MKEC ENGINEERING CONSULTANTS, INC.
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LETTER OF TRANSMITTAL

PROJECT: EOD Disposal Facility

PROJECT NO: 06530

DATE: November 3, 2006

TO: Scott Lindebak, P.E./Vicky Huang, P.E.
City of Wichita – Engineering Division
455 N. Main – 7th Floor
Wichita, Kansas 67202

We are sending you the following items:
✓ Attached
____ Under separate cover
✓ Via Delivery

____ Drawings ____ Specifications ____ Maps

____ Computer Disks ____ Petitions ✓ Other

COMMENTS: Sending two (2) copies of the Drainage Report for the EOD Disposal Facility Project, Wichita, Kansas.

____ For Your Approval ____ As Requested

✓ For Your Use ____ For Your Files

____ Approved As Noted ____ For Review and Comment

REMARKS: Please call me if you have any questions.

Signed: Kara Anderson by cw
Kara Anderson, P.E.

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MKEC ENGINEERING CONSULTANTS, INC.
Kansas City Oklahoma City Wichita

November 3, 2006

Mr. Scott Lindebak
Engineer, Stormwater Management
City of Wichita
455 N. Main, 7th Floor
Wichita, KS 67202

Re: EOD – Wichita, Kansas
COW Drainage Criteria

Dear Mr. Lindebak:

Enclosed please find a drainage report for the Explosive Ordnance Device (EOD) Disposal Facility. The Engineering Division Stormwater Management Subdivision Submittal Checklist was used as a guide in preparation of this report. As a first draft through the report, we maintained the order of the report as it is in the checklist. We found it difficult to keep the report clear and concise. I have included a draft copy of the report with this format.

In further revisions of the report we tried to adapt the checklist to fit with the design process of the project. The bound report for this project is in the modified format. I have also included an outline of format that includes references to the sections from the Stormwater Management Submittal Checklist.

I understand that this checklist is a currently a working document and would like to share our first experience with you. Please feel free to contact us with any questions you might have, or if additional information is needed.

Sincerely,

MKEC ENGINEERING CONSULTANTS, INC.

Kara L. Anderson

Kara L. Anderson, P.E.

Cc: Greg Allison, MKEC

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I) Existing Conditions Description

A) Site Location , reference USGS Map (APPENDIX – USGS Map) *(1A)*
B) Surrounding Area – offsite conditions that are important**(1C)*
C) Vegetation, reference color Aerial (APPENDIX - Color Aerial Photograph) *(2A & 2H)*
D) Existing topo and slopes (1-foot contours, max of 2-foot)* (APPENDIX – Existing Drainage Plan) *(2C)*
E) Benchmark* *(2E)*
F) Streams/water bodies* - location, description etc. *(2F)*
G) On-site impervious/pervious areas *(2D)*
   1) Site use
   2) Location of roads, bldgs. Etc.* *(2J)*
   3) *Conservation areas*, natural feature protection – setbacks etc.* *(2I)*
H) Soil type, reference soil survey (APPENDIX - Soil Survey) *(2G)*
I) Existing utilities and easements* *(2K)*
J) Existing drainage
   1) Flow pattern* *(2M)*
   2) Conveyance systems – sws, natural swales etc* *(2L)*
   3) Existing Channels* *(2N)*
K) Discuss Floodplain Issues
   1) Provide source of flood profile – include FIRM/FBFM (APPENDIX – FIRM/FBFM)
   2) Nearest base flood elevations*
   3) Delineation of pre-developed regulatory floodplain/floodway limits*
   4) Modeling (was/was not required)

II) Existing Conditions - Hydrologic Analysis

A) Runoff Method *(2B)*
B) Curve number selection *(2Q)*
C) Time of concentration calculation (APPENDIX – Tc Calculations) *(2P)*
D) Hydrologic analysis of 2, 5, 10, 25 and 100-year, 24 hour storm event (APPENDIX – Hydrologic Output) *(2O)*
E) Downstream capacity *(2R)*
F) Existing structure elevations* *(2S)*
G) Existing channel analysis (APPENDIX – Hec-Ras) *(2T)*
H) Groundwater elevation for basements* *(2U)*

*Indicates item should be shown on Existing Conditions Map

III) Proposed Conditions Description

A) Development description (APPENDIX – Plat) *(1F)*
B) Lowest Openings on Plat (APPENDIX – Plat) *(3U)*
C) Proposed impervious areas
   1) Site use
   2) Location of roads, bldgs. Etc.** *(3M)*
   3) Discuss conservation areas, natural feature protection – post development**
D) Proposed drainage(APPENDIX – Proposed Drainage Plan)
   1) Flow Pattern**
   2) Conveyance systems – SWS, natural swales, etc.**
   3) Channels
   4) Ponds and Drainage ways
      (a) Emergency overflow structure's flow path *(3R)*
      (b) Proposed Contours *(3D)*

E) Benchmarks**

F) Proposed utilities and easements (APPENDIX – Utility Plan) *(3N)*
   (a) Utilities located within easements
   (b) Stormwater Management Facilities located within a Reserve *(3V)*

G) Floodplain
   1) Delineation of post-development regulatory floodplain and floodway limits ** *(00)*
   2) Floodplain boundary determination per elevation** *(00)*
   3) Source of floodway data table and discharges (APPENDIX) *(00)*
   4) Hydrologic study information for floodplain studies, unnumbered Zone A area elevation determinations and floodplain map revisions (APPENDIX) *(00)*
   5) Regulatory floodway and 4 natural profile models (10, 50, 100, 500-year) for existing and future watershed conditions (APPENDIX) *(00)*
   6) Location of floodplain/way limits and relationship of site to up/downstream properties *(00)* **
   7) Floodplain/ways located in reserve ** *(00)*

H) Evidence of acquisition of all necessary legal documents – attach copies at the end of Section VII *(6A)*

I) Maintenance of stormwater management facility specified in the platters text as the responsibility of homeowner of business association *(6B)*

IV) Proposed Conditions - Hydrologic Analysis

A) Runoff Method

B) Curve number selection *(3C)*

C) Time of concentration calculation (APPENDIX– Tc Calculations) *(3B)*

D) Hydrologic Analysis – 2, 5, 10, 25 and 100-year storm (APPENDIX) *(3A)*

E) Calculation of stormwater controls – Ponds & Drainageways (APPENDIX – calculations, may be HF output) *(3E)*
   1) Drainage area** *(3E)*
   2) Storage - general *(3E)*
   3) Outlet configuration - general *(3E)*
   4) Stage-storage discharge or outlet rating curves and inflow and outflow hydrographs *(3F)*
   5) Detention pond design/elevations
      (a) Normal Pool and Pond Bottoms *(3J)*
      (b) Define and show 10 and 100-year HWL** *(3T)*
      (c) Detention facilities provide 1 foot of freeboard above HWL and emergency outfall** *(3S)*
   6) Preliminary location and dimension of proposed channel modifications such as bridge or culvert crossings *(3P)*
   7) Dam Safety *(3H)*

F) Structural Details and specifications of structural control designs, outlet structures, embankments, spillways, grade control structures, conveyance channels, etc.** *(3K)*

G) Stormwater Sewer
   1) Location of proposed conveyance systems such as storm drains, inlets, catch basins, channels, swales, and areas of overland flow** *(3P)*
   2) Preliminary selection and location of stormwater sewer controls**(3Q)
   3) Sizing calculations *(3E & 3I)*

H) Grading Plan (APPENDIX – Lot Grading Plan) *(1G)*
   1) Limits of clearing and grading (Included on GP) *(3L)*

I) Final analysis of potentential upstream/downstream impact/effects of project where necessary

**Indicates item should be included in Proposed Conditions APPENDIX *(00)*

V) Floodplain Submittal

A) Source of flood information
   1) Flood Profile*(4A)*
   2) Floodway data table and discharges*(4A)*

B) Nearest base flood elevations *(4B)*

C) Delineation of regulatory floodplain and floodway limits
   1) pre-developed *(4C)*
   2) post-developed *(4D)*
   3) Floodplain boundary limits determination per elevation (project limits shown) *(4E)*

D) Hydrologic and hydraulic study information for site-specific floodplain studies, unnumbered Zone A area elevation determinations and floodplain map *(4G)*

E) Regulatory floodway and four natural profile models (10, 50, 100, and 500-year) *(4H)*
   1) pre-developed
   2) post-developed

F) Location of floodplain/floodway limits and relation ship of site to upstream/downstream properties (floodplain limits to be per elevation and scaled location) *(4I)*

G) Floodplains and floodways located within a Reserve *(4J)*

VI) Summary

A) Site Location *(1A)*

B) Discussion of development, existing conditions, and proposed impacts on stormwater, wetland riparian and floodplain *(1B)*

C) Summary of runoff calculations (pre/post development) no increase in peak discharge for all storm series *(1D)*

D) Compare pre/post development flow rates, velocities *(00)*
   1) Impact on stormwater, wetlands, riparian areas, channels etc. *(00)*

E) Up/downstream impacts *(00)*

F) Permanent BMPs *(1E)*

VII) Applicable Federal and State Permits *(5A, 5B, 5C, 5D, 5E, 5F, & 5G)*

Name of Permit	Regulating Agency	Applicable to Project (Y/N)	Describe how permit pertains to project	Application Date	Regulator Response (Y/N)
401 Water Quality Certification	USACE				
404 Permit	USAC				
Stream Obstructions	Kansas DWR				
Channel Change	Kansas DWR				
Floodplain Fill	Kansas DWR				
Water Appropriations	Kansas DWR				
LOMA	FEMA				
CLOMR	FEMA				
LOMR	FEMA				
LOMR-F	FEMA				
	KDWP				
	KDOT				
	U.S. Fish and Wildlife				
Notice of Intent	KDHE				
	EPA				
OTHER	OTHER				

VIII) Other

A) CD of drainage plan in PDF format *(6C)*

B) Stamp of PE on cover *(1H)*

(1A) – Section from COW checklist.

EOD Disposal Facility
Wichita, Sedgwick County, Kansas

Section 1. Project Narrative

A. *Site Location Map*

The proposed Explosive Ordnance Device (EOD) disposal facility is located in Wichita, Sedgwick County Kansas. The site encompasses a portion of Section 26, Township 29 South, Range 4 West of the 6th Principal Meridian. The site is between W. 343rd Street and W. 327th Street and north of W. 111th Street South. 617 acres is being platted, however, the EOD disposal facility occupies only 61 acres. The remaining 556 acres is undeveloped agricultural land. The site is shown on the USGS (United States Geological Survey) Quadrangle Map, Section 1, Figure 1.

B. *Development*

The site is undeveloped agricultural land. Sixty-one acres of the site is proposed for an explosive ordnance disposal facility.

C. *Offsite Conditions*

The area surrounding the site is agricultural land. There is a homestead in the southeast corner of the site that is not being platted.

D. *Summary of Runoff*

a. *Pre-Project*

The project site was analyzed as one watershed; there is no significant off-site runoff contribution. The drainage ditches along W. 343rd St., W. 327th St. and W. 111th St. S. will contain runoff from the boundary roads. The existing site sheet flows to four drainage swales that flow north toward Sand Creek. The runoff characteristics were modeled using the rational method in HydraFlow Hydrographs 2004 by Intelisolve, Section 1, Figure 2. Table 1 shows the runoff coefficient and corresponding flow for the 2, 5, 10, 25 and 100-year design storm.

Table 1. Pre-Project Runoff.

Description	Flows (cfs)				
	2-Year	5-Year	10-Year	25-Year	100-Year
Runoff Coefficient	0.22	0.25	0.33	0.33	0.49
Runoff from On-site Watershed	139	219	368	437	948

b. *Post-Project*

Post-project runoff characteristics will remain similar to pre-project conditions. The percent impervious area will increase form 0% to 0.3%. This slight increase in impervious area has no affect on the weighted rational coefficient for the site, consequently, post-project conditions and therefore, runoff characteristics will not change from pre-project conditions. The runoff characteristics were modeled using the rational method in

HydraFlow Hydrographs 2004 by Intelisolve, Section 1, Figure 2. Table 2 shows the runoff coefficient and corresponding flow for the 2, 5, 10, 25 and 100-year design storm.

Table 2. Post-Project Runoff.

Description	Flows (cfs)				
	2-Year	5-Year	10-Year	25-Year	100-Year
Runoff Coefficient	0.22	0.25	0.33	0.33	0.49
Runoff from On-site Watershed	139	219	368	437	948

E. Permanent Best Management Practices (BMP's)

The EOD development will not significantly impact the surrounding area. Earthen berms are proposed to protect structures and outlying areas from the explosive detonation process. Post-project impervious surfaces represent only 0.3% of the total site area; extensive BMP's are unnecessary.

F. Plat

The plat is included Section 1, Figure 3.

G. Lot Grading Plan

Developed slopes will be 0.5% minimum and the post-project drainage patterns will resemble those in pre-project conditions. The proposed Grading Plain is included in Section 1, Figure 4.

H. Professional Engineer Seal

The front cover of the report has been signed by a professional engineer.

Section 2. Existing Conditions Runoff Calculations

A. *Aerial Photograph*

A copy of the orthophoto showing the proposed project is included in Section 2, Figure 5.

B. *Runoff Method*

The pre-development runoff values were calculated using the Rational Method in Hydraflow Hydrographs 2004 by Intellisolve. The calculation output for pre-development is in Section 1, Figure 2.

C. *Existing Topography*

Slopes across the site are generally 1-4%. Four drainage swales carry runoff from the site north to Sand Creek. The existing contours of the site are shown on the Existing Conditions Map, Section 2, Figure 6.

D. *Areas*

The total site area is 617 acres. Since the site is agricultural land, there are no impervious areas.

E. *Benchmarks*

The benchmarks used for site control are shown on the Existing Conditions Map, Section 2, Figure 6.

F. *Streams*

Sand Creek is just north of the north-central site boundary. Four drainage swales flow south to north toward the Creek. One of the drainage swales flows through a small pond in the northern portion of the site.

Approximately, 47 acres of the platted area is in the Zone A floodplain, 1.7 acres on EOD site. The site is shown on the FIRM and FBFM in Section 2, Figure 7.

G. *Soils*

Soils on the site range from ____ to _____, Soil Survey, Section 2, Figure 8. The soils on site are classified as Hydrologic Soil Group "C".

H. *Vegetation*

Boundaries of the existing vegetation are shown on the Orthophoto Map, Section 2, Figure 5. The site is primarily agricultural land, with few trees or native vegetation.

I. *Protection and Conservation Areas*

No wetlands or conservation areas exist on-site

J. *Impervious Areas*

The site consists of no impervious areas, as shown on the Existing Conditions Map, Section 2, Figure 6.

K. *Utilities*

Minimal utilities are present on-site as the area is undeveloped. Easements and existing utilities are shown on the Existing Conditions Map, Section 2, Figure 6.

L. *Conveyance Systems*

Runoff from the site sheet flows north toward one of the four drainage paths and then north toward Sand Creek. The EOD disposal site is on a ridge that divides the facility area runoff between the east and west, as shown on the Existing Conditions Map, Section 2, Figure 6.

M. *Flow Paths*

The existing drainage pattern is generally from south to north. The four drainage swales on site convey runoff, from the site, north to Sand Creek. The EOD disposal site contributes runoff to two drainage swales, one to the east of the EOD disposal site and one to the west, as shown on the Existing Conditions Map, Section 2, Figure 6.

N. *Channels, Bridges and Culverts*

There are no channels, bridges or culverts on-site, as shown on the Existing Conditions Map Section 2, Figure 6.

O. *Hydrologic Analysis*

The project site was analyzed as one watershed; there is no significant off-site runoff contribution. The drainage ditches along W. 343rd St., W. 327th St. and W. 111th St. S. will contain runoff from the boundary roads. The runoff characteristics were modeled using the rational method in HydraFlow Hydrographs 2004 by Intelisolve. The output from this modeling is found in Section 1, Figure 2. Table 3 shows the runoff coefficient and corresponding flow for the 2, 5, 10, 25 and 100-year design storm.

Table 3. Pre-Project Runoff.

Description	Flows (cfs)				
	2-Year	5-Year	10-Year	25-Year	100-Year
Runoff Coefficient	0.22	0.25	0.33	0.33	0.49
Runoff from On-site Watershed	139	219	368	437	948

P. *Runoff Curve Numbers*

Runoff curve numbers were selected based on the following pre-project conditions, the site is cultivated agricultural area with 1-4% slopes and soil on-site is classified as Hydrologic Soil Group "C".

Q. *Time of Concentration*

The FAA method, within Hydraflow, was used to determine the time of concentration for the site watershed, as shown in Section 1, Figure 2.

R. *Downstream Capacity*

Downstream capacity of the drainage swales or Sand Creek was not analyzed as runoff conditions will not change from pre to post-project, therefore, downstream capacity will not be affected by this development.

S. *Structural Elevations*

There are no existing structures on-site.

T. *Cross Section Data for Open Channels*

Cross-Section data was not pertinent to this study because no existing open channels will be modified.

U. *Groundwater Elevations*

Groundwater elevations are not pertinent to this site because basements will not be constructed.

Section 3. Post-Development Hydrologic Analysis

A. *Proposed Conditions*

A portion of the 617–acre site will be developed for explosive disposal. A gravel access drive, 75 foot by 40 foot service building, parking area, small storage buildings, viewing bunker, burn pit, fire pit and private utilities are proposed. Earthen berms will be constructed around structures as added protection from the explosive detonation process.

Runoff characteristics will remain similar to pre-project conditions. The percent impervious area will increase form 0% to 0.3%. This slight increase in impervious area has no affect on the weighted rational coefficient for the site, consequently, post-project conditions and therefore, runoff characteristics will not change from pre-project conditions. The runoff characteristics were modeled using the rational method in HydraFlow Hydrographs 2004 by Intelisolve, Section 1, Figure 2. Table 4 shows the runoff coefficient and corresponding flow for the 2, 5, 10, 25 and 100-year design storm.

Table 4. Post-Project Runoff.

Description	Flows (cfs)				
	2-Year	5-Year	10-Year	25-Year	100-Year
Runoff Coefficient	0.22	0.25	0.33	0.33	0.49
Runoff from On-site Watershed	139	219	368	437	948

B. *Time of Concentration*

The FAA method, within Hydraflow, was used to determine the time of concentration for the site watershed, as shown in Section 1, Figure 2.

C. *Runoff Curve Numbers*

A weighted rational coefficient was used for the post-development analysis. Table 5 shows the developed area and the corresponding rational coefficient. Because of the small percentage of developed area, the weighted curve numbers were identical to the pre-project coefficients.

Table 5. Post-Project Weighted Rational Coefficients.

Description	Area	Rational Coefficients				
	Acres	2-Year	5-Year	10-Year	25-Year	100-Year
Parking/Buildings	0.6	0.87	0.87	0.88	0.88	0.89
Lagoon	0.06	0.87	0.88	0.90	0.90	0.93
Storage	0.004	0.80	0.85	0.90	0.90	0.93
Utilities	0.02	0.80	0.85	0.90	0.90	0.93
Paved (Future)	0.9	0.87	0.88	0.90	0.90	0.93
Undeveloped Area	615.4	0.22	0.25	0.33	0.33	0.49
Weighted Coefficient	617	0.22	0.25	0.33	0.33	0.49

D. Contours

Minimal grading will be needed for the EOD disposal site. The proposed contours and existing drainage-ways are shown on the Proposed Conditions Map, Section 3, Figure 9.

E. Sizing Calculations

Stormwater controls will consist of minimal grading and working within the existing drainage pattern. No Storage and/or flow control structures are needed.

F. Stage-Storage-Discharge

Storage facilities are not pertinent to this site.

G. Upstream/Downstream Impacts

Upstream and downstream impacts are negligible because of the small percentage of the area that will be developed.

H. Dam Safety

Dam safety is not applicable to this project.

I. Structural Elevations

Existing and proposed structural elevations are shown on the Proposed Conditions Map, Section 3, Figure 9.

J. Water Surface Elevations

The existing pond on the north edge of the site will not be affected by the EOD disposal site development. In addition, no storage facilities are proposed; therefore, water surface elevations are not pertinent to this site.

K. Structural Details and Specifications

Extensive drainage structures will not be constructed for this project. The disposal site will maintain existing drainage patterns.

L. Limits of Clearing and Grading

Minimal grading will be needed for the EOD disposal site. The proposed contours and existing drainage-ways are shown on the Proposed Conditions Map, Section 3, Figure 9.

M. Impervious Areas

Location of existing roads and the proposed access drive as well as the buildings and other impervious areas are shown on the Proposed Conditions Map, Section 3, Figure 9

N. Utilities

The location of existing and proposed utilities and easements, including water, gas, telephone, sewer and electric are shown on the Utility Plan, Section 3, Figure 10. Private utilities are proposed on-site.

O. Conveyance Systems

The existing drainage swales and overland flow patterns will be retained for post-project runoff conveyance, as shown on the Proposed Conditions Map, Section 3, Figure 9

P. *Channel Modifications*

No channel, bridge or culvert modifications are proposed.

Q. *Stormwater Controls*

The primary stormwater control is to maintain existing flow patterns throughout the site; this will be accomplished through proper site layout and limited grading.

R. *Overflow Structure*

Since no control structures are proposed, overflow structures and the associated flow patterns are not relevant to this site.

S. *Freeboard*

Detention facilities are not required for this project site.

T. *HWL*

The 10-year and 100-year HWL are not applicable to this site since detention facilities are unnecessary.

U. *Pad Elevations*

Minimum pad elevations are shown on the Proposed Conditions Map, Section 3, Figure 9

V. *Stormwater Management Facilities*

Stormwater management facilities are not appropriate for this site.

Section 4. Floodplain Submittal

A. *Flood Profile*

A flood profile is not provided.

B. *Base Flood Elevations*

Base flood elevations are not readily available for this site. Extensive modeling would be required and is not feasible since the site will have minimal development.

C. *Floodplain/Floodway Limits*

The FIRM and FBFM, Section 2, Figure 7, show the floodplain limits in relationship to the site.

D. *Floodplain/Floodway Limits*

Post-development floodplain and floodway limits will remain the same as the existing limits, shown on the FIRM and FBFM, Section 2, Figure 7.

E. *Floodplain Boundary*

The floodplain boundary is shown on the FIRM and FBFM, Section 2, Figure 7.

F. *Floodway Data*

Floodway data is not applicable to this site as the project site is not within the floodway limits and development will not significantly impact the floodway.

G. *Hydrologic and Hydraulic Study Information*

Hydraulic study information is not pertinent to this site. No site-specific floodplain studies, unnumbered Zone A area elevation determinations or flood plain map revisions are needed for this project.

H. *Regulatory Floodway*

Profile models (10, 50, 100, and 500-year) for existing and future watershed conditions are unnecessary for this site as the development will have minimal impact on the watershed.

I. *Location of Floodplain/Floodway Limits*

Site development will not have any impact on upstream or downstream neighbors, as the post-project drainage conditions will be almost identical to pre-project conditions

J. *Floodplains/Floodways within a Reserve*

No floodplains or floodways are located within a reserve. No reserves are needed for this project.

Section 5. Evidence of Acquisition of Applicable Federal and State Permits

A. *USACE*

USACE regulatory program permits are not applicable to this development.

B. *Kansas Division of Water Resources Permit*

Kansas Division of Water Resources permits are not applicable to this development

C. *FEMA*

Letter of Map Changes are not applicable to this development.

D. *Kansas Department of Wildlife and Parks*

??

E. *Kansas Department of Transportation*

??

F. *United States Fish and Wildlife*

??

G. *Environmental Protection Agency*

??

Section 6. Other

A. Legal Agreements

Evidence of acquisition of all necessary legal agreements (e.g. easements, covenants, land trusts etc.)

??

B. Maintenance

Maintenance of a stormwater management facility does not pertain to this project.

C. CD

See attached CD for a PDF file of "Drainage Report for Explosive ORDNANCE Disposal Facility Wichita, Sedgwick County, Kansas".