Kendall County Forest Preserve District
Fox River Bluffs Planting Project
Initial Credit Project Design Document

Table of Contents

INSTRUCTIONS

Project Operators complete and submit this Initial Credit Project Design Document (PDD) after planting has been completed. City Forest Credits then reviews this PDD for validation with all other required project documents. An approved third-party verifier then conducts verification. A separate amendment to the Project Design Document will need to be submitted for future verification at years 4, 6, and after year 25.

Please complete sections starting on page 5 where you find "[Enter text here]" as thoroughly as possible.

PROTOCOL REQUIREMENTS

Below are a list of the eligibility requirements in the City Forest Credits (CFC) Tree Planting Protocol Version 9, dated February 7, 2021. Begin your responses on page 4 under Project Overview.

Project Operator (Section 1.1)

Identify a Project Operator for the project. This is the person or entity who takes responsibility for the project for the 25-year duration.

Commit to 25-year Project Duration in the Project Implementation Agreement (Section 1.2 and Section 5)

Sign the Project Implementation Agreement – this is the 25-year agreement between the Project Operator and CFC for an urban forest carbon project.

Location Eligibility (Section 1.3)

Project Areas must be located in parcels within or along the boundary of at least one of the following criteria.

A. The Urban Area boundary ("Urban Area"), defined by the most recent publication of the United States Census Bureau
B. The boundary of any incorporated city or town created under the law of its state;
C. The boundary of any unincorporated city, town, or unincorporated urban area created or designated under the law of its state;
D. The boundary of any regional metropolitan planning agency or council established by legislative action or public charter. Examples include the Metropolitan Area Planning Council in Boston and the Chicago Metropolitan Planning Agency;
E. The boundary of land owned, designated, and used by a municipal or quasi-municipal entity such as a utility for source water or watershed protection;
F. A transportation, power transmission, or utility right of way, provided the right of way begins, ends, or passes through some portion of A through E above.

Ownership Eligibility (Section 2)

Project Operator must demonstrate ownership of property and eligibility to receive potential credits by meeting at least one of the following:

A. Own the land, the trees, and potential credits upon which the Project trees are located; or
B. Own an easement or equivalent property interest for a public right of way within which Project trees are located, own the Project trees and credits within that easement, and accept ownership of those Project trees by assuming responsibility for maintenance and liability for them; or

C. Have a written and signed agreement from the landowner granting ownership to the Project Operator of any credits for carbon storage or other benefits delivered by Project trees on that landowner's land. If Project trees are on private property, this agreement must be recorded in the property records of the county in which the land containing Project trees is located.

Additionality (Section 4 and Appendix D)
Legally Required Trees NOT Eligible - project trees cannot be required by law or ordinance to be planted.

Performance Standard Baseline - Project trees must be additional based on the performance standard baseline attached.

Multiple planting sites may be aggregated into one project (Section 8)
Planting sites can be on public and private land, in different cities, and aggregated into one project, provided that planting on all properties occurs within a 36-month period and that all properties comply with protocol requirements.

Carbon Quantification (Section 12 and Appendix B)
CFC has developed spreadsheets and methods for quantifying carbon stored and credited. The project design including tree spacing and goals will determine the quantification and monitoring requirements. Project Operators will quantify CO_2 using the method appropriate for the project type. CFC supplies all quantification tools. The three main project designs are:

- Single Tree - trees are scattered and spaced apart more than 10 feet, as in streets, yards, some parks, and schools, individual trees are tracked and randomly sampled
- Clustered Parks - trees are relatively contiguous in park-like settings and change in canopy is tracked
- Canopy – trees are planted very close together, often but not required to be in riparian areas, significant mortality is expected, and change in canopy is tracked. The two main goals are to create a forest ecosystem and generate canopy
- Area Reforestation – this quantification methodology is new and is described in Attachment 9. Area reforestation projects plant trees less than 10 feet apart over larger areas. Projects can quantify using the GTR tables or sample data as approved by CFC.

Verification by third-party verifiers (Section 13)
All projects must be verified before receiving credits.

Imaging Requirements (based on planting method)
In order to receive credits, additional information is required at Years 4, 6, and 26. Below are the imaging requirements by planting method:

1) Single Tree (spaced 10' or more apart, i.e. street trees or linear plantings)
    a. Initial Credit: The carbon quantification tool for your project contains a worksheet called "Data Collection" for use in tracking each tree. In that file, document the GPS coordinates for each tree planted.
    b. Years 4, 6, and 26: Geocoded photos or imaging of a minimum sample of 20% of the trees is required at Years 4, 6, and 26. The tracking file includes a column where each tree is assigned a unique serial number to help with tracking each coordinate and tree picture or image.

2) Clustered Parks (spaced 10' apart but continuously so to generate canopy over time, i.e. natural areas)
    a. Initial Credit: Projects must document the planting through photos or imaging. Select points and take geo-coded photos that when taken together capture the newly planted trees in the project area. If site is rectilinear, take a photo at each of the corners. If the site is large, take photos at points along the perimeter looking into the project area. If necessary to capture the trees, take photos facing each of the cardinal directions while standing in the middle of the project area. If site is nonrectilinear, identify critical points along property boundaries and take photographs at each point facing in towards the middle of the site. Next, take photographs from the middle of the project area facing out at each cardinal direction.
    b. At Years 4, 6, and 26: Project provides images of the Project Area from any telemetry, imaging, remote sensing, i-Tree Canopy, or UAV service, such as Google Earth and estimate the area in tree canopy cover (acres). Imaging from Google Earth with leaf-on may be used. Project operators will calculate the percent of canopy cover from the Google Earth imaging. Projects can use i-Tree Canopy and point sampling to calculate canopy cover. Using i-Tree Canopy, continue adding points until the standard error of the estimate for both the tree and non-tree cover is less than 5%. i-Tree Canopy will supply you with the standard errors. If tree canopy cover is determined using another approach, such as image classification, a short description of the approach should be provided, as well as the QA/QC measures that were used. A tree cover classification accuracy assessment should be conducted, as with randomly placed points, and the percentage tree cover classification accuracy reported.
3) Canopy (closely planted with spacing less than 10' apart so to generate canopy and forest ecosystem, high tree mortality expected, i.e. riparian areas)
    a. Initial Credit: Projects must document the planting through photos or imaging. Select points and take geo-coded photos that when taken together capture the newly planted trees in the project area. If site is rectilinear, take a photo at each of the corners. If the site is large, take photos at points along the perimeter looking into the project area. If necessary to capture the trees, take photos facing each of the cardinal directions while standing in the middle of the project area. If site is nonrectilinear, identify critical points along property boundaries and take photographs at each point facing in towards the middle of the site. Next, take photographs from the middle of the project area facing out at each cardinal direction.
    b. At Years 4, 6, and 26: Project provides images of the Project Area from any telemetry, imaging, remote sensing, i-Tree Canopy, or UAV service, such as Google Earth and estimate the area in tree canopy cover (acres). Imaging from Google Earth with leaf-on may be used. Project operators will calculate the percent of canopy cover from the Google Earth imaging. Projects can use i-Tree Canopy and point sampling to calculate canopy cover. Using i-Tree Canopy, continue adding points until the standard error of the estimate for both the tree and non-tree cover is less than 5%. i-Tree Canopy will supply you with the standard errors. If tree canopy cover is determined using another approach, such as image classification, a short description of the approach should be provided, as well as the QA/QC measures that were used. A tree cover classification

accuracy assessment should be conducted, as with randomly placed points, and the percentage tree cover classification accuracy reported.

4) Area Reforestation – this quantification methodology is new and is described in Attachment 9. Area reforestation projects plant trees less than 10 feet apart over larger areas. Projects can quantify using the GTR tables or sample data as approved by CFC.
   a. Projects must document the planting through photos or imaging. Select points and take geo-coded photos that when taken together capture the newly planted trees in the project area. If site is rectilinear, take a photo at each of the corners. If the site is large, take photos at points along the perimeter looking into the project area. If necessary to capture the trees, take photos facing each of the cardinal directions while standing in the middle of the project area. If site is nonrectilinear, identify critical points along property boundaries and take photographs at each point facing in towards the middle of the site. Next, take photographs from the middle of the project area facing out at each cardinal direction.

PROJECT OVERVIEW

Basic Project Details

Project Name: Fox River Bluffs Planting Project
Project Number: 019
Project Type: Planting Project
Project Start Date: April 8, 2020
Project Location: Yorkville, IL

Project Operator Name:
Kendall County Forest Preserve District

Project Operator Contact Information:

David Guritz, Executive Director
dguritz@co.kendall.il.us
630-538-6303
110 W. Madison Street
Yorkville, IL 60560

Stefanie Wiencke, Env. Education and Special Projects Manager
swiencke@co.kendall.il.us
630-229-4828
110 W. Madison Street
Yorkville, IL 60560

Project Description:
Kendall County Forest Preserve District (District) planted trees as part of this carbon project on 40-acres of the Fox River Bluffs Forest Preserve (Preserve) in Yorkville, IL. The District acquired the 168-acre Preserve in 2015 with an overall goal to restore 99 acres of the former farmland to prairie and a reforested natural area.

After five years of analysis and preparation, the District and community volunteers planted native trees and shrubs in April 2020. For this carbon project, 23,917 were planted including six Oak species, Shagbark hickory, and Black walnut.

The restoration plan for the remainder of the Preserve is divided into several phases and activities. In addition to this carbon planting project, the District seeded 60+ acres of the Preserve with a diverse prairie mix and woodland edge mix to support pollinators. This pollinator seed mix will support recovery of a local population of the federally endangered Rusty-Patched Bumble Bee (*Bombus affinis*) to establish high-quality forage and habitat for this and other local wildlife species. The District also planted an additional 2,749 understory shrubs and trees within the carbon project area.

The remaining 66-acres of the Preserve, which includes Fox River island, contains high-quality natural resources including oak-dominated bluffs and ravines, seeps, and Fox River shoreline. The District cleared invasive species along the woodland edges, and broadcast additional woodland edge seed mix to further improve habitat quality and plant community diversity. A floristic quality study with long-term management recommendations was also completed in 2020.

LOCATION AND OWNERSHIP OF PROJECT AREA (Section 1.3 and Section 2)

Project Area Location
Describe where the Project Area is located and how it meets the location criteria.

This project is located at Fox River Bluffs Forest Preserve, Fox Township, Kendall County, Illinois. Fox River Bluffs is located along the south bank of the Fox River north of Eldamain Road, west of the United City of Yorkville. Preserve boundaries includes the 6-acre "Van Cleves" island in the Fox River.

The project area is located within parcels that are located along the boundary of the United City of Yorkville.

Kendall County, Illinois Property Index Numbers:
01-36-400-010
04-01-200-006

Maps
Provide a detailed map of the Project Area. Also provide a regional-scale map that shows the Project Area within the context of relevant urban/town boundaries. Include numbered title/filename of attachments (Ex: 1 - Regional Scale Map)

Attachment 1 – Regional Map
Attachment 2 – Project Area Map

https://maps.co.kendall.il.us/parcelviewer/
41°38'02.7"N 88°29'38.8"W
41.634089, -88.494109

Attachment 3 - Fox River Bluffs Preserve Soil Types and Tree/Shrub Planting Areas

Project Area Ownership and Right to Receive Credits
Describe the property ownership and include relevant documentation including numbered title/filename as an attachment (Ex: 2 - Attestation of Land Ownership, or 2 - Agreement from Owner to Transfer Credits).

Fox River Bluffs Forest Preserve is owned and operated by the Kendall County Forest Preserve District. The District is a county municipal government agency established in 1965 under the Illinois Downstate Forest Preserve District Act (https://www.ilga.gov/legislation/ilcs/ilcs3.asp?ActID=875&ChapterID=15).

The mission of the Kendall County Forest Preserve District is to acquire, preserve, and manage natural areas and open spaces, provide environmental education, and offer recreational opportunities for Kendall County residents.

The property is protected by the District, and an overarching easement under the Illinois Department of Natural Resources.

Attachment 4 – Attestation of Land Ownership

Additional Notes
None.

PROJECT DURATION (Section 1.2 and 5)

Project Operator commits to the 25-year project duration requirement through a signed Project Implementation Agreement with City Forest Credits.

ATTESTATIONS

Complete and attach the following attestations: Attestation of No Double Counting of Credits, Attestation of No Net Harm, Attestation of Planting, and Attestation of Planting Affirmation. Provide any additional notes as relevant.

Kendall County Forest Preserve District attests to the following, see attached:

Attachment 5 – Attestation of No Double Counting of Credits
Attachment 6 – Attestation of No Net Harm
Attachment 7 – Attestation of Planting
Attachment 8 – Attestation of Planting Affirmation

ADDITIONALITY (Section 4 and Appendix D)

Legally Required Trees NOT Eligible:
Project trees are not required by law or ordinance to be planted. See Attestation of Planting.

Performance Standard Baseline:
Project trees are additional based on the performance standard baseline attached to this PDD.

PLANTING DESIGN

Describe detailed planting design, including spacing between trees. Will the trees be planted as scattered individual trees, clustered in groups like in natural areas, or tightly clustered to restore a forest ecosystem?

Describe your data collection on Project Trees and show it in the quantification section below. For example, Project Operator can use the data collection sheet contained in the CFC quantification tool or your own approved method.

Background
The District acquired the 168-acre Preserve with an overall goal to restore 99 acres of the former farmland to prairie and a reforested natural area.

Beginning in 2017, the agricultural footprint was planted in soybeans for three consecutive years to reduce weed competition and increase soil nitrogen levels in preparation for completing cropland conversion. In summer 2019, pesticide use was curtailed to clear soils of herbicide residuals prior to seeding and planting in winter-spring 2020. The District began converting the former cropland in January 2020. The entire 99-acre footprint was seeded with a cover crop mix of winter wheat and Virginia wild rye after first snowfall. Approximately 58-acres of this area was also seeded with a high-diversity native prairie pollinator seed mix. Acres seeded with the prairie pollinator seed mix will support recovery of an identified population of Rusty Patched Bumble Bee (*Bombus affinis*).

The District will expand and improve habitat quality, plant community ecotypes and ecotype diversity. The overall plan will feature oak- and hickory- dominated woodland bluff and riparian habitats, including the conversion of the preserve's agricultural areas to a diverse tree canopy, shrub understory, and herbaceous plant community transitioning over time from open prairie and savannah to woodland habitat. In 2020, the District completed a floristic quality survey of the Fox River Bluffs Forest Preserve's remnant oak woodland areas, which will serve to guide restoration management plan objectives within the conversion footprint over time.

<u>Carbon Project Planting Design</u>
For this carbon planting project, 23,917 trees and shrubs were planted using the CFC area reforestation method (Attachment 9) in April 2020 at the Preserve over 40 acres. Trees were planted 8' on center to create a forest ecosystem and generate canopy cover over time.

Seedling stock purchased from the Illinois Department of Natural Resources (see Table 1 below) was sorted and planted by formula in rows approximately 8'-10' on center. Seedling roots were kept moist in water buckets during transport out to the field prior to planting. Pre-planting water buckets and sapling roots were inoculated with mycorrhizae fungus (Mykos WP) and perlite-nutrient mix prior to planting.

Table 1: Tree and shrub stock

Species	# per Acre	Total over 40-Acres
Bur Oak	135	5,417
Red Oak	135	5,417
Shagbark Hickory	104	4,167
Black Oak	63	2,500
White Oak	42	1,667
Swamp White Oak	42	1,667
Pin Oak	31	1,250
Black Walnut	25	1,000
American Plum	21	832
TOTALS	**598**	**23,917**

Trees were planted in rows with a tree planter loaned to KCFPD from the Illinois Department of Natural Resources. State Forester Tom Gargrave provided technical assistance and support. District staff and volunteers planted the trees and shrubs following broadcast seeding of cover crop and diverse prairie mix over several dates in April 2020. Rifts in the soil created by the tree planter were sealed by District staff and volunteers. Use of ATV vehicles was employed to further close soil gaps around the planted stock. District staff walked the site to ensure quality control, replanting by hand improperly planted individual seedlings to reduce root exposure and maximize initial survivorship.

Fox River Bluffs Planting Photos – April 2020.

In winter 2021, all established woodland edge timberlines adjacent to the converted cropland areas were cleared of invasive honeysuckle brush, with a woodland edge seed mix broadcast into snow cover.

Periodic qualitative monitoring observations have been performed over the initial 2-years post conversion. Initial mortality appears low, with all trees and shrub species planted exhibiting expected and healthy foliar proliferation and growth.

CARBON QUANTIFICATION DOCUMENTATION (Section 12 and Appendix B)

Describe which quantification approach you anticipate using, list the project's climate zone, and outline the estimated total number of credits to be issued to the project as well as the amount to be issued upon successful verification. When requesting credits after planting, attach one of the three quantification tool documents below and provide the data you have collected for Project Trees.

- *Single Tree - trees are scattered and spaced apart more than 10 feet, as in streets, yards, some parks, and schools, individual trees are tracked and randomly sampled*
- *Clustered Parks - trees are relatively contiguous in park-like settings and change in canopy is tracked*
- *Canopy - trees are planted very close together, often but not required to be in riparian areas, significant mortality is expected, and change in canopy is tracked. The two main goals are to create a forest ecosystem and generate canopy*
- *Area Reforestation - this quantification methodology is new and is described in Attachment 9. Area reforestation projects plant trees less than 10 feet apart over larger areas. Projects can quantify using the GTR tables or sample data as approved by CFC. CFC has approved of the sample data collected and used by the District for this project. This section describes the trees planted, the sample data, and the calculations of credits.*

Total number of trees planted	23,917
Project area (acres), if applicable	40
Total number of trees per acre, if applicable	598
Credits attributed to the project (tCO2e)	5,328
Credits after mortality deduction (default is 20%) – Canopy project	N/A
Contribution to Registry Reversal Pool (5%) (tCO2e)	266.4
Total credits to be issued to the Project Operator (tCO2e)	5,061.6
Total credits requested to be issued in Year 1 (10% of above)	506.16

<u>Carbon Quantification Process, Data, and Calculations</u>

In compliance with the Area Reforestation method approved by CFC, the District obtained approval from CFC to sample a 25-year planting of the same oak forest as the project trees. This sampling of 25-year trees of the same species in the same metropolitan region would constitute the most accurate projection of CO_2 storage for the project trees.

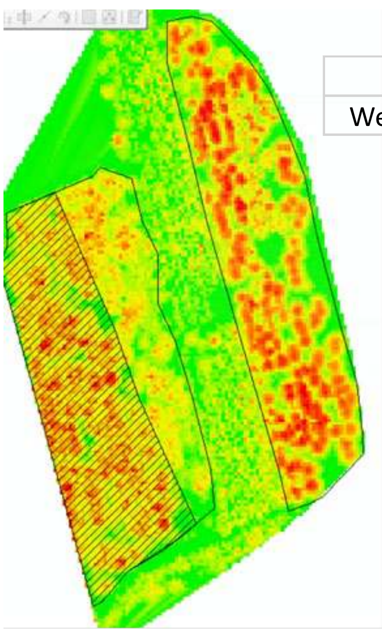
In fall 2020, KCFPD conducted sampling and measurement of DBH at Hoover Forest Preserve, Kendall Township, of a 25-year old grove of row-planted oak trees planted approximately 8' – 10' on center to extrapolate growth projections and CO_2 storage for the first 25-years for the trees planted at Fox River Bluffs Forest Preserve.

The planted grove of trees sampled and measured at Hoover Forest Preserve were planted in 1995 by the Boy Scouts of America under supervision of Tom Gargrave, Illinois Department of Natural Resources State Forester. Student EcoClub volunteers sponsored by Scott Johnson, Environmental Science Teacher from Oswego East High School SD 308, Oswego, Illinois collected DBH measures for the trees planted at Hoover Forest Preserve. The EcoClub students were trained and supervised by David Guritz, Executive Director of the Kendall County Forest Preserve District, and Stefanie Wiencke, Natural Beginnings Early

Learning Program and Special Projects Manager. Students were instructed to capture DBH (diameter at breast-height) measures for each of the trees in each of the planted rows, identify the tree species as Oak sp., Pine, or other, and measure distances between planted trees, denoting suspected tree mortality as evidenced by gaps within the planted tree rows, and documented missing individual trees on the data sheets provided. Students completed the field work using the data collection form templates, with the final Excel data compilation spreadsheet completed under the supervision of Scott Johnson, Environmental Science Teacher and EcoClub Sponsor at Oswego East High School.

Field data was entered into the Excel workbook for analysis. The field data records and final spreadsheet was examined for accuracy, with the original data records maintained by the Kendall County Forest Preserve District. The final Excel workbook/spreadsheet is included as Attachment 10. We refer to this as the Quantification Workbook because it contains the data and calculations for quantification of CO_2. Based on site conditions, it was determined that the first 20-rows (west to east) of oak trees planted at Hoover Forest Preserve would serve as the comparable grove size in order to extrapolate growth projections at Fox River Bluffs Forest Preserve.

Lindsay Darling, GIS Administrator for The Morton Arboretum's Chicago Region Trees Initiative provided a GIS calculated average height of 26.59 feet for the tree canopy for rows 1-20 (shaded) on January 15, 2021.



Area	MaxHeight_ft	AverageHeight_ft	PatchArea_sqft
WestWest	60.552368	26.590263	93479.31347

Based on the GIS height study, the height for trees in the westernmost polygon (shaded - all planted Oak sp.) averages 26.59 ft., with a height maximum of 60.55 ft. Within the west polygon, field observations confirm the GIS analysis- that oak tree heights within the study area generally decreases within the rows as the observer travels from west to east.

For the purposes of comparison to the Fox River Bluffs tree planting project, and based on the collected data for the first 20-rows (hatched area in left figure) of oaks located within the west polygon, the average DBH is 8.6".

Average spacing between planted trees within the first 20-rows was 15' 8", with an estimated original planted-stock tree estimate (which includes presumed mortality) of 843, with 594 standing trees remaining after 25-years (mortality =30%).

In short, the resulting figures presented above are consistent with our field observations. Limiting comparative data to only include the first 20-rows within the west polygon factors out the stunted Oak sp. growth from the planted pine rows' shade impacts within the eastern section of the polygon.

Final data collected for the first 20-rows of the 25-year grove at Hoover Forest Preserve was sent to CFC scientists to review the sampling and complete sequestered carbon calculations for the 93,478.3 sq. ft. (+/- 3.27 acres) planted area (Planted Rows 1-20) at Hoover Forest Preserve. The sample data described above was based on student collected data and GIS-average height data provided by Lindsay Darling, PhD student - Purdue University and GIS Administrator - Chicago Region Trees Initiative and Center for Tree Science Fellow at The Morton Arboretum.

Based on the CFC scientist's calculations, which are shown in Calcs tab of the Quantification Workbook, the planted oak trees at Hoover Forest Preserve yield 109.9 tCO_2e total biomass sequestration through age 25 above ground and below.

The Quantification Workbook contain the following tabs:

Hoover MetaData
Hoover Area
Hoover Trees
Calcs

Here is a guide to the Hoover Trees Tab of the Quantification Workbook:

The DBH measures for each tree were used to calculate above ground biomass figures in Column H (H2 to H583 for planted rows 1-20) according to the following table formula:

=IF(C24="P",EXP(-2.5356+(2.4349*LN(E24*2.54))),EXP(-2.48+(2.4835*LN(E24*2.54))))

In the equation, the reference to column C checks the species of the tree for which biomass is being estimated. If the species code is "P", which represents pine, then the following equation is applied:

EXP(-2.5356 + (2.4349 * LN(E2*2.54) is applied.

For non-pine trees, the equation for mixed hardwoods is applied:

EXP (-2.48+(2.4835 * LN(E2*2.54)

The equation required tree diameter in centimeters. Tree diameters are in column E of the spreadsheet, and are in inches. Multiplying the diameter by 2.54 converts the diameter to centimeters. The equations estimate total aboveground tree biomass, dry weight, in kg.

Equations for estimating tree biomass from tree size are from Jenkins, Jennifer C.; Chojnacky, David C.; Heath, Linda S.; Birdsey, Richard A. 2004. Comprehensive database of diameter-based biomass regressions for North American tree species. Gen. Tech. Rep. NE-319. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. 45 p.

Column K (K69 to K88) shows Kgs of Biomass Above-ground (ABG) for each row measured.

Column L (L69 to L88) shows conversion of Biomass to Carbon

Cell O108 shows total Carbon ABG of 21.2t/acre

Cell R108 adds belowground carbon (BG) and shows Total Carbon (ABG+BG) converted to CO_2 e of 93.1tCO_2/acre

The District, with approval from CFC, applied a 0.20 factor to ABG carbon to obtain below-ground live carbon (non-soil):

Cell O111 shows other non-soil carbon sequestration (dead wood, shrubs and litter) of 4.6t/acre (20% of 21.2t/acre ABG carbon)

Cell R112 shows the conversion of that other nonsoil carbon to CO_2 of 16.9t.acre

The sum of the ABG CO_2 and the below-ground CO_2 is shown in Cell R112 at 109.9tCO_2/acre

These calculations are summarized in the Calcs Tab of the Quantification Workbook.

Per the Area Reforestation methodology, soil carbon can be credited if the site has been in active tillage for at least three of the ten years prior to planting. The Area Reforestation methodology gives a standard soil carbon index of 23.3 metric tons CO_2(e). In order to calculate total CO_2e sequestration for the project, the standard soil carbon index of 23.3 per acre is added to the total above ground and below ground measures, for a total per acre of 133.2.

From this figure, a deduction of 5% of the total project credits is taken for the reversal pool, so credit issuance to the project for the Fox River Bluffs Planting Project is 126.54 tCO_2e per acre through age 25.

With 40 acres planted for crediting, the total GHG emissions removals projected for this project is 5,328. After the deduction for the reversal pool maintained by CFC, the credits issuable to the District are 5,062.

CFC also requires, and the District understands its commitment to sample the project trees for mortality at Year 4 and to sample and measure DBH of the project trees at Year 6 to determine whether growth of the project trees is consistent with the CO_2 storage of the 25-year Hoover trees used as the basis for projecting CO_2 of the project trees. The District also intends to sample and measure DBH to calculate CO_2 storage at Year 12 of this project.

Attachment 9 – Area Reforestation Project Type and Quantification
Attachment 10 – Carbon Quantification Workbook
Attachment 11 – Aerial Images

CARBON CO-BENEFITS QUANTIFICATION DOCUMENTATION (Section 12 and Appendix B)

Summarize co-benefit results based on the project's planting method and provide supporting documentation. CFC can provide co-benefits quantification for Project Operator for rainfall interception, air quality improvements, and energy savings.

- *Single Tree - trees are scattered and spaced apart more than 10 feet, as in streets, yards, some parks, and schools, individual trees are tracked and randomly sampled*
- *Clustered Parks - trees are relatively contiguous in park-like settings and change in canopy is tracked*
- *Canopy - trees are planted very close together, often but not required to be in riparian areas, significant mortality is expected, and change in canopy is tracked. The two main goals are to create a forest ecosystem and generate canopy*
- *Area Reforestation - this quantification methodology is new and is described in Attachment 9. Area reforestation projects plant trees less than 10 feet apart over larger areas.*

Ecosystem Services	***Resource Units***	***Value***
Rainfall Interception (m3/yr)	10,820.4	$77,472.17
Air Quality (t/yr)	0.4529	$681.87
CO2 Avoided from Energy	64.8	$1,296.13
Cooling – Electricity (kWh/yr)	85,177	$6,464.96
Heating – Natural Gas (kBtu/yr)	1,592,668	$15,504.27
Grand Total ($/yr)		**$101,419.41**

Co-Benefits per year with current tree canopy cover.

Ecosystem Services	**Resource Units Totals**	**Res Unit/Acre Tree Canopy**	**Total $**	**$/Acre Tree Canopy**
Rain Interception (m3/yr)	10,820.4	270.5	$77,472.17	$ 1,936.80
CO2 Avoided (t, $20/t/yr)	64.8	1.6	$1,296.13	$ 32.40
Air Quality (t/yr)				
O3	0.2065	0.0052	$312.81	$ 7.82
NOx	0.0345	0.0009	$52.20	$ 1.31
PM10	0.1056	0.0026	$136.10	$ 3.40
Net VOCs	0.1063	0.0027	$180.76	$ 4.52
Air Quality Total	0.4529	0.0113	$681.87	$17.05
Energy (kWh/yr & kBtu/yr)				
Cooling - Elec.	85,177	2,129	$6,464.96	$ 161.62
Heating - Nat. Gas	1,592,668	39,817	$15,504.27	$ 387.61
Energy Total ($/yr)			$21,969.23	$549.23
Grand Total ($/yr)			$101,419.41	$2,535.49

Attachment 12 – Co-Benefits Quantification Tool

MONITORING AND REPORTING PLANS (Appendix A)

Project Operator is required to submit an annual monitoring report by the anniversary of the first approved verification report. For example, if the verification report is dated January 1, 2021, the first monitoring report will be due by January 1, 2022 and each January 1st thereafter for the duration of the project.

Anticipated Reporting Schedule

Monitoring Report – Year 2	2022	Monitoring Report – Year 15	2035
Monitoring Report – Year 3	2023	Monitoring Report – Year 16	2036
Monitoring Report – Year 4*	2024	Monitoring Report – Year 17	2037
Monitoring Report – Year 5	2025	Monitoring Report – Year 18	2038
Monitoring Report – Year 6*	2026	Monitoring Report – Year 19	2039
Monitoring Report – Year 7	2027	Monitoring Report – Year 20	2040
Monitoring Report – Year 8	2028	Monitoring Report – Year 21	2041
Monitoring Report – Year 9	2029	Monitoring Report – Year 22	2042
Monitoring Report – Year 10	2030	Monitoring Report – Year 23	2043
Monitoring Report – Year 11	2031	Monitoring Report – Year 24	2044
Monitoring Report – Year 12*	2032	Monitoring Report – Year 25	2045
Monitoring Report – Year 13	2033	Monitoring Report – Year 26*	2046
Monitoring Report – Year 14	2034		

* Denotes a year where additional information is required in order to receive credits

Monitoring Reports

The report must contain any changes in eligibility status of the Project Operator and any significant tree loss. Monitoring report questions are listed below. The following are questions contained in CFC's annual monitoring report template:

1. Has the contact information for the Project Operator changed? If so, provide new information.
2. Have there been changes in land ownership of the Project Area?
3. Have there been any changes in the Project Design?
4. Have there been any changes in the implementation of management of the Project?
5. Have there been any significant changes to the site (such as flooding or human changes)?
6. Have there been any significant tree or canopy losses?
7. Any other significant elements to report?

Drone imagery will be used to capture canopy coverages minimally in years 4, 6, 12, and 26. The District anticipates that individual trees will appear on drone aerial imagery for counting purposes by year 10.

1. The District also will conduct in-field quantification studies at year 4, 6, 12, and 26. 50-random GIS coordinates will be selected and documented for continuing plot studies from within the planted area.
2. The District will complete stem counts and diameter measures for planted trees located within 50' of each random point within the planted area.
3. Final plot reports will be compiled and submitted to CFC.

ADDITIONAL INFORMATION

Include additional noteworthy aspects of the project. Examples include collaborative partnerships, community engagement, or project funders.

The Kendall County Forest Preserve District worked with several partner agencies to complete a 25-year planted oak-grove comparative growth analysis with Oswego East High School District 309, Oswego, Illinois, The Morton Arboretum, Lisle, Illinois, Purdue University, Lafayette, Indiana.

Key personnel include:

1. David Guritz, Executive Director - KCFPD
2. Stefanie Wiencke, Environmental Education and Special Projects Manager - KCFPD
3. Tom Gargrave, Illinois Department of Natural Resources State Forester
4. Scott Johnson, Environmental Science Teacher at Oswego East High School SD 308
5. Lydia Scott, Director - Chicago Region Trees Initiative at The Morton Arboretum
6. Lindsay Darling, PhD student - Purdue University and GIS Administrator - Chicago Region Trees Initiative and Center for Tree Science Fellow at The Morton Arboretum

Other project partners: The Conservation Foundation, Naperville, Illinois; Illinois Clean Energy Community Foundation, Chicago, Illinois, Illinois Department of Natural Resources, OpenLands-ComEd Green Region Program; Kendall County, US Fish and Wildlife Service

PROJECT OPERATOR SIGNATURE

Signed on December 7 in 2021, by David Guritz, Executive Director for the Fox River Bluffs Planting Project.

Signature

David Guritz, Executive Director
Printed Name

630-553-4131

dguritz@co.kendall.il.us

ATTACHMENTS

1 - Regional Map
2 - Project Area Map
3 - Fox River Bluffs Preserve Soil Types and Tree/Shrub Planting Areas
4 - Attestation of Land Ownership
5 - Attestation of No Double Counting of Credits
6 - Attestation of No Net Harm
7 - Attestation of Planting
8 - Attestation of Planting Affirmation
9 - Area Reforestation Project Type and Quantification
10 - Carbon Quantification Workbook
11 - Aerial Images
12 - Co-Benefit Quantification Tool

PERFORMANCE STANDARD BASELINE METHODOLOGY (Section 4 and Appendix D)

There is a second additionality methodology set out in the WRI GHG Protocol guidelines – the Performance Standard methodology. This Performance Standard essentially allows the project developer, or in our case, the developers of the protocol, to create a performance standard baseline using the data from similar activities over geographic and temporal ranges.

The common perception, particularly in the United States, is that projects must meet a project specific test. Project-specific additionality is easy to grasp conceptually. The 2014 Climate Action Reserve urban forest protocol essentially uses project-specific requirements and methods.

However, the WRI GHG Protocol clearly states that either a project-specific test or a performance standard baseline is acceptable.[1] One key reason for this is that regional or national data can give a more accurate picture of existing activity than a narrow focus on one project or organization.

Narrowing the lens of additionality to one project or one tree-planting entity can give excellent data on that project or entity, which data can also be compared to other projects or entities (common practice). But plucking one project or entity out of its regional or national context ignores all comparable regional or national data. And that regional or national data may give a more accurate standard than data from one project or entity.

By analogy: one pixel on a screen may be dark. If all you look at is the dark pixel, you see darkness. But the rest of screen may consist of white pixels and be white. Similarly, one active tree-planting organization does not mean its trees are additional on a regional basis. If the region is losing trees, the baseline of activity may be negative regardless of what one active project or entity is doing.
Here is the methodology described in the WRI GHG Protocol to determine a Performance Standard baseline, together with the application of each factor to urban forestry:

Table 2.1 Performance Standard Factors

WRI Performance Standard Factor	**As Applied to Urban Forestry**
Describe the project activity	Increase in urban trees
Identify the types of candidates	Cities and towns, quasi-governmental entities like utilities, watersheds, and educational institutions, and private property owners
Set the geographic scope (a national scope is explicitly approved as the starting point)	Could use national data for urban forestry, or regional data
Set the temporal scope (start with 5-7 years and justify longer or shorter)	Use 4-7 years for urban forestry
Identify a list of multiple baseline candidates	Many urban areas, which could be blended mathematically to produce a performance standard baseline

[1] WRI GHG Protocol, Chapter 2.14 at 16 and Chapter 3.2 at 19.

The Performance Standard methodology approves of the use of data from many different baseline candidates. In the case of urban forestry, those baseline candidates are other urban areas.[2]

As stated above, the project activity defined is obtaining an increase in urban trees. The best data to show the increase in urban trees via urban forest project activities is national or regional data on tree canopy in urban areas. National or regional data will give a more comprehensive picture of the relevant activity (increase in urban trees) than data from one city, in the same way that a satellite photo of a city shows a more accurate picture of tree canopy in a city than an aerial photo of one neighborhood. Tree canopy data measures the tree cover in urban areas, so it includes multiple baseline candidates such as city governments and private property owners. Tree canopy data, over time, would show the increase or decrease in tree cover.

Data on Tree Canopy Change over Time in Urban Areas

The CFC quantitative team determined that there were data on urban tree canopy cover with a temporal range of four to six years available from four geographic regions. The data are set forth below:

[2] See Nowak, et al. *"Tree and Impervious Cover Change in U.S. Cities,"* Urban Forestry and Urban Greening, 11 (2012), 21-30

Table 2.2 Changes in Urban Tree Canopy (UTC) by Region (from Nowak and Greenfield, 2012, see footnote 7)

City	Abs Change UTC (%)	Relative Change UTC (%)	Ann. Rate (ha UTC/yr)	Ann. Rate (m2 UTC/cap/yr)	Data Years
EAST					
Baltimore, MD	-1.9	-6.3	-100	-1.5	(2001–2005)
Boston, MA	-0.9	-3.2	-20	-0.3	(2003–2008)
New York, NY	-1.2	-5.5	-180	-0.2	(2004–2009)
Pittsburgh, PA	-0.3	-0.8	-10	-0.3	(2004–2008)
Syracuse, NY	1.0	4.0	10	0.7	(2003–2009)
Mean changes	-0.7	-2.4	-60.0	-0.3	
Std Error	0.5	1.9	35.4	0.3	
SOUTH					
Atlanta, GA	-1.8	-3.4	-150	-3.1	(2005–2009)
Houston, TX	-3.0	-9.8	–890	-4.3	(2004–2009)
Miami, FL	-1.7	-7.1	-30	-0.8	(2003–2009)
Nashville, TN	-1.2	-2.4	-300	-5.3	(2003–2008)
New Orleans, LA	-9.6	-29.2	–1120	-24.6	(2005-2009)
Mean changes	-3.5	-10.4	-160.0	-7.6	
Std Error	1.6	4.9	60.5	4.3	
MIDWEST					
Chicago, IL	-0.5	-2.7	-70	-0.2	(2005–2009)
Detroit, MI	-0.7	-3.0	-60	-0.7	(2005–2009)
Kansas City, MO	-1.2	-4.2	-160	-3.5	(2003–2009)
Minneapolis, MN	-1.1	-3.1	-30	-0.8	(2003–2008)
Mean changes	-0.9	-3.3	-80.0	-1.3	
Std Error	0.2	0.3	28.0	0.7	
WEST					
Albuquerque, NM	-2.7	-6.6	-420	-8.3	(2006–2009)
Denver, CO	-0.3	-3.1	-30	-0.5	(2005–2009)
Los Angeles, CA	-0.9	-4.2	-270	-0.7	(2005–2009)
Portland, OR	-0.6	-1.9	-50	-0.9	(2005–2009)
Spokane, WA	-0.6	-2.5	-20	-1.0	(2002–2007)
Tacoma, WA	-1.4	-5.8	-50	-2.6	(2001–2005)
Mean changes	-1.1	-4.0	-140.0	-2.3	
Std Error	0.4	0.8	67.8	1.2	

These data have been updated by Nowak and Greenfield.[3] The 2012 data show that urban tree canopy is experiencing negative growth in all four regions. The 2018 data document continued loss of urban tree cover. Table 3 of the 2018 article shows data for all states, with a national loss of urban and community tree cover of 175,000 acres per year during the study years of 2009-2014.

To put this loss in perspective, the total land area of urban and community tree cover loss during the study years totals 1,367 square miles – equal to the combined land area of New York City, Atlanta, Philadelphia, Miami, Boston, Cleveland, Pittsburgh, St. Louis, Portland, OR, San Francisco, Seattle, and Boise.

Even though there may be individual tree planting activities that increase the number of urban trees within small geographic locations, the performance of activities to increase tree cover shows a negative baseline. The Drafting Group did not use negative baselines for the Tree Planting Protocol, but determined to use baselines of zero.

Deployment of the Performance Standard baseline methodology for a City Forest Planting Protocol is supported by conclusions that make sense and are anchored in the real world:

- With the data showing that tree loss exceeds gains from planting, new plantings are justified as additional to that decreasing canopy baseline. In fact, the negative baseline would justify as additional any trees that are protected from removal.
- Because almost no urban trees are planted now with carbon as a decisive factor, urban tree planting done to sequester carbon is additional;
- Almost no urban trees are currently planted with a contractual commitment for monitoring. Maintenance of trees is universally an intention, one that is frequently reached when budgets are cut, as in the Covid-19 era. The 25-year commitment required by this Protocol is entirely additional to any practice in place in the U.S. and will result in substantial additional trees surviving to maturity;
- Because the urban forest is a public resource, and because public funding falls far short of maintaining tree cover and stocking, carbon revenues will result in additional trees planted or in maintenance that will result in additional trees surviving to maturity;
- Because virtually all new large-scale urban tree planting is conducted by governmental entities or non-profits, or by private property developers complying with governmental regulations (which would not be eligible for carbon credits under our protocol), and because any carbon revenues will defray only a portion of the costs of tree planting, there is little danger of unjust enrichment to developers of city forest carbon projects.

Last, The WRI GHG Protocol recognizes explicitly that the principles underlying carbon protocols need to be adapted to different types of projects. The WRI Protocol further approves of balancing the stringency of requirements with the need to encourage participation in desirable carbon projects:

Setting the stringency of additionality rules involves a balancing act. Additionality criteria that are too lenient and grant recognition for "non-additional" GHG reductions will undermine the GHG program's effectiveness. On the other hand, making the criteria for additionality too stringent could unnecessarily limit the number of recognized GHG reductions, in some cases excluding project activities that are truly

[3] Nowak et al. 2018. "Declining Urban and Community Tree Cover in the United States," *Urban Forestry and Urban Greening,* 32, 32-55

additional and highly desirable. In practice, no approach to additionality can completely avoid these kinds of errors. Generally, reducing one type of error will result in an increase of the other. Ultimately, there is no technically correct level of stringency for additionality rules. GHG programs may decide based on their policy objectives that it is better to avoid one type of error than the other.[4]

The policy considerations weigh heavily in favor of "highly desirable" planting projects to reverse tree loss for the public resource of city forests.

[4] WRI GHG Protocol, Chapter 3.1 at 19.

QUANTIFYING CARBON DIOXIDE STORAGE AND CO-BENEFITS FOR URBAN TREE PLANTING PROJECTS (Appendix B)

Introduction

Ecoservices provided by trees to human beneficiaries are classified according to their spatial scale as global and local (Costanza 2008) (citations in Part 1 are listed in References at page 16). Removal of carbon dioxide (CO_2) from the atmosphere by urban forests is global because the atmosphere is so well-mixed it does not matter where the trees are located. The effects of urban forests on building energy use is a local-scale service because it depends on the proximity of trees to buildings. To quantify these and other ecoservices City Forest Credits (CFC) has relied on peer-reviewed research that has combined measurements and modeling of urban tree biomass, and effects of trees on building energy use, rainfall interception, and air quality. CFC has used the most current science available on urban tree growth in its estimates of CO_2 storage (McPherson et al., 2016a). CFC's quantification tools provide estimates of co-benefits after 25 years in Resource Units (i.e., kWh of electricity saved) and dollars per year. Values for co-benefits are first-order approximations extracted from the i-Tree Streets (i-Tree Eco) datasets for each of the 16 U.S. reference cities/climate zones (https://www.itreetools.org/tools/i-tree-eco) (Maco and McPherson, 2003). Modeling approaches and error estimates associated with quantification of CO_2 storage and co-benefits have been documented in numerous publications (see References below) and are summarized here.

Carbon Dioxide Storage

There are three different methods for quantifying carbon dioxide (CO_2) storage in urban forest carbon projects:

- Single Tree Method - planted trees are scattered among many existing trees, as in street, yard, some parks, and school plantings, individual trees are tracked and randomly sampled
- Clustered Parks Planting Method - planted trees are relatively contiguous in park-like settings and change in canopy is tracked
- Canopy Method – trees are planted very close together, often but not required to be in riparian areas, significant mortality is expected, and change in canopy is tracked. The two main goals are to create a forest ecosystem and generate canopy
- Area Reforestation Method – large areas are planted to generate a forest ecosystem, for example converting from agriculture and in upland areas. This quantification method is under development

In all cases, the estimated amount of CO_2 stored 25-years after planting is calculated. The forecasted amount of CO_2 stored during this time is the value from which the Registry issues credits in the amounts of 10%, 40% and 30% at Years 1, 4, and 6 after planting, respectively. A 20% mortality deduction is applied before calculation of Year 1 Credits in the Single Tree and Clustered Parks Planting Methods. A 5% buffer pool deduction is applied in all three methods before calculation of any crediting, with these funds going into a program-wide pool to insure against catastrophic loss of trees. At the end of the project, in year 25, Operators will receive credits for all CO_2 stored, minus credits already issued.

In the Single Tree Method, the amount of CO_2 stored in project trees 25-years after planting is calculated as the product of tree numbers and the 25-year CO_2 index (kg/tree) for each tree-type (e.g., Broadleaf Deciduous Large = BDL). The Registry requires the user to apply a 20% tree mortality deduction before calculation of Year 1 Credits. Year 4 and Year 6 Credits depend on sampling and mortality data. A 5% buffer pool deduction is applied as well before calculation at any stage.

In the Clustered Parks Planting Method, the amount of CO_2 stored after 25-years by planted project trees is based on the anticipated amount of tree canopy area (TC). Because different tree-types store different amounts of CO_2 based on their size and wood density, TC is weighted based on species mix. The estimated amount of TC area occupied by each tree-type is the product of the total TC and each tree-type's percentage TC. This calculation distributes the TC area among tree-types based on the percentage of trees planted and each tree-type's crown projection area. Subsequent calculations reduce the amount of CO_2 estimated to be stored after 25 years based on the 20% anticipated mortality rate and the 5% buffer pool deduction.

In the Canopy Method, the forecasted amount of CO_2 stored at 25-years is the product of the amount of TC and the CO_2 Index (CI, t CO_2 per acre). This approach recognizes that forest dynamics for riparian projects are different than for park projects. In many cases, native species are planted close together and early competition results in high mortality and rapid canopy closure. Unlike urban park plantings, substantial amounts of carbon can be stored in the riparian understory vegetation and forest floor. To provide an accurate and complete accounting, we use the USDA Forest Service General Technical Report NE-343, with biometric data for 51 forest ecosystems derived from U.S. Forest Inventory and Assessment plots (Smith et al., 2006). The tables provide carbon stored per hectare for each of six carbon pools as a function of stand age. We use values for 25-year old stands that account for carbon in down dead wood and forest floor material, as well as the understory vegetation and soil. If local plot data are provided, values for live wood, dead standing and dead down wood are adjusted following guidance in GTR NE-343. More information on methods used to prepare the tables and make adjustments can be found in Smith et al., 2006. See Attachment A at the end of this Appendix for more information on the Canopy Method.

Source Materials for Single Tree Method and Clustered Parks Planting Methods
Estimates of stored (amount accumulated over many years) and sequestered CO_2 (i.e., net amount stored by tree growth over one year) are based on the U.S. Forest Service's recently published technical manual and the extensive Urban Tree Database (UTD), which catalogs urban trees with their projected growth tailored to specific geographic regions (McPherson et al. 2016a, b). The products are a culmination of 14 years of work, analyzing more than 14,000 trees across the United States. Whereas prior growth models typically featured only a few species specific to a given city or region, the newly released database features 171 distinct species across 16 U.S. climate zones. The trees studied also spanned a range of ages with data collected from a consistent set of measurements. Advances in statistical modeling have given the projected growth dimensions a level of accuracy never before seen. Moving beyond just calculating a tree's diameter or age to determine expected growth, the research incorporates 365 sets of tree growth equations to project growth.

Users select their climate zone from the 16 U.S. climate zones (Fig. 1). Calculations of CO_2 stored are for a representative species for each tree-type that was one of the predominant street tree species per reference city (Peper et al., 2001). The "Reference city" refers to the city selected for intensive study within each climate zone (McPherson, 2010). About 20 of the most abundant species were selected for sampling in each reference city. The sample was stratified into nine diameter at breast height (DBH) classes (0 to 7.6, 7.6 to 15.2, 15.2 to 30.5, 30.5 to 45.7, 45.7 to 61.0, 61.0 to 76.2, 76.2 to 91.4, 91.4 to 106.7, and >106.7 cm). Typically 10 to 15 trees per DBH class were randomly chosen. Data were collected for 16 to 74 trees in total from each species. Measurements included: species name, age, DBH [to the nearest 0.1 cm (0.39 in)], tree height [to the nearest 0.5 m (1.64 ft.)], crown height [to the nearest 0.5 m (1.64 ft.)], and crown diameter in two directions [parallel and perpendicular to nearest street to the nearest 0.5 m (1.64 ft.)]. Tree age was determined from local residents, the city's urban forester, street and home construction dates, historical planting records, and aerial and historical photos.

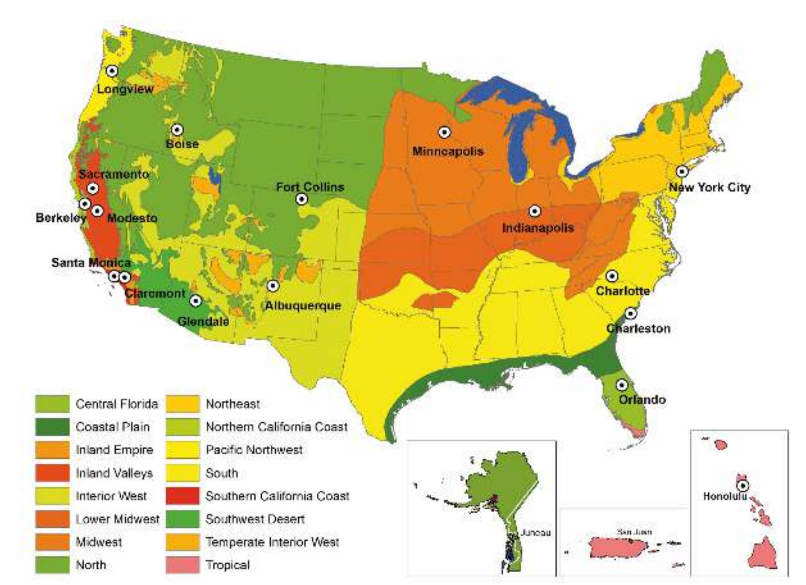


Fig. 1. Climate zones of the United States and Puerto Rico were aggregated from 45 Sunset climate zones into 16 zones. Each zone has a reference city where tree data were collected. Sacramento, California was added as a second reference city (with Modesto) to the Inland Valleys zone. Zones for Alaska, Puerto Rico and Hawaii are shown in the insets (map courtesy of Pacific Southwest Research Station).

Species Assignment by Tree-Type

Representative species for each tree-type in the South climate zone (reference city is Charlotte, NC) are shown in Table 1. They were chosen because extensive measurements were taken on them to generate growth equations, and their mature size and form was deemed typical of other trees in that tree-type. Representative species were not available for some tree-types because none were measured. In that case, a species of similar mature size and form from the same climate zone was selected, or one from another climate zone was selected. For example, no Broadleaf Evergreen Large (BEL) species was measured in the South reference city. Because of its large mature size, *Quercus nigra* was selected to represent the BEL tree-type, although it is deciduous for a short time. *Pinus contorta*, which was measured in the PNW climate zone, was selected for the CES tree-type, because no CES species was measured in the South.

Table 1. Nine tree-types and abbreviations. Representative species assigned to each tree-type in the South climate zone are listed. The biomass equations (species, urban general broadleaf [UGB], urban general conifer [UGC]) and dry weight density (kg/m^3) used to calculate biomass are listed for each tree-type.

Tree-Type	Tree-Type Abbreviation	Species Assigned	DW Density	Biomass Equations
Brdlf Decid Large (>50 ft)	BDL	*Quercus phellos*	600	*Quercus macrocarpa* [1.]
Brdlf Decid Med (30-50 ft)	BDM	*Pyrus calleryana*	600	UGB [2.]
Brdlf Decid Small (<30 ft)	BDS	*Cornus florida*	545	UGB [2.]
Brdlf Evgrn Large (>50 ft)	BEL	*Quercus nigra*	797	UGB [2.]
Brdlf Evgrn Med (30-50 ft)	BEM	*Magnolia grandiflora*	523	UGB [2.]
Brdlf Evgrn Small (<30 ft)	BES	*Ilex opaca*	580	UGB [2.]
Conif Evgrn Large (>50 ft)	CEL	*Pinus taeda*	389	UGC [2.]
Conif Evgrn Med (30-50 ft)	CEM	*Juniperus virginiana*	393	UGC [2.]
Conif Evgrn Small (<30 ft)	CES	*Pinus contorta*	397	UGC [2.]
[1.] from Lefsky, M., & McHale, M.,2008. [2] from Aguaron, E., & McPherson, E. G., 2012				

Calculating Biomass and Carbon Dioxide Stored

To estimate CO_2 stored, the biomass for each tree-type was calculated using urban-based allometric equations because open-growing city trees partition carbon differently than forest trees (McPherson et al., 2017a). Input variables included climate zone, species, and DBH. To project tree size at 25-years after planting, we used DBH obtained from UTD growth curves for each representative species.

Biomass equations were compiled for 26 open-grown urban trees species from literature sources (Aguaron and McPherson, 2012). General equations (Urban Gen Broadleaf and Urban Gen Conifer) were developed from the 26 urban-based equations that were species specific (McPherson et al., 2016a). These equations were used if the species of interest could not be matched taxonomically or through wood form to one of the urban species with a biomass equation. Hence, urban general equations were an alternative to applying species-specific equations because many species did not have an equation.

These allometric equations yielded aboveground wood volume. Species-specific dry weight (DW) density factors (Table 1) were used to convert green volume into dry weight (7a). The urban general equations required looking up a dry weight density factor (in Jenkins et al. 2004 first, but if not available then the Global Wood Density Database). The amount of belowground biomass in roots of urban trees is not well researched. This work assumed that root biomass was 28% of total tree biomass (Cairns et al., 1997; Husch et al., 2003; Wenger, 1984). Wood volume (dry weight) was converted to C by multiplying by the constant 0.50 (Leith, 1975), and C was converted to CO_2 by multiplying by 3.667.

Error Estimates and Limitations

The lack of biometric data from the field remains a serious limitation to our ability to calibrate biomass equations and assign error estimates for urban trees. Differences between modeled and actual tree growth adds uncertainty to CO_2 sequestration estimates. Species assignment errors result from matching species planted with the tree-type used for biomass and growth calculations. The magnitude of this error depends on the goodness of fit in terms of matching size and growth rate. In previous urban studies the prediction bias for estimates of CO_2 storage ranged from -9% to +15%, with inaccuracies as much as 51% RMSE (Timilsina et al., 2014). Hence, a conservative estimate of error of ± 20% can be applied to estimates of total CO_2 stored as an indicator of precision.

It should be noted that estimates of CO_2 stored using the Tree Canopy Approach have several limitations that may reduce their accuracy. They rely on allometric relationships for open-growing trees, so storage estimates may not be as accurate when trees are closely spaced. Also, they assume that the distribution of tree canopy cover among tree-types remains constant, when in fact mortality may afflict certain species more than others. For these reasons, periodic "truing-up" of estimates by field sampling is suggested.

Co-Benefit: Energy Savings

Trees and forests can offer energy savings in two important ways. In warmer climates or hotter months, trees can reduce air conditioning bills by keeping buildings cooler through reducing regional air temperatures and offering shade. In colder climates or cooler months, trees can confer savings on the fuel needed to heat buildings by reducing the amount of cold winds that can strip away heat.

Energy conservation by trees is important because building energy use is a major contributor to greenhouse gas emissions. Oil or gas furnaces and most forms of electricity generation produce CO_2 and other pollutants as by-products. Reducing the amount of energy consumed by buildings in urban areas is one of the most effective methods of combatting climate change. Energy consumption is also a costly burden on many low-income families, especially during mid-summer or mid-winter. Furthermore, electricity consumption during mid-summer can sometimes over-extend local power grids leading to rolling brownouts and other problems.

Energy savings are calculated through numerical models and simulations built from observational data on proximity of trees to buildings, tree shapes, tree sizes, building age classes, and meteorological data from McPherson et al. (2017) and McPherson and Simpson (2003). The main parameters affecting the overall amount of energy savings are crown shape, building proximity, azimuth, local climate, and season. Shading effects are based on the distribution of street trees with respect to buildings recorded from aerial photographs for each reference city (McPherson and Simpson, 2003). If a sampled tree was located within 18 m of a conditioned building, information on its distance and compass bearing relative to a building, building age class (which influences energy use) and types of heating and cooling equipment were collected and used as inputs to calculate effects of shade on annual heating and cooling energy effects. Because these distributions were unique to each city, energy values are considered first-order approximations.

In addition to localized shade effects, which were assumed to accrue only to trees within 18 m of a building, lowered air temperatures and windspeeds from increased neighborhood tree cover (referred to as climate effects) can produce a net decrease in demand for winter heating and summer cooling (reduced wind speeds by themselves may increase or decrease cooling demand, depending on the circumstances). Climate effects on energy use, air temperature, and wind speed, as a function of neighborhood canopy cover, were estimated from published values for each reference city. The percentages of canopy cover increase were calculated for 20-year-old large, medium, and small trees, based on their crown projection areas and effective lot size (actual lot size plus a portion of adjacent street and other rights-of-way) of 10,000 ft^2 (929 m^2), and one tree on average was assumed per lot. Climate effects were estimated by simulating effects of wind and air-temperature reductions on building energy use.

In the case of urban Tree Preservation Projects, trees may not be close enough to buildings to provide shading effects, but they may influence neighborhood climate. Because these effects are highly site-specific, we conservatively apply an 80% reduction to the energy effects of trees for Preservation Projects.

Energy savings are calculated as a real-dollar amount. This is calculated by applying overall reductions in oil and gas usage or electricity usage to the regional cost of oil and gas or electricity for residential customers. Colder regions tend to see larger savings in heating and warmer regions tend to see larger savings in cooling.

Error Estimates and Limitations

Formulaic errors occur in modeling of energy effects. For example, relations between different levels of tree canopy cover and summertime air temperatures are not well-researched. Another source of error stems from differences between the airport climate data (i.e., Los Angeles International Airport) used to model energy effects and the actual climate of the study area (i.e., Los Angeles urban area). Because of the uncertainty associated with modeling effects of trees on building energy use, energy estimates may be accurate within ± 25 percent (Hildebrandt & Sarkovich, 1998).

Co-Benefit: CO_2 Avoided

Energy savings result in reduced emissions of CO_2 and criteria air pollutants (volatile organic hydrocarbons [VOCs], NO_2, SO_2, PM_{10}) from power plants and space-heating equipment. Cooling savings reduce emissions from power plants that produce electricity, the amount depending on the fuel mix. Electricity emissions reductions were based on the fuel mixes and emission factors for each utility in the 16 reference cities/climate zones across the U.S. The dollar values of electrical energy and natural gas were based on retail residential electricity and natural gas prices obtained from each utility. Utility-specific emission factors, fuel prices and other data are available in the Community Tree Guides for each region (https://www.fs.fed.us/psw/topics/urban_forestry/products/tree_guides.shtml). To convert the amount of CO_2 avoided to a dollar amount in the spreadsheet tools, City Forest Credits uses the price of $20 per metric ton of CO_2.

Error Estimates and Limitations

Estimates of avoided CO_2 emissions have the same uncertainties that are associated with modeling effects of trees on building energy use. Also, utility-specific emission factors are changing as many utilities incorporate renewable fuels sources into their portfolios. Values reported in CFC tools may overestimate actual benefits in areas where emission factors have become lower.

Co-Benefit: Rainfall Interception

Forest canopies normally intercept 10-40% of rainfall before it hits the ground, thereby reducing stormwater runoff. The large amount of water that a tree crown can capture during a rainfall event makes tree planting a best management practice for urban stormwater control.

City Forest Credits uses a numerical interception model to calculate the amount of annual rainfall intercepted by trees, as well as throughfall and stem flow (Xiao et al., 2000). This model uses species-specific leaf surface areas and other parameters from the Urban Tree Database. For example, deciduous trees in climate zones with longer "in-leaf" seasons will tend to intercept more rainfall than similar species in colder areas shorter foliation periods. Model results were compared to observed patterns of rainfall interception and found to be accurate. This method quantifies only the amount of rainfall intercepted by the tree crown, and does not incorporate surface and subsurface effects on overland flow.

The rainfall interception benefit was priced by estimating costs of controlling stormwater runoff. Water quality and/or flood control costs were calculated per unit volume of runoff controlled and this price was multiplied by the amount of rainfall intercepted annually.

Error Estimates and Limitations

Estimates of rainfall interception are sensitive to uncertainties regarding rainfall patterns, tree leaf area and surface storage capacities. Rainfall amount, intensity and duration can vary considerably within a climate zone, a factor not considered by the model. Although tree leaf area estimates were derived from extensive measurements on over 14,000 street trees across the U.S. (McPherson et al., 2016a), actual leaf area may differ because of differences in tree health and management. Leaf surface storage capacity, the depth of water that foliage can capture, was recently found to vary threefold among 20 tree species (Xiao & McPherson, 2016). A shortcoming is that this model used the same value (1 mm) for all species. Given these limitations, interception estimates may have uncertainty as great as ± 20 percent.

Co-Benefit: Air Quality

The uptake of air pollutants by urban forests can lower concentrations and affect human health (Derkzen et al., 2015; Nowak et al., 2014). However, pollutant concentrations can be increased if the tree canopy restricts polluted air from mixing with the surrounding atmosphere (Vos et al., 2013). Urban forests are capable of improving air quality by lowering pollutant concentrations enough to significantly affect human health. Generally, trees are able to reduce ozone, nitric oxides, and particulate matter. Some trees can reduce net volatile organic compounds (VOCs), but others can increase them through natural processes. Regardless of the net VOC production, urban forests usually confer a net positive benefit to air quality. Urban forests reduce pollutants through dry deposition on surfaces and uptake of pollutants into leaf stomata.

A numerical model calculated hourly pollutant dry deposition per tree at the regional scale using deposition velocities, hourly meteorological data and pollutant concentrations from local monitoring stations (Scott et al., 1998). The monetary value of tree effects on air quality reflects the value that society places on clean air, as indicated by willingness to pay for pollutant reductions. The monetary value of air quality effects were derived from models that calculated the marginal damage control costs of different pollutants to meet air quality standards (Wang and Santini 1995). Higher costs were associated with higher pollutant concentrations and larger populations exposed to these contaminants.

Error Estimates and Limitations

Pollutant deposition estimates are sensitive to uncertainties associated with canopy resistance, resuspension rates and the spatial distribution of air pollutants and trees. For example, deposition to urban forests during warm periods may be underestimated if the stomata of well-watered trees remain open. In the model, hourly meteorological data from a single station for each climate zone may not be spatially representative of conditions in local atmospheric surface layers. Estimates of air pollutant uptake may be accurate within ± 25 percent.

Conclusions

Our estimates of carbon dioxide storage and co-benefits reflect an incomplete understanding of the processes by which ecoservices are generated and valued (Schulp et al., 2014). Our choice of co-benefits to quantify was limited to those for which numerical models were available. There are many important benefits produced by trees that are not quantified and monetized. These include effects of urban forests on local economies, wildlife, biodiversity and human health and well-being. For instance, effects of urban trees on increased property values have proven to be substantial (Anderson & Cordell, 1988). Previous analyses modeled these "other" benefits of trees by applying the contribution to residential sales prices of a large front yard tree (0.88%) (McPherson et al., 2005). We have not incorporated this benefit because property values are highly variable. It is likely that co-benefits reported here are conservative estimates of the actual ecoservices resulting from local tree planting projects.

References

Aguaron, E., & McPherson, E. G. (2012). Comparison of methods for estimating carbon dioxide storage by Sacramento's urban forest. In R. Lal & B. Augustin (Eds.), *Carbon sequestration in urban ecosystems* (pp. 43-71). Dordrecht, Netherlands: Springer.

Anderson, L. M., & Cordell, H. K. (1988). Influence of trees on residential property values in Athens, Georgia: A survey based on actual sales prices. Landscape and Urban Planning, 15, 153-164.

Cairns, M. A., Brown, S., Helmer, E. H., & Baumgardner, G. A. (1997). Root biomass allocation in the world's upland forests. Oecologia 111, 1-11.

Costanza, R. (2008). Ecosystem services: Multiple classification systems are needed. Biological Conservation, 141(2), 350-352. doi: http://dx.doi.org/10.1016/j.biocon.2007.12.020

Derkzen, M. L., van Teeffelen, A. J. A., & Verburg, P. H. (2015). Quantifying urban ecosystem services based on high-resolution data of urban green space: an assessment for Rotterdam, the Netherlands. Journal of Applied Ecology, 52(4), 1020-1032. doi: 10.1111/1365-2664.12469

Hildebrandt, E. W., & Sarkovich, M. (1998). Assessing the cost-effectiveness of SMUD's shade tree program. Atmospheric Environment, 32, 85-94.

Husch, B., Beers, T. W., & Kershaw, J. A. (2003). *Forest Mensuration* (4th ed.). New York, NY: John Wiley and Sons.

Jenkins, J.C.; Chojnacky, D.C.; Heath, L.S.; Birdsey, R.A. (2004). Comprehensive database of diameter-based biomass regressions for North American tree species. Gen. Tech. Rep. NE-319. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. 45 p.

Lefsky, M., & McHale, M. (2008). Volume estimates of trees with complex architecture from terrestrial laser scanning. Journal of Applied Remote Sensing, *2*, 1-19. doi: 02352110.1117/1.2939008

Leith, H. (1975). Modeling the primary productivity of the world. Ecological Studies*, 14*, 237-263.

Maco, S.E., & McPherson, E.G. (2003). A practical approach to assessing structure, function, and value of street tree populations in small communities. Journal of Arboriculture. 29(2): 84-97.

McPherson, E. G. (2010). Selecting reference cities for i-Tree Streets. Arboriculture and Urban Forestry, *36*(5), 230-240.

McPherson, E. Gregory; van Doorn, Natalie S.; Peper, Paula J. (2016a). Urban tree database and allometric equations. General Technical Report PSW-253. U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station, Albany, CA. 86 p. TreeSearch #52933

McPherson, E. Gregory; van Doorn, Natalie S.; Peper, Paula J. (2016b). Urban tree database. Fort Collins, CO: Forest Service Research Data Archive. http://dx.doi.org/10.2737/RDS-2016-0005

McPherson, G., Q. Xiao, N. S. van Doorn, J. de Goede, J. Bjorkman, A. Hollander, R. M. Boynton, J.F. Quinn and J. H. Thorne. (2017). The structure, function and value of urban forests in California communities. Urban Forestry & Urban Greening. 28 (2017): 43-53.

McPherson, E. G., & Simpson, J. R. (2003). Potential energy saving in buildings by an urban tree planting programme in California. Urban Forestry & Urban Greening, 3, 73-86.

McPherson, E. G., Simpson, J. R., Peper, P. J., Maco, S. E., & Xiao, Q. (2005). Municipal forest benefits and costs in five U.S. cities. Journal of Forestry, 103, 411-416.

Nowak, D. J., Hirabayashi, S., Bodine, A., & Greenfield, E. (2014). Tree and forest effects on air quality and human health in the United States. Environmental Pollution, 193, 119-129.

Peper, P. J., McPherson, E. G., & Mori, S. M. (2001). Equations for predicting diameter, height, crown width and leaf area of San Joaquin Valley street trees. Journal of Arboriculture, 27(6), 306-317.

Schulp, C. J. E., Burkhard, B., Maes, J., Van Vliet, J., & Verburg, P. H. (2014). Uncertainties in ecosystem service maps: A comparison on the European scale. PLoS ONE 9(10), e109643.

Scott, K. I., McPherson, E. G., & Simpson, J. R. (1998). Air pollutant uptake by Sacramento's urban forest. Journal of Arboriculture, 24(4), 224-234.

Smith, James E.; Heath, Linda S.; Skog, Kenneth E.; Birdsey, Richard A. 2006. Methods for calculating forest ecosystem and harvested carbon with standard estimates for forest types of the United States. Gen. Tech. Rep. NE-343. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. 216 p.

Timilsina, N., Staudhammer, C.L., Escobedo, F.J., Lawrence, A. (2014). Tree biomass, wood waste yield and carbon storage changes in an urban forest. Landscape and Urban Planning. 127: 18-27.

Vos, P. E. J., Maiheu, B., Vankerkom, J., & Janssen, S. (2013). Improving local air quality in cities: To tree or not to tree? Environmental Pollution, 183, 113-122. doi: http://dx.doi.org/10.1016/j.envpol.2012.10.021

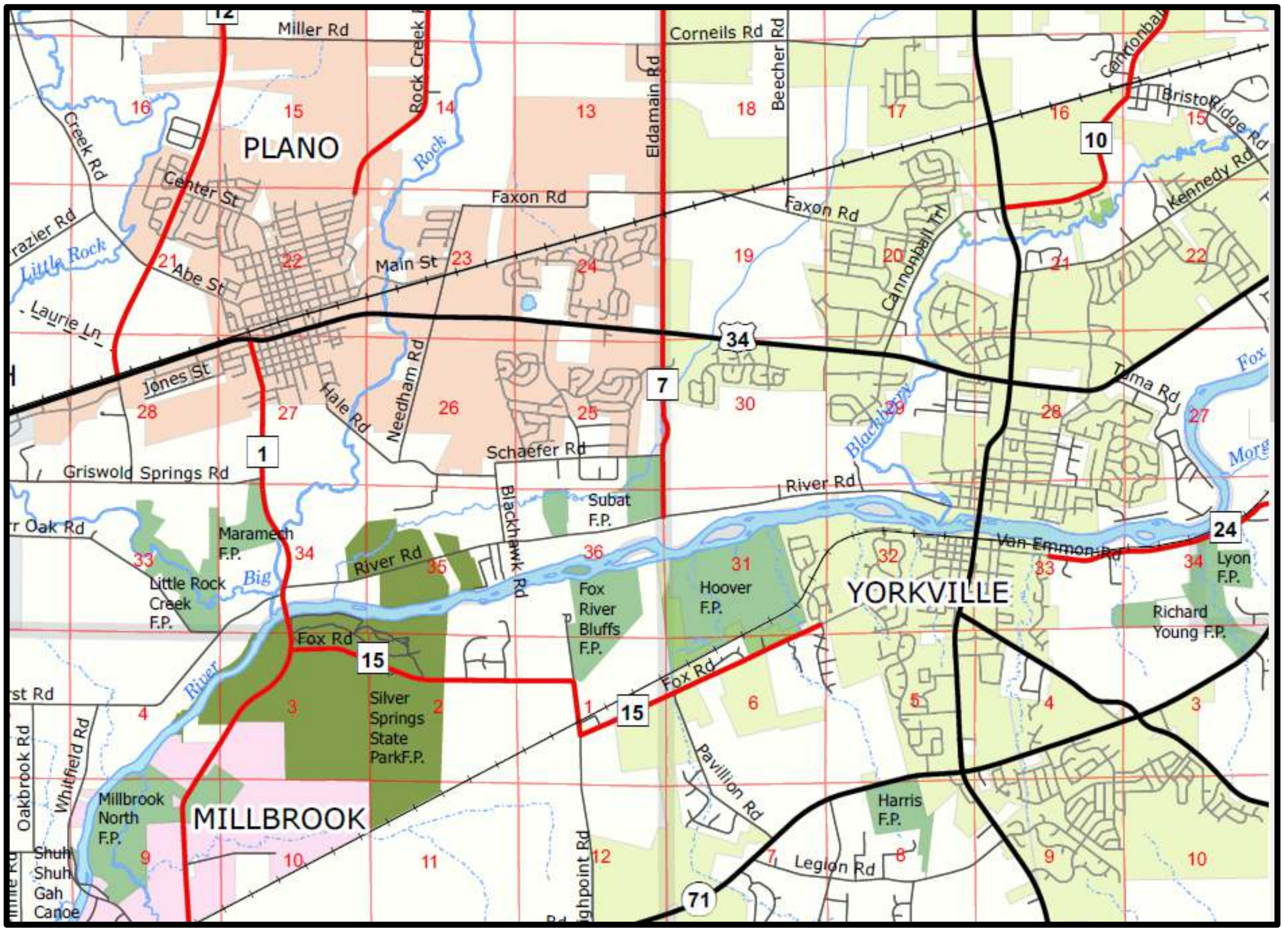
Wang, M.Q.; Santini, D.J. (1995). Monetary values of air pollutant emissions in various U.S. regions. Transportation Research Record 1475. Washington DC: Transportation Research Board.

Wenger, K. F. (1984). Forestry Handbook. New York, NY: John Wiley and Sons.

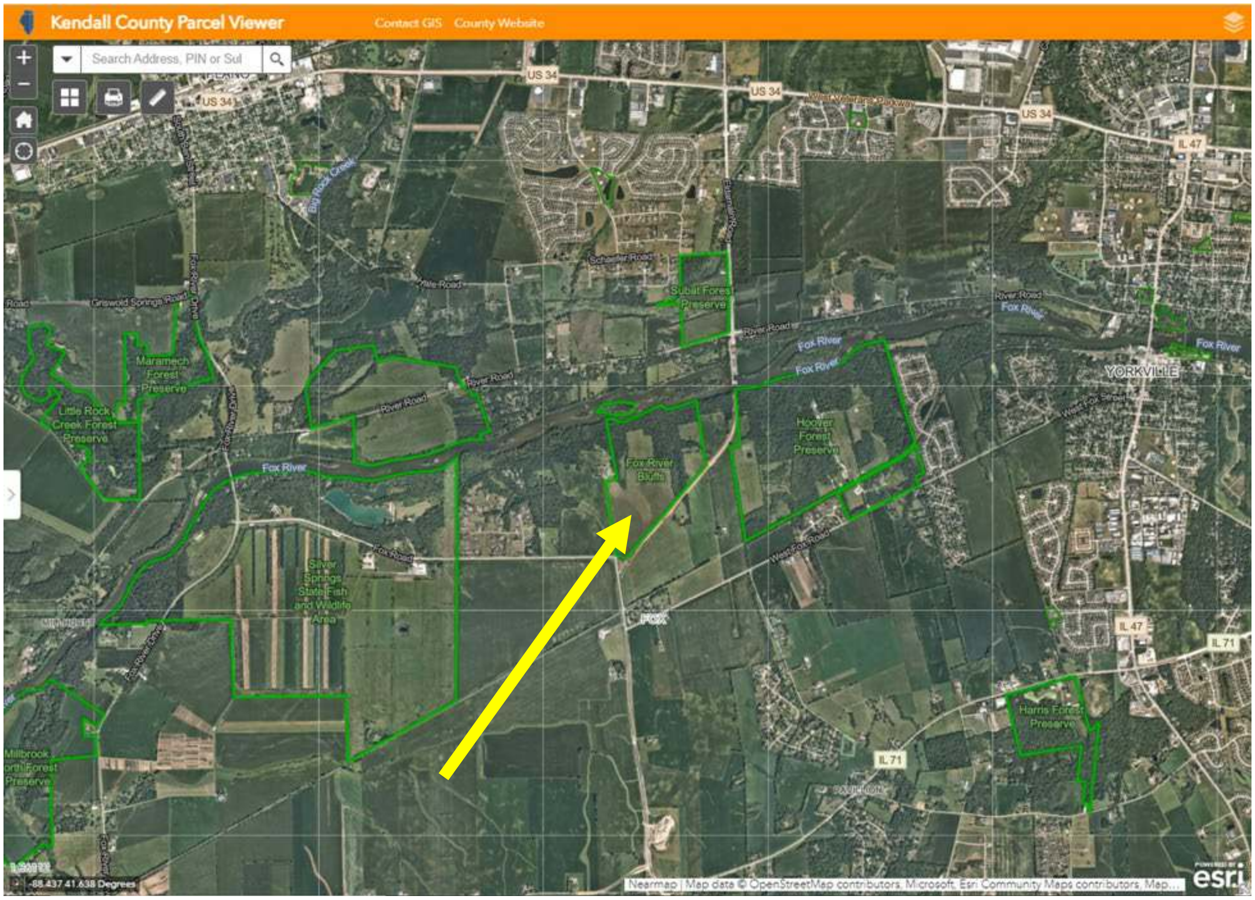
Xiao, Q., E. G. McPherson, S. L. Ustin, and M. E. Grismer. A new approach to modeling tree rainfall interception. Journal of Geophysical Research. 105 (2000): 29,173-29,188.

Xiao, Q., & McPherson, E. G. (2016). Surface water storage capacity of twenty tree species in Davis, California. Journal of Environmental Quality, 45, 188-198.

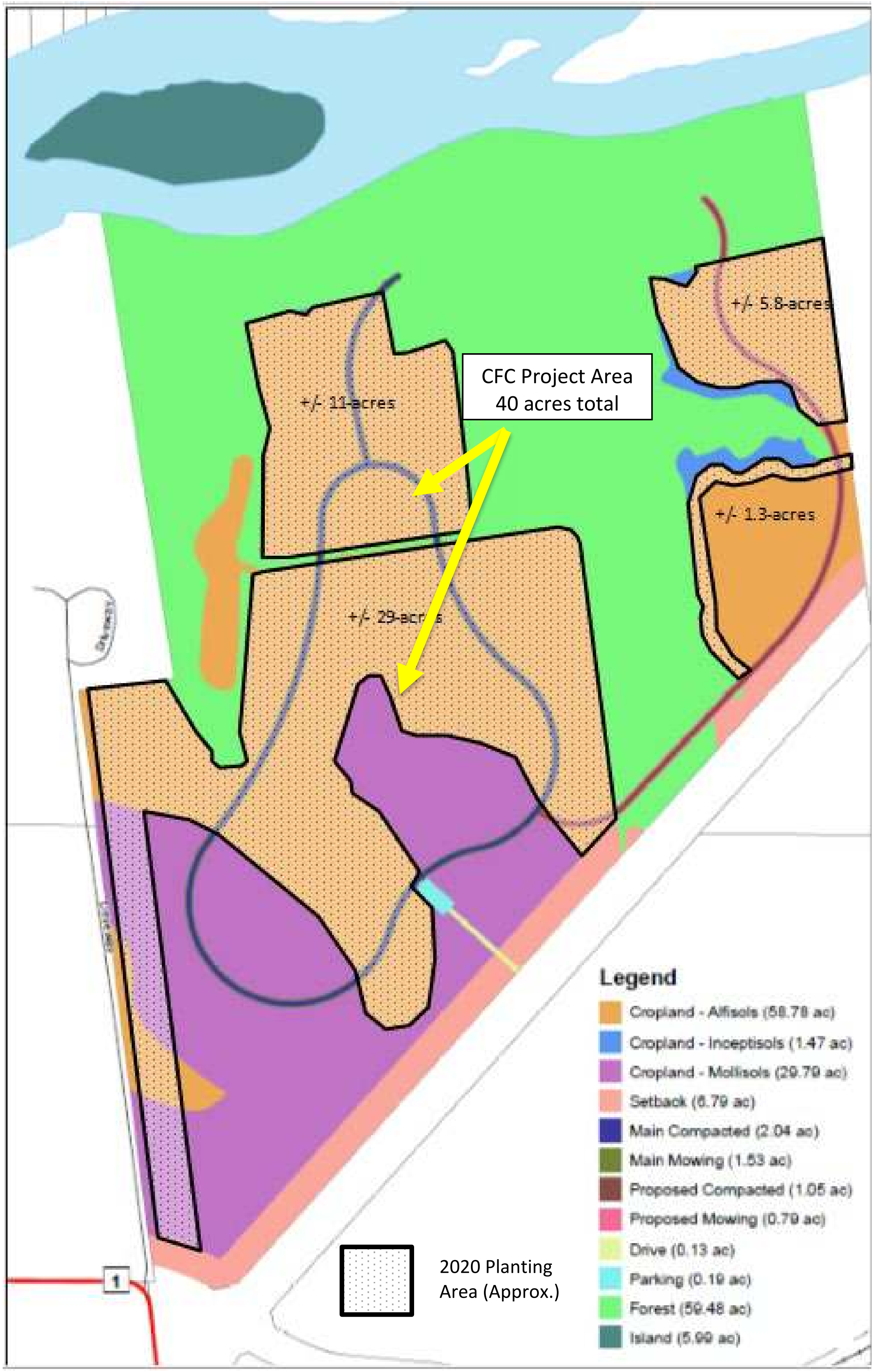
Attachment 1 – Regional Map



2 – Project Area Map



Attachment 3 - Fox River Bluffs Preserve Tree and Soil Map



CITY FOREST
CREDITS

Fox River Bluffs Planting Project
Attestation of Land Ownership

I am the President of the Kendall County Forest Preserve District and make this attestation regarding the ownership of land upon which the Kendall County Forest Preserve District is the Project Operator of a tree planting project known as the Fox River Bluffs Planting Project.

1. Land Ownership

The Kendall County Forest Preserve District is the owner in fee simple of the land identified in Section 2 and in Exhibit A.

2. Subject Lands

The Kendall County Forest Preserve District is planting trees on the Property known as Fox River Bluffs Forest Preserve, which is the subject of this Declaration as specified in Exhibit A.

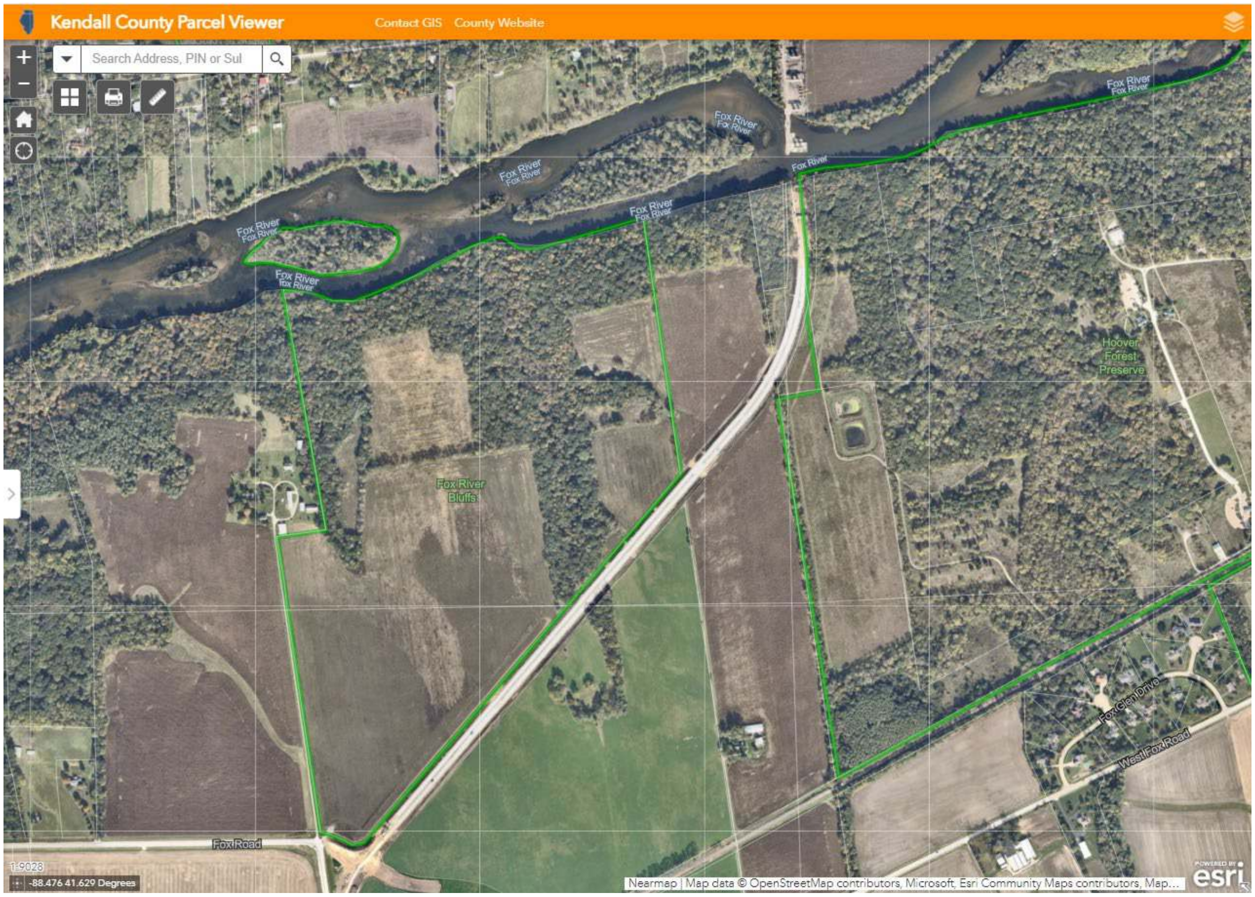
Signed on December 7 in 2021, by Judy Gilmour, President for Kendall County Forest Preserve District.

Judy Gilmour

Judy Gilmour
630-553-4025
jgilmour@co.kendall.il.us

Exhibit A

Kendall County, Illinois Property Index Numbers:
01-36-400-010
04-01-200-006



CITY FOREST
CREDITS

Fox River Bluffs Planting Project
Attestation of No Double Counting of Credits

I am the Executive Director of the Kendall County Forest Preserve District and make this attestation regarding the no double counting of credits from tree planting project, Fox River Bluffs Planting Project.

1. Project Description

The Project that is the subject of this attestation is described more fully in both our Application and our Project Design Document (PDD), both of which are incorporated into this attestation.

2. No Double Counting by Applying for Credits from another registry

Kendall County Forest Preserve District will not seek credits for CO_2 for the project trees or for this project from any other organization or registry issuing credits for CO_2 storage unless the Project Implementation Agreement is terminated prior to the issuance and release of all credits.

3. No Double Counting by Seeking Credits for the Same Trees or Same CO_2 Storage

Kendall County Forest Preserve District will not apply for a project including the same trees as this project nor will it seek credits for CO_2 storage for the project trees or for this project in any other project or more than once unless the Project Implementation Agreement is terminated prior to the issuance and release of all credits.

Signed on December 7 in 2021, by David Guritz, Executive Director for Kendall County Forest Preserve District, Kendall County, Illinois.

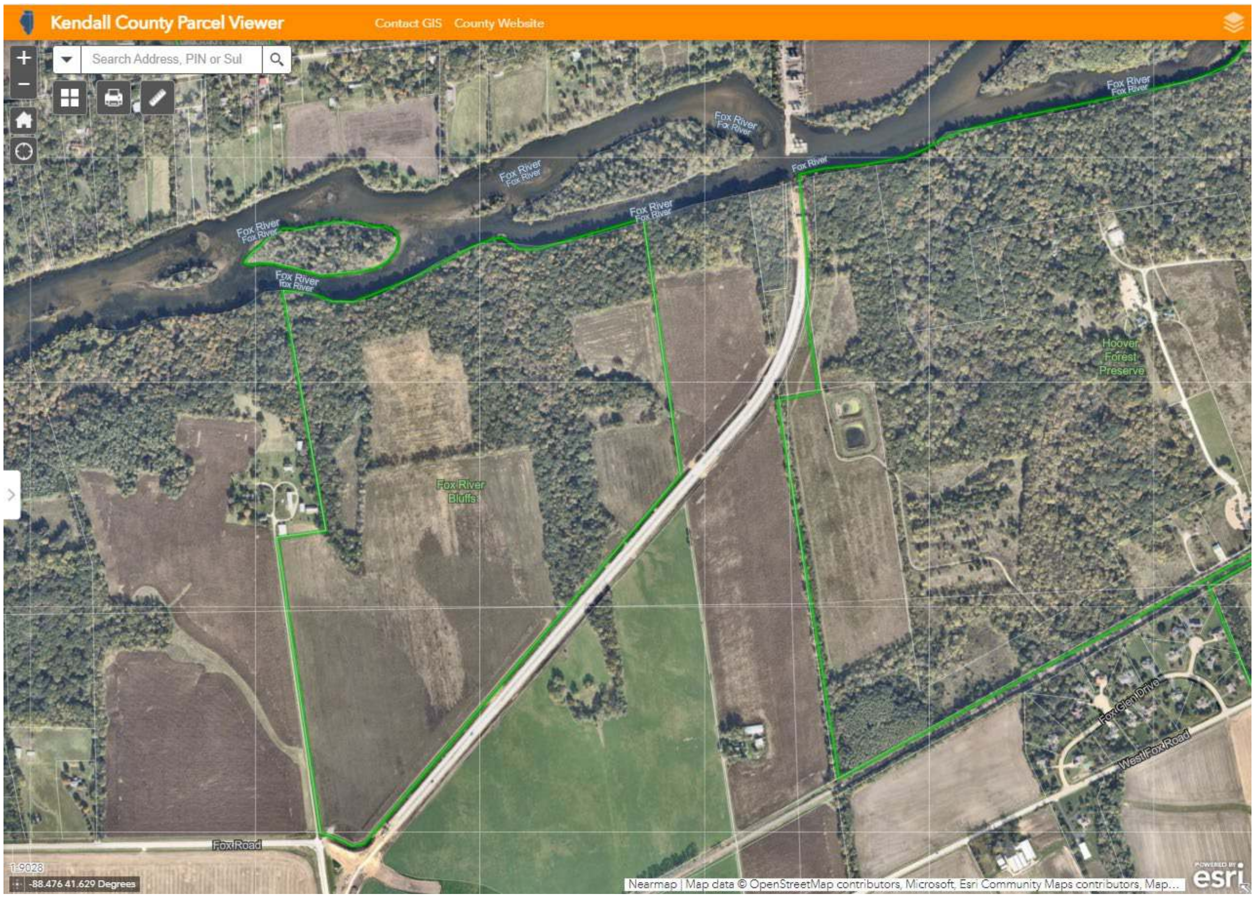
David Guritz

630-553-4131

dguritz@co.kendall.il.us

Exhibit A

Kendall County, Illinois Property Index Numbers:
01-36-400-010
04-01-200-006



CITY FOREST CREDITS

Fox River Bluffs Planting Project
Attestation of No Net Harm

I am the Executive Director of the Kendall County Forest Preserve District and make this attestation regarding the no net harm from tree planting project, Fox River Bluffs Planting Project.

1. Project Description

The Project that is the subject of this attestation is described more fully in both our Application and our Project Design Document (PDD), both of which are incorporated into this attestation.

2. No Net Harm

The trees planted in this project will produce many benefits, as described in our Application and PDD. Like almost all urban trees, the project trees are planted not for harvest but for the benefits they deliver to people, communities, and the environment as living trees in a metropolitan area.

The project trees will produce many benefits and will not cause net harm. Specifically, they will not:

- Displace native or indigenous populations
- Deprive any communities of food sources
- Degrade a landscape or cause environmental damage

Signed on December 7 in 2021, by David Guritz, Executive Director for Kendall County Forest Preserve District, Kendall County, Illinois

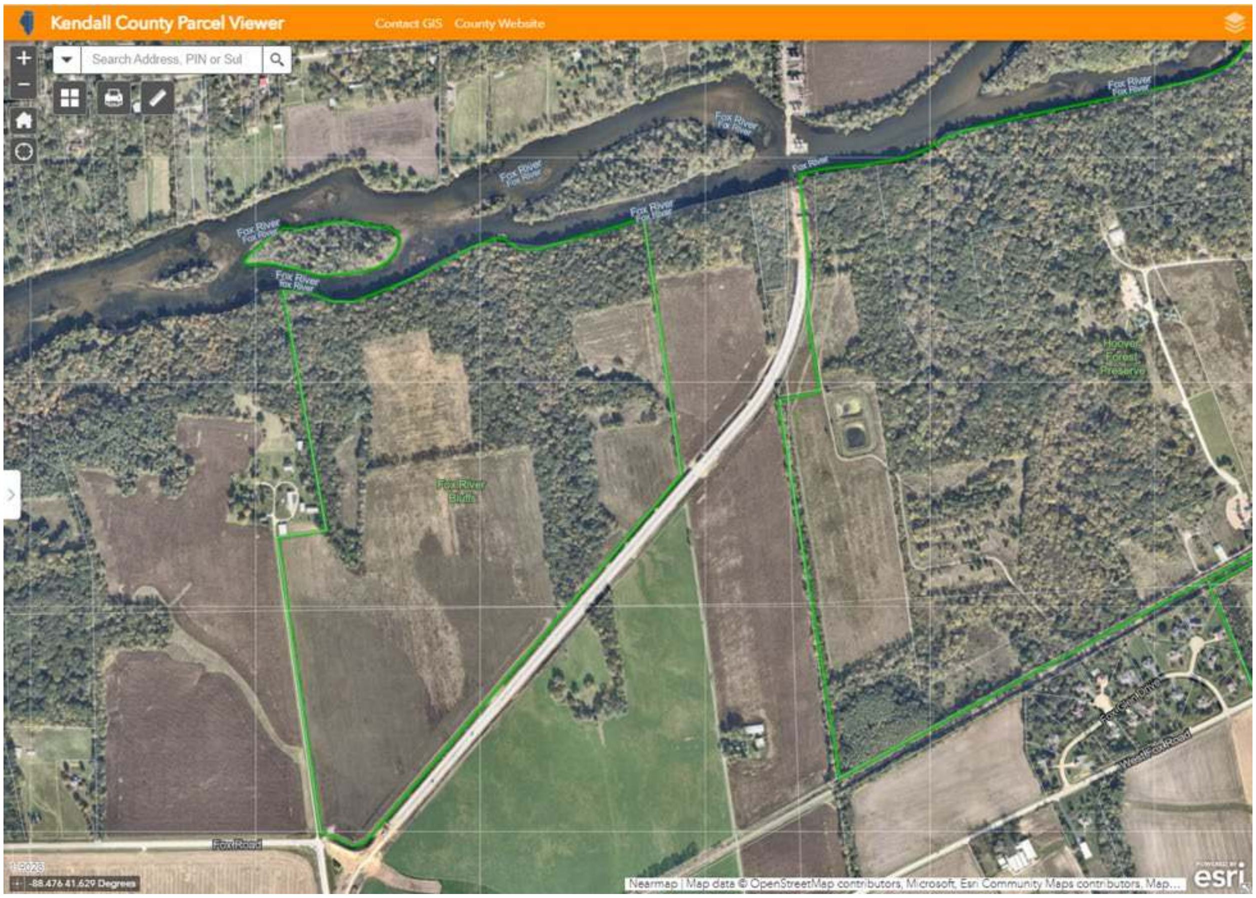
David Guritz

630-553-4131

dguritz@co.kendall.il.us

Exhibit A

Kendall County, Illinois Property Index Numbers:
01-36-400-010
04-01-200-006



CITY FOREST CREDITS

Fox River Bluffs Planting Project
Project Operator Attestation of Planting

I, the undersigned Project Operator for the Planting Project named Fox River Bluffs Planting Project located at Fox River Bluffs Forest Preserve, Yorkville, Illinois 60560 and submitted to City Forest Credits by application dated November 2, 2021, attest to the following in order to confirm the planting of trees under this Project:

- Trees planted were not required by any law or ordinance to be planted;
- Trees were planted under this project on the following date (s): April 10 through 22, 2020
- The organizations or groups that participated in the planting event(s) include: Kendall County Forest Preserve District, various invited community volunteers
- Planting events are shown in photos attached
- The number of trees planted by species are, to a reasonable certainty:

Species	Amount (Over 40 acres)
Bur Oak	5,417
Red Oak	5,417
Shagbark Hickory	4,167
Black Oak	2,500
White Oak	1,667
Swamp White Oak	1,667
Pin Oak	1,250
Black Walnut	1,000
American Plum	833
	23,917

These planting numbers are confirmed by one or more of the following supporting and attached documents:

1. Invoices for trees planted, or
2. Invoices or a statement from the party who funded the tree purchase or supplied the trees attesting to the number of trees purchased, or
3. Any reporting to the owner or public body regarding the planting, invoices, costs, or other data re the planting, or
4. Any other reliable estimate of trees planted that is approved by the Registry

Signed on December 7 in 2021, by Judy Gilmour, President for Kendall County Forest Preserve District, Kendall County, Illinois.

Judy Gilmour
Signature

630-553-4025
Phone

jgilmour@co.kendall.il.us
Email

ILLINOIS

Illinois Department of Natural Resources

One Natural Resources Way Springfield, Illinois 62702-1271
www.dnr.illinois.gov

JB Pritzker, Governor
Colleen Callahan, Director

NATURAL RESOURCES

INVOICE

Inv. #00255

February 27, 2020

SOLD TO: Kendall County Forest Preserve District
110 W Madison St
Yorkville, IL 60560

SPECIES	# WANTED	PRICE/EACH	TOTAL
Shagbark Hickory	5,000	$0.50/ea	$ 2,500.00
Black Walnut	1,200	$0.50/ea	$ 600.00
Bur Oak	6,500	$0.50/ea	$ 3,250.00
Red Oak	6,500	$0.50/ea	$ 3,250.00
Hazelnut	2,000	$0.35/ea	$ 700.00
Elderberry	300	$0.35/ea	$ 105.00
Pin Oak	1,500	$0.50/ea	$ 750.00
Swamp White Oak	2,000	$0.50/ea	$ 1,000.00
White Oak	2,000	$0.50/ea	$ 1,000.00
Black Oak	3,000	$0.50/ea	$ 1,500.00
American Plum	1,000	$0.35/ea	$ 350.00
TOTAL	**31,000**		**$ 15,005.00**

Please make checks payable to:
Illinois Department of Natural Resources
Please remit to:
Mason State Nursery
FEIN #37-1349602(6156701)
17855 N. County Rd. 2400E, Topeka, IL 61567

Thank you for your order!

Project Photos:

CITY FOREST CREDITS

Fox River Bluffs Planting Project
Attestation of Planting Affirmation

I, the undersigned working on behalf of the State of Illinois - Illinois Department of Natural Resources attest and confirm that tree planting(s) occurred on the following dates under the project named in the City Forest Credits registry Fox River Bluffs Planting Project by the Project Operator, Kendall County Forest Preserve District.

Trees were planted under this project on the following date(s): April 10 through 22, 2020

The approximate number of trees planted is: 23,917 trees over approximately 40 acres at Fox River Bluffs Preserve.

Signed on November 16 in 2021, by Tom Gargrave for Illinois Department of Natural Resources.

[signature]

Signature

TOM GARGRAVE

Tom Gargrave

630-399-3249

Phone

Tom.Gargrave@illinois.gov

Area Reforestation Project Type and Quantification

October 25, 2020

Area Reforestation seeks two main goals – create a dynamic forest ecosystem and generate canopy over parcels or properties greater than 5 acres and some cases over dozens or hundreds of acres. Examples are projects to convert agricultural land to forest or reforestation of natural areas. To accomplish these goals, area reforestation plants trees closely together, using a diverse palette of species and size, with relatively high expected mortality. Mortality is not the central measure of success of area reforestation, because certain species and trees are expected to out-compete others. Recruitment often occurs that results in mature trees that were not planted by the project operator.

The amount of CO_2 stored after 25-years by planted project trees is based on the anticipated amount of tree canopy area (TC). The forecasted amount of CO_2 stored at 25-years is the product of the amount of tree canopy (TC) and the CO_2 Index (CI, t CO_2 per acre). This approach recognizes that forest dynamics for area reforestation projects are different than for street trees or parks projects. In many cases, native species are planted close together and early competition results in high mortality and rapid canopy closure. The Single Tree Method and the Canopy Method for Parks-like plantings, which are based on the biometrics of open-growing urban trees, do not adequately describe biomass distribution among closely-spaced trees and the dynamic changes in CO_2 stored in dead wood and understory vegetation as a forest stand matures.

City Forest Credits (referred to as the Registry) issues credits at four times during a 25-year area reforestation project. Assuming compliance with all protocol requirements and third-party verification, the Registry issues credits based on projected CO_2 storage over the 25-year project duration. It issues 10% of projected credits after planting, 40% of projected credits at Year 4, and 30% of projected credits at Year 6 after planting. At the end of the project, in year 25, the Operator will receive credits for all CO_2 stored, minus credits already issued. A 5% buffer pool deduction is applied at each issuance of credits, with these funds going into a program-wide pool to insure against catastrophic loss of trees (unavoidable reversals).

To quantify the CO_2 for these kinds of area reforestation projects, Project Operators may choose one of two methods – local data or a forest ecosystem approach using the USDA Forest Service General Technical Report (GTR), with its biometric data and allometrics for 51 forest ecosystems in regions of the U.S. (Smith et al., 2006). In this GTR method, the forecasted amount of CO_2 stored at 25-years is the product of the amount of TC and the CO_2 Index (CI, t CO_2 per acre).

Local Data

Project Operators may apply to the Registry to quantify the projected CO_2 storage from local data for tree growth that more accurately reflects CO_2 storage than the GTR tables. If a Project Operator has local data for 25-year-old stands like those planted, it can submit that data to the Registry. The Registry retains sole discretion to determine the applicability of that data to the planting project of the Project Operator.

Use of GTR Tables

A Project Operator may alternatively choose to use the USDA Forest Service General Technical Report (GTR), with its biometric data and allometrics for 51 forest ecosystems in regions of the U.S. (Smith et al., 2006). The GTR tables provide carbon stored per hectare for each of six pools as a function of stand age. We used values for 25-year old stands for afforestation projects, because the sites contain little carbon in down dead wood and forest floor material at the time of planting. Data used to derive the 51 forest ecosystem tables came from U.S. Forest Inventory and Assessment plots. More information on methods used to prepare the tables can be found in Smith et al. (2006). The value from the applicable table, for total non-soil carbon stock for age 25 (or other source approved by the registry) is the CO_2 Index (CI).

Project Operators determine their forest type and select the type from their region in the GTR tables. Project Operators then utilize the carbon totals for year 25 from the tables. If a project is planted on an area that has been tilled to grow crops for at least three of ten years before tree planting, then soil carbon may be claimed.

SOIL CARBON SEQUESTRATION

- If a project converts land from tillage, the project may receive credit for increasing soil carbon sequestration. If a project does not convert land from tillage, the project shall not receive credit for soil carbon sequestration. To receive soil carbon credits, the project must document a history of cropping in at least three of the 10 years preceding initiation of the project. Options for documenting tillage include cropping records, crop subsidy payment receipts, and historical aerial photos showing cropping.
- Following the United Nations Framework Convention on Climate Change, Intergovernmental Panel on Climate Change (IPCC) afforestation/reforestation methodological tool "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities, Version 01," projects that are on sites that are productive enough to grow trees and that stop tillage are assumed to gain more than the IPCC's maximum creditable amount of soil carbon of 16 tC/ha, which is 23.7 tCO_2e/acre over the 25 year life of the sequestration project.
- When a project converts agricultural land to forest and makes no change in the demand for agricultural products, the project creates pressure to bring other lands into agriculture. Economists call the rate that other resources are increased to serve a supply the "price elasticity of supply." The average price elasticity of supply of agricultural land in the U.S. is calculated by Barr et al. (2010) to be 0.018, which is 1.8%. To account for this expected conversion of some other land to agriculture, and assuming that land brought into agriculture loses the same amount of carbon that soil taken out of agriculture regains, the Registry deducts 1.8% of the IPCC creditable amount of carbon gain. As a result, projects that convert land from tillage to trees may count

23.3 tCO_2e per acre of soil carbon gain as a result of the project over the 25 year life of the project.

After conversions from Carbon to CO_2, **the CO_2 Index (CI) is tons CO_2 per acre of tree canopy (TC) and the forecasted amount of CO_2 stored after 25-years is the CI x TC.** This is the value from which the Registry will issue credits.

If a Project operator feels that the GTR table applicable to its project does not reflect accurate CO_2 storage for that project, he or she may apply to the Registry for use of a different GTR table in a more accurate way. Here is a non-exhaustive list of factors the Registry will consider in any requests to deviate from the GTR values:

- Soils
- Precipitation
- Climate information for the area
- Site productivity
- Local measurements of growth
- Proximity to the border of another region

Guidance on Numbers of Trees per Acre to Plant for Crediting under this Area Reforestation Quantification Method

To determine how many trees to plant, the project must estimate what mortality of planted seedlings it will have. With professional tree planters, quality planting stock, growing conditions conducive to growth, and little animal damage, planting at 10' by 10' spacing (436 trees per acre) often results in more than 400 trees per acre surviving at Year 6.

In harsh site conditions, or planting at the wrong time of year, or not keeping seedlings cool and moist, or not planting with good contact between roots and soil, mortality of 30-50% is common. Planting by volunteer planters, or in sites with high animal browsing, can result in mortality greater than 80-90%. CFC recommends having someone with tree planting expertise manage the acquisition of planting stock and manage the planting process.

Methods for Determining Canopy Cover Growth or Tree Survival, and Progress Standards for Issuance of Credits at Years 4 and 6

Projects can choose one of two methods for determining canopy or tree survival – the Canopy Cover Growth Method or the Trees Per Acre Method

CANOPY COVER GROWTH METHOD

- Project provides images of the Project Area from any telemetry, imaging, remote sensing, i-Tree Canopy, or UAV service, such as Google Earth and estimate the area in tree canopy cover (acres).
    - Imaging from Google Earth with leaf-on may be used. Project operators will calculate the percent of canopy cover from the Google Earth imaging
    - Projects can use i-Tree Canopy and point sampling to calculate canopy cover. Using i-Tree Canopy, continue adding points until the standard error of the estimate for both the tree and non-tree cover is less than 5%. i-Tree Canopy will supply you with the standard errors.
    - If tree canopy cover is determined using another approach, such as image classification, a short description of the approach should be provided, as well as the QA/QC measures that were used. A tree cover classification accuracy assessment should be conducted, as with randomly placed points, and the percentage tree cover classification accuracy reported.

- Progress Requirements for Issuance of Credits in Years 4 and 6:

    - At Year 4, projects must show canopy coverage of at least 2.8% of the Project Area (400 trees per acre with an average canopy area of 3.14 square feet per tree (2-foot diameter of canopy) is 2.8% of an acre)
    - At Year 6, projects must show canopy coverage of at least 26% of the Project Area (400 trees with an average canopy area of 28.26 square feet per tree (6-foot diameter of canopy) is 26% of an acre)

Note: if projects exceed these Progress Requirements, they will not receive credits early or out of schedule. If projects fail to meet the Progress Requirements, they will not be eligible to request credits until they meet the Progress Requirements.

TREES PER ACRE METHOD

- Select 60 plots within the project area. This can be done using i-Tree Canopy and downloading plot center coordinates, or by travelling to the project area, choosing a random starting point, and walk a grid that locates at least 60 plots within the project area, well distributed across the project area. If locating the plots in the field, record the coordinates of each plot center. The Registry can provide examples of methods for determining the grid spacing and doing a random start.
- Mark each plot center with flagging, with the plot number written on the flagging. For a circular plot with 11.78' radius measured horizontally from plot center (not slope distance). This 11.78' radius makes a 1/100 acre plot.
- Count the number of live trees on the plot, counting only tree species that typically will reach 6" DBH by age 25 under the conditions present within the project area.

- Calculate the average number of trees per plot. Multiply the average number of trees per plot by 100. This is the average number of trees per acre present on the project.
- Divide the number of trees per acre on the project area by 400. This is the fraction canopy cover expected to be achieved by age 25.
- Multiply the fraction canopy cover expected to be achieved by age 25 by the live tree carbon stock (in metric tons of carbon per acre) at age 25 from the appropriate afforestation table in US Forest Service GTR NE-343. This is the carbon stock expected to be present at age 25. Multiply this expected carbon stock by 3.67 to calculate the expected carbon stock in metric tons CO_2e per acre.
- Report to the Registry:
  - The method used to locate plot centers.
  - Plot center coordinates.
  - Plot data, specifically the number of trees on each plot, by plot.
  - The average number of trees per acre calculated from plot data.

To count as fully stocked, at Year 6 (after five years of growth since planting) the project must have 400 surviving trees per acre of species that typically will reach 6" DBH by age 25 under the conditions present within the project area.

If 200-400 trees per acre are surviving at Year 6, predicted carbon sequestration is adjusted by multiplying the predicted carbon stock for full stocking at age 25 times the fraction (live trees per acre divided by 400). If the project has fewer than 200 trees per acre at Year 6, the CFC "single tree" quantification tool should be used.

QUANTIFICATION AT END OF YEAR 25

- Project may calculate Trees Per Acre as described above, or
- Project provides images of the Project Area from any telemetry, imaging, remote sensing, i-Tree Canopy, or UAV service, such as Google Earth and estimate the area in tree canopy cover (acres).
  - Projects can use i-Tree Canopy and point sampling to calculate canopy cover. Using i-Tree Canopy, continue adding points until the standard error of the estimate for both the tree and non-tree cover is less than 5%. I-Tree Canopy will supply you with the standard errors.
  - If tree canopy cover is determined using another approach, such as image classification, a short description of the approach should be provided, as well as the QA/QC measures that were used. A tree cover classification accuracy assessment should be conducted, as with randomly placed points, and the percentage tree cover classification accuracy reported.
  - Project calculates total CO_2 storage at end of Year 25 as follows:
    - Multiply the CI (carbon index times the acres of TC (tree canopy) in the Project Area.

References

Barr, Kanlaya J., Bruce A. Babcock, Miguel Carriquiry, Andre Nasser, and Leila Harfuch. 2010. "Agricultural Land Elasticities in the United States and Brazil." CARD Working Papers. 519. http://lib.dr.iastate.edu/card_workingpapers/519

Smith, James E.; Heath, Linda S.; Skog, Kenneth E.; Birdsey, Richard A. 2006. Methods for calculating forest ecosystem and harvested carbon with standard estimates for forest types of the United States. Gen. Tech. Rep. NE-343. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. 216 p.

Kendall County Forest Preserve District - Hoover Forest Preserve
25-Year Stand - Growth Rate Data
5.98 +/- Total Acres - Hardwood
2.15 +/- Total Acres - Pine Planting

Average DBH - All		9.27"
Average DBH - O		8.12"
Average DBH - W		12.56"
Average DBH - H		12.97"
Average DBH - P		14.56"

Species Code			
Oak sp.	O	Pine sp.	P
Walnut	W	Dead	X
Hickory	H	Other	

Average Spacing (all rows) - 12.54'
Average Height - 50.8' (students) v/s GIS 26.44'
Mortality Count (X) 442/1888 (23.4%)

Diameter measurement was circumference to nearest inch. DBH calculated by dividing circumference by 3.14

QC Tree Diameter changes

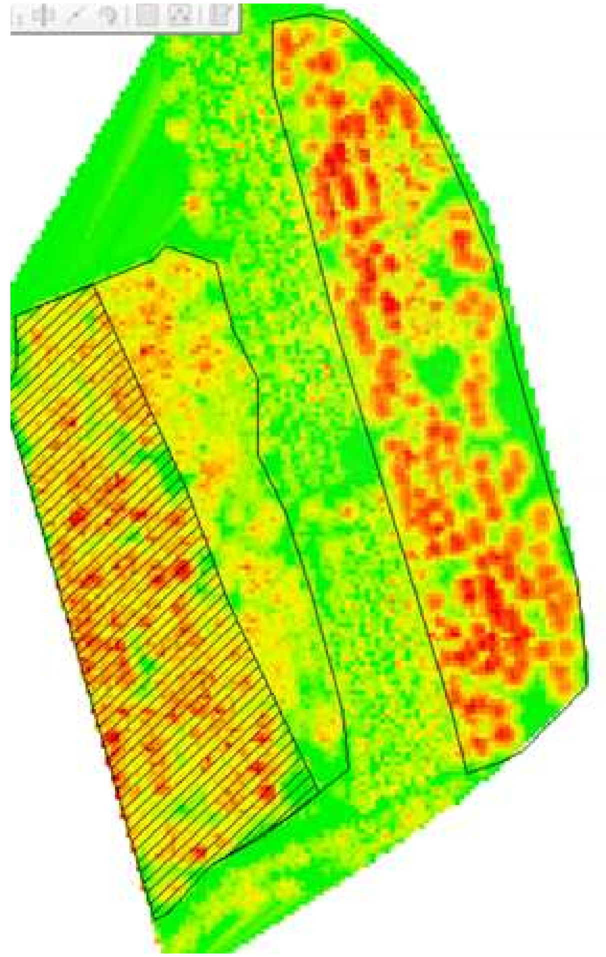
Row	Tree #	Change
24	40	Circumference from 188" to 18" to match nearby trees
10	1	Circumference from 132" to 32" to match nearby trees
19	15	Not changed: Reported circumference 84" nearby trees in range of 8" circumference

Biomass equations are general equations for pine and mixed hardwoods from:
Jenkins, Jennifer C.; Chojnacky, David C.; Heath, Linda S.; Birdsey, Richard A. 2004. Comprehensive database of diameter-based biomass regressions for North American tree species. Gen. Tech. Rep. NE-319. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. 45 p.

Area	MaxHeight	AverageHe	PatchArea_sqft	Patch_Acres
West	53.52417	26.43906	142,368	3.27
East	60.55237	24.35093	117,603	2.70
WestWest	60.55237	26.59026	93,479	2.15
Total			353,450	
		West + Eas	5.97	
GS google earth 2 June 2021				3.32

15.8 reported spacing
174 TPA based on reported spacing

15.7 spacing from data
177 predicted TPA from reported spacing
159 TPA from data



Total	379,060	189.53	190	8.83	21.5	159			
Check Total	379,060		tC/area	Acres	tC ABG live/ac	TPA	Belowgrou	Live tree tCO2/ac Above and belowground	
Rows 1-20		69.18	69	3.27	**21.2**	178	0.2	**93.1**	
GTR NE-343, Table B10, live tree, age 25					13.6		0.2	59.8	
				Note: acres subject to re-mapping					
GTR NE-343, Table B10, age 25				Other nonsoil carbon	4.6			16.9	
								109.9	Total sequestration per acre, at age 25
			DBH, in	Bark:DBH	Age	Growtl	Rings/inch		
		Median, all trees	8.92	0.05	25	0.17	5.9		
		67th percentile	11.15	0.05	25	0.21	4.7		
		90th percentile	14.97	0.05	25	0.28	3.5		
		Largest tree	26.75	0.05	25	0.51	2.0		

SUMMARY FOR HOOVER FP 1995 TREE PLANTING PROJECT - ROWS 1-20

Source	Check Total 379,060		tC/area	Acres	tC ABG live/ac	Trees Per Acre	Below Ground Ratio	Live tree tCO2/ac Above and belowground	
Oswego East HS Student Collected Data	**Rows 1-20**	69.18	69	3.27	**21.2**	178	0.2	**93.1**	
https://www.nrs.fs.fed.us/pubs/gtr/ne_gtr343.pdf	**GTR NE-343, Table B10, live tree, age 25**				**13.6**		0.2	*59.8*	*Live Tree tC02/acLiterature Comparison*
https://www.nrs.fs.fed.us/pubs/gtr/ne_gtr343.pdf	**GTR NE-343, Table B10, age 25**	Other nonsoil carbon			**4.6**			**16.9**	
								109.9	Total sequestration per acre, at age 25 (93.1 + 16.9)

	DBH, in	Bark: DBH ratio	Age	Growth ring width, in	Rings/inch
Median, all trees	8.92	0.05	25	0.17	5.9
67th percentile	11.15	0.05	25	0.21	4.7
90th percentile	14.97	0.05	25	0.28	3.5
Largest tree	26.75	0.05	25	0.51	2.0

Note: Acres subject to re-mapping completed in consultation with Lindsay Darling - The Morton Arboretum for Rows 1-20

Row #	Tree #	Species Co	Spacing Be	DBH	Height	Notes	Kg biomass	DBH Class
19	15	O	4	26.75159			2972.878	22
1	2	O	7	23.56688			2170.033	22
27	44	O	6	23.24841			2097.934	22
21	1	O		22.92994			2027.284	22
32	49	P	4	22.61146			1521.204	22
28	2	O	2	22.29299			1890.299	22
35	14	B	13	21.02		triple	1633.475	22
36	9	B	9	20.06		triple	1454.431	22
36	17	B	4	19.43		triple	1343.62	18
37	16	P	4	19.43		Double tre	1051.562	18
8	24	O	67	19.10828			1289.045	18
21	10	O	63	19.10828			1289.045	18
31	17	P	7	18.79			969.2077	18
38	1	P	X	18.79			969.2077	18
38	9	P	12	18.79			969.2077	18
38	16	P	42	18.79			969.2077	18
38	46	P	12	18.79		Double Tre	969.2077	18
32	18	P	9	18.78981			969.1837	18
32	46	P	30	18.78981			969.1837	18
25	19	O	8	18.47134			1184.958	18
20	1	O		18.15287			1134.866	18
32	12	P	25	18.15287			891.1242	18
32	22	P	12	18.15287			891.1242	18
32	37	P	12	18.15287			891.1242	18
32	44	P	6	18.15287			891.1242	18
32	47	P	12	18.15287			891.1242	18
32	60	P	64	18.15287			891.1242	18
34	37	P	63	18.15	61		890.7816	18
33	25	P	23	18.15	54		890.7816	18
34	16	P	46	18.15			890.7816	18
35	7	B	8	18.15		double	1134.421	18
13	49	O	15	17.83439			1086.061	18
34	9	P	16	17.83	62		853.0234	18
37	17	P	4	17.83			853.0234	18
37	49	P	4	17.83			853.0234	18
38	4	P	8	17.83			853.0234	18
38	36	P	14	17.83			853.0234	18
34	21	P	36	17.52			817.3606	18
38	7	P	7	17.52			817.3606	18
32	43	P	11	17.51592			816.8976	18
32	50	P	13	17.51592			816.8976	18
38	43	P	46	17.2	49		781.4852	18
33	9	P	7	17.2		dt	781.4852	18
33	43	P	33	17.2			781.4852	18
34	8	P	12	17.2			781.4852	18
38	6	P	7	17.2			781.4852	18
38	10	P	8	17.2			781.4852	18
9	30	O	25	17.19745			992.2688	18
27	40	O	10	17.19745			992.2688	18
34	30	P	12	16.88			746.5548	18
4	11	O	43	16.56051			903.4908	18
9	44	O	25	16.56051			903.4908	18
18	9	O	16	16.56051			903.4908	18
32	51	P	15	16.56051			712.6152	18
38	56	P	19	16.56	57		712.5618	18
33	39	P	6	16.56			712.5618	18
34	27	P	6	16.56			712.5618	18
37	20	P	2	16.56			712.5618	18
37	21	P	2	16.56			712.5618	18
38	35	P	43	16.56			712.5618	18
38	50	P	14	16.56			712.5618	18
38	54	P	29	16.56			712.5618	18
37	41	P	12	16.24	54		679.4984	18
31	47	P	12	16.24			679.4984	18
33	26	P	11	16.24			679.4984	18
34	3	P	10	16.24			679.4984	18
34	17	P	6	16.24			679.4984	18
37	15	P	6	16.24			679.4984	18
37	19	P	8	16.24			679.4984	18
37	33	P	7	16.24			679.4984	18
38	17	P	17	16.24			679.4984	18
38	26	P	8	16.24			679.4984	18
38	37	P	19	16.24			679.4984	18
38	57	P	17	16.24			679.4984	18
39	10	H	42	16.24			860.6858	18
3	20	O	10	15.92357			819.6368	14
19	2	O	10	15.92357		Double	819.6368	14
25	31	O	4	15.92357			819.6368	14
25	71	O	6	15.92357			819.6368	14
32	61	P	12	15.92357			647.71	14
38	24	P	49	15.92	53		647.3568	14
39	23	H	16	15.92	49		819.1809	14
33	13	P	10	15.92	48		647.3568	14
31	29	P	20	15.92			647.3568	14
33	5	P		15.92			647.3568	14
34	7	P	6	15.92			647.3568	14
34	24	P	12	15.92			647.3568	14
37	1	P		15.61	49		617.0911	14
39	4	H	13	15.61	46		780.136	14
31	25	P	29	15.61			617.0911	14
31	43	P	45	15.61			617.0911	14
33	37	P	1	15.61			617.0911	14
34	2	P	7	15.61			617.0911	14
34	6	P	6	15.61			617.0911	14
34	26	P	16	15.61			617.0911	14
34	29	P	9	15.61			617.0911	14
35	11	B	19	15.61			780.136	14
36	18	B	6	15.61		double	780.136	14
37	14	P	6	15.61			617.0911	14
37	18	P	5	15.61			617.0911	14
37	43	P	4	15.61			617.0911	14
38	59	P	6	15.61			617.0911	14
39	26	H	8	15.61			780.136	14
3	29	O	15	15.6051			779.5274	14
7	26	O	19	15.6051			779.5274	14
9	16	O	12	15.6051			779.5274	14

Max HT=62' =2.48' annual HT growth increment; 11 trees >50' HT deemed plausible

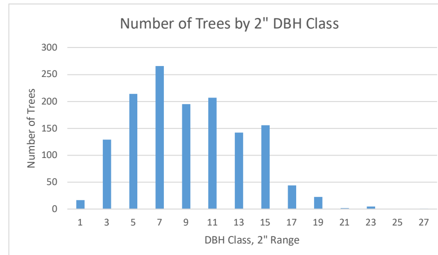
DBH >in	Count, tree	%, trees
24	1	0.07%
22	3	0.21%
20	8	0.57%
18	31	2.21%

Size class

Min DBH	Max DBH	Size class	Count
0	4	2	146
4	8	6	480
8	12	10	402
12	16	14	298
16	20	18	67
20	99	22	8

Size class

Min DBH	Max DBH	Size class	Count
0	2	1	17
2	4	3	129
4	6	5	214
6	8	7	266
8	10	9	195
10	12	11	207
12	14	13	142
14	16	15	156
16	18	17	44
18	20	19	23
20	22	21	2
22	24	23	5
24	26	25	0
26	28	27	1



9	43	O		36	15.6051		779.5274	14
32	1	P	X		15.6051		616.6191	14
32	30	P		10	15.6051		616.6191	14
32	36	P		10	15.6051		616.6191	14
32	41	P		40	15.6051		616.6191	14
32	53	P		12	15.6051		616.6191	14
31	4	P		27	15.29		586.7408	14
31	5	P		24	15.29		586.7408	14
31	14	P		17	15.29		586.7408	14
31	28	P		23	15.29		586.7408	14
31	44	P		10	15.29		586.7408	14
33	19	P		2	15.29		586.7408	14
33	27	P		10	15.29		586.7408	14
36	12	B		10	15.29	double	741.0205	14
36	21	B		13	15.29		741.0205	14
4	37	O		36	15.28662		740.6142	14
9	11	O		10	15.28662		740.6142	14
13	20	O		5	15.28662		740.6142	14
16	1	O			15.28662		740.6142	14
19	37	O		14	15.28662		740.6142	14
25	36	O		4	15.28662		740.6142	14
26	9	O		8	15.28662	Double	740.6142	14
27	58	O		30	15.28662		740.6142	14
32	4	P		3	15.28662		586.4255	14
32	10	P		105	15.28662		586.4255	14
31	27	P		6	14.97		557.2885	14
31	54	P		12	14.97		557.2885	14
33	38	P		2	14.97		557.2885	14
33	44	P		8	14.97		557.2885	14
33	50	P		4	14.97		557.2885	14
34	10	P		6	14.97		557.2885	14
34	23	P		10	14.97		557.2885	14
34	39	P		12	14.97		557.2885	14
36	11	B		15	14.97	double	703.1008	14
37	3	P		4	14.97		557.2885	14
38	8	P		6	14.97		557.2885	14
38	28	P		4	14.97		557.2885	14
38	47	P		12	14.97		557.2885	14
38	58	P		12	14.97		557.2885	14
39	20	H		8	14.97		703.1008	14
39	24	H		16	14.97		703.1008	14
1	15	H		7	14.96815		702.8853	14
17	47	O		2	14.96815		702.8853	14
21	6	O		67	14.96815		702.8853	14
25	70	O		6	14.96815		702.8853	14
31	53	P		12	14.65		528.7259	14
34	4	P		11	14.65		528.7259	14
35	9	B		15	14.65		666.3647	14
37	13	P		6	14.65		528.7259	14
37	34	P		7	14.65		528.7259	14
37	45	P		2	14.65		528.7259	14
37	46	P		7	14.65		528.7259	14
37	53	P		9	14.65		528.7259	14
38	27	P		6	14.65		528.7259	14
38	38	P		13	14.65		528.7259	14
38	45	P		8	14.65		528.7259	14
38	48	P		6	14.65		528.7259	14
38	60	P		6	14.65		528.7259	14
3	25	O		22	14.64968		666.3287	14
4	12	O		18	14.64968		666.3287	14
4	17	O		24	14.64968		666.3287	14
6	26	O		12	14.64968		666.3287	14
7	14	O		19	14.64968		666.3287	14
18	3	O		8	14.64968		666.3287	14
18	19	O		8	14.64968		666.3287	14
23	88	O		7	14.64968		666.3287	14
27	38	O		16	14.64968		666.3287	14
32	3	P		4	14.64968		528.6979	14
32	48	P		6	14.64968		528.6979	14
3	32	O		8	14.33121		630.9322	14
7	24	O		60	14.33121		630.9322	14
9	33	O		54	14.33121		630.9322	14
10	23	O		90	14.33121		630.9322	14
10	46	O		4	14.33121		630.9322	14
11	17	O		111	14.33121		630.9322	14
12	6	O		12	14.33121		630.9322	14
13	28	O		48	14.33121		630.9322	14
24	53	O		8	14.33121		630.9322	14
25	1	O	X		14.33121		630.9322	14
25	58	O		20	14.33121		630.9322	14
25	72	O		6	14.33121		630.9322	14
27	9	O		6	14.33121		630.9322	14
32	2	P		6	14.33121		501.1476	14
32	13	P		6	14.33121		501.1476	14
32	23	P		10	14.33121		501.1476	14
32	33	P		4	14.33121		501.1476	14
36	1	B		12	14.33	42 double	630.7999	14
31	13	P		30	14.33		501.0446	14
31	30	P		10	14.33		501.0446	14
31	35	P		6	14.33		501.0446	14
31	52	P		13	14.33		501.0446	14
33	10	P		9	14.33		501.0446	14
34	1	P			14.33		501.0446	14
34	28	P		4	14.33		501.0446	14
37	2	P		5	14.33		501.0446	14
37	12	P		9	14.33		501.0446	14
37	47	P		8	14.33		501.0446	14
38	3	P		12	14.33		501.0446	14
38	30	P		9	14.33		501.0446	14
38	44	P		6	14.33		501.0446	14
38	49	P		9	14.33		501.0446	14
39	18	H		14	14.33		630.7999	14
3	42	O		43	14.01274		596.6837	14
7	1	O	X		14.01274		596.6837	14
7	31	O		29	14.01274		596.6837	14
9	36	O		57	14.01274		596.6837	14
13	52	O		15	14.01274		596.6837	14

18	40	O		16	14.01274			596.6837	14
20	30	O		16	14.01274			596.6837	14
24	17	O		10	14.01274			596.6837	14
32	16	P		9	14.01274			474.462	14
37	27	P		23	14.01	60		474.2362	14
38	5	P		8	14.01	49		474.2362	14
31	3	P		8	14.01			474.2362	14
31	37	P		7	14.01			474.2362	14
33	2	P		8	14.01			474.2362	14
33	20	P		2	14.01			474.2362	14
33	32	P		11	14.01			474.2362	14
33	45	P		81	14.01			474.2362	14
33	49	P		8	14.01			474.2362	14
34	22	P		5	14.01			474.2362	14
37	22	P		2	14.01			474.2362	14
37	44	P		2	14.01			474.2362	14
38	19	P		11	14.01			474.2362	14
38	25	P		12	14.01			474.2362	14
1	8	O		9	13.69427			563.5706	14
2	18	O		17	13.69427			563.5706	14
2	24	O		13	13.69427			563.5706	14
3	31	O		42	13.69427			563.5706	14
4	33	O		24	13.69427			563.5706	14
5	18	O		23	13.69427			563.5706	14
7	28	O		40	13.69427			563.5706	14
8	9	O		93	13.69427			563.5706	14
15	35	O		1	13.69427			563.5706	14
28	46	O		14	13.69427			563.5706	14
31	16	P		4	13.69			448.2923	14
31	36	P		6	13.69			448.2923	14
33	28	P		2	13.69			448.2923	14
33	29	P		3	13.69			448.2923	14
34	5	P		12	13.69			448.2923	14
34	38	P		6	13.69			448.2923	14
35	3	B		6	13.69			563.1346	14
35	6	B		7	13.69			563.1346	14
36	5	B		6	13.69		double	563.1346	14
36	22	B		9	13.69		double	563.1346	14
37	32	P		7	13.69			448.2923	14
38	18	P		13	13.69			448.2923	14
38	29	P		4	13.69			448.2923	14
38	55	P		15	13.69			448.2923	14
39	21	H		9	13.69			563.1346	14
31	26	P		4	13.38	59		423.9753	14
37	10	P		6	13.38	52		423.9753	14
34	25	P		13	13.38	47		423.9753	14
35	5	B		12	13.38	43		531.9955	14
33	18	P		2	13.38			423.9753	14
33	33	P		4	13.38			423.9753	14
33	47	P		7	13.38			423.9753	14
34	11	P		7	13.38			423.9753	14
35	2	B		10	13.38			531.9955	14
35	16	B		12	13.38			531.9955	14
38	2	P		6	13.38			423.9753	14
38	31	P		7	13.38			423.9753	14
4	32	O		11	13.3758			531.5805	14
4	34	O		13	13.3758			531.5805	14
6	22	O		38	13.3758			531.5805	14
8	19	O		29	13.3758			531.5805	14
10	53	O		3	13.3758			531.5805	14
15	22	O		6	13.3758			531.5805	14
18	29	O		13	13.3758			531.5805	14
22	2			60	13.3758			531.5805	14
25	69	O		8	13.3758			531.5805	14
32	29	P		90	13.3758			423.651	14
32	42	P		6	13.3758			423.651	14
31	2	P		16	13.06			399.7078	14
31	49	P		8	13.06			399.7078	14
33	46	P		7	13.06			399.7078	14
35	4	B		6	13.06			500.9554	14
35	15	B		10	13.06			500.9554	14
39	32	H		31	13.06			500.9554	14
1	11	O		16	13.05732			500.7006	14
2	8	O		46	13.05732			500.7006	14
2	10	O		7	13.05732			500.7006	14
2	31	O		9	13.05732			500.7006	14
2	43	O		28	13.05732			500.7006	14
9	41	O		3	13.05732			500.7006	14
13	31	O		32	13.05732			500.7006	14
13	33	O		5	13.05732			500.7006	14
13	34	O		31	13.05732			500.7006	14
13	50	O		6	13.05732			500.7006	14
17	13	O		4	13.05732			500.7006	14
18	18	O		23	13.05732			500.7006	14
22	6			6	13.05732			500.7006	14
27	75	O		8	13.05732			500.7006	14
32	31	P		12	13.05732			399.5084	14
32	32	P		3	13.05732			399.5084	14
32	35	P		5	13.05732			399.5084	14
33	1	P			12.74	52		376.2786	14
33	36	P		2	12.74	46		376.2786	14
33	51	P		7	12.74			376.2786	14
35	19	B		8	12.74			471.0234	14
37	28	P		7	12.74			376.2786	14
37	48	P		2	12.74			376.2786	14
1	14	H		15	12.73885			470.9181	14
3	7	O		12	12.73885			470.9181	14
3	13	O		14	12.73885			470.9181	14
5	1	O	X		12.73885			470.9181	14
8	17	O		12	12.73885			470.9181	14
9	17	O		11	12.73885			470.9181	14
9	29	O		120	12.73885			470.9181	14
13	4	O		19	12.73885			470.9181	14
13	12	O		9	12.73885			470.9181	14
15	38	O		5	12.73885			470.9181	14
16	32	O		7	12.73885			470.9181	14
21	7	O		20	12.73885			470.9181	14

22	4			16	12.73885			470.9181	14
25	68	O		6	12.73885			470.9181	14
25	73	O		6	12.73885			470.9181	14
26	20	O		9	12.73885			470.9181	14
28	5	O		4	12.73885			470.9181	14
32	20	P		4	12.73885			376.1962	14
1	4	O		14	12.42038			442.22	14
1	9	O		9	12.42038			442.22	14
6	13	O		7	12.42038			442.22	14
6	14	O		29	12.42038			442.22	14
7	11	O		90	12.42038			442.22	14
7	30	O		12	12.42038			442.22	14
8	14	O		5	12.42038			442.22	14
8	16	O		17	12.42038			442.22	14
8	21	O		41	12.42038			442.22	14
9	40	O		9	12.42038			442.22	14
14	23	O		7	12.42038			442.22	14
15	5	O		5	12.42038			442.22	14
16	30	O		6	12.42038			442.22	14
17	34	O		13	12.42038			442.22	14
23	94	O		10	12.42038			442.22	14
26	22	O		15	12.42038			442.22	14
27	16	O		6	12.42038			442.22	14
27	26	O		4	12.42038			442.22	14
27	73	O		8	12.42038			442.22	14
27	82	O		4	12.42038			442.22	14
31	15	P		5	12.42	45		353.6789	14
31	45	P		8	12.42			353.6789	14
33	16	P		7	12.42			353.6789	14
33	34	P		4	12.42			353.6789	14
33	35	P		3	12.42			353.6789	14
33	48	P		6	12.42			353.6789	14
35	17	B		9	12.42			442.1862	14
35	23	B		7	12.42			442.1862	14
39	11	H		13	12.42			442.1862	14
2	34	O		6	12.10191			414.593	14
3	30	O		18	12.10191			414.593	14
4	4	O		18	12.10191			414.593	14
8	2	O		45	12.10191			414.593	14
10	7	O		20	12.10191			414.593	14
13	23	O		3	12.10191			414.593	14
17	12	O		31	12.10191			414.593	14
18	1	O	NA		12.10191			414.593	14
20	31	O		6	12.10191			414.593	14
24	26	O		7	12.10191			414.593	14
26	13	O		8	12.10191		Double	414.593	14
26	74	O		20	12.10191			414.593	14
27	71	O		10	12.10191			414.593	14
27	80	O		6	12.10191			414.593	14
32	15	P		5	12.10191			332.0272	14
36	15	B		13	12.1			414.4305	14
39	5	H		14	12.1			414.4305	14
39	19	H		6	12.1			414.4305	14
1	13	H		15	11.78344			388.0239	10
2	15	O		7	11.78344			388.0239	10
2	21	O		26	11.78344			388.0239	10
2	33	O		9	11.78344			388.0239	10
3	43	O		54	11.78344			388.0239	10
4	35	O		12	11.78344			388.0239	10
7	2	O		27	11.78344			388.0239	10
7	19	O		9	11.78344			388.0239	10
8	7	O		14	11.78344			388.0239	10
10	12	O		9	11.78344			388.0239	10
11	7	O		10	11.78344			388.0239	10
12	7	O		9	11.78344			388.0239	10
14	15	O		14	11.78344			388.0239	10
14	16	O		7	11.78344			388.0239	10
16	38	O		20	11.78344			388.0239	10
17	15	O		10	11.78344			388.0239	10
17	19	O		1	11.78344			388.0239	10
19	51	O		8	11.78344			388.0239	10
22	8			4	11.78344			388.0239	10
23	96	O		10	11.78344			388.0239	10
27	78	O		10	11.78344			388.0239	10
31	33	P		1	11.78			310.9311	10
31	46	P		10	11.78			310.9311	10
33	14	P		8	11.78			310.9311	10
33	17	P		4	11.78			310.9311	10
37	36	P		8	11.78			310.9311	10
37	50	P		6	11.78			310.9311	10
37	51	P		6	11.78			310.9311	10
37	52	P		6	11.78			310.9311	10
39	25	H		9	11.78			387.7426	10
1	1	O			11.46497			362.4989	10
2	11	O		19	11.46497			362.4989	10
2	19	O		23	11.46497			362.4989	10
4	3	O	X		11.46497			362.4989	10
4	16	O		9	11.46497			362.4989	10
5	4	O		18	11.46497			362.4989	10
5	17	O		38	11.46497			362.4989	10
7	13	O		27	11.46497			362.4989	10
7	21	O		20	11.46497			362.4989	10
8	5	O		7	11.46497			362.4989	10
8	8	O		7	11.46497			362.4989	10
8	23	O		16	11.46497			362.4989	10
9	14	O		7	11.46497			362.4989	10
9	37	O		18	11.46497			362.4989	10
9	46	O		18	11.46497			362.4989	10
10	9	O		8	11.46497			362.4989	10
10	24	O		12	11.46497			362.4989	10
14	1	O			11.46497			362.4989	10
16	15	O		14	11.46497			362.4989	10
16	23	O		6	11.46497			362.4989	10
18	26	O		5	11.46497			362.4989	10
18	28	O		5	11.46497			362.4989	10
24	10	O		8	11.46497			362.4989	10
25	75	O		6	11.46497			362.4989	10

25	79	O		6	11.46497			362.4989	10
27	76	O		12	11.46497			362.4989	10
27	85	O		6	11.46497			362.4989	10
28	19	O		2	11.46497			362.4989	10
31	1	P			11.46			290.7643	10
33	4	P		6	11.46			290.7643	10
39	3	H		10	11.46			362.1089	10
39	12	H		12	11.46			362.1089	10
35	20	B		11	11.15	49	double	338.2683	10
31	12	P		74	11.15			271.9832	10
31	50	P		2	11.15			271.9832	10
31	51	P		18	11.15			271.9832	10
33	3	P		8	11.15			271.9832	10
33	15	P		7	11.15			271.9832	10
35	8	B		14	11.15			338.2683	10
36	13	B		11	11.15			338.2683	10
39	2	H		6	11.15			338.2683	10
39	17	H		29	11.15			338.2683	10
2	14	O		17	11.1465			338.0045	10
2	29	O		7	11.1465			338.0045	10
2	30	O		12	11.1465			338.0045	10
2	32	O		9	11.1465			338.0045	10
3	5	O		11	11.1465			338.0045	10
3	27	O		20	11.1465			338.0045	10
6	16	O		31	11.1465			338.0045	10
9	15	O		20	11.1465			338.0045	10
10	38	O		4	11.1465			338.0045	10
13	9	O		9	11.1465			338.0045	10
15	46	O		5	11.1465			338.0045	10
15	47	O		4	11.1465			338.0045	10
15	48	O		7	11.1465			338.0045	10
16	21	O		16	11.1465			338.0045	10
17	53	O		1	11.1465			338.0045	10
19	13	O		6	11.1465			338.0045	10
21	5	O		29	11.1465			338.0045	10
25	2	O		8	11.1465			338.0045	10
25	78	O		6	11.1465			338.0045	10
25	83	O		6	11.1465			338.0045	10
26	18	O		20	11.1465			338.0045	10
27	84	O		8	11.1465			338.0045	10
32	17	P		4	11.1465			271.7752	10
31	19	P		1	10.83			253.3666	10
31	48	P		5	10.83			253.3666	10
33	30	P		7	10.83			253.3666	10
35	10	B		9	10.83			314.669	10
36	7	B		9	10.83			314.669	10
37	4	P		14	10.83			253.3666	10
39	22	H		12	10.83			314.669	10
6	18	O		16	10.82803			314.5266	10
11	1	O	X		10.82803			314.5266	10
13	22	O		4	10.82803			314.5266	10
15	39	O		8	10.82803			314.5266	10
17	33	O		13	10.82803			314.5266	10
18	41	O		21	10.82803			314.5266	10
22	9			4	10.82803			314.5266	10
23	85	O		17	10.82803			314.5266	10
23	89	O		9	10.82803			314.5266	10
23	100	O		8	10.82803			314.5266	10
24	11	O		5	10.82803			314.5266	10
25	16	O		48	10.82803			314.5266	10
25	84	O		6	10.82803			314.5266	10
27	19	O		4	10.82803			314.5266	10
27	72	O		6	10.82803			314.5266	10
27	81	O		8	10.82803			314.5266	10
28	11	O		6	10.82803			314.5266	10
28	27	X		28	10.82803			314.5266	10
32	14	P		4	10.82803			253.2541	10
32	52	P		2	10.82803			253.2541	10
31	32	P		1	10.51	43		235.5228	10
31	18	P		2	10.51			235.5228	10
31	34	P		7	10.51			235.5228	10
35	1	B			10.51			292.0818	10
35	12	B		12	10.51			292.0818	10
35	21	B		13	10.51			292.0818	10
35	22	B		14	10.51			292.0818	10
36	2	B		9	10.51			292.0818	10
36	6	B		8	10.51			292.0818	10
36	20	B		12	10.51			292.0818	10
39	1	H	X		10.51			292.0818	10
2	27	O		5	10.50955			292.0511	10
3	1	O	X		10.50955			292.0511	10
5	7	O		7	10.50955			292.0511	10
5	13	O		5	10.50955			292.0511	10
5	14	O		23	10.50955			292.0511	10
6	25	O		10	10.50955			292.0511	10
7	5	O		15	10.50955			292.0511	10
7	29	O		10	10.50955			292.0511	10
9	13	O		31	10.50955			292.0511	10
10	4	O		35	10.50955			292.0511	10
10	8	O		12	10.50955			292.0511	10
10	10	O		15	10.50955			292.0511	10
10	48	O		6	10.50955			292.0511	10
11	9	O		6	10.50955			292.0511	10
11	13	O		8	10.50955			292.0511	10
12	13	O		15	10.50955			292.0511	10
13	10	O		14	10.50955			292.0511	10
13	18	O		27	10.50955			292.0511	10
14	2	O		2	10.50955			292.0511	10
14	22	O		46	10.50955			292.0511	10
16	13	O		7	10.50955			292.0511	10
16	42	O		12	10.50955			292.0511	10
18	27	O		15	10.50955			292.0511	10
21	19	O		17	10.50955			292.0511	10
22	11			8	10.50955			292.0511	10
22	12			5	10.50955			292.0511	10
23	15	O		16	10.50955			292.0511	10
23	93	O		8	10.50955			292.0511	10

25	9	O		8	10.50955		292.0511	10
25	62	O		10	10.50955		292.0511	10
25	74	O		6	10.50955		292.0511	10
25	82	O		6	10.50955		292.0511	10
27	20	O		8	10.50955		292.0511	10
27	67	O		6	10.50955		292.0511	10
28	25	O		2	10.50955		292.0511	10
32	34	P		6	10.50955		235.4985	10
2	22	O		12	10.19108		270.5636	10
2	23	O		9	10.19108		270.5636	10
2	38	O		9	10.19108		270.5636	10
3	34	O		23	10.19108		270.5636	10
6	2	O		7	10.19108		270.5636	10
6	9	O		7	10.19108		270.5636	10
6	17	O		7	10.19108		270.5636	10
7	20	O		7	10.19108		270.5636	10
10	1	O	X		10.19108		270.5636	10
10	47	O		4	10.19108		270.5636	10
10	52	O		9	10.19108		270.5636	10
11	34	O		55	10.19108		270.5636	10
12	1	O	X		10.19108		270.5636	10
13	16	O		23	10.19108		270.5636	10
13	19	O		6	10.19108		270.5636	10
14	14	O		67	10.19108		270.5636	10
15	24	O		3	10.19108		270.5636	10
15	32	O		63	10.19108		270.5636	10
18	13	O		52	10.19108		270.5636	10
18	21	O		25	10.19108		270.5636	10
19	18	O		4	10.19108		270.5636	10
22	45			7	10.19108		270.5636	10
23	41	O		7	10.19108		270.5636	10
23	69	O		9	10.19108		270.5636	10
23	98	O		10	10.19108		270.5636	10
25	76	O		6	10.19108		270.5636	10
25	80	O		6	10.19108		270.5636	10
26	32	O		13	10.19108		270.5636	10
26	66	O		11	10.19108		270.5636	10
26	73	O		7	10.19108		270.5636	10
27	77	O		6	10.19108		270.5636	10
27	79	O		4	10.19108		270.5636	10
27	83	O		10	10.19108		270.5636	10
28	9	O		10	10.19108		270.5636	10
28	22	O		6	10.19108		270.5636	10
28	51	O		6	10.19108		270.5636	10
35	18	B		13	10.19		270.4922	10
37	11	P		9	10.19		218.4419	10
1	7	O		7	9.872611		250.0496	10
2	39	O		7	9.872611		250.0496	10
3	2	O		9	9.872611		250.0496	10
3	21	O		11	9.872611		250.0496	10
4	19	O		30	9.872611		250.0496	10
5	8	O		4	9.872611		250.0496	10
6	23	O		10	9.872611		250.0496	10
7	25	O		15	9.872611		250.0496	10
8	1	O	X		9.872611		250.0496	10
9	39	O		34	9.872611		250.0496	10
11	4	O		36	9.872611		250.0496	10
11	29	O		6	9.872611		250.0496	10
13	7	O		9	9.872611		250.0496	10
13	13	O		6	9.872611		250.0496	10
16	10	O		10	9.872611		250.0496	10
16	14	O		18	9.872611		250.0496	10
18	5	O		16	9.872611		250.0496	10
18	14	O		8	9.872611		250.0496	10
18	25			32	9.872611		250.0496	10
19	39	O		6	9.872611	Double	250.0496	10
19	41	O		4	9.872611		250.0496	10
20	39	O		3	9.872611		250.0496	10
23	6	O		16	9.872611		250.0496	10
25	24	O		54	9.872611		250.0496	10
25	77	O		6	9.872611		250.0496	10
25	81	O		6	9.872611		250.0496	10
26	16	O		24	9.872611		250.0496	10
26	25	O		5	9.872611		250.0496	10
27	70	O		6	9.872611		250.0496	10
28	23	O		6	9.872611		250.0496	10
28	49	O		6	9.872611		250.0496	10
31	7	P		15	9.87		202.1135	10
31	20	P		2	9.87		202.1135	10
35	13	B		7	9.87		249.8854	10
2	44	O		12	9.55414		230.4942	10
3	4	O		10	9.55414		230.4942	10
3	17	O		13	9.55414		230.4942	10
3	24	O		21	9.55414		230.4942	10
3	38	O		9	9.55414		230.4942	10
4	30	O	X		9.55414		230.4942	10
5	6	H		13	9.55414		230.4942	10
6	5	O		24	9.55414		230.4942	10
8	22	O		14	9.55414		230.4942	10
9	7	O		10	9.55414		230.4942	10
11	10	O		13	9.55414		230.4942	10
13	1	O	X		9.55414		230.4942	10
13	6	O		5	9.55414		230.4942	10
13	14	O		6	9.55414		230.4942	10
13	42	O		5	9.55414		230.4942	10
15	40	O		6	9.55414		230.4942	10
16	24	O		21	9.55414		230.4942	10
16	25	O		25	9.55414		230.4942	10
17	32	O		13	9.55414		230.4942	10
17	57	O		14	9.55414		230.4942	10
19	33	O		4	9.55414		230.4942	10
19	50	O		7	9.55414		230.4942	10
22	3			12	9.55414		230.4942	10
23	90	O		8	9.55414		230.4942	10
24	84	O		7	9.55414		230.4942	10
25	41	O		10	9.55414		230.4942	10
26	54	O		8	9.55414		230.4942	10

27	63	O	6	9.55414			230.4942	10
28	57	O	6	9.55414			230.4942	10
28	100	O	2	9.55414			230.4942	10
33	31	P	9	9.55			186.5274	10
36	3	B	11	9.55			230.2463	10
36	19	B	12	9.55			230.2463	10
36	10	B	12	9.24			212.1293	10
2	17	O	23	9.235669			211.8824	10
3	8	O	11	9.235669			211.8824	10
3	11	O	12	9.235669			211.8824	10
3	26	O	15	9.235669			211.8824	10
3	36	O	22	9.235669			211.8824	10
6	6	O	14	9.235669			211.8824	10
6	7	O	13	9.235669			211.8824	10
6	21	O	84	9.235669			211.8824	10
8	3	O	12	9.235669			211.8824	10
8	6	O	19	9.235669			211.8824	10
8	11	O	19	9.235669			211.8824	10
9	45	O	22	9.235669			211.8824	10
10	54	O	15	9.235669			211.8824	10
16	26	O	18	9.235669			211.8824	10
19	23	O	4	9.235669			211.8824	10
19	28	O	4	9.235669		Double	211.8824	10
22	7		24	9.235669			211.8824	10
22	15		6	9.235669			211.8824	10
23	3	O	4	9.235669			211.8824	10
23	10	O	7	9.235669			211.8824	10
23	30	O	9	9.235669			211.8824	10
23	59	O	13	9.235669			211.8824	10
24	31	O	7	9.235669			211.8824	10
24	36	O	8	9.235669			211.8824	10
24	63	O	10	9.235669			211.8824	10
26	5	O	21	9.235669			211.8824	10
27	7	O	6	9.235669			211.8824	10
27	8	O	14	9.235669			211.8824	10
27	13	O	4	9.235669			211.8824	10
27	48	O	4	9.235669			211.8824	10
28	6	O	4	9.235669			211.8824	10
28	21	O	8	9.235669			211.8824	10
28	28	O	6	9.235669			211.8824	10
28	81	O	6	9.235669			211.8824	10
31	6	P	31	8.92	60		157.9705	10
31	31	P	2	8.92			157.9705	10
37	35	P	7	8.92			157.9705	10
2	25	O	7	8.917197			194.1987	10
3	18	O	12	8.917197			194.1987	10
4	31	O	10	8.917197			194.1987	10
4	39	O	8	8.917197			194.1987	10
6	10	O	10	8.917197			194.1987	10
6	12	O	7	8.917197			194.1987	10
7	3	O	10	8.917197			194.1987	10
12	15	O	21	8.917197			194.1987	10
13	48	O	10	8.917197			194.1987	10
19	27	O	4	8.917197		Double	194.1987	10
19	34	O	14	8.917197			194.1987	10
19	46	O	2	8.917197			194.1987	10
21	24	O	46	8.917197			194.1987	10
23	1	O	3	8.917197			194.1987	10
23	5	O	6	8.917197			194.1987	10
24	4	O	4	8.917197			194.1987	10
24	48	O	6	8.917197			194.1987	10
24	83	O	6	8.917197			194.1987	10
26	3	O	7	8.917197			194.1987	10
26	67	O	6	8.917197			194.1987	10
27	11	O	4	8.917197			194.1987	10
27	22	O	4	8.917197			194.1987	10
27	49	O	4	8.917197			194.1987	10
28	35	O	6	8.917197			194.1987	10
28	75	O	6	8.917197			194.1987	10
28	89	O	4	8.917197			194.1987	10
1	6	O	14	8.598726			177.4277	10
3	14	O	7	8.598726			177.4277	10
5	2	O	16	8.598726			177.4277	10
7	27	O	24	8.598726			177.4277	10
8	12	O	7	8.598726			177.4277	10
9	10	O	4	8.598726			177.4277	10
10	50	O	20	8.598726			177.4277	10
12	3	O	12	8.598726			177.4277	10
12	12	O	33	8.598726			177.4277	10
13	2	O	6	8.598726			177.4277	10
13	41	O	6	8.598726			177.4277	10
13	45	O	9	8.598726			177.4277	10
14	6	O	21	8.598726			177.4277	10
16	27	O	25	8.598726			177.4277	10
16	37	O	9	8.598726			177.4277	10
16	39	O	9	8.598726			177.4277	10
16	41	O	9	8.598726			177.4277	10
17	20	O	9	8.598726			177.4277	10
21	12	O	15	8.598726			177.4277	10
21	18	O	34	8.598726			177.4277	10
22	1			8.598726			177.4277	10
22	14		4	8.598726			177.4277	10
23	18	O	6	8.598726			177.4277	10
23	25	O	16	8.598726			177.4277	10
23	36	O	13	8.598726			177.4277	10
23	40	O	5	8.598726			177.4277	10
24	5	O	10	8.598726			177.4277	10
24	13	O	2	8.598726			177.4277	10
25	37	O	6	8.598726			177.4277	10
27	10	O	8	8.598726			177.4277	10
27	29	O	4	8.598726			177.4277	10
27	34	O	6	8.598726			177.4277	10
28	30	O	6	8.598726			177.4277	10
2	9	O	9	8.280255			161.5533	10
7	15	O	16	8.280255			161.5533	10
9	5	O	11	8.280255			161.5533	10
15	18	O	36	8.280255			161.5533	10

15	53	O		31	8.280255			161.5533	10
17	25	O		3	8.280255			161.5533	10
17	37	O		5	8.280255			161.5533	10
18	33	O		8	8.280255			161.5533	10
19	32	O		4	8.280255			161.5533	10
22	22			5	8.280255			161.5533	10
23	31	O		7	8.280255			161.5533	10
23	86	O		8	8.280255			161.5533	10
24	32	O		8	8.280255			161.5533	10
24	69	O		8	8.280255			161.5533	10
25	32	O		6	8.280255			161.5533	10
25	67	O		6	8.280255			161.5533	10
26	1	O		26	8.280255			161.5533	10
26	19	O		18	8.280255			161.5533	10
26	30	O		12	8.280255			161.5533	10
26	42	O		10	8.280255			161.5533	10
26	52	O		8	8.280255			161.5533	10
27	27	O		6	8.280255			161.5533	10
27	36	O		6	8.280255			161.5533	10
27	61	O		12	8.280255			161.5533	10
27	65	O		8	8.280255			161.5533	10
28	8	O		2	8.280255			161.5533	10
28	65	O		50	8.280255			161.5533	10
28	72	O		6	8.280255			161.5533	10
36	4	B		12	8.28			161.5409	10
36	8	B		9	8.28			161.5409	10
36	16	B		14	8.28			161.5409	10
7	22	O		35	7.961783			146.5593	6
13	8	O		9	7.961783			146.5593	6
14	34	O		10	7.961783			146.5593	6
15	12	O		18	7.961783			146.5593	6
15	13	O		13	7.961783			146.5593	6
15	50	O		8	7.961783			146.5593	6
18	6	O		16	7.961783			146.5593	6
18	7	O		16	7.961783			146.5593	6
19	44	O		3	7.961783			146.5593	6
20	46	O		4	7.961783			146.5593	6
20	51	O		2	7.961783			146.5593	6
21	37	O		67	7.961783			146.5593	6
22	5			26	7.961783			146.5593	6
22	36			8	7.961783			146.5593	6
22	53			6	7.961783			146.5593	6
23	11	O		8	7.961783			146.5593	6
23	20	O		7	7.961783			146.5593	6
23	29	O		10	7.961783			146.5593	6
23	33	O		8	7.961783			146.5593	6
23	57	O		7	7.961783			146.5593	6
23	58	O		10	7.961783			146.5593	6
23	64	O		13	7.961783			146.5593	6
23	72	O		34	7.961783			146.5593	6
23	92	O		6	7.961783			146.5593	6
25	5	O		8	7.961783			146.5593	6
25	10	O		10	7.961783			146.5593	6
25	63	O		6	7.961783			146.5593	6
27	23	O		4	7.961783			146.5593	6
27	53	O		6	7.961783			146.5593	6
28	17	O		2	7.961783			146.5593	6
28	43	O		4	7.961783			146.5593	6
28	44	O		8	7.961783			146.5593	6
32	19	P		6	7.961783			119.7851	6
36	14	B		13	7.96	41		146.4778	6
3	6	O		11	7.643312			132.4293	6
3	33	O		10	7.643312			132.4293	6
6	8	O		50	7.643312			132.4293	6
6	11	O		19	7.643312			132.4293	6
6	19	O		29	7.643312			132.4293	6
7	4	O		15	7.643312			132.4293	6
9	6	O		9	7.643312			132.4293	6
10	11	O		15	7.643312			132.4293	6
10	44	O		66	7.643312			132.4293	6
14	41	O		112	7.643312			132.4293	6
15	23	O		6	7.643312			132.4293	6
15	44	O		26	7.643312			132.4293	6
15	55	O		5	7.643312			132.4293	6
16	46	O		12	7.643312			132.4293	6
19	8	O		4	7.643312			132.4293	6
19	21	O		2	7.643312		Double	132.4293	6
19	48	O		10	7.643312			132.4293	6
23	2	O		8	7.643312			132.4293	6
23	8	O		7	7.643312			132.4293	6
23	13	O		7	7.643312			132.4293	6
23	45	O		2	7.643312			132.4293	6
23	60	O		8	7.643312			132.4293	6
23	67	O		9	7.643312			132.4293	6
24	29	O		8	7.643312			132.4293	6
24	41	O		8	7.643312			132.4293	6
24	74	O		8	7.643312			132.4293	6
25	43	O		20	7.643312			132.4293	6
25	48	O		6	7.643312			132.4293	6
25	49	O		6	7.643312			132.4293	6
26	10	O		9	7.643312			132.4293	6
26	14	O		1	7.643312			132.4293	6
26	36	O		5	7.643312			132.4293	6
26	51	O		4	7.643312			132.4293	6
27	21	O		6	7.643312			132.4293	6
28	29	O		6	7.643312			132.4293	6
28	37	O		6	7.643312			132.4293	6
28	55	O		6	7.643312			132.4293	6
6	4	O		7	7.324841			119.1463	6
7	12	O		27	7.324841			119.1463	6
9	1	O	X		7.324841			119.1463	6
10	37	O		160	7.324841			119.1463	6
12	8	O		9	7.324841			119.1463	6
13	3	O		17	7.324841			119.1463	6
13	5	O		6	7.324841			119.1463	6
13	47	O		15	7.324841			119.1463	6
14	7	O		10	7.324841			119.1463	6

14	8	O	8	7.324841	119.1463	6
15	26	O	18	7.324841	119.1463	6
15	37	O	16	7.324841	119.1463	6
15	58	O	4	7.324841	119.1463	6
16	20	O	20	7.324841	119.1463	6
16	29	O	56	7.324841	119.1463	6
17	21	O	4	7.324841	119.1463	6
17	43	O	13	7.324841	119.1463	6
17	67	O	50	7.324841	119.1463	6
20	23	O	10	7.324841	119.1463	6
20	29	O		7.324841	119.1463	6
22	32		5	7.324841	119.1463	6
22	54		3	7.324841	119.1463	6
23	14	O	7	7.324841	119.1463	6
23	23	O	6	7.324841	119.1463	6
23	24	O	6	7.324841	119.1463	6
23	35	O	7	7.324841	119.1463	6
24	59	O	8	7.324841	119.1463	6
25	42	O	6	7.324841	119.1463	6
26	27	O	18	7.324841	119.1463	6
26	34	O	16	7.324841	119.1463	6
26	40	O	17	7.324841	119.1463	6
26	72	O	13	7.324841	119.1463	6
27	14	O	6	7.324841	119.1463	6
27	31	O	6	7.324841	119.1463	6
27	54	O	6	7.324841	119.1463	6
28	3	O	10	7.324841	119.1463	6
28	74	O	4	7.324841	119.1463	6
28	80	O	4	7.324841	119.1463	6
28	88	O	4	7.324841	119.1463	6
28	97	O	4	7.324841	119.1463	6
2	3	O		7.006369	106.6931	6
4	40	O	31	7.006369	106.6931	6
5	3	O	9	7.006369	106.6931	6
10	5	O	15	7.006369	106.6931	6
11	12	O	15	7.006369	106.6931	6
12	2	O	15	7.006369	106.6931	6
13	21	O	23	7.006369	106.6931	6
13	44	O	10	7.006369	106.6931	6
14	4	O	9	7.006369	106.6931	6
17	29	O	2	7.006369	106.6931	6
17	30	O	5	7.006369	106.6931	6
17	49	O	5	7.006369	106.6931	6
19	52	O	9	7.006369	106.6931	6
22	19		6	7.006369	106.6931	6
22	21		6	7.006369	106.6931	6
22	23		8	7.006369	106.6931	6
22	28		4	7.006369	106.6931	6
22	58		6	7.006369	106.6931	6
22	63		12	7.006369	106.6931	6
23	17	O	6	7.006369	106.6931	6
23	38	O	6	7.006369	106.6931	6
23	66	O	8	7.006369	106.6931	6
23	87	O	8	7.006369	106.6931	6
25	18	O	20	7.006369	106.6931	6
26	50	O	32	7.006369	106.6931	6
26	59	O	12	7.006369	106.6931	6
26	70	O	10	7.006369	106.6931	6
27	2	O	8	7.006369	106.6931	6
27	30	O	16	7.006369	106.6931	6
27	32	O	6	7.006369	106.6931	6
28	14	O	4	7.006369	106.6931	6
28	39	O	4	7.006369	106.6931	6
28	40	O	4	7.006369	106.6931	6
28	47	O	2	7.006369	106.6931	6
28	50	O	8	7.006369	106.6931	6
28	53	O	6	7.006369	106.6931	6
28	98	O	4	7.006369	106.6931	6
3	3	O	18	6.687898	95.05196	6
3	35	O	32	6.687898	95.05196	6
8	10	O	79	6.687898	95.05196	6
9	8	O	8	6.687898	95.05196	6
9	9	O	7	6.687898	95.05196	6
11	8	O	11	6.687898	95.05196	6
11	28	O	200	6.687898	95.05196	6
12	14	O	6	6.687898	95.05196	6
13	40	O	63	6.687898	95.05196	6
13	46	O	7	6.687898	95.05196	6
14	33	O	170	6.687898	95.05196	6
15	4	O	3	6.687898	95.05196	6
15	57	O	6	6.687898	95.05196	6
16	33	O	24	6.687898	95.05196	6
16	36	O	35	6.687898	95.05196	6
17	23	O	3	6.687898	95.05196	6
17	44	O	19	6.687898	95.05196	6
18	4	O	16	6.687898	95.05196	6
20	14	O	10	6.687898	95.05196	6
22	20		8	6.687898	95.05196	6
22	59		13	6.687898	95.05196	6
23	9	O	8	6.687898	95.05196	6
23	34	O	8	6.687898	95.05196	6
23	37	O	8	6.687898	95.05196	6
23	43	O	8	6.687898	95.05196	6
23	65	O	8	6.687898	95.05196	6
25	3	O	10	6.687898	95.05196	6
25	44	O	14	6.687898	95.05196	6
25	53	O	6	6.687898	95.05196	6
25	55	O	6	6.687898	95.05196	6
25	56	O	12	6.687898	95.05196	6
25	64	O	4	6.687898	95.05196	6
26	45	O	21	6.687898	95.05196	6
27	28	O	6	6.687898	95.05196	6
27	47	O	4	6.687898	95.05196	6
27	51	O	4	6.687898	95.05196	6
27	56	O	4	6.687898	95.05196	6
28	18	O	2	6.687898	95.05196	6
28	24	O	8	6.687898	95.05196	6

3	37	O	27	6.369427	84.20491	6
5	9	O	22	6.369427	84.20491	6
5	11	O	15	6.369427	84.20491	6
8	4	O	10	6.369427	84.20491	6
10	6	O	10	6.369427	84.20491	6
12	5	O	9	6.369427	84.20491	6
13	43	O	12	6.369427	84.20491	6
15	1	O	8	6.369427	84.20491	6
15	14	O	8	6.369427	84.20491	6
15	54	O	8	6.369427	84.20491	6
17	22	O	6	6.369427	84.20491	6
17	45	O	5	6.369427	84.20491	6
18	16	O	23	6.369427	84.20491	6
18	22	O	8	6.369427	84.20491	6
19	30	O	3	6.369427	84.20491	6
20	15	O	7	6.369427	84.20491	6
20	68	O	6	6.369427	84.20491	6
22	10		6	6.369427	84.20491	6
22	16		4	6.369427	84.20491	6
22	17		5	6.369427	84.20491	6
22	27		5	6.369427	84.20491	6
22	35		4	6.369427	84.20491	6
23	22	O	16	6.369427	84.20491	6
23	80	O	94	6.369427	84.20491	6
24	18	O	10	6.369427	84.20491	6
24	34	O		6.369427	84.20491	6
24	37	O	8	6.369427	84.20491	6
24	72	O	6	6.369427	84.20491	6
24	75	O	8	6.369427	84.20491	6
25	39	O	20	6.369427	84.20491	6
25	45	O	1	6.369427	84.20491	6
25	50	O	6	6.369427	84.20491	6
26	21	O	8	6.369427	84.20491	6
26	43	O	4	6.369427	84.20491	6
26	68	O	8	6.369427	84.20491	6
27	39	O	10	6.369427	84.20491	6
27	41	O	10	6.369427	84.20491	6
28	4	O	4	6.369427	84.20491	6
28	45	O	2	6.369427	84.20491	6
28	58	O	6	6.369427	84.20491	6
28	95	O	6	6.369427	84.20491	6
9	4	O	30	6.050955	74.13342	6
10	13	O	6	6.050955	74.13342	6
11	5	O	13	6.050955	74.13342	6
13	51	O	12	6.050955	74.13342	6
15	41	O	6	6.050955	74.13342	6
16	17	O	10	6.050955	74.13342	6
16	18	O	9	6.050955	74.13342	6
17	39	O	5	6.050955	74.13342	6
18	2	O	18	6.050955	74.13342	6
19	10	O	4	6.050955	74.13342	6
19	11	O	8	6.050955	74.13342	6
19	42	O	6	6.050955	74.13342	6
19	55	O	5	6.050955	74.13342	6
20	11	O	6	6.050955	74.13342	6
20	16	O	6	6.050955	74.13342	6
20	42	O	5	6.050955	74.13342	6
21	15	O	36	6.050955	74.13342	6
22	26		6	6.050955	74.13342	6
22	31		5	6.050955	74.13342	6
22	34		7	6.050955	74.13342	6
22	43		9	6.050955	74.13342	6
22	60		6	6.050955	74.13342	6
22	65		7	6.050955	74.13342	6
22	69		10	6.050955	74.13342	6
23	68	O	8	6.050955	74.13342	6
24	22	O	10	6.050955	74.13342	6
24	23	O	8	6.050955	74.13342	6
24	51	O	10	6.050955	74.13342	6
24	58	O	6	6.050955	74.13342	6
24	67	O	11	6.050955	74.13342	6
25	35	O	8	6.050955	74.13342	6
26	2	O	14	6.050955	74.13342	6
26	39	O	36	6.050955	74.13342	6
27	37	O	6	6.050955	74.13342	6
28	13	O	1	6.050955	74.13342	6
28	33	O	6	6.050955	74.13342	6
28	90	O	2	6.050955	74.13342	6
28	101	O	2	6.050955	74.13342	6
3	15	O	10	5.732484	64.81846	6
3	28	O	30	5.732484	64.81846	6
7	23	O	24	5.732484	64.81846	6
8	20	O	17	5.732484	64.81846	6
15	49	O	8	5.732484	64.81846	6
15	56	O	4	5.732484	64.81846	6
17	16	O	3	5.732484	64.81846	6
17	24	O	6	5.732484	64.81846	6
17	26	O	9	5.732484	64.81846	6
17	38	O	5	5.732484	64.81846	6
17	74	O	50	5.732484	64.81846	6
19	26	O	12	5.732484	64.81846	6
19	49	O	8	5.732484	64.81846	6
19	57	O	7	5.732484	64.81846	6
22	18		3	5.732484	64.81846	6
22	39		13	5.732484	64.81846	6
22	40		6	5.732484	64.81846	6
22	44		13	5.732484	64.81846	6
22	55		7	5.732484	64.81846	6
23	7	O	8	5.732484	64.81846	6
23	12	O	7	5.732484	64.81846	6
23	95	O	8	5.732484	64.81846	6
24	9	O	7	5.732484	64.81846	6
24	28	O		5.732484	64.81846	6
24	71	O	6	5.732484	64.81846	6
24	77	O	4	5.732484	64.81846	6
24	80	O	6	5.732484	64.81846	6
24	81	O	10	5.732484	64.81846	6

25	4	O		6	5.732484	64.81846	6
25	47	O		12	5.732484	64.81846	6
25	51	O		6	5.732484	64.81846	6
25	61	O		6	5.732484	64.81846	6
26	7	O		7	5.732484	64.81846	6
26	23	O		6	5.732484	64.81846	6
26	26	O		12	5.732484	64.81846	6
26	41	O		4	5.732484	64.81846	6
26	47	O		23	5.732484	64.81846	6
26	56	O		8	5.732484	64.81846	6
26	69	O		9	5.732484	64.81846	6
26	71	O		8	5.732484	64.81846	6
27	18	O		6	5.732484	64.81846	6
27	45	O		2	5.732484	64.81846	6
27	55	O		12	5.732484	64.81846	6
27	59	O		4	5.732484	64.81846	6
28	1	O	X		5.732484	64.81846	6
28	20	O		4	5.732484	64.81846	6
28	41	O		6	5.732484	64.81846	6
28	42	O		4	5.732484	64.81846	6
28	56	O		3	5.732484	64.81846	6
28	60	O		10	5.732484	64.81846	6
28	67	O		6	5.732484	64.81846	6
28	82	O		2	5.732484	64.81846	6
28	87	O		6	5.732484	64.81846	6
24	40	O		8	5.555556	59.96322	6
3	16	O		10	5.414013	56.24052	6
3	39	O		10	5.414013	56.24052	6
6	3	O		7	5.414013	56.24052	6
10	51	O		13	5.414013	56.24052	6
11	6	O		11	5.414013	56.24052	6
12	4	O		8	5.414013	56.24052	6
14	3	O		7	5.414013	56.24052	6
16	16	O		26	5.414013	56.24052	6
17	35	O		5	5.414013	56.24052	6
19	6	O		6	5.414013	56.24052	6
19	20	O		4	5.414013	56.24052	6
19	35	O		12	5.414013	56.24052	6
19	40	O		8	5.414013	56.24052	6
19	47	O		8	5.414013	56.24052	6
20	38	O			5.414013	56.24052	6
20	44	O		6	5.414013	56.24052	6
20	67	O		7	5.414013	56.24052	6
22	13			4	5.414013	56.24052	6
22	38			8	5.414013	56.24052	6
22	42			5	5.414013	56.24052	6
22	47			6	5.414013	56.24052	6
22	52			4	5.414013	56.24052	6
22	64			10	5.414013	56.24052	6
24	3	O		6	5.414013	56.24052	6
24	15	O		10	5.414013	56.24052	6
24	73	O		6	5.414013	56.24052	6
25	29	O		54	5.414013	56.24052	6
25	38	O		17	5.414013	56.24052	6
25	46	O		6	5.414013	56.24052	6
25	52	O		4	5.414013	56.24052	6
25	65	O		4	5.414013	56.24052	6
26	35	O		6	5.414013	56.24052	6
26	64	O		16	5.414013	56.24052	6
27	1	O	X		5.414013	56.24052	6
27	15	O		8	5.414013	56.24052	6
27	62	O		2	5.414013	56.24052	6
28	34	O		4	5.414013	56.24052	6
28	38	O		4	5.414013	56.24052	6
28	59	O		4	5.414013	56.24052	6
28	70	O		6	5.414013	56.24052	6
28	79	O		2	5.414013	56.24052	6
28	94	O		2	5.414013	56.24052	6
4	15	O		32	5.095541	48.3795	6
4	36	O		18	5.095541	48.3795	6
8	15	O		24	5.095541	48.3795	6
15	36	O		34	5.095541	48.3795	6
16	6	O		8	5.095541	48.3795	6
17	17	O		2	5.095541	48.3795	6
17	27	O		6	5.095541	48.3795	6
18	39	O		54	5.095541	48.3795	6
19	1	O		14	5.095541	48.3795	6
19	4	O		6	5.095541	48.3795	6
19	56	O		7	5.095541	48.3795	6
20	65	O		6	5.095541	48.3795	6
21	32	O		123	5.095541	48.3795	6
22	48			23	5.095541	48.3795	6
22	61			7	5.095541	48.3795	6
22	67			8	5.095541	48.3795	6
23	4	O		1	5.095541	48.3795	6
23	62	O		18	5.095541	48.3795	6
23	97	O		8	5.095541	48.3795	6
24	2	O		14	5.095541	48.3795	6
24	12	O		10	5.095541	48.3795	6
24	52	O		10	5.095541	48.3795	6
24	57	O		6	5.095541	48.3795	6
25	40	O		6	5.095541	48.3795	6
25	54	O		6	5.095541	48.3795	6
25	59	O		8	5.095541	48.3795	6
26	61	O		8	5.095541	48.3795	6
27	6	O		30	5.095541	48.3795	6
27	35	O		8	5.095541	48.3795	6
27	52	O		8	5.095541	48.3795	6
27	66	O		4	5.095541	48.3795	6
28	12	O		2	5.095541	48.3795	6
28	32	O		16	5.095541	48.3795	6
28	36	O		12	5.095541	48.3795	6
28	54	O		8	5.095541	48.3795	6
28	66	O		6	5.095541	48.3795	6
28	68	O		4	5.095541	48.3795	6
28	83	O		4	5.095541	48.3795	6
28	86	O		2	5.095541	48.3795	6

28	99	O		6	5.095541		48.3795	6
5	10	O		5	4.77707		41.21469	6
6	20	O		21	4.77707		41.21469	6
11	14	O		6	4.77707		41.21469	6
17	68	O		6	4.77707		41.21469	6
19	5	O		12	4.77707		41.21469	6
19	53	O		6	4.77707		41.21469	6
20	17	O		6	4.77707		41.21469	6
20	19	O		11	4.77707		41.21469	6
20	22	O		6	4.77707		41.21469	6
20	36	O			4.77707		41.21469	6
20	61	O		3	4.77707		41.21469	6
22	33			6	4.77707		41.21469	6
22	49			10	4.77707		41.21469	6
22	50			7	4.77707		41.21469	6
22	51			4	4.77707		41.21469	6
22	68			11	4.77707		41.21469	6
24	24	X		20	4.77707		41.21469	6
24	25	O			4.77707		41.21469	6
24	49	O		8	4.77707		41.21469	6
24	64	O		6	4.77707		41.21469	6
24	79	O		2	4.77707		41.21469	6
24	82	O		6	4.77707		41.21469	6
25	8	O		24	4.77707		41.21469	6
25	33	O		4	4.77707		41.21469	6
26	6	O		12	4.77707		41.21469	6
26	11	O		1	4.77707		41.21469	6
26	24	O		1	4.77707		41.21469	6
27	50	O		6	4.77707		41.21469	6
28	10	O		2	4.77707		41.21469	6
28	93	O		4	4.77707		41.21469	6
2	37	O		18	4.458599		34.72469	6
6	1	O	X		4.458599		34.72469	6
8	18	O		14	4.458599		34.72469	6
10	45	O		4	4.458599		34.72469	6
15	7	O		13	4.458599		34.72469	6
15	10	O		31	4.458599		34.72469	6
16	12	O		20	4.458599		34.72469	6
17	69	O		19	4.458599		34.72469	6
19	22	O		1	4.458599		34.72469	6
19	24	O		18	4.458599		34.72469	6
20	56	O		1	4.458599		34.72469	6
20	57	O		4	4.458599		34.72469	6
20	69	O		16	4.458599		34.72469	6
22	24			5	4.458599		34.72469	6
22	62			4	4.458599		34.72469	6
23	19	O		13	4.458599		34.72469	6
23	42	O		5	4.458599		34.72469	6
24	44	O		12	4.458599		34.72469	6
25	34	O		6	4.458599		34.72469	6
26	33	O		7	4.458599		34.72469	6
26	60	O		5	4.458599		34.72469	6
27	33	O		6	4.458599		34.72469	6
15	6	O		6	4.140127		28.88735	6
16	3	O		6	4.140127		28.88735	6
16	5	O		9	4.140127		28.88735	6
16	11	O		13	4.140127		28.88735	6
17	42	O		42	4.140127		28.88735	6
19	9	O		10	4.140127		28.88735	6
19	36	O		10	4.140127		28.88735	6
20	6	O			4.140127		28.88735	6
20	13	O		5	4.140127		28.88735	6
20	43	O		0.5	4.140127		28.88735	6
20	70	O		9	4.140127		28.88735	6
23	46	O		13	4.140127		28.88735	6
23	99	O		9	4.140127		28.88735	6
24	1	O			4.140127		28.88735	6
24	35	O		10	4.140127		28.88735	6
24	42	X		17	4.140127		28.88735	6
24	43	O			4.140127		28.88735	6
24	76	O		4	4.140127		28.88735	6
25	60	O		6	4.140127		28.88735	6
26	28	O		13	4.140127		28.88735	6
26	55	O		12	4.140127		28.88735	6
26	62	O		11	4.140127		28.88735	6
27	60	O		4	4.140127		28.88735	6
27	68	O		8	4.140127		28.88735	6
28	16	O		6	4.140127		28.88735	6
28	96	O		2	4.140127		28.88735	6
2	28	O		6	3.821656		23.67969	2
13	11	O		47	3.821656		23.67969	2
15	3	O		3	3.821656		23.67969	2
16	2	O		12	3.821656		23.67969	2
16	8	O		20	3.821656		23.67969	2
16	9	O		4	3.821656		23.67969	2
16	19	O		8	3.821656		23.67969	2
17	48	O		6	3.821656		23.67969	2
19	7	O		8	3.821656		23.67969	2
19	16	O		18	3.821656		23.67969	2
19	17	O		5	3.821656	Double	23.67969	2
20	32	O		2	3.821656		23.67969	2
20	54	O		6	3.821656		23.67969	2
20	64	O		7	3.821656		23.67969	2
23	16	O		8	3.821656		23.67969	2
23	91	O		9	3.821656		23.67969	2
24	6	O		6	3.821656		23.67969	2
24	16	O		10	3.821656		23.67969	2
25	30	O		4	3.821656		23.67969	2
26	29	O		11	3.821656		23.67969	2
26	57	O		4	3.821656		23.67969	2
26	63	O		7	3.821656		23.67969	2
27	24	O		4	3.821656		23.67969	2
28	48	O		6	3.821656		23.67969	2
28	52	O		6	3.821656		23.67969	2
28	84	O		2	3.821656		23.67969	2
28	92	O		4	3.821656		23.67969	2
6	24	O		50	3.503185		19.07779	2

15	21	O	26	3.503185	19.07779	2
16	40	O	6	3.503185	19.07779	2
17	62	O	6	3.503185	19.07779	2
19	19	O	4	3.503185	19.07779	2
20	10	O	6	3.503185	19.07779	2
20	20	O	6	3.503185	19.07779	2
20	45	O	3	3.503185	19.07779	2
20	58	O	5	3.503185	19.07779	2
20	62	O	4	3.503185	19.07779	2
22	57		4	3.503185	19.07779	2
23	63	O	9	3.503185	19.07779	2
24	8	X	16	3.503185	19.07779	2
24	55	O	8	3.503185	19.07779	2
24	62	O	8	3.503185	19.07779	2
26	17	O	7	3.503185	19.07779	2
26	31	O	7	3.503185	19.07779	2
27	64	O	10	3.503185	19.07779	2
28	78	O	2	3.503185	19.07779	2
28	85	O	2	3.503185	19.07779	2
28	91	O	2	3.503185	19.07779	2
28	102	O	2	3.503185	19.07779	2
2	26	O	7	3.184713	15.05669	2
3	41	O	15	3.184713	15.05669	2
5	12	O	15	3.184713	15.05669	2
16	4	O	7	3.184713	15.05669	2
17	36	O	5	3.184713	15.05669	2
17	46	O	12	3.184713	15.05669	2
17	58	O	4	3.184713	15.05669	2
17	59	O	6	3.184713	15.05669	2
19	25	O	8	3.184713	15.05669	2
19	29	O	10	3.184713	15.05669	2
19	45	O	2	3.184713	15.05669	2
19	54	O	4	3.184713	15.05669	2
20	7	O	5	3.184713	15.05669	2
20	12	O	8	3.184713	15.05669	2
20	40	O	1	3.184713	15.05669	2
20	59	O	6	3.184713	15.05669	2
22	25		6	3.184713	15.05669	2
22	41		7	3.184713	15.05669	2
22	46		4	3.184713	15.05669	2
22	56		2	3.184713	15.05669	2
22	66		3	3.184713	15.05669	2
23	44	O	5	3.184713	15.05669	2
23	56	O	1	3.184713	15.05669	2
24	47	X		3.184713	15.05669	2
24	68	O	8	3.184713	15.05669	2
24	78	O	4	3.184713	15.05669	2
26	12	O	6	3.184713	15.05669	2
27	46	O	6	3.184713	15.05669	2
27	69	O	6	3.184713	15.05669	2
28	73	O	10	3.184713	15.05669	2
6	15	O	31	2.866242	11.59019	2
15	2	O	16	2.866242	11.59019	2
17	55	O	6	2.866242	11.59019	2
17	61	O	9	2.866242	11.59019	2
22	37		9	2.866242	11.59019	2
24	7	O	6	2.866242	11.59019	2
24	39	O		2.866242	11.59019	2
24	50	O	8	2.866242	11.59019	2
24	56	O	7	2.866242	11.59019	2
27	12	O	6	2.866242	11.59019	2
27	17	O	6	2.866242	11.59019	2
13	32	O	10	2.547771	8.650743	2
15	33	O	1	2.547771	8.650743	2
15	34	O	10	2.547771	8.650743	2
16	22	O	5	2.547771	8.650743	2
16	31	O	12	2.547771	8.650743	2
17	28	O	2	2.547771	8.650743	2
17	51	O	26	2.547771	8.650743	2
19	31	O	4	2.547771	8.650743	2
19	38	O	16	2.547771	8.650743	2
20	9	O	6	2.547771	8.650743	2
20	55	O	3	2.547771	8.650743	2
20	60	O	3	2.547771	8.650743	2
20	63	O	5	2.547771	8.650743	2
20	66	O	5	2.547771	8.650743	2
23	28	O	27	2.547771	8.650743	2
26	58	O	10	2.547771	8.650743	2
26	65	O	10	2.547771	8.650743	2
27	25	O	14	2.547771	8.650743	2
28	71	O	4	2.547771	8.650743	2
28	76	O	6	2.547771	8.650743	2
3	40	O	16	2.229299	6.209125	2
15	45	O	9	2.229299	6.209125	2
17	54	O	2	2.229299	6.209125	2
19	3	O	18	2.229299	6.209125	2
19	12	O	8	2.229299	6.209125	2
19	14	O	5	2.229299	6.209125	2
20	8	O	6	2.229299	6.209125	2
20	21	O	6	2.229299	6.209125	2
20	49	O	5	2.229299	6.209125	2
22	30		4	2.229299	6.209125	2
24	14	O	7	2.229299	6.209125	2
24	30	O	8	2.229299	6.209125	2
24	54	O	6	2.229299	6.209125	2
24	70	O	14	2.229299	6.209125	2
25	66	O	2	2.229299	6.209125	2
27	43	O	6	2.229299	6.209125	2
27	74	O	10	2.229299	6.209125	2
28	7	O	2	2.229299	6.209125	2
28	15	O	2	2.229299	6.209125	2
9	2	O	5	1.910828	4.234168	2
17	60	O	5	1.910828	4.234168	2
19	43	O	6	1.910828	4.234168	2
20	18	O	6	1.910828	4.234168	2
20	41	O	7	1.910828	4.234168	2
20	47	O	1	1.910828	4.234168	2

20	48	O	5	1.910828	4.234168	2
20	53	O	4	1.910828	4.234168	2
23	32	O	6	1.910828	4.234168	2
27	42	O	4	1.910828	4.234168	2
17	14	O	9	1.592357	2.692288	2
17	52	O	9	1.592357	2.692288	2
20	52	O	3	1.592357	2.692288	2
22	29		3	1.592357	2.692288	2
23	39	O	5	1.592357	2.692288	2
28	69	O	6	1.592357	2.692288	2
17	18	O	13	1.273885	1.54684	2
20	50	O	1	0.955414	0.757112	2

Row #	Tree #	Species Code	Spacing Between (Nearest Foot)	DBH	Height	Notes	Kg biomass ABG
1	1	O		11.46			362
1	2	O	7	23.57			2170
1	4	O	14	12.42			442
1	6	O	14	8.60			177
1	7	O	7	9.87			250
1	8	O	9	13.69			564
1	9	O	9	12.42			442
1	11	O	16	13.06			501
1	13	H	15	11.78			388
1	14	H	15	12.74			471
1	15	H	7	14.97			703
2	3	O		7.01			107
2	8	O	46	13.06			501
2	9	O	9	8.28			162
2	10	O	7	13.06			501
2	11	O	19	11.46			362
2	14	O	17	11.15			338
2	15	O	7	11.78			388
2	17	O	23	9.24			212
2	18	O	17	13.69			564
2	19	O	23	11.46			362
2	21	O	26	11.78			388
2	22	O	12	10.19			271
2	23	O	9	10.19			271
2	24	O	13	13.69			564
2	25	O	7	8.92			194
2	26	O	7	3.18			15
2	27	O	5	10.51			292
2	28	O	6	3.82			24
2	29	O	7	11.15			338
2	30	O	12	11.15			338
2	31	O	9	13.06			501
2	32	O	9	11.15			338
2	33	O	9	11.78			388
2	34	O	6	12.10			415
2	37	O	18	4.46			35
2	38	O	9	10.19			271
2	39	O	7	9.87			250
2	43	O	28	13.06			501
2	44	O	12	9.55			230
3	1	O	X	10.51			292
3	2	O	9	9.87			250
3	3	O	18	6.69			95
3	4	O	10	9.55			230
3	5	O	11	11.15			338
3	6	O	11	7.64			132
3	7	O	12	12.74			471
3	8	O	11	9.24			212
3	11	O	12	9.24			212
3	13	O	14	12.74			471
3	14	O	7	8.60			177
3	15	O	10	5.73			65
3	16	O	10	5.41			56
3	17	O	13	9.55			230
3	18	O	12	8.92			194
3	20	O	10	15.92			820
3	21	O	11	9.87			250
3	24	O	21	9.55			230
3	25	O	22	14.65			666
3	26	O	15	9.24			212
3	27	O	20	11.15			338
3	28	O	30	5.73			65
3	29	O	15	15.61			780

Row #	Tree #	Species Code	DBH	Height	Notes
36	14	B	7.96	41	
31	6	P	8.92	60	
31	32	P	10.51	43	
35	20	B	11.15	49	double
31	15	P	12.42	45	
33	36	P	12.74	46	
33	1	P	12.74	52	
35	5	B	13.38	43	
34	25	P	13.38	47	
37	10	P	13.38	52	
31	26	P	13.38	59	
38	5	P	14.01	49	
37	27	P	14.01	60	
36	1	B	14.33	42	double
39	4	H	15.61	46	
37	1	P	15.61	49	
33	13	P	15.92	48	
39	23	H	15.92	49	
38	24	P	15.92	53	
37	41	P	16.24	54	
38	56	P	16.56	57	
38	43	P	17.20	49	
34	9	P	17.83	62	
33	25	P	18.15	54	
34	37	P	18.15	61	
Average HT				50.8	

Row	Kg Biomass, ABG	Count, trees	Avg DBH	Avg Spaci	Count trees for th	Avg D	Avg spacing for this row and above
1	6470.548182	11	13.1	11.3			
2	9117.698389	29	10.3	13.5			
3	10483.53962	37	9.6	17.6			
4	7203.502191	18	11.3	21.1			
5	3624.985609	15	9.1	15.2			
6	6022.492782	26	8.9	21.6			
7	8320.060326	23	11.0	25.0			
8	7692.686127	23	10.4	25.8			
9	10576.80811	27	11.0	22.9			
10	6768.27085	25	9.7	23.1			
11	3387.127513	15	8.9	35.8			
12	2591.961604	12	8.8	13.5			
13	11437.99886	39	9.8	14.8			
14	3388.126791	15	9.1	35.0	315	10.1	21.2
15	6497.025496	40	7.4	12.4			
16	6652.815582	39	7.5	14.6			
17	6303.424992	50	6.3	10.2			
18	7743.204261	24	10.3	18.3			
19	9710.95814	57	6.7	7.3			
20	4369.519909	57	4.7	5.5			
21	5938.314761	12	11.4	47.0			
22	7876.32404	69	6.5	8.1			
23	10898.94921	74	7.4	10.1			
24	7212.583037	72	6.0	8.1			
25	16013.92785	67	8.7	9.8			
26	8694.305117	64	7.0	11.2			
27	17708.80798	81	8.2	7.4			
28	12791.31588	95	6.8	5.6	801	7.5	12.5
31	17549.282	41	13.2	13.5			
32	23480.44904	39	15.1	15.7			
33	18483.44667	39	13.8	9.2			
34	16236.07551	26	15.6	14.0			
35	11973.87028	23	12.9	10.7			
36	10767.73326	22	12.2	10.4			
37	18994.179	36	14.4	6.5			
38	26069.88016	41	15.7	14.1			

m	b	0.90	38.06
se m	se b	0.45	6.45
r^2	se v	0.15	5.92
F	df	4.03	23.00
ss reg	ss resid	141.19	804.81

DBH	HT Est
8	45.2
9	46.1
10	47.0
11	47.9
12	48.8
13	49.7
14	50.6
15	51.5
16	52.4
17	53.3
18	54.2
19	55.1
20	56.0
21	56.9
22	57.8
23	58.7
24	59.6

3	30	O	18	12.10			415
3	31	O	42	13.69			564
3	32	O	8	14.33			631
3	33	O	10	7.64			132
3	34	O	23	10.19			271
3	35	O	32	6.69			95
3	36	O	22	9.24			212
3	37	O	27	6.37			84
3	38	O	9	9.55			230
3	39	O	10	5.41			56
3	40	O	16	2.23			6
3	41	O	15	3.18			15
3	42	O	43	14.01			597
3	43	O	54	11.78			388
4	3	O	X	11.46			362
4	4	O	18	12.10			415
4	11	O	43	16.56			903
4	12	O	18	14.65			666
4	15	O	32	5.10			48
4	16	O	9	11.46			362
4	17	O	24	14.65			666
4	19	O	30	9.87			250
4	30	O	X	9.55			230
4	31	O	10	8.92			194
4	32	O	11	13.38			532
4	33	O	24	13.69			564
4	34	O	13	13.38			532
4	35	O	12	11.78			388
4	36	O	18	5.10			48
4	37	O	36	15.29			741
4	39	O	8	8.92			194
4	40	O	31	7.01			107
5	1	O	X	12.74			471
5	2	O	16	8.60			177
5	3	O	9	7.01			107
5	4	O	18	11.46			362
5	6	H	13	9.55			230
5	7	O	7	10.51			292
5	8	O	4	9.87			250
5	9	O	22	6.37			84
5	10	O	5	4.78			41
5	11	O	15	6.37			84
5	12	O	15	3.18			15
5	13	O	5	10.51			292
5	14	O	23	10.51			292
5	17	O	38	11.46			362
5	18	O	23	13.69			564
6	1	O	X	4.46			35
6	2	O	7	10.19			271
6	3	O	7	5.41			56
6	4	O	7	7.32			119
6	5	O	24	9.55			230
6	6	O	14	9.24			212
6	7	O	13	9.24			212
6	8	O	50	7.64			132
6	9	O	7	10.19			271
6	10	O	10	8.92			194
6	11	O	19	7.64			132
6	12	O	7	8.92			194
6	13	O	7	12.42			442
6	14	O	29	12.42			442
6	15	O	31	2.87			12
6	16	O	31	11.15			338
6	17	O	7	10.19			271
6	18	O	16	10.83			315
6	19	O	29	7.64			132

	39	10007.52531	19	13.1	14.9	286	14.0	12.1	
Total		379059.7244	1402		15.7	1402			
Row		Kg biomass ABG/row	tC/row	tC/area	Acres	tC ABG live/ac	TPA		
	1	6,471	3.24						
	2	9,118	4.56						
	3	10,484	5.24						
	4	7,204	3.60						
	5	3,625	1.81						
	6	6,022	3.01						
	7	8,320	4.16						
	8	7,693	3.85						
	9	10,577	5.29						
	10	6,768	3.38						
	11	3,387	1.69						
	12	2,592	1.30						
	13	11,438	5.72						
	14	3,388	1.69	49	3.27	14.9	96		
	15	6,497	3.25						
	16	6,653	3.33						
	17	6,303	3.15						
	18	7,743	3.87						
	19	9,711	4.86						
	20	4,370	2.18						
	21	5,938	2.97						
	22	7,876	3.94						
	23	10,899	5.45						
	24	7,213	3.61						
	25	16,014	8.01						
	26	8,694	4.35						
	27	17,709	8.85						
	28	12,791	6.40	64					
	31	17,549	8.77						
	32	23,480	11.74						
	33	18,483	9.24						
	34	16,236	8.12						
	35	11,974	5.99						
	36	10,768	5.38						
	37	18,994	9.50						
	38	26,070	13.03						
	39	10,008	5.00	77					
Total		379,060	189.53	190	8.83	21.5	159		
Check Total		379,060		tC/area	Acres	tC ABG live/ac	TPA	Belowgrou	Live tree tCO2/ac Above and belowground
Rows 1-20			69.18	69	3.27	**21.2**	178	0.2	**93.1**
GTR NE-343, Table B10, live tree, age 25						13.6		0.2	59.8
					Note: acres subject to re-mapping				
GTR NE-343, Table B10, age 25				Other nonsoil carbon		4.6			16.9
									109.9 Total sequestration per acre, at age 25

	DBH, in	Bark:DBH	Age	Growt	Rings/inch
Median, all trees	8.92	0.05	25	0.17	5.9
67th percentile	11.15	0.05	25	0.21	4.7
90th percentile	14.97	0.05	25	0.28	3.5
Largest tree	26.75	0.05	25	0.51	2.0

6	20	O	21	4.78			41
6	21	O	84	9.24			212
6	22	O	38	13.38			532
6	23	O	10	9.87			250
6	24	O	50	3.50			19
6	25	O	10	10.51			292
6	26	O	12	14.65			666
7	1	O	X	14.01			597
7	2	O	27	11.78			388
7	3	O	10	8.92			194
7	4	O	15	7.64			132
7	5	O	15	10.51			292
7	11	O	90	12.42			442
7	12	O	27	7.32			119
7	13	O	27	11.46			362
7	14	O	19	14.65			666
7	15	O	16	8.28			162
7	19	O	9	11.78			388
7	20	O	7	10.19			271
7	21	O	20	11.46			362
7	22	O	35	7.96			147
7	23	O	24	5.73			65
7	24	O	60	14.33			631
7	25	O	15	9.87			250
7	26	O	19	15.61			780
7	27	O	24	8.60			177
7	28	O	40	13.69			564
7	29	O	10	10.51			292
7	30	O	12	12.42			442
7	31	O	29	14.01			597
8	1	O	X	9.87			250
8	2	O	45	12.10			415
8	3	O	12	9.24			212
8	4	O	10	6.37			84
8	5	O	7	11.46			362
8	6	O	19	9.24			212
8	7	O	14	11.78			388
8	8	O	7	11.46			362
8	9	O	93	13.69			564
8	10	O	79	6.69			95
8	11	O	19	9.24			212
8	12	O	7	8.60			177
8	14	O	5	12.42			442
8	15	O	24	5.10			48
8	16	O	17	12.42			442
8	17	O	12	12.74			471
8	18	O	14	4.46			35
8	19	O	29	13.38			532
8	20	O	17	5.73			65
8	21	O	41	12.42			442
8	22	O	14	9.55			230
8	23	O	16	11.46			362
8	24	O	67	19.11			1289
9	1	O	X	7.32			119
9	2	O	5	1.91			4
9	4	O	30	6.05			74
9	5	O	11	8.28			162
9	6	O	9	7.64			132
9	7	O	10	9.55			230
9	8	O	8	6.69			95
9	9	O	7	6.69			95
9	10	O	4	8.60			177
9	11	O	10	15.29			741
9	13	O	31	10.51			292
9	14	O	7	11.46			362
9	15	O	20	11.15			338

9	16	O	12	15.61			780
9	17	O	11	12.74			471
9	29	O	120	12.74			471
9	30	O	25	17.20			992
9	33	O	54	14.33			631
9	36	O	57	14.01			597
9	37	O	18	11.46			362
9	39	O	34	9.87			250
9	40	O	9	12.42			442
9	41	O	3	13.06			501
9	43	O	36	15.61			780
9	44	O	25	16.56			903
9	45	O	22	9.24			212
9	46	O	18	11.46			362
10	1	O	X	10.19			271
10	4	O	35	10.51			292
10	5	O	15	7.01			107
10	6	O	10	6.37			84
10	7	O	20	12.10			415
10	8	O	12	10.51			292
10	9	O	8	11.46			362
10	10	O	15	10.51			292
10	11	O	15	7.64			132
10	12	O	9	11.78			388
10	13	O	6	6.05			74
10	23	O	90	14.33			631
10	24	O	12	11.46			362
10	37	O	160	7.32			119
10	38	O	4	11.15			338
10	44	O	66	7.64			132
10	45	O	4	4.46			35
10	46	O	4	14.33			631
10	47	O	4	10.19			271
10	48	O	6	10.51			292
10	50	O	20	8.60			177
10	51	O	13	5.41			56
10	52	O	9	10.19			271
10	53	O	3	13.38			532
10	54	O	15	9.24			212
11	1	O	X	10.83			315
11	4	O	36	9.87			250
11	5	O	13	6.05			74
11	6	O	11	5.41			56
11	7	O	10	11.78			388
11	8	O	11	6.69			95
11	9	O	6	10.51			292
11	10	O	13	9.55			230
11	12	O	15	7.01			107
11	13	O	8	10.51			292
11	14	O	6	4.78			41
11	17	O	111	14.33			631
11	28	O	200	6.69			95
11	29	O	6	9.87			250
11	34	O	55	10.19			271
12	1	O	X	10.19			271
12	2	O	15	7.01			107
12	3	O	12	8.60			177
12	4	O	8	5.41			56
12	5	O	9	6.37			84
12	6	O	12	14.33			631
12	7	O	9	11.78			388
12	8	O	9	7.32			119
12	12	O	33	8.60			177
12	13	O	15	10.51			292
12	14	O	6	6.69			95
12	15	O	21	8.92			194

13	1	O	X	9.55			230
13	2	O	6	8.60			177
13	3	O	17	7.32			119
13	4	O	19	12.74			471
13	5	O	6	7.32			119
13	6	O	5	9.55			230
13	7	O	9	9.87			250
13	8	O	9	7.96			147
13	9	O	9	11.15			338
13	10	O	14	10.51			292
13	11	O	47	3.82			24
13	12	O	9	12.74			471
13	13	O	6	9.87			250
13	14	O	6	9.55			230
13	16	O	23	10.19			271
13	18	O	27	10.51			292
13	19	O	6	10.19			271
13	20	O	5	15.29			741
13	21	O	23	7.01			107
13	22	O	4	10.83			315
13	23	O	3	12.10			415
13	28	O	48	14.33			631
13	31	O	32	13.06			501
13	32	O	10	2.55			9
13	33	O	5	13.06			501
13	34	O	31	13.06			501
13	40	O	63	6.69			95
13	41	O	6	8.60			177
13	42	O	5	9.55			230
13	43	O	12	6.37			84
13	44	O	10	7.01			107
13	45	O	9	8.60			177
13	46	O	7	6.69			95
13	47	O	15	7.32			119
13	48	O	10	8.92			194
13	49	O	15	17.83			1086
13	50	O	6	13.06			501
13	51	O	12	6.05			74
13	52	O	15	14.01			597
14	1	O		11.46			362
14	2	O	2	10.51			292
14	3	O	7	5.41			56
14	4	O	9	7.01			107
14	6	O	21	8.60			177
14	7	O	10	7.32			119
14	8	O	8	7.32			119
14	14	O	67	10.19			271
14	15	O	14	11.78			388
14	16	O	7	11.78			388
14	22	O	46	10.51			292
14	23	O	7	12.42			442
14	33	O	170	6.69			95
14	34	O	10	7.96			147
14	41	O	112	7.64			132
15	1	O	8	6.37			84
15	2	O	16	2.87			12
15	3	O	3	3.82			24
15	4	O	3	6.69			95
15	5	O	5	12.42			442
15	6	O	6	4.14			29
15	7	O	13	4.46			35
15	10	O	31	4.46			35
15	12	O	18	7.96			147
15	13	O	13	7.96			147
15	14	O	8	6.37			84
15	18	O	36	8.28			162

15	21	O	26	3.50			19
15	22	O	6	13.38			532
15	23	O	6	7.64			132
15	24	O	3	10.19			271
15	26	O	18	7.32			119
15	32	O	63	10.19			271
15	33	O	1	2.55			9
15	34	O	10	2.55			9
15	35	O	1	13.69			564
15	36	O	34	5.10			48
15	37	O	16	7.32			119
15	38	O	5	12.74			471
15	39	O	8	10.83			315
15	40	O	6	9.55			230
15	41	O	6	6.05			74
15	44	O	26	7.64			132
15	45	O	9	2.23			6
15	46	O	5	11.15			338
15	47	O	4	11.15			338
15	48	O	7	11.15			338
15	49	O	8	5.73			65
15	50	O	8	7.96			147
15	53	O	31	8.28			162
15	54	O	8	6.37			84
15	55	O	5	7.64			132
15	56	O	4	5.73			65
15	57	O	6	6.69			95
15	58	O	4	7.32			119
16	1	O		15.29			741
16	2	O	12	3.82			24
16	3	O	6	4.14			29
16	4	O	7	3.18			15
16	5	O	9	4.14			29
16	6	O	8	5.10			48
16	8	O	20	3.82			24
16	9	O	4	3.82			24
16	10	O	10	9.87			250
16	11	O	13	4.14			29
16	12	O	20	4.46			35
16	13	O	7	10.51			292
16	14	O	18	9.87			250
16	15	O	14	11.46			362
16	16	O	26	5.41			56
16	17	O	10	6.05			74
16	18	O	9	6.05			74
16	19	O	8	3.82			24
16	20	O	20	7.32			119
16	21	O	16	11.15			338
16	22	O	5	2.55			9
16	23	O	6	11.46			362
16	24	O	21	9.55			230
16	25	O	25	9.55			230
16	26	O	18	9.24			212
16	27	O	25	8.60			177
16	29	O	56	7.32			119
16	30	O	6	12.42			442
16	31	O	12	2.55			9
16	32	O	7	12.74			471
16	33	O	24	6.69			95
16	36	O	35	6.69			95
16	37	O	9	8.60			177
16	38	O	20	11.78			388
16	39	O	9	8.60			177
16	40	O	6	3.50			19
16	41	O	9	8.60			177
16	42	O	12	10.51			292

16	46	O	12	7.64			132
17	12	O	31	12.10			415
17	13	O	4	13.06			501
17	14	O	9	1.59			3
17	15	O	10	11.78			388
17	16	O	3	5.73			65
17	17	O	2	5.10			48
17	18	O	13	1.27			2
17	19	O	1	11.78			388
17	20	O	9	8.60			177
17	21	O	4	7.32			119
17	22	O	6	6.37			84
17	23	O	3	6.69			95
17	24	O	6	5.73			65
17	25	O	3	8.28			162
17	26	O	9	5.73			65
17	27	O	6	5.10			48
17	28	O	2	2.55			9
17	29	O	2	7.01			107
17	30	O	5	7.01			107
17	32	O	13	9.55			230
17	33	O	13	10.83			315
17	34	O	13	12.42			442
17	35	O	5	5.41			56
17	36	O	5	3.18			15
17	37	O	5	8.28			162
17	38	O	5	5.73			65
17	39	O	5	6.05			74
17	42	O	42	4.14			29
17	43	O	13	7.32			119
17	44	O	19	6.69			95
17	45	O	5	6.37			84
17	46	O	12	3.18			15
17	47	O	2	14.97			703
17	48	O	6	3.82			24
17	49	O	5	7.01			107
17	51	O	26	2.55			9
17	52	O	9	1.59			3
17	53	O	1	11.15			338
17	54	O	2	2.23			6
17	55	O	6	2.87			12
17	57	O	14	9.55			230
17	58	O	4	3.18			15
17	59	O	6	3.18			15
17	60	O	5	1.91			4
17	61	O	9	2.87			12
17	62	O	6	3.50			19
17	67	O	50	7.32			119
17	68	O	6	4.78			41
17	69	O	19	4.46			35
17	74	O	50	5.73			65
18	1	O	NA	12.10			415
18	2	O	18	6.05			74
18	3	O	8	14.65			666
18	4	O	16	6.69			95
18	5	O	16	9.87			250
18	6	O	16	7.96			147
18	7	O	16	7.96			147
18	9	O	16	16.56			903
18	13	O	52	10.19			271
18	14	O	8	9.87			250
18	16	O	23	6.37			84
18	18	O	23	13.06			501
18	19	O	8	14.65			666
18	21	O	25	10.19			271
18	22	O	8	6.37			84

18	25		32	9.87			250
18	26	O	5	11.46			362
18	27	O	15	10.51			292
18	28	O	5	11.46			362
18	29	O	13	13.38			532
18	33	O	8	8.28			162
18	39	O	54	5.10			48
18	40	O	16	14.01			597
18	41	O	21	10.83			315
19	1	O	14	5.10			48
19	2	O	10	15.92		Double	820
19	3	O	18	2.23			6
19	4	O	6	5.10			48
19	5	O	12	4.78			41
19	6	O	6	5.41			56
19	7	O	8	3.82			24
19	8	O	4	7.64			132
19	9	O	10	4.14			29
19	10	O	4	6.05			74
19	11	O	8	6.05			74
19	12	O	8	2.23			6
19	13	O	6	11.15			338
19	14	O	5	2.23			6
19	15	O	4	26.75			2973
19	16	O	18	3.82			24
19	17	O	5	3.82		Double	24
19	18	O	4	10.19			271
19	19	O	4	3.50			19
19	20	O	4	5.41			56
19	21	O	2	7.64		Double	132
19	22	O	1	4.46			35
19	23	O	4	9.24			212
19	24	O	18	4.46			35
19	25	O	8	3.18			15
19	26	O	12	5.73			65
19	27	O	4	8.92		Double	194
19	28	O	4	9.24		Double	212
19	29	O	10	3.18			15
19	30	O	3	6.37			84
19	31	O	4	2.55			9
19	32	O	4	8.28			162
19	33	O	4	9.55			230
19	34	O	14	8.92			194
19	35	O	12	5.41			56
19	36	O	10	4.14			29
19	37	O	14	15.29			741
19	38	O	16	2.55			9
19	39	O	6	9.87		Double	250
19	40	O	8	5.41			56
19	41	O	4	9.87			250
19	42	O	6	6.05			74
19	43	O	6	1.91			4
19	44	O	3	7.96			147
19	45	O	2	3.18			15
19	46	O	2	8.92			194
19	47	O	8	5.41			56
19	48	O	10	7.64			132
19	49	O	8	5.73			65
19	50	O	7	9.55			230
19	51	O	8	11.78			388
19	52	O	9	7.01			107
19	53	O	6	4.78			41
19	54	O	4	3.18			15
19	55	O	5	6.05			74
19	56	O	7	5.10			48
19	57	O	7	5.73			65

20	1	O		18.15			1135
20	6	O		4.14			29
20	7	O	5	3.18			15
20	8	O	6	2.23			6
20	9	O	6	2.55			9
20	10	O	6	3.50			19
20	11	O	6	6.05			74
20	12	O	8	3.18			15
20	13	O	5	4.14			29
20	14	O	10	6.69			95
20	15	O	7	6.37			84
20	16	O	6	6.05			74
20	17	O	6	4.78			41
20	18	O	6	1.91			4
20	19	O	11	4.78			41
20	20	O	6	3.50			19
20	21	O	6	2.23			6
20	22	O	6	4.78			41
20	23	O	10	7.32			119
20	29	O		7.32			119
20	30	O	16	14.01			597
20	31	O	6	12.10			415
20	32	O	2	3.82			24
20	36	O		4.78			41
20	38	O		5.41			56
20	39	O	3	9.87			250
20	40	O	1	3.18			15
20	41	O	7	1.91			4
20	42	O	5	6.05			74
20	43	O	0.5	4.14			29
20	44	O	6	5.41			56
20	45	O	3	3.50			19
20	46	O	4	7.96			147
20	47	O	1	1.91			4
20	48	O	5	1.91			4
20	49	O	5	2.23			6
20	50	O	1	0.96			1
20	51	O	2	7.96			147
20	52	O	3	1.59			3
20	53	O	4	1.91			4
20	54	O	6	3.82			24
20	55	O	3	2.55			9
20	56	O	1	4.46			35
20	57	O	4	4.46			35
20	58	O	5	3.50			19
20	59	O	6	3.18			15
20	60	O	3	2.55			9
20	61	O	3	4.78			41
20	62	O	4	3.50			19
20	63	O	5	2.55			9
20	64	O	7	3.82			24
20	65	O	6	5.10			48
20	66	O	5	2.55			9
20	67	O	7	5.41			56
20	68	O	6	6.37			84
20	69	O	16	4.46			35
20	70	O	9	4.14			29
21	1	O		22.93			2027
21	5	O	29	11.15			338
21	6	O	67	14.97			703
21	7	O	20	12.74			471
21	10	O	63	19.11			1289
21	12	O	15	8.60			177
21	15	O	36	6.05			74
21	18	O	34	8.60			177
21	19	O	17	10.51			292

21	24	O	46	8.92			194
21	32	O	123	5.10			48
21	37	O	67	7.96			147
22	1			8.60			177
22	2		60	13.38			532
22	3		12	9.55			230
22	4		16	12.74			471
22	5		26	7.96			147
22	6		6	13.06			501
22	7		24	9.24			212
22	8		4	11.78			388
22	9		4	10.83			315
22	10		6	6.37			84
22	11		8	10.51			292
22	12		5	10.51			292
22	13		4	5.41			56
22	14		4	8.60			177
22	15		6	9.24			212
22	16		4	6.37			84
22	17		5	6.37			84
22	18		3	5.73			65
22	19		6	7.01			107
22	20		8	6.69			95
22	21		6	7.01			107
22	22		5	8.28			162
22	23		8	7.01			107
22	24		5	4.46			35
22	25		6	3.18			15
22	26		6	6.05			74
22	27		5	6.37			84
22	28		4	7.01			107
22	29		3	1.59			3
22	30		4	2.23			6
22	31		5	6.05			74
22	32		5	7.32			119
22	33		6	4.78			41
22	34		7	6.05			74
22	35		4	6.37			84
22	36		8	7.96			147
22	37		9	2.87			12
22	38		8	5.41			56
22	39		13	5.73			65
22	40		6	5.73			65
22	41		7	3.18			15
22	42		5	5.41			56
22	43		9	6.05			74
22	44		13	5.73			65
22	45		7	10.19			271
22	46		4	3.18			15
22	47		6	5.41			56
22	48		23	5.10			48
22	49		10	4.78			41
22	50		7	4.78			41
22	51		4	4.78			41
22	52		4	5.41			56
22	53		6	7.96			147
22	54		3	7.32			119
22	55		7	5.73			65
22	56		2	3.18			15
22	57		4	3.50			19
22	58		6	7.01			107
22	59		13	6.69			95
22	60		6	6.05			74
22	61		7	5.10			48
22	62		4	4.46			35
22	63		12	7.01			107

22	64		10	5.41			56
22	65		7	6.05			74
22	66		3	3.18			15
22	67		8	5.10			48
22	68		11	4.78			41
22	69		10	6.05			74
23	1	O	3	8.92			194
23	2	O	8	7.64			132
23	3	O	4	9.24			212
23	4	O	1	5.10			48
23	5	O	6	8.92			194
23	6	O	16	9.87			250
23	7	O	8	5.73			65
23	8	O	7	7.64			132
23	9	O	8	6.69			95
23	10	O	7	9.24			212
23	11	O	8	7.96			147
23	12	O	7	5.73			65
23	13	O	7	7.64			132
23	14	O	7	7.32			119
23	15	O	16	10.51			292
23	16	O	8	3.82			24
23	17	O	6	7.01			107
23	18	O	6	8.60			177
23	19	O	13	4.46			35
23	20	O	7	7.96			147
23	22	O	16	6.37			84
23	23	O	6	7.32			119
23	24	O	6	7.32			119
23	25	O	16	8.60			177
23	28	O	27	2.55			9
23	29	O	10	7.96			147
23	30	O	9	9.24			212
23	31	O	7	8.28			162
23	32	O	6	1.91			4
23	33	O	8	7.96			147
23	34	O	8	6.69			95
23	35	O	7	7.32			119
23	36	O	13	8.60			177
23	37	O	8	6.69			95
23	38	O	6	7.01			107
23	39	O	5	1.59			3
23	40	O	5	8.60			177
23	41	O	7	10.19			271
23	42	O	5	4.46			35
23	43	O	8	6.69			95
23	44	O	5	3.18			15
23	45	O	2	7.64			132
23	46	O	13	4.14			29
23	56	O	1	3.18			15
23	57	O	7	7.96			147
23	58	O	10	7.96			147
23	59	O	13	9.24			212
23	60	O	8	7.64			132
23	62	O	18	5.10			48
23	63	O	9	3.50			19
23	64	O	13	7.96			147
23	65	O	8	6.69			95
23	66	O	8	7.01			107
23	67	O	9	7.64			132
23	68	O	8	6.05			74
23	69	O	9	10.19			271
23	72	O	34	7.96			147
23	80	O	94	6.37			84
23	85	O	17	10.83			315
23	86	O	8	8.28			162

23	87	O	8	7.01			107
23	88	O	7	14.65			666
23	89	O	9	10.83			315
23	90	O	8	9.55			230
23	91	O	9	3.82			24
23	92	O	6	7.96			147
23	93	O	8	10.51			292
23	94	O	10	12.42			442
23	95	O	8	5.73			65
23	96	O	10	11.78			388
23	97	O	8	5.10			48
23	98	O	10	10.19			271
23	99	O	9	4.14			29
23	100	O	8	10.83			315
24	1	O		4.14			29
24	2	O	14	5.10			48
24	3	O	6	5.41			56
24	4	O	4	8.92			194
24	5	O	10	8.60			177
24	6	O	6	3.82			24
24	7	O	6	2.87			12
24	8	X	16	3.50			19
24	9	O	7	5.73			65
24	10	O	8	11.46			362
24	11	O	5	10.83			315
24	12	O	10	5.10			48
24	13	O	2	8.60			177
24	14	O	7	2.23			6
24	15	O	10	5.41			56
24	16	O	10	3.82			24
24	17	O	10	14.01			597
24	18	O	10	6.37			84
24	22	O	10	6.05			74
24	23	O	8	6.05			74
24	24	X	20	4.78			41
24	25	O		4.78			41
24	26	O	7	12.10			415
24	28	O		5.73			65
24	29	O	8	7.64			132
24	30	O	8	2.23			6
24	31	O	7	9.24			212
24	32	O	8	8.28			162
24	34	O		6.37			84
24	35	O	10	4.14			29
24	36	O	8	9.24			212
24	37	O	8	6.37			84
24	39	O		2.87			12
24	40	O	8	5.56			60
24	41	O	8	7.64			132
24	42	X	17	4.14			29
24	43	O		4.14			29
24	44	O	12	4.46			35
24	47	X		3.18			15
24	48	O	6	8.92			194
24	49	O	8	4.78			41
24	50	O	8	2.87			12
24	51	O	10	6.05			74
24	52	O	10	5.10			48
24	53	O	8	14.33			631
24	54	O	6	2.23			6
24	55	O	8	3.50			19
24	56	O	7	2.87			12
24	57	O	6	5.10			48
24	58	O	6	6.05			74
24	59	O	8	7.32			119
24	62	O	8	3.50			19

24	63	O	10	9.24			212
24	64	O	6	4.78			41
24	67	O	11	6.05			74
24	68	O	8	3.18			15
24	69	O	8	8.28			162
24	70	O	14	2.23			6
24	71	O	6	5.73			65
24	72	O	6	6.37			84
24	73	O	6	5.41			56
24	74	O	8	7.64			132
24	75	O	8	6.37			84
24	76	O	4	4.14			29
24	77	O	4	5.73			65
24	78	O	4	3.18			15
24	79	O	2	4.78			41
24	80	O	6	5.73			65
24	81	O	10	5.73			65
24	82	O	6	4.78			41
24	83	O	6	8.92			194
24	84	O	7	9.55			230
25	1	O	X	14.33			631
25	2	O	8	11.15			338
25	3	O	10	6.69			95
25	4	O	6	5.73			65
25	5	O	8	7.96			147
25	8	O	24	4.78			41
25	9	O	8	10.51			292
25	10	O	10	7.96			147
25	16	O	48	10.83			315
25	18	O	20	7.01			107
25	19	O	8	18.47			1185
25	24	O	54	9.87			250
25	29	O	54	5.41			56
25	30	O	4	3.82			24
25	31	O	4	15.92			820
25	32	O	6	8.28			162
25	33	O	4	4.78			41
25	34	O	6	4.46			35
25	35	O	8	6.05			74
25	36	O	4	15.29			741
25	37	O	6	8.60			177
25	38	O	17	5.41			56
25	39	O	20	6.37			84
25	40	O	6	5.10			48
25	41	O	10	9.55			230
25	42	O	6	7.32			119
25	43	O	20	7.64			132
25	44	O	14	6.69			95
25	45	O	1	6.37			84
25	46	O	6	5.41			56
25	47	O	12	5.73			65
25	48	O	6	7.64			132
25	49	O	6	7.64			132
25	50	O	6	6.37			84
25	51	O	6	5.73			65
25	52	O	4	5.41			56
25	53	O	6	6.69			95
25	54	O	6	5.10			48
25	55	O	6	6.69			95
25	56	O	12	6.69			95
25	58	O	20	14.33			631
25	59	O	8	5.10			48
25	60	O	6	4.14			29
25	61	O	6	5.73			65
25	62	O	10	10.51			292
25	63	O	6	7.96			147

25	64	O	4	6.69			95
25	65	O	4	5.41			56
25	66	O	2	2.23			6
25	67	O	6	8.28			162
25	68	O	6	12.74			471
25	69	O	8	13.38			532
25	70	O	6	14.97			703
25	71	O	6	15.92			820
25	72	O	6	14.33			631
25	73	O	6	12.74			471
25	74	O	6	10.51			292
25	75	O	6	11.46			362
25	76	O	6	10.19			271
25	77	O	6	9.87			250
25	78	O	6	11.15			338
25	79	O	6	11.46			362
25	80	O	6	10.19			271
25	81	O	6	9.87			250
25	82	O	6	10.51			292
25	83	O	6	11.15			338
25	84	O	6	10.83			315
26	1	O	26	8.28			162
26	2	O	14	6.05			74
26	3	O	7	8.92			194
26	5	O	21	9.24			212
26	6	O	12	4.78			41
26	7	O	7	5.73			65
26	9	O	8	15.29		Double	741
26	10	O	9	7.64			132
26	11	O	1	4.78			41
26	12	O	6	3.18			15
26	13	O	8	12.10		Double	415
26	14	O	1	7.64			132
26	16	O	24	9.87			250
26	17	O	7	3.50			19
26	18	O	20	11.15			338
26	19	O	18	8.28			162
26	20	O	9	12.74			471
26	21	O	8	6.37			84
26	22	O	15	12.42			442
26	23	O	6	5.73			65
26	24	O	1	4.78			41
26	25	O	5	9.87			250
26	26	O	12	5.73			65
26	27	O	18	7.32			119
26	28	O	13	4.14			29
26	29	O	11	3.82			24
26	30	O	12	8.28			162
26	31	O	7	3.50			19
26	32	O	13	10.19			271
26	33	O	7	4.46			35
26	34	O	16	7.32			119
26	35	O	6	5.41			56
26	36	O	5	7.64			132
26	39	O	36	6.05			74
26	40	O	17	7.32			119
26	41	O	4	5.73			65
26	42	O	10	8.28			162
26	43	O	4	6.37			84
26	45	O	21	6.69			95
26	47	O	23	5.73			65
26	50	O	32	7.01			107
26	51	O	4	7.64			132
26	52	O	8	8.28			162
26	54	O	8	9.55			230
26	55	O	12	4.14			29

26	56	O	8	5.73			65
26	57	O	4	3.82			24
26	58	O	10	2.55			9
26	59	O	12	7.01			107
26	60	O	5	4.46			35
26	61	O	8	5.10			48
26	62	O	11	4.14			29
26	63	O	7	3.82			24
26	64	O	16	5.41			56
26	65	O	10	2.55			9
26	66	O	11	10.19			271
26	67	O	6	8.92			194
26	68	O	8	6.37			84
26	69	O	9	5.73			65
26	70	O	10	7.01			107
26	71	O	8	5.73			65
26	72	O	13	7.32			119
26	73	O	7	10.19			271
26	74	O	20	12.10			415
27	1	O	X	5.41			56
27	2	O	8	7.01			107
27	6	O	30	5.10			48
27	7	O	6	9.24			212
27	8	O	14	9.24			212
27	9	O	6	14.33			631
27	10	O	8	8.60			177
27	11	O	4	8.92			194
27	12	O	6	2.87			12
27	13	O	4	9.24			212
27	14	O	6	7.32			119
27	15	O	8	5.41			56
27	16	O	6	12.42			442
27	17	O	6	2.87			12
27	18	O	6	5.73			65
27	19	O	4	10.83			315
27	20	O	8	10.51			292
27	21	O	6	7.64			132
27	22	O	4	8.92			194
27	23	O	4	7.96			147
27	24	O	4	3.82			24
27	25	O	14	2.55			9
27	26	O	4	12.42			442
27	27	O	6	8.28			162
27	28	O	6	6.69			95
27	29	O	4	8.60			177
27	30	O	16	7.01			107
27	31	O	6	7.32			119
27	32	O	6	7.01			107
27	33	O	6	4.46			35
27	34	O	6	8.60			177
27	35	O	8	5.10			48
27	36	O	6	8.28			162
27	37	O	6	6.05			74
27	38	O	16	14.65			666
27	39	O	10	6.37			84
27	40	O	10	17.20			992
27	41	O	10	6.37			84
27	42	O	4	1.91			4
27	43	O	6	2.23			6
27	44	O	6	23.25			2098
27	45	O	2	5.73			65
27	46	O	6	3.18			15
27	47	O	4	6.69			95
27	48	O	4	9.24			212
27	49	O	4	8.92			194
27	50	O	6	4.78			41

27	51	O	4	6.69			95
27	52	O	8	5.10			48
27	53	O	6	7.96			147
27	54	O	6	7.32			119
27	55	O	12	5.73			65
27	56	O	4	6.69			95
27	58	O	30	15.29			741
27	59	O	4	5.73			65
27	60	O	4	4.14			29
27	61	O	12	8.28			162
27	62	O	2	5.41			56
27	63	O	6	9.55			230
27	64	O	10	3.50			19
27	65	O	8	8.28			162
27	66	O	4	5.10			48
27	67	O	6	10.51			292
27	68	O	8	4.14			29
27	69	O	6	3.18			15
27	70	O	6	9.87			250
27	71	O	10	12.10			415
27	72	O	6	10.83			315
27	73	O	8	12.42			442
27	74	O	10	2.23			6
27	75	O	8	13.06			501
27	76	O	12	11.46			362
27	77	O	6	10.19			271
27	78	O	10	11.78			388
27	79	O	4	10.19			271
27	80	O	6	12.10			415
27	81	O	8	10.83			315
27	82	O	4	12.42			442
27	83	O	10	10.19			271
27	84	O	8	11.15			338
27	85	O	6	11.46			362
28	1	O	X	5.73			65
28	2	O	2	22.29			1890
28	3	O	10	7.32			119
28	4	O	4	6.37			84
28	5	O	4	12.74			471
28	6	O	4	9.24			212
28	7	O	2	2.23			6
28	8	O	2	8.28			162
28	9	O	10	10.19			271
28	10	O	2	4.78			41
28	11	O	6	10.83			315
28	12	O	2	5.10			48
28	13	O	1	6.05			74
28	14	O	4	7.01			107
28	15	O	2	2.23			6
28	16	O	6	4.14			29
28	17	O	2	7.96			147
28	18	O	2	6.69			95
28	19	O	2	11.46			362
28	20	O	4	5.73			65
28	21	O	8	9.24			212
28	22	O	6	10.19			271
28	23	O	6	9.87			250
28	24	O	8	6.69			95
28	25	O	2	10.51			292
28	27	X	28	10.83			315
28	28	O	6	9.24			212
28	29	O	6	7.64			132
28	30	O	6	8.60			177
28	32	O	16	5.10			48
28	33	O	6	6.05			74
28	34	O	4	5.41			56

28	35	O	6	8.92			194
28	36	O	12	5.10			48
28	37	O	6	7.64			132
28	38	O	4	5.41			56
28	39	O	4	7.01			107
28	40	O	4	7.01			107
28	41	O	6	5.73			65
28	42	O	4	5.73			65
28	43	O	4	7.96			147
28	44	O	8	7.96			147
28	45	O	2	6.37			84
28	46	O	14	13.69			564
28	47	O	2	7.01			107
28	48	O	6	3.82			24
28	49	O	6	9.87			250
28	50	O	8	7.01			107
28	51	O	6	10.19			271
28	52	O	6	3.82			24
28	53	O	6	7.01			107
28	54	O	8	5.10			48
28	55	O	6	7.64			132
28	56	O	3	5.73			65
28	57	O	6	9.55			230
28	58	O	6	6.37			84
28	59	O	4	5.41			56
28	60	O	10	5.73			65
28	65	O	50	8.28			162
28	66	O	6	5.10			48
28	67	O	6	5.73			65
28	68	O	4	5.10			48
28	69	O	6	1.59			3
28	70	O	6	5.41			56
28	71	O	4	2.55			9
28	72	O	6	8.28			162
28	73	O	10	3.18			15
28	74	O	4	7.32			119
28	75	O	6	8.92			194
28	76	O	6	2.55			9
28	78	O	2	3.50			19
28	79	O	2	5.41			56
28	80	O	4	7.32			119
28	81	O	6	9.24			212
28	82	O	2	5.73			65
28	83	O	4	5.10			48
28	84	O	2	3.82			24
28	85	O	2	3.50			19
28	86	O	2	5.10			48
28	87	O	6	5.73			65
28	88	O	4	7.32			119
28	89	O	4	8.92			194
28	90	O	2	6.05			74
28	91	O	2	3.50			19
28	92	O	4	3.82			24
28	93	O	4	4.78			41
28	94	O	2	5.41			56
28	95	O	6	6.37			84
28	96	O	2	4.14			29
28	97	O	4	7.32			119
28	98	O	4	7.01			107
28	99	O	6	5.10			48
28	100	O	2	9.55			230
28	101	O	2	6.05			74
28	102	O	2	3.50			19
31	1	P		11.46			291
31	2	P	16	13.06			400
31	3	P	8	14.01			474

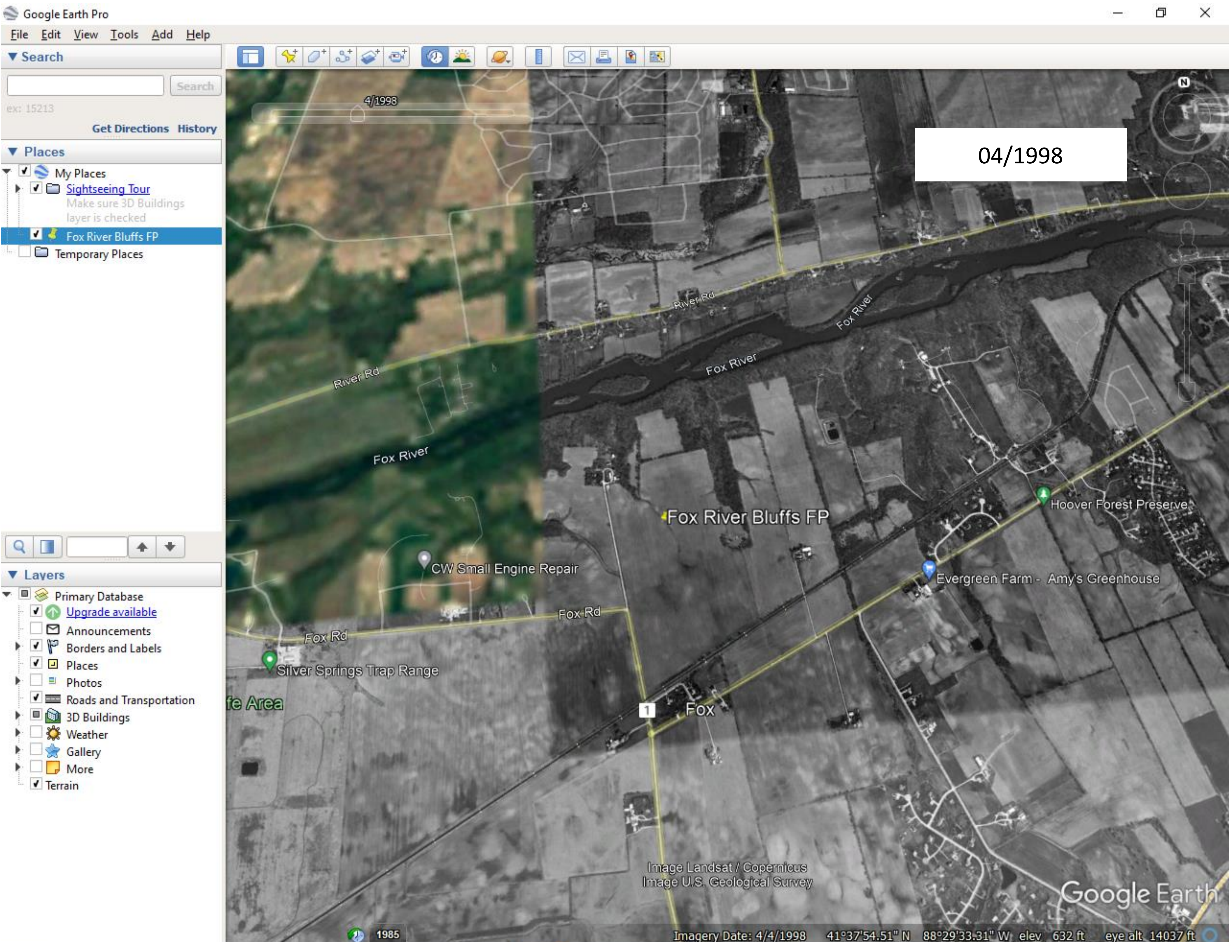
31	4	P	27	15.29			587
31	5	P	24	15.29			587
31	6	P	31	8.92	60		158
31	7	P	15	9.87			202
31	12	P	74	11.15			272
31	13	P	30	14.33			501
31	14	P	17	15.29			587
31	15	P	5	12.42	45		354
31	16	P	4	13.69			448
31	17	P	7	18.79			969
31	18	P	2	10.51			236
31	19	P	1	10.83			253
31	20	P	2	9.87			202
31	25	P	29	15.61			617
31	26	P	4	13.38	59		424
31	27	P	6	14.97			557
31	28	P	23	15.29			587
31	29	P	20	15.92			647
31	30	P	10	14.33			501
31	31	P	2	8.92			158
31	32	P	1	10.51	43		236
31	33	P	1	11.78			311
31	34	P	7	10.51			236
31	35	P	6	14.33			501
31	36	P	6	13.69			448
31	37	P	7	14.01			474
31	43	P	45	15.61			617
31	44	P	10	15.29			587
31	45	P	8	12.42			354
31	46	P	10	11.78			311
31	47	P	12	16.24			679
31	48	P	5	10.83			253
31	49	P	8	13.06			400
31	50	P	2	11.15			272
31	51	P	18	11.15			272
31	52	P	13	14.33			501
31	53	P	12	14.65			529
31	54	P	12	14.97			557
32	1	P	X	15.61			617
32	2	P	6	14.33			501
32	3	P	4	14.65			529
32	4	P	3	15.29			586
32	10	P	105	15.29			586
32	12	P	25	18.15			891
32	13	P	6	14.33			501
32	14	P	4	10.83			253
32	15	P	5	12.10			332
32	16	P	9	14.01			474
32	17	P	4	11.15			272
32	18	P	9	18.79			969
32	19	P	6	7.96			120
32	20	P	4	12.74			376
32	22	P	12	18.15			891
32	23	P	10	14.33			501
32	29	P	90	13.38			424
32	30	P	10	15.61			617
32	31	P	12	13.06			400
32	32	P	3	13.06			400
32	33	P	4	14.33			501
32	34	P	6	10.51			235
32	35	P	5	13.06			400
32	36	P	10	15.61			617
32	37	P	12	18.15			891
32	41	P	40	15.61			617
32	42	P	6	13.38			424
32	43	P	11	17.52			817

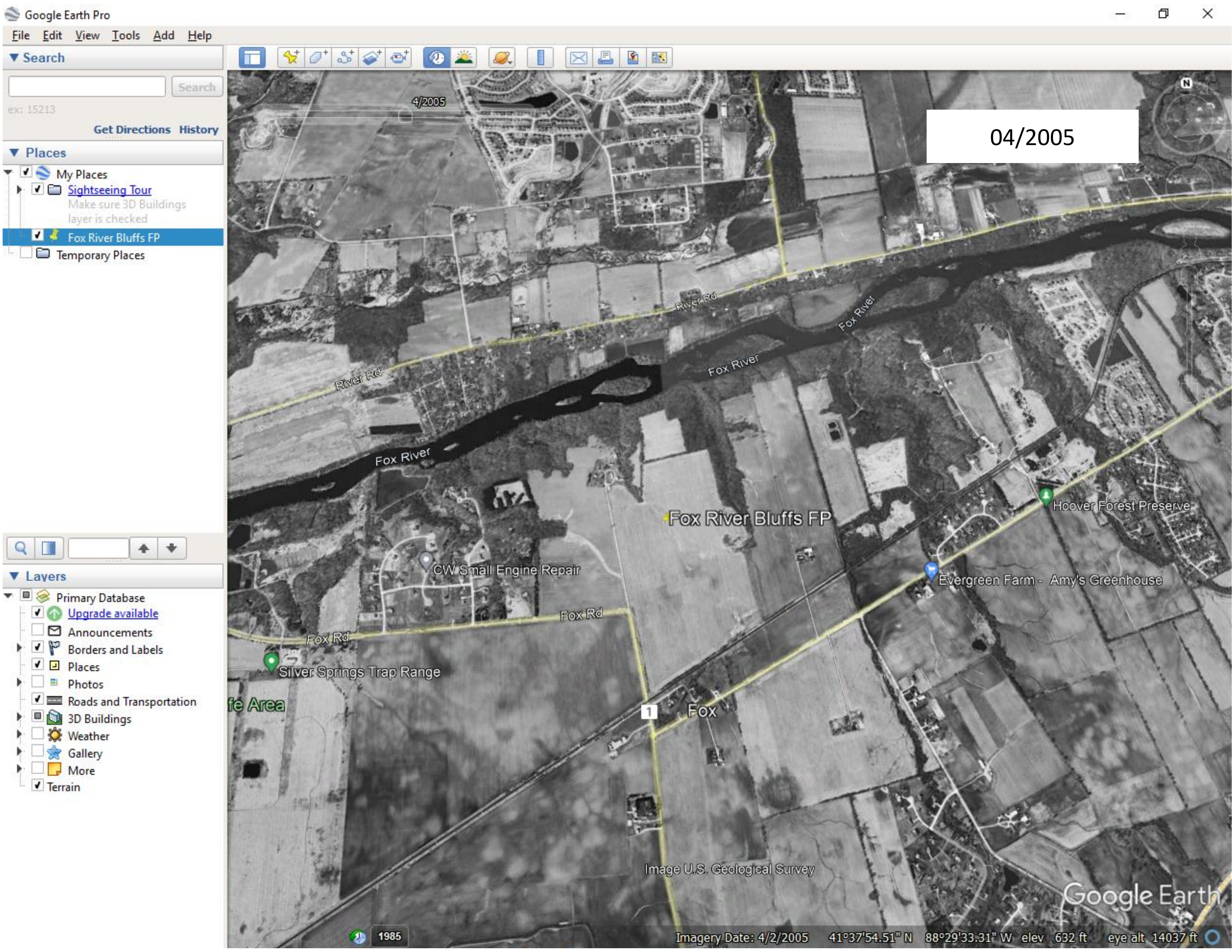
32	44	P	6	18.15			891
32	46	P	30	18.79			969
32	47	P	12	18.15			891
32	48	P	6	14.65			529
32	49	P	4	22.61			1521
32	50	P	13	17.52			817
32	51	P	15	16.56			713
32	52	P	2	10.83			253
32	53	P	12	15.61			617
32	60	P	64	18.15			891
32	61	P	12	15.92			648
33	1	P		12.74	52		376
33	2	P	8	14.01			474
33	3	P	8	11.15			272
33	4	P	6	11.46			291
33	5	P		15.92			647
33	9	P	7	17.20		dt	781
33	10	P	9	14.33			501
33	13	P	10	15.92	48		647
33	14	P	8	11.78			311
33	15	P	7	11.15			272
33	16	P	7	12.42			354
33	17	P	4	11.78			311
33	18	P	2	13.38			424
33	19	P	2	15.29			587
33	20	P	2	14.01			474
33	25	P	23	18.15	54		891
33	26	P	11	16.24			679
33	27	P	10	15.29			587
33	28	P	2	13.69			448
33	29	P	3	13.69			448
33	30	P	7	10.83			253
33	31	P	9	9.55			187
33	32	P	11	14.01			474
33	33	P	4	13.38			424
33	34	P	4	12.42			354
33	35	P	3	12.42			354
33	36	P	2	12.74	46		376
33	37	P	1	15.61			617
33	38	P	2	14.97			557
33	39	P	6	16.56			713
33	43	P	33	17.20			781
33	44	P	8	14.97			557
33	45	P	81	14.01			474
33	46	P	7	13.06			400
33	47	P	7	13.38			424
33	48	P	6	12.42			354
33	49	P	8	14.01			474
33	50	P	4	14.97			557
33	51	P	7	12.74			376
34	1	P		14.33			501
34	2	P	7	15.61			617
34	3	P	10	16.24			679
34	4	P	11	14.65			529
34	5	P	12	13.69			448
34	6	P	6	15.61			617
34	7	P	6	15.92			647
34	8	P	12	17.20			781
34	9	P	16	17.83	62		853
34	10	P	6	14.97			557
34	11	P	7	13.38			424
34	16	P	46	18.15			891
34	17	P	6	16.24			679
34	21	P	36	17.52			817
34	22	P	5	14.01			474
34	23	P	10	14.97			557

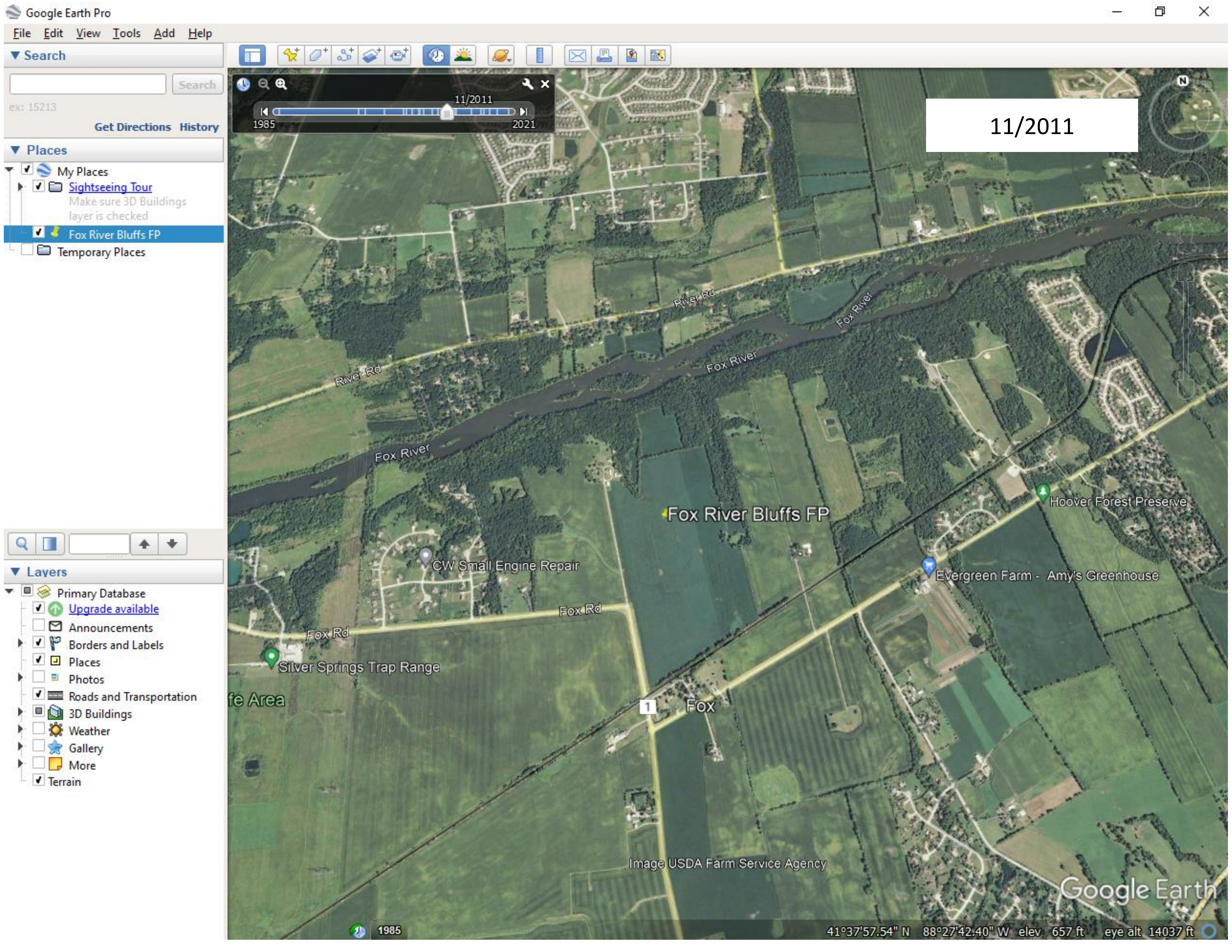
34	24	P	12	15.92			647
34	25	P	13	13.38	47		424
34	26	P	16	15.61			617
34	27	P	6	16.56			713
34	28	P	4	14.33			501
34	29	P	9	15.61			617
34	30	P	12	16.88			747
34	37	P	63	18.15	61		891
34	38	P	6	13.69			448
34	39	P	12	14.97			557
35	1	B		10.51			292
35	2	B	10	13.38			532
35	3	B	6	13.69			563
35	4	B	6	13.06			501
35	5	B	12	13.38	43		532
35	6	B	7	13.69			563
35	7	B	8	18.15		double	1134
35	8	B	14	11.15			338
35	9	B	15	14.65			666
35	10	B	9	10.83			315
35	11	B	19	15.61			780
35	12	B	12	10.51			292
35	13	B	7	9.87			250
35	14	B	13	21.02		triple	1633
35	15	B	10	13.06			501
35	16	B	12	13.38			532
35	17	B	9	12.42			442
35	18	B	13	10.19			270
35	19	B	8	12.74			471
35	20	B	11	11.15	49	double	338
35	21	B	13	10.51			292
35	22	B	14	10.51			292
35	23	B	7	12.42			442
36	1	B	12	14.33	42	double	631
36	2	B	9	10.51			292
36	3	B	11	9.55			230
36	4	B	12	8.28			162
36	5	B	6	13.69		double	563
36	6	B	8	10.51			292
36	7	B	9	10.83			315
36	8	B	9	8.28			162
36	9	B	9	20.06		triple	1454
36	10	B	12	9.24			212
36	11	B	15	14.97		double	703
36	12	B	10	15.29		double	741
36	13	B	11	11.15			338
36	14	B	13	7.96	41		146
36	15	B	13	12.10			414
36	16	B	14	8.28			162
36	17	B	4	19.43		triple	1344
36	18	B	6	15.61		double	780
36	19	B	12	9.55			230
36	20	B	12	10.51			292
36	21	B	13	15.29			741
36	22	B	9	13.69		double	563
37	1	P		15.61	49		617
37	2	P	5	14.33			501
37	3	P	4	14.97			557
37	4	P	14	10.83			253
37	10	P	6	13.38	52		424
37	11	P	9	10.19			218
37	12	P	9	14.33			501
37	13	P	6	14.65			529
37	14	P	6	15.61			617
37	15	P	6	16.24			679
37	16	P	4	19.43		Double tree	1052

37	17	P	4	17.83			853
37	18	P	5	15.61			617
37	19	P	8	16.24			679
37	20	P	2	16.56			713
37	21	P	2	16.56			713
37	22	P	2	14.01			474
37	27	P	23	14.01	60		474
37	28	P	7	12.74			376
37	32	P	7	13.69			448
37	33	P	7	16.24			679
37	34	P	7	14.65			529
37	35	P	7	8.92			158
37	36	P	8	11.78			311
37	41	P	12	16.24	54		679
37	43	P	4	15.61			617
37	44	P	2	14.01			474
37	45	P	2	14.65			529
37	46	P	7	14.65			529
37	47	P	8	14.33			501
37	48	P	2	12.74			376
37	49	P	4	17.83			853
37	50	P	6	11.78			311
37	51	P	6	11.78			311
37	52	P	6	11.78			311
37	53	P	9	14.65			529
38	1	P	X	18.79			969
38	2	P	6	13.38			424
38	3	P	12	14.33			501
38	4	P	8	17.83			853
38	5	P	8	14.01	49		474
38	6	P	7	17.20			781
38	7	P	7	17.52			817
38	8	P	6	14.97			557
38	9	P	12	18.79			969
38	10	P	8	17.20			781
38	16	P	42	18.79			969
38	17	P	17	16.24			679
38	18	P	13	13.69			448
38	19	P	11	14.01			474
38	24	P	49	15.92	53		647
38	25	P	12	14.01			474
38	26	P	8	16.24			679
38	27	P	6	14.65			529
38	28	P	4	14.97			557
38	29	P	4	13.69			448
38	30	P	9	14.33			501
38	31	P	7	13.38			424
38	35	P	43	16.56			713
38	36	P	14	17.83			853
38	37	P	19	16.24			679
38	38	P	13	14.65			529
38	43	P	46	17.20	49		781
38	44	P	6	14.33			501
38	45	P	8	14.65			529
38	46	P	12	18.79		Double Tree	969
38	47	P	12	14.97			557
38	48	P	6	14.65			529
38	49	P	9	14.33			501
38	50	P	14	16.56			713
38	54	P	29	16.56			713
38	55	P	15	13.69			448
38	56	P	19	16.56	57		713
38	57	P	17	16.24			679
38	58	P	12	14.97			557
38	59	P	6	15.61			617
38	60	P	6	14.65			529

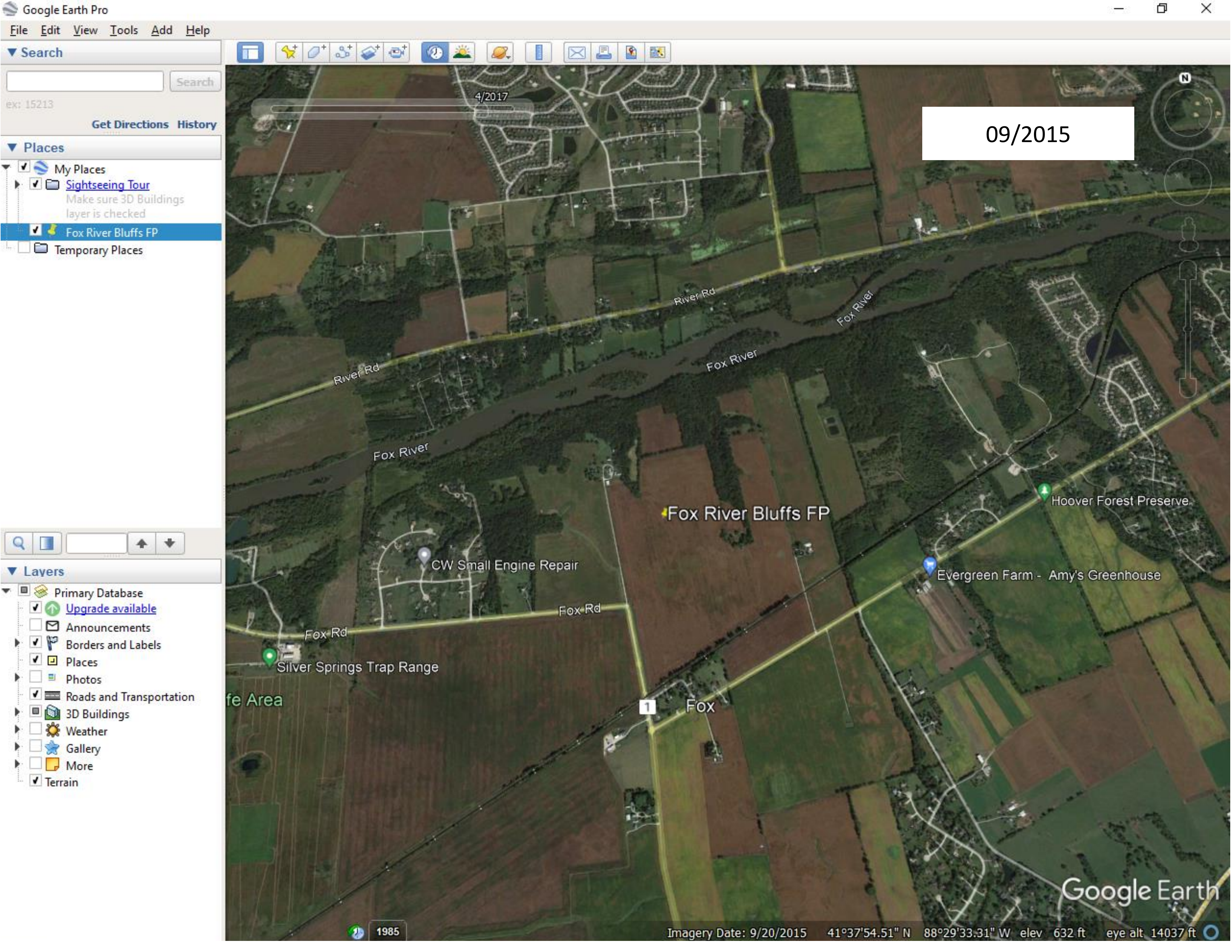
39	1	H	X	10.51			292
39	2	H	6	11.15			338
39	3	H	10	11.46			362
39	4	H	13	15.61	46		780
39	5	H	14	12.10			414
39	10	H	42	16.24			861
39	11	H	13	12.42			442
39	12	H	12	11.46			362
39	17	H	29	11.15			338
39	18	H	14	14.33			631
39	19	H	6	12.10			414
39	20	H	8	14.97			703
39	21	H	9	13.69			563
39	22	H	12	10.83			315
39	23	H	16	15.92	49		819
39	24	H	16	14.97			703
39	25	H	9	11.78			388
39	26	H	8	15.61			780
39	32	H	31	13.06			501

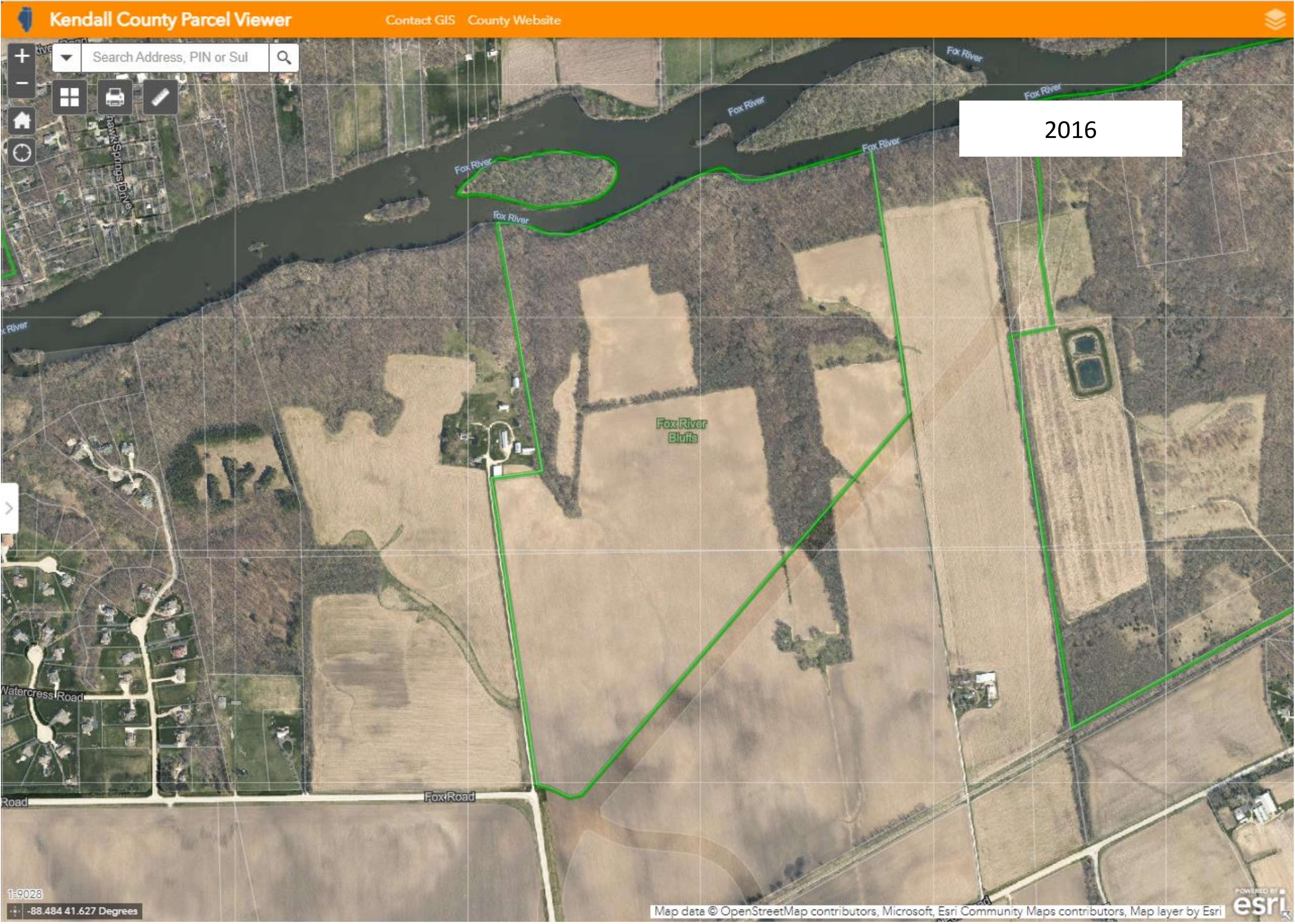

Google Earth Pro
File Edit View Tools Add Help
Search
Search
ex: 15213
Get Directions History
Places
My Places
Sightseeing Tour
Make sure 3D Buildings layer is checked
Fox River Bluffs FP
Temporary Places
Layers
Primary Database
Upgrade available
Announcements
Borders and Labels
Places
Photos
Roads and Transportation
3D Buildings
Weather
Gallery
More
Terrain
4/1998
04/1998
River Rd
Fox River
Fox River Bluffs FP
Hoover Forest Preserve
Evergreen Farm - Amy's Greenhouse
CW Small Engine Repair
Fox Rd
Silver Springs Trap Range
fe Area
1
Fox
Image Landsat / Copernicus
Image U.S. Geological Survey
Google Earth
1985
Imagery Date: 4/4/1998 41°37'54.51" N 88°29'33.31" W elev 632 ft eye alt 14037 ft


Google Earth Pro
File Edit View Tools Add Help
Search
Search
ex: 15213
Get Directions History
Places
My Places
Sightseeing Tour
Make sure 3D Buildings layer is checked
Fox River Bluffs FP
Temporary Places
Layers
Primary Database
Upgrade available
Announcements
Borders and Labels
Places
Photos
Roads and Transportation
3D Buildings
Weather
Gallery
More
Terrain
04/2005
4/2005
River Rd
Fox River
Fox River
Fox River
River Rd
Fox River Bluffs FP
Hoover Forest Preserve
CW Small Engine Repair
Evergreen Farm - Amy's Greenhouse
Fox Rd
Fox Rd
Silver Springs Trap Range
Fox
Image U.S. Geological Survey
Google Earth
1985
Imagery Date: 4/2/2005 41°37'54.51" N 88°29'33.31" W elev 632 ft eye alt 14037 ft

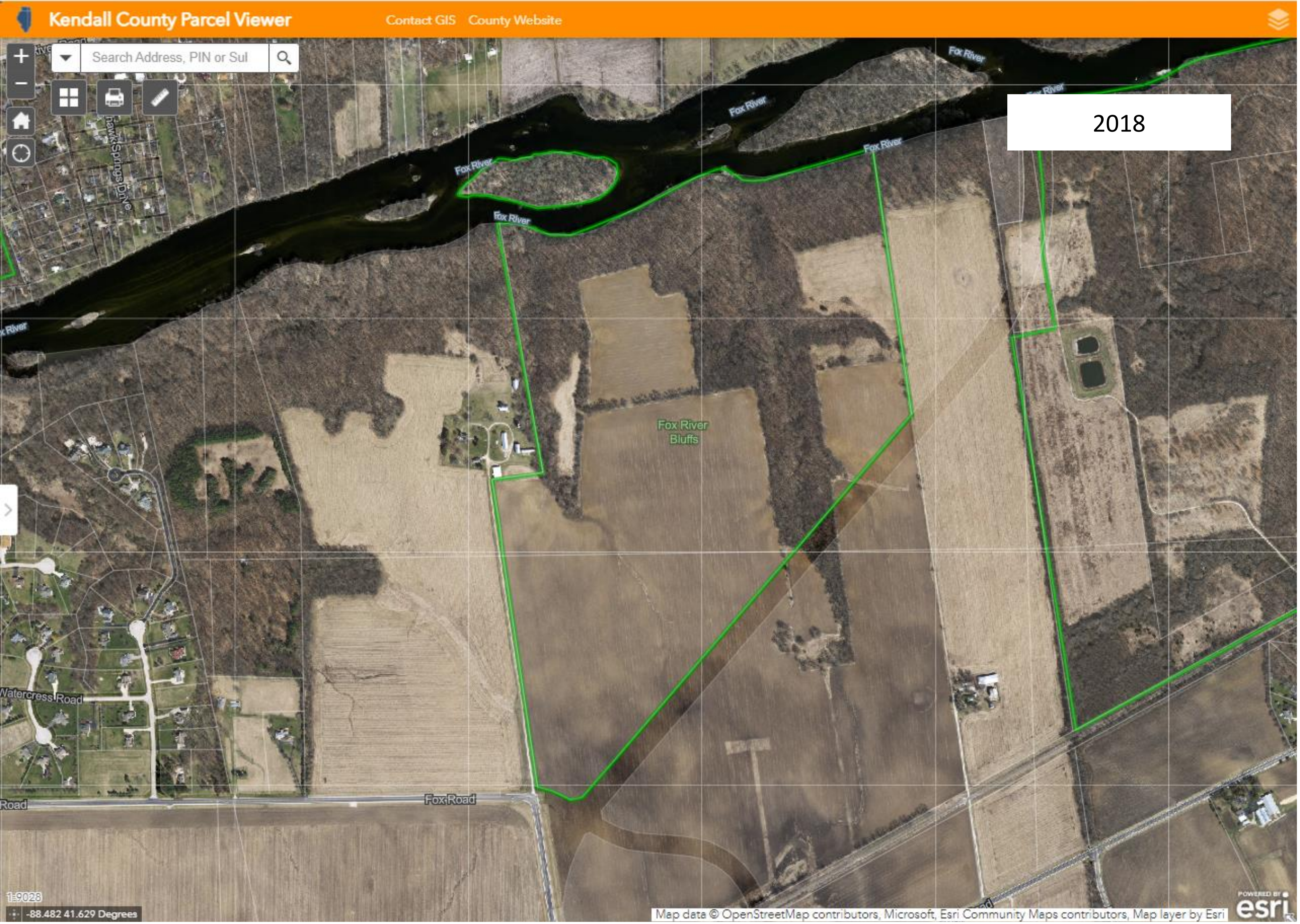


Google Earth Pro
File Edit View Tools Add Help
Search
Search
ex: 15213
Get Directions History
Places
My Places
Sightseeing Tour
Make sure 3D Buildings layer is checked
Fox River Bluffs FP
Temporary Places
Layers
Primary Database
Upgrade available
Announcements
Borders and Labels
Places
Photos
Roads and Transportation
3D Buildings
Weather
Gallery
More
Terrain
11/2011
1985
2021
11/2011
River Rd
Fox River
Fox River Bluffs FP
Hoover Forest Preserve
CW Small Engine Repair
Evergreen Farm - Amy's Greenhouse
Fox Rd
Silver Springs Trap Range
Fox
Image USDA Farm Service Agency
Google Earth
41°37'57.54" N 88°27'42.40" W elev 657 ft eye alt 14037 ft

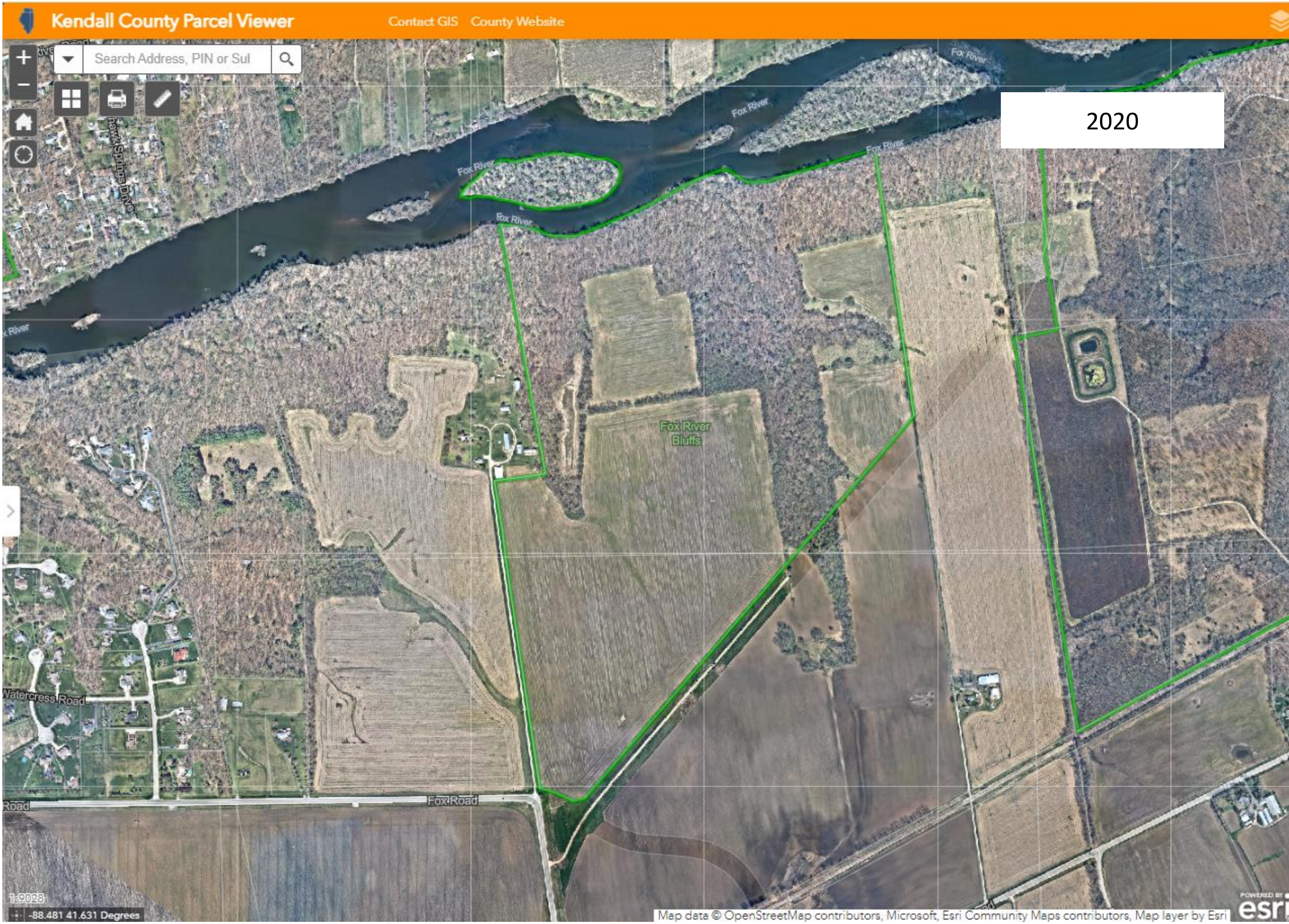

Google Earth Pro
File Edit View Tools Add Help
Search
Search
ex: 15213
Get Directions History
Places
My Places
Sightseeing Tour
Make sure 3D Buildings layer is checked
Fox River Bluffs FP
Temporary Places
Layers
Primary Database
Upgrade available
Announcements
Borders and Labels
Places
Photos
Roads and Transportation
3D Buildings
Weather
Gallery
More
Terrain
4/2017
09/2015
River Rd
Fox River
Fox River Bluffs FP
Hoover Forest Preserve
CW Small Engine Repair
Evergreen Farm - Amy's Greenhouse
Fox Rd
Silver Springs Trap Range
fe Area
Fox
1985
Google Earth
Imagery Date: 9/20/2015 41°37'54.51" N 88°29'33.31" W elev 632 ft eye alt 14037 ft



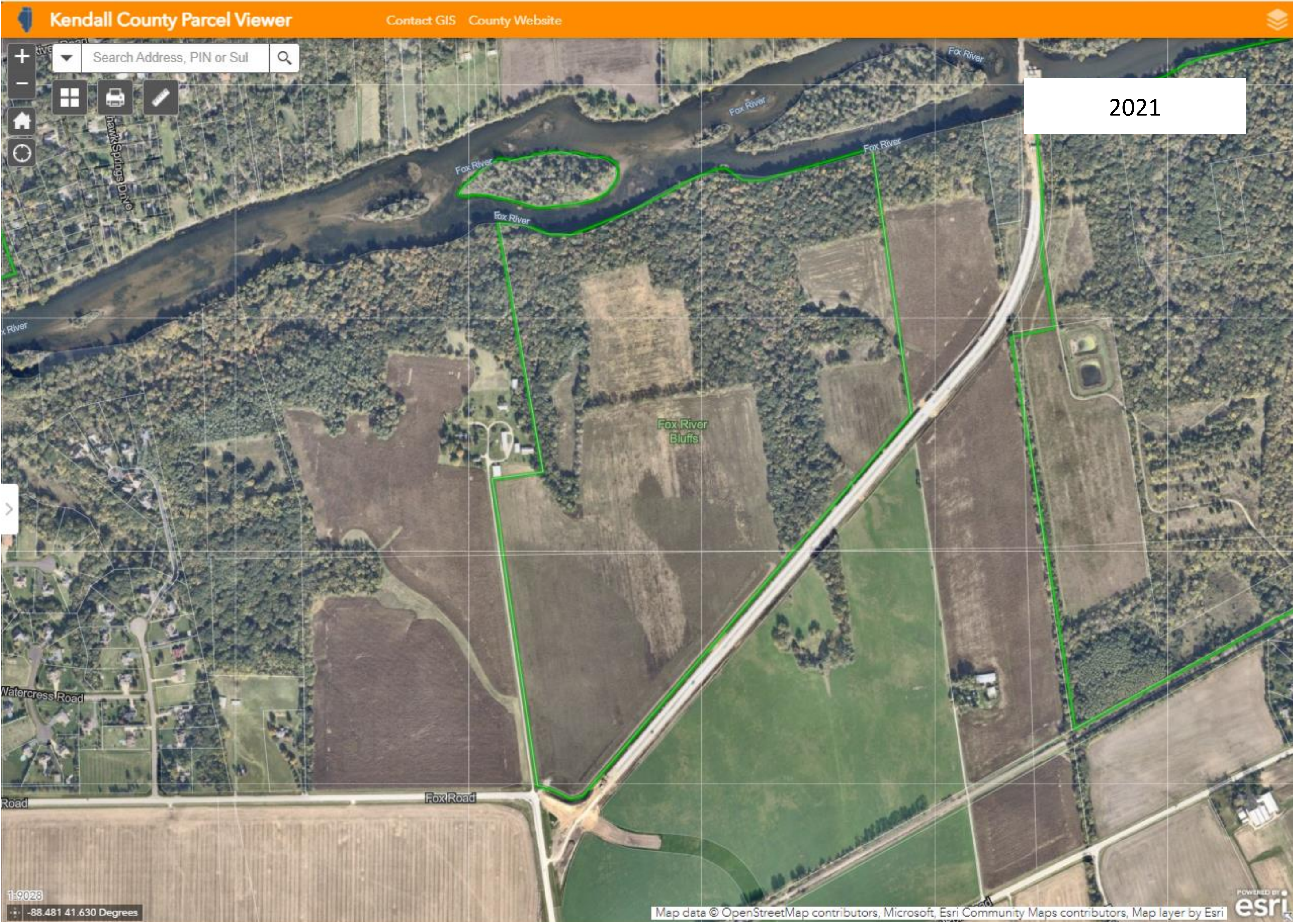
KC-GIS Imagery Year: 2016



KC-GIS Imagery Year: 2018



KC-GIS Imagery Year: 2020



KC-GIS Imagery Year: 2021

Light pink background denotes an input cell ->

Directions

1) Use i-Tree Canopy, or another tool, to estimate the amount of deciduous and coniferous tree cover area (acres) (Cell C18 and D18).

2) Use i-Tree Canopy, or another tool, to estimate the amount of non-tree cover area (acres) (Cell F18) in the project area.

3) In Cell G18 the total area of the project is calculated (acres). Prompt i-Tree Canopy to provide an estimate of the project area by clicking on the gear icon next to the upper right portion of the image and selecting "Report By Area."

4) Total Project Area, cell G15 should equal 100%.

Table 1. Tree Cover

	Deciduous Tree Cover	Coniferous Tree Cover	Total Tree Cover	Non-Tree (	Total Project Area
Percent (%)	100%	0%	100%	0%	100%
Area (sq miles)	0.063	0.000	0.063	0.000	0.06
Area (m2)	161,873	0	161,873	0	161,873
Area (acres)	40	0.00	40.00	0.00	40.00

Using the information you provide on tree canopy cover, the tool provides estimates of co-benefits in Resource Units and $ per year.

Table 2. Co-Benefits per year with current tree canopy cover.

Ecosystem Services	Resource Units Totals	Res Unit/Acre Tree Canopy	Total $	$/Acre Tree Canopy
Rain Interception (m3/yr)	10,820.4	270.5	$77,472.17	$ 1,936.80
CO2 Avoided (t, $20/t/yr)	64.8	1.6	$1,296.13	$ 32.40
Air Quality (t/yr)				
O3	0.2065	0.0052	$312.81	$ 7.82
NOx	0.0345	0.0009	$52.20	$ 1.31
PM10	0.1056	0.0026	$136.10	$ 3.40
Net VOCs	0.1063	0.0027	$180.76	$ 4.52
Air Quality Total	0.4529	0.0113	$681.87	$17.05
Energy (kWh/yr & kBtu/yr)				
Cooling - Elec.	85,177	2,129	$6,464.96	$ 161.62
Heating - Nat. Gas	1,592,668	39,817	$15,504.27	$ 387.61
Energy Total ($/yr)			$21,969.23	$549.23
Grand Total ($/yr)			$101,419.41	$2,535.49