Department of Energy
Office of Legacy Management

SEP 2 5 2007

Mr. Don Aragon, Executive Director
Wind River Environmental Quality Commission
Building 10, Washakie Street
Fort Washakie, WY 82514

Subject: Transmittal of the Oxbow Lake White Paper

Dear Mr. Aragon:

Enclosed is a copy of the *Oxbow Lake Remediation Options Riverton, Wyoming,* for your information. This paper identifies and analyzes issues associated with five various remedial options for the Oxbow Lake designed to eliminate or reduce risk to the ecosystem from elevated uranium concentrations. We look forward to discussing any comments you may have.

Please contact me at (970) 248-6091 or Sam Campbell at (970) 248-6654 if you have any questions.

Sincerely,

Raymond M. Plieness, Deputy Director
Office of Site Operations

Enclosure

cc w/enclosure:
J. Arum, Ziontz, Chestnut, Varnell, Berley, and Slonim
B. Crocker, Baldwin and Crocker
J. Redman, Northern Arapaho Utility
B. Von Till, Nuclear Regulatory Commission
D. Wolf, Sonosky, Chambers, Sachse, Endreson, and Perry

cc w/o enclosure:
S. Campbell, Stoller (e)
File Code: RVT 410.02 (Roberts)

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19901 Germantown Road, Germantown, MD 20874 ☐ 2597 B 3/4 Road, Grand Junction, CO 81503
3610 Collins Ferry Road, P.O. Box 880, Morgantown, WV 26507 ☐ 626 Cochrans Mill Road, P.O. Box 10940, Pittsburgh, PA 15236
1000 Independence Ave., S.W., Washington, DC 20585 ☐ 11025 Dover Street, Suite 1000, Westminster, CO 80021
REPLY TO: Grand Junction Office

DOE–LM/1476–2007

Oxbow Lake Remediation Options Riverton, Wyoming

August 2007

U.S. Department of Energy

Office of Legacy Management

Work Performed Under DOE Contract No. DE–AC01–02GJ79491
for the U.S. Department of Energy Office of Legacy Management.

DOE–LM/1476-2007

Office of Legacy Management

Oxbow Lake Remediation Options
Riverton, Wyoming

August 2007

Work Performed by S.M. Stoller Corporation under DOE Contract No. DE–AC01–02GJ79491
for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado

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Acronyms

CFR	*Code of Federal Regulations*
DOE	U.S. Department of Energy
EA	Environmental Assessment
EPA	U.S. Environmental Protection Agency
FWA	Floodplain/Wetlands Assessment
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
SHPO	State Historic Preservation Officer
T&E	Threatened and Endangered
THPO	Tribal Historic Preservation Officer
UMTRA	Uranium Mill Tailings Remedial Action
USACE	U.S. Army Corps of Engineers

End of current text

1.0 Introduction and Purpose

The selected remedy for remediation of the contaminated ground water associated with the U.S. Department of Energy (DOE), Office of Legacy Management, Riverton, Wyoming, Processing Site is the implementation of a natural flushing strategy, in conjunction with institutional controls and monitoring. Under this remedy, elevated concentrations of contaminants in the shallow alluvial aquifer are predicted to naturally flush to levels below established ground water standards (maximum concentration limits) within approximately 60 years under natural aquifer flow conditions. An Oxbow Lake is located hydrologically downgradient of the contaminated ground water plume. Therefore, the ground water that recharges the Oxbow Lake has elevated concentrations of site-related contaminants.

This paper identifies and analyzes issues associated with five various remedial options designed to eliminate or reduce risk to the ecosystem from elevated uranium concentrations, the primary constituent of concern, currently present in the surface water and crayfish of the Oxbow Lake. Analytical results of surface water samples collected in the lake have ranged from 0.063 to 0.662 milligrams per liter for uranium. Risk assessments have been conducted (Evaluation of Risks Associated with the Riverton, Wyoming, UMTRA Ground Water Site, Stoller 2004, internal memo) and have shown that there is presently no unacceptable risk to humans or the environment from the uranium in the surface water.

The Oxbow Lake is an approximately 1 acre, crescent-shaped lake, which was created as a result of stream bank meandering of the Little Wind River. The lake was formed in 1994 when the meander was cut off from the main river channel. The lake is located on the north side of the Little Wind River in Township 1 South, Range 4 East, Section 10. Figure 1 is an aerial photograph, which shows the regional area and the Oxbow Lake. The land is located on the Wind River Indian Reservation on allotted Tribal lands.

The lake is approximately 3 feet deep at its deepest point. Ground water flowing in the shallow alluvial aquifer recharges the lake. When the Little Wind River water levels are high, surface water from the river intermittently flows into and out of the Oxbow Lake through the restricted, abandoned stream channels. The size of the lake also varies seasonally. Up to 6 acres of wetland and special aquatic habitat exist along the channels and lake.

2.0 Complete Fill-In Option

2.1 Description

Under this option, the Oxbow Lake will be filled in with approximately 17,100 cubic yards of gravel (pit run) up to the average high ground-water level so that ground water no longer daylights and forms a lake. This option significantly reduces the pathway for biological uptake of uranium-contaminated water. The Oxbow Lake will no longer be considered a wetland under this option, and human health and environmental risk would be essentially eliminated.

The construction of a graveled access road into the Oxbow Lake area will be required. All necessary earthen fill material will be acquired from a commercial source; DOE will not conduct any quarrying operations.

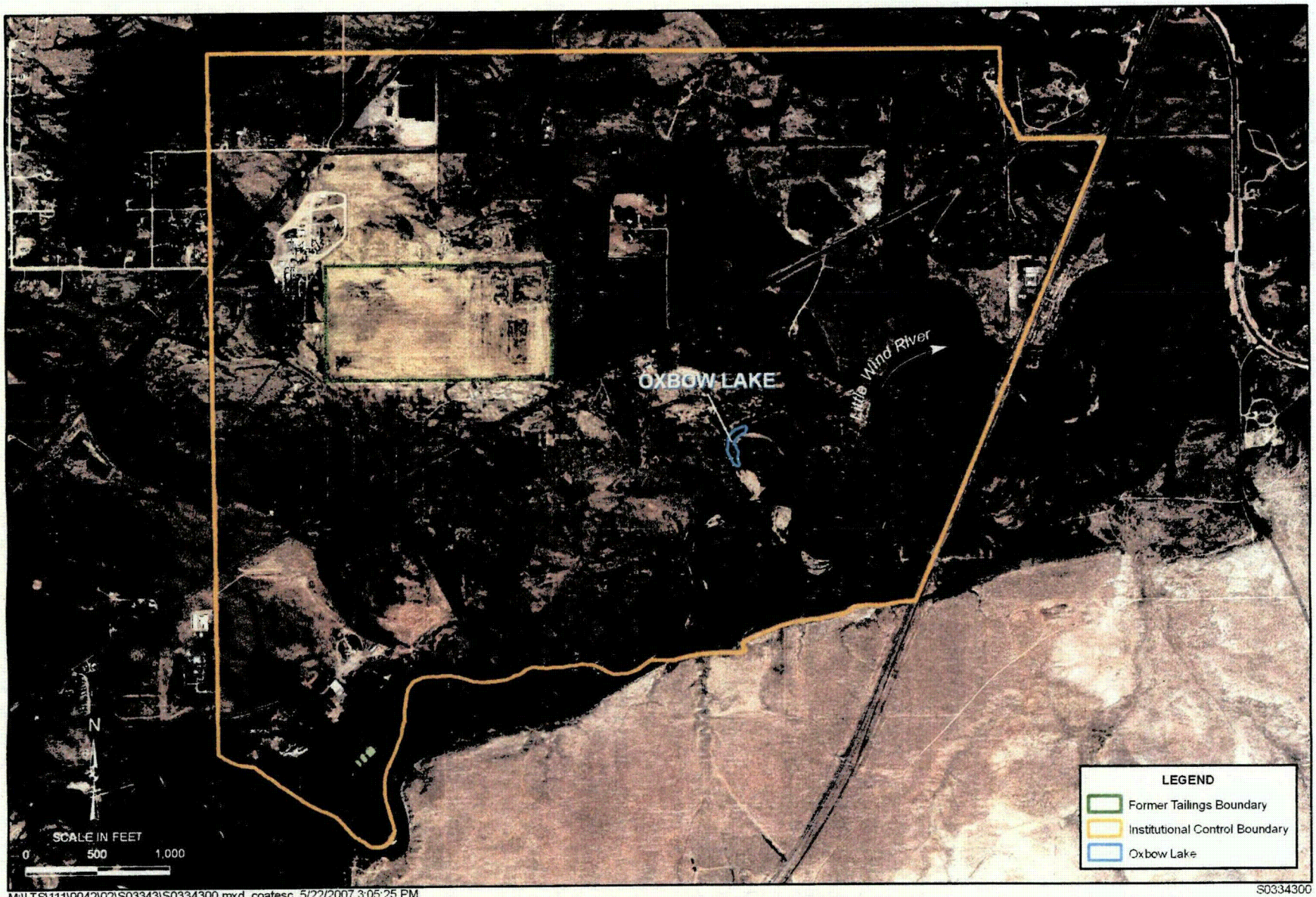

Figure 1. Riverton, Wyoming, Oxbow Lake Location Map

2.2 Landowner/Access Issues

Landowner permission for access to the project area is a critical path concern for this option. This option will require access to the area for any activities and permission must be received from a majority (51 percent interest) of the allottees prior to any activity beginning. The Oxbow Lake area is located within Lot 11 of Tribal Allotted Land Parcel 1628-A and Lot 16 of Tribal Allotted Land Parcel 1629-C.

In addition to access permission, this option, if implemented, would result in major, long-term changes to the current characteristics of the property; landowner concurrence for this remedial option is a major consideration in determining feasibility of this option. Any remediation option would require a majority approval from the allottees of both parcels to conduct the project, to construct a road, and could include compensation for project implementation and the right-of-way. This process would likely entail multiple rounds of notification to, and approval by, parcel allottees that could take up to 2 years to complete. However, DOE is in the process of securing access over an existing road in Parcel 1629-C for future installation of a well on tribal land. If the same survey and road right-of-way application can be amended to include access to the Oxbow Lake area, the process could potentially be shortened.

Landowner/access issues are categorized as a "major consideration" or "applicable" for each of the options in the Summary Table (Table 1) to facilitate option comparisons.

Table 1. Summary Table[a]

Category	Complete Fill-In	Partial Fill-In	Rerouting the River Through the Oxbow	Surface Water Exchange via Pumping	Phytoremediation
Landowner/Access Issues	X[b]	X	X	x[c]	x
Regulatory Items:					
Wetlands/Dredge and Fill	X	X	X	x	
NEPA	x	x	x	x	x
Floodplain	x	x	x	x	
Threatened and Endangered			x	x	
Surface Water				X	
Storm Water	x	x	x		
Water Rights	X	x	x	x	
Air Quality	x	x	x		
Archaeological/Historical	x	x	x		
Relative Total Cost Ranking[d]	2	4	1	3	5

[a]This table is intended to provide a general overview; it should be used in conjunction with associated text discussions.
[b]X = Major/substantial consideration
[c]x = Applicable item
[d]This ranking (scale of 1 to 5) is based on a comparison of estimated Total Costs for each option. The rank of "1" represents the highest overall estimated total cost. The rank of "5" represents the lowest overall estimated total cost.

2.3 Regulatory Issues

The following discussion identifies potential regulatory issues by environmental category as they pertain to this option.

Wetlands/Dredge and Fill

Because of the acreage to be disturbed, the complete fill-in option would require an individual 404 permit issued by the U.S. Army Corps of Engineers (USACE). This is a complex and time-consuming process involving formal wetland delineations, a Section 401 water quality certification, and extensive coordination with federal, state, local, and tribal regulatory agencies. If an individual permit is approved, compliance with permit conditions as assigned by USACE will be required, including restrictions on materials and equipment to be used. At the present time, the average processing time of an individual permit is 2.25 years.

The permit conditions also include wetland mitigation and monitoring requirements. To compensate for temporal loss of wetland functions, USACE generally requires the creation of additional wetlands, often 3 acres or more for each acre disturbed. Under the complete fill-in option, land would be purchased for the mitigation wetlands, water rights would be secured, approximately 9 acres of mitigation wetlands would be constructed, and quarterly-to-annual monitoring would be performed for 3–5 years. The construction of mitigation wetlands generally takes about 6 months. As an alternative to constructing wetlands, mitigation credits can be purchased, if available, to meet the wetland mitigation requirements.

It is unlikely that USACE would approve an individual permit for the complete fill-in option because all wetland disturbances are managed by USACE with the "avoid and minimize" approach. This means that all other less-damaging options must be exhausted before they will permit a project. This would be difficult to demonstrate in the Oxbow Lake, particularly because there is presently no unacceptable risk to human health or the environment posed by the elevated contaminants in the ground water.

NEPA (National Environmental Policy Act)

A short Environmental Assessment (EA) would need to be prepared for this option. It is anticipated that the EA would be less than 30 pages and would require approximately 6 months to process.

Floodplain

Because earthwork would take place in the floodplain of the river, DOE's floodplain and wetland review requirements would apply. The requirements state that all practical measures must be taken to reduce impact to floodplains and wetlands and if options exist with less impact, they should be utilized. It would be difficult, under this option, to demonstrate this because there is presently no unacceptable risk posed by the exposed ground water. However, if this option were chosen, a Floodplain/Wetlands Assessment (FWA) would be prepared and attached to the EA, and a Floodplain/Wetlands Statement of Findings would be included in the final EA. Some public review periods required for the EA process and the floodplain/wetlands are typically combined.

Fish and Wildlife—Threatened and Endangered Species (T&E)
There are no federal- or state-listed fish or their habitat that would be affected by this option. There are no federal- or state-listed wildlife species that are known to inhabit the potentially affected area.

Surface Water Quality
Under this option, only the location of where the Riverton site's shallow alluvial aquifer becomes expressed as surface water will be changed. The non-point source recharge, which currently occurs at the Oxbow, will occur instead at the Little Wind River. The mechanics of how and what is discharged will not be changed. Because both the Oxbow Lake itself and the Little Wind River adjacent to the Riverton site are classified as Class 2AB waters by the State, the surface water quality standard (which only exists for manganese) are the same. All considerations that applied when the natural flushing remedy was selected for the site's contaminants of concern (uranium, sulfate, molybdenum, and manganese) remain the same for this option. No special surface water quality issues or permitting requirements exist for the long-term implementation of this option.

During the short-term (e.g., at the time of implementing this remedy), any increases in turbidity would be addressed through the 404 permit. Also, although the concentrations of contaminants in the Oxbow water are elevated because of a lack of mixing with the river, the initial introduction of the relatively small volume of Oxbow Lake water into the surface water of the river will be of limited duration. No special regulatory considerations apply.

Surface Water—Storm Water
For disturbances greater than 1 acre, a storm-water plan and permit would be required. In Wyoming, on Reservation lands, the U.S. Environmental Protection Agency (EPA) is the permitting authority. Preparation of a plan would require approximately 5 days. The permit would be obtained electronically and there is no charge for a federal permit.

Water Rights
No water rights issues would be associated with the fill activities, but construction of new offsite wetlands would require purchasing water rights with an associated adjudication process. An estimated 27 acre-feet may be required for mitigation wetlands.

Air Quality
Fugitive dust, an air contaminant, is the only air quality issue applicable for this option. Although the State of Wyoming Division of Environmental Quality does not have jurisdiction for activities conducted entirely on Tribal land, their requirements are considered as guidance. State of Wyoming regulations establish that the visible emission standard for anthropogenic fugitive dust be limited to 20 percent opacity, as determined by a qualified observer, and that fugitive dust source operations control fugitive dust emissions to the greatest extent possible through the implementation of best management practices. Relevant sources could include:

- Construction activities (clearing or leveling of land, earthmoving, excavation, moving of construction equipment and trucks over access roads or cleared land, etc.).
- The transporting of materials likely to give rise to airborne dust.
- The handling and storage of material source piles.

Dust control measures, as identified in the regulations, may include watering, the application of chemical stabilization, asphalting unpaved roads, the removal of tracked material from paved roads, and the covering of beds on transport vehicles.

No air quality-operating permits would be required for these new surface area disturbances.

Archaeological/Historical Resources

Areas that are anticipated to be disturbed by construction activities, primarily the access route and oxbow area, would need to be inventoried for cultural resources by a permitted archaeologist before the final engineering design is completed. Results of this "Class III" field inventory might determine the exact location of the access route, as DOE would attempt to avoid cultural sites if present. Assuming cultural sites were not discovered or, if discovered, were completely avoided, DOE's responsibilities under the National Historic Preservation Act would be completed after the Wyoming State Historic Preservation Officer (SHPO) and/or the Tribal Historic Preservation Officer (THPO) (depending upon land ownership of affected areas) were notified of the inventory findings and lack of adverse effect to cultural resources.

Although unlikely, if a cultural site eligible for inclusion in the National Register of Historic Places were discovered in an area to be disturbed and could *not* be avoided, full and open consultation with the SHPO and/or THPO and other affected entities would need to occur. A mitigation plan for the cultural resource would need to be agreed upon and documented in a Memorandum of Agreement before construction could begin. DOE's responsibilities under the National Historic Preservation Act would be completed after the agreement was made and the mitigation was completed.

Regulatory Requirement Summary

Table 1 summarizes the regulatory requirements for this option and identifies the requirements that are considered to be the most substantial. Regulatory requirements for the other options discussed in this paper are also included in Table 1 to facilitate option comparisons.

A relative cost ranking system, using a scale of "1" to "5" (with "1" representing the highest cost), was developed to compare the estimated regulatory costs for this option against the regulatory costs of the other four options. Regulatory costs for this complete fill-in option rank as a "2" (second highest regulatory cost).

2.4 Construction Issues

An engineering and construction design will be prepared to support the construction of a road and the hauling and placement of the approximately 17,100 cubic yards of gravel for this complete fill-in option.

Using the relative cost ranking system discussed in Section 2.3 (scale of "1" to "5," with "1" representing the highest cost) to compare the estimated construction costs for this option against the construction costs of the other four options results in a construction cost rank of "2" (second highest construction cost) for this complete fill-in option.

Using the relative cost ranking system, the Total Overall Estimated Cost (landowner/access, regulatory, and construction) rank for the complete fill-in option is "2" (second highest total

cost). The Total Overall Estimated Cost rank values are included in Table 1 to facilitate option comparisons.

3.0 Partial Fill-In Option

3.1 Description

Under this option, the Oxbow Lake will be partially filled with approximately 12,400 cubic yards of gravel or adjacent native material to a level below the average high ground water level so that the area contains water only during spring runoff when ground water levels are the highest. This option will allow uranium-contaminated water to pond only during high ground water levels and will, therefore, eliminate benthic organisms from living in the lake year round and concentrating uranium. This option will allow the Oxbow Lake to retain wetland status, although the wetland will be classified differently. This option will reduce (but not eliminate) risk as water will be ponded for approximately 2 weeks per year.

The construction of a graveled access road into the Oxbow Lake area will be required. With the exception of the use of material from the adjacent area, all other necessary earthen fill material will be acquired from a commercial source.

3.2 Landowner/Access Issues

Landowner permission for access to the project area is a critical path concern for this option. Previous access and cost discussions in Section 2.2 are also relevant to this option. In addition to access permission, this option, if implemented, would result in major, long-term changes to the current characteristics of the property; landowner concurrence for this remedial option is a major consideration in determining feasibility of this option (see Table 1).

3.3 Regulatory Issues

Wetlands/Dredge and Fill

Because of the wetland acreage to be disturbed, the partial fill-in option would require an individual 404 permit. The permitting process would be similar to the complete fill-in option. It is likely that USACE would require creation of additional wetlands to compensate for temporal loss of wetland functions, but this additional acreage could potentially be created onsite by lowering the topography of the land surrounding the Oxbow Lake. An estimated 3 acres of mitigation wetlands would be constructed in addition to the 3 acres disturbed by filling the Oxbow Lake.

It is unlikely, under the partial fill-in option, that USACE would approve an individual permit for the same reasons outlined under the complete fill-in option.

NEPA

A short EA would need to be prepared for this option. It is anticipated that the EA would be less than 30 pages and would require approximately 6 months to process.

Floodplain
Because earthwork would take place in the floodplain of the river, DOE's floodplain and wetland review requirements would apply. These requirements are the same as those outlined in the complete fill-in option.

Fish and Wildlife (T&E)
There are no federal- or state-listed fish or their habitat that would be affected by this option. There are no federal- or state-listed wildlife or their habitat that would be affected by this option.

Surface Water Quality
The previous discussion in Section 2.3 on long-term surface water quality considerations also applies to this option. There would be no short-term effects to surface water quality under this option. No special surface water quality regulatory considerations apply.

Surface Water—Storm Water
For disturbances greater than 1 acre, a storm-water plan and permit would be required. In Wyoming, on Reservation lands, EPA is the permitting authority. Preparation of a plan would require approximately 5 days. The permit would be obtained electronically and there are no fees associated with a federal permit.

Water Rights
No water rights issues would be associated with the partial fill activities, but construction of new wetlands, either onsite or offsite, would require purchasing water rights. The cost of the water rights are difficult to estimate at this time because it is dependent upon the size of the mitigation wetland (determined by USACE if permitting were approved for this option) and the seniority of the water rights available for purchase.

Air Quality
The previous discussion on fugitive dust control measures in Section 2.3 also applies to this option.

Archaeological/Historical Resources
The previous discussion on cultural resources in Section 2.3 also applies to this option.

Regulatory Requirement Summary
Table 1 summarizes the regulatory requirements for this option and identifies the requirements that are considered to be the most substantial.

Using the relative cost ranking system discussed in Section 2.3 (scale of "1" to "5," with "1" representing the highest cost) to compare the estimated regulatory costs for this option against the regulatory costs of the other four options results in a regulatory cost rank of "3" (third highest regulatory cost) for this partial fill-in option.

3.4 Construction Issues

An engineering and construction design will be prepared to support the construction of a road and the hauling and placement of the approximately 12,400 cubic yards of gravel or adjacent native material for this partial fill-in option.

Using the relative cost ranking system discussed in Section 2.3 (scale of "1" to "5," with "1" representing the highest cost) to compare the estimated construction costs for this option against the construction costs of the other four options results in a construction cost rank of "3" (third highest construction cost) for this partial fill-in option.

Using the relative cost ranking system, the Total Overall Estimated Cost (landowner/access, regulatory, and construction) rank for the partial fill-in option is "4" (forth highest total cost). The Total Overall Estimated Cost rank values are included in Table 1 to facilitate option comparisons.

4.0 Flow-Through Option

4.1 Rerouting the River Through the Oxbow

4.1.1 Description

Under this option, an 800-foot armored diversion structure will be built across the Little Wind River to reroute the river through the Oxbow Lake and back into its original channel, thereby eliminating the Oxbow Lake and the associated risk.

The construction of a graveled access road into the Oxbow Lake area will be required. All necessary earthen material will be acquired from a commercial source.

4.1.2 Landowner/Access Issues

Landowner permission for access to the project area is a critical path concern for this option. Previous access and cost discussions in Section 2.2 are also relevant to this option. In addition to access permission, this option, if implemented, would result in major, long-term changes to the current characteristics of the property; landowner concurrence for this remedial option is a major consideration in determining feasibility of this option (see Table 1).

4.1.3 Regulatory Issues

Wetlands/Dredge and Fill

If the river were rerouted for the sole purpose of flushing the Oxbow Lake, an individual 404 permit would be required. The permitting process would be similar to the complete fill-in option. However, the extent of wetland disturbance would be smaller (restricted to the wetlands on the banks of the river and in the reconstructed channel), so the wetlands mitigation requirement would also be smaller. An estimated 3 acres of mitigation wetlands would be constructed under this option. Construction of the mitigation wetlands could probably be accomplished on site, in areas along the river channel.

The need for an individual 404 permit and mitigation wetlands could be eliminated under this option by making fish habitat restoration an additional project goal. The USACE Omaha District currently offers a General Permit #97-01 for aquatic habitat restoration, enhancement, or creation. This permit includes restoring or creating "habitat on streams, including secondary channels or former channels referred to as oxbows." Under this option, design and construction

of the channel would be coordinated with the Wyoming Game and Fish Department in order to create appropriate fish habitat, and specific design restrictions would apply per conditions of the General Permit (e.g., no more than 1/10 acre of shrub wetland can be disturbed). Obtaining a General Permit would include a wetlands delineation and USACE verification, a Section 401 water quality certification, and coordination with federal, state, local and tribal regulatory agencies. A General Permit is similar to a Nationwide Permit in costs and processing time, currently approximately 10.5 months.

NEPA

A short EA would need to be prepared for this option. It is anticipated that the EA would be approximately 30 pages and would require approximately 6 months to process.

Floodplain

Because construction and earthwork would take place in the floodplain of the river, DOE's floodplain and wetland review requirements would apply. These requirements are the same as those outlined in the complete fill-in option.

Fish and Wildlife (T&E)

There are no federal-listed fish present in the Little Wind River. However, there is one state 'sensitive' fish known to be present in the Little Wind River in the area under consideration. The sauger (*Sander canadensis)* is a type of perch that is considered a game fish but is important to the state of Wyoming because it is genetically pure and may have future importance as related to stock for reproduction. There are no anticipated long-term impacts to the saugers as a result of reconnecting the former meander.

Prior to any channel-disturbing activities, the State Game and Fish Department would require that one of their fisheries biologists examine the particular stretch of river that would be impacted for possible nursery or breeding areas. It is recommended that any channel-disturbing activities be conducted in late fall (i.e., October would be optimal, but prior to mid-November) prior to ice-up; at that time the saugers are moving into deeper holes for the winter. In the spring, the saugers move to spawning areas.

There are no federal- or state-listed wildlife or their habitat that would be affected by this option.

Surface Water Quality

Under this option, the shallow alluvial aquifer becomes expressed as surface water (via non-point source recharge) directly into the Little Wind River. Although the water quality of the recharging ground water will not change, the water will be mixed and moved directly with the river as recharging occurs. Because both the Oxbow Lake and the Little Wind River adjacent to the Riverton site are classified as Class 2AB waters by the State, their surface water quality standards are the same. All surface water considerations that applied when the natural flushing remedy was selected for the Riverton site remain the same for this option. Any concentration variations between the water quality of the Oxbow Lake and the river at the time of implementing this option will be quickly obviated by the volume of water in the river. No special surface water quality issues or permitting requirements exist for the implementation of this option.

Surface Water—Storm Water

For disturbances greater than 1 acre, a storm-water plan and permit would be required. In Wyoming, on Reservation lands, EPA is the permitting authority. Preparation of a plan would

require approximately 1 week. The permit would be obtained electronically and there are no fees associated with a federal permit.

Water Rights

Surface water rights are not an issue under this option because water is not being appropriated or diverted through a diversion structure. If fish habitat restoration is not incorporated into the design (not recommended) and an individual permit is therefore required, the construction of new onsite mitigation wetlands may require purchasing water rights. The cost of the water rights would be dependent upon the size of the mitigation wetlands and the seniority of the water rights available for purchase.

Air Quality

The previous discussion on fugitive dust control measures in Section 2.3 also applies to this option.

Archaeological/Historical Resources

The previous discussion on cultural resources in Section 2.3 also applies to this option.

Regulatory Requirement Summary

Table 1 summarizes the regulatory requirements for this option and identifies the requirements that are considered to be the most substantial.

Using the relative cost ranking system discussed in Section 2.3 (scale of "1" to "5," with "1" representing the highest cost) to compare the estimated regulatory costs for this option against the regulatory costs of the other four options results in a regulatory cost rank of "4" (fourth highest regulatory cost) for this rerouting the river option.

4.1.4 Construction Issues

An engineering site study will be conducted, and an engineering and construction design will be prepared to support the construction of a road and the hauling and placement of material needed to create and stabilize an 800-foot armored diversion structure for this river rerouting option.

Using the relative cost ranking system discussed in Section 2.3 (scale of "1" to "5," with "1" representing the highest cost) to compare the estimated construction costs for this option against the construction costs of the other four options results in a construction cost rank of "1" (highest construction cost) for this rerouting the river option.

Using the relative cost ranking system, the Total Overall Estimated Cost (landowner/access, regulatory, and construction) rank for the rerouting the river through the oxbow option is "1" (highest total cost). The Total Overall Estimated Cost rank values are included in Table 1 to facilitate option comparisons.

4.2 Surface Water Exchange via Pumping

4.2.1 Description

Under this option, solar powered pumps will pump water into and out of the Oxbow Lake via piping to reduce contaminant concentrations. One pump will intake water from the Little Wind River and pump it into the Oxbow Lake at the upgradient end, while another pump will simultaneously pull water from the Oxbow Lake on the downgradient end and discharge it into the Little Wind River adjacent to the property. Pump operation will be monitored via telemetry. This option will not operate during the winter months. Risk will be reduced, as uranium concentrations are expected to decline, but will not be eliminated because the Oxbow Lake will still exist and uranium concentrations will rebound during the winter when pumping is shut down. However, access to the water in the Oxbow Lake would remain limited in its iced-over winter condition.

4.2.2 Landowner/Access Issues

Landowner permission for access to the project area is a critical path concern for this option. Previous access and cost discussions in Section 2.2 are also relevant to this option. If implemented, this option would not result in major, long-term changes to the current characteristics of the property. Although necessary, landowner concurrence for this remedial option is not as major of a consideration for determining feasibility for this option as it is for some of the other options (see Table 1).

4.2.3 Regulatory Issues

Wetlands/Dredge and Fill

Installation of the pumping stations would entail minimal disturbance to wetlands and the banks of the river. Therefore, this option would probably qualify for a Nationwide 404 Permit #7 (construction of outfall structures and associated intake structures). This Nationwide Permit would require wetland delineations and USACE verification, coordination with federal, state, local and tribal regulatory agencies (including National Pollutant Discharge Elimination System [NPDES] regulations) and compliance with USACE permit conditions (generally less strict than individual permit restrictions). At this time, Nationwide permits average 10.5 months for processing time.

NEPA

A short EA would need to be prepared for this option. It is anticipated that the EA would be less than 30 pages and would require approximately 6 months to process.

Floodplain

Because installation of the pump stations would take place in the floodplain of the river, DOE's floodplain and wetland review requirements would apply (10 CFR 1022). An FWA would be prepared and attached to the EA, and a Floodplain/Wetlands Statement of Findings would be included in the final document.

Fish and Wildlife (T&E)

There are no anticipated impacts to federal- or state-listed fish as a result of this option. However, prior to final selection of the pump intake and outfall areas, the Wyoming Game and Fish Department would need to be consulted to ensure that no spawning or nursery areas for the state-listed saugers (*Sander canadensis)* would be impacted. This consultation would require a fisheries biologist to evaluate the areas under consideration prior to a final determination of the pump locations. As stated earlier, the Little Wind River contains genetically pure sauger that the State considers important to its fisheries.

There are no federal- or state-listed wildlife or their habitat that would be affected by this option.

Surface Water Quality

The federal Clean Water Act provides that the discharge of any pollutants from a point source into surface water of the United States must be regulated under the NPDES Program. Because the confined conveyance of the water from the Oxbow Lake would not qualify as natural conditions, an NPDES permit will be required for the point source discharge into the Little Wind River. EPA will have jurisdictional authority over the discharge because the discharge point will be located within the Wind River Reservation. Pollutants (defined as contamination or other alteration of the physical, chemical or biological properties of any waters) will likely require weekly monitoring. Likely parameters would include suspended solids, algae, dissolved oxygen, temperature, pH, and flow rate. Monitoring for site contaminants of concern would probably not be required because the recharge water will be so diluted. The water quality limits, as established in the permit, would need to be obtained in order for discharging to occur. Monitoring may also be required to ensure that erosional control measures are minimizing erosion at the point of discharge. The submittal of quarterly discharge monitoring reports to EPA will be required. A consultation meeting should be held with EPA prior to preparing the application. It would take approximately 40 hours to complete the permit application and negotiate monitoring parameters and limits with EPA. For a new permit, it would take approximately 3 months for the permit application to be processed. A required 30-day public notice period is included in the 3-month time frame. There is no permitting fee. The permit and associated monitoring and reporting would likely be required to be maintained for the duration of the discharge (e.g., 60 years).

Surface Water—Storm Water

Because less than 1 acre will be disturbed, a storm water permit will not be required.

Water Rights

A Point of Diversion permit would be required from the Wyoming State Engineer's Office for a non-consumptive surface water right for transporting the water through the pipelines.

Air Quality

Not likely to apply. The potential for dust emissions are greatly reduced under this option because of the smaller area of disturbance.

Archaeological/Historical Resources

Not likely to apply. The potential for new surface disturbances to occur under this option is greatly reduced. Areas of new disturbance would need to be evaluated as specified in Section 2.3

Regulatory Requirement Summary

Table 1 summarizes the regulatory requirements for this option and identifies the requirements that are considered to be the most substantial.

Using the relative cost ranking system (scale of "1" to "5," with "1" representing the highest cost) to compare the estimated regulatory costs for this option against the regulatory costs of the other four options results in a regulatory cost rank of "1" (the highest regulatory cost) for this surface water exchange via pumping option.

4.2.4 Construction Issues

Using the relative cost ranking system discussed in Section 2.3 (scale of "1" to "5," with "1" representing the highest cost) to compare the estimated construction costs for this option against the construction costs of the other four options results in a construction cost rank of "5" (lowest construction cost) for this surface water exchange via pumping option.

Using the relative cost ranking system, the Total Overall Estimated Cost (landowner/access, regulatory, and construction) rank for the surface water exchange via pumping option is "3" (third highest total cost). The Total Overall Estimated Cost rank values are included in Table 1 to facilitate option comparisons.

5.0 Phytoremediation

5.1 Description

The phytoremediation option would make use of specialized plant communities to reduce contaminant availability to organisms in the Oxbow Lake. Phytoremediation generally works in three different ways to reduce contamination in a system: phytodegradation (the breakdown of toxic compounds by plant metabolism), phytoextraction (the accumulation of compounds through uptake by plants), and phytostabilization (reducing the movement or availability of materials in the environment).

Phytodegradation is not possible with radionuclides. Phytoextraction is a possibility in the Oxbow Lake, but contaminants would accumulate in plant tissues. These contaminants may become harmful to herbivores unless the plants were regularly mowed and removed. Phytostabilization is likely the best phytoremediation option for the Oxbow Lake. If this option were chosen, contaminants would remain in insoluble form and become less available to plants and animals in the area. However, the insoluble contaminants could accumulate in sediments, necessitating monitoring (at approximately 5 year intervals). Although it is unlikely, periodic dredging of sediments may be necessary over time if contaminant concentrations reach unacceptable levels.

In order to implement the phytoremediation option, site characterization would need to be performed and pilot plots would need to be constructed to determine the most appropriate species and planting plans for the site's conditions and contaminants. The most successful phytoremediation strategy would then be implemented across the Oxbow Lake. It is recommended that qualified professionals experienced with phytoremediation of uranium and

heavy metals be subcontracted to perform the work. The subcontractor would design, pilot, test, implement, and monitor the project until the desired reductions have been achieved.

5.2 Landowner/Access Issues

Landowner permission for access to the project area is a critical path concern for this option. Previous access and cost discussions in Section 2.2 are also relevant to this option. If implemented, this option would not result in major, long-term changes to the current characteristics of the property. Although necessary, landowner concurrence for this remedial option is not as major of a consideration for determining feasibility for this option as it is for some of the other options (see Table 1).

5.3 Regulatory Issues

Wetlands/Dredge and Fill
Because no dredge and fill activities would occur within wetlands, and activities would be conducted in such a way as to avoid disturbance to wetlands (e.g., restrict vehicle access to upland areas), no 404 permits would be required for the phytoremediation option.

NEPA
This option could be considered categorically excluded from further EA under exclusionary criteria B3 or B6.

Floodplain
Because no construction within floodplains or dredge/fill activities within wetlands would be associated with the phytoremediation option, DOE's floodplain and wetland review requirements would not apply.

Fish and Wildlife (T&E)
There are no federal- or state-listed fish or their habitat that would be affected by this option.
There are no federal- or state-listed wildlife or their habitat that would be affected by this option.

Surface Water Quality
There are no surface water quality regulatory issues associated with this option.

Surface Water—Storm Water
Because less than 1-acre will be disturbed, a storm water permit will not be required.

Water Rights
No water rights issues are associated with the phytoremediation option.

Air Quality
Not likely to apply. The previous discussion on fugitive dust control measures in Section 2.3 also applies to this option, but the potential for dust emissions is greatly reduced.

Archaeological/Historical Resources
Not likely to apply. The potential for new surface disturbances to occur under this option is greatly reduced. Areas of new disturbance would need to be evaluated as specified in Section 2.3.

Regulatory Requirement Summary
Table 1 summarizes the regulatory requirements for this option and identifies the requirements that are considered to be the most substantial.

Using the relative cost ranking system (scale of "1" to "5," with "1" representing the highest cost) to compare the estimated regulatory costs for this option against the regulatory costs of the other four options results in a regulatory cost rank of "5" (the lowest regulatory cost) for this phytoremediation option.

5.4 Construction Issues

Using the relative cost ranking system (scale of "1" to "5," with "1" representing the highest cost) to compare the estimated regulatory costs for this option against the regulatory costs of the other four options results in a regulatory cost rank of "4" (fourth highest regulatory cost) for this phytoremediation option.

Using the relative cost ranking system, the Total Overall Estimated Cost (landowner/access, regulatory, and construction) rank for the phytoremediation option is "5" (lowest total cost). The Total Overall Estimated Cost rank values are included in Table 1 to facilitate option comparisons.