

# Land Use Atlas for Coastal Watersheds in the Maritimes Region

Javier Guijarro-Sabaniél and Noreen E. Kelly

Fisheries and Oceans Canada  
Science Branch, Maritimes Region  
Coastal Ecosystem Science Division  
Bedford Institute of Oceanography  
PO Box 1006  
Dartmouth Nova Scotia  
Canada  
B2Y 4A2

2022

**Canadian Technical Report of  
Fisheries and Aquatic Sciences 3494**



## **Canadian Technical Report of Fisheries and Aquatic Sciences**

Technical reports contain scientific and technical information that contributes to existing knowledge but which is not normally appropriate for primary literature. Technical reports are directed primarily toward a worldwide audience and have an international distribution. No restriction is placed on subject matter and the series reflects the broad interests and policies of Fisheries and Oceans Canada, namely, fisheries and aquatic sciences.

Technical reports may be cited as full publications. The correct citation appears above the abstract of each report. Each report is abstracted in the data base *Aquatic Sciences and Fisheries Abstracts*.

Technical reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page.

Numbers 1-456 in this series were issued as Technical Reports of the Fisheries Research Board of Canada. Numbers 457-714 were issued as Department of the Environment, Fisheries and Marine Service, Research and Development Directorate Technical Reports. Numbers 715-924 were issued as Department of Fisheries and Environment, Fisheries and Marine Service Technical Reports. The current series name was changed with report number 925.

## **Rapport technique canadien des sciences halieutiques et aquatiques**

Les rapports techniques contiennent des renseignements scientifiques et techniques qui constituent une contribution aux connaissances actuelles, mais qui ne sont pas normalement appropriés pour la publication dans un journal scientifique. Les rapports techniques sont destinés essentiellement à un public international et ils sont distribués à cet échelon. Il n'y a aucune restriction quant au sujet; de fait, la série reflète la vaste gamme des intérêts et des politiques de Pêches et Océans Canada, c'est-à-dire les sciences halieutiques et aquatiques.

Les rapports techniques peuvent être cités comme des publications à part entière. Le titre exact figure au-dessus du résumé de chaque rapport. Les rapports techniques sont résumés dans la base de données *Résumés des sciences aquatiques et halieutiques*.

Les rapports techniques sont produits à l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement auteur dont le nom figure sur la couverture et la page du titre.

Les numéros 1 à 456 de cette série ont été publiés à titre de Rapports techniques de l'Office des recherches sur les pêcheries du Canada. Les numéros 457 à 714 sont parus à titre de Rapports techniques de la Direction générale de la recherche et du développement, Service des pêches et de la mer, ministère de l'Environnement. Les numéros 715 à 924 ont été publiés à titre de Rapports techniques du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom actuel de la série a été établi lors de la parution du numéro 925.

Canadian Technical Report of  
Fisheries and Aquatic Sciences 3494

2022

Land Use Atlas for Coastal Watersheds in the Maritimes Region

by

Javier Guijarro-Sabaniél and Noreen E. Kelly

Fisheries and Oceans Canada  
Maritimes Region  
Bedford Institute of Oceanography  
P.O. Box 1006  
Dartmouth, Nova Scotia  
Canada B2Y 4A2

© Her Majesty the Queen in Right of Canada, 2022.  
Cat. No. Fs 97-6/3494E-PDF ISBN 978-0-660-44250-1 ISSN 1488-5379

Correct citation for this publication:

Guijarro-Sabaniel, J., and Kelly, N.E. 2022. Land Use Atlas for Coastal Watersheds in the Maritimes Region. Can. Tech. Rep. Fish. Aquat. Sci. 3494: viii + 135 p.

## TABLE OF CONTENTS

|  |      |
|--|------|
| LIST OF TABLES.....                              | iv   |
| LIST OF FIGURES .....                            | iv   |
| ABSTRACT.....                                    | vii  |
| RÉSUMÉ.....                                      | viii |
| INTRODUCTION .....                               | 1    |
| MATERIALS AND METHODS .....                      | 1    |
| <i>STUDY AREA AND WATERSHED BOUNDARIES</i> ..... | 2    |
| <i>LAND COVER</i> .....                          | 2    |
| <i>HUMAN POPULATION</i> .....                    | 4    |
| <i>MAPPING</i> .....                             | 4    |
| <i>ANALYSIS</i> .....                            | 4    |
| RESULTS .....                                    | 4    |
| DISCUSSION.....                                  | 5    |
| ACKNOWLEDGEMENTS .....                           | 7    |
| REFERENCES .....                                 | 7    |
| TABLES .....                                     | 10   |
| FIGURES .....                                    | 18   |
| <i>BAY OF FUNDY SUB-REGION MAPS</i> .....        | 21   |
| <i>EASTERN SUB-REGION MAPS</i> .....             | 69   |
| <i>WESTERN SUB-REGION MAPS</i> .....             | 87   |
| <i>CAPE BRETON SUB-REGION MAPS</i> .....         | 112  |
| APPENDIX .....                                   | 135  |

## LIST OF TABLES

|   |     |
|---|-----|
| Table 1. List of data sources, years of coverage, and hyperlinks (where available), used in the creation of this land use atlas. .... | 10  |
| Table 2. Total area and areal values of 8 land cover types in 109 coastal watersheds in the Maritimes Region.....                     | 14  |
| Table A.1. Adjusted Cape Breton Island sub-region watershed IDs.....  | 135 |

## LIST OF FIGURES

|   |    |
|---|----|
| Figure 1. Map of 109 coastal watersheds in the Maritimes Region .....                   | 18 |
| Figure 2. The percent contribution to total watershed area across land cover types..... | 19 |
| Figure 3. PCA biplot of percentage land use cover in 109 coastal watersheds.....        | 20 |
| Figure 4. Bay of Fundy sub-region.....  | 21 |
| Figure 5. Land-use map for Annapolis watershed A_1.....                                 | 22 |
| Figure 6. Land-use map for Annapolis watershed A_2.....                                 | 24 |
| Figure 7. Land-use map for Avon watershed Av_1.....                                     | 25 |
| Figure 8. Land-use map for Economy watershed E_1.....                                   | 26 |
| Figure 9 . Land-use map for Economy watershed E_2.....                                  | 27 |
| Figure 10. Land-use map for Gaspereau watershed Ga_1. ....                              | 28 |
| Figure 11. Land-use map for Gaspereau watershed Ga_2. ....                              | 29 |
| Figure 12. Land-use map for Gaspereau watershed Ga_3. ....                              | 30 |
| Figure 13. Land-use map for Kennetcook watershed K_1.....                               | 31 |
| Figure 14. Land-use map for Kennetcook watershed K_2.....                               | 32 |
| Figure 15. Land-use map for Kennetcook watershed K_3.....                               | 33 |
| Figure 16. Land-use map for Lower Saint John - Kennebecasis watershed LK_1. ....        | 34 |
| Figure 17. Land-use map for Magaguadavic watershed M_01.....                            | 35 |
| Figure 18. Land-use map for Magaguadavic watershed M_02.....                            | 36 |
| Figure 19. Land-use map for Magaguadavic watershed M_03.....                            | 37 |
| Figure 20. Land-use map for Magaguadavic watershed M_04.....                            | 38 |
| Figure 21. Land-use map for Magaguadavic watershed M_05.....                            | 39 |
| Figure 22. Land-use map for Magaguadavic watershed M_06.....                            | 40 |
| Figure 23. Land-use map for Magaguadavic watershed M_07.....                            | 41 |
| Figure 24. Land-use map for Magaguadavic watershed M_08.....                            | 42 |
| Figure 25. Land-use map for Magaguadavic watershed M_09.....                            | 43 |
| Figure 26. Land-use map for Magaguadavic watershed M_10.....                            | 44 |
| Figure 27. Land-use map for Magaguadavic watershed M_11.....                            | 45 |
| Figure 28. Land-use map for Meteghan watershed Met_1.....                               | 46 |
| Figure 29. Land-use map for Minas Channel - Parrsboro watershed M-P_1. ....             | 47 |
| Figure 30. Land-use map for Petitcodiac watershed P_1.....                              | 48 |
| Figure 31. Land-use map for Petitcodiac watershed P_2.....                              | 49 |
| Figure 32. Land-use map for Petitcodiac watershed P_3.....                              | 50 |
| Figure 33. Land-use map for Petitcodiac watershed P_4.....                              | 51 |
| Figure 34. Land-use map for Philip watershed Ph_1.....                                  | 52 |

|   |    |
|---|----|
| Figure 35. Land-use map for Philip watershed Ph_2.....                            | 53 |
| Figure 36. Land-use map for Philip watershed Ph_3.....                            | 54 |
| Figure 37. Land-use map for Point Wolfe watershed PW_1.....                       | 55 |
| Figure 38. Land-use map for Point Wolfe watershed PW_2.....                       | 56 |
| Figure 39. Land-use map for Point Wolfe watershed PW_3.....                       | 57 |
| Figure 40. Land-use map for Point Wolfe watershed PW_4.....                       | 58 |
| Figure 41. Land-use map for Point Wolfe watershed PW_5.....                       | 59 |
| Figure 42. Land-use map for Point Wolfe watershed PW_6.....                       | 60 |
| Figure 43. Land-use map for Salmon watershed Sa_1.....                            | 61 |
| Figure 44. Land-use map for Salmon watershed Sa_2.....                            | 62 |
| Figure 45. Land-use map for St. Croix watershed SC_4.....                         | 63 |
| Figure 46. Land-use map for St. Croix watershed SC_6.....                         | 64 |
| Figure 47. Land-use map for Shubenacadie watershed Sh_1.....                      | 65 |
| Figure 48. Land-use map for Sissiboo watershed Si_1.....                          | 66 |
| Figure 49. Land-use map for Sissiboo watershed Si_2.....                          | 67 |
| Figure 50. Land-use map for Sissiboo watershed Si_3.....                          | 68 |
| Figure 51. Eastern sub-region.....  | 69 |
| Figure 52. Land-use map for East and West River Sheet Harbour watershed EW_1..... | 70 |
| Figure 53. Land-use map for East and West River Sheet Harbour watershed EW_2..... | 71 |
| Figure 54. Land-use map for Liscomb watershed L_1.....                            | 72 |
| Figure 55. Land-use map for Liscomb watershed L_2.....                            | 73 |
| Figure 56. Land-use map for Liscomb watershed L_3.....                            | 74 |
| Figure 57. Land-use map for Musquodoboit watershed Mus_1.....                     | 75 |
| Figure 58. Land-use map for Musquodoboit watershed Mus_2.....                     | 76 |
| Figure 59. Land-use map for Musquodoboit watershed Mus_3.....                     | 77 |
| Figure 60. Land-use map for New Harbour watershed NH_1.....                       | 78 |
| Figure 61. Land-use map for New Harbour watershed NH_2.....                       | 79 |
| Figure 62. Land-use map for New Harbour watershed NH_3.....                       | 80 |
| Figure 63. Land-use map for South and West Antigonish watershed SW_1.....         | 81 |
| Figure 64. Land-use map for St. Francis Harbour watershed SF_1.....               | 82 |
| Figure 65. Land-use map for St. Francis Harbour watershed SF_2.....               | 83 |
| Figure 66. Land-use map for St. Marys watershed SMa_1.....                        | 84 |
| Figure 67. Land-use map for Tangier watershed T_1.....                            | 85 |
| Figure 68. Land-use map for Tangier watershed T_2.....                            | 86 |
| Figure 69. Western sub-region.....  | 87 |
| Figure 70. Land-use map for Clyde watershed Cl_1.....                             | 88 |
| Figure 71. Land-use map for Clyde watershed Cl_2.....                             | 89 |
| Figure 72. Land-use map for Gold watershed G_1.....                               | 90 |
| Figure 73. Land-use map for Gold watershed G_2.....                               | 91 |
| Figure 74. Land-use map for Gold watershed G_3.....                               | 92 |
| Figure 75. Land-use map for LaHave watershed La_1.....                            | 93 |
| Figure 76. Land-use map for Medway watershed Med_1.....                           | 94 |
| Figure 77. Land-use map for Medway watershed Med_2.....                           | 95 |
| Figure 78. Land-use map for Mersey watershed Mer_1.....                           | 96 |
| Figure 79. Land-use map for Mersey watershed Mer_2.....                           | 97 |
| Figure 80. Land-use map for Mersey watershed Mer_3.....                           | 98 |

|  |     |
|--|-----|
| Figure 81. Land-use map for Meteghan watershed Met_1.....                  | 99  |
| Figure 82. Land-use map for Roseway watershed R_1.....                     | 100 |
| Figure 83. Land-use map for Roseway watershed R_2.....                     | 101 |
| Figure 84. Land-use map for Sackville watershed S_1.....                   | 102 |
| Figure 85. Land-use map for Sackville watershed S_2.....                   | 103 |
| Figure 86. Land-use map for Sackville watershed S_3.....                   | 104 |
| Figure 87. Land-use map for St. Margarets Bay watershed SM_1.....          | 105 |
| Figure 88. Land-use map for St. Margarets Bay watershed SM_2.....          | 106 |
| Figure 89. Land-use map for St. Margarets Bay watershed SM_3.....          | 107 |
| Figure 90. Land-use map for Tusket watershed Tu_1.....                     | 108 |
| Figure 91. Land-use map for Tusket watershed Tu_2.....                     | 109 |
| Figure 92. Land-use map for Tusket watershed Tu_3.....                     | 110 |
| Figure 93. Land-use map for Tusket watershed Tu_4.....                     | 111 |
| Figure 94. Cape Breton sub-region.....                                     | 112 |
| Figure 95. Land-use map for Victoria County watershed Vi_1.....            | 113 |
| Figure 96. Land-use map for Victoria County watershed Vi_2.....            | 114 |
| Figure 97. Land-use map for Victoria County watershed Vi_3.....            | 115 |
| Figure 98. Land-use map for Victoria County watershed Vi_4.....            | 116 |
| Figure 99. Land-use map for Richmond County watershed Ri_1.....            | 117 |
| Figure 100. Land-use map for Richmond County watershed Ri_2.....           | 118 |
| Figure 101. Land-use map for Richmond County watershed Ri_3.....           | 119 |
| Figure 102. Land-use map for Bras d'Or Lake watershed watershed Br_1.....  | 120 |
| Figure 103. Land-use map for Bras d'Or Lake watershed watershed Br_2.....  | 121 |
| Figure 104. Land-use map for Bras d'Or Lake watershed watershed Br_3.....  | 122 |
| Figure 105. Land-use map for Bras d'Or Lake watershed watershed Br_4.....  | 123 |
| Figure 106. Land-use map for Bras d'Or Lake watershed watershed Br_5.....  | 124 |
| Figure 107. Land-use map for Bras d'Or Lake watershed watershed Br_6.....  | 125 |
| Figure 108. Land-use map for Bras d'Or Lake watershed watershed Br_7.....  | 126 |
| Figure 109. Land-use map for Bras d'Or Lake watershed watershed Br_8.....  | 127 |
| Figure 110. Land-use map for Bras d'Or Lake watershed watershed Br_9.....  | 128 |
| Figure 111. Land-use map for Bras d'Or Lake watershed watershed Br_10..... | 129 |
| Figure 112. Land-use map for Bras d'Or Lake watershed watershed Br_11..... | 130 |
| Figure 113. Land-use map for Cape Breton County watershed Ca_1.....        | 131 |
| Figure 114. Land-use map for Cape Breton County watershed Ca_2.....        | 132 |
| Figure 115. Land-use map for Cape Breton County watershed Ca_3.....        | 133 |
| Figure 116. Land-use map for Cape Breton County watershed Ca_4.....        | 134 |



## ABSTRACT

Guijarro-Sabaniél, J., and Kelly, N.E. 2022. Land Use Atlas for Coastal Watersheds in the Maritimes Region. Can. Tech. Rep. Fish. Aquat. Sci. 3494: viii + 135 p.

Human activities occurring on land can impact marine coastal ecosystems, yet baseline information on the spatial distribution and intensity of such activities across broad spatial scales remains a knowledge gap. To advance this knowledge, land use maps were generated for 109 coastal watersheds draining into the Maritimes Region of Fisheries and Oceans Canada. Land use maps were compiled from publicly available spatial data sources and grouped into one of four sub-regions (Cape Breton Island, Eastern, Western, Bay of Fundy). Each map provides areal values of different land cover types (such as forested areas, pervious or impervious surfaces, agricultural areas, peatlands, parks and protected areas, wetlands and freshwater bodies), human population density, civic address locations, and locations of riverine outflows (i.e. pour points). Collectively, the maps demonstrate an anthropogenic gradient in land use, illustrating the footprint of human settlement and activity across the broader region. While most watersheds are predominantly forested, some watersheds have high percentages of agriculture or impervious cover from urban development. This atlas provides quantitative measures of the spatial extent of human land-use alterations across the Maritimes Region, which may be useful for risk analyses, conservation planning purposes in both freshwater and coastal marine environments, and cumulative effects mapping and analysis.

## RÉSUMÉ

Guijarro-Sabaniél, J., and Kelly, N.E. 2022. Land Use Atlas for Coastal Watersheds in the Maritimes Region. Can. Tech. Rep. Fish. Aquat. Sci. 3494: viii + 135 p.

Les activités humaines sur terre peuvent avoir un impact sur les écosystèmes côtiers marins. Hors, il subsiste des lacunes dans les renseignements de base sur les emplacements et l'intensité de ces activités à grande échelle. Afin d'approfondir les connaissances à ce sujet, des cartes d'utilisation des terres ont été créées pour 109 bassins versants côtiers se déversant dans la région des Maritimes de Pêches et Océans Canada. Ces cartes ont été établies à partir de diverses sources de données spatiales accessibles au public et divisées en quatre sous-régions (Île du Cap-Breton, Est, Ouest et baie de Fundy). Chaque carte fournit des statistiques de base sur les surfaces de différentes couvertures terrestres (telles que les zones forestières, les surfaces perméables ou imperméables, les zones agricoles, les tourbières, les parcs et les zones protégées, les zones humides et les plans d'eau douce), la densité de la population humaine, les emplacements des bâtiments et les emplacements des principaux points duquel l'eau d'une région s'écoule (points d'écoulement). Combinées, ces cartes montrent le gradient anthropique dans l'utilisation des terres, illustrant ainsi l'empreinte de l'occupation et de l'activité humaines dans la région en général. Même si les bassins versants sont principalement boisés, certains comptent de forts pourcentages de terres agricoles ou de surfaces imperméables en raison du développement urbain. Cet atlas fournit des mesures quantitatives de la portée spatiale de l'utilisation des terres par les humains dans la région des Maritimes, lesquelles pourraient être utiles aux fins d'analyse, de planification de la conservation dans les milieux d'eau douce et côtiers et dans la cartographie et l'analyse des effets cumulatifs.

## INTRODUCTION

Coastal ecosystems are highly vulnerable to human activities. The close proximity of human settlements to coastal ecosystems means they are often exposed simultaneously to intense fishing pressure, run-off of land-based nutrients and pollutants, shipping, and coastal development, among other stressors (Lu et al., 2018; Halpern et al., 2019; Thrush et al., 2021). Baseline information on the locations and intensity of these stressors are critical components of any impact assessment or spatial planning approach seeking to mitigate stress and protect or restore coastal ecosystems.

Land-based human activities can impact coastal marine areas through watershed-level processes, such as pollutants like fertilizers and pesticides that are transported from land to coastal waters via streams and rivers. For example, for select embayments along the Scotian Shelf, Murphy et al. (2019) found that land-based human activities (e.g., land alteration from urban or agricultural use, human population density, nutrient loading) contributed to the risk of decline for eelgrass, an important biogenic habitat prioritized for marine protection (DFO 2009a). Multiple studies have identified the need to include land-based activities in any management of marine coastal zones (Alvarez-Romero et al., 2015; Brown et al., 2018; Birch and Reyes 2018). However, for the DFO Maritimes Region, a comprehensive collection of information on many land-based human uses across a broad spatial scale remains a significant knowledge gap.

The land-use maps presented herein are a first attempt to fill this knowledge gap. They were originally created as part of a larger effort to estimate nutrient loading in coastal watersheds across the Maritimes Region (see Kelly et al., 2021; Kelly and Guijarro-Sabaniel 2022). A prerequisite of this project required the compilation of disparate sources of spatial data within 109 coastal watersheds in Nova Scotia and New Brunswick into Geographic Information Systems (GIS) based maps detailing human land use in coastal watersheds. This report contributes additional documentation on the creation of these watershed land-use maps, while also provides a robust table of data sources, enabling rapid updating of source information for future iterations or research purposes. Each map included in this report is publicly available for additional uses at DFO and in the wider research community through the Government of Canada's Open Data portal.<sup>1</sup> The present atlas provides baseline information needed for analyses and models to assess impacts of human land uses on the coastal zone of the Bay of Fundy and Scotian Shelf, and may aid in marine spatial planning, ecological risk assessment, aquaculture management, cumulative impact mapping, coastal marine protected area network design, fish and fish habitat protection, and coastal restoration work.

## MATERIALS AND METHODS

This atlas contains information on land uses compiled from open federal and provincial government data sources (Table 1). All mapping analyses (i.e. area calculations, watershed

---

<sup>1</sup> See <https://open.canada.ca/data/en/dataset/85d6c4c2-6683-4d56-adf4-8cacef2676be>

boundary determinations) were conducted in ArcGIS 10.6 (ESRI 2018). Analyses of land-use patterns across watersheds were conducted in R (R Core Team, 2021).

#### *STUDY AREA AND WATERSHED BOUNDARIES*

This study focuses on coastal watersheds located in the Scotian Shelf Biogeographic Marine Management Sub-region (hereafter “Maritimes Region”) of Fisheries and Oceans Canada (DFO 2009b), which spans portions of the coastlines of the provinces of New Brunswick (NB) and Nova Scotia (NS) in Atlantic Canada (Fig. 1).

Watershed boundaries were created to achieve a balance among the scale of available data, the ability to capture the relevant human activities within hydrologically meaningful borders, and the need to maintain a manageable number of watersheds throughout the sub-region for logistical tracking purposes. To predict the watercourse drainage patterns, a digital elevation model (DEM) for each province was combined with national hydrographic data (Table 1). To delineate the watershed boundaries in each province, the flow direction and accumulation grid were calculated for each DEM. The *Stream Order* tool in ArcMap was used to create stream orders for the stream network. Values of stream order  $\geq 4$  were used to locate the highest flow accumulation value for each watershed. In some areas, such as Bras d'Or Lake (Cape Breton, NS) and Grand Manan Island (NB), a stream order equal to 3 was selected. The locations of these values were used to assign the coastal pour points (i.e. the point at which water flows out of an area) for each watershed. The pour points also helped to delineate the watersheds along with the national hydrographic data (Table 1). This method resulted in a total of 109 watersheds: 85 in NS and 24 in NB.

For ease of reference, the study area was divided into 4 sub-regions: Bay of Fundy, Eastern, Western, and Cape Breton Island (Fig. 1). The watersheds with coastal pour points draining into the Bay of Fundy, regardless of province, were included in the Bay of Fundy Sub-region. All watersheds in Cape Breton Island were grouped into the Cape Breton Island sub-region, regardless of pour point drainage location (Bras d'Or Lake or Atlantic Ocean). The Western and Eastern sub-regions were delineated using the city of Halifax as the frontier between the two sub-regions.

#### *LAND COVER*

To estimate the area of land cover types in each watershed, several digital land cover and land use datasets were gathered from the open data portals of the provinces of NS and NB (Table 1). Land cover types included forest, wetlands, inland water, agriculture, parks and protected areas, turf, peatland (harvested, non-harvested), and developed urban areas and roads, which were further subdivided into pervious and non-pervious surfaces. The GIS layers of different land cover types were assigned to the watersheds using the *Intersect* tool in ArcGIS. To avoid overlap between different land cover types in each watershed, we first divided the layers between natural (forest, water, and wetland) and human land use (agriculture, impervious, pervious, and peatland), then applied the *Erase* tool in ArcMap to remove overlapping areas between polygons. Beginning with the forest layer, we sorted the remaining layers as erase features in order of decreasing spatial coverage: (1) water, wetland, agriculture, impervious, pervious, and peatland

(human); (2) for the water: wetland, agriculture, impervious, pervious, and peatland; wetland: agriculture, impervious, pervious, and peatland; agriculture: impervious, pervious, and peatland; impervious: pervious and peatland; and pervious: peatland. After the final subtraction, land use units were summed to calculate the area of each type of usage per watershed.

For those watersheds located in the province of NS, the Nova Scotia Forest Inventory was used to calculate areas covered by forest, wetlands, and agricultural fields (Table 1). The Nova Scotia Topographic DataBase (NSTDB) contained several datasets which were used to estimate the total area of turf, pervious, and impervious surfaces in each watershed (Table 1). The Roads, Trails and Rails dataset was used to delineate the areas of roads, trails, and railroads. This dataset is represented by lines; in order to convert these features into a 2-dimensional polygon, we added a buffer around the lines to estimate the spatial footprint for these features in each watershed. Using the imagery basemap from ArcGIS Online (ESRI 2019) we measured randomly 25 roads for each province, and calculated the average width (~ 3 m). We applied this same buffer for trails and railroads. The Designated Areas dataset included the spatial extent of developed urban areas such as parking lots and industrial areas, but also cemeteries, golf courses, rest areas, and sport fields (Table 1). The Buildings dataset was used to extract the non-residential building footprints (e.g., factories, fire stations, churches, etc.). These three datasets contain information about which type of surface (pervious or non-pervious) is associated with each feature layer, and so land cover from all three datasets was further subdivided into pervious and impervious surfaces. The Water Features dataset was used to delineate the area of freshwaters (i.e. lakes, rivers, and ponds).

For those watersheds located in the province of NB, the land cover and land use datasets were collected from NB's provincial digital geographic database (GeoNB) to extract information on the area of forest, wetlands, peatlands (harvested and non-harvested), civic address and lots, recreation, industrial, infrastructure, and agricultural areas (Table 1). We used the Non-Forest dataset to identify the areas of cemeteries, golf courses, and sports fields. The New Brunswick Road Network (NBRN) dataset was used to delineate the areas of roads, trails and railroads (Table 1). To estimate the spatial footprint of these features in each watershed, the same approach for the Roads, Trails and Rails dataset in NS was applied. The New Brunswick Hydrographic Network (NBHN) (Table 1) was used to represent the area of freshwater.

To calculate land cover in residential areas in NB and NS, we followed the calculations outlined in Nagel et al., (2018) to determine the area covered by residential turf (i.e. lawns and gardens), as well as the amount of impervious (i.e. roofs + driveways) and pervious cover (i.e. residential forested areas). To calculate an average residential lot size for NB watersheds, we matched civic address locations with property parcels, or lots, using the Digital Property Map layer from the Provincial Digital Geographic Database (Table 1). Large non-residential lots with assigned civic addresses (e.g., provincial parks) and lots > 50 ha were excluded, as they overlapped with areas designated as farmland. The proportion of residential lots covered by turf, impervious, and other pervious surfaces were then calculated for a random sample of 25 lots in each watershed. For NS watersheds, we used information from the Nova Scotia Property Records Database (NSPRD; Table 1); property parcel boundaries were overlaid onto an imagery base map (ESRI 2019) from which we calculated the areas of turf, impervious, and pervious surfaces,

using a random sample of 25 parcels within each watershed. The total area of residential cover (turf, impervious, and pervious) in each watershed was then determined by multiplying the average percent residential cover by the average lot size and number of lots. Because of the summary nature of these calculations, the turf land-use category associated with residential cover does not have associated spatial location information.

#### *HUMAN POPULATION*

To estimate the population density (persons ha<sup>-1</sup>) in all watersheds, the civic address dataset from both provinces was used (Table 1). The population size for each watershed was calculated using the number of civic addresses present in each watershed and multiplying this by the average number of residents per household (2.3) in NS and NB (Statistics Canada 2017). Population density was calculated using the population size in each watershed divided by the watershed area in hectares. The civic address in each watershed was classified into 2 categories, within 200 m of the coastline and greater than 200 m (Nagel et al., 2018), used to estimate direct effects of human habitation immediately adjacent to the coastline (see Kelly et al., 2021 for further details).

#### *MAPPING*

Geodatabases were generated for each province containing geospatial data for each land-use in each watershed. To optimize the process of creating the maps the *Data Driven Pages* tool was used, which enabled the creation of a multi-page map series from a single map document. In total, 109 watershed land use maps were created and are presented herein. For each map, the total watershed area, population density (persons ha<sup>-1</sup>), percentage of total land-use values, civic address locations within or outside the 200 m boundary from the coastline, and the pour point, are provided in addition to the spatial extent of each land-use category (except for turf, which is not included as spatially explicit data). The spatial extent of parks and protected areas are also included in each map. The geographic position of the watershed within the sub-region is also highlighted in the inset of each map.

#### *ANALYSIS*

We conducted two separate but complementary analyses to compare patterns in land use in all watersheds across the Maritimes Region, as well as among the four sub-regions. First, we compared the percentage contribution of different land-use types to identify the dominant land uses in watersheds. Second, a Principal Component Analysis (PCA) was used to visualize gradients in percentages of land-use types and identify land cover types that explained the most variation in land use. Land cover types were centered and scaled before analysis. We considered any land cover type that had contributed more than one variable worth of information (>0.353) as an important contributor to the principal component.

## **RESULTS**

The atlas is arranged by watershed sub-region: Bay of Fundy (Figs. 4 – 50), Eastern (Figs. 51 – 68), Western (Figs. 69 – 93), and Cape Breton Island (Figs. 94 – 116). In each section, the watershed sub-region map is presented first, followed by the individual watershed maps. Raw

data (i.e. area values in hectares) for land-use types in each watershed are displayed in Table 2. All maps are available for download through the Government of Canada's Open Data portal (Guijarro-Sabaniel and Kelly, 2022).

Across all coastal watersheds in the Maritimes Region, the percentage contribution to total watershed area was highest for forest cover (range = 44 – 98%, mean = 79.4, median = 80.1), followed by wetlands (range = 0.6 – 24.1%, mean = 7.79, median = 6.64), freshwater (range = 0.2 – 16.6%, mean = 4.45, median = 4.37), agriculture (range = 0 – 40%, mean = 3.64, median = 1.12), pervious surfaces (range = 0.2 – 10.2%, mean = 2.95, median = 2.43), impervious surfaces (range = 0.1 – 21%, mean = 1.07, median = 0.52), turf (range = 0 – 11.1%, mean = 0.65, median = 0.23) and peatland (range = 0 – 0.5%, mean = 0.02, median = 0) (Fig. 2a). Minor differences in this pattern of land use extent were observed among the sub-regions (Fig. 2b). For example, the Bay of Fundy sub-region had both the highest and lowest percentage cover values for forest (range of 44% – 98%), agriculture (0% – 40%), wetlands (0% – 25%), and peatlands (0 – 0.5%). Turf (0.04 – 11.1%) and pervious (0.9 – 10.1%) land uses were highest in watersheds from the Western sub-region, while Eastern sub-region watersheds displayed the largest range of freshwaters (3.4 – 16.6%; Fig. 2b). The range of percentage cover of impervious land-use was greatest in watersheds in the Eastern sub-region (0.1 – 21%) and lowest in watersheds of the Cape Breton Island and Bay of Fundy sub-regions (<3%) (Fig. 2b). Peatland cover was low across all watersheds in the Eastern, Western, and Bay of Fundy sub-regions (<1%). Peatland was not present in Cape Breton Island sub-region watersheds.

The first two principal component axes in the PCA explained ~54% of the total variance in land-use types across all watersheds (Fig. 3). The first principal component separated predominantly forested watersheds from those with higher values of other land cover types; watersheds with higher values of turf, pervious, and peatland cover, or watersheds with higher values of impervious cover. The second principal component separated watersheds with high values of wetlands and freshwaters from those with high values of agriculture. Eastern and Western sub-region watersheds generally had higher values of wetland and freshwater cover than Bay of Fundy and Cape Breton watersheds, which generally exhibited greater proportions of agriculture (Figs. 2b, 3). Together, these axes demonstrate that land-use in the Maritimes Region is represented primarily by a gradient between forest cover and human activities, and secondarily by the variation in natural water features present on the landscape (Fig. 3).

## DISCUSSION

This collection of high-resolution maps provides quantitative measures of the spatial extent of human land-use alterations across the Maritimes Region. Collectively, the maps demonstrate an anthropogenic gradient in land use and illustrate the footprint of human settlement and activity across the broader region. While most watersheds are predominantly forested, some watersheds have high percentages of agriculture (e.g., Ga\_2, Ga\_3, P\_4) or impervious surfaces from urban development (e.g., watersheds S\_2, S\_3). Human activities that change sedimentation and pollutant run-off, in particular agriculture, forestry, and urbanization, can result in changes to freshwater and marine water quality, habitats, and fisheries (Brown et al., 2018; Breitburg et al.,

2018; Malone and Newton 2020). For example, significant negative effects on submerged aquatic vegetation (Li et al., 2007), nearshore faunal communities (Kornis et al., 2017), and freshwater stream ecosystems (Jackson et al., 2022) have been documented at 18 – 30% agricultural or developed land cover. Quantifying the spatial extent of human land-use change is thus critical to providing the baseline information necessary to determine the potential impacts of terrestrial human activities on freshwater, estuarine, and coastal and marine ecosystems.

Users of this atlas should recognize that the estimates of pervious and impervious surfaces have greater uncertainty than for other surface types. Due to data limitations, the areal extent of pervious and impervious surfaces from roofs and driveways within urban and residential areas, as well as paved and unpaved roads and trails, could be underestimated. For example, spatially explicit data delimiting roofs and driveways were not available in either province, and so we used an average area from a random subset of available residential lots (see section *Materials and Methods: Land cover*). Due to the spatial resolution of the available datasets, the estimated buffers around roads and trails are good representations for highways and other wide roadways, but are likely overestimates for smaller secondary roads and trails. Finally, classifying impervious and pervious surfaces were conducted by overlapping feature layers with aerial imagery; the resolution of air photos used to interpret and digitize these land uses varied between and within provinces. As additional spatial data improves, these estimates can be easily updated within the maps in future. Alternately, novel approaches such as using multispectral imagery could be used in future to classify impervious and pervious surfaces which would increase the accuracy of the areal estimates of these surface types.

Land-use maps form the baseline knowledge of the state of watersheds, and are key prerequisites required to estimate spatial impacts of human activities in aquatic ecosystems (Sheelanere et al., 2013). In a recent publication, Kelly et al., (2021) used the atlas to estimate nitrogen loading to the coastal zone of the Maritimes Region, as well as estimate potential impacts of eutrophication on seagrass beds in 40 embayments. These maps can also be useful for other conservation and/or planning initiatives at Fisheries and Oceans Canada and by coastal communities and municipalities, such as for the protection of fish and fish habitat including ecologically significant freshwater areas, coastal or marine conservation areas network planning, and coastal land-use planning bylaws and strategies. At a time when coastal zones are experiencing pressures from multiple human stressors (Lu et al., 2018), baseline information on the state of watersheds provides an opportunity to support land-sea conservation planning initiatives (e.g., Alvarez-Romero et al., 2015). For example, this atlas could be a useful component to support effective watershed management, and in particular for the general assessment of, and calculation of threats to, watershed health (e.g., Sterling et al., 2014). Finally, managers could use this atlas to account for human land-use activities during environmental or cumulative impact assessments on the coastal zone (e.g., Alvarez-Romero et al., 2014; Kappel et al., 2012; Murphy et al., 2019, 2022).



## ACKNOWLEDGEMENTS

We thank Rebecca Zimmerman for providing data mining and collection. We also thank Glen Herbert for providing valuable assistance and funding to access the Nova Scotia Residential Property Database (NSPRD), and Scott Coffen-Smout and Kasia Rozalska for providing reviews and comments that improved the report. Funding for this project was provided by Fisheries and Oceans Canada through a Strategic Program for Ecosystem-based Research and Advice (SPERA) grant to NEK.

## REFERENCES

- Álvarez-Romero, J.G., Wilkinson, S.N., Pressey, R.L., Ban, N.C., Kool, J. and Brodie, J. 2014. Modeling catchment nutrients and sediment loads to inform regional management of water quality in coastal-marine ecosystems: A comparison of two approaches. *J. Environ. Manage.* 146: 164-178. <https://doi.org/10.1016/j.jenvman.2014.07.007>.
- Álvarez-Romero, J.G., Pressey, R.L., Ban, N.C., and Brodie, J. 2015. Advancing land-sea conservation planning: integrating modelling of catchments, land-use change, and river plumes to prioritise catchment management and protection. *PLoS One* 10: e0145574. <https://doi.org/10.1371/journal.pone.0145574>.
- Birch, T. and Reyes, E. 2018. Forty years of coastal zone management (1975–2014): Evolving theory, policy and practice as reflected in scientific research publications. *Ocean Coast. Manag.* 153: 1-11. <https://doi.org/10.1016/j.ocecoaman.2017.12.003>.
- Breitburg, D., Levin, L.A., Oschlies, A., Grégoire, M., Chavez, F.P., Conley, D.J., Garçon, V., Gilbert, D., Gutiérrez, D., Isensee, K. and Jacinto, G.S. 2018. Declining oxygen in the global ocean and coastal waters. *Science*: 359(6371). DOI: 10.1126/science.aam7240.
- Brown, C.J., Jupiter, S.D., Albert, S., Anthony, K.R., Hamilton, R.J., Fredston-Hermann, A., Halpern, B.S., Lin, H.Y., Maina, J., Mangubhai, S. and Mumby, P.J. 2019. A guide to modelling priorities for managing land-based impacts on coastal ecosystems. *J. Appl. Ecol.* 56(5): 1106-1116. <https://doi.org/10.1111/1365-2664.13331>.
- DFO. 2009a. Does eelgrass (*Zostera marina*) meet the criteria as an ecologically significant species? DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2009/018. <https://waves-vagues.dfo-mpo.gc.ca/Library/337549.pdf>.
- DFO. 2009b. Development of a Framework and Principles for the Biogeographic Classification of Canadian Marine Areas. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2009/056. <https://waves-vagues.dfo-mpo.gc.ca/Library/338958.pdf>.
- ESRI. 2018. ArcGIS Desktop: Release 10.6. Environmental Systems Research Institute. Redlands, CA.
- ESRI. 2019. "World Imagery" [basemap]. Scale Not Given. "World Imagery Map". Dec 12, 2009. <https://www.arcgis.com/home/item.html?id=10df2279f9684e4a9f6a7f08feb2a9>.

- Guijarro-Sabaniel, J. Kelly, N.E. Land use atlas for coastal watersheds in the Maritimes Region. Published May 2022. Coastal Ecosystems Science Division, Fisheries and Oceans Canada, Dartmouth, N.S. Available from:  
<https://open.canada.ca/data/en/dataset/85d6c4c2-6683-4d56-adf4-8cacef2676be>.
- Halpern, B.S., Frazier, M., Afflerbach, J., Lowndes, J.S., Micheli, F., O'Hara, C., Scarborough, C. and Selkoe, K.A. 2019. Recent pace of change in human impact on the world's ocean. *Sci. Rep.* 9(1): 1-8. <https://doi.org/10.1038/s41598-019-47201-9>.
- Jackson, C.R., Cecala, K.K., Wenger, S.J., Kirsch, J.E., Webster, J.R., Leigh, D.S., Sanders, J.M., Love, J.P., Knoepp, J.D., Fraterrigo, J.M. and Rosemond, A.D. 2022. Distinctive connectivities of near-stream and watershed-wide land uses differentially degrade rural aquatic ecosystems. *BioScience* 72(2): 144-159. <https://doi.org/10.1093/biosci/biab098>.
- Kappel, C., Halpern, B., Napoli, N. 2012. Mapping cumulative impacts of human activities on marine ecosystems. (03.NCEAS.12) Boston: SeaPlan. Available from:  
[http://seaplan.org/wp-content/uploads/2012/01/mapping\\_cumulative\\_indicators-nceas-12.pdf](http://seaplan.org/wp-content/uploads/2012/01/mapping_cumulative_indicators-nceas-12.pdf).
- Kelly, N.E., Guijarro-Sabaniel, J., and Zimmerman, R. 2021. Anthropogenic nitrogen loading and risk of eutrophication in the coastal zone of Atlantic Canada. *Estuar. Coast. Shelf Sci.* 263: 107630. <https://doi.org/10.1016/j.ecss.2021.107630>.
- Kelly, N.E., and Guijarro-Sabaniel, J. 2022. Estimates of anthropogenic nitrogen loading and eutrophication indicators for the Bay of Fundy and Scotian Shelf. Government of Canada's Open Government Data Portal. Available from:  
<https://open.canada.ca/data/en/dataset/08746031-1970-4bf6-b6d4-3de2715c8634>.
- Kornis, M.S., Breitbart, D., Balouskus, R., Bilkovic, D.M., Davias, L.A., Giordano, S., Heggie, K., Hines, A.H., Jacobs, J.M., Jordan, T.E. and King, R.S. 2017. Linking the abundance of estuarine fish and crustaceans in nearshore waters to shoreline hardening and land cover. *Estuaries Coasts* 40: 1464-1486. <https://doi.org/10.1007/s12237-017-0213-6>.
- Li, X., Weller, D.E., Gallegos, C.L., Jordan, T.E., and Kim, H.C. 2007. Effects of watershed and estuarine characteristics on the abundance of submerged aquatic vegetation in Chesapeake Bay Subestuaries. *Estuaries Coasts* 30: 840-854. <https://doi.org/10.1007/BF02841338>.
- Lu, Y., Yuan, J., Lu, X., Su, C., Zhang, Y., Wang, C., Cao, X., Li, Q., Su, J., Ittekkot, V., Garbutt, R.A., Bush, S., Fletcher, S., Wagey, T., Kachur, A., and Sweijd, N. 2018. Major threats of pollution and climate change to global coastal ecosystems and enhanced management for sustainability. *Environ. Pollut.* 239: 670–680. <https://doi.org/10.1016/j.envpol.2018.04.016>.
- Malone, T.C., and Newton, A. 2020. The globalization of cultural eutrophication in the coastal ocean: causes and consequences. *Front. Mar. Sci.* 7: 670. <https://doi.org/10.3389/fmars.2020.00670>
- Murphy, G.E.P., Wong, M.C., and Lotze, H.K. 2019. A human impact metric for coastal ecosystems with application to seagrass beds in Atlantic Canada. *FACETS* 4: 210–237. <https://doi.org/10.1139/facets-2018-0044>.

- Murphy, G.E.P., Kelly, N.E., Lotze, H.K., and Wong, M.C. 2022. Incorporating anthropogenic thresholds to improve understanding of cumulative effects on seagrass beds. *FACETS* [accepted 05/05/2022].
- Nagel, E.J., Murphy, G., Wong, M.C., and Lotze, H.K. 2018. Nitrogen loading rates for twenty-one seagrass inhabited bays in Nova Scotia, Canada. *Can. Tech. Rep. Fish. Aquat. Sci.* 3260 v + 37. <https://waves-vagues.dfo-mpo.gc.ca/Library/4068099x.pdf>.
- R Core Team. 2021. R: A language and environment for statistical computing. Version 4.1.2. R Foundation for Statistical Computing, Vienna, Austria. URL <https://www.R-project.org/>.
- Sheelanere, P., Noble, B.F. and Patrick, R.J. 2013. Institutional requirements for watershed cumulative effects assessment and management: Lessons from a Canadian trans-boundary watershed. *Land Use Policy* 30(1): 67-75. <https://doi.org/10.1016/j.landusepol.2012.03.001>.
- Statistics Canada. 2017. Nova Scotia, New Brunswick [Province] and Canada [Country] (table). Census Profile. 2016 Census. Statistics Canada Catalogue no. 98-316-X2016001. Ottawa. Released November 29, 2017. <https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E>.
- Sterling, S.M., Garroway, K., Guan, Y., Ambrose, S.M., Horne, P. and Kennedy, G.W. 2014. A new watershed assessment framework for Nova Scotia: A high-level, integrated approach for regions without a dense network of monitoring stations. *J. Hydrol.* 519: 2596-2612. <https://doi.org/10.1016/j.jhydrol.2014.07.063>.
- Thrush, S.F., Hewitt, J.E., Gladstone-Gallagher, R.V., Savage, C., Lundquist, C., O'Meara, T., Vieillard, A., Hillman, J.R., Mangan, S., Douglas, E.J. and Clark, D.E. 2021. Cumulative stressors reduce the self-regulating capacity of coastal ecosystems. *Ecol. Appl.* 31(1): e02223. <https://doi.org/10.1002/eap.2223>.

## TABLES

Table 1. List of data sources, years of coverage, and hyperlinks (where available), used in the creation of this land use atlas. NB = New Brunswick; NS = Nova Scotia.

| Monitoring program or dataset name                | Province | Description  | Years of data coverage | Source  | Component of calculation   |
|---|----------|--|------------------------|---|--|
| Georeferenced Civic Address Data Base (GCADB)     | NB       | Includes a geo-referenced civic address database   | 2019                   | <a href="http://www.snb.ca/geonb1/e/DC/GCADB.asp">http://www.snb.ca/geonb1/e/DC/GCADB.asp</a>   | Civic addresses<br>Population density  |
| Province of Nova Scotia Geographic data directory | NS       | Physical locations which have been assigned a civic number by Municipalities and First Nations Communities.                                | 2015                   | <a href="https://data.novascotia.ca/Municipalities/Nova-Scotia-Civic-Address-File-Civic-Points/tntn-er5g">https://data.novascotia.ca/Municipalities/Nova-Scotia-Civic-Address-File-Civic-Points/tntn-er5g</a>   | Civic addresses<br>Population density  |
| NS Topographic database (NSTDB)                   | NS       | Land cover [utilities (i.e. transmission lines, tanks) and buildings (i.e. community centers, fire stations) layers]                       | 2019                   | <a href="https://data.novascotia.ca/Lands-Forests-and-Wildlife/Nova-Scotia-Topographic-DataBase-Land-Cover-Map/2mpd-kw4r">https://data.novascotia.ca/Lands-Forests-and-Wildlife/Nova-Scotia-Topographic-DataBase-Land-Cover-Map/2mpd-kw4r</a>         | Land cover: pervious surface<br>Land cover: impervious surface   |
|   |          | Water features (lakes, rivers, swamps, breakwater, wharf, canal, dam, dyke, falls, rapids, reservoirs)                                     | 2019                   | <a href="https://data.novascotia.ca/Lands-Forests-and-Wildlife/Nova-Scotia-Topographic-DataBase-Water-Features-Po/h8jb-hzrm">https://data.novascotia.ca/Lands-Forests-and-Wildlife/Nova-Scotia-Topographic-DataBase-Water-Features-Po/h8jb-hzrm</a>   | Land cover: freshwater   |
|   |          | Designated areas (parking lots, pits, campgrounds, sport fields, cemeteries, peat cutting)   | 2019                   | <a href="https://data.novascotia.ca/Lands-Forests-and-Wildlife/Nova-Scotia-Topographic-Database-Designated-Areas/ty4r-gcnk">https://data.novascotia.ca/Lands-Forests-and-Wildlife/Nova-Scotia-Topographic-Database-Designated-Areas/ty4r-gcnk</a>     | Land cover: pervious surface<br>Land cover: impervious surface<br>Land cover: turf<br>Land cover: peatland                             |
|   |          | Roads, Trails, Rails (road, trail, railroad, bridge, track)  | 2019                   | <a href="https://data.novascotia.ca/Roads-Driving-and-Transport/Nova-Scotia-Topographic-DataBase-Roads-Trails-and-/845c-gbqt">https://data.novascotia.ca/Roads-Driving-and-Transport/Nova-Scotia-Topographic-DataBase-Roads-Trails-and-/845c-gbqt</a> | Land cover: pervious surface<br>Land cover: impervious surface   |
| Forest Inventory                                  | NS       | Includes information on forest cover, wetlands, agriculture and blueberry fields, industrial areas (i.e. gravel pits, pipeline corridors). | 2016                   | <a href="https://data.novascotia.ca/Lands-Forests-and-Wildlife/Forest-Inventory/c8ai-fjbt">https://data.novascotia.ca/Lands-Forests-and-Wildlife/Forest-Inventory/c8ai-fjbt</a>   | Land cover: forest<br>Land cover: agriculture<br>Land cover: wetland<br>Land cover: pervious surface<br>Land cover: impervious surface |

| <b>Monitoring program or dataset name</b> | <b>Province</b> | <b>Description</b>   | <b>Years of data coverage</b> | <b>Source</b>   | <b>Component of calculation</b>   |
|---|-----------------|--|-------------------------------|---|---|
| Nova Scotia Protected Areas System        | NS              | Included National Parks, National Wildlife Areas, Provincial Wilderness Areas, Provincial Nature Reserves, selected Provincial Parks and selected land trust properties and easements. | 2019                          | <a href="https://data.novascotia.ca/Environment-and-Energy/The-Nova-Scotia-Protected-Areas-System/ticv-5du5">https://data.novascotia.ca/Environment-and-Energy/The-Nova-Scotia-Protected-Areas-System/ticv-5du5</a> | Land cover: parks and protected areas   |
| New Brunswick Road Network (NBRN)         | NB              | Includes road centerlines, road names, road class, surface type, address ranges and other road attributes  | 2019                          | <a href="http://www.snb.ca/geonb1/e/DC/NBRN.asp">http://www.snb.ca/geonb1/e/DC/NBRN.asp</a>   | Land cover: pervious surface<br>Land cover: impervious surface  |
| Forest                                    | NB              | Forest cover polygons interpreted from aerial imagery.   | 2017                          | <a href="http://www.snb.ca/geonb1/e/DC/forest.asp">http://www.snb.ca/geonb1/e/DC/forest.asp</a>   | Land cover: forest  |
| Non- forest                               | NB              | Non-forest cover polygons interpreted from aerial imagery (i.e. non-forest characteristics including agriculture, settlement, utility corridors, etc.)                                 | 2015                          | <a href="http://www.snb.ca/geonb1/e/DC/non-forest.asp">http://www.snb.ca/geonb1/e/DC/non-forest.asp</a>   | Land cover: agriculture<br>Land cover: pervious surface<br>Land cover: impervious surface<br>Land cover: turf |
| Wetland                                   | NB              | Provincially significant wetlands and other wetland types (i.e. coastal wetlands, unique forested wetlands, floodplain wetlands, aquatic bed, bog, fen, shrub, freshwater marsh).      | 2011                          | <a href="http://www.snb.ca/geonb1/e/DC/RW.asp">http://www.snb.ca/geonb1/e/DC/RW.asp</a>   | Land cover: wetland<br>Land cover: freshwater   |
| Peatland                                  | NB              | Polygons that depict the perimeter of individual peatlands.  | 2013                          | <a href="http://www.snb.ca/geonb1/e/DC/peat.asp">http://www.snb.ca/geonb1/e/DC/peat.asp</a>   | Land cover: peatland  |
| Pipelines                                 | NB              | Approximate centerline location of major energy transmission pipelines including the name of each pipeline.  | 2013                          | <a href="http://www.snb.ca/geonb1/e/DC/pipeline.asp">http://www.snb.ca/geonb1/e/DC/pipeline.asp</a>   | Land cover: impervious surface  |
| Federal Parks and Protected Areas         | NB              | The administrative boundaries (exterior limits) of National Parks in New Brunswick   | 2012                          | <a href="http://www.snb.ca/geonb1/e/DC/FFPPA.asp">http://www.snb.ca/geonb1/e/DC/FFPPA.asp</a>   | Land cover: parks and protected areas   |

| <b>Monitoring program or dataset name</b>  | <b>Province</b> | <b>Description</b>  | <b>Years of data coverage</b> | <b>Source</b>   | <b>Component of calculation</b>  |
|--|-----------------|---|-------------------------------|---|--|
| Provincial Parks   | NB              | Polygons representing the limits of the provincial parks in New Brunswick   | 2019                          | <a href="http://www.snb.ca/geonb1/e/DC/ProParks.asp">http://www.snb.ca/geonb1/e/DC/ProParks.asp</a>   | Land cover: parks and protected areas  |
| National Hydro Network (NHN)   | NB, NS          | Geometric description and basic attributes describing Canada's inland surface waters. It provides geospatial digital data for lakes, reservoirs, watercourses (rivers and streams), canals, islands, drainage linear network, toponyms or geographical names, constructions and obstacles related to surface waters, etc. |                               | <a href="https://open.canada.ca/data/en/dataset/a4b190fe-e090-4e6d-881e-b87956c07977">https://open.canada.ca/data/en/dataset/a4b190fe-e090-4e6d-881e-b87956c07977</a> | Watershed boundaries<br>Location of pour points  |
| New Brunswick Hydrographic Network (NBHN)  | NB              | Surface drainage features including rivers, streams, lakes, islands, and watershed boundaries including names for many rivers and streams.  | 2018                          | <a href="http://www.snb.ca/geonb1/e/DC/NBHN.asp">http://www.snb.ca/geonb1/e/DC/NBHN.asp</a>   | Land cover: freshwater   |
| Canadian Digital Elevation Model Mosaic  | NB              | The Canadian Digital Elevation Model (CDEM) is part of Natural Resources Canada's altimetry system designed to better meet the users' needs for elevation data and products.  | 2011                          | <a href="https://open.canada.ca/data/en/dataset/7f245e4d-76c2-4caa-951a-45d1d2051333">https://open.canada.ca/data/en/dataset/7f245e4d-76c2-4caa-951a-45d1d2051333</a> | Watershed boundaries<br>Location of pour points  |
| DP ME 55, Version 2, 2006, Enhanced Digital Elevation Model, Nova Scotia, Canada | NS              | This digital product consists of a hydrologically correct 20m Digital Elevation Model for the province of Nova Scotia.  | 1986-1999                     | <a href="https://novascotia.ca/natr/meb/download/dp055.asp">https://novascotia.ca/natr/meb/download/dp055.asp</a>   | Watershed boundaries<br>Location of pour points  |
| Property Assessment Map  | NB              | Provides a digital representation of the property assessment parcels.   | 2019                          | <a href="http://www.snb.ca/geonb1/e/DC/propmap.asp">http://www.snb.ca/geonb1/e/DC/propmap.asp</a>   | Residential lot size<br>Land cover: turf<br>Land cover: pervious surface<br>Land cover: impervious surface |
| Digital Property Map   | NB              | Includes approximate boundaries for all land parcels.   | 2019                          | <a href="http://www.snb.ca/geonb1/e/DC/DPM.asp">http://www.snb.ca/geonb1/e/DC/DPM.asp</a>   | Residential lot size<br>Land cover: turf   |

| Monitoring program or dataset name            | Province | Description      | Years of data coverage | Source  | Component of calculation   |
|---|----------|------------------|------------------------|---|--|
| Nova Scotia Property Records Database (NSPRD) | NS       | Property parcels | 2020                   | <a href="https://novascotia.ca/sns/access/land/property-online.asp">https://novascotia.ca/sns/access/land/property-online.asp</a> | Land cover: pervious surface<br>Land cover: impervious surface<br>Residential lot size<br>Land cover: turf<br>Land cover: pervious surface<br>Land cover: impervious surface |

Table 2. Total area and areal values of 8 land cover types in 109 coastal watersheds in the Maritimes Region. All area values are given in hectares (ha). The corresponding figure number for each land use map is also listed.

| <b>Watershed ID*</b> | <b>Total Area**</b> | <b>Agriculture</b> | <b>Forest</b> | <b>Impervious</b> | <b>Pervious</b> | <b>Peatland</b> | <b>Turf</b> | <b>Wetland</b> | <b>Freshwater</b> | <b>Fig. no.</b> |
|----------------------|---------------------|--------------------|---------------|-------------------|-----------------|-----------------|-------------|----------------|-------------------|-----------------|
| A_1                  | 175819              | 17979.59           | 133468.4      | 1005.32           | 4842.67         | 54.04           | 831.12      | 8919.85        | 7391.94           | Fig. 5          |
| A_2                  | 43215               | 3075.77            | 37330.79      | 186.82            | 998.42          | 0               | 174.21      | 613.77         | 260.02            | Fig. 6          |
| Av_1                 | 130674              | 9529.45            | 102176.7      | 598.79            | 3995.87         | 0               | 723.92      | 5467.82        | 6760.27           | Fig. 7          |
| Br_1                 | 47091               | 778.27             | 42186.24      | 366.4             | 965.13          | 0               | 24.04       | 1923.31        | 307.91            | Fig. 102        |
| Br_10                | 12911               | 116.33             | 11064.92      | 50.16             | 545.4           | 0               | 10.47       | 753.78         | 168.31            | Fig. 111        |
| Br_11                | 10726               | 156.75             | 9255.98       | 67.84             | 310.38          | 0               | 12.27       | 538.64         | 104.06            | Fig. 112        |
| Br_2                 | 46905               | 900.8              | 39179.51      | 490.59            | 1640.27         | 0               | 93.39       | 3073.2         | 974.7             | Fig. 103        |
| Br_3                 | 46701               | 919.52             | 40892.77      | 153.72            | 1532.16         | 0               | 15.9        | 2106.47        | 539.94            | Fig. 104        |
| Br_4                 | 37114               | 531.52             | 32635.15      | 123.35            | 681.05          | 0               | 85.8        | 1882.4         | 504.85            | Fig. 105        |
| Br_5                 | 24037               | 504.26             | 19997.34      | 133.62            | 694.56          | 0               | 22.28       | 1139.4         | 546.35            | Fig. 106        |
| Br_6                 | 23403               | 916.05             | 20642.88      | 105.99            | 535.62          | 0               | 36.11       | 675.28         | 128.26            | Fig. 107        |
| Br_7                 | 19115               | 1602.65            | 14633.9       | 187.04            | 610.99          | 0               | 51.13       | 480.98         | 196.36            | Fig. 108        |
| Br_8                 | 16602               | 180.78             | 14380.34      | 85.91             | 583.78          | 0               | 89.48       | 739.38         | 340.42            | Fig. 109        |
| Br_9                 | 14435               | 106.32             | 12521.06      | 48.99             | 242.39          | 0               | 8.01        | 832.73         | 318.54            | Fig. 110        |
| Ca_1                 | 113379              | 1349.51            | 86558.02      | 420.97            | 3240.29         | 0               | 411.05      | 12643.85       | 7927.64           | Fig. 113        |
| Ca_2                 | 47822               | 93.89              | 33449.14      | 299.88            | 467.27          | 0               | 26.76       | 9721.49        | 4239.74           | Fig. 114        |
| Ca_3                 | 40238               | 1327.32            | 25408.99      | 843.54            | 3627.39         | 0               | 614.83      | 2729.67        | 1608.5            | Fig. 115        |
| Ca_4                 | 21751               | 333.45             | 13997.72      | 288.65            | 1682.33         | 0               | 414         | 3061.08        | 867.66            | Fig. 116        |
| Cl_1                 | 85688               | 106.38             | 67269.69      | 155.23            | 817.67          | 0               | 91.36       | 13483.73       | 4806.54           | Fig. 70         |
| Cl_2                 | 57403               | 68.51              | 38983.62      | 340.03            | 1388.85         | 0               | 423.89      | 12331.33       | 3819.33           | Fig. 71         |
| E_1                  | 49428               | 2101.36            | 43725.53      | 74.17             | 925.99          | 0               | 46.65       | 1846.1         | 284.41            | Fig. 8          |
| E_2                  | 27808               | 2649.7             | 22714.03      | 86.45             | 717.98          | 0               | 72.42       | 728.56         | 180.98            | Fig. 9          |
| EW_1                 | 63772               | 16.17              | 51760.96      | 88.68             | 901.03          | 0               | 46.51       | 6509.25        | 5115.85           | Fig. 52         |
| EW_2                 | 41074               | 5.35               | 33150.16      | 663.42            | 585.97          | 0               | 19.81       | 3946.99        | 2832.08           | Fig. 53         |
| G_1                  | 42702               | 422.18             | 36898.4       | 127.41            | 922.95          | 0               | 161.59      | 2516.14        | 1874.3            | Fig. 72         |
| G_2                  | 41647               | 1494.3             | 30637.13      | 678.08            | 1749.56         | 0               | 476.57      | 2637.32        | 3473.05           | Fig. 73         |
| G_3                  | 22600               | 178.3              | 19090.74      | 214.73            | 824.75          | 0               | 320.38      | 863.84         | 770.84            | Fig. 74         |



| <b>Watershed ID*</b> | <b>Total Area**</b> | <b>Agriculture</b> | <b>Forest</b> | <b>Impervious</b> | <b>Pervious</b> | <b>Peatland</b> | <b>Turf</b> | <b>Wetland</b> | <b>Freshwater</b> | <b>Fig. no.</b> |
|----------------------|---------------------|--------------------|---------------|-------------------|-----------------|-----------------|-------------|----------------|-------------------|-----------------|
| Ga_1                 | 53474               | 3111.02            | 39748.45      | 186.73            | 1145.85         | 0               | 125.07      | 3774.24        | 5727.48           | Fig. 10         |
| Ga_2                 | 43663               | 16513.13           | 18275.78      | 805.98            | 2407.86         | 223.53          | 941         | 1769.77        | 366               | Fig. 11         |
| Ga_3                 | 36577               | 7748.01            | 25959.16      | 231.4             | 1025.1          | 0               | 177.46      | 534.57         | 72.6              | Fig. 12         |
| K_1                  | 48323               | 4406.32            | 38137.71      | 145.38            | 1174.49         | 127.94          | 69.74       | 3856.38        | 216.01            | Fig. 13         |
| K_2                  | 39284               | 2980.85            | 33252.75      | 90.5              | 795.19          | 0               | 59.45       | 1700.92        | 234.49            | Fig. 14         |
| K_3                  | 23653               | 1422.53            | 19551.49      | 76.99             | 401.43          | 0               | 46.61       | 2356.48        | 136.27            | Fig. 15         |
| L_1                  | 58438               | 9.62               | 46540.22      | 179.37            | 622.92          | 0               | 25.19       | 8365.64        | 2890.24           | Fig. 54         |
| L_2                  | 41752               | 7.71               | 34296.4       | 103.45            | 509.62          | 0               | 33.23       | 3981.23        | 2705.2            | Fig. 55         |
| L_3                  | 15025               | 0                  | 12317.22      | 33.54             | 155.92          | 0               | 18.13       | 1353.18        | 1016.4            | Fig. 56         |
| La_1                 | 168778              | 4123.04            | 139176.8      | 770.18            | 4415.31         | 0               | 942.48      | 10499.01       | 9465.89           | Fig. 75         |
| LK_1                 | 616388              | 36647.53           | 481126.7      | 4400.61           | 29909.07        | 1013.74         | 4733.43     | 24116.55       | 29477.61          | Fig. 27         |
| M_01                 | 197291              | 5750.56            | 162306.9      | 458.11            | 3130.64         | 0               | 377.72      | 12351.16       | 9307.2            | Fig. 28         |
| M_02                 | 47344               | 1866.86            | 39498.49      | 126.14            | 962.05          | 0               | 38.06       | 3573.3         | 466.62            | Fig. 29         |
| M_03                 | 34090               | 186.77             | 28316.76      | 101.03            | 821.46          | 0               | 46.17       | 2122.62        | 2115.06           | Fig. 30         |
| M_04                 | 24202               | 114.27             | 19409.06      | 108.62            | 480.08          | 0               | 19.65       | 2087.31        | 1616.11           | Fig. 31         |
| M_05                 | 23756               | 5.57               | 18303.15      | 78.68             | 760.79          | 82.09           | 13.07       | 2207.11        | 2164.46           | Fig. 32         |
| M_06                 | 15670               | 160.73             | 13279.33      | 30.53             | 291.14          | 0               | 9.85        | 1084.7         | 558.22            | Fig. 33         |
| M_07                 | 15436               | 1028.56            | 12091.1       | 123.88            | 685.25          | 0               | 30.77       | 968.39         | 153.88            | Fig. 34         |
| M_08                 | 14156               | 64.99              | 10806.11      | 222.3             | 736.45          | 0               | 206.63      | 1000.52        | 151.65            | Fig. 35         |
| M_09                 | 10522               | 182.2              | 8276.65       | 114.64            | 652             | 0               | 138.68      | 303.31         | 783.16            | Fig. 36         |
| M_10                 | 3954                | 7.13               | 2839.41       | 83.1              | 322.13          | 0               | 110.52      | 421.02         | 51.24             | Fig. 37         |
| M_11                 | 3204                | 0.94               | 2518.01       | 51.37             | 225.35          | 0               | 38.53       | 166.64         | 24.21             | Fig. 38         |
| Med_1                | 166219              | 1479.2             | 136806.6      | 392.5             | 3175.32         | 0               | 213.71      | 12570.39       | 13806.41          | Fig. 76         |
| Med_2                | 28182               | 997.86             | 21002.84      | 305.82            | 1002.36         | 3.47            | 165.34      | 1765.97        | 2596.2            | Fig. 77         |
| Mer_1                | 204523              | 292.49             | 152098.4      | 228.2             | 1983.01         | 8.85            | 97.88       | 23162.84       | 30042.95          | Fig. 78         |
| Mer_2                | 66177               | 84.65              | 52125.14      | 124.6             | 836.14          | 37.2            | 64.76       | 13194.25       | 1112.23           | Fig. 79         |
| Mer_3                | 40425               | 5.87               | 32551.18      | 436.93            | 563.86          | 0               | 69.92       | 6486.86        | 1413.06           | Fig. 80         |
| Met_1                | 36923               | 826.63             | 28665.28      | 315.52            | 1346.57         | 0               | 247.98      | 3780.01        | 2475.28           | Fig. 16         |
| Met_2                | 32474               | 824.62             | 24615.83      | 129.3             | 748.97          | 0               | 92.7        | 3001.65        | 3639.65           | Fig. 81         |
| M-P_1                | 85615               | 3883.5             | 73763.45      | 189.97            | 1703.77         | 0               | 175.84      | 5078.11        | 283.59            | Fig. 17         |

| <b>Watershed ID*</b> | <b>Total Area**</b> | <b>Agriculture</b> | <b>Forest</b> | <b>Impervious</b> | <b>Pervious</b> | <b>Peatland</b> | <b>Turf</b> | <b>Wetland</b> | <b>Freshwater</b> | <b>Fig. no.</b> |
|----------------------|---------------------|--------------------|---------------|-------------------|-----------------|-----------------|-------------|----------------|-------------------|-----------------|
| Mus_1                | 83655               | 5219.83            | 64836.42      | 483.22            | 1766.99         | 0               | 302.73      | 6825.13        | 4483.58           | Fig. 57         |
| Mus_2                | 44014               | 161.98             | 32290.5       | 732.03            | 2110.81         | 0               | 2515.16     | 3372.15        | 2899.4            | Fig. 58         |
| Mus_3                | 22625               | 54.98              | 14767.56      | 237.62            | 1109.93         | 0               | 235.07      | 1710.44        | 3597.25           | Fig. 59         |
| NH_1                 | 44347               | 6.86               | 26560.89      | 9159.58           | 472.71          | 0               | 109.33      | 4222.96        | 3096.05           | Fig. 60         |
| NH_2                 | 37413               | 227.11             | 31652.03      | 887.44            | 737.38          | 0               | 21.5        | 2568.73        | 1867.1            | Fig. 61         |
| NH_3                 | 25478               | 0                  | 18275.85      | 2541.16           | 225.36          | 0               | 11.21       | 2477.86        | 1960.33           | Fig. 62         |
| P_1                  | 199768              | 17586.98           | 154169.5      | 2691.1            | 11534.09        | 0               | 4618.11     | 4720.1         | 1067.6            | Fig. 39         |
| P_2                  | 44951               | 5175.78            | 34489.03      | 291.89            | 1924.65         | 0               | 483.02      | 1310.34        | 182.57            | Fig. 40         |
| P_3                  | 33302               | 6117.18            | 22412.06      | 229.33            | 1293.98         | 0               | 538.77      | 2062           | 443.36            | Fig. 41         |
| P_4                  | 11833               | 3032.49            | 6271.54       | 27.06             | 181.9           | 0               | 31.76       | 1217.63        | 369.53            | Fig. 42         |
| Ph_1                 | 69695               | 6649.71            | 55212.54      | 318.49            | 1870.85         | 0               | 235.53      | 4130.61        | 810               | Fig. 18         |
| Ph_2                 | 59152               | 4404.41            | 49275.3       | 92.04             | 867.9           | 0               | 46.7        | 3892.55        | 556.71            | Fig. 19         |
| Ph_3                 | 21763               | 3163.16            | 10832.78      | 156.25            | 629.15          | 0               | 236.11      | 5093.84        | 987.38            | Fig. 20         |
| PW_1                 | 49164               | 102.64             | 46575.86      | 114.71            | 311.3           | 0               | 24.43       | 1093.21        | 413.15            | Fig. 43         |
| PW_2                 | 45387               | 2844.36            | 38342.26      | 139.28            | 592.27          | 0               | 154.25      | 2175.62        | 488.34            | Fig. 44         |
| PW_3                 | 30103               | 277.01             | 23698.56      | 220.45            | 1244.36         | 0               | 206.41      | 2075.54        | 1964.11           | Fig. 45         |
| PW_4                 | 26200               | 5.19               | 25194.37      | 21.96             | 67.22           | 0               | 0           | 254.74         | 132.07            | Fig. 46         |
| PW_5                 | 22447               | 88.86              | 21320.75      | 57.98             | 298.23          | 0               | 46.94       | 146.47         | 84.8              | Fig. 47         |
| PW_6                 | 19762               | 567.13             | 17085.8       | 156.85            | 560.46          | 0               | 118.97      | 751.63         | 153.79            | Fig. 48         |
| R_1                  | 83886               | 65.16              | 66938.15      | 348.6             | 1029.21         | 0               | 146.14      | 10879.47       | 4988.62           | Fig. 82         |
| R_2                  | 57158               | 8.92               | 46061.2       | 52.22             | 538.25          | 0               | 25.81       | 8156.65        | 3932.98           | Fig. 83         |
| Ri_1                 | 30982               | 210.3              | 23322.77      | 77.59             | 875.51          | 0               | 26.1        | 3776.72        | 2517.69           | Fig. 99         |
| Ri_2                 | 16379               | 127.43             | 13115.93      | 90.67             | 581.36          | 0               | 25.28       | 1459.49        | 472.25            | Fig. 100        |
| Ri_3                 | 11315               | 152.36             | 7386.85       | 123.21            | 570.37          | 0               | 89.07       | 1568.79        | 755.95            | Fig. 101        |
| S_1                  | 39876               | 10.98              | 30065.31      | 1034.52           | 1778.15         | 0               | 705.04      | 2016.3         | 3170.3            | Fig. 84         |
| S_2                  | 31036               | 50.66              | 14528.98      | 2226.37           | 2586.21         | 0               | 2832.59     | 1647.77        | 1580.8            | Fig. 85         |
| S_3                  | 20781               | 17.18              | 15479.27      | 595.09            | 742.46          | 0               | 290.47      | 1351.04        | 1854.78           | Fig. 86         |
| Sa_1                 | 81737               | 7241.95            | 62730.06      | 581.63            | 3806.19         | 0               | 656.13      | 2911.03        | 428.55            | Fig. 21         |
| Sa_2                 | 40006               | 3771.57            | 31499.59      | 203.31            | 1649.24         | 0               | 112.8       | 1653.5         | 407.67            | Fig. 22         |
| SC_4                 | 19919               | 1512.8             | 15548.29      | 179.49            | 1059.82         | 0               | 277.05      | 728.9          | 214.9             | Fig. 49         |

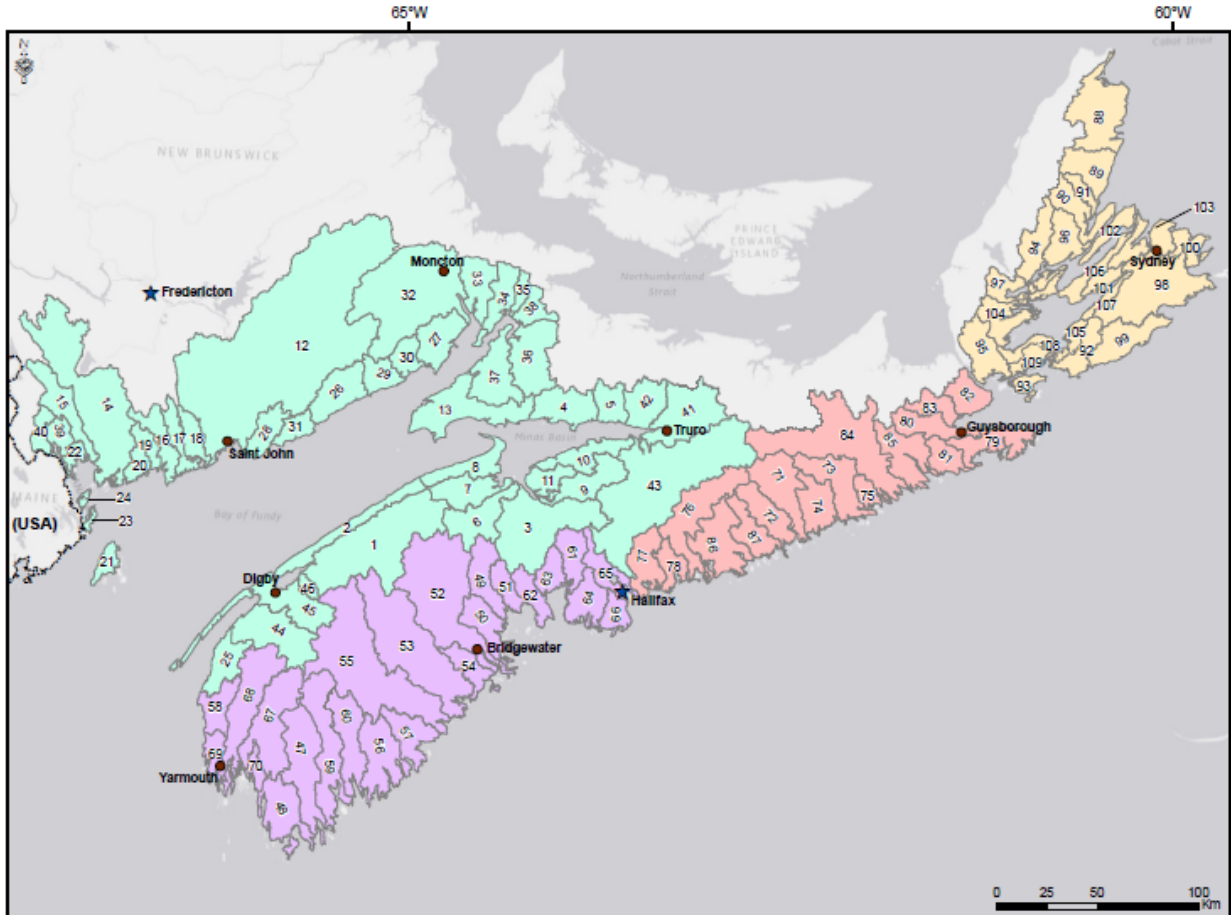
| Watershed ID* | Total Area** | Agriculture | Forest   | Impervious | Pervious | Peatland | Turf    | Wetland  | Freshwater | Fig. no. |
|---------------|--------------|-------------|----------|------------|----------|----------|---------|----------|------------|----------|
| SC_6          | 16654        | 1344.24     | 12008.83 | 224.1      | 1051.74  | 85.53    | 331     | 1168.66  | 249.25     | Fig. 50  |
| SF_1          | 31986        | 431.21      | 25851.11 | 250.03     | 466.22   | 0        | 33.17   | 3283.88  | 1409.75    | Fig. 63  |
| SF_2          | 23944        | 453.5       | 19986.45 | 58.64      | 642.48   | 0        | 73.96   | 1351.74  | 1090.46    | Fig. 64  |
| Sh_1          | 255974       | 19620.64    | 196398.5 | 2265.71    | 6555.6   | 8.85     | 2027.64 | 15056.84 | 7888.75    | Fig. 23  |
| Si_1          | 90236        | 871.9       | 74682.15 | 358.83     | 1656.88  | 0        | 132.34  | 5761.46  | 6399.89    | Fig. 24  |
| Si_2          | 55962        | 1421.1      | 46810.02 | 259.42     | 1278.3   | 0        | 215.35  | 1992.06  | 3153.05    | Fig. 25  |
| Si_3          | 7771         | 373.2       | 6533.78  | 46.18      | 206.2    | 0        | 26.24   | 329.95   | 129.85     | Fig. 26  |
| SM_1          | 33956        | 10.3        | 25933.86 | 253.72     | 1466.13  | 0        | 325.99  | 1289.46  | 3848.87    | Fig. 87  |
| SM_2          | 26232        | 75.18       | 21553.77 | 278.38     | 764.56   | 0        | 157.63  | 1430.44  | 1740.2     | Fig. 88  |
| SM_3          | 23526        | 1.17        | 19991.44 | 57.05      | 638.08   | 0        | 91.93   | 995.79   | 1772.99    | Fig. 89  |
| SMa_1         | 156330       | 2137.04     | 133181.6 | 204.28     | 2335.05  | 0        | 90.23   | 13006.17 | 5292.91    | Fig. 65  |
| SW_1          | 55460        | 423.67      | 44970.11 | 170.02     | 962.8    | 37.2     | 81.97   | 6954.23  | 1963.15    | Fig. 66  |
| T_1           | 68015        | 11.01       | 54159.45 | 179.47     | 763.03   | 0        | 126.91  | 5485.99  | 7089.5     | Fig. 67  |
| T_2           | 36761        | 17.6        | 28416.78 | 785.2      | 500.02   | 0        | 34.41   | 3188.01  | 3828.85    | Fig. 68  |
| Tu_1          | 87917        | 344.96      | 70082.7  | 243.65     | 1091.95  | 0        | 60.3    | 8431.57  | 8767.19    | Fig. 90  |
| Tu_2          | 86803        | 760.44      | 68471.35 | 877.45     | 1775.39  | 0        | 194.87  | 8380.85  | 7443.64    | Fig. 91  |
| Tu_3          | 21476        | 1796.61     | 12359.91 | 325.63     | 1199.83  | 0        | 536.61  | 2746.5   | 1125.84    | Fig. 92  |
| Tu_4          | 12236        | 84.34       | 8550.14  | 64.87      | 241.68   | 0        | 33.89   | 2180.2   | 907.8      | Fig. 93  |
| Vi_1          | 85750        | 167.62      | 69720.64 | 2357.43    | 775.72   | 0        | 178.96  | 10529.89 | 1506.36    | Fig. 95  |
| Vi_2          | 42245        | 43.4        | 32801.75 | 121.05     | 683.26   | 0        | 11.91   | 6398.98  | 2031.19    | Fig. 96  |
| Vi_3          | 40238        | 79.93       | 36078.79 | 104.77     | 704.03   | 0        | 8.77    | 2677.51  | 356.74     | Fig. 97  |
| Vi_4          | 13181        | 9.56        | 11531.33 | 13.02      | 114.82   | 0        | 7.39    | 1257.42  | 204.09     | Fig. 98  |

\* Watershed IDs from the Cape Breton Island sub-region have been changed from those used in Kelly et al., (2021). See Appendix for details.

\*\* Due to variations in spatial resolution among datasets, the total area of each watershed may be slightly lower or higher than the sum of its components.

# FIGURES

## Watershed Region



| Bay of Fundy         |            |           | Western              |           | Eastern              |          | Cape Breton Island   |             |
|----------------------|------------|-----------|----------------------|-----------|----------------------|----------|----------------------|-------------|
| Label / Watershed ID |            |           | Label / Watershed ID |           | Label / Watershed ID |          | Label / Watershed ID |             |
| 1 / A_1              | 17 / M_04  | 33 / P_2  | 47 / Cl_1            | 63 / SM_3 | 71 / EW_1            | 87 / T_2 | 88 / Vi_1            | 104 / Br_3  |
| 2 / A_2              | 18 / M_05  | 34 / P_3  | 48 / Cl_2            | 64 / S_1  | 72 / EW_2            |          | 89 / Vi_2            | 105 / Br_10 |
| 3 / Av_1             | 19 / M_06  | 35 / P_4  | 49 / G_1             | 65 / S_2  | 73 / L_1             |          | 90 / Vi_3            | 106 / Br_5  |
| 4 / E_1              | 20 / M_07  | 36 / Ph_1 | 50 / G_2             | 66 / S_3  | 74 / L_2             |          | 91 / Vi_4            | 107 / Br_11 |
| 5 / E_2              | 21 / M_08  | 37 / Ph_2 | 51 / G_3             | 67 / Tu_1 | 75 / L_3             |          | 92 / Ri_1            | 108 / Br_8  |
| 6 / Ga_1             | 22 / M_09  | 38 / Ph_3 | 52 / La_1            | 68 / Tu_2 | 76 / Mus_1           |          | 93 / Ri_3            | 109 / Ri_2  |
| 7 / Ga_2             | 23 / M_10  | 39 / SC_4 | 53 / Med_1           | 69 / Tu_3 | 77 / Mus_2           |          | 94 / Br_1            |             |
| 8 / Ga_3             | 24 / M_11  | 40 / SC_6 | 54 / Med_2           | 70 / Tu_4 | 78 / Mus_3           |          | 95 / Br_2            |             |
| 9 / K_1              | 25 / Met_1 | 41 / Sa_1 | 55 / Mer_1           |           | 79 / NH_1            |          | 96 / Br_4            |             |
| 10 / K_2             | 26 / PW_1  | 42 / Sa_2 | 56 / Mer_2           |           | 80 / NH_2            |          | 97 / Br_6            |             |
| 11 / K_3             | 27 / PW_2  | 43 / Sh_1 | 57 / Mer_3           |           | 81 / NH_3            |          | 98 / Ca_1            |             |
| 12 / LK_1            | 28 / PW_3  | 44 / Si_1 | 58 / Met_2           |           | 82 / SF_1            |          | 99 / Ca_2            |             |
| 13 / M-P_1           | 29 / PW_4  | 45 / Si_2 | 59 / R_1             |           | 83 / SF_2            |          | 100 / Ca_4           |             |
| 14 / M_01            | 30 / PW_5  | 46 / Si_3 | 60 / R_2             |           | 84 / SMa_1           |          | 101 / Br_8           |             |
| 15 / M_02            | 31 / PW_6  |           | 61 / SM_1            |           | 85 / SW_1            |          | 102 / Br_7           |             |
| 16 / M_03            | 32 / P_1   |           | 62 / SM_2            |           | 86 / T_1             |          | 103 / Ca_3           |             |

Figure 1. Map of 109 coastal watersheds in the Maritimes Region, separated into four sub-regions.

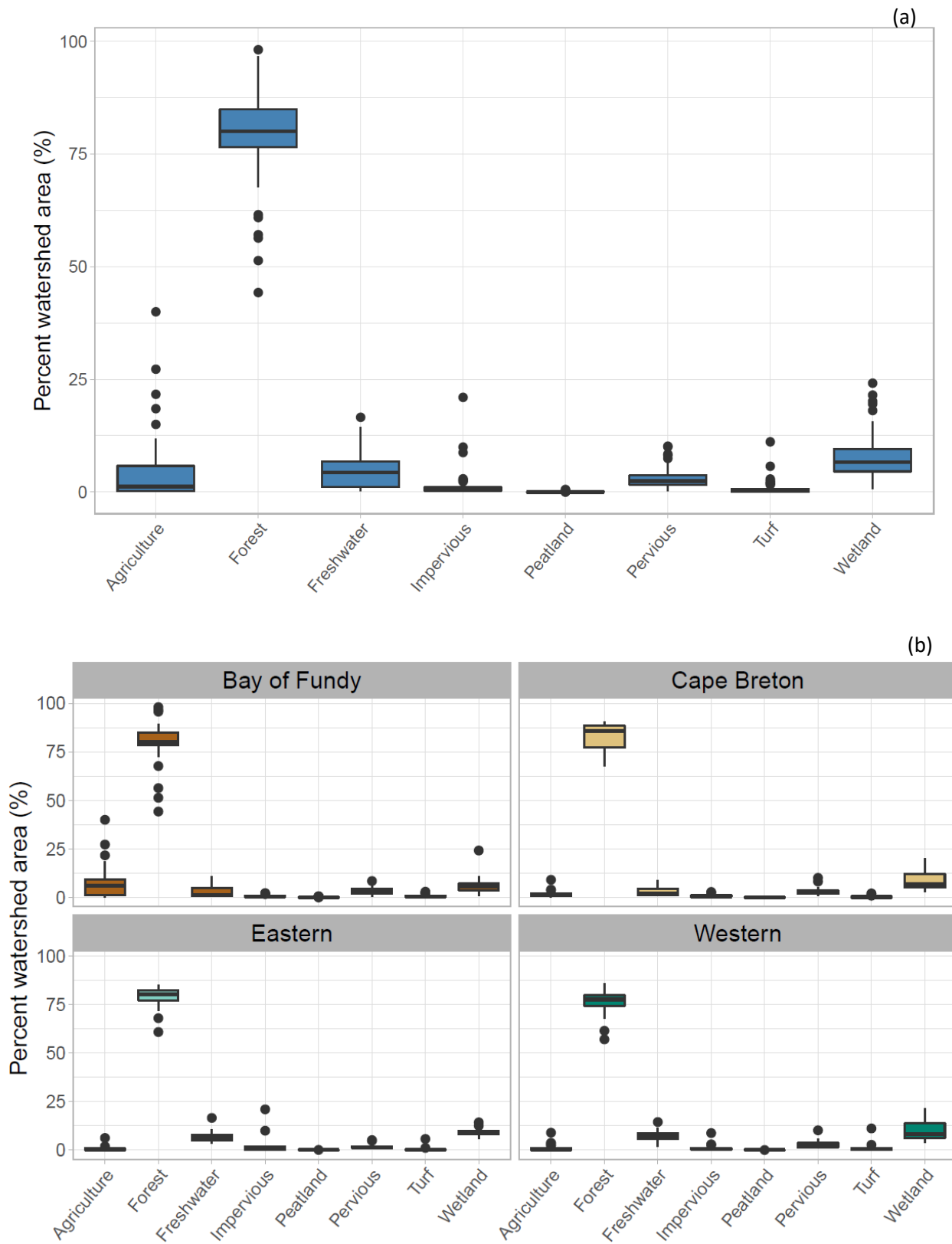


Figure 2. The percent contribution to total watershed area across land cover types for (a) all watersheds, and (b) all watersheds within each sub-region.

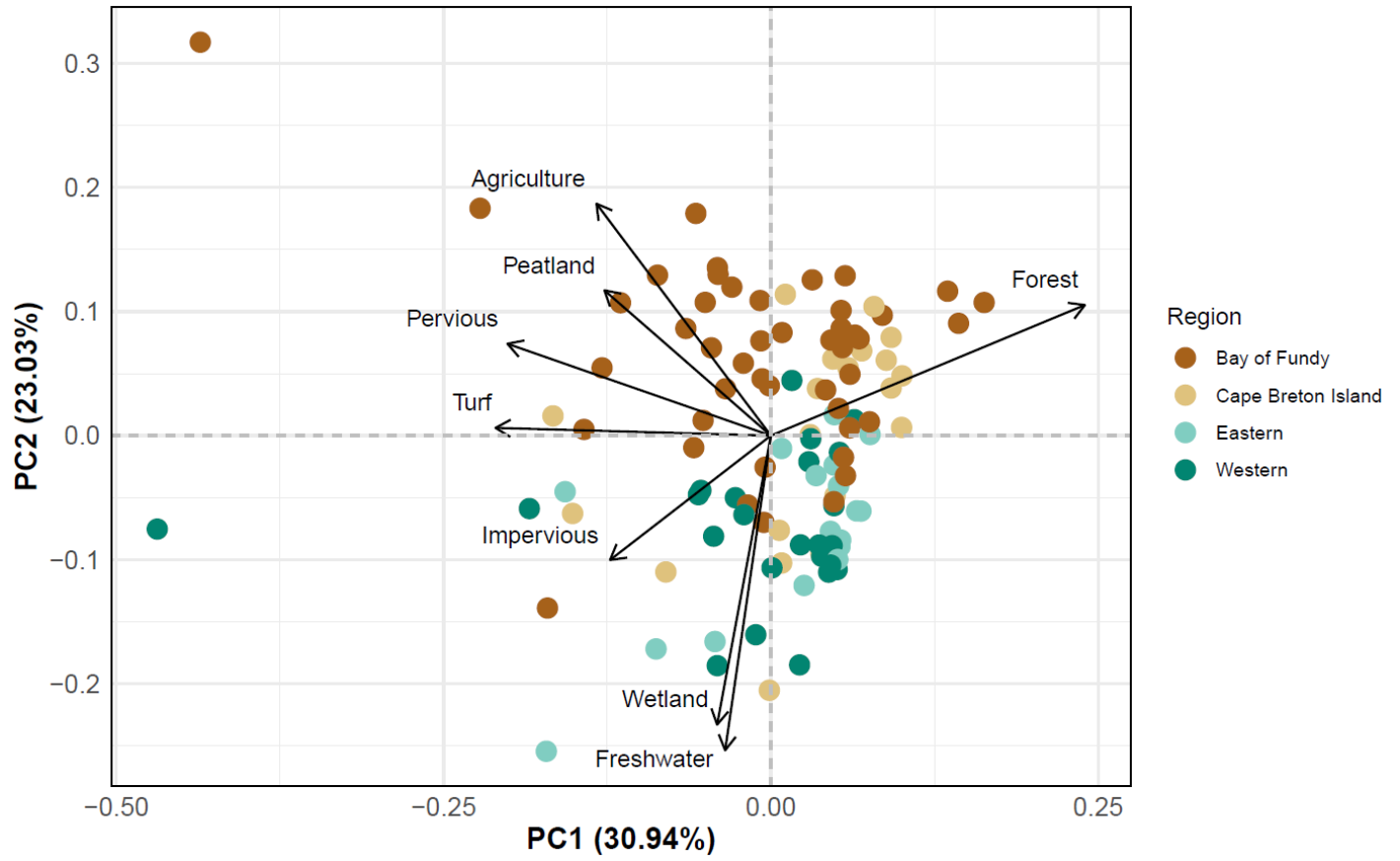


Figure 3. PCA biplot of percentage land use cover in 109 coastal watersheds.

BAY OF FUNDY SUB-REGION MAPS

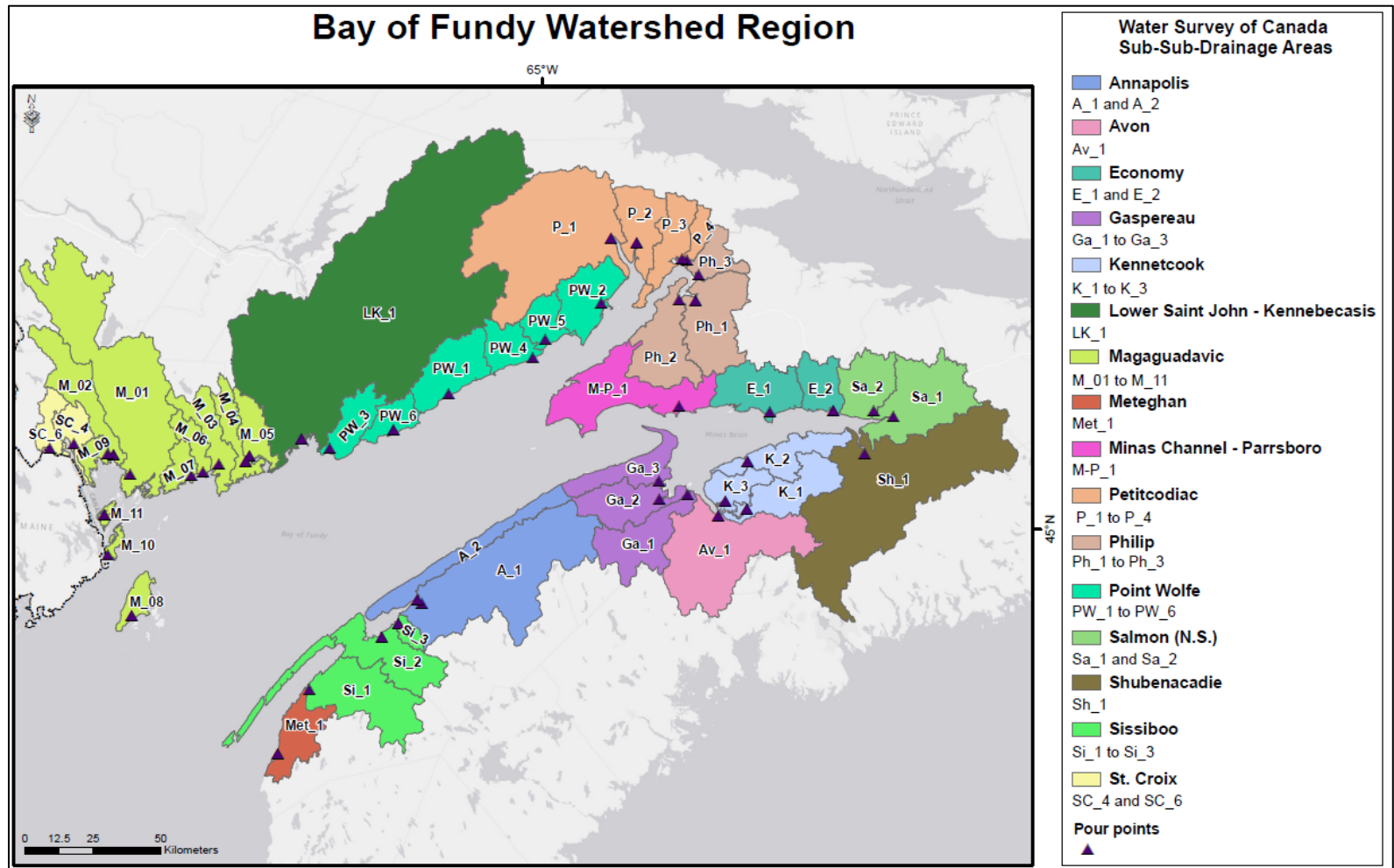


Figure 4. Bay of Fundy sub-region, displaying sixteen Water Survey of Canada sub-sub-drainage areas (denoted by differing colours) and their associated watersheds. Black triangles represent the major pour points (largest outlets into the coastal zone).

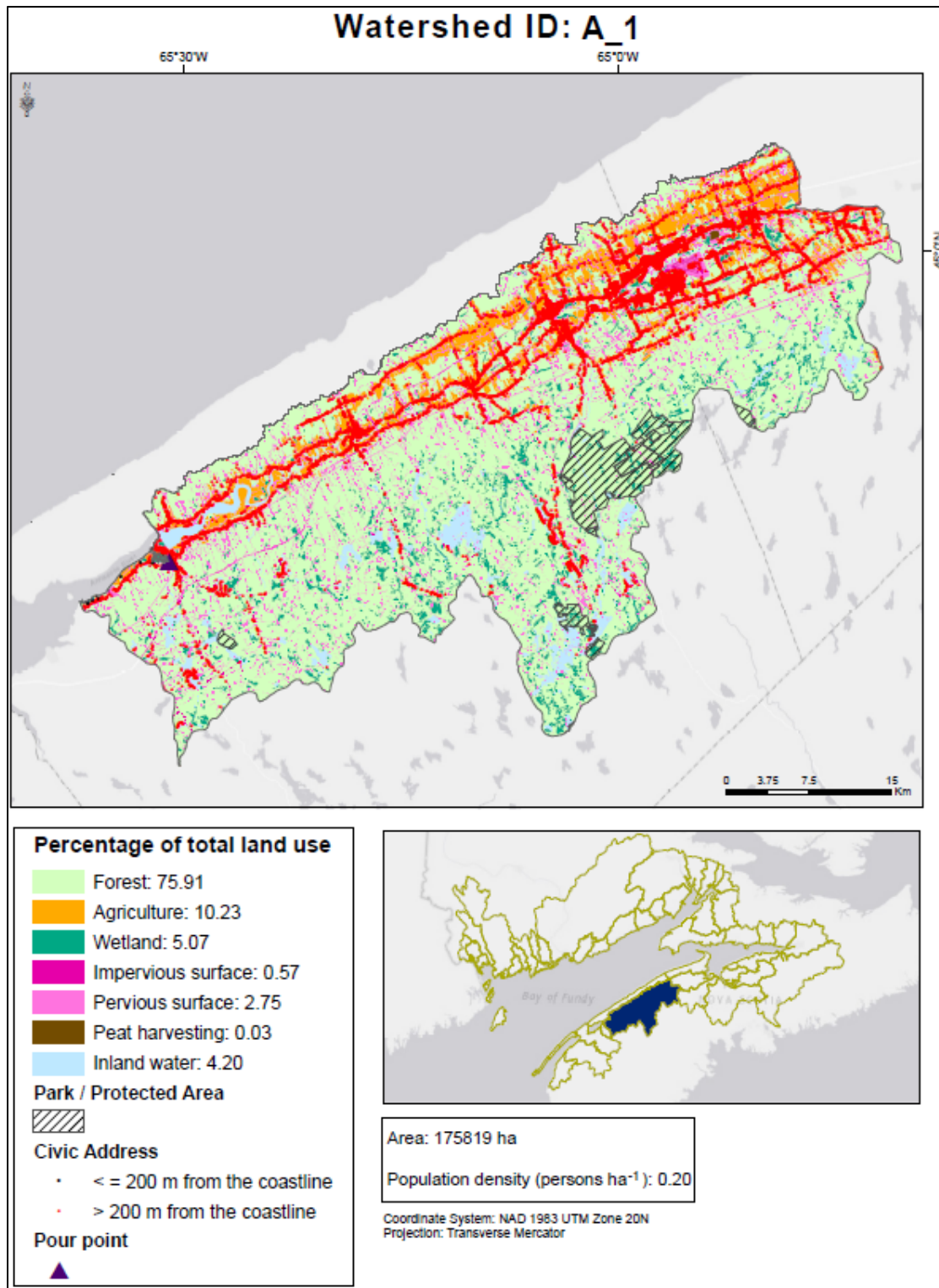


Figure 5. Land-use map for Annapolis watershed A\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).





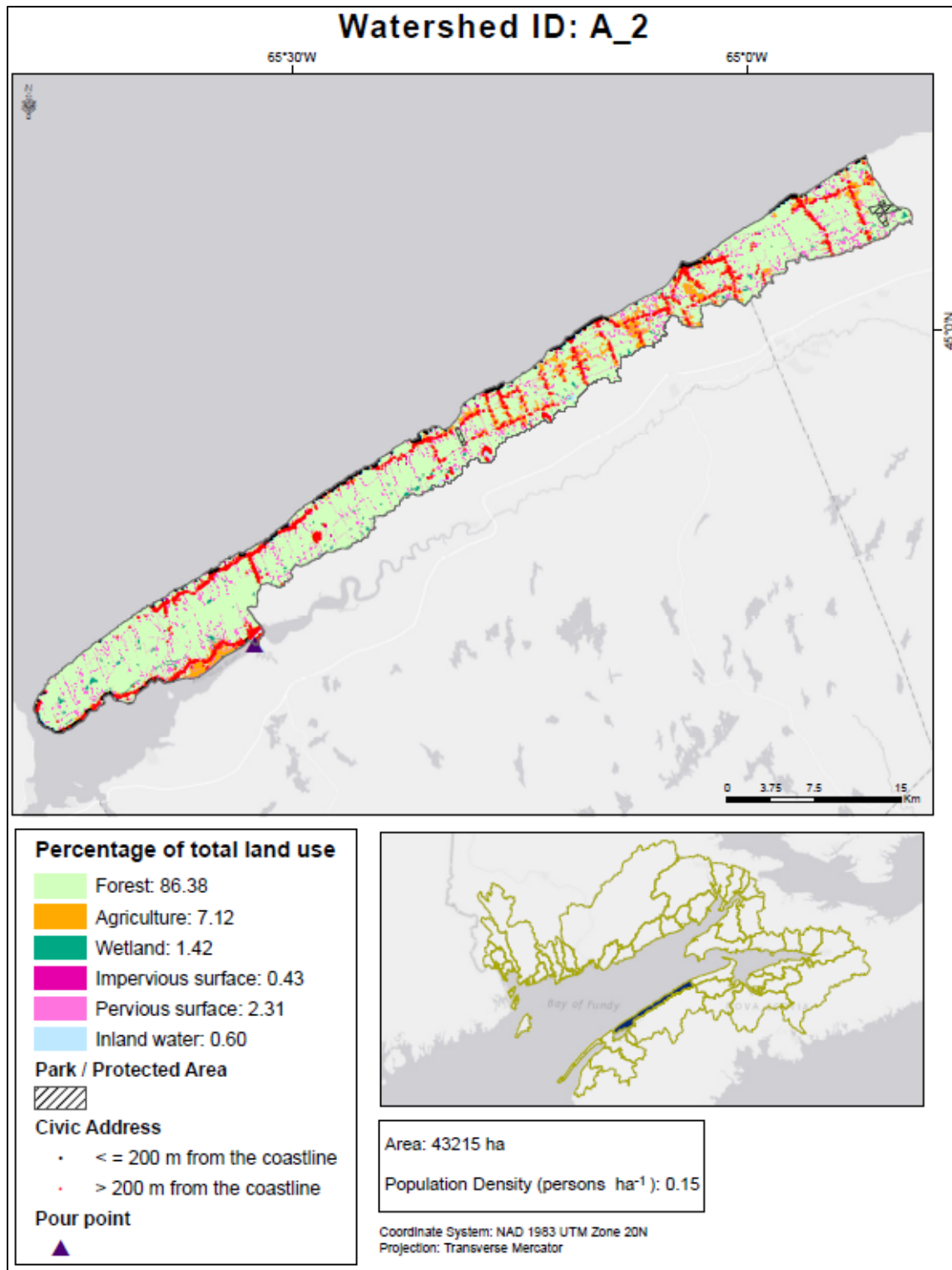


Figure 6. Land-use map for Annapolis watershed A\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

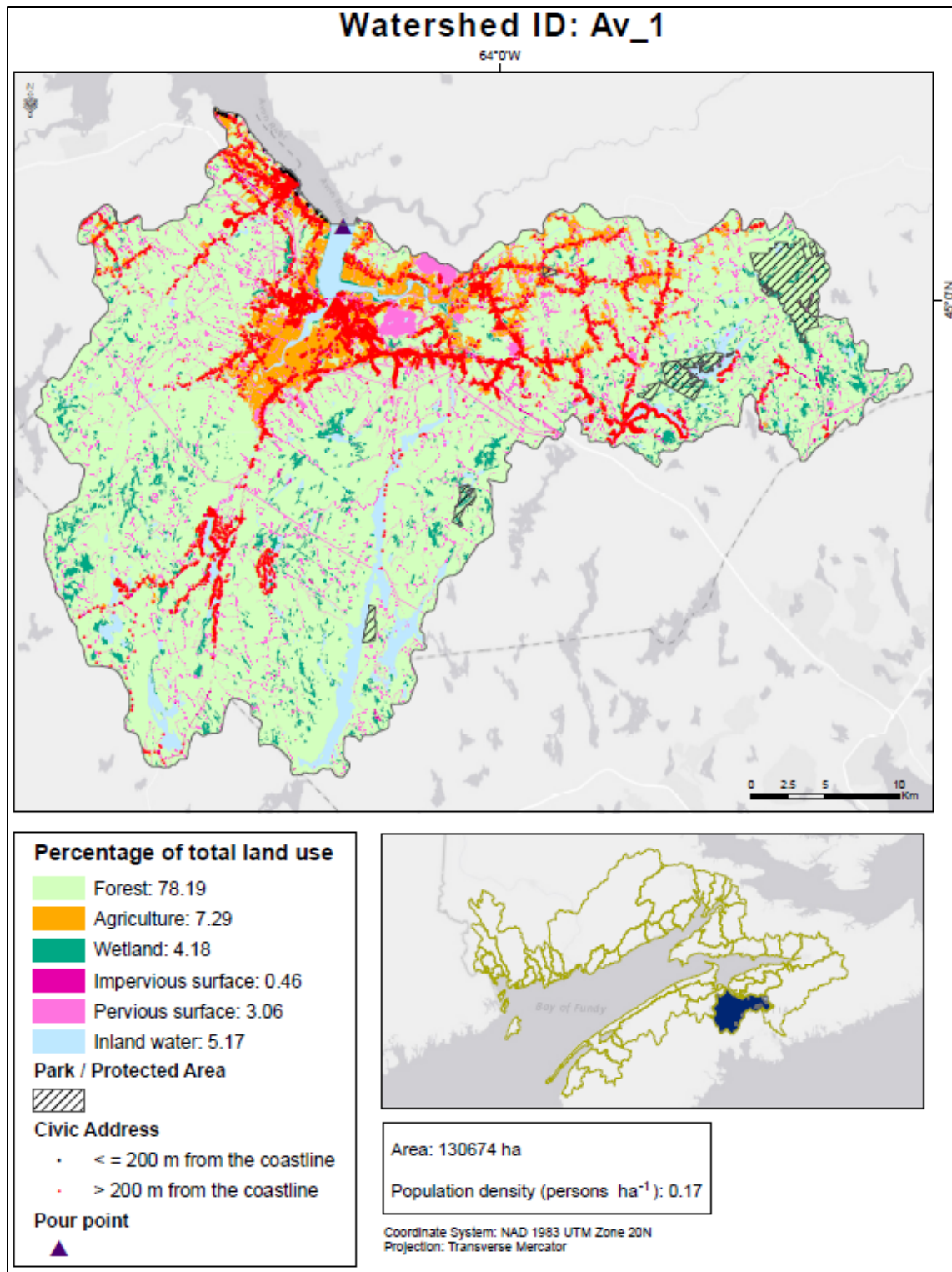


Figure 7. Land-use map for Avon watershed Av\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

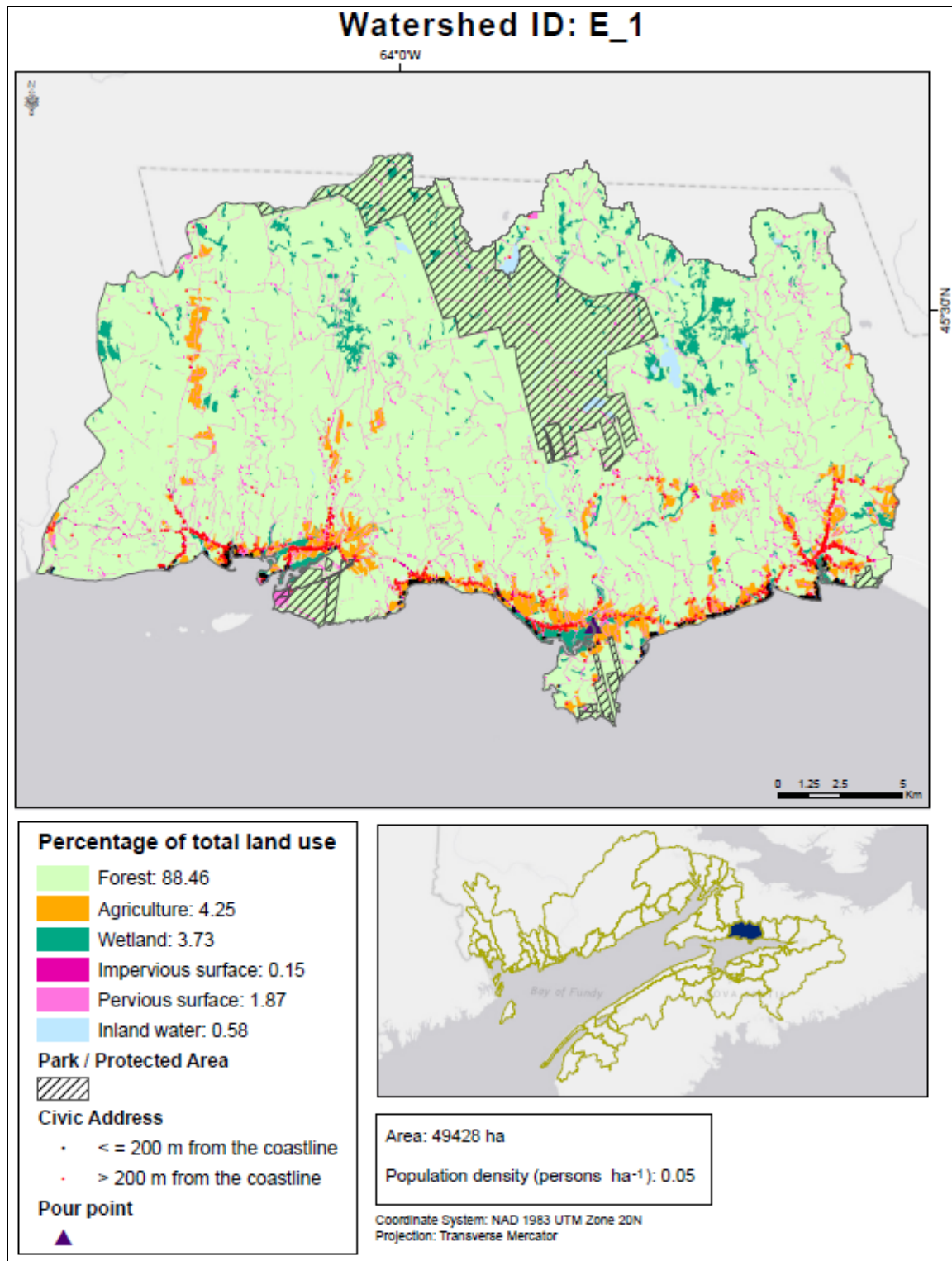


Figure 8. Land-use map for Economy watershed E\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

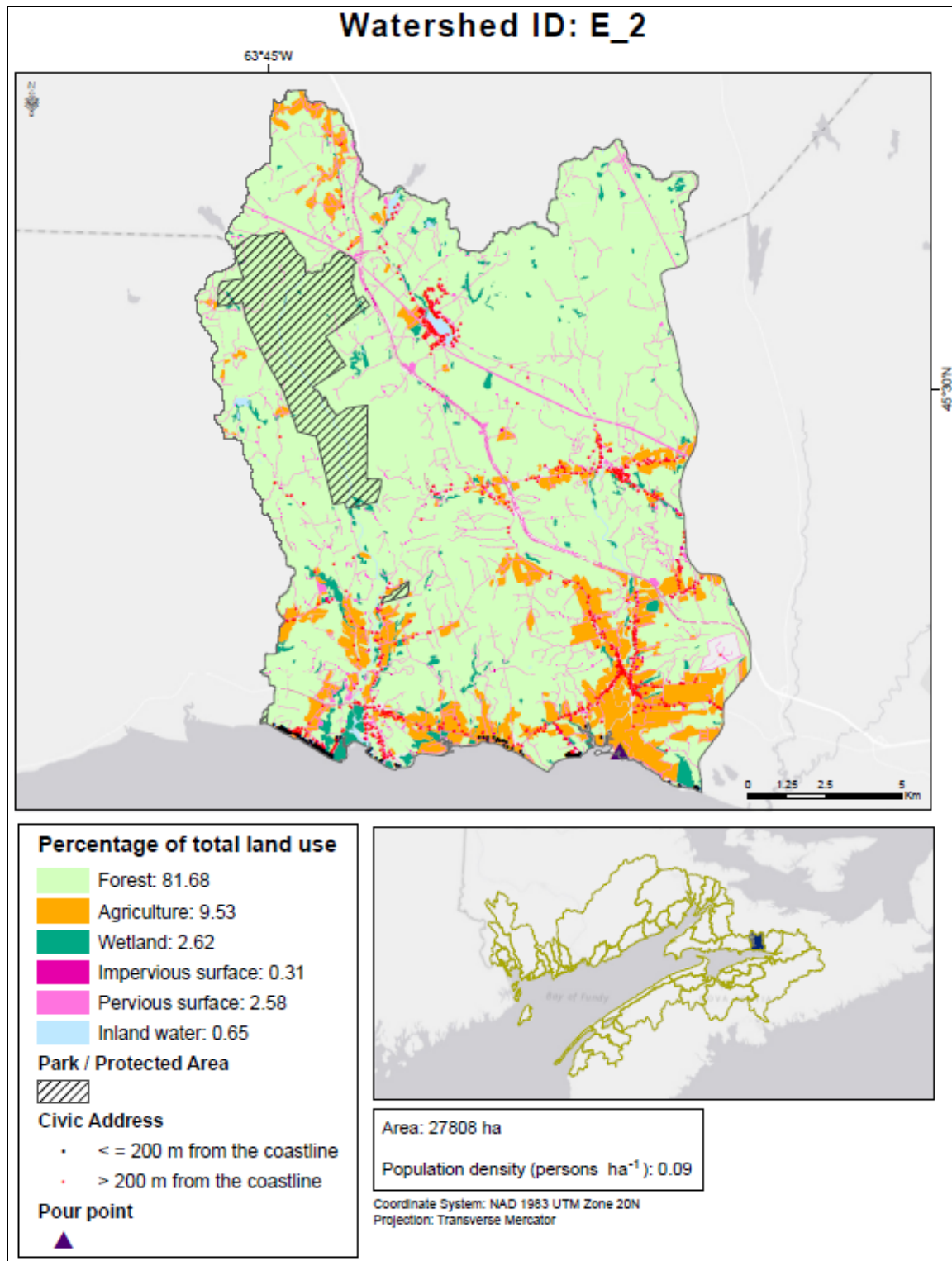


Figure 9 . Land-use map for Economy watershed E\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

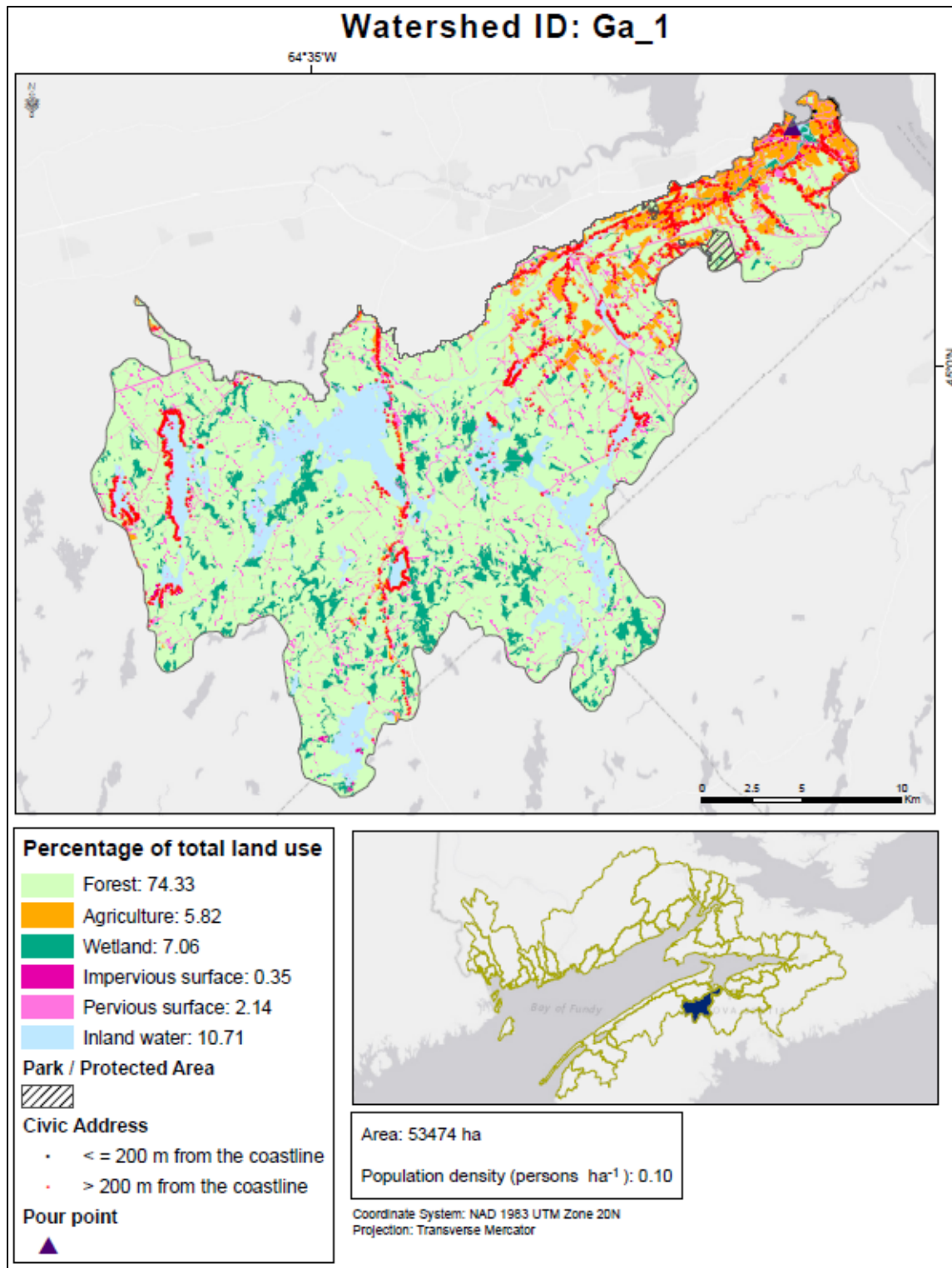


Figure 10. Land-use map for Gaspereau watershed Ga\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

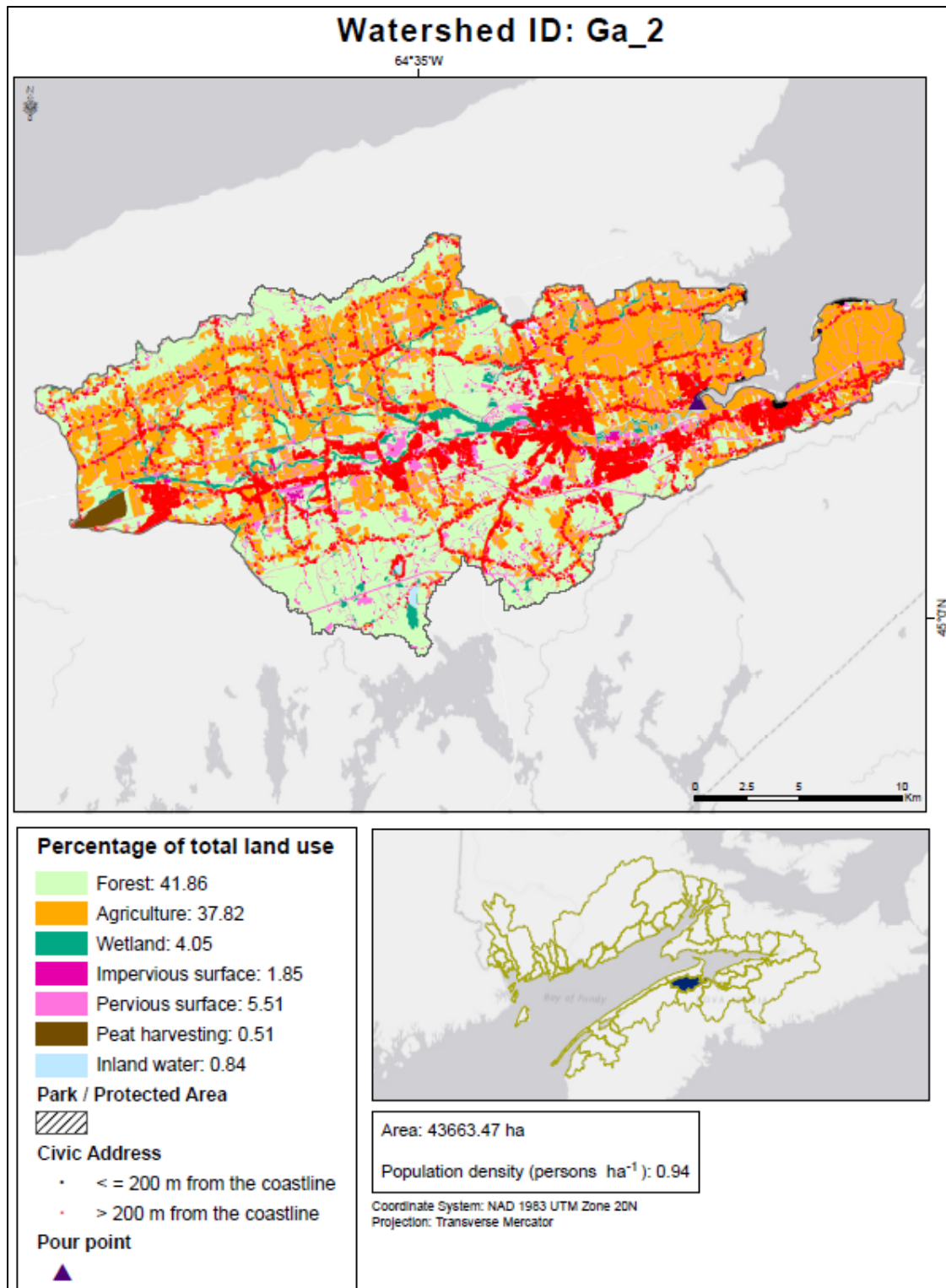


Figure 11. Land-use map for Gaspereau watershed Ga\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

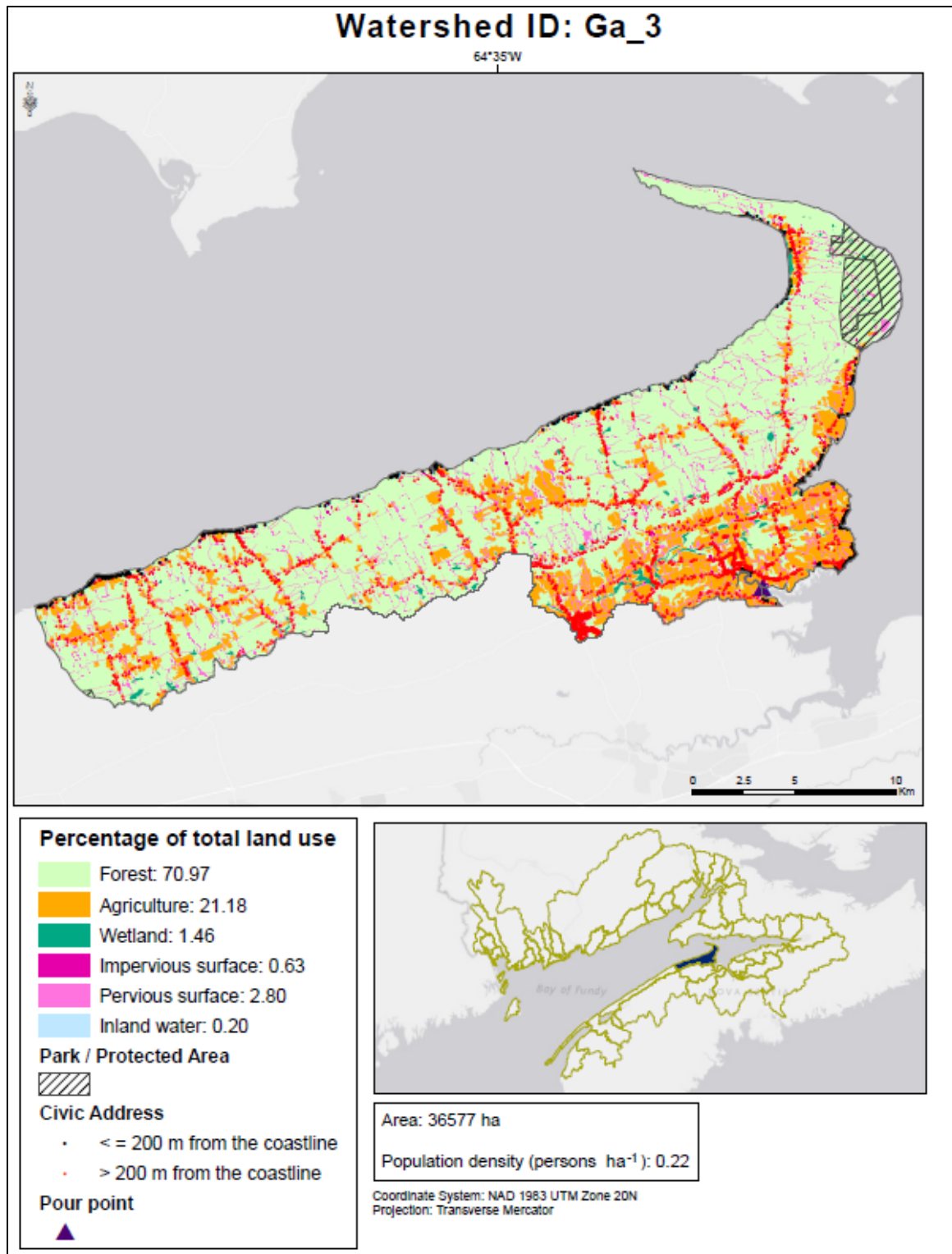


Figure 12. Land-use map for Gaspereau watershed Ga\_3. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).



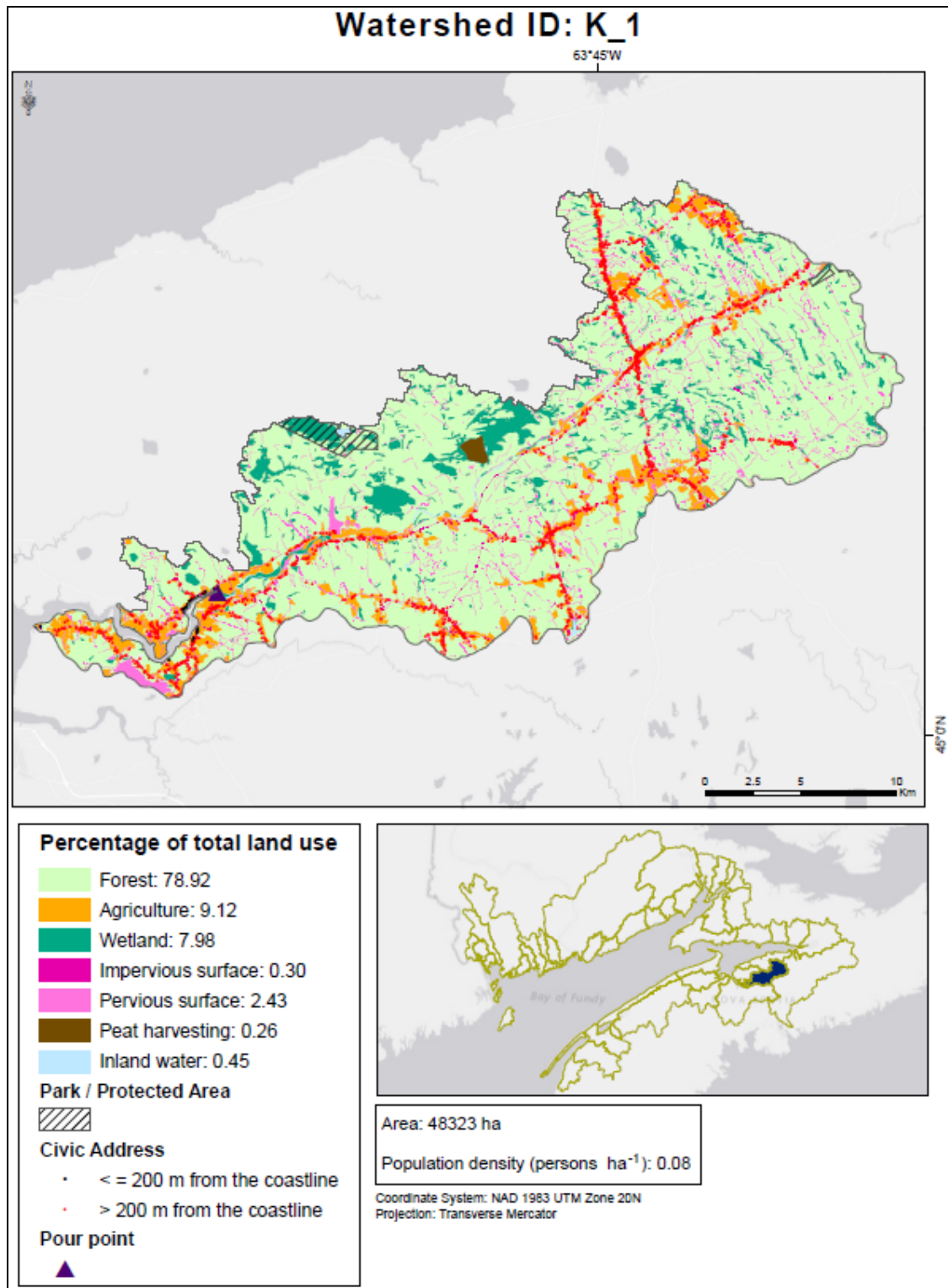


Figure 13. Land-use map for Kennetcook watershed K\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

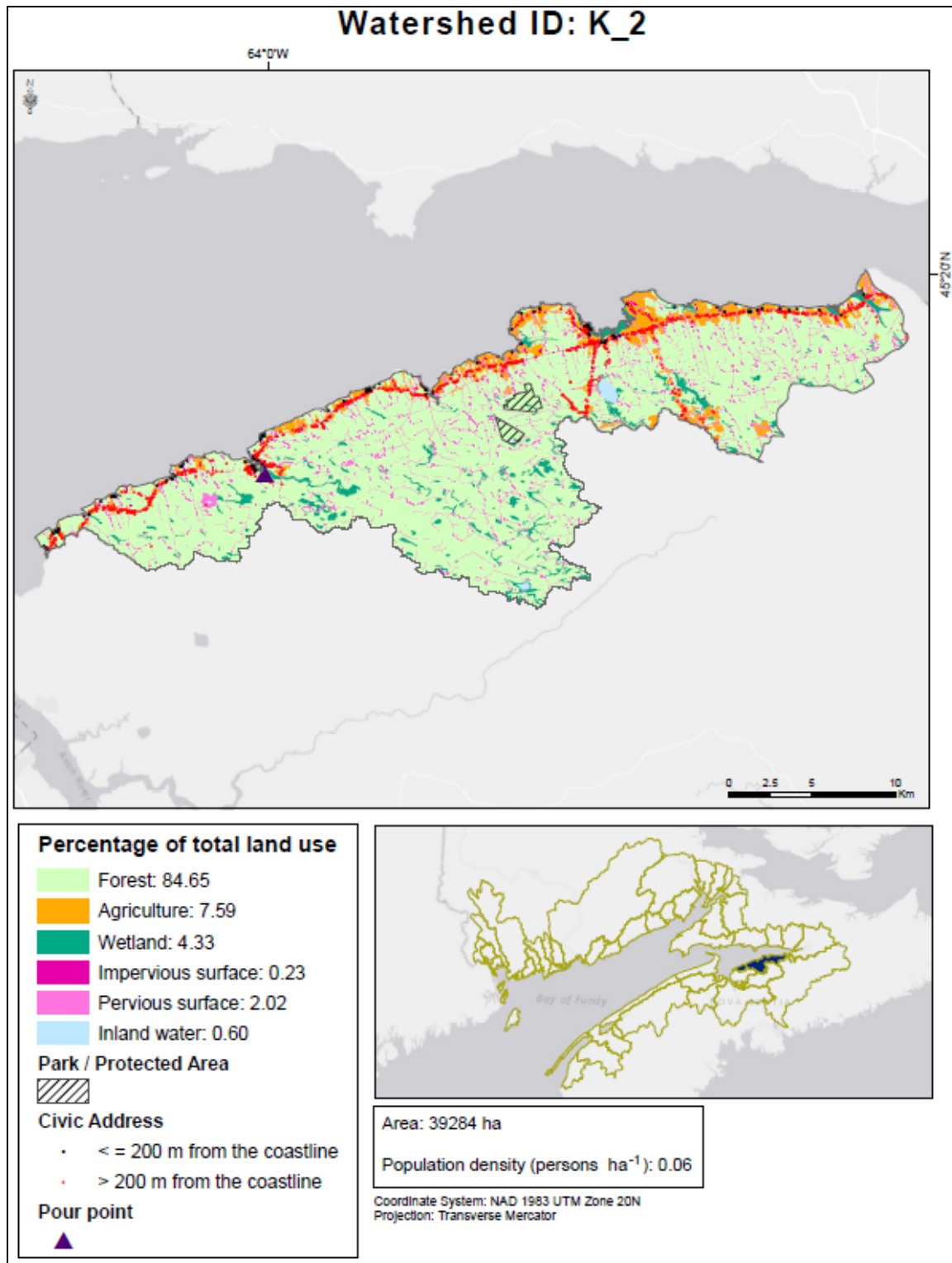


Figure 14. Land-use map for Kennetcook watershed K\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

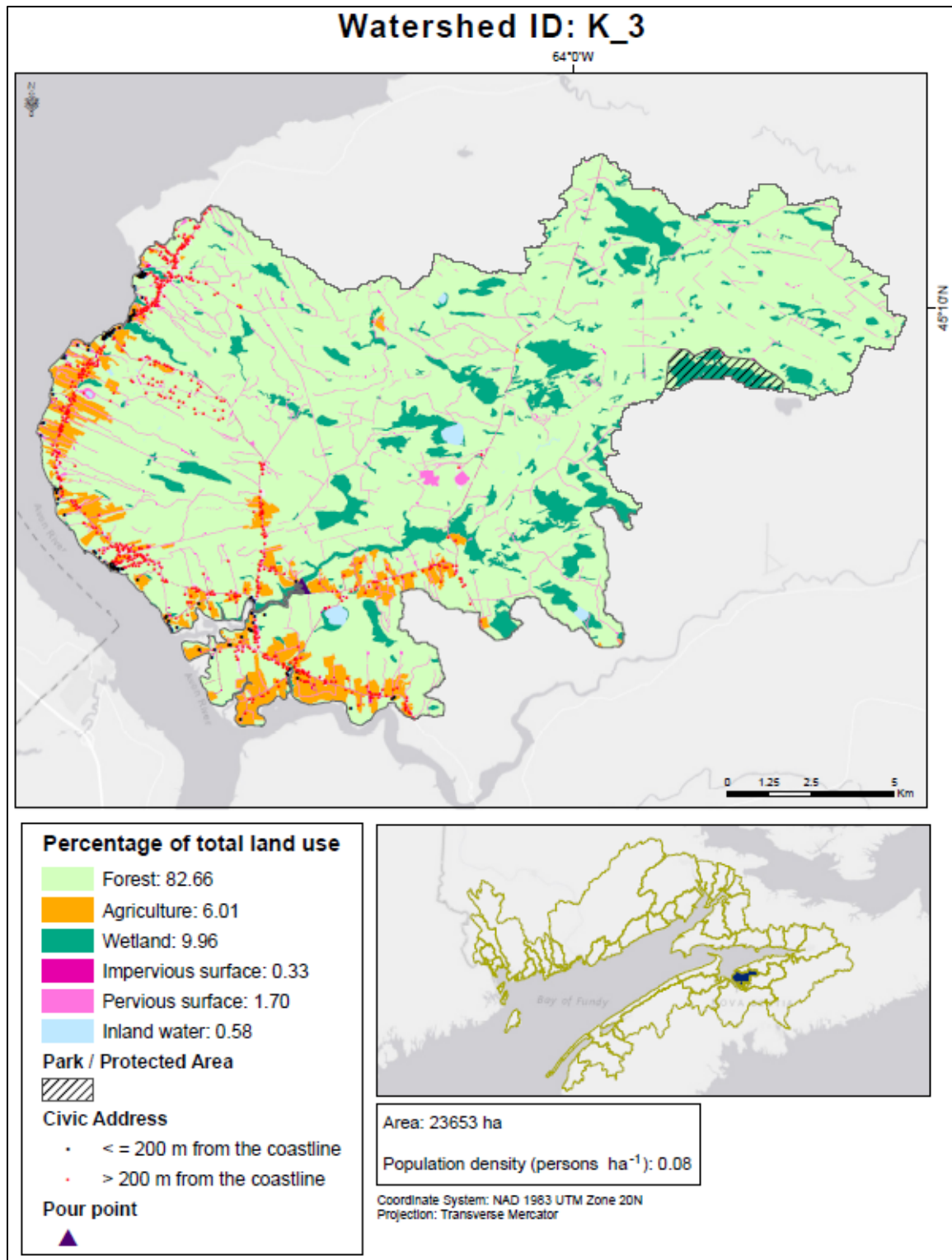


Figure 15. Land-use map for Kennetcook watershed K\_3. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

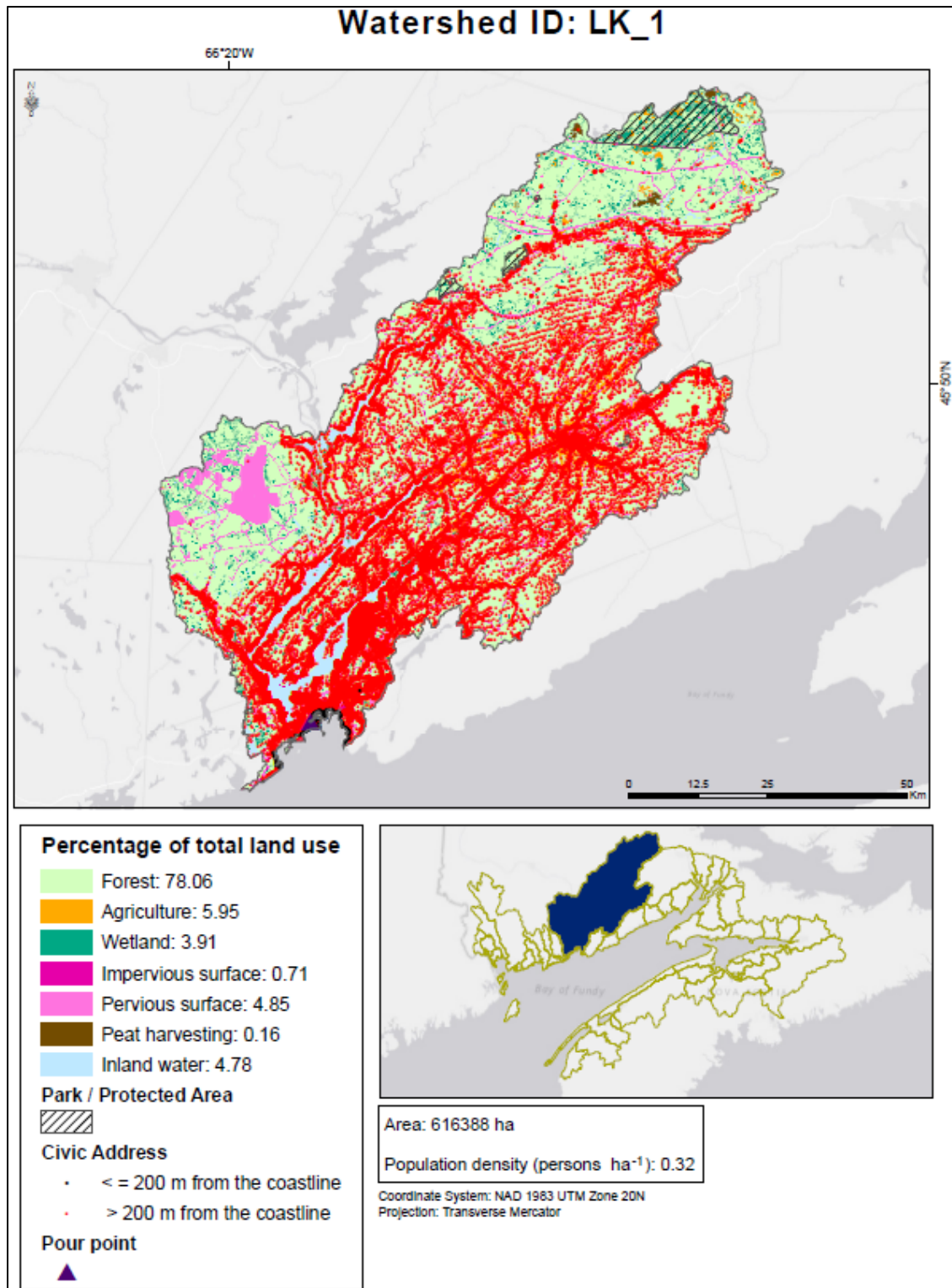


Figure 16. Land-use map for Lower Saint John - Kennebecasis watershed LK\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

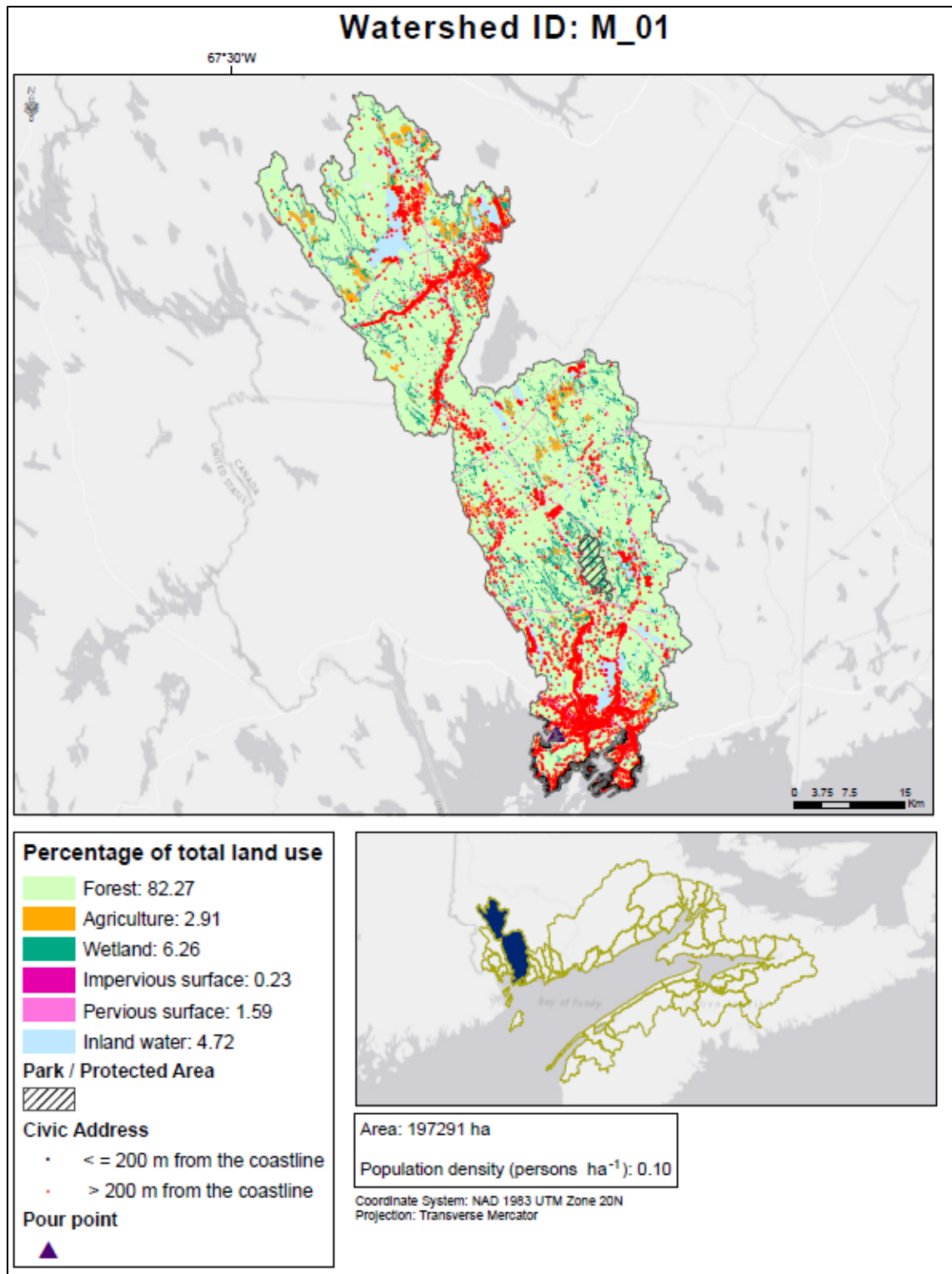


Figure 17. Land-use map for Magaguadavic watershed M\_01. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

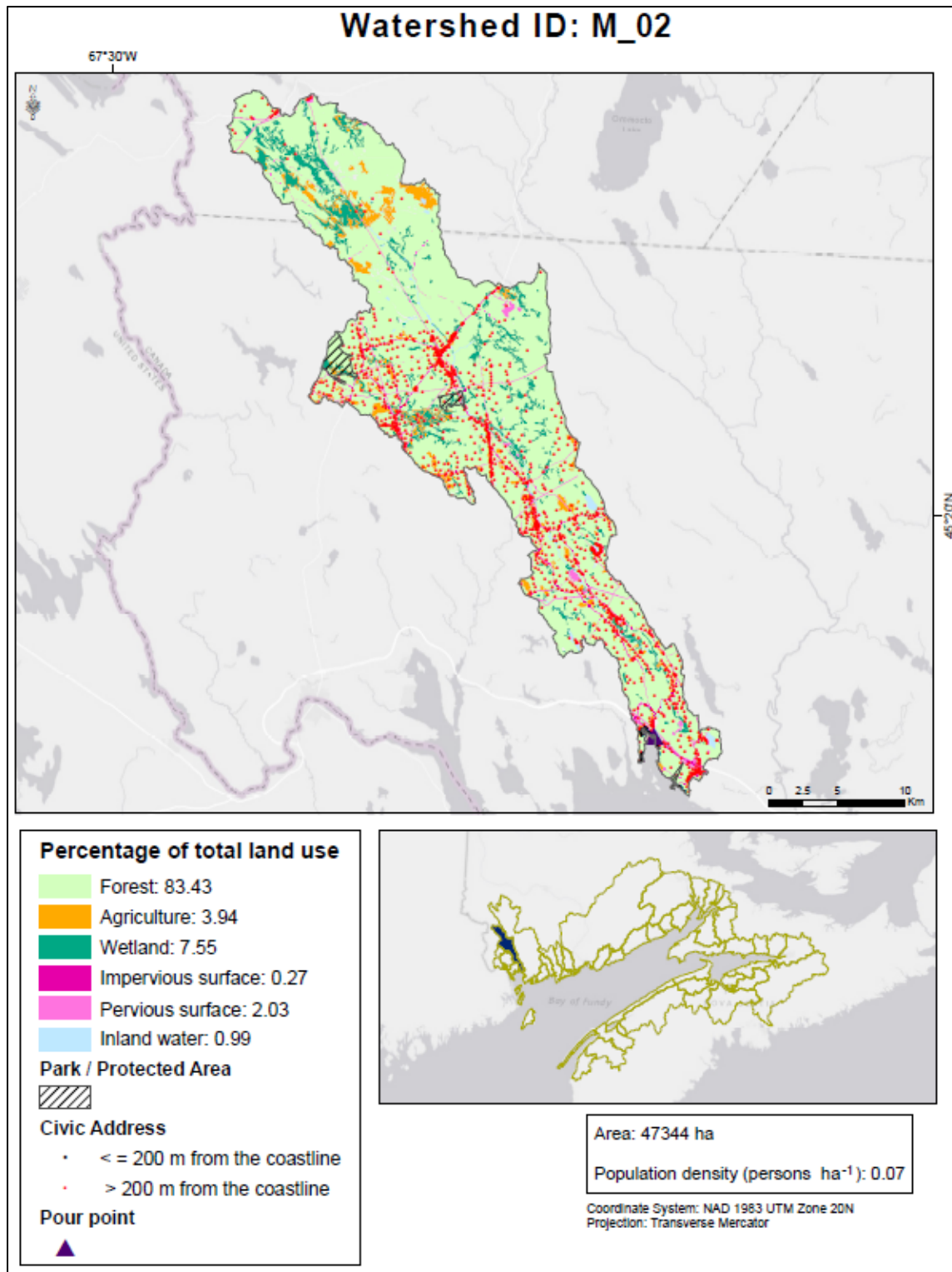


Figure 18. Land-use map for Magaguadavic watershed M\_02. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

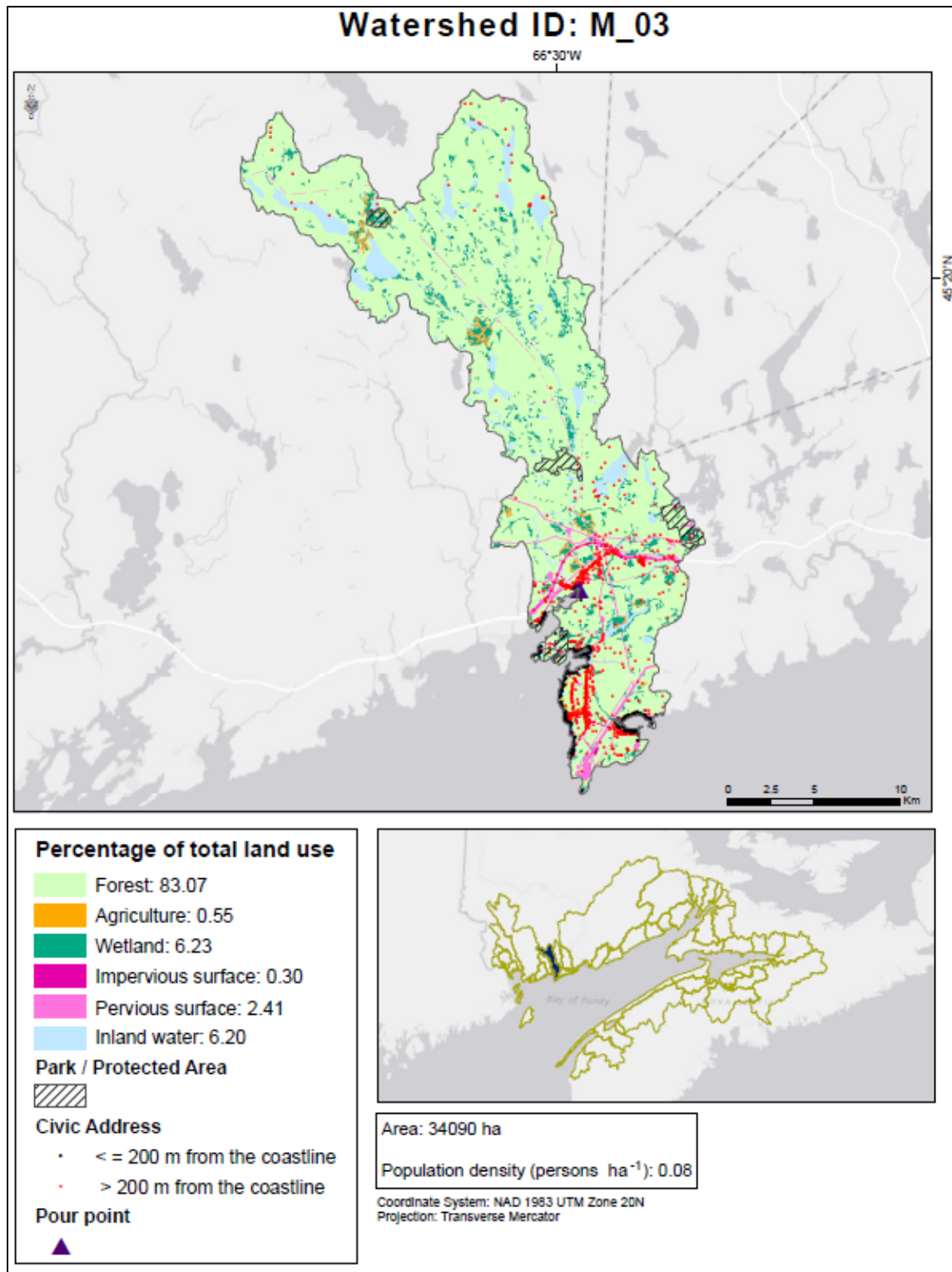


Figure 19. Land-use map for Magaguadavic watershed M\_03. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

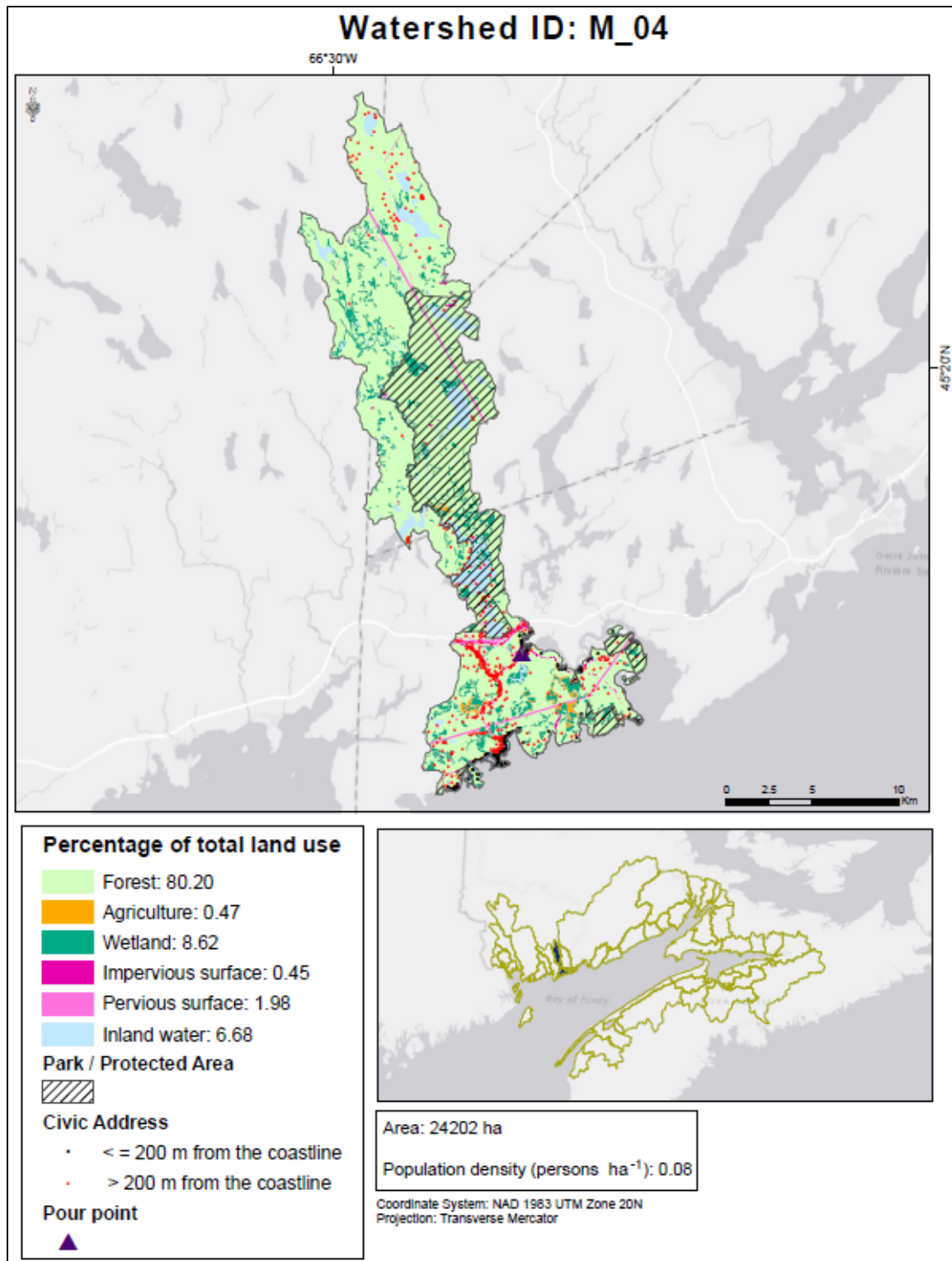


Figure 20. Land-use map for Magaguadavic watershed M\_04. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).



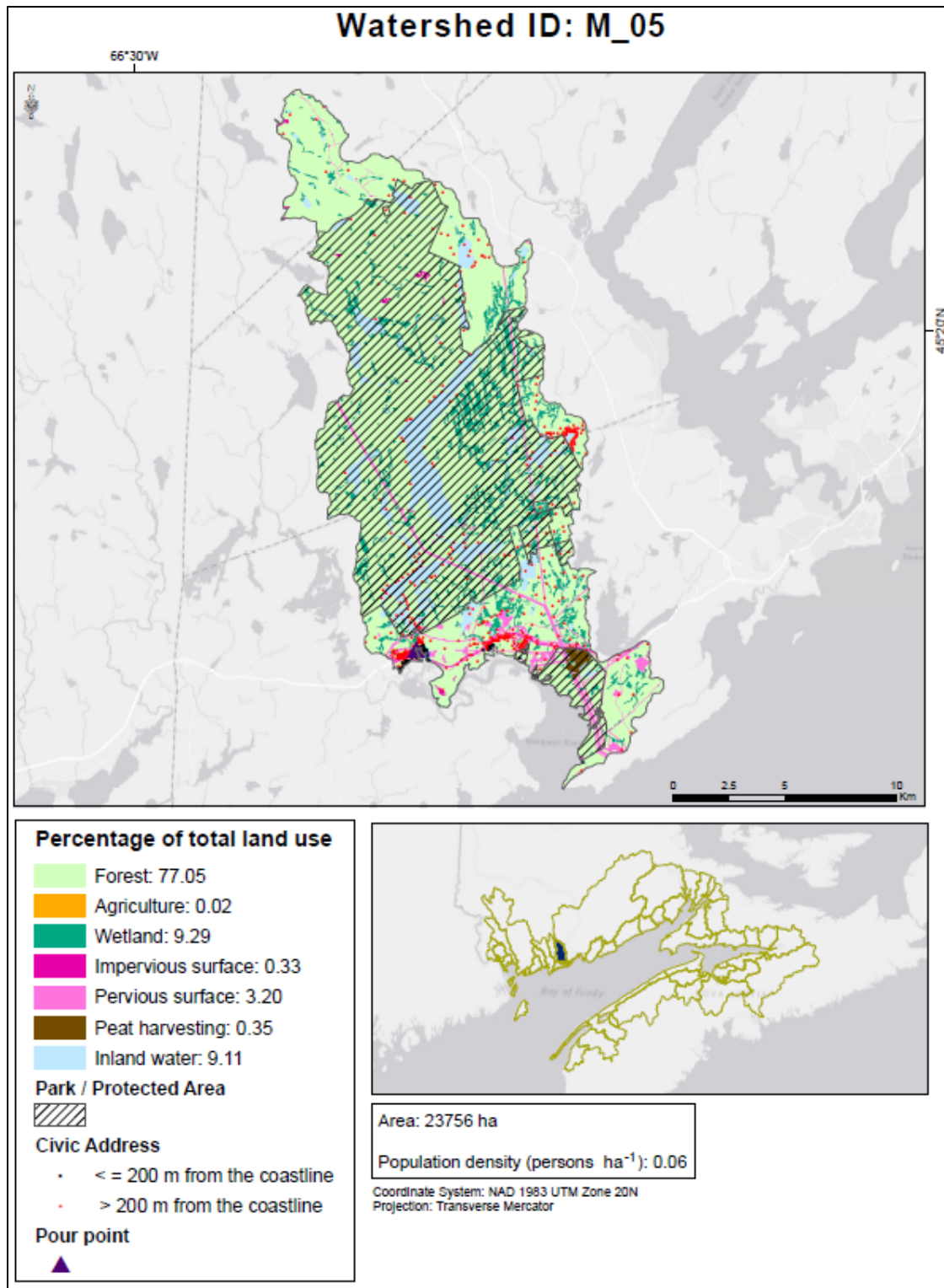


Figure 21. Land-use map for Magaguadavic watershed M\_05. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

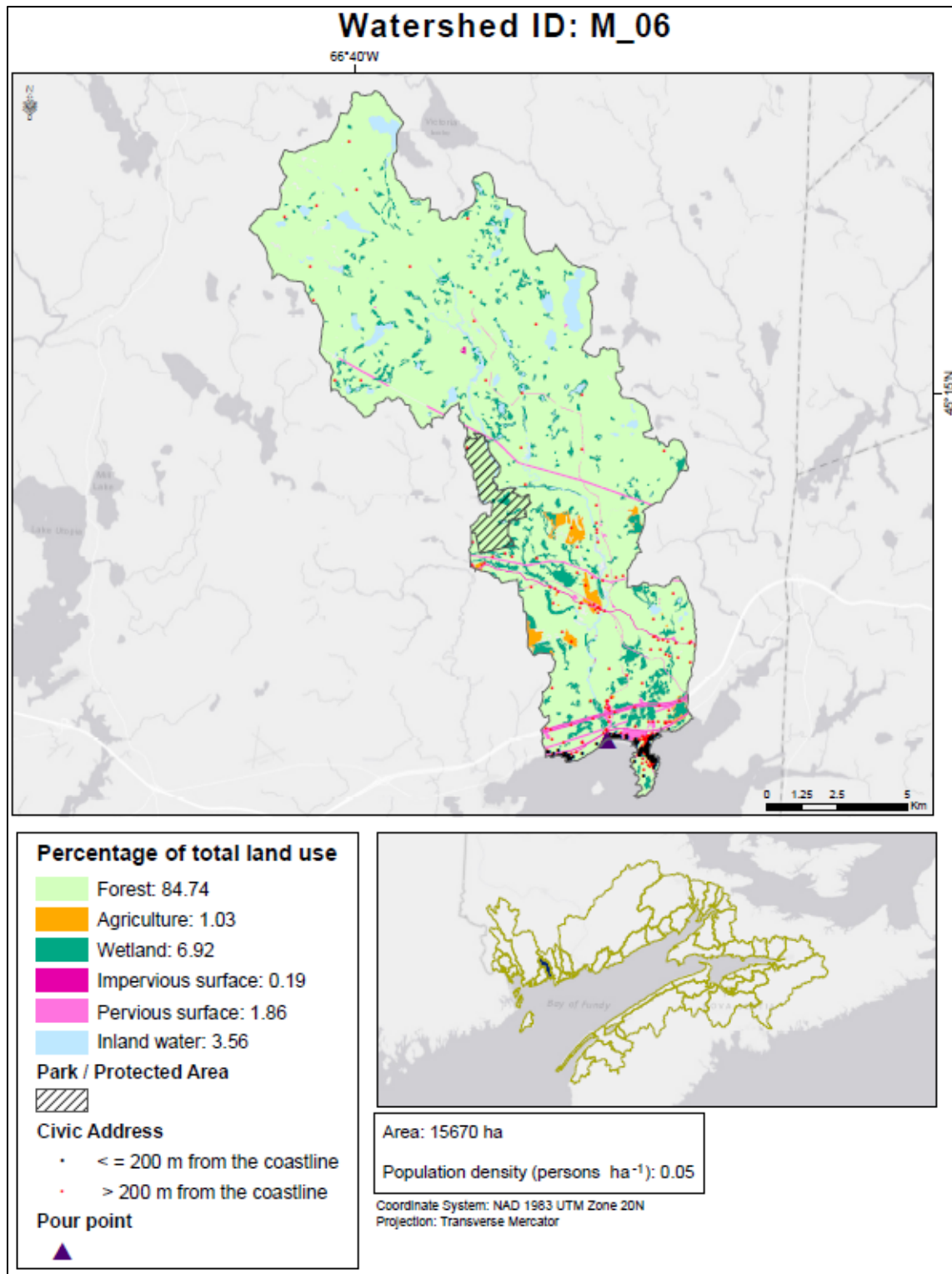


Figure 22. Land-use map for Magaguadavic watershed M\_06. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

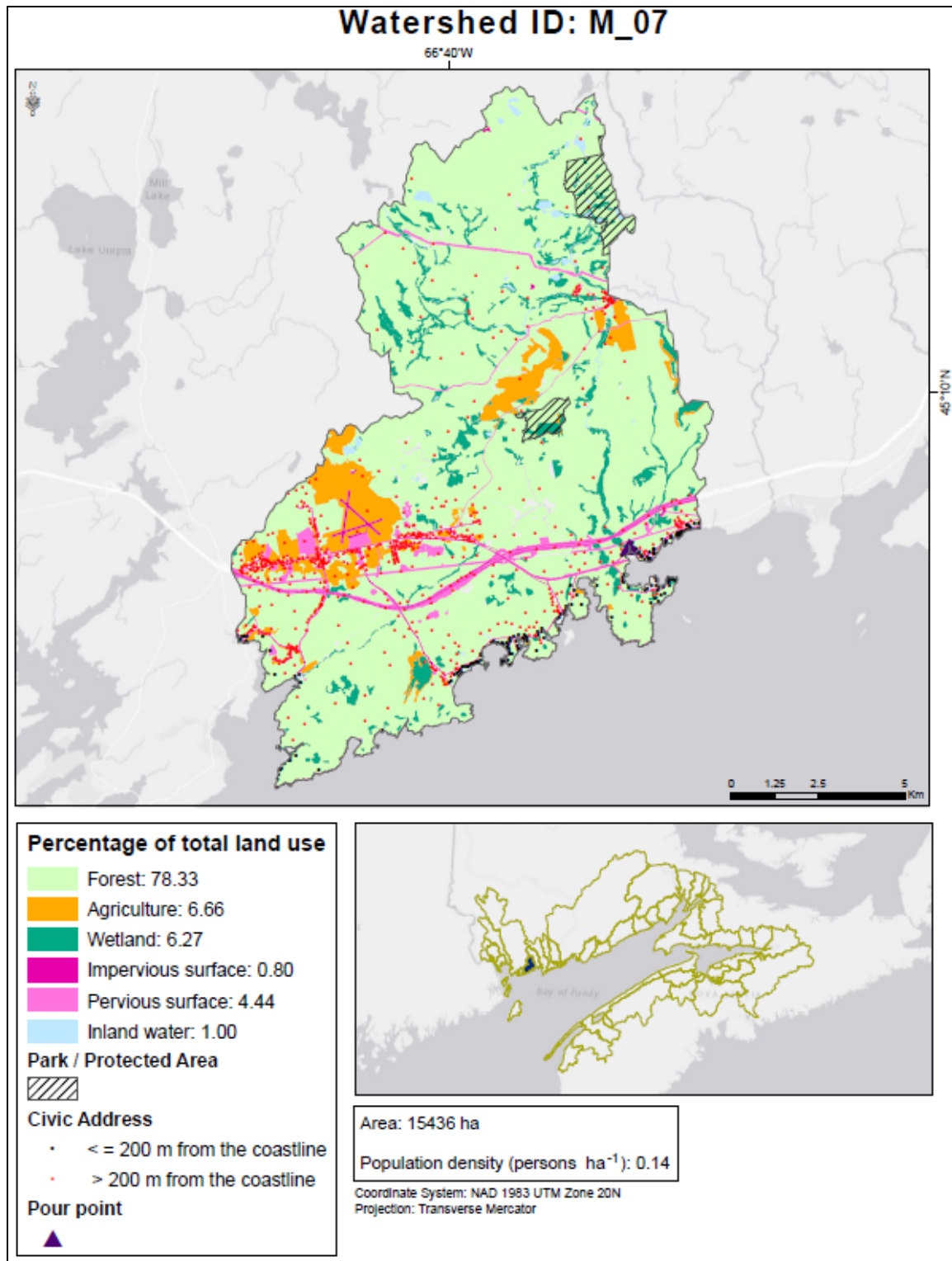


Figure 23. Land-use map for Magaguadavic watershed M\_07. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

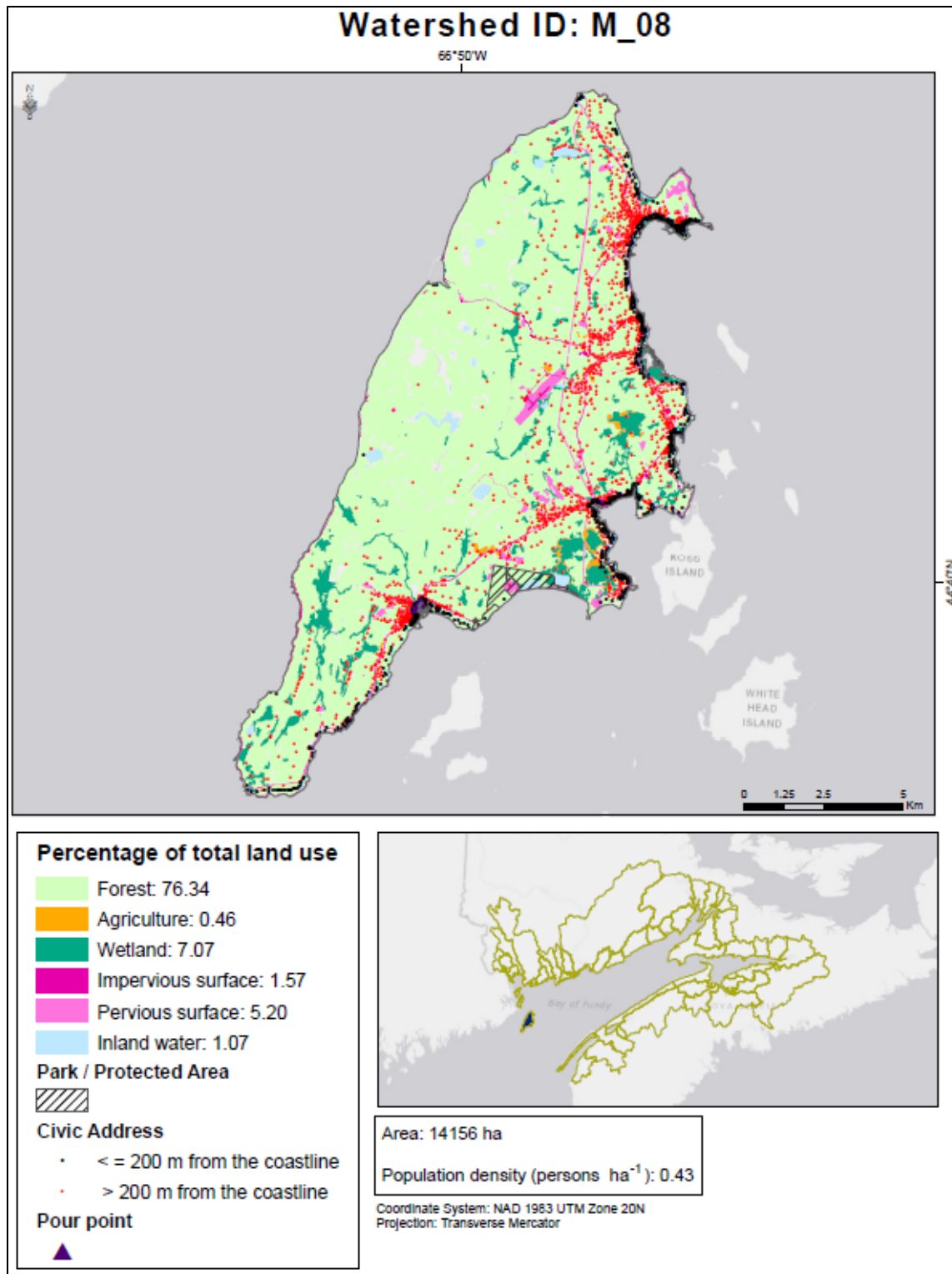


Figure 24. Land-use map for Magaguadavic watershed M\_08. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

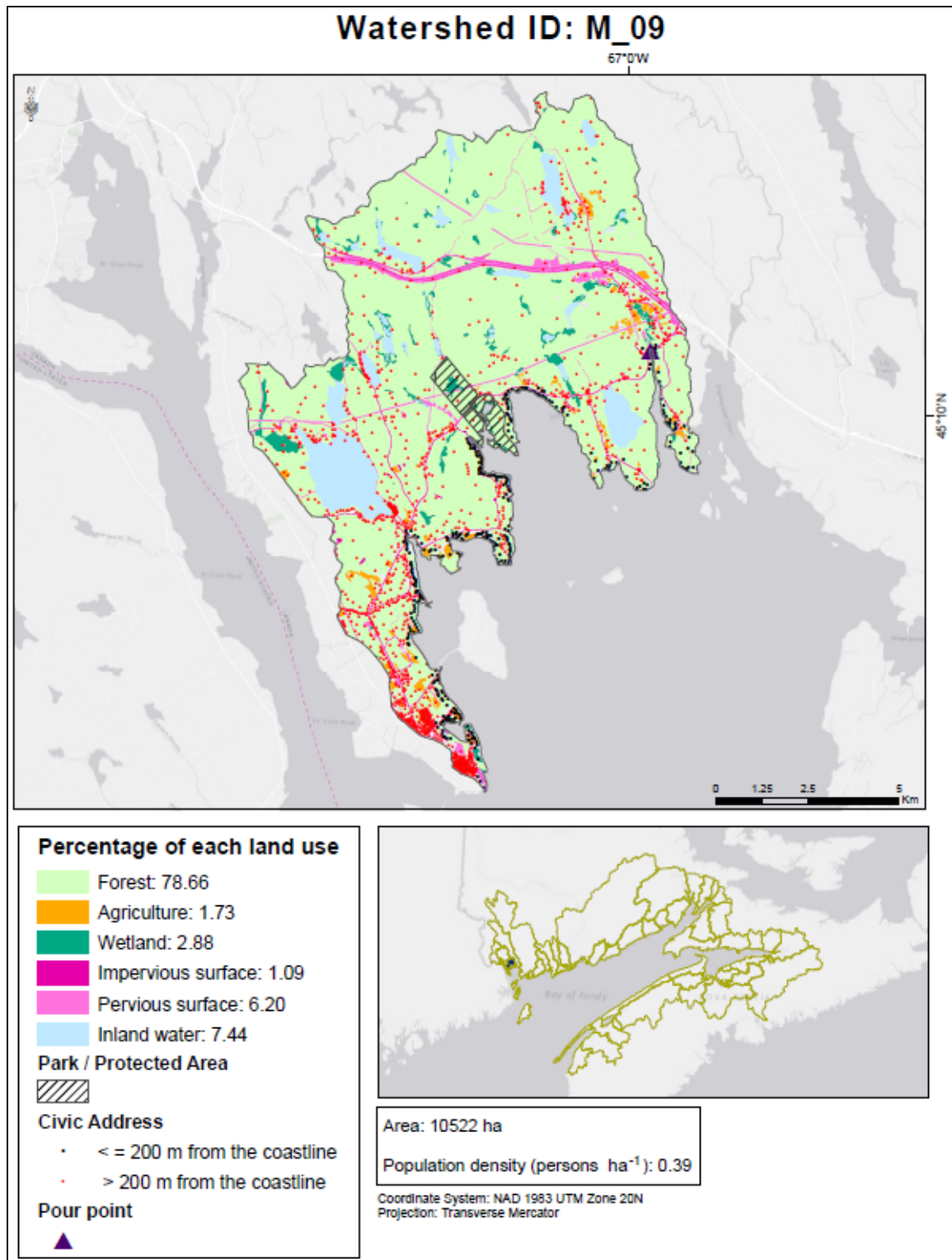


Figure 25. Land-use map for Magaguadavic watershed M\_09. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

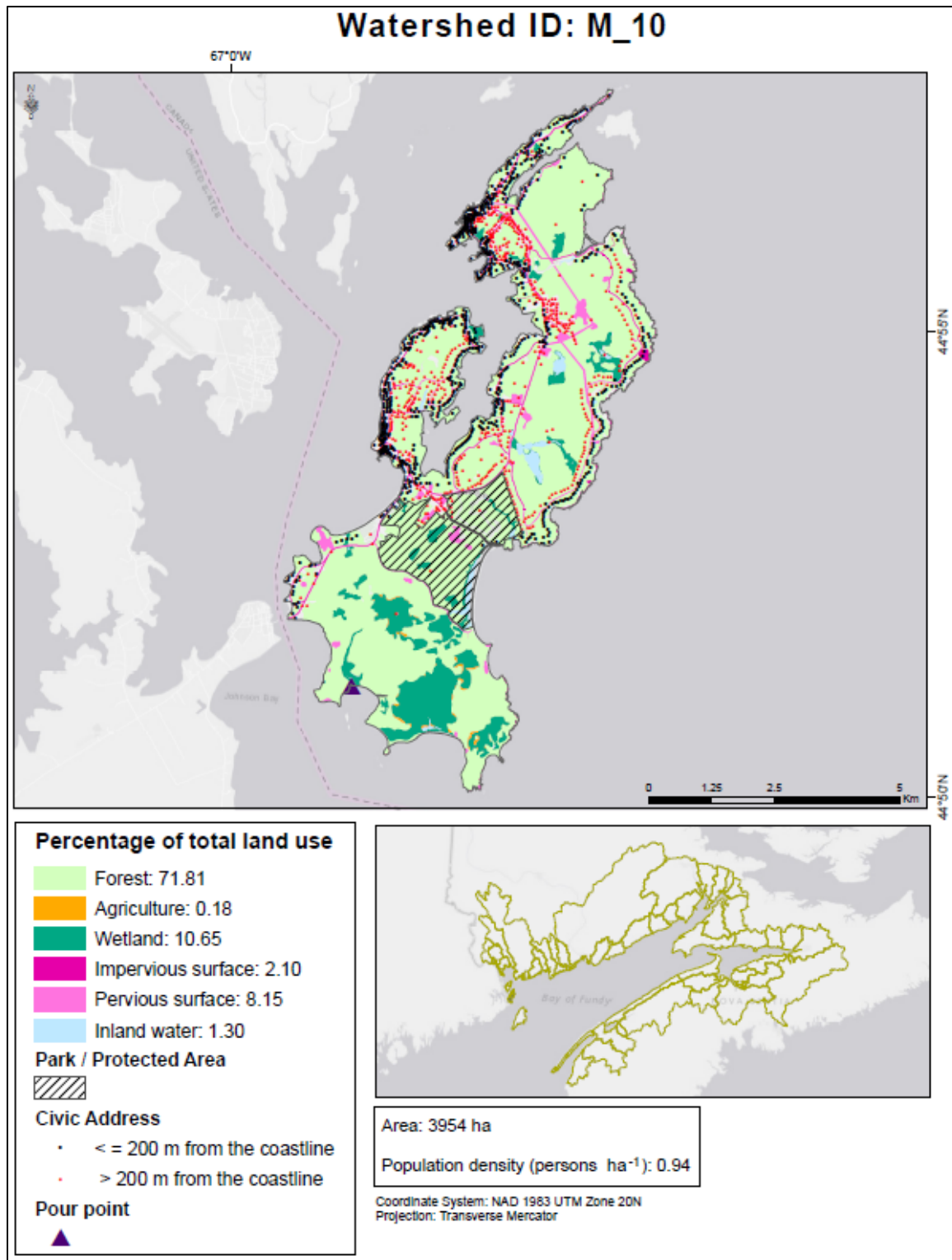


Figure 26. Land-use map for Magaguadavic watershed M\_10. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

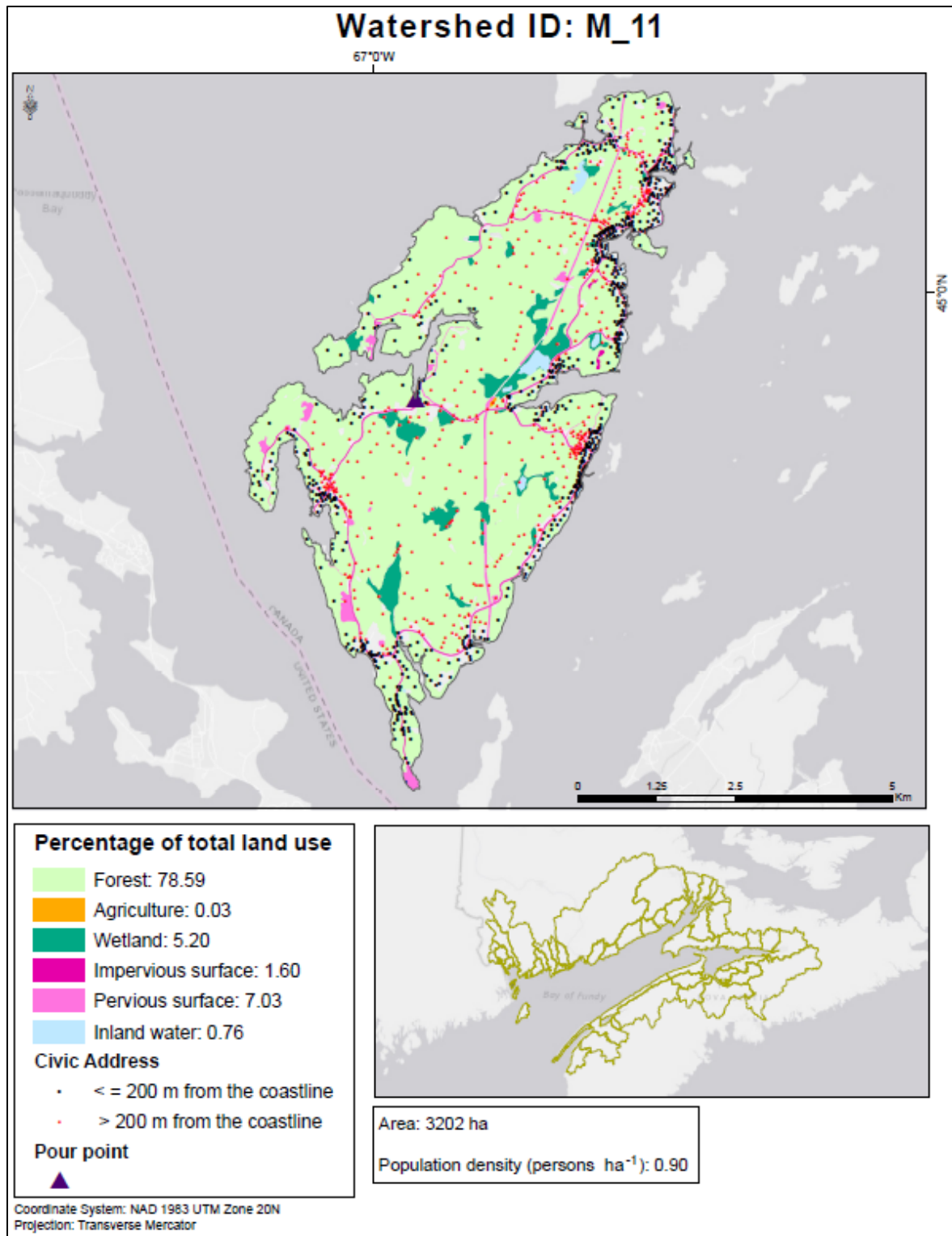


Figure 27. Land-use map for Magaguadavic watershed M\_11. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

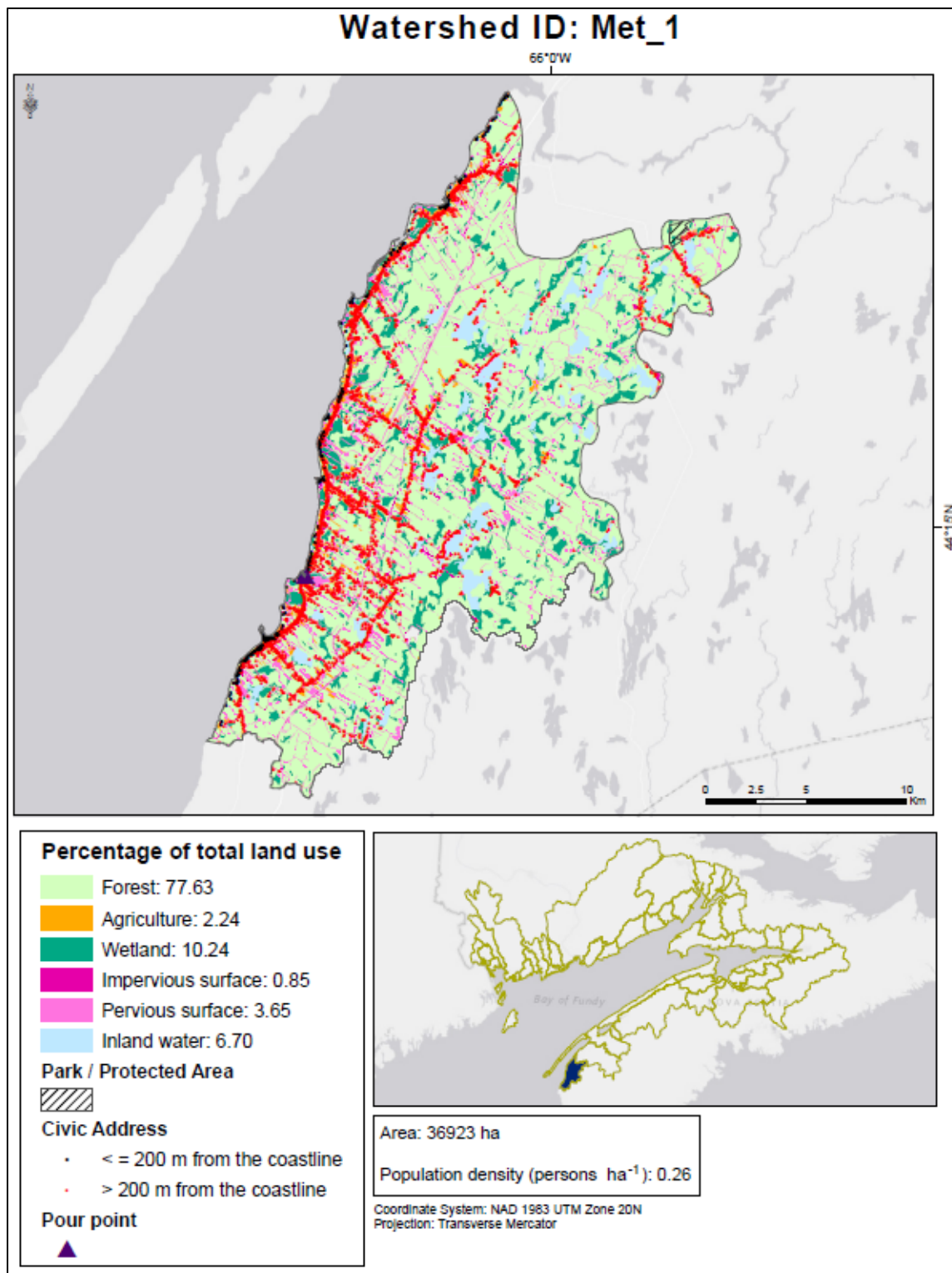


Figure 28. Land-use map for Meteghan watershed Met\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).



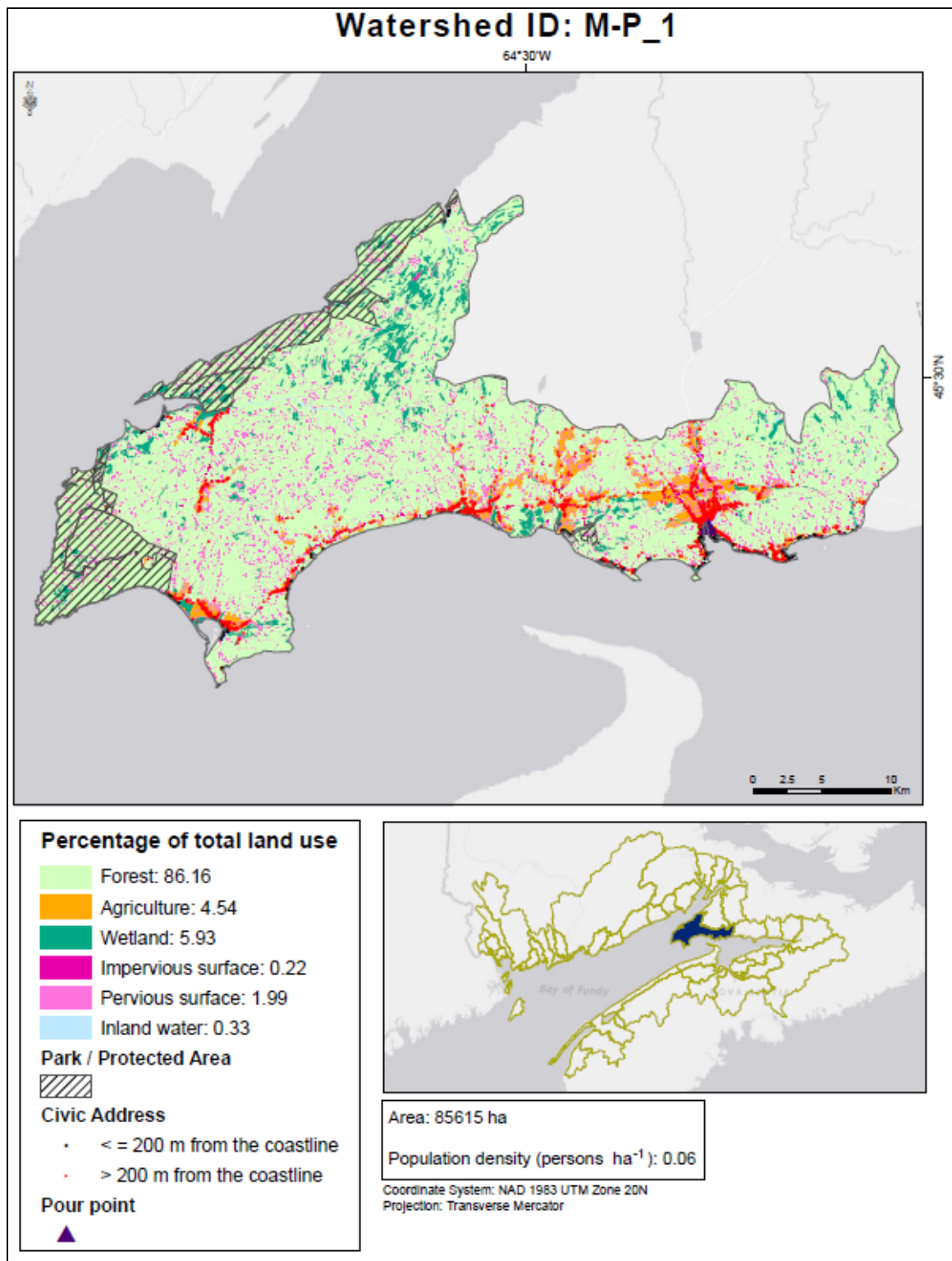


Figure 29. Land-use map for Minas Channel - Parrsboro watershed M-P\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

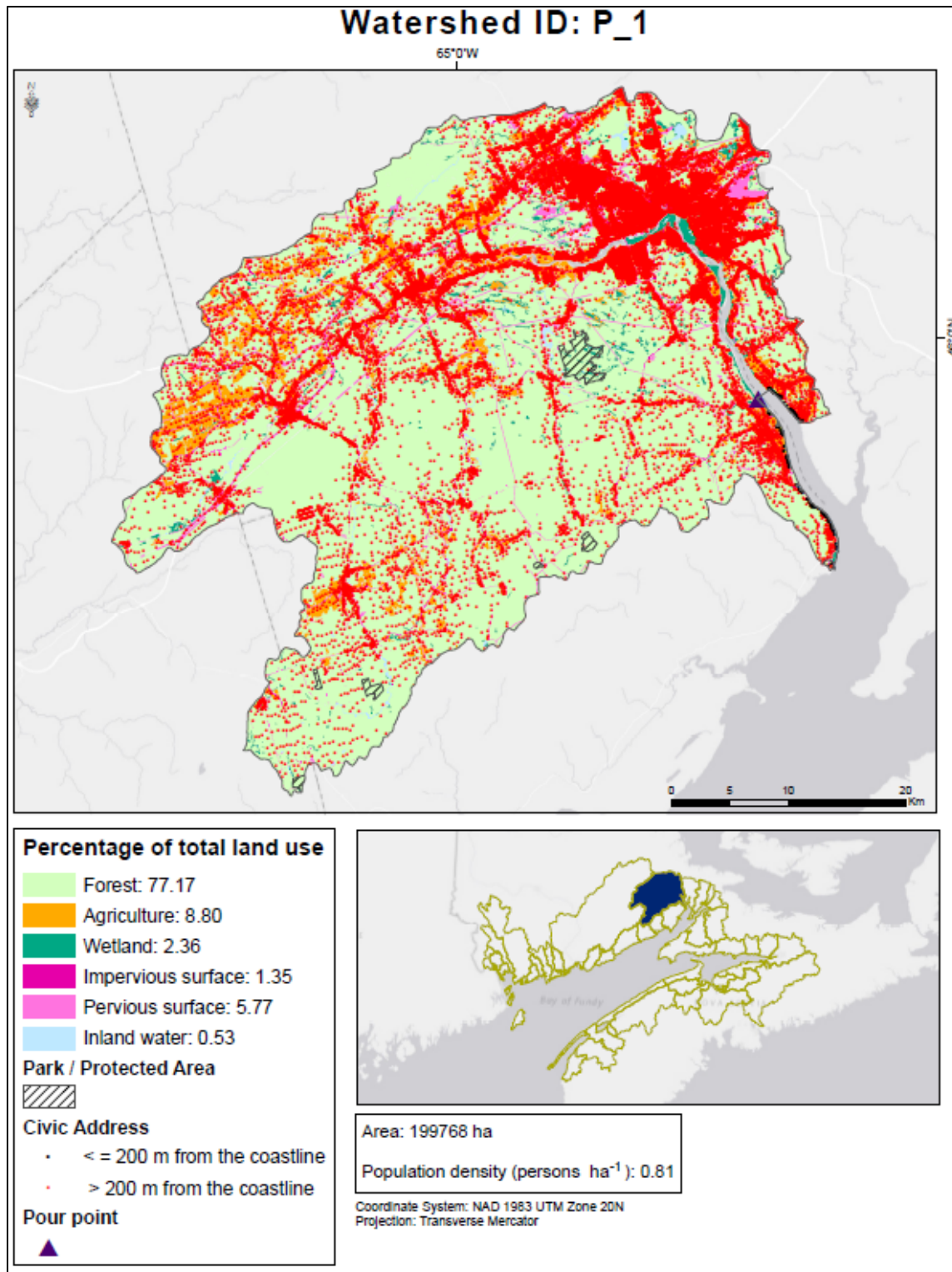


Figure 30. Land-use map for Petitcodiac watershed P\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

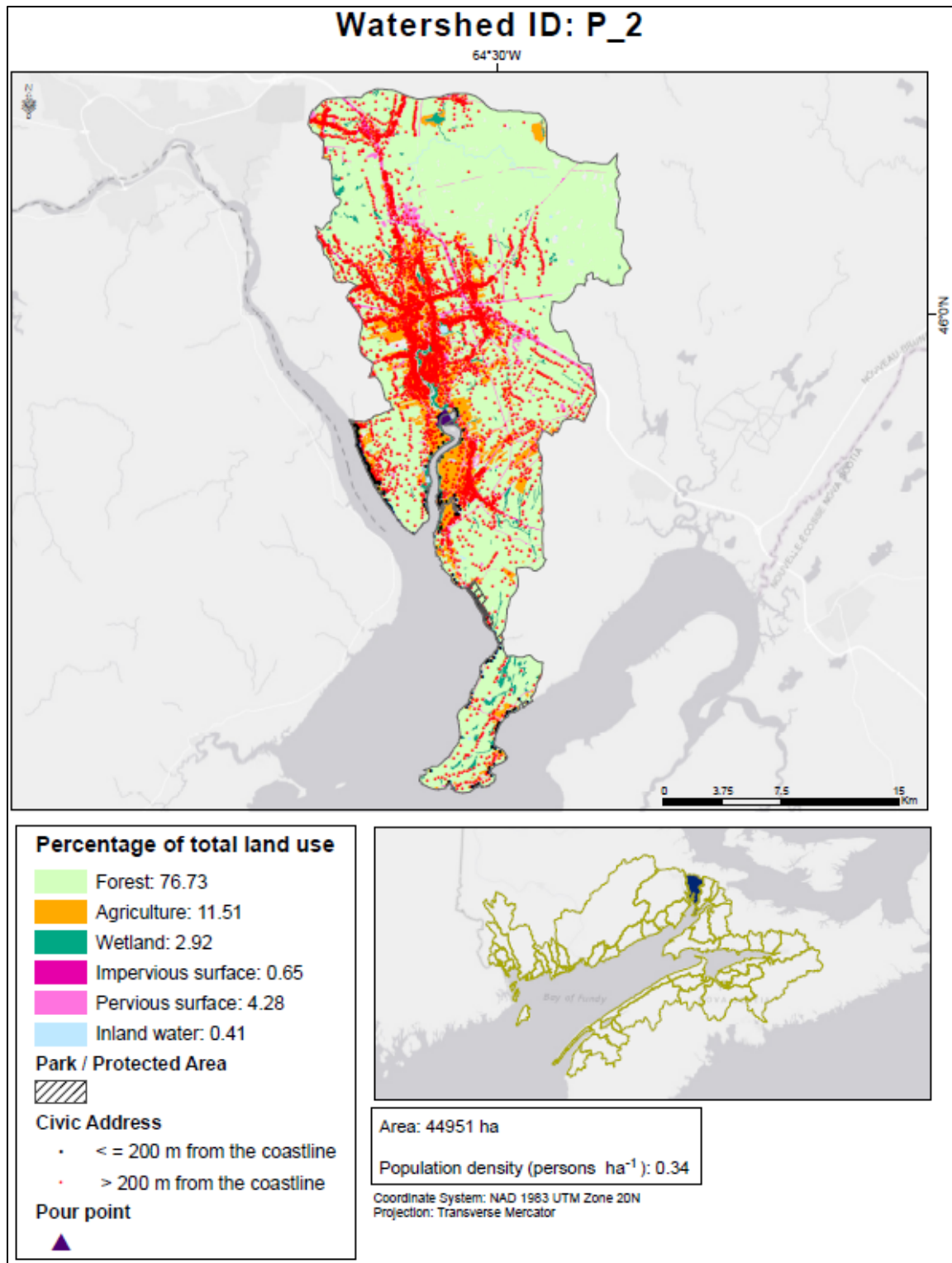


Figure 31. Land-use map for Petitcodiac watershed P\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

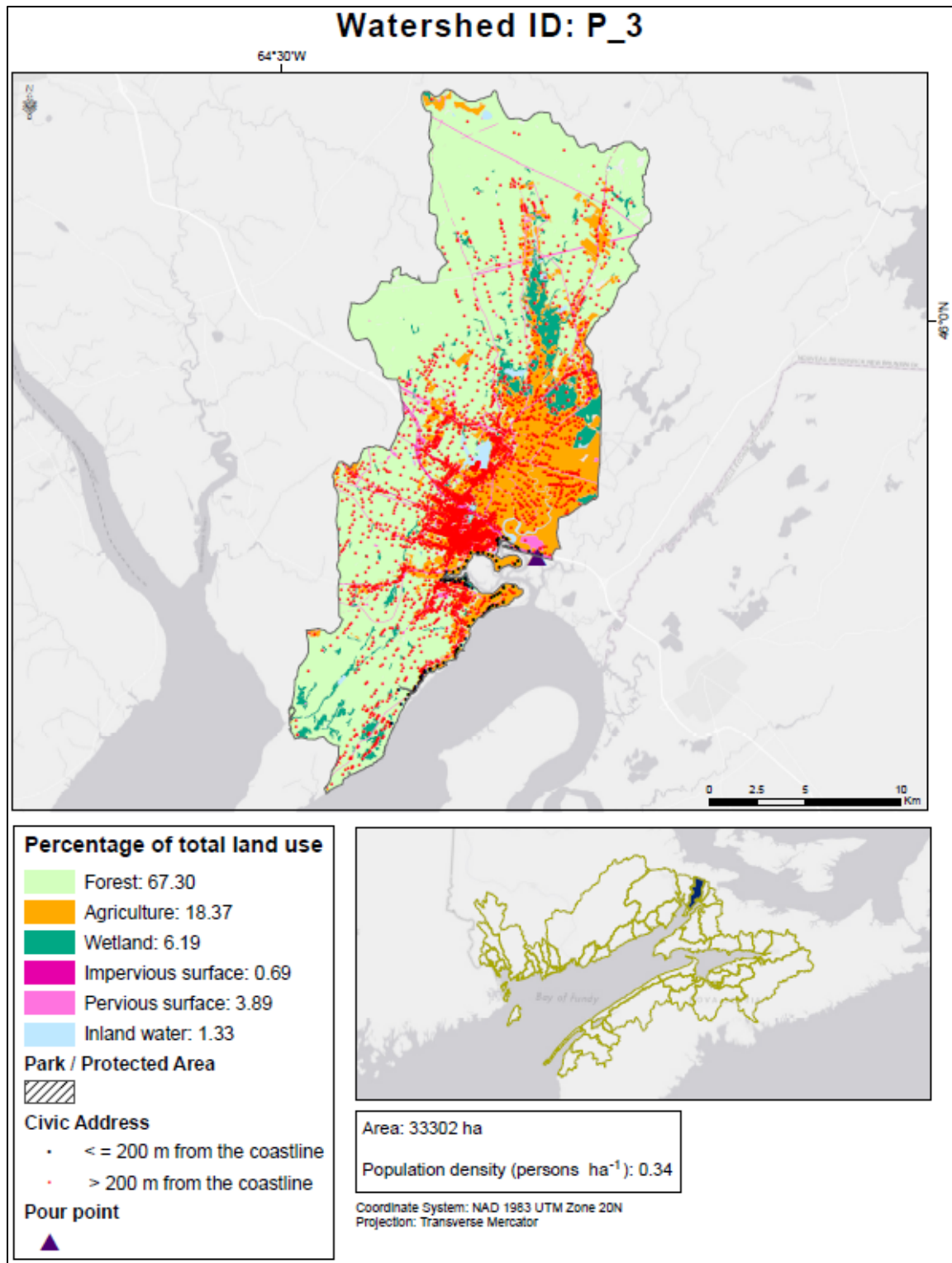


Figure 32. Land-use map for Petitcodiac watershed P\_3. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

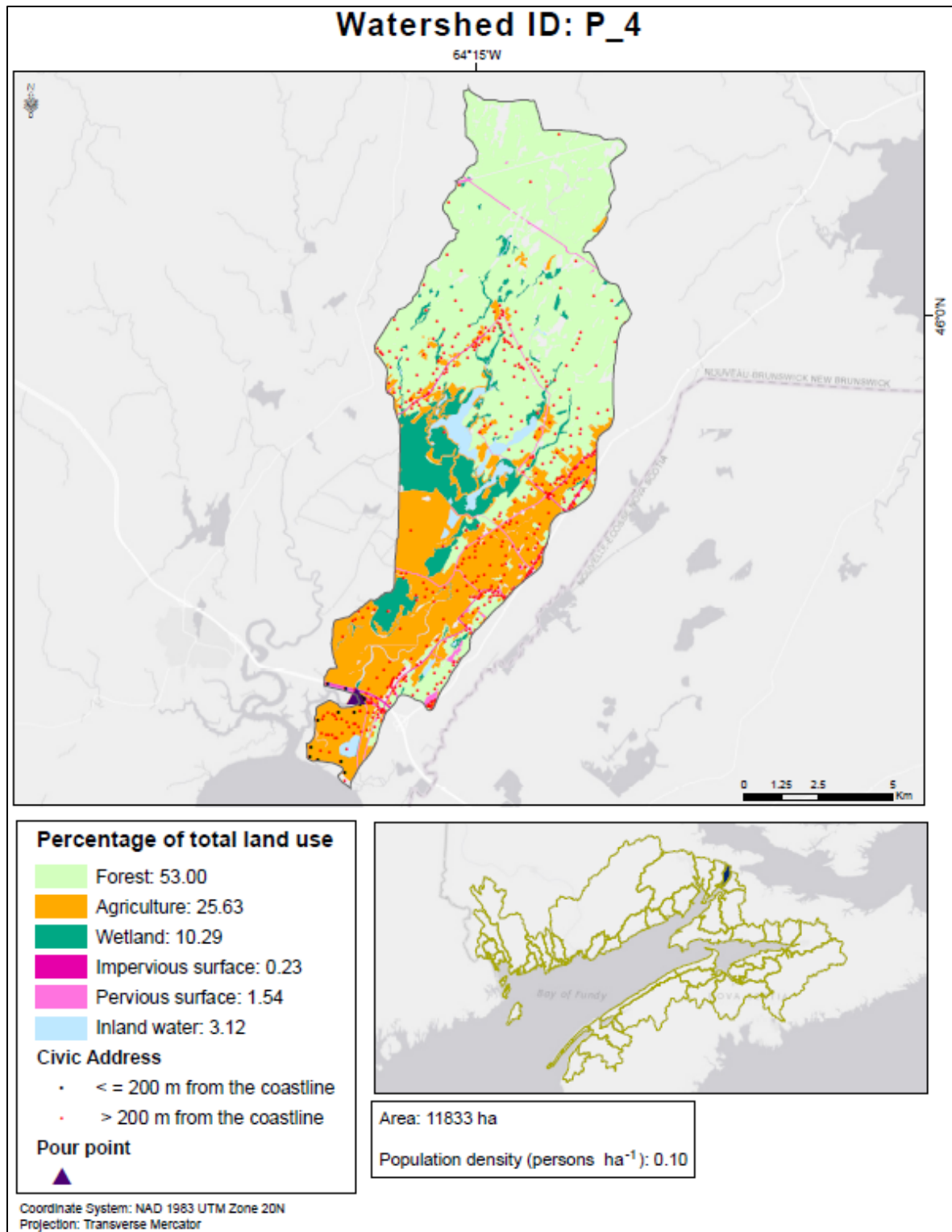


Figure 33. Land-use map for Petitcodiac watershed P\_4. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

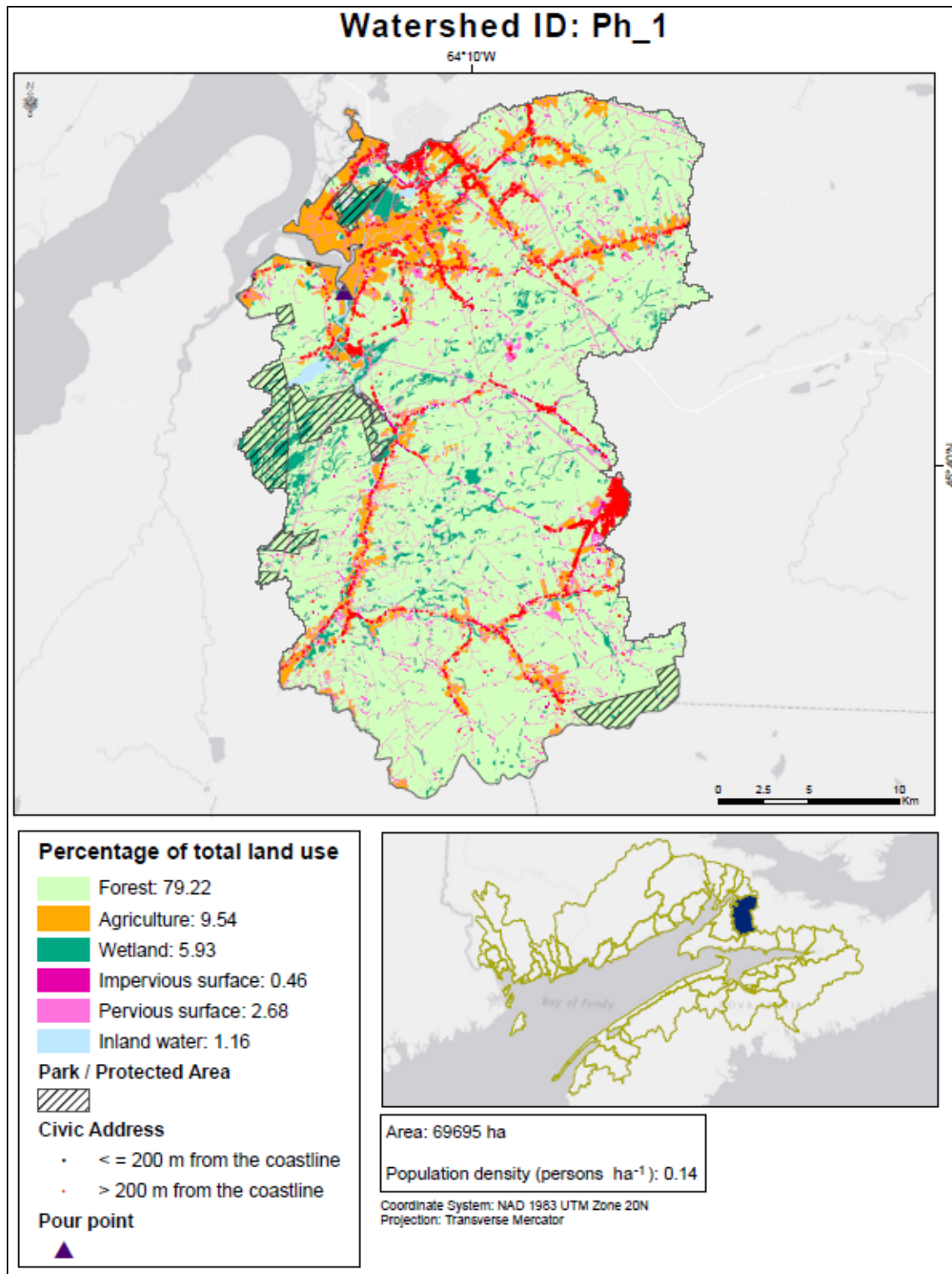


Figure 34. Land-use map for Philip watershed Ph\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

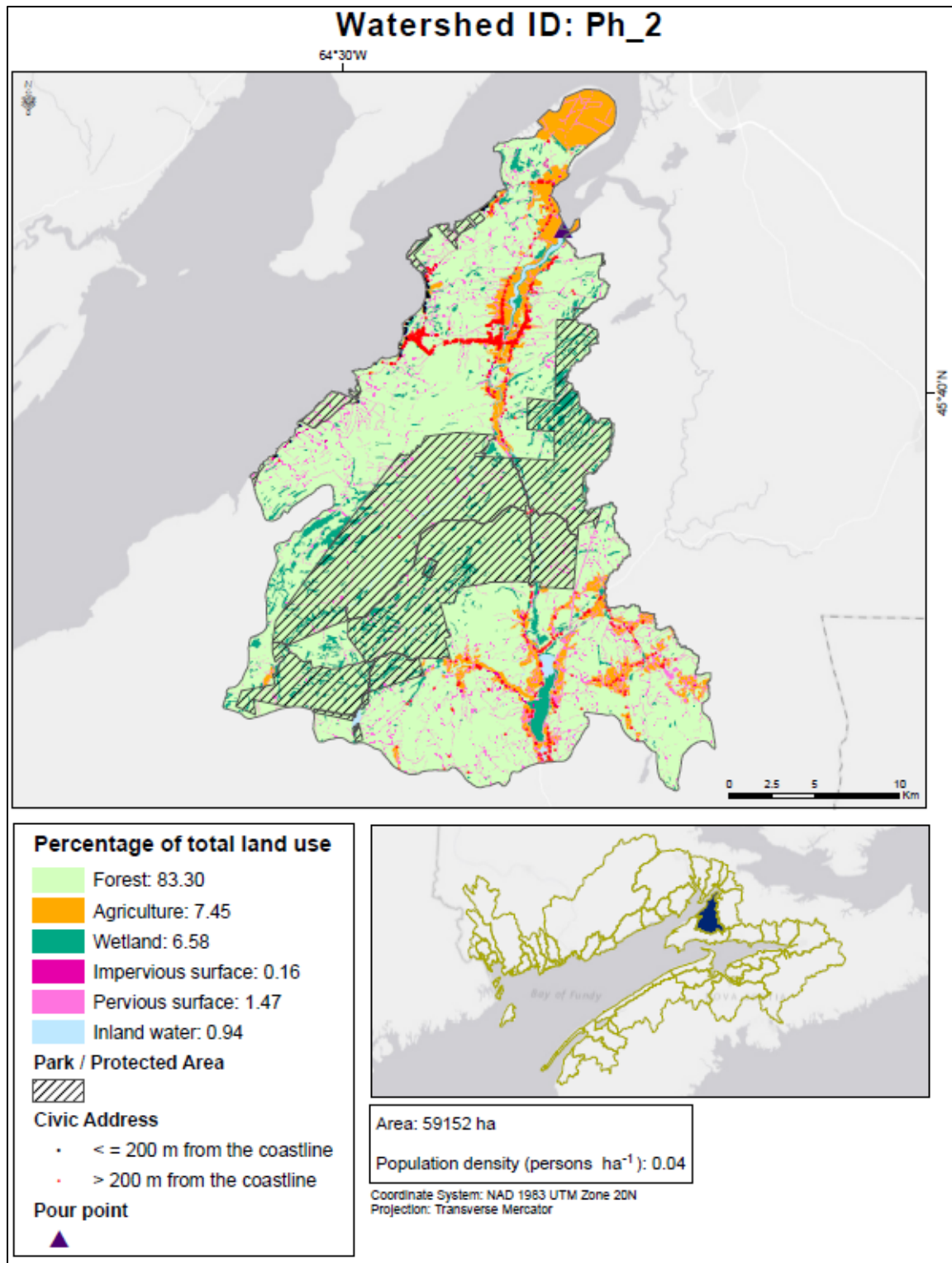


Figure 35. Land-use map for Philip watershed Ph\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

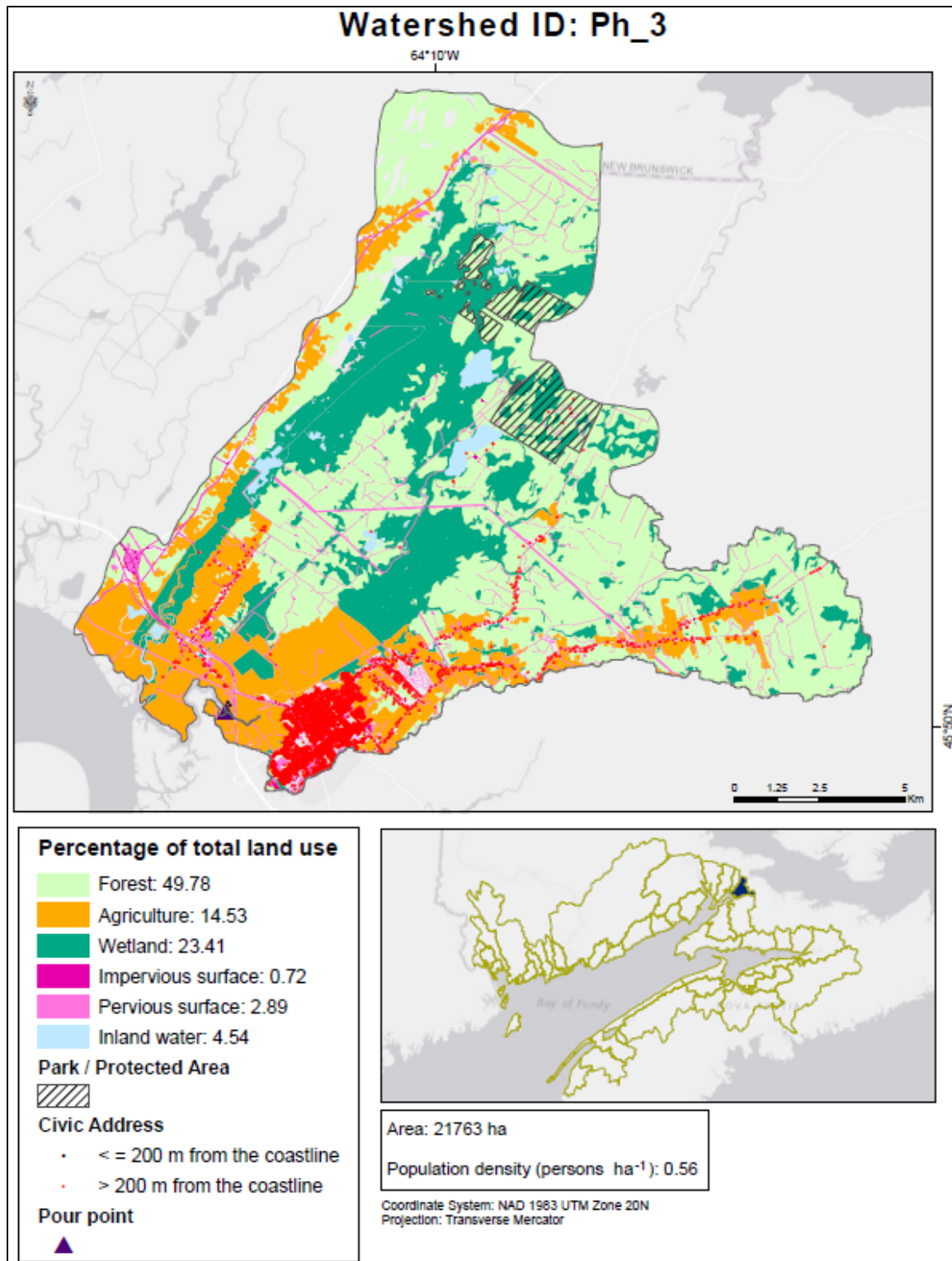


Figure 36. Land-use map for Philip watershed Ph\_3. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).



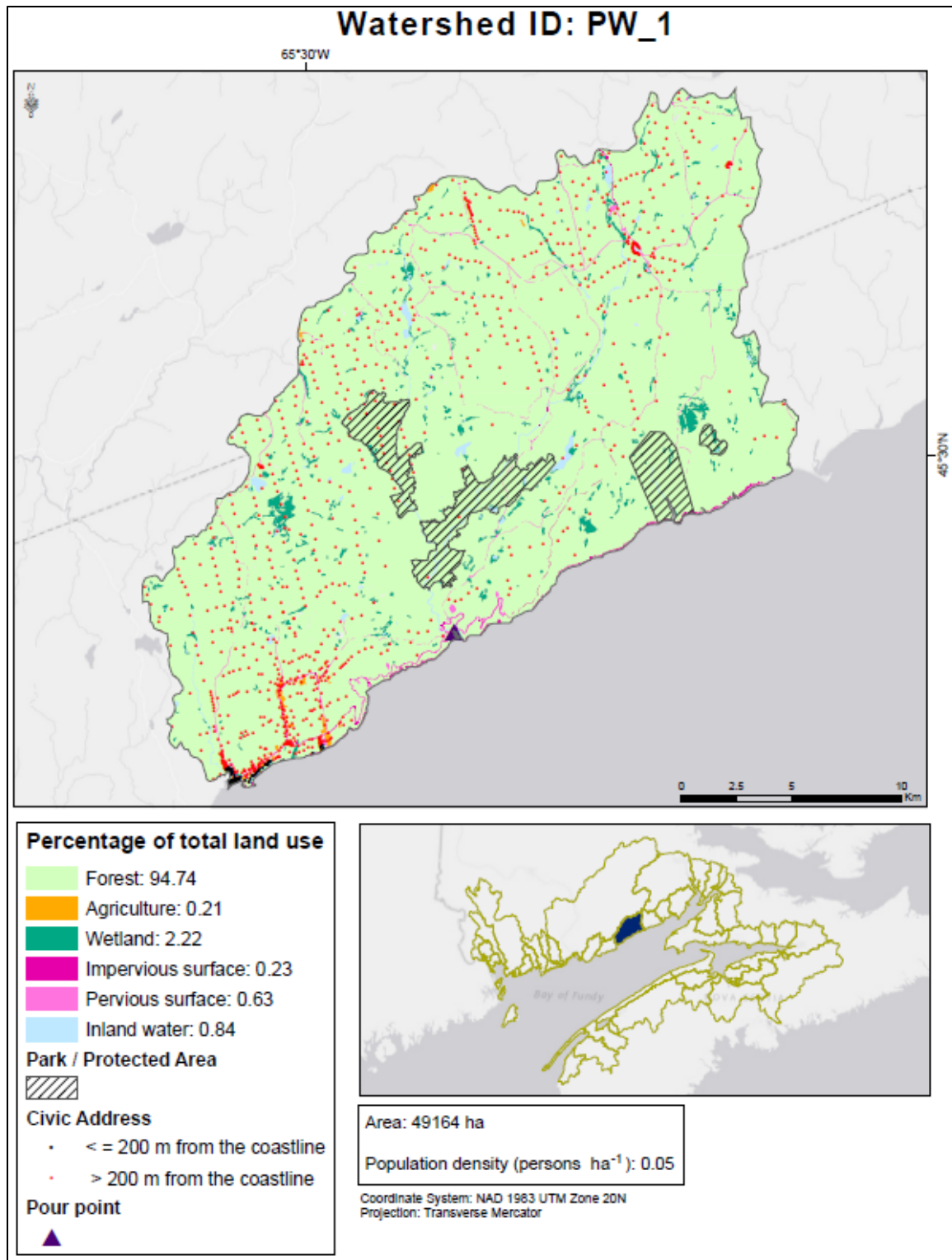


Figure 37. Land-use map for Point Wolfe watershed PW\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

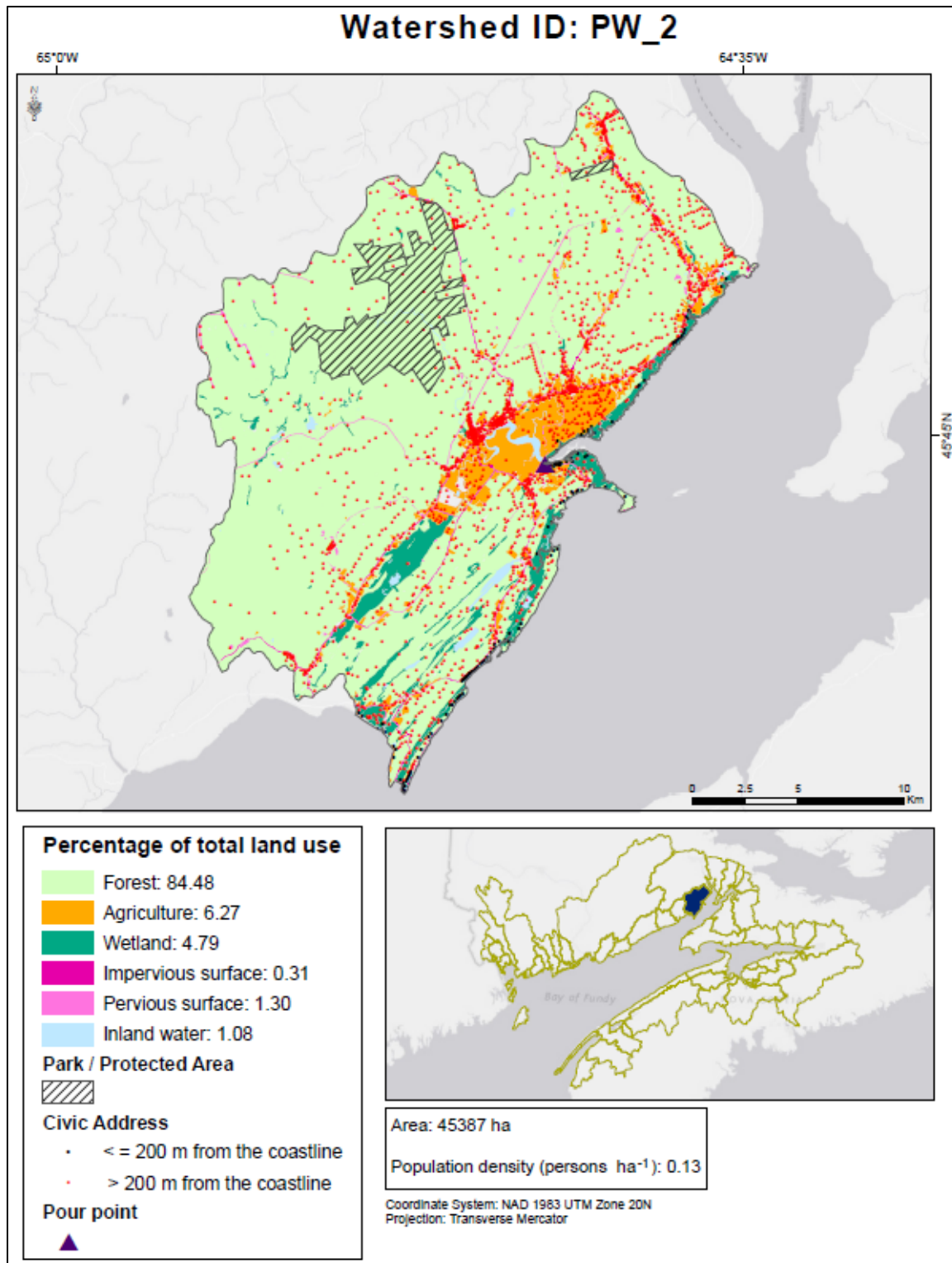


Figure 38. Land-use map for Point Wolfe watershed PW\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

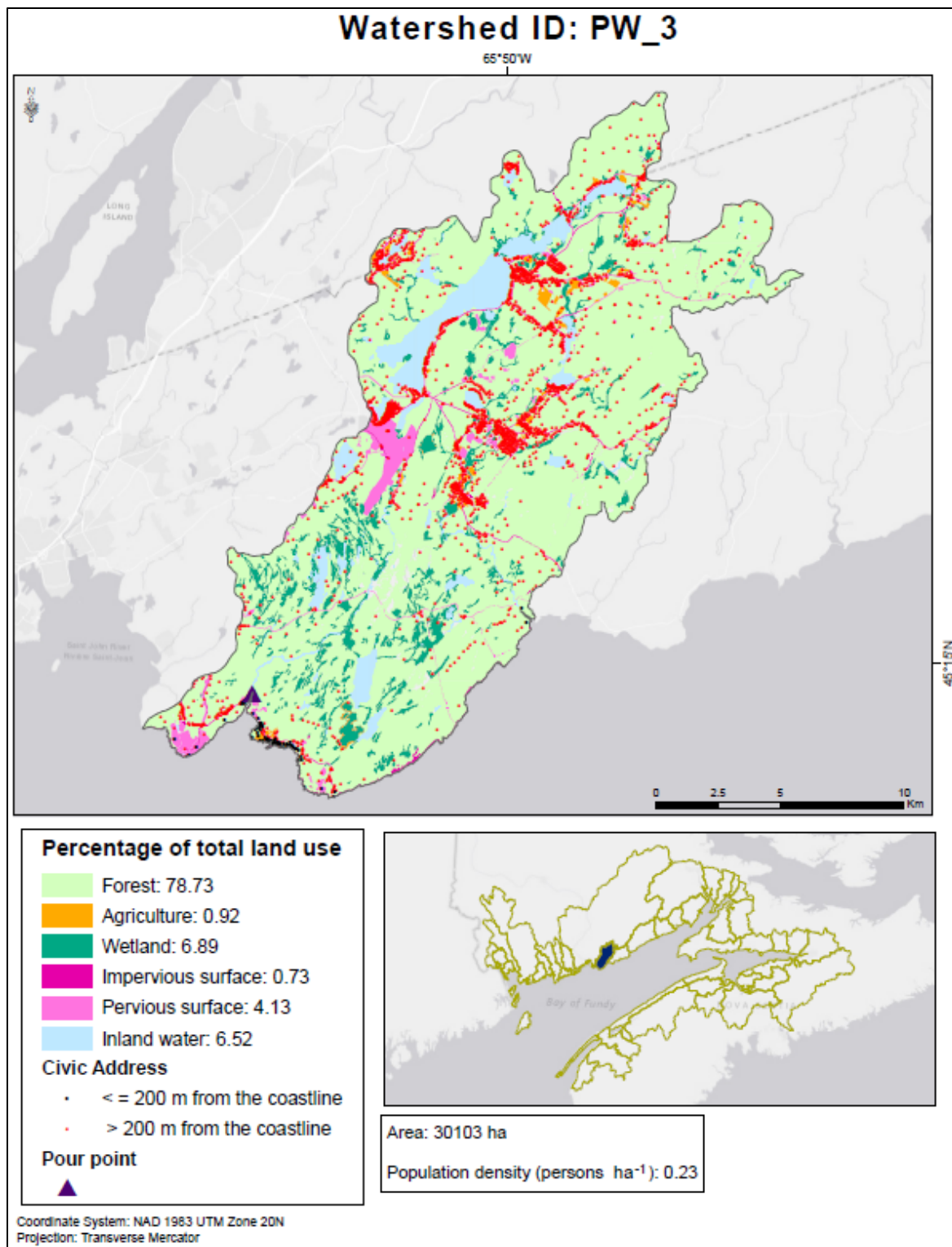


Figure 39. Land-use map for Point Wolfe watershed PW\_3. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

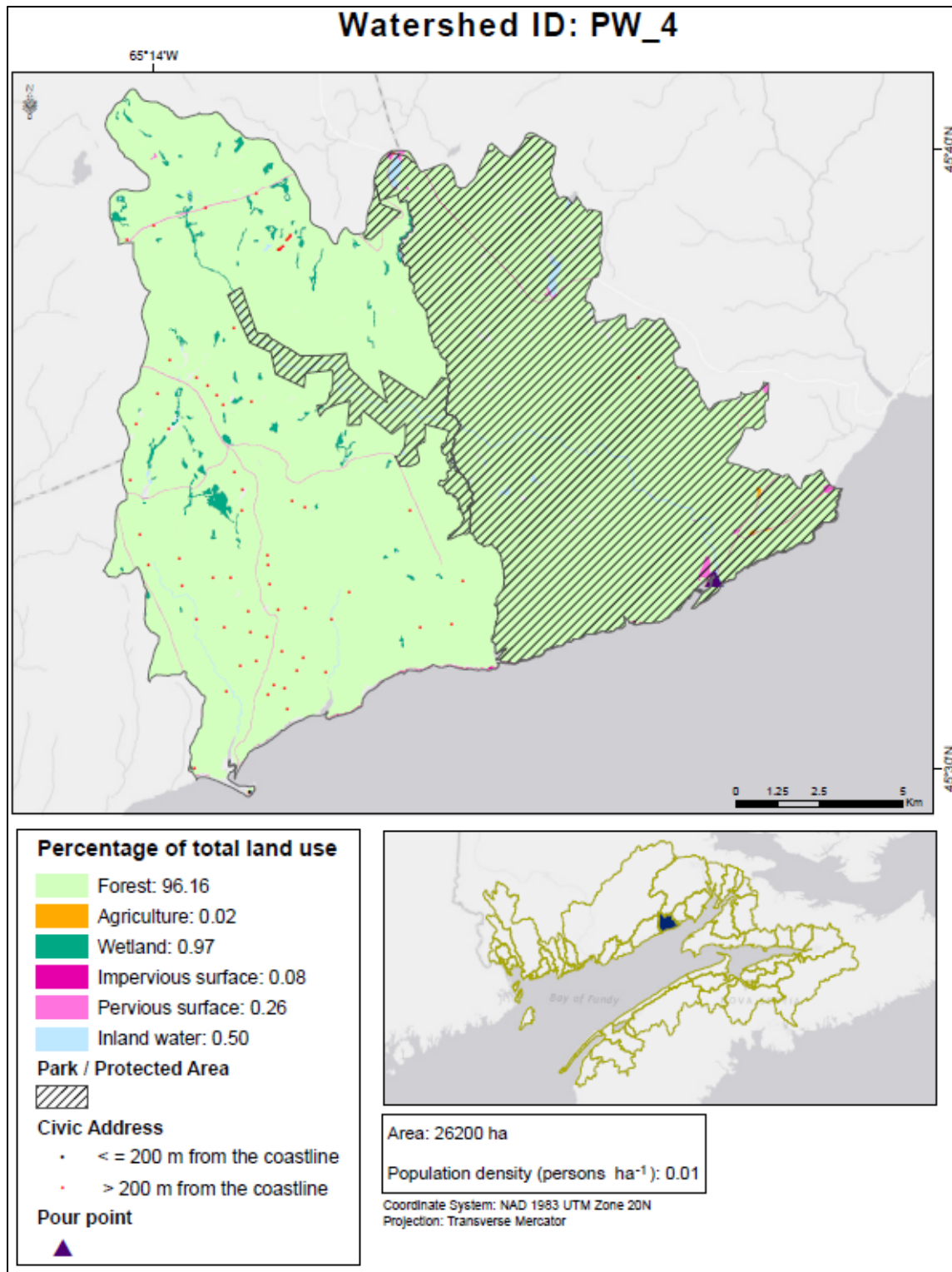


Figure 40. Land-use map for Point Wolfe watershed PW\_4. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

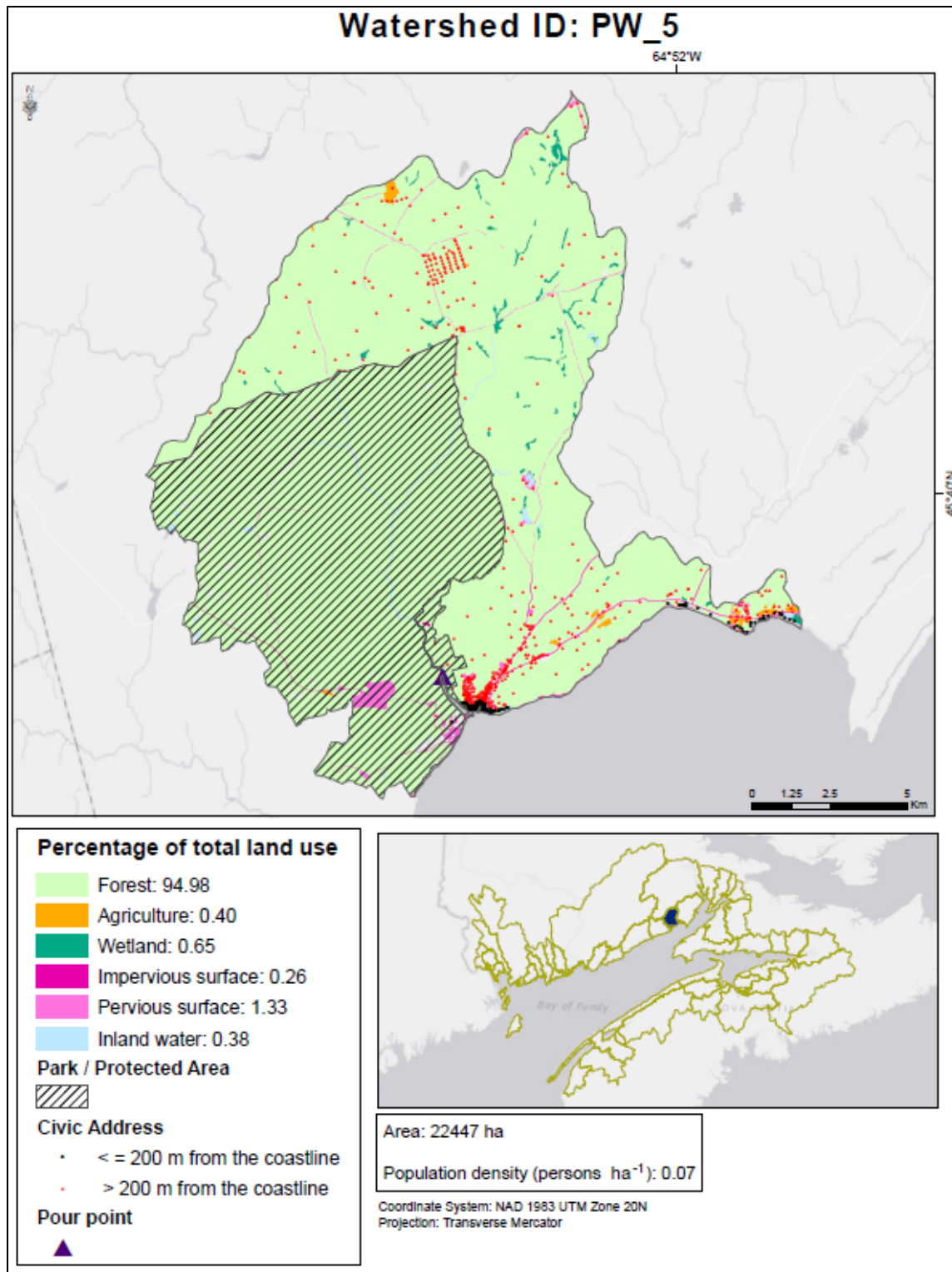


Figure 41. Land-use map for Point Wolfe watershed PW\_5. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

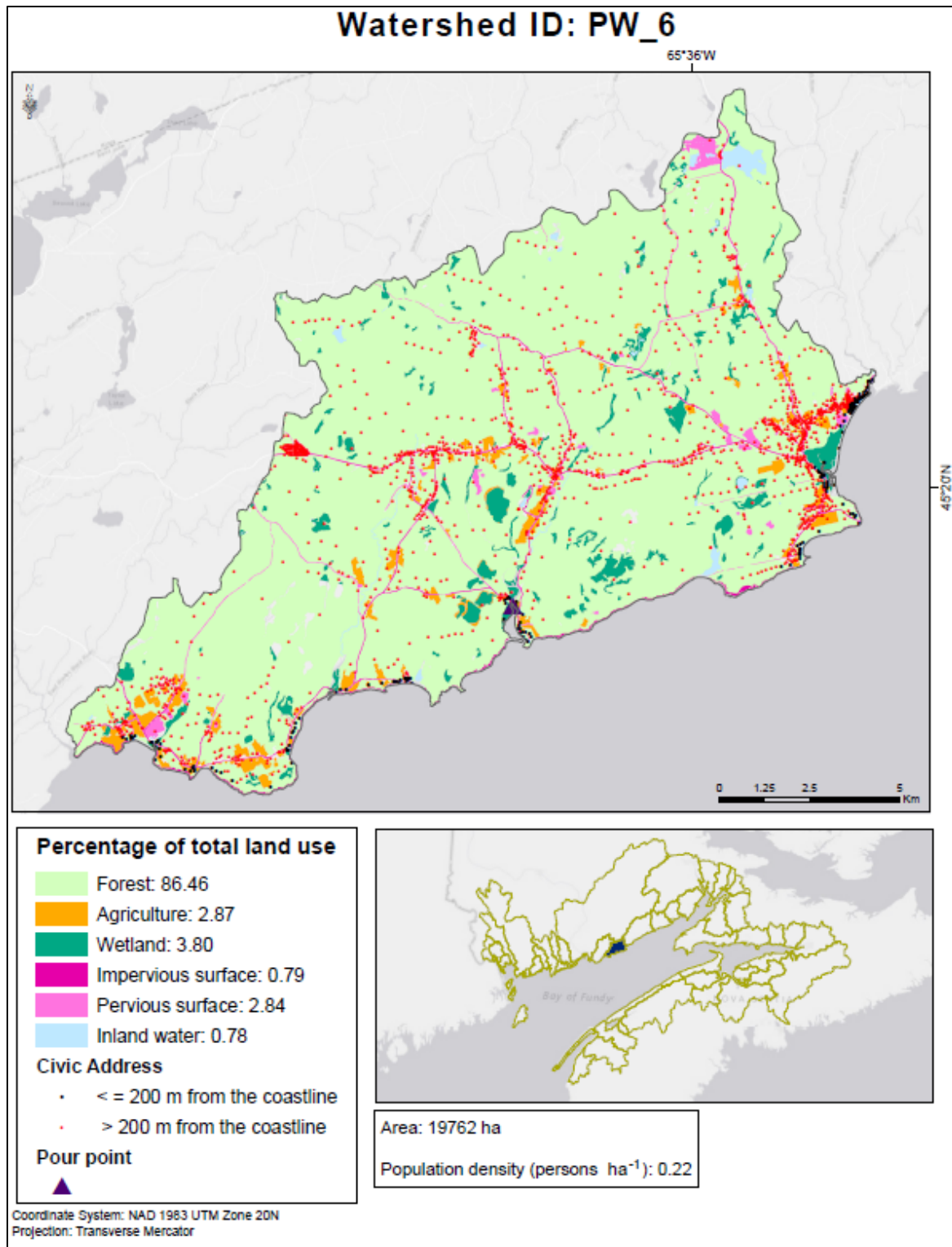


Figure 42. Land-use map for Point Wolfe watershed PW\_6. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

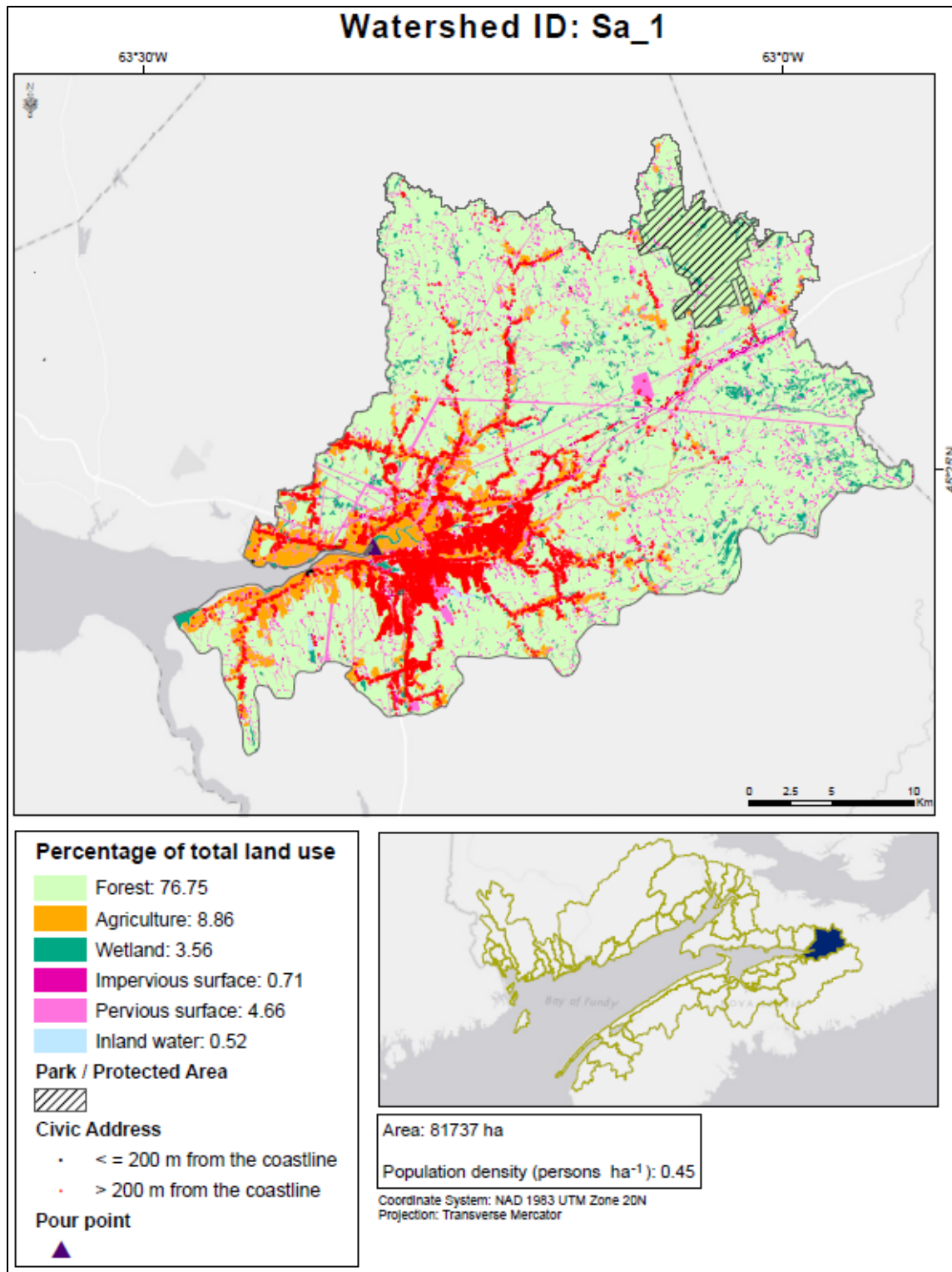


Figure 43. Land-use map for Salmon watershed Sa\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

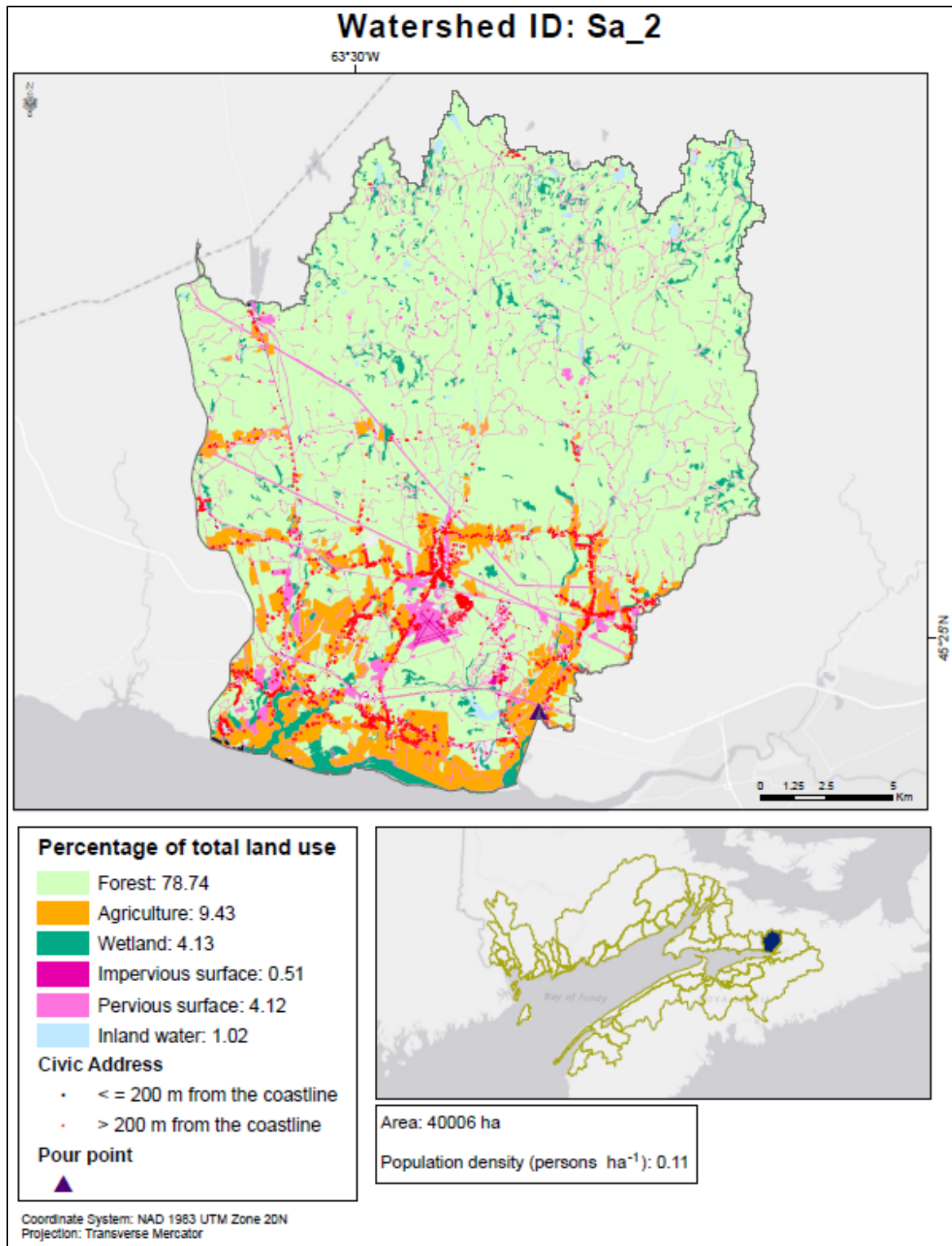


Figure 44. Land-use map for Salmon watershed Sa\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).



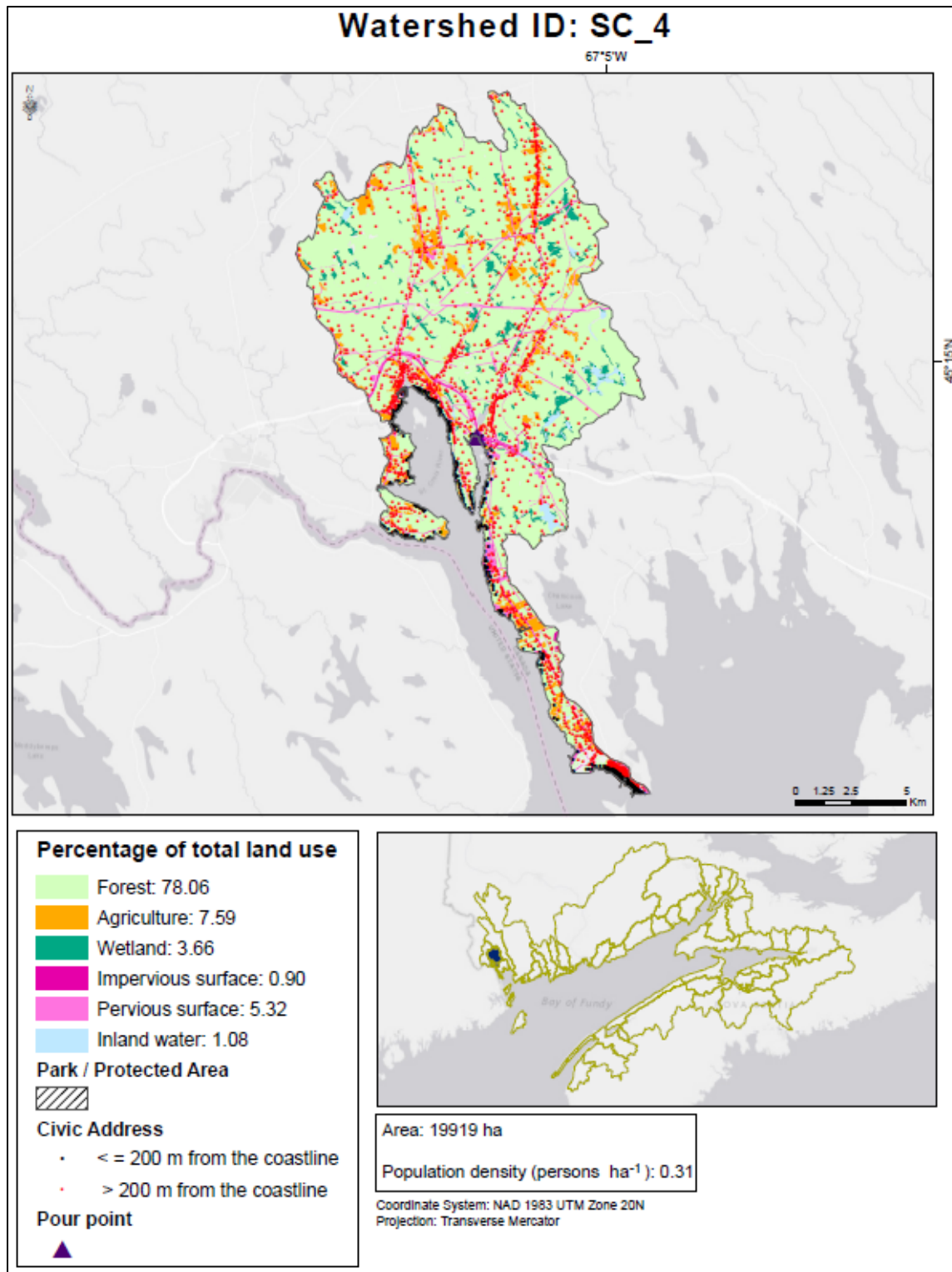


Figure 45. Land-use map for St. Croix watershed SC\_4. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

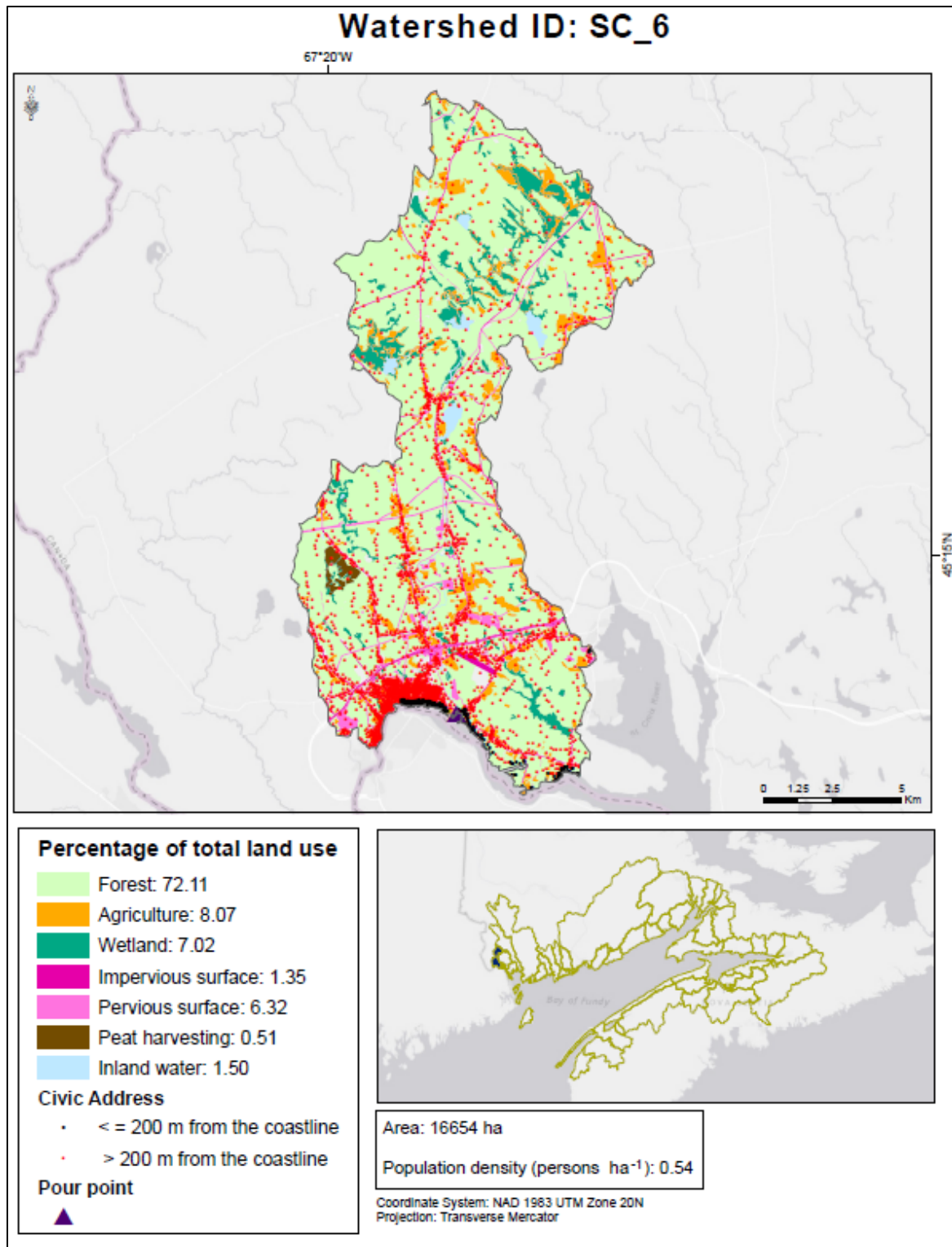


Figure 46. Land-use map for St. Croix watershed SC\_6. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

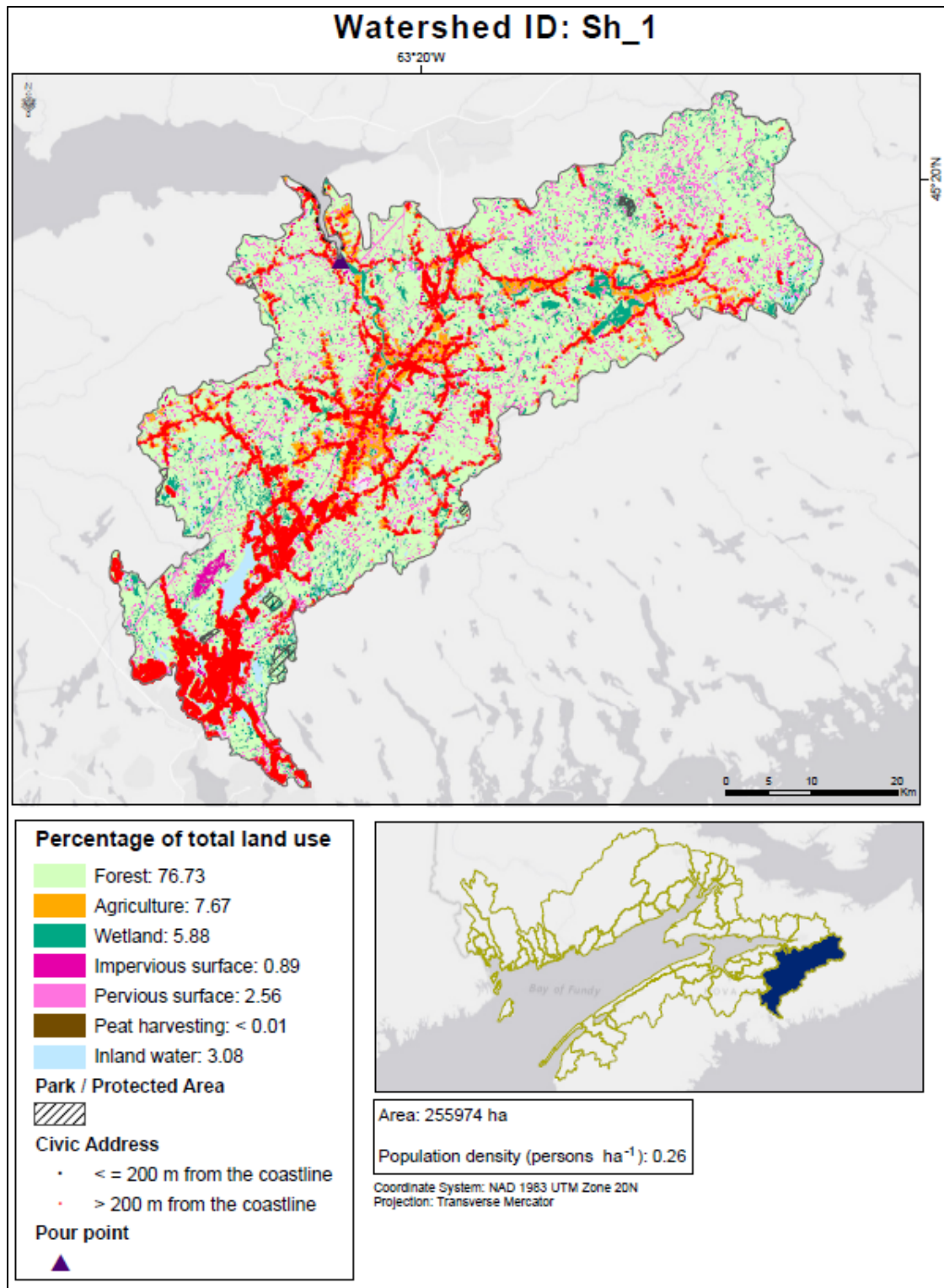


Figure 47. Land-use map for Shubenacadie watershed Sh\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

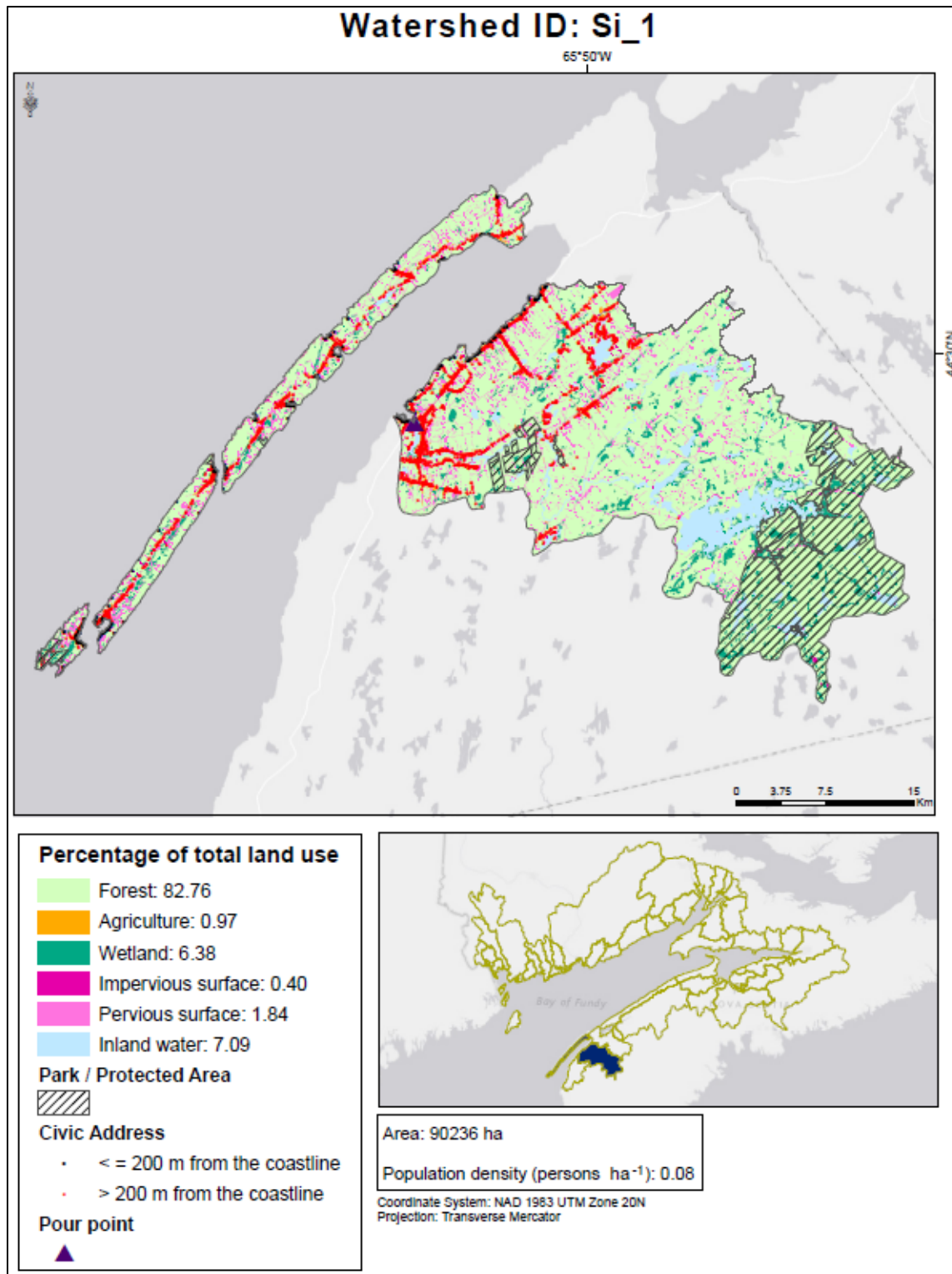


Figure 48. Land-use map for Sissiboo watershed Si\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

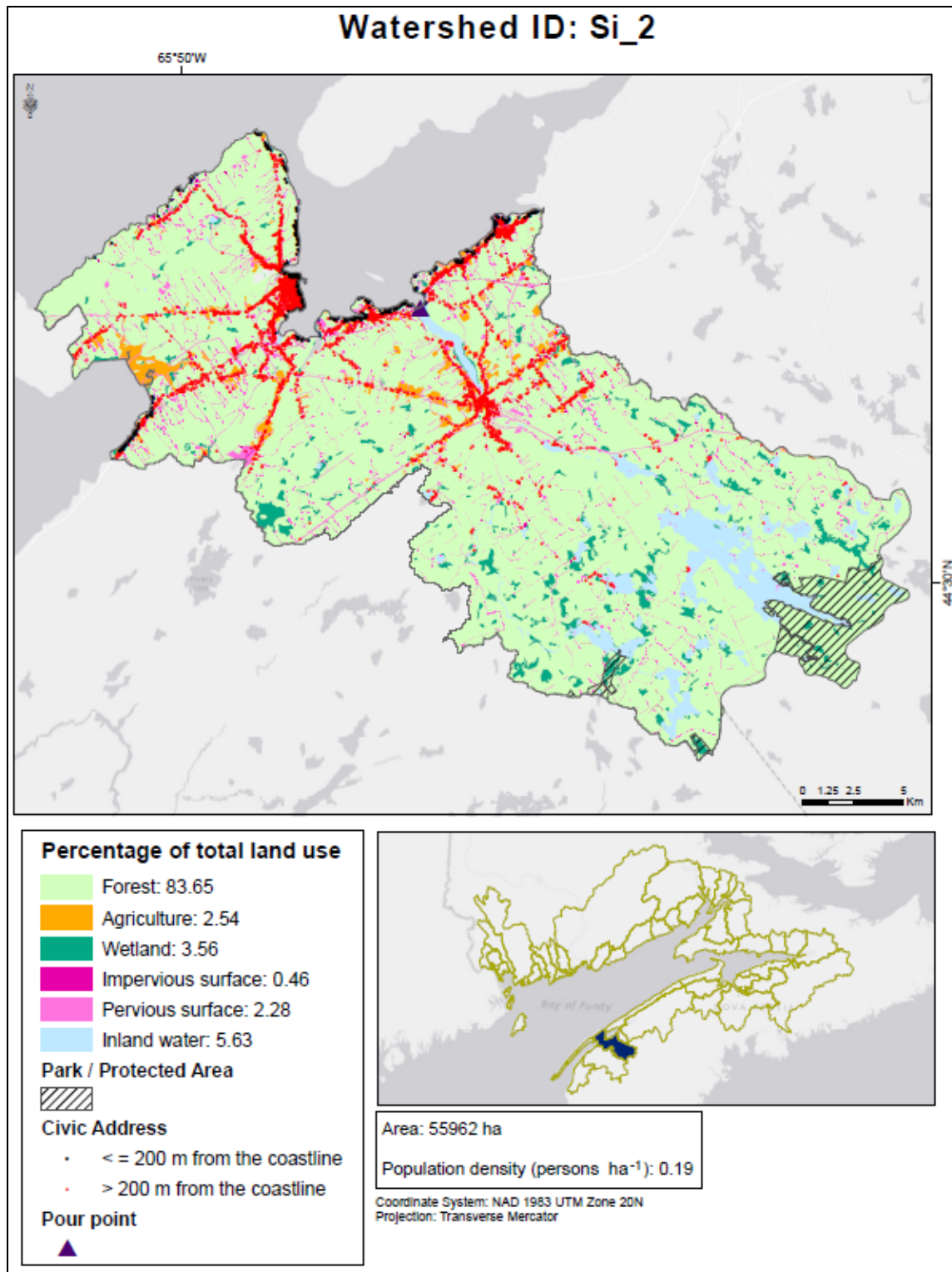


Figure 49. Land-use map for Sissiboo watershed Si\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

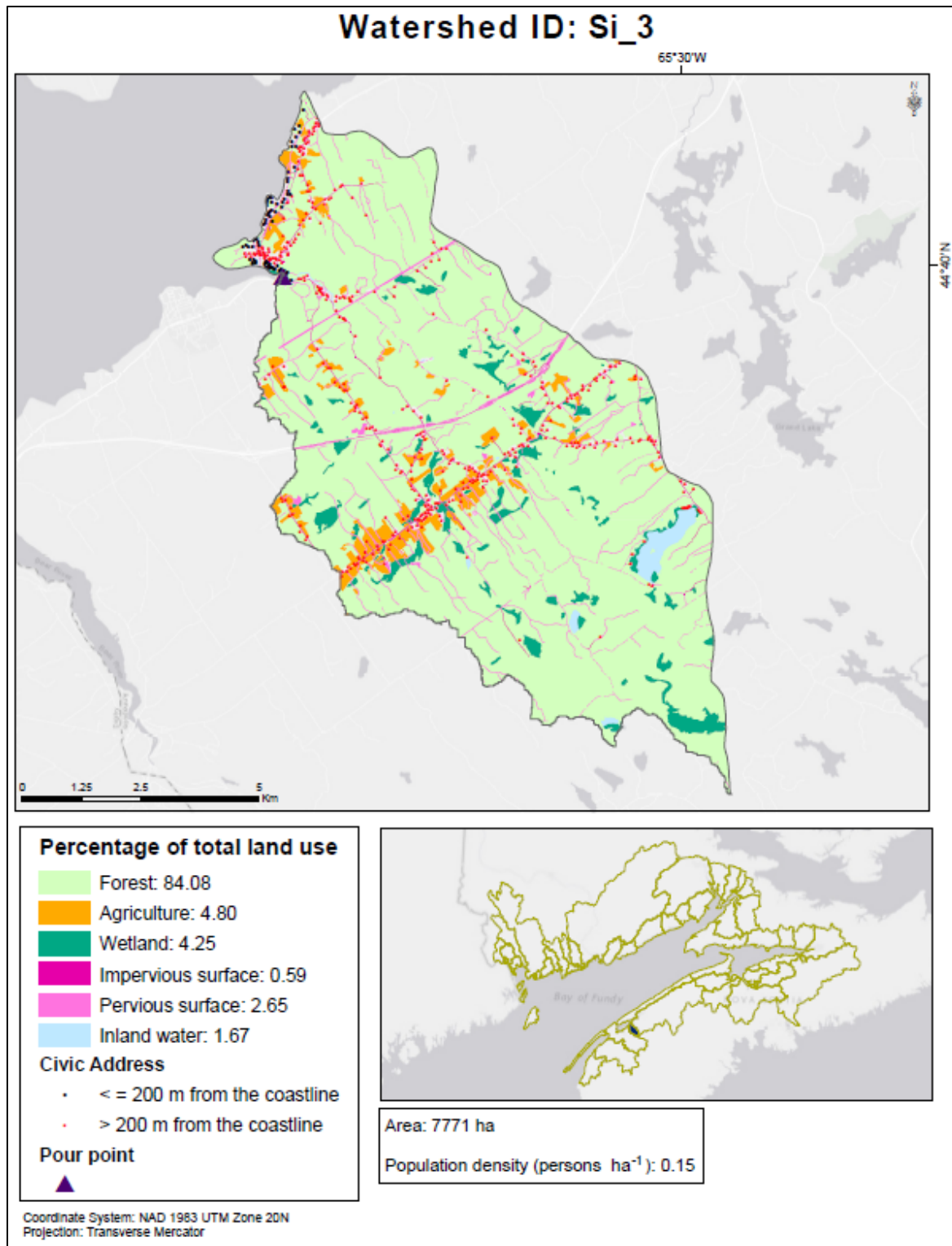


Figure 50. Land-use map for Sissiboo watershed Si\_3. Insets: Watershed area and population density (lower right); location of watershed in relation to the Bay of Fundy sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

## Eastern Watershed Region

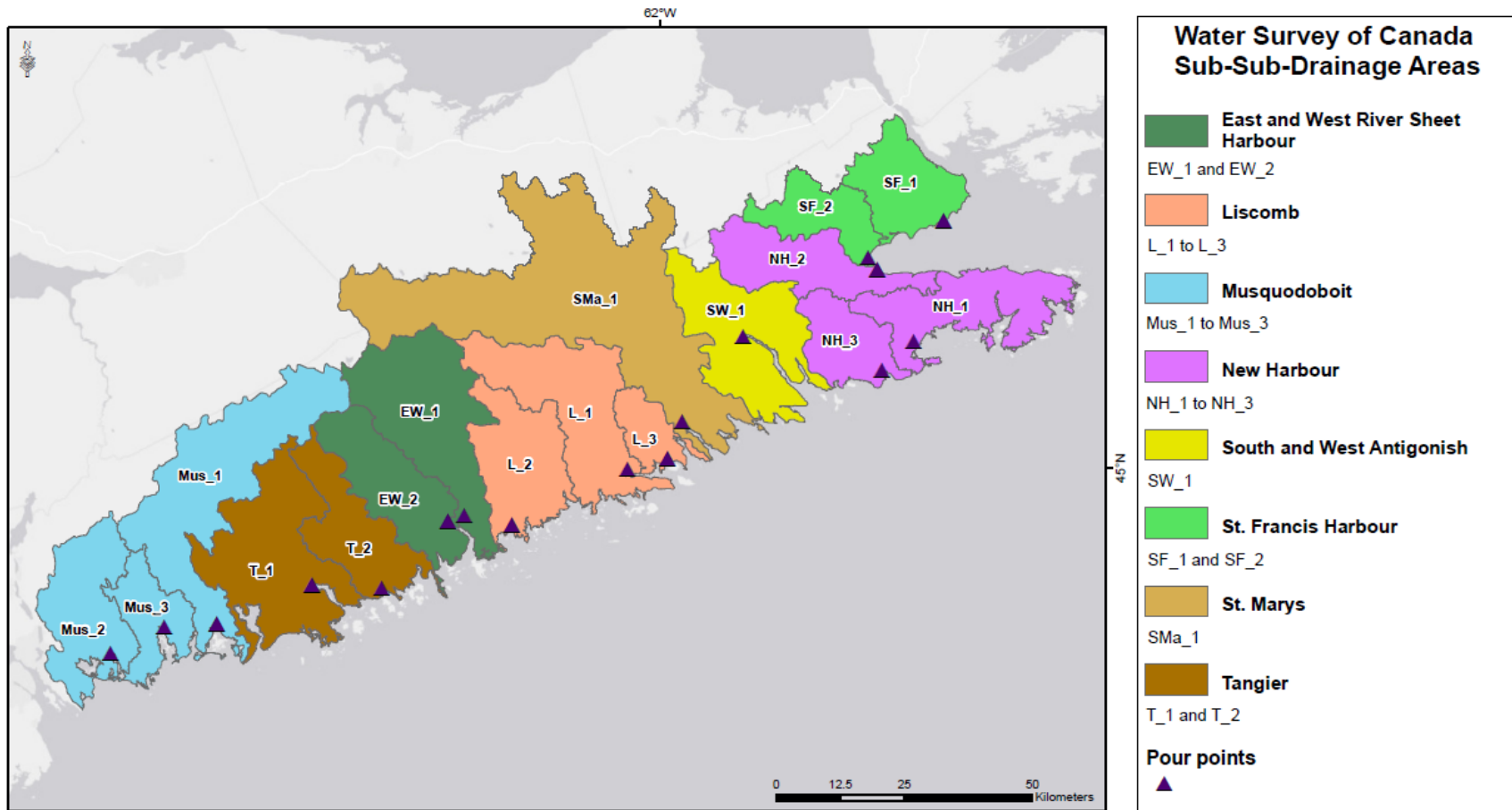


Figure 51. Eastern sub-region, displaying eight Water Survey of Canada sub-sub-drainage areas (denoted by differing colours) and their associated watersheds. Black triangles represent the major pour points (largest outlets into the coastal zone).

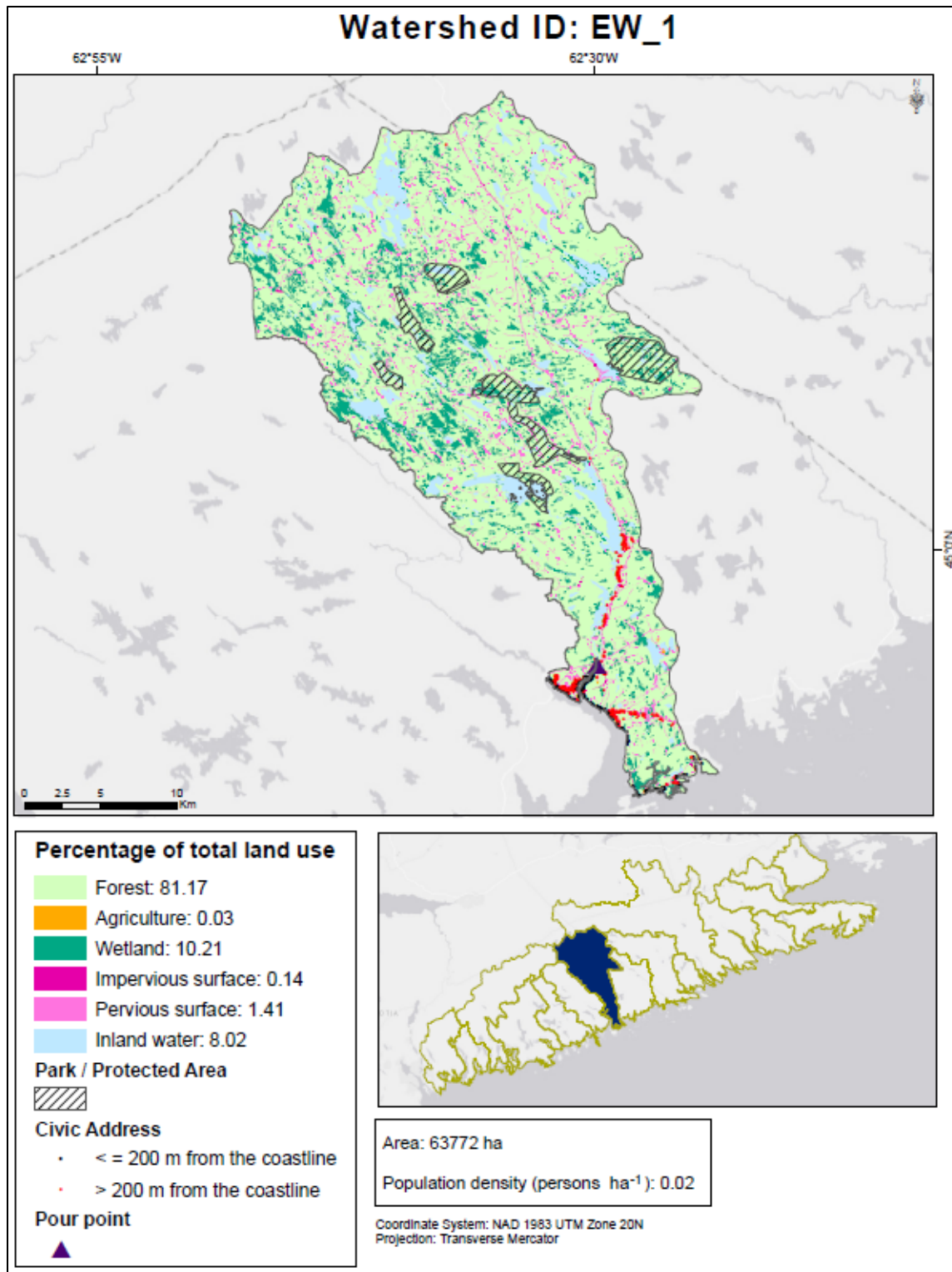


Figure 52. Land-use map for East and West River Sheet Harbour watershed EW\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Eastern sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).



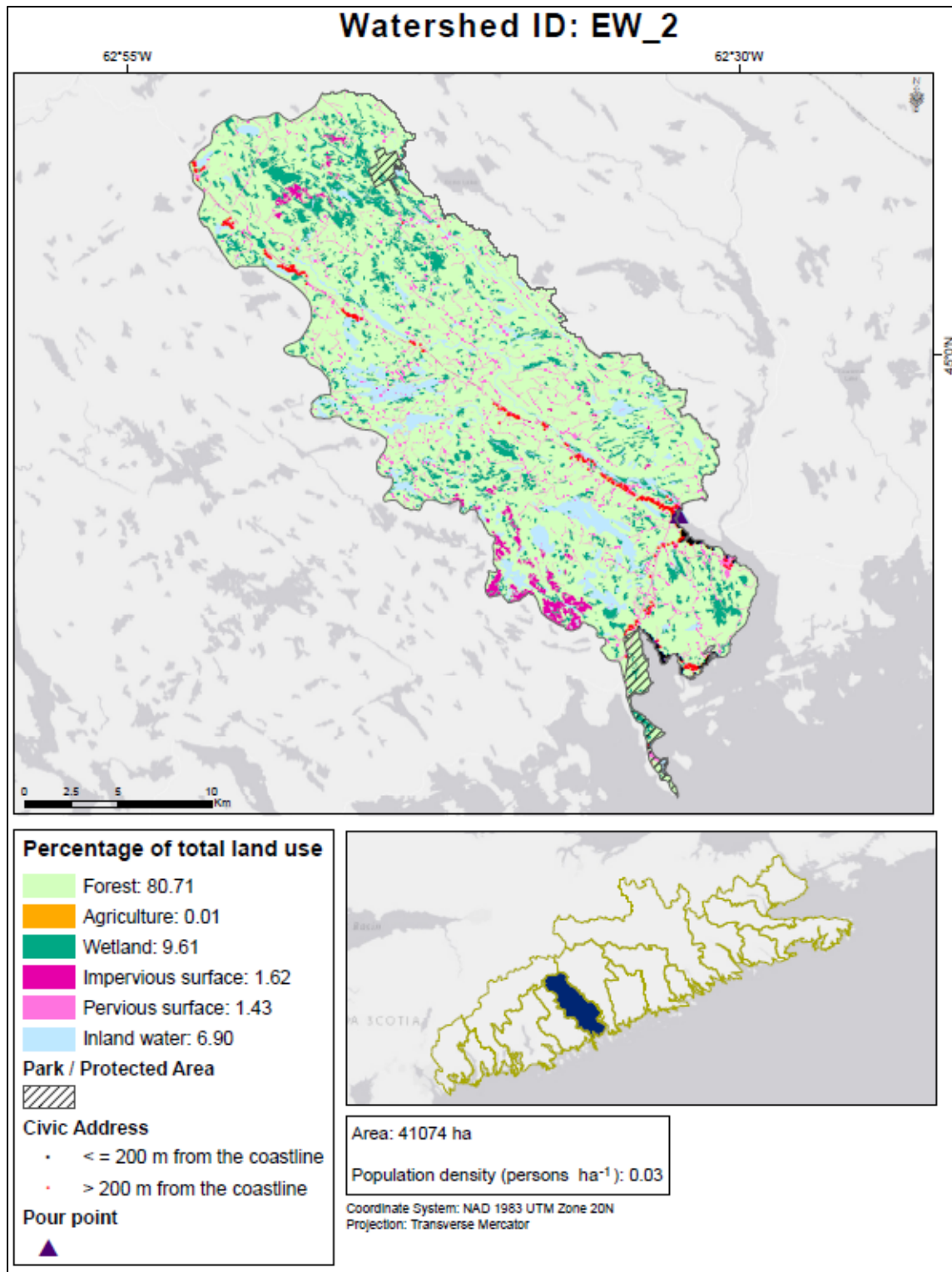


Figure 53. Land-use map for East and West River Sheet Harbour watershed EW\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Eastern sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

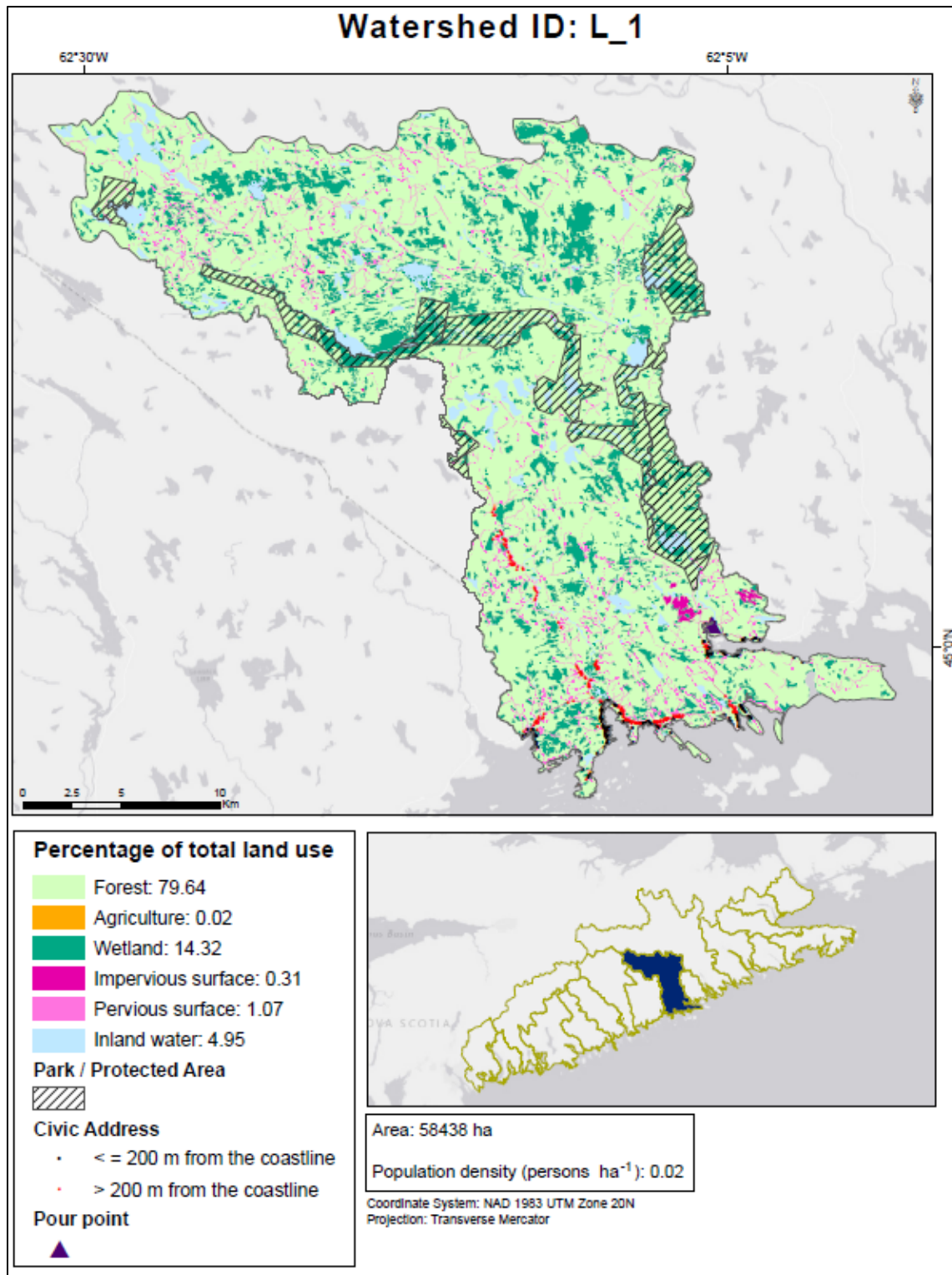


Figure 54. Land-use map for Liscomb watershed L\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Eastern sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

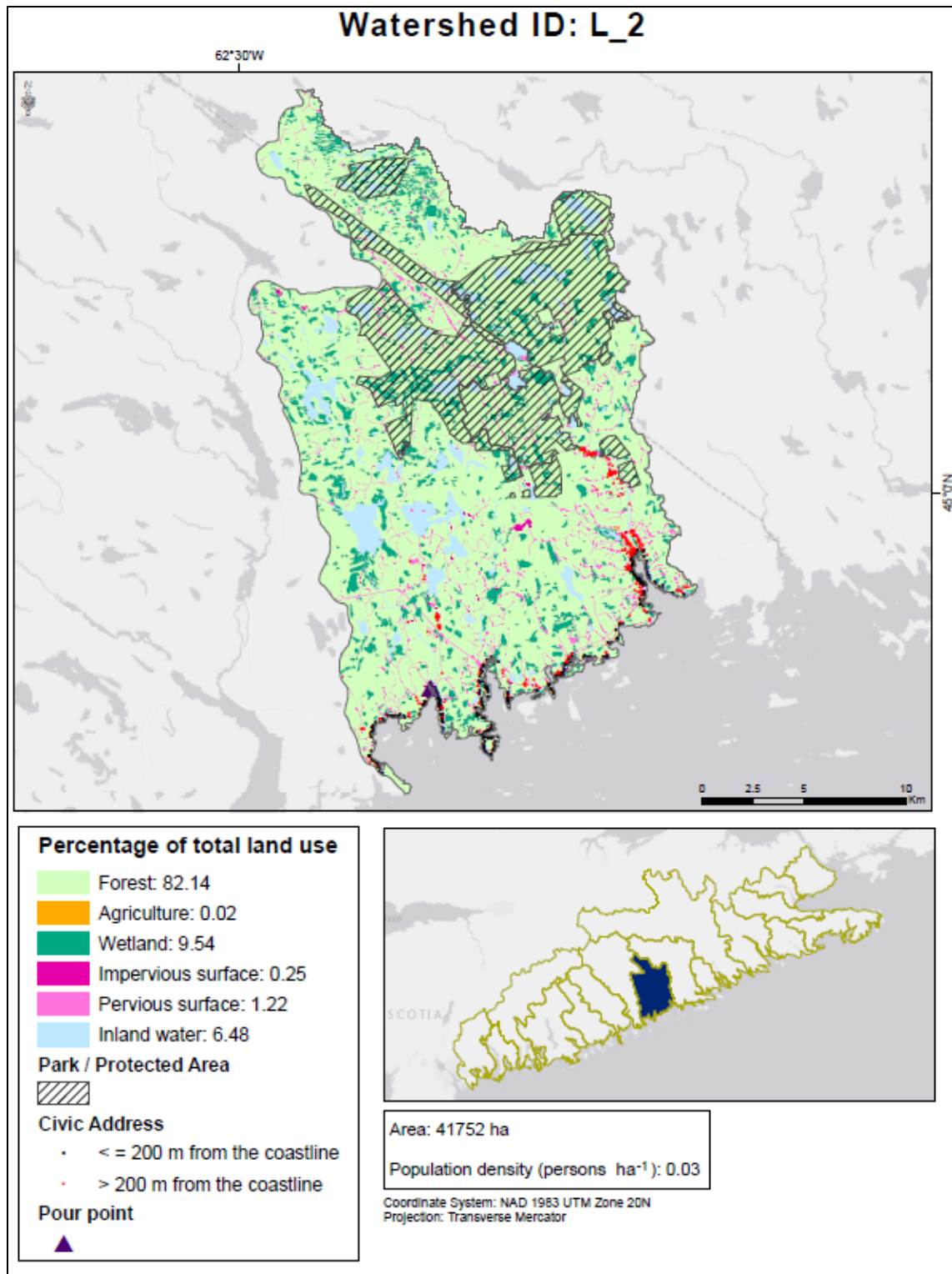


Figure 55. Land-use map for Liscomb watershed L\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Eastern sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

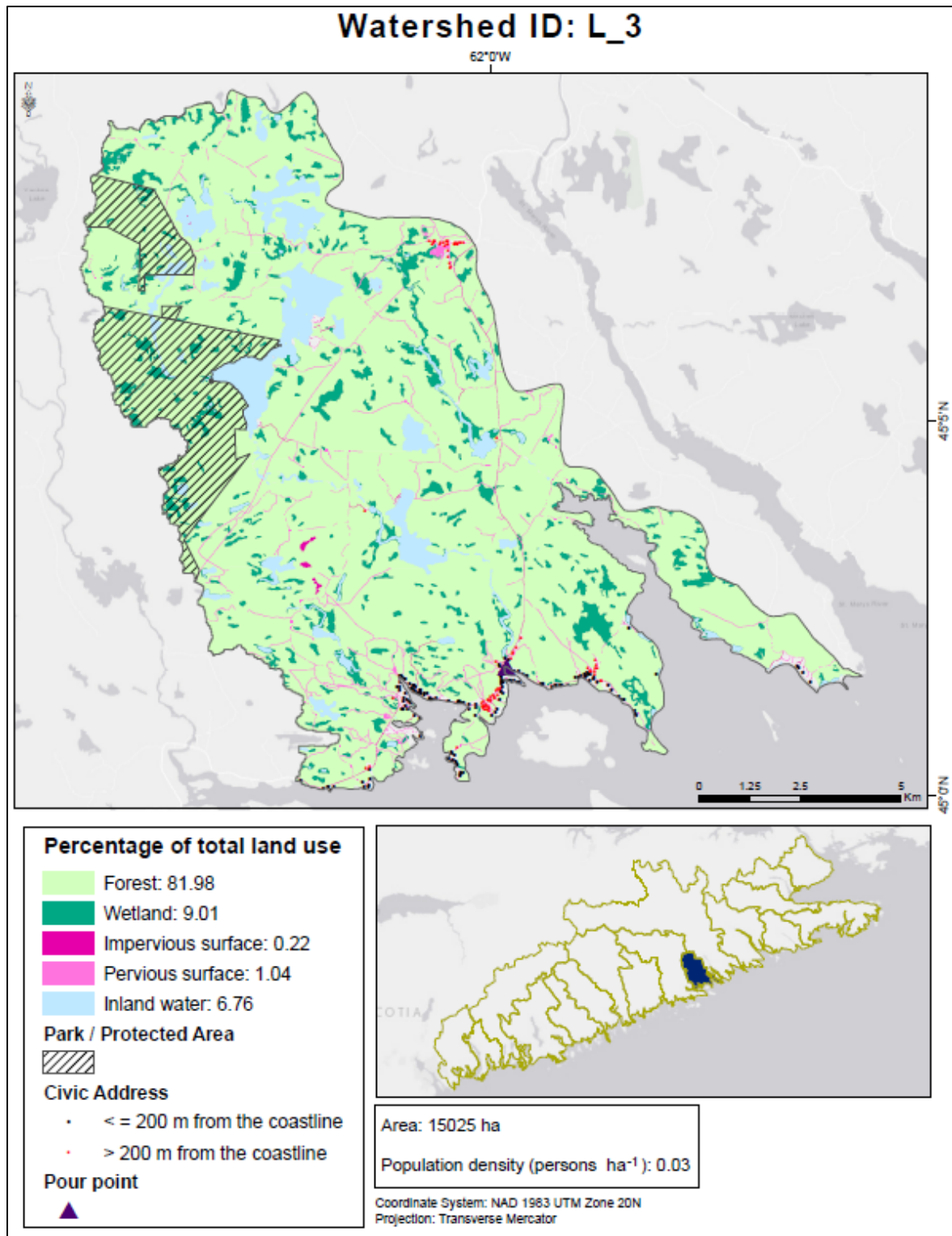


Figure 56. Land-use map for Liscomb watershed L\_3. Insets: Watershed area and population density (lower right); location of watershed in relation to the Eastern sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

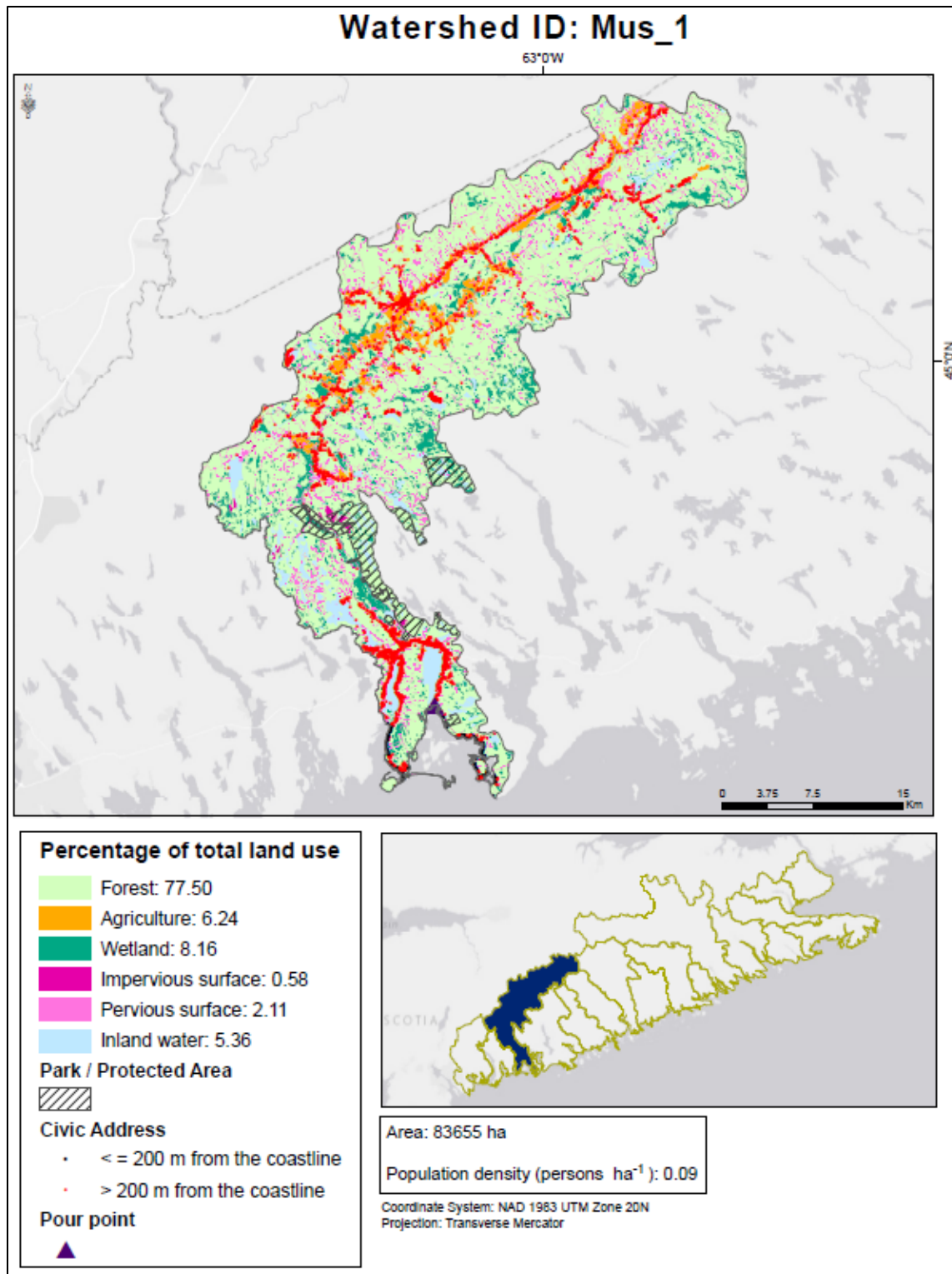


Figure 57. Land-use map for Musquodoboit watershed Mus\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Eastern sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

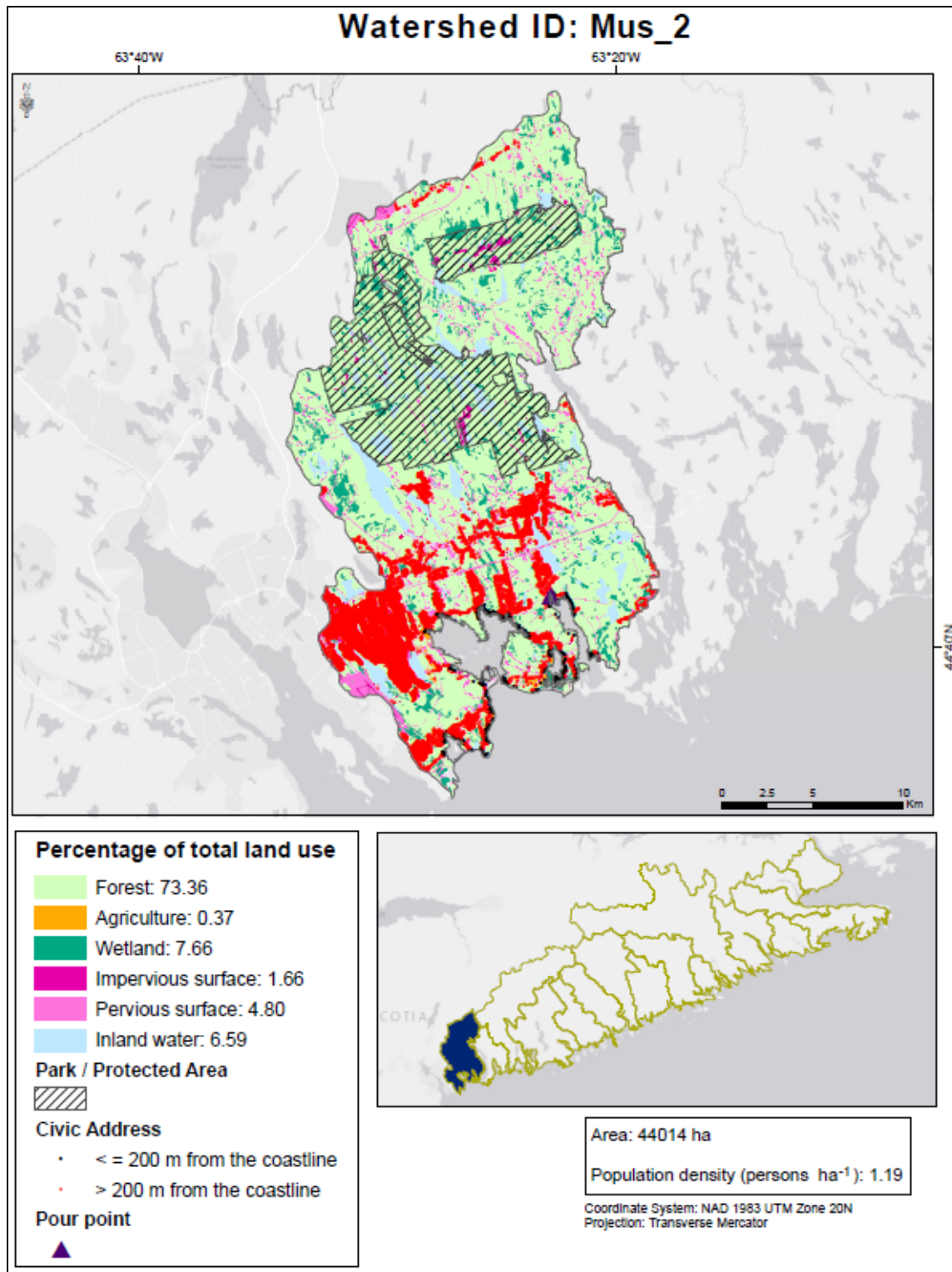


Figure 58. Land-use map for Musquodoboit watershed Mus\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Eastern sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

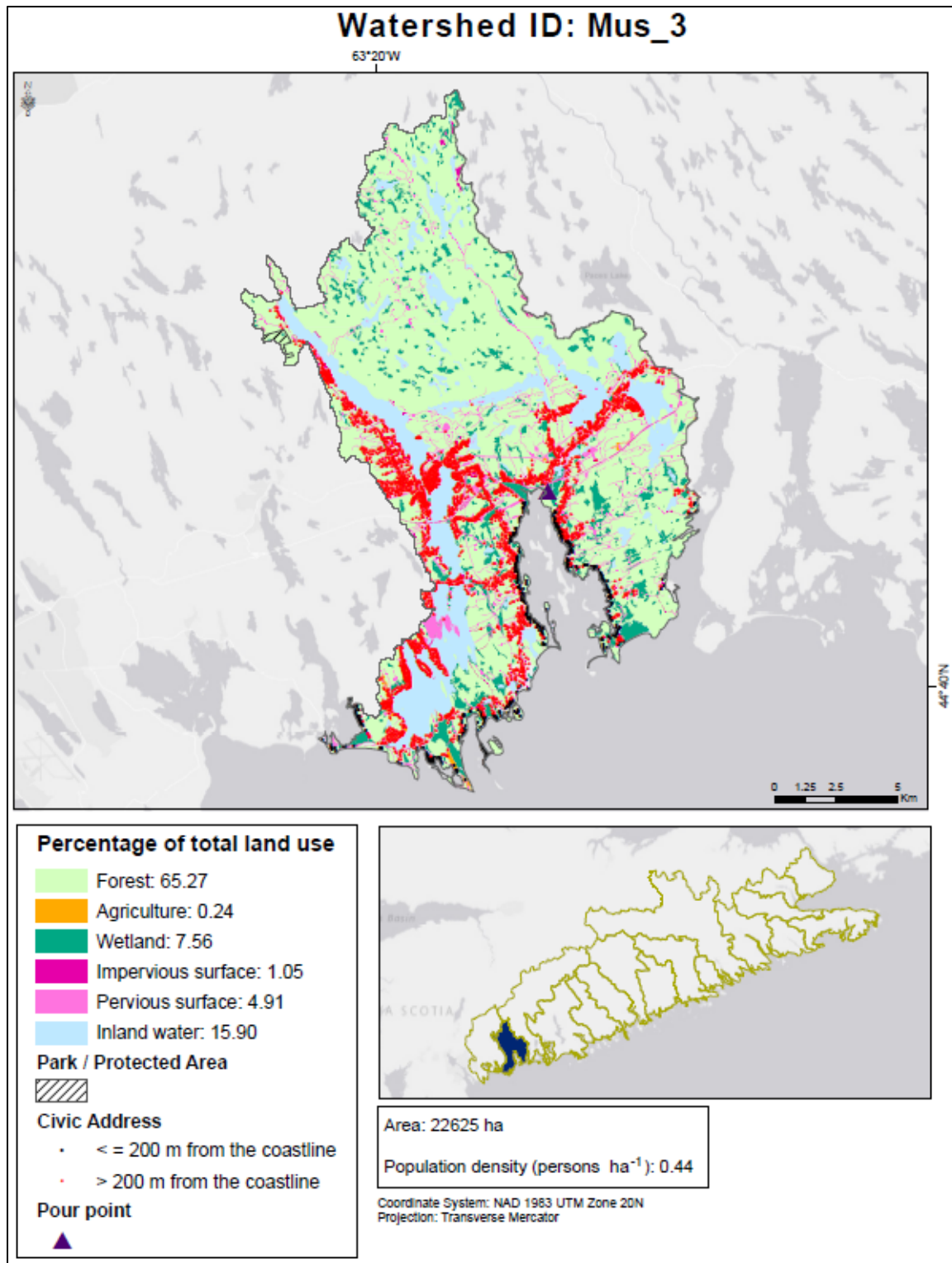


Figure 59. Land-use map for Musquodoboit watershed Mus\_3. Insets: Watershed area and population density (lower right); location of watershed in relation to the Eastern sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

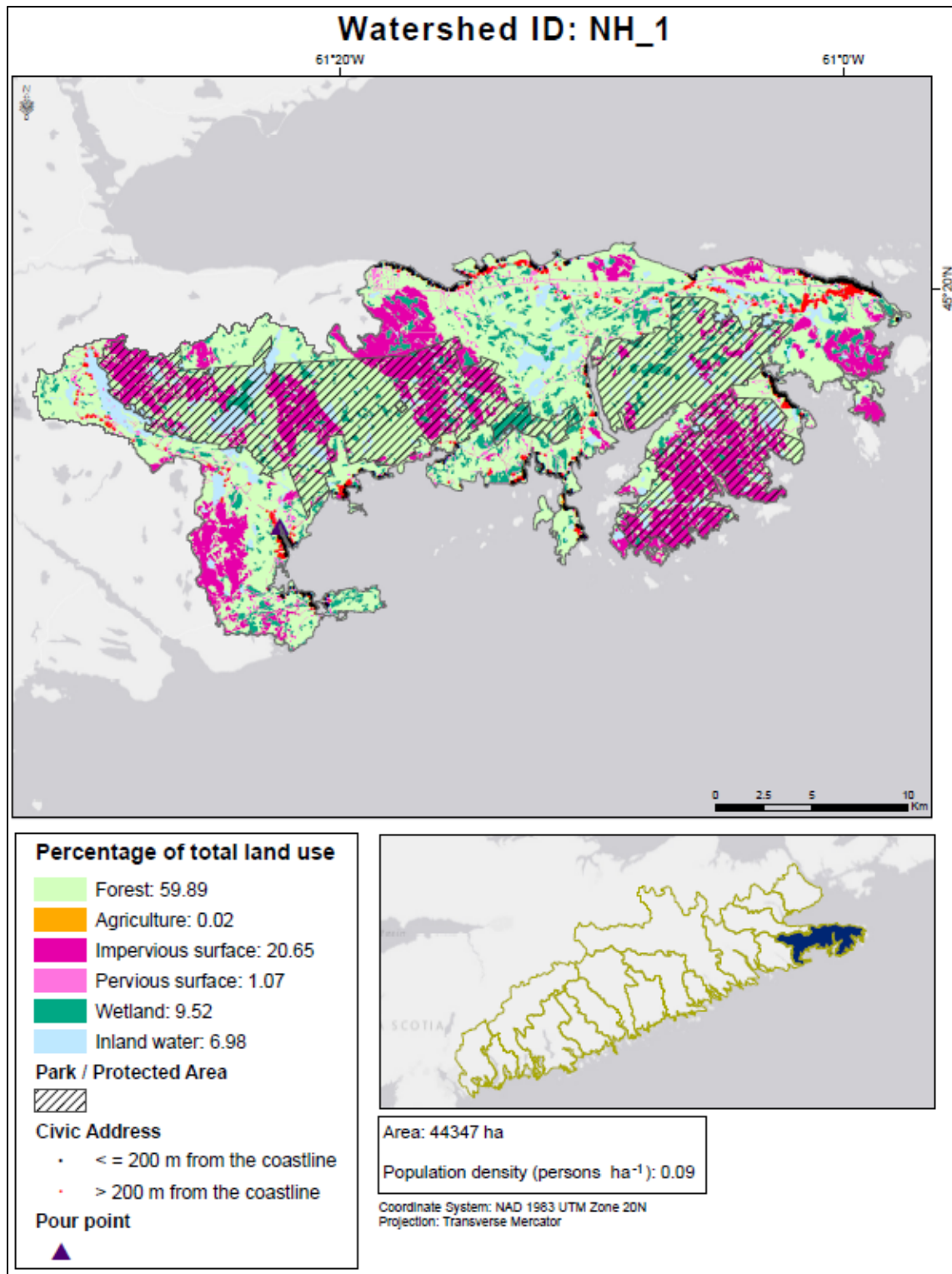


Figure 60. Land-use map for New Harbour watershed NH\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Eastern sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).



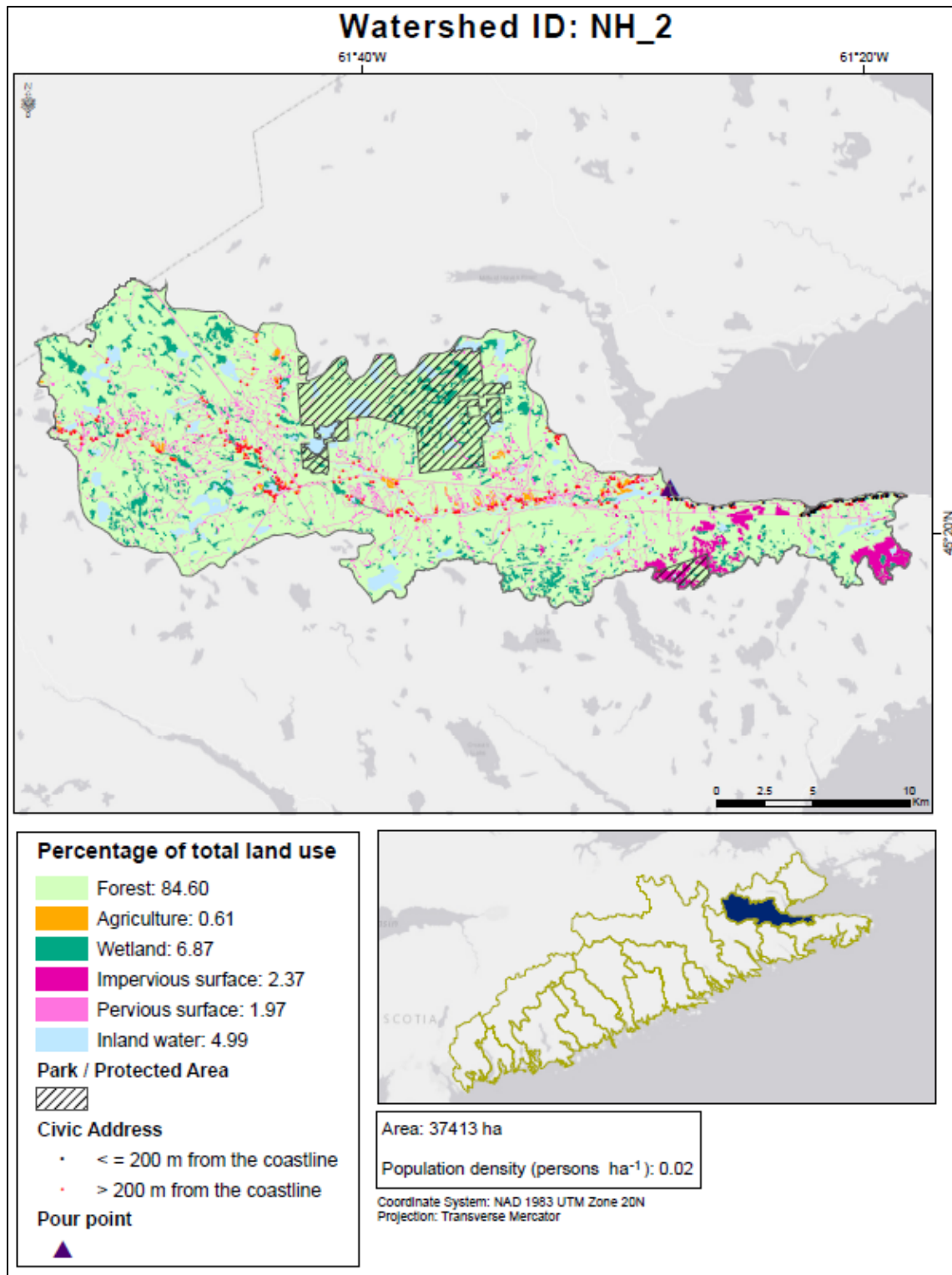


Figure 61. Land-use map for New Harbour watershed NH\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Eastern sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

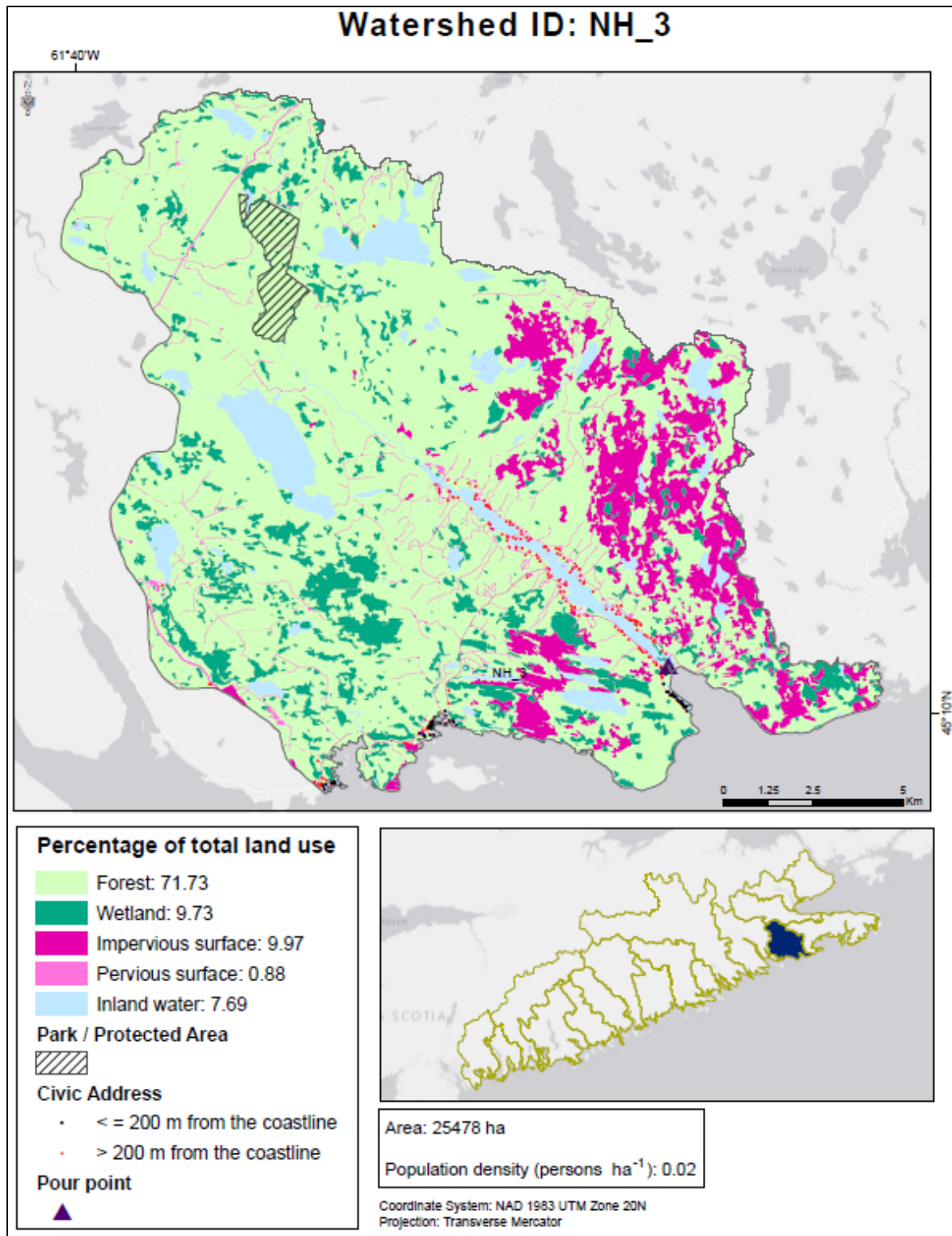


Figure 62. Land-use map for New Harbour watershed NH\_3. Insets: Watershed area and population density (lower right); location of watershed in relation to the Eastern sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

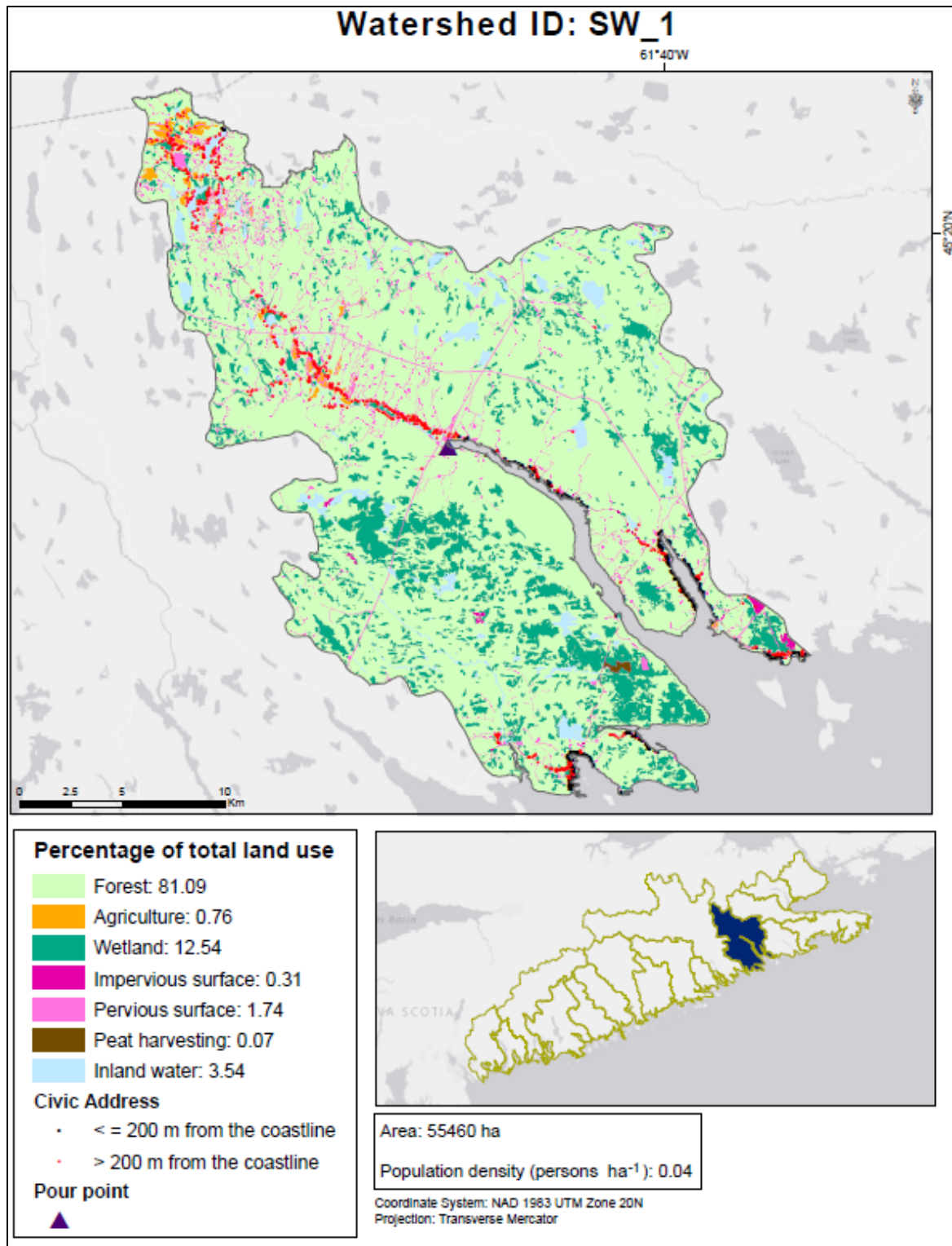


Figure 63. Land-use map for South and West Antigonish watershed SW\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Eastern sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

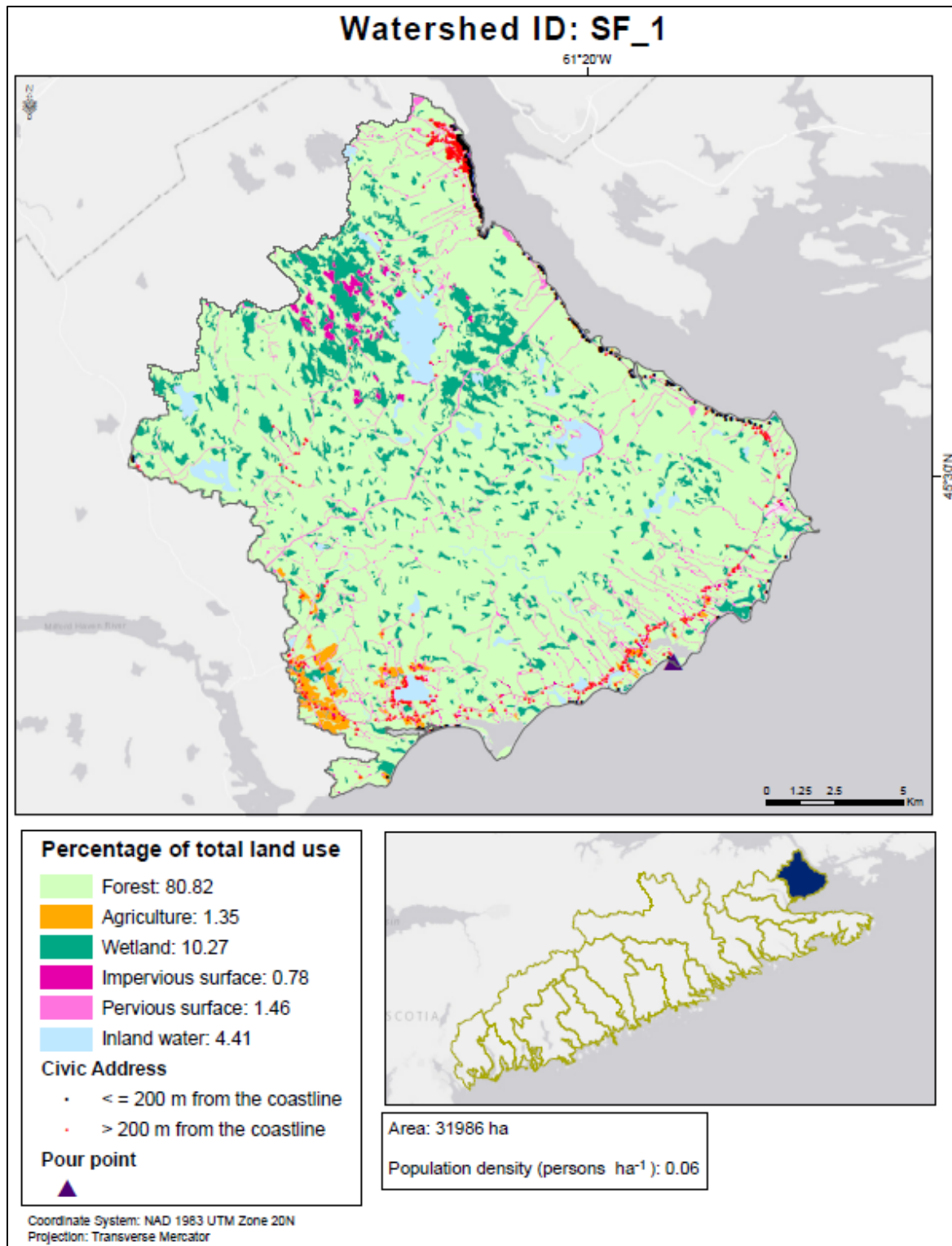


Figure 64. Land-use map for St. Francis Harbour watershed SF\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Eastern sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

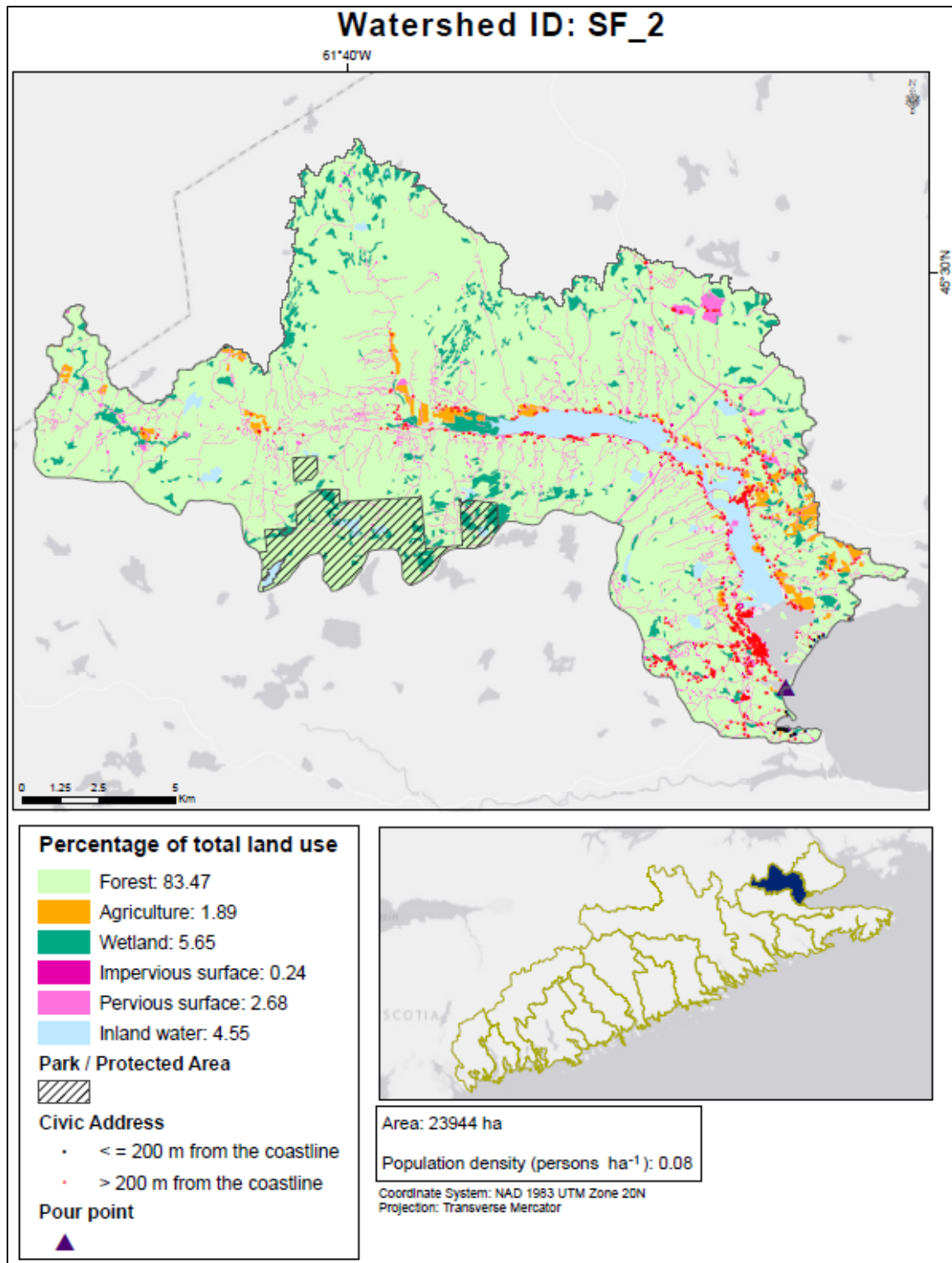


Figure 65. Land-use map for St. Francis Harbour watershed SF\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Eastern sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

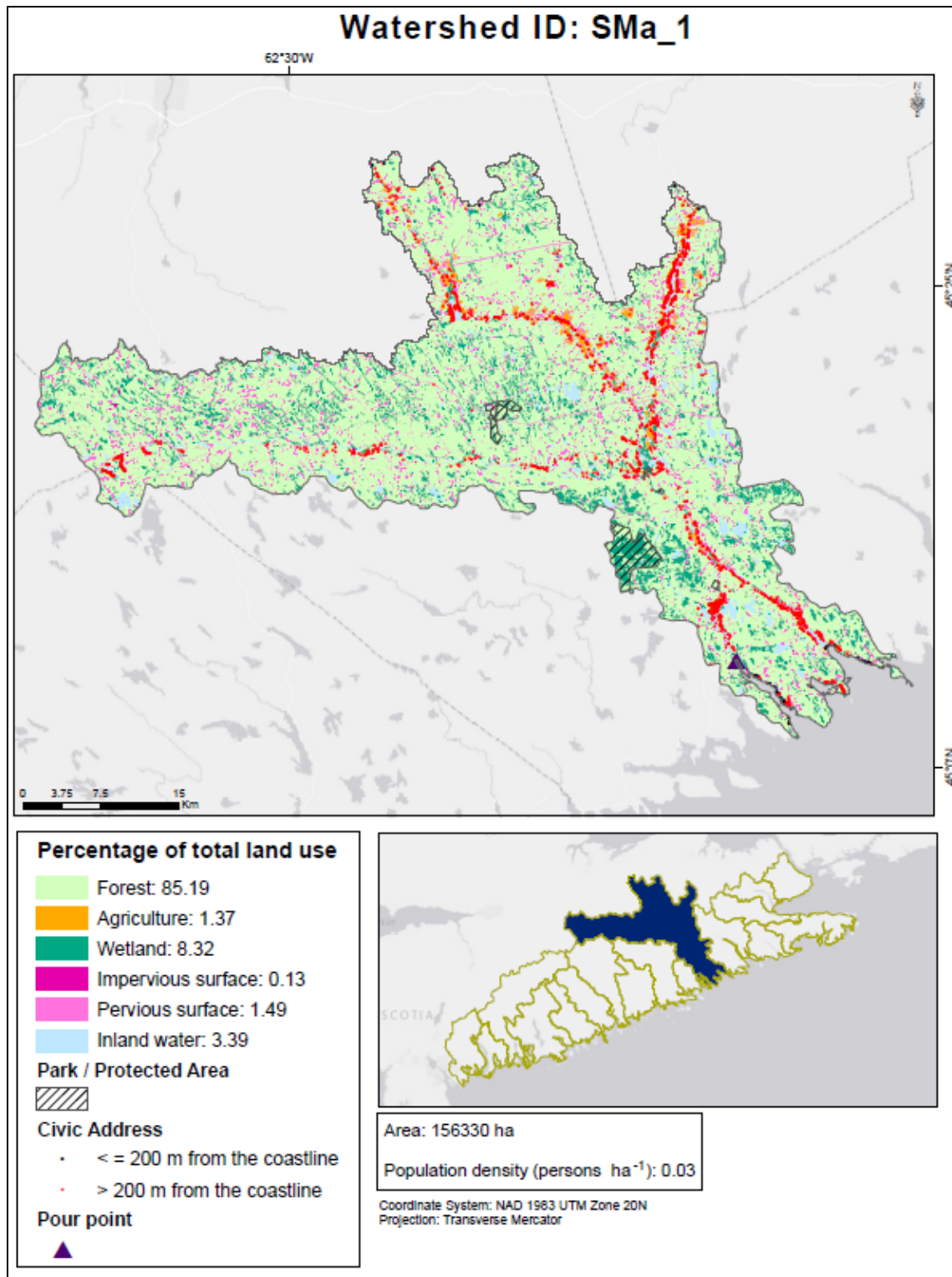


Figure 66. Land-use map for St. Marys watershed SMa\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Eastern sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

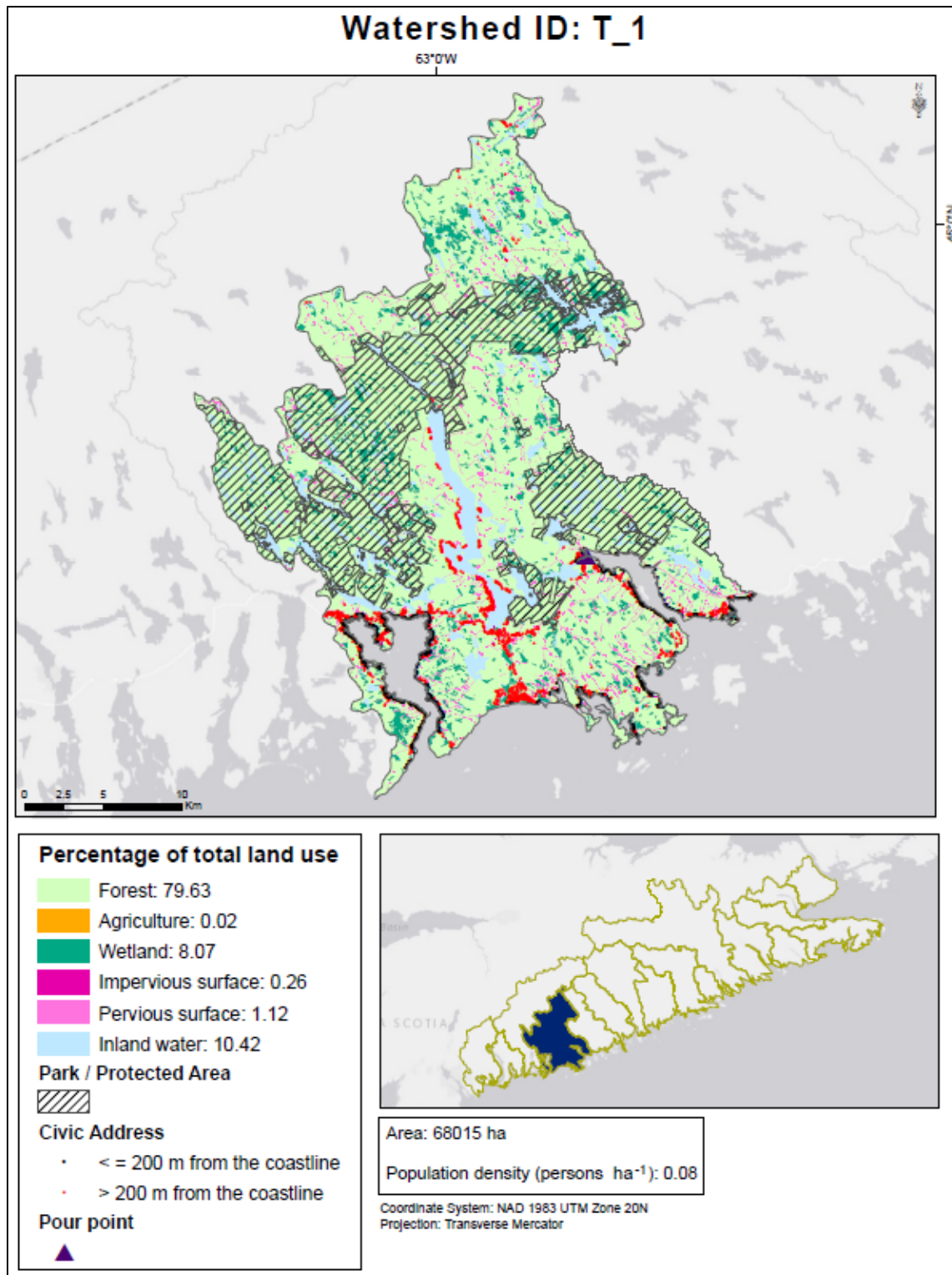


Figure 67. Land-use map for Tangier watershed T\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Eastern sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

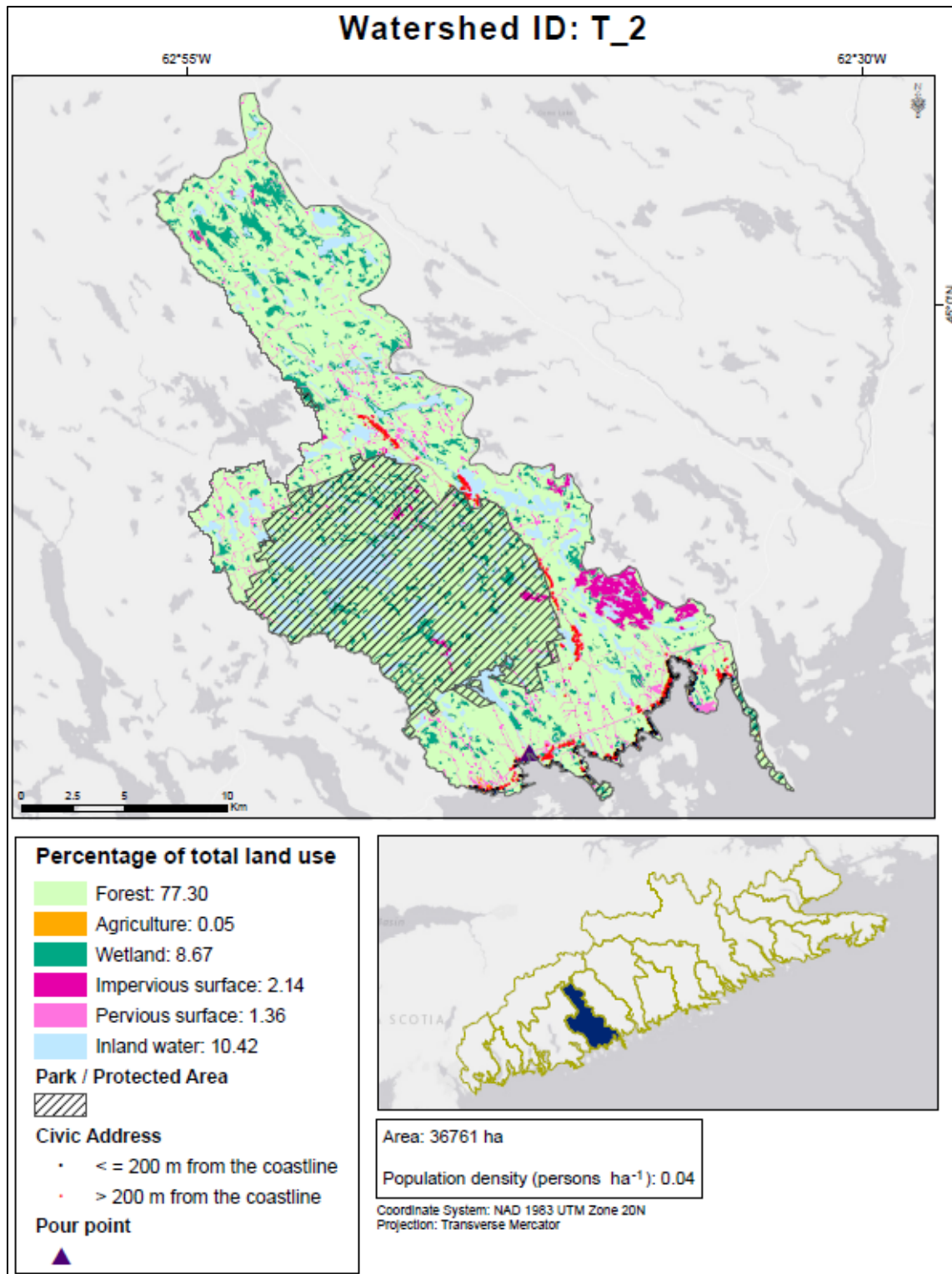


Figure 68. Land-use map for Tangier watershed T\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Eastern sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).



## Western Watershed Region

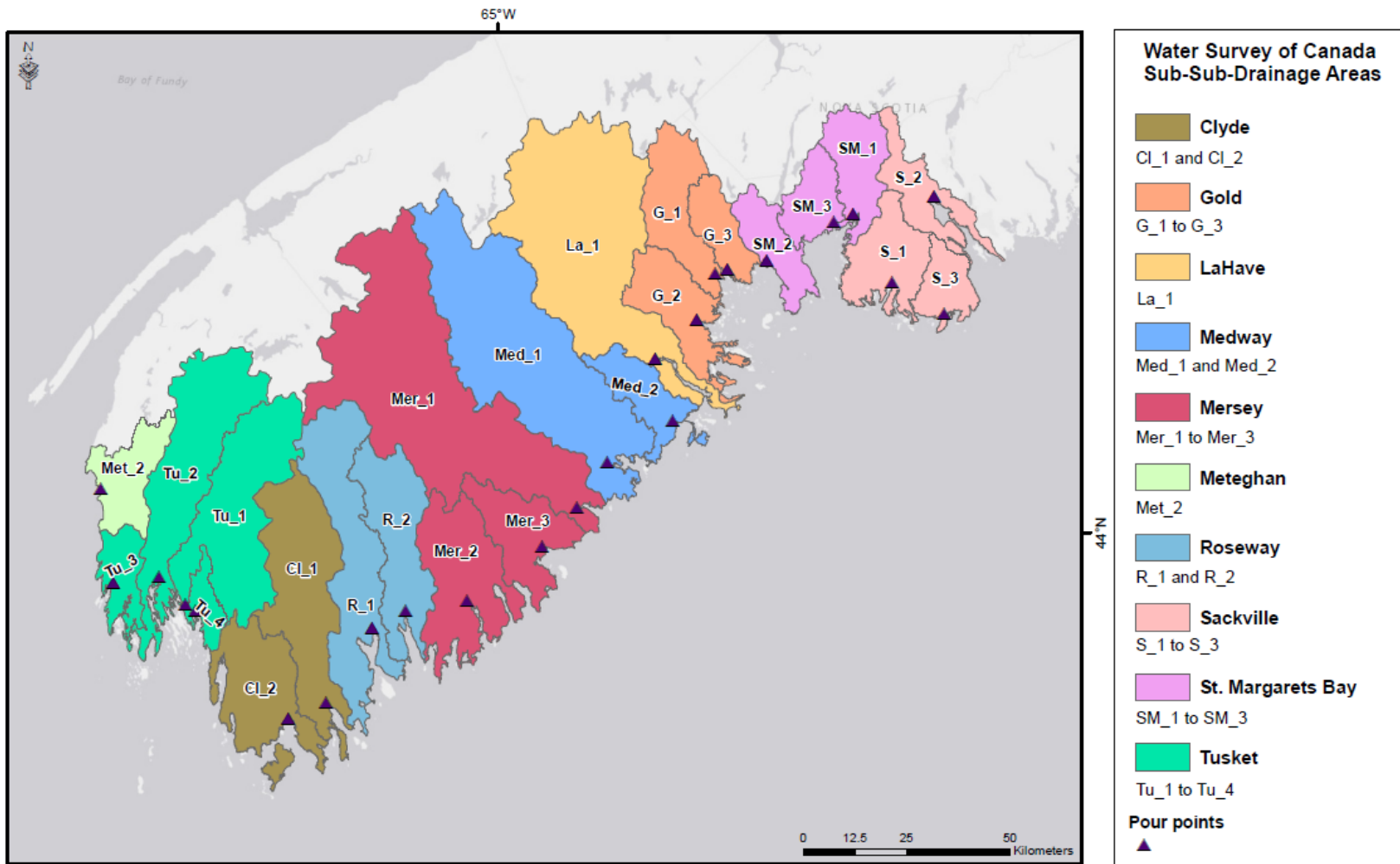


Figure 69. Western sub-region, displaying ten Water Survey of Canada sub-sub-drainage areas (denoted by differing colours) and their associated watersheds. Black triangles represent the major pour points (largest outlets into the coastal zone).

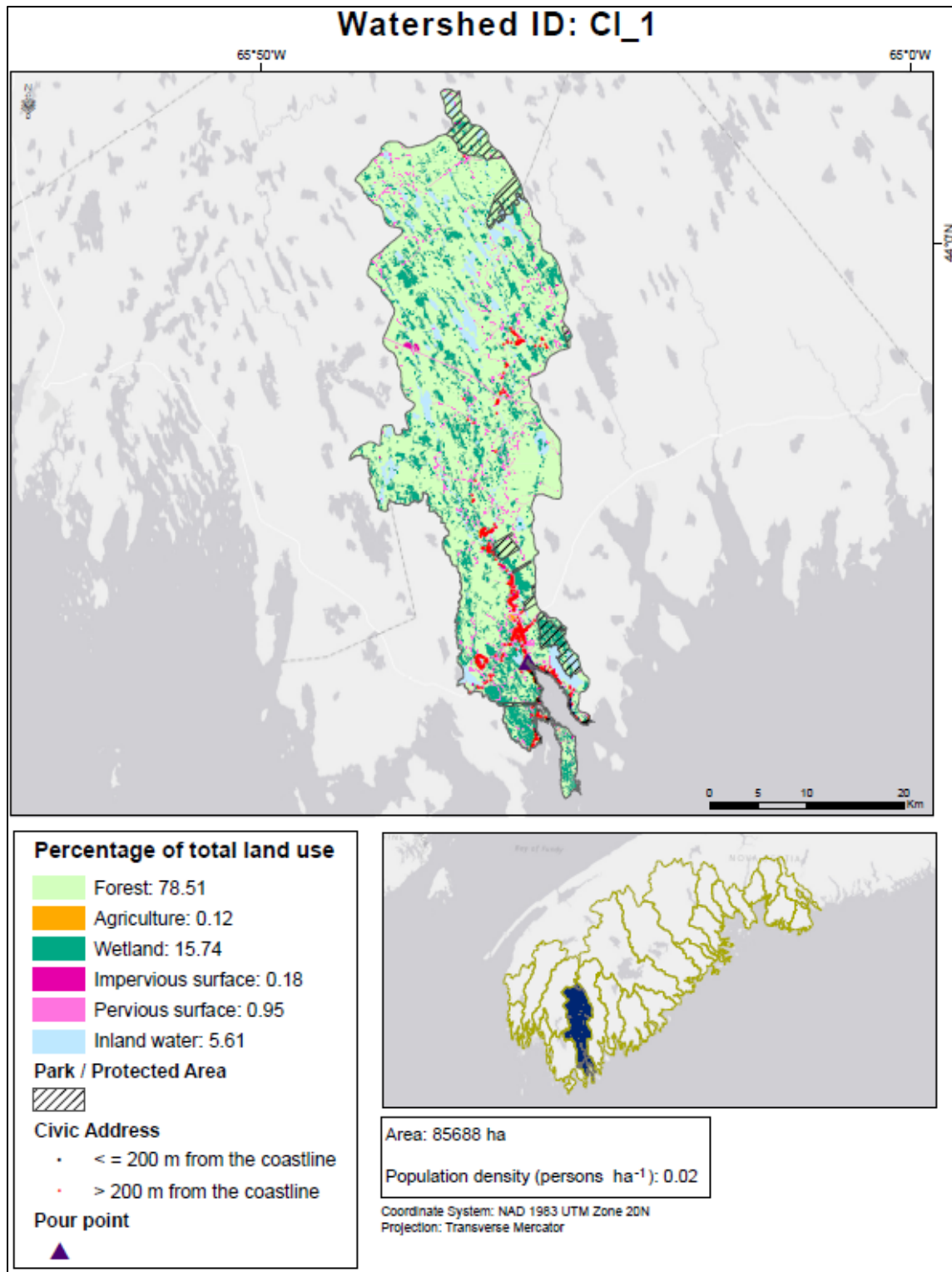


Figure 70. Land-use map for Clyde watershed CI\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Western sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

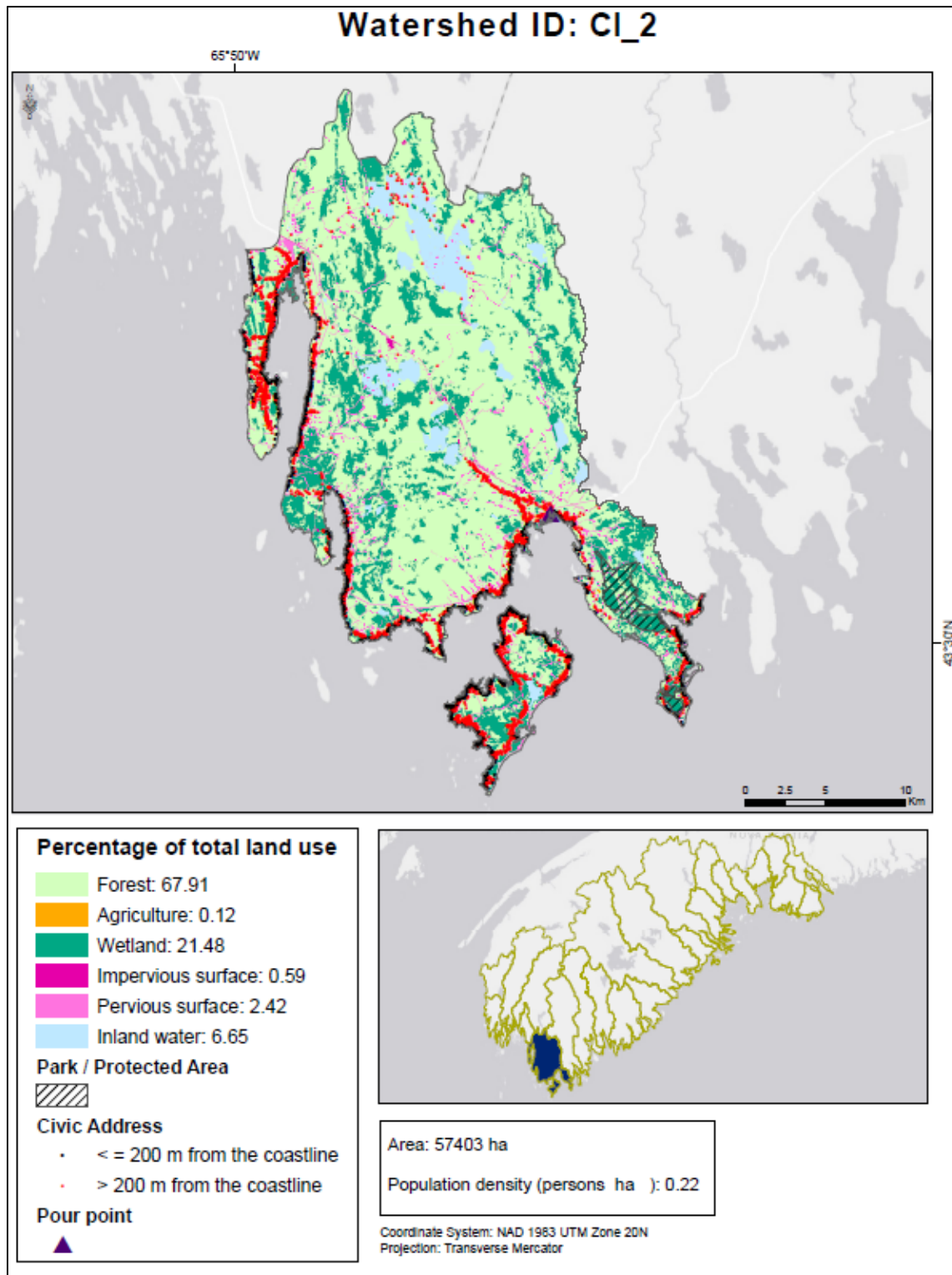


Figure 71. Land-use map for Clyde watershed CI\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Western sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

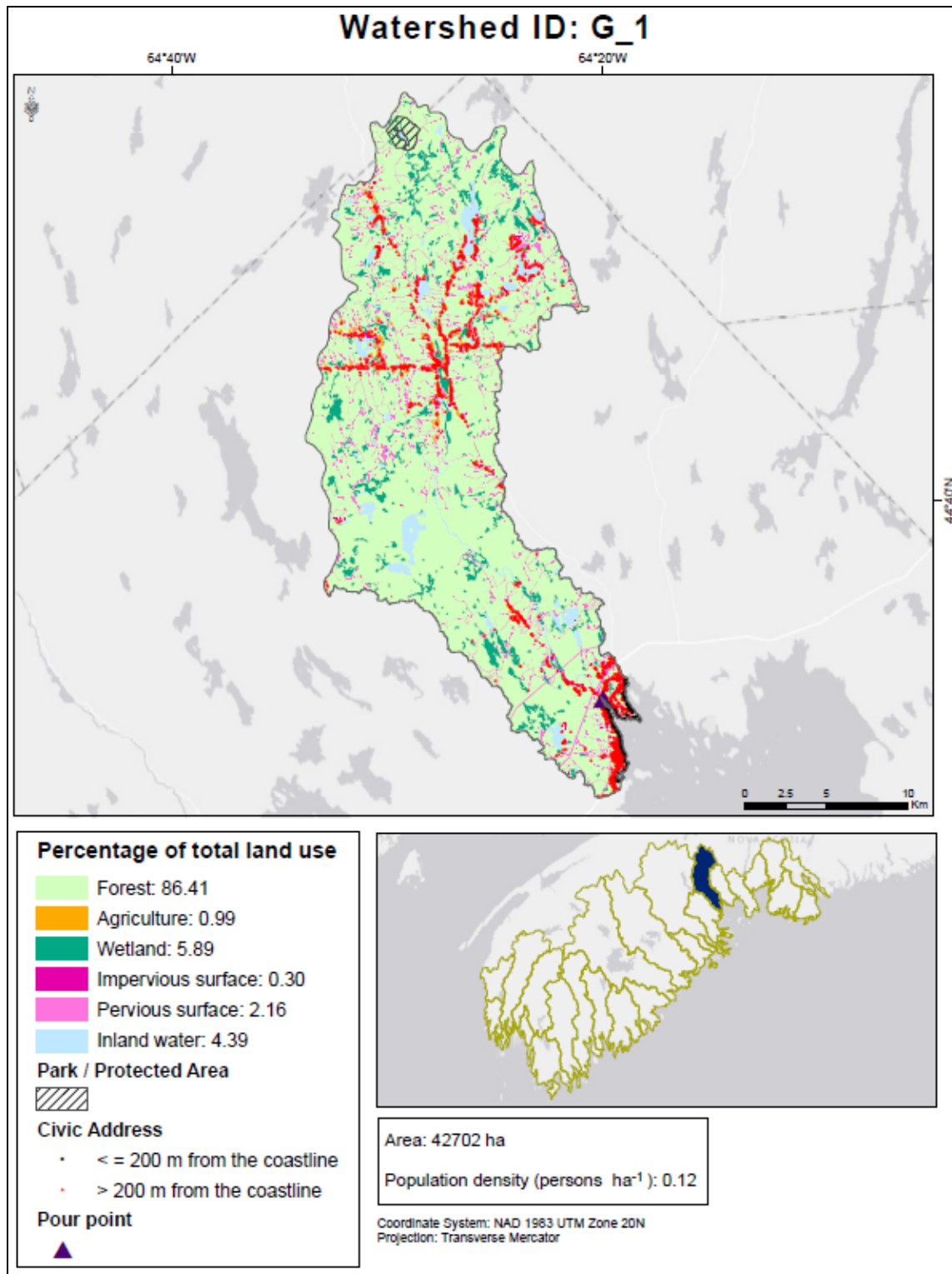


Figure 72. Land-use map for Gold watershed G\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Western sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

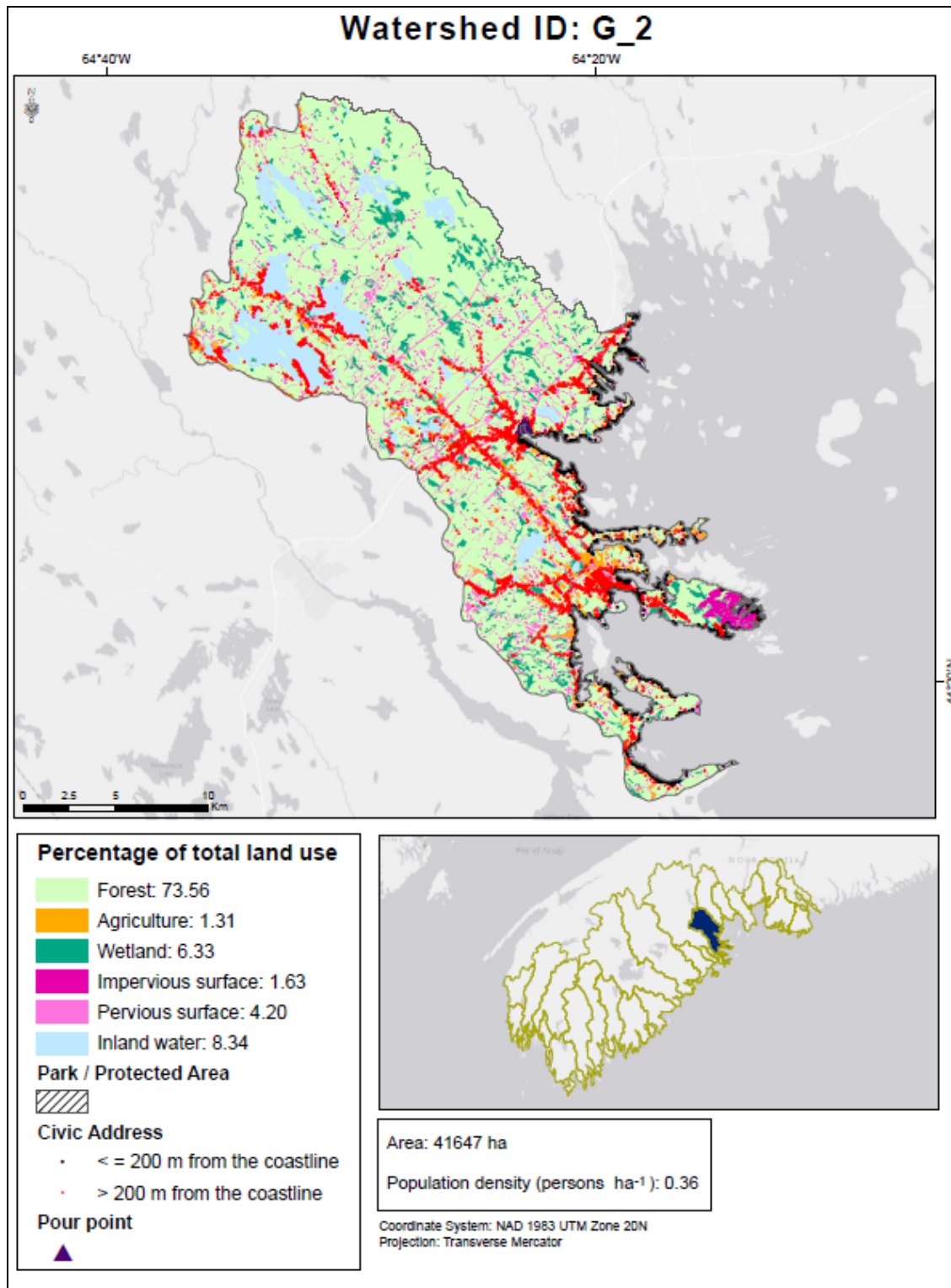


Figure 73. Land-use map for Gold watershed G\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Western sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

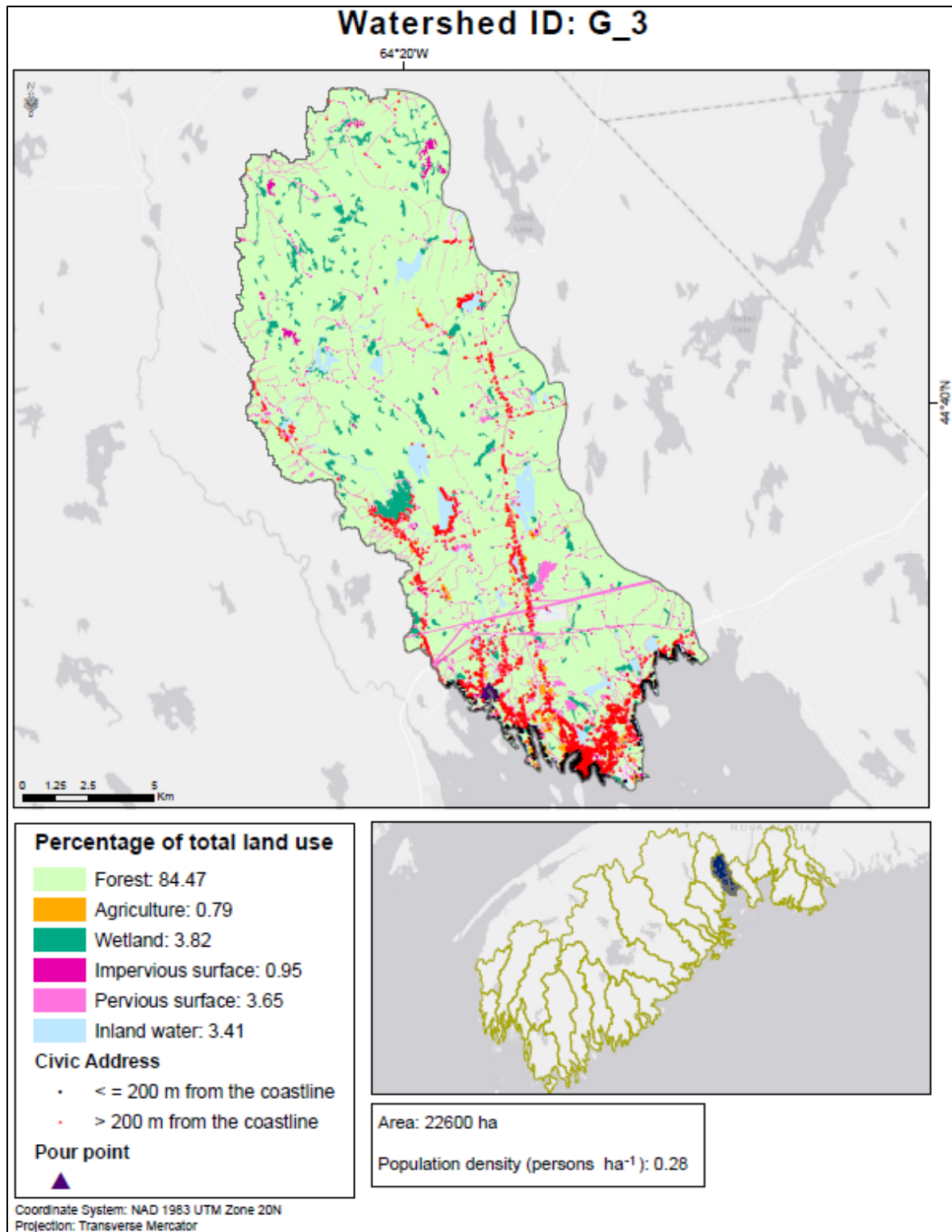


Figure 74. Land-use map for Gold watershed G\_3. Insets: Watershed area and population density (lower right); location of watershed in relation to the Western sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

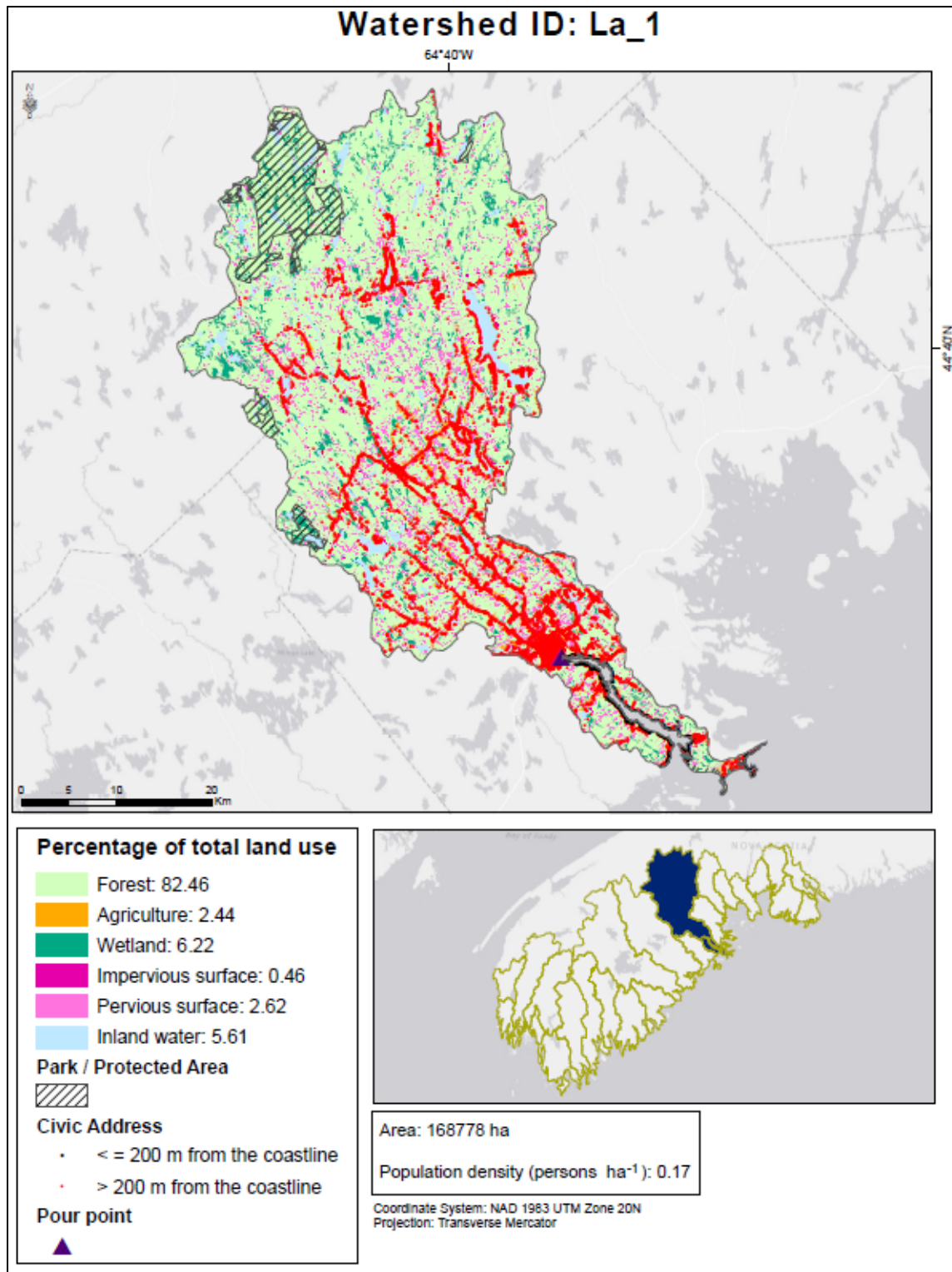


Figure 75. Land-use map for LaHave watershed La\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Western sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

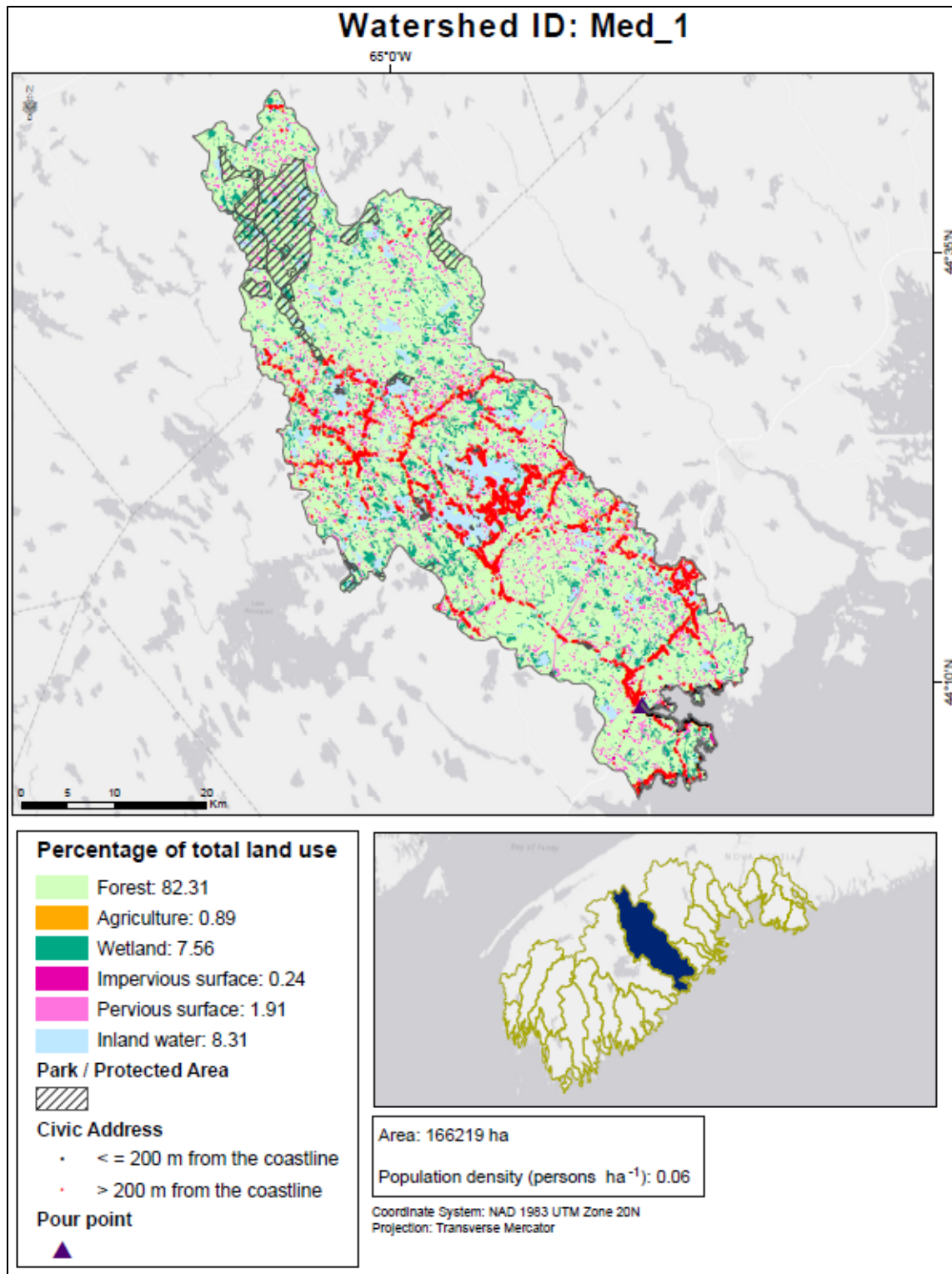


Figure 76. Land-use map for Medway watershed Med\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Western sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).



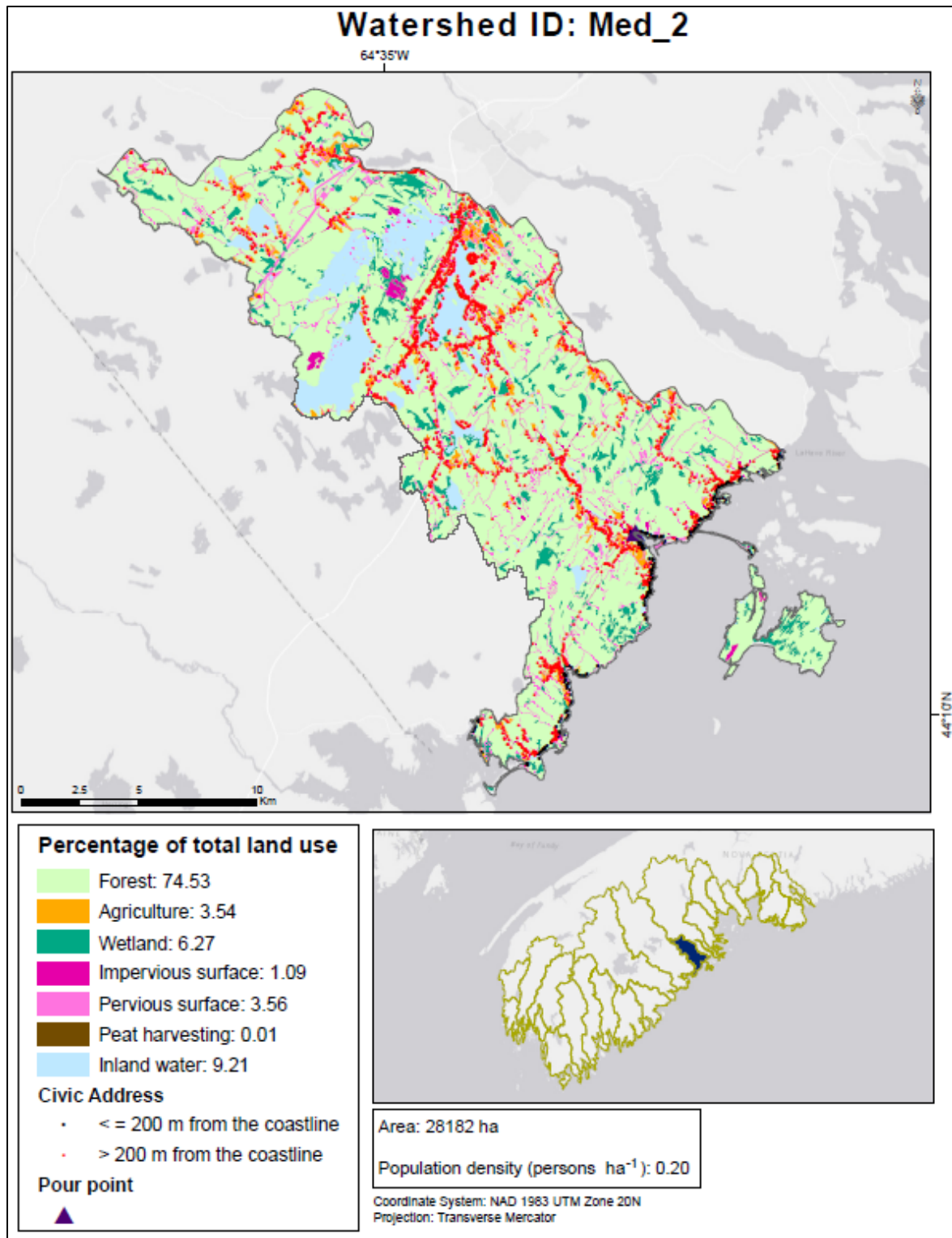


Figure 77. Land-use map for Medway watershed Med\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Western sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

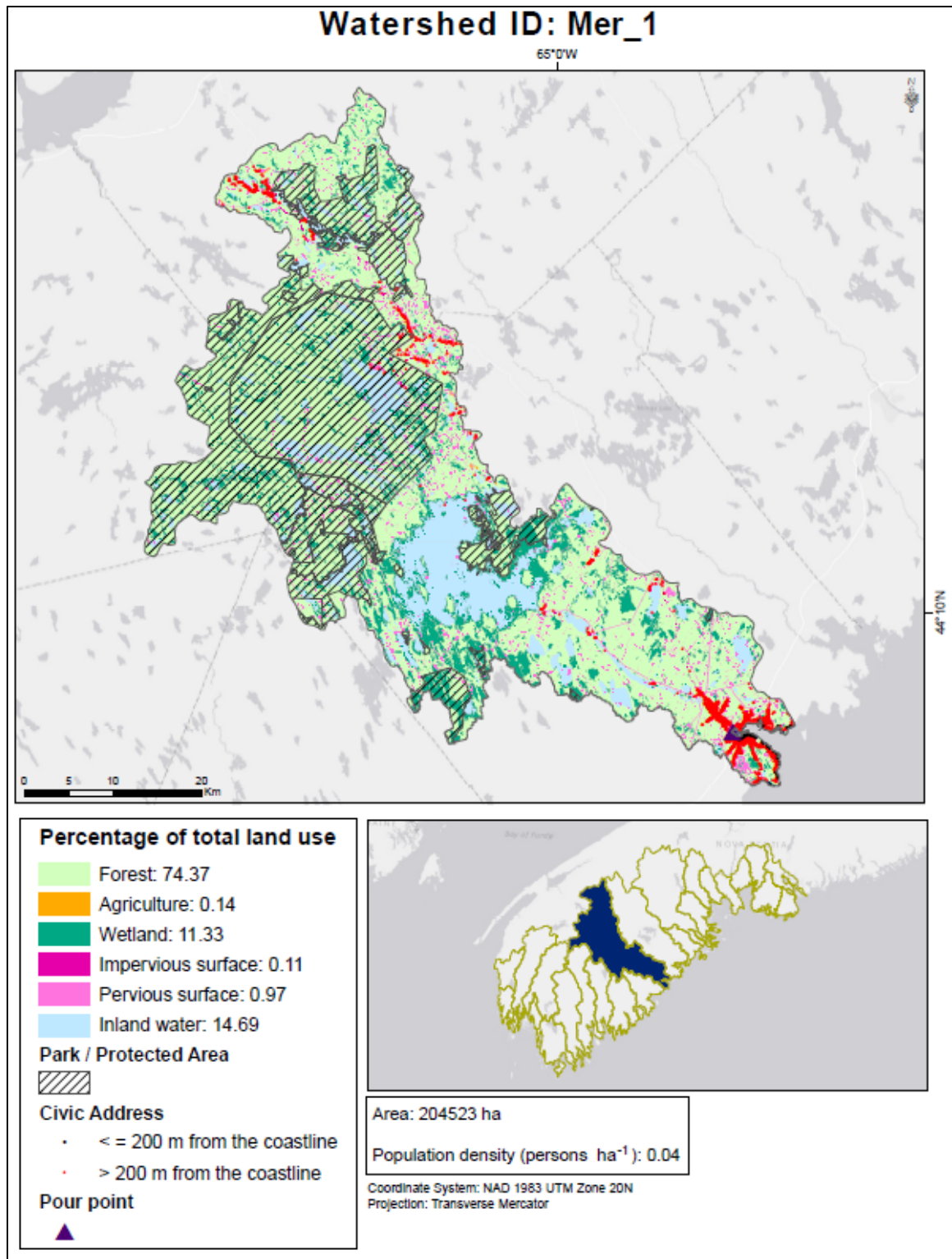


Figure 78. Land-use map for Mersey watershed Mer\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Western sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

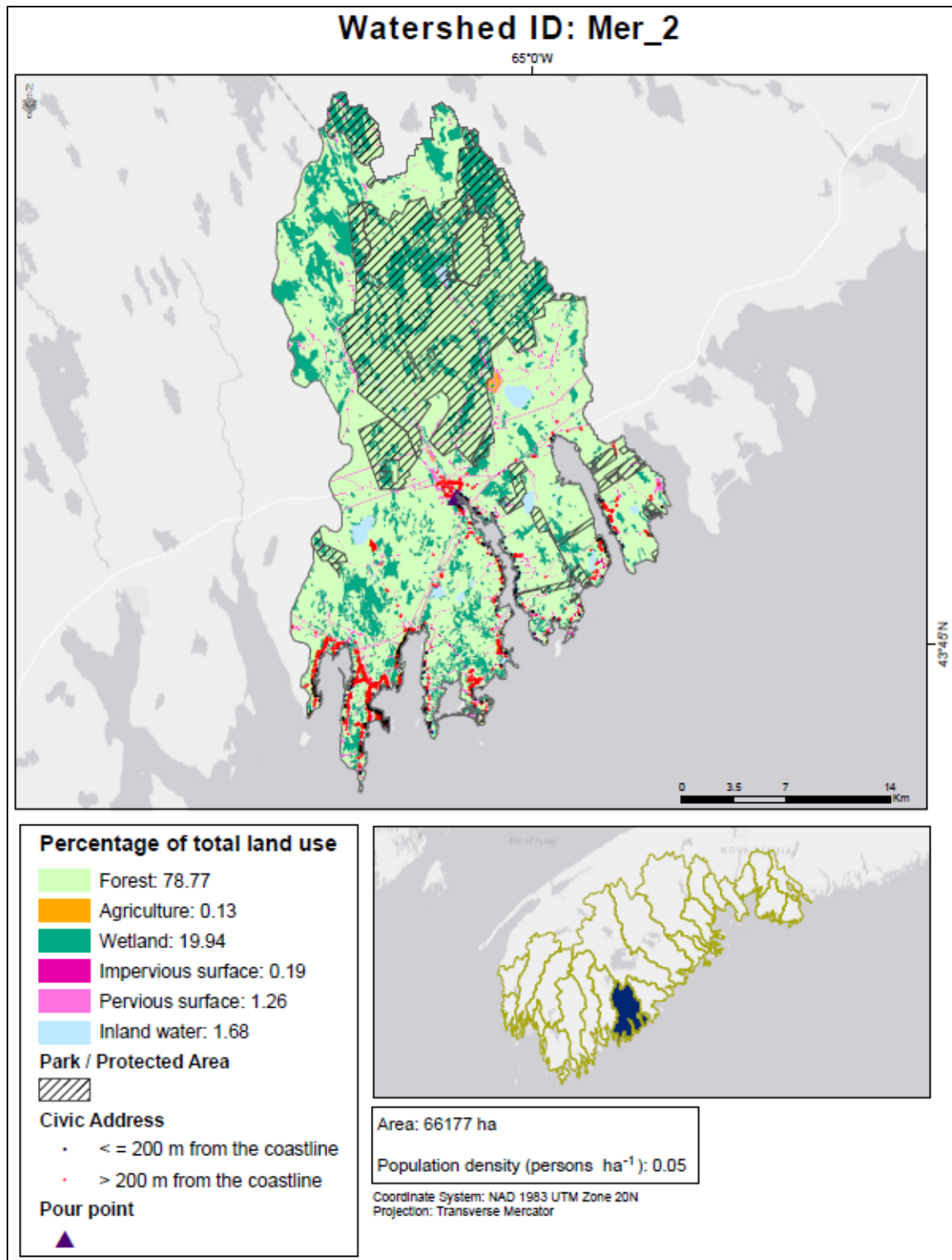


Figure 79. Land-use map for Mersey watershed Mer\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Western sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

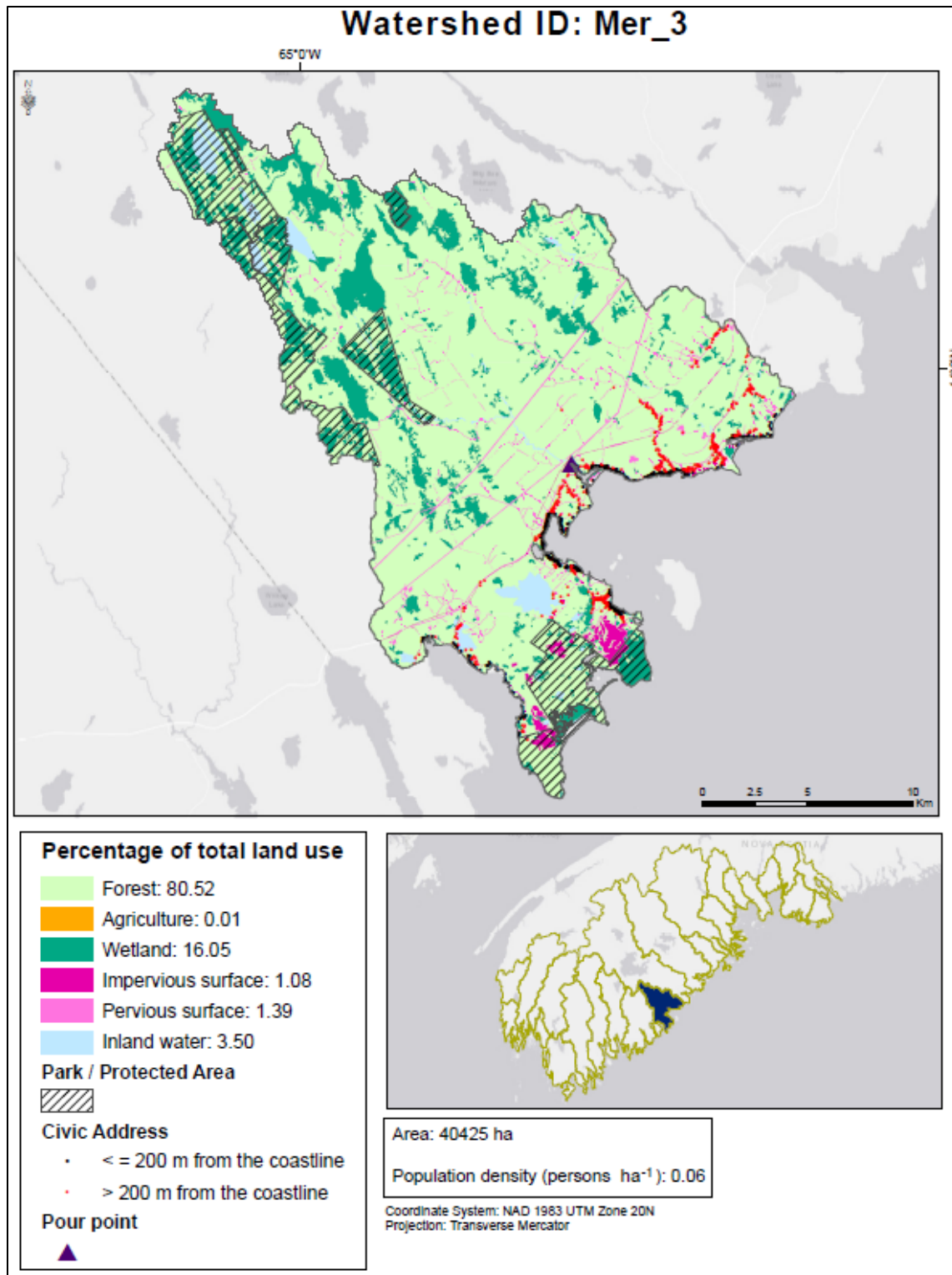


Figure 80. Land-use map for Mersey watershed Mer\_3. Insets: Watershed area and population density (lower right); location of watershed in relation to the Western sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

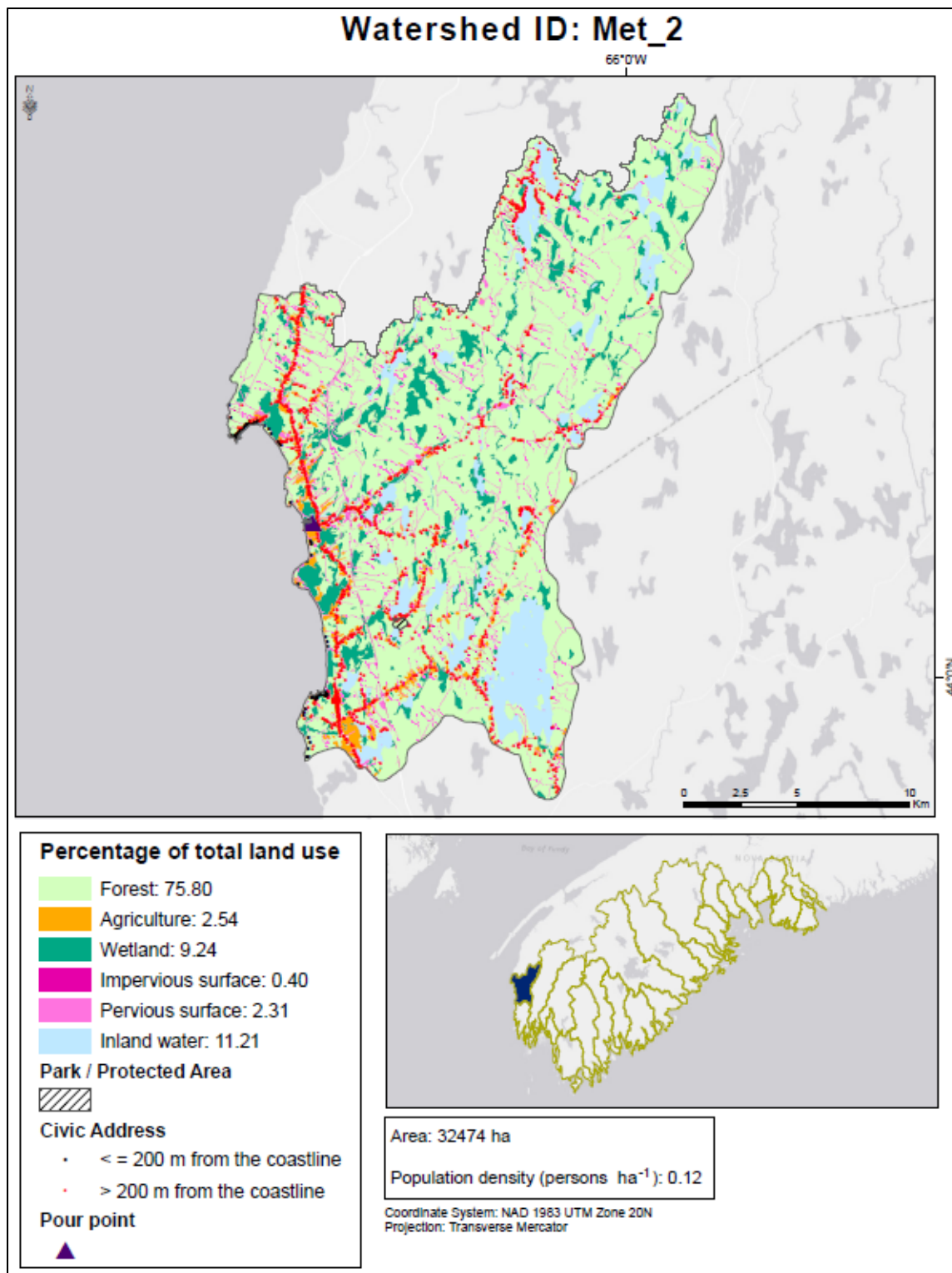


Figure 81. Land-use map for Meteghan watershed Met\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Western sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

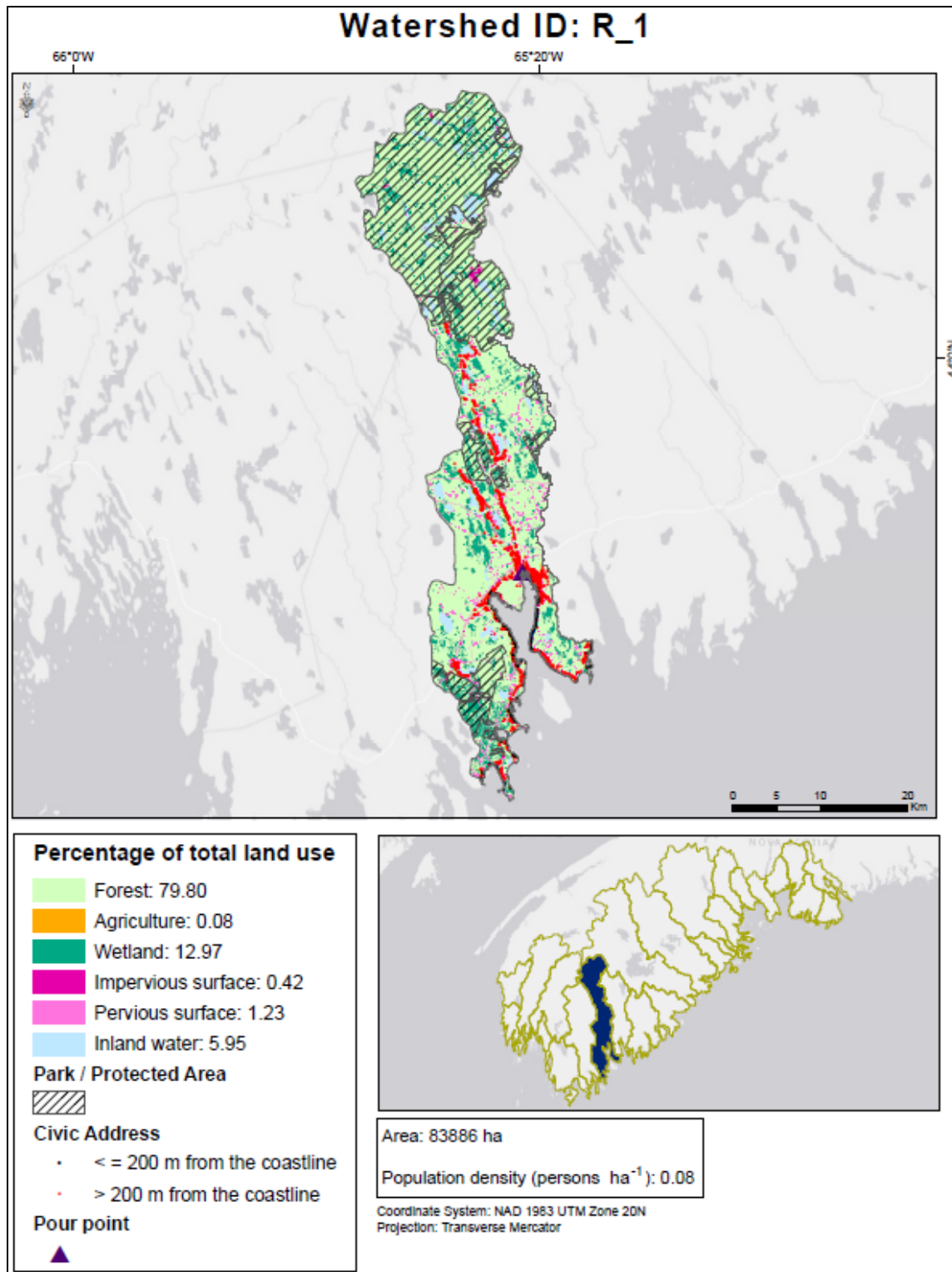


Figure 82. Land-use map for Roseway watershed R\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Western sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

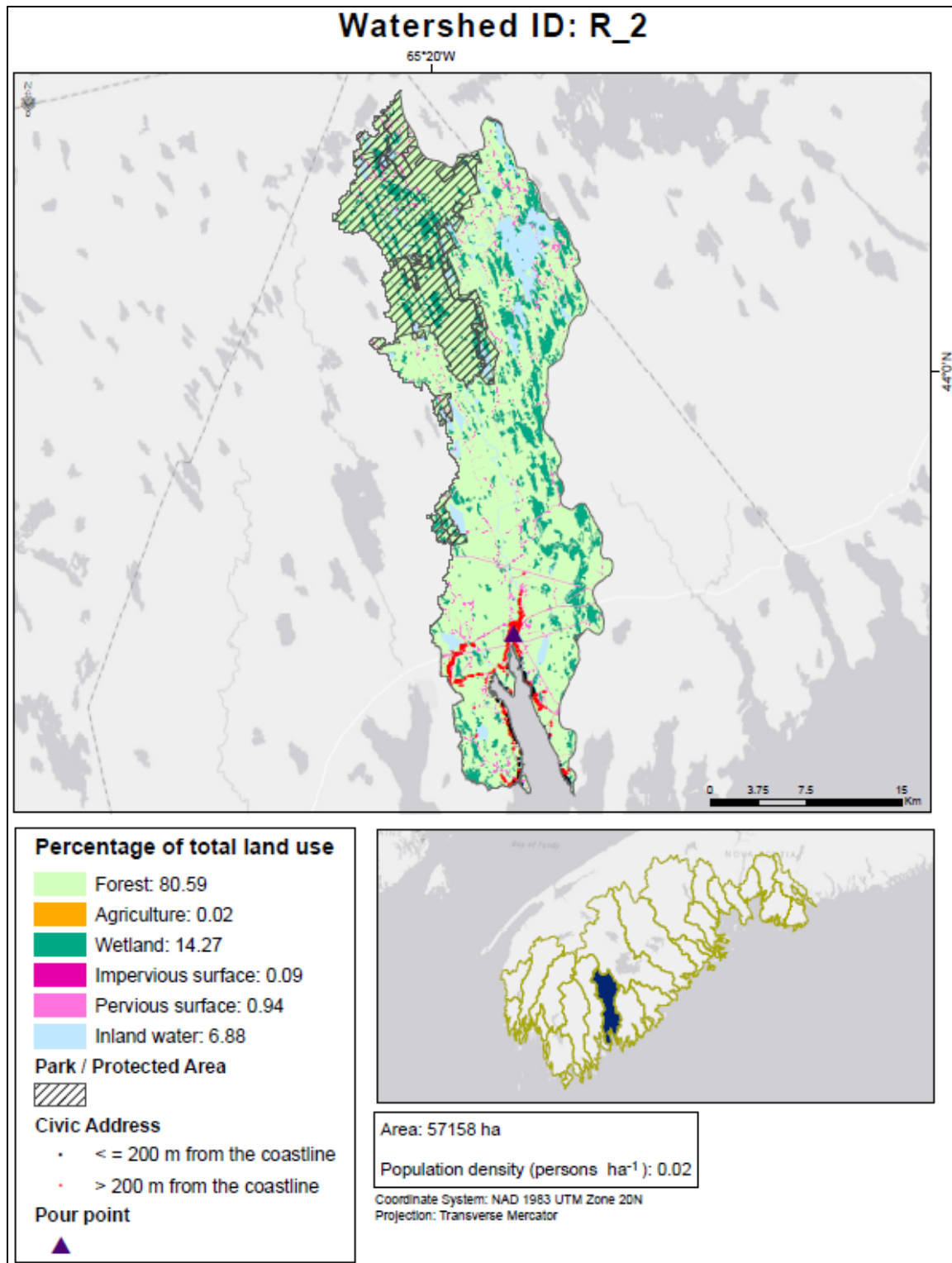


Figure 83. Land-use map for Roseway watershed R\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Western sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

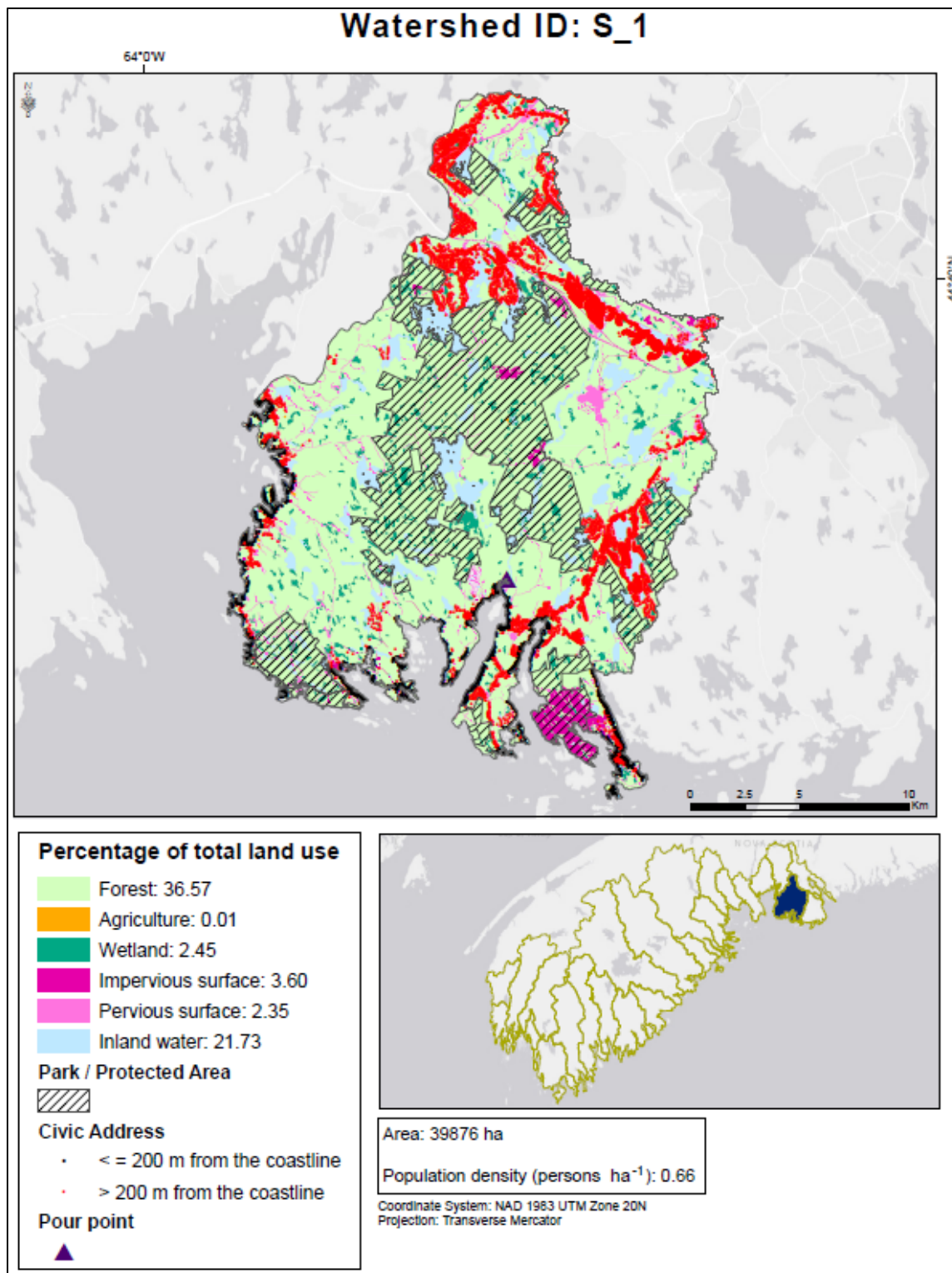


Figure 84. Land-use map for Sackville watershed S\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Western sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).



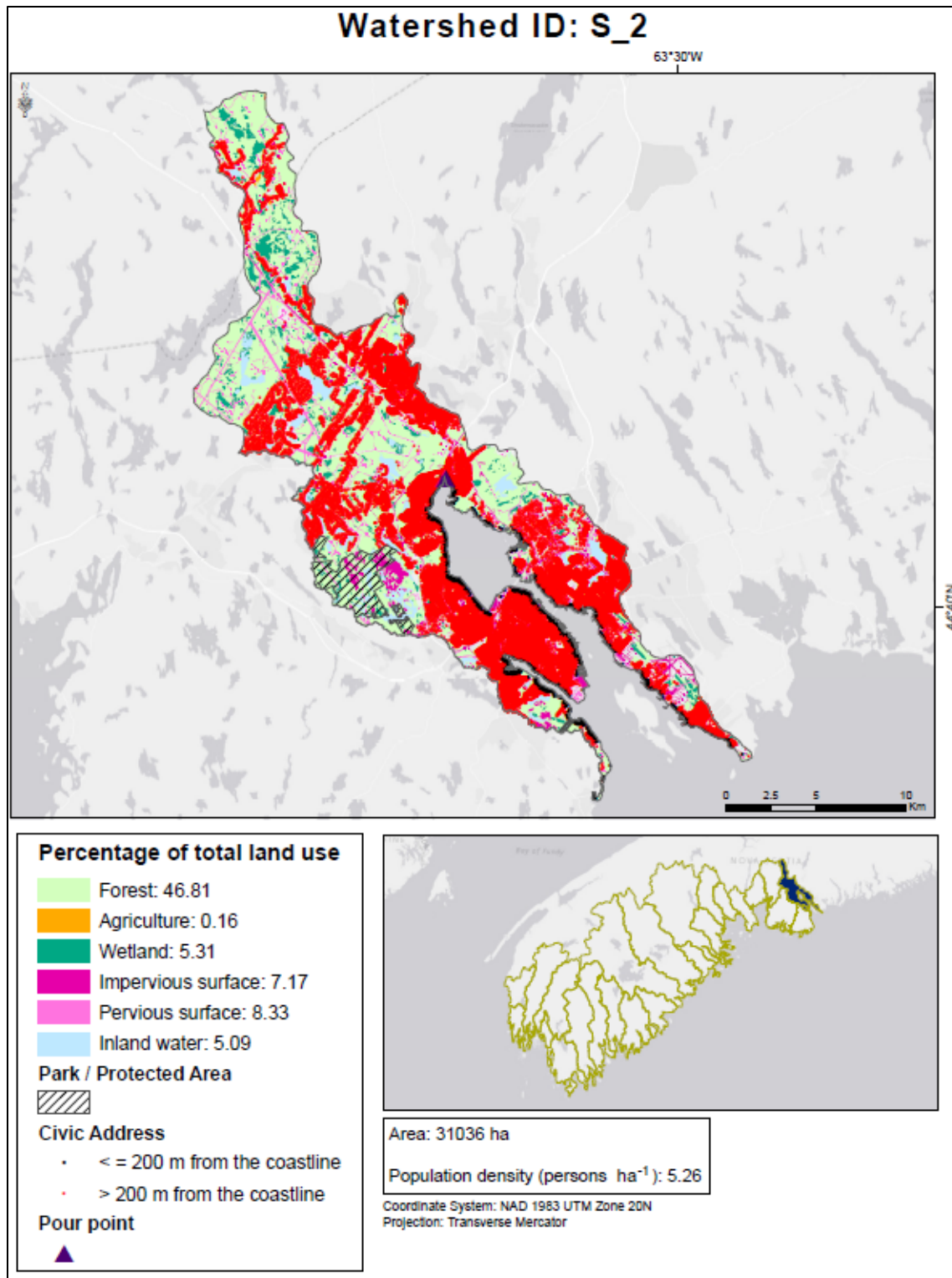


Figure 85. Land-use map for Sackville watershed S\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Western sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

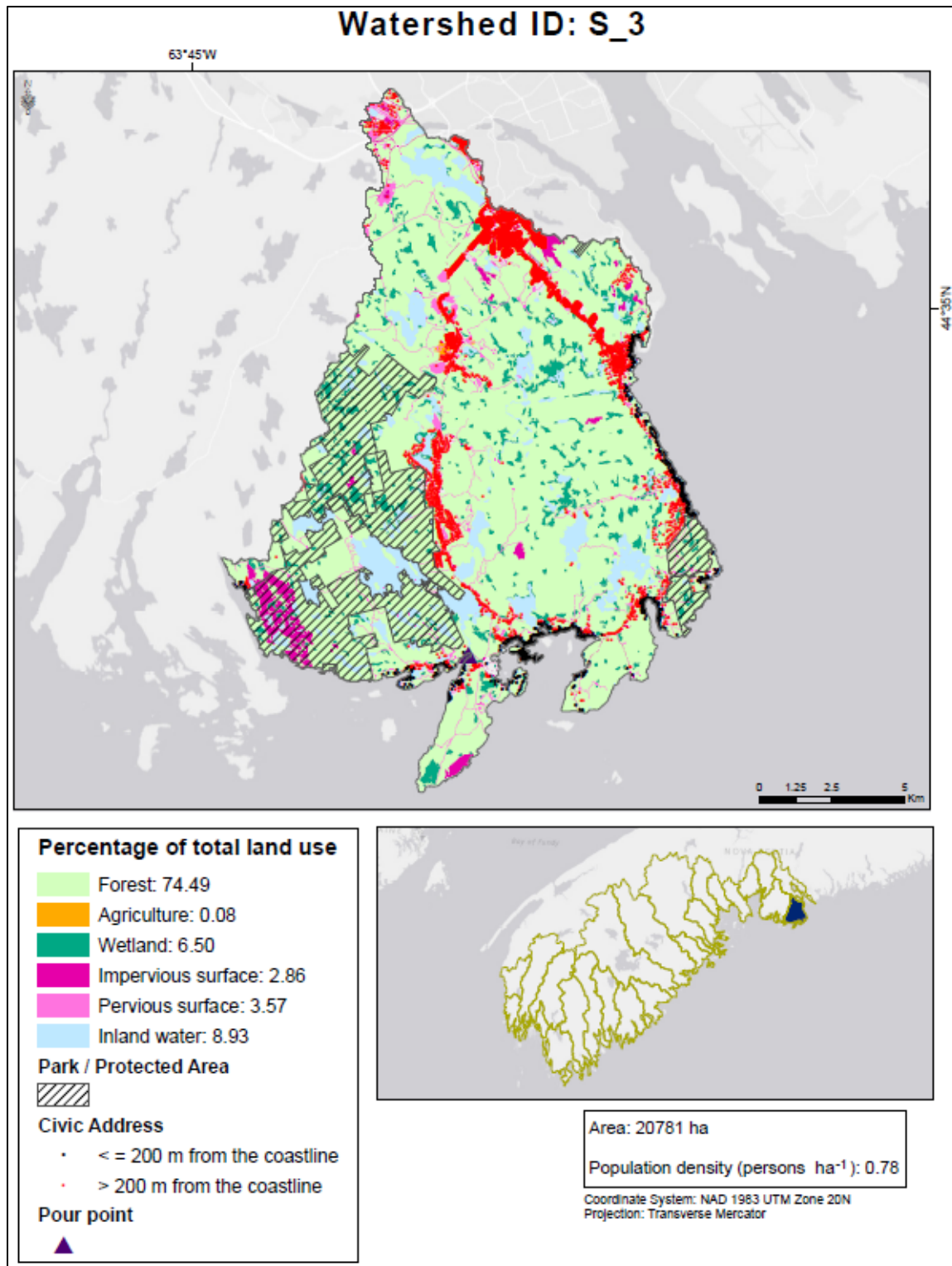


Figure 86. Land-use map for Sackville watershed S\_3. Insets: Watershed area and population density (lower right); location of watershed in relation to the Western sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

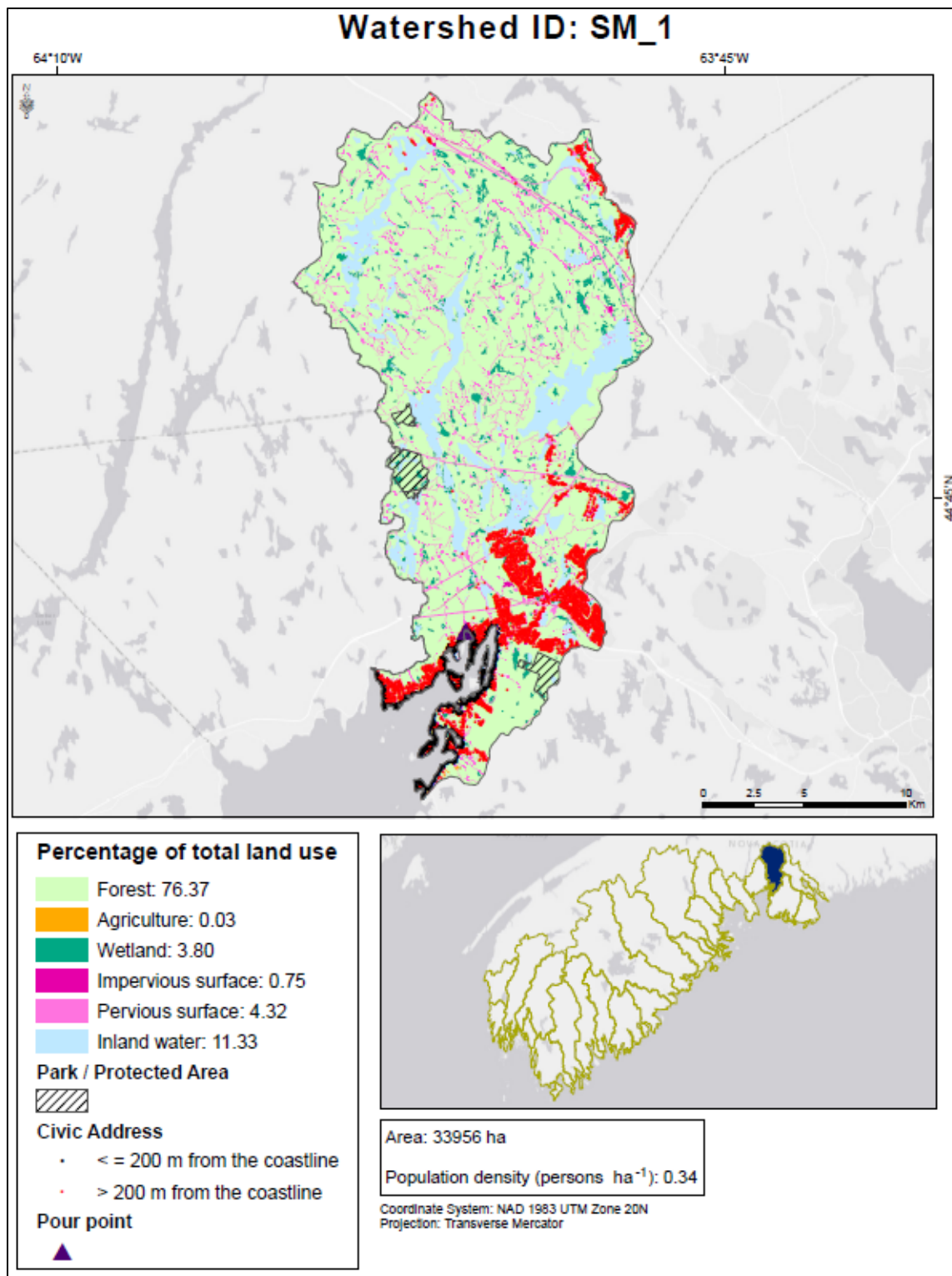


Figure 87. Land-use map for St. Margarets Bay watershed SM\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Western sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

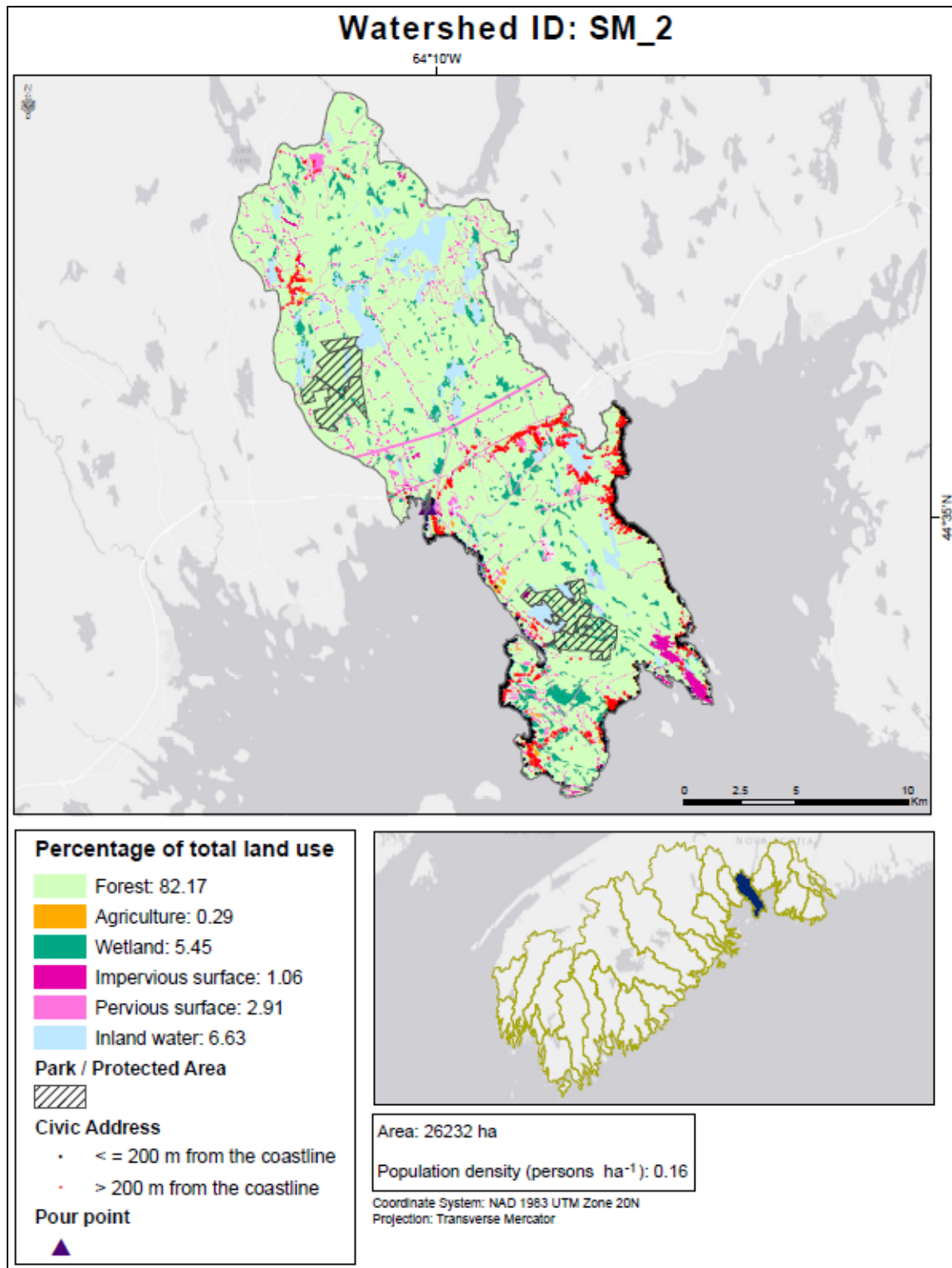


Figure 88. Land-use map for St. Margarets Bay watershed SM\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Western sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

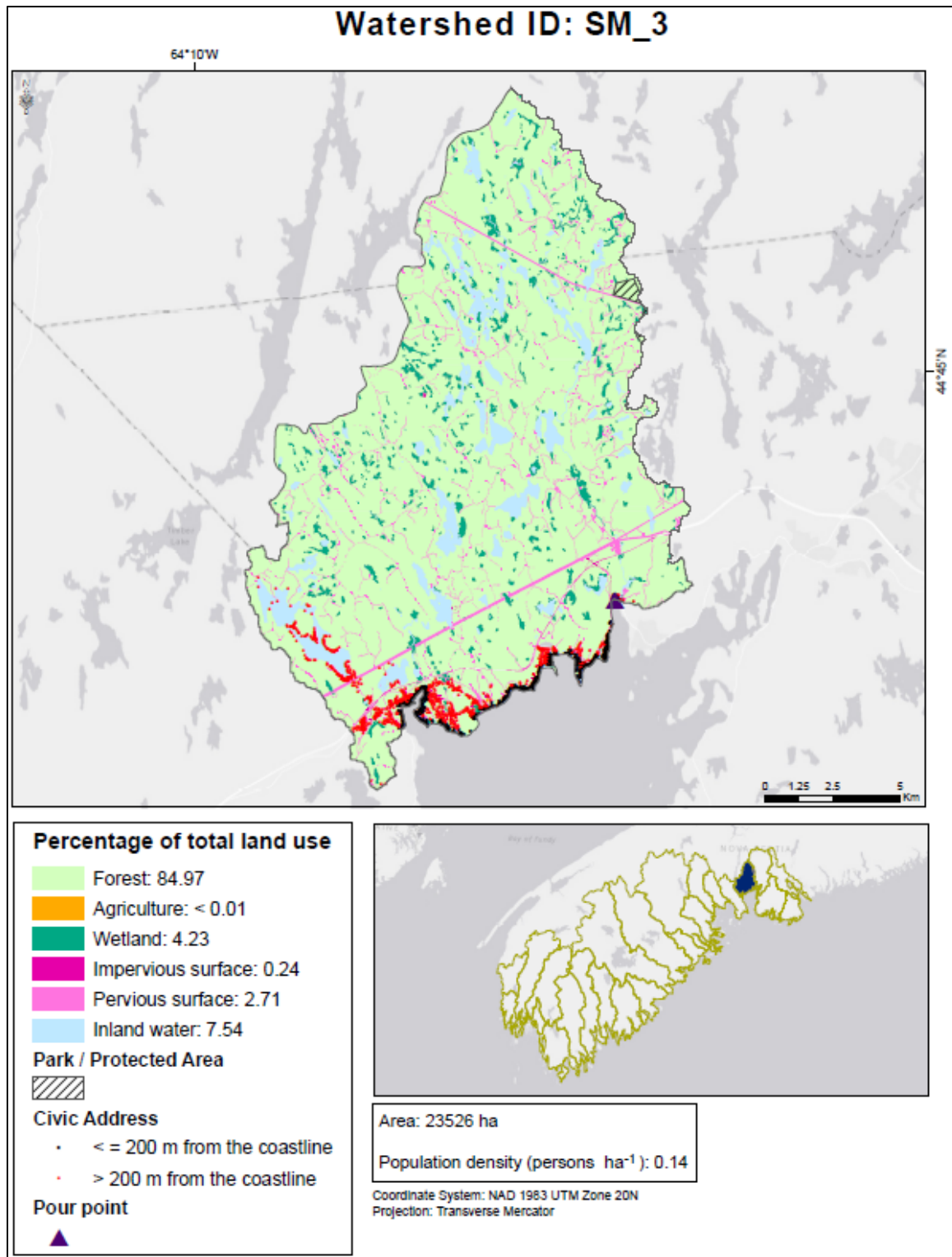


Figure 89. Land-use map for St. Margarets Bay watershed SM\_3. Insets: Watershed area and population density (lower right); location of watershed in relation to the Western sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

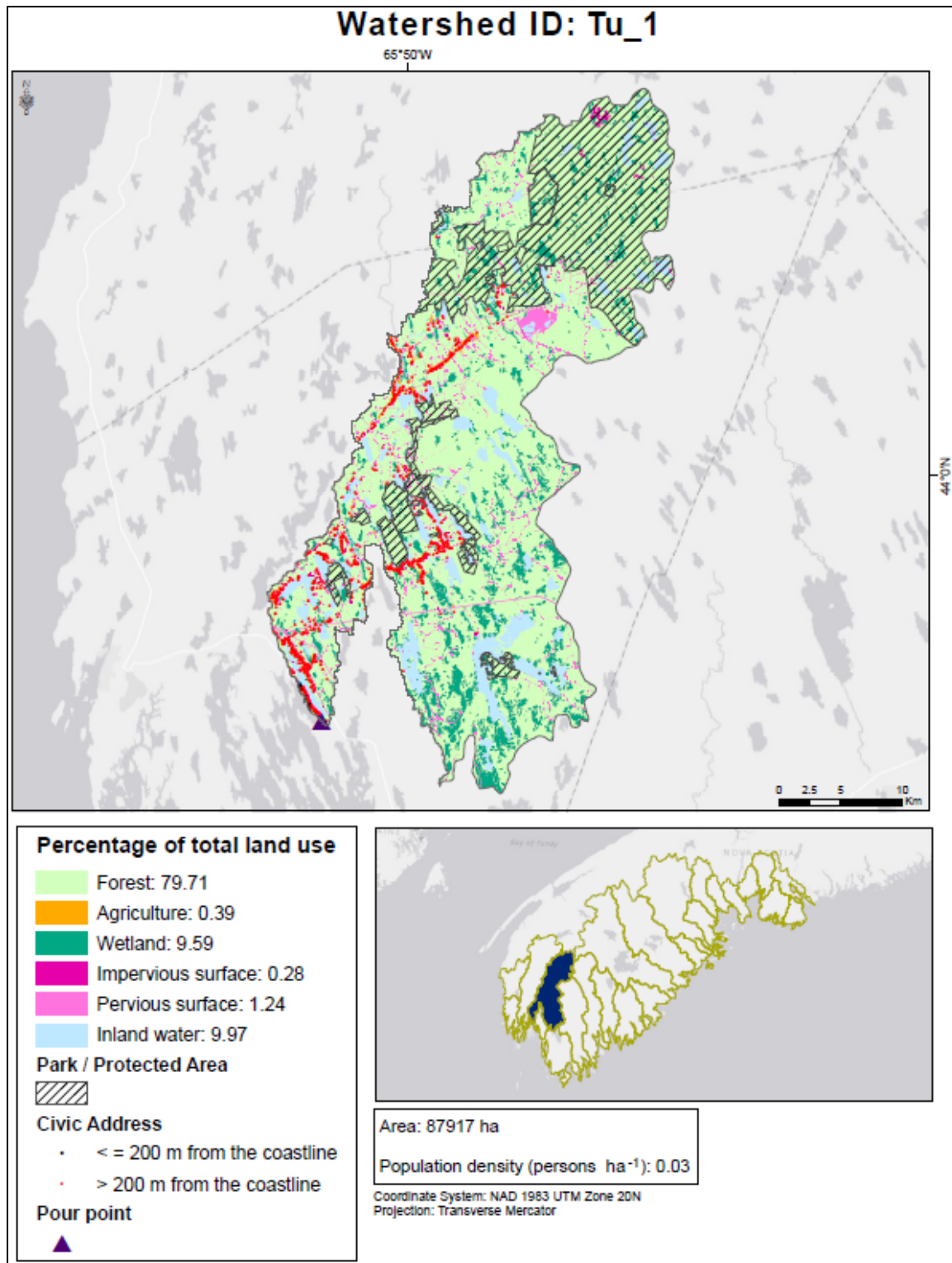


Figure 90. Land-use map for Tusket watershed Tu\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Western sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

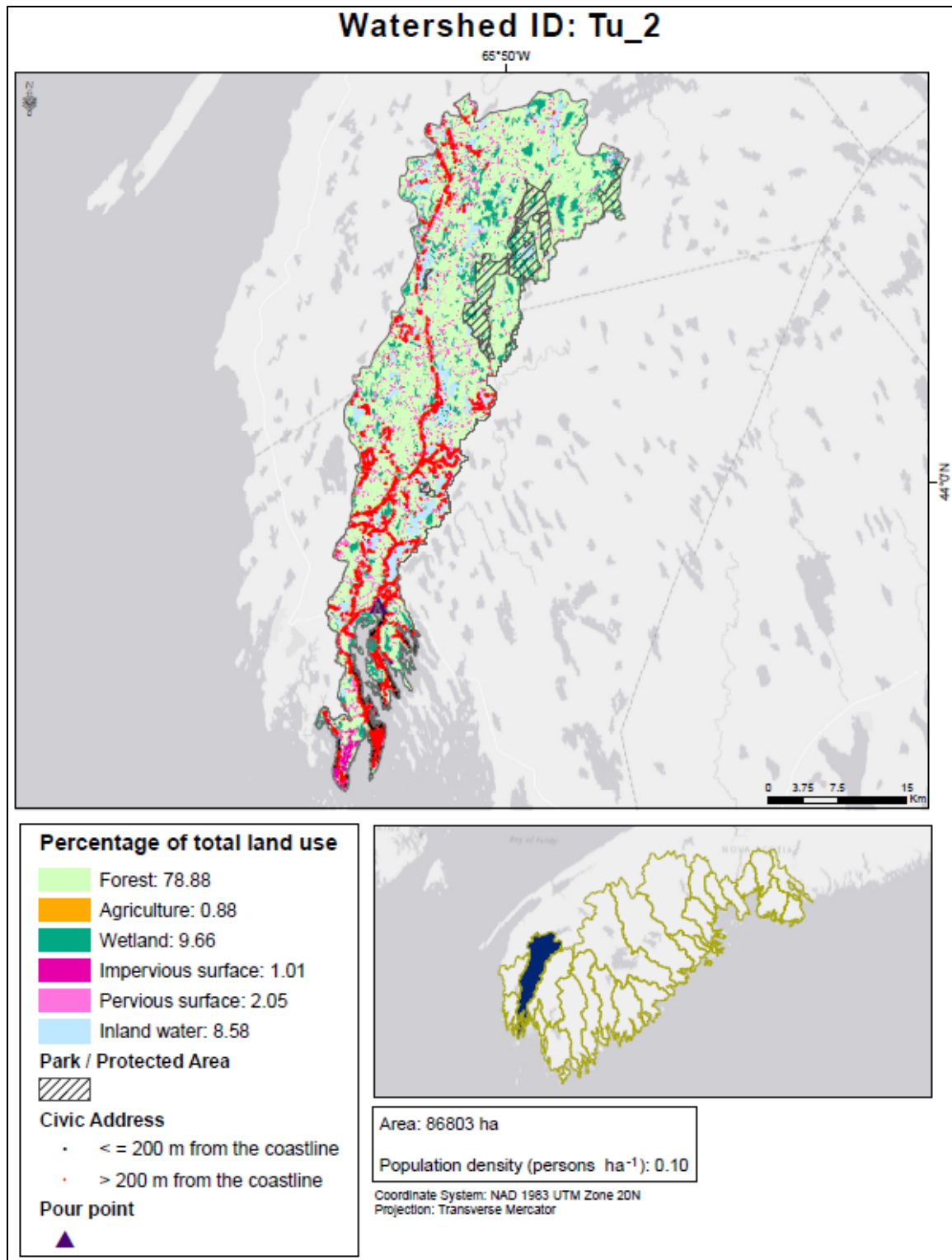


Figure 91. Land-use map for Tusket watershed Tu\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Western sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

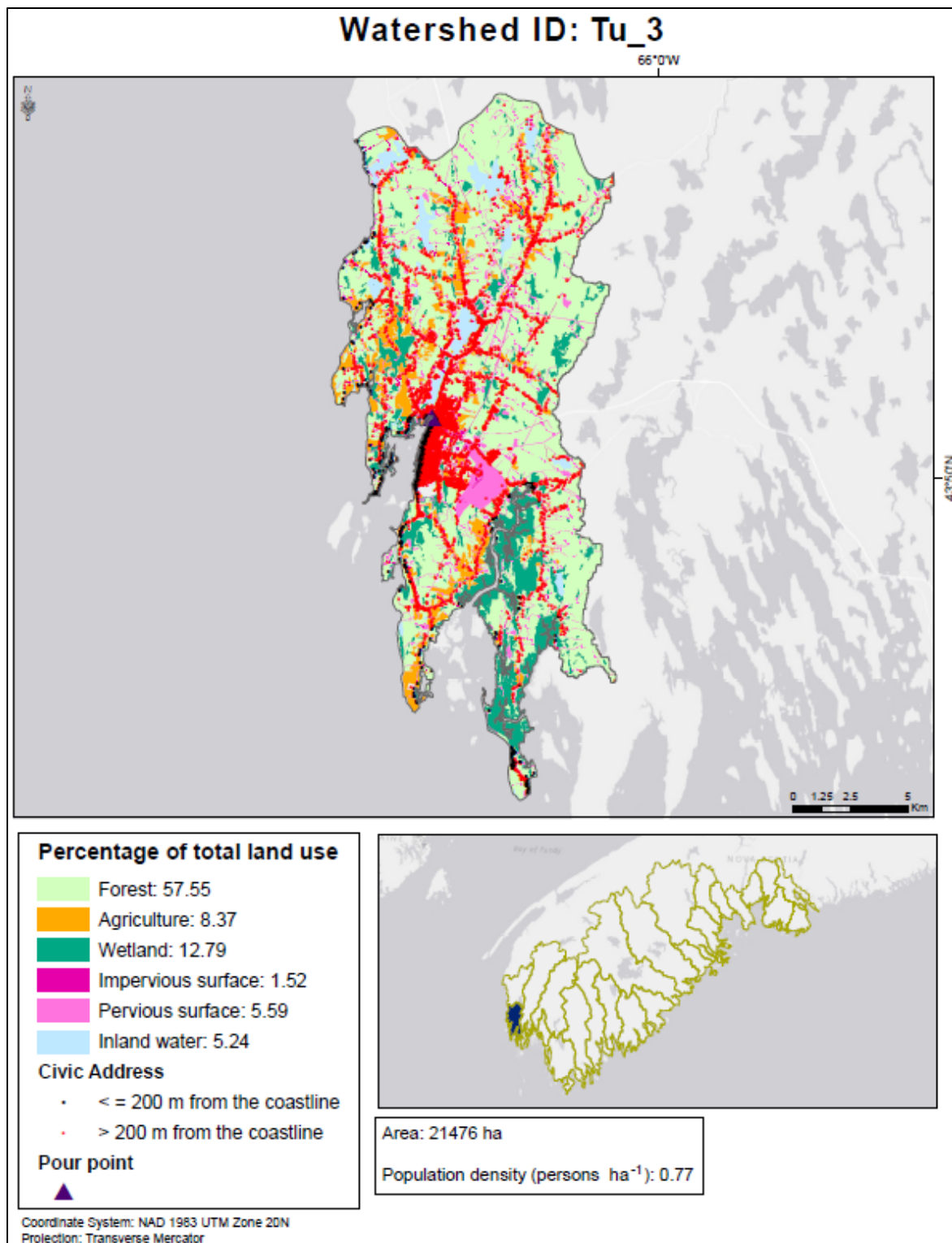


Figure 92. Land-use map for Tusket watershed Tu\_3. Insets: Watershed area and population density (lower right); location of watershed in relation to the Western sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).



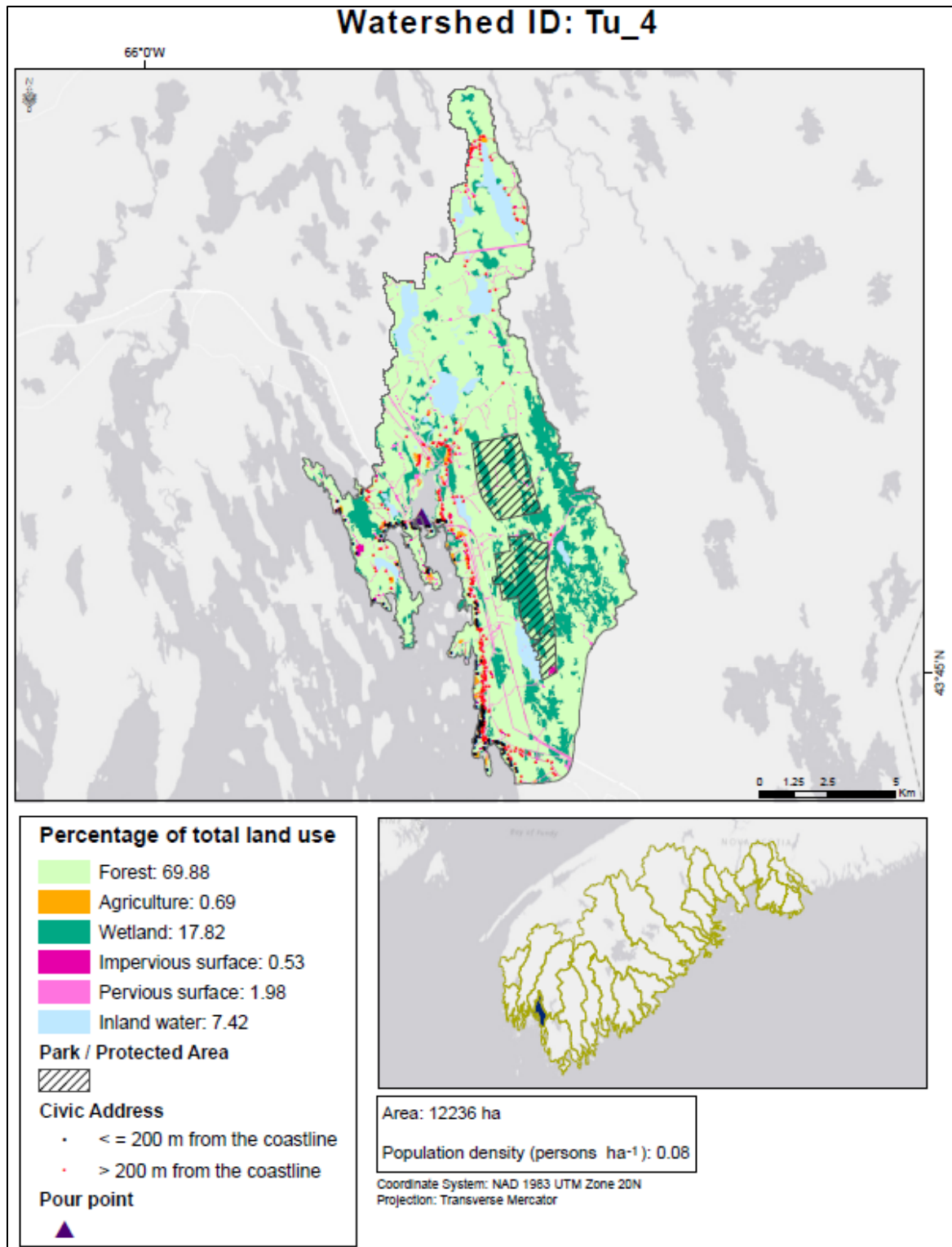


Figure 93. Land-use map for Tusket watershed Tu\_4. Insets: Watershed area and population density (lower right); location of watershed in relation to the Western sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

# Cape Breton Island Watershed Sub-region

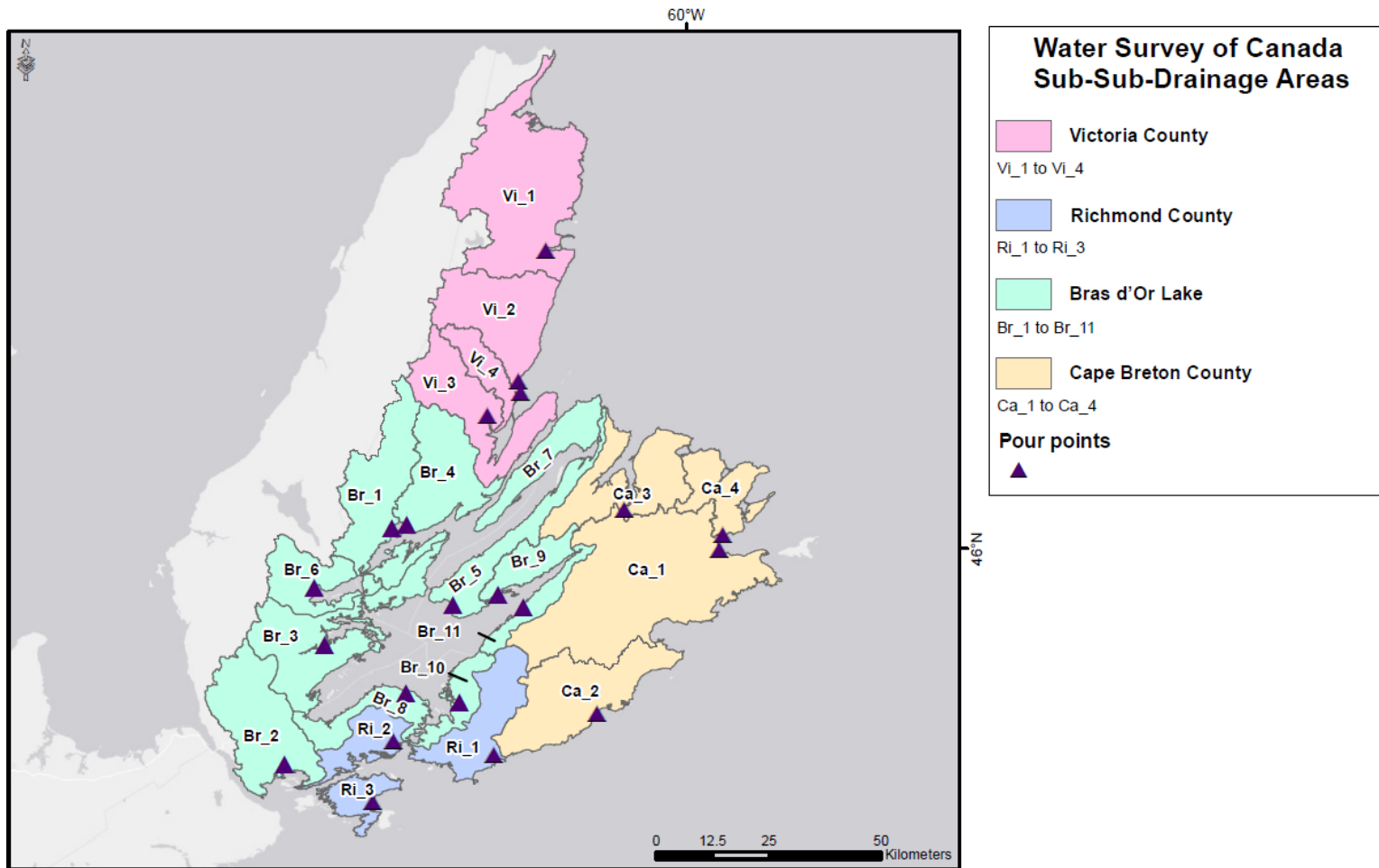


Figure 94. Cape Breton sub-region, displaying four Water Survey of Canada sub-sub-drainage areas (denoted by differing colours) and their associated watersheds. Black triangles represent the major pour points (largest outlets into the coastal zone).

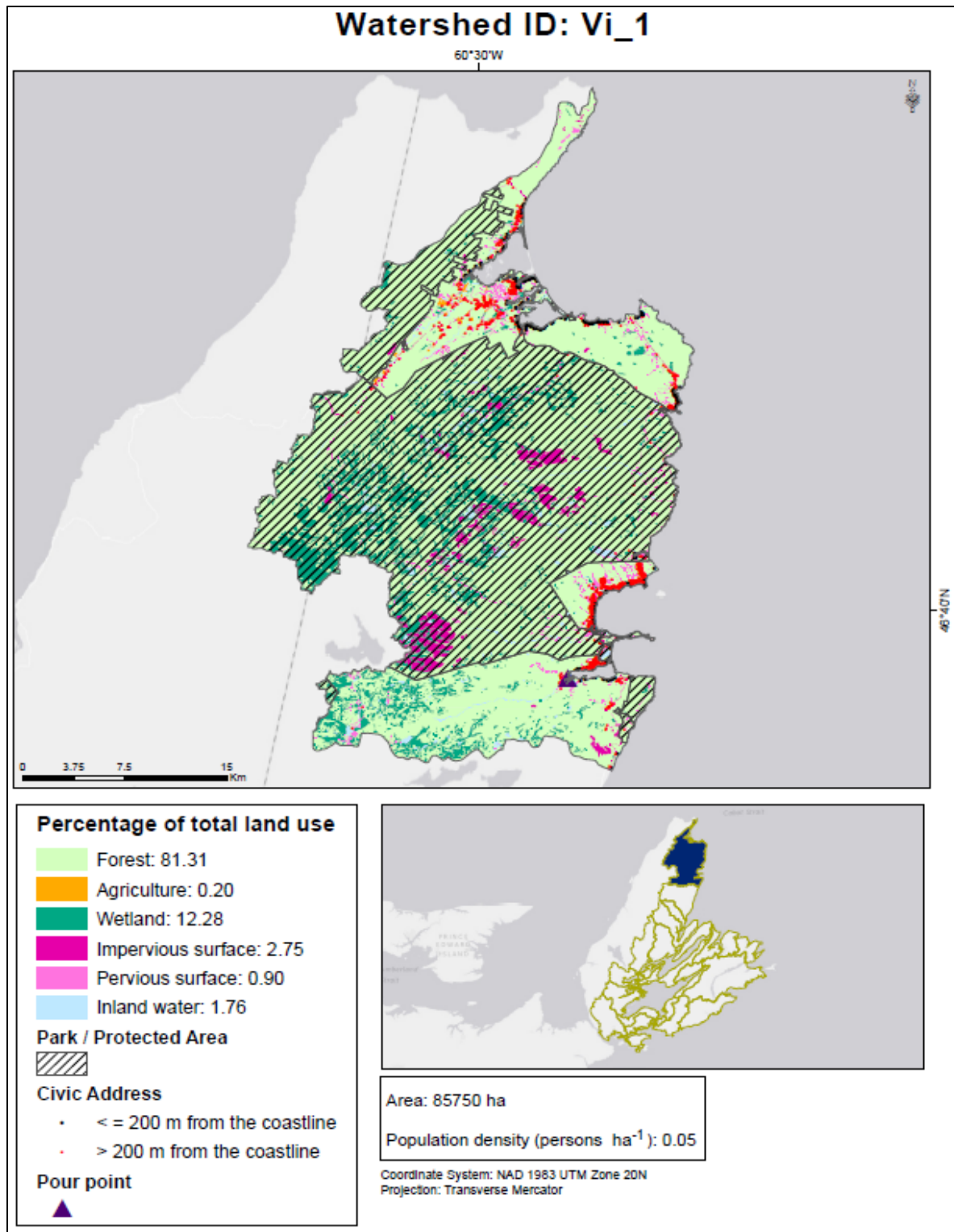


Figure 95. Land-use map for Victoria County watershed Vi\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Cape Breton Island sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

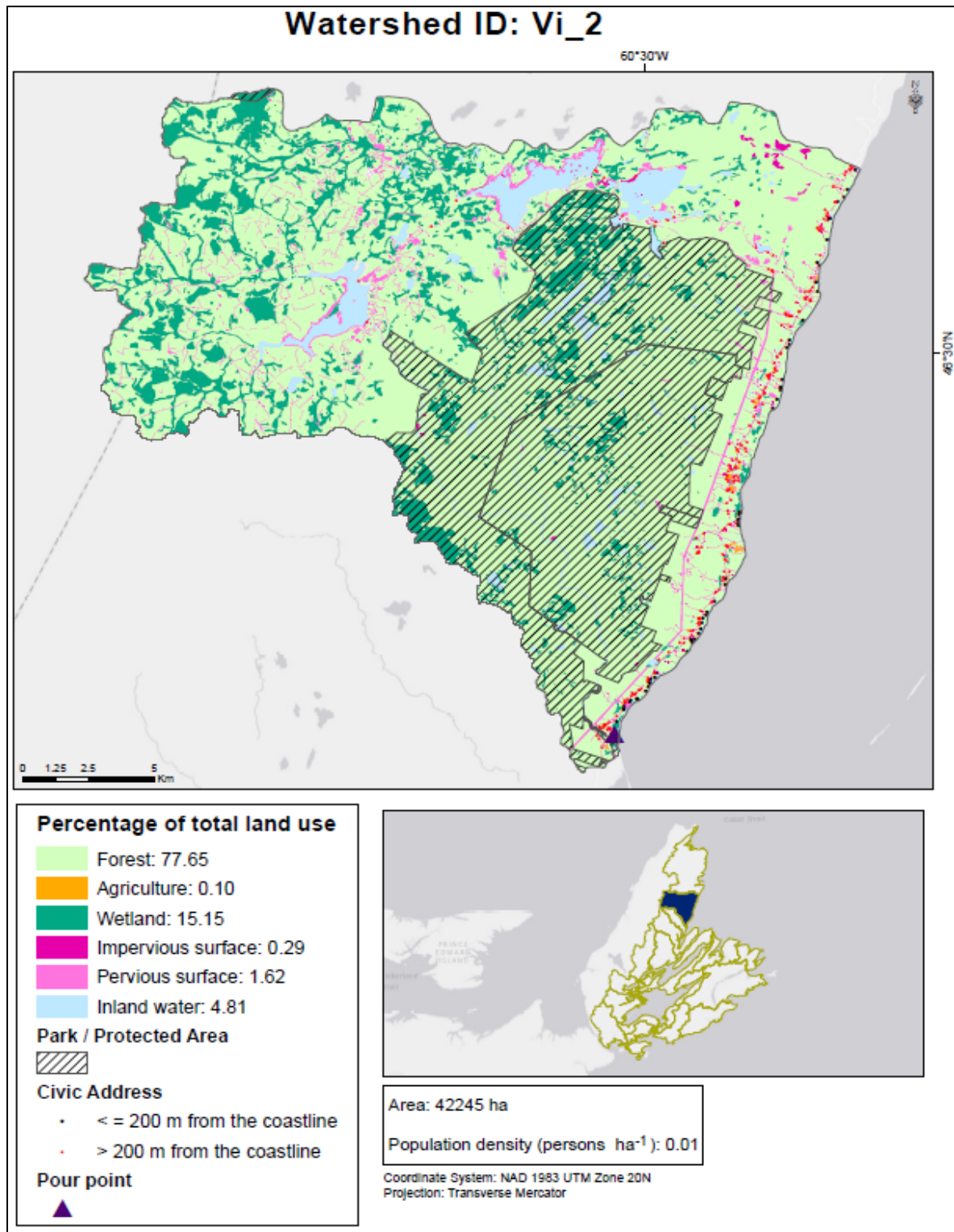


Figure 96. Land-use map for Victoria County watershed Vi\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Cape Breton Island sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

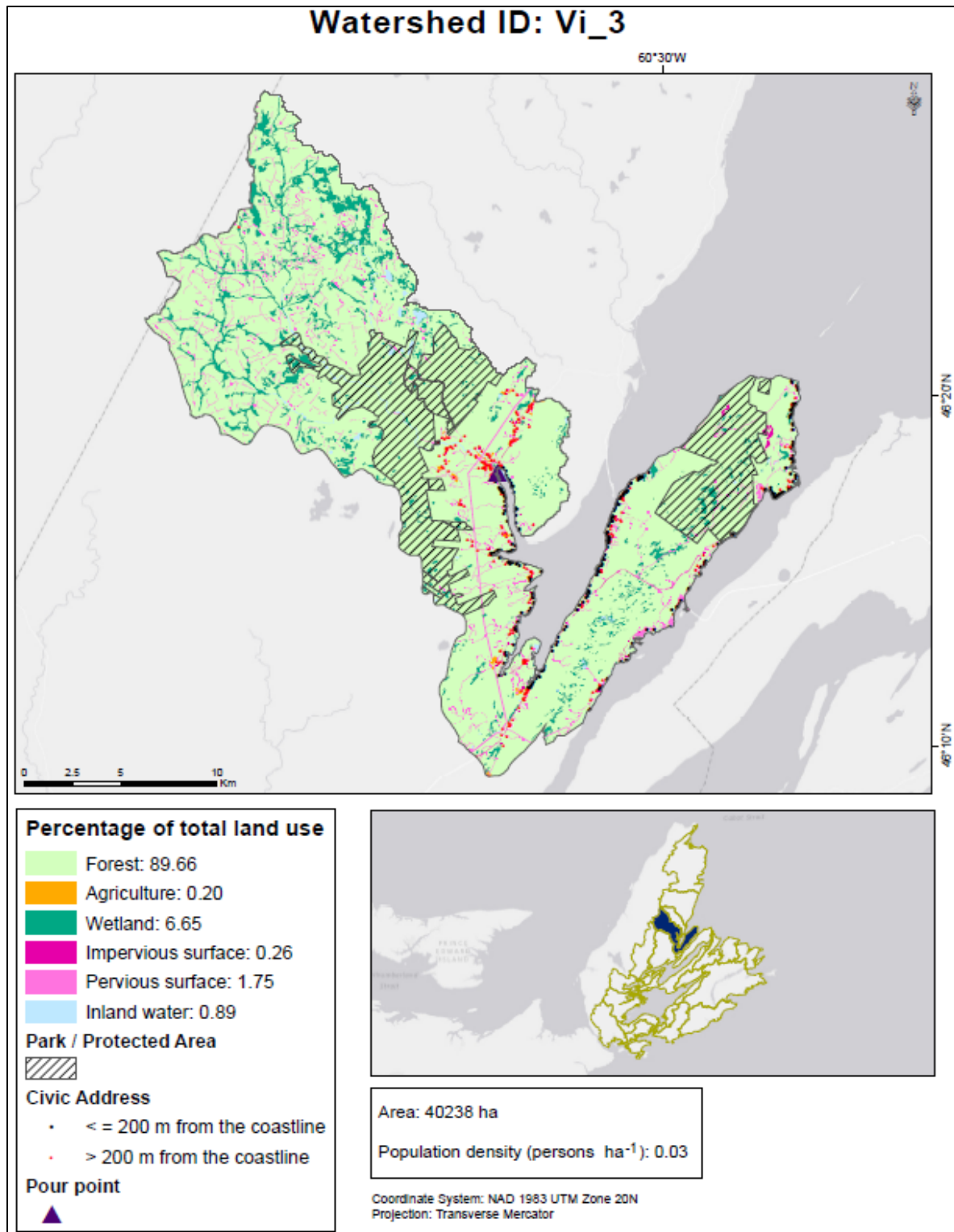


Figure 97. Land-use map for Victoria County watershed Vi\_3. Insets: Watershed area and population density (lower right); location of watershed in relation to the Cape Breton Island sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

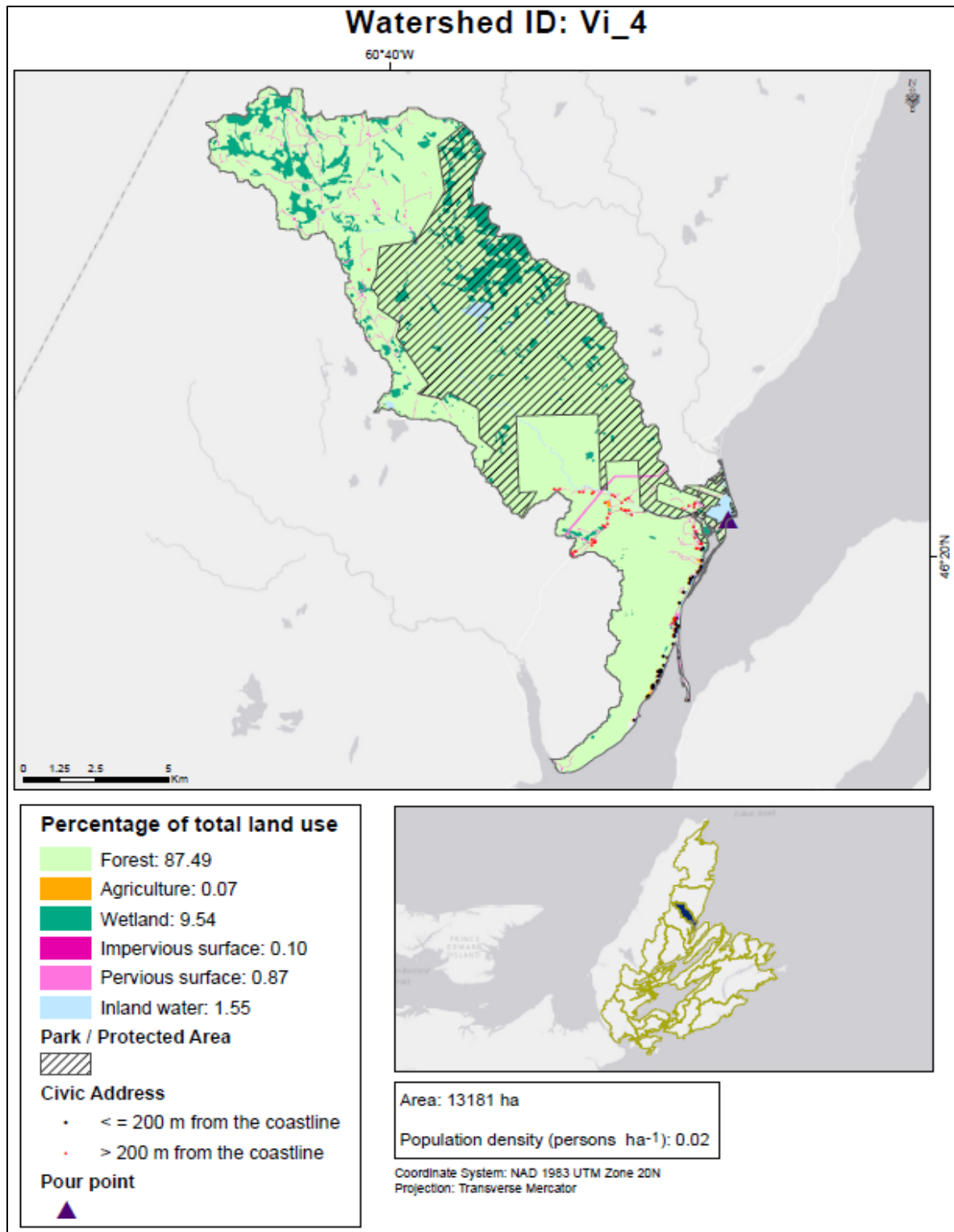


Figure 98. Land-use map for Victoria County watershed Vi\_4. Insets: Watershed area and population density (lower right); location of watershed in relation to the Cape Breton Island sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

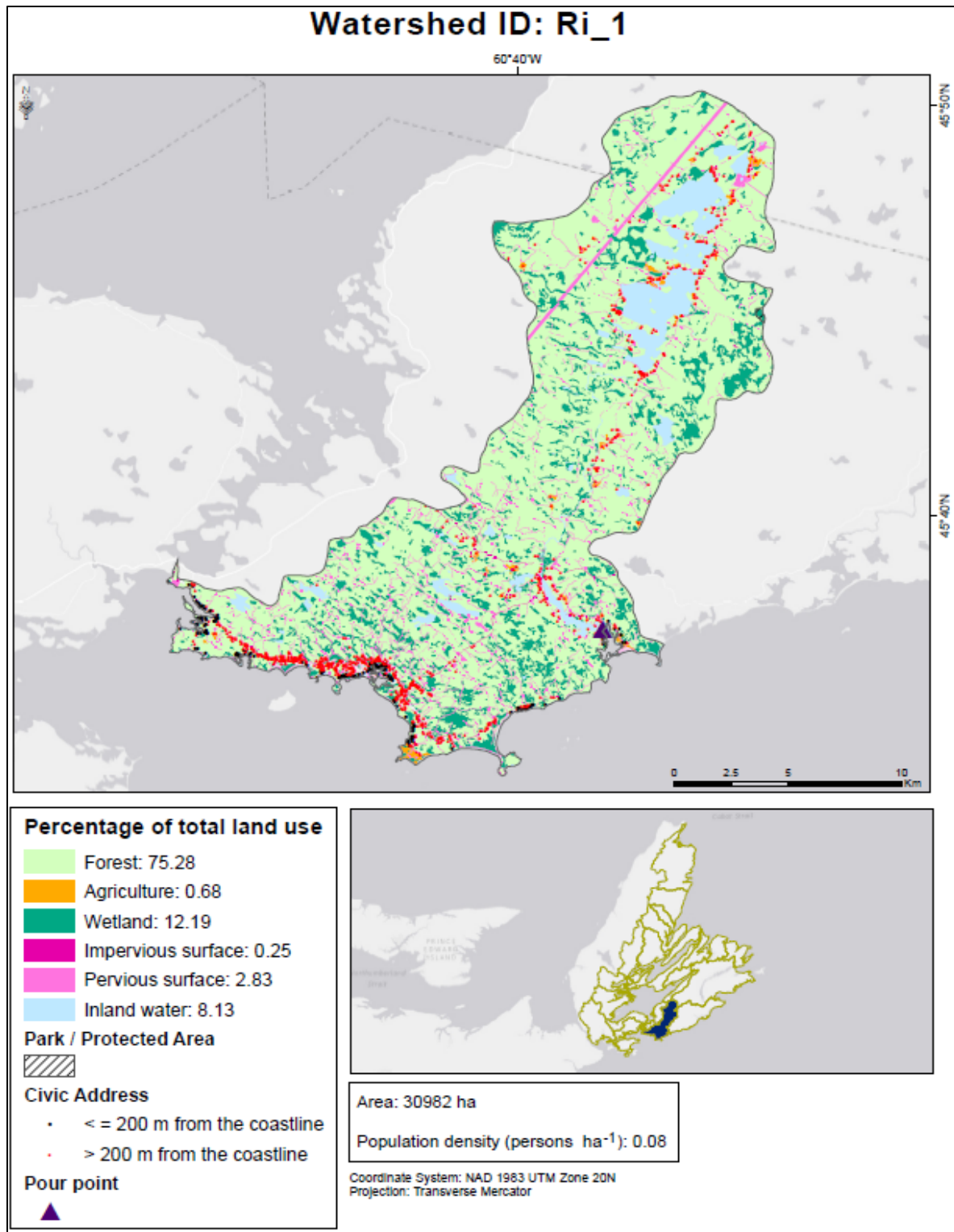


Figure 99. Land-use map for Richmond County watershed Ri\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Cape Breton Island sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

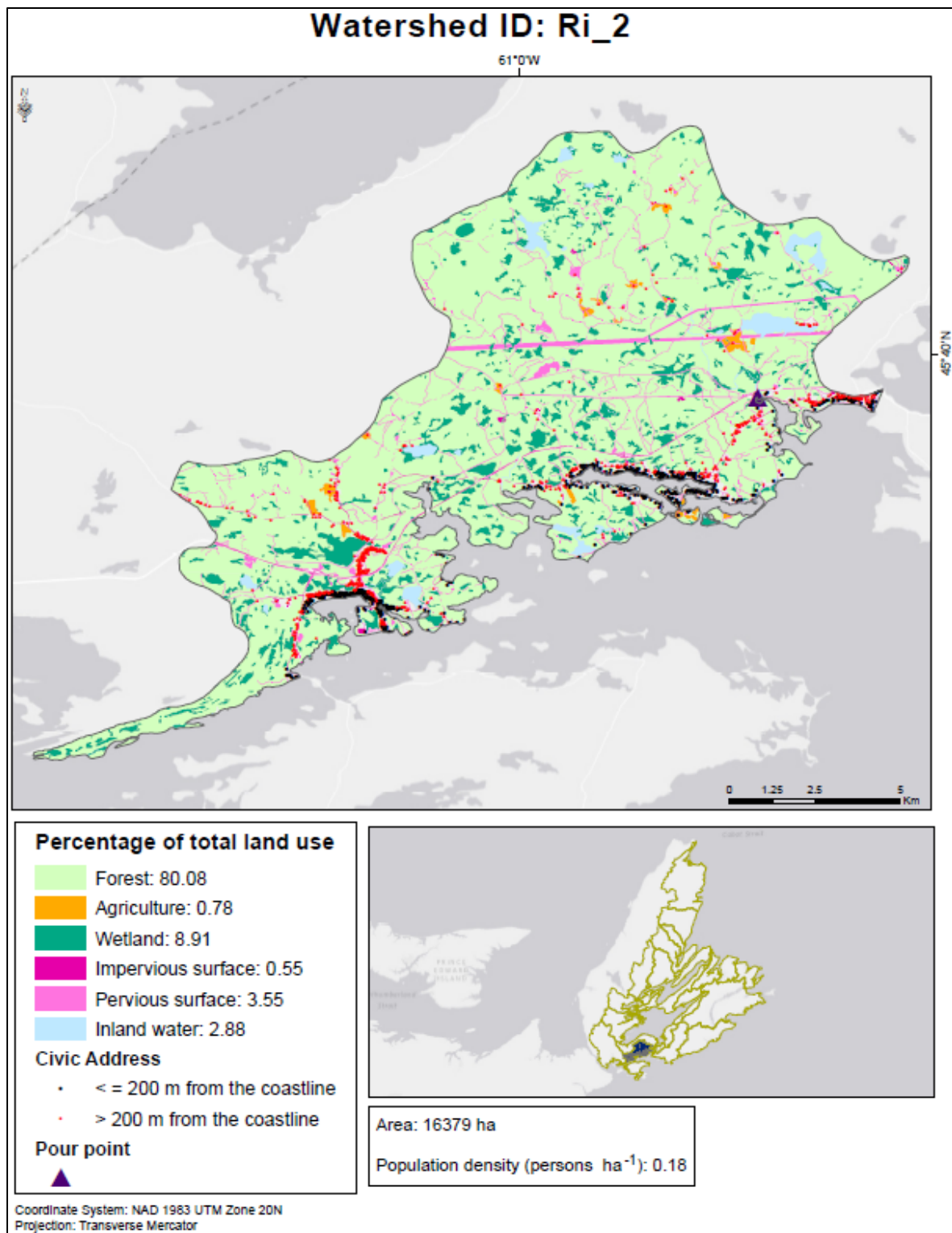


Figure 100. Land-use map for Richmond County watershed Ri\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Cape Breton Island sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).



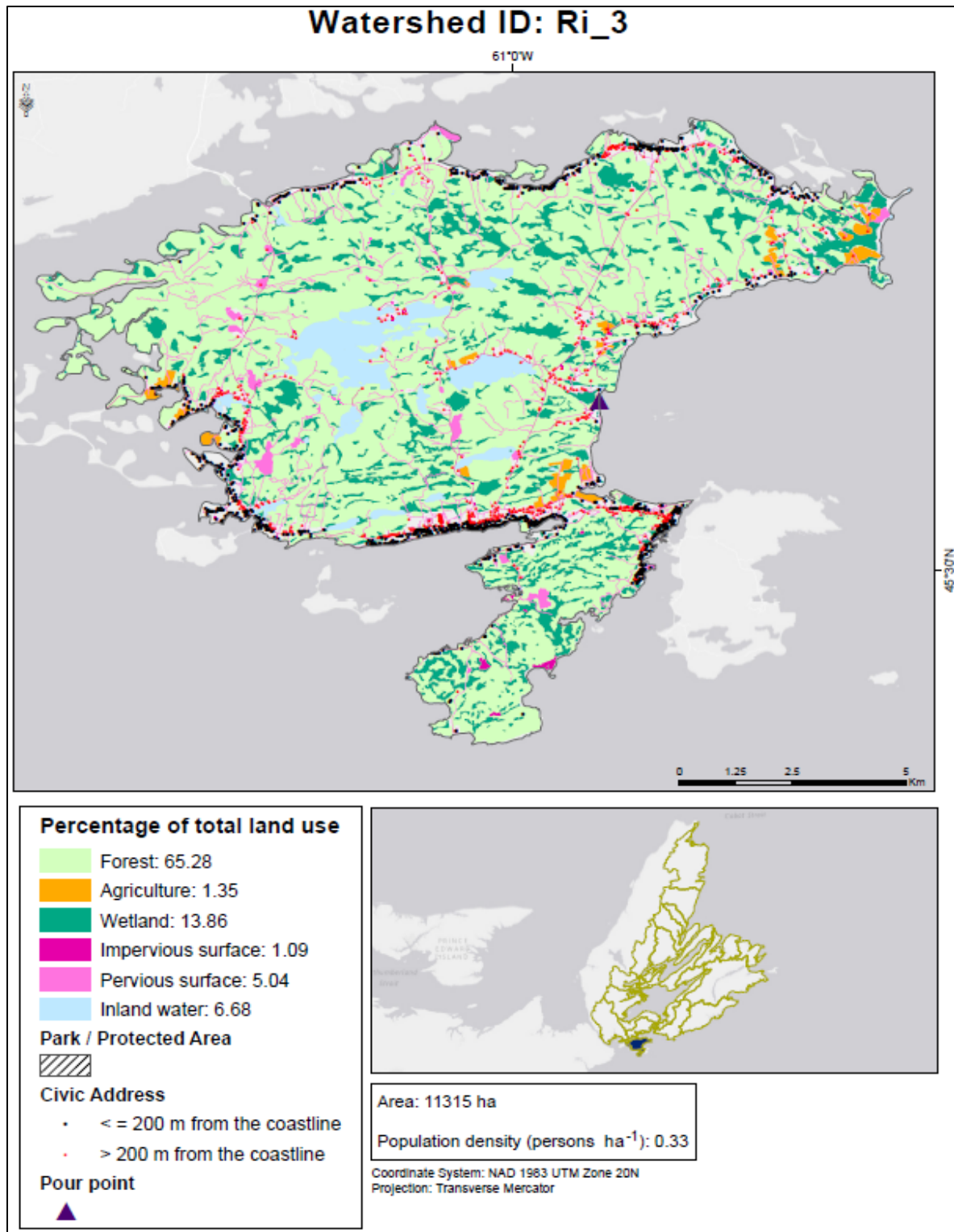


Figure 101. Land-use map for Richmond County watershed Ri\_3. Insets: Watershed area and population density (lower right); location of watershed in relation to the Cape Breton Island sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

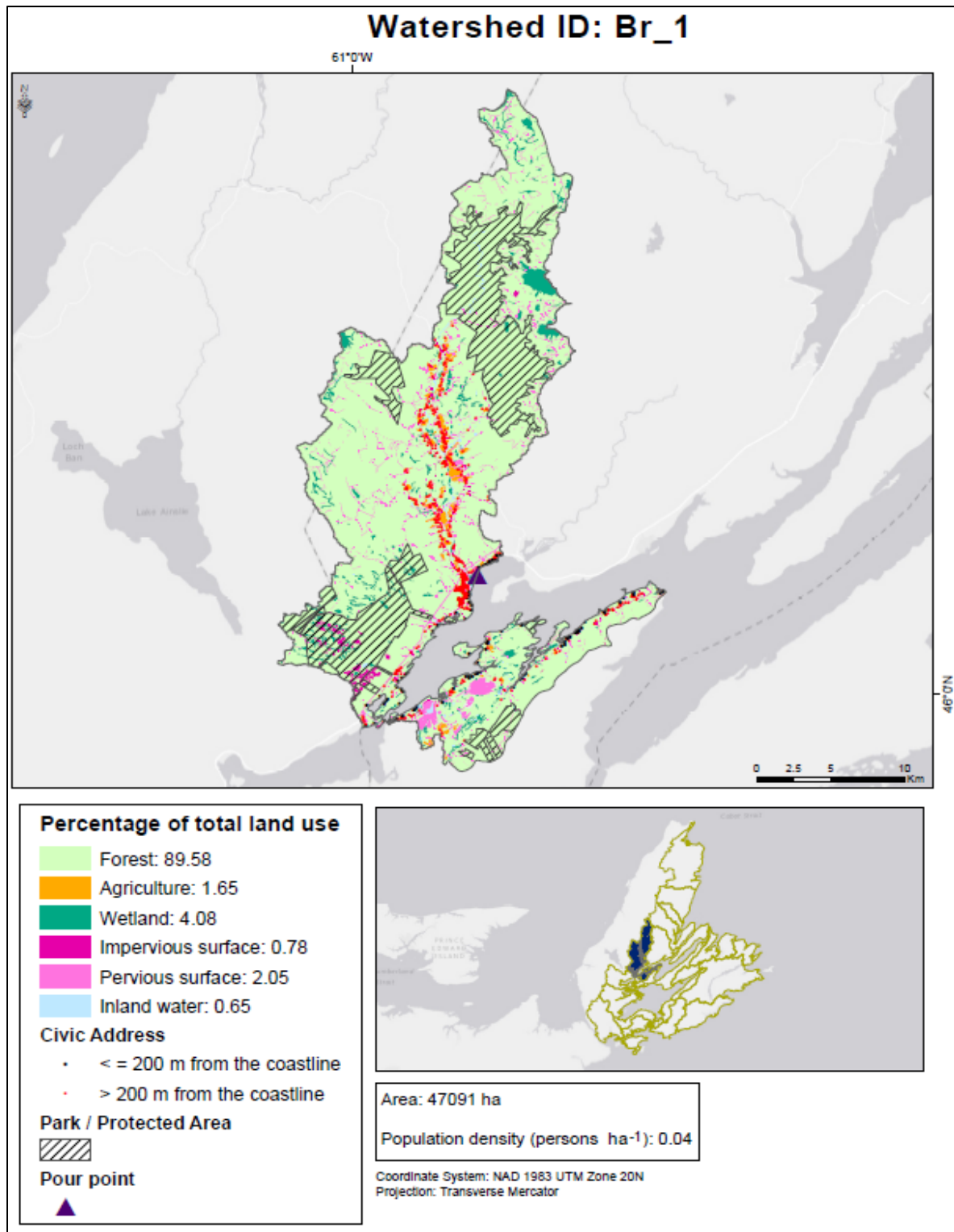


Figure 102. Land-use map for Bras d'Or Lake watershed Br\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Cape Breton Island sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

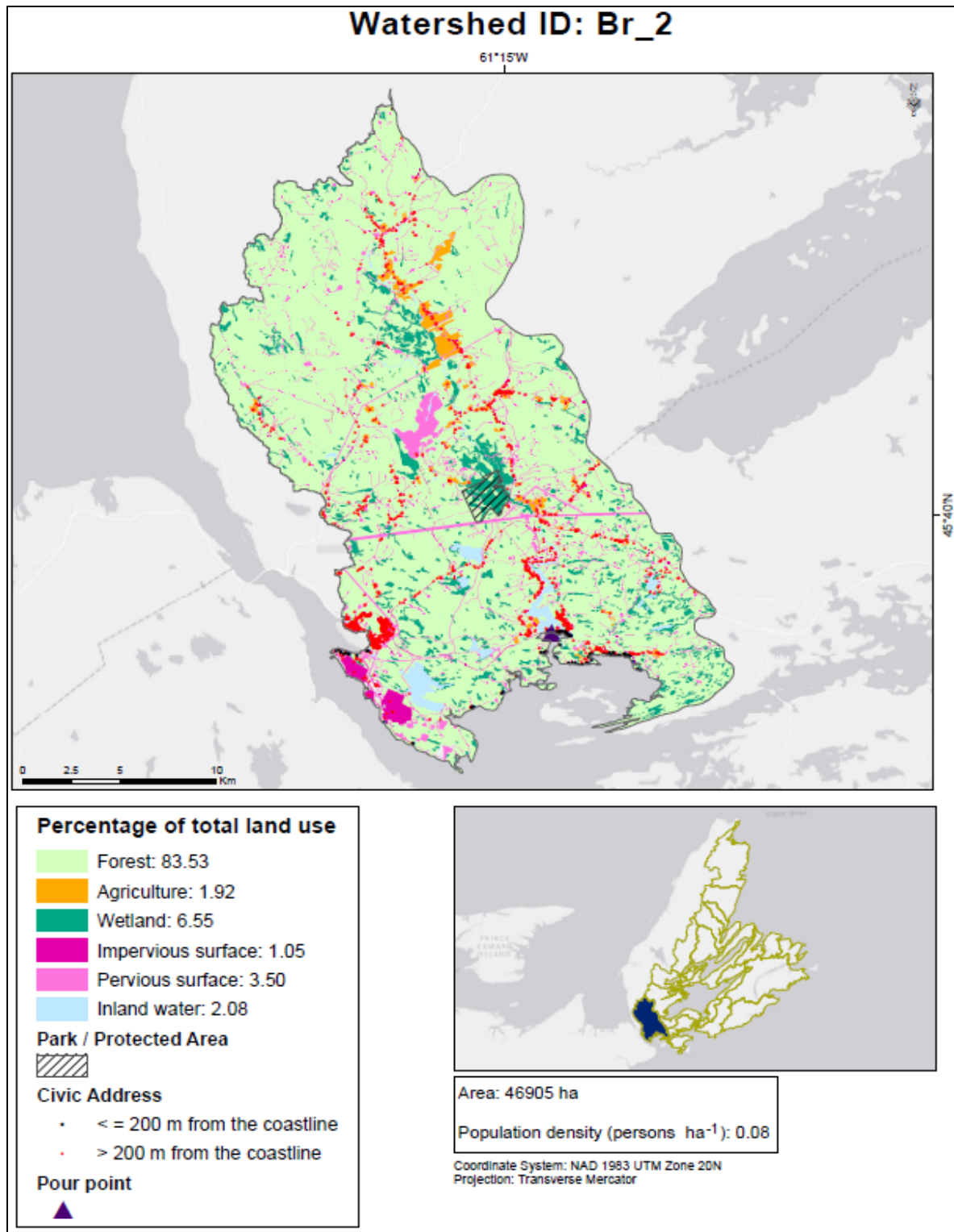


Figure 103. Land-use map for Bras d'Or Lake watershed Br\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Cape Breton Island sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

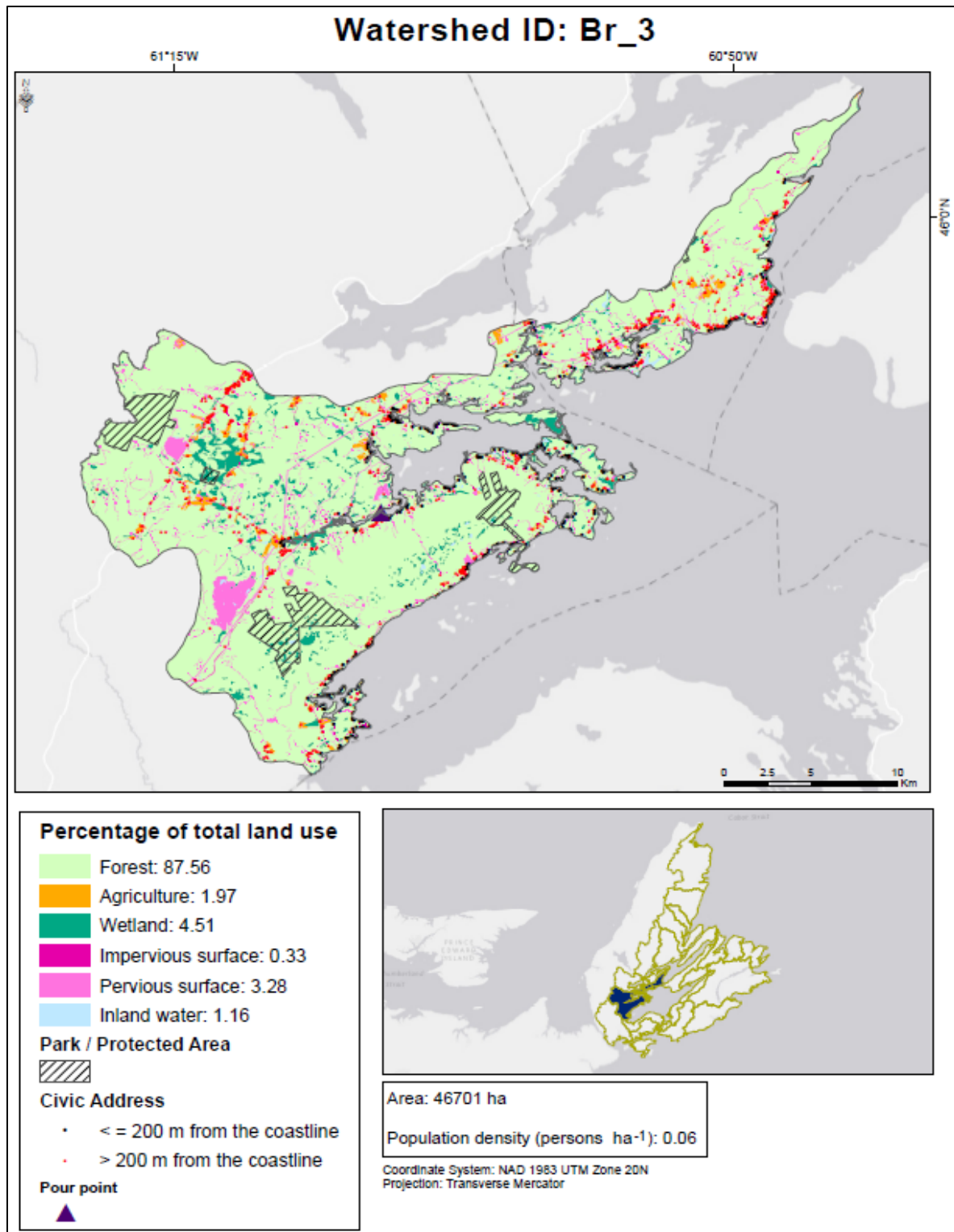


Figure 104. Land-use map for Bras d'Or Lake watershed Br\_3. Insets: Watershed area and population density (lower right); location of watershed in relation to the Cape Breton Island sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

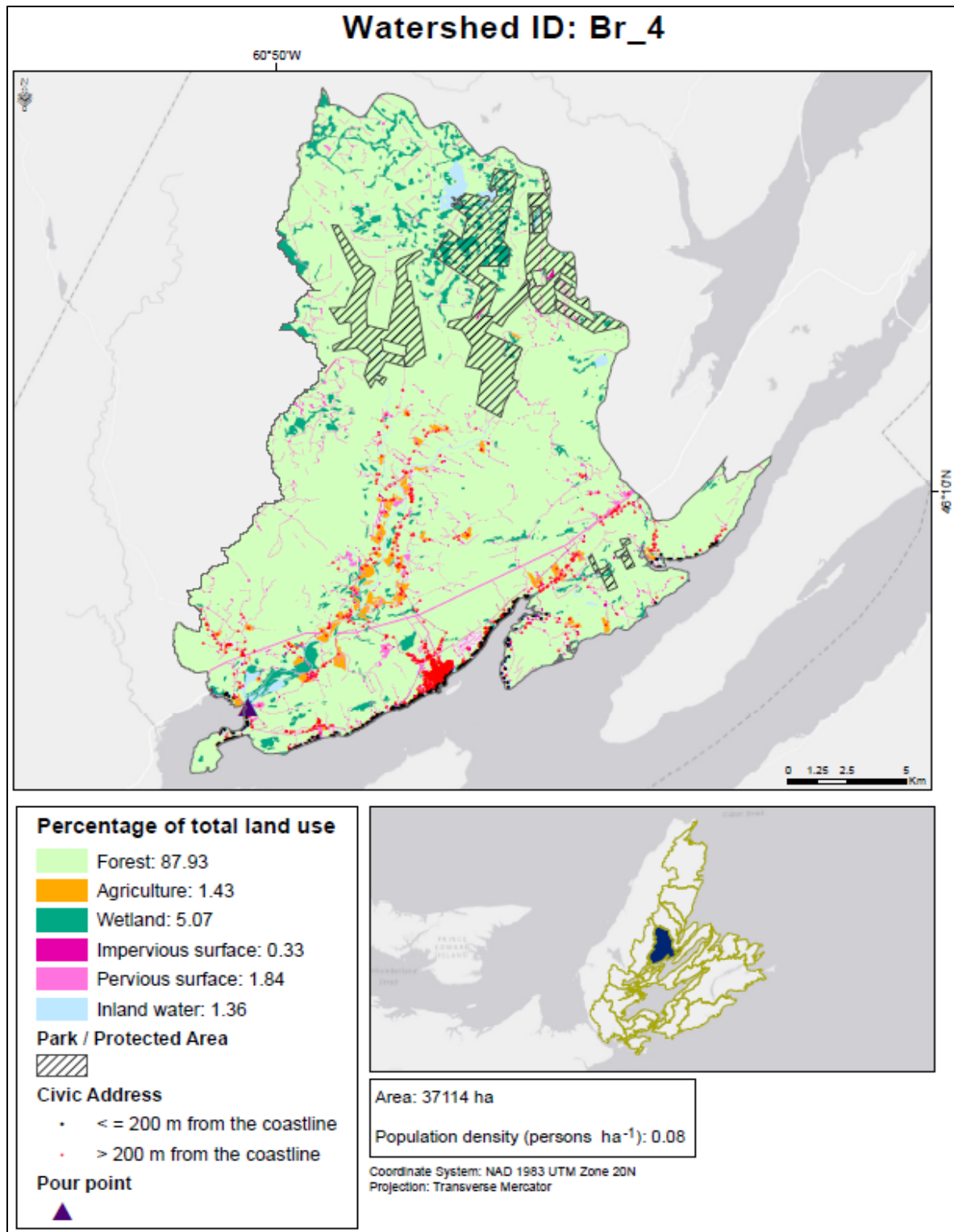


Figure 105. Land-use map for Bras d'Or Lake watershed Br\_4. Insets: Watershed area and population density (lower right); location of watershed in relation to the Cape Breton Island sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

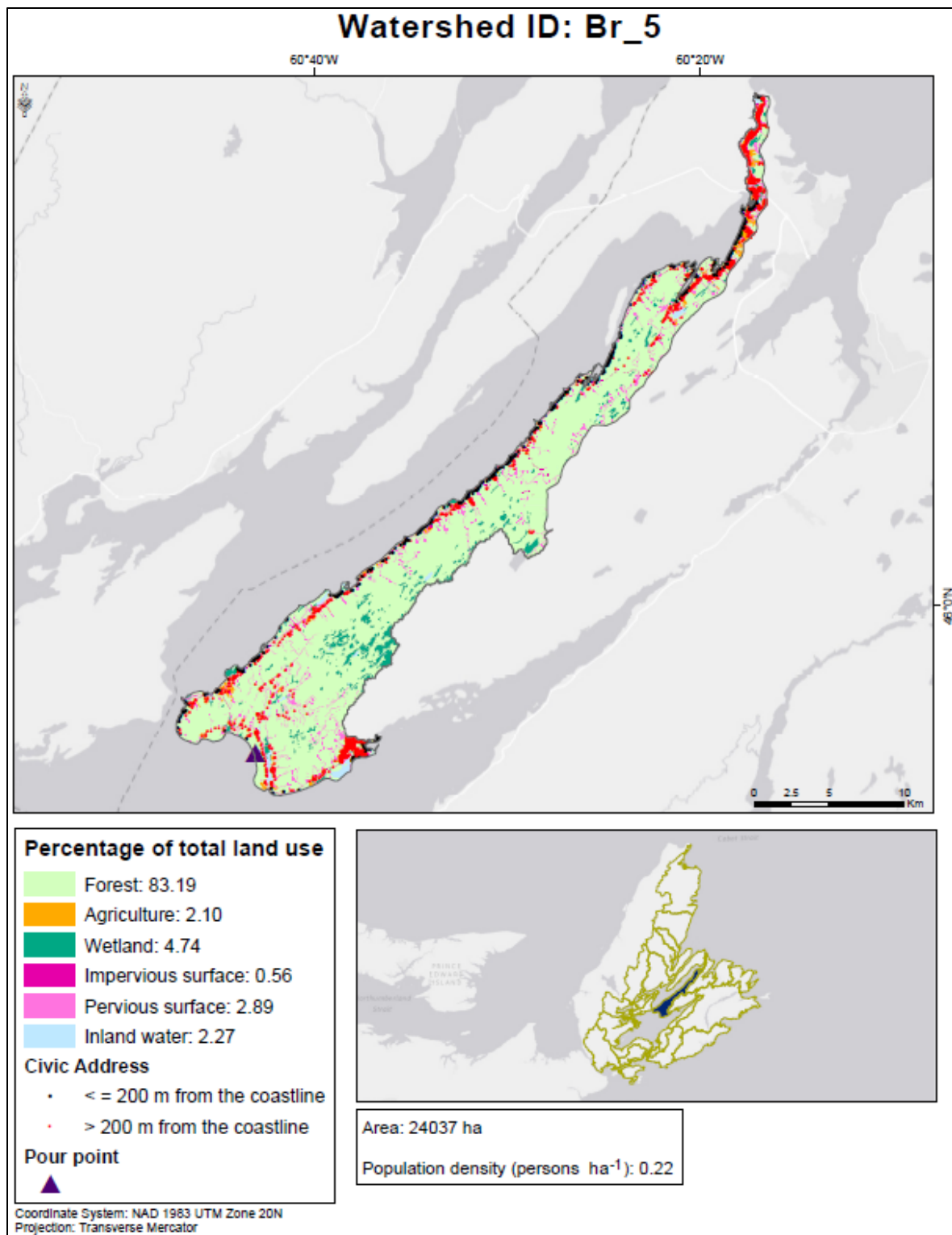


Figure 106. Land-use map for Bras d'Or Lake watershed Br\_5. Insets: Watershed area and population density (lower right); location of watershed in relation to the Cape Breton Island sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

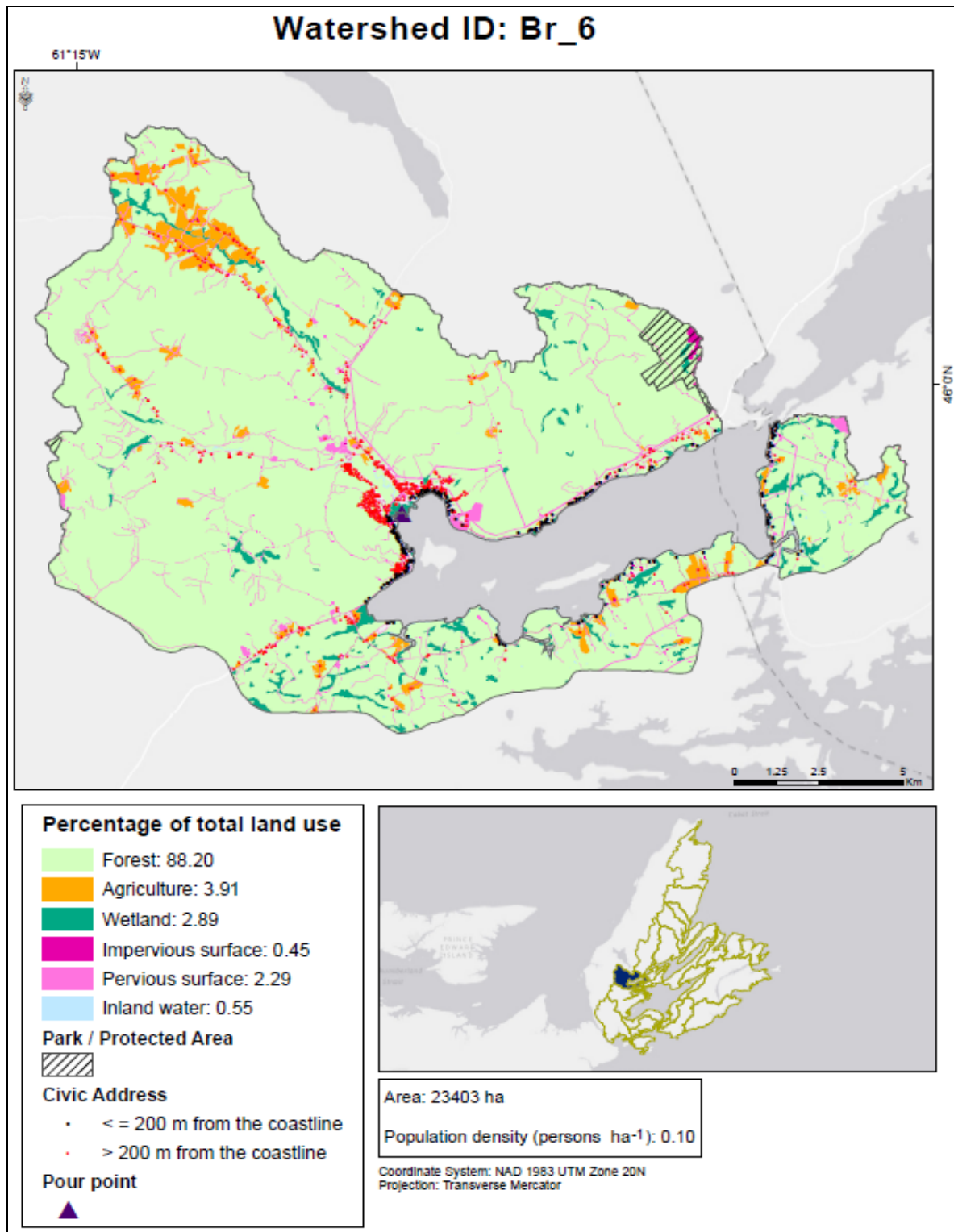


Figure 107. Land-use map for Bras d'Or Lake watershed Br\_6. Insets: Watershed area and population density (lower right); location of watershed in relation to the Cape Breton Island sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

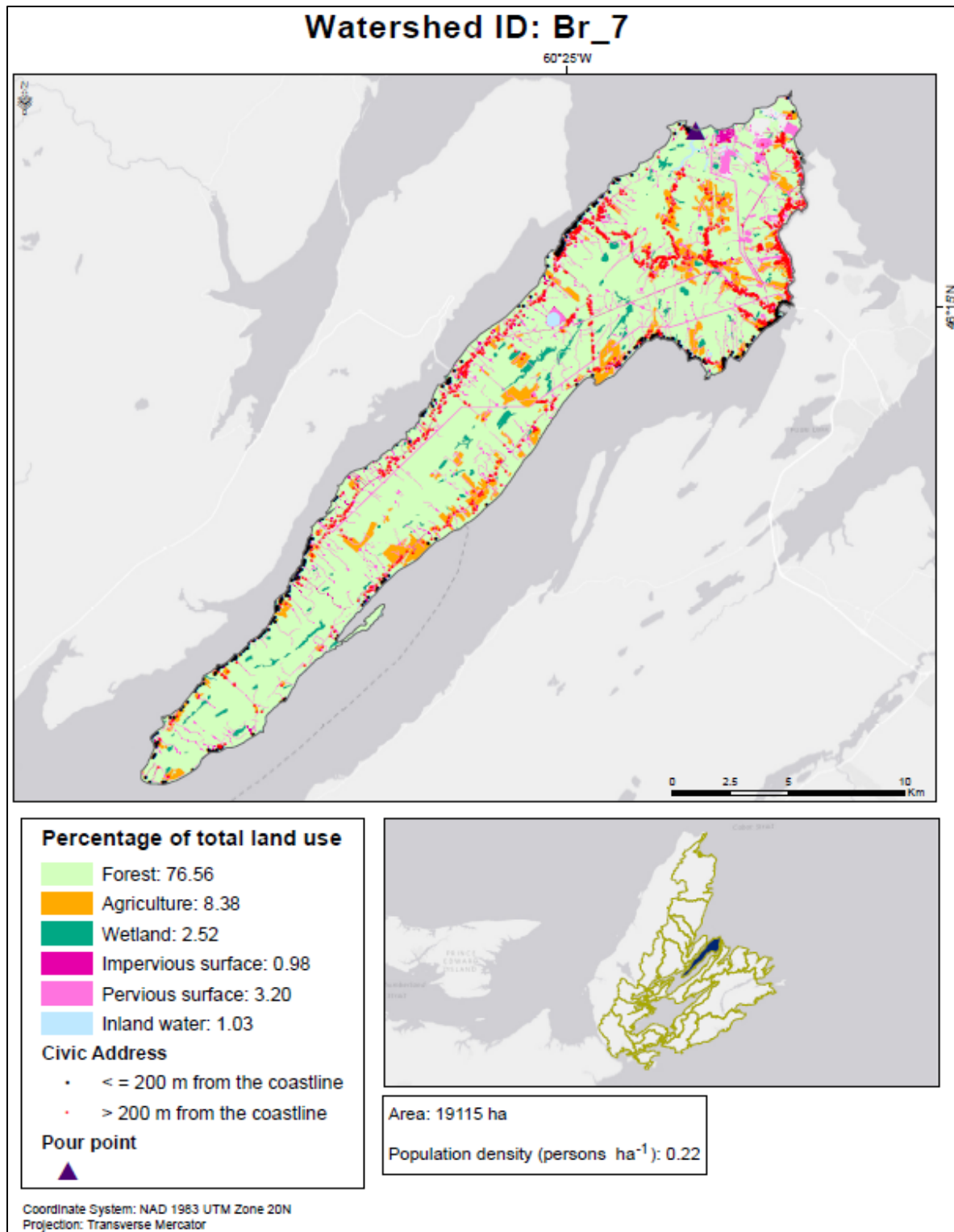


Figure 108. Land-use map for Bras d'Or Lake watershed Br\_7. Insets: Watershed area and population density (lower right); location of watershed in relation to the Cape Breton Island sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).



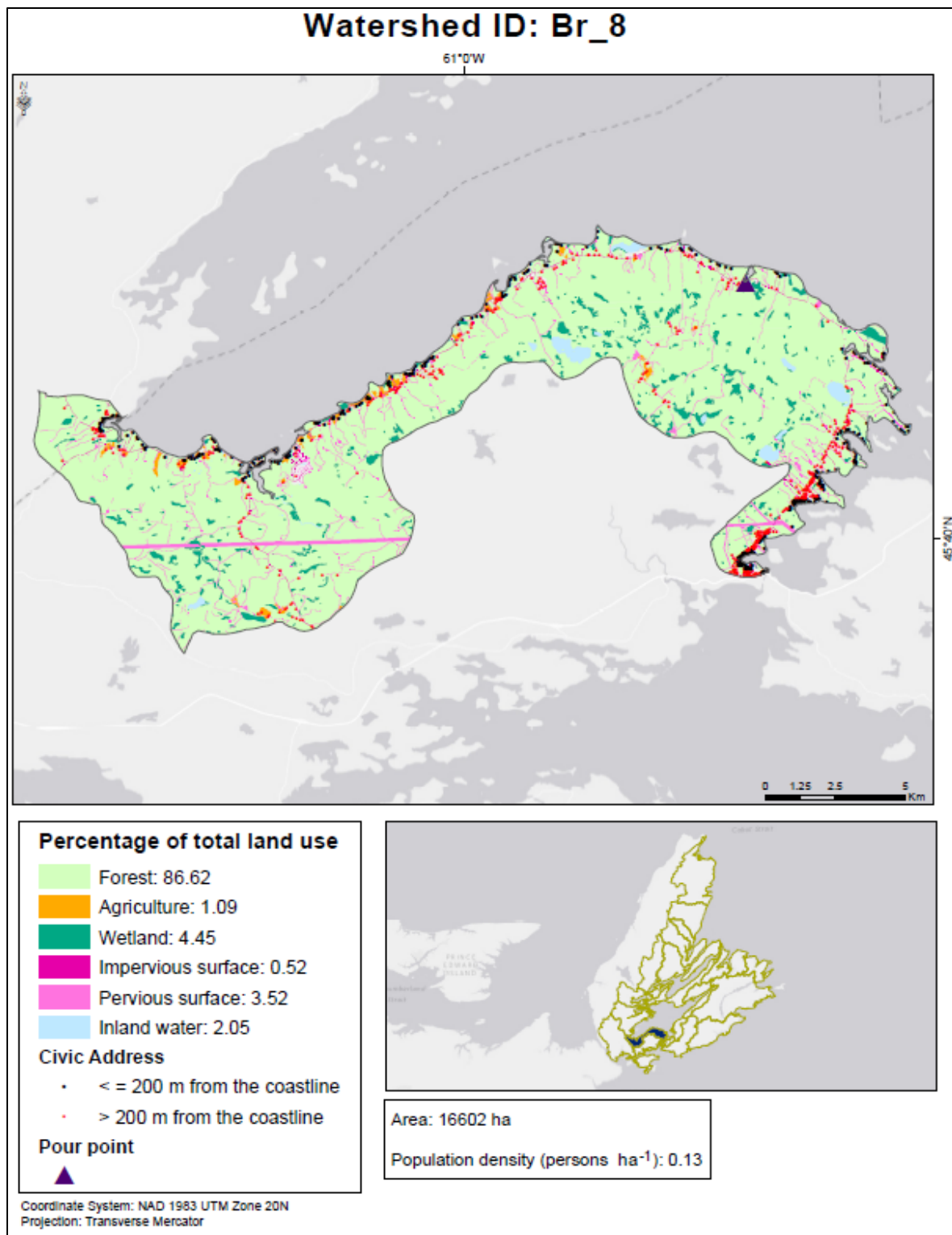


Figure 109. Land-use map for Bras d'Or Lake watershed Br\_8. Insets: Watershed area and population density (lower right); location of watershed in relation to the Cape Breton Island sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

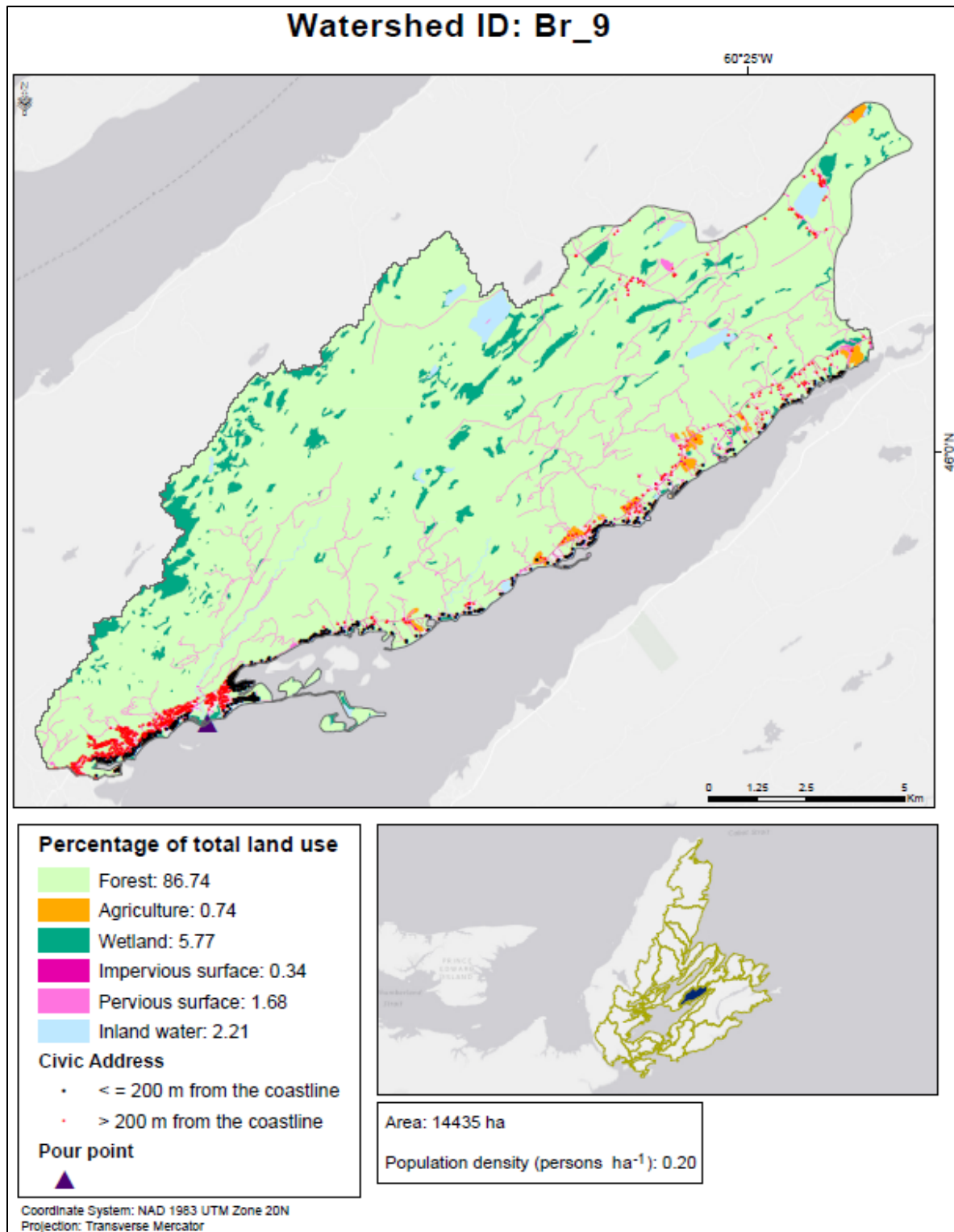


Figure 110. Land-use map for Bras d'Or Lake watershed Br\_9. Insets: Watershed area and population density (lower right); location of watershed in relation to the Cape Breton Island sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

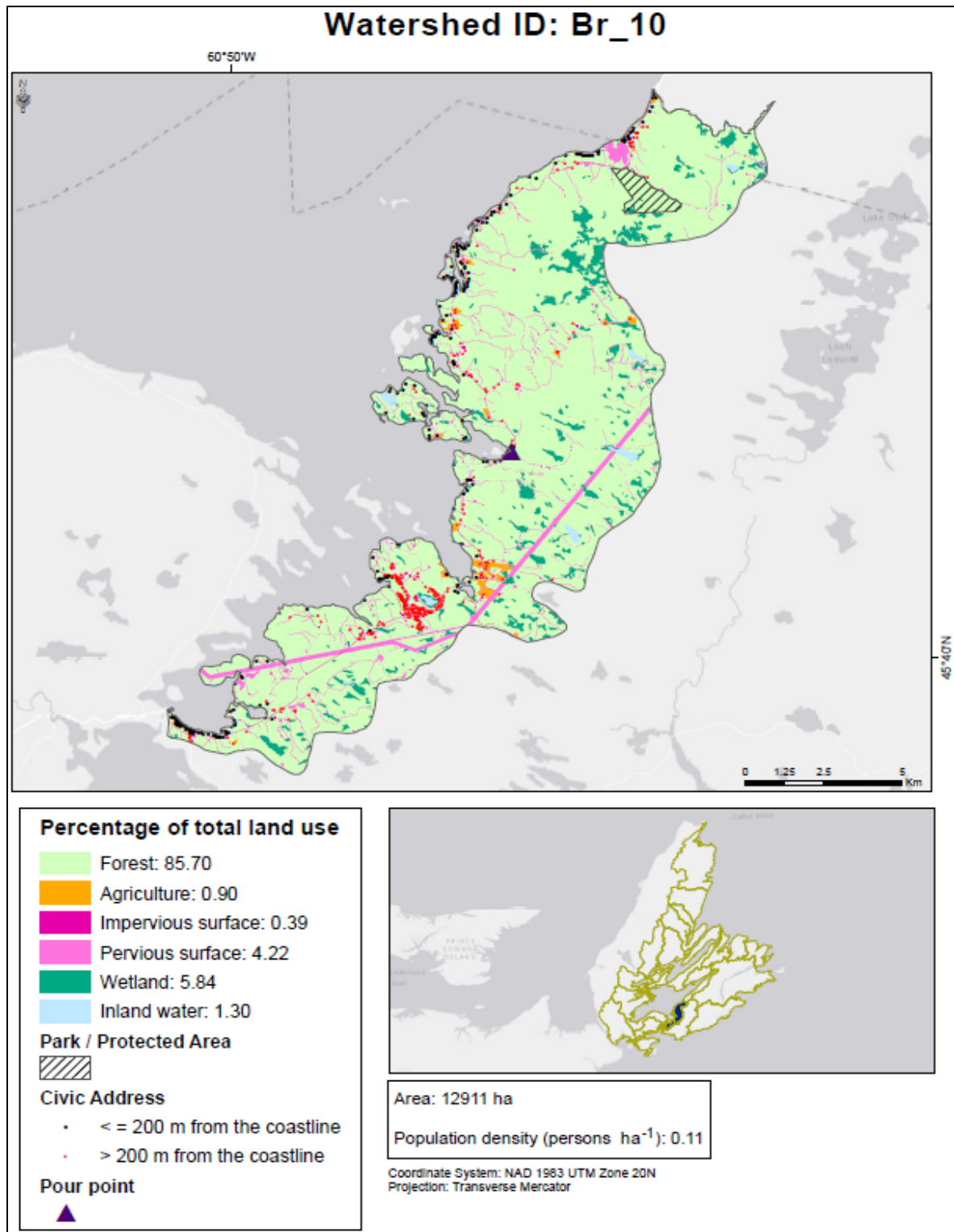


Figure 111. Land-use map for Bras d'Or Lake watershed Br\_10. Insets: Watershed area and population density (lower right); location of watershed in relation to the Cape Breton Island sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

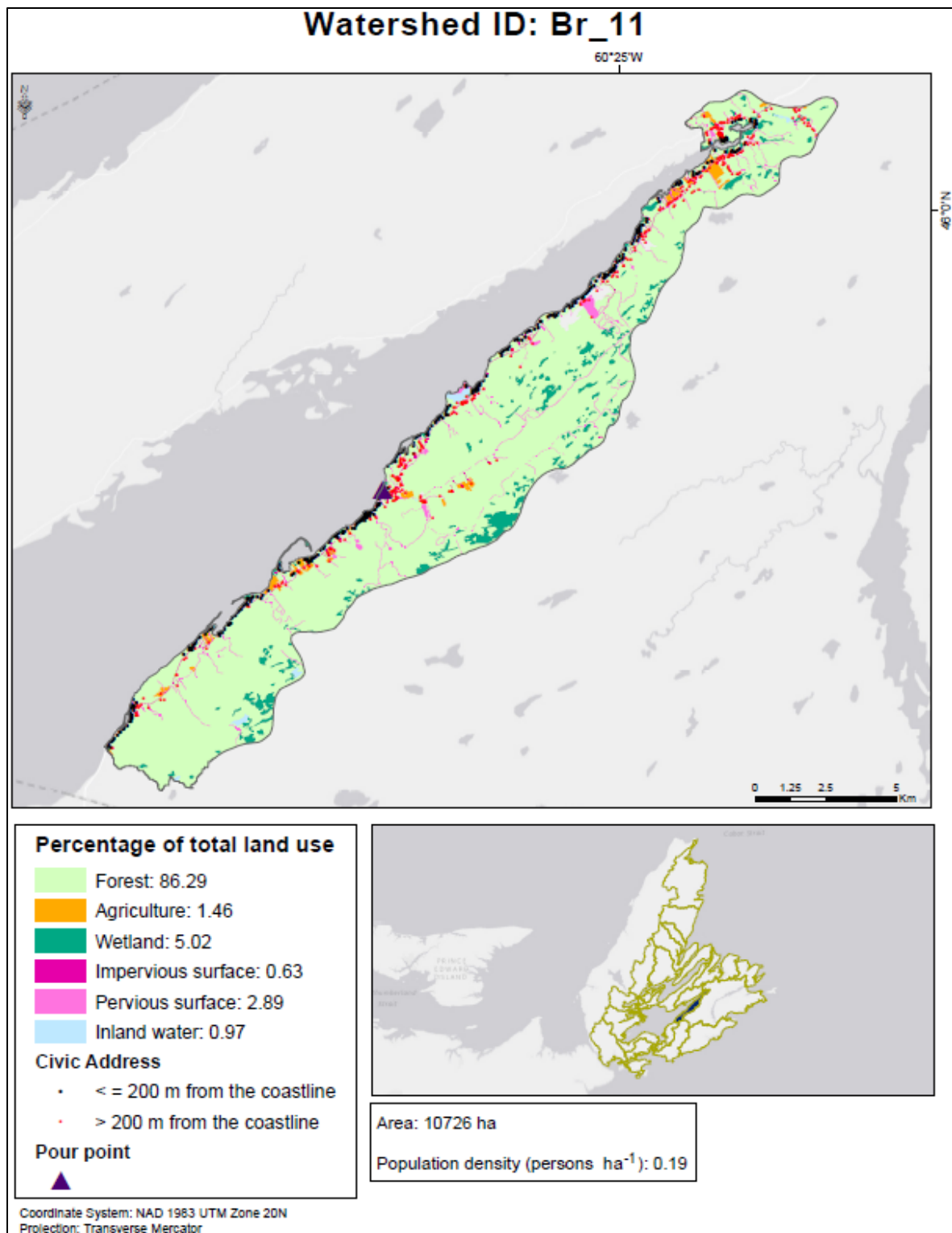


Figure 112. Land-use map for Bras d'Or Lake watershed Br\_11. Insets: Watershed area and population density (lower right); location of watershed in relation to the Cape Breton Island sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

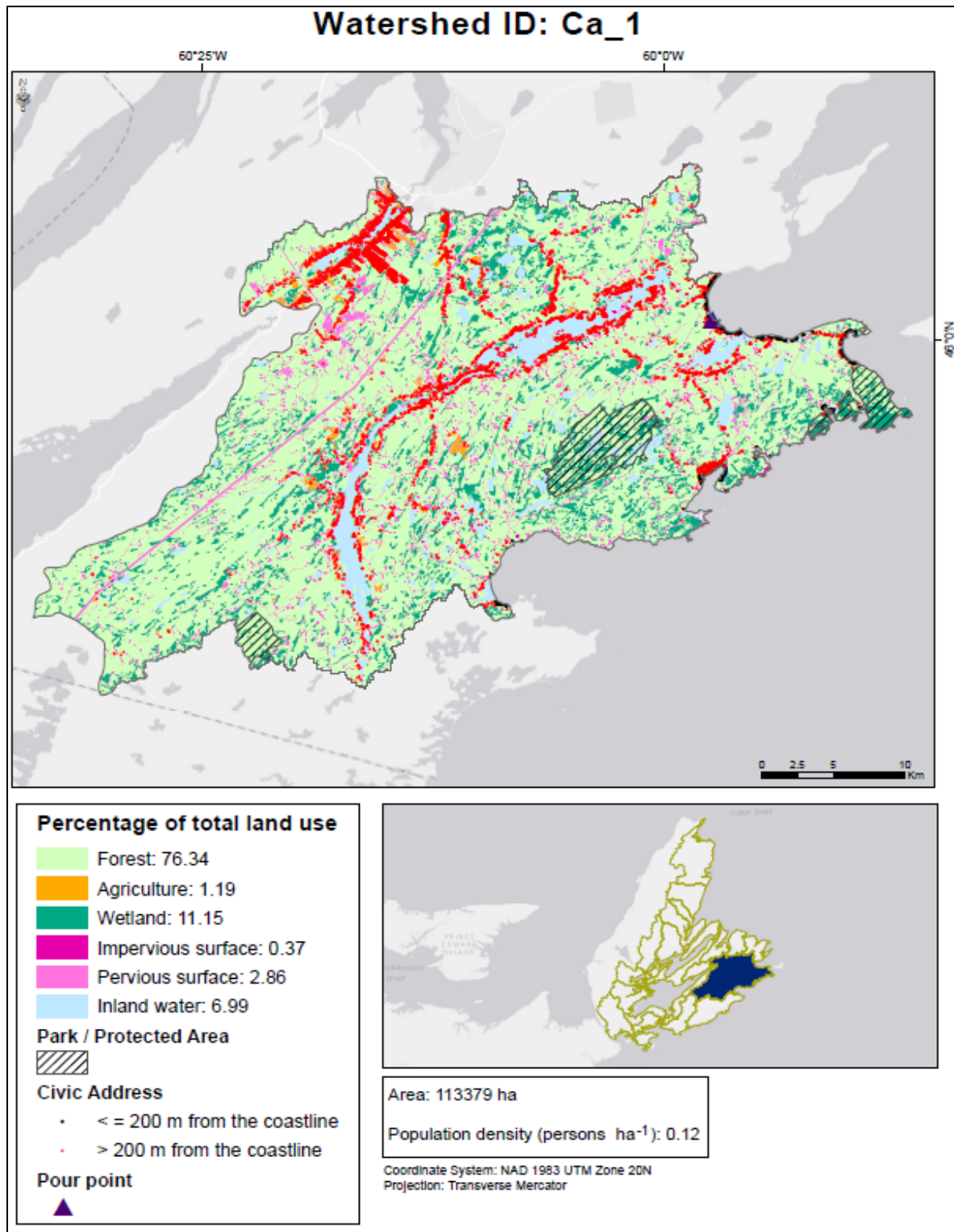


Figure 113. Land-use map for Cape Breton County watershed Ca\_1. Insets: Watershed area and population density (lower right); location of watershed in relation to the Cape Breton Island sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

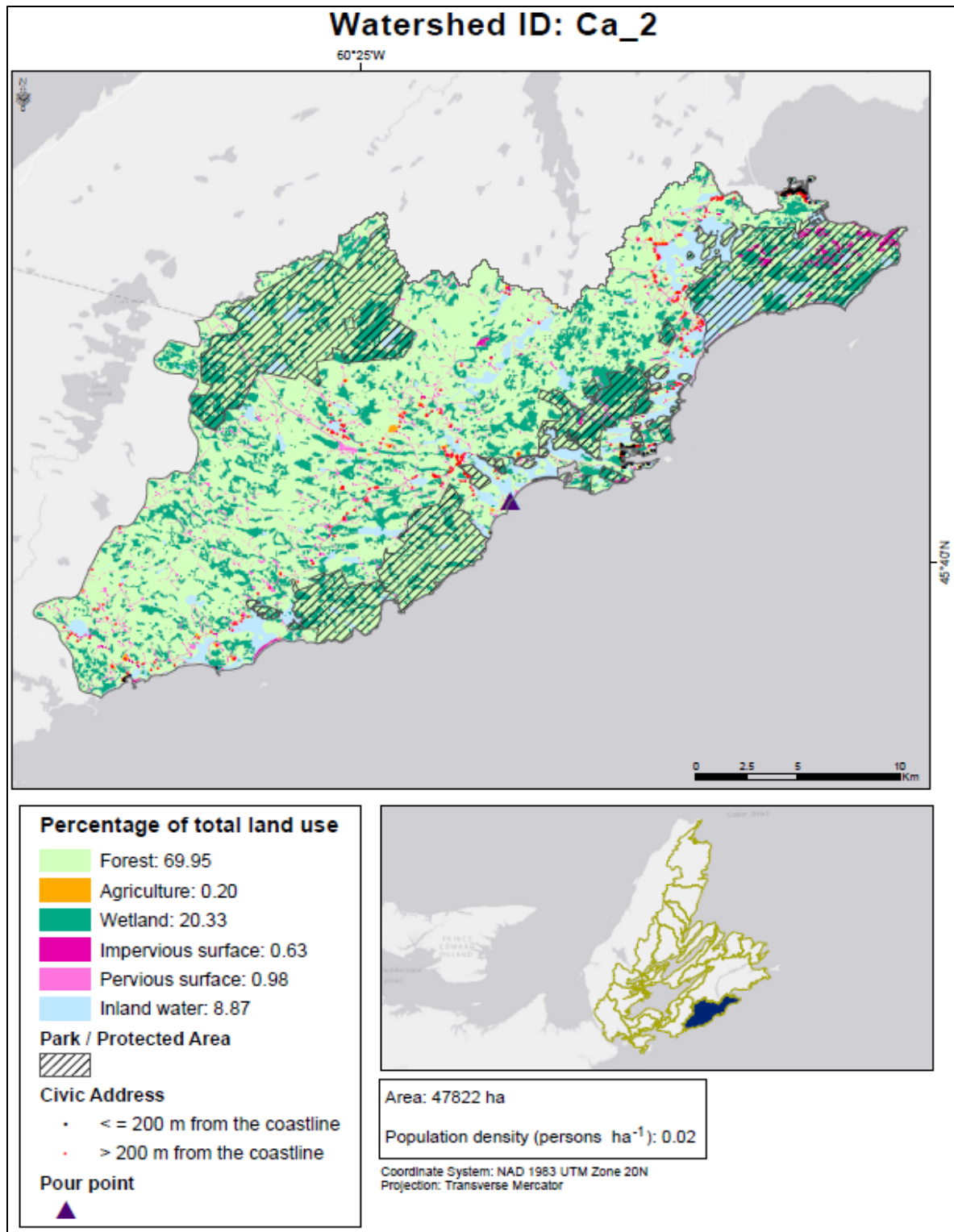


Figure 114. Land-use map for Cape Breton County watershed Ca\_2. Insets: Watershed area and population density (lower right); location of watershed in relation to the Cape Breton Island sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

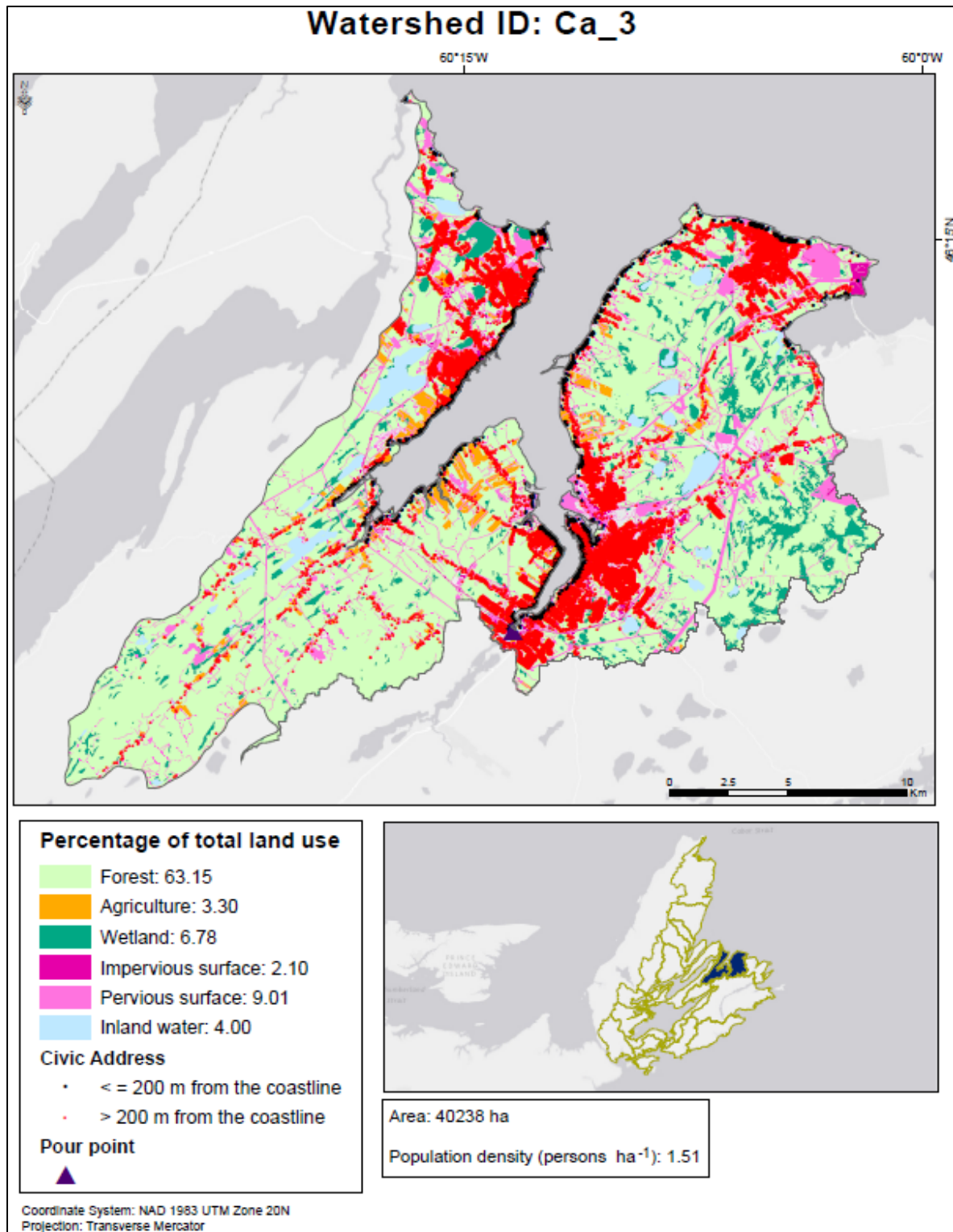


Figure 115. Land-use map for Cape Breton County watershed Ca\_3. Insets: Watershed area and population density (lower right); location of watershed in relation to the Cape Breton Island sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).

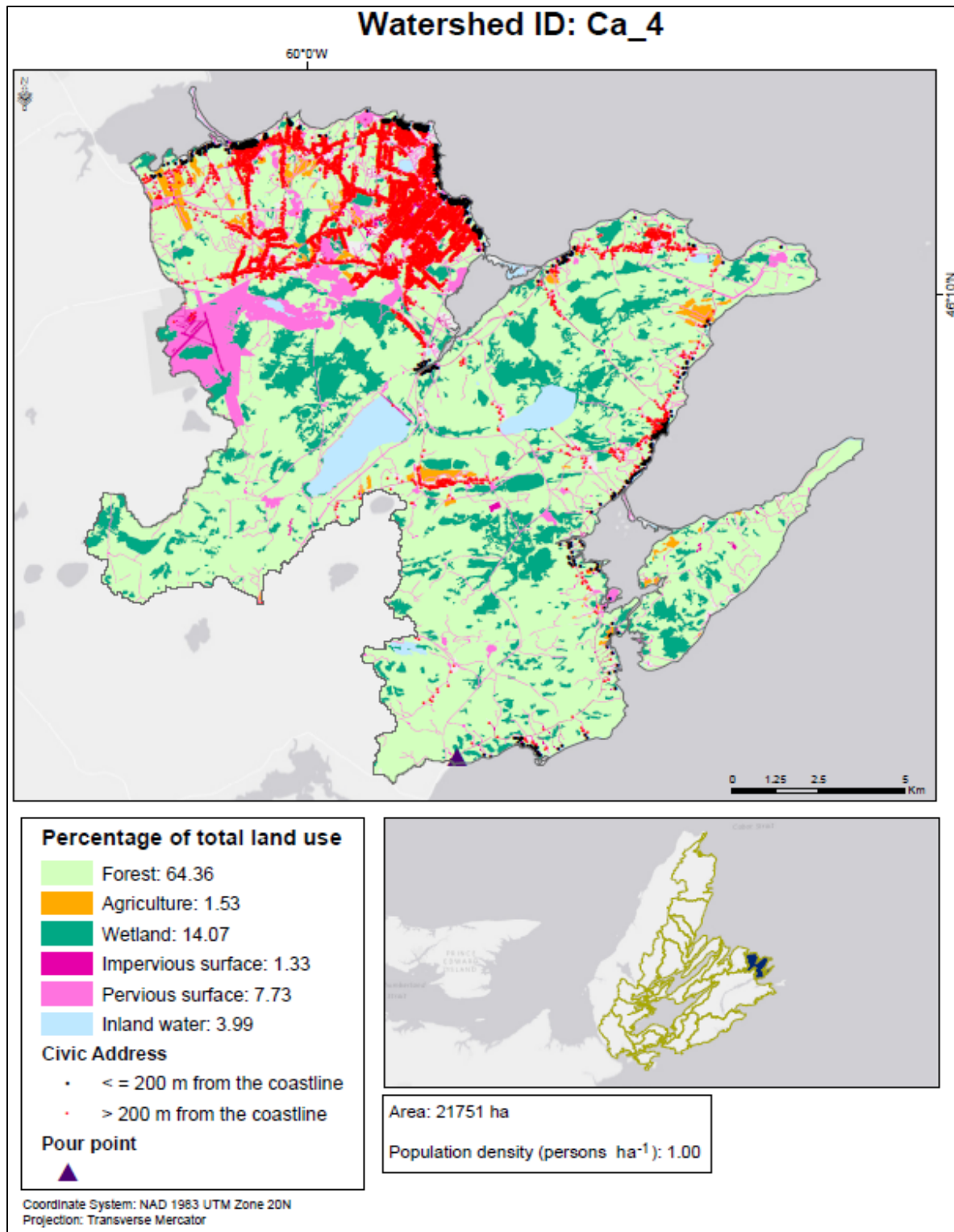


Figure 116. Land-use map for Cape Breton County watershed Ca\_4. Insets: Watershed area and population density (lower right); location of watershed in relation to the Cape Breton Island sub-region (centre right); and percentage of total land-use (lower left). The black triangle represents the major pour point (largest outlet into the coastal zone).



## APPENDIX

Table A.1. Adjusted Cape Breton Island sub-region watershed IDs as they appear in this technical report versus the original watershed IDs used in Kelly et al. (2021) . Watershed IDs were updated for this report in order to better reflect the geographical place names used in this area of the province.

| Land Use Atlas<br>watershed IDs | Kelly et al. (2021)<br>watershed IDs |
|---------------------------------|--------------------------------------|
| Vi_1                            | Ch_1                                 |
| Vi_2                            | Ch_2                                 |
| Vi_3                            | Ch_3                                 |
| Vi_4                            | Ch_4                                 |
| Ri_1                            | Gr_1                                 |
| Ri_2                            | Gr_2                                 |
| Ri_3                            | Gr_3                                 |
| Ca_1                            | Mi_1                                 |
| Ca_2                            | Mi_2                                 |
| Ca_3                            | Mi_3                                 |
| Ca_4                            | Mi_4                                 |
| Br_7                            | Mi_5                                 |
| Br_1                            | Hab_1                                |
| Br_2                            | Hab_2                                |
| Br_3                            | Hab_3                                |
| Br_4                            | Hab_4                                |
| Br_5                            | Hab_5                                |
| Br_6                            | Hab_6                                |
| Br_8                            | Hab_7                                |
| Br_9                            | Hab_8                                |
| Br_10                           | Hab_9                                |
| Br_11                           | Hab_10                               |