NORTHERN DELTA-MENDOTA REGION PUMPING REDUCTION PLAN

DRAFT | October 2024

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Prepared for:

Northern Deta-Mendota Region Management Committee

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1 INTRODUCTION

The Northern Delta Mendota Region Management Committee (Committee) has developed this Pumping Reduction Plan (PRP) in accordance with Section 16.1 of the 2024 revised Groundwater Sustainability Plan (2024 GSP) for the Delta Mendota Subbasin (Basin). The PRP addresses the following six required components of the 2024 GSP:

(1) Monitoring and Data Collection Plan,
(2) Overdraft Mitigation Plan,
(3) Groundwater Level Minimum Threshold (GWL-MT) Avoidance Plan,
(4) Water Quality Minimum Threshold (WQ-MT) Exceedance Plan,
(5) Subsidence Avoidance Plan, and
(6) Groundwater Allocation Backstop.

This PRP is applied to the five groundwater sustainability agencies (GSAs) forming the Committee (member GSAs), namely the City of Patterson GSA (City GSA), DM-II GSA, Northwestern Delta-Mendota GSA (NW-DM GSA), Patterson Irrigation District and Twin Oaks GSA (PID GSA), and West Stanislaus Irrigation District (WSID GSA).

For applicable PRP components, specific triggers and procedures are defined. These include an entry trigger to activate the PRP, a zone of impact (ZOI) to determine where the PRP will be applied, a cutback approach to provide quantitative estimates of pumping reductions, an exit trigger to conclude the cutback once objectives are met, and enforcement measures to ensure successful implementation. Additional monitoring and reporting requirements are outlined in each component, aligning with the Monitoring and Data Collection Plan.

Although the Committee has worked diligently to create this plan in support of achieving the 2024 GSP sustainability goals, the PRP is designed as a living document. It will be updated and adapted as new data and information become available to better serve the Committee and the Basin in achieving its sustainability goal.

2 MONITORING AND DATA COLLECTION PLAN

In accordance with Section 16.1 of the 2024 GSP, the Monitoring and Data Collection Plan developed by each GSA or GSA Group must include commitments and strategies for achieving the eight components outlined in Table 1. The Committee members have committed to meeting all these requirements as detailed in Table 1.

Table 1. Scheduled Compliance With the Requirements of the Monitoring and Data Collection Plan

Requirement	Commitment
Regular monitoring network(s) assessment	To be conducted on a regular basis, at least once annually, by the Committee
Quarterly groundwater level monitoring	To be implemented starting Fall 2024
Semiannual water quality monitoring	To be implemented starting Fall 2024
Well registration policy	All members will have adopted policies prior to January 2025
Well metering policy	
Well extraction reporting policy	To be measured and reported at least annually, or more frequently as needed by other plans, starting January 2025, and based on metered pumping starting January 2026
Provide well construction information for all monitoring wells	Committee is already in compliance
Replacing composite/production wells in the monitoring network with dedicated monitoring wells by 2030	Committed to complete by 31 December 2029, as-needed

3 OVERDRAFT MITIGATION PLAN

3.1 Objective and Requirement

The member GSAs are required to reduce their average pumping, based on the overdraft evaluation period (Water Year [WY] 2003 to WY 2023), by approximately 9,000 acre-feet per year (AFY) in the Lower Aquifer by 2030. The 2024 GSP mandates achieving this reduction through an annual minimum of 20% of the total apportioned pumping cut, beginning in January 2025 and continuing each year for the following five years.

3.2 Implementation Approach

Each member GSA will reduce its pumping from the Lower Aquifer from the Model-estimated pumping for WY 2019-2023, as shown in Table 2. Pumping reduction under this plan may be adjusted and adapted based on model updates and the availability of additional data and measurements.

Table 2. Planned Lower Aquifer Pumping by 2030

Member GSA	Annual Pumping Reduction Starting in 2025 (AFY)	Target Pumping Reduction by 2030 (AFY)
City GSA	92	460
DM-II GSA	1,100	5,498
NW-DM GSA	194	968
PID GSA	83	417
WSID GSA	336	1,680
Total	**1,805**	**9,023**

3.3 Additional Monitoring and Reporting Requirements

Planned pumping reductions will be verified and adjusted through pumping estimation using ET products in 2025 and metered pumping after, conducted according to the Monitoring and Data Collection Plan.

3.4 Enforcement

The Groundwater Allocation Backstop will be enforced in cases of implementation lapses, with further actions governed by the dispute resolution mechanisms in the Basin GSAs' Memorandum of Agreement (MOA).

4 GROUNDWATER LEVEL MINIMUM THRESHOLD AVOIDANCE PLAN

4.1 Objective and Requirements

Member GSAs are required to identify GWL-MT hotspots based on defined triggers by the end of February each year and implement targeted pumping cutbacks, on an acre-foot per acre basis, for identified groundwater level representative monitoring wells (RMW-WL) within each principal aquifer. These cutbacks will be accompanied by increased monitoring frequency.

4.2 Cutback Entry Trigger

The occurrence of any of the following conditions at an RMW-WL triggers a GWL-MT cutback and requires pumping reductions:

- Exceedance of the GWL-MT, determined by comparing the most recent seasonal low measurement (Fall) to the defined MTs; OR
- Projected exceedance of the GWL-MT, based on the linear trend of the previous four Fall groundwater level measurements (using the seasonal average if multiple measurements are taken); OR
- A seasonal high (Spring) groundwater level measurement lower than the RMW-WL-specific spring target level. If insufficient data exists to establish a spring target level, the February GWL from the last year without a GWL-MT exceedance will be used as a substitute.

If multiple measurements are taken during a season, the average will be used for comparison. Spring target levels are defined for each RMW-WL by adding the respective GWL-MTs to the average seasonal variation, which is calculated as the long-term average (typically more than six years) difference between seasonal highs and lows at the RMW-WL.

4.3 Zone of Impact and Cutback Approach

The ZOIs around hotspot RMW-WLs will be delineated based on model simulations and validated through analytical calculations. These zones represent areas where groundwater pumping directly influences water levels at the RMW-WL. The ZOIs may extend beyond GSA boundaries and are defined using a sensitivity threshold, which quantifies the change in GWL at the RMW-WL in response to pumping variations in different well clusters.

Sensitivities will be calculated as the rate of GWL change per unit of pumping reduction. To achieve the desired groundwater level recovery, defined as the difference between the measured GWL and the trigger target, a uniform acre-foot per acre pumping limit will be identified. The cumulative impact of the defined cutback across the ZOI will be assessed to estimate the overall recovery at the RMW using the estimated sensitivities. The objective is to minimize the total volume of pumping reduction while achieving the necessary groundwater level increase. The estimations of the ZOI and the cutback serve as starting points and will be adaptive. Curtailment adaptation follows the 3-month rolling linear trend of groundwater levels, proportionally increasing or decreasing curtailment based on the difference between the slopes of the rolling 3-month trend and the trendline ending in Fall or Spring target levels.

Following the determination in February of each year, the uniform acre-foot per acre pumping limit will be implemented by the respective GSA(s) throughout the ZOI through communications with the

applicable landowners/pumpers. Pumping within the ZOI and the need for any curtailment adaptation will be assessed by the respective GSA(s) on a quarterly basis to ensure compliance.

4.4 Cutback Exit Trigger

The pumping cutback may be exited upon occurrence of all of the following conditions:

- Cutbacks have been implemented for at least one water year (a period including consecutive Spring and Fall periods); OR
- Projected exceedance of GWL MT is projected to be avoided in the following year based on the linear trend calculated from the previous four Fall GWLs; OR
- An increasing spring level trend calculated based on the measurements made in the first quarter and Spring GWL has recovered to be above the Spring Target Level.

Following the determination that the exit trigger condition(s) have been met, the uniform acre-foot per acre pumping limit will be removed by the respective GSA(s) throughout the ZOI through communications with the applicable landowners/pumpers.

4.5 Additional Monitoring and Reporting Requirements

The GWLs and pumping within the ZOI will be measured monthly during the implementation of the pumping cutback. Measured data within the ZOI should be submitted to the Committee within two weeks of collection. All data reported should also be imported into the Basin DMS by the respective GSA(s). In the absence of metering, GSAs agree to report detailed surface water delivery data monthly, as applicable, and utilize monthly evapotranspiration products (such as OpenET) to estimate pumping.

4.6 Enforcement

The Groundwater Allocation Backstop will be enforced in cases of implementation lapses or if a GSA fails to implement policy within two quarters. Further actions will be governed by the dispute resolution mechanisms in the Basin GSAs' MOA.

5 WATER QUALITY MINIMUM THRESHOLD EXCEEDANCE PLAN:

5.1 Objective and Requirements

Member GSAs are responsible for identifying exceedances or projected exceedances of a WQ-MT. If such exceedances are linked to Basin management (pumping or recharge), GSAs must investigate the cause and, if necessary, design and implement appropriate mitigation measures, including pumping cutbacks or other strategies, to prevent future WQ-MT exceedances caused by Basin management.

The WQ-MT Plan triggers pumping cutbacks only when a direct relationship or convincing linkage is established between changes in water quality concentrations exceeding or projected to exceed their MTs and management actions of the GSAs in the Basin or changes in groundwater levels. In the absence of such correlations or due to data gaps, continued monitoring and data collection are prioritized. When necessary, pumping cutbacks are implemented using the same approach outlined in the GWL-MT Plan. A general framework of this plan is illustrated in Figure 1.

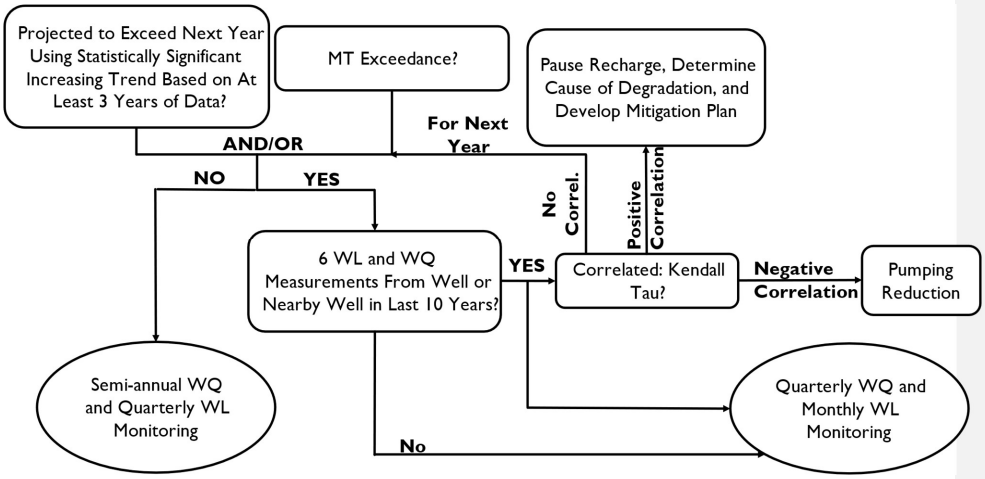

Figure 1. Investigation and Pumping Cutback Workflow for WQ-MT Plan

5.2 Investigation trigger

The occurrence of any of the following conditions at an identified groundwater quality representative monitoring well (RMW-WQ) triggers an investigation to assess the cause of the degradation and its correlation with groundwater level changes

- Exceedance of the WQ-MT, determined by comparing the most recent seasonal low measurement (Fall) to the defined MTs; OR
- Projected exceedance of the WQ-MT, based on a statistically significant linear trend of the previous three Fall groundwater level measurements (using the seasonal average if multiple measurements are taken).

The statistical significance of a linear trend is determined using the p-value of the linear model. A p-value of less than 0.05 is generally considered statistically significant, but this threshold can be adjusted based on sample size and professional judgment. It's important to note that the occurrence of an investigation trigger does not automatically necessitate the implementation of pumping cutbacks.

Commented [AM1]: With the number of samples we have in most wells, this condition will rarely be satisfied and may bother SWRCB if they review. I did not want to increase it unilaterally either, so opened the door for GSAs to make a judgment call if they actually observe a linear trend that makes sense to be addressed.

5.3 Investigation Approach

Respective GSAs are required to conclude an investigation within 60 days of reporting a WQ-MT investigation trigger and recommend next steps to be taken to the Committee. A Kendall Tau test will be used to assess potential correlations between water quality (WQ) and GWLs at a triggered RMW-WQ site. At least six WQ/GWL sample pairs from the same or nearby wells are required, with pairs consisting of samples collected within the same year and season (e.g., Fall of a specific year) or within a sufficiently close timeframe.[1] If there are not enough samples, monitoring will continue until sufficient data is available. For groundwater management projects (e.g., recharge facilities) with known operational changes, additional case-specific investigations will be performed.

A significant correlation is identified when at least six WQ/GWL measurements, taken within the last decade—including at least one from the current year—yield an absolute Kendall Tau coefficient ($|\tau|$) of 0.6 or greater and a p-value of 0.05 or less.[2] If a statistically significant correlation is not found or if the sample size is insufficient, more frequent sampling is implemented until a re-evaluation is possible. Otherwise, mitigation is triggered for the RMW-WQ and it is assigned as a WQ hotspot. A correlation between declining GWL and WQ prompts a reduction in pumping, while any correlation between GWL and WQ for recharge projects will require actions related to project implementation.

5.4 Mitigation Approach

Commented [AD2]: Is noticing to domestic/drinking water wells w/in 1-mile required?

Commented [AM3R2]: It is not required in the GSP and was not discussed. However, it can be helpful. I defer to GSAs to comment if they think we should add this here.

Commented [AM4]: We increased this from 60 to 90 days based on review of a few other mitigation plans.

Upon triggering mitigation, respective GSAs will have 90 days to propose a mitigation action plan to address increased concentrations of constituents of concern (COCs) and prevent future exceedances of WQ-MTs. The mitigation approach will depend on whether the trigger is caused by GWL declines due to pumping or by the implementation of projects and management actions (P/MAs), primarily recharge projects.

5.4.1 Mitigation for Degradation Due to Groundwater Level Decline

When WQ degradation is linked to GWL declines, a temporary GWL-MT hotspot is established at the RMW-WQ, or a nearby well with similar construction, to monitor and control conditions. The temporary GWL trigger is set to the previous year's seasonal high (average Spring water level). Pumping cutback is implemented following the GWL-MT process, based on the temporary GWL trigger set at the well, acting as the target level and the most current seasonal high measurement. Upon achieving the GWL target, the conditions will be reevaluated. If cutback exit trigger is not met (WQ is not stabilized), the WQ/GWL correlation will be re-investigated. If a significant correlation persists, further cutbacks should be implemented.

[1] In the absence of sufficient data or at the beginning of implementation, more flexible thresholds may be necessary, and samples from different years could be considered as pairs for the Kendall Tau test.
[2] The p-value of less than 0.05 is a typical threshold for hypothesis testing and statistical significance. These correlations can be loosened by the GSAs on an as-needed basis and based on professional judgment. It is recommended that depending on sample size and data available, a larger p-value is considered to be sufficient when a clear correlation can be observed from hydrographs.

5.4.2 Mitigation for Degradation Due to Recharge Projects

If it appears that the WQ-MT has been triggered by a recharge project, the investigation will determine if the degradation results from factors such as poor-quality recharge water, flushing of soil constituents, geochemical reactions, altered groundwater gradients, etc.

The respective GSA will submit a detailed mitigation plan to the Committee within the 90-day time frame. The recharge project must be paused during this period and until the exit trigger is met unless the GSA can justify successful mitigation through modified or continued operation. The plan should address the source of water quality degradation, identified in the investigation, and propose modifications to operations to mitigate incurred impacts. Throughout this period, WQ monitoring continues to ensure that any future triggers are addressed promptly. These actions aim to ensure a stable balance between groundwater recharge efforts and the protection of groundwater quality in the Basin, adapting as needed based on new data and observations.

5.5 Exit Trigger

Mitigation action (pumping cutback or mitigation plan) can be exited if any of the following occur:

- GWL target is met, and WQ at the hotspot RMW-WQ does not show a statistically significant increasing trend using the last three measurements; OR
- GWL target is met, and a significant correlation between WQ and GWL can no longer be established; OR
- Projected WQ at the RMW-WQ will not exceed the respective WQ-MT.

Commented [AM5]: This is different from the entry trigger since it includes all measurements not just Fall to allow GSAs to exist in sub-annual periods.

5.6 Additional Monitoring and Reporting Requirements

Monitoring will be generally conducted as outlined under the Monitoring and Data Collection Plan. If an investigation is triggered but insufficient data is available to conduct meaningful investigation and statistical correlation, WQ monitoring at the RMW-WQ will be increased to quarterly sampling for the specified COC, and GWL measurement will be increased to monthly. For any recharge project, regardless of trigger status, a minimum of quarterly WQ monitoring should be conducted at least in one upstream and one downstream well. Pumping should be measured monthly within the ZOI. All measurements and monitoring at the WQ hotspots should be reported to the Committee within two weeks. All data reported should also be imported into the Basin DMS by the respective GSA(s).

5.6.1 Enforcement

Enforcement of this plan is governed by the dispute resolution mechanisms in the Basin GSAs' MOA. When pumping cutbacks are implemented, enforcement mirrors the procedures used for GWL-MT violations. In such cases, failure to comply with implementation or a delay of more than two quarters will trigger the Groundwater Allocation Backstop.

6 SUBSIDENCE AVOIDANCE PLAN

6.1 Objective and Requirements

Member GSAs are required to proactively address progressing land subsidence that does not or is not projected to comply with the requirements of the 2024 GSP. The Subsidence Avoidance Plan has two components that lead to different requirements. The Critical Infrastructure Component only applies to critical infrastructure and includes areas around the Delta Mendota Canal (DMC) and California Aqueduct (Aqueduct) in the Northern Delta Mendota Region (Region). The Hotspot Mitigation Component applies to the entire Basin and will correspondingly apply to the entire Region.

6.2 Cutback Entry Trigger

The pumping cutback under the Subsidence Avoidance Plan is triggered under the following conditions for each component:

- **Critical Infrastructure Component**: the three-year average subsidence rate exceeds 0.2 feet per year (ft/year) within 0.5 miles of critical infrastructure (DMC and Aqueduct, shown in Figure 2)
- **Hotspot Mitigation Component:** The five-year linear trend established based on InSAR data indicates a projected subsidence of more than 2.0 feet by 2040 (MT), or more than 0.5 feet by 2030 (IM) or exceedance of any subsequent IM.

Triggers under both components will be based on subsidence caused by Basin management, or under conditions that such causality cannot be justifiably established.

6.3 Zone of Impact and Cutback Approach

6.3.1 Critical Infrastructure Component

The ZOI will be identified as areas where the three-year average subsidence rate exceeds 0.1 ft/year and is located within 0.5 miles of critical infrastructure or contiguous with such defined zone of exceedance. The ZOI is defined symmetrically on both sides of the infrastructure, to the extent possible and justifiable.

Pumping cutback starts at 0.35 AFY/acre (approximately the estimated sustainable yield for the Lower Aquifer in the Region)[3] within the ZOI. Pumping cutbacks are increased based on rolling annual average rates of subsidence to ensure reduction in subsidence. However, pumping cutbacks can only be decreased annually, based on rates calculated over the same period as the entry trigger. No new Lower Aquifer or Composite Wells are permitted within the ZOI until the exit trigger is met.

6.3.2 Hotspot Mitigation Component

The ZOI is defined as a radius of 0.5 miles around any point that meets the cutback entry trigger. Pumping cutbacks are initiated at a rate of 0.35 AFY/acre (approximately the estimated sustainable yield for the Lower Aquifer in the Region)[4] and adjusted based on rolling annual average subsidence rates.

[3] The Committee may adjust this limit upon availability of additional data and information.
[4] The Committee may adjust this limit upon availability of additional data and information.

If ZOIs defined under different components intersect, the largest overlapping area is subject to the most stringent criteria under the Subsidence Avoidance Plan. Adjustments to the pumping cutback under both components should be made based on the ratio of cutbacks to reduced subsidence achieved.

6.4 Cutback Exit Trigger

Pumping cutback under the Subsidence Avoidance Plan may be relieved if the conditions defined under each respective component below are met:

- **Critical Infrastructure Component**:
  - the four-year average subsidence rate within the ZOI is smaller than 0.1 feet per year (ft/year); OR
  - GSA(s) can sufficiently justify that subsidence is not caused due to pumping within ZOI, using multiple years of pumping measurement data gathered after the trigger.
- **Hotspot Mitigation Component:**
  - Subsidence due to Lower Aquifer Pumping attributable to Basin is eliminated; OR
  - The five-year linear trend established based on InSAR data no longer indicates exceedance of cumulative MT or Ims; OR
  - GSA(s) can sufficiently justify that subsidence is not caused due to pumping within ZOI, using multiple years of pumping measurement data gathered after the trigger.

Commented [AM6]: Added this upon further review.

Commented [AM7]: Added this upon further review.

6.5 Additional Monitoring and Reporting Requirements

Monthly pumping measurements and subsidence rates (if available) should be reported to the Committee within two weeks of collection. All data reported should also be imported into the Basin DMS by the respective GSA(s). If subsidence data is unavailable, quarterly reporting is sufficient. GWL measurements in the Lower Aquifer should be measured monthly within the ZOI and reported within two weeks of collection. The number of new Lower Aquifer or Composite wells within the ZOI should be reported monthly. For the purposes of the Subsidence Avoidance Plan, composite wells are conservatively considered Lower Aquifer wells for calculating pumping cutbacks and complying with other requirements, unless detailed data and information are provided to support a more precise apportionment and decision-making process. All data reported should also be imported into the Basin DMS by the respective GSA(s).

Commented [AD8]: INSAR is monthly correct?

Commented [AM9R8]: It is monthly, but I built it in here just in case.

6.6 Enforcement

The Groundwater Allocation Backstop will be enforced in cases of implementation lapses, or if a GSA fails to implement policy within two quarters. Further actions will be governed by the dispute resolution mechanisms in the Basin GSAs' MOA.

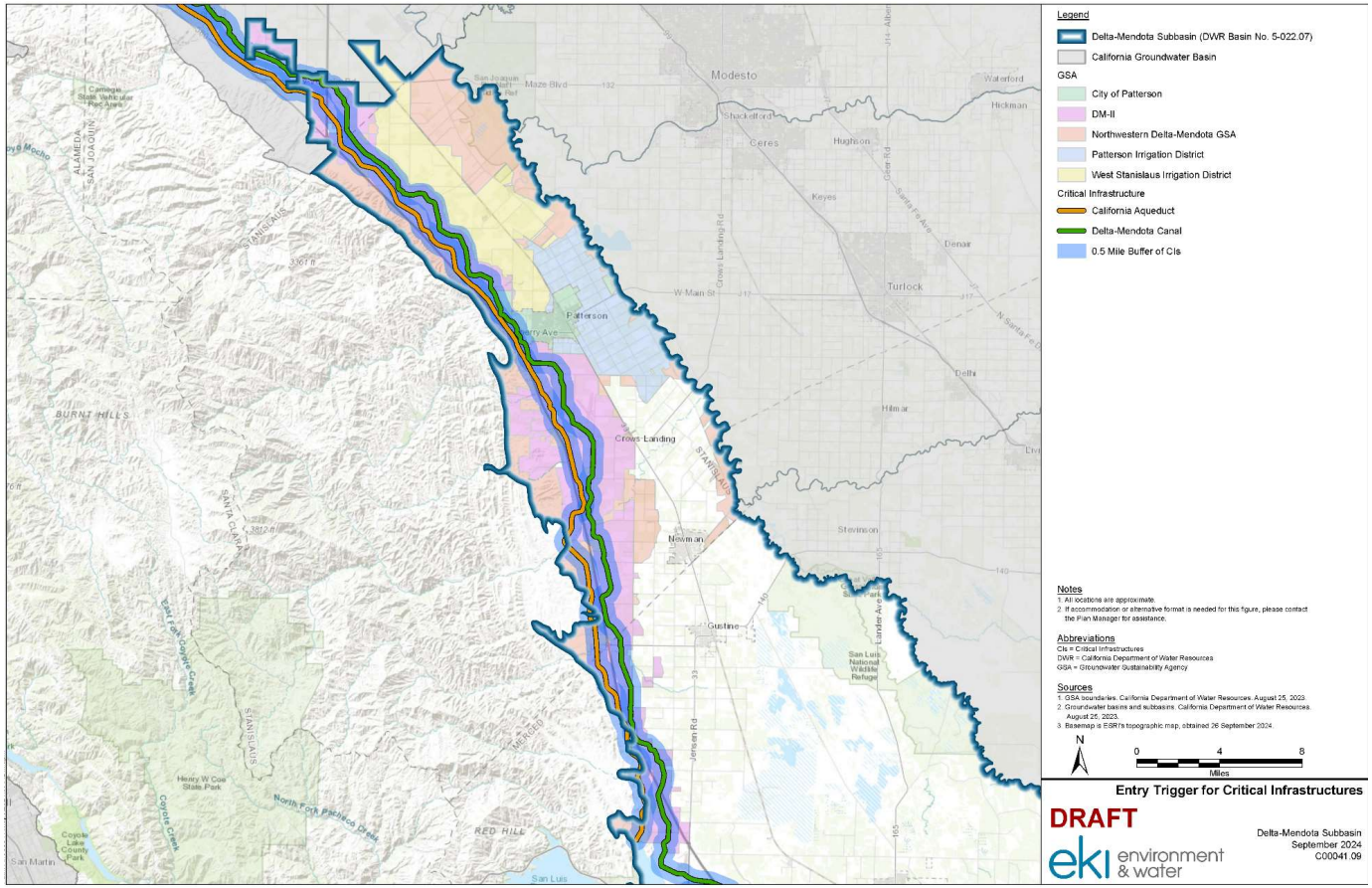

Figure 2. Area Around Critical Infrastructure Subject to Subsidence Avoidance Plan

7 GROUNDWATER ALLOCATION BACKSTOP

7.1 Objective and Requirements

In accordance with Exhibit C of the MOA, GSAs are required to implement the groundwater allocation backstop plan if they cannot sufficiently meet the requirements of the GSP 2024.

7.2 Cutback Entry Trigger

The occurrence of any of the following conditions will result in groundwater allocation backstop:

- GWL-MT exceedances for 2 consecutive years; OR
- Failure to achieve allocated Overdraft Mitigation pumping reduction by 2030; OR
- Failure to comply with the GWL-MT or GWQ-MT requirements.
- Failure to comply with the Subsidence Avoidance Plan requirements.

7.3 Zone of Impact and Cutback Approach

This plan applies to the entire service area of the GSA subject to it. Pumping within the subjected GSAs will be limited to the estimated sustainable yield for the Basin and implemented through AFY/acre allocations.

7.4 Additional Monitoring and Reporting Requirements

Monthly pumping measurements should be reported to the Committee within two weeks of collection. All data reported should also be imported into the Basin DMS by the respective GSA(s).

7.5 Enforcement

Enforcement of the groundwater allocation backstop is governed by the dispute resolution mechanisms in the Basin GSAs' MOA.