AP. 60

STAGE 1 & 2 REPORTS

DATE: /2-22-10

Hansen, Edward J., EMNRD

From:

Katie Jones [kjones@riceswd.com]

Sent:

Friday, February 18, 2011 1:18 PM

To:

Hansen, Edward J., EMNRD

Cc: Subject: Hack Conder; lpg@texerra.com

Attachments:

EME Jct. K-33-1 (AP-60) and Sarah Phillips EOL (1R427-17) Termination Request Addendum EME Jct. K-33-1 and Sarah Phillips Termination Request Addendum - Figure 7.pdf

Mr. Hansen,

Attached is a revised Figure 7 to replace Figures 7a and 7b (pages 10 and 11) of the EME Jct. K-33-1 (AP-60) and Sarah Phillips EOL (1R427-17) Termination Request. ROC also requests to plug and abandon MW-1, MW-2, MW-3, and MW-4 located at Jct. K-33-1 and MW-1 located at Sarah Phillips EOL using a cement grout with 1 to 3% bentonite and a 3 foot cap of cement. If you have any questions or require any additional information, please contact Hack Conder at (575)631-6432 or myself at (575)393-9174.

Thank you.

Katie Jones **Environmental Project Coordinator** RICE Operating Company

| | 150 | 300 | 354 | 407 | 461 | 514 | 568 | 621 | 628 | 635 | 642 | 649 | 656 | - 8 | 661 | 653 | 651 | 648 | 646 | 648 | ely |
|---------------------------------------|--------|------|------|------|------|------|------|-------|-------|---------|--------|--------|--------|----------------|--------|-----|-----|-----|-----|-----|--|
| | 125 | 220 | 368 | 418 | 467 | 517 | 566 | 616 | 631 | 636 | 640 | 644 | 649 | 653 | 657 | 651 | 648 | 949 | 644 | 644 | derat |
| Jot | 100 | 220 | 367 | 415 | 464 | 513 | 562 | 611 | 626 | 631 | 635 | 640 | 645 | 649 | 654 | 648 | 646 | 644 | 642 | 641 | the mo |
| | 75 | 220 | 365 | 413 | 461 | 509 | 557 | 909 | 621 | 626 | 631 | 636 | 641 | 646 | 651 | 646 | 644 | 642 | 641 | 637 | ce of |
| K-33-1 | 20 | 220 | 363 | 410 | 458 | 505 | 553 | 009 | 616 | 621 | 626 | 632 | 637 | 642 | 647 | | 642 | 641 | 639 | 633 | e sour |
| .) from | 25 | 220 | 361 | 408 | 455 | 501 | 548 | 595 | 614 | 619 | 624 | 629 | 634 | 639 | 644 | 635 | 634 | 634 | 633 | 631 | hat th |
| Lateral Distance (ft) from K-33-1 Jct | -25 | 220 | 359 | 405 | 451 | 498 | 544 | 590 | 610 | 615 | 621 | 929 | 631 | Jct 636 | 641 | 631 | 631 | 630 | 630 | 629 | licate t |
| al Dista | 50 | 220 | 357 | 403 | 448 | 494 | 539 | 585 | 590 | 595 | 009 | 605 | 610 | K-33-1 J | 620 | 625 | 625 | 625 | 979 | 627 | ata ind |
| Later | -75 | 220 | 338 | 377 | 417 | 456 | 495 | 535 | 546 | 557 | 568 | 579 | 591 | 602 K | 613 | 624 | 624 | 624 | 624 | 624 | ese d |
| | -100 | 220 | 323 | 357 | 392 | 426 | 460 | 495 | 511 | 527 | 543 | 559 | 575 | 591 | 607 | 623 | 623 | 623 | 623 | 622 | t). Th |
| | -125 | 220 | 308 | 337 | 366 | 396 | 425 | 454 | 475 | 496 | 517 | 538 | 560 | 581 | 602 | 623 | 622 | 622 | 622 | 620 | .0 (righ |
| | -150 | 220 | 225 | 311 | 335 | 358 | 382 | 405 | 466 | 478 | 490 | 503 | 515 | 527 | 539 | 551 | 563 | 576 | 588 | 009 | ations (mg/kg) for 2007 (left) and 2010 (right). These data indicate that the source of the moderately |
| | 150 | 300 | 374 | 449 | 523 | 598 | 672 | 747 | 752 | 757 | 761 | 992 | 771 | 776 | 792 | 753 | 743 | 734 | 725 | 721 | (left) a |
| | 125 | 300 | 466 | 522 | 577 | 633 | 688 | 743 | 758 | 759 | 759 | 760 | 260 | FOL 760 | 761 | 747 | 742 | 737 | 732 | 707 | 2007 |
| | 100 | 300 | 465 | 520 | 575 | 630 | 685 | 740 | 754 | 754 | 754 | 754 | 754 | SP 8 | 755 | 741 | 735 | 729 | 723 | 693 | kg) for |
| Jct | 75 | 300 | 464 | 518 | 573 | 627 | 682 | 736 | 750 | 750 | 749 | 749 | 749 | 749 | 749 | 735 | 728 | 721 | 714 | 629 | (mg/ |
| K-33-1 Jct | 20 | 300 | 462 | 516 | 570 | 625 | 629 | 733 | 745 | 745 | 745 | 744 | 747 | 743 | 743 | 22 | 721 | 713 | 705 | | rations |
| Lateral Distance (ft) from K | 25 | 300 | 461 | 515 | 568 | 622 | 675 | 729 | 738 | 738 | 738 | 737 | 737 | 737 | 737 | 727 | 719 | 711 | 703 | 663 | ncent |
| nce (ft | -25 | 300 | 460 | 513 | 566 | 619 | 672 | 726 | 730 | 730 | 730 | 730 | 731 | 731 | 731 | 726 | 718 | 710 | 702 | 661 | ride co |
| al Dista | - 20 | 300 | 458 | 511 | 564 | 617 | 699 | 773 | 722 | 723 | 723 | 724 | 724 | 724 | 725 | 725 | 717 | 708 | 700 | 629 | er chlo |
| Latera | -75 | 300 | 439 | 486 | 532 | 579 | 625 | 672 | 21.9 | 682 | 289 | 692 | 269 | 702 | 707 | 712 | 705 | 869 | 691 | 929 | dwate |
| | -100 | 300 | 424 | 466 | 507 | 549 | 590 | 632 | 640 | 649 | 657 | 999 | 674 | 683 | 691 | 200 | 694 | 889 | 683 | 654 | groun |
| | -125 - | 300 | 409 | 446 | 482 | 519 | 555 | 591 | 604 | 616 | 628 | 640 | 653 | 999 | 219 | 069 | 685 | 089 | 9/9 | 652 | nnual |
| | -150 - | 300 | 320 | 439 | 459 | 480 | 200 | 521 | 561 | 569 | 577 | 586 | 594 | 602 | 610 | 618 | 979 | 634 | 642 | 650 | Average annual groundwater chloride concentr |
| | 1 | -325 | -300 | -275 | -250 | -225 | -200 | -175 | -150 | -125 | -100 | -75 | -50 | -25 | 25 | 20 | 75 | 100 | 125 | 150 | |
| | | | | | | | 1: | 3-I 1 | m K-3 | t) froi | ர) əɔu | Distaı | lenibi | ามุฮินด | ך ר | | | | | | igure 7 |

known to exist to the west of these sites. The data also indicate that chloride concentrations are gradually diminishing over time due to natural attenuation. elevated groundwater chloride concentrations observed near the EME K-33-1 and Sarah Phillips junction boxes in 2007 is from the regional chloride plume [The regional direction of groundwater flow is from NW to SE. North is "up". Maps are approximations to actual scale].

Texerra

75 Wuthering Heights Drive Colorado Springs, CO 80921 Tel: 719-339-6791 E-mail: lpg@texerra.com

December 22nd, 2010

Mr. Edward Hansen New Mexico Energy, Minerals, & Natural Resources Oil Conservation Division, Environmental Bureau 1220 S. St. Francis Drive Santa Fe, New Mexico 87504 RECEIVED

JAN - 3 7011

Oil Conservation Division 1220 S. St. Francis Drive

RE: Groundwater Monitoring Report & Remediation Termination Request 87505
Rice Operating Company EME SWD System
Sarah Phillips Jct – NMOCD Case Number 1R-427-17
K-33-1 Jct - NMOCD AP-60

Sent via E-mail and U.S. Certified Mail: No. 7008 1140 0001 3068 8715

Mr. Hansen:

This letter presents and interprets groundwater chloride monitoring data collected for the above-referenced projects over the past several years. In this report we are aggregating the groundwater monitoring data from both the EME K-33-1 and the EME Sarah Phillips sites because of their close proximity (Figures 1, 2 & 3). The location of the K-33-1 and Sarah Phillips sites relative to the known regional chloride plume south of Monument is shown in Figure 4.

The chloride concentration of groundwater that encounters and flows across the K-33-1 and Sarah Phillips locations is presented Figure 5a. The baseline groundwater chloride concentration has dropped from approximately 750 mg/kg to approximately 550 mg/kg over the last nearly four years. Nearly identical patterns in groundwater chloride concentrations over time have been observed in the K-33-1 near source, down-gradient monitor well (MW-1, Figure 5b) and in the (farther) down-gradient monitor well (MW-3, Figure 5c). A far up-gradient monitor well (MW-4, Figure 5d) illustrates lower concentrations but a similar pattern of decline over time, dropping from approximately 320 mg/kg to approximately 280 mg/kg over the past three years. Groundwater chloride data from the near source, down-gradient monitor well at the Sarah Phillips location (Figure 6) illustrates a pattern strikingly similar to the near source downgradient monitor well at the K-33-1 location. These data are presented in plain view in Figure 7, where it is evident that the center of mass of the groundwater chloride plume has moved downgradient and had become more dilute (through natural groundwater dispersion) over the past three years. In fact the largest declines (in dark blue) are in and near the center of mass of the plume, indicating that there has been little or no downward migration of residual soil chlorides into groundwater.

EME Sarah Phillips & K-33-1

Taken together, these data are indicative of a groundwater chloride plume that has migrated across the Sarah Phillips and K-33-1 locations from an up-gradient source and that is gradually moving down-gradient and decreasing in concentration over time. The average, aggregate rate of decline in groundwater chloride concentrations among all of the monitor wells is approximately 5% per year. We may expect, then, that the groundwater chloride concentrations below and proximal to these locations to diminish below 250 mg/kg in approximately 20 years (Figure 8).

It having been demonstrated that the observed impacts on groundwater quality beneath the Sarah Phillips and K-33-1 locations have apparently been caused by historical up-gradient land use practices which are gradually diminishing over time, and that natural vegetation is becoming reestablished across these sites (Figure 9), we respectfully request that NMOCD grant remediation termination or similar/closure status to these projects.

ROC is the service provider (agent) for the EME Salt Water Disposal System and has no ownership of any portion of pipeline, well or facility. The EME SWD System is owned by a consortium of oil producers, System Parties, who provide all operating capital on a percentage ownership/usage basis.

Please do not hesitate to contact either myself or Rice Operating Company if you have any questions or need additional information.

Sincerely,

L. Peter Galusky, Jr. Ph.D.

Copy: Rice Operating Company

EME Sarah Phillips & K-33-1



Figure 1 – Location of EME Sarah Phillips & K-33-1 sites (yellow box). The prevailing direction of groundwater flow is toward the southeast (lower right).



Figure 2 – Aerial photograph showing locations of Sarah Phillips and K-33-1 sites and monitor wells. The up-gradient monitor well (K-33-1 MW-2) provides data on the baseline quality of groundwater as it encounters and flows across the K-33-1 and Sarah Phillips locations.

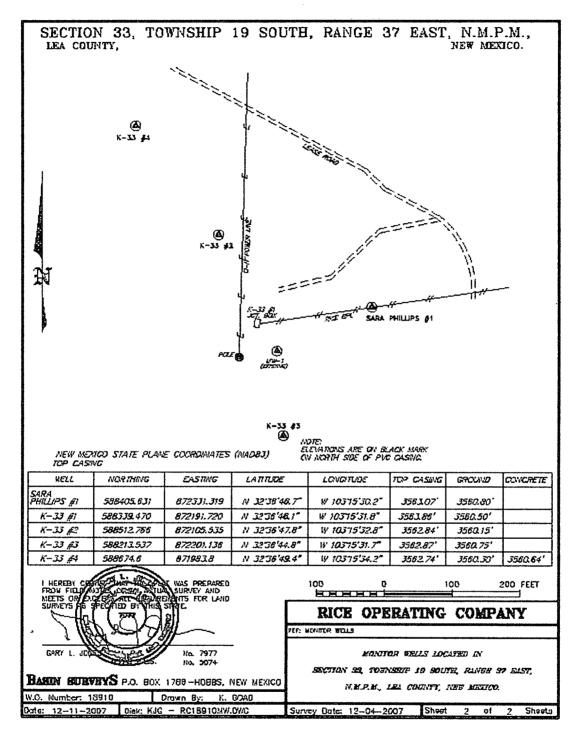


Figure 3 – Surveyed plat showing locations of groundwater monitor wells at EME K-33-1 and Sarah Phillips locations.

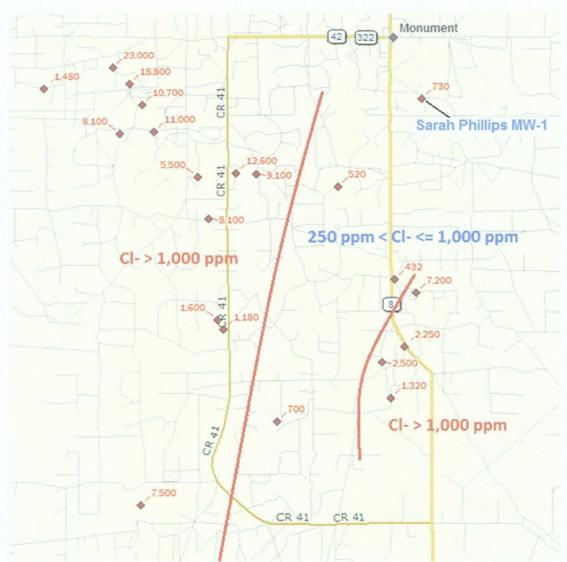
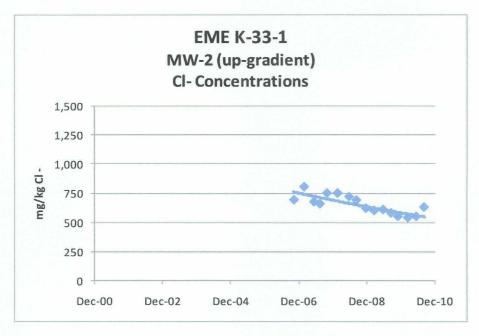


Figure 4 – Groundwater chloride concentrations in "up-gradient" wells (4th qtr, 2009) at various Rice Operating Company locations. The groundwater south of Monument is clearly "regionally impacted" from historical land use activities not caused by Rice operations. The 2ndth Qtr 2009 chloride concentration of the near-source monitor well at the Sarah Phillips location is shown in the upper right portion of the figure. The Sarah Phillips and K-33-1 sites appear to be just north of this regional plume but are likely affected by similar regional, historical land use factors.



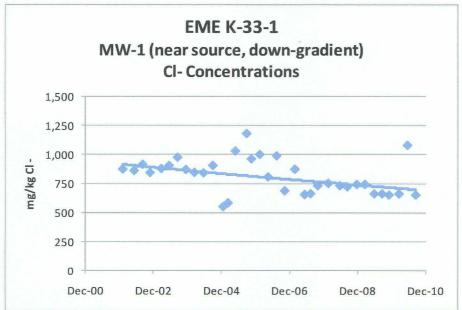
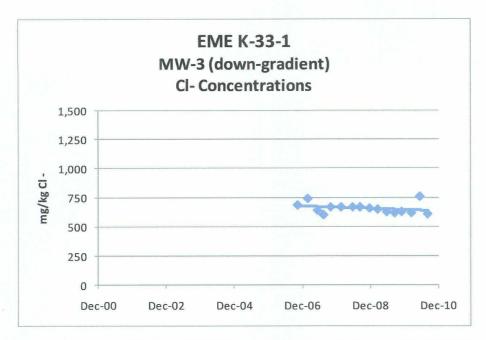


Figure 5 – EME K-33-1 groundwater monitoring data. 5a (upper graph) – upgradient monitor well data. 5b (lower graph) – near source down-gradient monitor well data.



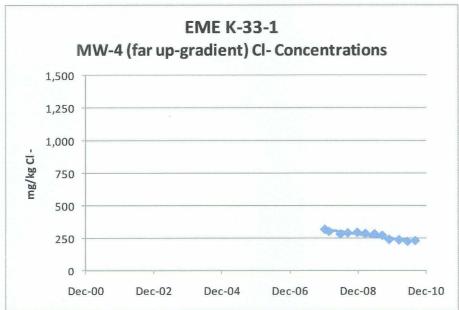


Figure 5 (cont'd) – EME K-33-1 groundwater monitoring data. 5c (upper graph) – downgradient monitor well data. 5d (lower graph) – far up-gradient monitor well data.

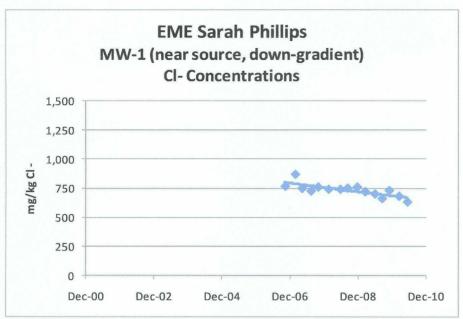


Figure 6 – EME Sarah Phillips down-gradient monitor well data.

| | | | | | Lateral D | Distance (f | t) from Plui | me Centerl | ine | | | | |
|------|------|------|------|-----|-----------|-------------|--------------|------------|-----|-----|-----|-----|-----|
| | -150 | -125 | -100 | -75 | -50 | -25 | 0 | 25 | 50 | 75 | 100 | 125 | 150 |
| | | | | | | | MW-4 | | | | | | |
| -300 | 200 | 220 | 240 | 260 | 280 | 300 | 320 | 300 | 280 | 260 | 240 | 220 | 200 |
| -275 | 200 | 230 | 259 | 289 | 318 | 348 | 377 | 348 | 318 | 289 | 259 | 230 | 200 |
| -250 | 200 | 239 | 278 | 317 | 357 | 396 | 435 | 396 | 357 | 317 | 278 | 239 | 200 |
| -225 | 200 | 249 | 297 | 346 | 395 | 444 | 492 | 444 | 395 | 346 | 297 | 249 | 200 |
| -200 | 200 | 258 | 317 | 375 | 433 | 491 | 550 | 491 | 433 | 375 | 317 | 258 | 200 |
| -175 | 200 | 268 | 336 | 404 | 471 | 539 | 607 | 539 | 471 | 404 | 336 | 268 | 200 |
| -150 | 200 | 277 | 355 | 432 | 510 | 587 | 665 MW-2 | 587 | 510 | 432 | 355 | 277 | 200 |
| -125 | 200 | 287 | 374 | 461 | 548 | 635 | 722 | 635 | 548 | 461 | 374 | 287 | 200 |
| -100 | 200 | 287 | 374 | 462 | 549 | 636 | 723 | 636 | 549 | 462 | 374 | 287 | 200 |
| -75 | 200 | 287 | 375 | 462 | 550 | 637 | 725 | 637 | 550 | 462 | 375 | 287 | 200 |
| -50 | 200 | 288 | 375 | 463 | 551 | 638 | 726 | 638 | 551 | 463 | 375 | 288 | 200 |
| -25 | 200 | 288 | 376 | 464 | 552 | 640 | 727 MW-1 | 640 | 552 | 464 | 376 | 288 | 200 |
| o | 200 | 288 | 376 | 464 | 553 | 641 | 729 | 641 | 553 | 464 | 376 | 288 | 200 |
| 25 | 200 | 285 | 371 | 456 | 542 | 627 | 713 | 627 | 542 | 456 | 371 | 285 | 200 |
| 50 | 200 | 283 | 366 | 448 | 531 | 614 | 697 | 614 | 531 | 448 | 366 | 283 | 200 |
| 75 | 200 | 280 | 360 | 440 | 520 | 600 | 681 MW-3 | 600 | 520 | 440 | 360 | 280 | 200 |

Figure 7a – Measured and interpolated groundwater chloride concentrations: Average 2007 values. [Note that the lateral plume boundaries were assumed to equal a baseline groundwater chloride concentration of 200 mg/kg].

| | | | | | Lateral D | Distance (| ft) from Plur | ne Centerl | ine | | | | |
|------|------|------|------|-----|-----------|------------|---------------|------------|-----|-----|-----|-----|-----|
| | -150 | -125 | -100 | -75 | -50 | -25 | 0 | 25 | 50 | 75 | 100 | 125 | 150 |
| -300 | 200 | 205 | 210 | 215 | 220 | 225 | MW-4 230 | 225 | 220 | 215 | 210 | 205 | 200 |
| 300 | 200 | 203 | | | 220 | | | | | | | | |
| -275 | 200 | 213 | 226 | 240 | 253 | 266 | 279 | 266 | 253 | 240 | 226 | 213 | 200 |
| -250 | 200 | 221 | 243 | 264 | 285 | 307 | 328 | 307 | 285 | 264 | 243 | 221 | 200 |
| -225 | 200 | 230 | 259 | 289 | 318 | 348 | 377 | 348 | 318 | 289 | 259 | 230 | 200 |
| -200 | 200 | 238 | 275 | 313 | 351 | 388 | 426 | 388 | 351 | 313 | 275 | 238 | 200 |
| -175 | 200 | 246 | 292 | 338 | 383 | 429 | 475 | 429 | 383 | 338 | 292 | 246 | 200 |
| -1/5 | 200 | 246 | 292 | 336 | 303 | 423 | 4/3 | 423 | 363 | 336 | 232 | 240 | 200 |
| -150 | 200 | 254 | 308 | 362 | 416 | 470 | 524 MW-2 | 470 | 416 | 362 | 308 | 254 | 200 |
| -125 | 200 | 262 | 324 | 387 | 449 | 511 | 573 | 511 | 449 | 387 | 324 | 262 | 200 |
| -100 | 200 | 265 | 331 | 396 | 461 | 526 | 592 | 526 | 461 | 396 | 331 | 265 | 200 |
| -75 | 200 | 268 | 337 | 405 | 473 | 542 | 610 | 542 | 473 | 405 | 337 | 268 | 200 |
| -50 | 200 | 271 | 343 | 414 | 486 | 557 | 628 | 557 | 486 | 414 | 343 | 271 | 200 |
| | | | | | | | | | | | | | |
| -25 | 200 | 274 | 349 | 423 | 498 | 572 | 647 MW-1 | 572 | 498 | 423 | 349 | 274 | 200 |
| 0 | 200 | 278 | 355 | 433 | 510 | 588 | 665 | 588 | 510 | 433 | 355 | 278 | 200 |
| 25 | 200 | 275 | 351 | 426 | 502 | 577 | 653 | 577 | 502 | 426 | 351 | 275 | 200 |
| 50 | 200 | 273 | 347 | 420 | 493 | 567 | 640 | 567 | 493 | 420 | 347 | 273 | 200 |
| 75 | 200 | 271 | 343 | 414 | 485 | 556 | 628 | 556 | 485 | 414 | 343 | 271 | 200 |
| 100 | 200 | 269 | 338 | 408 | 477 | 546 | MW-3 615 | 546 | 477 | 408 | 338 | 269 | 200 |

Figure 7b – Measured and interpolated groundwater chloride concentrations: Average 2010 year-to-date values. [Note that the lateral plume boundaries were assumed to equal a baseline groundwater chloride concentration of 200 mg/kg].

| | | | | | Lateral D | istance (ft |) from Plu | me Centerl | Lateral Distance (ft) from Plume Centerline | | | | | | | | | | | | | |
|------|------|------|------|-----|-----------|-------------|--------------|------------|---|-----|-----|-----|-----|--|--|--|--|--|--|--|--|--|
| | -150 | -125 | -100 | -75 | -50 | -25 | 0 | 25 | 50 | 75 | 100 | 125 | 150 | | | | | | | | | |
| | | | | | | ı | MW-4 | | | | | | | | | | | | | | | |
| -300 | 0 | -15 | -30 | -45 | -60 | -75 | -90 | -75 | -60 | -45 | -30 | -15 | 0 | | | | | | | | | |
| -275 | 0 | -16 | -33 | -49 | -66 | -82 | -98 | -82 | -66 | -49 | -33 | -16 | 0 | | | | | | | | | |
| -250 | 0 | -18 | -36 | -53 | -71 | -89 | -107 | -89 | -71 | -53 | -36 | -18 | 0 | | | | | | | | | |
| -225 | 0 | -19 | -38 | -58 | -77 | -96 | -115 | -96 | -77 | -58 | -38 | -19 | 0 | | | | | | | | | |
| -200 | 0 | -21 | -41 | -62 | -82 | -103 | -124 | -103 | -82 | -62 | -41 | -21 | 0 | | | | | | | | | |
| -175 | 0 | -22 | -44 | -66 | -88 | -110 | -132 | -110 | -88 | -66 | -44 | -22 | 0 | | | | | | | | | |
| -150 | 0 | -23 | -47 | -70 | -94 | -117 | -140 MW-2 | -117 | -94 | -70 | -47 | -23 | 0 | | | | | | | | | |
| -125 | 0 | -25 | -50 | -74 | -99 | -124 | -149 | -124 | -99 | -74 | -50 | -25 | 0 | | | | | | | | | |
| -100 | 0 | -22 | -44 | -66 | -88 | -110 | -132 | -110 | -88 | -66 | -44 | -22 | 0 | | | | | | | | | |
| -75 | 0 | -19 | -38 | -57 | -76 | -96 | -115 | -96 | -76 | -57 | -38 | -19 | 0 | | | | | | | | | |
| -50 | 0 | -16 | -33 | -49 | -65 | -81 | -98 | -81 | -65 | -49 | -33 | -16 | 0 | | | | | | | | | |
| -25 | 0 | -13 | -27 | -40 | -54 | -67 | -81 MW-1 | -67 | -54 | -40 | -27 | -13 | 0 | | | | | | | | | |
| 0 | 0 | -11 | -21 | -32 | -43 | -53 | -64 | -53 | -43 | -32 | -21 | -11 | 0 | | | | | | | | | |
| 25 | 0 | -10 | -20 | -30 | -40 | -50 | -60 | -50 | -40 | -30 | -20 | -10 | 0 | | | | | | | | | |
| 50 | 0 | -9 | -19 | -28 | -38 | -47 | -57 | -47 | -38 | -28 | -19 | -9 | 0 | | | | | | | | | |
| 75 | 0 | -9 | -18 | -27 | -35 | -44 r | -53 MW-3 | -44 | -35 | -27 | -18 | -9 | 0 | | | | | | | | | |
| 100 | 0 | -8 | -17 | -25 | -33 | -41 | -50 | -41 | -33 | -25 | -17 | -8 | 0 | | | | | | | | | |

Figure 7c – Change in measured and interpolated groundwater chloride concentrations from 2007 to 2010. All values inside the plume boundaries are negative indicating that groundwater chloride concentrations have declined. The largest declines (in dark blue) are in and near the center of mass of the plume, indicating that there has been little or no downward migration of residual soil chlorides into groundwater.

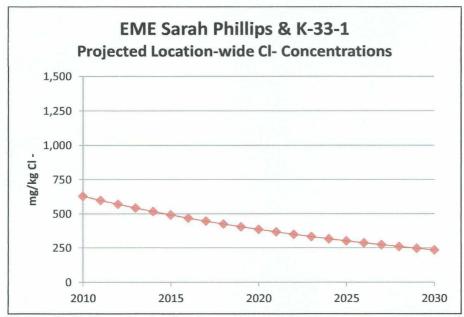


Figure 8 – Projected reduction in maximum (plume center) groundwater chloride concentrations.





Figure 9 – Sarah Phillips and K-33-1 locations showing the reestablishment of natural vegetation. **9a** (upper photograph) – K-33-1 MW-1 facing North. **9b** (lower photograph) – Sarah Phillips facing West towards K-33-1.