

# Chapter 5 Management Alternatives

## 5.1 ACTION PLANS BY MAIN 1-2 COMMUNITIES

Individual action plans were established on a community-by-community basis. These proposed actions were tabulated and became the foundation of the subwatershed plan. These proposed actions are also the basis on which each community will develop a SWPPI. The SWPPI will be the responsibility of each permittee.

In general, SWAG members developed a list of management actions that included actions currently being carried out, planned actions and new initiatives. Short term actions are defined as those to be completed by 2005 and long term actions are defined as those that are on-going beyond 2005 and/or those not completed by 2005. These actions will likely become part of the SWPPI for each community. These lists were developed by a team that usually included the Director of Public Works, the City/Township Engineer, and the Director of Parks and Recreation. Table 5-1 shows the Management Action Lists prepared by each community.

**Table 5-1: Community Storm Water Management Alternatives**

MATRIX NUMBER	STORMWATER MANAGEMENT ALTERNATIVE	SHORT TERM	LONG TERM	NEW INITIATIVE
<b>City of Auburn Hills</b>				
AH1	Storm drain cleaning and repair	X	X	
AH2	Ditchline maintenance	X	X	
AH3	TV inspection for sanitary sewers	X	X	
AH4	Street sweeping	X	X	
AH5	Downspout extension ordinance and enforcement	X	X	
AH6	Wetland ordinance and enforcement	X	X	
AH7	Infrastructure GIS mapping	X		
AH8	Woodland ordinance (20% of lot has to be landscaped)	X	X	
AH9	Quarterly newsletter	X	X	
AH10	Distribution of public information materials	X	X	
AH11	Website	X	X	
AH12	Smart growth signs	X	X	
AH13	Road salt controls/calibrate all equipment for efficiency	X		
AH14	HHW Day	X		
AH15	Engineering ordinance/retention basin and storm water review	X		
AH16	Pollution prevention ordinance/Rouge Friendly business program	X		
AH17	Downspout ordinance	X		
AH18	Footing drain disconnect program	X		X
AH19	Sanitary sewer maintenance program	X		

MATRIX NUMBER	STORMWATER MANAGEMENT ALTERNATIVE	SHORT TERM	LONG TERM	NEW INITIATIVE
AH20	Redesign/Retrofit DPW yard retention tank		X	X
AH21	Healthy landscaping on public property	X		
AH22	Oil/grease trap ordinance	X		
AH23	Border collie for geese	X		
<b>Village of Beverly Hills</b>				
BV1	Streambank stabilization		X	X
BV2	Improving culvert crossing-Riverview Dr.		X	
BV3	Downspout disconnection program	X		
BV4	Annual River Day		X	
BV5	Swales maintenance/ improvement		X	X
BV6	Sanitary Sewer manhole inspection in flood plain	X		
BV7	Street sweeping		X	
BV8	Storm drain cleaning	X		
BV9	Clean catch basins	X		
BV10	IDEP	X		
BV11	HHW program/SOCRRA	X		
BV12	Mailings to riparian land owners	X		
BV13	TV inspection for storm drains	X		
BV14	Storm sewer/utilities mapping	X		
BV15	Web site	X		
BV16	Newsletter	X		
BV17	Log jam removal	X		
BV18	Douglas-Evans Nature Preserve education/brochure	X		
BV19	Rebuilding bridge at Old Pond	X		
BV20	Dredge Old Pond		X	X
BV21	Leaf mulching/SOCRRA compost program	X		
BV22	Rebuild/repair salt storage bldg.	X		
BV23	Remove all septic	X		
BV24	Participate in Evergreen/Farmington	X		
BV25	Support FOTR to expand REP to local schools	X		X
<b>City of Birmingham</b>				
B1	Conducting IDEP Program	X		X
B2	Citizen Newsletter, quarterly		X	
B3	Display at DPW Open House, annual		X	
B4	River Day, annual		X	
B5	GIS/Storm system coverage, ongoing		X	
B6	Considering Fertilizer Reduction Program via SOCRRA		X	X
B7	Planning streambank stabilization project at Springdale Park,		X	X
B8	Quarton Lake dredging/public involvement		X	
B9	Street sweeping, ongoing		X	

MATRIX NUMBER	STORMWATER MANAGEMENT ALTERNATIVE	SHORT TERM	LONG TERM	NEW INITIATIVE
B10	Curbside leaf pickup, ongoing		X	
B11	HHW program/SOCRRA, ongoing		X	
B12	Catch basin cleaning, annually		X	
B13	Residential Downspout ordinance/downspout disconnection (considering commercial program)		X	X
B14	Public education at Acacia Park basin and Douglas-Evans Nature Preserve		X	
B15	Soil erosion ordinance		X	X
B16	Log jam removal		X	X
B17	Identification of riparian landowners.		X	X
B18	Identification of septics (6), will hook up to sewer		X	
B19	Goose egg replacement	X		
B20	Support FOTR to expand REP to local schools	X		X
<b>Bloomfield Township</b>				
BT1	Goose Round-up, ongoing program		X	
BT2	River Day, annually		X	
BT3	Sewer system cleaning, ongoing		X	
BT4	HHW Drop-off Day, twice annually		X	
BT5	Considering implementing phosphorus reduction program around lakes		X	X
BT6	Publicize correct HHW practices, ongoing		X	
BT7	Developing list of riparian landowners		X	X
BT8	Public Participation Programs, ongoing		X	
BT9	Considering local erosion control ordinance		X	X
BT10	Wetland inventory mapping (maps effective 11/14/97)		X	X
BT11	Considering stream obstruction prevention and removal practices in the Franklin Branch		X	X
BT12	Maintain soil stabilization measures		X	
BT13	Construction BMP program, ongoing		X	
BT14	Natural features ordinance #474		X	
BT15	Working with Lake Owners Associations in organizing watershed groups		X	X
BT16	Citizen Newsletter, published quarterly		X	
BT17	Developing fertilizer reduction program		X	X
BT18	GIS for septics, ongoing		X	
BT19	Videoring sanitary sewers, ongoing			
BT20	Metering sanitary sewers, ongoing			
BT21	Sanitary manhole inspection in flood plain, ongoing			
BT22	Developing various storm drain projects		X	X
BT23	Support FOTR to expand REP to local schools	X		X
<b>City of Farmington</b>				
FM1	Illicit connection detection/elimination	X		

MATRIX NUMBER	STORMWATER MANAGEMENT ALTERNATIVE	SHORT TERM	LONG TERM	NEW INITIATIVE
FM2	Storm sewer inspection	X		
FM3	Hot line reporting system	X		
FM4	Household hazardous materials management	X		
FM5	Storm water management for new development	X		
FM6	Public facilities management	X		
FM7	Monthly main street and residential street cleaning	X		
FM8	Maintenance practice review for public lands	X		
FM9	Catch basin cleaning	X		
FM10	Sewer system cleaning	X		
FM11	Constructed swales and filter strips	X		
FM12	Constructed storm water infiltration basins	X		
FM13	Constructed sediment ponds	X		
FM14	Constructed storm system media filters	X		
FM15	Require oil and grease trap devices	X		
FM16	Sponsor Trout Derby		X	
<b>City of Farmington Hills</b>				
FH1	Illicit connection detection/elimination	X		
FH2	Illegal Dumping/Spill Controls	X		
FH3	Hot line reporting system	X		
FH4	Household hazardous materials management	X		
FH5	Storm water management for new development	X		
FH6	Home lawn and garden maintenance	X		
FH7	Admin. Soil and sedimentation controls	X		
FH8	Storage/loading/unloading operations mgt.	X		
FH9	Outdoor work area mgt.	X		
FH10	Vehicles and equipment management	X		
FH11	Residential Streets (secondary)	X		
FH12	Main roads (primary)	X		
FH13	Deicing practices review	X		
FH14	Golf courses/recreation area management	X		
FH15	Audit of chemical use/storage	X		
FH16	OSDS Inspection/Maintenance	X		
FH17	Regional septage disposal facilities		X	X
FH18	Sewer system operation/maintenance/cleaning	X		
FH19	Catch basin cleaning/SSO identification/control	X		
FH20	Maintain storm water infrastructure	X		
FH21	Environmental ordinance development		X	
FH22	Sanitary system controls/oil and grease trap devices	X		
FH23	Outlet stabilization	X		
FH24	GIS for planning public facility management	X		
FH25	Habitat restoration	X		
FH26	Entrance recreational amenities tree planning	X		



MATRIX NUMBER	STORMWATER MANAGEMENT ALTERNATIVE	SHORT TERM	LONG TERM	NEW INITIATIVE
FH27	Environmental education programs	X		
FH28	Direct mailings to homes/Rouge Rescue	X		
FH29	Rouge Education Project	X		
FH30	Rouge Friendly Business project	X		
FH31	River signage	X		
FH32	Cable broadcasts/web site	X		
FH33	Video tapes	X		
FH34	Community meetings on subwatershed plan	X		
<b>Village of Franklin</b>				
F1	Newsletter	X		
F2	Web Site with link to SOCRRA and RPO	X		
F3	SOCRRA Healthy Lawn Workshops	X		
F4	Rouge Rescue/River Day promotion		X	
F5	Direct mailing to residents and businesses about recycling, leaf pickup	X		
F6	HHW program	X		X
F7	Wetlands mapping	X		
F8	Wetlands Ordinance	X		
F9	Display at Library and Village Hall w/materials	X		
F10	IDEP Program/OCDC	X		
F11	Community Events	X		
F12	Cable TV running Headwaters and RPO Videos	X		
F13	Septics ordinance	X		
F14	GIS for septic and pressure system		X	
F15	Tree ordinance	X		
F16	Participation in Evergreen/Farmington	X		
F17	Fertilizer Education	X		
<b>Oakland County Drain Commissioners Office</b>				
OC1	IDEP Program	X	X	X
OC2	Illicit Connection Training	X	X	X
OC3	Maintenance Inspections	X	X	X
OC4	Illegal Dumping Hotline	X	X	X
OC5	Inspection of golf course outfalls	X	X	X
OC6	Health Dept. follow-up inspections	X	X	
OC7	Tributary Signage	X	X	X
OC8	Storm drain stenciling	X	X	X
OC9	Rouge Education Project	X	X	X
OC10	Workshops	X		
OC11	HHW program/SOCRRA	X	X	X
OC12	Fertilizer reduction ordinance		X	X
OC13	Work with Meadowbrook lake to reduce nutrients	X	X	X
OC14	SSO Study on Evergreen/Farmington	X	X	



MATRIX NUMBER	STORMWATER MANAGEMENT ALTERNATIVE	SHORT TERM	LONG TERM	NEW INITIATIVE
OC15	Streambank Stabilization Grant	X	X	X
OC16	CSO program	X	X	
OC17	Oakland County Hotline magnets	X	X	X
OC18	Maintain list of riparian landowners	X	X	X
OC19	Rouge Display in lobby	X	X	X
OC20	Catch basin cleaning	X	X	
OC21	Storm Drain inspection	X	X	
OC22	Sanitary Sewer Inspection.	X	X	
OC23	Rouge Friendly Business Program	X	X	
OC24	Storm Drain GIS	X	X	
OC25	Detention Pond Inventory	X	X	
OC26	Log jam removal on county drains	X	X	
OC27	Smart Growth Planning		X	X
OC28	Meet with Oakland County Schools on Rouge Education	X	X	X
OC29	Distribute Rouge Recreation Maps	X		X
OC30	Creation and distribution of IDEP SWAT Team brochure	X	X	X
OC31	Develop Watershed Web Site	X	X	X
OC32	Conducted public meetings	X	X	X
<b>City of Southfield</b>				
S1	IDEP Program with OCDC	X		
S2	On-Site sewage disposal system (OSDS) ordinance OSDS must be inspected and certified every 3 years.	X		
S3	Pollution Control Facilities Program - New sanitary sewer installation for areas that do not already have access to sewers.		X	X
S4	Bridge street slope failure - project for repair of slope failure along branch of the Rouge River. Project in cooperation with the US Army Corps of Engineers.	X		
S5	Soil Erosion Inventory - Program with Main 1-2 SWAG	X		
S6	Detention Pond Inventory - Program with Main 1-2 SWAG	X		

MATRIX NUMBER	STORMWATER MANAGEMENT ALTERNATIVE	SHORT TERM	LONG TERM	NEW INITIATIVE
S7	Mailing to all Riparian owners in Southfield on proper riparian management.	X		
S8	Office of Storm Water Management: Created last spring to deal with storm water management issues.	X		X
S9	A Storm Water Management Master Plan has been created for the City and provides a long - term strategy for managing subwatersheds and storm water runoff with in the City	X		X
S10	Hydrologic and Hydraulic modeling	X		
S11	TV inspection of storm sewer - inspection of suspected storm sewer problem areas.	X		
S12	GIS storm sewer database - Creation of GIS storm sewer data base.	X		
S13	Public Education Website - Public education on Rouge River water quality issues and storm water issues, on the City of Southfield website.	X		
S14	City golf courses environmental management - Implement more environmentally friendly golf course management practices.	X		
S15	Logjam removal - Removal of logjams in the Rouge River that impede the flow of the River.	X		
S16	Catch Basin Cleaning	X		
S17	Street Sweeping	X		
S18	Leaf and yard pickup - provide leaf and yard waste pickup for all residents in Southfield.	X		
S19	Detention Pond Ordinance – develop for critical areas	X		
S20	HHW - Continue to provide residents with 2 HHW collection days per year.	X		
S21	Tree ordinance; woodland and wetland ordinance - continue to enforce tree ordinance; woodland and wetland ordinance.	X		

MATRIX NUMBER	STORMWATER MANAGEMENT ALTERNATIVE	SHORT TERM	LONG TERM	NEW INITIATIVE
S22	Used oil drop-off - continue to provide residents with 2 HHW drop off days where they can drop-off their used oil.	X		
S23	Regional detention (10 year) - The City will be looking into regional detention.		X	X
S24	Rouge Rescue - The City will continue to do its annual Rouge River cleanup for logjam removal along the Rouge River.	X		
S25	Healthy lawn and garden (SOCWA) - The City will continue to use SOCWA healthy lawn and garden programs.	X		
S26	Storm sewer system cleaning.	X		
S27	Publicize correct HHW management practices - Publicize HHW mgt. practices on local cable, city newsletters and local media.	X		
S28	Identify all riparian land owners - This has been done through GIS	X		
S29	Incorporate BMPs into swales - Sec. 34 Clean Michigan Initiative grant for swale construction. This project will incorporate BMPs into design features.	X		X
S30	Rouge Friendly Business Program - Implement a Rouge Friendly Program for Southfield businesses		X	X
S31	Public Ed. survey - Develop and administer a survey to residents to determine if public ed programs are working in the Southfield area.	X		
S32	Native plants program at Birney Middle School - continue to support Birney Middle school with their native planting and education programs.	X		
S33	Public land maintenance; incorporate native species or no mow zones.	X		
S34	Provide illegal dumping hotline / OCDC	X		
S35	Support Rouge Education Project - Provide support for the Rouge Education Project	X		

MATRIX NUMBER	STORMWATER MANAGEMENT ALTERNATIVE	SHORT TERM	LONG TERM	NEW INITIATIVE
S36	Soil erosion ordinance (completed)	X		
S37	Signage - The city will put up signage at local Rouge River crossings.	X	X	
S38	Fishing Derby - The city will continue to host an annual trout derby along the Rouge River.	X		
S39	Cable TV Programming - The city will continue to provide cable programming on Rouge River, and storm water education topics.	X		X
S40	Participate in Evergreen Farmington Sewage Disposal District Task Force.	X		
S41	Natural features ordinance	X		
S42	Native planting at City Hall	X		
S43	Neighborhood Brochure (Rouge Friendly Practices) The city has developed a neighborhood brochure that will be handed out to all new residents. This brochure has information on how you can be a Rouge River Friendly household	X	X	X
S44	Rummell Drain improvements – consist of various improvements to the open channel section of the Rummell Drain in section II to reduce flooding, restore habitat and improve aesthetics	X	X	
S45	Beacon Square I/I study – Pilot study to study and eliminate excessive inflow and infiltration of storm water and ground water entering the sanitary sewer system		X	X
<b>City of Troy</b>				
T1	Streambank Stabilization projects behind Post Office and City Hall	X	X	X
T2	Formed storm water division, ongoing process	X	X	
T3	GIS for drainage; flood plain maps; Storm water modeling; and Locate septics		X	X
T4	Considering Natural features and wetlands protection ordinances		X	X
T5	Tree ordinance, ongoing	X	X	X
T6	Video camera for sanitary and storm sewers, ongoing	X	X	
T7	Replace failing septics with sewers as notified by Health Department	X	X	
T8	Septics education	X		

MATRIX NUMBER	STORMWATER MANAGEMENT ALTERNATIVE	SHORT TERM	LONG TERM	NEW INITIATIVE
T9	Street sweeping (four/10 hour days)	X	X	
T10	Curbside leaf pickup, ongoing	X	X	
T11	Used oil drop-off, ongoing	X	X	
T12	Downspout ordinance		X	
T13	10-yr storm detention ponds			
T14	IDEP program	X		
T15	Troy Daze/River Day	X	X	
T16	Healthy Lawn and Garden Program		X	
T17	Conducted metering study on Evergreen/ Farmington	X	X	
T18	Partnership with EMEAC /storm water education		X	
T19	Studying Troy system	X	X	
T20	Troy share of DWSD		X	
T21	Partnership with neighboring developers to create pond at Firefighters Park	X	X	
T22	Lloyd Stage Outdoor Recreation Center		X	
T23	Golf Course on old landfill; fixed pumping station		X	
T24	Dredge Northfield Hills Condos		X	X
T25	Survey of Emerald Lakes/high e-coli	X		X
T26	Flatten banks at Firefighter Park		X	X
T27	Various storm drain projects		X	
T28	Restore McCulloch Drain pond and expand wetlands		X	X
T29	Support FOTR to expand REP to local schools	X		X
<b>West Bloomfield Township</b>				
WB1	Illicit connection detection/elimination training	X		
WB2	Storm sewer outfall inspection	X	X	
WB3	Illegal dumping ordinance	X		
WB4	Annual household hazardous materials management		X	X
WB5	Storm water management for new development	X		
WB6	Home lawn and garden maintenance	X		
WB7	Admin. Soil and sedimentation controls	X		
WB8	Sanitary Sewer Cleaning	X		
WB9	Storm Water Master Planning.	X	X	
WB10	Constructed Wetlands	X		
WB11	Swales and Filter Strips	X		
WB12	Storm Water Infiltration Basins	X	X	
WB13	Sediment Ponds	X		
WB14	Require oil and grease trap devices in local bldg. Codes	X		
WB15	Mailings/Pollution Prevention	X		
WB16	River Signage	X		

MATRIX NUMBER	STORMWATER MANAGEMENT ALTERNATIVE	SHORT TERM	LONG TERM	NEW INITIATIVE
WB17	Brochure distribution	X		
WB18	Cable TV programs	X		

## 5.2 MATRIX OF ACTIONS VERSUS GOALS

The next challenge was to compare the list of management alternatives identified by each SWAG community with the short- and long-term goals identified by the SWAG as a whole, as well as the BMPs. Questions that needed to be addressed included:

- Have all the goals been addressed at some level?
- Collectively, will the actions identified “solve” the problem?
- Should additional goals be included?
- What other actions can be accomplished through collaboration among communities?
- What actions can/should be accomplished by others such as MDOT, County Parks, MDEQ, etc?
- Have the communities controlled their storm water to the **Maximum Extent Practicable (MEP)**?
- Are water quality standards going to be met?

Table 5-2 presents community actions in relation to both goals and BMPs. The alphanumeric matrix number from Table 5-1, have been placed within the matrix to depict which goal and BMP that best corresponds to a particular action.











### 5.3 CRANBROOK POLICIES, GOALS AND OBJECTIVES

Although the Cranbrook Education Community is not a permittee under the General Storm Water Permit, they have partnered with the Main 1-2 SWAG and have participated in the storm water management planning process. Listed below are the policies, goals and objectives that Cranbrook has developed for storm water management.

- Policy I – Build a base of public approval and facilitate working relationships with governmental agencies in support of Cranbrook’s water management as a component in a regional storm water management.
  - Goal A – Obtain support from surrounding communities and State and Federal agencies for Cranbrook’s water resource management activities.
    - Objective 1 – Develop and implement a cooperative storm water management plan that protects the property of downstream neighbors to the south while safeguarding Cranbrook.
    - Objective 2 – Develop and implement a cooperative management plan to control storm water passing through the campus from the northern communities.
    - Objective 3 – Incorporate State and Federal needs and regulations into Cranbrook’s water management planning and implementation activities.
  
- Policy II – Cranbrook acknowledges the Rouge River as a major component in its water management planning.
  - Goal A – Control and guide water movement in and through the campus in a secure and cost-effective manner.
    - Objective 1 – Develop a means on Cranbrook property to reduce the velocity of water flowing through the campus from other parts of the sub-watershed.
    - Objective 2 – Dredge Kingswood Lake and reconstruct the dam so that the water flow can be regulated and floodwater contained within designated boundaries.
    - Objective 3 – Consistent with current best management practices, pursue ecologically sensitive methods to reduce sediment buildup in Kingswood Lake.
    - Objective 4 – Repair/replace existing weirs and construct new weirs to improve floodwater storage and to manage water discharge.
  
- Policy III – Implement a water resource management plan to protect Cranbrook from dangers posed by flooding from a 100-year storm.
  - Goal A – Manage a 100-year storm event through modifications and improvements to Cranbrook’s drainage system and active management of water as it flows through the campus.
    - Objective 1 – Recognize the potential for major flood damage at Kingswood and Brookside schools.
    - Objective 2 – Identify all possible on-campus locations for flood water storage.
    - Objective 3 – Locate athletic practice and intramural fields to allow for partial emergency storage of floodwater.
    - Objective 4 – Participate in a County Storm Alert Advisory Program and when requested by the Oakland County Drain Commission, lower the level of Kingswood Lake to increase on site flood water storage capacity for the benefit of Cranbrook and its downstream neighbors.

- Goal B – Determine the feasibility of a storm water bypass at the Lone Pine Bridge
  - Objective 1 – During a 100-year storm, recognize that Cranbrook’s property cannot store the total volume of water draining through the 13.5 square miles of the watershed upstream of the campus.
  - Objective 2 – Involve all concerned individuals and organizations in the development, operating procedures and approval of a physical design for a Long Pine storm water bypass, including operating procedures and regulations. The purpose of this bypass will be a means to protect Cranbrook and its downstream neighbors from flood damage.
  - Objective 3 – Size impoundment areas and the bypass line by balancing available on campus storm water storage sites with the amount of water permitted to flow through the bypass at the Lone Pine Bridge.
  - Objective 4 – Increase the number of outlets on Kingswood Lake to reduce over-topping, minimize erosion and diminish the potential for a blowout of the dam.
  
- Policy IV – Environment, health and safety concerns shall be integrated into all aspects of storm water management at Cranbrook.
  - Goal A – Reduce storm water runoff from Cranbrook property and minimize the discharge of particulate matter.
    - Objective 1 – Replace, where possible, storm water trunk lines currently discharging directly into the Rouge River and into public storm water systems with lines that release into the earth so that ground water on campus will be recharged, flooding reduced and water quality enhanced.
    - Objective 2 – Utilize storm water management systems to promote wildlife and increase the diversity of plants and animals on campus. This could include fish ladders on the lakes and the construction of aquatic and semi-aquatic habitats.
  
- Policy V – Preserve and enhance the aesthetic and historic qualities of Cranbrook’s landscape as water resource management related repairs, improvements or new initiatives are carried out.
  - Goal A – Incorporate “state of the art technology” into water management, planning and implementation by blending and concealing new innovations within the historic context and character of the campus.
    - Objective 1 – Replicate and restore historic on-campus water management features consistent with the need to resolve current issues and problems.
    - Objective 2 – Automate the management of water flows through dams and weirs.
    - Objective 3 – When feasible, utilize sustainable, attractive, and diverse landscape design solutions to reduce erosion along stream banks and shorelines consistent with Cranbrook founder, George Booth’s desire for plant diversity at a botanical garden level.
  - Goal B – Incorporate the preservation and enhancement of the visual character of the campus as an integral part of water resource planning.
    - Objective 1 – Develop and implement a water management plan that contributes to the enhancement and preservation of Cranbrook’s essential visual character.
    - Objective 2 – Preserve the natural and the man-made characteristics of the landforms and watercourses of Cranbrook.

- Objective 3 – Implement a forest renewal management plan with sustainable deep rooted and diversified trees and shrubs that serve to increase ground water storage.
- Policy VI – Storm and sanitary sewers must be in sound working order.
  - Goal A – Upgrade the existing Cranbrook storm and sanitary sewer system to meet current and future needs.
    - Objective 1 – Eliminate, if existing, any cross connections between the current storm and sanitary systems.
    - Objective 2 – Replace all sanitary sewer and storm sewer trunk lines. This need was documented by an extensive cleaning and video analysis of the storm and sanitary sewer systems throughout the campus.
    - Objective 3 – Coordinate designs for storm and sanitary trunk lines with long-range needs as defined in the Campus Plan.
    - Objective 4 – Integrate repair and replacement of storm and sanitary drains (collector lines, footer drains and downspouts) with the restoration expenditures for each campus building and related grounds.
- Policy VII – Increase Cranbrook’s operating efficiencies in the use of water resources.
  - Goal A – Utilize non-potable artesian water sources, derived from underground reserves to supply fountains, pools and irrigation.
    - Objective 1 – Develop well capacity on the campus to meet non-potable water requirements.
    - Objective 2 – Develop control strategies that allow the non-portable water system to supply fountains and pools during the day and irrigation systems at night.
  - Goal B – Reduce campus wide energy consumption.
    - Objective 1 – Coupled with ecological safeguards, utilize the constant 57-degree artesian water temperature to provide cooling in Cranbrook buildings through “state of the art” heat exchange methods.
    - Objective 2 – Protect the Rouge River from thermal impacts resulting from Cranbrook’s use of artesian water for cooling by dissipating heat through seasonal use of irrigation systems.
- Policy VIII – Educate the general public about matters of hydrology.
  - Goal A – Include hydrology in Cranbrook’s public education mission.
    - Objective 1 – Document and disseminate information about water management techniques used at Cranbrook.
    - Objective 2 – Allow Cranbrook to serve the general public as a readily available model demonstration area on water resource management.
    - Objective 3 – Encourage guided tours (docent programs) and self-guided tours (maps and texts) about the water features on the campus.
- Policy IX – Integrate water management issues into routine landscape maintenance practices.
  - Goal A – Use state of the art environmentally sensitive snow/ice removal processes.
    - Objective 1 – During snow storms utilize mechanical means such as motorized broom, snowthrowers, in box sand spreaders and rubber edge plows, in conjunction with early starts to decrease the amount of ice melt required to keep walkways free of hazards.

- Objective 2 – Replace high traffic pedestrian walkways, as opportunities arise, with heated surfaces that do not require the use of ice melt products.
- Objective 3 – Use “state of the art” paving practices, such as porous paving when resurfacing to reduce the need for road salt on above ground parking lots and when constructing new parking lots, consider below ground structures that do not require salt applications.
- Objective 4 – Minimize lawn fertilizer and pesticides by applying material based on Integrated Pest Management (IPM) practices.
- Objective 5 – When possible, substitute self-sustaining landscape plants for ornamental flora which will reduce the need for extensive use of pesticides and fertilizer.