CHINO DESALTER PHASE 3
Comprehensive Predesign Report

Prepared for
Jurupa Community Services District,
City of Ontario, and
Western Municipal Water District

REVISED FINAL

December 2010
Jurupa Community Services District, City of Ontario, and Western Municipal Water District

CHINO DESALTER PHASE 3
COMPREHENSIVE PREDESIGN REPORT

TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>TABLE OF CONTENTS</td>
<td></td>
</tr>
<tr>
<td>EXECUTIVE SUMMARY</td>
<td></td>
</tr>
<tr>
<td>SECTION 1 - INTRODUCTION</td>
<td></td>
</tr>
<tr>
<td>1.1 BACKGROUND</td>
<td>1-1</td>
</tr>
<tr>
<td>1.1.1 Phase 3 Project</td>
<td>1-1</td>
</tr>
<tr>
<td>1.1.2 Project Sponsors</td>
<td>1-1</td>
</tr>
<tr>
<td>1.2 OBJECTIVES</td>
<td>1-2</td>
</tr>
<tr>
<td>1.3 AUTHORIZATION</td>
<td>1-6</td>
</tr>
<tr>
<td>1.4 ABBREVIATIONS</td>
<td>1-7</td>
</tr>
<tr>
<td>1.5 REFERENCES</td>
<td>1-9</td>
</tr>
<tr>
<td>SECTION 2 - GROUNDWATER AND WELLS</td>
<td></td>
</tr>
<tr>
<td>2.1 INTRODUCTION</td>
<td>2-1</td>
</tr>
<tr>
<td>2.2 HYDRAULIC CONTROL</td>
<td>2-1</td>
</tr>
<tr>
<td>2.2.1 Chino Creek Well Field (CCWF)</td>
<td>2-2</td>
</tr>
<tr>
<td>2.3 CHINO DESALTER WELL FIELDS</td>
<td>2-2</td>
</tr>
<tr>
<td>2.3.1 Models</td>
<td>2-5</td>
</tr>
<tr>
<td>2.3.1.1 GEOSCIENCE Groundwater Model</td>
<td>2-5</td>
</tr>
<tr>
<td>2.3.1.2 Wildermuth Model</td>
<td>2-9</td>
</tr>
<tr>
<td>2.3.1.3 Conclusions from Groundwater Models</td>
<td>2-12</td>
</tr>
<tr>
<td>2.4 NEW WELL FACILITIES</td>
<td>2-15</td>
</tr>
<tr>
<td>2.4.1 Well Construction Standards and Criteria</td>
<td>2-15</td>
</tr>
<tr>
<td>2.4.1.1 Pump and Driver</td>
<td>2-15</td>
</tr>
<tr>
<td>2.4.1.2 Wellhead Piping and Appurtenances</td>
<td>2-16</td>
</tr>
<tr>
<td>2.4.1.3 Surge Control</td>
<td>2-17</td>
</tr>
<tr>
<td>2.4.1.4 Electrical Equipment</td>
<td>2-18</td>
</tr>
<tr>
<td>2.4.1.5 Instrumentation and Control</td>
<td>2-19</td>
</tr>
<tr>
<td>2.4.1.6 Site Work</td>
<td>2-20</td>
</tr>
<tr>
<td>SECTION 3 - RAW WATER PIPELINES</td>
<td></td>
</tr>
<tr>
<td>3.1 INTRODUCTION</td>
<td>3-1</td>
</tr>
<tr>
<td>3.2 CHINO CREEK WELL FIELD PIPELINES</td>
<td>3-1</td>
</tr>
<tr>
<td>3.3 CHINO II WELL FIELD EXPANSION PIPELINE</td>
<td>3-3</td>
</tr>
<tr>
<td>3.4 CHINO I/II RAW WATER INTERTIE</td>
<td>3-5</td>
</tr>
<tr>
<td>3.4.1 Water Quality</td>
<td>3-11</td>
</tr>
<tr>
<td>3.5 RAW WATER PIPELINE CRITERIA</td>
<td>3-14</td>
</tr>
</tbody>
</table>
SECTION 4 - CHINO DESALTERS
4.1 INTRODUCTION ...................................................................................................... 4-1
4.2 WATER QUALITY .................................................................................................... 4-1
  4.2.1 Sources ........................................................................................................ 4-2
  4.2.2 Nitrate .......................................................................................................... 4-2
  4.2.5 VOC Modeling .............................................................................................. 4-8
  4.2.6 VOC Treatment Recommendations ........................................................... 4-11
    4.2.6.1 TCE Treatment Recommendations .................................................. 4-11
    4.2.6.2 TCP Treatment Recommendations ............................................... 4-15
  4.2.7 Other Water Quality Contaminants ............................................................. 4-18
4.3 CHINO I DESALTER .............................................................................................. 4-20
  4.3.1 Existing Process Facilities .......................................................................... 4-20
  4.3.2 Process Facility Modifications ..................................................................... 4-26
  4.3.3 Cost Allocations .......................................................................................... 4-30
4.4 CHINO II DESALTER ............................................................................................. 4-31
  4.4.1 Existing Process Facilities .......................................................................... 4-31
  4.4.2 Process Facility Modifications ..................................................................... 4-35
  4.4.3 Cost Allocations .......................................................................................... 4-35
    4.4.3.1 Costs Shared by Sponsors Only .................................................. 4-35
    4.4.3.2 Costs Shared by All CDA Members ............................................. 4-37
    4.4.3.3 Costs Shared by Sponsors and All CDA Members ...................... 4-37

SECTION 5 - CONCENTRATE DISPOSAL FACILITIES
5.1 BACKGROUND ........................................................................................................ 5-1
5.2 CHINO I SARI CAPACITY .................................................................................. 5-2
5.3 CHINO II SARI CAPACITY .................................................................................. 5-4
5.4 CONCENTRATE REDUCTION OPTIONS .............................................................. 5-8

SECTION 6 - PRODUCT WATER FACILITIES
6.1 OVERVIEW ............................................................................................................... 6-1
  6.1.1 Deliveries to JCSD ..................................................................................... 6-3
  6.1.2 Deliveries to Ontario ............................................................................... 6-3
  6.1.3 Deliveries to WMWD .................................................................................. 6-9
6.2 PRODUCT WATER PIPELINES ............................................................................ 6-11
  6.2.1 Chino II to Riverside-Hamner and Arlington Pipelines ............................... 6-12
6.3 PUMP STATIONS ................................................................................................... 6-16
  6.3.1 Chino II Product Water Pump Stations ..................................................... 6-16
    6.3.1.1 Chino II 1010 Zone Pump Station .................................................. 6-19
  6.3.2 Milliken Pump Station ............................................................................. 6-22
  6.3.3 Surge Protection .......................................................................................... 6-24
    6.3.3.1 Chino II 1010 Zone Product Water Pumping Station Surge
             Analysis ................................................................................................. 6-24
6.4 CHINO I – CHINO II PRODUCT WATER INTERTIE ............................................. 6-24
  6.4.1 Operational Intertie Practices ..................................................................... 6-24
  6.4.2 Physical Intertie Options .......................................................................... 6-25
SECTION 7 - PERMITS

7.1 INTRODUCTION ........................................................................................................ 7-1
7.2 CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA) ........................................................ 7-1
7.3 CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH) .................................................. 7-1
7.4 SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (AQMD) ................................... 7-2
7.5 CALIFORNIA DEPARTMENT OF TRANSPORTATION (CALTRANS) .................................... 7-2
7.6 CALIFORNIA DIVISION OF OCCUPATIONAL SAFETY AND HEALTH (CAL/OSHA) ........... 7-2
7.7 ARMY CORPS OF ENGINEERS (ACE) ................................................................................. 7-2
7.8 CALIFORNIA DEPARTMENT OF FISH AND GAME (DFG) .................................................. 7-3
7.9 CALIFORNIA WATER RESOURCES CONTROL BOARD (STATE WATER BOARD) ............. 7-3
7.10 SAN BERNARDINO COUNTY ............................................................................................. 7-4
  7.10.1 Building Permit ..................................................................................................... 7-4
  7.10.2 Fire Permit .......................................................................................................... 7-4
  7.10.3 Well Drilling Permit ............................................................................................. 7-4
  7.10.4 Encroachment Permit ............................................................................................ 7-4
  7.10.5 Flood Control Permit ............................................................................................ 7-4
7.11 RIVERSIDE COUNTY ..................................................................................................... 7-4
  7.11.1 Building Permit ..................................................................................................... 7-5
  7.11.2 Fire Permits .......................................................................................................... 7-5
  7.11.3 Well Drilling Permit ............................................................................................. 7-5
  7.11.4 Encroachment Permit ............................................................................................ 7-5
  7.11.5 Flood Control Permit ............................................................................................ 7-5
7.12 CITY OF CHINO ............................................................................................................. 7-6
  7.12.1 Building Permit ..................................................................................................... 7-6
  7.12.2 Fire Permits .......................................................................................................... 7-6
  7.12.3 Encroachment Permit ............................................................................................ 7-6
  7.12.4 Storm Drain Discharge .......................................................................................... 7-6
7.13 CITY OF ONTARIO ......................................................................................................... 7-6
  7.13.1 Building Permit ..................................................................................................... 7-7
  7.13.2 Fire Permits .......................................................................................................... 7-7
  7.13.3 Encroachment Permit ............................................................................................ 7-7
7.14 CITY OF NORCO ........................................................................................................... 7-7
  7.14.1 Encroachment Permit ............................................................................................ 7-7
7.15 SOUTHERN CALIFORNIA EDISON (SCE) ......................................................................... 7-7
7.16 INLAND EMPIRE UTILITIES AGENCY (IEUA) ................................................................. 7-8
7.17 UNION PACIFIC RAILROAD (UPRR) ................................................................................ 7-8
7.18 FEDERAL COMMUNICATIONS COMMISSION (FCC) ..................................................... 7-8
7.19 FEDERAL AVIATION ADMINISTRATION (FAA) .................................................................. 7-8

SECTION 8 - COST ESTIMATES

8.1 INTRODUCTION ............................................................................................................. 8-1
8.2 SARI COSTS .................................................................................................................... 8-1
8.3 CAPITAL COSTS ............................................................................................................. 8-4
  8.3.1 Option A—Expand Chino II to 20.5 mgd and Modify Chino I to Nameplate Capacity .................................................. 8-4
  8.3.2 Option B—Expand Chino II to 22.7 mgd (Including Raw Water Bypass) .................................................. 8-6
  8.3.3 Option C—Expand Chino II to 22.7 mgd (Including Concentrate Reduction Facilities) .............................................. 8-7
  8.3.4 Cost Estimates ........................................................................................................... 8-11
8.4 OPERATIONS AND MAINTENANCE COSTS ................................................................. 8-11
  8.4.1 Pipeline O&M Costs ...................................................................................... 8-13
  8.4.2 Well and Pump Station O&M Costs ............................................................ 8-13
  8.4.3 Treatment Plant O&M Costs ....................................................................... 8-14
8.5 FUNDING AND COST OFFSETS ........................................................................... 8-17
  8.5.1 Grant Funding ............................................................................................. 8-17
  8.5.2 MWD LRP Funding ..................................................................................... 8-17
  8.5.3 Groundwater Replenishment ...................................................................... 8-18
8.6 SUMMARY OF COSTS .......................................................................................... 8-18

APPENDICES

APPENDIX A: WELL FIELD
  Appendix A.2: Tabulation of Chino Well Field Modeling Data (GEOSCIENCE, 2008)
  Appendix A.3: Chino Desalter Wells Historical and Modeled Levels and Pumping Rates
  Appendix A.4: CCWF and Chino II Expansion Wells PDR (GEOSCIENCE, 2009)

APPENDIX B: WELL PUMPS
  Appendix B.1: Southern California Edison (SCE) Tests of CDA Wells
  Appendix B.2: [Not Used]
  Appendix B.3: [Not Used]
  Appendix B.4: Chino II Raw Water System Hydraulic Calculations

APPENDIX C: WATER QUALITY
  Appendix C.1: Chino I Well VOC Data
  Appendix C.2: CCWF 10-Year Travel Time Water Quality

APPENDIX D: DESALTERS
  Appendix D.1: Chino I Hydraulic Grade Line, Etc.
  Appendix D.2: Chino I Desalter Product Water Pump Station Criteria
  Appendix D.3: Chino II Expansion Criteria
  Appendix D.4: Chino II Expansion Supplemental Spare Parts

APPENDIX E: CONCENTRATE
  Appendix E.1: Chino II Sari Direct User Discharge Permit
  Appendix E.2: SARI Purchase Agreements for Chino I and Chino II
  Appendix E.3: Pellet Marketing Survey

APPENDIX F: PRODUCT WATER
  Appendix F.1: Chino II Expansion Product Water Delivery Facilities Technical Memorandum
  Appendix F.2: Pipeline Design Criteria
  Appendix F.3: Plan and Profile of Proposed Riverside-Hamner Pipeline
  Appendix F.4: Hamner Pipeline Drawings
    • Schliesman Rd to South of Santa Ana River (Design Drawings): Sheets 5-10
    • South of Santa Ana River to West Side of Detroit Street Bridge (Record Drawings): Sheets 11-12, 13A
    • Detroit Street Bridge (Design Drawing): Sheet 13B
  Appendix F.5: Chino II 1010 Zone Product Water Pump Station Hydraulic Grade Line Calculations
  Appendix F.6: [Not Used]
Appendix F.7: Milliken Pump Station MWH Technical Memorandum

APPENDIX G: COSTS
 Appendix G.1: Buy-In Methodology
 Appendix G.2: Well Cost Estimates
 Appendix G.3: Raw Water Pipeline Cost Estimates
 Appendix G.4: Raw Water Pump Station Cost Estimates
 Appendix G.5: Treatment Plant Cost Estimates
 Appendix G.6: Product Water Pipeline Cost Estimates
 Appendix G.7: Product Water Pump Stations Cost Estimates
 Appendix G.8: Concentrate Disposal Pipeline
 Appendix G.9: Desalter Expansion Option A and Option B Costs
 Appendix G.10: Independent O&M Cost Review

APPENDIX H: COMMENTS
LIST OF TABLES

Table 1.1 Volumes and Capacities ................................................................. 1-3
Table 1.2 CDA Product Water Entitlement .................................................. 1-4
Table 2.1 Summary of Existing Chino Desalter Well Equipment^{a} .......... 2-4
Table 2.2 Summary of Groundwater Model Well Production Rates ........ 2-11
Table 2.3 Current and Projected Conditions for Pump Setting and Screens 2-14
Table 3.1 Extremely Impaired Well Treatment Cost Comparison .......... 3-13
Table 4.1 Summary of Chino I VOC Levels ............................................... 4-7
Table 4.2 Summary of Chino I TCP Treatment Options ......................... 4-17
Table 4.3 Water Quality and Treatment Process Alternatives ............... 4-19
Table 4.4 Chino I Product Water Nitrate and TDS Levels ....................... 4-22
Table 4.5 Chino II Product Water Nitrate and TDS Levels .................... 4-33
Table 4.6 Chino II Expansion Criteria Summary ..................................... 4-36
Table 5.1 SARI Ownership (2006) ............................................................ 5-2
Table 5.2 Chino I SARI Capacity Requirements ...................................... 5-4
Table 5.3 Chino II SARI Capacity Requirements ..................................... 5-5
Table 5.4 Effect of Concentrate Reduction on Flows and Efficiencies ....... 5-10
Table 5.5 Concentrate Reduction Chemical Delivery Schedule .............. 5-16
Table 5.6 Concentrate Reduction Labor Requirements ......................... 5-17
Table 5.7 Chino Desalter Concentrate Reduction Operation and Maintenance Cost Estimates .............................................................. 5-18
Table 5.8 Chino Desalter Concentrate Reduction Capital Cost Estimate .... 5-19
Table 5.9 Effect of Concentrate Reduction on SARI Capacity Costs ......... 5-20
Table 5.10 Concentrate Reduction Annual Cost Comparison .................. 5-23
Table 6.1 Chino II Product Water Pumping Requirements: 20.5 mgd Capacity 6-4
Table 6.2 Chino II Product Water Pumping Requirements: 22.7 mgd Capacity 6-5
Table 6.3 Summary of Chino II Pressure Zone Pumping Costs ............... 6-8
Table 6.4 Summary of Pipeline Design Criteria^{a} .................................... 6-12
Table 6.5 Comparison of Hamner Avenue Pipe Diameter Options Between Riverside Dr. and Schleisman Rd. ^{a} .................................................. 6-15
Table 6.6 Summary of Existing CDA Product Water Pump Station ......... 6-17
Table 6.7 Chino II Product Water Pump Station Criteria ......................... 6-18
Table 6.8 Milliken Pump Station Criteria .................................................. 6-22
Table 7.1 Summary of Permit Information ............................................... 7-9
Table 8.1 Historical SARI Treatment and Pipeline Capacity Costs .......... 8-2
Table 8.2 Summary of SARI Capital Costs ................................................. 8-3
Table 8.3 Current SARI Volumetric and Use Charges ............................. 8-4
Table 8.4 Summary of Phase 3 Project Options Capital Costs ................. 8-9
Table 8.5 Summary of Phase 3 Options Capacities ................................... 8-10
Table 8.6 Summary of Construction Project Capital Costs for Option C: Expand Chino II to 22.7 mgd with Concentrate Reduction ..................... 8-12
Table 8.7 Raw Water Pumping Costs ....................................................... 8-13
Table 8.8 Summary of O&M Costs for Option C (Expand Chino II to 22.7 mgd with Concentrate Reduction) ......................................................... 8-16
Table 8.9 Grant Funding ............................................................................. 8-17
Table 8.10 Capital Cost Distribution for Option C (Expand Chino II to 22.7 mgd with Concentrate Reduction) ......................................................... 8-19
Table 8.11 Current and New CDA Costs (FY 09/10 Budget Year) for Option C (Expand Chino II to 22.7 mgd with Concentrate Reduction) ............. 8-21
Table 8.12 Summary of Unit Costs (Includes O&M and Debt Services) .... 8-22
## LIST OF FIGURES

| Figure 2.1 | Groundwater Elevation Contours and Flow | 2-3 |
| Figure 2.2 | GEOSCIENCE Scenario 1 Model Groundwater Level Changes | 2-6 |
| Figure 2.3 | GEOSCIENCE Scenario 2 Model Groundwater Level Changes | 2-7 |
| Figure 2.4 | GEOSCIENCE Scenario 3 Model Groundwater Level Changes | 2-8 |
| Figure 2.5 | Chino Desalter Well Locations | 2-10 |
| Figure 3.1 | Vicinity Map | 3-2 |
| Figure 3.2 | Chino Desalter Raw Water Intertie Options | 3-4 |
| Figure 3.3 | Chino Desalter Raw Water Intertie Schematic | 3-6 |
| Figure 3.4 | Raw Water Intertie Site Plan | 3-7 |
| Figure 3.5 | Chino II Raw Water Pipeline Plan | 3-9 |
| Figure 3.6 | Chino II Raw Water Pipeline Profile | 3-10 |
| Figure 4.1 | Chino Desalter Well Field Nitrate Levels | 4-4 |
| Figure 4.2 | Chino Desalter Well Field TDS Levels | 4-5 |
| Figure 4.3a | Current and Projected VOC Plume Locations | 4-9 |
| Figure 4.3b | VOC Pie Chart Comparison Map | 4-10 |
| Figure 4.4 | Short-Term Modeled and Historical Raw Water TCP Levels | 4-12 |
| Figure 4.5 | Projected TCP Concentrations in Existing Chino I Desalter Wells | 4-13 |
| Figure 4.6 | Projected TCP Concentrations in Chino Creek Well Field A | 4-14 |
| Figure 4.7 | Historical and Projected Chino I Product Water TCP Concentrations | 4-16 |
| Figure 4.8 | Chino I Process Flow Frequency Distributions | 4-21 |
| Figure 4.9 | Effect of Raw Water TDS on Existing Chino I Capacity | 4-23 |
| Figure 4.10 | Frequency Distribution of Chino I RO/IX Raw Water TDS | 4-25 |
| Figure 4.11 | Effect of Raw Water TDS on Chino I Capacity with Additional RO | 4-27 |
| Figure 4.12 | Effect of Raw Water TDS on Chino I Capacity with VOC Air Stripper Supply Wells at 1.5 mgd | 4-29 |
| Figure 4.13 | Chino II Process Flow Frequency Distributions | 4-32 |
| Figure 4.14 | Effect of Raw Water TDS on Expanded Chino II Bypass | 4-34 |
| Figure 5.1 | Chino I SARI Flow Frequency Distribution | 5-3 |
| Figure 5.2 | Chino II SARI Flow Frequency Distribution | 5-7 |
| Figure 5.3 | Chino Desalter Concentrate Reduction Schematic | 5-11 |
| Figure 5.4 | Chino I Concentrate Reduction Site Plan | 5-14 |
| Figure 5.5 | Chino II Concentrate Reduction Site Plan | 5-15 |
| Figure 5.6 | Effect of Pellet Disposal Cost on Concentrate Disposal Cost | 5-24 |
| Figure 6.1 | Overview of Option A Product Water Delivery Facilities | 6-6 |
| Figure 6.2 | Chino II Product Water Pumping Schematic | 6-7 |
| Figure 6.3 | Overview of WMWD Delivery Facilities | 6-10 |
| Figure 6.4 | Overview of Riverside-Hamner Product Water Pipeline | 6-14 |
| Figure 6.5 | Chino II Product Water Pump Station Site Plan | 6-20 |
| Figure 6.6 | Chino II 1010 Zone Pump Station System Curves | 6-21 |
| Figure 6.7 | Milliken Pump Station Site Plan | 6-23 |