

Legend

- Community
- Lock & Dam
- ⬮ Raccoon Ck Watershed
- ▭ County

Terrain

- High : 1565 ft (477m)
- Low : 623 ft (190m)

Roads

- Interstate
- State Route
- US Route

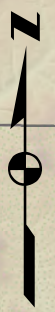
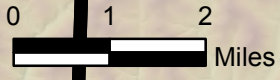
Municipality

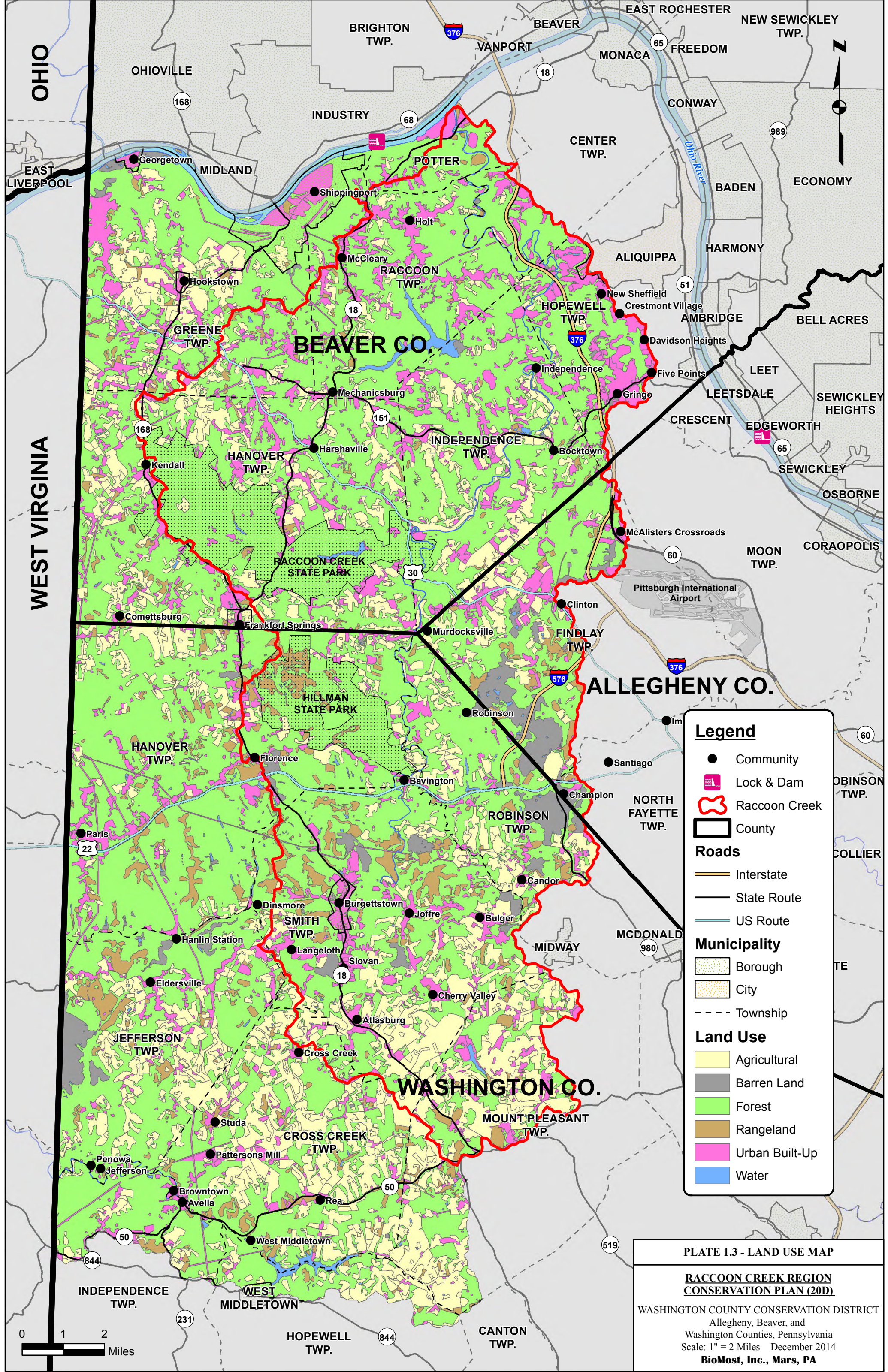
- ▨ Borough
- ▨ City
- - - Township

PLATE 1.2 - TERRAIN MAP

RACCOON CREEK REGION CONSERVATION PLAN (20D)

WASHINGTON COUNTY CONSERVATION DISTRICT
 Allegheny, Beaver, and Washington Counties, Pennsylvania
 Scale: 1" = 2 Miles December 2014
BioMost, Inc., Mars, PA





Legend

- Community
- Lock & Dam
- ⬭ Raccoon Creek
- ▭ County

Roads

- Interstate
- State Route
- US Route

Municipality

- ▨ Borough
- ▨ City
- - - Township

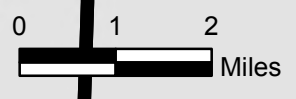
Land Use

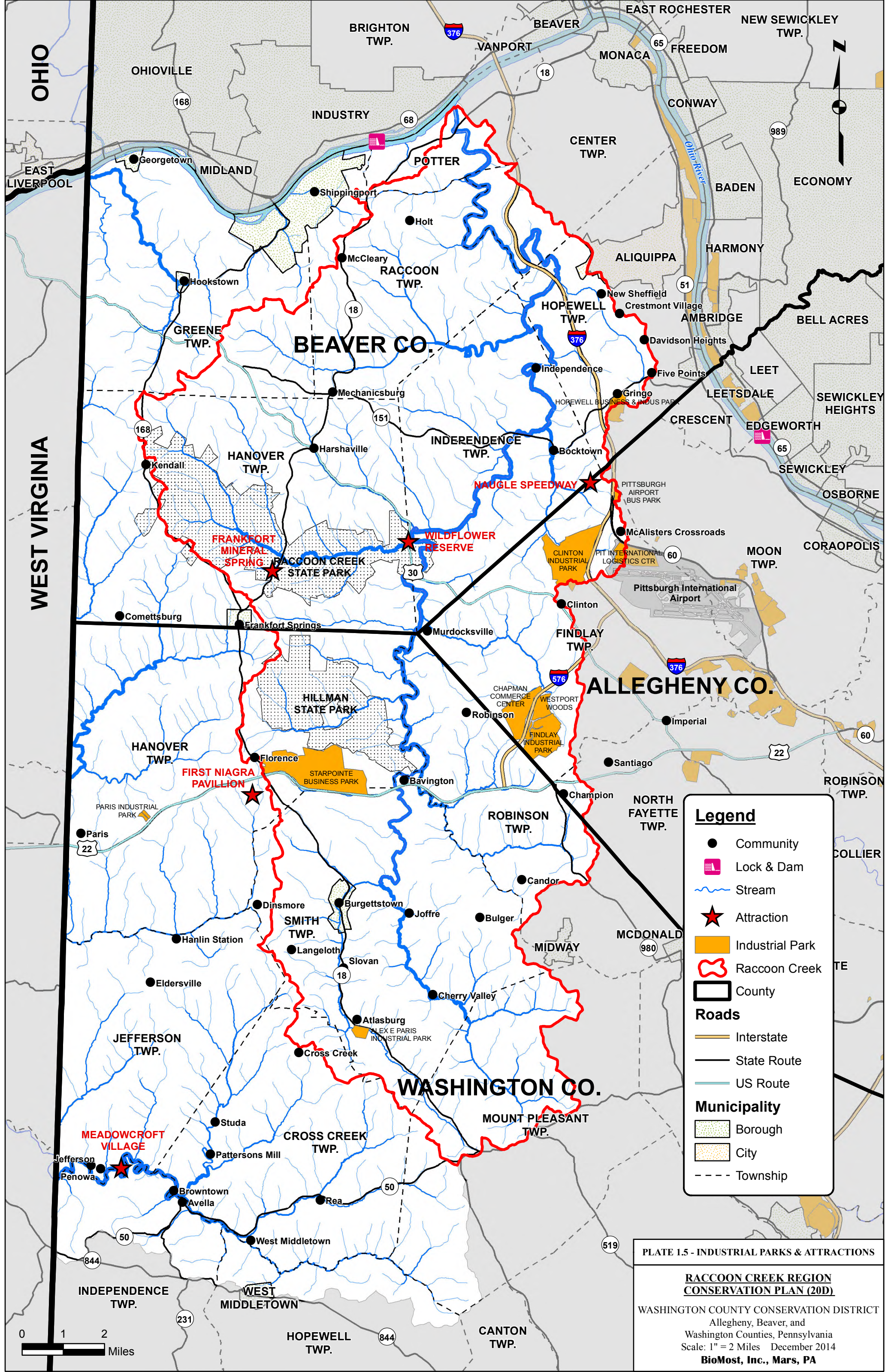
- Agricultural
- Barren Land
- Forest
- Rangeland
- Urban Built-Up
- Water

PLATE 1.3 - LAND USE MAP

RACCOON CREEK REGION
CONSERVATION PLAN (20D)

WASHINGTON COUNTY CONSERVATION DISTRICT
 Allegheny, Beaver, and
 Washington Counties, Pennsylvania
 Scale: 1" = 2 Miles December 2014
BioMost, Inc., Mars, PA





Legend

- Community
- Lock & Dam
- ~ Stream
- ★ Attraction
- Industrial Park
- ⬮ Raccoon Creek
- ▭ County

Roads

- Interstate
- State Route
- US Route

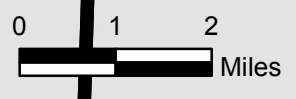
Municipality

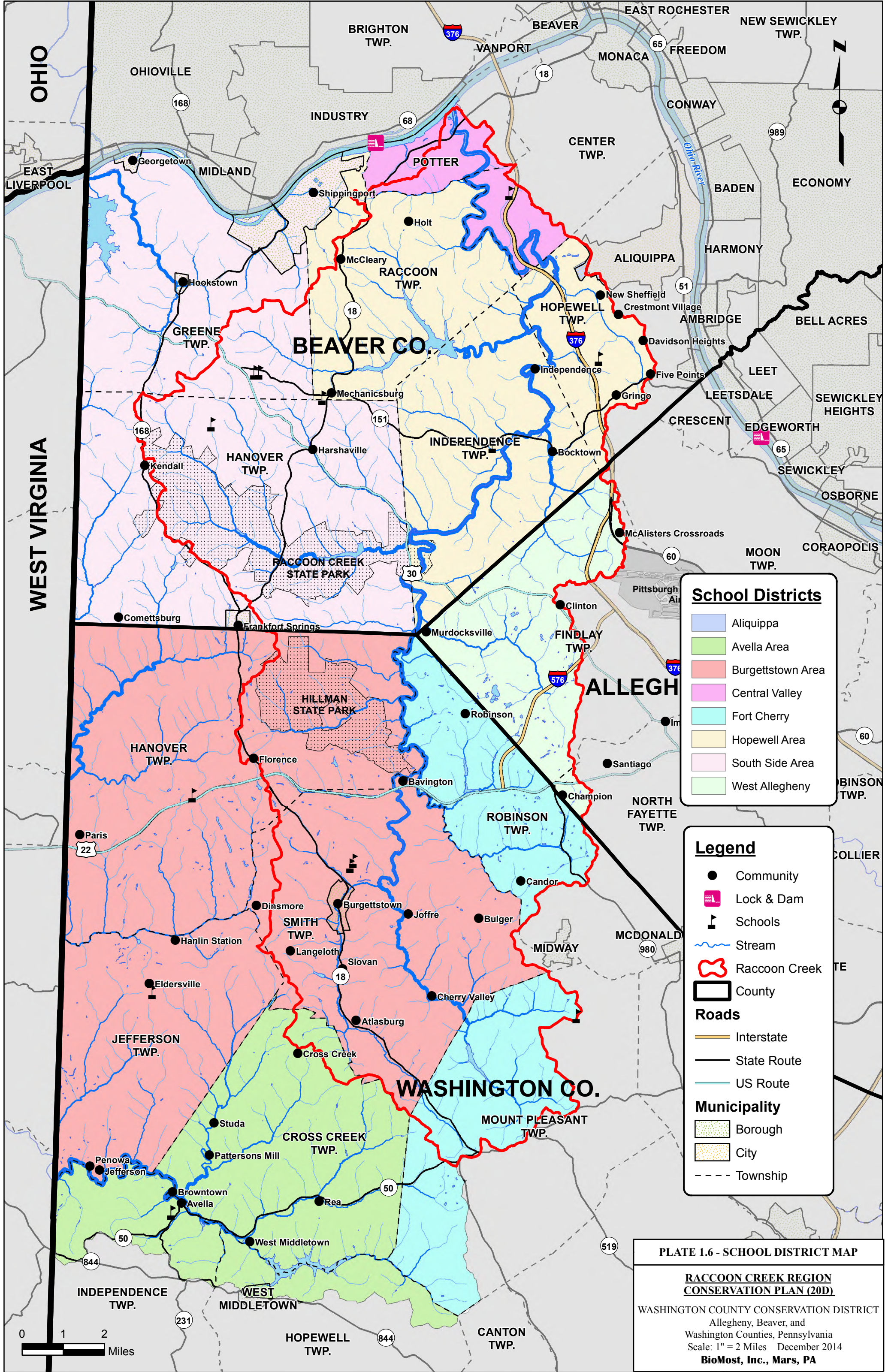
- ▨ Borough
- ▨ City
- - - Township

PLATE 1.5 - INDUSTRIAL PARKS & ATTRACTIONS

RACCOON CREEK REGION CONSERVATION PLAN (20D)

WASHINGTON COUNTY CONSERVATION DISTRICT
 Allegheny, Beaver, and Washington Counties, Pennsylvania
 Scale: 1" = 2 Miles December 2014
BioMost, Inc., Mars, PA





School Districts

- Aliquippa
- Avella Area
- Burgettstown Area
- Central Valley
- Fort Cherry
- Hopewell Area
- South Side Area
- West Allegheny

Legend

- Community
- Lock & Dam
- Schools
- Stream
- Raccoon Creek
- County

Roads

- Interstate
- State Route
- US Route

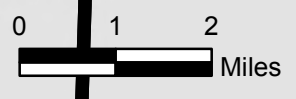
Municipality

- Borough
- City
- Township

PLATE 1.6 - SCHOOL DISTRICT MAP

RACCOON CREEK REGION
CONSERVATION PLAN (20D)

WASHINGTON COUNTY CONSERVATION DISTRICT
Allegheny, Beaver, and
Washington Counties, Pennsylvania
Scale: 1" = 2 Miles December 2014
BioMost, Inc., Mars, PA



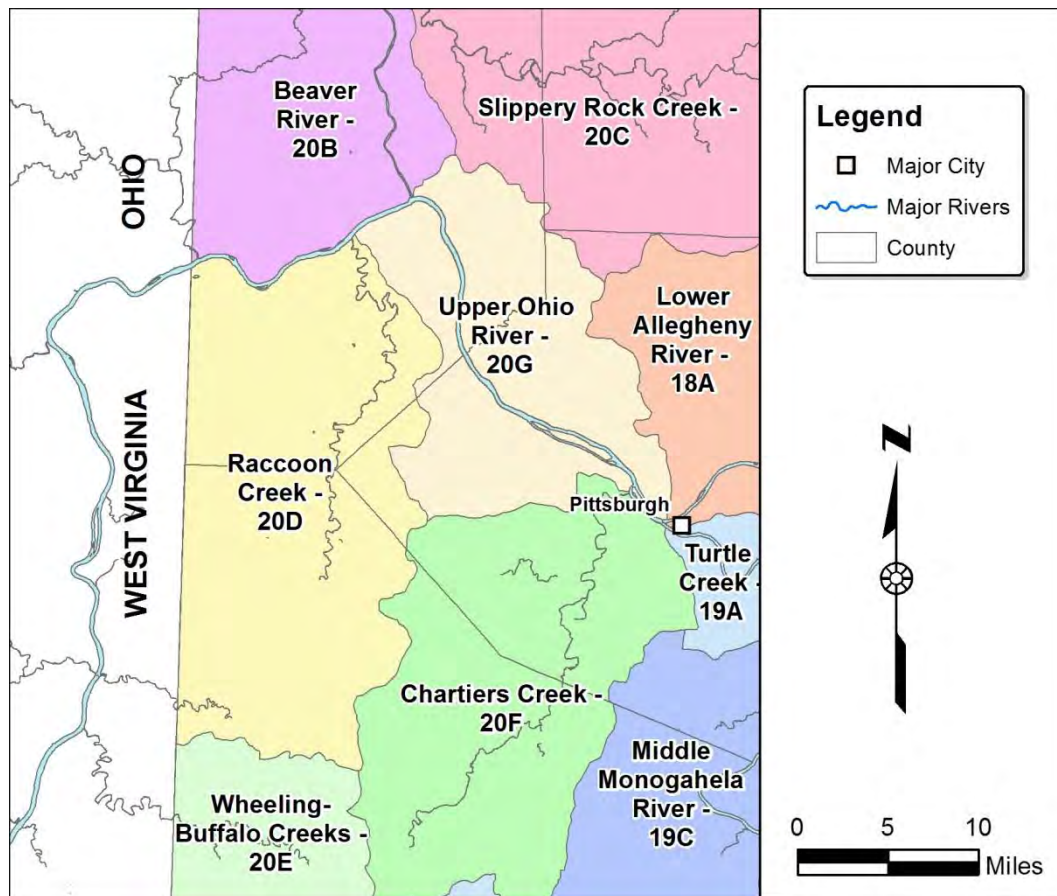
Section 2: Issues, Concerns, Constraints

Introduction

Stakeholder input was vital to developing the 20D Raccoon Creek Region Conservation Plan. A stakeholder is someone who is involved in or affected by a course of action. The Issues, Concerns and Constraints Section of this Plan consists of input from those who live, work or play in the Raccoon Creek Region and therefore have a vested interest in its future.

The Raccoon Creek Region is defined in this Plan as the entire 20D Sub-basin of the Pennsylvania State Water Plan (see Figure 2.1 and Plate 4.1). This 330.5 square mile region includes not only the Raccoon Creek Watershed itself, but also the part of Pennsylvania drained by smaller tributaries of the Ohio River that lie between the West Virginia state line and the Raccoon Creek Watershed. The 20D Region covers southern Beaver County, northern Washington County, and a small part of northwestern Allegheny County. It includes seventeen townships, six boroughs and a small section of one city. Over 64,000 people live in the 20D Sub-basin. In Figure 2.1 below, the Raccoon Creek Region is depicted in pale yellow.

Figure 2.1: Pennsylvania's State Water Plan Sub-Basins



The following methods were used to identify issues of concern to stakeholders in the Raccoon Creek Region:

- Research conducted by the 20D Raccoon Creek Region Conservation Plan Steering Committee, Independence Conservancy, Raccoon Creek and Cross Creek Watershed Associations and Stream Restoration Inc. (a 501c3 non-profit organization).
- Distribution of surveys at community events.
- Meetings with organizations and individuals.
- Coordination and meetings with municipalities.
- Coordination with regulatory agencies.
- Email communications to local groups, notices in local newspapers and the Independence Conservancy website.
- Online survey offered on Survey Monkey.

In addition, an extensive effort to seek public input for plan preparation was made by the 20D Raccoon Creek Region Conservation Plan Project Facilitator, including:

- Coordinating Steering Committee meetings.
- Coordination and meetings with municipalities.
- Conducting personal interviews.
- Coordination and meetings with local organizations.
- Exhibiting informational displays at community and regional events.
- Media coordination.
- Publishing information in newsletters of local organizations and partner groups.
- Placing information and updates on the Independence Conservancy website and e-newsletter.

Thank you to the local residents, elected officials, agency representatives and community leaders who took time to complete Raccoon Creek Watershed surveys!

Public Outreach

Initial Meetings with Municipalities

The Pennsylvania Department of Conservation and Natural Resources (DNCR) application for the Watershed Conservation Plan required that each county and municipality in the 20D Raccoon Creek Watershed Region be notified about the Plan in writing by the Project Facilitator. Table 2.1 lists the municipalities and planning commissions in the 20D Region that provided letters of support for the development of the 20D Raccoon Creek Region Conservation Plan.

Table 2.1: Municipal Support for the 20D Raccoon Creek Region Conservation Plan

County	Municipality	Address	Phone	Letter Dated
Allegheny	Allegheny County Economic Development, Planning Division	425 Sixth Ave., Suite 800 Pittsburgh, PA 15219	412-350-1000	4/18/2011
	Township of Findlay	PO Box W Clinton, PA 15026	724-695-0500	1/27/2011
Beaver	Beaver County Planning Commission	810 Third Street Beaver, PA 15009	724-728-5700	2/15/2011
	City of Aliquippa	581 Franklin Ave. Aliquippa, PA 15001	724-375-5188	1/19/2011
	Township of Center	224 Center Grange Rd. Aliquippa, PA 15001	724-774-0271	1/19/2011
	Township of Greene	PO Box 181 Hookstown, PA 15050	724-573-1111	2/8/2011
	Township of Hopewell	1700 Clark Blvd. Aliquippa, PA 15001	724-378-1460	3/10/2011
	Township of Potter	206 Mowry Rd. Monaca, PA 15061	724-495-6220	4/13/2011
	Borough of Shippingport	PO Box 76 Shippingport, PA 15077	724-643-4333	4/6/2011
Washington	Washington County Planning Commission	100 W. Beau St., Suite 701 Washington, PA 15301	724-228-6811	1/19/2011
	Township of Cross Creek	28 Clark Ave. Avella, PA 15312	724-587-3442	3/15/2011
	Township of Hanover	11 Municipal Dr. Burgettstown, PA 15021	724-947-9109	3/21/2011
	Township of Mount Pleasant	31 McCarrell Rd. Hickory, PA 15340	724-356-7974	No Date
	Township of North Fayette	400 North Branch Rd. Oakdale, PA 15071	724-788-4888	4/5/2011
	Township of Smith	PO Box 94 Slovan, PA 15078	724-947-9456	3/14/2011

Public Meetings and Focus Areas

Stakeholders were given the opportunity to make their voices heard at three sets of public meetings conducted during the development of the 20D Raccoon Creek Region Conservation Plan. Extensively advertised public meetings were held at the project’s kick-off, after completion of the draft Plan and upon completion of the final Plan.

The sheer size and diversity of the 20D Region – about 24 miles north to south and 12 miles east to west – necessitated dividing the area into four Focus Areas based on predominant historic and current land use (see “Plate 2.1 Focus Area Map”).

Focus Area #1 is the southernmost part of the 20D Region. It is defined by the Cross Creek Watershed and lies mostly in Jefferson, Cross Creek and Mount Pleasant Townships. Along the main stem of Cross Creek are many small “coal patch” towns, each with its eroding coal waste piles and abandoned mine drainage seeps. Despite these legacy effects on the main stem, water quality is very good in the headwaters of Cross Creek. Focus Area #1 contains the greatest concentration of shale gas wells in the 20D Region and many productive farms.

Focus Area #2 lies to the north and east of Focus Area #1. It consists of the headwaters of the main stem of Raccoon Creek flowing north, as well as Harmon Creek flowing to the west. It lies within Mount Pleasant, Smith, Hanover, Robinson and Findlay Townships. From the late 19th to mid-20th century, this northern-most extent of the Pittsburgh Coal Seam was largely depopulated, heavily deep mined and strip mined. In many places, streams run orange and are devoid of aquatic life. More populated parts of Focus Area #2 are its coal patch towns and villages, located along Raccoon Creek and near the entrances of the early 20th-century drift mines.

Focus Area #3 lies to the north of Focus Area #2. It comprises most of southern Beaver County, bounded on the north by the Ohio River, and to the east, bounded roughly by I-376. This area is predominantly rural residential, woodland and farmland. It is also home to Raccoon Creek State Park and Wildflower Reserve. Overall water quality is much better than that of Focus Area #2. Many productive farms are found in the northwest of Focus Area #3.

Focus Area #4 consists of three small, lightly populated but heavily industrialized sites along the southern bank of the Ohio River in Potter and Greene Townships. These former farmlands were transformed into petrochemical factories critical to national defense during World War II, and into power generating facilities vital to post-war development. Part of Focus Area #4 is being considered for a new, multi-billion-dollar plant that will refine ethane from locally produced shale gas.

In July of 2013, the first of three sets of stakeholder meetings was held in Focus Areas #1, #2 and #3 (see Table 2.2). The purpose of these meetings was to introduce the 20D Raccoon Creek Region Conservation Planning process to interested residents of the Region and seek their opinions about how they perceive and value various aspects of their watershed. Promotional literature invited people to share their vision for the future of the Raccoon Creek Region.



Figure 2.3: Stakeholder meeting for Focus Area #3, Raccoon Township Municipal Building, 7/25/13. Photo by Michael Harcher.

Several members of the 20D Plan Steering Committee were on hand to lead discussion, answer questions about mapping displayed around the room, and provide Citizen Surveys for attendees to complete. Turn-out was light at all three meetings, despite substantial efforts at advertising. The first meeting of the first round was no doubt hampered by a severe thunderstorm. The second and third meetings, however, were held on beautiful summer evenings, which may have been a distraction in itself.

The second set of advertised meetings was held in June of 2014 to present a draft version of the 20D Plan to stakeholders for discussion and comment. Based on low turn-out at the first round of public meetings, draft plan presentations were held in Focus Areas #1 and #3 only, i.e., the southern and northern areas of 20D where participants had been more numerous.

Seven people attended the June 11, 2014 public meeting at Cross Creek Township Municipal Building in Focus Area #1. Highlights of the Draft Plan were presented, as well as dozens of maps and figures illustrating various features of the Region. Discussion centered mainly on thoughtful concern for the long-term, unforeseen impacts of the shale gas industry on the environment and quality of life for residents. Each attendee was given a copy of the draft plan and asked to return an enclosed comment form.

On June 16, 2014, eighteen people attended the public meeting at the Raccoon Township Municipal Building in Focus Area #3. Group discussion touched on these topics, among others:

- The need for bicycle trails in our greenways, especially along Raccoon Creek Road – so few bicycle routes exist in Beaver County.
- The idea of connecting Beaver County's Raccoon Creek green corridor with green corridors in Washington County, connecting Raccoon and Hillman State Parks, perhaps connecting with Tomlinson Run State Park in West Virginia and over to the Ohio River.
- How to approach landowners about conservation easements to establish greenways.
- The long-term fate of Horsehead's flyash landfill on Raccoon Creek in Potter Township.
- Successes and failures of various land preservation efforts in the past.
- Protecting water quality in the Ohio River.

Again, each attendee was given a copy of the draft plan and asked to return an enclosed comment form in a timely fashion. No written comments were received in response to the material presented at the June 11 or June 16, 2014 public meetings.

"Appendix 2.1: Public Comments" lists stakeholder comments about the draft 20D Raccoon Creek Region Conservation Plan as received verbally, via email, or in print.

Table 2.2: 20D Raccoon Creek Region Public Meeting Locations and Dates

Location	Project Kick-off	Draft Plan Completion	Final Plan Presentation
Cross Creek Township Municipal Building	7/23/2013	6/11/2014	-----
Raccoon Township Municipal Building	7/25/2013	6/16/2014	-----
Pepsi Cola Road House Smith Township	7/30/2013	-----	-----
Recreation Hall Raccoon Creek State Park	-----	-----	

Dot Exercises

Because turn-out at public meetings was poor and the number of completed Citizen and Municipal Surveys was low, the Project Facilitator conducted five “dot exercises” at public events to offer a quick, easy way for people to share their perceptions of the Raccoon Creek Watershed Region.

The Project Facilitator set up two printed charts, one asking the question, “**How important to you are the following things in the Raccoon Creek Watershed?**” The other chart’s question read, “**What water quality issues concern you the most in the Raccoon Creek Watershed?**” These questions were taken directly from the Citizen Survey. Every participant was given two self-stick dots with which to vote for ideas listed on the charts.

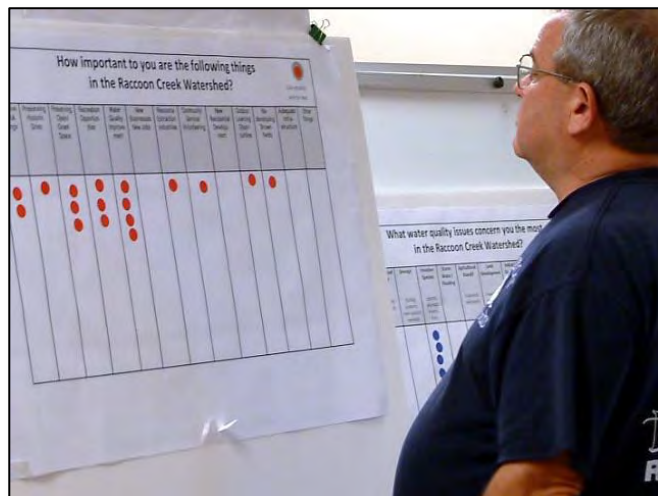


Figure 2.4: A resident works on the “dot exercises” at the Focus Area #3 meeting, 7/25/13.

Due to space limitations of the display area on the Ohio River Watershed

Celebration Cruise, only the chart dealing with overall aspects of the region was set out for casting votes. The following figures, 2.5 and 2.6, summarize the results of the dot exercises at all five venues.

General trends appeared through the series of dot exercises. These are the highlights:

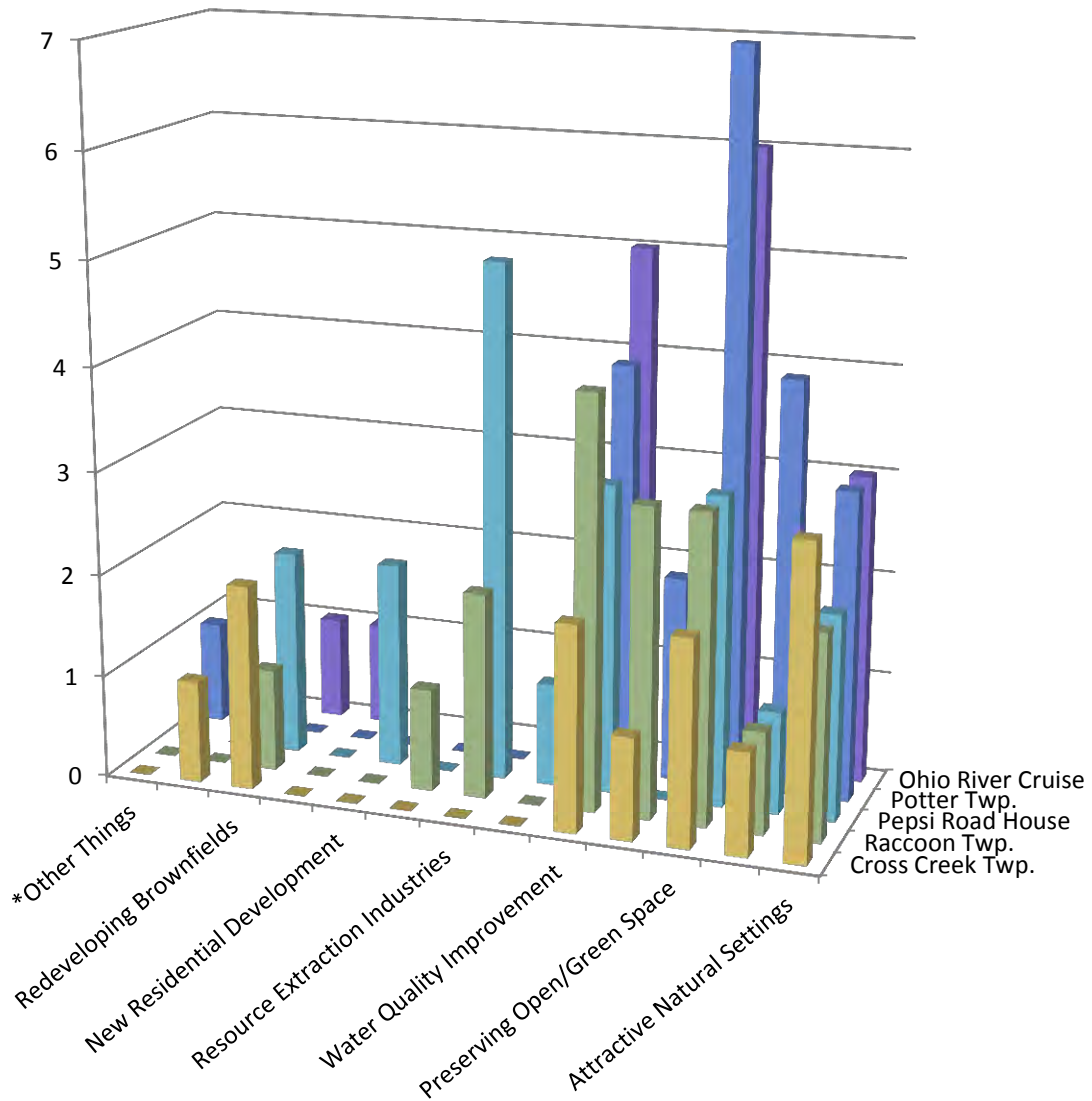
- People indicated that they were more concerned about the Marcellus Shale industry’s long-term impacts in the downstream/northern reaches of the watershed (Focus Areas #2 and #3) than they are in the southern/headwaters region (Focus Area #1) where the industry is already well-underway.

- The 'green and quiet' aspect of the Raccoon Creek Region is highly valued in all focus areas of the watershed, as is the beautiful scenery, rural character and recreational potential; people do not want this spoiled by development or pollution.
- Abandoned mine drainage is a greater concern in the headwaters (historic mined areas of the Pittsburgh Coal Seam) than farther downstream.
- Historic resource extraction industries have had a tremendous impact on the region; new resource extraction industries will bring changes we cannot even imagine at this time.



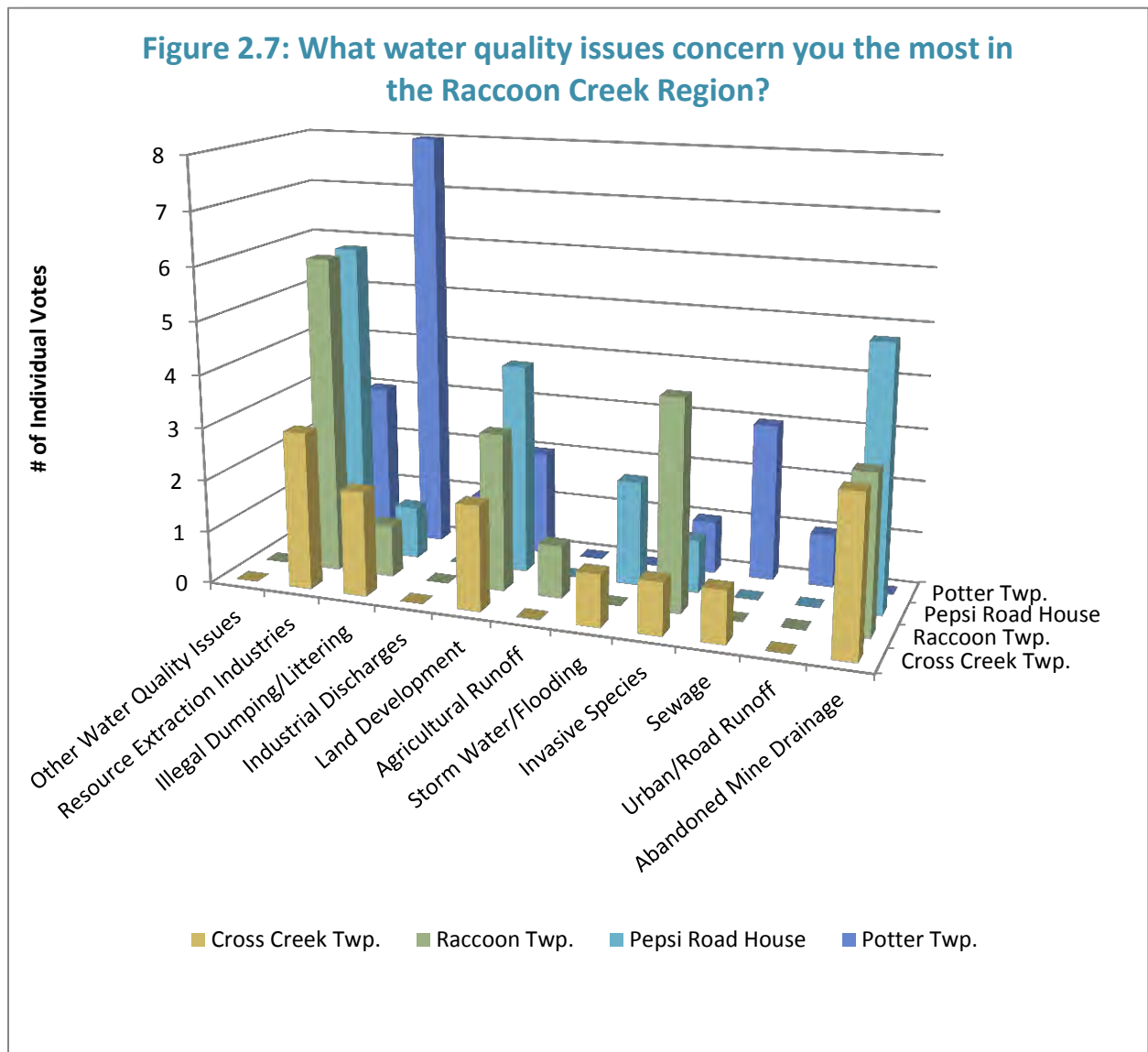
Figure 2.5: Civilian Conservation Corps workers use a pulley-rigged crane to help build the dam at the upper lake, ca. 1935. Notice the light covering of snow on the job site. Photo courtesy of Raccoon Creek State Park Archives.

Figure 2.6: How important to you are the following things in the Raccoon Creek Region?



* Other not specified

■ Cross Creek Twp. ■ Raccoon Twp. ■ Pepsi Road House ■ Potter Twp. ■ Ohio River Cruise



Multi-Media Publicity

The 20D Raccoon Creek Region Conservation Plan Project Facilitator coordinated efforts to publicize the Plan’s development through various printed and digital media. Each publication offered opportunities for stakeholders to share their views and concerns for the future of the Raccoon Creek Region. Table 2.3 details publication dates in various local media.

Table 2.3: 20D Raccoon Creek Region Conservation Plan Multi-Media Publication Dates

Date	Publication Details
May 2013	"Tomorrow" Washington County Conservation District hardcopy newsletter – 20D surveys mentioned among watershed activities
6/1/2013	Friends of Raccoon Creek State Park survey invitation and link posted on website www.friendsofraccoon.org
7/1/2013	Independence Conservancy's website, www.independenceconservancy.org , link to Citizen Survey
7/11/2013	"Farm & Dairy" hardcopy regional newspaper – small article announcing July 2013 round of public meetings and inviting participation in Citizen Survey online
7/19/2013	"PA Environment Digest" online newsletter – announcing opportunities for public input http://www.paenvironmentdigest.com/newsletter/default.asp?NewsletterArticleID=26048
7/20/2013	"Beaver County Times" hardcopy newspaper – small article announcing 20D RCWCP and series of three public meetings; paid advertisement published same day – 3 column x 6"
7/22/2013	Beaver County Conservation District website - http://beavercountyconservationdistrict.org/ and FaceBook page https://www.facebook.com/BeaverCountyConservationDistrict
7/25-30/2013	Electronic billboard at Pepsi Cola Roadhouse on Route 18 near Burgettstown – announcing July 30 th public informational meeting
7/25/2013	Survey link posted on Washington County Conservation website http://www.pawccd.org
Sept. 2013	"Tomorrow," Washington County Conservation District Newsletter - prominent reprints of Citizen Survey invitation advertising (full page)
10/3/2013	Independence Conservancy "News & Notes" e-newsletter promoting Municipal Official Survey http://archive.constantcontact.com/fs103/1115032642974/archive/1115139245777.html
10/6/2013	Independence Conservancy email invitation to municipal officials requesting participation in municipal survey and/or request a public presentation about the 20D RCWCP http://archive.constantcontact.com/fs103/1115032642974/archive/1115179806810.html
10/28/2013	Independence Conservancy "News & Views" e-newsletter http://archive.constantcontact.com/fs103/1115032642974/archive/1115436794880.html
11/1/2013	Re-sent 10/6/2013 invitation to Municipal Officials for survey and public presentation offer
Jan. 2014	"Tomorrow," Washington County Conservation District Newsletter - 20D surveys mentioned among "Watershed Activities"
May 2014	"Tomorrow," - 20D public meetings for June announced among "Watershed Activities"
6/2/2014	Independence Conservancy email invitation to municipal officials announcing second round of public meetings 6/11/14 at Cross Creek Twp. and 6/16/14 at Raccoon Twp. http://archive.constantcontact.com/fs103/1115032642974/archive/1115168304184.html
6/3/2014	Independence Conservancy email invitation to general public announcing second round of public meetings 6/11/14 at Cross Creek Twp. and 6/16/14 at Raccoon Twp. http://archive.constantcontact.com/fs103/1115032642974/archive/1115168304184.html
6/6/2014	Feature article in Beaver County Times, "Input sought on watershed; meeting planned for Raccoon."
6/11/2014	News brief in Washington Observer-Reporter, "Hearing Set on Raccoon Creek Plan"
Sept. 2014	"Tomorrow" article requesting public comment on Draft 20D Plan via Independence Conservancy's web link.

6/30/2014	Independence Conservancy “News & Views” e-newsletter requesting public comment on draft 20 D Plan http://archive.constantcontact.com/fs103/1115032642974/archive/1117790456051.html
9/24/2014	Independence Conservancy “News & Views” e-newsletter requesting public comment on draft 20D Plan http://archive.constantcontact.com/fs103/1115032642974/archive/1118605521793.html

Surveys and Interviews

Residents, municipal officials and key persons completed surveys whose purpose was to identify how stakeholders use and perceive the Raccoon Creek Region and its resources. Survey participants were encouraged to share their vision for the future of the area. The results of Citizen Surveys, Municipal Official Surveys and Key Person Interviews are summarized in this section of the 20D Plan.

Surveys were made available at public events (refer to Table 2.4) and advertised in local papers and newsletters. Invitations were e-mailed with a link to Independence Conservancy’s website (<http://www.independenceconservancy.org/news-projects>) where stakeholders could complete the surveys online. Printed surveys were also mailed by request. Many surveys were hand-delivered to requesters by the Project Facilitator. Most participants elected to complete the survey as “anonymous.” Results were tabulated and included in this section.

Survey participation was light, particularly among municipal officials, despite the Project Facilitator making numerous phone calls, sending many direct emails and making personal visits to municipal officials. As a result, the Project Facilitator attempted to obtain additional public input by conducting “dot exercises” at various public venues. The results of the dot exercises are also summarized later in this section of the Plan.

The expressed views and opinions represent those of the stakeholders and do not necessarily reflect the views of the 20D Raccoon Creek Region Conservation Plan Steering Committee, of the Washington County Conservation District, of Independence Conservancy, of Stream Restoration, Inc., or of any other contributors to, or partners in, the 20D Plan.

Table 2.4: 20D Plan Displays and Survey Forms Distributed at Public and Private Events

Date	Event or venue manned by Project Facilitator
8/15/2012	Washington County Conservation District booth at Washington County Fair
8/18/2012	Potter Township Centennial Celebration at Potter Municipal Building and Park
9/27/2012	Ohio River Watershed Celebration Cruise on the Gateway Clipper Majestic
1/15/2013	Marcellus Shale Impacts seminar at Washington County Conservation District
1/30/2013	Washington County Watershed Alliance Banquet at Julian’s Banquet Hall in Washington, PA
2/26/2013	Monthly meeting of the Raccoon Creek Watershed Association at Raccoon

	Creek State Park
8/16/2013	Washington County Conservation District booth at Washington County Fair
8/17/2013	Potter Township Picnic at Potter Township Municipal Building and Park
8/18/2013	Baden Borough 175 th Anniversary Celebration at Baden Municipal Complex
8/28/2013	Beaver County Sportsmen’s Conservation League booth at Big Knob Fair in New Sewickley Township
9/19/2013	Ohio River Watershed Celebration Cruise on the Gateway Clipper Empress
9/21/2013	Independence Conservancy Community Tire Collection at Brighton Township Public Works
9/24/2013	Monthly meeting of the Raccoon Creek Watershed Association at Raccoon Creek State Park
9/28/2013	Independence Conservancy Community Tire Collection at Economy Borough Municipal Building
10/3/2013	Beaver County Sportsmen’s Conservation League monthly meeting at Green Valley Sportsmen’s Club in Potter Township
10/18/2013	Independence Conservancy Community Tire Collection at Hookstown Fair Grounds
10/19/2013	Independence Conservancy Community Tire Collection at Brighton Township Public Works
11/20/2013	Route 18 Community & Economic Advisory Panel (RECAP) bi-monthly meeting at Bocktown Grille in Beaver Valley Mall
1/14/2014	Route 18 Community & Economic Advisory Panel (RECAP) bi-monthly meeting at Beaver County Community College
3/19/2014	Washington County Watershed Alliance Banquet at Julian’s Banquet Hall in Washington, PA
5/15/2014	Speaking engagement at Geneva College, undergraduate science course, “The Worth of Water”
9/18/2014	Ohio River Watershed Celebration at North Park

Citizen Surveys

Citizen Surveys were offered to watershed stakeholders at each public event and municipal meeting attended by the Project Facilitator. Citizen Surveys were also made available at the offices of the Beaver and Washington County Conservation Districts, the Penn State Cooperative Extension Office in Beaver; the Potter Township, Cross Creek Township and Greene Township Municipal Buildings, at Raccoon Creek State Park’s main office and interpretive center at the Wildflower Reserve. A list of meetings and events are provided in Tables 2.2 & 2.4.

A total of 66 Citizen Surveys were completed, either online or on paper. Respondents were asked to name the municipality and sub-watershed in which they reside. If they were unsure, a sub-watershed map was provided for guidance and education (see Plate 4.1).

Most Citizen Survey respondents live in Beaver County and reside near the main stem of Raccoon Creek, or not at all in 20D. Non-resident participation tends to show that people are interested in the welfare of the Raccoon Creek Region even though they may not live within its boundaries. Harmon Creek and Mill Creek were also included as selections for the residence question, although no one chose either of these sub-watersheds as their home.

Figure 2.8: In Which County Do You Reside?

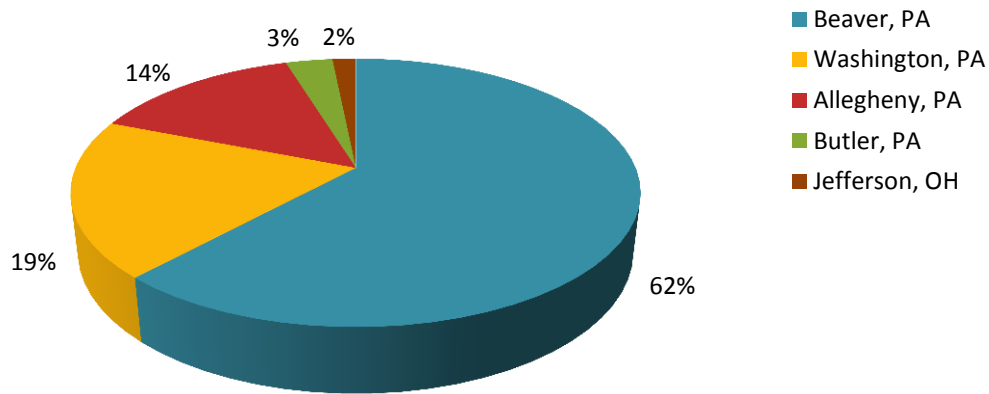


Figure 2.9: In Which Sub-Watershed Do You Reside?

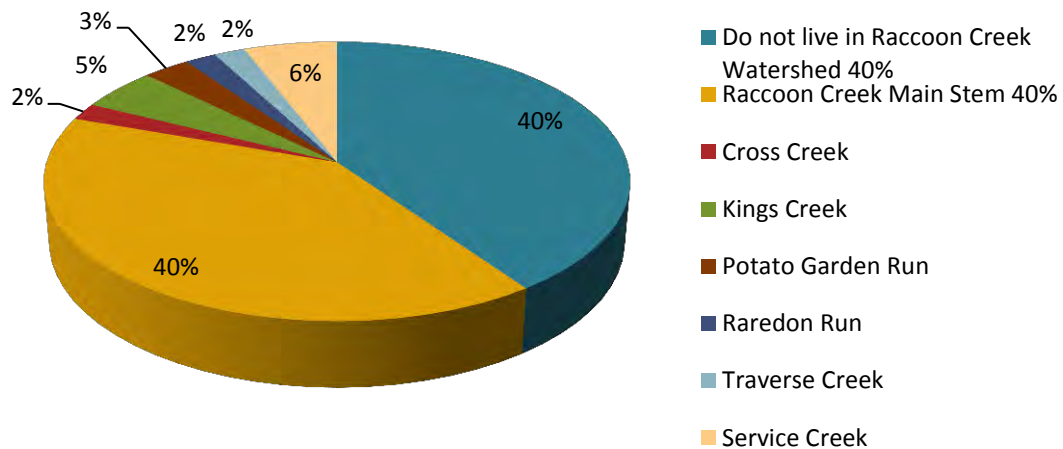
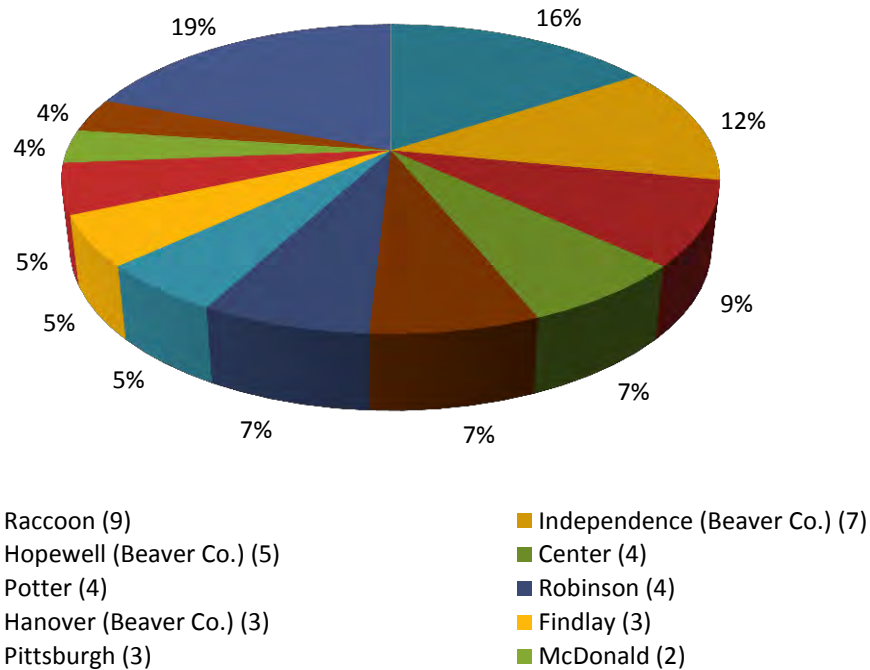


Figure 2.10: In Which Municipality Do You Reside?



Other includes: Ambridge, Beaver Borough, Cecil, Clinton, Cross Creek, Economy, Hanover (Washington Co.), Harmony (Butler Co.), Industry, New Sewickley and Steubenville (Jefferson Co.)

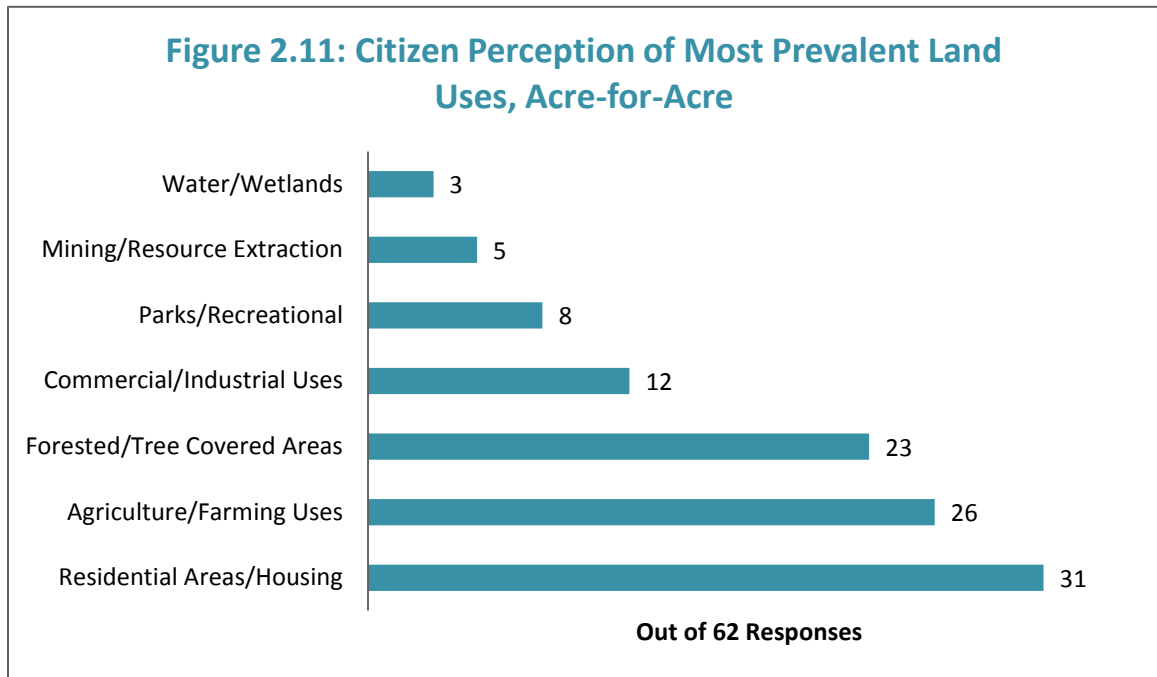
Compiled Citizen Survey Results

The Citizen Survey was designed to identify how stakeholders use and perceive the Raccoon Creek Region, its features and its resources. Survey questions relate to land use, water quality, important attributes, recreational opportunities, flooding, favorite places and things to do, quality of life, places worthy of permanent preservation and other comments. The following sections summarize the responses.

Land Use

As shown in Figure 2.11, many people mistakenly believe residential areas to be the most prevalent land use, acre-for-acre, in the Raccoon Creek Region. In actuality, residential areas occupy less than ten percent of the region’s land cover. (Refer to “Section 1: Project Area Characteristics.”) This may indicate a disconnection between how people perceive the use of land and how the land is actually used. However, participants did recognize that agriculture and forested/tree covered areas make up a substantial portion of the Raccoon Creek Region.

Most people in the watershed do indeed live in either a residential or agricultural area.



Water Quality

The greatest water quality issues identified in the Citizen Surveys were abandoned mine drainage or AMD, followed by illegal dumping/littering and resource extraction activities like shale gas, coal mining, quarries and logging. The results are seen in Figure 2.12. They appear to be reflective of several factors:

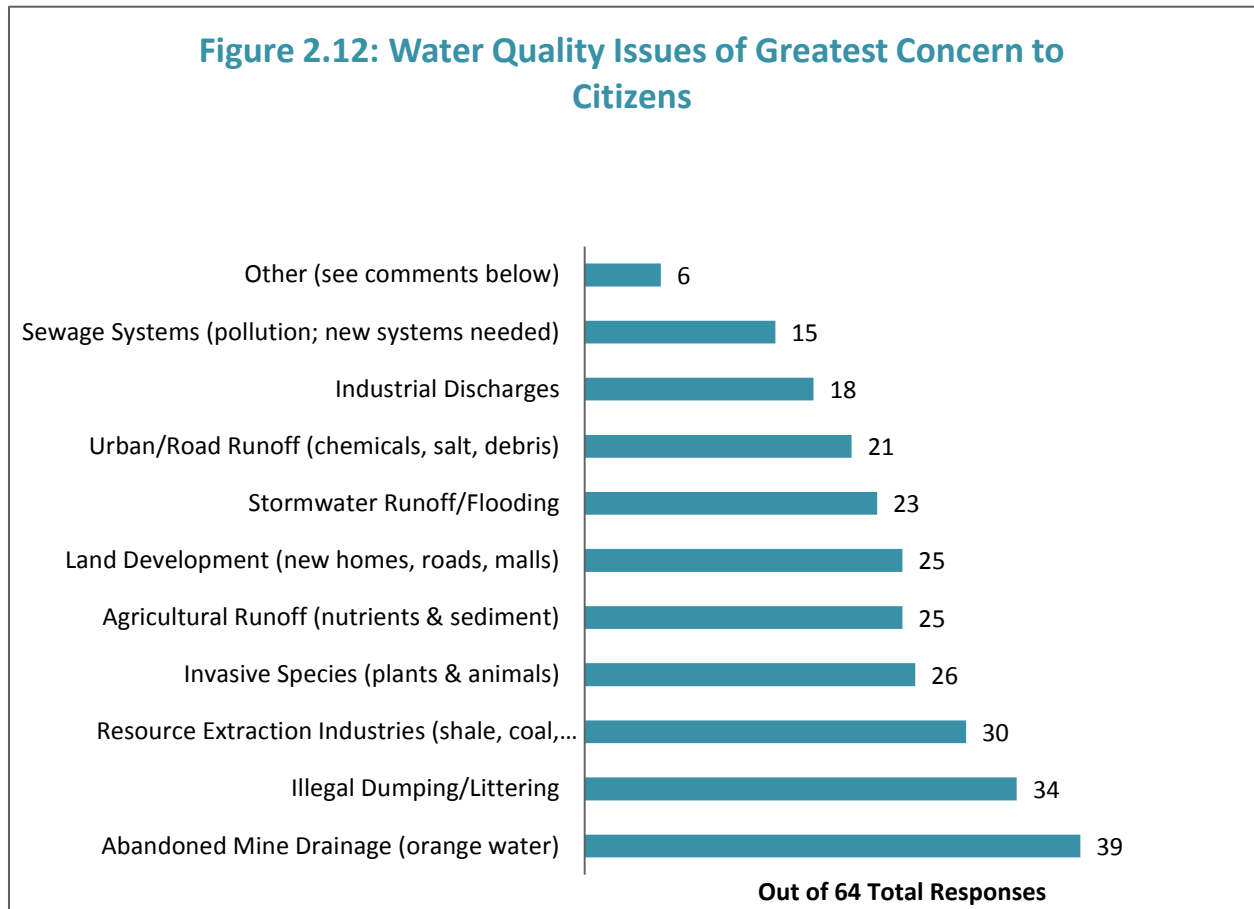
- obviousness of AMD in the watershed
- effectiveness of educational outreach by the many entities working to clean up AMD discharges, illegal dump sites and fugitive tires
- northward expansion of the shale gas extraction industry

Major progress has been made in cleaning up the Raccoon Creek Watershed!

Since 1999, public-private partnership efforts have resulted in construction of five passive systems that treat about 2.5 billion gallons of abandoned mine drainage annually in the headwaters of Raccoon Creek.

Volunteers have cleaned over 250 tons of illegally dumped trash from dozens of remote areas.

Community tire collections, ongoing since 2004, have netted over 33,000 scrap tires and wheels for proper disposal.



Water quality issues of greatest concern to citizens -other comments:
Poor riparian area protection on farms and in development projects--most of the time the head-water streams are disturbed, dug up, covered over, or devoid of vegetation.
Zoning should be pro-active, not re-active. Zoning should protect pristine areas now before they are lost forever.
All of these issues are very important and should be addressed one by one.

Watershed Attributes

The Citizen Survey asked people to rank the importance of twelve aspects or attributes of the Raccoon Creek Region, rating each item on a scale of 1 (lowest) to 5 (highest). Respondents placed the greatest importance on attractive natural settings, preserving open, green space, water quality improvement and preserving historical sites – in that order.

Citizens surveyed deemed new businesses, new jobs and resource extraction industries much less important than attractive natural settings and open green space. New residential development

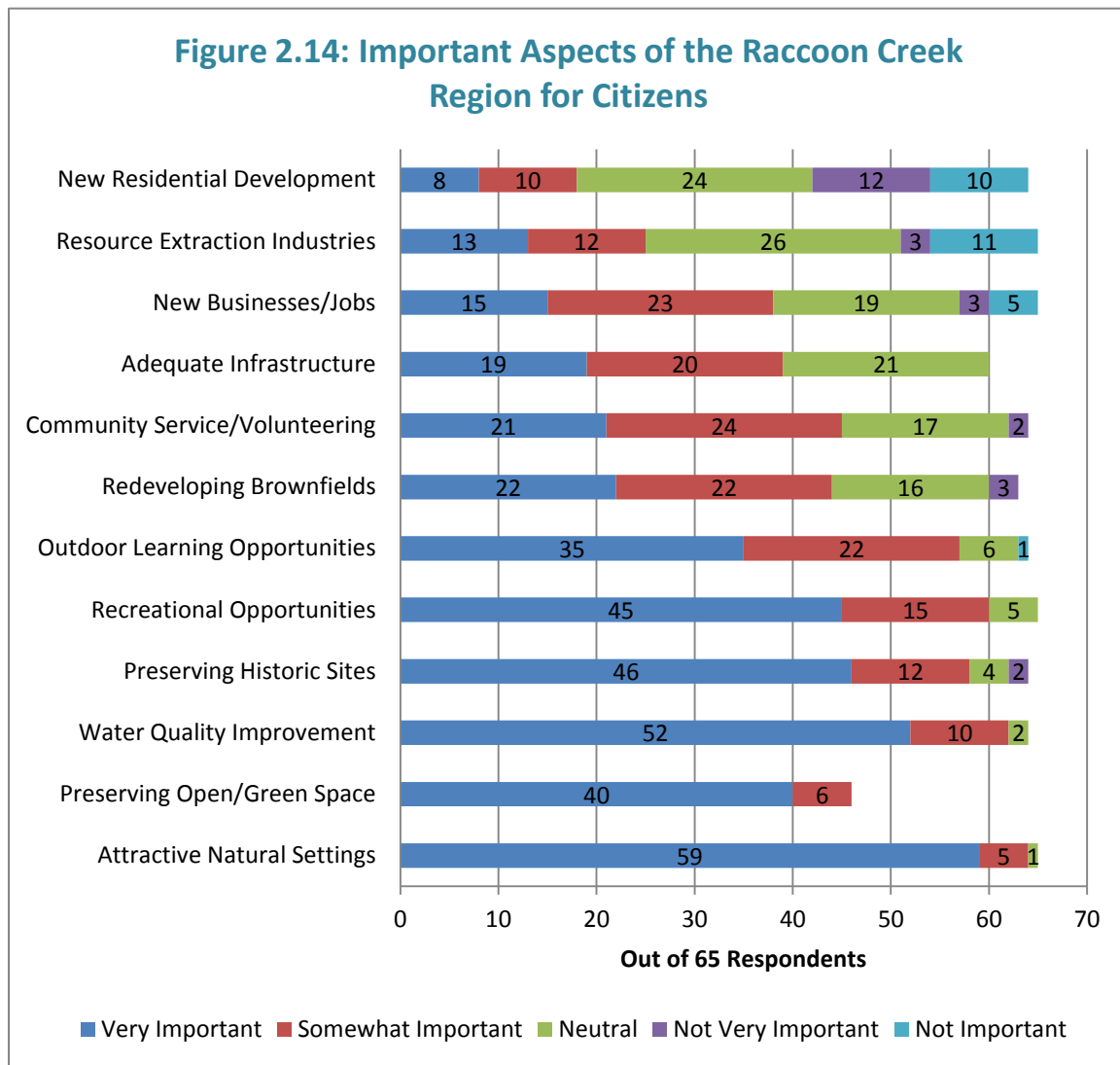
was ranked least important of the twelve aspects. This result warrants commentary. The shale gas industry has the potential to grow exponentially in the 20D Region. Unless the industry stagnates, the need for new worker housing and adequate infrastructure will become critical. Meeting the needs and adapting to the changes of the new industry without destroying the most highly valued features of the region – its attractive natural settings, open space and rural character – will require thoughtful planning on a regional scale and better communication among sectors where there is normally scant dialogue and a vast imbalance of power.

Figure 2.28 summarizes the lack of open/green space planning on the part of individual municipalities. Open space planning is now conducted, if at all, only on the county level and is not binding upon townships and boroughs.

Please see “Section 7: Management Options” for recommendations regarding the impacts of the developing shale gas industry in the 20D Region.



Figure 2.13: A new hotel is shoe-horned into a sliver of land between North Branch Presbyterian Church's cemetery and the intersection of PA 18 and Brodhead Road, Center Township - one mile from the proposed Shell ethane cracker plant. 4/28/14.



Recreational Opportunities

The Citizen Survey asked people how they feel about recreational opportunities in the Raccoon Creek Region by rating various opportunities on a scale of 1 (lowest priority) to 5 (highest priority). Hiking was rated the highest, followed closely by kayaking/canoeing and visiting public lands. Lowest ranked activities were outdoor team sports, shopping and Off-Road Motor Sports such as ATV riding. In general, the stakeholders preferred relatively low-impact, fairly quiet outdoor activities not involving teams or built environments.

Raccoon Creek State Park is usually the first thing that comes to mind in any discussion of recreational opportunities in the 20D Region. Raccoon Creek and “Raccoon Park,” as it is locally known are almost synonymous in many people’s minds – hardly surprising, given that Raccoon and neighboring Hillman State Park together cover more than 10,000 acres of southern Beaver

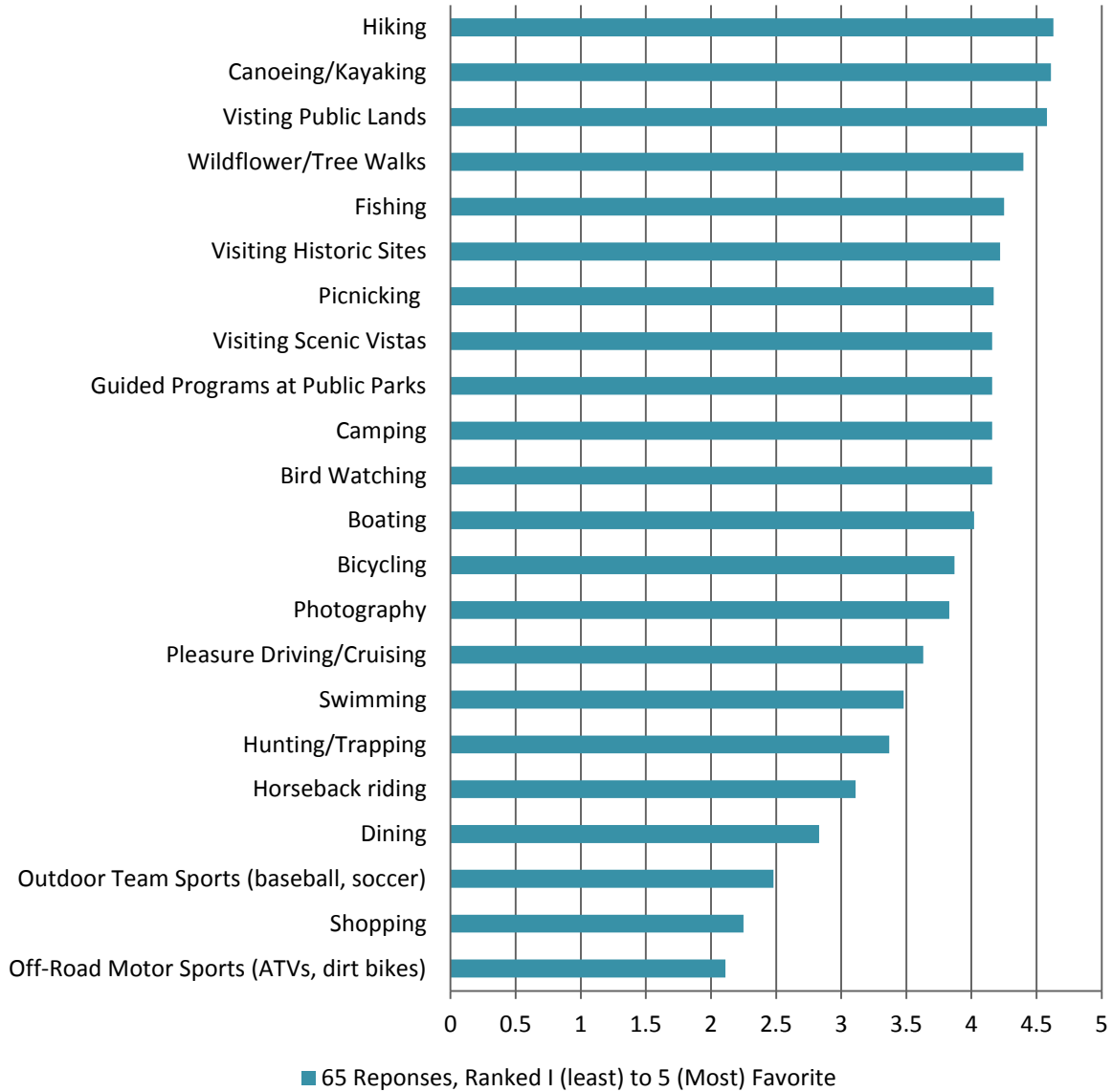
and northern Washington Counties. Citizen Survey results showed a great fondness and affinity for many aspects of the Park. For the sake of objectivity, the Project Facilitator often reminded survey respondents and interviewees to ‘think beyond the Park’ to other, more subtle aspects of the 20D Region.

“Section 6: Cultural Resources” describes in detail the various recreational opportunities available in the 20D Region. Figure 2.16 ranks the most popular recreational opportunities as indicated by the Citizen Survey.



**Figure 2.15: Paul Cusack and Myron Elliot enjoy the day at Hookstown Fair, 8/24/2013.
Photo courtesy of the Beaver County Times.**

Figure 2.16: Most Popular Recreation Opportunities in the Raccoon Creek Region



Flooding

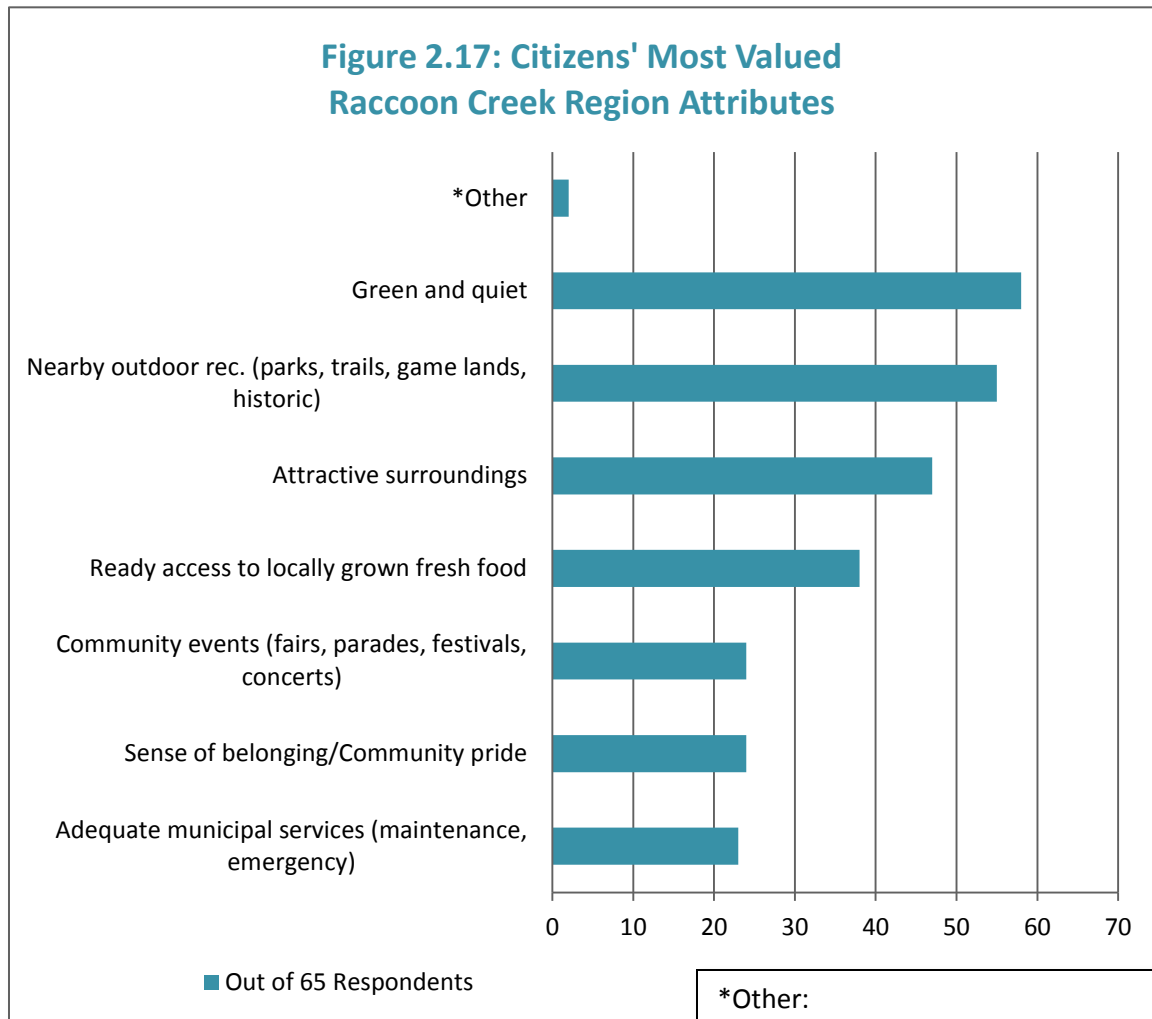
The Citizen Survey asked people if flooding was a problem in their area. Forty-nine people responded to the question; seventeen did not. Some respondents did not live within the 20D Region but their answers reflect larger regional issues and therefore are included herein.

Is flooding a problem in your area? If so, please explain.
No – 22 respondents.
I live in Pittsburgh's Northside, where flooding doesn't happen much. But elsewhere in the city and in adjacent low-lying communities, it's a huge problem.
Yes, and each time the creek bed changes due to high water and erosion, I'm concerned about land flooding and damage to structures and houses.
In my area it is not a problem, but I am familiar with the Rocky Bottom Natural Area along Raccoon Creek and flooding there is an issue during major rain events.
We live in the Elkhorn Run flood plain. Upstream housing development has increased storm water run-off.
Sometimes - if it rains continually. We live in the Elkhorn flood plain in Center Township.
No. At extremely high elevation. Only in extreme situations do the roads flood temporarily.
Not at my home directly (I'm on a hill) but I live near Campbell's Run road, and once in the 1.5 years I've lived here, part of the road was closed due to flooding.
Sometimes - depends on the amount of rain or snow.
Yes, a combination of the Ohio River rising up and backing up Raccoon Creek, and other streams flooding and trying to empty into Raccoon Creek. The road ends up under water and residents become stranded.
Somewhat controlled.
Yes, during unusually wet seasons or unusually heavy rainfall like we've had this summer.
No, but I was born and raised in Potter Twp. -PA. This area you are referring is beautiful area. I live two miles away and I enjoy taking hikes and driving through this area. Let's make it right so everyone can enjoy the beauty of Raccoon Creek Watershed.
Only into basement w/lots of rain over several days due to clay soil despite 2 acres lined w/dozens of trees.
Yes, lower section of town floods every 10 -20 years.
YES--stream waters are running higher and faster during rains.
Not usually. We have two USDA flood control dams that were built by the USDA. These two dams provide fairly good protection from major floods for the local towns.
Yes - toilet paper in the rivers after every rain.
Yes - probably due to impervious surfaces upstream.
Yes, Connoquenessing Creek often crests its banks.
Yes, as we are located near Raccoon Creek and in a floodplain area; when heavy rains occur the creek will crest its banks and flood the property.
Yes, floods happen about every 10 years along Robinson Run that damages businesses and

homes along the creek.
Yes, the wetland at our office can become very flooded if it's rains exceptionally hard for a period of time. The neighboring farms get very flooded as a result of our flood-prone area as well.
Yes. Potato Garden Run floods sections of the roadway on a regular basis.

What do you like about the Raccoon Creek Region?

The Citizen Survey asked people what they liked about the Raccoon Creek Region, offering them the opportunity to check any or all of eight attributes. “Green and Quiet” was the resounding favorite. Sixty-five people responded to this question; one did not; two provided additional comments.



***Other:**
 Municipal services are adequate.
 Good fishing in Raccoon Creek.

What is your favorite place in the Raccoon Creek Watershed?

The Citizen Survey asked people an open-ended question, “What is your favorite place in the Raccoon Creek Watershed?” Sixty-one people responded; five skipped the question. Their answers are summarized into general categories where possible; more detailed answers are quoted below.

Citizen Survey respondents’ favorite places in the Raccoon Creek Watershed:
My own back yard (15 respondents; 3 of which listed their farm or family farm)
Raccoon Creek State Park (11 respondents)
Raccoon Creek State Park’s hiking trails (9 respondents)
Raccoon Creek State Park’s Wildflower Reserve (6 respondents)
Raccoon Creek State Park’s lake and/or beach area (4 respondents)
Heavily wooded/forested areas (3 respondents)
Rocky Bottom Natural Area (2 respondents)
The wetlands in independence (2 respondents)
Raccoon Creek, downstream of the State Park, also Hillman State Park/Bavington
The area from Service Creek to Ohio River-appreciate the natural surroundings and wildlife.
I-376 (former PA 60) the bend in Raccoon Creek near Green Garden - the fall colors. And - a tie - Frankfort Springs grotto lit up with tiki torches at night, reflecting on the falling water.
Independence Township Community Park
Sandy Beach area (Raccoon Creek Road, Raccoon Township)
Fishpot Run as it empties into Raccoon Creek and the downstream area.
Bridge by St Joe's Boat dock
Hozak’s is a favorite too...
Hunting on my property
The rural areas along the main stem of Raccoon Creek, and the established estuary along Creek Road.
Meadowcroft Museum of Rural Life and Rock Shelter.
Stream at gun club; boat launch near Ohio River
Raccoon Creek downstream from the state park
All areas downstream of Moffet Mill bridge to Route 18
St. Joe Boat Club
From wild flower reserve to Independence wetlands
Both the uplands an creek bottoms in the state game lands in and Raccoon Creek State Park
Frankfort Mineral Springs in Raccoon Creek park. The path used to be really nice but a few years back after a bad round of storms a good deal of it was washed out. I would love to see it restored.
The Tank Farm in Potter Township
Cherry Valley Reservoir, Hillman State Park, First Niagara Pavilion, and Harmon Creek Lake at Starpointe.

What is your favorite thing to do outdoors?

The Citizen Survey asked people an open-ended question, “*What is your favorite thing to do outdoors in the Raccoon Creek Watershed?*” Sixty-one people responded; five skipped the question. Where possible, their answers are summarized into general categories. More detailed answers are quoted below.

Citizen Survey Respondents’ favorite things to do outdoors in the Raccoon Creek Watershed:
Hiking/walking on trails (25 respondents, 16 of which mentioned Raccoon Creek State Park)
Fishing/fly fishing/fishing from watercraft/wading fishing (17 respondents)
Canoeing/kayaking (8 respondents)
Nature watching/bird or wildlife watching (6 respondents)
Bicycling/mountain biking (6 respondents)
Hunting (6 respondents)
Visiting public parks (4 respondents)
Cruising/pleasure driving (4 respondents)
Living here (3 respondents)
Camping (3 respondents)
Swimming (3 respondents)
Photography (3 respondents)
Visiting historic sites (3 respondents)
Boating (2 respondents)
Picnicking (2 respondents)
Attending local fairs (2 respondents)
Play outdoors with my dog (2 respondents)
Too many to mention
Hunting and fishing in Raccoon Creek State Park and Rocky Bottom Conservation Area
Love visiting Raccoon Creek State Park, enjoy Cross Creek County Park, bike riding on the Montour Trail, bird and nature watching
Help to run the Sportsmen's Youth Conservation Camp at Raccoon Park in the summer. In the fall, drive along Route 60 and see the colorful leaves.
Driving through the Park and seeing everything.
Hike with my young kiddo at Frankfort Mineral springs
Canoeing Independence Township
Car cruises at the Midway Bar & Grill
Working around our property at home
Covered Bridge Festival
Doak Field programs at Raccoon Creek State Park, hiking the trails at RCSP, medicinal plants workshop at RCSP, walks at the Wildflower Reserve
Primitive Skills Workshop at Raccoon Creek State Park
Breathe fresh air and see stars at night
Farming

Enjoy the beautiful areas along the rural watershed.
Ride my motorcycle
Hiking at Raccoon Creek State Park; fishing for smallmouth bass in Raccoon Creek
Duck hunt from canoe
It was fishing
Sit by the creek and quietly relax, or drive around the country roads and just look at the scenery.
Walking with the dog and playing in the water with him. Also bird watching.
Mountain Biking at Hillman State Park. Fishing at Harmon Creek Lake at Starpointe.

Q: What is your favorite thing to do in the Raccoon Creek Watershed?

A: Breathe fresh air and see stars at night

Quality of Life Improvements

The Citizen Survey proposed ten different quality-of-life scenarios with the following question: **“Would you favor these things to improve the quality of life for everyone in the Raccoon Creek Region?”** Respondents could vote yes or no to the suggested ideas. Sixty-five people answered this question; one skipped it.

More outdoor recreation opportunities (parks, game lands, trails) garnered the most “yes” votes and the fewest “no” votes. Strong support was also shown for mandatory trash/refuse collection, directing new development away from pristine natural areas, better maintenance of existing parks/recreation facilities. These preferences outranked better roads and bridges, more family sustaining jobs and improved municipal services.

Opinion was closely split on the issue of consolidating municipal services such as police, fire, schools, water and sewage. Thirty-five people favored consolidation; twenty-seven opposed it.

High-speed internet access was another divided issue with thirty-six people favoring it and twenty-four opposing it. Survey results may indicate lack of awareness that the best connective technology offered in suburban and urban areas is not universally available in rural areas. The internet continues to gain importance in communication, commerce, education and nearly every aspect of life. In rural areas like the Raccoon Creek Region, dial-up and satellite may sometimes be the only connectivity options. Without broadband or high-speed cable internet connections, rural residents suffer a distinct disadvantage.

Regardless of public perception, the “digital divide” does exist and is well documented¹. Internet usage is much less among the elderly, the less-educated, those with lower incomes and those who live in rural locales. The Federal Communications Commission (FCC) states that about 15 million Americans, most of them living in rural areas, lack access to broadband and the link it provides to jobs, education and economic prosperity².



Figure 2.18:
20D Plan Project Facilitator Vicky Michaels expresses frustration with her rural internet access. Photo: Cynthia M. Leonard, Bayer Center for Nonprofit Management

Places Worthy of Permanent Preservation from Development or Disturbance

The Citizen Survey asked people, “**Are there places in the Raccoon Creek Watershed, other than state parks and game lands, which you believe should be permanently protected from development or disturbance? If so, please describe:**” Thirty-nine people answered the question; twenty-seven skipped it.

One person thought there were no places worthy of permanent preservation in the Raccoon Creek Region. Two people named Raccoon Creek State Park, despite instruction to the contrary.

¹ Pew Research Internet Project – How Americans Go Online, available at <http://www.pewinternet.org/2013/09/25/how-americans-go-online/>; accessed 3/18/2014.

² AG Professional - FCC aims to offer high-speed internet to rural America, available at <http://www.agprofessional.com/news/208715731.html>; accessed 3/18/2014.

One comment about conservation easements seemed to indicate a misunderstanding of the voluntary nature of land protection, whether achieved through conservation easements or outright purchase of land for permanent preservation. This suggests a need for public education about land preservation methods by land trusts, farmland preservation boards, watershed groups and conservation districts.

Where possible, the answers are summarized into general categories. Most responses were rather detailed and are quoted below.

Citizen Survey responses to places worthy of permanent preservation from development or disturbance
Farmlands, historic farms, agriculture security areas (7 respondents)
Riparian areas, stream banks (6 respondents)
Waterways, headwaters, small feeder streams (5 respondents)
Great Blue Heron rookeries on Raccoon Creek and its tributaries (3 respondents)
Rocky Bottom Natural Area (3 respondents)
The sub-watershed of Aunt Clara's Fork (2 respondents)
Independence Twp. Park Area... Extend State Park to Park Road area.
YES... conservation easements should be protected regardless of proposed use. Temporary impacts can be mitigated for - but new developments should be directed AWAY from conservation areas.
Any location within a reasonably designated area of existing homes.
Rocky Bottom Natural Area It is a naturally diverse area occurring at the lower reaches of Raccoon Creek where diversity is the greatest among aquatic organisms and also is an area where terrestrial organisms thrive.
1) Streamside buffer zone along the creek - water trail from Sandy Beach area to Rocky Bottom - loop off of I-376 in Center Township section. 2) Meadowcroft Village. 3) King's Creek & Aunt Clara Fork Watersheds - hands off!
Any undeveloped areas along Raccoon Creek
Areas near schools and areas directly next to state parks
I'm not too familiar with the Raccoon Creek Watershed outside of Raccoon Creek State Park, but I'm sure there are plenty of places that I don't know about that would merit protection. What happens in one part of the watershed affects the entire watershed, so if you ask me, the whole thing should be of special concern!
Rocky bottom area and old tank farm
Conservation areas along the major tributaries, wetlands and estuaries within the watershed. Responsible development is key to enriching an area without destroying it.
Kings Creek Watershed should be preserved as the link and loop. Greenspace connection for raccoon creek park wildlife and the Ohio river. A trail system that loops to and forms a portage with both watersheds and the river as a resource to the park and its future preservation.
I'd like to see much of the farmland and open space in the Raccoon Creek Watershed

maintained.
No drilling for gas in residential areas
All riparian areas should be protected in some way regardless of who owns the land.
Floodways and wetlands along streams
The blue heron rookery along Creek Road in Robinson Twp., the areas identified by municipalities that are conservation areas and the old Bigger Homestead/Farm/barns on Bigger Road.
The historic farms of the area
The stream itself and public access to it for water trails
Downstream of Moffet Mill bridge to Route 18; maybe from I-376 near cement plant and downstream. Other places such as headwaters would be benefited by protection, i.e., water quality and quantity.
Farm lands and undeveloped forests, such as those found in Independence Township
Conservation easements or purchases should be the choice of the landowners
Beaver County needs more walking trails.
The Ohio River slopes; the Kings Creek Watershed; Peggs Run Watershed; Gums Run Watershed; undisturbed areas surrounding Raccoon Creek State Park; Potter Township's Tank Farm and the entire lower Raccoon Creek Biological Diversity Area.
The lake at Starpointe Business Park should never be developed with houses around it. Too much wildlife in that area.

Additional Comments about the 20D Raccoon Creek Watershed Conservation Plan

The Citizen Survey offered people the chance to comment on issues not addressed anywhere else in the Plan. Seventeen people responded, of which five stated they had no additional comments. The remaining responses are quoted below. Predominantly, they point out the need for vigilance, education and wise development of the shale gas industry to protect the natural resources of the Raccoon Creek Region. They also call for correcting the legacy effects of the coal mining industry, namely coal waste piles.

Citizen Survey Respondents' additional comments about the 20D Plan:
Pipelines for gas wells need to be better managed/located. Very destructive and unsightly.
Gas related activities have heavily impacted the watershed in the last 3 years. Yes, the pipelines are temporary - as well as the drill pad impacts - however there have been so many spills, problems and illegal dumping at individual sites - it is unclear as to the level of regulatory inspection and PROPER cleanup for long term health of groundwater, surface waters, and habitat. I worry about the previous problems coming back in years to come and discovering spills and leaks were not PROPERLY taken care of... Gas activities should be addressed in the plan... as they impact most of the watershed now.
More environmental monitoring of gas development

I am newly married and moved to this area 6 months ago. My husband has been a long time resident of this area.
Increased education for the public about this plan to gain involvement.
The watershed is a vast watershed - if development is conducted away from the conservation areas it still impacts the watershed - increased runoff, sewage and water issues, traffic, etc. Improve what is already developed instead of continuing to cut into undeveloped areas and cause unavoidable loss both directly and in-directly. No need to keep disturbing areas... no need to keep developing area when areas of development sit and are not maintained.
The ag area & its protection
Focus areas should be: long term remediation of mine drainage and mined lands, access to the creek and public lands for consumptive (hunting & fishing) and passive (hiking, canoeing) recreation, wetland conservation for water quality and flood control, brownfield redevelopment, focus development in existing communities, maintenance of infrastructure vs. expansion (road, sewer, water, housing)
Beaver county needs more walking trails.
Ambridge Reservoir
BAN HYDRO_FRACKING GLOBALLY
We need to clean up our coal waste piles. There are hundreds in the watershed. We missed a golden opportunity to do so when the proposed Champion Power Plant was shot down by imported environmental wacko NIMBYs and big power companies who didn't want any local competition.
The watershed was greatly disadvantaged when local activists fought again a proposed high-tech waste coal burning power plant in Robinson Township.

Familiarity with Local Watershed/ Outdoor/Conservation Organizations

The Citizen Survey asked people, **“How familiar are you with these local watershed/outdoor/conservation organizations?”** The organizations listed in the question are very active and successful in a wide variety of regional projects such as:

- Building passive systems to treat abandoned mine drainage (AMD)
- Stabilizing stream banks and establishing riparian buffers
- Reducing non-point pollution sources
- Securing funding for recreational improvements and environmental remediation projects
- Cleaning up illegally dumped trash and tires
- Promoting recreational enjoyment of our streams, lakes and public lands
- Preserving and enhancing open space, green corridors and prime wildlife habitat
- Providing outdoor learning opportunities for people of all ages

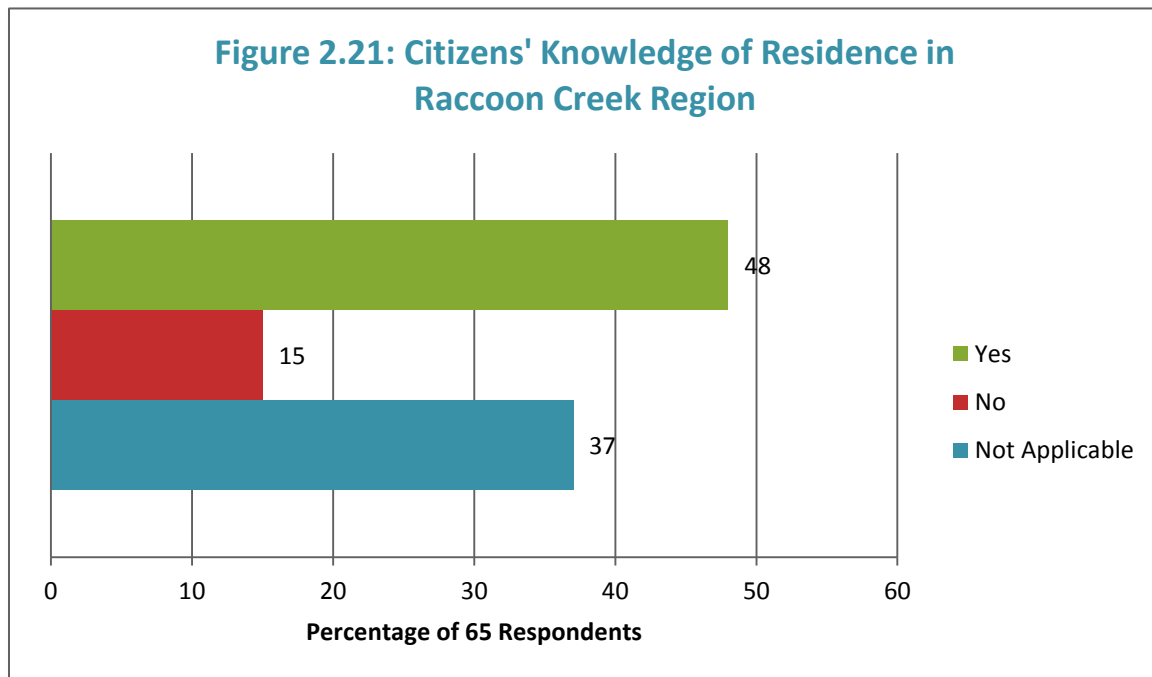
Not surprisingly, the larger, more regional entities showed better name recognition than the smaller local groups. Results may be somewhat skewed by the fact that many respondents were reached through the membership bases of the 20D Plan’s sponsoring organizations.

However, it may also reflect these groups' success at education and outreach in the Raccoon Creek Region. Results are summarized in Figure 2.21 below.

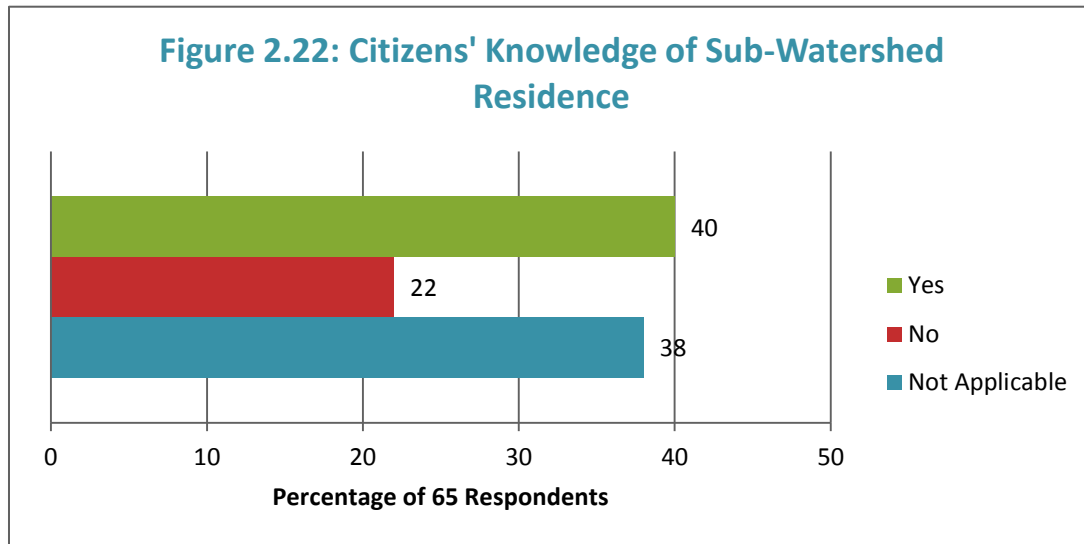
Knowledge of Residence within the 20D Raccoon Creek Watershed

The Citizen Survey concluded by asking people if, before completing the survey, they were aware of the watershed in which they reside. Many respondents lived outside of the Raccoon Creek Region. The results indicate a slightly greater awareness of Raccoon Creek than of the smaller sub-watersheds. Sixty-five people answered the question; one did not.

“Before participating in this survey, did you know you lived in the Raccoon Creek Watershed?”



“Before participating in this survey, did you know what Raccoon Creek Sub-Watershed you live in?”



Municipal Official Surveys

Municipal Official Surveys were designed by the 20D Plan Steering Committee to gauge elected and appointed officials’ perceptions, opinions and needs related to various issues in the Raccoon Creek Region. Similar to the Citizen Surveys, they contained questions relating to land use, infrastructure, water quality, recreation, economics, values, etc.

The Project Facilitator mailed multiple copies of the Municipal Official Survey with an introductory letter to each municipal office in the 20D Region. Only six people responded to the mailed Survey. The Project Facilitator also e-mailed the Survey to every township, borough office or individual for which an e-mail address was known. Despite hand-delivery of Surveys to offices, repeated mailings and phone requests, e-newsletter appeals and a QR Code (Quick-Response Code) link to the Survey online, only six Municipal Official Surveys were completed and returned to the Project Facilitator. Table 2.5 shows Municipal Official Survey respondents by municipality.

Compiled Municipal Official Survey Results

Table 2.5: Municipal Official Survey Respondents by Municipality

County	Municipality	# of Respondents
Beaver	Greene	1
	Potter	2
	County of Beaver	1
Washington	Cross Creek	2

Table 2.6: In What Sub-Watershed/s is Your Municipality Located?

Sub-Watershed Name	# Respondents
Raccoon Creek Main Stem	3
Cross Creek Sub-Watershed	2
Harmon Creek Sub-Watershed	0
King's Creek Sub-Watershed	0
Potato Garden Run Sub-Watershed	0
Raredon Run Sub-Watershed	1
Traverse Creek Sub-Watershed	1
Service Creek Sub-Watershed	1
Mill Creek Sub-Watershed	2

Table 2.7: What are the two most prevalent/widespread land uses in your watershed, acre-for-acre? In other words, with what is the bulk of the land in your municipality now covered?

Perceived Predominant Land Use	# of Respondents
Residential Areas/Housing	0
Commercial/Industrial Uses	1
Water/Wetlands	0
Mining/Resource Extraction Activities	2
Forested/Tree-Covered Areas	1
Agriculture/Farming Uses	4
Parks/Recreational Uses	0

Figure 2.23: How important are these community aspects to you as an elected official?

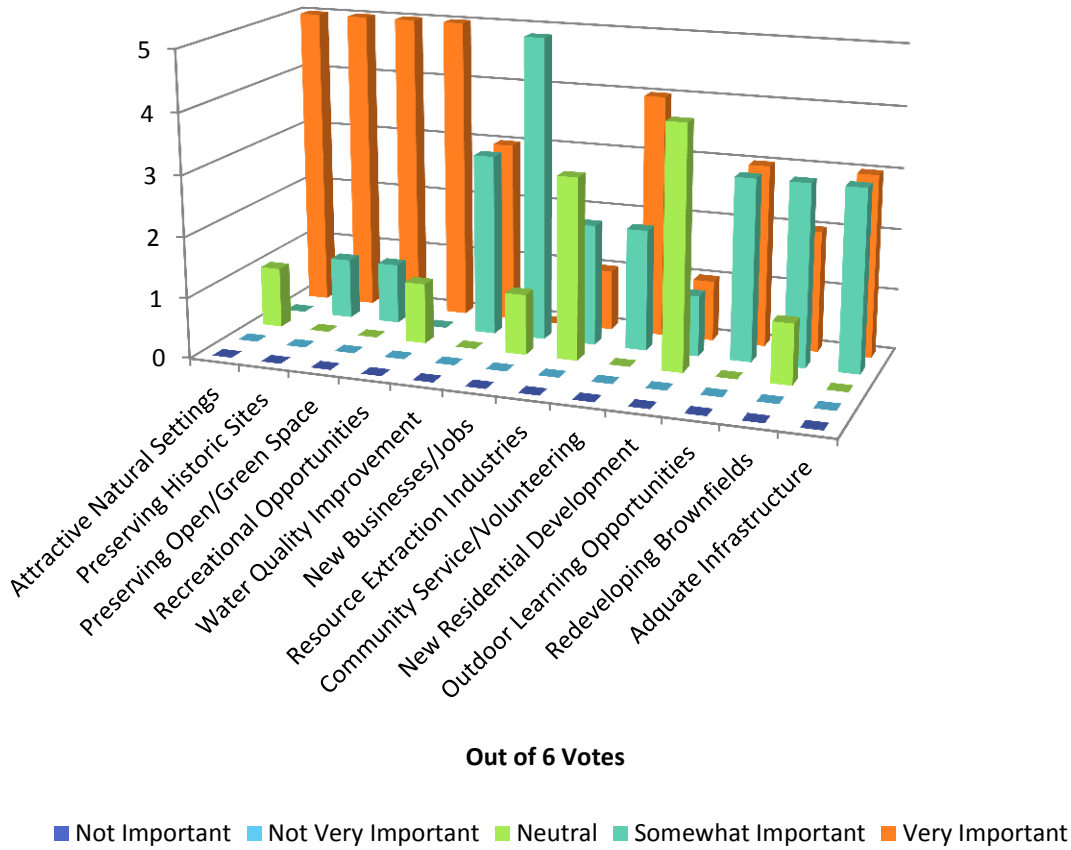
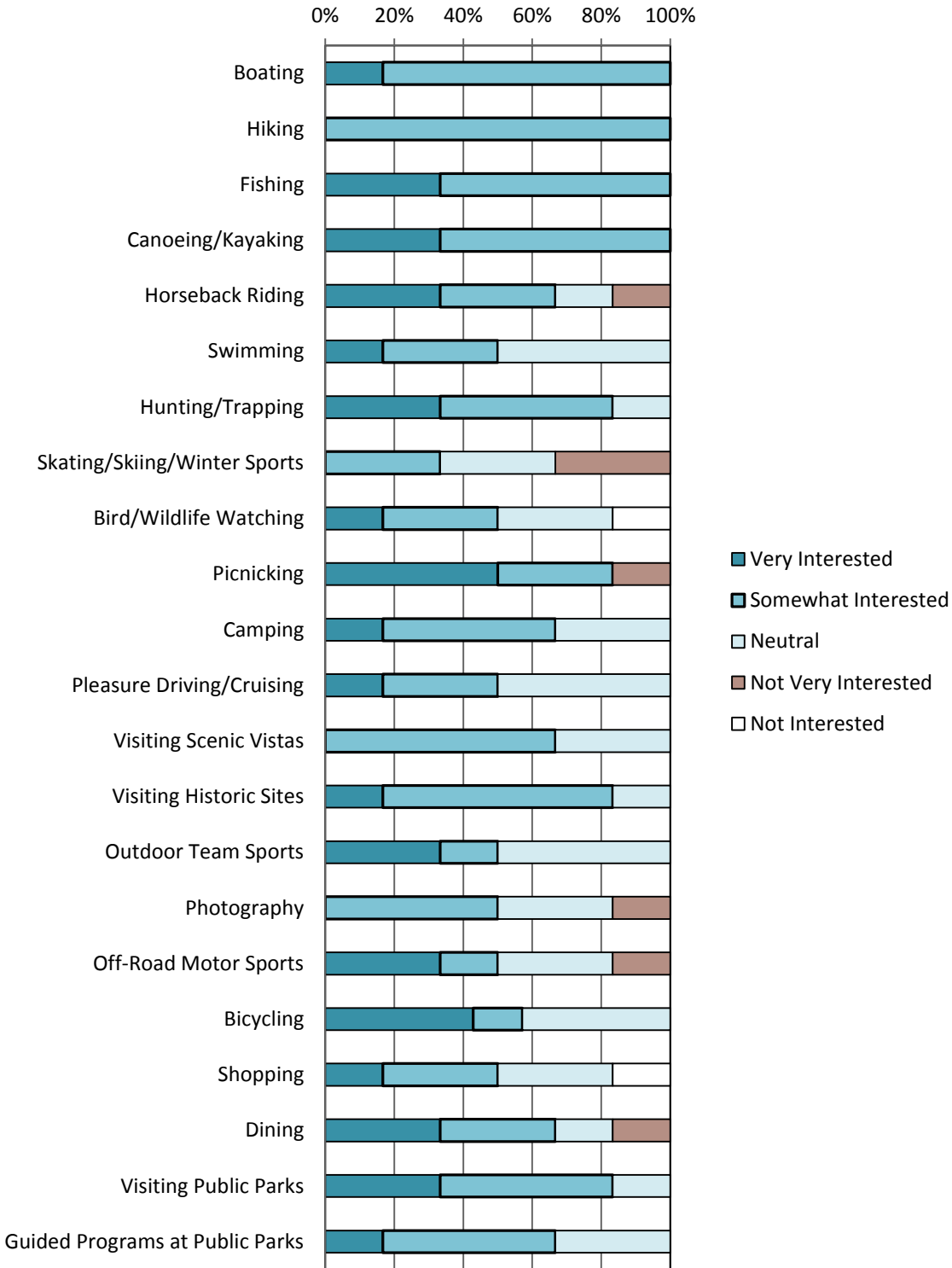


Figure 2.24: How do you think your constituents feel about these recreational opportunities in the entire Raccoon Creek Region?



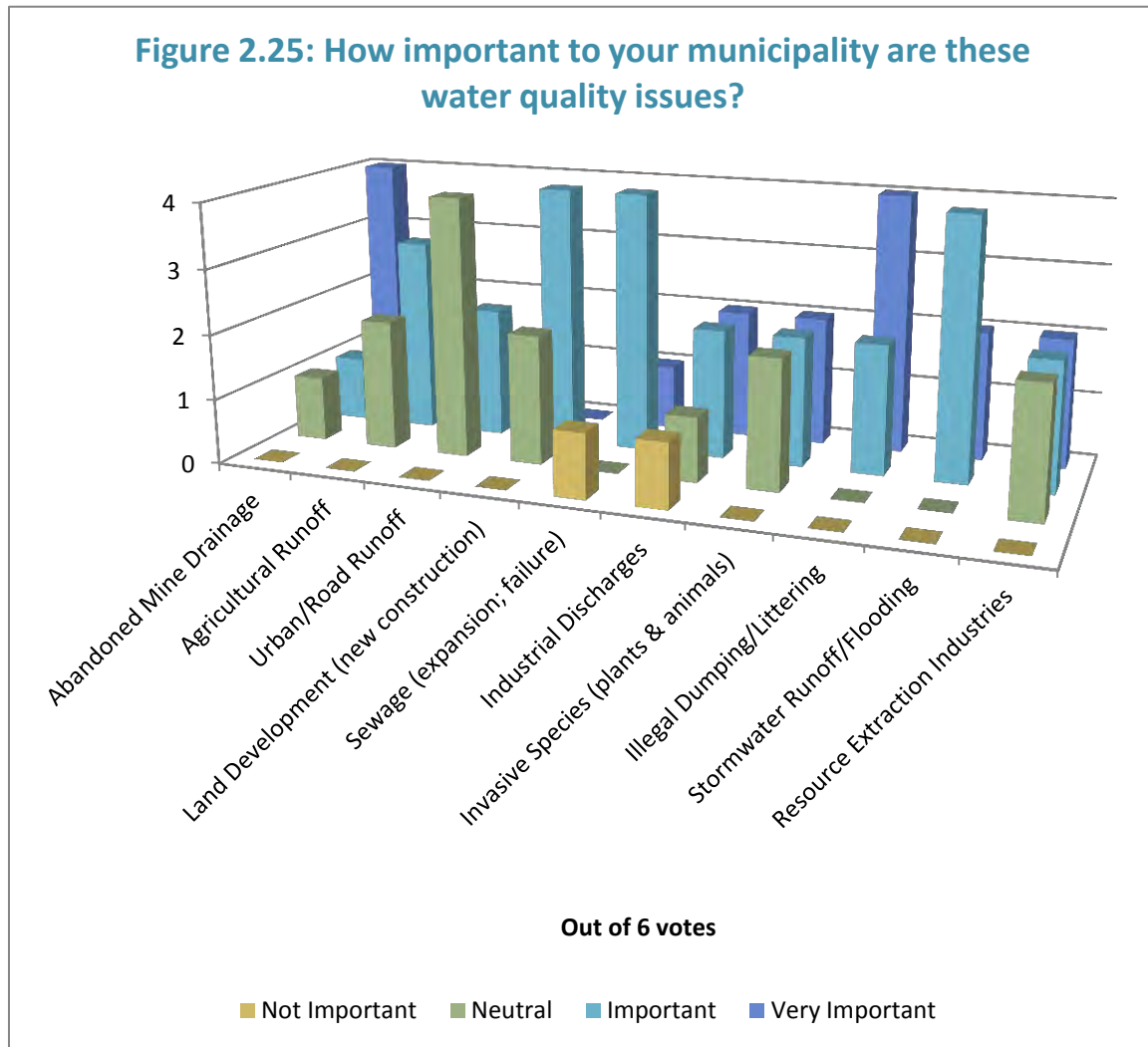
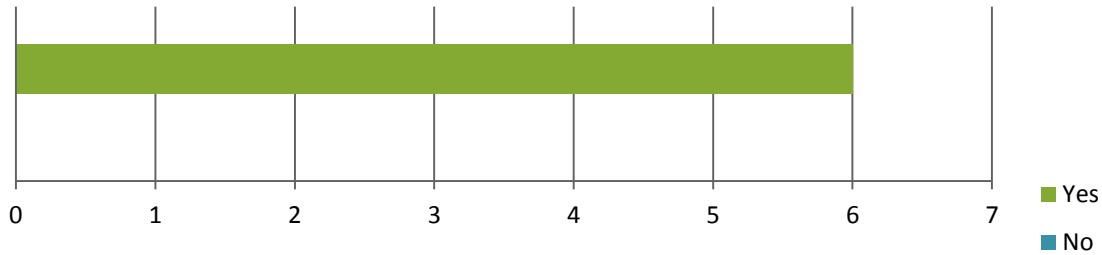


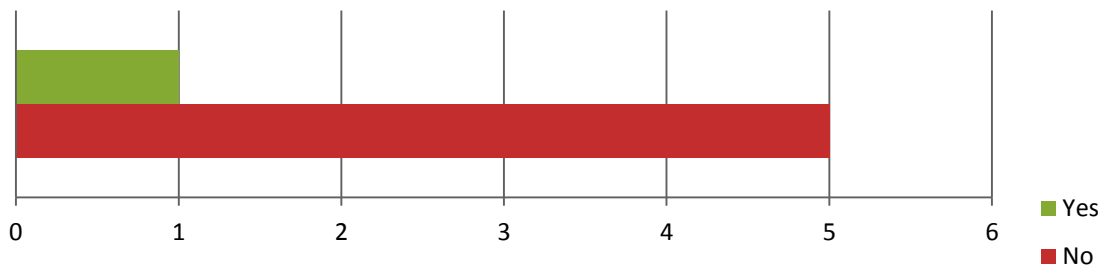
Figure 2.26: Barb Rupert, Hubie Miller & John Davidson take a break at one of Independence Conservancy's tire dump cleanups in Greene Township - August, 2005.

Figure 2.27: Does your municipality have a comprehensive plan? What is the name of the plan and when was it adopted?



Comprehensive Plan for Greene, Independence, Raccoon and Potter - 2005.
Cross Creek Region Comprehensive Plan - May 2006.
Beaver County Comprehensive Plan - 2010.

Figure 2.28: Does your municipality have a greenways or open space plan? What is the name of the plan and when was it adopted?



Greenways and Trails Plan for Beaver County - 2008.

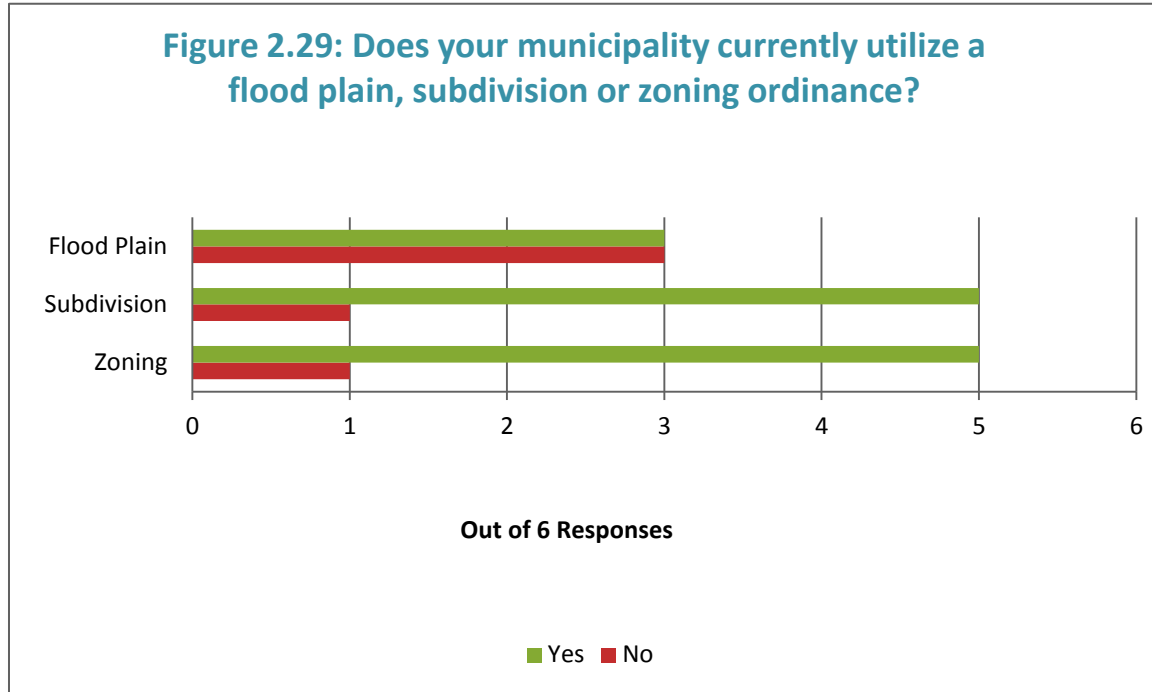


Table 2.8: What are the three most critical needs or challenges in your county or municipality that affect the Raccoon Creek Region?

Most critical needs or challenges affecting the Raccoon Creek Region
<ol style="list-style-type: none"> 1. Sewage management 2. Storm water management 3. Animal waste management
<ol style="list-style-type: none"> 1. Dealing with Marcellus gas extraction activities 2. Road maintenance and repair 3. Extending public sewer and water systems
<ol style="list-style-type: none"> 1. Abandoned mine drainage 2. Flooding 3. Illegal dumping
<ol style="list-style-type: none"> 1. Industrialization with Shell cracker plant, plant services, customers 2. Encroaching residential development 3. Abandoned mine drainage
<ol style="list-style-type: none"> 1. Storm water run-off and flooding 2. Under-education and apathy among corporate neighbors 3. Lack of funding

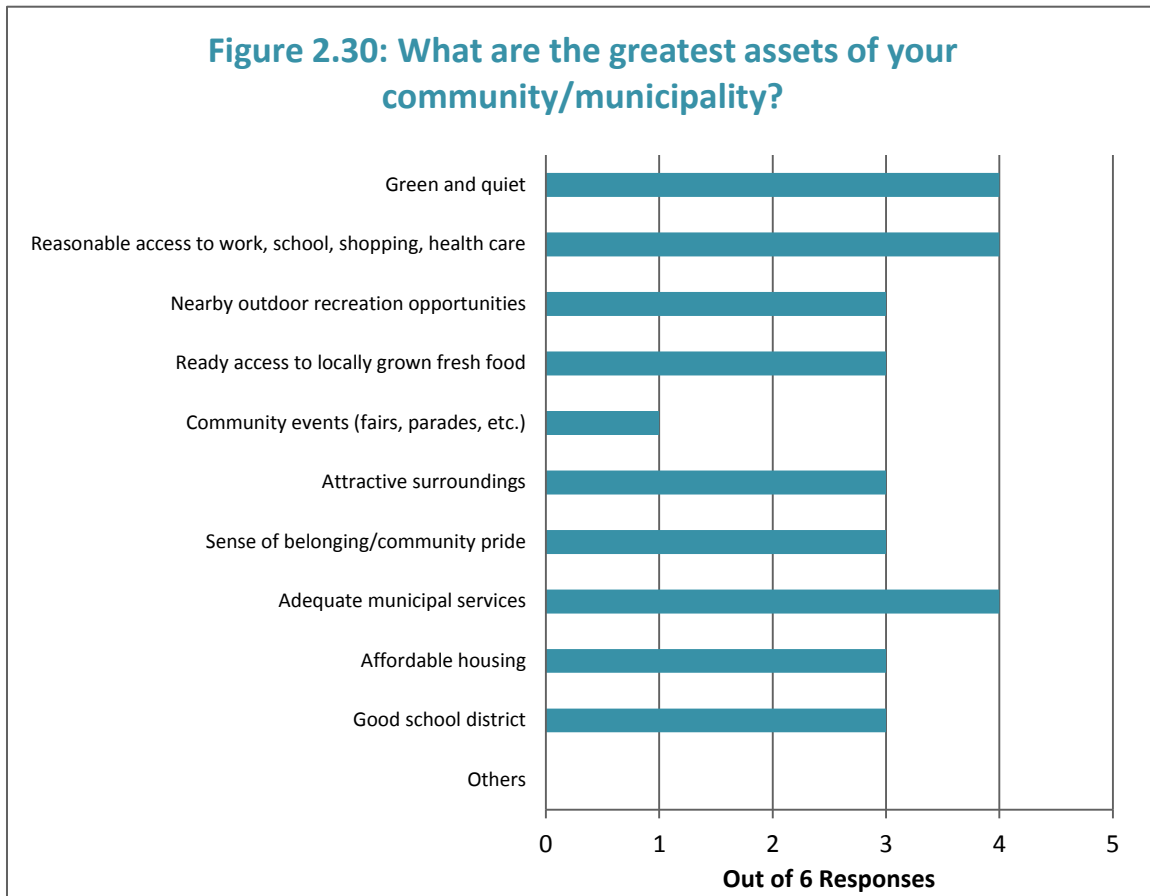
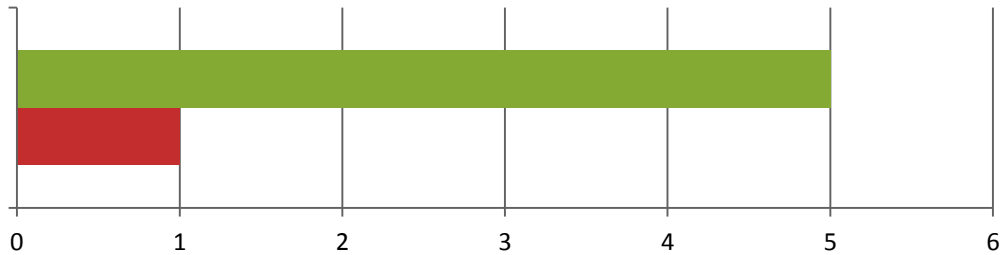


Figure 2.31: Peyton Bradley tries to lift a pumpkin at Hozak’s Farm, Hanover Township, Beaver County, 10/26/2013. Photo courtesy of the Beaver County Times.

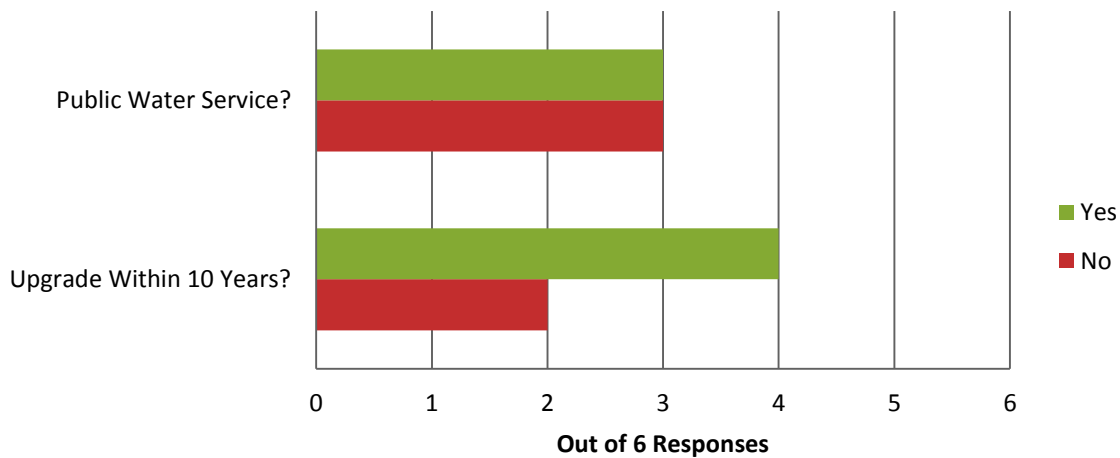
Figure 2.32: Are there places in the Raccoon Creek Region, other than state parks and game lands, which you believe should be permanently protected from development?



Entire length of Raccoon Creek from Raccoon Township line to Ohio River.
 In Potter Township from Fishpot Run to Route 18 along Raccoon Creek Road.
 Meadowcroft Museum of Rural Life and Rock Shelter; Devils' Den area; Scott Run; King's Creek Watershed.

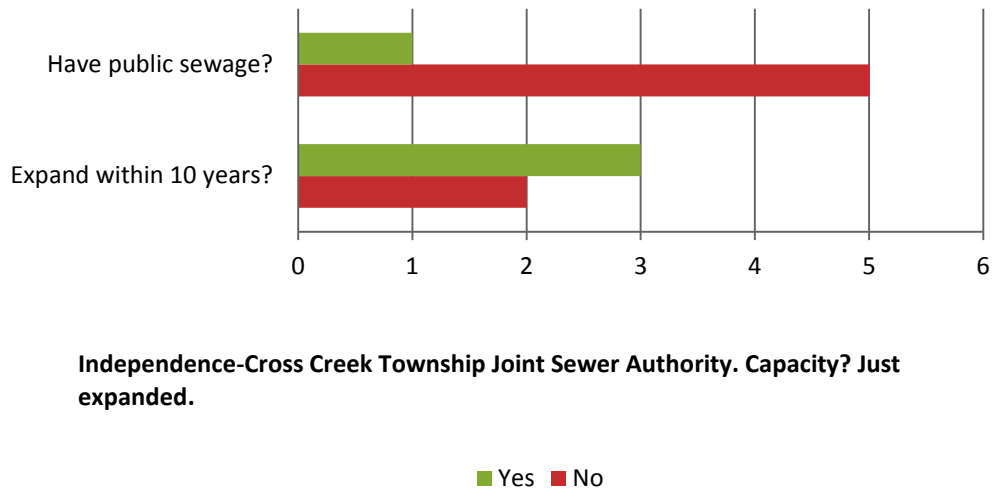
■ Yes ■ No

Figure 2.33: Does your municipality have public water service in the Raccoon Creek Region? Do you foresee need to upgrade within 10 years?



Out of 6 Responses

Figure 2.34: Does your municipality have a public sewage system in the Raccoon Creek Region? Do you foresee need to establish/expand within 10 years?



Independence-Cross Creek Township Joint Sewer Authority. Capacity? Just expanded.



**Figure 2.35: A gentleman admires the newly completed Independence-Cross Creek Township Joint Sewer Authority Treatment System plant expansion - January, 2012.
Photo courtesy of Rachel Blosser, Manager, Cross Creek Township.**

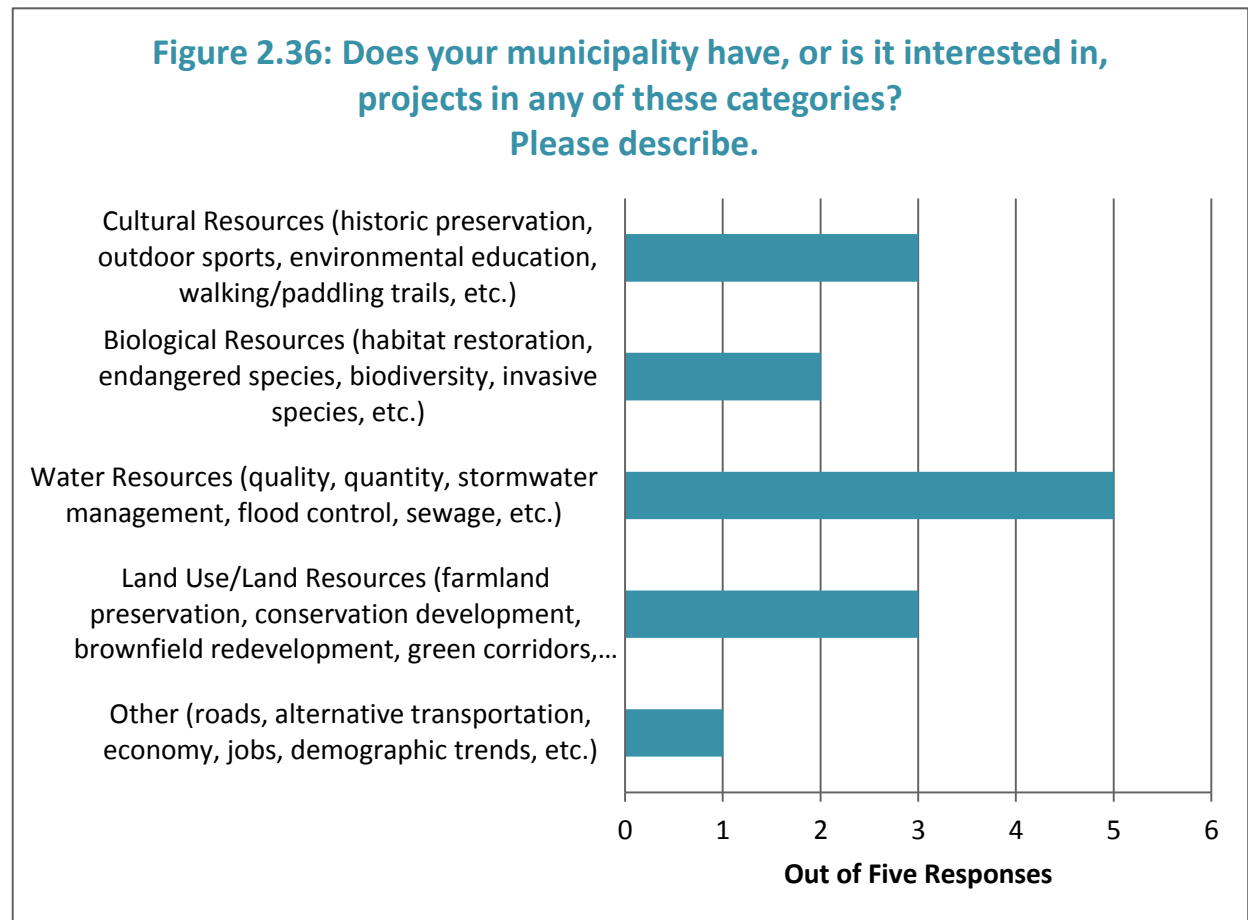


Table 2.9: Do you have any projects, or is your municipality interested in developing any projects related to cultural resources, biological resources, water resources, land use or any other natural resource? If so, please describe.

Municipal interest in watershed projects
"Interested in developing the Tank Farm as a Township Park - it will need water and sewage. Interested in green corridor from Tank Farm to St. Joe Boat Club. Interested in water quality; invasive species control; historic preservation."
"We are working with state grants and other sources of funding to upgrade out township park (Cedar Grove Park) to build a pavilion with restrooms and a food preparation area. We also plan to eventually build a basketball court on the site."
"None pending, but interested in open space planning and green corridors, water quality, flood control, outdoor classrooms, walking & biking trails and road projects."
"Biological resources development or protection would depend on stronger environmental education among residents."

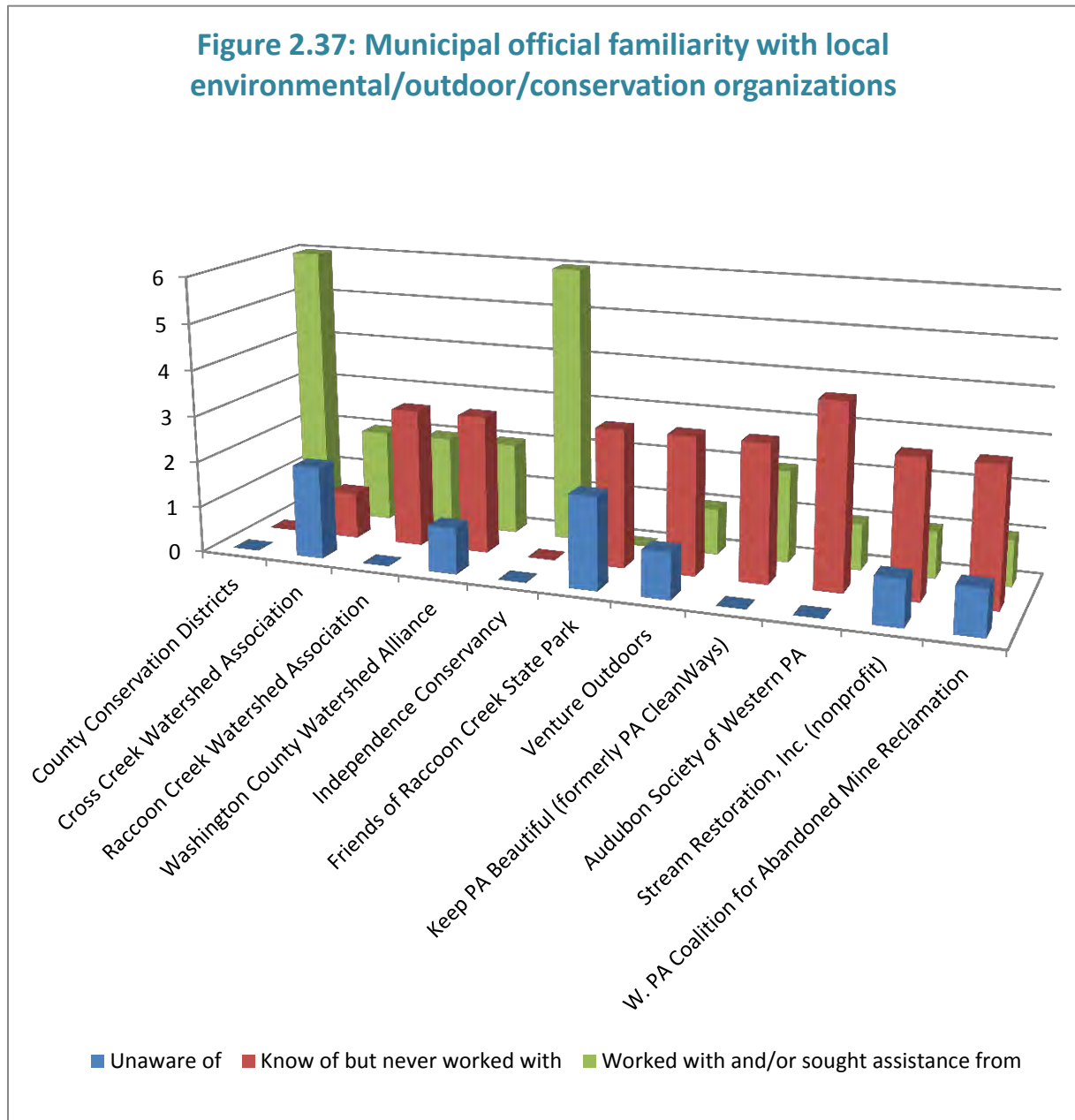


Table 2.10: Do you have any other comments about the Raccoon Creek Watershed or the Raccoon Creek Watershed Conservation Plan not previously addressed?

Other comments
"It will be helpful to residents and those interested in watershed conservation to have an entity they can identify with it, such as Independence Conservancy or Raccoon Creek Watershed Association. Names and faces would help the issues and opportunities resonate."
"Some of the questions should have had a Not Applicable box (16-19)."

Key Person Surveys

The 20D Raccoon Creek Watershed Conservation Plan Steering Committee compiled a list of “Key Persons” with extensive knowledge of the history of the region, its assets, challenges and changes. The Project Facilitator interviewed as many of these Key People as were gracious enough to share their perspectives about the greater Raccoon Creek region. The 20D RCWCP Steering Committee is grateful for their participation."

Although many people were asked to give a Key Person interview, responses were relatively few. Those who provided Key Person Interviews were:

Jeremiah Allen, Waterways Conservation Officer for the PA Fish & Boat Commission; patrolling the Raccoon Creek Watershed for the past three years, addressing fishing and boating violations.

Joseph E. Petrella, Jr., Chairman/Administrator of the Beaver County Agricultural Land Preservation Board since 1994; farming in the Raccoon Creek Watershed for over 40 years.

Kevin A. Gurchak, Manager of Environmental Compliance, Allegheny County Airport Authority, Pittsburgh International Airport; 20 year resident and sportsman.

Patrick Adams, Environmental Education Specialist, PA Department of Conservation & Natural Resources, Raccoon Creek State Park; working within the watershed for the past 22 years.

David Schofield, Director, Meadowcroft Rockshelter and Historic Village; working at Meadowcroft for 20 years. Meadowcroft is not only a tourism attraction; it owns 275 acres near Avella, devoted to conservation and interpretation of historic and modern resources on the property.

John W. Davidson, retired Mine Conservation Inspector, PA Department of Environmental Protection; member of the Raccoon Creek Watershed Association; sportsman who fishes the stream; interested in preservation of undeveloped land with Independence Conservancy.

Matthew Kramer, Wildlife Conservation Officer, PA Game Commission, assigned to Beaver County for the past five years.

Albert F. Moran, Chairman, Independence Conservancy; sportsman for sixty-plus years; hunter safety instructor for over 25 years; student president of Aliquippa High School Conservation, Fishing & Hunting Club in 1949; has been cleaning up the creek for years.

Victoria Carlton, Fire Chief, Potter Township Volunteer Fire Department; resident and fire officer who occasionally uses the stream's water for fire-fighting purposes.

Philip and Rebecca Floyd, owners of Douds-Floyd family vegetable farm in Potter Township; Phil has lived above Raccoon Creek all his life.

Barbara Rupert, educator specializing in Environmental and Agricultural Education. Barb has taught lessons concerning the watershed and enjoys recreation in the region. She is active with the Southside Historical Village in Hookstown.

Compiled Key Person Survey Results

Questions and answers for the Key Person Survey are listed below. Individual responses to the questions have been randomized. Not everyone answered every question in the survey.

Q: Have you noticed good changes in the Raccoon Creek Watershed over time?

"In the 50's and 60's Raccoon Creek had a pH below 4.0 and was devoid of aquatic life from the headwaters to the mouth. Now it supports a diverse aquatic community from the mouth upstream of the Beaver-Washington County line."

"Return of native fish populations (smallmouth bass); increase in waterfowl populations (wood ducks)."

"Mine drainage discharges have been cleaned up; the water is a thousand times better than when it was orange; most places where litter and illegal dumps were removed have remained clean."

"The water used to be milky white with dead fish floating in it and an awful smell. Absolutely good changes!"

"We swam in the creek in the 50's and 60's when the bottom was slimy and yellow but that didn't keep us out. The water is beautiful now."

"The driving cross overs at Todd Road and Gums Run Road were removed years ago to help prevent flooding by allowing water to flow smoother. The Green Garden Road Bridge was replaced after a major flood and raised to also allow the water to flow better."

"Improvements in water quality. Stream bank stabilization and stream restoration improvement projects."

"As a kid, when we would make hay, our arms and clothes would be black by the time we were done. It wasn't soil – it wasn't brown. It was black from chemicals from the factories along the river. There's a lot of cadmium in the soil but no longer all that black coming out of the factories."

"In the short time I have been assigned to Beaver County, I haven't noticed many changes, but the St. Joe Boat Club seems to be busier – more people around."

"Certainly the Cross Creek water quality has improved with the addition of a sewage treatment facility in Avella and the remediation of acid mine drainage in the Avella area. A major change over the last five years would be the development of the Marcellus Shale play throughout the watershed."

"I have experienced both good changes - that being in the water quality itself - and bad changes - in the area near Boggs in Washington County where it still runs orange. I feel that the Independence Marsh and the treatment areas in Washington and Allegheny counties have helped the water quality and reduced the effects of flooding."

"Industrial attitudes and regulations have changed and improved. The cadmium in the soil from St. Joe Lead (Horsehead) is worse than anything we're going to get from Shell."

Q: Have you noticed bad changes in the Raccoon Creek Watershed over time?

"None - general improvement all the way."

"Increase in litter and fires."

"Continued loss of agricultural land for development."

"Don't know where the gas pipelines are going to run or what natural areas they will ruin; lack of money to finish building all the mine discharge treatment systems the creek needs."

"During Hurricane Ivan flooding, the path of Raccoon Creek along Service Creek Road has been rerouted so bad that it may cause more flooding."

"I am concerned about the drilling for natural gas, I am afraid we are trading energy source production for water. I know I can live without natural gas but I know I cannot live without good water."

"I haven't noticed many changes in the short time I have been assigned to Beaver County."

"The fly ash dump for St. Joe Lead/Horsehead took some of the best farmland in Beaver Co. We don't have that much good farmland. It was a big loss to cover that land with flyash."

Q: What do you believe are the three biggest assets of the Raccoon Creek Watershed?

1. "Its ability to support an aquatic community to provide recreational fishing."
2. "Its undeveloped riparian zones for much of its length."
3. "It's large enough for canoes and kayaks much of the year."

1. "Recreation potential"
2. "Wildlife habitat"
3. "Natural beauty"

1. "Recreational assets: Raccoon Creek, Cross Creek Park, Panhandle Trail, Montour Trail."
2. "Rural aspect to majority of the region."
3. "Historic & archaeological resources: Krepps, Hanover-McClurg and Pinebank Covered Bridges; Meadowcroft Rockshelter."

1. "You can get to the creek and enjoy it - just watch you don't get run over by quads! It's great for canoeing, kayaking and edible fish."
2. "It's nature like it should be - it has a back-country feel."
3. "It's wonderful to have Raccoon Creek State Park so close."

"Raccoon Creek provides fishing for young and old anglers, canoeing for all, and water for fire departments due lack of city water in rural areas."

"The recreational assets followed by the individuals like yourself [Vicky Michaels] and John Davidson who work diligently to improve the watershed. Why? Many people use the watershed for recreational purposes."

1. "Public access - allows the public access to a good fishery."
2. "Good fishery – many different and large species of fish are often caught in Raccoon Creek."
3. "Big fishery – large in size with many different types of waters (pools, riffles and runs)."

1. "Access for canoes/kayaks, fishing, swimming; i.e., recreation."
2. "Diversity of wildlife and plants"
3. "Areas of quiet and solitude."

1. "Recreation is the greatest asset to this area. We know that quality of life draws people to the area, having places to fish, swim, boat, and hike keep people healthy and excited about where they live."
2. "Another way to keep people healthy is to have clean water to drink and to use for all of our most basic needs so that is a most pressing need."
3. "Water is not only OUR need but needed for the plants & animals that live in the watershed and downstream. Without the BEAUTY of this green, growing bounty, we would be poor indeed."

Q: What do you believe are the three biggest needs of the Raccoon Creek Watershed?

1. "Continue to improve water quality in the headwaters through the construction of passive treatment systems to treat abandoned mine drainage."
2. "Preserve undeveloped land for future generations."

3. "Minimize the impact of pipelines to prevent forest fragmentation."

1. "Continued monitoring of Acid Mine Drainage."
2. "Identification of species of special concern."
3. "Regulation of shale drilling within the watershed."

1. "We need the watershed protected from those who abuse and pollute - people who put their needs and enjoyment above their knowledge and understanding concerning the negative effects that their actions can have."

2. "It would be beneficial to have more qualified people who could enforce the laws concerning pollution and activities such as ATVs which can cause major erosions problems including unsightly trails and disruption to the flora and fauna."

3. "Having residents and individuals who care about and understand the environmental impact of our human activities who can band together is a powerful weapon against those who are uncaring and under educated."

1. "Continue to improve water quality."

2. "Continue to preserve recreational, rural and historic/archaeological resources of the region."

3. "Manage growth in a way that balances progress with the retention of the rural aspect to the region."

1. "We need more trails and public access to the creek - there need to be places where kids can have fun - more canoe launches if they were taken care of and not left without maintenance."

2. "We need better information about Marcellus Shale activities - where the well pads and pipelines are going to be."

3. "New workers will need housing but we don't need trailer parks infringing on the creek."

1. "Better education to landowners on keeping the water clean and uncontaminated."

2. "Straightening out the bad bends and flood hazards."

1. "Like many watershed groups you need to somehow engage the younger generations; someone will need to carry the ball when you are not able to."

2. "Funding for maintaining existing projects. Money is hard to find, but is it possible to engage the drilling and midstream companies."

3. "To get the PADEP to "buy into the idea" that AMD Projects should be considered mitigation. If this were true companies would look to do more AMD Projects and receive stream credits."

1. "More public access – draws anglers and boaters."

2. "Public boat access – lacks a public boat ramp for motorboats."

3. "Kayak/Canoe portage areas – kayaking is becoming a popular outdoor activity."

1. "Stopping ATV and dirt bike trespass on private property. These people and their machines are destroying land, causing erosion and damaging peoples' property. The police need to enforce trespassing laws."
 2. "Stopping ATV trespassers from abusing new places after construction starts on the Shell cracker plant."
 3. "We need sensible FDA food regulations for production and marketing, especially regarding manure."
-
1. "Controlling water quality."
 2. "Protecting the natural beauty of the creek."
 3. "Controlling building and development near the creek area."

Q: Are you, or is your agency/business, currently involved in any projects or programs that will benefit the Raccoon Creek Watershed? Can you suggest any?

"PA Game Commission has participated in nest box construction along the creek. This program is designed to benefit wildlife through the placement of nest box structures."

"Not directly, but we [Potter Township Volunteer Fire Department] support efforts of our township supervisors."

"The Agricultural Land Preservation Program preserves open space, which in turn keeps ground open for water absorption, rather than developments that cause flooding due to excessive runoff during storms."

"We [Allegheny County Airport Authority] are currently exploring one stream restoration project, but are always open minded to other potential projects."

"None that I am aware of besides law enforcement."

"Meadowcroft preserves and interprets the national historic landmark Meadowcroft Rockshelter and the Pine Bank Covered Bridge. The purpose of the museum is to tell the big story of 16,000 years of a human presence in the upper Ohio Valley and how people have used the natural resources found here to survive and build a better life for their families."

"Independence Conservancy has worked with the local people to clean up tons of tires and garbage from almost every tributary of Raccoon Creek. We also have plans to improve public access to the creek at Rocky Bottom in Potter Township. Our Community Tire Collection Program has been going since 2004 - we've collected and properly disposed over 35,000 tires that could have been thrown over the hills."

"Though I have been highly involved in the past, my involvement currently limited to keeping the garbage off of local roads. All of this trash eventually ends up in our waterways but before

that, it is an eye sore at best. I am also lightly involved with some organizations who advocate for the environment."

"Yes. Independence Conservancy is interested in land preservation and continued access to the stream. Raccoon Creek Watershed Association is interested in water quality improvement through construction of passive treatment systems."

Q: What is your vision for the future of the Raccoon Creek Watershed?

A prosperous, viable region where residents possess a sense of pride and ownership in our natural, cultural and historic resources. Where progress and quality of life are not mutually exclusive.

"I hope to see it preserved for future generations to enjoy, not to be abused."

"Continue the improvement of water quality so the entire watershed can support aquatic life. Preserve as much of the undeveloped land as possible along the main stem."

"Continued growth and renewal."

"That it be the best creek for canoeing; that the farmers can keep farming; that the cracker plant and the Marcellus industry bring good jobs but be careful about places they shouldn't touch with pipelines or well pads or compressor stations."

"With continued education, all of the above listed positives can be kept together for generations."

"Any bottom land, especially Allegheny Loam soils, should remain in agriculture."

"A healthier stream where more areas can be stocked. More canoe launches so that people can see the beauty of the stream. Young people involved with restoring and protecting the watershed."

"Have the foresight to develop new housing without scattering out all the houses so there are no woods to play in. We need to preserve the green spaces – lots of them-we need them everywhere-children need to be able to play in green places as they grow up. A great fishery that is open to the public for their enjoyment, with parking and access near the creek. Clean water is the key."

Q: What topics should be included in the Raccoon Creek Watershed Conservation Plan to make it most useful and relevant?

"Water quality issues; land preservation; commonsense development."

"Water quality; erosion; no business development along the banks."

"Identify all the illegal dumps and places that still need to be cleaned up."

"Identify sites for public recreation in addition to the state park - tourist-friendly places where people can eat or shop or buy gas."

"Identify places that should be preserved and not developed or messed with."

"Education, education, education cannot be stressed enough. The public needs to be more mindful."

"Protection issues, how to protect what we have. Maybe having regular walks or walkers to monitor delicate areas would help."

"Tell people how they can get involved in helping the volunteer groups like yours [Independence Conservancy and Raccoon Creek Watershed Association]. People are looking for ways to get involved. Help them connect. How many more rocks could you move if you had just three more people? Try to get the big corporations like CONSOL and MarkWest involved as partners for mitigation projects."

"A map of legal public access to the creek would be helpful – showing where you can park, whose property is open to the public and what's off limits to the public. It would be very helpful."

"Of great relevance is addressing Marcellus Shale drilling activity."

Q: How can we best engage the public in developing the Raccoon Creek Watershed Plan

"Public meetings; ask for comments on the Independence Conservancy and Raccoon Creek Watershed Association websites."

"Public meetings; direct mail asking for opinions."

"This is a problem in any endeavor you try to do for the public. People want things changed for the better, but no one wants to help. Lots of people have great ideas, but won't help implement them."

"Post information on your website [Independence Conservancy]; have information available at Raccoon Creek State Park; contact sporting clubs and schools."

"Maps/literature with goals and success stories of the Raccoon Creek watershed."

"Perhaps interview those folks who currently use the area."

"Provide progress updates via e-mail, social media and traditional media with opportunity for the public to provide feedback along the way."

"This can be a difficult question but think the best way is to make recreational areas that are highly used and available, picnic areas, open playing fields, trails to hike, creeks to fish and boat."

"The Raccoon Creek could be a wonderful canoeing and kayaking waterway. I am wary of it because of limited access and the many trees that have fallen into the water way causing hazards. I don't know who is responsible for clearing those hazards but I would like to see it made safer."

"When people are invested in using an area they are more likely to help care for it."

Q: Do you have any other comments for the record?

"We need more information up front from the [Marcellus] gas people - not just wait to find out what ends up being built after it's too late to suggest alternatives."

"I would love to see churches involved in stewardship issues; that care for God's creation should be a big part of our worldview."

"How realistic is it to keep farming in Beaver County? Is it fair to make your family live like paupers just so you can farm, especially if your kids attend Central Valley where the kids have everything? Except for hobby farming and people who have other sources of income, farming is dead in this area."

"For the size of your organizations [Raccoon Creek Watershed Association & Independence Conservancy] you guys have done an amazing job on making improvements to the watershed. It speaks to the dedication of the people involved. Why don't schools want to jump in? Hang out with the watershed association volunteers and learn what needs to be done. Finding people in the younger generations who want to help is like pulling teeth. Kids could help through their senior projects."

"When I moved here, more than 30 years ago, I was amazed that with all of the water features, especially the Ohio River, there was no access for residents or sportsmen to utilize it! This has gotten better, but I am still awed by the number of industries that corner the market on river access."

"There are still more threats to the waters and its quality with more industry adding to the brown fields we already had. The hazardous waste plant, WTI, the proposed Shell plant and all of the 'fracking' being done. The economy always seems to upstage protection of our natural resources - consumerism wins the day."

"I'm a happy transplant to this area...grew up in southeastern PA...still awed by the Ohio River. We thrill to hear the spring peepers, dimly the first night, but louder and louder as they ascend the hill from the creek to our farm."



Figure 2.38: The McDonald Family work together to bale hay on their farm along PA Route 151 in Independence Township. David McDonald watches his father David catch a bale as it pops out of the baler, run by Grandpa Wayne McDonald. 6/20/2013. Photo courtesy of the Beaver County Times.

Appendix 2.1: Public Comments Received

The following is a compilation of quotes received from stakeholders in response to the draft version of the 20D Raccoon Creek Region Conservation Plan. Input was gathered by various means: at public presentations by the Project Facilitator, from phone calls or conversations with the Project Facilitator or Steering Committee members, or from written or emailed comments received through Independence Conservancy's website.

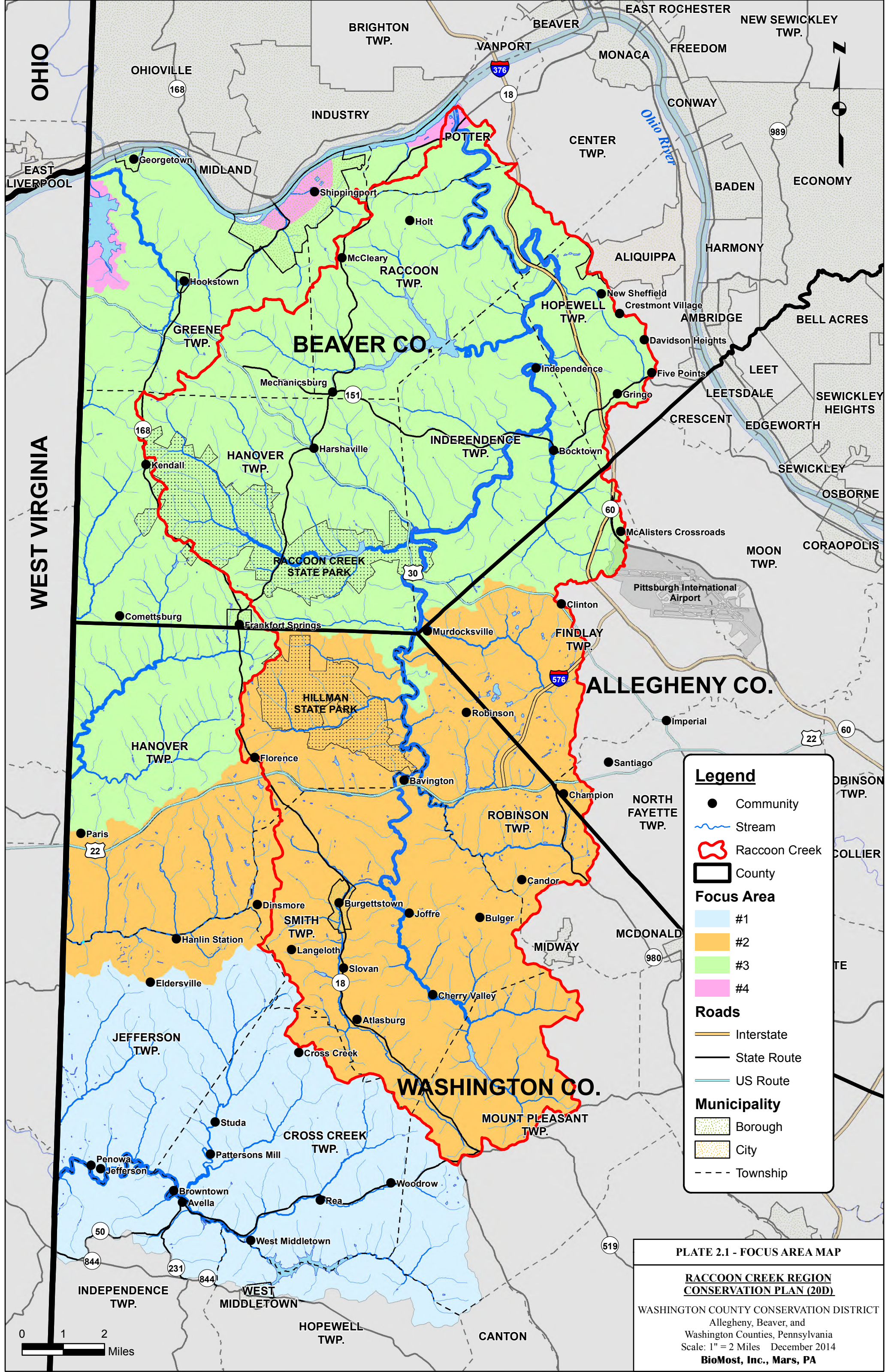
Connect Raccoon Creek State Park and Hillman State Park by preserving the closed Paris landfill near Clinton-Frankfort Road.
Provide a green corridor for wildlife movement within the Starpointe Industrial Park by preserving the stream corridor feeding Harmon Creek Lake, connecting it to State Game Lands 117.
Wonderful maps – very well done!
I haven't had time to read it all but what I've seen is a great job.
This is so comprehensive and well-researched. Thank you for all your hard work!
I must say I am overall very impressed by the amazing amount of information and consideration that went into this effort, even if the response from the general public and public officials was disappointing.
I enjoyed reading it – and I learned a lot!
I love the thorough discussion of AMD! How about a map of the affected areas? Something which highlights the streams considered impaired by AMD. I don't know how up to date or complete this information is.
Overall this is a great report! Thank you!
I would include a little discussion of the American Chestnut reintroduction program using trees that are 97 1/2% American 2 1/2 % Chinese.
Ponds you remark are typically man made after discussing Lakes. Actually all your Lakes are man-made -- really reservoirs. I believe the only natural lakes in PA are the result of something a glacier did and we are too far south. A natural lake has it warm and cold water turn over in the fall at least in temperate areas.
I think DEP/DCNR will confirm that statewide the biggest loss of wetlands is to flooding! This is somewhat distorted by the Poconos where so many swamps have been turned into ponds and lakes for vacation home developments or to enhance individual dream homes. Even here many farm ponds replaced "useless wetland areas". And many wetland replacement projects have much more open water than the wet meadows, seep areas shrub swamps they were supposedly replacing - the popular Padot Mayview Wetlands being a prime example.
These may pale compared to AMD in your area, but my memory is there is a huge backlog of leaking abandoned oil and gas wells, and progress on plugging them is very slow with only the most dangerous relative few getting done each year. Couldn't this be expanded a bit, or is this mostly to the north of you. A Hopewell teen huffed himself to death at an abandoned well not long ago.

Worthwhile project indeed. I look forward to digging into the details of the history over the winter when I have more time. Well done Vicky, thanks.

I don't know much about conservation plans, their purpose, who they pertain to , etc. I just have a very general knowledge. As I understand it, it's an admirable and important (vital even?) pursuit. I think the folks who've spent good portions of their lives here take it for granted that "of course we want this place to stay the way it is" and maybe don't see all the threats and encroachments to that. Seems like we're naturally a people who want to be left alone and have things left alone

Section 2: PLATES

Plate 2.1: Focus Area Map of the 20D Raccoon Creek Region



Legend

- Community
- ~ Stream
- ⬮ Raccoon Creek
- ▭ County

Focus Area

- #1
- #2
- #3
- #4

Roads

- Interstate
- State Route
- US Route

Municipality

- ▨ Borough
- ▨ City
- - - Township

PLATE 2.1 - FOCUS AREA MAP

RACCOON CREEK REGION CONSERVATION PLAN (20D)

WASHINGTON COUNTY CONSERVATION DISTRICT
 Allegheny, Beaver, and
 Washington Counties, Pennsylvania
 Scale: 1" = 2 Miles December 2014
BioMost, Inc., Mars, PA



Section 3: Land Resources

Introduction

The 20D Raccoon Creek Region is rich in resources: choice farmland, abundant timber, reserves of coal, sand & gravel, gas and oil. In the 19th Century these natural resources helped to build the industrial might of the greater Pittsburgh area. During the Second World War, coal, zinc, synthetic rubber and petrochemicals produced in the Raccoon Creek Region were crucial to the Arsenal of Democracy and the ultimate victory of the Allies.

This section of the 20D Raccoon Creek Region Conservation Plan provides a comprehensive overview of available information relating to the geology, soils, ecoregions, land use, property ownership, hazardous areas and energy resources in the 330-square mile Region. Although the text provides explanations, the reader is urged to study the eleven plates which are found at the end of this section. They provide a graphic guide to the land features of the Region. “Plate 3.11: Energy Resources” illuminates our industrial history, shows development trends in unconventional gas extraction and possible future impacts to our economy, environment and landscape.

Much of the economy and overall sustainability of the communities in the Raccoon Creek Region is still based on land resources. The advent of the shale gas extraction industry is bringing new development, opportunities and challenges to the Region. As new industries develop, it is imperative that we avoid repeating mistakes of the past by using resources wisely, protecting ecologically sensitive areas and consolidating disturbances to preserve the quiet rural character our residents have clearly stated they cherish.

We must also address the legacy effects of abandoned mines, oil and gas wells from the era before regulations were enacted to protect our environment. Pollution from these sites significantly degrades both land and water resources in much of the Raccoon Creek Region.

Geology

Geology is the science and study of the rocks that comprise the Earth and the processes which cause the formation, movement and changes in the rocks. The landscape in Western Pennsylvania today is a reflection of the natural processes that have been occurring for millions of years and the impacts of man primarily in the last three centuries.

Physiographic Provinces and Sections

As noted in “Section 1: Project Area Characteristics,” Pennsylvania has six physiographic provinces which display distinctive landscapes and geologic features. These physiographic provinces have been divided into twenty-three sections with similar geologic features and climate on a smaller regional scale. According to the Department of Conservation & Natural

Resources (DCNR) classification system, the 20D Raccoon Creek Region is located in the Appalachian Plateau Province and covers two sections, the Pittsburgh Low Plateau Section and the Waynesburg Hills Section. These are illustrated in Figure 3.1.

Pittsburgh Low Plateau Section

The majority (230.8 square miles) of the 20D Raccoon Creek Region lies in the Pittsburgh Low Plateau Section.¹ This physiographic section was not glaciated and is characterized by a smooth undulating (rolling) upland surface cut by numerous, narrow, relatively shallow valleys. The uplands are developed on rocks containing the bulk of the significant bituminous coal in Pennsylvania. The landscape reflects this by the presence of some operating surface mines, many abandoned strip mines and reclaimed stripped areas. Local relief, the variation between valley bottoms and upland surfaces, may be as much as 600 feet. Valley sides are usually moderately steep except in the upper reaches of streams where the side slopes are fairly gentle. Elevations range from 660 to 1,700 feet. Some of the land surface in the southwestern part of the Section is very susceptible to landslides.²

Waynesburg Hills Section

The remaining 99.7 square miles of the 20D Region lies within the Waynesburg Hills Section.³ Topography in this section is very hilly with narrow hilltops and steep-sloped, narrow valleys. The local relief is typically 600 to 1000 feet. Elevations range from about 800 to 1,700 feet. Some of the land surface of the Waynesburg Hills Section is very susceptible to landslides.⁴



Figure 3.1: A sugar maple tree clings to a sandstone and shale outcropping along the Raccoon Creek floodplain at the Wildflower Reserve, 4/24/2006.

¹ GIS compiled from data collected by the Southwest Pennsylvania Commission and PASDA.

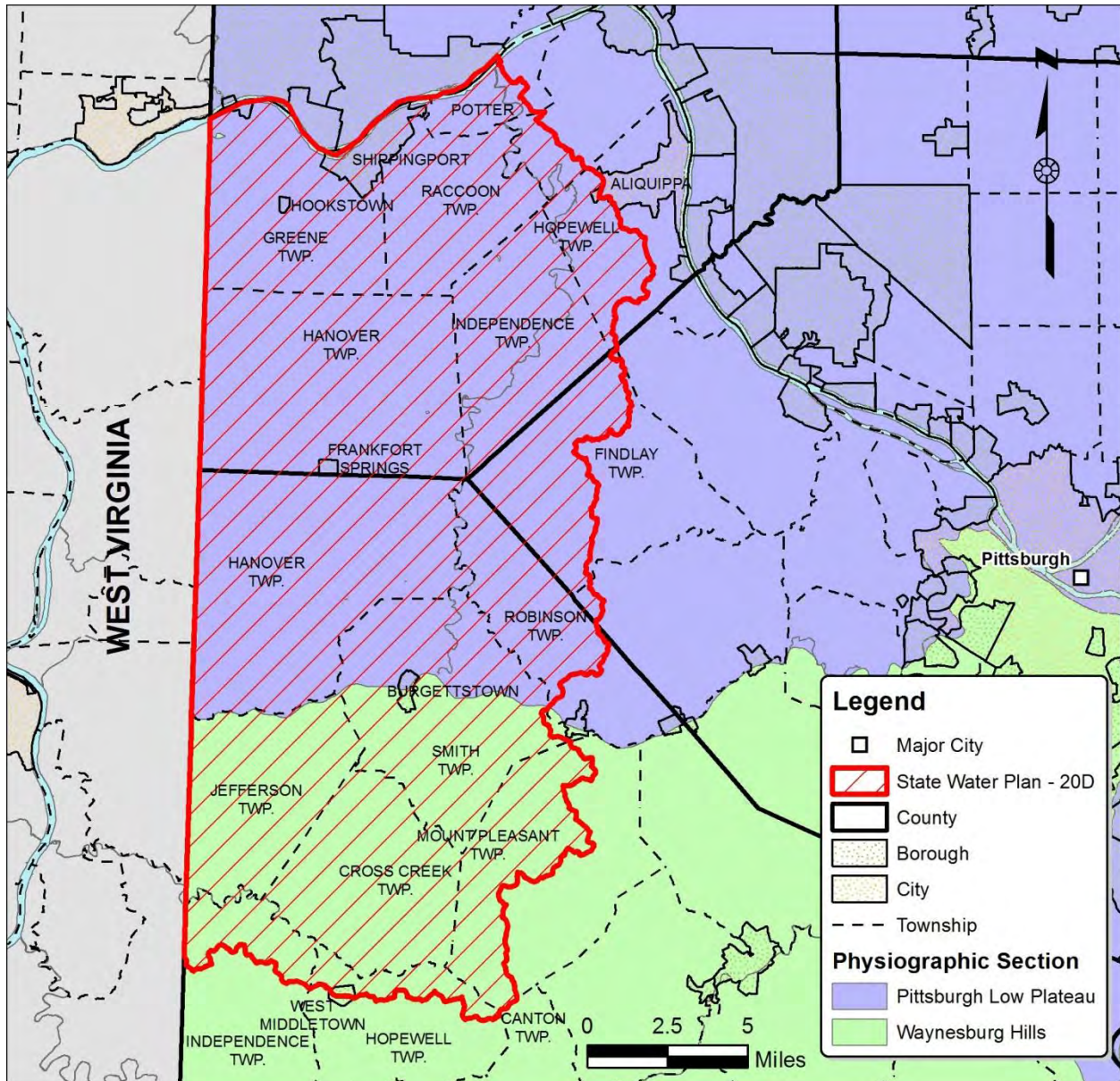
² DCNR, Pittsburgh Low Plateau Section, Appalachian Plateaus Province, available at <http://www.dcnr.state.pa.us/topogeo/field/map13/13ppls/index.htm>; accessed 7/13/2014.

³ GIS compiled from data collected by the Southwest Pennsylvania Commission and PASDA.

⁴ DCNR, Waynesburg Hills Section, Appalachian Plateau Province, available at <http://www.dcnr.state.pa.us/topogeo/field/map13/13whs/index.htm>; accessed 7/13/2014.

An outstanding scenic geological feature of the Waynesburg Hills Section is Meadowcroft Rockshelter near Avella. Please see "Section 6: Cultural Resources" for detailed description of this site - the oldest-known human habitation in North America, dating back 16,000 years.

Figure 3.2: Physiographic Sections of Pennsylvania



Bedrock

Bedrock is the “solid” rock material that underlies the soil. In western Pennsylvania, the bedrock near the surface is composed of sedimentary rocks. Sedimentary rocks are formed from the deposition (or settling) and accumulation of sediments, chemical precipitates (solids from chemical reactions), and/or organic (plant or animal) matter in an ocean, lake or river. Over long periods of time and under great pressure these layers of sediments compact and cement together, turning into layers of rock. The most common sedimentary rocks found in Western Pennsylvania are shale, mudstone, claystone, siltstone, sandstone, conglomerate, limestone and coal.

Rock layers, also known as beds, are characterized and named using a complex system which first divides the rocks into units of time on the geologic time scale (please see Table 3.1) when they were first formed. These units of time include a supereon, eons, periods or systems, series or epochs, and ages. In general, and especially when talking about sedimentary rocks, the younger rocks are on top of older rocks because newly created sediments are deposited upon older sediments. Often the rock layers within a period or system are further classified into groups, formations and then finally individual layers called beds. Names for these layers are often based upon their rock type - sandstone, limestone or coal – and by the name of a place such as Pittsburgh where the rock layer was first identified or has the best exposure.

In the Raccoon Creek Region, rock layers of the near-surface bedrock were generally deposited during one of two geologic time periods - the Carboniferous Period or the slightly more recent Permian Period. Much of the Region’s bedrock was deposited during the Pennsylvania subperiod (about 300 to 320 million years ago) of the Carboniferous period (about 300-360 million years ago). In the southern part of the watershed, a smaller portion of the near-surface bedrock was deposited during the slightly younger Permian Period (about 250 to 300 million years ago). Major geologic time periods in Pennsylvania are charted on the Geologic Time Scale in Table 3.1. Geographic locations of surface rock layers are shown on the map in Figure 3.3.

The Carboniferous and Permian Periods are both part of the Paleozoic era, about 250 to 540 million years ago. The Paleozoic era is part of the Phanerozoic eon, the current geologic eon spanning the last 540+ million years. All geologic time prior to the Phanerozoic eon is often referred to as the Precambrian eon. The Precambrian consists of the Proterozoic, Archean and Pre-Archean Eons. It makes up nine-tenths of the estimated time span of Earth’s history.⁵

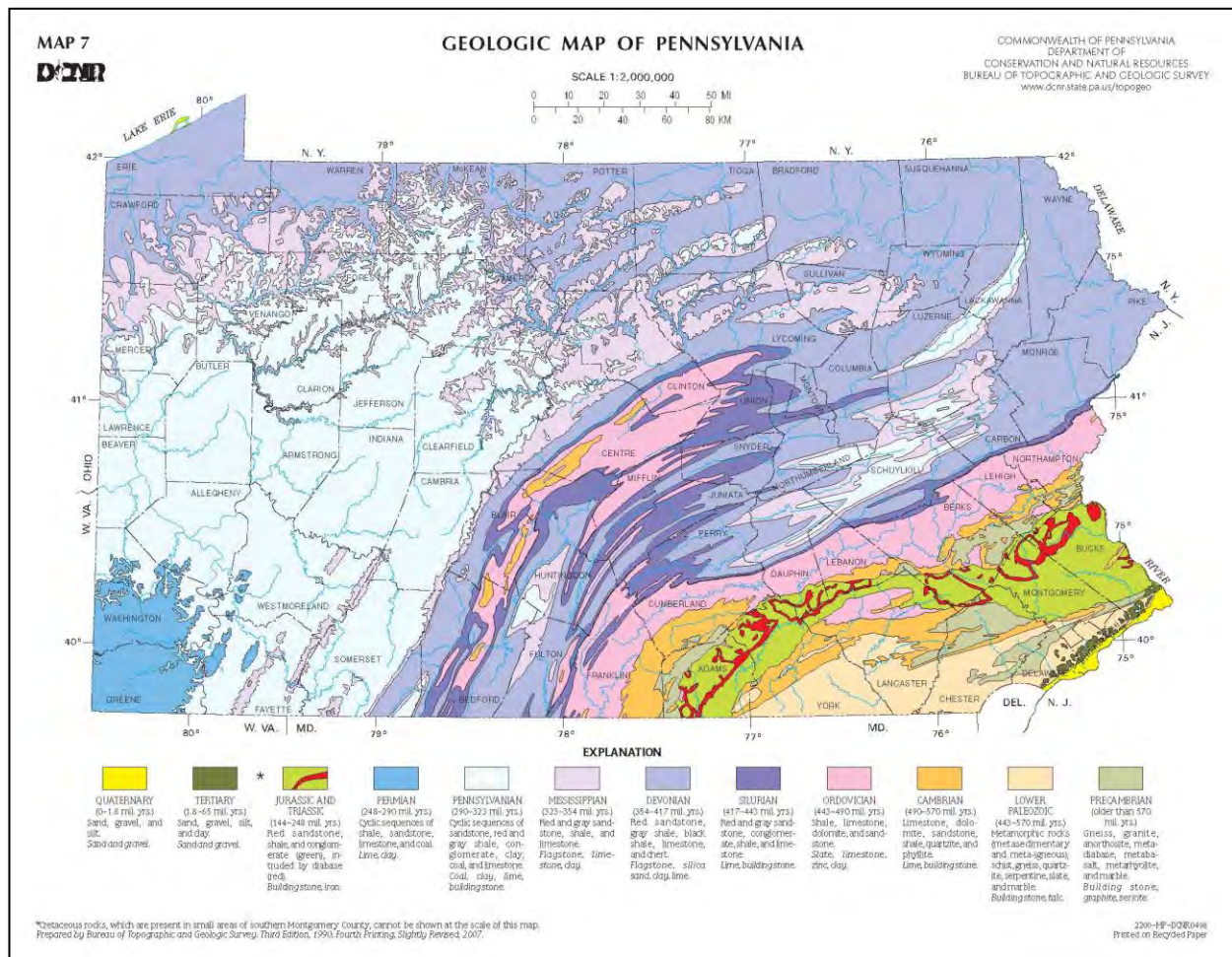
⁵Orndorff, Randall C., U.S. Geological Survey, *Divisions of Geologic Time—Major Chronostratigraphic and Geochronologic Units: Fact Sheet*, 2010 (accessed August 23, 2014); available from <http://pubs.usgs.gov/fs/2010/3059/pdf/FS10-3059.pdf>

Table 3.1: Geologic Time Scale in Pennsylvania

GEOLOGIC TIME SCALE in PENNSYLVANIA					
Years Ago	Era or Eon	Period	Activity Affecting Pennsylvania	Main Rock Types or Deposits in PA	Dominant Life Forms in Pennsylvania
0 to 1.8 million	Cenozoic Era	Quaternary	Glaciation; periglacial erosion and deposition	Sand, silt, clay, gravel	Mammals, including humans
1.8 million to 66 million		Tertiary	Weathering and erosion; creation of present landscape	Sand, silt, gravel	Mammals, grasses
66 million to 146 million	Mesozoic Era	Cretaceous	Erosion and weathering	Clay, sand	Dinosaurs, mammals, birds
146 million to 200 million		Jurassic	Diabase intrusions; opening of Atlantic Ocean	Diabase	Dinosaurs, mammals, birds
200 million to 251 million		Triassic	Separation of North America from Africa; sedimentation in rift valley	Shale, sandstone, diabase	Dinosaurs, early mammals and birds
251 million to 299 million	Paleozoic	Permian	ALLEGHANIAN OROGENY: Collision of Africa and North America; mountain building, thrust faulting and folding; much erosion	Sandstone, shale	Insects, amphibians, reptiles
299 million to 359 million		Pennsylvanian and Mississippian (Carboniferous)	Alluvial deposition; eastward advance of shoreline followed by development of low, flat alluvial plain	Sandstone, siltstone, shale, coal, limestone	Trees, ferns, amphibians, air breathing mollusks, insects
359 million to 416 million		Devonian	ACADIAN OROGENY: Collision of Avalonia, Europe and North America; formation of Catskill Delta	Conglomerate, sandstone, shale	Fish, amphibians, insects, land plants
416 million to 444 million		Silurian	Erosion of mountains; deposition of sand and mud	Conglomerate, sandstone, limestone	Corals, fish
444 million to 488 million		Ordovician	TACONIC OROGENY: Thrusting of volcanic arc; development of Appalachian Basin	Shale, limestone, dolomite	Molluscs, bryozoan, graptolites
488 million to 542 million		Cambrian	Transgression of the sea; carbonate deposition	Limestone, dolomite, quartzite	Trilobites, brachiopods
542 million to 2.5 billion	Proterozoic Eon		Accretion of microplates to form Laurentia	Schist, slate, marble	Blue-green algae, jellyfish, worms
2.5 billion to 4 billion	Archean Eon		Bombardment by meteorites and comets; creation of continental crust	None identified	Bacteria
4 billion to 4.5 billion	Pre-Archean Eon		Formation of Earth and solar system	None identified	None identified

Modified from Barnes, J. H., and Sevon, W. D., 2002, The Geological Story of Pennsylvania (3rd edition): Pennsylvania Geological Survey, 4th series, Educational Series 4, 44 pages.

Figure 3.3: Geologic Map of Pennsylvania⁶



During the Pennsylvanian period, what is now western Pennsylvania was actually situated near a giant sea or ocean approximately 5-10 degrees south of the equator. The warm, moist, tropical climate provided ideal conditions for vigorous plant growth which produced an enormous amount of biomass. At times, the area contained wetlands such as swamps, bogs, and fens. Because the soils drained poorly in these wetlands, dead plant matter accumulated, up to tens of feet in thickness, in an anoxic (no oxygen) environment. This dead plant matter gradually turned into peat.

At other times, the same land area was covered by the sea. The shoreline of the sea underwent cycles of transgression (sea level rise) and regression (sea level fall) across what is now western Pennsylvania. These cycles changed the depositional environment and determined whether layers of peat, sand, silt, clay, or seashells, etc., were being deposited. Passing time and

⁶ Pennsylvania Department of Conservation and Natural Resources, Map 7, Geologic Map of Pennsylvania, 2007; accessed August 5, 2014; available from http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_016205.pdf

increasing pressure from the subsequent layers of sand, silt and clay forced volatile compounds to vaporize from the peat. As the process continued, carbon left behind in the peat was concentrated, transforming it into the rich coal reserves found in the Raccoon Creek Region today.

Over geologic time, the remains of sea shells, clams, coral, etc. and chemical precipitates of calcite and dolomite became limestone. Large and small siliciclastic sediments such as sand, silt and clay were cemented into the layers of sandstone, siltstone, claystone and shales.⁷ Please refer to “Plate 3.1: Bedrock Geology” for a detailed map of bedrock formations in the Raccoon Creek Region.

By the end of the Pennsylvanian subperiod, the marine sea was completely regressed from western Pennsylvania. During the Permian Period, a dramatic change occurred when North America and Africa collided, resulting in the creation of mountains we know today as the Alleghenies. This mountain-forming process is called the Alleghanian Orogeny. As the Allegheny Mountains eroded, large amounts of sediments were carried away and deposited in what is now Western Pennsylvania. Little evidence remains of these sediments as most were also eroded away. However, some rock layers of the Permian Period do still remain in southwestern Pennsylvania.

Geologists describe layers of rock to identify the locations of coal, road building materials and other resources in the subsurface. Sequences of rock layers that are distinctive to a specific depositional environment, that extend over a substantial area, and that can be mapped are called “formations.” In the Raccoon Creek Region, eight distinct geologic formations are found. Depending on the elevation and orientation of the rocks, these formations lie just below the soil, or are exposed in outcrops at the ground surface. As with individual rock beds, each formation is typically named for the geographic area with the best exposure or where the formation was first described.

Raccoon Creek’s eight geologic formations are, from youngest to oldest: Greene, Washington, Waynesburg, Uniontown, Pittsburgh, Casselman, Glenshaw and Allegheny. The Allegheny Formation is sometimes divided into the Freeport, Kittanning and Clarion Formations. The Uniontown and Pittsburgh Formations are sometimes combined and referred to as the Monongahela Group. Because the bedrock dips or “tilts” very generally to the southwest, the youngest formations (Greene, Washington and Waynesburg) crop out in the southernmost portions of the Raccoon Creek Region and the oldest formation (Allegheny) crops out in the northernmost portion. The various formations and their orientations are depicted in “Plate 3.1: Bedrock Geology.” Major features of the formations are summarized in Table 3.2 on page 9.

⁷ Barnes, John H. & Sevon, W.D., *The Geological Story of PA, 4th Series*, 2002 (accessed June 14, 2010); available from: www.dcnr.state.pa.us/topogeo/education/es4.pdf

Table 3.2: Geologic Groups and Formations of the 20D Raccoon Creek Region⁸

Group Name	Formation Name	Thickness (in feet)	Major Features	Approx. % Coverage of 20D Region
Dunkard Group	Greene Formation	700-800	Poorly developed coals and limestone. Stratigraphic details and continuity of individual beds are presently not well understood.	< 1%
	Washington Formation	160-270	Distinguished by three widespread limestone units at top, middle and base of the formation: Upper, Middle & Lower Washington limestones. Contains the Washington coal.	~5%
	Waynesburg Formation	85-210	Thickness of the formation increases from northwestern Washington County southward into Greene County. Contains the Waynesburgh coal.	~8%
Monongahela Group	Uniontown Formation	270-400	Consists mostly of thin-bedded sandstones, but also contains siltstones and shales that may grade laterally into bedded limestones or cherty limestone. Contains the Little Waynesburg and Uniontown coals.	~25%
	Pittsburgh Formation		Upper portions consist mostly of inter-layered beds of limestone and calcareous mudstone. The Pittsburgh sandstone sits above the Pittsburgh coal and can be up to 80 feet thick. At the base is the Pittsburgh coal seam which can range from 4 to 10 feet thick; is uniquely persistent with consistently high quality and low sulfur content; is one of the most valuable coal beds in the world; has been widely used for metallurgical purposes. Also contains the Sewickley, Redstone, and Fishpot coals.	
Conemaugh Group	Casselman Formation	230-485	Bottom portion is of marine origin and represents the last known coverage of the ancient sea during the Paleozoic Era. Above the marine zone, rocks are exclusively freshwater deposits of claystone, limestone, sandstone, shale and coal. Red beds are scattered throughout the formation. Casselman is one of the least studied formations of the Pennsylvanian period because it lacks economically important rocks and significant fossil zones.	~39%
	Glenshaw Formation	280-400	Characterized by a cyclic sequence of shale, sandstone, red beds, with thin limestone and coal. The Pittsburgh red beds are a 40-60 foot rock layer composed of mostly reddish, greenish and grayish claystones that easily weather and are known to be unstable. They are often a major cause of landslides.	~19%
Allegheny Group	Allegheny Formation	270- 330	Characterized by repetitive cycles of sandstone, shale, claystone and coal with occasional limestone. Home to six major valuable coalbeds: Upper & Lower Freeport, Upper, Middle & Lower Kittanning, and Brookville-Clarion at the base of the formation. Contains commercially valuable claystones mined for bricks and pottery; contains the Vanport limestone. Coal and limestone beds are generally too deep to be economically mined in most of watershed.	~3%

⁸ Shultz, Charles H, ed. The Geology of Pennsylvania. Harrisburg, PA: Pennsylvania Geological Survey, 1999; and Berg, T. M., et. al., Pennsylvania Department of Conservation and Natural Resources, Pennsylvania Geological Survey: Digital Bedrock Geology, 1980 (accessed June 14, 2010); available from <http://www.dcnr.state.pa.us/topogeo/map1/bedmap.aspx>

The Geographic Information System (GIS) data used to create “Plate 3.1: Bedrock Geology” was obtained from the Pennsylvania Bureau of Topographic and Geologic Survey of the Department of Conservation and Natural Resources (DCNR). According to the meta-data associated with the file, the data for the geologic units was primarily digitized from the 1980 Geologic map of Pennsylvania that was developed by the Pennsylvania Geological Society along with other source material. The meta-data advises against creating maps at scales finer than 1:250,000. Therefore, the depiction of bedrock geology in Plate 3.1 is provided as a generalized overview of the geology of the Raccoon Creek Region and should not be used as a definitive location of specific rock sequences. Field verification of specific beds is always recommended.

Surficial Material

In layman’s terms, surficial material is the dirt or soil that we walk on, dig in, build on, and farm. Surficial material sustains all life on Earth! Scientifically, surficial material is defined as the unconsolidated material lying on top of the bedrock and consisting of residual, alluvial, glacial, or human influenced deposits. It is typically unstratified (lacks layers) and is the most recently deposited material in terms of geologic time. Based upon current understanding of geology in Pennsylvania, the Raccoon Creek Region does not have any surficial glacial deposits.

Surficial material of the Raccoon Creek Region consists of soil, alluvium, colluvium and human influenced material. Alluvium is a general term for clay, silt, sand, gravel, cobbles, etc. that was deposited relatively recently, in respect to geologic time, by flowing water (streams). Alluvial material is typically found lining stream beds and in floodplains. Loose rocks, rounded cobbles and clay in the bed and banks of streams are examples of alluvial material. Colluvium is a general term for a mass of soil or rock fragments that have collected at the base of a hill due to weathering or gravity. Of course, there is also man-made or human-influenced surficial material. This would include roads, pavement, concrete, mine spoil, coal refuse and other miscellaneous materials.

Overview of Soils

Soils are more than just dirt! The nature of soils determines what types of plants can grow in a given area. Plants, in turn, determine the types of insects and animals that the environment can support. Soils play five key roles in any ecosystem:

- First, soils support plant growth by providing a medium and a source of elements essential to plant growth.
- Second, soil properties affect the loss, utilization, contamination and purification of water.
- Third, soils recycle dead plant and animal matter, making the nutrients available to other organisms.
- Fourth, soils provide a habitat for a wide range of organisms from microscopic bacteria to large mammals.

- Fifth, soils are an important engineering medium for humans, supporting activities like the construction of roads, buildings, ponds and other structures. As soils play a key role in the ecosystem function, soils can be utilized to help determine the appropriate land use.⁹

General Soils Associations

Soils are formed from the weathering of the underlying bedrock and the breakdown of surficial materials – alluvial and/or abandoned mine spoil.¹⁰ According to the Soil Society of America, soil is, “The unconsolidated mineral or organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants.” Soils are classified and named based on their physical and chemical properties. There are five major factors in the soil formation process: parent material (bedrock, glacial material, etc.), climate, biota, topography and time. Each plays an important role in soil formation. Soil, therefore, is site-specific or region-specific as each variable will change from one area to the next.

Soil Limitations and Suitability

Soils play an important role in determining how a landscape can be used. Every soil type has a different set of chemical and physical properties that can help determine the most suitable uses for the site - not only for farming but also development of residential subdivisions, industrial parks, roadways, etc. By examining the limitations and suitabilities of soils, better decisions can be reached regarding appropriate uses of land.

The USDA NRCS has published soil surveys for most of the United States. A soil survey is a detailed report on the soils of an area. It has maps with soil boundaries and photos, descriptions and tables of soil properties and features. Soil surveys are used by farmers, real estate agents, land use planners, engineers and others who desire information about soils.¹¹

The USDA NRCS soil surveys can be accessed online at <http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>, or by visiting the nearest county NRCS office. In the Raccoon Creek region, the USDA Local Service Center is located at 2800 North Main Street, Washington PA; phone 724-222-3060 ext 107. Rennie Stoy is the District Conservationist.

“Plate 3.5: Building Suitability” maps the Region according to building suitability based on soils. It is worth noting that very few places in the Region are “not limited.” Know your soil before you build!

⁹ Brady, Nile C., & Weil, Ray R., *The Nature and Properties of Soils* (Alexandria, VA: Prentice Hall, 2001).

¹⁰ Soil Science Society of America, *Glossary of Soil Science Terms*, n.d., available from <https://www.soils.org/publications/soils-glossary#>; accessed on 7/13/2014.

¹¹ USDA NRCS Web Soil Survey, available at <http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>, accessed 7/13/2014.

Unstable Soils

Soil stability is dependent on a number of factors including slope, relative wetness or dryness, vegetation cover and soil texture. Organic matter in the soil acts as a “glue” and helps enhance stability, while clay in the soil reduces stability due to expansion and contraction when wetted or dried. Generally speaking, the more water present and the greater the slope, the less stable the soil. As rainfall and soil moisture vary from place to place, slope can provide a quick determination of soil stability. Some indicators can be observed in the field which will point to unstable soils: pistol-butted trees (trunks greatly curved near the ground), tipped trees, or tension cracks in the soil.¹²

Although most of the known landslides in western Pennsylvania have occurred since World War II, sliding certainly is nothing new in the area. The Monongahela River is named for the Native American word "Menaungehilla" which means "river with the sliding banks" or "high banks, which break off and fall down."¹³

“Plate 3.6: Erodible Land” maps the Raccoon Creek Region based on the erosion potential of soils. Note that, because of terrain, much of the Region is considered moderately to severely erodible. The Ohio River Slopes in Potter and Greene Townships are clearly indicated as the only areas in the Region being very severely prone to erosion, more so than any other place in the entire 330-square mile Region. Earth disturbances or vegetation removal on these slopes should be avoided.

Soil pH

Soil pH is a measure of acidity or alkalinity present within the soil. Soil pH is one of the characteristics that are important in selecting crops and other plants, evaluating soil amendments for fertility and stabilization, and determining the risk of corrosion to certain materials.¹⁴

“Plate 3.7: Soil pH” clearly shows that soils become increasingly acidic moving northward and downstream through the Raccoon Creek Region. This is due to the chemical composition of the rocks underlying the area.

Hydric Soils

According to the Natural Resources Conservation Service (NRCS), a hydric soil is one that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic (airless) conditions in the upper part. The concept of hydric soils includes soils developed under sufficiently wet conditions to support the growth and

¹² Rossiter, D. G. University of Twente - The Netherlands: Dept. of Geo-Information Science and Earth Observation, Chapter 10 - Slope Stabilization, n.d. ,available from http://www.itc.nl/~rossiter/Docs/FM5-410/FM5-410_Ch10.pdf; accessed 7/13/2014.

¹³ The Pittsburgh Geological Society, Landsliding in Western Pennsylvania, available at <http://pittsburghgeologicalsociety.org/landslide.pdf>; accessed 7/13/2014.

¹⁴ USDA NRCS, Web Soil Survey, available at <http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>; accessed 7/13/2014.

regeneration of hydrophytic (water-loving) vegetation. Soils that are wet because of artificial measures are included in the concept of hydric soils.

The national list of hydric soils is maintained in the National Soil Information System (NASIS) database developed by the National Technical Committee for Hydric Soils. Hydric soil lists have a number of agricultural and nonagricultural applications. These include assistance in land-use planning, conservation planning and assessment of potential wildlife habitat.

A combination of hydric soil, hydrophytic vegetation and hydrology (water moving through the soil) must all be present in an area for it to be correctly classified as a jurisdictional wetland, a wetland over which the PA DEP or the US Army Corps of Engineers has authority.¹⁵ Please see “Plate 3.8: Hydric Soils.”

Drainage Class

Drainage class is the natural, undisturbed drainage condition of the soil. Drainage class refers to the frequency, duration and amount of water in soils. There are seven drainage classes that range from excessively drained to very poorly drained.¹⁶ Drainage classes indicate, among other things, whether crops can be grown or if an area is likely to be a wetland. Please refer to “Plate 3.9: Soil Drainage Class.”

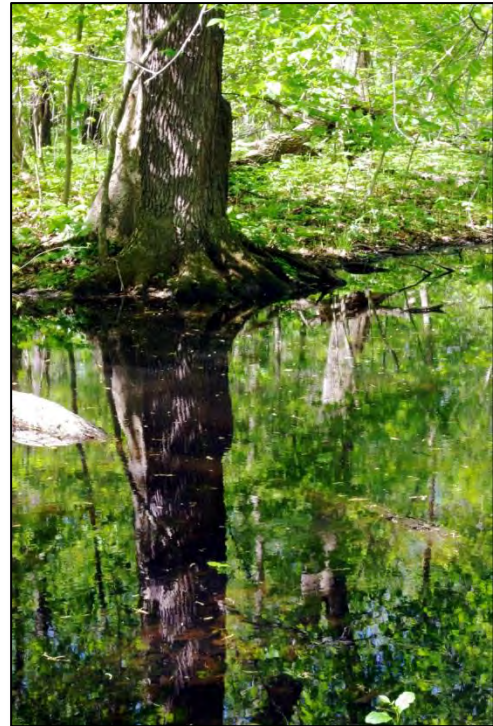


Figure 3.4: A vernal pool at the Wildflower Reserve, 5/6/2010.

Ecoregions of the 20D Raccoon Creek Watershed

An ecoregion, or ecological region, is typically a large area of land or water with similar ecological and geographical characteristics throughout. The plants, animals and ecosystems that exist in a particular ecoregion are distinct from those of other ecoregions. As can be expected in the natural world, defining ecoregions is not an exact science. Ecoregions do not usually have distinct edges and therefore can blend together as they transition from one to another. Transition zones between ecoregions are sometimes referred to as “ecotones.”

Various ecoregion classification systems exist, created by different organizations for different purposes. Many of these classification systems overlap one another, have similar names,

¹⁵ USDA NRCS, Hydric Soils, available at http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/use/hydric/?cid=nrcs142p2_053961; accessed on 7/13/2014.

¹⁶ ESRI, ArcGis Resources, Soil Hydrology, available at <http://resources.arcgis.com/en/communities/soils/02ms00000008000000.htm>; accessed 7/13/2014.

and/or provide essentially the same information, but with some differences resulting from the scale and geography of the areas described.

Three ecoregion classification systems will be used to characterize the 20D Raccoon Creek Region using information from the following organizations:

- US Forest Service (USFS)
- World Wide Fund for Nature (WWF), formerly known as World Wildlife Fund
- US Environmental Protection Agency (USEPA)

The USFS and WWF classifications will be summarized briefly; the USEPA classification will be described and illustrated in greater detail.

US Forest Service: Ecoregion 221, Eastern Broadleaf Forest (Oceanic) Province

The US Forest Service ecoregion classification divides the land into regions called Domains based upon generalized climate conditions. Domains are then subdivided into Divisions and Provinces based upon dominant vegetation and other characteristics.¹⁷

According to the USFS system, the Raccoon Creek Region lies within the 221 Eastern Broadleaf Forest (Oceanic) Province of the 220 Hot Continental Division, of the Humid Temperate Domain. This ecoregion covers 104,500 square miles and includes the Appalachian Plateaus, New England lowlands, mid-Atlantic coastal plain and Piedmont Plateau.

Major components of the USFS Ecoregion 221 description include:

- Topography of diverse nature and origin with hilly, mountainous, dissected landforms.
- Altitudes range from 1,000 to 3,000 feet.
- Strong annual temperature cycle with cold winters and warm summers.
- Average annual precipitation is between 35 and 60 inches.
- Small water deficit incurred in summer; large water surplus normally develops in spring.
- Characteristic vegetation is temperate deciduous forest; dominant species include American beech, tuliptree (or yellow-poplar), several basswoods, sugar maple, sweet buckeye, red oak, white oak and eastern hemlock.
- Deciduous forest soils are acidic with a thick humus layer; younger soils are found on plateaus; older, more developed soils at lower altitudes.
- Important mammals include whitetail deer, black bear, bobcat, gray fox, raccoon, gray squirrel, fox squirrel, eastern chipmunk, white-footed mouse, pine vole, shorttail shrew and cotton mouse.
- Large bird populations include turkey, ruffed grouse, bobwhite, mourning dove, cardinal, tufted titmouse, wood thrush, summer tanager, red-eyed vireo, blue-gray gnatcatcher and Carolina wren.
- Characteristic reptiles include the box turtle, common garter snake, and timber rattlesnake.

¹⁷US Forest Service website www.fs.fed.us/land/ecosysgmt/index.html accessed August 2014

World Wildlife Fund for Nature: Appalachian Mixed Mesophytic Forests Ecoregion

The World Wildlife Fund's ecoregion classification system divides the terrestrial world into eight biogeographic realms, 14 biomes and 867 ecoregions. WWF is a nonprofit organization that conserves ecologically important areas, especially those that are biologically diverse and contain threatened or endangered species. Therefore, WWF's descriptions tend to focus on natural elements that make an ecoregion unique, and on perceived threats to those unique characteristics.

According to WWF's classification system, the Raccoon Creek Region is in the Narctic realm, the Temperate Broadleaf & Mixed Forests biome, and the Appalachian Mixed Mesophytic Forests ecoregion (Scientific Code NA0402).

The following information about the 74,200 square mile Appalachian Mixed Mesophytic Forests is condensed from the WWF website:¹⁸

The Mixed Mesophytic Forest ecoregion represents one of the most biologically diverse temperate regions of the world. Forest communities often support more than 30 canopy tree species at a single site, and rich understories of ferns, fungi, herbaceous plants, shrubs, small trees and diverse animal communities. Songbirds, salamanders, land snails and beetles are examples of some particularly diverse taxa. The ecoregion harbors some of the richest and most endemic land snail, amphibian and herbaceous plant biotas in the U.S. and Canada. The ecoregion's freshwater communities are the richest temperate freshwater ecosystems in the world, with globally high richness and endemism in mussels, fish, crayfish, and other invertebrates.*

Over 95 percent of this habitat, perhaps more, has been converted or degraded at some point in the last 200 years. Only a few very small and scattered fragments of undisturbed or old-growth forests still remain. Forests were converted for agriculture, coal mining, logging for charcoal, dams and road building. Most of the agricultural lands are being abandoned, with an increase in the growth of secondary, or pioneer, forests. These regrowing forests lack many of the features and much of the diversity of undisturbed, or old-growth forests, namely large trees, variable age classes of trees, structural complexity such as multiple canopy layers, and diverse and abundant flora and fauna. Much of the existing forest, whether old growth or regrowth forests, is still distributed in a highly fragmented mosaic throughout the region, broken by agriculture, roads, power lines, towns and other forms of development. Fragmentation is highest in the northern part of the ecoregion, primarily in southwestern Pennsylvania and Ohio.

*endemism is the ecological state of a species being unique to a defined geographic location, such as an island, nation, country or other defined zone, or habitat type.

¹⁸ World Wide Fund for Nature Ecoregion info obtained from www.worldwildlife.org/ecoregions/na0402

US EPA: Ecoregion 70, Allegheny Plateau

The US Environmental Protection Agency system is based upon James Omernik’s work entitled “Ecoregions of the Conterminous United States” completed in 1987. It is based on the idea that ecoregions can be defined by biotic and abiotic characteristics that affect or reflect differences in the quality and integrity of the ecosystem. These characteristics include geology, physiography, vegetation, climate, soils, land use, wildlife and hydrology.

EPA’s classification system uses Roman-numeral levels. Each successive level divides the country into more specific ecoregions. For example, Level I divides North America into 15 broad regions while Level III divides the continent into 182 regions.¹⁹

According to the US EPA Ecoregion classification system, the Raccoon Creek Region is in the Level I Eastern Temperate Forests, the Level II Ozark, Outachita-Appalachian Forests and the Level III Western Allegheny Plateau. The Western Allegheny Plateau is further divided into three Level IV ecoregions. As can be seen in Figure 3.5, the Raccoon Creek Region falls within two Level IV ecoregions, the 70b Monongahela Transition Zone and the 70c Pittsburgh Low Plateau.²⁰

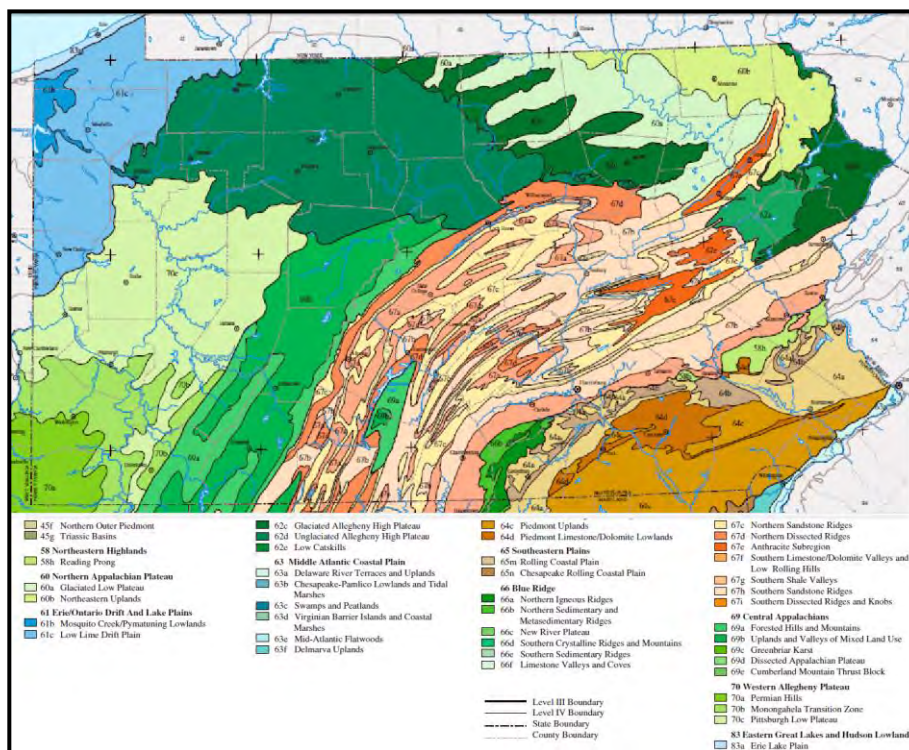


Figure 3.5: Level III and Level IV Ecoregions of Pennsylvania, available at http://www.epa.gov/wed/pages/ecoregions/reg3_eco.htm

¹⁹ <http://www.epa.gov/wed/pages/ecoregions.htm>

²⁰ Woods, A.J., Omernik J.M., Brown D.D. Level III and IV Ecoregions of Delaware, Maryland, Pennsylvania, Virginia, and West Virginia, 1999. US EPA (accessed 7/30/14) available http://www.epa.gov/wed/pages/ecoregions/reg3_eco.htm

The following descriptions of the Western Allegheny Plateau, Monongahela Transition Zone and the Pittsburgh Low Plateau ecoregions are taken and condensed from the Level III and IV Ecoregions of Delaware, Maryland, Pennsylvania, Virginia and West Virginia located on the [EPA's website](#). Please visit the site for more detailed information. Some of the information provided may not be applicable to the Raccoon Creek Region, as these ecoregions cover much larger geographical areas.

Ecoregion 70 is a mostly unglaciated plateau composed of beds of sedimentary rock that have been severely eroded resulting in a hilly to mountainous terrain. Soils have developed primarily from the erosion and weathering of bedrock and support a potential natural vegetation of Appalachian Oak Forest. The region receives a moderate amount of precipitation.

The land use and land cover is a mosaic of forests, urban-suburban-industrial activity, general farms, dairy and livestock farms, pastures, coal mines and oil-gas fields. Urban and industrial activity is common in valleys along the major rivers. Bituminous coal mining is widespread and has diminished water quality and reduced fish diversity; recent stream quality improvements have occurred in some streams and rivers including the Allegheny, Monongahela, Youghiogheny, and Ohio.

The boundary of the Western Allegheny Plateau (70) with the less rugged, more agricultural Erie/Ontario Hills and Lake Plain (61) approximates the furthest extent of the Wisconsin ice sheet (glacier) in Pennsylvania. Its boundary with the North Central Appalachians (62) approximates breaks in land use/land cover and elevation in which Ecoregion 70 is less forested, warmer, and lower in elevation than Ecoregion 62. Its border with the Central Appalachians (69) approximates the break in elevation and forest density that occurs near the limit of the Pennsylvanian Allegheny Group where Ecoregion 70 is lower, warmer, less steep, and less densely forested than Ecoregion 69 and is underlain by less resistant rock.

On the ecoregion map (Figure 3.5), the Western Allegheny Plateau (70) is composed of three level IV ecoregions: the Permian Hills (70a), the Monongahela Transition Zone (70b), and the Pittsburgh Low Plateau (70c). The Raccoon Creek Watershed lies within only the Monongahela Transition Zone and Pittsburgh Low Plateau. Descriptions of the individual characteristics of these two ecoregions follow.

70 b: Monongahela Transition Zone

The unglaciated hills, knobs and ridges of the Monongahela Transition Zone (70b) are typically underlain by limestone, shale, sandstone and coal of the Monongahela Group. Today, forests are extensive. Urban, suburban and industrial activity are found in the river valleys which also serve as transportation corridors. Bituminous coal mining is common and some oil production occurs. There is also some general farming although it is less prevalent than in Ecoregion 70c. Acid mine drainage, siltation and industrial pollution have degraded stream habitat and have affected fish and invertebrates. Water quality has improved recently and some species have reappeared upstream from Pittsburgh.

70 c: Pittsburgh Low Plateau

Ecoregion 70c is unglaciated and is characterized by rounded hills, narrow valleys, fluvial terraces, entrenched rivers, general farming, landslides and bituminous coal mining. The average annual growing season varies inversely with elevation and ranges from about 170 days in the southwest to 120 days in the northeast.

Today, farming is more common than woodland. General farming and dairy operations predominate but are often handicapped by sloping terrain, soil wetness, low soil fertility and a short growing season. Industry and population are concentrated in the Beaver, lower Allegheny and Ohio River valleys.

Widespread coal mining has left some land barren or reverting to woodland. Other areas have been reclaimed but their soils are not always satisfactory for cultivation. Extensive acidic mine drainage and industrial pollution have degraded stream habitat and caused the loss of at least sixteen fish species from the Ohio River watershed.



Figure 3.6: Overburden is blasted away to expose the Pittsburgh Coal Seam for re-mining near Burgettstown in the 70c Pittsburgh Low Plateau Ecoregion, 7/17/2007.

Land Use

Agricultural Lands

Food does not grow on grocery store shelves! Fertile soils produce the crops upon which all life depends. Soil characteristics determine what lands are most suitable for raising food, livestock and other agricultural activities.

Agriculture is the largest industry in Pennsylvania, producing over \$50 billion annually and providing approximately 1 in 7 jobs in agriculture and ag-related business.²¹ However, farmers are facing a tough challenge to keep their land profitable through agriculture.²² If enough farmland in an area is converted to non-farm use, the farming communities lose the critical mass necessary to keep local farm-related businesses and hence the whole farm economy alive. Between 1982 and 2007, America lost 23,163,500 acres of farmland to development.²³



Figure 3.7: Janoski's Farm Market, Greenhouse and Country Restaurant on Route 30 in Findlay Township are landmark family businesses. 4/10/2014.

Prime Farmland

According to the USDA National Soil Survey Handbook, "Prime farmland...has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is also available for these uses. The land could be cropland, pastureland, rangeland, forest land, or other land, but not urban built-up land or water. The soils are of the highest quality and can economically produce sustained high yields of crops when treated and managed according to acceptable farming methods."

"Very specific technical criteria were established by Congress to identify prime farmland soils. In general, the criteria reflects adequate natural moisture content; specific soil temperature

²¹ Growing Greener Coalition, Farmland Preservation, available at <http://pagrowinggreener.org/issues/farmland-preservation/>; accessed 7/20/2014.

²² PA Department of Agriculture, Bureau of Farmland Preservation, Easement Purchase Program, available at: http://www.agriculture.state.pa.us/portal/server.pt/gateway/PTARGS_0_2_24476_10297_0_43/AgWebsite/ProgramDetail.aspx?Fname%3DEasement-Purchase-%26navid%3D12%26parentnavid%3D0%26palid%3D11%26; accessed 7/20/2014.

²³ Growing Greener Coalition, Farmland Preservation, available at <http://pagrowinggreener.org/issues/farmland-preservation/>; accessed 7/20/2014.

range; pH between 4.5 and 8.4 in the rooting zone; low susceptibility to flooding; low risk to wind and water erosion; minimum permeability rates; and low rock fragment content.”²⁴

Prime agricultural soils play an important role in the economy of the Raccoon Creek Region as agriculture is one of the leading industries in western Pennsylvania. There are 27 prime agricultural soils in the watershed that total 25,857 acres or 12.23% of the watershed.²⁵ Please refer to “Plate 3.3: Farmland Classification” and “Plate 3.4: Farmland Map” of the Raccoon Creek Region.

Farmland of Statewide Importance

Farmlands of Statewide Importance are designated by Natural Resources Conservation Service (NRCS) district conservationists. These lands can be very productive under the right conditions, but the soils do not meet the physical and chemical guidelines needed to be recognized as prime agricultural soils. These areas may also include tracts of land that have been designated for agriculture by local or state law. There are 44 soils designated as supporting farmland of statewide importance in the Raccoon Creek Region, totaling 61,743 acres or 21.19% of the watershed.²⁶ “Please refer to Plate 3.3: Farmland Classification.”

Table 3.3: Agricultural Soils of the 20D Region²⁷

Farm Soil Classification	Acres	Square Miles	Percentage of Region
Prime Farmland	25,857	40.4	12.23%
Farmland of Statewide Importance	61,743	96.5	29.19%
Not Prime Farmland	123,896	193.6	58.58%
Totals	211,496	330.5	100%

Agricultural Security Areas

Pennsylvania’s Bureau of Farmland Preservation administers the Agricultural Security Area Program at the state level. Ag Security Areas (ASAs) are a tool for strengthening and protecting our quality farmland from the urbanization of rural areas.²⁸

Enrolling land in an ASA is a voluntary choice for farmers and landowners. The benefits of enrollment are:

- Prerequisite for applying to the county farmland preservation program
- Protection against local nuisance ordinances related to farming activity (noise, smell, etc.)
- Oversight in certain cases of eminent domain.

²⁴ USDA Natural Resources Conservation Service, Prime Farmlands, available at http://www.nrcs.usda.gov/wps/portal/nrcs/detail/ak/soils/surveys/?cid=nrcs142p2_035988; accessed 7/13/2014.

²⁵ GIS compiled from data collected by the Southwest Pennsylvania Commission and PASDA.

²⁶ Ibid.

²⁷ GIS compiled from data collected by the Southwest Pennsylvania Commission and PASDA.

²⁸ Pennsylvania Department of Agriculture, Agriculture Security Areas, available at http://www.agriculture.state.pa.us/portal/server.pt/gateway/PTARGS_0_2_24476_10297_0_43/AgWebsite/ProgramDetail.aspx?palid=10&; accessed 7/13/2014.

The ASA program is administered on the county level by local Ag Preservation Boards. Detailed guidance and application assistance for residents of the Raccoon Creek Region is available from these local Agriculture Land Preservation Boards:²⁹

Allegheny County Ag Land Preservation Board

Chris Goswick, Program Administrator
412-350-1025
christine.goswick@alleghenycounty.us
www.alleghenyfarmland.com

Beaver County Ag Land Preservation Board

Joseph Petrella, Chairman
724-770-4429
jpetrella@beavercountypa.gov
www.beavercountypa.gov

Washington County Ag Land Preservation Board

Caroline Sinchar, Planning Administrator
724-228-6811
sincharc@co.washington.pa.us
www.co.washington.pa.us



Figure 3.8: Vultures perch on a hay wagon in Findlay Township, 7/25/2013.

Farmland Preservation Program³⁰

Pennsylvania's Bureau of Farmland Preservation administers the Easement Purchase program, developed in 1988 to help slow the conversion of farmland to non-agricultural uses and curb the loss of prime farmland soils. The program enables state, county and local governments to purchase voluntary conservation easements, sometimes called development rights, from owners of quality farmland.

Pennsylvania counties participating in the program appoint agricultural land preservation boards overseen by a state board. The state board is responsible for distribution of state funds, approval and monitoring of county programs and specific easement purchases.

Farm owners who wish to preserve their land for future farming uses may apply to the Ag Preservation Board in their county. Applications are ranked and then forwarded to the state board for approval after offers to purchase development rights have been made. Farmers may choose to receive the proceeds from easement sales in a lump sum payment, installments up to

²⁹ PA Farmland Preservation Association, Statewide County Program Contact Information, 4/11/2013, available at <http://www.pafarmland.com/MembershipDirectory.pdf>; accessed 10/3/2014.

³⁰ PA Department of Agriculture, Bureau of Farmland Preservation, Easement Purchase Program, available at: http://www.agriculture.state.pa.us/portal/server.pt/gateway/PTARGS_0_2_24476_10297_0_43/AgWebsite/ProgramDetail.aspx?Fname%3DEasement-Purchase-%26navid%3D12%26parentnavid%3D0%26palid%3D11%26; accessed 7/20/2014.

five years, or on a long-term installment basis. Many farmers use the proceeds from easement sales to reduce debt loads, expand operations and pass their farms on to the next generation.

To date, more than 500,000 acres on over 4,500 family farms have been permanently protected. Pennsylvania leads the nation in farmland preservation. Cigarette tax revenue is the most significant source of dedicated funding for farmland preservation in Pennsylvania, generating an annual amount of approximately \$20.5 million.³¹

Within the Raccoon Creek Region, there are approximately 33,891 acres designated as agricultural security areas and 2077 acres of farmland conserved through the state Farmland Preservation Program.³² In addition, 38 acres of farmland are privately conserved by Independence Conservancy.³³ Sixteen percent of the acreage in the watershed is conserved for agricultural purposes. Please refer to “Plate 3.4: Farmland Map” which shows Ag Security Areas and conserved farms.

More information about farmland preservation in Pennsylvania is available from the [PA Farmland Preservation Association](#), or PFPA. PFPA is a non-profit, nonpartisan statewide incorporated association of conservation easement professionals, dedicated to promoting and enhancing the interests of agricultural land preservation in Pennsylvania.³⁴

Forestry

The name “Pennsylvania” literally means “Penn’s Woods.” In 1681, William Penn advised his settlers to leave one acre of trees for every five cleared.³⁵ By the early 1900s, only 30% of Pennsylvania remained tree-covered due to the demand for timber by our growing nation. Today, our forests have rebounded – 60% of the Commonwealth is covered by high-quality hardwood forest, perhaps unequaled elsewhere on earth. Penn’s Woods support a \$5.5 billion forest industry employing 100,000 people. Our forests protect over 25,000 miles of streams used for drinking



Figure 3.9: Oak logs await transport from a timber harvest operation in Greene Township, 6/19/2006.

³¹ Growing Greener Coalition, Farmland Preservation, available at <http://pagrowinggreener.org/issues/farmland-preservation/>; accessed 7/20/2014.

³² GIS compiled from data collected by the Southwest Pennsylvania Commission and PASDA.

³³ Independence Conservancy, Preserved Lands, Red Oak Farm Conservation Easement, available at <http://www.independenceconservancy.org/services/land-conservation/preserved-lands>; accessed 8/1/2014.

³⁴ Pennsylvania Farmland Preservation Association website, available at <http://pafarmland.org/>; accessed 10/3/2014.

³⁵ The Pennsylvania Forestry Association, About Us, available at <http://www.paforestry.org/about-us/>; accessed 7/23/2014.

water and recreation. They shelter dozens of rare and endangered species of plants, animals and fish while providing recreation opportunities that are vital to Pennsylvania's tourism industry.³⁶

The majority of Pennsylvania's forests, about 70%, are privately owned, including 5% held by forest products companies. Approximately 30% of the forests are owned by the state or federal government.³⁷

Forests are the predominant land use in the Raccoon Creek Region at 58%. Nearly all of this acreage is deciduous forest with less than 1% evergreen.³⁸ More information about forest land cover is available in "Section 1: Project Area Characteristics." Forest habitats are discussed in "Section 5: Biological Resources."

Land Ownership

About 93% (about 197,036 acres or about 308 square miles) of the 211,496-acre (330.5-square mile) 20D Raccoon Creek Region is privately owned with about 7% (about 14,460 acres or about 23 square miles) held as public lands primarily for recreational purposes.³⁹

Public Lands

Within the Raccoon Creek Region there are three state gamelands, two state parks, twenty-two municipal parks and one county park.⁴⁰ Tracts held by the federal government are used for military or navigation purposes and are not open to the public. For the purposes of the Plan, public lands do not reflect public property held for non-recreational purposes such as township buildings, schools, etc. Please refer to "Section 6: Cultural Resources" for detailed discussion of recreational opportunities in the Raccoon Creek Region.

Private Lands

A cursory review of property ownership indicates that private lands are typically owned by individuals, families and local businesses. Parcel sizes range from less than an acre to a few hundred acres. Except where streams flow through or border on state lands (for example, Traverse Creek through Raccoon Creek State Park) tracts along Raccoon Creek and other major tributaries are privately owned. Parcels fronting the Ohio River are, for the most part, owned by businesses and industries and are not, therefore, accessible to the public.

³⁶ PA DCNR Bureau of Forestry Strategic Plan, Sustaining Penn's Woods, available at http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_20026631.pdf; accessed 7/23/2014.

³⁷ Pennsylvania Forest Products Association, Quick Facts, available at <http://paforestproducts.org/quickfacts.cfm>; accessed 7/23/2014.

³⁸ GIS compiled from data collected by the Southwest Pennsylvania Commission and PASDA.

³⁹ Ibid.

⁴⁰ Ibid.

Rocky Bottom Natural Area along Raccoon Creek Road in Potter Township is privately owned by Independence Conservancy but is open to the public for low-impact, non-motorized public recreation including access to the main stem of Raccoon Creek for fishing, wading and paddling. Please see “Section 8: Management Recommendations” for more information about public access improvements planned for Rocky Bottom.

Table 3.4: Land Ownership in the 20D Raccoon Creek Region⁴¹

Land Ownership	Acres	Square Miles	Percentage of Region
Privately owned	197,036	307.87	93.16%
Publicly owned-dedicated to public recreation	14,460	22.59	6.84%
Totals	211,496	330.46	100%

Land Preservation

Why protect open space? Open, green space provides public values benefiting everyone. Tourism, agriculture, timber production, hunting & fishing, wildlife watching and outdoor recreation pump billions of dollars into Pennsylvania’s economy every year. Municipalities and schools districts save money by curbing sprawl and the demands it places on infrastructure and public services. Protecting working farms and forests saves money, preserves the fabric of communities and ensures fresh, local food supply.⁴²

There can be no greater issue than that of conservation in this country.

Theodore Roosevelt, 1912

The Case for Conservation

According to a statewide opinion poll conducted by the Center for Research at Penn State Harrisburg, 97.4% of Pennsylvanians support the continued dedication of state funds for preserving farmlands and open space, creating parks and trails and protecting our water. 82.6% of Pennsylvanians support increasing state funds for conservation and recreation – and would be willing to pay \$10 more annually toward such an increase.⁴³

⁴¹ GIS compiled from data collected by the Southwest Pennsylvania Commission and PASDA.

⁴² Independence Conservancy, Land Conservation Tools, available at <http://www.independenceconservancy.org/services/land-conservation/land-conservation-tools>; accessed 7/21/2014.

⁴³ ConserveLand, a Publication of the Pennsylvania Land Trust Association, Summer 2014.

Land Conservation Tools

Land trusts and conservancies are 501c3 non-profit entities organized specifically to work with land owners who voluntarily choose to preserve the natural values of their farms, woodlands and open spaces. Land trusts typically protect open space by acquiring conservation easements or by fee acquisition (ownership) of land parcels.

A land trust is a nonprofit organization that, as all or part of its mission, actively works to conserve land by undertaking or assisting in land or conservation easement acquisition, or by stewardship of such land or easements. By effectively saving land, land trusts enhance the economic, environmental and social values of their communities. They provide clean water, fresh air, safe food, places for recreation and a connection to the land that sustains us all. Please see “Section 6: Cultural Resources” for a listing of land trusts active in or near the Raccoon Creek Region.

Easement Agreements

A conservation easement is a voluntary agreement between a private landowner and a qualified organization, such as a land trust, that protects the natural, cultural and/or historic resources of the land in perpetuity. The easement agreement allows a land owner to retain ownership and use of his/her property while limiting certain uses that may be harmful to the resources being protected. It is tailored to the conservation goals of the land owner and the land trust, and to the features of the property itself.

Eased properties may or may not be open to the public, depending on the owner’s wishes. Easements can provide access for trail corridors, fishing and boating, or riparian buffers. Easement agreements apply to the current and future owners of the land.

Fee Simple Acquisition

Fee simple acquisition is legal terminology for purchasing the deed to a parcel of land. Land trusts can become the owners and permanent stewards of ecologically valuable properties through bequests, gifts, bargain sales or fair-market purchases of land. Fee simple ownership by a land trust can provide the strongest guarantee of long-term conservation of a tract of land.

A wealth of information on open space preservation is available from the national [Land Trust Alliance](#) and the [Pennsylvania Land Trust Association](#).

Critical Areas

For the purposes of the 20D Raccoon Creek Watershed Conservation Plan, critical areas associated with land resources include not only problematic areas, such as floodplains or unstable slopes, but also areas that have great value because of geologic resources or agricultural soils. Critical areas discussed in this section will include floodplains, stream bank erosion, farmlands and geologic resources.

Floodplains

Flooding is a natural and recurring event for a river or stream. Flooding happens when heavy or continuous rainfall exceeds the soil's capacity to absorb water and the flow capacity of a river or creek is exceeded. This causes a watercourse to overflow its banks onto adjacent lands.

Generally, floodplains are those lands adjacent to rivers and streams, most subject to recurring floods. Floodplains are therefore "flood-prone" and not usually suitable for development.⁴⁴

Flooding is an issue of concern for many residents of the Raccoon Creek Region. Please see "Section 2: Issues, Concerns & Constraints" for stakeholder comments about flooding.

The Federal Emergency Management Agency, or FEMA, maintains an inventory of digital floodplain maps to help communities gain a better understanding of flood risk and its potential impacts. According to its website, "...FEMA is currently working on updating flood risk identification using state of the art technology and through partnerships with communities. The map products of this effort are called Digital Flood Insurance Rate Maps (DFIRMs)... these new DFIRMS are used to calculate the cost of insurance premiums, to establish flood risk zones and base flood elevations to mitigate against potential future flood damages to properties." More information is available from FEMA's online [Map Service Center](#)⁴⁵ or by contacting your county Conservation District or Planning Commission.



Figure 3.10: Eroded stream banks on Raredon Run, damaged by Hurricane Ivan and not helped by lawn mowing to the water's edge. Photo by John Burglund of Wallace & Pancher, Inc. 2/16/2014.

Streambank Erosion

Streambank erosion is another serious concern of landowners in the Raccoon Creek Region. After the hurricanes of September 2004, many property owners suffered damage similar or worse than is depicted in Figure 3.10.

It is common practice to mow to the edge of a creek's banks to maintain a view of the water or be able to walk to it easily. But removing the natural buffer of well-rooted woody plants, shrubs

⁴⁴ Organization of American States, Primer on Natural Hazard Management in Integrated Regional Development Planning, 1991, available at <https://www.oas.org/dsd/publications/Unit/oea66e/ch08.htm>; accessed 7/22/2014.

⁴⁵ FEMA Map Service Center, available at <http://www.fema.gov/national-flood-insurance-program/map-service-center#1>; accessed 7/22/2014.

and trees makes stream banks more susceptible to erosion by flood waters. Densely vegetated streambanks, or riparian buffers, not only resist erosion, they help to filter out pollutants, keep water temperatures cooler so that fish can thrive, and provide green corridors for wildlife habitat. Riparian buffers save soil, preserve useable property and reduce sediment loading in our waterways.

Farmlands

Modern civilization depends on farms and the food, fiber and livestock they produce. The 20D Raccoon Creek Region is predominantly rural with many scenic and productive family farms. The origins of many of these farms can be traced to the late 1700s when “depreciation lands” were granted to veterans as payment for service in the Revolutionary War. The McConnell farm and orchards in Independence Township, Beaver County, dating to 1787, is the oldest property continually farmed by one family in Western Pennsylvania.⁴⁶



Figure 3.11: The Campbell Farm on Covered Bridge Road in Smith Township is one of the many picturesque and productive farms in the Raccoon Creek Region. 6/18/2014.

According to the USDA National Agricultural Statistics Service, Washington County is ranked first in Pennsylvania in total production of sheep and lambs; second in the total number of beef, sheep and goat farms; third in the total number of mules, burros and donkeys; first in the number of llamas; third in the total number of farms of all types; and fourth in the production of all types of forage. Washington County also has a tremendous horse industry, both pleasure and professional, ranking 4th in the state for number of horses.⁴⁷

In Beaver County, the rich bottom-land soils of the Jodikinos farm along Park Road in Independence Township set records for bushels-per-acre corn yield for many years in the 1970s through early 2000s.⁴⁸

⁴⁶ Times Online, Obituaries, Anna Marie McConnell, July 14, 2014, available at http://www.timesonline.com/community/obituaries/anna-marie-mcconnell/article_6a775b89-e499-52b3-8cb9-0ed0f19dc066.html; accessed 7/14/2014.

⁴⁷ Washington County Conservation District website, Agricultural Division, available at <http://pawccd.org/ag.html>; accessed 7/23/2014.

⁴⁸ Penn State Extension, Results from Corn Club programs, available at <http://extension.psu.edu/plants/crops/grains/corn/club/past-results>; accessed 7/24/2014.

As noted in “Section 1: Project Area Characteristics,” active farming occurs on about 21% of the Raccoon Creek Region. Farming is conducted not only on prime agricultural soils which cover about 25,857 acres (about 12%) of the Region but also on other suitable soils. Needless to say, farmland, the second largest land use in the study area, is critical to the sustainability of agricultural activities.

Geologic Resources

Significant reserves of sand & gravel, bituminous coal, and oil & gas remain in the 20D Raccoon Creek Region. Each industry will be discussed in this section.

Sand & Gravel

Sand and gravel are non-renewable resources – non-renewable because they form over geologic time – hundreds of thousands to millions of years. The Ohio River, which borders the 20D Region to the north, is a rich source of gravel formed by glaciers retreating from the Ohio Valley more than 12,000 years ago. Glaciers advancing and retreating from far north in Canada tore apart billions of tons of stone, tumbling it like a giant rock polisher and depositing it as they melted. Glacier-fed streams cut through the ice and gravel, carrying it to the Ohio River’s broad, migrating channel.



Figure 3.12: An array of beautiful colors and interesting textures in a pile of river gravel, 7/26/2014.

The harder the stone, the longer it takes to make it smooth. Igneous and metamorphic rocks become the most colorful rounded pebbles - particularly granite, diorite, gabbro, gneiss, quartzite and amphibolite. Sedimentary rocks, like limestone and chert, tend to be white and gray, while sandstone can be almost any color. Even when rounded, sandstone is gritty to the touch. Not all rocks will form pebbles – shale turns to mud.⁴⁹

Gravel is commercially valuable for its durability and its ability to drain water rapidly. It is used as aggregate in concrete, for landscaping applications like French drains or decorative placement in plantings, or as a component in on-lot sewage systems. Hard glacial gravel is preferred in highway construction for the traction it affords to cars on pavement.

Commercial dredging of the Ohio River began over 100 years ago, first for the sand used in glass-making, later for gravel and sand for road and building construction. In recent years dredging has been confined to the Montgomery pool of the Ohio River between Baden and

⁴⁹ Indiana Department of Natural Resources, Origin of Our River Rock, available at http://www.falloftheohio.org/Ohio_River_Rock.html; accessed 7/26/2014.

Midland to protect recovering fragile freshwater mussel and clam beds.⁵⁰ Environmental impacts of dredging are discussed in “Section 4: Water Resources.”

Tri-State River Products Inc. of Beaver operates a dredge barge in the Montgomery pool. Georgetown Sand & Gravel, located in Georgetown and Greene Township, is one of the few remaining river-oriented businesses for which Georgetown was once famous. Please see “Section 6: Cultural Resources” for more information about historic Georgetown.

Coal

Today’s coal mining is an important part of the economy of the Raccoon Creek Region. The PA DEP’s Bureau of Mining Programs administers the environmental regulatory program for all mining activities in Pennsylvania. The bureau develops and implements policy, scientific analysis, statistical reporting and technical guidance in support of DEP’s mine permitting, licensing and compliance operations.⁵¹



Figure 3.13: Youngsters from the Beaver County Sportsmen's Conservation League Youth Camp tour a re-mining operation in Smith Township, 7/17/2007.

Coal is a solid brown or black carbon-rich material that most often occurs in stratified sedimentary deposits. It is one of the world’s most important fossil fuels. Coal contains more than fifty percent by weight, or seventy percent by volume, carbonaceous matter produced by the compaction and hardening of ancient plant remains.

Coal has many important uses worldwide, most significantly in generating electricity, producing steel, manufacturing cement and as a liquid fuel. Forty percent of the world’s electric power is generated by burning coal. Since 2000, global coal consumption has grown faster than any other fuel. The five largest coal users - China, USA, India, Russia and Japan - account for seventy-six percent of total global coal use.⁵²

⁵⁰ Post-Gazette.com, Commercial Dredging to end on Allegheny River, 6/16/2013, available at <http://www.post-gazette.com/local/region/2013/06/16/Commercial-dredging-to-end-on-Allegheny-River/stories/201306160172>; accessed 7/26/2014.

⁵¹ PA DEP Bureau of Mining Programs, available at http://www.portal.state.pa.us/portal/server.pt/community/bureau_of_mining_programs/20865; accessed 7/26/2014.

⁵² World Coal Association, Uses of Coal, available at <http://www.worldcoal.org/coal/uses-of-coal/>; accessed 7/26/2014.

The Pittsburgh coal seam is the thickest and most extensive coal bed in the Appalachian Basin.⁵³ It is the most economically important coal deposit in the eastern United States.⁵⁴ The first reference to the Pittsburgh coal bed was made by H.D. Rodgers of the First Geological Survey of Pennsylvania on a 1751 map.⁵⁵ The northern extent of the Pittsburgh coal seam underlies the headwaters of the Raccoon Creek Region in northern Washington and western Allegheny Counties.

To the north of the Pittsburgh coal seam in Beaver County, several other smaller coal seams are located beneath Greene, Hanover, Independence, Raccoon and Hopewell Townships. These include the Bakerstown, Harlem/Platt, Elk Lick, Lower/Upper Freeport, and the Lower/Middle/Upper Kittanning.⁵⁶ Rosebud Mining Company of Kittanning PA operates a deep mine near Shippingport in Greene Township, marketing coal from the Upper Freeport Seam for electric power generation.

An important aspect of the modern coal mining industry in the Raccoon Creek Region is re-mining, or “the practice of surface mining of abandoned surface or underground mines or reprocessing of coal refuse piles where preexisting pollution discharges will be affected.”⁵⁷ Modern mining machinery is able to do a better, more efficient job of reaching and extracting coal than the equipment used decades ago.

In the Raccoon Creek Region, and in Pennsylvania as a whole, re-mining has proven to be a very successful means of addressing Abandoned Mine Lands and AMD problems. By allowing coal operators to extract remaining coal for its value in exchange for reclamation of the re-mined sites, a win-win situation is created. The coal operator has an opportunity to mine coal that would normally go untouched because of potential liabilities; the citizens gain no-cost or little-cost land reclamation, often accompanied by improved water quality.⁵⁸

Natural Gas

Natural gas is a non-renewable hydrocarbon fuel formed over geologic time. Its energy comes from the decomposition of microscopic plants and animals that lived in the ocean millions of years ago. When these plants and animals lived, they absorbed energy from the sun, storing it as carbon molecules in their bodies. When they died, they sank to the bottom of the sea. Over

⁵³ Susan J. Tewalt, Leslie F. Ruppert, Linda J. Bragg, Richard W. Carlton, David K. Brezinski, Rachel N. Wallack, and David T. Butler, 2000. Chapter C - A Digital Resource Model of the Upper Pennsylvanian Pittsburgh Coal Bed, Monongahela Group, Northern Appalachian Basin Coal Region. U.S. Geological Survey Professional Paper 1625-C, 106 p.; available at http://pubs.usgs.gov/pp/p1625c/CHAPTER_C/CHAPTER_C.pdf; accessed 7/26/2014.

⁵⁴ Encyclopedia Britannica, Coal, available at <http://www.britannica.com/EBchecked/topic/122863/coal>; accessed 7/26/2014.

⁵⁵ Evenson, H.N., 1938, The Pittsburgh coal bed; its early history and development: American Institute of Mining and Metallurgical Engineers Transactions, v. 130, p. 1–55

⁵⁶ Coal Resources of Western Pennsylvania, Geological Survey Bulletin 1143-A, Elmer D. Patterson, United States Government Printing Office, Washington: 1963, available at <http://pubs.usgs.gov/bul/1143a/report.pdf>; accessed 7/26/2014.

⁵⁷ AMR Clearinghouse.org, Remining, available at <http://www.amrclearinghouse.org/Sub/landreclamation/remining/>; accessed 7/26/2014.

⁵⁸ Ibid.

millions of years, heat and pressure began to rise. The amount of pressure and the degree of heat, along with the type of biomass, determined if the material became oil or natural gas. Very high heat or biomass made predominantly of plant material produced natural gas. Oil and natural gas deposits migrated and became trapped under impermeable layers of rock or clay. These trapped deposits are where we find oil and natural gas today.⁵⁹

As of 2012, natural gas meets 28 percent of U.S. energy demand. Natural gas heats 51% of U.S. households. It is also used for cooling homes and as fuel for cooking. Because natural gas burns cleaner than gasoline or diesel, many municipalities and companies are deploying fleets of natural gas-powered vehicles to reduce emissions. There are approximately 142,000 natural gas powered cars, trucks and buses operating on American roads.⁶⁰

Marcellus Shale Gas

This section about the Marcellus Shale Gas industry was contributed by Matt Pitzarella, Director, Corporate Communications and Public Affairs for Range Resources Corporation.

Pennsylvania has long been home to various forms of energy development, from oil, gas, coal and to wind and solar. Today, modern natural gas development supports more than 240,000 Pennsylvania jobs in developing gas from organic shales found more than one mile beneath the surface.

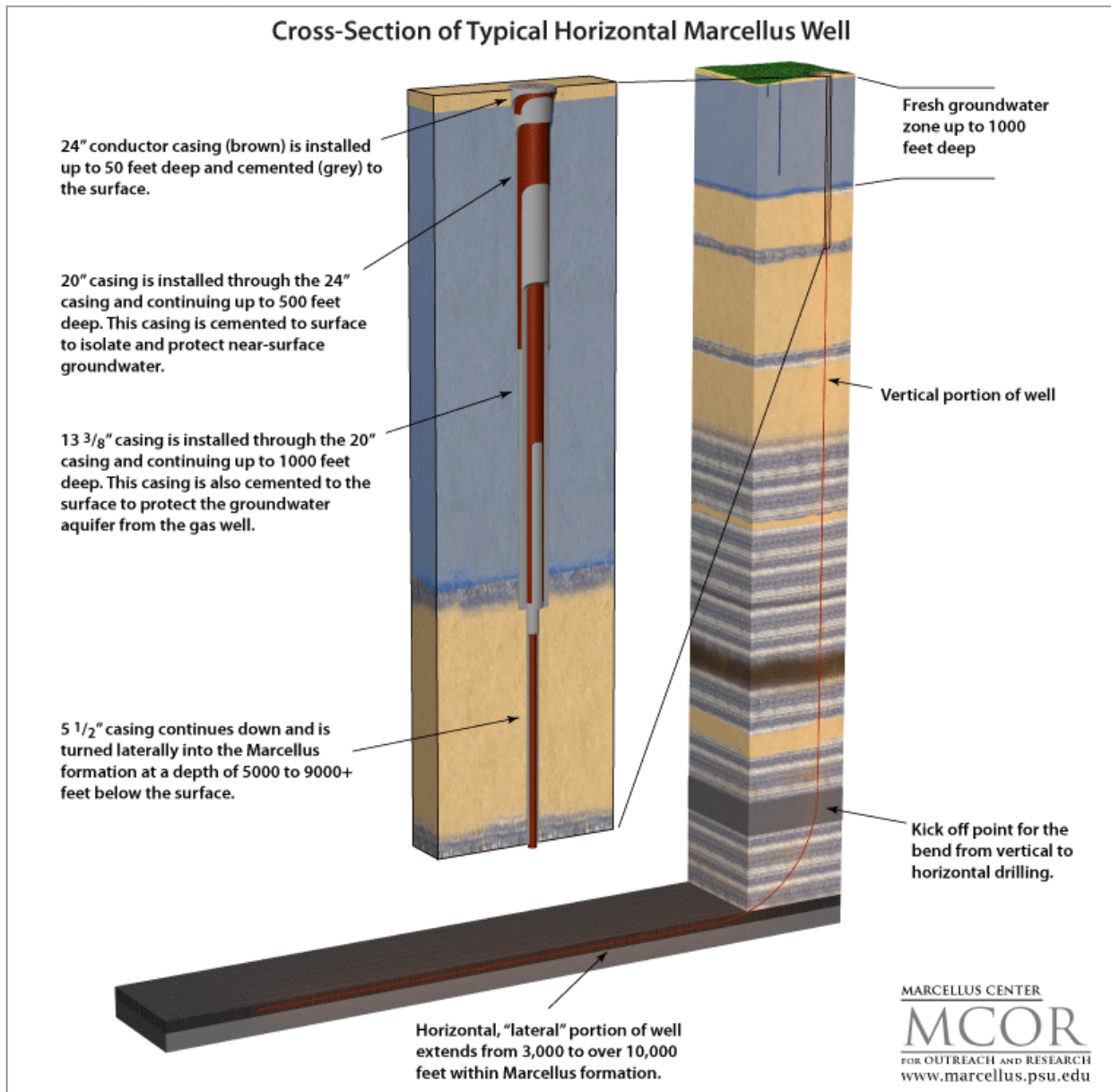
The Marcellus Shale is now the largest producing gas field in the nation and was pioneered and discovered by Range Resources in 2004. The company also pioneered the Upper Devonian and Utica/Point Pleasant Shales in 2009 found above and beneath the Marcellus. These three layers combined could one day combine to make the largest known natural gas field on the planet.

Developing shale gas utilizes state-of-the-art technologies – horizontal drilling and hydraulic fracturing – that were first developed 65 years ago and applied together at a large scale over the last 30 years. The industry has drilled more than 7,000 horizontal shale wells across the Commonwealth. All told, more than 55,000 wells are now producing natural gas in Pennsylvania. PA has the second highest number of gas wells in the country and is the second largest producer of gas by volume. Development will last for generations and perhaps much, much longer.

⁵⁹ American Petroleum Institute, Natural Gas Overview, Natural Gas and its Uses, available at <http://www.api.org/oil-and-natural-gas-overview/exploration-and-production/natural-gas/natural-gas-uses>; accessed 8/1/2014.

⁶⁰ Ibid.

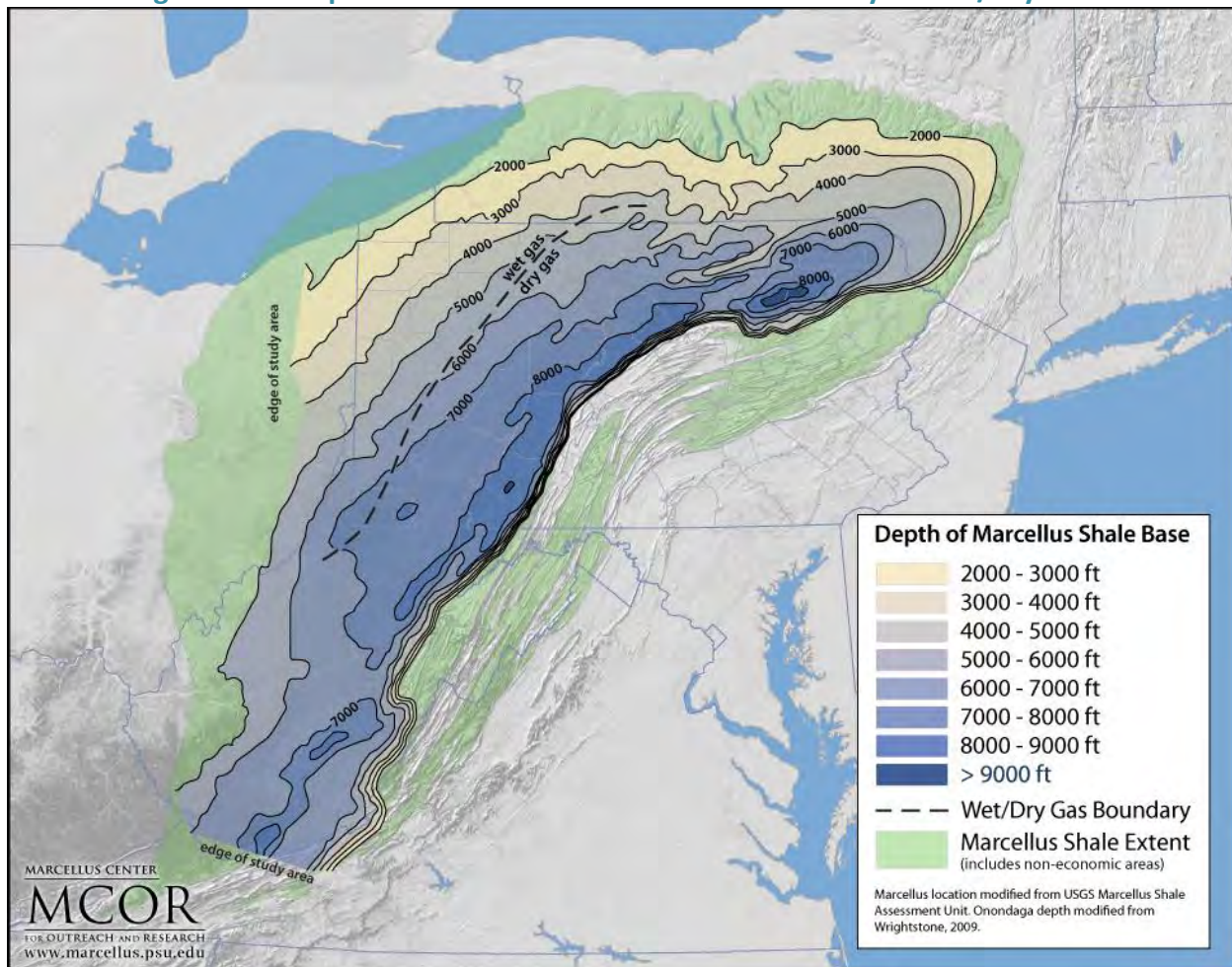
Figure 3.14: Cross-Section of a Typical Horizontal Marcellus Well⁶¹



⁶¹ Penn State University, Marcellus Center for Outreach and Research, available at http://www.marcellus.psu.edu/images/horizontal_well.gif; accessed 7/26/2014.

Natural gas is known as being dry or wet, with dry gas being more thermally mature and wet gas less thermally mature. Thermal maturity is a crude indication of the maximum temperature rock has experienced and of the organic changes progressing within the rock.⁶² Dry gas consists primarily of methane, whereas wet gas may contain natural gas liquids including ethane, butane, propane and pentane. These liquids need to be separated from the methane to ensure a consistent BTU content for consumers. Wet gas is currently considered to be more valuable as the natural gas liquids are also marketable commodities.⁶³

Figure 3.15: Depth of Marcellus Shale Base and Boundary of Wet/Dry Gas⁶⁴



Please see “Plate 3.11: Energy Resources” for mapping of unconventional vertical and horizontal wells in the 20D Raccoon Creek Region.

⁶² Monash University, Faculty of Science, Heat Flow, Chapter 5: Thermal Maturity, available at <http://monash.edu/science/about/schools/geosciences/heatflow/chapter5.html>; accessed 7/26/2014.

⁶³ Penn State University, Marcellus Center for Outreach and Research Available at <http://www.marcellus.psu.edu/resources/maps.php>; accessed 7/26/2014.

⁶⁴ Penn State University, Marcellus Center for Outreach and Research, available at http://www.marcellus.psu.edu/images/Wet-Dry_Line_with_Depth.gif; accessed 7/26/2014.

Hazardous Areas

A variety of hazardous areas exist within the Raccoon Creek Region. These include some types of waste disposal areas, abandoned mine features and sink holes. Most, if not all, of these areas have the potential to be restored to a valuable land use. In some cases, funding is available to help reclaim these sites. Hazardous area features are shown on “Plate 3.10: Waste Sites” and “Plate 3.11: Energy Resources Map.”

Waste Sites

For the purposes of the 20D Raccoon Creek Region Conservation Plan, the following are considered waste sites: municipal waste sites, residual waste sites, illegal dumpsites, brownfields and superfund sites. Please see “Plate 3.10: Waste Sites” for the locations of various types of waste sites.

Municipal Waste Sites

PA DEP's Bureau of Waste Management administers statewide hazardous, municipal and residual waste programs. The office also oversees implementation of municipal waste planning and recycling, waste transportation, and the Covered Device Recycling Act. The Covered Device Recycling Act (CDRA), Act 108 of 2010, requires manufacturers to provide recycling programs for desktop computers, laptop computers, computer monitors, computer peripherals and televisions sold to consumers in Pennsylvania beginning in January 2012. As of January 24, 2013, all such devices and any components thereof may no longer be disposed in Pennsylvania with municipal waste.

DEP regulates municipal waste operations through the Municipal Waste Program. Regulated operations include Municipal Composting Sites, Land Applications, Abandoned Landfills, Landfills, Processing Facilities, Resource Recovery Sites and Transfer Stations. A brief description of each type of site or facility follows:

Municipal Composting Sites

Facilities where organic waste decomposes under controlled aerobic or anaerobic conditions (with/without air), yielding a humus-like product, better known as compost.

Land Application Sites

Sewage sludge of an acceptable quality is applied at a specified rate as fertilizer on mine reclamation sites, agricultural lands or soils low in nutrients.

Abandoned Landfills

The Abandoned Landfill Inventory Project collects geospatial and descriptive data for closed and abandoned landfills throughout Pennsylvania.

Permitted Landfill or Sanitary Landfill

A facility with a DEP-approved permit that uses land for the disposal of municipal waste. Sanitary landfills are sites where municipal solid waste is buried in a manner to reduce the environmental impacts. Imperial Landfill in Findlay Township is located partially within the

boundaries of the 20D Sub-watershed. It is the only active municipal waste disposal landfill in the Raccoon Creek Region.

Processing Facility

A transfer station, composting facility, resource recovery facility, or a facility that reduces the volume or bulk of municipal waste for offsite re-use.

Resource Recovery Facility

Provides for the extraction and utilization of materials or energy from municipal waste. The resource recovery facility can be a mechanical extraction facility or a combustion facility (incinerator).

Transfer Station

A processing facility that receives and processes or temporarily stores municipal waste or recyclables at a location other than the generation site.

Residual Waste Sites

Residual waste is waste generated at an industrial, mining, or wastewater treatment facility. PA DEP's Bureau of Waste Management has jurisdiction over residual waste sites. The Raccoon Creek Region has several of these sites, most notable of which is the 1700-acre Little Blue Reservoir in Greene Township, the largest unlined flyash disposal site in the United States. Little Blue is covered in detail in "Section 1: Project Area Characteristics." Please see "Plate 3:10 Waste Sites" for locations of residual waste sites in the 20D Region.

Illegal Dump Sites

Illegal dumping is a matter of great concern to many stakeholders in the 20D Raccoon Creek Region. By no means a rural problem exclusively, illegal dumping is a widespread, chronic, hazardous practice that degrades our environment, poses harm to people and animals and consumes limited public resources. Illegal dumping is a deliberate act, done out of ignorance, habit or to hide other criminal activity. Dump sites often contain tires, appliances, furniture, auto parts, construction/demolition debris and other heavy objects.

In the Raccoon Creek Region, as in every rural area, secluded roadside pull-offs are a favorite target for illegal dumpers. Our natural terrain of steep slopes and deep valleys – and our abandoned strip mines - compounds the difficulty and expense of cleaning up trash-strewn hillsides. Often, heavy equipment and specialized skills are needed to remove debris from such places. Even with volunteer labor, illegal dump cleanups can cost between \$1,000 and \$2,000 per ton of material retrieved and properly disposed.⁶⁵

⁶⁵ Independence Conservancy, Our Projects, available at <http://www.independenceconservancy.org/our-projects>; accessed 7/24/2014.

In 1999, an informal coalition of volunteer groups and government bodies agreed to do something about illegal garbage and tire dumps in the valleys of the Raccoon Creek Watershed. The cleanup partners - composed of the Townships of Greene, Potter and Raccoon, the Raccoon Creek Watershed Association, PA CleanWays of Beaver County (now Keep PA Beautiful), Beaver County Department of Waste Management and the Independence Conservancy identified and prioritized several highly visible dumpsites located along public roads. Many targeted sites contained a share of the over 100,000 tires which had been collected from auto shops and illegally dumped into remote areas of the Raccoon Creek Watershed in the late 1980's and early 1990's. Cleanup campaigns at the most critical sites throughout the watershed netted 22,000 fugitive tires and 300 tons of illegally dumped residential garbage.⁶⁶



Figure 3.16: Al Moran and John Davidson of Independence Conservancy retrieve a load of scrap metal and tires from an illegal dump on Kennedy Hill in Greene Township, 7/10/2006.

Independence Conservancy's Community Tire Collection Program was developed in 2004 as an outgrowth of the Raccoon Creek cleanups. Since the program's inception, over 35,000 worn out tires and wheels have been properly disposed by residents of Beaver, Allegheny and Washington Counties. Program details and schedules can be viewed at the Conservancy's website: <http://www.independenceconservancy.org/services/community-tire-collection-program>.

Keep Pennsylvania Beautiful (KPB) is a nonprofit organization that empowers people to eliminate illegal dumping and littering in Pennsylvania through various education and environmental programs. KPB has conducted illegal dump surveys of Allegheny, Beaver and Washington Counties by driving public roads and recording observations.⁶⁷ The results of these surveys are mapped on "Plate 3:10 Waste Sites." However, these findings only represent a small fraction of the number of illegal dump sites within the Raccoon Creek Region.

Please see "Section 2: Issues, Concerns & Constraints" for stakeholder comments about illegal dumping.

⁶⁶ Independence Conservancy, Stewardship in Action, Raccoon Creek Cleanups, available at <http://www.independenceconservancy.org/services/watershed-stewardship>; accessed 7/24/2014.

⁶⁷ Keep Pennsylvania Beautiful, Illegal Dump Surveys, available at <http://www.keppabeautiful.org/IllegalDumpSurveys.aspx>; accessed 7/24/2014.

Brownfields

The US EPA defines brownfields as “real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties protects the environment, reduces blight, and takes development pressures off greenspaces and working lands. Cleaning up previously contaminated properties for reuse can help reinvigorate communities, preserve green space, and prevent sprawl. Revitalized land can be used in many ways—from the creation of public parks and the restoration of ecological systems, to the construction of community development projects and the establishment of new businesses.”⁶⁸

Superfund Sites

“Superfund” is the name given to the environmental program established to address abandoned hazardous waste sites. Superfund is also the name of the fund established by the federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980. Superfund sites are regulated under Section 111 of CERCLA. Under this legislation, the USEPA identifies potential hazardous waste sites which pose a threat of release of hazardous substances, pollutants, or contaminants.

A review of US EPA’s Pennsylvania Superfund Sites shows none within the Raccoon Creek Region.⁶⁹

Pennsylvania’s Hazardous Sites Cleanup Act

Pennsylvania’s Hazardous Sites Cleanup Act (HSCA) provides DEP with the funding and authority to conduct cleanup actions at sites where hazardous substances have been released. HSCA also provides DEP with enforcement authority to force the persons who are responsible for releases of hazardous substances to conduct cleanup actions or to repay public funds spent on a DEP-funded cleanup. HSCA also allows the Commonwealth to participate fully in the cleanup of Pennsylvania sites under the Federal Superfund program.⁷⁰

Additional information about HSCA is provided at DEP’s Hazardous Sites Cleanup Program website:

http://www.portal.state.pa.us/portal/server.pt/community/hazardous_sites_cleanup_program/20600

⁶⁸ US EPA, Brownfields and Land Revitalization, available at <http://www.epa.gov/brownfields/>; accessed 7/24/2014.

⁶⁹ US Environmental Protection Agency, Pennsylvania Superfund Sites, available at <http://www.epa.gov/reg3hwmd/super/pa.htm>; accessed 7/24/2014.

⁷⁰ PA DEP Hazardous Sites Cleanup Program, available at http://www.portal.state.pa.us/portal/server.pt/community/hazardous_sites_cleanup_program/20600; accessed 7/24/2014.

Abandoned Geologic Extraction Sites

Coal, oil and natural gas have been extracted commercially for over 150 years in the Raccoon Creek Region. Until the latter part of the 20th century these industries operated with little regard for the damage they cause to our lands and waterways. Substantial degradation continues to this day as a result of unregulated practices of the past.

Abandoned Oil & Gas Wells

Abandoned oil and gas wells can pose human and environmental health hazards if the well casings rust or break, allowing water or fluids to leak into the groundwater. PA DEP's Abandoned and Orphaned Well Plugging Program was created to plug abandoned wells that have the potential to cause health, safety or environmental concerns.

Since 1859, thousands of oil and gas wells were drilled in Pennsylvania. Active wells with known operators are responsible for plugging them when they reach the end of their productive life. Abandoned wells without a known responsible party are addressed by the Well Plugging Program. More information about this program is available on DEP's website: http://www.portal.state.pa.us/portal/server.pt/community/abandoned_orphan_well_program/20292.

"Plate 3.11: Energy Resources of the 20D Region" shows the locations of historic wells and conventional oil and gas wells. Note that many historic wells are located near, or in some cases beneath, present day lakes, impoundments and water features.

Abandoned Mine Lands

Abandoned Mine Lands (AML) are the most pervasive issue from the Raccoon Creek Region's historic mining legacy. The southern half of the Region, under which lies the Pittsburgh Coal Seam, bears the scars of 100+ years of unregulated mining with very few pre-1950s attempts to restore the land.

PA DEP has identified seven primary Abandoned Mine Discharge (AMD) sources, remediation of which is crucial to improving water quality in the Region. "Section 4: Water Quality" contains an extensive discussion of abandoned mines, lists the primary discharges and details the accomplishments and challenges involved in their treatment.



Figure 3.17: A Bucyrus-Erie cable tool drilling rig in Smith Township bears witness to the Region's industrial past. 6/18/2014.

The US Department of the Interior Office of Surface Mining Reclamation and Enforcement (OSMRE) has established levels of priority for reclaiming abandoned mine features, based on inherent hazards and problems of sites. An inventory of land and water impacted by past mining (primarily coal mining) is maintained by OSMRE to provide information needed to implement the federal Surface Mining Control and Reclamation Act of 1977 (SMCRA), re-authorized by Congress in 2006. The inventory contains information on the location, type and extent of AML impacts, as well as information on costs associated with reclaiming those problems.⁷¹



Figure 3.18: Slope entry to the Langeloth Mine, built in 1914. 4/13/2005.
Never enter a mine – stay out – stay alive!

“Figure 3:11: Energy Resources” maps OSMRE Priority 1, 2 and 3 areas in the Raccoon Creek Region. For the most part, the Region’s sites are Priority 3. Priority 1 and 2 sites are those posing a threat to health, safety and general welfare of people. Priority 3 sites are those impacting the environment.⁷² OSMRE’s criteria for prioritizing abandoned mine sites by their features and impacts are listed in Table 3.5. This table lists OSMRE priorities, problem descriptions and site counts within the 20D Region. Note that, of 207 sites in 20D identified and prioritized by OSMRE, only twelve, or 5.8%, are listed as having been reclaimed. “Appendix 3.1: OSMRE Abandoned Mine Lands Problem Type Definitions” further explains the nature of Priority 1 and Priority 2 problems.

Table 3.5: OSMRE Priority 1, 2 and 3 Problem Listings⁷³

OSMRE Priority	Problem Types
Priority 1 and Priority 2	CS Clogged Streams; CSL Clogged Stream Lands; DH Dangerous Highwalls; DI Dangerous Impoundments; DPE Dangerous Piles & Embankments; DS Dangerous Slides; GHE Gases Hazardous/Explosive; HEF Hazardous Equipment & Facilities; HWB Hazardous Water Bodies; IRW Industrial/Residential Waste; P Portals; PWAI Polluted Water Agricultural & Industrial; PWHC Polluted Water Human Consumption; S Subsidence; SB Surface Burning; UMF Underground Mine Fires; VO Vertical Openings
Priority 3	BE Bench; DP Industrial/Residential Waste; EF Equipment/Facility; GO Gob; H Highwall; HR Haul Road; MO Mine Opening; PI Pits; SA Spoil Area; SL Slurry; SP Slump; WA Water Problems; WS Water Supplies

⁷¹ Office of Surface Mining Reclamation and Enforcement, U.S. Department of the Interior, available at <http://www.osmre.gov/programs/AMLIS/description.shtm>; accessed 7/25/2014.

⁷² Ibid.

⁷³ Ibid.

Table 3.6: OSMRE Abandoned Mine Lands Priority 1, 2, 3: Problems Existing and Reclaimed⁷⁴

OSMRE Priority	Description	# of Sites in 20D	# of Sites Reclaimed
1	Underground mine fire	1	0
	Burning refuse pile	4	0
2	Dry strip mine	17	3
	Flooded strip mine	11	3
	Refuse pile	4	0
	Subsidence prone areas	2	0
	Underground mine fire	1	0
	Vertical mine shaft	1	0
	Coal processing settling basin	2	2
3	Dry strip mine	69	3
	Flooded strip mine	9	0
	Refuse pile	7	0
	Spoil pile	74	0
	Subsidence prone area	1	0
	Suspected subsidence prone area	2	1
	Underground mine fire	2	0
	Totals		207

The PA DEP Bureau of Abandoned Mine Reclamation (BAMR) also maintains an inventory of AML features. A summary of these sites in the 20D Raccoon Creek Watershed Region is listed in Table 3.7 below.

Table 3.7: BAMR Abandoned Mine Lands Inventory in 20D⁷⁵

AML Description	# of Sites in 20D
Open Shaft/Mine Entry	19
Erosion-prone Area	1
AMD Discharge Area	123
Flooded strip mine	1
Mine Entry	6
Vertical Mine Shaft	5
Mine Slope	1
Abandoned Structure	4
Untreated Discharge	4
Treated Discharge	1
Total Sites	165

⁷⁴ GIS compiled from data collected by the Southwest Pennsylvania Commission and PASDA; OSMRE data compiled from BAMR inventories.

⁷⁵ GIS compiled from data collected by the Southwest Pennsylvania Commission and PASDA; data compiled from BAMR inventories.

During the course of researching the Abandoned Mine Lands topic for inclusion in the 20D Raccoon Creek Region Conservation Plan, it became apparent that state and federal AML databases can be out-of date by several years to decades. The data presented in this Plan is the most current available from official sources. However, it differs from first-hand knowledge of the 20D Region by individuals involved in preparing this Plan. Many problem sites have been eliminated in the course of re-mining areas originally mined in the early 20th century. The OSMRE Priority 1 underground mine fire is one such issue that has been resolved by re-mining. Also, several AMD discharges have been addressed by the construction of passive treatment systems. These systems are described in detail in “Section 4: Water Resources.”

Coal Waste Piles

In past times, as coal was removed from underground mines, unwanted material would be brought to the surface with the coal. Separating the coal from its accompanying refuse material was a necessary part of the process. As a result, large piles of refuse material grew as mining operations progressed. Because the separation process was inefficient, coal itself is generally a major component of these piles.

Coal waste piles are known variously as gob piles, slate dumps or boney piles. Almost every coal patch village has a pile – a reminder of long-gone mining days. Far from benign, coal waste piles are safety hazards, eyesores, and are responsible for environmental degradation, including the sometimes prolific production of AMD. Generally they are bare or sparsely vegetated and are easily identified by their steep, eroded, unstable, dark gray banks. If the material had burned, the pile will have a pink-ish color called “red dog.”

Within the 20D Raccoon Creek Region are dozens – if not hundreds – of coal waste piles. Many are marked as OSMRE



Figure 3.19: The Champion #1 coal washer in operation, June 27, 1946, serviced by the Montour Railroad. Photograph courtesy of the Archives Service Center, University of Pittsburgh.

Priority 3 reclamation sites on “Figure 3:11: Energy Resources.” They are included in this Plan as energy resources because many of them contain a high percentage of combustible coal and are suitable for re-use as fuel.

The Raccoon Creek Region contains the largest coal waste pile east of the Mississippi River.⁷⁶ Near the intersection of Routes 22 and 980 in Robinson Township, Washington County, the 440-acre Champion coal refuse pile is the lingering remnant of the Pittsburgh Coal Company’s Champion #1 coal washer operations. In the 1950s, the plant replaced rail transport with a two-mile long conveyor system to move bony from the washer to a disposal site across the roadway.⁷⁷ As decades passed, the disposal site became a huge mountain of waste. Today, runoff from the Champion coal waste pile is channeled into a series of treatment ponds where it is dosed with lime to reduce acidity and settle iron, a costly process that must continue until the pile is reclaimed or re-used as fuel.

A relatively new technology enabling the removal and re-use of millions of tons of coal refuse is called Circulating Fluidized Bed (CFB) Combustion. CFB, more than any other method, is the greatest hope of reclaiming the Champion pile and other coal refuse piles in Pennsylvania. CFB is an advanced power-generating process, utilizing advanced pollution control equipment to meet the strictest air quality emission standards in producing electricity. The byproduct ash produced has proven very useful in reclaiming abandoned mine lands polluted with acids and metals - including the very coal refuse sites that fuel the plants!⁷⁸



Figure 3.20: A view from the top of the Champion coal waste pile looking toward Imperial Landfill. On a clear day the skyscrapers of downtown Pittsburgh - fifteen miles distant - are visible from this vantage point. 6/10/2005.

In 2005, a private study assessed available fuel supplies for the Beech Hollow Power Plant, a 300 megawatt CFB power generating plant proposed to re-use the Champion coal waste pile. Within a 15 mile radius of

⁷⁶ Post-Gazette.com, Local News, October 20, 2002, available at http://old.post-gazette.com/neigh_washington/20021020wacover2.asp; accessed 7/25/2014.

⁷⁷ SitNews, Stories in the News, Recycling for Profit and Preservation by Bob Ciminel, June 29, 2005, available at http://www.sitnews.us/BobCiminel/062905_focb.html; accessed 7/25/2014.

⁷⁸ AMR Clearinghouse.org, Circulating Fluidized Bed (CFB) Reactor Power Plants, available at www.amrclearinghouse.org/Sub/landreclamation/cfb/; accessed 7/25/2014.

the plant's location, piles containing 33 million tons were located, mostly within the Raccoon Creek Watershed.⁷⁹ Combined with the estimated 60 million tons of coal in the Champion pile itself, the Beech Hollow Plant could generate electricity for 25 years.⁸⁰

Development of Environmental Regulations for Coal Mining & Reclamation Efforts in PA

Citizens of Pennsylvania have long recognized the impact of early mining practices on the environment, but only in recent decades have we begun to address this legacy. Interestingly, during World War II (1941 to 1945) the demand for coal was high, but, to conserve diesel fuel for the war effort, mine land reclamation was discouraged. After the war, surface mining became regulated. By the 1960s, reclamation efforts began on a wide scale. Today's surface mining industry integrates land reclamation as a regular part of its operations.

A brief overview of the laws, regulations and programs relating to the coal mining industry since the end of World War II is provided in Table 3.8.



Figure 3.21: Lifeless Burgetts Fork flows through a man-made channel past the Climax-Langeloth coal waste pile in Smith Township, 4/13/2005.

⁷⁹ Michaels, Victoria E., 2005, Inventory of Coal Waste Piles Within a 15-Mile Radius of Champion, Washington County, PA, prepared for Robinson Power Company, LLC.

⁸⁰ Post-Gazette.com Local News, October 20, 2002, available at http://old.post-gazette.com/neigh_washington/20021020wacover2.asp; accessed 7/26/2014.

Table 3.8: Timeline of Selected Mining Regulations & Reclamation Efforts in PA

Year	Description
1945	<u>PA Clean Streams Law</u> (passed in 1937) amended to include acid mine drainage
1945	<u>PA Surface Mining Conservation and Reclamation Act</u> passed to regulate surface coal mining
1965	<u>PA Clean Streams Law</u> amended to define acid mine drainage as industrial waste, requiring all mines to treat drainage to specified standards
1968	<u>Operation Scarlift</u> with \$200 million (from \$500 million bond issue) to finance abandoned mine land reclamation
1968	<u>PA Coal Refuse Disposal Control Act</u> passed to help control pollution from coal refuse piles
1977	<u>Federal Surface Mining Control and Reclamation Act</u> passed to require active coal mines to restore lands, in most instances, to approximate original contour and to treat drainage to specified standards for perpetuity, if necessary
1980	<u>PA Surface Mining Conservation and Reclamation Act</u> amended to be equal to or more stringent than the Federal Surface Mining Control and Reclamation Act
1984	<u>PA Noncoal Surface Mining and Conservation Act</u> passed to regulate quarries and other industrial mineral mines
1992	<u>PA Surface Mining Conservation and Reclamation Act</u> amended to better protect water supplies and to provide incentives for remaining previously abandoned areas
1994	<u>PA Mine Subsidence and Land Conservation Act</u> amended to include better protection of water supplies affected by underground coal mining
1994	<u>PA Coal Refuse Disposal Control Act</u> passed to include siting of coal refuse disposal areas on previously affected mine lands
1996	<u>PA Surface Mining Conservation and Reclamation Act</u> amended to encourage private reclamation of abandoned mine lands through re-mining
1998	<u>Reclaim PA</u> initiated to form partnerships with stakeholders to reclaim abandoned mine lands and to treat abandoned mine drainage
1999	<u>PA Growing Greener</u> initiated to provide grants to stakeholders that included reclamation of abandoned mine lands and treatment of abandoned mine drainage
1999	<u>PA Good Samaritan Act</u> intended to encourage landowners and others to reclaim abandoned mineral extraction lands and abate water pollution caused by abandoned mines, and oil and gas wells. The Environmental Good Samaritan Act protects landowners, groups and individuals who volunteer to do such projects from civil and environmental liability.
2006	<u>Federal Surface Mining Control and Reclamation Act</u> re-authorized by Congress to include mandatory payouts to states to conduct reclamation activities.
2012	<u>PA Act 13</u> establishes the Marcellus Legacy Fund and allocates funds to the Commonwealth Financing Authority for abandoned mine drainage, abatement, and treatment with the Abandoned Mine Drainage Abatement and Treatment Program (AMDATP).

The Pennsylvania Department of Environmental Protection has established Abandoned Mine Land Reclamation Priority Sites in the 20D Sub-basin. These are listed in Table 4.11 of “Section 4: Water Resources.”

Sinkholes

A sinkhole is a feature of the landscape in which there is downward movement of surface material due to physical and chemical weathering of carbonate bedrock. Most carbonate rock formations are found in the central and eastern parts of Pennsylvania. There are no sinkholes known to exist within the 20D Raccoon Creek Region.



Figure 3.22: One of several pump jacks in the Bonnymede vicinity of Smith Township. Widely used throughout the U.S. to extract shallow reserves of gas and oil, basic pump jack design has changed little since 1859. Some rural Pennsylvania pump jacks, or “gas donkeys,” have been on the job for one hundred years or more. 6/18/2014.

Appendix 3.1: OSMRE Abandoned Mine Lands Problem Type Definitions⁸¹

BE Bench: A ledge that forms a single level operation along which mineral or waste materials are excavated.

CS Clogged Stream: Any filling of a stream bed, usually in a narrow valley, with AML-originated silt and debris sedimentation carried downstream by surface runoff. The sedimentation causes temporary blocking of the stream and flooding, posing a danger to improved property and human health, safety and welfare. Clogged streams are measured in miles of stream that will be dredged to abate the problem.

CSL Clogged Stream Lands: Any filling of a stream bed, usually in a narrow valley, with AML-originated silt and debris sedimentation carried downstream by surface runoff. The sedimentation causes temporary blocking of the stream and flooding, posing a danger to improved property and human health, safety and welfare. Clogged streams are measured in miles of stream that will be dredged to abate the problem. Any AML-related surface mining spoil pile and bank, mine waste and earth material disturbed by mining activity which would be eroded and carried downstream by surface runoff, and deposited in a stream bed (thus causing a clogged stream). This silt erosion contributes to stream sedimentation and causes local flooding resulting in property damage and a human health, safety and general welfare threat. Clogged stream lands are measured in acres of land affected by spoil, mine waste and earth material that are directly contributing to the clogged stream.

DP Industrial/Residential Waste Dump: An AML area used to dispose of any kind of industrial or residential waste not related to mining or processing.

DPE Dangerous Pile or Embankment: An AML-related mine waste pile or bank located within close distance to a populated area, public road, or other area of intense visitation, and posing a danger to public health, safety and general welfare by adverse effect resulting from an unstable steep slope or wind-blown particulate matter.

DH Dangerous Highwall: Any AML-related unprotected unreclaimed highwall located in close proximity to a populated area, public road, or other area of intense visitation, and posing a threat to public health, safety and general welfare by falling from a highwall or from being hit by falling rock.

DI Dangerous Impoundment: Any AML-related large-volume water impoundment such as a mine waste embankment, sedimentation pond, or underground mine water pool which poses a threat of flooding and catastrophic destruction to downstream property and human health, safety, and general welfare in the event of rupture or breach of the water retention structure.

⁸¹ Office of Surface Mining Reclamation and Enforcement, U.S. Department of the Interior, e-AMLIS Priority 1 and 2, available at http://www.osmre.gov/programs/AMLIS/priority1_2.shtm; accessed 8/1/2014.

The description of a DI must give evidence of a weak, unstable, or otherwise inadequate impounding structure, such as lack of an emergency spillway or improper primary spillway.

DS Dangerous Slide: Any AML-related land mass slide of surface-subsurface soil, mine waste pile or bank, or surface mine spoil due to instability of its own weight or lubricating effects of mine drainage water, that endangers human health, safety and general welfare and destruction of improved property located uphill or downhill from the land mass.

EF Equipment/Facility: Any equipment or buildings used to mine, process, or transport coal or mineral ores.

GHE Hazardous or Explosive Gases: AML-related venting of hazardous or explosive gases.
Hazardous Equipment or Facilities: Any AML-related dilapidated hazardous equipment or facilities located within close proximity to populated areas, along public roads, or other areas of intense visitation.

GO Gob: The refuse or waste removed from a mine. This includes mine waste, rock, pyrites, slate, or other unmarketable materials which are separated during the cleaning process.

H Highwall: The face of exposed overburden or the face or bank on the uphill side of a contour strip mine excavation. The vertical wall consisting of the deposit being mined and the overlying rock and soil strata of the mining site.

HR Haul Road: A road built and used for transporting mined material by truck. The road can be from a mine head or pit to a loading dock, tippie ramp, or preparation plant.

HWB Hazardous Recreational Water Body: Any non-polluted, impounded water, regardless of depth or surface area, that is considered an attractive nuisance and is located within close proximity to a populated area, public road, or other areas of intense visitation. The hazard must result from some AML-related feature(s) such as steep or unstable banks, hidden underwater ledges, or rocks or debris on the bottom. The fact that a pond is present is not sufficient evidence of a hazard.

IRW Industrial or Residential Waste: Unauthorized use of AML-impacted areas for residential or industrial waste disposal that poses a danger to public health, safety and general welfare from unsanitary conditions or from the toxic emissions from the burning refuse.

MO Mine Opening: Any surface entrance or opening related to an underground mine.

P Portal: Any AML-related surface entrance to a drift, tunnel, adit or entry which is not sealed or barricaded, and is located within close proximity to a populated area, public road or other area of intense visitation, posing a threat to public safety and general welfare.

PI Pit/Open Pit/Strip Pit: The last uncovered cut adjacent to the highwall. In surface mining the working area may be known as a strip pit. Mine workings or excavations open to the surface are also termed pits.

PWAI Polluted Water: Agricultural/Industrial: Any surface or subsurface water used for agricultural or industrial purposes which does not meet standards (especially those for suspended solids, acid or alkaline conditions, heavy metals concentrations, or radioactivity) because of AML-related impact

PWHC Polluted Water: Human Consumption: Any surface or subsurface water used for human consumption or recreational waters used for swimming that does not meet standards (especially those for suspended solids, acid or alkaline conditions, heavy metals concentrations, or radioactivity) because of AML-related impact.

S Subsidence-Prone Area: Any surface expression of AML-related subsidence such as tension cracks, potholes, troughs, shearing faults, or caving caused by AML-related underground mine voids which damages property and poses danger to human safety, health and general welfare. The age of the subsidence occurrence is limited to the past 5 years.

SA Spoil Area/Spoil Bank: The overburden material removed in gaining access to a coal seam or mineral deposit.

SB Surface Burning: Any AML-related continuous combustion of mine waste material resulting in smoke, haze, heat, or venting of hazardous gases located within close distance to a populated area, public road or other public use area and posing a danger to public health, safety and general welfare. Burning must currently be occurring or be demonstrated to occur on a regular basis. Burning in a mine dump, even if beneath the surface of the material, is surface burning.

SL Slurry: Fine particle material from coal or mineral processing collected in a pond. Solid must be separated from the water in order to have clear effluent for reuse or discharge.

SP Slump: Surface expressions resulting from the caving in of underground mine voids. Slumps are differentiated from subsidence because they are normally in undeveloped areas. The area has infrequent public visitation, recreational use, farming, livestock use, etc. In all likelihood slumps will not cause loss of life, serious injury or economic loss.

UMF Underground Mine Fire: Any AML-related continuous smoke, haze, heat, or venting of hazardous gases from underground mine coal combustion posing a danger to public health, safety and general welfare.

VO Vertical Opening: Any AML-related vertical or steeply-inclined shaft or opening which is not sealed or barricaded, or a subsidence-caused opening that is more than 5 years old and has

become a hazard, regardless of proximity to populated areas, public road or other area of intense visitation, posing a threat to the public health, safety and general welfare.

WA Water Problems: Water leaving the AML and causing environmental impacts because of its pH, sediments load, or other pollutants, or because of its effect on other lands due to poor drainage conditions (i.e. agricultural flooding).

WS Water Supplies: Water supplies adversely affected by coal mining that are replaced through the repair, replacement, construction, or enhancement of facilities, including water distribution facilities and treatment plants.

Appendix 3.2: Further Reading

A wealth of information exists about modern coal, oil and gas extraction industries, abandoned mines and wells, technologies used to treat these problems and efforts to do so by businesses, governments, non-profits groups and citizen volunteers. The following is a brief list of selected resources for further information.

[AMRClearinghouse.org](#): an information resource for watershed organizations working on Abandoned Mine Land issues.

[DataShed](#): a collaborative effort of Stream Restoration Incorporated, PA DEP and others to provide the tools needed to actively monitor and maintain passive AMD treatment systems.

[Independence Conservancy](#): a non-profit land trust based in Industry PA; works for clean water, open green space and recreational access in the Raccoon Creek Watershed.

[PA DEP Bureau of Abandoned Mine Reclamation](#): BAMR is responsible for resolving problems such as mine fires, mine subsidence, dangerous highwalls, open shafts and portals, mining-impacted water supplies and other hazards which have resulted from pre-1977 coal mining practices.

[Penn State Center for Marcellus Outreach & Research](#): MCOR is Penn State's education and research initiative on unconventional gas plays; committed to expanding research and to providing science-based programming while protecting the Commonwealth's water resources, forests and transportation infrastructure.

[Pennsylvania Spatial Data Access](#): PASDA serves as a comprehensive geospatial data digital library by providing free, universal access to geospatial data and information by, for, and about the Commonwealth of Pennsylvania.

[Raccoon Creek Watershed Association](#): RCWA works to restore and protect the wetlands, streams and lakes of the Raccoon Creek Watershed.

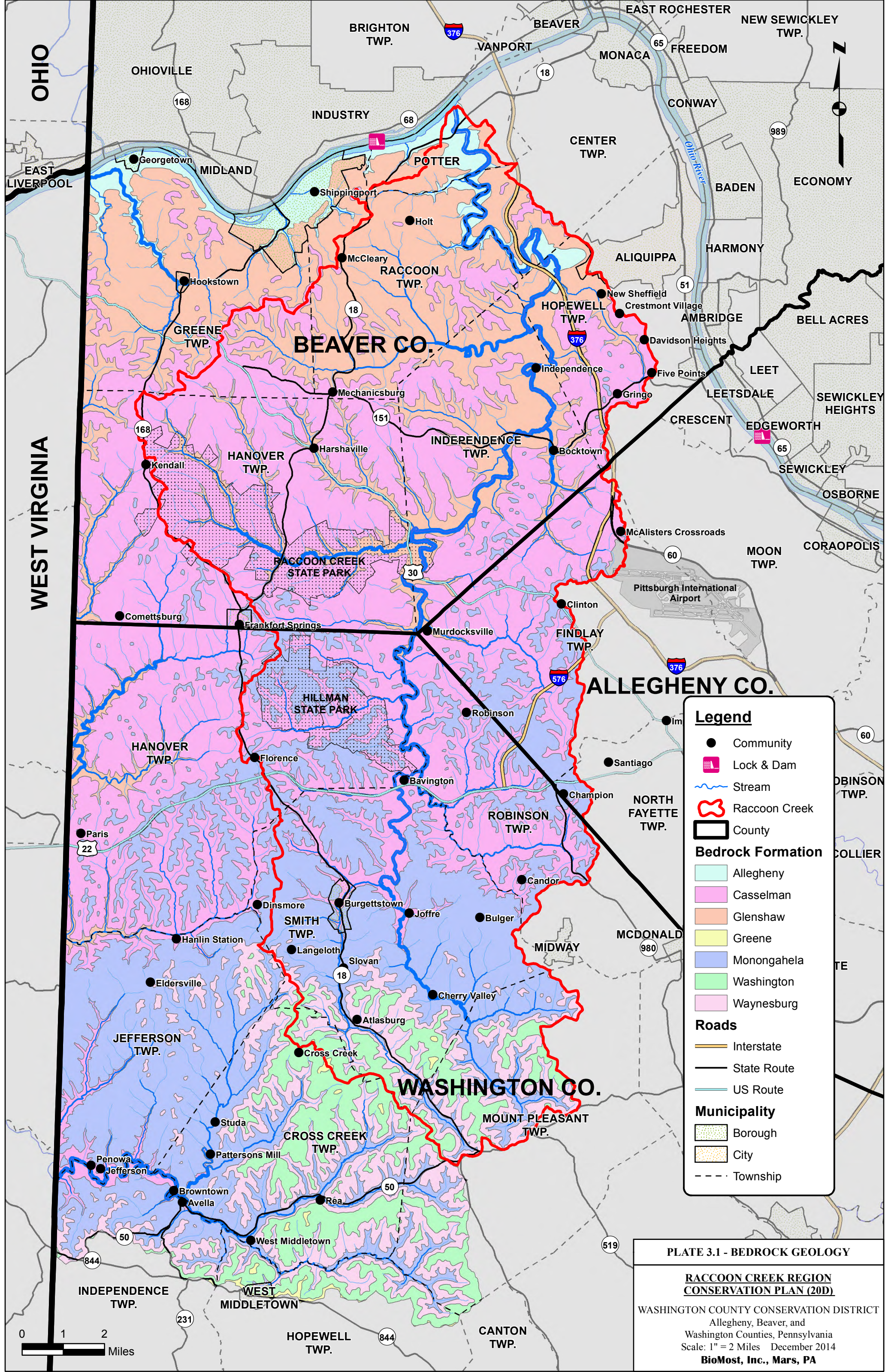
[Stream Restoration, Inc.](#): SRI is a non-profit organization based in Mars, PA, specializing in restoration of AMD-impacted waterways.

[US Department of the Interior, Office of Surface Mining and Reclamation Enforcement](#): OSMRE protects the environment and people while regulating surface coal mining in the United States; funds the restoration of abandoned coal mines.

[Western PA Coalition for Abandoned Mine Reclamation](#): WPCAMR works with watershed volunteers, technical remediation experts and government agencies to reclaim lands and streams polluted by historic coal mining in Western Pennsylvania.

Section 3: Plates

- Plate 3.1: Bedrock Geology of the 20D Raccoon Creek Region**
- Plate 3.2: General Soil Associations of the 20D Raccoon Creek Region**
- Plate 3.3: Farmland Classification of the 20D Raccoon Creek Region**
- Plate 3.4: Farmland Map of the 20D Raccoon Creek Region**
- Plate 3.5: Building Suitability of the 20D Raccoon Creek Region**
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- Plate 3.11: Energy Resources of the 20D Raccoon Creek Region**



Legend

- Community
- Lock & Dam
- ~ Stream
- ⬮ Raccoon Creek
- ▭ County

Bedrock Formation

- Allegheny
- Casselman
- Glenshaw
- Greene
- Monongahela
- Washington
- Waynesburg

Roads

- Interstate
- State Route
- US Route

Municipality

- Borough
- City
- Township

PLATE 3.1 - BEDROCK GEOLOGY

**RACCOON CREEK REGION
CONSERVATION PLAN (20D)**

WASHINGTON COUNTY CONSERVATION DISTRICT
Allegheny, Beaver, and
Washington Counties, Pennsylvania
Scale: 1" = 2 Miles December 2014
BioMost, Inc., Mars, PA

