

TECHNICAL MEMORANDUM

Subject: Proposed Area of Notification (Response to Requirements of Part 18.7.3 of 6 CCR 1007-1 Radiation Regulations),

To: John Hamrick, Jim Cain, Cotter Corporation

From: Errol Lawrence, HydroSolutions

Date: November 29, 2011



Introduction

Part 18.7.3 of 6 CCR 1007-1 (Radiation Regulations), effective 4/30/11, requires that the licensee of any site or facility licensed for radioactive materials that has caused a release to groundwater that exceeds groundwater standards, as determined by the Colorado Department of Public Health and the Environment (CDPHE), must provide annual written notice of the status of the release and any remediation activities associated with the release by certified or registered mail, return receipt requested, to the current address for each registered groundwater well within one mile of the known extent of the release, unless the licensee demonstrates that a distance less than one mile is warranted. Cotter Corporation is the licensee for the Canon City Milling Facility that has caused a release that exceeds Colorado Groundwater Quality Standards for uranium and molybdenum. Therefore Cotter Corporation is required, under the conditions of Part 18.7.3, to notify well owners within one mile of the known extent of the release of the status of the release and any remediation activities associated with the release by certified or registered mail. Site environmental conditions limit the extent of the release and warrant a reduced area of notification from the prescribed one mile distance. This memorandum provides information that justifies an area of notification of less than one mile from the known extent of the release.

The intent of Part 18.7.3 of 6 CCR 1007-1 (Radiation Regulations) is notification of the public that may have potential risk through contact with groundwater impacted from uranium production/processing operations. In the case of the Cotter Milling Facility, a one mile radius is unnecessary for the protection of public health. An area of notification that is based on site environmental considerations is presented herein.

Proposed Area of Notification (Science Based)

An area of notification that is based on geologic, hydrologic and geochemical conditions of the area is as follows. North of the Soil Conservation Service (SCS) Dam (in the area of Lincoln Park)

the area of notification should extend no further than the Arkansas River. The Arkansas River provides a natural hydrologic boundary that limits migration of groundwater from the Canon City Milling Facility. South of the Canon City Milling Facility, the area of notification should extend no further than the Restricted Area. Groundwater flow and the geologic framework prevent southward migration of groundwater from the Canon City Milling Facility. Figure 1 delineates the proposed area of notification. The following technical information supports this position.

Site Geology

The Cotter Milling Facility sits within the Chandler Syncline (Figure 2). The syncline forms a basin that is circumscribed by bedrock ridges with limited surface drainage inlets and outlets. Surficial deposits within the Chandler Syncline are predominately alluvial/colluvium deposits and weathered bedrock. The shallowest bedrock within the Chandler Syncline is the Poison Canyon Formation (Fm). Groundwater impacts within the Chandler Syncline are generally limited to the alluvium/colluvium and upper weathered Poison Canyon Fm.

Beneath the Poison Canyon Formation are the Raton Sandstone (SS) and the Vermejo Formation (Fm). Because of the synclinal structure of the basin, the Raton SS and Vermejo Fm form bedrock ridges that surround the Chandler Syncline. The Raton SS is present in outcrop along the north bounding ridge of the Chandler Syncline (the Raton Ridge). The Raton SS and Vermejo Fm dip steeply to the north on the south side of basin, and steeply to the south on the north end of the basin. The Poison Canyon is not present immediately north or south of the Chandler Syncline. North of the Raton Ridge, the base of the Vermejo subcrops at a distance of over 3,000 feet north of the Raton Ridge/SCS Dam area, and 3,000 to 4,000 of feet south the Arkansas River. The Vermejo Fm is underlain by the Trinidad Sandstone and then the Pierre Shale. The bedrock units north of the Raton Ridge are partially covered by Arkansas River alluvium toward the Arkansas River to the north and east. In some areas just south of the Arkansas River, the Pierre Shale (bedrock) is present in outcrop, effectively limiting the migration of alluvial groundwater. Groundwater impacts north of the Raton Ridge are limited to the alluvial materials and shallow bedrock of the Vermejo Formation.

The Canon City Milling Facility is flanked on the south by a bedrock ridge (referred to as the Hogback) comprised of the Raton SS and Vermejo Fm. The Hogback is south of the lined tailings impoundments. Geologic units south of the Hogback include the Pierre Shale and older geologic units (Figure 2). Data from monitor wells along the south edge of the Chandler Syncline, upgradient of the tailings impoundments, indicate that groundwater impacts from uranium and molybdenum do not extend south of the Hogback.

A bedrock ridge, comprised of Raton SS and Vermejo Fm is also present along the west side of the Chandler Syncline, west of Oak Creek Rd. Monitor well data indicate no groundwater impacts west of Oak Creek Rd.

Site Hydrogeology

The only current surface drainage that allows flows into the Chandler Syncline is at Alkali Gap, located southwest of the Canon City Milling Facility. The shallowest occurrence of groundwater is within the alluvial materials or weathered bedrock (Poison Canyon Fm). Water level data from an extensive network of monitor wells indicate that groundwater flow is generally north to northeasterly across the Chandler Syncline (Figure 3). Surface and groundwater discharge points from the basin are limited to the Sand Creek Drainage, the drainage west of Sand Creek that exits at the West SCS Dam, and potentially through deeper pathways via coal beds or other transmissive units within the Vermejo Fm.

The Vermejo pathway has been investigated and has not been proven. As previously described, the base of the Vermejo Fm subcrops 3,000 to 4,000 feet south of the Arkansas River. Therefore, even if a deep Vermejo pathway exists, groundwater migrating along that pathway would discharge to the overlying alluvium several thousands of feet south of the Arkansas River. The beds dip steeply to the south in the area between the SCS Dam and the Arkansas River. This greatly limits the northward migration of groundwater within the bedrock aquifer(s). Northward migration of impacted groundwater within Lincoln Park is generally limited to the alluvial aquifer system.

Alluvial groundwater flows toward the Arkansas River from both sides of the river. The Arkansas River is a major hydrologic sink (discharge point) for alluvial groundwater. It is improbable that alluvial groundwater (impacted or not) could migrate from south of the Arkansas River to the north side. Further, water quality data that have been collected for decades indicate the limit of impacts from the Canon City Milling Facility north of the SCS Dam to several thousand feet south of the Arkansas River. The only area where elevated uranium levels are detected in groundwater near the Arkansas River is toward the east.

There are two upgradient monitor wells within the Chandler Syncline that indicate no uranium or molybdenum impacts to groundwater. As described, groundwater flow across the Cotter Milling Facility and Restricted Area is to the northeast. There is no southward component of flow that would allow groundwater migration south of the Restricted Area Boundary.

Site Geochemistry (Water Quality)

Water quality data have been collected from site monitor wells and private wells for several decades. Those data are reported in quarterly reports to CDPHE. An annual report that

provides an analysis of the data, including the extent of impacts and water quality trends, is submitted to CDPHE. In addition to the routine groundwater monitoring conducted on an annual and quarterly basis, water use surveys and water quality analyses are periodically conducted of all private wells within the area of impacts. The extent of the uranium and molybdenum impacts has been well documented from these activities. Figures 4 and 5 show the uranium and molybdenum concentration maps provided in the 2010 annual report to CDPHE. The data indicate that outside of the Restricted Area, groundwater impacts related to uranium production at the Milling Facility do not extend to the Arkansas River. Surface water samples collected from the Arkansas River confirm no impacts. Most monitor locations in Lincoln Park show decreasing trends in uranium and molybdenum. The overall extent of the uranium and molybdenum plumes has also been gradually decreasing over time. These trends indicate that the migration of impacted groundwater beyond currently known limits is not occurring.

Groundwater impacts are also not present at the background wells upgradient of the Primary and Secondary Tailings Impoundments. Further, water quality data from monitor wells west of the Canon City Milling Facility and east of the Restricted Area indicate no groundwater impacts.

Water quality data also indicate that deeper bedrock north of the SCS dam is minimally impacted if at all, from Cotter operations. Therefore, the only potential migration pathway for impacted groundwater beyond the Vermejo Fm basal contact would be via the alluvial aquifer system.

Other Considerations

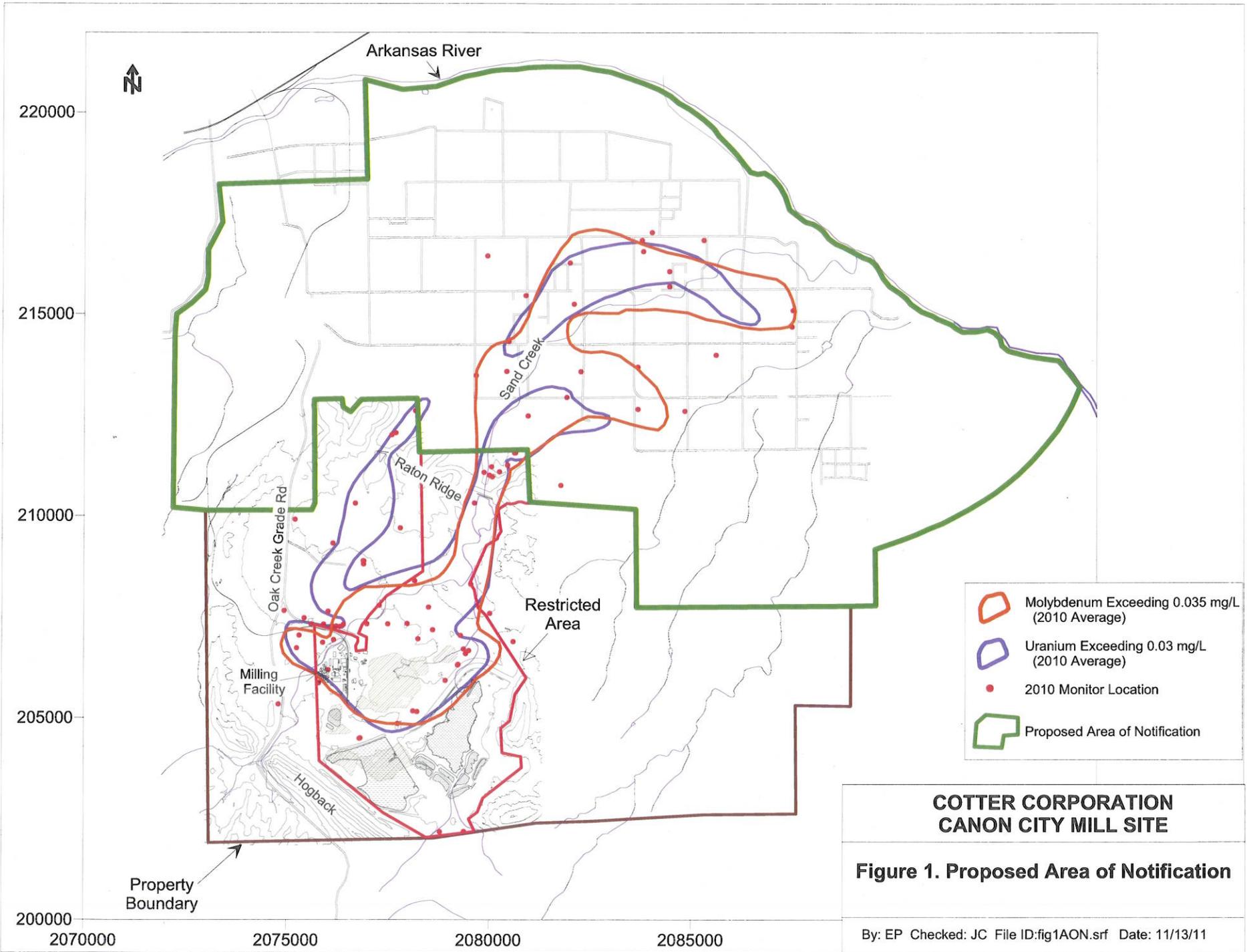
There is evidence that deep water supply wells (completed in bedrock) north of the Arkansas River contain elevated levels of uranium. These occurrences cannot be the result of Cotter's historic operations for the reasons previously cited. There is known occurrence of uranium mineralization in the vicinity Canon City. Expanding the limits of the area of notification beyond what is reasonable from a science-based perspective may result in identification of wells that have elevated uranium that is unrelated to Cotter activities. While the presence of elevated uranium in water supply wells does present a potential health risk, inclusion of wells that could potentially contain high uranium values outside of the area that can be reasonably and scientifically attributed to Cotter activities would only cause confusion and result in additional investigation and monitoring required of Cotter that is unwarranted.

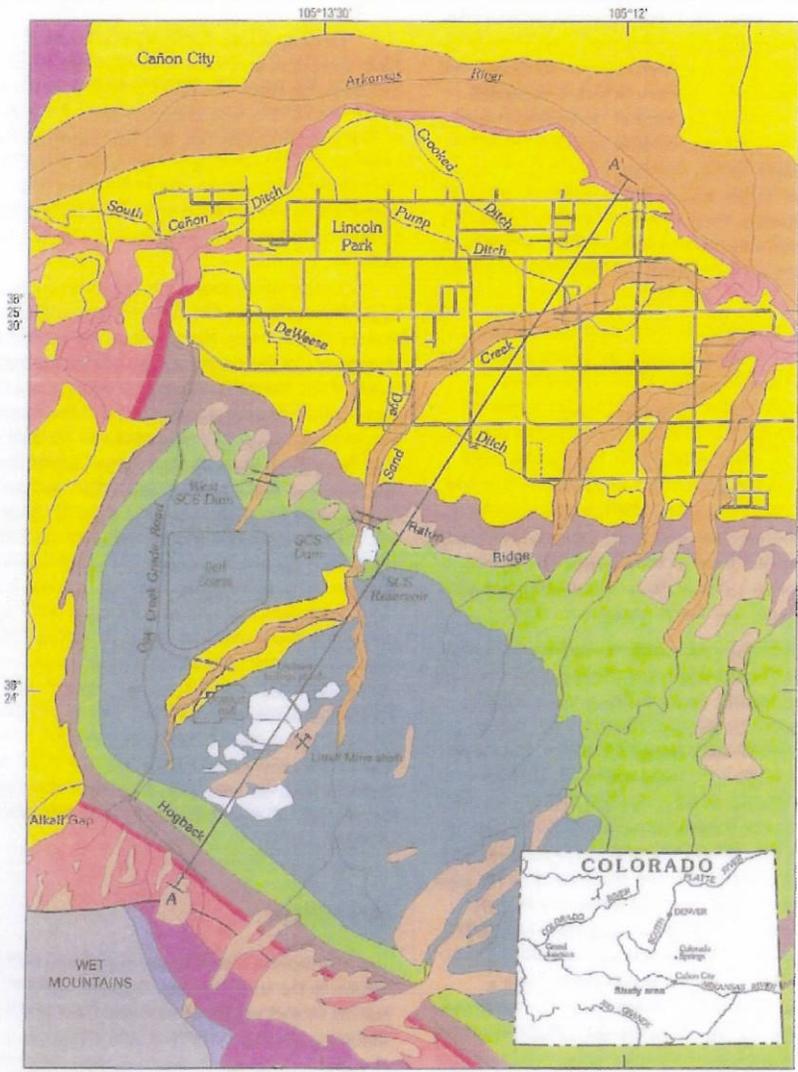
Additional uranium exploration and mining is being planned further to the south, an indication that uranium mineralization is present and may result in localized elevated uranium that is not connected to Cotter operations. Based on the water quality from the upgradient monitor well

locations, there is no justification for inclusion of wells south of the Cotter Restricted Area in the area of notification.

Summary

An area of notification is proposed that is based on site environmental conditions instead of the one mile requirement cited in Part 18.7.3 of 6 CCR 1007-1 (Radiation Regulations). Geologic, hydrologic and water quality data from the Canon City Milling Facility and surrounding area has delineated the extent of groundwater impacts from historic uranium production and processing activities. The data indicate that the extent and magnitude of the groundwater impacts are decreasing with time. Monitoring is ongoing. North of the Restricted Area, no evidence indicates that impacts from the Canon City Milling Facility extend beyond the Arkansas River. Similarly, water quality data from upgradient monitor wells and the geologic framework indicate that groundwater impacts have not migrated to the south. Based on these data, it is proposed that the area of notification be bounded on the north by the Arkansas River and south by the limits of the Restricted Area. The western and eastern limit of the area of notification north of the Restricted Area extends not less than one mile beyond the currently known limits of groundwater impacts from historic uranium production and processing activities, except in areas bounded by the Arkansas River, as shown on Figure 1.



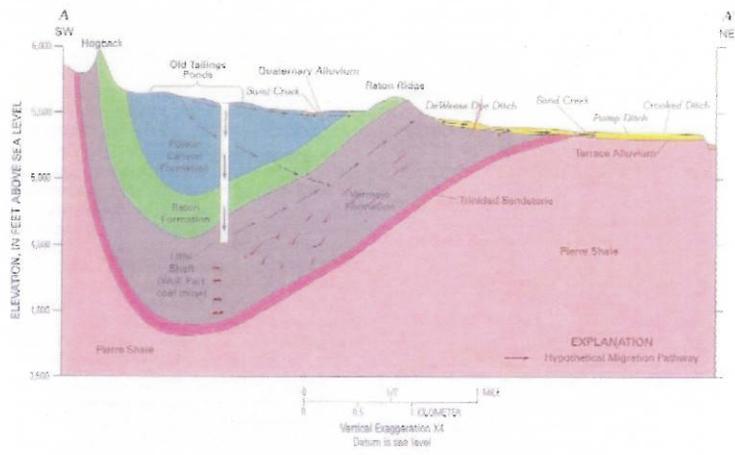


Base from U.S. Geological Survey, 1:24,000 scale map State Plane Coordinate System Zone 947E
 0 0.5 1 1.5 KILOMETERS
 0 1/2 1 1 1/2 MILES
 Geology modified from Hershey, 1977; Scott, 1977

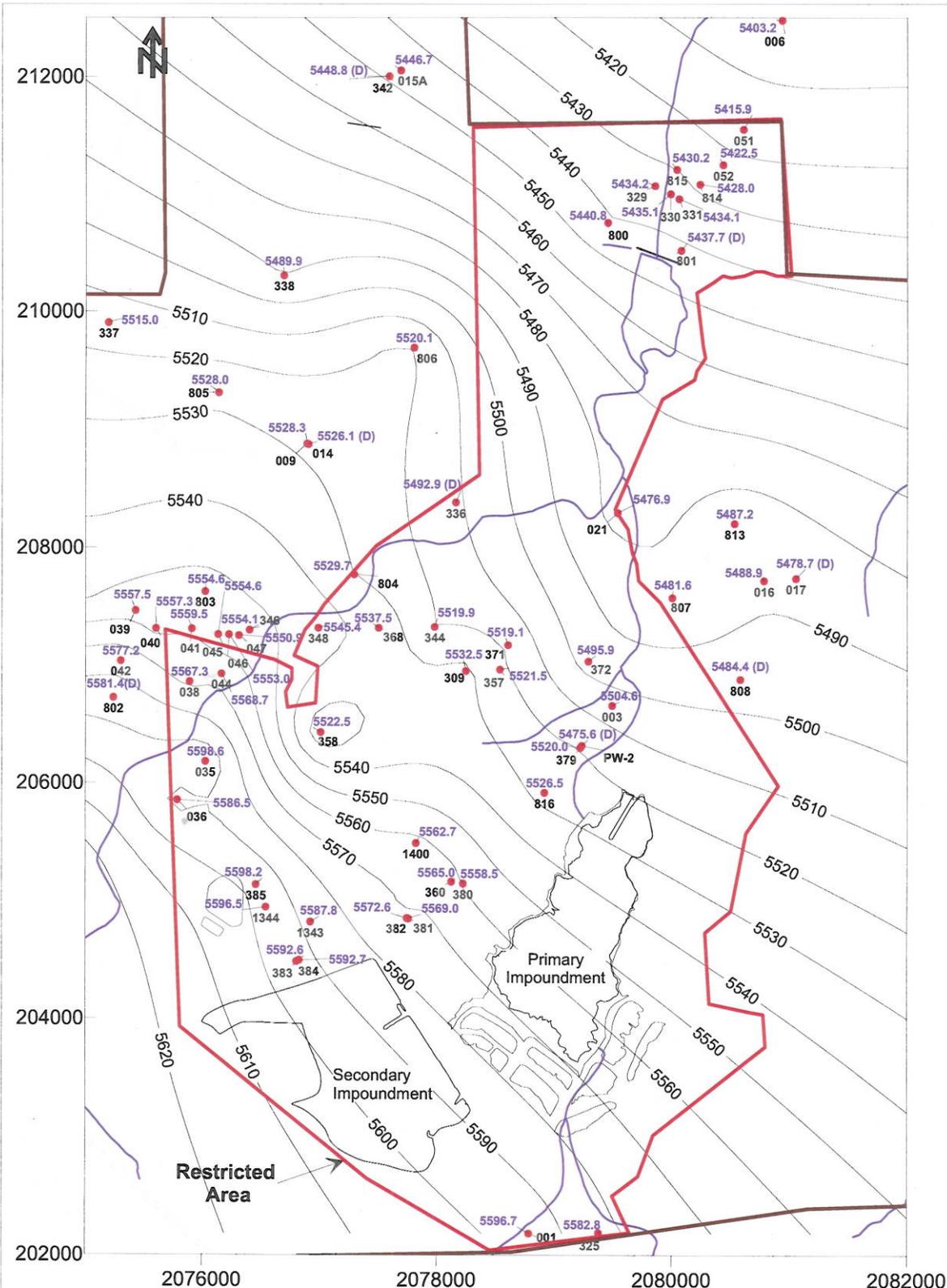
Figure 1. Geology of the study area.

EXPLANATION

- Alluvium (Quaternary)
- Terrace alluvium (Quaternary)
- Terrace deposits (Quaternary)
- Poison Canyon Formation (Tertiary)
- Raton Formation (Tertiary and Cretaceous)
- Vermejo Formation (Cretaceous)
- Trinidad Sandstone (Cretaceous)
- Pierre Shale (Cretaceous)
- Niobrara Formation, Carlile Shale, Greenhorn Limestone, Graneros Shale, Dakota Sandstone, and Purgatoire Formation, undifferentiated (All Cretaceous)
- Morrison and Ralston Creek Formations (Jurassic)
- Migmatitic biotite gneiss (Precambrian)
- Contact
- Fault
- A A' Line of section—Geologic section shown in figure 2



**COTTER CORPORATION
 CANON CITY MILL SITE**
**Figure 2. Geology of the
 Canon City Milling Facility Area**
 (after Hershey, 1977, Scott, 1977, USGS 1999)
 By: EP Checked: JC File ID:fig1AON.srf Date: 12/07/10



Potentiometric Surface (ft amsl)
 Contour Interval = 10 ft

2010 Average
 Water Level Elevation

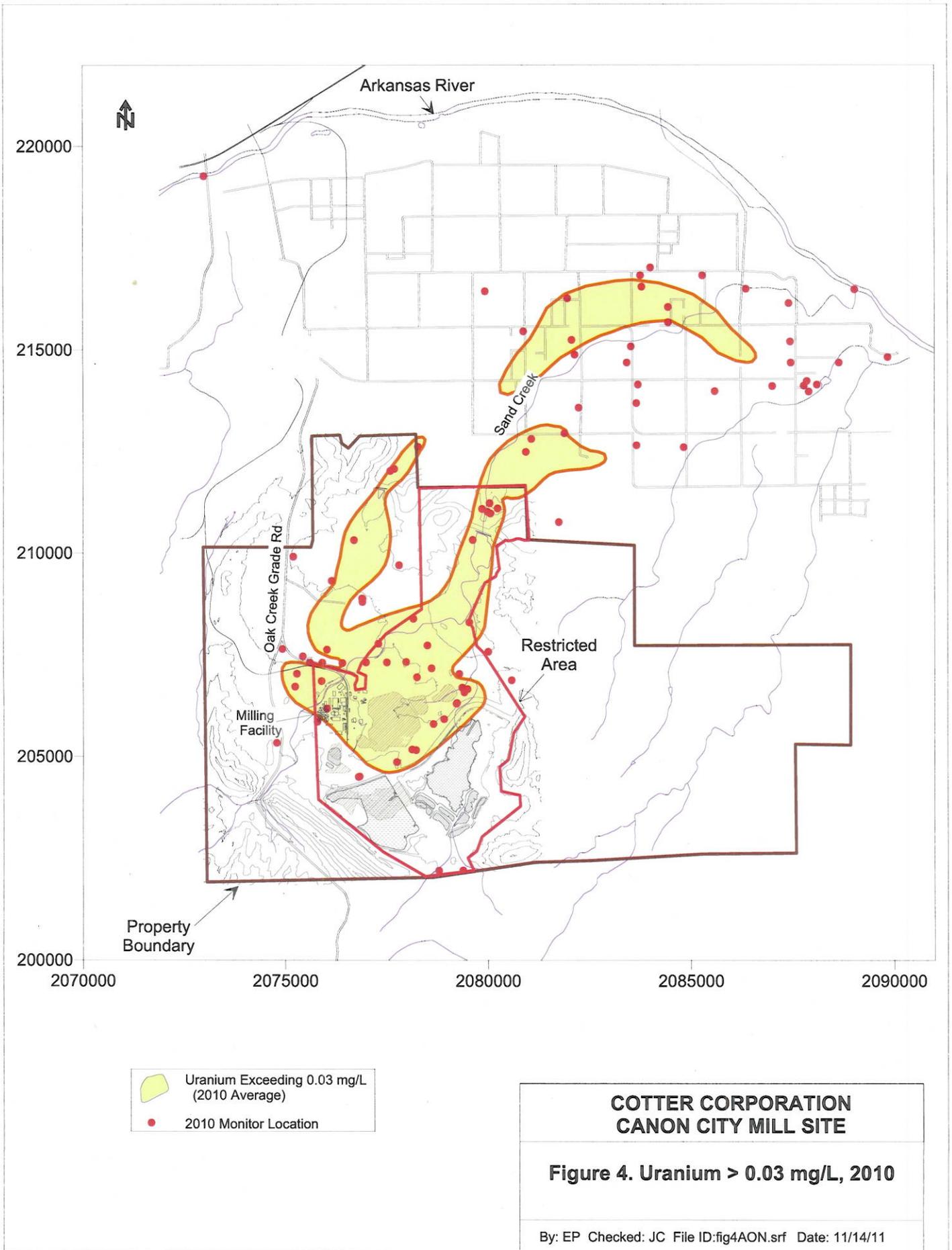
Well ID

Note: Water level data from deep wells (> 100 TD) (identified with a D) were not used for contouring the potentiometric surface

COTTER CORPORATION
CANON CITY MILLING FACILITY

Figure 3
2010 AVERAGE GROUNDWATER ELEVATION

By: EPL Checked: JC File ID:fig3AON.srf Date: 11/27/11

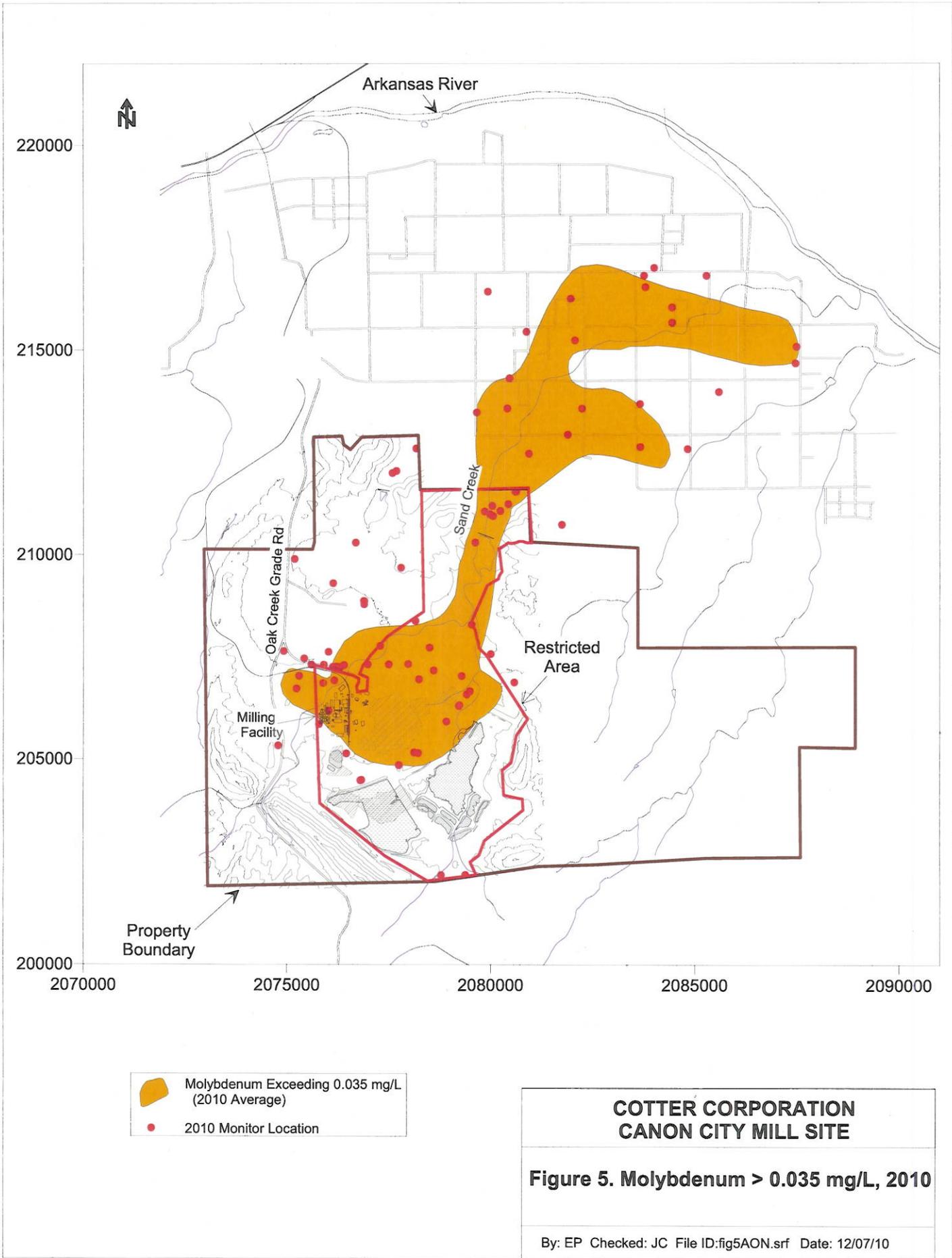


 Uranium Exceeding 0.03 mg/L (2010 Average)
 2010 Monitor Location

**COTTER CORPORATION
CANON CITY MILL SITE**

Figure 4. Uranium > 0.03 mg/L, 2010

By: EP Checked: JC File ID:fig4AON.srf Date: 11/14/11



Arkansas River

220000

215000

210000

205000

200000

2070000

2075000

2080000

2085000

2090000

Property Boundary

Milling Facility

Oak Creek Grade Rd

Sand Creek

Restricted Area

- Molybdenum Exceeding 0.035 mg/L (2010 Average)
- 2010 Monitor Location