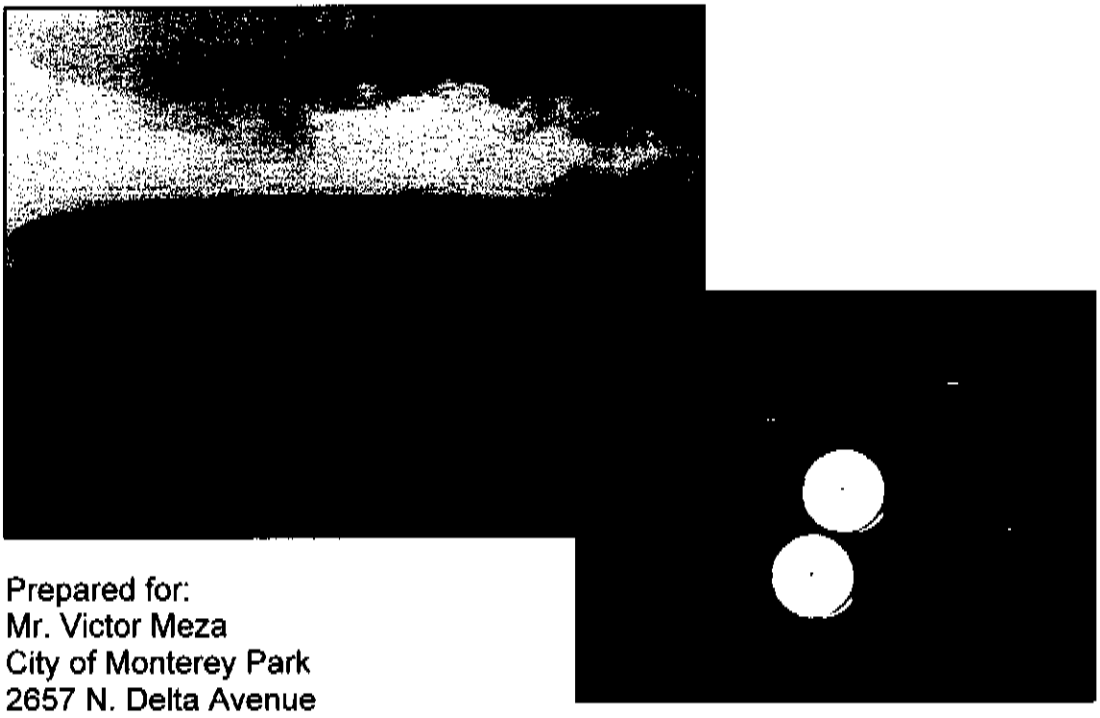
P. O. Box 801357, Santa Clarita, CA 91380 877.274.2422

Final Report
Maintenance Inspection

Russell 3.0MG Water Storage Reservoir 1A
City of Monterey Park



Prepared for:
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City of Monterey Park
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Prepared by:
CSI Services, Inc.

Pat Sweeney
Project Manager

July 30, 2010

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Introduction

The City of Monterey Park authorized CSI Services, Inc. (CSI) to conduct a maintenance inspection on the Russell 3MG Reservoir 1A located in Monterey Park, CA. The reservoir is one of two tanks on site, and is the tank closest to the access road. The focus of this maintenance dive inspection was to evaluate the tank coatings and develop recommendations for maintenance activities.

Coatings maintenance recommendations have been made in accordance with the applicable requirements of American Water Works Association's Standard (AWWA) D102 "Coating Steel Water Storage Tanks," AWWA Standard M42 "Steel Water Storage Tanks, and CSI's experience with evaluating hundreds of water storage facilities. A photo summary and narrated DVD video are also included to document the condition of the tank.

The field-work was completed on Wednesday, July 7, 2010 by a two man team comprised of Mr. Emilio Smith and Mr. Damian Hackett. The exterior shell observations were made mostly from grade level, while the exterior of the roof was examined close-up. The interior inspection was carried out with the tank water level at approximately twenty-two feet using special underwater diving equipment and techniques. Mr. Smith was the lead diver and Mr. Hackett was the dive tender throughout the inspection. Mr. Pat Sweeney, Project Manager, reviewed the results of the field data and prepared recommendations for maintenance work. Mr. Sweeney is a certified SSPC and NACE inspector, an SSPC Certified Protective Coating Specialist, and has evaluated hundreds of water storage tanks.

Summary

With respect to corrosion, the exterior paint system is in overall fair to good condition with heavier corrosion on the edges of appurtenances and minor, negligible rust spots throughout most areas. The paint system is heavily chalked with satisfactory adhesion. The chalking on the roof has resulted in a very thin film that is reaching a point where its will no longer provide the required barrier protection. At this time, the only reason to paint the exterior would be for aesthetic purposes. It is recommended that the exterior be reevaluated in 3 to 5 years to determine if the tank should be spot repaired and overcoated soon after.

Overall, the interior lining is in poor condition with severe corrosion developing within the roof area and significant coating breaks below the highest water level (HWL). Although there is exposed metal below the HWL, there is only a minimal amount of metal loss at these defects. This is the direct result of the added benefit of the cathodic protection (CP) system's operation. Unfortunately, the system provides no protection to the roof or upper areas of the shell. Furthermore, the amount of breaks in the lining below the HWL is advancing towards a threshold where the CP will no longer be able to properly protect the

exposed steel.

The immediate driving force for any lining work in the tank will be the condition of the roof, and it is projected that the roof will require relining within the next 3 to 5 years to prevent any widespread corrosion development. Consideration to completing the exterior paint repairs with the interior should be made to better amortize construction costs.

Background

The Russell Reservoir 1A is welded steel above grade cylindrical structure. The tank was erected in 1981 by American Bridge Co. The tank is approximately 146 feet in diameter by 24 feet high, providing a nominal capacity of approximately 3MG. Specifically, the tank is located at GPS coordinates 34.05202 and -118.120.20 and adjacent to Russell Road.

The tank shell has three courses connected to a pitched roof. The roof plates are supported internally by rafters, girders, support beams, and columns. The overflow consists of an interior pipe stub that connects to a pipe that exits the lower course. There is one center roof vent. The tank has two shell manways, one being a flush clean-out. There is one interior that leads to the single roof access hatch. The tank piping has flexible couplings and enter the tank through the first course. There is a cathodic protection (CP) system installed, which includes CP hand-holes throughout the roof. There is no external CP system is in place. The tank does not have an exterior ladder, and rests on a concrete ring wall with no anchoring. The tank site itself has been asphalted.

It is believed that the tank coatings are the original and that no coating maintenance activities have taken place. All of the interior steel tank surfaces are coated with a bitumastic lining. The interior steel surfaces above the second course; including the roof, shell, support members, and appurtenances are coated with a bitumastic cut-back solution (Supertank). The lowest two courses and floor have a hot-mop coal-tar enamel bitumastic lining. The exterior paint system on the roof, shell, hand rail assembly and appurtenances are painted with what appears to be an alkyd enamel paint system.

Field Evaluation

The purpose of this survey was to assess the conditions of the existing coatings and recommend remedial work where applicable. The evaluation mainly involved visual observations. Photographs and video was taken to document the field inspections. A photo summary and narrated DVD is included with this narrative report.

For survey purposes, the tank evaluation has been segmented areas: exterior roof

structure, exterior shell, interior roof structure, interior shell, and interior floor. The various appurtenances within each of these areas have also been evaluated. A rating system has been developed to quantify the condition of the various tank areas. Each of the rating criteria is found in the Attachments (Charts 1 through 6).

The condition of the coating systems was rated as being poor, fair, good, or excellent (Chart 1). The extent of any rust defects identified within each of the areas were generally determined using guidelines set forth in ASTM D610 "Standard Test Method for Evaluating the Degree of Rusting of Painted Steel Surfaces" (Chart 2). Where applicable, the characteristic or stage of corrosion was determined according to CSI Corrosion Grade criteria (Chart 3). The degree of chalking was determined in accordance with ASTM D4214 "Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films," Test Method D659, Method C (Chart 4). Coating adhesion was assessed in accordance with ASTM D3359 "Standard Test Method for Evaluating Adhesion by Tape Test, modified Method A or ASTM D6677 "Standard Test Method for Evaluating Adhesion by Knife" (Chart 5). Any blistering that may have been present was rated in accordance with ASTM D714 "Standard Test Method for Evaluating the Degree of Blistering in Paints" (Chart 6). The result of the evaluation follows:

Exterior

Close-up visual observations of the coating was limited to the first (lowest) shell course, upper shell areas adjacent to the roof, and the roof. The exterior paint on the roof is in fair to good condition with heavy chalking (ASTM D4214, No. 4) and isolated patches of blisters and light and dark rust spots (CSI Corrosion Grades 1 and 2). Although dark rust is present in many areas, no pitting or significant metal loss is associated with any of these areas, and the majority of coating breaks only extend to a red primer. The majority of the rust on the roof was at three primary areas: on appurtenances and in depressions in the roof plates that have a tendency to collect and pond water. The amount of corrosion on the roof was rated to be less than 0.03 percent of the roof surface (ASTM D610, 9). The paint dry film thickness on the exterior roof was measured to range between 4 and 7 mils and film adhesion was found to be good (ASTM D3359, 4A). It was noted that the drip edge that runs the circumference of the roof has a tendency to collect and pond atmospheric water.

The exterior paint on the shell is in fair to good condition with heavy chalking (ASTM D4214, No. 6). Areas damaged by mechanical means (i.e. dings and scrapes) are present and there are both light and dark rust spots (CSI Corrosion Grades 1 and 2) present in isolated areas (ASTM D610, <9). The majority of these spots were a result of either rocks that had been thrown against the shell or on the edges of appurtenances. Much of the coating on the ring wall had a red primer exposed. The paint DFT on the exterior of the tank was measured to range between 10 and 12 mils and film adhesion was found to be satisfactory (ASTM D3359, 4A). The concrete ring wall was painted with the same red primer, white finish as the tank. The overflow pipe was found to have a screened air-gap.

Interior

The water level at the time of the survey was at approximately twenty-two feet, and close-up visual observations were made to all areas below the waterline. The coating on the roof is in poor condition. The majority of all surfaces have corrosion. Rust is present mid-plate and on the various edges of the roof plates and roof support structure including the rafters, ring girders, and columns. The roof has areas with patches of light and dark rust (CSI Corrosion Grade 1 through 2). The total amount of rust on the roof was rated to be more than 50 percent of the total surface area (ASTM D610, <1). Blistering (ASTM D714, No. 6 medium) is noted on the roof and on the center column. There appears to be some twisting and bending of roof rafters, as evidenced by the rust lines on the roof plate. This condition appears to be old without any recent development.

The coating on the shell was found to be in overall poor condition. The lining exhibits coating checking, cracking, and delaminations in all areas. The vast majority of all delaminations were in the lowest two courses, the areas with the hot-mop coal tar enamel. In addition, the upper portion of the shell in the areas above the common water level was found to have both light and dark rust spots (CSI Corrosion Grades 1 and 2). The coating breaks below the common water level have white calcareous deposits. Although there was extensive bare metal, the amount of red rust on the shell was rated to have a rust grade of less than .03 percent of its total surface (ASTM D610, <9). Blistering was noted in each quadrant of the shell (ASTM D714, No. 2 medium) some of which extended to a bare substrate. A swastika was present in the form of graffiti on the interior manway lid.

Although the majority of the floor coating was not visually accessible, observations noted that its level of corrosion in spot area of the tank bottom was minor. The floor was obscured by approximately 1/8-1/4 inches of sediment. Cracking (ASTM D661, No. 6 moderate) and large blisters (ASTM D714, 4 medium) were found in each quadrant of the floor. No significant metal loss in the form of pitting was observed below the HWL.

All of the various appurtenances within the tank were found to be in generally fair condition. Much like the tank shell the ladder, hatch, pipe, and overflow had light and dark rust (CSI Corrosion Grades 1 and 2) in the areas commonly above the high water line and white calcareous deposits in the areas below the common water line. Blistering (ASTM D714, 6 medium) and cracking was noted on the ladder and columns below the high water line. All pipe openings, including inlet had coating cracking (ASTM D661, No. 6 moderate) with white calcareous deposits as well as blistering (ASTM D714, 4 medium).

Discussion

With respect to corrosion, the exterior paint system is in good condition. The paint is heavily chalked with satisfactory adhesion. Paint sample analysis was not a part of this assignment, but it presumed that all films contain heavy metals. The paint on the shell is in better condition than the paint on the roof, which has slightly more coating degradation. The more advanced exterior coating degradation on the roof is the result of the paint experiencing significant chalking and weathering. Chalking occurs as a film's binder degrades in ultraviolet light, which leaves behind the film's pigment in the form of unbound chalk. The weathering is the result of the chalk being slowly removed by cycles of wind and rain. Although there is only a relatively minor amount of corrosion on the roof, the thin chalky film will soon not provide enough of barrier protection from atmospheric moisture. This will result in more advanced rust development within 5 to 7 years.

Generally speaking, there are four possible approaches to maintenance painting. The coatings can be either completely removed and replaced (repainted), spot repaired, spot repaired and overcoated, or simply overcoated. In evaluating the condition of a coating to determine the best painting approach there are a number of different factors to consider. The first set of factors includes the determination of the coating's ability to withstand the added stress of an additional coat(s). Attributes impacting this decision include film thickness and adhesion. If the paint film is too thick or has poor adhesion, the tension from the curing stresses and/or weight of the additional paint can cause the existing system to disbond. The second set of factors to consider when determining what painting approach to take is the amount of surface area requiring repair, the overall difficulty in providing access to the structure, and whether the coating system contains heavy metals (i.e. lead, cadmium, and chromium). The final factor is the condition of the substrate.

When considering whether a spot repair approach is a viable option, a good rule of thumb is that spot repair, with or without overcoat, makes sense with up to 10 percent of the surface area requiring repairs. With more than 10% in disrepair, making spot repairs and overcoating becomes a diminishing return. With 10 percent rusting, overcoating may be an option if the adhesion is better than fair. If there is more than 10 percent rusting and the substrate is free of mill scale, overcoating may be considered an option if the adhesion is excellent. Once the amount of surface area in need of repair exceeds this range, the cost of cleaning and coating the individual rust spots approaches (or exceeds) the total cost of removal and replacement.

The exterior paint system is presumed to contain heavy metals. As a result, the focus of any future exterior paint work should be to spot repair and overcoat the tank (i.e. lead encapsulation) before the existing coating system degrades to a level where wholesale paint replacement is required. Any work disturbing the heavy metal bearing film will require that the workers and environment are properly protected. At this time, the only reason to paint the exterior would be for aesthetic purposes. It is recommended that the exterior be

reevaluated in 3 to 5 years to determine if the tank should be spot repaired and overcoated soon after. It was also noted that the drip edge that runs the circumference of the roof has a tendency to collect and pond atmospheric water, and it is that the drains be periodically cleaned to remove any accumulated debris that would clog the drains. The paint at these areas was not designed for immersion.

Overall, the interior lining is in poor condition with advanced corrosion developing on the roof. Although there is wide spread delaminations and coating breaks in the immersed areas of the tank, as evidenced by a relatively large amount of white calcareous deposits, there was no significant corrosion in the form of metal loss noted below the highest water level (HWL). The specific areas that show the most advanced corrosion are in areas that tend to face the most severe stress from constant wetting and drying cycles associated with the highest afternoon heat and fluctuations in water levels. The calcareous deposits are a bi-product of the cathodic protection (CP) system protecting the immersed areas of the steel from metal loss. However, although the CP has prevented the development of corrosion in the areas of the steel below the HWL, it provides no protection to the roof or upper areas of the shell, each of which is starting to show more advanced corrosion. Furthermore, the amount of lining breaks in the lining is advancing towards a point to where the CP will no longer be able to properly protect the immersed, exposed steel. The driving force for any lining work in the tank is the condition of the roof. It is projected that the roof will begin to develop more significant metal loss in the form of minor pitting or scaling within the next few years. On this basis, it is recommended that the tank be relined within the next 3 to 5 years. Consideration to completing the exterior paint repair with the interior should be made as a way to better amortize construction costs.

The cost estimates for the relining work has been developed from recent qualified construction bids in the Southern California market. The tank can be relined, including specification and in-process inspection for approximately $350,000. Consideration to completing the exterior paint repair with the interior should include the price tag of approximately $150,000.

Recommended Work

The following is recommended:

Exterior

1) Complete periodic operational inspections to assure that the roof drains to not become clogged with leaves and other debris.

2) Reevaluate the exterior paint system in 3 to 5 years for possible spot repair and/or overcoating needs.

Interior

1) Within the next 3 to 5 years, reline the tank interior. This work should include abrasive blast cleaning of all surfaces in accordance with "Near White Metal Blast Cleaning" (SSPC-SP10) followed by three coats of an NSF 61 polyamide epoxy each at 4-6 mils per coat for a minimum dry film thickness of 15 mils.

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	Emilio Smith		

Water Tank Dive Inspection Report

Tank Owner/Client: City of Montery Park	**Dive Supervisor:** Emilio Smith
Client Contact: Victor Meza	**Lead Diver:** Emilio Smith
Tank Name: Russel 1A	**Dive Tender:** Damian Hackett
Date of Last Inspection:	

Scope of Work	Maintenance Dive ☒	Warranty Dive ☐	Cleaning ☐	Patch Repairs ☒	UT Readings ☐	Sampling ☐

Site

Item	Yes	No	Data
GPS Coordinates	☒	☐	34.05202 -118.120.20
Cross Street			S Russel Ave
Tank Location			closest to access road
Perimeter Fencing	☒	☐	
Site secured on arrival	☒	☐	
Nearest Structures	☒	☐	Russel 2A reservoir
Overhead Power Lines	☐	☒	
Antenna on Tank			No, on ground
Surrounding Site	☒	☐	paved
Impact potential	☒	☐	tree
	☐	☐	

Structural

Item	Data	Item	Data
Capacity	3 MG	Number of Roof Vents	one center
Diameter	146	Roof Vent Design	round hooded
Height	24	Center Roof Vent Size	24"
Erection Year	1981	Roof vent sealed	Yes - screened
Contract No.	K9499	Roof Rail System	yes
Tank Substrate	welded steel	Roof Rail Satisfactory	Yes, 42" high, 2 midrails, 4 inch
Tank Profile	on grade	Rail Location	other
Tank Geometry	cylindrical	Ext Roof Access	none present
Number of Courses	three	Exterior Vandal Deterrent	not present
Height of Each Course	8 feet	Ext Ladder Sat	none
Roof Design	pitched roof	Ext Ladder Fall Prevent	none
Roof Structure	one girder with rafters	Roof Tie-Off Present	no
Column Design	pipe	Tank Piping	common inlet/outlet
Upper Center Column	dollar plate	Inlet Diameter	12"
Column Base Design	free plate with stabilizing c	Outlet Diameter	12"
Structural Connections	bolted	Flexible Pipe Coupling	present
No. Shell Manways	two	Overflow Pipe Diameter	12"
Type of Manways	round	Overflow Exterior Design	screened air-gap
Manway Cover Design	bolt circle with hinge	Overflow Interior Design	pipe lower course exit
Diameter of Manways	36"	Drain location	flush clean-out
No. Roof Hatches	multiple	Tank Foundation	concrete ringwall with no anch
Hatch Design	steel hinged	CP System	interior sacrificial
Size of Roof Hatch	36"x48", 24"x24"	Water Level Indicator	telemetry

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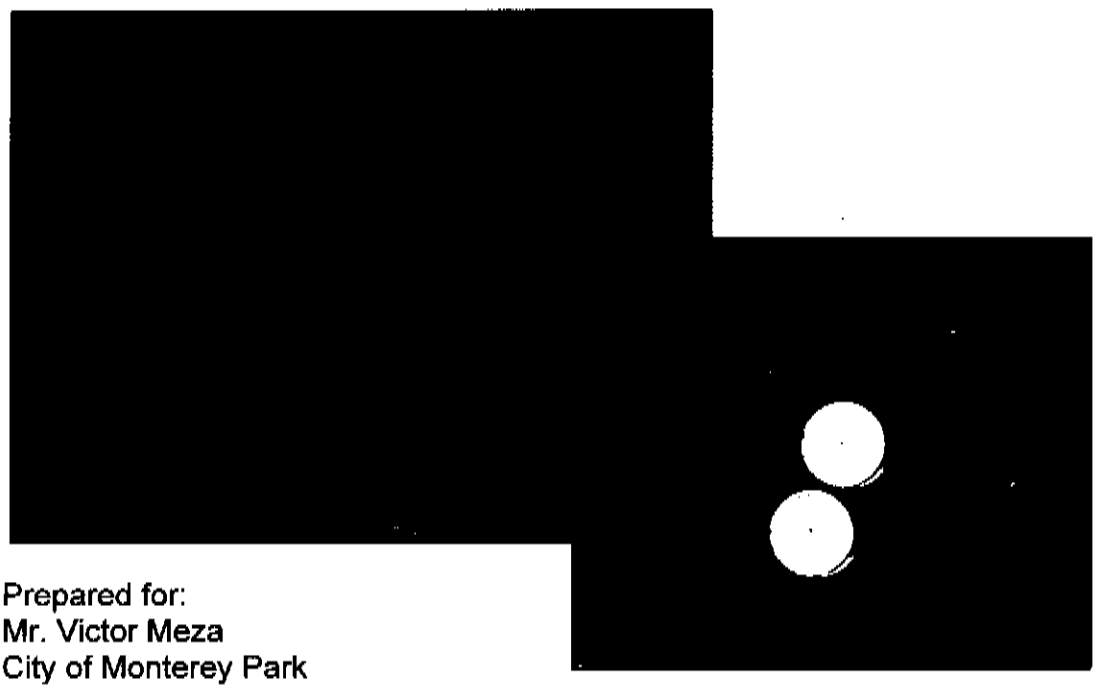

Prepared for:
Mr. Victor Meza
City of Monterey Park
2657 N. Delta Avenue
Rosemead, CA 91770-3220

Prepared by:
CSI Services, Inc.

Pat Sweeney
Project Manager

July 31, 2010

Introduction

The City of Monterey Park authorized CSI Services, Inc. (CSI) to conduct a maintenance inspection on the Russell 3MG Reservoir 2A located in Monterey Park, CA. The reservoir is one of two tanks on site, and is the tank farthest from the access road. The focus of this maintenance dive inspection was to evaluate the tank coatings and develop recommendations for maintenance activities.

Coatings maintenance recommendations have been made in accordance with the applicable requirements of American Water Works Association's Standard (AWWA) D102 "Coating Steel Water Storage Tanks," AWWA Standard M42 "Steel Water Storage Tanks, and CSI's experience with evaluating hundreds of water storage facilities. A photo summary and narrated DVD video are also included to document the condition of the tank.

The field-work was completed on Wednesday, July 7, 2010 by a two man team comprised of Mr. Emilio Smith and Mr. Damian Hackett. The exterior shell observations were made mostly from grade level, while the exterior of the roof was examined close-up. The interior inspection was carried out with the tank water level at approximately twenty-one feet using special underwater diving equipment and techniques. Mr. Smith was the lead diver and Mr. Hackett was the dive tender throughout the inspection. Mr. Pat Sweeney, Project Manager, reviewed the results of the field data and prepared recommendations for maintenance work. Mr. Sweeney is a certified SSPC and NACE inspector, an SSPC Certified Protective Coating Specialist, and has evaluated hundreds of water storage tanks.

Summary

With respect to corrosion, the exterior paint system is in overall good condition with heavier corrosion on the edges of appurtenances and minor rust spots throughout most areas. The paint system is heavily chalked with satisfactory adhesion. At this time, the only reason to paint the exterior would be for aesthetic purposes. Overall, the interior lining is in poor to fair condition with corrosion developing within the roof area and significant coating breaks below the highest water level (HWL). Although there is exposed metal below the HWL, there is only a minimal amount of metal loss at these defects. This is the direct result of the added benefit of the cathodic protection (CP) system's operation. Unfortunately, the system provides no protection to the roof or upper areas of the shell. Furthermore, the amount of breaks in the lining below the HWL is advancing towards a threshold where the CP will no longer be able to properly protect the exposed steel. It was noted that some of the roof rafters shifted years ago. It is recommended that the tank be placed back on a 3 to 5 maintenance inspection cycle with any eye on completing coating repairs shortly after this benchmark.

Background

The Russell Reservoir 2A is welded steel above grade cylindrical structure. The tank was erected in 1987 by San Luis Tank and Piping Company, Inc. The tank is approximately 146 feet in diameter by 24 feet high, providing a nominal capacity of approximately 3MG. Specifically, the tank is located at GPS coordinates 34.05202 and -118.120.20 and adjacent to Russell Road

The tank shell has three courses connected to a pitched roof. The roof plates are supported internally by rafters, girders, support beams, and columns. The overflow consists of an interior pipe that is anchored to the tank by fusion bonded epoxy coated bracing and exits the tank at the lower course. There is one center roof vent. The tank has two shell manways, one being a flush clean-out. There is one interior that leads to the single roof access hatch. The tank piping has flexible couplings and enters the tank through the first course. There is a cathodic protection (CP) system installed, which includes CP hand-holes throughout the roof. There is no external CP system is in place. The tank does not have an exterior ladder, and rests on a concrete ring wall with no anchoring. The tank site itself has been asphalted.

It is believed that the tank coatings are the original and that no coating maintenance activities have taken place. All of the interior steel tank surfaces are coated with a bitumastic lining. The interior steel surfaces above the second course; including the roof, shell, support members, and appurtenances are coated with a bitumastic cut-back solution (Supertank). The lowest two courses and floor have a hot-mop coal-tar enamel bitumastic lining. Some interior piping and appurtenance bracing is lined with a fusion bonded epoxy (FBE). The exterior paint system on the roof, shell, hand rail assembly and appurtenances are painted with what appears to be an alkyd enamel paint system.

Field Evaluation

The purpose of this survey was to assess the conditions of the existing coatings and recommend remedial work where applicable. The evaluation mainly involved visual observations. Photographs and video was taken to document the field inspections. A photo summary and narrated DVD is included with this narrative report.

For survey purposes, the tank evaluation has been segmented areas: exterior roof structure, exterior shell, interior roof structure, interior shell, and interior floor. The various appurtenances within each of these areas have also been evaluated. A rating system has been developed to quantify the condition of the various tank areas. Each of the rating criteria is found in the Attachments (Charts 1 through 6).

The condition of the coating systems was rated as being poor, fair, good, or excellent (Chart 1). The extent of any rust defects identified within each of the areas were generally determined using guidelines set forth in ASTM D610 "Standard Test Method for Evaluating the Degree of Rusting of Painted Steel Surfaces" (Chart 2). Where applicable, the characteristic or stage of corrosion was determined according to CSI Corrosion Grade criteria (Chart 3). The degree of chalking was determined in accordance with ASTM D4214 "Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films," Test Method D659, Method C (Chart 4). Coating adhesion was assessed in accordance with ASTM D3359 "Standard Test Method for Evaluating Adhesion by Tape Test, modified Method A or ASTM D6677 "Standard Test Method for Evaluating Adhesion by Knife" (Chart 5). Any blistering that may have been present was rated in accordance with ASTM D714 "Standard Test Method for Evaluating the Degree of Blistering in Paints" (Chart 6). The result of the evaluation follows:

Exterior

Close-up visual observations of the coating was limited to the first (lowest) shell course, upper shell areas adjacent to the roof, and the roof. The exterior paint on the roof is in good condition with heavy chalking (ASTM D4214, No. 4) and light and dark rust spots (CSI Corrosion Grades 1 and 2). Although dark rust is present in many areas, no pitting or significant metal loss is associated with any of these areas, and the majority of coating breaks only extend to a red primer. The majority of the rust on the roof was at three primary areas: on appurtenances and in depressions in the roof plates that have a tendency to collect and pond water. The amount of corrosion on the roof was rated to be less than 0.03 percent of the roof surface (ASTM D610, 9). The paint dry film thickness on the exterior roof was measured to range between 4 and 10 mils and film adhesion was found to be good (ASTM D3359, 4A). It was noted that the drip edge that runs the circumference of the roof has a tendency to collect and pond atmospheric water.

The exterior paint on the shell is in good condition with moderate chalking (ASTM D4214, No. 8). Areas damaged by mechanical means (i.e. dings and scrapes) are present and there are both light and dark rust spots (CSI Corrosion Grades 1 and 2) present in isolated areas (ASTM D610, <9). There is an area approximately one square foot area on the upper course with an isolated patch of rust spots. The majority of the rust spots on the shell are on the manway bolts and adjacent to appurtenances. Much of the coating on the ring wall had a red primer exposed. The paint DFT on the exterior of the tank was measured to range between 4 and 5 mils and film adhesion was found estimated to be satisfactory, but not tested due to the overall satisfactory appearance of the shell. The concrete ring wall was painted with the same red primer, white finish as the tank. The overflow pipe was found to have a screened air-gap. Some of the piping entering the tanks has extensive peeling paint from an intact galvanized undercoat.

Interior

The water level at the time of the survey was at approximately twenty-one feet, and close-up visual observations were made to all areas below the waterline. The coating on the roof has many areas with checking and/or cracking. The coating on the roof is in poor to fair condition. The majority of all surfaces have some level of corrosion. Although patches of rust are present on some roof plates, the majority of the corrosion on the roof is on the various edges of the roof plates and roof support structure including the rafters, ring girders, and columns. Rust was found to be both light and dark (CSI Corrosion Grade 1 through 2), depending upon the area. The total amount of rust on the roof was rated to be approximately 1 percent of the total surface area (ASTM D610, 6). There appears to be some twisting and bending of roof rafters, as evidenced by the rust lines on the roof plate. This condition appears to have dark rust in the exposed areas.

The coating on the shell was found to be in overall poor to fair condition. The lining exhibits coating checking, cracking, and delaminations in many areas all areas. The vast majority of all delaminations were in the lowest two courses, the areas with the hot-mop coal tar enamel. In addition, the upper portion of the shell in the areas above the common water level was found to have both light and dark rust spots (CSI Corrosion Grades 1 and 2). The coating breaks below the common water level have white calcareous deposits. Although there was extensive bare metal, the amount of red rust on the shell was rated to have a rust grade of less than .03 percent of its total surface (ASTM D610, <9). Blistering was noted in each quadrant of the shell (ASTM D714, No. 2 medium) some of which extended to a bare substrate. Although the majority of all coating breaks had white calcareous deposits, there was also some indication of red rust in areas.

Although the majority of the floor coating was not visually accessible, observations noted that its level of corrosion in spot area of the tank bottom was minor. The floor was obscured by approximately 1/8-1/4 inches of sediment. No indication of significant lining defects is suspected on the floor.

All of the various appurtenances within the tank were found to be in generally fair condition. The hatch had some minor light and dark rust. The piping, and overflow had only a minor amount of coating breaks with some light and dark rust (CSI Corrosion Grades 1 and 2) in the areas commonly below the common water line. Blistering (ASTM D714, 6 medium) and cracking was noted on the ladder and columns. It is suspected that the ladder is comprised of stainless steel.

Discussion

With respect to corrosion, the exterior paint system is in good condition. The paint is heavily chalked with satisfactory adhesion. Paint sample analysis was not a part of this assignment, but it presumed that all films contain heavy metals. The paint on the shell is in better condition than the paint on the roof, which has more coating degradation. The more advanced exterior coating degradation on the roof is the result of the paint experiencing significant chalking and weathering. Chalking occurs as a film's binder degrades in ultraviolet light, which leaves behind the film's pigment in the form of unbound chalk. The weathering is the result of the chalk being slowly removed by cycles of wind and rain. Although there is only a relatively minor amount of corrosion on the roof, the thin chalky film will, at some point, not provide enough of barrier protection from atmospheric moisture.

Generally speaking, there are four possible approaches to maintenance painting. The coatings can be either completely removed and replaced (repainted), spot repaired, spot repaired and overcoated, or simply overcoated. In evaluating the condition of a coating to determine the best painting approach there are a number of different factors to consider. The first set of factors includes the determination of the coating's ability to withstand the added stress of an additional coat(s). Attributes impacting this decision include film thickness and adhesion. If the paint film is too thick or has poor adhesion, the tension from the curing stresses and/or weight of the additional paint can cause the existing system to disbond. The second set of factors to consider when determining what painting approach to take is the amount of surface area requiring repair, the overall difficulty in providing access to the structure, and whether the coating system contains heavy metals (i.e. lead, cadmium, and chromium). The final factor is the condition of the substrate.

When considering whether a spot repair approach is a viable option, a good rule of thumb is that spot repair, with or without overcoat, makes sense with up to 10 percent of the surface area requiring repairs. With more than 10% in disrepair, making spot repairs and overcoating becomes a diminishing return. With 10 percent rusting, overcoating may be an option if the adhesion is better than fair. If there is more than 10 percent rusting and the substrate is free of mill scale, overcoating may be considered an option if the adhesion is excellent. Once the amount of surface area in need of repair exceeds this range, the cost of cleaning and coating the individual rust spots approaches (or exceeds) the total cost of removal and replacement.

The exterior paint system is presumed to contain heavy metals. As a result, the focus of any future exterior paint work should be to spot repair and overcoat the tank (i.e. lead encapsulation) before the existing coating system degrades to a level where wholesale paint replacement is required. Any work disturbing the heavy metal bearing film will require that the workers and environment are properly protected. At this time, the only reason to paint the exterior would be for aesthetic purposes. Based on the above, it is recommended that the exterior surfaces be reevaluated for possible spot repair and

overcoat within the next 3 to 5 years. It was also noted that the drip edge that runs the circumference of the roof has a tendency to collect and pond atmospheric water, and it is that the drains be periodically cleaned to removed any accumulated debris that would clog the drains. The paint at these areas was not designed for immersion.

Overall, the interior lining is in poor to fair condition with advanced corrosion developing on the edges of the roof structure. Although there is wide spread delaminations and coating breaks in the immersed areas of the tank, as evidenced by a relatively large amount of white calcareous deposits, there was no significant corrosion in the form of metal loss noted below the highest water level (HWL). The specific areas that show the most advanced corrosion are in areas that tend to face the most severe stress from constant wetting and drying cycles associated with the highest afternoon heat and fluctuations in water levels. The calcareous deposits are a bi-product of the cathodic protection (CP) system protecting the immersed areas of the steel from metal loss. However, although the CP has prevented the development of corrosion in the areas of the steel below the HWL, it provides no protection to the roof or upper areas of the shell, each of which is starting to show more advanced corrosion. Furthermore, the amount of lining breaks in the lining is advancing towards a point to where the CP will no longer be able to properly protect the immersed, exposed steel. Some of the edges of piping are already exhibiting some red rust. It was noted that some of the roof rafters have shifted exposing a few inches of a "paint shadow". These strips of exposed metal have dark rust and this indicates that the rafters shifted, probably from a seismic event. The dark rust at these areas indicates that the condition is not a recent development. It is recommended that the tank lining be evaluated in 3 to 5 years with any eye of possible relining shortly after that inspection benchmark.

Recommended Work

It is recommended that the tank be placed back on a 3 to 5 years maintenance inspection schedule.

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		Emilio Smith	

Water Tank Dive Inspection Report

Tank Owner/Client: City of Monterey Park	**Dive Supervisor:** Emilio Smith
Client Contact: Victor Meza	**Lead Diver:** Emilio Smith
Tank Name: Russel 2A	**Dive Tender:** Damian Hackett
Date of Last Inspection:	

Scope of Work	Maintenance Dive ☒	Warranty Dive ☐	Cleaning ☐	Patch Repairs ☒	UT Readings ☐	Sampling ☐

Site

Item			
GPS Coordinates	☒	☐	**34.05202 / -118.12020**
Cross Street			**South Russell Ave**
Tank Location			farthest from access road
Perimeter Fencing	☒	☐	satisfactory
Site secured on arrival	☒	☐	
Nearest Structures	☒	☐	**Reservoir 1A**
Overhead Power Lines	☐	☒	
Antenna on Tank			**On ground**
Surrounding Site	☒	☐	paved
Impact potential	☒	☐	tree
	☐	☐	

Structural

Item			
Capacity	3 MG	**Number of Roof Vents**	**one center**
Diameter	146	**Roof Vent Design**	**round hooded**
Height	24	**Center Roof Vent Size**	**24"**
Erection Year	1987	**Roof vent sealed**	Yes - screened
Contract No.	2804	**Roof Rail System**	yes
Tank Substrate	welded steel	**Roof Rail Satisfactory**	Yes, 42" high, 2 midrails, 4 inch
Tank Profile	on grade	**Rail Location**	other
Tank Geometry	cylindrical	**Ext Roof Access**	**none present**
Number of Courses	three	**Exterior Vandal Deterrent**	not present
Height of Each Course	8 feet	**Ext Ladder Sat**	none
Roof Design	pitched roof	**Ext Ladder Fall Prevent**	none
Roof Structure	one girder with rafters	**Roof Tie-Off Present**	no
Column Design	pipe	**Tank Piping**	**common inlet/outlet**
Upper Center Column	cone	**Inlet Diameter**	12"
Column Base Design	free plate with stabilizing c	**Outlet Diameter**	12"
Structural Connections	bolted	**Flexible Pipe Coupling**	present
No. Shell Manways	two	**Overflow Pipe Diameter**	**12"**
Type of Manways	round	**Overflow Exterior Design**	**screened air-gap**
Manway Cover Design	bolt circle with hinge	**Overflow Interior Design**	**pipe lower course exit**
Diameter of Manways	36"	**Drain location**	**flush clean-out**
No. Roof Hatches	multiple	**Tank Foundation**	**concrete ringwall with no anch**
Hatch Design	steel hinged	**CP System**	**interior sacrificial**
Size of Roof Hatch	**36"x48", 24"x24"**	**Water Level Indicator**	**telemetry**