vast segments of the trail utilize the old Pomeroy rail bed. The trail grades are gentle and the user will experience riparian habitat along the creek.

- Tri-State Marker Trail
  The 3.8 mile loop trail (1.3 in DE and 2.5 in PA) traverses meadow and mature hardwood forest of maple, oak, and popular over a packed earth surface. The trail begins at the nature center and passes the tri-state marker at the western part of the trail.

- Tri-Valley Trail
  The 4.5 mile long single and double-track trail passes through hardwood forest and hayfields over a packed earth and paved surface. The trail serves as a spine trail traversing through the Possum Hill Area and Middle Run Natural Area (County) to the Judge Morris Estate area. This spin trail offers many options to connect to other area trails. A short segment also serves as part of the cross country course.

- Twin Valley Trail
  The 3.6 mile long single and double-track trail begins at the Carpenter Area parking lot. The trail passes through hardwood forest and hayfields over a packed earth surface. This trail loops around the core of Carpenter Recreational Area of the park.

- Whitely Farms Trail
  The 3.5 mile long single-track loop trail passes through hardwood forest and hayfields over mostly a packed earth surface. A cut-off trail is located at the approximate midpoint along the trail and cut the outer loop in half. The trail begins at the Nine Foot Road parking lot.

  See Table 4 for a listing of the major existing trails, mileage, and allowed uses.

Table 4- Existing Trails, Miles & Uses

Trail	Length in Miles	Pedestrian	Biking	Equestrian
Bryan's Field	2.2	√	√	
Charles Bailey	0.5	√		
Chestnut Hill	3.3	√	√	
David English	2.4	√	√	
Mill Stone	1.1	√		
Nature Preserve	1.1	√		
Pomeroy	4.1	√	√	
Tri-State Marker	3.8	√		
Tri-Valley	4.5	√	√	
Twin Valley	3.6	√		
Whitely Farms	3.5	√	√	

A series of maps depicting existing conditions for characteristics of the White Clay Creek State Park's trail network were developed to highlight specific trail attributes. Trail characteristics maps include existing 2018 trail system, trail environmental sustainability, permitted uses, width, trail surfaces, and accessibility (See Appendix A Map 1 - 7). In 2018 the trail system was comprised of 39.8 miles of officially recognized trail (Map 1). Permitted uses on park trails included pedestrian, biking and equestrian activities. Additionally, trails fall into two width categories – single and double track. In 2018 the trail system was comprised of 14.9 miles of double track, defined as widths greater than 36 inches and 24.9 trail miles of single track - widths 36 inches or less.

Trail Infrastructure

Trail infrastructure includes bridges, trail wayfinding markers, information boards, and parking (See Appendix A Map 7). Currently visitors access White Clay Creek State Park predominately by car. Eight parking lots serve the majority of trail use. However there is off-site parking both within other protected lands managed by New Castle County, the City of Newark, and on private lands that connect to the regional trail network.

Trail wayfinding starts at the trailheads. Trailhead parking lots typically have an information board and state park map. Four-by-four posts with plastic over-sleeves are installed along trails at intersections where there are directional trail choices. These trail marker posts contain information such as trail names, use, destinations, and latitude and longitude. Trail names have a color coding that corresponds to the same color used on park maps to highlight the specific trail. Maps are located at trailheads and on the Delaware State Park web site at https://destateparks.com/Trails .

Typical Trailhead Information Board

Typical Trail Marking Post

Typical Trail Bridge

Trail Plan

Assessment Process

In analyzing and assessing WCCSP existing trail system, the Division evaluated changes made since the 1998 comprehensive trail data collection effort and determined progress made in achieving trail-related objectives. Geographic Information System (GIS) and field evaluations were used to assess factors and conditions that characterize White Clay Creek State Park. GIS technology is valuable in discovering the relationship of trails within landscapes and habitat and an invaluable tool in moving from diagnosis to prevention, mitigation and enhancement.

GIS analyses, combined with field reviews, have revealed trail segments that fragment high quality habitat, are prone to erosion, and limit access. Habitat and natural heritage findings identified by both the Division's Stewardship Program and DNREC Natural Heritage and Endangered Species Program (NHESP) were examined within the context of the existing trail system. Trail relationships to forested blocks, ranked habitat quality, and natural heritage data revealed site specific impacts. Other analyses quantified the scale of trail system overlap with fall-line, floodplain, flat area and hydric soil conditions. Known and potential cultural resource sites were analyzed for their relationship to both the existing and planned trail system.

Analyses and recommendations outlined in this trail system plan for White Clay Creek State Park are based on the principles of sustainable trail design and development and trail best management practices (See Appendix C). Using GIS tools and field review, resource experts determined impacts to natural resources, cultural resources, and to unsustainable trail conditions (fall-line, hydric soils, etc.) Subsequent Trail Plan sections outline the locations of new trail alignments. Areas of the White Clay Creek will require trail reroutes, realignments, closures and new trail construction to continue to achieve the objectives outlined within this plan.

Sustainability

Designing and constructing *sustainable trails* is paramount to protecting natural and cultural resources, providing great trail experiences, providing diverse recreational opportunities, and maintaining the life span of a trail system (see Appendix C). Trail sustainability is defined as the location of any given trail segment and how the segment relates to contours, drainage, and soil types, and, how well a trail segment withstands the impacts of weather and recreational use over time. The better a trail segment withstands these impacts, the more sustainable it is. Reducing impacts to natural resources such as native vegetation and wildlife and cultural resources are key Division objectives in trail planning. In addition, *when* trails are used, impacts sustainability. Using natural surface trail during wet conditions dramatically reduces trail life span. Proper and continued education for park visitors on use etiquette are a sustainability necessity.

Many trail management problems, erosion and user conflict for example, stem from poor trail planning, design, construction, or management. Ignoring best management trail design, construction, and management practices results in accelerated trail degradation leading to an increase in maintenance costs and tasks as well as reduced trail user safety and enjoyment. While all trail users affect the trail surface and surrounding environment, user impacts rise when trails are poorly planned and constructed. The Division of Parks and Recreation adopted the principles of sustainable trail design and construction to ensure that trails remain accessible to users, valuable resources are protected, and future maintenance costs are minimized.

Current trail sustainability principles prescribe that all present and future impacts will not burden social, economic and environmental systems. White Clay Creek State Park's trails currently fall short of an acceptable level of sustainability. The analysis of the White Clay Creek State Park shows that of the current 39.8 total trail miles, about 36% (14.3 miles) is in need of some degree of change or enhancement to achieve a higher level of sustainability and environmental protection.

Designing a sustainable trail and trail system requires the analysis and evaluation of the following elements and factors:

- Cultural resources
- Endangered or sensitive plant and animal species
- Occurrence and health of native plants and animals
- Mature growth forests
- Quality of ecosystems
- Natural drainage
- Topography, slope and grade changes
- Ease of access from control points such as trailheads
- User safety
- Characteristics of trail users
- Accessibility
- Provide interesting experiences across the landscape.

Trails constructed over the past ten years in Delaware State Parks were planned according to sustainability objectives. Current practices adopted by the Division have proven that this planning method is very effective in minimizing the environmental effects of trails.

Objectives

Healthy lifestyles and livable communities are key considerations in the planning process. Walkability and bikeability play a role in how trails are planned and constructed. Creating diverse opportunities for more people and connecting trails to people is critical in helping to turn around the trend of declining number of kids, and adults who participate in outdoor recreation and help mitigate obesity and other health issues.

All State Park trail plans, including White Clay Creek State Park, have objectives that recommend:

- Changes to the trail system that meet socially, environmentally and culturally sustainable principles;
- Reducing habitat fragmentation;
- Enhancing habitat quality through sustainable trail planning and design;
- Supporting environmental education opportunities;
- Supporting pedestrian, biking, and equestrian activities;
- Providing a diversity of accessible experiences;
- Considering existing and future recreational trends;
- Integrating the park's trail system as part of wider regional network of existing and future trail opportunities and makes community connections;
- Adapting to future land conservation measures;
- Reducing costly unsustainable trail maintenance achieved by holistic and sound trail planning, construction and innovative trail maintenance techniques;
- Utilizing the best scientific data and research available such as state-wide GIS data layers, user surveys (SCORP), and trail research (such as best practices, erosion, and recreational impacts);

- Enhancements including trail realignments, bridges, trail uses and trail enhancements within sustainable trail standards;
- Include a diverse recreational appeal;
- Has a visual environmental quality;
- Including opportunities to enjoy a great diversity of physical settings;
- Providing visitors with a dynamic mix of interesting experiences that range from easy to challenging;
- A trail system that is safe;
- Considering the existing high school cross country running program;
- Providing water access; and
- Providing safe trail links between the east and west side of the White Clay Creek; and
- Providing technical trail challenge

Technical Trail Challenge

National and state recreational use trends indicate adventure sports, including triathlon, adventure racing, backpacking, mountain biking, and climbing (to name a few), showing significant growth in the past several years (Adventure Racing up 28% *Outdoor Foundation Topline Reports*). A reoccurring and increasing trend is the interest of users from all trail related activities seeking a challenge. There are various ways to incorporate "challenge" into a trail experience. Integrating tread obstacles and/or maintaining narrow widths are two options for increasing the technical nature of a trail. Creating more technical options along a trail corridor, utilizing man-made or natural features such as logs or rocks, can provide additional interest and challenge to an otherwise easy trail.

Technical rock options alongside accessible trail in Redd Park-City of Newark

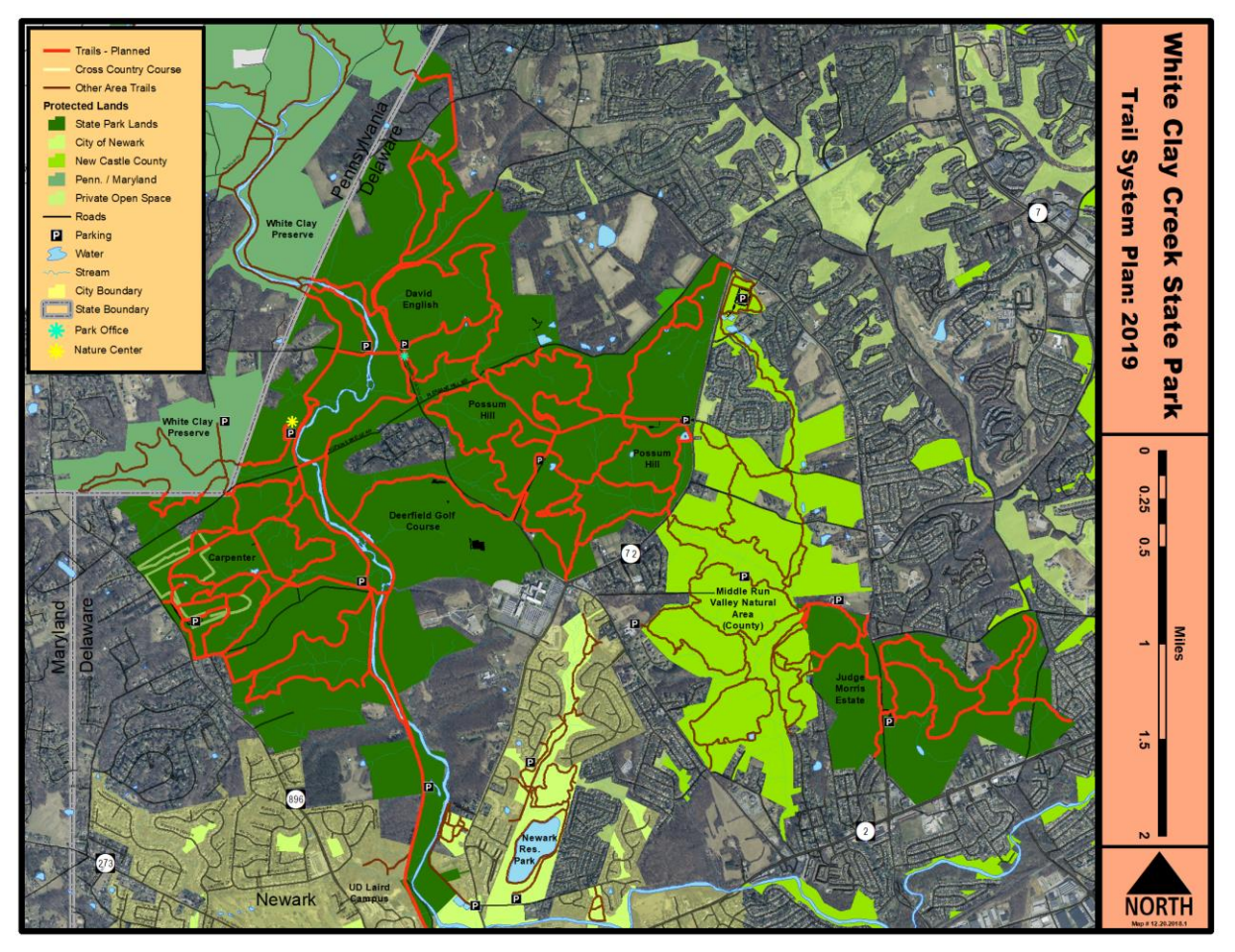
Planned Trail System

The DNREC Trail and Stakeholders Working Group considered the following variables and conditions in making recommendations for new trail alignments: current trail alignments; trail safety; community connections; soil types; topography; hydrology; plant and animal distribution; current and future use; challenge; accessibility; experience; trail use trends; anticipated regional land use growth; park staffing levels; maintenance practices; and trail sustainability.

Final trail alignment recommendations account for natural resource protection, erosion, hydric soil avoidance, and expansion of trail recreational opportunities. Alignment changes will account for an increase of 5.9 miles of trail, the overall changes will improve access, sustainability, accessibility, and experience of the trail system.

Final trail alignment decisions were based on reviewing a number of alignment alternatives. Map 10 depicts 45.7 mile planned trail system for White Clay Creek State Park. Maps 10 - 17 address planned trail system, sustainability, use, widths, surfaces, accessibility, infrastructure, and trail naming (see Appendix A).

Map 10 - Planned Trail System



Summary: Overall the existing 39.8 mile trail system will be increase by 15% or 5.9 miles.

Trail Characteristics, Accessibility, Safety, and Infrastructure

Trail Characteristics

Trail characteristics includes measureable trail conditions such as sustainability, surface, width, permitted uses, and accessibility. Table 5 provides a summary of all current trail characteristics and the planned changes (see Map 15 for planned accessible trails).

Table 5 –Current and Planned Trail Characteristics

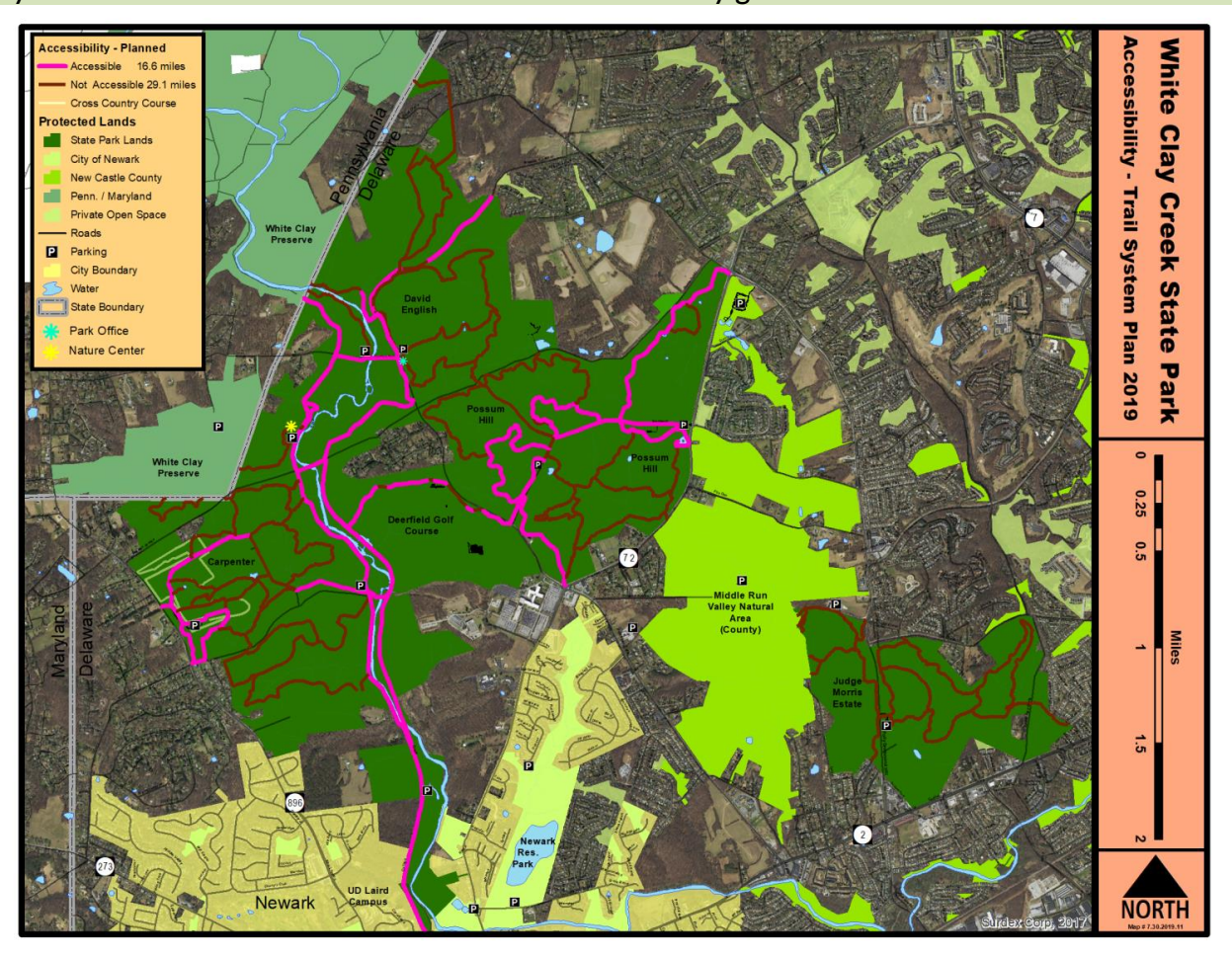
Trail Characteristics	Current Trail System	Planned System	Change in Mileage	Percent of Planned System
Total Mileage	39.8	45.7	Increased 5.9	+100%
Sustainability				
Good	25.5	40.0	Increased 14.5	88
Fair	5.3	5.1	Reduced 0.2	11
* Poor	9.0	0.6	Reduced 8.4	1
Surface				
Natural	26.9	27.6	Increased 0.7	60
Hardened	12.9	18.1	Increased 5.2	40
Width				
Single Track	24.9	30	Increased 5.1	66
Double Track	14.9	15.7	Increased 0.8	34
Permitted Use				
Pedestrian Only	8.6	6.3	Reduced 2.3	14
Pedestrian /Bike	28.4	31.5	Increased 3.1	69
Pedestrian /Bike/Equine	2.8	7.9	Increased 5.1	17
Accessibility				
Accessible	10.1	16.6	Increased 6.5	36
Not Accessible	29.7	29.1	Reduced 0.6	64

*Note: the planned 0.6 mile of *poor* trail sustainability (Preserve Trail north of Chamber Rock Road) that remains is in the dynamic flood plain of the White Clay Creek where little can be done to improve sustainability.

Accessibility

This plan includes opportunities for improving access for all visitors including those with disabilities. Currently White Clay Creek State Park offers 10.1 miles of accessible trail opportunities. Delaware State Parks is committed to providing more accessible trails throughout the statewide trail network. See Map 15 for planned accessible trails.

Map 15 - Planned Trail Accessibility – shows the planned hardened surface portion of the trail system that will meet or exceed Federal trail accessibility guidelines.



Trail Safety

Providing the safest user experience possible is linked to good trail planning and construction, performing needed maintenance, and providing the right information for the users. Safety can be broken into two perspectives – user and agency. From the trail user perspective, where to park, what activities are allowed, how to navigate, what type of users one can expect, how wide, long, and steep is the trail, trail etiquette, and how to seek help are some items that must be addressed to keep trails safe. Not everyone will feel the same level of safety for all the different trail experience such as narrow vs. wide trail, single use vs. shared use, or smooth vs. rough tread surface. Providing the right information for the users is critical in allowing the users to make informed decisions on what experiences are right for them. Trail access and wayfinding information is a critical component to trail safety.

From a managing agency perspective, good planning, construction, and maintenance is required. An understanding of the landscape design challenges, breadth of trail experiences being offered, types of users, volume of users, maintenance needs, and required signage and information to best guide the trail visitors are all key components to safe trail experiences.

Trail Infrastructure

Trail infrastructure includes trail wayfinding markers, information boards, and bridges. Table 7 shows bridge infrastructure – existing, new, replacements, and removals (see Table 7 notes). This trail plan provides general trail wayfinding guidelines. Signage for any park should include roadside directions to trailheads or major trail access points throughout the park; trailhead information such as mapping and trail characteristics; and clear trail markings throughout the system providing clear direction and safely guide visitors through the trail system back to their point of origin or to their intended destination. An additional layer of wayfinding is a numbering system for marker posts and bridges and graphically representing that numbering system on the park maps.

Park user navigation aids are in the top five of the most used and sought after trail amenity –such as trail maps and markers. Information Centers should be located at all trailhead parking areas (see Map 16) and will include maps, trail use designations, etiquette, and accessibility information.

State Park trailhead maps exhibit all the official trails – trails constructed and maintained by Delaware State Parks. Maps include trail names, permitted uses, as well as trail width, length and average grade, markers, and bridges. Trail line colors coincide with trail marker colors. For example, the White Clay Trail is depicted by a red line on the Park map and with red way finding markers on posts along the trail. Marker posts are located at all trail and road intersections and include trail name (color coded to match map), permitted trail uses, and post number. Posts also contain destination/facility information with directional arrows.

Typical Marker Post

Typical Information Board

Plan Implementation

Trail Plan implementation in White Clay Creek State Park will occur in phases over time. System wide trail projects fall into two main categories 1) projects handled by park staff and volunteers or 2) large contract projects requiring engineering and construction companies. Prioritizing projects will be guided by available funding, park master plan priorities, public demand, health and safety, and trail plan objectives. Objectives include: safety, accessibility, community linkage, improve sustainability, alternative pedestrian biking transportation corridor, potential or existing level of use, shared use, available funding, available work force, engineering needs, targets key activity, links other key areas of the park, trails, or other regional trail systems. See Table 6.

Table 6 - Planned Trail Maintenance – Existing Trails the following table summarizes planned trail changes for widths, current and recommended users, and suitable use for the trail system. There are no changes planned for trail types and widths.

Trail	Trail Type	Width Avg.	Current Trail Users	Future Users	Change Required	Trigger
Bryan's Field	Single Track	3 feet	Pedestrian Bicycles	(No Change)	• Reroutes • Armoring • Signs	• User Safety • Enviro. Protection • Funding
Charles Bailey	Single Track	3 feet	Pedestrian	Pedestrian Equestrian Bicycles	• Signs	• Funding
Chestnut Hill	Single Track	3 feet	Pedestrian Bicycles	(No Change)	• Reroutes • Armoring • Signs	• User Safety • Enviro. Protection • Funding
David English	Single Track	3 feet	Pedestrian Bicycles	(No Change)	• Reroutes • Armoring • Signs	• User Safety • Enviro. Protection • Funding
Mill Stone	Single Track	3 feet	Pedestrian	(No Change)	• Reroutes • Armoring • Signs	• User Safety • Enviro. Protection • Funding
Nature Preserve	Single Track	3 feet	Pedestrian	(No Change)	• Reroutes	• User Safety • Enviro. Protection • Funding
Old Cart Road	Single Track	3 feet	Pedestrian Bicycles	(No Change)	• Minor Reroutes • Armoring	• User Safety • Enviro. Protection • Funding
Pomeroy	Double Track	10 feet	Pedestrian Bicycles	Pedestrian Equestrian Bicycles	• Armoring • Surface Upgrade	• Accessibility • Enviro. Protection • Funding
Tri-State Marker	Single Track	3 feet	Pedestrian	(No Change)	• Armoring • Signs	• Enviro. Protection • Funding
Twin Valley	Single and DoubleTrack	3 feet	Pedestrian	(No Change)	• Reroutes • Armoring • Signs	• User Safety • Enviro. Protection • Funding
Wells Field	Single Track	3 feet	Pedestrian	Pedestrian Bicycles	• Reroutes • Armoring • Signs	• Krantz Connector • Funding
Whitely Farms	Single Track	3 feet	Pedestrian Bicycles	(No Change)	• Reroutes • Armoring • Signs	• User Safety • Enviro. Protection • Funding

Table 6 - Planned Trail Changes - New Trail

Trail	Trail Type	Width Avg.	Current Trail Users	Future Users	Change Required	Trigger
Creek Road	*Double Track*	*16 feet*	*NA*	*Pedestrian Equestrian Bicycles*	• Convert to Trail	• Policy Change
Carpenter All-Weather Loop	*Double Track*	*8 feet*	*NA*	*Pedestrian Bicycles*	• *New Trail* • *Signs*	• Park Office Change
Chambers Rock Road Connector	*Double Track*	*4 feet*	*NA*	*Pedestrian Equestrian Bicycles*	• *New Trail* • *Signs*	• User Safety • Connection Need • Funding
Deerfield Connector	*Double Track*	*8 feet*	*NA*	*Pedestrian Bicycles*	• *New Trail* • *Signs*	• Connection Need • Funding
Pomeroy Extension	*Double Track*	*4 feet*	*NA*	*Pedestrian Equestrian Bicycles*	• *New Trail* • *Signs*	• Funding • Accessibility • Connection Need
Krantz Connector	*Single Track*	*3 feet*	*NA*	*Pedestrian Bicycles*	• *New Trail* • *Signs*	• Camping • Funding
Thompson Station Road	*Double Track*	*10 feet*	*NA*	*Pedestrian Bicycles*	• Convert to Trail	• Policy Change
Wells Field Connector	*Single Track*	*3 feet*	*NA*	Pedestrian	• *New Trail* • *Signs*	• Camping • Funding
Wells Lane Connector	*Double Track*	*4 feet*	*NA*	*Pedestrian Bicycles*	• *New Trail* • *Signs*	• User Safety • Funding

Action Items

Protection of existing natural and cultural resources and providing recreational opportunities in state designated resource areas is of primary concern. Recreation at White Clay Creek State Park falls into two major categories, active (such as cross country course and disc golf) and passive recreation (trail activities like hiking and biking). Lands that fall within the active areas should continue to take the brunt of recreational impact. Lands that fall within the passive areas should be protected to the fullest with limited additional infrastructure added. In response to an internal assessment of the state of the trails at WCCSP a list of action items have been established that will improve upon the existing infrastructure.

Action items that will provide safer, consistent trail access to and within the park:

- Upgrade all trails where needed to meet sustainability goals
- Provide more information to visitors on trail characteristics (width, use, surface, accessibility), and etiquette
- Replace, repair, remove, or install new bridges
- Install new or improve existing trail links to communities
- Create safe connections between east and west side of the White Clay Creek
- Create accessible trail experiences along the White Clay Creek, Possum Hill, and Carpenter Recreation Area.

Action items for long term protection:

- Close all trail segments not included in the trail plan and block off access as required
- Monitor degraded areas for natural recovery
- Promote plant re-colonization
- Analyze access sites as they pertain to hunting in protected resource areas

The following project priorities listed below fall into either the short, mid, or long-term category. Short-term priorities should be accomplished in the first few years after official adoption of the plan. Mid-term priorities should be undertaken within three to five years. Long-term projects are at least five years out. Trail project priorities may change from year to year and may be triggered by one or more of the following: park master plan priorities, resource protection, user safety, funding, and accessibility.

Priority Project List

Short Term:

- Update way-finding system including trail names reconfiguring. See Map 17
- Rebuild or remove bridges (9) that do not meet safety codes. See Table 7
- Close down select trails to be removed from the system.
- Armor short segment of Tri-State Marker Trail.
- Construct select segments of Twin Valley for reroutes.
- Armor segments of Bryan's Field Trail.
- Reroute select segments of David English Trail.
- Establish new connection under Paper Mill Road to Middle Run.

Mid Term

- Establish community connections for Chestnut Hill Trail.
- Reroute select segments of David English Trail: mid-term
- Build short trail segment connecting Cart Road Trail to Wendel Cassel Trail.
- Reroute select segments of Twin Valley Trail.
- Reroute select segments of Bryan's Field Trail.

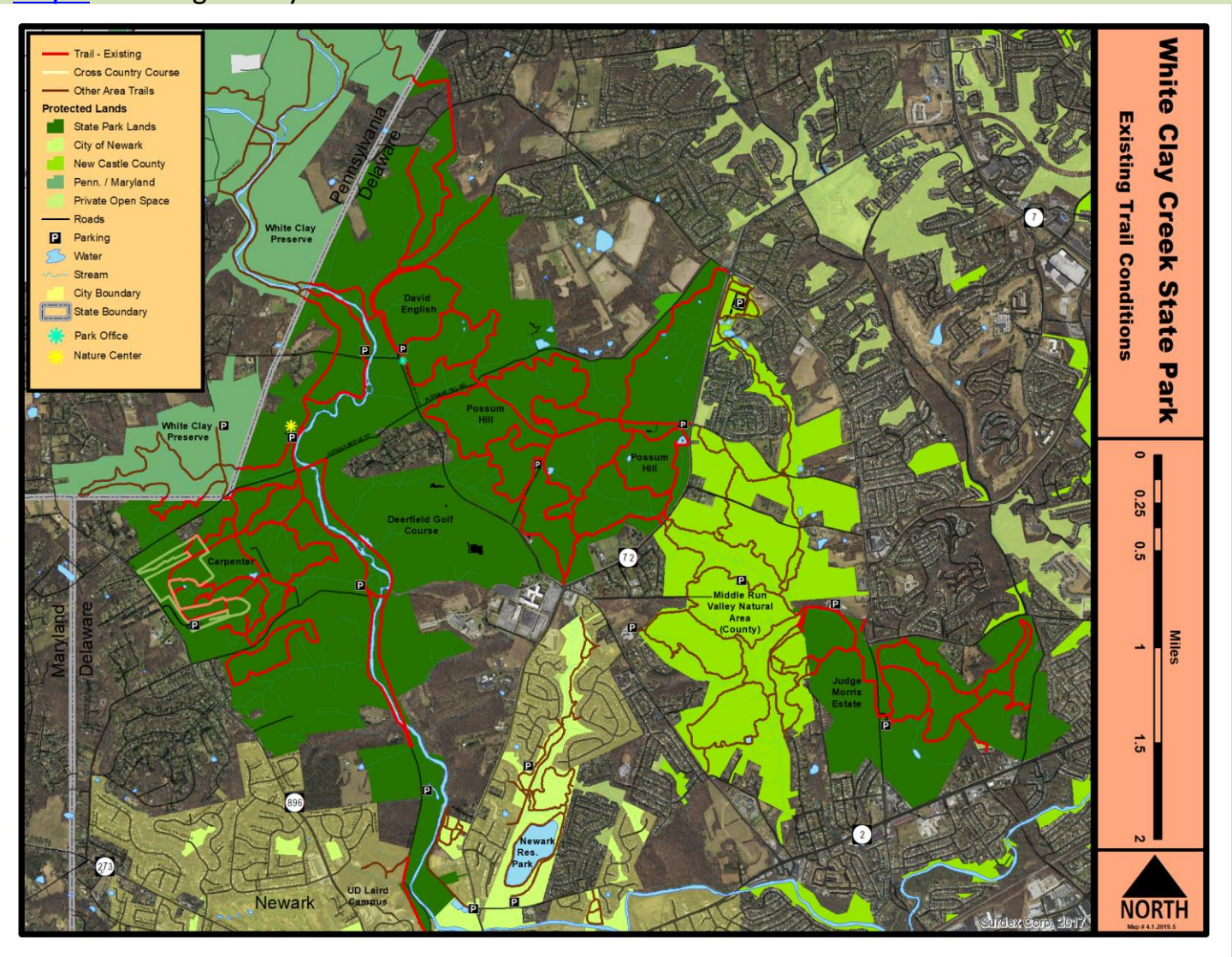
Long Term

- Create all-weather trail in Carpenter Recreation Area.
- Creek Road / Wells Lane Connector.
- Add new connector trail to Well Field.
- Add new connector trail to Krantz Farm.
- Build Pomeroy Extension from Hopkins Road to Chamber Rock Road.
- Reroute select segments of David English Trail.
- Reroute select segments of Bryan's Field Trail.

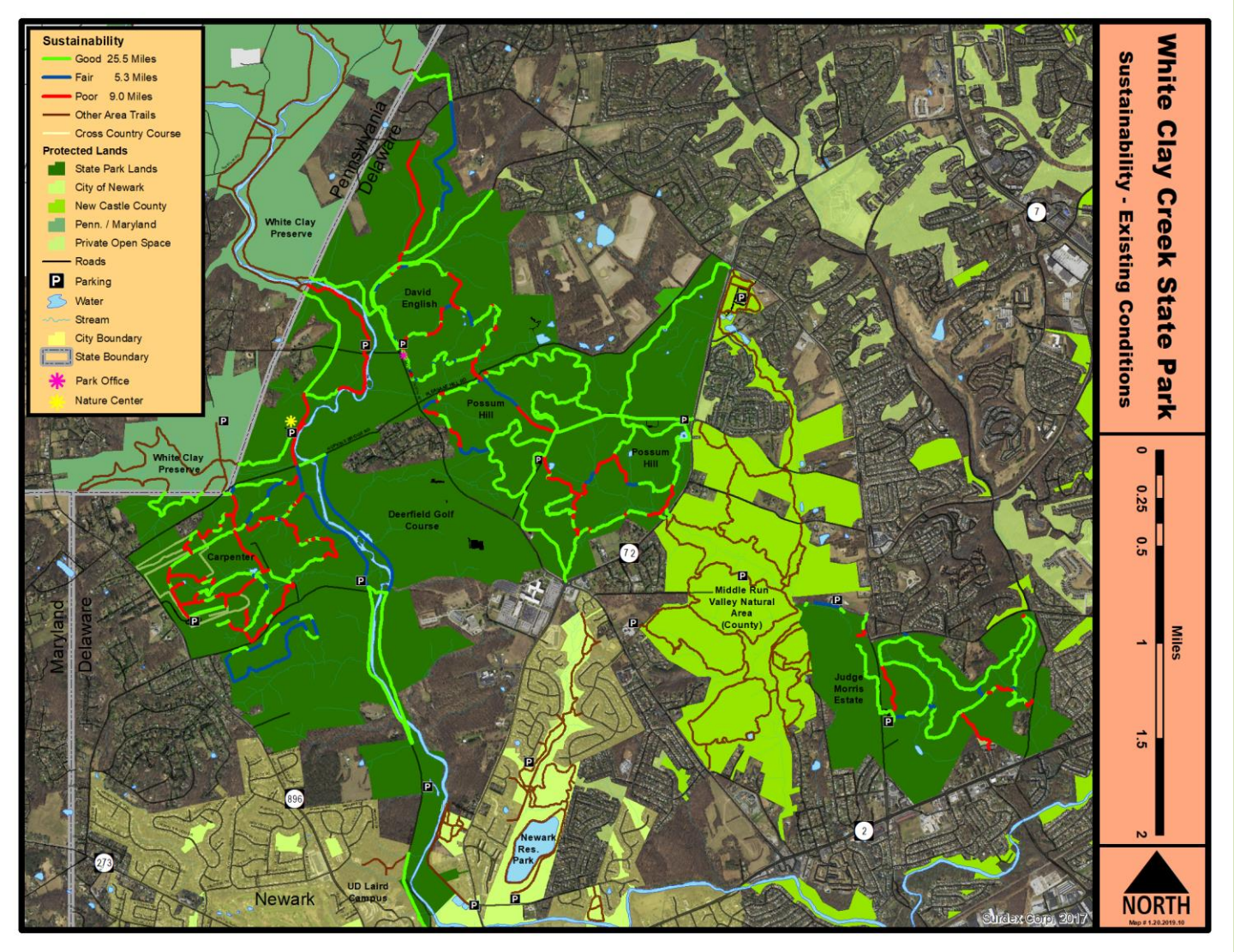
Appendix

Appendix A: Existing and Planned Condition Maps

Map 1 - Existing Trail System

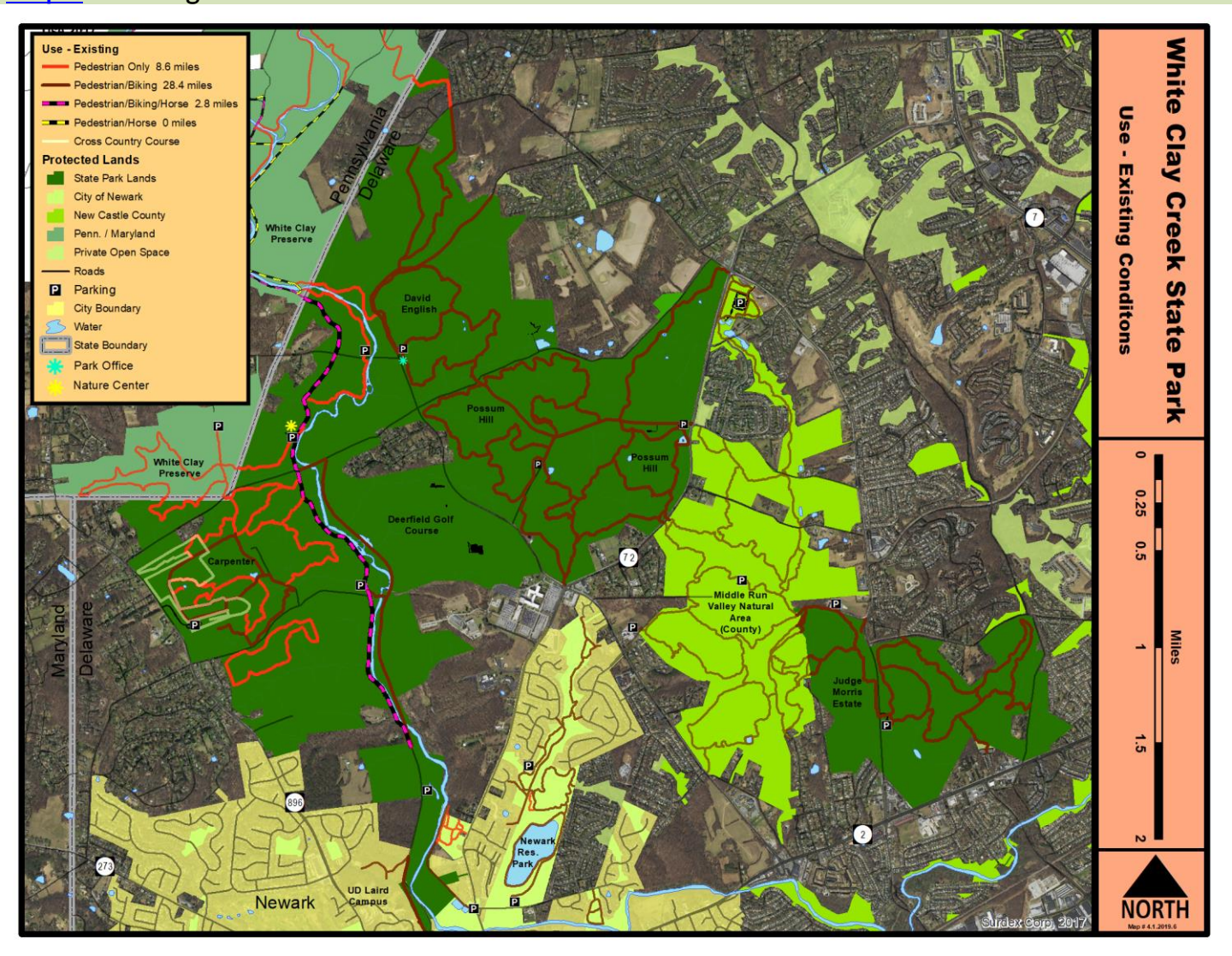


Map 2 – Existing Sustainability



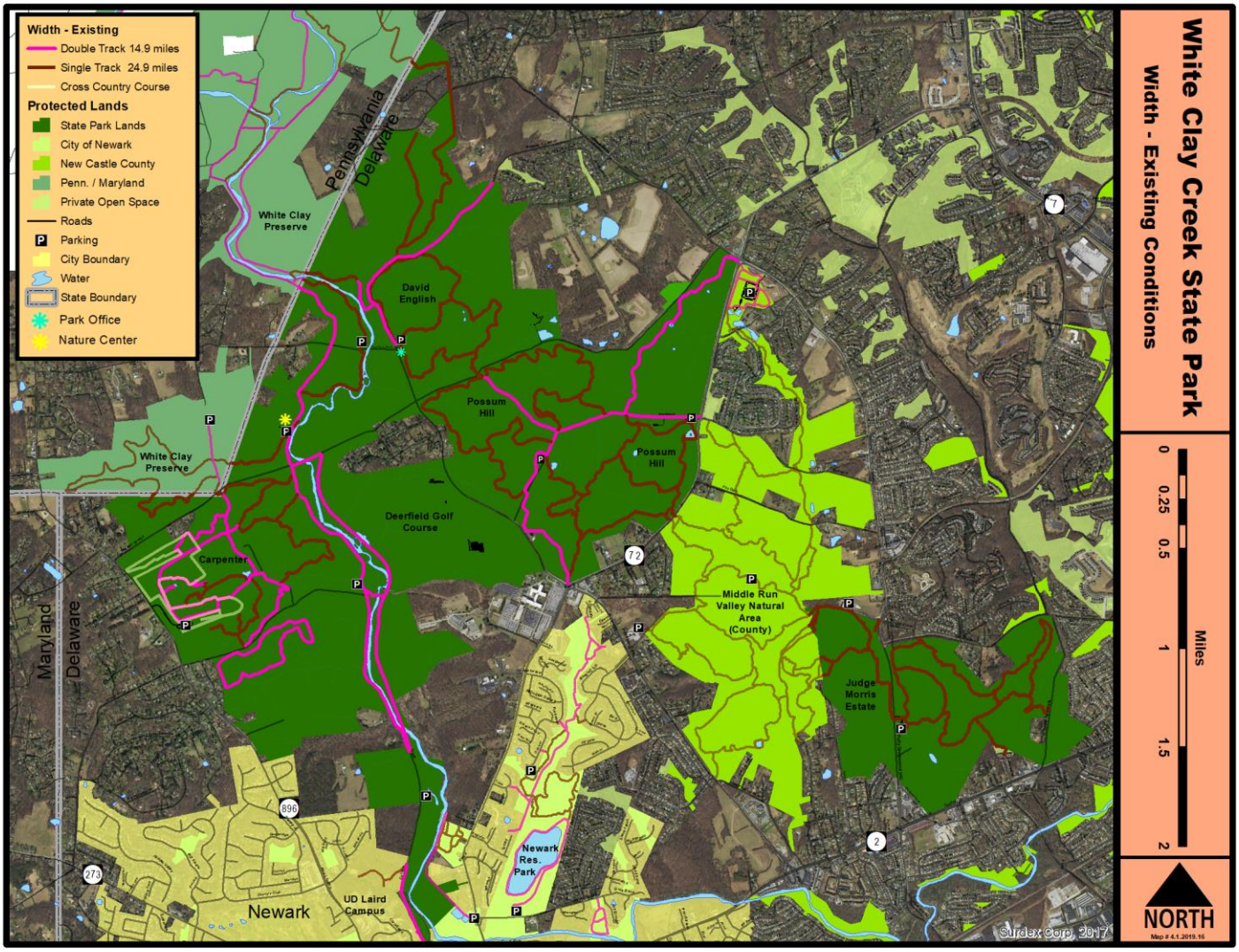
Summary: current sustainability metrics are: 9.0 miles of Poor trail, 5.3 miles of Fair trail, and 25.5 of Good trail.

Map 3 - Existing Permitted Trail Uses



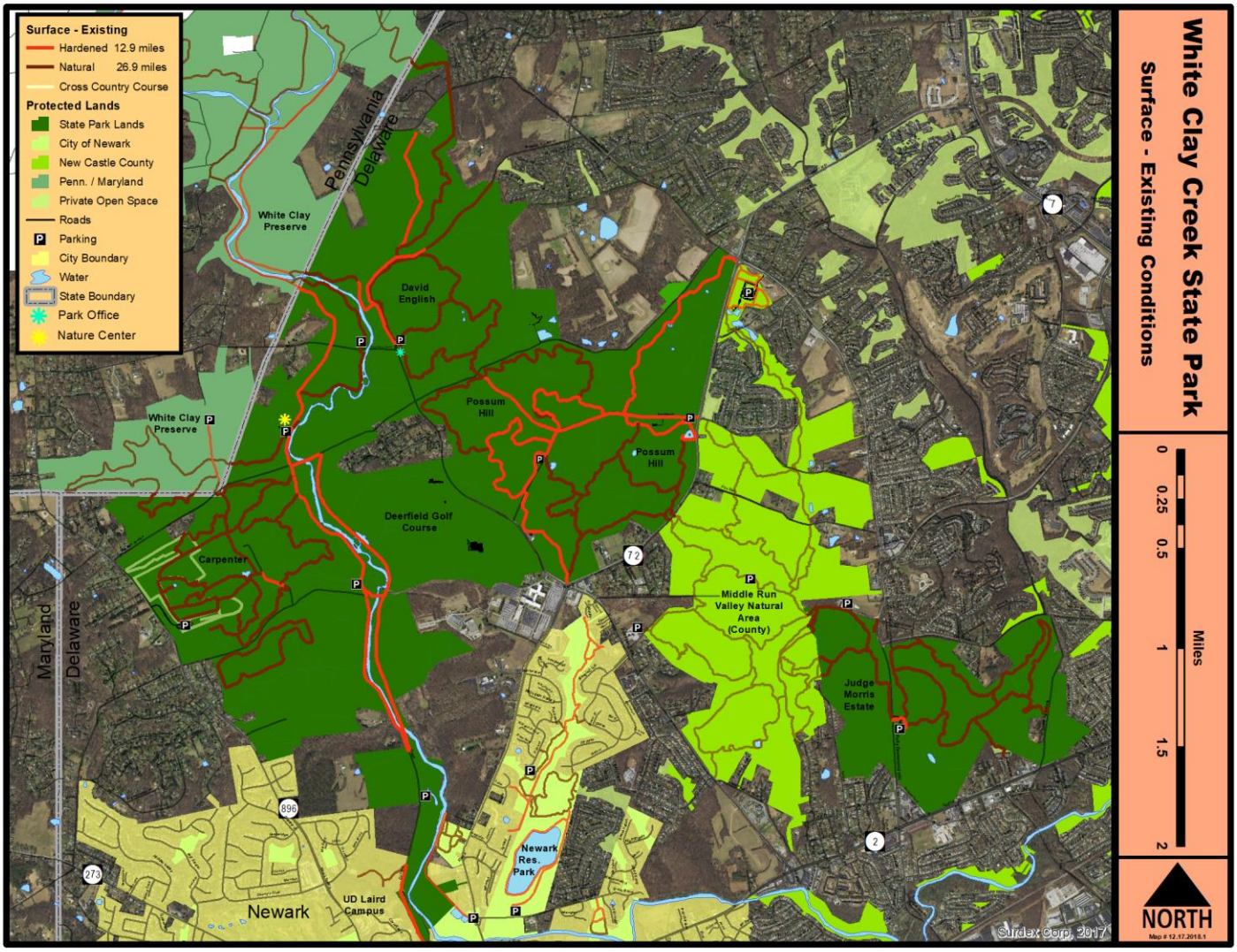
Summary: current permitted uses by mileage are: pedestrian only 8.6 miles; 28.4 pedestrian and biking; 2.8 pedestrian, biking, equestrian use.

Map 4 - Existing Trail Width



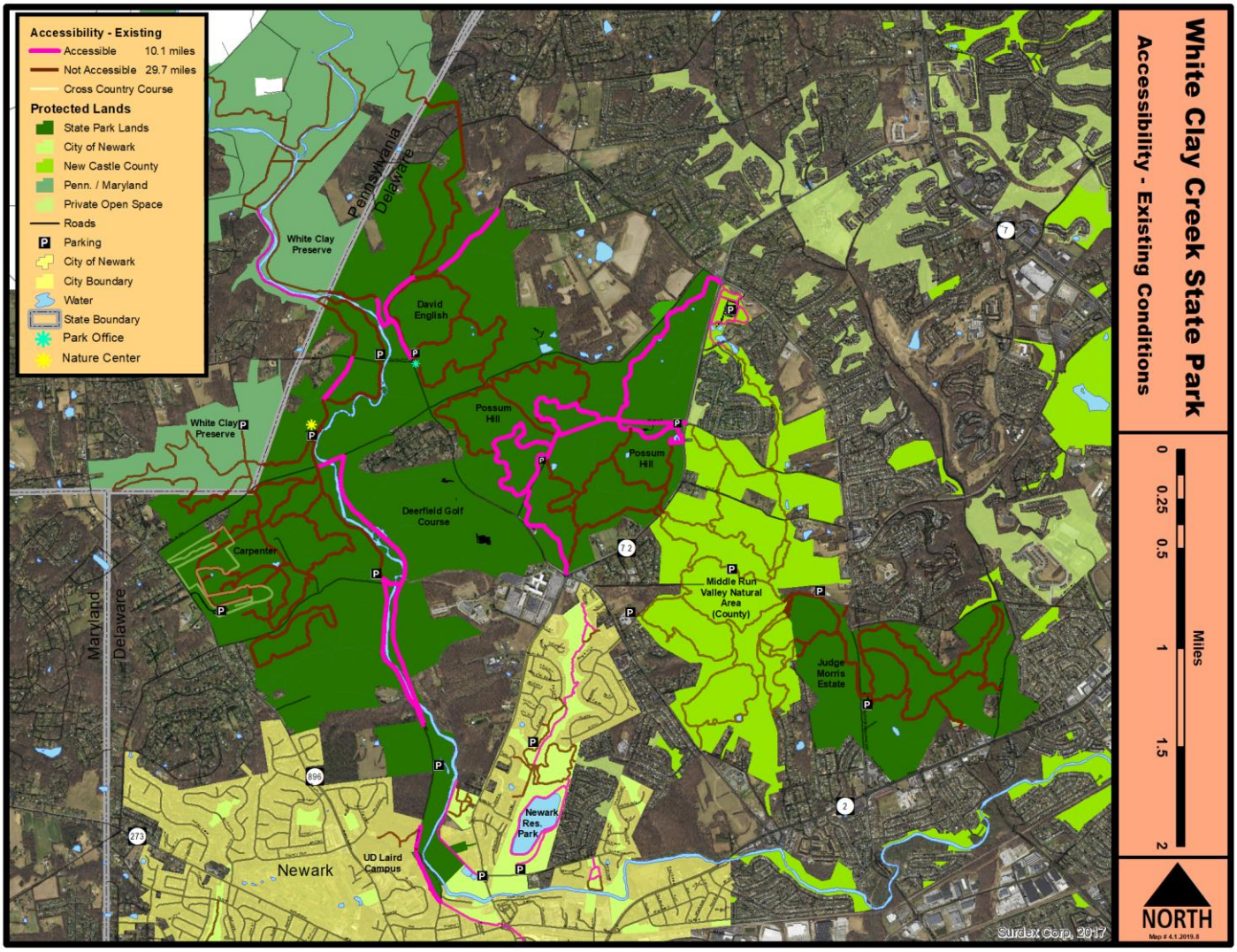
Summary: current trail widths by mileage are: single track 24.9 miles; double track 14.9 miles

Map 5 - Existing Trail Surface



Summary: current trail surfaces by mileage are: natural 26.9 miles; hardened 12.9 miles

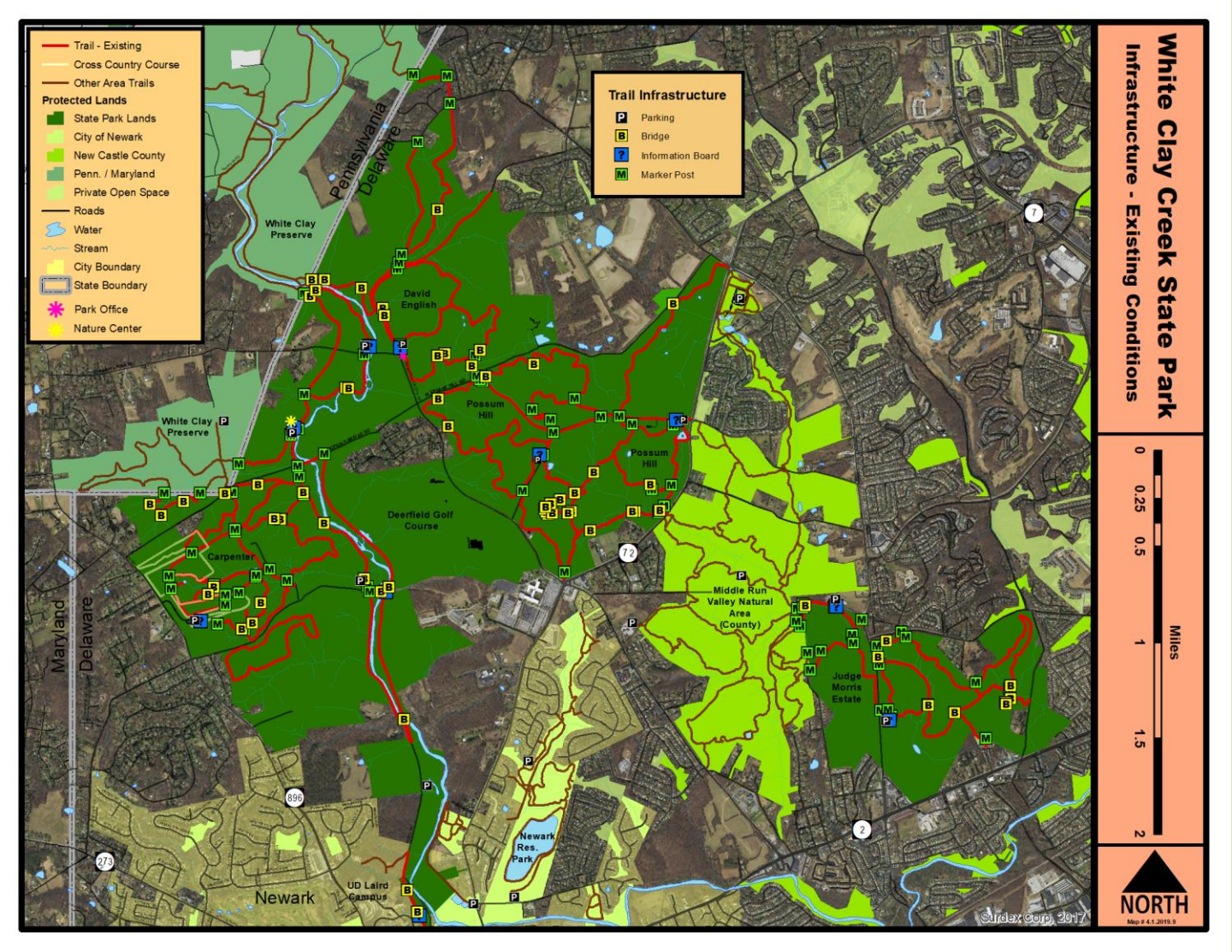
Map 6 - Existing Trail Accessibility



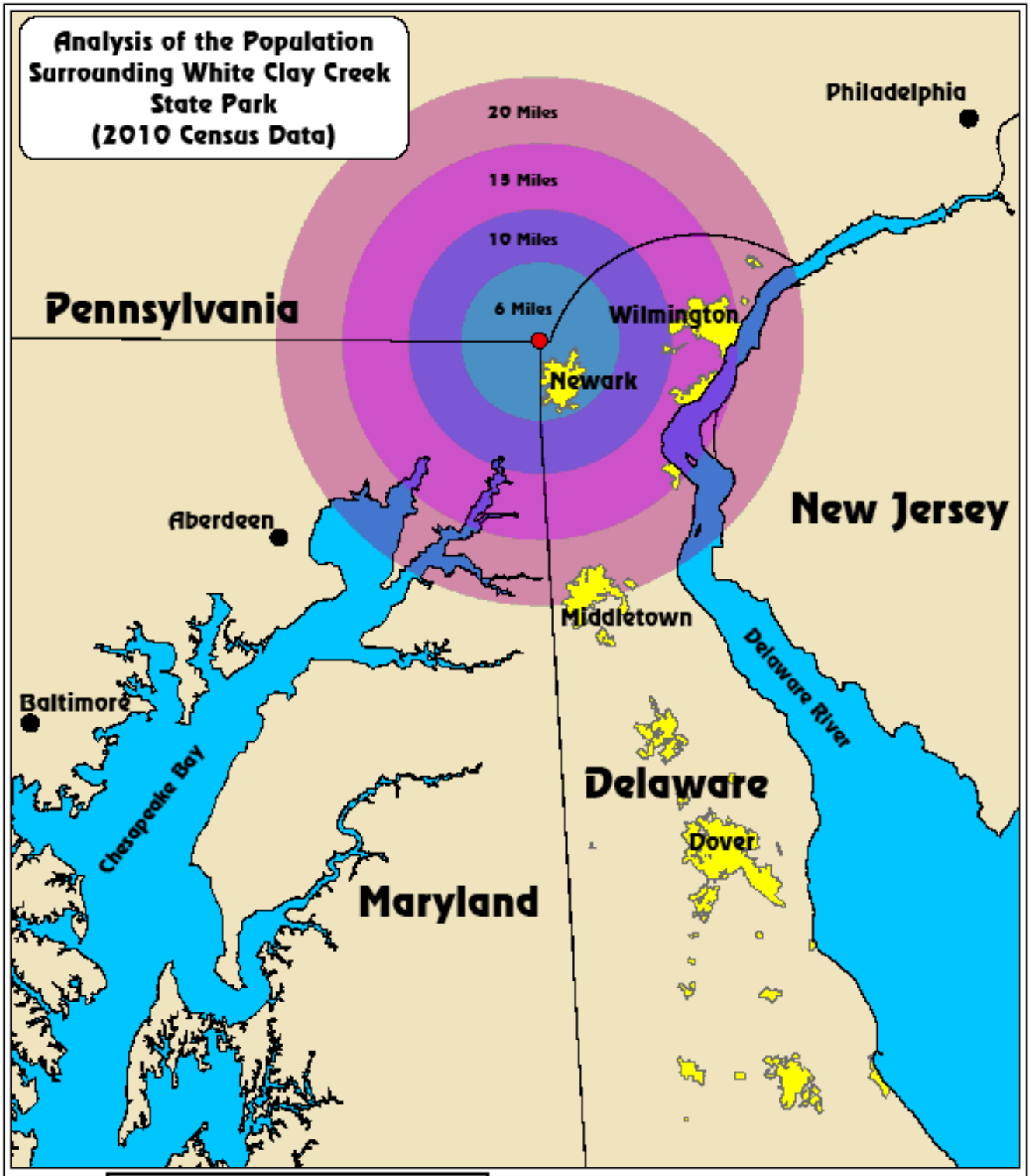
Summary: current trail accessibility by mileage are: accessible 10.1 miles; not accessible 29.7 miles

Map 7 shows locations of trailhead parking lots, information boards, bridges, and trail markers within the existing White Clay Creek State Park trail system. All parking areas for trail access are depicted with the P icon. Access to the trail system is available via eight parking lots or trailheads.

Map 7 - Existing Trail Infrastructure

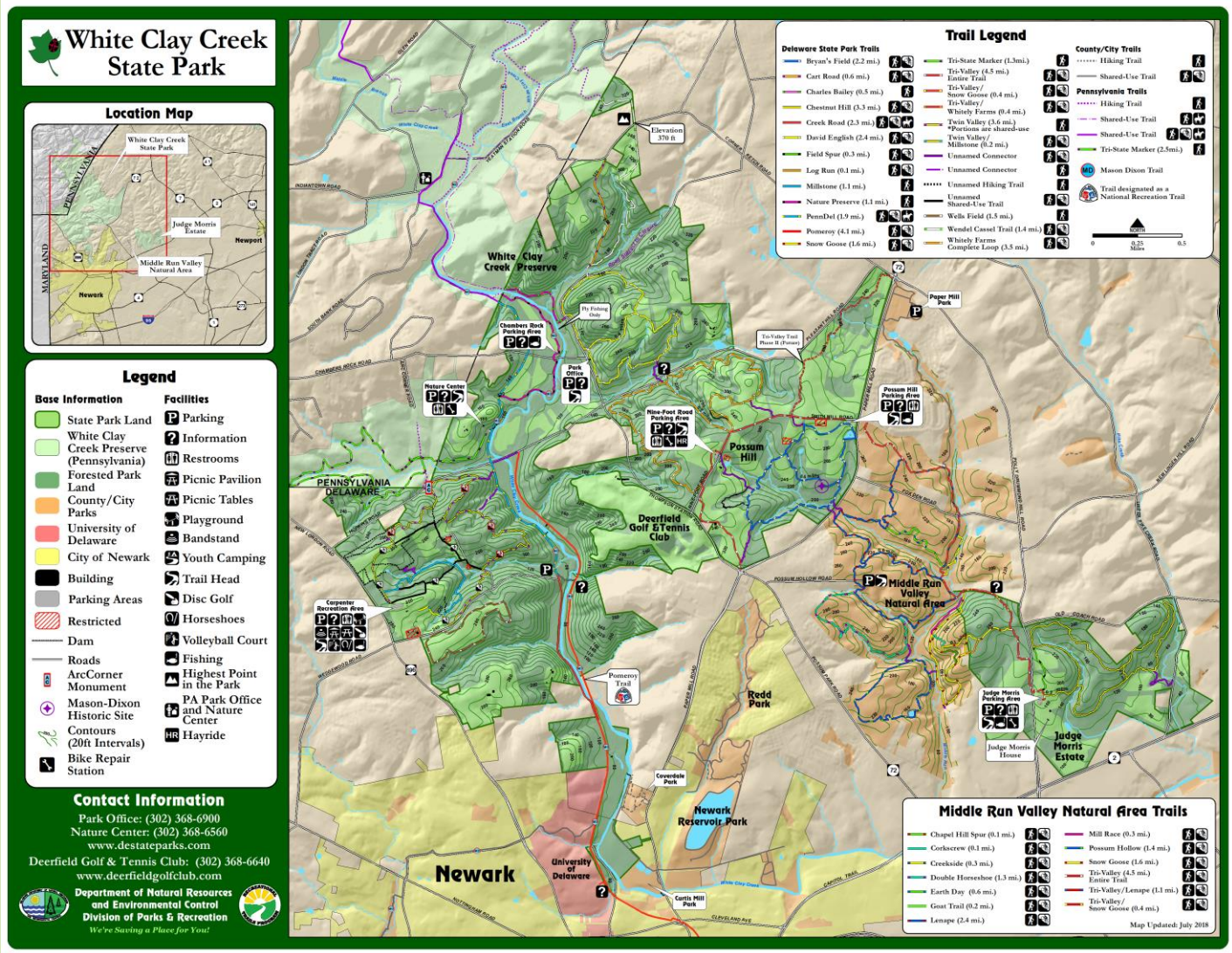


Map 8 – White Clay Creek State Park Regional Context

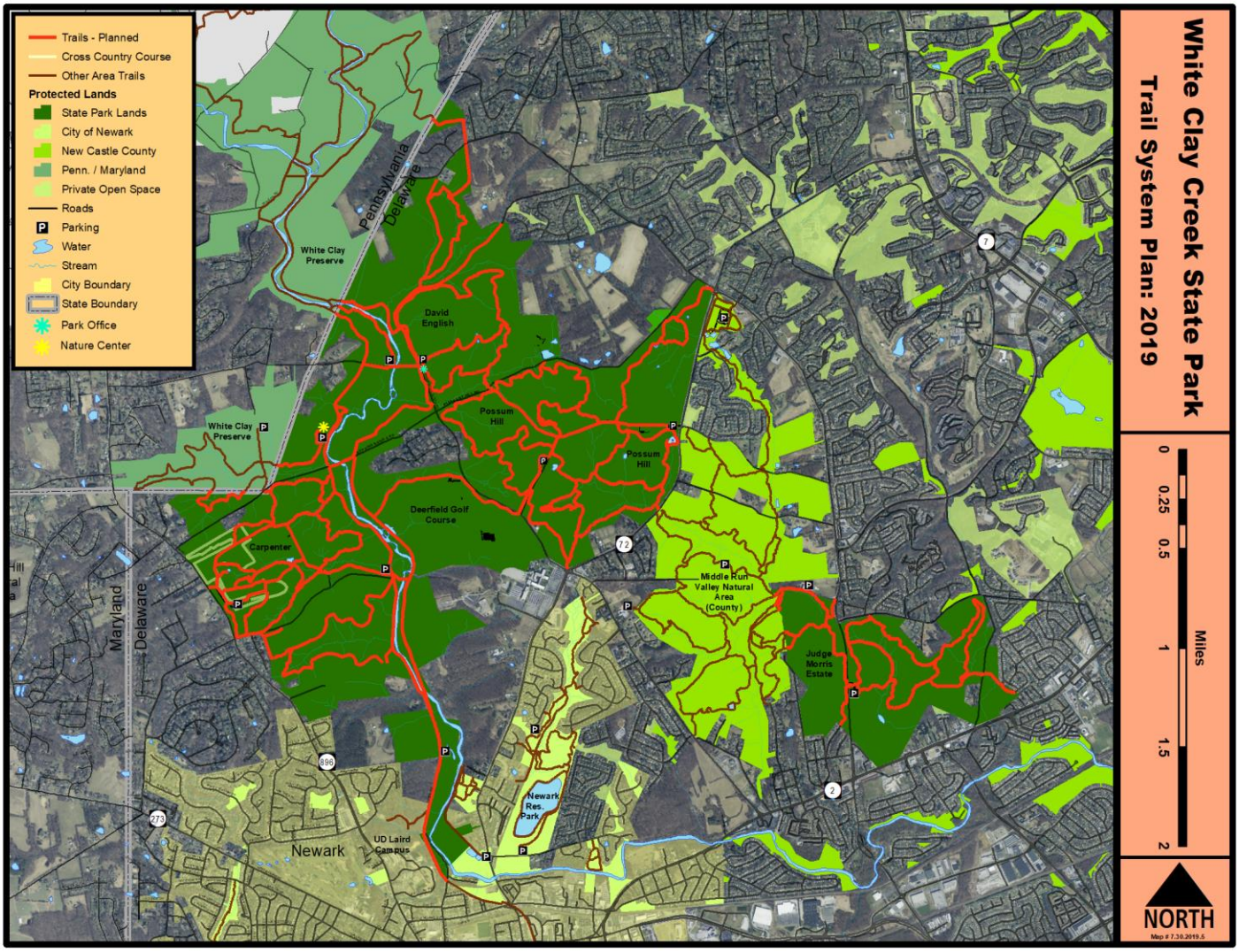


State	Population 6 Miles	10 Miles	15 Miles	20 Miles
DE	97,207	249,908	432,039	518,123
MD	11,350	38,933	69,904	95,262
NJ	0	0	2,879	29,592
PA	16,934	61,706	103,129	275,044
Total	125,491	350,547	607,951	918,021

Map 9 – White Clay Creek State Park - Current On-line Trail Map

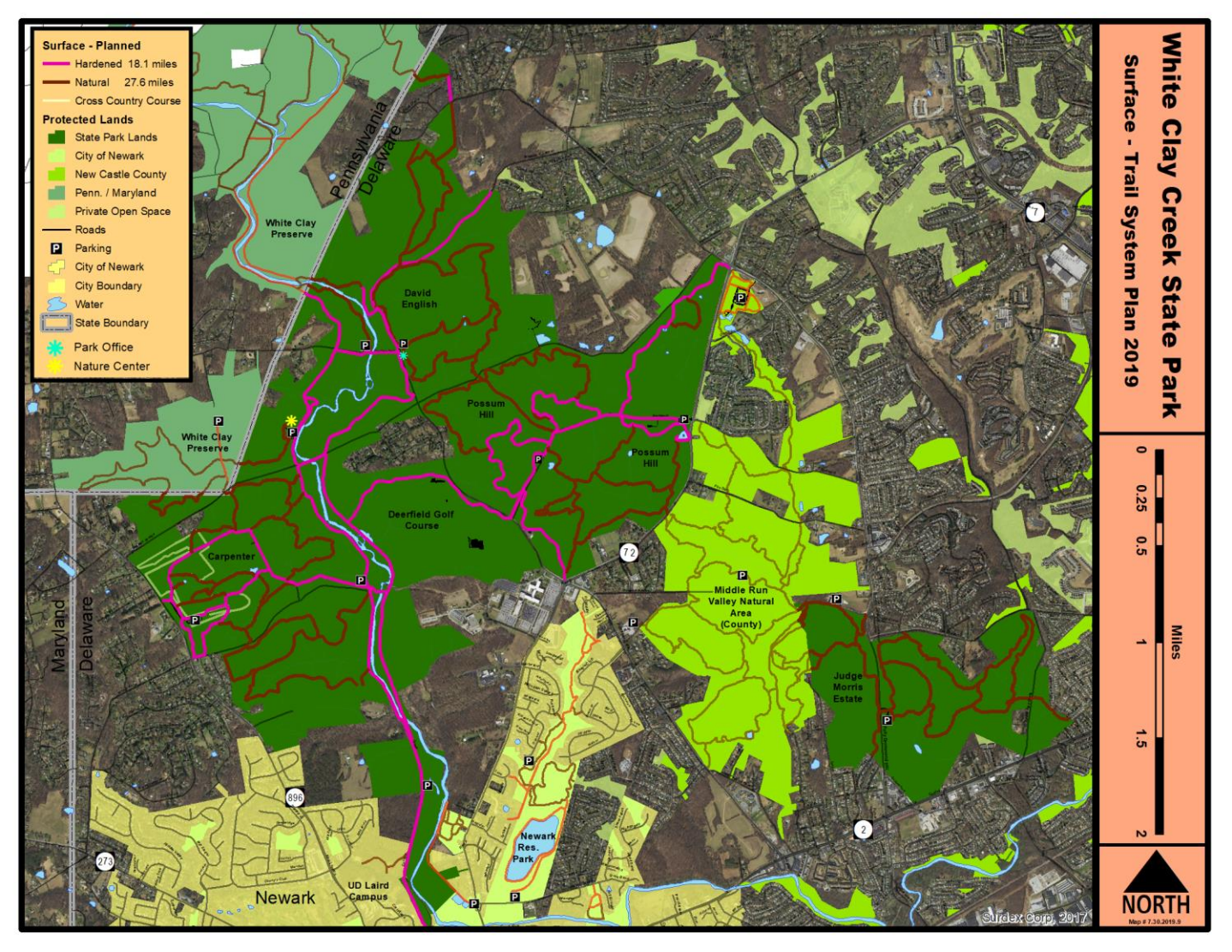


Map 10 - Planned Trail System



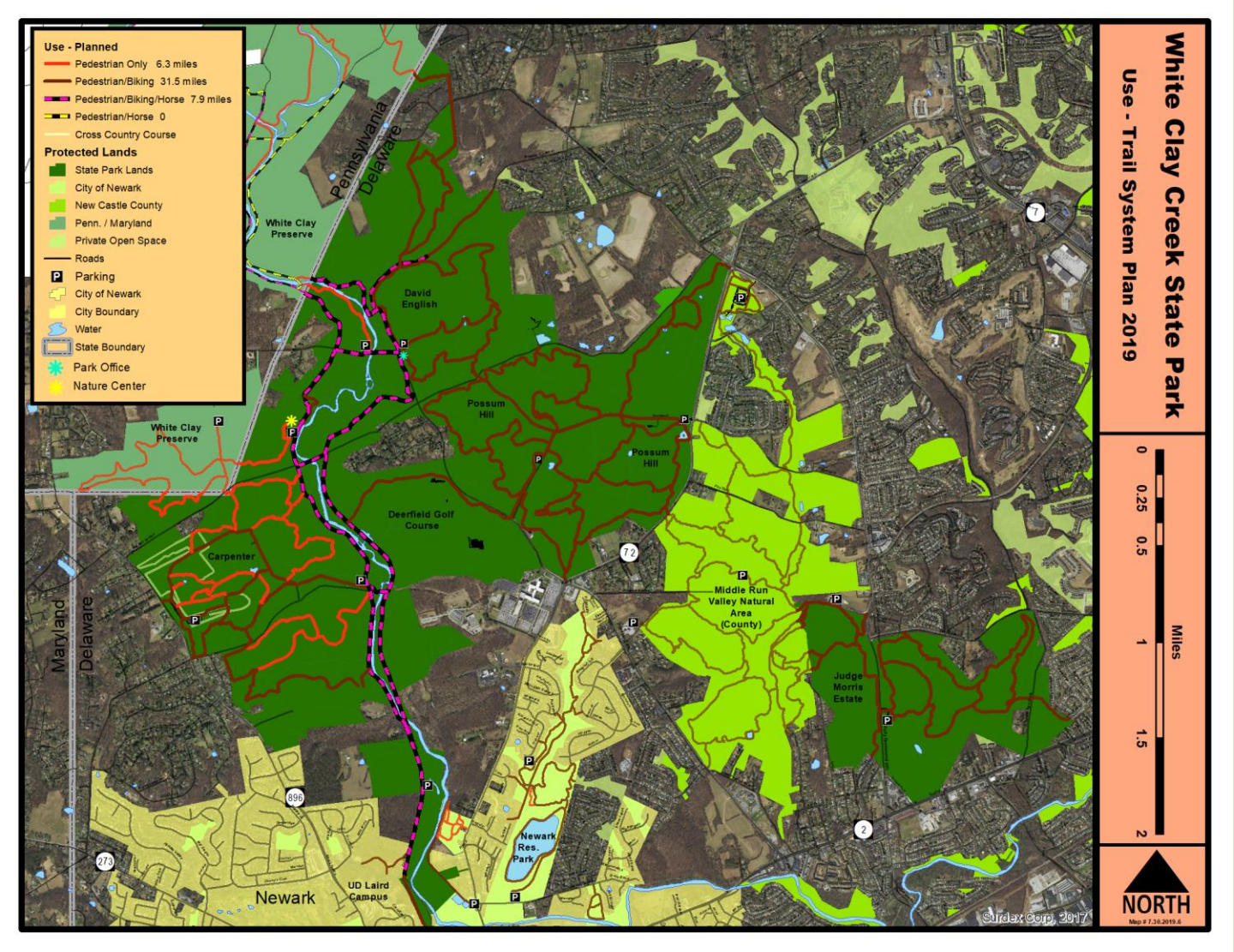
Summary: Overall the existing 39.8 mile trail system will be increase by 15% or 5.9 miles resulting in 45.7 miles overall.

Map 11 - Planned Trail Sustainability



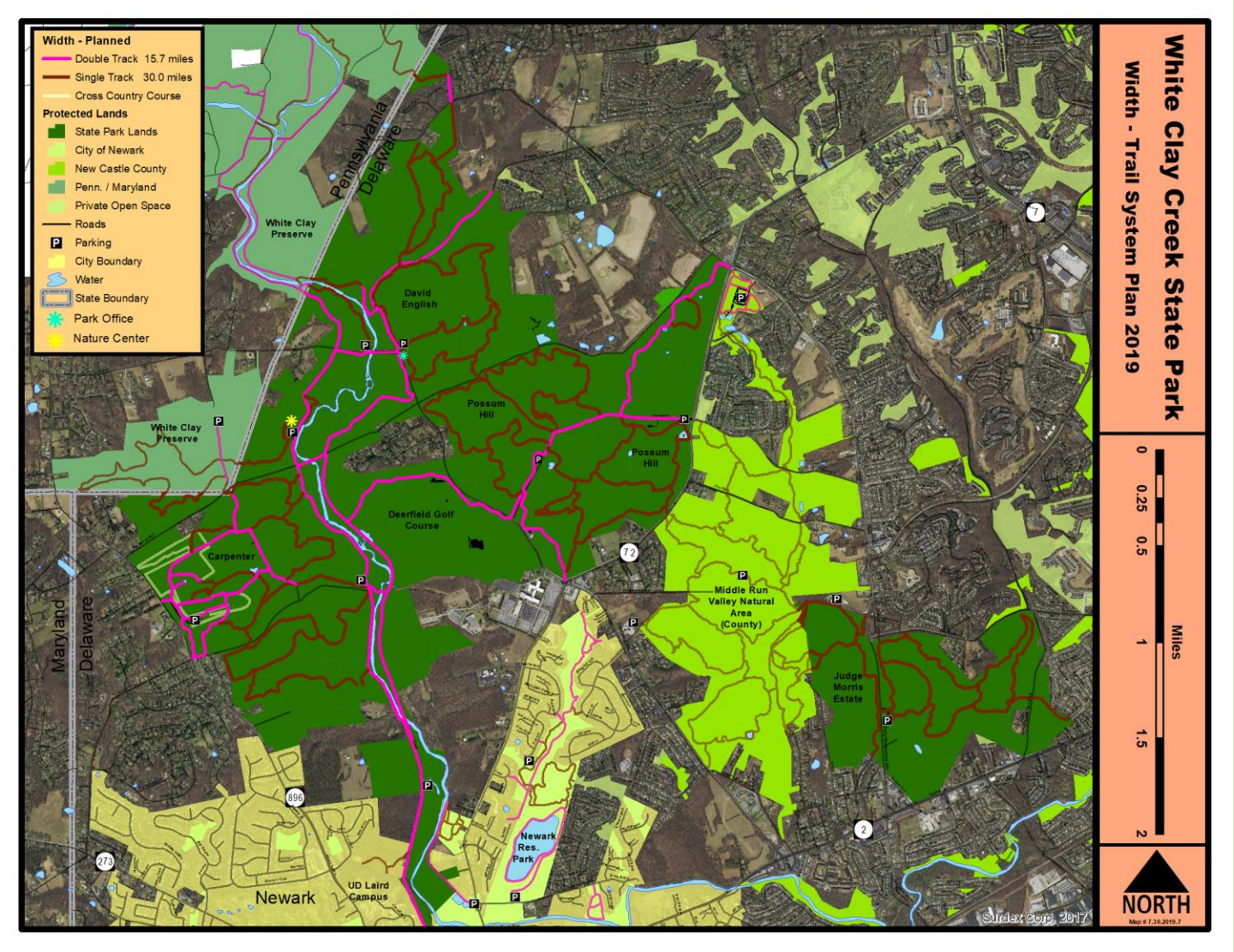
Summary: Overall with realignments and enhancements and new construction techniques, the existing 9.0 miles of trail categorized as “poor sustainability” will be reduced by 8.4 miles or 93%.

Map 12 - Planned Trail Use



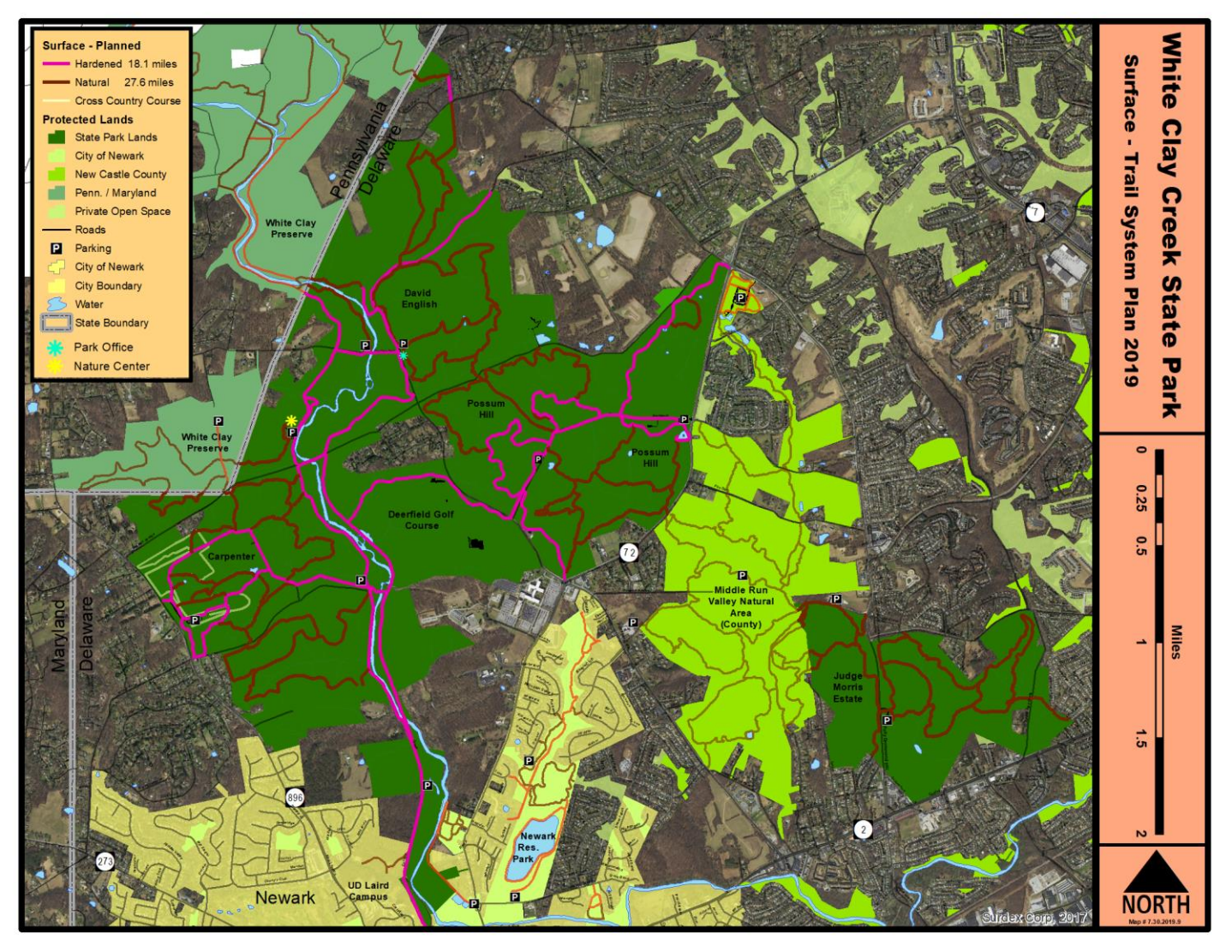
Summary: Overall with realignments and enhancements the existing 39.8 miles of trail increased to 45.7 miles. Current 8.6 miles of pedestrian only trail will decrease to 6.3 miles;
Current 28.4 miles of pedestrian and biking trail will increase to 31.5 miles; and current 2.8 miles of pedestrian, biking, and equestrian trail will increased to 7.9 miles.

Map 13- Planned Trail Width



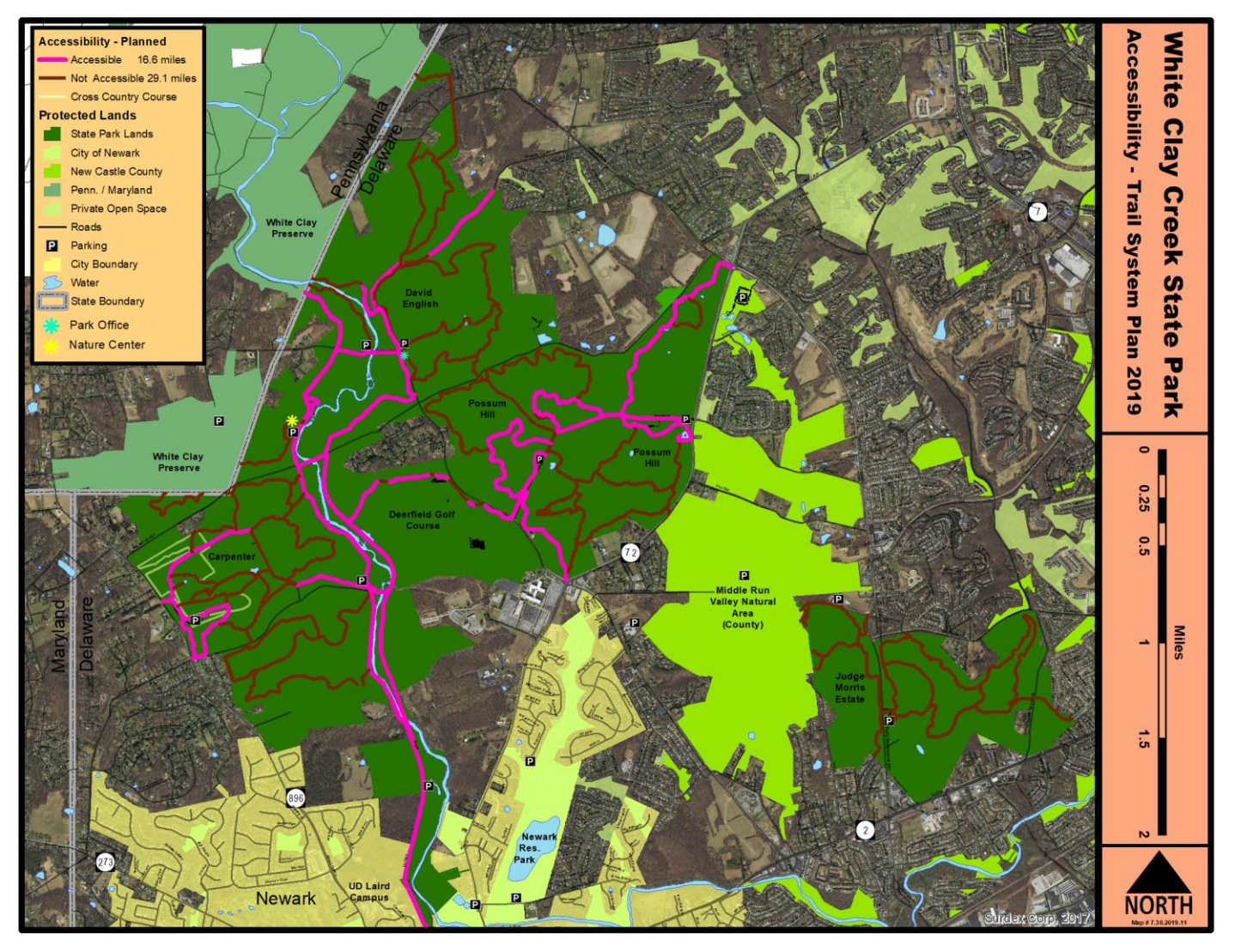
Summary: Overall, existing 24.9 miles of single track trail will be increased to 30.0 miles. Double track trail will increase from 14.9 miles to 15.7 miles.

Map 14- Planned Trail Surfaces



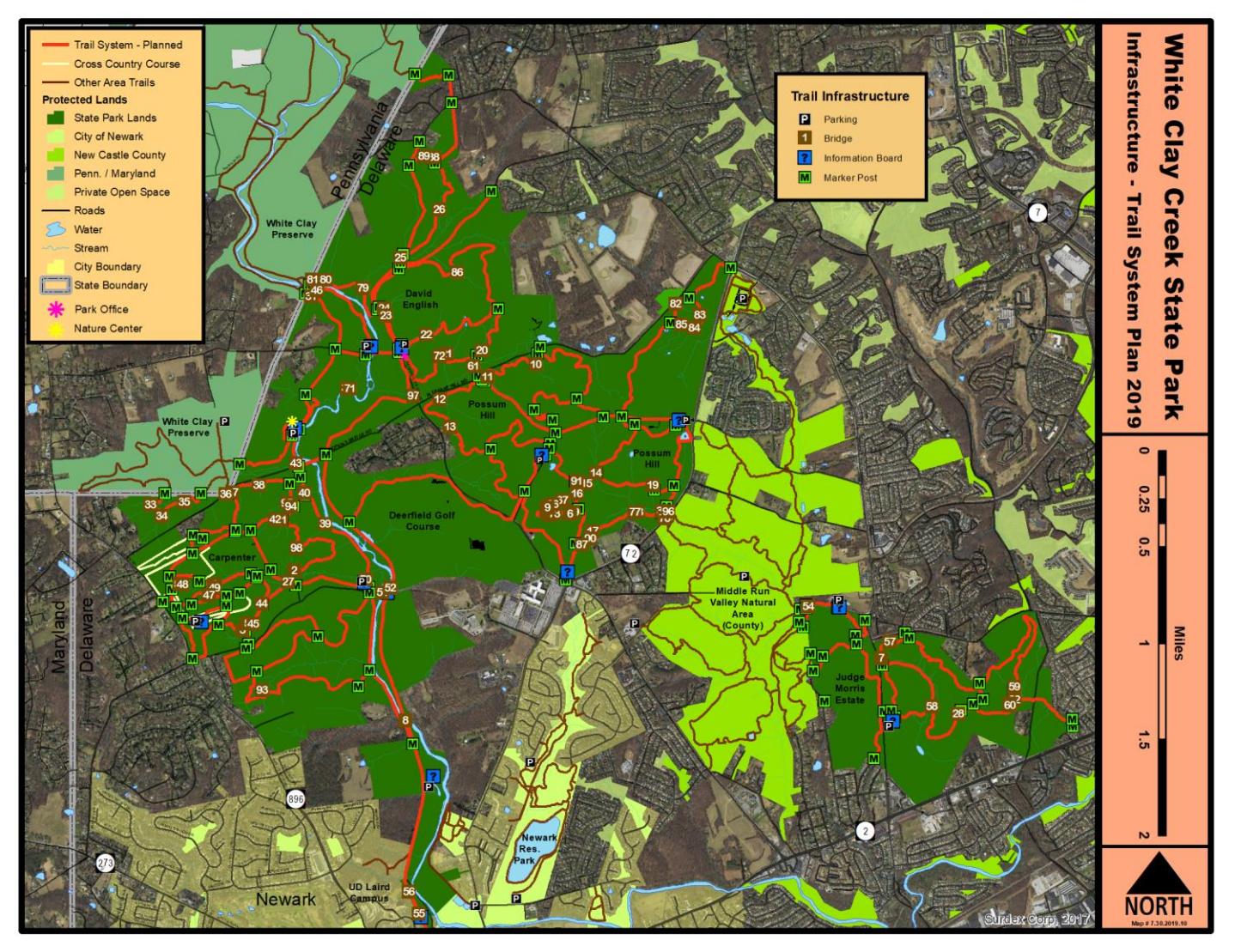
Summary: Overall the existing 12.9 miles of hardened surface trail will increase to 18.1 miles. Current 26.9 miles of natural surface trail will be increase by 0.7 miles to 27.6 miles.

Map 15 - Planned Trail Accessibility – shows the planned hardened surface portion of the trail system that will meet or exceed Federal trail accessibility guidelines.

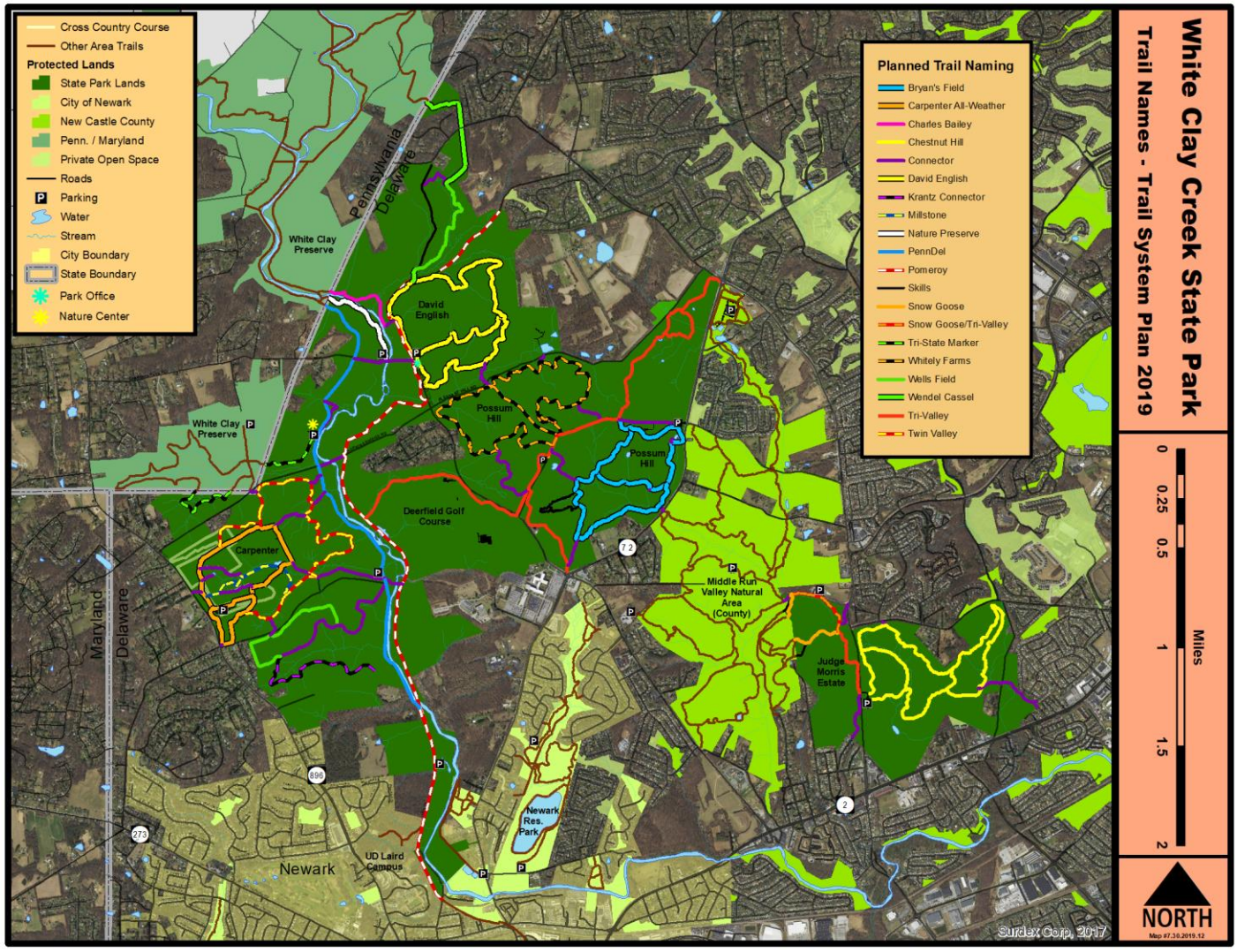


Summary: Overall the existing 10.1 miles of accessible surface trail will increase to 16.6 miles. Current 29.7 miles of trail not accessible will be decreased by 0.6 miles to 29.1 miles.

Map 16 - Planned Trail Infrastructure



Map 17 - Planned Trail Naming



Appendix B: Tables

Table 1, Statewide Trail Distribution Analysis, provides an overview of the State Park trail systems.

Table 1 – State Park Trail Distribution Analysis

County	State Park	Miles	Percent of Total Trail Miles	Total Miles	Percent Total Trail Miles Per County	*Percent Total Population
New Castle	Alapocas Run SP	6.5	4%	103	65%	59%
	Auburn Heights NP	3.9	2%			
	Bellevue SP	9.7	6.%			
	Brandywine Cr SP	16.7	11%			
	Flint Woods NP	2.4	2%			
	Fort DE SP	0.8	0.5%			
	Fort DuPont SP	1.3	1%			
	Fox Point SP	2.3	1 %			
	Lums Pond SP	18.7	11%			
	White Clay Cr SP	39.8	24%			
	Wilmington SP	3.5	3%			
Kent	Killens Pond SP	7.5	4%	7.5	4%	18%
Sussex	Barnes Woods NP	0.8	0.5%	43.5	31%	23%
	Cape Henlopen SP	15.9	12%			
	DE Seashore SP	9.0	5%			
	Fenwick Is SP	0	0.0%			
	Holts Landing SP	2.4	2%			
	Trap Pond SP	13.0	8%			
	Total	154	100%	154	100%	100%

	Trail Usage (miles)		Trail Width (miles)		Trail Surfacing (miles)	
County	Shared Use	Single Use (Pedestrian Only)	Double Track	Single Track	Natural Surface Tread	Hardened Surface Tread
New Castle	65.9	34.7	63	40	64	40
Kent	3.2	4.3	6	1.5	4.5	3
Sussex	34.5	9	35	8.5	16.5	21
Total	106	45.7	104	50	84	70

Table 2 - Existing Trail Uses

Existing Trail Uses	Mileage
Pedestrian (All trails open to Pedestrians)	39.8
Pedestrian Only	8.6
Pedestrian/Bike	25.6
Pedestrian/Bike/Equestrian	2.8

Table 3 - Existing Trail Characteristics

Trail Characteristics	Existing Trail Mileage	Percentage of Park System
Total Mileage	39.8	100%
Sustainability		
Good	25.5	64
Fair	5.3	13
Poor	9.0	23
Surface		
Natural	26.9	68
Hardened	12.9	32
Width		
Single Track	24.9	63
Double Track	14.9	37
Permitted Use		
Pedestrian Only	8.6	22
Pedestrian/ Bike	28.4	70
Pedestrian/ Bike/Equestrian	2.8	8
Accessibility		
Accessible	10.1	25
Not Accessible	29.7	75

Table 4- Existing Trails, Miles & Uses

Trail	Length in Miles	Pedestrian	Biking	Equestrian
Bryan's Field	2.2	√	√	
Charles Bailey	0.5	√		
Chestnut Hill	3.3	√	√	
David English	2.4	√	√	
Mill Stone	1.1	√		
Nature Preserve	1.1	√		
PennDel	1.9	√	√	√
Pomeroy	4.1	√	√	
Tri-State Marker	3.8	√		
Tri-Valley	4.5	√	√	
Twin Valley	3.6	√		
Whitely Farms	3.5	√	√	

Table 5 –Existing and Planned Trail Characteristics and Accessibility

Trail Characteristics	2019 Trail System	Planned System	Change in Mileage	Percent of Planned System
Total Mileage	39.8	45.7	Increased 5.9	+100%
Sustainability				
Good	25.5	40.0	Increased 14.5	88
Fair	5.3	5.1	Reduced 0.2	11
Poor	9.0	0.6	Reduced 8.4	1
Surface				
Natural	26.9	27.6	Increased 0.7	60
Hardened	12.9	18.1	Increased 5.2	40
Width				
Single Track	24.9	30	Increased 5.1	66
Double Track	14.9	15.7	Increased 0.8	34
Permitted Use				
Pedestrian Only	8.6	6.3	Reduced 2.3	14
Pedestrian /Bike	28.4	31.5	Increased 3.1	69
Pedestrian /Bike/Equine	2.8	7.9	Increased 5.1	17
Accessibility				
Accessible	10.1	16.6	Increased 6.5	36
Not Accessible	29.7	29.1	Reduced 0.6	64

Table 6 - Planned Trail Changes

Note: Triggers determine when any potential project gets moved to an active funded project. For example: A storm causing a tree to fall and destroy a bridge would trigger a bridge replacement project for safety reasons.

Trail	Trail Type	Width Avg.	Current Trail Users	Future Users	Change Required	Trigger
Bryan's Field	Single Track	3 feet	Pedestrian Bicycles	Pedestrian Bicycles	• Reroutes • Armoring • Signs	• User Safety • Enviro. Protection • Funding
Carpenter All-Weather Loop	*Double Track*	*8 feet*	Pedestrian Bicycles	*Pedestrian Bicycles*	• Reroutes • Surface Upgrade	• User Safety • Enviro. Protection • Funding
Charles Bailey	Single Track	3 feet	Pedestrian	Pedestrian Equestrian Bicycles	• Signs	• Funding
Chestnut Hill	Single Track	3 feet	Pedestrian Bicycles	Pedestrian Bicycles	• Reroutes • Armoring • Signs	• User Safety • Enviro. Protection • Funding
David English	Single Track	3 feet	Pedestrian Bicycles	Pedestrian Bicycles	• Reroutes • Armoring • Signs	• User Safety • Enviro. Protection • Funding
Mill Stone	Single Track	3 feet	Pedestrian	Pedestrian	• Reroutes • Armoring • Signs	• User Safety • Enviro. Protection • Funding
Nature Preserve	Single Track	3 feet	Pedestrian	Pedestrian	• Reroutes	• User Safety • Enviro. Protection • Funding
Old Cart Road	Single Track	3 feet	Pedestrian Bicycles	Pedestrian Bicycles	• Minor Reroutes • Armoring	• User Safety • Enviro. Protection • Funding
Pomeroy	Double Track	10 feet	Pedestrian Bicycles	Pedestrian Equestrian Bicycles	• Armoring • Surface Upgrade	• Accessibility • Enviro. Protection • Funding
Tri-State Marker	Single Track	3 feet	Pedestrian	Pedestrian	• Armoring • Signs	• Enviro. Protection • Funding
Twin Valley	Single Track	3 feet	Pedestrian	Pedestrian	• Reroutes • Armoring • Signs	• User Safety • Enviro. Protection • Funding
Wells Field	Single Track	3 feet	Pedestrian	Pedestrian Bicycles	• Reroutes • Armoring • Signs	• Krantz Connector • Funding
Whitely Farms	Single Track	3 feet	Pedestrian Bicycles	Pedestrian Bicycles	• Reroutes • Armoring • Signs	• User Safety • Enviro. Protection • Funding

Table 6 - Planned Trail Changes - New Trail

Trail	Trail Type	Width Avg.	Current Trail Users	Future Users	Change Required	Trigger
Creek Road	*Double Track*	*16 feet*	*NA*	*Pedestrian Equestrian Bicycles*	• Convert to Trail	• Policy Change
Carpenter All-Weather Loop	*Double Track*	*8 feet*	*NA*	*Pedestrian Bicycles*	• *New Trail* • *Signs*	• Park Office Change
Chambers Rock Road Connector	*Double Track*	*4 feet*	*NA*	*Pedestrian Equestrian Bicycles*	• *New Trail* • *Signs*	• User Safety • Connection Need • Funding
Deerfield Connector	*Double Track*	*8 feet*	*NA*	*Pedestrian Bicycles*	• *New Trail* • *Signs*	• Connection Need • Funding
Pomeroy Extension	*Double Track*	*4 feet*	*NA*	*Pedestrian Equestrian Bicycles*	• *New Trail* • *Signs*	• Funding • Accessibility • Connection Need
Krantz Connector	*Single Track*	*3 feet*	*NA*	*Pedestrian Bicycles*	• *New Trail* • *Signs*	• Camping • Funding
Thompson Station Road	*Double Track*	*10 feet*	*NA*	*Pedestrian Bicycles*	• Convert to Trail	• Policy Change
Wells Field Connector	*Single Track*	*3 feet*	*NA*	Pedestrian	• *New Trail* • *Signs*	• Camping • Funding
Wells Lane Connector	*Double Track*	*4 feet*	*NA*	*Pedestrian Bicycles*	• *New Trail* • *Signs*	• User Safety • Funding

Table 7 Trail Bridge Conditions

Trail Bridge Number	2018 Condition	Year Built	Planned Action
1	Excellent	2015	None
2	Fair	2000	Replace
3	Good	unknown	Replace
4	Good	2000	None
5	Good	2001	Remove with Reroute
6	Excellent	2018	None
7	Good	2000	None
8	Excellent	2009	None
9	Excellent	2018	None
10	Good	2002	None
11	Good	2003	None
12	Good	2003	None
13	Good	2003	None
14	Good	2002	None

15	Good	2002	Remove with Reroute
16	Good	2002	None
17	Good	2002	None
18	Good	2002	None
19	Good	2005	None
20	Good	2001	None
21	Good	2002	None
22	Good	2002	Remove with Reroute
23	Good	2004	None
24	Good	2004	None
25	Poor	unknown	Replace
26	Good	2004	None
21	Poor	unknown	Replace
28	Good	2004	None
30	Good	2002	None
31	Fair	unknown	None
32	Good	2008	None
33	Excellent	2015	None
34	Excellent	2015	None
35	Excellent	2015	None
36	Excellent	2015	None
37	Poor	unknown	Replace
38	Good	2002	None
39	Good	2000	None
40	Good	2000	None
41	Good	2001	None
42	Excellent	2017	None
43	Fair	unknown	Replace
44	Excellent	2019	None
45	Good	2001	None
46	Fair	unknown	None
47	Excellent	2015	None
48	Poor	unknown	Replace
49	Excellent	2015	None
50	Poor	unknown	Replace
51	Good	2001	None
52	Fair	unknown	None
53	Good	2006	None
54	Excellent	2006	None
55	Excellent	2012	None
56	Excellent	2012	None
57	Good	1999	None

58	Poor	2000	Replace
59	Good	1999	None
60	Good	2000	None
61	Excellent	2013	None
62	Good	2000	None
63	Good	2006	None
64	Good	2004	None
66	Good	2004	None
67	Good	2004	None
69	Excellent	2018	None
70	Good	unknown	None
71	Good	2008	None
72	Good	2002	None
73	Good	2006	None
74	Good	2004	None
76	Good	2004	Remove with Reroute
77	Good	2002	None
78	Good	2002	None
79	Excellent	2018	None
80	Excellent	2018	None
81	Excellent	2018	None
82	Planned	Planned	Planned with New Trail
83	Planned	Planned	Planned with New Trail
84	Planned	Planned	Planned with New Trail
85	Planned	Planned	Planned with New Trail
86	Planned	Planned	Planned with Reroute
87	Planned	Planned	Planned with Reroute
88	Planned	Planned	Planned with New Trail
89	Planned	Planned	Planned with New Trail
90	Planned	Planned	Planned with Reroute
91	Planned	Planned	Planned with Reroute
92	Planned	Planned	Planned with Reroute
93	Planned	Planned	Planned with New Trail
94	Planned	Planned	Planned with Reroute
95	Planned	Planned	Planned with Reroute
96	Planned	Planned	Planned with New Trail
97	Planned	Planned	Planned with New Trail
98	Planned	Planned	Planned with Reroute

Appendix C: Sustainable Trail Best Management Practices

Designing, constructing, and properly maintaining trails for sustainability is of paramount importance to preserving the designed experience, health, and life span of the trail system. Many trail management problems, ranging from erosion to user conflicts, stem from poor trail planning and design, management, and use. A poorly designed trail, no matter how well it is built, will degrade at a faster rate and cause more problems for managers and trail users.

User type and volume impacts are most notable on natural surface trails. Over the years there have been a number of studies that have examined the relationship between users and the trail. The ability to loosen or displace (move short distances) tread materials will help determine the sustainability of any given trail. Although the "footprint" may look different, the foot and the tire exhibit about the same amount of wear and tear on the trail-pounds per square inch on the tread are actually lower for a bike. The equestrian, at least four times the weight, can have a more dramatic effect on compacting or loosening the tread. Once tread materials are loose they become more susceptible to displacement and/or erosion. Depending on soil conditions, user type and volumes, trail width, canopy cover, and slopes, the amount and distance of displacement or erosion will vary. In general the distance for displacement will not exceed one or two feet. Erosion on the other hand is not confined to short distances; in fact soil may be carried hundreds if not thousands of feet by water.

Site conditions all being equal, the heavier horse will loosen and displace many times more tread material than either the pedestrian or biker. However, sheer numbers of any one user type can overwhelm just a few of another. The impact of one horse in a muddy area is no match for twenty hikers. Nor are a handful of hikers going through a stream comparable to ten bikers splashing across at speed. All trail users affect the trail surface and surrounding environment, especially when trails are poorly planned and constructed. The impacts are intensified when trail activities occur during fragile environmental times - such as when natural surface trails are soft (winter freeze thaw cycle, heavy or prolonged rain events). Soft trails are more susceptible to soil compaction, displacement, and erosion, or vegetation loss or trampling when users avoid puddles or soft tread areas.

The increase of knowledge and understanding of the inner workings of the natural environment and how trail activities impact and interact with local site conditions, has reshaped how the Division approaches trail planning/design, development, and maintenance. It has been the accumulation, and continuation, of this knowledge that has led to a broader and more in-depth approach to the planning process.

The basic principles of sustainable trails include the following:

- Incorporate contour trail design
- Maximize natural and cultural resource protection
- Support current and future use
- Minimize adverse effects on plant or animal life in the area
- Avoid disruption of the natural hydrology
- Minimize adverse effects on tread surface erosion or displacement
- Minimize future rerouting and long-term or recurring maintenance
- Minimize or eliminate recurring trail maintenance costs.

In essence, greater level of sustainability relates directly to water and user management. Adopting these principles ensures a more accessible and sustainable trail system for the future.

Designing a sustainable trail system requires the analysis and evaluation of the following elements and factors: cultural resources; endangered or sensitive plant and animal species; occurrence and health of native plants and animals; mature growth forests; natural drainage; topography, soils, slope and grade changes; ease of access from control points such as trailheads; user type and volume; and user safety. A sustainable trail system will offer trail users interesting experiences in varying landscapes.

Current research suggests that the most effective way to minimize the environmental effects of trail uses is to build environmentally sustainable trails. A sustainable trail balances many elements including location, expected trail use, construction methods, grade changes (grade reversals) and employing quality construction techniques and material.

Maintaining trails to be sustainable will mean that park operations may need to be conducted differently than had been in the past. Using ATVs or gators instead of trucks to access trails, or small mowers replacing large tractors with brush mowers will minimize impacts to the trail. Park volunteers are enlisted in Trail Patrols to educate visitors and help pick up small branches and other debris. Volunteers also help out by reporting downed tree locations or other unsafe trail conditions or maintenance situations that must be carried out by park staff.

Trail Construction and Maintenance Best Management Practices General Guidelines:

- Obtain permits or notifications first.
- Before beginning any trail construction, install necessary measures to minimize and prevent erosion.
- Stabilizing slopes, creating natural vegetation buffers, diverting runoff from exposed areas, controlling the volume and velocity of runoff, and conveying that runoff away from the construction area all serve to reduce erosion.
- Ensure low environmental impact during construction and maintenance- based on seasonal conditions, soils, slope, and vegetative cover.
- Use the proper size tool for the job.
- Minimize the amount of soil disturbance.
- Construct trails during the dry months when soil saturation and water levels are at their lowest.
- Stabilize trail construction areas.
- Install temporary erosion control measures such as hay bales before construction begins. Keep them in place and maintained during construction and remove them only after the site has been stabilized.
- Trails through wet areas should be avoided or bridged.

Appendix D: Natural and Cultural Resources

Natural Environment

White Clay Creek hosts a variety of ecosystems including: wooded uplands, fresh water wetlands, open meadows, and steep stream valleys. As noted elsewhere in this plan, trails can be sources of erosion, compaction and of habitat division and disturbance. But the greatest impacts of trails upon the park's natural resources are as avenues of incursion for non-native invasive plant species into native habitats. This occurs because of the constant soil disturbance and exposure that is typical of even lightly used trails. The passing of humans, no matter whether by foot, horse, bike or maintenance vehicle, is a persistent source of seed dispersal of some of the most highly invasive plants in Delaware's forested landscapes. These plants are not just a nuisance; they can alter and degrade the local ecology. Even the cocoons (containing eggs) of invasive earthworms can be moved this way. Introduction of these invasive plants and animals are the greatest threat to intact native forest habitat throughout our park system. Regular annual monitoring (and treatment if required) is necessary along all trails: existing and abandoned.

Cultural Landscape

Although archaeologists are not yet certain exactly when the first human occupation of Delaware took place, we can say with certainty that people were living in the area 12,000 years ago. These earliest inhabitants hunted, large game such as mastodons, mammoths, and other Pleistocene megafauna, and by gathering plant foods – both linked to resource availability. During this early period until the Historic Period, the grassland settings of the floodplain and the ecotone between the grasslands and the forests along White Clay Creek provided an attractive setting for big game and a variety of food plants. It was in these areas during prehistoric times where small bands would have camped for short periods, especially in sheltered locations overlooking low order streams.

It now appears that maize agriculture was never an important focus for the prehistoric peoples of the Delmarva, unlike along the large rivers further inland. However, multi-family groups occupied seasonal camps allowing them to more fully exploit native foods, thus increasing the likelihood of evidence left behind. The biggest change occurred during the Historic Period. The history of White Clay Creek area strongly reflects the agricultural and small-scale industrial heritage of northern New Castle County when European settlers established farmsteads. It is these historic farmsteads, and likely prehistoric sites that warrant investigation as they relate to trail development to ensure protection.

Historic Landscape in New Castle County (Brandywine Creek State Park)

Appendix E: Public Demand for Trail Opportunities

Trail-related activities are the number one outdoor recreation activities in Delaware to fulfill public needs and trends. These findings were documented in the 2018 - 2022 Statewide Comprehensive Outdoor Recreation Plan (SCORP), a 5-year plan outlining both the demand and need for outdoor recreation facilities. The Plan then projects facilities that will fulfill gaps in outdoor recreation opportunities that meet the public's recreational needs

In August 2011, the Division of Parks and Recreation conducted a telephone survey of Delaware residents to gather information and trends on outdoor recreation patterns and preferences as well as other information on their landscape perception. These findings are the foundation of the 2018 - 2022 update of the Statewide Comprehensive Outdoor Recreation Plan. For purposes of planning and projecting outdoor recreational facility needs, the State was divided into five regions for reporting. White Clay Creek State Park falls in Region 1. Within Region 1, 84% of telephone survey respondents expected a member of their household to participate in walking or jogging; 59% participate in bicycling; 60% in hiking; 30% in mountain biking; and 23% in horseback riding. Based on a comparison of findings (from the previously published 2013-2018 SCORP), the trend for trail-related activities continues to be popular among the recreating public.

Delaware is home to diverse population centers, landscape types, and varying development patterns, regional variations in outdoor recreation needs are to be expected. However, a common thread in all regions is the need for linear facilities, such as trails, and paved pathways, that accommodate walkers, joggers, hikers, bicyclists and horse riders. These activities ranked high in every region, as well as among different ethnic groups and age categories. Therefore more linear facilities should be constructed to keep pace with the population growth and the public's participation.

The SCORP survey queried participants on several aspects of their recreational lifestyles. When asked why they participate in outdoor recreation, telephone survey respondents gave these top four answers: 1) for physical fitness, 2) for relaxation, 3) to be with family and friends , 4) to be close to nature and, 5) for mental well-being.

Appendix F: Minimizing Resource Impacts Utilizing Sustainable Trail Design

Minimizing impacts on natural and cultural resources is critical. The intersection of recreational trails, trail use, and resource protection leads to the most effective way to minimize impacts-sustainable trail design, construction, and maintenance principles. What is a sustainable trail? Although there are many elements that determine whether a trail is sustainable, there are four main trail goals that help determine how sustainable a trail will be; resistance to erosion; fulfills the user's needs; requires little maintenance; and mitigates conflicts between different users. The more successful one is in meeting these goals, the more sustainable a trail is. By far, the biggest threats to non-paved trail sustainability are erosion and soil compaction and displacement.

Erosion is the natural process by which soil and other material is transported by wind or water. If left unchecked, erosion can quickly cause serious damage to trails and the very resources we are charged to protect. Soil compaction and displacement is a localized issue directly related to trail use that can impact a foot to several feet of trail, but can have devastating effects.
Trail erosion and soil compaction and displacement can be accelerated by seasonal conditions, weather patterns, trail use, use volume, use type, terrain, vegetative cover, and gravity to name a few. Depending on the combination of the listed conditions above, tread material susceptibility will vary. However, one can only mitigate trail erosion through the utilization of sustainable trail principles.

Sustainable trail principles work together and when applied will create contour trails that will effectively manage erosion, provide high quality low maintenance trails that are fun to use, and help to reduce environmental impact, risk, and user conflicts. The main two goals of these principles are to manage water and users. Success is measured by keeping water off the trail and users on the trail. The following is a list of the main principles of trail sustainability.

Trail Sustainability Elements

- Trail location: along hillsides or on flat well-draining soils are best
- Trail alignment: along contours
- Trail grades: keep grades 10% or less on average on steep terrain
- Grade reversals: incorporate *frequent* drainage throughout trail system
- Outslope: slope tread toward downhill side to encourage sheet flow across trail
- Adaptive trail design: consider trail design change as soil texture, vegetation cover and other site characteristics change
- Minimize soil displacement: design must take into account type of users
- Prevent user created trails: close all unofficial trail created by users
- Maintain trails: perform regular maintenance

Trail layout and design must take into account the natural and cultural resources of the site. The highest quality habitats and sensitive cultural sites should be avoided to minimize the impact of trail construction on rare species and habitats and archaeological sites. As ongoing trail design and recreational needs intersect with protection of natural and cultural resources at the park, the problem of identification, conflict and resolution of the challenges faced has led to a more sustainable trail system. Keeping trails dry necessitates locating trails on the steeper slopes (8% and steeper) or on well-draining soils whenever possible.

Reducing and minimizing trail impacts in zones of high quality habitat and archaeological sites are planning objectives. Creating a trail system that maintains stable firm tread conditions is a main objective and achieves a higher level of sustainability, yet this very objective can play differently against the balance of protecting certain natural and cultural resources. Because of this, trail planning for high quality sites must occur over no less than

one growing season to observe habitat conditions in the context of planned trails and how that may relate to targeted higher protection sites. In preparing this Trail Plan, observations have occurred over several growing seasons to assess trail impacts.

Erosion along one of the White Clay Trails

Appendix G: 2016-2018 Public Participation and Analysis

Public participation for the 2019 Trail Plan included feedback from 2016/2017 trail user group stakeholder meetings and the park master plan process. Throughout 2016/2017 five public meeting and five Division review meetings were held to review possible changes to the 2011 Trail Plan. In May of 2018, a press release and emails were disseminated to stakeholders and the general public to announce the start of the White Clay Creek State Park master planning process.

Use of the Delaware's government web site for posting maps, information, and announcements made information more widely available for public review. The Division held four open houses at the White Clay Creek State Park golf center over the Summer of 2018 to solicit public thoughts about current conditions and ideas for the future. More than 235 individuals attended the open houses. In addition, the Division engaged several state councils and stakeholder organizations with known interests in the Park to solicit additional feedback. An online public survey provided additional opportunity for gauging public interests and generating comments. There were 1,096 individuals who responded to the online survey.

Following the 2016/2017 user group stakeholder meeting and the 2018 Open House master planning events and comment period, the Division's evaluated all public comments related to trails and to consider the following:

- How comments met the Trail Plan objectives
- How comments fit into a larger regional trail system
- How potential recreational alternatives might contribute to regional recreation diversity
- How opportunities can be linked to larger trail systems.

Below are the questions from the public comment form. Limited feedback for some questions did not provide enough data for analysis but are included here to provide a full record.

White Clay Creek State Park
Master Plan Public Survey

- The purpose of this survey is to gain a broad, public perspective on White Clay Creek State Park to guide the planning process.
- Survey responses are strictly confidential and anonymous.
- This is an initial survey. We may conduct one or more future surveys to address specific interests that may arise later in the planning process.
- Thank you for providing complete, and honest answers. Your responses will help in the planning process!

1. Approximately how far do you live from White Clay Creek State Park (What is the drive time from where you live to the area you would typically enter the park)?
   - Less than a 5 minute drive away
   - Somewhere between a 5 and 15 minute drive
   - Somewhere between a 15 and 30 minute drive
   - More than a 30 minute drive away
   - Not sure

2. How do you most typically visit White Clay Creek State Park?
   - By vehicle at a designated State Park parking area, then go on foot or by bicycle
   - I park my vehicle outside the State Park and enter on foot or by bicycle

- I enter on foot or by bicycle from where I live or work
- I just enjoy it from inside my vehicle, I drive along roads through the park but don't otherwise enter the Park

3. How often do you visit, or anticipate visiting, White Clay Creek State Park during each season?
Cells are selected (in survey they are circles) such that there is only one selection per row

	1-10 days	11-20 days	21-30 days	30 or more days	Never
Spring					
Summer					
Fall					
Winter					

4. Which areas of White Clay Creek State Park do you use (select all that apply)?
   - The Carpenter Recreation Area (main entrance off of 896/New London Rd.)
   - The Southern end of the Park where N. College Ave becomes Creek Road
   - The Judge Morris Estate Area (off Polly Drummond Hill Rd.)
   - The Nine Foot Road/Niven Area
   - The Possum Hill Area (near where Smith Mill Rd. intersects with Paper Mill Rd./72)
   - The Chambers Rock and Park Office areas (near were Chambers Rock Road and Thompson Station Road intersect)
   - The Nature Center Area
   - Don't know
   - Other _____

5. What area of White Clay Creek State Park do you use the most?
   - The Carpenter Recreation Area (main entrance off of 896/New London Rd.)
   - The Southern end of the Park where N. College Ave becomes Creek Road
   - The Judge Morris Estate Area (off Polly Drummond Hill Rd.)
   - The Nine Foot Road/Niven Area
   - The Possum Hill Area (near where Smith Mill Rd. intersects with Paper Mill Rd./72)
   - The Chambers Rock and Park Office areas (near were Chambers Rock Road and Thompson Station Road intersect)
   - The Nature Center Area
   - Don't know
   - Other _____

6. What do you enjoy the most about White Clay Creek State Park?

7. If you feel strongly that something *should* change in White Clay Creek State Park, what would it be? (limit to 50 words)

8. If you feel strongly that something *should not* change in White Clay Creek State Park, what would it be? (limit to 50 words)

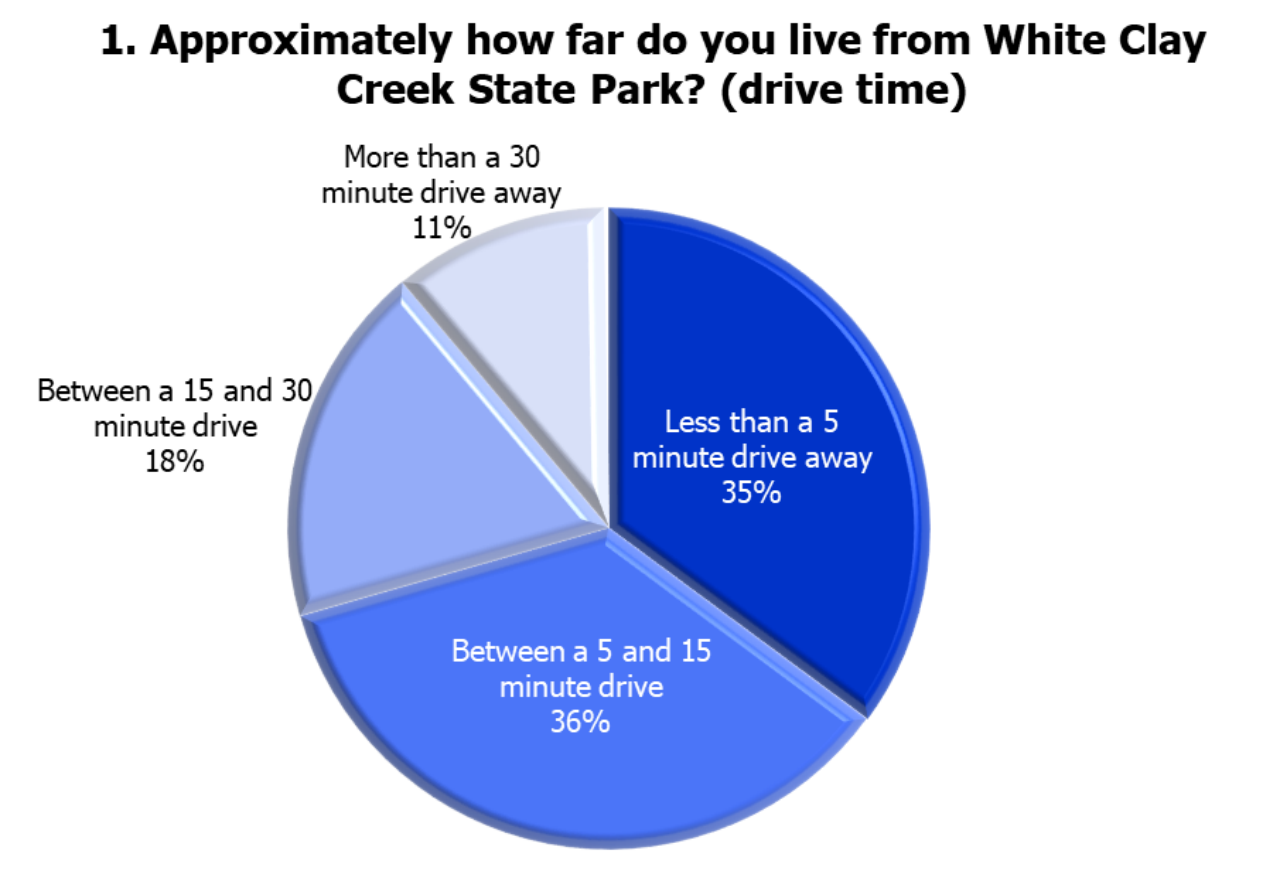
9. What is the zip code of where you currently reside?

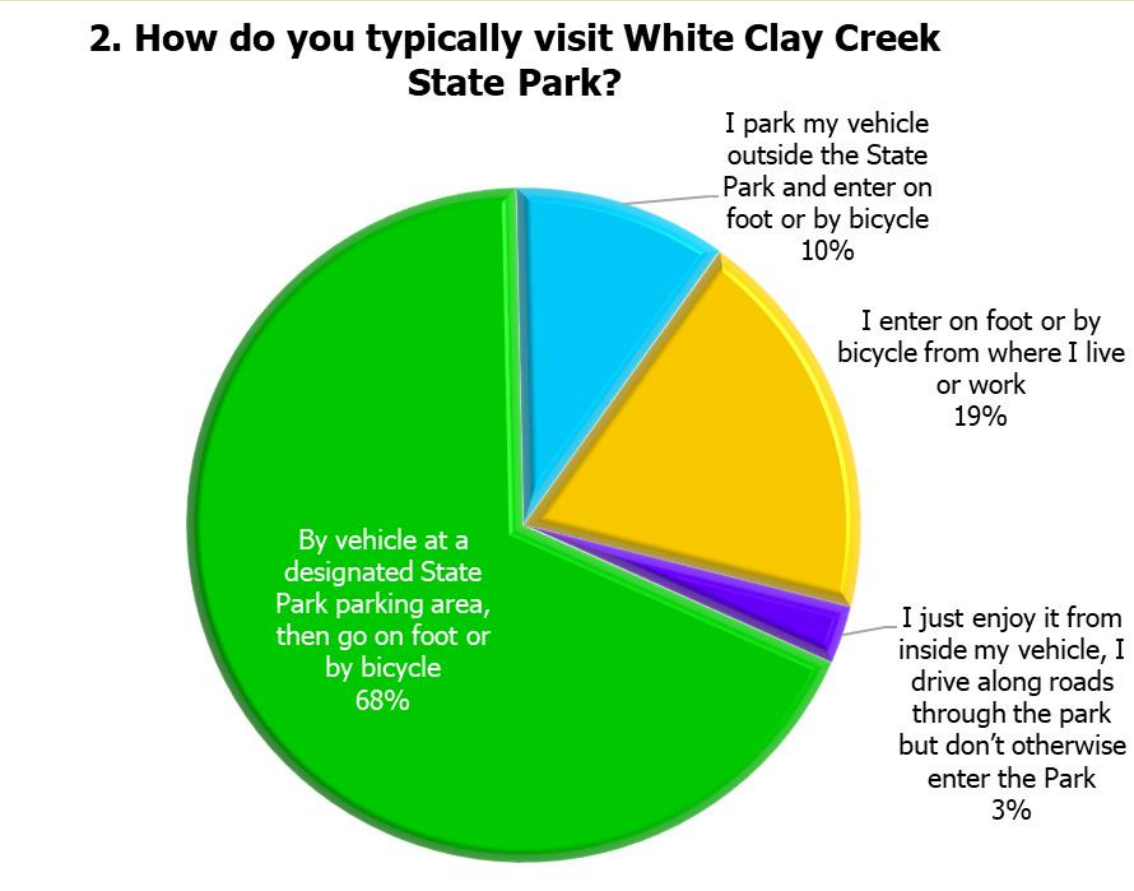
10. Do you have any other comments?

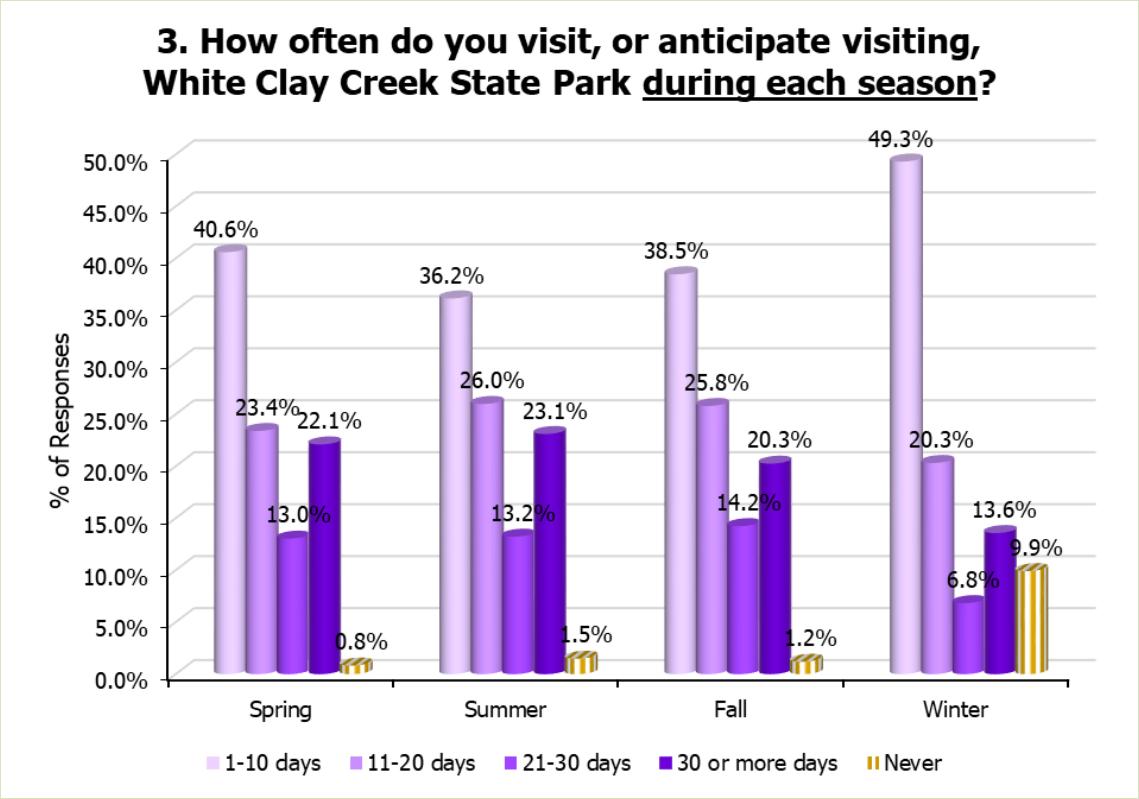
Results from the Online Survey

May-September 2018
1,096 Completed Surveys

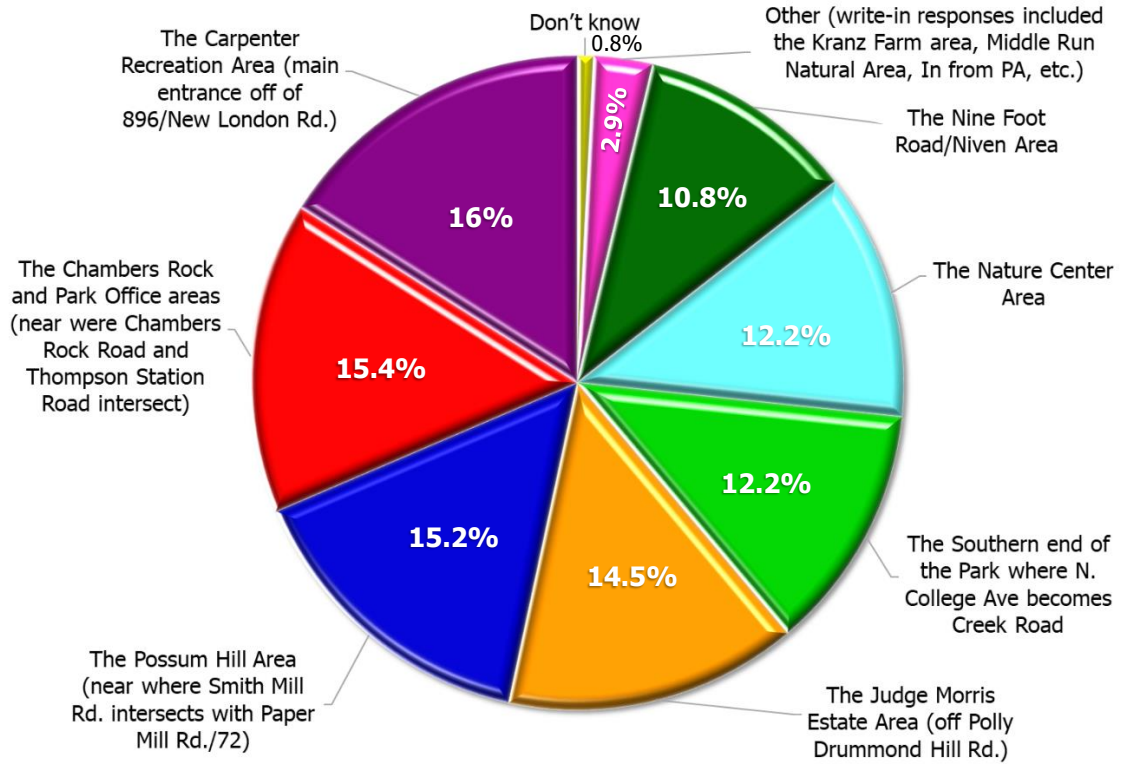
This document presents data that has been compiled and generalized or categorized to protect the confidentiality and anonymity of respondents. Individual responses are intentionally not presented.



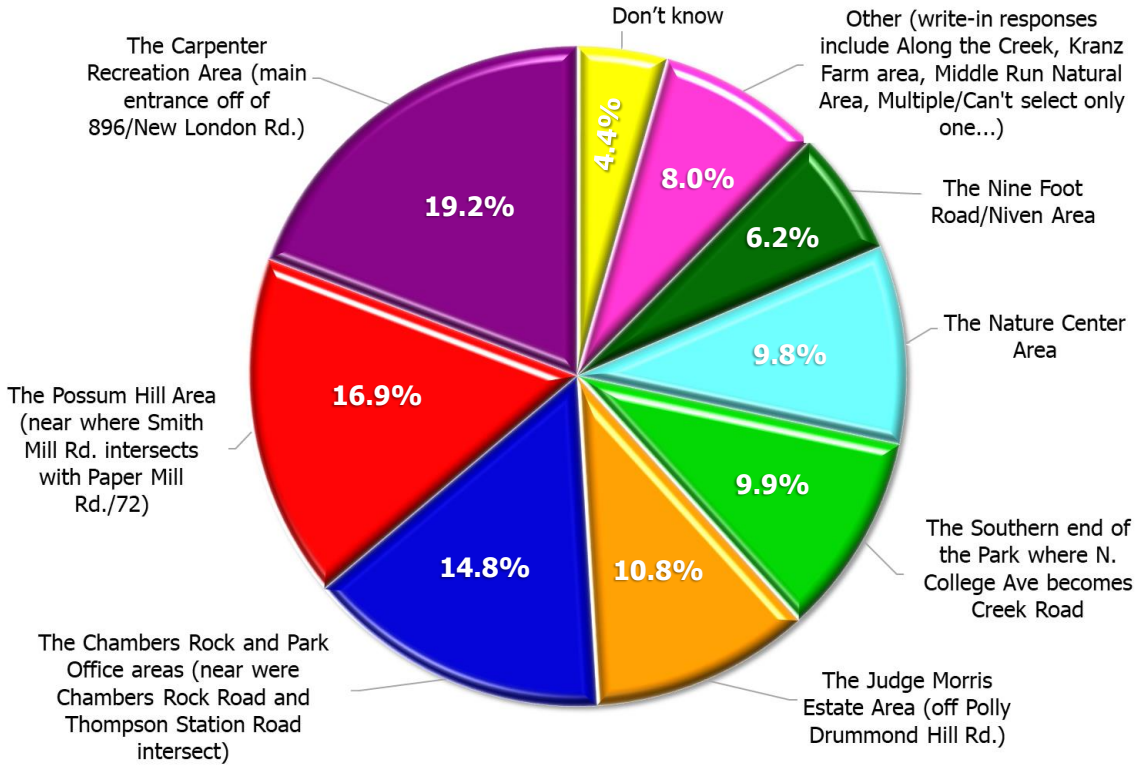

2. How do you typically visit White Clay Creek State Park?
I park my vehicle outside the State Park and enter on foot or by bicycle 10%
I enter on foot or by bicycle from where I live or work 19%
I just enjoy it from inside my vehicle, I drive along roads through the park but don't otherwise enter the Park 3%
By vehicle at a designated State Park parking area, then go on foot or by bicycle 68%

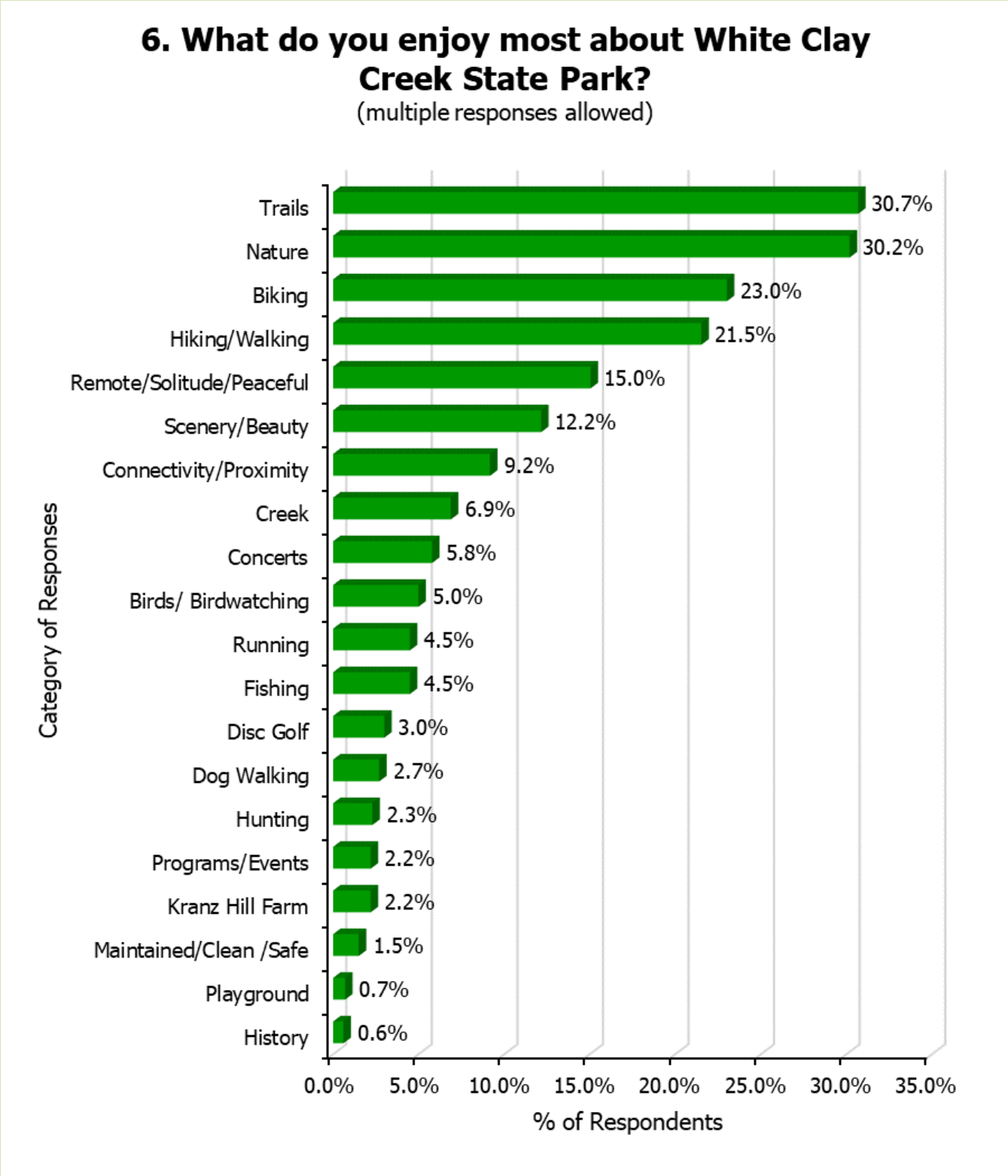

3. How often do you visit, or anticipate visiting, White Clay Creek State Park during each season?
% of Responses
50.0%
45.0%
40.0%
35.0%
30.0%
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
40.6%
23.4%
13.0%
22.1%
0.8%
36.2%
26.0%
13.2%
23.1%
1.5%
38.5%
25.8%
14.2%
20.3%
1.2%
49.3%
20.3%
6.8%
13.6%
9.9%
Spring
Summer
Fall
Winter
1-10 days
11-20 days
21-30 days
30 or more days
Never

4. Which areas of White Clay Creek State Park do you use?
Select all that apply.
(% of Responses)



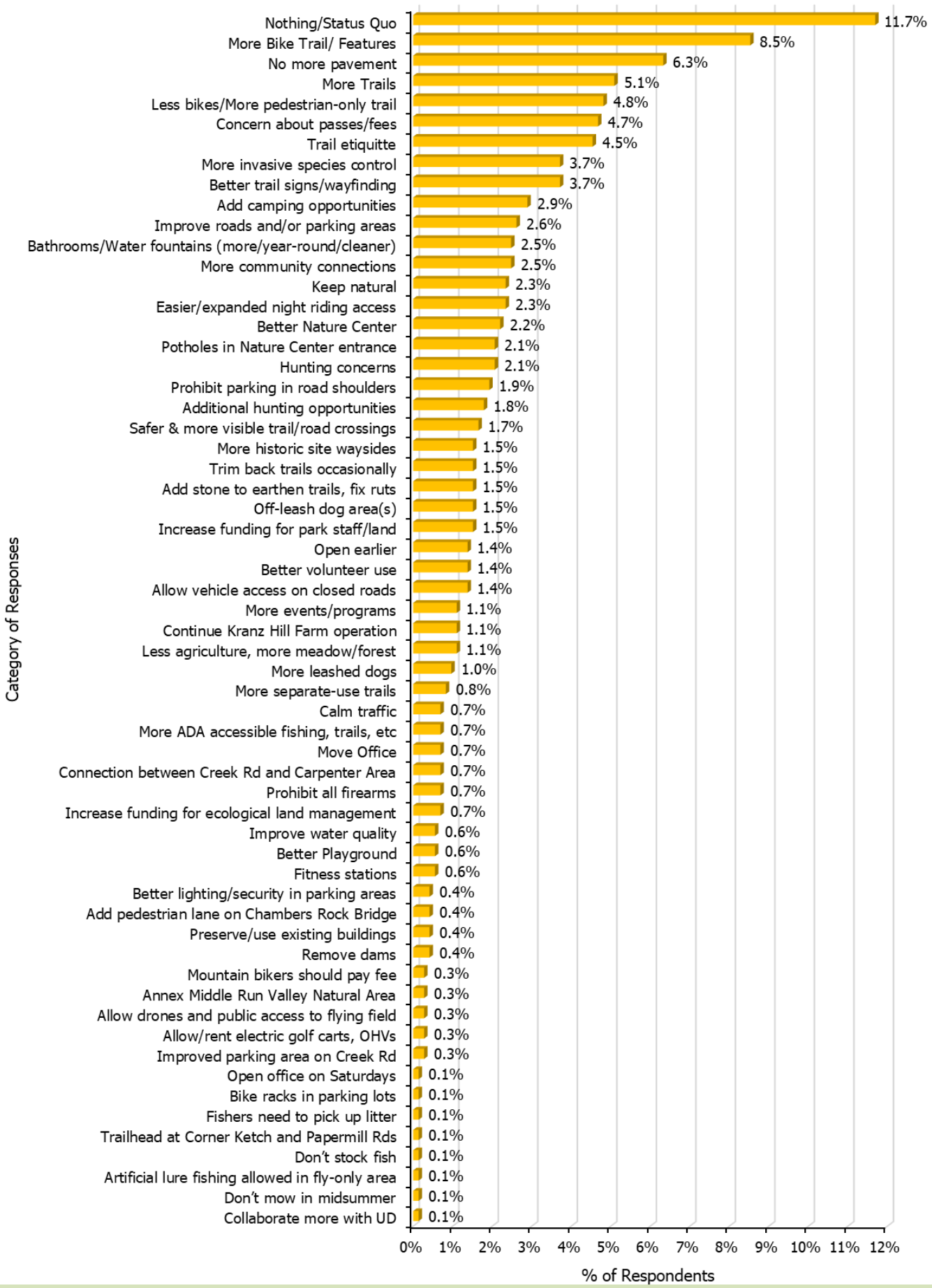
5. Which area of White Clay Creek State Park do you use <u>the most</u>?
Select only one.
(% of Responses)




6. What do you enjoy most about White Clay Creek State Park?
(multiple responses allowed)
Category of Responses
Trails 30.7%
Nature 30.2%
Biking 23.0%
Hiking/Walking 21.5%
Remote/Solitude/Peaceful 15.0%
Scenery/Beauty 12.2%
Connectivity/Proximity 9.2%
Creek 6.9%
Concerts 5.8%
Birds/ Birdwatching 5.0%
Running 4.5%
Fishing 4.5%
Disc Golf 3.0%
Dog Walking 2.7%
Hunting 2.3%
Programs/Events 2.2%
Kranz Hill Farm 2.2%
Maintained/Clean /Safe 1.5%
Playground 0.7%
History 0.6%
0.0% 5.0% 10.0% 15.0% 20.0% 25.0% 30.0% 35.0%
% of Respondents

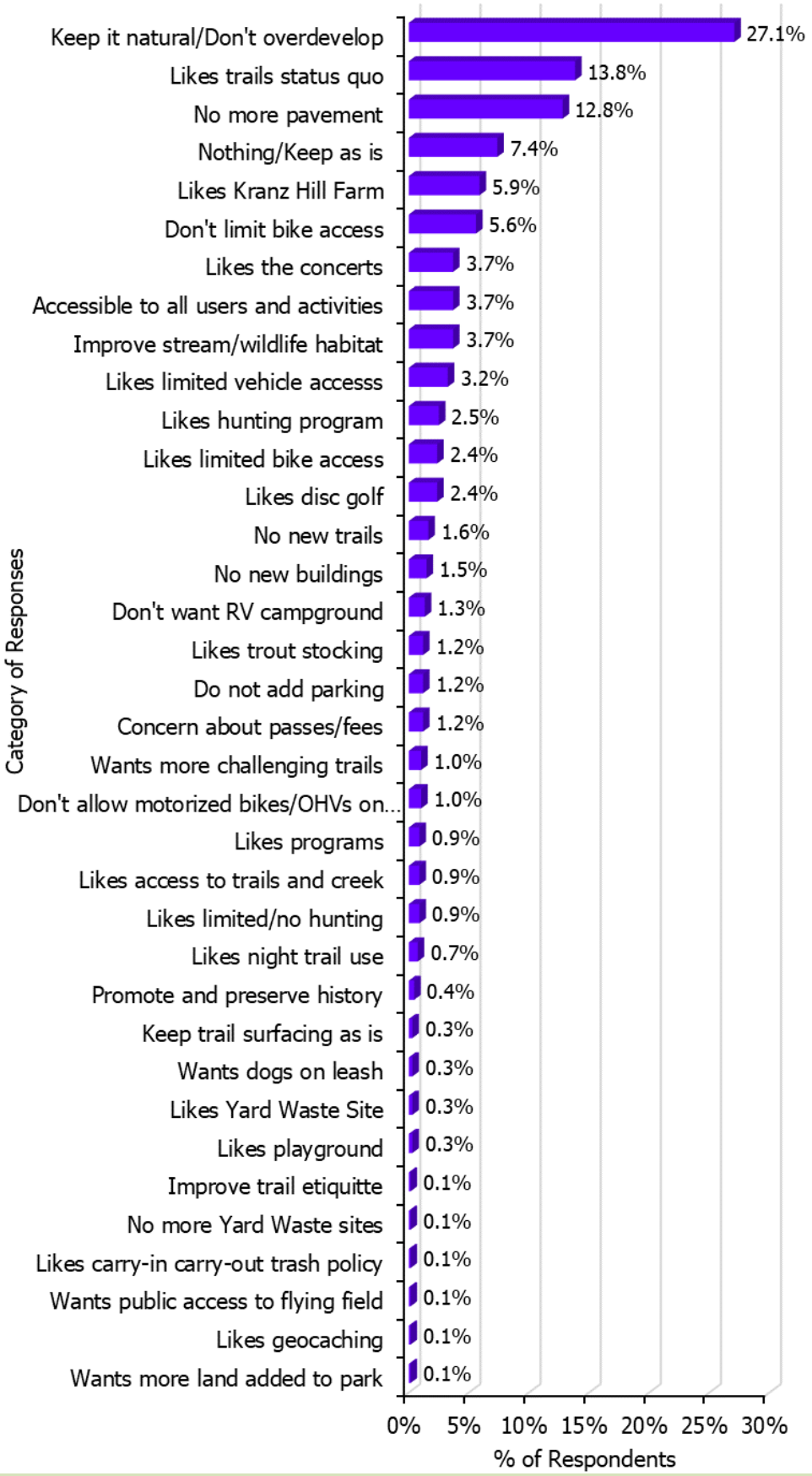
7. If you feel strongly that something *should* change in White Clay Creek State Park, what would it be?

(multiple responses allowed)

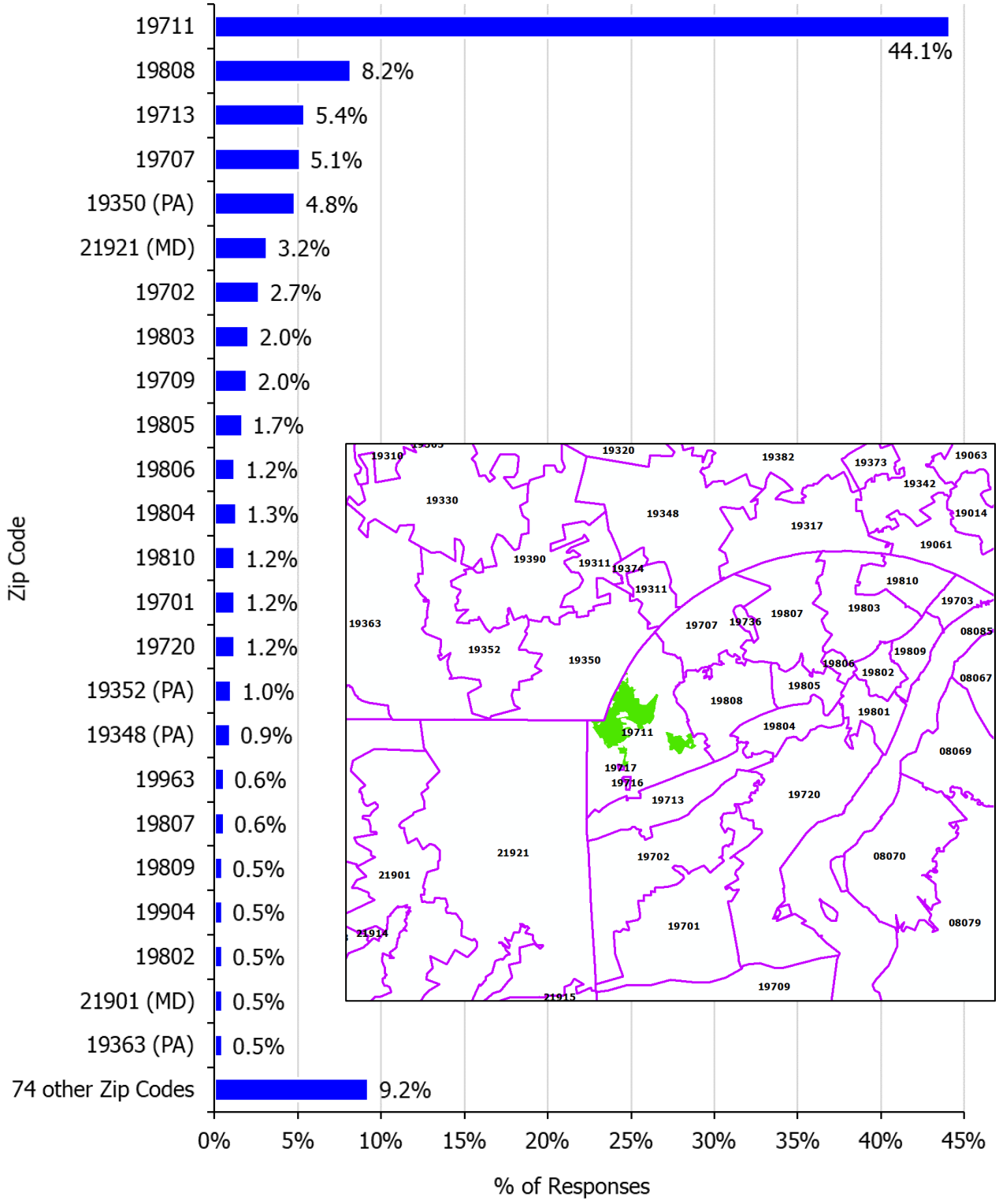


8. If you feel strongly that something *should not* change in White Clay Creek State Park, what would it be?

(multiple responses allowed)



9. What is the zip code of where you currently reside?



Appendix H: Accomplishments

Following the official release of the 2011 White Clay Creek State Park Trail Plan there has been some accomplishments.

Completed projects since 2011

- Tri-Valley Trail phase 1
- Charles Bailey Trail reconstruction
- Bridge 44 and reroute connections in Carpenter
- Marker post system updated
- 15 bridges built
- Possum Hill accessible all-weather trails built
- Accessible trail and fishing at Possum Hill
- Tri-State Marker Trail
- Hopkins Road trail crossing installed
- PennDel Trail improvements north of nature center
- Skills Trail – select features updates and replacements
- Yard Waste area trail reroute
- Polly Drummond Hill Road trail crossing installed
- Tri-Valley Trail phase 2
- Whitely Farms Trail addition and reroute

New Bridge on the Charles Bailey Trail

Appendix I: Glossary of Terms

Accessible Trail – A trail that complies with the Americans with Disabilities Act (ADA) and follows federal accessibility guidelines.
Bridge – Structures used to transport trail users over obstacles like ravines, bogs, creeks, or rivers.
Contour Trail – A trail constructed such that it follows a contour or a constant elevation.
Double-Track Trail – A trail wide enough to easily allow passing or allow trail users to recreate side by side: 41" and wider.
Drainage – Methods of getting water off the trail.
Economic Sustainability – Any trail alignment that supports current and future use as it relates to the cost/benefit of that trail to the public.
Ecoregion_ – A major ecosystem defined by distinctive geography and receiving uniform solar radiation and moisture
Erosion – The natural process of wearing down and removing rock and soil by wind and water. One of the main processes that impact level of trail sustainability.
Essential Experience – A theme that is critical to the park's story and shares the natural and cultural importance that makes each park special for visitors. The essential experiences are the landscapes, structures (natural and historic), resources, and interactions within the park that connects with the visitor to evoke passion, care, commitment, and investment to the greater good of the park as a whole, the life of the individual, and future generations to come.
Fall line – Direction water flows downhill (path of least resistance). A trail that runs on the fall line will channel water down the trail.
Geographic Information System – Software system used to display data allowing for the visualization and analyzation of that data.
Geomorphology – The study of the physical features of the surface of the earth and their relation to its geological structures
Global Positioning System (GPS) – a system used to map trails and other infrastructure locations using satellites and portable receivers.
Habitat Fragmentation – The emergence of discontinuities (fragmentation) in a plant or animal's preferred environment.
Hardening – The manual, mechanical, or chemical action that results in a harder less erosive trail surface
Hydric Soil – Soil that forms under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part
Percent of Grade – The method of measuring how steep a trail or slope is. (10 percent = a rise or fall of 10 feet per 100 linear feet of trail.)
Reroute – new section of trail that replaces and existing section.
Shared Use Trail – Trails that are designed and built for more than one possible user. For example: hikers, bikers and equestrians using one trail.
Single-Track Trail – Trails only wide enough for travel in single file: Usually 12-36" wide.
Single Use Trails – Trails that are designed and built for only one intended user.
Slope – The natural (or created) shape of the land. Change of elevation shown on contour maps. The term is generally used to refer to the hill, not the trail.
Social trails – Unplanned/unauthorized trails developed informally from users and are not recognized or maintained by managing agency.
Social Sustainability – Any trail alignment that supports current and future use as it pertains to the public's acceptance and use of that trail
Sustainable Trail – Any trail alignment that supports current and future use with minimal impact to the natural resources; does not adversely affect the plant and animal life; recognizes that pruning or removal of certain plant species may be necessary for proper maintenance; produces negligible soil loss or movement; requires little or no rerouting or minimal long-term maintenance.

Tight and Technical – A type of trail design that allows for tight turns, slow speeds, and can take fuller advantage of natural features.
Trail Corridor – Area including the tread and trim zone on either side of the tread.
Trail Construction – Any new trail or trail segment that is not a replacement or a reroute for an existing trail.
Trail Maintenance – Any routine trail work within an existing trail corridor including, but not limited to, filling ruts, holes, and low spots, deberming, nicking, vegetative management, obstacle removal. Also included are more advanced maintenance needs such as trail structure repair or replacement, resurfacing, and repairing any trail section that has been damaged by uprooted trees, erosion, or wet conditions. It also includes reroutes 50' or less that are needed to mitigate any unsustainable or climate related condition such as erosion, wet areas, steep grades, uprooted trees, etc.
Trail Network – A grouping of trail systems on a regional, state, national, or global scale
Trail Reconstruction – Any trail work within an existing trail corridor including, but not limited to, significant rebuilding, enhancing, or modifying unsustainable, failing, severely damaged, or unsafe trail segments. Also included are reroutes exceeding 50' in length needed to mitigate any unsustainable trail condition such as erosion, wet areas, steep grades, etc.
Trail Surface – surface of any give trail. Examples include sand, grass, dirt, stone, asphalt, and concrete.
Trail System – A set of connected Trails
Trail Use – type of recreation use designed or managed for any given trail (such as hiking, biking, equestrian, motorized, etc.).
Trail Width – width of a trail. Designed width often based on location, terrain constraints, and type or volume of use of a trail.

End of Trail