CHAPTER THREE

SUMMARY OF REVISED RECOMMENDED PLAN

This chapter summarizes the components of the revised recommended plan for CSO control for Alewife Brook, and provides a comparison to the original recommended plan as developed in the July 1997 FEIR. Following this summary, a discussion of the incremental benefits of phased implementation of the revised recommended plan is presented. This chapter concludes with a discussion of why elimination of CSOs to Alewife Brook through sewer separation is not recommended.

SUMMARY OF THE REVISED RECOMMENDED PLAN

The elements of the revised recommended plan are summarized as follows:

- Complete separation of the combined sewer system upstream of regulator RE-041 (outfall CAM004), and closure of the regulator. The scope of this work includes construction of a new stormwater outfall for the CAM004 tributary area, a detention basin downstream of the new outfall to attenuate flows, and sewer flushing/grit accumulation chambers to control the buildup of sediment in the new pipes.
- Separation of the combined manholes upstream of outfall CAM400.
- Increasing the capacity of the dry weather flow connections between the CSO regulator and the MWRA interceptor for outfalls CAM002, CAM401B and SOM01A
- Providing relief of the siphon between the ABBS and the ABC downstream of the Rindge Avenue combined sewer
- Providing a hydraulic relief gate at outfall MWR003, to relieve the hydraulic grade line during extreme storm events
- Providing floatables control for outfalls CAM001, CAM002, MWR003, CAM400, CAM401A, CAM401B and SOM01A

The total estimated capital cost of the revised recommended plan is $68.5 million. Upon completion of the plan, the average annual activation frequency of CSO discharge to Alewife Brook will be reduced from 63 to 7, and the average total annual volume of CSO will be reduced from 50 to 7.4 million gallons. With this plan in place, CSOs will not preclude attainment of

Class B water quality criteria approximately 98 percent of the time on average. The Class B criteria for fecal coliform bacteria, however, will continue to be violated even in dry weather, until non-CSO sources of bacteria are substantially controlled.

The revised recommended plan will result in a net increase in the total volume of stormwater discharged to Alewife Brook on an annual basis, as a result of the sewer separation projects. It is noted, however, that currently approximately 75 percent of the annual stormwater volume tributary to Alewife Brook is from the non-CSO communities of Arlington and Belmont. A comparison of the annual CSO and stormwater volumes from Cambridge and Somerville for existing conditions and the recommended plan is presented Figure 3-1. Despite the net increase in annual stormwater volume, the bacteria and solids loads from stormwater to Alewife Brook are predicted to decrease (Figures 3-2 and 3-3). The predicted decrease in loads is a result of measures to be provided by the City of Cambridge to capture sand and grit prior to discharge at either the existing CAM004 outfall or the proposed detention basin, and the expected removal of bacteria and additional sand and grit for flow that passes through the detention basin.

COMPARISON OF REVISED RECOMMENDED PLAN TO ORIGINAL RECOMMENDED PLAN

Table 3-1 presents an outfall-by-outfall comparison of the scope of the original recommended plan for Alewife Brook with the revised recommended plan presented herein. As indicated in Table 3-1, with the exception of outfall CAM002, the scope of work under the revised recommended plan is significantly expanded over the scope of the original plan. The key common element of each plan is the separation of outfall CAM004. The revised recommended plan expands the scope of the CAM004 separation to address such issues as the limited capacity of the CAM004 drainage system, chronic sediment deposition, elimination of the regulator, and mitigation of the impacts of the separated flows on Alewife Brook and the Little River. Under the revised plan, the hydraulic benefits of separating outfall CAM004 are enhanced by increasing the capacity of dry weather flow connections to the interceptor system.

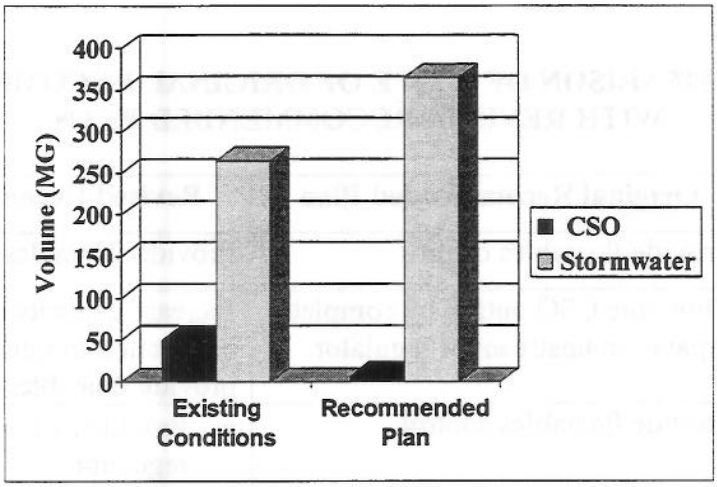

FIGURE 3-1. COMPARISON OF TOTAL ANNUAL CSO AND STORMWATER VOLUMES FROM CAMBRIDGE AND SOMERVILLE FOR EXISTING CONDITIONS AND RECOMMENDED PLAN

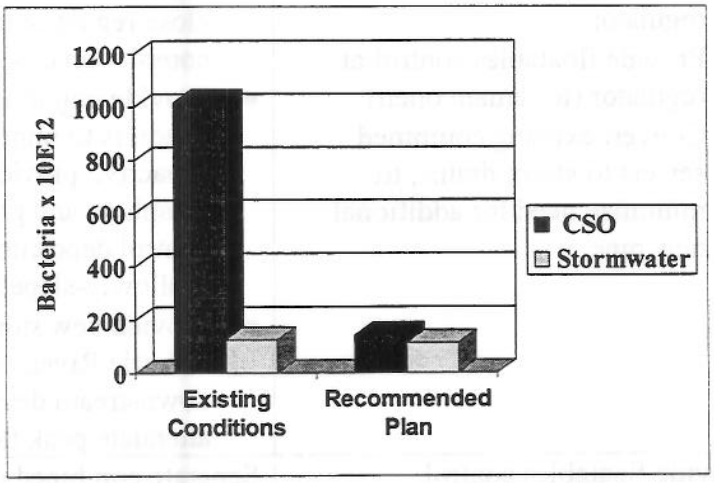

FIGURE 3-2. COMPARISON OF TOTAL ANNUAL CSO AND STORMWATER BACTERIA LOAD FROM CAMBRIDGE AND SOMERVILLE FOR EXISTING CONDITIONS AND RECOMMENDED PLAN

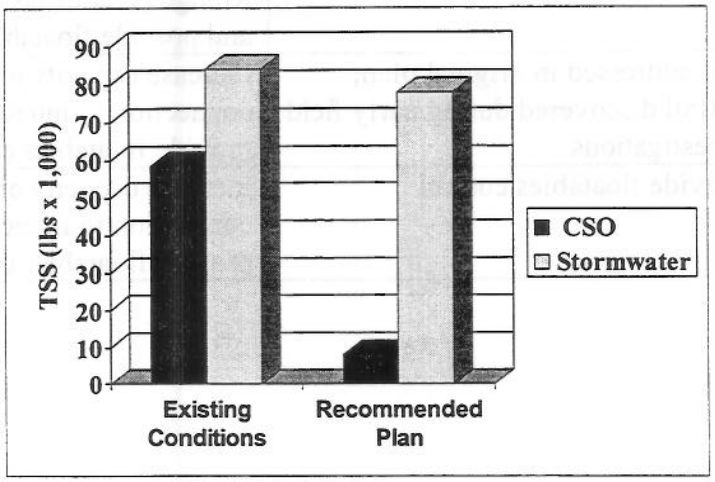

FIGURE 3-3. COMPARISON OF TOTAL ANNUAL CSO AND STORMWATER TSS LOAD FROM CAMBRIDGE AND SOMERVILLE FOR EXISTING CONDITIONS AND RECOMMENDED PLAN

TABLE 3-1. COMPARISON OF SCOPE OF ORIGINAL RECOMMENDED PLAN WITH REVISED RECOMMENDED PLAN

Outfall	Original Recommended Plan	Revised Recommended Plan
CAM001	Provide floatables control	Provide floatables control
CAM002	Eliminate CSO outfall by complete separation upstream of regulator	Increase capacity of local connection to interceptor, and provide floatables control
MWR003	Provide floatables control	• Provide hydraulic relief gate at regulator • Provide floatables control
CAM004	• Reduce activation frequency by separating area upstream of regulator • Provide floatables control at regulator (to remain open) • Convert existing combined sewers to storm drains, to minimize need for additional new pipe	• Separate area upstream of regulator, and permanently close regulator upon completion of separation work. • Provide major new storm drain conduits to improve drainage capacity; provide flushing chambers and grit pits to control deposition in shallowly-sloped pipes • Provide new stormwater outfall to Little River, with downstream detention basin to attenuate peak flows
CAM400	Provide floatables control	Separate combined manholes upstream of regulator, and provide floatables control
CAM401A	Provide floatables control	Relieve siphon downstream of Rindge Avenue combined sewer, and provide floatables control
CAM401B	Not addressed in original plan; outfall discovered during early field investigations	Increase capacity of local connection to interceptor, and provide floatables control
SOM01A	Provide floatables control	Increase capacity of local connection to interceptor, and provide floatables control

The estimated cost and performance of the original and revised recommended plans are presented in Table 3-2. In terms of short-term and long-term impacts, construction work under the original plan was expected to take place primarily in streets, and once construction was completed, no significant long-term negative impacts were anticipated. Based on these findings, a Phase I waiver was granted for this project. Under the revised recommended plan, only the new CAM004 stormwater outfall/detention basin, and the Rindge Avenue siphon relief project would be considered to have short-term and/or long-term impacts beyond the scope of the original plan. Impacts and mitigation are summarized in Table 3-3, and presented in more detail Chapter Eight.

BENEFITS OF INCREMENTAL IMPLEMENTATION OF THE RECOMMENDED PLAN

The current implementation schedule calls for completion of most elements of the recommended plan except for the upstream separation of outfall CAM004 by mid-2003. Completion of the CAM004 separation and closure of the regulator is scheduled to be completed by 2008. Details on the schedule for implementation of the revised recommended plan are presented below in Chapter Eight. It is important to note, however, that significant reductions in CSO activation frequency and volume will be attained before 2008, and in fact, improvements have already been made as a result of on-going construction.

Table 3-4 presents a summary of the average annual CSO frequency and volume under conditions prior to the start of construction contracts 2A and 2B along Fresh Pond Parkway, and at key milestones in the implementation of the recommended plan. Contracts 2A and 2B included installation of large-diameter pipe, box conduits and structures along Fresh Pond Parkway, and represented an early phase of the implementation of the original recommended plan. These contracts will also be an integral part of the revised recommended plan. As part of these construction contracts, interim measures were incorporated to reduce the activation frequency of outfall CAM004 until the full scope of separation of the CAM004 area could be completed. These interim measures divert dry weather flow from the upstream combined areas

TABLE 3-2. COMPARISON OF ESTIMATED COST AND PERFORMANCE OF ORIGINAL RECOMMENDED PLAN WITH REVISED RECOMMENDED PLAN

	Estimated Capital Cost	Baseline Condition		With Plan Implementation		Percent Reduction in Annual Volume
		Annual Activation Frequency	Annual CSO Volume (MG)	Annual Activation Frequency	Annual CSO Volume (MG)	
Original Plan	$12.1M	16	18.3	4	2.9	84%
Revised Plan	$74.0M	63	49.7	7	7.4	84 %

into the new sanitary system constructed along Fresh Pond Parkway. In addition, weirs were constructed at the new chamber at the Ground Round rotary to divert significant wet weather combined flows to the interceptor system. As a result of these measures, the predicted annual activation frequency at CAM004 has been reduced from 63 to 14, and the annual volume from 24 to 7.7 million gallons. This improvement at outfall CAM004 has reduced the total annual volume of CSO to Alewife Brook from all outfalls from approximately 50 to 33 million gallons.

The next milestone will occur in 2003, with the completion of the common manhole separation at CAM400, the interceptor connection relief projects at CAM002, CAM401B and SOM01A, the hydraulic relief gate at MWR003, and the Rindge Avenue relief siphon. With these projects in place, the total annual CSO activation frequency to Alewife Brook will be further reduced to 13, and the annual volume reduced to 22 million gallons, a volume reduction of more than 50 percent compared with conditions prior to the start of construction.

TABLE 3-3. SUMMARY OF BENEFITS, IMPACTS AND MITIGATION FOR NPC PROJECTS

Project	Change from Previous MEPA Filing	Project Benefits	Short-Term		Long-Term	
			Impacts	Mitigation	Impacts	Mitigation
CAM 004 ♦ Sewer Separation	Same as proposed in ENF when Phase I waiver was received	Elimination of CAM004 CSO outfall, resulting in water quality improvements due to reduction of CSO discharges to Alewife Brook and protection of Fresh Pond Reservoir	Traffic, dust, noise	Comply with measures outlined in MWRA's 1998 Draft Mitigation Guidelines for Phase I waiver projects	Minor, short term disruptions for routine maintenance	None
♦ New Stormwater Outfall	New project component due to determination that the existing outfall has insufficient hydraulic capacity	Reduction of flooding in CAM004 tributary area during 10-year storm events and storm events of less intensity	Traffic, dust, noise, wildlife disruption, disruption of access to MDC Reservation	Construction mitigation will include seasonal restrictions, groundwater monitoring, erosion control. Additional mitigation to be coordinated with MDC	Disruption of 12,160 sq. ft. of BVW and 1,000 sq. ft. of LUW; disruption of trails in MDC Reservoir; change to wildlife habitat; addition of stormwater to Little River	Construction of detention basin to dampen peak flow discharges, improve stormwater quality and create wetland habitat; net gain of 62,555 sq. ft. of BVW; improvement to trails; installation of upstream BMP's to reduce TSS and oil/grease; construction of berm in Arlington to mitigate existing flooding and marginal impact of project
CAM400 Sewer Separation	New Project Component arising from reassessment of recommended CSO control plan	Water quality improvements due to reduction in CSO activation frequency and volume of outfall CAM400	Traffic, dust, noise	Comply with measures outlined in MWRA's 1998 Draft Mitigation Guidelines for Phase I waiver projects	Minor, short term disruptions for routine maintenance	None
Interceptor Connection Relief at CAM002, CAM401B and SOM01A	CAM002 relief connection proposed instead of CAM002 sewer separation due to increased costs for overall project and determination of cost-effectiveness; relief connection at CAM401B is new project component due to discovery of new outfall; SOM01A relief identified in earlier planning report, but not implemented	Water quality improvements due to reduction of CSO activations at CAM002, CAM401B and SOM01A	Traffic, dust, noise	Comply with measures outlined in MWRA's 1998 Draft Mitigation Guidelines for Phase I waiver projects; develop traffic management plan in consultation with MDC, Cambridge, Somerville and Arlington	Minor, short term disruptions for routine maintenance	None

TABLE 3-3 (Continued). SUMMARY OF BENEFITS, IMPACTS AND MITIGATION FOR NPC PROJECTS

Project	Change from Previous MEPA Filing	Project Benefits	Short-Term		Long-Term	
			Impacts	Mitigation	Impacts	Mitigation
MWR003 Floatables Control and Hydraulic Relief Gate	Floatables control is same as proposed in ENF; hydraulic relief gate is new project component arising from reassessment of recommended CSO control plan	Reduction in floatables and solids discharged to Little River from outfall MWR003; relief of upstream flooding during extreme storm events	Dust, noise, disruption of wildlife and pedestrians in MDC Reservation; work in 100-foot buffer zone and riverfront area	Comply with measures outlined in MWRA's 1998 Draft Mitigation Guidelines for Phase I waiver projects; use sedimentation and erosion controls at limits of construction	Monthly maintenance inspections; minor loss of wildlife habitat and pedestrian disruption	Revegetate disturbed areas and repair trails in accordance with overall landscaping plans
Floatables Control for Alewife Brook Outfalls CAM001 CAM002♦ CAM 401A* CAM 401B♦ CAM001* CAM400*	♦ New Project Component * Same as Proposed in ENF	Reduction in floatables and solids discharged to Alewife Brook	Dust, noise, traffic	Comply with measures outlined in MWRA's 1998 Draft Mitigation Guidelines for Phase I waiver projects	Minor, short term disruption for routine maintenance	None

TABLE 3-4. SUMMARY OF PERFORMANCE OF INCREMENTAL IMPLEMENTATION OF SEWER SEPARATION ALTERNATIVE A

Outfall	Existing Conditions Prior to Contract 2A/2B Construction		Existing Conditions Based on Current Status of Contract 2A/2B Construction[1]		Incremental Implementation of Sewer Separation Alternative A, without Contracts 8 and 9[2]		Sewer Separation Alternative A	
	Annual Frequency	Annual Volume (MG)	Annual Frequency	Annual Volume (MG)	Annual Frequency	Annual Volume (MG)	Annual Frequency	Annual Volume (MG)
CAM001	1	0.01	0	0.00	5	0.02	5	0.20
CAM002	7	1.57	7	1.52	5	0.95	4	0.72
MWR003	1	0.06	1	0.05	4	0.62	5	1.03
CAM004	63	24.1	14	7.69	13	12.67	0	0.00
CAM400	10	0.80	10	0.78	7	0.31	5	0.27
CAM401A	7	2.74	7	2.77	5	1.77	5	1.65
CAM401B	25	10.5	25	10.7	8	2.98	7	2.24
SOM01A	10	9.89	10	9.90	6	2.37	3	1.29
Totals	**63**	**49.7**	**25**	**33.4**	**13**	**21.9**	**7**	**7.4**

Notes on Table 3-4:

(1) As part of the Contract 2A/2B construction, interim measures were incorporated to reduce the activation frequency of outfall CAM004, until the full scope of separation of the CAM004 tributary area can be completed. These interim measures divert dry weather flow from the upstream combined areas into the new sanitary system constructed along Fresh Pond Parkway. In wet weather, flow up to the capacity of the new sanitary system is conveyed directly to the interceptor system. Excess flows are conveyed via the new large conduits in Fresh Pond Parkway to Drain Vault No. 5, where temporary weirs have been installed to divert additional wet weather flow to the interceptor. As indicated in Table 1, these interim measures reduce the predicted annual discharge frequency at outfall CAM004 by more than 75 percent, and the annual discharge volume by almost 70 percent.

(2) This condition includes the interim measures constructed under Contracts 2A/2B described under Note 1, along with increasing the size of interceptor connections at CAM002, CAM401B and SOM01A; sewer separation of CAM400; and completion of the Rindge Avenue CS Siphon Relief (basically all elements of Partial Sewer Separation Alternative A, except for the sewer separation work in the upstream CAM004 area).

DISCUSSION ON WHY CSO ELIMINATION IS NOT RECOMMENDED

Both the state and the national CSO policies indicate that the ultimate goal for CSO control is to attain water quality standards. Where the existing water quality standard is Class B, attainment of that standard requires total elimination of CSOs. It is recognized, however, that attainment of existing water quality standards (i.e., CSO elimination) is not always feasible, and the regulations identify a limited number of specific conditions where a change to water quality standards would be allowed. Among these conditions is where attainment of the standard would cause "substantial and widespread social and economic impact". DEP has interpreted this clause as meaning where additional expenditures on CSO control would not result in significant improvement in water quality based on cost-effective analyses, provided that remaining CSO impacts are sufficiently minimized. While the analyses presented in the chapters that follow demonstrate these points, it was clear from the public meetings preceding this NPC that additional discussion on why CSO elimination was not recommended for Alewife Brook is warranted. To expand upon the analyses presented in subsequent chapters, the reasons

for not recommending elimination of CSOs to Alewife Brook can be summarized under three categories: total cost, practical implementability issues, and cost/benefit considerations.

Total Cost

In Chapter Five, Table 5-5 indicates that the difference in cost between complete separation, and separation of just outfalls CAM004 and CAM400 is on the order of $100 million. This incremental cost would be approximately 20 percent of the entire cost of the MWRA's current CSO control program. It has to be recognized that extraordinary justification would have to be provided to support such an increase in program cost given the responsibility and accountability of the MWRA to the rate payers in its 43 member communities.

Practical Implementability Considerations

While it is understood that many implementability issues can be overcome with higher cost, three implementability issues bear further discussion. First, in order to eliminate CSO outfalls, a sufficient degree of stormwater inflow must be removed from the collection system so that closure of the outfall will not cause flooding in extreme storm events. In certain parts of Boston, it has been observed that the roof drains for multi-story, flat-topped residential buildings may connect with the interior building plumbing. Removing this source of inflow would require changing the interior building plumbing, which would be extremely expensive and time-consuming. It is not known how many buildings in the combined sewer areas tributary to Alewife Brook would fall into this category, but the degree of achievable sewer separation is a key issue in assessing the technical feasibility of eliminating CSOs.

A second implementability issue pertains to the CAM401A/B tributary area. This area is very flat, and the existing sanitary, combined and storm drain piping is highly inter-connected. One of the reasons for the degree of interconnections is the combination of

limited available depth of the pipes given the flat topography, the criteria for minimum cover over the pipes, and the need for the pipes to drain by gravity either to the MWRA interceptors or to Alewife Brook. It is not clear how a new system of storm drains and sanitary piping would be installed in this area given the need to maintain existing flows. At a minimum, significant bypass pumping would be required, which would further increase the cost of separation in this area. It may even be determined that new stormwater and sanitary pump stations would be required, which would again further increase costs and add siting issues as further complexities to be considered.

The third implementability issue draws on the issues associated with separation of the CAM004 area, in particular the limited conveyance capacity of the existing collection system and the need to attenuate flows to Alewife Brook. The capacity of the existing CAM401A outfall to convey combined sewer flows to Alewife Brook is limited to approximately the same degree as the existing CAM004 outfall, if not more so. The extent of the CAM401 combined tributary area to be separated would be approximately on the same scale as the currently-proposed CAM004 area (approximately 250 acres). It would therefore be expected that a new stormwater outfall approximately on the same scale as the proposed CAM004 outfall would be required in order to convey separated stormwater flows from the CAM401 area to Alewife Brook. Similarly, it would be expected that the need to attenuate peak flow rates and velocities in the new outfall would be similar to the need at outfall CAM004.

It has already been determined by the City of Cambridge that separation of the entire CAM002 tributary area would require new, larger-diameter storm drains along Massachusetts Avenue between Alewife Brook and Porter Square. The ability of the existing Tannery Brook Drain to carry separated stormwater flows from the area upstream of outfall SOM01A has not been assessed, but it should be noted that the total combined sewer tributary area upstream of outfall SOM01A is approximately 280 acres. Thus, even if a new outfall were not required, the peak flows and velocities from the Tannery Brook Drain would certainly need to be attenuated.

It is not at all clear how the additional peak stormwater flows from the CAM002, CAM401 and SOM01A areas would be attenuated to avoid exacerbating bank erosion and downstream flooding, given the scale of the detention basin needed to attenuate the flows from the CAM004 tributary area. It seems that this issue goes beyond one of cost, to a question of the physical availability of space required to provide such attenuation. Without a feasible means to attenuate these flows, complete sewer separation along Alewife Brook is not implementable.

Cost-Benefit Considerations

Elimination of CSO by sewer separation, if implementable, would mean that CSOs would no longer contribute to exceedance of the Class B water quality criteria in Alewife Brook during wet weather. The receiving water model, supported by recent sampling data, indicates that the current quantity and quality of stormwater tributary to Alewife Brook causes substantial exceedence of the Class B criteria for bacteria. Approximately 75 percent of the total annual stormwater runoff volume tributary to Alewife Brook comes from the non-CSO communities of Belmont and Arlington. Even if the additional stormwater discharge resulting from sewer separation in Cambridge and Somerville could in some way be treated, such as by the constructed wetlands proposed for the new CAM004 outfall, the remaining untreated stormwater from Belmont and Arlington would continue to cause exceedances of the Class B criteria. Further, the monitoring data indicate that the Class B bacteria criteria are exceeded continuously during dry weather.

The conclusion to be drawn from these observations is that CSO elimination by sewer separation, at an incremental cost of at least $100 million beyond the cost of the revised recommended plan, will not result in attainment of the Class B standard. While there certainly would be value in the knowledge that combined sewage no longer discharged to Alewife Brook during wet weather, consideration must be given to how resources can most effectively be spent to affect the greatest improvement in water quality. It is possible, if not likely, that some fraction of the day-to-day dry weather bacteria load to Alewife Brook is caused by cross-connections between the sanitary sewer system and

separate storm drains directly tributary to Alewife Brook and/or the Little River. It is suggested that if additional resources were to be spent on Alewife Brook beyond the cost of the revised recommended plan, the target of those resources should be the sources causing both the non-CSO wet weather violations and the day-to-day exceedances of the bacteria standard, as opposed to further reducing the activations of CSOs in larger and less-frequent storm events. These activities would appropriately start to move beyond the scope of the MWRA's CSO control program, and introduce the need for engagement and participation of other entities that are responsible for the discharge of flow to Alewife Brook.