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CITY OF BARSTOW

BEFORE THE

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

In the Matter of the City of Barstow's Petition for Review of Action and Failure to Act by the California Regional Water Quality Control Board, Lahontan Region, in Issuing Cleanup or Abatement Order No. R6V-2007-0017 and Order to Submit Additional Technical Information in Accordance with Section 13267 of the California Water Code	**CITY OF BARSTOW'S PETITION FOR REVIEW AND REQUEST FOR STAY; (Wat. Code § 13320) [PRELIMINARY MEMORANDUM OF POINTS AND AUTHORITIES AND DECLARATIONS IN SUPPORT OF STAY FILED UNDER SEPARATE COVER]** **[REQUEST FOR STAY – WATER CODE §13321 AND 23 CCR § 2053]** **[REQUEST FOR HEARING – 23 CCR § 2052(b)]**

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INTRODUCTION

Petitioner, the City of Barstow ("City"), pursuant to Water Code Section 13320 and Title 23 of the California Code of Regulations, hereby petitions to the State Water Resources Control Board ("State Board") for review of the California Regional Water Quality Control Board, Lahontan Region's ("Regional Board") (1) May 18, 2007 Order Pursuant to California Water Code Section 13267 ("Section 13267 Order") and (2) May 25, 2007 Cleanup or Abatement Order No. R6V-2007-0017("CAO"). True and correct copies of the May 18 Order and the May 25 CAO are attached hereto as Exhibits A and B respectively. The Section 13267 Order and CAO are sometimes referred to individually or collectively as the "Orders".

The City requests that the State Board review the Regional Board's Orders, and in particular, the time schedule in the Section 13267 Order requiring the City to conduct its investigation and to submit technical reports on an expedited basis and in contradiction to established site assessment and remediation procedures.

The City further requests that the State Board review the Regional Board's findings in the CAO on the ground that such findings are not supported by substantial evidence. Among other things, the Regional Board's determination of 5mg/L nitrate as nitrogen as the trigger level of concentration at which the City is required by the Regional Board to supply replacement drinking water, in place of the standard drinking water Maximum Contaminant level ("MCL") for nitrate as nitrogen,10mg/L, is contrary to state and federal law.

Lastly, the City requests that the State Board review the Regional Board's Orders to the City which are derived from the Regional Board's unsupported findings and inaccurate calculation of a trigger level for supply of replacement drinking water.

A. NAME AND ADDRESS OF PETITIONER:

1. The City is a general law city, operating under the laws of the State of California and ordinances adopted by the City Council, and is located in the County of San Bernardino, California.

The address for Petitioner is:

City of Barstow
220 E. Mountain View Street, Suite A
Barstow, California 92311
Attn: Hector Rodriguez, City Manager
Email: hrodriguez@barstowca.org

Petitioner's counsel:

John J. Harris, Esq.
Gregory Newmark, Esq.
Chrystal James, Esq.
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333 S. Grand Avenue, Suite 1670
Los Angeles, California 90071
Tel.: (213) 626-2906

B. BACKGROUND:

2. The City owns an existing waste water treatment facility located on the eastern side of the City of Barstow ("Facility"). The City acquired the Facility in 1979. Aquarion operates the Facility under contract to the City. The Facility includes a waste water treatment plant ("Plant"), eight percolation ponds ("Ponds") and two reclamation fields. One reclamation field is located to the north of the Plant ("Northern Irrigation Field") and the other reclamation field is located to the south of the Plant ("Southern Irrigation Field"). The Plant provides secondary-level treatment of domestic wastewater using conventional activated sludge treatment. Wastewater is currently discharged at the eight Ponds and Southern Irrigation field. Until August 2003, biosolids generated at the Plant were applied to the Northern and Southern Irrigation fields. Since August of 2003, biosolids have been hauled offsite for disposal. Secondary effluent was used as spray irrigation for alfalfa crops in the Northern Irrigation Field until 2003 and currently is still used as spray irrigation in the Southern Irrigation field. (Exhibit B, May 25 CAO, Finding 5, p.2.)

3. The Facility is comprised of approximately five square miles and is located within Region 6 of the South Lahontan Hydrologic Basin Planning Area, Mojave Hydrologic Unit, Lower Mojave Hydrologic Area 628. Beneficial uses for groundwater in the Lower Mojave

Hydrologic Area include municipal, agricultural, industrial, freshwater replenishment and aquiculture. (See DPRA March 2007 Remedial Investigation Report, attached hereto as Exhibit F, p.3.)

4. The Basin Plan requires that the ground waters designated for municipal and domestic use not contain concentrations of chemical constituents in excess of the primary MCL based upon the drinking water standards specified in Title 22 of the California Code of Regulations. Title 22 specifies the standard drinking water MCL for nitrate as nitrogen is 10mg/L. This MCL was set by the California Department of Health Services and was derived from the federal MCL set by the U.S. Environmental Protection Agency.

5. Comprehensive groundwater monitoring at the Site began in the early 1980s. In 1982, the Regional Board established groundwater monitoring requirements for the Facility and the Northern and Southern Irrigation fields. These requirements were updated by the Regional Board in 1985. (Exhibit F, DPRA March 2007 RIR, p.3.)

6. During the 1980s, ten groundwater monitoring wells were installed in the vicinity of the Facility. In 1993, 15 new groundwater monitoring wells were installed and in 2005 three additional wells were installed. (Exhibit F, DPRA March 2007 RIR, p.3.)

7. In 2005, groundwater sampling was conducted that included all existing monitoring wells. Elevated nitrate concentrations were found to exist at some wells in the northern shallow groundwater zone of the Soapmine Road neighborhood. The Soapmine Road neighborhood includes approximately 40 private drinking water wells. Subsequent groundwater monitoring data obtained in 2006 and 2007 exhibited elevated concentrations of nitrate at some wells.

8. The City has worked with the Regional Board to implement a work plan to conduct additional groundwater monitoring and to investigate the source of the elevated nitrate concentration in the Soapmine Road area.

9. On March 30, 2007, the City submitted a Remedial Investigation Report (RIR), prepared by its consultants, DPRA, to the Regional Board. (See Exhibit F, attached hereto.) The Regional Board issued the May 18, 2007 Section 13267 Order in response to the DPRA's RIR.

No hearing was conducted on the Order, nor was the City given any opportunity to present evidence or contest the Order. The Section 13267 Order directs the City to submit a number of technical reports in accordance with a time schedule included in the order. The current schedule, as set forth in the Section 13267 Order, requires the City to establish and delineate the plume to background levels remedial alternatives prior to the determination of what the nitrate background level is. The Regional Board allowed an unreasonably short period of time for these activities (within only 14 months from start to final plan for remediation). This expedited timeline and manner of investigating and delineating the nitrate contamination will increase annual costs and may result in unnecessary costs to the City.

10. On June 13, 2007, the City requested an extension of time, through a proposed alternative time schedule, which would permit the City and its consultants, DPRA, to conduct a properly phased investigation of the background nitrate concentration levels to inform and guide plume delineation and any future remedial action, including a scientifically justified cleanup level. The City should not be required to identify where the edge of the plume reaches background level or develop plans to cleanup to background before determining what the background level of nitrate is. As of the date of this Petition, the Regional Board has not responded to the City's request.

11. On May 25, 2007, the Regional Board issued Cleanup or Abatement Order No. R6V-2007-0017 (CAO) directing the City to supply replacement drinking water to residences serviced by private wells exhibiting a nitrate as nitrogen concentration levels equal or greater than 5mg/L ("trigger level"). The standard drinking water MCL of 10mg/L was established by the California Department of Health Services pursuant to the California Safe Drinking Water Act and is set forth in Title 22 of the California Code of Regulations, Division 4, Chapter 15, Domestic Water Quality Monitoring. Although all of the potential contamination sources have not been definitively identified, the City has been supplying replacement drinking water to residences serviced by private wells in the Soapmine Area exhibiting a nitrate as nitrogen concentration level equal or greater than 5mg/L in accordance with the CAO. No hearing or other opportunity to contest the CAO or to present evidence was provided to the City.

12. The Regional Board's calculation of the trigger level for supplying replacement water and for conducting well monitoring is not consistent with the standard drinking water MCL of 10mg/L for nitrate as nitrogen as set forth in Title 22 of the CCR. The CAO also requires the City to conduct quarterly well monitoring and to submit quarterly reports documenting the laboratory results of the quarterly well monitoring. The City is and will continue to provide the replacement water in accordance with the CAO pending review of this Petition to affected residences on Soapmine Road.

C. THE SPECIFIC ACTIONS AND FAILURES TO ACT BY THE REGIONALOARD WHICH THE STATE BOARD IS REQUESTED TO REVIEW:

13. The City requests that the State Board review the following specific actions by the Regional Board, among others:

Actions in the May 18, 2007 Section 13267 Order

(a) The Regional Board's order that the City submit a Revised Remedial Investigation Report by September 15, 2007.

(b) The Regional Board's order that the City submit a Remediation Plan by October 15, 2007.

(c) The Regional Board's order that the City submit a Background, Seasonality and Migration Report by August 15, 2008.

(d) The Regional Board's order that the City submit a Final Remediation Plan by August 15, 2008.

Actions in the May 25, 2007 CAO

(e) The Regional Board's unsupported Finding No. 2 that the elevated nitrate concentrations in the groundwater were caused by the City's discharge of wastes to the northern irrigation field.

(f) The Regional Board's unsupported Finding No. 7 that the City caused or allowed or threatened to cause nitrate-containing wastes to be

discharged to waters of the State underlying and down gradient of the Northern Irrigation Field.

(g) The Regional Board's unsupported Finding No. 12 that the discharges from the City's facility have caused groundwater beneath the area down gradient from the Northern Irrigation Field to exceed the drinking water standard for nitrate as nitrogen (10mg/L).

(h) The Regional Board's unsupported Finding No. 12 that the discharges from the City's Facility have unreasonably affected the water for municipal and domestic supply beneficial use and caused a condition of pollution.

(i) The Re gional Board's determination that 5mg/L nitrate as nitrogen is the "trigger level," instead of the established standard drinking water MCL of 10mg/L, for which the City is required to supply replacement drinking water to the Soapmine Road area.

(j) The Re gional Board's order that City supply "replacement water service…to residences served by private wells within the Soapmine Road area in which the nitrate has been detected at concentrations at or exceeding 5mg/L nitrate as nitrogen."

(k) The Regional Board's order that the City, by September 30, 2007, "complete the next quarterly sampling of private domestic wells within the Soapmine Road area and submit samples with chain of custody documentation to a California certified laboratory for nitrate analyses and that the City collect quarterly samples thereafter (October -December, January - March, April - June, July – September)."

(l) The Re gional Board's order that the City, by October 15, 2007, and quarterly thereafter submit to the Regional Board California-certified laboratory results and other quality assurance/control documentation from

the first quarterly sampling event for all potentially affected private domestic wells.

(m)The Regional Board's order that the City, by August 15, 2007, submit a detailed Alternative Water Supply Implementation Work Plan for long-term, uninterrupted replacement water for domestic supply wells with nitrate concentrations exceeding 5mg/L nitrate as nitrogen and that the City include a report describing the volumes of interim uninterrupted water supplied to specific addresses up to July 31, 2007.

D. THE CITY REQUESTS A HEARING ON THE ORDERS

14. The City also requests a hearing on the Orders.

E. THE DATE ON WHICH THE REGIONAL BOARD ACTED

15. The Regional Board issued the Section 13267 Order on or about May 18, 2007. The City received the Order on or about May 18, 2007.

The Regional Board issued the Cleanup or Abatement Order No. R6V-2007-0017 on May 25, 2007.

16. This Petition is timely filed pursuant to Title 23 California Code of Regulations Section 2050(b) which provides in pertinent part "if the thirtieth day following the date of the action or inaction falls on Saturday, Sunday, or state holiday, the petition must be received by the state board no later than 5:00 p.m. on the first business day following." The thirtieth day following the date of the Regional Board's action on the Section 13267 Order fell on Sunday, June 17, 2007. Petitioner filed this Petition on the following business day, Monday June, 18, 2007.

F. STATEMENT OF REASONS WHY THE ACTION WAS INAPPROPRIATE OR IMPROPER:

17. The actions taken by the Regional Board, among other things, are inconsistent with the requirements with the provisions of the California Water Code; are not supported by evidence in the record before the Regional Board; and are arbitrary and capricious and an abuse

of discretion. A detailed discussion of these issues is presented in the City's Memorandum of Points and Authorities filed separately herewith and incorporated herein.

(1) The Regional Board's Time Schedule Forces the City to Unnecessarily Investigate Background Levels and Remedial Measures on a Parallel Track

18. The May 18 2007 Order requires the City to conduct investigation of background nitrate levels at the same time it is investigating horizontal and vertical extent of the nitrate concentration to background level and developing remedial alternatives. As directed by the Regional Board, the City would be required to investigate remedial alternatives to submit a report by October 15, 2007, prior to the August 15, 2008 determination of background levels.

19. DPRA has found that "[t]he schedule proposed by the RWQCB will result in an inefficient method for remediating the Study Area...The RWQCB's May 18 Order requires a multi-tasked approach of preparing and implementing an Interim Remedial Action, Remedial Investigation and Feasibility Study, concurrent with monitoring for establishment of background nitrate concentration" (Declaration of Robert Falero, 5.) Thus, the Regional Board's actions are not consistent with State Board polices or established assessment and remediation practices. The actions taken by the Regional Board, among other things, are inconsistent with the requirements with the provisions of the California Water Code; are not supported by evidence in the record before the Regional Board; and are arbitrary and capricious and an abuse of discretion. A detailed discussion of these issues is presented in the City's Memorandum of Points and Authorities filed separately herewith and incorporated herein.

(2) The Regional Board Failed To Properly Consider The Burden To The City, Including Costs Of The Reports In Comparison To The Benefits To Be Obtained

20. Water Code Section 13267 requires that the burden, including costs, of these reports shall bear a reasonable relationship to the need for the report and the benefits to be obtained from the reports. Similarly, Water Code Section 13225 (c) requires that "the burden, including costs, of such reports shall bear a reasonable relationship to the need for the report and the benefits to be obtained therefrom."

21. The benefits from forcing the City to proceed with the parallel investigations do not outweigh the burden to the City. The City will be forced to incur higher annual costs and faced with the risk of incurring additional, unnecessary overall costs.

22. The technical reports required on the time schedule directed by the Regional Board in the May 18 Section 12367 Order unnecessarily burden the City in at least two ways. First, by requiring the City to conduct the investigations and to submit the reports on an expedited basis, the City is forced to outlay the entire amount of investigation and remediation costs in the span of approximately one year (August 2007 – August 2008).
Second, the Regional Board's directive to the City to investigate background levels at the same time it investigates the extent of the nitrate contamination to background levels and determines the cost and effectiveness of remedial alternatives prior to establishing background level is impossible and is likely to result in unnecessary and additional overall costs to the City.

(3) The Regional Board Provides No Basis For Seeking The Expedited Time Schedule

23. The City has and is taking interim actions to mitigate and remediate the effects of the nitrate contamination in the vicinity of the Facility. Moreover, the City is supplying the affected residents with replacement drinking water. Therefore, there is no imminent threat to the public health or to the environment to justify the Regional Board's actions.

(4) The Regional Board's Findings Are Not Supported By The Evidence

24. The Regional Board provides no evidence or factual support that the City is the sole source of elevated nitrate levels in the vicinity of the Facility. Further investigation is necessary to identify all of the potential sources of nitrate contamination in the Northern Irrigation Field region. Until such investigation is completed, there is no substantial evidence supporting the finding that the City's discharges are the cause of the elevated nitrate concentration.

(5) The Regional Board Improperly Imposes An Inappropriate Trigger Level For Replacement Drinking Water

25. The Regional Board issued Cleanup or Abatement Order No. R6V-2007-0017 directing the City to supply replacement drinking water to residences in the Soapmine Road area serviced by private wells exhibiting a nitrate as nitrogen concentration level equal or greater than 5mg/L ("trigger level").

(6) The Regional Board's Calculation of 5mg/L Nitrate as Nitrogen is Contrary to the Law.

26. The Regional Board's Calculation of the "trigger level" for affected wells is contrary to the State established MCL for nitrate as nitrogen. The standard drinking water MCL is 10mg/L as established by the California Department of Health Services (DHS) pursuant to the California Safe Drinking Water Act and located in Title 22 of the California Code of Regulations, Division 4, Chapter 15, Domestic Water Quality Monitoring. Further, the Department of Health Services derived the 10mg/L MCL from the MCL established by the U.S. Environmental Protection Agency (USEPA) The Regional Board's determination of the 5mg/L trigger level ignores the expertise of DHS and USEPA in determining the standard drinking water MCL.

(7) The Regional Board Should Defer to Agency Expertise

27. This State Board has previously determined that where MCL's have been developed by DHS, the Regional Board should defer to the agency's expertise. "Where new water replacement orders are considered, or where existing agreements or orders provide for reconsideration of replacement water levels, regional water boards should ***defer*** to OEHHA and DHS in determining safe drinking water levels." (*In the Matter of the Petitions of Olin Corporation and Standard Fusee Incorporated,* Order WQ 2005-0007, 2005 WL 5166379.)

(8) The Regional Board Improperly Includes Fluctuations in Sampling in the Trigger Level Calculation

28. The Regional Board improperly uses fluctuations in the sampling of groundwater taken from the private wells to calculate the MCL that is lower than that required by

state and federal standards. This State Board has previously determined that fluctuations are not a factor of consideration in setting the trigger levels for providing replacement water.

(9) The Regional Board Improperly Requires the City to Take Additional Actions Based Upon the Inaccurate Trigger Level

29. The CAO further requires the City to conduct quarterly well monitoring of all private domestic wells within the Soapmine Road area and to submit the samples to a laboratory for nitrate analyses. The City must also submit quarterly results and other quality assurance, quality control documentation to the Regional Board for all potentially affected private domestic wells at or exceeding the 5mg/L trigger level. Lastly the City is required to submit, by August 15, 2007, an alternative Water Supply Implementation Work Plan for long-term, uninterrupted, replacement water for domestic supply wells exhibiting nitrate as nitrogen concentrations at or exceeding 5mg/L.

30. The Regional Board improperly imposes these additional requirements on the City based upon a trigger level that is inconsistent with state and federal standards.

(10) Due Process Violation

31. By failing to provide a hearing on either order, the City was denied due process in violation of the Administrative Procedures Act, among other things.

G. <u>THE MANNER IN WHICH THE PETITIONER IS AGGRIEVED:</u>

32. The City is and will be adversely affected by the actions taken by the Regional Board. The City, as an aggrieved party, is challenging the Regional Board's Section 13267 Order directing the City to submit technical reports in an unreasonably short period of time. The short time period will cause the City to incur higher annual outlays and risk unnecessarily higher overall costs. Additionally, the City is adversely affected by the Regional Board's directive establishing 5mg/L nitrate as nitrogen as the trigger level for affected wells for which the City must supply replacement drinking water and conduct quarterly well monitoring because this order increases the City's replacement water costs. The Regional Board's Orders are not supported by substantial evidence; the Regional Board's actions are an abuse of discretion; and

the Regional Board's actions are improper, inappropriate, arbitrary and capricious and contrary to state and federal law.

H. THE SPECIFIC ACTION BY THE STATE OR REGIONAL BOARD WHICH PETITIONER REQUESTS:

33. The City seeks an Order by the State Board to:

A. Vacate the May 18, 2007 Section 13267 Order and remand the Section 13267 Order to the Regional Board with the instructions to adopt the implementation time schedule proposed by the City as follows:

1. Background Level Determination – Beginning August 15, 2007 and ending August 15, 2008;
2. Revised Groundwater Investigation Work Plan – October 28, 2008;
3. Revised Remedial Investigation Report – January 30, 2009;
4. Groundwater Monitoring (1 year) – Beginning September 9, 2008 and ending September 9, 2009;
5. Remediation Plan (Feasibility Plan) - November 25, 2009; and
6. Final Remedial Action Plan – March 10, 2010.

B. Vacate the May 25, 2007 CAO and remand the CAO to the Regional Board with instructions to set the trigger level for supplying replacement drinking water to the standard drinking water MCL of 10mg/L or in the alternative, permit modification of the trigger level, if appropriate, upon the completion of the City's investigation as set forth herein.

C. Order the Regional Board to conduct evidentiary hearings on the Orders.

I. A STATEMENT OF POINTS AND AUTHORITIES IN SUPPORT OF LEGAL ISSUES RAISED IN THE PETITION:

34. The City has filed a separate memorandum of points and authorities in support of this Petition under separate cover.

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J. A STAY IS NECESSARY PENDING STATE BOARD REVIEW OF THIS ACTION:

35. Pursuant to Water Code §13321 and California Code of Regulations, Title 23 Section 2053, the City respectfully requests this State Board stay the Orders pending review of this Petition. A stay of the action taken by the Regional Board is necessary to avoid substantial harm to the City.

36. Without the issuance of a stay, the City will be required to immediately commence the implementation of the directives in the Section 13267 Order under an unreasonable time schedule and in a manner that is inconsistent with site assessment and remediation standard practices. (See Declaration of Robert Falero, ¶5.) The Section 13267 Order requires the City to take a number of immediate actions that will both expensive and may prove unnecessary if the State Board adopts the City's schedule for investigation and remediation. Further, pursuant to the CAO, the City will be required to supply replacement water and to monitor private wells and file quarterly reports to the Regional Board for residences whose samples exceed the 5mg/L trigger level set by the Regional Board, when those directives are clearly contrary to state and federal standards.

37. A stay of the action taken by the Regional Board is necessary to minimize the harm that will result to the City and to the general public. If a stay of the Regional Board's actions is not granted, the City will be forced to proceed with its investigation in a manner that will result in greater annual costs and may result in additional unnecessary overall costs to the City. These costs will require a significant diversion of funds away from other important City services. Given the City's limited resources, it is aggrieved when required to take actions that use resources to accomplish ends that are unnecessary and/or not required by law.

38. In contrast, a stay of the action taken by the Regional Board, pending review of this Petition, will not result in any harm to other interested persons or the public. The City is and will continue to provide replacement water pending review of the Orders, thereby eliminating any imminent or substantial danger to the public or the environment.

39. No evidence has been presented by the Regional Board or its staff that would show that a delay in the imposition of the Regional Board's deadlines to allow the State Board's review will result in substantial harm to the public. The City will continue to provide replacement drinking water; investigate the sources of nitrate contamination; and implement a groundwater monitoring process to establish a scientifically valid and statistically significant data set to determine background levels of nitrate. The harm that will result to the City and the public, if the City is forced to comply with the Orders, unless modified, will far outweigh any alleged harm to interested persons and the public from the issuance of a stay.

40. As set forth in the City's Memorandum of Points and Authorities, substantial questions of both law and fact exist which must be resolved before a determination can be made on whether the actions taken by the Regional Board are consistent with state and federal law, and whether the findings and determinations made by Regional Board are substantially supported by law and the evidence in the record.

K. A LIST OF PERSONS KNOWN TO HAVE AN INTEREST IN THE SUBJECT MATTER OF THE PETITION:

41. A list of persons known to have an interest in this Petition is attached hereto as Exhibit C.

L. A STATEMENT THAT THE PETITION HAS BEEN SENT TO THE REGIONAL BOARD:

42. A copy of this Petition will be simultaneously served on the Respondent, the Regional Board, through its Executive Officer at the following address:

Harold J. Singer, Executive Officer
California Regional Water Quality Control Board, Lahontan Region
2501 Lake Tahoe Boulevard
South Lake Tahoe, CA 96150

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M. A STATEMENT THAT THE ISSUES RAISED IN THE PETITION WERE PRESENTED TO THE REGIONAL BOARD BEFORE THE REGIONAL BOARD ACTED OR FAILED TO ACT, OR EXPLANATION OF WHY THE PETITIONER COULD NOT RAISE THOSE OBJECTIONS BEFORE THE REGIONAL BOARD:

43. The City presented the issues raised in this Petition to the Regional Board by letter dated June 13, 2007. A true and correct copy of the letter is attached hereto as Exhibit D. On June 18, 2007, the City received a response from the Regional Board by letter dated June 15, 2007 informing the City that the Regional Board is "not willing to modify the [May 18 Section 13267] Order to allow for this lengthy delay." The letter also stated that the Regional Board was "not prepared to revise the CAO at this time. However, I am willing to use new data, as it is developed, to revise the 5mg/L trigger point for providing an alternate water supply." A true and correct copy of the letter is attached hereto as Exhibit G.

N. COPY OF A REQUEST TO THE REGIONAL BOARD FOR PREPARATION OF THE REGIONAL BOARD RECORD:

44. By letter dated June 15, 2007, Petitioner requested that the Regional Board prepare the administrative record related to the issuance of the Orders. A true and correct copy of the letter is attached hereto as Exhibit E.

WHEREFORE, the City prays, as follows:

(1) That an order be issued by the State Board vacating the directives set forth by the Regional Board in the May 18 Section 13267 Order and remanding to the Regional Board with the instructions to implement the time schedule proposed by the City;

(2) that an order be issued vacating the May 25, 2007 CAO and remanding the CAO to the Regional Board with instructions to set the trigger level for supplying replacement drinking water to the standard drinking water MCL for nitrate as nitrogen 10mg/L and modifying the directives for quartering well monitoring and quarterly reporting to be conducted on private wells exhibiting equal of greater levels of concentration than the standard drinking water MCL for nitrate as nitrogen 10mg/L accordance with state and federal law; and

(3) that the City be provided a hearing to allow the City to address the issues presented in this Petition which the City was precluded from addressing in a hearing before the Regional Board. The City was denied due process of law and a sufficient opportunity to be heard by the Regional Board's failure to hold a hearing to allow the City an opportunity to present evidence prior to issuing the May 18 Section 13267 Order an the May 25, CAO.

(4) that an order be issued by the State Board providing for such other and further relief as is just and proper; and

O. REQUEST TO HOLD PETITION IN ABEYANCE

45. Pursuant to California Code of Regulations, Title 23 Section 2050.5(d), the City requests that the State Board initially hold this Petition in abeyance to allow time for the City to attempt to resolve the issues raised in this Petition with the Regional Board informally. The City will promptly notify the State Board when the City seeks to have its Petition and request for stay considered. The City does not request that its stay request be held in abeyance.

Dated: June 18, 2007

Respectfully submitted,

MEYERS, NAVE, RIBACK, SILVER & WILSON

By _____
Chrystal B. James
Attorneys for Petitioner
City of Barstow

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EXHIBIT A

California Regional Water Quality Control Board
Lahontan Region

Linda S. Adams
Secretary for
Environmental Protection

2501 Lake Tahoe Boulevard, South Lake Tahoe, California 96150
(530) 542-5400 • Fax (530) 544-2271
www.waterboards.ca.gov/lahontan

Arnold Schwarzenegger
Governor

MAY 1 8 2007

Hector Rodriguez
City Manager
City of Barstow
220 E. Mountain View Street, Suite A
Barstow, CA 92311

COMMENTS ON MARCH 2007 REMEDIAL INVESTIGATION REPORT AND ORDER TO SUBMIT ADDITIONAL TECHNICAL INFORMATON IN ACCORDANCE WITH SECTION 13267 OF THE CALIFORNIA WATER CODE, CITY OF BARSTOW GROUNDWATER INVESTIGATION, SAN BERNARDINO COUNTY, WDID NO. 6B360101001

The City of Barstow submitted a Remedial Investigation Report (Report), prepared by its consultant, DPRA, to the Regional Water Quality Control Board, Lahontan Region (Water Board) on March 30, 2007. Water Board staff reviewed the Report and has determined the Report does not fully identify and characterize the extent of groundwater affected by the City of Barstow's (City's) wastewater discharges.

Although progress has been made on groundwater characterization, additional information is needed to determine the background nitrate concentration and to fully delineate the horizontal and vertical extent of the City's nitrate plume to the background concentrations. Also, it is not known how the City's plume is affected by the percolation ponds, pumping from private wells, and possible contribution from other sources.

This letter provides: I) specific comments on the Report; and, II) identifies the technical reports I am ordering the City to submit. Nothing in this Order relieves the City of its responsibility to comply with previous Orders except for the requirement to submit a Remediation Plan by June 15, 2007.

I. COMMENTS ON REMEDIAL INVESTIGATION REPORT

The City's Report provides an assessment of previous investigations, contains results and findings from DPRA's January-February 2007 remedial investigation, and presents four recommendations. Our comments are organized as: A) Northern Region; B) Southern Region; C) Background and Other Factors; and, D) City's Recommendations.

EXHIBIT A

A. NORTHERN REGION

The Report data demonstrate the nitrate plume originated from the City's northern irrigation field and extends in an east and southeast direction about 6000 feet with the prevailing groundwater direction. The nitrate plume appears to be at least 2000 feet wide, from north to south, at Webster Road. However, the full extent of the nitrate plume has not been delineated to background concentrations. Additional water quality information is also needed in the intermediate zone in the down-gradient direction, northeast of the northern irrigation field, to determine if the nitrate plume extends below the shallow groundwater zone (i.e., deeper than 100 feet).

The Report identified the Hacienda Mobile Home Park as a potential contributor to the nitrate plume originating at the City's former northern irrigation field. Based on the data presented, the Mobile Home Park may be a nitrate source but the Mobile Home Park is cross-gradient from the northern field and there is no evidence to suggest the Mobile Home Park is the source of the high nitrate concentrations detected at the edge of the northern irrigation field.

B. SOUTHERN REGION

The Report indicates that a nitrate plume above the drinking water standard of 10 milligrams per liter (mg/L) originated from the southern boundary of the south irrigation field. However, the full horizontal and vertical extent of the City's nitrate plume has not been delineated to background concentrations.

The predominant groundwater direction in the vicinity of the south field is to the south and east although localized groundwater mounding is indicated around the southern irrigation field and Pond 3. The localized groundwater mounding is not well defined and may have a significant effect on the nitrate plume migration.

The Report does not provide an evaluation of wastewater treatment plant discharges at the southern field and at various ponds. Changes in these discharge volumes may affect local groundwater levels, flow rates, flow directions, and nitrate concentrations in the groundwater.

C. BACKGROUND AND OTHER FACTORS

Background nitrate conditions, potential seasonal changes in groundwater directions, potential migration from boundaries of plume(s), and possible effects from percolations ponds and pumping for private wells have not been fully evaluated. Monitoring Wells MW-1 and MW-3 appear to be the only two locations truly upgradient from the nitrate plumes, but more information is needed to properly establish the representative background nitrate concentrations, including areas upgradient and downgradient of the City's nitrate plumes. Evaluating effects of possible seasonal changes is necessary for understanding how the City's nitrate plumes may migrate and change character.

D. CITY'S RECOMMENDATIONS

The City's Report provided four recommendations for further action. Our comments are as follows:

Recommendation 1 – The City recommends terminating certain contractual agreements with its sampling coordinator. These contracts are between the City and its contractor, so I have no opinion on the City's recommendation.

Recommendation 2 – The City recommends that eleven monitoring wells should be monitored for water levels and nitrate as N on a quarterly basis. I concur that these wells should be monitored quarterly. After four consecutive quarters of monitoring, the City may propose, with appropriate justification, to discontinue monitoring any or all of these wells.

Recommendation 3 – The City recommends that monitoring wells MW-1 through 23 and NWP-4, 5, and 6 should be monitored on a semi-annual basis for one year. While I agree these wells should be monitored, the frequency must be quarterly because seasonal trends have not yet been determined and the full extent of nitrate contamination is not known. After one year, the City may propose, with appropriate justification, to discontinue monitoring of any or all of these wells or to change the frequency of monitoring.

Recommendation 4 – The City recommends that either 11 mg/L or 10 mg/L nitrate as N be used as the final cleanup level for the City's plume. Although 10 mg/L nitrate as N is the drinking water standard, the final cleanup level cannot be set until the City submits a complete analysis of remedial alternatives including options that result in cleanup to background.

II. ORDER FOR INFORMATION

Pursuant to California Water Code section 13267, I am ordering the City to submit the following technical reports to the Water Board's South Lake Tahoe and Victorville offices. Investigating the groundwater quality is necessary for determining the impact of the City's discharge on water quality, public health, and beneficial uses. This information is also necessary for identifying, evaluating, and implementing remedial actions intended to protect and restore water quality and the beneficial uses of the groundwater. Enclosed with this letter is a Fact Sheet that contains information regarding submitting technical reports pursuant to California Water Code section 13267.

Each technical report described below must be prepared under the supervision of and be signed and stamped by a Professional Geologist or Professional Civil Engineer registered in California.

A. INTERIM REMEDIATION PLAN

By June 30, 2007, submit a technical report identifying alternatives for remediating nitrate pollution at and above 10 mg/L in groundwater affected by the City's wastewater discharges. The Interim Remediation Plan must be based on the most current reliable site information available and should focus on actions that can be immediately taken to remediate nitrate contamination. The Interim Remediation Plan must also contain three essential elements:

1. Narrative description and ranking of a minimum of three remedial alternatives.

2. Implementation schedule for the proposed alternative.

3. Estimated time to reduce nitrate-nitrogen concentrations in groundwater to below 10 mg/L at all locations in the areas affected by the City's discharge.

B. GROUNDWATER INVESTIGATION WORK PLAN

By June 30, 2007, submit a technical report providing a work plan to obtain the following information:

1. Identify proposed or existing wells or other methods of collecting groundwater samples necessary to establish up-gradient groundwater quality (background) not affected by the City's current and past wastewater disposal and reuse facilities.

2. Identify proposed or existing wells or other methods for collecting groundwater samples necessary to fully delineate the vertical and horizontal extent of groundwater affected by the City's wastewater discharges. This must include: (i) identifying any proposed new well locations or other proposed methods for collecting groundwater samples necessary to characterize groundwater quality; (ii) identifying any proposed new well locations or other proposed methods for collecting groundwater samples necessary to complete the horizontal and vertical characterization; and, (iii) identifying monitoring wells that have been sampled during past City groundwater investigations regarding nitrate-nitrogen contamination for re-sampling. The purpose of the proposed monitoring system is to provide adequate groundwater data necessary to fully identify and map the horizontal and vertical extent of groundwater nitrate as nitrogen (N) contamination and degradation to an interim level of 2 mg/L nitrate as N associated with the City's current and past wastewater disposal and reuse practices. Any new monitoring wells installed as part of this investigation must be sampled on the same frequency as the existing monitoring wells are sampled.

3. Identify the water quality parameters and analytical methods that will be used to characterize groundwater quality and to identify the horizontal and vertical extent of groundwater nitrate-nitrogen contamination.

4. Identify all wells and other proposed methods necessary for producing site-specific groundwater elevation data, and for fully characterizing the groundwater flow rate and direction for the areas affected by the City's nitrate plume. The purpose of establishing site-specific groundwater elevations, flow rate, and directional information is so that the City and Water Board can fully understand the transport and fate of the City's wastewater discharges and associated groundwater nitrate-nitrogen contamination.

5. Identify site-specific data necessary to evaluate any presumptive remedial alternatives and the necessary activities for obtaining such data. For example, identify data that would be necessary to indicate whether or not denitrification is a viable alternative for remediation. Another example is to identify groundwater and/or soil data that may be necessary to evaluate the feasibility of remediation of elevated nitrate sources (i.e., hot spots) within the northern irrigation field.

The report must provide the well information in a narrative format and illustrate the locations on a site map of appropriate scale that allows for easy viewing. The report must also include the City's rationale or basis for its well selections and proposed methodologies for obtaining the above-referenced data and information.

C. REVISED REMEDIAL INVESTIGATION REPORT

By **September 15, 2007,** submit a technical report that provides the results from implementing the Water Board-accepted groundwater investigation work plan. This technical report must include, at a minimum, the following information:

1. Groundwater elevations from each well sampled in tabular format, and shown on a site map. Groundwater contour line intervals must be one foot in the vicinity of the south irrigation field and Pond 3. A map of depth to groundwater below ground surface in the northern region must be included.

2. Site map illustrating groundwater flow rates and directions for the area affected by the City's nitrate plumes.

3. Hydrogeologic cross sections that illustrate prevailing hydrogeologic conditions as they change throughout the study area.

4. Results of all groundwater quality analyses in tabular format.

5. Nitrate distribution maps. These maps must illustrate both vertical and horizontal distribution, and must delineate the nitrate concentration contours in 5 mg/L intervals from background concentrations to maximum concentrations. Nitrate concentration contour lines of 2 mg/L, 5 mg/L, and 10 mg/L must be delineated.

D. REMEDIATION PLAN

By **October 15, 2007,** submit a technical report identifying **alternatives** to establish hydraulic control of the nitrate plume and remediate nitrate contamination in groundwater affected by the City's wastewater discharges. The City must consider and evaluate alternatives that result in cleanup to background water quality conditions, the beneficial use standard and some value in between. The City must consider all beneficial uses of groundwater and the most restrictive standard for each use. If remediation to natural background concentrations is not technically or economically feasibly, the City may propose a final remediation goal that is protective of beneficial uses and follows State Water Resources Control Board Resolution No. 92-49. The Remediation Plan must include, but not be limited to, the following information for each alternative:

1. Narrative description.
2. Implementation schedule.
3. Estimated time to reduce nitrate-nitrogen concentrations in groundwater to natural background concentrations at all locations in the area affected by the City's discharge.
4. Description of groundwater model(s), if any, and associated input parameters and assumptions used to predict results.
5. Cost estimates for major components.

The report must also include the City's preferred alternative, and the comparative analysis used to justify its preferred alternative. The comparative analysis must include, but not be limited to, technical feasibility, predicted effectiveness in achieving cleanup standards, and costs.

E. BACKGROUND, SEASONALITY, AND MIGRATION REPORT

By **August 15, 2008,** submit a technical report identifying background nitrate conditions; seasonal variability in nitrate concentrations, groundwater levels, groundwater rates and directions; and any indications that the nitrate plume is migrating over time. Identify any proposed modifications to the remediation plan (see Item D above) based upon the results in the Background, Seasonality, and Migration Report.

F. FINAL REMEDIATION PLAN

By **August 15, 2008**, submit a final Remediation Plan incorporating results in the Background, Seasonality, and Migration Report.

If you have any questions regarding this letter, please contact John Steude, Engineering Geologist, at (530) 542-5571, or Doug Smith, Senior Engineering Geologist at (530) 542-5453.

HAROLD J. SINGER
EXECUTIVE OFFICER

Enclosure: Fact Sheet – *Requirements for Submitting Technical Reports Under Section 13267 of the California Water Code*

cc w/o encl: Pat Lendway/City of Barstow
Scott Rose/County of San Bernardino Environmental Health Services
Gary Vargus/DPRA
Christina Byrne

JSS/dldT:/BarstowGWInvestCommeIns5-17-07
[File: City of Barstow, VVL files]

EXHIBIT B

California Regional Water Quality Control Board
Lahontan Region

Linda S. Adams
Secretary for
Environmental Protection

2501 Lake Tahoe Boulevard, South Lake Tahoe, California 96150
(530) 542-5400 • Fax (530) 544-2271
www.waterboards.ca.gov/lahontan

Arnold Schwarzenegger
Governor

MAY 25 2007

Hector Rodriguez
City Manager
City of Barstow
220 E. Mountain View Street, Suite A
Barstow, CA 92311

CLEANUP OR ABATEMENT ORDER NO. R6V-2007-0017, CITY OF BARSTOW NITRATE CONTAMINATION IN GROUNDWATER, SAN BERNARDINO COUNTY, WDID NO. 6B360101001

Enclosed is Cleanup or Abatement Order (CAO) No. R6V-2007-0017. This CAO directs the City of Barstow to supply provide an uninterrupted replacement water supply (i.e. bottled water, well head treatment or equivalent) to well owners with elevated nitrate concentrations in private drinking water supply wells in the area north of the Mojave River. The City of Barstow is responsible for complying with the requirements of this order because it caused or contributed to the pollution and degradation of groundwater in the area northwest of its historic agricultural disposal area.

The CAO requires the City of Barstow to provide uninterrupted replacement water to residences in the Soapmine Road area where analysis of groundwater samples taken since 2006 have indicated or future sample results indicate nitrate nitrogen levels equal to or higher than 5 milligrams per liter (mg/L). The CAO requires the City to test all private wells four times per year. The City may cease supply of uninterrupted water service if four consecutive quarters of testing indicate that nitrate nitrogen concentrations are all less than 5 mg/L.

If you have any questions, please contact John Steude at (530) 542-5571 (jsteude@waterboards.ca.gov) or Doug Smith at (5430) 542-5453 (dfsmith@waterboards.ca.gov).

Harold J. Singer
Executive Officer

Attachment: Soapmine Road Area Drinking Water Supply Wells

cc: Lahontan Water Board Members
David Coupe, OCC, State Water Resources Control Board
San Bernardino County Health Department
Mailing list

file: T:/Barstow CAO Cover Letter R6V-2007 522-07 DFS

EXHIBIT 81

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LAHONTAN REGION

CLEANUP OR ABATEMENT ORDER NO. R6V-2007-0017

REQUIRING THE CITY OF BARSTOW TO CLEANUP OR ABATE THE EFFECTS OF DISCHARGING NITRATE CONTAMINANTS TO GROUNDWATERS OF THE MOJAVE RIVER HYDROLOGIC UNIT, WASTEWATER TREATMENT PLANT, CITY OF BARSTOW, WDID NO. 6B360101001

SAN BERNARDINO COUNTY

The California Regional Water Quality Control Board, Lahontan Region (Water Board), finds:

FINDINGS

1. The City of Barstow (hereafter "Discharger") owns and operates the municipal Wastewater Treatment Plant (WWTP) located at 2200 Riverside Drive in Barstow.

2. The Discharger is the responsible party subject to this Order because, as the former owner of the northern reclamation field property, the Discharger was responsible for the operation of the reclamation field and the discharge of wastes that caused elevated nitrate concentrations in groundwater.

3. Two irrigated fodder-crop (alfalfa) fields, located north and south of the Mojave River, have been used by the Discharger to reclaim secondary-treated effluent and biosolids from the WWTP. Disposal of effluent at the 67-acre, northern reclamation field property and its effect on groundwater are the subject of this Order.

4. The Discharger is required to comply with Waste Discharge Requirements (WDRs) specified in Board Order No. 6-94-26. The WDRs authorized discharge of secondary-treated effluent and biosolids at the two reclamation fields provided that waste discharges complied with applicable requirements.

5. Until 2004, and for approximately two decades prior to 2004, the Discharger applied up to 1.2 million gallons per day of secondary-treated effluent to the northern reclamation field. The secondary-treated effluent discharged by the WWTP contained nitrate nitrogen as well as ammonia and total Kjeldahl (TKN) nitrogen that convert to nitrate nitrogen. The

Discharger also spread unknown amounts of secondary-treated sewage biosolids from the WWTP on the northern reclamation field.

6. The WWTP secondary treated effluent and biosolids discharged at the northern reclamation field are defined as wastes pursuant to CWC section 13050(d).

7. The Discharger caused or allowed or threatened to cause nitrate-containing wastes to be discharged to waters of the State underlying and down gradient of the northern reclamation field.

8. Nitrate-containing wastes have impacted groundwater beyond the boundaries of the reclamation field. The Remedial Investigation Report (Report) submitted by the Discharger to the Water Board on March 30, 2007, details the presence of nitrate nitrogen in groundwater beyond the property boundary of the reclamation field. The Report identified a shallow nitrate plume, with a maximum nitrate nitrogen concentration of 32 milligrams per liter (mg/L), originating at the northern reclamation field. The results presented in the Report indicate that the nitrate plume originating at the reclamation field has migrated down gradient into the Soapmine Road neighborhood. The nitrate plume, as currently delineated, is approximately 6000 feet long and 2000 feet wide.

9. The Soapmine Road neighborhood includes approximately 40 private domestic drinking supply wells. Monitoring data (see Attachment A) from 2006 and 2007 indicate that approximately 13 of these wells contain water with nitrate nitrogen concentrations exceeding the drinking water Maximum Contaminant Level (MCL) of 10 mg/L for nitrate nitrogen. The MCL was established by the California Department of Health Services pursuant to the California Safe Drinking Water Act and may be found in Title 22 of the California Code of regulations, Division 4, Chapter 15, *Domestic Water Quality Monitoring*.

10. CWC section 13050(l) defines "pollution" as follows:

> *as an alteration of the water quality to a degree that unreasonably affects either beneficial uses or facilities that serve these beneficial uses.*

11. Pursuant to Chapter 2 of the Water Quality Control Plan, Lahontan Region (Basin Plan), present and potential beneficial uses of groundwater underlying the reclamation field, and down gradient, include domestic and

municipal water supply, agricultural water supply, industrial water supply, freshwater replenishment, and aquaculture.

12. Because the discharges have caused groundwater beneath and immediately down gradient of the reclamation field to exceed the drinking water standard for nitrate nitrogen (10 mg/L), the affected ground water is no longer useable for drinking or domestic supply. This alteration is unreasonable because the aquifer is currently used for drinking water and the portion of the aquifer affected by the discharge is no longer suitable for this beneficial use. The discharges have, therefore, unreasonably affected the water for municipal and domestic supply beneficial use and caused a condition of pollution.

13. The MCL for nitrate nitrogen is 10 mg/L. Therefore, water containing nitrate nitrogen at levels less than 10 mg/L is suitable for domestic use. Data from three sampling events of private wells indicate that nitrate nitrogen levels fluctuate. Private drinking water supply wells having nitrate nitrogen levels below the MCL during one sampling event have exhibited levels above the MCL on a subsequent sampling event. Therefore, to ensure that water above the 10 mg/L MCL is not used for domestic water supply, it is appropriate to require uninterrupted replacement water service to residences where there is the possibility for nitrate nitrogen levels to increase from levels below the MCL to levels above the MCL between sampling events. Between 2006 and 2007, 22 of the 40 domestic wells (those that had nitrate nitrogen concentrations of less than 10 mg/L in 2006) exhibited an average nitrate nitrogen concentration increase of 1 mg/L. The standard deviation of this 1 mg/L increase is 4 mg/L. Therefore; it is reasonable to apply a safety factor to establish the level of nitrate nitrogen concentration in domestic supply wells that would require uninterrupted replacement water supply. Adding the standard deviation of 4 mg/L to the average annual increase of 1 mg/L would provide a safety factor of 5 mg/L. Therefore, it is appropriate to require the City of Barstow to provide uninterrupted replacement water supply to residences with private wells exhibiting a nitrate nitrogen concentration of 5 mg/L or greater (10 mg/L MCL – 5 mg/L safety factor = 5 mg/L).

AUTHORITY – LEGAL REQUIREMENTS

14. The California Water Code (CWC) section 13304(a) states:

Any person...who has caused or permitted, causes or permits, or threatens to cause or permit any waste to be discharged or deposited

where it is, or probably will be, discharged to waters of the state and creates, or threatens to create, a condition of pollution or nuisance, shall upon order of the regional board clean up or abate the effects of the waste, or, in the case of threatened pollution or nuisance, take other necessary remedial action, including but not limited to, overseeing cleanup and abatement efforts. A cleanup and abatement order issued by the state board or a regional board may require the provision of, or payment for, uninterrupted replacement water service, which may include wellhead treatment, to each affected public water supplier or private well owner. Upon failure of any person to comply with the cleanup or abatement order, the Attorney General, at the request of the board, shall petition the superior court for that county for the issuance of an injunction requiring the person to comply with the order. In the suit, the court shall have jurisdiction to grant a prohibitory or mandatory injunction, either preliminary or permanent, as the facts may warrant.

15. Pursuant to CWC section 13304, subdivision (f):

Replacement water provided pursuant to subdivision (a) shall meet all applicable federal, state, and local drinking water standards, and shall have comparable quality to that pumped by the public water system or private well owner prior to the discharge of waste.

16. The conditions described in Findings 8 and 9 constitute violations of WDRs and the Basin Plan. The conditions described in these Findings also identify discharges of wastes where it has been discharged or deposited into waters of the State (groundwater) or probably will be discharged into the waters of the State. The Discharger is therefore subject to CWC section 13304.

17. Pursuant to CWC section 13267(b):

In conducting an investigation specified in subdivision (a), the regional board may require that any person who has discharged, discharges, or is suspected of having discharged or discharging, or who proposed to discharge waste within its region, or any citizen or domiciliary, or political agency or entity of this state who has discharged, discharges, or is suspected of having discharged or discharging, or who proposes to discharge, waste outside of its region that could affect the quality of waters within its region shall furnish, under penalty of perjury, technical or monitoring program reports which the regional board requires. The burden, including costs, of these reports shall bear a reasonable relationship to the need for the report and the benefits to be obtained from

the reports. In requiring those reports, the regional board shall provide the reports, and shall identify the evidence that supports requiring that person to provide the reports.

18. This Order requires monitoring, work plans and reports pursuant to CWC section 13267(b). The work plans and monitoring required by this Order are necessary to design a water replacement plan and implementation schedule and to determine compliance with this Order.

19. Pursuant to CWC section 13304, the Water Board is entitled to, and may seek, reimbursement for all reasonable costs actually incurred by the Water Board to investigate unauthorized discharges of wastes or to oversee cleanup of such waste, abatement of the effect thereof, or other remedial action pursuant to this Order.

20. The issuance of this Order is an enforcement action taken by a regulatory agency and is exempt from the provision of the California Environmental Quality Act (Public Resources Code, section 21000 et seq.), pursuant to California Code of Regulations (CCR), title 14, section 15321, subdivision (a)(2). The implementation of this Order is also an action to assure the restoration of the environment and is exempt from the provisions of the California Environmental Quality Act (Public Resources Code, section 21000 et seq.), in accordance with CCR title 14, sections 15308 and 15330.

21. Any person affected by this action of the Water Board may petition the State Water Resources Control Board (State Board) to review the action in accordance with CWC section 13320 and Title 23, CCR, section 2050 through 2068. The State Board, office of Chief Counsel, must receive the petition within 30 days of this Order.

ORDERS

IT IS HEREBY ORDERED, pursuant to CWC sections 13267 and 13304, that the City of Barstow shall abate the effects of waste discharges at or near the northern reclamation field as follows:

1. **By May 27, 2007**, supply interim uninterrupted replacement water service (i.e., bottled water or equivalent), to residences served by private domestic wells within the Soapmine Road area in which nitrate has been detected at concentrations at or exceeding 5 mg/L nitrate nitrogen, based on nitrate nitrogen concentration information generated in May 2006, August 2006,

and May 2007. The Soapmine Road area is defined as the area that is east of the Hacienda Mobile Home Park, north of the Mojave River, west of the Waterman Fault, and south of Soapmine Road including residences adjacent to and on both sides of Soapmine Road. Furthermore, the City shall supply interim uninterrupted replacement water service (i.e., bottled water or equivalent), to a residence served by private domestic wells within the Soapmine Road area within 48 hours of determining that the private well at that residence exhibits a nitrate nitrogen concentration of 5 mg/L or greater for the first time.

2. By May 30, 2007, submit a technical report to the Water Board listing all residences that have been provided interim uninterrupted replacement water service. The report must include the method that the City has implemented to provide interim uninterrupted replacement water service including how this service will be maintained. If a residence should have been provided interim uninterrupted replacement water service based on the requirement in Order No. 1 above and has not been provided interim uninterrupted replacement water service, the technical report must include actions the City has taken and will continue to take to provide interim uninterrupted replacement water service to the residence. If the reason that the City has failed to provide interim uninterrupted replacement water service is the refusal of the occupants of the residence to accept such service, the report must include a statement from the occupants of this refusal.

3. By June 1, 2007, provide notification to all parcel owners and residents in the Soapmine Road area that nitrate nitrogen concentrations in groundwater may exceed the MCL of 10 mg/L. The City shall also include notification that all potentially affected wells will need to be sampled on a quarterly basis, beginning July 1, 2007. (1)

4. By September 30, 2007, complete the next quarterly sampling of all private domestic wells within the Soapmine Road area and submit samples with chain of custody documentation to a California certified laboratory for nitrate analyses. Samples from these wells must be collected quarterly thereafter (October – December, January – March, April – June, July – September). 7/1 — 9/30

5. By October 15, 2007, and quarterly thereafter (January 15, April 15, July 15 and October 15) but no later than 21 days after completing the well sampling required in 4 above, submit to the Water Board California-certified laboratory results and other quality assurance/control documentation from the first quarterly sampling event (and subsequent

quarterly sampling events) for all potentially affected private domestic wells and a list of residences with nitrate nitrogen concentrations at or exceeding 5 mg/L in their supply water that will receive bottled water or equivalent (using Method Detection Limit of 1 mg/L or better). If the results of this monitoring identify a well that exhibits a nitrate nitrogen concentration at or exceeding 5 mg/L for the first time, the City must notify the Water Board of this information within 48 hours of the City receiving the monitoring information.

6. By August 15, 2007, submit a detailed Alternative Water Supply Implementation Work Plan for long-term, uninterrupted, replacement water, for domestic supply wells with nitrate concentrations at or exceeding 5 mg/L nitrate as N. Include a report describing the volumes of interim uninterrupted water supplied to specific addresses up to July 31, 2007.

7. Following Executive Officer's concurrence with the detailed Alternate Water Supply Implementation Work Plan for wells with nitrate concentrations of 5 mg/L or greater, **the City shall implement the plan according to a schedule approved by the Executive Officer**.

The Discharger shall be liable, pursuant to CWC section 133304, to the Water Board for all reasonable costs incurred by the Water Board to investigate unauthorized discharges of waste, or to oversee cleanup of such waste, abatement of the effects thereof, or other remedial action, pursuant to this Order. The Discharger shall reimburse the Water Board for all reasonable costs associated with site investigation, oversight, and cleanup. Failure to pay any invoice for the Water Board's investigation and oversight costs within the time stated I the invoice (or within thirty days after the date of invoice, if the invoice does not set forth a due date) shall be considered a violation of this Order. If the Property is enrolled in a State Board-managed reimbursement program, reimbursement shall be made pursuant to this Order and according to the procedures established in that program.

All technical and monitoring plans and reports required in conjunction with this Order are required pursuant to CWC section 13267 and shall include a statement by the Discharger, or an authorized representative of the Discharger, certifying (under penalty of perjury in conformance with the laws of the State of California) that the work plan and/or report is true, complete, and accurate. Hydrogeologic reports and plans shall be prepared or directly supervised by, and signed and stamped by a Professional Geologist or Professional Civil Engineer registered in California.

This Order in no way limits the authority of this Water Board to institute additional enforcement actions or to require additional investigation and cleanup of the site consistent with the CWC. The Order may be revised by the Executive Officer as additional information becomes available.

Failure to comply with the terms or conditions of this Cleanup and Abatement Order will result in additional enforcement action, which may include the imposition of administrative civil liability pursuant to CWC sections 13350 and 13268 or referral to the Attorney General of the State of California for such legal action as he or she may deem appropriate.

Ordered by: Harold J. Singer Dated: May 25, 2007

HAROLD J. SINGER
EXECUTIVE OFFICER

T:/BarstowWaterCAO5-22-07

ATTACHMENT A: Soapmine Road Area Drinking Water Supply Wells

Nitrate Nitrogen Concentrations (mg/L)

Well	May-06		Aug-06		May-07
a	5.8				7.3
b	6.6				7.9
c	14		14		15
d			11		11
e	3.6				4.4
f			5.3		6.5
g	7.5				6.3
h	9.4				11
i	3.8				3.4
j	7.8				7.6
k	3.4				3.5
l	11				13
m	14				
n	13				8.8
o	18				25
p			13		10
q			11		4.5
r	3.3				3.1
s	3.7				3.3
t	3.4				3.5
u	4.7				5.2
v	1.9				3.9
w	7.4				7.3
x	1.7				1.6
y			13		13
z	6.8				20
aa	3.8				4.8
bb	0.91				0.96
cc	2.6				2.6
dd	3.7				4.5
ee	4				4.2
ff	4.1				8.4
gg			13		15
hh					3.5
ii					0
jj					13
kk					5
ll					2.9
mm					2.6

EXHIBIT C

List of Persons Known To Have
An Interest In The Subject Matter
Of The Petition

No.	Name & Address
1	Gordon Andrews 35390 Marks Road Barstow, CA 92311
2.	Vince Aviles 31685 Clay River Road Barstow, CA 92311
3.	Janice Bailey 31557 Clay River Road Barstow, CA 92311
4.	Nicole Bechel 35393 Webster Road Barstow, CA 92311
5.	James Bilyew 35395 Webster Road Barstow, CA 92311
6.	Laurie Blackwell 2200 Soapmine Road Barstow, CA 92311
7.	Ward Blackwell 2200 Soapmine Road Barstow, CA 92311
8.	Cori Brogan 31625 Clay River Road Barstow, CA 92311
9.	Denise Brown 31673 Soapmine Road Barstow, CA 92311
10.	Gene Brown 1601 State Street Barstow, CA 92311

11. Linda Brown
35424 Marks Road
Barstow, CA 92311

12. Paul Campbell
31554 Clay River Road
Barstow, CA 92311

13. Kathy Clapham
31818 Clay River Road
Barstow, CA 92311

14. Leroy J. Clapham
31823 Nelson Road
Barstow, CA 92311

15. Shawna J. Clark
35282 Marks Road
Barstow, CA 92311

16. Gary Courtney
31516 Clay River Road
Barstow, CA 92311

17. Paul Courtney
31516 Clay River Road
Barstow, CA 92311

18. Sheri Craybill
31557 ½ Clay River Road
Barstow, CA 92311

19. Larry Dilling
31823 Nelson Road
Barstow, CA 92311

20. Debbie Friend
31685 Clay River Road
Barstow, CA 92311

21. Luther Friend
31801 Marks Road
Barstow, CA 92311

22. George & Virginia
35161 Marks Road
Barstow, Ca 92311

23. Corianne Griffeth
31509 Soapmine Road
Barstow, CA 92311

24. Sharon Thurston
Hacienda Mobile Home Park, Owner
30997 Soapmine Riad
Barstow, CA 92311

25. The Hassel's
2190 Soapmine Road
Barstow, CA 92311

26. Margaret Jerscheid
31888 Soapmine Road
Barstow, CA 92311

27. Raymond Jordan
31325 Clay River Road
Barstow, CA 92311

28. Hope G. Lopez
31588 Clay River Road
Barstow, CA 92311

29. Patricia Mace
31625 Soapmine Road
Barstow, CA 92311

30. William McCaffery
31724 Nelson Road
Barstow, CA 92311

31. Gladys McGinnis
35485 Webster Road
Barstow, CA 92311

32. Matt McKerall
31582 Clay River Road
Barstow, CA 92311

33. Marine Corps Logistics Base-Barstow
Colonel Kenneth D. Enzor,
Commanding Officer
P. O. Box 110100
Barstow, CA 92311-5050

34. Buck & Barbara Mead
31314 Clay River Road
Barstow, CA 92311

35. Jeannie Miramontes
2190 Soapmine Road
Barstow, CA 92311

36. The Mitchell's
31491 Soapmine Road
Barstow, CA 92311

37. Charles H. Monds
31961 Nelson Road
Barstow, CA 92311

38. The Razani's
35377 Marks Road
Barstow, CA 92311

39. BV Reddy, DVM
35190 Marks Road
Barstow, CA 92311

40. Summer Reney
35266 ½ Webster Road
Barstow, CA 92311

41. Hacienda Mobile Home Park Residents
30997 Soapmine Road
Barstow, CA 92311

42. Rios Family
31582 Clay River Road
Barstow, Ca 92311

43. Byron Seever
31664 Clay River Road
Barstow, CA 92311

44. Service Rock Company
31300 Highway 66
Barstow, CA 92311

45. The Smith's
35634 Soapmine Road
Barstow, CA 92311

46. Ray Smith
35650 Soapmine Road
Barstow, CA 92311

47. The Smith's
35676 Soapmine Road
Barstow, CA 92311

48. The Soutar's
31804 Soapmine Road
Barstow, CA 92311

49. Robert Stapp
33938 M Street
Barstow, CA 92311

50. Jim Swartwout
35191 Nelson Road
Barstow, CA 92311

51. Beth Usonyi
31879 Nelson Road
Barstow, CA 92311

52. Vito Valento
31801 Soapmine Road
Barstow, CA 92311

53. William Yriate
35394 Webster Road
Barstow, CA 92311

EXHIBIT D

THE CITY OF
BARSTOW
CROSSROADS OF OPPORTUNITY

June 13, 2007

VIA FACSIMILE AND FEDERAL EXPRESS

Harold J. Singer
Executive Officer
California Regional Water Quality Control Board, Lahontan Region
2501 Lake Tahoe Boulevard
South Lake Tahoe, CA 96150

RE: May 18, 2007 Order to Submit Additional Technical Information in Accordance With Section 13267 of the California Water Code, City of Barstow Groundwater Investigation, San Bernardino County, WDID No. 6B360101001 and May 25, 2007 Cleanup or Abatement Order No. R6V-2007-0017

Dear Mr. Singer:

The City of Barstow ("City") has received (1) your May 18, 2007 letter directing the City to submit certain technical reports ("May 18 letter"); and (2) your May 25, 2007 Cleanup or Abatement Order No. R6V-2007-0017 ("CAO"), with respect to the area in the vicinity of the City's Waste Water Treatment Facility ("Study Area"). As discussed below, the City requests an extension of time to meet the deadlines set forth in the May 18 letter and requests that the CAO be revised or withdrawn.

Although the City does not believe that responsibility for the nitrate levels has been definitively established, it is prepared to conduct a methodical investigation of the background nitrate concentration levels which ultimately would lead to the determination of the scope and extent of any remedial action, including a scientifically justified cleanup level. The current schedule, as set forth in the May 18 letter, requires the City to establish remedial alternatives prior to determining background nitrate levels for the Study Area. This expedited timeline and manner of conducting the investigation and delineating the nitrate contamination may result in unnecessary costs, and is inconsistent with established site assessment and remediation procedures.

Since the City is already providing replacement drinking water and will continue to do so, the City believes that, there is no need to proceed with delineation and remediation planning before the background level of nitrate is determined.

The City is not seeking to avoid the issues raised by the May 18 and May 25 orders; the City shares your concern that groundwater problems within the City are fully and appropriately investigated and promptly addressed. Although all of the potential contamination sources have not yet been definitively identified, the City has taken, and continues to take steps toward the mitigation and remediation of the effects of nitrate levels encountered in the Study Area. Accordingly, an extension of time would be appropriate to first

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properly determine background nitrate concentration levels so that proper delineation and cleanup levels could be determined, especially considering the absence of any imminent and substantial endangerment to the public health or the environment.

The current deadlines, as set forth in your May 18 letter, require the City to submit technical reports to the Water Board's South Lake Tahoe and Victorville offices in an unnecessarily short period of time. Requiring the City to meet these deadlines, will likely result in an unnecessary increase in overall costs to the City. Therefore, the City requests an extension of time, as indicated below, for each report.

Groundwater Investigation Work Plan Current Deadline: June 30, 2007

While the City is prepared to submit a groundwater investigation work plan by the June 30 deadline, however, as discussed more fully below, the City and its environmental consultants, DPRA, believe that it is necessary to first establish a statistically significant data set for nitrate concentration by conducting quarterly groundwater monitoring for one year. The City believes that the submittal of the groundwater investigation work plan by the current June 30 deadline is premature.

Interim Remedial Action Plan (IRAP) – Current Deadline: June 30, 2007

Although the City's and other parties' responsibility for the nitrate concentration has not been established, the City has taken the interim mitigation and remediation steps described below and will continue such interim actions:

1. The City ceased the application of waste biosolids at the Northern and Southern irrigation fields. The City has also stopped the discharge of effluents in the northern region of the Study Area.

2. The City continues to supply replacement drinking water to households served by private domestic wells with nitrate nitrogen concentrations at or exceeding 5mg/L.

3. The City has implemented a long term mitigation plan to build a tertiary treatment plant to further reduce the nitrate concentration levels in any discharged wastewater from its facility.

Additionally, the City intends to immediately investigate within the Northern and Southern irrigation fields to identify any potential source of elevated nitrate concentrations as an interim remedial action before the proposed installation of additional monitoring wells to determine background levels. The City is prepared to submit an interim remedial action plan by the June 30, 2007 deadline which will incorporate these interim measures.

Background, Seasonality and Migration Report – Current Deadline: August 15, 2008

Background Level Determination – Beginning August 15, 2007 - Ending August 15, 2008

The City's consultant, DPRA, recommends that one full year of groundwater monitoring should be conducted to establish an accurate and statistically significant data set to define the background nitrate concentration levels for the Study Area in order to determine the nature and extent of the nitrate contamination within the Study Area. Presently, to our knowledge, no accurate or statistically significant data for background nitrate exists for the Study Area. DPRA proposes to install 2 additional wells upgradient from the site to collect background level data. Establishing correct background nitrate concentrations will provide a baseline and minimize the risk that future investigative work will be conducted in an inefficient or ineffective manner. The City and DPRA believe that proper groundwater monitoring should be conducted for one year through August 15, 2008.

Revised Groundwater Investigation Work Plan – Proposed Deadline: October 28, 2008

After the one-year collection of an accurate set of nitrate background data, DPRA recommends that the Groundwater Investigation Work Plan may need to be revised to reflect any changes in well numbers, well placement, and frequency, as well as changes in sampling frequency, analytes sampled, etc. Accordingly, the City and DPRA propose submittal of a revised Groundwater Investigation Work Plan by October 28, 2008.

Revised Remedial Investigation Report – Current Deadline: September 15, 2007/ Proposed Deadline January 30, 2009

After installation of any necessary monitoring wells and analyses of groundwater characteristics, a technical report will be submitted to the Regional Board identifying DPRA's findings. However, to conduct a scientifically valid remedial investigation, it is necessary to first determine an established background concentration. Only after the establishment of an accurate background nitrate concentration can an effective and accurate remedial investigation proceed. DPRA recommends that all data collected during the Groundwater Investigation Work Plan would be incorporated into a subsequent Revised Remedial Investigation Report. The incorporation of this data would serve to further solidify the groundwater characteristics within the Study Area and to outline the characteristics of the source area(s).

Groundwater Monitoring (1 year) – Beginning September 9, 2008 - Ending September 9, 2009

Subsequent to the completion of the well monitoring installation during the remedial investigative reporting period, DPRA recommends that a statistically significant number of sampling events should take place to establish groundwater characteristics, the nature and extent of nitrate contamination, including delineation to background level, plume migration and seasonal variations in groundwater characteristics and nitrate contamination. DPRA also recommends that such sampling events occur over one year of quarterly monitoring to ensure collection of a statistically significant data set for this purpose.

Remediation Plan (Feasibility Plan) - Current Deadline: October 15, 2007/Proposed Deadline: November 25, 2009

Once a background nitrate contamination level has been established, and all of the sources and parties responsible for the contamination are identified, the cost and effectiveness of remedial alternatives can be determined and a proper feasibility study could be prepared to the Regional Board. The current schedule proposed in the May 18 letter requires the submittal of such feasibility study identifying remedial alternatives (September 15, 2007) prior to the establishment of the level (October 15, 2007), making a cost-effectiveness analysis of cleanup to background impossible.

Final Remedial Action Plan – Current Deadline: August 15, 2008/Proposed Deadline: March 10, 2010

The determination of the most feasible remedial alternatives for the Study Area is dependent on several important events: (i) the collection of data generated during the remedial investigative reporting period; (ii) the subsequent monitoring of wells; (iii) the characterization of the source area(s); and (iv) identifying the parties responsible for the contamination. The appropriate time needed for each of these factors is outlined above.

Water Code §13267(b) provides that the burden of any report, including the costs, must bear a reasonable relationship to the need for the report and the benefits to be obtained. The current deadlines, as set forth in the May 18 letter, impose a timeline on the City that is neither efficient nor cost-effective. Requiring the City to unnecessarily proceed in such an expedited manner when no imminent and substantial danger to the public health or the environment exists does not, in our view, conform with the requirements of Water Code §13267.

As previously stated, the City is committed to working with the Regional Board to ensure a thorough investigation to obtain the necessary information to identify the sources of the elevated nitrate concentrations and the parties responsible for any elevated concentrations; to characterize the nature, extent and migration of the nitrate plumes; and to establish the proper representative background nitrate concentrations for the Study Area so that appropriate remedial measures can be determined. The City believes that the revised schedule which it proposed would permit DPRA to proceed with the investigation in a manner that is more methodic and more conducive to achieving the goals of the investigation, by first confirming the background nitrate levels prior to determining the delineation of nitrate contamination and proposing feasible remedial alternatives.

In consideration of all of the above, the City requests that the Board rescind or revise the May 18 Order and allow the City to proceed with an investigation on the schedule set forth above.

The City also believes that the findings contained in the May 25 CAO are not supported by substantial evidence. For example, the City believes that any determination of 5mg/L as the trigger level to provide replacement water to residences with private wells exhibiting a nitrate as nitrogen concentration equal or greater to this level should be revised to the standard drinking water Maximum Contaminant Level (MCL) of 10mg/L for nitrate as nitrogen. The sample data set from the private wells from which the 5mg/L trigger level was derived was very limited (3 water sample testing dates). Moreover, the scientific reliability of the

sample set is questionable as there were, evidently, breaks in the chain of custody of the samples while in transit to the laboratories. The City requests that the trigger level for requiring the City to provide replacement drinking water be revised to the standard drinking water MCL for nitrate as nitrogen, 10mg/L.

The City welcomes the opportunity to work with the Regional Board to resolve the issues discussed above. However, in order for the City to protect its rights, the City may have to file a petition with the State Board as to both the May 18 letter and the May 25 CAO should it be unable to resolve these issues with the Regional Board. Considering the deadlines set forth in the May 18 letter and the CAO, we would appreciate a response to our request by no later than this Friday morning, June 15, 2007.

Very truly yours,

Hector Rodriguez
City Manager

c: Gary Vargas, DPRA
Yvette Abich, Esq.
Chrystal James, Esq.

1248.002/977254v4

EXHIBIT E

meyers | nave riback silver & wilson
professional law corporation

Chrystal B. James
Attorney at Law
213.626.2906

June 15, 2007

Harold J. Singer, Executive Officer
California Regional Water Quality Control Board
Lahontan Region
2501 Lake Tahoe Boulevard
South Lake Tahoe, CA 96150

RE: Request for Preparation of Administrative Record – Petition for Review of Regional Board Actions in Issuing the May 18, 2007 Order Pursuant to California Water Code Section 13267 and the May 25, 2007 Cleanup or Abatement Order No. R6V-2007-0017

Dear Mr. Singer:

I am writing this letter in connection with the filing of a Petition to the State Water Resources Control Board on behalf of the City of Barstow concerning the actions of the Regional Water Quality Control Board - Lahontan Region in issuing the May 18, 2007 Order Pursuant to California Water Code Section 13267 and the May 25, 2007 Cleanup or Abatement Order No. R6V-2007-0017. We are preparing a petition to the State Water Resources Control Board pursuant to Water Code § 13320.

In accordance with Title 23 of the California Code of Regulations, Section 2050, please have the Regional Board's full administrative record on these matters prepared, including all documents and copies of any Reporter's Transcripts for any hearings held by the Board and relied upon by the Regional Board in making its findings and issuing the directives contained in the above-referenced orders.

In addition, pursuant to the regulations and in furtherance of the Petition to the State Water Resources Control Board, please prepare a list of persons that are known to the Regional Board to have an interest in the subject matter of this Petition and have copies of such list forwarded to this office and to the State Water Resources Control Board, as well as the City of Barstow.

Thank you for your assistance in this matter. Please do not hesitate to contact me should you have any questions.

Very truly yours,

Chrystal B. James

CBJ/ld
c: Hector Rodriguez, City Manager
Gary Vargas, DPRA

1248.002/978895

EXHIBIT E

EXHIBIT F

OFFICE

DPRA

Creative People. Smart Solutions.

REMEDIAL INVESTIGATION REPORT

City of Barstow Nitrate Investigation
Barstow, California

March 2007

EXHIBIT F

DPRA

Creative People. Smart Solutions.

REMEDIAL INVESTIGATION REPORT

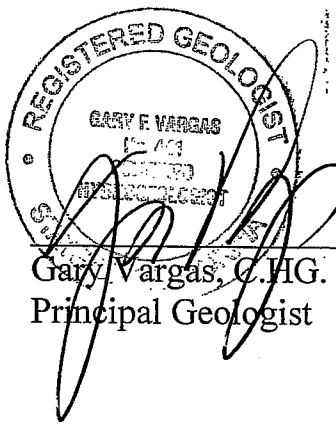
City of Barstow Nitrate Investigation
Barstow, California

Prepared for:
The City of Barstow

Prepared by:
DPRA, Inc.
100 E San Marcos Blvd
Suite 308
San Marcos
California 92069

Project Number:
004573.0007

Date:
March 2007



Gary Vargas, C.HG. ####
Principal Geologist

Roberto Falero
Staff Geologist

Paul Garcia
Staff Geologist/Project Manager

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1. Introduction

This Remedial Investigation Report (RIR), prepared for the City of Barstow, is a required document as outlined in the administrative agreement between the City of Barstow and the California Regional Water Quality Control Board (CRWQCB) Lahontan Region dated December 21, 2006 (Acceptance of Groundwater Investigation Work Plan and Time Extension to Complete Investigation and Remedial Action Plan for Groundwater Contaminated with Nitrates From City of Barstow Wastewater Discharges, San Bernardino, WDID No. 6B360101001).

The City of Barstow is located in San Bernardino County California (Figure 1). This RIR addresses the impact of potential waste discharges into the Mojave River Groundwater Basin (Figure 2). The primary focus of this RIR are two irrigated fields controlled by the City of Barstow and a residential neighborhood, the Soapmine Road Neighborhood (Figure 3).

The steps to complete this RIR were outlined in the November 27, 2006 Remedial Investigation Workplan (RIW) and the December 5, 2006 supplement to the RIW (DPRA, 2006).

This RIR was prepared to assess the following:

- The vertical and horizontal extent of nitrate in groundwater throughout the Study Area;
- Groundwater gradient and flow direction(s) throughout the Study Area;
- Identification of nitrate source areas throughout the Study Area;
- Document how the percolation ponds and a pumping well affect groundwater conditions in the southern region of the Study Area;
- Identification of potential denitrification processes active in the northern Study Area; and
- Determine background nitrate concentration in the Study Area.

1.1. Physical Setting

The Study area is located within the Mojave Desert Geomorphic Province. The Mojave Desert Geomorphic Province has two fault trends, northwest-southeast and a secondary trend of east-west. These are best exemplified by the San Andreas Fault and the Garlock Fault. The topography of the Mojave Desert Geomorphic Province consists of isolated mountain ranges separated by desert plains.

The Study Area is located within the Mojave River groundwater basin. The Mojave River groundwater basin extends north from the foothills of the San Bernardino and San Gabriel mountain ranges, and east to Afton Canyon, covering an area of approximately 1400 mi^2 (Stamos et. al., 2001b) (Figure 2). The surface water drainage basin that feeds the Mojave River groundwater basin covers an area of approximately 3800 mi^2 and is bisected by the Mojave River (Stamos et al., 2001b). Pre-Tertiary consolidated deposits consisting of primarily Cretaceous and Jurassic aged granitic and metamorphic

rocks form the San Bernardino and San Gabriel mountains that border the Mojave River groundwater basin to the south. These mountains form the basement complex and serve as the main catchment area for the Mojave River groundwater basin and the head waters of the Mojave River (Stamos et. al., 2001a&b; Densmore et. al., 1997; Cox and Wilshire, 1993).

The Study Area is located within Region 6 of the South Lahontan Hydrologic Basin Planning Area, Mojave Hydrologic Unit, Lower Mojave Hydrologic Area 628.50 (CRWQCB, Basin Plan). Beneficial uses for the inland surface waters of the Lower Mojave Hydrologic Area include municipal, agricultural, groundwater recharge, recreational, warm and cold freshwater habitat and wildlife habitat. Beneficial uses for groundwater in the Lower Mojave Hydrologic Area include, municipal, agricultural, industrial, freshwater replenishment and aquiculture. The water quality objective for the Lower Mojave Hydrologic Area, Mojave River (upstream side of Waterman Fault 6-40) is 11 mg/L of nitrate (as N). The US EPA and California Maximum Contaminant Levels (MCL) for nitrate as (N) is 10 mg/L.

1.2. Site Location

The Study area covers approximately five square miles and is bordered on the west by a line located one-quarter mile northwest of and parallel to Interstate 15, and bordered on the east by the eastern boundary of the Marine Corps Logistics Base. The northern boundary is Soapmine Road and a virtual extension of that road to the eastern boundary. The southern boundary is a line parallel to and one-half mile south of the Mojave River's southern bank (Figure 3).

The Study area straddles the main channel of the Mojave River. To the north and south of the Study area are mountains composed of Tertiary volcanic rocks that create small gullies and arroyos that dissect the Study Area before terminating at the Mojave River. The land use within the Study Area is a mix of residential, commercial, agricultural, transportation/utilities and public facilities (Nebo). Agricultural land is primarily located in the northern region of the Study area while transportation/utilities and public facilities dominate the southern regions (Figure 3).

1.3. Study Area Topographic Information

The elevation within the Study Area ranges from approximately 2188 feet above mean sea level (msl) at the northwest corner to approximately 2000 feet above msl in the river channel at the southeastern most boundary.

2. Previous Environmental Investigations

2.1. Summary of Previous Investigation Activities

Comprehensive groundwater monitoring at the Waste Water Treatment Plant (Site) began in early 1980s, when the north and south irrigated alfalfa fields were first constructed by the City of Barstow.

In 1982, the RWQCB issued order 6-82-80 establishing groundwater monitoring requirements for the Facility and the adjacent irrigated fields. These requirements were further updated by order 6-85-60 issued by the RWQCB in June 1985.

During the 1980s ten groundwater monitoring wells were installed in and around the Site to assess the quality of the groundwater. In 1993, nine of these wells were abandoned due to their deteriorated conditions.

On June 12, 1991, the RWQCB issued a Notice of Violation (NOV) letter to the City of Barstow, citing elevated nitrate concentrations in the groundwater in the vicinity of the Site. An investigation was conducted by the Boyle Engineering Corporation (Boyle) (Boyle, 1996). As a result of the investigation, a new groundwater monitoring program was initiated.

In 1993, 15 new groundwater monitoring wells: MW-1 (1, 2, 3 and 4), MW-2 (1, 2, and 3), MW-3 (1, 2, 3, and 4), and MW-4 through 7 were installed to study groundwater conditions at the Site (Boyle, 1993).

In July 2005, DPRA supervised the installation of three additional groundwater monitoring wells MW-8, MW-9, and MW-10. During this period, two soil borings: B-1 and B-2 were also drilled to assess nitrate concentrations in the irrigated field soils (Boyle, 2005b).

2.2. Nature and Extent of Impacted Media

2.2.1. Soil

Soil was primary investigated to provide additional data for the groundwater model created by Boyle. In August of 2005 Boyle Engineering completed two soil borings, B-1 and B-2, in the northern and southern irrigation fields respectively. Soil samples were collected and analyzed every five feet with the vadose zone. The constituents analyzed in the soil samples within the Study Area were nitrate, ammonia, chloride, and TKN. The soil sampling performed at these 2 locations were not intended to delineate any of these analytes and should not be interpreted as such.

2.2.2. Groundwater

Shallow:
Nitrate is the primary contaminant of concern for groundwater within the Study Area. In August of 2005, Boyle Engineering conducted a sampling event that included all existing monitoring wells at the time (MW-1 thru MW-10 and NWP-04 thru NWP-06). A total of 14 well locations were used to analyze the nitrate concentrations in the shallow groundwater zone during the August 2005 investigation. Data collected ranged from <0.10 mg/L to 28 mg/L (nitrate-nitrite) across the Study Area. Elevated nitrate concentrations were found to exist in the northern shallow groundwater zone west of the Soapmine Road neighborhood (MW-9 @ 28 mg/L) and east of the northern irrigation field (MW-2 @ 14 mg/L) (See Figure 2--Boyle, September 9, 2005. Due to the lack of wells in the northern region of the Site, the nitrate plume could not be adequately delineated.

Nitrate concentrations to the south ranged from <0.10 mg/L MW-7-2 to 4.2 mg/L at MW-6. Due to the lack of wells in the southern region of the Site, the shallow nitrate plume could not be adequately delineated.

Intermediate:
In August 2005, four wells were used to characterize the concentration of nitrate in the intermediate groundwater zone. MW-01-4, MW-02-3, MW-03-4 and MW-07-2 had nitrate concentrations that ranged from 0.13 mg/L at MW-3-3 to 1.1 mg/L at MW-7-1. No significant distinction between the northern and southern regions of the Study Area could be made based on these results.

Deep:
In August 2005, characterization of nitrates in the deep groundwater zone was based on the analytical results from 3 well locations in August 2005. MW-1 thru MW-3 had nitrate concentrations that ranged from <0.10 mg/L at MW-3-1 to 0.24 mg/L at MW-2-1. Due to the low concentration of nitrates in this zone no further study was deemed necessary.

3. Remedial Investigation Program

3.1. Introduction

Following the submittals of the October 2006 Remedial Investigation Workplan, the November 2006 Revised Remedial Investigation Workplan, and a December 5, 2006 letter documenting the agreements made between the City of Barstow, DPRA, and the RWQCB during a meeting held on December 1, 2006, the following field activities were formally approved. In a letter from the RWQCB letter dated December 21, 2006, it states that "[t]he Work Plan, with revisions documented in the November 27, 2006 and December 5, 2006 submittals, is hereby accepted."

The following sections discuss the field activities performed during the January/February 2007 RI program. The field activities were designed to characterize the horizontal and vertical extent of elevated nitrate conditions in groundwater, determine groundwater gradient and flow direction(s), determine what effects of the wastewater percolation ponds and an industrial pumping well have on local groundwater conditions in the southern region of the Study Area, identify potential sources of nitrate, determine if denitrification conditions naturally exist, and determine background nitrate concentrations within the
Study Area.

The field activities included:

- installation of 14 new monitoring wells (MW-11 thru MW-23);
- survey MW-08 through MW-10 as well as all new monitoring well and hydropunch/temporary well locations;
- collection of groundwater grab samples at 7 hydropunch/temporary well locations (HP-1 thru HP-7);
- collection of soil samples at 6 hydropunch/temporary well locations (HP-2 thru HP-7) and 4 monitoring well locations (MW-20 thru MW-23); and

- collection of groundwater samples from all existing and new monitoring wells (MW-1 thru MW-23 and NWP-04 thru NWP-06).

The locations of existing and new monitor wells and temporary well locations are indicated on Figure 3 and the construction details for the Site monitoring and temporary wells are summarized in Table 1

3.1.1. Drilling and Monitoring Well/Temporary Well Installation

3.1.1.1.Monitoring Wells

Thirteen shallow monitor wells (MW-11 through MW-23) and one intermediate depth monitor well (MW-20i) were installed to further delineate the extent of elevated nitrate concentrations in groundwater and to determine groundwater flow conditions throughout the Study Area.

In the northern region of the Study Area, existing monitor well MW-9 is screened in the shallow aquifer zone at an elevation of approximately between 2023.03 to 2043.03 feet above mean sea level (ft msl). MW-21, MW-22, and MW-23 were installed to provide downgradient (east/southeast) and upgradient/cross-gradient (north) delineation at this same interval if possible (Figure 4).

In the southern region of the Study Area, MW-11, MW-16, MW-17, MW-18, and MW-19 were installed and screened in the shallow aquifer zone upgradient/cross-gradient (south of the percolation ponds) to provide groundwater flow data and to provide additional background nitrate concentrations of groundwater flowing towards the Mojave River. Additionally, MW-12, MW-13, MW-14, and MW-15 were installed and screened in the shallow aquifer zone around percolation pond 3 at the City of Barstow's waste water treatment plant to determine how the percolation ponds influence groundwater flow in the southern region of the Study Area (Figure 3).

With the exception of MW-20i, all wells were drilled using either a CME-85 or CME-1050 hollow stem auger rigs. MW-20i was drilled using a mud rotary rig.

Wells were constructed using 2" schedule 40 PVC piping with screened intervals (0.020 slot) typically completed 5 feet above and 10 feet below first water. The wells were completed using #3 Monterey sand around the screens to approximately 2 feet above the highest screened portion. Above the sand, approximately 2 feet of bentonite chips were emplaced followed by bentonite grout to approximately 2 feet below ground surface. Above the grout, either flush mounted well boxes or monuments were set in concrete and completed at the surface. More details can be found in (Table 1; Appendix A; Appendix B).

Lithologic samples were typically collected at five foot intervals at each well location and classified according the Unified Soil Classification System (Appendix A). Samples were collected using a split spoon sampler for the wells installed with a CME-85/CME-1050 truck-mounted hollow stem auger. Lithologic samples for the wells installed with a mud-rotary rig (HP-1 and MW-20i) were collected from drill cuttings at the surface.

3.1.1.2. Temporary Wells

Seven temporary wells were installed in the Study Area north of the Mojave River and south of Soapmine Road (Figure 3). The initial sampling plan proposed for these locations (Remedial Investigation Workplan, October 12, 2006 and Revised Investigation Workplan, November 27, 2006) called for a strataprobe/hydropunch sampling technique. However, strataprobe samplers only extract 40mL voas per grab. Due to the necessity to collect 8 liters of water sample for isotope analysis, DPRA decided that installing temporary wells using 2" diameter PVC casing would allow for conventional sampling techniques to be employed saving a considerable amount of time and costs.

Temporary wells HP-2 through HP-6 were screened in the shallow aquifer zone and HP-1 was screened in the intermediate zone. Shallow temporary wells were screened 5 feet below the water table and temporary well HP-1 was screened from 140-150 feet below ground surface.

The temporary wells were constructed using 2" schedule 40 PVC piping with screened intervals (0.020 slot) typically completed 5 feet below the water table. The wells were completed using #3 Monterey sand around the screens to approximately 2 feet above the highest screened portion. Above the sand, approximately 2 feet of bentonite chips were emplaced and then the well was capped and covered with a temporary well cover. More details can be found in (Table1; Appendix A; Appendix B).

3.1.2. Monitoring Well/Temporary Well Development

Newly installed monitoring wells (MW-11 thru MW-23) and temporary wells (HP-1 thru HP-7) were developed prior to groundwater sampling. Well screens were surged for approximately five to 30 minutes depending on casing volume and turbidity and then bailed to remove sediment. The wells were then pumped at a rate of approximately two gallons per minute for approximately 5 to 30 minutes. Development proceeded until a minimum amount of turbidity was achieved in discharge waters.

3.1.3. Monitoring Well/Temporary Well Survey

A well survey was conducted by Hunsaker & Associates, a California-licensed survey company on January 11, 2007 (Appendix; C). For wells (MW-8 through MW-10) the concrete pad and casing elevation were surveyed. For temporary and new well locations a brass disk was inserted into the ground near the proposed well location and surveyed. After completion, well and hydropunch casing elevations were measured by DPRA using a TOPCON RLH3C™ laser level. Using the surveyed brass disk locations as a reference point, new well location and elevations were updated. Additionally, lateral changes in well placement relative to the brass disks were measured with a tape measure and Brunton compass. In most instances, final well placement was within 10 feet of the surveyed brass disks (Table 1).

3.1.4. Water Level Measurement Collection

Static groundwater levels were measured prior to the start of field operations on December 13, 2006 (Table 2). These measurements were used to establish preliminary groundwater flow direction across the Study Area and to aid in the placement of future temporary and permanent groundwater monitoring wells. All measurements were to the nearest 0.01 foot using a Kerk ET™ electronic water level meter.

On February 7, 2007, after the completion of all monitoring well installations and groundwater sampling, another set of static groundwater levels were measured for all new and existing monitoring wells. These data are incorporated into this report and will be used to establish groundwater flow direction and potential mounding within the Study Area (Table 3).

In addition to the new and existing monitoring wells four wells (NPZ-17, NS2-3, NNP-3 and NS1-5) on the NEBO base were also gauged to determine their static water level (Figure 4). Two wells (NPZ-17 and NS2-3) are located west of the Waterman Fault and two wells (NNP-3 and NSI-5) are located east of the Waterman Fault. The geographic distribution of these data points across the Waterman Fault will show the effectiveness (if any) of the Waterman Fault as a barrier to groundwater flow.

Dynamic groundwater level measurements were logged over a 14 day period (Between March 2, 2007 and March 15, 2007) at six monitoring wells using wireless Solinst Levelogger 3001 LT™ or LTC™ transducers. Each transducer was preprogrammed using the Solinst Levelogger™ software to collect data that included temperature, pressure, depth to water and at one location, conductivity.

Prior to placement of the transducers, depth to water was measured, as well as the transducer length and the length of string anchoring the transducer to the well casing. Each transducer was placed exactly 5 feet below the water table. The transducers were programmed to begin logging approximately 5 to 10 minutes after they were installed at each well. The logging interval was set to continuously collect data in 1 minute increments. Groundwater levels were again measured prior to retrieving the transducer. Data from transducers was downloaded and then analyzed and plotted (Figures 5, 6, & 7; Appendix D).

In the vicinity of pond 3, four of the six wells were located at the Site and lie in a northeast-southwest transect. A Solinst Levelogger™ was placed in each of these monitoring wells (MW-12 thru MW-15) in order to determine the influence (if any) this pond has on the shallow groundwater zone such as groundwater mounding. The dynamic groundwater level measurements would also aid in distinguishing any external influence on local groundwater fluctuations such as irrigation of the southern irrigation field and discharging and recharging of pond 3. This data is further discussed in section 6.2.1.

Documents provided by the California RWQCB indicated that a 750,000 gal/day industrial well was located on the Service Rock Industries property near the NEBO Marine Corps Logistics Base (Compliance Status and Order to Submit Technical Reports in Accordance With Section 13267 of the California Water Code, City of Barstow Groundwater Investigation,

San Bernardino County, WDID No. 6B360101001). Dynamic groundwater level measurements of monitoring wells MW-18 and MW-19, situated near this industrial well were logged using the Solinst Levelogger™ transducers. The purpose of logging these wells was to determine the effect this well has (if any) on the local shallow groundwater zone. This data is further discussed in section 6.2.1.

3.1.5. Groundwater Sampling

Groundwater samples were collected from existing wells (MW-1 thru MW-10), new wells (MW-11 thru MW-23), temporary wells (HP-1 thru HP-7) and from the U.S. Marine Corps/Nebo wells (NWP-04 thru NWP-06).

Prior to sample collection, depth to water and total depth of each well casing was gauged, using a decontaminated Kerk ET™ electronic water level meter, to calculate to the volume of water present in each well casing. A minimum of 3 borehole volumes of water was purged from each well using a Grundfos Redi-Flo™ submersible pump at a rate of 2 to 4 gallons per minute (gpm). During purging, water quality parameters including, pH, specific conductance, temperature and turbidity were measured for stabilization purposes. After purging was completed, a dedicated disposable bailer was used for groundwater sample collection. Groundwater samples were transferred to laboratory-supplied containers, placed in coolers with ice and transported to Calscience Environmental Laboratories, E.S. Babcock Laboratories, GEL Analytical, and Zymax Labs, with the appropriate chain of custody (Appendix #-FIELD DATA SHEETS).

The select groundwater samples were analyzed for nitrate (as N) (EPA method 300.0), total kjeldahl nitrogen (EPA method 351.3), inorganic cations (calcium, magnesium, sodium, potassium, iron, boron) (EPA method 6010B), inorganic anions (sulfate, chloride) (EPA method 300.0), total alkalinity (as $CaCO_3$) (standard method 2320B), fluoride (EPA method 340.2), ammonia (EPA method 350.2), total dissolved solids (EPA method 160.1), MBAS (EPA method 425.1), nitrate isotopes, oxygen isotopes, caffeine and fecal coliform bacteria (standard method 9221E) (Table 4).

3.1.6. Soil Sampling

Soil samples were collected in the vadose zone for HP-2 through HP-7, MW-21, MW-22 and MW-23.

Samples were collected using a split spoon sampler attached to the drill rig. Fitted with two inch by six inch stainless steel sleeves, the sampler was driven into the desired soil interval with a 60lb drive weight. The filled sleeve ends were then covered with Teflon tape and held in place with plastic caps. The sample was then placed in coolers with ice and transported to CalScience, a California-certified laboratory, with the chain of custody.

Soil samples were analyzed for total organic carbon (EPA method 9060), ammonia (EPA method 350.2M), nitrate as N (EPA method 353.3M), total Kjeldahl nitrogen (EPA method 351.3M) and total nitrogen (Table 4).

3.1.7. Investigative Derived Waste

Soil and groundwater waste generated by this investigation was characterized as non-hazardous. Soil cuttings from drilling procedures were stockpiled at the Barstow WWTP. Purge water from drilling and well sampling activities was disposed of on adjacent land surfaces.

3.2. Quality Assurance and Quality Control

3.2.1. Laboratory Quality Control

Calscience Environmental Laboratories, Inc. (Calscience):
Calscience performed analyses on select samples for nitrate/nitrite (as N) (EPA method 300.0), total kjeldahl nitrogen (EPA method 351.3), inorganic cations (calcium, magnesium, sodium, potassium, iron, boron) (EPA method 6010B), inorganic anions (sulfate, chloride) (EPA method 300.0), total alkalinity (as $CaCO_3$) (standard method 2320B), fluoride (EPA method 340.2), ammonia (EPA method 350.2), total dissolved solids (EPA method 160.1), and MBAS (EPA method 425.1).

According to Calscience laboratory data sheets, no quality control concerns were noted with respect to analytical methodology blanks (Appendix F).

Sample-specific quality control concerns were identified for the aqueous samples MW-2-3, MW-4, MW-8, and MW-9. The "Nitrate as N" analytical results for these samples were flagged with "(1) Dilution analysis was performed outside the recommended holding time." The original "Nitrate as N" analysis was performed within the holding time; due to the concentration exceeding the calibration range, a dilution was required to report a final result within the calibration range. Since it is the dilution analysis only that was performed past the holding time, DPRA considers the data to be representative of actual conditions and suitable for use in forming conclusions and recommendations in tandem with other data.

E.S. Babcock & Sons, Inc. (Babcock):
Babcock performed analyses on select groundwater samples for fecal and total coliforms (standard method 9221B, E), and heterotrophic plate count (standard method 9215B).

No QAQC concerns were indicated in laboratory reports produced by Babcock except for HP-7, which exceeded the target 6 hour hold time by approximately 1.5 hours (Appendix F). According to Section 64415(a) of the California Code of Regulations, analysis of coliform samples is required to be performed in accordance with EPA approved methods. Section 141.21 (Coliform Sampling) of the Code of Federal Regulations, which is incorporated by the above reference, states: *"For the analysis of total coliforms in drinking water, the time between sample collection and the placement of sample in the incubator must not exceed 30 hours (per regulation at 40 CFR 141.21(f)(3)). All samples received in the laboratory should be analyzed on the day of receipt. If the laboratory receives the sample late in the day, the sample may be refrigerated overnight as long as analysis begins within 30 hours of sample collection."* Given that the sample from HP-7 was analyzed well within this 30 hour EPA hold time, DPRA

considers the data to be representative of actual conditions and suitable for use in forming conclusions and recommendations in tandem with other data.

GEL Analytics, LLC (GEL):
GEL performed analyses on select groundwater samples for caffeine by liquid chromatography/mass spectrometry/mass spectrometry (LC/MS/MS). No QAQC concerns were indicated in laboratory reports produced by GEL except for MW-8. According to the laboratory report, the 250 ml HDPE sample container for MW-8 arrived with its lid ajar and only about 50ml of sample left in the jar (Appendix F). Analysis was performed on the remaining contents of the sample container. Due to the possibility of contamination, however, DPRA did not use the resulting data in forming conclusions or recommendations.

The sample container from MW-17 intended for GEL's caffeine analysis was mistakenly sent to Zymax. Zymax forwarded the sample under appropriate chain of custody to GEL for analysis. DPRA considers the results of caffeine analysis of MW-17 to be representative of actual conditions and suitable for use in forming conclusions and recommendations in tandem with other data.

Zymax Forensics, Inc. (Zymax):
Zymax performed analyses on select groundwater samples for isotopes analysis. No QAQC concerns were indicated in laboratory reports produced by Zymax (Appendix F).

3.2.2. Equipment Blanks

Equipment blanks are collected from the final rinse water from equipment decontamination. The samples were collected prior to the installation of temporary wells HP-2 through HP-7. Deionized water was poured over the drilling equipment and collected into laboratory supplied containers. Equipment blank samples were analyzed for nitrate/nitrite (as N) (EPA method 300.0), and fecal coliform bacteria (standard method 9221E).

Analysis of these samples were not detect for all analytes. Therefore, it was determined that no cross-contamination between hydropunch locations exist (Appendix F).

3.3. Decontamination Procedures

Drilling equipment was decontaminated by rinsing augers and sampler with a high pressure steam cleaner. Groundwater and soil sampling equipment was decontaminated prior to and between each well. Sampling equipment was rinsed, scrubbed with Alconox® or Liquinox® solution, and then rinsed with distilled water.

4. Site conditions

4.1. Introduction

The Study Area straddles the main channel of the Mojave River. The elevation within the Study Area ranges from approximately 2188 feet above mean sea level (msl) at the

northwest corner to approximately 2000 feet above msl in the river channel at the southeastern most boundary. To the north and south of the Study Area are mountains composed of Tertiary volcanic rocks that create small gullies and arroyos that dissect the Site before terminating at the Mojave River. The land use within the Study Area is a mix of residential, commercial, agricultural, transportation/utilities and public facilities (Nebo). Agricultural land is primarily located in the northern region of the Study Area while transportation/utilities and public facilities dominate the southern regions (Figure 3).

4.2. Regional Geology

The geology of the Mojave River groundwater basin is generally divided into two broad groups: consolidated pre-Tertiary and Tertiary deposits and unconsolidated Pliocene to Holocene deposits (Stamos et. al., 2001; Densmore et. al., 1997; Cox and Wilshire, 1993; Woolfenden, 1984; Hardt, 1971) (Figure 8). The pre-Tertiary consolidated deposits form the basement complex of the Mojave River groundwater basin and consist primarily of Cretaceous and Jurassic aged granitic and metamorphic rocks (Stamos et. al., 2001; Densmore et. al., 1997; Cox and Wilshire, 1993). These rocks form the San Bernardino and San Gabriel mountains that border the Mojave River groundwater basin to the south, serving as the main catchment area for the Mojave River groundwater basin and the head waters of the Mojave River. Tertiary volcanic and sedimentary rocks comprise the remainder of the consolidated deposits throughout the Mojave River groundwater basin. These deposits include a lower sequence of early Miocene volcanic rocks, unconformably overlain by an upper sequence of middle Miocene sedimentary rocks (Stamos et. al., 2001; Densmore et. al., 1997; Cox and Wilshire, 1993).

Unconsolidated deposits found in the Mojave River groundwater basin are principally composed gravel, sand, silt and clay deposited by the recent Mojave River and Plio-Pleistocene Mojave River, local tributary alluvial fans and older alluvial fans that pre-date the Mojave River drainage basin (Stamos et. al., 2001).

Older alluvial fan deposits are composed of sands, silts and gravels and contain abundant detrital clasts of the basement complex (Densmore et. al., 1997; Cox and Wilshire, 1993). These deposits exhibit significant amounts of erosion and structural deformation in the form of folding and faulting (Densmore et. al., 1997; Cox and Wilshire, 1993).

Younger and recent Mojave River alluvium overlie the Older alluvium and consists of coarse sands and gravels that range from unconsolidated to partly consolidated (Densmore et. al., 1997). The sedimentary constituents of both units are dominated by material derived from the San Bernardino and San Gabriel mountains at the headwaters of the Mojave River. For roughly two-thirds the length of the Mojave River groundwater basin, the mapped width of the Younger alluvium is approximately 1.5 miles before expanding into the Mojave Valley (Densmore et. al., 1997). The thickness of the Younger alluvium is fairly consistent at 200 feet over the length of the Mojave River groundwater basin. The recent alluvium is confined within the modern channel of the Mojave River and has incised the Younger alluvium as much as 15-25 feet during the Holocene (Densmore et. al., 1997).

4.2.1. Faulting

Faulting within the Mojave River groundwater basin is dominated by northwest-southeast trending right-lateral strike-slip faults (Figure 8). Four major strike-slip faults (Helendale, Lockhart, Camp Rock/Harper Lake Fault Zone [a.k.a. Waterman Fault] and the Calico-Newberry Fault) as well as a multitude of minor faults, dissect the Mojave River and the Mojave River groundwater basin, affecting the flow of surface and groundwaters (Stamos et. al., 2001; Densmore et. al., 1997; Hardt, 1971). All four major faults within the Mojave River groundwater basin impede the flow of groundwater within the regional aquifer to varying degrees (Stamos et. al., 2001; Densmore et. al., 1997; Hardt, 1971). Only the Camp Rock/Harper Lake Fault Zone shows evidence of impeding groundwater flow within the shallower floodplain aquifer (Stamos et. al, 2001).

The Camp Rock/Harper Lake Fault Zone is defined by five relatively young individual faults (faults A-E) that traverse beneath the U.S. Marine Corps Nebo Annex, approximately 5 miles east of Barstow (Stamos et. al., 2001; Densmore et. al., 1997; Cox and Wilshire, 1993) (Figure 9). Water level data have exhibited a significant difference from west to east across the Camp Rock/Harper Lake Fault Zone. Differences of 45 feet reported by Miller (1969), 30 feet reported by Hughes (1975) and 5 to 10 feet reported by Tetra Tech EM Inc. (2003) suggest that the Camp Rock/Harper Lake Fault Zone forms a significant barrier to groundwater flow throughout the regional and floodplain aquifers. Fault C, commonly referred to as the Waterman Fault, is especially significant because it is the primary groundwater barrier to groundwater flow within the floodplain aquifer (Stamos et. al., 2001; Densmore et. al., 1997; Cox and Wilshire, 1993; Robson, 1974). A trench investigation by Densmore et al (1997) across the master fault-plane of fault C revealed the formation of clay gouge caused by movement along the fault. Associated with the area dominated by the abovementioned clay gouge is a drop in groundwater elevation. For the current study (2007) water level measurements were taken across the Waterman Fault and revealed that water levels are approximately 11 feet higher on the west side of the Waterman Fault relative to east side (Figure 4).

4.3. Regional Hydrology

Infiltration from the Mojave River accounts for approximately 80% of the groundwater recharge within the Mojave River groundwater basin (Stamos et al, 2001; Hardt, 1971). Generally this recharge results from large storm events that cause sustained overland flow (typically referred to as floodflows) along significant stretches of the Mojave River (Stamos et al., 2001; Densmore et al., 1997; Lines, 1996). Recharge from flood-flows along the lower reaches of the Mojave River contribute primarily to the floodplain aquifer. The majority of the recharge to the Mojave River groundwater basin however, occurs at the headwaters of the Mojave River where flood-flows are more frequent and of greater magnitude (Stamos et al., 2001). Direct infiltration from precipitation is considered negligible as a source of recharge to groundwater due to the combination of low precipitation and high evaporation/transpiration potentials in this arid environment (Densmore et al., 1997; Lines, 1996)

The Mojave River groundwater basin is naturally divided into two unconfined aquifers, the upper floodplain aquifer (commonly referred to as the Mojave River aquifer and the alluvial aquifer in previous reports) and the regional aquifer, which underlies and surrounds the floodplain aquifer (Smith et al., 2004; Izbicki, 2004; Izbicki and Michel, 2004; Stamos et al., 2001; Densmore et al., 1997; Mendez and Christiansen, 1997; Lines, 1996 Hughes, 1975; Robson, 1974) (Figure 10). The floodplain aquifer typically consists of Recent and Younger Mojave River alluvial deposits and ranges from 100-200 feet thick (Stamos et al., 2001; Densmore et al., 1997; Robson, 1974; Hardt, 1971).

Just east of Barstow at the U.S. Marine Corps Nebo Annex the floodplain aquifer is approximately 1 to 1.5 miles wide and is 200 feet thick. The floodplain aquifer is generally more permeable than the regional aquifer and historically has been the more productive of the two aquifers (Smith et al., 2004; Lines, 1996). The transmissivity of the floodplain aquifer were reported by Hardt (1971) as ranging between 13,000 to 27,000 ft^2/day, although more recent data produced by Stamos et al. (2001) estimate the transmissivity of the recent Mojave River alluvium in the floodplain aquifer ranging from 1,000 to 60,000 ft^2/day. Yields between 100 and 2,000 gal/min are common for wells perforated within the floodplain aquifer (Stamos et al., 2001; Lines, 1996; Hardt, 1971). A number of wells west of Barstow, perforated within the floodplain aquifer, have been known to yield 4,000 gal/min (Lines, 1996; Hardt, 1971).

The regional aquifer is comprised of the Pleistocene to Tertiary aged younger and older alluvial fan deposits and the older alluvium (Smith et al., 2004; Stamos et al., 2001; Densmore et al., 1997). The thickness of this aquifer ranges from 1,000-2,000 feet and is typically greater than 1,000 feet thick in and around the city of Barstow (Stamos et al., 2001; Densmore et al., 1997; Hardt, 1971) (Figure 10). Most of the groundwater in the Mojave River groundwater basin is stored in the regional aquifer (Densmore et al., 1997). Permeability in the regional aquifer is low due to increased cementation and the fine-grained nature sediments that compose this aquifer (Stamos et al., 2001; Densmore et al., 1997; Robson, 1974; Hardt, 1971). Estimated transmissivity for the regional aquifer as reported by Hardt (1971) ranges from 1,000-13,000 ft^2/day. Stamos et al. (2001) estimated the transmissivity of the regional aquifer as ranging from 300-17,000 ft^2/day.

Pre-Tertiary consolidated deposits of the basement complex are considered non-water bearing throughout the Mojave River groundwater basin due to their low porosity (Stamos et al., 2001; Densmore et al., 1997). Although in areas of intense fracture small quantities of water may be recovered from these deposits but they tend to be of poor quality water (Stamos et. al., 2001; Densmore et. al., 1997; Hughes, 1975).

Groundwater underflow into the Barstow area is estimated at 1,100 acre-ft/year during 1946-1958 and decreased from 1959-1971 to 800 acre-ft/year (Robson, 1974). Underflow varies significantly due to constant changes in the saturated thickness of the aquifers.

4.4. Study Area Geology

Subsurface Geophysical data suggests that the Older alluvial fan deposits beneath the U.S. Marine Corps Nebo Annex in Barstow range from 1,000-2,500 feet thick, shallowing abruptly

towards the Mojave River to the north (Stamos et. al., 2001; Densmore et. al., 1997). Older alluvium deposited by the Plio-Pleistocene Mojave River is found primarily in the western regions of the Mojave River groundwater Basin. Localized occurrences of older alluvium have been encountered in boreholes on the US Marine Corps Yermo Annex near Barstow, where it ranges in thickness from 150-200 feet (Figure 11). This unit typically consists of granitic sands, gravels and silts with occasional boulders and is generally more permeable than the Older alluvial fan deposits (Stamos et. al., 2001; Densmore et. al., 1997; Cox and Wilshire, 1993; Woolfenden, 1984; Hardt, 1971).

Younger alluvial fan deposits overlie the Older alluvial fan deposits in the area surrounding the U.S. Marine Corps Nebo Annex and exhibit a decrease in grain size towards the toes of the fans (Densmore et. al., 1997). The silty nature of the fan toe and the abundance of secondary clay and calcitic cements greatly lowers the permeability of the Younger alluvial fan deposits (Stamos et. al., 2001; Densmore et. al., 1997).

The recent alluvium typically ranges from 50-70 feet thick, although in the area surrounding the Barstow/US Marine Corps Nebo Annex the thickness is usually less than 30 feet (Stamos et. al., 2001; Densmore et. al., 1997) (Figure 11).

Three cross sections were created across the Study Area to depict the subsurface geology (Figure 12)

Cross section A-A':
Analysis of lithologic logs compiled for wells in the southern region of the Study Area demonstrate the shallow subsurface lithology south of the Site is characterized by a fine grained unit of younger alluvial fan deposits (Figure 13). This unit varies in thickness from nine to 41 feet and is composed of silts and sandy silts with localized occurrences of fine grained clay lenses. Sands encountered within this unit range from coarse to fine sand and are all poorly sorted (Appendix A). Underlying this unit are coarser grained deposits of older alluvial fan deposits dominated by coarse sands and gravels. Typically this unit is composed of medium to coarse grained, poorly sorted sands, with large gravels with occasional occurrences of fine grained lenses of clays and silts. The thickness of the older alluvial deposits is generally 10-60', although this is constrained by the depth of the borings installed and may extend further into the subsurface.

Cross section B-B':
Lithologic logs of well locations paralleling the Mojave River north of the Site are primarily composed of coarse grained sands of the recent Mojave river channel underlain by coarse gravels (Figure 14). The contact between the recent Mojave river deposits and the coarser gravels that underlie them is not distinct. Deposits of the Recent Mojave River are dominated by moderately to poorly sorted, sub-rounded, granitic clasts. Underlying gravels range from .5"-1.5" in diameter and are typically sub-rounded clasts derived from granitic and metamorphic parent material (Figure 14).

Cross section C-C':
Lithologic logs of well locations perpendicular to the axis of the Mojave River were analyzed in cross section C-C' (Figure 15). The vertical stratigraphy north and south of the active river channel is generally similar. The upper portions of the stratigraphy are characterized by fine-grained deposits of silts and silty sands. Coarser, poorly sorted, granitic sands underlie this fine grained upper unit and exhibit interbedded clay layers that are not laterally extensive. Gravely sands were encountered at depths ranging from 20 fbgs north of the active river channel to 35 fbgs south of the active river channel. These gravels were typically found in minor quantities and ranged in size from .5" to 1" diameter. A relatively thick (10 feet south of the Site and 20 feet north of the Site) sandy clay layer was encountered at a depth of 50 fbgs in the southern region of the Study Area and 30 fbgs in the northern region of the Study Area.

Fine to coarse grained, poorly sorted sands of the Mojave River dominated the sub-surface lithology of the active river channel.

4.5. Study Area Hydrology

The main hydrologic feature of the Study Area is the Mojave River. The Mojave River flows west to east across the Study Area and lacks surface waters except during large storm event that produce overland flooding.

Sources of local groundwater recharge within the Study Area include seepage of sewage effluent, irrigation return and groundwater underflow from adjacent groundwater basins (Densmore et al., 1997). In the area surrounding the City of Barstow several sources of sewage effluent recharge have been identified. The City of Barstow sewage treatment plant (upper and lower sewage ponds), the City of Barstow effluent irrigated alfalfa fields, the U.S. Marine Corps sewage treatment plant and the U.S. Marine Corps irrigated golf course (Figure 16). Considering the recharge from direct percolation of the sewage ponds owned by the City of Barstow and the U.S. Marine Corps at the Nebo Annex, as well as recharge from irrigation return flow from the effluent irrigated fields listed above, the total amount of estimated recharge from sewage effluent ranges from 15-28% of the total recharge from the Mojave River (Stamos et al., 2001; Lines, 1996; Densmore et al., 1997; Hughes, 1975; Robson, 1974).

5. Remedial Investigation Results

5.1. Introduction

Following the submittals of the October 2006 Remedial Investigation Workplan, the November 2006 Revised Remedial Investigation Workplan, and a December 5, 2006 letter documenting the agreements made between the City of Barstow, DPRA, and the RWQCB during a meeting held on December 1, 2006, the following sampling locations were formally approved. In a letter from the RWQCB letter dated December 21, 2006, it states that "[t]he Work Plan, with revisions documented in the November 27, 2006 and December 5, 2006 submittals, is hereby accepted."

5.2. Soil Analytical Results

5.2.1. Study Area North

The most recent analysis of vadose zone soils was conducted February of 2007, and included 10 sampling locations throughout the northern region of the Study Area (Table 5; Figure 17).

Samples were typically collected at 5 to 10 feet bgs at most locations with the exception of MW-22 which was collected at 40 feet bgs, but still in the vadose zone. Nitrate concentrations for these data ranged from 1.1 mg/kg (HP-2, & 7 and MW-20s & 21) to 2.6 mg/kg (HP-4), within the Soapmine Road neighborhood (Table 5; Figure 17).

5.3. Groundwater Results

5.3.1. Water Levels

Shallow:
All new, existing and temporary well locations were gauged to determine the elevation, flow direction and gradient of groundwater across the Study Area (Figure 4). Shallow groundwater contours for the Study Area were created by using 36 well locations within the Study Area. These data show that groundwater is flowing east southeast though the Study Area, generally following the Mojave River channel. Previous studies suggested that shallow groundwater flow direction was towards the north, into the southern region of the Study Area. However, the data collected clearly demonstrates that there is no northerly component of groundwater flow within the shallow groundwater zone.

Groundwater gradients for the shallow groundwater zone increase west to east across the Study Area (Figure 4). The shallow groundwater gradient in the western region of the Study area was calculated using MW-1, HP-3 and MW-16. This calculation resulted in a groundwater gradient of .0011. The eastern shallow groundwater gradient was calculated using HP-6, MW-23 and NWP-04. These three wells resulted in a groundwater gradient of .0026.

Four existing monitoring wells at the Marine Corps Logistics Base (MCLB) were gauged to assess what level of impedance (if any) the Waterman Fault exhibited on shallow groundwater flow. Two wells (NPZ-17 and NS2-3) west of the Waterman Fault, were gauged at 2010.2 feet msl and 2010.9 feet msl respectively. Two wells (NNP-3 and NS1-5) east of the Waterman Fault were gauged at 1998.9 feet msl and 1994.87 feet msl respectively. These wells represent a minimum decrease in groundwater elevation of 11.3 feet msl within a 1000 foot transect across the fault. This rate of decrease is not seen between any other wells within the Study Area and suggests that the Waterman Fault is a semi-impermeable boundary at the eastern edge of the Study Area within the shallow groundwater zone and appears to have little long term damming effect on shallow groundwater flow (Figure 4).

Four permanent monitoring wells were installed and screened within the shallow groundwater zone along a northeast – southwest transect across percolation pond 3 at the Site. Water level

data gathered from these wells indicates that a mound of groundwater in the shallow zone may surround pond 3. The mounding effect caused by pond 3 however, is localized and does not impact the shallow groundwater zone at any significant lateral distance.

Vertical components groundwater flow between the shallow and intermediate groundwater zones was analyzed at five well locations (Table 3; Appendix G). It was determined that the shallow groundwater zone has a downward flow component to the intermediate groundwater at MW-1 and MW-20. In contrast, there is an upward component of flow from the intermediate zone at the western edge of the Soapmine Road neighborhood north of the Mojave River and west of the southern irrigated field south of the Mojave River and at the Site at MW's 2, 3, and 7 respectively. These trends are consistent with historical vertical groundwater gradients throughout the Study Area (Appendix G).

Intermediate:
Six wells screened within the intermediate groundwater zone were gauged to determine flow direction and gradient of groundwater. Groundwater is highest at MW-03-3 (2052.82 msl) in the southwestern region of the Study Area and is primarily flowing in a northerly direction before it curves towards the east moving west to east across the Study Area to the low point at MW-20i (2026.38).(Figure 18).

The groundwater gradient for the intermediate zone is .0028 and calculated using MW-7-1, MW-2-2 and MW-20i. This gradient is consistent across the western region of the Study Area.

Deep:
Deep groundwater flow direction and gradient was determined using three wells, MW-1-2, MW-2-1 and MW-3-2, all located in the western most region of the Study Area. The groundwater flow direction is primarily towards the north northeast with a gradient of .0076 (Figure 19).

Vertical components of groundwater flow between the deep and intermediate groundwater zones was determined by calculating the change in groundwater elevation between the intermediate and deep groundwater zones at each well. Calculations indicate that the deep groundwater zone has an upward component of flow to the intermediate groundwater zone at each location. This is consistent with historical groundwater conditions within this zone (Table 2; Appendix G).

5.3.2. General Minerals

All monitor wells were sampled for general minerals. Review and analysis of the common ion data, specifically common ions (cations; sodium, potassium, calcium, and magnesium and anions; chloride, bicarbonate, and sulfate) was conducted using two methods; Stiff and Piper diagrams (Freeze & Cherry, 1979; Hem, 1992) (Table 6).

5.3.2.1.Data Analysis

Previous sampling was conducted by the USGS from 1992 through 1994 (Densmore, et al, 1997). Wastewater samples were collected from the City of Barstow Wastewater Treatment

plant holding ponds. Goundwater samples were collected from City of Barstow Monitor Wells MW-1, 2, and 7 and other wells downgradient. The Table below correlates the City of Barstow well ID with the USGS nomenclature.

	Barstow	USGS	Barstow	USGS	Barstow	USGS
Shallow	MW-1-03	9N/1W-4M5	MW-2-03	9N/1W-4R4	MW-7-02	9N/1W-10E4
Intermed	MW-1-02	9N/1W-4M6	--	--	--	--
Deep	MW-1-01	9N/1W-4M7	--	--	--	--

USGS analysis of the wastewater treatment ponds indicates that Total Dissolved Solids ranged from 846 to 867 mg/l. USGS analysis indicates that the wastewater is characterized as sodium being the dominant cation with chloride being the predominant anion, but less than 50% and sulfate next.

USGS analysis indicates that 1 of the 3 shallow monitor well groundwater samples, MW-7-02, is characterized as sodium being the dominant cation. Shallow monitor wells MW-1-03 and MW-2-03 groundwater samples are characterized as sodium-calcium cationic waters with sodium being the predominant cation, but less than 50% and calcium next. USGS analysis of Monitor Well MW-1-03 groundwater sample is characterized as bicarbonate being the dominant anion. Monitor Well MW-7-02 is characterized as bicarbonate-chloride anionic water with bicarbonate being the predominant anion, but less than 50% and chloride next. Monitor Well MW-2-03 groundwater sample is characterized as sulfate-bicarbonate anionic water with sulfate being the predominant anion, but less than 50% and bicarbonate next. USGS analysis of intermediate Monitor Well MW-1-02 groundwater sample indicates calcium being the predominant cation, but less than 50% and sodium next. Intermediate Monitor Well MW-1-02 groundwater sample is characterized as sulfate anionic water. USGS analysis of deep Monitor Well MW-1-01 groundwater sample indicates sodium being the predominant cation, but less than 50% and calcium next. Deep Monitor Well MW-1-01 groundwater sample is characterized as bicarbonate anionic water. USGS analysis of common ions downgradient of the City of Barstow Monitor Wells also indicates a predominance of the sodium cation. However, as regards the anions, none of the three predominates across the USGS Study Area (Densmore, et al., 1997).

Stiff Diagrams

Stiff diagrams can be used to identify visually the relative similarities and differences of water compositions. The ionic concentrations are an approximate indication of total ionic content. Classification of water type is determined by the relative percent ionic concentration of each cation and anion. The cation or anion with a relative percent concentration greater than 50% is dominant. If no cation or anion has a relative percent concentration greater than 50% then the two cations or anions that add to greater than 50% are predominant.

Shallow Zone

Stiff diagrams were prepared for all 23 shallow monitor wells (Figure 20; Appendix H). Analysis indicates that 21 of 23 monitor well groundwater samples are characterized as sodium being the dominant cation. Monitor wells MW-1 and MW-5 groundwater samples are

characterized as sodium-calcium cationic waters with sodium being the predominant cation, but less than 50% and calcium next. Analysis of anions indicates a more diverse trend. Monitor Well MW-5 groundwater sample is characterized as bicarbonate being the dominant anion. Monitor Wells MW-1 and MW-6 are characterized as bicarbonate-chloride anionic waters with bicarbonate being the predominant anion, but less than 50% and chloride next. Monitor Wells MW-4, MW-20 and MW-21 groundwater samples are characterized as bicarbonate-sulfate anionic waters with bicarbonate being the predominant anion, but less than 50% and sulfate next. Monitor Wells MW-7, 12, 15, and 18 groundwater samples are characterized as chloride-bicarbonate anionic waters with chloride being the predominant anion, but less than 50% and bicarbonate next. Monitor Wells MW-9, 13, and 19 groundwater samples are characterized as chloride-sulfate anionic waters with chloride being the predominant anion, but less than 50% and sulfate next. Monitor Wells MW-2, MW-16, and MW-22 groundwater samples are characterized as sulfate being the dominant anion. Monitor Wells MW-8, 10, and 23 groundwater samples are characterized as sulfate- chloride anionic waters with sulfate being the predominant anion, but less than 50% and chloride next. Monitor Wells MW-3, 11, 14, and 17 groundwater samples are characterized as sulfate-bicarbonate anionic waters with sulfate being the predominant anion, but less than 50% and bicarbonate next.

Ionic concentrations in these groundwater samples also varied. Ionic concentrations in Monitor Wells MW-1, 4, 7, 8, 12, 13, 14, 15, 19, 20, and 21 were all less than 10 milliequivalents per liter per constituent. These monitor wells are located within or adjacent to the Mojave River channel or percolation ponds. This can be correlated with Total Dissolved Solids (TDS) content from these Monitor Wells (Figure 21; Table 7). TDS for Monitor Wells MW-1, 4, 7, 8, 12, 13, 14, 15, 19, 20, and 21 are all below 1,000 mg/l. The USGS also noted lower TDS concentrations within the Mojave River aquifer as compared to the regional aquifer (Densmore, et al, 1997).

The cationic Stiff diagram comparisons indicate that there is one predominant cationic water type in the Study Area, sodium. The anionic Stiff diagram comparisons indicate that there are three predominant anionic water types in the study. Each of these three anionic water types appears to correlate with either surface, local, or regional features. For example, the shallow monitor well groundwater samples that are characterized as bicarbonate-anionic are all within, adjacent or near the Mojave River, MW-1, 4, 6, 8, 20 and 21 (Figure 20) except for MW-5 adjacent to the mobile home park. This predominance along the Mojave River is most likely due to upgradient groundwater flow into the Study Area within the very high hydraulic conductive sands and gravels of the Mojave River aquifer. The shallow monitor well groundwater samples that are characterized as chloride-anionic are adjacent or near the Wastewater Treatment Plant and ponds, MW-7, 12, 13, 15, 18 and 19 with one monitor well MW-9 adjacent and south of the former northern irrigation field. This is most likely due to wastewater pond water recharge containing remnant chlorine from chlorination of drinking water. The USGS analysis of 1993 indicates that chloride is the predominant anion in the City of Barstow's wastewater. The shallow monitor well groundwater samples that are characterized as sulfate-anionic are generally away from the Mojave River, MW-2, 3, 8, 10, 11, 13, 16, 17, 20, 22, and 23, except for MW-14, adjacent to the Wastewater Treatment Plant, pond 3. These sulfate-ionic waters can also be correlated to TDS concentrations greater than 1,000 mg/l, except for MW-14 with a concentration of 730 mg/l. However, MW-14 is adjacent to wastewater pond 3 and USGS work in 1993 indicated that the wastewaters contained a TDS of approximately 850 mg/l and the

predominant anions were chloride and sulfate. It appears that the sulfate anion is regional in nature and the bicarbonate anion associated with the Mojave River aquifer is a localized feature. Sulfate anionic waters may be the predominant regional anion (See discussion below) (Densmore et al., 1997).

Intermediate Zone

Stiff diagrams were prepared for all five intermediate monitor wells (Figure 22; Appendix H). Analysis indicates that four of five monitor well groundwater samples are characterized as sodium being the dominant cation. Monitor well MW-1 groundwater sample is characterized as sodium-calcium cationic water with sodium being the predominant cation, but less than 50% and calcium next. Analysis of the anions indicates only two anions predominate. Monitor Well MW-2 groundwater sample is characterized as bicarbonate being the dominant anion. Monitor Wells MW-2 and 3 groundwater samples are characterized as sulfate being the dominant anion. Monitor Wells MW-7 and 20 groundwater samples are characterized as sulfate- chloride anionic waters with sulfate being the predominant anion, but less than 50% and chloride next.

USGS data collected in the intermediate zone at MW-1 also indicated a predominance of the sodium cation and the sulfate anion. However, USGS data collected downgradient of the Site, in the vicinity of the Nebo Annex, indicates that the predominant anions vary between chloride, bicarbonate, and sulfate in the intermediate zone (Densmore, et al, 1997).

Deep Zone

Stiff diagrams were prepared for all 3 deep monitor wells (Figure 23; Appendix H). Analysis indicates that two of three monitor well groundwater samples are characterized as sodium being the dominant cation. Monitor well MW-1 groundwater sample is characterized as sodium-calcium cationic waters with sodium being the predominant cation, but less than 50% and calcium next. Analysis of anions indicates only two anions predominate. Monitor Well MW-1 groundwater sample is characterized as bicarbonate being the dominant anion. Monitor Wells MW-2 and 3 are characterized as sulfate being the dominant anion.

USGS data collected in the deep zone at MW-1 indicated a predominance of the sodium cation and the bicarbonate anion. However, USGS data collected downgradient of the Site, in the vicinity of the Nebo Annex, indicates that the predominant anion does appear to be the sulfate anion at depths greater than 300 feet (Densmore, et al, 1997).

Piper Diagrams

In order to compare the large volumes of common ion data, Piper diagrams are used. By representing cation and anion compositions in a single graph, major groupings or trends in the data can be discerned.

The Piper diagrams are prepared from the same milliequivalent data as the Stiff diagrams, therefore it is not surprising that the descriptions of the waters are similar. Piper diagrams are useful to determine mixing of unique waters. The shallow Piper diagram indicates similar

characteristics as the Stiff diagrams, sulfate anionic waters appear to mix with the other anionic type waters.

Shallow Zone

The shallow zone Piper Diagram cationic plot indicates that virtually all the waters are sodium-potassium types, as described by the Stiff diagrams. However, the anionic plot indicates that the waters vary from sulfate type, MW-2, 16, and 22, to slightly bicarbonate, MW-1, 5, and 20, with the majority plotting as mixtures with a dominant anion, again as described by the stiff diagrams (Appendix H).

Intermediate Zone

The intermediate zone Piper Diagram cationic plot indicates that virtually all the waters are sodium-potassium types, as described by the Stiff diagrams. However, the anionic plot indicates that the waters vary from sulfate type, MW-1 and 3, to slightly bicarbonate, MW-2, with the remaining two plotting as mixtures with a dominant anion, again as described by the stiff diagrams (Appendix H).

Deep Zone

The deep zone Piper Diagram cationic plot indicates that virtually all the waters are sodium-potassium types, as described by the Stiff diagrams. However, the anionic plot indicates that the waters vary from sulfate type, MW-2 and 1, to slightly bicarbonate, MW-1, again as described by the stiff diagrams (Appendix H).

5.3.3. Nitrates

Shallow Zone

The primary contaminant of concern for the groundwater within the Study Area is nitrate. The most recent chemical analysis of shallow groundwater for nitrates conducted in February 2007 suggests that nitrates are ubiquitous throughout the Study Area (Figure 24). However, shallow groundwater nitrate concentrations can be divided into northern and southern regions, with the Mojave River representing the division between the two, due to its very low nitrate concentrations and a distinct water type as outlined in section 5.3.2. Fourteen well locations were analyzed for nitrates north of the Mojave River and the concentrations ranged from 2.1 mg/L (MW-1-4) to 32 mg/L (MW-9). The highest nitrate concentrations are located on the eastern edge of the northern irrigation field (MW-9) and near the center of the Soapmine Road neighborhood (HP-4).

Nitrate concentrations decline radially outward from this area and are bounded to the west by MW-1-4 with a concentration of 2.1 mg/L and to the east by MW-23 with a concentration of 11 mg/L. Wells MW-22 and MW-5 along the northern most boundary of the northern Study Area region have measured nitrate concentrations ranging from 14 mg/L to 25 mg/L respectively.

Wells MW-21 and MW-4 along the southern most boundary of the northern Study Area region have nitrate concentrations ranging from 2.7 mg/L to 11 mg/L respectively (Figure 24; Table 8).

Fourteen well locations were analyzed south of the Mojave River and helped characterize the southern extent of nitrate contamination in the Study Area. Nitrate concentrations south of the Mojave River range from .83 mg/L (NWP-5) to 22 mg/L (MW-6). The highest concentration at MW-6 is located on the southern border of the southern irrigated field. The lowest concentration was detected at the eastern most well, NWP-5 on the NEBO Marine Corps Logistic Base. Generally the concentrations of nitrates in the southern region of the Study Area are higher in the west and decrease towards the east (Figure 24; Table 8).

Within the Mojave River, four well locations were analyzed for nitrates. These values ranged from 0.11 mg/L (MW-15 and MW-20s) to 0.86 mg/L (NWP-6). These well locations lie directly north of the Site within the active river channel (Figure 24; Table 8).

Intermediate Zone

Three well locations were used to characterize the nitrate concentrations in the northern region of the Study area (Figure 25; Table 8). The nitrate concentrations range from 3.8 mg/L at MW-1-3 to 0.61 mg/L at MW-2-2 within this zone.

The southern region of the Study Area is characterized by two well locations. MW-3-3 with a nitrate concentration of 5.9 mg/L represents the western most well within the Study Area. This well is located west of the southern irrigation field. East of the southern irrigation field within the Site is MW-7-1. The nitrate concentration at MW-7-1 is 8.1 mg/L (Figure 25; Table 8).

Only one well was sampled within the Mojave River that is screened within the intermediate zone. At MW-20i nitrate was detected at 8.1 mg/L. This represents the easternmost detection of nitrates within the intermediate groundwater zone (Figure 25; Table 8).

Deep Zone

Three wells are screened within the deep zone of the Study area, MW-1-2, MW-2-1 and MW-3-2. Both MW-1-2 and MW-2-1 are located in the northern region of the Study Area, north of the Mojave River. Nitrate concentrations within these wells are 0.76 mg/L in MW-1-2 and 0.10 mg/L in MW-2-1 (Figure 26; Table 8).

Monitoring well MW-3-2 is located west of the southern irrigation field in the southern region of the Study Area. The nitrate concentration in this well is 0.29 mg/L.

5.3.4. Fecal Coliform

The purpose of analyzing for fecal coliform was primarily to determine the impact of septic systems on the shallow groundwater zone. Fecal coliform was analyzed at 22 groundwater well locations within the Study Area, consisting of 7 temporary wells and 15 newly installed permanent monitoring wells (Figure 27).

Fecal coliform was detected at MW-13, MW-14 and MW-15, surrounding pond 3 at the Site, and at HP-4 within the Soapmine Road neighborhood. Detections from wells at the Site (MW-13, 14, 15) ranged from 1.1 MPN/100ml to 2.2 MPN/100ml and the detection within the Soapmine Road neighborhood (HP-4) was 1.1 MPN/100ml (Figure 27; Table 9).

A secondary treated effluent sample was collected at the Site had a detected fecal coliform count of >23 MPN/100mL (Figure 27; Table 9).

5.3.5. Caffeine

Caffeine analysis was performed on all existing, new and temporary wells throughout the Study Area (Figure 28). Similar to Fecal coliform, the primary purpose of this analysis was to determine the anthropogenic impact of septic systems on the Study Area groundwaters and to determine any potential offsite source waters which may be impacting the Study Area.

Shallow Zone

Caffeine detections were found in 6 shallow groundwater zone wells, MW-3-4, MW-4, and MW-8, at the western region of the Study Area and at HP-5, in the Soapmine Road neighborhood, south of HP-4 which had a fecal coliform detection. Caffeine concentrations at these locations were 0.136 ng/mL, 0.116 ng/mL, 0.369 ng/mL, and 0.0524 ng/mL respectively. Additionally, caffeine was detected at the eastern region of the Study Area at Nebo wells NWP-5 and NWP-6. Caffeine concentrations at these locations were 0.069 ng/mL and 0.04 ng/mL (Figure 28; Table 9).

Intermediate Zone

Caffeine detections were found in 2 intermediate groundwater zone wells, MW-7-1 and MW-20i at the southern region of the Study Area and near the Site. Caffeine was detected at concentrations of 0.106 ng/mL and 0.127 ng/mL respectively.

Deep Zone

Caffeine detections were found in 2 deep groundwater zone wells, MW-1-2 and MW-3-2 at the western region of the Study Area. Caffeine was detected at concentrations of 0.207 ng/mL and 0.075 ng/mL respectively.

A secondary treated effluent sample was collected at the Site had a detection of 0.097 ng/mL (Figure 28; Table 9).

5.3.6. Isotopes

Stable isotopes of nitrates and oxygen have been widely used for identifying nitrogen sources. Many studies have shown that stable isotope techniques, especially a combination of $\delta^{18}O$ and $\delta^{15}N$ of nitrate, are a very powerful tool to distinguish the major contamination sources of nitrate in groundwater (Wassenaar, 1995; Kendall, 1998; Spoelstra et al., 2001; Chang et al., 2002; Mayer et al., 2002; Silva et al, 2002). Nitrate can originate from different sources, such as the atmosphere, fertilizer, soil and animal waste or sewage. These possible contaminates generally have sufficiently distinct isotope signatures to allow source separation. For example, synthetic fertilizer derived nitrate has $\delta^{15}N$ values of -1 – 2 ‰ and $\delta^{18}O$ values of about 22 ‰,

while nitrate derived from manure or sewage usually has $\delta^{15}N$ value of about 8 – 25 ‰ and $\delta^{18}O$ values of -1 – 15 ‰. In addition, $\delta^{18}O$ and $\delta^{15}N$ of nitrate are very useful to determine denitrification of nitrate (Aravena and Robertson, 1998; Panno et al., 2001; Mayer et al., 2002; Clement et al., 2003; Fukada et al., 2003 and 2004). During microbial denitrification, lighter isotopes ^{14}N and ^{16}O are preferentially removed by micro-organisms, a kinetic process that causes enrichment in δ–values of the remaining nitrate. In a closed system with a single nitrate source, both $\delta^{18}O$ and $\delta^{15}N$ will increase systematically with a decrease in nitrate concentration during microbial denitrification. Nitrate after denitrification, therefore, will show unique stable isotope signatures.

In this investigation, 41 groundwater samples from 34 monitoring wells and one effluent sample from the water treatment facility were collected. They were analyzed for $\delta^{18}O$ and $\delta^{15}N$ values of dissolved nitrate, and for $\delta^{18}O$ and δD of water as well. The major objectives of the stable isotope study are: (1) to identify the possible sources for nitrate in the area; and (2) to determine whether microbial denitrification actually occurs in these samples.

Shallow Zone

Nitrate from the wells in the south area exhibit large variation in both $\delta^{18}O$ and $\delta^{15}N$ values (Appendix—LAB DATA). Their $\delta^{15}N$ values range from 1.6 – 49.34 ‰ and $\delta^{18}O$ values from -0.3 – 32.4 ‰. In general, the samples from the wells near the southeast side of this area have enriched δ-values with NWP-06 and NWP-05 having the most enriched δ-values in the area. A plot of $\delta^{18}O$ vs $\delta^{15}N$ values shows a clear linear correlation between δ–values, with the exception of those from wells MW-03, MW-08 and MW-11. Such correlation between $\delta^{18}O$ and $\delta^{15}N$ values of nitrate is an indication of denitrification as found in many other studies (Aravena and Robertson, 1998; Panno et al., 2001; Mayer et al., 2002; Fukada et al., 2004). Also, a linear correlation exists between δ–values of nitrate and nitrate concentrations in these samples, i.e., δ-values of nitrate increase with an increase in nitrate concentrations. These samples have $\delta^{18}O$ and $\delta^{15}N$ values of 0 – 5 ‰ and 8 – 12 ‰, respectively, similar to δ-values of nitrate in groundwater that is derived from nitrification of ammonium produced as a product of the hydrolysis of urea in human sewage waste (Kendall, 1998; Chang et al., 2002; Mayer et al., 2002; Silva et al., 2002). Human urea samples usually have $\delta^{15}N$ values of 5 – 8 ‰ (Fukada et al., 2004) but nitrate derived from sewage has relatively enriched $\delta^{15}N$ values relative to original human urea because nitrification is a process that will enrich the $\delta^{15}N$ values. Nitrate from some wells have δ-values a little lower than the range expected for that of nitrate from sewage, likely implying the minor mixing with nitrate derived from soil organic materials.

Variation in both $\delta^{18}O$ and $\delta^{15}N$ values of nitrate in the north area are less than that observed in the south area (Appendix—LAB DATA); $\delta^{18}O$ and $\delta^{15}N$ of nitrate in this area range from 0.9 – 23.7 ‰ and 1.5 – 19.78 ‰, respectively. Like those in the southern area, the samples from the monitoring wells in the north area can also be grouped into two groups, one with denitrification and one without denitrification, including wells HP-05, MW-02, MW-04, MW-08 and MW-22.

There is a linear correlation between $\delta^{18}O$ and $\delta^{15}N$ values of nitrate in the majority of the wells. In this group, heavier nitrogen isotope ^{15}N is enriched relative to heavier oxygen isotope ^{18}O by a

ratio of 1.8 similar to that reported in other studies of denitrification (Bottcher et al., 1990; Aravena and Robertson, 1998; Fukada et al, 2004). At MW-01, δ-values of nitrate attenuate with depth and correlate with a decrease in the nitrate concentrations as well (Appendix F), and the enrichment ratio of ^{15}N to ^{18}O is 2:1, demonstrating clear denitrification at this site. Unlike the southern area, however, the change in nitrate concentrations in groundwater in the north area is not correlated to that in δ-values, although δ-values of nitrate indicate the occurrence of denitrification. Linear correlation between δ-values and nitrate concentrations mainly reflects a single nitrate source in a closed system. It has been indicated that mixing of two or more sources can result in an increase in both $\delta^{15}N$ values and concentrations of nitrate (Mayer et al., 2002). In the study area, there are likely more than one nitrate source that have impacts on the local groundwater. Mixing of different sources of nitrate complicate correlation observed between δ-values and nitrate concentrations, and thus such correlation may no longer be linear. Variations in δ-values of nitrate from the following wells do not follow the denitrification trend: HP-05, MW-02, MW-04, MW-08 and MW-22. Their δ-values largely represent a signature of source nitrate. $\delta^{15}N$ values of nitrate from MW-04 and HP-05 are within the range of nitrate derived from sewage (septic) or manure. $\delta^{15}N$ value of nitrate at MW-22 implies a source of soil organic nitrogen.

Intermediate and Deep Zones

At MW-01, δ-values of nitrate attenuate with depth and correlate with a decrease in the nitrate concentrations as well (Appendix F), and the enrichment ratio of ^{15}N to ^{18}O is 2:1, demonstrating clear denitrification at this site. At MW-02, samples were also collected from different levels of the aquifer but their δ-values of nitrate decreased instead of increased with an increase in depth, different from what was observed at site MW-01 where denitrification occurs. Such isotope behavior suggests that the isotopic signature of nitrate is not due to denitrification. The likely source of nitrate at this site is manure or sewage waste but also probably mixing with nitrate from both soil organic and the atmosphere, which will explain the low $\delta^{15}N$ values with higher $\delta^{18}O$ values (Appendix F). Isotope dilution in the groundwater system may also be partially responsible for such variation in δ-values of nitrate with depth at MW-02

5.3.7. Fluoride

Fluoride analysis was performed on all existing, and new wells throughout the Study Area (Figure 29). Similar to caffeine, the primary purpose of this analysis was to determine the anthropogenic impact of septic systems on the Study Area groundwaters and to determine any potential offsite source waters which may be impacting the Study Area.

Shallow Zone

Fluoride detections were found in all 26 shallow groundwater zone wells in the Study Area. Concentrations ranged from 1.2 mg/L at MW-21 to 45 mg/L at MW-16.

In the northern region of the Study Area, fluoride concentrations average approximately 6.8 mg/L with concentrations decreasing east of MW-9 which had the highest concentration of the northern region at 16 mg/L.

In the southern region of the Study Area, fluoride concentrations average approximately 15.3 mg/L with concentrations decreasing north and east of MW-16 which had the highest concentration of the southern region at 45 mg/L. Fluoride concentrations are generally elevated south and west of the Site suggesting anthropogenic impacted waters are prevalent in the southern region of the Study Area (Figure 29; Table 9).

For wells located in the Mojave River, fluoride concentrations average approximately 5.7 mg/L with concentrations decreasing east of MW-15 which had the highest concentration at 6.5 mg/L.

Intermediate Zone

Fluoride detections were found in all 5 intermediate groundwater zone wells in the Study Area. Concentrations ranged from 4 mg/L at MW-1-3 to 42 mg/L at MW-3-3.

In the northern region of the Study Area, fluoride concentrations average approximately 5.7 mg/L with concentrations decreasing west of MW-2-2 which had the highest concentration of the northern region at 7.4 mg/L.

In the southern region of the Study Area, fluoride concentrations average approximately 18 mg/L with concentrations greatly decreasing east of MW-3-3 which had the highest concentration of the southern region at 42 mg/L. (Figure 29; Table 9).

For MW-20i, located in the Mojave River, fluoride was detected at a concentration of 5.4 mg/L.

Deep Zone

Fluoride detections were found in all 3 deep groundwater zone wells, MW-1-2, MW-2-1, and MW-3-2 at the western region of the Study Area. Fluoride was detected at concentrations of 5.4 mg/L, 54 mg/L, and 83 mg/L, respectively.

A secondary treated effluent sample was collected at the Site had a fluoride detection of 12 mg/L (Figure 29; Table 9).

5.3.8. Boron

Boron analysis was performed on all new wells throughout the Study Area (Figure 30). Similar to caffeine, the primary purpose of this analysis was primarily to determine the impact of septic systems on the Study Area groundwaters, to determine any potential offsite source waters which may be impacting the Study Area and to supplement existing 2005 data collected at wells MW-1 through MW-10

All boron data from 2005 and 2007 will be described as one data set in the following text.

Shallow Zone

Boron detections were found in all 26 shallow groundwater zone wells in the Study Area. Concentrations ranged from 0.12 mg/L at MW-1-4 to 16 mg/L at MW-22.

In the northern region of the Study Area, boron concentrations average approximately 2.4 mg/L with concentrations generally decreasing west to east. MW-22, at the northern edge of the Study Area, had the highest concentration of the northern region at 16 mg/L.

In the southern region of the Study Area, boron concentrations average approximately 2.6 mg/L with concentrations varying across the region. MW-16 had the highest concentration of the southern region at 13.9 mg/L. (Figure 30; Table 9).

For wells located in the Mojave River, boron concentrations average approximately 0.42 mg/L with concentrations decreasing west of MW-15 which had the highest concentration at 0.655 mg/L.

Intermediate Zone

Boron detections were found in all 5 intermediate groundwater zone wells in the Study Area. Concentrations ranged from 0.211 mg/L at MW-2-2 to 1.55 mg/L at MW-7-1.

In the northern region of the Study Area, boron concentrations average approximately 0.69 mg/L with concentrations decreasing west of MW-1-3 which had the highest concentration of the northern region at 1.16 mg/L.

In the southern region of the Study Area, boron concentrations average approximately 4.5 mg/L with concentrations decreasing east of MW-3-3 which had the highest concentration of the southern region at 7.43 mg/L. (Figure 30; Table 9).

For MW-20i, located in the Mojave River, boron was detected at a concentration of 1.12 mg/L.

Deep Zone

Boron detections were found in all 3 deep groundwater zone wells, MW-1-2, MW-2-1, and MW-3-2 at the western region of the Study Area. Boron was detected at concentrations of 0.168 mg/L, 12 mg/L, and 13 mg/L, respectively.

A secondary treated effluent sample was collected at the Site had a boron detection of 12 mg/L (Figure 30; Table 9).

5.3.9. Methylene Blue Active Substance (MBAS)

MBAS analysis was performed on all existing, new and temporary wells throughout the Study Area. Similar to Fecal coliform, the primary purpose of this analysis was to determine the anthropogenic impact of septic systems on the Study Area groundwaters and to determine any potential offsite source waters which may be impacting the Study Area.

MBAS was not detected at any of the sampling locations (Table 9).

6. Findings

6.1. Soil

Ten vadose zone soil samples were collected and analyzed during this investigation (Table 5). These samples were gathered from the northern region of the Study Area, within and around the Soapmine Road neighborhood. The primary objective of the soil sampling was to determine the amount of total organic carbon (TOC) present in the soil. TOC is an integral factor in the denitrification process (see Section 6.4). Determining the availability of organic carbon in the soil, in and around the Soapmine Road neighborhood, is necessary to understand the potential for denitrification.

A secondary objective of the vadose zone soil sampling was to characterize nitrates. It was determined that nitrates within the soil throughout the Soapmine Road neighborhood had low concentrations. This suggests that nitrates found in groundwater are either being deposited at depths deeper than the soil samples were collected, are being leached out through irrigation and precipitation, are migrating via groundwater flow, or any combination of the above.

6.2. Groundwater

Shallow Zone

Shallow groundwater contours for the Study Area show that groundwater is flowing east southeast, generally following the Mojave River channel. Groundwater gradients for the shallow groundwater zone increase west to east across the Study Area with the western region exhibiting a gradient of .0011 and the eastern region (west of the Waterman Fault) exhibiting a gradient of .0026.

The contours appear to be fairly uniform in shape and spacing except for the area east of Webster Road in the northern Soapmine Road neighborhood and around percolation pond 3 at the Site.

Water level data gathered from wells near Webster Road indicate that the water table in this vicinity is lower than expected. This may be due to drawdown caused by an agricultural well located near MW-2.

Water level data gathered from wells at the site near pond 3 indicated that groundwater mounding may be occurring in the shallow groundwater zone in the immediate vicinity of percolation pond 3. Section 6.2.1 of this report provides greater detail on this phenomenon (Figure 4).

Intermediate Zone

Intermediate groundwater in the Study Area flows in a northerly direction and curves towards the east moving west to east. The groundwater gradient for the intermediate zone is .0028 and calculated using MW-7-1, MW-2-2 and MW-20i.

The contours appear to be fairly uniform in shape and spacing throughout the Study Area (Figure 18).

Deep Zone

Deep groundwater flow direction and gradient was determined using three wells, MW-1-2, MW-2-2 and MW-3-2, all located in the western most region of the Study Area. The groundwater flow direction is primarily towards the north northeast with a gradient of .00764.

The contours appear to be fairly uniform in shape and spacing throughout the Study Area (Figure 19).

6.2.1. Transducer Data

Pond 3 Water Levels:

The purpose of monitoring water levels around percolation pond 3 was to determine what affect water percolating from the pond had on groundwater flow in the vicinity of the ponds.

Between March 2, 2007 and March 15, 2007, groundwater levels at monitor wells MW-12, MW-13, MW-14, and MW-15 were continuously gauged at one minute intervals as specified in section 3.1.4 (Appendix D). Due to a memory limitation with an older model transducer in MW-13, data collection halted on March 13th.

On March 15, 2007, DPRA meet with Aquarion (Aquarion) personnel at the water treatment plant to discuss day to day plant operations. The purpose of this meeting was to determine what affect (if any) daily plant operations had on groundwater levels collected around pond 3. Typically, on the west side of the plant, treated effluent flows in series from ponds 3 through 1. On the east side of the plant, treated effluent flows in series to ponds 4 through 8. Daily, the southern irrigation field receives approximately 1 million gallons of treated effluent pumped from ponds 3 and 4 at a combined rate of approximately 2,200gpm. At the meeting, Aquarion informed DPRA that on March 8th, secondary treated effluent was being temporarily diverted to pond 4 so that the irrigation pump at pond 3 could be repaired. As of March 15th, effluent was still flowing to pond 4.

Water level data collected from MWs 12, 14, and 15 shows that groundwater elevation changes at these three locations are virtually identical (Figure 31). Typical daily elevation changes are approximately 0.25 ft per day and do not appear to be influenced by on Site activities. As expected, groundwater elevations gauged at these wells correspond well to the shallow groundwater contour map (Figure 4) created with the February 2007 gauging data.

Water level data collected from MW-13 is somewhat noisy (Figure 31). According to the transducer vendor, this is due to this transducer having a lower level of resolution than the others and not due to any malfunction or rapid changes in groundwater elevations (Appendix D). The data collected shows changes of 0.10 feet or more per minute which is unrealistic. Given that pond 3 was inactive from March 8th through the 15th, yet the noisy data still persists, it is unlikely the rapidly changing data is a result of any pond activities. Excluding the noisiness of the data, a graph representative of the changing groundwater conditions could still be made. By comparing the graph of MW-13 to the others, it shows that the groundwater elevation changes correspond

well across all of the wells gauged with MWs 12, 14, and 15 appearing to be more attenuated. As expected, groundwater elevations gauged at this well corresponds well to the shallow groundwater contour map (Figure 4) created with the February 2007 gauging data. Assuming that there was not any artificial recharge occurring at pond 3, we would expect the groundwater elevation of MW-13 to be approximately 2039 ft. msl, similar to MW-12 which is approximately 180 feet upgradient of MW-13. However, MW-13 has an elevation of approximately 2040.5 ft msl. This would indicate that the groundwater table is raised or mounded approximately 1.5 feet higher than normal static conditions. This mounding effect is only observed at MW-13 indicating it is very limited in horizontal extent and has virtually no effect on shallow groundwater flow. We would expect a similar mounding effect to occur at all infiltration ponds across the Site.

Service Rock Well Area Water Levels:
The purpose of monitoring water levels around the vicinity of the Service Rock industrial well was to determine what effect pumping from this well has on shallow groundwater flow.

Between March 2, 2007 and March 15, 2007, groundwater level data was collected at monitor wells MW-18 and MW-19, respectively located approximately 780 feet and 850 feet from the Service Rock well. MW-18 and MW-19 were continuously gauged at one minute intervals as specified in section 3.1.4 (Appendix D).

Water level data collected from MW-18, and MW-19 shows that groundwater elevation changes at these locations are virtually identical (Figure 32). Typical daily elevation changes are approximately 0.25 ft per day. As expected, groundwater elevations gauged at these wells correspond well to the shallow groundwater contour map (Figure 4) created with the February 2007 gauging data. When compared to data collected at the pond 3 area, the graphs for MW-18 and MW-19 show the same upward and downward trends, albeit less attenuated (Figure 7). As such, the data does not indicate that pumping groundwater from the Service Rock well has any effect on shallow groundwater flow. This is likely due to the highly transmissive nature of the soil types beneath the Site coupled with the large amounts of available water. Also, the Service Rock well is screened from 87 to 276 feet bgs (DPRA, 2006), which is approximately 37 to 226 feet deeper than the screened portions of either gauged well.

6.3. Source and Extent of Nitrates

Discussions regarding the source and extent of nitrates and other constituents within the shallow groundwater zone need to take into account the effect that the Mojave River has on groundwater flow and constituent migration.

As was discussed in section 6.2, groundwater flows in an east southeast direction across the Study Area. Highly transmissive soil lithologies promote a preferential flow path for the large quantities of water that migrate along its axis. Due to these conditions, it is virtually impossible for any fluids to migrate from the Site in the southern region of the Study Area, across the river, and into the northern region of the Study Area. This is quite apparent when you examine the average nitrate concentrations in shallow groundwater south of the river, in the river, and north of the river are approximately 9 mg/L, 0.46 mg/L, and 16.3 mg/L respectively. Similar patterns

of dilution are exhibited with other constituents that were analyzed. Common ion analysis discussed in section 5.2.2 indicates that a unique water type occurs within the river and along its prehistoric banks as evidenced by bicarbonate waters within and along the banks of the river and low total dissolved solids (TDS) values relative to the rest of the Study Area provides additional evidence of a unique region of groundwater within the Study Area.

Due to these unique groundwater conditions, contaminant source and extent discussions will be broken up into a northern region and southern region (relative to the Mojave River aquifer).

6.3.1. Shallow Zone –Northern Region

Nitrate concentrations in the northern region range from 2.1 mg/L to 32 mg/L. The distribution of data indicates that a nitrate plume exists primarily in the central portion of the region with concentrations generally decreasing at the northern, southern, and eastern boundaries of the Soapmine Road neighborhood and west of MW-9 in the northern irrigation field. Another nitrate plume may be emanating from an area around MW-5, however there aren't enough well points surrounding MW-5 to completely contour a plume in this vicinity (Figure 24).

In order to explain the significance of these results other data must be considered in the context of the Study Area. The shallow groundwater flow direction in the northern region of the Study Area and through the Soapmine Road neighborhood is east southeast (Figure 24). Any sources of nitrate in the shallow groundwater zone east of the Soapmine Road neighborhood would be expected to mimic this east southeasterly path. To help differentiate nitrate impacted water potentially emanating from the northern irrigation field area and water from the neighborhood area, DPRA contracted with various laboratories to perform fecal coliform bacteria, caffeine, boron, fluoride, MBAS, and isotope analyses. These "tracer" constituents have been used by others to demonstrate the influence that septic systems and other anthropogenic effects have on local soil and groundwater.

Fecal coliform

The presence of fecal coliform in any groundwater sample would provide strong evidence that septic discharges are directly impacting shallow zone groundwater. Fecal coliform was found only at HP-4, within the Soapmine Road neighborhood. It is unclear why fecal coliform was only found at one location in the neighborhood. The most likely reason is that the groundwater sample collected at HP-4 was near the leech field of a nearby resident and other samples were far enough away from any active leech field that fecal coliform could not be detected. It should be noted that, the nitrate concentration at HP-4 was the highest within the neighborhood (30 mg/L) and had the second highest concentration in the northern region of the Study Area.

Caffeine

Like fecal coliform, the presence of caffeine in any groundwater sample would provide additional evidence that septic discharges are impacting the shallow zone groundwater. Caffeine was found only at HP-5, within the Soapmine Road neighborhood. It is unclear why caffeine was only found at one location in the neighborhood. As shown in Figure 28, caffeine was found in 2 other locations (MW-4 and MW-8) in the northern irrigation field. No detections at MW-9 and HP-2, downgradient of MW-4 and along the groundwater flow path, suggest the detection at HP-5 is likely due to septic discharges in the vicinity of the HP-5 and not due to offsite

migration. It should be noted that, the nitrate concentration at HP-5 was the third highest within the neighborhood (16 mg/L) and had the sixth highest concentration in the northern region of the Study Area Figure 24.

Boron

Elevated concentrations of boron in any groundwater samples would provide additional evidence that septic discharges are impacting the shallow zone groundwater. Boron concentrations at 3 neighborhood wells had detections of between 0.5 and 1 mg/L. This range is typical across the entire Study Area. At one additional neighborhood well, boron was detected at 16 mg/L (MW-22). This detection represents the highest boron concentration in the *entire* Study Area Figure 30. Additional boron detections east of MW-22 in the northern irrigation field had detections ranging from 0.12 to 0.979 mg/L. Low boron detections upgradient of MW-22 suggest the detection at MW-22 may be due to septic discharges in the vicinity of the HP-5 and not due to offsite migration.

Fluoride

Elevated concentrations of fluoride in any groundwater samples would provide additional evidence that septic discharges or other human activities have impacted the shallow zone groundwater. The USGS reports that naturally occurring fluoride concentrations in groundwater are generally less than 1 mg/L, primarily due to its low solubility (Hem, 1992). Fluoride concentrations at 4 neighborhood wells had detections between 1.2 and 6.6 mg/L. Across the entire northern region, fluoride detections ranged from 1.2 (MW-21) to 16 mg/L (MW-9). This range is generally low as compared to other areas within the Study Area which received fluoridated water (Figure 29). The largest fluoride detections in the northern region at MW-9 and MW-8 may possibly occur due to irrigation of treated fluoridated effluent waters. The detection of fluoride at MW-2-3 may be due to offsite migration. It should be noted that, the second highest fluoride concentration in the northern region occurred at MW-8, the same location which had the highest caffeine detection (Figure 29; Figure 28).

Isotopes

At the north area of the river, the groundwater was likely affected by more than one source of nitrate, including manure or septic system or sewage, soil organic nitrogen and atmospheric nitrate. But the nitrate from the majority of sites of the area is a mixture of sewage (septic waste) and/or possible manure with soil organic nitrogen. Higher $\delta^{18}O$ values observed at a few sites can be attributed to the minor contribution of atmospheric nitrate (Figure 33). $\delta^{18}O$ and $\delta^{15}N$ values of nitrate cannot clearly distinguish between manure, septic waste and sewage. Analysis of non-conventional isotopes such as boron and strontium likely will provide answer with more confidence.

Methyl Blue Activated Substance (MBAS)

MBAS is a chemical found in some household and industrial soaps and detergents. Detections of MBAS in any groundwater sample would provide additional evidence that septic discharges or other human activities have impacted the shallow zone groundwater. MBAS was not detected in any of the groundwater samples analyzed.

Nitrate/Chloride

Chloride has been proven to be a useful tracer of septic-systems due to its non-reactive properties and its presence in all sewage (McQuillan, 2004). Due to the conservative nature of the chloride ion, the ratio of nitrate to chloride can be indicative of potential source areas. McQuillan (2004) demonstrated that chloride concentrations ranging from 30 to 200 mg/L and nitrate concentrations ranging from 10 to 60 mg/L were indicative of septic system impact on groundwater.

All shallow groundwater wells north of the Mojave River were plotted on a nitrate v. chloride graph to determine the source of groundwater contamination (Figure 34). Monitoring wells MW-08, MW-05, MW-21, MW-04, MW-23, MW-22 and residential well 31314 CLAY (A) all fell within the nitrate/chloride range considered to be influenced by septic/sewage contamination. Monitoring wells MW-09, and residential wells 31314 CLAY (B) and 31879 NELS plotted outside the septic/sewage impacted zone although they are considered potentially impacted by both sewage and septic systems. Monitoring wells MW-01-1 is upgradient of all potential source areas and its position on the plot outside the septic/sewage impacted zone suggests that nitrate/chloride concentrations detected in this well are representative of background levels.

Shallow Zone – Northern Region Conclusions

Nitrate concentrations in the northern region of the Study Area decrease significantly moving cross gradient (south) towards the active Mojave River channel (Figure 24). This reduction of nitrate concentration within the active Mojave River channel is partly due to groundwater flow direction paralleling the active river channel through the Study Area and the dilution effect of the groundwater within the active river channel. The active Mojave River channel is effectively a zone of low nitrate concentration that is impeding the migration of nitrate contaminants from the southern region of the Study Area towards the northern region of the Study Area and vice versa.

Data from the "tracer" analyses indicate that 3 nitrate source areas may exist in the northern region of the Study Area.

Source Area 1

The northwest corner of the Study Area is bounded by the 6.5 acre Hacienda Mobile Home Park and has provided 47 spaces estimated to house over 100 residents since 1960. The residents in this park dispose of sewage via septic systems. The USGS estimates that the average person uses approximately 80 to 100 gallons of water a day primarily for sanitary purposes (USGS, 2007). Based upon their estimate, approximately 8,000 to 10,000 gallons of septic sewage would be discharged per day from a relatively small area. The nitrate concentration at MW-5, adjacent to the park, was 25 mg/L. It is unknown where the leech field(s) from the park are located, but it is possible that if the leech lines are placed up and cross gradient of MW-8, we would see nitrates and other anthropogenic constituents in MW-5 and MW-8. This may explain why MW-8, which is located at the very northwestern upgradient edge of the northern irrigation field and approximately 1,500 southwest of the mobile home park, has an unexpectedly high nitrate concentration and detections of caffeine and high fluoride concentrations. Further research and investigation would be necessary to test this hypothesis.

Source Area 2
The northern irrigation field, located west of the Soapmine Road neighborhood and south of the mobile home park, is considered another nitrate source area. The City of Barstow had reportedly irrigated this field with treated effluent water and possibly spread solids from the WWTP. The city has since stopped this practice in 2005 when the property was sold. In addition to the nitrate plume that clearly emanates from the field, the presence of elevated fluoride concentrations at MW-9 and common ion data indicate that chloride/fluoride waters that are present in the vicinity of MW-9 are very similar to the WWTP water types used to irrigate the field. (Figure 20; Figure 29).

Source Area 3
The Soapmine Road neighborhood, located east of the northern irrigation field, is considered another nitrate source area. Every resident within this neighborhood uses septic tanks to dispose of sewage. Tracer constituents such as isotope analysis, fecal coliform, caffeine, and boron have provided evidence that septic sewage is coming in contact with shallow groundwater in the area. Additionally, pasturing and farming practices may also be contributing to the nitrate problem in the neighborhood.

It is unlikely that anyone will be able to quantify how much of the nitrate impacted water is due to fluid migration and septic/agricultural discharges. What is known is that based on the analyses done to date, the waters from each source area are mixing.

6.3.2. Intermediate Zone – Northern Region

Intermediate zone nitrate concentrations in the northern region range from 0.61 mg/L to 3.8 mg/L. HP-1 was drilled in the intermediate groundwater zone adjacent to MW-9. The purpose of collecting a groundwater sample at this location was rule out the possibility that high nitrate concentrations associated with MW-9 were also impacted the intermediate groundwater zone in the same vicinity. The spatial distribution of nitrate data indicates that the nitrate concentration at MW-1-3 at 3.8 mg/L is actually higher than that found at HP-1 at 3.1 mg/L. Additionally, the concentration at MW-2-2 was even lower at 0.61 mg/L (Figure 25).

Limited "tracer" constituent analyses were performed in this zone and region. The purpose of performing these analyses were primarily geared to establish naturally occurring background concentrations of certain constituents rather than trying to identify nitrate sources.

Fecal coliform
Fecal coliform analysis was not performed in any of the intermediate zone wells.

Caffeine
Caffeine was not detected in any of the northern region intermediate wells (Figure 28).

Boron
Boron concentrations at monitor well MW-1-3 and MW-2-2 were 1.16 and 0.211 mg/L respectively. This range is typical across the entire northern region of the Study Area at all intervals and is indicative of naturally occurring processes (Figure 30).

Fluoride
Fluoride concentrations at monitor well MW-1-3 and MW-2-2 were 4 and 7.4 mg/L respectively. The occurrence of fluoride at this interval may be due to the downward vertical gradient at these two wells. Additionally, given the relatively high fluoride concentrations in the southern region and the northerly intermediate groundwater flow at the western portion of the Study Area, it is possibly migration from the southern region may be occurring (Figure 29; Figure 18).

Isotopes
Due to the lack of data points in this interval, isotope data is best represented by examining the entire data set. Sections 5.3.6 and 6.3.1 discuss the overall trends in the northern region.

Methyl Blue Activated Substance (MBAS)
MBAS was not detected in any of the northern region intermediate wells (Table 9).

Nitrate/Chloride Ratio
Monitoring wells screened within the intermediate and deep groundwater zones were plotted on a nitrate v. chloride graph in order to determine potential spetic/sewage contamination (Figure 35). Monitoring wells MW-01-1, MW-03-3, MW-07-1 and MW-20i all plotted within the septic/sewage contamination zone although MW-01-1 and MW-03-3 are considered upgradient from potential source areas. MW-07-1 and MW-20i are located within and downgradient of the Site suggesting that the potential for septic/sewage contamination exists. Monitoring wells MW-01-2, MW-03-2 and MW-02-1 all plotted outside of the septic/sewage impact zone.

Intermediate Zone – Northern Region Conclusions

Nitrate concentrations in the northern region of the Study Area decrease significantly moving down gradient (east) (Figure 25). As expressed by data collected at HP-1 in the northern irrigation field, and MW-2-2 at the western edge of the Soapmine Road neighborhood, there is no indication that nitrate conditions in the intermediate groundwater zone warrant further investigations. Nitrate concentrations are below the state MCL level of 10 mg/L and the RWQCB investigative level of 5 mg/L.

6.3.3. Deep Zone – Northern Region

Deep zone nitrate in the northern region deep groundwater zone was detected at 0.1 mg/L at MW-2-1 and 0.76 mg/L at MW-1-2. The spatial distribution of nitrate data indicates that the nitrate concentrations are greater at western edge of the northern region than that of central portion of the region. (Figure 26).

Limited "tracer" constituent analyses were performed in this zone and region. The purpose of performing these analyses was primarily geared to establish naturally occurring background concentrations of certain constituents rather than trying to identify nitrate sources.

Fecal coliform
Fecal coliform analysis was not performed in any of the deep zone wells.

Caffeine
Caffeine was detected in MW-1-2 at 0.207 ng/mL and non-detect at MW-2-1 in the northern region deep groundwater zone wells (Figure 28). Given the limited number of wells screened in this zone, the source of caffeine found in MW-1-2 can not be determined.

Boron
Boron concentrations at monitor well MW-1-2 and MW-2-1 were 0.168 and 12 mg/L respectively. Given the limited number of wells screened in this zone, the source of elevated boron found in MW-2-1 can not be determined (Figure 30).

Fluoride
Fluoride concentrations at monitor well MW-1-2 and MW-2-1 were 5.4 and 54 mg/L respectively. Given the relatively high fluoride concentrations in the southern region and the northerly deep zone groundwater flow at the western portion of the Study Area, it is possibly migration from the southern region may be occurring (Figure 29; Figure 19). Given the limited number of wells screened in this zone, the source of elevated fluoride found in MW-2-1 can not be determined.

Isotopes
Due to the lack of data points in this interval, isotope data is best represented by examining the entire data set. Sections 5.3.6 and 6.3.1 discuss the overall trends in the northern region.

Methyl Blue Activated Substance (MBAS)
MBAS was not detected in any of the northern region deep wells (Table 9).

Nitrate/Chloride Ratio
Refer to section 6.3.2

Deep Zone – Northern Region Conclusions

Nitrate concentrations in the northern region of the Study Area in the deep groundwater zone do not warrant further investigations. Nitrate concentrations are well below the state MCL level of 10 mg/L and the RWQCB investigative level of 5 mg/L.

6.3.4. Shallow Zone – Southern Region

Nitrate concentrations in the southern region range from 0.19 mg/L to 22 mg/L. The distribution of data does not indicate that a nitrate plume clearly exists. Generally nitrate concentrations decrease from west to east across the region and north towards the river. Elevated nitrate concentrations are present south and cross-gradient of the Site, with concentrations as high as 16 mg/L (MW-16, 11). On the Site, nitrate concentrations from 0.19 mg/L (MW-14) to 22 mg/L (MW-6) (Figure 24). These data indicate that there are upgradient and offsite sources of nitrate.

Fecal coliform
Fecal coliform was only detected at the Site in vicinity of percolation pond 3. All other sample locations were non-detect for fecal coliform (Figure 27).

Caffeine
Caffeine was only detected at MW-3-4 in the shallow zone. All other sample locations were non-detect for caffeine (Figure 28).

Boron
Boron concentrations in the southern region of the Study Area had detections of between 0.173 and 13.9 mg/L. Typical concentrations across the entire southern region ranged from 0.8 to 3 mg/L. At MW-16, boron was detected at 13.9 mg/L. This detection represents the second highest boron concentration in the *entire* Study Area and the highest in the southern region (Figure 30). It should be noted that MW-16 had one of the highest nitrate concentration in the region at 16 mg/L.

Fluoride
Fluoride concentrations in the southern region were significantly higher than those in the northern region. Detections ranged from 3.8 to 45 mg/L across the entire southern region. These concentrations clearly show the anthropogenic effect of fluoridated water in the region (Figure-29). The largest fluoride detection in the southern region was again, at MW-16.

Isotopes

The isotope data for the southern region (FIGRE 36) indicates that the major source of nitrate source material emanates from the sewage/animal waste region of the graph. As expected, most of the data points that fall within this range are located in the vicinity of the WWTP. However, MW-10, MW-17, and MW-11 are considered background wells due to their up and cross-section positions, relative to the WWTP (Figure – SHALLOW GW CONT).

Other points on the plot indicate that nitrate found in MW3-4 is indicative of nitrate fertilizer, MW-20s having an ammonia fertilizer source, and MW-10 likely containing a mix of different sources from the urban area.

Methyl Blue Activated Substance (MBAS)
MBAS was not detected in any of the groundwater samples analyzed.

Nitrate/Chloride Ratio
Shallow groundwater zone wells south of the Mojave River were plotted to display the nitrate v. chloride concentrations Figure 37. This plot demonstrated that monitoring wells MW-12, MW-13, MW-14, MW-15, MW-06, MW-07-2, MW-03-4, MW-19, MW-20s and NWP-06 fell within the septic/sewage impact zone. Each of these wells, with the exception of MW-03-4, MW-19, MW-20 and NWP-06 is within 200 feet of or on the Site. This suggests that septic/sewage contamination demonstrated by the nitrate v. chloride plot is accurate for these wells. Monitoring wells MW-10, MW-18, MW-17, MW-16 and MW-11 all plotted outside of the septic/sewage impact zone suggesting that these well are not being impacted by septic/sewage contamination.

Shallow Zone – Southern Region Conclusions

Nitrate concentrations in the southern region of the Study Area decrease significantly moving cross gradient (north) towards the active Mojave River channel (Figure 24). This reduction of nitrate concentration within the active Mojave River channel is partly due to groundwater flow direction paralleling the active river channel through the Study Area and the dilution effect of the groundwater within the active river channel. The active Mojave River channel is effectively a zone of low nitrate concentration that is impeding the migration of nitrate contaminants from the southern region of the Study Area towards the northern region of the Study Area and vice versa.

Data from the "tracer" analyses indicate that 2 nitrate source areas exist in the northern region of the Study Area.

Source Area 1
The area surrounding the southern irrigation field, located west of the WWTP and south of the Mojave River, and the infiltration ponds at the WWTP is considered a nitrate source area as evidenced by the elevated nitrate concentrations at MW-6 (22 mg/L), MW-7-2 (8.6 mg/L), and MW-13 (7.1 mg/L) and elevated fluoride concentration at MW-6 (25 mg/L). The City of Barstow has reportedly irrigated this field with treated effluent water and possibly spread solids from the WWTP. The city continues to irrigate this field with treated effluent and operate the WWTP ponds. It is anticipated that the field and ponds will continue to be a nitrate source until such a time when irrigation activities cease, the WWTP is upgraded, and the nitrates naturally degrade. (Figure 24; Figure 29).

Source Area 2
The Main Street neighborhood, located south of the WWTP, is considered another nitrate source area. It is unclear how or if the neighborhood is contributing to the shallow groundwater. Presumably some residents are on septic systems, however tracer constituents such as isotope analysis, fecal coliform, caffeine, and boron have provided very little evidence suggesting that septic sewage is coming in contact with shallow groundwater in the area. Due to the fact that wells in this neighborhood are cross-gradient of the southern irrigation field and the percolation ponds and the water types are distinctly different, it is likely the nitrate concentrations seen in this neighborhood are more indicative of fertilizer (Figure 4; Figure 20).

6.3.5. Intermediate Zone – Southern Region

Intermediate zone nitrate concentrations found in the southern region range from 5.9 mg/L to 8.1 mg/L. MW-20i was drilled in the intermediate groundwater zone north of the WWTP ponds 5 and 6 in the Mojave River. The purpose of collecting a groundwater sample at this location was identify what impacts, if any, the WWTP has on the intermediation groundwater zone. The spatial distribution of nitrate data indicates that the nitrate concentrations generally increase from west to east. Nitrates detected at MW-7-1 at the WWTP and MW-20i north of the WWTP have identical nitrate concentrations of 8.1 mg/L. These concentrations are below the state MCL of 10 mg/L and the RWQCB water basin plan level of 11 mg/L. Similar to the shallow groundwater flow, intermediate zone groundwater flows in a east southeastly direction north of

the WWTP. Due to this condition, nitrates in the intermediate groundwater zone would not be able to migrate north of the WWTP to the northern region of the Study Area (Figure 25). Nitrate found in MW-3-3 was detected at 5.9 mg/L. This location is west and upgradient of the southern irrigation field and any other Site activities in the southern region.

Limited "tracer" constituent analyses were performed in this zone and region. The purpose of performing these analyses was primarily geared to establish naturally occurring background concentrations of certain constituents rather than trying to identify nitrate sources.

Fecal coliform
Fecal coliform analysis was not performed in any of the intermediate zone wells.

Caffeine
Caffeine was detected in 2 of 3 intermediate zone screened wells in the southern region. MW-3-3 was non-detect while MW-7-1 and MW-20i had detections of 0.106 and 0.127 ng/mL respectively. These concentrations match closely with the effluent sample collected at the WWTP which had a caffeine detection of 0.097 ng/mL (Figure 28).

Boron
Boron concentrations at monitor well MW-3-3 and MW-7-1 and MW-20i were 7.43, 1.55, and 1.12 mg/L respectively. Given the limited number of wells screened in this zone, the source of elevated boron found in MW-3-3 can not be determined (Figure 30).

Fluoride
Fluoride concentrations at monitor well MW-3-3 and MW-7-1 and MW-20i were 42, 6.7, and 5.4 mg/L respectively. Given the limited number of wells screened in this zone, the source of elevated fluoride found in MW-3-3 can not be determined. The occurrence of fluoride at this interval may be due to the upward vertical gradient between MW-3-2 and MW-3-3. MW-3-2, screened in the deep zone had a fluoride concentration of 83 mg/L (Figure 29; Table 3; Appendix G).

Isotopes
Due to the lack of data points in this interval, isotope data is best represented by examining the entire data set. Sections 5.3.6 and 6.3.4 discuss the overall trends in the southern region.

Methyl Blue Activated Substance (MBAS)
MBAS was not detected in any of the northern region intermediate wells (Table 9).

Nitrate/Chloride Ratio
Refer to section 6.3.2

Intermediate Zone – Southern Region Conclusions

Nitrate concentrations in wells screened in the intermediate groundwater zone in the southern region of the Study Area increase as you move downgradient in the vicinity of the WWTP

(Figure 25). However, nitrate concentrations are below the state MCL of 10 mg/L and the RWQCB water basin plan level of 11 mg/L.

Source Area 1
Similar caffeine and nitrate concentrations at MW-7-1 and MW-20i suggest that the WWTP is the source of nitrate in the southern region intermediate groundwater zone.

Source Area 2
In addition to a upgradient nitrate detection at MW-3, elevated concentrations of fluoride and boron at this well suggest that there is another potential source of nitrate within this zone. However, given the limited number of wells screened in this zone around this well, the source of nitrates, and elevated boron and fluoride can not be determined.

6.3.6. Deep Zone – Southern Region

Nitrate in the southern region deep groundwater zone was detected at 0.29 mg/L at MW-3-2. The spatial distribution of nitrate data could not be determined due to the fact that only one well screened in the deep groundwater zone exists within this region (Figure 26).

Limited "tracer" constituent analyses were performed in this zone and region. The purpose of performing these analyses was primarily geared to establish naturally occurring background concentrations of certain constituents rather than trying to identify nitrate sources.

Fecal coliform
Fecal coliform analysis was not performed in any of the deep zone wells.

Caffeine
Caffeine was detected in MW-3-2 at 0.075 ng/mL (Figure 28). Given the limited number of wells screened in this zone, the source of caffeine found in MW-3-2 can not be determined.

Boron
Boron was detected in MW-3-2 at 13 mg/L. Given the limited number of wells screened in this zone, the source of boron found in MW-3-2 can not be determined. (Figure 30).

Fluoride
Fluoride was detected in MW-3-2 at 83 mg/L. Given the limited number of wells screened in this zone, the source of fluoride found in MW-3-2 can not be determined. (Figure 29).

Isotopes
Due to the lack of data points in this interval, isotope data is best represented by examining the entire data set. Sections 5.3.6 and 6.3.4 discuss the overall trends in the southern region.

Methyl Blue Activated Substance (MBAS)
MBAS was not detected in any of the southern region deep wells (Table 9).

Nitrate/Chloride Ratio
Refer to section 6.3.2

Deep Zone – Southern Region Conclusions

Nitrate concentrations in the southern region of the Study Area in the deep groundwater zone do not warrant further investigations. Nitrate concentrations are well below the state MCL level of 10 mg/L (Title 22, California Code of Regulations), and below RWQCB water basin plan level of 11 mg/L (RWQCB, Basin Plan Lahontan Region).

6.4. Denitrification processes

Denitrification refers to the microbial mediated process where nitrite is irreversibly reduced to inert nitrogen gas. Concentrations of nitrate decrease when groundwater conditions become favorable for denitrification. The requirements necessary for denitrification include the presence of oxygenated species of dissolved nitrogen, available supply of electron donors, anaerobic conditions, and denitrifying microorganisms using nitrogen oxides as terminal electron acceptor during respiration (Firestone, 1982).

Denitrification is often qualified as autotrophic or heterotrophic depending on the source of carbon fixed by the bacteria participating in the redox process. Typically, heterotrophic bacteria fix carbon from organic sources while utilizing organic electron donors (Equation 1); autotrophic bacteria fix carbon from inorganic sources while utilizing inorganic electron donors (Equation 2) (Groffman et al., 2006).

$$5CH_2O + 4NO_3^- + 4H^+ \rightarrow 2N_2 + 5CO_2 + 7H_2O \qquad (1)$$

$$2FeS_2 + 6NO_3^- + 2H_2O \rightarrow 3N_2 + 2FeOOH + 4SO_4^{2-} + 2H^+ \qquad (2)$$

The magnitude of oxygen inhibition and response of denitrification rate to oxygen concentration is illustrated in Figure 38.

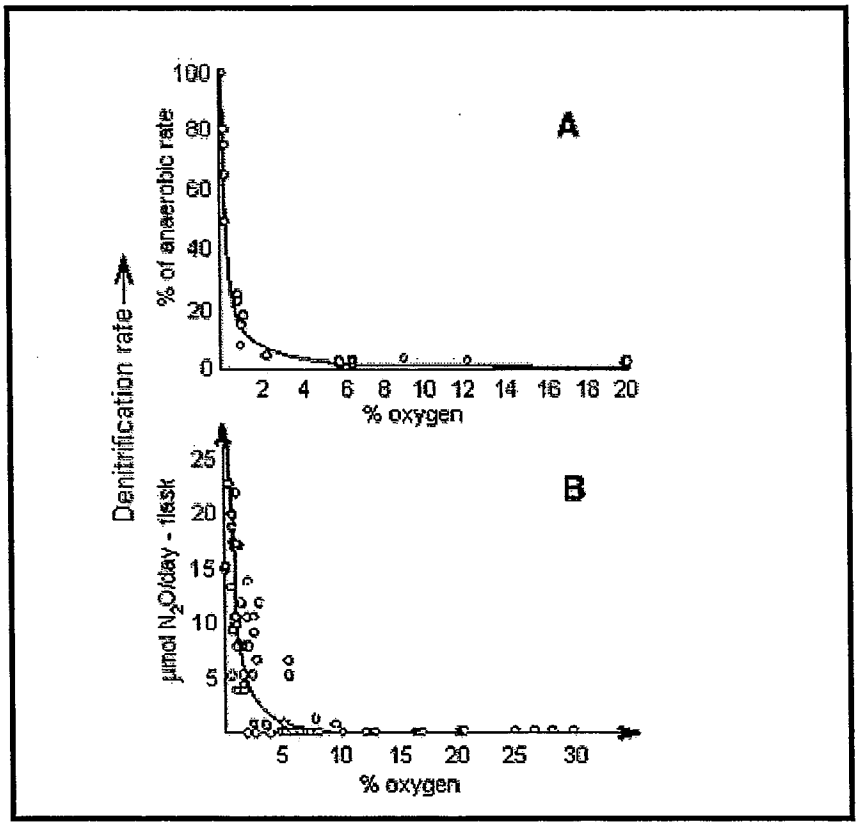

Figure 38. Effect of O2 concentration on denitrification (A) a soil core and (B) a wheat-*Azospirillum* rhizosphere association (Tiedje 1988).

Denitrification kinetics appear to be first-order when concentrations of nitrate are less than 40 mg/L. (Starr and Parlange, 1975 and Vanderborght and Billen, 1975).

By analyzing site specific physical parameters such as temperature, oxidation reduction potential (ORP), pH, nitrate/chloride ratios, O^{18}/N^{15} rations, bicarbonate concentrations, sulfate concentrations, total organic carbon (TOC) concentrations, and the presence of bacteria, it can be determine if site conditions are conducive and indicative of denitrification.

Site Conditions

Temperature:
While the optimum temperature range for denitrification depends on the denitrifying species, it is generally accepted that denitrification occurs at significant rates in the range of 15 to 60°C (Nommik 1956; Goering and Dugdale 1966; and Konishi, 1969). At low temperatures, denitrification decreases significantly but is measurable between 0 and 5°C (NRC, 1978).

Temperatures of groundwater were measured ranging from 11.2°C to 22.9°C during the groundwater monitoring activities performed from January 29 to February 7, 2007 (Table 11). Thirty one of 34 measurements were above 15°C, which indicated that denitrification may occur at significant rates throughout the majority of groundwater within the Study Area. It is important

to note that these measurements occurred in the winter season. The temperatures may be higher at any other times but are not likely to exceed 60°C. Therefore, the temperature of groundwater in the Study Area favors denitrification.

Oxidation Reduction Potential:
Nitrate is the first compound to be reduced after oxygen depletion. The denitrification process preferentially occurs when the oxidation reduction potential (ORP) (Eh) is less than 750 millivolts (mV) (Figure 39.) (Hemond and Fechner-Levy, 2000)

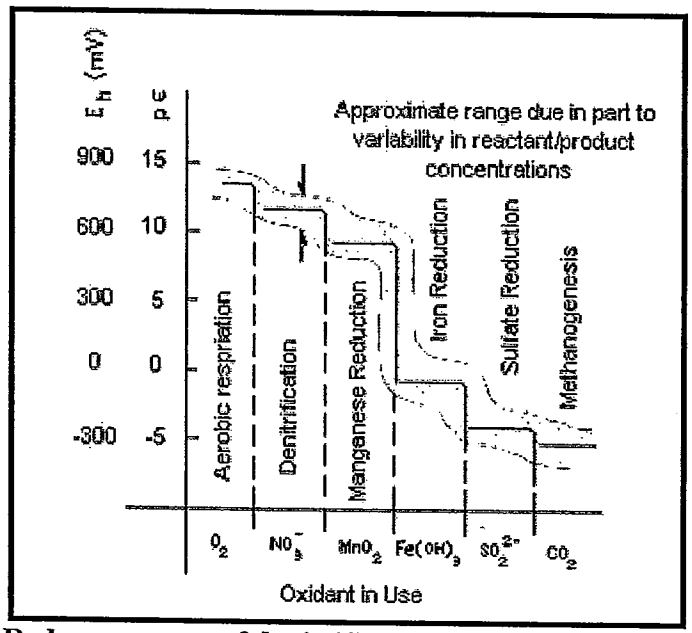

Figure 39. The Redox sequence of denitrification (Hemond and Fechner-Levy, 2000).

During groundwater monitoring activities, ORP measurements ranged from 38 mV to 135 mV (Table 11). All 27 measurements were below 750 mV, which has been determined as a threshold for denitrification. When groundwater temperature increases, the dissolved oxygen in the groundwater generally decreases and subsequently ORP will decrease. Therefore, ORP conditions of groundwater in the Study Area favors denitrification.

pH:
The optimum range of pH for denitrification is 6.0 to 8.0, which is similar to the optimum survival range of heterotrophic organisms (Firestone, 1982).

The pH measurements taken during groundwater monitoring in the Study Area ranged from 6.86 to 8.17 (Table 11). Only 2 of 34 measurements exceeded a pH of 8. Therefore, the pH of groundwater in the Study Area favors denitrification.

Nitrate/chloride ratio:
Nitrate/chloride ratios are used to identify areas where biochemical reduction of nitrate (i.e. denitrification) may be occurring. Nitrate/chloride ratios remain constant within an area of contamination due to the non-reactive nature of both the nitrate and chloride ions and the ease of

which these ions move through soil and groundwater. If dilution or other physical processes reduce nitrate concentrations downgradient, chloride concentrations will not vary from the sources to downgradient locations.

The nitrate/chloride ratio for data collected from 2005 and 2007 was calculated in Table 12 and plotted on Figure 40.

In the northern region of the Study Area, MW-9, MW-4, and MW-2 were identified as potential source areas of nitrate by the high nitrate/chloride ratios. Downgradient of the northern region source area, nitrate/chloride ratios of MW-21, MW-23, and MW-20s are much lower than those of the potential source area. The rate of decrease of nitrate concentrations exceeds the rate of decrease of chloride concentrations moving from the northern irrigated field downgradient into the Soapmine Road Neighborhood (Figure X—Shallow North nitrate:chloride ratio graph). This suggests that either denitrification or dilution is occurring along this transect.

In the southern region of the Study Area near the percolation ponds, nitrate/chloride ratios were higher at MW-11, MW-17, MW-16, and MW-13. Downgradient of the potential source area, MW-14, MW-18, MW-19, and NWP-04 thru NWP-06 have lower nitrate/chloride ratios. Nitrate attenuation exceeding chloride dilution is evidence that denitrification is occurring. Therefore, the decreased nitrate concentration at the downgradient wells may be the result of natural biodenitrification in addition to dilution.

Bicarbonate:
Inorganic carbon is the dominant product of heterotrophic organism denitrification. This is most commonly observed as HCO_3^- at aquifer pH ranges of 6 to 8 (Trudell et al., 1986; Appelo and Postma, 1996).

The observation of bicarbonate in all analyzed groundwater samples provides strong evidence that heterotrophic denitrification may be occurring in the Study Area.

Sulfate:
In autotrophic denitrification, SO_4^{2-} and Fe^{3+} are the commonly observed products where iron sulfide is the electron donor (Appelo and Postma, 1996). Therefore, sulfate can be an indicator of autotrophic denitrification. If denitrification occurs within the Study Area, the observations of sulfate are another line of evidence supporting the occurrence of denitrification and indicate that a portion of the observed denitrification is autotrophic in nature (Table 11).

Bacteria:
Microorganisms are essential for denitrification to occur in soil and groundwater. The detection of bacteria in groundwater throughout the Study Area is another line of evidence that suggests that denitrification may be occurring (Table11).

Total organic carbon:
The presence of Total organic carbon (TOC) in soil and groundwater supports heterotrophic organisms, thus aiding the denitrification process within the Study Area (Table 11).

Isotope Ratios

As discussed earlier, Nitrate from the wells in the southern region exhibit large variation in both $\delta^{18}O$ and $\delta^{15}N$ values. Their $\delta^{15}N$ values range from 1.6 – 49.3 ‰ and $\delta^{18}O$ values from -0.3 – 32.4 ‰. In general, the samples from the wells near the southeast side of this area have enriched δ-values with NWP-06 and NWP-05 having the most enriched δ-values in the area (Figure 36).

In the northern region, a plot of $\delta^{18}O$ vs $\delta^{15}N$ (Figure 33) do not clearly indicate that denitrification is occurring. Due to two known nitrate contributing source areas (southern irrigation field and Soapmine Road neighborhood) continually discharging nitrate laden waters to the aquifer, no large scale denitrification trends can be observed. On a smaller scale, a denitrification trend line could be drawn between the different intervals of MW-2.

Denitrification Conclusions

Physical site data indicate that conditions are conducive to denitrification in the northern and southern regions of the site.

Nitrate/Chloride ratios indicate that in the northern region, that 2 source areas (northern irrigation field and Soapmine Road neighborhood) exist, corroborating other evidence that suggest the same source areas. This data also indicates that as you move away from the source areas, the ratio drops, indicative of denitrifying conditions relative to the source areas. This same trend exists in the southern region with the WWTP and an area south of the WWTP being potential source areas with ratios decreasing as you move east (downgradient) of these source areas.

Additionally, isotopic data has provided strong evidence that denitrification is occurring on a large scale basis in the southern region and on a small scale basis in the northern region.

6.5. Background Nitrate Concentrations

A background nitrate concentration for shallow zone groundwater needs to be established and agreed on by DPRA, the City of Barstow, and the RWQCB before a Remedial Action Plan (RAP) can be drafted.

After careful examination of the shallow groundwater contour map (Figure 4) and areas DPRA has established as being source areas, DPRA proposes using monitoring wells MW-1-4, 3-4, 5, 8, 10, 11, 16, 17, 18, 19, and NWP-4 to establish a background nitrate concentration. All of these wells are located upgradient or cross-gradient of known nitrate source areas thought to be impacting groundwater in the shallow groundwater zone. By averaging the nitrate data at these wells with the 2005 and 2007 data by DPRA, a preliminary Study Area background nitrate concentration of 6.4 mg/L is proposed (Table 13). A conversation with the RWQCB on March 27, 2007 suggested that DPRA calculate background nitrate values for the northern and southern regions of the Study Area. These calculations indicate preliminary background nitrate values of 6.1 mg/L and 6.7 mg/L for the northern and southern regions respectively. As seen in the data, nitrate concentrations varied significantly from 2005 and 2007, in some instances by an order of

magnitude (Appendix I). Due to these variations, a final background number for the northern and southern regions may need to be recalculated when additional groundwater data becomes available.

Due to the low nitrate concentrations in the intermediate and deep groundwater zones, DPRA does not feel that it is necessary to establish a background nitrate concentration for these water bearing zones.

During previous conversations with the RWQCB, the RWQCB recommended that DPRA use WWTP monthly monitoring sampling data to provide additional data in establishing background nitrate concentrations. After careful examination of the reports provided by the City of Barstow and excerpts provided by RWQCB and conversations with Aquarion personnel, DPRA has serious concerns regarding the validity of this data. Among our concerns are: at least a dozen reports show data that have duplicate or near duplicate results across several analytes for multi-depth wells and other wells (DPRA data show significant nitrate decreases at depth), none of the reports have laboratory QA/QC data, the vast majority of the reports do not include chain of custody records, numerous instances of inconsistencies between the field data sheets and laboratory reports, and numerous inconsistencies between field data sheets from one month to the next ie, well depths and depth to water. All of these findings are listed in Appendix J.

DPRA suspected in 2006 that there was a problem with the monthly monitoring reports but could not establish if it was a laboratory issue or a sampling issue. Conversations with Aquarion personnel about this issue resulted in DPRA learning that the monitoring wells are not being sampled properly. In 2005 and 2007, it took DPRA personnel 1 full day to properly sample 6 to 7 well casings. Aquarion personnel indicated that the field technician performing the work was doing the same amount of well casings in a couple of hours. This directly contradicts what the field data sheets indicate (Appendix I). DPRA does not believe that every well was purged and sampled. It is likely that only a couple wells may have been sampled property, with the remaining sample containers simply filled with water from these wells. The laboratory data, field data sheets, and Aquarion observations clearly support this opinion.

Without having a full understanding of how the monitoring wells were sampled for each monthly monitoring report, DPRA proposes to wholly reject all of the WWTP monthly monitoring data in establishing background nitrate concentrations.

7. Recommendations

Based on the conclusions of this report, DPRA recommends the following.

Recommendation 1
The City of Barstow and Aquarion should consider terminating its relationship with the environmental consultant performing monthly groundwater sampling. The validity of the data collected has put Aquarion and the City of Barstow in a perilous situation with various state agencies. DPRA can either conduct or supervise the replacement sampling program.

Recommendation 2
DPRA recommends that monitoring wells MW-1-4, 3-4, 5, 8, 10, 11, 16, 17, 18, 19, and NWP-4 be monitored for water levels and Nitrate as N on a quarterly basis for a period of one year. The purpose of this monitoring is to provide additional data to calculate an agreed upon final background concentration of nitrate in the shallow groundwater zone. Quarterly groundwater monitoring reports would be submitted to the RWQCB Lahontan Region no later than 30 days after the sampling has taken place.

Recommendation 3
DPRA recommends that monitoring wells MW-1 through 23 and MCLB monitoring wells NWP-4, 5, and 6 be monitored for water levels and Nitrate as N on a semi-annual basis for a period of one year. The purpose of this monitoring is to provide additional data to establish nitrate trends and patterns throughout the Study Area. Semi-Annual groundwater monitoring reports would be submitted to the RWQCB Lahontan Region no later than 30 days after the sampling has taken place.

Recommendation 4
a) DPRA can continue to follow the schedule agreed to in earlier documentation (CRWQB, 2006). DPRA has demonstrated that denitrification conditions exist and is occurring in groundwater within the Study Area. However, the issue of background nitrate concentrations has not been resolved. For this investigation, DPRA has used 5 mg/l nitrate as N as a working background number in the hopes that existing data would provide a defensible concentration. The sampling program conducted by Aquarion's subconsultant does not appear to be valid, which throws into question the validity of utilizing this data for analysis of background concentrations. DPRA can prepare the Remedial Action Plan as agreed, but the RWQCB must be made aware that a clean up objective cannot be established for Nitrates unless the RWQCB arbitrarily defines the Basin Plan objective, which is 11 mg/l nitrate as N for groundwater in the Mojave River upstream of the Waterman Fault (CRWQB, Basin Plan) or the MCL of 10 mg/L as the clean up objective. It should be noted that Table 3-20 in the Basin Plan, lists the objective value as Nitrate as Nitrate (NO_3 as NO_3). DPRA suspects this might be a typographical error, as all of the other tables in the plan list the nitrate objective as Nitrate as Nitrogen (NO_3 as N). DPRA can move forward with the schedule as agreed with direction from the RWQCB regarding the clean up objective; or

b) If there is not agreement regarding the cleanup objective, DPRA suggests that at the conclusion of one full year of technically correct groundwater monitoring, DPRA will draft a Remedial Action Plan to be submitted to the RWQCB Lahontan Region on August 29, 2008.

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EXHIBIT G

Lahontan Region

Linda S. Adams
Secretary for
Environmental Protection

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http://www.waterboards.ca.gov/lahontan

Arnold Schwarzenegger
Governor

ATTN; Greg Newmark

JUN 15 2007

Hector Rodriguez
City Manager
City of Barstow
220 E. Mountain View Street, Suite A
Barstow, CA 92311

CITY OF BARSTOW REQUEST FOR REVISIONS TO ORDERS RELATED TO NITRATE CONTAMINATION IN GROUNDWATER, SAN BERNARDINO COUNTY, WDID NO. 6B360101001

I have received and reviewed your June 13, 2007 letter in which the City of Barstow requests additional time to submit technical reports pursuant to the May 18, 2007 Order to submit technical reports and requests that I revise or withdraw the May 25, 2007 Cleanup or Abatement Order (CAO) for uninterrupted alternative water supply.

The City of Barstow suggests that the characterizations of the groundwater contamination be delayed by more than one year while the City determines background levels for nitrate in the area. I disagree with the assertions presented in the June 13, 2007 letter to support postpone the groundwater characterization; therefore, I am not willing to modify the Order to allow for this lengthy delay. I am willing to discuss minor modifications to the schedule for submitting workplans and reports. It is clearly appropriate and is common practice to complete the characterization and background determination on a parallel track. Furthermore, I am not prepared to revise the CAO at this time. However, I am willing to use new data, as it is developed, to revise the 5 mg/L trigger point for providing an alternate water supply.

If you would like to discuss the need for minor changes in the required schedules, please contact Water Board staff Doug Smith at (530) 542-5453 or John Steude at (530) 542-5571 to schedule a meeting.

Harold J. Singer

HAROLD J. SINGER
EXECUTIVE OFFICER

cc: Water Board members
David Coupe, OCC

EXHIBIT 6

PROOF OF SERVICE

I, Lillian Dominguez, declare:

I am a resident of the State of California and over the age of 18 years and not a party to the within action. I am employed in the County of Los Angeles, State of California. My business address is Meyers, Nave, Riback, Silver & Wilson, 333 South Grand Avenue, Suite 1670, Los Angeles, California 90071. On June 18, 2007, I served the within document:

CITY OF BARSTOW'S PETITION FOR REVIEW AND REQUEST FOR STAY

On the interested parties in this action by placing a true copy thereof in a sealed envelope(s), each envelope addressed as follows:

(x) (BY FIRST CLASS MAIL) I caused each such envelope, with postage thereon fully prepaid, to be placed in the United States mail at Los Angeles, California. I am readily familiar with the business practice for collection and processing of mail in this office; and that in the ordinary course of business said document would be deposited with the U.S. Postal Service in Los Angeles on that same day. I understand that service shall be presumed invalid upon motion of a party served if the postal cancellation date or postage meter date on the envelope is more than one day after the date of deposit for mailing contained in this declaration.

(X) (BY FACSIMILE) By use of facsimile machine telephone number 213 262-0215, I served a copy of the within document(s) on the listed interested parties at the facsimile number(s) listed below. The transmission was reported as complete and without error.

Harold J. Singer, Executive Officer
California Regional Water Quality Control Board
Lahontan Region
2501 Lake Tahoe Boulevard
South Lake Tahoe, CA 96150

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct. Executed on June 18, 2007, at Los Angeles, California.

Lillian Dominguez

LILLIAN DOMINGUEZ

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Attorneys for Petitioner
CITY OF BARSTOW

BEFORE THE

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

In the Matter of the City of Barstow's Petition for Review of Action and Failure to Act by the California Regional Water Quality Control Board, Lahontan Region, in Issuing Cleanup or Abatement Order No. R6V-2007-0017 and Order to Submit Additional Technical Information in Accordance with Section 13267 of the California Water Code	**DECLARATION OF ROBERTO FALERO IN SUPPORT OF PETITION FOR REVIEW AND REQUEST FOR STAY (Wat. Code § 113320)** [Request for Immediate Stay - Water Code §13321 and 23 CCR §2053]

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DECLARATION OF ROBERTO FALERO

I, Roberto Falero, hereby declare, as follows

1. I am employed as an Associate Geologist with DPRA Inc. I have a Bachelors of Science and a Masters of Science degree in Geology from the University of California, Riverside. I have been employed by DPRA, Inc. for two years and have worked as an environmental consultant for two years. During my tenure with DPRA Inc. I have performed critical analyses of numerous site assessment and remedial action reports performed by others, as well as conducting and assisting in such assessments by DPRA Inc.

2. I am submitting this declaration in support of the City of Barstow's ("City") Petition for Review and Request for Stay.

3. Since August 2006, I have been actively involved and I am very well versed in all aspects of the Soapmine Road area groundwater contamination investigation. I have personally been involved with the planning, drafting, and implementation of most of the field activities performed by DPRA, Inc. to date.

4. The May 18, 2007 order from the Regional Water Quality Control Board (RWQCB), Lohanton Region requires the City to submit an Interim Remedial Actions Plan (IRAP) to: 1) provide three remedial alternatives, 2) propose a schedule to implement such alternative(s), and 3) provide an "Estimated time to reduce nitrate-nitrogen concentrations in groundwater to below 10 mg/L at all locations in the area affected by the City's discharge". Beyond providing replacement water to affected residents in the Soap Mine Road neighborhood, which the City is doing and continues to do, the RWQCB request for an Interim Remediation Plan is premature. Even though all potential nitrate sources have not been completely identified and characterized, the RWQCB's order on this matter is forcing the City to spend its finite resources in an unscientific fashion. It is *imperative* that these potential sources be completely characterized *prior* to implementing any further remedial actions, interim or otherwise. After an

accurate assessment of the irrigation fields, local groundwater flow conditions, and background nitrate-N conditions are determined, then remedial action alternatives and clean up goals can be assessed.

5. The schedule proposed by the RWQCB will result in an inefficient method for remediating the Study Area. To the best of my knowledge, no statistically significant data set currently exists that allows for the determination of background nitrate concentrations within the Study Area. The May 18, 2007 order from the RWQCB proposes a schedule that would result in the determination of background nitrate concentrations *after* the commitment of a significant amount of investigative work is conducted via a second phase Remedial Investigation Report and subsequent Revised Remedial Investigation Report and a Feasibility Study. If background nitrate conditions have not been fully evaluated, it is not possible to declare, as the RWQCB's Order does, that the nitrate plumes have not been delineated to background concentrations. The RWQCB's May 18 Order requires a multi-tasked approach of preparing and implementing an Interim Remedial Action, Remedial Investigation and Feasibility Study, concurrent with monitoring for establishment of background nitrate concentration. The California Department of Toxic Substances (DTSC) has identified significant problems with such multi-faceted approaches: Management of tasks is more difficult; initial costs tend to be higher due to overlapping and concentration of tasks within a shorter time schedule; and most importantly, the risk of error and associated error corrections are increased due to the reduced turn-around time for analysis (CalEPA, 1995). The risk of error correction is inevitable if the schedule proposed by the RWQCB is implemented for the Study Area because once background nitrate concentrations are established, the Revised Remedial Investigation Report and the Feasibility Study will have to be revised and resubmitted to the RWQCB. The RWQCB's Order also increases the potential of over-estimating the number of wells necessary to delineate the nitrate-N plumes.

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6. We at DPRA suggest that establishing background levels of nitrate prior to the initiation of investigative procedures within the Study Area will allow for a more efficient approach to investigating and remediating any potential contamination caused by the City.

7. We at DPRA are of the opinion that the following schedule of actions is technically superior and more efficient scientifically than the schedule imposed by the RWQCB:

- First, background nitrate concentrations should be established through quarterly monitoring of upgradient wells for one year, beginning August 15, 2007 and ending August 15, 2008;
- Then, a Groundwater Investigation Workplan should be developed by October 28, 2008;
- Next a Revised Remedial Investigation Report will be submitted to the RWQCB by January 30, 2009;
- Quarterly monitoring of all wells will then occur for one year to establish changes in nitrate concentrations caused by seasonal variation and/or potential plume migration beginning September 9, 2008 and Ending September 9, 2009;
- A Feasibility Study will then be submitted to the RWQCB by November 25, 2009, identifying potential remedial alternatives;
- Lastly, a Remedial Action Plan outlining the alternative accepted by the RWQCB will be submitted by March 10, 2010.

This step-wise, methodical approach to investigating and remediating groundwater contamination caused by the City reduces the potential for errors and increased costs by efficiently and effectively establishing a cleanup goal prior to the initiation of subsequent phases of investigation.

8. The RWQCB's requirement to conduct remedial actions, feasibility studies, nature and extent of contamination studies, and determine background concentrations simultaneously is unnecessary or technically inappropriate. A measured and methodical

assessment and cleanup approach as proposed above best serves the City, the RWQCB and nearby residents. The City is currently providing bottled water to all well owners who are or who could potentially be affected by levels of nitrates in their drinking water considered to be elevated by the RWQCB. The City has addressed any immediate need for drinking water to these residents and the urgency of the matter has been resolved.

9. Due to the fact that the RWQCB is requiring the City to perform investigative and remedial activities in a scientifically unorthodox manner, it is highly likely that City funds could be misspent in investigative activities that could have been better spent in other aspects of this project. Based on the investigative scope of work prepared by the RWQCB in the May 18, 2007 order, we at DPRA estimate that it will cost the City of Barstow approximately $700,000 to $800,000 in investigative and monitoring costs over the course of one year. If DPRA's recommended methodical investigative approach to this investigation is implemented, costs the City would presently be required to incur for one year of investigative activities, would be spread out over the course of 2 to 3 years. This would allow the City and DPRA to direct investigative funds in the most cost effective manner.

10. The May 18 RWQCB Order directs the City to "...provide adequate groundwater data necessary to fully identify and map the horizontal and vertical extent of groundwater nitrate as nitrogen (N) contamination and degradation **to an interim level of 2 mg/L nitrate as N**..." No justification for delineation to an interim level of 2 mg/L is given by the RWQCB. Previous conversations between the personnel at RWQCB, DPRA, and the City, indicate that the RWQCB wishes the City to restore groundwater to background conditions. The RWQCB staff also takes the position that MW-1 and MW-3 are the only upgradient wells within the Study Area. Given the limited amount of data (2 sampling events) that we at DPRA believe to be verifiable for these two wells, we believe that it is premature to require the City to delineate nitrate-Nitrogen to 2mg/L or any other concentration before actual background conditions have been established.

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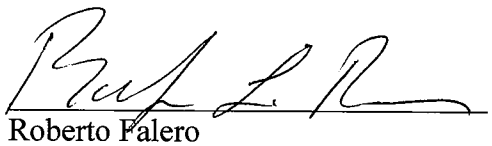
If called as a witness, I could and would competently testify to the foregoing from my own personal knowledge.

I declare under penalty of perjury that the foregoing is true and correct.

Executed this 15th day of June 2007 at San Marcos, California.



Roberto Falero

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Attorneys for Petitioner
CITY OF BARSTOW

BEFORE THE

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

In the Matter of the City of Barstow's Petition for Review of Action and Failure to Act by the California Regional Water Quality Control Board, Lahontan Region, in Issuing Cleanup or Abatement Order No. R6V-2007-0017 and Order to Submit Additional Technical Information in Accordance with Section 13267 of the California Water Code	**DECLARATION OF MARK W. MURPHY IN SUPPORT OF PETITION FOR REVIEW AND REQUEST FOR STAY (Wat. Code § 113320)** [Request for Immediate Stay - Water Code §13321 and 23 CCR §2053]

DECLARATION OF MARK W. MURPHY

I, Mark W. Murphy, hereby declare, as follows:

1. I am employed with the City of Barstow ("City") as the Senior Management Analyst and Barstow Enterprise Zone Administrator. I have been employed with the City for five years and served in the capacity of Senior Management Analyst for two years.

2. I am submitting this declaration in support of the City of Barstow's Petition for Review and Request for Stay of the actions of the Regional Water Quality Control Board, Lahontan Region ("Regional Board")

3. As a public entity, the City of Barstow has limited financial resources.

4. The Regional Board's May 18, 2007 Order Pursuant to California Water Code Section 13267 ("Section 13267 Order") and the May 25, 2007 Cleanup or Abatement Order No. R6V-2007-0017("CAO") will impose significant costs on the City.

5. The Regional Board's directives in the May 18 Section 13267 Order require the City to outlay a significant amount of money for investigation and remediation of the nitrate contamination in essentially one year. DPRA, the city's environmental consultants, has estimated this amount to be $700,000 - $800,000. An outlay of funds this large in one year imposes substantial harm to the City as it is economically burdensome for the City. Incurring these costs in one year will likely result in a diversion of City resources from other important City services to pay for the costs.

6. Additionally, DPRA has advised the City that the Regional Board's requirement in the May 18 Section 13267 Order that the City determine the cost and/or effectiveness of a remedial alternative when the cleanup level has not yet been determined, is impossible to meet

and will result in unnecessary costs to the City by requiring DPRA to go back and perform duplicative work. The City will be substantially harmed by these additional and unnecessary costs.

7. Although, the City believes that other responsible parties for the nitrate concentration have yet to be identified, the City is and will continue to take interim actions to mitigate the effects of the nitrate concentrations in the Soapmine Road area considered by the regional Board to be elevated. We at the City estimate it will spend approximately $ 25,000, annually to provide replacement drinking water to those identified residences in the Soapmine Road area whose private wells exhibit a nitrate as nitrogen concentration level of 5mg/L or above, as determined by the Regional Board.

8. Although the City believes that the Regional Board has improperly imposed the trigger level MCL of 5mg/L nitrate as nitrogen in the May 25 CAO, the City is currently, and will continue for the time being, to supply replacement drinking water to the currently identified affected residences in the Soapmine Road area whose private drinking wells exhibit nitrate as nitrogen concentration levels equal or greater to 5mg/L.

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If called as a witness, I could and would competently testify to the foregoing from my own personal knowledge.

I declare under penalty of perjury that the foregoing is true and correct.

Executed this 15 day of June 2007 at Barstow, California.

Mark W. Murphy

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CITY OF BARSTOW

BEFORE THE

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

In the Matter of the City of Barstow's Petition for Review of Action and Failure to Act by the California Regional Water Quality Control Board, Lahontan Region, in Issuing Cleanup or Abatement Order No. R6V-2007-0017 and Order to Submit Additional Technical Information in Accordance with Section 13267 of the California Water Code	**PRELIMINARY MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF PETITION (Wat. Code § 113320)** [Request for Immediate Stay - Water Code §13321 and 23 CCR §2053] [Request for Hearing 23 CCR §2050(b)]

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I. INTRODUCTION

The City of Barstow owns a waste water treatment facility located on the eastern side of the City of Barstow ("Facility"). The Facility consists of a treatment plant, percolation ponds and reclamation irrigation fields located to the north and south of the treatment plant. Historically, the Facility has discharged wastewater effluent and biosolids into the percolation ponds and at the reclamation irrigation fields. The surrounding area includes a dairy farm, a mobile home park and a residential neighborhood, commonly referred to as, the Soapmine Road Area.

Elevated levels of the contaminant, nitrate nitrogen, have been found in the groundwater in and around the Facility, particularly in the region surrounding and underlying the northern irrigation field. Although all potential responsible parties for the elevated nitrate concentrations have not yet been identified, the City has been working with the California Regional Water Quality Control Board, Lahontan Region ("Regional Board") to implement groundwater monitoring programs and to identify source(s) of elevated nitrate concentrations.

Recently, the Regional Board issued to the City, a May 18, 2007 Order Pursuant to California Water Code Section 13267 ("Section 13267 Order") and a May 25, 2007 Cleanup or Abatement Order No. R6V-2007-0017("CAO"), which are Exhibits A and B, respectively, to the City's Petition for Review by the State Board (filed concurrently herewith).

No hearing was conducted in either Order, nor was any evidence presented to support the findings of either Order, nor was the City give an opportunity to contest either order. In its Petition, the City requests that the State Board review the timing and sequence of actions in the Section 13267 Order requiring the City to conduct its investigation and to submit technical reports on an expedited basis and in contradiction to established site assessment and remediation procedures and to conduct an evidentiary hearing. The City requested that its Petition be initially held in abeyance. The City intends and reserves the right to supplement its contentions regarding the Regional Board's violation of due process at the time it requests its petition be removed form abeyance.

The Regional Board has unreasonably and inappropriately required the City to delineate the extent of nitrate contamination to background before the background level has been determined. Similarly, the Regional Board required the City to submit a remediation plan and to develop remedial alternatives prior to the determination of what the nitrate background level is.

The City further requests that the State Board review the Regional Board's findings in the CAO. The City contends that such findings are not supported by substantial evidence and the City has not had an opportunity to contest the findings of the Orders. The City further contends that the Regional Board's determination of 5mg/L nitrate as nitrogen as the trigger level of concentration at which the City is required to supply replacement drinking water, in place of the established standard drinking water Maximum Contaminant level ("MCL") for nitrate as nitrogen, 10mg/L, is contrary to state and federal standards.

Lastly, the City requests that the State Board review the Regional Board's directives to the City in the CAO, to conduct well monitoring and to submit technical reports based on results obtained from the well monitoring, also based upon the Regional Board's unsupported findings and inaccurate calculation of the 5mg/L nitrate as nitrogen trigger level for supply of replacement drinking water.

II. FACTUAL BACKGROUND

The City acquired the Facility in 1979. Aquarion operates the Facility under contract to the City. The Facility includes a waste water treatment plant ("Plant"), eight percolation ponds ("Ponds") and two reclamation fields. One reclamation field is located to the north of the Plant ("Northern Irrigation Field") and the other reclamation field is located to the south of the Plant ("Southern Irrigation Field"). The Plant provides secondary-level treatment of domestic waste water using conventional activated sludge treatment. Wastewater is currently discharged at the eight Ponds and Southern Irrigation fields. Until August 2003, biosolids generated at the Plant were applied to the Northern and Southern Irrigation fields. Since August of 2003, biosolids are hauled offsite for disposal. Secondary effluent was used as spray irrigation for alfalfa crops in the Northern Irrigation Field until 2003 and currently is still used as spray irrigation in the Southern Irrigation field. (Exhibit B to Petition, May 25 CAO, Finding 5, p.2.)

The Facility is comprised of approximately five square miles and is located within Region 6 of the South Lahontan Hydrologic Basin Planning Area, Mojave Hydrologic Unit, Lower Mojave Hydrologic Area 628.50. Beneficial uses for groundwater in the Lower Mojave Hydrologic Area include municipal, agricultural, industrial, freshwater replenishment and aquiculture. (Exhibit F to Petition, DPRA March 2007 RIR, p.3.)

The Basin Plan requires that the ground waters designated for municipal and domestic use not contain concentrations of chemical constituents in excess of the primary MCL based upon the drinking water standards specified in Title 22 of the California Code of Regulations. Title 22 specifies the standard drinking water MCL for nitrate as nitrogen is 10mg/L. This MCL determined by the California Department of Health Services which derived the MCL from the federal MCL set by the U.S. Environmental Protection Agency.

Comprehensive groundwater monitoring at the Facility began in the early 1980s. In 1982, the Regional Board established groundwater monitoring requirements for the Facility and the Northern and Southern Irrigation fields. These requirements were updated by the Regional Board in 1985. (Exhibit F to Petition, DPRA March 2007 RIR, p.3.)

During the 1980s ten groundwater monitoring wells were installed in the vicinity of the Facility. In 1993, 15 new groundwater monitoring wells were installed and in 2005 three additional wells were installed. (*Id.*)

In 2005, groundwater sampling was conducted that included all existing monitoring wells. Nitrate concentrations were found to exist at some wells in the northern shallow groundwater zone of the Soapmine Road neighborhood. The Soapmine Road neighborhood includes approximately 40 private drinking water wells. (Exhibit B to Petition, May 25 CAO, Finding 8, p. 2.) Subsequent groundwater monitoring data obtained in 2006 and 2007 also exhibited elevated concentrations of nitrate at some wells.

Although all potential responsible parties for the nitrate concentration levels have not been identified, the City has worked with the Regional Board to implement a work plan to conduct additional groundwater monitoring and to investigate the source of the elevated nitrate concentration in the Soapmine Road area.

On March 30, 2007, the City submitted a Remedial Investigation Report (RIR), prepared by its consultants, DPRA, to the Regional Board. (Exhibit F to Petition) The Regional Board issued the May 18, 2007 Section 13267 Order in response to the City's (RIR). The Section 13267 Order directs the City to submit a number of technical reports in accordance with a time schedule included in the order.

The current schedule, as set forth in the Section 13267 Order, requires the City to establish and delineate the plume to background levels and to develop remedial alternatives prior to the determination of what the nitrate background level is. The Regional Board allowed an unreasonably short period of time for these activities (within only 14 months from start to final plan for remediation). The City's consultants, DPRA, have advised that this expedited timeline and manner of investigating and delineating the nitrate contamination on a parallel track will increase annual costs and may result in unnecessary, additional overall costs to the City. (See Declaration of Robert Falero, ¶5.)

On June 13, 2007, the City requested an extension of time through a proposed alternative time schedule, which would permit the City and DPRA, to first conduct a properly phased investigation of the background nitrate concentration levels to inform and guide plume delineation and any future remedial action, including a scientifically justified cleanup level. The City should not be required to identify where the edge of the plume reaches background level or develop plans to cleanup to background before determining what the background level of nitrate is.

On May 25, 2007, the Regional Board issued Cleanup or Abatement Order No. R6V-2007-0017, directing the City to supply replacement drinking water to residences in the Soapmine Road area serviced by private wells exhibiting a nitrate as nitrogen concentration levels equal or greater than 5mg/L ("trigger level"). The standard drinking water MCL of 10mg/L was established by the California Department of Health Services pursuant to the California Safe Drinking Water Act and is set forth in Title 22 of the California Code of Regulations, Division 4, Chapter 15, Domestic Water Quality Monitoring. Although all of the responsible parties for the nitrate levels have not been definitively identified, the City has been

supplying replacement drinking water to residences serviced by private wells in the Soapmine Road area exhibiting a nitrate as nitrogen concentration level equal or greater than 5mg/L in accordance with the CAO.

However, the City believes that the Regional Board's calculation of the trigger level for supplying replacement water and for conducting well monitoring is not consistent with the standard drinking water MCL of 10mg/L for nitrate as nitrogen set forth in Title 22 of the CCR. The CAO also requires the City to conduct quarterly well monitoring and to submit quarterly reports documenting the laboratory results of the quarterly well monitoring. The City is and will continue to provide the replacement water in accordance with the CAO pending review of this Petition. (Declaration of Mark Murphy, ¶8.)

III. THE REGIONAL BOARD'S ACTIONS IN THE MAY 18 ORDER ARE IMPROPER AND INAPPROPROPRIATE

A. The Regional Board's Time Schedule Forces the City to Unnecessarily Investigate Background Levels and Remedial Measures on a Parallel Track

The May 18 2007 Order requires the City to conduct investigation of background nitrate levels at the same time it is investigating horizontal and vertical extent of the nitrate concentration to background level and developing remedial alternatives. The Order requires the City to submit the following reports in an unreasonably short period of time:

- Revised Remedial Investigation Report by September 15, 2007;
- Remediation Plan by October 15, 2007;
- Background, Seasonality and Migration Report by August 15, 2008; and
- Final Remediation Plan by August 15, 2008.

As directed by the Regional Board, the City would be required to investigate remedial alternatives to submit a report by October 15, 2007, prior to the August 15, 2008 determination of background levels.

Moreover, the May 18 Section 13267 Order directs the City to "...provide adequate groundwater data necessary to fully identify and map the horizontal and vertical extent of groundwater nitrate as nitrogen (N) contamination and degradation to an interim level of 2 mg/L

nitrate as N..." The Regional Board provides no justification for delineation to an interim level of 2 mg/L is given by the Regional Board. Rather the Regional Board takes the position that MW-1 and MW-3 are the only up gradient wells within the Study Area and appears to have averaged the latest samplings from these wells to arrive at the 2mg/L interim level. However, given the limited amount of data (2 sampling events) that DPRA believes to be verifiable for these two wells, DPRA believes that it is premature to require the City to delineate nitrate-nitrogen to 2mg/L or any other concentration before actual background conditions have been established. (Declaration of Robert Falero, ¶10.)

The City has proposed the following time schedule:

- Background Level Determination – Beginning August 15, 2007 and ending August 15, 2008;
- Revised Groundwater Investigation Work Plan – October 28, 2008;
- Revised Remedial Investigation Report – January 30, 2009;
- Groundwater Monitoring (1 year) – Beginning September 9, 2008 and ending September 9, 2009;
- Remediation Plan (Feasibility Plan) - November 25, 2009; and
- Final Remedial Action Plan – March 10, 2010.

The City's proposed time schedule allows for the investigation of background level first; then provides for the determination of the nature and extent of contamination to background level; and lastly a remedial plan based on technically sound data. The City's approach is consistent with well established site assessment and remediation procedures and consistent with the directives of the State Board.

State Water Resources Control Board Resolution 92-49, Policies and Procedures For Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304, requires that Regional Boards, prescribes that the Regional Boards establish "procedures for identifying and utilizing the most cost-effective method for detecting contamination or pollution and cleaning up or abating the effects of contamination or pollution." (SWRCB Resolution 92-49, 5(c).) DPRA suggests that establishing background prior to the initiation of investigative

procedures within the Study Area will allow for a more efficient approach to investigating and remediating any potential contamination caused by the City. (Declaration of Robert Falero, ¶6.)

In contrast, DPRA has found that "[t]he schedule proposed by the RWQCB will result in an inefficient method for remediating the Study Area...The RWQCB's May 18 Order requires a multi-tasked approach of preparing and implementing an Interim Remedial Action, Remedial Investigation and Feasibility Study, concurrent with monitoring for establishment of background nitrate concentration" (Declaration of Robert Falero, ¶5.) Thus, the Regional Board's actions are not consistent with State Board polices or established assessment and remediation practices.

B. The Regional Board Failed To Properly Consider The Burden To The City, Including Costs Of The Reports In Comparison To The Benefits To Be Obtained

Water Code Section 13267 requires that the burden, including costs, of these reports shall bear a reasonable relationship to the need for the report and the benefits to be obtained from the reports. Similarly, Water Code Section 13225 (c) requires that "the burden, including costs, of such reports shall bear a reasonable relationship to the need for the report and the benefits to be obtained therefrom." The Regional Board states in the May 18 Section 13267 Order "Investigating the groundwater quality is necessary for determining the impact of the City's discharge on water quality, public health and beneficial uses. This information is also necessary for identifying, evaluating, and implementing remedial actins intended to protect and restore water quality and the beneficial uses of the groundwater." (Exhibit A to Petition, May 18 Section 13267 Order, p.3.) The needs stated by the Regional Board do not bear a reasonable relationship to the costs of the reports as directed by the Regional Board in this order.

The reports required in the May 18 Section 13267 Order require the City to perform investigative and remedial activities in an unorthodox manner that will likely result in misspent funds for investigative activities that could be better utilized on other aspects of the project without any evidence that the benefit of these reports will outweigh the burden to the City. (Declaration of Robert Falero, 9.) The technical reports required on the time schedule directed

by the Regional Board in the May 18 Section 12367 Order unnecessarily burden the City in at least two ways.

First, by requiring the City to conduct the investigations and to submit the reports on an expedited basis, the City is forced to outlay the entire amount of investigation and remediation costs in the span of approximately one year (August 2007 – August 2008). The City's consultants, DPRA, have estimated that the costs of conducting the investigations as currently directed by the Regional Board would be approximately $700,000 to $800,000. (Declaration of Robert Falero, ¶9.) As a public entity, the City has limited resources and operates on an annual budget. To require the City to unnecessarily outlay this significant sum of money in essentially one year creates substantial harm to the City and is economically burdensome for the City. Incurring these costs in one year will likely require a diversion of City resources from other important City services to pay for the costs. (Declaration of Mark W. Murphy, ¶5.)

Second, the Regional Board's directive to the City to investigate background levels at the same time it investigates the extent of the nitrate contamination to background levels and determines the cost and effectiveness of remedial alternatives prior to establishing background level is impossible and is likely to result in unnecessary and additional overall costs to the City. (See Declaration of Robert Falero, ¶8.) DPRA advised the City that it is impossible to determine the cost and/or effectiveness of a remedial alternative if the cleanup level has not yet been determined.

However, that is just what the Regional Board's May 18 Order requires the City to do by requiring the that the City submit a remediation plan prior to the establishment of an accurate background nitrate contamination level.

Clearly, the benefits from forcing the City to proceed with the parallel investigations do not outweigh the burden to the City. The City will be forced to incur higher annual costs and faced with the risk of incurring additional, unnecessary overall costs. DPRA has stated that the City's proposed time schedule will result in a more methodical and efficient investigation and remedial process. (Declaration of Robert Falero, ¶9.)

C. The Regional Board Provides No Basis For Seeking The Expedited Time Schedule

Although Water Code Section 13267(b)(1) only requires the Regional Board to provide a written explanation with regard to the need for the reports, the Regional Board's unreasonable time schedule is wholly unsupported by the evidence and is not justified by the need. The City has and is taking interim actions to mitigate and remediate the effects of the nitrate contamination in the vicinity of the Facility. Moreover, the City is supplying the affected residents with replacement drinking water. Therefore, there is no imminent threat to the public health or to the environment to justify the Regional Board's actions. A properly phased investigation and remedial plan, based on scientifically valid data is a more reasonable and appropriate response to the remediation of the nitrate contamination.

IV. THE REGIONAL BOARD'S FINDINGS ARE NOT SUPPORTED BY THE EVIDENCE

In the May 25, 2007 CAO, the Regional Board makes numerous findings that are not supported by the evidence. First, the Regional Board finds in Finding No. 2, that the elevated nitrate concentrations in the groundwater were caused by the City's discharge of wastes to the Northern Irrigation Field. The Regional Board offers no evidentiary support for this finding. Although preliminary investigation has revealed that elevated concentrations of nitrate exist in the Northern Irrigation Field, all potential sources for the elevated nitrate levels have not been definitively identified. For example, the City's consultants, DPRA have identified a mobile home park located to the northwest of the facility potential source of nitrate contamination in the Northern Irrigation Field. The Regional Board concedes in its May 18 Section 12367 Order that the mobile home park may be a source and no evidence exists to exclude the mobile home park as a source of the elevated nitrate levels. Nevertheless, the concession exemplifies the fact that further investigation is necessary to identify all of the potential sources of nitrate contamination in the Northern Irrigation Field region. Until such investigation is completed, there is no substantial evidence supporting the finding that the City's discharges are the cause of the elevated nitrate concentration.

Other Regional Board findings suffer the same lack of evidentiary support for the same reasons discussed above: the Regional Board's Finding No. 7 that the City caused or allowed or threatened to cause nitrate-containing wastes to be discharged to waters of the State underlying and down gradient of the northern irrigation field is not supported by the evidence; the Regional Board's Finding No. 12 that the discharges from the City's facility have caused groundwater beneath the area down gradient from the northern irrigation field to exceed the drinking water standard for nitrate as nitrogen (10mg/L) is not supported by the evidence; and the Regional Board's Finding No. 12 that the discharges from the City's Facility have unreasonably affected the water for municipal and domestic supply beneficial use and caused a condition of pollution is not supported by the evidence.

Although the City has taken steps to attempt to identify the source(s) of the nitrate contamination and to mitigate and remediate the effects of the contamination, all potentially responsible parties have not been identified. Therefore the Regional Board's findings are unsupported, premature, improper and inappropriate.

V. THE REGIONAL BOARD IMPROPERLY IMPOSES AN INAPPROPRIATE TRIGGER LEVEL FOR REPLACEMENT DRINKING WATER

The Regional Board issued Cleanup or Abatement Order No. R6V-2007-0017 directing the City to supply replacement drinking water to residences in the Soapmine Road area serviced by private wells exhibiting a nitrate as nitrogen concentration level equal or greater than 5mg/L ("trigger level"). Although all of the potential contamination sources have not been definitively identified, the City has been supplying replacement drinking water to these residences in accordance with the CAO. However, the City believes that the Regional Board's determination of the 5mg/L nitrate as nitrogen trigger level is contrary to the state and federal standards.

The Regional Board explains its calculation of the 5mg/L trigger level in Finding 13 of the CAO as follows:

> Between 2006 and 2007, 22 of the 40 domestic wells (those that had nitrate nitrogen concentrations of less than 10mg/L in 2006) exhibited an average nitrate nitrogen increase of 1 mg/L. The standard deviation of this 1mg/L increase is 4 mg/L. Therefore, it is reasonable to apply a safety factor to establish the level of nitrate nitrogen concentration in domestic supply wells that would require uninterrupted replacement

water supply. Adding the standard deviation of 4mg/L to the average annual increase of 1mg/L would provide a safety factor of 5mg/L. Therefore, it is appropriate to require the City of Barstow to provide uninterrupted replacement water supply to residences with private wells exhibiting a nitrate nitrogen concentration of 5mg/L or greater (10mg/L MCL – 5mg/L safety factor = 5mg/L).

The Regional Board provides no legal or evidentiary support for arbitrarily diverging from state and federal standards by including a "safety factor" based upon sampling fluctuations.

A. The Regional Board's Calculation of 5mg/L Nitrate as Nitrogen is Contrary to the Law.

The Regional Board's Calculation of the "trigger level" for affected wells is contrary to the State established MCL for nitrate as nitrogen. The standard drinking water MCL is 10mg/L as established by the California Department of Health Services (DHS) pursuant to the California Safe Drinking Water Act and located in Title 22 of the California Code of Regulations, Division 4, Chapter 15, Domestic Water Quality Monitoring. Further, the Department of Health Services derived the 10mg/L MCL from the MCL established by the U.S. Environmental Protection Agency (USEPA) The Regional Board's determination of the 5mg/L trigger level ignores the expertise of DHS and USEPA in determining the standard drinking water MCL.

B. The Regional Board Should Defer to Agency Expertise

This State Board has previously determined that where MCL's have been developed by DHS, the Regional Board should defer to the agency's expertise. "Where new water replacement orders are considered, or where existing agreements or orders provide for reconsideration of replacement water levels, regional water boards should ***defer*** to OEHHA and DHS in determining safe drinking water levels." (*In the Matter of the Petitions of Olin Corporation and Standard Fusee Incorporated*, Order WQ 2005-0007, 2005 WL 5166379.)

C. The Regional Board Improperly Includes Fluctuations in Sampling in the Trigger Level Calculation

The Regional Board improperly uses fluctuations in the sampling of groundwater taken from the private wells to calculate the MCL that is lower than that required by state and federal standards. This State Board has previously determined that fluctuations are not a factor of

consideration in setting the trigger levels for providing replacement water. "[Petitioner] must meet the replacement water requirements at whatever level is determined appropriate, regardless of fluctuations." (*In the Matter of the Petitions of Olin Corporation and Standard Fusee Incorporated*, Order WQ 2005-0007, 2005 WL 5166379 *3) The DHS has determined that 10mg/L is the appropriate drinking water standard for nitrate as nitrogen. The Regional Board's imposition of the 5mg/L trigger level is not supported by the evidence, is contrary to state and federal standards and constitutes an abuse of discretion. Here the Regional Board ignores the standard set by the DHS and improperly recalculates a lower trigger level that is inappropriately imposed on the City.

D. The Regional Board Improperly Requires the City to Take Additional Actions Based Upon the Inaccurate Trigger Level

The CAO further requires the City to conduct quarterly well monitoring of all private domestic wells within the Soapmine Road area and to submit the samples to a laboratory for nitrate analyses. The City must also submit quarterly results and other quality assurance, quality control documentation to the Regional Board for all potentially affected private domestic wells at or exceeding the 5mg/L trigger level. Lastly the City is required to submit, by August 15, 2007, an alternative Water Supply Implementation Work Plan for long-term, uninterrupted, replacement water for domestic supply wells exhibiting nitrate as nitrogen concentrations at or exceeding 5mg/L.

The Regional Board improperly imposes these additional requirements on the City based upon a trigger level that is inconsistent with state and federal standards.

VI. A STAY IS NECESSARY PENDING STATE BOARD REVIEW OF THIS ACTION

A stay of the action taken by the Regional Board is necessary to minimize the harm that will result to the City and to the general public. If a stay of the Regional Board's actions is not granted, the City will be forced to proceed with its investigation in a manner that will result in greater annual costs and may result in unnecessary costs to the City. (Declaration of Robert Falero ¶ 9.) These costs will require a significant diversion of funds away from other important City services. (Declaration of Mark W. Murphy, ¶4.) Given the City's limited resources, it is

aggrieved when required to take actions that use resources to accomplish ends that are unnecessary and/or not required by law. DPRA, has estimated the costs of conducting the investigations as currently directed by the Regional Board to be $700, 000 – 800,000. (See Declaration of Robert Falero, ¶9.) An outlay of funds this large in one year imposes substantial harm to the City as it is economically burdensome for the City. Incurring these costs in one year will likely result in a diversion of City resources from other important City services to pay for the costs. As a public entity, the City has limited resources. (Declaration of Mark W. Murphy, ¶4.) To require the City to unnecessarily outlay this enormous amount of money in essentially one year is extremely unfair and burdensome to the City

Further, pursuant to the CAO, the City will be required to supply replacement water and to monitor private wells and file quarterly reports to the Regional Board for residences whose samples exceed the 5mg/L trigger level set by the Regional Board, when those directives are clearly contrary to state and federal standards. (Declaration of Mark W. Murphy, ¶5.)

Without the issuance of a stay, the City will be required to immediately commence the implementation of the directives in the Section 13267 Order under an unreasonable time schedule and in a manner that is inconsistent with site assessment and remediation standard practices. (Declaration of Robert Falero, ¶5.) The Section 13267 Order requires the City to take a number of immediate actions that will be both expensive and may prove unnecessary if the State Board adopts the City's schedule for investigation and remediation.

In contrast, a stay of the action taken by the Regional Board, pending review of this Petition, will not result in any harm to other interested persons or the public, as the City is providing replacement water and will continue to do so pending review of the Orders thereby eliminating any imminent or substantial danger to the public or the environment. (Declaration of Mark W. Murphy ¶6.)

No evidence has been presented by the Regional Board or its staff that would show that a delay in the imposition of the Regional Board's Orders to allow the State Board's review will result in substantial harm to the public. The City will continue to provide replacement drinking water to identified residences at the current estimated cost of $25,000 annually; investigate the

sources of nitrate contamination; and implement a groundwater monitoring process to establish a scientifically valid and statistically significant data set to determine background levels of nitrate. (Declaration of Mark W. Murphy, ¶5.) The harm that will result to the City and the public if the City is forced to comply with the Orders, unless modified, will far outweigh any alleged harm to interested persons and the public from the issuance of a stay.

Moreover, as discussed above, substantial questions of both law and fact exist which must be resolved before a determination can be made on whether the actions taken by the Regional Board are consistent with state and federal law, and whether the findings and determinations made by Regional Board are substantially supported by law and the evidence in the record.

VII. CONCLUSION

Based on the foregoing, the City respectfully requests that the State Board vacate the May 18 Order and Adopt the City's proposed time schedule; vacate the May 25 Order or revise the trigger level to the standard drinking water level of 10mg/L nitrate as nitrogen as established by state and federal standards or in the alternative permit the future modification to the trigger level, if appropriate, upon the completion of the City's investigation; in the interim, issue a stay of the May 18 Order pending the review of this Petition.

Dated: June 18, 2007

Respectfully submitted,

MEYERS, NAVE, RIBACK, SILVER & WILSON

By 

Chrystal B. James
Attorneys for Petitioner,
City of Barstow

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PROOF OF SERVICE

I, Lillian Dominguez, declare:

I am a resident of the State of California and over the age of 18 years and not a party to the within action. I am employed in the County of Los Angeles, State of California. My business address is Meyers, Nave, Riback, Silver & Wilson, 333 South Grand Avenue, Suite 1670, Los Angeles, California 90071. On June 18, 2007, I served the within document:

PRELIMINARY MEMORANDUME OF POINTS AND AUTHORITIES IN SUPPORT OF PETITION

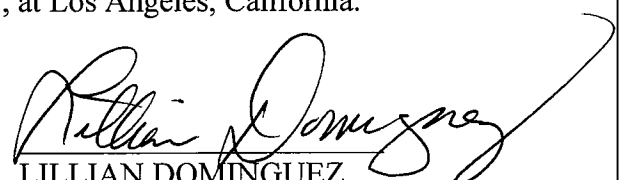
On the interested parties in this action by placing a true copy thereof in a sealed envelope(s), each envelope addressed as follows:

(x) (BY FIRST CLASS MAIL) I caused each such envelope, with postage thereon fully prepaid, to be placed in the United States mail at Los Angeles, California. I am readily familiar with the business practice for collection and processing of mail in this office; and that in the ordinary course of business said document would be deposited with the U.S. Postal Service in Los Angeles on that same day. I understand that service shall be presumed invalid upon motion of a party served if the postal cancellation date or postage meter date on the envelope is more than one day after the date of deposit for mailing contained in this declaration.

(X) (BY FACSIMILE) By use of facsimile machine telephone number 213 262-0215, I served a copy of the within document(s) on the listed interested parties at the facsimile number(s) listed below. The transmission was reported as complete and without error.

Harold J. Singer, Executive Officer
California Regional Water Quality Control Board
Lahontan Region
2501 Lake Tahoe Boulevard
South Lake Tahoe, CA 96150

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct. Executed on June 18, 2007, at Los Angeles, California.



LILLIAN DOMINGUEZ

meyers | nave riback silver & wilson
professional law corporation

Chrystal B. James
Attorney at Law
213.626.2906

June 18, 2007

VIA FACSIMILE (530) 544-2271 & U.S. MAIL

Harold J. Singer, Executive Officer
California Regional Water Quality Control Board
Lahontan Region
2501 Lake Tahoe Boulevard
South Lake Tahoe, CA 96150

RE: Petition for Review of Regional Board Actions in Issuing the May 18, 2007 Order Pursuant to California Water Code Section 13267 and the May 25, 2007 Cleanup or Abatement Order No. R6V-2007-0017

Dear Mr. Singer:

Please find enclosed a copy of the City of Barstow's Petition For Review of the Regional Water Quality Control Board - Lahontan Region actions in issuing the May 18, 2007 Order Pursuant to California Water Code Section 13267 and the May 25, 2007 Cleanup or Abatement Order No. R6V-2007-0017. We are submitting this petition to the State Water Resources Control Board pursuant to Water Code § 13320 and 23 C.C.R. § 2050, et seq.

If you should have any questions please do not hesitate to contact me.

Very truly yours,

Chrystal B. James

CBJ/ld
c: Hector Rodriguez, City Manager (w/o encl.)
Yvette Abich, Esq. (w/o encl.)
Gary Vargas, DPRA (w/o encl.)
Greg Newmark, Esq. (w/o encl.)

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professional law corporation

Chrystal B. James
Attorney at Law
213.626.2906

June 18, 2007

VIA HAND DELIVERY, FEDERAL EXPRESS & FACSIMILE (916) 341-5199

State Water Resources Control Board
Office of Chief Counsel
1001 "I" Street, 22nd Floor
Sacramento, CA 95814

ATTENTION: Elizabeth Miller Jennings, Esq.
Senior Staff Counsel

Re: Petition for Review of City of Barstow concerning the actions of the Regional Water Quality Control Board - Lahontan Region in issuing the May 18, 2007 Order Pursuant to California Water Code Section 13267 and the May 25, 2007 Cleanup or Abatement Order No. R6V-2007-0017

Dear Ms. Jennings:

I am enclosing herewith the original and two copies of the Petition to the State Water Resources Control Board of the City of Barstow concerning the actions of the Regional Water Quality Control Board - Lahontan Region in issuing the May 18, 2007 Order Pursuant to California Water Code Section 13267 and the May 25, 2007 Cleanup or Abatement Order No. R6V-2007-0017. We are submitting this petition to the State Water Resources Control Board pursuant to Water Code § 13320 and 23 C.C.R. § 2050, et seq.

We would appreciate it if you could conform one of the copies of the petition and return it to us in the enclosed, stamped, self-addressed envelope. (The other copy is a courtesy copy.)

Please do not hesitate to contact me should you have any questions regarding the petition.

Very truly yours,

Chrystal B. James

CBJ/ld
Enclosures
cc: Hector Rodriguez, City Manager w/enclosure
Yvette Abich, Esq. w/enclosure
Gary Vargas, DPRA w/enclosure
Greg Newmark, Esq. w/o enclosure

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meyers | nave riback silver & wilson
professional law corporation

Chrystal B. James
Attorney at Law
213.626.2906

June 19, 2007

VIA EMAIL AND FEDERAL EXPRESS

State Water Resources Control Board
Office of Chief Counsel
1001 "I" Street, 22nd Floor
Sacramento, CA 95814

ATTENTION: Jeannette Bashaw

Re: Petition For Review Of City Of Barstow Concerning The Actions Of The Regional Water Quality Control Board - Lahontan Region In Issuing The May 18, 2007 Order Pursuant to California Water Code Section 13267 And The May 25, 2007 Cleanup or Abatement Order No. R6V-2007-0017

Dear Ms. Bashaw:

I am writing this letter in regards to the above-referenced Petition for Review submitted by the City of Barstow on June 18, 2007. I spoke with Ted Cobb of your office, today, about the City's request in its Petition for a stay of the Regional Board's actions and its request to hold the Petition in abeyance. Mr. Cobb informed me that the City would need to choose to proceed either with the request for stay or the request for abeyance and directed me to put the City's response in writing, to your attention.

The City would like to proceed with its request for a stay and rescind its request for the Petition to be held in abeyance at this time.

Please do not hesitate to contact me should you have any questions regarding the above-matter or the Petition.

Very truly yours,

Chrystal B. James

CBJ/ld
c: Greg Newmark, Esq.

1248.002/979604