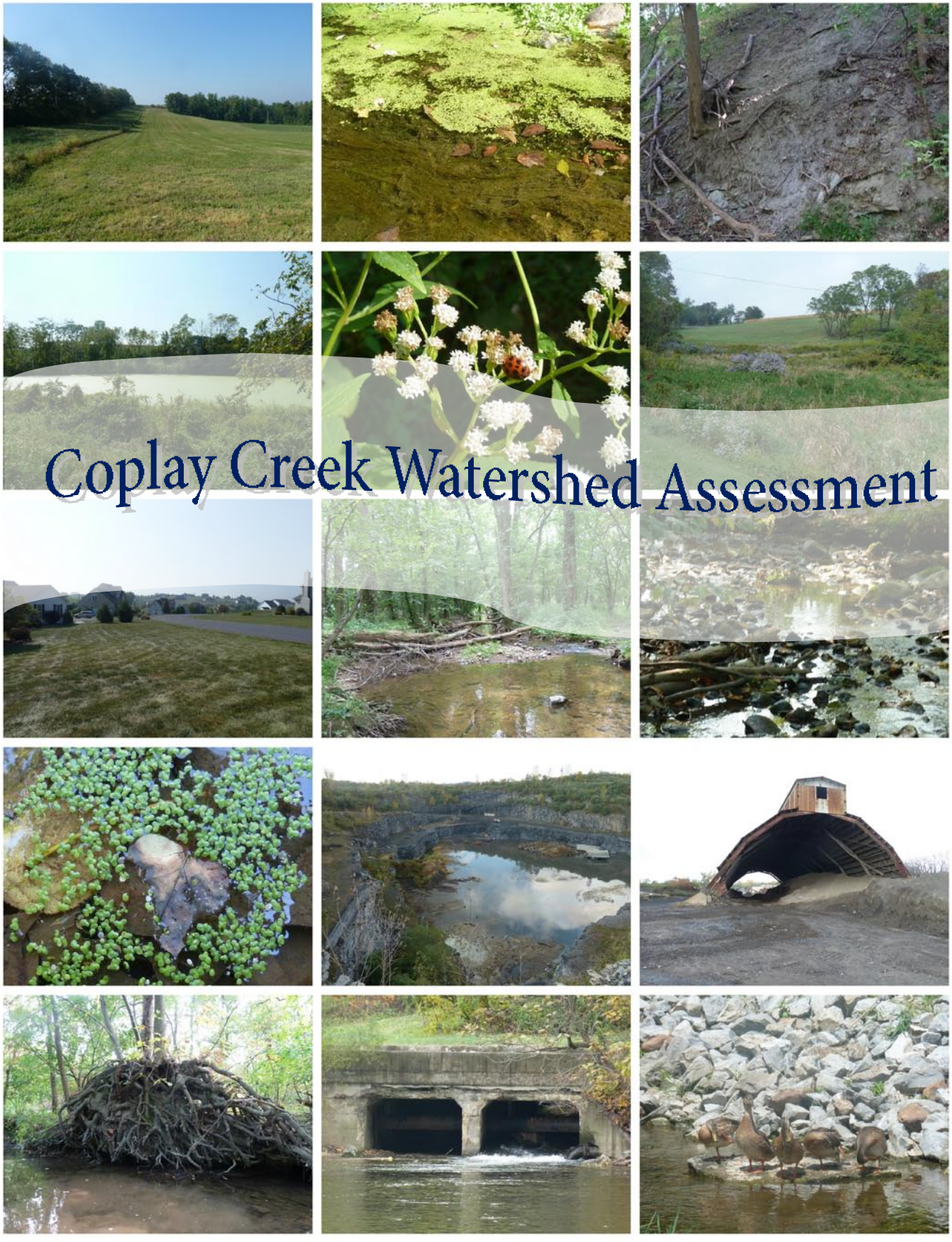


Coplay Creek Watershed Assessment

This project was funded by the Coldwater Heritage Partnership.

COPLAY CREEK WATERSHED ASSESSMENT

Table of Contents

REPORT

MAPS

Acknowledgements and Funding

This study was funded by a grant from the Coldwater Heritage Partnership. The water quality and macroinvertebrate data collected during the course of this study was funded by a grant from the Pennsylvania Department of Environmental Protection (PADEP).

Field work for the visual assessment was assisted by John Rackus of Whitehall Township; Whitehall Township also provided the location for the public meeting. Ken Nicholson of North Whitehall Township kindly provided transportation for the field assessors. Lee Creyer of the Pennsylvania Fish and Boat Commission also provided valuable data on the fish community. Thanks are also due to the Coplay Creek streamside landowners for allowing access to their properties.

Need for Study

Segments of the Coplay Creek are listed by the PADEP as impaired; the source in all cases is siltation, and the causes are listed as surface mining, agriculture, and urban runoff. Although there is a wealth of biological, chemical, and physical water and stream quality data available for the Coplay Creek, it has never been gathered together and analyzed, prior to this study. Further, despite the degradation compatible with the expected effects of mining, farming, and urban development, no study has been done to investigate the exact location of the sources of the water quality impairments.

Scope of Work

This assessment consisted of a number of separate components:

- Full stream visual assessment: The main stem of the Coplay Creek was assessed, based upon a protocol modified from the United States Department of Agriculture (USDA) stream assessment method.
- NPDES (National Pollutant Discharge Elimination System) permit analysis: The existing and historic NPDES files were searched to determine the existing NPDES (discharge) permits in the watershed. These sites were visited to analyze the potential of these discharges to impact water quality.
- Public meetings: Two public meetings were held, in addition to a meeting of the watershed municipalities.
- Historical Aerial Photo and Land Use Analysis – Aerial photos from 1938, the 1971 and 2009 were analyzed to determine present and historic land use in the watershed.
- Coplay Creek Watershed Association: The Coplay Creek community will be encouraged t to start a watershed association.
- Final Report

STUDY AREA & BACKGROUND INFORMATION

Location and Background Information

The Coplay Creek watershed is comprised of portions of Washington, North Whitehall, South Whitehall, and Whitehall Townships and Coplay Borough in Lehigh County, Pennsylvania. The total watershed area is 19.7 square miles, with over 26 stream miles of the main stem and mapped tributary streams. Of that, the lower 2 miles of the main stem are listed as "impaired" for siltation due to agriculture, urban runoff and storm sewer, and surface mining. That designation was made by PADEP biologists on the basis of macroinvertebrate sampling done in 2006. In 2004, the PA Fish and Boat Commission carried out fish species analyses on four sites on the main stem of the Coplay Creek and found a variety of fish species, including both hatchery and wild-reproducing brown and rainbow trout. A Total Maximum Daily Load (TMDL) – a pollution abatement model – is planned for 2012. This model will determine the most effective ways that the water quality in the Coplay Creek can be improved, thus allowing it to once again meet the water quality standards for which it is designated – Cold Water Fishery.

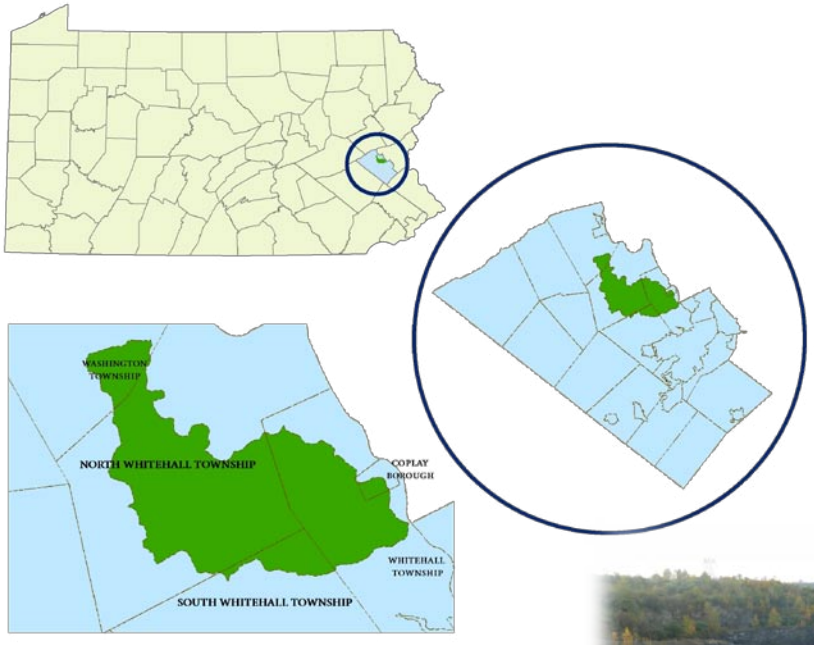


Photo kindly permitted at Coplay Aggregates

Geology

The shape of the landscape, the characteristics of the water and the form that streams take are all influenced by the geology of the region. The Coplay Creek watershed is comprised of a mixture of limestone and non-limestone rocks. Limestone rocks, generally speaking, tend to be softer, and usually form valley-bottoms; whereas siltstone, sandstone, and shale silicon-based rocks tend to be more resistant to weathering and form ridges. Limestone rocks are often also prone to forming sinkholes (and caves).

The headwaters area of the Coplay Creek watershed is comprised of Paleozoic mixed siltstones, sandstones, and shales with some minor inclusions of dolomite. The two formations in the watershed are the Bushkill Member and the Ramseyburg Member. This rock is more resistant to erosion than the Paleozoic limestone and dolomite that forms the lower part of the watershed. **Map: Geology** shows the division between the limestone and non-limestone areas. The Jacksonburg Limestone is well-known for producing a type of limestone good for cement making. All of the rocks in the watershed are originally sedimentary in nature, but some have experienced some metamorphosis through high temperatures and pressures throughout geologic time.

Soils

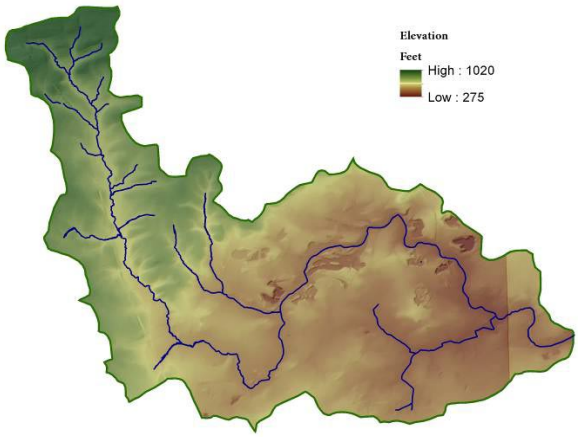
The specific soil characteristics of a watershed are extremely important in determining the land use and runoff patterns in a watershed. Soils have widely varying characteristics in factors such as nutrient levels and drainage rates. These soil characteristics determine what types of land uses are suitable in different locations (i.e., crops, pasture, recreational trails or fields and development). The rate at which water infiltrates, or soaks, into soils also has a significant impact on watershed runoff patterns. Soils with high infiltration rates, such as sandy soils, produce less overland runoff; soils high in clay are typically less permeable, and will produce more runoff. See **Map: Soils** to view the soil types of the Coplay Creek watershed.

The upper, non-carbonate portion of the watershed is primarily composed of a Bedington-Berks complex and Berks-Weikert complex; both soils are well drained, but the Berks-Weikert complex is shallower. Holly and Comly silt loams, which have moderately slow drainage, are the major soils along the stream channels. The slower drainage rate in the floodplain allows for the retention of floodwaters and the growth of hydrophilic (water-loving) vegetation. The lower portion of the watershed, underlain with carbonate geology, contains limestone soils such as Washington silt loam and Duffield silt loam, which are characterized as deep and well drained. Holly silt loam is the predominant soil in the floodplain and there is a higher concentration of urban soils than in the northern area of the watershed,

Aside from industrial and urban areas, the majority of the watershed contains agricultural soils of statewide significance, according to the Lehigh County Soil Survey. These soils have slightly greater slopes and additional limitations, such as poorer drainage and lower fertility, than soils deemed "Prime Farmland Soils", but are still very suitable for agricultural use. Prime farmland soils are considered to have the best characteristics for agricultural activities.

Topography

Elevations in the Coplay Creek watershed range from 1020 feet above sea level in the headwaters in Washington Township to 275 feet above sea level at the confluence with the Lehigh River in Whitehall Township. The majority of the slopes within watershed range between 0 to 8% slopes, with a few areas varying between 8 and 15% in the headwaters. There are also a handful of steeper slopes (25 – 60%) in the watershed found near the stream channels.



HISTORY & LAND USE

Coplay Creek Watershed History

This section is summarized from information contained in The Early History of North Whitehall Township and Whitehall Commemorative booklet, both bicentennial reports on the history of the two townships. Thanks are extended to the staff of these two Townships for providing these publications. Copies of both publications are available at the Township buildings and through the local historical societies.

Agriculture was the first industry in the Coplay Creek region and is still prominent today. Starting in 1830, the area became a hot spot of limestone and iron mining due to the wealth of resources and the vicinity to the Lehigh River, which provided inexpensive transportation.

Iron mining was at its peak from the Civil War era until around 1885, when ores from New Jersey and Lake Superior replaced local ores. In that period, several mines were developed that still influence the water resources in the Coplay Creek watershed. The Thomas Iron Company began mining in Hokendauqua, near the mouth of the Coplay Creek. The company was also responsible for the construction of the Coplay-Ironton Rail Road. Other mines include the Joseph Balliet mine and the Frank P. Mickley mine, located in North Whitehall Township.

Limestone mines and cement quarries dotted the landscape during the mid- to late- 1800's. And while active iron mining has disappeared over the past century, there are still many active cement quarries. The Coplay Cement Company was one of the first to establish a facility in 1866 in the Borough of Coplay; the raw materials were mined in Whitehall Township. Keystone Cement Company was located between Cementon and Coplay. Egypt Mills was located south east of Egypt, with newer mills built near the Coplay Creek crossing of the Ironton Railroad.

Historically, there were also several grist and saw mills along the Coplay Creek near Sand Spring: the Wotring Mill, the Coplay Creek Saw mill, and the Romich Mill.

Historical Aerial Photo Study and Land Use

Method

Land use has changed dramatically throughout the Lehigh Valley region over the past century. The extent and rate of the changes in land use are important factors in assessing the current health of the Coplay Creek. It is possible to analyze the changes in land uses over time using historical aerial photography. These photographs are available on the internet from Penn Pilot for the area starting back

in the late 1930's. The historical aerial photos were geo-referenced in computer mapping software and analyzed for land use. The results are land use layers reflecting the uses in 1938, 1971, and 2009. Land uses were broken down by category based upon what was visible in the historical air photos: agriculture, forest, industry, suburban, highway, golf, commercial, and urban. **Maps of the historical aerial photographs for 1938, 1971, and 2009 and their corresponding land uses are included in this report.**

Findings

Substantial changes have taken place in land use in the Coplay Creek watershed since 1938. The watershed, nearly 85% agriculture in the 1930's, was only 44% agriculture in 2009. This decline in agriculture came largely at the expense of urban and suburban growth. These two land uses together comprised only 3% of the watershed in 1938, and now constitute over 33%. Forested land more than doubled: from around 4% in 1938 to nearly 10% in 2009. This data is displayed in the accompanying charts.

Land Use Impacts on Streams

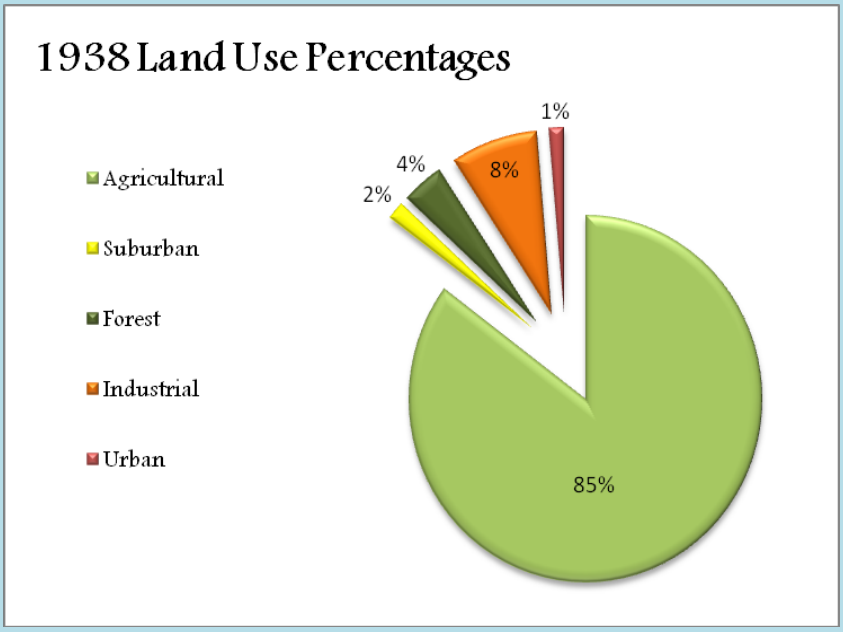
Impervious Cover

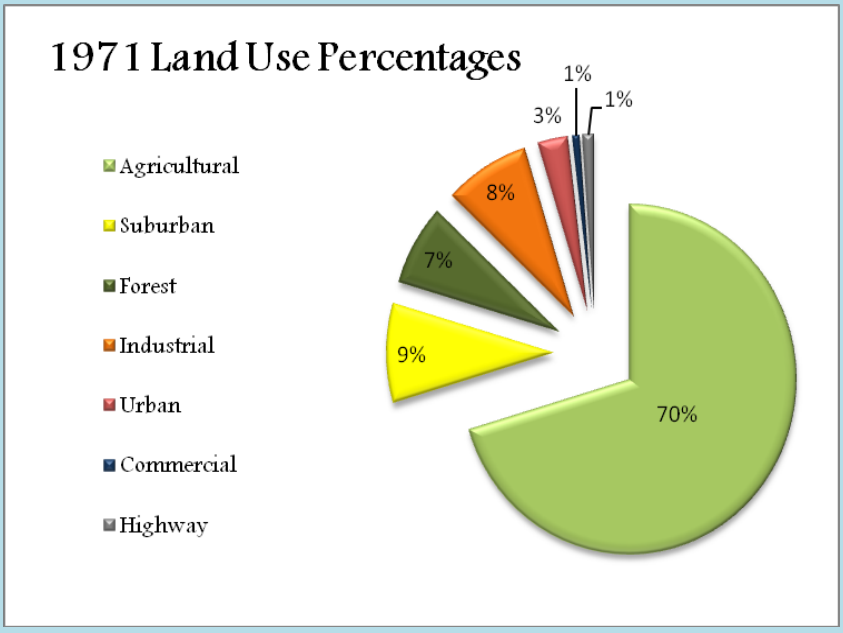
One critical aspect of differing land uses on water quality is the percentage of the land use that is covered with impervious surface, such as roofs and roads that do not absorb any rainfall. A forest absorbs, or uses most of the precipitation that falls on it; a paved industrial complex will absorb almost none. Determining the percentage of a watershed that is currently impervious is an important tool in watershed management. Sources vary as to the exact number, but there is general agreement that, when a stream's watershed reaches certain threshold percentages of impervious surface, the quality of the stream declines rapidly. One critical number is around 10% impervious cover, and another is between 20% and 30%. At approximately 10% impervious cover, streams tend to lose sensitive aquatic organisms; over 20-30%, most stream indicators drop to "poor" condition. Knowing the percentage of impervious cover in a watershed allows managers to make informed decisions about what types of future development may negatively impact water quality.

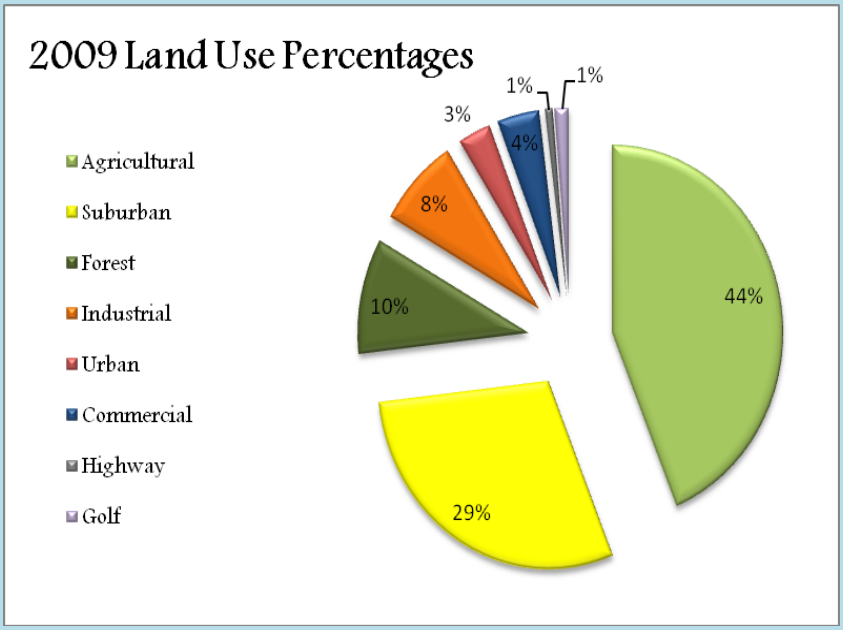
Using the aerial photos and land uses maps, an estimate of both historic and present day impervious cover was determined. This data is displayed in the adjoining table. As agricultural land uses changed to suburban and commercial uses, the amount of impervious cover in the watershed more than doubled, from about 9% in 1938 to 20% in 2009. This is a significant increase. A 20% level of impervious cover is generally recognized as critical

Estimated Acreage of Impervious Coverage

Land Use Type	% Impervious	1938 Acres	1971 Acres	2009 Acres
Agricultural	3	322	266	166
Suburban	25	51	288	924
Forest	2	10	19	25
Industrial	73	729	757	720
Urban	50	84	183	195
Commercial	73	0	66	362
Highway	100	0	141	88
Golf	3	0	0	5
Total Impervious Acreage:		**1195**	**1720**	**2483**
Percentage of Watershed Area:		**9%**	**14%**	**20%**


1938 Land Use Percentages
Agricultural
Suburban
Forest
Industrial
Urban
1%
8%
4%
2%
85%


1971 Land Use Percentages
Agricultural
Suburban
Forest
Industrial
Urban
Commercial
Highway
1%
3%
1%
8%
7%
9%
70%


2009 Land Use Percentages
Agricultural
Suburban
Forest
Industrial
Urban
Commercial
Highway
Golf
1%
1%
3%
4%
8%
10%
44%
29%

threshold for impairment. At this level, stormwater runoff has a strong scouring effect on the stream channel and base flow, the flow in the stream during dry weather, begins to drop off. This effect is mitigated somewhat in the Coplay Creek, because the impervious cover is not distributed evenly throughout the watershed. Urban, commercial, and industrial land uses are concentrated in the lower portion of the watershed, and the upper, headwaters portion has a much lower percentage of impervious cover.

NPDES Permit Analysis

The NPDES program – National Pollutant Discharge Elimination System – is a nation-wide system of permits required for any site or industry which has a point-source that discharges wastewater or stormwater. NPDES permits are a requirement of the Clean Water Act of 1972. As part of this study, an analysis was done of all existing permitted discharges in the watershed. These permits, along with the accompanying chart and **Map: NPDES Sites**, shows each of the permitted discharges. This gives an indication of the sources of water quality impairments in the watershed.

The map shows that there are a wide variety of discharges in the watershed. The majority of these are for residential and industrial developments, and the permits are for the stormwater basins that catch and hold stormwater runoff, releasing it into the creek slowly over time. Most of these basins have been built to control only water quantity, not quality, and so opportunities exist for "retrofitting" these basins with native plantings and created wetlands to improve the quality of water being discharged into the Coplay Creek.

Recommendation: That a watershed-wide study be carried out to determine suitable locations for stormwater retrofits, with associated costs. Because the Coplay Creek is severely impaired, the only measures that will be able to restore the creek will be to retrofit existing stormwater basins to decrease the amount of water entering the stream during storm condition. Retrofits can also significantly improve the quality of stormwater, as well, through wetland plantings and other measures designed to remove pollutants. Other types of retrofits are also possible, such as using grassy meadows or pervious paving to promote infiltration.

Conversion from Agriculture to Suburban Land

Since 1938, agricultural lands in the Coplay Creek Watershed have been overtaken by suburban development, and by newly re-grown forests. People generally assume that this change –from agriculture to suburban development – means that water quality declines. But that is not necessarily so. Suburban development contributes different pollutants to the streams than agriculture: contaminants to groundwater from septic systems, runoff from roads such as motor oil and road salts, and household chemicals washed down the drain. The sheer volume of runoff from all the additional impervious surfaces in a suburban development is substantial, as well, and can have well-documented negative impacts on streams.

But agricultural lands, while not as impervious as roads and rooftops, are often not particularly effective at infiltrating rainwater. And there are other factors. In 1938, agricultural lands were farmed primarily with conventional practices, utilizing fertilizers, pesticides and herbicides with little in the way of soil conservation practices. As can easily be seen on the aerial photos of the time, tilling often went right to

the edge of the stream. Further, farmers often dredged streams, moved them, and drove equipment across streams. Livestock often had unrestricted access to streams. Uncontrolled agricultural runoff from the 85% of the watershed in agriculture would have contributed chemicals and sediment in large quantities to the streams. So, historically, agriculture severely impacted stream health as well.

Thus, the shift from agricultural lands to suburban development does not, by itself, necessarily create obvious conditions for water quality degradation. Particularly in a watershed like the Coplay Creek watershed, where industrial and mining land uses play an important role, separating out the influence of the conversion from agriculture to suburban development can be difficult.

Quarries

Industrial land uses – primarily quarrying – have been substantial in the Coplay Creek watershed since the mid-19th century. The amount of quarrying today has remained similar since 1938, comprising around 8%-9% of the watershed. The quarrying has had, and continues to have, a significant impact on the water resources of the region. First of all, blasting and pumping associated with the quarry places fine sediments directly into the Coplay Creek. Pumping also decreases the volume of the stream's base flow, or year-round flow from groundwater sources. This happens because the quarry holes intersect with the groundwater aquifers, capturing water that would normally provide base flow in the stream. In order to keep quarry holes dry, quarry operators pump this water out. The pumped groundwater is discharged directly to the stream. When pumping is not done continually, this can create significant variations in stream flow, with impacts similar to stormwater discharges. When the quarry ceases operations, pumping of the holes stop and there is a temporary decrease in base flow until the caverns fill up. In extreme cases with very large operations, this has caused streams to dry up for several years before the base flow could return; however, the size of the active quarries in the Coplay watershed would have a minor impact.

Further, as can easily been seen on the 2009 aerial photos, the abandoned quarry holes are filled with water. Generally speaking, the water quality in these quarry holes is excellent, with very cold temperatures and little in the way of pollutants. However, there is some discussion as to whether the water in these holes is still diverting base flow from the streams.

Conclusions

In 1938, land use in the Coplay Creek watershed was primarily agricultural. By 2005, this had shifted to a mixture suburban and forest land, with lesser amounts of urban, golf course, agriculture, and industrial land. Each of these different land uses is associated with different types of pollutants and stormwater runoff. While the land use changes undoubtedly had significant impacts on the water quality of the Coplay Creek and its tributaries, it is difficult to say whether the overall impacts would have been positive or negative. It would be possible through a watershed hydrological analysis to project some of the expected impacts. Development of specific recommendations to improve water quality would require further understanding of the contributions of each type of land use to the stream's impairment. To accomplish this, more in-depth water quality testing and biological analysis would be required.

Recommendation: Conduct a watershed hydrological analysis with additional water quality testing and biological analysis to assess the impacts of each land use on stream health.

NPDES Sites

Municipal Waste Operations

Site Name	Type
LANDFILL	LANDFILL
HELEVA LANDFILL	LANDFILL
LEHIGH VALLEY RECYCLING	TRANSFORMATION STATION

Water Pollution Control Facilities

Site Name	Type	Details
JAINDLS TURKEY FARM	TREATMENT PLANT	INDUSTRIAL WASTE
JAINDLS TURKEY FARM	LAND DISCHARGE	INDUSTRIAL WASTE
JAINDLS TURKEY FARM	LAND DISCHARGE	INDUSTRIAL WASTE
BUCKMAN IRON & METAL	DISCHARGE POINT	STORMWATER-INDUSTRIAL
BUCKMAN IRON & METAL	DISCHARGE POINT	STORMWATER-INDUSTRIAL
BUCKMAN IRON & METAL	DISCHARGE POINT	STORMWATER-INDUSTRIAL
JAINDLS TURKEY FARM	PRODUCTION SERVICE UNIT	INDUSTRIAL WASTE
NORTH WHITEHALL TWP LEHIGH CNTY	CONVEYANCE SYSTEM	Unavailable
BUCKMAN IRON & METAL	DISCHARGE POINT	STORMWATER-INDUSTRIAL
ESSROC CEMENT CORP	DISCHARGE POINT	INDUSTRIAL WASTE
DOMCO TARKETT INC	DISCHARGE POINT	INDUSTRIAL WASTE
LEHIGH VALLEY RECYCLING INC	PRODUCTION SERVICE UNIT	STORMWATER-INDUSTRIAL
LEHIGH VALLEY RECYCLING INC	DISCHARGE POINT	STORMWATER-INDUSTRIAL

Construction Sites

Project Name	Total Acres
VILLAGE @ ST STEPHENS	10.21
IRON LAKES SPORTS CLUB	6.3
KOLARIK & ROCCO ASSOCIATES SD	17.22
WAWA FOOD MARKET-MACARTHUR RD.	2.89
MAPLE WOODS (REVISED 3/29/95)	
WHITETAIL ESTATES-SECTION 2	17.4
OAKWOOD FIELDS (REV 6-30-03)	10.08
NORTH WHITEHALL INDUSTRIAL PARK	71.7
NORTH WHITEHALL INDUSTRIAL PARK	999
NORTH WHITEHALL TWP PUBLIC WORKS BUILDING	17.9
PARK STREET SUBDIVISION	2.29
NORTH WHITEHALL INDUSTRIAL PARK	999
BONTON DEPT. STORES, INC. (7-3-03)	35.2
PARANCHOK PARK	22.019
GARDNER CRYOGENICS	3.55
WASHINGTON PARK (REVISED 11/13/98)	8.6
TIMBER RIDGE - SECTION 6 & 7	999
GATEWAY VIEW SUBDIVISION	9.63
BRIARWOOD COMMONS (REV 06/27/06)	34.7
TIMBER RIDGE - SECTION 6 & 7	999
TIMBER RIDGE - SECTION 6 & 7	15.5
CHESTNUT ST BRIDGE REPLACEMENT	1.6
TAYLOR VILLAS	50.2
MARY ANN'S PLAZA (REV. 5-16-03)	2.63
EAGLE RIDGE RESIDENTIAL SD	26.9
TAYLOR VILLAS	999
BELMONT GLEN SD	19.88
BELLVIEW PLACE	22.8
FAIRLAND FARMS	154.7
JOHN COUGHLIN	12.57
RISING SUN FARM SD	24.06
ANIMAL HOSPITAL - HIGHLAND VIEW FARM LLC	2.86
SCHNECK LOT DEVELOPMENT	1.7

VISUAL ASSESSMENT

Background and Method

As part of this study, a full visual assessment was carried out on the 15 miles of the main stem of the Coplay Creek. To accomplish this, the stream was broken down into 85 reaches, using aerial photos to determine reach breaks where they would be visible on the ground. Reaches were an average of 930 feet long, but individual reaches varied in length. **Map: Coplay Creek Visual Assessment** shows the breakdown of the reaches. The entire stream assessment is included at the end of this report on a disc; recommendations that apply to specific reaches are included in the data for each reach.

The visual assessment protocol used was generally based upon the United States Department of Agriculture (USDA)/Natural Resources Conservation Services (NRCS) Stream Visual Assessment Protocol, with modifications to the method so that it is easier for volunteers to use. Additions were made to the standard protocol to collect data on the material on the stream bed, and in the stream banks, which will assist with future stream and flood plain restoration projects. The visual assessment protocol used an excellent/good/fair/poor rating scale for certain parameters, and asked for a narrative explanation of others. A copy of the assessment sheet is included as **Figure: Visual Assessment Data Sheet**.

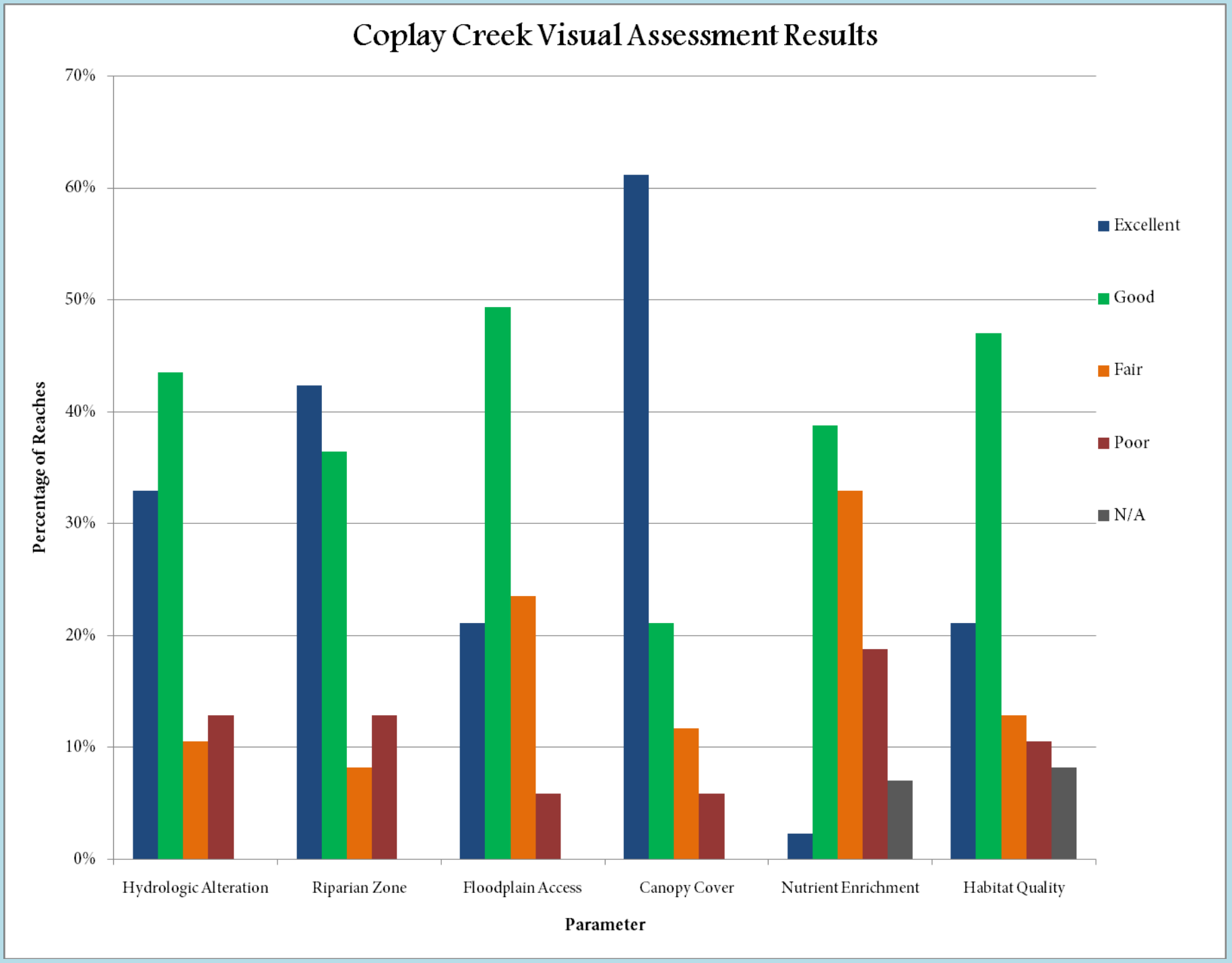
The parameters scored on a rating scale were:

- stream alteration
- riparian zone condition
- floodplain access/channel incision
- canopy cover
- nutrient enrichment
- In-stream fish and invertebrate habitat

Also noted were:

- degree of sedimentation,
- presence of invasive plant species
- unusual or severe problems
- barriers to fish movement

Maps displaying the scores of each parameter throughout the length of the channel are contained in this report; the frequency of the overall results can be seen in the following table.


Coplay Creek Visual Assessment Results
70%
60%
50%
40%
30%
20%
10%
0%
Percentage of Reaches
Excellent
Good
Fair
Poor
N/A
Hydrologic Alteration
Riparian Zone
Floodplain Access
Canopy Cover
Nutrient Enrichment
Habitat Quality
Parameter

Stream Alteration: This describes the degree to which the stream has been visibly altered or confined by human activity. Bridge crossings, retaining walls, dams, dykes, or rip-rap banks (lined with large rocks) are all considered alterations. These structures are of concern because they constrain the natural functioning of the stream channel, reduce habitat, and reduce natural conditions for aquatic wildlife. There is generally little that can be done about most of the stream alterations, as existing bridges and stabilized stream banks cannot be removed. The presence of in-line dams and rock dams was also noted; these structures, especially rock dams, can be removed to restore the streams natural patterns.

Recommendation: Where feasible, when bridges are replaced, ensure that they are adequately sized to prevent acting as obstacles to the free movement of stormwater.

*Recommendation: Remove all existing in-line dams and rock dams in the Coplay Creek (see **Map: Barriers to Fish Movement**).*

Riparian Zone Condition: Ideally, all streams should be protected by a forested or meadow riparian buffer of full-height (i.e., not mowed) trees or meadow grasses. This buffer protects the stream from overland runoff, removes pollutants such as nutrients and silt, and stabilizes the banks with deep, thick root systems. There was quite a bit of variability in the riparian zone condition along the Coplay Creek, from excellent (a buffer over twice as wide as the stream is) to poor (stream bank mowed to the edge or paved). Where ratings were other than "excellent", opportunities exist for improving the buffer condition.

According to recent regulations put in place by the PADEP, all streams are best protected by a stream buffer of at least one hundred and fifty feet (150').

Recommendation: Where riparian buffers are less than "excellent", contact landowners with information about the benefits of riparian buffers and resources available to encourage their installation.

Floodplain Access/Channel Incision: A channel in a natural condition has low banks, less than a foot or so high, allowing the channel to easily access its flood plain during storm flows. When channels are deeply incised, there is enormous erosion pressure on the banks during flood flows, as fast-moving storm water cannot reach the flood plain, spread out, and slow down. The majority of the Coplay Creek had banks 3 feet in height, with little chance for flood waters to spread out and abate.

Recommendation: Regrade the banks where possible, creating shallow, vegetated banks.

Canopy cover is the extent to which the stream is shaded by overhanging trees. This shading keeps the water cool, which is important for trout and other cold-water species of fish. Canopy cover for the Coplay Creek is generally good to excellent throughout the watershed, with some exceptions on the golf course and on agricultural lands.

Recommendation: Plant trees along the stream banks in areas without enough shade. This would be a good project for a volunteer organization.

Nutrient enrichment describes the amount of aquatic vegetation on the stream bed and on the rocks on the stream bottom. The amount of aquatic vegetation generally reflects the amount of nutrients in the stream, specifically nitrogen and phosphorous. The excessive amount of vegetation becomes a concern when the algae begin to decompose and consume dissolved oxygen in the water column; fish are unable to survive when the dissolved oxygen in a stream falls below 6.0 mg/L. Sources of nutrients include lawn and farm fertilizers, poorly functioning septic systems, manure on fields, and sewage treatment plant discharges. Throughout the Coplay Creek, there is considerable variation in the level of nutrient enrichment. There were several areas where algal and aquatic vegetative growth was significant. In one location, it appears that fertilizer may be running off into the stream directly. On the agricultural lands, manure also contributes to nutrient enrichment.

Recommendation: Follow up with landowners whose property has significant nutrient enrichment with suggestions for improving the riparian buffer, and decreasing the amount of nutrients reaching the stream.

Recommendation: Take dissolved oxygen measurements in areas with severe nutrient enrichments.

Fish and macroinvertebrate habitat includes riffles, thick root mats, leaf packs, logs and other woody debris, overhanging vegetation, pools, boulders, undercut banks, and any habitat improvement structures built as part of a stream improvement project. This parameter measures how much habitat there is for both fish, and the aquatic insects that the fish eat, such as mayfly larvae. Except in the headwaters area, the habitat is good or excellent. Where desired, habitat improvements can be made through simple projects which can be carried out by community groups.

Recommendation: Install fish and macroinvertebrate habitat improvement projects at noted locations on the Coplay Creek. Improvement projects could include root wad revetments, log veins, or strategic placement of large boulders.

Sedimentation: In addition, the assessment examined the degree of stream bottom sedimentation. A stream in a natural condition will have a bottom comprised of large gravel and small boulders. When the stream bottom is largely covered with fine sediment (silt and mud), habitat for fish and aquatic macroinvertebrates is degraded.

Many segments of the Coplay Creek showed significant amounts of stream bottom sedimentation. There are several obvious causes for this sedimentation: excessive stormwater runoff from urbanizing areas with inadequate stormwater controls, erosion of steep stream banks, and fine sediment being discharged from mining activities.

Recommendation: Investigate a watershed-wide stormwater retrofit plan, which would examine all the areas where presently uncontrolled runoff could be treated and infiltrated back into the ground, or taken up by plants.

Recommendation: Develop plans for streambank stabilization projects and the planting of native riparian buffers on all the stream segments that rate as "fair" or "poor," to control stream bottom sedimentation.

Invasive Plant Species: The visual assessment made note of where invasive plants were a significant issue along the Coplay Creek. Invasive plants are typically exotic species that were either intentionally or inadvertently introduced. Of the numerous species found, Multiflora rose was the most significant invasive plant present.

An exotic species is one that is not native, but has been introduced and has become established. In 1998, there were some 1,300 species of exotic plants in Pennsylvania (PA DCNR, 1998), and more introduced plants are identified every year. A native plant is defined as one that occurred within the state before settlement by Europeans. Over 27% of the vascular plants species now growing within the borders of Pennsylvania are not native.

An invasive plant not only becomes established, but spreads aggressively into other areas and environments. Most invasive plants are introduced from other continents, leaving behind in their native homeland population controls like pests, diseases and predators, which serve to keep these species in

check. Due to this absence of natural controls, invasive plants reproduce rapidly and can form stands that exclude nearly all other plants. In the process, they damage natural areas, altering ecosystem processes and displacing desirable native plant species. Invasive species may pose a serious threat to the abundance and diversity of vegetation in the Coplay Creek watershed.

Recommendation: Carry out a stream-wide multiflora rose control program, contacting affected landowners with information on controlling the plant and strategies for removal and replanting. This program would have to start with the headwaters to avoid re-colonizing the multiflora rose from upstream sources.

Figure: Visual Assessment Data Sheet

Coplay Creek Watershed
Stream Visual Assessment Protocol

Evaluator(s): Owners Name:

Organization: Reach ID:

Date:

Weather conditions today:

Approximate width of the stream:

Stream Alteration (man-made changes to the stream)

☐	Excellent	Natural channel, currently no structures: bridges, retaining walls, dams, weirs, dikes or riprap.
☐	Good	Single bridge at upstream end of reach, 1 structure present, riprap along less than 25% of the reach.
☐	Fair	Altered channel; 25% - 50% of the reach with riprap and/channelization, 2 structures present.
☐	Poor	Greater than 50% of the reach with riprap or channelization, 3+ structures present.

Riparian Zone

☐	Excellent	Natural vegetation (vs. a manicured lawn) extends at least 2 stream widths on each side.
☐	Good	Natural vegetation extends at least one stream width on each side.
☐	Fair	Natural vegetation extends less than half of the stream width on each side.
☐	Poor	Streambank edge is mowed grass, pavement, or concrete; filtering function is severely compromised.

Note: Small disturbances are acceptable if they do not reduce the filtering capacity (i.e. a path to access the stream).

Floodplain Access/Channel Incision

☐	Excellent	Channel is not incised. Both banks are low, allowing the channel to easily access its floodplain or there is minimal erosion or incision (less than 1ft) on an outside bend.
☐	Good	Limited channel incision (1- 2ft on outside bends) with adequate access to floodplain.
☐	Fair	Floodplain access is moderately restricted by actively eroding, unvegetated banks (2-3ft).
☐	Poor	Channel is deeply incised (+3ft) and unvegetated. Floodplain is inaccessable. Some straight reaches and inside edges of bends are actively eroding as well as outside bends (overhanging vegetation at top of bare bank, numerous mature trees falling into stream annually, numerous slope failures apparent).

Canopy Cover

☐	Excellent	>75% of water surface throughout reach is shaded.
☐	Good	>50% shaded in reach.
☐	Fair	20 to 50% shaded.
☐	Poor	<20% of water surface in reach shaded.

Nutrient Enrichment

☐	Excellent	Little algal growth on stream substrates.
☐	Good	Moderate algal growth on stream substrates.
☐	Fair	Overabundance of algal growth on stream substrates.
☐	Poor	Severe algal blooms create thick algal mats in stream.

Remember to take photos of the reach facing upstream. Photograph any unique features, discharge pipes, and/or areas of concern.

Barriers to Fish Movement

☐ There is NO barrier blocking the movement of fish

☐ There is a barrier

Approximately how high is the barrier?

Is the barrier natural or man-made?

Instream Fish Cover/Invertebrate Habitat

Circle which habitat types are present in significant amounts (1 stick does not = a significant amount!):

Riffles	Logs/woody debris	Deep pools (2 times deeper than the prevailing water depth)
Thick root mats	Overhanging vegetation	Boulders/Cobble
Leaf packs	Isolated /backwater pools	Undercut banks
	Dense macrophyte beds	Habitat improvement structures

☐ **Excellent** 8 to 10 habitat types present in the reach.
☐ **Good** 5 to 7 habitat types.
☐ **Fair** 3 to 4 habitat types.
☐ **Poor** 1 to 2 habitat types present in the reach.

Describe the structure of the reach. How many riffles are there? Where are the riffles located (i.e. on a bend or a straight section)? Approximately how long is each riffle? How deep is the deepest pool?

Describe the material along the stream bottom in riffles, runs, glides and unvegetated bars (i.e. boulder, cobble, gravel, sand, silt, mud).

Describe the degree of sedimentation. Are the riffles completely buried by sediment or are the gravel/cobble particles relatively uncovered? Is there mud over the entire bottom?

Are there stands of invasive plant species (i.e. purple loosestrife, japanese knotweed, tree of heaven)? If so, how extensive is the problem?

In your opinion, are there any severe problems or unusual areas? What might be the cause?

Are there any recommendations that you can think of to improve the conditions of this reach?

Other Notes (Are there good fishing pools? Nice stretches for kayaking? Birding opportunities?):

WATER QUALITY

Water Quality Designations

All of the mapped streams in the Coplay Creek watershed have been given water quality designations by the PADEP in Title 25 Pa Code Chapter 93. These designations are based upon the PADEP evaluation of historic and present stream quality, and they set the standard for which the stream will be managed. The designation for the entire main stem of the Coplay Creek and its tributaries is Cold Water Fishery (CWF).

Determining Water Quality

The PADEP determines stream quality through sampling of the of stream macroinvertebrates: the aquatic insects that live in the stream and on the rocks, fallen woody debris, and leaf packs in the stream. Fly fishermen are familiar with these insects because the "flies" they use imitate them, hoping to fool the fish into biting what looks like a familiar food.

Aquatic macroinvertebrates have very different tolerances for habitat and water quality; some, like leeches and black fly larvae, are very tolerant of polluted and poor quality conditions. Others, like mayfly larvae, are more sensitive and require clean water and good habitat to survive. Therefore, the PADEP determines water quality by sampling the aquatic insects and identifying which ones are living in a particular stretch of stream. Since these organisms live in the water for long periods, this is a more accurate way to measure stream health than taking water samples, which only reveal the water quality at the moment the sample is taken.

Impaired Streams

Sections of the Coplay Creek have been designated as "impaired" by the PADEP due to siltation caused by agriculture, surface mining, and urban storm sewers. The impaired reaches are show in **Map: Stream Designations**. An impaired stream is one that does not meet the water quality standard for its designated use. When a stream is listed as impaired, it is required to develop a plan to return the stream to the higher water quality standard associated with its designated use. This plan is called a TMDL – Total Maximum Daily Load, and the development of a TMDL is mandated by the Federal Environmental Protection Agency in accordance with the Clean Water Act. A TMDL plan locates the sources of the impairments, and calculates what pollutant load reductions are required to return the stream to its designated use. This study will form the initial data collection round for the eventual development of the Coplay Creek TMDL.

Water Quality Data

Concurrently with this study, extensive water quality testing, funded by the Pennsylvania Department of Environmental Protection, was being carried out on the Coplay Creek. The water quality data collected as part of this study included four water quality samples – one in dry weather, and three in wet weather.

Sample sites were at Quarry Street, and along Eberhart Road close to the mouth of the Coplay Creek. Bacteria sampling also took place at these two sites.

Chemical Water Quality Testing

Water quality samples were taken in two locations, as mentioned above, and submitted to an EPA certified lab for analysis. The samples were tested for nitrogen, phosphorus, total suspended solids, ammonia, and biological oxygen demand (a measure of how much of the available dissolved oxygen in the water is being used by microorganisms). Nitrogen and phosphorus are nutrients, and their presence is indicative of poorly functioning septic systems, runoff from animal waste, and/or applications of fertilizers. Testing was also done for heavy metals, whose presence indicates industrial contamination. The tests were carried out in both wet and dry weather conditions. None of the results indicated a problem with water quality. All results were either normal, or well within established limits for a stream designated Cold Water Fishery.

In-field Sampling

A hand-held field probe was used to test for total dissolved solids, temperature, pH, conductivity, salinity, and turbidity. Although turbidity measures were high for the Coplay Creek during storm conditions, they were not alarming compared with storm flow turbidity measurements in other area streams.

Macroinvertebrate Sampling

In-stream kick samples were collected at the two sites, and were sent to Stroud Water Research for analysis. Both samples indicated a severely impaired stream, with the downstream site, along Eberhart Road, being significantly more impaired than the upstream site. These results were commensurate with earlier macroinvertebrate sampling done by the PADEP, which had all resulted in a designation of impairment. The "IBI" scores – indication of biological integrity – in the Coplay Creek range from around 40 down to the mid-teens, with the threshold of impairment being around 63.

Bacteria Sampling

Bacteria samples were taken in accordance with PADEP protocol. For bacteria sampling the requirement is that five samples have to be taken in a 30 day period, twice during the year, in a variety of weather conditions. Bactera (fecal coliform) counts ranged from a low of 25 CFU (colony forming units) per 100 ml to a high of greater than 4000 CFU (the detection limit) per 100 ml. Whether a stream is considered impaired for recreational contact – fishing and wading – depends upon the geometric mean of the sampling results. A stream is impaired if the geometric mean is above 200 CFUs. According to the conclusions of the PADEP, the downstream portion of the Coplay Creek is considered "impaired" for recreational uses.

Recommendation: Further testing, particularly macroinvertebrate testing, is recommended further upstream than Quarry Street to determine if any headwaters segments of the stream are not impaired and to further determine causes of impairment.

Recommendation: Municipalities, watershed landowners and businesses, and the community should participate in the development of the Coplay Creek TMDL to ensure a watershed-wide buy in with the project. For streams that have a designation of impairment, the EPA requires the development of a TMDL – Total Maximum Daily Load. This is a model which calculates how pollution loading needs to be decreased so that the stream can meet the water quality standards appropriate to its designated use. Currently, the Northeastern Region of the PADEP plans to begin development of a TMDL for the Coplay Creek in 2012.

EDUCATION & OUTREACH

In order to effectively address issues concerning natural resources, the appropriate knowledge base must exist within all aspects of the watershed community. Residents, government elected officials and staff, business owners, and schools all play essential parts in protecting and conserving the natural resources. It is not enough for a few natural resource professionals to understand the problems and the potential solutions; those solutions must be conveyed to and adopted by the people able to implement the solutions. So, it is public works staff who are able to keep salt-laden snow from being dumped into streams by storing plowed snow in fields. It is individual homeowners who must keep their septic systems working properly. It is government elected officials who must enact and enforce ordinances that effectively protect natural resources. And, for any of these actions to take place, the appropriate individuals or groups must understand the problem or issues, accept solutions, and then act upon them. This section highlights areas where efforts at outreach, education, and behavior changes may be needed.

Watershed Association

One of the most important and most pressing recommendations from this report is to create a community-based watershed association. Community-based watershed associations have taken a leading role in protecting the water and land resources within their boundaries across the state of Pennsylvania for many years. These local organizations are generally made up of citizen volunteers who take an interest in the health of the streams and rivers in their area. Watershed Associations use community participation, local leadership, and on-the-ground project development and construction to restore degraded waters and protect the health of pristine waters. See **Graphic: Watershed Associations** for example projects.

Government Elected and Appointed Officials

This group includes township supervisors, council members, planning commission and zoning hearing board members, and Environmental Advisory Council (EAC) members. These decision-makers must be well-informed in order to put in place sound regulations, and then implement those regulations to appropriately protect the resource. A strong zoning ordinance may do little good if exceptions are routinely granted.

Recommendation:
Future education and outreach efforts to reach this group should include:

- *Presentations at supervisors' and council meetings, and planning commission and zoning hearing board meetings to present the results of this report, and to determine where additional educational resources might be needed. Topics that may need to be addressed would include EITs, conservation easements, benefits of wetlands and wetland protection, and stream health.*
- *Once a Coplay Creek Watershed Association exists, establish a watershed-wide EAC network to work on establishing common goals and working together on natural resource management*

WATERSHED ASSOCIATIONS

Example Projects:

- Workshops & Seminars covering topics such as rain barrel workshops, rain garden workshops, backyard wildlife habitat,
- Illegal Dump Clean Ups
- Invasive plant removal & native plantigs

throughout the watershed. Working on the recommendations from this document could provide a jumping-off point.
    - *There are currently EACs established in Whitehall and South Whitehall Townships. An EAC should be created in Washington and North Whitehall Townships and the Coplay Borough should appoint a representative to serve as a liaison to the Whitehall Township EAC.*
- *Establish a watershed-wide elected official network, bringing together Township Council members and supervisors and Borough Council members to discuss issues concerning zoning, regulation, and development. Regulatory consistency across municipal boundaries could be a goal of this network.*
- *Work with Zoning Hearing Boards and Planning Commissions to further their education and knowledge of natural resources and environmental protection, focusing particularly on the regulatory power these Boards have to influence how regulations are interpreted.*

Municipal Public Works, Roads, and Utility Staff

Municipal staff has responsibility for a number of activities that can have a profound effect on water and natural resources. Among these activities are: mowing of municipally owned properties and roadsides, spraying of herbicides and pesticides, maintenance and upgrade of infrastructure such as sewers and water lines, sewage treatment plants, and heavy equipment operation.

Recommendation: A general educational outreach program should be developed for municipal staff to keep them informed about the best management practices that affect the activities they carry out.

Municipal Attorney

Generally, the municipal governing board will have an attorney and the zoning hearing board may have another. These attorneys often have a significant voice in municipal decision-making. In many cases, these attorneys may take a conservative approach to environmental decisions, encouraging bodies to routinely grant exceptions to environmental regulations, with the goal of keeping the municipality from being sued.

Recommendation: A comprehensive municipal attorney outreach and education program should be developed to keep this group informed about current case law, and about the importance of a long term strategy for protecting the municipal resource. The goal of this outreach would be to bring the attorneys on board in natural resource protection at the municipal level.

Municipal Engineers

Municipal engineers are involved with all aspects of development projects, and are often involved with the writing of zoning ordinances and SALDOs. Yet, their continuing education obligations often do not adequately keep municipal engineers up to date on the latest developments in natural resource conservation. Often, engineers take a conservative approach, mandating conventional practices, including non-native species in landscaping, mandatory soil compaction on construction sites, and wide curbed roads containing unnecessary impervious surfaces.

Recommendation: Outreach to municipal engineers should provide attractive opportunities to keep up to date on trends and technology related to development and municipal planning.

Landowners and Residents

Landowners control nearly all the land within the Coplay Creek watershed. Landowners fall into a number of categories: residential, commercial, and industrial. (Landowners also include developers and investment buyers, who own land as an investment; they are discussed in the next section). It is the practices that landowners carry out on their land that has the greatest influence on water quality in the Coplay Creek and its tributaries. For that reason, it is essential that effective outreach and education target this group, ensuring that they have the appropriate information to properly manage their land, and put in place conservation and best management practices that will protect the resource.

Recommendation:
Specific efforts should be made to reach landowners in the following areas:

- *Reach out to all streamside landowners informing them of the appropriate ways to care for streamside property and giving them opportunities to seek technical advice should they need it.*
- *Educate landowners about a wide variety of best management practices that affect residential and commercial property, including, but not limited to: care of septic systems, proper use of lawn and garden chemicals, dealing with stormwater, understanding the infiltration systems, such as rain gardens and swales, that may be on their property, how to dispose of household hazardous waste, washing vehicles on lawn areas, not on driveways, and the benefits of native vegetation. Other topics could include: use of detergents on sidewalks, dealing with lawn and garden waste and autumn leaves, landscaping with native plants, and pet waste.*
- *Watershed municipalities and the watershed association should carry out informational workshops for their residents to promote a sense that everyone has a stake in the health of the watershed, and that individuals can make a difference. Workshops should emphasize local examples.*
- *Ensure that all residents are aware of and have opportunities to connect with the Coplay Creek Watershed Association. Incorporate Watershed Association materials into the municipal newsletters.*

Developers

Reaching out to developers and investment property owners is challenging in any community. Developers often may not be residents, and may not have any ongoing connection to the communities in which they are developing, and thus may not be well-informed about local natural resource concerns. Because gaining zoning and development approvals can be complex and expensive, developers often come into the process already having invested considerable amounts in planning, leaving them less interested in working around natural resource issues. Additionally, because each community in Pennsylvania regulates differently, developers may be dealing with many different ordinances, and may not have an interest in creative options. So, effective outreach to developers has to be proactive, making sure that information is easy to obtain, that the development process is as accessible and transparent as possible, and that creative options exist.

Recommendation:
Specific suggestions for education and outreach to developers include:

- *Carry out periodic workshops for developers and investment property owners on regulations in the watershed. Ideally, several municipalities could partner on workshops, even if their regulations differ, so that developers can achieve more "one stop shopping" for information.*
- *Carry out workshops on innovative techniques and environmental best practices: rain gardens, green roofs, low impact development. Inform this group about best methods to protect trees during construction. Make sure they understand the environmental harm caused by soil compaction, and are encouraged to use native plants in their landscape designs.*
- *Work with developers to develop ways to inform future residents about the on-site stormwater facilities that may be on individual lots: swales, etc., so that these facilities are properly cared for.*
- *Have municipal EAC's contact new owners when larger parcels of land are purchased to carry out initial outreach about natural resource protection. Site visits can also be a valuable educational opportunity.*

School Students and Staff

Schools can become involved with water and stream monitoring, and can carry out pertinent environmental projects. Advocacy for natural resources in schools can be an extremely effective strategy for reaching out to the community overall, since energized students frequently take home ideas to their parents. Parent-teacher organizations are also key for an even broader dissemination of stewardship practices.

Recommendation:
To encourage greater participation from the school districts in protecting the natural resources in the watershed, the following should be executed:

- *Prepare presentations for school children of various ages as well as the school boards and PTOs.*
- *Contact science teachers and discuss field trips, environmental lesson plans, and research-based projects.*

Community Groups

There are numerous groups within the watershed carrying out a range of missions related to the community. These groups include Kiwanis clubs, church groups, girl and boy scout troops, and historical societies. With education, these entities have the chance to assist with natural resource protection projects while meeting their own objectives. Community groups serve as a major vehicle in spreading the word to a diverse assemblage of residents.

Recommendation:
The following recommendations should be implemented to involve these groups:

- *Invite group leaders to Watershed Association and EAC meetings*
- *Notify groups of volunteer projects*
- *Carry out presentations at monthly or regular organizational meetings.*

Other Groups

The groups listed above certainly do not represent an exhaustive list of stakeholders. Outreach and education about natural resources is important for a variety of others. Among these are: planners, county elected officials; landscaping and nursery owners; and universities and colleges. Workshops and educational opportunities are recommended for any of these groups, or others not identified here, as the need becomes clear.

NEXT STEPS & OVERALL RECOMMENDATIONS

Coplay Creek Watershed Association: A Coplay Creek Watershed Association should be formed to carry out education and outreach on issues of concern to water quality and stream health within the Coplay Creek watershed. Example projects include:

- Carry out outreach to all streamside landowners informing them of the appropriate ways to care for streamside property and giving them opportunities to seek technical advice should they need it.
- Educate landowners about a wide variety of best management practices that affect residential and commercial property, including, but not limited to: care of septic systems, proper use of lawn and garden chemicals, dealing with stormwater, understanding the infiltration systems, such as rain gardens and swales, that may be on their property, how to dispose of household hazardous waste, washing vehicles on lawn areas, not on driveways, and the benefits of native vegetation. Other topics could include: use of detergents on sidewalks, dealing with lawn and garden waste and autumn leaves, landscaping with native plants, and pet waste.
- Watershed municipalities and the watershed association should carry out informational workshops for their residents to promote a sense that everyone has a stake in the health of the watershed, and that individuals can make a difference. Workshops should emphasize local examples.
- Ensure that all residents are aware of and have opportunities to connect with the Coplay Creek Watershed Association. Incorporate Watershed Association materials into the municipal newsletters.

Coplay Creek EAC Network: Once a Coplay Creek Watershed Association exists, establish a watershed-wide EAC network to work on establishing common goals and working together on natural resource management throughout the watershed. Working on the recommendations from this document could provide a jumping-off point.

- There are currently EACs established in Whitehall and South Whitehall Townships. An EAC should be created in Washington and North Whitehall Townships and the Coplay Borough should appoint a representative to serve as a liaison to the Whitehall Township EAC.

Streambank Stabilization: Develop plans for streambank stabilization projects and the planting of native riparian buffers on all the stream segments that rate as "fair" or "poor," to control stream bottom sedimentation. Regrading the banks where possible to create shallow, vegetated banks will also allow for additional floodplain storage.

Riparian Buffers: Where riparian buffers are less than "excellent" contact landowners with information about the benefits of riparian buffers and resources available to encourage their installation.

Flooding: Where feasible, when bridges are replaced, ensure that they are adequately sized to prevent acting as obstacles to the free movement of stormwater.

Flooding: Remove all existing in-line dams and rock dams in the Coplay Creek.

Additional water quality testing: Chemical and macroinvertebrate tests were carried out at two locations on the Coplay Creek, and both locations were determined to be severely impaired. Further testing, particularly macroinvertebrate testing, is recommended further upstream than Quarry Street to determine if any headwaters segments of the stream are not impaired and to further determine causes of impairment.

Additional water quality testing: Conduct a watershed hydrological analysis with additional water quality testing and biological analysis to assess the impacts of each land use on stream health.

Additional water quality testing: Take dissolved oxygen measurements in areas with severe nutrient enrichments.

TMDL development: For streams that have a designation of impairment, the EPA requires the development of a TMDL – Total Maximum Daily Load. This is a model which calculates how pollution loading needs to be decreased so that the stream can meet the water quality standards appropriate to its designated use. Currently, the Northeastern Region of the PADEP plans to begin development of a TMDL for the Coplay Creek in 2012. Municipalities, watershed landowners and businesses, and the community should participate in the development of the Coplay Creek TMDL to ensure a watershed-wide buy in with the project.

Landowner Water Quality Improvement: Follow up with landowners whose property has significant nutrient enrichment with suggestions for improving the riparian buffer, and decreasing the amount of nutrients reaching the stream.

Stormwater Quality Improvement: Stormwater retrofit study: Because the Coplay Creek is severely impaired, the only measures that will be able to restore the creek to "attaining" status will be to retrofit existing stormwater basins to decrease the amount of water entering the stream during storm condition. Retrofits can also significantly improve the quality of stormwater, as well, through wetland plantings and other measures designed to remove pollutants. Other types of retrofits are also possible, such as using grassy meadows to create sheet flow and infiltration. Investigate a watershed-wide stormwater retrofit

plan, which would examine all the areas where presently uncontrolled runoff could be treated and infiltrated back into the ground, or taken up by plants

Invasive Plant Management: Carry out a stream-wide multiflora rose control program, contacting affected landowners with information on controlling the plant and strategies for removal and replanting. This program would have to start with the headwaters to avoid re-colonizing the multiflora rose from upstream sources.

Fish & Macroinvertebrate Habitat: Develop and put in place fish and macroinvertebrate habitat improvement projects at noted locations on the Coplay Creek. Improvement projects could include root wad revetments, log veins, or strategic placement of large boulders.

Fish & Macroinvertebrate Habitat: Plant trees along the stream banks in areas without enough shade. This would be a good project for a volunteer organization.

SUPPLEMENTARY WATER QUALITY DATA

The following pages contain macroinvertebrate and chemical water quality data for the Coplay Creek.

Station:	Sample Type:	Sample Name:	Subsample Fraction	Sample Date:	Time of Sample:
1	Kick in Riffles	Coplay Creek	4/28	April 2010	N/A
Swec 22		Off Eberhart Rd		4/7/2010	10:49 am

Code	Count	Tally	Taxon
1			Ephemeroptera
40			*Siphlonurus sp.*
39			*Isonychia sp.*
2	5	5	Baetidae
374			*Centroptilum sp.*
5			*Pseudocloeon sp.*
459			*Heterocloeon*
863			*Acentrella*
41	1	1	*Tricorythodes sp.*
42			*Leptohyphes*
7			*Brachycercus sp.*
8			*Caenis sp.*
988			*Plauditus*
9			*Ephemera sp.*
10			*Hexagenia sp.*
2465			*Ephoron*
36			*Anthropotomus sp.*
	1	1	*Ephemerella wp.*
32			*Leptophlebia sp.*
510			*Choroterpes*
11			Ephemerellidae
19			*Serratella sp.*
2608			*Teloganopsis sp*
2607			*Serratella*
23			Heptageniidae
462			*Heptagenia grp.*
24			*Heptagenia*
29			*Maccaffertium sp*
463			*Leucrocuta sp.*
26			*Nixe sp.*
27			*Rhithrogena sp.*
520			*Stenacron sp*
29			*Stenonema sp.*
48			Aeshnidae
53			*Neurocordulia sp.*
55			Gomphidae
56			*Dromogomphus sp.*
71			*Ischnura sp.*
72			*Argia*
57			*Gomphus sp.*
58			Libellulidae
62			*Macromia sp.*
63			Zygoptera
69			Coenagrionidae
70			*Anomalagrion/Ischnura grp*
78			Plecoptera
86			Perlidae
87			*Acroneuria sp.*
95			*Agnetina sp.*
93			*Paragnetina*
91			*Neoperla*
1119			*Pteronarcys*
218			Corixidae
112			Corydalidae
2213			*Corydalus*
114			*Nigronia sp.*
117			*Sialis sp.*
477			*Climacia sp.*
121			Trichoptera
125			Glossosomatidae
127			*Protoptila sp.*
149			Philopotamidae
150			*Chimarra*
629			*Lype sp*
489			*Psychomyia sp.*
151			Polycentropodidae
154			*Neureclipsis sp.*
155			*Nyctiophylax sp.*
156			*Phylocentropus sp.*
157			*Polycentropus sp.*
128			Hydropsychidae
129	3	3	*Cheumatopsyche sp.*
514			*Macrostemum sp.*
130	7	7	*Hydropsyche wp.*

Data recorded by SP on _____ 2010
this is a QA/QC sample these are QA/QC counts

Reviewed by _____ on _____ 2010
Computer entry by _____ on _____ 2010

Station:	Sample Type:	Sample Name:	Subsample Fraction	Sample Date:	Time of Sample:
Swec 22	Kick in Riffles	Coplay Creek	6|28	April 2010	N/A

Code	Count	Tally	Taxon
132			Hydroptilidae
133			*Hydroptila sp.*
488			*Leucotrichia sp.*
139			Leptoceridae
140			*Ceraclea sp.*
145			*Oecetis sp.*
146			*Triaenodes sp.*
573			*Mystacides sp.*
138			*Lepidostoma sp.*
148			*Pycnopsyche sp.*
540			*Neophylax sp.*
123			*Brachycentrus sp.*
689			*Helicopsyche*
242			*Petrophila sp.*
171			*Laccobius sp.*
172			*Tropisternus sp.*
191			*Dineutus sp.*
192			*Gyrinus sp.*
193			*Berosus sp.*
2184			*Psephenus sp*
743			*Anchytarsus*
190			*Peltodytes*
173	4	4	Elmidae
360			*Ancyronyx*
175			*Dubiraphia sp.*
359			*Macronychus*
493			*Microcylloepus sp.*
180			*Optioservus sp.*
981			*Optioservus/Oulimnius*
576			*Promoresia*
183	5	5	*Stenelmis*
243			Diptera
497			*Blepharicera*
244			Ceratopogonidae
245			*Bezzia grp.*
305			Empididae
366	1	1	*Chelifera* sp.
306			*Hemerodromia* sp.

Code	Count	Tally	Taxon
252			Simulidae
253	1	1	*Simulium sp.*
907			*Prosimulium sp*
258			*Tabanus sp.*
261			Tipulidae
263	2	2	*Antocha sp.*
498			*Dicranota sp.*
499			*Erioptera sp.*
500			*Limonia sp.*
501			*Ormosia sp.*
265	15	15	Chironomidae
444			Amphipoda
508			Gammaridae
317			*Gammarus*
509			Asellidae
318			*Asellus*
382			Isopoda
328			Acari
454			Bivalvia
329			*Corbicula sp.*
330			*Sphaerium sp.*
331			Unionidae
332			Gastropoda
507			Ancylidae (limpets)
348			Hirudinea (Leeches)
358			*Helobdella sp.*
389			Planariidae
347			Nematoda
349		173	Oligochaeta
739			Nemertea

Data recorded by SP on _____2010
this is a QA/QC sample these are QA/QC counts

Reviewed by _____ on _____2010
Computer entry by _____ on _____2010

Station: 2	Sample Type: Kick in Riffles	Sample Name: Coplay Creek Quarry Rd	Subsample Fraction 18/28	Sample Date: April 2010 4/7/2010	Time of Sample: ~~N/A~~ 11:48
SWRC #23					

Code	Count	Tally	Taxon
1			Ephemeroptera
40			*Siphlonurus sp.*
39			*Isonychia sp.*
2			Baetidae
3	5	5	*Baetis sp.*
374			*Centroptilum sp.*
5			*Pseudocloeon sp.*
459			*Heterocloeon*
863			*Acentrella*
41			*Tricorythodes sp.*
42			*Leptohyphes*
7			*Brachycercus sp.*
8			*Caenis sp.*
988			*Plauditus*
9			*Ephemera sp.*
10			*Hexagenia sp.*
2465			*Ephoron*
36			*Anthropotomus sp.*
	1	1	*Ephemerella sp.*
32			*Leptophlebia sp.*
510			*Choroterpes*
11	1	1	Ephemerellidae
19			*Serratella sp.*
2608			*Teloganopsis sp*
2607			*Serratella*
23			Heptageniidae
462			*Heptagenia grp.*
24			*Heptagenia*
29			*Maccaffertium sp*
463			*Leucrocuta sp.*
26			*Nixe sp.*
27			*Rhithrogena sp.*
520			*Stenacron sp*
29			*Stenonema sp.*
48			Aeshnidae
53			*Neurocordulia sp.*
55			Gomphidae
56			*Dromogomphus sp.*
71			*Ischnura sp.*
72			*Argia*

Code	Count	Tally	Taxon
57			*Gomphus sp.*
58			Libellulidae
62			*Macromia sp.*
63			Zygoptera
69			Coenagrionidae
70			*Anomalagrion/Ischnura grp*
	1	1	*Amphinemura*
78			Plecoptera
86			Perlidae
87			*Acroneuria sp.*
95			*Agnetina sp.*
93			*Paragnetina*
91			*Neoperla*
1119			*Pteronarcys*
218			Corixidae
112			Corydalidae
2213			*Corydalus*
114			*Nigronia sp.*
117			*Sialis sp.*
477			*Climacia sp.*
121			Trichoptera
125			Glossosomatidae
127			*Protoptila sp.*
149			Philopotamidae
150	11	11	*Chimarra*
629			*Lype sp*
489			*Psychomyia sp.*
151			Polycentropodidae
154			*Neureclipsis sp.*
155			*Nyctiophylax sp.*
156			*Phylocentropus sp.*
157			*Polycentropus sp.*
128	11	11	Hydropsychidae
129	12	11+1	*Cheumatopsyche sp.*
514			*Macrostemum sp.*
130	3	3	*Hydropsyche sp*

Data recorded by SP on _____ 2010
this is a QA/QC sample these are QA/QC counts

Reviewed by _____ on _____ 2010
Computer entry by _____ on _____ 2010

Station: 2	Sample Type: Kick in Riffles	Sample Name: Copley Creek	Subsample Fraction 13/28	Sample Date: April 2010	Time of Sample: N/A
SWRC 23					

Code	Count	Tally	Taxon
132			Hydroptilidae
133			*Hydroptila sp.*
488			*Leucotrichia sp.*
139			Leptoceridae
140			*Ceraclea sp.*
145			*Oecetis sp.*
146			*Triaenodes sp.*
573			*Mystacides sp.*
138			*Lepidostoma sp.*
148			*Pycnopsyche sp.*
540			*Neophylax sp.*
123			*Brachycentrus sp.*
689			*Helicopsyche*
242			*Petrophila sp.*
171			*Laccobius sp.*
172			*Tropisternus sp.*
191			*Dineutus sp.*
192			*Gyrinus sp.*
193			*Berosus sp.*
2184			*Psephenus sp*
743			*Anchytarsus*
190			*Peltodytes*
173	8	8	Elmidae
360			*Ancyronyx*
175			*Dubiraphia sp.*
359			*Macronychus*
493			*Microcylloepus sp.*
180			*Optioservus sp.*
981			*Optioservus/Oulimnius*
576			*Promoresia*
183	6	6	*Stenelmis*
243			Diptera
497			*Blepharicera*
244			Ceratopogonidae
245			*Bezzia grp.*
305	2	2	Empididae
366	1	1	*Chelifera sp.*
306			*Hemerodromia sp.*
	2	2	Clinocera

Code	Count	Tally	Taxon
252	3	3	Simuliidae
253			*Simulium sp.*
907			*Prosimulium sp*
258			*Tabanus sp.*
261			Tipulidae
263	5	5	*Antocha sp.*
498			*Dicranota sp.*
499			*Erioptera sp.*
500			*Limonia sp.*
501			*Ormosia sp.*
265	63	63	Chironomidae
444			Amphipoda
508			Gammaridae
317			*Gammarus*
509			Asellidae
318			*Asellus*
382	3	3	Isopoda
328	2	2	Acari
454	2	2	Bivalvia
329			*Corbicula sp.*
330			*Sphaerium sp.*
331			Unionidae
332	1	1	Gastropoda
507	1	1	Ancylidae (limpets)
348			Hirudinea (Leeches)
358			*Helobdella sp.*
389			Planariidae
347	3	3	Nematoda
349	69	69	Oligochaeta
739			Nemertea

Data recorded by _____ on _____2010
this is a QA/QC sample these are QA/QC counts

Reviewed by _____ on _____2010
Computer entry by _____ on _____2010

Coplay Creek Water Quality Sampling Data

Site	Date	Time	Temperature (°C)	pH	pHmV (mV)	ORP (mV)	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	TDS (g/L)	Salinity (ppt)	BOD	TSS	Ammonia-N	Ortho-P	Phosphorus
Baseflow Samples																
1	12/18/2009	12:45PM	4.81	7.84	-12	335	0.59	7.7	16.33	0.378	0.3	< 2.0	6	< 0.05	< 0.05	0.06
2	12/18/2009	1:15PM	4.06	8.47	-44	305	0.468	8.5	17.45	0.304	0.2	< 2.0	< 5	< 0.05	< 0.05	0.09
Storm Samples																
Precipitation: 0.25 inches																
1	8/13/2010	11:42 AM	17.88	8.42	-69	182	0.6	5.1	9.49	0.384	0.3		5	<0.05	<0.05	<0.05
2	8/13/2010	11:58 AM	20.63	8	-47	192	0.551	2.5	7.4	0.352	0.3		<5	0.06	0.07	0.09
Precipitation: 0.66 inches																
1	9/28/2010	2:37 PM	20.09	8.38	-57	222	0.379	185	7.7	0.246	0.2		330	<0.05	0.12	0.22
2	9/28/2010	2:58 PM	21.54	8.03	-38	206	0.353	314	7.5	0.23	0.2		120	<0.05	0.36	0.24
Precipitation: 5.73 inches																
1	9/30/2010	12:36 PM	19.77	8.02	-38	192	0.252	162	8.16	0.155	0.1		98	<.05	0.09	0.15
2	9/30/2010	12:01 PM	19.36	8.4	-58	191	0.237	129	8.26	0.154	0.1		160	0.08	0.16	0.24

						mg/L										
P Dissolved	**N, Kjeldahl, Total**	**N, Nitrate**	**N, Nitrate-Nitrite**	**N, Nitrite**	**N Total**	**Mercury**	**Arsenic**	**Barium**	**Cadmium**	**Calcium**	**Magnesium**	**Chromium**	**Hardness**	**Lead**	**Selenium**	**Silver**
< 0.05	< 0.5	3.5		0.011												
0.07	< 0.5	5.1		0.016												
<0.05	<0.5		4.4	0.009	4.4	<0.0002	<0.025	0.025	<0.001	82.7	23.6	<0.010	303	<0.010	<0.040	<0.002
0.08	<0.5		3.4	0.029	3.4	<0.0002	<0.025	0.047	<0.001	45.8	13.5	<0.010	170	<0.010	<0.040	<0.002
0.06	<0.5		1.8	0.013	1.8	<0.0002	<0.025	0.052	<0.001	70	15.2	<0.010	238	0.013	<0.040	<0.002
0.15	1		1.4	0.055	2.4	<0.0002	<0.025	0.037	<0.001	27.3	8.31	<0.010	102	<0.010	<0.040	<0.002
0.07	<.5		0.92	0.01	0.9	<0.0002	<0.025	0.02	<0.001	31.8	6.99	<0.010	108	<0.010	<0.040	<0.002
0.13	1.1		2.2	0.021	3.3	<0.0002	<0.025	0.034	<0.001	30.2	8.24	<0.010	109	<0.010	<0.040	<0.002