Identification of Important Casco Bay Fish and Wildlife Habitats at Risk from Future Development

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Introduction

The Casco Bay Estuary Project (CBEP) and U.S. Fish and Wildlife Service (FWS) Gulf of Maine Project cooperated on a study to identify important fish and wildlife habitats in the lower Casco Bay watershed which may be eliminated or degraded by future development. The fifteen towns that comprised the study area include: Brunswick, Cape Elizabeth, Cumberland, Falmouth, Freeport, Harpswell, Long Island, North Yarmouth, Phippsburg, Portland, Pownal, South Portland, West Bath, Westbrook, and Yarmouth. The study consisted of three elements; mapping of important habitats, mapping of areas in which development is expected to occur, and identification of areas in which development threatens habitat values. Areas showing the highest probability of impact to substantial habitat values should be considered candidates for conservation actions.

Methods

Mapping of Important Habitats: Important habitats were regarded as those used by or suitable for one or several evaluation species characteristic of Casco Bay islands, near shore habitats, rivers, lakes, and interior wetlands. In addition to their importance locally, these species are priorities for the CBEP, FWS, and the Gulf of Maine Council. They included saltmarsh cordgrass, eelgrass, commercially important marine worms and shellfish, resident and migratory fishes, endangered species, waterbirds, seabirds and wading birds.

Habitats were mapped from species occurrence records, biological reports, and existing GIS coverages (Banner and Libby 1995). We identified additional habitat by first characterizing the environmental needs and tolerances for each species, then mapping those areas having suitable combinations of conditions, occurring within the species' range. These approaches yielded maps of habitat, scored by suitability or level of actual use, for each species.

For some species, structures and activities associated with development can be expected to degrade values of nearby habitats. The distances to which species are sensitive were derived from technical literature, agency recommendations, and GIS analysis of minimum distances between developments and occupied

habitats. Habitat sensitivity was based both on distance from development and on the relative value of the habitat. For example, relatively low value foraging habitats for wading birds were degraded by half if within 30 m of development, while moderate and high value habitats were degraded by half if within 90 m of development. We applied this information by reducing scores of habitats occurring within the relevant buffer or sensitivity distances.

Maps for all evaluation species were combined, taking into account the relative abundance of the habitat and the relative importance on the species. Importance was based on ranking factors developed for the Gulf of Maine Council (USFWS 1994), considering institutional, social, and ecological criteria. Procedures and findings of the habitat analysis are detailed in Banner and Libby (1995).

Potential for Development: We performed an analysis of potential land development in fifteen towns that are located in the lower portion of the Casco Bay watershed. Development was assessed in relation to town general zoning. Harpswell, North Yarmouth, and Phippsburg, have no formal general zoning; in these instances development was examined within shoreland zones and for other lands within the town boundaries.

Three steps were involved in generating the map of potential intensity of development in the study area. These were: 1) simplifying the general zoning categories; 2) selecting neighborhoods representing the fully built-out condition for each generalized zone, calculating the development density (proportion of each neighborhood that is developed), and applying this number to the respective zones; 3) identifying and clipping out areas precluded from future development. These steps are described below.

1) Simplifying General Zoning: General and Shoreland zoning were digitized from maps held by each town. The digital maps and databases were produced by the Greater Portland Council of Governments (GPCOG), Portland Maine, and by The Maine Mapping Service, Damariscotta, Maine.

We grouped zones within each town that share the same minimum lot size, and thus would have the same developed to non-developed ratios. Each grouped zone was named according to its apparent uses. For instance, the Commercial Development District, Highway Commercial, and Business Limited Highway zones from Brunswick, Cumberland and Westbrook respectively, all have implied commercial uses and were renamed commercial or COM in the simplified zoning scenario. The simplified zoning categories are as follows:

Numeric/	Alpha/	Description
101	COM	Commercial
102	IND	Industrial

Numeric/	Alpha/	Description
112	OP	Office Park
113	LOB	Local Operated Business

103	LDR	Low-Density Residential	114	RR1	Rural Residential
104	MDR	Med-Density Residential	115	RR2	Rural Residential 2
105	RP	Resource Protected	116	CMM	High Density Commercial
106	RR	Rural Residential	117	VC	Village Commercial
107	V	Village	118	UNK	Unknown
108	WOC	Water Based Commercial	119	CPZ	Coastal Protection Zone
109	HDR	High Density Residential	120	NRI	Non-Resident Industrial
110	BUS	Business	121	BNAS	Bruns. Naval Air Station
111	ROS	Recreation/Open Space	123	IR1	Island Residential

It should be noted that the simplified zoning categories are a naming convention only, developed in order to reduce the general zoning data into a manageable size. While towns may share the same designation (e.g., commercial = COM), beyond sharing an implied permissible use there is no consistent relationship between them. Each town and simplified zone combination was considered independently for the buildout analysis (see Appendix A).

2) Characterization of Representative Neighborhoods and Calculation of Potential Development Densities: Representative neighborhoods are areas we sampled to gain statistics on the maximum expected extent of development, by combined zoning class and town. Working from aerial photographs, town planners assisted in identifying specific areas for each zone that best represented a fully "built out" condition.

Earthsat Inc. and GOMP analyzed a 1991 Landsat image of Casco Bay, producing a GIS coverage including a developed/disturbed landuse type, and ten other classes. The representative neighborhoods were overlaid on this landuse coverage, allowing us to calculate the proportion of each neighborhood that was developed/disturbed. For instance, the area in Freeport that was identified as best representing the fully developed Village Commercial Zone was found to consist of 78% developed/disturbed landuse (the balance was 19% grass and 3% bare ground/crop signatures). Accordingly, other areas that Freeport zoned Village Commercial may be expected to approximate that percentage of developed/disturbed when fully developed.

We then examined the difference between the potential and the existing density of development for each zone, by town. This difference was considered a measure of the threat or risk to habitats within these zones. That is, zoning which permits a future increase in development density of 20% would put the land within that zone at a 20% risk of being developed.

Because there exists some chance of further development even for areas currently at the "built out" intensity (variances may be granted), a minimum risk of 3% was assigned to any open area not otherwise precluded from development. Similarly, a maximum risk of 97% was assigned even in areas zoned for high

density development. We recognized that existing development and the risk of future development is not evenly distributed within the zones but decided not to predict where development will be more and where less intense than the zonal average.

3) Areas Precluded from Development: The following areas were regarded as having no risk of future development: all wetland and deepwater areas, slopes in excess of 20%, road rights of way, publicly owned lands, areas designated as Resource or Stream Protection from shoreland zoning, previously developed lands, public utility corridors, and strict Resource Protection areas from general zoning. Sources for exclusion layers are listed in Appendix B. The results from the analysis are shown in the figure: Potential Intensity of Development, Casco Bay, Maine.

Effects of Future Development on Habitat: Habitats on lands subject to development are at risk from direct habitat alteration, and also from development on adjacent lands, within the sensitivity distances mentioned previously. The overall potential loss of habitat value was quantified, by species, as the sum of two elements: that from direct habitat alteration (the existing habitat score multiplied by the risk of development), and that from adjacent development (half the existing score times the probability of development within the appropriate sensitivity distance).

Degradation by development of adjacent lands also can affect habitats in the areas excluded from future development, such as the edges of protected lands and waters. Potential for habitat loss in these areas was calculated from the potential for development of the adjacent lands, and the distance to them.

Potential habitat losses from the above analyses by species were summed, then plotted to show the aggregate potential habitat loss for all of the evaluation species (figure: Habitats at Risk from Potential Development, Casco Bay Maine).

Results and Discussion

Approximately one third of the overall important habitat areas identified in the initial analysis were found to be at some risk from development activities (28800 of 87917 acres). However, the combination of high risk and high value was a much smaller proportion of the potentially affected habitat. The range of scores (risk times habitat value) was 0 to 295; only 10% of the area at risk scored over 29. Just 54 acres produced the top 50 percent of scores. Thus, conservation of these highlighted areas should be relatively practical and cost effective.

The maps and analysis need to be reviewed for correctness of both habitat values and extent of risk. Highlighted areas should be inspected to verify the

environmental conditions, modeling assumptions and/or level of wildlife use used to create the map of important habitats. The potential for development impact should be reviewed, particularly regarding conservation status. Information on conservation easements could not be obtained for this analysis, but may be determined for the smaller number of areas identified as high value and at risk. Similarly, data on public lands should be updated and digitized at a larger scale. Finally, the status of conservation easements, designation of resource protection, and public ownership should be examined with regard to the efficacy and duration of protection of wildlife values.

Literature Cited

Banner, A. and J. Libby. 1995. Identification of Important Habitats in the Lower Casco Bay Watershed. Casco Bay Estuary Project, Portland ME. 75 pp.

USFWS. 1994. Identification of Species for Priority Habitats. U.S. Fish and Wildlife Service Gulf of Maine Project, Falmouth ME. 8 pp.

APPENDIX A:
Combined/condensed Zoning Categories

Brunswick General Zoning

Combination	Zone	Description
COM	CDD	Commercial Development District
	MUUD	Mixed Use Urban District
	MUZII	Mixed Use Zone II
	SRD	Suburban Residential District
IND	MDIZ	Moderate Density Industrial Zone
	HDIZ	High Density Industrial Zone
	MUZI	Mixed Use Zone I
LDR	CRIID	Country Residential II District
MDR	IRIID	Intown Residential II District
	IRIID	Intown Residential II District
	CUD	College use District
RR	CRID	Country Residential District
HDR	TCD	Town Center District
	IRID	Intown Residential District
CPZ	CPZ	Coastal Protection Zone
BNAS	BNAS	Naval air Station
RP	UNK	Areas not coded in general zoning
	XX	

Cape Elizabeth General Zoning

Combination	Zone	Description
LDR	RA	Residence A
MDR	RB	Residence B
BUS	BA	Business A
	BB	Business B
RP	FW	Fort Williams
	RP1	Resource Protection 1 Critical Wetland
	RP2	Resource Protection 2 Wetland Protection
	RP3	Resource Protection 3 Flood plain

Cumberland General Zoning

Combination	Zone	Description
COM	HC	Highway Commercial
IND	I	Industrial
LDR	LDR	Low Density Residential
MDR	MDR	Medium Density Residential
	IR	Island Residential
OP	OC	Office Commercial
LOB	LB	Local Business
	IB	Island Business
RR	RR1	Rural Residential 1
RR2	RR2	Rural Residential 2
RP	UNK	Areas not coded in general zoning
	XX	

Falmouth General Zoning

Combination	Zone	Description
COM	SB-1	Route 1 Business
	MUC	Mixed Use Cluster
	BP	Business & Professional
LDR	RC	Residential C
MDR	RB	Residential B
RR	F	Farm & Forest
HDR	RA	Residential A
VC	VMU	Village Mixed Use
RP	UNK	Areas not coded in general Zoning
	XX	

Freeport General Zoning

Combination	Zone	Description
COM	C-1	Commercial 1

	LB	Local Business
IND	I-I	Industrial I
	I-II	Industrial II
	I-III	Industrial III
	MEOD	Mining & Extraction
LDR	RR-I	Rural Residential I
	RR-II	Rural Residential II
	RR-1A	Rural Residential IA
MDR	MDR-I	Medium Density Residential I
	MDR-II	Medium Density Residential II
	MD	Medium Density
HDR	V-I	Village I
	V-II	Village II
CMM	C-II	Commercial II
	C-III	Commercial III
VC	VC-I	Village Commercial I
	VC-II	Village Commercial II
	VC-III	Village Commercial III
WOC	MW	Marine/Waterfront
RP	RP-I	Resource Protection I
	RP-II	Resource Protection II

Harpswell, Phippsburg, North Yarmouth

The towns of Harpswell, Phippsburg, and North Yarmouth have no General Zoning, in these cases the Shoreland Zoning was used and the following zoning categories assigned. Land not in the Shoreland Zoning districts was labeled as unknown or UNK.

Harpswell Shoreland Zoning

Combination	Zone	Description
BUS	SP	Shoreline Business
	CF	Commercial Fisheries
	CF2	Commercial Fisheries 2
MDR	RS	Residential Shoreline
LDR		All land outside of shoreland zoning
RP	SP	From shoreland zoning (resource protected stream
	RP	protected areas)

Phippsburg Shoreland Zoning

RP	RP	Resource Protection
	SP	Stream Protection
	RC	Resource Conservation
LDR	R	Residential
V	V	Village
MDR	GD	General Development

North Yarmouth Shoreland Zoning

RP	RP	Resource Protection
	SD	Stream District
LDR		All land outside of shoreland zoning

Long Island General Zoning

Combination	Zone	Description
LDR	IR-1	Island Residential I
MDR	IR-2	Island Residential II
BUS	I-B	Island Business
ROS	R-OS	Resource Open Space
RP	UNK	Areas not coded in general zoning
	XX	

Pownal General Zoning

Combination	Zone	Description
V	V	Village
RR	RA	Residential A
	RB	Residential B

South Portland General Zoning

Combination	Zone	Description
COM	C	Commercial
	CG	General Commercial
IND	I	Industrial
	IL	Light Industrial

LDR	AA	Residential AA
MDR	A	Residential A
	A-1	Conditional Residential
	CS	Suburban Commercial
RP	RP	Resource Protection
RR	RF	Rural Residential
HDR	G	Residential G
	G-1	Contract Residential 1
	G-2	Contract Residential 2
BUS	LB	Limited Business
	LB-1	Conditional Limited Business
OP	PO	Professional office
NR1	INR	Non-residential Industrial
CMM	CRR	Central & Regional Commercial

Portland General Zoning

Combination Zone		Description
IND	AB	Airport Business
	I-1	Industrial 1
	I-2	Industrial 2
	I-2b	Industrial 2b
	I-3	Industrial 3
	I-3b	Industrial 3b
	I-4	Industrial 4
	IP	Industrial park
LDR	R-1	Residential 1
	R-2	Residential 2
IR1	IR-1	Island Residential 1
	IR-2	Island Residential 2
	IR-3	Island Residential 3
MDR	R-3	Residential 3
	R-4	Residential 4
	R-5	Residential 5
HDR	R-6	Residential 6
	R-7	Residential 7
BUS	B-1	Neighborhood Business

	B-2	Business Community 2
	B-3	Downtown Business 3
	B-3b	Downtown Business 3b
	B-4	Downtown Business 4
	B-5	Urban Commercial 5
OP	OP	Office Park
	RP	Residential Professional
	IB	Island Business
ROS	ROS	Recreation Open space
RP	RP2	Resource Protection

West Bath General Zoning

Combination	Zone	Description
COM	BC	Business & Commercial
	UB	Urban Business
LDR	R	Residential
MDR	HDS	High Density Shoreline
	MHP	Mobile Home Park
RR	RR	Rural Residential
RP	UNK	Areas not coded in general zoning
	XX	

Westbrook General Zoning

Combination	Zone	Description
COM	BL	Business Local
	BH	Business Highway
	BLH	Business Limited Highway
IND	I	Industrial
	MU	Mixed Use
LDR	R2	Residential (2 units/acre)
MDR	R3	Residential (3 units/acre)
	R4	Residential (4 units/acre)
HDR	R8	Residential (8 units/acre)
	RG	Residential General

	C1	Conditional
RR	RFC	Residential Farming & Conservation
BUS	BG	Business General
RP	RP	Resource Protection

Yarmouth General Zoning

Combination	Zone	Description
COM	C	Commercial
	CII	Commercial
	CIII	Commercial
IND	IND	Industrial
LDR	LDR	Low Density Residential
MDR	MDR	Medium Density Residential
RR	RR	Rural Residential
V	VI	Village I
	VII	Village II
WOC	WOC	Water Oriented Commercial
	WOCII	Water Oriented Commercial
RP	UNK	Area not coded in general zoning
	XX	

APPENDIX B
Exclusion Layers for the Buildout Analysis

Slopes - Slopes in excess of 20% were regarded as unlikely to be developed; these were derived from U.S.G.S. Digital Topographic Data at 10 and 20 foot contour intervals.

Public Utility Corridors - Public utility corridors were derived from U.S.G.S. 1:24,000 transmission line coverages.

Road Rights of Way - Roads in the study area were selected from U.S.G.S. 1:24,000 scale digital basemaps. The right of way width was based on the road class and Maine Department of Transportation widths per travel lane. The overall widths, including shoulders and right-of-ways are as follows: class 1 = 100 feet, class 2 and 3 = 60 feet, class 4 = 40 feet, and class 5 and 6 = 30 feet.

Public lands - Public owned lands that occur within the study area were incorporated from the 'Maine Land in Federal, State, Municipal, and Non-Profit Conservation Ownership' coverage, 1:250,000 scale, Maine State Planning Office, 1993.

Shoreland Zoning - 'Resource Protection', and 'Stream Protection', districts were extracted from the shoreland zoning coverages of each town. Digital shoreland zoning covers were produced by the Greater Portland Council of Governments, Portland Maine, Maine Mapping, Damariscotta, Maine, and the Casco Bay Estuary Project.

Wetlands - Wetlands selected for exclusion include those that are subject to regulation by Federal and/or State agencies. Under Maine's current regulations, these were assumed to include all freshwater and coastal wetlands. Wetland locations were derived from U.S. Fish and Wildlife National Wetlands Inventory digital maps, 1:24000 scale.

Developed Land - A GIS coverage of landcover produced as part of this study was used for designating lands which are currently 'developed/disturbed'.

Resource Protected - Resource Protection Areas prohibiting development activities were derived from general zoning maps. In many cases these areas were coincident with shoreland zoning.

POTENTIAL INTENSITY OF DEVELOPMENT

This map shows existing development, potential for further development, and landuse limitations in the lower Casco Bay watershed (see documentation in the report "Identification of Important Fish and Wildlife Habitats at Risk from Future Development, Casco Bay, Maine." The potential for further development is used as a measure of risk or threat for fish and wildlife habitats in those locations.

First, potential building intensity was determined from the actual level of development in mature neighborhoods in each town. For each zoning class, we had town planners identify one or more neighborhoods representing a fully developed condition. Landcover of these areas was examined, and the percentage of development calculated. We then calculated the potential development intensity by subtracting the existing level of development from the level expected using the representative neighborhoods.

Certain areas were regarded unlikely to experience further development. These included slopes exceeding 20%, road and utility rights of way, public lands, shoreland protected areas, wetlands and open water, sites already developed, and areas identified as Resource Protection in general zoning. Some areas may fall into more than one of these categories: their depiction on this map is as the last category in the sequence mentioned.

This map does not yet take into account areas unlikely to be developed because of conservation easements or pivate ownership for conservation purposes.

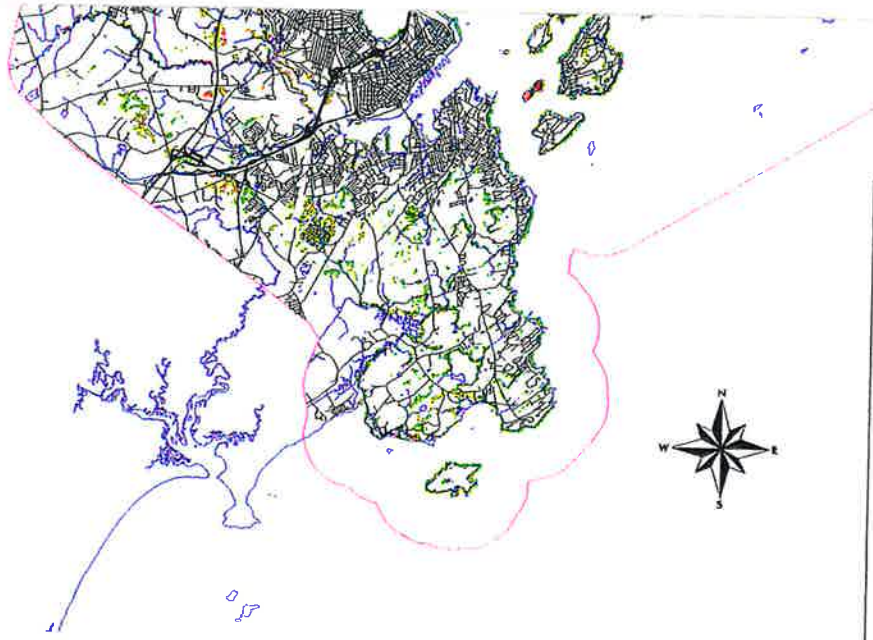
HABITATS AT RISK FROM POTENTIAL DEVELOPMENT

This map displays potential loss of wildlife habitat value from development which may occur within the study area. Impacts considered in this analysis include alteration of land cover and disturbance from residential or commercial activities, not pollution or hydrologic changes. Development was projected from existing zoning (interpretted by town planners), land ownership, landuse restrictions and physical suitability.

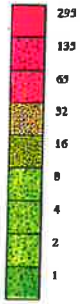
This analysis synthesized data from two sources. The first is shown in the figure "Important Habitats for all Evaluation Species, Casco Bay, Maine." This displays habitats scored on the basis of their relative scarcity, quality, and observed level of use by one or more of the evaluation species (eelgrass, shellfish, marine worms, cordgrass, seabirds, endangered species, waterbirds, great blue herons, and freshwater and anadromous fishes. The overall scores highlight areas having the greatest values for the largest proportions of these species.

The other data source is depicted in the figure "Potential Intensity of Development, Casco Bay, Maine". Thisdisplays the existing level of development, areas precluded from development, and the development which may occur,leading to a "built-out" condition.

The potential for impact takes into account the probability of development occurring at each site plus the probability that development in neighboring areas may degrade habitat values of the site. The overall threat of habitat loss was calculated by multiplying the potential for impact times the existing habitat score for each species, then summing these products.



HABITAT VALUE TIMES RISK



STUDY AREA BOUNDARY
ROADS
COASTLINE

This map displays potential loss of wildlife habitat value from development which may occur within the study area. Impacts considered in this analysis include alteration of land cover and disturbance from residential or commercial activities, not pollution or hydrologic changes. Development was projected from existing zoning (interpreted by town planners), land ownership, landuse restrictions and physical suitability.

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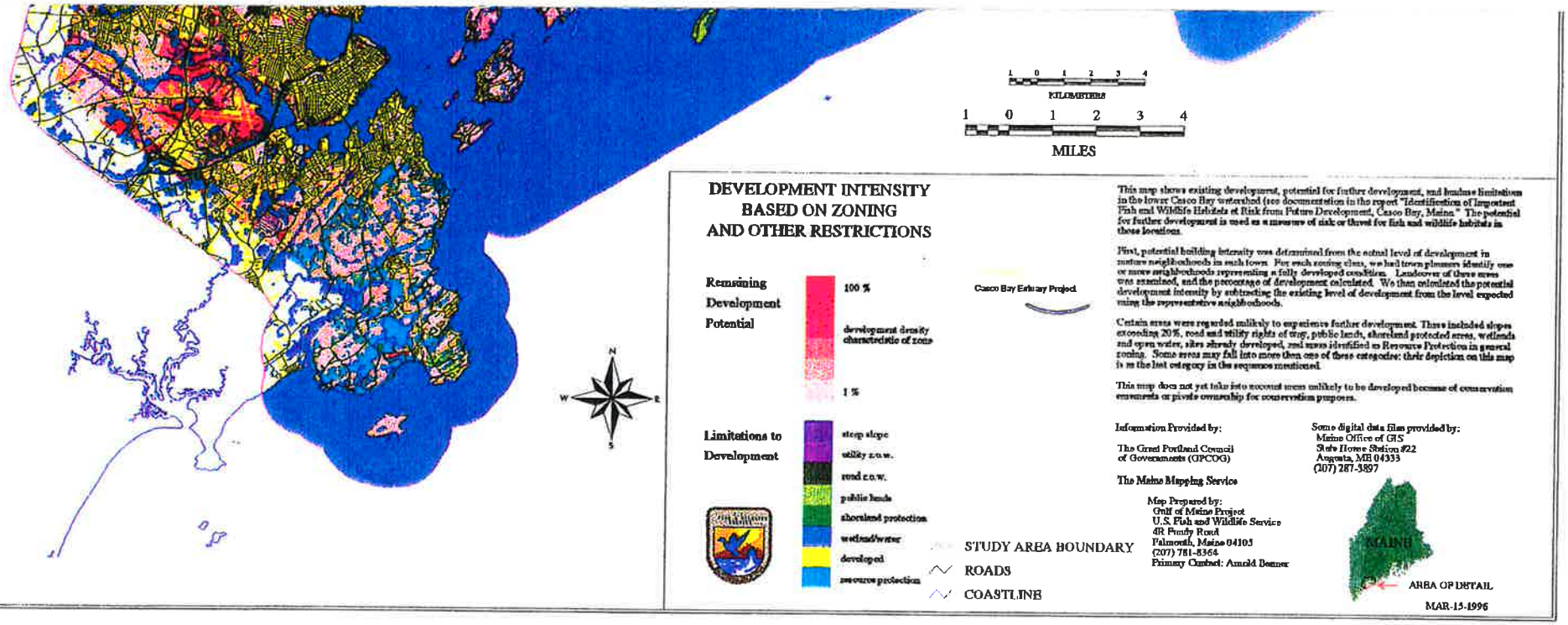
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steep slope
utility r.o.w.
road r.o.w.
public lands
shoreland protection
wetland/water
developed
resource protection
Casco Bay Estuary Project
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