TASK ORDER NO. 7.0

FRANKLIN COUNTY WATER DISTRICT (FCWD)

AND

CAROLLO ENGINEERS, INC.

This Task Order is issued by the OWNER and accepted by ENGINEER pursuant to the mutual promises, covenants, and conditions contained in the Agreement between the above named parties dated the 19 day of April 2016, in connection with:

**Preliminary Engineering Report (PER) for**
**Flood Relief Project Alternatives**

## SCOPE OF SERVICES

## 1.0 MEETINGS, DELIVERABLE PREPARATION, AND PROJECT MANAGEMENT

Engineer will provide Project Management (PM) services to facilitate efficient project completion. The anticipated Engineer's efforts will include the following activities. Effort will be based on the assumptions as stated, where applicable:

### 1.1 Project Administration

Engineer will prepare professional engineering services contract for Owner's review and execution. The terms of final executed professional engineering services contract will be adhered to throughout the duration of contract term by the Engineer. Engineer will also secure the services of sub-consultant(s) for the performance of specialized tasks associated with the engineering services. This will include development of detailed scopes of work, negotiation, scheduling, coordination, review, and integration of sub-consultant work products into the overall Project.

### 1.2 Project Status Reports

Engineer will prepare and submit, in electronic PDF format, status reports summarizing the work completed by Engineer, anticipated work, current budget and schedule status, and any project issues requiring discussion or resolution, as necessary.

### 1.3 Establish Document Management System and Procedures

Engineer will develop and implement a standardized in-house document management system and protocol to be utilized throughout the course of project, to facilitate the storage and tracking of meeting agendas and summaries, design notes and calculations, reports, drawing files, technical specifications, contract documents, addenda, bid tabulations, recommendations of award, quality review documentation, etc.

During the final phase of the project, all files and folders inside the document management system will be delivered to the Owner for future use, as needed. This is a cost-saving technique that will be helpful if this project enters a design phase.

#### 1.3.1 Develop Project Schedule

Engineer will prepare and submit to Owner, in electronic PDF format, a project schedule that includes all phases of the project and the essential tasks associated with each, in order to illustrate Engineer's overall plan for the execution of the work, and its anticipated duration. Engineer will update the project schedule in conjunction with the completion of each major project milestone, and will submit to Owner in electronic PDF format.

### 1.4 Conduct Project Meetings

Engineer will schedule, attend, and conduct meetings with Owner during the course of the project as outlined below. Following all meetings, Engineer will prepare and distribute a written meeting summary, formatted to track action items and key decisions, as necessary, and at the client's request. Anticipated meetings include:

#### 1.4.1 Kick-off Meeting

Engineer will conduct kick-off meeting to include team member introductions, personnel roles, and responsibilities, guidelines for communication, document control procedures, work plan review, design criteria, coordination requirements, review procedures, budget, Owner needs/preferences, project site familiarity, etc. It is assumed that each meeting is attended in-person by three (3) Engineer representatives.

#### 1.4.2 Periodic Project Status Meetings

Engineer will conduct periodic project status meetings to be held throughout the duration of the project phase for the purpose of updating Owner regarding project status and as a forum for discussing any questions or outstanding issues identified during the course of the work.

### 1.5 Conduct Public Forums

Engineer will schedule, attend, and conduct forums with the public with the support of the Owner (scheduling, advertising, location, etc.) during the course of the project as outlined below. Anticipated public forums will include:

### 1.5.1 Alternatives Presentation

Engineer will conduct an Alternatives Presentation to include a presentation to the local public in Mt. Vernon, TX of both structural and operational alternatives to be evaluated in further detail in this PER. It is assumed that each meeting is attended in-person by three (3) Engineer representatives.

### 1.5.2 Results and Recommendations Presentation

Engineer will conduct a public Results and Recommendations Presentation to include a presentation to the local public in Mt. Vernon, TX of results and recommendations outlined in the PER. Public forum will be scheduled and completed after final deliverable of PER to Owner.

### 1.6 Invoicing

Engineer will prepare and submit monthly invoices to Owner for review and processing. Invoices will be based on a time and materials basis, as completed through the end of the prior month.

## 2.0 DATA COLLECTION AND REVIEW OF RELEVANT PROJECT DATA

Engineer will request, collect, and review all available data associated with the project from Owner. Engineer will digitize, in electronic PDF format, all information received from Owner, in conjunction with established document management system. Assume timely provision of legible hard copy and/or electronic files by Owner, and that Engineer may reasonably expect to rely upon accuracy and completeness of information provided by Owner.

## 3.0 ALTERNATIVES IDENTIFICATION

### 3.1 No Action

Engineer will work with Owner to establish the definition of a No-Action Alternative. This includes an assessment of damage caused by the recent record-high event (383.92 FT MSL) using survey data collected on the FCWD website. This will also include an assessment of damage caused by other high events using forecasted flooding (with slab elevation survey data recently collected) and assumptions about average damages.

### 3.2 Structural Alternatives

Engineer will work with Owner to establish up to five (5) structural design alternatives to be evaluated during this PER project. Each alternative will selected based on likelihood of positive benefit-cost and foreseeable public acceptance. Structural Alternatives will be established in a conceptual form and presented to the public at the Structural Alternatives Presentation (Task 1.5).

After the Structural Alternatives Presentation, Engineer will work with Owner to choose two (2) structural alternatives (named herein Structural Alternative 1 and Structural Alternative 2) to be analyzed in Section 4.0 below. Structural Alternatives will only consist of a conceptually defined functionality (pumped, gravity, gated, etc.), elevation, width, and general location for a proposed alternative and will not include design-related details.

NOTE: Please refer to Section 4.0 below for alternative assumptions for guidance on relevant information necessary for this evaluation. As outlined below, detailed design elements are not necessary for this preliminary evaluation of structural alternatives.

### 3.3 Operational Alternatives

Engineer will work with Owner to establish a single (1) alternative related to modification to operations of the reservoir. This will include the selection of up to three (3) modified conservation pool elevations lower than the existing pool of 378.0 msl. This Operational Alternative (and up to 3 sub-alternatives) will be established in a conceptual form and presented to the public at the Alternatives Presentation (Task 1.5).

## 4.0 STRUCTURAL ALTERNATIVES EVALUATION

Using the alternatives developed in Section 3.2 above with the Owner and public, Engineer will analyze the two (2) structural alternatives as outlined in the tasks below. In general, the evaluation of the alternatives will begin with the development of a Revised Existing Frequency Analysis (REFA) Curve. Then, Engineer will incorporate the proposed Structural Alternatives 1 & 2 into the REFA model to determine the overall effect of each alternative on the water-surface elevations in the lake. The response in lake-levels for each of the proposed alternatives will be compared to the REFA Curve to showcase the hydrologic effectiveness of the Structural Alternatives 1 & 2. After, an evaluation of the jurisdictional hurdles and downstream stakeholders associated with each of the structural alternatives will be evaluated.

A detailed breakdown of the structural alternative evaluation tasks is outlined below:

### 4.1 Hydrologic Modeling of Structural Alternatives

Hydrologic modeling of Structural Alternatives 1 & 2 is necessary to confirm a conceptual functionality of each alternative and determine its effectiveness. As such, hydrologic modeling using HEC-HMS is proposed as detailed below.

NOTE: The proposed hydrologic modeling will determine the *response of the lake* (with the REFA Curve) to flooding scenarios. Modeling will not include the HEC-RAS hydraulic counterpart that will be required to understand, in more detail, how the Structural Alternatives would respond in various flooding scenarios.

### 4.1.1 Develop the Revised Existing Frequency Analysis (REFA) Curve

Engineer will develop a Revised Existing Frequency Analysis (REFA) Curve. This REFA Curve will be developed by using the Hydrologic Modeling Center (HEC) Hydrologic Modeling System (HMS) software called HEC-HMS. The REFA Curve, representing high-level lake-system elements (stage-storage curves, service spillway measurements, emergency spillway orientation, etc.), will be used as the foundation to create a Proposed Frequency Analysis (PRA) Curve for Structural Alternatives 1 & 2 in Section 4.1.4 below. The REFA Curve will be developed using model results from the proposed 2-year, 5-year, 10-year, 25-year, 50-year, 100-year, and 500-year storm events. Events of greater magnitude (1,000-year, 2,500-year, 5,000, and 10,000-year) will be evaluated, but will utilize interpolated rainfall amounts and durations (as statistical information related to these events is not available through Technical Paper 40 or Atlas of Depth Duration Frequency of Precipitation Annual Maxima for Texas).

### 4.1.2 Develop the Lake Cypress Springs Damage Curve

Using the REFA Curve, a Damage Curve will be created. The Damage Curve will predict probable amounts of damage to residential structures (houses, boat houses, retaining walls, etc.) per half-foot of rise in the water surface elevation of the lake. The damage curve will be created by utilizing the flood-damage survey results for the record-event (384.92') on the FCWD website, the Franklin County Appraisal District (FCAD) data (where applicable), and the elevation survey results from the Arroyo Environmental survey. The Damage Curve will be used in the Hydrologic Modeling tasks presented below.

### 4.1.3 Hydrologic Evaluation of No-Action Alternative

Engineer will evaluate the effect of taking no action to add a secondary service spillway. This analysis will be performed by coupling the REFA (developed in Section 4.1.1) coupled with the Damage Curve (developed in Section 4.1.2) to determine a predicted dollar-amount of damage to lakeside residences for each of the storm events.

### 4.1.4 Hydrologic Evaluation of Alternatives 1 & 2

Engineer will alter the REFA model to represent the features proposed in Structural Alternatives 1 & 2. The model will result in a Proposed Frequency Analysis (PFA) Curve for each alternative that can be compared to the REFA Curve. The Proposed Frequency Analysis Curve will be developed for the 2-Year, 5-Year, 10-Year, 25-Year, 50-Year, 100-Year, and 500-Year events. Events of greater magnitude (1,000-year, 2,500-year, 5,000, and 10,000-year) will be evaluated, but will utilize interpolated rainfall amounts and durations (as statistical information related to these events is not available through Technical Paper 40 or Atlas of Depth Duration Frequency of Precipitation Annual Maxima for Texas).

Using the PFA Curve, a Damage Curve will be created for each alternative by utilizing the flood-damage survey results for the record-event (384.92') on the FCWD website, the FCAD data (where applicable), and the elevation survey results from the Arroyo Environmental survey.

## 4.2 Stakeholder Assessment

### 4.2.1 Lake Bob Sandlin

It is necessary during this process to communicate with stakeholders of Lake Bob Sandlin (in particular, Titus County Fresh Water Service District (TCFWSD)) to understand concerns they have with a larger water release downstream. Engineer will discuss the concept with Lake Bob Sandlin Stakeholders to get input on concerns. Details regarding this discussion and the identified hurdles will be documented in the report deliverable.

### 4.2.2 Lake O' the Pines (LOTP)

Lake O' the Pines is a flood control reservoir with significant flood-pool storage volume. As such, it is not anticipated that Lake O' the Pines stakeholders (in particular North East Texas Municipal Water District (NETMWD)) will protest a larger surge of water from Lake Cypress Springs from the addition of a secondary spillway. With that said, it is necessary during this process to communicate with NETMWD to understand concerns they have with a larger water release downstream. Engineer will discuss the concept with Lake Bob Sandlin Stakeholders to get input on concerns. Details regarding this discussion and the identified hurdles will be documented in the report deliverable.

## 4.3 Other Design constraints and Issues

### 4.3.1 Flow Control Solutions

Engineer, within the delivered PER, will discuss alternative flow control solutions that could be implemented. These could include sluice gates, weir gates, bulkheads, stop logs, tainter gates, or other solutions that might not be addressed in the higher-level conceptual analysis of each Structural Alternative.

### 4.3.2 Land Acquisition for Footprint or Floodwaters

It is anticipated that flow into areas of Andy's Creek or in proximity to the dam could require the acquisition of additional land for installation of the Structural Alternatives or for the inundation of property with flood flows. Engineer will discuss hurdles associated with land acquisition and determine likely amounts (without performing additional modeling) that might be required for the two structural alternatives.

### 4.3.3 Concerns with Andy's Creek

Based on previous discussions with Owner, Engineer anticipates structural alternatives identified in Section 3.0 to involve the discharge of lake floodwaters into Andy's Creek, which is located directly downstream of the existing emergency spillway. Engineer will discuss hurdles associated with determining the capacity of Andy's Creek and confirming that the creek has capacity to accept additional flood-flows. Engineer will also discuss hurdles associated with the possibility that Andy's creek does not have capacity to take additional flow from Lake Cypress Springs (i.e. reconfiguration, armoring, etc.)

NOTE: Engineer does not propose hydraulic modeling associated with determining the capacity of Andy's Creek.

### 4.4 Development of Preliminary Cost Estimates for Structural Alternatives 1 & 2

Engineer will develop a high-level Opinion of Probable Construction Cost (OPCC) estimate for Structural Alternatives 1 & 2. This cost estimate will estimate costs associated with permitting, environmental, design (including survey, geotechnical, etc.), bidding, and construction of each structural alternative.

Note: In examining items with regard to cost, because this estimate is for the purpose of planning, estimated costs will include a contingency factor. Also, costs should be considered a moderate level of accuracy and subject to change as detailed information (survey, geotechnical, environmental, land acquisition, etc.) is updated. Methods of analysis used in the development of this cost estimate will be consistent with a planning level of this detail.

## 5.0 OPERATIONAL ALTERNATIVES EVALUATION

Using the alternatives developed in Section 3.3 above with the Owner and public, Engineer will analyze the Operational Alternative (and sub-alternatives) as outlined in the tasks below. In general, the evaluation of the alternative will begin with the use of the Revised Existing Frequency Analysis (REFA) Curve. Then, Engineer will incorporate the proposed Operational Alternative into the REFA model to determine the overall effect of keeping the lake at a lower conservation pool elevation. The response in lake-levels for each of the proposed alternatives will be compared to the REFA Curve to showcase the hydrologic effectiveness modifying the operations of the reservoir.

A detailed breakdown of the operational alternative evaluation tasks is outlined below:

### 5.1 Hydrologic Modeling of Operational Alternative

Hydrologic modeling of the Operational Alternative is necessary to confirm a conceptual functionality and determine its effectiveness. As such, hydrologic modeling using HEC-HMS is proposed as detailed below. In addition to hydrologic modeling, water availability modeling is necessary for this task as presented below.

Engineer will alter the REFA model to represent the constant lowering of the lake as proposed in the Operational Alternatives. The model will result in a Proposed Frequency Analysis (PFA) Curve for the alternative that can be compared to the REFA Curve. The Proposed Frequency Analysis Curve will be developed for the 2-Year, 5-Year, 10-Year, 25-Year, 50-Year, 100-Year, and 500-Year events. Events of greater magnitude (1,000-year, 2,500-year, 5,000, and 10,000-year) will be evaluated, but will utilize interpolated rainfall amounts and durations (as statistical information related to these events is not available through Technical Paper 40 or Atlas of Depth Duration Frequency of Precipitation Annual Maxima for Texas).

### 5.2 Water Availability Modeling

It is anticipated that the Operational Alternative will have an impact to water availability for FCWD customers. Water Availability Modeling (WAM) is necessary to confirm a conceptual functionality and determine its effectiveness. As such, WAM modeling using the Water Rights Analysis Package (WRAP) is proposed.

Carollo will acquire the Water Availability Models (WAMs) available online provided by the Texas Commission on Environmental Quality (TCEQ). The existing WAM models will be run to determine the availability and dependability the existing water rights. The WAM will be modified for a new conservation storage volume (SA/SV record modification) and re-run. The existing model will be compared to the proposed model to determine the water availability effect of the Operational Alternative.

NOTE: It is already known through previous work with FCWD that some elements of the operational agreement as part of the certificate of adjudication (i.e. water right) are not represented in the current TCEQ WAMs. Carollo will not modify the WAM models for the existing conditions. The proposed model will only contain alterations necessary to modify the conservation elevation of the reservoir.

## 6.0 SUMMARY OF RESULTS AND CONCLUSION

Engineer will summarize the analysis performed for the Structural and Operational Alternatives in the tasks above and provide the Owner concluding remarks for future decisions on alternatives.

**DELIVERABLES**

Engineer will deliver to the Owner the completed Preliminary Engineering Report (PER) documenting and summarizing our findings in the study.

**SCHEDULE**

In completing this PER to analyze structural alternatives for a secondary spillway, Carollo will accomplish the basic services tasks, as described in the “Scope of Services” section above, in an anticipated ***7 Month*** time period from the authorization date.

**PROPOSED FEE**

In completing this PER to analyze structural alternatives for a secondary spillway, Carollo will accomplish the basic services tasks, as described in the "Scope of Services" section above, for a proposed time and materials not to exceed ***$137,500***. A detailed fee breakdown, outlining the proposed budgetary allocation for each identified task is provided in Attachment A.

Enclosures: Attachment A

CAROLLO ENGINEERS, INC.

By: _____

David K. Harkins
Vice President
P.E. # 87732

By: _____

Scott P. Hoff
Senior Vice President
P.E. # 89056

OWNER

Accepted this 19 day of April, 2016

By: _____

Owner

**Preliminary Engineering Report (PER) for Secondary Spillway Structural Alternatives**

**BUDGET**

| Carollo Proj. #: 10070A.00 | | | | | | | | | | | | | | Totals | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Personnel:** | | | | **Principal** | **Lead Engineer (PM)** | **Engineer in Training (EIT)** | **Technician** | **Document Processing / Clerical** | | | | | | | |
| **Hourly Rate:** | | | | $230 | $175 | $145 | $110 | $96 | $0 | $0 | $0 | $0 | $0 | **Cost** | **Hrs.** |
| **1.0 MEETINGS, DELIVERABLE PREPARATION, AND PROJECT MANAGEMENT** | | | | | | | | | | | | | | | |
| | 1.1 | Project Administration | | 2 | 10 | | | | | | | | | $2,210 | 12 |
| | 1.2 | Project Status Reports | | 4 | 6 | | | | | | | | | $1,970 | 10 |
| | 1.3 | Establish Document Management System and Procedures | | | 4 | | | | | | | | | $700 | 4 |
| | | 1.3.1 | Develop Project Schedule and Work Plan | | 4 | | | | | | | | | $700 | 4 |
| | 1.4 | Conduct Project Meetings | | | | | | | | | | | | $0 | 0 |
| | | 1.4.1 | Kick-off Meeting | 4 | 4 | 2 | | | | | | | | $1,910 | 10 |
| | | 1.4.2 | Periodic Project Status Meetings | 8 | 16 | | | | | | | | | $4,640 | 24 |
| | 1.5 | Conduct Public Forums | | | | | | | | | | | | $0 | 0 |
| | | 1.5.1 | Alternatives Presentation | 16 | 8 | | | | | | | | | $5,080 | 24 |
| | | 1.5.2 | Results and Recommendations Presentation | 16 | 8 | | | | | | | | | $5,080 | 24 |
| | 1.6 | Invoicing | | | 3 | | | | | | | | | $525 | 3 |
| **2.0 DATA COLLECTION AND REVIEW OF RELEVANT PROJECT DATA** | | | | | | | | | | | | | | $0 | 0 |
| **3.0 STRUCTURAL ALTERNATIVES IDENTIFICATION** | | | | | | | | | | | | | | | |
| | 3.1 | No Action | | 2 | 4 | | | | | | | | | $1,160 | 6 |
| | 3.2 | Structural Alternatives | | 8 | 20 | 4 | | | | | | | | $5,920 | 32 |
| | 3.3 | Operational Alternatives | | 6 | 10 | 2 | | | | | | | | $3,420 | 18 |
| **4.0 STRUCTURAL ALTERNATIVES EVALUATION** | | | | | | | | | | | | | | | |
| | 4.1 | Hydrologic Modeling of Structural Alternatives | | | | | | | | | | | | $0 | 0 |
| | | 4.1.1 | Develop the Revised Existing Frequency Analysis (REFA) Curve | | 30 | 30 | 8 | | | | | | | $10,480 | 68 |
| | | 4.1.2 | Develop the Lake Cypress Springs Damage Curve | | 20 | 30 | | | | | | | | $7,850 | 50 |
| | | 4.1.3 | Hydrologic Evaluation of No-Action Alternative | | 8 | 16 | | | | | | | | $3,720 | 24 |
| | | 4.1.4 | Hydrologic Evaluation of Alternatives 1 & 2 | | 30 | 60 | 4 | | | | | | | $14,390 | 94 |
| | 4.2 | Jurisdictional Assessment and Identification of Possible Permitting Requirements | | | | | | | | | | | | $0 | 0 |
| | | 4.2.1 | Sedimentation, Biological, and Wetland Impacts (USACE) | 4 | 6 | 2 | | | | | | | | $2,260 | 12 |
| | | 4.2.2 | Dam Safety (USACE and TCEQ) | 4 | 30 | 16 | | | | | | | | $8,490 | 50 |
| | | 4.2.3 | Water Quality (TCEQ) | 4 | 16 | 8 | | | | | | | | $4,880 | 28 |
| | | 4.2.4 | FM 3122 (TxDOT) | 2 | 8 | 4 | | | | | | | | $2,440 | 14 |
| | | 4.2.5 | Texas Parks and Wildlife (TPWD) | 2 | 8 | 2 | | | | | | | | $2,150 | 12 |
| | | 4.2.6 | Single (1) Additional Agency Contact | 4 | 8 | 4 | | | | | | | | $2,900 | 16 |
| | 4.3 | Stakeholder Assessment | | | | | | | | | | | | $0 | 0 |
| | | 4.3.1 | Lake Bob Sandlin | 8 | 2 | | | | | | | | | $2,190 | 10 |
| | | 4.3.2 | Lake O' the Pines (LOTP) | 8 | 2 | | | | | | | | | $2,190 | 10 |
| | 4.4 | Other Design constraints and Issues | | | | | | | | | | | | $0 | 0 |
| | | 4.4.1 | Flow Control Solutions | | 4 | 2 | | | | | | | | $990 | 6 |
| | | 4.4.2 | Land Acquisition for Footprint or Floodwaters | | 4 | 16 | | | | | | | | $3,020 | 20 |
| | | 4.4.3 | Concerns with Andy's Creek | | 2 | 4 | | | | | | | | $930 | 6 |
| | 4.5 | Development of Preliminary Cost Estimates for Structural Alternatives 1 & 2 | | 8 | 20 | 30 | | | | | | | | $9,690 | 58 |
| **5.0 OPERATIONAL ALTERNATIVES EVALUATION** | | | | | | | | | | | | | | | |
| | 4.1 | Hydrologic Modeling of Operational Alternative | | | 5 | 25 | 4 | | | | | | | $4,940 | 34 |
| | 4.1 | Water Availablity Modeling | | | 4 | 15 | 2 | | | | | | | $3,095 | 21 |
| **5.0 CONCLUSION AND DEVELOPMENT OF RECOMMENDATIONS** | | | | 8 | 16 | 8 | | 8 | | | | | | $6,568 | 40 |
| | | | Total Hours: | 118 | 320 | 280 | 18 | 8 | 0 | 0 | 0 | 0 | 0 | | |
| | | | **Total Labor:** | **$27,140** | **$56,000** | **$40,600** | **$1,980** | **$768** | **$0** | **$0** | **$0** | **$0** | **$0** | **$126,500** | **744** |

| **Subconsultants** | | **Fee** | **% Mark-Up** | **Totals** |
|---|---|---|---|---|
| | Arroyo Environmental | $9,000.00 | 0% | $9,000 |
| | | | | $0 |
| | | | | $0 |
| | | | **Total Subs** | **$9,000.00** |

| **Expenses** | | **Fee** | **% Mark-Up** | **Totals** |
|---|---|---|---|---|
| | Travel | $2,000.00 | 0% | $2,000 |
| | | | | $0 |
| | | | | $0 |
| | | | **Total Expenses** | **$2,000.00** |

| **Totals** | | |
|---|---|---|
| | Total Hours | 744.0 |
| | Total Labor | $126,500 |
| | Total Subconsultants | $9,000 |
| | Total Expenses | $2,000 |
| | **Project Total** | **$137,500** |