



Final Supplemental Watershed Plan No. 1 - Environmental Assessment

United States
Department of
Agriculture

Central Sonoma Watershed - Matanzas Creek Dam Rehabilitation Project
Sonoma County, California

Natural
Resources
Conservation
Service

Sponsoring Local Organization: Sonoma County Water Agency
Lead Agency: Natural Resources Conservation Service (NRCS)

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Appendix D - TM008 - Frequency Flood Routing



TM008 – Frequency Flood Routing

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1.0 Introduction

Matanzas Creek Dam (CA00794) is an earthen embankment dam located in Sonoma County, California. Construction of the dam was proposed as a result of the original Central Sonoma Watershed Plan developed in 1958 under the National Resources Conservation Service (NRCS) PL-566 program. The dam was designed by the NRCS and constructed in 1964 as a flood control structure. Sonoma Water Agency (Sonoma Water) currently owns, operates, and maintains the dam.

In 2016, HDR and Kleinfelder completed a dam assessment for the NRCS, which evaluated the dam based on Technical Release 210-60 (TR-60) (NRCS, 2019b) design criteria. It was determined that Matanzas Creek Dam is out of compliance with TR-60 criteria due to its inability to route the principal spillway hydrograph without activating the earthen auxiliary spillway (HDR; Kleinfelder, 2016).

1.1 Purpose and Scope

Jones & DeMille Engineering (JDE) and AECOM have contracted with the NRCS to develop a supplemental watershed plan and environmental document (further referred to as Plan-EA). The purpose and need of the Plan-EA is to bring Matanzas Creek Dam into compliance with NRCS and California Division of Safety of Dams (CA DSOD) standards and to preserve and/or increase the flood protection downstream of the dam. JDE and AECOM are to develop alternatives for the dam to meet the purpose and need of the Plan-EA and to provide an economic analysis of those alternatives.

Hydrologic and hydraulic routing of recurrence interval storms for the dam and its potential alternatives is needed for the economic analysis. The purpose of this technical memo is to describe the methods, procedures, and results of the flood frequency routing and hydraulic modeling performed for the Plan-EA. The recurrence-interval storms to be included in the flood frequency routing are the 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year 24-hour duration storm events.

1.2 Site Overview

Matanzas Creek Dam is an earthen embankment dam that was constructed in 1964 for flood protection for downstream infrastructure, which includes the City of Santa Rosa. The dam is located approximately five river miles upstream from the confluence of the Santa Rosa Creek and Matanzas Creek. The contributing watershed to the dam is 11.45 square miles. The NRCS and CA DSOD hazard classifications for the dam are High Hazard and Extremely High Hazard, respectively.

The dam has a crest elevation of 427.63 feet (NAVD 88; all elevations reported in this document refer to this datum), a crest length of approximately 685 feet, a crest top width of 24 feet, and a total height of approximately 95 feet. The embankment has a 3:1 upstream slope with one wave berm that is 10 feet in width. The downstream face of the dam has a 2.5:1 slope and two stability berms that are also both 10 feet wide. The dam features a principal spillway and auxiliary spillway with crest elevations of 377.63 feet and 412.63 feet, respectively. The auxiliary spillway of the dam is a vegetated earthen spillway that wraps around the right abutment of the embankment. The auxiliary spillway operates as a broad-crested weir with a weir length of 200 feet and 2:1 side slopes. The crest of the spillway includes a concrete cut-off wall that extends 10 feet below the ground surface.

For additional information and photographs of the existing dam, refer to *TM001 – Existing Condition Assessment* (JDE & AECOM, 2023) and *TM005 – Existing Hydrology Analysis* (JDE, 2023a).

2.0 Hydrology

Hydrologic modeling of the Matanzas Creek Dam watershed was completed following guidelines from the NRCS National Engineering handbook (NEH) Part 630 – Hydrology (NRCS, 2020). The U.S. Army Corps of Engineers’ (USACE) Hydrologic Modeling System (HEC-HMS) software (version 4.9) was utilized to route recurrence intervals storms, and NRCS’s SITES software (version 2005.1.11) was used to analyze the required federal and state design storms. The recurrence interval storms included in the analysis are the 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year 24-hour duration storm events.

2.1 Watershed and Dam Characteristics

JDE has completed a thorough hydrologic analysis of the Matanzas Creek Dam watershed. The analysis involved determining existing watershed characteristics for the dam such as watershed area, curve number (CN), and time of concentration. Stage-storage-discharge relationships for the existing dam were also developed. The characteristics of the watershed and dam were further calibrated through available precipitation, stream flow, and reservoir water surface elevation gages. The summary of characteristics for Matanzas Creek Dam and its watershed is shown in Table 2-1. For more information on the hydrologic analysis and the dam’s characteristics, refer to *TM005 – Existing Hydrology Analysis* (JDE, 2023a).

Table 2-1. Summary of Characteristics for the Existing Matanzas Creek Dam

Characteristic	Value
Watershed Area	11.45 sq. mi.
Curve Number, CN	71.4
Watershed Lag Time	1.8 hr
Dam Crest Elevation	427.63 ft
Auxiliary Spillway Crest Elevation	412.63 ft
Principal Spillway Crest Elevation	377.63 ft

2.2 Precipitation

NOAA Atlas 14 precipitation data was used to determine the precipitation depths for the dam’s watershed, as shown in Table 2-2. Precipitation depths were distributed by methods found in NEH Part 630 Chapter 4 (NRCS, 2019a) and the CA-1 regional rainfall distribution developed by the NRCS (NRCS, 2013). The CA-1 rainfall distribution data is provided in Appendix A.

Table 2-2. Precipitation Depths for Matanzas Creek Dam Watershed

Recurrence Interval (years)	Precip. Depth (inches)
2	5.04
5	6.26
10	7.24
25	8.53
50	9.50
100	10.47
200	11.45
500	12.76

2.3 Alternative Development

TM007 – Alternative Development and Evaluation describes the Future Without Federal Investment (FWOFI), decommissioning, non-structural, and structural rehabilitation alternatives to be included in the Matanzas Creek Dam Plan-EA (JDE, 2023b).

There are three structural rehabilitation alternatives to be included in the flood frequency modeling. Alternative 1 consists of converting the dam’s existing earthen auxiliary spillway to a structural spillway with a labyrinth weir. The crest elevation of the labyrinth weir would be raised to 417.88 feet, which is the highest possible raise without needing to raise the crest of the dam. Alternative 2 consists of raising the earthen auxiliary spillway crest to 420 feet. This spillway crest elevation allows the principal spillway hydrograph to be routed solely through the principal spillway, which is a current deficiency for the dam. Alternative 3 consists of raising the earthen auxiliary spillway crest to 424 feet, which allows the 100-year storm event to be routed solely through the principal spillway. Note that Alternatives 1 through 3 do not anticipate elevation or size changes to the current principal spillway. Therefore, it is expected that peak reservoir water surface elevations and peak outflows for the 2-, 5-, 10-, and 25-year storm events for the proposed alternatives will be relatively the same as the existing conditions of the dam.

Alternatives 1 through 3 all bring the dam in compliance with current federal and state dam safety regulations. The hydrologic modeling was performed in SITES for federal and state design storms, and the modeling outputs of these alternatives are provided in Appendix A. Refer to *TM005 – Existing Hydrology Analysis* (JDE, 2023a) for more information on the existing dam’s deficiencies, NRCS and CA DSOD criteria, and methods and procedures of the hydrologic modeling. *TM007 – Alternative Development and Evaluation* (JDE, 2023b) contains the conceptual design drawings for these alternatives.

The decommissioning alternative was also included in the frequency flood modeling. However, only data for the 100-year recurrence interval is included in this report since this alternative was dismissed from further detailed analysis. Inundation depths from the dam breach analyses for the dam (JDE, 2021a) were used for the economic analysis on the FWOFI and non-structural alternatives; therefore, additional frequency flood routing for these two alternatives was not needed.

2.4 Hydrologic Modeling Results

Table 2-3 provides a summary of peak inflows, peak reservoir water surface elevations, and peak outflows for the existing conditions and Alternatives 1 through 3 for Matanzas Creek Dam.

The existing condition of the dam can route up to the 25-year storm event solely through the principal spillway with barely activating the auxiliary spillway. Alternative 1 will route the 25-year storm solely through the principal spillway with the labyrinth weir crest elevation was raised to 417.88 feet. The dam’s flood storage increases up to the 50-year storm event for Alternative 2 (auxiliary spillway crest elevation is 420 feet). For Alternative 3 (auxiliary spillway crest elevation is 424 feet), the flood storage increases to the 100-year storm event. Flood storage and protection, in this sense, refers to the dam’s ability to attenuate high runoff flows to lower, controlled flows. It does not indicate that flooding will not occur downstream of the dam, due to insufficient capacity of Matanzas Creek, for example.

Additional hydrology results of the existing conditions and proposed alternatives for the dam is provided in Appendix A. The outflow hydrographs produced from the hydrologic modeling will be used for the frequency flood routing, or hydraulic modeling, that will be used to analysis downstream flooding impacts.

Table 2-3. Hydrologic Results

Recurrence Interval (years)	Peak Inflow (cfs)	Existing Conditions		Alternative 1		Alternative 2		Alternative 3	
		Peak Reservoir Elevation (feet)	Peak Outflow (cfs)	Peak Reservoir Elevation (feet)	Peak Outflow (cfs)	Peak Reservoir Elevation (feet)	Peak Outflow (cfs)	Peak Reservoir Elevation (feet)	Peak Outflow (cfs)
2	1,449	387.1	972	387.1	972	387.1	972	387.1	972
5	2,112	396.7	1,071	396.7	1,071	396.7	1,071	396.7	1,071
10	2,663	404.4	1,146	404.4	1,146	404.4	1,146	404.4	1,146
25	3,410	412.6	1,219	412.6	1,219	412.6	1,219	412.6	1,219
50	3,982	414.3	2,036	418.2	1,709	418.5	1,270	418.5	1,270
100	4,558	414.9	2,552	418.6	2,354	421.2	2,225	423.8	1,313
200	5,146	415.5	3,250	418.9	2,989	421.6	2,649	425.4	2,459
500	5,932	416.3	4,328	419.3	4,050	422.2	3,508	425.9	3,043

3.0 Hydraulic Modeling

The USACE’s River Analysis System (HEC-RAS) software (version 6.2) was used to hydraulically model the flood inundation results from the dam’s outflow hydrographs. The purpose of the hydraulic modeling is to evaluate the flood conditions downstream of the existing dam for each alternative and compare the proposed and existing floodplains. Each alternative’s impacts to flooding can then be evaluated in the economic analysis.

Note that the Matanzas Creek watershed is a contributor to the broader Central Sonoma watershed. The Central Sonoma watershed consists primarily of the Santa Rosa Creek watershed with the surrounding tributary subbasins. To accurately model the outflows from Matanzas Creek Dam, additional hydrologic and hydraulic modeling is needed for the broader Central Sonoma watershed. This ensures outflows from the dam are routed in conjunction with runoff flows from the broader watershed. This broader modeling effort has already been completed and provided by ESA, which will be discussed further in Section 3.1.

3.1 Central Sonoma Watershed Model – ESA

ESA has previously contracted with the Sonoma County Water Agency to complete a hydrologic and hydraulic model of the broader Central Sonoma watershed (ESA, 2017a and 2017b). These reports and modeling files were provided to JDE to complete of the Matanzas Creek Dam Plan-EA. In addition, ESA in conjunction with AECOM is currently working with the NRCS to complete a separate supplemental watershed plan for the Central Sonoma watershed; therefore, ESA has been able to update the hydrologic and hydraulic models since the 2017 version. The updated, draft hydraulic model has been provided by ESA for the completion of the frequency flood routing for Matanzas Creek Dam (ESA, 2022).

This section provides a brief summary of ESA’s HEC-RAS model for the Central Sonoma watershed:

- The received model is a 1-dimensional and 2-dimensional (1D/2D) HEC-RAS model
- Extent of the model includes the conveyances of Austin Creek, Brush Creek, College Creek, Ducker Creek, Forestview Creek, Lornadell Creek, Matanzas Creek, Middle Fork Brush Creek, Paulin Creek, Peterson Creek, Piner Creek, Rincon Creek, Santa Rosa Creek, Spring Creek, and Wendell Creek
- Several diversions and flow conditions are set within the model to accurately model the broader watershed

- LiDAR data within the channel conveyances have been updated with survey cross-section data that was collected in 2006
- Bridge and culvert structure geometry data was verified with survey data
- 1D reaches and cross-sections were connected to 2D mesh cells via lateral structures
- Manning’s roughness values on the 1D cross-sections were calibrated and updated appropriately
- Manning’s roughness values for 2D mesh cells used the default value of 0.06
- All inflow hydrographs were developed via HEC-HMS and appropriately entered as boundary conditions
- Both the HEC-HMS and HEC-RAS models were thoroughly calibrated with available precipitation and streamflow gage data

JDE has reviewed the received models and agree with the methods, procedures, tolerances, and general findings for the Central Sonoma watershed. For the purposes of Matanzas Creek Dam’s Plan-EA, the received models were used to complete the frequency flood routing and economic analysis of existing conditions and the proposed alternatives. The dam’s outflow hydrographs from the hydrologic modeling described in Section 2.0 were utilized on the Matanzas Creek boundary condition, which is located directly downstream of the dam in the ESA HEC-RAS model.

3.2 Results and Inundation Maps

Depth rasters and inundation boundaries from the hydraulic modeling results were exported to create inundation maps (see Appendix B). The depth rasters were then intersected with available parcel data, building footprints, and other GIS data to assign flood depths to various types of infrastructure downstream of the dam. This GIS data was processed and sent to AECOM for the economic analysis described in *TM009 – Economics* (AECOM, 2023).

For the existing conditions of Matanzas Creek Dam, the hydraulic modeling shows Matanzas Creek being overtopped near the Bennett Valley Golf Course during the 2-year flood event outflows. The extents and intensity of the flooding increase with lower frequency storms. In general, these overtopping flows continue northwest, but eventually are conveyed back into Matanzas Creek before the Highway 12 road crossing. There is extensive flooding observed near the confluence of Matanzas Creek and Santa Rosa Creek.

For Alternative 1, there is minimal differences in flood depths and extents when comparing to the existing conditions. This is due primarily to the same functionality of the principal spillway and the inability of the proposed labyrinth spillway to increase flood protection by routing a lower frequency without the auxiliary spillway being activated. While Alternatives 2 and 3 provide some flood reduction for the 50-year and 100-year storm events, the reduced floodplain is primarily located within the first mile downstream from the dam where there is limited infrastructure. Downstream from the Bennett Valley Golf Course, there is minimal differences in inundation boundaries when comparing the alternative results to the existing conditions. The hydraulic modeling displayed no concerns of induced flooding for Alternatives 1 through 3.

Inundation maps for the existing conditions, Alternatives 1 through 3, and the decommission alternative (100-year recurrence interval only for the decommission alternative) are provided in Appendix B. Inundation maps for existing conditions are provided for the broader Central Sonoma watershed to indicate the overall flooding from surrounding watersheds. For proposed alternatives, the flood extents between Matanzas Creek Dam and Highway 12 are provided; there was no significant difference or induced flooding from the existing conditions flood maps downstream from Highway 12. This is due to the larger flooding produced from Santa Rosa Creek rather than Matanzas Creek. The 2-, 5-, 10-, and 25-year recurrence interval inundation maps for the proposed conditions were not created due to their similar mapping as the existing conditions flood maps.

4.0 Summary

JDE has completed a hydrologic analysis for the existing conditions of Matanzas Creek Dam and Alternatives 1 through 3. The outflow hydrographs were then hydraulically modeled using a 1D/2D HEC-RAS model that was developed and received from ESA. The results of the hydraulic modeling were used to create flood maps for the existing conditions and the proposed alternatives. Depth raster data was analyzed to determine the flood plain differences, if any, which will then be used to complete an economic analysis of the alternatives.

For more information on the complete list of alternatives to be included in the Plan-EA or the economic analysis, refer to *TM007 – Alternative Development and Evaluation* (JDE, 2023b) and *TM009 – Economic Analysis* (AECOM, 2023), respectively.

5.0 References

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- AECOM, Jones & DeMille Engineering (JDE). (2023). Technical Memorandum No. 001 – *Existing Conditions Assessment*.
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- HDR, Kleinfelder. (2016). California Dam Assessment for Matanzas Creek Dam Sonoma County, CA. Prepared for USDA-NRCS California State Office. April 2016.
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- NRCS. (2019a). National Engineering Handbook, Part 630 Hydrology, Chapter 4: Storm Rainfall Depth and Distribution. August 2019.
- NRCS. (2019b). Technical Release 210-60. *Earth Dams and Reservoirs*. U.S. Department of Agriculture. March 2019.
- NRCS. (2022). National Engineering Handbook Part 630 – Hydrology. March 2020.

Appendix A. Hydrologic Modeling

A.1. CA-1 Rainfall Distribution

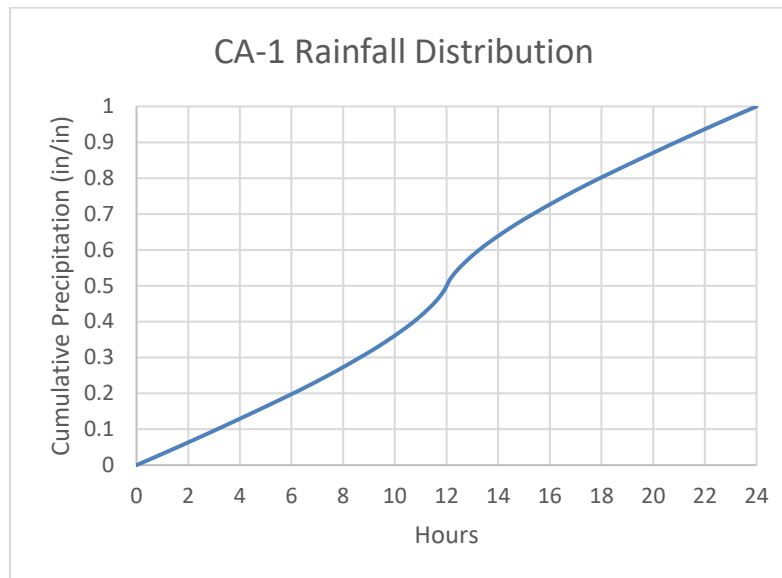


Figure A-1. CA-1 Rainfall Distribution (NRCS, 2013)

Table A-1. Cumulative Precipitation Depths

Time (hr)	Recurrence Interval							
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR	200-YR	500-YR
0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.1	0.02	0.02	0.02	0.03	0.03	0.03	0.04	0.04
0.2	0.03	0.04	0.05	0.05	0.06	0.07	0.07	0.08
0.3	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.12
0.4	0.06	0.08	0.09	0.11	0.12	0.13	0.14	0.16
0.5	0.08	0.10	0.11	0.13	0.15	0.16	0.18	0.20
0.6	0.09	0.12	0.14	0.16	0.18	0.20	0.21	0.24
0.7	0.11	0.14	0.16	0.19	0.21	0.23	0.25	0.28
0.8	0.13	0.16	0.18	0.21	0.24	0.26	0.29	0.32
0.9	0.14	0.18	0.20	0.24	0.27	0.30	0.32	0.36
1	0.16	0.20	0.23	0.27	0.30	0.33	0.36	0.40
1.1	0.17	0.22	0.25	0.29	0.33	0.36	0.40	0.44
1.2	0.19	0.24	0.27	0.32	0.36	0.39	0.43	0.48
1.3	0.21	0.26	0.30	0.35	0.39	0.43	0.47	0.52
1.4	0.22	0.28	0.32	0.38	0.42	0.46	0.50	0.56
1.5	0.24	0.30	0.34	0.40	0.45	0.49	0.54	0.60
1.6	0.25	0.32	0.37	0.43	0.48	0.53	0.58	0.64
1.7	0.27	0.34	0.39	0.46	0.51	0.56	0.61	0.68
1.8	0.29	0.36	0.41	0.48	0.54	0.60	0.65	0.73
1.9	0.30	0.38	0.43	0.51	0.57	0.63	0.69	0.77
2	0.32	0.40	0.46	0.54	0.60	0.66	0.73	0.81
2.1	0.34	0.42	0.48	0.57	0.63	0.70	0.76	0.85
2.2	0.35	0.44	0.51	0.60	0.66	0.73	0.80	0.89
2.3	0.37	0.46	0.53	0.62	0.69	0.76	0.84	0.93
2.4	0.38	0.48	0.55	0.65	0.72	0.80	0.87	0.97
2.5	0.40	0.50	0.58	0.68	0.76	0.83	0.91	1.02
2.6	0.42	0.52	0.60	0.71	0.79	0.87	0.95	1.06
2.7	0.43	0.54	0.62	0.73	0.82	0.90	0.99	1.10
2.8	0.45	0.56	0.65	0.76	0.85	0.94	1.02	1.14
2.9	0.47	0.58	0.67	0.79	0.88	0.97	1.06	1.18
3	0.48	0.60	0.69	0.82	0.91	1.00	1.10	1.22
3.1	0.50	0.62	0.72	0.85	0.94	1.04	1.14	1.27
3.2	0.52	0.64	0.74	0.87	0.97	1.07	1.17	1.31
3.3	0.53	0.66	0.77	0.90	1.01	1.11	1.21	1.35
3.4	0.55	0.68	0.79	0.93	1.04	1.14	1.25	1.39
3.5	0.57	0.70	0.81	0.96	1.07	1.18	1.29	1.44
3.6	0.58	0.73	0.84	0.99	1.10	1.21	1.33	1.48
3.7	0.60	0.75	0.86	1.02	1.13	1.25	1.36	1.52

Time (hr)	Recurrence Interval							
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR	200-YR	500-YR
3.8	0.62	0.77	0.89	1.04	1.16	1.28	1.40	1.56
3.9	0.63	0.79	0.91	1.07	1.20	1.32	1.44	1.61
4	0.65	0.81	0.94	1.10	1.23	1.35	1.48	1.65
4.1	0.67	0.83	0.96	1.13	1.26	1.39	1.52	1.69
4.2	0.69	0.85	0.98	1.16	1.29	1.42	1.56	1.74
4.3	0.70	0.87	1.01	1.19	1.32	1.46	1.60	1.78
4.4	0.72	0.89	1.03	1.22	1.36	1.49	1.63	1.82
4.5	0.74	0.92	1.06	1.25	1.39	1.53	1.67	1.87
4.6	0.75	0.94	1.08	1.28	1.42	1.56	1.71	1.91
4.7	0.77	0.96	1.11	1.30	1.45	1.60	1.75	1.95
4.8	0.79	0.98	1.13	1.33	1.48	1.64	1.79	2.00
4.9	0.81	1.00	1.16	1.36	1.52	1.67	1.83	2.04
5	0.82	1.02	1.18	1.39	1.55	1.71	1.87	2.08
5.1	0.84	1.04	1.21	1.42	1.58	1.74	1.91	2.13
5.2	0.86	1.07	1.23	1.45	1.62	1.78	1.95	2.17
5.3	0.88	1.09	1.26	1.48	1.65	1.82	1.99	2.21
5.4	0.89	1.11	1.28	1.51	1.68	1.85	2.03	2.26
5.5	0.91	1.13	1.31	1.54	1.71	1.89	2.07	2.30
5.6	0.93	1.15	1.33	1.57	1.75	1.92	2.11	2.35
5.7	0.95	1.17	1.36	1.60	1.78	1.96	2.15	2.39
5.8	0.96	1.20	1.38	1.63	1.81	2.00	2.19	2.44
5.9	0.98	1.22	1.41	1.66	1.85	2.03	2.22	2.48
6	1.00	1.24	1.43	1.69	1.88	2.07	2.26	2.52
6.1	1.02	1.26	1.46	1.72	1.91	2.11	2.31	2.57
6.2	1.03	1.28	1.48	1.75	1.95	2.14	2.35	2.62
6.3	1.05	1.31	1.51	1.78	1.98	2.18	2.39	2.66
6.4	1.07	1.33	1.53	1.81	2.01	2.22	2.43	2.71
6.5	1.09	1.35	1.56	1.84	2.05	2.26	2.47	2.75
6.6	1.11	1.37	1.59	1.87	2.08	2.30	2.51	2.80
6.7	1.12	1.40	1.61	1.90	2.12	2.33	2.55	2.85
6.8	1.14	1.42	1.64	1.93	2.15	2.37	2.60	2.89
6.9	1.16	1.44	1.67	1.96	2.19	2.41	2.64	2.94
7	1.18	1.47	1.70	2.00	2.22	2.45	2.68	2.99
7.1	1.20	1.49	1.72	2.03	2.26	2.49	2.72	3.04
7.2	1.22	1.51	1.75	2.06	2.30	2.53	2.77	3.09
7.3	1.24	1.54	1.78	2.09	2.33	2.57	2.81	3.13
7.4	1.26	1.56	1.81	2.13	2.37	2.61	2.86	3.18
7.5	1.28	1.59	1.83	2.16	2.41	2.65	2.90	3.23
7.6	1.30	1.61	1.86	2.19	2.44	2.69	2.95	3.28

Time (hr)	Recurrence Interval							
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR	200-YR	500-YR
7.7	1.32	1.64	1.89	2.23	2.48	2.73	2.99	3.33
7.8	1.34	1.66	1.92	2.26	2.52	2.78	3.04	3.38
7.9	1.36	1.69	1.95	2.30	2.56	2.82	3.08	3.44
8	1.38	1.71	1.98	2.33	2.59	2.86	3.13	3.49
8.1	1.40	1.74	2.01	2.36	2.63	2.90	3.17	3.54
8.2	1.42	1.76	2.04	2.40	2.67	2.94	3.22	3.59
8.3	1.44	1.79	2.07	2.43	2.71	2.99	3.27	3.64
8.4	1.46	1.81	2.10	2.47	2.75	3.03	3.32	3.70
8.5	1.48	1.84	2.13	2.50	2.79	3.07	3.36	3.75
8.6	1.50	1.87	2.16	2.54	2.83	3.12	3.41	3.80
8.7	1.52	1.89	2.19	2.58	2.87	3.16	3.46	3.86
8.8	1.54	1.92	2.22	2.61	2.91	3.21	3.51	3.91
8.9	1.57	1.95	2.25	2.65	2.95	3.25	3.56	3.96
9	1.59	1.97	2.28	2.68	2.99	3.29	3.60	4.02
9.1	1.61	2.00	2.31	2.72	3.03	3.34	3.65	4.07
9.2	1.63	2.03	2.34	2.76	3.07	3.39	3.71	4.13
9.3	1.65	2.06	2.37	2.80	3.12	3.43	3.76	4.19
9.4	1.68	2.08	2.41	2.84	3.16	3.48	3.81	4.25
9.5	1.70	2.11	2.44	2.88	3.20	3.53	3.86	4.30
9.6	1.72	2.14	2.47	2.92	3.25	3.58	3.91	4.36
9.7	1.75	2.17	2.51	2.96	3.29	3.63	3.97	4.42
9.8	1.77	2.20	2.54	3.00	3.34	3.68	4.02	4.49
9.9	1.80	2.23	2.58	3.04	3.38	3.73	4.08	4.55
10	1.82	2.26	2.61	3.08	3.43	3.78	4.14	4.61
10.1	1.85	2.29	2.65	3.12	3.48	3.83	4.19	4.67
10.2	1.87	2.33	2.69	3.17	3.53	3.89	4.25	4.74
10.3	1.90	2.36	2.72	3.21	3.57	3.94	4.31	4.80
10.4	1.92	2.39	2.76	3.25	3.62	3.99	4.37	4.87
10.5	1.95	2.42	2.80	3.30	3.67	4.05	4.43	4.94
10.6	1.98	2.46	2.84	3.35	3.73	4.11	4.49	5.01
10.7	2.01	2.49	2.88	3.39	3.78	4.16	4.56	5.08
10.8	2.04	2.53	2.92	3.44	3.83	4.23	4.62	5.15
10.9	2.07	2.57	2.97	3.49	3.89	4.29	4.69	5.23
11	2.10	2.61	3.01	3.55	3.95	4.35	4.76	5.31
11.1	2.13	2.65	3.06	3.60	4.01	4.42	4.84	5.39
11.2	2.16	2.69	3.10	3.66	4.07	4.49	4.91	5.47
11.3	2.20	2.73	3.15	3.72	4.14	4.56	4.99	5.56
11.4	2.23	2.77	3.20	3.78	4.20	4.63	5.07	5.65
11.5	2.27	2.82	3.26	3.84	4.27	4.71	5.15	5.74

Time (hr)	Recurrence Interval							
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR	200-YR	500-YR
11.6	2.31	2.87	3.31	3.90	4.35	4.79	5.24	5.84
11.7	2.35	2.92	3.37	3.98	4.43	4.88	5.34	5.95
11.8	2.40	2.98	3.44	4.06	4.52	4.98	5.45	6.07
11.9	2.45	3.05	3.52	4.14	4.62	5.09	5.57	6.20
12	2.52	3.12	3.61	4.25	4.74	5.22	5.71	6.37
12.1	2.59	3.22	3.72	4.38	4.88	5.38	5.88	6.56
12.2	2.64	3.28	3.80	4.47	4.98	5.49	6.00	6.69
12.3	2.69	3.34	3.86	4.55	5.07	5.59	6.11	6.81
12.4	2.73	3.40	3.92	4.62	5.15	5.67	6.21	6.92
12.5	2.77	3.45	3.98	4.69	5.22	5.76	6.30	7.02
12.6	2.81	3.49	4.03	4.75	5.29	5.83	6.38	7.11
12.7	2.85	3.54	4.08	4.81	5.36	5.91	6.46	7.20
12.8	2.88	3.58	4.13	4.87	5.42	5.98	6.54	7.29
12.9	2.91	3.62	4.18	4.93	5.49	6.05	6.61	7.37
13	2.95	3.66	4.23	4.98	5.55	6.11	6.69	7.46
13.1	2.98	3.70	4.27	5.03	5.61	6.18	6.76	7.53
13.2	3.01	3.74	4.32	5.08	5.66	6.24	6.83	7.61
13.3	3.04	3.77	4.36	5.13	5.72	6.30	6.89	7.68
13.4	3.07	3.81	4.40	5.18	5.77	6.36	6.96	7.76
13.5	3.09	3.84	4.44	5.23	5.82	6.42	7.02	7.83
13.6	3.12	3.87	4.48	5.27	5.87	6.47	7.08	7.89
13.7	3.15	3.91	4.51	5.32	5.92	6.53	7.14	7.96
13.8	3.17	3.94	4.55	5.36	5.97	6.58	7.20	8.03
13.9	3.20	3.97	4.59	5.40	6.02	6.63	7.26	8.09
14	3.22	4.00	4.62	5.45	6.07	6.68	7.31	8.15
14.1	3.25	4.03	4.66	5.49	6.11	6.74	7.37	8.22
14.2	3.27	4.06	4.69	5.53	6.16	6.79	7.43	8.28
14.3	3.30	4.09	4.73	5.57	6.20	6.84	7.48	8.34
14.4	3.32	4.12	4.76	5.61	6.25	6.89	7.54	8.40
14.5	3.34	4.15	4.80	5.65	6.29	6.94	7.59	8.46
14.6	3.37	4.18	4.83	5.69	6.34	6.98	7.64	8.52
14.7	3.39	4.21	4.86	5.73	6.38	7.03	7.69	8.58
14.8	3.41	4.24	4.90	5.77	6.42	7.08	7.75	8.63
14.9	3.43	4.27	4.93	5.81	6.47	7.13	7.80	8.69
15	3.46	4.29	4.96	5.84	6.51	7.17	7.85	8.75
15.1	3.48	4.32	4.99	5.88	6.55	7.22	7.89	8.80
15.2	3.50	4.35	5.02	5.92	6.59	7.26	7.94	8.85
15.3	3.52	4.37	5.05	5.95	6.63	7.30	7.99	8.91
15.4	3.54	4.40	5.08	5.99	6.67	7.35	8.04	8.96

Time (hr)	Recurrence Interval							
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR	200-YR	500-YR
15.5	3.56	4.43	5.11	6.02	6.71	7.39	8.09	9.02
15.6	3.58	4.45	5.14	6.06	6.75	7.44	8.14	9.07
15.7	3.60	4.48	5.17	6.09	6.79	7.48	8.18	9.12
15.8	3.63	4.50	5.20	6.13	6.83	7.52	8.23	9.17
15.9	3.65	4.53	5.23	6.16	6.86	7.56	8.28	9.23
16	3.67	4.55	5.26	6.20	6.90	7.61	8.32	9.28
16.1	3.69	4.58	5.29	6.23	6.94	7.65	8.37	9.33
16.2	3.71	4.60	5.32	6.27	6.98	7.69	8.41	9.38
16.3	3.73	4.63	5.35	6.30	7.02	7.73	8.46	9.43
16.4	3.75	4.65	5.38	6.33	7.05	7.77	8.50	9.48
16.5	3.77	4.68	5.40	6.37	7.09	7.81	8.55	9.53
16.6	3.79	4.70	5.43	6.40	7.13	7.85	8.59	9.58
16.7	3.81	4.73	5.46	6.43	7.16	7.90	8.64	9.63
16.8	3.82	4.75	5.49	6.47	7.20	7.94	8.68	9.68
16.9	3.84	4.77	5.52	6.50	7.24	7.98	8.73	9.73
17	3.86	4.80	5.54	6.53	7.27	8.01	8.77	9.78
17.1	3.88	4.82	5.57	6.56	7.31	8.05	8.81	9.82
17.2	3.90	4.84	5.60	6.59	7.34	8.09	8.85	9.87
17.3	3.92	4.87	5.62	6.63	7.38	8.13	8.90	9.92
17.4	3.94	4.89	5.65	6.66	7.41	8.17	8.94	9.97
17.5	3.96	4.91	5.68	6.69	7.45	8.21	8.98	10.01
17.6	3.97	4.94	5.70	6.72	7.48	8.25	9.02	10.06
17.7	3.99	4.96	5.73	6.75	7.52	8.28	9.06	10.10
17.8	4.01	4.98	5.76	6.78	7.55	8.32	9.10	10.15
17.9	4.03	5.00	5.78	6.81	7.58	8.36	9.14	10.19
18	4.05	5.03	5.81	6.84	7.62	8.40	9.19	10.24
18.1	4.06	5.05	5.83	6.87	7.65	8.43	9.23	10.28
18.2	4.08	5.07	5.86	6.90	7.68	8.47	9.26	10.33
18.3	4.10	5.09	5.88	6.93	7.72	8.50	9.30	10.37
18.4	4.12	5.11	5.91	6.96	7.75	8.54	9.34	10.42
18.5	4.13	5.13	5.93	6.99	7.78	8.58	9.38	10.46
18.6	4.15	5.16	5.96	7.02	7.82	8.61	9.42	10.51
18.7	4.17	5.18	5.98	7.05	7.85	8.65	9.46	10.55
18.8	4.19	5.20	6.01	7.08	7.88	8.69	9.50	10.59
18.9	4.20	5.22	6.03	7.11	7.91	8.72	9.54	10.64
19	4.22	5.24	6.06	7.14	7.95	8.76	9.58	10.68
19.1	4.24	5.26	6.08	7.16	7.98	8.79	9.62	10.72
19.2	4.26	5.29	6.11	7.19	8.01	8.83	9.66	10.77
19.3	4.27	5.31	6.13	7.22	8.04	8.86	9.70	10.81

Time (hr)	Recurrence Interval							
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR	200-YR	500-YR
19.4	4.29	5.33	6.16	7.25	8.08	8.90	9.74	10.86
19.5	4.31	5.35	6.18	7.28	8.11	8.94	9.78	10.90
19.6	4.32	5.37	6.20	7.31	8.14	8.97	9.82	10.94
19.7	4.34	5.39	6.23	7.34	8.17	9.01	9.85	10.99
19.8	4.36	5.41	6.25	7.37	8.20	9.04	9.89	11.03
19.9	4.38	5.43	6.28	7.40	8.24	9.08	9.93	11.07
20	4.39	5.46	6.30	7.43	8.27	9.11	9.97	11.11
20.1	4.41	5.48	6.33	7.45	8.30	9.15	10.01	11.16
20.2	4.43	5.50	6.35	7.48	8.33	9.18	10.05	11.20
20.3	4.44	5.52	6.38	7.51	8.36	9.22	10.09	11.24
20.4	4.46	5.54	6.40	7.54	8.40	9.25	10.12	11.29
20.5	4.48	5.56	6.42	7.57	8.43	9.29	10.16	11.33
20.6	4.49	5.58	6.45	7.60	8.46	9.32	10.20	11.37
20.7	4.51	5.60	6.47	7.62	8.49	9.36	10.24	11.41
20.8	4.53	5.62	6.50	7.65	8.52	9.39	10.28	11.46
20.9	4.54	5.64	6.52	7.68	8.55	9.43	10.31	11.50
21	4.56	5.66	6.54	7.71	8.59	9.46	10.35	11.54
21.1	4.58	5.68	6.57	7.74	8.62	9.50	10.39	11.58
21.2	4.59	5.70	6.59	7.77	8.65	9.53	10.43	11.62
21.3	4.61	5.73	6.62	7.79	8.68	9.56	10.46	11.67
21.4	4.63	5.75	6.64	7.82	8.71	9.60	10.50	11.71
21.5	4.64	5.77	6.66	7.85	8.74	9.63	10.54	11.75
21.6	4.66	5.79	6.69	7.88	8.77	9.67	10.58	11.79
21.7	4.68	5.81	6.71	7.90	8.80	9.70	10.61	11.83
21.8	4.69	5.83	6.73	7.93	8.83	9.73	10.65	11.87
21.9	4.71	5.85	6.76	7.96	8.86	9.77	10.69	11.91
22	4.72	5.87	6.78	7.99	8.90	9.80	10.73	11.96
22.1	4.74	5.89	6.80	8.01	8.93	9.84	10.76	12.00
22.2	4.76	5.91	6.83	8.04	8.96	9.87	10.80	12.04
22.3	4.77	5.93	6.85	8.07	8.99	9.90	10.84	12.08
22.4	4.79	5.95	6.87	8.10	9.02	9.94	10.87	12.12
22.5	4.81	5.97	6.90	8.12	9.05	9.97	10.91	12.16
22.6	4.82	5.99	6.92	8.15	9.08	10.00	10.95	12.20
22.7	4.84	6.01	6.94	8.18	9.11	10.04	10.98	12.24
22.8	4.85	6.03	6.97	8.21	9.14	10.07	11.02	12.28
22.9	4.87	6.05	6.99	8.23	9.17	10.10	11.05	12.32
23	4.89	6.07	7.01	8.26	9.20	10.14	11.09	12.36
23.1	4.90	6.09	7.03	8.29	9.23	10.17	11.13	12.40
23.2	4.92	6.11	7.06	8.31	9.26	10.20	11.16	12.44

Time (hr)	Recurrence Interval							
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR	200-YR	500-YR
23.3	4.93	6.13	7.08	8.34	9.29	10.24	11.20	12.48
23.4	4.95	6.15	7.10	8.37	9.32	10.27	11.24	12.53
23.5	4.97	6.17	7.13	8.39	9.35	10.30	11.27	12.57
23.6	4.98	6.19	7.15	8.42	9.38	10.33	11.31	12.61
23.7	5.00	6.21	7.17	8.45	9.41	10.37	11.34	12.64
23.8	5.01	6.23	7.19	8.47	9.44	10.40	11.38	12.68
23.9	5.03	6.25	7.22	8.50	9.47	10.43	11.41	12.72
23.9	5.04	6.26	7.24	8.53	9.50	10.47	11.45	12.76

A.2. Stage-Storage-Discharge**Table A-2. Stage-Storage-Discharge for Alternative 1**

Stage (feet, NAVD88)	Storage (acre-feet)	Principal Spillway Discharge (cfs)	Auxiliary Spillway Discharge (cfs)	Notes
377.63	88.9	0.0	0	Principal Spillway Crest
378.13	94.7	42.4	0	
378.63	100.5	119.9	0	
379.13	106.3	220.2	0	
379.63	112.1	339.1	0	
380.63	125.5	622.9	0	
381.43	136.2	888.0	0	
381.53	137.6	911.2	0	
385.63	207.3	957.6	0	
400.63	756.4	1111.0	0	
405.63	1016.0	1157.7	0	
415.63	1652.7	1245.7	0	
417.88	1821.0	1264.6	0.0	Auxiliary Spillway Crest
418.67	1880.9	1271.2	1277.2	
419.46	1943.4	1277.8	3170.1	
421.04	2070.4	1290.8	6557.9	
422.63	2202.8	1303.7	10080.4	
423.42	2269.0	1310.1	12111.6	
424.21	2342.4	1316.5	14353.0	
425.00	2418.4	1322.8	16800.0	

Table A-3. Stage-Storage-Discharge for Alternative 2

Stage (feet, NAVD88)	Storage (acre-feet)	Principal Spillway Discharge (cfs)	Auxiliary Spillway Discharge (cfs)	Notes
377.63	88.9	0.0	0	Principal Spillway Crest
378.13	94.7	42.4	0	
378.63	100.5	119.9	0	
379.13	106.3	220.2	0	
379.63	112.1	339.1	0	
380.63	125.5	622.9	0	
381.43	136.2	888.0	0	
381.53	137.6	911.2	0	
385.63	207.3	957.6	0	
400.63	756.4	1111.0	0	
405.63	1016.0	1157.7	0	
415.63	1652.7	1245.7	0	
420	1985.9	1282.2	0.0	Auxiliary Spillway Crest
421	2066.7	1290.4	660.0	
422	2150.4	1298.6	1866.8	
423	2234.1	1306.7	3429.5	
424	2322.3	1314.8	5280.0	
426	2518.0	1330.7	9700.0	
428	2705.8	1346.6	14934.1	
430	2893.48	1362.2	20871.0	

Table A-4. Stage-Storage-Discharge for Alternative 3

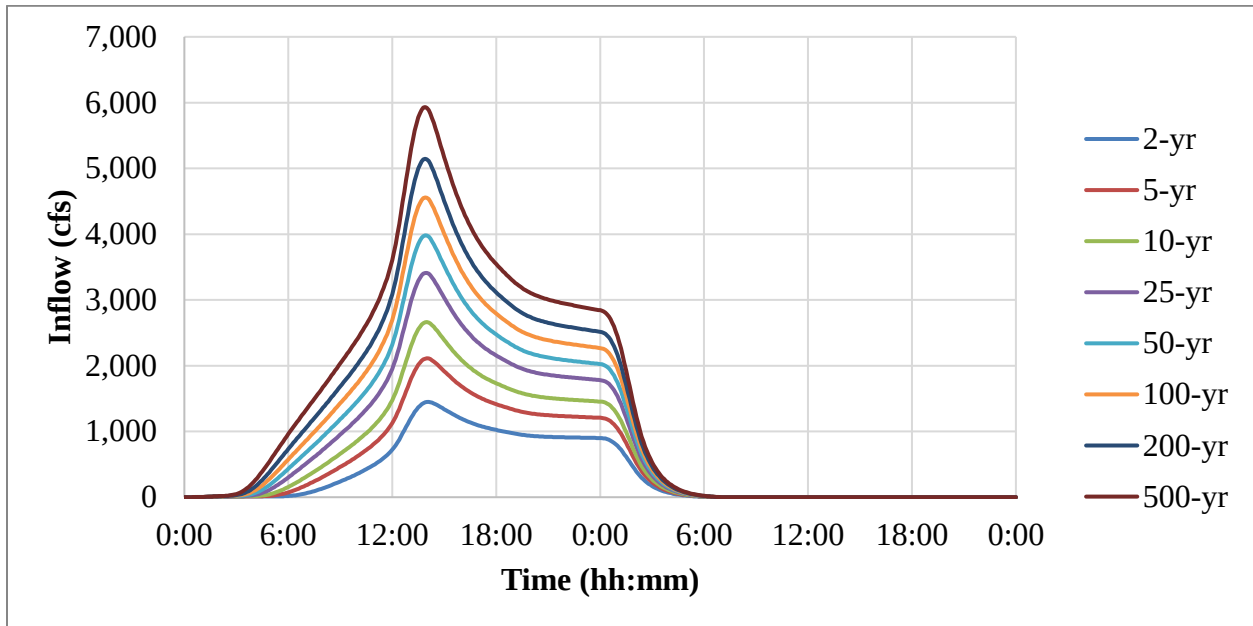
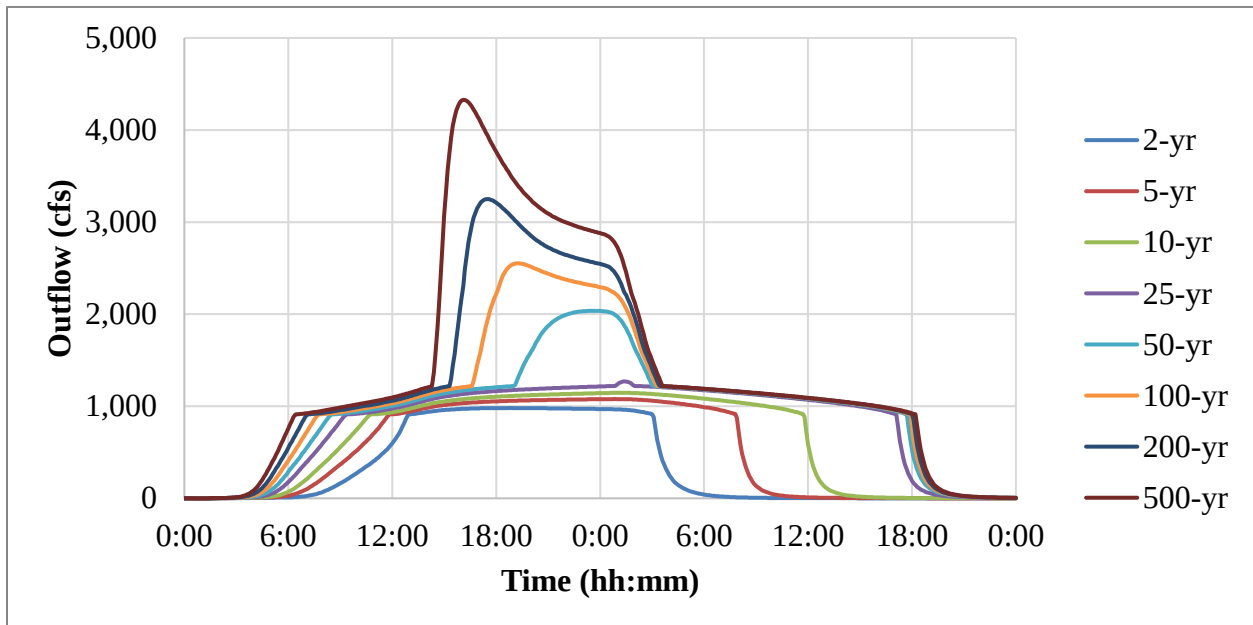
Stage (feet, NAVD88)	Storage (acre-feet)	Principal Spillway Discharge (cfs)	Auxiliary Spillway Discharge (cfs)	Notes
377.63	88.9	0.0	0	Principal Spillway Crest
378.13	94.7	42.4	0	
378.63	100.5	119.9	0	
379.13	106.3	220.2	0	
379.63	112.1	339.1	0	
380.63	125.5	622.9	0	
381.43	136.2	888.0	0	
381.53	137.6	911.2	0	
385.63	207.3	957.6	0	
400.63	756.4	1111.0	0	
405.63	1016.0	1157.7	0	
415.63	1652.7	1245.7	0	
420.63	2035.8	1287.4	0.0	
424	2322.3	1314.8	0.0	Auxiliary Spillway Crest
425	2418.4	1322.8	660.0	
426	2518.0	1330.7	1866.8	
428	2705.8	1346.6	5280.0	
430	2893.5	1362.2	9700.0	
432	3081.2	1377.9	14934.1	
434	3268.9	1393.5	20871.0	

A.3. SITES Output

Table A-5. SITES Output for Alternatives 1 through 3

Parameter Description	Alternative 1	Alternative 2	Alternative 3
Site Identification	S1	S1	S1
Watershed Runoff Curve Number	N/A	N/A	N/A
Total Watershed Drainage Area (Sq.Miles)	11.45	11.45	11.45
Watershed Time of Concentration (Hours)	N/A	N/A	N/A
SDH Rainfall Total (Inches)	N/A	N/A	N/A
SDH Rainfall Duration (Hours)	N/A	N/A	N/A
FBH or Storm Rainfall Total (Inches)	N/A	N/A	N/A
FBH or Storm Rainfall Duration (Hours)	N/A	N/A	N/A
SDH Inflow Peak (CFS)	5391.9	5391.9	5391.9
FBH or Storm Inflow Peak (CFS)	18348.2	18348.2	18348.2
Initial Reservoir Elevation (Feet)	377.63	377.63	377.63
Maximum WS SDH (Feet)	419.04	421.59	424.81
Maximum WS FBH or Storm (Feet)	424.98	428.69	432.58
Storage at Max. WS FBH or Storm (Acre-Ft)	2416.5	2884.7	3135.6
Top Dam (Feet)	424.98	428.69	432.58
Storage, Top Dam (Acre-Ft)	2416.0	2885.0	3135.0
Emb. Yardage (CY)	N/A	N/A	N/A
PSH Drawdown (Days)	N/A	N/A	N/A
378 Drawdown (Days)	N/A	N/A	N/A
PS Crest (Feet)	377.63	377.63	377.63
PS Number of Conduits	N/A	N/A	N/A
PS Conduit Diameter (Inches)	N/A	N/A	N/A
PS Conduit Height (Feet)	N/A	N/A	N/A
PS Conduit Width (Feet)	N/A	N/A	N/A
PS Conduit Area (Sq. Feet)	N/A	N/A	N/A
Storage, PS Crest (Acre-Ft)	89.	89.	89.
PS Discharge at AS Crest (CFS)	1264.6	1282.2	1314.8
PS Discharge for SDH (CFS)	1274.3	1295.3	1321.2
PS Discharge FBH or Storm (CFS)	1322.6	1352.0	1382.4
AS Crest (Feet)	417.88	420.00	424.00
Storage, AS Crest (Acre-Ft)	1821.0	1985.9	2322.3
AS Width (Feet)	N/A	200.	200.
AS Exit Slope (%)	N/A	5.02	5.43
AS Ret. Curve Index	N/A	5.60	5.60
AS Veg. Cover Factor	N/A	0.75	0.75
AS Maintenance Code	N/A	1	1
AS Max. Head SDH (Feet)	1.16	1.59	0.81

Parameter Description	Alternative 1	Alternative 2	Alternative 3
AS Peak Discharge SDH/Storm (CFS)	N/A	1375.1	531.8
AS Exit Velocity SDH or Storm (Ft/S)	N/A	7.77	4.55
AS Stress SDH or Storm (Lb./Sq.Ft.)	N/A	0.110	0.043
Hp FBH or Storm (Feet)	7.10	8.69	8.58
AS Peak Discharge FBH/Storm (CFS)	16725.	16996.	16647.
Uncontrolled Drainage Area (Sq.Miles)	11.45	11.45	11.45
Number of Errors	0	0	0

A.4. HEC-HMS Output – Recurrence Interval Hydrographs**Figure A-2. Inflow Hydrographs for Matanzas Creek Dam Watershed****Figure A-3. Existing Matanzas Creek Dam – Outflow Hydrographs**

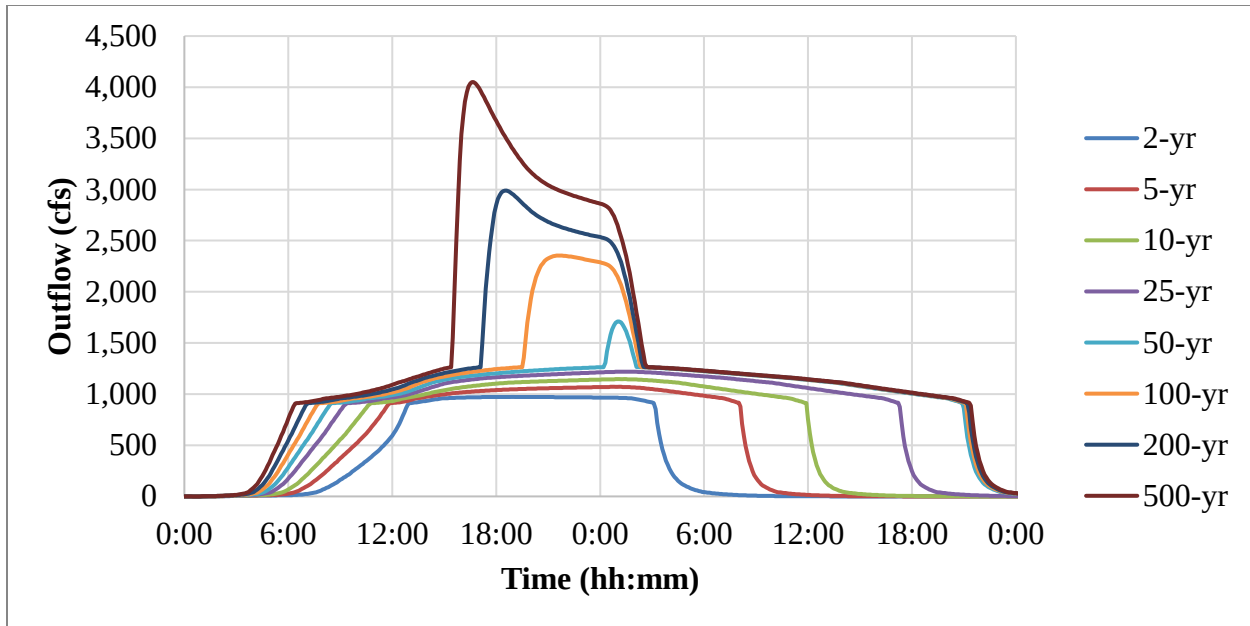


Figure A-4. Outflow Hydrographs – Matanzas Creek Dam Alternative 1

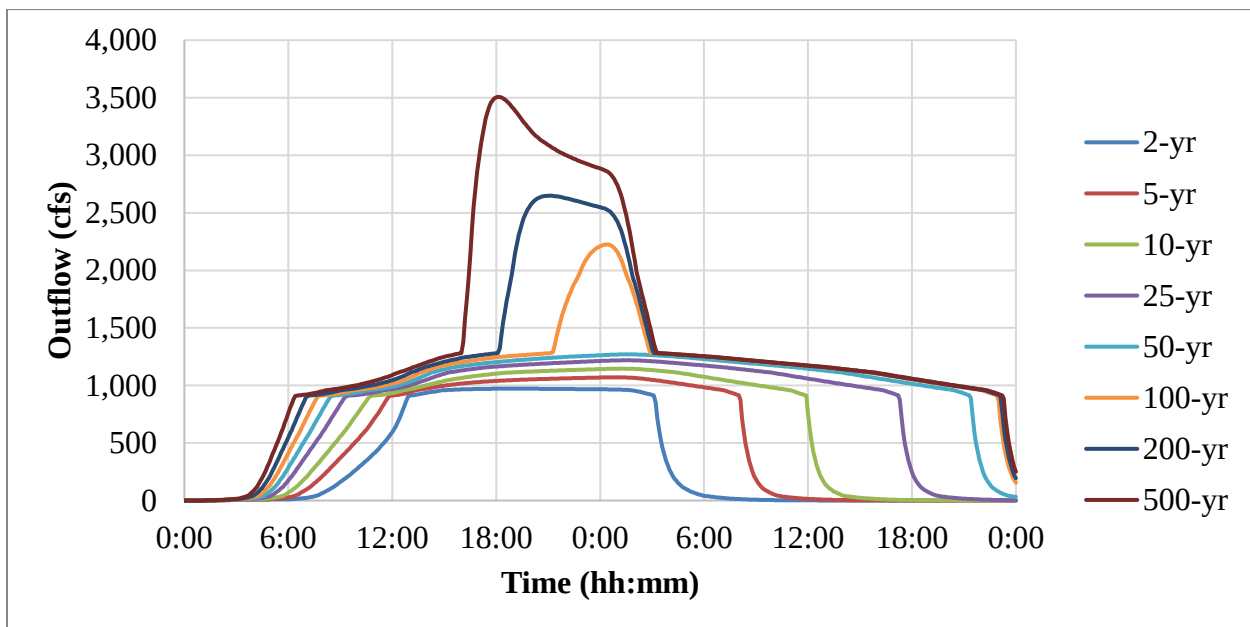


Figure 5. Outflow Hydrographs – Matanzas Creek Dam Alternative 2

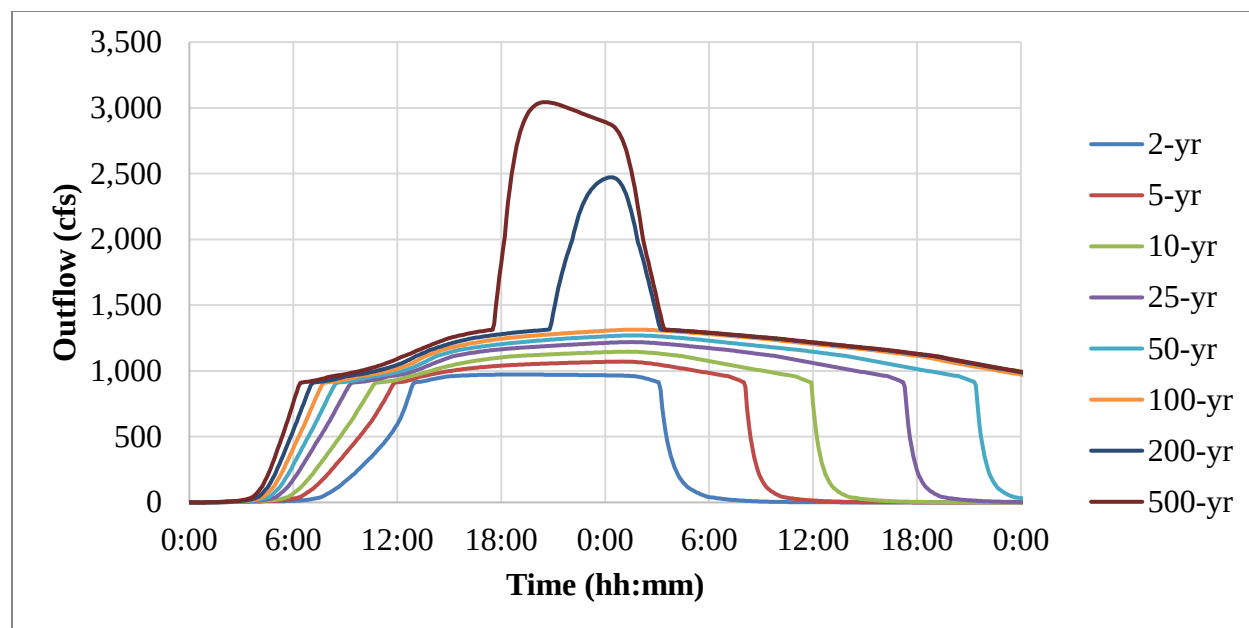
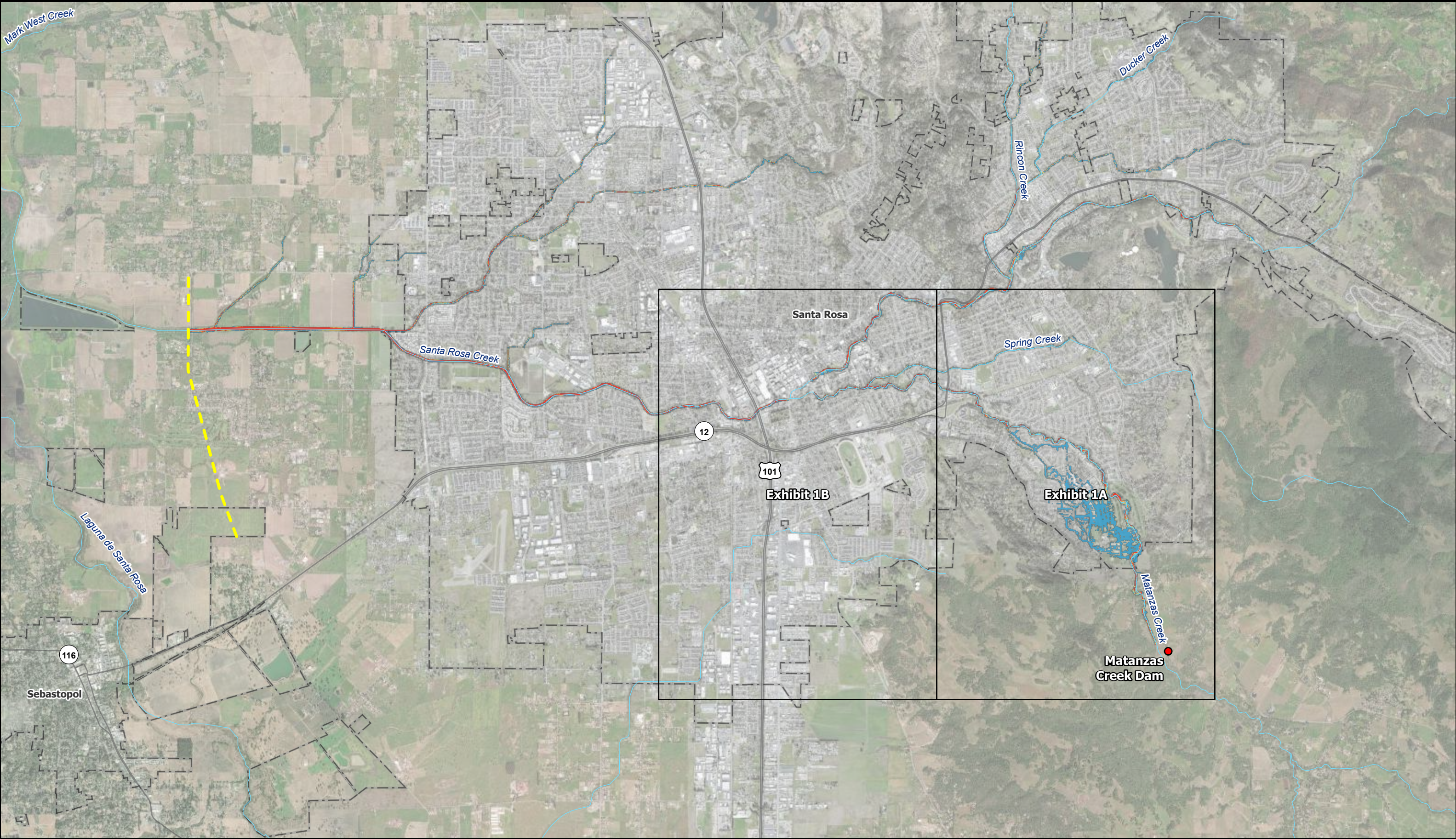


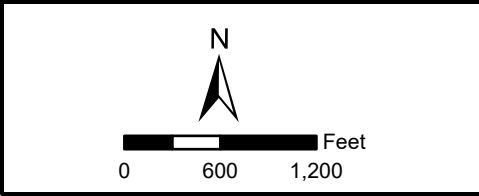
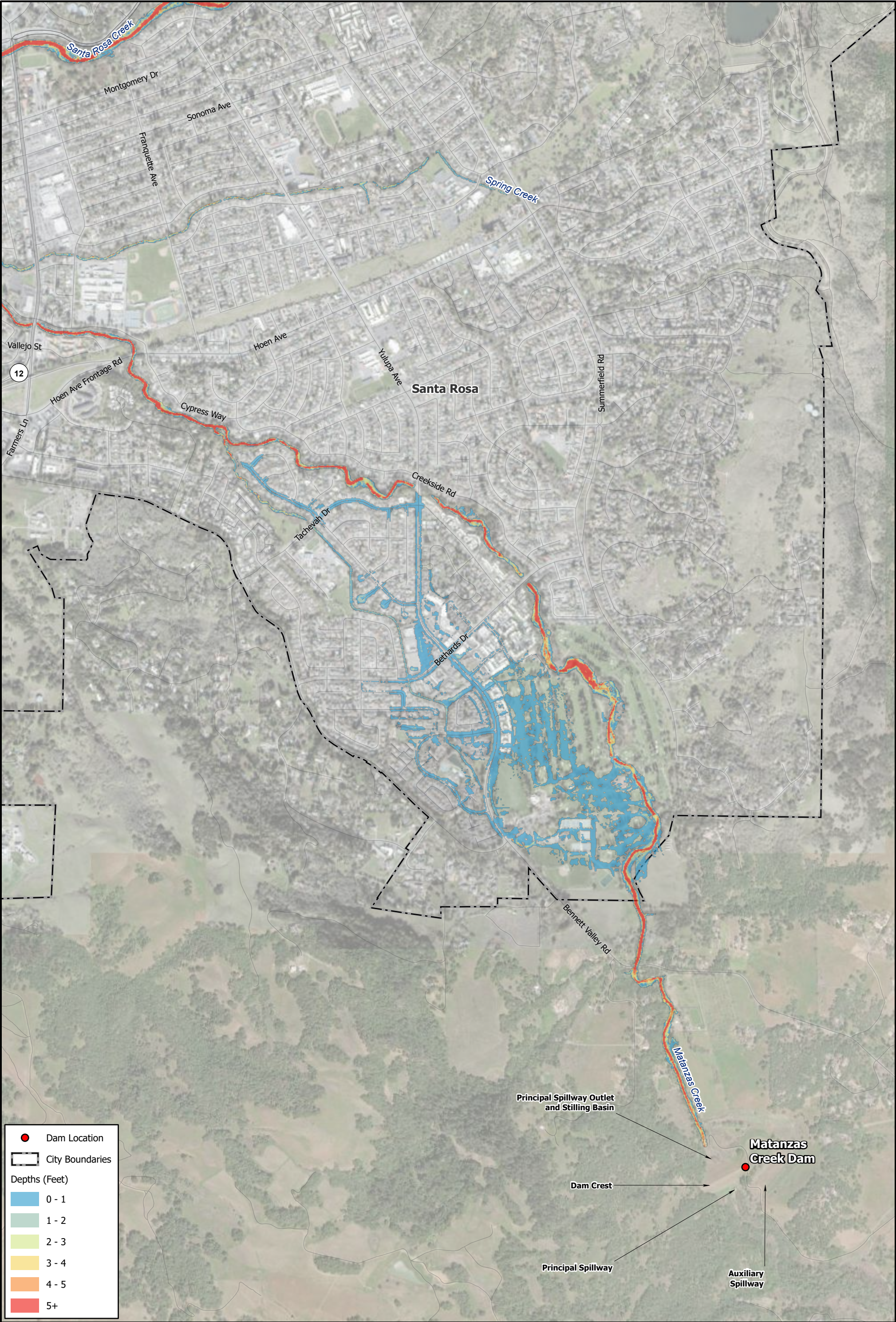
Figure A-6. Outflow Hydrographs – Matanzas Creek Dam Alternative 3

Appendix B. Flood Maps

B.1. Existing Conditions



- Dam Location - Extent of Hydraulic Model - Major Rivers (NHD) - City Boundaries	Depths (Feet) <table border="1"><tr><td></td><td>0 - 1</td></tr><tr><td></td><td>1 - 2</td></tr><tr><td></td><td>2 - 3</td></tr><tr><td></td><td>3 - 4</td></tr><tr><td></td><td>4 - 5</td></tr><tr><td></td><td>5+</td></tr></table>		0 - 1		1 - 2		2 - 3		3 - 4		4 - 5		5+	 0 2,000 4,000 Feet Jones & DeMille Engineering - Shaping the Quality of Life - 800.748.5275 www.jonesanddemille.com	<table border="1"><tr><td colspan="3">Natural Resource Conservation Service (NRCS)</td></tr><tr><td colspan="3">Matanzas Creek Dam - Existing Conditions 2-Year 24-Hour Flood Event</td></tr><tr><td colspan="3">Map Name: H:\JD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Existing Index Pages</td></tr><tr><td>Project Number: 2006-048</td><td>Drawn by: JWW 06-22</td><td>Last Edit: 08/31/2022</td></tr></table>	Natural Resource Conservation Service (NRCS)			Matanzas Creek Dam - Existing Conditions 2-Year 24-Hour Flood Event			Map Name: H:\JD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Existing Index Pages			Project Number: 2006-048	Drawn by: JWW 06-22	Last Edit: 08/31/2022	<table border="1"><tr><td>Sonoma County</td></tr><tr><td>Scale: 1" = 4,000'</td></tr><tr><td>EX-1</td></tr></table>	Sonoma County	Scale: 1" = 4,000'	EX-1
	0 - 1																														
	1 - 2																														
	2 - 3																														
	3 - 4																														
	4 - 5																														
	5+																														
Natural Resource Conservation Service (NRCS)																															
Matanzas Creek Dam - Existing Conditions 2-Year 24-Hour Flood Event																															
Map Name: H:\JD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Existing Index Pages																															
Project Number: 2006-048	Drawn by: JWW 06-22	Last Edit: 08/31/2022																													
Sonoma County																															
Scale: 1" = 4,000'																															
EX-1																															





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Matanzas Creek Dam - Existing Conditions 2-Year 24-Hour Flood Event		
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Project Number: 2006-048	Drawn by: JWW 06-22	Last Edit: 07/07/2022

Sonoma County
Scale: 1" = 1,200'
EX-1A



N

0

600

1,200

Feet

Jones & DeMille

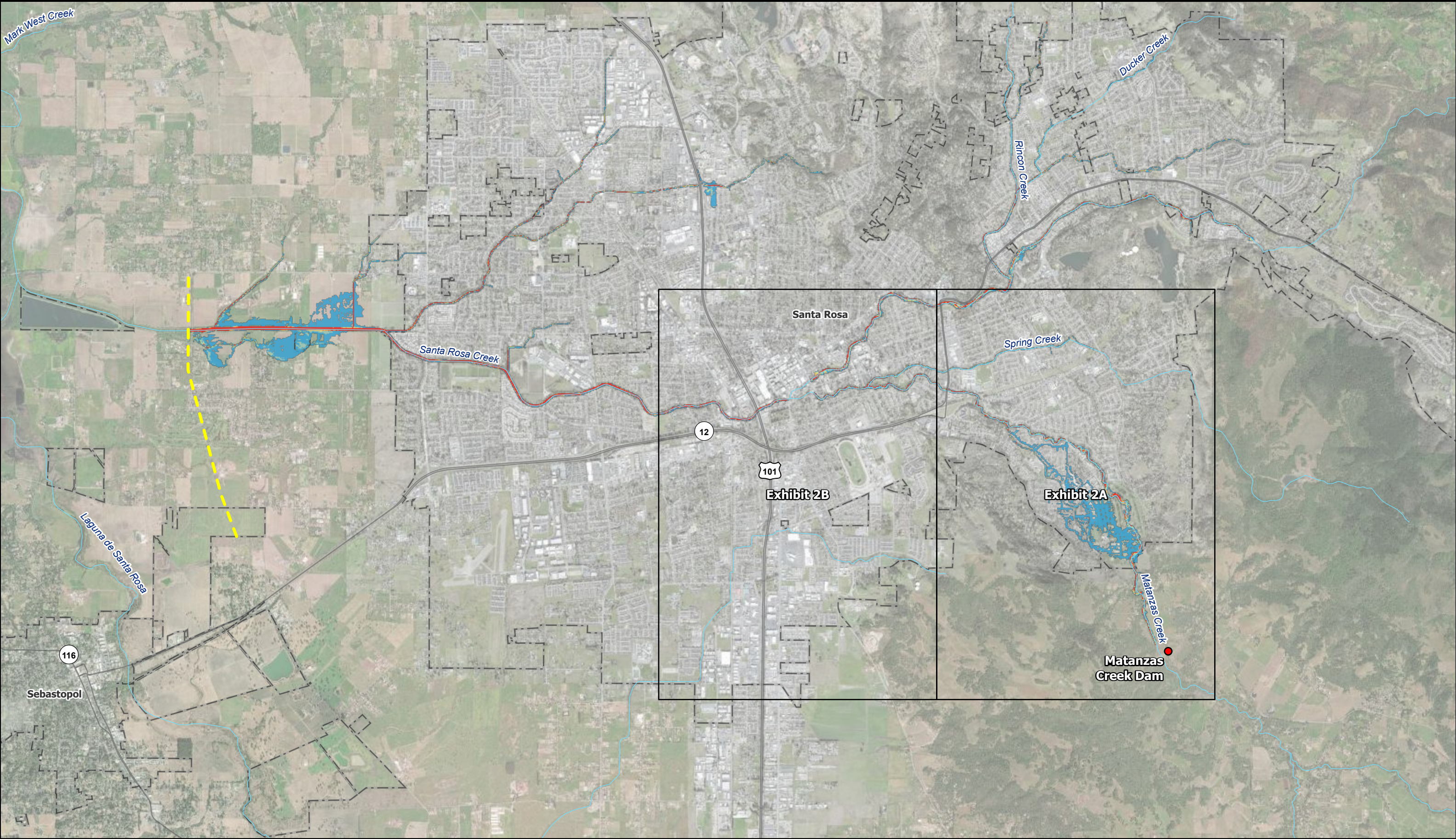
Engineering

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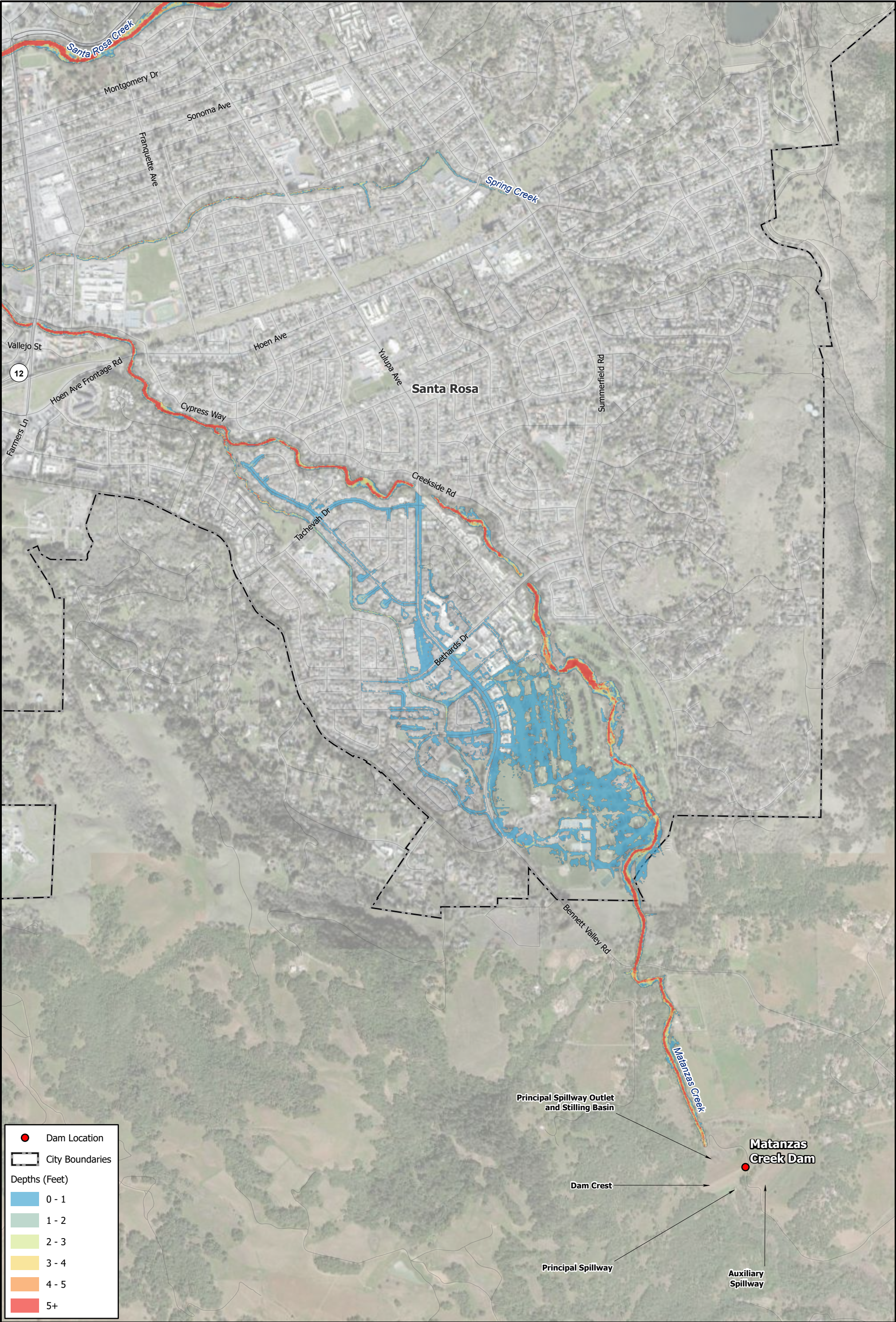
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Matanzas Creek Dam - Existing Conditions 2-Year 24-Hour Flood Event		
Map Name: H:\UD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Existing B Pages		
Project Number: 2006-048	Drawn by: JWW 06-22	Last Edit: 07/07/2022

Sonoma County
Scale: 1" = 1,200'
EX-1B



● Dam Location --- Extent of Hydraulic Model --- Major Rivers (NHD) City Boundaries	Depths (Feet) ■ 0 - 1 ■ 1 - 2 ■ 2 - 3 ■ 3 - 4 ■ 4 - 5 ■ 5+	 N 0 2,000 4,000 Feet	 Jones & DeMille Engineering - Shaping the Quality of Life - 800.748.5275 www.jonesanddemille.com	Natural Resource Conservation Service (NRCS) Matanzas Creek Dam - Existing Conditions 5-Year 24-Hour Flood Event Map Name: H:\UD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Existing Index Pages Project Number: 2006-048 Drawn by: JWW 06-22 Last Edit: 08/31/2022	Sonoma County Scale: 1" = 4,000' EX-2
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Dam Location

City Boundaries

Depths (Feet)

0 - 1

1 - 2

2 - 3

3 - 4

4 - 5

5+

N

0

600

1,200

Feet

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Natural Resource Conservation Service (NRCS)

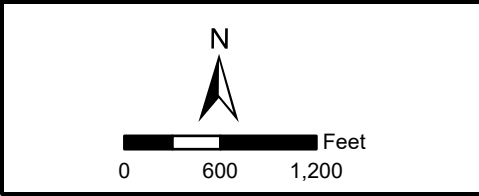
Matanzas Creek Dam - Existing Conditions
5-Year 24-Hour Flood Event

Map Name: H:\UD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Existing A Pages
Project Number: 2006-048 Drawn by: JWW 06-22 Last Edit: 07/07/2022

Sonoma County

Scale: 1" = 1,200'

EX-2A



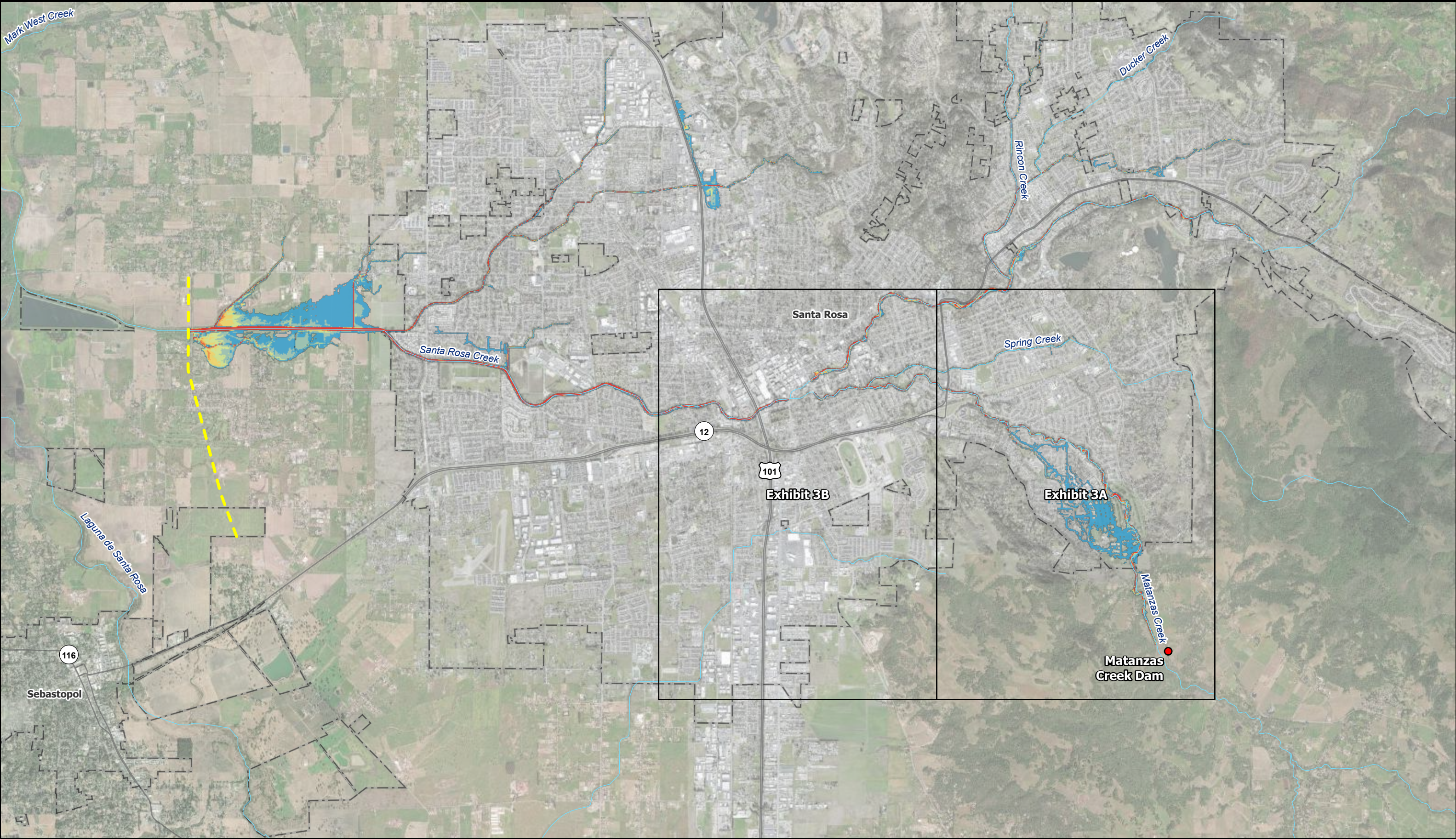


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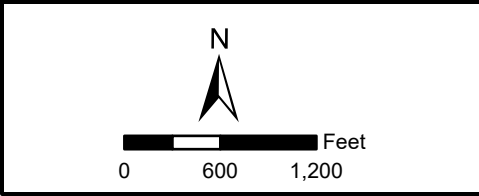
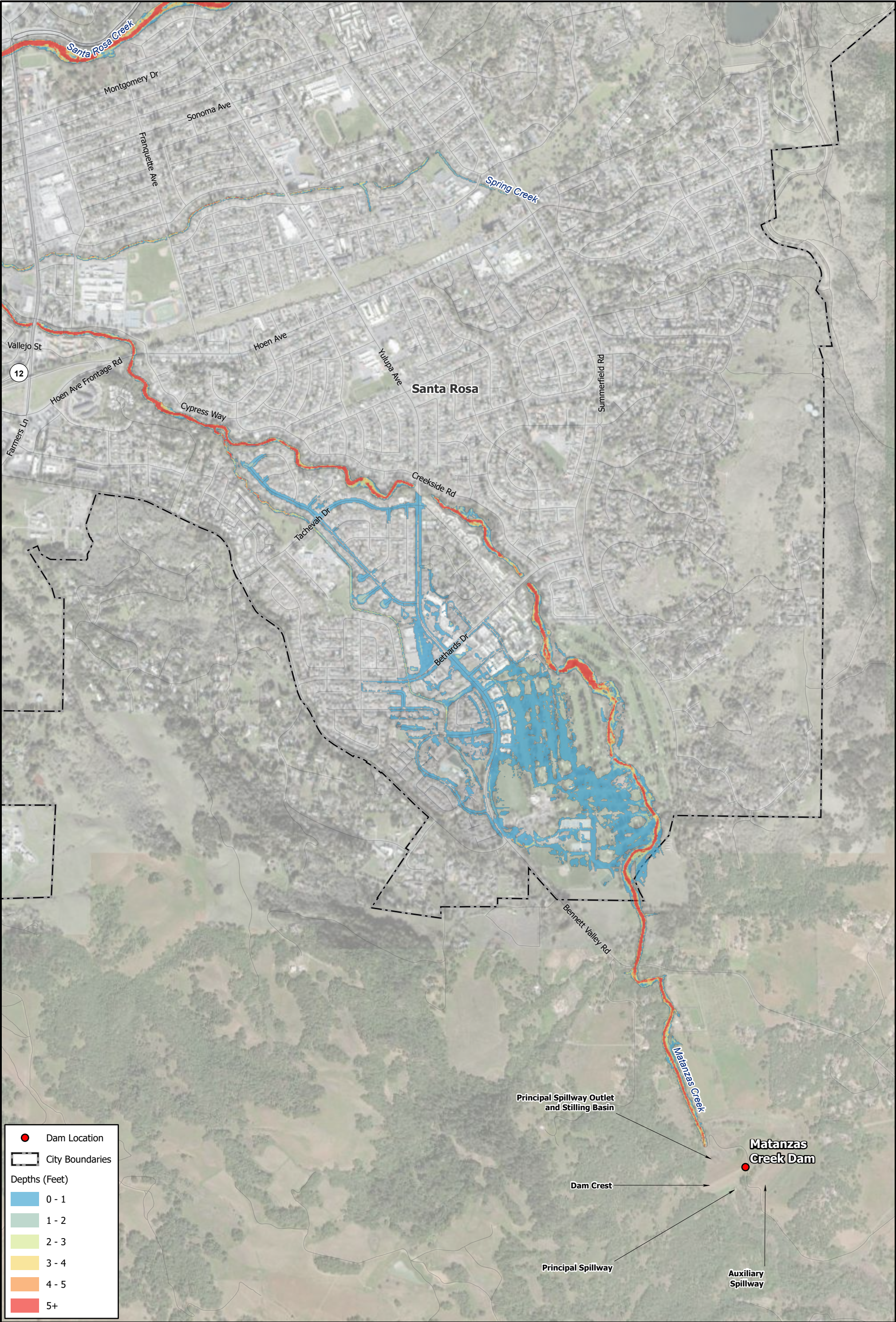
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Natural Resource Conservation Service (NRCS)		
Matanzas Creek Dam - Existing Conditions 5-Year 24-Hour Flood Event		
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Project Number: 2006-048	Drawn by: JWW 06-22	Last Edit: 07/07/2022

Sonoma County
Scale: 1" = 1,200'
EX-2B



● Dam Location --- Extent of Hydraulic Model --- Major Rivers (NHD) City Boundaries	Depths (Feet) ■ 0 - 1 ■ 1 - 2 ■ 2 - 3 ■ 3 - 4 ■ 4 - 5 ■ 5+	 N 0 2,000 4,000 Feet	 Jones & DeMille Engineering - Shaping the Quality of Life - 800.748.5275 www.jonesanddemille.com	Natural Resource Conservation Service (NRCS) Matanzas Creek Dam - Existing Conditions 10-Year 24-Hour Flood Event Map Name: H:\UD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Existing Index Pages Project Number: 2006-048 Drawn by: JWW 06-22 Last Edit: 08/31/2022	Sonoma County Scale: 1" = 4,000' EX-3
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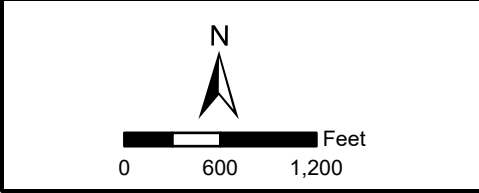


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Matanzas Creek Dam - Existing Conditions 10-Year 24-Hour Flood Event		
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Project Number: 2006-048	Drawn by: JWW 06-22	Last Edit: 07/07/2022

Sonoma County
Scale: 1" = 1,200'
EX-3A



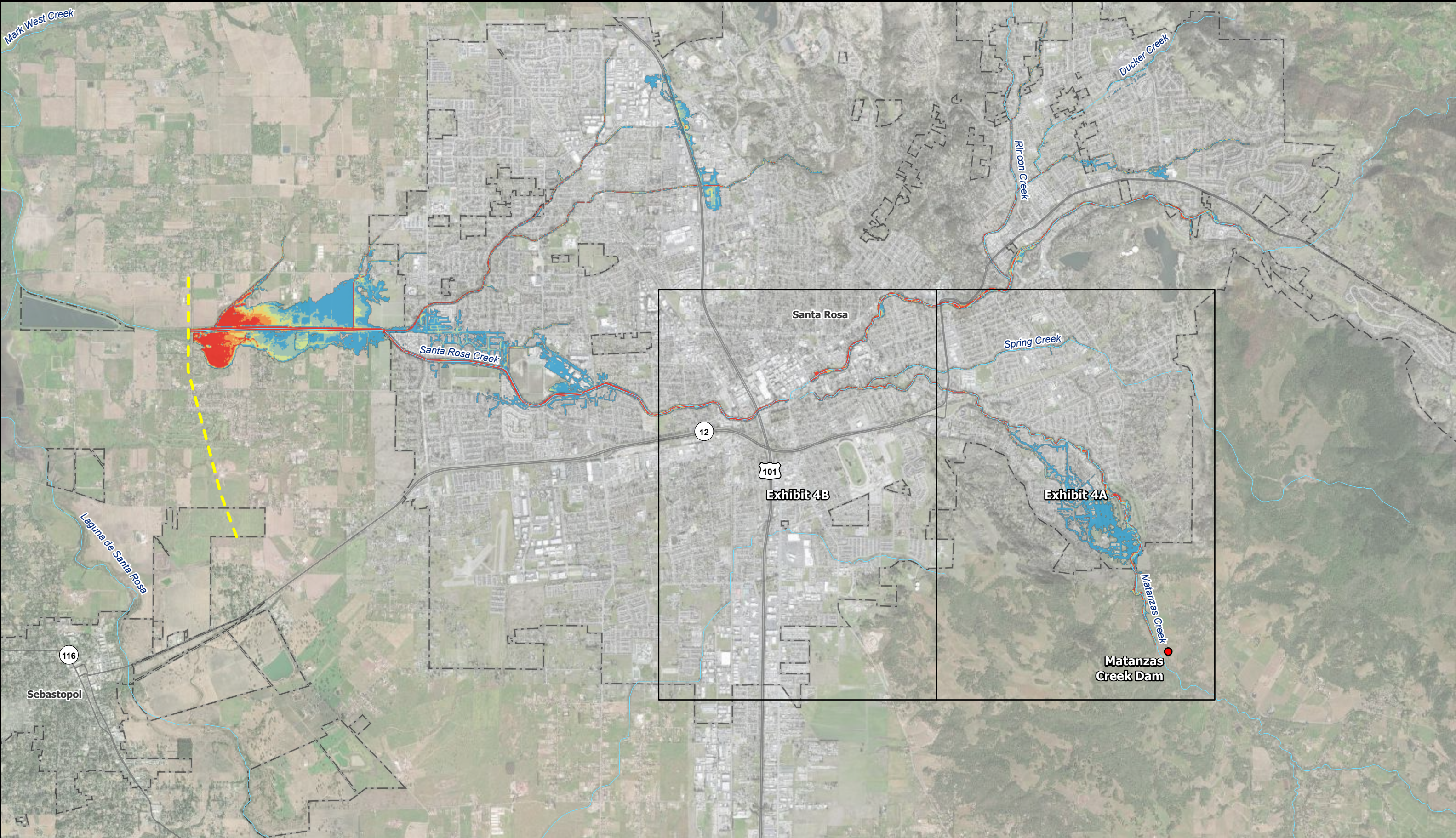


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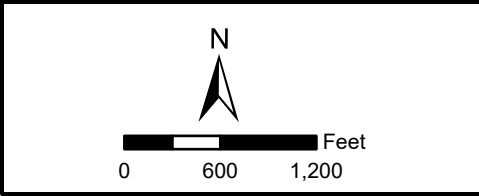
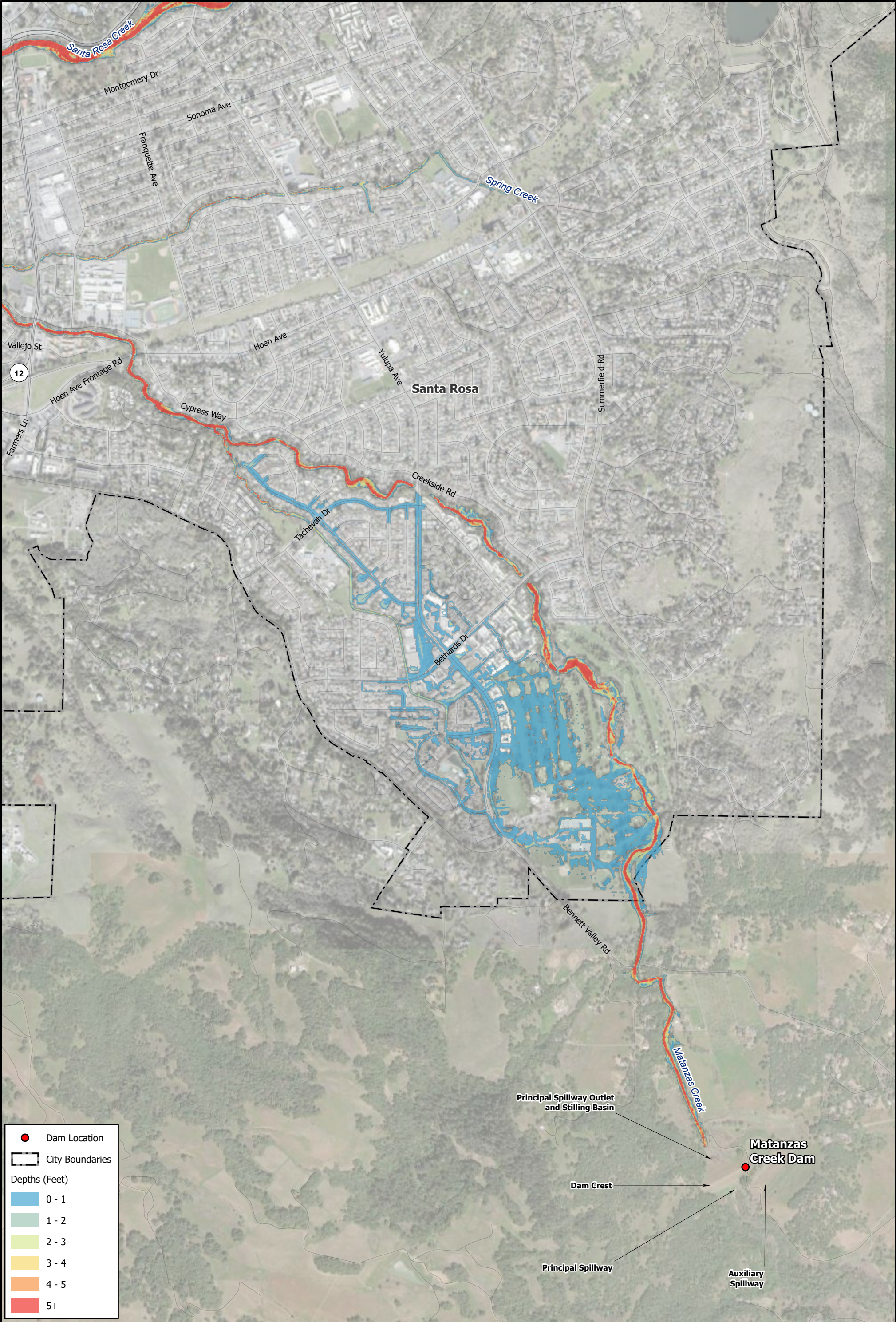
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Natural Resource Conservation Service (NRCS)		
Matanzas Creek Dam - Existing Conditions 10-Year 24-Hour Flood Event		
Map Name: H:\UD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Existing B Pages		
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Sonoma County
Scale: 1" = 1,200'
EX-3B



- Dam Location - Extent of Hydraulic Model - Major Rivers (NHD) - City Boundaries	Depths (Feet) <table border="1"><tr><td> 0 - 1</td><td> 3 - 4</td></tr><tr><td> 1 - 2</td><td> 4 - 5</td></tr><tr><td> 2 - 3</td><td> 5+</td></tr></table>	0 - 1	3 - 4	1 - 2	4 - 5	2 - 3	5+	 N 0 2,000 4,000 Feet	 Jones & DeMille Engineering - Shaping the Quality of Life - 800.748.5275 www.jonesanddemille.com	Natural Resource Conservation Service (NRCS) Matanzas Creek Dam - Existing Conditions 25-Year 24-Hour Flood Event Map Name: H:\JD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Existing Index Pages Project Number: 2006-048 Drawn by: JWW 06-22 Last Edit: 08/31/2022	Sonoma County Scale: 1" = 4,000' EX-4
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1 - 2	4 - 5										
2 - 3	5+										



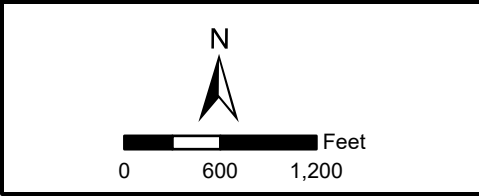


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Project Number: 2006-048	Drawn by: JWW 06-22	Last Edit: 07/07/2022

Sonoma County
Scale: 1" = 1,200'
EX-4A



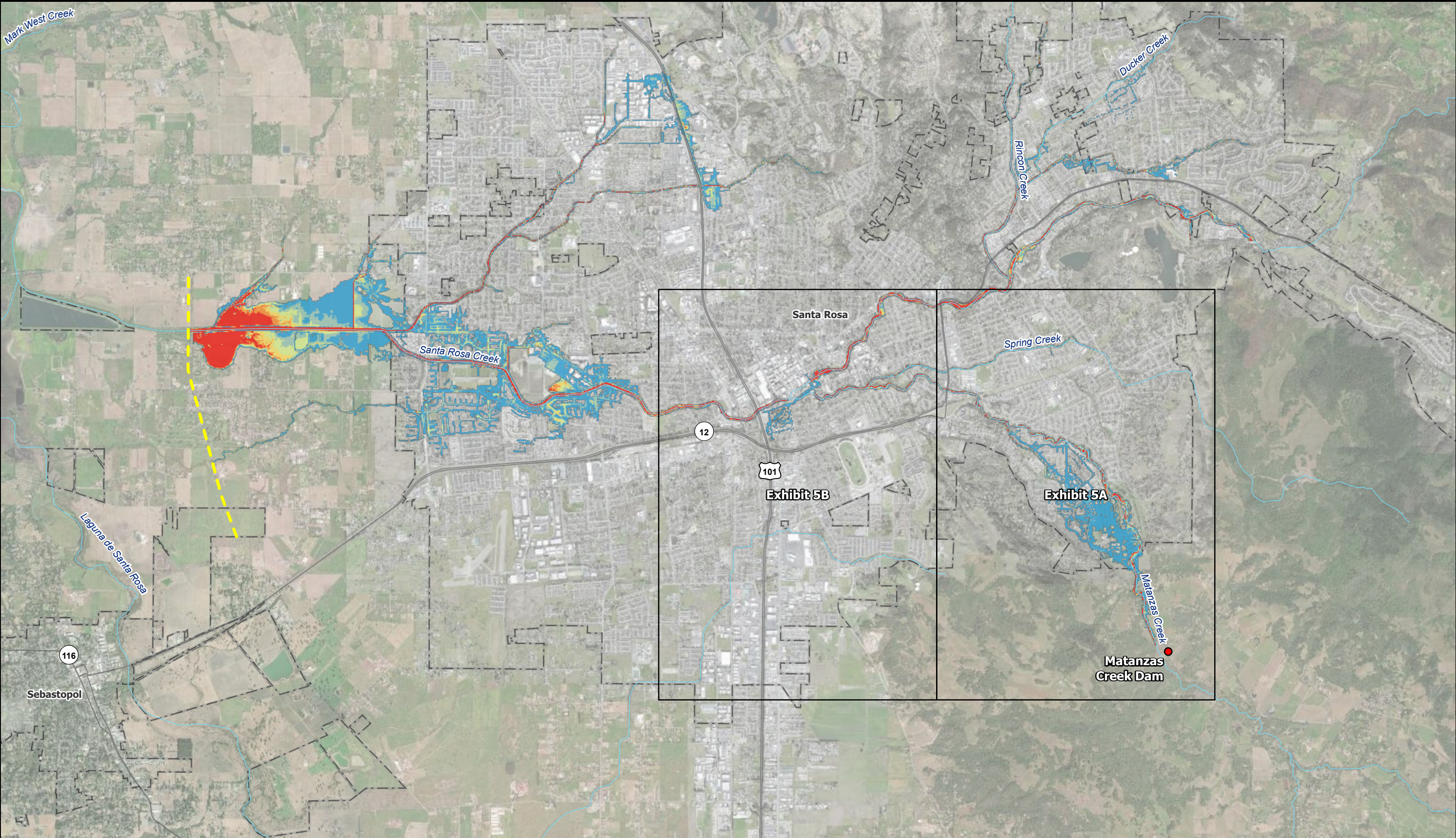


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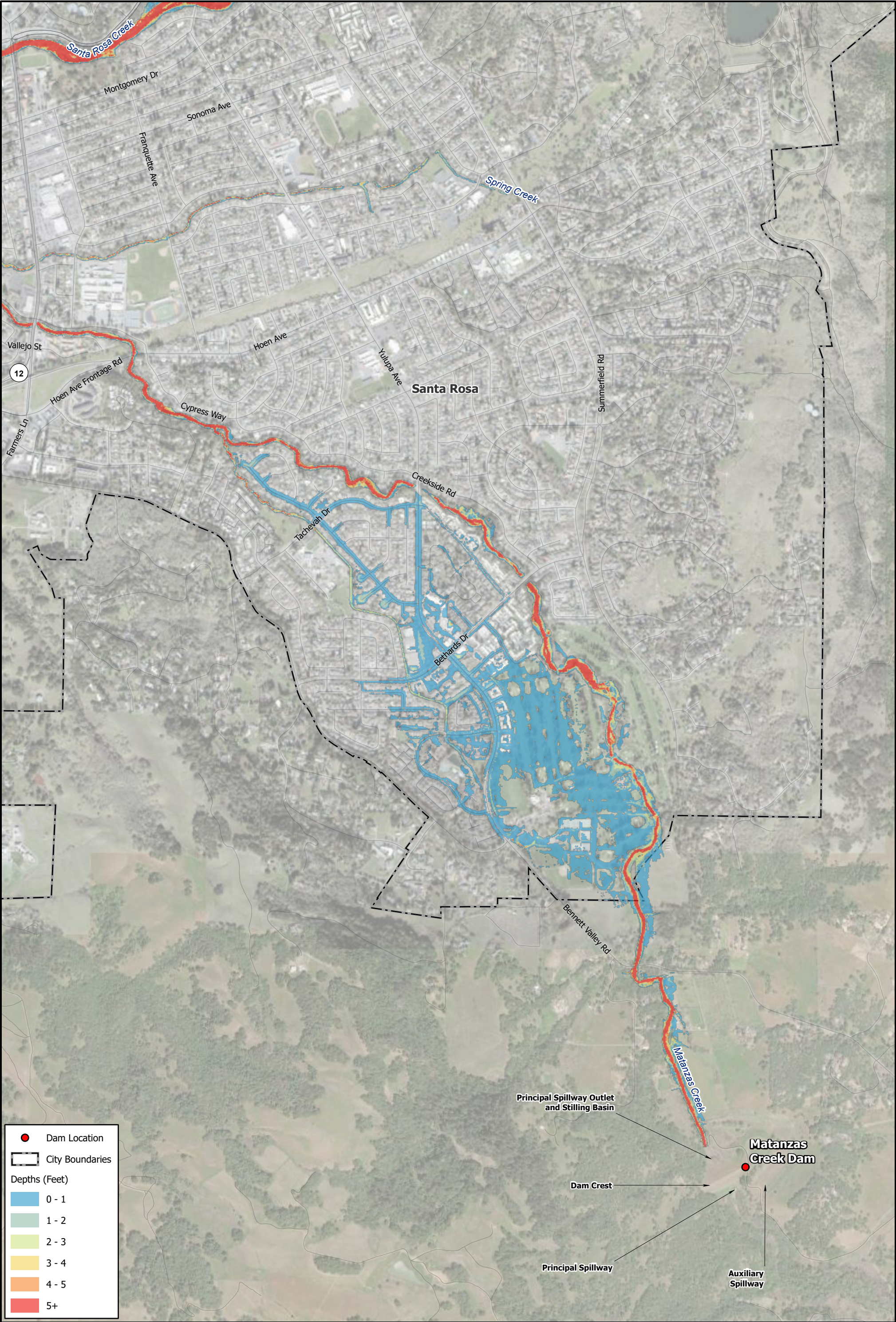
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Natural Resource Conservation Service (NRCS)		
Matanzas Creek Dam - Existing Conditions 25-Year 24-Hour Flood Event		
Map Name: H:\UD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Existing B Pages		
Project Number: 2006-048	Drawn by: JWW 06-22	Last Edit: 07/07/2022

Sonoma County
Scale: 1" = 1,200'
EX-4B



- Dam Location - Extent of Hydraulic Model - Major Rivers (NHD) - City Boundaries	Depths (Feet) <table border="1"><tr><td> 0 - 1</td><td> 3 - 4</td></tr><tr><td> 1 - 2</td><td> 4 - 5</td></tr><tr><td> 2 - 3</td><td> 5+</td></tr></table>	0 - 1	3 - 4	1 - 2	4 - 5	2 - 3	5+	 0 2,000 4,000 Feet Jones & DeMille Engineering - Shaping the Quality of Life - 800.748.5275 www.jonesanddemille.com	Natural Resource Conservation Service (NRCS) Matanzas Creek Dam - Existing Conditions 50-Year 24-Hour Flood Event Map Name: H:\JD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Existing Index Pages Project Number: 2006-048 Drawn by: JWW 06-22 Last Edit: 08/31/2022	Sonoma County Scale: 1" = 4,000' EX-5
0 - 1	3 - 4									
1 - 2	4 - 5									
2 - 3	5+									



Dam Location

City Boundaries

Depths (Feet)

0 - 1

1 - 2

2 - 3

3 - 4

4 - 5

5+

N

0

600

1,200

Feet

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Natural Resource Conservation Service (NRCS)		
Matanzas Creek Dam - Existing Conditions 50-Year 24-Hour Flood Event		
Map Name: H:\UD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Existing A Pages		
Project Number: 2006-048	Drawn by: JWW 06-22	Last Edit: 07/07/2022

Sonoma County
Scale: 1" = 1,200'
EX-5A



Dam Location

City Boundaries

Depths (Feet)

0 - 1

1 - 2

2 - 3

3 - 4

4 - 5

5+

N

0

600

1,200

Feet

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Natural Resource Conservation Service (NRCS)

Matanzas Creek Dam - Existing Conditions
50-Year 24-Hour Flood Event

Map Name: H:\UD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Existing B Pages

Project Number: 2006-048

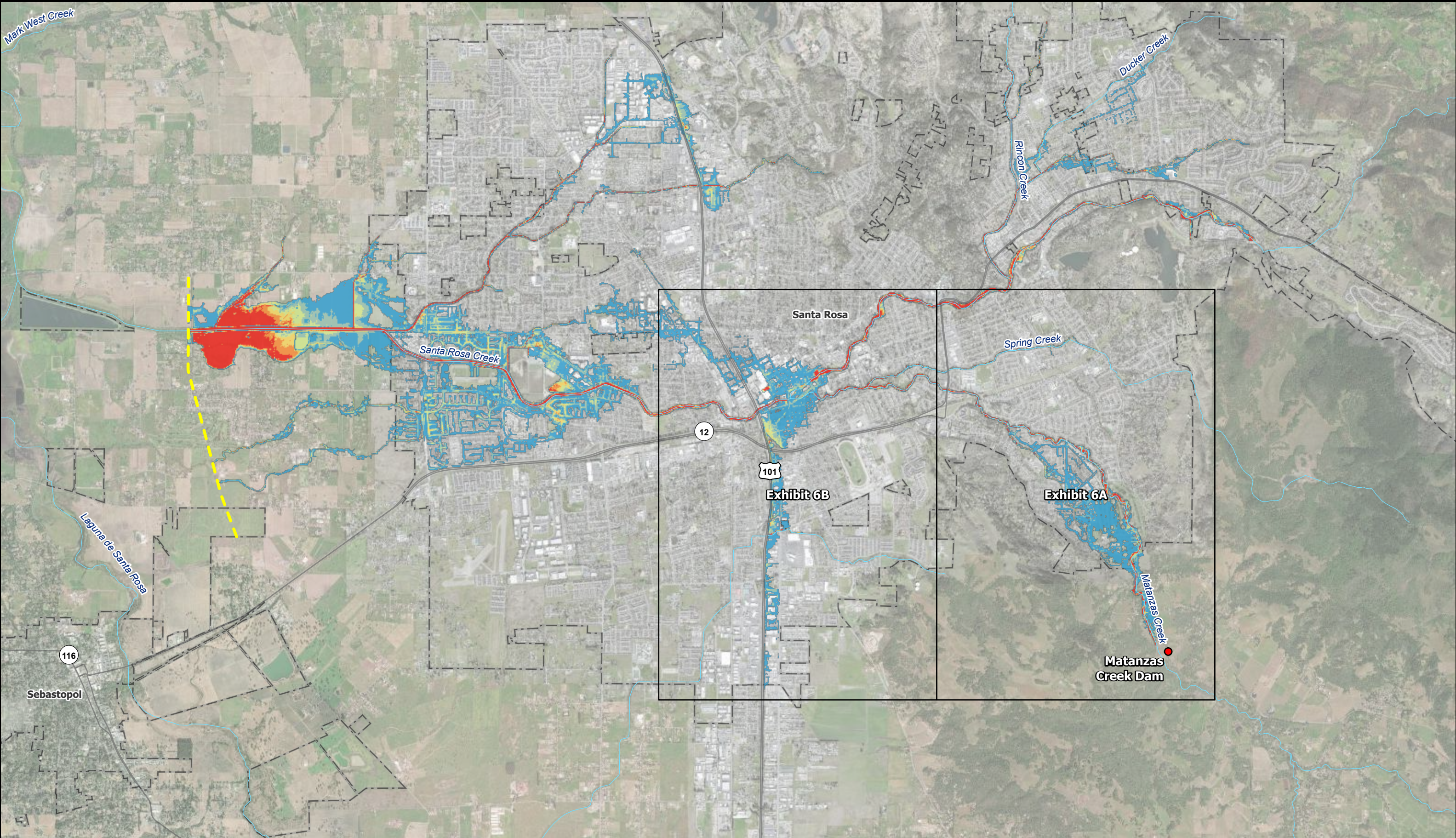
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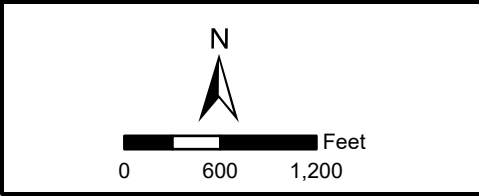
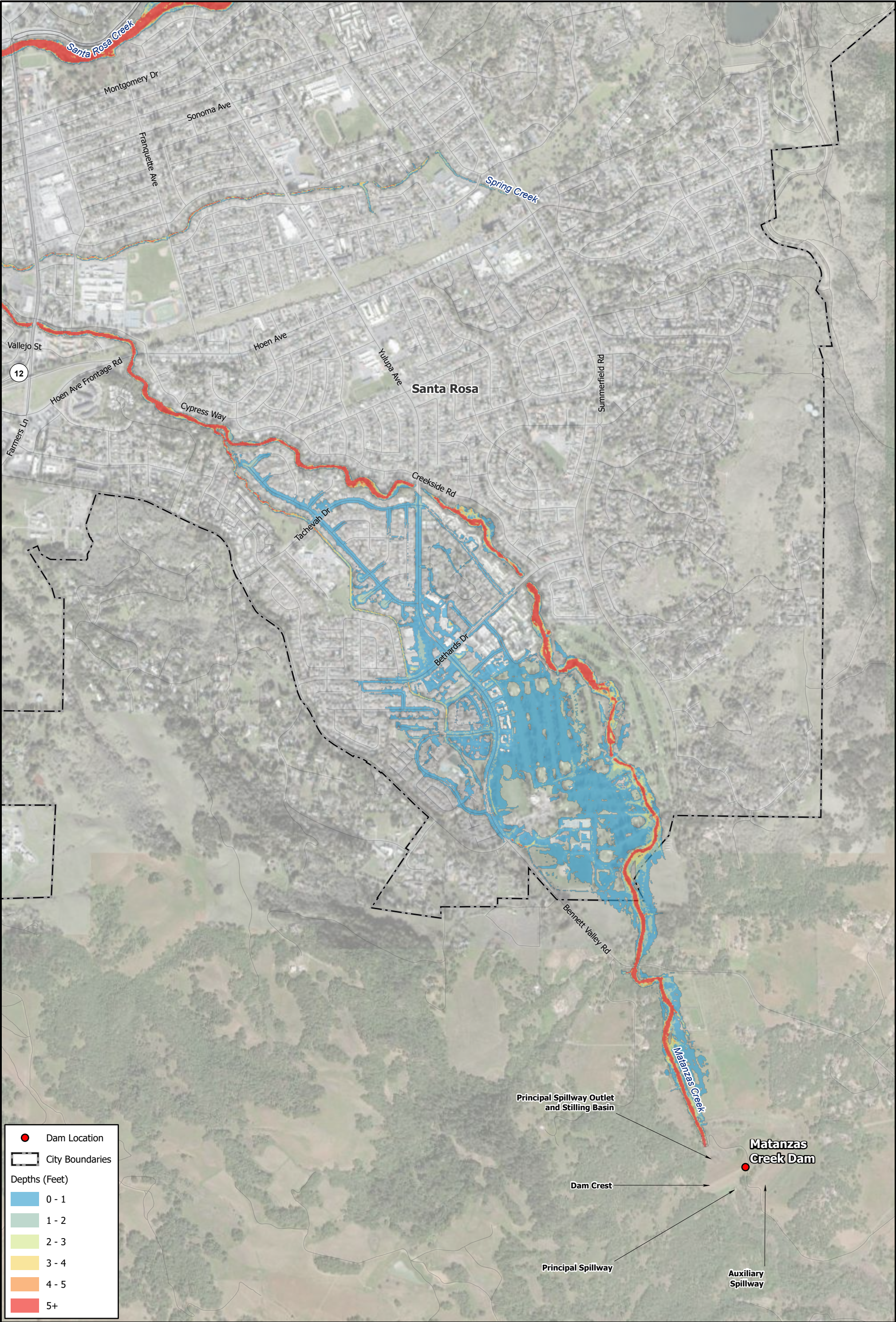
Sonoma County

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EX-5B



- Dam Location - Extent of Hydraulic Model - Major Rivers (NHD) - City Boundaries	Depths (Feet) 0 - 1 1 - 2 2 - 3 3 - 4 4 - 5 5+	 	 Jones & DeMille Engineering - Shaping the Quality of Life - 800.748.5275 www.jonesanddemille.com		Natural Resource Conservation Service (NRCS)		Sonoma County		
			Matanzas Creek Dam - Existing Conditions 100-Year 24-Hour Flood Event		Scale: 1" = 4,000'		EX-6		
			Map Name: H:\JD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Existing Index Pages						
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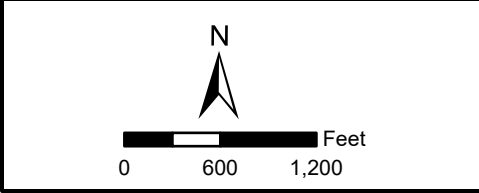
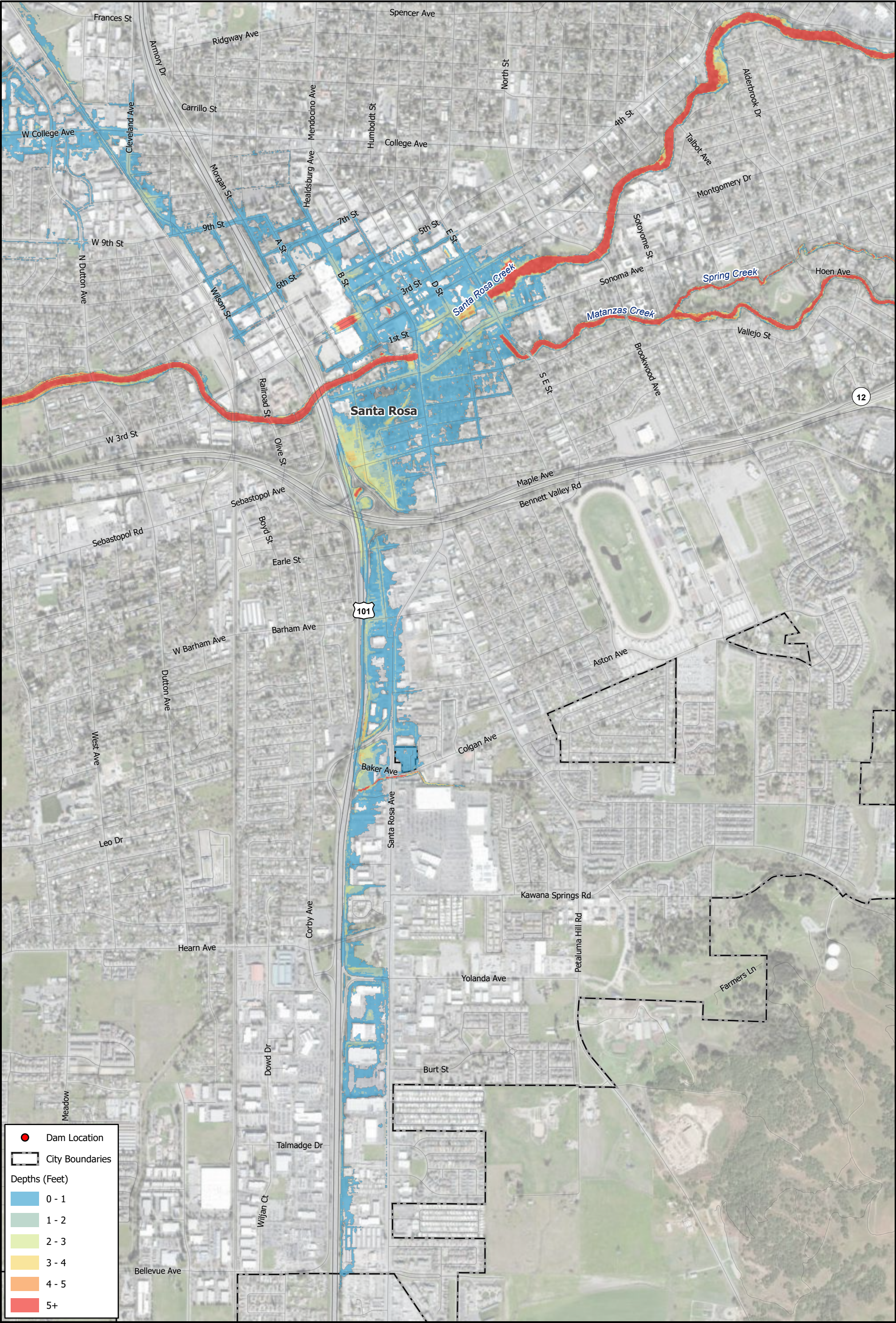


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Matanzas Creek Dam - Existing Conditions 100-Year 24-Hour Flood Event		
Map Name: H:\UD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Existing A Pages		
Project Number: 2006-048	Drawn by: JWW 06-22	Last Edit: 07/07/2022

Sonoma County
Scale: 1" = 1,200'
EX-6A



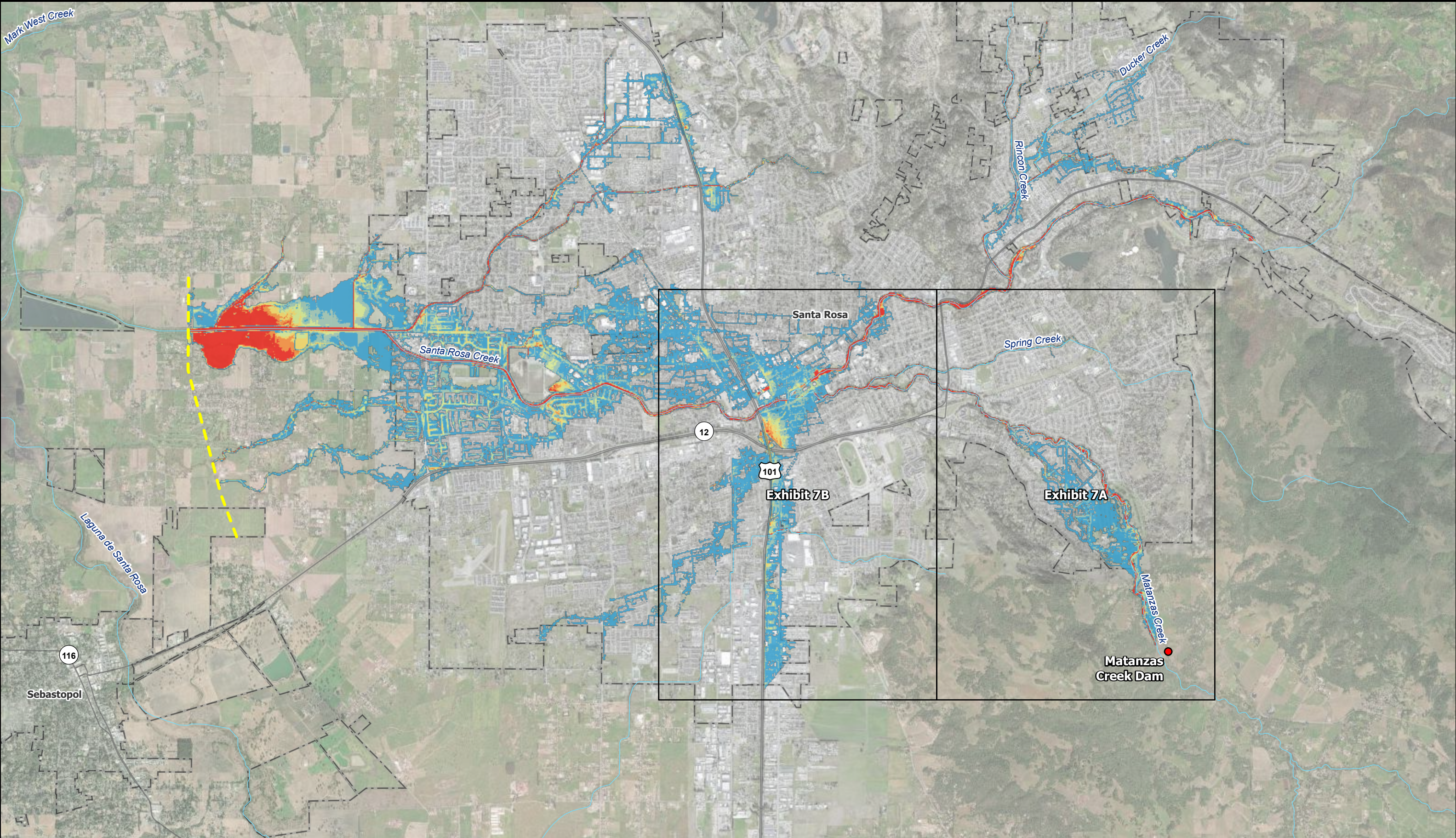


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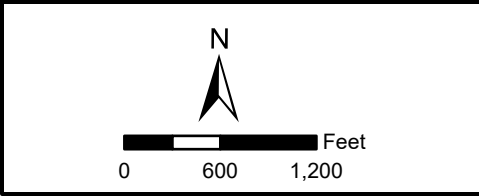
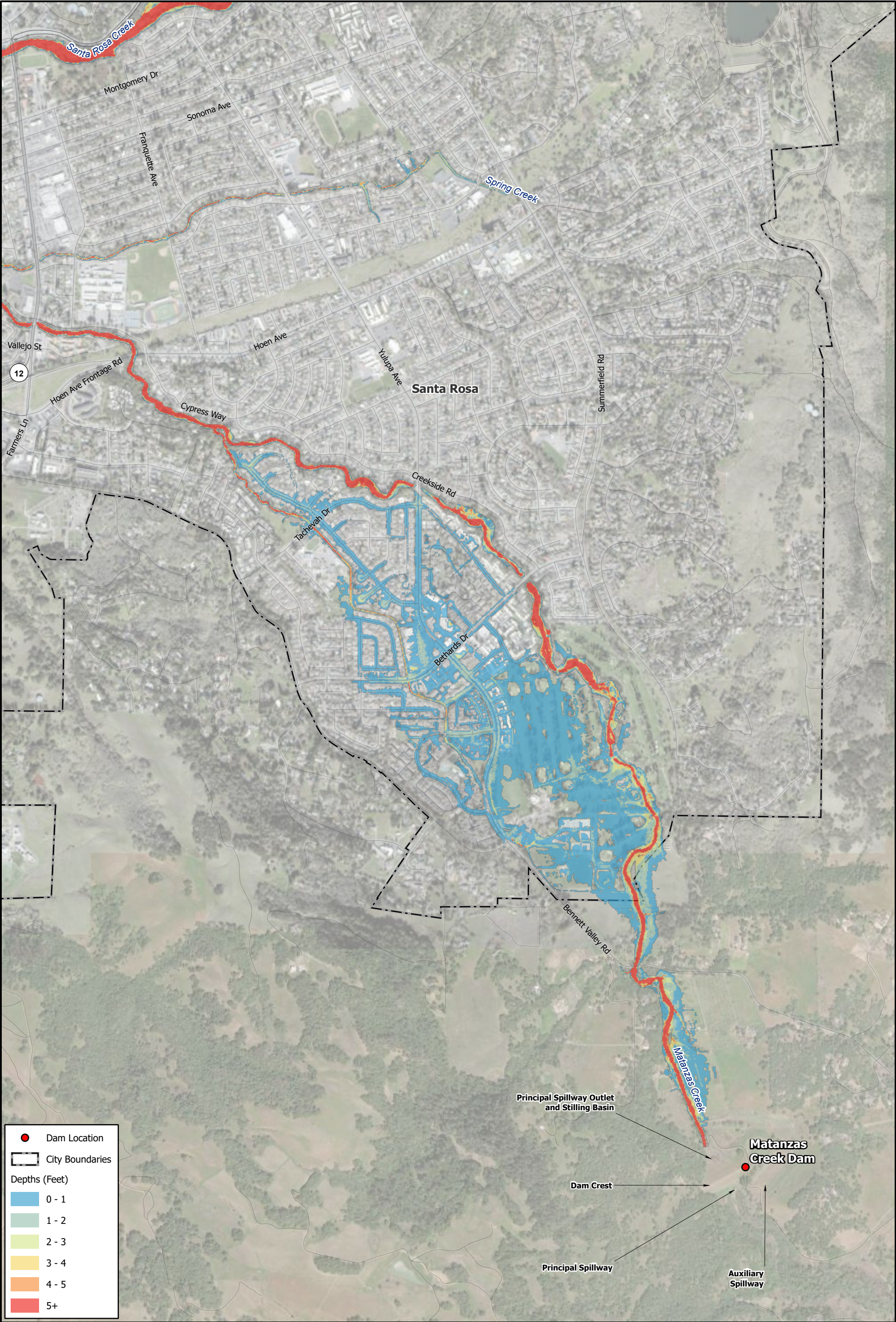
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Natural Resource Conservation Service (NRCS)		
Matanzas Creek Dam - Existing Conditions 100-Year 24-Hour Flood Event		
Map Name: H:\UD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Existing B Pages		
Project Number: 2006-048	Drawn by: JWW 06-22	Last Edit: 07/07/2022

Sonoma County
Scale: 1" = 1,200'
EX-6B



- Dam Location - Extent of Hydraulic Model - Major Rivers (NHD) - City Boundaries	Depths (Feet) <table><tr><td> 0 - 1</td><td> 3 - 4</td></tr><tr><td> 1 - 2</td><td> 4 - 5</td></tr><tr><td> 2 - 3</td><td> 5+</td></tr></table>	0 - 1	3 - 4	1 - 2	4 - 5	2 - 3	5+	 0 2,000 4,000 Feet Jones & DeMille Engineering - Shaping the Quality of Life - 800.748.5275 www.jonesanddemille.com	Natural Resource Conservation Service (NRCS) Matanzas Creek Dam - Existing Conditions 200-Year 24-Hour Flood Event Map Name: H:\JD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Existing Index Pages Project Number: 2006-048 Drawn by: JWW 06-22 Last Edit: 08/31/2022	Sonoma County Scale: 1" = 4,000' EX-7
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1 - 2	4 - 5									
2 - 3	5+									



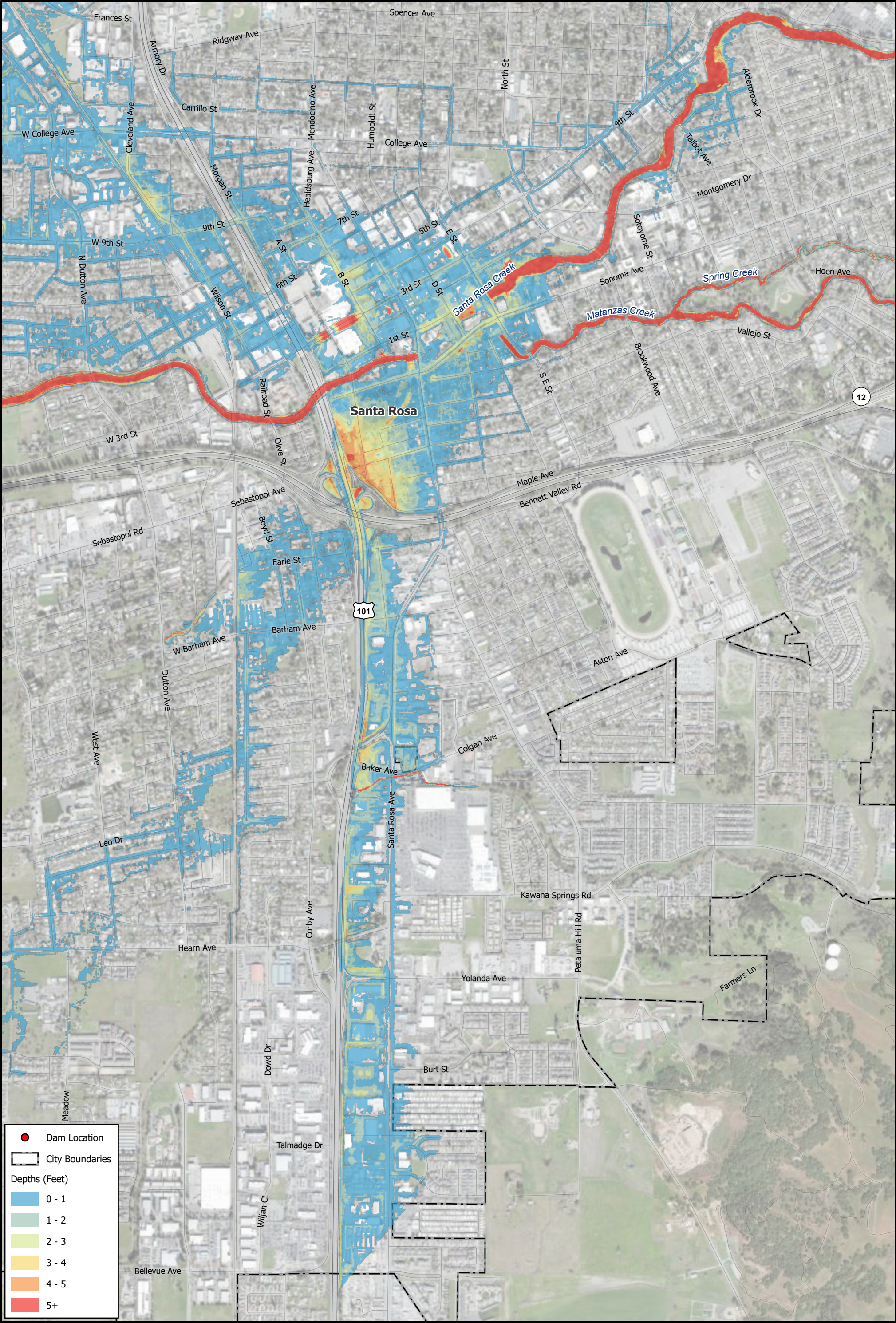


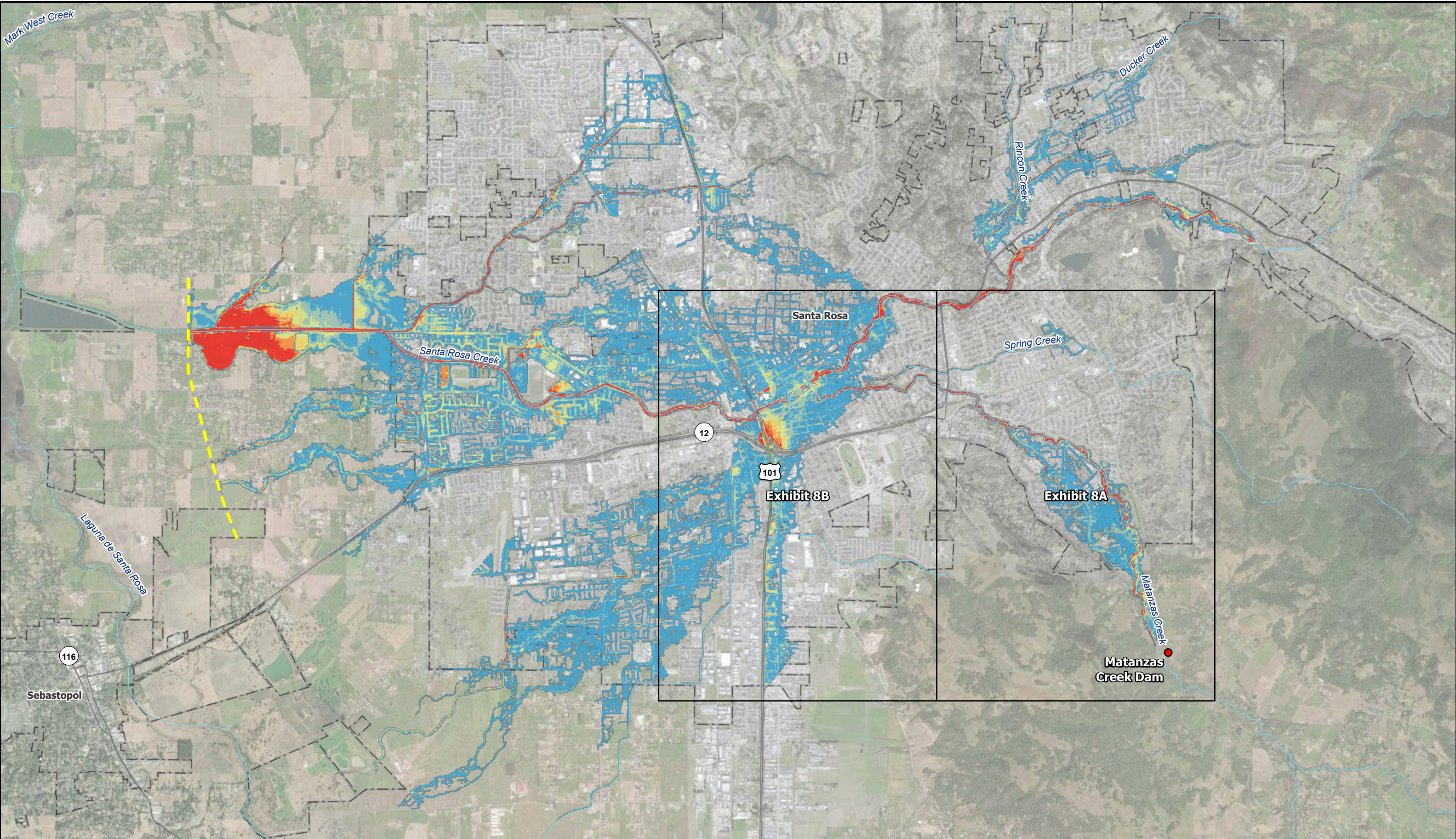
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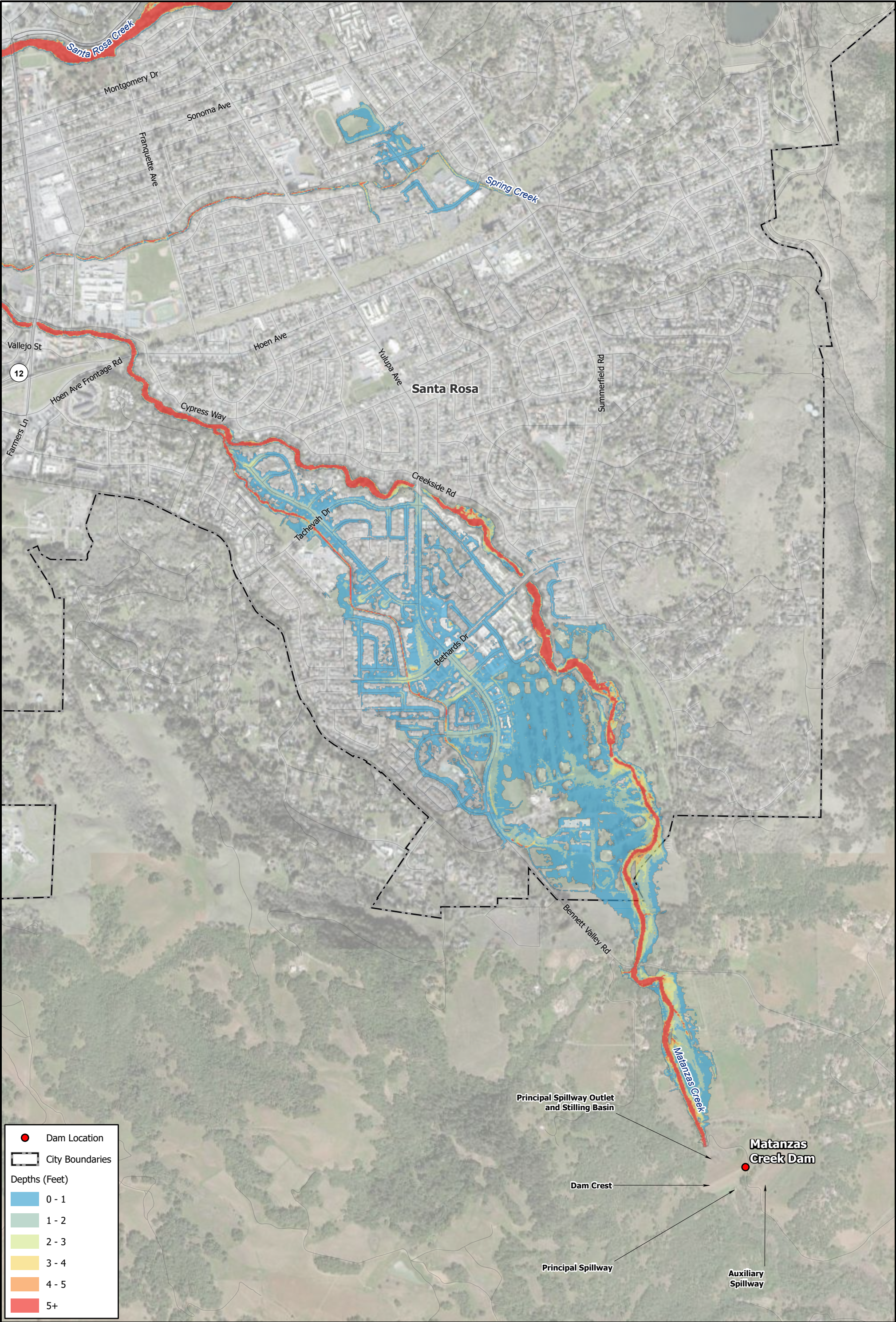
Natural Resource Conservation Service (NRCS)		
Matanzas Creek Dam - Existing Conditions 200-Year 24-Hour Flood Event		
Map Name: H:\JD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Existing A Pages		
Project Number: 2006-048	Drawn by: JWW 06-22	Last Edit: 07/07/2022

Sonoma County
Scale: 1" = 1,200'
EX-7A





- Dam Location - Extent of Hydraulic Model - Major Rivers (NHD) - City Boundaries	Depths (Feet) <table border="1"><tr><td> 0 - 1</td><td> 3 - 4</td></tr><tr><td> 1 - 2</td><td> 4 - 5</td></tr><tr><td> 2 - 3</td><td> 5+</td></tr></table>	0 - 1	3 - 4	1 - 2	4 - 5	2 - 3	5+	0 2,000 4,000 Feet N	Jones & DeMille Engineering - Shaping the Quality of Life - 800.748.5275 www.jonesanddemille.com	Natural Resource Conservation Service (NRCS) Matanzas Creek Dam - Existing Conditions 500-Year 24-Hour Flood Event Map Name: H:\JD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Existing Index Pages Project Number: 2006-048 Drawn by: JWW 06-22 Last Edit: 08/31/2022	Sonoma County Scale: 1" = 4,000' EX-8
0 - 1	3 - 4										
1 - 2	4 - 5										
2 - 3	5+										



Dam Location

City Boundaries

Depths (Feet)

0 - 1

1 - 2

2 - 3

3 - 4

4 - 5

5+

N

0

600

1,200

Feet

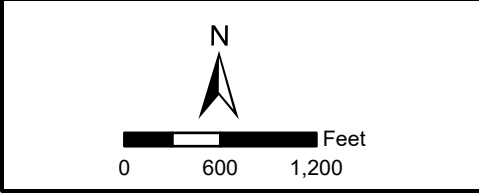
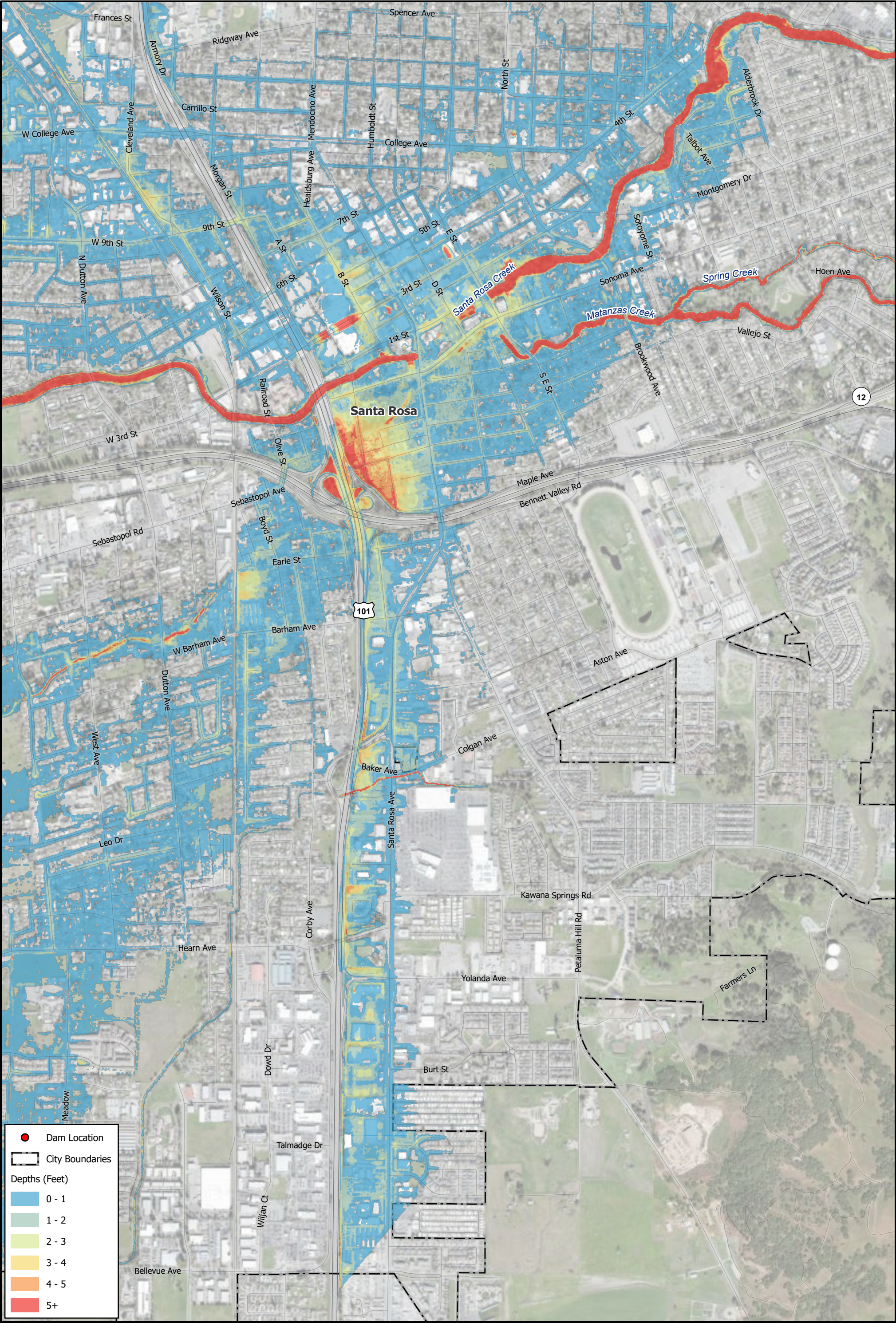
Jones & DeMille
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Natural Resource Conservation Service (NRCS)		
Matanzas Creek Dam - Existing Conditions 500-Year 24-Hour Flood Event		
Map Name: H:\UD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Existing A Pages		
Project Number: 2006-048	Drawn by: JWW 06-22	Last Edit: 07/07/2022

Sonoma County
Scale: 1" = 1,200'
EX-8A





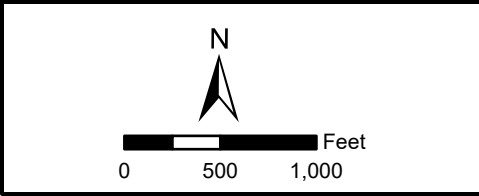
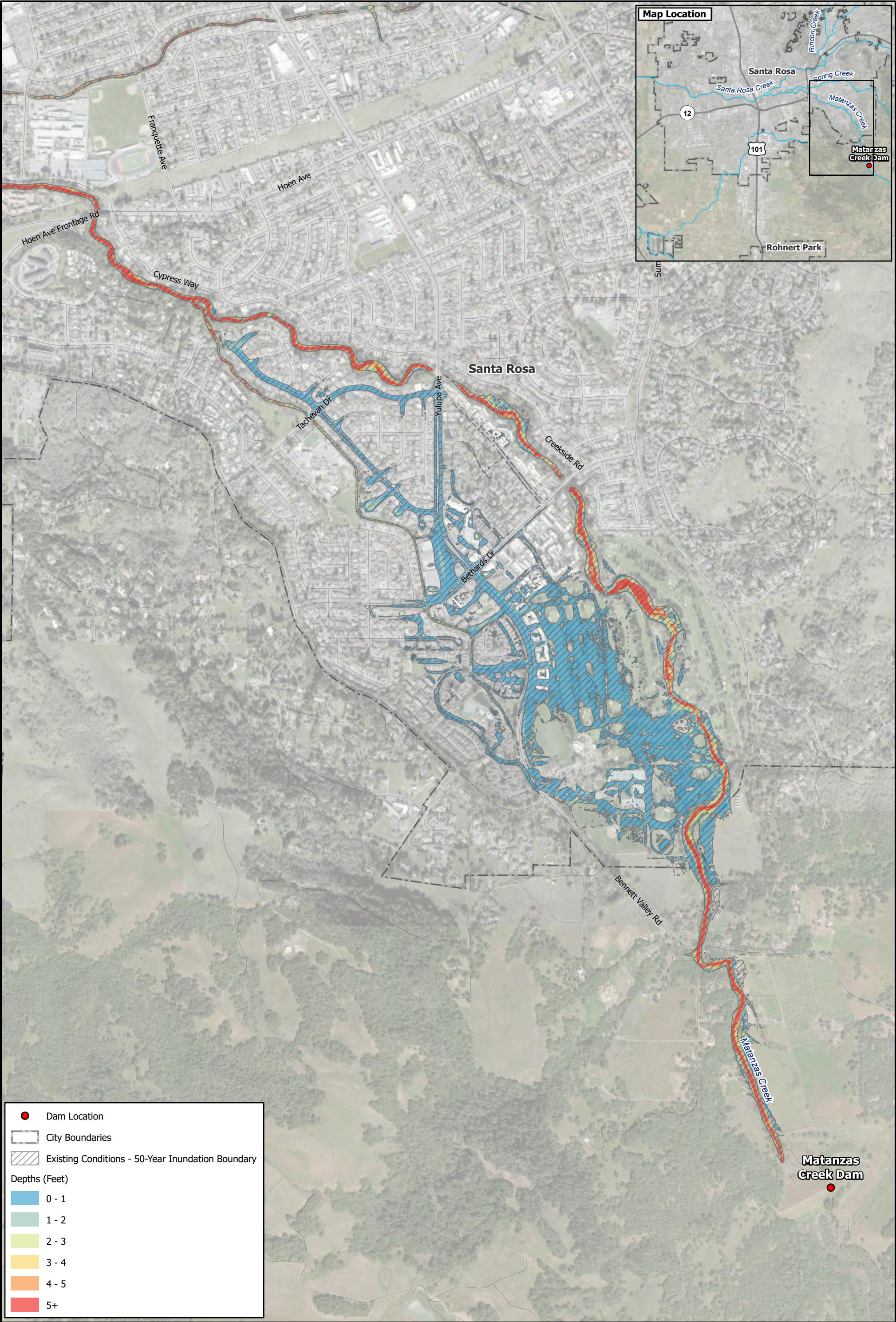
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Natural Resource Conservation Service (NRCS)		
Matanzas Creek Dam - Existing Conditions 500-Year 24-Hour Flood Event		
Map Name: H:\UD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Existing B Pages	Project Number: 2006-048	Drawn by: JWW 06-22
		Last Edit: 07/07/2022

Sonoma County
Scale: 1" = 1,200'
EX-8B

B.2. Alternative 1



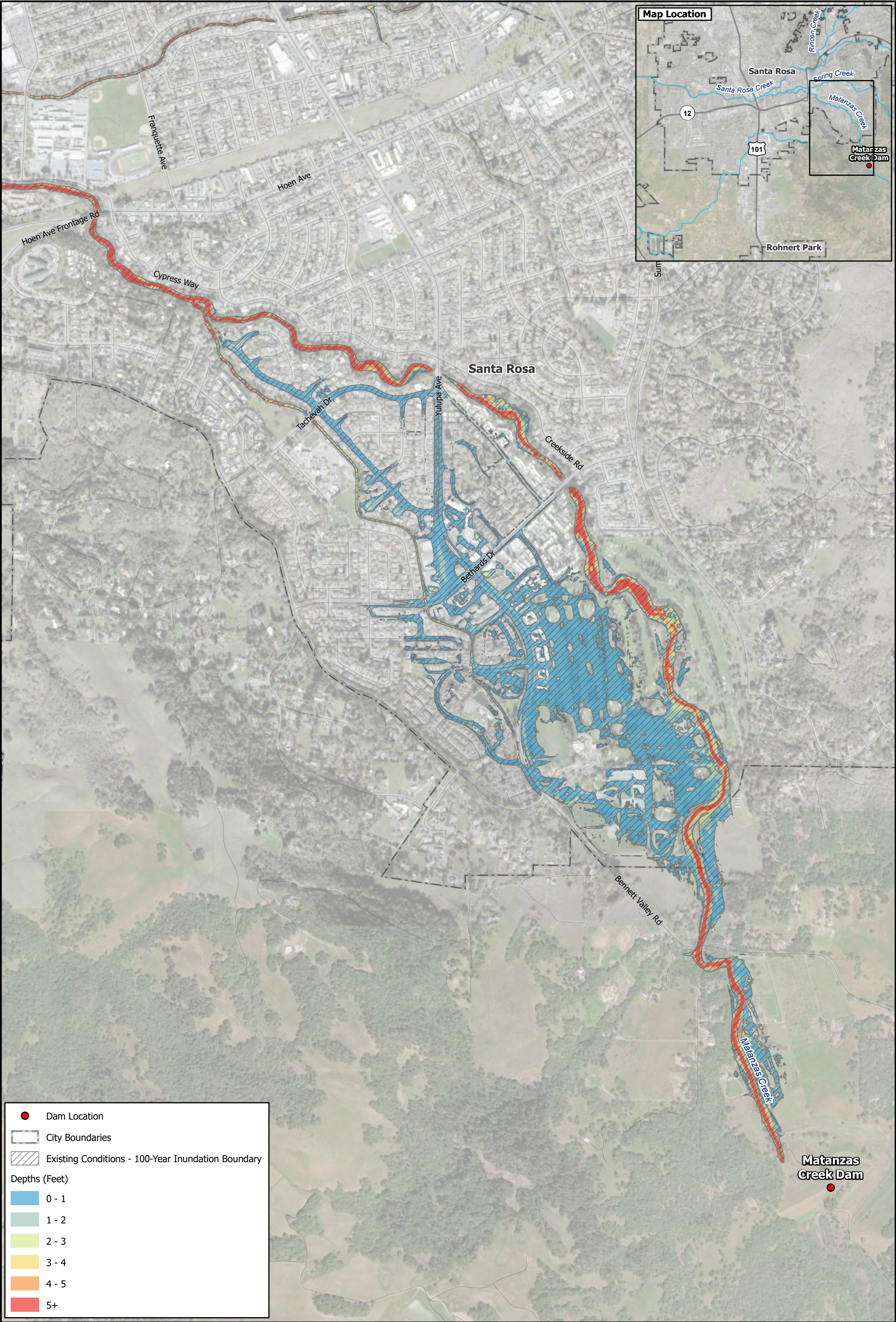


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Natural Resource Conservation Service (NRCS)		
Matanzas Creek Dam - Alternative 1 50-Year 24-Hour Flood Event		
Map Name: H:\JD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Proposed Pages Alt 01		
Project Number: 2006-048	Drawn by: JWW 04-21	Last Edit: 07/07/2021

Sonoma County
Scale: 1" = 1,000'
EX-1



Dam Location

City Boundaries

Existing Conditions - 100-Year Inundation Boundary

Depths (Feet)

0 - 1

1 - 2

2 - 3

3 - 4

4 - 5

5+

N

0

500

1,000

Feet

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Natural Resource Conservation Service (NRCS)

Matanzas Creek Dam - Alternative 1
100-Year 24-Hour Flood Event

Map Name: H:\JD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Proposed Pages Alt 01

Project Number: 2006-048

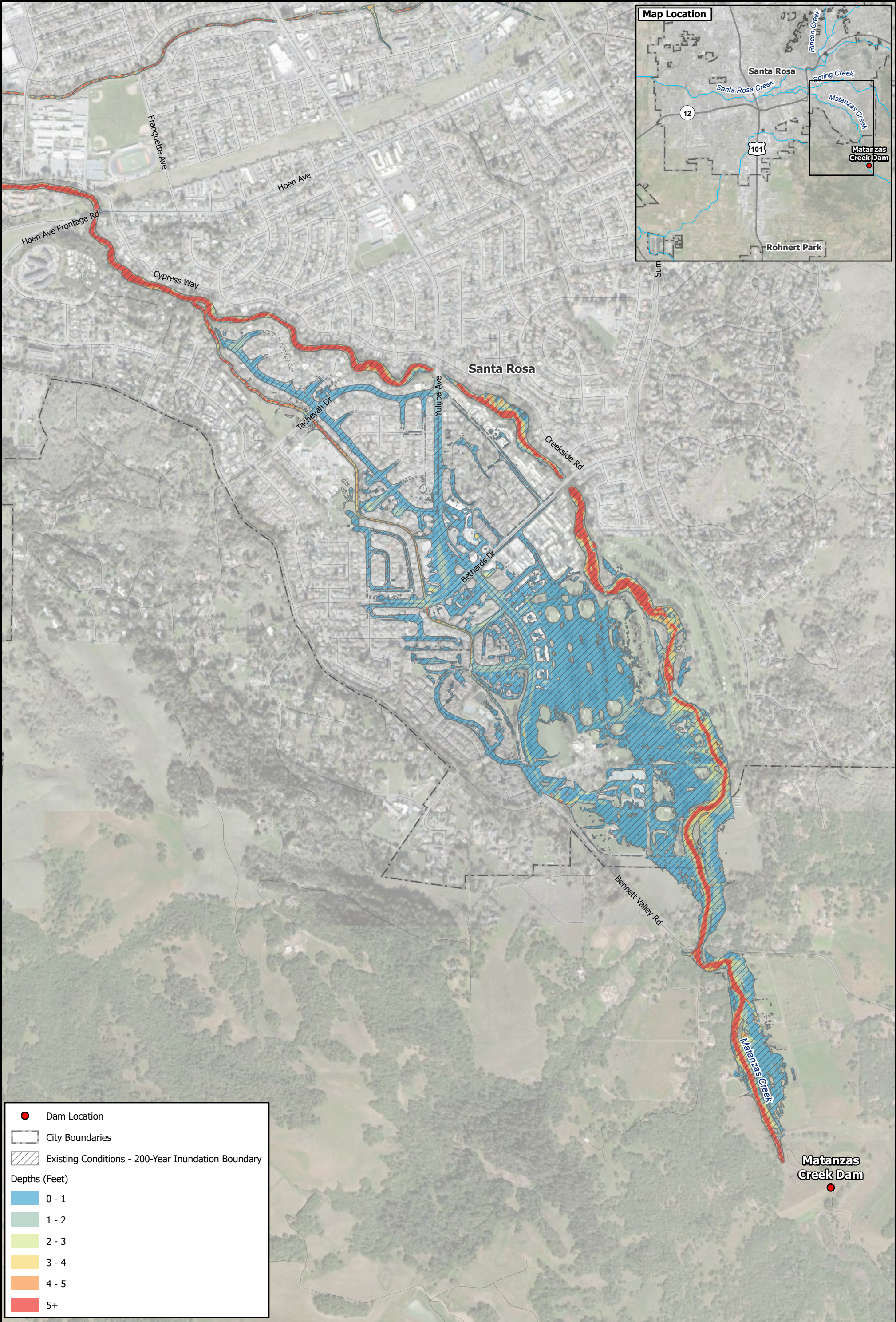
Drawn by: JWW 04-21

Last Edit: 07/07/2021

Sonoma County

Scale: 1" = 1,000'

EX-2



Dam Location

City Boundaries

Existing Conditions - 200-Year Inundation Boundary

Depths (Feet)

0 - 1

1 - 2

2 - 3

3 - 4

4 - 5

5+

N

0

500

1,000

Feet

Jones & DeMille

Engineering

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Natural Resource Conservation Service (NRCS)

Matanzas Creek Dam - Alternative 1
200-Year 24-Hour Flood Event

Map Name: H:\JD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Proposed Pages Alt 01

Project Number: 2006-048

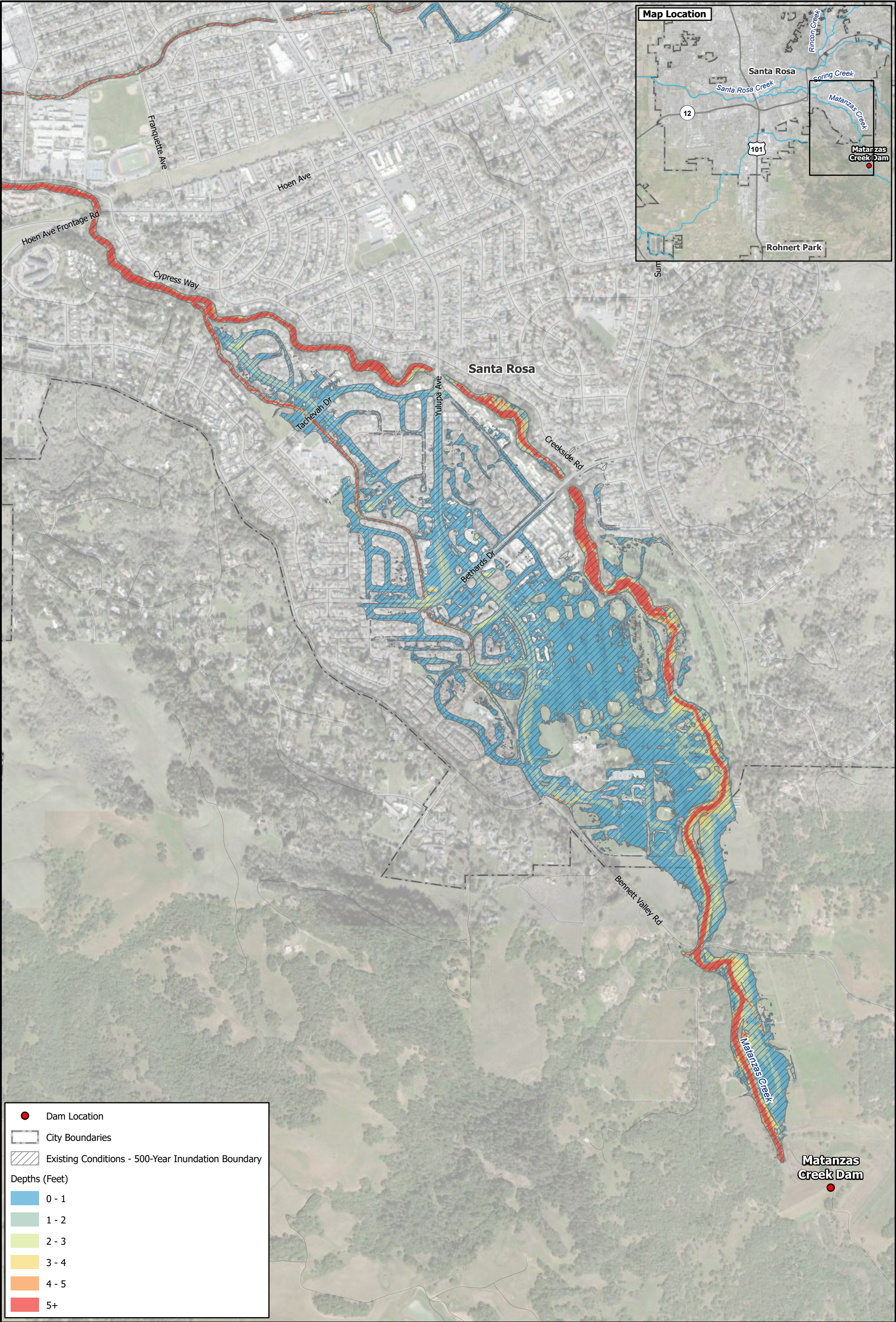
Drawn by: JWW 04-21

Last Edit: 07/07/2021

Sonoma County

Scale: 1" = 1,000'

EX-3



Dam Location

City Boundaries

Existing Conditions - 500-Year Inundation Boundary

Depths (Feet)

0 - 1

1 - 2

2 - 3

3 - 4

4 - 5

5+

N

0

500

1,000

Feet

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Natural Resource Conservation Service (NRCS)

Matanzas Creek Dam - Alternative 1
500-Year 24-Hour Flood Event

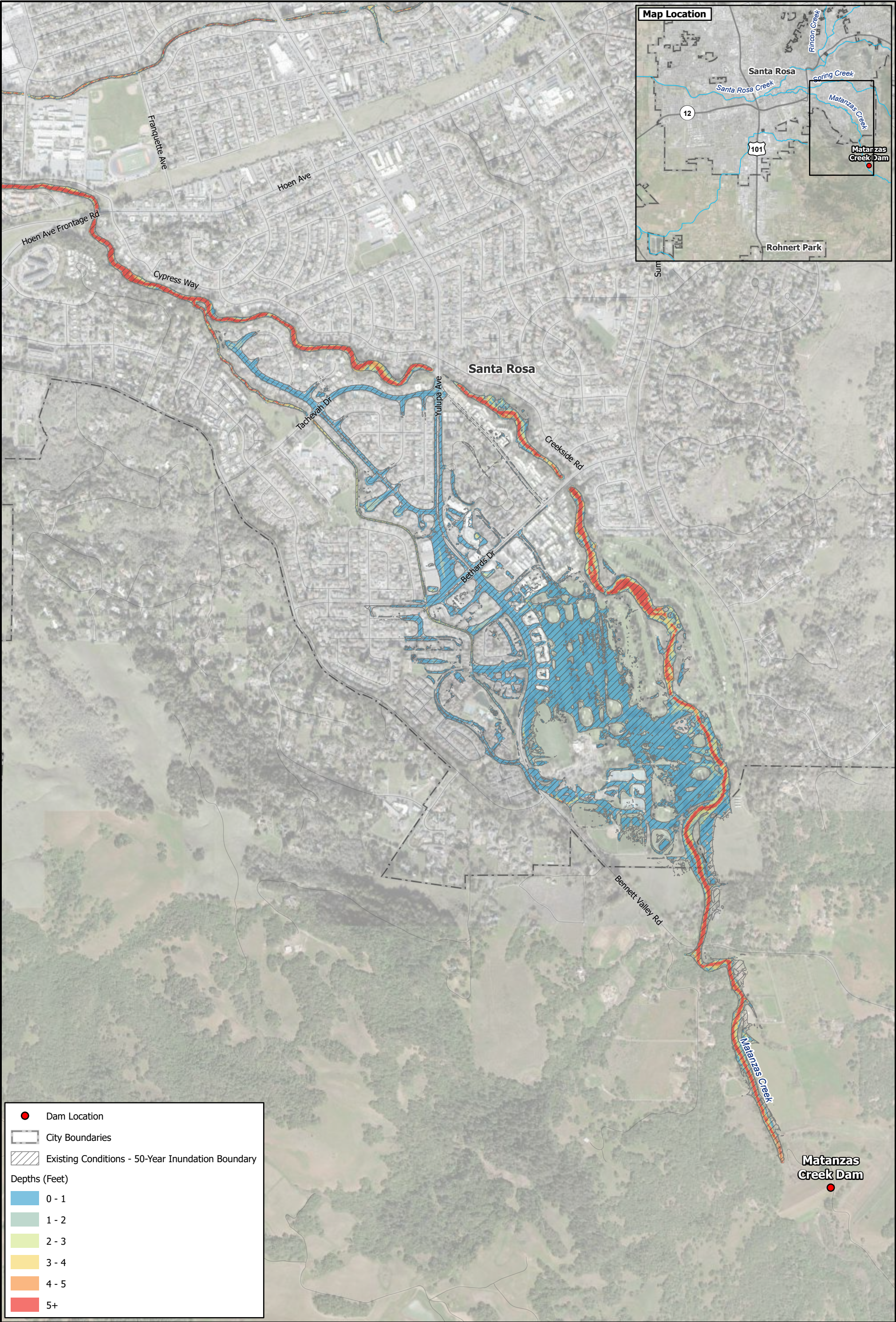
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Project Number: 2006-048 Drawn by: JWW 04-21 Last Edit: 07/07/2021

Sonoma County

Scale: 1" = 1,000'

EX-4

B.3. Alternative 2



Dam Location

City Boundaries

Existing Conditions - 50-Year Inundation Boundary

Depths (Feet)

0 - 1

1 - 2

2 - 3

3 - 4

4 - 5

5+

N

0

500

1,000

Feet

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Natural Resource Conservation Service (NRCS)

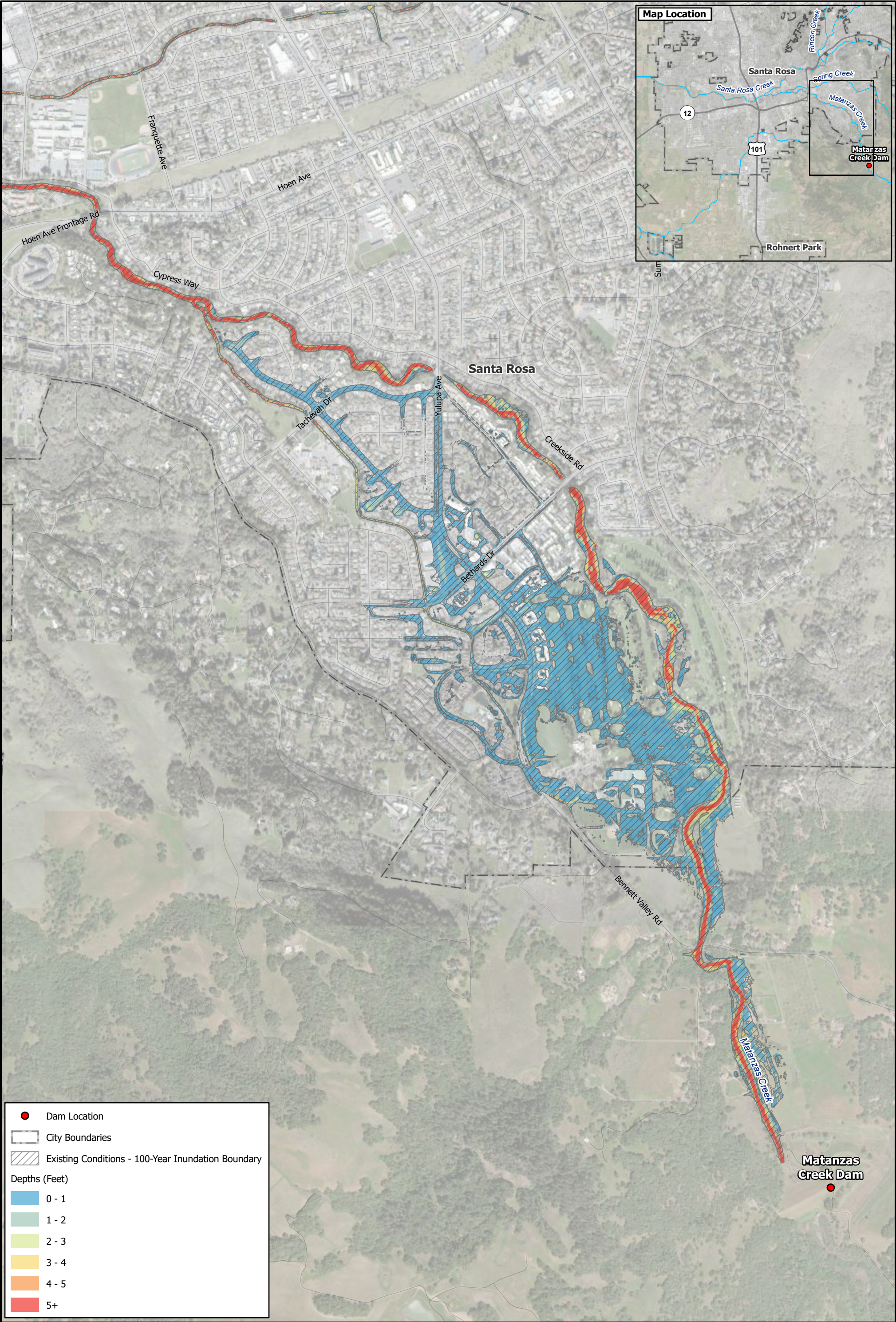
Matanzas Creek Dam - Alternative 2
50-Year 24-Hour Flood Event

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Project Number: 2006-048 Drawn by: JWW 04-21 Last Edit: 07/07/2021

Sonoma County

Scale: 1" = 1,000'

EX-1



Dam Location

City Boundaries

Existing Conditions - 100-Year Inundation Boundary

Depths (Feet)

0 - 1

1 - 2

2 - 3

3 - 4

4 - 5

5+

N

0

500

1,000

Feet

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Natural Resource Conservation Service (NRCS)

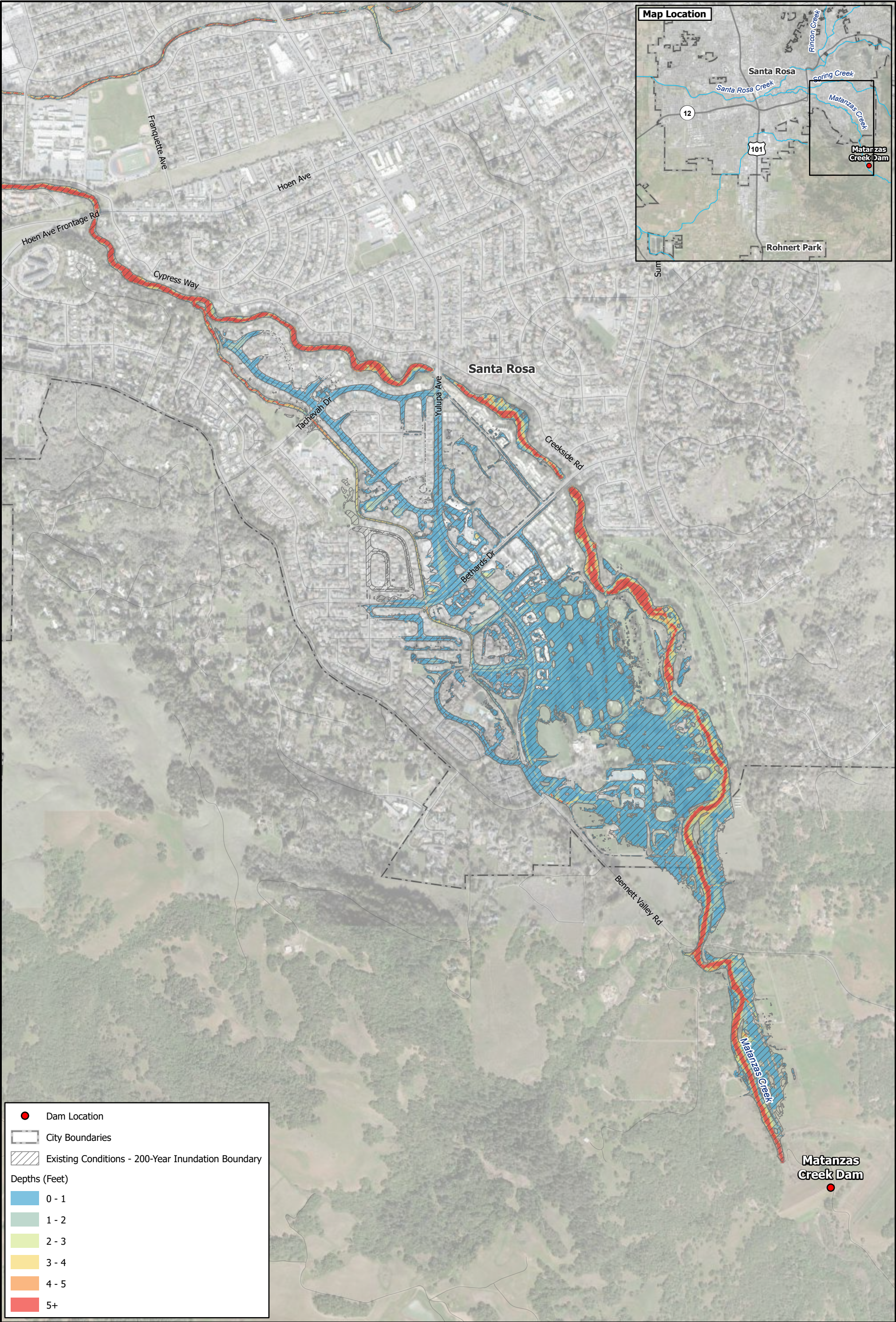
Matanzas Creek Dam - Alternative 2
100-Year 24-Hour Flood Event

Map Name: H:\JD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Proposed Pages Alt 02
Project Number: 2006-048 Drawn by: JWW 04-21 Last Edit: 07/07/2021

Sonoma County

Scale: 1" = 1,000'

EX-2



Dam Location

City Boundaries

Existing Conditions - 200-Year Inundation Boundary

Depths (Feet)

0 - 1

1 - 2

2 - 3

3 - 4

4 - 5

5+

N

0

500

1,000

Feet

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Natural Resource Conservation Service (NRCS)

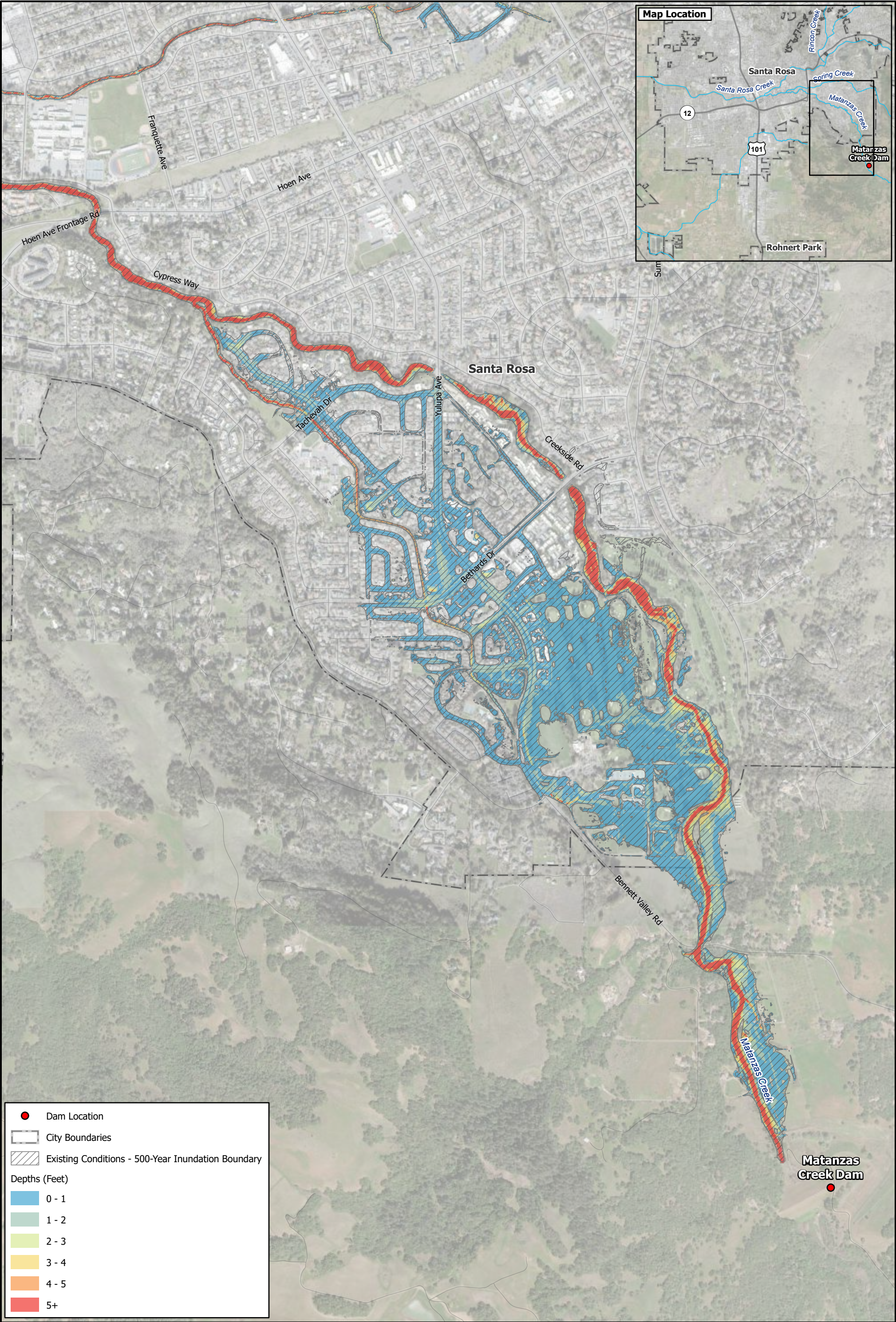
Matanzas Creek Dam - Alternative 2
200-Year 24-Hour Flood Event

Map Name: H:\JD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Proposed Pages Alt 02
Project Number: 2006-048 Drawn by: JWW 04-21 Last Edit: 07/07/2021

Sonoma County

Scale: 1" = 1,000'

EX-3



Dam Location

City Boundaries

Existing Conditions - 500-Year Inundation Boundary

Depths (Feet)

0 - 1

1 - 2

2 - 3

3 - 4

4 - 5

5+

N

05001,000

Feet

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Natural Resource Conservation Service (NRCS)

Matanzas Creek Dam - Alternative 2

500-Year 24-Hour Flood Event

Map Name: H:\JD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Proposed Pages Alt 02

Project Number: 2006-048

Drawn by: JWW 04-21

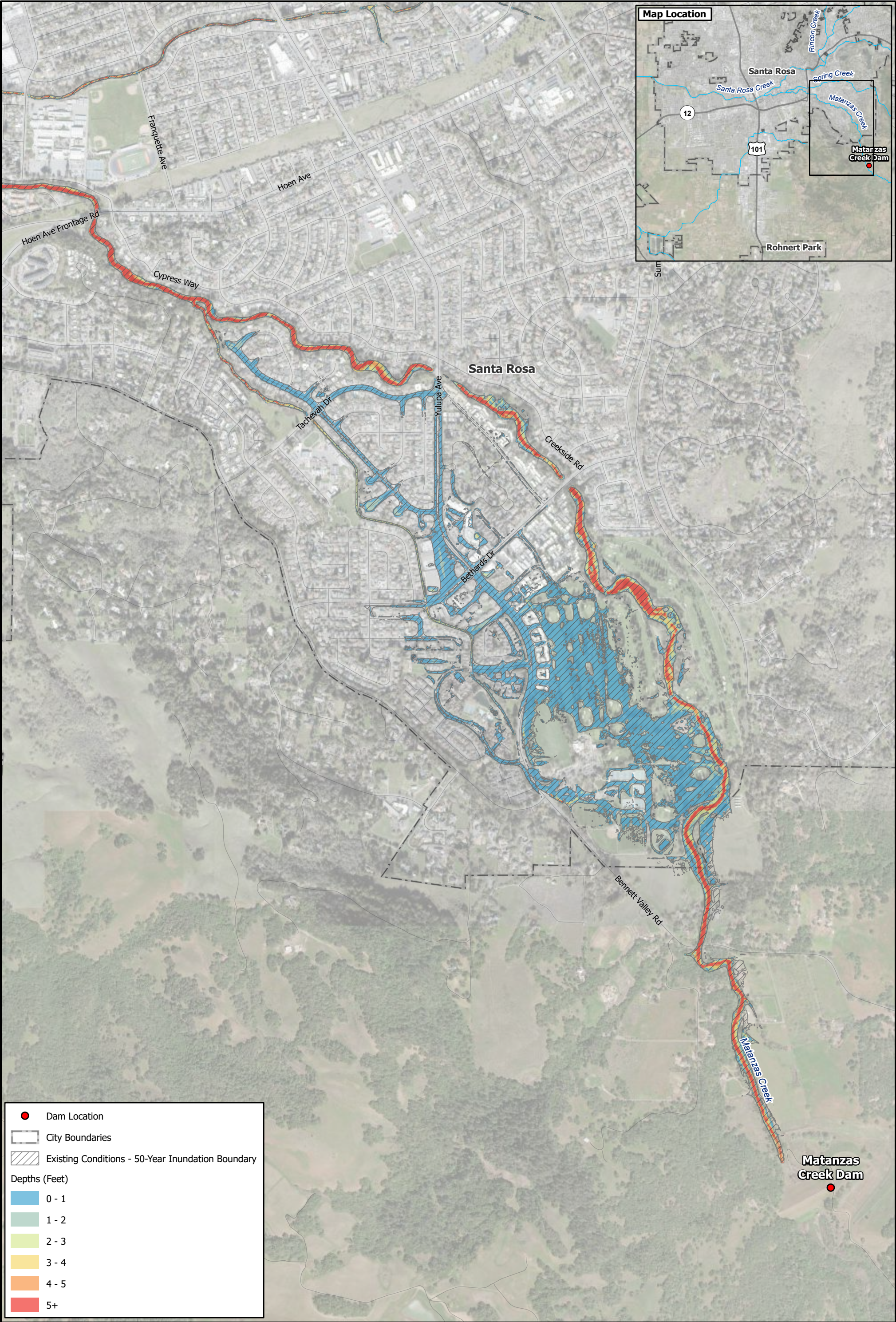
Last Edit: 07/07/2021

Sonoma County

Scale: 1" = 1,000'

EX-4

B.4. Alternative 3



Dam Location

City Boundaries

Existing Conditions - 50-Year Inundation Boundary

Depths (Feet)

0 - 1

1 - 2

2 - 3

3 - 4

4 - 5

5+

N

05001,000

Feet

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Natural Resource Conservation Service (NRCS)

Matanzas Creek Dam - Alternative 3
50-Year 24-Hour Flood Event

Map Name: H:\JD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Proposed Pages Alt 03
Project Number: 2006-048

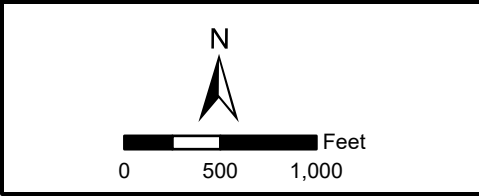
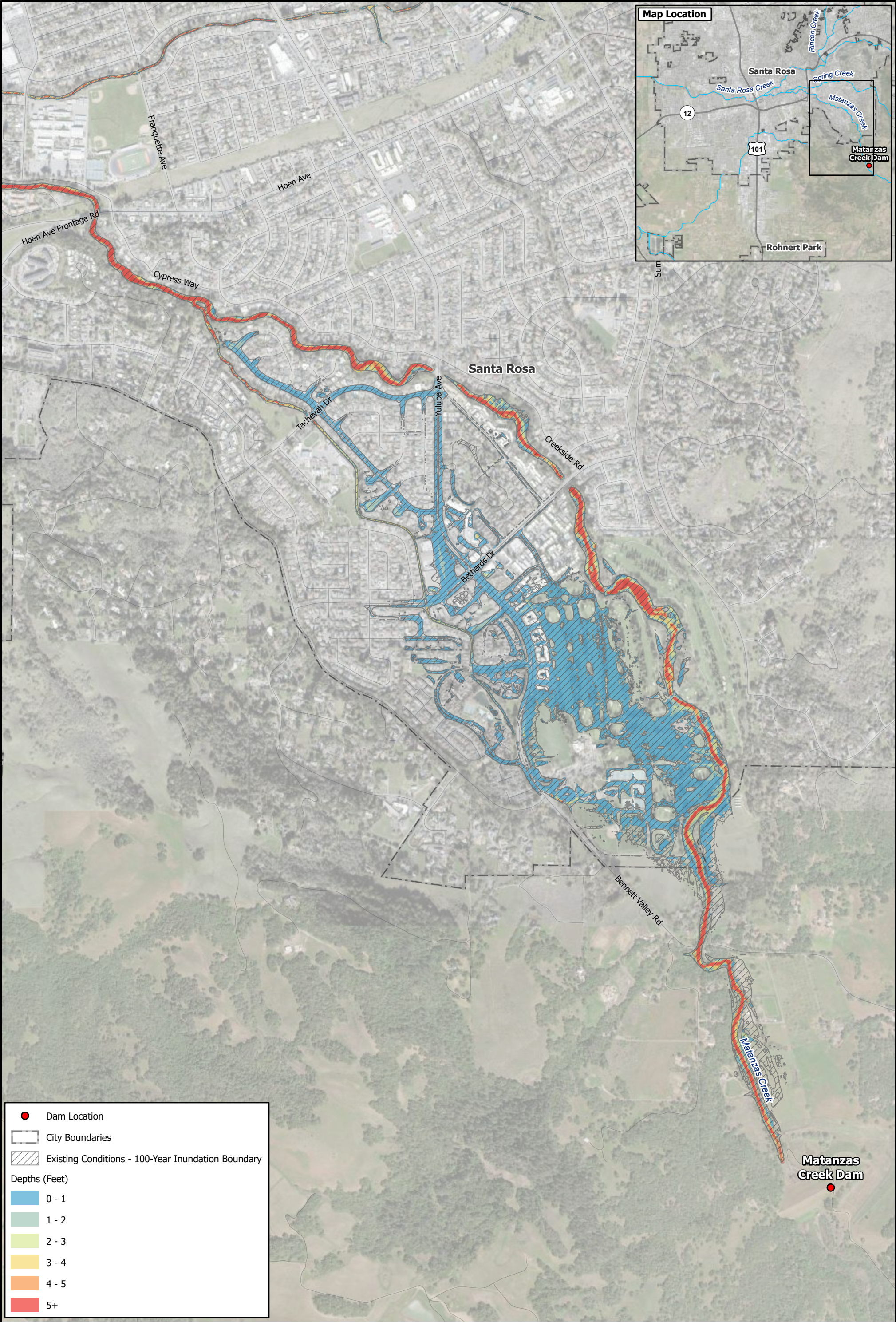
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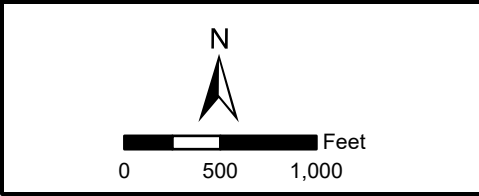
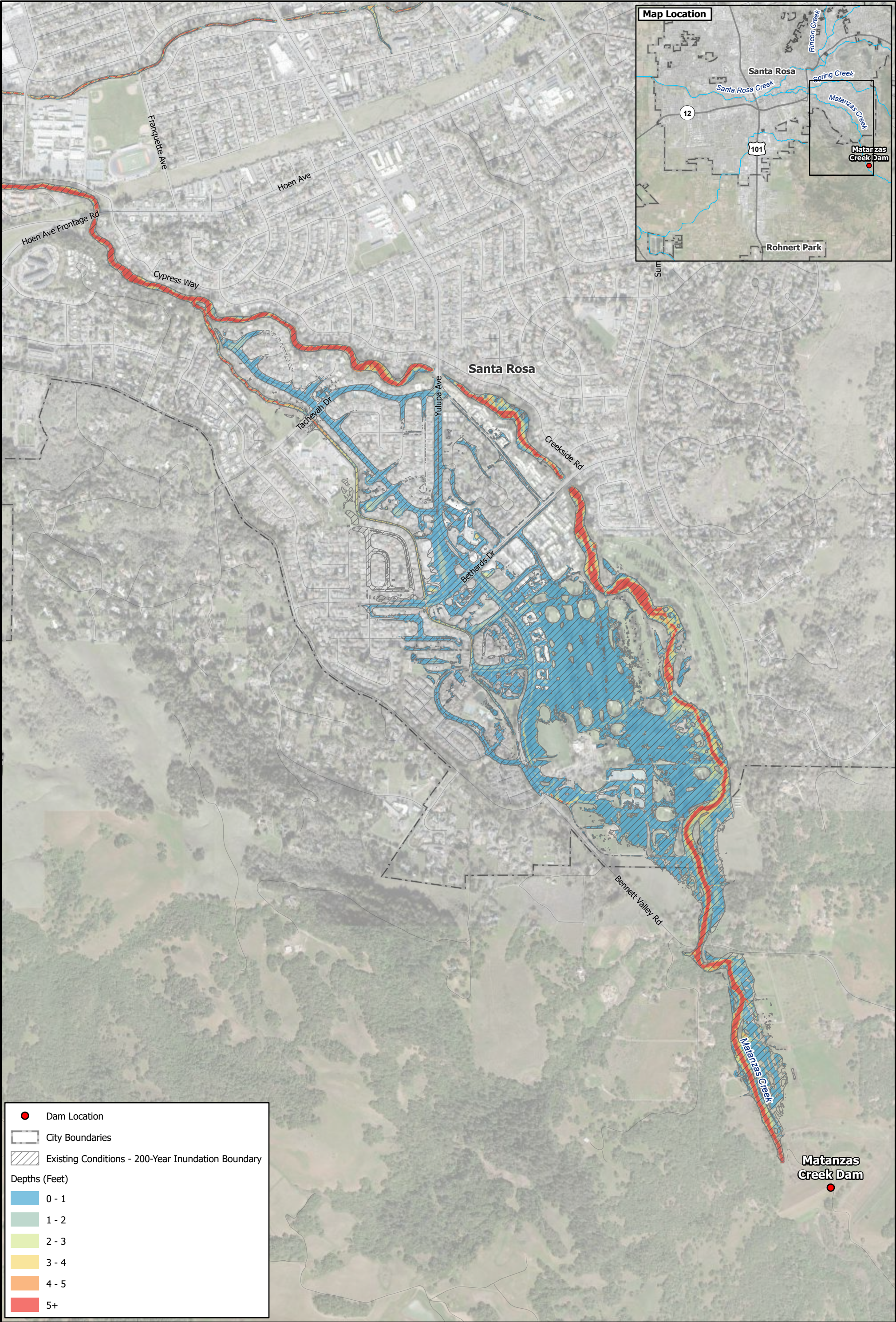
Last Edit: 07/07/2021

Sonoma County

Scale: 1" = 1,000'

EX-1





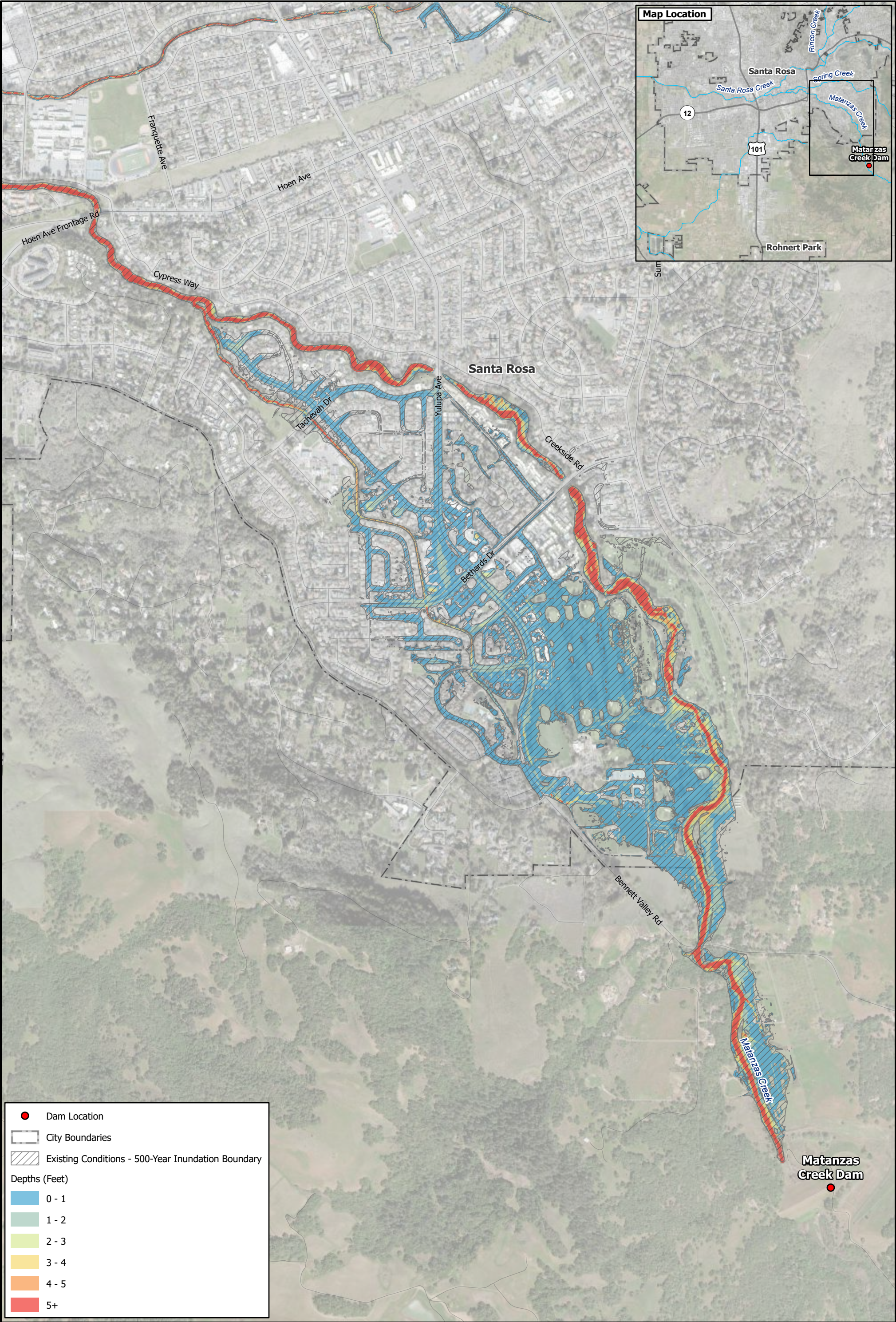


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Natural Resource Conservation Service (NRCS)		
Matanzas Creek Dam - Alternative 3 200-Year 24-Hour Flood Event		
Map Name: H:\JD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Proposed Pages Alt 03	Project Number: 2006-048	Drawn by: JWW 04-21
Last Edit: 07/07/2021		

Sonoma County
Scale: 1" = 1,000'
EX-3



Dam Location

City Boundaries

Existing Conditions - 500-Year Inundation Boundary

Depths (Feet)

0 - 1

1 - 2

2 - 3

3 - 4

4 - 5

5+

N

05001,000

Feet

Jones & DeMille Engineering

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Natural Resource Conservation Service (NRCS)

Matanzas Creek Dam - Alternative 3
500-Year 24-Hour Flood Event

Map Name: H:\JD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Proposed Pages Alt 03
Project Number: 2006-048

Drawn by: JWW 04-21

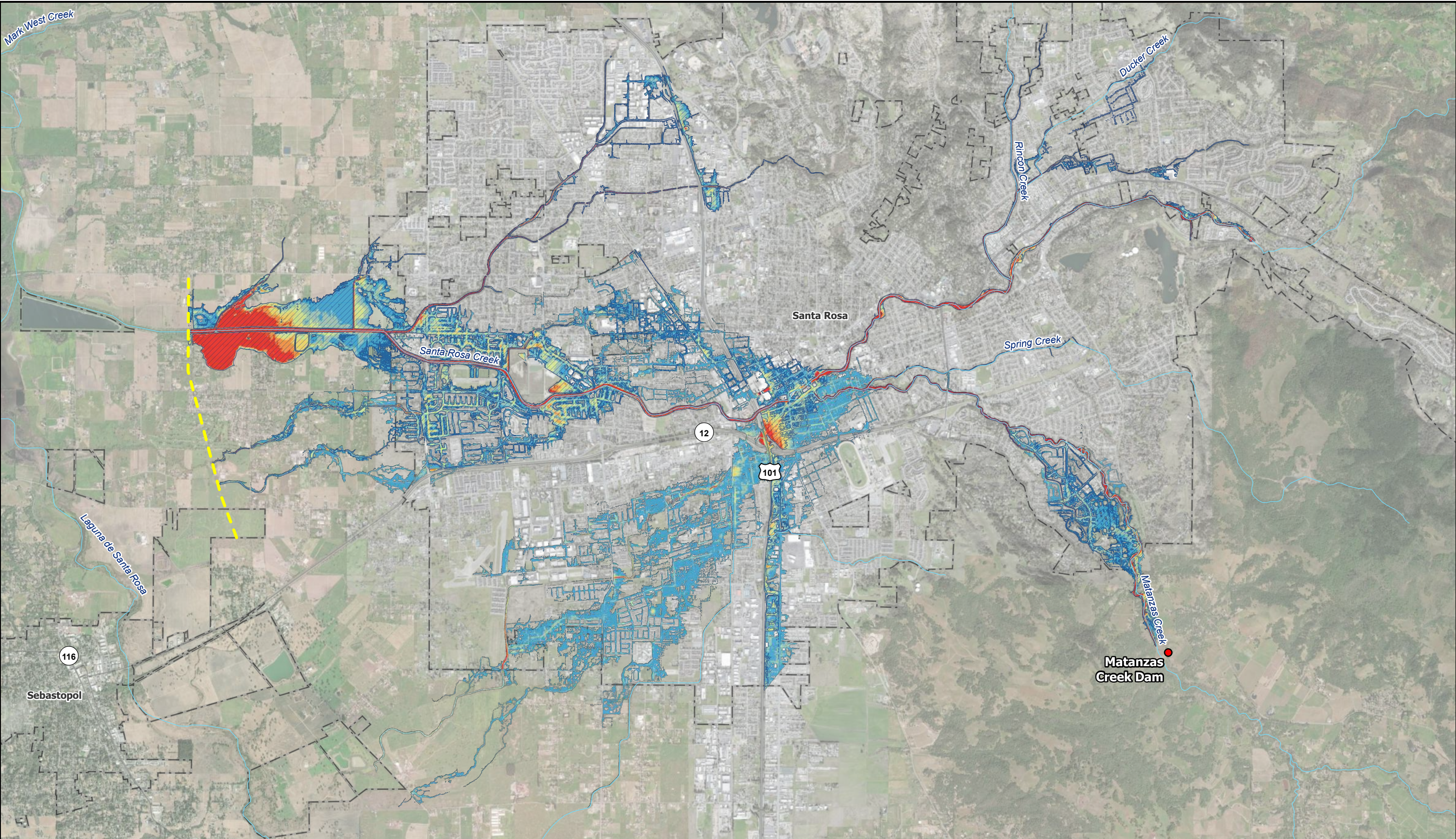
Last Edit: 07/07/2021

Sonoma County

Scale: 1" = 1,000'

EX-4

B.5. Decommissioning Alternative – 100-year Only



- Dam Location - Extent of Hydraulic Model - Major Rivers (NHD) - City Boundaries - Existing Conditions - 100-Year Inundation Boundary	Depths (Feet) 0 - 1 1 - 2 2 - 3 3 - 4 4 - 5 5+	0 2,000 4,000 Feet N	Jones & DeMille Engineering - Shaping the Quality of Life - 800.748.5275 www.jonesanddemille.com	Natural Resource Conservation Service (NRCS)		Sonoma County
				Matanzas Creek Dam - Decommission Alternative		Scale: 1" = 4,000'
				100-Year 24-Hour Flood Event		EX-1
				Map Name: H:\JD\Proj\2006-048\Design\GIS\Projects\2006-048_Econ\2006-048_Econ.aprx - Exh Flood Depths Dam Decommission Alternative Project Number: 2006-048 Drawn by: JWW 06-22 Last Edit: 07/07/2022		