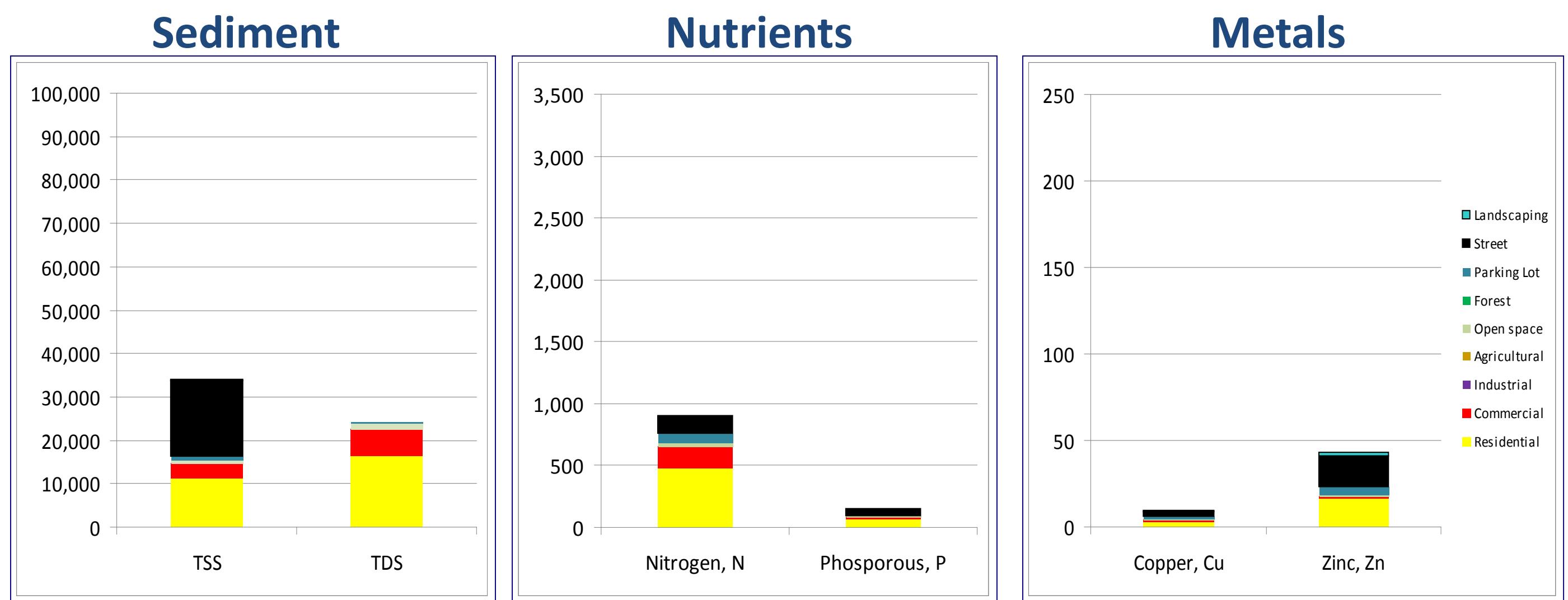


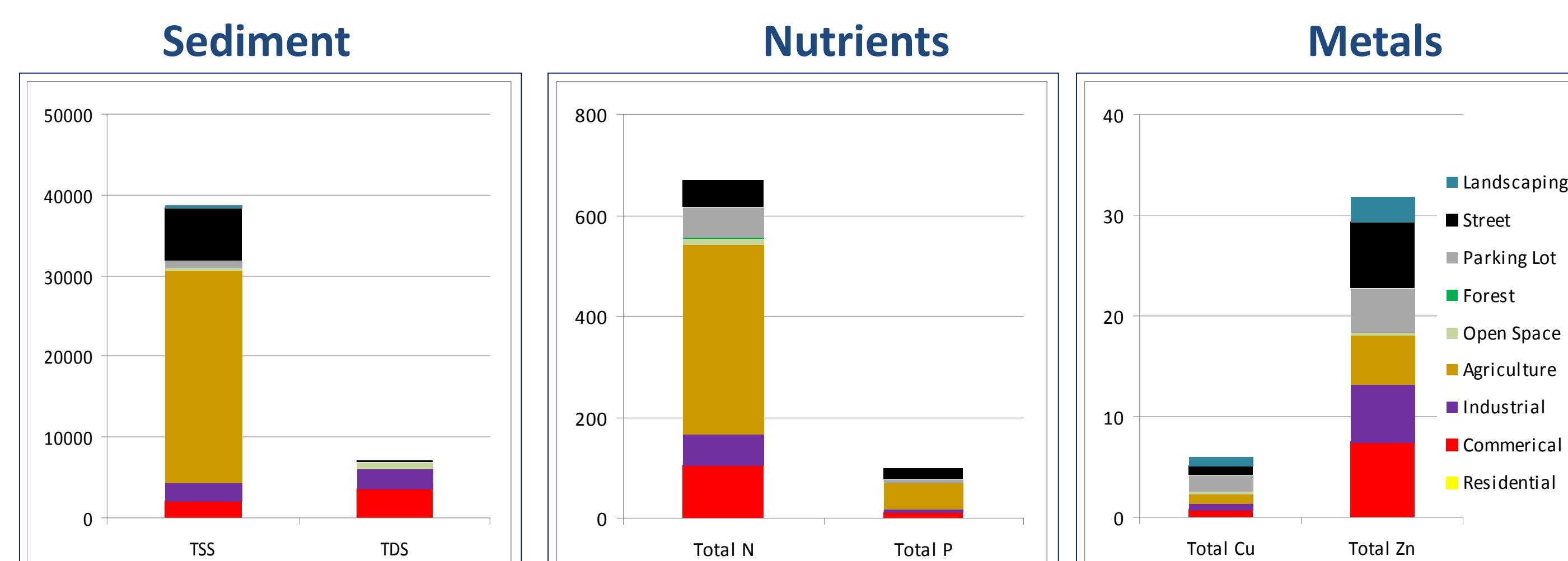
**CW1: Estimated Total Annual Pollutant Loads (Lbs/sub-watershed/yr)**



Pollutant type	Major Sources
Sediment	Lawns, roads, construction
Nutrients	Fertilizers, soil erosion
Metals	Streets, roofs, parking lots

Current	Recommended
Few water retention areas	Add wet retention pond, wetlands
Signs on storm drains	Replace missing signs
Some street sweeping	Expand street sweeping efforts
Runoff from roofs	Add green roof on campus

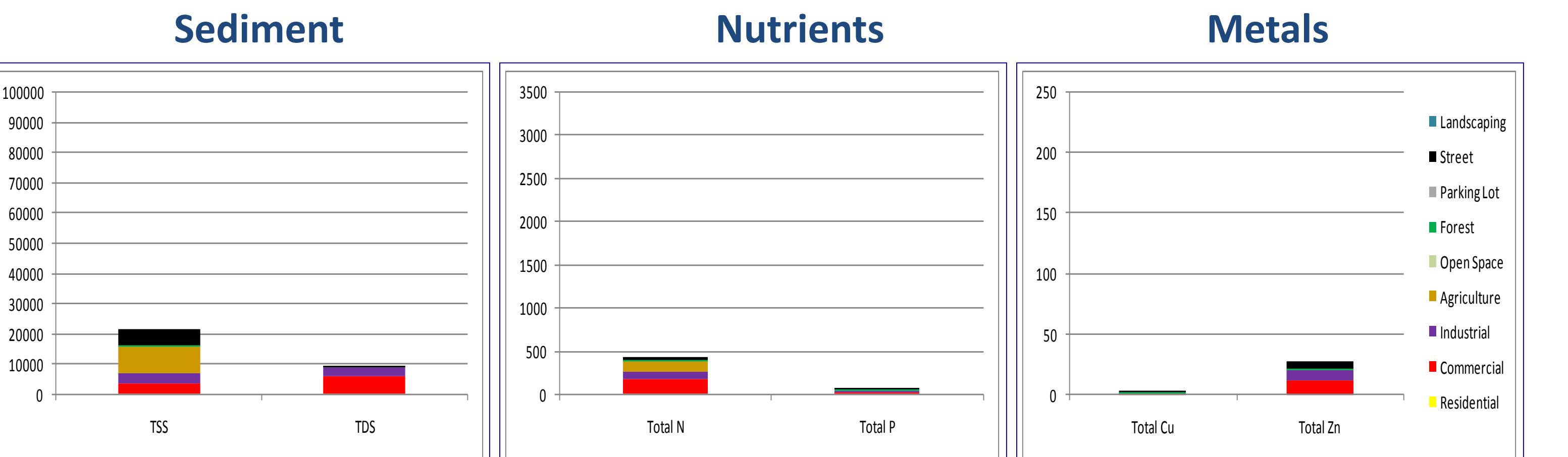
**CW2: Estimated Total Annual Pollutant Loads (Lbs/sub-watershed/yr)**



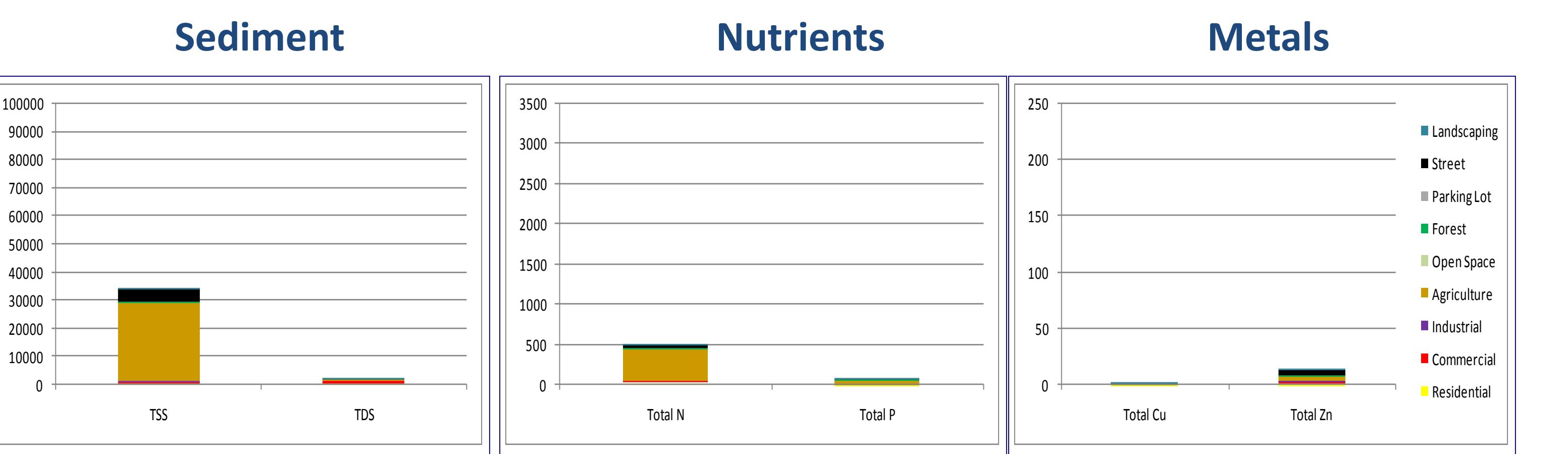
Pollutant type	Major Sources
Sediment	Erosion from crops, pastures, urban runoff, stream channels
Nutrients	Fertilizers, manures, soil erosion
Metals	Streets, roofs, parking lots

Current	Recommended
Nutrient management plan	Improve control of farmyard runoff
Winter cover crops	Cover crops (increase acreage)
Buffers/filter strips	Wetlands to filter runoff (increase)
Stormwater management	Stream channel restoration
Compost/export manure	Manage/replace invasive species

**CM4: Estimated Total Annual Pollutant Loads (Lbs/sub-watershed/yr)**



**CM5: Estimated Total Annual Pollutant Loads (Lbs/sub-watershed/yr)**



#### Sources of Nonpoint Pollution in CM4 & CM5

Pollutant type	Major Sources
Sediment	Erosion from crops, pastures, urban runoff, stream channels
Nutrients	Fertilizers, manures, soil erosion
Metals	Streets, roofs, parking lots, junkyard, railroad

#### Best Management Practices for Pollution Control

Current	Recommended
Nutrient management plan	Redesign weir & retention basin
Winter cover crops	Drainage system capable of pollutant removal near junkyard
Buffers/filter strips	Reevaluate cement plant permit
Stormwater management	Stream channel restoration
Compost/export manure	Wetlands to filter runoff (increase)
	Cover crops (increase acreage)
	Manage/replace invasive species

## UD WATER - Project Goals and Recommendations

### The goals of the UD WATER project were – for the UD Campus:

- (1) Identify major nonpoint sources of pollution in the Cool Run Sub-watershed of the White Clay Creek (a wild and scenic river with tributaries on the campus)
- (2) Estimate, using USEPA methods and average pollutant concentrations in runoff, the annual pollutant loads to the Cool Run tributary from different land uses
- (3) Develop recommendations to improve stormwater management, reducing flooding and improving water quality in the White Clay creek watershed

### Findings and Recommendations:

- 1) The estimated loads of sediment (TSS, TDS), nutrients (N, P), and metals (Cu, Zn) were determined by UD-WATER interns and are shown for each sub-watershed and to the right for the entire watershed. Primary sources of nonpoint pollution by stormwater runoff appear to be commercial lands, streets, and parking lots.
- 2) The UD-WATER team recommends wider use of the following “best management practices” to reduce stormwater runoff and pollution of the White Clay Creek:
  - ✓ Increase the acreage of wetlands and bio-retention ponds and swales
  - ✓ Expand use of vegetated swales and filter strips along roadways
  - ✓ Use more winter annual cover crops in the agricultural sub-watersheds

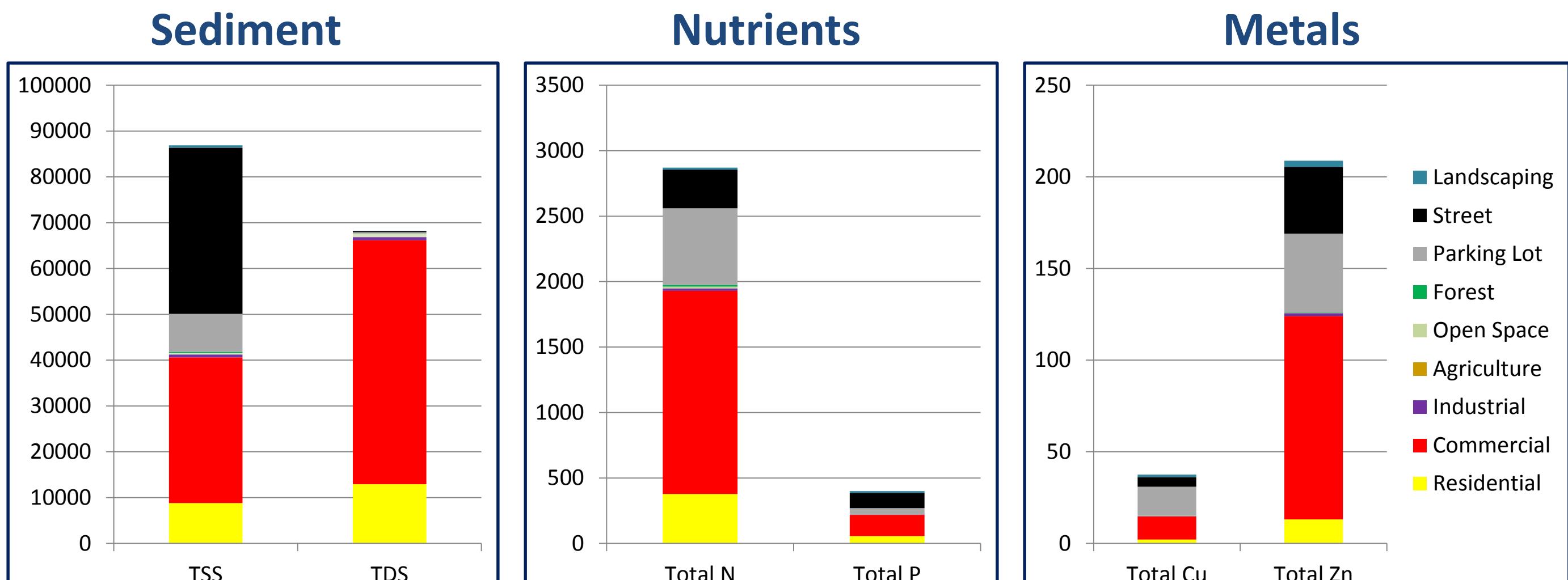
### What is “UD WATER”?

The UD WATER Project (Watershed Action Team for Ecological Restoration) was formed in early 2008 as a collaborative initiative with the long-term goal of merging and facilitating university-wide efforts to minimize the environmental impacts of storm water runoff from our campus. The UD WATER initiative is synergistic with the University’s Path to Prominence strategic goal to become a Green Campus.

The UD WATER team brings together a consortium of faculty, staff, and students from various departments and disciplines across campus to work collaboratively to implement creative and innovative storm water management techniques in the most holistic and efficient manner achievable. The ultimate goal for this team is to reduce the quantity and increase the quality of storm runoff from campus properties, which will ultimately benefit our local waterways and is consistent with the mission of EPA regulations requiring the University and City of Newark to have a National Pollutant Discharge Elimination System (NPDES) permit. Membership on this team include faculty and staff from Occupational Health and Safety, Facilities Planning and Construction, Facilities Grounds Maintenance Services, Delaware Water Resources Center, and the Departments of Bioresources Engineering and Plant & Soil Sciences within the College of Agriculture and Natural Resources, the Delaware Geological Survey, the UD Water Resources Agency within the Institute for Public Administration in the College of Education and Public Policy, and stormwater specialists from the City of Newark. UD WATER has also funded 6 undergraduate interns to work with UD faculty and staff and develop a watershed management plan for the UD campus.

In the future, the UD WATER team hopes to add other faculty and students at UD with an interest in water resource management to participate in our efforts to use the UD campus as a storm water research laboratory for multiple disciplines. For more details, or to join the UD WATER project, contact one of the project co-directors, Dr. Tom Sims (Delaware Water Resources Center: jtssims@udel.edu), Jerry Kauffman (UD Water Resources Agency, jerryk@udel.edu) or Leslie York-Hubbard (Occupational Health and Safety; lesleyh@udel.edu).

**CE1: Estimated Total Annual Pollutant Loads (Lbs/sub-watershed/yr)**



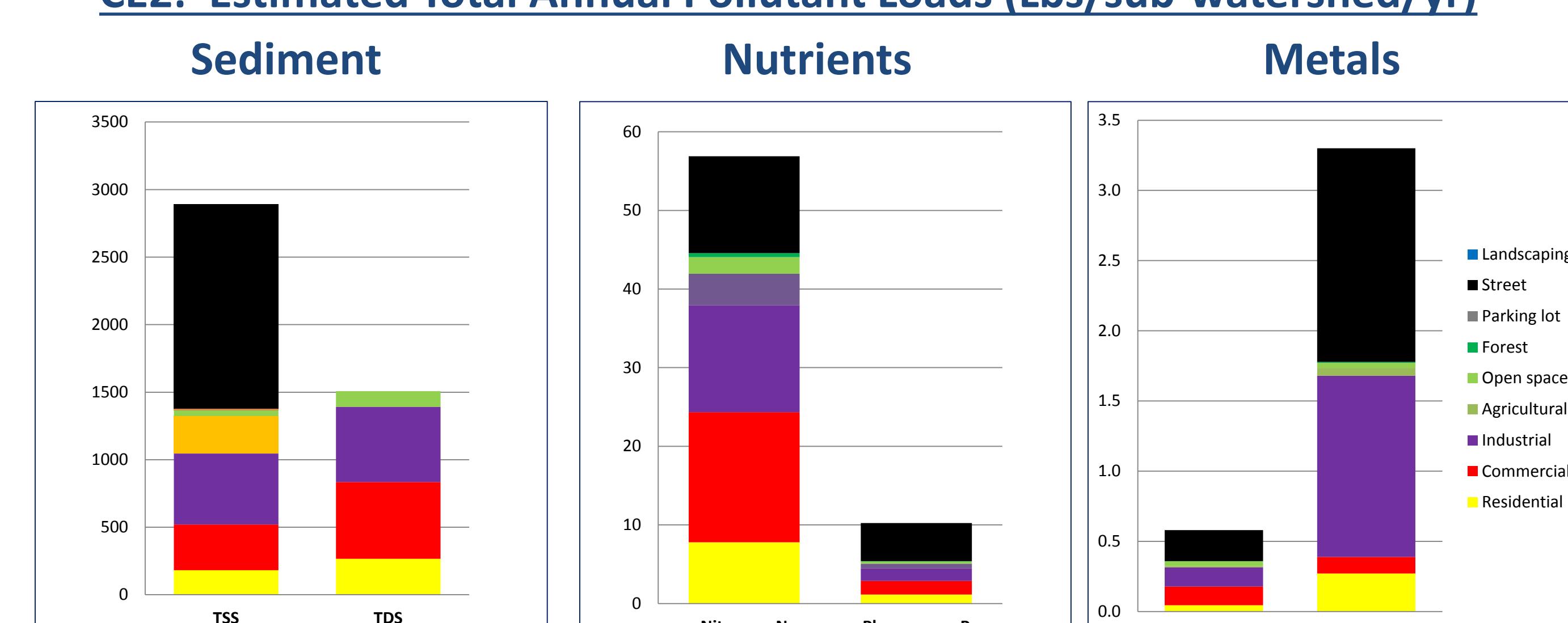
#### Sources of Nonpoint Pollution in CE1

Pollutant type	Major Sources
Sediment	Streambank erosion, Roads, Construction, Urban Runoff
Nutrients	Landscaping, Atmospheric Deposition, Animals
Metals	Atmospheric Deposition, Urban Runoff, Industrial Facilities

#### Best Management Practices for Nonpoint Pollution Control

Current	Recommended
Dry and Wet Detention Ponds	Add wet retention ponds
Stormwater Wetlands	Increase vegetative buffers around parking lots
Pollution Control Strategy	Porous pavement
Parking Lot Stormwater Sewers	

**CE2: Estimated Total Annual Pollutant Loads (Lbs/sub-watershed/yr)**



Pollutant type	Major Sources
Sediment	Urban Runoff, streets, construction, industrial facilities
Nutrients	Lawns, fertilizer application
Metals	Streets, roofs, atmospheric deposition, construction site

#### Best Management Practices for Nonpoint Pollution Control

Current	Recommended
Bioretention pond	Add more bioretention pond or increase the size of existing pond
Emergent wetland	Increase vegetative buffers; Vegetation harvesting
Sedimentation pond	Plant aquatic native vegetation to increase efficiency of the pond
Storm drain filter	Add biofiltration swales

**Watershed Totals for Estimated Annual Pollutant Loads (Lbs/watershed/yr)**

