ParcelMap BC
Compiling a Parcel Fabric for the Province of British Columbia
WENDY AMY and ELLEN STYNER
Who is MNC?

- Established in 1997, MNC is a geomatics engineering firm located in Calgary, Alberta.

- MNC specializes in working with very large datasets (city/county/province-wide) across multiple formats and platforms.

  - Digital Integrated Dispositions (DIDs) Mapping for Alberta Data (400,000 + activities maintained)

  - Alberta Titles Mapping and Alberta Cadastral Dataset for Government of Alberta (1.9 million parcels)

  - Integrated Property Parcel Fabric for Manitoba Hydro (1.5 million parcels)
The Land Title and Survey Authority of British Columbia (LTSA)

• Responsible for land titles and survey systems in British Columbia (BC)

• Stakeholder’s longstanding need for an easy, efficient means of accessing land title and survey information

• Intuitive map-based access
Strategic Objectives – ParcelMap BC (PMBC)

Primary goal for the ParcelMap BC (PMBC) project is to create and develop an operational model for a **single**, **complete**, **trusted** and **sustainable** visual representation of lands within a given parcel and its relationship to adjacent parcels.

<table>
<thead>
<tr>
<th>Single</th>
<th>Complete</th>
<th>Trusted</th>
<th>Sustainable</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Includes parcel fabrics for all local government areas including municipalities, the rural areas of all Regional Districts, and all surveyed parcels of provincial Crown lands.</td>
<td>• Includes all active parcels in the provincial Crown Land Registry and all parcels with active titles in the LTSA’s Land Title Register.</td>
<td>• The parcel fabric will adhere to standards for parcel attribution, topology, currency, auditability, and spatial accuracy. New surveys are to adhere to spatial accuracy standards, and as a result, the quality of the entire parcel fabric will improve over time.</td>
<td>• PMBC parcel fabric and operational framework is financially sustainable and will be maintained and enhanced over time by LTSA with guidance from our stakeholders.</td>
</tr>
</tbody>
</table>
MNC Scope for PMBC – Three Elements

#1 CADASTRAL TIE COLLECTION
To support accuracy assessments and on-going spatial improvements

#2 PARCEL FABRIC
Single, complete, trusted and sustainable (conversion and compilation)

#3 SURVEY PLAN SUBMISSIONS
Web based digital plan submission and checking system
#1 Cadastral Tie Collection

To support accuracy assessments and on-going spatial improvements
Field Tie Collection

To support accuracy assessments and on-going spatial improvements
Field CAD Tie Collection Process

Text goes here

- **Challenge**: Collecting, checking and managing the survey data (spatial and metadata) in an affordable way

- ArcGIS On-line; CAD tie planning and workflow management

- Configured ArcGIS Collector; field tie collection
ArcGIS Online Planning Field Ties
### GPS Locations: DEMO

<table>
<thead>
<tr>
<th>ID</th>
<th>DEMO</th>
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<tbody>
<tr>
<td>PlanNumber</td>
<td>83460</td>
</tr>
<tr>
<td>IP_Offset</td>
<td>2.10m</td>
</tr>
<tr>
<td>GPS_Base_Station_ID</td>
<td>MPT20141003</td>
</tr>
<tr>
<td>Observer</td>
<td>Bill</td>
</tr>
<tr>
<td>Temperature</td>
<td>14°C</td>
</tr>
<tr>
<td>WeatherConditions</td>
<td>Sunny</td>
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<tr>
<td>RTKHeightOffset</td>
<td>0.6m</td>
</tr>
<tr>
<td>ObstructionSeverity</td>
<td>Tall Building 3m north</td>
</tr>
<tr>
<td>GPSDataCollectorFileName</td>
<td>20141003</td>
</tr>
<tr>
<td>AdditionalNotes</td>
<td>Lead plug in sidewalk; GNSS</td>
</tr>
<tr>
<td>CollectedDate</td>
<td>October 3, 2014</td>
</tr>
</tbody>
</table>
Plan Image Red Lines

5039 CHECK IP

32.0910°N 14.320m

32.0910°N 14.330m

5.463m

190° MAG
Field Tie Image

Date & Time: Mon Dec 1 13:35:44 PST 2014
Position: +049.36432° / -123.28327°
Altitude: 288ft
Azimuth/Bearing: 291° N69W 5173mils (True)
Elevation Angle: -66.6°
Horizon Angle: +26.1°
Zoom: 1X
Field Crew Training
Survey Plan Ties

**Purpose:** Capture cadastral ties from existing survey plans to improve spatial accuracy in selected Integrated Survey Areas (ISAs) (54 in total)

**Process:**
1. Pre-calculate how many ties are needed for each ISA
2. Navigate around each ISA and collect survey ties with these parameters in mind:
   - Target newer plans → they generally have better-quality data
   - Evenly distribute ties throughout ISA (more or less)
3. Once a desirable plan is found, check the plan by opening it from MNC’s custom LTSA Data Entry Toolbar
   - Preferable to have a direct tie to a Mascot
Filling Out the Data Entry Form

Some fields are filled in manually with info provided in the survey plan:

- Survey Method
- UTM Zone
- Datum
- Elevation Type
- Elevation
- Combined Scale Factor (CSF)
- CSF Source
- Positional Accuracy
- Degrees, Minutes and Seconds (to Mascot)
- Distance (to Mascot)

Other fields are automatically filled in when features are identified from the toolbar:

- Control ID (automatically assigned)
- Filled in when a parcel is selected from the map:
  - LTSA Plan
- Filled in when a Mascot is selected from the map:
  - Mascot
  - GCM
  - Northing and Easting
Tie Collection from Survey Plans

To support accuracy assessments and on-going spatial improvements
Identifying Features and Filling Out the Form
Red Lining the Survey Plan

P2678555
#2 Parcel Fabric

Single, complete, trusted and sustainable (conversion and compilation)
Parcel Fabric Delivery Plan
Esri’s parcel fabric was selected as the preferred data model and maintenance tool set for LTSA operations team because:

1. Commercial off-the-shelf (COTS) solution

2. Proven solution - implemented in various other large jurisdictions similar to BC (2 million parcels)

3. Least Squares Adjustments (LSA) engine to improve the fabric’s spatial accuracy
The ‘best’ parcel fabric is one built from survey plans, whereby all observations (distances and bearings) are captured and retained.
Precision Input Example

Parcel Details

<table>
<thead>
<tr>
<th>From</th>
<th>Bearing</th>
<th>Distance</th>
<th>Radius</th>
<th>Chor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N60°47'54&quot;E</td>
<td>31.600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>C29°15'04&quot;E</td>
<td>13.500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>S60°39'55&quot;W</td>
<td>30.525</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>N29°17'09&quot;W</td>
<td>4.594</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>N31°14'35&quot;W</td>
<td>13.026</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>S63°31'14&quot;W</td>
<td>0.130</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>N31°00'26&quot;W</td>
<td>15.963</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Misclose: S55°22'42"E 0.001 m Acc: High

0.104 ha
Lessons Learned: Interesting Data Conditions
Acceptance Process

- A test plan organizes the testing and acceptance process
- Total of 54 tests to ensure completeness and correctness
- Comprehensive – increment and/or province-wide
- Random samples for visual inspection
- **Lesson Learned review**
#3 Survey Plan Submissions

Web based digital plan submission and checking system
Survey Plan Submissions (SPS)

• Innovative webmap application that helps BC land surveyors validate their digital survey plan **quality** online before submission to the LTSA for plan registration.

• The system runs custom geoprocessing services to perform various **business rule checks**.

#3  SURVEY PLAN SUBMISSIONS:
Built a web based application called Survey Plan Submission (SPS) to support B.C.’s operational maintenance.
Plan Submission & Checking Online

The Benefits

- Reduced Errors & Costs
- Improved Quality
- User Friendly
- Visual Check for Users
- Faster Approvals
- Reduced Effort
- More Secure
- More Information and Detail

British Columbia
Survey Plan Submission (SPS) 2016

Alberta
Survey Plan Online Checker (SPOC) 2010

Saskatchewan
Plan Submission Online (PSO) 2013
Submit Survey Plan Dataset

CAD file, control point CSV file and metadata
Verify/View Dataset Validation Results

myLTSA

Verify Dataset Validation Results

Results will automatically refresh approximately every 5 seconds until complete. While the validation is running, you can leave this page and return later. If the checkbox below is selected, you will be notified when the validation has completed.

Plan Number Check: Complete with error(s). Please click to verify.
Structure Check: Running
Parcel Topology Check: Not Started
Dimension Check: Not Started
Bearing Check: Not Started
Control Point Check: Not Started

Send notification to the myLTSA inbox when validation has completed

Back to Submit Survey Plan Dataset
Parcel Topology Check Result

Parcel corner(s) in the CAD file at the UTM grid coordinates noted below do not close within a tolerance of 0.05. Please review the CAD file for closure errors and resubmit.

[8014]

<table>
<thead>
<tr>
<th>X Coordinate</th>
<th>Y Coordinate</th>
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<tbody>
<tr>
<td>498022.47</td>
<td>5449915.146</td>
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<tr>
<td>498083.081</td>
<td>5449899.911</td>
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<tr>
<td>498284.542</td>
<td>5449828.966</td>
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<td>497961.937</td>
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<td>5449831.97</td>
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<tr>
<td>498083.101</td>
<td>5449900.921</td>
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</table>

Override Error  Close
Perform Map Check
### Input

<table>
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<tr>
<th>Category</th>
<th>Count</th>
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<tbody>
<tr>
<td>Land Title Register (Parcel Attribute Data)</td>
<td>2 Million</td>
</tr>
<tr>
<td>ICIS Source Parcels</td>
<td>1.7 Million</td>
</tr>
<tr>
<td>ICF Source Parcels</td>
<td>1.5 Million</td>
</tr>
<tr>
<td>Cadastral Ties</td>
<td>65,400</td>
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<tr>
<td>Crown Primaries</td>
<td>76,000</td>
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<tr>
<td>Crown Subdivisions</td>
<td>173,000</td>
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<tr>
<td>Crown Transportation</td>
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<tr>
<td>Crown Undersurface</td>
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<tr>
<td>Crown SRW</td>
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<tr>
<td>Indian Reserves</td>
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<td>Federal Harbor &amp; Port Authority</td>
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<td>Integrated Survey Areas</td>
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<td>Land Title Districts</td>
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<td>Municipalities</td>
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<td>National Parks</td>
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<td>Parks and Protected Areas</td>
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<tr>
<td>Regional Districts</td>
<td>29</td>
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<tr>
<td>Survey Plans</td>
<td>200,000</td>
</tr>
</tbody>
</table>

### Create New Data

- Cadastral Field Ties: 2,600
- Cadastral Ties from Plans: 4,500
- Catch-up Plans: 2,500
- Attribute Correction: 55,000
- Precision Input of Missing Parcels: 10,000

### Fabric Compilation

Extract, Transform and Load

### Output

From Disparate Source Data to a Single, Complete, Trusted and Sustainable Parcel Fabric

2 Million Parcels Completed in 2½ Years
# Project Status

The project status chart shows the progression of various tasks and their completion dates. The chart includes:

- **Field Tie Program**
- **PWL Province Wide Layers**
- **FCP Fabric Compilation Plan**
- **Acceptance Test Plan**
- **Ties from Survey Plans**

## Fabric Increments Accepted

- Inc. 1
- Inc. 2
- Inc. 3
- Inc. 5/6
- Inc. 7/9
- Inc. 11/12
- Inc. 4/8
- Inc. 10/13
- Inc. 14/15

## SPS Application Mandatory for Surveyors

- Increments Currently in Progress:
  - Inc. A - target acceptance - April
  - Inc. B - target acceptance - May
  - Inc. C - target acceptance - June

## Project Completed

- "Largest Parcel Fabric Implementation in Canada"
Thank you!

If you have any questions or would like more information please contact:

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