Farmers making sense out of a cartographic landscape

Like a patchwork of clothes, rather than just chunks of... parcels

by

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Author's declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Abstract

Planning maps are not only, as is often silently assumed by planners, neutral technical tools to assist them in their design and analytical tasks or to communicate their findings to others. In complex multi-stakeholder planning processes maps are also inherently coloured representations of knowledge, the outcomes a specific way of learning resulting from the activity of mapping itself, and discursive means through which norms and interests are promoted as objective truths.

This thesis research explored how members of a local stakeholder group representing farm business made sense out of, and judged the data quality of planning maps in a combined highway planning and environmental impact study in southern Ontario, executed by the province's Ministry of Transportation. More specifically it was concerned with how participants evaluated the cartographic representation issues of interest to them in the context of a mayor decision in the transportation study: the location of the highway route, in which both its existing route and new route sections through rural lands were options. The research instruments were a map review workshop and a questionnaire.

This research was theoretically underpinned by a framework that integrates three fields of knowledge: cartographic theory, planning theory, and theory on knowledge and sensemaking. The framework served as a sensitizing concept for the analysis and interpretation of the observations obtained from research participants. All three fields were explored with an emphasis on social constructivist understandings which facilitated the understanding of situations characterized by complexity and ambiguity where certain and objective knowledge becomes impossible and where the perspectives and interests of multiple stakeholders come to the foreground.

The spatial data on the study cartography in general was judged as correct. The big exception was the data on water-related phenomena. Here participants, although they were familiar with the area, had access to the reviewed cartography for more than two years, and were well aware of the importance of water-related issues in the decision-making process, only during the workshop became aware that the data, recently released by an official data source, were strongly outdated. The findings confirmed the usefulness for planning processes of the simple review procedure followed in the workshop.

The process of sensemaking by participants focussed strongly on two areas. First, the central issue of the group: the recognition of agriculture as strong and relevant business deserving recognition equal to urban businesses. Second, on an issue that was not part of the goals of the study, the identification

of needs for compensation, not only for loss of assets, but also for ongoing increases of operational costs. Participants, in contrast to the study's thematically organized overlay analysis which resulted in a fragmented determination of impacts based on readily available public information, emphasized the need to use the farm (business) as a functional whole against which to measure impacts, considering its overall operation and viability. In the workshop it became clear that determining impacts on a complex entity like a farm is equally complex, and hard to map in a comprehensive way. Using maps not for a comprehensive analysis but for learning by illustration or example, however, offers opportunities in these cases. In practice this would require a review of what is considered as legitimate knowledge in formal decision-making.

Participants attitudes towards (the representation of) nature showed to widely divergent, and attachment to place was virtually not touched upon. The emphasis on agribusiness seemed to stem not only from material interests, but was also strongly related to identity.

Participants judged that the study cartography reflected a strong urban bias. They found that agriculture was underrepresented compared to urban economic and ecological interests and sometimes also misrepresented. Numerous suggestions were made to include new layers of data in the cartography, and to visually emphasize already included data related to agriculture. Although some information was found as redundant, is was above all the lack of more detailed information on agriculture and agribusiness that participants emphasized as issues they would like to see corrected. Whereas some data on some issues where emphasized as missing altogether, in other cases, notably in drainage, participants emphasized missing complementary perspectives. Information suggested by participants to be included mostly served to emphasize the importance of the agricultural sector as a whole and to spare it from impacts, but would create both technical and political difficulties if it were to be used for the comparison between different route options through rural lands.

Different types of metaphors played an important role in the sensemaking process by the participants. Some participants followed more rational approaches to sensemaking that emphasized the correctness and information content of the data, while others seemed to be stronger ware of the strategic-discursive role of the maps. Many participants judged the study cartography as little explicit and highly ambiguous in many aspects, an observation for which a plausible explanation is the MTO's needs to make decisions not only based on technical evaluations, but also taking into account strong

informal political forces which required the study team to be able to review its positions if necessary and justify them largely based on the maps.

Based on the research some recommendations for better public map use are suggested in order to make better use of the potential of cartography in planning to facilitate learning and mediation between multiple perspectives and interest.

Future research, using anthropological methods, observing the process of creation and use of maps in planning in action is suggested as important to move beyond the limitations of perspectives that emphasize maps as representations.

Acknowledgements

The author of the present thesis that bears my name would be visualized more accurately as a rhizome or a mycelium than as a single person, but conventions are other and we respect them. This thesis is the outcome of the effort of all those persons that individually and collectively produced the works from which this present work has benefited. Some of these publications and their authors are acknowledged, not here in this section, but at the end, in the references section. Many others whose work greatly enriched my own thinking are not listed there, and like the authors on which the referenced works built, will remain anonymous here. To all these authors I extend my thanks.

At the University of Waterloo, first of all I want to extend my thanks to my supervisor Dr. Rob Feick, first of all for accepting me as a graduate student based on only a few one-page proposals, and having little more than the most basic understanding of GIS. Returning to the metaphor of the rhizomes, I am grateful not only for his sound academic advice on what finally became this thesis, his support in some rougher moments, but also for his down-to-earth observations that helped to keep my work on track, and counterbalance my tendencies to spread out in (too) many (although sometimes very interesting) directions.

My thanks also go to Dr. Pierre Filion, not only for his inspiring course in planning theory, but also for the enthusiasm he expressed for my initial ideas to deconstruct planning maps at a moment I thought nobody shared nor understood my interest to link these icons of rationalism and modernism with art and philosophy. I guess his francophone background pleads guilty here. The deconstructive project was never realized, but the injection of confidence to explore areas outside the purely rational and instrumental terrain was given, and many smaller deconstructive exercises were done outside the formal research process and substantially influenced this thesis.

I also want to extend my thanks to the staff of Mapping, Analysis, and Design (yes, MAD) and the Map Library that helped me out with cartographic and other material, and especially at the beginning, with my struggles with the GIS Software. My special thanks to Jonathan Morgan and Eva Dodsworth of the Map Library, and to Mary Burden and Scott MacFarlane of MAD.

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we worked together on some alternative mappings! For reasons of research ethics guidelines I cannot include names here, but you know who you are.

Finally, I want to thank Fabian and Lisa for their patience with a dad that was sometimes of their map, Maritza for compensating for this, my sister Joke for her emails and sense of humour under all circumstances, and Marc and Carmen Luz for friendships that survived considerable distance and time.

Dedication

For my parents, who gave life to me.

For my children, and those who will follow them.

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List of Abbreviations

ABC	Agriculture Business Communities (ABC) of Perth East, Perth South and Wilmot Wes
ANSI	Area of Natural and Scientific Interest
CLI	Canada Land Inventory
DFO	Fisheries and Oceans Canada
DIK	Data - Information - Knowledge
DIKW	Data - Information – Knowledge - Wisdom
EA	Environmental Assessment
GIS	Geographic Information Systems
GISc	Geographic Information Science
HW 7 & 8 Study / the Study	Highway 7 and 8 Transportation Corridor Planning and Class EA Study.
MNR / OMNR	Ontario Ministry of Natural Resources
MPP	Member of the Provincial Parliament
MTO	Ontario Ministry of Transportation
NHIC	Natural Heritage Information Centre (MNR)
OMAFRA	Ontario Ministry of Agriculture, Food and Rural Affairs
PGIS	Participatory Geographic Information Systems
PIC	Public Information Centre
PPGIS	Public Participation Geographic Information Systems
PPS	Provincial Policy Statement
SDI	Spatial data infrastructure
SRA	Shakespeare Residents Association
SWOOP	Southwestern Ontario Orthophotography Project

Science manipulates things and gives up living in them. Operating within its own realm, it makes its constructs of things; operating upon these indices or variables to effect whatever transformations are permitted by their definition, it comes face to face with the real world only at rare intervals. It is, and always has been, that admirably active, ingenious, and bold way of thinking whose fundamental bias is to treat everything as though it were an object-in-general—as though it meant nothing to us and yet was predestined for our ingenious schemes.

Maurice Merleau-Ponty, 1964

However, the ability of maps to interfere directly with the workings of the world can also be defended on theoretical grounds and in a context-independent manner. Maps, in this view, continued to perform magical functions after the explicit magical associations of maps faded away towards the end of the 17th century, as relationality is not only of historical, but also ontological significance. Thus, maps function as instruments of perception and thereby restructure human–environment relations. Indeed, it seems likely that maps worked against their own magical associations, which were originally a source of their authority, due to the 'objectifying' mode of representation that they made use of. Maps taught people to perceive the world as (if) composed of bounded and static entities with fixed properties, and thus made people relate to the world in a new manner. The magical power of maps, therefore, was not lost but hidden in the post-Renaissance world.

Vesa-Pekka Herva, 2010

"*And this is the map that got us organized."*

Workshop Participant, 2010

Chapter 1
Introduction

1.1 Overview

When spatial planning involves multiple stakeholder groups and implies tensions between different interests and perspectives, each group would like to see itself and the issues it considers important to be duly represented in the planning process, and moreover so in terms it considers correct and just. Although landscape, issues, and stakeholders generally are also represented in reports and in verbal discourse, cartographic representations play a special, and often a crucially important representative role in spatial planning. This special importance of maps is related to the double role they play. At the one side, maps have strong discursive and rhetoric qualities, and this is one of the reasons why they often play prominent roles in the public spaces of planning processes. Maps as a form of discourse are all about defining and communicating what a planning problem is fundamentally about, what issues and relationships have to be considered, and which ones can be - most often silently - left aside. At the same time, maps -and more generally GIS and geospatial technologies- are fundamental technical tools in understanding and addressing planning problems. It is largely with the help of, and through the eyes of cartography, that spatial planners construct, understand, and solve the problems they work with. 'Doing' cartography, or doing cartography in a particular way, hence is also a particular 'way of knowing', a practice that creates a particular kind of knowledge about an area, issues, and people. In spatial planning thus, what is and what is not on the map, and how things are on maps, exercises a fundamental influence on the outcomes of spatial planning exercises.

Because of this important influence of maps on planning outcomes, stakeholders have a big interest in that the issues of importance to them are well represented. Most planning maps, however, are made, and most representation is done by planning agencies. These, like any stakeholder, have their particular perspectives and interests. To address the frequent situation of uneven representation, under the labels of Public Participation GIS (PPGIS) and Participatory GIS (PGIS), a wide range of approaches have addressed the issue of putting 'ordinary people's' issues, literally, on the map. Some practitioners and researchers, often guided by the ideals of collaboration and consensus, have focussed on mainstreaming this method of participation into the planning process. Others, often focusing more on divergent interests and the role of power in planning, opted for counter-mapping, the production of maps that explicitly defy and offer alternative, non-official views on landscapes,

people, and issues. Both approaches, however, have done little explicit research on how planning maps are experienced and understood by 'ordinary' people who inhabit the mapped landscape. It is this issue that is addressed in this thesis.

1.2 Research gap

Since the 1980's new perspectives on maps, largely based on postmodern concepts, have emerged. The dominant idea of maps as ideally objective and truthful representations of a part of the earth was replaced by an understanding of maps and mapping as perspectival forms of knowledge, and as socially constructed discourse. Likewise, approaches using discourse analysis as their main method were used to understand planning and policy making from a multi-stakeholder perspective. Planning and maps thus became de-essentialized, and their role as inherently subjective and discursive representations was brought to the foreground. In planning, however, still little attention has been given to maps from this perspective, and the research that has addressed the issue has largely focused on planning maps of an openly perspectival, visionary and political character, most often related to large-scale spatial policy process. Virtually no research from a perspective of maps as selective and perspectival representations has been done on the enormous amount of 'technical' maps that are produced routinely in low-level, 'ordinary' planning processes. Consequently, little is known about how local stakeholders perceive the ´technical´ planning maps that are made of the areas they live and work in, and how they understand the way in which they themselves, their communities, and the issues of importance to them are represented on these maps. Moreover, cartographic and GIS-science research most often separated the 'subjective' issues of representation, perspectives, and interests from the 'objective' and 'technical' issue of data quality. However, with the growing role of spatial data infrastructures that greatly facilitate the use of 'off-the-shelf' data, not only the perspectives implied by all spatial data, but also their quality and currentness can be reasonably be expected to influence the landscape or territory that is 'represented on', or according to others, 'created by', the map.

This thesis, from an integrated perspective that considers both content-style of the map and data quality, by means of a case study, addresses the research gap of how local stakeholder groups make sense out of a series of 'technical' planning maps. Particularly, it looks at how they evaluate the way in which they themselves and the issues of importance to them are represented. The adopted sensemaking perspective is closely related to constructionist and perspectival ideas on knowledge,

and explicitly addresses how people create meaning and render intelligible a situation where knowledge is incomplete or uncertain, in order to orient their response to that situation. It is this focus on different perspectives and on uncertainty that makes the sensemaking approach especially suitable to understand complex multi-stakeholder planning issues and that motivated its use in this thesis.

1.3 Research objectives

The objectives of the present research are the following:

1. Develop, based on a literature review from planning theory, cartographic theory and theories on knowledge and sensemaking, a conceptual framework to aid the understanding of the production, use and interpretation of publicly used planning maps;
2. Apply the framework in a case study to explore the process of making sense out of planning maps by a stakeholder group living in a mapped space in a multi-stakeholder spatial planning process.
3. Derive some lessons for the production and use of publicly used planning maps that are conductive to transparent and participatory planning.

1.4 Thesis Overview

The thesis, in Chapter 2, after a short introduction on some practical issues faced in maps and map use in multi-stakeholder planning starts out with an overview of three relevant fields of literature: cartographic theory, planning theory, and knowledge and sensemaking theory, and a review of the different roles of maps and map use in multi-stakeholder planning. Based on the literature review, and integrating elements from the reviewed fields Chapter three presents a framework to understand the process of making sense out of planning maps. This framework takes into account the multiple functions map can play in complex multi-stakeholder planning processes, not only as representations of perspectival knowledge, but also as the outcome of the very process of mapping as a form of knowledge creation. Concerning the public use of planning framework emphasizes two contrasting but complementary roles: on one hand that of convincing the reader of the map of its knowledge and proposals, and on the other hand that of learning and mediating between the knowledges and interests of stakeholders. The role of the framework is that of a sensitizing concept in the analysis of the research outcomes. Chapter 4 provides the necessary background information on the case study used

for the research. After providing some general information on highway-related transportation studies in Ontario it reviews the immediate background and methods of the Highway 7 & 8 Study on which the research centers, and presents the Agricultural Business Community, the stakeholder group from which the research participants were drawn. The research design and the research methods, a map review workshop and a questionnaire are presented in Chapter 5. Chapter 6 discusses the results of the workshop and the survey, the conclusions of which and some derived recommendations for the production and use of public planning maps are presented in the Chapter 7.

Chapter 2
Literature Review

This chapter first reviews three fields of theory that together help to understand maps and map use in multi-stakeholder planning. It starts out with a review of aspects of cartographic theory, followed by elements of planning theory, and finishes with a review of aspects of the literature on knowledge and sensemaking. All three reviews discuss developments from realist and objectivist stances towards constructionist and performative epistemologies that took place during the last decades. After reviewing these three fields largely separately, the chapter discusses how they converge into a fruitful understanding of maps and map-use in multi-stakeholder planning. To situate the more theoretical sections, the chapter starts out with an overview of some important practical and political cartographic issues faced in multi-stakeholder planning.

2.1 Practical and political cartographic issues on cartography in multi-stakeholder planning

Maps are helpful and fundamental tools in spatial planning, and in most cases not only for planners' internal use, but also in the public parts of planning processes. They are used, for example, to communicate planning problems, to discuss them with and obtain feedback from stakeholders, to explain planners' arguments and reasoning, and to communicate and 'sell' understandings, arguments, conclusions and recommendations to the public and decision makers. Whereas maps from an instrumental point of view may be seen as rather straightforward technical tools, when issues become complex and a variety of stakeholders are involved, maps and mapping, also with increasing expectations of local stakeholders to be involved in decision-making, are often surrounded by much controversy (Carton and Thissen, 2009; Dühr, 2007).
By means of introduction, some of the most prominent issues surrounding the public use of maps in multi-stakeholder spatial planning will be briefly discussed.

Maps always and necessarily represent and create a perspective. Without such a perspective (or point of view) maps would be meaningless and useless. However, one perspective at the same time excludes its alternatives. Since the perspectives, interests and understandings of 'expert' planners that generally create the maps are often quite different from local stakeholders, that what planners may

consider an objective representation of a planning area and issues, is not necessarily experienced so by local stakeholders. Their 'correct' map might look slightly or even radically different. Different perspectives may not only concern how to address the problem, but may start much earlier with how the planning issue, the goals, and the planning area itself are understood. For example, whereas planners might be concerned with conserving the biodiversity in an area, local residents might be more concerned with their quality of life. Although both concerns are not necessarily mutually exclusive, they involve different issues and understandings, and … different maps. Since planning maps tend to be important in many areas such as problem formulation, design, analysis, deliberation, and decision-making, having (or not) ones perspective 'on the map' in a literal sense, easily implies the same in a figurative sense. Cartographic representations thus are important to local stakeholders.

The frequent lack of representation of local perspectives and interests (or local worlds) in official planning cartography would not be so much a limitation to more democratic planning if the capacities to perform GIS-based spatial analysis and to create and circulate maps were relatively evenly distributed among stakeholders. Although hardware and software cost now no longer are major obstacles (Elwood, 2006), unevenly distributed technical capacities, and time and other costs, make that local stakeholders and still face many obstacles to produce their own maps (Elwood, 2006; Sieber, 2006).This implies that when spatial perspectives of stakeholders are different from those of planners, they are generally less well represented in the planning process.

Although this is gradually changing (Elwood, 2008; Goodchild, 2007), most spatial data used in official planning are still created by government agencies, and thus reflect their needs and perspectives (Scott, 1998; Elwood, 2008; Sieber, 2004). While the state most often is concerned in the first place with generally applicable public policies, local stakeholders may be more interested in the particularities of their area and in private perspectives. Thus, while the needs, wishes, perspectives and interests of local stakeholders can be quite different from those of official bodies, their capacity to create the type of spatial data that can be used in GIS-based spatial analysis or in cartographic representations is generally much less than the capacity of the state to create spatial data (Elwood, 2006b).

States both for political and practical (e.g. technical and budgetary) reasons are mostly interested in relatively stable spatial data (Scott, 1998). This implies that dynamic and changing phenomena, or incipient trends perceived only clearly at the local level, are often not well represented in public spatial data (Elwood, 2006b; Elwood, 2006c).

Public access to official spatial data in many countries, also in Canada, has improved considerably trough the creation of central and local spatial data warehouses, through fast, easy and cheap data distribution over the Internet, and, importantly, through legal reforms. Although local groups now frequently make use of the opportunities this implies (Elwood, 2006b), technical capacities of lay persons and grassroots groups continue to be an obstacle to an equitable use of now publicly available spatial data (Sieber, 2006).

Only recently issues of spatial metadata (data about data) are receiving substantial attention. Many older datasets lack reliable metadata about very basic issues such as the standards and methods used in their creation, their technical quality, details about updating (Goodchild, 2003), and even if such metadata are available they are often hard to understand for non-expert users (Elwood, 2006b). Planning thus often works with spatial data whose strengths and limitations are often hard to judge, especially for lay people.

In planning the term 'spatial analysis' almost invariable refers to GIS-based spatial analysis. Likewise, the term 'spatial data' now almost invariably refers to standardized and abstracted data that can be manipulated using GIS. However, as e.g. emphasized by humanist geographers like (Tuan, 1977) and sociologists like (Lefebvre, 1991), much spatial information, experience, and knowledge related to everyday life, may be hard to capture in GIS. For example, there may be a data layer 'cemeteries', but a lived experience verbally expressed as "there is the grave of my mother and during the summer we like to bike there on Sundays" are generally not considered usable spatial data. The dominant language used in GIS suggest that there is only one type of spatial analysis and 'spatial knowing' and that all other forms of knowing must be 'translated' to that particular 'objective' mode. These translations can be seen as either a practical technical necessity, but also as an inherent power-laden bias that dominates mainstream GIS (cf. Scott, 1998 and the personalized and qualitative

geovisualizations of Kwan (2002 and 2004) and Pavlovskaya (2004), which offer other ways of geospatial learning).

Commonly used cartographic conventions are not necessarily always understood by lay persons (MacEachren, 2004). Also, nevertheless the constantly increasing precision of spatial measurements, and the now sometimes advanced analytic methods used in planning maps, just like paintings, novels and other complex representations, planning maps generate complex and often different meanings in different persons and groups. A planning map is thus not necessarily understood as intended by its creators (Dühr, 2007; Carton, 2007). Moreover, map's meanings are often multilayered (Wood and Fels, 1986; Wood & Fels, 2008), and although different readers may share meaning at one level, at other levels their meanings may strongly diverge. Thus, although very explicit and precise concerning location, maps are not necessarily reliable vehicles to communicate complex meanings (MacEachren, 2004; Motro, 2005). Planners or other stakeholders are not necessarily aware of this limitation, and thus can be locked in their own understanding of the map (Jackson, 2008; Carton, 2007). For these and other reasons, maps in planning often lead to misunderstandings and controversies (Carton and Thissen, 2009; Dühr, 2007).

Although discussed because they provide important background information, the immediate concern of this thesis is not so much with the uneven capacities of stakeholders to access spatial data, to perform GIS-based spatial analysis, or create cartographic representations, nor with how these issues can or should be remedied. These concerns are addressed in the fields of Participatory GIS (PGIS) and Public Participation GIS (PPGIS). Going at a somewhat slower pace, this research is concerned with planning maps as complex and meaningful representations, and how these representations are shaped by the data that are included and excluded and how they are displayed on maps. More specifically the research addresses how local stakeholders experience the way in which they themselves, 'their' area, and 'their' issues are represented (or not) in technical planning maps, and how they define the gap between their own and planners perspectives.

2.2 Approaches to maps and mapping

Understandings about maps and mapping have undergone substantial changes over time, and on continuation some fundamental understandings concerning the nature of cartography as they have

evolved post World War II are discussed. Although they cannot be separated from each other by neat lines, we will discuss them using four central ideas: *objective*, *cognitive*, *social constructionist*, and *post-representational* approaches. Together these provide us with different and complementary elements about how mapmakers make sense out of landscapes and issues, and about how map readers make sense out of maps.

2.2.1 Objective approaches

Although mapmaking can be traced back to ancient Babylon some 600 years BC, the 'cartographic revolution' that started around 1600 was particularly important in the evolution of maps as planning devices. In fact this ´revolution´, as Wood (1992) and Turnbull (2000) argue, was a long and often a local, haphazard, and discontinuous process which started much earlier. For example, Mercator´s famous map projection (1569), which greatly facilitated (commercial) navigation and the imperial overseas expansion of European nation states, was only one (however a very important) event in a long chain of interlinked theoretical, technological and social innovations in mapmaking and state building. As Turnbull (2000: 94) states, gradually "the state, science and cartography became so strongly intermeshed that in effect they coproduced one another." Notwithstanding these scientific innovations, mapmaking continued to be considered largely a craft and an art.

Starting at the mid 1950's, a view of cartography as a modern and objective techno-science became gradually dominant, and delegated understandings of cartography as a craft and an art to the background (MacEachren, 2004; Cartwright, 2009). This view is based on a realist and dualist Cartesian object-subject epistemology. It implies a clear separation between the object, that is, a world 'out there' that supposedly exists totally independent from its observer (the subject, the cartographer). Maps are seen as -although inherently imperfect- mirrors or representations of this objective and independent reality (Pickles, 2004) in the sense of a model or a theory (Turnbull, 2000), and the quality of maps is measured by their truthfulness and instrumental efficiency. Therefore, a clear distinction can be made between good maps which truthfully reflect the essence of reality, technically bad maps that unintentionally distort this reality, and finally propaganda maps that for ideological reasons intentionally distort reality in order to mislead the map reader (Pickles, 2004). Truth and ideology, and technology and politics, are clearly separated issues, with subjective ideologies distorting objective truths.

Maps were often perceived as designed for a specific purpose, to convey a clearly defined package of information, a specific message, or as aiming to induce in the map reader a desired understanding or a specific action. Cartographic theories and research paid little attention to the cognitive mechanisms that could provide insight in how maps, as often complex representations, function (MacEachren, 2004).

The objective approach to mapping is the one adapted in rational approaches to planning (section 2.3.1). Together they share an objectivist-realist epistemology and the closely related idea that science and politics can be clearly separated.

2.2.2 Cognitive approaches

Cognitive approaches to cartography emerged from a desire for a better understanding of how maps as mental representations work. They aimed at opening the black box theories of both map creation and map reading that dominated the objective approach. It was argued that most maps are complex, that they are often used in an explorative way, and that during map reading the map reader actively constructs new knowledge. In this process of making sense out of maps, pre-existing knowledge plays as big a role as the map itself (MacEachren, 2004). Cognitive approaches to cartography maintain the idea that maps are representations of reality, but in both the elaboration of the map and in its reading a cognitive process of sensemaking is at work (MacEachren and Brewer, 2004; MacEachren, 2004). The map here becomes a representation of our mental image or of our understanding of reality, and no longer is there a single best objective map that represents reality. Fundamental to this approach is, as argued by e.g. Lakoff (1987), that objects and their categorization are not objectively existing parts of reality. Instead, they are considered actively created cognitive constructs that help a subject to understand and interact with its environment. Cognitive approaches to cartography, although they may differ in their understandings on the fundamental nature of reality, thus adapt a constructionist epistemology.

A cognitive approach especially important to planning is geovisualization. Geovisualization emphasizes the importance of spatial patterns in making sense out of maps (Kraak, 2007; MacEachren, 2004) and focuses on the flexible creation, manipulation and visualization of spatial (and other) data in order to create or discover novel and useful spatial patterns, and on avoiding what in section 2.4.2 we will call ‘pattern entrainment’.

Different mechanisms of how GIS and cartography by 'describing' the world at the same time engage in what Goodman (1978) called 'worldmaking' are described for GIS by Bibby (2005). Goodman's worldmaking involves reorganizing existing worlds by first splitting them up into fragments and then regrouping and reorganizing the newly created objects into novel taxonomies. Among other mechanisms, this is done by deleting elements and filling in gaps, by emphasizing some elements and deemphasizing others, and finally by deforming entities and relationships. Essential here is the idea that a newly created world is always one out of many possible worlds that could have been created. In this way of thinking, each map that we create is one out of many possible ones.

Worldmaking is not only a personal, cognitive process, but also a collective, social process in which cultures, societies, sub-cultures, professions, etc. engage based on their collective values and experiences (Lakoff, 1987; Cronon, 1996; Schön and Rein, 1994). It is this latter collective aspect that is emphasized by the social constructionist approaches discussed below.

2.2.3 Social constructionist approaches

As part of wider debates beyond the scope of this thesis, different approaches to social constructionism take different stances concerning if that what is constructed are different realities or different understandings or representations of a single reality (Sismondo, 1996). The discussion presented here will follow the second line of thought and some elements of the first will be taken up in the next subsection.

Social constructionist approaches to cartography share many elements with cognitive approaches, but whereas the latter focuses principally on the 'private' cognitive processes of the individual, they emphasize that our understanding of what we call 'reality' is largely the outcome of social processes. Although a very influential one, positivist science is considered as but one, historically and spatially situated knowledge tradition among many others, and positivism's claims to universal and objective representations of reality - also through cartography- are denied (Pickles, 2004; Turnbull, 2000). Maps here are thus socially constructed and negotiated understandings or representations of 'reality', that often, by claiming to be objective mirrors of reality, confirm or promote a particular perspective on reality as *the* (unique, objective) reality.

Based on constructionist postmodern and post-structural ideas, in the late 1980's and early 1990's, a fundamental and strongly ideological critique on 'objective' cartography surged. Brian Harley (1989) and Denis Wood (Wood 1992; Wood and Fels, 1986) emphasized that maps are of a selective and

interested nature, and that they are part of wider ideological discourses. Disguised as objective truths they tried to impose their coloured and value-laden images of reality on (innocent) map readers. Most often, Wood and Harley emphasized, those images corresponded to the perspectives and interests of the state and the powerful groups that control both the state and most mapmaking (Pickles, 2004). However, in contrast to Harley, Wood (1992) emphasized that the 'power of maps' could also be harnessed to produce counter-hegemonic discourses, an idea that later, after Peluso (1995), became widely known as 'counter-mapping'. Maps here have an important discursive aspect, and form part of wider elitist and colonial discourses, and as both Wood and Harley argued, in cartographic discourse the absences or silences are as important as the presences. Maps thus above all were seen as ideological instruments that not only promoted or confirmed certain perspectives as 'reality', but that -intentionally or not, but always conveniently- also silenced other perspectives not conductive to the interests of their creators.

Contemporary social constructionist approaches offer broader and more nuanced views on how social representations of realities are constructed. They relate 'ideology' as much to shared cultural beliefs or mental models as to the explicit social, economical, and political stances that may divide societies (e.g. Van Dijk, 2009). Ideological critique on maps here is not a project of finding (political) fault, but of questioning and examining the many unexamined assumptions underlying the knowledges embedded in a map (Crampton, 2010). In one of their more recent works, 'The Natures of Maps', Wood and Fels (2008) exemplify these ideas trough showing how cartography constructs ideologically and socially different *natures* (in the sense of *essences*) of that what often is considered as that what is most remote from culture and ideology: *nature* (as opposed to the cultural or man-made, cf. Cronon, 1996).

Often related to social constructionist approaches is the 'power of maps' discourse. Maps here are attributed a strong rhetoric power which is supposed to rest on the great objectivity people tend to attribute to maps (Harley, 1989; Wood, 1992). Some authors relate this power to the special importance that is attributed to sight in modern epistemologies (e.g. Turnbull, 2000). Wood and Fels (2008) argue that through establishing a non-debatable relationship between an object and its location ('*there'*) at the same time the idea of that object as objectively existing ('this *is*') is transferred. Starting from basic, broadly accepted 'spatial facts' they call "postings" ('*this is there*'), trough nesting, gradually more complex and more ideological (understandings of) realities are constructed. In these the spatial nature of the assertions serve as a reality test of the assertions themselves: ''Why

would we put it there if it weren't so? Check it out if you want!''(2008:6). The map moreover, by referring to the pre-existing knowledge of the map reader and or other 'objective' sources of information surrounding the map, actively engages the map reader in what is experienced as an independent process of knowledge construction, which further reinforces the credibility of the map. However, Wood and Fels (2008) argue, this process of actively making sense out of a map is considerably, although not necessarily intentionally, steered. All maps, Wood et al. (Wood, Fels, and Krygier, 2010; Wood and Fels, 2008) declare, are systems of propositions and arguments.

2.2.4 Non-representational or performative approaches

Although both cognitive and social constructionist approaches question the epistemological underpinnings of objectivist map theories, their main focus remains on the map as a representation of reality, and most often the central object of study is the map as an artefact. The basic shift is one from an objectivist towards a subjectivist epistemology. Non-representational approaches go a step further and question the ontological security of maps as either objective or subjective representations of a supposedly independent and pre-existent reality. Instead they focus more on the practices of map making and map-use, the context in which these take place, and the resulting effects (Kitchin, 2010; Pickles, 2004). After e.g. Massey (2005; 2006), drawing on relational ontologies, cartographic and other spatial practices, as part of wider networks, constantly recreate spaces. Following e.g. Latour, (2005), Turnbull (2000) and Haraway (1988) the situated and power-laden nature of the institutional networks in which these process unfold are emphasized. Relational ontologies, in essence, state that 'objects', 'entities', 'things' or 'phenomena' have no substantial or independent existence, but are 'performed' into being trough practices that create and maintain relationships, and that the resulting objects or realities only continue to exist as long as the relationships that sustain them are in place (Castree, 2005; Massey, 2005). What generally is considered as the 'representation' of objects, is seen as a relational practice that helps to bring (or 'perform') these objects into being or sustain their existence. The object-subject, observer-observed dualities, and thus the idea of a cartographer observing and representing a world that exist independently of those processes fall away altogether. Alfred Korzybski's famous statement 'the map is not the territory' became seriously questioned (Kitchin, Perkins, and Dodge, 2009), or even was radically reversed (Baudrillard, 1994). Objects, both on maps and in the landscape, became less independent, fixed and stable, their meaning instead became seen as permanently (re-) created within constantly reconstituted webs of relations and

practices (Dodge, Kitchin, and Perkins, 2009; Kitchin, 2010). To understand maps, cartographic practices, and the effects they bring about, it has to be understood how technology, scientific methods and institutions, and cultural and political discourse mutually influence each other in the creation of space (Kitchin et al., 2009; Pickles, 2004).

Observing societal developments and building on relational ontologies, maps and geospatial technologies, Pickles (2004) argues, do not so much represent our world, but above all (re-)shape it. Map use and geospatial technologies, the argument goes, have become so pervasive in contemporary life that they profoundly shape our understanding of space, and exercise an enormous influence on its organization and administration. This influence now has reached such levels that a clear separation of the map from the 'real' space becomes untenable, and map and 'real' space almost fuse in what we could call a 'map-space'. The map hence precedes, inscribes, creates, and finally, in a sense, becomes the territory. The map however does not accomplish this effect just by itself, as if the power of maps was embedded in the map itself, but as part of wider institutionalized and / or socially assented practices (Wood and Fels, 2008; Pickles, 2004).

Several authors argue that not only humans as users of spatial techniques are actors in these processes. Drawing on ideas from Actor Network Theory (Latour, 1993; see also Latour, 2005), Pickles (2004) illustrates how maps (and geospatial technologies in general) are not just passive tools used by mapmakers, but instead themselves actors that almost autonomously exercise an influence on the cartographic process and on the thinking and acting of their human creators. Networks of artefacts, techniques, and institutions together provide the 'validity' of maps as representations of a 'real' world whose existence depends on these same networks. Maps, as Wood et al. (2010) put it "work", but they do so only as long as they (and the institutions and practices that produce and sustain them) receive social assent, based upon what he calls "reference authority". Therefore, reference to other networks and sources of authority (government, science, etc.) in e.g. the form of the technologies used, or logotypes and style elements (Wood and Fels, 1986), are important to make a map a 'real' -that is, a valid and authoritative- 'representation' of the world.

Rethinking maps in ontological terms also changes how map reading and the meaning of maps are understood. In each use of a map, depending on the particular context and the 'luggage' a map reader brings to the map reading process, the map (or more literally, the meaning created during map use) is newly created (Kitchin et al., 2009). Although Wood and Fels (2008) argue that this process can be

steered to a considerable amount, other authors like e.g. Del Casino and Hanna (2000; 2005), at the cost of the idea of maps as carriers of stable meanings, attribute much more autonomy to the map reader. At each reading the map has the potential to be become a new map, lead to the creation of different meanings and produce different effects. In social terms a particular reading of a map becomes more 'real' or authoritative when the networks that sustain that reading are wider, more powerful and more stable. Carton (2007) and Dühr (2007) provide examples how actors try to expand their network around maps in spatial planning to elevate their status as authoritative representations.

2.2.5 Content and style in cartography

"Obviously, subject is what is said, style is how. A little less obviously, that formula is full of faults." These are the opening words of Goodman's (1978:23) discussion of style that, although focusing on the arts, is very informative for cartography. Also in many cartographic texts, style, more commonly referred to as 'design', is seen as a supportive means to help communicate the map's content and to improve its aesthetical quality (e.g. Brewer (2005; 2008) and Slocum et al. (2005)). Goodman argues that although often there are different ways of saying almost the same thing, in many cases *how* things are said is a fundamental aspect of *what* is said. In the process of making sense out of a map, content and style can thus only partially be separated. Applying Goodman's insights to planning cartography in a multi-actor setting, where the connotative meanings derived from a map can be of equal or even greater importance than its efficiency to 'correctly' communicating denotative meanings, design or style are thus better seen as tightly integrated parts of the map image. An example of such an approach to understanding maps can be found in Dühr's (2007) framework of 'graphical structure' used in her comparative work on the visual language of planning cultures in different countries of the European Union.

Cartographic style or design also plays an important meta-communicative role. It tells us if we should consider a map as a playful invitation to e.g. explore a tourist area, as a sound and truthful scientific representation of reality, as a tentative spatial vision to be discussed, or as a set of authoritative rules we better adhere to if we want to avoid trouble. For this, as Wood and Fels (1986) argue, we should not only look at the map image itself, but also pay attention to for example institutional logotypes, the quality of the paper, other printed materials surrounding the map, the textual language used, font types, etc. In a later work Wood and Fels (2008) call these elements the *paramap*. This paramap, they

propose, consists of the *perimap* and the *epimap.* The perimap encompasses the non-spatial elements on the map sheet itself, e.g. titles, legends, north arrows, text boxes, institutional logos and font types, which can be seen as part of a map's style, while the *epimap* consist of the wider elements that surround the map (e.g. reports, articles, websites, workshops).

Out of the cognitive, social constructionist, and non-representational approaches to maps and mapping surges an image of maps as having two faces. The first one is that of the map as a representation, but no longer an objective representation of the landscape, but more one of a mental map that represents the private cognitive and (importantly, in planning as an social and institutional undertaking) the collective social knowledges and interests of its creators. The second face is that of maps as a form of discourse: maps are performative, they *work*, propose and promote certain perspectives and as such they exercise influence and bring (understandings of) issues, territories and worlds into being. But also maps themselves are 'worked' or 'performed' into being; they are the outcome of a process of map creation. To understand maps from this perspective, the focus no longer is on the map itself, but more on the networks, institutions and practices through which maps are created, circulated, and put to use. Let us say, that how the story is told, who tells it, and who play roles in it are fundamental ingredients that determine the credibility of the story's conclusions (the map itself) and its implications. Although most mapmakers, be they persons or organizations, like to consider themselves as the creators of maps, geospatial technologies and increasingly also widely available spatial datasets, both directly, and via their influence on the mapmaker also indirectly, take part in the creation of maps, also in planning (Jackson, 2008; Lejano, 2008). Importantly, like in other forms of communication, *how* maps say things is part of *what* they say.

2.3 Three basic approaches to planning

In this section we will briefly discuss three influential approaches to planning: the rational, the advocacy, and the deliberative or communicative model. Each approach, like the approaches to mapping we discussed, has its own understanding of what 'reality' is, and how we can understand it in order to plan. Depending on the assumptions of each model, different understandings of what maps are and what roles they can play in planning arise.

2.3.1 Rational planning

The 'rational' or 'rational comprehensive' planning model emerged after World War II based upon operations research largely developed to support war efforts (van de Riet, 2003) and is, despite its age and the substantive critique it received, arguably still the most influential planning paradigm. (Hostovsky, 2006; Hanna, 2005).

Fundamental characteristics and assumptions of the rational model are:

- A clear separation between on the one side goal setting and decision-making which correspond to value-based politics, and on the other side the design, analysis and comparison of alternative options which correspond to value-free, rational techno-science (Lindblom, 1959).
- A single authoritative decision maker that at the start of the planning process sets goals and criteria, and at its end, based on the technical recommendations of the planners, makes the final decisions (van de Riet, 2003).
- Experts with the knowledge and resources to objectively (rationally) identify and compare alternative solutions, implying planners' capability to reliably predict the consequences of the evaluated alternatives (van de Riet, 2003; Hanna, 2005).
- Comprehensiveness: all relevant variables that can affect or that are affected by the planning proposal are taken into account (Hostovsky, 2006; Lindblom, 1959).
- In some descriptions of the model (e.g. van de Riet, 2003), feedback loops are included, while other models suppose an entirely linear planning process.

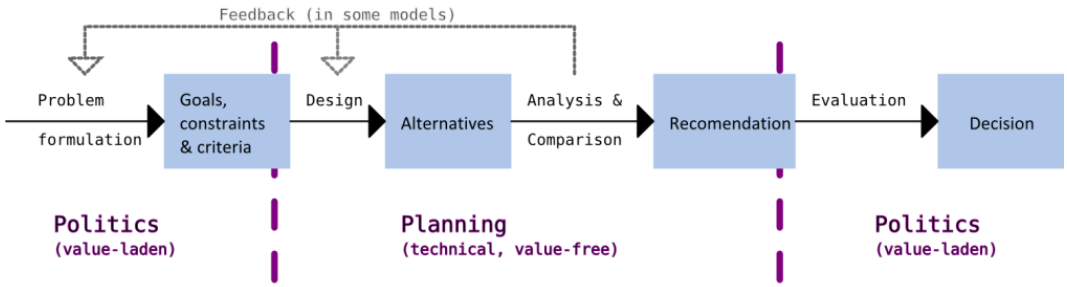

Figure 2-1: Model of a rational (comprehensive) planning process.

In the rational model (Figure 2-1) value-free planners thus first design and then evaluate and compare various solution alternatives, in order to recommend the most instrumental means to reach a predefined value-laden goal that was defined and finally is to be decided upon by politics (Lindblom, 1959).

The rational comprehensive model already in the late 1950's received substantive critique that questioned both its claims to *rationality* and to *comprehensiveness.* Charles Lindblom argued that it is impossible to separate goals and means, and that limits on information, resources, and human cognition make it impossible to be comprehensive. Instead, he argued for the gradual improvement of existing policies trough 'successive comparisons' or the 'science of muddling through' (Lindblom, 1959). A similar influential critique that emphasized the limits of human cognition was found in Herbert Simon's (1982) ideas on 'bounded rationality'.

In the rational comprehensive model, with its instrumental model of objective science, maps ideally are truthful and objective representations or models of reality, which by reducing scale and trough a certain simplification make this reality easier to understand and to manipulate.

2.3.2 Advocacy planning

Apart from the influential critiques of among others the well-established conservative academics Lindblom and Simon, the rational model and its implementation in the 1960's also became under growing pressure from citizen movements. Progressive activists questioned the close and interested relations between powerful actors in the worlds of planning, politics, bureaucracy, and business, and they demanded major levels of political influence on planning by citizens (Dear and Laws, 1986). In support of this demand for more democracy, planning theorist Paul Davidoff (1965) promoted 'advocacy planning'. Davidoff argued for the assignment of professional planners to different stakeholders groups. In this way he hoped to promote pluralism and reduce power imbalances. This radical critique prominently called attention to the issue of the uneven distribution of power in planning, questioned the value-neutrality of planners and the state, and the existence of an objective, single common good. Given the uncomfortable questions it raised, not surprisingly, advocacy planning has never become an influential model in official planning cultures. However, Davidoff's critique and his arguments for a pluralist and if necessary antagonistic planning style can still be clearly recognized in much contemporary thinking about planning.

Advocacy planning demonstrates much affinity with the 'power of maps' discourse. The powerful actors (typically 'the state') have the power to control and circulate interested maps, that are disguised as objective, technical representations. In advocacy planning, ideally, different stakeholders would have the opportunity to produce and circulate their own maps which would represent their perspectives on the issues at stake, in order to promote plurality and 'level the playing field'. These ideas are reflected in many approaches to participatory GIS (PGIS) (e.g. Ramsey, 2008 and 2009; S. Elwood, 2006a and 2006c; Kyem, 2004) including counter-mapping (Peluso, 1995).

2.3.3 Deliberative planning

In the late 1970's a more moderate critique that claimed to have overcome the split between 'liberal' ('rational') and radical ('political') views on planning was proposed and gradually started gaining momentum. Based on Habermas's social theories and Bessette's (Bessette, 1981 and 1994) writings on deliberative democracy the so-called collaborative, communicative, or deliberative turn in planning was born (Innes and Booher, 1999; Healey, 1996 and 1992; Forester, 1997). These three very closely related approaches (we will use the term 'deliberative' because this term reflects best how the 'split' is to be overcome) assume that if planning processes provide the appropriate conditions, different stakeholders by means of rational and open dialogue (deliberation) are able to collaborate and construct a consensus around an inclusive and jointly agreed upon common good. In deliberative planning knowledge no longer was considered to be the exclusive domain of the authoritative expert, but was to be generated jointly with other actors in a collaborative learning process that would lead to a new integrated knowledge, negotiated and constructed by stakeholders through dialogue and rational argument (Brand and Gaffikin, 2007).

The most fundamental critique on the deliberative model focuses on its alleged ingenuity concerning the (uneven) exercise of power, and on actors' common inclination towards strategic behaviour. According to Flyvbjerg (1998; Flyvbjerg and Richardson, 2002) the model's assumptions involve "leaps of faith", while Brand and Gaffikin (2007:306) speak of "the humble power of rationality when confronted with the rationale of power". Moreover, these authors argue, the emphasis in collaborative planning on the 'pragmatic' and the 'local' tends to underplay the larger political contexts in which particular planning process take place. Brand and Gaffikin (2007) also argue that the model's strong emphasis on consensus easily leads to superficial agreements that ignore areas of disagreement, and that these agreements consequently most often do not stand during

implementation. In contrast to advocacy planning, many planning regimes in liberal democracies have incorporated elements of the deliberative model in their planning discourse and/or practices.
Concerning the role of maps in planning, the deliberative models shows much affinity with the tenets of Public Participation GIS (PPGIS) and collaborative GIS (e.g. Balram & Dragicevic, 2006; see also (Balram, Dragicevic, and Feick, 2009 for an overview) and more recent ideas about spatial decision-support systems that seek to 'mainstream' more collaborative approaches to GIS in spatial planning (e.g. Nyerges and Jankowski, 2010). Also much technologically oriented work to create platforms that support communication, collaboration and deliberation between stakeholders (e.g. Rinner, 2006; Leahy et al., 2006) subscribe to many of the assumptions of deliberative planning, although these technological platforms may also be used to consolidate citizens views on planning issues (e.g. Hall et al., 2010).

Both advocacy planning and deliberative planning question two important assumptions of the rational comprehensive models: its value neutrality and the exclusive expertise of planners. Whereas advocacy planning emphasizes the often divergent or even fundamentally opposed interests of different actors, deliberative planning assumes that these differences can be overcome through rational collaborative dialogue. Both practicing planners and planning theorists maintain a persistent disagreement on in how far and under which conditions planning, through deliberation and collaboration, can result in 'win-win' as opposed to 'zero-sum' outcomes arrived at through 'gaming', and in how far deliberative practices can offset imbalances in power between different stakeholders. Concerning the use of cartography and GIS in planning, both approaches correspond broadly, although often no clear-cut distinction between approaches can be made, to collaborative and PPGIS on one side, and PGIS and critical GIS and cartography on the other.

2.3.4 Complex multi-stakeholder planning: uncertainty and ambiguity

As discussed, early critiques on the rational planning model questioned planners' ability to reliably predict the consequences of interventions and the model's assumed clear separation between goals and means. Based on more recent epistemological insights and complexity theory, more elaborate understandings on these issues, which also consider the changed expectations and practices concerning stakeholder participation, have evolved.

Citing Hischemöller (1993) and Van de Graaf and Hoppe (1996), Hommes et al. (2009) classify planning problems according to the available knowledge base and the level of agreement of the involved stakeholders on values and norms, for which they use the terms *uncertainty* and *ambiguity*, respectively. They relate *uncertainty* to the inherent *complexity* of many planning situations in which the multiple interactions and feedback loops between phenomena, their often non-linear behaviour, together with limited resources and expertise, often make reliable predictions impossible. *Ambiguity*, in turn, results from fuzzy objectives and the multiple goals and perspectives of different actors. Complexity thus has to do largely with limited capacities to make reliable predictions in problem solving, while ambiguity has to do with how the planning problem itself is defined in the first place (cf. Ramsey, 2009). From this perspective, planning problems are not objectively given, but instead socially constructed and dependent on stakeholders' perspectives, values, and interests. Similar arguments on the nature of social planning problems were already made much earlier by Rittel and Webber (1973) who coined the term "wicked" problems (Figure 2-2). Hommes et al. (2009) propose an approach where problem structuring and the creation of a better knowledge base - using both expert and lay knowledge - go hand in hand, while e.g. Ramsey (2009) advocates a separate phase of problem exploration before full-fledged instrumental efforts to solve the problem are initiated.

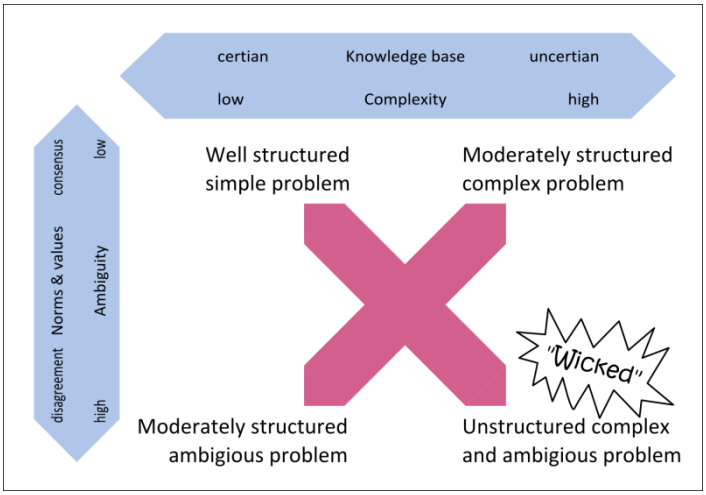

Figure 2-2: Classification of planning problems (Adapted from Hommes et al. (2009) and Rittel and Webber (1973)).

A further reaching approach to address complexity and ambiguity is that of 'social learning' and 'adaptive management' (Pahl-Wostl, 2004). This proposal goes beyond a project

approach, accepts that knowledge and predictions are inherently uncertain, and calls for consistent monitoring and follow-up. In this way, depending on the observed actual effects of the implemented planning measure, additional interventions to "stabilize desirable patterns and destabilize undesirable ones" (Kurtz and Snowden, 2003:466) can be made. Many or even most planning problems, especially the ones this thesis is concerned with, can be classified as relatively unstructured, complex and ambiguous.

2.4 Knowledges and sensemaking in planning

As was discussed in the previous section, when planning issues are complex and involve different stakeholder groups, different views on the landscape and the issues at stake inevitably arise. These different views often cannot be exclusively attributed to different 'objective' interests (or 'stakes'), but also involve different perspectives, knowledges or 'ways of knowing'. The term 'knowledges' thus is used here in its old English plural, recognizing explicitly the presence of different co-existing and complementary forms of knowledge that can be applied simultaneously to complex multi-stakeholder planning problems. This section will first briefly discuss two idealized ways of knowing which in planning practice are often associated with professional planners and subject matter experts, and local stakeholders, respectively. Based on these ideal types, a more nuanced, less dualistic perspective on how different knowledges of professional planners and local stakeholders can be understood, especially in relation to the spatial aspects that dominate maps, will be presented. This discussion is followed by a review on two closely related theories of knowledge and sensemaking that are particularly insightful to understanding to understanding these processes in multi-stakeholder planning contexts and that also are very informative to understanding spatial and cartographic data, information and knowledge in these contexts.

2.4.1 Expert, local and lay knowledge in spatial planning

The terms 'expert knowledge', 'lay knowledge', and 'local knowledge' are often defined in relation to each other. For reasons of space and accepting some loss of nuance, 'lay knowledge' will be discussed here under the label 'local knowledge', also because of the focus of this thesis is on spatial knowledge. Moreover, in planning practice both are often considered to be virtually similar, while at the same time fundamentally different from (universal) expert knowledge.

Raadgever and Mostert (2007) propose that expert knowledge is defined by its specialized and abstract nature, is often produced by formal scientific methods that aim at objectivity and reproducibility, and has a high social status that is often used to legitimate decisions. However, the authors argue, although expressed in terms of objective reasoning and as strictly fact-based, expert knowledge, and although having a reputation of objectivity, like all knowledge, is inevitably of a subjective nature. Klein (2009) argues that much export knowledge is largely tacit in nature, and that it often needs to be formalized and rationalized afterwards to make it conform to institutional and cultural standards before it can be communicated to decision makers and the public. Also, he argues, many experts gained their expertise largely through practical experience and these persons do not necessarily define themselves as experts, nor do they need to be socially or formally recognized as such. A differentiation between the nature(s) of expert knowledge(s), its social status, and the way it is expressed or communicated, thus seems to be in place. In terms of its usage, expert knowledge can be mobilized to rationally orient decisions through instrumental learning, to enlighten policy making trough conceptual learning, and -by discursively exploiting its high social status- to politically influence decisions (Hertin et al., 2009). Expert knowledge, when selectively and strategically mobilized, thus can be at odds with democratic values (Davoudi, 2006; Fisher, 2000; Haikio, 2007; Robbins, 2006).

The term 'local knowledge', when opposed to 'expert knowledge', implies that the latter is 'universal', while lay people's knowledge -its binary opposite- would be contingent and 'local' in nature (Turnbull, 2000). Just as in the case of expert knowledge, it makes sense to distinguish between, on the one hand, local and lay knowledge as distinctive knowledge types, and, on the other hand, their social status. The social status of local knowledge until a few decades ago was generally low, but a certain revaluation of especially local environmental knowledge has taken place. At the same time expert knowledge has lost part of its unquestioned high social status. In other words, a certain democratization of knowledges has taken place. Many scholars nowadays consider both local and scientific knowledge as contingent, situated, and socially constructed (Cidell, 2008; Latour, 1993; Turnbull, 2000). More nuanced images of local knowledge as embedded in often global networks, as based on a variety of information sources and experiences, as unevenly distributed and internally contested within communities, and as constantly evolving, have emerged (Nygren, 1999; Agrawal,

2003). Moreover, local stakeholders may well have non-vernacular expert knowledge on the issues that are at stake in a planning process (see e.g. Cidell, 2008).

How local knowledge is perceived, valued, and used by planners in Western democracies varies strongly. Van Herzele and van Woerkum (2008) distinguish between local knowledge as a *resource* that can be tapped and fed into the planning process at the discretion of planners, and local knowledge as a *situated process* in action (cf. section 2.4.2). In the view of 'local knowledge as a situated process', knowledge is produced in action and for planning this implies the need to engage 'local' stakeholders actively in analysis or design so that they actively can apply their knowledge (including its associated values, norms, perspectives) to the planning issue at hand. In the terminology of the International Association for Public Participation these uses of local knowledge would be termed 'consultation' and 'involvement' and/or 'collaboration' respectively (IAP, 2007). The latter two approaches imply that planners accept a certain loss of control over the planning process. Just like expert knowledge, also local knowledge can be discursively used to legitimate planning processes and its outcomes (Rydin and Pennington, 2000).

In complex planning exercises, many forms of formal and informal expert knowledge can be relevant. Especially when the issues are of a spatial nature, a substantial part of this expertise can be held, exclusively or not, by groups or individuals living in the planned area. What counts as relevant knowledge, however, largely depends on how a planning problem is understood, and on the interests that are considered as (il)legitimate and (un)important. Hence, local knowledge can be ignored, instrumentally used, or empowered, and its relationship to expert knowledge is always firmly embedded in a political context, and is always -openly or not- subject to negotiation (Kyem, 2004; Robbins, 2006; Ramsey, 2009).

The discussion of knowledges, so far, dismantled stereotyped views of local, lay, and expert knowledge, in the sense of well-defined and fundamentally different types of knowledge. It also emphasized their shared contingent and perspectival nature, and how they all can be politically mobilized, and are negotiated in planning.

The negation of a radical binary distinction between local (lay) knowledge and (universal) expert knowledge, however, by no means denies that experts in many cases hold formal, unique and useful

knowledge. Likewise, people who live or work in the planned area often have specific and place-related, social, ecological, and other knowledge. Since this latter knowledge is often largely based upon daily life practices and observations that are of no interest to the state's experts and administrative bodies, detailed or specific place-related knowledges, and related spatial data, are seldom part of the official bodies of knowledge (Tobias, 2009; Ramsey, 2009; Cidell, 2008). Scott (1998) goes a step further and argues that the modern(-ist) state has a fundamental interest in eliminating this more complex, messy, grounded and lived local knowledge, in order to create simplified, homogenized and thus more 'legible' landscapes that are more compatible with the state's administrative needs and procedures. As Scott illustrates with various examples, the modernist state based on this simplified knowledge then tries to bring its simplified representations into actual being and tries to stabilize them.

Despite that local and official expert knowledge often imply different perspectives and interests, there are also aspects of place-related knowledge (or often better, data) which are socially non-controversial, and which thus can be accepted by all stakeholders as 'objective facts'. A simple example would be a recently paved road which in official data bases still 'is' unpaved. Often much of this place-related data is exclusively held by local persons and can be of special importance when spatial data from secondary sources presents an uneven coverage or when, as due to government spending cuts is nowadays frequently observed, the updating of spatial information is suboptimal (Goodchild, 2007).

To conclude, care must be taken to stereotype either expert or local knowledge in terms of universality, epistemology, and homogeneity. Moreover, since knowledges in planning are often discursively mobilized, it is necessary to pay attention to their social and political implications. Concerning the spatial aspects of planning, it is important to recognize that people and groups that live and work in the planned area often manage both 'objective' spatial data and particular, perspectival spatial knowledges that are outside the scope or interests of outsiders and government agencies, and that this local knowledge can be unevenly distributed and partly contested between the members of a local community.

2.4.2 Knowledge and sensemaking in complex and ambiguous planning situations

This section first adopts a more theoretical approach to knowledge and sensemaking, and then looks at some of the implications of the adapted approach for multi-stakeholder planning and for maps and map use in these situations. It first presents Calahan's (2007) theory of knowledge and Klein et al.'s (2006) Data/Frame theory of sensemaking which both are particularly useful to understand how different stakeholders, transcending blunt concepts concerning conflicts of interests, arrive at different views on a particular landscape and the planning issues at stake, and thus contribute to the creation of what we called 'wicked problems'. Additionally, it discusses pattern matching, a cognitive mechanism that lies at the heart of both theories, that is also emphasized by cognitive approaches to cartography (section 2.2.2) and that is especially useful to understand the process of making sense out of maps.

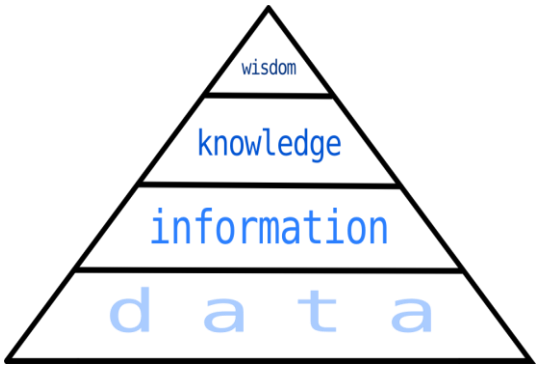

Figure 2-3: The DIKW hierarchy (Adapted from Hasan and Kazlauskas, 2009).

As an alternative to the commonly used DIKW-models that suppose that a large amount of 'raw' data (or observations of 'reality') is gradually structured and reduced in volume to first produce information, then knowledge, to finally culminate in wisdom (Figure 2-3), Calahan (2007, cited in Hasan and Kazlauskas, 2009) proposes an alternative process model in which knowledge is constantly (re-)created through a process of sensemaking (Figure 2-4). In contrast to the DIKW-models, Calahan proposes that data and information are not the raw and semi-raw materials out of which knowledge is distilled, but instead, that data is actively selected, and based on knowledge, is converted into information which then interacts with that knowledge. Calliono (2003, cited in Hasan and Kazlauskas, 2009) goes a step further concerning the nature of data and argues that knowledge

not only leads to the active selection of data, but that it also shapes the very search for data and information. This in turn implies that the data on a map can no longer be considered as raw and neutral pre-existing facts waiting to be discovered, but that these data is either actively selected out of existing data and/or that it is newly created based on pre-existing knowledge (including perspectives, beliefs, areas of interest, values, norms, procedures, available technology, etc.) of the creator of the map.

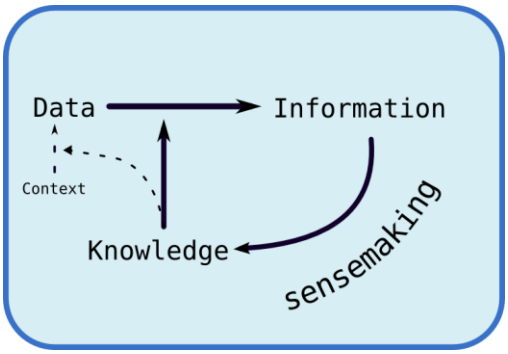

Figure 2-4: Calahan's model of the relationship between data, information and knowledge (Source: Calahan (2007) modified (dashed arrows) after Calliono (2003), both cited in Hasan and Kazlauskas (2009)).

Closely related to Calahan's model is Klein et al.'s (2006) Data/Frame Theory of Sensemaking which understands sensemaking as an ongoing process of pattern matching between data and frames (Figure 2-5). The model proposes that when people try to make sense out of complex situations in which they cannot rely on standard routines to arrive at answers that help to determine their course of action, they adopt some perspective or viewpoint which they call a *frame.* A frame serves as a mental model or a pattern and can be expressed among others in the form of stories, (mental) maps, and diagrams. Frames are used and modified in subsequent and parallel cycles of sensemaking. By providing structure, the frame not only defines what counts as data (acting thus as a filter), but actually shapes the data and brings them into being. The frame thus approximately occupies the role of what is termed *knowledge* in Calahan's model. Like Calahan's knowledge, frames here are not seen as immutable; instead, they serve more as a hypothesis that can be modified, expanded, or discarded.

Data and frame engage in a ongoing dynamic interaction. If the data does not fit in a particular frame, people will try to adapt the frame so that the data will fit in. Alternatively, they may discard the frame

altogether and look for a better one by trying out several new frames and evaluate how well the data fits in. New data can thus either be assimilated in the existing frame and give rise to its preservation or elaboration, or lead to the adaption of a new frame. Importantly, when more credibility is given to the frame than to troublesome data, the latter can be explained away or simply be silenced. As new data comes in, the process of sensemaking is constantly reiterated in alternating cycles of references to past events and forward looking projections.

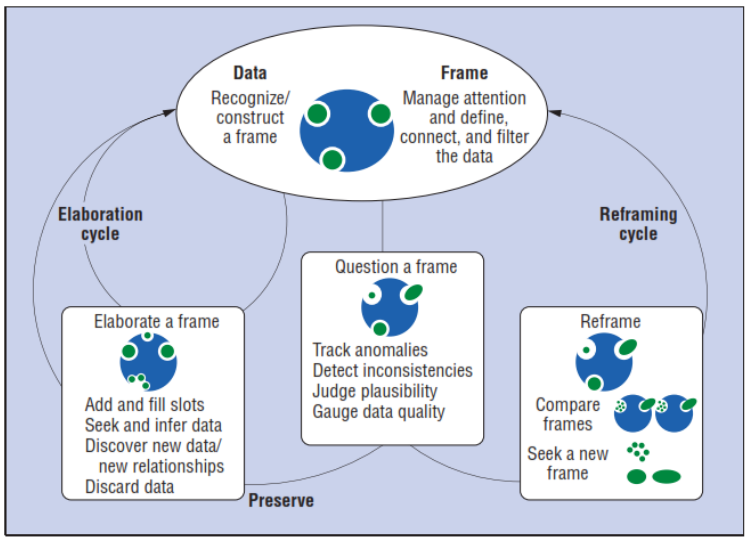

Figure 2-5: The Data/Frame Theory of sensemaking (Source: Klein et al., 2006).

Important for multi-stakeholder planning, the Data/Frame Theory of sensemaking allows us to understand how frames (or knowledges) run the risk of becoming entrenched by what Snowden (2005) calls 'pattern entrainment', that is, by the human tendency to 'discover' or assimilate only those data (or 'facts') that fit in pre-established and sometimes firmly entrenched patterns or frames. In the case of multi-stakeholder planning this may lead to 'intractable' or 'stubborn' conflicts (Schön and Rein, 1994; Shmueli, Elliott, and Kaufman, 2006; Shmueli, 2008). However, Klein (2009) argues, as long as we are open to reframing, the adoption of an initial frame has important advantages. Not only does the adopted frame provide the necessary guidance for efficient information gathering, it also offers a testing ground for both the data and the frame. Therefore, more and faster learning can take place, and skilled decision makers iterate quickly between attempts to confirm and challenge their frames.

Snowden (2005) much like Schön and Rein (1994) argues that widely divergent frames pose serious challenges to communication and joint knowledge creation. In planning, members of a particular stakeholder group do not only share a particular frame or way of knowing, they also share a closely related common language. This language, when used for communication with persons with very different frames, loses its much of its functionality. The frames or knowledges that different actors bring to the planning process are shaped by many factors, including professional background and education, lived experience, cultural values and norms, and the perceived goals and interests of the actors. Frames, however, do not only relate to the known, but also very importantly to uncertainty since frames are fundamental for the way in which we fill in the gaps caused by incomplete datasets or not well understood relationships (Schön and Rein, 1994; Hommes, 2008). They are thus of particular importance in complex planning situations where straightforward and reliable predictions of the outcomes of planning interventions are impossible.

Importantly, in planning not only the frames stakeholders hold about the issues at stake (*substance* or *issue* frames) are relevant, also the frames they hold about who they and other actors are (*identity* or *characterization* frames) and about power, fairness, etc. in the planning process (*process* frames) are of fundamental importance (Dewulf et al., 2009; Shmueli, 2008).

Finally, actors in multi-stakeholder planning often recur to the conscious discursive 'framing' of issues in order to influence the sensemaking process of other stakeholders, the public opinion, and decision makers (Hajer and Versteeg, 2005; Portugali and Alfasi, 2008; Schön and Rein, 1994). In this process data and plausible relationships that are convenient to a particular way of knowing and interests are actively selected, constructed, and/or emphasized, while inconvenient data and relationships can be consciously silenced, or discredited. However, since we often believe (and express) what is most convenient to our (perceived) interests, the line between the cognitive and discursive framing of issues is not always a clear one (Schön and Rein, 1994).

Frame analysis, frame reflection, and reframing supported by outside assistance, in order to help overcome protracted conflicts in multi-actor planning and policymaking, were first proposed by Schön and Rein (1994). Through denaturalizing the objectivity of knowledge claims and by uncovering their underlying norms, values, and assumptions, actors become more conscious about both their own and others' cognitive frames, while at the same time discursive frames become more

transparent. Frame reflection thus, Hajer and Versteeg (2005) argue, can improve the democratic quality of planning and policymaking. However, when the perceived –not only material- stakes are high, and the differences in frames are large, reframing can be hard or impossible to obtain (Shmueli, 2008).

Together, Calahan's and Klein et al.'s theories on knowledge and sensemaking provide us with a good working model to understand how different stakeholders with different knowledges or frames in complex situations select or create different data, organize them in different ways, arrive at different understandings or meanings, and finally arrive at different conclusions about what needs -and what needs not- to be done. Although not always clearly distinguishable from their cognitive aspects, frames can also be consciously, discursively created and deployed to influence the sensemaking process of others. Frame reflection, is a broad methodological proposal to assist parties in becoming more aware of their own and other's cognitive and discursive frames and to help create productive dialogues between different stakeholders with conflicting frames.

2.5 Maps and map use in complex multi-stakeholder planning

This section starts out with a discussion of the implications of the knowledge and sensemaking theories of the preceding section for maps and map use for multi-stakeholder planning processes that, like our case study, involve high levels of uncertainty and ambiguity. This is discussion followed by a review of the different roles that map play in multi-stakeholder planning. The last subsection discusses mechanisms of how cartographic language can be used to communicate meaning in spatial planning.

2.5.1 A sensemaking perspective on maps in multi-stakeholder planning

First of all, the adopted perspective on knowledge and sensemaking implies that the data visualized on planning maps are not simply raw or neutral observations, but instead facts that are actively selected and/or created, and dependent on the knowledge and areas of interests of the observer-creator. Equally, the relationships that are, implicitly or explicitly, established between the map data are related to pre-existing knowledge and perspectives.

However, the implications of abandoning the idea of data as raw and neutral facts go much further. First off all, the very activity of mapping (and GIS) is a particular 'way of knowing' (and of

communicating) about a landscape and a spatial problem. As its tends to favour the use and creation of certain types of data, the very activity of mapping serves as a frame in its own right. Mapping results in the creation of homogenized and standardized spatial data that fits in the available spatial data models, that can be manipulated with the analytical methods used, and that can be visualized using common cartographic conventions. Moreover, implicitly or explicitly, mapping and the related spatial analysis denote or suggest certain relationships between the entities on the maps. These relationships are generally based on spatial criteria like proximity, overlay, flows and network connectivity, and on the entities and categories deployed (sameness, difference and similarity). By privileging a particular 'way of knowing', mapping at the same time delegates other types of spatial knowledge to the background, or even excludes them altogether (Pickles, 2004; Jackson, 2008; Lejano, 2008; Ramsey, 2009; Soderstrom, 1996). For example, much of our personal experience, lived experienced 'on the ground', and the related often vague and subjective objects like e.g. a 'beautiful area' are hard to map (Miller, 2006). Likewise, trends and change, which are generally important in how we normally evaluate a situation, are often hard to map using the cartographic techniques most commonly used in planning and that privilege a static understandings of space. This does not mean that, using appropriate indicators, vague objects and spatial dynamics cannot be mapped (e.g. Raymond & Brown, 2006; Shipley and Feick, 2009; Hawthorne, Krygier, and Kwan, 2008), but they imply generally innovative, openly subjective, mixed methods. In short, we could say that most spatial planning cartography has a bias towards (dominant understandings of) objective and static, easily mappable information and knowledge.

Secondly, maps can be seen as a form of language. Language not only represents, but is always also performative (Austin, 1979), and profoundly shapes our views on the world (Hajer and Versteeg, 2005; Fairclough, 2003; Lakoff, 2004), and the way in which an issue is discursively 'framed' can influence decision-making in often predictable ways (Kahneman and Tversky, 1979). Maps thus not only describe an area or issue, but also are devices that influence the process of sensemaking of others. Because of their image of objectivity, many authors attribute strong rhetoric qualities to maps (see section and 2.2.4 and 2.2.5), and given their pervasive- also public- use in spatial planning maps may be expected to substantially influence decision-making processes. Controlling what *is* (and what is *not*) on the map, and *how* things are mapped thus exercises a certain control over the sensemaking process of others, including that of decision makers. This may happen often unconsciously, but the

'power of maps' can also be consciously harnessed in the form of deliberately designed cartographic rhetoric.

From a sensemaking perspective, maps thus are always the reflection of a certain knowledge (or perspective, with all the assumptions it implies), while the activity of mapping in itself acts like a frame (a perspectival, biased way of knowing). Maps also, be they intentionally deployed for this purpose or not, influence the sensemaking process of others.

2.5.2 The roles of maps in multi-stakeholder planning

Maps and map use in multi-stakeholder planning fulfill a wide range of functions. Carton (2007), based upon research on cartographic visualization and map use in deliberative spatial policy making in the Netherlands, proposes a distinction between three archetypical roles of maps. These roles correspond to three fundamentally different understandings of the basic functions of maps and map-use in the planning process: *design*, *analysis* and *negotiation* (Table 2-1). Two of these roles, design and analysis, clearly relate to elements of the rational planning model (Figure 2-1). The negotiation frame, on the other hand, refers to an element that is not part of that model: the pervasive and inevitable presence of norm and value-based politics in all phases and activities of the planning process. Carton provides a series of stereotypical characteristics of maps for each role (Table 2-1) aspects of which can be expressed simultaneously and in different degrees in a single map.

	Archetypical roles and characteristics of maps
	Analysis: "Map use as science"
Basic role / functionality	Clarify spatial (social / physical) facts and mechanisms Synthesize analytic results, providing accurate model information (detailed, precise and reliable) about spatial distributions
Values	Objective and valid information Valid according to model and cartographic heuristics Use of technology and preference for rigid, unambiguous definitions and specified information
Map characteristics	Specific, superfluous information Legend with clearly defined categories and sub-classes Sharp boundaries

	Archetypical roles and characteristics of maps
	Design: "Map use as art"
Basic role / functionality	Visualize and articulate imaginative spatial planning concepts Stimulate creativity in order to identify and elicit patterns in the landscape and impose (new) structure on space
Values	Broad, holistic information Visual impressions of artistic quality and coherent design Use of examples, associations, 'back talk', and imagination to create innovative ideas
Map characteristics	Abstract, metaphoric information Legends with conspicuous names with ambiguous interpretations Sketchy boundaries
	Negotiation: "Map use as politics"
Basic role / functionality	Put problems on the agenda, create a sense of urgency Persuade by mediation or advocacy and by using the map as an argument
Values	Comprehensible information Map information is sufficient and opportune for the occasion Strengthen arguments and map use according to pragmatic and strategic considerations
Map characteristics	Dedicated and selective information Few legend items –only those (to be) decided upon Boundaries and what is on or off the map according to a negotiation strategy

Table 2-1: Archetypical roles of map-use and their cartographic characteristics (Derived from Carton, 2007:299).

The roles that map plays in planning processes tend to vary between the different stages of these processes (Carton, 2007). Following the rational model (Figure 2-1), at the start of a planning process, although according to the model this formally should be done by politics, maps often play an important role in agenda setting by helping to delimit both geographically and conceptually the planning problem. Later in the process, maps may focus more on the presentation of different options (design), followed by maps that help to analyze and compare different options. Towards the end of the process maps may be used to communicate (or in political terms, 'sell') the evaluation outcomes and the proposed solution to the public and policymakers. As issues and actor constellations often change, in the course of a planning process a single map may play different roles and be given different meanings and interpretations (Carton, 2007; Dühr, 2007; see also section 2.2.4).

A potentially important role of maps that Carton (2007) recognizes and describes, but that is not clearly present in her final framework of archetypical roles and characteristics of maps is that of maps as mediators. Maps can play this role since they are excellent generators of conversation (Dühr, 2007; van Herzele and van Woerkum, 2008). Also, the notion of maps as 'boundary objects' (MacEachren, 2001; Chrisman, 1999) is helpful to understand this role. Chrisman describes boundary objects as:

> *mediat[ing] between different groups; they don't provide a common understanding or consensus between participants. They don't create a common language or a perfect translation. Instead, boundary objects serve a dual function: at the same time they serve to distinguish differences, they also supply common points of reference (1999:4).*

As boundary objects maps thus provide a common point of reference for stakeholders, but, if they are sufficiently ambiguous, at the same they leave the stakeholders freedom to either ignore differences or to explore and gradually adjust them. Maps, even if there are clear differences in interests and understanding between stakeholders, could be conductive to gradual approximation or help to create partial agreements between stakeholders in a non-confrontational style. This role of maps in planning however is little researched, and the work of Carton (Carton, 2007; Carton and Thissen, 2009) and Dühr (2007) seems to be just the first steps towards a better understanding of what type of maps or cartographic practices under what conditions can either deepen or help to overcome conflicts in planning. This mediation role of maps is clearly a political one, but instead of arguing or convincing it concerns probing, learning, adjustment of knowledges and positions, and mediation, however all this in ways much less explicit than those proposed by some deliberative tools and methods around maps. The characteristics of a map for this function would be almost opposite of those described by Carton for her 'negotiation' frame (Table 2-1).

Although rarely done explicitly, a potential role of maps closely related to the former one, is their use in a phase of problem exploration and negotiation before fully entering in problem solving (design and analysis) as proposed by Chapman (2008) and Ramsey (2008; 2009). Such a phase, building on the tenets of advocacy planning (section 2.3.2) would start out with the creation of multiple spatial representations based on the different perspectives of the involved stakeholders.

2.5.3 Cartographic language and the construction of meaning in multi-stakeholder planning

Maps are a combination of visual and textual language. In section 2.4.2 we already briefly touched upon how maps as a form of language both reflect and shape processes of sensemaking. From a language perspective, maps can be analyzed at different levels, ranging from very basic visual and textual elements, all the way up to the level of cultural myths. The latter approach is exemplified by Wood & Fels's (1986) famous deconstruction of the North Carolina highway map, while Bertin's (1967) visual variables and a series of visual (perceptual) gestalt principles (Faludi, 1996; Scheiter, Wiebe, and Holsanova, 2009) serve to understand the basic visual and perceptual aspects of map construction and reading.

Just as in textual language, there is no all-encompassing and widely accepted theory about how maps finally produce social meanings at different levels. The, for many controversial, work of Denis Wood, based on semiotics and cognitive linguistics (Wood and Fels, 1986; Wood et al., 2010; Wood and Fels, 2008), is an interesting, ongoing, and an influential attempt in this direction. Also, the translation between cartographic and textual language, -important for decision-making in spatial planning- is poorly understood (Aitken, 2009), and is complicated by the fact that cartographic language is largely based on visual and spatial patterns, while verbal or written language is sequential. Finally, the role of emotions in the process of making sense out of maps has been little researched (Aitken, 2009), notwithstanding the evidence that emotions play important and necessary roles in decision-making (Damasio, 2003).

At an intermediate level, a number of authors have referred to a number of *mechanisms* that are useful to understand the creation and transfer of meaning with planning maps:

- A wide range of *visual metaphors*. For example, visual contrast representing conceptual contrast; colour intensity representing the intensity or importance of a phenomenon; relative size of a point or thickness of a line representing the relative importance of a phenomenon; outstanding colours to emphasize important issues; clear, neat lines to suggest clear knowledge or neatly defined categories; fuzzy boundaries to reflect uncertainty or gradual transitions, and so on. (Rambaldi, 2005; Dühr, 2007; MacEachren, 2004; Bertin, 1967).
- The use of *culturally significant colours* (green for natural, red for danger, and so on) which can be part of cartographic conventions (Rambaldi, 2005).

- The use of *spatial metaphors* like e.g. green belts, copper belts, core and buffer zones (Carton, 2007; Dühr, 2007).
- The use of *metonymy***.** For example a map layer of protected bird species standing in for a wider 'concern for nature' (Wood and Fels, 2008).
- Selective (but not necessarily conscious) *inclusion or creation of certain objects*, facts, names, phenomena, *and the exclusion of others* from the map image and or the legend. (Harley, 1989; Dühr, 2007; Rambaldi, 2005; Wood et al., 2010; Scott, 1998).
- The way items in objects on the map legend are conceptually organized in *categories* (Ahlqvist et al., 2005; Schuurman, 2005)
- The *labels* (*names*) attached to map objects on the map and their *connotative meanings* (Ahlqvist et al., 2005; Schuurman, 2005; Wood and Fels, 1986)
- The use of *textual elements* on or attached to the map *which guide the map's reading or interpretation* (Wood and Fels, 2008).
- The presence and style of non-spatial graphic elements on the map sheets (e.g. logotypes, photos, north arrows, etc) Wood and Fels, 1986; Wood et al., 2010)

These mechanisms can be grouped in four basic categories

1. The presences and absences (or silences) of spatial objects.
2. The visual (re-)presentation of spatial objects.
3. The organization of spatial objects into categories and their labelling.
4. The use of a wide range of non spatial elements on the maps sheet, like e.g. logo types, guiding texts, font style.

Important to understand the creation of meaning in multi-stakeholder planning is the notion from cognitive and non-representational cartographic theories (sections 2.2.2 and 2.2.4) that maps do not have an 'inherent' meaning, but that the map reader during engagement with the map actively constructs meaning, combining information derived from the map with other sources of information and pre-existing knowledge (see also section 2.2.3). In a planning context, sensemaking out of maps takes place in the context of the wider planning process and (the perception by the map reader of) the particular state of that process at the time the reading of the map takes place.

Chapter 3
A Framework to Make Sense Out of Publicly Used Planning Maps

This chapter presents a conceptual framework to understand publicly used planning maps from a sensemaking perspective. It first proposes a general framework on the roles of maps in planning that serves as the basis for a framework for understanding the *public* use of planning maps, helpful to understand how stakeholders make sense out of these maps. The general framework builds on Carton's (2007) framework on the archetypical roles of maps, but expands on the political roles of maps. It proposes that politically, maps can be both used to argue or to convince, but also to support learning and to mediate between the interests and perspectives of different stakeholders. When maps are used publicly, however, the design and analysis roles of planning maps are relegated to the background and, although 'talking' about design and analysis, the communicative, discursive aspects of maps become their dominant aspects. Maps here become a mixture of proposed knowledge and discourse that must balance between convincing others (or eventually simply impose decisions) at the risk of creating conflict, and the need to arrive at socially acceptable solutions.

The framework does not aim to serve as a closed theory in which to forcefully fit observations of the sensemaking process by the research participants, nor as a theory to be confirmed or denied. Its function is more that of a 'sensitizing framework' (Patton, 2002) that provides guidance for observations and serves a starting point for thinking in the present explorative research. The framework hence makes explicit our initial assumptions about what planning maps are and how they function, and together with the notions about sensemaking and framing discussed in section 2.5.1, plays a supportive role in observation and interpretation of the research participants' sensemaking processes, but at the same leaves space for new insights.

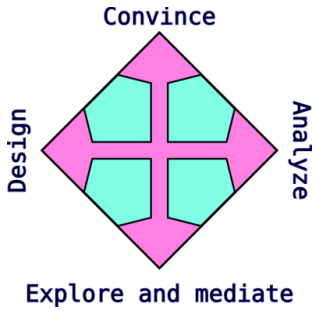

Figure 3-1: Conceptual framework roles of maps in planning.

3.1 Conceptual framework for the roles of maps in multi-stakeholder planning

This section first presents a conceptual framework intended to understand the roles or functions of maps in planning (Figure 3-1) which builds upon the work of Carton that distinguishes between the design, the analytic and the political roles of maps (Carton, 2007; Carton and Thissen, 2009) but expands on the political role of maps.

The fundamental argument is that a planning agency, as is argued by Faludi (1996), just as it must find a balance between design (clarity, synthesis possibilities) and analysis (comprehensiveness, restrictions), it also needs to find a balance between argumentation and mediation. At the one hand, in its roles of 'expert' and designer, it wants to convince others of its views and proposals, and on the other hand, in its role of a mediator and in the light of either the desire for inclusive solutions or the need to arrive at socially and politically acceptable compromises, it must mediate and balance between the different 'hard' interests and subjective perspectives, values, and norms of stakeholders. Where this balance lies will depend on the norms and values of the planning agency, the nature of the planning problem and the planning process, and on the distribution of power among stakeholders. This two-faced and somewhat ambiguous political role of maps results from the double and complicated role of many most planning agents who act both as an 'expert' and as a proposing and thus interested stakeholder in itself, and as a mediator or broker between the knowledges and interests of all involved stakeholders, including itself. Whereas the role of argumentation and convincing, as Carton (2007) argued, requires selective maps that forward clear arguments, the role of exploration and mediation -building on the concept of maps as boundary objects- would require more ambiguous maps that allow for different interpretations. Here stakeholders can learn from each other, and if required they can adjust positions without losing face, and without there being the need to frequently draw new maps that reflect revised positions. Maps here, although providing a common ground for communication, at the same time are chameleons that up to a certain degree can change colour as required. Importantly, also very selective argumentative political maps can serve as a form of learning by 'probing' the reactions of others, but their use involves a larger risk of provoking open confrontation and the need to draw new maps. The latter, when the planning process is formally technical, and the planning agent is in an expert role, implies a certain loss of face.

3.2 Conceptual framework for understanding publicly used maps in multi-stakeholder planning

Whereas design and analysis in planning generally are done 'in house' before they are presented publicly, we start from the notion that all publicly used maps (be they concerned with design, analysis, or something else), in the first place are part of a communicative process. As discussed in the preceding subsection, when a planning agency operates in situations where decision-making power to a certain degree is shared, this communicative process has an ambiguous character. It will both reflect the expert's desire to convince others, and the mediator's desire or need to balance and mediate between knowledges and interests, and thus must facilitate some form of negotiation and / or social learning. Convincing with public maps has two faces which are represented by the two lateral sides of the triangle of our model (Figure 3-2).

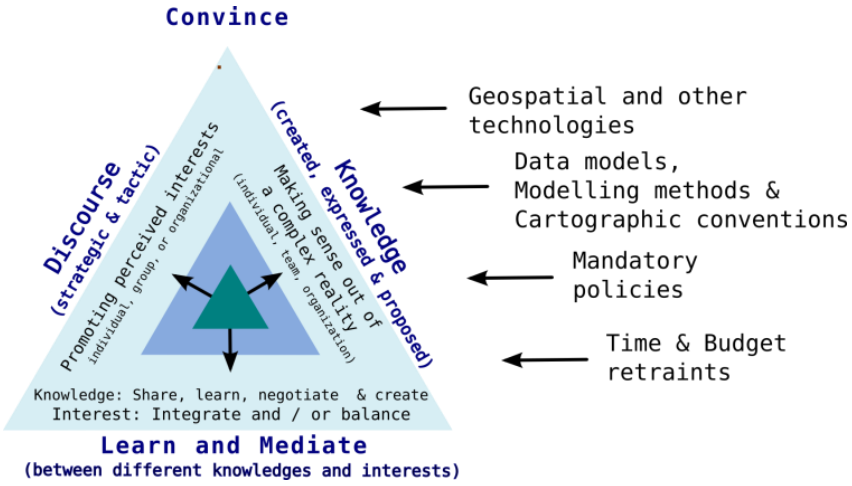

Figure 3-2: Conceptual framework of publicly used planning maps

At one side (the right) maps are both *a reflection or a representation of a certain knowledge*, and at the same time *the embodied outcome of certain way of knowing*, of a process of creating knowledge about a landscape and a planning issue. The latter implies a process of making sense out of an often complex and messy situation trough structuring and simplification, which involves the extensive use of maps and other spatial technologies and methods, and most often standardized spatial data. The map thus largely represents knowledge created through the process of mapping and other related

spatial technologies and methods. This knowledge always is tied up to certain perspectives, and thus can be contested.

However, maps do not only reflect the ways of knowing, understandings and viewpoints of the individuals or the team directly involved in their creation and the knowledge (culture, values, norms, methods, interests, expectations, etc.) of the organizations and institutions these teams operate in. The knowledge 'represented' on the map is also importantly shaped by factors that operate largely independent from is human creators. Geospatial and other technologies, data models, methods of spatial modeling and analysis, available data sets, and cartographic conventions are not simply tools used by the mapmaker, but exercise their own direct influence on the map. Although lacking intentionality, they have their own agency. They do this by shaping and limiting options that leave a direct imprint on the spatial analysis process and on the maps (Pickles, 2004), but also importantly by shaping the reasoning of planners and mapmakers and thereby the understanding of problems and potential solutions (Jackson, 2008; Lejano, 2008; Pickles, 2004; Ramsey, 2009). Tools, resources, and their human users, in a sense thus 'use' each other mutually. What many planners and mapmakers may believe to be the passive tools they use and control, actually substantially influence the process and the mapmaker-planner's ways of defining, solving and "representing" planning problems and solutions. Also, in many cases, important mandatory policies simply must be reflected on the map independent of the understandings of the mapmaker. Finally, restrictions in time and budget make that the mapmaker can never create its 'ideal' map. The knowledge on a map in our framework is thus the outcome of an interplay between on one side the individuals, teams, and organizations directly creating and 'standing behind' the map, a pre-existing knowledge partly reflected or represented by the map, knowledge that was constructed through the activity of spatial analysis and map making, and on the other side, factors we consider to operate independent of the mapmaker. A planning map thus should be seen as a complex representation and presentation of the knowledge or perspective of the mapmaker (normally a team) about the landscape and other factors that operate independently of the mapmakers.

Importantly, when used publicly, a planning map apart from a being *(re-)presentation* of a particular knowledge and way of knowing (be it concerning the nature of the planning problem, potential solutions, the outcomes of an analysis, etc.) in the first place is a proposition made to others. The map

is an invitation to accept the particular knowledge and way of knowing it embodies, together with its associated norms and values. The map wants, so to say, convince others of being both right and just.
Apart from embodying a particular way of knowing, maps can also be used by their creators to engage in cartographic discourse, in order to consciously influence others' perceptions. This aspect is represented by the left lateral of the triangle of Figure 3-2. By consciously engaging in cartographic discourse, using subtle or straightforward rhetoric, the creators of maps try to change the thinking of other stakeholders, rally support for their cause and perspectives, undermine the arguments of other stakeholders, and draw decision makers on their side. Like in all communicative games, discourse can be strategic and concerned with the structural and fundamental shaping of understandings of the planning problem and its potential solutions, but also involve contingent tactical elements. Obviously, the role of consciously created discourse is to convince.

In most cases a planning agency in western democracies plays both the role of the planning expert (and often also planning authority), but also that of a facilitator of social and technical learning, and that of a mediator or broker of interests, including importantly its own. This own interest in the outcome of the planning process does not need to be material, but for example may involve planners' professional status, the technical and moral credibility of the agency, the belief in 'doing things the right way', 'serving the common good', etc. In its expert role, a planning agency thus wants to convince others of its expertise knowledge, and in case of doubt of the efficacy of its arguments it can engage in consciously created cartographic discourse to underpin the validity of its knowledge and / or other interests.
However, in western democracies planners, in different degrees, by wish or by force, have to take into account the interests and knowledges of other stakeholders, and this involves both learning and mediation. Learning can be used to create new forms of knowledge that satisfy the needs of more stakeholders, or it can be used to work out compromises that trade off and balance different interests in politically and socially acceptable ways. These latter aspects are represented by the base of the triangle of Figure 3-2: Maps to facilitate learning and/or mediation. This role, and together that of 'convincing' make up what Carton (Carton, 2007; Carton and Thissen, 2009) calls 'negotiation', although she heavily emphasizes the aspect of convincing.

Depending on the institutional culture of the planning agency itself, the society it operates in, the character of the planning problem and the planning process, and the relative power of stakeholders the agency will assume more the role of an authoritative and interested expert planner, or more that of facilitator of learning and mediator of interests.

Chapter 4
The Highway 7 & 8 Study: Background and Overview

This chapter provides background information that establishes the context required for a meaningful interpretation of the research outcomes. After a review of elements of the wider context in which highway and transportation studies in Ontario take place, the immediate background of the "Highway 7 and 8 Transportation Corridor Planning and Class Environmental Assessment (EA) Study" (hereafter "the Highway 7 & 8 Study" or "the Study") is reviewed. This review is followed by an overview of the objectives and methods of the Study and its outreach and consultation process. The Agricultural Business Community (ABC), the group from which research participants were drawn, is introduced, and finally some aspects of map use in the Study are discussed.

4.1 Background on highway and transportation studies in Ontario

Transportation and especially highway and transit policies in Southern Ontario are a contested issue. Recent provincial policies, specifically the Provincial Policy Statement (Ontario, 2005) and the Growth Plan for the Greater Golden Horseshoe (Ontario, 2006) seek to reduce the pressures on agricultural lands, on rural areas, and on the local and global environment resulting from population and economic growth, and try to integrate transportation policies in a broader land use framework. These policies however leave ample room for different interpretations and especially outside the Greater Golden Horseshoe region (Figure 4-1) their implementation mechanisms are not fully developed (see e.g. Ontario Professional Planners Institute, 2010). Many groups, ranging from local cycling and transit advocacy groups to continental transportation coalitions, research, debate, and try to influence transportation and highway policies. The discourses of these groups are strongly divergent. Some groups frame the role of highways in a strictly economic context, emphasizing the central role of highways for Ontario's economic "health" and the need to improve the "flows" of goods and people on what is considered the "lifeblood of the economy" (e.g. Van Pelt and Kuykendall, 2005; Kuykendall, 2008). Other groups emphasize quality of life, and local and global environmental responsibility. These groups frame highways and the policy emphasis on car and truck transportation as the main modes of transportation as part of an inefficient and "addictive" transportation system that causes unnecessary urban sprawl and negative environmental impacts. They argue for a stronger transit orientation, more energy efficient modes of goods transportation,

and a stronger integration of land use, environmental, and transportation policies (e.g. Burda, Bailie and Haines, 2010). However, not only in the wider society, but also within the government of Ontario strongly divergent discourses on transportation and highways can be heard, and these discourses are remarkably similar to those of the civil society (e.g. Environmental Commissioner of Ontario, 2007; Ontario Minister of the Environment, 2006).

Despite the provincial government's efforts towards more integrated policies, outside metropolitan areas with more developed mechanisms for integrated land-use planning in place, highway development and planning remains largely a sectoral matter of the Ministries of Transportation and Infrastructure. MTO's most important planning instruments for southern Ontario is its Southern Highways Program, an annually updated five-year investment plan of a strong programmatic nature (e.g. Ontario, 2007b). Environmental assessments are carried out on a project-to-project basis and, appealing to more recent thought on strategic environmental assessment (e.g. Hanna, 2005; Noble, 2006), these assessments have been questioned for their limited scope, and for ignoring the cumulative impacts of "the incremental components of large projects" (Burda, 2008).

4.2 Location and immediate context of the study

The area of the (at the moment of this writing still ongoing) Highway 7 & 8 Study is located in south-western Ontario (Figure 4-1, Figure 4-2). The involved municipal jurisdictions are the Township of Wilmot (major population centre: New Hamburg), the single-tier municipality of the City of Stratford; and the rural townships of Perth South, and Pert East. The area corresponding to the Township of Wilmot (part of the Region of Waterloo) forms part of the strongly urbanized Greater Golden Horseshoe region, and is subject to the regulations of this region's Growth Plan (Ontario, 2006). While the three larger urban cores of the Region of Waterloo constitute a strong and dynamic economic centre that is driven largely by its two universities and a strong high-tech and knowledge sector, the much smaller and slow-growing city of Stratford was a more traditional industrial city that is looking to strengthen and diversify its economic base, among others trough a cultural and hospitality industry. Wilmot Township's urban cores, New Hamburg and Baden, are largely commuter communities oriented towards the Tri-cities of Waterloo Region (Kitchener, Waterloo and Cambridge), but the major land area of the township has a rural and agricultural character. The

townships of Perth East and West have no major population centres and are of a strong rural character, while their population between 2001 and 2006 slightly decreased (Table 4-1).

Figure 4-1: Location of the Highway 7 &8 Study area in southern Ontario.

Census area	Population 2001	Population 2006	Change 2001-2006 (%)
Cities of Kitchener, Waterloo and Cambridge	387,314	442,543	9.1
Wilmot Township	14,866	17,097	15.0
City of Stratford	29,780	30,461	2.3
Townships of Perth East and South	16,418	16,173	-1.5
Ontario (Province)	11,410,046	12,160,282	6.6

Table 4-1: Demographic indicators of study area (Source: Statistics Canada Community Profiles).

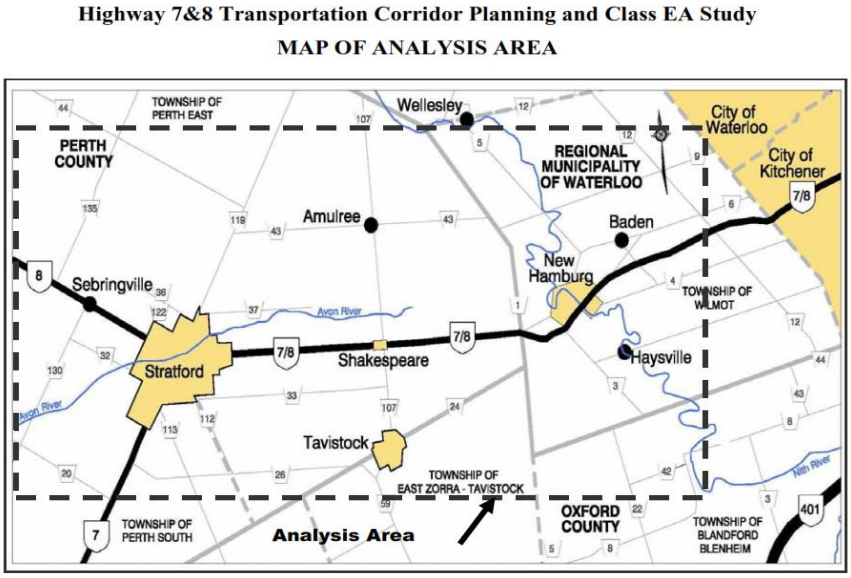

Figure 4-2: Map of Study Area used by Highway 7 & 8 Study (Source: Ontario, 2007a).

The Highway 7 & 8 Study was initiated in 2007 by the Ontario Ministry of Transportation (MTO) to address the section of Highway 7 & 8 located between the town of New Hamburg and the city of Stratford (distanced approximately 24 km) and the connections from Stratford to the southwest (Highway 7 heading to London) and to the northwest (Highway 8, heading to the port of Goderich) (Figure 4-1 and Figure 4-2). Highway 7 & 8 from the City of Kitchener up to approximately 4 kilometres west of New Hamburg has four lanes and from there on continues as a two-lane highway towards Stratford, traversing the hamlet of Shakespeare. The Study builds on several earlier studies by the MTO in the area, the last one in 2005. The undertaking situates itself strategically in the policy documents listed in Table 4-2. Specific and current integrated transportation and land-use strategies to implement the more recent policies of the 2005 Provincial Policy Statement are not in place for the area.

Although the Study's objectives briefly refer to connections with other regions, as is also reflected in Figure 4-2, it is predominantly presented as a 'stand-alone' project of a local character. However, three similar highway planning studies -approved and in progress- directly connect with the HW 7 & 8 Study and together, if all approved, they would create a four and more lanes highway connection between the northern Greater Toronto Area and Stratford (Figure 4-1). In the Draft Strategic

Transportation Directions for South-Western Ontario (Ontario, 2002), to which the study refers, the study area is part of larger ‘commutershed’ (

Figure 4-3). However, these undertakings and plans, which would place the Study in a broader context, are not addressed in the study reports, nor are they reflected in its cartography.

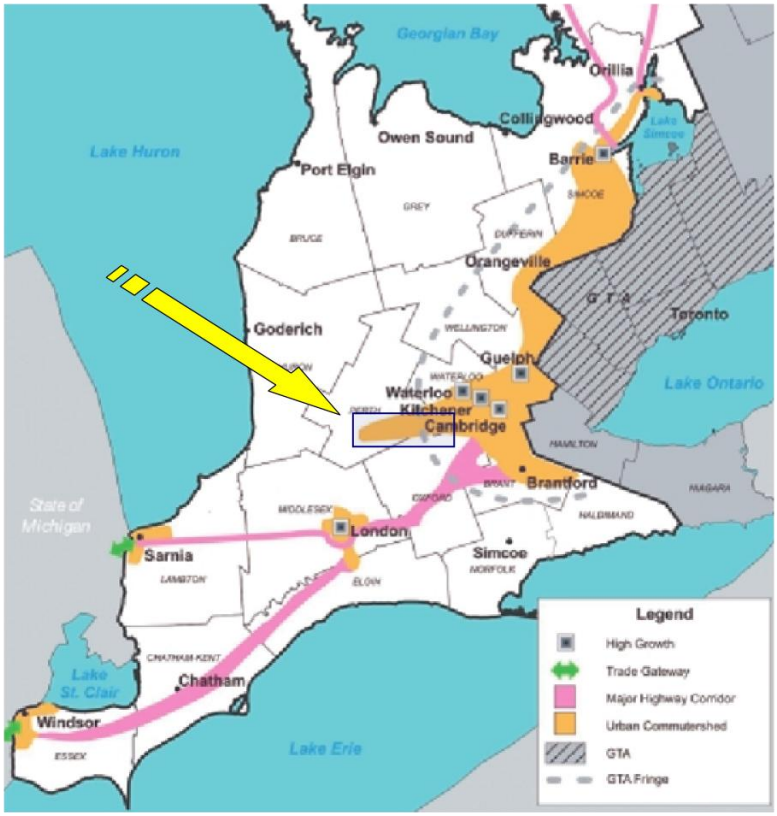

Figure 4-3: "Urban Centres and Commutersheds" (Source: Ontario, 2002; approximate Outline of Study Area, blue rectangle, added).

Policy documents and strategies
The Provincial Policy Statement, PPS (Ontario, 2005). The global land use planning and development policy for Ontario. This policy document among others promotes more compact urbanization and better integration of land use and transportation policies.
The Growth Plan for the Greater Golden Horseshoe (Ontario, 2006). A plan to implement the PPS in the Greater Golden Horseshoe region (Ontario's most urbanized area with the Greater Toronto Area at its centre, and of which a small area in the eastern part of the study area forms part).
The Draft Strategic Transportation Directions for South-Western Ontario (Ontario, 2002). An older (draft!) transportation strategy, elaborated before the 2005 Provincial Policy Statement introduced substantial changes in the province's transportation and urbanization policies. Situates the study area as part of a larger "commutershed" surrounding the Greater Toronto Area (GTA) (see **¡Error! No se encuentra el origen de la referencia.**).
The Southern Highways Program (Ontario, 2007b). A strong programmatic document listing major maintenance, upgrading, and new construction projects and studies. This 'living' document has a 5 year horizon, but is updated annually.

Table 4-2: Main policy documents and strategies referred to in the Study Plan (Ontario, 2007a).

4.3 Objectives and methods of the Highway 7 & 8 Study

The Study is oriented by a preliminary list of broadly formulated transportation problems and opportunities (Table 4-3) that, slightly modified, are also reflected in a problem map that was presented after the formal assessment of preliminary list of problems (Figure 4-4).

Transportation problems
▪ Capacity concerns in the 4-lane section in New Hamburg area and the 2-lane section between New Hamburg and Stratford.
▪ Concerns of through traffic through Shakespeare and Stratford.
▪ Concerns regarding connections with other transportation corridors.
▪ Concerns regarding road geometry and safety.
▪ Lack of highway access management to address highway protection and highway related urban growth.
▪ Integration of transportation and land use planning.

Table 4-3: Identified transportation problems (Source: Ontario, 2007a).

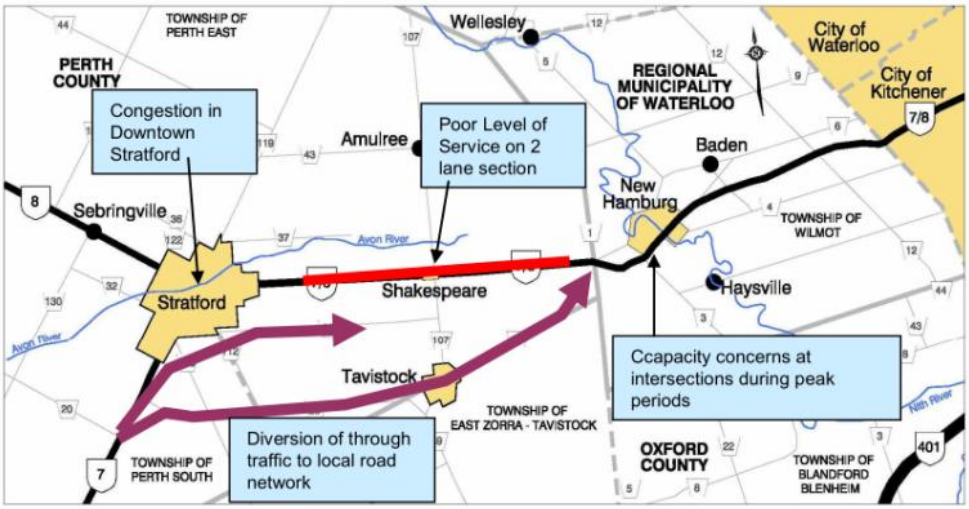

Figure 4-4: Map of "Existing transportation issues" (Source: Ontario, 2008a).

Based on the initial list of transportation problems and opportunities, the Study Team elaborated a list of broadly formulated objectives (Table 4-4).

Study objectives
1. To identify and assess the factors that are driving 'Area Transportation System' needs;
2. To apply those driving factors in preparing a Transportation Development Strategy to address long-term multi-year needs for the movement of people and goods;
3. To undertake the planning and preliminary design of the provincial roadway components (provincial highways and provincial transitways) of those strategies;
4. To conduct the planning and preliminary design of provincial roadways with an inherent approach of avoiding or minimizing overall environmental impacts;
5. To identify highway access management measures for growth management and highway protection;
6. To engage public and stakeholders early in the study process and continue to engage them throughout the study process.

Table 4-4: Objectives of the HW 7 & 8 Study (Source: Ontario, 2007a).

The study thus aims to assess the transportation needs and problems of the area from a provincial perspective, and elaborate a corresponding transportation strategy with a focus on interurban and interregional transportation, which is a provincial responsibility. Although the Study formally considered a wide range of transportation modes, including rail and transit, it clearly demonstrated a

pre-defined focus on the highway system. This focus was not only reflected in the Study's name, but also in the predefined goal to deliver a preliminary design of the provincial (highway or transit) roadway components of the transportation strategy to be elaborated. A Class Environmental Assessment (EA), a "streamlined" assessment for "projects that are carried out routinely and have predictable environmental effects that can be readily managed" and that therefore do not need a formal review by the Ministry of Environment under the Environmental Assessment Act (Ministry of Environment, 2010) is part of the Study, and seeks to minimize the environmental impacts of the undertaking.

One fundamental option to augment the capacity of the highway consisted in a widening of the two-lane sections to four (and in some areas to five) lanes, which could be accompanied by access control measures. This option in New Hamburg raised concerns for its potential impacts on the access to the town centre and to the residential and business sectors areas located along the existing highway. In the case of the hamlet of Shakespeare there were concerns regarding potential social and economical disruption of the hamlet. Shakespeare is a small, elongated community north and south of the existing highway with many roadside retail businesses. The other fundamental option, the construction of new route sections trough the rural area, raised concerns regarding the uptake of agricultural land, the impact on agricultural business, ecological impact, and its high costs. In the case of Shakespeare, this option raised concerns of loosing most of the trough traffic on which most of the hamlet's retail sector depends.

Briefly stated, the study first had to further clarify a rather broadly defined transportation problem, find a solution to that problem, and carry out an environmental impact study. Following the logic of the rational planning paradigm, the further refinement of the study problem, and the orientation of potential solutions (in the midst of societal debates; section 4.1) were considered technical decisions. However, as illustrated earlier, the study faced a series of fundamental trade-offs unable to be resolved through a purely rational-instrumental approach.

The Study method was based on a series of stepwise refinements. The Study started out with the elaboration of a broad transportation strategy that was gradually to be refined and that must finally arrive at a fairly detailed preliminary road design that is to be accompanied by a set of measures to

limit and mitigate environmental impacts. A schematic overview of this process of gradual refinement is presented in Figure 4-5. Following the rational planning paradigm (Figure 2-1), in each step a set of alternatives were designed, which were then compared based on a set of criteria. Finally, the best solution was chosen, and carried over to the next step. Each step included criteria related to transportation (capacity, safety, engineering standards, etc.) and to environmental impacts. The term 'environmental' was broadly defined, and included the natural, the socio-economic, and the cultural environment (Ontario, 2007a).

Although the Study Plan once briefly mentioned possible conflicts of interests between stakeholders, as its title "Report A: Study Plan for Technical Work, Outreach and Consultation" (Ontario, 2007a) suggests, the study was essentially presented as a technical exercise. The Study's formal instrumental and technical orientation was also reflected in its formal-analytical language. At the onset of the Study a total of 64 criteria, grouped into 30 subfactors were identified. The factors were organized into five factor groups: Natural Environment, Land Use / Socio-Economic, Cultural Environment, Area Economy and Transportation. More details on the factors are provided in Appendix D. In the course of the process, from 2007 to 2011, some additional criteria were added based on stakeholder consultation.

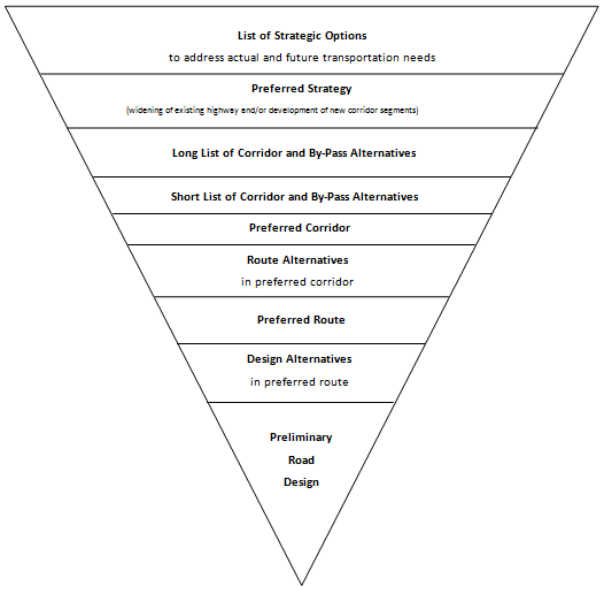

Figure 4-5: Overview of the different steps of the study methodology (Derived from Ontario, 2007a).

In the first two steps (Figure 4-5) different 'strategic' options were created and evaluated. Out of a set of options - e.g. do nothing, improve passenger rail service, improve freight rail service, traffic demand management, expand capacity of provincial highways- a set of stand-alone and combined alternatives to address the stated transportation problems were elaborated (Ontario, 2008b). The strategic option that was finally selected was to increase the capacity of the provincial highways, either through upgrading the existing route or through the construction of one or more new highway sections through rural lands (see Figure 4-8 and Appendix C). In the following three steps, out of an initial long list of corridor sections, via a short list, a 'preferred corridor' (which simply stated is an approximate route) was arrived upon. In the latter stages, the exact location of the route in the somewhat broader corridor was to be decided upon, followed by more detailed planning and design of issues such as intersections. Finally, in a preliminary way, engineering issues, such as the design of stream crossings, are to be addressed. As will be discussed later, due to the reactions of stakeholders, the process of corridor selection in practice was 'messier' than the idealized process presented here. In the course of the study process several disputes over the Study's formal rational-instrumental approach arose. Firstly, publications in the local press made it clear that the decisions on the overall transportation strategy and the scope of highway construction (e.g. upgrading vs. new routes) were not considered by all as technical-instrumental decisions to be taken solely by the Study Team. Public discussion and political lobby around this issue continued throughout the course of the study process. Secondly, as will be discussed later, in some cases that what the Study Team considered as 'details' to be addressed in the latter phases, for other actors were major issues to be considered already in earlier phases of the Study. Following Lindblom's critique on the rational planning model (section 2.3.1), goals and means, in practice, seemed not as clearly separable as in theory.

The *reasoned argument (or trade-off) evaluation method* was the primary tool used by the Study Team to evaluate and compare among corridor alternatives. According to the Study Plan, this method "will provide a clear presentation to stakeholders of the key trade-offs between the various evaluation factors and the reasons why one alternative is preferred over another" (Ontario, 2007a:41). The reasoned argument method is a qualitative method and involves many value-judgements, importantly also in determining in the first place which trade-offs count as *'key'* trade-offs'. For example, land adjacent to the railway that runs parallel to the existing highway (Figure 4-9) was repeatedly qualified by the Study Team as "previously disturbed land" and used as an argument for reduced impact on

agriculture (e.g. Ontario, 2009a:Appendix A). Both the qualification of being "disturbed" and the derived arguments were contested by farmers, which argued that these lands were of equal value to agriculture than other lands. Likewise, in the screening results which led initially to the recommendation of widening of the existing highway through Shakespeare, mention was made of "removal of some existing development" in the hamlet. In the final rationale this issue was not mentioned. However, later this turned out to be the key issue that gave rise to the review of the recommended route.

The *arithmetic* (*weighting-scoring) method*, essentially a weighted multi-criteria evaluation, was indicated as a secondary tool to validate and apply a sensitivity analysis to the conclusions arrived at by the former method. In this method the degree of impact (*score*) is multiplied by its assigned importance (*weight*), and although "Weighting scenarios can be developed in consultation with the public, regulatory agencies, First Nations and municipalities" (Ontario, 2007a:41) the weighting factors were finally assigned by the Study Team.

Given the large amount of criteria, their application in different phases of the Study, their often general formulation that allowed for different interpretations, the implied trade-offs between different goals and underlying values, and the large amount of potential feedback loops between factors, the Study obviously dealt with a complex problem. Moreover, a substantial number of stakeholders, local and non-local, private and institutional, with different values and perceived interests were and are involved in the Study (Figure 4-6). Together these conditions make it obvious that the Study deals with what in section 2.3.4 we called an 'unstructured, complex, and ambiguous' or a 'wicked' problem.

For example, the criteria considered to compare between and decide on route alternatives were not the same during the different phases of the study process (Figure 4-5), and in some cases this generated controversy. Illustrative was an ongoing dispute between the farming community and the Study Team about the moment in which transportation linkages between dispersed sites of farm operations had to be taken into account. Farmers insisted that this criterion should be considered from the start on, and thus be taken into account in the evaluation and comparison of different corridor options. The study methodology, however, only took this factor into account once the corridor location was decided

upon. Hence, in some cases not only the content of the decision-making criteria, but also their moment of application, were major issues in agenda setting.

The controversial nature of transportation and highway policies in the wider society as discussed in section 4.1, although this particular study did not generate major controversies outside of the study area itself, nevertheless added to the wicked character of the Highway 7 & 8 Study.

4.4 The public process: outreach, consultation, and beyond

The Study Plan states that the "Public Outreach and Consultation Process**"** (Figure 4-6) was a "major component" of the Study (Ontario, 2007a:63), which was structured around "key points" in the decision-making process. The process was supported by Public Information Centres (PICs), the release of draft reports for review, the release of newsletters, and a web site. Other follow-up activities with stakeholders were foreseen to be organized on demand (Ontario, 2007a).

Figure 4-6: Graphic representation of the Outreach and Consultation Process (Source: Ontario, 2007a).

Although not explicitly defined, the Study Plan made it clear that the term 'consultation' had to understood in line with its understanding by the International Association for Public Participation which describes it as "[t]o obtain public feedback on analysis, alternatives and / or decisions" (IAP, 2007:1). The Association situates this level of participation between "to inform", where stakeholders only receive information, and "to involve", which implies "[t]o work directly with the public throughout the process to ensure that the public concerns and aspirations are consistently understood and considered" (IAP, 2007:1). The MTO was the owner of the Study and also -at least formally- the final decision maker, while the public process would "allow comments and views of stakeholders to assist the MTO in the decision-making process" (Ontario, 2007a:63).

The most important formal avenue for direct interaction between the Study Team and the 'general public' were the Public Information Centres (PICs) organized around 'key points' in the decision-making process (Ontario, 2007a). In the Study Plan six PICs were planned. Up to the moment of this writing, two additional PICs and three workshops to overcome conflictive situations and gridlocks were been added to this total. An overview of the PICs which also provides a useful oversight of the study phases is presented in Appendix E, together with key maps and a timeline of the Study.

At each PIC the findings and recommendations of the corresponding concluded study phase were made public, and feedback was gathered. Study reports and key maps were posted on the Study's website[1] on the first day of each PIC, and were accompanied by the release of a newsletter. After each PIC, depending on the type of reports released, stakeholders were given a 30 or 60 day period to respond by means of written submissions. Feedback from the public thus has predominantly been sought once a particular study phase was finished, and after draft reports with recommendations were published.

The PICs were organized as drop-in events. Study reports, information panels and maps could be consulted and members of the Study Team were available to answer questions or to exchange points of view with individual members or small groups of the attending public. Comment sheets allowed attendants to submit formal written comments. The received feedback was afterwards published on the Study's website.

Figure 4-7: Conversations around a map during a Public Information Centre in New Hamburg. Photo: author.

[1] www.7and8corridorstudy.ca

As can be observed in Figure 4-7, most conversation at the PICs crystallized around maps. The outreach and consultation process of the Study gained momentum after the MTO presented in the second round of Public Information Centres (PICs) in June 2008 its initial 'long list of corridor and by-pass alternatives' to be studied (Figure 4-8 and Appendix C).

Shortly after this second round of PICs, a group of farmers organized a protest rally in Stratford to express their concerns regarding possible new highway sections through rural lands. Shortly afterwards, although by different persons and pursuing a different relationship with the MTO, the Agricultural Business Community (ABC) was formed. The widespread concerns and opposition in the rural and urban communities to the MTO's 'grand plans', but also expressions of support, together with the divided opinions of local governments were extensively covered by (mostly) the local media and on local websites (e.g. NHI, 2009; NHI, 2008; iTalk Stratford, 2008; Hinz, 2008).

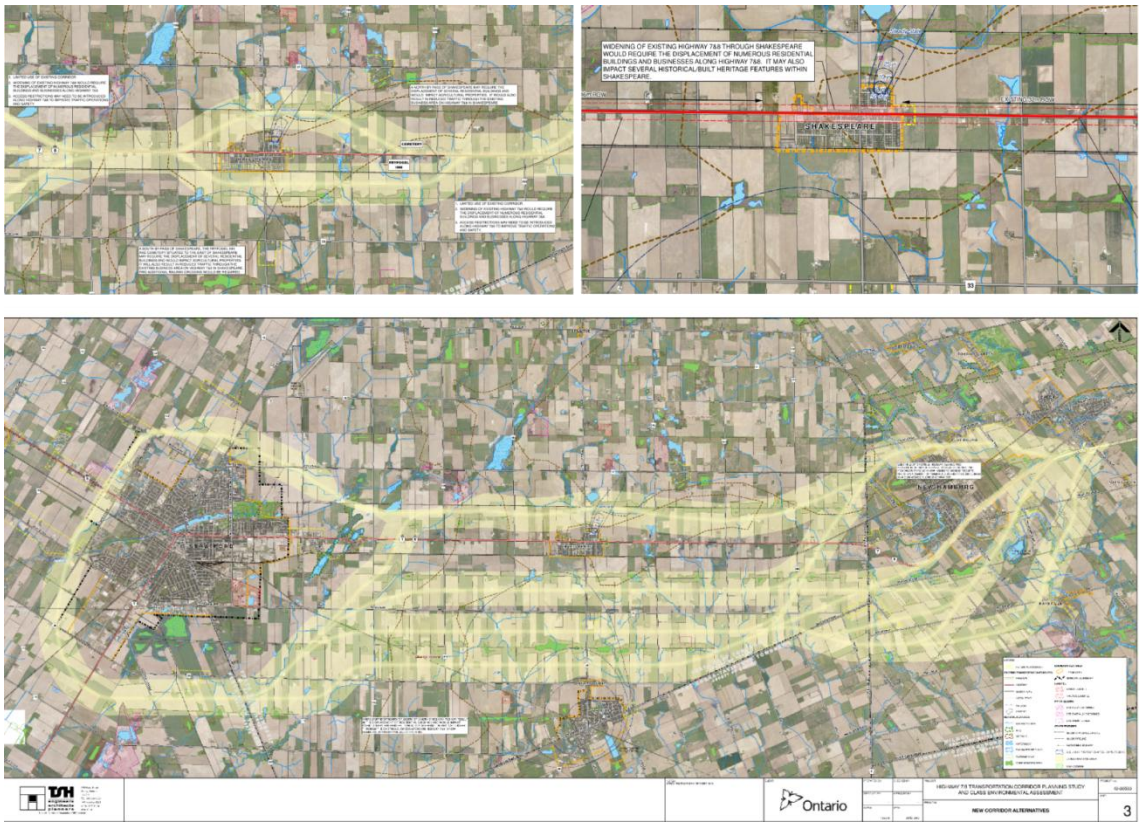

Figure 4-8: Fragments of corridor option maps presented at PIC 2. (Source: By-pass corridor alternatives [Map], 2008; Existing corridor alternative [Map], 2008; New corridor alternatives [Map], 2008).

Apart from the PICs, some other meeting formats that allowed for a more active involvement of stakeholders were held. In March 2009 in New Hamburg a workshop was held to discuss with residents the merits of different corridor alternatives in that area (TSH, n.d.).

After the Study Team in July 2009 indicated that the widening of the existing two-lane highway through Shakespeare to four or five lanes was part of its 'preferred corridor option', this recommendation was fiercely critiqued by the residents and business owners of Shakespeare, and their protests received considerable coverage and support from the local media (e.g. Sutton, 2009; Zoomer Radio, 2009). Residents and business owners claimed that this option would cut the community in two, would affect the safety of its residents, and would also disrupt the roadside businesses that depend for most of their clientele on trough-traffic. Shakespeare has a small but regionally well known cluster of antique, craft, pastry, and other specialty shops, and this sector claimed that the MTO's proposal would be fatal to them. The Study Team hence was confronted with considerable pressure from a strongly polarized public opinion which was extensively covered by different local media. Moreover, by then stakeholder groups had well established contacts to influence the decision-making process via, among others, their municipal governments and members of parliament.

Following these events, in March 2010, two externally facilitated meetings with representatives of stakeholder groups were held to identify and discuss alternatives in a well-defined area around the hamlet. It was after these two workshops, but before the Study Team's reviewed position on the preferred corridor was made public, that the workshop and the questionnaire of this thesis research took place. For both farmers and the residents and business owners of Shakespeare this was a period considerable uncertainty.

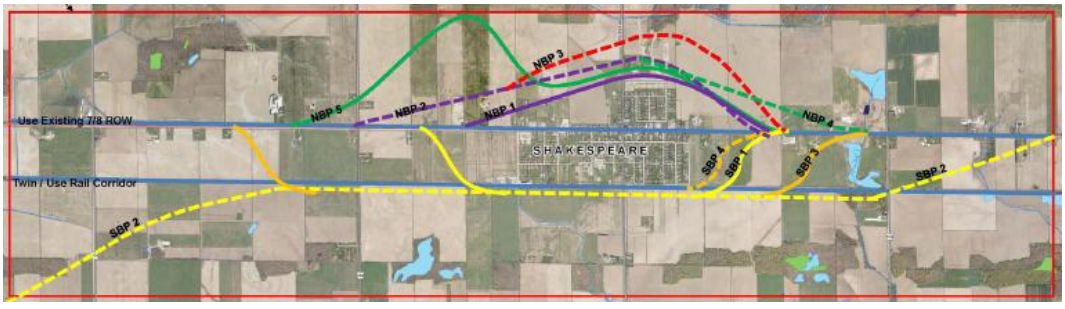

Figure 4-9: Map (fragment) with route alternatives generated in March 8, 2010 workshop (Source: Ontario, 2010).

In January 2011 the Study Team presented its new and revised recommendation for the 'preferred corridor'. This new corridor would first follow a route south of Shakespeare, continue parallel to the railway that runs south of the existing highway, and finally drop south and then continue west towards Stratford (Figure 4-10).

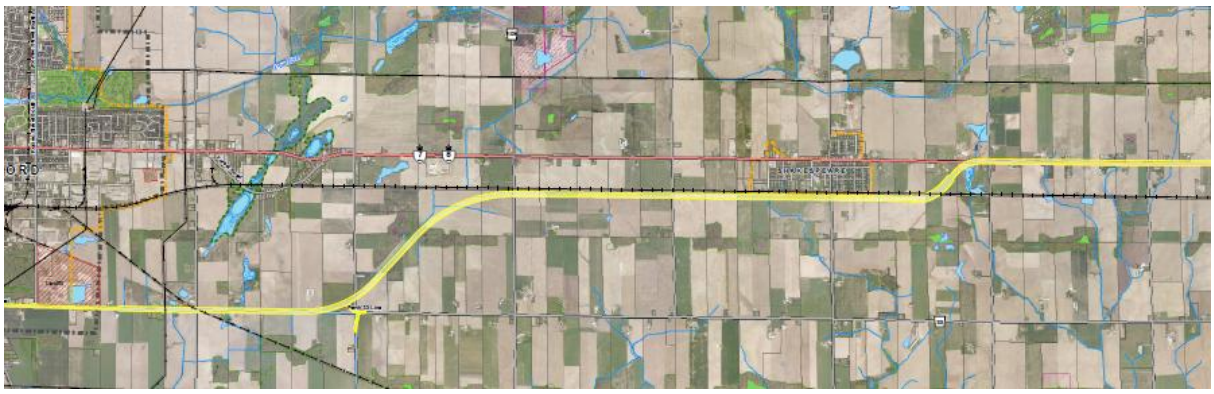

Figure 4-10: (Fragment of) preferred corridor map (January 2011) between Shakespeare and Stratford (Source: Ontario, 2011).

To conclude, the "public outreach and consultation process" in practice has show to be much more than a consultation process. Consultation implies discretionary decision-making by one central decision maker -in this case the MTO- which in practice obviously was not the case. While public participation formally was limited to "consultation" in the case of the decision of the location of the highway corridor, given extensive media coverage, direct publications of several stakeholders on web pages, and the multiple contacts of local stakeholder groups with local and provincial politicians, the Minister of MTO, and with local MPPs (one holding the post of Minister of the Environment) also politics and informal negotiation can be supposed to have exercised considerable influence on the decision-making process. The reversal of the long-studied decision to locate the corridor through Shakespeare is a clear indication of this influence.

4.5 The Agriculture Business Communities

The Agriculture Business Communities of Perth East, Perth South, and Wilmot West (hereafter, ABC) claims a membership of 300 and constituted itself shortly after the second round of Public Information Centres was held in June 2008. The aim of ABC was (and at the moment of writing still

is) to represent the interests of agricultural business and the farming community in the study process (ABC, no date). In the Study Plan, farmers and their organizations were defined as part of the "general public" (Figure 4-6). ABC, however, challenged this view, and has profiled itself in the first place as the representative of a business sector. The group has continuously argued for recognition of agriculture as a business, and for an equal treatment of rural and urban economies and businesses. ABC's basic argument and sentiment is reflected well in the following fragment of a letter of an ABC member submitted to a local newspaper.

> *Many farming operations are now multi-million-dollar businesses. The new route would reduce or in some cases destroy what are now efficiently run businesses. This wouldn't be allowed to happen to businesses located within Stratford, yet the rural community is expected to accept it. Why the double standard? Why is the rural community pushed to the margins on this because there is an assumed benefit to the urban centre?* (Clayburn and Clayburn, 2011)

ABC has closely and continuously followed the study process and has submitted both observations and suggestions to the Study. According to ABC leaders (personal communication), the group has also maintained direct meetings and contacts with the Study Team, local governments, provincial farming organizations, and Members of Parliament. An important role of ABC has been that of pointing out the implications of different corridor options for agriculture, in order to "educate" the Study Team on agriculture and agribusiness. ABC repeatedly has recognized the need to improve Highway 7&8, and has profiled itself never as a protest group. Rather, the group repeatedly expressed it wanted the Study to arrive as quickly as possible at the best solution. Moreover, concerned about prolonged periods of uncertainty and its impact on farm businesses, the group has argued for any plans to be implemented as soon as possible (ABC, 2009a). ABC has distanced itself discreetly from an earlier protest rally by farmers, and instead chose to build up a constructive, although critical, working relationship with the Study Team. The group, after each PIC, has submitted formal reactions to the Study's findings in the form of 'Community Reports'. Copies of these reports were also submitted to local Members of Parliament and local governments, and were published on ABC's blog site[2].

[2] www.hwy7and8.blogspot.com

In the course of the study process the relationship with the Study Team gradually became more tense, and expressions of frustration and distrust concerning the Study Team's willingness to take into account the group's concerns and arguments became more prominent and explicit in ABC's later Community Reports, especially (but certainly not exclusively) after the Study Team's revision of the first preferred route it had recommended in July 2009 [3]. ABC claimed that much of the information it had provided was not taken into account, and that it arguments were not responded to by the Study Team. In the report following the PIC where the (first) preferred corridor was announced, the group's tone, however, was more laudable. ABC repeatedly, and from the start on, has critiqued what it considered the low quality and vague character of much of the information generated by the Study Team (see e.g. ABC, 2009a:3). This information, ABC claimed, was often far removed from the 'grounded' reality, and, because of its elusive character, hard to respond to (ABC, 2009a; ABC, 2009b; ABC, 2010; ABC, 2011). In an attempt to broaden the scope and character of the consultation process and seeking more debate around fundamental issues, ABC (unsuccessfully) proposed to include public meetings as part of the PIC's (ABC, 2009a).

A good decision, according to ABC, should recognize agriculture as a business, protect prime agricultural lands, minimize impacts on agricultural business, assume responsibilities for all implied drainage costs before and after highway construction, and acknowledge (not only urban but also) rural heritage (ABC, 2009a). Important issue concerns expressed by ABC in the course of the study process are presented in Table 4-5 below.

[3] This "preferred corridor" for its major part used the existing highway route and compared to earlier considered options only a limited amount of rural land land for a by-pass south-east of Stratford. For ABC this was not the ideal but obviously a satisfactory if not favourable outcome As dicussed earlier, this route choice had a strong impact on the community of Shakespeare, since the existing two-lane highway was to be widened to five lanes. The public and political pressure was such that the Study Team decided to conduct a "further review of Shakespeare route alternatives which was defined in response to comments received through the PIC #3 consultation process to allow the study team to conduct a more detailed review of route alternatives in the Shakespeare area" (Ontario, 2011:4)

Fundamental issue concerns expressed by ABC
Agriculture is not only a form of land-use, but also a highly successful business sector that deserves respect and consideration equal to urban business. Impact of a new or widened highway must not only consider land-uptake and the direct loss of assets, but also the impact on functional 'integrated agricultural business units', including but not only, ongoing increases in operation costs, negative impacts on nutrient management which can lead to downscaling of production, and reduced opportunities for future expansion. Since farm business units normally operate on multiple sites, the impact on transportation linkages must be considered in all phases of the Study, and must consider all farm units in the study area. The Study lacks a drainage perspective on water, which is a fundamental issue for agriculture. Both potential impacts on field drainage infrastructure and on private and municipal drainage channels must be considered. The Study's approach to cultural heritage has a strong urban bias and largely ignores rural heritage. Growth and traffic forecasts are exaggerated, and the Study has a bias towards big engineering solutions, forgoing soft measures and smaller-scale incremental improvements.

Table 4-5: Major issue concerns of ABC (Source: ABC, 2008; ABC, 2009a; ABC, 2009b; ABC, 2010; ABC, 2011)

Figure 4-11: Fragment of early by-pass options in the Shakespeare area. (Source: By-pass corridor alternatives [Map], 2008).

4.6 A few comments on maps and map use in the study

4.6.1 Map use in the study's outreach and consultation process

Although much wider use of maps was made during the Study, this research focuses on those publicly used maps that were most central to the process of selecting the location of the preferred corridor, arguable the most fundamental decision in the Study. This same decision was also the one that participants in this research were asked to use as their point of reference when 'reading' the maps.

Although some of the publicly used maps discussed here may have been also used internally by the Study Team, the focus in this research is on their public use in the PICs, newsletters, and in publicly distributed study reports. In this research a distinction is made (cf. section 3.2) between the maps' formal public roles (to inform, and/or invite for public feedback), and their plausible informal and political roles. We see these roles not as mutually exclusive, but more as co-existing aspects of map-use. Reference to 'plausible political roles' does not imply that maps were used consciously as a part of a strategic discourse. Publicly used maps, both as carriers of 'knowledge' and as embodied 'discourse' (thus pertaining either to the left, or the right side of the triangle of Figure 3-2) are considered here in the first place as propositions for sensemaking, aiming in different degrees at 'convincing' and/or 'learning' and 'mediation'.

Maps, both visually and functionally, played a prominent role in the Public Information Centres. Most probably the capacity of maps to present considerable amounts of information in a condensed form, combined with their explicitness concerning location attracted visitors' attention much stronger than the study reports that were mostly voluminous and with lots of descriptive content. Consequently their meaningful analysis required considerable amounts of time. Importantly, maps also allowed visitors to relate considered options and recommendations directly to the location of their homes, farms, community, etc. Also in the study reports themselves, maps seemed to play the role of presenting fundamental information in a condensed and spatially explicit form. In the PICS much information exchange was observed around the maps. In how far this exchange of information gave way to social learning between stakeholders is hard to judge. In the course of the study its cartography has undergone little change. One thematic map (on field drainage) was added on farmers request, and on the corridor alternatives maps, which served as the basis for many other maps, the only observed change was the disappearance (for unknown reasons) of "development clusters" from those maps. A considerable amount of corridor options, other than the initially proposed ones, however were observed on these maps in the course of the study. This, at first sight, suggests that these corridor maps have played more a role in 'bargaining' on different corridor options, than in social and conceptual learning on the landscape and in a dialogue on the decision-making criteria between stakeholders.

Key map(s) in decision on corridor location	Fundamental public roles
Thematic maps: at the onset of the study process (PIC 1 and 2), and partly based on former work, a set of eleven thematic maps were publicly presented and included in a study report describing the area.	FP: Inform on information used in analysis and design, and invite feedback from the public. PP: Agenda setting: defining the issues concerned to be of fundamental concern to the Study.
A map of the study area (Figure 4-2) was used in all study reports, newsletters and PICs.	FP: Communicate the geographical extent of the study area. PP: Frame the study as a local, independent project. Bounding both the geographic and the social-political scope of the Study.
Map of existing transportation issues (Figure 4-4).	FP: Inform on the Study Team's synthesis of encountered transportation issues; invite the public feedback from. PP: Propose a certain perspective on transportation issues (problem framing).
(Various series) of corridor alternative maps. (See Appendix C). (Sections of these maps were also used as indexical maps in tables presenting the outcomes of the comparisons between different corridor alternatives).	FP: Inform on design options and the criteria for their evaluation; inform about key considerations in evaluation; invite for feedback from the public. PP: (1) Setting and confirming agenda and problem understanding (convince on content); (2) convey that evaluation and decision making is an objective, neutral, technical, and transparent process (convince on process) ; (3) probe stakeholders' reactions, and provide space for Study Team to adjust or modify positions without openly creating contradictions.
Maps with route alternatives based on inputs of stakeholders during Shakespeare workshop (Figure 4-9).	FP: Gather design options and arguments from stakeholders. PP: (1) Probe stakeholders' reactions to options; (2) Provide legitimacy to the study process and to a future new recommendation for a preferred corridor.

FP = Formal public role(s); **PP** = Plausible Political role(s).

Table 4-6: Key public maps and their role in the Highway 7 & 8 Study

4.6.2 Counter mapping by stakeholders

Although also the Shakespeare Business Association produced some counter maps with proposals for truck-only bypasses and tunnels which would allow the light traffic on which its business sector largely depends to continue using the existing route, the focus here is on the counter mapping by the researched stakeholder group ABC, which was technically assisted by the author. During the initial contacts with the author for this research, some ABC volunteers became increasingly aware of the potential of maps as a powerful means for the communication of spatial issues, and in shaping the public opinion around the Study. Moreover, they perceived the cartographic skills and access to

spatial data of the author as an opportunity to visually communicate some issues with an important spatial component which they repeatedly had pointed out in their Community Reports, but that had not been taken up by the Study Team. In two instances similar sets of maps were produced. These maps visualized both the considerable size and the spatially dispersed nature of (most) agricultural business units, and illustrated some of the functional and spatial linkages between the dispersed sites that make up most farm businesses. The latter was illustrated by manure and forage flows between different parcels, visualized as connecting arrows. Two maps from the later set are available in Appendix F.

The first set of maps was produced shortly before the second stakeholder consultation workshop in Shakespeare, after the Study Team decided to reconsider its recommendation to widen the existing highway in the hamlet, and was presented in this meeting. The second set was elaborated after the Study Team published its new preferred corridor option which included new corridor sections through rural lands and that raised large concerns in ABC. Data collection in both opportunities was realized by ABC volunteers, while the author transferred the collected information to a spatial database and elaborated the maps. In the second round of counter mapping much more data was collected as farmers felt more threatened and overcame their initial reluctance to publicly disclose information on their properties. While the first set of maps was shown to the MTO and other stakeholders, and was used in several follow-up meetings with local governments, ABC never made these maps available to the MTO, nor did the group publish them. The second set of maps however, was published in a community report available on ABC's website (ABC, 2011) and was used in several meetings with local governments and MPPs. ABC's counter maps and their use closely fitted to Carton's description of political maps: they were designed to focus on specific issues, and to transmit a reduced number of clearly defined arguments related to those issues. The maps can be understood largely as a reaction of ABC to not seeing a series of its fundamental arguments that were of an imminent spatial nature, incorporated in the official study cartography. An overview of the most important roles of ABC's counter maps is presented in Table 4-7.

Counter maps	Fundamental public roles
Integrated Farms Business Units	FP: (1) Visually illustrate ABC's arguments on the considerable size of agricultural businesses units, and support arguments that land uptake affects a business as a whole. (2) Argue against the newly defined corridors through agricultural lands. PP: Demonstrate that this type of mapping is plausible, and does not imply mayor time or resources, whenever the will to do so is there.
Forage and Nutrient Flows between multiple sites of Integrated Farms Business Units	FP: (1) Visually illustrate the concept of the integrated agricultural business unit as an integrated whole that depends on functional linkages. Emphasize specifically the importance of functional road connections between different farm sites. (2) Argue against the newly defined corridors through agricultural lands. (3)In case the recommendation on rural corridors went ahead: provide information and arguments to keep as many as possible local roads connections open. PP: Demonstrate that this mapping is plausible, and does not imply mayor resources, whenever the will to do so is there.

FP = Formal public role(s); **PP** = Plausible Political role(s).

Table 4-7: Roles of ABC's counter maps

Chapter 5
Research Design and Methods

This chapter first describes how the conceptual framework presented in section 3.2 was made operational for its use in the research instruments: a workshop and a questionnaire investigating how participants perceived that they, and issues of importance to them for the decision on the highway corridor location, were cartographically represented in the Highway 7 & 8 Study. On continuation, the selection of the maps and the research participants are discussed. Finally, in the last two sections of the chapter, the design of the workshop and the questionnaire are discussed.

5.1 Turning the conceptual framework operative: making sense out of planning maps

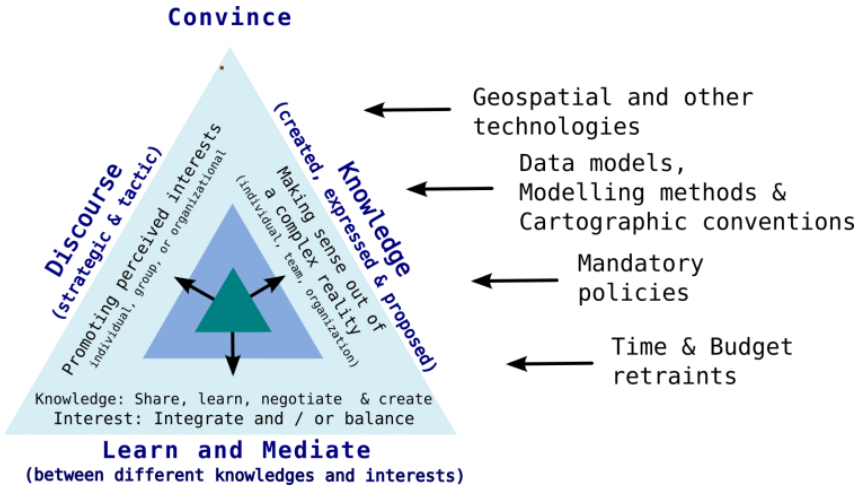

Figure 5-1: Conceptual framework of publicly used planning maps

The objectives of this thesis proposed, based on a review and integration of different fields of literature, to develop a framework for the understanding of public maps and map-use in complex multi-stakeholder planning processes. This framework, presented in Chapter 3, proposes a view of planning maps as instruments that embody both knowledge and discourse and that play two basic roles: that of convincing others of its views, and that of facilitating learning and mediation between the views, interests and knowledges of different stakeholders. The embodied knowledge is partly

representing knowledge held by its creators, but also the outcome of the very process of map making (and spatial analysis). The framework also proposes that planning maps are not entirely the reflections of their human creators and the organizations they represent, but that also non-human factors, like spatial technologies, data models, mandatory policies, and time and budget restraints actively take part in shaping maps (Figure 5-1).

In order to examine how local stakeholders make sense out of planning maps, focussing on how they and the issues of their interest, are represented on these maps, we return to the four basic groups of mechanisms that are used to create and transfer meaning with maps that we identified in section 2.5.3:

1. The presences and absences (or silences) of spatial objects. *What* issues *are* on the map, and what potentially relevant issues, *are not* on the map?
2. The visual (re-) presentation of spatial objects. *How* are the issues graphically depicted?
3. The organization of spatial objects into categories and their labelling. How are the items on the maps grouped into categories, and what plausible meanings are implied in the names used for items and categories?
4. The use of a wide range of non-spatial elements on the map sheet, like e.g. logo types, guiding texts, font types. How do these elements, as part of the map image itself, or as part of the legend help to produce meaning?

These four mechanisms formed the basis for the design of a map review workshop (section 5.4), and for a follow-up mail-back questionnaire to deepen aspects of the third mechanism: categorization and labelling (section 5.5).

Concerning the process of reading and making sense out of maps, based on the literature review, it became clear that complex maps are most fruitfully understood as having no inherent meaning, but that meaning instead is created 'on-the-fly' during the process of interaction of the map reader with the map and when done in a group setting with other map readers. In this process data derived from the map is combined with pre-existing (normative) knowledge on the overall planning situation and its wider context. Making sense out (often complex) maps in a complex multi-stakeholder planning context not only involves frames in the form of pre-existing knowledge and perspectives that create, filter and organize data, but also requires an goal that directs the sensemaking process. Normally this

is goal is the need to determine a course of action, which includes the option to abstain from action. Research participants were asked to use the goal of "an informed and balanced decision-making process regarding a corridor in the Shakespeare area" as a guiding perspective for reading the cartographic material presented to them. We appealed thus to participants' perception of objectivity and/or fairness of the cartographic representation in the light of the decision-making process, which could orient their eventual action in case of a felt need to correct perceived imbalances. Given the currentness of the issue in the Highway 7 & 8 Study at the moment of the research this was a task in which participants quite naturally engaged. Since sensemaking is intimately related to identity, narratives, lived-experience, interpretation and dialogue (Klein, 2009; Weick, Sutcliffe and Obstfeld, 2005), the research was given a strong qualitative orientation, and in the presentation of the outcomes ample space was reserved to preserve the rich information embedded in participants' own words.

5.2 Selection of maps

The maps selected for this research were all closely related to problem understanding or agenda setting concerning the decision of the location of the highway corridor, and included a map on corridor alternatives and a selection of maps that were part a set of thematic maps presented on the outset of the study.

To provide a clear focus for the workshop, a section of a map on route alternatives in the area of Shakespeare was selected. Route options in this section included both the widening of the existing route and/or the construction of new highway sections trough rural lands. At the moment of the map review workshop, after the Study Team decided to revise its initial proposal to widen the existing corridor through the hamlet of Shakespeare, a new decision on the route in this area was pending. For ABC this obviously meant a setback, since several by-pass options through rural land had again become very feasible. A few workshop participants had participated in an MTO stakeholder consultation workshop to address the issue of route alternatives in the Shakespeare area. The map section reviewed during the workshop (Appendix G) thus was very meaningful for all participants and was used to investigate all of the four basic mechanisms to create meaning with maps referred to in the preceding subsection. For the questionnaire, out of this same map and the thematic maps released at the onset of the Study, six issues with a close relationship to agriculture were chosen to deepen the research on the use of categories and labels, an issue that for time restraints was given less emphasis during the map review workshop.

5.3 Selection of research participants

Participants were selected through purposeful sampling with the help of a member of ABC's executive committee. The two selection criteria were active involvement in the activities of ABC and familiarity with Shakespeare and its surroundings. No special ability or affinity for working with maps was asked for. Since ABC volunteers were men and women in approximate equal numbers, the selection of participants strived to maintain this gender balance. Since the research aimed principally at qualitative information, and since the workshop was the main research instrument, the number of participants was held small and based on a balance between sufficient variety of perspectives, at the one hand, and the opportunity for all participants to actively participate in the workshop, on the other. Striving for a number between eight and twelve participants, 15 potential participants were approached of which eleven (six male and five female) finally participated in the research.

5.4 The map review workshop

The goal of the workshop was to learn how participants made sense out of the route alternatives maps that were used in the decision-making process concerning the location of a preferred corridor route, considering various alternatives. These maps (Appendix C) showed various corridor route alternatives and reflected many of the principal elements used to evaluate and compare among these alternatives. Participants were asked to consider a fragment of one of those maps, and evaluate how well they and issues of their interest were represented on the map fragment, in the light of an "objective and balanced" decision on a preferred corridor in the Shakespeare area.

The workshop was held on June 10, 2011 in the Spatial Decision Support Laboratory at the University of Waterloo, lasted from 7.30 to 10.30 pm., and was facilitated by Prof. Dr. Robert Feick and the author.

5.4.1 Method and organization

In order to provide for a flexible manipulation of the map during the workshop, a selected area of the corridor alternatives map around the hamlet of Shakespeare to be reviewed was precisely reconstructed in digital form using ArcGIS 9.3 (Appendix G). The reconstruction was based on publicly available data layers, proprietary data licensed to the university's Map Library, and some information digitized from the original MTO map. Based on concerns expressed in ABC's

Community Reports, some additional data layers were prepared and added to the digital map, ready to be rendered visible if referred to by participants (Table 5-1).

Data layer	Data Source and release date
MTO Shakespeare study area (area under formal review at the moment of workshop).	Digitized from original MTO map
Corridor and bypass options	Digitized from original MTO map
Roads	OMNR (2008)
Railways	OMNR (2008)
Urban areas	Digitized from original MTO map
Development clusters	Digitized from original MTO map
Waterbodies	OMNR (2007)
Watercourses	OMNR (2007)
Evaluated Wetlands	OMNR (2007)
Wooded areas and Core wooded areas	OMNR (2007) core areas derived trough buffer operation
Moraines	Digitized from original MTO map
Wellhead and flow time areas	Digitized from original MTO map
Parcels	Terranet (2008)
Aerial images	SWOOP (2006) (30 cm resolution)
Tile (field)drainage	OMAFRA (2008)
Rural buildings and silos (*)	Digitized from SWOOP aerial images
Private roads	Digitized from SWOOP aerial images
Constructed drains (*)	OMAFRA (2008)
Avon river (thicker line) (*)	Modified version of Waterbodies layer
Layers marked with an asterisk (*) were created by the author containing information not on the original map. These layers were part of the digital map but were initially invisible and were rendered visible only if the issue was raised by participants.	

Table 5-1: Data layers and sources used for the map reviewed in the workshop.

During the workshop two digital data projectors were used. One projector was used to project the digital map to be reviewed with the help of ArcGIS 9.3 on a large whiteboard (approximately. 1.75 x 3.5 m). This allowed participants, alone or in small groups, to interact with the map using hands and whiteboard markers, while one member of the research team operated the GIS software on their behalf. A second data projector was used to project other information and, during the actual process of map review, the map's legend, on a screen next to the whiteboard.

The workshop was divided into two main parts. The first part consisted of a short 20 minute warm-up exercise in which participants individually formulated comments on the meaning(s) they derived from the reviewed map and then shared their views with the other participants and the researchers. Three intentionally very open-ended questions were provided to help participants engage with the map,

focusing on (a) what they believed the Study Team wanted to convey with the map, (b) what the map meant to participants, and (c) what issues on the map attracted their attention in particular. After individually engaging with the maps for about 5 minutes, participants during 15 minutes shared their observations verbally with each other and the facilitators. The workshop script is reproduced in Appendix A.

After the warm-up exercise, participants engaged in two more substantive tasks, that sought their opinions concerning:

1. Participants' appreciation of how correct, current, and complete the information on the map's individual data layers was.
2. Participants' appreciation and suggestions, considering both the map image and the map's legend, concerning the appropriateness of the overall content and style of the map in the light of "an informed and balanced decision-making process regarding the location of a highway corridor in the Shakespeare area".

This second part consisted of reviewing participants' specific perceptions concerning:

a. Data or information (themes) considered to be missing and important enough to be included on the map;
b. Data or information (themes) considered to be better removed from the map;
c. The graphical style in which themes were rendered on the map;
d. The content and style of the text in text boxes used on the map that was intended to guide its interpretation by the map reader.

Together the two tasks thus covered both what we could call 'terrain knowledge' and the process of 'making sense' of the map fragment.

In facilitating the workshop, a balance was sought between providing a certain level of structure to the review process and giving participants the opportunity to express knowledge, perspectives and suggestions as they spontaneously arose. In parallel to interview guides, the workshop script thus could be called 'semi-structured'.

Participants were both invited to comment on their interpretation of the map and to suggest changes, but no attempt was made to create a completely new map. Map manipulation during the workshop included turning data layers on and off, and zooming in and out on areas of interest. Also, following participant's suggestions, the cartographical style of the map was altered, e.g. changes in the colour and transparency of polygon fills, the colour and thickness of lines, and the size and colour of points symbols were made. The locations of participants' observations that referred to a specific geographic area, often drawn with a marker on the whiteboard, were registered with ArcGIS on a previously prepared empty polygon layer, and participants' their comments were registered in an associated text attribute field (Figure 5-2). For simplicity, comments referring to a specific point were registered as small polygons, while those referring to linear features were registered as elongated polygons. The workshop was audio and video recorded for later analysis.

Figure 5-2: Example of cartographic registration of a participant's observation

Prior to starting their workshop tasks, participants were exposed to a short PowerPoint presentation that familiarized them with some basic information concerning how maps can be digitally manipulated with GIS software. Also, some basic ideas were provided concerning how maps by including, excluding, emphasizing and deemphasizing data, always and necessarily, provide certain among many possible perspectives (see Appendix A fort details).

5.4.2 Analysis and presentation of workshop results

The steps for the analysis of the workshop results were the following:

1. Integral transcription of the audio recording.
2. Coding the transcript with the help of a qualitative analysis software package (NVivo) using an initial coding scheme based upon the workshop tasks.
3. Subsequent coding of the workshop transcript applying emergent codes that emerged from the content of participants' comments, using the conceptual framework presented in Chapter 3 as a sensitizing concept (Patton, 2002).

To assure the reliability (consistency) (Patton, 2002; VanderStoep and Johnston, 2009) of the coding process, three quality measures were applied. First, to avoid code drift during the coding process all codes were precisely defined to serve as a stable point of reference during the coding process. Secondly, two weeks after the first coding run the transcript was coded a second time and compared with the first run, resulting in some minor corrections. Thirdly, ABC's Community Reports were used as a source of information for triangulation (Patton 2002).

5.5 The questionnaire on categories and labels

The labelling (naming) and categorizing (conceptually organizing) of phenomena is essential to the process of sensemaking (Weick et al., 2005). The questionnaire on categories and labels (Appendix B), aimed at providing insights in participants' appreciations concerning the categories and labels used in the legends and titles of study maps. Classifications are based on what the person or group who does the classifying considers most important (or strategically convenient). E.g. roads, when referring to their maintenance and jurisdiction, might be classified *as provincial*, *regional* and *local*. Alternatively, when the interest is on safety they might be classified as *safe, moderately safe*, and *unsafe*. Each classification selectively emphasizes ('frames') certain aspects, while at the same time it de-emphasizes or silences aspects that may be of crucial importance to other stakeholders. The way in which a resource is classified, thus both reflects and influences the reasoning about it, and potentially also the outcomes of the decision-making processes. Likewise, as discussed in section 2.2.5, 'descriptions' are never merely descriptive; they are always normative and implying a certain perspective. Moreover, descriptions are *performative*: they result effects. Providing a (bold) example; in the context of the Study the use of the term "undrained swamp" would imply different values, and

might have different effects on the decision-making process, than its alternative description "wetland ecosystem". From this perspective, the categories and descriptions of the publicly used maps can be considered as expressions of perspectival knowledge and/or and or strategic discourse, and can reasonably be expected to affect decision outcomes. The questionnaire thus essentially researched similarities and differences in the (perspectival) knowledge and (desired strategic) discourse between the Study Team and participants, concerning how issues on the map are conceptually organized (categorized) and named (labelled).

The mail-back questionnaire was distributed at the end of the workshop and all eleven copies were received back in the following two weeks. Given the fact that some of the issues covered in the questionnaire were also discussed or briefly referred to during the workshop, the questionnaire must be considered more as an extension of the workshop than as an independent instrument intended to research participants' individual perceptions. Given that sensemaking by definition is a social process (Weick et al., 2005), the influence of the workshop experience on the questionnaire answers hence is not seen as a shortcoming.

5.5.1 The structure of the questionnaire

The questionnaire was divided into three sections. The first section concerned some basic personal characteristics of the participants and their contact information, while the second section gathered information concerning participants' level of familiarity with the study reports, the study maps, and maps in general. The third and main section consisted of six questions concerning participants' perceptions regarding the classification and labelling by the Study of phenomena related to agriculture, both on the corridor alternatives map and on several thematic maps. Each question consisted of two parts.

In the first part of each question a 5-point Likert scale was used to ask participants for their level of agreement or disagreement concerning if a certain classification or label used in the study expressed 'the most important and relevant aspects' of the phenomenon referred to . For example, one question asked for participants' perceptions concerning the labelling on the study maps of "wooded areas" as "natural heritage" Participants were then asked to explain their answer choice. This question invited participant to express in how far their perspectives on the labels or categorization schemes used coincided or diverged from those of the Study Team. For example, since most woodlands in Ontario are managed in some degree, and part of them has been planted and is privately owned, we

anticipated the possibility of a disagreement on the use of terminology that (plausibly) emphasized the wooded areas as (exclusively) "natural", and as "heritage", the latter term (again, plausibly) emphasizing old age and their public relevance.

The second part of each question asked participants if they perceived that the categories or labels used on the maps were conductive to "objectivity or balance in the evaluation and decision-making on corridor alternatives". Participants could answer 'yes', 'no', and 'no opinion', and in order to explore their perceptions of the implications of the connotative meanings they perceived on decision concerning the location of the highway corridor, again were asked to explain their choice. Continuing with our example, we researched if, and if so, for what reasons, participants perceived that the use of the terms "wooded areas" and "natural heritage" introduced a bias in the decision-making process. For example, farmers might perceive an undue protection of that resource, compared to the imaginable alternative term "farm woodlots", which would emphasize their managed character and private ownership.
Each question was accompanied by a map image and insets that enlarged relevant areas (Figure 5-3).

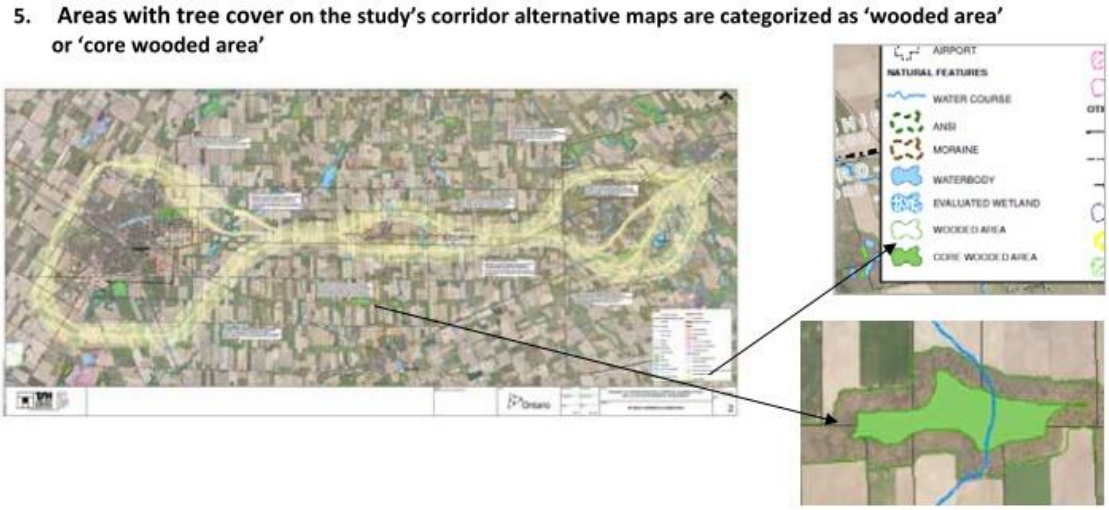

Figure 5-3: Example of a map image with amplified insets used the questionnaire.

Categories and labels referred to in the questionnaire
The labelling of 'Wooded areas' and 'Core wooded areas' as 'Natural Heritage Resources'.
The categorizing of areas with tree cover as either 'Wooded Area' or 'Core Wooded Area'.
The labelling of the watercourses in the study area as 'streams' and 'aquatic resources'.
The categorization of agricultural lands in terms of their Canada Land Inventory (CLI) Class and their drainage status.
The categorization used on a thematic map on land use in the study area.
The road categories used on the corridor alternative and by-pass alternative maps.

Table 5-2: Categories and labels referred to in the questionnaire

Chapter 6

Results

This chapter discusses the results of both the workshop and the questionnaire. The discussion of the results of the workshop follows the structure in which the workshop tasks were organized. After a discussion of the results of the warm-up exercise, the discussion turns to the participants' review of the factual correctness of the reviewed corridor map. This is followed by a discussion of missing information themes, and contested and redundant themes that participants would rather see removed from the map, and by a review of some text boxes placed on the corridor alternatives maps. Finally some comments on the map's legend are discussed. The discussion of the results of the questionnaire focuses on the qualitative outcomes and follows the structure of the six questions on categories and labels based that constituted the core of the questionnaire (see 0 for details).

6.1 Workshop results

In the presentation of the comments of and dialogues between participants, the following conventions are used. For reasons of clarity, comments and dialogues are separated by short dotted lines (- - -). In order to facilitate the understanding of the flow of dialogue between participants, the contributions of each participants are labelled with an uppercase letter (A:, B:, C:, etc). Note that a given participant may be represented by different letters in different dialogues. To assure clarity of reference between participants' words and the main text, participants' expressions and dialogues (quotations) were numbered (Q1, Q2, etc). Clarifications, comments, or connecting words added by the author are rendered between square brackets *[as shown here]*.

When reading the sections on the workshop results, it is important to note that participants' comments do not necessarily reflect a group consensus. The workshop did not aim at reaching group consensus, nor were participants stimulated to speak out on eventual (dis)agreement with other participants. As discussed in section 2.4.1, local knowledge should not be considered as homogeneous in its content or in its underlying norms and values. Although most participants seemed to share opinions on ABC's central issue, agribusiness, in some instances clearly divergent opinions were expressed, especially concerning that what on the map appeared as 'natural features' (Q1).

Q1: A: Because we wanna show that we'd rather have them plough through bush ground than through tillable farmland. We are the exact opposite of some others.

[…]

B: When they were talking about putting a new highway 25 years ago they were going to go right through all the bush land in South Easthope. And that wasn't a very good idea either!

Where opinions among participants were clearly and substantially divergent, quotations that reflected this diversity, as much as space allowed, are included.

6.1.1 Warm-up exercise

During the warm-up exercise, by means of three very openly formulated questions, participants were invited to formulate and share opinions on the meanings the reviewed map had to them. Although a little more than two years had passed since the publication of the first corridor alternative maps, and substantive interaction between ABC and HW 7 & 8 Study Team had taken place since then, participants' appreciations of messages and meanings derived from the corridor map were highly diverse. Whereas some participants believed that the map revealed pre-defined preferences of the study-team (Q2, Q3), others emphasized that the map reflected the open and undetermined character of the map. The latter was interpreted both positively, as reflecting openness and flexibility (Q4), but also negatively in terms of strategic ambiguity or even deceptive communication (Q5, see also Q11). One participant initially interpreted the map as a means for the Study Team to probe on the (political) weight different issues were going to be assigned outside of the formal process, while at the same time expressing the Study Team's own preferences (Q9).

Q2: They make it look as if to they have that pact through already too. There is nothing, no obstacle there other than Shakespeare.

\- - -

Q3: This map shows that going through Shakespeare is not an option at all. They wanna go around Shakespeare no matter what.

\- - -

Q4: I think they wanted convey they had a fair bit of flexibility though. That's why the brush is so broad. That they were willing to move all over the place, even though this is sort of the route, but it is still a very broad idea.

Q5: I think they wanted to convey that they were open to other ideas. Simply by that map... This is on there, but it is not carved in stone, we have flexibility, as you say. But we know different now! [Laughs].

Participants explained their observations based on specific style elements (Q4, Q11), on the overall impression left by the map image (Q5, Q6 and Q10), on the text boxes (Q7), and on the explicit combination of information on the map with other pre-existing knowledge (Q8, Q9).

Q6: You know that map ... it doesn't look as near as invasive as the other one does. The other one looks so much scarier than that one does.

- - -

Q7: Well, the fact that they identified the cemetery and the Fryfogel [Inn; two iconic heritage features often referred to in the media and in the study documentation] gives them a priority. Nothing else is identified with words, and the boxes [have] the same font size as Shakespeare almost.

- - -

Q8: At one point [Study Team Member X] became very animated about the fact that they could do the southern [bypass] beside the railway, all the way along, but this map indicates [that] the center of that route could be potentially just south of the railway. So they wanted to convey that.

The difficulty of making sense out of complex maps in complex and ambiguous situations, and the importance of the background knowledge the reader brings to the process of map reading (section 2.2.2) is well expressed in the following quotation (Q9). While in an earlier reading the participant had perceived the map as a means of the Study Team to 'take the temperature' on politically sensitive and potentially conflictive issues, in the workshop, using new background knowledge, the same participant emphasized that the map expressed preferences of the Study Team. As argued in the conceptual framework (section 3.2), maps may well serve both goals at the same time.

Q9: Well, at that point my impression was that the Fryfogel [Inn], the cemetery, that was on their radar. They had figured out that that was going to be trouble there and that there was going to be some trouble dealing with the wetlands, particularly on the north side, through to where Shakespeare's Stables are, where the [river] Thames strides. This was all the picture, broad brush strokes stuff, but there were some things they already knew that we're going to be tension around. And that was like the historical ... heritage stuff, and ... you know, the wetlands. What strikes me now,

looking at it in retrospective, basically this was saying that the Shakespeare core was not going to be affected.

Several participants described an interesting reading of the projected map that actually took place more than two years before the workshop. More precisely, their comments referred to the whole set of initial corridor and by-pass alternatives maps of which the map fragment referenced in the workshop formed part.

Q10: A: These maps convey the image they have the power to place the highway wherever they want.
B: And this is the map that got us organized!
C: It made us wake up…
D: Those wide sweeping strikes… it had a brush line like that trough every farm lot…

This reading is a clear example of the multiple powers of maps; not only the institutional power that participants felt was reflected in those maps and gave weight to their content, but also the power of maps to mobilize people by arousing strong emotions. In this case, the perceived expression of power played an important role in mobilizing countervailing power. The dialogue also illustrates the importance of the visual impression left by a map image as a whole. 'Cold' rationality told participants that only one highway route could result from the Study. However, the image of a "brush line through every farm lot" (Q10, Figure 6-1) had a strong mobilizing effect on the farming community. In the terminology of cognitive science, the map was a visual 'conceptual blend' that fused several exclusive options in a single mental and visual image (Turner, 2007). However, before this blend was unravelled, that is, before it was consciously reasoned that only one corridor could be developed, strong emotions were already aroused and provided a strong impulse to the mobilization of the community.

Several participants expressed the perception that maps were used as a form of consciously created discourse in what they perceived as a strategic game surrounding the study process. As the following quotation (Q11) illustrates, maps not only directly communicate content, they also fulfill metacommunicative roles. In this case, the participant saw the map a means to validate the study process as technically sound and therefore as legitimate.

Figure 6-1: Maps with new corridor and by-pass alternatives. Source: (By-pass corridor alternatives [Map], 2008; New corridor alternatives [Map], 2008)

Q11: And as it unfolded, I think that map says, "We want to convince you we're doing a good diligence. But we want to go the existing route, and we want to keep Shakespeare sleeping." [...] It makes me wonder if it wasn't like a kind of political agenda, you know, by what they highlighted, the cemetery and those things, in black. In black, it grabs you! I mean the colours, that yellow, that neutral yellow, light, that pacifying colour, ... right through the middle of the corridor, that plays on a people's psyche, those colours, do they?

The results of the warm-up exercise support the idea that it is not possible to arrive at a single conclusive reading of maps in situations characterized by uncertainty and complexity (see section 2.2.4). In the research, this observation seems to hold true even after prolonged and substantial interaction around such a complex map.

Although participant's readings were highly diverse, in several aspects they were far from mutually exclusive. The corridor alternative maps can well be read as a means to communicate (real, or hoped for) institutional power, and as a means for the Study Team to subtly seed their initial preferences for certain corridor options. At the same time, these maps may have contained expressions of flexibility and ambiguity that, together with the indication of 'hot topics' (e.g. a historic cemetery and the Fryfogel Inn) recognized the reality that a final decision on a corridor option was the outcome of an uncertain process of power sharing that involved many actors. Maps here, thus, may have also played the role of political 'probes' and boundary objects (section 2.5.2) that facilitated discussion and discrete and indirect negotiation on 'hot' topics, and, as once participant suggested, as meta-communication on the technical solidity and political legitimacy of the study process.

6.1.2 Task 1: Factual correctness, completeness, and currency, of data layers

A total of twenty, spatially localized, perceived factual errors were registered during the workshop (Table 6-1). Nineteen of these were related to water, and many of them could be easily appreciated on the aerial images included in the map.

On MTO Map	Reported by participants as	Cases registered	Comments
Waterbodies	Wetland / Much smaller / Wooded area / Arable land	9	Information reported as at least 25 years outdated.
Watercourses	Closed drain/ Seasonal open drain / Converted to ditch following a new course/ Arable land / Nonexistent (no details)/ Canalized	8	Information reported as at least 25 years outdated.
Not on map	Man-made pond	1	Approximately 25 yrs old.
Not on map	Major pipe drain parallel to railway	1	
Road label	Road label (number on map reported as outdated)	1	(reported error was confirmed after workshop)
TOTAL		20	

Table 6-1: Perceived, spatially localized, factual errors reported during the workshop.

It is important to note that the above list of reported factual errors on water-related features was not exhaustive. For reasons of time, error reporting on the issue was curtailed by the facilitators after it became clear that the data on watercourses, water bodies, and wetlands was outdated apparently by at least 25 years, and that participants could identify more errors.

The contested nature of facts on water bodies and wetlands seemed to be partly due to their inherent seasonal and annual variations (Q12, Q13), and to the fuzzy limits between different water-related categories (Q14).

Q12: That's a wetland. That's not pond, that's a wetland. In really wet years you'll have water standing there. [...]

- - -

Q13: We know that property a bit. Somebody stuck a boat here, I mean, a little rowboat. There's only water in there that a boat could flow on if it's an exceptionally wet year.

- - -

Q14: A: I would say those are more wetlands than [a] water[body].

B: Actually it's almost grassland, it's hardly wetland.

C: That's that horse farm that was sold

D: Oh yeah. It's not really a water body, isn't it?

B: No, the water is further back in the bush?

D: Yeah, the bush is really wet.

Participants' comments on water related phenomena demonstrated that the line between different perspectives or interpretations on one hand, and factual errors on the other, is sometimes blurry. Whereas the perspective on watercourses on the study cartography was dominated by a aquatric ecosystem perspective, clearly related to the OMNR-DFO fisheries protocol (DFO, 2006), workshop participants emphasized a drainage perspective. Participants not only questioned an (exclusive) characterization of watercourses as 'natural heritage' (Q15), but sometimes contested their very existence (Q16). Here planner and farmers, based on their interests and lived experience, used different ontologies, classifications, and terminology.

Q15: I don't know if it's a style thing, but the municipal drains and the man-made ponds and stuff like that, if they could be a different colour than the natural occurring ones. Because [...] the man-made stuff is different from the natural.

Q16: This one comes across [Farmer X']s place, that's going up the ditch [...] That's not a watercourse, it might flow at six inches of rain, but it's not a spring fed watercourse [...] Part of it is a ditch, [a] road side ditch.

The latter quotation also demonstrates that it is hard, if not impossible, to use labels with an exclusively denotative meaning. Plausibly, the term 'watercourse' was chosen by the Study Team for its 'neutral' tone. However, placing that label in the legend under 'natural features' conveyed a clear connotative meaning to the participants, that of a permanent and 'natural' watercourse, as distinguished from a man-made drain.

Most of the errors related to waterbodies perceived by participants, however, were not a matter of perspective, but were related to seriously outdated information. The data on the map, although only two years old, and released by the OMNR, clearly did not reflect the extensive drainage measures that were implemented in the study area during the last two decades. These measures not only included newly constructed drainage channels, but also the straightening of many watercourses (Q17, Figure 6-2) or even their conversion into closed drains (Q18). Related to this expansion of agricultural drainage, several ponds or wetlands on the map were reported as not existing anymore (see Figure 6-3). Participants here demonstrated the potential of editors of validators of official spatial datasets as discussed in recent literature on volunteered geographic information (VGI, e.g. Goodchild, 2007), demonstrating detailed place-related knowledge (Q16, Q17), but also differences in ontology (Q18).

Q17: The creek that goes through our property is actually not that squiggly [as on the map] and was straightened years ago. That's 25 year old information, at least!

- - -

Q18: A: Well, a watercourse, do they... well what's the definition of a watercourse? Is a watercourse that … that the water actually runs there [on the surface]?
B: It doesn't run there.
C: This one here's a private drain; closed ... water never runs there [on the surface.] It's a private [closed] drain... This little branch is also a private drain.

Figure 6-2: Straightened watercourse. The lower branch at the left was reported as non-existent. Source: (Existing corridor alternative [Map], 2008) (fragment).

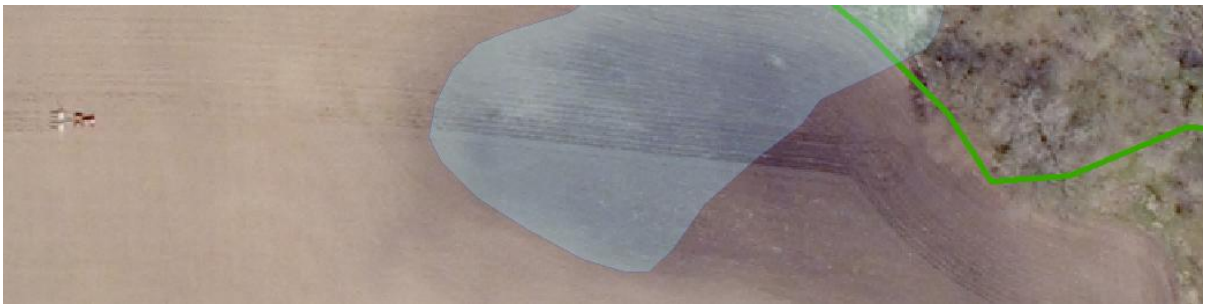

Figure 6-3: Tractor heading to a farmed 'waterbody'. Screenshot based on data layers used in HW 7 & 8 corridor alternatives maps. Note the darker colour of the soil which most probably was due to higher organic matter content caused by the historic presence of a waterbody or a wetland, and the (in this case small) overlap between 'waterbody' (blue) and wooded area (green outline). This particular example was not pointed out by participants, but was chosen because of its illustrative character.

Illustrative of the power of maps to present themselves as truthful and trustworthy representations (section 2.2.3) is the fact that it was only during the workshop that participants became aware of a level of error that both surprised and shocked them. This discovery happened late in the study process, more than two years after the Study Team had provided ABC with large hardcopy maps, and notwithstanding participants' clear awareness of the important role that water played in the decision-making process. Apparently, not only the conscious effort to scrutinize the map's data, but also the

exchange of information resulting in a group setting, was necessary to make participants aware of the level of error and the potential consequences of those errors (Q19, Q20).

Q19: A: You wonder how much… look at that little corridor that we're familiar with… how much of it is inaccurate?!

B: It's kind of scary.

- - -

Q20: A: We need sample maps to show [...] just a sample of the inaccuracies that we established by a few people with limited knowledge of the local area. Showing that their information on this stuff is flawed!

B: And they are making very big decisions based on this flawed information.

C: Well and if you look later at the [comparison of corridor] options ... They count the number [of times] they cross a water. So if these don't exist…

Water and its representation are inherently complex and are often contested issues in spatial planning and policy-making. This is related to fuzzy conceptual boundaries, the seasonal and annual variations of water-related phenomena, and the many functions and actors involved in water management (Hommes, 2008). That especially wetland mapping is not a straightforward exercise was demonstrated by Chrisman (1999), who comparing different wetland mappings in the USA, found that even in the four most compatible data sources only 8% of the area determined to be wetland in at least one of the sources was similarly classified by all four. Already during the reconstruction by the author of the reviewed study map, using the same dataset as the Study, it became clear that not only the data itself, but also the order that data layers were stacked was fundamental to the resulting map product. Many areas formed simultaneously part of the data layers on wooded areas, waterbodies, and wetlands. Therefore, depending on which layer was placed on top, an area 'became' a waterbody, a wetland, or a forest (Figure 6-4).

Water and wetlands were important issues in the decision on the location of the corridor alternatives in the Highway 7 & 8 Study. They represent an excellent example of inherent system complexity, to which ambiguity was added in the form of divergent perspectives of stakeholders. This combined complexity and ambiguity, however, makes it all the more important that a base of non-contested factual information is in place. Strong reliance on 'out-of-the-box' official, but not verified, spatial

data, in this case proved to be an unreliable approach that resulted in many errors and often highly ambiguous representations. Official spatial data, maybe especially in rural areas, thus cannot be assumed to be always current and of a consistent high quality (Goodchild, 2007). The inability to distinguish visually between what participants labelled "a road-side ditch [in which water] might flow at six inches of rain" (Q16) and for example the Thames River (approximately five meters wide north of Shakespeare), is a telling example of this ambiguity. The workshop demonstrated not only that local knowledge of residents can be a quick source to verify the reliability and currentness of spatial data, but also of the necessity of such exercises in spatial planning. It is important to note that even when an issue is of major interest to local stakeholders, this verification apparently does not happen automatically after making maps public and inviting the public for feedback. Structured and targeted exercises seem to be required to effectively incorporate local knowledge.

Figure 6-4: A frequently observed overlap of data layers. Screenshot of map by author: 'Wooded area' (green outline), 'Waterbody (blue outline), and 'evaluated wetland' (red outline), and a fragment of a corridor map covering the same area (Existing corridor alternative [Map], 2008).

6.1.3 Task 2a: Review of missing information themes

After the review of the correctness of information on the data layers of the reviewed map, participants were invited to think from their perspective about what data or information was missing altogether on the map, in order to make a balanced decision on the location of the highway corridor.

Concerning data or information that from their perspective was missing, participants indicated four partly overlapping issues:

1. The visibility and the implied importance of agriculture and agribusiness.
2. An agricultural perspective on the area's drainage system.

3. The (integrated) Agricultural Business Unit as the unit of reference to measure impacts on agribusiness.
4. More detailed information to establish the right for, and determine approximate amounts of, compensation, not only for loss of land and assets, but also for ongoing negative impacts on business operations.

Information to enhance the visibility of agriculture and agribusiness

Participants made numerous suggestions to enhance the visibility of agriculture by proposing both new content and changes in style. Their suggestions illustrated the difficulty of a radical separation between content and style in planning cartography (section 2.2.5). Nevertheless in this subsection, as far as possible, we will focus on important content that was reported as missing.

Workshop participants commented their perception of agriculture on the Highway 7 & 8 Study cartography as an almost a "blank spot" on the map. Similarly, they linked the lack of legend categories indicating different agricultural land-uses to a perceived lack of importance assigned to agriculture. This perception was based on comparing rural with urban land-uses, and agribusiness with urban economic activities. The absence of more detailed information on agriculture was not perceived as a technical shortcoming of the maps, but as a fundamental issue of politics and identity (Q21, Q22).

Q21: A: Everything important is labelled....

B: Just think about! Look at the […] map and then look the legend!

C: You're right ...

B: By default, agriculture and agricultural business units, or however you may want to define it.[…] It needs a whole subsection with, you know, categories. It's just not there! Is like a lacuna! [...] The major feature of the land is not labelled!

- - -

*Q22: What is **not** included is more important than whether the accuracy of what is included is important , because the biggest errors on these maps is the fact that things that **are** important for us aren't there at all.*

Participants' suggested a number of topics that should be included in the cartography, for the maps to be more representative of their perspective. In particular, they noted that information on the differentiation of farm types (e.g. dairy, cash crops, livestock raising, mixed farming), on lands dedicated to food production, and on the acreage and economic scale of agricultural operations and business was missing. They also noted the lack of the visibility of agricultural buildings on the map, especially on smaller scale reproductions.

The political importance of emphasizing the presence, relevance, and identity of the agricultural sector, and of showing its internal differentiation, was obvious in all these suggestions. Knowing *where* something is, as Wood (2008) expressed, also confirms *that* something exists, and the existence of issues on study maps was seen as recognizing their importance in the decision-making process (Q23).

> *Q23: [B]iologists have been hired and we know where the chorus tree frogs are, but we don't know where the agricultural business units are.*

Having 'things' on the map is important because, beyond representing their direct referent in the terrain, they can also serve as indirect *pointers*, that refer to other phenomena that cannot be easily mapped. This was clearly illustrated by a participant after a data layer created by the author that showed rural buildings more clearly was rendered visible (Q24).

> *Q24: It's too bad we couldn't differentiate between the houses and the buildings. Because the buildings are business and the houses are homes.*

Participants' suggestions, although made in an advanced stage of the study, were essentially concerned with agenda setting, a process that according to their perception had never closed.

All the information proposed by participants to be added to the cartography was supportive of arguments to spare agricultural land and agribusinesses in general. However, its use in the comparison of different corridor options trough rural areas would not only result very complex, but would also imply a series of dilemmas concerning how to value different factors. For example, it would imply value judgements such as if the loss of a certain area for organic vegetable production for regional specialty markets, would be more or less important than the loss of a industrial hog

production unit. This, of course, could easily divide the agricultural sector internally, and ABC consciously never engaged in this type of judgments.

Although participants expressed the desire that issues related to farm businesses be mapped in more detail, at the same time they referred to a culture among farmers of hiding their wealth and property. This culture would make it hard to 'reveal' concrete economic information that could sustain ABC's claim of agribusiness as a 'big business'. However, as the following dialogue illustrates, the selective and strategic use of information was seen by several participants as a practice used both by the MTO and the farming community (Q25).

Q25: A: Either you wanna be a respected as business, or you wanna hide, just like my dad, from the tax man, or whatever. Don't let them know what we've really got here. We've got to be careful, cagy…
B: You're right about that.
A: Like, it's really a game. Let's get it on the table! A game there, right? We want a review, we want to reveal, but we go to conceal… [..] just as MTO
C: We're worse!

An agricultural perspective on the area's drainage system

The Study Team's perspective on water, obviously in compliance with official policies and guidelines on the issue (DFO, 2006), strongly centered on fisheries. Additionally, from a cost and engineering perspective, the number of 'stream' crossings was considered to compare route alternatives (Ontario, 2007a; Ontario, 2009a). On the request of ABC, the Study Team created a map on field drainage that visualized the investments in tile drainage realized in most fields in the study area. This map, based on recently released OMAFRA data, was criticized by an ABC leader (personal communication) as strongly outdated. During the workshop, although important for farmers for the investments it represents, field drainage was only briefly mentioned, and the focuses of the discussion was on the system that evacuates the water once it leaves the fields.

According to several participants, deficient natural drainage once was the most important limiting factor to soil productivity in the study area, and therefore most fields are now tile drained. In order to speed up the evacuation of water once its leaves the fields, and in order to improve the efficiency of mechanized farming, many streams were straightened or deepened (Figure 6-2). A substantial number

of ditches were constructed and some streams were replaced altogether by buried pipelines. Property of, and the administrative, operational, and financial responsibilities for the drainage system in the area are distributed between private land owners, municipalities and watershed authorities. Together they make up a complex system whose properties are not easily cartographically represented

Participants pointed out that an agricultural and drainage perspective on water was altogether absent from the MTO map (Q26).

> *Q26: A: What we are hearing [in this workshop] is a lot about water. A **lot** about water. We never heard very much about water from those engineers, the consultants that put all this stuff together.*
> *Facilitator: To me it looks like water is a big issue for the MTO. Wetlands and streams seem to be important. Also, on the screening maps they count the number of watercourses a route would cross….*
> *A and B: But, it's from an ecological, a fisheries point of view. Not from a farming, a drainage perspective.*

According to participants, incorporating an agricultural drainage perspective would require a different categorization of watercourses. Such a categorization should consider ownership, management responsibilities, size, the eventual seasonality of water flows, a distinction between open and closed flows, and (the level of) their natural or man-made character.

Participants also illustrated that the perspective from which phenomena are represented on a planning map is so much not about the map being correct or incorrect *per se*, but about the sometimes very direct implications that may result from a certain focus (Q27).

> *Q27: A: […] You know, they send down guys from de Feds and they find some species of carp or something, you know, in a ditch, and the next thing, you know, you can't do anything.*
> *B: All these ditches are man-made and you can't clean them up!*
> *A: There's a huge disconnect here between one way of looking at water and how to manage it, and another way of looking at water and how to manage it.*

After the issue of drainage was raised and discussed, a data layer released by OMAFRA in 2008 on drainage was projected by the facilitators (Figure 6-5). All watercourses in the attribute table of this dataset (including the Thames River) were classified as "constructed drains" and many entries

included a drain name. This data layer, according to participants, provided an important missing perspective. However, also this dataset on water was judged as strongly outdated, and participants pointed out several drains that were observable on the aerial image, but that were missing on the map.

Figure 6-5: Fragment of projected drainage layer. Different blue shades correspond to different types of drainage channels.

The integrated agricultural business unit as the unit of reference for impacts on agribusiness

In order to both compare route alternatives and to determine fair amounts of compensation, participants noted that the Study's cartography lacked the concept of what ABC called *integrated agricultural business unit*, a functional unit representing much more than the sum of its parts. The reviewed map depicted land parcels but did not account explicitly for the fact that virtually all farm businesses are comprised of multiple parcels. These parcels can be adjacent or disconnected, rented or owned.

The issue of the explicit representation of farm businesses was not simply one more suggested theme. Rather, participants focussed on a series of more fundamental questions relating it to in how far the Study 'mapped' and analyzed impacts (also in its reports) on individualized low-level objects, or in how far it also considered more complex and dynamic entities (e.g. landscapes, farm operations), and the relationships that render those entities functional. Low-level objects (e.g. parcels, buildings, woodlots), without doubt, are relatively easy to model and manipulate in spatial analysis. This way of framing the analysis, however, has potentially far reaching implications on decision-making. For example, ABC has argued in its community reports that the criterion of agricultural land uptake used by MTO to determine impacts on agriculture was important but insufficient (Figure 6-6). This

criterion did not recognize that farm businesses are functional units that need to maintain many interlinked functions, linkages, and equilibriums to be viable.

Figure 6-6: The major indicator for impact on agriculture: the direct uptake of land. The black division lines correspond to cadastral units and not necessarily to different farm units or landowners. Map fragment (Source: Ontario, 2009b).

The evaluation of impacts on agriculture as proposed by participants, should consider issues such as for example nutrient management systems, land-livestock equilibriums, transportation links between multiple farm operations, and opportunities for future expansion tied to minimum distance requirements. A farm from this perspective is not the simply the sum of a number of parcels and buildings, but a functional and emergent entity that brings together a variety of connected resources and practices. The integrated farm business unit thus not only consists of (easily mappable) individual resources and assets, but is also the outcome of a large number of internal and external relationships. The determination of impacts of route alternatives on a farm thus is a complex issue, moreover because many impacts are not linear. For example, as one participant explained, a relatively small decrease in the land base of a farm business may cause a larger drop in its operations because of nutrient management issues. This in turn may lead to an even greater drop in profitability, which can finally make a farm business unviable. Farms hence are complex and dynamic functional units with emergent properties, and the impacts on these units cannot be taken as simply linear to the loss of, or impacts on, individual farm assets. The participant here clearly illustrated what in complexity science is referred to as ‘non-linear behaviour’ and ‘tipping-points’ (c.f. Pahl-Wostl, 2004). Overlay analysis clearly cannot model this. To add even more complexity to the issue, many farms work with long- or short-term leased lands that are vital for their functioning. The land base of many farms thus is

dynamic (ABC, 2009b:7) which makes it hard to model the long-term impacts of different routes on the viability of farm businesses.

Modelling a farm business and determining impacts on it, be it with GIS or other methods, is clearly not a simple issue, and is not only a matter of space, but also of time (Q28).

Q28: A: So the potential one solution [when the travel time between two farm operations because of road building becomes longer] is to actually do a calculation. So if you're hauling 50 loads of manure to one of your farms, and it's gonna take you 20 minutes extra per load. […] So what's the replacement cost to do that? If there is no other land available.
B: And the fact that you have to do that forever. It's not a short time thing, it's a forever thing.
C: The other thing is that once that time is elapsed you can't get it back. For instance, a 20 acre field. Say you haul 20 loads to it. Your 20 minutes extra per load. Well, there's [an extra] 400 minutes which is around six and a half hours. Sometimes that weather window doesn't exist. That means that you might not get the job done in that time frame anymore.
A: Or you gonna buy another 350 thousand dollar machine to get it done in the same time.
C: So how do you wanna put that on this map?
D: We're all apprised of the complexity of that. It's... How in the world do you show that?
E: How do you package it?

Using GIS to model in a comprehensive way the potential impacts of potential highway routes on complex and dynamic entities like farm businesses results in almost insurmountable theoretical and methodological challenges. Omitting these issues therefore altogether, given the central role of spatial analysis and maps in the Study method, however means that complex but fundamental issues such as drainage and farm transportation are easily delegated to the margins of the analysis and the decision-making process. Similar cases could be made for other complex entities, like for example 'the forest component of the landscape' or 'Shakespeare's specially store district'. These are all clearly composed and socially constructed entities whose existence and boundaries are inherently disputable.

A participant forwarded a potential solution to the problems faced in the comprehensive mapping of complex phenomena, and suggested that maps should not only be used as comprehensive technical-

analytical tools. The use of maps to construct case studies could serve to understand, illustrate and finally 'sell' complex issues (Q29).

> *Q29: What do we want to convey? To me, if I wanted to sell a problem to [the MTO] I would like to have a sample copy of producers that have a fully registered nutrient management plan, and those would be highlighted. That's an issue with litigation ... you gonna have to deal with it if you mess with those businesses.*

The goal of mapping proposed here was not the detailed comparison among different route alternatives through farmland, but, although exact quantification might be impossible, but to illustrate and make the impacts and implications associated with route alternatives through rural areas literally visible. This type of information could inform a more nuanced political discussion on the costs and merits of different route options by making issues (in this case, nutrient management and eventual compensation and legal liabilities) more tangible. Mapping here thus would serve to 'inform' or 'enlighten' a discussion, not to perform a comprehensive, formulaic type of spatial analysis. The suggestion of the participant questions to the dominant norm of comprehensiveness in rational planning, which is also reflected in its mapping practices. What cannot be comprehensively mapped or modelled is delegated to the margins as 'subjective'. However, learning about and understanding an issue, in daily life, but also in education and business practice, is often based on illustration and exemplification, and these methods are now generally recognized as valid or even fundamental. For example, Goodman (1978:32) argues that "exemplification, though obviously different from denotation (that is, description or representation), is no less a species of reference", however, one that in planning cartography seems to be generally ignored and that is not considered as valid.

The issue of the integrated agricultural business unit and the MTO's silent refusal to map them also raises political questions and illustrates a wider tendency. Most objects on the corridor alternatives map are what we could call 'low-level objects'. Urban land-use zones and wetland complexes, which are defined as such by their corresponding authorities, are the most notable exceptions. In the case of wetlands, their conception as higher level 'complexes' clearly provides them with an additional degree of protection. In this case, without asking further questions on their internal dynamics, impacts on a part of the complex, following the precautionary principle, are supposed to affect the complex as a whole. A similar logic could be followed for ABC's proposed integrated agricultural business units.

The issue is illustrative of the power-laden nature of the power to 'construct' certain entities and have them recognized as 'real' for purposes of the spatial analysis, that is, of the map's ontology. Wetlands at this moment of time clearly enjoy broad political, social and institutional support. Disintegrating a wetland complex in its constituent parts and informing that one of its parts would be taken up by road construction would politically be unacceptable. Agriculture/agribusiness does not seem to enjoy this broad support, and despite ABC's insistence on the issue, the integrated agricultural business unit never became a recognized object in the study cartography and was only marginally taken into account in spatial analysis. Land uptake in the study was measured in hectares and not by the total business area or the amount of businesses affected. Even on photorealistic maps, the map's ontology remains a largely social and power-laden issue (see Figure 6-7 for an example). On the other side, issues of privacy and the reluctance of some farmers to publicly disclose their wealth and land holdings, together with the complexity of the issue, were factors that inherently limited the scope of ABC's proposal.

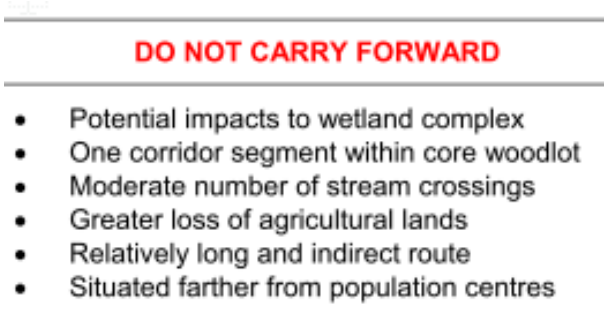

Figure 6-7: "Key" reasoned arguments. Note the mixed (and arguable) use of low and high level objects/facts on the map (e.g. low-level 'woodlot' and 'stream crossings' vs. high-level 'wetland complex') in the evaluation and decision-making process (Source: Ontario, 2009a).

The need for more detailed information to establish rights for compensation

In the study methodology the information on impacts is oriented in the first place towards the comparison between route alternatives, considering the overall impact of each route. Workshop participants indicated another, complementary information requirement that corresponded more to a private perspective: the need to recognize and determine fair amounts of compensation (Q30, Q31).

Q30: If you ask the question: 'Why [showing farm businesses as spatially dispersed but functionally connected subunits] is this important?' I think it's important because, when the actual changes happen to the highway, we need a proper way of determining compensation. It's just that simple.

One participant even considered that for many farmers compensation was the most fundamental issue.

Q31: From my perspective as a farmer, and it might not be correct… As a livestock farmer, the number one issue is the ability to talk about compensation. Any of the farms are for sale, for the most part, unless there is historical importance of some kind. It's a question of compensation.

Obviously, negotiating amounts of compensation requires information. Information however was seen not only as important to help determine the amounts of compensation, but also for, in the first place, having impacts and derived rights for compensation recognized. The participant argued that information on compensation should, at least partially, be gathered during the study, and the integrated agricultural business unit should serve as its unit of reference.

An overview of information related to impacts on agriculture, agribusiness and compensation that participants reported as missing in the study cartography, and that they suggested to be mapped (although not necessarily on the route alternatives map studied during the workshop) is presented in Table 6-2.

Suggestions of missing information to be mapped
▪ Integrated agricultural business units (as functional integrated units vs. the parcel-based perspective on the study map) ▪ Transportation links between multiple farm operations. ▪ Drainage from an agricultural and farm business perspective. Needs to distinguish between private and municipal drains because of different management responsibilities and liabilities. ▪ Land fragmentation, and the creation of irregular and thus hard to work fields (as a complementary criterion to land area uptake). ▪ High quality agricultural land (to be put not only on a thematic map as was the case, but also to be included on corridor alternative maps) ▪ Rural and farm buildings, differentiating homes and business. ▪ Information that indicates size or scale of farm businesses. ▪ Registered nutrient management plans. (These are normally very tightly crafted and are fundamental to especially intensive livestock farming; loss of land base means that the productive capacity of barns can no longer be fully used). ▪ Farm access and transportation needs for supplies and transportation of farm outputs. ▪ Private wells (not only public ones).

Table 6-2: Suggested information to be mapped related to impacts on farming and to compensation.

6.1.4 Task 2b: Contested and redundant concepts to be removed from the map.

When participants were prompted to think about information themes that were on the map, but that they would rather see removed from it, they identified the themes and arguments listed below in Table 6-3. It is, again, important to keep in mind that the comments discussed in this section do not represent a group consensus. Rather, they correspond to observations by one or more individuals that were not contested by other participants.

The distinction between *wooded areas* and *core wooded areas* was not considered by any of the participants as meaningful. Several participants questioned the assignment of a higher value to the core areas, based on what one participant considered a "totally theoretical concept" with "no real value". Another participant argued that the concept was based exclusively on the significance of core woodlots for certain bird species, but that its use for a general classification of the importance of wooded areas was unjustified and lacking scientific support.

Map theme	Reason for suggesting the theme's removal from the map
'Core wooded areas' as distinguished from 'Wooded areas'	The meaningfulness of the distinction between the two categories was contested. Core wooded areas were seen a receiving too much weight in decision-making, and as virtually untouchable for any potential highway corridor.
Property lines	Suggests that each property is a farm. Makes agriculture look 'small' and 'static'.
Development clusters	Confusing, not a well-known or well-defined concept.
Moraines	Lacking perspective or background information for interpreting their meaning
Pits, quarries, and landfills	Lacking perspective or background information for interpreting their meaning
ANSIs (Areas of Natural & Scientific Interest)	Lacking perspective or background information for interpreting their meaning

Table 6-3: Themes suggested to be removed from the map (See Appendix C for a legend of the reviewed MTO map).

Development clusters, a concept that is not defined in the study documentation, was considered by several participants as an unclear and confusing concept that did not have any meaning to them. Therefore it was considered as redundant. Although visually quite prominent on the earliest versions of the corridor alternatives maps, development clusters disappeared from later versions of these maps, without further explication in the study reports. The quotation that follows illustrates the confusion that this undefined concept caused among participants (Q32).

Q32: A: Those development areas... put a little line around it and forget the colouring.

B: Are they really development areas, though? What's the definition?

A: Those yellow lines... it makes them look like ...

C: It makes them look very important, and they are not.

D: No. Find a different colour!

2 participants: They shouldn't be there!

E: Well, the terminology is wrong. It should be 'filled up areas' instead of development clusters.

C: It should say 'developed areas' instead of 'development areas'

Although many participants did not seem to be very familiar with the meaning of the term, *Moraines* in themselves were not a contested issue. However, a few participants argued that they were redundant on the map, because the Study did not provide information on their relevance and had not assigned them a clear role in the decision-making process (Q33).

Q33: But we need to know how [these moraines are] categorized. There are moraines all over Ontario, but the Province has identified some as being significant, as water recharge areas, and others as just moraines. So these [on the map] might be just moraines; just like we are just sitting in chairs.

Participants thus not only expressed the need for clear concepts or definitions of the mapped objects, but also for a clear description of their role in the analysis and finally in the decision-making process (Q34).

Q34: [Pits, quarries and landfills are not clearly distinguishable on the map] And that's the same with the moraines and the ANSIs and the moraines; they have got no categories, no perspective. So it's useless.

Of the information suggested to be removed from the map only core wooded areas and property lines (discussed in the next subsection) were clearly contested by several participants. In all other cases, the concepts themselves, or their implications for the decision-making process, were not clear to them. In some cases (e.g. in the case of ANSIs, landfills), this could be attributed to participants' incomplete consultation of the study reports. In other cases, however, the concepts or their implications for decision-making were not clearly described or justified in the study reports (e.g. moraines, wooded and core wooded areas) or not discussed at all (e.g. development clusters). Participants' comments thus can be interpreted as indicating the need for an intermediate layer of information, somewhere between the very brief and (formally) purely denotative map legends and the very extensive study reports, whose consultation takes considerable amounts of time.

Importantly, it was noted that participants' engagement with identifying information to be removed from the map was not nearly as strong as with what they considered to be missing on the maps (see also Q22).

6.1.5 Task 2c: Review the graphical style on the map

When reviewing the graphical style of the map, participants sometimes focused on the overall broad impressions that they derived from the map image as a whole (Q36), while in other cases their attention was drawn to specific details (Q35). The vast majority of the comments on style issues were related to the perceived importance (or lack of importance) of certain information themes.

Q35: A:[Facilitator,] can you narrow-up the blue lines for the watercourses?

B: Because a lot of them are really just an open ditch, and there's not much water in them

A: Yeah, they're not major rivers.

More specifically, most comments indicated a perceived lack of importance given by the Study to agriculture and agribusiness (Q36). In several cases, notions of missing information and perceptions of style were hard to separate (Q36).

Q36: A: [W]hen you look at that greyish tone in which agricultural lands are on the map], to anyone who'se not a farmer that just looks like blank canvas. To draw the highway through.

B: A parking lot!

A: It looks as a parking lot, and there's nothing going on there!

Several participants commented that they would like to see the *property lines* removed from the map. This, not because of the information in itself was contested, but because of the resulting visual perception. They feared wrong interpretations of other map readers who could unconsciously equal property lines (not included in the map's legend) with the almost invariably much larger farm businesses. Several participants argued that the property lines communicated a "static" and "antiquated" image of agriculture, an "old ma and pa show, [as if] agriculture has always stayed the same", which impeded an appreciation of "how huge" and "how connected it all is", "because a lot of these farms are four, five, seven hundred acres". After removal by the facilitators of the property boundaries on the projected map, participants expressed that the map image conformed better to their expectations (Q37).

Q37: A: It's a huge difference.

B: Now it looks if agriculture is more a complex, like a patchwork of clothes, rather than just chunks of... parcels.

[...]

B: Right! It looks like Saskatchewan!

This example clearly illustrates that maps are not just carriers of factual, denotative information, and emphasizes the importance of the 'look', 'feel', or the overall intuitive impression a map causes on a person that are affectively involved with the represented area. In this case, several issues were at

stake. First, several participants perceived the property lines as communicating a sense of disconnectedness. That what participants considered functional, integrated and valuable farms businesses, became "just chunks of … parcels". Their representation did not convey ownership, function, importance, or linkages. As a counterproposal, a participant evoked the metaphor of a "patchwork of clothes", of pieces, each with its particular value, texture, and history, that are carefully stitched together to form a complex and valuable whole. The map image, for them, did not correctly represent what agriculture 'is'. Second, there were concerns that the impression of small farms might negatively affect agribusiness in the decision-making process, since it did not communicate an image of an economically strong and socially relevant sector. Closely related to this, also the issue of the identity of those who 'inhabit' the map', was clearly at stake. Participants wanted to be considered as owners of successful businesses of a considerable size. This perception is much in line with the main tenor of ABC's Community Reports, the metaphor of an "agricultural powerhouse", and even the committee's name (ABC, 2008).

The issue of property lines thus was another illustration of the fact that the line between style and content in planning cartography is often hard to draw. Although the information on the map on property lines was objectively 'true', and the concept itself was not contested by participants, it caused a visual effect concerning a number of issues that were fundamental to participants. For closely intertwined intellectual and emotional reasons they strongly disliked this visual effect.

Figure-ground is an important concept in cartography where the mapmaker, consciously or unconsciously, separates that what is important (figure) from that what is context or background information (ground) relative to the map's message. One participant referred explicitly to this principle and illustrated how the line that divides the style of a map from its content is often a blurry one. This participant, quite emotionally, ventilated frustration concerning how agriculture served as the background image of the map; a background on which supposedly more important information was prominently displayed in the form of vector layers and that moreover were included in the map's legend (Q38).

> *Q38: The major feature of the map [agriculture and agricultural business units] is not labelled! It's, God, like yeah! It's like figure-ground, eh. You could just take this and flip it a completely different*

way, and the rest of this would just become, you know, 'OK there's a concern, that's a good...' You wanna eat? Look left! You want it developed? Look right!'

This figure ground-perception was clearly linked to a perceived lack of importance given to agriculture (the ground) and this in turn was perceived as conducive to new route alternatives through rural lands (Q39).

Q39:A: They define everything that's on the landscape, except for one exception, like you've got the woodlots, you've got your water bodies, you've got your urban areas, but you don't have agricultural land [on the legend].
B: Yeah very good point!
A: I've always read it like that. That means that by default that agricultural land is the number one priority area for [highway] development.

Not only the perception that agriculture was 'only' present on the map as the 'ground' in the form of aerial images, and not represented as 'figure' by means of vector layers with legend entries, drew participants' attention. Also the impression left by the nature of the aerial photography itself drew the attention of participants[4]. Clearly, they felt that the dull and lifeless image of the bare fields in early spring, communicated little worth compared to the green and golden looking fields that would have been observed in the summer or early autumn (Q40):

Q40: A: The whole landscape just looks dull! Because it's all grey and muted. So to say that that is valuable... it isn't the impression you get.
B: Yeah, making it rich and fertile.
[...]
A: It just doesn't... it could be a desert... it doesn't convey value.

This example clearly illustrates that maps cannot be considered as simple representations of the mapmaker´s concepts or values projected on the landscape. The map production process and its inputs -in this case, the only high resolution aerial images known to be available for the area- clearly left

[4] The colour impression left by aerial image depends to a certain degree on the reproduction method. Although the colours of the images, taken in early spring, without doubt are dull, projection during the workshop led to a less than average liveliness of colours and contrasts. Aerial photes are taken in 'leaf-off' spring to allow for the visisbility of structures, roads, streams, etc, that in other seasons could be obscured by vegetation.

their own traces of meaning on the map. It is also worthwhile realizing that different printing, reproduction, and projection techniques can substantially change the impression left by these types of images. In a case like the HW 7 & 8 Study, this factor in practice is virtually outside the control of the mapmaker. Additionally, the scale of reproduction is of substantial influence. Where e.g. on larger-scale reproductions rural buildings are clearly visible, on smaller-scale maps the rural landscape looks virtually uninhabited (Figure 6-8). Hence, the impression a map causes is only partially under the control of the mapmaker. Although photos are cultural icons of objectivity (Barthes, 1977), "photorealistic" maps do not necessarily bring us closer to a "truer" (neutral, objective) representation of reality, and even photographic images seem to lead their own life on a map.

Figure 6-8: Detail of SWOOP (Southwestern Ontario Orthophotography Project) 2006 areal image with 30 cm. resolution, and a fragment of a small scale corridor map using the same imagery (Existing corridor alternative [Map], 2008) (fragment). As illustrated by rural buildings, scale and the resolution on the actual reproduction strongly determine *what is* and *what is not* (visible) on the map.

Apart from referring to the overall colour tone of the aerial images, participants made several observations related to the use of specific colours and their associated meanings. Some colours are widely used in culture-specific but commonly used metaphorical language, and some of these colours were referred to by participants. As the quotation that follows shows, the use of colours is often not only conventional, but at the same time can be highly value-laden (Q41, Q42).

Q41: [M]ake [the farm buildings] green. Environmental friendly, you know. [laughs].

\- - -

Q42: Agricultural [land] looks like a blank canvas. To draw the highway through.

Ignoring common cartographic conventions, colours were also interpreted in an iconic sense, and evaluated based on their resemblance to 'real life' colours (Q43, Figure 6-9).

Q43: A: Make the wetland a different blue, then... that dotting doesn't work. That dotting is not contrasting enough. It looks like if there's all that water there. Visually it just isn't right.

B: Make the wetlands a different colour of blue...

C: Brown! Muddy...

(Wetlands are rendered brown by the facilitators)

C: That looks more than it actually is …

A: (Seeing that it takes several steps to change the default symbol for wetlands) Even this program is biased [laughs].

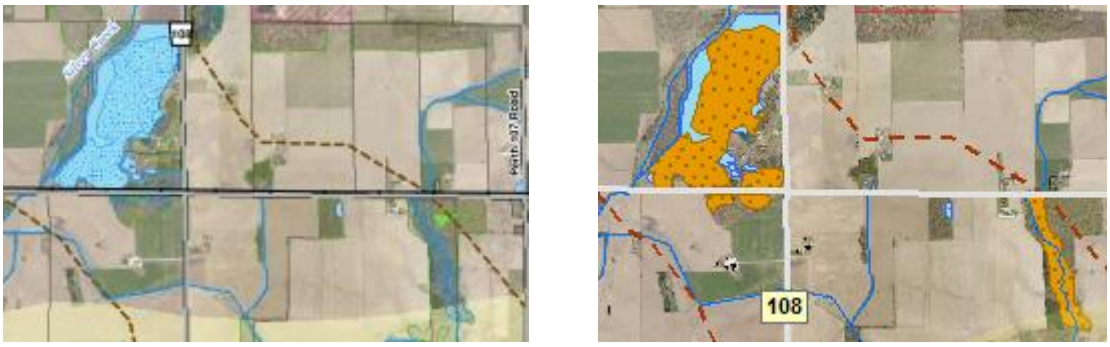

Figure 6-9: Illustration of a proposed alternative rendering of wetlands by a participant. Left: original map fragment (New corridor alternatives [Map], 2008). Right: proposed alternative rendering by a workshop participant considered to be closer to how "it actually is". Note also how wetlands not superimposed on waterbodies were hardly visible.

However, in this particular case the issue may not be solely one of detail and ease of understanding (contrast). Although many colours are valued differently by different people, blue is the colour that is valued most consistently and is generally positively valued as pleasant and agreeable (Brewer, 2005). In the study cartography, the wetlands layer was a transparent polygon filled with blue dots stacked on top of the waterbodies layer. Wetlands therefore were blue. More than a conscious decision of the human mapmaker, the map here most probably reflected cartographic conventions and default settings of the GIS software. However, as the participant pointed out, these conventions are not necessarily neutral (Q43).

Line thickness, and in the case of polygons also the presence of outlines, was unequivocally related to importance. Participants in various instances asked themes they considered to be given too much importance to be rendered with thinner lines (Q35) or, in the case of polygons, without an outline (Q44).

> *Q44: [B]ut the outline [of wooded areas] is gone, I like that better. It doesn't give them any more importance [than farmland].*

For a discussion of the stylistic use of the "broad brush stokes at the map" and their meaning to participants see section 6.1.1.

Cartographic style cannot be clearly separated from a map's content. Although sometimes in different ways, participants linked meaning to stylistic issues in ways quite similar to the presences and absences they commented upon. In many cartographic textbooks with a focus on the communication of information this issue is however largely ignored (see Krygier and Wood (2005) for a notable exception). Participants' associations of style issues with meaning always implied a value judgement. Some of the associations and judgements observed during the workshop might be hard to predict, and some style issues, e.g. the value assigned to the "broad brush strokes", were interpreted differently by different participants. In many other cases however, participants' reactions coincided clearly with cartographic textbook knowledge and commonly used metaphors. Many style effects thus seem to be reasonably predictable. Visual emphasis, visual contrasts, bounding and separation, but also some spatial and colour metaphors are examples observed in the workshop. In these cases, style issues may reveal more about the conscious or subconscious ideas and value judgments of the map maker than about the 'represented' landscape itself. Exercises as carried out during the workshop can be instructive for stakeholders to learn not only to reflect on their own perceptions of the landscape, but also to learn about those of the mapmaker. Therefore they can play in role in the process of reframing issues as proposed by Schön and Rein (1994, see section 2.4.2). At the same time, conscious and cautious use by the mapmaker of basic knowledge on style issues will not necessarily foster agreement between stakeholders, but certainly can avoid unnecessary misunderstandings.

6.1.6 Task 2d: Review of text boxes on the map

All the corridor alternative maps used in the Study included text boxes that can be considered as reflections of how the Study Team made sense out of certain aspects of the map and/or as suggestions for map readers on how to read -that is, make sense out of- these maps (Figure 6-10). Also, they can be considered as a mid-point between the very condensed information on the map image and the extensive texts of the study reports, as was referred to in section 6.1.4. Participants were shown three text boxes that provided comments on different corridor options in the Shakespeare area, and they were invited to comment on how they made sense out of them.

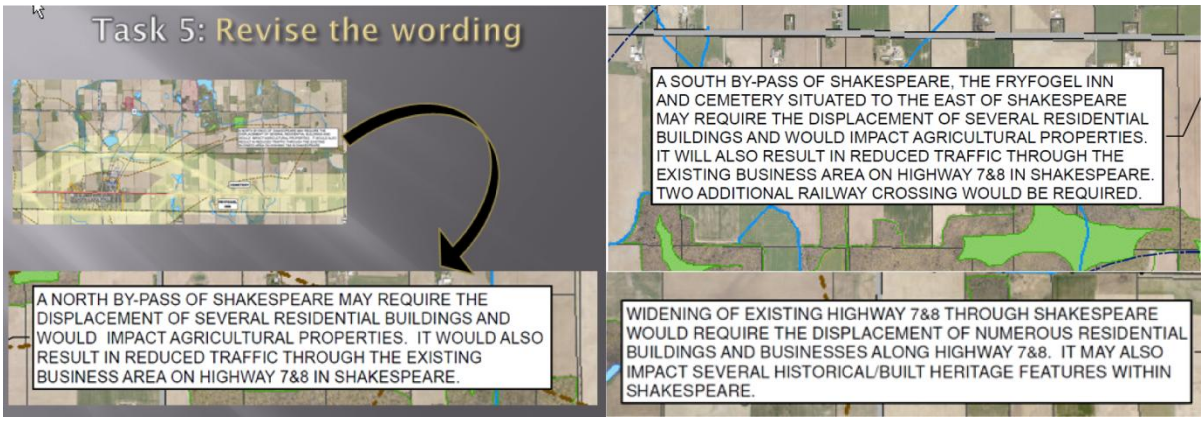

Figure 6-10: Slides used during the workshop showing text boxes commenting on route options in the Shakespeare area taken from corridor alternative maps.

Opinions concerning the meaning of the text boxes were strongly divergent. One participant saw the text boxes as 'leading' the map readers towards certain conclusions (Q45), while several others emphasized their broad, ambiguous character and expressed the wish for clearer and more concrete information on how the Study Team valued different corridor options (Q46).

> *Q45: In a way I think they are leading. They lead you, to say 'OK, because of these impacts this is a better route, or this is a worse route', or something like that. When you read all of them... you kind of weigh... OK, well this is going to impact more people than this one is going to impact. So you know this one is going to be a better route.*
>
> - - -

Q46: [T]hey should have the data. If they gonna do this they should be able to say X route will impact four buildings built in 1843, two built to in 1979. Like this is just too [...] too broad, too broad. They shouldn't be able to use the word 'may' or 'would' [in their reports and or on their maps].

Various participants expressed distrust, strong emotions and irritation concerning the perceived ambiguous character of the text boxes (Q47 - Q50).

Q47: I think, reading all three [textboxes on different corridor options in the Shakespeare area] … it pits one side against the other. Because the north and south bypass [text boxes] say 'several residences and several agricultural properties'. And the other one says 'numerous residences and businesses'. It is putting the Shakespeare residences and businesses in the middle box, saying let's go the other route, and the other two boxes saying, well lets ... you know? It's pitting the people reading this against each other, as opposed to the consultants taking the responsibility.

- - -

Q48: I find them (the text boxes) to be a veiled threat and a lot of afterthought. Like, you know, this may happen. It's very anxiety provoking for people to read this.

- - -

Q49: I find them very distracting. You know what they did to me? I got so crossed when I read those; I said to [one of the Study Team members] 'whose stupid idea was this?' Because I was furious! […] They made me so cross, because it was all negative and completely distracting. I think they didn't want you to take a look at the route; I think they wanted you to read those things.

- - -

Q50: The tone of all of them ... is that they are musing. About the impacts. [...] But the people that stand there [in a Public Information Centre], and look at and read the maps, it's not about musing. It's about emotions! The people are coming and looking at those maps they think: what the hell is going to be done to my community, my property, my house? Or whatever. But those statements, they muse, you know. [...] It's kind of like Damocles' sword hanging there in the air. Who is it going to drop on? Well we can muse... it might be this... it might be... the Fryfogel [Inn]... or the agricultural properties... And it is worded in a fuzzy, non specific way too. And I think they justify it because they say 'we're just talking about corridors; we're not talking about routes. When we get to route planning we gonna tell you, well this tree is going to be cut down, or that houses go to be levelled. But this musing, it really

bothered me when I read these originally! God, it's all up in the air. It could be anything, we could go anywhere.

From these comments, it is clear that participants either expected the opportunity to form their own opinion in an unguided way, or (and clearly not contradictory) expected clear, unambiguous information and judgements of the Study Team. The textboxes on the corridor alternative maps seemed to have contributed to an uncertain and emotion-laden environment. Given the high stakes of farmers this resulted in anxiety and frustration.

Participants' comments were also illustrative of how map readers in an emotion-laden situation can focus on what most map readers and mapmakers would consider minor details and choices that might even be purely guided by inevitable and practical map design constraints. Every detail seemed to imply, a real or imagined, value judgement (Q51, Q52).

Q51: Why don't they put [these text boxes] right on the town of Shakespeare, instead of on the agricultural land?

- - -

Q52: [This text box] talks about agricultural properties, instead of agricultural businesses.

6.1.7 Some observations on the map's legend

Due to time constraints, and since the issue was covered in the questionnaire, no explicit review of the legend took place during the workshop. However, participants made some insightful comments referring to the legend. First, participants asserted that the presence of an issue on the map's legend, just as its presence on the map itself, implied a recognition of the importance of that issue. The legend was thus seen as a key issue in setting the agenda of the planning process. Participants perceived that the legend of the reviewed map (Appendix C) indicated that little importance was given to agriculture and expressed an urban bias. For example, participants argued that urban recreational needs received more importance than rural livelihoods (Q53).

Q53: A: Yeah, and that's the case! And you've got all the entrances, except those for agriculture, captured here. Pipelines…

B: Golf courses!

C: Golf courses!

A: Golf courses, moraines...

E: You name it we've got it!

F: Don't do anything with the golf courses! [Various participants laughing] Don't touch the golf courses.

Finally, a participant who was impressed by the power of maps to communicate a sense of reliability and truthfulness indicated the need to have metadata on the legend which should inform on the currency and completeness of the data displayed on the map (Q54, Q55).

*Q54: Here's the danger in the maps, because maps are power. So you plot things on maps and they are not comprehensive in nature, they have to be **clearly** labelled samples, or else they make the assumption that everything is included. Right? And then it's almost more dangerous than if you don't have the information.*

- - -

Q55: Now that would be important to have on the map: that this building information is 2006. And […] that the latest update on the watercourse information was 1975. You see the difference? Then you could use that in the weighting of the criteria. Well... this is outdated information, so...

6.2 Questionnaire

The questionnaire distributed at the end of the workshop, was partly a response to time constraints in the workshop. More importantly, it also aimed at providing deeper insights in participants' individual appreciations on the way phenomena related to agriculture where classified and named by the study team, and on the estimated impacts of these choices on the decision-making process concerning the location of the highway corridor.

On a first reading of the answers of the questionnaire (Appendix B) it became apparent that participants' level of agreement on the labels and categories, as expressed on the Likert scale in the first part of each question, was not always consistent with the comments they provided on their choice. Out of a total of 66 answers, 10 were not interpretable or demonstrated a clear contradiction between the rating on the Likert scale and the content of the comment. In most of those cases participants seemed to express judgements concerning the *importance of the phenomenon* the

question referred to, and not regarding their level of agreement concerning *the appropriateness of the labelling or classification* in itself. Similar doubts arose concerning some answers regarding the perceived influence of the map´s classification or labelling scheme on objectivity or balance in the evaluation and decision making process concerning corridor options. Where contradictions between the answer option (yes/ no/no opinion) and the comment on the motivation of the answer choice arose, answers mostly seemed to correspond to a judgement regarding *the level of influence per se* of the classification or labelling on the decisions making process, and not -as was the intention of the questions-, if this influence was conductive to *objectivity or balance*. For the above reasons, in the sections that follow only the rich qualitative information provided by participants is examined.

6.2.1 Wooded and Core Wooded Area as 'Significant Natural Heritage Resources'

Wooded Areas and Core Wooded Areas in the study cartography received the overarching label 'Significant Natural Heritage Resources' by placing them on a thematic map with that title. This item was included in the questionnaire since many wooded areas in Ontario, varying from relatively natural forest remnants to tree plantations, are managed by farmers. Following Latour (1993), it can be argued that even both extremes of this spectrum are better understood as nature-culture hybrids. The questionnaire explored the extent that the Study Team's framing of wooded areas was shared by participants, and what they thought the chosen frame might imply for decision-making concerning the location of the corridor.

Out of eleven answers two were not interpretable, since they did not express the personal views or judgments of the participant on the statement. Seven comments expressed concerns on the implications of the label 'significant natural heritage' for decision-making. These comments expressed a fear of overvaluation of these areas in relation to farmland (Q56), and some argued that the label '(natural) heritage' made the wooded areas virtually untouchable (Q57).

Q56: Because of this text ['significant natural heritage'] wooded areas are given heightened importance over farm land.

- - -

Q57: The word 'heritage' means 'to stay away from at all costs'.

One participant clearly expressed agreement with a view of wooded areas as a ‘natural’ and ‘inherited’ resource and the implied emphasis on its preservation (Q58). Three participants explicitly expressed that they did not consider the (core) wooded areas a ‘natural’ resource, arguing that (at least) part of them is planted, managed and harvested (Q58, Q59). Two comments also referenced to these areas as not necessarily ‘old’ and thus contested the ‘heritage’ element of the label, which implied that these areas were inherited from past generations.

The four comments below four reveal a sliding scale of participants’ perceptions concerning the perceived ‘naturalness’ of wooded areas (natural - hybrid - cultural) as opposed to a radical nature-culture dichotomy (Q58 - Q61).

Q58: Most of these areas are natural, existing in or produced by nature. Most are inherited. We did not plant them. They are a resource for the environment. As a society we want to preserve ‘natural’, we want to keep our heritage and manage our resources well.

\- - -

Q59: I agree that they are a 'natural resource' to be harvested or managed.

\- - -

Q60: The woods in our area are all harvested from time to time both for firewood and for saw logs. They are NOT natural -some have been planted.

\- - -

Q61: They are a crop, like corn or beans.[...] They are trees, even though they may be planted close together.

Participants comments illustrated a wide range of perceptions not only concerning the ‘factual’ level of ‘naturalness’ of wooded areas, but also concerning the value of those areas, something that was also observed during the workshop. Perceptions ranged from a resource to be simply exploited for the benefit of man (Q61), to a valued heritage to be managed under the concept of sustainable use (Q58).

Two comments explicitly referred to how the choice of the term ‘natural heritage’ could influence the decision-making process on corridor options (Q62, Q63).

Q62: It gives [wooded and core wooded areas] a higher standing. If a map title said 'poisonous snake habitat' it would produce a different impression than 'natural heritage resource'.

Q63: [The wording 'Significant Natural Heritage Resource'] socializes the stewardship of woods, implying that the woods are common provincial heritage, but the liability and stewardship still rests with the individual owners.

Participants´ opinions on the perceived level of naturalness of 'wooded' and 'core wooded areas' as 'significant natural heritage' were found to be highly variable. With respect to the decision on the location of the corridor route, most participants perceived the term 'natural heritage' to be highly value-laden and leading to an overvaluation of wooded areas in comparison to farmland. Of course, in the study context, giving importance to wooded and core areas has important and uncertain implications for farmers. On the one hand, their importance may serve as an argument against new corridor alternatives through rural areas. However, in case of opting for new corridors through rural lands, their importance might favour route options that take up arable land as opposed to wooded areas. Participants' comments focussed on the second aspect: the fear that wooded areas are overvalued in relation to farmland, and that farmland might be sacrificed to spare wooded areas.

Out of the comments emerges a view of wooded areas as neither simply natural nor cultural. A less bipolar perspective on the natural or cultural nature of the resource could be supportive of a more nuanced discussion of the functions and importance of these areas. This in turn could lead to more flexibility and more nuanced decisions in the design of corridor options. For example, some woodlots might be unique and relatively natural forest remnants, while other planted areas might be easily replaced by newly planted areas. The participants' observations also make it clear that wooded areas are neither simply a public nor a private resource, but that both interests in the resource co-exist and should be considered. The Study clearly emphasized a natural-public perspective, that was contested – although in different degrees and ways- by most participants .

6.2.2 Areas with tree cover categorized as 'wooded area' or 'core wooded area'

Wooded areas on the corridor alternative maps and on a thematic map named 'Significant natural heritage resources' are classified as either 'wooded area' or as 'core wooded area'. Core wooded areas are those areas that are at least 100 meters removed from the edge of the forest or woodlot. The remaining area that surrounds the core is classified as 'wooded area' (Figure 5-3).

Since the answers of the others six respondents referred to wooded areas in general without explicitly discussing the distinction between 'core' and non-core areas, the information presented here is derived from the answers of only five participants. The answers suggest that the formal implications of the distinction between *core* and *non-core* wooded areas was missed by many, or maybe even by all participants. Finding out that none-core wooded areas were not a formal criterion in the decision-making on the location of the corridor required detailed consultation of the study reports. Although all participants realized that core areas were considered as *more* important, many perceived that wooded areas in general were considered as more important than agricultural land. This (wrongly) perceived bias was further reinforced by the 'creation' of even more important core wooded areas.

In terms similar to the discussion in the workshop, the distinction between *wooded* and *core* wooded areas was not seen as conceptually meaningful. Participants' answers expressed disagreement concerning the major importance assigned to core wooded areas and the (perceived) implications for the decision-making process (Q64, Q65).

> *Q64: The legend does not explain the difference [between wooded area and core wooded area] and it is a subjective statement without fact.*
>
> - - -
>
> *Q65: The core is not more important than the rest of the wooded area. Areas with dark green cores look more important, to stay away from, than smaller areas with no core.*

One participant expressed disagreement not necessarily with the concept of 'core wooded area' as such, but with the poorly justified employment of its use in the study context (Q66).

> *Q66: [The term] 'core wooded area' implies a higher significance without an explanation … [It] is an academic category and may or may not be arbitrary. [The category is] related to bird reproduction. BUT, are these bird populations important? And, for what reason?*

The concept of a *spatial core*, in combination with a very general and very briefly discussed concept of these areas as "a sign of woodland health" (Ontario, 2008c:26), is a good example of the common use of metaphors on maps. In the Study, the idea of a spatially defined core was metaphorically extended in a far reaching way, in the sense of (only) the core being *essential* to be conserved. Participants however perceived the 'core' as receiving even *more* importance than ´non-core´ areas,

which according to their perception already received much weight. However, the distinction between core and non-core areas actually served to take away importance from the non-core areas. Non-core wooded areas on the map were delineated only by very discrete and hardly visible green lines, and in the decision-making criteria non-core areas were (at least formally) not considered as an obstacle for the location of a corridor. Participants however seemed to be somewhat overwhelmed by a fear that all woodland somehow competed for importance with farmland. Possibly led by this fear, they 'missed' a clear 'clue' on the map, which could be confirmed by consultation of the decision-making criteria in the study reports.

6.2.3 Watercourses labelled as 'streams' and 'aquatic resources'

The watercourses in the study area are labelled as 'streams' on a thematic map named 'Aquatic resources'. These streams are then classified as either *permanent* or *intermittent* and, additionally - according to their thermal regime for fisheries- as *coolwater* or *warmwater*. This, together with the placement on the corridor alternatives of 'watercourses' in the legend group 'natural features', indicated a strong nature- and fisheries-oriented perspective on watercourses. This 'bias' was extensively discussed by participants during the workshop (section 6.1.3). The used classification was closely related to the MTO fisheries guidelines that are based upon the controversial (DFO, 2006) MTO/DFO/OMNR Fisheries Protocol that replaced an earlier (1993) protocol between DFO, MNR, and the MTO. Closely related to the federal "Smart Regulation" initiative and strong cutbacks in DFO staff and budgets, the new protocol puts more substantially more responsibility and discretionary power in the hands of MTO, also because compliance of the new guidelines became enforced through "self screening". Obviously, the MTO has a strong interest in publicly demonstrating that the regulations of the protocol, which according to the Environmental Commissioner of Ontario (2008), was "undermined by crippling cutbacks" is strictly adhered to.

The questionnaire explored the degree to which the participants shared the perception of watercourses as "natural" features, and how they judged the influence of this perspective on the decision-making for the location of the highway corridor.

Out of ten, seven answers expressed that the map failed to express other perspectives on water courses that were deemed important by participants. Agricultural drainage was mentioned most frequently, but one participant also mentioned the importance of water courses for preventing the

flooding of urban areas, maybe also because parts of New Hamburg suffered severe flooding in the early spring of 2010. Three participants mentioned the severely outdated character of the data, an issue already discovered during the workshop, and another three comments made mention of how many largely natural streams were canalized and converted into highly artificial and intensively managed drainage channels. These measures, as was pointed out during the workshop, involved the straightening of meandering watercourses, their relocation to make them follow field boundaries or roads, and sometimes even their replacement by closed pipes.

Three participants perceived that the term 'streams' conveyed the impression of relatively big watercourses, and by implication as more important than they 'really' are. (All watercourses were symbolized with a line of a uniform thickness; see final part of section 6.1.2). By stating *"Aquatic resources for "who"? Sounds like an urban water resource concern"*, one participant suggested that concerns for water came exclusively from a nature and fisheries perspective. This exclusivity was clearly not shared by all farmers. The participant´s comment is also illustrative of how farmers often perceived the Study as a struggle between urban and rural interests and perspectives; a struggle in which they believed the former had undue influence.

Water management is a complex and multifaceted field that is generally characterized by both *uncertainty* resulting from uncertain knowledge and the often multiple roles that waterbodies and watercourses fulfil, and by *ambiguity* resulting from the multiple perspectives of different stakeholders (section 2.3.4). In the questionnaire as well as in the workshop, participants expressed a perspective on water that did not contradict the prevailing natural and fisheries perspectives adopted by the Study. Instead they complemented this perspective by emphasizing a dimension that is vital for their businesses, namely that of agricultural drainage. Together with the flood control issue, both the fisheries and the agricultural drainage perspectives illustrated the multi-functional and multi-stake character of the watercourses in the area. The study cartography clearly did not reflect this complexity and multiple perspectives.

To better understand drainage in the context of the HW 7& 8 study, according to several participants, a classification of water features should include categories that reflect diverse drainage functions and management-ownership roles. Such a classification could include categories such as 'open municipal

drain', 'private ditch', and 'closed private drain'. The inclusion of such a perspective would not only require updating the existing official information, but also the creation of new data that is more specific and detailed. The latter, in order to build upon the formal and experiential knowledge of farmers and other water managers, would require direct collaboration with farmers, municipalities, and watershed authorities.

Drainage as a system of interconnected flows, where impacts might spread through the network, is a good illustration of the limitations to predict impacts using the overlay analysis method employed in the Highway 7 & 8 Study, and one that farmers were very concerned about, given the potential implications for farming. More reliable predictions of impacts on drainage would require a form of (more complex) network modeling that would inevitable have to make use of local knowledge by the day-to-day private and institutional managers of the system. While a reliable prediction of impacts of route alternatives on the drainage system in practice might be very hard or even impossible, the issue serves as a warning that the overlay modelling technique might better be used to inform discussions on complex issues than as a direct and rather mechanically applied indicator to compare different corridor options.

6.2.4 Agricultural lands categorized in terms of their Canada Land Inventory (CLI) Class and their drainage status

The study cartography includes a thematic map with the title 'Agricultural soils' in which lands are categorized according to their Canada Land Inventory (CLI) Class for Agriculture. The CLI inventory was started in 1963 by the federal government, and ninety percent of the mapping was finished by 1975. The CLI project used what is often considered the world's first operational GIS, and classified land according to its inherent capabilities for agriculture, forestry, recreation, waterfowl, ungulates, and fish. Its current custodians claim that the CLI, because of its ecosystem-based approach to land classification, is a (sic!) "timeless data base" (CGDI, 2010). Preservation of CLI class I, II and III lands, the best agricultural lands in the classification system, is a provincial policy goal. Initially, the uptake of CLI Class I, II & III lands was the only criterion related to agriculture that was used for the evaluation of corridor alternatives (Ontario, 2009a:29). Virtually all land in the study area, with the exception of wetlands, is classified as Class I or II, with Class I lands compromising the vast majority. After ABC drew attention to the large investments in field drainage infrastructure and to

how drainage increased land productivity and value, a map on field drainage based on data released in 2009 by OMAFRA was included in the Study, and investments in field drainage were also included as a criterion in assessing a short list of corridor alternatives (Ontario, 2009b: 39).

Participants' opinions concerning the adequacy of classifying agricultural lands using (only) the CLI classification and the land's drainage status were diverse. Two participants expressed agreement and emphasized the importance of conserving high quality agricultural lands, and the importance of field drainage (Q67, Q68).

> *Q67: Agricultural lands [CLI Class] #1 is not replaceable and should be reserved for agricultural use / food production. Development should happen elsewhere when possible.*
>
> - - -
>
> *Q68: A lot of people would not understand that CLI I is very high quality land for producing food, somehow the label should need to include this.[…] You can't replace this land, just like the water and trees can't be replaced.*

Five other participants expressed explicit disagreement. They, however, did not deny the importance of conserving high quality lands or drainage investments *per se*, but emphasized that the value of land for an agricultural business is largely determined by other factors that are not considered in the Study (Q69 - Q71), and that non-drained land may be as valuable as drained land (Q72).

> *Q69: The land provides the base for the business of agriculture. The action of systematically tiling [draining] the land makes it more "valuated" from an economic perspective. [But] the management of the land, e.g. fertilizing, crop rotation etc., makes it the "business of agriculture". If you are simply identifying the raw resource then mapping Class 1, 2 & 3 land is extremely important.*
>
> - - -
>
> *Q70: The CLI is an older system of classifying lands that may not be as discerning of the differences in productivity of agricultural lands as it implies that it is.*
>
> - - -
>
> *Q71: [This land use classification] has no indication of income generating capacity, especially on livestock operations.*
>
> - - -

Q72: The drainage status is irrelevant. Fields that are not tiled can also be important. Also these fields are part of a business; not JUST land. They support the livestock on that farm. [...]. A lot of the undrained land is just as valuable. Sometimes it does not need to be tiled; it drains naturally, so it may be more valuable.

One participant indicated that CLI data should not considered as timeless (Q73).

Q73: Drainage can increase the value of land capability, so land that is systematically drained can move from a Class 3 to Class 1 with proper management.

Although probably no farmer in the study area would negate the importance of protecting high quality agricultural lands and investments in field drainage, from participants' comments emerges a more nuanced and complex image of the value of agricultural land. This image does not relate directly to public policies, but more to a private, agricultural business perspective. First of all, most of the lands in the area are CLI Class I or II. Class II land in the study area were classified as such -now more than 30 years ago- based on drainage deficiencies, which have mostly been overcome by artificial drainage measures. This makes that virtually all land would now be classified as Class I land. Secondly, as was also commented during the workshop, the value of land, especially for intensive livestock farming, is only partially related to the raw crop production capacity which is reflected in the CLI classification. The lands' location in relation to livestock operations and its contribution to satisfying nutrient management requirements can be more decisive of land value for this type of farm business, just as good access and opportunities for future expansion may be decisive.

Arguments similar to those of the participants were also made by the current custodians of the CLI data when indicating their appropriate use, but these arguments were not considered in the HW 7 & 8 Study.

Factors such as present use, accessibility, ownership, price, market conditions - while critical in resource planning- were excluded when the inventory was designed. These and other socio-economic and environmental considerations should be integrated in the planning process (CGDI, 2010).

Thirdly, the high inherent quality of most agricultural lands in the study area without doubt is an important argument against new corridor alternatives trough rural areas. However, as participants

indicated, the criterion was not very helpful in comparing the merits or impacts of alternative route sections through rural areas (Q74).

Q74: The majority of land is Class I land and it is all affected equally, no matter what corridor.

The comments of participants on the use of the CLI classification illustrated several relevant aspects concerning the use of data from existing databases that deserve reflection for future studies similar to the Highway 7 & 8 Study.

Time: Although the validity of some data may be longer than that of other, the value of all data is finally eroded over time. In the Highway 7 &8 case, both drainage measures and changing farming practices eroded the validity and the relevance of CLI data.

Scale and scope: Does the data use respect the scale and the intended use of the data? In the Highway 7 & 8 case, the relevance of the CLI classification as a criterion for comparing between different route alternatives is very arguable. In the Highway 7 & 8 Study, despite being raised by various actors, a more global and substantial discussion was never held around if the uptake of a substantial amount of high quality rural lands (a conclusion for which the data considering their scale were more suitable) would be justified or not. This unavoidable and largely normative discussion finally took place outside the formal study process in the political and the media sphere. The Study, however, centered on a large amount of 'objective' details which did not substantially inform or enrich the public debate.

Private versus public perspectives: Many datasets may be valid for representing public perspectives, but they do not necessarily adequately reflect private perspectives, which are often of a more dynamic and detailed nature. Many of the limitations of the CLI data that were indicated by its custodians refer to this private perspective, which was not considered in the Study.

Regarding field drainage, an image similar to the CLI classification emerges. Investments in field drainage could be used as a general argument against new corridors through agricultural areas. However, according to participants, since most land that now is not tile-drained does not require artificial drainage, the lands' drainage status was not very helpful in comparing between different route alternatives trough rural lands. The drainage data also reminds us of the limitations that many government agencies face in maintaining their spatial data sets current, and warn us that the use of recently released and updated data set does not automatically mean that the whole data set is current.

To conclude, the Study, from an agricultural perspective, also considering the homogeneity of the study area in terms of the land value indicators it used, did not manage to construct meaningful indicators to compare among different route alternatives. Doing so, taking into account also private perspectives, without doubt would have been both technically and socially a very challenging or maybe even an impossible exercise At the same time, by focussing on detailed comparisons, the Study delegated broader discussions on the value of agricultural lands and business, for which the used data were more meaningful, to the informal sphere. This issue invites for reflection on the way spatial data and criteria are used in decision-making processes like the Highway 7 &8 Study. It suggests that certain data can be meaningfully used to inform a dialogue or a debate, while their use in rather mechanical and detailed 'objective' decision-making procedures that fail to take into account more global and fundamental factors may be inappropriate.

6.2.5 Land use categories used on a thematic land-use map

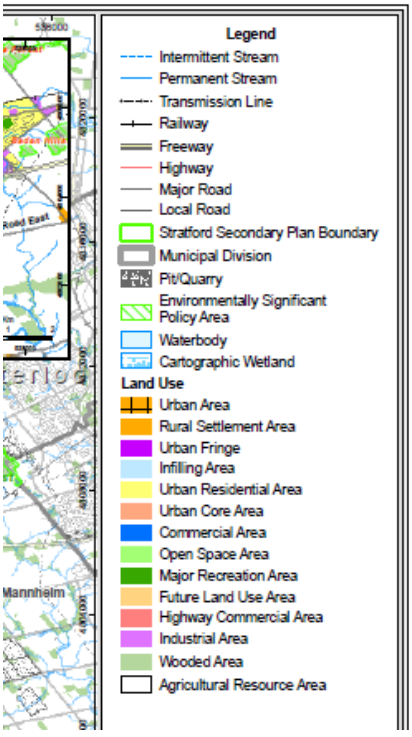

Figure 6-11: Legend of land use map.

The land use categorization that participants were asked to evaluate was taken from a thematic map on land-use that was released at the beginning of the study process (Figure 6-11). The legend entries were organized into two groups. The first group was unnamed and contained a diversity of elements. Most entries in the second group called 'land use', resembled those typically used in zoning maps. 'Agricultural Resource Area' is an entry in this second group.

Participants' comments provided little information on their perception of the overall categorization scheme and instead focussed primarily on the category 'Agricultural Resource Area'. Two participants expressed general agreement with the categories used, while another considered the information as partially outdated. Seven comments referred to a perceived lack of importance assigned to agricultural land. This perception was clearly related to two aspects of the map: first, the white colour

(Q75, Q76) used for agricultural land, and secondly, agriculture being the last, bottom, entry in the legend (Q77, Q78).

Q75: The urban areas and the wooded areas stand out, but the agriculture area is so wide and vast that its value gets lost in the observation. [You] see so much white that you think 'no big deal; [it] would be easy to put the road here'.

Q76: It emphasizes the residential, what is left over after all of the land-uses are represented by nicer colours [is the agricultural land]

- - -

Q77: People will organize importance according to the order things appear on the scale [and agriculture is the last entry].

- - -

Q78: It seems to give every category equal value. But if they insist on this, agriculture should be at the top of the legend, not at the bottom.

One participant also reported a perceived lack of differentiation between different agricultural land-uses as compared to the more detailed categories of urban land use. This, together with insets that enlarged urban areas to show more detail, and the more lively colours used to depict urban land uses, was taken as a sign of the heightened importance assigned to urban areas (Q79).

Q79: Urban areas are broken down into multiple subsections (residential, commercial, etc.) while 'Agricultural Resource Area' implies one homogeneous area with one generic use. Colours are used to highlight some areas, with white actually highlighting agriculture. Urban areas being enlarged by use of inserts will imply increased importance.

Overall, participant's comments did not refer so much to the overall conceptual validity of the land use classification scheme, but demonstrated a focussed and predominantly political reading which was related to one of their most fundamental concerns, that is, the value assigned to agricultural lands in the decision-making process. Most comments focussed on a perceived lack of importance of agriculture in relation to other, especially urban, land-uses. The process of sensemaking was often highly metaphorical and partly based of the overall perception of the map image. For example, agriculture was perceived as a vast but undifferentiated white area that was "not highlighted" and got

“lost in the observation”. Moreover, it was placed at “the bottom” of the legend. Also, participants consistently related the amount of detail and internal differentiation of different land uses to their assigned relative importance.

The political-metaphorical readings by participants of this at first sight highly analytical (technical-administrative) map on land use, focussed much more on the implications for decision-making than on the truthfulness of the classification of the land use classification scheme *per se*, and indicate that map makers in planning must be prepared for political readings of *all* maps. In the workshop, participants argued for a more visible and detailed representation of agriculture, in this case of agricultural land use as compared to urban land uses. Also in this case, more detailed data on agriculture might have been supportive of arguments to limit the impacts on agricultural land use, but that same data would not automatically have produced criteria for comparing among different new route alternatives trough rural lands: Spatial data suitable for one use not necessarily serves other uses, and participants’ attention was directed persistently towards arguments to save agricultural lands in general.

6.2.6 Roads classification on the corridor evaluation maps

On the corridor alternatives and on several other study maps, roads are classified into four categories: Freeways, highways, major roads, and local roads. Private roads and off-road corridors used by farm machinery are not included on the map. The used classification scheme is frequently used in a very broad range of maps, and because of this almost standardized use may easily appear as ´natural´ to many. The research wanted to explore the degree in which the participants perceived the classification scheme as appropriately representing the relevant attributes of roads for an ‘objective or balanced’ decision-making process on different corridor alternatives.

Six participants agreed on the road classification scheme used on the Study maps, while four participants explicitly expressed disagreement. Two of the participants that agreed with the scheme as such, nevertheless, provided comments that expressed concerns regarding the scheme’s *implications for decision-making.* They expressed that the classification was value-laden, and that it reflected a lack of importance assigned to local roads and local traffic (Q80, Q81).

Q80: All roads are for local traffic. The major roads and highways are for through and local traffic. The term freeway may be seen as most desirable, if it is implying that it's free of travel related problems.

- - -

Q81: They give somewhat good information [on roads]. Local roads again have no colour. MTO is not concerned about local roads (or community?)

Participants who expressed disagreement on the classification suggested a number of supplementary criteria they considered important for the classification of roads and which are summarised in Table 6-4.

Suggested criteria
▪ Jurisdiction: provincial, county, township (author's note: jurisdiction is implied in the categories used by the Study) ▪ A functional classification based on actual road use, instead of a formal administrative one. Mentioned were road use by school buses, emergency vehicles, and farm equipment. ▪ Winter maintenance. ▪ Surface: paved or gravel (note: most *public* roads in the study area are paved)

Table 6-4: Suggested criteria for road classification

Road classification schemes are part of our every day interaction with maps, and they are a good example of how cartographic classification schemes through repeated use can become highly naturalized. Participants´ answers demonstrated the usefulness of the distinction between the denotative and connotative aspects of a classification scheme. Participants' agreement (or maybe more appropriately their familiarity), with the denotative aspects of the used road classification did not imply their agreement on its connotative meanings. Participants were especially concerned about the perceived implications of the scheme on the decision-making process. Their concerns and disagreement were based on the use of extensive and highly contextual background knowledge.

Participants suggested a number of alternative and complementary criteria that included road uses based on their lived experience, and that were mainly of local importance. Also, the comments of the participants that agreed on the classification as such, indicated that both terminology (freeway versus

local road) and the visually highly differentiated emphasis these road types received, gave rise to concerns regarding the inclusion of local perspectives and interests in the Study. 'Local', the participants seemed to fear, meant 'unimportant'.

Overall, the findings of the workshop and the questionnaire confirmed the importance of maps as perspectival devices that play important roles in the conceptual and discursive framing of planning processes. As participants pointed with numerous examples, what *is* and what *is not* on the map, and *how* things are on the map profoundly influences the created planning space, and thereby the potential range of outcomes of a planning process. The view of participants on the planning maps was largely political, that is, focussing much more on their potential implications in the decision-making process and on their interests, than on more detailed technical-analytical aspects. Their sometimes quite emotionally observations reflect that, contrary to the analytical phase in which the planning process was formally engaged, the fundamental debate around what had to be considered in the analysis had far from concluded. Clearly, there where fundamental and ongoing disagreements on the agenda of the planning process. Maps played an important, although not formally recognized, role in this disagreement, and participants demonstrated to be well aware of this. They often expressed that they did not see their interests and perspectives reflected in the space that was created by the study maps and they made numerous corresponding suggestions to modify the content and style of the maps. Participants also expressed various concerns regarding the correctness and currency of the cartographic data, especially concerning water, without doubt not only a complex but also a dynamic issue, where the official data where considerably outdated. Although agreeing in the fundamental aspects of what they consider shortcomings of the study cartography, participants also demonstrated they did not always interpret the study maps in the same way.

The concerns and limitations expressed by the participants during the workshop and the questionnaire by no means seem to be an isolated case, but are emblematic of much map-use in multi-stakeholder spatial planning processes.

Chapter 7
Conclusions and Recommendations

As stated in Chapter 1, the goal of this research was to explore by means of a case study, how a group of non-expert, local stakeholders make sense out of planning cartography of the area they inhabit and that is used for making decisions that potentially strongly affect them. Central to the research approach was an understanding of planning maps as devices that serve both sensemaking and discursive roles, and that both represent and create space. Based on the conceptual framework presented in Chapter 3 and on issues that emerged as fundamental from the research itself, the conclusions presented here centre on three areas: the factual correctness of the data, the content of the sensemaking process, and the sensemaking process itself. Based on the research findings, some recommendations for planning agencies that want to make better use of the potential of maps to facilitate learning and mediation between multiple perspectives and interests are suggested. Finally, some limitations of the present and recommendations for future research are presented.

7.1 On the factual correctness of the study cartography

The cartography reviewed in this research was made public more than two years prior to the workshop and ABC had commented on some outdated information concerning drainage early in the Study process (ABC, 2008). Despite this, upon closer review of the map fragment during the workshop, participants were surprised by both the level of error that they discovered concerning drainage, and by the potential implications of these errors on the decision-making process. This observation is an indication of the usefulness of the quick and relatively simple exercise carried out with participants. The map review exercise can be useful both to planning agencies that want to verify the quality of the data on its maps, as to local stakeholder groups that are interested in a 'watchdog'-role and in advocating their interest. Surprisingly, and although participants declared high levels of familiarity with both the study reports and the study cartography, few or no participants seemed to be intimately familiar with the sources of the data that were used on the maps. In several cases, participants also did not seem to be fully aware of the relationship between the information on the map and the formal decision-making criteria. Participants hence seemed to be somewhat optimistic in the appreciation of their familiarity with those aspects of the Study and correspondingly discovered many new aspects during the workshop.

Overall, the data on the corridor alternatives map was judged by participants as factually correct, complete and current. However, in the case of water related phenomena – a fundamental issue for decision-making for both farmers and the Study Team - participants found the cartography seriously deficient. The limitations of spatial data models, the multiple functions that water-related phenomena fulfill, and water's changing and fluid nature, all played a role in this. Equally important, participants demonstrated that the official information on water in the area was far from current, and partially at least 25 years outdated. Water thus was not only contested based on different perspectives; the database used by the Study lacked factual solidity, which obviously was not supportive of a dialogue between different perspectives. Official data sources, even if recently released and updated, clearly cannot be taken as overall current and correct without further verification.

7.2 On the content of the sensemaking process

Making sense out of the planning maps by participants was done mainly from two perspectives or major areas of concern. First, the perception that agriculture and agribusiness in the study cartography was sometimes misrepresented, but above all, underrepresented. Participants considered the latter to be a sign that agriculture received too little political weight in the decision-making process. Representation on the map, visual weight in its design, inclusion in its legend and detailed categorisation were unequivocally equated with political representation and weight in the decision-making process. Second, participants perceived a need to generate more concrete information to identify and recognize needs or rights for compensation of eventual negative impacts on agriculture and agribusiness, including ongoing impacts on farm operations. They argued that for this purpose the principal point of reference should be the farm as a functioning whole. ABC formalized this idea in what in their reports they called Integrated Agricultural Business Units.

The perceived underrepresentation of agriculture and agribusiness

Overall, participants argued that the study cartography reflected that agriculture and agribusiness - as compared to urban land-uses, urban business interests, and ecological concerns - received (too) little overall weight in the Study and therefore in the decision-making process on the location of the highway corridor. This in turn was perceived by the participants as reflecting a general urban bias. Their judgment, of course, was not only based on the maps, but involved their overall appreciation of

the study process. From a cartographic perspective, this underrepresentation corresponded to two major types of observations by participants.

First and most important, participants considered that many issues and perspectives on issues important to them were missing altogether on the maps. Many of these were raised in ABC's Community Reports, some of them repeatedly. Participants feared that the limited understanding and visibility of potential impacts on agricultural businesses diminished the weight of agricultural concerns and interests in the decision-making process. They argued that information that represented agriculture as a healthy, strong, and socially important business sector, and information on the fundamental conditions for its functioning (e.g. good connections between spatially disperse farm operations) was missing completely from the maps. Perhaps the most important missing single perspective was agricultural drainage. Although participants suggested some items to be taken from the map, missing information and perspectives were their major areas of concern.

Secondly, participants found that most of the information that was included on the map also reflected the little weight assigned to agriculture in the study process. Agriculture was found to be the last entry at the bottom of the legend, the blank undifferentiated canvas on which new lines (highways) could be freely drawn, and the background image used to display other, more important, information. Participants, using arguments of graphic emphasis and colour associations, argued that other map features were often relatively overvalued. Style and content of the maps were often hard to separate.

The participants made numerous suggestions for missing information to be included and other suggestions to visually stronger emphasize issues already included in the maps. In all this, by emphasizing the overall importance of agriculture and agribusiness, their focus was mainly on keeping the highway corridor out of rural areas. Little thought was given to how the suggested information might be used for the comparison between different alternative routes through rural areas. The latter inevitably would imply assigning relative weights to different factors (and thus interests) within agriculture and agribusiness. This was an issue from which ABC always explicitly distanced itself, most probably to avoid internal conflicts and division. The choice of ABC to frame its discourse around 'agriculture as a business' may reflect that, considering the substantial individual differences concerning attachment to place and the importance of nature and the environment, it was 'agriculture as a business' that allowed the group to produce a unified and coherent discourse that was uniformly supported across the group.

Essentially, participants' comments and suggestions indicated that from their point of view, after more than two years, the process of agenda setting had still not closed. This issue is also clearly reflected in ABC's Community Reports. Participants considered the study cartography much more from a broader, political and agenda setting perspective than from a finer, technical-analytic perspective, which was (at least formally) its most important purpose in the Study. The observations of participants counter the still dominant view of a stepwise organized rational planning process, that starts out with problem identification (agenda setting) and that, once concluded this phase, moves on to the design and comparison of alternatives, and finally to the selection of the best solution. This view, as Simon (1969) already argued, is an idealized view. Maps, throughout the study process, continued to play an important role in an ongoing, informal and political struggle over the agenda of the planning process.

Sensemaking by participants focussed strongly on agriculture, especially on agriculture as a business. Themes that are often raised in the literature on place, space and planning conflicts, such as attachment to place, community life, and quality of life, were hardly referred to during the research. Also in ABCs Community Reports, these issues played a secondary role. In part this may reflect a process of concentration in which entrepreneurial farmers with a strong business orientation historically absorbed other less dynamic farms, but it may also be related partially to the composition of ABC's leadership. ABC's focus on agribusiness does not necessarily be taken as a sign that farmers' concerns regarding the study are purely materialistic. Farmers' identity, although a historical relationship with the place spanning several generations exists in many cases (ABC, 2008), also seemed to be one of breaking away from the stereotyped historical image of the 'old pa-and-ma farm' in favour of an image and an identity of agriculture as a modern, dynamic, big, and socially relevant business. It was also this identity that participants wanted to see socially recognized and reflected in the study cartography.

Many aspects of the study's maps and participants' comments on them can be understood against the background of a diminishing importance of agriculture in the economy of southern Ontario during the last decades, the marginal number of votes that agriculture represents in provincial politics, a largely urban environmental and spatial agenda, and a corporate-driven and trade-oriented economic

integration process at a continental scale. Also in Canada, urbanization has resulted in changing perceptions of, and demands on, the rural landscape (Vouligny, Domon and Ruiz, 2009). Whereas participants emphasized the rural landscape as a primarily a site of agricultural production, urban societies have very different ties with the rural landscape. The latter tend to emphasize aspects of leisure, visual aesthetics, environmental services (Buijs, Pedroli and Luginbuehl, 2006; Buijs, 2009; Rogge, Nevens and Gulinck, 2007), aspects which could be clearly recognized in the Study's decision-making criteria and in its cartography. Urbanized societies also undergo changes in the way nature itself is perceived, and often develop idyllic perceptions of nature (Cronon, 1996; Buijs, 2009). The prominent attention of the Study on selective aspects of 'nature' that are appealing to urban constituencies (fish, birds, wetlands, etc), that receive broad political and societal support, and that are reflected in official policies, can be seen in this light. Although quite divergent attitudes to nature were observed among the participants, they did not share this particular ´urban´ view on nature.

Importantly, the MTO saw the study area as a provider of space for transportation linkages between urban areas. For these often contested projects, the MTO inevitably must seek a balance between responding to major political and social concerns and, through restrictive scoping and agenda setting, keeping the number of arguments and obstacles to its proposed projects within limits. Within the political process of balancing between economic growth and environmental concerns, although some revaluation of agriculture in Ontario is taking place, farmers obviously actually do not find themselves in a very strong position. Therefore, it can be argued that the MTO did not need to prominently incorporate agricultural (and also other) perspectives in its study cartography. Although extensive negotiations on corridor options took place in the course of the study process, the MTO felt no need, at least in its cartography, to revise the terms and the basic logic in which these negotiations took place. The thematic and corridor alternative maps thus remained virtually unaltered and suggest that in the course of the Study social learning and the creation of new knowledge was limited. The study maps, and the spaces they created, responded mostly to the needs of remote bureaucratic decision-making procedures and only marginally incorporated local interests and perspectives.

Impact and compensation for functional agricultural business units

At least partly based on past experience, participants expressed a fear that not all negative impacts of road construction on agribusiness would be duly compensated for. Moreover, they argued, impact

evaluation should consider the effects on the functioning of an agricultural business unit as an integrated whole. Participants also drew attention to the fact that the negative impacts on agribusiness do not only relate to loss of land and other assets, but also to ongoing increases in operation costs and thus profitability. As illustrated by participants, impacts can be complex, chained, and non-linear, and they often escape the kind of thematic and comprehensive cartographic or GIS modelling as used in the Study. This draws attention to the use of comprehensive mapping and spatial overlay analysis *as methods*. Because of their limitations to model more complex and dynamic issues, these methods are far from neutral, and should be complemented by other methods of spatial knowing.

Used otherwise, mapping can play additional roles in understanding and communicating complex and dynamic issues. Participants suggested the use of maps to illustrate or exemplify, by means of case studies, complex issues that cannot be mapped comprehensively. This approach would allow 'selling' an issue, that is, placing it on the agenda, and learn about it by exemplification. Incorporating these insightful suggestions of participants in similar future studies would require a fundamental change in the definition of what counts as valid knowledge, since it would require reducing the weight given to comprehensive maps as icons of objectivity and (sole) reflections of knowledge. Essentially, it would require creating space for complementary forms of spatial learning and knowing, and for new forms in which recommendations can be publicly justified. Obviously, this implies a change from rational, instrumental and 'neutral' (external) expert-driven approaches to more open and deliberative forms of planning, which inevitably would produce shifts in the power relations between the involved actors.

7.3 On the process of the sensemaking process

Participants in their process of sensemaking drew extensively on three sources of information and knowledge: the maps themselves and their intuitive understandings of cartographic conventions and communication; their lived experience, formal knowledge, and attitudes concerning the landscape and the issues at stake; and finally, their wider appreciation of the study process. Participants had different backgrounds and knowledges (including consultancy experience) and demonstrated divergent attitudes to several issues. During the workshop, and although severely restricted by time, participants´ differentiated knowledges entered in dialogue with each other to generate new and shared understandings. Although many participants expressed clearly defined opinions on certain aspects of the maps, it was clear that the maps, especially the complex corridor alternative maps, escaped final, certain and shared interpretations. Given the advanced stage of the study process and

the considerable interaction between farmers and the Study Team this can be seen as another sign that only limited social learning had taken place around the study's maps. Maps, although spatially explicit, thus cannot be considered by default as devices that facilitate unambiguous spatial communication and learning.

Participants' observations reflected that they considered maps both as forms of knowledge and as forms of discourse in a political game. Individual participants, however, varied considerably in the way they approached the maps. Some participants showed a strong awareness of the political and strategic-discursive role of maps in the study process, seemed to accept this reality, and asked how they could make use of the discursive qualities of maps. Others participants paid more attention to the 'correctness' of data and the richness of information content of the maps to compare corridor options. These participants often found that the corridor alternative maps, although rich in data, lacked clear information and clear interpretations on behalf of the Study Team. This, they argued, left all options open and participants suggested that the Study Team here avoided its professional responsibilities of carrying out an analysis and make clear recommendations based on that analysis.

While the first approach essentially corresponds to what in our conceptual framework we called "to convince", the second perspective, emphasizing ambiguity, can be read as referring to a "mediation" role of maps. However, some participants found that the Study Team lacked sufficient clarity in expressing its own interpretations and positions, and thereby limited effective dialogue, transparent argumentation and learning. Whereas for learning and mediation a certain level of ambiguity may be required, the level of ambiguity in especially the corridor alternatives map seemed such that making sense out of the maps was often very hard for participants.

In our personal judgment, maps informally played both argumentative and meditative roles, and we argue that exactly this double role imbued the public maps with a power in a study process that was characterized by complexity and ambiguity. The Study Team formally had to do a neutral and technical study. Logically, in its role as a designer, based inevitable and legitimate biases and perspectives, it wanted to promote its own preferences. However, it had to do so within the limits of an uncontrollable, unpredictable and constantly changing space that was shaped largely by political forces, the media, and the public opinion. In our judgement, the formally scientific-objective

cartography, based upon official sources, was often highly ambiguous. This ambiguity can be partly explained by the complex position of a Study Team that needed arguments to ´objectively´ support its own positions, but also, as was clearly demonstrated in the course of the process, flexibility to change and review these positions (sometimes radically, as it turned out) in a fluctuating political landscape.

Although much recent academic literature has deconstructed ideas of a radical distinction between technical-expert knowledge and local-lay knowledge, this distinction in the Highway 7 & 8 Study case was found to be a very substantial and relevant one. This was largely due to the fact that the knowledge on the maps (but also in the earlier study reports), was overwhelmingly based on information from existing spatial databases and other secondary sources, and seemingly this information was often used without further verification. The 'expert' or 'technical' way of knowing the study area thus was largely an assemblage of existing, readily available, official and administrative knowledge. Both study reports and maps alike were largely descriptive and thematically organized, without providing a clear interpretation concerning how issues on the map and in the landscape functioned and related with each other. This in turn raises the question of how far the Study, apart from its inherent and unavoidable political character, managed to create a reliable base of information in order to understand the complex relations involved in a *functioning* landscape. James Scott's (1998) reading of geographic and cartographic framing by modern(ist) states as essentially a form of administrative simplification to make the landscape "legible" and "homogenous" for its own administrative needs and logic, more than an intent to understand the often complex landscapes and issues, gives much food for thought. So does Lejano's (2008:654) reading of GIS' "unprecedented ability to reduce complex data to simple representations, which facilitates its use in the institution of planning where analysis is primarily a formal operation".
In contrast to Scott´s (1988) most stunning examples of spatial simplification by technocracies in autocratic states with modernist ideologies, MTO's decision-making power was far from discretionary, and also the province of Ontario is a far from autocratic and monolithic entity. Therefore, it can be argued that the study cartography, although in a sense strongly simplifying the landscape, also had to be 'complex' enough to allow the Study Team to manoeuvre with flexibility in a field of changing forces.

In the Highway 7 & 8 Study, spatial analysis was often very fragmented, largely based on thematic layers and overlay and proximity techniques, and with little relationships established between the thematic layers. More than as in-depth 'expert' knowledge, the study cartography can be seen as a recombination through standardized procedures of existing 'official' knowledge'. ABC's referred to this as "a cookie cutter approach that could see the geographic names of the communities interchanged" (ABC, 2008:8).

As it turned out in the course of the Study, the fragmented style of analysis employed in the Study allowed the Study Team to recombine information and arguments flexibly and selectively, and to arrive at strongly divergent conclusions and recommendations. The highly ambiguous corridor maps were supportive to this practice.

The strong emphasis on the use of comprehensive mapping and on overlay and proximity analysis for (the justification of) decision-making brought its own logic to a Study process. This logic limited the generation of rich contextual knowledge that cannot be easily represented and analyzed by these methods, and thereby also the understanding and debate on some more complex issues were severely limited. Based on these findings, we argue for the use of more diverse map types (among others illustrative) in planning, and for less emphasis on the use of comprehensive maps to legitimize decisions. In order to facilitate sensemaking out of the study cartography and to reduce ambiguity, an intermediate layer of communication between the (very brief, formally denotative) study maps and the very extensive study reports, in the form of e.g. summary reports or comment sheets interpreting the maps, could be useful. Such a practice obviously has implications in the power relations in a planning process, and its putting in practice thus may require the political support from decision makers.

A comparative synthesis of key aspects of the process of cartographic sensemaking by the Study Team and participants is provided in Table 7-1.

Issue	Study Team [5]	Participants
Orientation / goal	Compare total impacts of different alternatives to select an optimal corridor route.	Avoid as far as possible new corridor routes through rural areas and negative impacts on agriculture and agribusiness. Determine and obtain formal recognition of eventual impacts on functional agribusiness units for compensation purposes.
Perspective	Public; not openly interested. Although recognizing conflicts of interests, strong reference to a "common good" which provides guidance for decisions and trade-offs. "Neutral", technical knowledge, reflecting largely official policies and agency mandates on politically sensitive issues.	Private; openly interested. Fully recognizing conflicts of interests and seeking debate on them. Focus on representing interests and issues of concern.
Way of (spatial) knowing about landscape and issues	Overwhelmingly based on existing, official spatial data sources. Impacts and their dimensions known largely through, thematically separated, overlay techniques.	Based on lived experience and formal knowledge. Anticipated impacts mostly based upon knowledge and reasoning about the functioning farm businesses.
Organization of knowledge	Analytic and abstract. Strong orientation towards individual features, separated in thematic layers (and corresponding descriptions) corresponding to different (selective) agency mandates and public policies.	Synthetic and functional. Mostly from a individual perspective and centered around functional integrated agribusiness units. Less emphasis on system wide (collective) impacts.
Determining best route alternative	Formally an instrumental, technical exercise.	Largely based on political choices and priorities, and an advocacy perspective. Did not explicitly recommend a particular corridor or route.

Table 7-1: Outstanding differences in cartographic sensemaking between Study Team and research participants

7.4 Recommendations for better map use in multi -stakeholder spatial planning

As reflected in the conceptual framework (section 3.2), planning agencies when using maps publicly operate in a tension between the discursive role of maps (to convince stakeholders and decision-makers of its points of view and/or proposals) and their potential to facilitate learning and mediation between multiple perspectives and interest. The recommendations provided here, derived from

[5] The perspective of the Study Team presented here, is based on the author´s interpretation of the study reports and maps, guided by the literature review on planning, cartography and knowledge, presented in Chapter 2.

insights from the current research, focus on a shift towards this second and underused potential of maps.

Planning agencies may conduct exercises similar to the map review workshop of this research in order to validate the factual correctness and currency of spatial data with stakeholders living in the planning area. The use of 'of-the-shelf' or 'prêt-a-porter' spatial data sets, which has been stimulated greatly through the expansion of spatial data infrastructures, should be done with the necessary care. The explicit mentioning of data sources, their date of publication and/or their last update may assist such a careful spatial data use.

Planning agencies should provide an intermediate level of information between the generally very condensed information on their maps and their often very voluminous reports. This information should help to better place publicly used planning maps in the context of the planning exercise. Special attention should be paid to making explicit the relationship between the data on the map and the criteria for decision-making. Although a certain level of ambiguity on planning maps may favour a constructive interaction between stakeholders and the planning agency, excessive levels of ambiguity can lead to confusion, irritation and conflict, and should be avoided.

Both planning agencies and stakeholders may benefit from critical reviews of the ontology of planning maps, that is, of the objects that are 'represented' on these maps. The 'represented' space not only reflects, but also largely constructs the mental space in which spatial planning takes place. These reflective reviews should not only focus on, as is extensively discussed in the literature, on what is (not) represented and/or created by those maps, but also importantly on the level of complexity (or aggregation) of the objects 'represented' on maps. As is illustrated in this research, looking at individual wetlands or wetland complexes, at individual farm buildings and or land parcels or at functional farm units profoundly influences individuals' approach to reasoning and therefore on the outcomes of spatial decision-making processes. For the same reason, the use of of-the-shelf data sets, often created for specific uses, should be done with extra care when used for other goals.

The representation of multiple perspectives, and intimately related to this, multiple interests, through multiple maps can assist in making explicit the ambiguity and tensions that are inherent to complex multiple stakeholder spatial planning. Although this may be somewhat threatening to 'expert'

planners educated in the rational-comprehensive tradition, this strategy may help assist them to deal more constructively with the unavoidable negotiations between realities and interests.

Planning agencies, again breaking away from a strict rational-comprehensive approach, should learn to use maps not exclusively to conduct comprehensive spatial analysis. Complementary to this approach, maps can also be used in illustrative ways to explore, learn about, and formally recognize issues that have escaped comprehensive spatial analysis and or representation. Including only those issues that can be comprehensively mapped in spatial decision-making processes easily excludes very relevant issues from consideration and decision-making. The value of maps to learn by exemplification or illustration therefore should be formally recognized. This implies the need to break away from the fiction of 'clean' rational decision-making procedures and the purely objective character of maps and other date sources to 'inform' substantive discussions that are inevitably somewhat ambiguous.

Cartographers and planners should realize that maps are far from strictly logical-rational devices, and that emotions, different types of metaphors and visual impressions play important roles in how stakeholders make sense out of planning maps. No simple rules can be given to avoid that unwanted interpretations are given to planning maps. However, paying attention to these aspects of the process of map interpretation can help to better understand stakeholder's perspectives and to produce planning maps that are more sensitive to their perspectives.

Finally, universities and other centres of education should provide mapmakers and or spatial analysts with a basic knowledge and a reflective attitude concerning the political and emotional aspects of planning maps, of spatial data, and of methods and technologies of spatial analysis.

7.5 Limitations of the present and recommendations for future research

Workshop and questionnaire

The method of map review used in the workshop, in a short time span, allowed to obtain a good overview of how participants made sense out of maps used in the Study. The method also allowed the identification of critical issues in data quality and their potential implications for decision-making from the perspective of ABC. The use of digital maps in the workshop was very functional, but ultimately not essential. The possibility to project additional data layers prepared by the author, and the ability to 'play' with visual variables were found to be conductive in gaining an understanding of

participant's perspectives, and helped participants to engage with the map review process. Also, the ability to zoom in on details was very useful. A major advantage of the used digital format was that participants could draw freely on the map and that notes could be taken of their comments without cluttering the map. The mayor disadvantage of the digital method was that participants could only draw on the map mediated by the facilitators. The research suggest that the most essential aspect of capturing stakeholder's cartographic perspectives concerns what information is and what information is not on the map, the relative visual emphasis that different data layers receives, and the categories and labels used in the map's legend. It is in these aspects that participation in the construction of maps is most meaningful. Other aspects can ultimately be left to the discretion of the cartographer. The essential goals of the map review workshop therefore could also have been obtained using paper maps. However, both the additional flexibly in the review process and the opportunity to instantly modify the map that resulted from the digital method were very valuable.

Concerning the questionnaire, it became clear that it was hard for participants to separate between the more abstract properties of maps and the supposed influence of maps on the decision-making process. Participants clearly judged the maps on what they believed were their implications on the decision-making in a planning process in which they had considerable stakes, and apparently they often found it hard to make their involved assumptions explicit. This, and the apparently too abstract language of the questions, led to unreliable answers concerning the more the more abstract elements of the questions. To explore in depth the perceptions and reasoning of individuals on planning maps, interviewing may be a more appropriate method than questionnaires.

The overall approach of the research

Understanding the role of maps and mapping in sensemaking processes in complex planning situations requires a multidisciplinary perspective. The conceptual framework presented in Chapter 3 allowed a good appreciation of how a single stakeholder groups appreciated planning maps at a specific moment in time. A major limitation of the research method was the lack of knowledge of the appreciation of the mapmakers and planners of the Study Team of their own maps. The review of study reports most probably allowed a reasonable approximation to the intentions behind the maps of the Study Team. However, this image ultimately was largely limited to the formal intentions and discourse expressed in the study reports. More informal viewpoints of the planners on their own maps

and feedback from the cartographer's concerning the more technical aspects of the mapmaking process could have enriched the research by allowing better comparisons between the perspectives and interpretations of farmers and the Study Team.

The review of reports from ABC and the Study Team, other secondary sources, and some comments of the participants themselves, allowed the findings of the workshop and the questionnaire to be put in the context of the wider ongoing planning process. However, the research did not explore how those maps were created in a process of interaction between cartographers, planners and technology. Neither did it explore how the interaction between the Study Team and different stakeholder groups in the course of the panning process changed the maps themselves or their interpretation. Direct and detailed observation of the process of creating, reading and interacting around maps in different settings, using anthropological methods, could provide a much deeper understanding of ´maps in action´ within spatial planning. Such research, building on the concept of interactional framing (Dewulf et al., 2009) could shed more light, not so much on maps as representations of knowledge, but more critically, on how through mapping and interaction around maps knowledge and meanings are constructed, debated, negotiated, enriched, and modified. Importantly, such a more performative approach could shed more light on the complex relationships between maps as forms of knowledge versus strategic discourse, and on the roles of mapping in convincing versus mediation and learning. Such an understanding could provide indications of how maps in planning are used as part of power games, but also of how they could be used to facilitate social learning. These are issues that the current research briefly touched upon, but that due to a lack of pertinent data could not be examined. These performative aspects of map making, spatial analysis and map use in multi-stakeholder planning are an important but virtually unexplored territory. To explore this field, future research should pay attention to the broader political context, to the perspectives and interests of different stakeholders, and to the micro-level aspects of cartographic and spatial analysis methods and of interaction around maps in different events such as open houses, workshops and team meetings.

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Appendix A
Workshop script

WELCOME

to the

MAPPING WORKSHOP

Goal of the Workshop

Learn from your knowledge and perspectives for creating one or more maps that include the knowledge and perspectives of farm business for highway corridor selection in the Shakespeare area

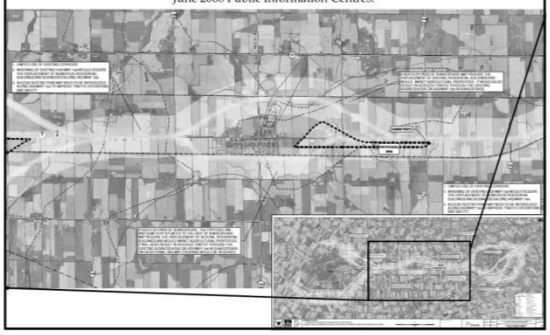
Organization

- Introduction: maps & digital maps
- Warm up exercise: What does this map mean to me?
- Task 1: Review of factual correctness and completeness of the information on the map
- Task 2: Review of content and style of the map in light of an informed an balanced decision-making process regarding a preferred corridor in the Shakespeare area
- Hand out of mail-back questionnaire.

You are invited to make any other comments on this or other study maps. We will take note of them. For time reasons however we might be unable to discuss them.

Point of departure

Portion of the "By-pass Alternatives" map presented at June 2008 Public Information Centres.



A few comments on

Maps & Digital maps

Thinking about Maps

Map = Image + Words

Map = Content (& Silences) + Style

What we say, what we *don't* say,

The *way* we say things.

Canada =

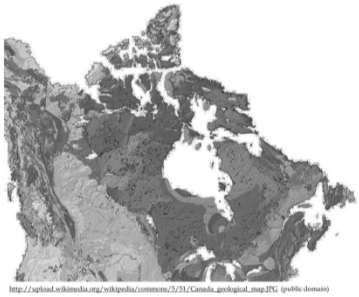
a Federation of Provinces & Territories

Image:http://upload.wikimedia.org/wikipedia/commons/2/2a/Map_Canada_political-fr.png(public domain)

Canada = one Country / State / Nation

http://upload.wikimedia.org/wikipedia/commons/1/1b/Canada_towns_map_trim_398_named.gif (public domain)

Canada = a geological wonder (too beautiful for words)



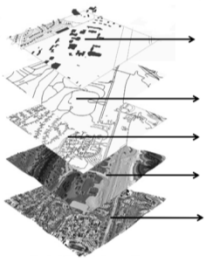
http://upload.wikimedia.org/wikipedia/commons/5/51/Canada_geological_map.JPG (public domain)

Each map tells us something

Each maps tells us something different
(no map could tell us everything)

Each map is selective

Digital maps



Digital maps consists of

LAYERS of information

STACKED upon each other

We can:

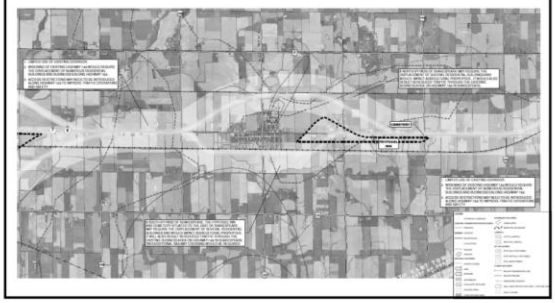
- Change single items on a layer (e.g. add o remove a single building)
- Add or remove a whole layer (e.g. all the buildings)
- Change the order in which the layers are stacked
- Change the way a layer looks like

Warm-up exercise

What does this map mean to me?

1. **What important information and / or views did the Highway 7 & 8 Study Team want to convey with this map for the area surrounding Shakespeare?**
2. **What does the information on this map mean to you?**
3. **What are the 3 issues that most grab your attention on this map?**

1. What important information and / or views did the Highway 7 & 8 Study Team wanto convey with this map for the area surrounding Shakespeare?
2. What does this map mean to you?
3. What are the 3 issues that most grab your attention on this map?



Task 1:
Review of factual correctness and completeness of the information

Is the information on this map:

- factually correct?
- complete? (e.g. If cemeteries are on the map are they ALL mapped?)
- up-to-date ?

If any, what corrections would you like to make?

- (for an informed and balanced decision-making process regarding a preferred corridor in the Shakespeare area)

Task 2:
Review of content and style of the map

(for an informed and balanced decision-making process regarding a preferred corridor in the Shakespeare area)

Task 2: Review of content and style of the map

We would like you to **review** based on your knowledge and perspective:

- The **information content** of the map
- The **graphical style** of the map
- The **wording** used on the map

In case you have any suggestions for change we would like to learn about them

Task 2: Review of **content** and style

Are there any themes or issues that are not on this map and that you consider important to be mapped?

If any:

- Which one(s)?
- Why?

Task 2: Review of **content** and style

Are there any themes or issues on this map that you would like to see removed?

If any:

- Which one(s)?
- Why?

Task 2:

Review of content and style:

How are items displayed on the map?

Not only the information itself, but also the way this information is displayed on the map influences how people make sense out of a map.

Visually we can

- Emphasize some issues and de-emphasize others
- (Try to) suggest meaning and importance

How do items on the map look like?

We can visually (de-) emphasize issues

Points : color, size.

Lines: color, thickness.

Areas: transparency or color, outline

Visual emphasis is often related to perceived importance

How do items on the map look like?

Suggest meanings (a tricky, unpredictable terrain in cartography!)

Colors: Often related to "natural ", "good", "safe", "protect"

Often related to "hazard" ,"danger", "avoid"

Lines & Precision: Neat lines may suggest : abrupt transitions precision

(compare property lines vs. soil types)

Vague lines may suggest imprecision, uncertainty, gradual change

Contrast: May suggest relative importance

Task 2: Review of content and style

How are things graphically presented on the map?

Revising the HW 7 &8 Study map and taking into account:

- the relative importance of issues you perceive
- the meanings you may perceive

Would you like to make changes in the way the information is graphically presented?

(

- If any:
  - What changes would you like to make?
  - Why?

Task 2: Review of content and style : the legend

The map's legend explains the symbols used on a map. This involves -conscious or unconscious- choices on :

- the words used
- the way items are grouped using headings.

Often these choices emphasize certain aspects over others. An Example:

"Park" ← → "Municipal park"

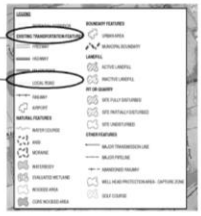
"Park" under "Recreational facilities "
← →
"Park" under "Natural areas"

Review of the legend

Reviewing the wording and organization of the map's legend: Are there any changes you would like to the to make?

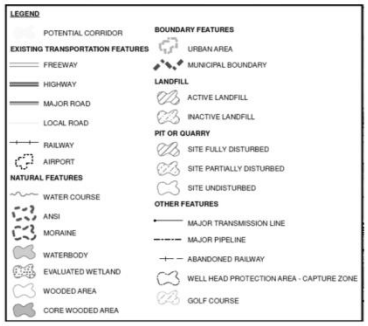
Heading ←

Label ←



If any:
Which one(s)?
Why?

Task 2: Review of **content** and style



Not included in the legend , but on the map are:

•Parcels (lot lines)

The aerial photo (taken in 2006) used as a background can also be considered an information layer

Task 2: Review of **content** and **style** : text boxes

The following slides contain 3 text boxes used on HW 7 & 8 study team maps for the evaluation of corridor alternatives. Each textbox contains a comment on a by-pass alternative

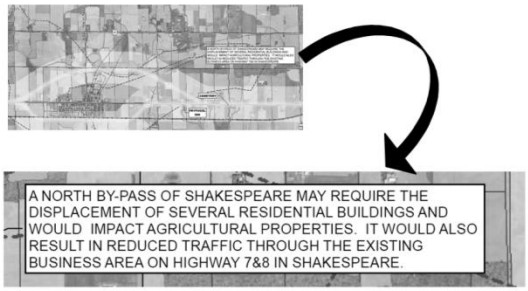
Would you like to make any changes to the texts in these text boxes?

If any:

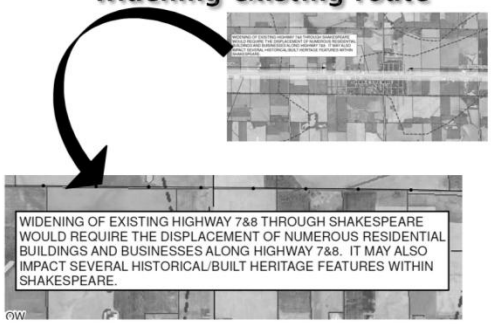
Which one(s)?

Why?

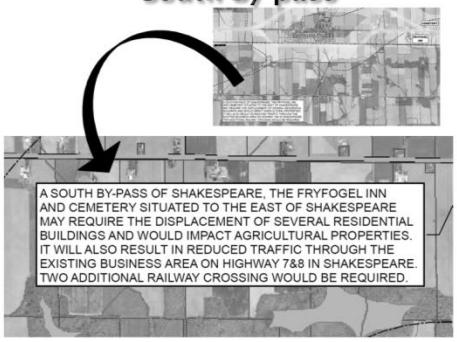
North By-pass



Widening existing route



South By-pass



Last comments

Do you have any other comments you would like to make on the maps used in the evaluation of highway corridor alternatives?

Questionaire

For each of you a questionnaire with a mail-back envelope is ready.

To learn more about your view and opinions on wordings used on the study maps.

The questionnaire would take you about 30 minutes to fill out.

Thank you very much for sharing your time, knowledge and perspectives!

Appendix B

Questionnaire

University of Waterloo

Faculty of Environment
School of Planning

Questionnaire on labels and categories on HW 7 & 8 Study maps

Introduction

The categories and labels we attach to things inevitably emphasize certain aspects and at the same time leave out other aspects.
For example, when a park agency describes a certain national park as "a pristine wilderness area" it emphasizes the park's 'natural' aspect. However, at the same time this label may exclude important 'human' aspects of that same park. For example in that park hunting and fishing by a First Nation group may have taken place for centuries. The park is at the same time both 'natural' and 'man-made'; the park agency using the label "pristine wilderness area" chose to emphasize the 'natural' aspect.
Similarly, when we categorize cars according to their brand name, we leave out other aspects; for example, their fuel economy or their safety ranking.

The use of labels and categories thus involves choices. Each choice emphasizes some characteristics of the thing we label or categorize at the cost of other characteristics. People or organizations may have varying degrees of agreement or disagreement concerning the labels and categories they consider most appropriate on a certain map.

The following questions are aimed at learning about your perspectives on some of the labels and categories used on Highway 7 & 8 Study maps. All the images that appear in the survey are sections of MTO maps produced during the highway corridor study process.

The first sheet of this questionnaire asks for some personal information. In order to protect your privacy and anonymity this sheet will be detached and stored separately from your other answers in a safe place.

The estimated time to fill out this interview is 30 – 45 minutes.

Thank you beforehand for sharing your time, knowledge and perspectives!

Instructions

When offered several options to choose from as indicated by check boxes (☐) select ONE ANSWER ONLY by checking the appropriate box (☒)

Participant Code: . .

Section 1: Personal information

Name: . . . . . .

Age: ☐ 18 - 30 ☐ 31 – 50 ☐ 51 – 70 ☐ 71or older **Sex:** ☐Female ☐ Male

What type of farm business do you own or manage? . . . . . .

. . . . . .

Please, briefly describe your role or participation in the Agricultural Business Community and the Highway 7 &8 Study Process?

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Contact information

Phone: . . . . . **Alternative phone:** . . . . . .

Email: . . . . . .

Information on the results of this research

☐ I would like to receive an email with an executive summary of the research in which I participate.

☐ I would like to receive an email with an electronic copy of the thesis based on the research in which I participate.

(If you sign up for emails with information on this research make sure you provide your email address)

Participant Code: . .

Section 2: Familiarity with Highway 7 & 8 Study documentation and maps

1. **How familiar are you with the study reports of the Highway 7 & 8 Study?** (choose one answer)
   - ☐ Very familiar
   - ☐ Quite familiar
   - ☐ Somewhat familiar
   - ☐ Little familiar
   - ☐ Not familiar at all

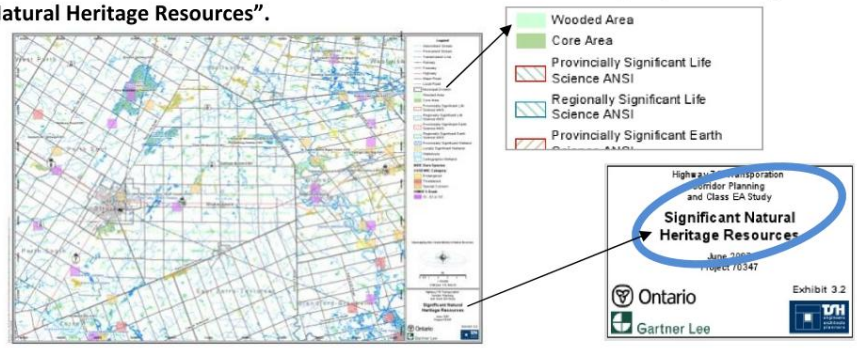
2. **How familiar are you with the maps of the Highway 7 & 8 Study?** (choose one answer)
   - ☐ Very familiar
   - ☐ Quite familiar
   - ☐ Somewhat familiar
   - ☐ Little familiar
   - ☐ Not familiar at all

3. **How comfortable do you feel in general working with maps** (choose one answer)
   - ☐ Very comfortable
   - ☐ Quite comfortable
   - ☐ Somewhat comfortable
   - ☐ Little comfortable
   - ☐ Uncomfortable

Participant Code: . .

Section 3: Labels and Categories on Highway7&8 Study Maps

4. **'Wooded Areas'** and '**Core Wooded Areas'** are on a thematic study map called **"Significant Natural Heritage Resources".**



Please indicate the degree to which you agree or disagree with the following statement:
"Within the context of the Highway 7 & 8 Study, labelling '*Wooded Areas'* and '*Core Wooded Areas'* as "Natural Heritage Resources" indicates their most important and relevant aspects."

- ☐ Strongly agree
- ☐ Agree
- ☐ Neither agree nor disagree (choose one answer)
- ☐ Disagree
- ☐ Strongly disagree

Please briefly describe the reasons underlying your answer :

. . . . . .

. . . . . .

. . . . . .

Do you think labelling '*Wooded Areas'* and '*Core Wooded Areas'* as "Natural Heritage Resources" may influence the objectivity or balance in the evaluation and decision-making on corridor alternatives?

☐ No, because . . . . . .

. . . . . .

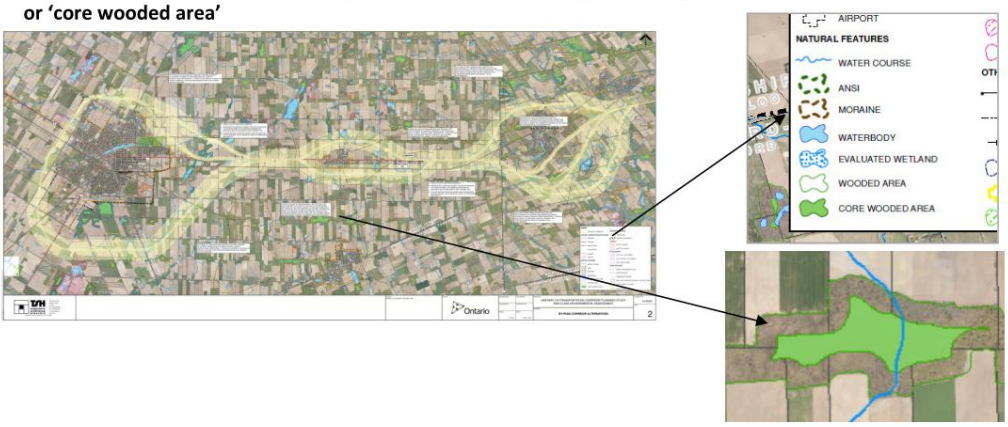
☐ Yes, because . . . . . .

. . . . . .

☐ I have no opinion

Participant Code: . .

5. Areas with tree cover on the study's corridor alternative maps are categorized as 'wooded area' or 'core wooded area'



Please indicate the degree to which you agree or disagree with the following statement:

"Within the context of the Highway 7 & 8 Study, categorizing areas with tree cover as 'Wooded Area' or 'Core Wooded Area' indicates their most important and relevant aspects."

☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree (choose one answer)
☐ Disagree
☐ Strongly disagree

Please briefly describe the reasons underlying your answer

. . . . . .

. . . . . .

. . . . . .

Do you think categorizing areas with tree cover as 'Wooded Area' or 'Core Wooded Area' may influence the objectivity or balance in the evaluation and decision-making on corridor alternatives?

☐ No, because . . . . . .

. . . . . .

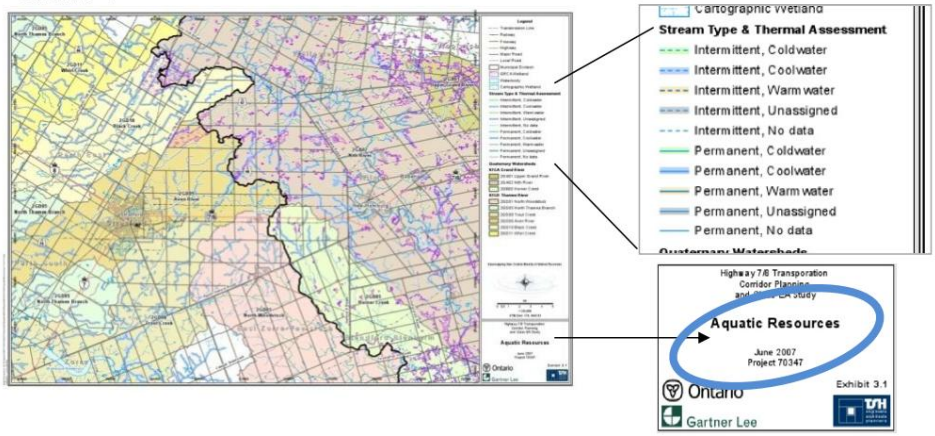
☐ Yes, because . . . . . .

. . . . . .

☐ I have no opinion

Participant Code: . .

6. The water courses of the study area on a thematic map called **"Aquatic resources**" **are** labelled as **"streams"** .



Please indicate the degree to which you agree or disagree with the following statement:

"Within the context of the Highway 7 & 8 Study, labelling the water courses in the study area as 'streams' and 'aquatic resources' indicates their most important and relevant aspects."

☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree (choose one answer)
☐ Disagree
☐ Strongly disagree

Please briefly describe the reasons underlying your answer

. . . . . .

. . . . . .

. . . . . .

Do you think labelling the water courses in the study area as 'streams' and 'aquatic resources' may influence the objectivity or balance in the evaluation and decision-making on corridor alternatives?

☐ No, because . . . . . .

. . . . . .

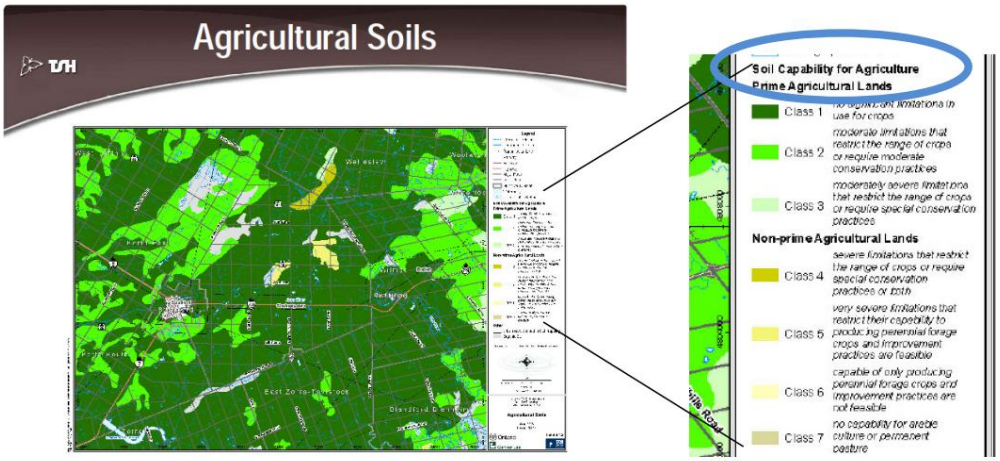
☐ Yes, because . . . . . .

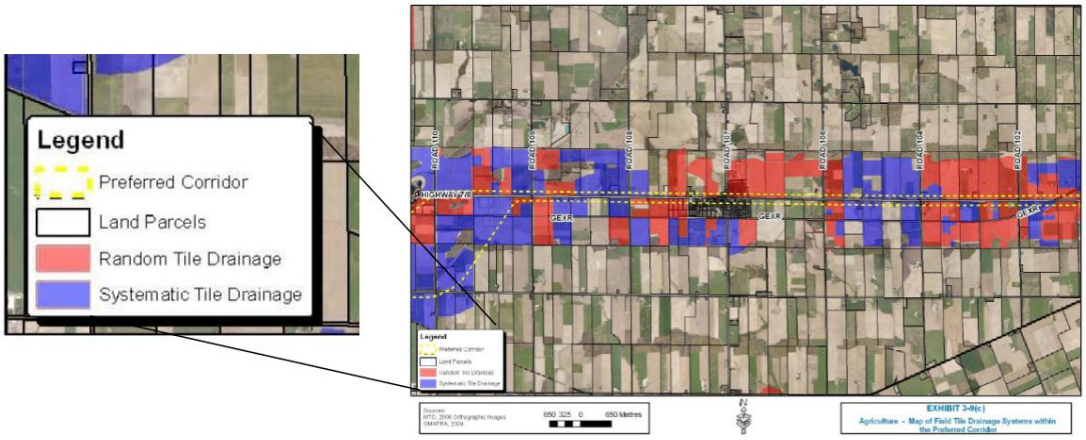
. . . . . .

☐ I have no opinion

Participant Code: . .

7. **Agricultural lands on the two study maps are classified according to their "Soil capacity for Agriculture" (Canadian Land Inventory Class, CLI) and indicating if they are tile drained or not.**





Participant Code: . .

Please indicate the degree to which you agree or disagree with the following statement:

"Within the context of the Highway 7 & 8 Study, categorizing agricultural lands in terms of their Canada Land Inventory (CLI) Class and their drainage status indicates their most important and relevant aspects."

☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree (choose one answer)
☐ Disagree
☐ Strongly disagree

Please briefly describe the reasons underlying your answer

. . . . . .

. . . . . .

. . . . . .

Do you think categorizing agricultural lands in terms of their Canada Land Inventory (CLI) Class and their drainage status may influence the objectivity or balance in the evaluation and decision-making on corridor alternatives?

☐ No, because . . . . . .

. . . . . .

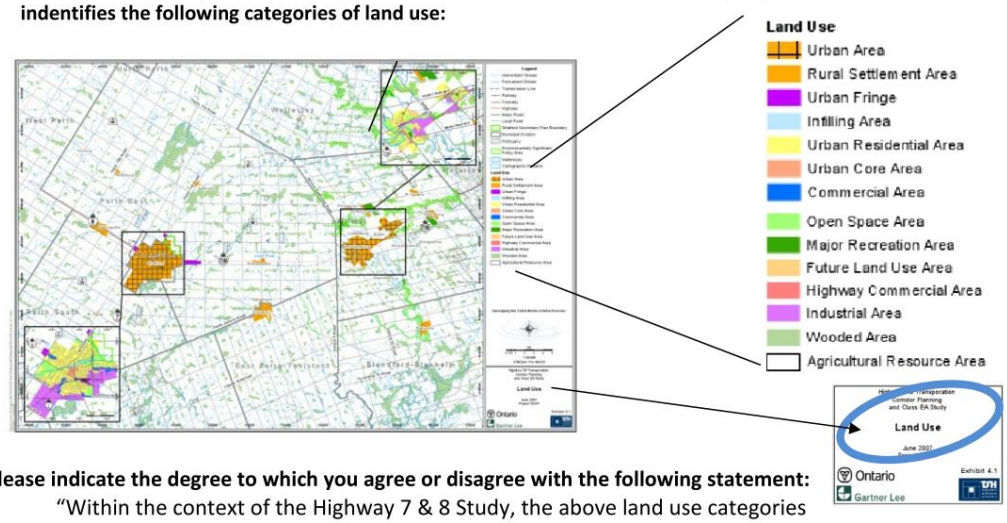
☐ Yes, because . . . . . .

. . . . . .

☐ I have no opinion

Participant Code: . .

8. On the thematic map on different types of "Land-use" in the study area the map legend indentifies the following categories of land use:



Please indicate the degree to which you agree or disagree with the following statement:

"Within the context of the Highway 7 & 8 Study, the above land use categories represents well the most important and relevant aspects of land use in the area."

☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree (choose <u>one</u> answer)
☐ Disagree
☐ Strongly disagree

Please briefly describe the reasons underlying your answer

. . . . . .

. . . . . .

. . . . . .

<u>If you chose answer d. or e. :</u> Do you think representing land use by means of the above land use categories may influence the objectivity or balance in the evaluation and decision-making on corridor alternatives?

☐ No, because . . . . . .

. . . . . .

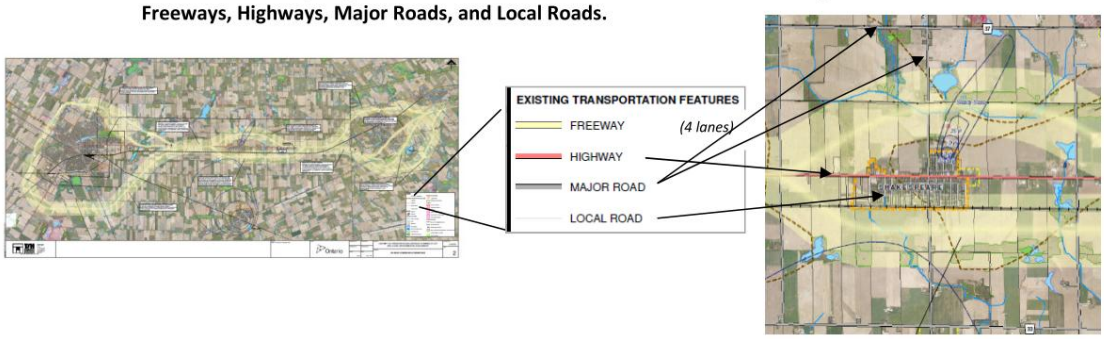
☐ Yes, because . . . . . .

. . . . . .

☐ I have no opinion

Participant Code: . .

9. Roads on the study maps for the evaluation of corridor alternatives are categorized as Freeways, Highways, Major Roads, and Local Roads.



Please indicate the degree to which you agree or disagree with the following statement:

"Within the context of the Highway 7 & 8 Study, the above categories indicate the most important and relevant aspects of different types of roads in the study area."

- ☐ Strongly agree
- ☐ Agree
- ☐ Neither agree nor disagree (choose one answer)
- ☐ Disagree
- ☐ Strongly disagree

Please briefly describe the reasons underlying your answer

. . . . . .

. . . . . .

. . . . . .

Do you think categorizing roads as shown above may influence the objectivity or balance in the evaluation and decision-making on corridor alternatives?

☐ No, because . . . . . .

. . . . . .

☐ Yes, because . . . . . .

. . . . . .

☐ I have no opinion

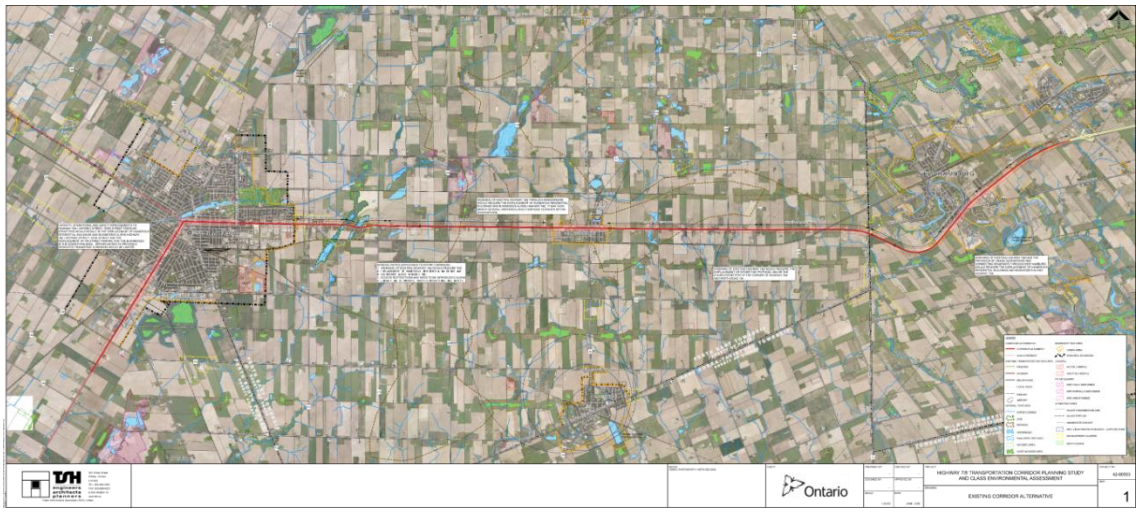
*** YOU HAVE REACHED THE END OF THIS SURVEY ***

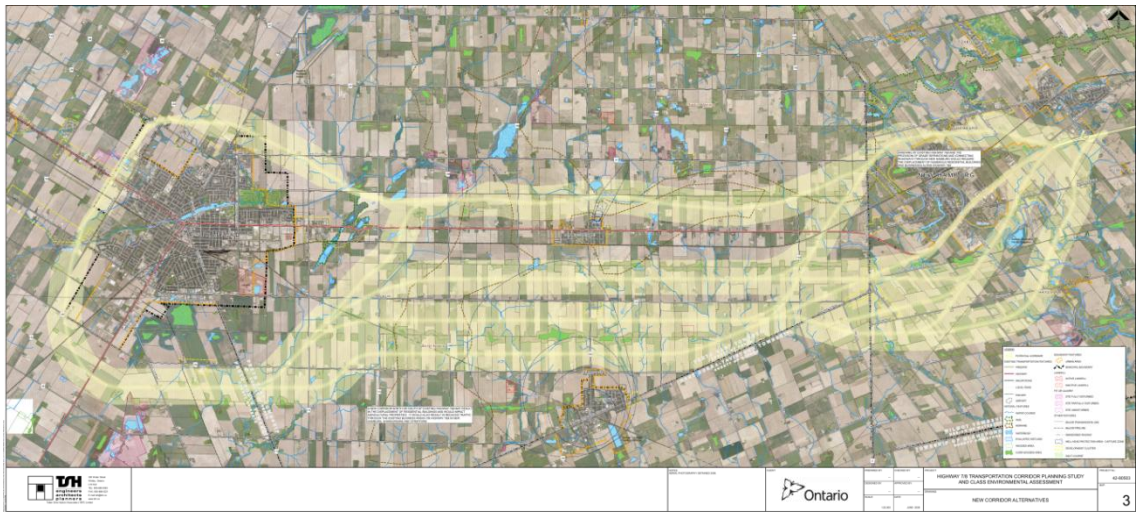
Thank you for sharing your time, knowledge and perspectives!

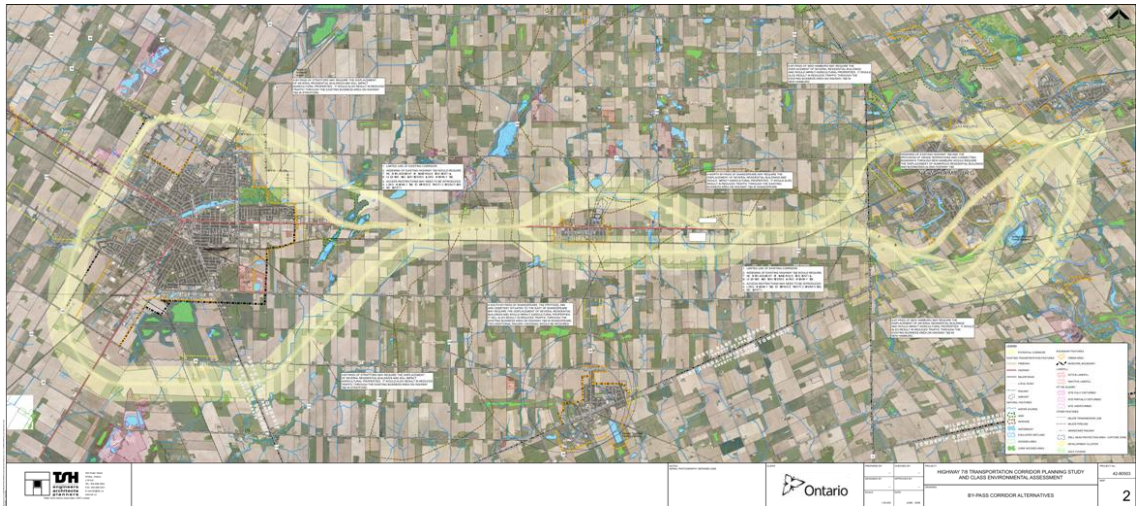
Participant Code: .

Appendix C

Initial Corridor Alternative maps







Long list of corridor maps as displayed in Public Information Centre #2 (June 2008).

Legend used on the corridor alternative maps.

Appendix D

Criteria for the Transportation Solution to be Developed

Factors and subfactors	Criteria
Natural Environmental Factors	17
Fisheries and Aquatic Ecosystems; Terrestrial Ecosystems; Groundwater; Surface Water; Air Quality.	
Land Use / Socio-Economic Factors	23
Land Use Planning Policies, Goals, Objectives; Land Use / Community; Noise Sensitive Areas (NSAs); Land Use / Resources; Major Utility Transmission Corridors; Contaminated Property and Waste Management; Landscape Composition.	
Cultural Environmental Factors	8
Cultural Heritage – Built Heritage and Cultural Landscapes; Cultural Heritage – Archaeology.	
Area Economy	4
First Nations Industry; Heavy Industry and Trade; Tourism and Recreation Industry; Agriculture Industry.	
Transportation Factors	12
Federal/Provincial/Municipal transportation planning policies/goals/objectives; Efficient movement of people; Efficient movement of goods; System reliability / redundancy; Safety; Modal integration, balance and efficiency; Linkages to Population and Employment Centres; Recreation and Tourism Travel; Accommodation for pedestrians, cyclists and snowmobiles; Constructability; Construction Cost; Traffic Operation.	
Factors:	5
Total: Subfactors:	30
Criteria:	64

Initial list of criteria for the solution to be developed (Derived from Ontario, 2007a).

Appendix E

Overview of Public Process with Key Processes and Key Maps

Public Information Centre (date)	Key processes /findings/ proposals presented	Key maps
PIC1 JUL/AUG 2007	Background and overview of study process General overview of Transportation, Land Use and Economic Conditions	Thematic maps
PIC2 JUN 2008	Traffic forecasts and problems; 5 strategic options to address transportation problems. Widening existing or development of new corridor sections proposed as most effective option to address actual and future transportation needs. A long list of corridor alternatives is presented Description of natural, socio-economic and cultural environment based on secondary sources.	Thematic maps 3 Maps with long corridor alternatives: new corridor options, by-pass options, and existing corridor.
Corridor Alternatives Workshop in New Hamburg MAR 2009	Obtain feedback on preliminary short list of corridor alternatives in New Hamburg area. Obtain inputs for improvement of existing corridor.	Short list of corridor alternatives in New Hamburg area. Different design options for the existing corridor.
PIC2B NOV/DEC 2009	A revised long list of corridor options. Screening criteria and process of long list resulting in short list of corridor alternatives	Thematic maps 3 Maps with revised long corridor alternatives: revised new corridor options, revised by-pass options, and existing corridor. Screening tables with maps of all corridor sections on which criteria were applied. Maps of short list of corridor options.
PIC2C APR 2009 (Stratford only)	A newly revised long list of corridor alternatives around the city of Stratford. Process and results of screening of long list resulting in a short list of corridor options	3 Maps with revised long corridor alternatives: revised new corridor options, revised by-pass options, and existing corridor. Screening tables with maps of all corridor sections on which criteria were applied. Maps of short list of corridor options.
PIC3 JUL/ AUG 2009	Screening process of short list of corridor options. The resulting preferred corridor. Route alternatives within the preferred corridor	Map of short list of corridor alternatives. Screening tables with maps of all corridor sections on which criteria were applied. Map of preferred corridor.

Public Information Centre (date)	Key processes /findings/ proposals presented	Key maps
Shakespeare Community Workshops no. 1 March 8, 2010	Criteria four evaluating route alternatives were discussed / generated. I workshop route new alternatives within a reduced study area surrounding Shakespeare are generated.	Based on workshop Study Team elaborated a new list of by-pass options around Shakespeare
Shakespeare Community Workshops no. 2 March 27, 2010	Review of criteria and route alternatives from former workshop. No preferred route presented.	Map of proposed routes by participants in Workshop No. 1. Map alternatives by MTO based on participants proposals. ABC presents counter maps with case studies to stress size of agricultural operations, the concept of the integrated farm business unit and the importance of linkages between multiple farm operations
PIC 4 Jan 2011	New shortlist of corridor alternatives, with changes in the area between Shakespeare and Stratford. Assessment (screening) of route alternatives New preferred route is presented; including changing outside the Shakespeare study area is presented.	Map with new short list of corridor alternatives Map of route alternatives in revised preferred corridor. Maps of route alternatives with screening tables Map of preferred.
PIC 5 (programmed)	List of Preliminary Design Alternatives	
PIC 6 (programmed)	Screening process of alternatives Preferred Preliminary Design Alternative.	

(Events that emerged in course of the Study process are shaded)

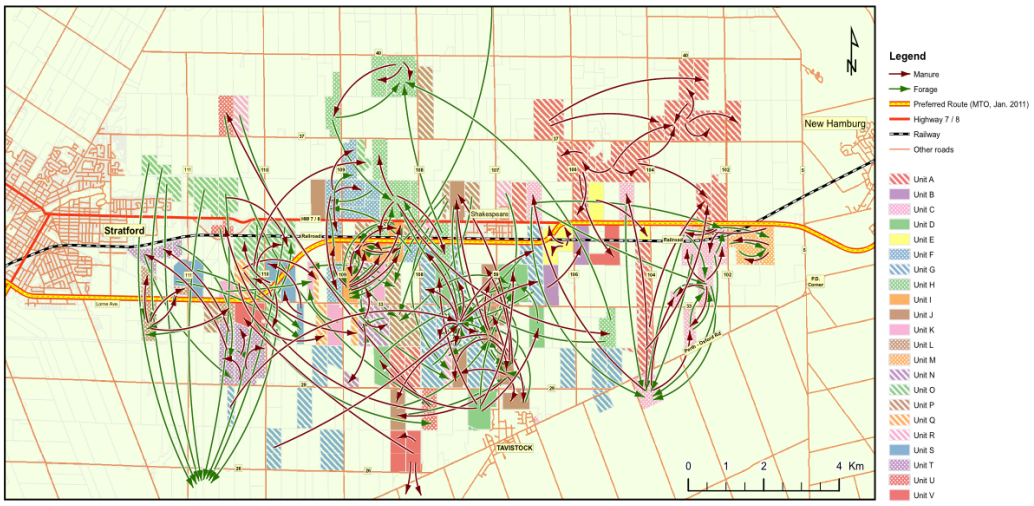
Appendix F

ABC Counter Maps

(All maps reproduced with permission of ABC)

Agricultural Business Community
Perth East, Perth South, and Wilmot West

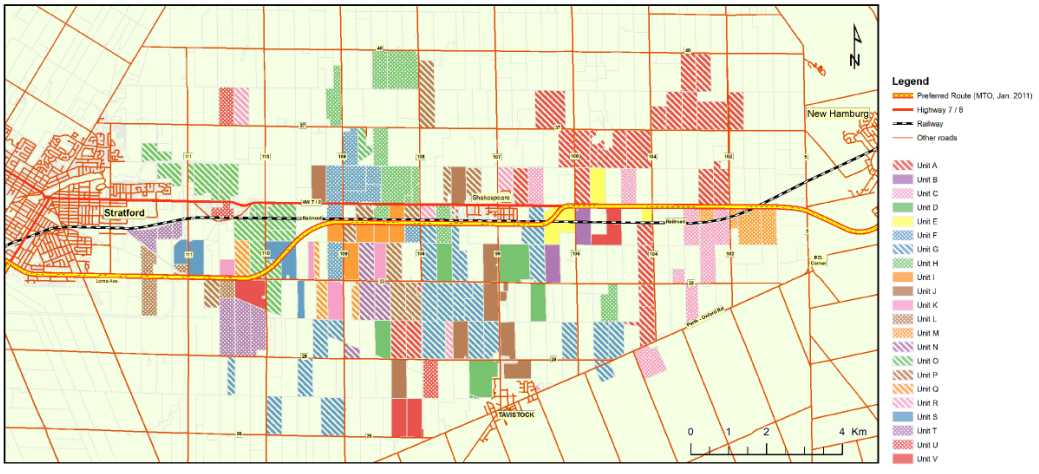
Manure and Forage Transportation



An Integrated Agriculture Business Unit: the land base , owned or leased, necessary to operate a viable agricultural business while meeting the current statutory requirements

Agricultural Business Community
Perth East, Perth South, and Wilmot West

Agricultural Business Units



An Integrated Agriculture Business Unit: the land base , owned or leased, necessary to operate a viable agricultural business while meeting the current statutory requirements

Appendix G

Map Image Reviewed During the Workshop