

**ANALYSES OF GROUND-WATER SAMPLES COLLECTED AT SPECIAL-STUDY SITES
MILL CREEK BASIN, STREAMBANK FENCING PROJECT**

Agriculture is the predominant land use in the Mill Creek Basin of Lancaster County, Pa., and much of the area along streams is used to pasture dairy cattle. Pastured areas have been identified as nonpoint sources of suspended sediment and nutrients to streams. Streambank fencing to exclude animal access is a best-management practice (BMP) that is targeted to reduce suspended-sediment and nutrient inputs to streams. The water-quality effects of specific BMP implementation, such as streambank fencing, on a basin scale are not well documented because of the typical occurrence of mixed land uses within a basin and the implementation of numerous BMPs on a basin-wide scale.

Presently, a cooperative project between the U.S. Geological Survey (USGS) and the Pennsylvania Department of Environmental Protection (PaDEP) is being conducted. The project is funded by PaDEP through the National Monitoring Program (NMP) of the U.S. Environmental Protection Agency. The NMP stems from Section 319 of the 1987 amendment to the Clean Water Act. The NMP was developed to document the effects of NPS pollution-control measures and associated land-use modifications on water quality. The objective of the project is to evaluate the effect of streambank fencing of pasture land on surface- and near-stream ground-water quality within a small watershed underlain by carbonate bedrock.

A paired-watershed approach was designed to quantify streambank-fencing effects. Data collection of surface water, shallow groundwater, and benthic-macroinvertebrate communities in the study basin began in 1993. Fence installation was started and finished in spring-summer 1997 with post-treatment data collection scheduled through water year 2001 and possibly beyond. The two watersheds are located within the Big Spring Run watershed which is a subbasin of the Mill Creek basin of Lancaster County (Fig. 5). The outlet of the control watershed (station number 01576521) drains 1.8 square miles with 2.7 total stream miles and about 2 miles of stream running through open pasture. The outlet of the treatment watershed (station number 01576529) drains 1.4 square miles with 2.8 total stream miles and about 2 miles of stream running through open pasture. Land uses in the basins are about 85 percent agriculture, 10 percent residential/commercial, and 5 percent forested. Agriculture in the two basins primarily involves crop production (mostly corn and alfalfa) and dairy farming.

Other sample locations for the study include five surface-water sites in the treatment basin (stations 01576525, 01576526, 015765265, 01576527, 01576528) and one surface-water site in the control basin (station 01576519). Data for these surface-water sites are shown in this report on pages 287-321. Two nests of wells (LN2037-LN2044) in the treatment watershed are also sampled monthly and are shown in tables in this report on pages 403-424. Additional sites sampled are given in table 2.

For additional information, contact Dan Galeone at the U.S. Geological Survey, 840 Market St., Lemoyne, PA 17043; 717-730-6952 (email dgaleone@usgs.gov).

TABLE 2.--Mill Creek Basin, streambank fencing project station list for well and spring sites sampled in water year 1999.

REMARKS.--Other data for this project presented in tables on pages 287-321 and 403-424.

| Station Number | Local Number | Latitude | Longitude |
|-----------------|--------------|-----------|-----------|
| 395957076155205 | LN 2070 | 39°59'57" | 76°15'52" |
| 395957076155206 | LN 2071 | 39°59'57" | 76°15'52" |
| 395957076155207 | LN 2072 | 39°59'57" | 76°15'52" |
| 395957076155208 | LN 2073 | 39°59'57" | 76°15'52" |
| 395947076145905 | LN 2074 | 39°59'47" | 76°14'59" |
| 395947076145906 | LN 2075 | 39°59'47" | 76°14'59" |
| 395947076145907 | LN 2076 | 39°59'47" | 76°14'59" |
| 395953076155520 | LN 2090 | 39°59'53" | 76°15'55" |
| 395953076155522 | LN 2092 | 39°59'53" | 76°15'55" |
| 400015076155001 | LN 2096 | 40°00'15" | 76°15'50" |
| 395925076153801 | LN SP17 | 39°59'25" | 76°15'38" |
| 395953076155526 | LN SP72 | 39°59'53" | 76°15'55" |
| 395953076155401 | LN SP73 | 39°59'53" | 76°15'54" |
| 395945076151501 | LN SP76 | 39°59'45" | 76°15'15" |

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REMARKS.--Some values for dissolved ortho-phosphorus exceed the values for dissolved phosphorus. These results are within the limits of analytical precision and methods.

WATER-QUALITY DATA, WATER YEAR OCTOBER 1998 TO SEPTEMBER 1999

MISCELLANEOUS STATION ANALYSES

| DATE | TIME | AGENCY ANA- LYZING SAMPLE (CODE NUMBER) (00028) | AGENCY COL- LECTING SAMPLE (CODE NUMBER) (00027) | OXYGEN, DIS- SOLVED (MG/L) (00300) | PH WATER WHOLE FIELD (STAND- ARD UNITS) (00400) | SPE- CIFIC CON- DUCT- ANCE (µS/CM) (00095) | TEMPER- ATURE WATER (DEG C) (00010) | CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940) |
|---|------|---|--|--|--|--|---|--|
| 395925076153801 LN SP17 (LAT 39 59 25N LONG 076 15 38W) | | | | | | | | |
| MAY 1999 05... | 1530 | 80020 | 1028 | 4.3 | 7.3 | 684 | 14.6 | -- |
| 395945076151501 LN SP76 (LAT 39 59 45N LONG 076 15 15W) | | | | | | | | |
| MAY 1999 05... | 1230 | 80020 | 1028 | 4.2 | 7.1 | 813 | 13.8 | -- |
| 395947076145905 LN 2074 (LAT 39 59 47N LONG 076 14 59W) | | | | | | | | |
| JAN 1999 21... | 1350 | 80020 | 1028 | -- | -- | -- | -- | -- |
| MAY 03... | 1500 | 80020 | 1028 | -- | -- | -- | -- | -- |
| 395947076145906 LN 2075 (LAT 39 59 47N LONG 076 14 59W) | | | | | | | | |
| JAN 1999 21... | 1305 | 80020 | 1028 | -- | -- | -- | -- | -- |
| 395947076145907 LN 2076 (LAT 39 59 47N LONG 076 14 59W) | | | | | | | | |
| JAN 1999 21... | 1340 | 80020 | 1028 | -- | -- | -- | -- | -- |
| MAY 03... | 1400 | 80020 | 1028 | -- | -- | -- | -- | -- |
| 395953076155401 LN SP73 (LAT 39 59 53N LONG 076 15 54W) | | | | | | | | |
| MAY 1999 04... | 1400 | 80020 | 1028 | 3.9 | 7.8 | 835 | 12.3 | -- |
| 395953076155520 LN 2090 (LAT 39 59 53N LONG 076 15 55W) | | | | | | | | |
| MAY 1999 04... | 1030 | 80020 | 1028 | .1 | 7.8 | 674 | 18.6 | -- |
| 395953076155522 LN 2092 (LAT 39 59 53N LONG 076 15 55W) | | | | | | | | |
| MAY 1999 04... | 1130 | 80020 | 1028 | .9 | 7.9 | 730 | 18.5 | -- |
| 395953076155526 LN SP72 (LAT 39 59 53N LONG 076 15 55W) | | | | | | | | |
| MAY 1999 04... | 0900 | 80020 | 1028 | -- | -- | -- | -- | -- |
| 395957076155205 LN 2070 (LAT 39 59 57N LONG 076 15 52W) | | | | | | | | |
| NOV 1998 17... | 1030 | 80020 | 1028 | -- | -- | -- | -- | 28 |
| 395957076155206 LN 2071 (LAT 39 59 57N LONG 076 15 52W) | | | | | | | | |
| NOV 1998 17... | 1040 | 80020 | 1028 | -- | -- | -- | -- | 30 |
| MAY 1999 05... | 0900 | 80020 | 1028 | .0 | 7.6 | 711 | 15.1 | -- |
| 395957076155207 LN 2072 (LAT 39 59 57N LONG 076 15 52W) | | | | | | | | |
| NOV 1998 17... | 1015 | 80020 | 1028 | -- | -- | -- | -- | 26 |

**ANALYSES OF GROUND-WATER SAMPLES COLLECTED AT SPECIAL-STUDY SITES
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WATER-QUALITY DATA, WATER YEAR OCTOBER 1998 TO SEPTEMBER 1999

MISCELLANEOUS STATION ANALYSES

| DATE | SULFATE DIS- SOLVED (MG/L AS SO4) (00945) | NITRO- GEN, DIS- SOLVED (MG/L AS N) (00608) | NITRO- GEN, AM- MONIA + ORGANIC DIS. (MG/L AS N) (00623) | NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631) | NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613) | PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666) | PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671) | DEPTH BELOW LAND SURFACE (WATER LEVEL) (FEET) (72019) |
|-------------------|--|---|---|--|--|--|--|--|
| | 395925076153801 LN SP17 (LAT 39 59 25N LONG 076 15 38W) | | | | | | | |
| MAY 1999 05... | -- | .034 | E.10 | 9.66 | <.010 | <.050 | .024 | -- |
| | 395945076151501 LN SP76 (LAT 39 59 45N LONG 076 15 15W) | | | | | | | |
| MAY 1999 05... | -- | .038 | E.10 | 12.0 | <.010 | <.050 | .012 | -- |
| | 395947076145905 LN 2074 (LAT 39 59 47N LONG 076 14 59W) | | | | | | | |
| JAN 1999 21... | -- | .029 | .24 | 15.4 | <.010 | <.004 | -- | -.03 |
| MAY 03... | -- | .144 | 1.3 | 15.7 | <.010 | <.050 | .026 | .15 |
| | 395947076145906 LN 2075 (LAT 39 59 47N LONG 076 14 59W) | | | | | | | |
| JAN 1999 21... | -- | .078 | .60 | 14.0 | <.010 | .009 | -- | .26 |
| | 395947076145907 LN 2076 (LAT 39 59 47N LONG 076 14 59W) | | | | | | | |
| JAN 1999 21... | -- | .023 | .85 | 29.3 | <.010 | .053 | -- | 1.29 |
| MAY 03... | -- | .067 | .45 | 12.7 | .018 | .051 | .052 | 1.39 |
| | 395953076155401 LN SP73 (LAT 39 59 53N LONG 076 15 54W) | | | | | | | |
| MAY 1999 04... | -- | .046 | .16 | 12.0 | <.010 | <.050 | .022 | -- |
| | 395953076155520 LN 2090 (LAT 39 59 53N LONG 076 15 55W) | | | | | | | |
| MAY 1999 04... | -- | .046 | .40 | .131 | <.010 | .064 | .017 | 1.71 |
| | 395953076155522 LN 2092 (LAT 39 59 53N LONG 076 15 55W) | | | | | | | |
| MAY 1999 04... | -- | .046 | E.10 | 6.90 | .016 | <.050 | .013 | -1.73 |
| | 395953076155526 LN SP72 (LAT 39 59 53N LONG 076 15 55W) | | | | | | | |
| MAY 1999 04... | -- | .039 | E.10 | 12.0 | <.010 | <.050 | .019 | -- |
| | 395957076155205 LN 2070 (LAT 39 59 57N LONG 076 15 52W) | | | | | | | |
| NOV 1998 17... | 32 | 1.04 | 1.2 | <.050 | <.010 | .213 | .071 | -- |
| | 395957076155206 LN 2071 (LAT 39 59 57N LONG 076 15 52W) | | | | | | | |
| NOV 1998 17... | 47 | 1.80 | 2.1 | .067 | <.010 | .081 | .010 | -- |
| MAY 1999 05... | -- | .720 | .86 | <.050 | <.010 | .082 | .078 | .57 |
| | 395957076155207 LN 2072 (LAT 39 59 57N LONG 076 15 52W) | | | | | | | |
| NOV 1998 17... | 20 | .930 | 1.1 | <.050 | <.010 | <.050 | <.010 | -- |

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WATER-QUALITY DATA, WATER YEAR OCTOBER 1998 TO SEPTEMBER 1999

MISCELLANEOUS STATION ANALYSES

| DATE | TIME | AGENCY | AGENCY | PH | | SPE- CIFIC | TEMPER- ATURE WATER | CHLO- RIDE, DIS- SOLVED (MG/L AS CL) |
|---|------|---|--|--|--|---------------|---------------------------|---|
| | | ANA- LYZING SAMPLE (CODE NUMBER) (00028) | COL- LECTING SAMPLE (CODE NUMBER) (00027) | OXYGEN, DIS- SOLVED (MG/L) (00300) | WATER WHOLE FIELD (STAND- ARD UNITS) (00400) | | | |
| 395957076155208 LN 2073 (LAT 39 59 57N LONG 076 15 52W) | | | | | | | | |
| NOV 1998 17... | 1010 | 80020 | 1028 | -- | -- | -- | -- | 27 |
| MAY 1999 05... | 1000 | 80020 | 1028 | .1 | 7.3 | 707 | 16.9 | -- |
| 400015076155001 LN 2096 (LAT 40 00 15N LONG 076 15 50W) | | | | | | | | |
| MAY 1999 05... | 1400 | 80020 | 1028 | .1 | 7.3 | 816 | 14.4 | -- |

| DATE | SULFATE DIS- SOLVED (MG/L AS SO4) (00945) | NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608) | NITRO- GEN,AM- MONIA + ORGANIC DIS. (MG/L AS N) (00623) | NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631) | NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613) | PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666) | PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671) | DEPTH BELOW LAND SURFACE (WATER LEVEL) (FEET) (72019) |
|---|--|--|--|--|--|--|--|--|
| | | 395957076155208 LN 2073 (LAT 39 59 57N LONG 076 15 52W) | | | | | | |
| NOV 1998 17... | 19 | .649 | 2.3 | <.050 | <.010 | .043 | .012 | -- |
| MAY 1999 05... | -- | .665 | .80 | .050 | <.010 | .090 | .079 | 2.11 |
| 400015076155001 LN 2096 (LAT 40 00 15N LONG 076 15 50W) | | | | | | | | |
| MAY 1999 05... | -- | .043 | E.10 | .134 | .057 | <.050 | <.010 | -- |