# CITY OF TRAVERSE CITY
# BID TABULATION

Project: Urban Tree Canopy Assessment etc. Location: 2d fl. conf. room

Date and Time Due: F, 6/8/2018 @10AM Staff: Julie Dalton

Staff: Derek Melville

| VENDOR | BID AND/OR EXTRAS | TOTAL |
|---|---|---|
| Plan-it GEO | | $16,000.00 |
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| Davey Resource Group | | see attached |
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Traverse City, Michigan

# Urban Tree Canopy Assessment, Report, & Field Inventory Project

Submitted to:

The City of Traverse City
Attn: Julie Dalton
Purchasing Agent

Submitted by:

Plan-It Geo, LLC
Arvada, CO
http://www.planitgeo.com

June 7, 2018

Julie Dalton, Purchasing Agent
400 Boardman Avenue, 2nd floor
Traverse City, MI 49684
Re: Urban Tree Canopy Assessment & Inventory

Dear Ms. Dalton:

Plan-It Geo, LLC is pleased to submit this proposal in response to the City of Traverse City's Request for Proposals to provide services for the City's Urban Tree Canopy Assessment and Inventory Project. We look forward to this collaborative opportunity to work with Traverse City, the State of Michigan, and other partners on this important project. The Plan-It Geo team will provide the City with the following benefits for this project:

- The best combination of urban forestry and geospatial analysis experience to provide the City and project partners with professional, customized, scientifically sound services, training, and support.
- Our team has conducted more than 200 similar studies among key staff, leading the way in Urban Tree Canopy (UTC) Assessments through the integration of i-Tree ecosystem services with geospatial desktop and web-browser based technologies. This deep bench of experience means that we can offer cost-effective tools, workflows, and project management processes as well as options for delivering understandable, easy-to-use products and services based on listening to and learning from our clients and contacts.
- We are fully committed and resourced to complete every aspect of this project on time and on budget and have provided project examples and references of our quality work products.
- Plan-It Geo has demonstrated to clients nationally (including in Michigan) our commitment to data quality, communications, and providing professional, customized, scientifically sound services. We go above & beyond to improve the accuracy, usefulness, and reliability of the products for the benefit of our clients. Your needs come first, not our bottom line.
- We have reviewed the RFP and the City's contract terms and insurance requirements and do not foresee any issues with proceeding with the terms for a timely start.

We are genuinely excited to provide the City with analysis, tools, reports, and data to establish a benchmark of the City's public and private trees. This project provides an opportunity to bring Traverse City's tree canopy into the forefront for city officials, developers, managers, planners and the general public in order to promote and expand the City's community forest resource. On behalf of the Plan-It Geo team, we are pleased to have this opportunity to submit our qualifications and solutions approach. If you have any questions regarding our submittal, please feel free to call me directly at the phone number listed below.

Respectfully submitted,

Ian S. Hanou
CEO/Founder and Senior Project Manager, Plan-It Geo, LLC
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## Statement of Qualifications

Plan-It Geo is a geospatial analysis, technology consulting, and planning firm specializing in natural resource management and related fields. We provide a full range of services involving GIS, remote sensing, cost/benefit analysis, urban forestry planning, water resources analysis, decision support systems, and web-based solutions. Our clients and partner affiliations include local, state and federal government as well as non-profits, private industry, academia, and utilities. From database management to natural resource inventories or needs assessments and management planning, we offer a nimble and highly skilled staff at affordable rates. Four out of five in our proposed team each have more than 10 years of experience applying GIS and remote sensing to natural resource management projects. We possess the resources and skills necessary to ensure the goals set forth in the RFP are met or exceeded. This section provides a summary of the team's capabilities most relevant to the Traverse City Urban Tree Canopy Assessment & Inventory Project.

### Urban Tree Canopy Assessments

Our team members have conducted UTC Assessments in more cities and communities than any other consultant that we are aware of. (See a map showing project locations that our team has managed, color-coded by category at http://www.planitgeo.com/project-map.) Our philosophy is that each project entails a unique set of opportunities and challenges, and we challenge ourselves to meet or exceed expectations by continually improving our process, workflow, deliverables, quality, attention to detail, flexibility, and client-focus. Tree canopy assessments are still a relatively new way to look at both public and private municipal forestry resources and we pride ourselves on asking the right questions, ensuring all stakeholders' voices are heard throughout the process, and providing deliverables that won't sit on the shelf but engage the city and community to catalyze positive change. Throughout this proposal, this will be evident in our explanation of options and cutting-edge services.

In addition, we know better than any other firm that the quality of the tree canopy mapping is critical. Automated classification and a brief visual review is not adequate to develop accurate and precise canopy data that is essential for baseline conditions and monitoring change in UTC over time. On UTC projects in Oakville, Ontario and Ann Arbor, MI, we have reviewed land cover data produced by another source and had to tell the client that the data could not be used to assess change in tree canopy citywide or on a parcel-basis. Our team is trained on and prepared to ensure that the Traverse City data will be adequate for future comparisons, and we will do this not only through strict QA/QC but also asking the right questions and documentation in the report and metadata.

At the conclusion of the project, Plan-It Geo will prepare a professional report with the City's input/review explaining the project data, analysis methods, and detailed findings. It will include a cover, acknowledgements/logos, table of contents, executive summary, findings, and an Appendix. Traverse City can contribute text, photos, logos, etc. and will have one main review and one brief final review. See examples at http://issuu.com/planitgeoissuu/docs.

## Geographic Information Systems

Plan-It Geo specializes in building cost-effective, spatially aware, decision support and operational productivity tools with a specialty in integrating GIS with science-based ecosystem benefit models and forestry/natural resources data. Focused on environmental, municipal, and spatial information management, we deliver solutions to many industry sectors, including all levels of government, water resources, environmental and utilities. Clients benefit from improved workflow, increased data integrity, enhanced communication as well as broader access to, and visualization of information.

With core capabilities in GIS Systems Analysis and Integration, Project Management, Business Intelligence, and Application Design and Development, Plan-It Geo provides focused solutions such as enterprise web-based mapping applications, ArcPy (Python) scripting and/or custom ESRI tools, and R statistical modeling. Our staff is well versed in Open Geospatial Consortium (OGC) and Federal Geographic Data Committee (FGDC) standards and we have applied them in numerous projects for government clients. The team's expertise involves data development, geodatabase management, automation workflows, and teaching/training for GIS. Software ranges from ESRI's ArcGIS Desktop (including Spatial Analyst, ModelBuilder, and Geostatistical Analyst), an open source web/mobile geospatial stack (PostgreSQL, PostGIS, Open Layers, etc.), and Feature Analyst.

## Remote Sensing & Analysis

Plan-It Geo has a well-qualified team to address the remote sensing requirements of this project. Our team has a background in and knowledge of classification of multi-sensor, multi-temporal resolution image analysis studies. We have classification experience using many sensor modalities and platforms include aerial (film, digital, multispectral NAIP, frame-based or line scanning systems), LiDAR, and satellite (high resolution multispectral such as QuickBird, IKONOS, and WorldView-2 or medium resolution sensors such as SPOT-5, Landsat-5, and Landsat-7). We have used ERDAS Imagine, Feature Analyst 5.2, LiDAR Analyst, and ENVI software on dozens of large and small, urban or rural, land cover classification projects. We have done object-based image analysis (OBIA) and required Quality Assurance / Quality Control (QA/QC) on over 200 (combined) land cover classification projects in the past 6 years.

Beyond the needs of this project, Plan-It Geo is also staffed with expertise in LiDAR processing/analysis for floodplain and forestry studies and hyperspectral imagery processing/analysis for tree species and tree health studies (e.g. Milwaukee and Oakville, Ontario EAB studies). Most recently, the Plan-It Geo team has conducted wide-area high resolution OBIA mapping and medium resolution spectral classification projects in King County, WA (203 sq. mi), Jacksonville, FL (508 sq. mi), the Snake River Valley, ID (160 sq. mi), and Colorado Springs, CO (195 sq. mi) for urban forestry, land use/land cover (LU/LC), change analyses, and hydrologic modeling studies.

## Urban Forestry

Plan-It Geo's staff specializes in urban forestry locally and nationally for canopy goal setting, planning, species and site selection, ecosystem services analysis, and GIS. Members of our staff have completed urban forestry projects with more than three dozen municipal foresters, non-profits, universities and state urban forestry coordinators and presented at state and national conferences and workshops over 20 times.

We have extensive experience in and knowledge of the U.S. Forest Service i-Tree suite of tools, have partnered with American Forests on numerous ecosystem services analysis projects or performed these ourselves, and are recognized nationally as a trusted source in progressive geospatial analysis and reporting related to urban forestry and green infrastructure. We have urban forestry project experience and academic experience involving Emerald Ash Borer (EAB), urban forest management plans, street tree inventories, wildland urban interface (fire) planning, and are members of industry associations such as the Society of Municipal Arborists (SMA) and the Front Range Urban Forest Council in Colorado.

Additionally, we have learned and applied urban forestry resources such as:

- "A Model for Urban Forest Sustainability" (Clark et.al. 1997) including application and evaluation of Criteria & Indicators for 3 areas: vegetation resources, community resources, and management
- Urban Forestry & Urban Greening's "Air Pollution Removal by Urban Trees and Shrubs in the United States" (Nowak et.al. 2006)
- APA's "Planning the Urban Forest: Ecology, Economy, and the Environment," and
- The 2011 Vibrant Cities & Urban Forests Task Force Report

## Generating Ecosystem Service Data

Our team has received training on and conducted numerous projects involving the modeling and reporting of ecosystem services provided by trees and other vegetation. Examples of these services include air quality improvements through pollutant removal and urban heat island mitigation, energy benefits from savings due to reduced heating and cooling costs, stormwater and water quality mitigation by improved infiltration, interception and erosion control, and carbon storage and sequestration. We have an expert in air quality modeling and monitoring and are a recognized leader in green infrastructure modeling, having lead the urban forestry section of Nashville, Tennessee's green infrastructure master plan. We employ the most appropriate modeling tools with an unbiased, agnostic approach, including the U.S. Forest Service i-Tree suite of tools as requested in the RFP (namely Eco, Landscape Streets, Vue, Design, Species Selector, Canopy and Hydro), CITYgreen, USFS Community Tree Guides, and EPA models such as the SUSTAIN model. We will provide professional and science-based guidance to Traverse City in choosing the most appropriate tools and models to fit the project requirements and budgets, including tradeoffs, limitations and features/benefits. Recently, we have performed the following related analyses:

- i-Tree Design summaries in Renton, WA, McKinney, TX, Salem, OR and PA
- Western Washington Hydrology Model (WWHM, HSPF (Fortran) based) in Renton, WA
- i-Eco training and analysis to Cleveland (OH) Metroparks
- i-Tree Hydro modeling in Cincinnati, OH
- CITYgreen reporting in NV, TX, OR, and WA
- And integrated these values with GIS-based tree canopy build-out models/tools

Integrating benefit and cost values from best available research and science with dynamic geospatial tools may be our team's single most important strength for the City's UTC Assessment.

## Organizational Capacity

Plan-It Geo is a small but growing company formed to apply dynamic, cutting-edge geospatial technologies to scientific disciplines involving urban forestry, green infrastructure, forest management, watershed and forest health, invasive species management, ecosystem services analysis and environmental planning. We are geospatial and natural resources professionals with 50+ years of combined experience in managing and successfully executing complex projects similar to the Traverse City UTC Assessment. Additionally, the team members presented here have managed GIS and natural resources assessment projects independently and as part of a team.

We employ the most appropriate modeling tools with an unbiased, agnostic approach, based on open communication with our clients. This includes but is not limited to ESRI ArcGIS software (version 10.4) including Spatial Analyst and other extensions, remote sensing software (Feature Analyst, ERDAS Imagine), CommunityViz (ESRI software extension for land use planning, scenarios/design, and visualization), CITYgreen software, and the U.S. Forest Service i-Tree software suite (Eco, Landscape Streets, Vue, Design, Species Selector, Canopy and Hydro).

Effective project management is essential for the successful completion of this project, and we have built tools and resources to track timelines, communications and task progress (living work plan documents) and budget (cost-to-complete exercises). These will be used to provide high quality service to the City throughout the project. We have sufficient capacity based on existing and proposed work to fulfill the needs and timeline of this project. Specifically, we anticipate Jeremy (Director of Geospatial Services) averaging 30-40% of his time on this project each month with remaining staff at 25-75% of their time. (Refer to the matrix on the next page to see all staff Plan-It Geo is proposing for this project.)

Our firm provides unparalleled resources to meet even the most complex environmental challenges, including conserving sensitive natural resources, evaluating environments and impacts, optimizing stressed water resources, managing ecosystem, restoring ecological processes and functions, and integrating sustainability into design.

Our environmental services are provided by a diverse team of environmental planners, scientists, and designers, who offer innovative, balanced, and objective solutions to the complex environmental and social issues of today and tomorrow. Services include watershed and river systems planning and design; environmental planning and assessment; natural resources management; ecological design; cartography; environmental geographic information systems mapping and analysis; sustainable design; visual resource analysis; and data visualization.

### Working with State & Local Government

We provide a wide range of services to municipalities, so in addition to the strengths of our own team, we also rely on numerous trusted, long-term relationships with local governments and non-profits. Plan-It Geo's proposed team members have successfully completed project work with over 50 local governments and several non-profit partners. The team proposed herein has worked with over three (3) dozen urban forestry clients at the municipal level, including community development, land use/environmental planning, city forestry/parks/ recreation, GIS, public works, and sustainability, making us well prepared to partner with the City of Traverse City on this UTC assessment.

Non-profit partners/clients include the Texas Trees Foundation (TTF), PA Community Forestry Council, CA Urban Forest Council, Keep Indianapolis Beautiful (KIB), the Sacramento Tree Foundation (STF), and Savannah Tree Foundation.

## Key Staff

In this section, we introduce our team, their qualifications, and their anticipated role in the project. We then provide summary descriptions of experience on similar projects.

Plan-It Geo has assembled a well-qualified team to address the technical requirements for this project including subject matter expertise in GIS, urban forestry, planning, air quality, ecosystem services analysis, and reporting. Collectively, our team has conducted over 150 related projects involving GIS-based tree canopy assessment, potential canopy analysis, management planning, and modeling/reporting of ecosystem services provided by trees and other green infrastructure.

Below we have provided a staff matrix illustrating each key team member's role in the Traverse City UTC project, along with staff bios. Resumes with a broader selection of work experience, education, publications, and other qualifications are also included later in this document.

| Staff Matrix that will be applied for this project | | | | | | |
|---|---|---|---|---|---|---|
| Team Member Name and Project Title | Land Cover Classification | UTC Analysis & Mapping | Accuracy Assessment | Field Inventory | i-Tree Ecosystem Benefits Analysis | Project Report |
| Ian Hanou, PM/Senior Analyst | / | X | / | / | / | X |
| Jeremy Cantor, Director of Geospatial Services | X | X | X | / | X | X |
| Maegan Blansett, GIS & Natural Resource Specialist | X | / | X | / | / | X |
| Patrick Saal, i-Tree Specialist | | | | / | X | / |
| Ben Wittman, GIS & Software Specialist | X | X | / | | / | / |
| Carrie Asselmeier, GIS Technician | X | / | | | | / |
| TJ Wood, Director of Field Operations | | | | X | / | / |
| X = Primary Role / = Supporting Role | | | | | | |

Ian Hanou, Founder, Owner, & Director of Business Development

Ian is Plan-It Geo's proposed project manager (PM). Ian has 15 years of experience in the geospatial industry, has received project management training, and has managed more than 100 similar urban forestry projects involving land cover classification & LiDAR, GIS analysis, ecosystem services analysis, reporting, training, and software tool development. Ian has also managed projects in forest health, wildfire risk assessment, green infrastructure planning, water conservation analysis, and stormwater. In 2011, the Society of Municipal Arborists gave Ian an Award of Achievement, "*For his innovative urban tree canopy solutions and tree planting applications that have greatly benefited members of the Society and advanced the profession of urban forestry.*"

As PM, Ian leads business development, provides services in project management, remote sensing / GIS analysis, ecosystem services modeling, technical report writing, training, and quality assurance (QA) review. He will be the main point of contact throughout the full length of the project while assuring budgets and timelines are meeting expectations.

Jeremy Cantor, Director of Geospatial Services

Jeremy has over 10 years of experience in geospatial analysis, data processing, object-based image analysis (OBIA), python scripting, LiDAR manipulation, and cartography. He has served as the lead geospatial analyst and overall project manager of seven urban tree canopy assessments during his first year at Plan-It Geo. Jeremy previously worked for the National Park Service for 7 years. For this project, he will be the primary remote sensing analyst, manager of all GIS tasks and final delivery, and assist in design of the web-based decision support and prioritization tool.

Thomas Jay (TJ) Wood, Director of Field Operations

TJ obtained a Bachelor of Science in Landscape Architecture from Colorado State University and has become an ISA Certified Arborist and Qualified Tree Risk Assessor. At Plan-It Geo, T.J. manages surveys and clients across the country (25+ inventory projects in 8 states). He also contributes to web/mobile application sales, software presentations/demos, GIS data development, land cover classification quality control, urban forest and natural resources assessments, design of planting plans, report compilation, and preparation of project deliverables. He will oversee the field inventory portion of this project.

Maegan Blansett, GIS & Natural Resource Specialist

Maegan specializes in GIS and data analysis. She will support this UTC assessment by performing quality assurance/quality control (QA/QC) on remote sensing land cover classification data, conducting change analyses and accuracy assessments, contributing to the report writing, and assisting with administrative duties such as task management, budgets, project proposals, and client communication. Prior to joining the Plan-It Geo team, she served as an AmeriCorps volunteer in New York City where she assisted with their citywide street tree census and discovered her passion for urban forestry and designed a study of oak woodlands in Southern California.

Patrick Saal, i-Tree Specialist

Patrick specializes in the use of GIS and i-Tree tools for complex geospatial analysis and software development projects. He has contributed to more than 15 tree canopy assessment and ecosystem services analysis projects at Plan-It Geo. For this canopy assessment project, Patrick will contribute in the areas of data review/preparation and perform the i-Tree ecosystem services analysis. Patrick also manages clients' Tree Plotter/Canopy Planner apps by offering technical and testing support, customer service, database updates and quality assurance. He is heavily involved in the setup and deployment of most web mapping applications and will be the main contact person for data fields (schema/structure) and user preferences should the City decide to pursue any of the optional, value-added software options offered by Plan-It Geo (see Additional Tools & Considerations section).

Ben Wittman, GIS Specialist & Software Technician

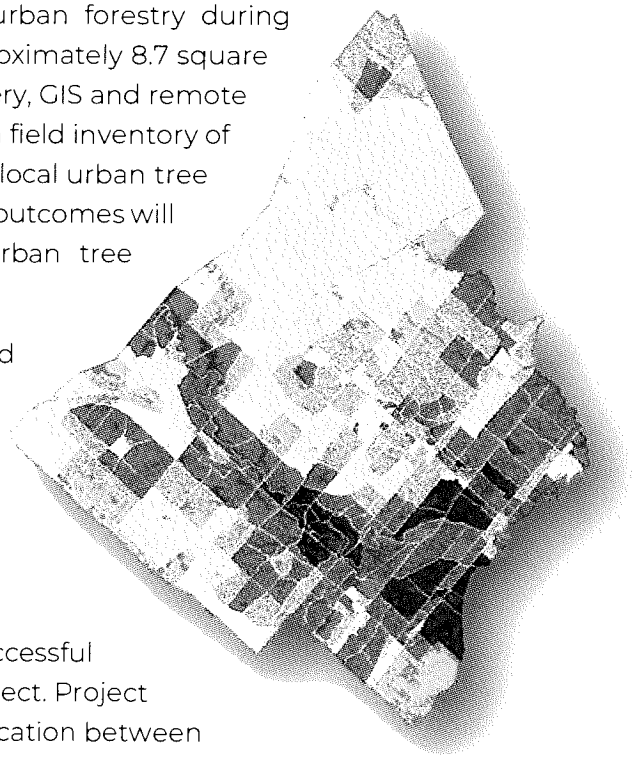
Ben attended The University of Colorado at Colorado Springs where he earned a degree in Geography and Environmental Studies with a certificate in GIS. Following university, Ben found an interest in forestry and natural resource management while giving his time and skills to an organization in Black Forest, Colorado. At Plan-It Geo, Ben applies natural resource and forestry concepts to understand and manage environmental and geographic (GIS) data sets. He reviews geographically modeled data using geospatial geoprocessing tools and provides QA/QC to review, organize and process aerial imagery and remotely sensed land cover data.

Carrie Asselmeier, GIS Technician

Carrie graduated with a Bachelor's degree in Geography and Sustainability from the University of Iowa. Before Plan-It Geo, Carrie interned with Chicago Wilderness, working on conservation issues and GIS. This past summer she worked for Cherry Creek State Park to educate park visitors and prevent the spread of aquatic nuisance species. At Plan-It Geo, Carrie will be assisting with urban tree canopy assessments by performing quality assurance/quality control (QA/QC) on remote sensing land cover classification data

## Project Approach

This Urban Tree Canopy (UTC) Assessment and Inventory project in Traverse City represents an important starting point for better understanding baseline conditions of tree canopy, its distribution, and the importance of urban forestry during planning processes. The study will encompass approximately 8.7 square miles. It will involve the use of high-resolution imagery, GIS and remote sensing technology, ecosystem benefits modeling, a field inventory of 750 trees, and a report to characterize regional and local urban tree canopy and other land cover data. The products and outcomes will support developing and monitoring of future urban tree canopy cover goals.



The following sections describe our management and technical approaches needed to successfully complete this project. Plan-It Geo's focus on communication, quality control, and our flexible approach to guiding and managing the scope demonstrate our managerial and technical strengths for this project.

We have provided a step by step work flow for the successful completion of the Traverse City UTC Assessment project. Project management provides the framework for communication between Plan-It Geo and City staff and is important from the organization of this proposal to the final project deliverables. Organization, collection and management of the many data types needed to complete this analysis is crucial for the project's success. Our Project Timeline table (p.12) details specific completion dates for each task listed.

### Project Steps

#### 1. Project Management, Initiation, and Communications

Plan-It Geo believes that clear communication between our staff and City staff regarding expectations, timelines, and project execution is essential for creating the best possible products. Therefore, our management approach from the project kick-off to reporting will focus on communication, customization, and execution.

Upon award, we will work with the City to finalize the Scope of Services including any best and final offer. A project kickoff meeting date will be determined. A memo will be sent following the commencement meeting outlying action items for all stakeholders and any impact to the project timeline. We will also have an initial internal Scope review meeting to discuss and confirm goals, data, roles, and timelines.

## 2. Data Collection

We have developed a UTC data collection checklist for streamlining data collection, as well as review/organization for UTC processing. This checklist includes data we will provide, data we will need from the City to complete the assessment, and data that is not required but can help improve our final product by adding additional details. Data collection and management will be performed by our GIS data specialists with review by project management staff. We are prepared to sign data sharing agreements; however, any costs/fees for access to data have not been included in our cost proposal. Note that prior to summarizing land cover and UTC metrics, we will screen for topology issues such as polygon overlap for the GIS assessment boundaries.

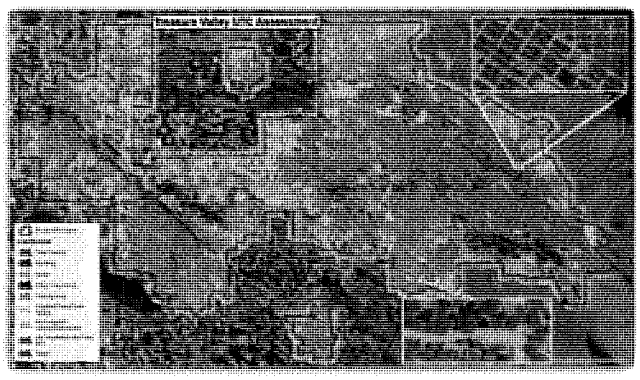
## 3. Comprehensive, City-Wide UTC Assessment

Our technical approach will include mapping the City's land cover, QA/QC of derived data, an accuracy assessment, and an analysis of land cover and UTC by the City's chosen preferred boundaries.

### *Land Cover Mapping*

Plan-It Geo is an industry leader in spectral and spatial remote sensing analysis, particularly using geographic object-based image analysis (OBIA) for various urban land cover classifications. This is a critical technique for accurately and cost-effectively mapping the region's tree canopy, impervious surfaces, open space/turf grass, bare soil/dry vegetation, and water. We utilize Feature Analyst software v5.2 for the OBIA classification which uses spectral and texture analysis and pattern recognition through an iterative machine-learning approach. High resolution (1-meter), multi-spectral (4-band) 2016 NAIP imagery (U.S. Department of Agriculture National Agriculture Imagery Program) will be used, unless Traverse City has a different data source to provide for the project. There are tradeoffs in terms of resolution/quality and time currency. Plan-It Geo will assist the City in selecting which imagery will be the best fit for this project if other options are available.

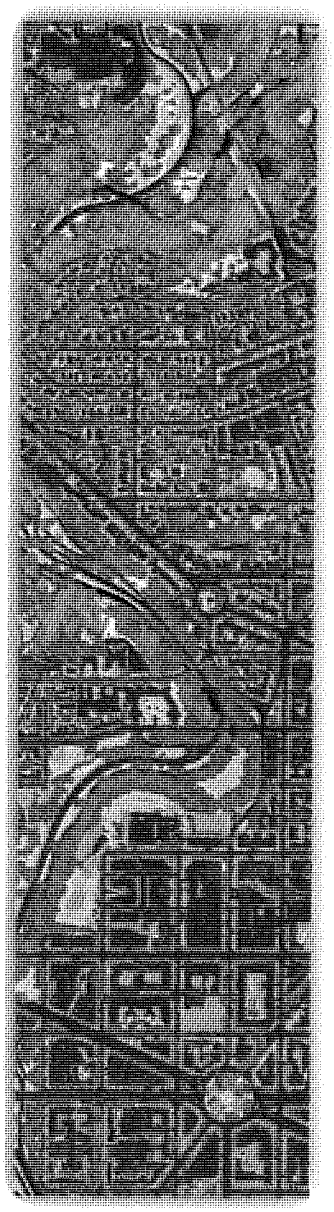
We have also identified several recent aerial LiDAR data collections in the study area with sufficient resolution (enough points per square meter) to assist in the mapping of UTC. After a close review, a memo will be sent to the City, and if the quality of the data and accuracy overlaying with recent NAIP imagery is determined acceptable, Plan-It Geo will develop a digital surface model (DSM) and use an existing bare earth DEM from the site to generate a normalized DSM (nDSM). This will be used as a fifth band for analysis of UTC along with the 4-band NAIP.



We employ a statistically and functionally rigorous protocol for classification and Quality Assessment and Control (QA/QC). Our technicians will manually correct errors in the automated classification at a scale of 1:1,250, repeating until targeted accuracies are reached. We have budgeted to achieve at least 92% overall mapping accuracy, with at least 94% user's accuracy specifically for tree canopy and impervious areas, at the 95% confidence interval with a minimum mapping unit (MMU) of 3x4 meters. The canopy layer will be provided for review and acceptance prior to other steps in the project. FGDC-compliant metadata will be provided for all spatial datasets created. Ian and Jeremy will be the remote sensing analysts. Pervious and impervious classes are listed below including our methods for the deliverables.

*Land Cover Classes*

**Urban tree canopy** mapping will include all vegetation generally greater than 10-15' tall, based on NAIP multispectral and object-oriented classification techniques. NAIP and LiDAR data will be used in an OBIA classification technique using spatial and spectral information, textural analysis, and pattern recognition.



**Other (non-canopy) vegetation** will include shrub/scrub vegetation, turf grass, and open space. Following the remote sensing classification and final QA/QC of the tree canopy data layer, the output will be used as a mask to extract all other types of vegetation using a Normalized Difference Vegetation Index (NDVI) analysis and OBIA techniques. These areas will be mapped using a combination of spectral information (near-infrared band), textural analysis (shadowing), and spatial/pattern recognition.

On-the-ground images from Google Street View will be used for training of the remote sensing classification inputs and for verification/refinement of the classification outputs. It may be useful to obtain photos from the local communities of any areas that cannot be identified.

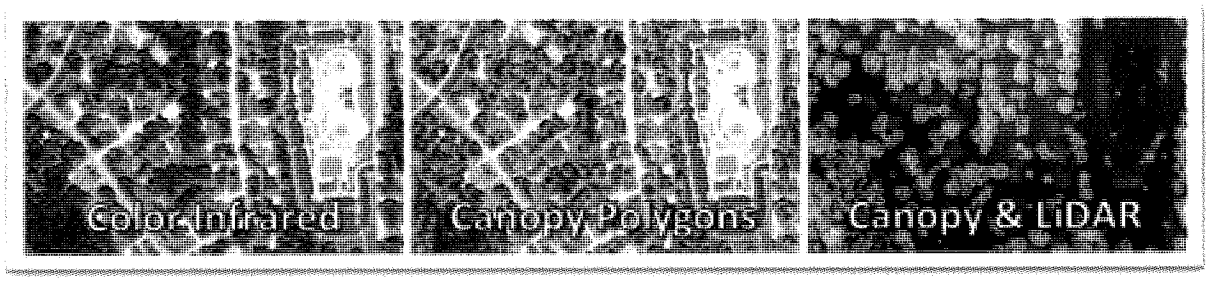
The results will be at an individual pixel level and will be smoothed and aggregated to a reasonable size for urban forestry and other planning applications (water conservation and supply planning). No specific MMU is proposed as the patch size can be easily adjusted at the end and incorporated along with the other land cover classes.

**Impervious surfaces** will comprise all paved surfaces and hardscapes and be broken out (sub-categorized) using existing data that the City is able to provide. These sub-categories can include streets, parking lots, buildings, sidewalks, and "other impervious areas" such as patios, driveways, and other miscellaneous hardscape surfaces (to be discussed at the project kickoff meeting).

These digitized impervious surface polygons (and any buffered point or line features for buildings, roads, etc.) will be incorporated into the land cover classification by overlaying "on top of" the impervious surface areas that are extracted via automated image classification procedures. This will also be valuable when merged with all other impervious layers to account for tree canopy overhang of built-up surfaces.

**Bare soil** will include barren soil, gravel pits, exposed dirt/open construction, rock, and sand as well as dry (non-photosynthetic) vegetation. The MMU will be 5x5 meters with individual class accuracy of at least 92%.

**Water** will be mapped from the base imagery and available hydrologic features such as lakes, rivers, ponds, and streams. The MMU will be 5x5 meters with individual class accuracy of at least 92%.




After automation and QA/QC of all land cover classes, we will conduct a point-based accuracy assessment. Jeremy will lead this exercise. The result will be a standard error (confusion) matrix which we have included routinely on land cover and UTC assessments. Once the tree canopy layer has 94% user's accuracy and other classes reach 92% overall accuracy, we will send samples of the results to the City for review and approval before proceeding with the GIS-based modeling of land cover and UTC metrics. The estimated National Map Accuracy Standard for the horizontal (positional) accuracy of the land cover data will be dependent upon the accuracy of the NAIP imagery as all data will be derived from it.

The following land cover raster layers will be produced: a simplified 5-class (tree canopy, other vegetation, impervious, bare soil, and water), and detailed all-class (separate impervious classes for building, road, parking, and "other" impervious background areas that are provided). In addition, separate raster and vector files will be delivered for tree canopy and all impervious surfaces. The final land cover products will be delivered in vector and raster format in ESRI ArcGIS 10 geodatabase in the UTM Zone 16T coordinate system and meet the Federal Geographic Data Committee (FGDC) metadata guidelines.

*Urban Tree Canopy Analysis & Mapping*

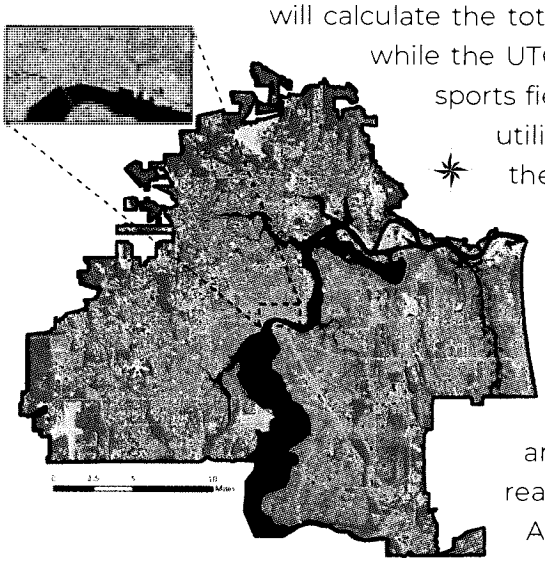
We will then conduct the land cover and UTC assessment and analysis. This includes the GIS-based modeling processes to calculate the area (acres/square feet) and percent of land cover, as well as what we refer to as "UTC land cover" for the boundaries listed in the RFP. This task will be led by Jeremy.

We assess both land cover metrics and UTC metrics, described more below, and these area and percent values will be added in new GIS table fields to the following geographic assessment boundaries:

- Full Project Area (AOI) – City of Traverse City Boundary
- Neighborhood
- Watershed
- City maintenance zone

Note: Additional assessment boundaries can be added if desired at an additional cost. Common examples include census blocks or block groups, city or county zoning, parcels, or right-of-way.

The difference between original land cover classes and UTC land cover classes is that UTC land cover includes additional analysis based on what planting area is realistic. Land cover metrics will calculate the total non-canopy vegetation by assessment boundaries, while the UTC metrics will reflect this area/percent after removing sports fields/courts, golf course fairways/greens, above ground utilities, and airports or other sensitive areas. If desired, these metrics can even reflect remaining non-canopy vegetation areas after buffering buildings, other infrastructure, and existing trees (with a larger buffer for small trees, and smaller buffer for larger trees). We will be doing that analysis regardless to produce accurate potential planting areas. We refer to this as Possible Planting Area – Vegetation, while parking lot area, a sub-type of total impervious where it is most realistic to establish canopy, is called Possible Planting Area – Impervious.



The existing UTC and PPA metrics will then be prepared and delivered in GIS format, maps, tables, charts and supporting graphics based on custom GIS queries. Note that our Python models for computing UTC metrics are available for Traverse City and its partners to obtain and utilize in the future if desired.

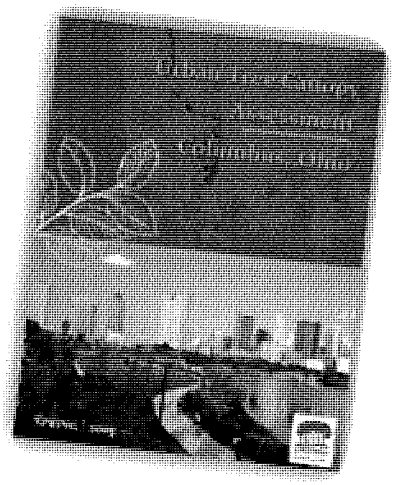
*Estimation of ecosystem services benefits using i-Tree software*

Once the tree canopy data has been produced (RFP Task 1) and the field inventory has been completed (RFP Task 3), we will use the USFS's suite of i-Tree tools to quantify the economic benefits of Traverse City's urban forest. These tools allow users to overlay the City's canopied areas with local information about the benefits of the specific trees in those areas to get an approximation of the economic benefits the trees are providing. The i-Tree tools will take both the total canopy area derived in the UTC assessment and the field survey data representing species composition, health, age, etc. into account when performing calculations. Plan-It Geo will work with the City to identify the best tools to use (such as i-Tree Eco, i-Tree Canopy, i-Tree Design, i-Tree Hydro, etc.) depending on which environmental benefits the City is most

interested in estimating and at what scale(s). Patrick, our i-Tree Specialist, will oversee this portion of the project with guidance from Jeremy.

### 4. Project Report

Plan-It Geo's team brings a significant background in writing urban forestry reports that are customized, attractive, and professional, include revision and input from multiple stakeholders, and successfully tie into existing plans or initiatives. We take pride in delivering tailored, custom reports specific to each project, to the intended audience, and with client/stakeholder input. We have learned from years of experience with UTC Assessment projects that the final report, whether to a technical audience or public one, can be the most important aspect of a successful project. The report will be concise and readable to the untrained citizen, using pull-out information boxes, bulleted lists of items, and shorter 'clear speak' paragraphs. We generate creative graphics and provide insightful, locally specific recommendations through discussions with the clients on the results/findings. Jeremy will lead the majority of the report writing task with support from other Plan-It Geo staff.



While we are flexible on the report style, content, and organizational structure, we anticipate that the project report will include a cover, acknowledgements/logos, a table of contents, executive summary, section on findings, and an Appendix with additional technical details such as methodology. We suggest that Traverse City and its core team partners have two (2) reviews of the draft report, which will be sent in an editable electronic version. When the review is complete, we will schedule a meeting to discuss edits/comments prior to the final draft. The final report will be provided in PDF and MS Word formats. No hard copies have been included in our cost.

In addition to the requested project report, we provide a two-page summary fact sheet as a condensed version of the process, key findings, and deliverables. The City would have input on the content and style of the fact sheet, as well as one (1) review of a draft. The cost for this has been included within our total reporting effort.

All supporting tables, data, graphs/charts, graphics, spreadsheets, and maps will be included in the final delivery. Traverse City will be asked to contribute text, photos, logos, and other graphic elements to support the report development.

### 5. Field Inventory of Remaining Trees

Plan-It Geo (PG) will complete Traverse City's street tree inventory of approximately 750 trees within City limits. Plan-It Geo understands the project areas to include the rights-of-way of City designated roadways. Plan-It Geo will work with the City to establish communications and protocols to ensure proper and standard operating procedures are met.

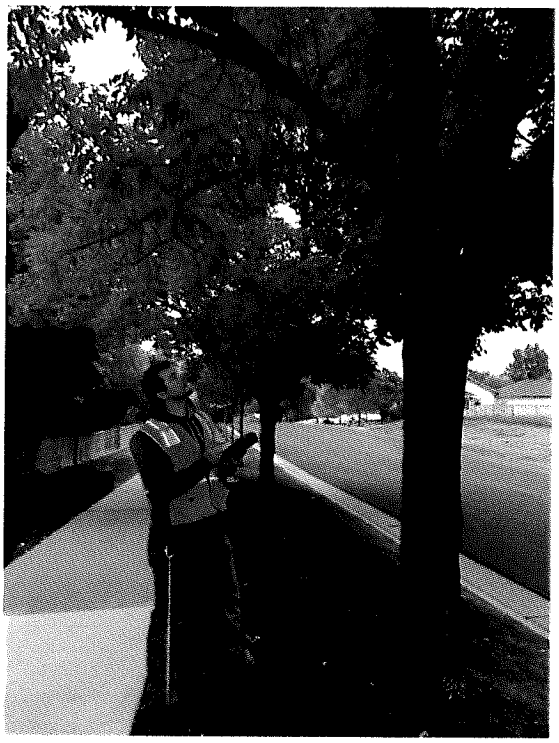
PG's GIS-based tree inventory will be performed using computer tablets (iPad and Android tablets) that read information directly from the World Wide Web. This means that any similar web-connected device can also be used to collect, edit, and manage the inventory resources.

*Web-Based GIS Data Collection*

Our web-based capabilities allow us to utilize the mobile GPS location feature built into our hardware devices (iPads). This location feature serves as the first tier for determining the exact location of the tree to be inventoried. The map used to collect tree inventory information can also contain parcels with addresses, utilities, and street centerlines (provided by the City) and high resolution aerial imagery. This will allow the inventory arborist to accurately determine the ownership and exact location of each tree and planting site.

Using this approach, Traverse City and Plan-It Geo's staff will gain these advantages:

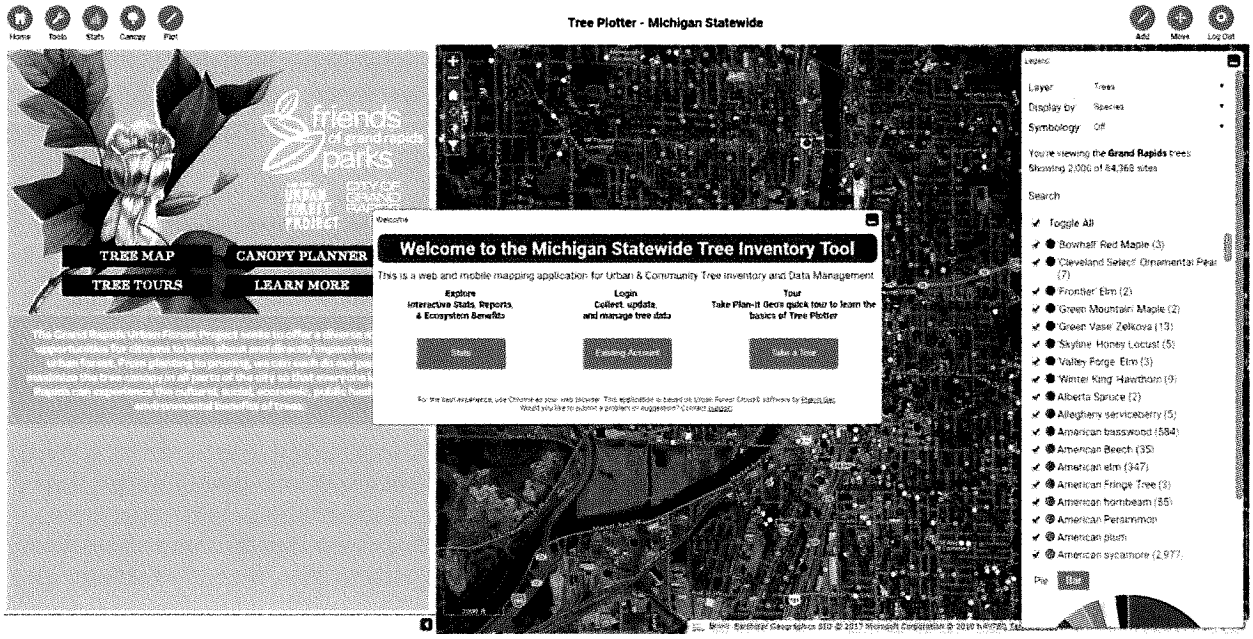
1. **Data and production transparency.** By utilizing a web-based data collection protocol PG will share the real time data collection map service so that collection progress can be monitored by appropriate staff members. Furthermore, web-based data collection enables PG to ensure that no trees are missed or that trees are not double inventoried throughout the entirety of the project.
2. **Increased production rates.** Location data entry using GIS with accurate basemap information is nearly twice as fast as using GPS equipment alone. Inventory personnel are not limited by weather conditions or interference by buildings or other obstructions.
3. **High level of location accuracy.** GIS is only limited by the accuracy of the basemap information provided. By utilizing the built-in GPS functionality of our hardware and our field expertise we can ensure accurate location information of 1-meter or less.
4. **Understand and Update.** With simple training, an unlimited number of simultaneous users (i.e. City managers and staff) can track and analyze existing trees according to hazard status, condition, maintenance need, species or any other inventory attribute and quickly and dynamically perform status updates as required over time.



*A Note on Data Security* - As inventory information is collected, data are instantaneously stored on secure remote servers eliminating the possibility of data loss and making it possible for City officials to access and download, at any time, real-time data collection with secure login credentials.

*Collection Method*

Plan-It Geo will equip our ISA certified arborists with a customized version of our ***Tree Plotter*** application for recording the location and attributes of each tree. The application enables each tree to be precisely mapped (within 1-meter spatial accuracy) with the attributes described below.




*Tree Inventory Data Fields*

The flexibility of our software and the expertise of our staff allow us to customize these data fields or add new ones to suit your needs. Our per-tree/task bid is based on these fields, but final selection data collection fields will be determined during the kick-off meeting. At minimum, Plan-It Geo will collect these attributes:

A. **Location** – Street, side, address and GPS coordinates will all be populated for each tree
B. **Species** – Trees are identified by genus and species using both botanical and common names and by cultivars where appropriate.
C. **Trunk diameter** – (to the nearest inch) at 4.5 feet above the ground.
D. **Estimated Tree Hight** – Estimated to the nearest foot or ranges approved by the City.
E. **Flagged for Maintenance** – True or False or Yes/No field will be populated

*Format Options for Inventory Data Deliverables*

Plan-It Geo will deliver tree and planting site inventory data in Microsoft Excel, Access, and ESRI geodatabase/shapefile congruent with the City's current tree inventory data structure. Data will be delivered in UTM Zone 16T and contain full metadata references. The Excel file will be compatible to i-Tree Streets. Data will be reviewed for errors prior to being provided to the City. Tree Plotter's "Exporter" tool can save data as CSV or Shapefile formats at any point in time during data collection if needed. Data export is free at any time and will be no extra cost to the City. If desired, PG can train City staff on Tree Plotter workflow or exporting data.

### *Quality Control*

Plan-It Geo will provide Traverse City with a professional, courteous, and informative tree inventory project experience beginning with high-quality tree inventory data. We can make this assurance because:

- Quality control begins with proper training and education. Plan-It Geo's ISA Certified Arborists are college-educated and skilled at conducting tree inventory. All technicians working on this project will have an ISA Certified Arborist Credential.
- During the inventory process, extensive quality control checks are applied regularly. Through the use of Plan-It Geo's proprietary *Tree Plotter* application access can be granted to City staff to dynamically monitor inventory progress.
- In addition to computerized quality checks and control, Director of Field Operations, TJ Wood will perform remote data checks to ensure data collected by other staff adhere to City work specifications and national industry standards.
- PG welcomes and encourages Traverse City to periodically perform on-site verification of the data. PG staff will cooperate fully City staff to achieve a high level of confidence in the accuracy of the data. PG will provide staff with daily status updates if needed.

PG assures that if any errant tree site location is detected, it is our responsibility to correct the data promptly.

## Deliverables

Data developed from this project will become the property of Traverse City. GIS products and project reporting will be evaluated by the project manager and assistant project manager prior to delivery. As requested, spatial data delivered will be in ESRI ArcGIS version 10 geodatabase format (vector and raster as applicable) and will contain FGDC metadata in ArcCatalog or XML format. Spatial products will be projected to UTM Zone 16T, datum NAD83.

The following lists the deliverables included in this proposal:

- Land Cover Classification: urban tree canopy, non-canopy vegetation, impervious surfaces, bare soil/dry vegetation, and water. Data will be in vector and raster format for the entire AOI.
- Land Cover / UTC Assessment: GIS files (full project area (AOI)/city boundary, watersheds, and city maintenance areas) with land cover and UTC metrics as new fields for existing urban tree canopy and Possible Planting Area (PPA) along with tables, charts, maps in MXD and PDF formats, and a supporting Excel spreadsheet. Areas unsuitable for tree plantings that were mapped during the process can also be delivered if desired.
- Project Report: in electronic format (MS Word and PDF) including a cover page, executive summary, introduction, major findings / results, methods, deliverables, and goals, opportunities, challenges, and recommendations.
- Field inventory of remaining trees: data can be delivered in Excel, Access, and/or ESRI geodatabase or shapefile format.

## Project Timeline

Plan-It Geo is available to start immediately and promises prompt discussions on a best and final offer. We can meet the schedule and timeline in the RFP. Approximate timelines for major tasks are provided in the chart below. We will work closely with the City throughout the project to provide monthly status update memos (also accompanied with invoices), including a forecast of when reviews and input will be required.

| Task | Description | Proposed Begin – End Date |
|---|---|---|
| 1. | Project Initiation | Immediately – Kickoff meeting in June |
| 2. | Data Collection | 6/11 – 6/15 |
| 3. | Comprehensive, City-Wide UTC Assessment | 6/18 – 8/3 |
| 4. | UTC Report & Recommendations | 8/6 – 8/17 (Reviews 8/10, 8/15) |
| 5. | Field Inventory of 750 Trees | 1 week, anytime 6/15 – 8/17 |
| 6. | Final Products Delivered | 8/20 |

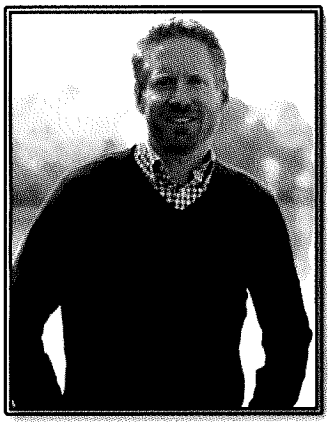
## Fee Schedule

| Task | Cost |
|---|---|
| 1. City-wide comprehensive UTC assessment | $8,000 |
| • Obtain and prepare source data<br>• Project kickoff meeting<br>• Land cover classification<br>• Quality assurance/quality control<br>• Accuracy assessment<br>• Data summary<br>• Map series<br>• Mid-project review | |
| 2. UTC report and recommendations | $4,000 |
| 3. Inventory remaining trees | $4,000 |
| Total | $16,000 |
| Additional/Optional Products & Services | See Additional Tools & Considerations section on page 36 |

Ian S. Hanou
CEO & Founder, Plan-It Geo
ianhanou@planitgeo.com | (303) 214-5067

# Resumes

## Ian S. Hanou



### Senior Project Manager | Urban Forestry Analyst | Owner/Founder

Professional Summary

Mr. Hanou has 15 years of experience applying innovative geospatial solutions in forestry, urban forestry, planning, natural resources, land management, and water resources. His work involves GIS and ecosystem services analysis, technical writing, software development, and business development with all levels of government, NGOs, and private entities. He is proficient in spatial analysis, remote sensing, training, and project/fiscal management.

Education

B.S. Forest Management, Colorado State University, 2001
Minor in Geographic Information Systems

Memberships/Affiliations

Society of American Foresters (SAF), Front Range Urban Forestry Council, and GISCO.

Experience (Examples of 100+ Urban Tree/Forest Canopy Assessments and Ecosystem Services Analysis Projects)

*Washington State Urban Tree Canopy (UTC) Assessments*

Since 2007, managed GIS/RS canopy studies in Seattle, Kirkland, Vancouver, Thurston County, Shoreline, Bothell, Snoqualmie, Issaquah, and others, including canopy change analysis, reporting, Council presentation, and i-Tree.

*Calgary, Alberta: Tree Canopy Assessment*

Managed a GIS/RS assessment of canopy and priority planting areas analysed for 292 communities, 67 land use types, and 300,000 parcels; developed a GIS-based suitability model to prioritize tree planting.

*Mississauga, Ontario: Mississauga Urban Forest Canopy Re-Assessment 2007-2014 and City Council Presentation*

Managed a follow-up UTC to a 2007 study. Mapped updated land cover and urban forest canopy distribution for 2014, and evaluated canopy cover changes over time, as well as historical canopy trends since 1992. Included data analysis, custom maps and tools, and broad recommendations for setting and achieving canopy objectives.

*Oakville, Ont.: Canopy Assessment, EAB Risk Management Mapping, and Goal Setting Scenarios*

Managed multiple UFC analysis and scenario planning studies since 2010. Included a hyperspectral imaging analysis of ash/EAB risk management and mapping of current canopy and available planting area town-wide, by communities, and by land use types. Lead GIS/RS consultant on a team to re-analyse Oakville's canopy in 2015/2016.

*Columbus, OH: Urban Tree Canopy Assessment, i-Tree Hydro Analysis, and Custom Canopy Planner Tool*
Managed this 250 square mile study, created planting prioritization and scenario tools, and provided training.

*Treasure Valley, Idaho: Urban Tree Canopy Assessment, i-Tree Eco Analysis, and Scenario Tool Development*
Conducted a 265 square mile study and created planting prioritization and scenario tools using CommunityViz (Esri land use planning extension) and i-Tree Eco data values. Classified land cover using remote sensing, summarized data at a variety of assessment scales, analysed ecosystem services, and reported all methods and findings. Provided training in Boise to 30+ attendees from the region (planners, GIS, foresters, park managers, etc.).

Presentations/Trainings
100+ webinars, training workshops & national/state conference or project presentations including PNW ISA (twice), Canadian Urban Forest Conference (twice), and the National Arbor Day "Partners in Community Forestry" Conference (four (4) times since 2009. Asked by U.S. Forest Service to present on the Urban Forest Connections webinar in October 2015 on innovative canopy tools.

# Jeremy Cantor

## Director of Geospatial Services

### Professional Summary

Jeremy graduated from Colorado State University with a Masters in Natural Resources Stewardship and Spatial Information Systems. He has an undergraduate degree in Geography with a minor in Economics from the University of Vermont. He has 12 years of combined experience between private sector and local/federal government positions.

Jeremy contributes to GIS modeling, remote sensing analysis of multispectral and LiDAR imagery, data production, IT, cartography, task management within the geospatial team, Urban Tree Canopy (UTC) assessment reports and delivery, and web/mobile mapping apps. Prior to Plan-It Geo, Jeremy worked in the Ocean & Coastal Resources Branch of the National Park Service Water Resources Division for seven years focusing on coastal systems, geospatial analysis, and website design/online mapping applications.

### Education

M.N.R.S. in Spatial Information Systems, Colorado State University, 2010.
B.A. in Geography, Minor in Economics, University of Vermont, 2006.

### Relevant Experience

*Richmond Hill, Ontario: Urban Tree Canopy Assessment and Change Analysis*

Provided an updated baseline and benchmark of the town's tree canopy and possible planting areas. High resolution aerial imagery from two time periods was utilized to map current tree canopy cover and perform a change analysis.

*Jacksonville, Florida: Urban Tree Canopy Assessment (in progress)*

Performing an accurate and comprehensive analysis to assess the current status of the City of Jacksonville's tree canopy. This includes data gathering, canopy analysis, GIS mapping, a summary final report, and educational programming. The assessment uses geospatial technologies to provide a top-down assessment of the urban forest and quantify existing canopy and potential planting areas in order to assist the community in meeting a variety of community development, sustainability, and environmental goals. An easy-to-use, interactive, online landscape-scale visualization and prioritization tool will allow users to view, plan, and grow their tree canopy.

*Denton, Texas: i-Tree Eco Study and Urban Tree Canopy Assessment and Change Analysis*

Developed GIS-based map book for 250 i-Tree Eco field plots. Managed and processed data for this urban tree canopy assessment. Utilized high resolution aerial imagery from two different time periods and a LiDAR derived Digital Surface Model (DSM) along with remote sensing technologies to derive tree canopy and land cover data. Project includes the assessment of tree canopy and possible planting areas at multiple geographic scales and multiple years, as well as the delivery of spatial data, related maps, Canopy Planner software (**https://pg-cloud.com/DentonTX/**), and professional technical report.

*Washington, D.C.: Urban Tree Canopy Assessment and Change Analysis*

Provided an updated baseline and benchmark of the District's tree canopy and other land cover types and map existing and possible planting areas. High resolution aerial imagery and LiDAR was utilized to map current tree canopy cover, as well as perform a change analysis from a previous year's study. Updated the District's existing Canopy Planner software app with the most recent canopy and planting space metrics (see **https://pg-cloud.com/DDOTUFA/**).

*Snoqualmie, Washington: Urban Tree Canopy Assessment and Change Analysis*

Provided an updated baseline and benchmark of the city's tree canopy. High resolution aerial imagery was utilized to map current tree canopy cover, as well as perform a change analysis from a previous year's study.

*Clyde Hill, Hunts Point, and Yarrow Point, Washington: Urban Tree Canopy Assessment and Change Analysis*

Provided an updated baseline and benchmark of the municipalities' tree canopy and possible planting areas. High resolution aerial imagery from three time periods was utilized to map current tree canopy cover and perform a change analysis.

*Denver, Colorado: South Platte River Urban Waters Partnership Natural Capital Grant Project*

Serving as a GIS analyst to map and evaluate the regional network of green infrastructure in Colorado's South Platte River watershed (6,000 square miles). Derived spatial data will be used to develop a tool to prioritize key areas for conservation and restoration based on the ecosystem services that the natural resources provide. Jeremy led the design of an online mapping and data exploration tool, currently in the final stages of testing, refinement, and deployment. See **https://pg-cloud.com/NaturalCapital/**.

*Miami, Florida: Miami-Dade Canopy Action Plan and Interactive Online Tree Tool, Million Trees Miami*

Served as a GIS analyst and web designer to provide an online engagement tool for the public and tree managers to view existing canopy, plan priority reforestation efforts based on environmental, health, and socioeconomic data, and track newly planted trees as a means to achieve local and regional canopy goals. See their Canopy Planner software application at **https://pg-cloud.com/MillionTreesMiami/**.

*Jacksonville, Florida: Salt Marsh Mapping, National Park Service, Timucuan Ecological & Historic Preserve*

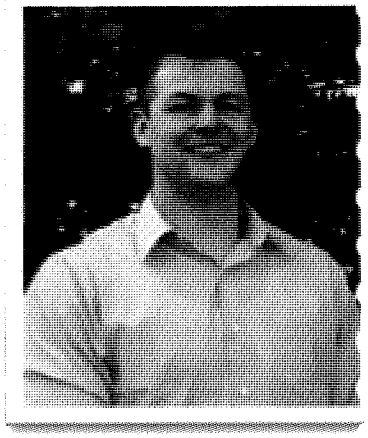
Performed an object-based image analysis to map over 45,000 acres of salt marsh using color-infrared aerial imagery and LiDAR data. The preserve uses this data as a baseline in order to identify changes in the marsh over time.

*Urban Forest Cloud suite of software tools*

Jeremy routinely contributes to Plan-It Geo's suite of web/mobile GIS, forestry, and data management software products including many custom applications. He provides design and styling, defines user requirements for the User Interface / User Experience (UI/UX), testing, review, demos, training, and CSS/HTML edits.

# Thomas Jay Wood

## Director of Field Operations | Certified Arborist



### Professional Summary

T.J. Wood graduated with a Bachelor of Science in Landscape Architecture from Colorado State University. He is proficient in architectural and design software such as AutoCAD, Google SketchUp, Esri ArcGIS, and the Adobe Creative Suite (Photoshop, Illustrator, and In Design). At Plan-It Geo, he contributes to tree inventories and assessments, Urban Forest Cloud sales and support, GIS data development, land cover classification quality control, design of planting plans, report compilation, and preparation of project deliverables. T.J. has experience conducting tree inventories in Colorado and Missouri and provides invaluable tree identification and risk assessment skills.

### Education

B.S. Landscape Architecture
Colorado State University, 2013

### Professional Certifications

International Society of Arboriculture: Certified Arborist
Certification ID: RM-7676A

### Memberships/Affiliations

International Society of Arboriculture - Rocky Mountain Chapter
American Society of Landscape Architecture

### Relevant Experience: Tree Inventories and Assessments

**Loveland, Colorado**

- Inventory Manager
- Inventory of 12,000 street ROW trees

**Joplin, Missouri**

- Inventory Manager
- Inventory of 6,250 city-managed trees in all parks and street ROW
- Software training to city staff
- Basic tree risk assessments provided for all trees inventoried

**St. Charles County, Missouri**

- Inventory Manager
- Inventory of 4,400 trees within all county parks
- Software training to county staff
- Basic tree risk assessments provided for all trees inventoried

**Cheyenne, Wyoming**

- Project Manager
- Inventory of 5,000 trees within city parks, greenways, and cemeteries

- Software training to city staff

Lakeway, Texas

- Inventory Manager
- Inventory of 1,100 trees within city parks and greenbelts
- Software training to city staff

Downtown Denver Partnership, Colorado

- Inventory Manager
- Inventory of 2,200 street trees managed by DDP

Rock Springs, Wyoming

- Project Manager
- Inventory of 4,000 trees within city parks, greenways, and cemeteries
- Software training to city staff

Highlands Garden Village, Colorado

- Inventory Manager
- Inventory of 400 community trees in communal areas and alleyways

Liberty, Missouri

- Inventory Manager
- Inventory of 700 street trees managed by the city of Liberty

Hunter Douglas Corporate Campus, Colorado

- Inventory Manager
- Inventory of all campus owned and maintained trees (~580 trees)
- Report and landscape design recommendations for Ash removals / mitigation when Emerald Ash Borer spreads to parts of the greater Denver area.

Jehn Engineering/Outdoor Design Group, Colorado

- Project Manager
- Inventory and a mitigation assessment were performed for a future development area
- Report and recommendations on mitigation was submitted to the City of Arvada for review and ruling

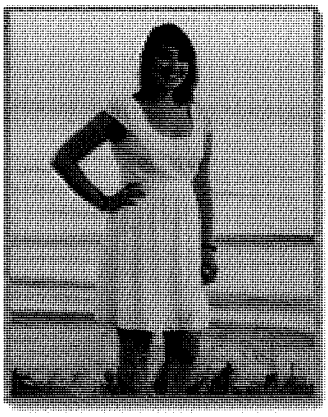
Tennyson Park HOA, Colorado

- Inventory Specialist and Project Manager
- Inventory all HOA maintained trees in Tennyson Knolls, Arvada. (~250 trees)
- Report of recommendations on tree maintenance, cost scenarios, and Emerald Ash Borer specific scenarios.
- Creation of maps to support HOA in decision making process
- Presentation of results and recommendations to HOA board and property management company

Sedalia, Missouri

- Inventory Specialist and Project Manager:
- Inventory of 1,800 street trees that lie in the public right of way GIS layer in Sedalia, Missouri.
- Risk management assessments were performed on all street trees.

# Maegan Blansett



## GIS and Natural Resources Specialist

Professional Summary:

Maegan graduated from the University of California, Santa Barbara with a Master's in Environmental Science and Management, where she specialized in Conservation Planning and Strategic Environmental Communications. She has a Bachelor's in Physical Geography with a minor in Forestry and Natural Resources from the University of California, Berkeley.

Maegan supports Plan-It Geo's urban tree canopy assessments with spatial analysis, data management, QA/QC of remote sensing products, client communication, report writing, proposals, and task management. Prior to joining the geospatial services team, she coordinated a water quality testing program at the Goleta Water District in Southern California and served as an AmeriCorps member focused on expanding urban gardens at public housing communities in New York City.

Education:

M.E.S.M. in Conservation Planning, University of California, Santa Barbara, 2017
B.A. in Geography, Minor in Forestry & Natural Resources, University of California, Berkeley, 2014

Relevant Experience:

*Urban Tree Canopy Assessment and Change Analysis, Richmond Hill, Ontario*

Provided an updated baseline and benchmark of the town's tree canopy and possible planting areas. High resolution aerial imagery from two time periods was utilized to map current tree canopy cover and perform a change analysis. Assisted with data analysis and reporting of final products.

*Urban Tree Canopy Assessment and Data Preparation, Snake River Valley, ID*

This assessment of five study areas throughout the state of Idaho provided a benchmark of tree canopy and other land cover types, identified areas suitable for future tree plantings, and prioritized planting sites based on a number of environmental and social criteria in order to update the state's existing Canopy Planner software app with the most recent canopy and planting space metrics. Performed the planting site suitability analysis and assisted with reporting, metadata, and delivery of final products.

*Urban Tree Canopy Assessment and Change Analysis, Shoreline, Washington*

Provided an updated baseline and benchmark of the City's tree canopy and other land cover types using remote sensing of high-resolution 2017 imagery and LiDAR and compared changes in canopy since a previous study conducted in 2010. Assisted with QA/QC of remote sensing products, change analysis, accuracy assessment, project management, client communications, and report writing.

*i-Tree Hydro Study and Urban Tree Canopy Assessment, King County, Washington (in progress)*

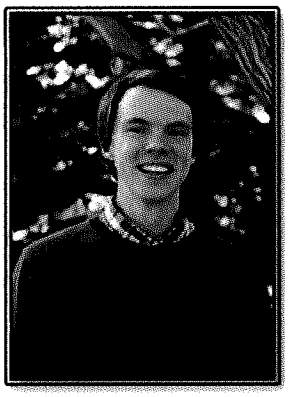
Provided an updated baseline and benchmark of tree canopy and other land cover types for a dozen municipalities in the county, as well as three additional pilot communities' tree canopy as it relates to stormwater benefits. High resolution aerial imagery and LiDAR was utilized to map current tree canopy cover, as well as perform a change analysis from a previous year's study where municipalities had previous study data available. Contributed to data gathering, QA/QC of remote sensing products, and project management/client communications.

*Urban Tree Canopy Assessment and Change Analysis, Colorado Springs, Colorado (in progress)*

Provided a baseline and benchmark of the City's tree canopy and possible planting areas for the first time and assessed canopy cover at two past time periods using a point-based sampling method. High resolution aerial imagery from three time periods was utilized to map current tree canopy cover and perform a change analysis. Performed the change analysis, designed a public opinion survey to launch the project, and assisted with data gathering, project management, and client communications.

# Patrick Saal

## GIS, Watershed, and i-Tree Specialist



### Professional Summary

Patrick graduated from Colorado State University in the spring of 2014 with a Bachelor of Science degree in Watershed Science and a minor in Sustainability. Through his studies at CSU, he became familiar with the many different facets of natural resource management, including water quality, soils, forestry, sustainability, and GIS software. At Plan-It Geo, Patrick's primary role has evolved into managing clients' Tree Plotter apps by offering technical and bug testing support, customer service, database updates and quality assurance. Since the introduction of Work Order Management (WOM) he has been heavily involved in its delivery to clients, customization, and subsequent testing/development.

### Education

B.S. in Watershed Science, Minor in Sustainability

Colorado State University, 2014

### Relevant Experience

*Urban Tree Canopy Assessment, Grand Rapids, Michigan*

Land cover classification quality control, data/spreadsheet analysis, cartography, ESRI ArcGIS spatial analysis, technical report writing, map book creation, metadata writing, and delivery of final data to clients.

*Urban Tree Canopy Assessment, Columbus, Ohio*

GIS Technician and Hydrologist: data/spreadsheet analysis, cartography, ESRI ArcGIS spatial analysis, technical report writing, i-Tree Hydro land cover change hydrology modelling.

*Urban Tree Canopy Assessment, Savannah, Georgia*

Assisted with cartography, technical report writing, data analysis, and delivery of final data to clients.

*Priority Planting Spaces Project, Peel, Ontario Region*

Assisted with cartography, spatial analysis in ESRI ArcGIS, and report editing.

*Urban Tree Canopy Assessment, Aspen, Colorado*

Assisted with object-based image analysis, land cover classification, quality control of spatial data, spreadsheets, cartography, fact sheets, and delivery.

*Keep Indianapolis Beautiful*

Prepared spatial data to be used concurrently with existing UTC data, processed US Census Bureau data for trend analysis.

*Urban Tree Canopy Assessment, Oakville, Ontario*

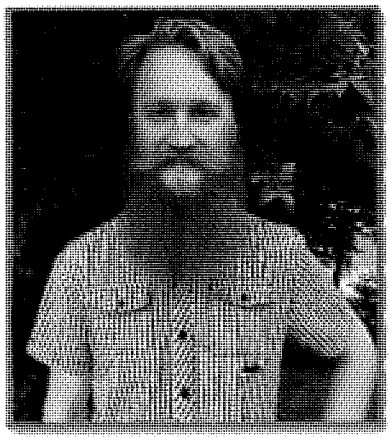
Performed accuracy assessments on land cover, digitized unsuitable and water areas within the city, quality assurance and control on tree canopy layers, cartography, and the organization of results.

*Urban Tree Canopy Assessment, Tupelo, MS*

Performed accuracy assessments on land cover, digitized unsuitable and water areas within the city, quality assurance and control on tree canopy layers, cartography, and a canopy change analysis from tornado damage.

# Ben Wittman

## GIS Specialist & Software Technician



Professional Summary:
Ben attended The University of Colorado at Colorado Springs where he earned a degree in Geography and Environmental Studies with a certificate in GIS. While at UCCS he learned skills in the fields of geomorphology, digital mapping, cartography and, GPS data collection. Following university, Ben found an interest in forestry and natural resource management while giving his time and skills to an organization in Black Forest, Colorado. At Plan-It Geo, Ben applies conceptual knowledge from the fields of natural resource and forestry to understand and manage GIS data sets. He reviews geographically modeled data using geospatial/geoprocessing tools and provides QA/QC to review, organize and process aerial imagery and remotely sensed land cover data.

Education:
B.S. in Geography and Environmental Studies
Emphasis in GIS
University of Colorado at Colorado Springs, 2014

Relevant Experience:

***Urban Forestry and Planning Projects:***

*i-Tree Eco Study and Urban Tree Canopy Assessment and Change Analysis, Denton, Texas*
*GIS Technician*: Land cover classification quality control, data/spreadsheet analysis, cartography, ESRI ArcGIS spatial analysis, technical report writing, map book creation, metadata writing, and delivery of final data to clients. Project includes the assessment of tree canopy and possible planting areas at multiple geographic scales and multiple years, as well as the delivery of spatial data, related maps, Canopy Planner software, and professional technical report

*Urban Tree Canopy Assessment and Change Analysis, Washington, D.C.*
*GIS Technician*: Provided an updated baseline and benchmark of the District's tree canopy and other land cover types and map existing and possible planting areas. High resolution aerial imagery and LiDAR was utilized to map current tree canopy cover, as well as perform a change analysis from a previous year's study. Updated the District's existing Canopy Planner software app with the most recent canopy and planting space metrics. Tasks and responsibilities included data/spreadsheet analysis, cartography, ESRI ArcGIS spatial analysis, technical report writing

*Urban Tree Canopy Assessment and Change Analysis, Richmond Hill, Ontario*

Assisted in providing an updated baseline and benchmark of the town's tree canopy and possible planting areas. Configured a web based interactive tool to view results from the tree

canopy assessment. This assessment used high resolution aerial imagery from two time periods to map current tree canopy cover and perform a change analysis.

*Urban Tree Canopy Assessment Jacksonville, FL*
*GIS Specialist & Software technician*: Provided an updated baseline and benchmark of tree canopy and other land cover types and map existing and possible planting areas. High resolution aerial imagery was utilized to map current tree canopy cover inside the city limits. Managed import of Tree canopy assessment results to Canopy Planner software app. Assisted in setup and configuration of the software tool Tree Plotter to be used in tandem with Canopy Planner to further accurately track new tree plantings. Tasks and responsibilities included data/spreadsheet analysis, cartography, ESRI ArcGIS spatial analysis, technical report writing, database management and configuration.

*Urban Tree Canopy Assessment Rowlett, TX*
*GIS Specialist & Software technician*: Provided an updated baseline and benchmark of the City's tree canopy and other land cover types and map existing and possible planting areas. High resolution aerial imagery was utilized to map current tree canopy cover inside the city limits. Managed import of Tree canopy assessment results to Canopy Planner software app. Tasks and responsibilities included data/spreadsheet analysis, cartography, ESRI ArcGIS spatial analysis, technical report writing.

*Tree Plotter Applications:*

*Software Developer/Tester:* Developed and tested applications for use in tree inventory collection and management for clients including and not limited to: Texas Tree Foundation, Tree Doctors (AZ), Nels Johnson, Sims Tree Health, City of Jacksonville, City of Cheyenne, City of Bowie (MD), CoTreeView (Colorado Statewide Inventory), Wisconsin DNR, Deerfield Beach (FL), Homewood Consulting (AUS), and South Suburban Parks and Recreation (CO)

# Carrie Asselmeier

## GIS/Natural Resources Technician

Professional Summary:

Carrie graduated with a Bachelor's degree in Geography and Sustainability from the University of Iowa. Before Plan-It Geo, Carrie interned with Chicago Wilderness, working on conservation issues and GIS. This past summer she worked for Cherry Creek State Park to educate park visitors and prevent the spread of aquatic nuisance species. At Plan-It Geo, Carrie assists with urban tree canopy assessments by performing quality assurance/quality control (QA/QC) on remote sensing land cover classification data.

Education:
B.A. in Geographical and Sustainability Science
University of Iowa, Iowa City, 2014

Relevant Experience:

***Urban Forestry and Planning Projects:***

*King Conservation District i-Tree Hydro Modeling and Urban Tree Canopy Assessment, King County, WA*
Using i-Tree Hydro, modeled and analyzed stormwater data using weather, DEM, Topographic, and Land Cover data. Performed QA/QC of land cover classification and tree canopy data. Processed target geography layers for 12 cities in King County.

*Urban Tree Canopy Assessment, Wichita, KS*
Performed QA/QC of land cover classification and tree canopy data for this assessment.

*Land Cover Classification, West Palm Beach, FL*
Performed QA/QC of land cover classification and tree canopy data for this assessment.

*Urban Tree Canopy Assessment, Shoreline, WA*
Performed QA/QC of land cover classification and tree canopy data for this assessment.

*Urban Tree Canopy Assessment and Socioeconomic Impact Analysis, Jacksonville, FL*
Performed QA/QC of land cover classification data for this urban tree canopy assessment. Researched, collected, and prepared socioeconomic and land use data to aid the city in focusing urban forestry resources throughout the city.

*Urban Tree Canopy Assessment and Data Preparation, Snake River Valley, ID*
Performed QA/QC of land cover classification and tree canopy data for this assessment. Contributed to and created land cover maps.

*Urban Tree Canopy Assessment and Change Analysis, Richmond Hill, Ontario*
Performed QA/QC of land cover classification and tree canopy data for this assessment. Created an Unsuitable layer for contribution to PPA results.

*Downtown Denver Urban Tree Canopy Assessment and Change Analysis, Denver, CO*
Digitized a Tree Canopy layer for the city of Denver. Performed a change analysis between 2018 digitized trees layer and previous 2014 tree canopy data.

## Professional References

We have provided numerous references for several clients who we've greatly enjoyed worked with on similar projects. We encourage you to contact these references to hear firsthand how Plan-It Geo (PG) focuses on the client, the process, end user needs, and outcomes.

Reference #1: City of Grand Rapids Urban Tree Canopy Assessment

*Description:* Plan-It Geo worked with the city and Friends of Grand Rapids Parks to conduct a UTC and i-Tree ecosystem benefits analysis, canopy change and trends assessment, and outreach and engagement online mapping tools.

*Role:* Led all GIS data modeling, land cover analysis, QA/QC, data delivery, reporting, canopy goal setting, and development & customization of Canopy Planner software application.

*Approximate Value:* $35,000

*Duration:* Jan-May 2015

*Contact:* City Forester, Joe Sulak, jsulak@grand-rapids.mi.us and FGRP Executive Director (Stephanie Adams) | (616) 288-7209 | PO Box 3199, Grand Rapids, MI 49501 |stephanie@friendsofgrparks.org

Reference #2: City of Ann Arbor, Urban Tree Canopy Assessment

*Description:* In 2010, Ian Hanou worked with the City of Ann Arbor and Michigan DNR to conduct an Urban Tree Canopy (UTC) analysis. The analysis mapped and assessed the existing and possible tree canopy covering approximately 29 square miles. The UTC analysis utilized 2009 leaf-on, multspectral aerial imagery and object-based image analysis (OBIA) techniques to develop a data set that included tree canopy, grass/open space, impervious surface area, bare soil, and water. Ann Arbor's UTC (all area covered by trees and forest) is 33%. Of the Existing UTC, residential areas represent 37% and pubic rights-of-way represent 24%. The UTC analysis provides a tool to help the City manage the urban and community forest resource. It is utilized for various planning activities, including the development of the city's yearly tree planting plan and to identify areas with low canopy cover that should be targeted for tree planting.

*Role:* Led all GIS data modeling, land cover analysis, QA/QC, data delivery, reporting, canopy goal setting, and development & customization of Canopy Planner software application.

*Approximate Value:* $35,000

*Duration:* Late 2009 and early 2010

*Contact:* Kerry Gray, Urban Forest and Natural Resource Planning Coordinator 734.794.6430 ext. 43703, KGray@a2gov.org

Reference #3: Columbus, Ohio Comprehensive Canopy and Ecosystem Services Analysis

*Description*: PG completed a Tree Canopy Assessment and Analysis of Emerald Ash Borer for the City of Columbus, Ohio (250mi$^2$). Our team provided imagery/LiDAR classification, data preparation and analysis, map development and a comprehensive project report. The deliverables provide essential data layers and tools to enhance forest management, recommendations for policy and planning, and priority planting areas. The report also extolls the calculated ecosystem service benefits of the canopy, evaluated correlations between tree canopy and socio-demographic indicators, and estimated the impact of Emerald ash borer (EAB) and Asian-long horned beetle (ALB) on future tree canopy goals/targets. The city is currently using our Canopy Planner web mapping software application (https://pg-cloud.com/Columbus/) to add & track tree planting events in the map, engage volunteers who can sign-up for events through the tool, and visualize the extent of existing canopy or priority planting areas.

*Role*: Led all PM, GIS, RS, reporting, training/presentation, and software development tasks

*Approximate Value*: $112,000 (US$, total contract value)

*Duration*: October 2014 – April 2015 (with continued hosting of the online Canopy Planner app)

*Contact*: John Bowers | Forestry GIS Specialist | (614) 724-2501

The Urban Tree Canopy (UTC) assessment provided by Plan-It Geo provided a comprehensive assessment of the community's UTC. The importance of such cannot be understated. Our City leaders need statistics to help formulate and justify policies, goals and objectives regarding the benefits of the urban tree landscape. The study provided that basis for North Little Rock's understanding of the benefits of the urban canopy and helped established a 42% canopy goal that should strengthen the future urban environment.

**Robert Voyles, City of North Little Rock**

"Forest ReLeaf of Missouri was very pleased with the outcome of our recent UTC assessment for St. Louis County and enjoyed working with the team at Plan-It Geo. In addition to providing us with excellent technical support, they were also very open to collaborating on new ways to communicate the results of the project. In other words, Plan-It Geo does not simply offer a "cookie cutter" approach when working with clients; rather, they seek to create innovative mapping and planning solutions for urban forestry organizations like Forest ReLeaf." – Donna Coles, Executive Director, Forest ReLeaf of Missouri

"The final draft UTC report looks great! It will be a valuable tool as Akron moves forward. It's good to compare to other cities in the region and how we stack up. I feel much more empowered to press for more funding to plant trees, as well as determining how to respond and lobby for legislation and plan for future development.

**Bill Hahn, City of Akron, Ohio**

## Example Reports from Similar Projects

Sample tree canopy and urban forestry assessment reports by Plan-It Geo include:

- City of Grand Rapids UTC Assessment: report https://issuu.com/planitgeoissuu/docs/grand_rapids_utc_assessment_report & interactive map https://pg-cloud.com/grandrapids
- City of Columbus Ohio UTC Assessment: http://issuu.com/planitgeoissuu/docs/columbus_urban_tree_canopy_assessme
- Bothell, WA: https://issuu.com/planitgeoissuu/docs/bothell_urbantreecanopyreport_final
- Comprehensive Urban Tree Canopy, i-Tree, and EAB Analysis in Columbus, Ohio: https://issuu.com/planitgeoissuu/docs/columbus_urban_tree_canopy_assessme
- Historical Canopy and Economic Analysis of DED and EAB in Milwaukee, Wisconsin: https://issuu.com/planitgeoissuu/docs/a_cost_benefit_analysis_of_ded__eab
- Memphis Regional "Canopy Action Plan": https://issuu.com/planitgeoissuu/docs/memphisregional_canopyactionplan_fi
- Urban Forest Canopy and Street Tree Assessment in Cambridge, Ontario: https://issuu.com/planitgeoissuu/docs/cambridge_urban_forest_canopy_repor
- Tornado Damage Assessment in Tupelo, Mississippi: https://issuu.com/planitgeoissuu/docs/tupelo_canopy_assessment_2015
- Land Use / Land Cover and Historical Canopy Assessment of Chatham County / Savannah, Georgia: https://issuu.com/planitgeoissuu/docs/chatham_county_urban_tree_canopy_as

## Additional Tools & Considerations

In addition to the technical qualifications listed above, Plan-It Geo is also well versed in several other areas and can offer a variety of optional, value-added services and products to suit Traverse City's unique needs. For example, our Urban Forest Cloud software provides powerful yet easy to use online tools for planners, resource managers, and arborists, with Tree Plotter and Canopy Planner in one tool, meeting the goals of this project and beyond. In this section, we list these web-based decision support & prioritization tools, as well as several other services related specifically to Traverse City's RFP and their associated costs to include.

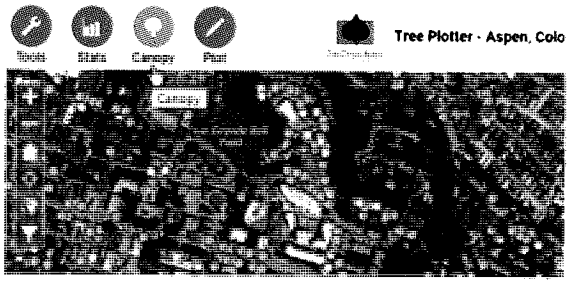
### Tree Plotter/ Canopy Planner

Plan-It Geo specializes in building cost-effective, spatially aware, decision support and operational productivity tools with a specialty in integrating GIS with science-based ecosystem benefit models and forestry/natural resources data. Our Urban Forest Cloud (UFC) suite of software tools includes Tree Plotter, Parks Plotter, Work Order Management, and Canopy Planner, as well as a dozen or more custom web browser mapping applications. We have more than 70 software clients (see http://www.TreePlotter.com/Clients) with total users >250 through statewide or regional tools in Colorado, Idaho, Iowa, Mississippi, Missouri, Nebraska, New Mexico, Pennsylvania, and Wisconsin, and large cities such as Saskatoon, Saskatchewan.

### Tree Plotter Online Software

**($1,500 for 1-year subscription, visit http://www.treeplotter.com/pricing for more details)**

In just three years, Tree Plotter software has become one of the premier tree management software tools in the world, widely considered the most user-friendly. It is used by dozens of private firms, cities, and nonprofits. Tree Plotter is a complete inventory management application that allows for quick data entry and provides a clear summary of statistics for city-wide tree data. This application is not only for the arborists collecting data, but it serves as a portal for the public to gather information on the trees they live and interact with. Our certified arborists use Tree Plotter in the field for our own inventory projects and consulting, therefore we have optimized it for data entry, updates, tracking, and reporting in many ways.

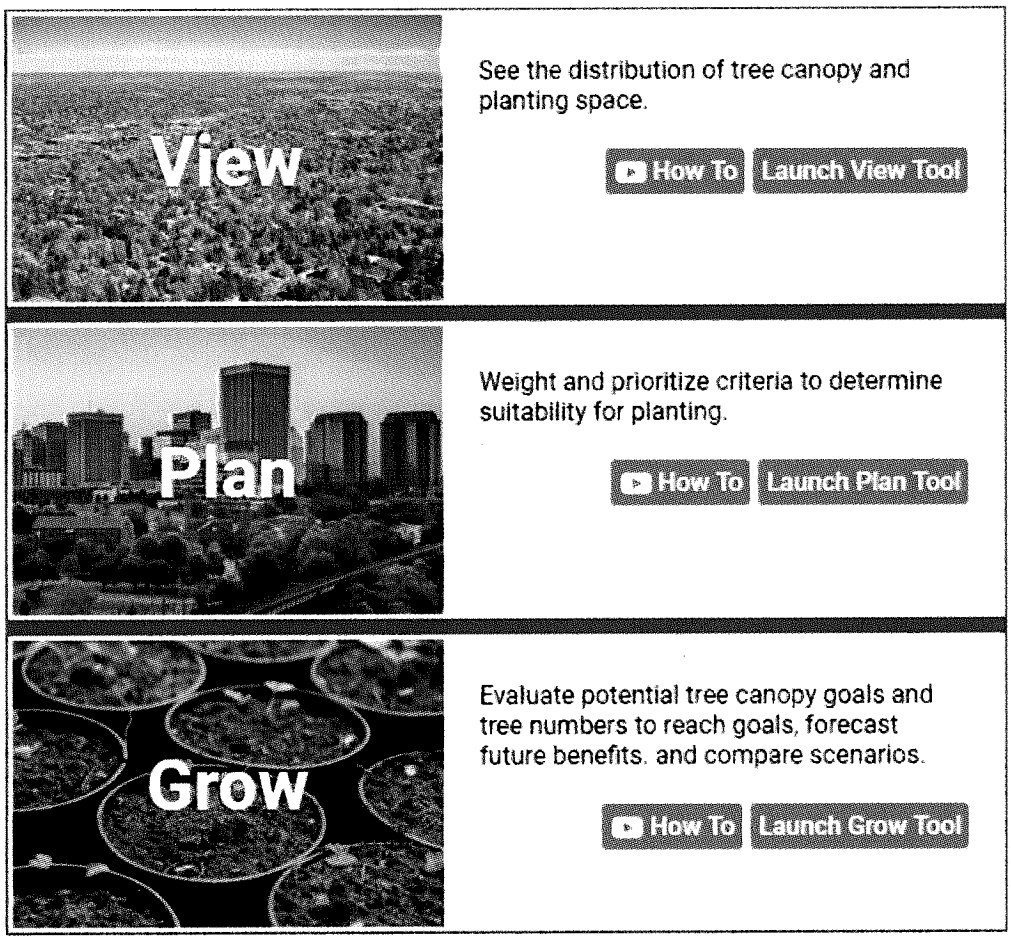



Furthermore, the flexibility of Tree Plotter is unique, including the ability to have any data fields, reporting/summary charts (many by default and others you create yourself), collecting and tracking maintenance on park or other assets/amenities, and consuming web services from other sources. Additionally, since TP is a web-based app, clients can access their data from any web-enabled computer, laptop, tablet, or phone on any web browser, making it the most accessible tree management software on the market. Finally, clients have direct access to an administration panel for creating unlimited user accounts with varying levels of administrative privileges and read/write capabilities. There are no limits on the number of users or seats/licenses or editing in real-time. Adding a 1-year or 3-year subscription to Tree Plotter would greatly benefit Traverse City's field inventory and future planning efforts.

## Canopy Planner Online Software
### ($2,000 for 3-year subscription and tree planting prioritization analysis)

In addition to Tree Plotter, which visualizes data recorded for actual, individual trees, Plan-It Geo also offers another tool: a Canopy Planner online software map. There are many benefits that this tool provides. It is web-based interactive map of tree canopy, accessible to the public and city departments, that allows users to explore existing canopy and planting areas data to interactively create "grow out" scenarios". Three tools are included:

1. The '**View**' tool component of Canopy Planner allows users to easily choose a geographic scale (e.g. wards) and display % metrics or filter data with slider bars.
2. The '**Plan**' tool is a GIS-based prioritization tool that requires GIS analysis / data preparation. We suggest 7-8 criteria be included. Weights from low to high are then set by the user for each criterion to see the thematic map update with priority areas based on the ranks / weights applied for specific objectives. Examples include existing tree canopy, plantable space, urban heat islands, stormwater management, and socioeconomic / demographic indicators.
3. The '**Grow**' tool allows users to create canopy cover & planting scenarios in the map and save scenario reports.



We can also combine our Tree Plotter and Canopy Planner software into one app, uniquely customized for the City's purposes. As an example of an app created for another municipality, Ian Hanou presented on a custom Tree Plotter + Canopy Planner application based on a UTC project with Columbus, Ohio via webinar through the U.S. Forest Service "Urban Forest Connections" series in October 2015. It can be viewed at http://www.fs.fed.us/research/urban-webinars/power-of-tree-canopy/.

Links to several current Canopy Planner software applications are found below:

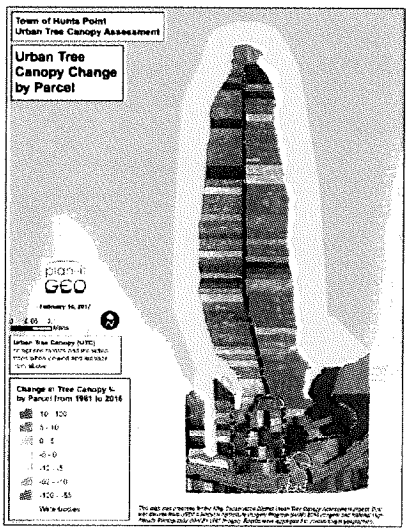
- State of Idaho: https://pg-cloud.com/Idaho/
- Million Trees Miami: https://pg-cloud.com/MillionTreesMiami/
- Denton, TX: https://pg-cloud.com/DentonTX/
- Bothell, WA: https://pg-cloud.com/Bothell/
- Keep Indianapolis Beautiful: https://pg-cloud.com/KIB/
- Columbus, OH: https://pg-cloud.com/columbus/

### Urban Forest Management Plan (details would need to be discussed to determine pricing)

Additionally, Plan-It Geo is an industry leader in creating custom-tailored Urban Forest Management Plans for municipalities based on UTC data. Our planning experience ranges from urban forest management/master plans, regional canopy action plans and strategies, strategic planting plans, analysis and reporting of tree inventories, and Urban Tree Canopy (UTC) reports for the municipal, private, and non-profit sectors on all scales. Chris Pfeiffer, our Director of Urban Forestry Consulting Services, has lead or assisted with over 5 management and/or master plans with cities across the country. The RFP indicated that this UTC assessment, report, and inventory project will all be key components in the City's next major step, creating a management plan. Our team is ready and well-prepared to assist with that process if the City would like to partner on that as well.

### Canopy Change Analysis ($1,000 for point-based change analysis)

Another component of many of Plan-It Geo's UTC assessments is a change analysis of canopy cover over time. These range from extremely in-depth (essentially, repeating the entire process of remote sensing, QA/QC, and analysis by assessment boundaries for an aerial image from a different time period), to simplified (for instance, a point-based sampling method involving assigning a reference value to randomly-generated points until a desired standard error is achieved). Time periods are selected with the guidance of the City and can reflect fixed time intervals or be designed to capture pre- and post-effects of a major event such as fire or drought. Since Traverse City has never conducted a UTC assessment before, it could be very informative for the City to assess not only their current canopy cover and composition in full detail, but also



perform some type of change analysis to see whether the canopy as varied significantly over time and include that information in future planning efforts.

### Additional Inventory Data (see pricing details below)

As currently requested in the RFP, the data to be collected in the inventory of the City's 750 remaining trees is very succinct and does not contain many data fields. If the City was interested in getting even more information about its urban forest resource (for example, not just the number or species of trees but their condition), there are many additional data fields that could be included in the inventory. Again, these fields would be selected by the City to reflect the information most pertinent to understanding its community forest.

Some examples include:

- Level 2 tree risk assessments (would raise the cost $1-2/tree)
- Primary and Secondary Maintenance needs (would raise $1/tree)
- Observations (would raise $0.25/tree)
- Location Fields (price depends on fields)

**DAVEY**
**Resource Group**

Corporate Headquarters
1500 North Mantua Street
P.O. Box 5193
Kent, Ohio 44240-5193
330.673.5685
Toll Free 1.800.828.8312
Fax 330.673.0860

Lee Mueller
Grand Rapids, MI
ISA Certified Arborist #414-8A
MI Registered Forester #46043
Tree Risk Assessment Qualified
248.2210439
Fax 330.676.7715

June 5, 2018

Julie Dalton
Purchasing Agent
City of Traverse City
400 Boardman Avenue, 2nd floor
Traverse City, Michigan 49684

*RE: Proposal*—Urban Tree canopy Assessment & Inventory

Dear Ms. Dalton:

Davey Resource Group, Inc. "DRG" is pleased to provide you with this proposal, which describes, in detail, our approach to your project. Our team has crafted this project scope based on the city's RFP and our understanding of your urban forest management goals. We understand that this project is a priority for city staff, leadership, and the residents of your community, and our proposal has been structured to best meet your community's particular needs and expectations.

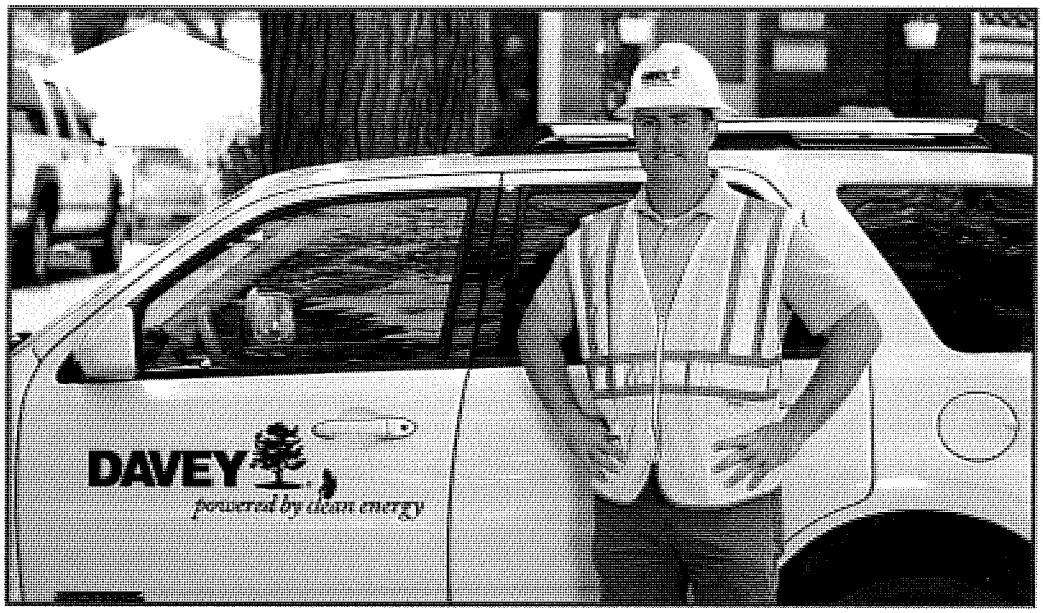
DRG has the experience and qualifications to successfully complete this project. We have a full complement of ISA Certified Arborists and college-educated foresters -- and can expand our complement to meet tight deadlines, if necessary.

Davey Resource Group, Inc. "DRG," formerly known as Davey Resource Group, a division of The Davey Tree Expert Company, has an unmatched legacy in the tree care business. Since 1990, Davey Resource Group has completed over 1,000 tree inventories across the nation. No other company has done as many tree inventories or master plans as Davey Resource Group.

If you need any additional information or clarification on the enclosed proposal, please feel free to contact me at 248-221-0439 or lee.mueller@davey.com.

Sincerely,

Lee Mueller
Forestry Specialist and Project Developer




Proposal for:

# Urban Tree Canopy Assessment and Inventory

Proposal Date: June, 2018

Prepared for:

City of Traverse City
400 Boardman Avenue
Traverse City, Michigan 49684

Prepared by:

Lee Mueller, Area Manager - Michigan
Davey Resource Group, Inc.
Grand Rapids, Michigan
C. 248-221-0439 / TF. 800.828.8312

DAVEY Resource Group

*"Innovations through Solutions and Expertise"*

# Project Understanding

Traverse City's charm is based, in part, on its natural character and proximity to beautiful lakes, streams, trees, and natural settings. These natural resources, in turn, provide numerous community benefits from promoting clean air and water, to providing space for recreation and reflection. Particularly celebrating the contribution of trees to Traverse City's appeal, the City has proudly been awarded Tree City USA status for more than 28 years and is currently in the process of completing both a street tree inventory and a review of the City's policies and ordinances pertaining to trees.

However, the City recognizes that its urban forest is comprised of more than public trees. The trees on both public and private property contribute a myriad of environmental benefits to both City residents and surrounding geographies. As the City continues to strengthen its urban forestry program, promoting the care and expansion of community trees citywide is a key goal. To do this effectively, the City needs to establish meaningful community forestry benchmarks that encompass all community trees – both public and private – as well as clear guidelines to meet community tree canopy objectives.

This project aligns with recent City efforts to complete a street tree inventory and the City's partnership with the Watershed Grand Traverse Bay to examine City ordinances. Davey Resource Group, Inc "DRG" will complete an urban tree canopy assessment, author a report detailing findings and recommendations, and complete the remaining 750 trees in the City's tree ordinance. Ultimately, the combination of this project plus the City's existing work will provide a significant foundation from which to set urban forestry goals, make strategic decisions to maintain City trees and expand urban tree canopy, and provide a strong foundation for the City's urban forestry program. With these tools, the City can confidently manage, plan, and care for community trees.

DRG has a deep understanding of urban forestry efforts and issues in Traverse City and the region. Over the last several years, our team has partnered with ReLeaf Michigan, the Michigan DNR, and the Watershed Center Grand Traverse Bay to perform urban tree canopy assessments, community training, and to plant trees using UTC data in Bellaire, Elk Rapids, Kalkaska, Kingsley, Leelanau Township, and Northport. Moreover, we have supported the Watershed Center's efforts over the last year to review and strengthen the City's tree policies and ordinances. Combined, this project experience provides our team with unmatched background and awareness of local challenges, regional issues, and City priorities.

With over 25 years in the business, DRG has provided expert consulting to over 500 clients from across the Country, including municipalities, parks, cemeteries, golf courses, utilities, and the private sector. We offer services ranging from tree inspections and appraisals, tree preservation plans, urban forest management plan, and tree canopy assessments to contract foresters, on-site arborist oversight, and ordinance and code enforcement. Our urban forestry consultants include International Society of Arboriculture (ISA) Certified Arborists, traditional foresters, Geographic Information Systems (GIS) analysts, urban planners, and biological and ecological scientists with knowledge, work experiences, and training to complete your project on time, for your budget, and beyond your expectations.

# Our Experience and Qualifications

DRG offers specialized consulting solutions and technical services for municipal, utility, and commercial clients. Established to nurture and protect natural resources, especially trees and urban forests in communities across North America, our regional offices and certified arborists are located near you, offering a range of professional arboriculture services, from GIS-based tree inventories to custom urban forest master plans.

With urban forestry and environmental consulting offices across 15 states, DRG provides professional services that are convenient for you. DRG specialists live and work in and around your community. Your local DRG office is in Grand Rapids, Michigan. Members of your project team work in Grand Rapids and Detroit, Michigan as well as from our corporate headquarters in Kent, Ohio.

## Project Team

DRG is the national leader in supporting local urban forestry programs. Many of the standard tools, best practices, and processes for effectively managing urban forests were first developed and promoted by our team of experts. We anticipate that our project team will include:

**Lee S. Mueller, M.S.**, is a forestry specialist and Michigan area manager with DRG. He specializes in community forestry, forest management, parks and recreation, outreach and education, and nonprofit organizations. Mr. Mueller has served as a staff or board member on a variety of professional and nonprofit organizations dedicated to forestry, arboriculture, and parks and recreation. Prior to joining DRG, Mr. Mueller was instrumental in building and managing an urban forestry outreach and volunteer program that garnered state and national recognition in Grand Rapids, Michigan. Mr. Mueller is an International Society of Arboriculture (ISA) Certified Arborist (MI-4148A), has an ISA Tree Risk Assessment Qualification (TRAQ), and is a Michigan Registered Forester in the State of Michigan. Mr. Mueller has a master's degree and a bachelor's degree in forestry from Michigan State University.

**Scott Larson** is a biologist and site manager with DRG. Mr. Larson carries out a variety of fieldwork, including tree assessments and inventories, wetland and stream delineations, ecological surveys, endangered species surveys, wetland vegetation assessments, and compensatory mitigation project monitoring. Mr. Larson is a Certified Arborist (MI-4418A) and a Licensed Commercial Applicator through the Ohio Department of Agriculture and maintains reciprocity in Michigan. Mr. Larson is a Certified Wilderness First Responder through the National Outdoor Leadership School (NOLS) Wilderness Medicine Institute and a certified Search and Rescue Technician II through The National Association for Search and Rescue. He has a bachelor's degree in applied ecology and environmental sciences, with an emphasis in plant ecology and wetlands from Michigan Technological University.

**William Ayersman, GISP, M.S.**, is the geospatial services coordinator within DRG. He is a lead geospatial analyst with extensive experience applying spatial analysis and predictive modeling to natural resource issues. His daily responsibilities involve GIS project coordination for remote sensing and image analysis projects, LiDAR analysis, database and project management, and the creation and design of predictive and suitability models. Since 2011, he has been the project lead on all urban tree

canopy (UTC) assessment and forestry analysis projects for urban forestry and utility services, including generating custom mapping and reports for transmission right-of-way projects. Mr. Ayersman holds a Master of Science degree in Forestry and a Bachelor of Science degree in Forest Management from West Virginia University. He is a member of the American Society of Photogrammetry and Remote Sensing (ASPRS), GIS Users of Northern Ohio (GUONO) and Ohio Urban Regional System Association (URISA) Ohio Chapter. He joined DRG in April 2011.

**Deborah E. Sheeler, M.A.,** is a Production Manager for GIS/IT services with 22 years of experience applying GIS technology to environmental analysis. She currently supervises GIS operations at DRG and has been with the company for over 20 years. Her work involves data acquisition, spatial analysis and interpretation, database and project management, and the creation and design of cartographic products through use of advanced GIS software. In addition, Ms. Sheeler has experience and knowledge in the fields of natural hazards research, aerial photography interpretation, remote sensing, and custom programming in Visual Basic and various GIS software, as well as numerous years of experience in the utilization, maintenance, and support of pen-computer hardware and global positioning systems (GPS). She has a master's degree in geography from Kent State University and a bachelor's degree in geography with a minor in earth science from Central Missouri State University.

**Joseph Gregory** is a regional operations manager for DRG's Environmental Consulting team. Mr. Gregory is responsible for providing operational, fiscal, and sales support to all regional operational teams. Mr. Gregory is a planner and an urban forester by training and has coordinated numerous projects throughout the U.S., including municipal inventories in Orlando, Detroit, Charlotte, Raleigh, Pittsburgh, and Elgin, Illinois. He has extensive experience with GIS and GPS technologies, several types of field data collection computers/units, tree inventories, tree inventory management software, urban tree risk assessment, urban tree canopy analyses, and the i-Tree suite of software. He is proficient at writing urban and community forestry management plans, benefit analyses, and urban forest master plans for municipal and nonprofit clientele. Mr. Gregory is an International Society of Arboriculture (ISA) Certified Arborist and Municipal Specialist (OH-1420AM). Mr. Gregory has a master's degree in geography and urban planning from The University of Akron and a bachelor's degree in conservation from Kent State University.

## Project Experience

DRG has provided descriptions of four projects that demonstrate our ability to complete a similar scope of work. We can provide many more examples of our work upon request, such as similar projects for Cleveland, OH, Portland, OR, and Roseville, CA, among many others.

In partnership with the **Michigan Department of Natural Resources** and **ReLeaf Michigan**, DRG secured a Great Lakes Restoration Initiative grant through the United States Forest Service. This project sought to develop a pilot program that developed community forestry capacity in rural Michigan communities. Specifically, the grant project included the development of urban tree canopy assessments, on-site training, and volunteer-led tree planting in the cities of Au Gres and Standish, Michigan. As part of the UTC analysis, DRG reviewed the distribution of community tree canopy, estimated ecosystem benefits, and developed a prioritized planting plan. DRG's consulting team

worked with the Michigan DNR and ReLeaf Michigan to distribute the UTC findings, train local community leadership on using UTC data, and hosted a series of public meetings. Subsequently, ReLeaf Michigan employed the prioritized planting plan for volunteer tree plantings with each community to demonstrate and provide instruction on its use.

Subsequently, this same program and partnership has been replicated in the Grand Traverse Watershed with the communities of Bellaire, Elk Rapids, Kalkaska, Kingsley, Leelanau Township and Northport through a United States Forest Service Landscape Scale Restoration grant. Assessment results can be viewed online: https://gtbaycanopy.weebly.com/

The **City of Ferndale** contracted DRG to perform an urban tree canopy assessment (UTC), ordinance review, phased inventory, and management plan. The UTC identified the City's total tree canopy, where tree canopy occurs, and opportunities for improvement. Coupled with the City's tree ordinance review, the City has clear direction and strategies to maximize tree canopy across the community. To date, 3 of 4 inventory phases have been completed. A total of 6,473 trees have been collected. As data are collected, the City immediately handles any maintenance concerns identified. These efforts have raised the visibility of the City's forestry program among City leadership. As a result, Ferndale crafted a series of goals and metrics to advance urban forestry in fiscal year 2018. To move these goals forward, Ferndale contracted DRG to provide a contract forester one day a month for a year. DRG has been supporting City efforts through tree inspections, further ordinance review, resident communication, and planting program evaluation. In 2018, the final phase of tree inventory data will be captured and DRG will craft a management plan to guide City tree maintenance efforts.

Over the last year, DRG has been leveraging its expertise in tree ordinances and policies to support work by the **Watershed Center Grand Traverse Bay** to review and update some of the City of Traverse City's ordinances as it relates to tree canopy protection and enhancement. DRG's consulting team has provided example ordinance language, researched implications of various policy decisions, advised on ordinance language, and provided examples of similar policies across Michigan and the nation. These inputs have helped facilitate a robust discussion among the Ordinance Review Task Force to build the best possible policies for Traverse City. Moreover, this project has lent our team a unique perspective into goals, priorities, and community initiatives in the City.

Combined, these projects provide DRG with a unique perspective and depth of experience working both within the Grand Traverse Bay and across Michigan on similar projects. Moreover, our array of national experience on other projects in Cleveland, Detroit, Pittsburgh, and Baltimore, among others, provides our team leading perspectives on emergent industry trends. No other firm has both the depth of local experience and the breadth of qualifications and skills to the support the City in its urban forestry efforts.

We are confident that our team will provide the City of Traverse City with a canopy study, report, and completed inventory that supports City decision-making and strategic efforts to protect, enhance, and expand Traverse City's tree cover.

# Project Approach

DRG approaches each project with our client's goals and challenges in mind. We have completed a wide range of forestry and natural resource management projects for communities, park districts, cemeteries, and campuses throughout the U.S. for over 25 years. We understand that having management tools like a tree inventory and urban tree canopy assessment enable our clients to recognize the maintenance needs of their trees, project workloads and budgets, and ultimately address overarching management goals such as canopy sustainability and climate change. Importantly, we understand that a tree inventory and canopy study are management tools you utilize in your daily work, helping you to complete crucial tasks such as prioritizing tree work, mitigating some of the risks associated with trees, justifying budgets, and find spacing to plant more trees.

The results of DRG's work will help you:

- Quickly locate trees in the office and in the field.
- Prioritize and plan tree maintenance and keep maintenance records up-to-date.
- Make data-driven decisions that can fuel program budgets and encourage support of your urban forestry program.
- Justify your urban forestry decisions; recommendations to prune, remove, and plant trees are legitimized by a tree inventory.
- Easily respond to calls about trees.
- Create tree-related reports.
- Share the benefits of your urban forest and promote the value of community trees.

Managing trees is an undeniable challenge. This project is a significant step towards meeting that challenge and achieving your urban forestry program's goals and objectives.

# Urban Tree Canopy Assessment and Inventory

The following steps detail how DRG will complete this project on time and within budget.

## Communication

DRG is client-driven. We pride ourselves on clear, consistent communication. From project beginning to end, Traverse City will know the staff assigned to this project and how it is progressing.

## Contract/Insurance/E-Verify

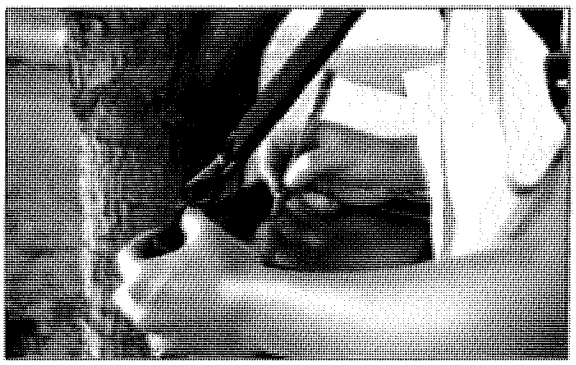
Once awarded this project, we will execute a contract and provide insurance per the project's specifications. DRG complies with e-Verify.

## Kick-off Meeting

Our staff will contact you after contract execution to schedule a kick-off meeting. During the kick-off meeting, we will discuss project elements such as staffing, schedule, safety, communication procedures, and project milestones. Data collection and analysis typically begins immediately after the kick-off meeting.

## Data Mining

After the kick-off conversation, our team will obtain necessary GIS data and imagery needed for the project. DRG's urban foresters work with our GIS department, and typically your GIS or planning department, to complete this step. We use the data fields defined in this proposal and the imagery, maps, and data files we obtain from various sources. If necessary, we can get imagery from other public sources to prepare our field computers and GIS platforms.



***DRG's ruggedized computers allow us to collect data and inventory trees quickly and accurately.***

## Task 1. City-wide, Comprehensive, Urban Tree Canopy Assessment

DRG will provide a high-resolution, spatially explicit, and detailed assessment of the City of Traverse City's current baseline conditions of land cover, tree canopy, and planting potential area using 2016 NAIP or newest available imagery (60-cm resolution). The analysis will achieve a minimum of 94% User's Accuracy for tree canopy and impervious classes. Overall Accuracy will be equal to or greater than 92%. The minimum mapping unit (MMU) for the project will be 9 square meters.

DRG utilizes three techniques to generate the "best" extraction results: 1) a segmentation classification; 2) an object-based image analysis (OBIA) approach; and 3) LiDAR data analysis, when available. DRG will use the following land cover classifications at a minimum:

- Tree Canopy
- Impervious Surfaces
- Grass/Low-Lying Vegetation
- Bare Ground
- Open Water

*Additional classifications for buildings, roads, tree canopy over pervious surfaces, tree canopy over impervious surfaces, wetlands, and agricultural areas can be included if data are available.*

## Land Cover Extraction

ArcGIS® and Overwatch's Feature Analyst™ will be the GIS and remote sensing software used to complete this automated extraction process. Feature Analyst™ is a powerful Automated Feature Extraction (AFE) tool for extracting object-specific geographic features and allows the MMU to be set prior to the initial feature extraction process. This option will be set before the classification is run, allowing only areas having this specified area aggregated, as well as certain spectral characteristics, to be classified as a particular cover type.

## Accuracy Standards

DRG's experience and knowledge in utilizing a combination of these powerful classification tools and techniques enable us to capture a much more accurate representation of the current land cover layer and decreases the amount of manual editing time needed in the quality control process.

DRG manually edits and conducts thorough quality assurance and quality control checks on all UTC and land cover layers. A quality assurance (QA)/quality control (QC) process will be completed using ArcGIS® to identify, clean, and correct any misclassification or topology errors in the final land cover dataset. DRGp will edit the initial land cover extractions in urban areas at a 1:1,500 quality control scale, rural areas at a 1:2,500 scale, and woodland/forested areas at a 1:5,000 scale utilizing the most current high-resolution aerial imagery to aid in the quality control process.

Generally, most vendors edit urban areas at a 1:2,500 scale. DRG will use a more detailed 1:1,500 scale in urban areas so that the results of the final land cover layer will reflect a more accurate representation of the true nature and extent of the urban landscape by capturing individual tree canopy features. Additionally, this higher scale will aid in achieving a minimum of 94% User's Accuracy for tree canopy and impervious classes. Overall Accuracy will be greater than or equal to 92%.

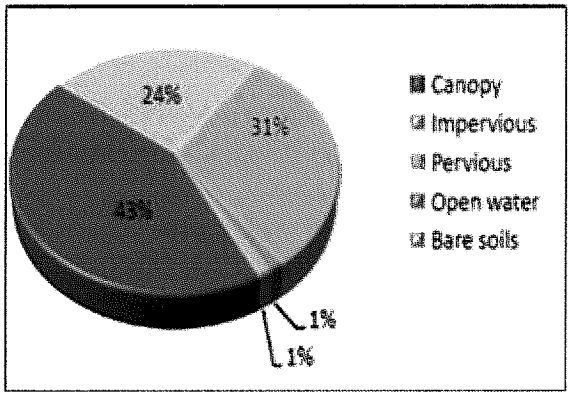
*UTC Project Data Parameter Summary Information*

| Parameter | Description |
|---|---|
| **Imagery** | **2016 NAIP 4-band (1m resolution)** |
| **Extraction Software** | **Overwatch Feature Analyst 5.0™ and ESRI ArcGIS®** |
| Land Cover Classes | Listed Above |
| Minimum Mapping Unit (MMU) | 9 square meters |
| QA/QC Scale | 1:1,500 (Urban) – 1:2,500 (Rural) – 1:5,000 (Woodland/Forested Areas) |

| | |
|---|---|
| Error Sampling Method | Random point generation |
| Statistical Metrics | Kappa, Quantity Disagreement, and Allocation Disagreement |
| Minimum User's Accuracy | Canopy = 94%, Impervious = 94%, Overall = 92% |

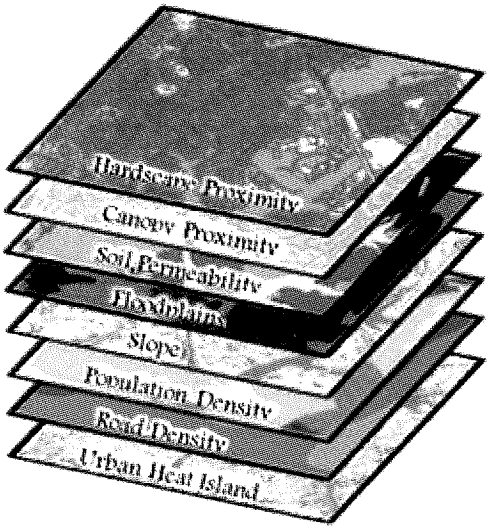
## Measuring Land Cover and Urban Tree Canopy

After completing the accuracy assessment, the final comprehensive land cover dataset will be processed in ArcGIS® to measure the existing UTC cover. Further analyses will provide the city with a statistical summary of the area and existing percent of canopy cover for the entire city and each quadrant. Area and percentages of canopy cover will be calculated for all areas assessed. Since this form of GIS analysis will support other spatial queries, it is anticipated that reporting on the canopy cover by other boundaries can also be conducted if GIS data layers are provided.




A final QA/QC check process will be completed using ArcGIS® geo-processing, analysis, and management tools to identify and correct any topology errors for the additional GIS layers created during this analysis process.

## Planting Site Analysis




A standard UTC can provide mapping and information on possible planting areas in the public right-of-way. The possible planting area calculation that a standard UTC analysis returns is the total of all areas that are open ground—such as golf courses, active agricultural fields, and sports fields. While it is theoretically possible that these types of pervious surfaces and land use areas could represent future tree planting areas, considering these is understandably not practical for implementation of actual planting projects nor is it realistic for urban forest planning and management.

Therefore, DRG can perform further analysis for the City of Traverse City to determine more real world and reasonable areas to plant trees within

the city; these are termed preferred planting areas. These data will assist the City of Traverse City with identifying future locations for tree planting. These areas can be prioritized based on projected impacts to environmental or social concerns, such as tree canopy distribution equity, stormwater interception, mitigation of the urban heat island or air quality.

## Ecosystem Benefits Analysis

Building on our remote sensing and GIS analysis experience, we have developed a comprehensive working knowledge of i-Tree and its many applications. In fact, The Davey Tree Expert Company is one of the key partners with the United States Forest Service in the development and distribution of the itree software suite. DRG's qualified experts understand the latest methods of determining UTC ecosystem services to provide the desired project outcomes for our clients.

From identifying the initial land cover data to mapping and graphing actual ecosystem services for the project area, DRG will utilize a combination of internal analytical processes and i-Tree tools to quantify the value and spatially represent specific tree canopy ecosystem services such as air pollution removal, carbon storage and sequestration, and stormwater runoff analysis.

**Analysis 1 – Air Quality**—The software model called i-Tree Canopy supports analysis of pollution removal from tree canopy for City of Traverse City. Recent innovations with the latest version of i-Tree Canopy will allow the software model to generate the overall ecosystem values for air quality. The report will be generated to quantify the monetary and unit values of pollution reduction for carbon monoxide, nitrogen dioxide, ozone, particulate matter, and sulfur dioxide.

**Analysis 2 – Carbon**—The software model i-Tree Canopy can again provide the solution to evaluating the carbon sequestration and storage services provided by Traverse City's tree canopy. The amount of UTC can be directly correlated to current and future increases in carbon reduction.

**Analysis 3 – Stormwater**—The software model i-Tree Hydro will be utilized to assess stormwater runoff for using land cover parameters in Traverse City. i-Tree Hydro is a simulation tool that analyzes how land cover influences the volume and quality of runoff. It can analyze historical or future hydrological events and allow the user to contrast runoff volume and quality from existing land cover (referred to as the Base Case) with runoff from the Alternative Case land cover. The new version of i-Tree Hydro allows for simulations based on non-watershed boundaries. This improved functionality allows users the ability to calculate runoff volumes for different geographies such as municipalities.

***Deliverables***: *Electronic files of ESRI-compatible GIS land cover (raster) and assessment data layers (vector). All deliverables will be produced and distributed as specified in the RFP. DRG delivers all GIS data in an ESRI ArcGIS® geodatabase in a projected coordinate system that fully integrates with our clients' existing GIS software. These data sets will be delivered complete with projection files and metadata using Federal Geographic Data Committee (FGDC) specifications.*

## Task 2. UTC Report and Recommendations

The final project report is as important as identifying, collecting, and analyzing the baseline data. The report will follow the guidelines set forth in accordance with the USDA Forest Service *UTC Assessment Guidelines*. Depending on findings, reports are generally 10-20 pages long and include full-color maps and narratives describing data analysis, general findings, and recommendations.

In addition to high-quality written reports, DRG also retains a highly skilled production, marketing, and communications team. Instead of or addition to written paper reports, DRG can develop web-based UTC reports, storymaps, or attractive images to help spread awareness of the city's tree canopy. Depending on the city's needs, one or more of these methods may be valuable to support the city's efforts.

### Option 2A - Management Plan

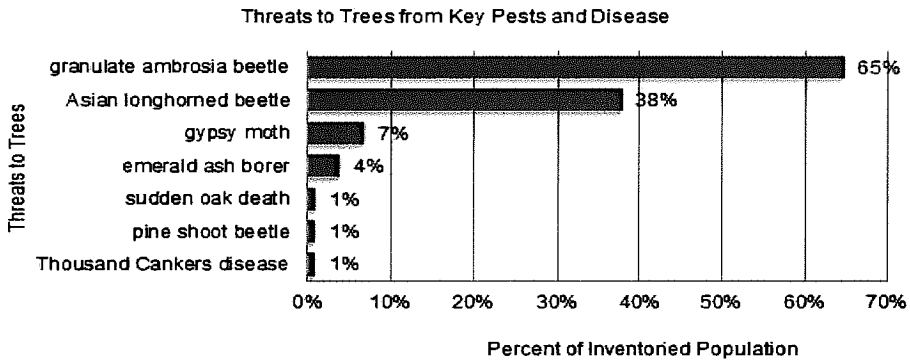
At the City's option, DRG can incorporate the UTC report into a full-fledged management plan.

Using the completed inventory data, our tree management plan is designed to help the City plan and budget for future tree maintenance, including steps you can take to become more proactive in caring for its community's trees. The tree management plan summarizes tree inventory findings and analyzes the data helping you understand the structure and composition of its urban forest. The plan also provides insight into current tree maintenance needs and some of the threats that trees face, which could impact you fiscally, aesthetically, and emotionally. Annual tree maintenance workloads and general budgets are provided in an easy-to-use, editable Excel™ spreadsheet. The tree management plan also demonstrates the environmental benefits of the urban forest by showcasing its value in carbon sequestration and storage, reducing stormwater runoff, and saving energy. The UTC report will be enshrined as a chapter in the City's management plan.

The following list illustrates the sections typically included in one of DRG's tree management plans:

#### Management Plan Sections

- **Executive Summary**—Presents a brief overview of inventory findings, including the current state of the urban forest and recommended tree maintenance needs.
- **Inventory Analysis**—Identifies the inventoried area and discusses the tree population characteristics that direct management, including species diversity, diameter size class distribution, general health, priority maintenance, and potential pest-related threats to trees. Trends, observations, and concerns noted during the inventory or identified during analysis of the data are also discussed in this section.
- **UTC Report**—This section contains the City's UTC report. .

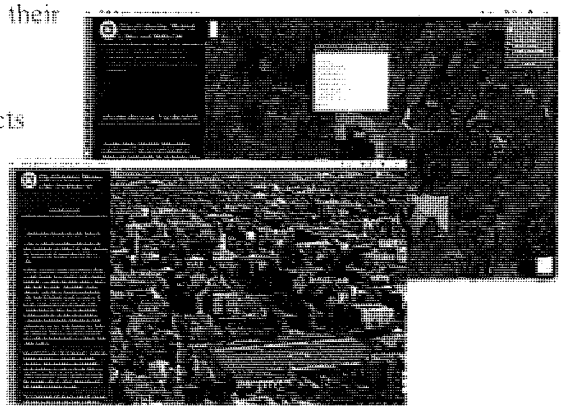



***DRG's analysis of tree inventory data will inform you of potential threats to the urban forest and the impact such threats may have on your tree population.***

- **Tree Management Program**—An essential component of any tree management program is knowing your maintenance needs. This section discusses the processes and activities that comprise a proactive, multi-year tree management program. We use your inventory data to project annual maintenance needs—including priority and proactive maintenance—such as priority tree removal and pruning, routine tree pruning, and structural pruning cycles. To help you with budget projections, we include a multi-year, editable Excel™ maintenance schedule and cost spreadsheet. This maintenance schedule will help you approximate the cost to perform the suggested tree maintenance based on average industry unit rates to perform similar work. Community outreach and plan and inventory updates are also presented in this section.
- **References, Glossary, and Appendices**—The management plan also provides a list of reference materials, a glossary of terms used in the plan, and relevant appendices which may include species recommended for future planting, and damaging regional invasive pests and diseases.

## Option 2B - Urban Tree Canopy Assessment Story Map

With the use of online capabilities, DRG has assembled a story map application so that the client and other stakeholders can view the results of the UTC Assessment from anywhere with an internet connection. Citizens can even see the UTC project results and use the story map to get more information about the UTC in their neighborhood or the region.



Davey Resource Group offers a service that can detail projects using online capabilities combined with data to produce an amazing visual display for the project. Story maps are put together through a fusion of text, data, and images to detail project findings. Using this online mapping technology can provide Traverse City with a simplified educational tool, and one that many of our clients appreciate as a

valuable web service and useful public relations portal.

The story map provides an excellent resource for planning and knowledge sharing. Examples can be viewed at https://gis.davey.com/gtbay or https://gis.davey.com/storymap/columbiamo/

***Deliverables***: *PDF and Microsoft Word format of final report and any optional add-ons selected by the City (e.g. full management plan, web viewer).*

## Task 3. Inventory Remaining Trees

Having worked on thousands of tree inventory projects, we have found that using a combination of GIS and a customized data collection program provides the most accurate data and the most efficient means for inventorying that data. We use our in-house designed GIS software tool in conjunction with ruggedized computers with a GPS receiver to collect inventory data. Under favorable conditions, our equipment allows for sub 2-meter location accuracy of point data.

### Data Access

Our in-house GIS collection tool syncs seamlessly to DRG's TreeKeeper® software which allows us to provide TreeKeeper® to you during data collection. You can utilize TreeKeeper® to review and field check data, and even to route and plan for tree work as the data are being collected by simply logging into our cloud-based, secure tree management software system.

### Personal Protective Equipment (PPE)

Safety is the number one priority of DRG. To ensure the safety of our workers and those traveling nearby, DRG uses the following PPE: ball caps, high-visibility safety vests, safety glasses, and over-the-ankle boots.

### Data Collection Protocols

Fieldwork consists of locating up to 750 remaining trees in maintained street ROW, parks, and public properties; evaluating trees; and recording the specified information in our field computers. During data collection, DRG urban foresters walk by each tree and assess the tree from the ground. Based on the conditions at the time of the assessment, DRG staff identify the tree's species and its location, measure tree diameter, and rate its health. All additional information particular to the job is also collected at this time. When data collection for a tree is complete, our urban foresters walk to the next tree and follow the same steps, in the same order, to ensure consistent data collection. We collect data Monday through Friday and often on weekends with our clients' permission.

## Data Fields and Tree Risk Assessment

For the inventory, we will collect the following specified data fields that align with the City's previous inventory efforts: address (street address and X and Y coordinates), species, diameter, height estimate, requires attention, notes, and the date of inventory. These data fields provide basic information to manage an urban forest proactively. However, if you have specific needs that the data fields do not address, such as tree condition, risk level, or tree roots lifting sidewalks or clearance concerns, we can add custom data fields to any project. Please contact us to learn more.

## Quality Control

To ensure that we meet your project goals and objectives and that the inventory data you receive are consistent, clean, and in the format you want, we employ a Quality Assurance Process (QAP). Our QAP defines the way our inventory data collection team performs and completes work from project start to project completion.

Before we start fieldwork on any project, we make sure the entire team understands the specifics of the scope of work, staffing requirements, and project deadlines. Once the DRG team is briefed and prepared, we introduce the key members to our clients and discuss how we plan to accomplish the work. We make sure everyone is on the same page and that we do not overlook any details or project requirements. We also ensure that a process is in place that allows for proper communication between our staff and your staff.

In addition to ensuring the correct scope of work, we spend extra time during fieldwork performing quality control checks on the data. DRG urban foresters periodically check about 2% of the data collected and analyze the data for consistency and adherence to the project scope. In addition to field tests, we run computerized quality control checks to confirm accuracy and check for completeness, duplicate sites, and proper addressing. We also invite you to perform on-site verification of the data.

Below is an example of our current quality control statistics for tree inventories. Should our results fall below the target score, we will let you know and take immediate corrective action.

| **Inventory Statistics** | | | | |
|---|---|---|---|---|
| Site Count to Date | | Percent Complete | Estimated Total Site Count | |
| 10,783 | | 10.28% | 104,865 | |
| **Quality Assurance** | | | | |
| Overall Critical Error Score | Target Critical Score | Target Non-Critical Error Score | Target Non-Critical Score | Percent Audited |
| 98.86% | 98% | 97.87% | 95% | 2% |

To keep you apprised of the project's process, we send weekly project status updates showing a screen capture of the inventory's progress and findings of our quality control checks. The updates also present any concerns found during data collection and inform you where we plan to inventory next.

### Tree Inventory Data Delivery

Tree inventory data will be delivered in Excel™ spreadsheet format and as ESRI® shapefiles. Metadata will be provided and be compliant with the City's data standards.

### Optional Formats

If you need the inventory data in additional formats, such as Google Earth's KML, AutoCAD®, or i-Tree, or for a particular asset management software program like CityWorks, Hansen, or Cartegraph, we can provide data in those formats for an additional charge. Please contact us for more information about data formatting options and fees.

## Timeline, Task List, and Deliverable Summary

The following table illustrates the main tasks associated with the project along with the anticipated completion dates. The table also summarizes project deliverables.

| Task | June | July | Aug. | Sep. | Deliverablese Summary |
|---|---|---|---|---|---|
| Award and Contract | June 15 | | | | Insurance, contract |
| Kick-off Meeting | June 20 | | | | Meeting summary as needed |
| Data Mining | 2 weeks | | | | Obtain basemaps and orthophotographs, GIS data for inventory and UTC assessment |
| Task 1. Urban Tree Canopy Assessment | | | | | Data will be provided in ESRI shapefile format. |
| Task 2. UTC Report | | | Aug 20 | | Final report will be submitted to the City in PDF and Microsoft Word formats. The City will have one, one-week period for review and comment, before final edits are made. |
| Task 3. Inventory Remaining Trees | | | | | 750 site inventory; ongoing field checks, and weekly summary |
| Inventory Data Delivery | | | Aug 20 | | All project data and deliverables will be submitted in electronic format. GIS data, including tree inventory, are delivered in ESRI shapefile. Reports will be delivered in PDF and Microsoft Word formats. |

## *References*

DRG has provided several references that can attest to our project quality, our team's communication, and our company's collaborative processes. Please feel free to reach out to our references and discuss your project and our approach.

| | |
|---|---|
| **Melinda Jones, Executive Director**<br>ReLeaf Michigan | 734-718-2702<br>mjones@releafmichigan.org |
| **Kevin Sayers, Urban and Community Forestry Coordinator**<br>Michigan Department of Natural Resources | 517-284-5898<br>sayersk@michigan.gov |
| **Christine Crissman, Executive Director**<br>Watershed Center Grand Traverse Bay | 231.935.1514 x1<br>ccrissman@gtbay.org |
| **Erin Quetell, Environmental Sustainability Planner**<br>City of Ferndale, Michigan | 248-336-4361<br>equetell@ferndalemi.gov |
| **Brent Geurink, Associate Planner**<br>City of Ferndale, Michigan<br>brent.geurink@macombgov.org | 586-469-6285 |
| **Doug LaFave, Assistant City Manager**<br>City of East Grand Rapids, Michigan | 616-940-4817<br>dlafave@eastgr.org |

## Client Responsibilities

1. Make project award in a timely manner.
2. Provide DRG with imagery, maps, and data files. Our request may include the following: digital orthophotographs, available GIS data layers, other electronic or paper copies of maps for roads, pavement widths, right-of-way widths, boundaries and utilities, and an electronic file or printed list of street names and end points.
3. Provide daily contact information and directions during the inventory process.
4. Provide a copy of any existing tree inventory database(s).
5. Coordinate and host an informational kick-off meeting immediately before the start of fieldwork.

# City of Traverse City's Investment

## Task 1. Citywide, Comprehensive, Urban Tree Canopy Assessment

- ❑ UTC assessment, ecosystem benefit analysis, and prioritized planting plan provided in ESRI shapefile format, for a cost of: $10,500

## Task 2. UTC Report Options

Select one option from:

- ❑ Option One: UTC report, including assessment process, results, findings, and recommendations: $4,900

  OR

- ❑ Option Two: Standard Tree Management Plan with UTC report section (Option 2A): $7,250
  *Data assessment with findings and recommendations for maintenance with a 5-year projected budget, and a UTC report included as a section.*

Additional Optional add-ons:

- ❑ Urban tree canopy story map, for a price of: $4,000

## Task 3. Inventory Remaining Trees

- ❑ Computerized inventory data collection of up to 750 existing trees, for a cost of: $4,400
- ❑ Additional inventory data collection above 750 trees/sites at a unit rate of: $5.40/tree

**Davey Resource Group, Inc.**
1500 North Mantua
Kent, Ohio 44240

Signed: Joe Gregory

Name: Joe Gregory

Title: Regional Operations Manager

Date: 6.4.2018

This proposal is valid for 60 days.

# Acceptance of Proposal

## Client

Contact:
City of Traverse City
400 Boardman Ave
Traverse City, Michigan 49684

DRG, Inc Representative: Lee Mueller
T: 248-221-0439
E: Lee.Mueller@Davey.com
Proposal Date: June 6, 2018

**ACCEPTANCE OF PROPOSAL:** The above prices and terms and conditions and warranty are hereby accepted. I am authorized to bind the City of Traverse City and authorize Davey Resource Group, Inc. to perform the specified work. I am familiar with and agree to the terms and conditions appended to this proposal. I understand that once accepted, this proposal constitutes a binding contract. This proposal is based on an estimated number of trees/sites to be inventoried. Davey Resource Group, Inc. reserves the right to renegotiate the price based on the timing of the award, scheduling of fieldwork, final methodology chosen by the client, and availability, completeness, and quality of maps and GIS information.

Authorized Signature:_____

Name:_____

Date:_____

Total:_____

Please add up the costs of services and insert total on the line above

Davey Resource Group, Inc.

Authorized Signature:_____

Name:_____

Date:_____

DAVEY Resource Group

# Appendix A
# Tree Inventory Data Fields

1. **Address/Location**—Identifies the location of each tree and stump by the following attributes.
    a. *Address.* House address.
    b. *On Street.* The street on which the tree is physically located.
    c. *Side.* The side of the house on which the tree stands in relation to the physical address.
    d. X and Y coordinates in the desired format.
    e. *Park Name.* The name of the park is recorded.
2. **Species**—Trees are identified by genus and species using both botanical and common names, and by cultivars where appropriate.
3. **Diameter**—Diameter is measured to the nearest ½ inch size classes at 4½ feet above ground, or diameter at breast height (DBH), using a Biltmore Stick.
4. **Height Estimate**—Tree height is estimated to the nearest 10-foot increment. Estimates are periodically checked against measurements with a Biltmore Stick.
5. **Requires Attention**—Trees with significant concerns or defects are flagged for further investigation. Such trees may have diseased, dead, decaying, damaged or dying limbs greater than 3 inches in diameter, decay or cavities encompassing more than ⅓ of the cross-sectional tree diameter, hangers, or similar defects.
6. **Notes**—Where appropriate, notes may be included to help prioritize management activities.
7. **Date of Inventory**—The date data are collected is recorded.

# Appendix B
# Limited Warranty

The Davey Tree Expert Company, its divisions, agents, representatives, operations, and subsidiaries (collectively "Davey") provides this Limited Warranty as a condition of providing the services outlined in the agreement between the parties, including any bids, orders, contracts, or understandings between the parties (collectively the "Services").

Davey provides the Services utilizing applicable standard industry practices and based on the facts and conditions known at the point in time the Services are performed. Facts and conditions related to the subject of the Services may change over time. Davey cannot predict or determine developments concerning the subject of the Services and will not be liable for any developments, changes, or conditions that occur, including, but not limited to, decay or damage by the elements, persons or implements, insect infestation, deterioration, conditions not discoverable using the means and methods used to perform the Services, or acts of God or nature or otherwise. If a visual inspection is utilized, visual inspection does not include aerial or subterranean inspection, testing, or analysis. Davey will not be liable for the discovery or identification of non-visually observable, latent, dormant, or hidden conditions or hazards, and does not guarantee that items will be healthy or safe under all circumstances or for a specified period of time, or that remedial treatments will remedy a defect or condition.

Davey may have reviewed publicly available or other third-party records or conducted interviews, and has assumed the genuineness of such documents and statements. Davey disclaims any liability for errors, omissions, or inaccuracies resulting from or contained in any information obtained from any third-party or publicly available source.

To the extent permitted by law, Davey does not make and expressly disclaims any warranties or representations of any kind, express or implied, with respect to completeness, accuracy, or current nature of the information contained in the Services or the reports or findings resulting therefrom beyond that expressly contracted for by Davey in the agreements between the parties, including but not limited to, performing diagnosis or identifying hazards or conditions not within the scope of the Services or not readily discoverable using applicable standard industry practices. Davey disclaims any warranty of fitness for any particular purpose. Davey's warranty is limited to one year from the date Services are performed. Davey's liability for any claim, damage, or loss, whether direct, indirect, special, consequential, or otherwise, caused by or related to the Services shall be limited to the Services expressly contracted to be performed by Davey.

DAVEY®
Resource Group

**Bidder - Please complete and return**

## BID SUMMARY

**TITLE: Urban Tree Canopy Assessment & Inventory**

**DUE DATE: Friday, June 8, 2018 at 10:00 AM**

Having carefully examined the attached specifications and any other applicable information, the undersigned proposes to furnish all items necessary for and reasonably incidental to the proper completion of this bid. Bidder submits this bid and agrees to meet or exceed all requirements and specifications unless otherwise indicated in writing and attached hereto.

Bidder certifies that as of the date of this bid the Company or he/she is not in arrears to the City of Traverse City for debt or contract and is in no way a defaulter as provided in Section 152, Chapter XVI of the Charter of the City of Traverse City.

Bidder understands and agrees, if selected as the successful Bidder, to accept a Purchase Order / Service Order / Contract and to provide proof of the required insurance.

Bidder submits this bid and agrees to meet or exceed all the City of Traverse city's requirements and specifications unless otherwise indicated in writing and attached hereto. Bidder shall comply with all applicable federal, state, local and building codes, laws, rules and regulations and obtain any required permits for this work.

The Bidder certifies that it is in compliance with the City's Nondiscrimination Policy as set forth in Administrative Order No. 47 and Chapter 605 of the City's Codified Ordinances.

The Bidder certifies that none of the following circumstances have occurred with respect to the Bidder, an officer of the Bidder, or an owner of a 25% or more share in the Bidder's business, within 3 years prior to the bid:

(a) conviction of a criminal offense incident to the application for or performance of a contract;

(b) conviction of embezzlement, theft, forgery, bribery, falsification or destruction of records, receiving stolen property, or any other offense which currently, seriously and directly reflects on the Bidder's business integrity;

(c) conviction under state or federal antitrust statutes;

(d) attempting to influence a public employee to breach ethical conduct standards; or

(e) conviction of a criminal offense or other violation of other state, local, or federal law, as determined by a court of competent jurisdiction or an administrative proceeding, which in the opinion of the City indicates that the bidder is unable to perform responsibility or which

reflects a lack of integrity that could negatively impact or reflect upon the City of Traverse City, including but not limited to, any of the following offenses or violations of:

i. The Natural Resources and Environmental Protection Act.

ii. A persistent and knowing violation of the Michigan Consumer Protection Act.

iii. Willful or persistent violations of the Michigan Occupational Health and Safety Act.

iv. A violation of federal, local, or state civil rights, equal rights, or non-discrimination laws, rules, or regulations.

v. Repeated or flagrant violations of laws related to the payment of wages and fringe benefits.

(f) the loss of a license or the right to do business or practice a profession, the loss or suspension of which indicates dishonesty, a lack of integrity, or a failure or refusal to perform in accordance with the ethical standards of the business or profession in question.

Bidder understands that the City reserves the right to accept any or all bids in whole or part and to waive irregularities in any bid in the best interest of the City. The bid will be evaluated and awarded on the basis of the best value to the City. The criteria used by the City may include, but will not be limited to: ability, qualifications, timeframe, experience, price, type and amount of equipment, accessories, options, insurance, permits, licenses, other pertinent factors and overall capability to meet the needs of the City. The City is sales tax exempt – Government.

Bidder agrees that the bid may not be withdrawn for a period of sixty (60) days from the actual date of the opening of the bid.

Submitted by:

Joe Gregory
Signature

Joe Gregory, Regional Operations Manager
Name and Title (Print)

330 673-5685
Phone Fax

**EMAIL ADDRESS:**

joe.gregory@davey.com

Davey Resource Group
Company Name

1500 N. Mantua Street
Company Address

Kent OH 44240
City, State, Zip

Corporation
Sole proprietorship/partnership/corporation

OHIO
If corporation, state of corporation