FEASIBILITY STUDY | JUNE 2025

THOMES CREEK DIVERSIONS FOR DIRECT OR IN-LIEU GROUNDWATER RECHARGE CORNING SUBBASIN

PREPARED FOR

TEHAMA COUNTY FCWCD

AND CORNING SUBBASIN GSA

PREPARED BY

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Consulting Engineers

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Meaning
AEM	Airborne Electromagnetic
CFS	Cubic Feet per Second
CWD	Corning Water District
DWR	Department of Water Resources
FCWCD	Flood Control and Water Conservation District
GSA	Groundwater Sustainability Agency
I-5	Interstate 5
LSCE	Luhdorff & Scalmanini Consulting Engineers
SAGBI	Soil Agricultural Banking Index
SWRCB	State Water Resources Control Board
TCWUA	Thomes Creek Water Users Association
tTEM	Towed Transient Electro Magnetic

1. INTRODUCTION

This feasibility study was conducted as part of the Tehama County GSP Implementation Prop 68 Grant under the Thomes and Elder Creek Diversions Task. This study covers the investigation of opportunities for recharge in the Corning Subbasin from Thomes Creek. As Thomes Creek forms the northern boundary of the groundwater subbasin, this study specifically covers the sites identified on the south side of Thomes Creek. Sites identified on the north side of Thomes Creek and along Elder Creek are covered in a feasibility study covering the Red Bluff Subbasin.

1.1. Location

The Corning Subbasin is located in the Northern Sacramento Valley. The subbasin covers the valley portion of southern Tehama County and northern portions of Glenn County. Thomes Creek forms the northern boundary of the subbasin. Sites identified in this feasibility study are generally along the northern boundary of the Subbasin due to proximity to Thomes Creek.

1.2. Project Goals

This project aims to utilize flows from Thomes Creek to recharge groundwater supplies within the Corning Subbasin. This recharge may take one or more forms. First, direct recharge through diversions into recharge ponds or basins may be utilized to increase stored groundwater. Alternatively, in-lieu recharge, which substitutes surface water supplies in situations where groundwater has historically been used, may also be implemented.

2. SITE IDENTIFICATION

2.1. Site Criteria

Sites were selected based various criteria which indicated their potential for groundwater recharge.

2.1.1. Proximity

Proximity to Thomes Creek was the first criteria assessed when searching for potential sites. Gravity surface water diversion and conveyance facilities on Thomes Creek are limited. Any recharge outside the small areas served by these facilities must currently be carried out via pumps and pipelines. Proximity to Thomes Creek ensures that pumping and pipe costs are minimized. Additionally, sites were evaluated to ensure that temporary pumps could physically be installed and operated during times of high flow on Thomes Creek. As the time periods when diversions will be allowed will be short in duration, the ability to access pumps to start and stop pumps quickly is necessary.

Additionally, in some cases, sites were also in close proximity to distribution infrastructure from other water sources. These additional water sources have the potential to be utilized during periods of flow in Thomes Creek that do not meet diversion criteria.

2.1.2. Topography and Land Use

Sites were further evaluated based on their ability to receive and infiltrate applied surface water. Various public datasets and information collected during site visits were utilized to evaluate sites. Analysis of sites prioritized those which were generally level, to encourage the spreading of applied water and encourage infiltration into the subsurface. Additionally, sites with land uses compatible with applications of large volumes of surface water during periods of high flow in Thomes Creek were sought out. These included present uses such as fallow, grazing/rangeland, and some orchard/vineyard crops.

2.1.3. Geology

Sites were evaluated based on their ability to infiltrate applied surface water. Two publicly available datasets, the Soil Agricultural Banking Index (SAGBI) developed by the University of California Soil Resource Lab and the Airborne Electromagnetic (AEM) Survey data collected by the California Department of Water Resources (DWR) were both utilized when evaluating sites.

SAGBI values are calculated based on five factors which influence the success of groundwater recharge including: deep percolation, root zone residence time, topography, chemical limitations, and soil surface condition. These factors are combined to create a rating from 0 to 100. Ratings from 49-69 are considered moderately good, 69-85 are considered good, while ratings from 85-100 are considered excellent. Sites with moderately good to excellent ratings were preferred.

AEM Survey data was used to further evaluate sites. The AEM survey conducted by DWR utilized an induced electrical current to determine the resistivity of subsurface materials at various depths. Contracted helicopter pilots flew “lines” across the state to collect resistivity data. Areas with low resistivity (3 – 10 Ohm-m) are associated with fine grained materials and/or saline water and areas with high resistivity (70 – 300 Ohm-m) are associated with coarse grained materials with fresh water. Sites with high resistivity values from AEM survey lines were preferred.

2.1.4. Landowner Cooperation

Successful groundwater recharge requires extensive cooperation from landowners. Landowners must be willing to allow diverted surface water to be applied to their land and be willing to operate temporary pumps to divert water during periods of high flow. In some cases, landowners must also be willing to allow modifications to their property to enhance recharge such as creating berms or shallow basins.

2.2. Sites Identified

Throughout 2024, various sites were identified by map reconnaissance and consultations with landowners in the Subbasin. Two specific sites, one along Simpson Road, hereafter known as the Simpson Road site, and Wolf Ranch, were identified. In addition to these specific sites, the Thomes Creek Water Users Association was identified as an area with potential for direct and in-lieu recharge utilizing existing diversion infrastructure.

3. SITE EVALUATION AND SELECTION

3.1. Simpson Road

3.1.1. Location and Land Use

The Simpson Road site is located between Thomes Creek and Simpson Road, northwest of the city of Corning. The site is directly adjacent to Thomes Creek. The main portion of the site consists of approximately 37 acres of former pasture which has since been left fallow. An additional 30 acres of former orchard land, also now fallow, lies directly to the east (see **Figure 3-1**). The site is generally flat, with a gentle slope northeast towards Thomes Creek. Photos of the site can be found in **Appendix A: Simpson Road Photos**.

As this site is directly adjacent to Thomes Creek, pump and piping requirements to divert water during high flow events will be minimal. Additionally, the site has access to distribution infrastructure from Corning Water District (CWD). This proximity allows the site to receive surface water from CWD, which obtains its water from the Sacramento River via the Corning Canal. This could provide a secondary source of recharge water for the property during periods of low flow on Thomes Creek.

As the site is currently unplanted, recharge operations would have no impact on current land use. Additionally, the gentle slope of the site allows for maximum spreading of applied water with minimal modification in terms of leveling and berm construction.

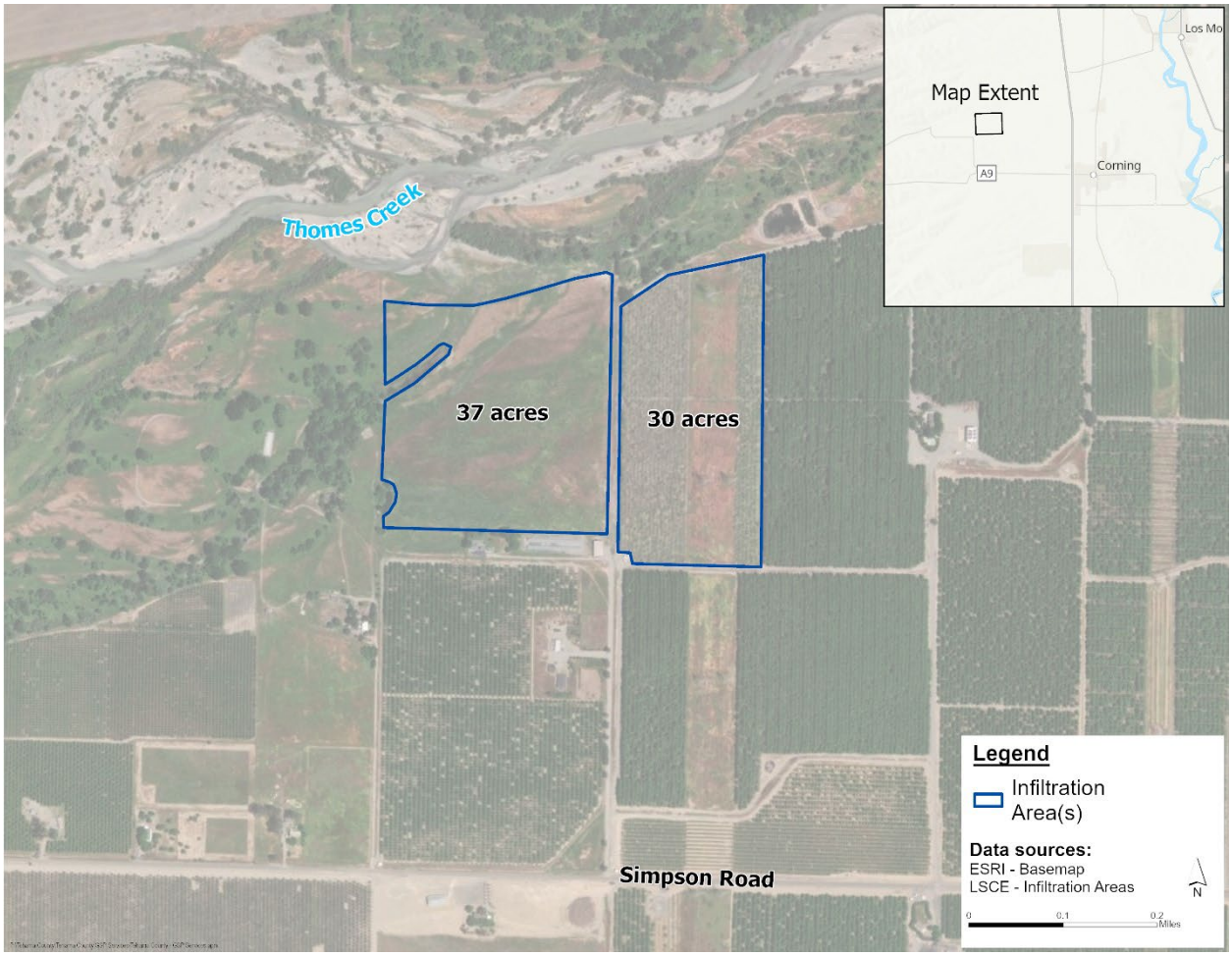

Figure 3-1. Simpson Road Site

3.1.2. Geology

The SAGBI ratings across the site vary from good to excellent (see **Figure 3-2**). AEM data was collected covering part of the site, with moderately high resistivity values recorded from the surface down to about 100 ft in depth (see **Figure 3-3**). Both data sets indicated a high probability that the site would rapidly infiltrate applied surface water.

Further investigation on the site was conducted as part of a multi-benefit pilot project. During the investigation, two pilot tests were carried out on the site with water obtained from CWD infrastructure. Rates observed during the long-term pilot study indicate that the site can infiltrate approximately 1 ft/day across the area of the site.

Following the pilot studies, a site-specific Towed Transient Electromagnetic (tTEM) survey of the site was conducted. This testing operates on the same principle as the AEM survey, but utilizing equipment towed across the ground. This testing gives more precise results about the granularity of sediments in the subsurface. This survey was conducted to determine subsurface flow paths that applied water would likely

take. The results of the survey indicate that applied water entering the subsurface will flow downwards and to the south.

Detailed results of the pilot testing and geophysical investigation can be found in the report “Multi Benefit Recharge Project Simpson Road, Corning” (LSCE, 2025).

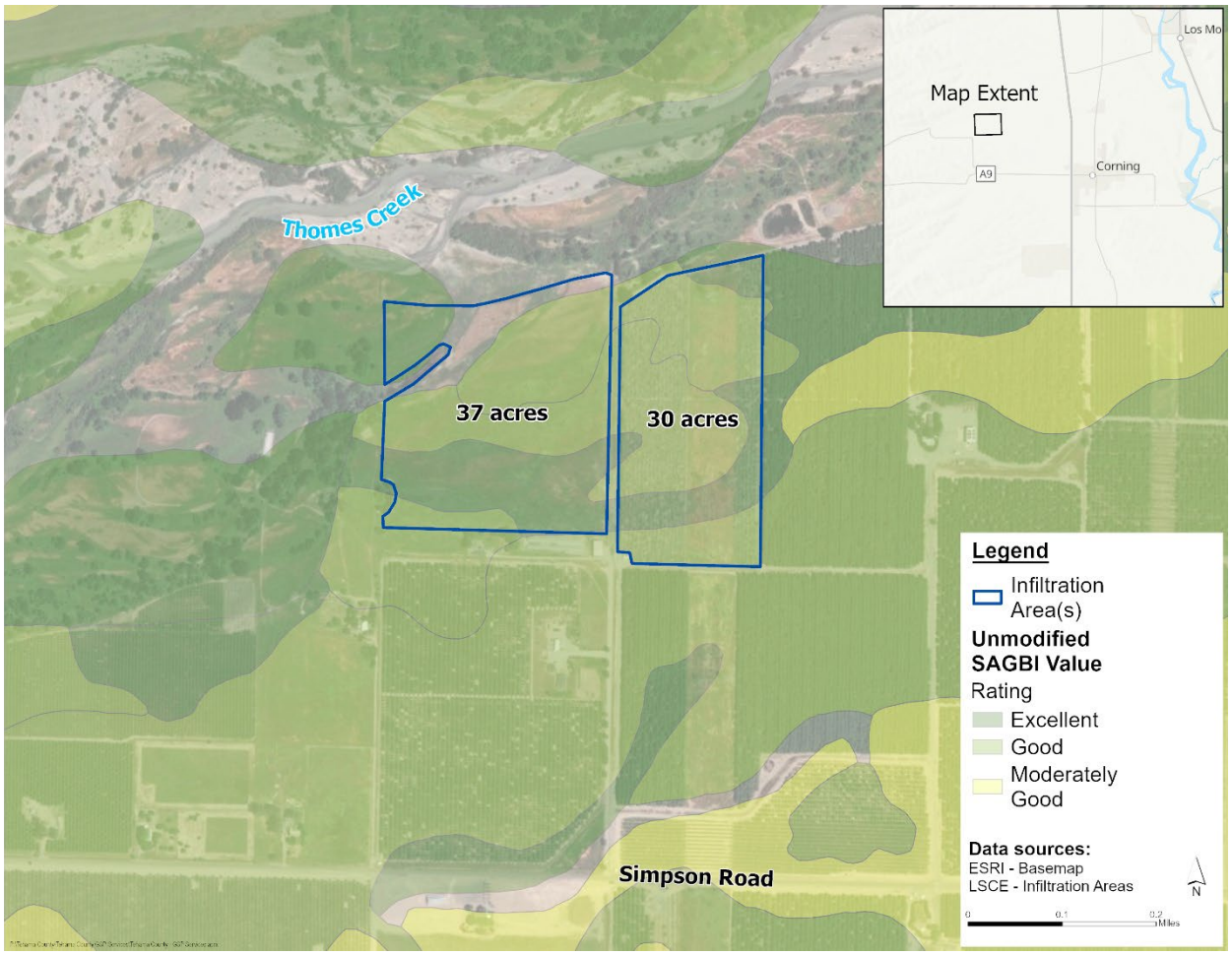

Figure 3-2. Simpson Road SAGBI

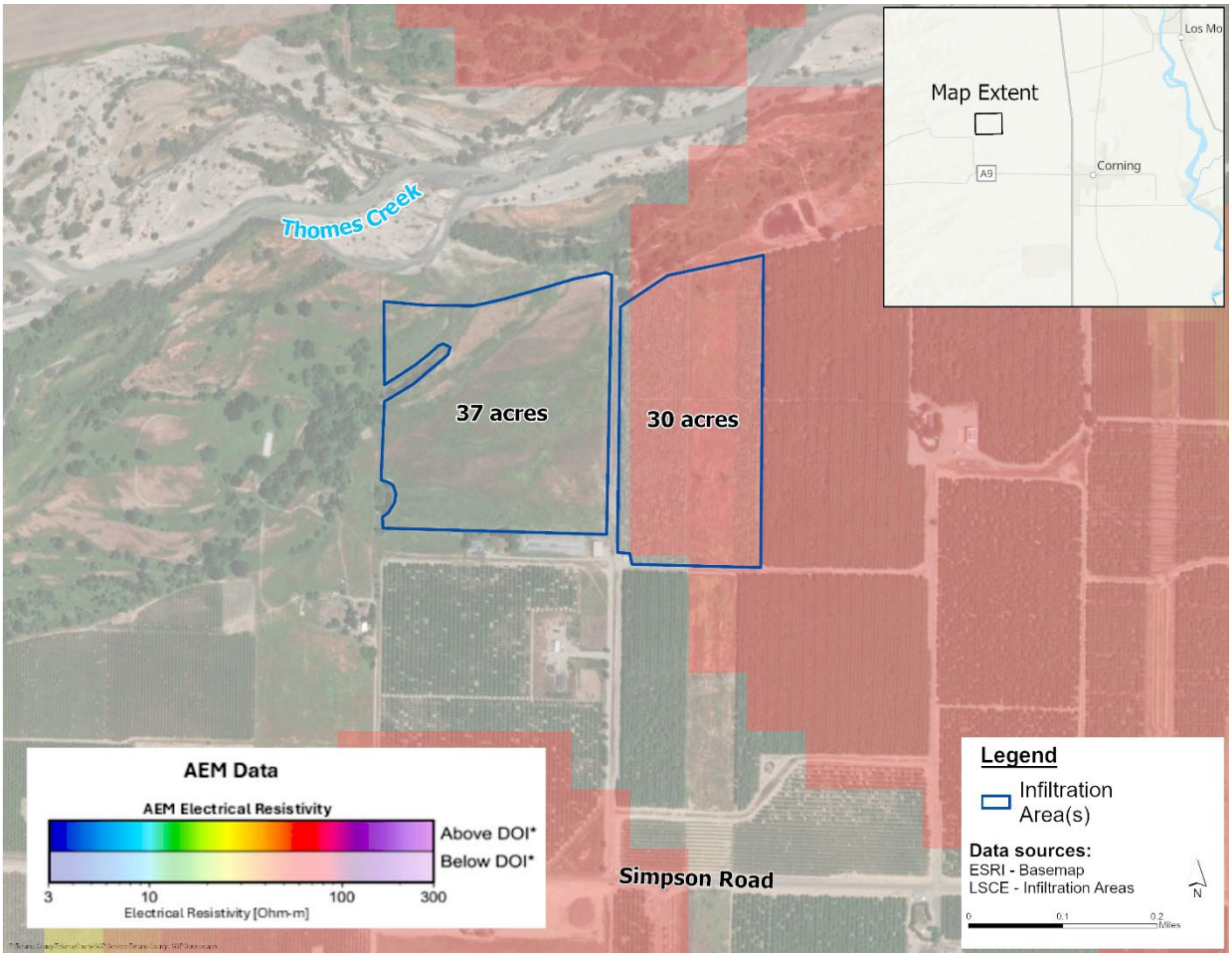

Figure 3-3. Simpson Road AEM 50-100 ft Depth

3.1.3. Landowner Cooperation

Throughout the process of site investigation and pilot testing, the landowners of the site have been cooperative and motivated to implement recharge on the site.

3.2. Wolf Ranch

3.2.1. Location and Land Use

The Wolf Ranch Site is located between the Corning Canal and Interstate 5 (I-5) on the south side of Thomes Creek. The site consists of approximately 69 acres of pasture and a former gravel pit (see **Figure 3-4**). The site has minor topographical variations including an unused drainage ditch and generally slopes east towards I-5. Additionally, the site has a levee on its northern edge, separating it from Thomes Creek. Photos of the site can be found in **Appendix B: Wolf Ranch Photos**.

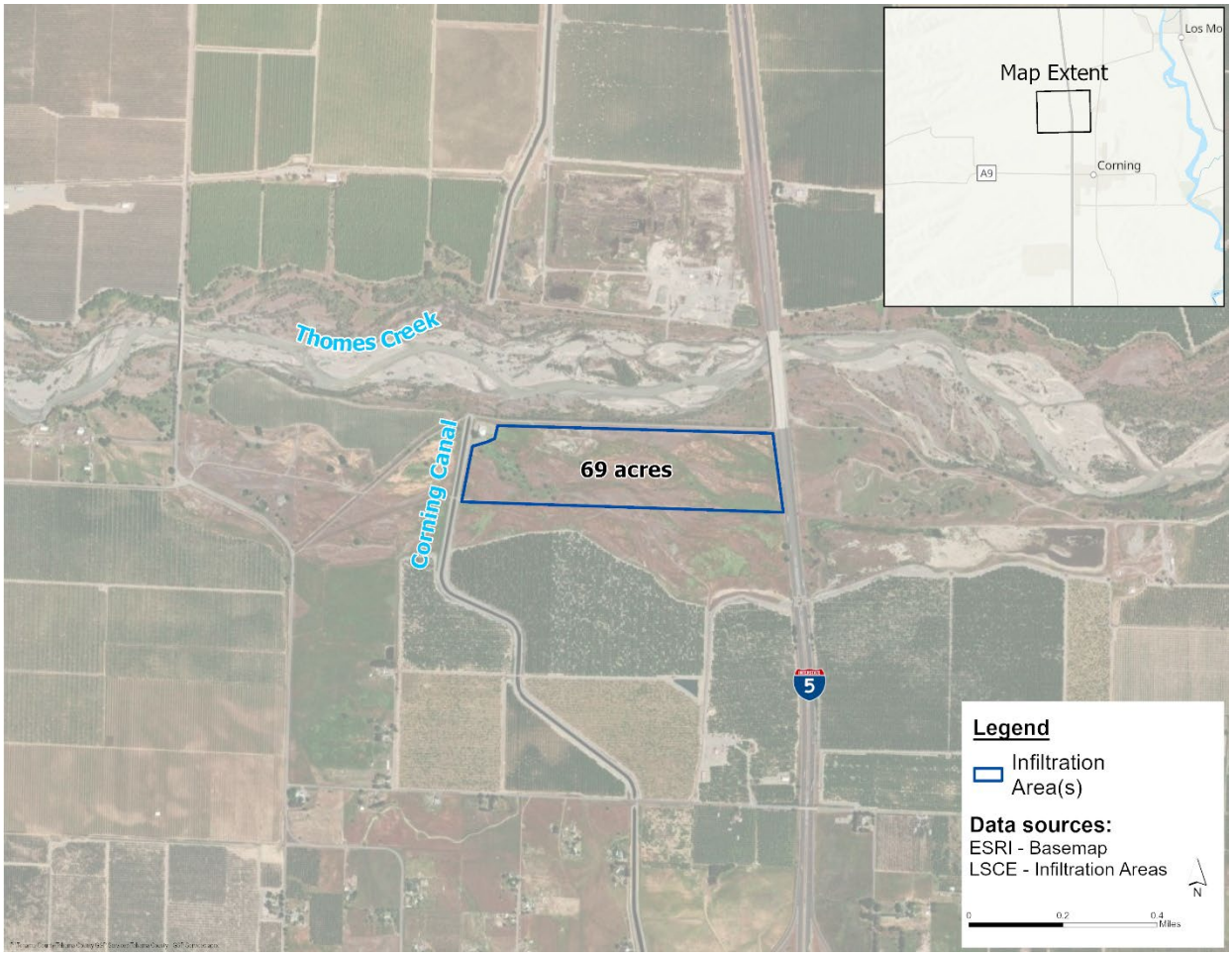

Figure 3-4. Wolf Ranch Site

The site is directly south of Thomes Creek, which will minimize pumping and piping requirements to divert from the creek. This location has the added benefit of proximity to the Corning Canal, which conveys water from the Sacramento River. This infrastructure could be utilized to obtain water from CWD if flows from Thomes Creek are not available.

The site is currently utilized as pasture, so recharge operations would have minimal impact on current land use. The topographical variations across the site will have minimal impact on the ability to spread water on the site and the levee on the north side will inhibit diverted water from flowing back towards the creek. Additionally, the existing gravel pit and ditch will likely positively impact the ability of the site to receive and infiltrate diverted water.

3.2.2. Geology

The SAGBI ratings across the site are generally excellent, with small areas rated as good (see **Figure 3-5**). AEM data was collected in lines adjacent to the site, with high resistivity values near the surface and

moderate resistivity values down to about 50 ft in depth (see **Figure 3-6**). Both data sets indicate a high probability that the site will rapidly infiltrate applied surface water.

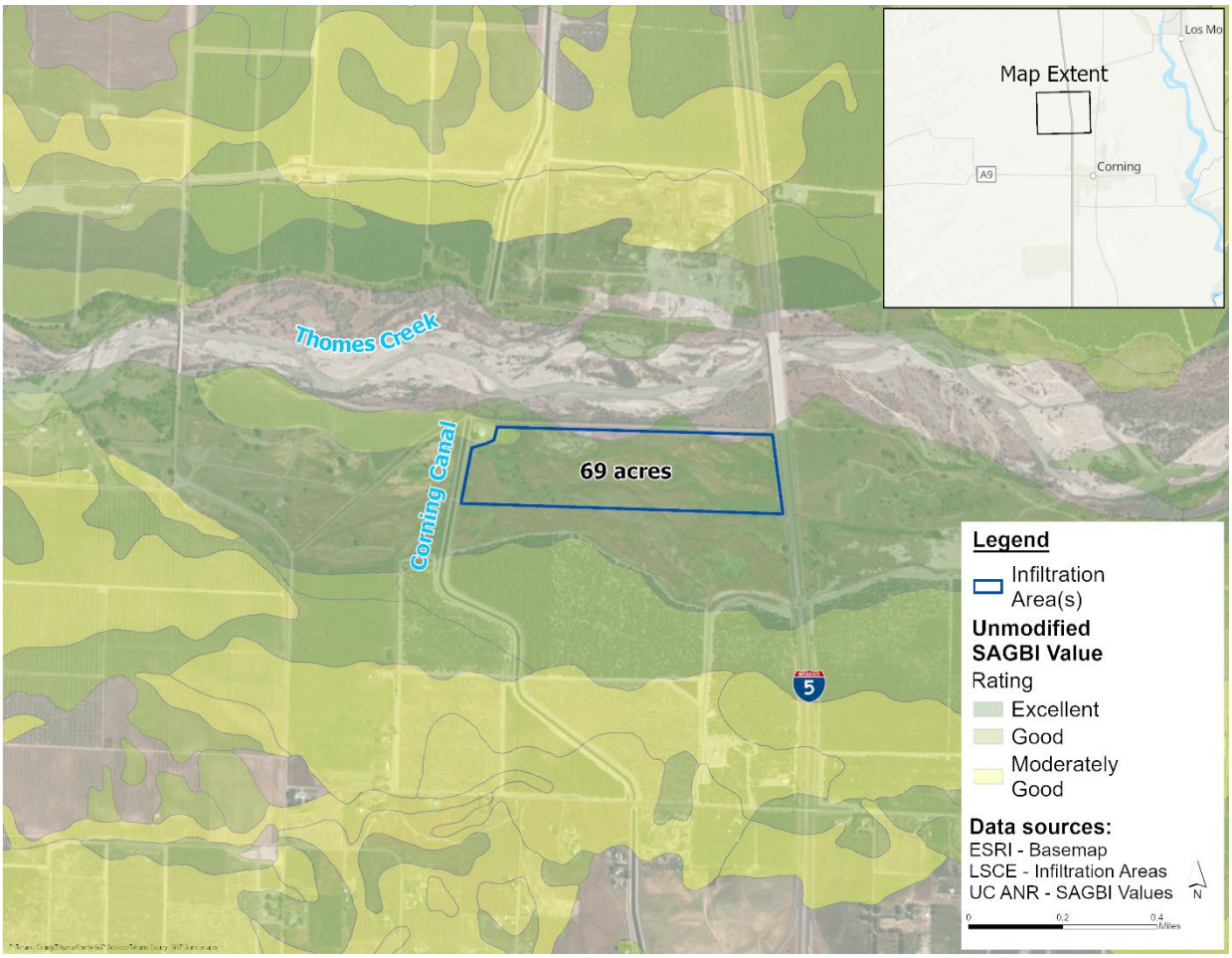

Figure 3-5. Wolf Ranch SAGBI

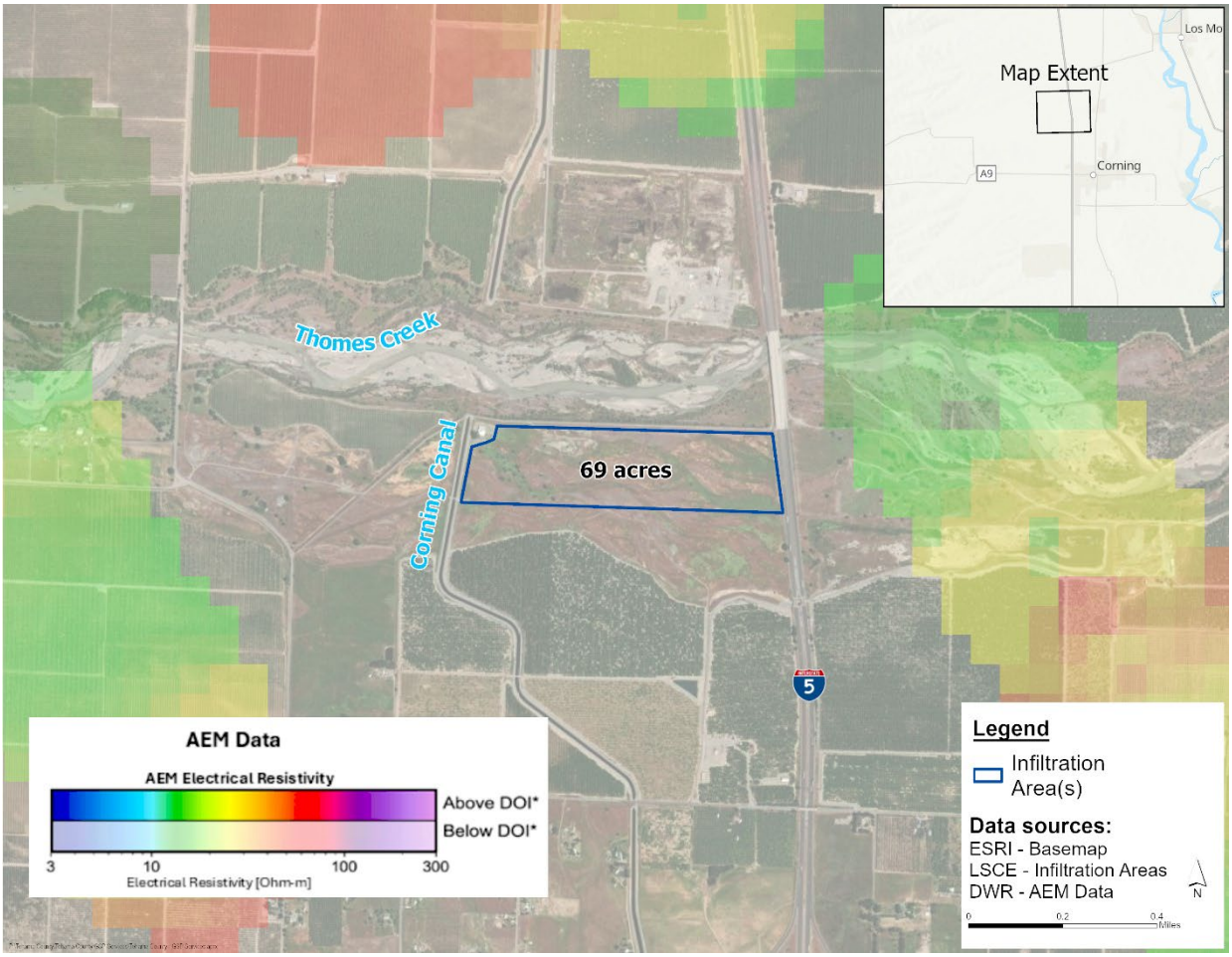

Figure 3-6. Wolf Ranch AEM 15-50ft Depth

3.2.3. Landowner Cooperation

Throughout the process of site investigation, the landowner has been cooperative and motivated to implement recharge on the site.

3.3. Thomes Creek Water Users Association

3.3.1. Location and Land Use

The Thomes Creek Water Users Association (TCWUA) is a collection of landowners along Thomes Creek who cooperatively maintain and operate a diversion off Thomes Creek to irrigate their lands. The centerpiece of the system is a main canal, approximately 6.3 miles long which directs flow from Thomes Creek via gravity flow. The area served by the TCWUA is significantly larger and more varied than the other two sites described previously. The area served by the TCWUA occupies the generally flat area on the south side of Thomes Creek about eight miles northwest of the city of Corning. A map showing the TCWUA canal and surrounding area are shown in **Figure 3-7**. The area generally flat and has a gradual slope

towards the east. Land use in the area consists mainly of a mixture of orchard crops, pasture and natural areas.

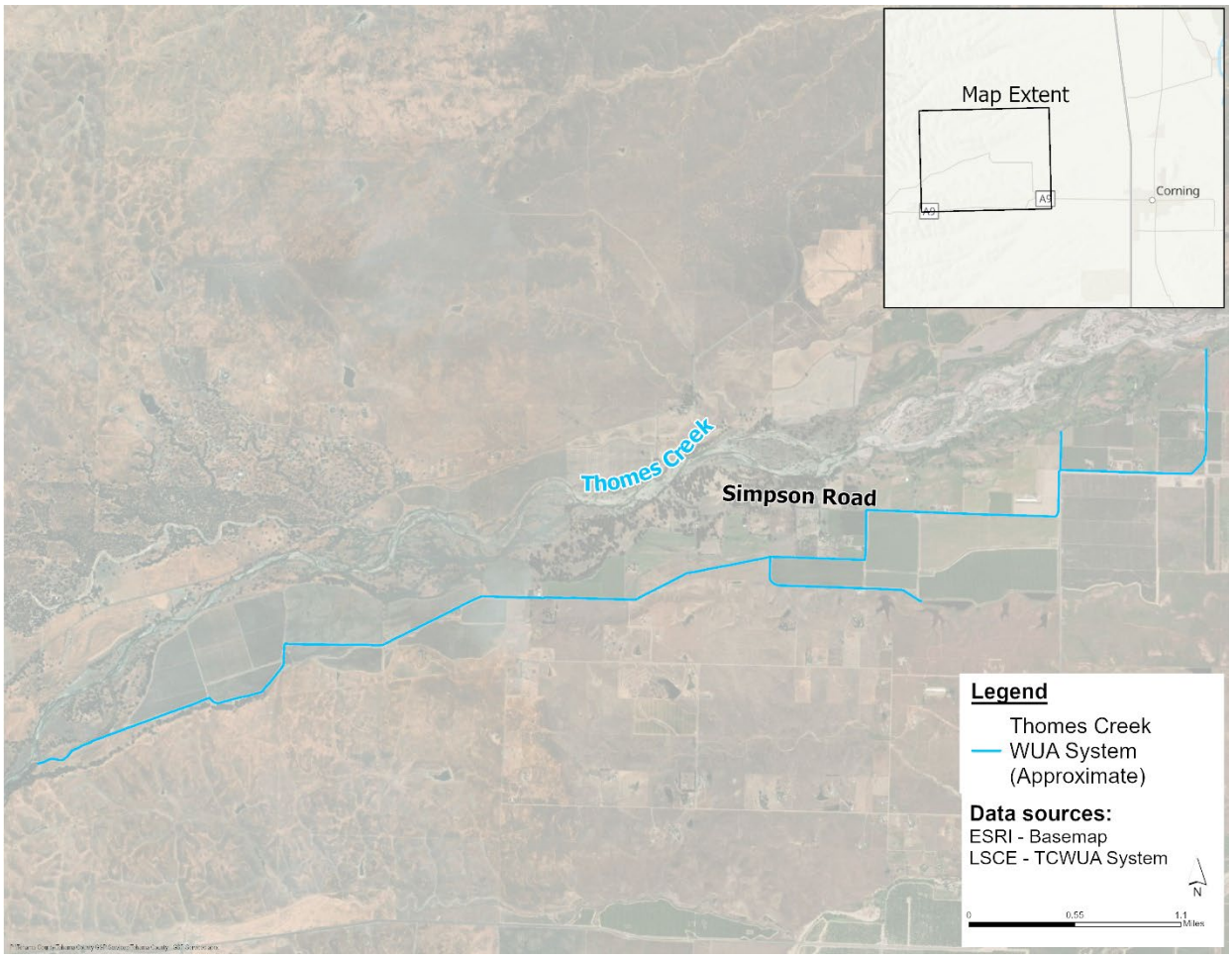

Figure 3-7. Thomes Creek Water Users Association Service Area

3.3.2. Geology

Due to its large size, SAGBI values vary across the area. However, the area is mostly classified as excellent or good, with small areas of moderately good classification (see **Figure 3-8**). AEM data collected over the area consists of multiple lines. The resistivity values across the area were moderately high to moderate down to about 100 ft (see **Figure 3-9**). Both datasets indicate potential for rapid infiltration of applied surface water, likely with some variation across the area.

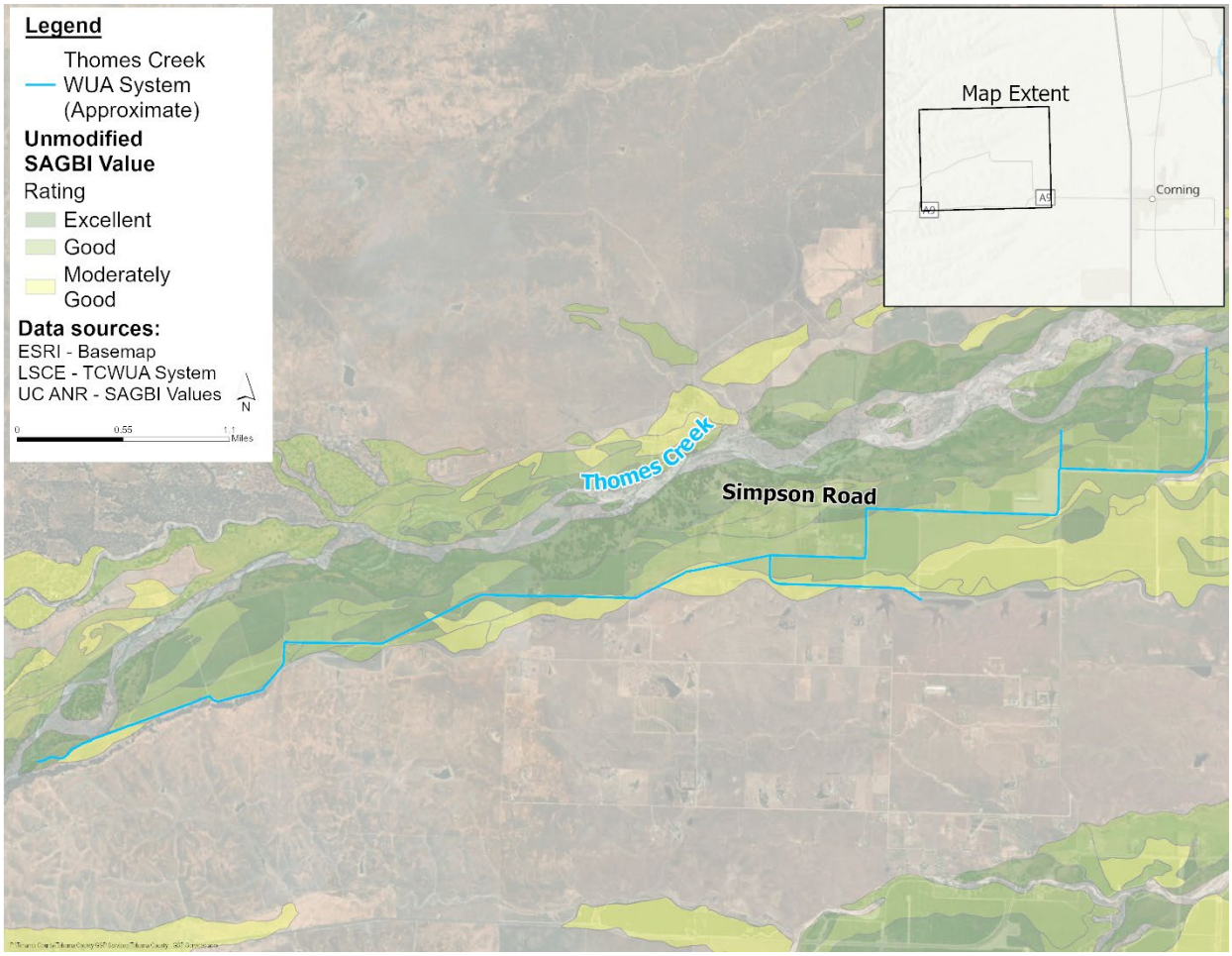

Figure 3-8. Thomes Creek Water Users Association SAGBI

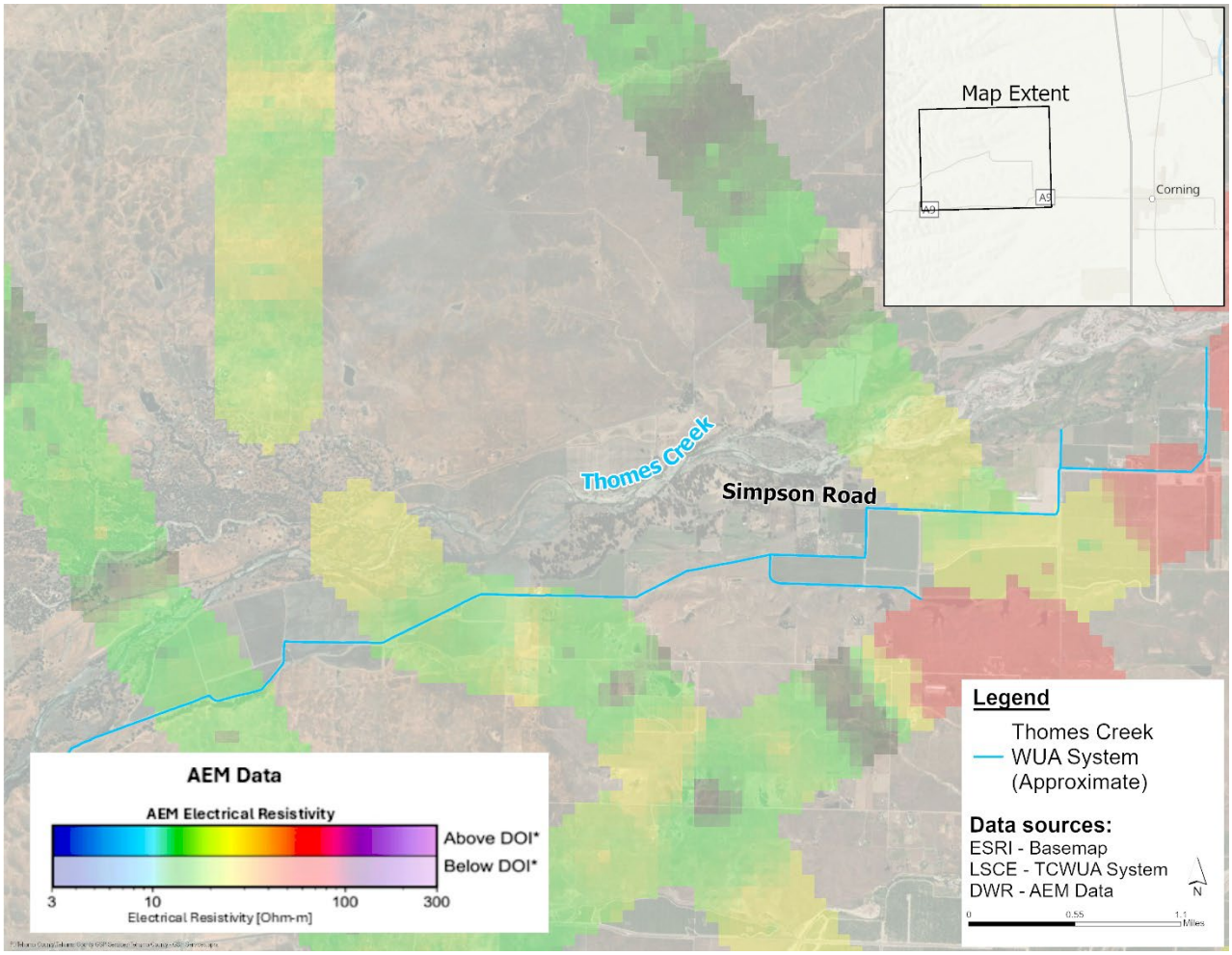

Figure 3-9. Thomes Creek Water Users Association AEM 50-100 ft Depth

3.3.3. Landowner Cooperation

As stated previously, land ownership varies across the area. Discussions with representatives of the TCWUA have been productive. There is generally support for groundwater recharge projects in the area. There is also interest in securing funding for system improvements to increase the system capacity to fully utilize the TCWUA's existing water right for in-lieu recharge.

4. PERMITTING PROCESS

4.1. 5-Year Temporary Permits

With the exception of the TCWUA, the other sites identified along Thomes Creek do not have existing appropriative water rights. Appropriative rights allow water to be diverted for underground storage, and so are a necessary step in implementing recharge on these sites. The California State Water Resources Control Board (SWRCB) issues temporary (180-day or 5-year) permits, as well as permanent water rights.

Temporary permits, as the name suggests, are temporary in nature, but are significantly lower in cost and can be approved in a shorter time frame than permanent rights.

Additionally, temporary rights are generally granted under the streamlined recharge permitting criteria. These criteria generally follow the "90th Percentile, 20 Percent Method" wherein diversions are allowed when the waterway is at or above its 90th percentile of flow and the flow diverted is less than or equal to 20 percent of the total flow. These streamlined criteria allow for an expedited evaluation of the permit application. A water availability analysis (WAA) was conducted on Thomes Creek based on flows observed at the Thomes Creek at Paskenta stream gauge. The 90th Percentile Flow for each day during the diversion season (December through March) was calculated based on 28 years of data collected at the station. These values are shown in **Table 4-1**. Additionally, total potential monthly diversion volumes were calculated based on water year type and are shown in **Table 4-2**.

The Groundwater Sustainability Agencies (GSA) are in the process of applying for 5-year temporary water rights permits to implement further pilot recharge projects on the identified sites. The GSAs have determined that 5-year temporary rights are most advantageous in this instance due to the variability of flows on Thomes Creek from one year to the next. During the 5-year permit period, the GSA expects to conduct diversions on Thomes Creek and apply the diverted water to the sites. The viability of each of the sites will then be fully evaluated based on the performance of the sites. The ability of the sites to receive and infiltrate surface water, and the subsequent positive impacts on water levels in the Subbasin will be evaluated during these pilot projects. Information sheets for each site were generated to assist in the permit application process, which provide details on each site as well as locations identified to monitor positive impacts groundwater levels in the Subbasin. These information sheets can be found in **Appendix C**.

Table 4-1. Thomes Creek 90th Percentile Flow (CFS)

Day	December	January	February	March
1	829	2802	1201	988
2	718	544	1509	1007
3	726	628	1280	1085
4	459	1642	1383	1156
5	620	1397	1446	1139
6	636	1059	2233	1345
7	432	1219	2678	1034
8	667	2011	1617	863
9	559	1979	1555	911
10	1119	1456	1410	1435
11	1154	1896	1141	1039
12	619	2101	951	1069
13	722	1507	1035	1565
14	1007	1737	1448	1610

15	840	1987	987	1747
16	795	2058	1190	1420
17	855	2132	1468	1256
18	493	1892	1306	981
19	957	1361	1296	1062
20	969	1340	1649	1253
21	1040	994	1744	1333
22	1009	856	1143	1441
23	651	1141	1163	1170
24	417	844	908	1180
25	316	1097	667	1052
26	738	1377	869	878
27	2697	1223	1138	1014
28	2132	1301	1325	985
29	1563	1546		1056
30	2613	1188		937
31	5497	942		1022

Table 4-2. Thomes Creek Potential Diversion Volumes (acre-feet)

Water Year Type	December	January	February	March	Total
Wet	891	736	1,026	861	3,513
Above Normal	66	529	496	536	1,627
Below Normal	0	250	40	309	598
Dry	264	132	0	66	463
Critically Dry	197	0	74	99	370
All Years	373	366	392	417	1,548

4.2. Permanent Water Rights

Pending the success of the planned pilot projects on each site, the GSAs may opt to convert the temporary water rights permits to permanent rights. The process of applying for and receiving a permanent water right is significantly longer, more complex and costly. A permanent water right requires an in-depth analysis of water availability, and potential impacts to other water rights holders and wildlife at various diversion times and volumes. The advantages of a permanent water right, though, are significant. As the name implies, rights are permanent and do not require periodic re-application. Additionally, in-depth analysis of required in-stream flows may indicate that diversions can be made at lower than 90th percentile flows. This would allow diversions to happen more often, and potentially outside the normal diversion

time period of December through March. It is expected that permanent water rights will only be pursued in cases where pilot projects indicate that diversions will have a significant positive impact on the subbasin.

5. NEXT STEPS

5.1. Permitting

A 5-year temporary permit for diversions from Thomes Creek is currently in progress. The GSA will be the permittee, as the diversions for recharge are to benefit the subbasin as a whole. The provisions of the permit will include both the Simpson Road site and Wolf Ranch (as well as a site on the north side of Thomes Creek in the Red Bluff Subbasin) as points of diversion. The GSA anticipates that a permit will be issued in time for potential diversions as early as December 2025. This permit will be in place for 5 years, allowing ample opportunity for diversions for pilot testing.

5.2. Pilot Testing

Following the issuance of the permit, diversions can be made as soon as diversion criteria are met. These diversions will be made via temporary pumps. Pilot testing will consist of various data collection efforts. Measurements of total diversions will be made throughout the diversion season via flow meters on the temporary pumps. Additionally, water depth transducers may be utilized to determine infiltration rates at various points across the sites, depending on specific site conditions. Finally, water levels in nearby wells will be recorded, either by manual measurements or via continuous monitoring equipment. These water levels will be compared with values from more distant wells to determine if recharge operations are having a measurable positive impact on water levels in the subbasin.

5.3. Construction

5.3.1. Simpson Road

As stated in the previous section, temporary pumps and piping will be used for pilot testing on the site. However, based on the results of the multi-benefit pilot project on the site, some minimal construction on this site prior to pilot testing would also be beneficial. Minor leveling and construction of berms on the site would maximize the ability to apply and spread water on the site and prevent surface flow back towards Thomes Creek. If pilot testing is successful on the site, more permanent structures for diverting and directing flow from Thomes Creek will be investigated.

5.3.2. Wolf Ranch

A temporary pump and piping will be used on the Wolf Ranch site to direct water to the recharge area. Based information gathered during site visits, it is not anticipated that any earthmoving will be required to direct and contain surface water on the site. During the pilot testing phase, the site will be observed to determine if any modifications to the site are necessary to encourage spreading and infiltration of applied water. If pilot testing is successful on the site, more permanent structures for diverting and directing flow from Thomes Creek will be investigated.

5.3.3. Thomes Creek Water Users Association

The TCWUA has existing diversion and distribution infrastructure which is capable of diverting flows from Thomes creek and delivering them to its service area via gravity flow. However, bottlenecks at various locations throughout the distribution network limits the overall capacity of the system. Work to improve system capacity would consist of debris and vegetation removal, and reshaping ditch channels and resizing control structures and culverts to ensure proper gradient and flow capacity. In addition to systemwide improvements, benefits could be gained from specific projects to connect parcels within the service. Installing additional control structures, booster pumps, filters and other infrastructure would allow for surface water use for both in-lieu and direct groundwater recharge.

6. REFERENCES

Luhdorff & Scalmanini Consulting Engineers (LSCE). 2025. “Multi Benefit Recharge Project Simpson Road, Corning.” Prepared for Tehama County FCWCD & Corning Subbasin GSA.

Appendix A: Simpson Road Photos

Esteve Property- Recharge Area

Esteve Property- Recharge Area
(during multi-benefit pilot project Oct-Nov 2024)

Appendix B: Wolf Ranch Photos

Wolf Ranch- Recharge Area

Wolf Ranch- Recharge Area

Wolf Ranch- Recharge Area

Wolf Ranch- Recharge Area

Wolf Ranch- Diversion Point

Appendix C: 5-Year Permit Information Sheets

Simpson Road

Information Package

This information package is intended to support the preparation of a 5-year temporary diversion permit to conduct groundwater recharge on the Simpson Road site. The information contained herein was gathered through site visits, analysis of the subject property through publicly available datasets, and input from the landowner. This package contains a table of site information gathered from visits to the location and communication with the landowner, calculations of potential recharge, information about wells, maps, and photos of the site.

The proposed project is located within the Corning Subbasin. The project consists of diversion of flood waters from Thomes Creek during periods of high flow. The land identified for infiltration is currently fallow farmland that has historically been pasture (**Table 1**). The infiltration area on the property is approximately 37.4 acres and has shown to be able to infiltrate water at a rate of up to 1 feet of water per day, or a total of around 37 acre-feet per day (**Table 2**). A water availability analysis of Thomes Creek indicates that between the months of October and March (when diversions are expected to occur), diversions could occur from between 19 days in Wet years and 2 days in Dry Years. Potential recharge is estimated to be between 703 acre-feet in Wet years and 74 acre-feet in Dry years (**Table 3**). Groundwater monitoring during recharge operations will be carried out on Three (3) wells near the property to capture both the influence of recharge operations and background conditions. Details for the wells are depicted in **Table 4**.

Table 1: Site Information

Historic Land Use	Fallow, pasture
Current Land Use of Recharge Area	100% fallow
Recharge Area	37.4 acres
Last Fertilization Date	N/A
Landowner Contact Information	Matt Esteve

Table 2: Potential Recharge Calculations

Project Name	Infiltration Site	Water Source	Infiltration Area (acres)	Infiltration Rate (observed ft/day)	Potential Total Amount Infiltrated (AF/Day)
Simpson Road	Multi Benefit	Thomes Creek	37.4	1	37

Table 3: Annual Recharge Estimates

Water Year Type	Total Expected Diversion Days	Potential Total Amount Recharged (AF/Year)
Wet	19	703
Above Normal	11	407
Below Normal	4	148
Dry	2	74
Critically Dry	3	111

Table 4: Wells

Well Identifier	Latitude	Longitude	Total Depth (ft)	Shallowest Screened Interval (ft bgs)	Purpose
8859	39.9628151°N	122.2769942°W	910	320-340	Direct Monitoring
24N04W02_902147	39.96065943°N	122.27798815°W	175	95-175	Direct Monitoring
24N04W02_502728	39.95556961°N	122.29113199°W	175	120-140	Background

Wolf Ranch

Information Package

This information package is intended to support the preparation of a 180-day diversion permit to conduct groundwater recharge on the Wolf Ranch Property. The information contained herein was gathered through site visits, analysis of the subject property through publicly available datasets, and input from the landowner. This package contains a table of site information gathered from visits to the location and communication with the landowner, calculations of potential recharge at the site, maps of the site and photos of the site.

The proposed project is located within the Corning Subbasin. The project consists of diversion of flood waters from Thomes Creek during periods of high flow. The land identified for infiltration is currently rangeland used for cattle grazing (**Table 1**). The infiltration area on the property is approximately 68 acres and is estimated to be able to infiltrate water at a rate of up to 2 feet of water per day, or a total of 136 acre-feet per day (**Table 2**). A water availability analysis of Thomes Creek indicates that between the months of October and March (when diversions are expected to occur), diversions could occur from between 19 days in Wet years and 2 days in Dry Years. Potential recharge is estimated to be between 2584 acre-feet in Wet years and 272 acre-feet in Dry or Critically Dry years (**Table 3**). Groundwater monitoring during recharge operations will be carried out on five (3) wells on and adjacent to the property to capture both the influence of recharge operations and background conditions. Details for the wells are depicted in **Table 4**.

Table 1: Site Information

Historic Land Use	grazing / pasture
Current Land Use of Recharge Area	100% grazing / pasture
Recharge Area	68 acres
Last Fertilization Date	Not fertilized
Landowner Contact Information	Hal Crain

Table 2: Potential Recharge Calculations

Project Name	Infiltration Site	Water Source	Infiltration Area (acres)	Infiltration Rate (estimated ft/day)	Potential Total Amount Infiltrated (AF/Day)
Wolf Creek Ranch	Main	Thomes Creek	68	2	136

Table 3: Annual Recharge Estimates

Water Year Type	Total Expected Diversion Days	Potential Total Amount Recharged (AF/Year)
Wet	19	2584
Above Normal	11	1496
Below Normal	4	544
Dry	2	272
Critically Dry	3	408

Table 4: Wells

Well Identifier	Latitude	Longitude	Total Depth (ft)	Shallowest Screened Interval (ft bgs)	Purpose
Corning #2	39.972133°N	122.225819°W			Background
Wolf Ranch Domestic	39.973729°N	122.213845°W	Unknown	Unknown	Direct Monitoring
WCR2012-000469	39.9696°N	122.1858°W	140	120-140	Background