Appendix 7: Long-Term Water Quality Monitoring Plan

Long-term Water Quality Monitoring Plan
Indian/Moxlie Creek Basin

By tracking water quality trends over the long-term, the monitoring plan will play a critical role in the protection and improvement of Indian and Moxlie Creeks chemical and biological integrity. Implementation of the monitoring plan will enable local governments and interested groups or individuals to:

- Detect and correct water quality problems.

- Identify trends in the water quality so success or failure of corrective actions may be evaluated.

Water quality investigations conducted during the basin planning effort focused on identifying nonpoint pollution sources within the basins. Types of nonpoint pollutants include sediments, pathogens, nutrients, and toxicants. These pollution sources, spread throughout the basin, have resulted in considerable water quality impacts to the creek system.

Current Water Quality Conditions

Initial monitoring, conducted from 1989 through 1990, indicates that both Indian and Moxlie Creeks have several major water quality problems. Specific types of pollution identified during the initial monitoring include the following:

• Indian/Moxlie Creek in the downtown Olympia area and the outfall to Budd Inlet at East Bay shows elevated fecal coliform bacteria levels. The area adjacent to Indian Creek near of South Bay Road also shows evidence of bacteriological pollution, possibly from septic systems.

• In the area of Indian Creek from Martin Way to the south side of Interstate 5, sediment analysis discloses contamination from two phthalate esters, bis(2-ethylhexyl)phthalate and indeno(1,2,3-c,d) pyrene.

• Bigelow Lake sediments contain elevated levels of several trace metals.

• PH and dissolved oxygen levels in Indian Creek occasionally exceed recommended threshold levels.

• Nutrient levels may be prompting excessive algae growth in portions of Indian Creek.

Water Quality Monitoring Plan

The Washington Department of Ecology (WDOE) has established guidelines for long-range water quality monitoring (Guidance for Conducting Water Quality Assessments, June, 1989). The monitoring program presented in the WDOE guidelines seeks to maximize the value of the collected information while minimizing costs and technical complexity. The guidelines recommend the following elements for a successful long-term monitoring program:

- High flow monitoring to evaluate pollutant loading during the worst conditions.
- Monitoring for select parameters at predetermined time intervals.

The proposed monitoring program will concentrate sampling efforts during the wet season when the majority of the pollutant load enters the creeks. With this in mind, a minimum of four sampling events will occur during the time period of November through April. Additionally, one or two sampling events will be scheduled for the late summer dry period when stormwater related pollutant loads are minimal.

Water column monitoring stations will be a permanent feature of the sampling program thereby providing long-term trend data. The upstream stations will accommodate corrections for background, seasonal, and flow related variations. The water column sampling parameters will include the following:

- Flow
- Fecal coliform organisms
- Total suspended solids (TSS)
- Turbidity
- Conductivity
- Dissolved oxygen
- Temperature
- pH

Flow, turbidity, conductivity, dissolved oxygen, temperature and pH will be taken at the time of sampling with field equipment. Creek flows will be obtained at the time of sampling in order to determine pollutant loadings.

Sediments at the mouth of the creeks will be sampled once every five years. Sampling will occur during late summer after yearly depositional settling has occurred. Sediments will be sampled for the following parameters:

- Particle size
- Total solids
- Total organic carbon
- Metals (mercury, lead, zinc, arsenic, chromium)
- Semi-volatile organic compounds

- Total petroleum hydrocarbons

Local governments with jurisdictions within the Indian/Moxlie Creek basin will meet annually to assess the quality of the creek and discuss the effect of any changes proposed in the basin. A report of the annual sampling results will be made available to interested parties on June 30 of each year. This information will enable local governments to assess the effect of policy and land use decisions and compare the quality of Indian and Moxlie Creeks to other creeks in the Puget Sound region.

Sample Site Locations

Sample site locations were selected based on distribution in the creek system and technical acceptability for successful sampling.

Water Column Sampling Locations

Station	Location	Monitoring emphasis
MI-1	Outlet at East Bay	Fecal coliform pollution
MI-3	Moxlie Creek at Plum Street	Mouth station for Moxlie Creek
MI-7	Headwaters of Moxlie Creek	Source of Moxlie Creek
MI-8	Indian Creek at Quince Avenue	Mouth station for Indian Creek
MI-12	Indian Creek at Puget Power and Light service yard	Major transportation corridor/existing chemical pollution
MI-15	Indian Creek at either: South Bay and 5th Avenue South Bay and 12th Avenue	Headwaters of Indian Creek

ESTIMATED PROJECT COSTS

Analysis	1991 costs/sample
Fecal coliform organisms	$ 15.00
Total suspended solids	$ 10.00
Particle size	$ 75.00
Total solids	$ 10.00
Total organic carbon	$ 30.00
Metals	$ 30.00
Semi-volatile organic compounds	A/BN EPA 625-Semi-Volatile Organic 1-5 samples - $ 475.00 6-10 samples - $ 440.00
Total petroleum hydrocarbons	$ 50.00

FIRST YEAR IMPLEMENTATION COSTS

Staff hours:

7.5 sampling days/year x 8 hour/day x $25.00/hr	= $ 1500.00
Shipping: $50.00/shipment x 7 shipments	= $ 350.00
Sub-total	= $ 1850.00

Water column sample analysis costs:

Fecal coliform analysis: 6 stations (plus one duplicate) x $15.00/sample	= $ 105.00
Total suspended solids: 6 stations (plus one duplicate) x $10.00/sample	= $ 70.00
Five rounds of sampling	x 5
Sub-total	= $ 875.00

Sediment analysis costs:

Particle size - 3 stations (plus one duplicate) x $75.00/sample	= $ 300.00
Total solids - 3 stations (plus one duplicate) x $10.00/sample	= $ 40.00
Total organic carbon - 3 stations (plus one duplicate) x $30.00/sample	= $ 120.00
Metals - 3 stations (plus one duplicate) x $30.00/sample	= $ 120.00
Semi-volatile organics - 3 samples (plus one duplicate) x $475.00/sample	= $1900.00
Total petroleum hydrocarbons - 3 samples (plus one duplicate) x $50.00/sample	= $ 200.00
Sub-total	= $2680.00

Total Costs = $5405.00

INDIAN/MOXLIE MONITORING SCHEDULE								
ACTION	**JAN**	**FEB**	**MARCH-JULY**	**AUG**	**SEPT**	**OCT**	**NOV**	**DEC**
Stream Gage	One Day each Month							
Water Column	*	*	*	*	*			*
Sediments	Every Five Years							
Meetings			*					
Data Reporting			*					

ANALYTICAL METHODS	
WATER COLUMN	
PARAMETER	ANALYTICAL METHOD
Fecal Coliform Organisms	Standard Methods 909c
Total Suspended Solids	EPA 160.2
Lead (Water Column)	EPA 200.7
SEDIMENTS	
Total Solids	160.3
Particle Size	PSP EPA CE/81-1
Total Organic Carbon (TOC)	EPA 415.1
Mercury	EPA 245.1
Zinc	EPA 200.7
Arsenic	EPA 200.7
Chromium	EPA 200.7
Total Petroleum Hydrocarbons	EPA 8100 (GC/FID)
Semi-volatile Organic Compounds	EPA 625/8270

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Appendix 8: Public Involvement and Education Documents

PIE APPENDICES

Over the past several years, education has become an integral part of environmental management. As stated in the Washington Department of Ecology's 2010 action agenda, "This has never been more true than it is today, with the dominant sources of pollution so dispersed, and so much a function of deeply ingrained habits, values, and lifestyles. Education can help people regulated themselves by developing widespread understanding of, and appreciation for, what is at stake and how those stakes can be protected." In their analysis of PIE programs throughout the Puget Sound region, the Authority found the following deficiencies in PIE programs: *most were sporadic or without any sustained funding base; very few agencies allocated staff or budget to education, little coordination occurred resulting in conflicting or poorly targeted messages and inefficient use of educational resources, and there was a need for more teacher training on water related issues.*

A primary justification for this approach in the Indian/Moxlie basin and the Thurston region comes from the initial level of community interest in water resource related issues, and in particular Stream Team related activities. Nearly 900 individuals have participated in training workshops, action projects (stencilling, clean-ups), and field training since it was initiated in October of 1990. Nearly 2,000 hours of volunteer time have been contributed by Stream Team volunteers to the future health of the Percival, Indian/Moxlie and Woodard/Woodland Creek basins.

Public involvement and education activities related specificaly to basin planning efforts will continue beyond the date this draft plan is published. Olympia Water Resources Program staff will enter into an aggressive phase of outreach during the sixth month review period for the draft, allowing additional opportunities for comment and public input. A community forum will be held regarding the draft plan on Wednesday, November 13. A final workshop on the draft plan will be scheduled for early 1992.

The information below illustrates the broad range of PIE approaches taken during plan development. The intent is to analyze the effectiveness of certain approached where possible, and recommend retaining or changing strategies. PIE guidelines and models from other agencies and environmental education groups included in these apendices are:

* Stream Team Statistics
* Regional PIE Approach (ETAC proposal, July, 1991)
* 2010 Guidelines for PIE
* Policies and Guidelines from PSWQA
* Environmental Education Legislation
* PIE Plan for Indian/Moxlie Basin Planning Effort
* Summary of Indian/Moxlie Public Workshop
* Environmental Education Prioritites for EPA Region 10

STREAM TEAM STATISTICS

The following information on Stream Team activities has been presented in a variety of ways for evaluation purposes. The statistics below reflect a variety of issues and trends relating to public involvement and education.

Participants in workshops and related activities are all asked to voluntarily fill out a Stream Team survey form, which puts them on our official register of available volunteers. 100 individuals and families are currently on this list. Of the total, 17 surveys (15%) listed an interest in Percival basin projects. 27 (24%) of the total number of surveys returned wanted to get involved, but had no preference as to where. This reflects a common situation in many communities, people who want to do something to help the environment -but don't know how to get started.

Over 300 individuals have been involved in Stream Team action projects since September 1990. These action projects include revegetation, storm drain stenciling, clean-ups, and wetland walks. They do not include the Stream Team training workshops themselves, and volunteers receive credits toward a t-shirt for these activities. 70 of these individuals have been involved in activities within the Indian/Molxie basin.

A. Total Stream Team Volunteer Hours October 1990 to present - 2,194 hours
B. Total hours spent in Percival basin in comparison to other basins
C. Total number of Stream Team participants - 699
D. Total number of volunteers interested Percival basin - 17 (15%)
E. Total number of registered volunteers interested in "any" basin - 27 (24%)
F. Total number of registered Stream Team volunteers - 115 volunteers

1. Stream Team Workshop and Project Overview

The following list includes a summary of all Stream Team workshops and action projects. Projects occurring in Woodland or Woodard Creeks were coordinated by Thurston County, Office of Water Quality staff. (Indian/Molxie specific activities appear in bold italics)

Indian Creek Clean-up - September, 1990	***30 vol.***	***x 2 hrs. =***	***90 hrs.***
Orientation Workshop - October 24, 1990	50 partic.	x 2 hrs. =	100 hrs.
Orientation Workshop - November 7, 1990	85 partic.	x 2 hrs. =	170 hrs.
Floods and Flows Workshop - Jan. 24, 1991	85 partic.	x 2 hrs. =	170 hrs.
Floods and Flows Training - Feb. 22, 1991	20 vol.	x 3 hrs. =	60 hrs.
Grass Lake Clean-up - March 2, 1991	6 vol.	x 3 hrs. =	18 hrs.
Landscaping for Healthy Streams Workshop - March 22, 1991	70 partic.	x 2 hrs. =	140 hrs.
Percival Creek Clean-up - April, 1991	11 vol.	x 1.5 hrs.=	16.5 hrs.
Woodland Creek Clean-up - April 20, 1991	9 vol.	x 1.5 hrs.=	13.5 hrs.
Woodard Creek Clean-up - April 20, 1991	16 vol.	x 2 hrs. =	32 hrs.
Moxlie Creek Revegetation - April 27, 1991	***30 vol.***	***x 3 hrs. =***	***90 hrs.***
Wetland, Wildlife and You Workshop - May 1, 1991	80 partic.	x 2 hrs. =	160 hrs.

Woodard Creek Revegetation - May 18, 1991	53 vol.	x 2 hrs. =	106 hrs.
Woodland Creek Revegetation - June 1, 1991	24 vol.	x 2 hrs. =	48 hrs.
Streamwalk Workshop - June 5, 1991	35 partic.	x 2 hrs. =	70 hrs.
Wetland Walks - June 11,13,19,23, 1991	***50 vol.***	***x 3 hrs. =***	***150 hrs.***
Streamwalk Training - July 16,18, 1991	***20 vol.***	***x 3 hrs. =***	***60 hrs.***
Totals for region	699 vol/partic.		2,194 hours

2. Stream Team Follow-up Training

This information was collected the six educational workshops offered in 1991. Volunteers were invited to participate in follow-up training to teach them the skills necessary to implement the field activities.

Floods and Flows (January)	2 hours - 85 participants
Follow-up training (February)	3 hours - 20 participants
Landscaping for Healthy Streams (March)	2 hours - 80 participants
Follow-up training (April)	3 hours - 30 participants
Wetlands, Wildlife, and You (May)	2 hours - 80 participants
Follow-up training (June/July)	3 hours - 50 participants
Streamwalk (June)	2 hours - 40 participants
Follow-up training (July)	3 hours - 20 participants
Bugs and Water Quality (July)	2 hours - 50 participants
Follow-up training (August)	3 hours - 12 participants
Fish Watching (September)	2 hours
Follow-up training	3 hours
	29 hours - 390 participants (as of July 17, 1991)

3. Stream Team Participation in Events

Participation in the following community events is part of the Stream Team's educational approach and also is an avenue for recruiting new volunteers and participation.

Earth Day - Olympia, April 1990 and 1991
Low Tide '91 Urban Shoreline Walk - Olympia, May 1991
Lacey Fun Fair - Lacey, May 1991
Environmental Education Assoc. of Washington Conference - Cispus, May 1991
Sportfishing Expo - Lacey, June 1990 and 1991

Community Awareness Days - Olympia, June 1990 and 1991
Adopt-A-Stream Workshop - Tacoma, July 1991
Northwest Assoc. of Marine Educators Conference - Port Townsend, July 1991

4. Stream Team Captain Statistics

Captains are recruited at Stream Team workshops. Primary duties include working closely with Stream Team staff, training "team" members, and organizing "team" meetings.
Whether location or project captains, these volunteers are crucial to the success of the program.

Floods and Flows		
Wetland Walks		
Moxlie Creek Revegetation		
Streamwalk	11 vol.	130 hours

5. Miscellaneous Stream Team Jobs

Implementation of the Stream Team project is often aided by volunteers in the office and in the field. Volunteer skills help diversify the program and provide opportunities for everyone.

Office help		
Mailings		
Photography		
Event Set-up/take down		
Library	11 vol.	70 hours
	22 captains and other volunteers	200 hours

6. Media Rankings from Stream Team Surveys

This information was collected on workshop evaluation forms. The following media approaches are ranked according to participant preference and effectiveness.

100 volunteers filled out Surveys as of July 17, 1991
39 ranked media, 61 did not. Of the 39 that ranked media options these are the results:

Community TV - 4.4
Radio - 4.2
Schools - 4.2
CityScape - 4.0
Newspaper Advertisements - 3.9
Newsletter - 2.9
Newspaper Articles - 2.5
Mail - 1.9

CITY OF OLYMPIA

Water Resources Program
Public Involvement and Education (PIE) Plan

Attachment

Indian/Moxlie Creek Basin Assessment Project
Public Involvement/Education Plan

1990-1991

SCOPE OF WORK

Public Involvement

PI-1. Implement storm drain stenciling for neighborhood streets located in the basin area. Schools in the area will be encouraged to participate. Obtain needed equipment for volunteer activities from the City of Olympia, local businesses, and volunteers. Purchase materials for kits.

PI-2. Implement at least 2 action projects for designated reaches of Indian/Moxlie Creeks. At least one project will be based on one of the Stream Team topic workshops. Obtain needed equipment for volunteer activities from the City of Olympia, local businesses, and volunteers.

PI-3. Recruit volunteers through local community groups, clubs, churches, schools, and environmental groups. Other recruitment possibilities include articles in newspapers, newsletters, City publications, inserts into utility bills, as well as public service announcements on radio and television.

PI-4. Train volunteers through 2 Stream Team orientation training sessions. Volunteers will have video tapes of workshops available for training. Limited training will occur through regularly scheduled club/group meetings, school classroom sessions, or on the job. Staff from federal, state, county, and municipal regulatory agencies may help develop and participate in sessions. Private business professionals with expertise in water quality issues may also serve as session or in field instructors. Stream Team captains will be recruited for this watershed.

PI-5. Organize a small (2 to 4 person) volunteer ad-hoc committee to assist the technical team on stream walks, and provide input to the Indian/Moxlie Creek basin assessment. The committee will also help organize

stream team activities in the basin. Volunteers with appropriate technical background or extensive knowledge of the basin will be sought for this committee.

PI-6. Organize and hold one public meeting/workshop to inform citizens about findings and recommendations for the basin and solicit citizen input to the Indian/Moxlie Creek Basin assessment.

Public Education

PE-1. Prepare a slide or video presentation about basin planning and public involvement activities. Use the program to recruit Stream Team volunteers.

PE-2. Prepare and print a door hanger with information about the volunteer opportunities available through the City of Olympia Water Resources Program. One side will highlight stencilling and the other will promote Stream Team/Basin Planning involvement. Volunteers involved in the stencilling project may distribute this door to door as stenciling takes place in the Indian/Moxlie basin area. The brochure would alert citizens about the activity, encourage their involvement, and help educate them about the storm drainage system and its impact on water quality.

PE-3. Focus local media attention on the Indian/Moxlie basin Identify and closely coordinate with newspapers, radio, and local television personnel through press releases, in field interviews, event scheduling, and feature articles.

PE-4. Prepare a map of the Indian/Moxlie watershed for residents which highlights locations to visit to "get to know" the area. Design this with a cut off section with questions for the Basin Planning program on specific problems. Mail to property owners and residents.

Evaluation

EV-1. Prepare an evaluation of PIE activities in Indian/Moxlie Creek basin.

BUDGET BY TASK

Summary

Labor = $8,300 (Public Involvement Coordinator rate of pay = $23/hour)

Materials = $3,450

Total = $11,750

Public Involvement

TASK	HOURS	LABOR	MATERIALS
PI-1	46	$1,050	$700
PI-2	46	$1,050	$150
PI-3	41	$950	$75
PI-4	76	$1,750	$100
PI-5	15	$350	$250
PI-6	41	$950	$300
Total	265	$6,100	$1,575

Public Education

TASK	HOURS	LABOR	MATERIALS
PE-1	24	$550	$800
PE-2	24	$550	$500
PE-3	35	$800	$50
PE-4	24	$550	$500
Total	107	$2,200	$1,850

Evaluation

TASK	HOURS	LABOR	MATERIALS
EV-1	25	$575	$25
Total	25	$575	$25

SCHEDULE

Public Involvement		Date(s)
PI-1	Stencilling kits available	8/5/90
PI-3	Stream Team recruitment campaign (to start)	8/5/90
PI-1 PI-2	Coastweeks clean-up/stencilling event	9/15/90
PI-5	Ad-Hoc Committee meets on WQ and Basin characteristics	9/30/90
PI-4	Stream Team orientation workshop	10/24/90 11/7/90
PI-2	Stream Team activities	9/15/90 4/30/91
PI-5	Ad-Hoc Committee meets on problem description	2/5/91
PI-6	Public workshop on basin problems	3/30/91
Public Education		
PE-1	Develop slide or video program	12/30/90
PE-2	Develop door hanger	11/30/90
PE-3	Media relations develop marketing materials	ongoing
PE-4	Develop Watershed Map/brochure	12/30/90
Evaluation		
EV-1	Indian/Moxlie PIE program evaluation	4/30/91

INDIAN/MOXLIE BASIN PUBLIC WORKSHOP

May 21, 1991

Summary of Public Comments

Ad-Hoc Members Present: S. Hulbert, A. Brown
Staff Present: J. Richter, L. Hoenig, A. Haub, J. Carr
Total number of public in attendance: 29

WATER QUALITY - 20

A. Management Alternatives

1. Increased/improved enforcement of regulations - 1
2. More stringent regulations with enforcement - 8
3. Improved stormwater treatment - 2
4. Expanded sanitary sewer - 0
5. Public involvement and education - 3

Comments:
- Want no net loss of WQ and habitat.

HABITAT LOSS - 30

A. Management Alternatives

1. Increased/improved enforcement of regulations - 3
2. More stringent development regulations - 7
3. Local purchase of sensitive areas - 9
4. Public involvement and education - 1
5. Monitoring of habitat conditions

Comments:
- Moxlie - development near pothole on Cain Road between Eskridge and 22nd (east side mainly).
- Moxlie - wooded area between railroad and right-of-way along west side of Plum Street on-ramp is in danger of private development.
- Indian Creek - East of Eastside Street along the freeway.
- Moxlie - Corridor behind Olympia Post Office, abandoned railroad grade to government parking lot "valuable wetland habitat."
- Moxlie - dig up piped section behind post office along abandoned right-of-way.

- City should not make deals with developers to acquire required quotas of open space.
- City should find "easy" mechanism for land purchase and acquisition.

FLOODING - 45

A. Management Alternatives

1. More stringent development regulations - 25
2. Zoning modifications - 3
3. Increased regional stormwater storage - 0
4. Preservation of wetlands and stream corridor - 6
5. Other:
   - A more complete and positive drainage program is needed with good administration and enforcement. (No dot)
   - Avoid dumping stormwater in previously developed areas.

FUNDING ALTERNATIVES

1. Development regulations - 13
2. Stormwater utility rates - 1
3. Local Improvement Districts - 0
4. Grants and loans - 0
5. Zoning changes - 0

DRAFT

STORM AND SURFACE WATER PUBLIC INVOLVEMENT AND EDUCATION (PIE) PROGRAM FOR THURSTON COUNTY AND THE CITIES OF OLYMPIA, LACEY, AND TUMWATER

The goal of this program is to develop a long range regional program that will give residents of Olympia, Lacey, Tumwater, and Thurston County an ongoing, action-oriented role in protecting water resources of our community and Puget Sound. Initially the program will focus on the storm and surface water utility area expanding county wide as the utility area expands. This program extends beyond the basin planning PIE efforts but will continue to support those efforts.

This program includes 6 elements for an ongoing, integrated public involvement and education program to improve surface water quality in streams, lakes, and wetlands initiated through the watershed planning process. During the first year a citizen training and education element, a grant program for community groups, and general community outreach element will be funded. In future years an advisory committee will be established, a database of volunteers and opportunities for involvement will be developed, and a technical monitoring program for volunteer activities will be funded. All of these programs will build on the success of existing programs such as Stream Teams, the Sustainable City Project, the Comprehensive Water Resources Education Program, and Business Education/Moderate Risk Waste Program but will be broad enough to allow for future programs.

The following program describes the rationale for developing a Public Involvement and Education program; defines elements necessary to achieve the long term success of the program; and identifies staffing, funding sources, and other resources required for the program.

Rationale

The role of Public Works Departments of Lacey, Olympia, Tumwater, and Thurston County Public Works has been expanded to provide water resource protection through the formulation of Storm and Surface Water Utilities. A component of this water resource protection is public awareness and involvement. The proposed PIE program will meet the needs not only of government but will satisfy public demand for more involvement into decisions regarding environmental actions. The benefits jurisdictions will realize from the program include active citizen participation of activities; continued program support; increasing public trust of program activities;

support for successful implementation of basin plans; and integration and coordination of local PIE activities. Businesses, schools, community organizations, service organizations, and city and county staff will also benefit from the program through an increasing awareness of city and county water resource program activities which allow citizens to make more informed decisions about issues concerning their environment.

The adopted watershed action plans for Eld, Henderson, and Totten/Little Skookum inlets and the Puget Sound Water Quality Management Plan (PSWQMP) contain recommendations for the development of a long term public involvement and education program to implement the plans.

This program not only meets the needs of Public Works Department efforts but integrates the community into broader issues and programs which include instruction about conservation, natural resources, and the environment at public schools; protecting Puget Sound which is an estuary of national significance; and affecting the quality of life in Thurston County. Regional coordination will continue existing volunteer restoration/enhancement projects designed to improve water quality in streams, lakes, and wetlands and modification of individual behavior where it impacts nonpoint source pollution.

Framework

The formation of an advisory committee composed of representatives from existing boards and committees will assist in the implementation of this program. This program will utilize and build on existing programs currently being implemented by Lacey, Olympia, Tumwater, Thurston County Storm and Surface Water and Office of Water Quality, and WSU cooperative extension. The 6 elements which make up the program are detailed below and include goals, required actions, and staffing recommendations. The program and each element will require a periodic evaluation for effectiveness and a review to ensure goals and objectives are being achieved. An annual report of activities and successes will also be produced.

Elements

1) Community Grants

Goal:

To provide a fund for community groups and businesses to get involved and solve local storm and surface water problems through volunteer action projects, school projects, and community education.

Starting Year: 1992

Action Required:

a) Establish criteria and guidelines for grant selections
b) Publicize program
c) Establish review and award process
d) Track each project to completion
e) Publicize projects and results

Recommended Staff:

.25 FTE cost shared by Thurston County, Olympia, Lacey, and Tumwater

2) Training and Education

Goal:

Provide continuation of the existing citizen volunteer and education programs. Target audiences such as the general public, businesses, youth and school groups, teachers, college students, and city and county staff. The types of programs include:

General audiences - fairs, festivals, presentation to civic groups, public workshops for planning activities, regionally sponsored special events

Volunteer audiences - build on existing programs such as WSU field agent, Stream Team, Sustainable City Project, and enhance their efforts

Business and Industry Audiences - build on existing programs such as Business Education program, Point of Purchase program/Moderate Risk Waste program, agricultural BMPs addressed through the SCS program. Develop ongoing video training for the drainage manual.

Youth audiences - teacher training such as existing Water Resources Education Program, classroom activity, field trip guide development, assembly program, science projects

College/University students - internships (PIE, research, credit opportunities), mini-lectures or environmental program development, UW/Evergreen graduate studies outreach projects, use of university labs in monitoring

City and County staff - seminars which train specific departments about new ordinances, policies, and BMPs

Starting Year: 1992

Action Required:

a) Identify target audiences for activity
b) Determine the tools needed for the specific target audiences to implement the desired actions or projects
c) Design training and education programs to meet these specific needs

Recommended Staff:

1 FTE from Thurston County
1.5 FTE from Olympia
.5 FTE from Lacey and
.1 FTE from Tumwater

3) General Outreach

Goal:

To provide the staff to ensure efficient, consistent, accurate, and attractive information on a variety of environmental issues through various forums and avenues.

Starting Year: 1992

Action Required:

a) Development of videos, brochures, and educational material
b) Intra-agency cooperation (parks, planning, and O&M Road Maintenance)
c) Media via public service announcements, commercials, ads, and press releases

Recommended Staff:

.25 FTE from Thurston County
.5 FTE each for Olympia and Lacey and
.1 FTE from Tumwater

4) Education and Involvement Technical Advisory Committee (ETAC)

Goal:

To provide each jurisdiction with regional participation and involvement in the PIE program.

Starting Year: 1993

Responsibilities:

a) Coordinate regional and basin planning PIE activities
b) Evaluate long term and basin planning PIE activities
c) Coordinate a Citizen Advisory Committee
d) Advise the surface water TAC

Recommended Staff:

.2 FTE from each Thurston County, Olympia, Lacey, and Tumwater

5) Technical Support

Goal:

To provide technical support to volunteer citizen groups. The technical support staff would be available to assist in sample collection design and to process water quality samples collected by volunteers.

Starting Year: 1994

Action Required:

a) Technical staffing for support to volunteer audiences
b) Development of a long-term citizen monitoring plan

Recommended Staff:

2 FTE cost shared by Thurston County, Olympia, Lacey, and Tumwater

6) Database Network

Goal:

Assemble a list of volunteers and their skills, project field sites, and project field trips to be used as a resource for volunteers, PIE managers, and agencies.

Starting Year: 1995

Action Required:

a) Capital expenditures for computer and software, etc
b) System maintenance
c) Initial setup and design of database with data entry
d) Identify database users
e) Data dissemination

Recommended Staff:

.25 FTE for maintenance of the system cost shared by Thurston County, Olympia, Lacey, and Tumwater

Funding

The intention of grant funding is to support and enhance the elements of this program. However, grant provisions may limit the scope of the program. A more permanent source may be to dedicate a fixed percent of special project costs (i.e. road projects, regional facility construction, and large scale developments), utility revenue, and general fund to the implementation of the program.

III. Raising Awareness and Changing Lifestyles
The Challenge of Environmental Education

III

"Education today, more than ever before, must see clearly the dual objectives: education for living and education for making a living."
— James Mason Woods

Raising Awareness and Changing Lifestyles

The centerpiece of the Washington Environment 2010 vision for the future is a citizenry that is the most environmentally enlightened and responsible in the country. To get there, we will need a multi-faceted, far-reaching, well coordinated program for teaching every person in the state about the natural environment, the impacts of human activities on that environment, and the things people can and should do to minimize those impacts.

Washingtonians are generally perceived as an environmentally caring and conscientious lot. And, relatively speaking, we are. But the Washington Environment 2010 assessment of the state of the environment and the citizens who participated in the public meetings around the state last winter suggest that relative conscientiousness is not enough.

A clear consensus emerged from those public meetings: environmental ignorance — a lack of environmental awareness and responsibility — underlies all of the environmental threats described and prioritized in the State of the Environment Report. Consequently, environmental education — what James Mason Woods called "education for living" — is cited repeatedly as the linchpin of any long-range plan to reduce or eliminate those threats.

Many Washingtonians, from teachers and school administrators to corporate executive officers and other businesspeople, have already recognized the importance of environmental education. Many schools, largely due to the bold efforts of a few individual teachers and administrators, have incorporated innovative environmental programs into their curricula. An assortment of magazine articles and books about the condition of the environment and what people can do to improve it have appeared recently in bookstores and shops across the state. Several local businesses have initiated programs to educate their customers about the environmental implications of consumer choices.

Efforts like these constitute an excellent beginning. But, by themselves, they will not get us to our desired end. Most of the ongoing environmental education efforts in the state are small-scale, reaching only small portions of the population. In our public schools, for example, where environmental education is strictly a voluntary endeavor, state experts estimate that only a small fraction of our children are exposed regularly to environmental issues. Such exposure varies widely across school districts and classrooms.

In addition, environmental education activities both inside and outside of the public school system, and the expertise and materials necessary to support those activities, need improved coordination to ensure that limited resources are used as effectively and efficiently as possible.

The challenge for environmental education is to build an extensive, well coordinated, state-of-the-art program that brings timely, accurate, and balanced information about our environment and natural resources to every citizen in the state. Environmental education should focus on a balanced depiction of environmental and

natural resource issues, such as how ecological systems work, human impacts on those systems including impacts of population growth, steps that can be taken to minimize those impacts, and the origins of our food, shelter, and other amenities.

Environmental education must influence all of the major mechanisms by which our values and attitudes are developed — families, peer groups, and the media, as well as classrooms.

Key Recommendations

▲ *Public-private partnerships should be established to develop materials and develop and implement environmental education strategies for targeted segments of the general public.* While improved environmental education in our public schools is a high priority, there are other needs as well, since we do much of our learning not in classrooms, but in our work places, our churches, and our living rooms. Government agencies and private organizations — businesses, community groups, television and radio stations, newspapers, churches, and others — need to work together, pooling both their ideas and their resources, to meet these needs.

The Boater Environmental Education Program, undertaken jointly by the state Parks and Recreation Commission and a coalition of local boaters' organizations, provides an excellent example of the kind of public-private partnerships that can make a difference. The commission and the boaters' groups collaborated to produce a manual on the proper disposal of boat wastes that has been very well received.

Partnerships like this one can bring together the best available expertise and help to spread the costs of education among interested parties. These joint programs can be especially effective by capitalizing on the credibility and the existing communication mechanisms of private organizations.

Collectively, these partnerships would constitute an extensive educational campaign that might be identified by a common logo or slogan. An educational campaign to discourage single occupancy commuting, for example, might be dubbed, "Solo-Commuting Is Polluting."

The Cooperative Extension at Washington State University, with its vast network, could play a critical role in implementing this recommendation.

▲ *State agencies should provide environmental education opportunities at convenient points of interaction with the public.* In short, state government should take an active leadership role in seeking out and capitalizing on their contacts with citizens to provide information and foster a better understanding about the environment. These actions can be as general as providing information on air quality issues to park visitors who stop at scenic roadside vistas, or as targeted as providing information about the role of car engine maintenance in reducing emissions to persons renewing their licenses and registrations. State agencies should prepare and implement environmental education action plans to carry out this recommendation.

▲ *All school districts in the state should be required to develop and implement a plan for infusing environmental education into their K-through-12 (kindergarten through 12th grade) curricula.* Environmental education should be infused into existing disciplinary curricula such as math, science, art, music, and literature, rather than added as a separate discipline. This will lessen the burden and heighten the effectiveness of environmental education. This requirement, which can be created by new legislation or by a State Board of Education policy under existing legislation, will help to ensure that, over time, every child in the state is exposed to environmental education. Local autonomy can be preserved by leaving the details of environmental education planning to the school districts themselves. A requirement like this one has proven to be very effective in the State of Wisconsin, according to environmental education experts there.

▲ *All teachers in the state should obtain a minimal level of environmental training as part of their certification requirements.* Again, this requirement can be established by new legislation or by State Board of Education policy. The new policy would lead training institutions to develop environmental education programs and would, over time, result in a corps of well-trained environmental educators. A similar training program in Wisconsin has worked very well. Special consideration should be given to hands-on teacher training, such as field trips and workshops with environmental professionals.

▲ *The Office of Environmental Education (within the Office of the Superintendent of Public Instruction) and other agencies and institutions that do teacher training should expand in-service training and outreach programs for local teachers and school administrators.* Additional requirements alone will not suffice. Many teachers and school administrators around the state are still unaware or unconvinced of the importance of environmental education, or uninformed about how it can be effectively incorporated. The resources currently allocated to OSPI for in-service teacher training in environmental education are grossly inadequate; just two people at the Office of Environmental Education are charged with reaching out to the state's 270 school districts and 30,000 teachers.

▲ *An environmental education coordinating group, consisting of the directors of the state's resource agencies and representatives from the legislative, business, environmental, and academic communities, and from tribes and local government, should be formed to establish broad environmental education goals for the state, and to foster communication, coordination, and cooperation among the member groups.* The group would make recommendations to the Governor, the Legislature, the Office of the Superintendent of Public Instruction, the State Board of Education, and the State Board of Higher Education, among others.

Meeting the Challenge of Environmental Education

There a number of examples of people and organizations around the state who are already doing their share to meet the challenge of environmental education. Here are just a few:

■ *At Bothell High School, environmental issues are an integral part of the 11th grade science program. Students go on field trips to local lakes and creeks, where they gather information on water quality and fish and wildlife habitat. This information is then entered into a computer program back in the classroom, which is linked to a national and international computer network.*

■ *QFC grocery stores have initiated a program whereby customers are paid three cents for returning paper bags. The proceeds are donated to the Nature Conservancy, a national conservation group.*

■ *At Mercer Island High School, teachers and students run a recycling center that serves the recycling needs of the community as well as the school district. The center's profits are returned to the school and used to fund environmental education programs.*

▲ *Establish an Environmental Education Clearinghouse at the Office of Environmental Education, to accumulate, maintain, and disseminate up-to-date environmental materials, to help coordinate environmental education initiatives, and to provide technical assistance to groups starting new environmental education programs.* The Office of Environmental Education already serves these functions, but they are limited largely to K-through-12 curriculum materials and activities. The new Clearinghouse would serve a wider purpose, maintaining materials and expertise for out-of-classroom environmental educational purposes as well.

Other Action Ideas

▲ Develop and enhance programs at community colleges to administer environmental education to adults.

▲ Incorporate environmental messages into television programming.

▲ Establish mentor programs and leadership development programs for environmental educators.

▲ Encourage manufacturers to display information about proper disposal of items on their packaging.

Puget Sound Water Quality Authority Policies for Public Involvement and Education Program Guidelines

PI-1.1 Policies for Public Involvement in Decision-Making

The public involvement policies established in this element shall be followed by all state agencies and local governments in implementing the Puget Sound plan. The Authority shall monitor public involvement activities of agencies implementing the plan.

The policies are:

a. A broad representation of the public, both those being directly affected and members of the general public, shall be consulted in developing and adopting rules, establishing criteria, setting guidelines, selecting sites or target areas, developing action plans, and carrying out other activities related to the Puget Sound plan.

b. A variety of public involvement techniques shall be used. Where advisory or review committees are deemed helpful to provide public involvement in the implementation of the plan, existing standing committees or commissions and established processes such as SEPA, the Shoreline Management Act, and local comprehensive plan procedures should be evaluated and improved where possible rather than creating new committees. However, new or additional committees or processes should be created if needed to achieve full public involvement. (Agencies shall consider reimbursing travel expenses of members of advisory bodies.)

c. Agencies shall allocate adequate staff resources to their public involvement programs. Agency staff responsible for public involvement shall receive training in public involvement techniques and skills.

d. State and local government agencies shall use public information techniques that exceed requirements for legal notice or publication in the or State register to ensure that: (1) public information on decisions to be made or actions to be taken for the Puget Sound plan is complete and understandable; (2) the effects - especially effects on special groups or geographic area - of the proposed decision or action are fully described; (3) the ways in which the public might be affected by the decision or action are fully presented; and (4) the ways in which the public may influence the decisionmaker and appeal the decision are explained.

e. To facilitate access to decision-making processes, state and local government agencies shall send notification for public hearings or meetings as early as possible, shall seek to

provide both day and evening meetings and hearings, and shall explain how public comment was incorporated into decisions and actions. For decisions affecting a large geographic area, meetings and hearings shall be held at locations throughout the area.

f. To facilitate understanding of decision making and plan programs, the Authority and other agencies will communicate clearly and simply using lay language whenever possible.

g. Intergovernmental relationships with tribes: To involve tribes in the decisionmaking process, agencies shall follow the Centennial Accord. Local governments shall communicate with local tribes to determine the most effective mechanism for inter-government communication with tribes on any programs or projects related to the Puget Sound Water Quality Management Plan. Tribes shall follow the Centennial Accord.

EPI-1. Education Guidelines

The following guidelines shall be used in developing programs as part of the long-range strategy for education and public involvement.

a. Support and develop activities which promote protecting Puget Sound as a treasure.

b. Move beyond the "us versus them" attitude and emphasize water quality as being in everyone's best interest.

c. Develop mechanisms for cooperation among the public sector, private sector, and educational institutions.

d. Focus on local issues and resources and how they relate to the larger picture, promoting a sense of place.

e. Emphasize interesting, innovative activities which involve people, put them in charge of decisions, and lead to local action.

f. Provide people with solutions, with things they can do.

g. Include concrete goals toward which everyone can work and which will visibly demonstrate progress and success.

h. Include connection with an ongoing information base which provides accurate information on Puget Sound issues. Build on existing programs.

i. Improve coordination of and cooperation among the education and public involvement resources and activities of state and local governments.

j. Design and organize activities, training, and information which are tailored to the target

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AMENDATORY SECTION (Amending WSR 90-17-009, filed 8/6/90, effective 9/6/90)

WAC 180-50-115 MANDATORY AREAS OF STUDY IN THE COMMON SCHOOL. (1) Pursuant to RCW 28A.230.020 all school districts shall provide instruction in reading, penmanship, spelling, mathematics, geography, English grammar, physiology, hygiene, and history of the United States.

(2) Pursuant to RCW 28A.230.030, unless instruction in a language other than English will aid the educational advancement of the student, all students shall be taught in English.

(3) Pursuant to RCW 28A.230.130, after July 1, 1986, each school district offering a high school program shall provide a course of study which includes the preparation for uniform college and university entrance requirements as published by the council of postsecondary education.

(4) In addition to the requirements in the above subsections, each such school district shall offer all required courses for a high school diploma as provided in chapter 180-51 WAC and shall provide an opportunity for high school students to take at least one course in the following areas of study:

(a) Art;
(b) Career education;
(c) Computer education;
(d) Consumer education;
(e) Economics;
(f) ((~~Environmental education;~~
~~(g)~~)) Foreign language;
((~~(h)~~)) (g) Health education;
((~~(i)~~)) (h) Home and family life;
((~~(j)~~)) (i) Music;
((~~(k)~~)) (j) Remedial education, including at least, remedial education in reading, language arts, and mathematics.

(5) Districts shall make available to all high school students enrolled therein the areas of study enumerated above either within the district or by alternative means which shall include equivalent education programs set forth in this chapter, interdistrict cooperative programs as permitted by RCW 28A.225.220, and/or the full-time or part-time release of such students to attend nonresident districts pursuant to chapter 392-137 WAC.

(6) Pursuant to RCW 28A.230.020 instruction about conservation, natural resources, and the environment shall be provided at all grade levels in an interdisciplinary manner through science, the social studies, the humanities, and other appropriate areas with an emphasis on solving the problems of human adaptation to the environment.

audience.

k. Include youth.

l. Concentrate resources at the local level but include a Soundwide entity or process which will provide common direction, standards, and coordination for local action.

m. Include an ongoing public awareness "theme" campaign which will support and connect education and public involvement activities.

n. Conduct educational activities in a variety of settings, both regulatory and non-regulatory.

o. Have clear goals and objectives and a built-in means of evaluating and modifying the strategy.

CRITICAL NEEDS IN ENVIRONMENTAL EDUCATION
EPA REGION 10
SPRING 1991

PURPOSE

The purpose of implementing a needs assessment in environmental education was to determine: (1) What do educators, citizens and administrators see as the most significant needs in environmental education and (2) What direction and role should EPA take in supporting and enhancing environmental education.

PROCESS

Public meetings were held in Portland, Boise and Spokane. At each meeting the group was divided into small groups (3-4). Each group was asked the question: "If you could only fund one large (+ $50,000) environmental education project, what would it be?" and "If you could only fund one small environmental education project (-$5,000) what would it be?"
After 30 minutes of brainstorming/discussion, each group reported out their response. All responses were discussed and written on a flip chart. After all reports, each participant was given five "dots" with which to vote for their favorite project. All dots could go to one project or be spread throughout the list.

PARTICIPANTS

56 people attended the meetings. Participants included teachers, educational administrators, federal, state, and local resource agency staff, professors, university administrators, and citizen activists.

SUMMARY COMMENT

It was significant that each group, without knowing what other groups had determined, defined the need for an environmental education clearing house as the most critical need. There was also a high level of agreement on other needs. The attached report has a complete description of the needs in priority order.

SIGNIFICANT ENVIRONMENTAL EDUCATION NEEDS

CLEARING HOUSE - RESOURCE CENTER

Purpose

Prevent duplication and re-invention

Access to most current information by all

easily accessible (1-800-#)

For educators and citizens

All Information on existing environmental education resources including

existing environmental education resources

good curriculum

Where available

for what grades

who sponsors

how integrated

cost

grants and scholarships which are available

interested citizen groups

publications/library

issue information

contacts for information

EXHIBITS AND MOBILE DISPLAYS

Purpose

Take state of art education to schools

Available to citizens and schools

To focus on one environmental aspect in detail e.g. riparian areas, watersheds, streams, groundwater or lakes

Move people from awareness to appreciation to action

Build educational program for students, parents, teachers and community leaders

Special emphasis for low soci-economic levels

Be focused on issue of local interest

Create the environment as it should be

In depth related to what students have learned

A UNIFIED AND EVALUATED CURRICULUM

Purpose

Take existing curriculum and create a central framework curriculum from which all disciplines can emerge: "wellspring"

Develop a coherent continuous k-12 curriculum

Evaluate materials and curriculum

Demonstrate relationships at all levels

Consolidate current materials and then train teachers

A COMMUNITY BASED ENVIRONMENTAL EDUCATION PROGRAM

Purpose

To have students, teachers and citizens involved with the same project.

To link volunteers, with schools and resource agencies

Provide support to teachers and educators in environmental education efforts

Focus on an issue which affects all the community

Has potential to solve environmental problems

Take materials learned, address problem and take action

Be sure to include labor and industry

Trains students and citizens to think environmentally

Appendix 9: Glossary of Technical Terms

Glossary

AESTHETIC AMENITIES - Relating to the increase in the beauty of an area.

ANADROMOUS - Fishes, such as salmon and sea-run trout, that live part or the majority of their lives in salt water but return to fresh water to spawn.

AQUIFER - A geologic stratum containing ground water that can be withdrawn and used for human purposes.

BASIN - A land area bounded by high points, which drain s all surface water into a single stream.

BEST MANAGEMENT PRACTICES - Structures, conservation practices, or regulations that improve water quality and reduce runoff, or reduce the impact of development on water quality and quantity.

BIOCHEMICAL OXYGEN DEMAND (BOD) - Amount of oxygen used by microorganisms (and by chemical reactions) in the biodegradation process. BOD is usually measured at 20 degrees Celsius for 5 days.

BRAIDING - A stream that divides into an interlacing of tangled network of several branching and reuniting channels separated from each other by branch islands or channel bars.

BUFFER - An area adjacent to a water body where the vegetation is protected from clearing and development so as to protect the water resources.

CATCH BASIN - A chamber or well, usually built at the curb-line of a street, for the admission of surface water to a sewer or sub-drain, having at its base a sediment sump designed to retain grit and detritus below the point of overflow.

CLEARING - The destruction and removal of vegetation by manual, mechanical, or chemical methods.

CLUSTER DEVELOPMENT - A development design technique which arranges buildings on a specific area of a site so as to preserve a portion of the entire site for common open space, recreation, or preservation of environmentally sensitive areas in perpetuity.

CONSERVANCY - Conservation of natural resources.

CONTAMINATE - To make impure by contact or mixture with a contaminate.

CONTIGUOUS CORRIDOR - The immediate area adjacent to the creek boundary.

CONVEYANCE SYSTEM - The drainage facilities which collect, contains and provides for the flow of surface and stormwater.

COTTIDS - Resident fresh water fish

CULVERT - Pipe or concrete box structure which drains open channels, swales or ditches under a roadway or embankment.

CREATED WETLAND - Man-made wetland.

DETENTION FACILITY - A facility (eg, pond, vault, pipe) in which surface and storm water is temporarily stored.

DETENTION POND - A stormwater storage pond with a "dead storage" volume and a "live storage" volume. The dead storage space is constantly filled, the live storage is filled by the runoff from a storm and then slowly drained.

DETRITUS - Particulate organic material together with primary decomposer organisms such as fungi and bacteria.

DISCHARGE - Volume of water flowing in a given stream at a given place and within a given period of time, usually expressed as cu. meters per sec, or cu. feet per sec.

DRY POND - A stormwater management facility that fills during rainstorms and completely drains between storms. These ponds have restricted outlets designed to give a nominal water residence time of more than 24 hours.

EFFECTIVELY IMPERVIOUS - The amount of surface area which is rendered impervious because of structures erected on it.

EFFLUENT - Waste liquid flowing into a river or estuary from a house, industry, sewage treatment plant, or other source.

ENERGY DISSIPATOR - The reduction of the total energy of the water by a mechanism which reduces velocity prior to or at, discharge from the outfall in order to prevent erosion.

EROSION - The wearing away of land surface by running water, wind, ice or other geological agents.

EROSIONS CONTROL - Techniques used to trap sediments carried by runoff from disturbed sites. Common practices include the use of mulches, filter fences, or straw bales.

ESTUARINE - A semi-enclosed body of salt water diluted by fresh water form river or stream. A very important rearing and transition area for most salmonid species.

EUTROPHICATION - Refers to the process where nutrient over-enrichment of water leads to excessive growth of aquatic plants, especially algae.

FAUNA - Assemblage of animals that occur in a specific region.

FECAL COLIFORM BACTERIA - Bacteria common to the intestinal tract of mammals. Indicates biowaste from livestock or humans and may be a sign of disease-causing pathogens.

FILL - The deliberate placement of (generally) inorganic materials in a stream, usually along the bank.

FISH BLOCKAGES - Man-made or naturally occurring obstacles which do not allow for the passage of most fish.

FLOODPLAIN - The total area subject to inundation by the base flood including the flood fringe and floodway.

FLORA - Localized plant life and vegetation indigenous to the area.

GEOMORPHOLOGY - Geologic study of the configuration and evolution of land forms.

GLIDE - Calm water flowing smoothly and gently, with moderately low velocities (10-20 cm/sec) and little or no surface turbulence.

GRASS-LINE SWALE - A drainage facility similar to a shallow, gently sloped ditch planted with vegetation (most often grass). The sloped sides provide additional surface area which allows the vegetation to filter and trap pollutants suspended in runoff.

GROUND WATER - Any water in the ground which is not open to the air, such as underground aquifers.

GROUND WATER RECHARGE - Inflow to a ground water reservoir.

HABITAT - The specific area or environment in which a particular type of plant or animal lives. An organism's habitat must provide all of the basic requirements for life and should be protected from harmful contaminants.

HEAVY METALS - Metals of high specific gravity, present in municipal and industrial wastes, that pose long-term environmental hazards. Such metals include cadmium, chromium, cobalt, copper, lead, mercury, nickel, and zinc.

HIGH FLOWS - Peak flows during storm events, which are considerably above the normal mean flows for a specific creek or river.

HYDROLOGIC CYCLE - The circuit of water movement from the atmosphere to the earth and return to the atmosphere through various stages or processes as precipitation, interception, runoff, infiltration, percolation, storage, evaporation, and transpiration.

HYDROLOGY - The science of the behavior of water in the atmosphere, on the surface of the earth, and underground.

HYDROPERIOD - A specific span of time or stage within the hydrologic cycle.

HYRDOPHYTE - Any plant growing in water or on a substrate that is at least periodically deficient in oxygen during some part of the growing season, as a result of excessive water content.

IMPERVIOUS - Any surface which cannot be effectively penetrated by water such as, asphalt, rooftops or compacted surfaces.

INFILTRATION - The downward entry of water into the surface of soil, as contrasted with percolation, which is movement of water through soil layers.

LARGE ORGANIC DEBRIS (LOD) - Any large piece of relatively stable woody material having a diameter greater than 10 cm and a length greater than 1 m that intrudes into the stream channel.

LIMNOLOGY - The scientific study of the life and phenomena of lakes, ponds and streams.

MASS WASTING - A general term for the dislodgement and downslope transport of soil and rock material under the direct application of gravitational body stresses.

MICROHABITAT - That specific combination of habitat elements in the locations selected by organisms for specific purposes and/ or events. Expresses the more specific and functional aspects of habitat and cover. Separated from adjoining microhabitats by distinctive physical characteristics such as velocity, depth, cover, etc.

MORPHOLOGY - The study of the structure and form of living organisms.

NON-POINT POLLUTION - Diffuse, overland runoff containing pollutants. Includes runoff collected in storm drains.

ON-SITE STORM WATER SYSTEM - A system designed for a specific site intended to deal with on-site storm water.

OUTFALL - The point where water flows from a manmade conduit, channel, or drain into a water body or other natural drainage feature.

OUTWASH - Gravel, sand, and silt, usually stratified, produced by glaciers and deposited by water that originated from the melting of glacial ice. Outwash deposited ahead of a progressing glacier is termed advance outwash. When deposited by the receding glacier, it is known as recessional outwash.

PATHOGENS - Microorganism which causes disease.

PEAK FLOWS - The maximum instantaneous rate of flow during a storm, usually in reference to a specific design storm event.

PEAT - Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture.

PERMEABILITY - The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves downward through the saturated soil.

PERVIOUS - A soil or material that has the specific quality of allowing the passage of water.

PESTICIDES - A general term used to describe any substance - usually chemical - used to destroy or control organisms; includes herbicides, insecticides, algicides, fungicides, and others. Many of these substances are manufactured and are not naturally found in the environment.

POINT SOURCE POLLUTION - A pipe that discharges effluent into a stream or other body of water.

POLLUTANT - Something that pollutes or contaminates air, soil or water.

POTHOLE - A topographic depression formed by glacial movement, possibly created by the melting of an isolated block of glacial ice.

REGIONAL DETENTION FACILITY (POND) - A stormwater quantity control structure designed to correct existing excess surface water runoff problems of a basin or subbasin.

REGULATORY MEASURES - Rules and regulations which are incorporated to insure overall water and habitat quality.

RETENTION POND - A stormwater storage pone the collects runoff and only releases it through infiltration or evaporation.

REVEGETATION - The process of restoring vegetation to a disturbed area.

RIPARIAN - Describing a stream or wetland and the surrounding environment which interacts directly with the water body. A riparian zone typically includes a stream and the low and high streambanks around it.

RUNOFF - The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

SCOUR - The localized erosion of channel banks and channel beds due to excessive velocity of the flow of surface and stormwater runoff.

SEDIMENT - Fragmental material that originates from weathering of rocks and decomposition of organic material that is transported by, suspended in, and eventually deposited by water or air or is accumulated in beds by other natural phenomena.

SEDIMENTATION - The act or process of depositing sediment from a state of suspension in air or water.

SEDIMENTATION POND - Commonly used during construction, these temporary ponds collect and store eroded particles before they can reach a water body or adjacent property. A common supplement to other erosion control techniques.

SENSITIVE AREA - Components of the natural environment easily degraded by various land uses. Sensitive areas include wetlands, steep slopes, aquifer sensitive areas, and fish and wildlife habitat areas.

SETBACK - A zone designed to protect sensitive areas from negative impacts associated with development.

SETTLING POND - A pond used to detain water for the purpose of allowing solids to separate from the water.

SIGNIFICANT TREE - Native and non-native trees of a ten inch trunk diameter.

SILTATION - The process by which a river, lake, or other water body becomes clogged with sediment. Silt can clog gravel beds and prevent successful salmon spawning.

SINUOSITY - The ratio of actual length between two points on a channel to the straight line distance between the same two points. Also the ratio of channel length to down valley length. Channels with sinuosities of 1.5 or more are called "meandering".

SOIL FAILURE - Occurs when the load applied to the soil is greater than the bearing capacity of the soil.

SOIL INFILTRATION - Stormwater management technique, which captures runoff and slowly discharges it to the soil. Functions best in soils of a medium texture which are less likely to clog, but effectively trap pollutants.

STORM EVENT - The occurrence of precipitation over a specific duration of elapsed time at a specific intensity, such as a 2, 10 or 100 year storm event.

SUBBASIN - A drainage area which flows to a point contained within a larger basin.

SUBSTRATE - The mineral and/or organic material that forms the bed of the stream.

SUSPENDED SOLIDS - Organic or inorganic particles that are suspended in and carried by the water. the term includes sand, mud, and clay particles (and associated pollutants) as well as solids in stormwater.

SWALE - A shallow drainage conveyance with relatively gentle side slopes, generally with flow depths less then one foot.

TILL - Unsorted, nonstratified glacial drift consisting of clay, silt, sand and rounded rock fragments (cobbles, stones, boulders) transported and deposited by glaciers.

TOXIC - Poisonous, carcinogenic, or otherwise directly harmful to life.

URBANIZING - The changing of an undeveloped area to an area which qualifies as urban.

VEGETATION - The plants and organic growth of a specific area.

WATER TABLE - The upper surface or top of the saturated portion of the soil or bedrock layer; indicates the uppermost extent of ground water.

WETLAND - Land which is inundated or saturated by enough ground or surface water to support vegetation adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands are critically important habitat for fish and wildlife.

Appendix 10: Open Space/Cluster Development

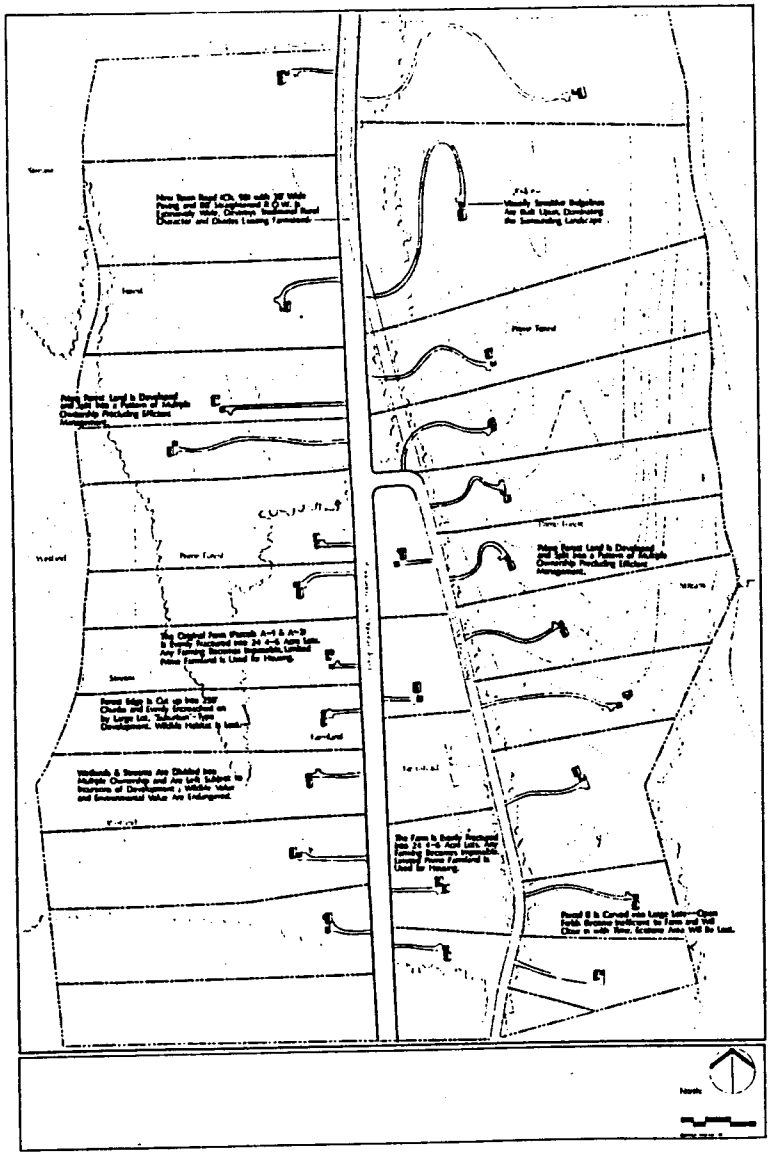
CLUSTER DEVELOPMENT

Creative development techniques are rapidly becoming a standard tool used to more effectively manage natural resources and the patterns of growth. Cluster is a development design technique which arranges buildings on a specific area of a site so as to preserve a portion of the entire site for common open space, recreation, or preservation of environmentally sensitive areas in perpetuity. Techniques such as cluster development are widely used on the east coast as a means of preserving the historic character of towns and rural areas, while at the same time allowing for continued growth.

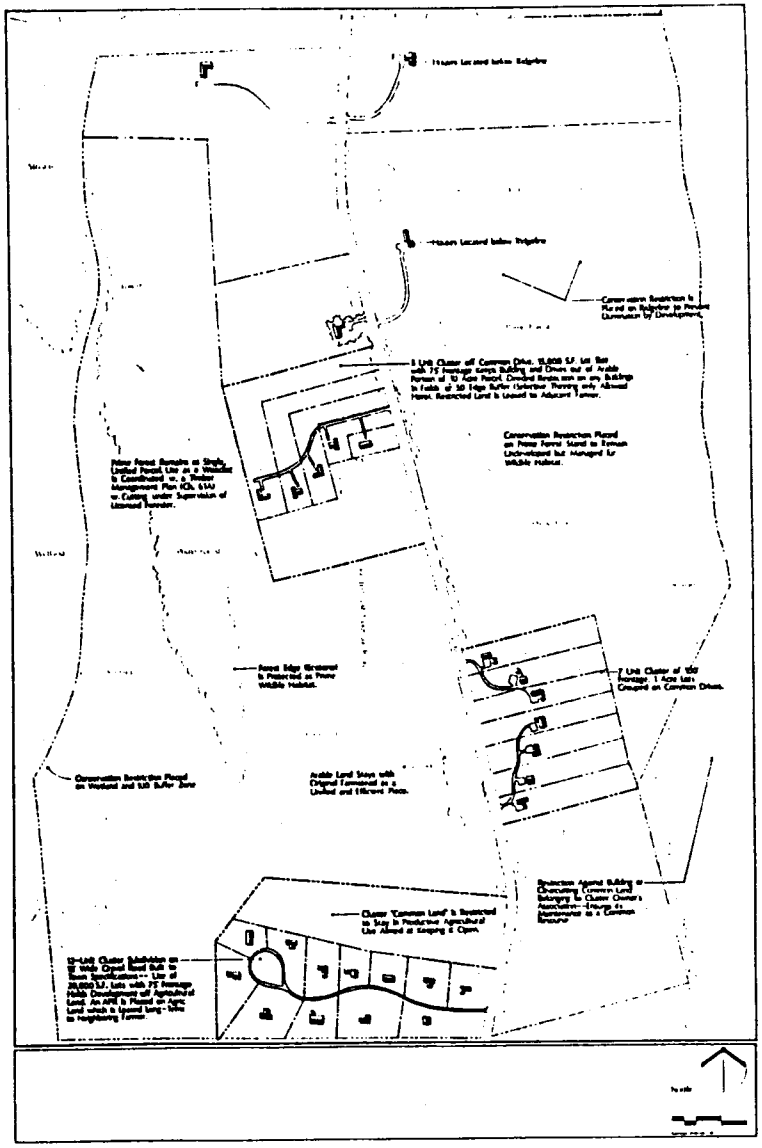
The use of innovative development design such as cluster development is equally advantageous on the west coast. Cluster development is an efficient means of reducing runoff, preserving natural functions, and maintaining aesthetic characteristics of a development site. Natural vegetation not only offers wildlife habitat areas and visual breaks between dissimilar land uses, but also absorbs and intercepts rainfall. Research in western Washington has shown that in undeveloped areas, little or no overland runoff is generated during rainstorms of even the highest intensity and duration. By maintaining a large undeveloped area within a development, cluster techniques substantially reduce the amount of runoff generated by an area.

New development is currently required to meet strict stormwater treatment and storage regulations. These regulations are anticipated to increase substantially in the future. By maximizing the amount of natural vegetation on a site, stormwater volumes can be greatly reduced. By constructing all the buildings on one portion of the site, the amount of disturbed vegetation and impervious road surfaces is minimized. In addition, cluster development is usually more aesthetically pleasing and studies have shown property values in cluster developments to appreciate more rapidly than those in conventional developments.

The following are a series of site plans intended to demonstrate the concept of cluster design. Two residential and one commercial cluster design have been included for comparison. These site plans have been borrowed from Dealing with Change in the Connecticut River Valley: A Design Manual for Conservation and Development. This document has been developed by the Massachusetts Department of Environmental Management and the Center for Rural Massachusetts.

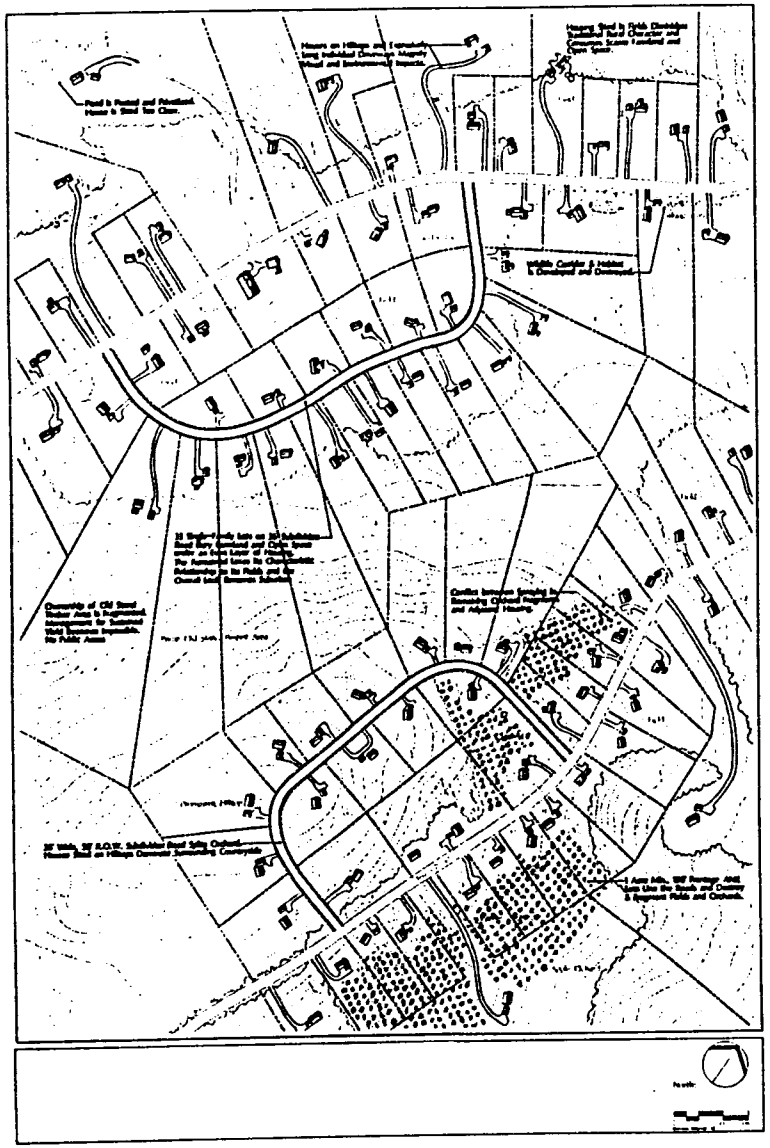


Plan of Site C After Conventional Development

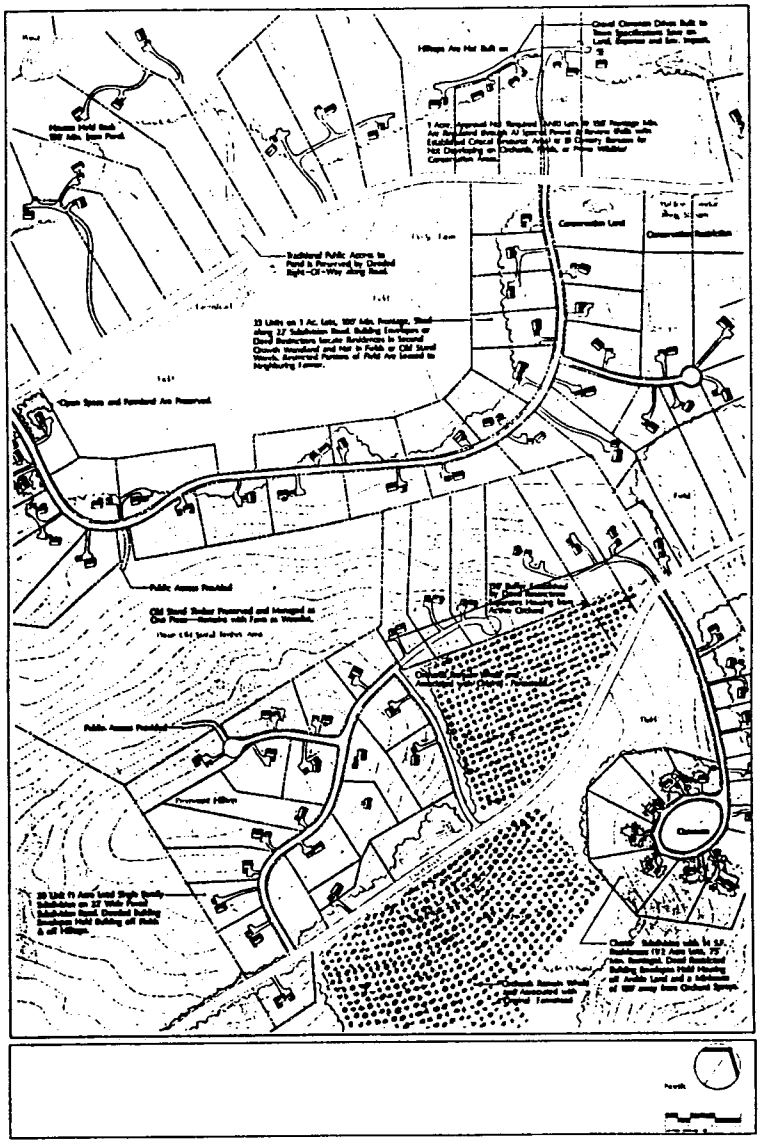


Plan of Site C After Creative Development

Borrowed from: Yaro, Robert, et al. Dealing with Change in the Connecticut River Valley: A Design Manual for Conservation and Development. Cambridge: Lincoln Institute of Land Policy, 1989.

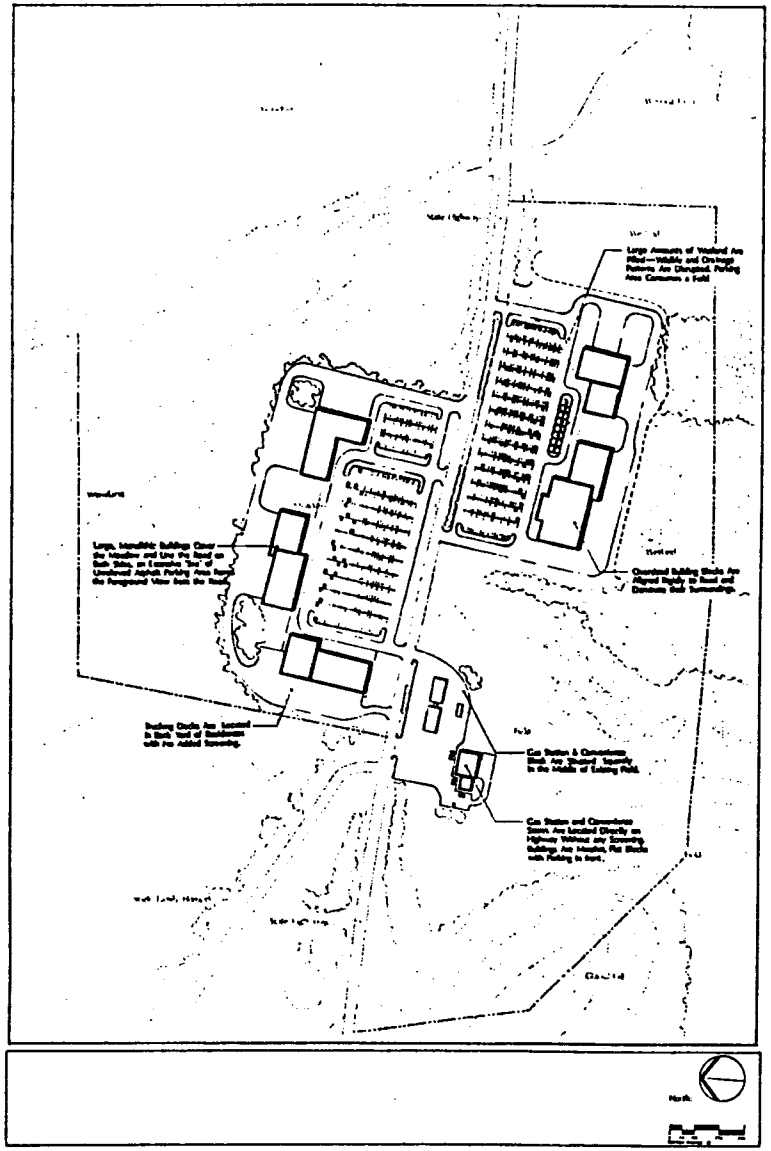


Plan of Site F After Conventional Development

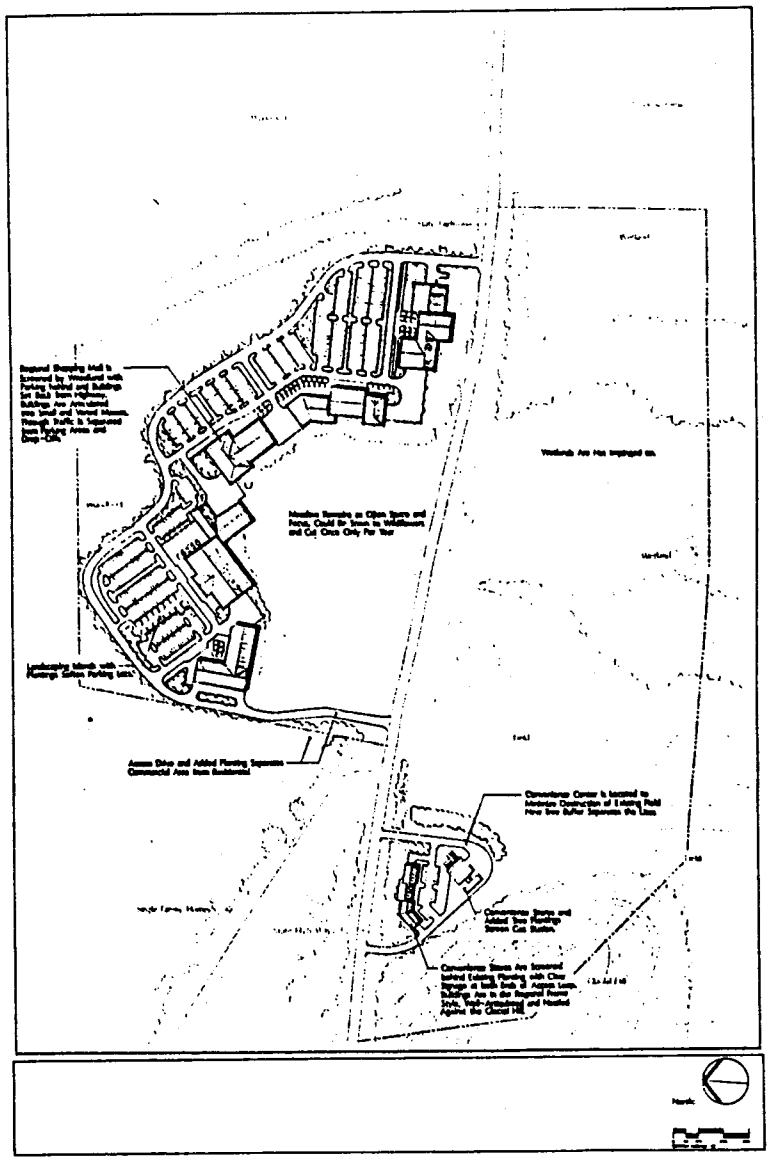


Plan of Site F After Creative Development

Borrowed from: Yaro, Robert, et al. Dealing with Change in the Connecticut River Valley: A Design Manual for Conservation and Development. Cambridge: Lincoln Institute of Land Policy, 1989.



Plan of Site E After Conventional Development



Plan of Site E After Creative Development

Borrowed from: Yaro, Robert, et al. Dealing with Change in the Connecticut River Valey: A Design Manual for Conservation and Development. Cambridge: Lincoln Institute of Land Policy, 1989.

Appendix 11: Pothole Management

Pothole Management

Although potholes are ideal geologic stormwater infiltration areas, there are social and natural considerations that must first be taken into account before they are used in such a capacity. The use of several potholes in the Moxlie basin for stormwater detention and infiltration has lead to concern among neighboring property owners. Because the basin continues to be developed, management policies for potholes need to be better defined.

A policy concerning the use of potholes in stormwater management has been developed as a part of the basin planning process. This policy is consistent with the goals of basin planning, the Water Resources Program mission statement and policies, the Environmentally Sensitive Areas ordinance, and the Council's Sustainable City goal which calls for the consideration of the long-term implications of management decisions. Responsible water resource management as practiced within the Olympia region requires the infiltration of stormwater and subsequent groundwater recharge whenever feasible.

The following evaluation considerations and management policy will be utilized to assess the appropriateness of each individual pothole within the basin for use in stormwater purposes. Acceptance of the classification of a pothole as presented in the policy represents a long-term management commitment.

Potholes will be assessed using the following set of criteria:

I. Potholes in the basin will be evaluated with respect to the following parameters:

<u>Social Concerns</u>

1. Ownership
    - Public
    - Private
2. Land use of adjacent property
    - Developed
    - Undeveloped
3. Current use of pothole
    - Open space
    - Recreation
    - Stormwater detention
4. Source of runoff
    - Local
    - Regional
5. Neighborhood acceptance

Soil Characteristics

1. Infiltration potential
2. Soil type
   - Hydric
   - Non-hydric

Other Natural Resource Attributes

1. Wildlife habitat
2. Aquifer sensitive area
3. Presence and/or classification of wetlands

Potential for Adverse Effects

1. Flooding potential
2. Impacts on significant trees
3. Impacts on significant wetlands

Hydrologic Concerns

1. Historic runoff patterns
2. Water storage capacity
3. Downstream impacts of other alternatives
4. Potential development in contributing area
5. Wetland classification

Water Quality Concerns

1. Runoff water quality
2. Runoff treatment potential

Financial Concerns

1. Cost of other alternatives

II. No potholes containing WDOE classified high quality wetlands (Class #1 and #2) will be used for stormwater management.

III. Ownership and Habitat Conditions

Type of ownership and land uses vary among potholes. The following traits and policies would govern the management of each category of pothole:

Private ownership/undeveloped

1. Receives minimal natural drainage from nearby development
2. Future use to be governed by existing regulatory guidelines and plat review process.

3. If determined to be suitable for regional stormwater storage, an acceptable agreement between the landowner and City of Olympia must be arranged prior to stormwater discharge.

Private Ownership/Open Space Designation

1. If identified on plat as neighborhood open space or community amenity, the pothole may be utilized for the neighborhood's stormwater management.
2. Use for regional stormwater management to be approved by neighborhood or after thorough investigation of associated financial and social costs to the neighborhood and region.

Public Ownership/Stormwater Management Designation

1. Primary use may be stormwater management if determined acceptable according to the criteria outlined in items I and II.

Public Ownership/Sensitive Area Designation

1. Stormwater management practices must ensure the preservation of existing wetland, habitat, and vegetation traits. As per item II, WDOE class 1 and 2 wetlands will not be used for stormwater management.

Appendix 12: Determination of Nonsignificance

SEPA NO.: O-92-017

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JUN 15 1992

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PUBLIC WORKS DEPT

DETERMINATION OF NONSIGNIFICANCE

Proponent:	City of Olympia Joanne Richter 837 - 7th Avenue SE Olympia, WA 98507
Description of Proposal:	Adoption of the Indian/Moxlie Creek Comprehensive Basin Plan that proposes a variety of structural and non-structural recommendations that address flooding, habitat and water quality in the Basin.
Location of Proposal:	City of Olympia
Section/Township/Range:	Citywide Tax Parcel No.: Citywide
Threshold Determination:	The lead agency for this proposal has determined that it does not have a probable significant adverse impact upon the environment. An Environmental Impact Statement is not required under RCW 43.21C.030(2)(C). This decision was made after review by the Lead Agency of a completed Environmental Checklist and other information on file with the Lead Agency. This information is available to the public on request.
Jurisdiction:	Olympia
Lead Agency:	Planning Department
Responsible Official:	Harold Robertson, AICP, Planning Director

Date of Issue: June 12, 1992
Comment Deadline: June 29, 1992

Paula Ehlers

Paula Ehlers, Environmental Review Officer

This Determination of Nonsignificance (DNS) is issued under 197-11-340(2); the lead agency will not act on this proposal for 15 days from the date of issue. No permits may be issued, and the applicant shall not begin work until after the comment deadline has expired and any other necessary permits are issued. If conditions are added, deleted, or modified during the 15 day review period, a modified DNS will be issued. Otherwise, this DNS will become final after the expiration of the comment deadline.

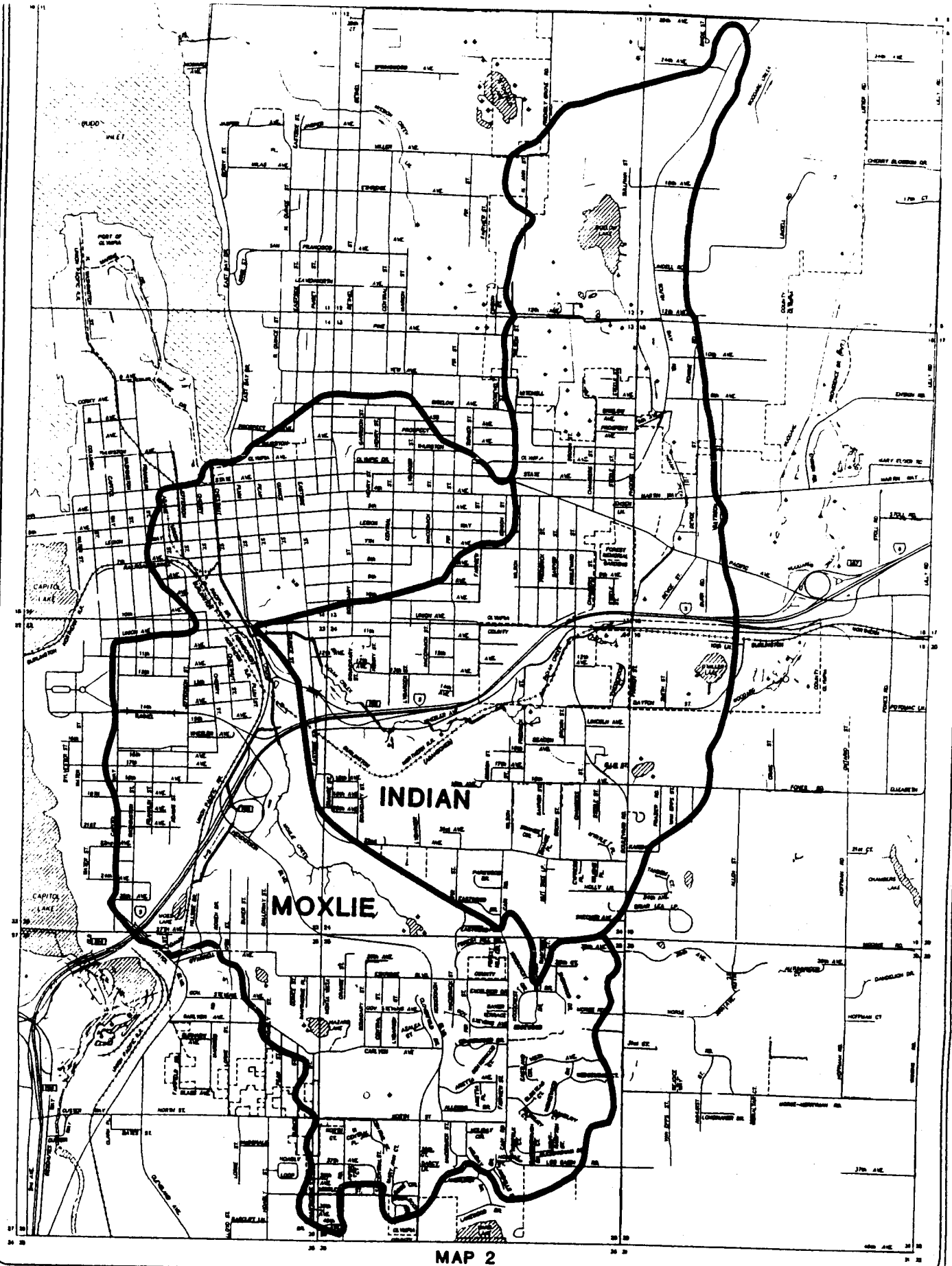
NOTE: Pursuant to RCW 43.21C.075 and Olympia City Code 14.04.160(A), a project denial based upon environmental information, and a conditioned or mitigated DNS may be appealed by any agency or aggrieved person. Appeals may only be filed for those conditions or mitigating measures identified in this DNS and the threshold determination is not appealable. Such appeals may be filed with the Planning Department within ten (10) days of the issuance of the written determination.

NOTE: The issuance of this Determination of NonSignificance does not constitute project approval. The applicant must comply with all applicable requirements of Thurston County Departments and/or the Hearing Examiner prior to receiving construction permits.

Olympia Planning Department, Environmental Review Officer
Building #1, Administration
2000 Lakeridge Drive S.W.
Olympia, WA 98502 (206) 786-5745

37:kb

cc:
Department of Ecology (2)
Jackie Boettcher
Cynthia Wilson
Jean Taylor
Steve Wise
Dept of Natural Resources
US Army Corps of Engineers
Adjacent Property Owners
Donna Bunten
Maher Abed
Mark Blosser
Dept of Fisheries
US Fish and Wildlife
Thurston Co Planning
Jeff Fant
Marianne Flannery
Steve Friddle
Dee Horiuchi
City of Tumwater
City of Lacey
All planning areas



MAP 2

City of Olympia

- WETLANDS
- FRESHWATER
- MARINE WATERS
- CULVERTS
- PIPES

INDIAN/MOXLIE BASIN

N

SCALE IN FEET

0 400 800 1600 2000

Appendix 13: Letters of Concurrence

THURSTON COUNTY
WASHINGTON
SINCE 1852

George L. Barner, Jr.
District One
Diane Oberquell
District Two
Les Eldridge
District Three

BOARD OF COUNTY COMMISSIONERS

September 22, 1992

Ms. Joanne E. Richter
Water Resources Program Supervisor
City of Olympia
Department of Public Works
P.O. Box 1967
Olympia, WA 98507-1967

Dear Ms. Richter:

SUBJECT: Indian/Moxlie and Percival Creek Comprehensive Drainage Basin Plans

Thank you for the opportunity to review and comment on the Indian/Moxlie and Percival Creek Comprehensive Drainage Basin Plans. Thurston County has recognized the importance and supported development of the plans to identify surface water quality and quantity problems, and the solutions to address current and future problems. The Board commends you on the preparation of two plans that clearly identify actions that are aimed to protect our surface water resources in Thurston County.

This letter serves as Thurston County's statement of concurrence on the Indian/Moxlie and Percival Creek Comprehensive Drainage Basin Plans. Thurston County agrees with the goals and objectives of the Plan and with the actions specified for the County subject to the following:

1. Availability of grant or specified local funds to carry out the actions or to accomplish them within the specified time period.

   With regards to funding, the County will make every effort to pursue funding but does not make a budget commitment through this statement. We also do not agree to pursue the actions if funding is unavailable.

2. The plans should not be static documents. As new information becomes available, Thurston County may wish to meet the goals and objectives of the plans through different actions.

Once again, thank you for the opportunity to review and comment on the Indian/Moxlie and Percival Creek Comprehensive Drainage Basin Plans. We look forward to cooperative solutions in addressing our common surface water management needs.

Sincerely,

BOARD OF COUNTY COMMISSIONERS
Thurston County, Washington

George L. Barner, Jr., Chairman

Diane Oberquell, Commissioner

Linda Medcalf, Commissioner

LS:lp\swanson\plncorr.let

Washington State Department of Transportation

Duane Berentson
Secretary of Transportation

District 3 Headquarters
5720 Captiol Boulevard, Tumwater
P.O. Box 47440
Olympia, WA 98504-7440
(206) 357-2600

July 30, 1992

Joanne Richter
Water Resource Program Supervisor
City of Olympia
P.O. Box 1967
Olympia, WA 98504-1967

RE: SR 5
Indian/Moxile Creek
Comprehensive Drainage Basin Plan

Dear Joanne:

As a follow-up to my telephone conversation with Andy Haub on July 29th, I would like to reiterate WSDOT's position regarding stormwater problem areas in the Indian/Moxile Creeks drainage basins.

Since we have previously addressed Recommendations 9.1.4 and 9.1.5 under current projects, I will only address Recommendation 9.1.3, on page 86 of the Indian/Moxile Creek comprehensive drainage basin plan.

We are aware of the concerns that stormwater runoff from I-5 may be impacting private properties adjacent to Indian Creek in the vicinity of Frederick and Wheeler Streets. Our previous investigations revealed that a private owner within Thurston County's jurisdiction had filled the draw through his property, causing impacts to his own property and possibly reflecting downstream. To my knowledge, this was not resolved and I know of no further activity on the property.

Our position would be the same at this location as it has been elsewhere in our previous cooperative endeavors with the City. As a property owner and stormwater discharger we would expect to contribute to a solution at this location based on an equitable distribution of the costs for design, contract preparation, and construction. Funding participation by WSDOT would be subject to availability and could affect timing of a proposed project. A cursory look at a possible solution suggests that remediation might have to occur upon the previously filled property lying within the County's jurisdiction. The solution then, could be dependent on the need for cooperating property owner who may have some responsibility for the ongoing problem. Additionally, some of the contributing area lies within the County and I note they haven't been identified in the recommendation.

We will be particularly interested in the timing of a project at this site since it will affect manpower and funding, therefore, we will appreciate periodic updates on the proposal.

Thank you for contacting us regarding this matter and I look forward to hearing from you.

Sincerely,

JERRY R. SCHULTZ
Environmental/Hydraulic Program Manager
District 3

JRS:rb

cc: R.C. Wade
G. Richardson