MEMORANDUM OF UNDERSTANDING BETWEEN THE COUNTY OF SAN MATEO AND THE GOLDEN GATE NATIONAL PARKS CONSERVANCY FOR THE DEVELOPMENT OF FINE SCALE GIS MAPPING OF PHYSICAL AND NATURAL LANDSCAPES OF SAN MATEO COUNTY

Purpose

This Memorandum of Understanding ("MOU") is made and entered into by and between THE COUNTY SAN MATEO, a political subdivision of the State of California ("County"), and the GOLDEN GATE NATIONAL PARKS CONSERVANCY ("Conservancy"), which may hereinafter be referred to individually as a "PARTY" and collectively as "PARTIES." The purpose of this MOU is to define the roles and responsibilities of the Conservancy and County in regards to the transfer of funds and sharing of resources and responsibility to support in the development of fine-scale GIS mapping of physical and natural landscapes of San Mateo County ("Project"). The Project forms the basis for managing and monitoring the County's infrastructure, ecosystems, fire fuels, and flood hazards. (All project deliverables and responsibilities are described in ARTICLES I and II below). The PARTIES to this MOU are bound by all stipulations set forth herein. Within the County, the departments that are involved in the Project are the Parks Department, the Office of Sustainability, the Department of Public Works, the Planning and Building Department, the Information Services Department, the Department of Agriculture/Weights and Measures, and the Office of Supervisor Don Horsley. In referring to "County" within this MOU, involvement of these listed departments is understood.

Term

This MOU will take effect on the date on which it is duly executed by both PARTIES and will be effective through July 1, 2022, unless earlier terminated in accordance with the provisions herein. The MOU is subject to a review by the PARTIES every twelve months and may be amended by mutual written agreement of the PARTIES. Notwithstanding any other provision herein, nothing shall prohibit the parties from executing an amendment to the MOU at any point throughout the Term. The Project deliverables and scope portion of the MOU (ARTICLE I) is subject to a regular review by the PARTIES and may also be amended by mutual agreement of the PARTIES. The goal of this MOU is to facilitate the transfer of funds for the duration of the Project and as consideration for completion of the Project. Either PARTY may terminate the MOU at any time, for any reason, with 60 days' written notice to the other PARTY. Should either PARTY terminate the MOU, neither PARTY shall thereafter have any responsibilities under the MOU.

Function of this MOU

This MOU is a statement of intent regarding how the PARTIES will work together to transfer funds and share resources and responsibility for the development and distribution of the spatial data developed as part of the Project. Labor provided by County personnel to complete this Project is provided without expectation of payment or reimbursement by the Conservancy. The County will provide funds as pledged herein either in cash and/or in-kind for various components of the Project. The County will contribute existing spatial data products where relevant and required for the completion of the Project. All aspects of the Project must be described in detail with defined roles and responsibilities in this MOU. Any role or responsibility not detailed herein and required for completion of the Project must be agreed to by both PARTIES and incorporated through a written amendment to this MOU.

County specifically agrees to contribute financial and/or staff resources to the Project because, in order to deliver the highest quality service to the residents of San Mateo County, improve

management decisions, and prioritize projects, the County has identified the need for high accuracy data on vegetation, surface characteristics, landscape-level hydrology, and fire risk.

ARTICLE I. BACKGROUND AND OBJECTIVES

Background

San Mateo County's various departments, land-management agencies and stewards have the responsibility to care for a diverse mix of ecosystems, including estuarine, marine, oak woodland, redwood forest, coastal scrub, grassland, and oak savannah. Home to more than 112,000 acres of protected lands, San Mateo County's open spaces provide County residents, neighbors and visitors with water, varied recreation opportunities, scenic vistas, wildlife habitat, and vital refuges for many threatened, endangered, and special status species. San Mateo County's natural resources provide numerous ecological, economic, and social benefits which are vitally interlinked to the county's communities. However, the health of San Mateo County's natural resources are threatened by global climate change; altered fire regimes; invasive, non-native plants and animals; habitat fragmentation; plant diseases and pathogens; noise, light, and air pollution; and other human and natural impacts.

To effectively care for the County's ecosystems and infrastructure, resource managers and land managers must know the location and distribution of those ecosystems across the County, and they must monitor changes in those ecosystems over time. Unfortunately, there are serious gaps in knowledge about the vegetation and landscapes of San Mateo County. A countywide, fine-scale vegetation map has never been completed, hampering cross ownership planning and often resulting in incomplete or piecemeal analysis.

Accurate and consistent San Mateo countywide spatial vegetation data will be an invaluable tool in managing and monitoring the County's fire and flood hazards, critical habitats, and climate resiliency, which requires fine-scale and thorough maps and databases of the County's vegetation and topography. To address these needs, the Golden Gate National Parks Conservancy, National Park Service, and the various land-management partners in San Mateo County will work together to achieve the common goal of developing a fine-scale, countywide vegetation map and landscape database.

Other deliverables that have been identified as highly valuable to the County and other project partners, which can be developed using the data acquired for this Project, include a product classifying all impervious and non-impervious ground surfaces; a product modelling the watershed boundaries, stream centerlines, and subsurface flow; a product modelling fire fuels and areas of high risk for fire spread; and a product modelling the relative cover of forest stands. These products will provide management and decision-making value for green infrastructure, sea-level rise, fire fuel management, and vegetation management projects within the county.

The first step of this Project has been to acquire countywide 6" digital multispectral orthoimagery as a base layer. This imagery was collected in June of 2018 and will be made publicly available through the San Mateo County Open Data Portal in early 2019. The second step will be to develop a comprehensive vegetation classification scheme and hierarchy countywide. This foundational data will provide the underpinning for the development of a fine scale vegetation map, fire fuels map, and topographic products for the County in Phase 2 of this Project.

The Conservancy is currently supporting a parallel countywide vegetation mapping effort in Marin County, which has broad local and regional support. Similarly, the Conservancy's partners in San Mateo County will contribute expertise to the Project's ecological design and goals, field sampling design and implementation, and provide funding and other resources to

support and implement the work. For this Project, the Parks Conservancy's staff will provide centralized data management, Project management support and fundraising.

Support for this Project is both broad (including the National Park Service, Midpeninsula Regional Open Space District, San Francisco Public Utilities Commission and California State Parks – Santa Cruz District) and substantial, as illustrated by Table 1, which lists the partners who have committed funding for, and participation in, this Project. Table 2 details the anticipated budget to complete Project and outlines the cost of key derivative products desired by the Project partners.

Table 1 – Funding Partners and Amount Pledged

San Mateo County	$229,500
- Parks Department ($50,000)	
- Office of Sustainability ($50,000)	
- Department of Public Works/San Mateo County Flood Control District ($25,000)	
- Planning and Building Department ($25,000)	
- Information Services Department [Contribution towards ortho-imagery, 1-foot contours, and impervious surfaces datasets] ($25,000)	
- Department of Agriculture Weights and Measures ($25,000)	
- Office of Supervisor Don Horsley [Specifically for Fire Fuels Modelling] ($29,500)	
C/CAG	$5,000
Golden Gate National Parks Conservancy	$50,000
National Park Service	$407,339
Midpeninsula Regional Open Space District	$150,000
San Francisco Public Utilities Commission	$150,000
Peninsula Open Space Trust	$25,000
TOTAL	$1,016,839

Table 2 – Anticipated Budget to Complete Vegetation Map Project and Derivative Products

Project management and administration	$54,000
6-inch orthoimagery acquisition and post processing	$62,014
San Mateo countywide vegetation classification production: field data acquisition and analysis	$261,733
National Vegetation Classification (NVC) Compliance	$15,000
Fine-scale vegetation map production and accuracy assessment	$498,855
San Mateo Fuels Mapping including ladder fuels proxy	$29,500
Optional 1-foot contour production	$4,030
Optional Relative cover for forested stands layer upgrade	$22,417
Optional Impervious surfaces layer upgrade with single track trails	$33,358
Optional Hydrologic System Mapping (NHD Hydrography – Level 3)	$94,108
Total	$1,075,015

Objective:

The objective of this MOU is to outline Conservancy and County roles and shared resources in support of the Project.

ARTICLE II. APPLICABILITY AND SCOPE

The terms and conditions of the MOU and any modifications remain in effect and apply to this Project Statement. The Parties agree to all rights and responsibilities as set forth in ARTICLE III below.

ARTICLE III. OBLIGATIONS AND RESPONSIBILITIES

A. The Conservancy shall:

1. **Manage the fund-raising efforts, budgets, and consultants, and coordinate the activities between the various organizations and agencies contributing to this effort.**

2. **Acquire 6-inch 4-band multispectral orthoimagery for San Mateo County plus a 250m buffer beyond the County boundary with no gaps under the following specifications:**
   a. Overall flight tolerances will be set to industry standards to support engineering accuracy and orthophotography specifications, utilizing the nadir-most portion of each image to minimize lean effects inherent with photography.
   b. All centers of the first and last digital photos of all flightlines shall fall outside of the project boundary or designated flightline.
   c. Imagery will be collected during peak sun angles for the day, under clear conditions with minimal cloud cover.
   d. Sun angle will be >30°.
   e. The flights will be tide coordinated so that imagery collection over coastal or bay lands is acquired during low tide.
   f. Imagery will be collected in the Spring/Summer of 2018.
   g. Imagery products will include 4-band, 6" orthoimagery, tiled in tif/tfw format, MrSid compressed mosaics, ground survey and final project report, and FGDC metadata.

4. **Perform quality control on the imagery:** The Conservancy shall manage quality control on the orthoimagery to ensure that it meets the specifications noted above. Conservancy staff and/or contractors responsible for this task shall be experienced and qualified to deliver the agreed-upon products.

5. **Develop a vegetation classification scheme for San Mateo County consistent with the Manual of California Vegetation.** The Conservancy will manage the process, with the California Native Plant Society and California Department of Fish and Wildlife, by:
   a. Allocating the additional samples as needed across the landscape
   b. Mobilizing and managing the sampling field crew including coordination with land managers, field data collection, and data entry.
   c. Analyzing existing and additional vegetation plot data to produce a classification of the vegetation alliances and associations of San Mateo County to current Manual of California Vegetation standards including a floristic key and a crosswalk showing the relationship between this and other classification systems plus descriptions of all vegetation alliances and associations which summarizes distributional, structural, environmental, and plant species data for each type.

6. **Develop a fine-scale vegetation map of all of San Mateo County generally to the alliance level of the Manual of California Vegetation and provide key derivative products:**
   a. The map will be delivered as an ESRI polygon feature class (see specific attributes in the 'Deliverables' section). The map and its derivatives (lifeform, agricultural lands, water and wetlands, and sensitive habitats) will be distributed to partner agencies as needed.
   b. Provide Relative cover for forested stands layer, which assigns relative conifer and hardwood cover in 5 classes to all forested stands
   c. Accuracy assessment / final report – this process provides a quantitative accuracy assessment of the vegetation map. Field verified map classes are compared to the vegetation map, and users and producers error rates are calculated for each map class and presented in error matrices.

7. **Create a derivative, fine-scale fuels map for San Mateo County. The end products of this work will result in the following:**
   a. **5-meter Fuel Model** – Conservancy will work with San Mateo County to understand their specific fuel-model needs and any required customizations. Conservancy will work with local and state fire experts to create a modified version of the Scott and Burgan fire behavior fuel model that is tailored to San Mateo County. This will be a crosswalk from San Mateo's fine-scale vegetation classes, aspect, vegetation height, and vegetation cover. The fuel model will be delivered as a 5-meter raster.
   b. **Landscape (.lcp) file for modeling** – Landscape files are a required input to fire behavior and fire spread models such as FlamMap and FARSITE. Landscape files consist of the following components, which will be delivered as a stack of 5-meter rasters:
      1. Elevation (derived from '17 LiDAR)
      2. Slope (derived from '17 LiDAR)
      3. Aspect (derived from '17 LiDAR)
      4. 5-meter Fuel Model - FBFM40 (LANDFIRE version 1.40). A refined, accurate and up-to-date representation of typical surface fuel arrangements or "collections of fuel properties" described to serve as input for mathematical surface fire behavior and spread models (Scott & Burgan, 2005).
      5. Canopy Cover - Described by percent cover of tree canopy in a stand (derived from '17 LiDAR).
      6. Canopy Height - Described as the average height of the top of the canopy for a stand (derived from '17 LiDAR).
      7. Canopy Base Height - Described by the lowest point in a stand where there is sufficient available fuel (0.25 in dia.) to propagate fire vertically through the canopy, reported in meters * 10 (estimated based on local knowledge)
      8. Canopy Bulk Density - Defined as the mass of available canopy fuel per unit canopy volume that would burn in a crown fire, reported in kg/m3*100 (will be estimated from the literature for each fuel model / canopy cover combination).
      9. Ladder Fuel Proxy – LiDAR derived proxy for ladder fuels delivered as a 30-meter raster.
      10. Report – 5-10 page report outlining methods.

8. **Work to identify key vegetation map and/or LiDAR derivative products desired by Project partners, and to develop scopes of work and specifications to meet the needs of the County and other project partners.**
   a. Proposed products may include:

I. 1-foot countywide contours.
II. An upgrade of the County's existing impervious surfaces dataset, to include additional classification of Paved Roads, Dirt or Gravel Roads, Buildings, Other Paved Surfaces, Other Dirt/Gravel Surfaces. An option to add single-track trails can be explored.
III. LiDAR derived hydrology dataset compliant to USGS National Hydrology Dataset standards; could include streamlines, subsurface flows, watershed boundaries, etc.

9. **Other:**
   a. Obtain necessary permits from County departments before accessing County-owned or -managed land.

B. The County shall:

1. **Funding:** Provide funding in the amount of $229,500, in accordance with Table 1, for the Conservancy to complete the tasks outlined above. County shall disperse funds upon completion of Project deliverables and acknowledgement from County departments involved that all required information has been collected and incorporated into the final deliverables. The contributing Departments shall journal the allocated funds for this project for ease of payment to the Conservancy. The County contribution is derived from these Departments as follows:

Parks Department	$50,000
Office of Sustainability	$50,000
Department of Public Works/San Mateo County Flood Control District	$25,000
Planning and Building Department	$25,000
Information Services Department	$25,000
Department of Agriculture Weights and Measures	$25,000
District 3 Supervisor Horsley for Fire Fuels Modelling	$29,500
Total	$229,500

2. **Payment:** Available funds for key project products will be dispersed to the Conservancy upon completion of milestones as outlined in the table below:

Milestone	Anticipated Cost	Estimated Completion
6-inch orthoimagery acquisition and post processing	$62,014	February 2019
Complete Vegetation Field Sampling	$177,106	July 2019
Impervious surfaces layer upgrade (includes add-alt for single track trails)	$33,358	June 2019
San Mateo countywide vegetation classification analysis, descriptions and key	$84,627	March 2020
Fine-scale vegetation map production incl. program development	$477,855	November 2021
Optional Relative cover for forested stands layer upgrade	$22,417	November 2021
Accuracy Assessment and Final Report	$25,000	January 2022
San Mateo County Fuels Mapping including ladder fuels proxy	$29,500	January 2022

Optional 1-foot contour production	$4,030	TBD
NHD Hydrography layer production	$94,108	TBD

3. **Project Support and Oversight**
   a. Identify a Project Manager from County staff to:
      I. Serve on the Project Interdisciplinary Review Team;
      II. Work with the Conservancy Project Manager to develop and adopt a project schedule and review process, to include milestones for review and review turnaround times;
      III. Be the liaison between the Conservancy and other County staff;
      IV. Ensure compliance with all County policies, permits and procedures;
      V. Ensure appropriate review and approval by key County staff;
      VI. Review and approve all deliverables;
      VII. Work with the Conservancy to deliver presentations and provide background information to other interested stakeholders.
      VIII. Compile list of stakeholders for project participation. Support invitation and recruitment of stakeholder and technical expert participation;
      IX. Actively participate in all workshops to ensure most complete representation of site knowledge and staff expertise; and
      X. Organize and oversee how funding allocation from the contributing departments is undertaken, and review invoices for approval & processing.

4. **Other:**
   a. Contribute additional County staff time toward fulfilling obligations of this contract as needed and mutually agreed upon in writing.
   b. Provide logistical support, to include:
      I. Identifying areas to stage vehicles;
      II. Identifying locations for representative vegetation classification sampling plots;
      III. Providing access to vegetation sampling teams through County fire road gates and other areas to facilitate sampling team access; and
      IV. Facilitating any compliance and permitting requirements to allow for vegetation sampling.
   c. Provide existing San Mateo countywide 4ppm LiDAR data acquired in 2017, to include:
      I. Classified LiDAR point cloud for entire area (preferably as .las or .laz files);
      II. Digital Surface Model (DSM), Digital Terrain Model (DTM), Canopy Height Model (CHM, also known as nDSM); All DEMs (DSMs, DTMS, CHMs) that are available;
      III. Derivatives like building footprints derived from LIDAR, if available; and
      IV. Any additional LAS data available.
   d. Provide public access to acquired imagery, vegetation map and derivative products through the County's Open Data Portal and GIS services.
      I. Facilitate appropriate data storage, protections, permissions, and access.

C. It is mutually agreed by all **PARTIES** that:

1. **Ownership, Lifespan and Sale:** All data, documents, materials, maps, and records prepared as a deliverable or draft deliverable of the Project shall be equally owned by all contributing Project partners. Each partner is allowed to use the data, maps, and files as determined most appropriate for each partner.

ARTICLE IV. AUTHORIZING SIGNATURES

IN WITNESS WHEREOF, the parties hereto, by their duly authorized representatives, have affixed their hands.

COUNTY OF SAN MATEO

By:_____
Carole Groom, President
Board of Supervisors
San Mateo County

Date:_____

Golden Gate National Parks Conservancy

By:_____

Date: 05.28.19