
# Muskoka River Watershed IWM Natural Capital Inventory

## Addendum 1: Natural Capital Data Support

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# 1. ASSIGNMENT OVERVIEW

This assignment included supporting the District of Muskoka's GIS team to identify strategies to reduce file size, options for data hosting, and troubleshooting flow direction symbology for the hydrologic network. When working with the large files in the final data set, efficient data management will be important to share and visualize the data. The goal of managing this dataset will be to compress the files while minimizing the loss of data and accuracy in order to efficiently host the data online.

Following exploration of various data reduction approaches and consultation with the District Project team and GIS Project Coordinator, the scope of the exercise was clarified to require that the data reduction approach would need to result in hosted data sets being approximately 100 – 150 mb in size. As well, it was clarified that the data that would be hosted and required size reduction would need to be applied to the following data sets:

- Watercourses
- Land Cover
- Significant Wildlife Habitat
- Flood Attenuation

For each of the data sets, specific considerations are outlined in Table 1.

Table 1: Specific requests/considerations for the hosted data sets

| Geodatabase | Recommendation |
|---|---|
| Watercourse | File size is OK as is, no change needed. Fix flow direction. |
| Significant Wildlife Habitat | Simplify to 50m resolution. |
| Land Cover | Simplify to 50m resolution.<br>Consider parsing different landcover classes.<br>Ensure polygon boundaries are maintained. |
| Flood Attenuation | Simply to 50m resolution.<br>Ensure polygon boundaries are maintained |

Various solutions to reduce the file size will be explored including but not limited to the following:

- Remove excess vertices in the geometry of the feature classes using an ArcGIS geoprocessing tool like simplify line or simplify polygon. This would keep the essential shape of the features but would reduce the accuracy of the boundaries.

- Remove smaller polygons deemed not necessary. This would retain the accuracy of the larger polygons but would result in the loss of some data.

- Refine the data further into smaller feature classes in order to process and host the information more efficiently.

# 2. DATA REDUCTION APPROACH

Various methodologies were explored in an attempt to reduce the size of the various watershed-scale data sets, while maintaining the accuracy of features/polygons within the respective Geodatabases.

Various approaches exist to help reduce the data size of features/polygons. Smoothing is used to reduce the number of straight edges and angular corners, replacing them with a series of smoothed line segments. Simplification of features reduces the curvature of edges based on a predefined allowable offset and reduces the number of vertices. Reduction of features involves removing small features by increasing the minimum feature size to reduce the overall number of features present. Vector tiles are used to contain a vector representation of data across a range of scales.

The approaches and preliminary thresholds used to reduce the data size included the following:

- Smoothing features (50m, 100 m, 250m)
- Simplification of features (50m, 100m)
- Reduction of features (>50m$^2$, <100m$^2$, <250m$^2$)
- Vector Tileset (min 1:295,828,764; max: 1:282)
- Simplification with Vector Tileset (Simplify to 50m; vector min 1:295,828,764; max: 1:282)

The resulting trials to reduce the landcover data set are shown in Figure 1.

Overall it was determined that a combination of simplifying the data and using a Vector Tileset approach provided the best data reduction results (over 95% reduction) while maintaining coarse-scale spatial accuracy.

The final data reduction approaches used for the various data sets is described in Table 2. In subsequent testing, it was determined that a higher precision threshold could be applied to Simplification of features tool (i.e., 2m) while still maintaining sufficient size reductions in the associated data layers.

| | | | File size (mb) | Percentage Change (%) | Size per file if divided by quarternary watershed (15 files total) (mb) |
|---|---|---|---|---|---|
| **Smoothing of features**** | Smooth 50 metres | Sample Area<br>Study Area* | 28.94<br>394.92 | -81.13 | ~6.75 - 48.36 |
| | Smooth 100 metres | Sample Area<br>Study Area* | 22.44<br>306.24 | -85.36 | ~5.24 - 37.5 |
| | Smooth 250 metres | Sample Area<br>Study Area* | 15.13<br>206.41 | -90.13 | ~3.53 - 25.28 |
| **Simplification of Features**** | Simplify 50 metres | Sample Area<br>Study Area | 5.48<br>74.83 | -96.42 | ~1.28 - 9.16 |
| | Simplify 100 metres | Sample Area<br>Study Area | 11.50<br>158.27 | -92.44 | ~2.71 - 19.38 |
| **Reduction of Features** | < 50 m2 | Sample Area<br>Study Area* | 153.36<br>2092.64 | 0.02 | ~35.78 - 256.28 |
| | < 100 m2 | Sample Area<br>Study Area* | 153.34<br>2092.31 | 0.00 | ~35.77 - 256.24 |
| | < 250 m2 | Sample Area<br>Study Area* | 152.74<br>2084.16 | -0.39 | ~35.63 - 255.24 |
| **Vector Tileset** | Min: 1:295,828,764 Max: 1:282 | Sample Area<br>Study Area | 18.84<br>199.22 | -90.48 | ~3.41 - 24.4 |
| **Simplification + Vector Tileset** | Simplify 50 metres, vector Min: 1:295,828,764 Max: 1:282 | Sample Area<br>Study Area | 6.70<br>54.35 | -97.40 | ~0.93 - 6.66 |

Figure 1. Preliminary approaches and associated results for testing various data reduction methods

# 3. DELIVERABLES AND RESULTS

All of the requested data modifications and data reduction approaches were applied to the associated data layers. A summary of the final data modifications and outcomes are presented in Table 2. All layers except Agricultural Fields resulted in a substantially reduced final data size (60 – 93% reductions). In some cases however, the final file size was not below the District's threshold. As such, it is recommended that landcover layers be represented as individual types, and that Forests, Wetlands, and Flood Attenuation layers be represented by subwatershed.

Table 2: Final data modifications and data reduction outcomes

| Feature class | Data modifications | Original file size (mb) | Final data size (mb) |
|---|---|---|---|
| Watercourse | Flow direction information addressed | 11.62 | 11.62 |
| Significant Wildlife Habitat | Data simplified with a simplification tolerance of 2m using the retain critical points (Douglas-Peucker) simplification algorithm. | 319.49 | 127.21 |
| Land Cover | Data revised based on outcome of landcover classification updates associated with Addendum 2. Smoothing was applied when converting the raster landcover to vector features. The smoothing (simplify) option within the raster to feature class tool applies smoothing in such a way that the polygon contains a minimum number of segments while remaining as close as possible to the original raster cell edges. This smoothing also removes the blocky effect caused by converting raters to vector data. As well, separate data layers are provided for each feature types. | Entire Landcover – 5890.95<br>Agriculture Fields – 2.07<br>Anthropogenic – 94.76<br>Aquatic – 562.99<br>Barren- 121.33<br>Forests – 2092.31<br>Meadows – 0.16<br>Shrubs – 16.19<br>Wetlands – 3620.62 | Entire Landcover – 594.69<br>Agriculture Fields – 4.52<br>Anthropogenic – 25.82<br>Aquatic – 41.84<br>Barren- 14.71<br>Forests – 155.56<br>Meadows – 0.04<br>Shrubs – 1.86<br>Wetlands – 367.61 |
| Flood Attenuation | Flood attenuation data revised based on updated Site Type processing completed for the OWES Screening (Addendum 3). Feature geometry is the same as in the Land Cover data set, but with Site Type attributes assigned. | 3292.64 | 200.65 |

Respectfully Submitted,

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