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Management Plan for Protection and Monitoring of
Lake Ladora, Lake Mary and Lower Derby Lake During RMA Remediation

1. Introduction: Section 9.1, Record of Decision (ROD) for the On-Post Operable Unit, Rocky Mountain Arsenal (RMA) (FWENC 1996) contains the following language:

- “Water levels in Lake Ladora, Lake Mary, and Lower Derby Lake will be maintained to support aquatic ecosystems. The biological health of the ecosystems will continue to be monitored.”

The purpose of this management plan is to further define the conditions that are required to be maintained in Lake Ladora, Lake Mary, and Lower Derby Lake (hereinafter “the Lakes). The U.S. Army (Army), Shell Oil Co. (Shell), U.S. Fish and Wildlife Service (Service), U. S. Environmental Protection Agency (EPA), and Colorado Department of Public Health and Environment (CDPHE) agree that if the Lakes are maintained in the conditions specified herein, the requirements of the ROD related to maintenance of water levels in the Lakes to support aquatic ecosystems, and monitoring of those systems, are met.

2. Term: This plan is effective from the date of the last signature until the end of the remedy. For the purposes of this plan, the end of the remedy means: the date on which EPA approves the final Construction Completion Report for the last cap and/or cover system required to be constructed under provisions of the ROD.

3. Aquatic Ecosystem Goals:

A. Lake Ladora and Lake Mary: This plan is designed to maintain sufficient quantity and quality of water in the Lake Ladora and Lake Mary to support a warm water recreational fishery. The Lakes will be managed to provide an ecosystem that sustains populations of green sunfish, bluegill sunfish, largemouth bass and other native or desirable naturalized game and forage fish species, as determined by the Service.

Predatory game fish are at the top of the food chain within the aquatic ecosystem, and maintenance of populations of species such as largemouth bass in sufficient numbers to sustain a quality recreational fishery is a reliable indication of the overall health of the ecosystem. Presence of those fish populations is not possible without a supporting food chain of invertebrate and vertebrate prey species reliant on the plant community and a healthy physical environment.

B. Lower Derby Lake: This plan is designed to maintain sufficient water quality and quantity in Lower Derby Lake to support a minimum of 50,000 use-days by migratory waterfowl during the period of October - April, annually. Target species include: mallard; gadwalls; blue-winged teal; green-winged teal; northern shoveller; American widgeon; cinnamon teal; pintail; wood duck; ring-necked duck; lesser scaup;

greater scaup; canvasback; redhead; common goldeneye; bufflehead; common merganser; red-breasted merganser; hooded merganser; and Canada goose.

Seasonal drawdowns of Lower Derby Lake during the spring and summer months will promote the growth of aquatic and wetland vegetation and stimulate populations of aquatic and terrestrial invertebrates at the lake's edge that provide the plant and animal food base required by waterfowl during the wintering and fall and spring migration periods. However, sufficient water must be maintained through the summer to support aquatic vegetation as a direct waterfowl food source and invertebrate substrate.

This management scheme meshes well with requirements of the remedy as water demands for the remedy are highest during the summer months and Lower Derby Lake will serve both as a significant aquatic wildlife habitat and as a water source for remedy related dust suppression and irrigation for grassland restoration.

This management regime will insure that water levels maintained in Lower Derby Lake are adequate for maintenance of the desired aquatic ecosystem. However, this management regime is also likely to result in occasional dewatering and exposure of contaminated sediments in Lower Derby Lake. The Interim Rocky Mountain Arsenal Institutional Control Plan (IRMAICP) (RVO 2006) addresses those periods when contaminated sediments may not be inundated. The IRMAICP defines restrictions to access and excavation and requires signs to be posted around Lower Derby Lake and worker training to minimize the potential for human exposure to contaminated lake sediments.

While the primary ecological function of Lower Derby Lake, for the duration of the surface remedy, is to provide waterfowl habitat, the Service may also conduct fishery management activities. If possible, warm water game fish and native and desirable naturalized forage fish will also be maintained in Lower Derby Lake. The purpose of the fishery is two-fold: to maintain predators to prevent or reduce infestation of the lake by common carp that are detrimental to waterfowl objectives; and to provide a base for potential future sportfishing opportunities.

4. Water Quality: Water in the Lakes must meet surface water quality standards of the State of Colorado, CDPHE, Water Quality Control Commission Regulation No. 31, specifically the requirements found in section 31.11, Basic Standards Applicable to Surface Waters of the State, and applicable standards for Physical and Biological Parameters, Metals and Inorganic Compounds, based on Use Classifications established by the State for these waters per Section 31.13 of the regulation. The Lakes are currently designated by the State of Colorado as part of Segment 16 of the South Platte River Drainage. This segment has a Class 2 aquatic life waters classification and is not a source of drinking water (Colorado Water Quality Control Commission).

5. Water Quantity: Requirements for minimum lake levels are established to maintain aquatic ecosystems in the Lakes. It is recognized that remedial activities require significant volumes of water from the lakes for dust control and irrigation for

revegetation. Depending on the annual water budget, maintaining full pools in the Lakes may be difficult during drought years. Maintenance of full pools is not necessary, to meet ecosystem goals of sustaining a warm water fishery. Indeed, maintaining full pool levels in the Lakes on a continuing basis is not ecologically desirable. In the prairie environment, natural water bodies fluctuate seasonally and over short and long-term climatic cycles. Dynamic water levels in the Lakes will partially emulate natural processes that recycle nutrients, create new and different habitat conditions and maintain or improve the overall biological health of the aquatic ecosystem of the Lakes.

Maintenance of the following minimum lake levels will insure that adequate water quantity is available to support the desired aquatic ecosystem.

A. Lower Derby Lake (full pool 454 ac. ft.) may be reduced 85% to approximately 68 ac. ft. The minimum elevation of the pool is 5237' msl.

B. Lake Ladora (full pool 415 ac. ft.) may be reduced 27% to approximately 300 ac. ft. The minimum elevation of the pool is 5217' msl.

C. Lake Mary (full pool 66 ac. ft.) may be reduced 10% to approximately 60 ac. ft. The minimum elevation of the pool is 5202.5' msl.

6. Biological Community: No conditions are established for fish populations or other components of the Lakes' biological community for the purposes of compliance with the ROD. The Service will manage the habitat, and aquatic plant and animal populations of the lakes in accordance with the approved refuge Comprehensive Management Plan (FWS 1996) and future step-down management plans (e.g. Fishing/Fisheries Management Plan, FWS TBP) to meet refuge goals for wildlife habitat and recreational fishing. The Lakes are all man-made impoundments and support aquatic ecosystems dominated by fish species that are not native to eastern Colorado. Management intervention, including stocking desirable forage and game fish species and carp control may be required periodically.

7. Monitoring for Biological Health: With regard to the Lakes, the ROD requires that: "The biological health of the ecosystems will continue to be monitored". Three types of surveys will constitute the monitoring program for the Lakes:

A. Water Quality Monitoring :

(1): Monitoring by Army: RVO performers monitor surface water quality in accordance with the Rocky Mountain Arsenal Surface Water Monitoring Program Sampling and Analysis Plan (SAP) (FWENC 2001). Lake Ladora, Lower Derby Lake, and Lake Mary are sampled once annually and analyzed for 29 analytes including six organochlorine pesticides, four anions, twelve metals/cations, five nutrients and dissolved organic carbon and total organic carbon. The full list of analytes is found at Table 3.1-1 of the SAP. This monitoring is conducted to comply with Remedial Action Objectives for ecological protection contained in Sections 7.2.2 and 7.4.2 of the ROD:

- Ensure that biota are not exposed to biota COCs in surface water in concentrations capable of causing acute or chronic toxicity.
- Ensure that biota are not exposed to COCs in soil and sediment at toxic concentrations via direct exposure or bioaccumulation.

This monitoring will continue as long as it is required by the ROD, or until the SAP is modified or replaced by new approved procedures. Results are reported per the approved Surface Water Monitoring Program, a responsibility of Army.

To date, there have been no exceedances of State surface water quality standards detected in Lake Ladora, Lake Mary or Lower Derby Lake for any of the 29 analytes listed in the SAP. Temporary excursions of pH and dissolved oxygen (DO) outside standards are expected to occur occasionally in these types of aquatic systems and have occurred rarely. These excursions are not biologically significant and are relatively common artifacts of daily weather patterns in shallow irrigation reservoirs in eastern Colorado.

(2): Water Quality Monitoring by the Service: In order to acquire baseline data for preparation of a new Fishery Management Plan, the Service conducted water quality sampling in Lake Ladora, Lake Mary and Lower Derby Lake in 2005 per the Aquatic Survey Plan for RMA NWR (FWS 2005). Parameters examined were: Temperature; DO; pH; ammonia; turbidity; total residual chlorine; conductivity; and total nutrients (N and K).

On an annual basis, typically in June, the Service will continue to monitor the following parameters, as a minimum, throughout the term of this plan: DO; temperature; pH, turbidity, nutrients (N and K), and chlorine, and make regular (not less than quarterly) visual inspections of the Lakes for conditions identified (e.g. floating debris, scum, bottom sludges, surface films, unusual water color or odors).

B. Biological Surveys: Health of the desired aquatic ecosystem in each lake will be monitored annually by the Service. This population monitoring will be in addition to any aquatic monitoring required in the Site-Wide Biological Monitoring Plan to be completed by the BAS in 2006.

(1) Lake Ladora and Lake Mary: Fish population surveys will be conducted each spring. Sampling will include overnight sampling using 125'X6" (3/4 to 3") monofilament experimental gill nets. Fish captured will be identified to species, individually measured and counted. This sampling provides a population index and continues a long-term data set compiled by the Service's Colorado Fish and Wildlife Assistance Office. These data are a primary aid in making fish management decisions.

In addition to gill net sampling, electroshocking will be conducted each year, depending on availability of assistance from the Colorado Division of Wildlife. When combined with the gill net surveys, electroshocking surveys provide a desirable and more complete

assessment of the total fishery, capturing data on small forage species and young of the year of larger game species.

(2) Lower Derby Lake: Fish population surveys, per (1) above will also be conducted in Lower Derby Lake. However, the principle biological monitoring for compliance with this plan will be the Monthly Waterfowl Survey, conducted October – April each year. Waterfowl use-days are calculated by multiplying the mean of consecutive counts by the number of days between surveys.

C. Water Quantity (Lake Level) Monitoring: Beginning in January, 2006, and continuing throughout the term of this plan, the Service will monitor and record lake levels on a monthly basis between the 1st and 10th day of each month. Measurements will be taken at the staff gauge located at the outlet structure of each lake that are surveyed and calibrated to measure elevations msl (above mean sea level).

Any time lake levels are found to be at or approaching the minimum levels specified in paragraph 3, above, the Refuge Manager will report the situation to the Army Program Manager. The Refuge Manager and Program Manager will negotiate a solution to maintain and/or restore minimum lake levels in accordance with the Memorandum of Understanding between the U. S. Army and the Department of the Interior/U. S. Fish and Wildlife Service To Accomplish the Transition of Rocky Mountain Arsenal into the Rocky Mountain Arsenal National Wildlife Refuge (Army, FWS 1999). Within five working days of reporting to the Army Program Manager, the Refuge Manager will notify EPA and CDPHE of the situation and advise those agencies of the Army/FWS plans for restoring lake levels.

8. Reports: Not later than March 1, annually, the Service will provide the Army, EPA, and CDPHE with a report containing the following information:

A. Due March 1, 2006 for 2005, the results of all sampling conducted pursuant to the Service's 2005 Aquatic Survey Plan, including: Fish populations, invertebrate populations, water quality data, and fish health assessment data for all lakes and waterfowl use-days for Lower Derby Lake for the period October – December 2005.

B. For 2006, through the remaining term of this plan, data from the Service's water quality surveys of all lakes, fish population data for Lake Ladora and Lake Mary, waterfowl use-days for Lower Derby Lake, and monthly lake level measurements for all lakes.

9. References:

Colorado Department of Public Health and Environment, Water Quality Control Commission. 1979 (as amended). Regulation 31. Basic Standards and Methodologies for Surface Water (5 CCR 1002-31).

Department of the Army and Department of the Interior (Army, DOI). 1999.

Memorandum of Understanding between the U. S. Army and Department of the Interior/U. S. Fish and Wildlife Service to Accomplish the Transition of Rocky Mountain Arsenal into the Rocky Mountain Arsenal National Wildlife Refuge.

Foster Wheeler Environmental Corporation (FWENC). 1996. *Record of Decision for the On-Post Operable Unit.*

FWENC. 2001. *Rocky Mountain Arsenal Surface Water Monitoring Program Sampling and Analysis Plan.*

Remediation Venture Office (RVO). 2006 (TBP). *Interim Rocky Mountain Arsenal Institutional Control Plan.*

U. S. Fish and Wildlife Service (FWS). 1996. *Rocky Mountain Arsenal National Wildlife Refuge Comprehensive Management Plan.*

FWS. 2005. *Aquatic Survey Plan for Rocky Mountain Arsenal National Wildlife Refuge.*

FWS. (TBP). *Fishing/Fisheries Management Plan.*