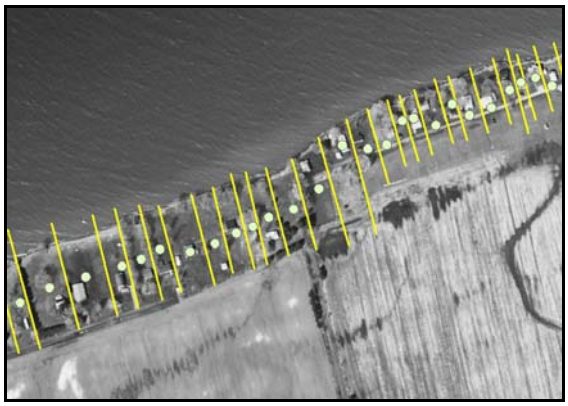
Task Summary Report

(Baird Phase III Task 1.5)

Development of Property Parcel Mapping and Related Attribute Data, Orleans County NY and Northumberland County, Ontario



Coastal Task Working Group
International Joint Commission
Lake Ontario – St. Lawrence River Regulation Study

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Prepared By

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Development of Property Parcel Mapping and Related Attribute Data, Orleans County NY and Northumberland County, Ontario (Baird Phase III, Task 1.5)

Status: This task is complete.

1.0 Introduction

This task forms part of a series of tasks being conducted for the Coastal Task Working Group (CWG) of the IJC Lake Ontario – St. Lawrence River Study by Christian J. Stewart Consulting (CJS) and W.F. Baird and Associates (Baird). Specifically this task comprises a portion of "Task 1.5 – Develop Strategy for Counties Without Digital Parcel Data" in the September 2002 Phase III proposal submitted to the CWG by Baird and CJS.

2.0 Purpose

The Coastal Task Group of the IJC Lake Ontario – St. Lawrence River Study requires a range of data and information regarding the Canadian and United States shorelines of Lake Ontario and the St. Lawrence River in order to complete a series of tasks examining the impacts of water level regulation on riparian shoreline interests. Data being collected will be utilized in a Flood and Erosion Prediction System (FEPS) - developed by Baird - to assess the physical and economic impacts to the riparian interest group of potential flooding, erosion and low water that may arise due to changes in the regulation plan of Lake Ontario and the St. Lawrence River.

Through a series of discussions, other task activities (Phase I and II), and preliminary modeling on a reach and shore unit basis, Baird and the CWG agreed that the analysis within the FEPS model should be performed on a property by property level basis around the entire Lake and River shoreline where possible. As such, there was a need to gather and integrate as much digital property parcel mapping as possible so that it could be brought into the FEPS GIS module and so that: 1) individual property parcels/lots could be identified; and 2) that required data could be attributed to each parcel as needed for analysis in the FEPS model.

In addition to the actual property parcels themselves, there was also a desire to collect related property assessment data (such as land and property value, ownership, year built, structure size, etc.), which would be useful for input to the economic analyses that would need to be performed in the FEPS.

2.1 Digital Parcel Mapping and Assessment Data Status

In Phase II of the Study, an initial scoping of available parcel data was undertaken (Stewart, 2002a) and any available parcel mapping and assessment data began to be collected. Data collection continued throughout Phase III of the Study and by the fall of 2003, up to date property parcel and related assessment data had been assembled for the majority of the open Lake Ontario shoreline and the U.S. side of the St. Lawrence River (green and light blue areas on Figure 1 below).

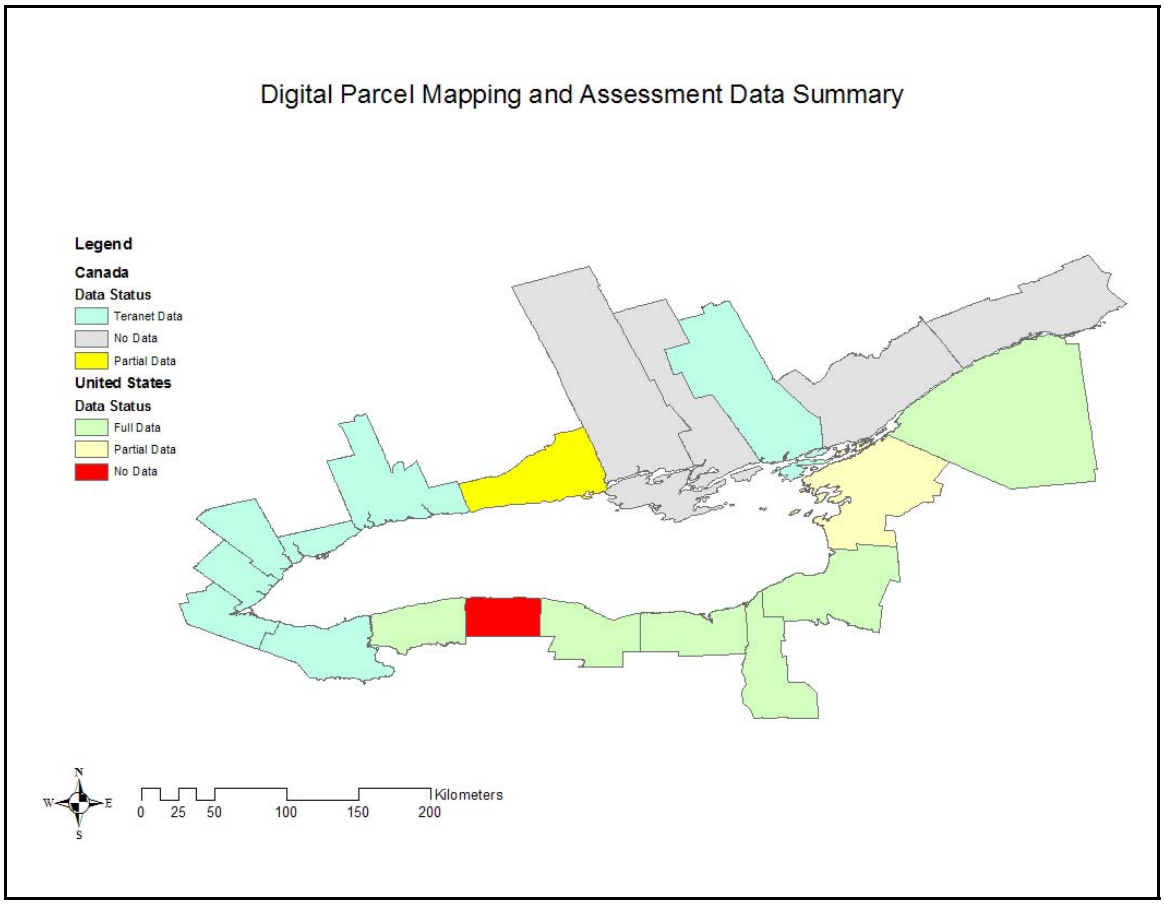

Figure 1 - Digital Parcel Mapping and Assessment Data Status

There were some exceptions to this. In New York, Jefferson County (light yellow) only had current parcel and assessment data for a few of it's townships and older parcel data only for the others. In Orleans County (red), there was no digital parcel mapping, but there were paper maps available as well as digital assessment data. In Ontario, Northumberland County (bright yellow) had older digital parcel data only for it's western 2 townships and data for the rest of the eastern counties including Prince Edward County and all those along the St. Lawrence River could not be obtained (grey).

To address these gaps, it was felt that if parcel data could be acquired and developed for as much as the open Lake Ontario coast as possible, this would provide a suitable data set for modeling within the FEPS. As such there was a need to address the lack of suitable parcel data for Orleans County, New York and Northumberland County, Ontario. The parcel gaps for other sections of shoreline (Jefferson County, New York) and the remainder of the Ontario counties, were felt to be less critical to include at this point, given that the majority of these shores are not subject to severe erosion hazards (largely bedrock) and that possible impacts could be represented by modeling shorelines of a similar nature where parcel data *was* available.

This Task Summary Report then summarizes the methodologies that were utilized to create parcel mapping and associated attribute data (assessment data and other data) for Orleans County, New York and Northumberland County, Ontario.

3.0 Methodology

3.1 Orleans County, New York

3.1.1 Data Sources

Parcel mapping and related attribute data for the Orleans County shoreline were derived using a number of key data sources:

Digital Orthophotography: 2002 black and white digital orthophotography for the Orleans County shoreline was prepared by the US Geological Survey and was downloaded from the New York State GIS Clearinghouse (Figure 2). This photography served as a base map for the study area.

Paper Tax Parcel Maps: Copies of paper tax parcel maps for the Orleans County shoreline (Yates, Carlton and Kendall Townships) were obtained (at cost) from the Orleans County Office of Real Property Services (Figure 3). These maps showed the full extent of all property parcels as well as road networks and rights of way and included parcel identification numbers.

Digital Oblique Aerial Photos: A series of high resolution, digital oblique aerial photos of the entire Lake Ontario shoreline were taken by Baird in the summer of 2003. These served as an excellent source for observation of current shoreline conditions and assisted in defining property boundaries and other attribute data required for each parcel. An example for the Orleans County shoreline is presented in Figure 4.

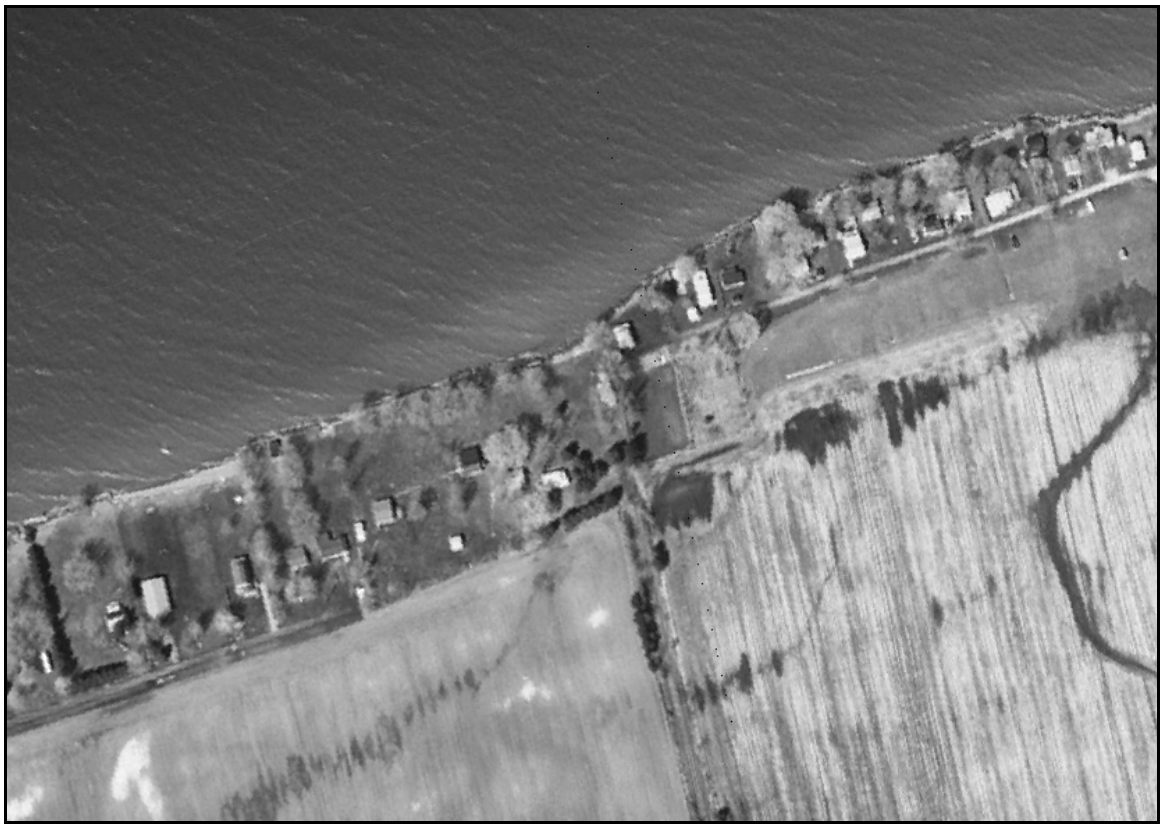

Figure 2 – 2002 USGS Digital Orthophoto Example, Orleans County, New York Shoreline

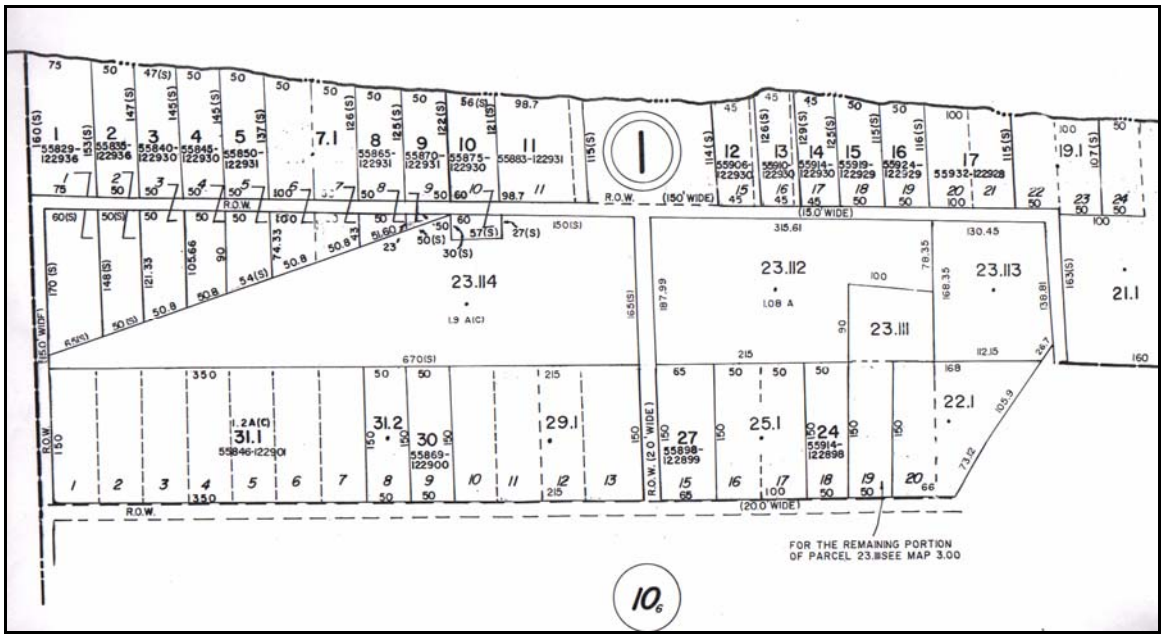

Figure 3 - Example of Paper Tax Parcel Mapping, Orleans County, New York.

Figure 4 - Example of 2003 Digital Oblique Aerial Photo, Orleans County Shoreline

Digital Assessment Data: While digital mapping for Orleans County was not available, digital assessment data was available and was obtained. This consisted of a spreadsheet (.dbf) file of XY coordinates, where each coordinate pair represented the center point (centroid) of each existing tax parcel present on the paper mapping. Associated with each centroid coordinate was a range of assessment data. A sample is presented in Figure 5.

x	y	PrintKey	OwnrName	SFLA	YrBuilt	LandAssess	TotAssess	Frontage	Depth	Acres
549240	1212180	24.12-1-1	Jurs, Ronald L	1300	1833	7200	42100	66.00	173.25	0.26
549340	1212410	24.12-1-2.1	Bowman Apple Products Inc			13000	13000	0.00	0.00	5.20
549120	1212300	24.12-1-2.21	Indian Summer Inc			7300	7300	108.00	250.47	0.62
549160	1212560	24.12-1-2.22	Village Of Lyndonville			2500	2500	32.00	625.46	1.55
549870	1212410	24.12-1-3	Bowman Apple Products Inc			23400	29900	0.00	0.00	8.00
550220	1212200	24.12-1-4	Oliver, Keith P	1566	1958	10400	61400	136.00	173.25	0.54
550340	1212210	24.12-1-5	Soule, Beverly A	952	1964	9300	54700	103.00	173.25	0.40
550430	1212210	24.12-1-6	Brabon, Robert A	1857	1920	8100	58700	82.50	173.25	0.32
550510	1212210	24.12-1-7	Bentley, Lynnette			7200	14700	66.00	173.25	0.26
550580	1212210	24.12-1-8	McDonald, Norman D	1024	1990	7200	42000	66.00	173.25	0.26
550640	1212210	24.12-1-9	Searls, Clayton E	1308	1878	7200	43100	66.00	173.25	0.26
550730	1212210	24.12-1-10	Cooper, Virginia	1776	1920	9400	45900	107.25	173.25	0.42
550820	1212210	24.12-1-11	Sambolin, Santa	1344	1890	7200	51600	66.00	173.25	0.26
550880	1212220	24.12-1-12	Lewis, Theodore	1512	1920	7200	52500	66.00	173.25	0.26
550970	1212220	24.12-1-13	Wirth, Frances	1508	1905	9700	47600	115.50	173.25	0.45
551070	1212220	24.12-1-14	Boyce, Leland H	1392	1860	8100	49900	82.50	173.25	0.32

Figure 5 - Example of Digital Assessment Data, Orleans County, New York

3.1.2 Define Property Parcel Boundaries

To define the property parcels, the 2002 USGS digital orthophotography (DOP) for Orleans County was imported to ArcMap GIS. Using the paper tax parcel maps and the oblique digital air photos as references, the alongshore (or in this case, the east-west) boundaries of each parcel were digitized on screen in the GIS (Figure 6) and saved as a separate shape (.shp) file.

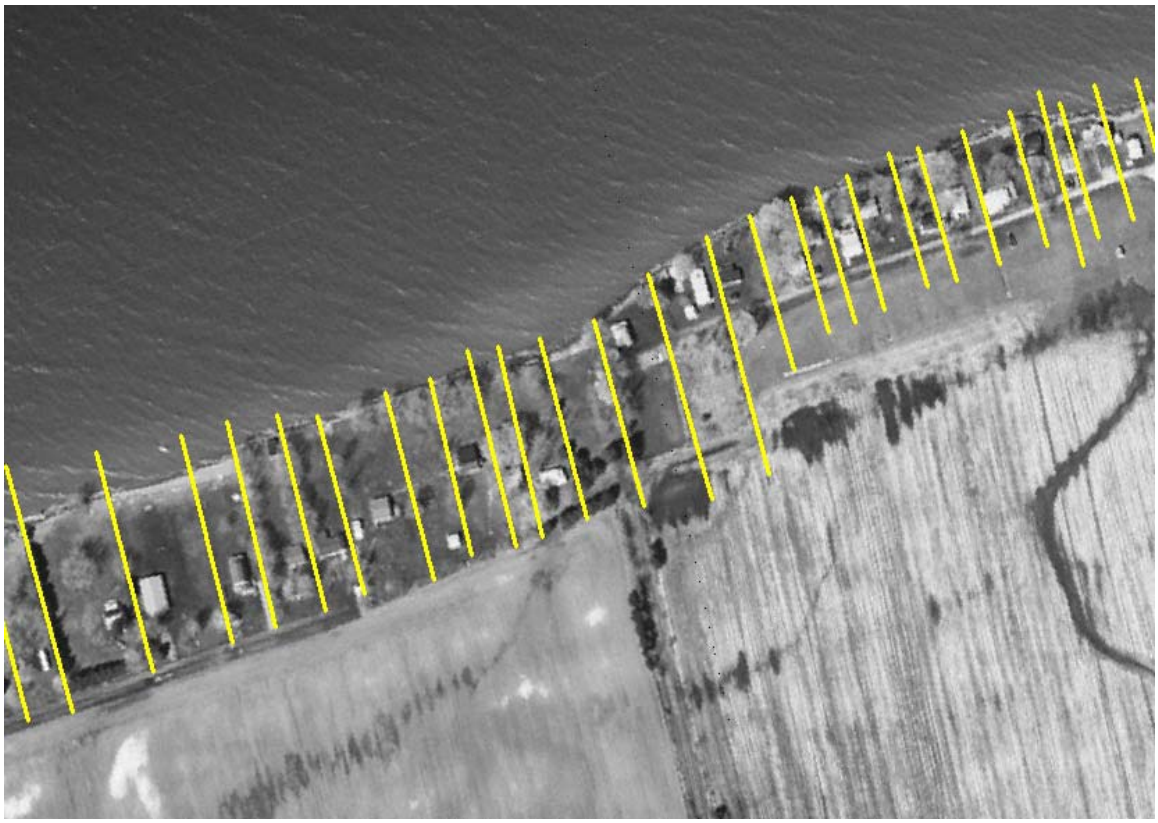

Figure 6 - Delineation of Alongshore (East-West) Parcel Boundaries, Orleans County, New York

Parcel boundaries were delineated for all shoreline parcels as well as any required "second tier" parcels (i.e., developed parcels immediately landward of a vacant shoreline parcel). Parcels were also delineated for short distances up creeks and rivers where they were present. The parcel boundaries were simple line segments and there is no attribute information attached to them except for the spatial information required by ArcMap for proper display in the GIS.

It should be noted that landward and lakeward parcel boundaries were not delineated for these parcels, except in the case of second tier parcels where the lakeward boundary was delineated in order that the *erosion buffer* attribute could be determined (see Attribute discussion).

3.1.3 Define Parcel Polygons

A parcel polygon then had to be created for each of the property parcels that were defined when creating the parcel boundary file. A polygon feature was required so that the Baird Shore Tools[1] "Populate Parcel Database" and "Parcel Shore Protection" tools could be used to assist in populating each parcel polygon with attribute information on shore protection, dimensions and distance to bluff (the tool is only designed to work on polygon features). Initially it was felt that a polygon delineating the outline of a main structure on a lot would suffice. However for vacant lots, this posed a problem. Fortunately, the digital assessment data that was provided by Orleans County (Section 3.1.1) contained XY coordinates of the center point of each property tax parcel. In addition, a range of assessment data was tied to each of these points in the database table. As such, converting these point data into polygons would create the polygon required for each property parcel, as well as have the benefit of already being populated with a range of assessment data.

Converting this point data to polygon data required a number of steps:

a) The Digital Assessment Data XY coordinates for the parcel centroids were plotted in Arc Map as a new shape file ("XYZ"_Twp_Parcel_Centroids.shp).

b) As the Baird Shore Tools was not designed to populate point data (only polygons) the Parcel Centroids shape file had to be converted into polygons. This was done as follows:

   i) Using the Buffer Wizard in ArcMap, a 2.5 meter buffer was placed around each point.. This created a new polygon file called "Buffer_of_"XYZ"_Twp_Parcel_Centroids.shp".

   ii) This new shape file did not carry over the required attribute information and so it needed to be "joined" with the initial assessment point file. The join was completed using the FID attribute which was the one common attribute that carried over in the buffering process.

   iii) Once the join was completed, the "Buffer_of..." file needed to be exported to a new shape file to preserve all the field changes. The

[1] Baird Shore Tools is a custom application that was designed for integration with ArcMap. It contains a series of tools for performing a range of coastal analyses and data compilation directly in the GIS. The "Populate Parcel Database" allows efficient measurement and entry of parcel dimension attributes including Frontage, Depth, Distance of Structure to Bluff, and Erosion Buffer. The "Parcel Shore Protection" tool allows each parcel to be assigned the appropriate shore protection classification as well as the Shore Protection length (as a percentage of the parcel Frontage).

new (and final) files are called ""XYZ"_Twp_Parcel_Centroids_Polygons_LCC.shp". The LCC refers to the fact that they were created in the IJC Study Lambert Conformal Conic projection.

c) This new shape file formed the base file to which all additional attribute information could be attached.

3.1.4 Adjust and Edit New Parcel Centroid Polygons

The previous step resulted in the creation of parcel polygon centroids for ALL parcels in the entire township including inland parcels. In examining the data, it was noted that in some cases, multiple XY points applied to the same parcel and some of these did not have assessment data[2]. In other cases, XY points for the lakeshore parcel were located some distance inland[3]. In still other cases, XY points had incorrect XY data and thus were not spatially correct. In any case, the parcels were first defined and then the appropriate XY point was moved closer to the shoreline and to the center of the parcel.[4] For some areas, XY assessment data did not seem to exist for a number of parcels (e.g. one 23 parcel stretch in Yates Twp.). In this case, new parcel centroids were created that do not have any assessment data associated with them. In a few minor cases, centroids were also created for large Right of Way areas and similarly, no assessment data is available for these.

Given the above issues, a thorough quality check of the data was undertaken to ensure that each property parcel that was defined along the shoreline (with the parcel boundaries) had a single, correct parcel polygon centroid (and related assessment data) associated with it. This was done by using the paper parcel maps and associated parcel ID number and checking it against the matching parcel ID number in the electronic assessment data.

This resulted in the deletion of a number of parcel polygon centroids (where multiple centroids existed for each parcel), as well as the relocation of those where the XY coordinates were incorrect. Where a parcel centroid for a property

[2] In examining the assessment data it appeared that this was due to the fact that a separate record existed for each structure present on the property, including outbuildings and secondary structures. In editing the data to select the appropriate centroid for inclusion in the coverage, we selected the data point that applied to the main structure, which was usually the record that contained complete assessment data.

[3] This was usually where large inland farm parcels had a small "panhandle" of property that provided lakefront access. As such the parcel centroid was located a distance inland and was subsequently relocated closer to the shore for mapping purposes.

[4] Given this, users of the mapping should be aware that the coordinates presented in the attribute table for the XY point, may not coincide with the actual spatial position that the point has been moved to on the map.

was not present in the database, a new one was created and assigned a unique parcel ID in keeping with the Parcel ID numbering format in the existing database.

In addition to these edits, for graphical and aesthetic purposes, many of the parcel polygon centroids were adjusted so that they appeared as close as possible in the centre of the property parcel and nearer the shoreline.

Finally, as only shoreline parcel polygons and second tier parcels (where needed) were required, all additional parcel centroids present within the Township were deleted from the database.

This parcel polygon centroid file and the property boundary file combined to form the final property parcel coverage (see Figure 7) that then needed to be attributed with additional information (see Section 3.3)

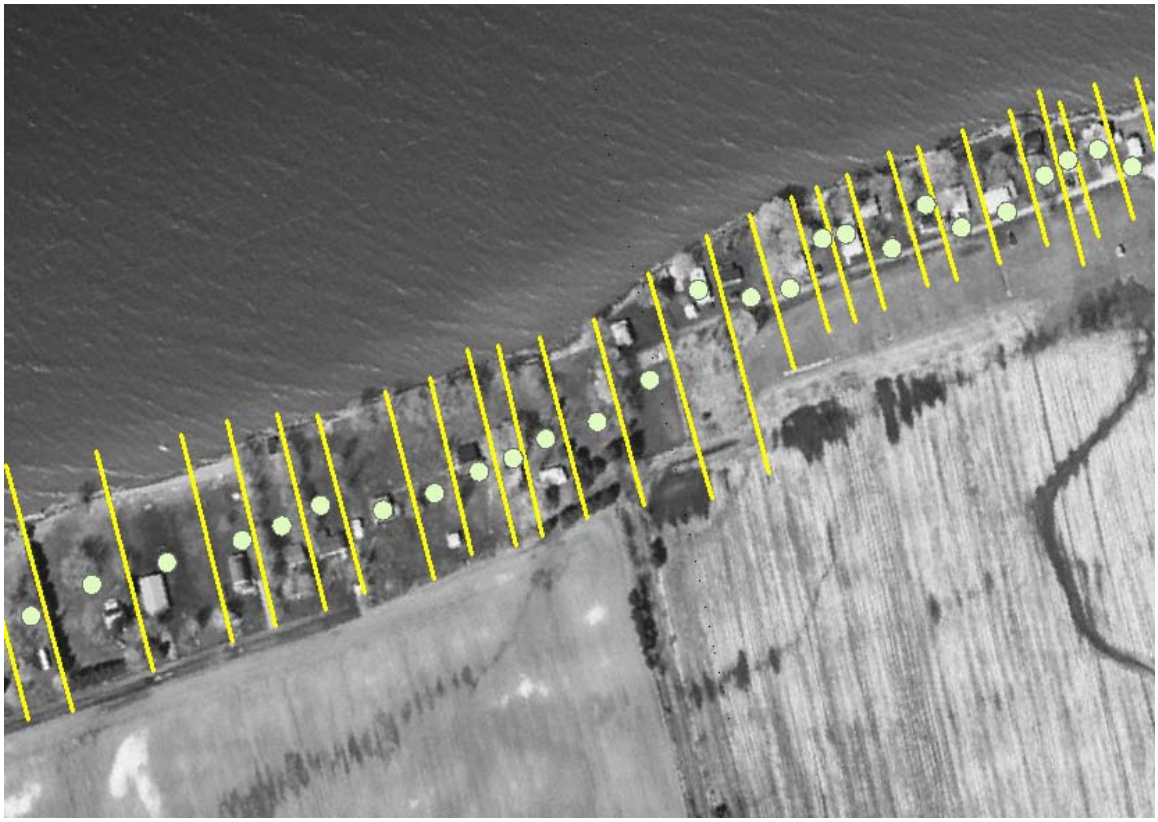

Figure 7 - Example of Final Parcel Delineation Including Parcel Boundaries (Yellow Lines) and Parcel Centroid Polygons (Light Green Circles), Orleans County, New York

3.2 Northumberland County, Ontario

3.2.1 Data Sources

Parcel mapping and related attribute data for the Northumberland County shoreline were derived using a number of key data sources:

Digital Orthophotography: 2002 color digital orthophotography for the Northumberland County shoreline was prepared by J.D. Barnes and Associates and was obtained from Environment Canada (Figure 8). This photography served as a base map for the study area.

GRCA Digital Parcel Mapping: Existing digital parcel mapping for the western half of the County (Hope and Hamilton Townships, and Towns of Port Hope and Coburg) was obtained from the Ganaraska Region Conservation Authority (GRCA) (Figure 9). Assessment data was not associated with this mapping, however a point file was provided for each parcel (except Towns of Coburg and Port Hope) that provided the assessment role number for the parcel.

Figure 8 - 2002 Digital Orthophoto Example, Northumberland County, Ontario Shoreline

Figure 9 - Ganaraska Region Conservation Authority Digital Parcel Mapping, Hope and Hamilton Townships and Town of Port Hope (Town of Coburg Not Shown Due to Projection Problems)

Digital Oblique Aerial Photos: A series of high resolution, digital oblique aerial photos of the entire Lake Ontario shoreline were taken by Baird in the summer of 2003. These served as an excellent source for observation of current shoreline conditions and assisted in defining property boundaries and other attribute data required for each parcel. An example for the Northumberland County shoreline is presented in Figure 10.

3.2.2 Define Property Parcel Boundaries and Polygons

For Northumberland County, parcel boundaries and associated polygons were created in two different manners. In the western half of the study area (up to and including Hamilton Township), the existing digital parcel mapping was overlain on the 2002 digital orthophotos and a new polygon coverage of shoreline parcels and required second tier parcels was digitized on screen[5]. Parcel boundaries

[5] The existing digital parcel mapping was provided in vector (polyline) format, and as such would not be compatible with the Baird Shore Tools when it came time to develop the required attribute data. As such, a new polygon coverage had to be created using the existing mapping as a guide.

Figure 10 - Example of 2003 Digital Oblique Aerial Photo, Northumberland County Shoreline

followed the outlines of the existing parcels as much as possible, except for instances where the orthophoto (which was more current than the existing parcel mapping) showed a significant change in parcels (e.g., new subdivision, etc.). In this case, the new parcels were drawn as accurately as possible (using development patterns as a guide) to produce the new coverage. An example of the final parcel polygon mapping for this section of the shoreline is presented in Figure 11.

For areas east of Hamilton Township, existing parcel data (of any type) was not available. Parcel polygons were thus delineated based on a "best guess" basis as to the actual lot boundaries using tree lines, lawn lines, hedge rows, road networks, etc. observed on the digital orthophotos and digital oblique photos to assist in definition. In some cases, parcels do not represent the full extent of what, in reality, would be the full parcel (e.g., large farm tracts, large wetland areas). An example of this can be found in Figure 12. For most parcels in this figure, the lot lines can be reasonably inferred from the development patterns, road networks, etc. However, for the parcel indicated with the red arrow, the exact landward limit of that parcel is more difficult to ascertain. In these situations an artificial landward boundary was created. When attributing such

Figure 11 - Parcel Polygon Delineation, Western Half of Northumberland County, Ontario

Figure 12 - Parcel Polygon Delineation, Eastern Half of Northumberland County. Parcel Highlighted by Red Arrow Has Unknown Landward Limit and Thus an Artificial Boundary Has Been Created.

parcels (see Section 3.3), dimension data such as Parcel Depth and Land Depth could not be collected.

Parcels were delineated for the full extent of the Northumberland County photo coverage including Presque Isle Bay and open lake parcels to the east of the Presque Isle spit.

3.3 Parcel Attribution and Related Data Issues

Once the parcel polygons were defined, they needed to be populated with a range of data that would be used in the FEPS for both physical and economic analyses. In addition to the assessment data that could be linked to the polygons (for Orleans County), a range of shore protection and dimension data were collected. These are discussed briefly below along with any issues or limitations that arose in the collection of the data.

3.3.1 Shore Protection

Shore Protection Type and Quality: Using the Baird Shore Tools "Parcel Shore Protection" tool within ArcMap (Figure 13), each parcel in the database was selected and then assigned a Shore Protection Type and Quality based on the existing shore protection classification scheme that is being used for the study (see Stewart, 2002b or 2003). The type and quality of protection present was determined through observation of the digital orthophotos as well as through use of the digital oblique air photos taken by Baird in the summer of 2003.

While attribution of the shore protection type and quality is generally accurate, a few minor issues did arise:

1. In some cases the digital oblique air photo coverage did not provide enough overlap and the protection present in the unphotographed parcels had to be determined from the digital orthophotographs alone. In some cases, due to DOP quality, this was difficult and the shore protection then had to be inferred from surrounding properties;

2. In some cases, more than one type of shore protection was present within one parcel property. In this case, the most dominant shore protection type was recorded. In cases where neither was dominant (e.g., a revetment that has been built in front of an existing seawall), then the shore protection that would first be impacted by water level and wave processes was recorded (e.g., the revetment in this example);

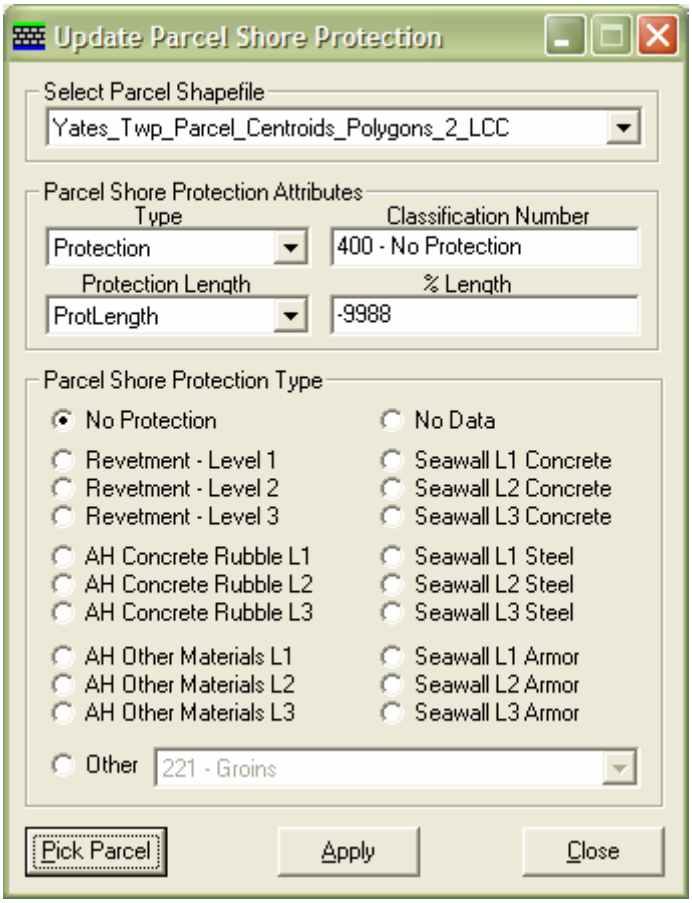

Figure 13 - Baird "Parcel Shore Protection" Tool

3. The GIS tool that was used for recording shore protection in the database was changed part way through the attribution process and as such, classification values for all US shore parcels (including Orleans County) will differ than those for Canadian parcels (including Northumberland County). In the US, the value recorded for seawalls was always 211, 212 or 213. For the Canadian shoreline, there was a desire to better differentiate between the type of materials used to construct seawalls and as such, new categories were added to differentiate between concrete (211, 212, 213) sheet steel (371, 372, 373) and armor block (381, 382, 383) walls. Users of the data need to be aware of this when looking at the shore protection data for parcels on these different shorelines. Also, on the Canadian shoreline, if there was a situation when the composition of the wall could not be determined, or if there was a wall that was composed of some other material (e.g., timber crib/wood), it was usually placed in the "initial" 211, 212, or 213 category. The number of occurrences of this was minor however in this Northumberland data set;

4. In some cases, vegetation present along the shoreline in both the DOP and the oblique digital photos made it difficult to see and determine the type of protection present; and

5. Shore parallel protection was primarily captured in this database except in cases where shore perpendicular protection was dominant or the only type present (e.g., jetties, groines).

Shore Protection Length: For each parcel, the length of shore protection present was recorded. It was recorded as a percentage of the frontage of the parcel covered by the shore protection. Estimates were subjectively made through observation of the digital orthophotos and the digital oblique photos. If the length was equal to the existing frontage (i.e. it covers the entire lot), the default was 100%. If the protection was less than the frontage, the "Parcel Shore Protection" tool allowed the user to select the percentage of the frontage covered (in multiples of 10%).

Similar to the type and quality determination, where digital oblique photos did not exist for a parcel and where vegetation and shadow obscured the shoreline on both the DOPs and the digital oblique photos, the percent length of shore protection had to be estimated "blindly."

3.3.2 Parcel Dimensions

The Baird "Populate Parcel Database" tool (Figure 14) allowed for the measurement and recording of a range of "dimension" data for each parcel. This included:

Frontage: The alongshore length of the lakeward facing side of a shoreline (first tier) or second tier parcel polygon (in meters).

Depth: The depth of the shoreline or second tier parcel measured in meters. Parcel Depth was measured perpendicular to the lakeward edge of the parcel. Where the Depth could not be measured accurately (e.g., Orleans County parcels and some parcels in the eastern portion of Northumberland County) a "0" value was entered in the database. For irregular parcels, the average depth of the digital parcel was recorded.

Land Depth: If the erosion reference (e.g., bluff crest, dune crest) was not located in the same location as the lakeward extent of the digital parcel, the actual land depth of the parcel was recorded in the database. This distance is measured from the current location of the erosion reference feature to the landward limit of the parcel. In other words, Land Depth records the current

condition for the parcel, while Depth records the original extent of the property parcel prior to erosion and loss of land above the lake surface.

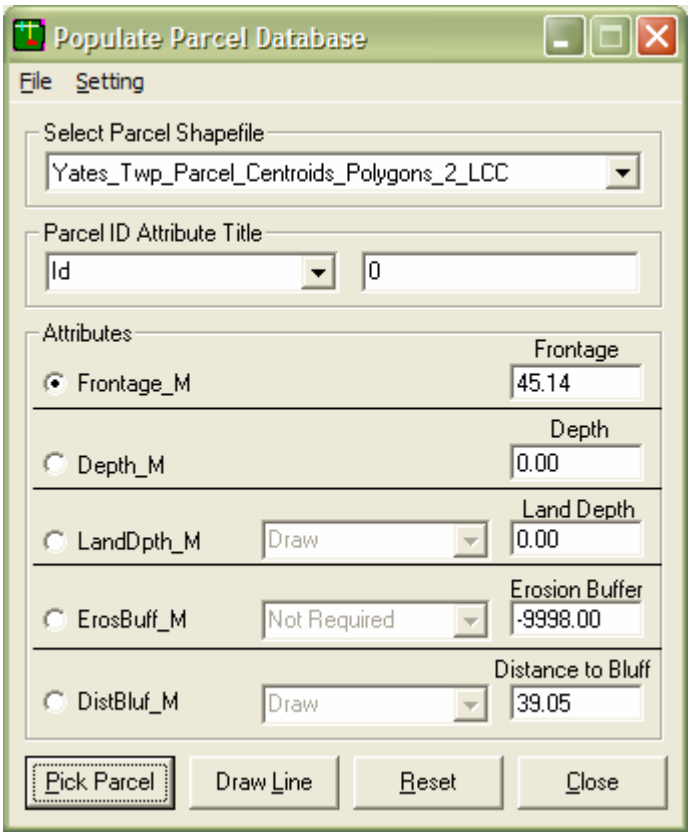

Figure 14 - Baird "Populate Parcel Database" Tool

Land Depth was not required to be measured if the digital parcel was a second or third tier property. In this case, -9997 was entered for the variable. Similarly, a value of -9997 was also entered for shoreline (first tier) parcels where the value was the same as the Parcel Depth. Land Depth was recorded as “0” where it could not be measured accurately (e.g., Orleans County parcels and some parcels in eastern portion of Northumberland County).

Erosion Buffer: If a parcel was not a waterfront lot (i.e. a second or third tier parcel), then the distance from the erosion reference feature of the waterfront parcel to the lakeward extent of the second or third tier parcel was recorded as the Erosion Buffer. If the parcel was a front row lot, then there is no erosion buffer and -9998 was entered in the database.

Distance to Bluff: This recorded the distance from the primary building on the parcel to the top of bluff, dune crest or some other erosion reference feature. A distance was only entered if there was a building on the parcel. For vacant lots

(i.e. no buildings) or Parks/Recreational Areas, one of the following numbers was entered as applicable:

- *-9999* - No distance to bluff because there is no building on parcel, however, the parcel appears to have development potential and is privately owned;

- *-9994* - Undeveloped conservation lands or park lands that presently have no buildings and will not have any in the future because of land use management practices; or

- *-9987* - Parcel represents a Park or Recreational Area with infrastructure such as roads, utilities and building(s). Distance to Bluff will not be recorded for each individual building in the park. However, other parcel variables, such as Frontage and Depth will be recorded.

For Orleans County, New York, all parcels that were delineated were populated with shore protection and dimension data as needed and as possible. For Northumberland County, Ontario, attribute data was only collected for the area of photo coverage up to an including the Presque Isle Spit. Parcels to the east of the spit were not attributed due to the lack of digital oblique aerial photos. Also, those parcels delineated on the north side (bay side) of the Presque Isle spit were attributed using only the DOPs as a reference as the digital oblique photography ended at the tip of the spit. Also, for those parcels in the eastern portion that had artificial landward boundaries created, Parcel Depth and Land Depth were not recorded.

4.0 Data Products

The following ArcMap shape (and related files (i.e., .dbf, .prj, .sbn, .sbx, .shx)) were delivered to Baird for incorporation to the FEPS and for storage on the Coastal Data Server:

4.1 Orleans County

Parcel Boundary Files
yates_property_lines.shp
carlton_parcel_lines.shp
kendall_parcel_lines.shp

Parcel Polygon Files (includes Assessment, Shore Protection and Dimension Data in Attribute Table)
Yates_Twp_Parcel_Centroids_Polygons_2_LCC.shp
Carlton_Twp_Parcel_Centroids_Polygons_LCC.shp

Kendall_Twp_Parcel_Centroids_Polygons_LCC.shp

FGDC Compliant Metadata Files
yates_property_lines.shp.xml
carlton_parcel_lines.shp.xml
kendall_parcel_lines.shp.xml
Yates_Twp_Parcel_Centroids_Polygons_2_LCC.shp.xml
Carlton_Twp_Parcel_Centroids_Polygons_LCC.shp.xml
Kendall_Twp_Parcel_Centroids_Polygons_LCC.shp.xml

4.2 Orleans County

Parcel Boundary and Polygon File (includes Assessment, Shore Protection and Dimension Data in Attribute Table)
Northumberland_Parcel_Polygons_LCC.shp

FGDC Compliant Metadata File
Northumberland_Parcel_Polygons_LCC.shp.xml

5.0 Summary and Proposed Activities for Phase IV

The parcel mapping and related attribute data developed for Orleans and Northumberland Counties will be integrated by Baird with parcel mapping and attribute data that is being developed for all other areas where digital parcel mapping was obtained (recall Figure 1) to create a parcel-by-parcel database for Lake Ontario and the St. Lawrence River. Attribute data for each parcel will then be input to the FEPS model as required for physical and economic analysis of a series of "Performance Indicators" on erosion and shore protection. Modeling results will also be integrated with the overall evaluation model being developed by the Plan Formulation and Evaluation Group within the IJC Study.

REFERENCES

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