Southeast Arkansas Feasibility Study

Hydrologic and Hydraulic Analyses

August 4, 2005
Scope of Work

1. Hydrology/Hydraulics for existing conditions and 3 flood control alternatives
   a. HEC-HMS (Develops flows)
   b. HEC-RAS (Develops water-surface profiles)
   c. FEAT (Develops flooded acres)

2. Water supply analysis
   a. Water demand for study area
   b. Water available from Arkansas River
Southeast Arkansas Study Area

Bayou Bartholomew
Hwy 52 – Wilmot
Hwy 4 – McGehee
Hwy 11 – Star City

Deep Bayou
Hwy 11 – Grady

Boeuf River
Hwy 8 – Eudora
Hwy 82 – Lake Village

Big Bayou
Hwy 82 – Lake Village
Bridge – Dermott

Black Pond Slough
Hwy 65 – McGehee

Canal 19
Hwy 54 – Dumas

Bayou Macon
Hwy 65 – Eudora

Ditch Bayou
Dam – Lake Village

Macon Lake
Bridge – Macon Lake

Canal 43
Hwy 4 – Ark. City

Canal 81
Hwy 4 – Ark. City
Existing Conditions

HEC-HMS Modeling

1. Determine basin characteristics.
2. Obtain frequency rainfall data from TP40.
3. Calibrate to measured flows at gage locations.
4. Input frequency rainfall and make runs.
Canal 19 – Exis Conds
2-yr Flow Hydrograph
Existing Conditions

HEC-RAS Modeling

1. Obtain channel geometry.
2. Field observation to determine channel and overbank roughness.
3. Calibrate to known events.
4. Input HEC-HMS discharges and make runs.
## Surveyed Cross Sections

<table>
<thead>
<tr>
<th>Basin Section</th>
<th>Stream</th>
<th>Number of Cross Sections</th>
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</thead>
<tbody>
<tr>
<td>West</td>
<td>Bayou Bartholomew</td>
<td>144</td>
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<tr>
<td></td>
<td>Deep Bayou / Jacks Bayou</td>
<td>23</td>
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<tr>
<td>Middle</td>
<td>Boeuf River / Canal 19</td>
<td>93</td>
</tr>
<tr>
<td></td>
<td>Big Bayou / Black Pond Slough</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>Canal 18</td>
<td>21</td>
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<tr>
<td>East</td>
<td>Bayou Macon / Ditch Bayou</td>
<td>23</td>
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<tr>
<td></td>
<td>Connerly Bayou / Macon Lake / Canal 81</td>
<td>56</td>
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<tr>
<td></td>
<td>Canal 43</td>
<td>36</td>
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<td><strong>Total</strong></td>
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Canal 19 Stage-Frequency Existing Conds

Stage-Frequency Curve
Canal 19 at Dumas

<table>
<thead>
<tr>
<th>FREQ</th>
<th>EXISTING</th>
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<tbody>
<tr>
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<td>156.5</td>
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<tr>
<td>100</td>
<td>157.0</td>
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</table>

Elevation, Ft. NGVD
0.1 1 10 100
Return Period, Yrs

EXISTING CONDITIONS
Existing Conditions

FEAT Modeling

1. Obtain DEM (Digital Elev. Model) data from USGS.
2. Input HEC-RAS water-surface profiles for selected frequencies into model.
3. Calibrate obtained flooded areas to known events using satellite photos.
4. Make production runs.
Existing 2-yr Flood
Existing 5-yr Flood
Existing 100-yr Flood
Canal 19
Stage-Area Curve

![Graph showing Stage-Area Curve for Canal 19 at Dumas, Existing. The x-axis represents Area Flooded Acres ranging from 0 to 80,000, and the y-axis represents Water Surface Elevation, ft NGVD, ranging from 130 to 160. The curve shows a gradual increase in elevation with increasing area flooded.]
Proposed work consists of clearing and snagging along Deep Bayou, Boeuf River, Canal 19, Big Bayou, Black Pond Slough, Canal 43, Canal 81, Macon Lake, and Bayou Macon.
Alternative 1
HEC-HMS Modeling

1. Change routing parameters (storage – outflow relationship) to reflect Alternative 1 conditions.

2. Make runs.
Canal 19 – Alt 1
2-yr Flow Hydrograph
1. Revise channel n-values to reflect Alternative 1 conditions.

2. Input revised HEC-HMS flows and make runs.
Canal 19 Stage-Frequency
Alt 1 vs Existing

Stage-Frequency Curve
Canal 19 at Dumas

<table>
<thead>
<tr>
<th>Freq (Yrs)</th>
<th>Existing</th>
<th>Alt 1</th>
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<tbody>
<tr>
<td>0.5</td>
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<td>148.8</td>
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<tr>
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<tr>
<td>100</td>
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</tbody>
</table>
Alternative 1

FEAT Modeling

1. Input revised HEC-RAS water-surface profiles for selected frequencies into model.

2. Make production runs.
Existing vs Alt 1
1-yr Flood
Existing vs Alt 1
2-yr Flood
Existing vs Alt 1
100-yr Flood
Proposed work consists of channel enlargement along Deep Bayou, Boeuf River, Canal 19, Big Bayou, and Black Pond Slough. Also, clearing/snagging will be proposed for Canal 43, Canal 81, Macon Lake, and Bayou Macon.
1. Change routing parameters (storage – outflow relationship) to reflect Alternative 2 conditions.

2. Make runs.
Canal 19 – Alt 2
2-yr Flow Hydrograph

HEC

Gage 25355

HMS

C19-6

Basin: Swamp A1 - Mid only
Run: Run 187
Time: 22 Jul 05, 08:26
Alternative 2
HEC-RAS Modeling

1. Revise channel geometry, channel n-values, etc., to reflect Alternative 2 conditions.

2. Input revised HEC-HMS flows and make runs.
Canal 19
2-Yr WS Profile
Exis vs Alt 1, Alt 2
Canal 19 Stage-Frequency
Alt 2 vs Existing, Alt 1

Stage-Frequency Curve
Canal 19 at Dumas

<table>
<thead>
<tr>
<th>Freq</th>
<th>Existing</th>
<th>Alt 1</th>
<th>Alt 2</th>
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<tbody>
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</tbody>
</table>

Return Period, Yrs
Elevation, ft NGVD

EXISTING
- - ALTERNATIVE 1
- - ALTERNATIVE 2
Alternative 2
FEAT Modeling

1. Input revised HEC-RAS water-surface profiles for selected frequencies into model.

2. Make production runs.
Water Demand

1. Demand curves provided by NRCS for entire study area.

2. Three different scenarios analyzed.
   a. 0% increase in on-farm storage (existing conditions).
   b. 10% increase…
   c. 25% increase…
Southeast Arkansas Demand Flows

Southeast Arkansas
Demand Flows in 10-day increments
0, 10, and 25% Storage

Date
Flow, cfs

0 500 1000 1500 2000 2500 3000 3500 4000 4500

- 25% Storage
- 10% Storage
- 0% Storage

2. Required minimum flows (per Arkansas Soil and Water) removed based on navigational needs and Fish and Wildlife regulations (3000 – 6778 cfs).
3. Flows removed for Bayou Meto project, based on demand curve from Memphis District COE.

4. Remaining flows assumed to be available for use. Statistical analysis shows % of time demand flows are available.
Bayou Meto Demand Flows

Bayou Meto Irrigation Study - Design Irrigation Demand Flows
Period of Record (1940-1996) - 10 Day Increments

[Graph showing flow rates by month]
Southeast Arkansas Water Supply Study

0% Storage

Flow (cfs) vs. Date for 0% Storage Demand at various reliability levels.
10% Storage

Southeast Arkansas Water Supply Study
10% Storage

80% Reliability
90% Reliability
95% Reliability
100% Reliability
10% Storage Demand

Flow (cfs)

Date

1 31 61 91 121 151 181 211 241 271 301 331 361
Southeast Arkansas Water Supply Study
25% Storage

25% Storage Demand
1. Waterfowl - Analyze daily flooded acres (01 Nov – 28 Feb), considering depth and duration of flooding.

3. Terrestrial - Analyze daily flooded wooded acres, considering seasonal durations.

4. Wetlands – Analyze daily flooded acres, considering seasonal durations.
Work in Progress

1. Finish evaluation of Alternative 2 channel enlargement.

2. Evaluate Alternative 3 (channel enlargement, possible flow diversions).

3. Evaluate water supply requirements.
West Section
Bayou Bartholomew
West Section
Deep and Jacks Bayous

Deep Bayou

Jacks Bayou
Middle Section - Big Bayou and Black Pond Slough
Middle Section
Boeuf River and Canal 18

Beouf River (Diversion)

Canal 18
East Section
Ditch and Connerly Bayous

Ditch Bayou

Connerly Bayou
A Proud Tradition…A Vision for the Future

The Engineer of Choice for the 21st Century