BARTLETT BROOK STORMWATER MANAGEMENT EVALUATION

Prepared For:
Lake Champlain Basin Program
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PART 2: Individual Watershed Stormwater Management Evaluations

The findings of this project are presented in the following individual watershed evaluations. The intent of reporting results in watershed format is to facilitate the incorporation of these findings into comprehensive watershed management plans for each of the project watersheds. These evaluations are not comprehensive management plans and should not be viewed as such. The intent is for these evaluations to serve to focus planning efforts and to provide a basis for evaluating specific implementation activities that will most likely result in environmental benefits in the form of minimized pollutant loadings to the target watersheds and to Lake Champlain and restoration of impaired riparian and aquatic habitat and the biologic communities that those habitats support. Above all, it is the hope of this project that these findings will stimulate the development of comprehensive multi-jurisdictional watershed planning efforts within the project area, resulting in watershed management conducted across political boundaries with full investment by local and regional authorities.

This project has assembled and/or created a number of Geographical Information System (GIS) data layers relevant to watershed planning in the project area (see Part I). Information from these data layers is presented in a series of figures attached to each watershed evaluation. These data layers with their associated data tables, will be available to local and regional planners. It should be recognized that the pollutant projections presented here are planning estimates and caution should be exercised when interpreting these values.

This project recognizes that local governments in the project area have made tremendous commitments to protecting and preserving the natural resources associated with surface waters. Local and regional planning, zoning, and conservation commissions have established a strong record of environmental concern. In order to fully realize effective watershed management, it is critical that individual missions, goals, objectives, and policies be consolidated under the umbrella of comprehensive watershed planing and management. It is hoped that the findings of this project will assist those responsible for planning and environmental management in the project area in their efforts to restore, protect, and preserve the aquatic resources of these highly vulnerable developing watersheds.

Bartlett Brook Stormwater Management Evaluation

Watershed Description

Bartlett Brook is named for the Bartlett family who had a farm and orchard located near the present day site of Shearer Chevrolet. Bartlett Bay is also similarly named. The watershed was converted from forest to pasture and orchards in the 19th century.

Bartlett Brook is a small developed watershed (3.79 km2) located on the border of South Burlington and Shelburne in the Shelburne Bay watershed of Lake Champlain (**Figure 2.1**). The stream consists of 3 separate tributaries or forks. The largest landowner, the University of Vermont Horticulture Farm, straddles the main or middle fork. Shelburne Road bisects the watershed. There are several large car dealerships with considerable impervious surface in the watershed.

Land Use

In 1995 the watershed land use was approximately 40% residential, 20% commercial, 30% agricultural/cropland and 10% forest. Regional planners predict the watershed to become approximately 50% subregional growth center and 50% mixed urban use. Impervious surface area in the watershed is approximately 17% (**Figure 2.2, Table 2-1**).

Table 2-1. Bartlett Brook: Current and Projected Land Use as percent watershed area. Projected land use is indicated in terms of zoning or planning categories. Forest and Residential/Developed land-use categories are subsumed into the planning designations.

	Ag/Open	Forest	Res/Dev	Com/Ind	Urban/ Mixed	Regional Growth Center	*Impervious Surface Area*
1995	30%	10%	40%	20%			*17%*
Projected					50%	50%	

Soils

Adams-Windsor loams and Agawam fine sandy loams are abundant throughout the watershed and well suited for stormwater infiltration best management practices. Soils suitable for wetponds are common in the lower watershed near Shelburne Bay (**Figures 2.3-5**). The stream channel is characterized by highly erodible Limerick soils which can be released and suspended by high stormwater velocities.

Riparian Corridor and Biological Evaluation

Riparian habitat and stream channel integrity have been protected in part by municipal zoning. However, current stormwater discharges and future discharges following Shelburne Rd.-Rte.7 reconstruction may drastically alter stream riparian conditions. Habitat alteration is close to severe in the lower watershed. The stream corridor upstream of Rte. 7 on the main fork is managed for agricultural uses but the corridor is for the most part intact and healthy (**Figure 2.6**). Sediment embeddedness in the brook is extremely high (silt fraction is 54% of total channel sediment sample) below Shelburne Road (**Figure 2.7**).

Fish sampling appears to reflect the sediment levels and habitat loss. The mottled sculpin, a relatively rare fish species in Vermont, was present in Bartlett Brook. Macroinvertebrate sampling also

indicates the effect of severe sedimentation and enrichment impacts in the upper watershed adjacent to the UVM farm. The stream does not meet the Class B water quality standard for biological condition at any of the biological assessment sites (**Figure 2.7**).

Watershed Management Goals

The following are watershed management goals suggested by the findings of this evaluation:

1. Minimize the discharge of pollutants from stormwater conveyances for the protection of stream water quality as a public water supply source area and to protect swimming water quality in Shelburne Bay.

2. Ensure the maintenance and protection of any existing high quality biological communities and habitats.

3. Restore impaired aquatic and riparian habitat such that biological integrity consistent with Class B water quality standards is attained.

4. Ensure that watershed residents are aware of watershed management issues and are well educated in the principles of stream and watershed protection.

Existing Zoning

Bartlett Brook currently has its storm water runoff managed under the Bartlett Brook Watershed Protection Overlay District. Any new major development or conversion project (>15,000 ft2) must meet flood control requirements for all design storms up to and including the 25-year/24 hour storm. The overlay district does not apply to pre-existing development or require water quality controls; it is specifically designed to maintain flows at culvert crossings. The brook located in S. Burlington has a 50' (50'/side) conservation buffer zone which precludes all new development. **Figure 2.8** shows additional features of the watershed including wetlands, 100 year floodplain, and Natural Heritage sites.

Education Strategy

An education strategy for urban nonpoint source pollution should include the following actions: 1) informational mailings and public service announcements to watershed residents on clean stream habits, 2) public involvement in cleanup, erosion and habitat restoration projects, 3) storm drain stenciling, 4) school natural history programs and, 5) citizen monitoring (Drinkwin, 1995; Lake Champlain Committee, 1992).

Implementation Strategy

There are 2 targeted storm sewers and no targeted discharge permits **(Table 2-2, Figures 2.9-2.13).** A wetpond BMP is recommended for Shelburne Rd. 1 (2 sites) and an infiltration BMP is recommended for Bay Court (map 1: Part 1). These practices should reduce annual sediment loading by 27,850 kg/yr or 62% of the existing load and annual TP loading by 33 kg/yr or 47%. Estimated capital costs for watershed implementation ranges from S19,688-S236,637. Implementation recommendations, estimated treatment efficiencies and loading reductions, and estimated capital and annualized capital costs are summarized in **Table 2-3.** Annualized capital costs for phosphorus and suspended solids loading reductions at individual sites range from S22 - S551 per kg/yr for phosphorus and S0.03 - S0.69 per kg/yr for suspended solids. Implementation recommendations, estimated treatment efficiencies and loading reductions, and estimated capital and annualized capital costs are summarized in **Table 2-3.**

Bay Court has some existing control structures (sediment basins) (Audette, personal communication) that could be incorporated into any retrofit proposal. The Agency of Transportation is currently planning a major reconstruction project of Shelburne Road that may include wetpond BMP implementation for the storm water sewers. This may result in possible elimination of this sewer from targeting depending on final site plan review.

An investigation by the Aquatic Biomonitoring Section of polynuclear aromatic hydrocarbon levels in the Shelburne Bay drainages found that, of all the tributaries assessed, Bartlett Brook's North and Middle Forks contained the highest levels of these compounds in the sediments of the tributaries assessed. This contamination is most likely a result of vehicular emissions and storage-repair-service of vehicles in the watershed drainage.

Recommendations: The following recommendations, deriving from the findings of this evaluation, are made as technical suggestions that, if implemented, have a high likelihood of positively influencing water quality goals for the watershed. They are not intended to replace the development of a fully comprehensive watershed management plan.

1. The Bartlett Brook Watershed Protection Overlay District is one of the strongest zoning policies for watershed protection encountered in this project. Additional consideration to stormwater treatment for water quality would strengthen this powerful planning tool.

2. The portion of Bartlett Brook Below route 7, with a cumulative impervious surface area of 17 percent, is clearly the most impacted area of the watershed. Aquatic habitat and biota are impaired. It is likely that measures to reduce the release of sediments and suspended solids to this portion of the watershed will result in improved habitat and biological integrity. Therefore:

- Additional feasibility studies for BMP implementation recommendations for targeted sewersheds **(Table 2-3)**, prioritized by estimated Total Suspended Solids loading **(Table 2-2)**, should be initiated (see implementation plan).

- Efforts to reduce discharges from significant sources of nonpoint sediment, such as eroding or unstable banks identified by this or other evaluations, should be pursued. Opportunities to implement stream and riparian habitat restoration and improvement activities should be fully explored. Programs such as the Youth Conservation Corps and the USFWS Partnership program are likely resources for implementing watershed restoration activities. Cooperative efforts between landowners and various State, private, and Federal Agencies should be encouraged and coordinated.

- Special attention should be given to coordination between VTAOT, VTDEC, and the City of South Burlington regarding stormwater management related to proposed Route 7 improvements.

Appropriate management will be critical to the restoration of lower Bartlett Brook habitat.

3. Resources should be allocated to provide for coordination of activities, including the acquisition of implementation resources, related to urban watershed management. VTDEC and USEPA are currently funding a limited service position to provide this function. If multi-jurisdictional urban watershed management is to be effective in the future, this function must be maintained, ideally through institutionalized regional planning.

4. Continued monitoring of watershed condition should be conducted. BMP implementation effectiveness should be monitored. While VTDEC plans to maintain a minimal level of biological monitoring at many of the sites previously monitored, its resources are limited. Monitoring issues should be developed through the watershed planning process that should evolve at the regional or local level (Brown, 1996).

5. A watershed management educational strategy should be developed and implemented for the Bartlett Brook watershed. Generalized materials related to watershed protection are available from various private and governmental organizations. The educational strategy should, among other things, address the means by which residents of the watershed will be exposed to the appropriate materials (Lake Champlain Committee, 1992; Drinkwin, 1995).

6. Relatively high densities of land uses related to the potential discharge of polynuclear aromatic hydrocarbons (PAH's) are reflected in elevated levels of PAH's in sediments at the mouth of Bartlett Brook, particularly in the north tributary. While there is no specific evidence that the levels found represent a significant environmental risk, some site control feasibility studies should be initiated for public drinking water supply protection purposes. The Champlain Water District may wish to include such studies while developing a source area protection plan.

Bartlett Brook Resources

Bartlett Brook Watershed Protection Overlay District (BBW). City of South Burlington Zoning Regulations, Article 23. City of South Burlington, VT.

Bartlett Brook Stream and Erosion Study.1984. Wagner, Heindel and Noyes, Inc., Burlington, VT.

Table 2-2. Significant Stormwater Discharges in the Bartlett Brook Watershed: Discharges are targeted based on estimated exceedence of annual loading thresholds for: suspended solids (4,536 kg/year); total phosphorus (6.8 kg/year); total metals (5.4 kg/year); total PAHs (36 kg/year); fecal coliform (500,000 colonies/yr). Existing treatment structures are indicated. *Italics indicate stormwater discharges with VTDEC stormwater permits.* EIA% is the percent surface area as Effective Impervious Surface Area. Loadings are calculated from the means of ranges in export coefficients taken from the literature. See Part 1 of this report for loading calculation methods.

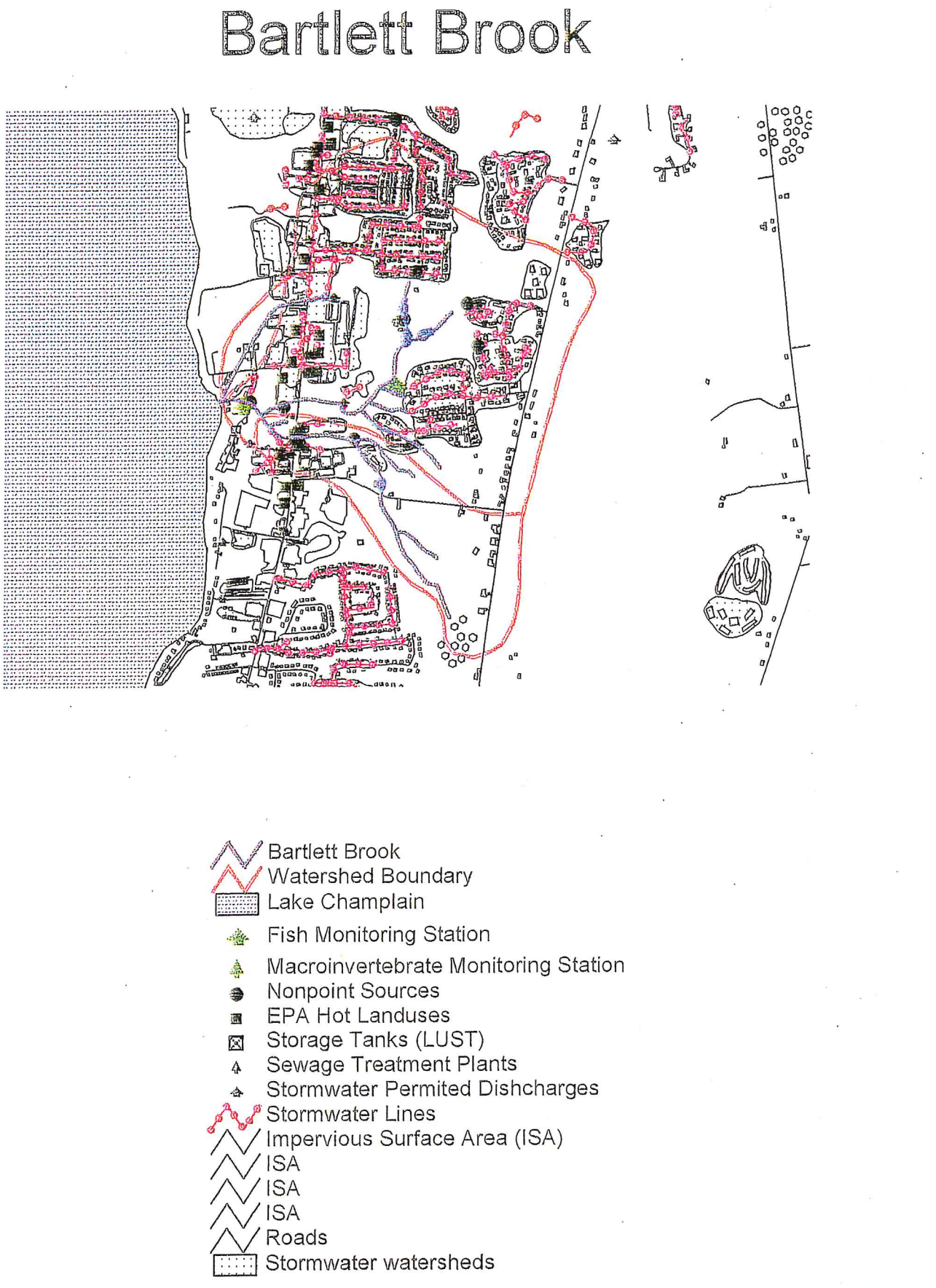
Recwater	Storm sewershed	Treatment (Appendix 4)	EIA%	Loading kg/yr
	Highest Total Suspended Solids (**Figure 2.10**)			
Bartlett	Shelburne Road 1	DP/OS/CB/GS	47.5	35,701
Bartlett	Bay Court	SF	14.7	9185
	Highest Total Phosphorus (**Figure 2.11**)			
Bartlett	Shelburne Road 1			56
Bartlett	Bay Court			14
	Highest Total PAH (**Figure 2.12**) (Commercial Landuses Only)			
Bartlett	Shelburne Road 1			382
	Highest Total Metals (**Figure 2.13**)			
Bartlett	Shelburne Road 1			43
Bartlett	Bay Court			11

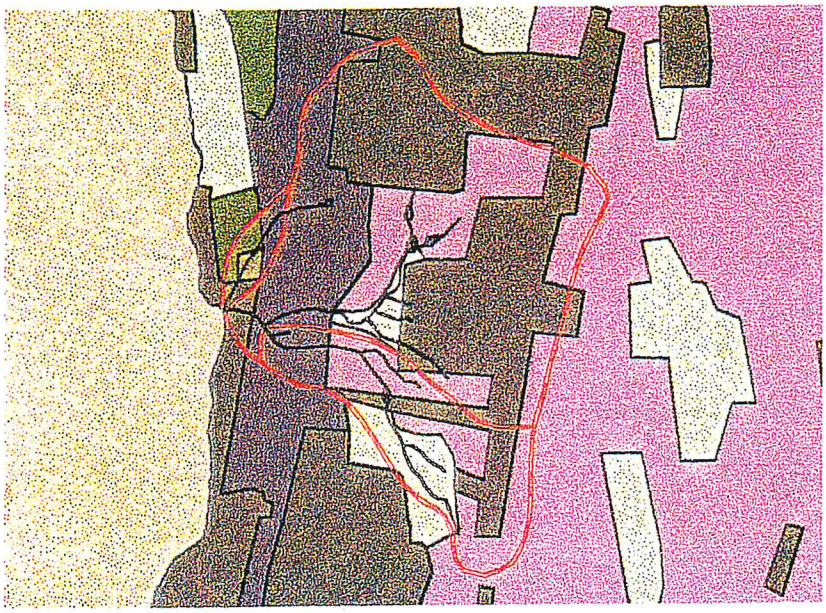
Table 2-3. Bartlett Brook Watershed: Stormwater BMP implementation treatment and capital costs estimates for targeted sewersheds. All estimates are based on a mean of a range of export coefficients for TP and TSS.

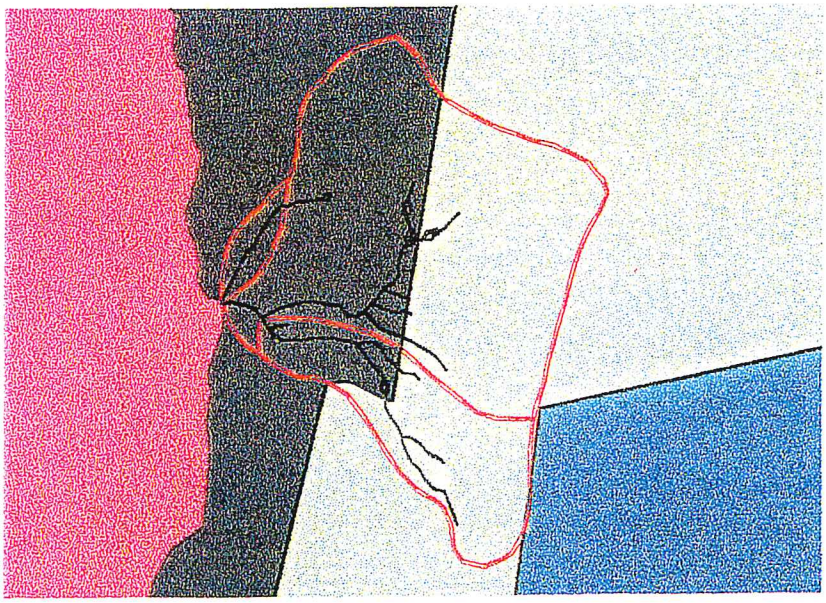
Rec. Wat.	Sewershed	BMP	TP Pre BMP Kgs/year	TP Post BMP Kgs/year	TP Reduction Kgs/year	TSS Pre-BMP Kgs/year	TSS Post-BMP Kgs/year	TSS Reduction Kgs/year	Capital Cost-Low	Capital Cost-High
Bartlett	Shelburne Road 1	Wetpond	56	31	25	35701	14280	21421	$8,393	$167,870
Bartlett	Bay Court	Infiltration	14	6	8	9185	2756	6429	$11,295	$67,767
		TOTALS	70	37	33	44886	17036	27850	$19,688	$235,637

	Capital Costs/kg				*Annualized Capital Costs*					
Sewershed	TP Cost Low dollars/kg	TP Cost High dollars/kg	TSS Cost Low dollars/kg	TSS Cost High dollars/kg	Annual TP Costs $/kg 30 yrs @ 5% Low	Annual TP Costs $/kg 30 yrs @ 5% High	Annual TSS costs $/kg 30 yrs @ 5% Low	Annual TSS costs $/kg 30 yrs @ 5% High	Total Annualized Costs 30 Years @ 5% Low	Total Annualized Costs 30 Years @ 5% High
Shelburne Road 1	$336	$6,715	$0.39	$8	$22	$437	$0.03	$0.51	$546	$10,920
Bay Court	$1,412	$8,471	$1.76	$11	$92	$551	$0.11	$0.69	$735	$4,408
AVERAGE	$597	$7,141	$0.71	$8	$39	$465	$0.05	$0.55	$1,281	$15,329

Figure 2.1: Bartlett Brook watershed showing: roads, surface waters, impervious surface areas, permitted wastewater and stormwater discharges, stormwater lines, nonpoint sources such as eroding stream banks, EPA hot land uses (gasoline service areas), underground storage tanks, and biological monitoring sites.







Bartlett Brook Watershed
Land Use 1995

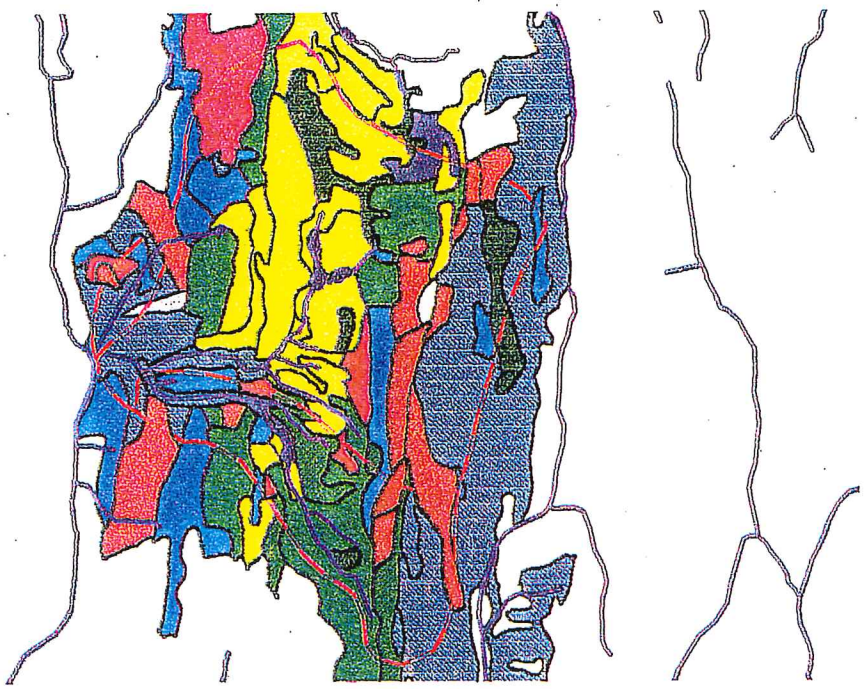
- 0
- 1100
- 1130
- 1190
- 1200
- 1210
- 1250
- 1252
- 1260
- 1270
- 1281
- 1300
- 1330
- 1370
- 1373
- 1400
- 1410
- 1412
- 1440
- 1460
- 1470
- 1480
- 1481
- 1482
- 1500
- 1510
- 1600
- 1700
- 1720
- 1730
- 1734
- 1735
- 1736
- 1737
- 1740
- 1790
- 2100
- 2200
- 2430
- 3000
- 3300
- 4100
- 4200
- 4300
- 5100
- 5200
- 5210
- 6000
- 6100
- 7200
- 7400

Bartlett Brook Watershed
Future Landuse

- 1200
- 1500
- 1600
- 1700
- 1730
- 2100
- 3000
- 4000
- 7000
- 7500

Figure 2.2: Bartlett Brook watershed 1995 actual land use; and future landuse as defined by zoning designation.

Figure 2.3: Bartlett Brook generalized soils map.



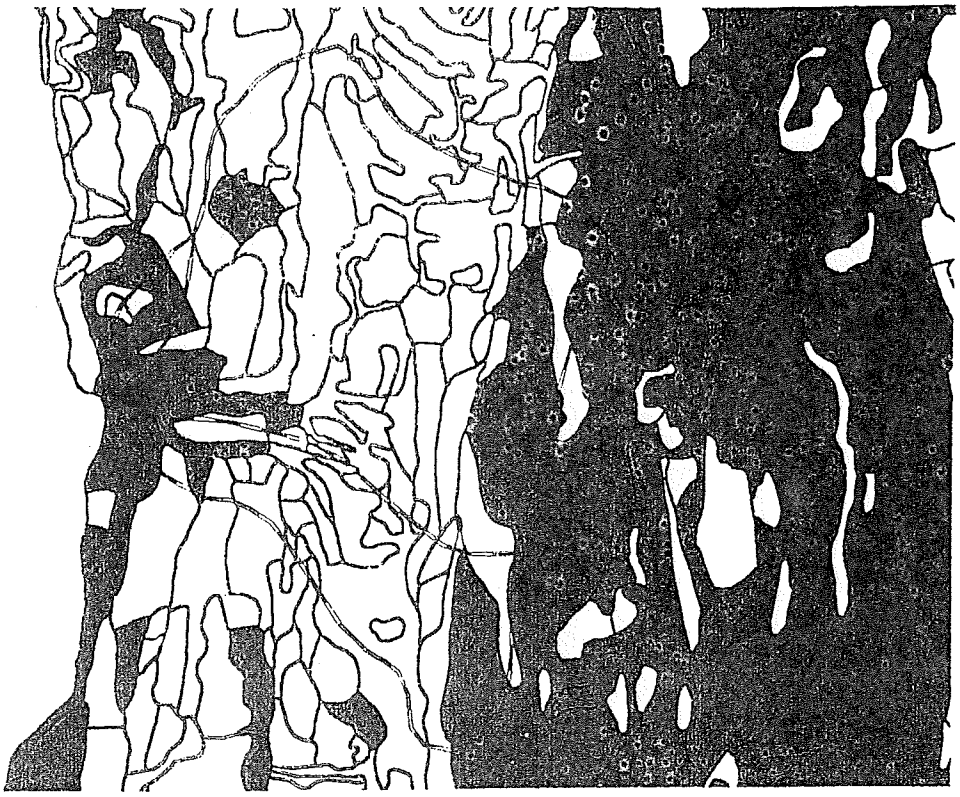


Figure 2.4: Bartlett Brook watershed - areas of highly erodible soils. These soils are easily displaced.

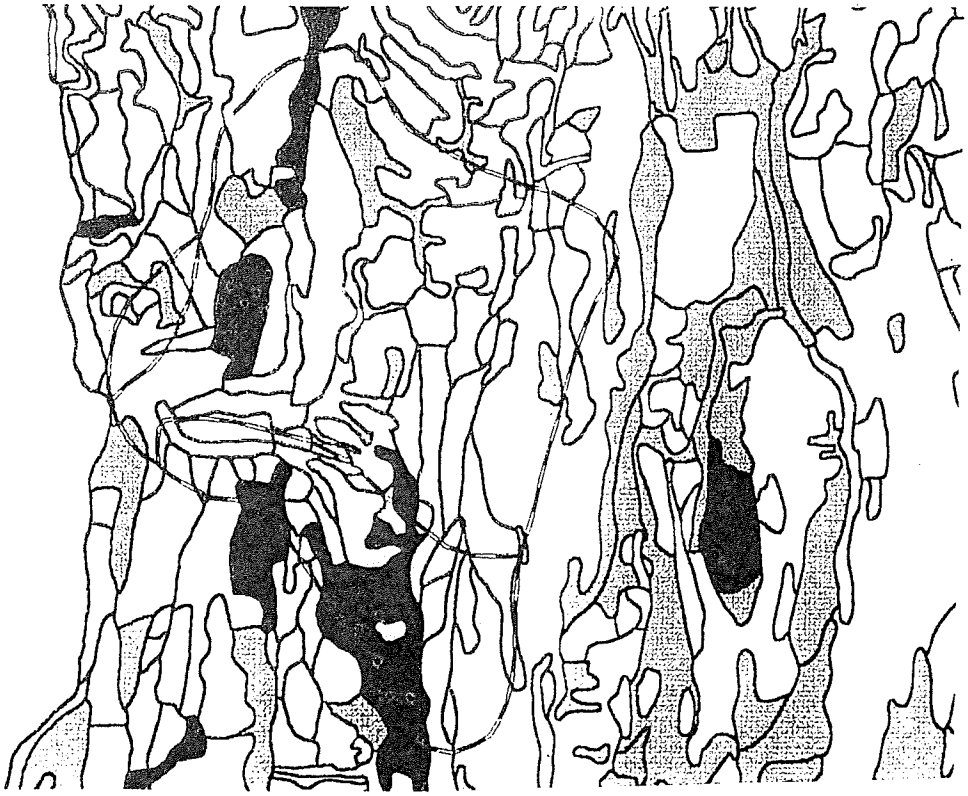
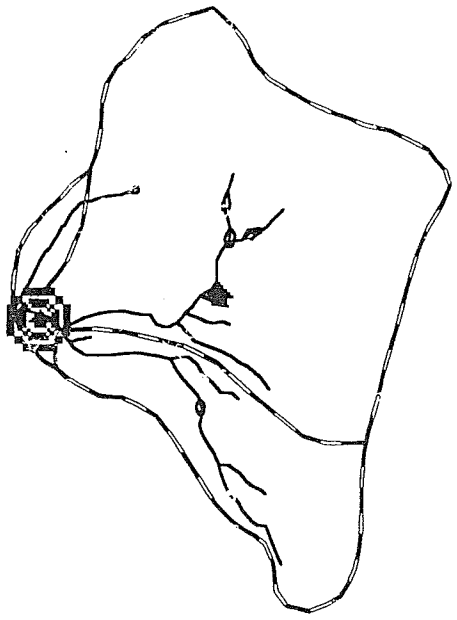
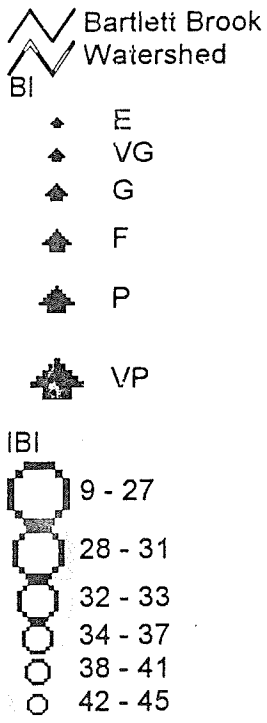


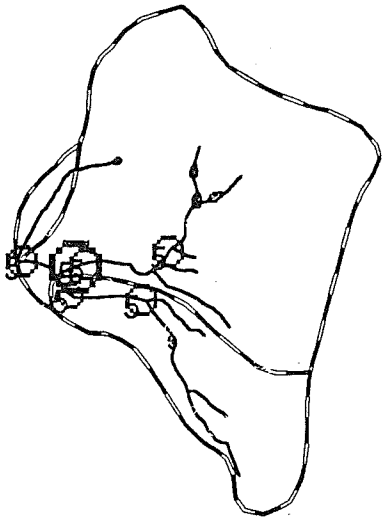
Figure 2.5: Bartlett Brook watershed - wetpond/wetland soils.

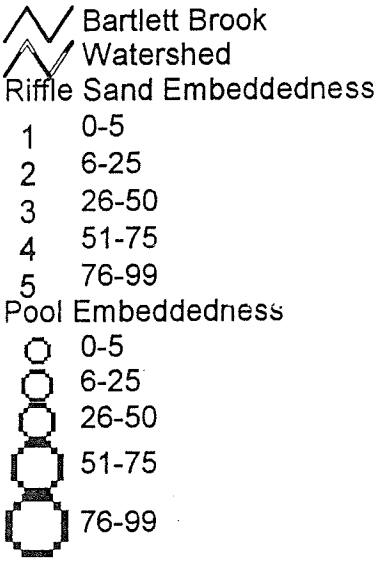
Figure 2.6: Bartlett Brook Riparian Corridor Corridor Evaluation. Evaluation was conducted using the Riparian Corridor Evaluation methodology (Petersen, 1992). A series of measurements and observations are recording while walking the stream channel.

Figure 2.7: Bartlett Brook watershed - biological condition. Fish and macroinvertebrate community measures of integrity. A macroinvertebrate biotic index (BI) rating of less than good is indicative of sub-Class B condition. A fish Index of Biotic Integrity (IBI) rating of less than 31 is indicative of sub-Class B condition.









Watershed measure of pool and riffle sedimentation. A high degree of sand embeddedness indicates excessive erosion and impairs aquatic habitat and the biological communities that are supported by that habitat.

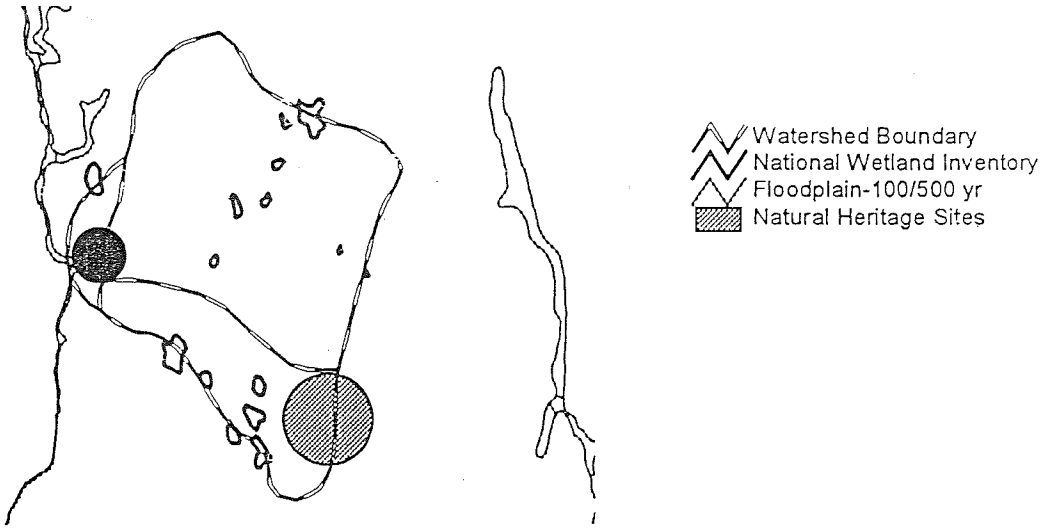


Figure 2.8: Bartlett Brook watershed - mapped wetlands, 100 yr. floodplain, and Natural Heritage sites.

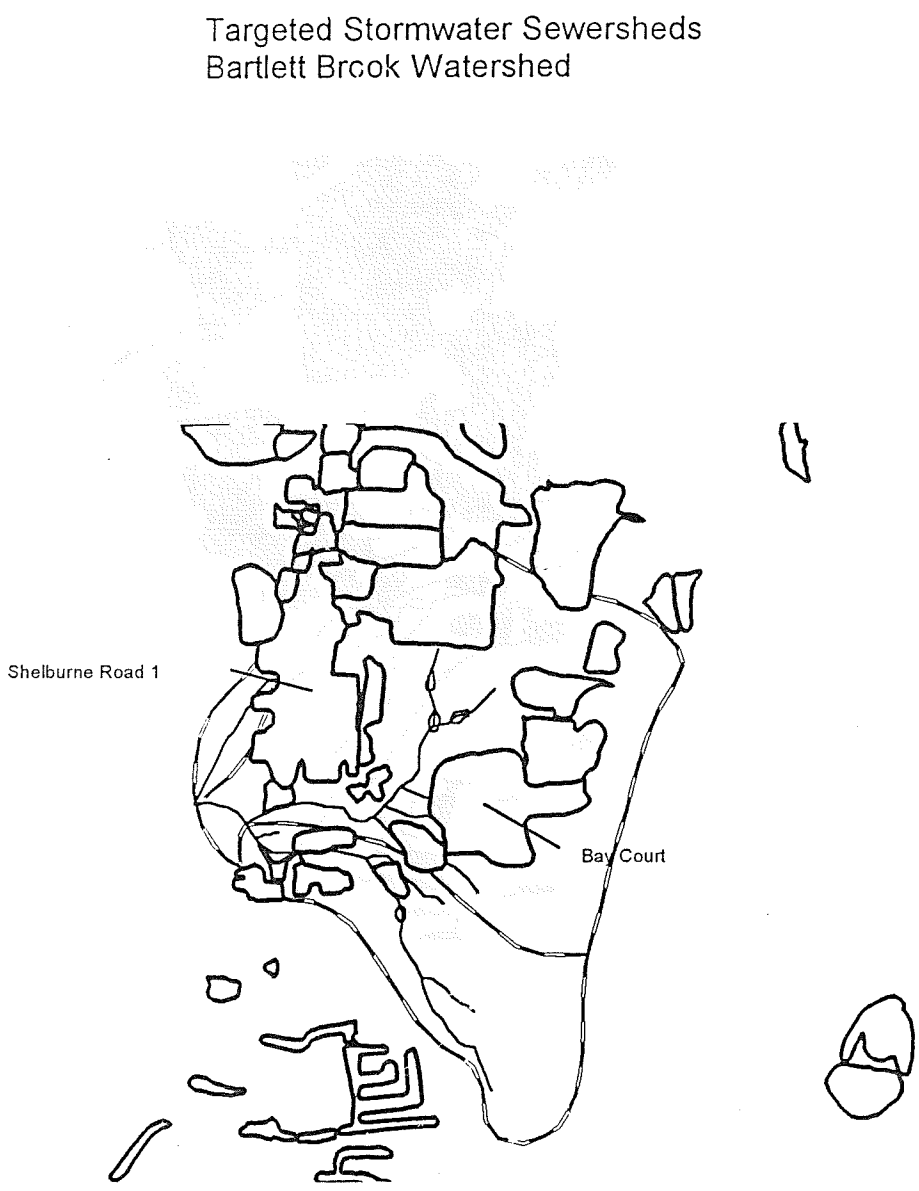


Figure 2.9: Targeted Stormwater Sewersheds in Bartlett Brook Watershed - Sewersheds were targeted based on exceedences of loading thresholds as described in Table 2.2. BMP recommendations are made for each targeted sewershed. Two sewersheds in the Bartlett Brook watershed have been targeted.

Figure 2.10: Estimated total suspended solids loading from sewersheds in the Bartlett Brook watershed.

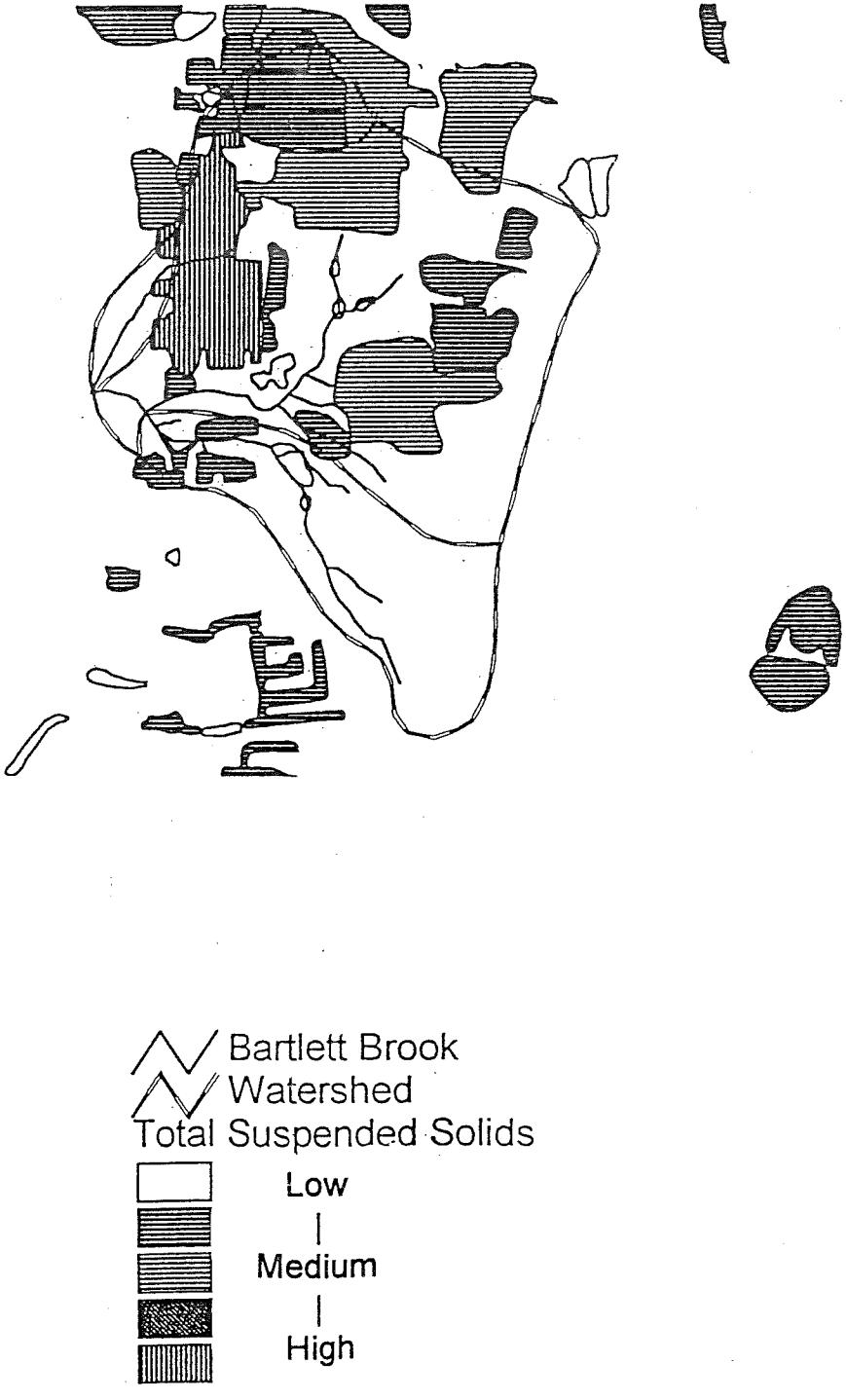


Figure 2.11: Estimated total phosphorus loading from sewersheds in the Bartlett Brook watershed.

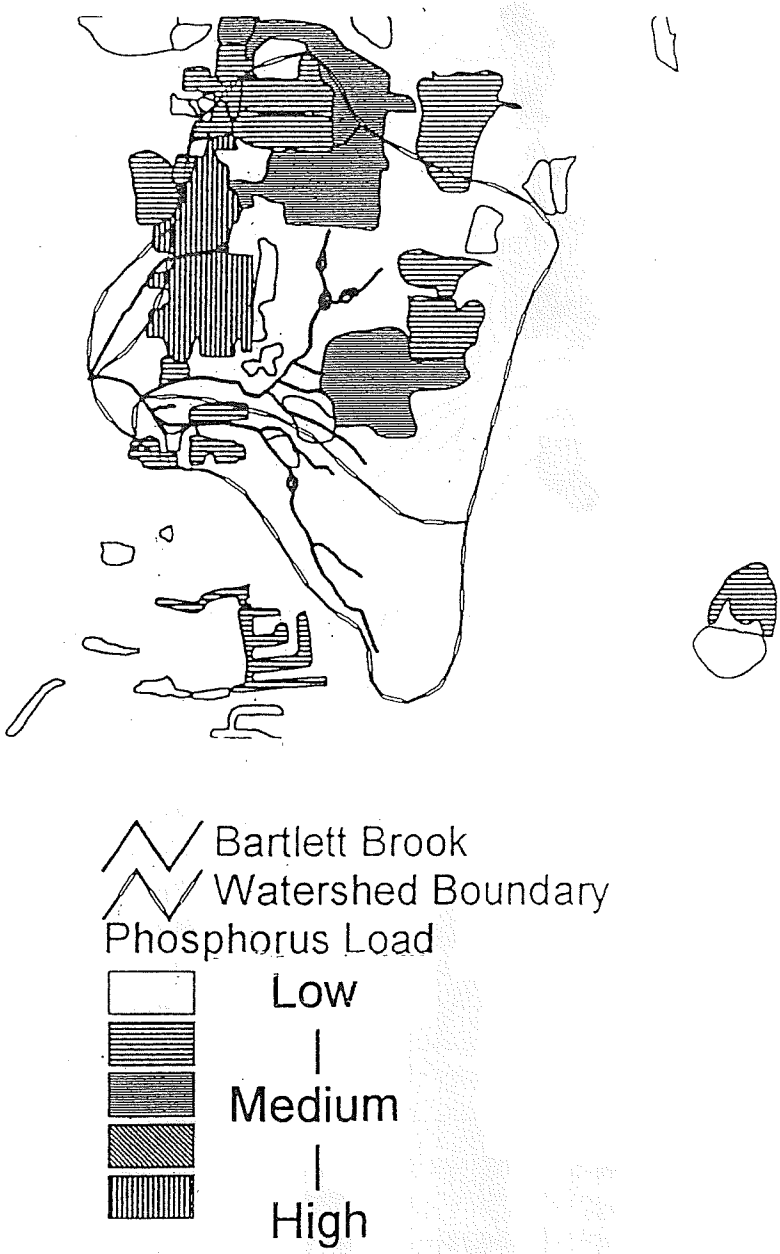
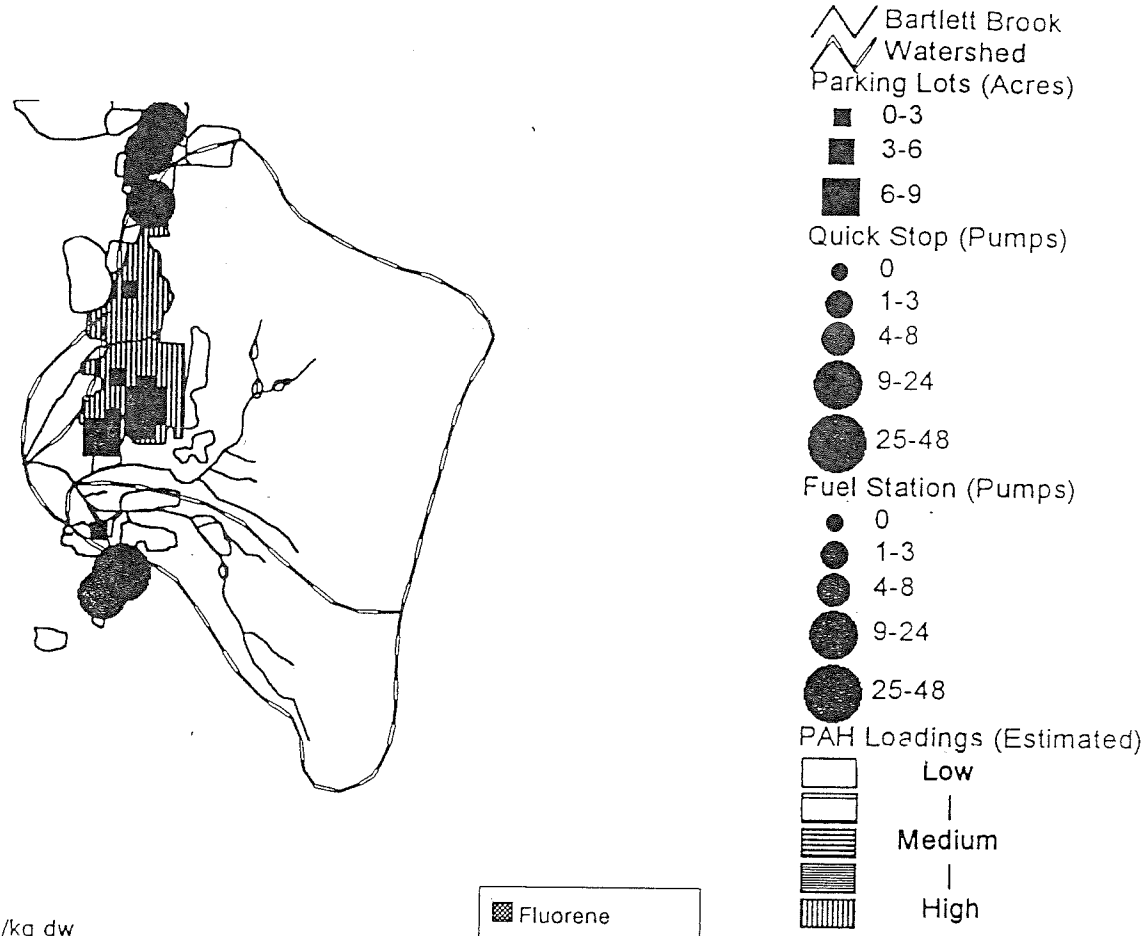
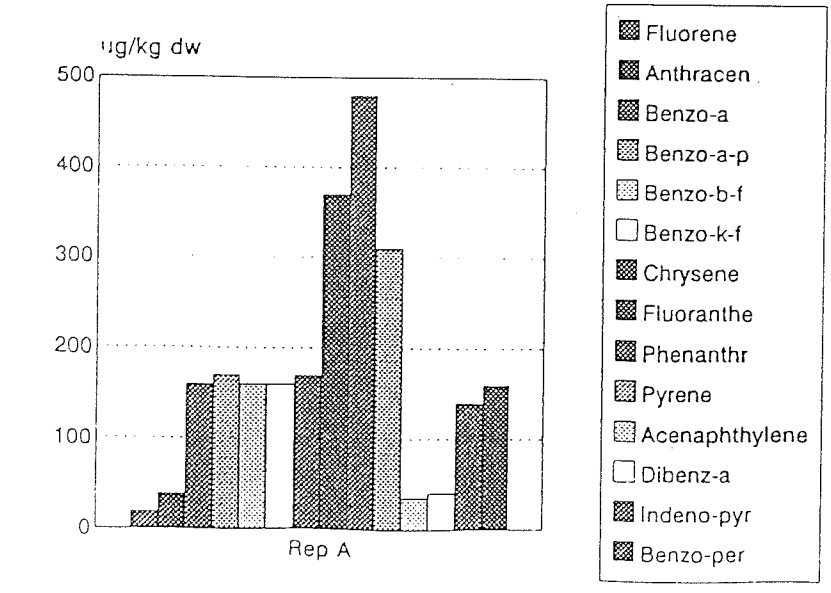


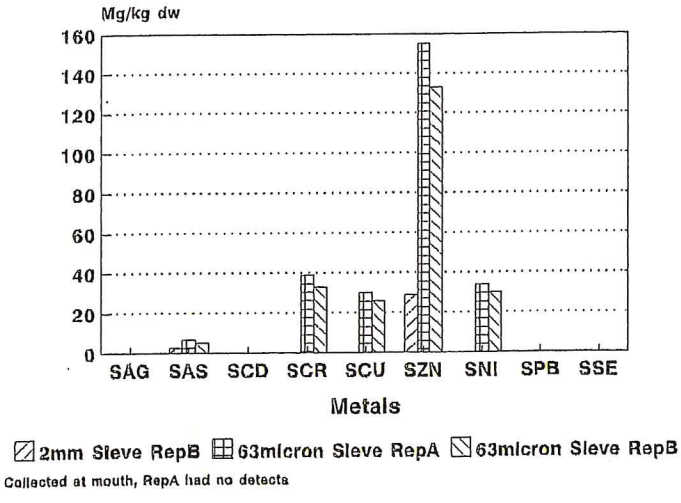
Figure 2.12: Estimated total PAH loading from sewersheds in the Bartlett Brook watershed. Graph at bottom shows concentrations of PAHs in sediments at the mouth of the Bartlett watershed. Samples collected in 1995. Potential sources of PAHs are identified as EPA hot spots - parking lots and gasoline service areas.





(Detected in Sediments)

Figure 2.13: Estimated total metals loading from sewersheds in the Bartlett Brook watershed. Graph at bottom shows concentrations of metals in whole (2mm) and fine fraction (63u) sediments at the mouth of the Bartlett watershed. Samples collected in 1995.



Soils

- AdA
- AdA
- AdA - AdB
- AdB - AdD
- AdD - AdE
- AdE - Au
- Au - BlA
- BlA - Br
- Br - Cv
- Cv - DdA
- DdA - EwA
- EwA - FaC
- FaC - FaE
- FaE - FsB
- FsB - Fu
- Fu - HlB
- HlB - HlE
- HlE - HnB
- HnB - Le
- Le - Lf
- Lf - MuD
- MuD - MyB
- MyB - MyC
- MyC - Rk
- Rk - ScB
- ScB - TeE
- TeE - W
- W - Wo

Land Use 1995

- 0
- 1100-Residential
- 1130-Residential-Single Family
- 1190-Residential-Other
- 1200-Commercial
- 1230-Commercial Services
- 1250-Government
- 1252-Military
- 1260-Institutional
- 1270-Educational
- 1281-Museum
- 1300-Industrial
- 1330-Industrial-Stone
- 1370-Industrial-Mining
- 1373-Sand/Gravel
- 1400-Transportation
- 1410-Transportation-Air
- 1412-Transportation-Air
- 1440-Transportaiton-Road
- 1460-Utilities
- 1470-Utilities
- 1480-Utilities
- 1481-Utilities
- 1482-Utilities
- 1500-Industrial
- 1510-Industrial Park
- 1600-Mixed Use
- 1700-Outdoor Built
- 1720-Outdoor Built
- 1730-Outdoor Recreation
- 1734-Ski Area
- 1735-Golf Course
- 1736-Campground
- 1737-Parks
- 1740-Cemetaries
- 1790-Other outdoor built
- 2100-Cropland
- 2200-Orchards
- 2430-Other Agriculture
- 3000-Brush
- 3300-Mixed Brush-grass
- 4100-Broadleaf Forest
- 4200-Coniferous Forest
- 4300-Mixed Forest
- 5100-Rivers
- 5200-Lakes/Ponds
- 5210-Lakes/Ponds
- 6000-Wetlands
- 6100-Forested Wetland
- 7200-Beaches/River banks
- 7400-Exposed Rock

Future Landuse

- 1200-Commercial
- 1500-Industrial
- 1600-Mixed Use
- 1700-Outdoor Built
- 1730-Outdoor Recreation
- 2100-Cropland
- 3000-Brush
- 4000-Forest
- 7000-Growth Center
- 7500-Subregional Growth Center