Phase VI: Short-term Investigation of Groundwater Quality in the Pavillion, WY Area

July, 2012

- Deliberative -

-For Agency Use Only-

EPAPAV0020843

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Project Planning Tasks

- Review Pavillion Gas Field data from DEQ, EPA, WOGCC, SEO, and BLM
- Identify data gaps and areas for potential additional investigation
- Further investigate the nature and extent of groundwater contamination within Areas of Interest (AOIs)
- Continued sampling of DWWs within Areas of Interest
- Project cost estimation

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Assumptions & Considerations

- All work to be completed by outside contractors under the direction and oversight of DEQ
- All work shall comply with applicable statutory and regulatory requirements
- Procedures for well drilling, construction, installation, development, QA/QC, sampling and analysis shall be required and approved by DEQ prior to commencement of activities
- Monitor wells to be constructed of 2" stainless steel, minimum
- Costs have been reasonably estimated but may differ considerably from actual costs
- Contingency costs (e.g. inclement weather, etc.) have not been included
- Drilling costs do not include rental for required blow-out prevention during drilling activities
- Assumed regional GW flow direction is generally to the Southeast; site specific GW flow direction may differ from regional flow as influenced locally by topography, irrigation activities & other surface water features
- Inventory of potential sources of contamination within 500 feet (minimum) of monitor well locations will be completed by DEQ
- Actual monitor well locations may differ from those proposed, based upon closer evaluation
- Production pit ranking (potential impacts to groundwater) were determined by review of Pit Working Group documentation
- Gas wells have been depicted on figures, however, additional field investigation is required to make a definitive identification of well name and location

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Sources of Data

- WOGCC Bradenhead Test Data
- WOGCC Online Database
- Draft EPA Pavillion Report
- Pavillion Working Group Tables
- WDEQ GIS Figures (various data sources)
- WDEQ VRP and Tribal Pavillion files
- SEO e-Permit files

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DWW Screening Criteria

- Is the Domestic Water Well (DWW) located within 1,000' of an invert well?
  - Invert well: gas well drilled w/diesel-based drilling fluid
- Is the DWW w/in 1,000' of a production pit?
- Is the DWW installed deeper than the surface casing w/in 1,000' of nearby gas well(s)?
- Is the DWW w/in 1,000' of a gas well where Bradenhead test showed pressure on the well annulus?
- Did the DWW exhibit the presence of methane, TPH/DRO/GRO, VOCs and SVOCs?

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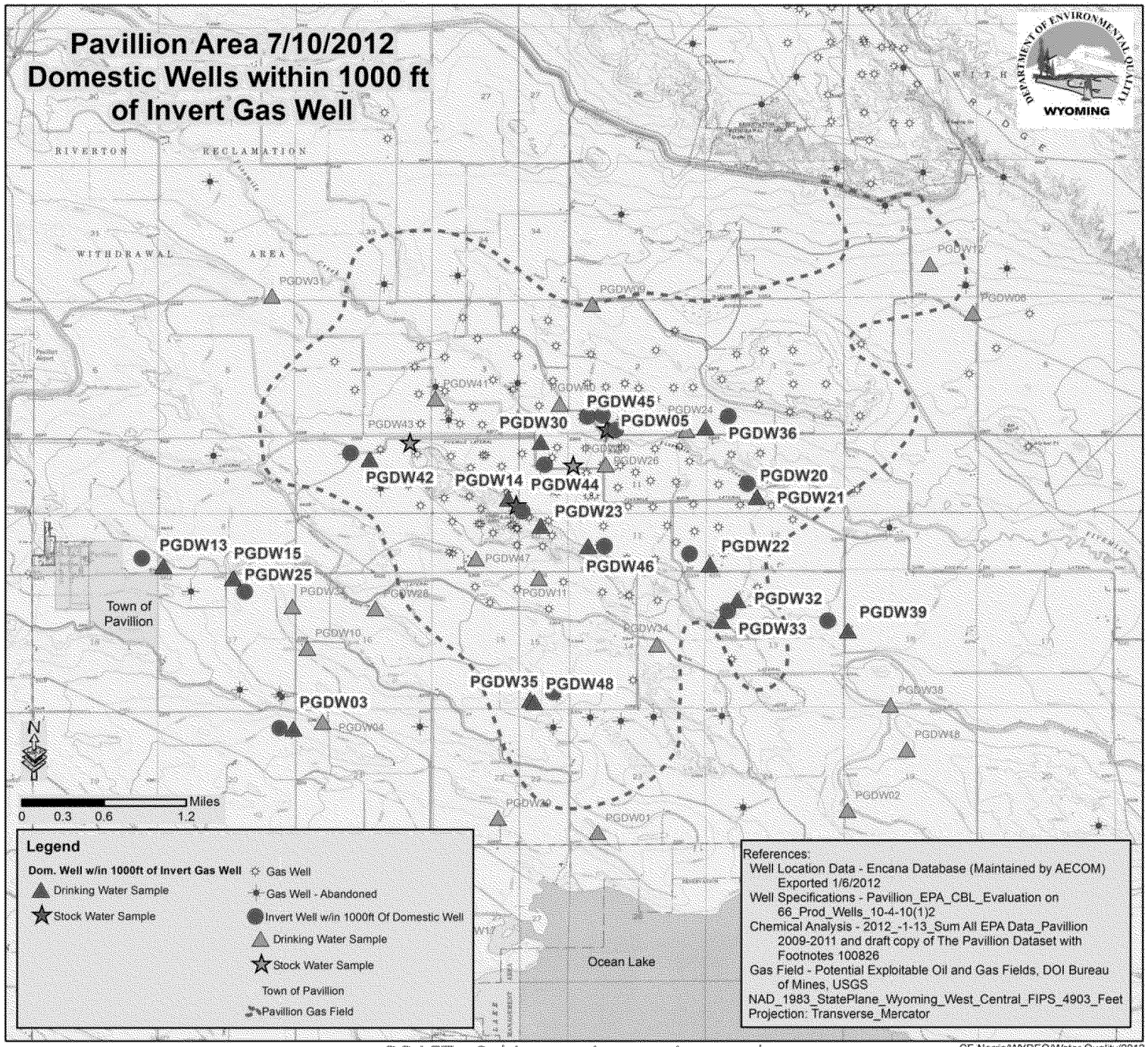

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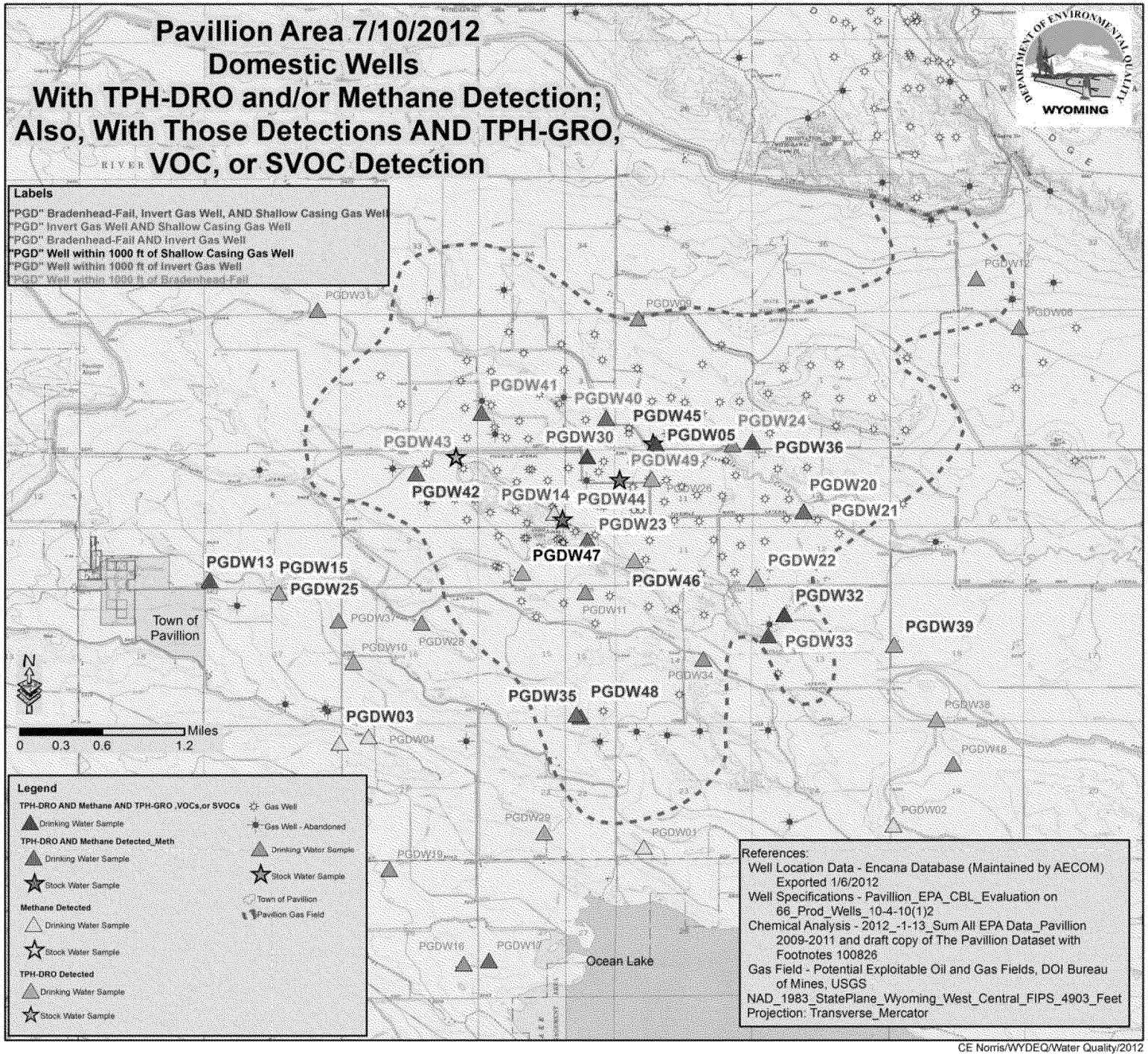
CE Norris/WYDEQ/Water Quality/2012



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DWW Screening Results

- Six Locations Met the Screening Criteria
  - AOI #1: (b)(6) privacy [Landowner name] Area
  - AOI #2: (b)(6) privacy [Landowner name]
  - AOI #3: (b)(6) privacy [Landowner name] Area
  - AOI #4: (b)(6) privacy [Landowner name]
  - AOI #5: (b)(6) privacy [Landowner name]
  - AOI #6: (b)(6) privacy [Landowner name]

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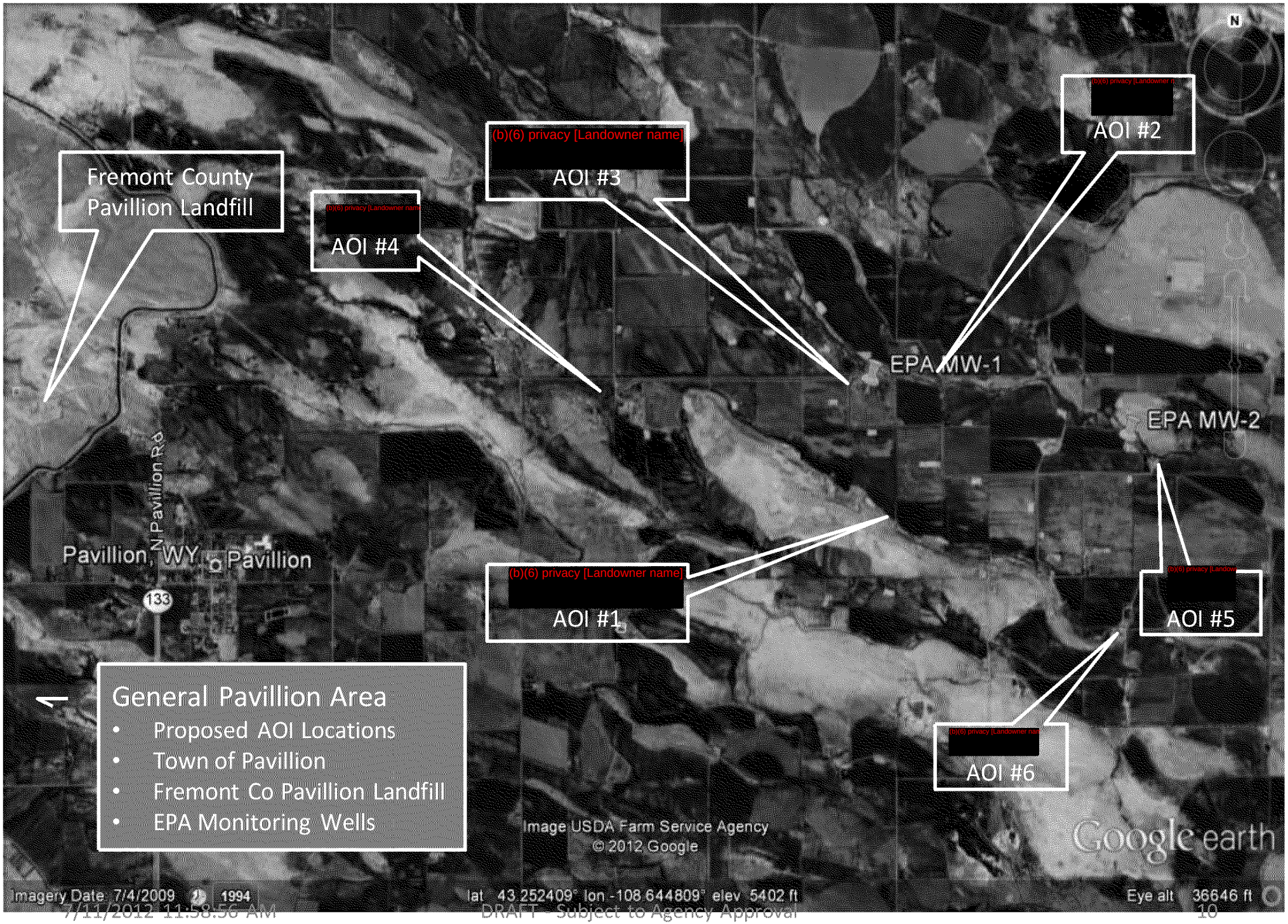
N
Fremont County
Pavillion Landfill
(b)(6) privacy [Landowner name]
AOI #4
(b)(6) privacy [Landowner name]
AOI #3
(b)(6) privacy [Landowner n
AOI #2
EPA MW-1
EPA MW-2
N Pavillion Rd
Pavillion, WY
Pavillion
133
(b)(6) privacy [Landowner name]
AOI #1
(b)(6) privacy [Landow
AOI #5
(b)(6) privacy [Landowner nam
AOI #6
General Pavillion Area
• Proposed AOI Locations
• Town of Pavillion
• Fremont Co Pavillion Landfill
• EPA Monitoring Wells
Image USDA Farm Service Agency
© 2012 Google
Google earth
Imagery Date 7/4/2009 1994
lat 43.252409° lon -108.644809° elev 5402 ft
Eye alt 36646 ft

INVESTIGATION PLAN FOR AOIs

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INVESTIGATION PLAN FOR AOIs

DOMESTIC WELLS

1. Down hole camera of DWWs to verify screened intervals
2. Sample domestic water wells within AOI for a minimum of two events prior to installation of monitoring wells
3. Conduct survey of land uses for other potential sources during DWW sampling in AOIs
4. All DWWs sampled for TPH-DRO and DRO with silica gel cleanup, BTEX, metals, and general chemistry
5. Additional wells sampled for TPH-GRO, VOCs, and/or SVOCs as necessary
6. Field Parameters
7. Conduct QAQC analysis on data
8. Review results prior to installation of monitoring wells

MONITORING WELLS

1. Conduct hydrophysical testing on wells to determine stratigraphic flow-regimes and use data to determine placement of well screened intervals
2. Initial sampling of monitoring wells for TPH-GRO/DRO, DRO with silica gel cleanup, VOCs, SVOCs, metals, and general chemistry
3. Semi-annual sampling of constituents of concern based on initial sampling results
4. Semi-annual sampling of monitoring wells at same time as DWWs
5. Select an upgradient MW location outside of O&G activities for background WQ sampling
6. Gas mudlogging of MW installations, if applicable

POTENTIAL CONCERNS

1. Landowner access agreements for sampling of DWWs and and installation of MWs
2. Drilling method (sonic, mud rotary, air rotary) to select; potential for encountering methane; need for blow-out preventers.

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AREA OF INTEREST #1:

(b)(6) privacy [Landowner name] AREA

(AOI #1: (b)(6) privacy [Landowner name] Area)

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Five Mile Creek
(b)(6) privacy [Landowner
(b)(6) privacy [Landowner
Figure AOI #1: (b)(6) privacy [Landowner name]
Proposed MW Locations
Assumed GW Flow Direction(s)
Assumed Gas Well Pad Location
© 2012 Google
Google earth
Eye alt 13125 ft

AOI #1: [redacted] Area

BACKGROUND INFORMATION

- DWWs Total Depths (TD): [redacted] well (PGDW 14) 190-ft bgs, [redacted] well (PGDW 23) 500 ft-bgs, [redacted] In-laws stock well (PGDW44) 750-ft bgs
- 32-10c (4,020' TD; 1,920' – 1,925' and 3,476' – 3484' perf zones; surface casing 8 5/8" to 626')
- 44-10 (5,200' TD; no perforation information; surface casing 8 5/8" to 625'; no cement information)
- 33x-10, invert well, (6,000' TD plug back to 5893'; 5,126' – 5,490' perf zone; surface casing 8 5/8" to 514')
- 32-10c and 44-10 failed Bradenhead test, 33x-10 passed
- Production Pits at 33x-10 (32-10 shared ?) and 42-10
- Invert well and production pits 33x-10 w/in 1,000 feet of [redacted] residences
- Methane detected in all three domestic wells, TPH-DRO detected in [redacted] and [redacted] In-law wells ([redacted] well not tested for TPH-DRO), Toluene and benzoic acid (j-flagged) detected in [redacted] in-law well

RECOMMENDATIONS

- Sample [redacted] and [redacted] In-law wells semi-annually (pre-irrigation time frame and during irrigation period)
- Installation of three sets of wells, nested at minimum of four depths (approx 50 ft, 200 ft, 500 ft, and 750 ft)
- Sampling & monitoring of the proposed MW's
- Further onsite investigation necessary to definitively locate & label all gas wells

Note: DWW ID Number in () is EPA identification for sampling.

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AREA OF INTEREST #2:

(b)(6) privacy [Landowner name]

(AOI #2: (b)(6) privacy [Landowner name]

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N
Figure AOI #2: (b)(6) privacy [Landowner name]
Proposed MW Locations
Assumed GW Flow Direction(s)
Assumed Gas Well Pad Location
(b)(6) privacy [Landowner name]
well
Five Mile Creek
Image USDA Farm
© 2012
Google earth
DRAFT - Subject to Agency Approval
Imagery Date 7/4/2009
1994
lat 43.262365° lon -108.611718° elev 5365 ft
Eye alt 12222 ft

AOI #2: [redacted]

BACKGROUND

- DWW TD: [redacted] (PGDW05) 207-ft bgs, [redacted] irrigation (PGDW45) 100-ft bgs
- 14-2, invert well, (5,250' TD; 3,767'- 4,962' perf zone; surface casing depths 18" to 47' and 8 5/8" to 599')
- 13-2, invert well, (3,400' TD; 2,811'- 3,040'perf zone; 8 ¾"surface casing to 404')
- 24-02, invert well, (3,942' TD; 1,538' – 1,550' and 3,874'-3,878' perf zones; 9 7/8" surface casing to 562')
- 13-2 failed Bradenhead test, 14-2 and 24-02 passed
- Production pits at 13-2 and 14-2, no information on 24-02
- Invert wells and production pits within 1000 ft of [redacted] wells
- Pit 14-2 in VRP, but on hold, sampling data not submitted to VRP? Large gas flow was observed to pit. Drill cutting buried in reserve pit
- Methane and TPH-DRO detected in both [redacted] wells, TPH-GRO detected in [redacted] well (PGDW05)

RECOMMENDATIONS

- Sample [redacted] wells semi-annually (pre-irrigation time frame and during irrigation period)
- Installation of two sets of wells, nested at minimum of three depths (~50 ft, ~200 ft, and ~300 ft)
- DWWs and MWs: add TPH-GRO to analytical list for this area
- Sampling & monitoring of the MW's

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AREA OF INTEREST #3:

(b)(6) privacy [Landowner name] AREA

(AOI #3: (b)(6) privacy [Landowner name] Area)

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AOI #3: [redacted] Area

BACKGROUND

- DWW TD: [redacted] stock (PGDW49) 50-ft bgs; [redacted] (PGDW30) 260-ft bgs
- 41x-10, invert well, (5,047' TD; 3,825' – 4,855' perf zone, 8 5/8" casing to 619')
- 41-10 (3,180' TD plug back to 3,165'; 1,618' – 3,152' perf zone, 7" casing to 534')
- 41-10B (3,841 TD plug back to 3,475'; 1,792'-3,024' and 3,545'-3,614' perf zones; 7" casing to 640')
- 42-10 (5,995' TD plug back to 5,932'; 5,403' – 5,476' perf zone; 8 5/8" casing to 626'), produces oil
- 42-10B (5,605' TD; 1,890'-1,902' and 4,855'-4,859 perf zones; 7" casing to 621')
- 31-10 (5,972' TD plug back to 5,675'; 3,335' – 4,689' perf zone; 8 5/8" casing to 598'), produces oil
- Production pit at 42-10 drill cuttings disposed onsite. No pit investigation information for the 42-10 or 41-10 locations.
- 41-10, 31-10, 42-10B failed Bradenhead tests, 41-10B and 41x-10 no Bradenhead test conducted, 42-10 passed
- Invert well located within 1,000 ft of [redacted] and [redacted]
- Methane and TPH-DRO detected in both wells, TPG-GRO and benzoic acid (j-flagged) detected in [redacted] well

RECOMMENDATIONS

- Review data from USGS sampling of EPA MW01
- Verify if EPA MW01 can be utilized in sampling program
- Sample DWWs semi-annually (pre-irrigation time frame and during irrigation period)
- Installation of one set of wells, nested at minimum of three depths (approx 50 ft, 260 ft, and 500 ft)
- DWWs and MWs: add TPH-GRO to analytical list for this area

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AREA OF INTEREST #4:

(b)(6) privacy [Landowner name]

(AOI #4: (b)(6) privacy [Landowner name]

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[redacted]
[redacted]
[redacted]
Figure AOI #4: [redacted] Area
Proposed MW Locations
Assumed GW Flow Direction(s)
Gas Well Pad Location
© 2012 Google
Image USDA Farm Service Agency
Google earth
Imagery Date 7/4/2009
1994
Eye alt 12514 ft

AOI #4: [redacted]

BACKGROUND

- DWWs TD: [redacted] (PGDW42) 200-ft bgs, [redacted]? (PGDW43) 100-ft bgs
- 21-9, invert well (5,304' TD; surface casing to 815'; no perf zone info), abandoned
- 31-9 (3,445' plug back to 3,350'; 2,313'-3,312' perf zone, 7" casing to 534'), produces small amount of oil
- 41-9 (5,200' TD; no perf zone information; 8 5/8" casing to 604'), produces small amount of oil
- 31-9 and 41-9 Bradenhead test passed
- Production pits at 21-9 and 31-9 being investigated
- Production pits and invert well within 1,000 ft of [redacted]
- Methane, benzene (j-flagged), napthalene (j-flagged), and phenol detected in 200' well (low level), TPH-DRO detected in both wells

RECOMMENDATIONS

- Sample DWWs semi-annually (pre-irrigation time frame and during irrigation period)
- Installation of one set of wells, nested at minimum of four depths (approx 50 ft, 100 ft, 200 ft, and 300 ft)

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AREA OF INTEREST #5:

(b)(6) privacy [Landowner name]

(AOI #5: (b)(6) privacy [Landowner name]

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N
EPA MW-2
[redacted]
Five Mile Creek
(b)(6) privacy [Landowner name]
[redacted]
Gas Well 13-12
Figure AOI #5 (b)(6) privacy [Landowner nam Area
Proposed MW Locations
Assumed GW Flow Direction(s)
Gas Well Pad Location
© 2012 Google
Image USDA Farm Service Agency
Google earth
Imagery Date 7/4/2009
lat 43.252179 lon -108.590877 elev 5330 ft
Eye alt 8705 ft

AOI #5: [redacted]

BACKGROUND

- DWW TD: [redacted] (PGDW20), (PGDW21) both 460' (?), (LD02) 610'
- 22-12 , invert well, (5,200' TD; 3,510' - 4,998' perf zone; surface casing to 586')
- 13-12 (3,275' TD plugged back to 3,150'; 2,170' – 3,125' perf zone; surface casing to 327')
- 12-12 (3,955' TD; 1,964'-2,025' and 3,645'-3,862 perf zones; 7" casing to 635')
- 22-12, 13-12, and 12-12 passed Bradenhead tests
- Invert well and production pits located within 1,000 ft of [redacted] wells
- Methane detected in all three wells (low level), TPH-DRO detected in PGDW21 and LD02; BTEX (j-flagged) detected in LD02; 2-BEP and benzoic acid (j-flags) detected in PGDW20 and LD02; 1,2,4-TMB and 1,3,5-TMB (j-flags) detected in LD02

RECOMMENDATIONS

- Sample DWWs semi-annually (pre-irrigation time frame and during irrigation period)
- Installation of two sets of wells, nested at minimum of four depths (approx 50 ft, 100 ft, 450 ft, and 650 ft)
- DWWs and MWs, add VOCs to sampling for this area
- Sampling & monitoring of MW's

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AREA OF INTEREST #6:

(b)(6) privacy [Landowner name]

(AOI #6: (b)(6) privacy [Landowner name]

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AOI #6: [redacted]

BACKGROUND

- DWW TD: [redacted] (PGDW32) 674', [redacted] (PGDW33) 30', [redacted] (PGDW34) 100'
- 11-13 (5,500' TD; expired permit, no records)
- 12-13, abandoned (5,331' TD plugged back to 3,351'; 3,300' – 3,462' perf zone; surface casing to 576')
- Invert well and production pits located within 1,000 ft
- 12-13 failed Bradenhead test (?), P&A'd in 2001
- Methane detected in PGDW32 and PGDW34 (PGDW33 not sampled), TPH-GRO and DRO detected in PGDW32 (PGDW33 and PGDW34 not sampled)

RECOMMENDATIONS

- Sample DWWs semi-annually (pre-irrigation time frame and during irrigation period)
- Installation of one set of wells, nested at minimum of four depths (approx 30 ft, 100 ft, and 675 ft)
- Sampling & monitoring of MW's

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SEMI-ANNUAL DWW AND MW SAMPLING WITHIN THE AOIs

EPAPAV0020873

Semi-Annual DWW Sampling
(15 DWWs within AOIs)

- Sampling Labor (1 Event) $6,500
  - Assumes 1 field tech @$80/hr; minimum 3 DWW's sampled/10 hr day
  - 2 travel days of 6 hrs/day; 6 days per diem @$145/day
  - Vehicle for 8 days @$90/day
  - Field equipment for 6 days (horriba @$300/wk, O/W probe $150/wk, pump @$300/wk)
  - Assumes all DWW's sampled in same mobilization
- Laboratory (15 Units)
  - TPH-DRO (15 units) $1,125
  - TPH-GRO (7 units) $525
  - TPH-DRO silica gel (15 units) $1,125
  - Metals, General Chemistry (15 units) $375
  - VOCs (6 units) $2,250
  - Methane Headspace (15 units) $1,500
  - QA/QC samples/event $2,750
- Total for 1 DW sampling event $16,150
- **Total for 2 events** **$32,300**

EPAPAV0020874

Semi-Annual MW Sampling
(10 MWs and 1 EPA well within AOIs)

- Sampling Labor (1 Event) $6,320
  - Assumes 1 field tech @$80/hr; minimum 3 MW's sampled/10 hr day
    - Request two field techs for safety considerations
  - 2 travel days of 6 hrs/day; 6 days per diem @$145/day
  - Vehicle for 6 days @$90/day
  - Field equipment for 6 days (horriba @$300/wk, O/W probe $150/wk, pump @$300/wk)
  - Assumes all MW's sampled in same mobilization
- Laboratory (11 Units)
  - TPH-DRO (11 units) $825
  - TPH-GRO (11 units) $825
  - TPH-DRO silica gel (11 units) $825
  - Metals, General Chemistry (11 units) $275
  - VOCs (11 units) $1,650
  - SVOCs (11 units) $2,970
  - Methane Headspace (11 units) $1,100
  - QA/QC samples/event $2,750
- Total for 1 MW sampling event $17,540
- **Total for 2 events** **$35,080**

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OPTIONAL ADDITIONAL GROUNDWATER INVESTIGATIONS

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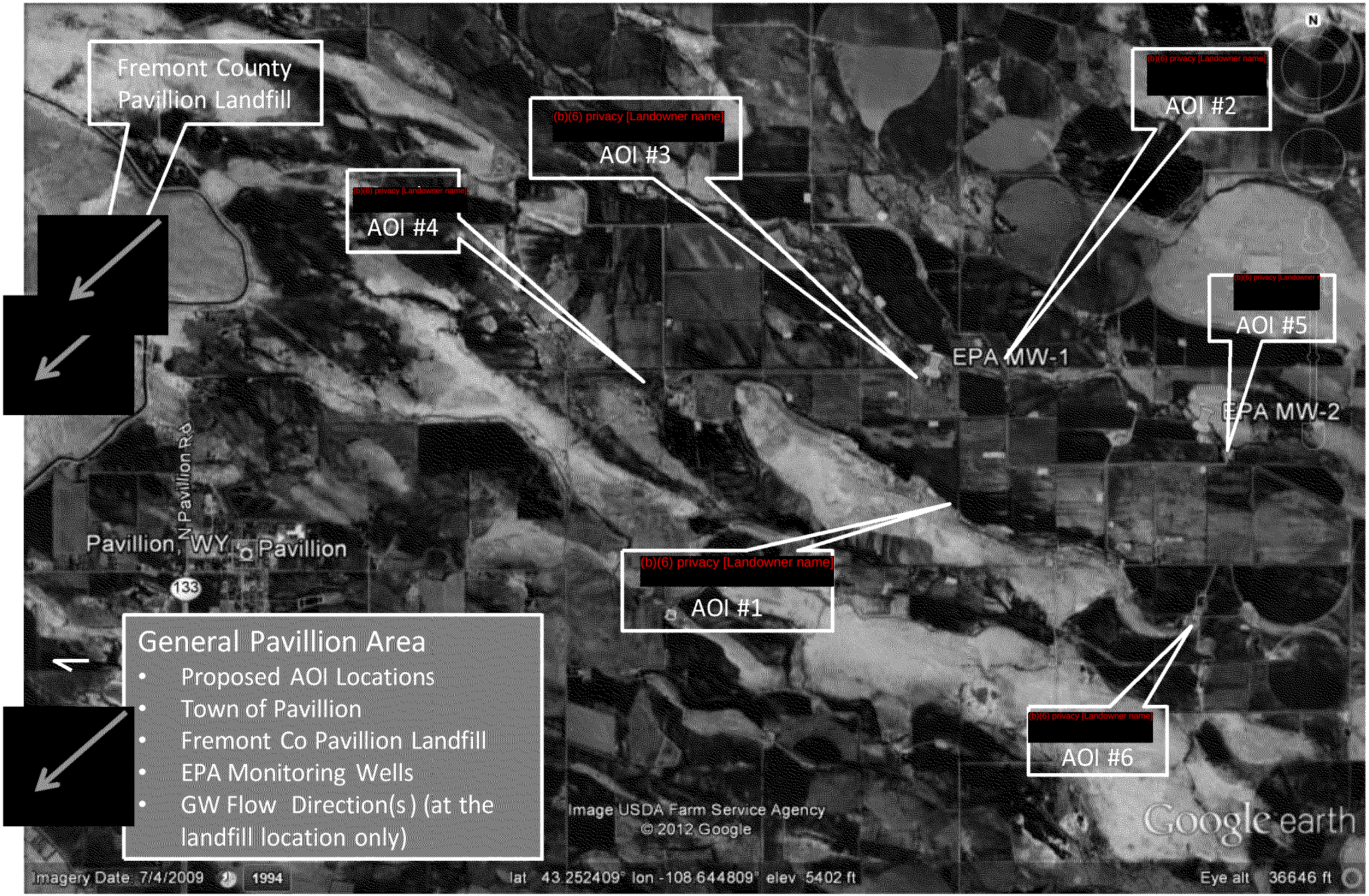

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OPTIONAL ADDITIONAL INVESTIGATIONS

Site #1 PAVILLION LANDFILL

Issue: Review of available groundwater data near the former Pavillion landfill shows a lack of down gradient sampling data. Pavillion landfill is likely hydrologically up gradient of the Pavillion Gas Field, and was unlined.

- Install one or two monitoring well sets down gradient of the landfill
- Semi-annual sampling of wells for TPH-GRO and DRO, VOCs, SVOCs, Metals, and General Chemistry

Site #2 PIT

Issue: This facility was closed as per WOGCC requirements and is not in the VRP. The GW was not sampled.

- Install two monitoring well sets down gradient of the pit
- Semi-annual sampling of wells for TPH-GRO and DRO, VOCs, SVOCs, Metals, and General Chemistry

Costs were not included in the final estimation for AOI investigation

- 4 MW's of 80'-100' depths each
- No gas mudlogging required; GW monitoring only
- Estimated Total Cost: $95,000

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Attachment 1

ESTIMATED COSTS FOR PHASE VI

(MONITOR WELL INSTALLATION, DWW and MW SAMPLING)

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ESTIMATED COSTS FOR PHASE VI (MONITOR WELL INSTALLATION, DWW and MW SAMPLING)

MW Installation Estimate	$2,278,054
DWW Sampling Estimate	$ 32,300
MW Sampling Estimate	$ 35,080
Estimated Total Cost	$2,345,434

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Monitor Well Installation Estimated Costs

- **Total** **$2,278,054**
- The projected estimate includes the following:
  - MW Drilling & Completion
  - Project Management & Draft/Final Reports
  - Geological Services & Equipment
  - Hydrophysical Testing of Deep Borehole
  - Access Issue Expenses
  - Drill Cuttings & Produced Water Disposal Costs

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SEMI-ANNUAL DWW AND MW SAMPLING WITHIN THE AOIs

EPAPAV0020882

Semi-Annual DWW Sampling
(15 DWWs within AOIs)

- Sampling Labor (1 Event) $6,500
  - Assumes 1 field tech @$80/hr; minimum 3 DWW's sampled/10 hr day
  - 2 travel days of 6 hrs/day; 6 days per diem @$145/day
  - Vehicle for 8 days @$90/day
  - Field equipment for 6 days (horriba @$300/wk, O/W probe $150/wk, pump @$300/wk)
  - Assumes all DWW's sampled in same mobilization
- Laboratory (15 Units)
  - TPH-DRO (15 units) $1,125
  - TPH-GRO (7 units) $525
  - TPH-DRO silica gel (15 units) $1,125
  - Metals, General Chemistry (15 units) $375
  - VOCs (6 units) $2,250
  - Methane Headspace (15 units) $1,500
  - QA/QC samples/event $2,750
- Total for 1 DW sampling event $16,150
- **Total for 2 events** **$32,300**

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Semi-Annual MW Sampling
(10 MWs and 1 EPA well within AOIs)

- Sampling Labor (1 Event) $6,320
  - Assumes 1 field tech @$80/hr; minimum 3 MW's sampled/10 hr day
    - Request two field techs for safety considerations
  - 2 travel days of 6 hrs/day; 6 days per diem @$145/day
  - Vehicle for 6 days @$90/day
  - Field equipment for 6 days (horriba @$300/wk, O/W probe $150/wk, pump @$300/wk)
  - Assumes all MW's sampled in same mobilization
- Laboratory (11 Units)
  - TPH-DRO (11 units) $825
  - TPH-GRO (11 units) $825
  - TPH-DRO silica gel (11 units) $825
  - Metals, General Chemistry (11 units) $275
  - VOCs (11 units) $1,650
  - SVOCs (11 units) $2,970
  - Methane Headspace (11 units) $1,100
  - QA/QC samples/event $2,750
- Total for 1 MW sampling event $17,540
- **Total for 2 events** **$35,080**

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Monitor Well Installation Estimated Costs: Summary

• Project Management	$32,602
• Health & Safety Plan	$5,000
• Rig Mobilization	$4,000
• Draft & Final Reports	$45,000
• Hydrophysical Testing	$88,000
• Gas Mudlogging	$100,000
• IDW Disposal Estimate	$60,000
• Downhole Camera	$13,580
• AOI #1	$831,762
• AOI #2	$209,515
• AOI #3	$150,825
• AOI #4	$125,060
• AOI #5	$463,925
• AOI #6	$148,785
• Estimated Total	$2,278,054

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Estimated Costs

- Project Management $32,602
- Health & Safety Plan $5,000
- Total $37,602

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Estimated Costs

- Rig Mobilization $4,000
- Total $4,000
- Assume driller will mobilize rig 1X from home base unless unable to install all MW's during same mobilization
- Assume mobilization charges for rig & support vehicle

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Estimated Costs

- Draft Report $40,000
- Assume a single report
- Report to include: well logs, potentiometric maps, GPS coordinates, site photos, maps & figures, data QA/AC
- Final Report $5,000
- Final report to include edits based on WDEQ comments
- Total $45,000

EPAPAV0020888

Estimated Costs

- Hydrophysical Testing of Deep Borehole:
  - Cost/deep borehole (11) $88,000
- IDW (Investigation Derived Waste) Disposal
  - $10,000 per AOI $60,000
- Gas Mudlogging
  - $4,000/day drilling, est. 25 days $100,000

- Total for 11 deep boreholes $248,000

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Estimated Costs

- Downhole camera of DWW $13,580
  - Assumes 1 field tech @$80/hr; 3 MW's sampled/day (10 hr day); two 6 hr travel days; Assumes vehicle @$90/day
  - Assumes two techs @$150/hr for two and 6 days per diem @$145/day; vehicle 6 days @$90/day
  - Assumes rental of downhole camera at $1,000/wk

– Total equipment cost $13,580

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Estimated Costs

- Onsite geologist total $74,327
- Assumes 39 field days/6 separate AOIs
- Assumes 1 field geologist @$100/hr for a total of 39 field days @10 hrs/day
- Assumes 39 days per diem @$145/day
- Assumes 39 days per vehicle @$90/day
- Assumes one person gas mudlogging unit onsite where applicable during MW installation includes geologist @$4,000/day for 25 days

EPAPAV0020891

AOI #1: (b)(6) privacy [Landowner name] Area

Cost Estimates:

• Drilling (# of units: 3)	$450,000
• Completion	$337,500
• Development	$12,000
• Labor	$30,292
• Field Equipment	$1,970
• Total Estimated Cost AOI #1:	$831,762

- Assume 4,500’ Total Depth

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AOI #2: (b)(6) privacy [Landowner name]

Cost Estimates:

• Drilling (# of units: 2)	$110,000
• Completion	$82,500
• Development	$6,000
• Labor	$9,880
• Field Equipment	$1,135
• Total Estimated Cost AOI #2:	$209,515

• Assume 1100’ Total Depth

EPAPAV0020893

AOI #3: (b)(6) privacy [Landowner name] Area

Cost Estimates:

• Drilling (# of units: 1)	$81,000
• Completion	$60,750
• Development	$3,000
• Labor	$4,940
• Field Equipment	$1,135
• Total Estimated Cost AOI #3:	$150,825

• Assume 810’ Total Depth

EPAPAV0020894

AOI #4: (b)(6) privacy [Landowner name]

Cost Estimates:

• Drilling (# of units: 1)	$65,000
• Completion	$48,750
• Development	$4,000
• Labor	$6,175
• Field Equipment	$1,135
• Total Estimated Cost AOI #4:	$125,060

• Assume 650’ Total Depth

EPAPAV0020895

AOI #5: (b)(6) privacy [Landowner name] [redacted]

Cost Estimates:

• Drilling (# of units: 2)	$250,000
• Completion	$187,500
• Development	$8,000
• Labor	$17,290
• Field Equipment	$1,135
• Total Estimated Cost AOI #5:	$463,925

- Assume 2,500’ Total Depth

EPAPAV0020896

AOI #6: (b)(6) privacy [Landowner name]

Cost Estimates:

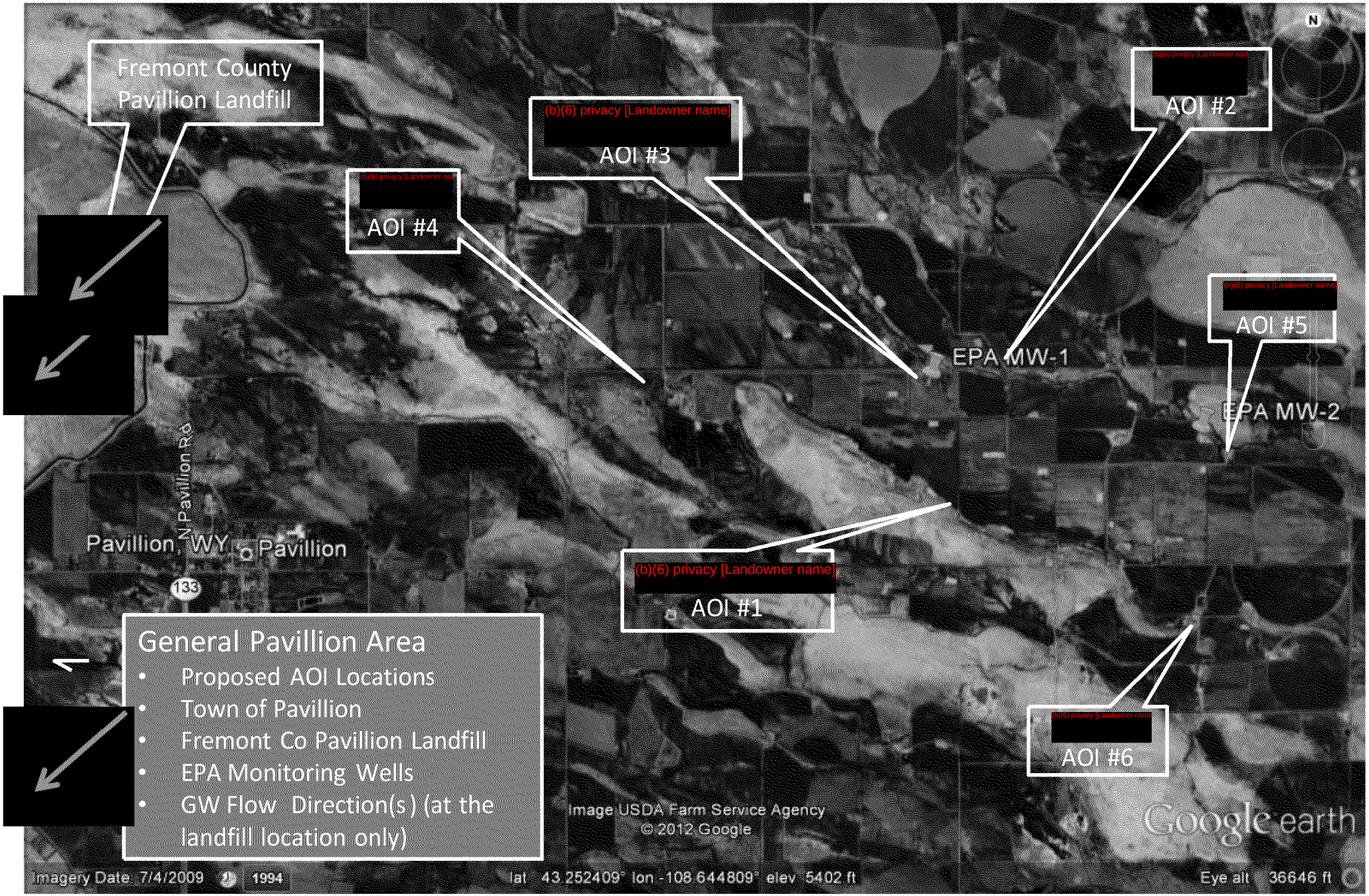
• Drilling (# of units: 1)	$80,500
• Completion	$60,400
• Development	$1,000
• Labor	$5,750
• Field Equipment	$1,135
• Total Estimated Cost AOI #6:	$148,785

• Assume 805’ Total Depth

EPAPAV0020897

OPTIONAL ADDITIONAL GROUNDWATER INVESTIGATIONS

EPAPAV0020898



EPAPAV0020899

OPTIONAL ADDITIONAL GROUNDWATER INVESTIGATIONS

Site #1 PAVILLION LANDFILL

Issue: Review of available groundwater data near the former Pavillion landfill shows a lack of down gradient sampling data. Pavillion landfill is likely hydrologically up gradient of the Pavillion Gas Field, and was unlined.

- Install one or two monitoring well sets down gradient of the landfill
- Semi-annual sampling of wells for TPH-GRO and DRO, VOCs, SVOCs and Metals

Site #2 Production Pit

Issue: This facility was closed as per WOGCC requirements and is not in the VRP. The GW was not sampled.

- Install two monitoring well sets down gradient of the pit
- Semi-annual sampling of wells for TPH-GRO and DRO, VOCs, SVOCs and Metals

Costs were not included in the final estimation for AOI investigation

- 4 MW's of 80'-100' depths each
- No gas mudlogging required; GW monitoring only
- Estimated Total Cost: $95,000

EPAPAV0020900

QUESTIONS?

SUMMARY

EPAPAV0020901

Semi-Annual Cistern Qualification DWW Sampling (General Groundwater Quality) -Voluntary Program-

- Sampling Labor (1 Event w/ 12 DWW's)
  - Assumes 1 field tech @$80/hr; 5 DWW's sampled/10 hr day; 1 DWW/hr
    - Request two field techs for safety considerations
  - 2 travel days of 6 hrs/day; 5 days per diem @$145/day
  - Vehicle for 5 days @$90/day
  - Field Equipment for the Week (horriba @$300/wk)
  - Assumes All DWW's Sampled During Same Mobilization
- Subtotal for Field Labor/Event $3,800

- Laboratory (12 DWW's)
  - TPH-DRO @$75/DWW $900
  - TPH-GRO @$75/DWW $900
  - TPH-DRO silica gel @$75/DWW $900
  - SVOCs @$270/DWW $3,240
  - VOCs @$150/DWW $1,800
  - Methane Headspace @$100/DWW $1,200
  - Metals (As, Fl, U, Nitrates) $900
    - $75/DWW w/ 1 hr/DWW
  - QA/QC samples/event $300
    - 1 blank duplicate/20 DWW's or single event
- Subtotal for Laboratory Analysis/Event $10,140

- **Total for 1 Event of 12 DWW's $13,940**
- **NOTE: The 37 DWW's included in the initial EPA sampling program included multiple stock & domestic wells at the [redacted] and [redacted] residences.**

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