



Meeting Date: May 18, 2017

Date Submitted: 5/10/2017

Originating Department: City Manager

Clearances:

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| <input checked="" type="checkbox"/> Attorney | <input checked="" type="checkbox"/> Community Development | <input type="checkbox"/> Public Safety |
| <input type="checkbox"/> Admin Services | <input type="checkbox"/> Finance & IT | <input type="checkbox"/> Public Works |
| <input checked="" type="checkbox"/> City Manager | <input type="checkbox"/> Parks & Recreation | |

Subject: Contract with the University of Washington for canopy cover analysis and urban forest management policy review.

Action Required: Authorize the City Manager to execute the contract (Exhibit 1).

Exhibits: 1. Contract and Scope of Work

Budget: \$145,000 is budgeted in the 2017-18 Community Development budget for Professional Services, of which \$115,000 is earmarked for the urban forest management planning effort.

Summary Statement:

This is a contract (Exhibit 1) with the University of Washington (UW) for research and analysis that will be used to inform the urban forest management planning effort. The contract consists of two projects:

1. **Canopy cover analysis:** Using aerial imagery, the UW team will measure the City's canopy cover and create a canopy map. They will also attempt to detect stressed Douglas fir trees and, if successful, create a stressed tree map.
2. **Urban forest management policy review:** The UW team will review the City's urban forest management policies considering best available science and provide ongoing input on recommended policies as part of the Urban Forest Management Plan (UFMP) process.

Findings from both projects will be presented to the City Council and will be accompanied by reports containing research methods, data and recommendations. The City also anticipates that the UW team will work in partnership with the consultant selected to develop the UFMP to ensure that their findings are incorporated into the goals and policy recommendations of the UFMP. Staff recommends that Council approve this contract so that the UW team's science-based analysis may be used to inform the UFMP.

Background:History

In February 2017, City staff met with two researchers, Karen Dyson and Matt Patterson, from the UW Urban Ecology Research Lab to discuss a research proposal that would explore specific urban forestry topics in preparation for the UFMP. This discussion was accompanied by a visit to Pine Lake Park, during which the researchers heard from staff about the effects of Laminated Root Rot (LRR) on trees in Sammamish. Following the visit, the researchers recommended that the City develop an ecologically complete policy approach to urban forest management in Sammamish, due in part to the widespread presence of LRR. They felt that all of the City's policies, from tree retention regulations to planting standards, needed a second look to help manage the spread of LRR and other ecological concerns.

In March 2017, the City was awarded \$15,000 in grant funding from the Department of Natural Resources as part of their Community Forestry Assistance grant program. The grant program is intended to assist communities in developing urban forest planning and programming tools and activities that may not otherwise receive local funding. The City's grant award will be used to fund a portion of the attached contract with the UW.

On May 9, 2017, the UW researchers presented their three-pronged research proposal to the City Council and Planning Commission during a joint meeting. This original proposal aimed to support the City's urban forest planning efforts by analyzing canopy cover, reviewing the City's existing urban forest policies and by developing methods to detect LRR.

Following the presentation, staff and the UW worked to develop a contract and scope of work (Exhibit 1) to define the specific tasks, deliverables and time estimations required for the project. While most of the original proposal presented to the Council and Planning Commission made it into the attached contract, the portion regarding development of methods to detect LRR did not. The UW estimated it would cost approximately \$200,000 to comprehensively study how LRR spreads in Pine Lake Park. The researchers noted that the LRR detection and verification methods that would be developed through this type of study would be beneficial for any jurisdiction experiencing LRR problems; therefore, the Council and Planning Commission discussed postponing this item until other contributors or grants could be identified to help pay for the cost. Unlike the policy review and canopy mapping, the LRR study is not within the scope of the UFMP, so it may be done independently.

Contract Scope of Work

The scope of work in the attached contract identifies two distinct projects that will both be integrated into the UFMP. It also provides for ongoing policy review throughout the UFMP planning process to ensure that proposed policy changes are in line with best scientific practices. The goal of this work is to inform and support the City's urban forest management planning efforts to safeguard the long-term preservation of Sammamish's forested character.

Project 1: Canopy Cover Mapping.

The UW team will use aerial imagery to create a multiclass land cover map of Sammamish depicting how much of the City is covered by trees, grass, water, impervious surface and other land cover classes. This analysis will result in a baseline canopy cover percentage that can be used to set a canopy cover goal and track changes in coverage over time.

Additionally, if the aerial imagery is of high enough quality, the UW team will attempt to detect stressed Douglas fir trees within Sammamish. This will be accomplished by using known patches of LRR as training samples. If this analysis is possible, the UW team will then perform site visits to confirm accuracy and assemble the data into a map of stressed trees. If successful, the stressed tree map may be used to analyze the spread of LRR throughout the City's urban forests.

Project 2: Policy Review.

The UW team will analyze the City's existing policy documents with a focus on fungal pathogens and other ecological concerns. This analysis will include a review of current best practices, including articles, conference papers and reports in the ecological and policy literature. The UW team will also draw on the extensive experience of Robert Edmonds, a UW professor and fungal pathologist of over 30 years. This research will be synthesized into a document containing findings and recommendations.

The UW will use this analysis to advise the City throughout the UFMP process and help the City integrate appropriate information and methods into the UFMP, related public education materials and policy guidelines.

Financial Impact:

This contract with the UW is not to exceed \$60,000.

\$145,000 is budgeted in the 2017-18 Community Development budget for Professional Services, of which \$115,000 is earmarked for the urban forest management planning effort.

The UFMP consulting contract will not exceed \$90,000, leaving a minimum of \$25,000 budgeted for the contract with the UW. This \$25,000 plus the \$15,000 in grant funding will cover two-thirds of the \$60,000 contract. The remaining \$20,000 will be funded from General Fund Contingency.

Recommended Motion:

Move to authorize the City Manager to execute the contract (Exhibit 1) with the University of Washington in an amount not to exceed \$60,000.

**EXHIBIT A
SCOPE OF SERVICES**

1. Overall Research Purpose Statement

- a. Goal:** Inform and support the City of Sammamish's urban forestry management planning efforts to safeguard the long-term preservation of the City's forested character.

- b. Challenges faced by City of Sammamish (the CITY)**
 - i. High public desire for tree preservation in face of ongoing development pressure and growth.
 - ii. Laminated root rot caused by *Phellinus sulphurascens* presents an ongoing tree management and preservation challenge.
 - iii. Urban forestry management planning process requires policy development to manage existing City land holdings and to inform future policy and code decisions related to management of the urban forest.
 - iv. Upcoming land acquisition, and future policy decisions require careful planning and scientific input to responsibly invest and safeguard the urban forest and citizens' tax dollars.

- c. Research Outcomes**
 - i. Baseline mapping of current canopy cover will inform development of urban forestry planning efforts.
 - ii. Revisions to allowed planting list and other urban forestry policies based on best available science will support tree preservation, ongoing laminated root rot management, and provide science-based planting options for developers.

2. Background

- a.** Laminated Root Rot (LRR) is a disease that impacts the root system of Douglas Fir. The disease is caused by a fungal pathogen, *Phellinus sulphurascens*, which is native to the Pacific Northwest. *P. sulphurascens* is a parasitic and saprophytic fungus, meaning that it infects live trees, and then consumes the dead wood of trees that have died as a result of infection. It persists in woody roots, stumps, and fallen trees for decades, and infects new host trees when their roots come into contact with infected material. It is estimated that between 5% and 15% of coastal Douglas Fir forests are infected by the fungus, but actual rates may be much higher. LRR does not usually kill mature trees directly, but instead weakens them for opportunistic attack by various insects, and can increase the risk of windthrow. Infection and subsequent loss of vigor and death in mature trees takes place over a ten to-fifteen-year time scale, and many trees may show no signs of infection for years. Small trees tend to be killed relatively rapidly after becoming infected.

- b.** Management methods for LRR are typically focused on timberlands and plantations, where thinning of trees near infection centers, decreases in rotation time, stump removal, and planting with resistant/immune species are the recommended courses of action. However, timber management techniques are largely inappropriate for the

Exhibit 1

urban context, and minimizing a loss of harvestable wood volume is a very different goal from long-term preservation of canopy and forest structure.

- c. The first step in managing LRR, and preventing future losses of tree cover to it, is to identify the location and extent of infection. Heavily infected trees can be identified by characteristic crown dieback. However, post-assessment tracking has shown that judging infection status by the condition of the canopy of a tree can be extremely difficult, with a high rate of both false positives and negatives. As most infected trees show little or no sign of infection for a long period, accurately mapping infected areas and determining the extent of infection is essentially impossible using traditional observational techniques. To minimize loss of trees and prevent the spread of the fungus to the greatest extent possible, it is necessary to develop reliable methods of detecting the presence of the fungus.

3. Projects

a. Canopy cover mapping (Part/Period 1)

- i. **Purpose Statement:** Create a canopy cover map for the CITY OF SAMMAMISH for use in its urban forestry planning efforts.
- ii. **Inputs and Requirements:**
 1. CITY will provide 4-band or better satellite imagery at resolution sufficient for their needs, < 1m (< 25 cm) preferred.
 2. CITY will specify required file format and spatial reference of outputs.
 3. UW TEAM shall advise CITY on data quality needs and sourcing as requested by the CITY.
 4. If CITY obtains sufficiently high-quality data, UW TEAM shall attempt to “train” cover analysis software algorithms to identify "stressed" Douglas fir trees/stands.
- iii. **Project Details:** For additional methods details, please see Appendix 1.

Task	Task/Activity Description	Deliverable/Outcome	Due Date/Timeframe	Estimated Person Hours	Estimated Materials Cost
1.0	Project Management				
1.1	<p>UW TEAM will participate in an initial project planning meeting with CITY staff. The meeting will define the CITY's desired deliverables and the data sources required to produce these outputs.</p> <p>CITY to coordinate logistics.</p>	Participate in initial project planning meeting; identify mapping objectives; define format of project deliverables	Within one to two weeks of contract approval.	<p>Prep work: 8</p> <p>Meeting: 4</p>	

Exhibit 1

1.2	CITY handoff of 4-band or better satellite imagery to UW TEAM. UW TEAM to coordinate with City GIS staff on handoff.		TBD by CITY		TBD by CITY
1.3	Participate in a bi-monthly, check-in meeting with CITY project manager(s) as needed. Meetings may be by phone or in-person.	Share progress and findings with CITY. Obtain direction/clarification on work items. Review and confirm schedule and timeline.	Ongoing, scheduled as needed	16 (8 calls)	
2.0	Canopy Analysis				
2.1	UW TEAM shall perform initial training and analysis of canopy cover based on provided aerial imagery to generate a multiclass land cover map of Sammamish.			125	
2.2	UW TEAM shall perform an accuracy assessment based on the results of initial training and analysis of canopy cover.			80	
2.3	UW TEAM shall create draft report of canopy cover output, metadata, accuracy assessment, and methods document report.	Submit draft canopy map in preferred spatial file format and datum with associated metadata, accuracy assessment, and draft report to CITY.	Within 16 weeks of receipt of raw data. CITY to provide comments back to UW team within 3 weeks.	50	

Exhibit 1

3.0	Stressed Tree Detection				
3.1	With sufficiently high-quality data, UW TEAM will attempt detection of stressed Douglas fir within Sammamish.			100	
3.2	UW TEAM shall report to CITY on success of stressed Tree map production. If possible, UW TEAM will provide updated timetable estimate for production of stressed tree map.	Share progress and findings with CITY and identify any next steps.	Within 4 weeks of canopy cover report submission.	2	
3.3	If possible, UW TEAM shall perform an accuracy assessment, including site visits to assess tree condition. UW TEAM will coordinate with CITY to gain access to necessary public sites.			50	
3.4	If possible, UW TEAM shall provide stressed tree map output, metadata, accuracy assessment, and associated methods report.	Submit draft stressed tree map, accuracy assessment, metadata, and associated final report.	TBD	50	
4.0	Recommendations and Next Steps				
4.1	UW TEAM will present their findings to CITY staff at an in-person meeting. The purpose of this meeting will be to communicate the relevant science to CITY staff, respond to any CITY staff questions, and discuss implications of work for CITY's future Urban Forest planning efforts.	Create presentation in PPT format Submit final report to CITY	Presentation within 2 weeks of receipt of CITY comments Final draft within 1 week of presentation	Presentation: 10 Meeting: 5 Report revision: 20 Stressed tree report revisions: 20	

Exhibit 1

	<p>If possible, UW TEAM will also present outcome of stressed tree map at this meeting.</p> <p>UW TEAM will help coordinate agenda, CITY to coordinate logistics.</p>				
5	Total Task Hours & Materials				
			TOTAL with Stressed Tree Analysis:	560*	

* Some hours are necessary to determine if the available imagery can be used to identify pockets of stressed trees. If it is not possible to find stressed trees based on available imagery, the scope of work will be adjusted upon mutual agreement by both parties.

b. Provide scientific input on existing and emerging urban forestry policies (Part/Period 1)

- i. Purpose Statement:** Review Sammamish urban forestry policies considering best available science and provide input on new policies and recommendations developed as part of the Urban Forestry Management Plan
- ii. Inputs and Requirements:**
 - 1. CITY will provide all existing tree regulations and other policy documents for review.
 - 2. CITY will specify desired project start date and report/presentation format.
- iii. Project Details:**

Task	Task/Activity Description	Deliverable/Outcome	Due Date/Timeframe	Estimated Person Hours	Estimated Materials Cost
1.0	Project Initiation and Management				
1.1	<p>UW TEAM will participate in an initial project planning meeting with CITY staff. The meeting will define policies for review and the CITY's desired project deliverables.</p> <p>CITY to coordinate logistics.</p>	Participate in initial project planning meeting; identify policies for review; define format of project deliverables.	TBD by CITY	<p>Prep work: 8</p> <p>Meeting: 4</p>	

Exhibit 1

1.2	Participate in check-in meetings by phone or in-person with CITY project manager(s) as needed.	Share progress and findings with CITY.	Ongoing	16 (8 calls)	
2.0	Policy Analysis				
2.1	UW TEAM will analyze existing policy documents, review relevant literature and current best practices, and write a synthesis document containing findings and policy review recommendations.	Submit draft report to CITY for approval.	Within 8 weeks of project initiation CITY to provide comments back to UW TEAM within 2 weeks	80	
2.2	UW TEAM will analyze new policy documents associated with development of urban forestry management plan.	Share findings and recommendations with CITY via memo.	When requested by CITY.	80	
3.0	Recommendations and Next Steps				
	UW TEAM will present their findings and policy review recommendations to relevant CITY staff. The purpose of this meeting will be to communicate the relevant science to CITY staff, report policy recommendations, respond to any CITY staff questions, and help brainstorm policy approaches and next steps for the Urban Forestry plan. UW TEAM will help coordinate agenda, CITY to coordinate logistics.	Create presentation in format TBD Submit final report to CITY	Presentation within 2 weeks of receipt of CITY comments Final draft within 1 week of presentation	Presentation: 10 Meeting: 5 Report revisions: 20	
4.0	Total Task Hours & Materials				
			TOTAL:	223	

Exhibit 1

Appendix 1: Methods and Sampling Design

Canopy and Land Cover Mapping

Methods

- Acquire 1m resolution, four band data or better satellite imagery, along with related products at other scales (several periods of NDVI data, etc.)
- Develop a comprehensive and exclusive set of land cover classes, in cooperation with the City of Sammamish (City).
- Perform an initial training and analysis of the canopy cover based on provided satellite imagery, resulting in a multiclass cover dataset that includes, at a minimum, canopy cover and impervious surfaces.
 - Software: QGIS (open-source), Orfeo ToolBox (open-source), Google Earth Engine
- Perform an accuracy assessment based on the results of the initial training and analysis. The sample evaluated using accuracy assessment will be determined based on a stratified random sampling of the different land cover classes.
- If desired by the City, and subject to data availability, repeat analysis on an older time step (possible years include 2011, 2013) to enable change analysis.
- Using known patches of laminated root rot as a training sample, attempt to develop a method for mapping of stressed Douglas-fir in the source imagery.

Policy Analysis

Methods

- To provide valuable feedback concerning the impact of fungal pathogens and other ecological concerns on the City's urban forestry management planning, we will find articles, conference papers, and government or consultant reports in the ecological and policy literature. We will also draw on the long experience of the PI, Robert Edmonds, a fungal pathologist of over 30 years.
- Key information from these sources applicable to the City's urban forestry management planning will be summarized in a white paper to provide scientifically grounded feedback on current and future urban forestry policies.
- We will use this knowledge to advise the City on the Urban Forest Management Plan process and help them integrate appropriate information and methods into the UFMP, related public education and outreach, and policy guidelines.