Exhibit C1 - Scope of Work

1. Scope of Work

Stockton Skywatch is designed as a community monitoring project to fulfill the goals of AB617 with an emphasis on community engagement and benefit. The **outcomes**, **benefits and community improvements** of this project include:

- Preparing a work plan and receiving feedback will ensure that the project is detailed, achievable, and in line with community air grant priorities as described in the CARB request for applications.
- Empowering the disadvantaged community of Stockton with information on the quality of air they are breathing, in real-time (Shair) and ahead of time (EPA AirNow, integrated into Shair), at high spatial resolution, with insight into influential sources near them, so that they can advocate for appropriate emission reduction measures.
  - Valuable and novel insight into the impact of Port of Stockton on the community's environmental burden, provided by real-time vessel assessment in Shair
  - Provide residents with real time information about the air they are breathing and the sources of pollution
  - Enable Stockton populace to make informed decisions about controlling their everyday exposure e.g., avoiding outdoor activity during high-pollution episodes
  - Provide Stockton residents with future air quality predictions in a single platform and information on the quality of those predictions to allow them to plan activities with air quality in mind
- Build leadership and air quality expertise and capacity within the community
  - Contribution to developing a skilled workforce and community capacity building on air quality and health
  - Provide youth and young adults with mentorship and workforce training opportunities that can lead to jobs in environmental science, data analysis, advocacy, policy, and research.
- Equitable public participation, local partnership building, collaboration, workforce development, and advancements in environmental justice
  - Address community concerns and engage the community members by soliciting feedback on sensor locations and placing sensors at locations representative of population density, low-income areas, and the demographic mix of the domain, leading to equitable creation of sensor network
  - Provide overall health education and socio-economic benefits to the community
  - Benefit from the knowledge on hyper-local community scale air pollution, health recommendations, and education on air quality related topics and assist community members in making informed decisions surrounding daily activities
- Facilitate community-driven, evidence-based air pollution reduction measures to reduce impacts to environmentally overburdened Stockton populace by utilizing Shair's source contribution feature and dashboard
  - Allow the community to explore trends in pollution hotspots and influential sources impacting their local air quality with continuous monitoring

    - Empower community to advocate for their own pollution reduction measures by aiding in identification of influential sources
- Community members will become active partners with the government to identify, evaluate, and ultimately reduce air pollution and harmful exposures within their community. Through the collection, analysis, and community engagement efforts surrounding air pollution data, community members can be better equipped to become active partners to reduce air pollution in their communities, as reflected in the letter of support we have received for Stockton Skywatch from the San Joaquin Valley Council of Governments (Attachment D) This outcome is directly in line with the implementation goals in CARB's AB617 Community Air Protection blueprint.
- Preparing and receiving feedback on the biannual reports will ensure that the project is on track, and that CARB is most up-to-date on the progress and any challenges encountered with the implementation of the project.

The **potential challenges** of this project include:

- Logistical issues with monitor siting e.g., access to electricity and WiFi
- Sensor performance and environmental interferences (e.g., overheating on excessively hot days, and signal overload from wildfire smoke episodes, both of which have become increasingly frequent in the San Joaquin valley).
- Sensor malfunction which would require taking the monitor offline to return to the vendor for repair, maintenance, and/or recalibration.
- Poor agreement between sensors and reference-grade instruments from collocated measurements could hamper the systematic calibration process.
- Limitations in access to data such as latest emissions inventories, real-time traffic and congestion, building topography, etc., which are inputs to the Shair model.
- Insufficient participation by community members in various aspects of community engagement such as providing suggestions for sensor locations, following and/or subscribing to social media alerts, providing feedback for improvements of Shair platform, etc.
- Significant delays in SJ Valley Air Pollution Control District's AB617 monitoring Data and potential bureaucratic access barriers.

Stockton Skywatch **contributes to the Community Air Grant Priorities**, as exemplified below:

- *Projects that propose/achieve equitable public participation and demonstrate local partnership building and coordination, resource leveraging, in-kind support, or other forms of collaboration.*
  Little Manila Rising calls on community participation and donated time, in-kind contributions, and resource leveraging from a variety of partners and separate funding mechanisms, as described in below:
    - Stockton Skywatch will solicit sensor location suggestions from the Stockton community, DAWN and GOTV participants. Community outreach for sensor siting will ensure that Stockton's new sensor network is representative of population density, low-income areas, and the demographic mix of the domain, and will reflect the community's needs. We only work in the most underserved census tracts.

- We have acquired separate funding from The California Department of Justice *San Joaquin Valley Center for Community Air Assessment and Injustice Reduction (SJV CC-AIR) project*. Stockton Skywatch will leverage this resource to cut costs on sensor purchase and will be able to leverage data to provide real-time information and forecasts of air quality conditions in Stockton, as well as major sources of emissions.
- SJV CC-AIR will also contribute research grade public health analysis of Skywatch data and will contextualize data for public health campaigns.
- Ramboll has agreed to provide in kind support in the form of integrating EPA's AirNow air quality prediction service into the Shair platform, as well as evaluating the accuracy of these predictions, so that the Stockton community can easily access both current and forecast conditions of air quality in one place.
- As described in **Section 2.5**, Little Manila Rising has over 20 years of community leadership experience in South Stockton. A particular landmark of our work is our *Decreasing Asthma Within Neighborhoods (DAWN)* initiative as part of the *Regional Asthma Mitigation Program (RAMP)*. We will leverage the DAWN program and will enable an inclusive network design that ensures broad utility for sensitive receptor populace in Stockton. Our recent work with UCLA GOTV campaign has also brought thousands of households into familiarity and trust with LMR's public health intervention work.
- As described in **Section 2.6**, Stockton Skywatch will leverage existing partnerships with various organizations such as Central Valley Air Quality Coalition, San Joaquin County Clinics, San Joaquin Council of Governments, San Joaquin Valley Health Foundation, Catholic Charities Diocese of Stockton, Hyphae Design Lab, California Department of Transportation, and the Central California Asthma Collaborative.

- *Projects that advance environmental justice within the context of California's air quality policies.*
  Stockton Skywatch will equip the community of Stockton with new information to better understand Stockton's air quality issues and the source of the community's environmental burden. This knowledge can help the community advocate for emissions control policies that can have a meaningful impact on air pollution. Stockton Skywatch supports this environmental justice community's understanding of source specific pollutant emissions.
  - Real-time vessel emissions evaluation module in Shair, focused on vessels going to and from the Port of Stockton, which lies within and/or adjacent to Stockton's disadvantaged and low-income neighborhoods as shown in **Figure 1**. Currently, port-related vessel activity is a *black box unknown* for the community it impacts. Prevailing winds distribute the vast majority of Port related pollution to our communities to the South and West. Ocean Going Vessel (OGV) class and efficiency are never communicated to the public and current Port Manifests are limited to projections that are often inaccurate. OGV movements are universally conveyed long after vessel activity can be mitigated. Moreover, due to congestion at our port and the outdated 'hoteling' practice that

only exists at bulk ports (where OGVs motor roughly in place while cheaper conveyor belts dump loose material into the ship's hold), we endure dirty fleet stays that are never powered down while at beth, though new at-berth regulations are supposed to have already settled in at this port. OGV pollution may be a significant source of Diesel Particulate Matter and a host of other pollutants, but satisfactory strategies for monitoring or mitigating this practice in real time has yet to emerge from CARB's Marine Strategies Division. Modeling this form of transitory pollution has beneficial application in all 11 California Ports and Environmental Justice Portside Communities around the world. This feature alone represents a unique opportunity for CARB to develop a powerful tool through the CAG Program rendering untold benefits.

- Analysis dashboard, which will summarize spatial and temporal patterns and major influential sources ascertained from two years of monitoring and Shair modeling, so that socioeconomic disparities in exposure to pollution across Stockton's various census blocks can be clearly inferred.
- Identifying major sources of air pollution in the community, which will empower the disadvantaged community to advocate for effective pollution emissions regulations.

- *Projects that focus on transferability of emission reduction strategies from AB 617 communities to other communities with similar sources of air pollution.*
  While the Stockton community has complex air quality related issues, there are other similar low-income and/or environmentally disadvantaged communities in the San Joaquin industrial valley that share air quality concerns with the Stockton community, such as Modesto and Merced. We believe that the following aspects of Stockton Skywatch are transferable to communities in these cities, and other similarly situated cities, looking to better understand their air quality issues and source information:
  - A web tool to allow the community to select air quality monitor locations
  - The Analysis Dashboard, which will provide valuable insights on spatial and temporal patterns and major influential sources from 2 years of monitoring and Shair modeling, aspects of which can be transferred to other communities with similar sources (e.g., $PM_{2.5}$ concentration profiles with increasing distance to California 99, which runs throughout the San Joaquin valley, and nearby highway, major industrial and/or commercial sources identified in Stockton that are also present in other communities).
  - Analyzing the accuracy of EPA's AirNow prediction tool will provide valuable lessons on interpreting and correcting predictions, both overall, and during specific episodes (e.g., if uncertainties are found to be higher during wildfire smoke events, these uncertainties may not be unique to Stockton, and could be applied to other cities as well).
  - By educating and training the community's youth on air quality fundamentals, air pollution health effects, data analysis and visualization, etc., Stockton Skywatch will empower Stockton's youth and contribute to the future workforce in environmental science, data analysis, advocacy, policy, and research. These benefits can be transferable to other disadvantaged communities as well. After

all, Little Manila Rising was founded by two college graduates that attended colleges in the Bay Area, and put their knowledge and skills to the use of their community.

In its request for applications document (pages 11-12), CARB recommends a specific structure for the scope of work section. **Table 1**, below, summarizes this required structure, and where different elements of the scope of work are located in this proposal.

Table 1. *Location of Scope of Work Elements in this Proposal*

Task / subsection	Aspect	Section within proposal
Work plan development	Outline of work plan	3.1
	Specific tasks, measures of success, milestones, expected outcomes, and benefits	3.0
Monitoring	Goals and objectives	3.2
	Specific tasks	3.2
	Success measures and milestones	3.2
	Benefits, outcomes, and contributions to CAG priorities	3.0
	Reporting of results	3.5
	Element 1: Forming community partnerships	3.2.1
	Element 2: Community-specific purpose for air monitoring	3.2.2
	Element 3: Scope of actions	3.2.3
	Element 4: Air monitoring objectives	3.2.4
	Element 5: Roles and responsibilities	3.2.5
Community engagement	Goals and objectives	3.3
	Specific tasks	3.3
	Success measures and milestones	3.3
	Benefits, outcomes, and contributions to CAG priorities	3.0
	Reporting of results	3.5
Workforce development	Goals and objectives	3.4
	Specific tasks	3.4
	Success measures and milestones	3.4
	Benefits, outcomes, and contributions to CAG priorities	3.0
	Reporting of results	3.5
Reporting	Goals and objectives	3.5
	Specific tasks	3.5
	Success measures and milestones	3.5
	Benefits, outcomes, and contributions to CAG priorities	3.0
Anticipated Benefits, potential challenges, and community improvement		3.0
Contributions to CAG priorities		3.0

1.1. Task 1: Work Plan Development

This proposal is for a Technical Community Air Grant. Consistent with that, **the goal** of this task is to develop a work plan with **the objective** of having a workable flexible plan that provides value to the community and contributes to the Community Air Grant Priorities. There are **two milestones** for the work plan development. A draft work plan for community and, if desired, CARB review, and a final work plan from which to build the project. **Success** will be measured on timely submission and community acceptance of the final work plan.

Little Manila Rising will develop and submit a work plan before beginning substantive work on this project, as recommended in CARB's Work Plan Contents document. We are proposing a community-led air-monitoring component and this technical Work Plan will describe how the Project will address community air pollution concerns.

The Work Plan will have the following five elements of Table E-2 from CARB's Community Air Protection Blueprint:

- Community support and participation.
- State the community-specific purpose for monitoring.
- Identify scope of actions.
- Define air monitoring objectives.
- Establish roles and responsibilities.

1.2. Task 2: Monitoring

In this section, we describe our work plan in detail, including goals and objectives of monitoring, specific monitoring details such as monitor and pollutant types, number of monitors, roles and responsibilities of different partners, and data analysis methods.

The overall **goals and objectives** of this multi-year monitoring project are itemized below:

- Effectively expand the currently existing, sparse network of $PM_{2.5}$ monitors in Stockton, CA with a new network of low-cost sensors distributed across the city (sensors' cost will be paid using separate funding acquired from California Department of Justice)
- Site the new monitors based on suggestions received from the community with an emphasis on low-income, disadvantaged communities, and proximity to prominent sources
- Provide hyperlocal air quality information based on modeling and monitoring for two years
- Quantify real-time emissions from vessels that call on the Port of Stockton in order to understand the impact of the Port of Stockton on the community's air quality burden
- Provide a single source of current and future air quality information for the community.
- Provide a platform for community analysis of the data to understand source contribution to each location from each source

- Compare the AirNow predictions to the actual air quality to provide the community with an understanding of how to best use the AirNow predictions

The **specific activities** planned around achieving the goals and objectives described above are itemized below and described in detail in **Section 3.2.4**.

- To evaluate sensor performance, collocate PurpleAir sensors (funded by The California Department of Justice *San Joaquin Valley Center for Community Air Assessment and Injustice Reduction (SJV CC-AIR) project*, as described in **Section 3.2.1**) with several reference BAMs owned and operated by the Central California Asthma Collective (CCAC) as part of their San Joaquin Valley air network[1].
- Disseminate a web app soliciting community suggestions for monitor locations and actively seek input from those without digital access
- Deploy sensors at locations that best represent suggestions received from community members and that can evaluate the impact of major sources in Stockton.
- Model real-time hyper-local $PM_{2.5}$ concentrations on a 20m x 20m scale in the low income or disadvantaged parts of the city of Stockton and couple it with monitored information to produce a live, intuitive map containing source contributions for two years
- Use real-time model to incorporate real-time vessel $PM_{2.5}$ emissions from the Port of Stockton
- Integrate EPA's AirNow air quality prediction module into Shair to provide both current and forecast conditions in one intuitive location
- Use data analytic techniques to provide a dashboard to the community showing long and short term emissions source contributions to the air to allow the community to formulate policies to improve air quality
- Compare the AirNow predictions to the actual air quality

Success Measures

- 1 new emerging air quality professional fully employed *in and from* a CA disadvantaged community
- 75 Regional Asthma MItigation Program participants will have access to real time protective AQ information.
- 75 PurpleAirs and 4 Aeroqual (2VOC/2 Ozone) installed
- Sensors deployed within 6 months of grant provision.
- 75% of the deployed sensors should be reporting data by the end of the monitoring period.
- Sensor performance will be evaluated for a 1 Month-long colocation study with each other to ensure inter device reliability, and consistency with reference-grade monitors purchased via California Department of Justice funding.
- Shair platform operational within 3 months of sensor deployment
- 95% up-time for the Shair platform
- Analysis dashboard prepared in at least two languages

[1] http://cencalasthma.org/

Milestones

- Acquiring PurpleAir and Aeroqual sensors via separate California Department of Justice grant (already awarded)
- Collocation of sensors for performance evaluation
- In-situ deployment of sensors
- Shair model implemented for Stockton
- Real-time vessel analysis implemented in Shair for Port of Stockton
- Integration of EPA's AirNow into Shair
- Assessment of the accuracy of EPA's AirNow Prediction feature
- Establishment of air quality dashboard and source contribution data analysis

1.2.1. Community Partnerships (Element 1)

- UCM Health Science Research Institute - Connecting Monitoring to Medicine
- OEHHA - Characterizing ambient AQ to Indoor Air Filtration efficiencies and School Site Biomonitoring
- CalTRANS - Placing Hwy 4 Assets & Impacts Case Study within ambient AQ model
- CCAC - Growing the SJV AIR Purple Air Calibrated Network to span the valley & refining best practices for deployment, co-Location and data quality assurance.
- Central Valley Air Quality Coalition - the power of data in policy work

Stockton Skywatch monitoring efforts will closely rely on Stockton community members' first-hand knowledge that is vital in understanding and addressing local air quality challenges. The primary forum for connecting non-Skywatch subscribers and sensor hosts to the data will be through the AB617 CERP implementation phase communications platforms and committee meetings. Skywatch's development and results can be regularly communicated throughout the General Assembly AB617 Community Steering Committee (CSC) meetings as a standing agenda item or as a subcommittee report. Matt Holmes, the Environmental Justice Director of Little Manila Rising, is an active steering committee member who regularly attends General Assembly meetings and the agenda setting meetings, and will ensure program findings are used strategically to inform decision making. Matt will also provide additional technical assistance in ad hoc planning sessions with SJVAPCD technical staff for the long delayed deployment of the Community Air Monitoring Project. Additional Staff will facilitate key subcommittees of the AB 617 implementation phase. Modeling data will be particularly valuable for the following: the Indoor Air Quality Subcommittee for identification of high risk neighborhoods (facilitated by LMR's Health Equity Director Elaine Barut-Labson); the Vegetative Barriers Subcommittee (facilitated by LMR's Urban Forestry Restoration Project Coordinators Nico Tamayo and Briana Garcia) specifically for targeted capital improvements funded through TCC and AB617 programs; the Harmful Algal Blooms CERP measure led by LMR partner Restore the Delta, and by delivering granular dispersion modeling data for the Bicycle and Pedestrian planning grant to the City of Stockton. Above all the Skywatch modeling data will serve to contextualize and to extrapolate potential health impacts from the FRM grade monitoring sites implemented by SJVAPCD's AB617 Community Air Monitoring

Plan. Suggestions and relevant concerns resulting from community steering committee meetings will have a fundamental and crucial role in designing and carrying out air monitoring goals and objectives, disseminating results to the community, and supporting effective pollution mitigation measures.

Little Manila Rising calls on community participation and donated time, in-kind contributions, and resource leveraging from a variety of partners such as the County Office of Education, the Council of Governance, the SJ County Clinics, Caltrans, and the Port of Stockton. These partners have shown support for the community air monitoring program in their letters of support and will allow Little Manila Rising to utilize their secure sites to host monitors. This allows Little Manila Rising to leverage the security of the sites in addition to access to A/C power and a secure WiFi connection.

The California Department of Justice funded the *San Joaquin Valley Center for Community Air Assessment and Injustice Reduction (SJV CC-AIR) project,* which will furnish 150 new remote sensors all monitoring $PM_{2.5}$ region wide and will provide ozone, VOC monitors, and General Reference Grade monitoring data through a mobile monitoring lab and respiratory clinic, increasing community confidence in data quality. The $PM_{2.5}$ sensors will be leveraged for this Stockton Skywatch air monitoring program.

<u>In-Kind Support</u>
In-kind support has already been offered from partners who believe in the mission and who seek to support the data analysis and consolidate all available real-time air quality data in one place to help the Stockton community mitigate exposure and better understand emissions source drivers in the community. Ramboll has offered upwards of $25,000 in time, expertise, and materials leading to specific benefits such as the integration of EPA's AirNow air quality forecasting module into Shair, as well as evaluating the accuracy of these predictions by leveraging the high resolution monitoring and modeling data generated from the low-cost sensor network and Shair modeling.

Central California Asthma Collaborative (CCAC) will contribute *parking lot calibration* services with their Fresno based BAM and a mobile e-BAM for all SJV CC-AIR purchased Purple Air Monitors assuring inter-device reliability and data quality across the sensor network.

City Systems will contribute their: a) *Green Economy Lab Assessment,* b) community assets mapping, and c) urban canopy lacunarity (gap assessments), as indicated in their letter of support in Attachment D. These data sets will respectively help: a) target our workforce development strategy to the defined neighborhoods that need it most, b) our community outreach efforts to the places and spaces that can offer the most communications support, and c) where we can assume there is an increased need for $PM_{2.5}$ assessment.

The project contact persons for any questions on the planned technical work are:

- Matt Holmes, Little Manila Rising, [redacted]

- Ayah Hassan, Ramboll Consulting, Inc, [redacted]

1.2.2. Community-specific purpose for air monitoring (Element 2)
Stockton is a major water and ground transportation hub, often referred to as the "crossroads" of California's Central Valley. As a result, Stockton has a complex set of air pollution emission sources, including shipping and shipping-related emissions associated with the Port of Stockton, as well as vehicular emissions from the major interstate and arterial road corridors, and freight rail yards. Furthermore, the city has a variety of industrial pollution sources, as illustrated in **Figure 2**.

The $PM_{2.5}$ contributions of these various source types (e.g., vehicular, industrial, shipping) to the community's air quality burden are not fully known, but Stockton, CA, is ranked as the city with the highest asthma rate in California, and the 4th highest in the Western US.[2] In addition, the asthma diagnosis for children is 20% higher in San Joaquin County than in all of California.[3] Some other examples of recently-increased emissions at the Port of Stockton include:

- The expansion of the Lehigh cement facility is expected to increase truck traffic by 42,000 vehicles per year, enabled by a Homeland Security funded trucking overpass.
- Cargo volume handled at the Port has increased by 133% in 2020.[4]
- Cement imports have increased by 76% in 2020.[5]
- Operational emissions of $PM_{2.5}$ from various activities such as ships idling at berth, barge-assisted tugboats, trucks (exhaust and road dust emissions from both transit and idling on-site), railway trains, conveying/loading (material handling dust emissions from bunkers and dome), and mobile sources (shuttle wagon and front-end loaders).

In the San Francisco Bay Area the Ports of Richmond and Oakland have historically added to the air quality burdens of the local communities because of $PM_{2.5}$ emissions from vessels and from shipping-related activities (e.g., drayage trucking, shipping). Additionally, the Port of Stockton is in an area identified by CARB as a low-income, disadvantaged community, which further demonstrates the need for community air quality monitoring, source contribution quantification, and pollution mitigation efforts. Stockton also has a variety of stationary industrial pollution sources, as illustrated in the permitted source mapping tool by San Joaquin Valley Air Pollution Control District (**Figure 2**).

[2] https://www.aafa.org/media/2426/aafa-2019-asthma-capitals-report.pdf

[3] https://www.sjcog.org/253/Air-Quality

[4] https://www.portofstockton.com/port-facts-figures/

[5] https://www.portofstockton.com/port-facts-figures/

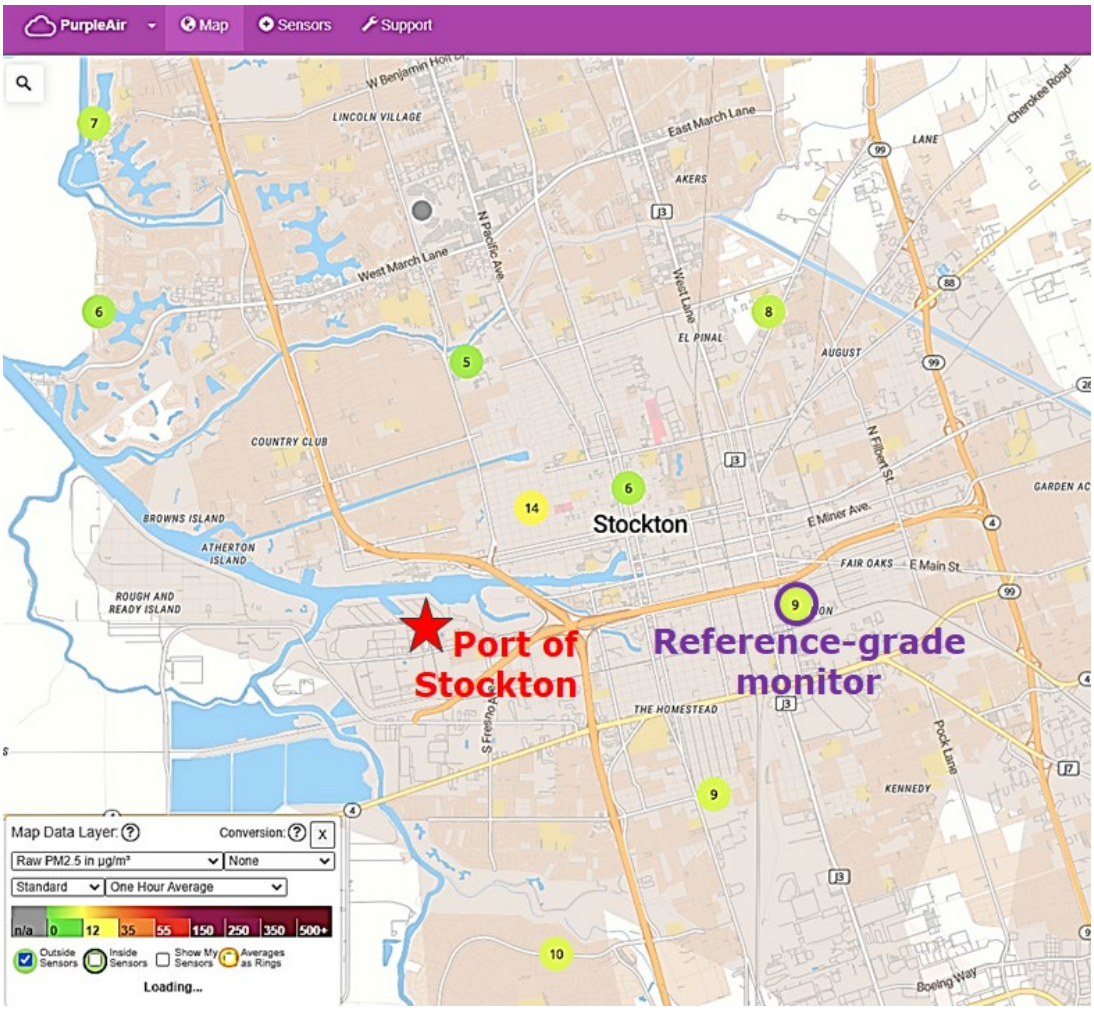

***Figure 3**: Map of Stockton, CA, showing 8 outdoor PurpleAir sensors and 1 reference-grade monitor as of Sept 9, 2021, with Port of Stockton overlayed for reference.*

Currently, the network of air pollution sensors in Stockton is very sparse (roughly 1 sensor per 40,000 people). As shown in the maps in **Figure 3**, the city has nine active PurpleAir sensors, and one reference-grade monitor operated by CARB, measuring $PM_{2.5}$. Furthermore, a substantial portion of the area identified as low-income, disadvantaged communities in CARB's Priority Populations map (**Figure 1**). The Port of Stockton has no sensors within a 1.5-mile radius.

An important aspect of Stockton Skywatch is the application of the Shair model in tandem with a new, spatially-dense $PM_{2.5}$ monitoring network, which will create a 20 m x 20 m resolution real-time map of $PM_{2.5}$ concentrations in Stockton. Shair can also provide valuable insights into real-time source contributions. The visual appeal, intuitive interface, and ease-of-access of the Shair platform can engage the community and provide awareness on their local air quality conditions, both current and in near future (much like the current and forecast weather conditions provided by weather applications ubiquitously found on smartphones and web-based platforms).

Another important aspect of Stockton Skywatch is the dashboard interface that will summarize the large dataset generated from two years of $PM_{2.5}$ monitoring in Stockton, to show overall spatial and temporal patterns and influential sources. This can empower communities to take control of their air pollution exposures, both in the short-term (by incorporating their local air quality patterns into their daily activity, e.g., avoid outdoor exercise within a certain proximity of sources especially during hours of peak emissions), and in the long-term (e.g. advocate for future air pollution mitigation measures by targeting sources). In addition, Stockton Skywatch will evaluate the effectiveness of AirNOW in the Stockton area, to help the community understand the reliability of the air quality predictions.

Despite bearing a disproportionate amount of environmental burden, people of color in the US are vastly underrepresented in the Science, Technology, Engineering, and Mathematics (STEM) workforce in relevant fields such as environmental engineering, atmospheric science, environmental science, and geoscience[6]. The community engagement, mentorship, and workforce development proposed as part of Stockton Skywatch will educate and train the underrepresented minorities of Stockton in various aspects of these fields such as air quality fundamentals, air pollution monitoring, data analysis and visualization, and the science-policy nexus.

The potential of Stockton Skywatch to bring about a long overdue alleviation of environmental burden and injustice in the Stockton area, as well as building community capacity for cleaner air advocacy, is reflected in the letters of support we have attached to our application (Attachment D). Some notable excerpts are listed below:

- Professor Asa Bradman, from University of California Merced states, "*This proposal directly aligns with the mission of UC Merced to promote health and equity in the San Joaquin Valley and our department is delighted to deepen our collaboration with community groups leading efforts to improve public health.*"
- Hailey Lang from San Joaquin Valley Council of Governments has stated in their letter of support: "*By modeling local air quality in a hyper-local format Skywatch will not only inform residents and enable behavior interventions, the baseline data collected by Skywatch will also serve as a useful planning and prioritization tool for the San Joaquin Council of Government in our role as the lead planning agency for the region, a region significantly impacted by transportation related air pollution.*"
- Sara Hoover from California Environmental Protection Agency's Office of Environmental Health Hazard Assessment has stated: "*The air quality data generated by Skywatch will be valuable input for OEHHA's activities under AB 617, which include conducting targeted biomonitoring studies in selected communities. Data from Skywatch will aid in interpretation of SAPEP[7] findings and help identify hyperlocal exposure sources of harmful air pollutants.*
- Dr. Catherine Garoupa White, executive director of the Central Valley Air Quality Coalition, has stated: "*Over nearly two decades of policy advocacy to restore*

[6] https://www.pewresearch.org/science/2021/04/01/diversity-in-stem-appendix/

[7] The *Stockton Air Pollution Exposure Project* is designed by CalEPA to increase understanding of children's air pollution exposures and evaluate the effectiveness of school air filtration in exposure reduc ion

clean air to the San Joaquin Valley, we have learned that modeling air quality in a hyper-local format is difficult to achieve in an easy to understand way. Skywatch's collaborative approach and extensive partners will enable innovation in behavioral interventions. The baseline data collected will serve as a useful planning and prioritization tool for the San Joaquin Valley Environmental Justice Steering Committee. Skywatch will also provide proof of concept to fully model the entire Valley airshed, assess, and directly address SJ Valley's chronic non-attainment status under the Clean Air Act."

- *"By modeling local air quality in a hyper-local format … Skywatch [will] provide an important context for our HWY 4 Study and an agency wide call to mitigate the impacts of transportation related facilities,"* states Marlon Regisford, Deputy District Director of the Planning, Local Assistance and Environmental section of California Department of Transportation, District 10.
- "*It is exciting to consider the opportunity provided by LMR and their technical partners to deliver a new tool that can address the chronic respiratory conditions that far too many of the residents of South Stockton suffer from,"* states Dr. Farhan Fadoo, CEO and CMO of San Joaquin County Clinics.

1.2.3. Scope of actions (Element 3)

Below is a description of how the various specific aspects of our monitoring plan will directly address the community-specific air monitoring needs described earlier:

- Expanding the currently existing, sparse network of air quality sensors will not only increase the spatial resolution of sensors in Stockton by nearly 500%, but the new network will also more fairly represent the low-income, disadvantaged areas (e.g., around the Port of Stockton), by directly implementing community feedback.
- Filling the sensor gaps by creating a real-time pollution map at 20-meter resolution using Shair modeling will enable community members to pin-point locations of interest to them (e.g., their house, their kids' school, etc.), and know the air quality conditions there, as well as major influential sources in real-time.
- Quantifying emissions from vessels on a real-time basis using the Port of Stockton Source Allocation module of the Shair model will not only help the community better understand the impact of the Port of Stockton on the community's air quality burden, but will also inform future source-targeted emissions reduction measures that the community undertakes.
- Enabling community members to easily access both real-time conditions as well as forecasts of air quality within the same application interface will ensure that the community members have the best available quality of air quality information at their disposal as they plan their day and week in advance (e.g., knowing that the air quality forecast for a particular time period is poor, one can rearrange their schedule such that outdoor activity can be avoided or minimized during that period).
- Creating a comparison of the EPA's AirNow predicted air quality and the actual air quality allows the community to better understand the reliability of air quality predictions
- Creating a user-friendly visual dashboard to analyze data collected from 24 months of sensor deployment to identify major sources, and understand the vessel-by-vessel contributions at the Port of Stockton and impact of source

controls will enable the community to engage in meetings to implement emissions reduction measures.

1.2.4. Air monitoring objectives (Element 4)

The air monitoring objectives are summarized in **Section 3.2**. Keeping in line with these objectives, the tasks and methods of our monitoring plan are as outlined below:

Monitoring location selection

Sites will be chosen from those proposed by the community combining information on potential sources of $PM_{2.5}$ and related community exposures, locations of disadvantaged and sensitive communities, potential for identifying and characterizing areas experiencing disproportionate air pollution impacts, and the ability to provide real-time data useful to the community. Little Manila Rising will utilize the security, A/C power, and WiFi access of community-based partner sites to host monitors, such as Caltrans and the Council of Education.

$PM_{2.5}$ measurement methods

The primary method used for measuring $PM_{2.5}$ concentrations will be a network of PurpleAir PA-II sensors. Using a separate grant acquired from the California Department of Justice, we will purchase 75 of these sensors. These sensors are inherently optical particle counters. The sensor houses laser-based Plantower particle counters that detect and resolve particles into different size bins (e.g., 0.3, 0.5, 1.0, 2.5, and 10 μm). The sensor reports $PM_{2.5}$ measurements every 10 minutes. Spatially dense installation of these sensors, combined with high temporal reporting resolution, will aid in capturing spatial and temporal patterns of $PM_{2.5}$. Further, deploying the sensors for a 24-month period will inform long-term representative patterns such as seasonal variations and meteorological influences. Due to its geographical location within the San Joaquin valley, the Stockton airshed often experiences insufficient ventilation of pollution, especially during meteorological inversion periods.

Figure 4 shows results of collocated measurements between multiple PurpleAir sensors previously deployed in the Richmond, CA under Air Rangers 2 grant objective, and BAM 1020, and eBAMs at the CARB 1309 T Street regulatory monitoring site in Sacramento, CA. Over this period, PurpleAir sensors better agree with the BAM 1020 in comparison to Clarity sensors, and appear to show more stability than the eBAM (**Figure 4**). From this month-long collocation, the mean R^2 between PurpleAir and the BAM was 0.65 (**Figure 5**), with root mean squared error of 1.8 µg/m3.

Table 2. *Sensor specifications*

Sensor	Resolution	Range	Precision	Accuracy
PurpleAir PA-II (PMS5003)	1 µg/m^3	0 - 500 µg/m^3	Correlation (R^2) between PurpleAir sensors > 0.9	Correlation (R^2) with regulatory monitor ~ 0.65

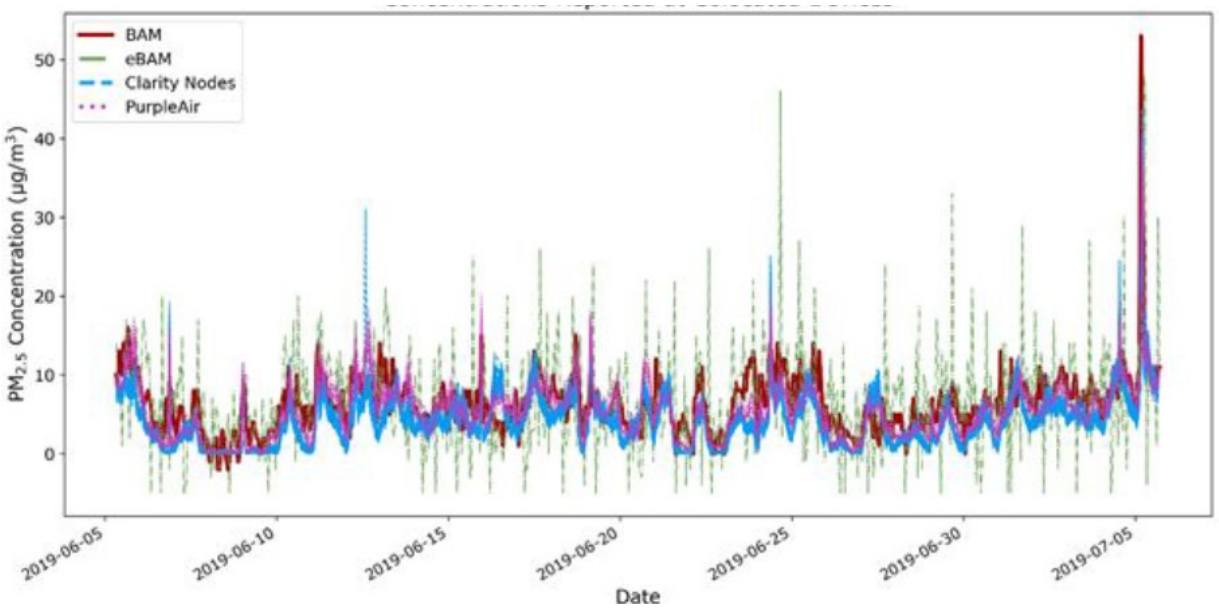

***Figure 4**: Time series of a month-long collocation between multiple PurpleAir sensors, Clarity sensors, BAM 1020, and eBAMs at the CARB regulatory monitoring site in Sacramento, CA.*

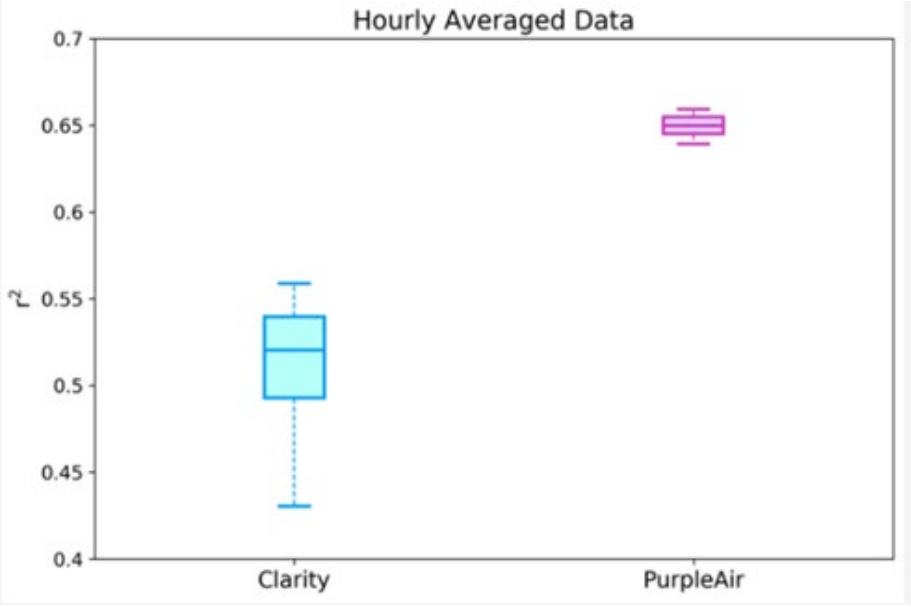

***Figure 5**. The distribution of correlations (R^2 values) between hourly average estimates produced from individual monitors as compared to BAM output.*

The PurpleAir monitoring network consists of low-cost air pollution monitoring devices that started to be deployed in the U.S. and worldwide in 2017. Overall, PurpleAir PA-II sensors show reasonably good accuracy compared to reference $PM_{2.5}$ measurements (i.e., R^2 ~ 0.65) over a concentration range of 0 to 250 µg/m^3. Further details regarding the lab evaluation of PurpleAir sensors conducted by the South Coast Air Quality Management District (AQ-SPEC team) and other research groups can be found

elsewhere. Recent studies have suggested the use of the PurpleAir network to supplement regulatory monitors for $PM_{2.5}$ exposure assessment.

Aeroqual ozone and VOC sensors

Using a separate grant acquired from the California Department of Justice, we will purchase 2 Aeroqual ozone (EOZ) and 2 VOC (VP) sensors in Stockton. The greatest benefit of monitoring ozone will be to identify days of strong photochemical activity, which can greatly accelerate the formation of secondary $PM_{2.5}$ at the regional background scale. Air districts typically advise residents to minimize vehicular travel, pumping gas, etc. on such high ozone days in order to minimize emissions of secondary PM precursors (i.e., VOCs). Measurements of VOCs and ozone in tandem will thus reinforce the identification and flagging of high photochemical activity periods.

The Aeroqual EOZ ozone sensor has a measurement range of 0 to 10 ppm, with a minimum detection limit of 10 ppb, and with a 1 minute time resolution. The Aeroqual VP VOC sensor has a measurement range of 0 to 500 ppm, with a minimum detection limit of 1 ppm, and a 30 second time resolution. A network of these sensors has been deployed previously in the San Joaquin Valley, and the sensors were found to be within 3 ppb of federal regulatory monitors.[8]

Sensor deployment

The PurpleAir sensors require electric power and WiFi connections. Little Manila Rising will leverage the property of longtime resident partners, and institutional partners like Caltrans, San Joaquin County Clinics and CBO to deploy the monitors at the general locations selected as described above. This alleviates challenges with security, and access to A/C power and WiFi. The suitability of these sites will be critically reviewed during physical field visits by Little Manila Rising and moved slightly as needed. Technicians will be coached and trained in selecting scientifically valid mounting points, utilizing siting methods influenced by the Imperial County Community Air Monitoring Project[9] and US Federal Siting protocols.[10] Once installed on-site, trained Little Manila Rising staff will regularly visit the sensor locations for status check of both the sensors and changes in surrounding conditions that may affect the sensor data (e.g., new food truck parked close to the sensor). Staff will fill out and submit site verification forms (Attachment C) for each visit.

Real-time quality assurance of PurpleAir data

Given the importance of sensor data calibration and quality control, we will use a two-step approach to post-process hourly PurpleAir $PM_{2.5}$ data to minimize the impact of sensor malfunction, intra-sensor bias, and environmental and operational parameter impact. This approach will apply a) systematic quality control and b) bias-correction.

---

8 https://www.aeroqual.com/case-studies/sti-sensor-network

9 Wong et al. 2018. Combining community engagement and scien ific approaches in next-generation monitor siting: the case of the Imperial County Community Air Network. International Journal of Environmental Research and Public Health. 15:523.

10 For example, consideration and quantification of the amount of restricted flow around each monitor and consideration of distance to the nearest obstruction.

Systematic Quality Control. A comprehensive description of the quality control method used in this study can be found in Lu et al.[11] More details including various statistical indicators can be found in the methods section of the mentioned study, but in summary, the systematic quality control consists of five steps: first, remove malfunctioning sensor data based on a low frequency of change (i.e., 5 h moving standard deviation of zero) in their readings across time; second, discard apparent $PM_{2.5}$ outliers with extreme hourly values that exceed the sensor's effective measurement range in both channels and readings higher than 3 times calculated median absolute deviation by one channel within a calendar month; third, identify periods of prolonged interruption or data loss due to power outages or data communication loss using a 75% completeness criterion (four or more 10 min measures per hour and 18 h or more in a day); fourth, evaluate the degree of agreement from dual-channel readings for each sensor within a given month of operation based on calculated statistical anomaly detection indicators as the coefficient of determination $R^2 > 0.8$ and mean absolute error < 4 µg/m3. Given the reported saturation issues of PurpleAir sensors at high particle mass loadings (>50 µg/m3), leading to higher measurement bias and uncertainty in the mean absolute error indicator, mean absolute percentage error > 0.3 is adopted as an additional criterion to handle the sensor's measurement limit at high particle mass loadings; fifth, in case of sensor data reported only from one channel, a linear regression of hourly readings for each sensor with its neighboring sensors within 3 km is performed and data from sensors with $R^2 < 0.6$ or having no neighboring sensors within 3 km is discarded from the analysis. Lastly, a correction for wildfire smoke impacts will be applied using the U.S EPA U.S. wide correction equation for PurpleAir sensor data[12].

Using the above-mentioned process for PurpleAir sensor data quality control, multiple field studies have shown that the regression between post-processed PurpleAir data against U.S. EPA's air quality system (AQS) data was improved significantly with less spikes detected in original sensor data against AQS data[13,14,15]. Further, the quality controlled data had a more robust dual channel agreement with the AQS data.

Bias-correction. A multi-week collocation study will be performed prior to sensor deployment at different locations. This collocation will involve all PurpleAir sensors placed adjacent to reference-grade BAMs (also acquired via separate funding mechanism) in a parking lot. Sensor-specific biases derived from this study will be used to develop correction factors, which will then be implemented into Shair after sensors are deployed at different locations.

<u>Post-processing of PurpleAir data</u>

---

11 Lu, Y.; Giuliano, G.; Habre, R. Estimating hourly $PM_{2.5}$ concentrations at the neighborhood scale using a low-cost air sensor network: A Los Angeles case study. Environ. Res. 2021, 195, 110653

12 Johnson, K., A. Holder, AND A. Clements. Development and Performance Validation of U.S. Wide Correction Equation for PurpleAir Sensor Data. AirNow Sensor Data Pilot Webinar, Research Triangle Park, NC, September 16, 2020. Avaialbe at https://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=350075&Lab=CEMM

13 Ardon-dryer, K.; Dryer, Y.; Williams, J.N.; Moghimi, N. Measurements of $PM_{2.5}$ with PurpleAir under atmospheric conditions. Atmos. Meas. Tech. 2020, 13, 5441–5458

14 AQ-SPEC. Evalua ion Summary Purple Air PM Sensor; Air Quality Management District: Diamond Bar, CA, USA, 2017.

15 AQ-SPEC. Field Evaluation Purple Air PM Sensor; Air Quality Management District: Diamond Bar, CA, USA, 2017.

In addition to the real-time corrections and quality checks described above, we will also perform the following additional data corrections after the end of the monitoring phase. Additional corrections and insights achieved from this post-processing will be used in reporting final results via our dashboard (Section 3.3), and the final report submitted to CARB (Section 3.5).

From the multi-week collocation study performed prior to sensor deployment, we will derive dynamic correction factors as functions of environmental conditions such as relative humidity and temperature for each PurpleAir sensor. These factors will then be calculated and applied retrospectively to the entire multi-year monitoring dataset generated from the sensor network. This added quality check will enable us to exclude environmental influences on sensors that may have resulted in apparent spatial and/or temporal variations. For instance, if a particular PurpleAir sensor develops a higher bias during high humidity conditions, a humidity-based correction factor must be applied to the time series of measurements obtained from that sensor.

Shair dispersion model specifications

The PurpleAir sensors will be fed as inputs to the sophisticated Shair model for uniform spatial enrichment and source apportionment. Shair uses a mixture of validated scientific models such as the Comprehensive Air Quality Model with extensions (CAMx; regional chemistry), Weather Research and Forecasting (WRF; meteorology and weather), Shairstreet (pollutant dispersion around the built environment), and real-time traffic congestion data to produce a real-time map of pollution concentrations at high spatial resolution (20 meters), with source apportionment analysis showing major sources influencing the air quality at each location. The final output of the Shair model is a nearly real-time look at $PM_{2.5}$ concentrations estimated at 20m x 20m spatial resolution, and these estimates are tethered to the actual measurements produced by any and all accessible sensors within the domain (PurpleAir, and reference-grade instrument(s)). The performance of the Shair model is thus greatly strengthened by the presence of sensors in the domain. **Figure 6** demonstrates the capability of the Shair model applied in Richmond, CA, where nearly 50 Clarity sensors are used as inputs to the model.

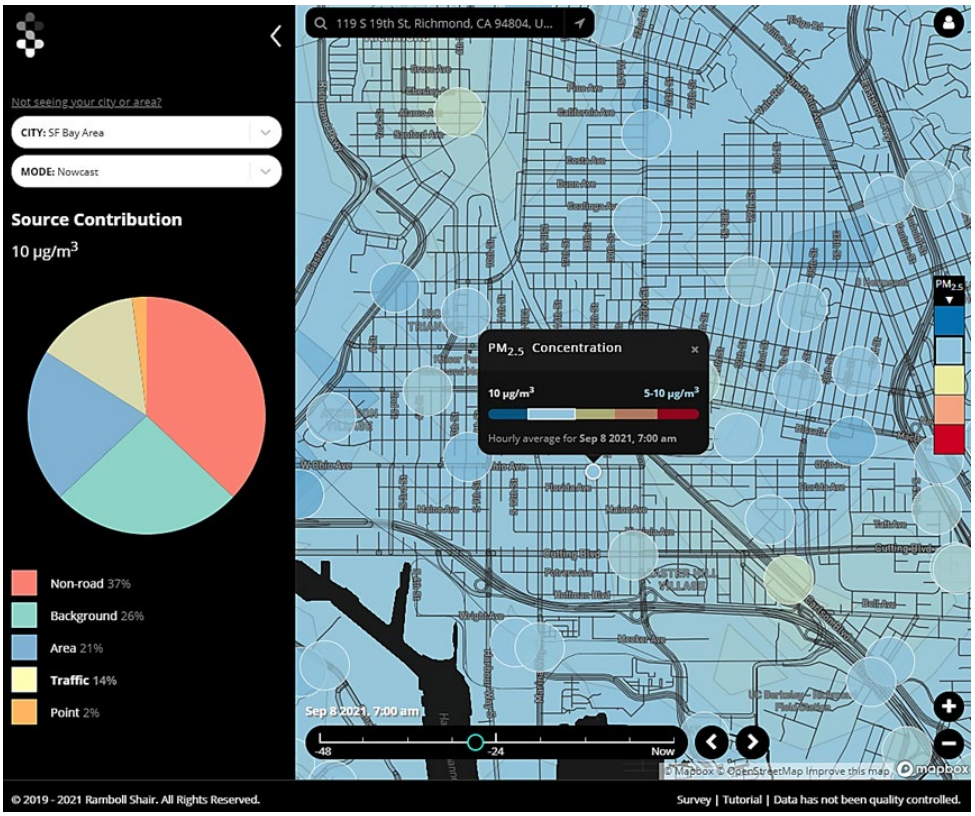

Figure 6. *A demonstration of the interactive Shair module, showing real-time $PM_{2.5}$ concentrations in Richmond, CA monitored by a network of Clarity sensors, as well as real-time source contribution analyses at any user-specified location.*

The Ramboll Shair model combines real-time sensor data with a variety of dispersion, weather, chemistry, and traffic models to quantify hyperlocal hotspot concentrations and likely source contributions. Shair uses roadway ("Shairstreet") and regional physical and chemical transport models (CAMx), which are based on real-time traffic data and emission inventories to estimate pollutant concentrations at a 20 m x 20 m spatial resolution. This pollution concentration surface is then "anchored" to monitoring data wherever monitors are located. This is a major innovative aspect of the Shair model, wherein sensor-based information is used to reduce model biases. In locations between sensors, Shair geo-interpolates the pollution concentrations using methods such as voronoi nearest-neighbor tessellation.

Shairstreet is the roadway component of Shair. It is composed of three main modules: a) an urban street canyon model, b) a reduced complexity NO_x chemistry model, and c) a dispersion model for pollutant concentrations away from the roadways. The urban street canyon model accounts for the effects of the built environment on traffic pollution dispersion, which is especially of importance for commercial city centers where adjacent tall buildings can trap polluted air between them, and/or cause recirculation. Capturing the complexity of wind flow patterns in street canyons is thus essential to understanding how pollutant concentrations change on streets and sidewalks - where exposure is potentially high - and how they move through the built environment. The default Shairstreet street canyon model was developed at Ramboll and is based on the

operational street pollution model (OSPM), a semi-empirical model developed by researchers at the National Environmental Research Institute of Denmark. OSPM has been updated and used widely over the last 20 years or so. It operates under the assumption that pollutant levels in a street canyon have three major contributors: direct contributions from vehicle tailpipes as affected by ground-level wind, contributions from pollution in air that is recirculated by a well-mixed vortex generated inside of the canyon, and background concentrations above the street canopy.

Shairstreet's default street canyon model assumes that vertical dispersion is governed primarily by mechanical turbulence with thermal stratification ignored, and that street-level mechanical turbulence is created by street level wind and traffic in the street. Real-time vehicle counts and average vehicle speeds for all roads - which are based on speed and congestion data - are used as inputs for calculating street level vertical turbulence. The traffic induced turbulence is especially important on windless days, when the ambient turbulence is small, in determining pollutant concentrations. The street level wind speed is derived from canopy-level wind speeds from WRF, and is calculated assuming a logarithmic reduction of wind speed over vertical distance. Traffic-induced turbulence is characterized in the same approach as OSPM, which accounts for flow distortion and related turbulence produced by vehicles moving on the street. For roads without adjacent buildings, street level concentrations are assumed to be affected by only the surface level wind and traffic-induced turbulence.

Atmospheric dispersion of a point source can be well-modeled using Gaussian dispersion principles. Estimated dispersion from line sources (e.g. roadways) is only appropriate when wind flow is perpendicular to the line source, which is not always a reality. Some models, like AERMOD, use a high number of point and area sources to approximate line source dispersion, but this is computationally expensive when the road network being modeled is large. Instead, Shairstreet employs a computationally efficient method for approximating Gaussian line source dispersion based on work published by researchers at the University of California, Riverside and National Center for Atmospheric Research[16]. This method has been shown to produce small, acceptable errors when compared to an exact solution. The resulting dispersed concentration values are then used to inform the concentrations of pollutants in nearby grid cells of the Shair model.

The Shair model's source contribution module has been improved and refined over the last years as part of Ramboll's involvement with a separate community air monitoring project in Richmond, CA. The original Shair model applied source contributions solely based on the CAMx outputs, which is based on emission inventories. As such, uncertainties in emissions would propagate to large uncertainties in Shair model outputs as well. An improvement that is being applied is to use the real-time monitoring network to adjust and fine-tune CAMx's source apportionment results to have a more accurate understanding of source contributions. Specifically, recent advances have been made in

[16] Venkatram A, Horst TW. Approximating dispersion from a finite line source. Atmospheric Environment. 2006 Apr 1;40(13):2401-8.

the realm of measurement-model integration that have been leveraged and incorporated into the Shair system.

Vessel-by-vessel emissions estimation for the Port of Stockton

The Ramboll Shair model can calculate source contribution at any location in real-time. To better understand the impact of the Port of Stockton in the community, Ramboll will substitute the static emission inventory (EI) for non-road vessel emissions with real-time vessel by vessel emissions and add an enhancement to the Shair web app that allows users to track vessels and view their most recent estimated emissions. This module will be used to improve the Shair source contribution feature, in addition to supporting emissions reduction programs and policy decisions associated with the Port.

High-resolution Automatic Identification System (AIS) vessel-tracking real-time feed will be used to inform near real-time vessel emissions for CAMx. AIS data provides 5-minute vessel position, speed, and direction information that can be cross-referenced with IHS data to obtain characteristics such as ship type, model year, size, design speed, and engine properties used to estimate engine loads and emission rates. Individual vessel emissions will be allocated in the 3-dimensional CAMx grid with plume rise (i.e., model layer distributions) and temporal distribution factors applied.

Figure 7. *An example of AIS vessel data around Richmond, CA. The Shair model deployment in Richmond did not incorporate AIS vessel emissions.*

EPA AirNow Prediction Integration and Assessment

EPA's AQ AirNow Map is used to provide current conditions and forecasted air quality maps and data across the U.S. AirNow shows air quality data on a coarser regional scale compared to Shair's hyper-local map. Integrating AirNow into the Shair app would allow residents of Stockton to see larger regional forecast trends and better prepare for future air quality within the Shair app. We propose to add AirNow maps as a layer to the Shair platform in Stockton. We also propose to assess the forecast accuracy of the predictions based on Shair's near real-time modeled concentrations. The methodology and results of this analysis will be documented in a report or dashboard. Determining the accuracy of air quality predictions would inform the community how this data can be used, and the forecasting feature will supplement the Shair nowcasts.

Gridded next-day forecast data at 8 km spatial resolution will be obtained from https://files.airnowtech.org/ and processed to be displayed on the Shair web app as Mapbox tileset layers. The retrospective analysis will compare the AirNow forecast data for Stockton to the Shair daily average nowcasts with the Shair data resampled to match AirNow resolution.

1.2.5. Roles and responsibilities (Element 5)

In this section, we list and describe the different partners involved in Stockton Skywatch, their background, and their specific role in the project.

Little Manila Rising

Little Manila Rising is a community-based nonprofit dedicated to working with partners to train Stockton youth to understand, work to remediate and alleviate the historically disproportionate environmental burdens experienced by Stockton residents through transformative projects. Little Manila Rising will serve as the face of Skywatch; act as liaison with ARB; prepare semi-annual reports for ARB; oversee subcontractors; invoice ARB; pay contractors; act as point of contact for community and resident inquiries and will deploy & maintain the remote sensor network with City and County partners.

Ramboll US Consulting, Inc.

Ramboll is an international company, based in Denmark, with a substantial California presence. Ramboll employs over 16,000 scientists and engineers in more than 300 offices around the world. Ramboll has extensive cross-sector experience in the sectors of Buildings, Transport, Planning, Urban Design, Water, Environment and Health, Energy and Management Consulting. Ramboll excels at combining local experience with a global knowledgebase and has previously worked on community-scale air quality monitoring with the non-profit Groundwork Richmond and the community of Richmond, CA, along with key stakeholders including CARB, BAAQMD, and the Richmond-San Pablo Community Air Monitoring steering committee.

The Ramboll air quality groups in San Francisco Bay Area locations have extensive experience in a wide range of air quality topics such as regional air quality planning (under district, state, federal, and international cross-border frameworks), photochemical model development (CAMx), local air dispersion modeling (Ramboll modeled pollutant concentrations across the city of San Francisco using AERMOD and

developed the street pollution model “Shairstreet”), cloud-based air quality modeling (Shair), air quality data analytical procedures, atmospheric chemistry, emission inventories, monitoring, management, land-use analysis (Ramboll developed the widely used software package “CalEEMod” for estimating emissions for land-use development projects), and regulatory development.

Ramboll will work with Little Manila Rising and other stakeholders to guide the deployment of the new sensors, train Little Manila Rising staff on sensor deployment and siting, deliver Shair model outputs on a publicly available platform in real-time, create a Shair module to determine the impact of Port of Stockton vessel emissions in the community, implement and assess the accuracy of EPA’s AQ AirNow prediction, lead the analysis of data collected during this project, prepare presentations for the steering committee, and display information from real-time monitoring and modeling on a centralized dashboard.

City Systems
City Systems is a non-profit consultancy that focuses on data-driven projects. City Systems will work with Ramboll and LMR to support distributing the sensor siting app into the community and support the final identification of sites based on community assets mapping and urban canopy lacunarity, coupled with CalEnviroScreen results.. College students will be encouraged to support sensor deployment.

California Department of Transportation District 10
California DOT will provide HW4 and other historic asset and health impacts case studies data in the project area to inform deployment, as well as right of access and planning assistance.

University of California, Merced: Health Science Research Institute
UCM will provide CA OAG-funded Purple Air Monitors, and integrate the SJV CC-AIR mobile monitoring lab data and health risk assessments of the data we collect to develop public information for outreach materials and alert strategies.

San Joaquin Council of Governments
SJCOG will utilize modeling data for future planning initiatives and proposals.

San Joaquin County Clinics
SJCC will provide support reaching impacted households and clinic locations for sensor siting and participant recruitment.

1.3. Task 3: Community engagement

LMR’s community engagement will rely most heavily on our asthma intervention work, Decreasing Asthma Within Neighborhoods (DAWN), a project originally funded by the CARB Community Air Grants Program. DAWN matriculated into long term funding through the Regional Asthma Mitigation Program of the San Joaquin Valley Health Fund. This program uses a non-medical model for identifying asthma impacted communities who have been alienated from traditional medical treatment. It requires a

long, slow relationship-building methodology to build trust and effect behavior change in a familiar and empowering setting. This experience working with residents concerned about air quality tragically expanded its impact and reach through our anti-racist Covid - 19 Testing and Get Out The Vaccine (GOTV) outreach campaign funded through the Governor's office and UCLA. The GOTV campaign placed Little Manila Staff and community partners in the homes of thousands of Stockton residents most directly impacted by respiratory distress. These intimate non-medicalized relationships developed under DAWN and GOTV are based on trust and participants are prepared to participate in the design and deployment of Stockton Skywatch. Participants and community members at large will be encouraged to submit monitor siting locations via the web app, and will have easy access to the results of the multi-lingual Shair model, to understand real-time air quality and associated source drivers. A multi-lingual data analysis dashboard will be disseminated to build community capacity for understanding air quality drivers, spatially and temporally, and empower the community to advocate for their own pollution reduction measures.

Little Manila Rising relies on a select group of institutional partners and a broad array of community partners to disseminate programmatic opportunities. In addition, we maintain a comprehensive database of key community partners, boards, committees and commissions to innervate existing decision-making bodies in the most effective way and to build support among key stakeholders. We also utilize a comprehensive digital outreach strategy that spans generations by relying on email, newsletters, Facebook, Instagram, Snapchat, etc. where many individuals are usually at – their mobile devices. A sample LinkedIn post, prepared for our DAWN program, is shown in **Figure 8**.

Figure 8. *A sample LinkedIn job post, prepared for our DAWN program.*

Still, we recognize that not all residents are readily available on social media. Accordingly, we conduct door-to-door canvassing to disseminate information about our community preservation, protection, and environmental justice programs. Previous

outreach has and will continue to be integrated into these efforts and will further promote utilization of our air monitoring data for residents to make informed choices about outdoor activity. Canvassing efforts will also share opportunities for residents to participate in the community events we lead, the service projects we facilitate and to pursue our paid education and training opportunities. We make every effort to ensure that the broadest possible sample of Stockton residents have access to our programs.

The community of Stockton will be involved in Stockton Skywatch from the very beginning. We propose to build a multilingual smartphone application and/or web-based tool where community members can enter suggestions for where they would like to see air quality sensors installed. These suggestions received from the community will be factored into deciding the sensor locations. Little Manila Rising will work with Ramboll and City Systems in preparing and distributing this application. Further, City Systems will support college students in participating with the sensor deployment at these locations.

In partnership with Ramboll, we will train Little Manila Rising members on monitor siting and deployment. We will also maintain communication and two-way feedback channels with the community via various platforms, both online and in-person, as well as easily accessible resources on air quality fundamentals, health risk and protection measures, and influential sources of air pollution in Stockton.

The goals and objectives, tasks, milestones, and success measures are described in detail below:

Goals and objectives

- Prepare a multilingual smartphone application and/or web-based tool for community members to submit potential sensor locations based on community needs.
-
- Disseminate the Shair Air Quality Model to the community to provide insight on real-time air quality, air quality predictions, and source allocations on a 20m x 20m hyperlocal scale in multiple languages
- Train community members on air quality fundamentals, monitor siting and deployment, and general awareness on air quality in multiple languages.
- Provide health protection recommendations for vulnerable populations via digital outreach.
- Enable community members to easily access both real-time conditions as well as forecasts of air quality within the same application interface.
- Provide free and intuitive access to historic and current air pollution concentration data and source contributions at each monitoring location using a dashboard interface to support emissions reductions strategy.
- Preparation of a multi-lingual dashboard for clear visualisation of the 24 months of air quality data, for community members to gain a spatial and temporal understanding of air quality and the associated source drivers.

Specific tasks

Siting location outreach: We propose a democratic, community-driven approach toward placement of the 75 new sensors that will be installed in Stockton. We will solicit suggestions from the community members for sensor locations, and these responses will be reviewed and assessed with major sources of $PM_{2.5}$ and locations of disadvantaged and sensitive communities and population density considered. In order to facilitate community input, particularly from those who may be home-bound or have transportation limitations, this grant proposes to use a web-tool that was initially developed for the Community Air Monitoring Grant in Richmond, California, and that can be leveraged to this project. When that web-tool was used to solicit community feedback it logged over 120 responses. A similar tool will be developed for Stockton and circulated to allow the community to provide input on where sensors should be sited and their reasons behind this. Little Manila Rising staff will engage residents without digital access to provide additional input into community monitor siting. The results gathered with the assistance of the location siting tool will be vetted by a team of air quality and community experts from Ramboll, Little Manila Rising staff, and resident volunteers.

Shair engagement: The visual appeal, layperson-friendliness, and ease of access of the Shair platform will provide the community with real-time information on their local air quality conditions, both current and forecasts for the near future, as well as information on major influential sources. Further, Shair will regularly communicate via social media platforms (Facebook, Instagram, Twitter).

Dashboard: We propose to build a live, multi-lingual, interactive dashboard for clear visualization of the air quality data collected during this project. This dashboard will be designed for ease of use for community members and will empower the community to take control of their air quality exposure by understanding spatial and temporal patterns of air pollution and identifying specific hotspot locations and/or times of day when outdoor activity in their vicinity should be minimized. The dashboard will be available in Spanish and English. Tagalog will be implemented upon request.

AQ Training and Engagement: We will present our findings from the air monitoring, modeling, and source allocation at steering committee meetings, as requested by the community. Via these presentations, we will educate and train the community on air quality fundamentals, air pollution health effects, and how mitigation measures can be designed to target major influential sources. Little Manila Rising will regularly communicate via social media platforms and newsletters to keep the community informed and up-to-date on latest air quality news, “spare the air” alerts, and protective guidelines. Communications will be prepared in Spanish and English. We will also create social media posts on Twitter, Facebook and Instagram, on air quality topics, including creating awareness of the Shair app, and current air quality issues.

Success measures

- Within a month, receiving more than 100 responses for sensor installation locations from the community will indicate the success of community outreach, with representation from a wide range of demographics and locations

- Participation from 30 community members during outreach activities
- 100 daily average Shair users, with representation from various demographics and locations
- An average of 50 metrics of community engagement received on social media posts (e.g. comments, likes, shares/retweets on Twitter, Facebook, and Instagram).
- Live, interactive dashboard with clear visualization of data, built and operational within a month of the end of sensor deployment

Milestones

- Prepare and deploy a web page-based tool to solicit suggestions from the community on sensor locations.
- Demonstrate to the community how to use Shair and include the features in newsletters and social media platforms.
- Demonstrate to the community the effectiveness of the Shair source contribution analysis in informing major influential sources of $PM_{2.5}$ in Stockton.
- Create social media posts to engage with the Stockton community on local air quality news, alerts, and guidelines.

1.4. Task 4: Workforce Development

Little Manila Rising builds opportunity creation into every project we develop. *Brain Drain* is one of the key threats to our region as we lose qualified emerging professionals to higher paying higher quality of life regions each year. We address this phenomenon by creating jobs *for us, by us* in the neighborhoods that matter most. While we can't always provide the wages that we would like, we are able to create meaningful jobs that have an impact in the communities they serve. Skywatch represents a significant opportunity for us to develop and advocate for the environmental monitoring career path that we believe has a future in every community.

To that end, Little Manila Rising and Ramboll will prepare educational training sessions and workshops for our Youth Advocate Program and community members to gain technical knowledge on air pollution fundamentals, data access, and analysis, while highlighting rewarding career paths that aren't generally promoted in neighborhoods like South Stockton. Through the Skywatch program Little Manila Rising and Ramboll will not only train and involve young adults in an educational capacity but we will also be able to provide Hands-On opportunities to job shadow during sensor deployment and maintenance thereby breaking down barriers to handling technical equipment and communicating across different and unfamiliar settings. LMR’s Youth Advocates program will have a formal role soliciting hosts for PurpleAir monitor deployment, made possible due to the ease of purple air installation and through funding from the UC Merced SJV CC-AIR.

Little Manila Rising will also hire a skilled Air Monitoring Technician from within the community to oversee the siting and device registration process, alongside Ramboll and post-docs from UC Merced. The Air Monitoring Technician will also be responsible for routine status check and maintenance of the sensors. These collaborative workplace

opportunities will allow Stockton youth to see academic Partners In Action as well as professionals from the air quality and data science world expanding what they know of as possible career paths.

Ramboll will host three train-the-trainer sessions for Little Manila Rising and community members on monitor siting, deployment, and key considerations around assessing the nodes during maintenance review.

In addition, City Systems will place fellowships for students in college to engage in the community by supporting sensor deployment. This will contribute towards building community capacity for air pollution monitoring and mitigation measures, and will also support developing a STEM workforce within the community.

Finally, through Little Manila Rising's role as a co-leader of the AB 617 Community steering committee, we will be able to showcase local youth and our air quality technician implementing air quality monitoring projects within the framework of the AB 617 subcommittee structure. A key AB 617 subcommittee will be the Electrical Vehicle Mechanics Training program at San Joaquin Delta Community College that will be facilitated by Little Manila staff and which is funded through the AB 617 program and additional Community sponsors.

The goals and objectives, success measures and outcomes, and milestones for the tasks mentioned above are included below:

Goals and objectives

- Support workforce development and build Little Manila Rising's capacity to site, deploy, and maintain a network of air quality sensors while developing skills within participating community
- Build community capacity and literacy in air quality issues by providing access to real-time hyperlocal air quality and source attribution, which will expose youth to careers in STEM and environmental justice

Success measures

- Place (4) Little Manila Rising Youth Advocates in monitor deployment
- (75) community partners in monitor siting, deployment, and maintenance trainings
- Coaching 1-2 individuals into junior STEM positions by the end of the program
- 2 Students will complete (2) Modeling Fellowships with Stanford's Future Bay Initiative
- Hiring 1 skilled air technician within 4 months of grant approval

Milestones and Outcomes

- Prepare three monitor siting and deployment training for eight Little Manila Rising or community members
- Identifying up to five passionate and driven youth or young adults for career mentorship. Hosting bi-monthly check-ins and providing support. Youth or young

adults may be members of Little Manila Rising or involved with the Stockton community.
- Creating a local full-time position, increasing air quality monitoring expertise in the community

1.5. Task 5: Reporting

The goals and objectives, success measures and outcomes, and milestones for this task are included below:

Goals and objectives

- Report and present data collection and findings to CARB
- Prepare progress reports on time

Specific tasks

Little Manila Rising will provide 6 biannual reports for this project, outlining which tasks in the timeline have been completed and progress of uncompleted tasks. These reports will follow the structure of the administrative reports requested in the Community Air Grants Program Grant Guidelines, as outlined in the Air Grants Reporting Template form:

- Project title, report number, grantee organization, date progress report submitted, and grant number.
- Name of CARB Grant Liaison, Project Contact or Administrator, Report Preparer
- Reporting period, beginning and end dates covered by the Progress Report Period.
- Brief of the project
- Percentage of the project completed during the reporting period
- Percentage of the project that remains to be completed
- Estimate of the funds already spent on Project up until reporting period and estimate of funds remaining for completion
- Reporting how grant is being utilized to meet the goals of AB 617
- A narrative of how the Project is benefitting from disadvantaged and low-income communities or low-income households during reporting period
- A summary of Work Completed and In-Progress since the last Reporting Period
- Any challenges or barriers encountered in the implementation of the project.

In addition, we understand that the Air Grant Reporting Template Form requires the Administrative Reports to include the following information related to project tasks:

- Task name or number, brief description, percentage completed during current reporting period and percentage of task that remains to be completed
- Estimate of the funds spent on the task this Reporting Period and estimate of the funds remaining for completion of the task
- Name of sub-contractor assigned to the task (if applicable)
- Quantify the amount of work completed on the task during the quarter (e.g., number of sensors purchased, number of meetings held, number of staff hired, number of community members engaged, etc.) to the extent feasible
- Identify any challenges or barriers encountered in the implementation of this task