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DRAFT TECHNICAL MEMORANDUM

DATE: May 10, 2023 Project No.: 941-80-22-26

TO: Ground-Level Monitoring Committee

FROM: Andy Malone and Garrett Rapp

REVIEWED BY: Andy Malone

SUBJECT: Recommended Scope of Work and Budget of the Ground-Level Monitoring Committee for Fiscal Year 2023/24 **(FINAL)**

BACKGROUND AND PURPOSE

Pursuant to the Optimum Basin Management Program Implementation Plan and the Peace Agreement, the Chino Basin Watermaster (Watermaster) implements a Subsidence Management Plan (SMP) for the Chino Basin to minimize or stop the occurrence of land subsidence and ground fissuring. The Court approved the SMP and ordered its implementation in November 2007 (2007 SMP). The 2007 SMP was updated in 2015 (2015 SMP) and can be downloaded from the Watermaster website. The SMP outlines a program of monitoring, data analysis, and annual reporting. A key element of the SMP is its adaptive nature—Watermaster can adjust the SMP as warranted by the data.

The Watermaster Engineer, with the guidance of the Ground-Level Monitoring Committee (GLMC), prepares annual reports which include the results of the monitoring program, interpretations of the data, recommendations for the Ground-Level Monitoring Program (GLMP) for the following fiscal year (FY), and recommendations for adjustments to the SMP, if any.

This Technical Memorandum (TM) describes the Watermaster Engineer's recommended activities for the GLMP for FY 2023/24 in the form of a proposed scope of services and budget.

Members of the GLMC are asked to:

- Review this TM prior to March 2, 2023.
- Attend a meeting of the GLMC at 9:00 am on March 2, 2023 to discuss the proposed scope of services and budget for FY 2023/24.
- Submit comments and suggested revisions on the proposed scope of services and budget for FY 2023/24 to the Watermaster by March 24, 2023.
- Attend a meeting of the GLMC at 9:00 am on March 30, 2023 to discuss comments and revisions to the proposed scope of services and budget for FY 2023/24 (if necessary).

- Submit additional comments and suggested revisions on the proposed scope of services and budget for FY 2023/24 to the Watermaster by April 7, 2023.

The final scope of services and budget that is recommended by the GLMC will be included in the Watermaster's FY 2023/24 budget. The final scope of services, budget, and schedule for FY 2023/24 will be included in Section 4 of the *2022/23 Annual Report of the GLMC*.

RECOMMENDED SCOPE OF SERVICES AND BUDGET – FY 2023/24

A proposed scope of services for the GLMP for FY 2023/24 is shown in Table 1 as a line-item cost estimate. The proposed scope of services is summarized below.

Task 1. Setup and Maintenance of the Monitoring Network

The Chino Basin extensometer facilities are key monitoring facilities for the GLMP. They require regular and as-needed maintenance and calibration to remain in good working order and to ensure the recording of accurate measurements.

Task 1.1. Maintain Extensometer Facilities

This subtask includes performing monthly visits to the Ayala Park, Chino Creek, and Pomona extensometer (PX) facilities to ensure functionality and calibration of the monitoring equipment and data loggers. One additional staff member is required at the PX site due to safety concerns.

Non-routine efforts to be performed during FY 2023/24 under this subtask include:

- Monthly adjustments to the PX extensometers to improve the accuracy of the measurements of aquifer-system deformation.
- Repair of the top of the rusted casings at the Ayala Park piezometers.

Task 1.2. Annual Lease Fees for the Chino Creek Extensometer Site

The County of San Bernardino (County) owns the land the Chino Creek extensometer facility is located on. As such, the Watermaster entered into a lease agreement with the County in 2012 and pays the County and annual rental payment of $1,596.

Task 2. Aquifer-System Monitoring and Testing

This task involves the collection and compilation of hydraulic head and aquifer-system deformation data from the Ayala Park, Chino Creek, and Pomona extensometer facilities.

Task 2.1. Conduct Quarterly Monitoring at Extensometer Facilities

This subtask involves the routine quarterly collection and checking of data from the extensometer facilities. Quarterly data collection is necessary to ensure that the monitoring equipment is in good working order and to minimize the risk of losing data because of equipment malfunction. For this subtask, the complete extensometer and piezometer records from the Ayala Park, Chino Creek, and Pomona extensometer facilities will be loaded to HydroDaVE^{SM} (Hydrologic Database and Visual Explanations) and checked.

Table 1. Work Breakdown Structure and Cost Estimates for the Ground-Level Monitoring Program: FY 2023/24

Task Description			Notes	Labor (days)		Other Direct Costs						Totals			
				Person Days	Total	Travel	New Equip.	Equip. Rental	Outside Pro	Misc.	Total	Totals by Task	Recommended Budget *2023/24*	Approved Budget *2022/23*	Net Change *from 2022/23*
													a	*b*	*a - b*
Task 1. Setup and Maintenance of the Monitoring Network					**$39,821**						**$7,968**	**$47,789**	**$47,789**	**$35,470**	**$12,319**
1.1	Maintain Extensometer Facilities														
	1.1.1	Routine maintenance of Ayala Park, Chino Creek, and Pomona extensometer facilities		25	$32,509	$649	$250	$300			$1,199	$33,707	$33,707	$22,380	$11,327
	1.1.2	Replacement/repair of equipment at extensometer facilities		4	$7,312	$173	$2,500		$2,500		$5,173	$12,485	$12,485	$11,494	$992
1.2	Annual Lease Fees for the Chino Creek extensometer facility			0	$0					$1,596	$1,596	$1,596	$1,596	$1,596	$0
Task 2. MZ-1: Aquifer-System Monitoring and Testing					**$30,552**						**$904**	**$31,456**	**$31,456**	**$30,687**	**$768**
2.1	Conduct Quarterly Monitoring at Extensometers Facilities														
	2.1.1	Download data from the Ayala Park Extensometer facility		2	$2,640	$332		$60			$392	$3,032	$3,032	$3,059	-$27
	2.1.2	Download data from the Chino Creek Extensometer facility		2	$2,640			$60			$60	$2,700	$2,700	$2,778	-$78
	2.1.3	Download data from Pomona Extensometer facility		8	$10,040	$332		$120			$452	$10,492	$10,492	$5,853	$4,639
	2.1.4	Process, check, and upload data to database		10	$15,232						$0	$15,232	$15,232	$18,997	-$3,765
Task 3. Basin Wide Ground-Level Monitoring Program (InSAR)					**$6,560**						**$90,000**	**$96,560**	**$96,560**	**$90,472**	**$6,088**
3.1	Acquire TerraSAR-X data and prepare interferograms for 2023/24			1	$2,336				$90,000		$90,000	$92,336	$92,336	$86,892	$5,444
3.2	Check and review InSAR results			2.5	$4,224						$0	$4,224	$4,224	$3,580	$644
Task 4. Perform Ground-Level Surveys					**$7,728**						**$76,552**	**$84,280**	**$84,280**	**$38,241**	**$46,039**
4.1	Conduct Spring-2024 Elevation surveys in Northwest MZ-1			0.5	$1,168				$27,192		$27,192	$28,360	$28,360	$26,259	$2,101
4.2	Conduct Spring-2024 Elevation Survey in the Northeast Area			0	$0				$50,820		$0	$0	$0	$0	$0
4.3	Conduct Spring-2024 Elevation Survey in the Southeast Area			0	$0				$53,812		$0	$0	$0	$0	$0
4.4	Conduct Spring-2024 Elevation and EDM Surveys in the Managed Area/Fissure Zone			0.5	$1,168				$30,080		$30,080	$31,248	$31,248	$0	$31,248
4.5	Replace Destroyed Benchmarks (if needed)			0	$0				$19,280		$19,280	$19,280	$19,280	$5,650	$13,630
4.6	Process, Check, and Update Database			3	$5,392						$0	$5,392	$5,392	$6,332	-$940
Task 5. Data Analysis and Reporting					**$85,412**						**$0**	**$85,412**	**$85,412**	**$87,888**	**-$2,476**
5.1	Prepare Draft 2022/23 Annual Report of the Ground-Level Monitoring Committee			20	$36,136						$0	$36,136	$36,136	$34,124	$2,012
5.2	Prepare Final 2022/23 Annual Report of the Ground-Level Monitoring Committee			8.5	$15,732						$0	$15,732	$15,732	$19,993	-$4,261
5.3	Compile and Analyze Data from the 2023/24 Ground-Level Monitoring Program			14	$23,544						$0	$23,544	$23,544	$21,643	$1,901
5.4	Continue Whispering Lakes Subsidence Investigation			0	$10,000						$0	$10,000	$10,000	$12,129	-$2,129
Task 6. Develop a Subsidence-Management Plan for Northwest MZ-1					**$15,536**						**$0**	**$15,536**	**$15,536**	**$25,203**	**-$9,667**
6.1	Aquifer-System Monitoring														
	6.1.1	Collect pumping and piezometric level data from agencies every three months; check and upload data to HDX		8	$10,560						$0	$10,560	$10,560	$12,995	-$2,435
	6.1.2	Prepare and analyze charts and data graphics of pumping and recharge (Northwest MZ-1), piezometric levels, and aquifer-system deformation from PX		3	$4,976						$0	$4,976	$4,976	$12,208	-$7,232
Task 7. Construct and Calibrate Additional 1D Models Across Western Chino Basin					**$192,356**						**$155**	**$192,511**	**$192,511**	**$140,339**	**$52,173**
7.1	Prepare a draft TM summarizing the background, objectives, and methods; distribute to the GLMC			6.5	$12,760						$0	$12,760	$12,760		
7.2	Prepare for and conduct a GLMC meeting to receive feedback and comments on the draft TM		a	2.5	$5,032	$78					$78	$5,110	$5,110		
7.3	Verify and/or recalibrate the 1D Model at Ayala Park Extensometer location			12.5	$22,736						$0	$22,736	$22,736		
7.4	Construct two additional 1D Models in the Southeast Area and Northeast Area			35	$62,368						$0	$62,368	$62,368		
7.5	Calibrate new 1D Models to derive properties of aquifers/aquitards and estimate the pre-consolidation stress(es)			25	$45,472						$0	$45,472	$45,472	$140,339	$52,173
7.6	Prepare a draft TM summarizing the construction/calibration of additional 1D Models; distribute to the GLMC			20	$37,024						$0	$37,024	$37,024		
7.7	Prepare for and conduct a GLMC meeting to receive feedback and comments on the draft TM		a	2.5	$5,032	$78					$78	$5,110	$5,110		
7.8	Incorporate the GLMC comments and prepare a final technical memorandum			1	$1,932						$0	$1,932	$1,932		
Task 8. Meetings and Administration					**$58,866**						**$362**	**$59,228**	**$59,228**	**$54,559**	**$4,669**
8.1	Prepare for and Conduct Four Meetings of the Ground-Level Monitoring Committee		a	18	$32,352	$284					$284	$32,636	$32,636	$29,986	$2,651
8.2	Prepare for and Conduct One As-Requested Ad-Hoc Meeting		a	3	$5,392	$78					$78	$5,470	$5,470	$5,025	$445
8.3	Perform Monthly Project Management			6	$11,592						$0	$11,592	$11,592	$10,740	$852
8.4	Prepare a Recommended Scope and Budget for the GLMC for FY 2023/24			5.25	$9,530						$0	$9,530	$9,530	$8,808	$722
Totals					**$436,831**						**$175,941**		**$612,772**	**$502,860**	**$109,912**

Notes:

a Assumes in-person meetings.

Task 3. Basin-Wide Ground-Level Monitoring Program (InSAR)

This task involves the annual collection and analysis of Synthetic Aperture Radar (SAR) scenes to estimate the vertical ground motion across the western portion of Chino Basin from March 2023 to March 2024.

Task 3.1. Acquire TerraSAR-X SAR Data and Prepare Interferograms for 2023/24

In this subtask, five SAR scenes that will be acquired by the TerraSAR-X satellite from March 2023 to March 2024 are purchased from the German Aerospace Center. General Atomics (formerly Neva Ridge Technologies) will use the SAR scenes to prepare 12 interferograms that describe the incremental and cumulative vertical ground motion that occurred from March 2023 to March 2024 and since 2011. The associated costs to task, acquire, purchase, and process the InSAR data is as follows:

- Task TerraSAR-X for five SAR acquisitions for the western Chino Basin ($13,000)
- Purchase TerraSAR-X data ($18,000)
- Prepare InSAR results, including GeoTIFFs and GIS raster datasets ($59,000)

Task 3.2. Check and Review InSAR Results

In this subtask, the Watermaster Engineer reviews the InSAR results with General Atomics, performs checks for reasonableness and accuracy of the InSAR estimates of vertical ground motion across the western Chino Basin, and uploads the InSAR results to the GIS database.

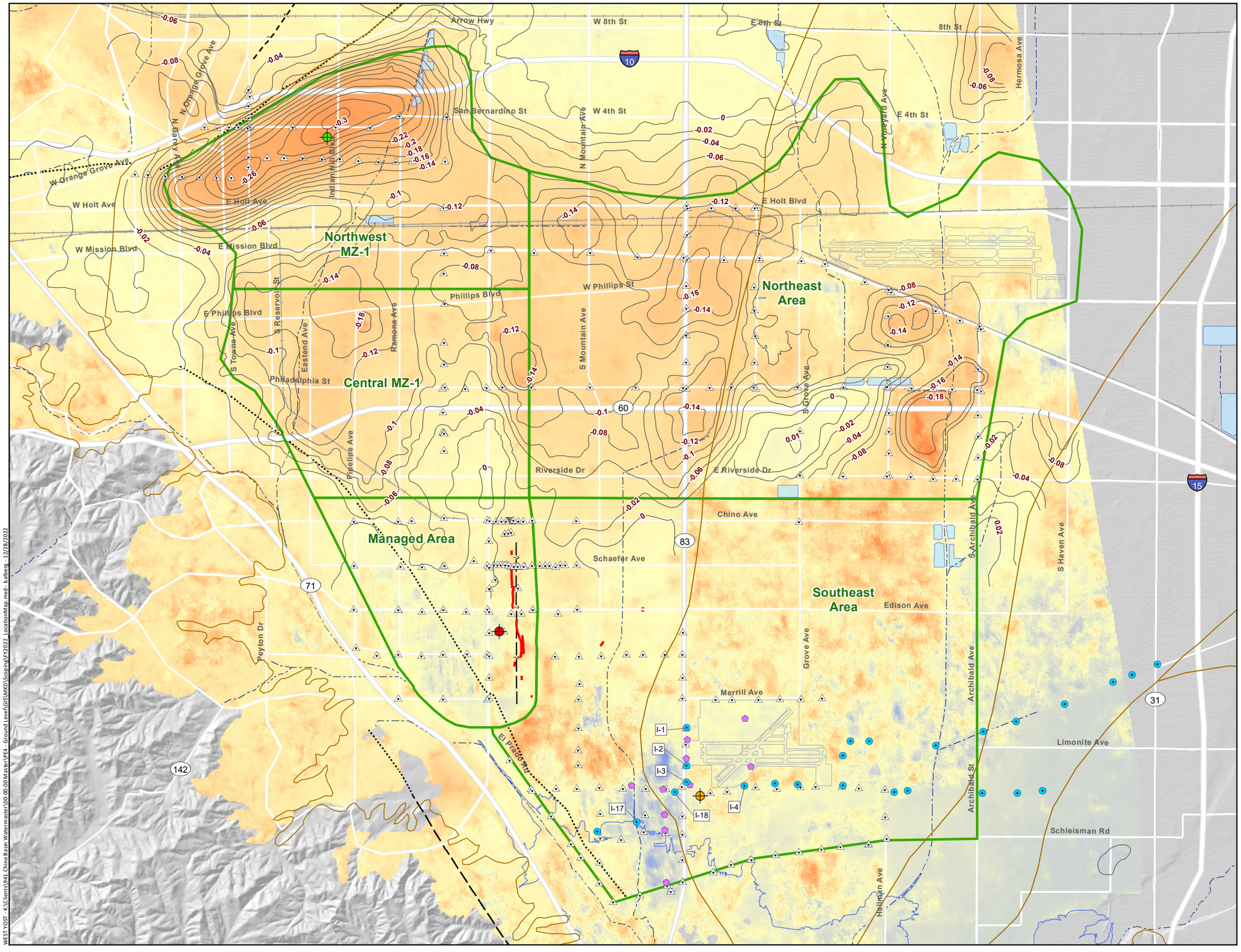
Task 4. Perform Ground-Level Surveys

This task involves conducting elevation surveys at benchmark monuments across defined areas of western Chino Basin to estimate the vertical ground motion that occurred since the prior survey. Figure 1 shows the location of the benchmark monuments surveyed across the western Chino Basin. Electronic distance measurements (EDM surveys) are also performed periodically between monuments to estimate horizontal ground motion in areas where ground fissuring due to differential land subsidence is a concern. Table 2 documents the areas surveyed over the last six years as part of the GLMP.

Table 2. History of Ground-Level Surveys

Ground-Level Survey Area	Ground-Level Survey Completed (Y/N)?					
	2018	2019	2020	2021	2022	2023[b]
Managed Area	Y	N	N	N	N	N
Fissure Zone Area[a]	Y	N	N	N	N	N
Central Area	N	N	N	N	N	N
Northwest Area	Y	Y	Y	Y	Y	Y
San Jose Fault Zone Area[a]	Y	Y	Y	Y	Y	N
Southeast Area	Y	N	N	N	Y	N
Northeast Area	Y	Y	Y	N	N	N

(a) Denotes EDM survey area (measurements of horizontal strain).
(b) The 2023 ground-level surveys are scheduled to begin in early March 2023.



N

0 1 2

Miles

Relative Change in Land Surface Altitude as Estimated by InSAR (March 2011 to March 2022)

+ 0.55 ft

0 ft

-0.55 ft

InSAR absent or incoherent

- Areas of Subsidence Concern
- Pomona Extensometer Facility
- Chino Creek Extensometer Facility
- Ayala Park Extensometer Facility
- Chino Desalter Authority Well
- SB County Proposed Extraction Well
- Ground-Level Survey Benchmark
- Ground Fissures
- Approximate Location of the Riley Barrier

Figure 1

Ground-Level Monitoring Program
Fiscal Year 2022/23

Chino Basin Watermaster
Ground-Level Monitoring Committee

The ground-level surveys recommended for FY 2023/24 include the following:

Task 4.1. Conduct Spring-2024 Elevation surveys in Northwest MZ-1

In this subtask, the surveyor conducts elevation and EDM surveys at the established benchmarks in Northwest MZ-1 in Spring 2024. The elevation survey will begin at the Pomona Extensometer Facility and includes benchmarks across Northwest MZ-1. The elevation survey will be referenced to a newly established elevation datum at the Pomona Extensometer.

The vertical elevation survey is recommended in FY 2023/24 because of the recent subsidence that has occurred in Northwest MZ-1 and because the survey will support the development of a subsidence management plan in Northwest MZ-1. The EDM survey is ***not*** *recommended to be performed across the San Jose fault zone because past surveys (2013-2021) have demonstrated that the horizontal strain measured between benchmark pairs appears to behave elastically. The EDM surveys should be conducted less frequently than annual (e.g., once every five years).*

Task 4.4. Conduct Spring-2021 Elevation and EDM Surveys in the Managed Area/Fissure Zone Area

In this subtask, the surveyor conducts elevation and EDM surveys at the established benchmarks in across the Managed Area in Spring 2024. These surveys are recommended because (i) the Managed Area is the primary focus of the Subsidence Management Plan and (ii) the last survey performed in this area was during spring 2018 which, by spring 2024, will be six years between surveys.

Ground-Level Surveys Not Recommended for FY 2023/24

Ground-level surveys are **not** recommended for FY 2023/24 in the other Areas of Subsidence Concern (i.e., Central, Southeast, and Northeast Areas). This recommendation is justified because:

- InSAR is proving to be an accurate, more efficient, higher-resolution method to monitor vertical ground motion across the western Chino Basin.
- Hydraulic heads and vertical ground motion in some of these areas are stable or increasing.

Ground-level surveys should be conducted in these areas less frequently than annual (*e.g.,* once every five years).

Task 4.5. Replace Destroyed Benchmarks (if needed)

In this subtask, the surveyor replaces benchmark monuments that have been destroyed since the last survey, if any.

Task 4.6. Process, Check, and Update Database

In this subtask, the Watermaster Engineer receives and catalogs the survey results provided by the surveyor, prepares the data for display as a GIS layer, and performs checks against InSAR and extensometer data for reasonableness and accuracy.

Task 5. Data Analysis and Reporting

Task 5.1. Prepare Draft 2022/23 Annual Report of the Ground-Level Monitoring Committee

Prepare the text, tables, and figures for a draft *2022/23 Annual Report of the GLMC* and submit the report to the GLMC by September 22, 2023 for review and comment.

Task 5.2. Prepare Final 2022/23 Annual Report of the Ground-Level Monitoring Committee

Update the text, tables, and figures based on the comments received from the GLMC and prepare a final *2022/23 Annual Report of the GLMC* by November 3, 2023. Responses to GLMC comments will be included as an appendix to the final report. The report will be included in the agenda packet for the November 2023 Watermaster meetings for approval.

Task 5.3. Compile and Analyze Data from the 2023/24 Ground-Level Monitoring Program

In this subtask, monitoring data generated from the GLMP during 2023/24 is checked, mapped, charted, and analyzed as the first step in the preparation of the subsequent annual report. Some of the maps, charts, and tables are shared with the GLMC at its meetings in early 2024 during the development of a recommended scope of services and budget for FY 2024/25.

Task 5.4. Conduct Whispering Lakes Subsidence Investigation of the Northeast Area

In the Northeast Area, the long-term and short-term InSAR estimates indicate that persistent downward ground motion has occurred in a concentrated area south of the Ontario International Airport between Vineyard Avenue and Archibald Avenue in the vicinity of Whispering Lakes Golf Course. The western edge of this subsiding area exhibits a steep subsidence gradient or "differential subsidence."

In FY 2021/22, the Watermaster Engineer conducted a Reconnaissance-Level Investigation that included the review and analysis of readily-available borehole and lithologic data, historical air photos, pumping and recharge data, hydraulic head data, and InSAR estimates of vertical ground motion. Figures and charts were prepared and analyzed to derive interpretations and recommendations for future investigations and monitoring. The investigation and recommendations were included in the FY 2021/22 Annual Report of the GLMC. Plausible mechanisms for this subsidence feature include pumping-induced aquitard drainage and shallow soil consolidation associated with historical land uses. The investigation identified data gaps in available site-specific hydrogeologic data.

Potential next steps presented to the GLMC at its December 13, 2022 meeting included:

- Aquifer-system monitoring (*e.g.,* collecting existing hydrogeologic data; installing transducers at wells in the study area; constructing an aquifer-system monitoring facility within the subsidence feature)
- Further investigation of the historical land use practices in the vicinity of the Whispering Lakes Golf Course (e.g., agricultural disturbance and augmentation of soils; historical sewage disposal and spreading of solids; golf course construction and maintenance activities)
- Perform field studies of shallow soil consolidation (i.e., develop a dataset of site-specific shallow soil compaction that could be compared to the rates of subsidence estimated by InSAR); and

The GLMC has recommended a stepwise, process-of-elimination approach to identify the subsidence mechanism(s). The GLMC approved a $10,000 budget for FY 2022/23 to implement the recommendations derived from the Reconnaissance-Level Investigation. This budget is being used to collect and evaluate existing data (e.g., hydrogeologic data, well information, reports, historical land use data) and install transducers at nearby pumping wells. The results of these efforts will be documented in the GLMC Annual Report for 2022/23 along with recommendations for follow-on work.

The GLMC should consider dedicating contingency budget for FY 2023/24 ($10,000) to continue the implementation of the recommendations derived Reconnaissance-Level Investigation and future recommendations based on results of work performed in 2022/23.

Task 6. Develop a Subsidence-Management Plan for Northwest MZ-1

The 2007 SMP called for ongoing monitoring and data analysis of the Managed Area; including annual reporting and adjustments to the SMP, as warranted by the data. The 2007 SMP also called for expanded monitoring of the aquifer-system and land subsidence in other areas of subsidence and ground fissuring concern. Figure 1 shows the location of these so-called Areas of Subsidence Concern: Central MZ-1, Northwest MZ-1, Northeast Area, and Southeast Area. The expanded monitoring efforts outside of the Managed Area are consistent with the requirements of OBMP Program Element 1 and its implementation plan contained in the Peace Agreement.[1]

The 2007 SMP stated that if data from existing monitoring efforts in the Areas of Subsidence Concern indicate the potential for adverse impacts due to subsidence, the Watermaster would revise the SMP to avoid those adverse impacts. The 2014 Annual Report of the GLMC recommended that the 2007 SMP be updated to better describe the Watermaster's land subsidence efforts and obligations, including areas outside of MZ-1. As such, the update included a name change to the 2015 Chino Basin Subsidence Management Plan (2015 SMP) and a recommendation to develop a subsidence management plan for Northwest MZ 1.

The Watermaster had been monitoring vertical ground motion in Northwest MZ-1 via InSAR during the development of the 2007 SMP. Land subsidence in Northwest MZ-1 was first identified as a concern in 2006 in the MZ-1 Summary Report and again in 2007 in the 2007 SMP. Of particular concern was the occurrence of concentrated differential subsidence across the San Jose Fault in Northwest MZ-1—the same pattern of differential subsidence that occurred in the Managed Area during the time of ground fissuring. Ground fissuring is the main subsidence-related threat to infrastructure. The issue of differential subsidence, and the potential for ground fissuring in Northwest MZ-1, has been discussed at prior GLMC meetings, and the subsidence has been documented and described as a concern in the Watermaster's State of the Basin Reports, the annual reports of the GLMC, and in the *Initial Hydrologic Conceptual Model and Monitoring and Testing Program for the Northwest MZ-1 Area* (WEI, 2017). The Watermaster increased monitoring efforts in Northwest MZ-1 beginning in FY 2012/13 to include ground elevation surveys and electronic distance measurements (EDM) to monitor ground motion and the potential for fissuring.

[1] http://www.cbwm.org/docs/legaldocs/Peace_Agreement.pdf.

In 2015, the Watermaster's Engineer developed the *Work Plan to Develop a Subsidence Management Plan for the Northwest MZ-1 Area* (Work Plan; WEI 2015b).[2] The Work Plan is characterized as an ongoing Watermaster effort and includes a description of a multi-year scope-of-work, a cost estimate, and an implementation schedule. The Work Plan was included in the 2015 SMP as Appendix B. Implementation of the Work Plan began in July 2015. On an annual basis, the GLMC analyzes the data and information generated by the implementation of the Work Plan. The results and interpretations generated from the analysis are documented in the annual report of the GLMC and used to prepare recommendations for future activities.

Progress to Implement Work Plan thru FY 2022/23

The progress that has been made to implement the Work Plan (through FY 2022/23) is described below:

- An initial hydrogeologic conceptual model of the Northwest MZ-1 Area was developed, and a report was published in 2017.[3] This report described the hydrogeology of the area, speculated on the causes of the observed land subsidence, and included a recommended monitoring program.

- A preliminary one-dimensional (1D) compaction model, based on hydrogeologic information from the MVWD-28 well site, was constructed, calibrated, and used to explore the future occurrence of subsidence in Northwest MZ-1 under various basin-operation scenarios of groundwater production and artificial recharge and to identify potential subsidence mitigation strategies. A report[4] was published to document the results of the modeling and included a recommendation to construct the Pomona Extensometer.

- The initial monitoring program was implemented to closely track groundwater-levels, groundwater production, recharge, and ground motion across Northwest MZ-1. This monitoring program included the construction of the Pomona Extensometer to measure and record depth-specific heads and aquifer-system deformation. Implementation of the monitoring program is ongoing.

- A new 1D model was constructed and calibrated using the hydrogeologic information collected at the Pomona Extensometer. The 1D model at MVWD-28 was also updated and recalibrated using current information. The objectives of this exercise were to: (i) describe the subsidence mechanisms and the pre-consolidation head by aquifer-system layer in Northwest MZ-1 and (ii) develop modeling tools that can be used to explore the future occurrence of subsidence in Northwest MZ-1 under various basin-operation scenarios of groundwater production and artificial recharge and to identify potential subsidence mitigation strategies. This work was reviewed by the GLMC, and additional model calibration refinements and sensitivity analyses were performed based on GLMC recommendations. In December 2022, the GLMC approved 1D Model calibrations and deemed them sufficient for simulation of future land subsidence under prospective plans for pumping and recharge.

[2] Work Plan to Develop a Subsidence-Management Plan for Northwest MZ-1
[3] https://cbwm.syncedtool.com/shares/folder/PaauzoQapiZ/?folder_id=5150940
[4] https://cbwm.syncedtool.com/shares/folder/PaauzoQapiZ/?folder_id=5150942

- In the first half of 2023, the GLMC is developing an initial "Subsidence Management Alternative" called SMA-1. SMA-1 is equivalent to the planning scenario that was simulated with the 2020 Chino Valley Model (CVM) to support the 2020 Safe Yield Recalculation (2020 SYR). The 2020 SYR was intended to represent and simulate the Parties' projected pumping, recharge, and use of storage through 2050. The results of the 2020 SYR (projected hydraulic heads by CVM layer) will be used as input data for the 1D Model simulations to predict the potential future occurrence of subsidence through 2050. The GLMC will evaluate the predicted hydraulic heads versus the predicted compaction as simulated by the 1D Models, and then make the following determinations and/or recommendations:

    a. Determine the "acceptableness" of the predicted land subsidence.

    b. Recommend "subsidence management strategies" for Northwest MZ-1. These recommended strategies can be considered a preliminary or draft *Subsidence Management Plan for Northwest MZ-1*, and may come in the form of:

        i. Recommended operating ranges for hydraulic heads by aquifer layer.

        ii. Recommended groundwater management practices, such as pumping, recharge, the use of local storage, and/or the design of Storage and Recovery Programs.

    c. Recommend the minimum recharge quantity of supplemental water in MZ-1.

    d. Or, recommend additional work, such as developing additional SMAs, performing CVM and 1D Model simulations of the additional SMAs, and making revised determinations and/or recommendations based on the model results (*i.e.,* a. through c. above). Any additional SMAs must be approved by the GLMC before taking the next step to simulate the SMA with the CVM and the 1D Models.

Based on the expected progress through FY 2022/23, the following work is recommended for FY 2023/24 to develop the *Subsidence Management Plan for Northwest MZ-1*:

Task 6.1. Aquifer-System Monitoring

The established monitoring program of piezometric levels and pumping at wells in Northwest MZ-1 will continue through various techniques, including: (i) SCADA-based monitoring by the Monte Vista Water District; (ii) monitoring of piezometric levels via sonar[5]; (iii) monitoring of piezometric levels via pressure transducers at City of Pomona production wells; and (iv) manual measurements of piezometric levels. These data, along with data collected from the PX in Task 2.1, will improve the understanding of the hydrogeology in Northwest MZ-1, will be used to develop the *Subsidence Management Plan for Northwest MZ-1*, and in the future, will be used to adapt the Chino Basin Subsidence Management Plan, as appropriate.

[5] The use of sonar technology to measure piezometric levels in wells in currently being used in Monte Vista Water District wells 28 and 31.

In this subtask, all data is collected, compiled, checked, and analyzed every three months. Charts and data graphics of pumping, piezometric levels, and aquifer-system deformation will be updated to support the data collection and analysis.

Task 6.5. Provide Advice in the Development of the 2025 SYR Scenarios

The forthcoming 2025 SYR will involve the development of multiple projection scenarios of future hydrology, pumping, managed recharge, and use of managed storage in the Chino Basin. These projection scenarios will be simulated with an updated CVM. The CVM results will be evaluated for MPI and then used to evaluate the current Safe Yield of the Chino Basin. The GLMC should advise in the development of the 2025 SYR scenarios, so that the 1D Models can be used to simulate the land subsidence and support in the evaluation of:

- Potential subsidence-related MPI associated with the Safe Yield estimates.
- The minimum recharge quantity of supplemental water in MZ-1 as required by the Peace II Agreement.

Providing GLMC advice on the projection scenarios should be conducted in conjunction with the 2025 SYR and can be discussed at regularly scheduled GLMC meetings at no additional cost.[6] The model evaluations for MPI and for the minimum recharge quantity of supplemental water in MZ-1 would likely be conducted in FY 2024/25.

Task 7. Construct and Calibrate Additional 1D Models Across Western Chino Basin

At the conclusion of FY 2022/23, the GLMC will have used the 1D Models at PX and MVWD-28 to develop recommended "subsidence management strategies" that can be considered the draft *Subsidence Management Plan for Northwest MZ-1*. In this task, additional 1D Models are constructed and calibrated across other Areas of Subsidence Concern in western Chino Basin, so that Watermaster can use all the 1D Models to:

- Evaluate for MPI during the 2025 SYR evaluation.
- Refine the draft *Subsidence Management Plan for Northwest MZ-1*.
- Evaluate for the minimum recharge quantity of supplemental water in MZ-1 as required by the Peace II Agreement.

This task will include the work to:

- Verify and/or recalibrate the 1D Model that was prepared by the GLMC in the Managed Area at the Ayala Park Extensometer.
- Construct and calibrate additional 1D Models in other Areas of Subsidence Concern, such as the Southeast Area around the Chino Desalter well fields and in the Northeast Area (City of Ontario).

[6] This is because most of these discussions will be occurring in the 2025 SYR peer review process with the same technical consultants that participate on the GLMC.

The deliverables of this task will be the following:

- A draft TM will be prepared to describe the background/objectives of the task and the methods to complete the task. The methods will include a description of the proposed locations for the additional 1D Models and the methods to construct and calibrate the models. A GLMC meeting will be held to review the draft TM and receive GLMC feedback.
- A draft TM will be prepared that summarizes the validation, construction, and calibration of the additional 1D Models. A GLMC meeting will be held to review the draft TM, and a final TM will be prepared based on GLMC feedback.

Task 8. Meetings and Administration

Task 8.1. Prepare for and Conduct Four Meetings of the Ground-Level Monitoring Committee

This subtask includes preparing for and conducting four meetings of the GLMC:

- July 2023 – Implementation of the GLMP for FY 2023/24
- September 2023 – Review the draft 2022/23 Annual Report of the Ground-Level Monitoring Committee
- Early March 2024 – Review the draft recommended scope and budget for FY 2024/25
- Late March 2024 – Review the final recommended scope and budget for FY 2024/25 (if needed)

Task 8.2. Prepare for and Conduct One As-Requested Ad-Hoc Meeting

This subtask includes preparing for and conducting one ad-hoc meeting of the GLMC, as requested by the GLMC or Watermaster staff.

Task 8.3. Perform Monthly Project Management

This subtask includes monthly project administration and management, including staffing, financial and schedule reporting to Watermaster and subcontractor coordination.

Task 8.4. Prepare a Recommended Scope and Budget for the GLMC for FY 2024/25

This subtask includes preparing a draft and final recommended scope of services and budget for FY 2024/25 for the GLMC to support the Watermaster's budgeting process.

Comments and Responses to Comments

The comments received from the GLMC as of March 31, 2023 on the "Recommended Scope of Services and Budget of the Ground-Level Monitoring Committee for Fiscal Year 2023/24 (Draft)" and the Watermaster Engineer's response to comments are documented below.

Comments from the City of Chino (Eric Fordham)

Comment 1 – Task 1. Setup and Maintenance of the Monitoring Network.

Concur with recommended scope and budget.

Response:

n/a

Comment 2 – Task 2. Aquifer System Monitoring and Testing.

Concur with recommended scope and budget.

Response:

n/a

Comment 3 – Task 3.1. Acquire TerraSAR-X SAR Data and Prepare Interferograms for 2023/24

Has General Atomics agreed to continue providing their InSAR services and for how long? What would be the contingency and financial impact should they decide to discontinue their services mid-year?

Response:

General Atomics has decided to terminate its subcontractor agreement with the Watermaster and will no longer provide InSAR services. General Atomics is in the process of transmitting to the Watermaster Engineer all historical SAR data and intermediate/final work products that have been generated for the GLMC since 2011.

The Watermaster Engineer is exploring other options to continue the InSAR time series of estimates of vertical ground motion across the western portion of Chino Basin using the same TerraSAR-X data and data-processing methods. Once a proposal and cost estimate has been prepared, the Watermaster Engineer will bring the proposal to the GLMC for review and comment.

Comment 4 –Task 4. Perform Ground-Level Surveys.

We concur with the recommendations and time frames for conducting the ground-level surveys.

Response:

n/a

Comment 5 –Task 5.4. Conduct Whispering Lakes Subsidence Investigation and the Northeast Area.

Concur with the approach of using a process of elimination to assess potential mechanisms for the observed subsidence. The study efforts and budget should be balanced with the potential for MPI for this relatively limited area.

Response:

We agree with the comment. Any additional recommended work on this task will be included in the draft 2022-23 Annual Report of the GLMC for review and comment by the GLMC.

Comment 6 –Task 6.5. Construct and Calibrate Additional 1D Models Across Western Chino Basin

Prior to constructing additional 1D models, areas where additional land subsidence evaluation could potentially identify the need to mitigate or abate MPI should be screened as to the actual or perceived potential for land subsidence. The need for additional 1D compaction models may not be warranted.

Response:

The additional 1D Models would only be proposed within the "Areas of Subsidence Concern" across the western Chino Basin, which are areas defined in the Chino Basin Subsidence Management Plan. These are areas where subsidence is currently and persistently occurring, or the underlying geology makes these areas susceptible to aquifer-system compaction and permanent land subsidence.

To address this comment, a TM has been added to the scope of work to describe the background and objectives of the task and the methods to complete the task. The methods will include a description of the proposed locations for the additional 1D Models and the methods to construct and calibrate the models. A GLMC meeting will be held to review the draft TM and receive feedback from the GLMC before proceeding with the construction and calibration of the additional 1D Models.

Comment 7 – Meetings and Administration.

Concur with recommended scope and budget.

Response:

n/a

Comment 8 – Table 1

The table should identify any unspent or carry-over budget from the approved 2022/23 budget.

Response:

Currently, it is too early to predict unspent budget from FY 2022/23 that could be carried over to FY 2023/24.

Comments from the State of California (Rick Rees)

Comment 1 – Task 6.5. Construct and Calibrate Additional 1D Models Across Western Chino Basin

We suggest that that Subtask 6.5, "Construct and Calibrate Additional 1D Models Across Western Chino Basin," be broken out as a separate full task because it is not a component of Task 6, "Develop a Subsidence Management Plan for Northwest MZ-1."

Response:

A new Task 7 has been added to the text and Table 1 for the task: "Construct and Calibrate Additional 1D Models Across Western Chino Basin."