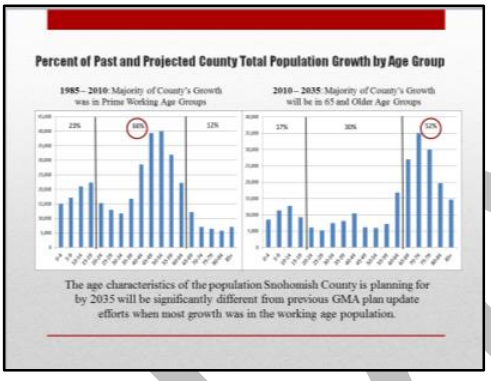
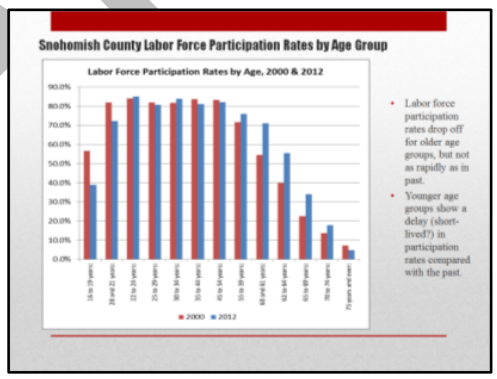
Snohomish County GeoMentor Program

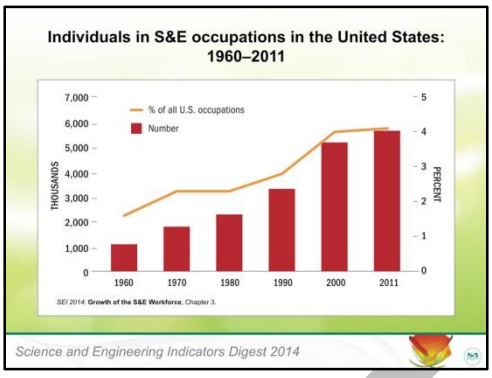
Using Environmental Systems Research Institute's (ESRI) newly created GeoMentor program, Snohomish County GIS Analysts have an opportunity for additional community outreach within the county's school districts. Through this program, Snohomish County GIS staff have an opportunity to increase geo-spatial awareness and build technology skills while assisting school districts to develop a more hands-on approach to Science, Technology, Engineering and Math (STEM) education within the classroom setting. According to ESRI, the goal of the GeoMentor program is to supplement Geography classroom instruction with hands-on, interactive instruction. Students will be able to develop skills in measuring geographic areas, spatial relationships, map comprehension and basic geographic analysis.

The Snohomish County economy is largely supported by aerospace manufacturing and other technical industries, including solar panel and medical equipment manufacturing. In the rural areas, natural resource jobs will need to be filled by a younger workforce as more and more current workers move into retirement. Boeing Corporation is the largest employer in the County and has been active in increasing STEM programs in the county's school districts, however they are aerospace based and rely heavily on CAD and CNC machinery software. According to Snohomish County Demographics, the majority of the County's population will be age 65 or older by 2035, and it is projected that they will contribute to 60% of the county's population growth between 2020 and 2030. It is important to support full STEM education within Snohomish County K-12 schools in order to have a future competitive workforce.





It is important that Snohomish County take an active role in providing STEM mentors in the county's class rooms. According to the National Math and Science Initiative (NMSI), more than half of the 30 fastest growing occupations require some level of post-secondary education which provides the STEM skills needed in an increasingly knowledge-intensive and innovation based economic landscape. It is projected that by 2018, 92% of traditional STEM occupations will require at least some secondary education, yet less than 20% of students choose a STEM path during their secondary education.



With an interdepartmental effort through the Applications and Citizen Participation GIS Committee, Snohomish County GIS staff can assist teachers in implementing ArcGIS Online into classroom Geography curriculum to allow students to visualize lessons while acquiring online mapping skills. The established GeoMentor (GM) can consult with a selected school district to choose one classroom to implement the program. The GM and teacher will then collaborate bi-weekly to design an online map to supplement classroom content, or in whatever other geo-spatial context the GM is working in the classroom, the GM will help the teacher develop hands-on classroom activities.

Consultations with Snohomish County Parks and Recreation have also revealed additional opportunities for outside activities that teach GPS or other spatial analysis skills. Parks has expressed interest in acquiring internal GPS trail data and is willing to work with a GM to check out the Trimble for field data collection by students. They also have guidelines available for ADA trail mapping which students can use to establish a methodology for ADA analysis of trails.

ESRI has established licensing agreements with the Washington Office of Superintendent of Public Instruction (OSPI) for all K-12 schools in the state through the Federal ConnectEd program. A technology representative or administrative staff of the school district can work with the GM to acquire a User ID for ArcGIS Online for in-class GIS instruction, but the school can also acquire desktop GIS software through the program if internet access is an issue, or if additional editing and publishing skills are being taught. Charlie Fitzpatrick is currently the ESRI School Program Manager who will contact Dennis Small at the WA OPSI office to assist the GM in software or access acquisition.

The GM should work with teachers to be sure they are supplementing classroom material and to establish Common Core standards to be met with the lesson plans. For Snohomish County, consideration of success of the program could be measured in multiple ways, none of which have been selected for any kind of metric analysis. One established goal for Snohomish County should be to get all students' hands on the software or the online version of maps in order to introduce basic geography skills such as finding locations, analyzing observations and data, and measuring distances or areas. Other cartographic skills to consider teaching would be digitizing, editing and publishing of maps and data.

Darrington School District Beta-Test

Due to initial lack of instruction from ESRI, the GM reached out to a local school district close to their home residence in the event the mentoring would need to be performed on a volunteer basis. Snohomish County showed initial interest in sponsoring the idea, but the program had not been tested or designed well enough for Planning and Development Services (PDS) sponsorship. However, Snohomish County Parks and Recreation (Parks) was willing to be a partner in the program, providing field equipment and GPS support. The PDS GM continued with the program on a volunteer basis through Parks.

The original beta-test idea was to start small and develop a program over 1-2 school years involving mostly high school teachers and students. The PDS GM and Parks agreed that using a Trimble to map internal trails at the Darrington Archery Range for ADA analysis would be a good fit for the program test as it was a business need for Parks and met the goals of the GeoMentor program. It would also establish methodology for ADA trail mapping that could be scaled up for the Whitehorse Trail or expanded to other Snohomish County or Town of Darrington public properties with internal trails. The GM was able to draft a project proposal which included some Common Core Curriculum goals for Science and Technology. Since this list was drafted, ESRI has compiled Common Core Curriculum goals for the GeoMentor program in conjunction with the Association of American Geographers and National Geographic.

After meeting with an external STEM coordinator working with the school district, a need to supplement Middle School Geography was discovered. The GM agreed to look into using Mapping Our World for ArcGIS Online curriculum to supplement the classroom materials. According to ESRI, part of the GM process is to link local schools with ArcGIS software through the Federal ConnectEd program and the OSPI licensing agreement. Since the curriculum was pre-established and the Washington state ESRI license was in place, the GM agreed to tailor a Mapping Our World lesson plan to an 8 week program for the full Middle School.

Since the goals of the GeoMentor program included getting students outside and thinking spatially, the first lesson was designed around the National Geographic Landscape Investigation Guidelines (pages 12-17). Geography and creating a map was to be introduced on a local scale to gain better comprehension of linking maps to places. The proceeding lessons were taken out of Mapping Our World and the intention was to follow most of the curriculum at a Middle School level while striving to include an outdoor component to some of the lessons. Teachers and staff were given the lesson schedule at a meeting and the beta-test was established. The original High School beta-test idea within the Archery Range was never implemented but could be explored in the future as a GPS activity for this school district or any other school group willing to make the trek to Darrington, in conjunction with Snohomish County Parks.

Original Lesson Schedule

Week 1 – Introduction to GIS and Mapping

Using the National Geographic Landscape Investigation Guidelines pages 12-17 students will work in teams to complete a map of their school campus and learn spatial concepts. Students will work outside for

the first half of the exercise and then draw maps in class of the campus as measured. GeoMentor will provide roll of paper for students to create large maps for display.

Week 2 – Mapping Our World Lesson 1 - The Basics and Geographic Inquiry

Using ESRI educational resource, Mapping Our World, students will go through the basics of using and interpreting an online map via ArcGIS online. The GeoMentor will walk students through the lesson as they work in groups of 2-3. Students will learn basic GIS vocabulary, how to work with ArcGIS online, and how to turn layers on and off to obtain map information. They will also have to opportunity to work in groups of 2-3 to develop and test a geographic hypothesis using concepts in the scientific method.

Week 3 – Mapping Our World Lesson 2 Part 1 – Geology

Using the same classroom structure as Lesson 1, students will walk through the exercise with the GeoMentor and expand geospatial skills using ArcGIS Online volcanic map.

Week 4 – Mapping Our World Lesson 2 Part 2 – Geology

Using the same classroom structure as Lesson 1, students will walk through the exercise with the GeoMentor and expand geospatial skills using ArcGIS Online Ring-of-Fire map. The GeoMentor will then introduce students to local geologic landforms and conditions and take students outside to observe.

Week 5 – Mapping Our World Lesson 3 – Climate Part 1, Week 1

Using the same classroom structure as Lesson 1, students will walk through the exercise with the GeoMentor and expand geospatial skills using ArcGIS Online climate map. Students will walk through the first steps with the GeoMentor, then work individually through Tasks 5 and 6. The GeoMentor will be available for in-class help.

Week 6 – Mapping Our World Lesson 3 – Climate Part 1, Week 2

Using the same classroom structure as Lesson 1, students will review the previous week's concepts with Task 8 of the exercise with the GeoMentor, then work individually through Task 11. The GeoMentor will be available for in-class help.

Week 7 – Mapping Our World Lesson 3 – Climate Part 2

The GeoMentor will provide a brief lecture on climate patterns with an emphasis on precipitation patterns and discuss local seasonal conditions. Students will then work in teams to complete the exercises in Climate Part 2 and the GeoMentor will be available for in-class help.

Week 8 – Mapping Our World Lesson 4 – Forces of Nature Part 1

Students will revisit the concept of Climate and Precipitation patterns and be introduced to the concept of Climate Change. Students will then walk through the entire exercise with the GeoMentor to encourage open conversation by students about possible climatic consequences of increasing air temperatures, polar ice sheet melting and sea level rise.

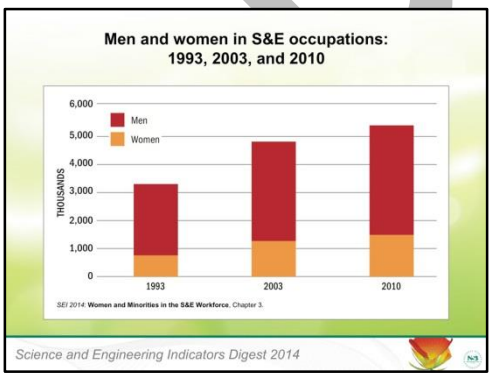
Beta-Test Lessons Learned

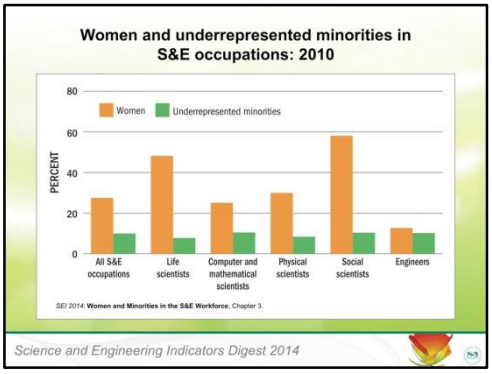
With limited resources, space and staff available when working in a small school district it is difficult to obtain optimal learning conditions where every student has a computer and the instructor has demonstration ability with a large screen. GeoMentors must be prepared for non-traditional classroom settings, especially in rural and charter schools. In the Darrington school district, the middle school consists of 4 classrooms which were combined into 2 GeoMentoring sessions of approximately 45 - 50 students.

The combination of the classrooms was crucial to fit the curriculum into a designated time slot for these types of activities and also depended on the GM's availability. If interested, it would benefit the district for the teachers to learn basic GIS skills from the GM to give students the opportunity for additional classroom instruction, and for sustainably using the software in the classroom setting after the GM lesson plan is completed. This was not implemented in Darrington, but the Beta-test GM highly recommends training an instructor employed by the school district to continue the hands-on education into the future. It would also help in the classroom setting if the GM does not have a projector or large screen for demonstration as the additional instructor would be available to give the students technical assistance.

Tutoring 45- 50 students with only one trained instructor may be overwhelming to some GeoMentors, especially if they are assisting on a volunteer basis. With school districts' budgets dwindling and no state or federal funding solutions in sight to reduce class sizes, this may be an issue in many other school districts. As stated before, the GM must be prepared for a non-traditional setting, so GM selection must not be done out of equal distribution of county analyst participation, but instead with the students in mind. The selected GM must have good people skills, be able to deal with students of all backgrounds and abilities, and be prepared to improvise instruction or activities if technology issues occur without showing frustration.

Another consideration for GM selection is the representation of women and minority professionals in the STEM field. Data shows that women and minorities are well under represented in the STEM field, and this begins before the secondary education process. It is important to make sure that demographics are considered in the group of GeoMentors in order to encourage women and minority students to continue interest in STEM education by observing professionals in action.





The first lesson was taken from the National Geographic Landscape Investigation Guidelines curriculum and was selected to introduce students to the process of observing and collecting field data and transforming it into a map. The students reviewed what GIS is, how it works, and how it is used by various industries. Students were also introduced to the basic parts of a map. The field portion of the lesson proved difficult with such a large class size, but could be helped by organizing students into pre-selected teams. The students also had some difficulties when they selected their own teams, as some were not listening due to intensive social interaction with their friends, and others were isolated from groups that formed.

Once students returned from the field to produce paper maps, the GM noticed that the female students were intimidated by drawing maps and heard a lot of I can't and I don't from the girls. Following the first lesson, it was determined that it would be beneficial to pair students into Geo-buddies based on skill and ability levels. This was successful in reducing the non-lesson related social interactions and isolation from the hands-on activity.

The following lessons were derived from ESRI's Mapping Our World and were selected from the ArcGIS Online curriculum plan as there were too many students to fit into the school computer lab for ArcGIS desktop instruction. The Beta-test GM highly recommends the ArcGIS desktop curriculum supplemented by ArcGIS Online curriculum so students can not only learn critical online application skills, but also the behind-the-scenes software used to create such applications.

The Beta-test GM went through a dry-run of ESRI's lesson plan within the 90 minute time slot allotted to the lesson plan. However, once classroom instruction began, many issues with strictly following the ESRI plan were discovered. First, the students were using Chrome Books on a closed, secure network, which blocked many links. After the first week, the GM sent the links to the school information officer for easy student access. The lesson plan was also printed and could not be uploaded to the Chrome books, so just logging in to the lesson map took much more time than expected.

To reduce log-in time, the GM began building their own ArcGIS Online lesson map based on the ESRI lesson maps, and sent a link for the customized map to the school information officer to load onto the Chrome Books bookmark tab. One of the most beneficial customizations was pre-loading geographic bookmarks in the customized map which reduced the time students spent zooming in and out of the map, as some were not as spatially aware as others. The Beta-test GM had previously eliminated questions determined to be above a middle school level, but after the first few lessons found that re-typing the questions and answers sheet not only saved paper, but time and confusion brought about by crossed out sections. Another beneficial customization included much more than just the interactive map.

Many students followed the instructions with minimal problems, but attention spans still tended to wane after about an hour, even with the hands-on interactive map activities. In order to increase interest in the lesson plans, and at the STEM coordinator's suggestion, the Beta-test GM began placing local layers in the interactive maps and customized the ESRI lessons to include local analysis and questions regarding local conditions and demographics. The GM was careful not to make the entire lesson revolve around the local area to be sure that students were being exposed to US and World conditions, environments and

demographics. This helped peak student interest as they could actually apply the knowledge to an area they were familiar with. The subject matter did shift from basic geography to Geologic Hazards which can be exciting on their own right. If possible, future lessons should be supplemented with more than just lecture, and should include graphics and video for better comprehension of the subject matter. The GM should consult with their school district's information technology team in order to coordinate student access to these materials.

The lesson schedule did not remain on schedule due to the extensive time of initial technology learning curves not only by the students, but of the Beta-test GM as well. Once the kinks of accessing the map and bookmarking locations were ironed out, the lessons moved along fluidly. However, a happy medium of lecture and hands-on mapping must be established or time may not allow for some of the technical activities. Also, the week the GM was not able to attend class, students did not get through the mapping activity with the STEM coordinator and the next week's lesson needed to be modified to finish up the previous topic and include the next topic. The GM decided to hybridize the topics through analytical questions on the students' question and answer sheets.

By the end of the customized Mapping Our World curriculum, students were comfortable with geographic bookmarks and modifying the map in many ways including adding layers from ArcGIS Online, viewing map tips and editing using Map Notes. Still, the Beta-test GM and the STEM coordinator both wanted to include outside activities in the lesson plan, which was incorporated into the last few lessons. Having an outdoor activity for at least the last 20 minutes of class seemed to motivate the students to listen and get through the lesson plan far more efficiently than previous lessons. It can also help solidify the comprehension of the lesson as students can view realistic conditions related to the subject matter.

The final lesson was given in 2 separate 3 hour lessons, segregated into girls only one week and boys only the next week due to a planned overnight field trip that was also segregated and split into 2 weeks. The lesson circled back around to the initial lesson of basic geographic and mapping concepts, but additional Land Use planning concepts were introduced. This lesson initially introduces sense of place with a short interactive mapping exercise asking students to add map notes regarding special and important places to them in their town. Once they understood the important places and locations that make a municipality unique and were introduced to basic zoning concepts, the students headed outside to create and zone a new 10'x10' town in sidewalk chalk.

Students were divided into 2 large groups and roles were assigned to several students from each group for placing zones and important places. The remaining students in the groups were assigned as field technicians and were instructed to take detailed drawing notes as the students designated as planners drew the town. The students then went inside for the remaining hour of the lesson to produce official zoning maps based on the field technician site notes. They were further divided into groups of 4 to complete this activity. The maps were then collected by the beta-test GM and taken to Snohomish County Planning and Development Services where they were displayed during one business day for a map contest judged by Cartographers, Engineers and Planners.

During the activity, the GM was encouraged to see full participation by most girls in the middle school. There were a few that opted for minimal participation in the outside activity, and even those who did not take good notes took initiative to draw a map, even if it did not match the map drawn outside. While their product was not the instructed product, teachers should be encouraged by the mere activity of drawing the map, especially since during the 1st week lesson, the majority of the girls were reluctant to draw any maps.

On the following week, the boys were much more organized at their initial approach and were dead set on scaling, which is a topic the girls avoided. Boys also divided roles and responsibilities and one group even had a pseudo-project manager walking around reminding his teammates of their delegation of duties. However, this high attention to detail left the boys with much less time to draw their official maps than the girls, which may be why 3 girl groups won prizes in the map contest as opposed to 1 group of boys.

Overall, the program could be viewed as successful in achieving ESRI's GeoMentor goal of supplementing Geography classroom instruction with hands-on, interactive instruction. It was also successful in achieving the Beta-test GM's goal of getting the students' hands on the software or the online version of maps in order to introduce basic geography skills such as finding locations, analyzing observations and data, and measuring distances or areas. Future GMs should be careful to work with the school district's teachers to establish curriculum goals and with the school's information technology officer to obtain technology policies and establish processes for electronic data sharing and interactive map access before drafting their customized curriculum.

Future of the Program

GeoMentor curriculum should be tailored to the school's needs and based on Common Core or NextGen Science standards according to the school district's request. The ESRI Mapping Our World curriculum gives a good out-of-the-box base for lesson development, but strictly following the ESRI lesson is not advised unless it is for an advanced level high school class. Even then, some data layers have changed since the creation of the curriculum, and GM's should work through every lesson prior to teaching it in the classroom. Since the development of this beta-test, ESRI has partnered with the Association of American Geographers to increase the availability of GIS and spatial analysis curriculum beyond the Mapping Our World program.

The Beta-test GM has compiled the actual lesson schedule with accompanying customized worksheets into a GeoMentor Beta test notebook. This hybridized curriculum can be followed for an 8 week lesson schedule, but the first few lessons should be modified to include a local component and possibly an outside component. GM's would then have an out-of-the-box lesson plan to take across the county. However, the GM has the freedom to draft their own curriculum granted that they continue to achieve the ESRI and Snohomish County goals and follow the Common Core or NextGen Science standards established by the classroom teacher.

Other ideas for one-time school visits or a shorter time period could also be incorporated into the program. For example, the Snohomish County Parks and Recreation internal trail mapping activity could be performed at multiple regional parks by multiple classrooms over time. There are also various new

external resources under the national GeoMentor program through ESRI and the Association of American Geographers:

ArcGIS Online: General Courses and Lessons

GeoInquiries for Earth Science

Thinking Spatially Using GIS (elementary level)

ArcLessons

Mapping Our World

SpatiaLABS

ArcGIS Online: Guided Projects (high school level)

STEM and GIS resources

GPS Loaner Program - http://gisetc.com/explore/gps-loaners/

Other training and opportunities are available through the TEALS program through the Everett Public Schools which requires local training and collaboration with Microsoft

Outside GIS Application Activities

SimTown with sidewalk chalk

Internal trail mapping of Snohomish County Regional Parks

ADA Mapping of Whitehorse Trail or inventory of trail features, built or environmental, on Centennial, Interurban or Whitehorse trails (Project Proposal attached)

Assisting PDS with Public Tree Canopy inventorying (Project Proposal attached subject to project approval)

GIS Resources

A brief presentation on STEM case studies using GIS in schools can be found here: http://www.esri.com/library/ebooks/advancing-stem-education-with-gis.pdf

Dennis Small – Educational Technology Director, Office of the Superintendent of Public Instruction
Old Capitol Building / PO Box 47200
Olympia, WA 98504
(360) 725-6384
Contact for ConnectEd software licensing for ArcMap and AutoDesk

Charlie Fitzpatrick – ESRI Schools Program Manager
2001 N 15th St #1403
Arlington, VA 2201
(651) 994-0823 x 1-8349
Contact for ESRI GeoMentor and Educator Resources and Training

Edward Fairbanks – GIS Analyst Level 5, Snohomish County Department of Informational Services
SnoCo GIS Team Chair
3000 Rockefeller Ave
Everett, WA 98201
(425) 388-3935
Contact for college level GIS internship opportunities

Brad Hofman – Business Process Analyst, Snohomish County Administration Office
3000 Rockefeller Ave
Everett, WA 98201
(425) 388-3717
GeoMentor – Engineering/AutoDesk software

Amy Lucas - Senior GIS Analyst, Snohomish County Planning and Development Services
SnoCo GIS Team Applications Citizen Participation Committee Chair
3000 Rockefeller Ave
Everett, WA 98201
(425) 388-3311 x2744
Contact for coordination of High School or Middle School GIS Outreach / Beta-test GeoMentor – ESRI/AAG software

Sharon Swan - Principal Park Planner, Snohomish County Parks
6705 Puget Park Dr
Snohomish, WA 98296
(425) 388-6616
Contact for Trail Mapping, use of Snohomish County GPS Trimble Unit and assistance with park and trail planning

Katie Heim - GIS Coordinator, City of Arlington
Snohomish County GIS Users Group Chair
238 N Olympic Ave
Arlington, WA 98223
(360) 403-3536
Contact for additional GIS outreach if SnoCo not available, or for collaboration on program

Appendix A – Whitehorse Trail ADA Mapping

Phase 1 – Middle School Level

Parks/PDS Goal – Develop GIS field methodology for mapping the Whitehorse Trail to ADA standards

Darrington School District/STEM Goal – Develop Project Management and teamwork skills and introduction to GIS

Problem
The Snohomish County Parks Department has produced a white paper on ADA standards for trail mapping. The Whitehorse Trail is in the Northeast corner of Park District 1 and will require large amounts of travel time for Parks staff to conduct ADA survey of Whitehorse Trail.

Proposal
Amy Lucas, PDS Sr. GIS Analyst is proposing to volunteer to assist Darrington Middle School students in developing the GPS/GIS field techniques required to collect the necessary information recommended by the Parks Department white paper. The middle school students will be divided into groups of 4-5 to introduce the concept of Project Management and working within project teams.

Resources Needed

Resource	Provider
ADA Methodology White Paper	Snohomish County Parks and Recreation
Project Manager/GIS Instructor	Amy Lucas, Sr. GIS Analyst, Snohomish County PDS
Trimble GPS unit	Snohomish County Parks and Recreation
Survey Tape	Project Manager
Survey tape measure	Project Manager
Notebooks	Project Manager
Desktop or Laptop computer(s)	Darrington School District or STEM program?
ESRI GIS software	ESRI via Washington State Schools GIS Project

Issues
The Whitehorse Trail is not adjacent to Darrington Middle School Property and would require at least 2 off-site field visits to trail. One option would be to beta-test data collection methodology

on the archery trails behind the school, but data collection site would not be on Snohomish County property.

Implementation

Process	**Common Core English Language Arts Standards Met - Science & Technical Subjects**
Teams research ADA and Snohomish County Parks white paper	CCSS.ELA-Literacy.RST.6-8.6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.
Teams research GPS and GIS basic skills with in-class instruction	CCSS.ELA-Literacy.RST.6-8.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics
Teams brainstorm GPS field data collection steps to develop into methodology	
Teams write project proposals for field data collection with citations and simple flow chart models	CCSS.ELA-Literacy.RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. CCSS.ELA-Literacy.RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
Class presentations by teams to select final methodology – can be modeled after single proposal or hybridized from many proposals	
Teams take turns in field with GPS and other survey equipment to Beta-test collection of trail data to ADA standards	CCSS.ELA-Literacy.RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
Adjustments to methodology made following field Beta-testing	

Phase 2 – High School Level

Goal – Use Darrington Middle School field data collection methodology and Beta-testing results to map ___ miles of Whitehorse Trail.

Appendix B – PDS Urban Public Tree Canopy Inventory

Snohomish County

Planning & Development Services

Urban Tree Canopy Assessment and GIS Inventory Review and Assessment Technology Project

Project Manager(s) – Amy Lucas and David Killingstad
12/16/2014

PURPOSE

The purpose of this project review and assessment is to outline the issues, process and scope of work required to review and develop a Technology/GIS project that would assist Planning and Development Services (PDS) with inventorying and assessing the overall urban tree canopy within unincorporated urban areas on a watershed basis at the sub-basin level. This project would also assist in inventorying and monitoring of urban residential development sites pursuant to SCC 30.25.014 that are subject to the Tree Canopy regulations in SCC 30.25.016 as well as those that have opted-in under SCC 30.25.013.

BACKGROUND

On October 27, 2014 the Snohomish County Council approved Ordinance 14-073 to establish tree canopy regulations for all residential development within unincorporated urban growth areas of Snohomish County. The ordinance amends Title 30 SCC to update the county's landscaping standards for trees from regulation of individual significant trees to a more comprehensive approach, conserving a healthy tree canopy within urban areas of Snohomish County's jurisdiction. One of the goals of the ordinance is to maintain the overall unincorporated urban tree canopy at approximately 30% (the baseline set through GIS analysis of the 2006 National Land Cover Dataset). In addition to the overall canopy goal, the ordinance set canopy

standards for all new residential development in unincorporated urban areas of the county according to the development type and size.

To measure implementation and success, the Snohomish County Council charged PDS with the annual responsibility of compiling permit applications subject to the new canopy regulations and analyzing their components to measure implementation benchmarks including: exemptions, canopy requirements for the site, adjustments to the canopy requirement, number of trees retained and number of trees planted. PDS employees would like to include other quantifiable metrics in the report that would assist staff in assessing the overall urban tree canopy in addition to identifying areas where canopy could be increased.

Staff is proposing to select a sub-basin to a major watershed to conduct an initial urban tree inventory that could be scaled-up and expanded to other unincorporated urban areas of the County. Once tree inventories have been completed, the development of an Urban Forest Master Plan will be feasible and canopy coverage can be tracked on a watershed level for other projects such as National Pollution Discharge Elimination System (NPDES) monitoring.

PROPOSED GIS Project

PDS proposes to purchase GIS tree inventory software, such as TreeWorks, to assist with building and maintenance of the unincorporated urban tree canopy inventory within Snohomish County. Initial inventory for the annual report can be built by scanning landscaping plans as they are submitted and approved, then georeferencing and digitizing the existing tree surveys and planting plans accordingly. Existing trees can be inventoried by County staff during site inspections and/or collected by the Futurewise community group in conjunction with community members and schools using a mobile tablet with ArcPad and stand-alone tree inventory software installed.

RESEARCH

American Forests and the American Planning Association endorse the use of tree canopy within landscaping to promote community aesthetics and to create a sense of place. Tree canopy within landscaping can humanize the built environment by providing shady places for relaxation as well as providing an appealing visual framework through size, texture and colors. Canopy coverage can also help to provide neighborhood scale through selective planting to either emphasize small structures or de-emphasize large structures allowing them to blend into the neighborhood, and can help to define outdoor spaces and increases privacy as well as visually soften corners of structures and lots. These attributes of tree canopy mitigate the impacts of urban residential development on neighboring development and helps preserve the character of existing neighborhoods.

A high-level GIS analysis of the Best Available Land Cover Data provided by the US Geologic Service, determined the unincorporated urban growth areas of Snohomish County contain an estimated 30 percent canopy coverage between public and private

lands. While permit applications and landscaping site plans will assist PDS staff with tracking canopy coverage on individual building sites, a method must be developed to inventory and track existing canopy coverage on a watershed basis to assist with measuring the overall urban tree canopy coverage and maintaining it at 30%.

Early research by PDS has shown that there are three options staff can pursue for development of an urban tree canopy inventory. The first GIS option available is to use ArcGIS Online as an inventory collection platform, which would require Snohomish County Information Services to purchase an ArcGIS Online Enterprise license as well as the Arc Collector extension. Another option would be to hire a consultant to conduct the initial inventory and perform updates on an annual basis. Many companies exist that will perform an initial inventory build, but the County would be obligated to perpetually contract the consultant to perform inventory updates and maintenance in order to keep the program sustainable.

A third GIS option, which is the preferred option, would be to purchase stand-alone GIS tree inventory software, such as TreeWorks, which would allow County Staff and volunteers to perform the work using existing County resources. County staff can also customize the requested information fields for inventory collection to tailor it to the needs of the Annual Urban Tree Canopy Report.

IMPACTS

This project falls in line with the Long Range Planning 2015 Work plan and would assist in the compilation of the mandatory Annual Urban Tree Canopy Report.

2015/2016 LRP DRAFT WORK PLAN – DETAILED SUMMARY

Activity	Themes					PAT Planner FTE				2017 & beyond	Council Action Required?	Notes
						2015		2016				
	A	B	C	D	E	Jan. - June	July – Dec.	Jan. - June	July – Dec.			
BASIC CORE FUNCTIONS												
Docketing/Annual Amendment Activity						0.15	0.15	0.15	0.15	Yes	Yes	
Annual CIP						0.15	0.15	0.15	0.15	Yes	Yes	
Proposed Annexation Review						0.10	0.10	0.10	0.10	Yes	Yes	
Annual Code Correction Ordinance						0.05	0.05	0.05	0.05	Yes	Yes	
Support to Boards/Commissions						0.10	0.10	0.10	0.10	Yes	No	
Permit Forecasting						0.05	0	0.05	0	Yes	No	
Legislative Tracking	All core functions involve a variety of activities that, collectively, address several of the five major departmental themes					0.20	0	0.20	0	Yes	No	Core functions include a wide range of mandatory items + other functions that are relied upon by PDS and other Depts.
Intergovernmental						0.20	0.20	0.20	0.20	Yes	No	
Tech. Support						0.20	0.20	0.20	0.20	Yes	No	
Open Space Application Processing						0.05	0.05	0.05	0.05	Yes	Yes	
Growth Monitoring						0.20	0.50	0.20	0.50	Yes	No	
Tribal Collaboration						0.05	0.05	0.05	0.05	Yes	No	
SOAP Commitments						0.05	0.05	0.0.	0.05	Yes	No	
Code effectiveness monitoring (Tree canopy, critical areas, URDS, etc.)						0.15	0.15	0.15	0.15	Yes	No	
Core Functions Total						***1.70***	***1.75***	***1.70***	***1.75***			

The software would allow County staff to build and display the existing tree canopy coverage and projected coverages for each residential development permit approved. The project itself can be scaled-up and expanded for any new code amendments for commercial or industrial landscaping canopy standards.

The resulting inventory and canopy coverage calculations can be used to supplement the National Land Cover Dataset that is released every 5 years by USGS to calculate the overall unincorporated urban tree canopy coverage. These results and

canopy calculations can be used on a watershed basis to assist in other Code Efficiency Monitoring Reports such as NPDES and Critical Areas Regulations (CAR) Monitoring projects.

There would be some up-front installation and training time needed to get staff comfortable with using the inventory software both out in the field and in the office. County GIS staff would need to be trained and assigned to digitize tree surveys and landscaping planting plans into GIS tree canopy inventory. Finally, Futurewise has agreed to assist PDS with inventorying existing canopy and staff would need to be dedicated to developing an urban tree canopy volunteer program with standards, training and outreach built into the program.

IMPLEMENTATION

As mentioned, the project will require an investment in software training in addition to GIS and inventory standards. A Senior or Principal Planner would be needed to assist Technology staff with inventory standards to ensure the software is set up to capture required elements of the Annual Tree Canopy Report. The Planner will also need to assist in measuring the conservation of the overall urban tree canopy coverage and assist Technology staff with the volunteer program and outreach to stakeholders.

Requirements of the project for the PDS workplan follow:

Staff Member	Year 1	Year 2	Year 3
Principal Planner	0.1 FTE	0.05 FTE	0.05 FTE
Senior GIS Analyst	0.25 FTE	0.25 FTE	0.1 FTE
GIS Analyst	0.1 FTE	0.25 FTE	0.1 FTE

Year 1 Budget

ITEM	TOTAL
Component: Inventory	
Project Manager: Principal Planner – 40 hours @ $55.58	2,223
Staff: Sr. GIS Analyst – 280 hours @ $43.19	12,093
Staff: GIS Analyst – 208 hours @ $40.32	8,386
Volunteers – 100 hours @ $22.55	2,255
Equipment: 2 Mobile Tablets ex. SurfacePro	1,600
Inventory Software: ex. TreeWorks	9,000
Component: Assessment for Annual Urban Tree Canopy Report and proposed Urban Forest Master Plan	

Project Manager: Principal Planner – 168 hours @ $55.58	9,337
Staff: Sr. GIS Analyst – 240 hours @ $43.19	10,365
TOTAL	**$55,259**

What other PDS Divisions or other County Departments will be affected?

Long Range Planning – Staff will need to assist with setting metrics for annual canopy report, stakeholder outreach and development of volunteer inventory program.
Business Process and Technology – Staff will need to assist IS with purchasing and installation as well as instituting GIS standards and building and maintaining GIS Canopy Inventory.
Information Services – Staff may need to assist installation software on County Server and mobile pads and Service Agreement for software will need to be written and signed.

ITAC
The proposal may be subject to consideration by the IT Advisory Committee.

Roles and Work Plan

Project Name: Urban Tree Canopy Assessment and GIS Inventory

Project Sponsor: County Executive

Project Manager: David Killingstad
The project manager responsibilities include:

- Development of overall work plan and schedule;
- Stakeholder participation and volunteer program development;
- Delegating GIS and field work assignments;
- Coordination with management, staff, prosecuting attorney, public and subject matter experts;
- Responding to inquiries from the public and County Council;
- Drafting and reviewing assessment materials for the Annual Urban Tree Canopy Report and proposed Urban Forest Master Plan;
- Quality control of all work products;
- Completing the work plan according to schedule; and
- Implementation of the inventory system

Project Team
Core Project Team Members

- Amy Lucas – GIS/Technology Lead, GIS Tree Inventory production, volunteer and staff training
- Jo-Anne Antoun – GIS Tree Inventory production

- PDS – Permitting Division subject matter experts for landscaping plans
- PDS – Planning and Technology Division for software maintenance and GIS configuration

Potential Stakeholders

The internal stakeholders include:

- *PDS – All Divisions*
- *Parks – may want to piggyback on software to track park tree maintenance*
- *Public Works – TES Division may want to piggyback on software to track street tree maintenance*

External stakeholders include:

- *General Public*
- *Snohomish County cities*
- *Master Builders Association of King and Snohomish Counties*
- *Futurewise*
- *Pilchuck Audubon Society*
- *Forterra*

Management Oversight Team

The management oversight team will provide general oversight and guidance to the project team. The management oversight team consists of the following:

Clay White, Director – PDS
Barb Mock, Manager – PDS
Kinyan Lui, Supervisor - PDS

Implementation Concerns / Issues

Staff training and stakeholder outreach will occur as part of implementation. At this time there are two identified implementation concerns. The software will need to be purchased and installed via County Information Services which is outside of the PDS environment. Staff and volunteers will need to be trained on the new software and possibly how to use the mobile pads.

DELIVERABLES, METRICS AND EXPECTED OUTCOMES

PDS is proposing the following deliverables:

- Tree Inventory Software installed and configured to work within the Snohomish County ArcMap and ArcPad environments
- Digitized elements of submitted site plans including existing trees, planted trees and Critical Area Protection Areas
- Maps of the North Creek sub-basin including landscaping site plans for new residential development and urban tree canopy coverage

The project may be evaluated by the following metrics:

- A minimum of one project management meeting per month to ensure scope, schedule and budget are on track
- One 4 hour training session for PDS GIS staff
- One 4 hour training session for PDS Permitting and Inspection Staff
- One 4-6 hour training session for Futurewise and volunteers
- A minimum of one inventory collection during the Beta Testing period for staff and volunteers
- A minimum of four volunteer inventory collections consisting of 4-6 hours in the field

PDS is expecting the following outcomes:

- Development of community urban tree inventory volunteer program in conjunction with Futurewise and possible inclusion of Northshore School District
- Establishement of New Plantings Urban Tree Canopy Inventory for the North Creek sub-basin
- Establishment of Existing Urban Tree Canopy Inventory upon submittal of site tree surveys and volunteer urban tree inventory collection for the North Creek sub-basin

SCHEDULE
The recommended priority for this project is high to assist with the Annual Urban Tree Canopy report and the possible development of an Urban Forest Master Plan.

The proposed schedule is as follows:

Task	Action	Responsibility	~Time Required	General Dates
1.	Review and Assessment	Project Manager(s)	2 weeks	
2.	Assemble project team	Project Manager(s)	1 week	
3.	Request for Proposals – software vendors	Team	1 month	
4.	Research	Team	1 month	
5.	Develop performance standards and inventory standards	Team	1 month	
6.	ITAC if needed	Project Manager(s)	TBD	
7.	Council Briefing/Hearing if	Project	TBD	

	needed	Manager(s)		
8.	Stakeholder outreach	Team	2 weeks	
9.	Technology Standards and Practices Development	Team	1 month	
10.	Peer review	Team	2 weeks	
11.	Beta Testing and Staff/Volunteer Training	Team & Stakeholders	2-3 months	
12.	Implementation	Team	1 month	

RECOMMENDATION:

DECISION:

The executive has directed PDS to _____. The PDS director and _____manger concur.