

**Going Green: Improving Health and Wellbeing Within Western's Workplaces Through  
Indoor Plants**

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**Project sponsor: Dr. Nick Stanger**

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## Executive Summary

Many of the buildings around the Western Washington University (WWU) campus were built without much regard for the people working inside them. A lot of the original buildings on campus were built in the 60's, 70's, and 80's, while some buildings such as Old Main, which started construction in 1895, were built much earlier (City of Bellingham, 2018). Standards for ventilation, sustainability, and aesthetics have vastly increased over the years, and these buildings are no longer up to par with what would presently be accepted as sustainable. Renovating these buildings would be costly and would require many more resources than are currently available or entirely necessary. This project will serve to examine small changes that could help improve both the livability and sustainability of these area, as well as improve the health of those occupying these buildings, without the need for major renovations. Arntzen Hall has been designated as the pilot building for these experiments. Research, surveys, sponsor, and stakeholder advice will inform any recommendations on this topic.

To improve the health and wellness of the faculty, staff, and students occupying Arntzen Hall, a trial run will be conducted where in common house plants will be placed throughout the second floor hallway and within the offices of interested faculty members to raise the air quality of the immediate area. Air quality tests measuring carbon dioxide concentration have been taken prior to the integration of plants and will be taken again both during the run of the pilot and during any time of continuation of this project to ensure successful lowering of emissions within the pilot building. Initial carbon dioxide test have already shown that levels on the first floor of Arntzen can reach levels that have been shown to cause up to a 15% decrease in cognitive ability by Grossman(2016). Preliminary surveys have been distributed and collected to measure interest in support of the project, and follow up surveys will be given out after the installation of the plants. Detailed cost analyses is be included in this report and can efficiently be adjusted for any future changes to cost as the experiment continues.

Surveys were distributed to all available faculty on the second floor of Arntzen. Twelve faculty members responded to the survey, and results showed overall support for the project with valid questions about maintenance arising from several people. Public outreach will be helpful to draw support from a larger pool of stakeholders. Visibility of the pilot project is essential for spreading awareness and helping to move the project forward into other campus buildings, including brief explanation cards on all potted plants located in public spaces. An advertisement or notice in one of WWUs publications such as The Western Front or The Planet is a possible avenue to spread awareness to a larger audience of stakeholders and garner support. Public outreach is going to play a key part in extending the project once the pilot has been completed.

Acquiring funding for the project will be essential to ensuring continuation of the project into and beyond the pilot phase. Application to the Sustainability, Equity, and Justice Fund (SEJF) has been sent in and if funding for the pilot cannot be acquired, resubmission for the grant is possible as many times as is required. Along with funding, coordination with maintenance staff will be key to arranging for care of the plants in the long term for both the pilot project and any other areas it may expand to.

The expansion of the project to other buildings after Arntzen has been set in place. Upon completion of the initial pilot project. The Sustainable office certification has requested the pilot project be extended to their office, and have expressed great interest in having and maintaining plants in their workspace.

## **Introduction**

Arntzen Hall is one of the older buildings on campus, it was built in 1974 (“Western Today”, 2012) and started construction before the State Building Code Council was created in Washington(SBCC, 2018) . Since older buildings are only required to meet the building codes that were in act when they were built (FEMA, 2018), many of the buildings on campus have air and ventilation systems are out of date. We are focusing on small changes that can be made now to improve sustainability at WWU, and this project fits neatly into that focus. The plants will be a low cost, low maintenance addition to Arntzen that will bring with them improvements in air quality, and hopefully improve the time of those who inhabit Arntzen.

We hope to improve the air quality within arntzen hall through the addition of indoor plants to the halls, offices, and classrooms. These plants will help to lower overall CO2 levels and help remove particulate matter in the air, thus improving the health of those spending their time within the walls of Arntzen. Once the pilot project has been completed, the next building to extend the project to has been identified. The members of Sustainability Office Certification, which certifies administrative and office groups in recognition of their efforts to positively impact campus and move toward WWUs goal of sustainability, have expresses the desire to have the project implemented in their workplace to improve their air quality and improve office health.

The negative effects of poor air quality on human physical and mental health and wellbeing have been thoroughly studied for a long period of time. An article published by Texas A&M found that plants have numerous health benefits along with better air quality. It goes without question that improvements in air quality, especially in enclosed indoor spaces, is a positive change that should be made for the benefit of all. Studies done more recently have only served to further cement the evidence that indoor air quality can play a major role in the lives of those within that space. Tests done within the last five years show that people“...measured a 15 percent decline of cognitive ability scores at 950 parts per million (ppm) and 50 percent declines at 1,400 ppm”(Grossman 2016). In addition “[o]ffice workers had significantly improved cognitive function scores when working in...[sustainable] environments compared with scores obtained when working in a Conventional environment”(Allen et. al. 2015). Refined workflow is a good indicator for positive mental health, and the Texas A&M study found that “[w]ork performed under the natural influence of ...plants is normally of higher quality and completed with a much higher accuracy rate than work done in environments... [without] of nature”(Serwach 2008). The improvement in mental health not only applies to productivity in the workplace, it has been shown that people surrounded by plants and greenspace also have better moods. “As a result of the positive energy they derive from the environment, the chances of suffering from stress-related depression are decreased”(Texas A&M 2011).

With general information from past studies and confirmation of many of those statements from recent studies, it is logical to place this project well within reason for the insisted importance of improving the indoor air quality of buildings on WWUs campus in the present.

## **Methodology**

The steps used to collect data for the pilot project came took two forms, carbon dioxide measurements, and surveys given to the faculty of the test area. Initial air quality measurements were taken with a carbon dioxide monitor, which can be rented from the equipment library located in the SMATE library. The CO<sub>2</sub> monitors were plugged into outlet in the survey areas and allowed to adjust and track numbers for between one and two hours while the CO<sub>2</sub> concentrations were marked every half hour. Tests were taken at various locations; outside Arntzen, and the first, second, and fifth floors between the hours of 10am and 4pm. The first round of measurements were taken on 10/24, 11/08, and 11/13 at the test locations before installation of plants and will again be taken after. The monitors are the quickest and most accurate way to determine CO<sub>2</sub> levels in the given test area and provide hard numerical data that will be tracked to verify any changes in air quality after the implementation of plant life into the test area ( the second floor of Arntzen Hall).

Interest surveys have been distributed to the faculty and staff of the pilot area. The survey provided insight into the general level of support from the stakeholders who would likely be most directly affected by any changes brought about by this study. We received responses back from 12 faculty members which allowed us to compile the results into tables and graphs illustrating our feedback. A copy of the survey questions and data on the results is located in the appendix.

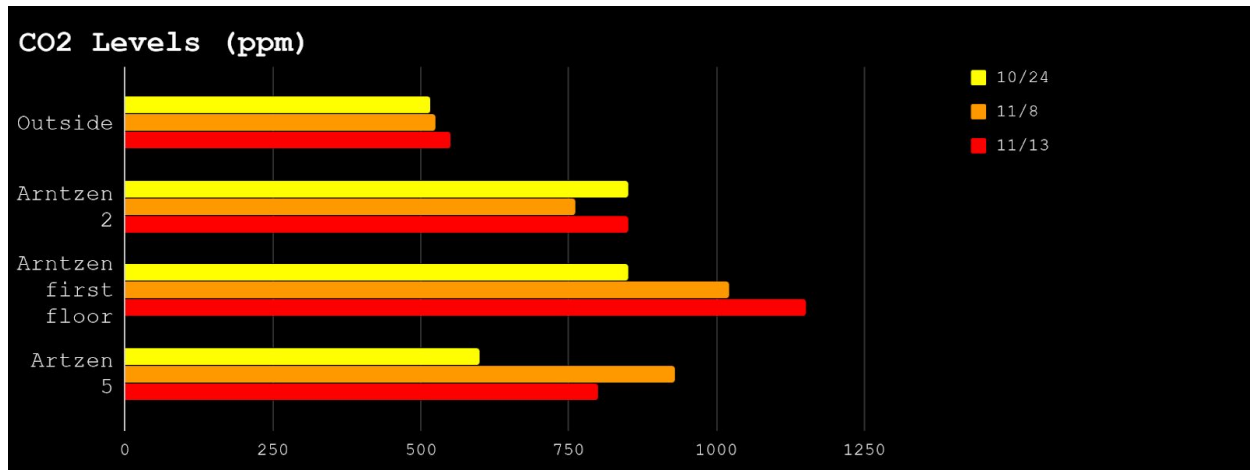
. Next information was gathered on the test location. A map of Arntzen halls second floor layout, was acquired from the WWU website archives. A map of campus was also acquired and the buildings we intend to expand the project to have been highlighted in green. In addition, SEJF funding will play an immediate role in the acquisition of plants for the initial phase of this study and the timing of its initiation. The first submission for funding has been put together and is ready for any further updates for future submissions for additional funding.

Information on the species of was gathered through online research and from the species used in the studies cited in this report. Budgeting data for the prices of the plants and the equipment for them, pot, soil, and watering utensils, was gathered via information pages on local nurseries and wholesale websites. These prices were calculated for the pilot project, and expansion to a building wide scale.

## **Results**

CO<sub>2</sub> measurements from in and around Arntzen Hall show clear differences in air quality Between inside and outside of the building. Measurements inside Arntzen, especially on the first floor, where many staff spend most of their day working in the food court area, reached very high levels, capping out at 1150 parts per million (ppm). Air quality levels this high have measurable effects on the students and employees who spend their time in these spaces, studies from Yale show that CO<sub>2</sub> levels of 900ppm resulted in a 15% drop in cognition (Grossman, 2016).

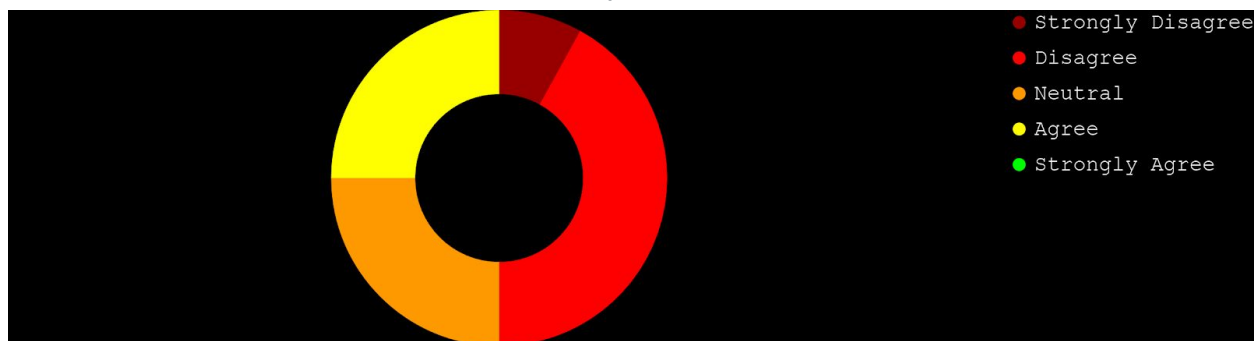
CO2 readings:



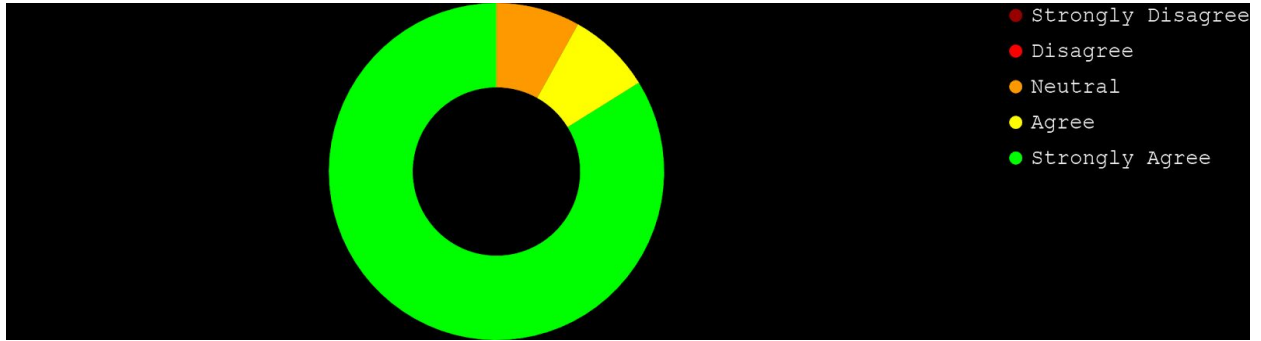
The conduction of a survey provided results that will inform how the pilot project is organized. Our results show that a large majority of the floor we surveyed were supportive of the project, were interested in participating, and even 75% of the people we surveyed expressed willingness to care for the plants on the hallways of their floor. The feedback we received is enough data to be confident that Arntzen 2 is a great candidate for our pilot, which will need an active and involved group of faculty and staff to gain the best feedback possible.

Survey Results:

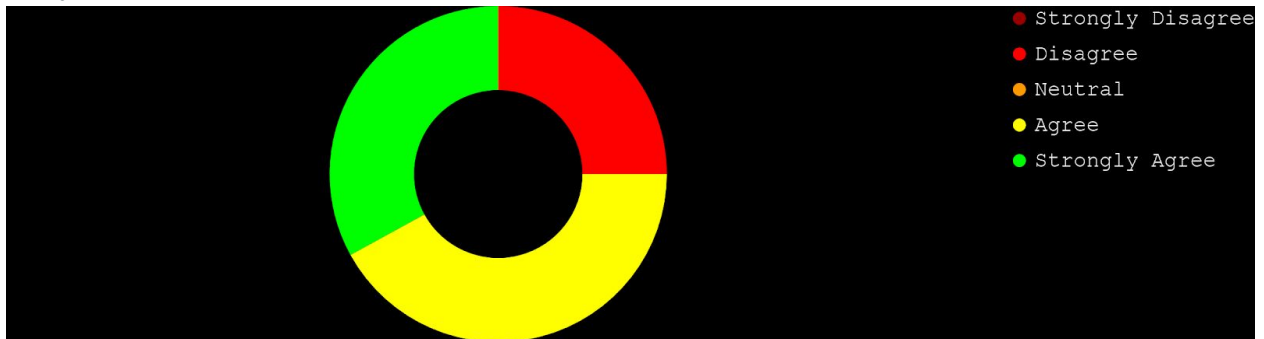
1) I am satisfied with Artzen Hall’s ventilation system and access to fresh air.



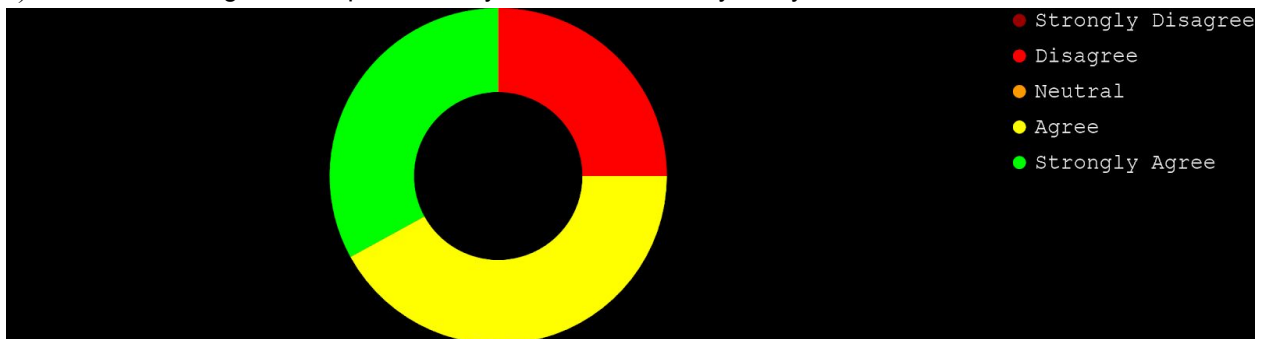
2) I would like to see more plant life in Arntzen Hall.



3) Assuming someone else cares for them, I would be interested in having plants in the hallway of my floor.



4) I would be willing to water plants if they were in the hallway of my floor.



5) Assuming I would care for them, I would be interested in having plants provided to me for my office

## **Recommendations**

Results from the survey showed that, while many staff people wanted more plants in their office, some did not want anything to do with the plants. Similarly, 75 percent responded to the survey saying that they would like to have plants in communal spaces, while others showed their concern for having to care for the plants.

So, to gain traction moving forward, it would be best to bring the project to the people who are interested, or draw in supporters through public outreach, rather than focusing on a floor/building where some of the staff might not want any part of the project. For the pilot, it made the most sense to localize the scope to one floor, but now that demand and success has been demonstrated on a small scale, the scope of the project can be expanded.

In order to get more people talking about the project, the goal should be to get plants living in as many different places on campus as feasible. This may mean moving plants from building to building instead of buying more plants than will be able to be taken care of. New plants or areas where plants are installed should advertise the project, with information on our mission and how to get involved. Spreading the plants around campus will expose more people to the project, as well as provide the benefits of indoor plants to a wider audience.

Word of mouth can only take this project so far. The project will benefit greatly from receiving publicity from Western's publications, such as *The Western Front* or *The Planet*. Having a spotlight on neo environmental work coming from a college campus can bring in new stakeholders and interest from outside groups, as well as other universities. Having a visual component, or some compelling statistics or headline would be a good way of making sure the story reaches a wider audience. The project will also need to gain support from the university as well as the general public. Leverage points are an important part of creating systemic change, if the project is to gain the support of the university, the project will need to be presented in a way that talks to the interests and desires of the university. Western has serious vested interest in sustainability as well as the health and wellbeing of its staff, so using those points to leverage the project to the school should be very effective.

A crucial next step for getting this project off the ground is tackling the problem of funding and long-term maintenance. A very helpful resource for project-based funding is The Sustainability, Equity, and Justice Fund (SEJF), "The Sustainability, Equity, & Justice Fund Grant Program promotes sustainability by providing students with the opportunity to create and implement projects that positively impact environmental, social, health, and economic practices on our campus and in our community" (cite). The grant program offers funding options from \$1000 up to \$120,000. The SEJF can be instrumental for funding a large-scale implementation of this project. We were able to work with the SEJF to fund our pilot project on Arntzen and they were very helpful and involved in the project.

When looking for ways to ensure proper maintenance for communal indoor plants, the Western groundskeeping staff and our head gardener Heidi Zeretzke are available for conversation. Western's groundskeepers are knowledgeable resources for maintenance and plant care, they will be a key component in successfully and smoothly implementing plants into Western's indoor spaces. It should be noted that many people responded positively to taking care of the plants on their floor, and that paid maintenance may not be necessary for this project.

After completion of the pilot project, a new level of attention is needed to ensure that the project sees expansion and growth within the school. In addition to being overseen by the project



sponsor, Dr. Nick Stanger, The Sustainable Office Certification Program has agreed to house the Going Green Project as it continues to evolve. The Sustainable Office Certification Program (SOC) is a part of the Office of Sustainability at Western, the program inspects and grades “administrative and academic office working groups, to measure, improve, and get recognition for their daily practices that reduce energy and materials consumption, impacts and waste.” (Gallup, 2018). Partnering with the SOC provides benefits to both programs in the form of publicity and incentive for participation, which will be very important for growing the program.

### **Monitoring and Evaluation**

Success will be tracked by the amount of new green space within Western’s buildings, improvements to staff/faculty health, the health of the plants, and reactions to the project from stakeholders:

By looking at the post-pilot surveys, it will be clear how well received the pilot project was. The survey questions will be focused to gain feedback on the relative success of our pilot and give us advice for what could be better and how to move forward. Positive responses to the pilot means that our hypothesis is valid and feasible at Western, while negative responses means the project design will have to be tweaked to work with the needs of staff.

A running tally of the number of plants moved into the buildings on campus will give a good sense of the progress this project has made. It is also important that the plants are doing well in their new homes, and that they are not wilting or dying from neglect. Our project will be considered more successful if there is a lot of support for the project and many more plants are welcomed into the offices and hallways around western. If a large majority of the plants continue to live and are well taken care of without many maintenance issues, the project can continue as is.

Success of the project will also be measured by how much traction the project has gained, or what kind of publicity it has received, locally and beyond. The project will be considered more successful if it receives mentions in newspaper, radio, or blogs. The effect of the project can only be as large as the university if nobody outside of Western knows about it, with more publicity, more people and institutions will follow in our footsteps.

Of course, collecting more data will be crucial in keeping track of progress, being able to reassess the air quality of the shared spaces on campus after having plants living in these spaces will be very valuable. Similarly, the success of the project relies on staff and faculty happiness and wellbeing as well, so interviews or more surveys with staff and faculty will shed light on how well the plant life has worked on the mental health front.

In order to evaluate the success of the project moving forward, more surveys will need to be conducted along the way. The feedback from the pilot project could be completely different or even irrelevant to later stages of the project. After implementing the project on a larger scale, it will be important to get feedback from more stakeholders that are being affected by this project so that adjustments can be made.

## **Budget**

A budget for the pilot project has been made, this smaller budget includes the cost of plants, soil, and basic maintenance. The budget contains a relatively minimal list of items, and only requires a single round of funding to complete the entire pilot. A budget estimate is listed for a larger application of the project, this includes recurring costs for each building, so the university will need to work along with funding to cover the cost of keeping the project running, and possibly hiring more employees to take care of indoor plants. This larger budget includes salaries, costs of advertising, and a larger cost associated with plants as more plants will be needed and more will need to be replaced as time goes on.

Our goal is to create a simple and affordable solution to the health issues that come with Western's out-of-date infrastructure. This plan does not include any kind of renovation and will in-turn save the university significant amounts of money by extending the lifetime of existing buildings. Western's budget for Carver gym renovations reached \$81.5 million when the building was completed in 2017(Cocke, 2017). It is unrealistic to renovate all of western's buildings to achieve modern standards of workplace health, our solution offers passive improvements to human health in the workplace without the need for expensive renovations.

Item	Cost per	#	Total
Spider Plant	10	4	40
Boston Fern	10	4	40
Pothos	7	4	28
Peace Lily	10	4	40
Snake Plant	15	6	90
Philodendron	9	3	27
Chinese Evergreen	20	2	40
6" planter	7	16	112
10" Planter	10	8	80
14" Planter	20	3	60
Soil	6	13	78
Watering can	5	4	20
Fertilizer	13	2	26
Moisture meter	8	4	32
TOTAL			713

Plant species have been chosen to be included in our pilot based on multiple factors that make them ideal for our purpose. The plants selected are at a cross section between ease of care,

affordability, and air filtration effectiveness. Not only are the selected plants excellent at converting CO<sub>2</sub> to oxygen, they are each proven to remove different harmful toxins from air, including ammonia, benzene, and formaldehyde (Richards, 2008).

A cost estimate has been created for when this project goes full scale and plants are purchased and installed through an SEJF grant. The estimate looks at the cost associated with purchasing and installing plants and advertising for the project in an average 5 story building on campus, with labor costs estimated from Western's payroll and plant costs quoted from Cascade Cuts Nursery. Our estimate comes out to nearly \$4000 per building. Upkeep of the project may require the hiring of more janitorial staff, which can cost the university around \$30,000 a year per employee for salary (Washington State Office of Financial Management, 2018).

## **Conclusion**

As Western continues to grow, it is increasingly important to promote and encourage sustainable practices within our community. Part of the mission of promoting sustainability is making use of the spaces we have, and not creating additional waste when not necessary. While the buildings we operate in may not be the most efficient or up to our current standards, the process of tearing them down and rebuilding them is a much more energy intensive process, and is not a long-term solution. Not only does installing plants inside these older buildings on campus improve health and well-being, it promotes a bigger message of a sustainable lifestyle where we don't just discard the old and defunct in exchange for new and shiny, but make use of the spaces we have right now.

Human health is a critical component of sustainability and any way we can improve the physical and mental wellbeing of those around us is a worthwhile investment that will pay itself back in productivity, happiness, and a generally more holistic workplace. Plants are just a small part of health on campus, but a great way to connect us back to our roots and create a more natural place of learning.

The Going Green project has gained a lot of support just over the course of this quarter. Our pilot floor is ready for the pilot project to be put into action and our sponsor as well as the SOC and SEJF are open and ready for collaboration to help ensure the project has the support it needs. As the project continues in the following quarters, under the right leadership, we will see a large influx of plants appearing inside of Western's buildings and the effects will be obvious.

Western Washington University is a beacon of sustainability in the world of American higher education, and the addition of this project to the campus will set an example that other universities will hopefully follow, continuing the cycle of inspiring and educating a sustainable mindset within our community.

## **Appendix**

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<https://sustain.wvu.edu/sejf/>

[https://www.ofm.wa.gov/sites/default/files/public/shr/CompensationAndJobClasses/Salary%20Schedules/2018Jul1\\_GWA/Represented/GS\\_2018Jul1\\_Represented.pdf](https://www.ofm.wa.gov/sites/default/files/public/shr/CompensationAndJobClasses/Salary%20Schedules/2018Jul1_GWA/Represented/GS_2018Jul1_Represented.pdf)

**DATA**

CO2 READINGS

10/24 10:30-11:00am

Artzen outside - 515ppm

Artzen 2 - 800ppm +- 50

Artzen 5 - 600ppm

Artzen first floor/ food court - 850ppm

11/8 2:30-3:00pm

Artzen outside - 525ppm

Artzen 2 - 760ppm

Artzen 5 - 930ppm

Artzen first floor/ food court - 1000ppm +-20

11/13 1:00-1:30pm

Artzen outside - 550ppm

Artzen 2 - 850ppm

Artzen 5 - 800ppm

Artzen first floor/ food court - 1100ppm +-50

**BUDGET**

Item	Cost per	#	Total
Spider Plant	10	4	40
Boston Fern	10	4	40
Pothos	7	4	28
Peace Lily	10	4	40
Snake Plant	15	6	90
Philodendron	9	3	27
Chinese Evergreen	20	2	40
6" planter	7	16	112
10" Planter	10	8	80
14" Planter	20	3	60
Soil	6	13	78
Watering can	5	4	20
Fertilizer	13	2	26
Moisture meter	8	4	32

TOTAL				713
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	Salary	per plant	per floor	per building	cost per 5 floor building
Plants + materials			27	135	3200
Potting plants	15	0.2 hrs	5.4 hrs	27 hrs	405
Installation	15		3 hrs	15 hrs	225
Labels + Advetrisment	1	1.25	33.75	168.5	168.5
TOTAL					3998.5

	1) I am satisfied with Artzen Hall's ventilation system and access to fresh air.	2)I would like to see more plant life in Arntzen Hall.	3)Assuming someone else cares for them, I would be interested in having...	4) I would be willing to water plants if they were in the hallway of my floor.	5) Assuming I would care for them, I would be interested in having plants provided to
	total (currently)	12			
Question#	SD	D	N	A	AS
1	1	5	3	3	0
2	0	0	1	1	10
3	0	0	1	3	8
4	0	3	0	5	4
5	1	1	3	2	4
		Survey Response Percentages			
Question#	Strong Disagree	Disagree	Neutral	Agree	Strong Agree
1	8	42	25	25	0
2	0	0	8	8	83
3	0	0	8	25	67
4	0	25	0	42	33
5	8	8	25	17	33




Map of plant placement for pilot project on Arntzen 2



**Map of possible buildings for project expansion**

**Care:**  
Place in indirect sunlight  
Water when top layer of soil is dry  
do not over water





## Peace Lily

This plant is part of a pilot project aimed at improving the health and wellbeing of Western's population through adding indoor plants to offices, hallways, and communal spaces.

💧
💧
💧

This project is in collaboration with the Office of Sustainability and the Sustainability, Equity, and Justice Fund.



  
**SUSTAINABLE**  
ACTION FUND  
Sustainability • Equity • Justice

**Example of maintenance/ project advertisement card (provided with plants)**