

IMPLEMENTATION OF STORMWATER BMPS IN THE LAKE LUXEMBOURG / CORE CREEK WATERSHED, BUCKS COUNTY, PA

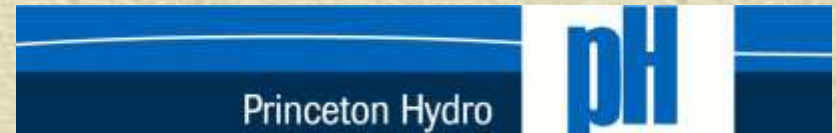
Fred S. Lubnow, Ph.D.

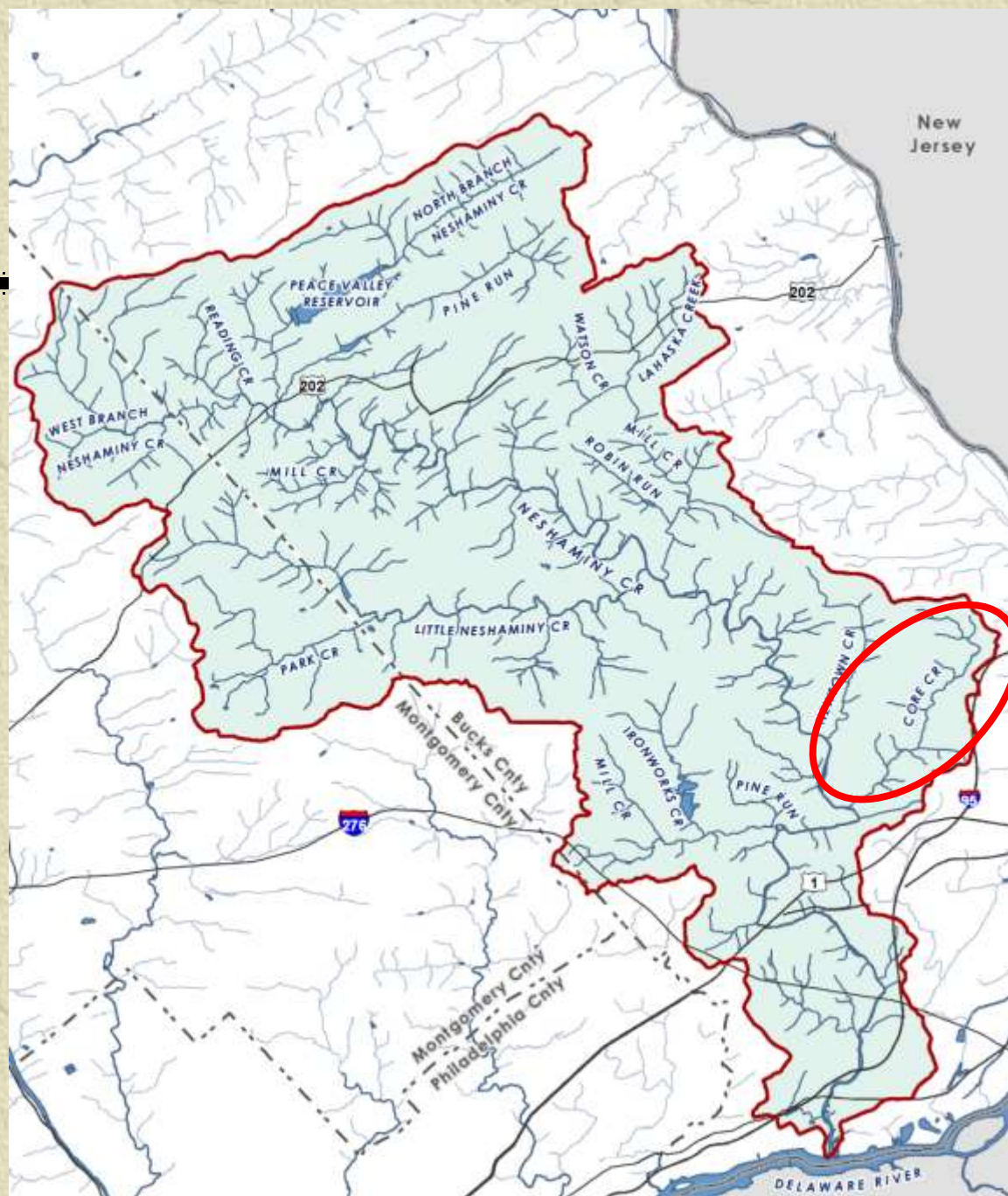
Princeton Hydro, LLC

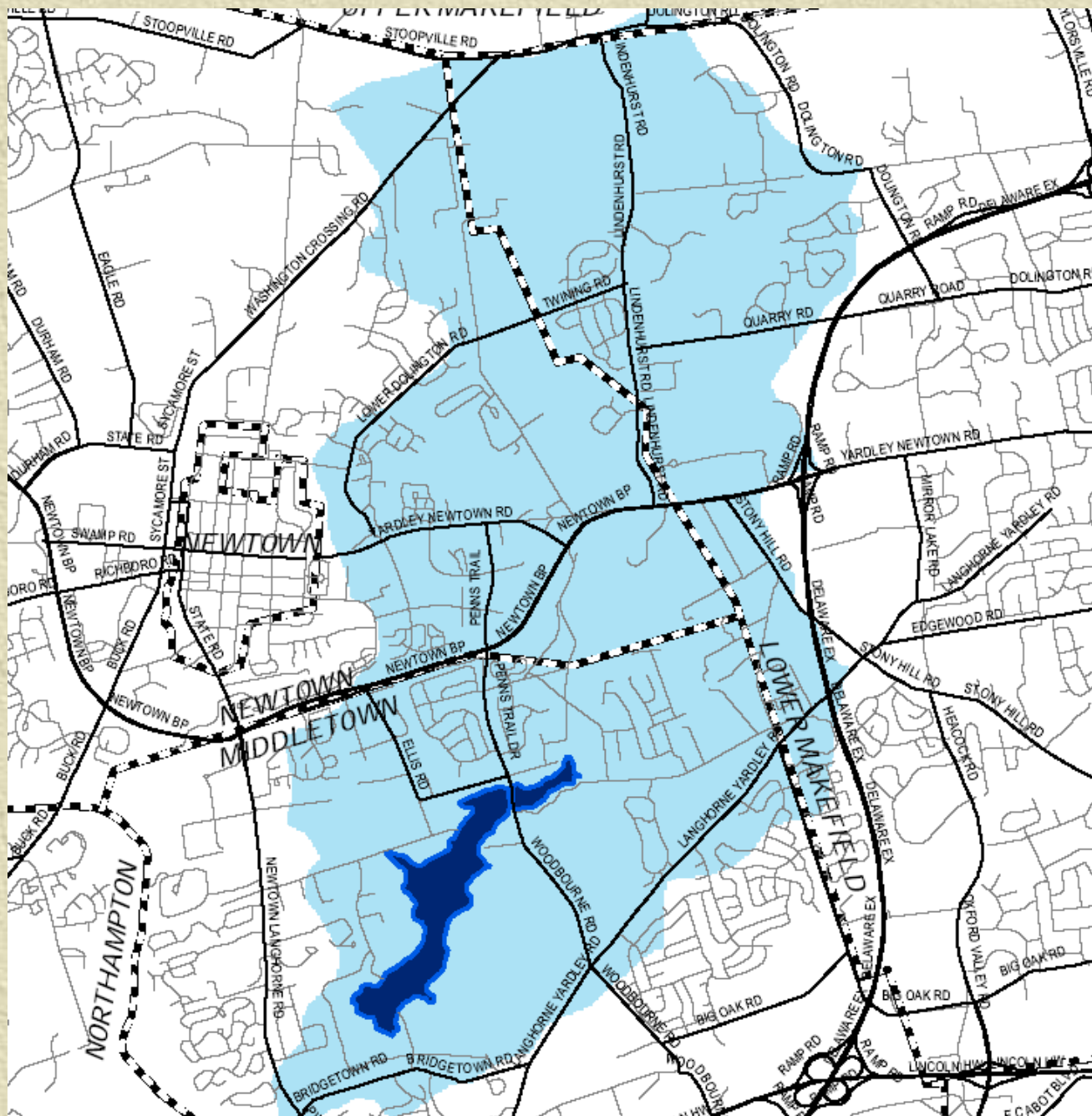
203 Exton Commons

Exton, Pennsylvania 19341

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CORE CREEK PARK

BUCKS COUNTY DEPARTMENT OF
PARKS AND RECREATION
901 E BRIDGETOWN PIKE
LANGHORNE, PA 19047 - 1597
215-757-0571 - PARK OFFICE
215-757-1225 - BOAT RENTAL
parksandrecreation@co.bucks.pa.us

- | | | | |
|--|--------------------|--|----------------------|
| | Main Office | | Fishing Dock (24hr) |
| | Maintenance Center | | Boat House |
| | Parking | | Boat Launch |
| | Restroom | | Boat Parking |
| | Athletic Fields | | Paved Walking Trails |
| | Playground | | Hike And Bike Trails |
| | Basketball Court | | |
| | Soccer Field | | |
| | Softball Field | | |
| | Tennis Court | | |
| | Pavillion | | |
| | Picnic Area | | |
| | Dog Park | | |
| | Dam | | |
| | Fishing | | |
| | Fishing Dock | | |



1 inch = 912 feet
Date: 5/7/2015

Lake Luxembourg



Lake Luxembourg

- ✧ Lake was constructed in 1977 as a flood control impoundment by the Soil Conservation Service.
- ✧ Surface area of 174 acres (17 acres of this total is the conservation pool).
- ✧ Mean and maximum depths of 6.9 ft and 27.7 ft, respectively.
- ✧ Watershed area of 6,209 acres
- ✧ Annual flushing rate of approximately 8 times per year
- ✧ Shift in dominant land type over 20 years from agriculture to residential



Princeton Hydro

pH

Original Clean Lakes Study

- ✦ Clean Lakes Study (314) was conducted in 1991-1992
- ✦ Collected detailed water quality / watershed data
- ✦ Calculated hydrologic / pollutant loads for the lake and watershed
- ✦ Developed a Restoration / Management Plan for lake and watershed

Past Studies / Projects at Lake Luxembourg / Core Creek

- ✦ High nutrient and solid loads.
- ✦ Phase I Diagnostic / Feasibility Study conducted in early 1990's (BCCD).
- ✦ Section 319 grant provided funds to reduce pollutant loads from agricultural lands (1995-1998; BCCD).
- ✦ Second 319 grant provided funds to address shoreline erosion and public education (1999-2002; BCCD).

Past Studies / Projects at Lake Luxembourg / Core Creek

- ✦ While the second 319 was underway in 1999, PADEP developed a TMDL for phosphorus and suspended solids pollutant loads.
- ✦ The TMDL was revised / updated by US EPA and Bucks County CD in 2005.
- ✦ A revised Restoration / Management Plan was developed in 2005, integrating the results of the TMDL into the Plan.

Past Studies / Projects at Lake Luxembourg / Core Creek

- ✦ A third 319 grant was awarded and focused on additional shoreline stabilization work and small-scale BMPs that could be used in suburban settings (2005-2008; BCCD).
- ✦ Updated the Plan in 2008.
- ✦ Ultimate goal is to reduce the existing TP and TSS loads that enter Lake Luxembourg as outlined in the TMDL.

Existing TMDL Scenarios for Lake Luxembourg

- ✦ Existing Pollutant Loads: TP is 2,979 lbs and TSS is 3.7 million lbs.
- ✦ Targeted Pollutant Loads: TP is 2,254 lbs and TSS is 2.9 million lbs.
- ✦ Thus, a 24% decline is identified for TP (725 lbs) and a 23% decline is identified for TSS (0.86 million lbs).

SFY2011 319 grant

- ✧ A fourth 319 grant (existing) was awarded the BCCD for the design and retrofit of four existing detention basins, converting them into naturalized dry, extended (water quality) basins.
- ✧ An additional 1,000 linear feet of shoreline stabilization
- ✧ Conducted a bathymetric assessment of the conservation pool
- ✧ In-lake and stormwater monitoring (2013 and 2014)

Over the last few years...

- ✦ Used the bathymetric data on the conservation pool to develop a proposed Scope of Work for converting the pool into some type of stormwater / wetland BMP
- ✦ Revised the Watershed Implementation Plan (2016)
- ✦ Have been working on the design of the conservation pool with funds provided through a 5th 319-grant (SFY2014)

Eroded shoreline - 2000



Students from Neshaminy Middle School assist in the planting of shoreline vegetation at Lake Luxembourg, 25 April 2001



Students from Neshaminy Middle School assist in the planting of shoreline vegetation at Lake Luxembourg, 25 April 2001



Shoreline vegetation project at Lake Luxembourg, mid-October 2001



Shoreline vegetation project at Lake Luxembourg, March 2005



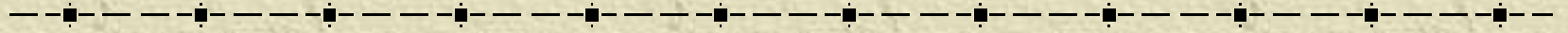
Shoreline vegetation project at Lake Luxembourg, March 2005



Shoreline vegetation project at Lake Luxembourg, late August 2005



Original stabilization project June 2006



Neshaminy Middle School students receive instructions on planting along the banks of Lake Luxembourg, April 2006



Neshaminy Middle School students determine where to plant vegetation that will protect Lake Luxembourg from harmful NPS pollution April 2006



Second shoreline stabilization site

30 May 2008



Pocket Wetland



Construction of Pocket Wetland

26 September 2007



Pocket Wetland

30 May 2008



Pocket Wetland

30 May 2008



Pocket Wetland

23 July 2008



Pocket Wetland

23 July 2008



Pocket Wetland

23 July 2008



Heather Ridge Basin CC-E63

Lower Makefield Township



Removal of low-flow concrete channel at Heather Ridge Basin



Heather Ridge Basin CC-E63 (June 2015)



Heather Ridge Basin CC-F59 (June 2015)



Yardley Run Basin CC-F57 (Lower Makefield; June 2015)



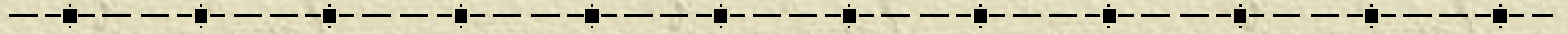
Nun Academy Basin CC-G54 (Lower Makefield; June 2015)



Eroded shoreline along southwestern corner of Lake Luxembourg (photo by BCCD)



Eroded shoreline along southwester corner of Lake Luxembourg (photo by BCCD)

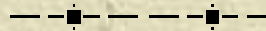


Re-grading the shoreline (September 2014)



Re-grading the shoreline (September 2014)











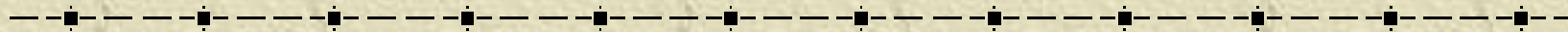


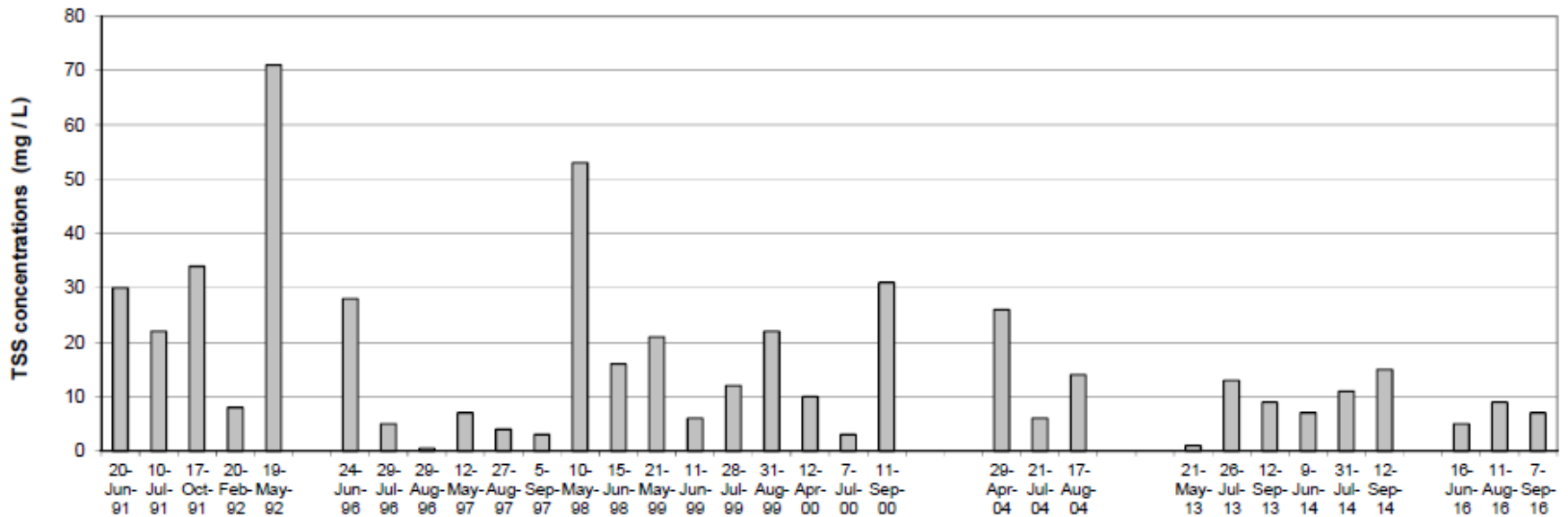
Table 3

**Summary of the TP and TSS loads removed as part of this 319-grant for
Lake Luxembourg / Core Creek, Bucks County, PA**

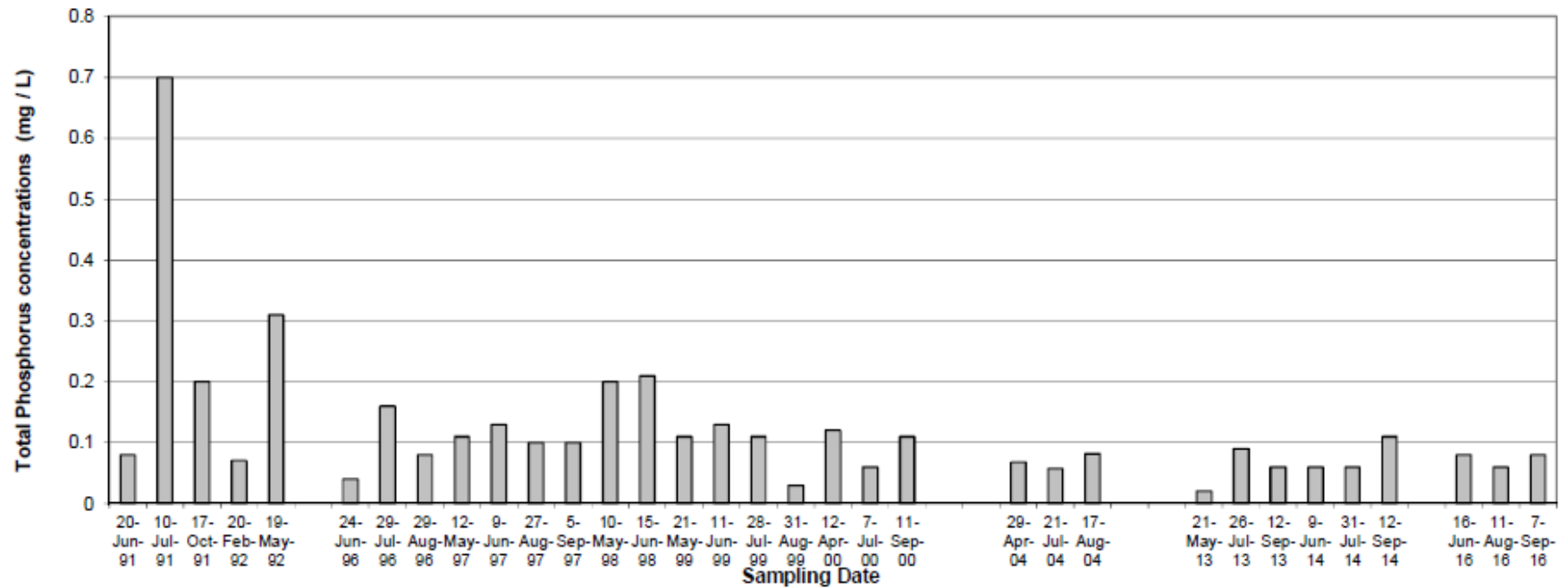
BMP	TP removed lbs	TSS removed lbs
Heather Ridge Basin CC-E63	6.4	6,410
Heather Ridge Basin CC-F59	6.4	6,410
Yardley Run Basin	4.3	4,274
Nun Academy Basin	4.3	4,274
Streambank Stabilization	0.4	792
Total	21.8	22,160

Scenario / Pollutant Removal Conditions	TP (lbs)	TSS (lbs)
Required Pollutant Load Reductions	725	859,833
Amount of Pollutants removed from 2008 319-grant	35	93,042
Amount of Pollutant removed from 2011 319-grant (existing)	22	21,968
Total from last two 319-grants	57	115,010
Percent of Required Pollutant Load Reductions Attained	7.9	13.4

Long-Term TSS in Lake Luxembourg



Long-Term TP in Lake Luxembourg



Targeted TMDL Endpoint

- ✱ 0.05 mg/L; mean surface water TP concentration (TSI for TP of 62)
- ✱ 2013 mean 0.06 mg/L (TSI for TP of 63)
- ✱ 2014 mean 0.08 mg/L (TSI for TP of 67)
- ✱ 2016 mean 0.07 mg/L (TSI for TP of 66)

Update the WIP

- ✦ Field-based assessments to identify additional watershed projects
- ✦ Basin retrofits, streambank stabilization, wet pond enhancement, goose control, etc.
- ✦ Conducted over 2015 - 2016









Rate of Sedimentation into the Conservation Pool

- ✦ Rate of sedimentation between 1977 and 1987 was approximately 30,000 cubic yards per year
- ✦ Rate of sedimentation between 1987 and 1992 was approximately 15,400 cubic yards per year
- ✦ Rate of sedimentation between 1992 and 2013 was approximately 2,500 cubic yards per year



Main Body of Lake Luxembourg (9 July 2014)



Conservation Pool

(9 July 2014; note high turbidity)

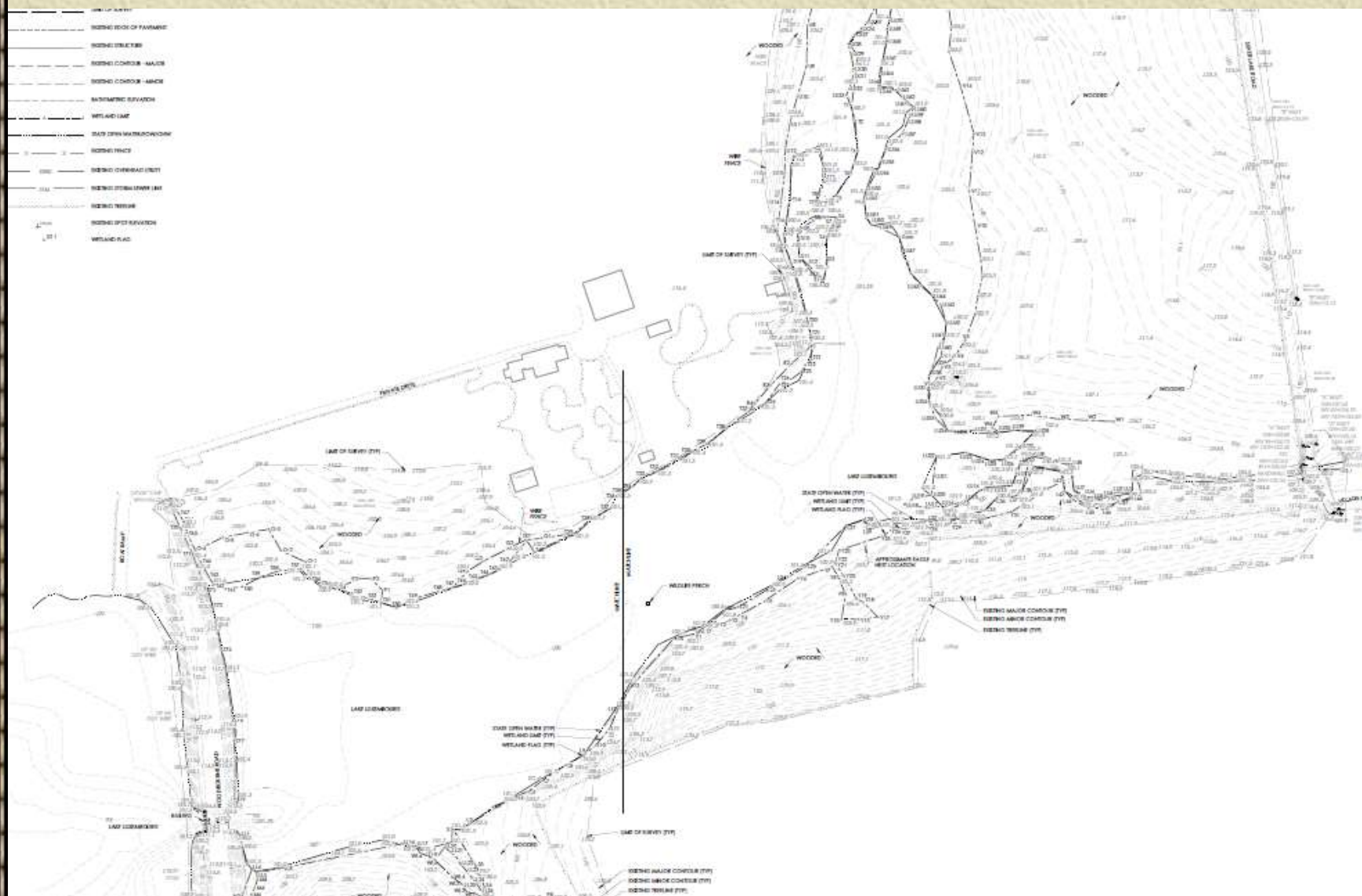


Conservation Pool

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- ✧ Originally designed to function as a BMP.
 - ✧ Now a source of pollutants instead of a sink.
 - ✧ In order for any update BMPs or watershed management activities to have a positive impact on Lake Luxembourg, something must be done with the conservation pool.
 - ✧ Converting the conservation pool into a large-scale, regional BMP (flood plain / wetland BMP) would produce the single largest reductions of TP and TSS of any implemented BMP

Conservation Pool

- ✦ To date, submitted conceptual design to BCCD and Bucks County Parks & Rec.
- ✦ Provided a series of recommendations including accommodating for educational access / facilities
- ✦ Reaching out to PA DEP to set up a pre-application meeting









THANK YOU

