MANHATTAN LOCAL PROTECTION PROJECT
FEASIBILITY STUDY
MANHATTAN, KANSAS
(Manhattan Levee)

(Section 216 Review of Completed Civil Works)

Cost Estimating Appendix
August 2014   Final Feasibility Report
Cost Engineering Appendix
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Cost Certification
Total Project Cost Summary
Abbreviated Risk Analysis
Risk Register
1. Overview of Cost Engineering Efforts for the Final Feasibility Report

The Cost Engineering contribution to the Final Feasibility Report consisted of the creation of a Total Project Cost Summary (TPCS), an abbreviated cost risk analysis, and coordination of review and certification of these products by the USACE Cost Engineering Mandatory Center of Expertise (MCX).

The estimate of the Recommended Plan was developed and reviewed by the Kansas City District Cost Engineering Section. In addition to the estimate, backup support was created for the excavation/haul production rates, detailed quantity take-offs were performed, and a construction schedule was created.

The abbreviated cost risk analysis consisted of developing the risk register to assist in creating a contingency amount to add to the cost estimate. The Project Delivery Team (PDT) assists in the creation of the risk register. Risks to the major project components were identified and a likelihood of occurrence and magnitude of impact assigned to each risk. Once a contingency amount is developed from the completion of the abbreviated cost risk analysis, the Total Project Cost Summary is created. It documents the project costs by each work breakdown structure account and escalates costs accordingly to the mid-point of each activity.

2. Project Narrative and Cost Estimate Development & Assumptions

The project site is the existing levee at Manhattan, KS. The levee consists of two segments. One is for the Big Blue River segment to the east of the city. The other is the Kansas River segment to the south of the city. The NED (National Economic Development) Plan is Plan 3, a levee raise with accompanying geotechnical and structural reliability improvements. The construction work is assumed to be split out into 3 contracts as shown below:

- **Contract #1**: Demolition and replacement of two gatewells where levee raise will occur. Gatewells are to be demolished and constructed to match the newly raised levee height. Full replacement of inlet & outlet pipes as well as associated inlet & outlet structures will also be replaced. An emergency closure system is to be used during demolition/construction of the gatewells in lieu of creating/removing ring levees as a cost savings measure. The emergency closure system consists of stockpiling adequate fill material on-site next to the gatewell to be able to use as backfill to plug the hole in the levee should a flood be anticipated. The Kansas City District Hydrology Section stated that the controlled releases from Tuttle Creek Dam on Big Blue River would give the
contractor sufficient time to close the holes in the levee in time before the river reached flood stage. The two gatewells to be replaced are at Sta. 163+00 and 269+50.

- Contract #2: Consists of utility relocations, levee raise, sand drain installation, underseepage berm installation, and relief well installation as described below:
  - Utility Relocations:
    - Raising 11 manhole structures that are located in areas where underseepage berms will be constructed.
    - Re-running 36” water line up and over new levee raise.
    - Minor modifications to outlet of Wastewater Treatment Plant
  - Levee Raise: 14,100 lf of 1.5 ft. average raise
  - Sand Drain Installation: 10,200 lf
  - Underseepage Berm Installation: 2,538 lf (Includes raising 11 manholes where underseepage berm will be placed)
  - Relief Well Installation: 29 (13 at 50’ depth and 16 at 60’ depth) plus installation of collector system

- Contract #3: Demolition and replacement of three gatewells where levee raise will not occur. These gatewells fail strength criteria under new criteria and will need to be replaced to bring whole levee system up to criteria. Once the levee is touched for any reason, the whole system needs to be updated to the new criteria. Gatewells are to be demolished and constructed to match the existing levee height. One section of 8 lf pipe on the inlet and the outlet sides of the gatewells will also be replaced. The three gatewells to be replaced are at Sta. 14+78, 62+20, and 89+83.

It is assumed that the acquisition strategy will be Invitation for Bid (either Small Business or Full and Open). This is reflected in the contractor markup structure. The prime contractor is assumed to perform the majority of the earthwork. Separate subcontractors are assumed for the Asphalt Paving, Concrete Work, Utility Relocation, Relief Well, and Seeding activities.

A construction schedule for each contract was developed using Microsoft Project. The schedules were developed assuming an 8 hour/day, 5 days/week work week. Two earthwork crews were assumed for the earthwork portions. The rest of the activities were assumed to be performed by one crew. Construction of Contract #1 is assumed to start during FY 18 and last 5 calendar months. Construction of Contract #2 is assumed to start during FY 19 and last 21 calendar months. Construction of Contract #3 is assumed to start during FY 22 and last 6 calendar months.
3. Abbreviated Cost Risk Analysis and Resulting Contingency Development

The major line items analyzed for the abbreviated cost risk analysis were as follows: Mobilization/Demobilization, Borrow Site, Levee Raise & Sand Drains, Underseepage Berms & Manhole Raises, Utility Relocations, Gatewell Replacements, Relief Wells, Planning, Engineering, & Design, and Construction Management.

These line items were analyzed for the following risk elements: Project Scope Growth, Acquisition Strategy, Construction Elements, Quantities for Current Scope, Specialty Fabrication or Equipment, Cost Estimate Assumptions, and External Project Risks.

The PDT met four times to develop the risk register. The first three times involved examining the array of four alternatives, of which the recommended plan (Plan 3) was one such alternative. The fourth meeting was to revisit the abbreviated cost risk analysis for the recommended plan in light of the revisions to the estimate from the original unit cost estimate to the detailed cost estimate. The four meetings and their dates and disciplines represented are listed below:

Meeting #1: July 29, 2013
- Geotechnical
- Structural
- Civil Design
- Cost Engineering
- Cost Engineering
- Real Estate
- Project Manager

Meeting #2: July 30, 2013
- Geotechnical
- Structural
- Cost Engineering
- Hydrology
- Project Manager

Meeting #3: August 7, 2013
- HTRW
- Construction
- Environmental Resources
- Structural
- Cost Engineering
- Project Manager
Meeting #4: October 2, 2013

- Geotechnical
- Structural
- Civil Design
- Economics
- Cost Engineering
- Hydrology
- Project Manager
- Construction

During the fourth meeting, the team identified several items like a relief well collector system that is now included in the refined Plan 3 estimate and could be removed as a risk item. The original risk item discussed the possibility of the header system being added to the project and is no longer applicable as that item is now a project feature. The changes lowered the resulting contingency percentage for the applicable line items in the abbreviated cost risk analysis.

The line items with the largest associated contingency percentages were the Levee Raise & Sand Drains, the Utility Relocations, and the Underseepage Berms & Manhole Raises.

The “Levee Raise & Sand Drains” and “Underseepage Berms & Manhole Raises” portions of the project were identified as having some of the largest risks associated to them. A large risk driver to each of these line items is the possibility of a flood event that could shut down the job and put the contractor on stand-by. This risk was modeled as possible with having a critical impact if it did occur. The cumulative contingency percentages for the “Levee Raise & Sand Drains” and “Underseepage Berms & Manhole Raises” line items are 31.99% and 26.36% respectively.

The “Utility Relocations” line item also was also identified as having some of the largest risks associated to it. One of the largest risks is that not all of the utility relocations necessary for completion of the project work have been identified to date. A thorough search was made of all county and city utilities but there may be more private utilities affecting project work that have yet to be identified. This risk of having to relocate more utilities was identified as a possible occurrence with a critical impact. The cumulative contingency percentage for “Utility Relocations” is 30.27%.

The Real Estate contingency percentage of 25% was provided by the Kansas City District’s Real Estate Division. However, the contingency percentage is added before administrative/incidental costs are applied to the total Real Estate costs for the project. Factoring in these costs as “before contingency costs” leads to a 22.10% contingency percentage in order to ensure the correct Real Estate total cost is incorporated in the Total Project Cost.
4. Total Project Cost Development

The Total Project Cost was developed and is presented in the Total Project Cost Summary (TPCS). The current fully funded Total Project Cost is $26,934,000.00. The Total Project Cost is comprised of the totals for the individual account totals for Lands & Damages (01), Relocations (02), Levees & Floodwalls (11), Planning, Engineering, & Design (30), and Construction Management (31). The Effective Price Level of the current account values is July 14, 2014. The Fully Funded Project Costs for each account are calculated by escalating from the Program Year to the mid-point of that account/activity.

The Planning, Engineering, & Design (PED) and Construction Management costs and associated contingency percentages were discussed and determined by the PDT. The engineering team members provided estimated labor budgets for each of the three projects. The remaining PED and S&A costs were based upon a percentage of construction costs. A contingency percentage of 15.62% was used for the PED (30) account and 22.43% was used for the Construction Management (31) account.

The PED cost breakdown includes the following individual costs: Project Management, Planning & Environmental Compliance, Engineering & Design, Engineering Tech Review ITR & VE, Contracting & Reprographics, Engineering During Construction, Planning During Construction, and Project Operations.

The Construction Management costs are composed of the following individual costs: Construction Management, Project Operation, and Project Management.

The cumulative contingency percentage of 26.36% was applied for the two construction accounts. These accounts were Relocations (02) and Levees & Floodwalls (11).

When all the applicable accounts (01, 02, 11, 30, & 31) are factored in, the total project contingency percentage is 24.14%.
CERTIFICATION STATEMENT

For Project No. 106928

NWK – Manhattan, Kansas
Local Protection Project Section 216

The Manhattan, KS Local Protection Project Section 216, as presented by Kansas City District, has undergone a successful Cost Agency Technical Review (Cost ATR), performed by the Walla Walla District Cost Engineering Mandatory Center of Expertise (Cost MCX) team. The Cost ATR included study of the project scope, report, cost estimates, schedules, escalation, and risk-based contingencies. This certification signifies the products meet the quality standards as prescribed in ER 1110-2-1150 Engineering and Design for Civil Works Projects and ER 1110-2-1302 Civil Works Cost Engineering.

As of July 16, 2014, the Cost MCX certifies the estimated total project cost of:

FY 2015 Price Level: $23,754,000
Fully Funded Amount: $26,934,000

It remains the responsibility of the District to correctly reflect these cost values within the Final Report and to implement effective project management controls and implementation procedures including risk management throughout the life of the project.

For Kim C. Callan, PE, CCE, PM
Chief, Cost Engineering MCX
Walla Walla District
### Total Project Cost Summary

**Project:** Manhattan Local Protection - Plan 3  
**District:** NWK Kansas City  
**Location:** Manhattan, KS  
**Prepared:** 7/14/2014

This estimate reflects the scope and schedule in report: Manhattan Local Protection Report August 2013

<table>
<thead>
<tr>
<th>WBS Number</th>
<th>Feature &amp; Sub-Feature Description</th>
<th>ESTIMATED COST</th>
<th>PROJECT FIRST COST (Constant Dollar Basis)</th>
<th>TOTAL PROJECT COST (FULLY FUNDED)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>COST</td>
<td>CNTG</td>
<td>TOTAL</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>02</td>
<td>RELOCATIONS</td>
<td>$686</td>
<td>$181</td>
<td>26%</td>
</tr>
<tr>
<td>11</td>
<td>LEVEES &amp; FLOODWALLS</td>
<td>$12,770</td>
<td>$3,366</td>
<td>26%</td>
</tr>
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</table>

**Construction Estimate Totals:**  
$13,455 | $3,547 | $17,002 | 1.6% | $13,665 | $3,602 | $17,267 | 0 | 12.3% | $15,349 | $4,046 | $19,395 |

| 01         | LANDS AND DAMAGES                 | $1,297 | $287 | 22% | $1,584 | 1.6% | $1,317 | $291 | $1,609 | 0 | 4.9% | $1,382 | $305 | $1,688 |
| 30         | PLANNING, ENGINEERING & DESIGN   | $2,990 | $467 | 16% | $3,457 | 2.2% | $3,054 | $477 | $3,531 | 0 | 17.9% | $3,601 | $563 | $4,164 |
| 31         | CONSTRUCTION MANAGEMENT           | $1,077 | $242 | 22% | $1,319 | 2.2% | $1,100 | $247 | $1,347 | 0 | 25.2% | $1,378 | $309 | $1,687 |

**Project Cost Totals:**  
$18,619 | $4,542 | $23,361 | 24% | $19,137 | $4,617 | $23,754 | 0 | 13.4% | $21,711 | $5,223 | $26,934 |

**Mandatory by Regulation:**  
- CHIEF, COST ENGINEERING
- PROJECT MANAGER
- CHIEF, REAL ESTATE
- CHIEF, PLANNING
- CHIEF, ENGINEERING
- CHIEF, OPERATIONS
- CHIEF, CONSTRUCTION
- CHIEF, CONTRACTING
- CHIEF, PM-PF
- CHIEF, DPM

**Estimated Federal Cost:** 65% $17,507  
**Estimated Non-Federal Cost:** 35% $9,427  
**Estimated Total Project Cost:** $26,934
### Civil Works Work Breakdown Structure

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<tr>
<th>WBS NUMBER</th>
<th>Feature &amp; Sub-Feature Description</th>
<th>ESTIMATED COST</th>
<th>PROJECT FIRST COST (Constant Dollar Basis)</th>
<th>TOTAL PROJECT COST (FULLY FUNDED)</th>
</tr>
</thead>
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<td>(%)</td>
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<td><strong>PHASE 1 or CONTRACT 1</strong></td>
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<td>($)</td>
<td>(%)</td>
<td>($)</td>
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<td>Levees &amp; Floodwalls</td>
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<td>$14</td>
<td>22%</td>
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**CONTRACT COST TOTALS:**

- $4,113 884 4,997 4,185 899 5,084 4,509 966 5,476

TPCS
### Civil Works Work Breakdown Structure

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<tr>
<th>WBS NUMBER</th>
<th>Civil Works Feature &amp; Sub-Feature Description</th>
<th>ESTIMATED COST</th>
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<th>TOTAL PROJECT COST (FULLY FUNDED)</th>
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#### PHASE 2 or CONTRACT 2

**02** RELOCATIONS

- **ESTIMATE COST**: $686
- **COST**: $181
- **COST CNTG**: 26%
- **TOTAL**: $866
- **ESC**
- **COST**: $696
- **COST CNTG**: 1.6%
- **TOTAL**: $880
- **Date**: 2021Q1
- **Mid-Point**: 12.4%
- **ESC COST**: $783
- **COST CNTG**: 20.6%
- **FULL**: $989

**11** LEVEES & FLOODWALLS

- **ESTIMATE COST**: $10,017
- **COST**: $2,640
- **COST CNTG**: 26%
- **TOTAL**: $12,658
- **ESC**
- **COST**: $10,173
- **COST CNTG**: 1.6%
- **TOTAL**: $12,854
- **Date**: 2021Q1
- **Mid-Point**: 12.4%
- **ESC COST**: $11,438
- **COST CNTG**: 20.6%
- **FULL**: $14,452

#### CONSTRUCTION ESTIMATE TOTALS:

- **ESTIMATE COST**: $10,703
- **COST**: $2,821
- **COST CNTG**: 26%
- **TOTAL**: $13,524
- **ESC**
- **COST**: $10,869
- **COST CNTG**: 1.6%
- **TOTAL**: $13,734
- **Date**: 2021Q1
- **Mid-Point**: 12.4%
- **ESC COST**: $12,220
- **COST CNTG**: 20.6%
- **FULL**: $15,442

#### 01 LANDS AND DAMAGES

- **ESTIMATE COST**: $0
- **COST**: $0
- **COST CNTG**: 0%
- **TOTAL**: $0
- **ESC**
- **COST**: $0
- **COST CNTG**: 0%
- **TOTAL**: $0
- **Date**: 0
- **Mid-Point**: 0%
- **ESC COST**: $0
- **COST CNTG**: 0%
- **FULL**: $0

#### 30 PLANNING, ENGINEERING & DESIGN

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<th>Percentage</th>
<th>Description</th>
<th>Estimate Prepared:</th>
<th>Project Management</th>
<th>Planning &amp; Environmental Compliance</th>
<th>Engineering &amp; Design</th>
<th>Reviews, ATRs, IEPRs, V&amp;I</th>
<th>Life Cycle Updates (cost, schedule, risks)</th>
<th>Contracting &amp; Reprographics</th>
<th>Engineering During Construction</th>
<th>Planning During Construction</th>
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#### CONSTRUCTION MANAGEMENT

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<th>Engineering &amp; Design</th>
<th>Reviews, ATRs, IEPRs, V&amp;I</th>
<th>Life Cycle Updates (cost, schedule, risks)</th>
<th>Contracting &amp; Reprographics</th>
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#### CONTRACT COST TOTALS:

- **ESTIMATE COST**: $13,148
- **COST**: $3,261
- **COST CNTG**: 26%
- **TOTAL**: $16,409
- **ESC**
- **COST**: $13,367
- **COST CNTG**: 1.6%
- **TOTAL**: $16,682
- **Date**: 2021Q1
- **Mid-Point**: 12.4%
- **ESC COST**: $15,328
- **COST CNTG**: 20.6%
- **FULL**: $19,110

TPCS
### TOTAL PROJECT COST SUMMARY

#### CONTRACT COST SUMMARY

**PROJECT:** Manhattan Local Protection - Plan 3  
**DISTRICT:** NWK Kansas City  
**LOCATION:** Manhattan, KS  
This Estimate reflects the scope and schedule in report: Manhattan Local Protection Report August 2013

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<tr>
<th>Civil Works Work Breakdown Structure</th>
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<th>PROJECT FIRST COST (Constant Dollar Basis)</th>
<th>TOTAL PROJECT COST (FULLY FUNDED)</th>
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## Manhattan Local Protection: Plan 3
### Feasibility (Recommended Plan)
#### Abbreviated Risk Analysis

<table>
<thead>
<tr>
<th>Potential Risk Areas</th>
<th>Mobilization - Demobilization</th>
<th>Borrow Site</th>
<th>Levee Raise &amp; Sand Drains</th>
<th>Underseepage Berms</th>
<th>Utility Relocations</th>
<th>Gatewell Replacements</th>
<th>Relief Wells</th>
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</table>
Risk Register

Project Scope Growth
Mob/Demob:
- Concerns: No concerns
- PDT Discussions/Conclusions: None
- Likelihood: Unlikely
- Impact: Negligible
- Risk Level: 0

Borrow Site:
- Concerns: Need larger borrow site for add'l fill if scope grows.
- PDT Discussions/Conclusions: Borrow requirements decreased as design progressed so unlikely.
- Likelihood: Unlikely
- Impact: Marginal
- Risk Level: 0

Levee Raise & Sand Drain:
- Concerns: Diversionary levee trail assumed to keep trail open during construction. Specifics of where temporary trail is located and for what length are not yet determined. Also, may need to add a minimal amount of rock on the riverside of the levee at the confluence.
- PDT Discussions/Conclusions: Fish & Wildlife will help determine exact details during design to keep trail open. Likely that current plan will change and could have an increase in costs. Also, analysis for adding rock at confluence has not been done but would be minimal if it occurs.
- Likelihood: Likely
- Impact: Marginal
- Risk Level: 2

Underseepage Berms:
- Concerns: If footprint goes up then RE costs will increase as well
- PDT Discussions/Conclusions: Lots of bldgs/businesses restrict to RW's so likely not expanding footprint any further but if had to, then it would be very expensive since businesses occur that land.
- Likelihood: Unlikely
- Impact: Significant
- Risk Level: 1
Utility Relocations:
- Concerns: Possibility for growth in number of relocations as well if scope were increased to impact more area.
- PDT Discussions/Conclusions: Definitely possible for encountering more utilities if project area grows.
- Likelihood: Possible
- Impact: Critical
- Risk Level: 3

Gatewell Replacements:
- Concerns: Possibility for growth in number of gate well replacements as well if scope were increased to impact more area.
- PDT Discussions/Conclusions: Definitely could impact more gatewells if project area increases. Would need to add in full replacement of pipe for more gatewells if levee raise area increases as well.
- Likelihood: Unlikely
- Impact: Significant
- Risk Level: 1

Relief Wells:
- Concerns: Qty may go up upon detailed design.
- PDT Discussions/Conclusions: Possible and could add significant costs to the RW costs.
- Likelihood: Possible
- Impact: Significant
- Risk Level: 2

Remaining Construction Items:
- Concerns: None
- PDT Discussions/Conclusions: None
- Likelihood: Unlikely
- Impact: Marginal
- Risk Level: 0

Planning, Engineering, & Design:
- Concerns: Long design duration
- PDT Discussions/Conclusions: Would increase costs
- Likelihood: Possible
- Impact: Marginal
- Risk Level: 1

Construction Management:
- Concerns: Longer construction duration.
- PDT Discussions/Conclusions: Would increase S&A costs.
- Likelihood: Possible
Acquisition Strategy

Mob/Demob:
- Concerns: Unknown contracting vehicle at this time.
- PDT Discussions/Conclusions: MATOC, Sole-Source, or SB acquisition methods could increase projects costs significantly as estimate assumes IFB with prime contractor performing all the earthwork.
- Likelihood: Unlikely
- Impact: Significant
- Risk Level: 1

Borrow Site:
- Concerns: Same as Mob/Demob
- PDT Discussions/Conclusions: Same as Mob/Demob
- Likelihood: Unlikely
- Impact: Significant
- Risk Level: 1

Levee Raise & Sand Drain:
- Concerns: Same as Mob/Demob
- PDT Discussions/Conclusions: Same as Mob/Demob
- Likelihood: Unlikely
- Impact: Significant
- Risk Level: 1

Underseepage Berms:
- Concerns: Same as Mob/Demob
- PDT Discussions/Conclusions: Same as Mob/Demob
- Likelihood: Unlikely
- Impact: Significant
- Risk Level: 1

Utility Relocations:
- Concerns: Same as Mob/Demob
- PDT Discussions/Conclusions: Same as Mob/Demob
- Likelihood: Unlikely
- Impact: Significant
- Risk Level: 1
**Gatewell Replacements:**
- Concerns: Same as Mob/Dembob
- PDT Discussions/Conclusions: Same as Mob/Dembob
- Likelihood: Unlikely
- Impact: Significant
- Risk Level: 1

**Relief Wells:**
- Concerns: Same as Mob/Dembob
- PDT Discussions/Conclusions: Same as Mob/Dembob
- Likelihood: Unlikely
- Impact: Significant
- Risk Level: 1

**Remaining Construction Items:**
- Concerns: No Remaining Construction Items. All are covered under other line items.
- PDT Discussions/Conclusions: None
- Likelihood: Unlikely
- Impact: Significant
- Risk Level: 1

**Planning, Engineering, & Design:**
- Concerns: Same as Mob/Dembob
- PDT Discussions/Conclusions: Same as Mob/Dembob
- Likelihood: Unlikely
- Impact: Significant
- Risk Level: 1

**Construction Management:**
- Concerns: Same as Mob/Dembob
- PDT Discussions/Conclusions: Same as Mob/Dembob
- Likelihood: Unlikely
- Impact: Significant
- Risk Level: 1
**Construction Elements**

**Mob/Demob:**
- Concerns: No Concerns
- PDT Discussions/Conclusions: None
- Likelihood: Unlikely
- Impact: Negligible
- Risk Level: 0

**Borrow Site:**
- Concerns: Colder weather could make compaction difficult and cause fill to be difficult to work with.
- PDT Discussions/Conclusions: Contractor may need to disk material or add admixtures if schedule requires him to work during the winter and he experiences cold weather/snow.
- Likelihood: Possible
- Impact: Marginal
- Risk Level: 1

**Levee Raise & Sand Drain:**
- Concerns: Colder weather could make compaction difficult and cause fill to be difficult to work with.
- PDT Discussions/Conclusions: Contractor may need to disk material or add admixtures if schedule requires him to work during the winter and he experiences cold weather/snow.
- Likelihood: Possible
- Impact: Marginal
- Risk Level: 1

**Underseepage Berms:**
- Concerns: Colder weather could make compaction difficult and cause fill to be difficult to work with.
- PDT Discussions/Conclusions: Contractor may need to disk material or add admixtures if schedule requires him to work during the winter and he experiences cold weather/snow.
- Likelihood: Possible
- Impact: Marginal
- Risk Level: 1

**Utility Relocations:**
- Concerns: Contractor may have to rush to complete relocations depending on window that utility provides for doing the relocations.
- PDT Discussions/Conclusions: Coordination for relocations with utility companies should be done well in advance or construction activities occurring.
- Likelihood: Unlikely
- Impact: Significant
- Risk Level: 1
**Gatewell Replacements:**
- Concerns: May have to accelerate repairs if it looks like river stages are coming up.
- PDT Discussions/Conclusions: Possible and would cause some overtime to occur.
- Likelihood: Possible
- Impact: Marginal
- Risk Level: 1

**Relief Wells:**
- Concerns: Relief Wells would likely be restricted to being installed and tested during fairer weather. This could delay the schedule.
- PDT Discussions/Conclusions: Contractor should be able to schedule relief well work around other activities.
- Likelihood: Unlikely
- Impact: Marginal
- Risk Level: 0

**Remaining Construction Items:**
- Concerns: No Remaining Construction Items. All are covered under other line items.
- PDT Discussions/Conclusions: None
- Likelihood: Unlikely
- Impact: Negligible
- Risk Level: 0

**Planning, Engineering, & Design:**
- Concerns: Accelerated schedule may require timely responses on RFI's and cause engineering personnel to be pulled away from other projects or use overtime to accomplish RFI's in a timely manner.
- PDT Discussions/Conclusions: None
- Likelihood: Possible
- Impact: Marginal
- Risk Level: 1

**Construction Management:**
- Concerns: Accelerated schedule may require additional oversight during overtime hours.
- PDT Discussions/Conclusions: None
- Likelihood: Possible
- Impact: Marginal
- Risk Level: 1
Quantities for Current Scope

Mob/Demob:
- Concerns: No Concerns
- PDT Discussions/Conclusions: None
- Likelihood: Unlikely
- Impact: Negligible
- Risk Level: 0

Borrow Site:
- Concerns: Compaction factor could change. Could hit water as dig deeper if qtys increase.
- PDT Discussions/Conclusions: Exact material qualities are unknown as no testing of borrow material has been done but this same site was used for original levee construction. Also, borrowing activities are assumed to not be performed if river stage is up.
- Likelihood: Unlikely
- Impact: Marginal
- Risk Level: 0

Levee Raise & Sand Drain:
- Concerns: Fairly accurate and recent Lidar survey. However, hydraulic profile could increase due to a change in the model.
- PDT Discussions/Conclusions: During design, H&H would like to have an actual survey performed and estimates that qtys could vary up to 10-15% from Lidar survey so there's a possible need for qty change. Also, hydraulic profile change would only marginally increase scope.
- Likelihood: Possible
- Impact: Marginal
- Risk Level: 1

Underseepage Berms:
- Concerns: Qtys could change as design is refined.
- PDT Discussions/Conclusions: Berms are fairly constricted in size so it's possible that their dimensions could change but not by much.
- Likelihood: Possible
- Impact: Marginal
- Risk Level: 1

Utility Relocations:
- Concerns: Overhead electric at approx. Sta. 205+00 may need to be raised to accommodate the levee raise at that location. Also, could find currently unknown private utilities even though lots of research has already been done.
- PDT Discussions/Conclusions: Based on recent site visit and discussions with Electrical Engineers, it is not thought that a small decrease in clearance height will be a problem. Unlikely to find more utilities but would have significant impact if they were found.
- Likelihood: Unlikely
- Impact: Significant
- Risk Level: 1

**Gatewell Replacements:**
- Concerns: No ring levees needed in current scope. Also, qty of gatewell replacements could grow if criteria for replacement change.
- PDT Discussions/Conclusions: Stockpiled material on-site is normally sufficient. Critical increase in costs if had to create 100 year level of protection ring levees though. For number of gatewells, confident in criteria and qty that needs replacement
- Likelihood: Unlikely
- Impact: Critical
- Risk Level: 2

**Relief Wells:**
- Concerns: See "Project Scope Growth". Could need to build ponds for collecting & controlling drainage
- PDT Discussions/Conclusions: Large effort in cost and design.
- Likelihood: Unlikely
- Impact: Critical
- Risk Level: 2

**Remaining Construction Items:**
- Concerns: No Remaining Construction Items. All are covered under other line items.
- PDT Discussions/Conclusions: None
- Likelihood: Unlikely
- Impact: Negligible
- Risk Level: 0

**Planning, Engineering, & Design:**
- Concerns: No Concerns
- PDT Discussions/Conclusions: None
- Likelihood: Unlikely
- Impact: Negligible
- Risk Level: 0

**Construction Management:**
- Concerns: No Concerns
- PDT Discussions/Conclusions: None
- Likelihood: Unlikely
- Impact: Negligible
- Risk Level: 0

**Specialty Fabrication or Equipment**

**Mob/Demob:**
- Concerns: No Concerns
- PDT Discussions/Conclusions: None
- Likelihood: Unlikely
- Impact: Negligible
- Risk Level: 0

**Borrow Site:**
- Concerns: No Concerns
- PDT Discussions/Conclusions: None
- Likelihood: Unlikely
- Impact: Negligible
- Risk Level: 0

**Levee Raise & Sand Drain:**
- Concerns: Large qty of sand needed (~150k tons) and this could be difficult to come by for the gradations needed. May need to haul sand in from long distances.
- PDT Discussions/Conclusions: Sand supplier said they could meet those qtys over the span of a few construction seasons, which is what this project would take.
- Likelihood: Unlikely
- Impact: Significant
- Risk Level: 1

**Underseepage Berms:**
- Concerns: No Concerns
- PDT Discussions/Conclusions: None
- Likelihood: Unlikely
- Impact: Negligible
- Risk Level: 0

**Utility Relocations:**
- Concerns: No Concerns
- PDT Discussions/Conclusions: None
- Likelihood: Unlikely
- Impact: Negligible
- Risk Level: 0
**Gatewell Replacements:**
- Concerns: Large qty of concrete will be ordered so this will require coordination with the concrete supplier to ensure timely deliveries and preparation for large qtys.
- PDT Discussions/Conclusions: Schedule could be delayed if contractor is waiting on concrete trucks for deliveries
  - Likelihood: Possible
  - Impact: Marginal
  - Risk Level: 1

**Relief Wells:**
- Concerns: Screens for RW's could be delayed if manufacturer has a backlog
- PDT Discussions/Conclusions: Unlikely to affect project schedule as there should be float within the schedule to accomplish RW work.
  - Likelihood: Unlikely
  - Impact: Marginal
  - Risk Level: 0

**Remaining Construction Items:**
- Concerns: No Remaining Construction Items. All are covered under other line items.
- PDT Discussions/Conclusions: None
  - Likelihood: Unlikely
  - Impact: Negligible
  - Risk Level: 0

**Planning, Engineering, & Design:**
- Concerns: No Concerns
- PDT Discussions/Conclusions: None
  - Likelihood: Unlikely
  - Impact: Negligible
  - Risk Level: 0

**Construction Management:**
- Concerns: No Concerns
- PDT Discussions/Conclusions: None
  - Likelihood: Unlikely
  - Impact: Negligible
  - Risk Level: 0
Cost Estimate Assumptions

Mob/Demob:
- Concerns: Assuming multiple contracts so multiple mob/demobs should already be covered.
- PDT Discussions/Conclusions: No concerns.
- Likelihood: Unlikely
- Impact: Negligible
- Risk Level: 0

Borrow Site:
- Concerns: Borrow site assumed at farm fields adjacent to borrow site that was used in construction of original levee. Borrow will be purchased through a per cubic yard royalty fee. Also, could hit water table as need to excavate down to 5'.
- PDT Discussions/Conclusions: Water table could be near these depths unless high flows are occurring and probably would not be working during high flows.
- Likelihood: Possible
- Impact: Significant
- Risk Level: 2

Levee Raise & Sand Drain:
- Concerns: Estimate assumes enough easement room for 1-way haul routes at levee toe along length of levee raise. Haul routes would be in a circuitous route to get back to borrow site since routes would be 1-way. May be tight to fit haul routes in some locations where levee backs up to businesses.
- PDT Discussions/Conclusions: Could need to re-route haul routes which would increase length and costs. Could have to haul atop levee which would require time for rutting repairs. Re-routing could take place on city streets, which would require restoration of roads.
- Likelihood: Possible
- Impact: Significant
- Risk Level: 2

Underseepage Berms:
- Concerns: Increase in fuel prices could have impact on costs of berms. Topsoil assumed to be able to be re-used but could have to haul in topsoil.
- PDT Discussions/Conclusions: Both concerns could significantly increase costs.
- Likelihood: Possible
- Impact: Significant
- Risk Level: 2

Utility Relocations:
Concerns: Casement Road Raise will change existing drainage at that location. No analysis has been done to see if that change will require additional modifications to handle the drainage pattern changes. Also, privately-owned utilities are not well mapped out at this location at this time. Also, unsure at this time how traffic control at this intersection will be need to be altered.
-PDT Discussions/Conclusions: Biggest concerns are unknown utilities and traffic control.
- Likelihood: Possible
- Impact: Significant
- Risk Level: 2

Gatewell Replacements:
- Concerns: Increase in steel prices could impact new gatewells as they would require lots of steel. Also, the assumed methodology and production rates may be lacking depending on the actual construction conditions.
- PDT Discussions/Conclusions: Definitely possible and could have marginal increase in costs for steel prices. Larger and more significant impact on costs is risk of being low in assumptions for methodology and production rates.
- Likelihood: Possible
- Impact: Significant
- Risk Level: 2

Relief Wells:
- Concerns: Increased flow from RW’s may require upgrades to pumping capacity, specifically at Poyntz Pump Station at Sta. 100+00. May need to add an additional pump to meet need. Increase in stainless steel prices could impact relief well costs.
- PDT Discussions/Conclusions: Recent quote for installed pump of size needed is around $50k. Civil Design section believes need for upgrade is unlikely. Also, stainless steel price increases are definitely possible and would have marginal increase in costs.
- Likelihood: Possible
- Impact: Significant
- Risk Level: 2

Remaining Construction Items:
- Concerns: No Remaining Construction Items. All are covered under other line items.
- PDT Discussions/Conclusions: None
- Likelihood: Unlikely
- Impact: Negligible
- Risk Level: 0

Planning, Engineering, & Design:
- Concerns: No concerns.
- PDT Discussions/Conclusions: None
- Likelihood: Unlikely
-Impact: Negligible
-Risk Level: 0

Construction Management:
-Concerns: Assuming multiple contracts so project should be easier to manage this way.
-PDT Discussions/Conclusions: Easier to manage multiple smaller contracts. Possible risk of coordination issues with lots of construction occurring at once.
-Likelihood: Possible
-Impact: Marginal
-Risk Level: 1

External Project Risks
Mob/Demob:
-Concerns: Multiple mob/demobs per contract could be needed due to funding stream limitations
-PDT Discussions/Conclusions: Adding additional mob/demobs would add significant cost increase to this line item
-Likelihood: Likely
-Impact: Significant
-Risk Level: 3

Borrow Site:
-Concerns: Some areas nearby were used as emergency landfills in the past and could cause HTRW concerns.
-PDT Discussions/Conclusions: Current borrow site does not show up in records as having been used as an emergency landfill so this is unlikely but could have a significant HTRW impact.
-Likelihood: Unlikely
-Impact: Significant
-Risk Level: 1

Levee Raise & Sand Drain:
-Concerns: Flood event would likely shut down job site and put contractor on stand-by.
-PDT Discussions/Conclusions: Definitely possible as big releases could come from Tuttle Creek in the event of flood and could have critical impact to cost & schedule.
-Likelihood: Possible
-Impact: Critical
-Risk Level: 3

Underseepage Berms:
-Concerns: Flood event would likely shut down job site and put contractor on stand-by.
-PDT Discussions/Conclusions: Definitely possible as big releases could come from Tuttle Creek in the event of flood and could have critical impact to cost & schedule.
  -Likelihood: Possible
  -Impact: Critical
  -Risk Level: 3

Utility Relocations:
-Concerns: Flood event would likely shut down job site and put contractor on stand-by.
-PDT Discussions/Conclusions: Shorter duration activity than levee raise or berm construction
  -Likelihood: Unlikely
  -Impact: Significant
  -Risk Level: 1

Gatewell Replacements:
-Concerns: Flood event would test the Emergency Closure System as it would be the weakest point of the levee. Floods out of Tuttle Creek will likely be large and long durations.
-PDT Discussions/Conclusions: Might have to armor for long duration or continuously add more fill.
  -Likelihood: Unlikely
  -Impact: Critical
  -Risk Level: 2

Relief Wells:
-Concerns: Contaminated plumes could cause relief wells to not be a viable option within certain reaches.
-PDT Discussions/Conclusions: According to HTRW section: Knowledge of contaminated areas are at Levee Sta. 63+00 and Sta. 211+00 to 213+00. Sta. 63+00 was a privately-owned landfill and not within our study area. Sta. 211+00 to 213+00 is a CIRCLA site that contains VOC's. Water flowing during high water scenarios would be from the river and not the plumes.
  -Likelihood: Possible
  -Impact: Significant
  -Risk Level: 2

Remaining Construction Items:
-Concerns: No Remaining Construction Items. All are covered under other line items.
-PDT Discussions/Conclusions: None
  -Likelihood: Unlikely
  -Impact: Negligible
  -Risk Level: 0

Planning, Engineering, & Design:
-Concerns: Interruption in funding stream could be devastating if project is spanned over multiple contracts as levee would be raised in some areas but not others. Therefore, it could potentially induce flooding in certain areas since whole system is not in place.
- PDT Discussions/Conclusions: Unlikely that funding would be interrupted once committed to on a project of this manner/life safety.
- Likelihood: Unlikely
- Impact: Critical
- Risk Level: 2

**Construction Management:**

- Concerns: Incremental funding stream could spread project out over many smaller contracts and increase costs due to inflation. Could cause funding delays as well.
- PDT Discussions/Conclusions: Likely under current funding climate for incremental funding and possible for funding delays. Would have critical impact on costs.
- Likelihood: Possible
- Impact: Critical
- Risk Level: 3