METROPOLITAN SEWER DISTRICT OF GREATER CINCINNATI

# PROJECT COSTING MANUAL

## Metropolitan Sewer District of Greater Cincinnati
## Wastewater Engineering Division Standard

Version 3

February 2024

## Record of Revision

| Revision No. | Date | Description |
|---|---|---|
| *0* | *May 2021* | *Initial issue.* |
| *1* | *February 2023* | *Major revision to simplify format and align the guidance with the PDS. Converted formula derivations into tables. Added guidance for progressive DB projects.* |
| *2* | *February 2024* | *Annual review/refresh per feedback from MSD and Hamilton County. Changes include:*<br>• *Revised calculation of indirect costs*<br>• *Removed capitalized interest cost*<br>• *Updated DBB and PDB PDS models*<br>• *Updated project cost estimate summary tables (Appendix C)*<br>• *Updated OMB and inflation rates in Section 3* |
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# 1. BACKGROUND

The Project Costing Manual (PCM) has been assembled as a Metropolitan Sewer District of Greater Cincinnati (MSD) Wastewater Engineering (WWE) Division Standard to serve as a single source of guidance for Metropolitan Sewer District (MSD) staff and consultants. It replaced the previously utilized Financial Analysis Manual (FAM) dated June 2013 and the related Estimating Guidelines document dated January 2009. The PCM provides guidance on the development of project cost estimates for Design-Bid-Build (DBB) projects and Progressive Design Build (PDB) projects. The purpose of the PCM is to ensure that all project estimates developed for MSD capital projects are prepared consistently and accurately. This standardization is intended to produce not only more accurate estimates, but also greater confidence in those estimates. While professional judgment and due diligence are critical to the proper development of any cost estimate, the standards and standard approaches established in this document should be used as the basis for all estimates created by MSD staff and consultants.

An effective project estimate can be used to establish a realistic project budget for cost monitoring and progress measurement throughout a project's lifecycle. The purpose of this document is to establish standard definitions and processes necessary to estimate various components of a project's cost. It is intended that this PCM be reviewed periodically and updated for review and approval by the MSD Standards Committee.

## 1.1. Definitions

In order to understand the relationship between various project cost estimating documents, it is necessary to clearly define the key components of the cost estimate:

- **Cost of Work:** Costs for labor, material, equipment, and other costs to create the asset.
- **Opinion of Probable Construction Cost (OPCC):** Cost of Work plus contractor mark-ups and other incidentals that are included in the contractors bid estimate for the project to be completed. This is also sometimes referred to as Total Construction Cost or Engineer's Estimate.
- **Total Project Cost:** OPCC plus the addition of the indirect costs necessary to complete the construction and startup of an asset. These indirect costs include Planning and Design, certain pre-construction and construction services performed by a Design consultant, Right of Way (ROW) costs, and other Miscellaneous expense. At the conclusion of the Planning Phase, this reflects the Class 4 estimate which is tracked as the baseline project estimate against which future estimate variances can be measured.
- **Life Cycle Cost:** Total Project Cost plus the operation and maintenance costs over the life of the asset. Life Cycle Costs are usually reported in terms of their present value. Present Value is used to compare alternatives over the life of the assets.

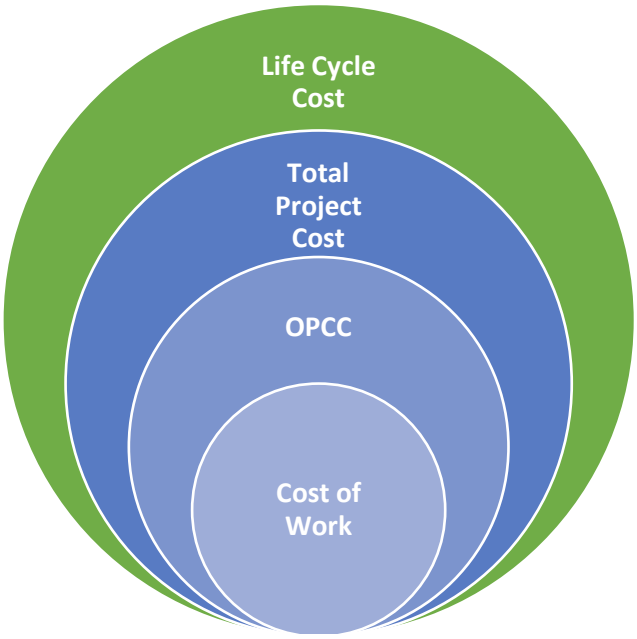


**Figure 1-1: Illustration of Project Cost Buildup**

## 2. PROJECT COST ESTIMATING

The following section provides specific guidance and explanation on how MSD project estimates are organized and developed. This is aligned with MSD's Project Delivery System (PDS) which defines the required milestone deliverables for projects along their lifecycle, including required cost estimates. MSD has developed a PDS for traditional design-bid-build and progressive design-build. Both of these delivery methods are addressed in this PCM.

### 2.1. Estimating Methods

In practice, estimating methodologies fall into two broad categories, conceptual and deterministic. As the level of project definition increases, estimating methodology tends to progress from conceptual methods to deterministic methods, as described below.

Conceptual estimating methods use independent variables that are generally something other than a direct measure of the units of the item being measured. They usually involve simple or complex modeling based on conferred or statistical relationships between costs and other, typically design-related, parameters. Often the cost estimating relationships used in conceptual estimating methods are subject to conjecture. The typical conceptual methods used are:

- Capacity Factor Method: A capacity factored estimate is one in which the cost of a new facility is derived from the cost of a similar facility with known (but usually different) capacity. This method relies on the non-linear relationship between capacity and cost.

- Ratio or Factor Methods: Ratio or factored estimating methods are used in situations where the total cost of an item or facility can be reliably estimated from the cost of a primary component. For example, these methods are commonly used when estimating the cost of specialized process equipment that makes up the significant portion of the construction cost.
- Parametric Method: A parametric model is a mathematical representation of cost relationships that provides a logical and predictable correlation between the physical or functional characteristics of a project and its resultant cost. A parametric estimate is developed using cost estimating relationships and other estimating functions that provide logical and repeatable relationships between independent variables, such as design parameters or physical characteristics, and the dependent variable, cost.

Conceptual cost estimating is typically performed at project nomination, during the planning phase of the project delivery cycle, and early in the design phase (30% design). At project nomination, where order of magnitude estimates are developed prior to the planning of a project, estimators must rely on industry standards and/or cost data for similar types of projects, facilities, or processes constructed in the past. Examples of conceptual methods traditionally used at this juncture are capacity factor or ratio factor methods. For the planning phase and early portions of the design phase, project definition has progressed, and conceptual estimating methods tend more toward parametric methods, which are mathematical representations of cost relationships that provide a logical and predictable correlation between the physical or functional characteristics of a project and its resultant cost.

Deterministic estimating methods use independent variables that are more or less direct measures of the item being estimated, such as straightforward counts or measures of items multiplied by known unit costs. Deterministic estimating methods rely on a high degree of precision and a determination of quantities, pricing, and a complete scope definition.

Deterministic cost estimating is typically performed during the later stages of the design phase (60%, 90% and Final Design). At the 60% design stage, however, deterministic methods are generally combined with conceptual methods to produce the estimate. In general, multiple methodologies are often used to account for varying degrees of scope definition for different project elements at various project stages. Estimators must select the most appropriate and advanced estimating methodologies based on scope definition and availability of historical cost data and parametric models.

## 2.2. Estimate Classification

Estimate classification is commonly used to indicate the overall maturity and quality of estimates. Most organizations will use some form of classification system to identify and categorize the various types of project estimates that they may prepare during the life cycle of a project. The classification described in this guide is based on the framework developed by the Association for the Advancement of Cost Engineering International (AACE). Their “Cost Estimate Classification System (Recommended Practice No. 18R-97)” provides generic guidelines for the general principles of estimate classification that may be applied across a wide variety of industries.

These guidelines have been adapted to fit the specific needs of MSD. Table 2-1 below shows the MSD Estimate Classification System. Like the AACE framework, MSD uses a five-level classification system to describe estimates developed for different project stages. Class 5 cost estimates refer to conceptual

estimates when a project is first conceived, and very little project information has been determined. As the project moves through the five classes, the number of unknowns in a project diminishes and the Class number decreases. An estimate may be classified as Class 1 when the project has reached 100% Design and is ready for bidding.

The Expected Accuracy Range column shows that a Class 1 estimate has a much narrower band of expected results than a Class 5 estimate. The two columns for contingency and accuracy are related but mean distinctly different things. AACE Recommended Practice 40R-08 (Contingency Estimating –General Principles) explains that an estimate's accuracy is dependent on the correct amount of contingency being included. Even after an appropriate contingency is applied, the accuracy range for a Class 5 estimate may still be -50% to +100%.

**Table 2-1: MSD Estimate Classification System**

| Class | MSD Phase/ Stage | Project Definition | Project Contingency | Background Information Used | Estimating Method | Expected Accuracy Range |
|---|---|---|---|---|---|---|
| 5 | Project Nomination (PNOM) | 1-5% | 40% | Few or no design parameters: estimate based on past history data | Conceptual | L: -20% to -50% H: +30% to +100% |
| 4 | Planning | 5-15% | 30% | Based on project narrative and recommendations | Conceptual | L: -15% to -30% H: +20% to +50% |
| 3 | 30% Design | 15-40% | 20% | Rudimentary design and estimator experience with known parameters needed to develop the estimate | Conceptual | L: -10% to -20% H: +10% to +30% |
| 3 | 60% Design | 40-60% | 15% | Design development documents. Estimator experience needed to determine appropriate estimating method. | Combination Conceptual & Deterministic | L: -10% to -20% H: +10% to +30% |
| 2 | 90% Design | 60-90% | 10% | Detailed estimating data from plans and specifications | Deterministic | L: -5% to -15% H: +5% to +20% |
| 1 | Final Design | 90-100% | 5% | Detailed documentation ready for bid submittal | Deterministic | L: -3% to -10% H: +3% to +15% |

## 2.3. Organization of Estimates

The organization of estimates into discrete work items is essential to the perception and subsequent analysis of estimates. MSD estimates should be organized by using the Work Breakdown Structure (WBS) with the Construction Specifications Institute (CSI) classification system encoded for each estimate line item. This allows for a schedule of values to be generated from the WBS.

All MSD Estimate Summaries will be organized using a predetermined WBS. The WBS provides a systematic organization for all the costs in the estimate and is typically unique to a particular type of

project. For example, a treatment plant may have a WBS structured around the plant process units, while a conveyance project may be organized by each defined reach or segment. A consistently applied WBS from the beginning of a project will facilitate a comparison of costs for each estimate submittal. Under each WBS heading, individual estimate line items will be coded using the CSI Masterformat 2016. The same estimate can then be presented in estimate reports that are either sorted in the WBS or the CSI classification system.

## 2.4. Schedule of Values

Estimates should be established as a control baseline as early as possible in the design process. Project budgets are derived from estimates prepared using all of the design and cost information available at the time. Although estimates will be refined as the projects are upgraded from conceptual to deterministic, all parties must be cognizant of the current estimates for their activities and for the execution of their work. Once the design process commences, project estimates will have necessarily stipulated the work breakdown structure that can be converted into an approved schedule of values. A schedule of values structure should be coordinated with the designers early in the design phase to ensure that all work output is included and defined with its own budget and schedule. This will simplify later evaluation of the effect of change and can be used as a future planning reference and risk analysis basis. The historical project information can then be used as raw data for trend analysis, indexing, and estimating unit data. The schedule of values should be developed no later than the 60% submittal during the design phase.

## 2.5. Estimating Approaches by Project Phase

MSD utilizes a formal Project Delivery System (PDS) for the delivery of all its capital projects. The PDS requires that project estimates be produced during the Project Nomination Phase, Planning Phase, and Design Phase of a project. The phases of a project are defined for all methods of project delivery by MSD, including traditional design-bid-build (DBB), DBB for assessment sewer projects (local and lateral sewers), and progressive design-build (PDB).

MSD's cost estimating approaches are outlined below for the DBB and PDB PDS models. More detailed information, guidance and requirements on project cost estimate elements / components and project cost estimate development and submittals are outlined in subsequent sections of the PCM.

### 2.5.1. Estimating Approach by Project Phase - Design-Bid-Build (DBB) Delivery

The traditional DBB PDS model through the Legislation Bid & Award Phase is depicted below. (For a view of the complete DBB PDS model see Appendix A.)

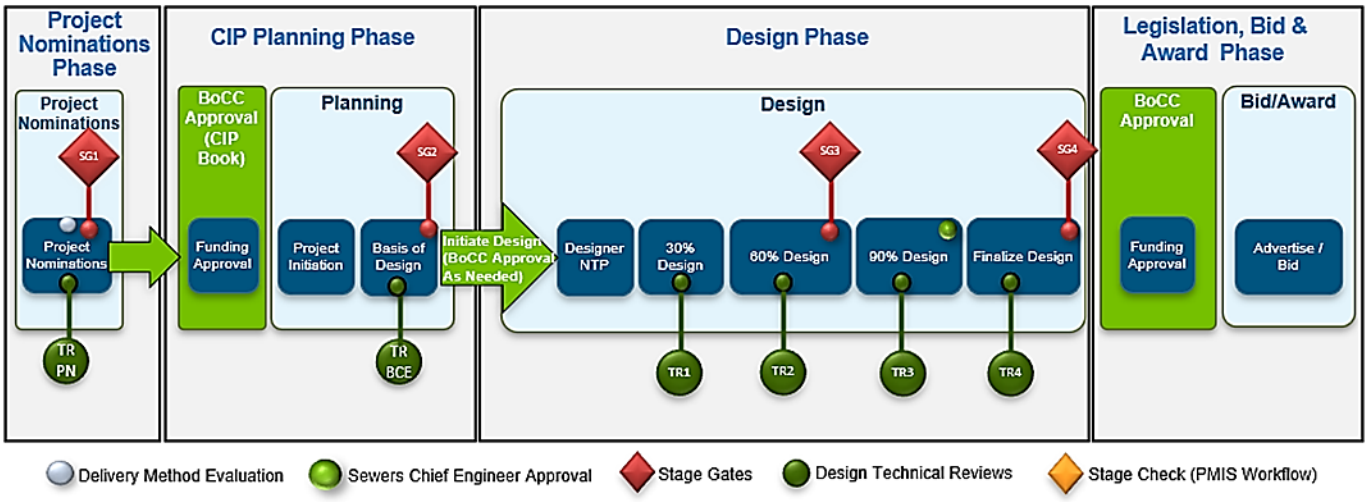


**Figure 2-1: PDS Model – Design-Bid-Build (DBB) Delivery**

Project Nomination (PNOM) Phase Estimates

The Project Nomination (PNOM) Phase requires that a Class 5 estimate be prepared and reviewed as part of the Stage Gate 1 approval process for inclusion in the Capital Improvement Program (CIP) Book. At this stage the project scope definition is limited to an understanding of the problem, a delineation of project limits, and some limited specificity of project components. The estimate would typically be developed based on a conceptual method (e.g., capacity factor or ratio factor) and carries the largest project contingency due to the lack of project definition. The project estimate at this stage is used for purposes of establishing the legislative requests in the CIP.

In accordance with MSD's PDS and PNOM process the project estimate will typically be developed in-house using internal cost estimating staff. The project estimate will be a key part of the project approval during the annual CIP adoption by the Board of County Commissioners (BoCC). This will provide the initial project estimates anticipated for the planning, design, construction services and miscellaneous expense. In order to provide a more reasonable estimation of these costs and ensure some consistency of approach at this early project development stage, formulas for Planning, Design, Miscellaneous Expense and Construction Services have been developed and are included in Section 2.7. These will aid the cost estimator in determining preliminary level estimate for these cost categories for purposes of project approval in the CIP and as a basis for contract negotiations once the project is approved and funds appropriated.

Once the CIP is approved, procurement starts for Planning, Design, and Construction Services. If the original estimate for these services is inadequate, the project will be delayed until additional funding can be approved through legislation.

Note: There is no Project Nomination Phase or Stage Gate 1 for assessment sewer projects (local and lateral sewers). No Class 5 cost estimates are prepared for these projects.

Planning Phase Estimates - BCE Estimates

The Planning Phase requires that a Class 4 estimate be prepared and reviewed as part of the Stage Gate 2 approval process prior to initiation of the Design Phase. During the Planning Phase an alternatives analysis is conducted resulting in a Business Case Evaluation (BCE) that recommends a preferred alternative. For assessment sewer projects (local and lateral sewers), the BCE is typically not prepared following alternatives analysis. However, the Class 4 estimate is developed and reviewed as part of the Stage Gate 2 approval process.

The Class 4 estimate produced in the Planning Phase establishes a baseline project estimate that is tracked by MSD and used as a basis for measurement of cost performance through the project lifecycle. Because design details may still be lacking, this estimate will likely be developed using a combination of the three conceptual estimating methods with emphasis towards the parametric method.

Design Phase Estimates - 30% and 60% Design Stages Estimates

Design Phase Estimates for 30% and 60% designs are Class 3 estimates. These estimates will be prepared, reviewed, and approved in accordance with the requirements of the PDS. The 30% project cost estimate should be based on a defined basis for design and project performance requirements. Design details should have been evolved from the planning level estimate and this estimate will likely be developed using a combination of conceptual estimating methods coupled with some deterministic estimating of specific items and unit costs.

At the 60% design stage, deterministic estimating methods should be utilized and the OPCC developed following a logical work breakdown structure aligned with the major project components. At this juncture the project should be very well defined in terms of sizing, locations, alignments, ROW acquisition requirements, and ancillary project needs. The 60% design stage Class 3 estimate will be reviewed as part of the Stage Gate 3 approval process, prior to initiation of the 90% design stage.

Note: For lateral sewer projects, there is no 60% Design stage or Stage Gate 3. No Class 3 cost estimates are developed for 60% design for these projects.

Design Phase Estimates - 90% and Final Design Stages Estimates

Design Phase Estimates for 90% designs are Class 2 estimates. Estimates for final designs are Class 1 estimate. These estimates will be prepared, reviewed, and approved in accordance with the requirements of the PDS. The 90% project estimate will be fully developed deterministically using a fully structured work breakdown structure consistent with MSD standards and shall contain current vendor pricing. There should not be any project scope changes occurring after the 90% submittal and cost estimate, just a refinement of the final design and incorporation of the technical review comments. It is not envisioned that the project cost estimate would change significantly between the 90% design stage and the final design stage. The final (100%) project estimate should be completely defined, contain updated vendor prices, and be reviewed as part of the Stage Gate 4 approval process to advertise the project for construction bids.

### 2.5.2. Estimating Approach by Project Phase - Progressive Design-Build (PDB) Delivery

The PDS model for the PDB delivery method through Phase 1 Services is depicted below. (For a complete view of the PDB PDS model see Appendix A.)

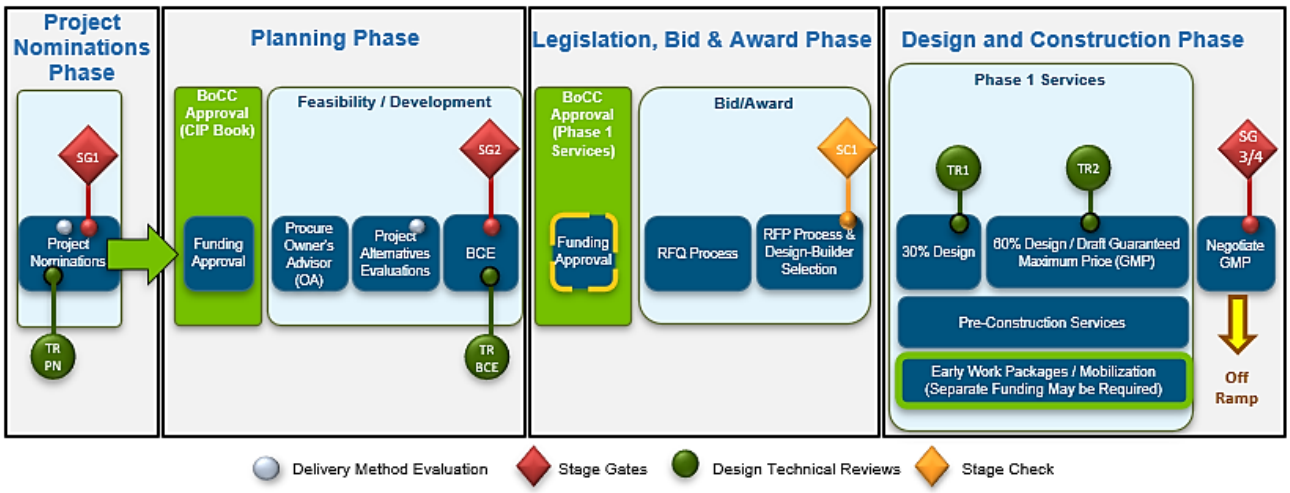


**Figure 2-2: PDS Model – PDB Delivery Method**

For PDB, the PDS also requires that project estimates be produced at Project Nomination as well as during planning and design. Estimates produced during design are performed as part of Phase 1 Services in the Design and Construction Phase.

Project Nomination (PNOM) Phase

The estimating approach for the PNOM Phase for PDB projects matches the approach outlined above for DBB projects during this phase. For PDB projects, however, MSD employs an additional PDB contingency to account for unforeseen site conditions, undisclosed hazardous environmental conditions, and additions to the scope of work. This contingency applies to all cost estimates produced over the project life cycle.

Planning Phase BCE Estimates

The estimating approach for the Planning Phase for PDB projects matches the approach outlined above for DBB projects during this phase. For PDB projects, however, it is likely that the alternatives analysis conducted during this phase and presented in the BCE will conclude with several viable options that may be carried into design-builder procurement (the Legislation, Bid & Award Phase).

Design and Construction Phase (Phase 1 Services) Estimates – 30% and 60% Design Stages

The estimating approach for the 30% design and 60% design stages for PDB projects matches the approach outlined above for DBB projects. For PDB projects, however, the 60% design stage Class 3 estimate will not be reviewed as part of any Stage Gate milestone. Instead, following the 60% design review, the design-builder will develop a Guaranteed Maximum Price (GMP) proposal for review as part of the PDB Stage Gate 3/4 approval process, prior to legislation and initiation of Phase 2 Services.

Note: For PDB, no cost estimates are prepared following development and negotiation of a GMP. Thus Class 2 and Class 1 estimates are not typically prepared during the 90% and final design stages in Phase 2 Services.

## 2.6. Project Cost Estimate Submittal Requirements

All MSD estimates should be developed and delivered via an estimate report to include the required components (as applicable) outlined below. All estimates should provide clear documentation on how the estimate was developed and the source of the costing info used.

### 2.6.1. Document List

The document list establishes the basis of the estimate. It will include a complete project description and reference all currently available drawings, sketches, reports, studies, equipment schedules, and outline specifications. The date on the drawings and documents will also be noted.

### 2.6.2. Assumptions

Assumptions include information regarding labor rates, labor productivity, hours of work, unique site restrictions, building materials used, and construction methods. Assumptions will be documented to understand costs that were estimated when there was insufficient or minimal project scope information.

### 2.6.3. Parametric Measurements

The estimate total and subtotal for each heading will be expressed in these commonly designated units for each estimate creation, evaluation of costs, and historical databases. If a parametric unit applies to the scope of the project, it can be shown in the Body of the Estimate. An example would be the “Million Gallons per Day” (MGD) for a Pump Station.

### 2.6.4. Body of Estimate

The Body of Estimate is the main component of the cost estimate submittal and includes the cost estimate line-item structure, quantities, units of measure, and pricing information. See Section 2.7 for details.

### 2.6.5. Total Project Cost Estimate Summary

All MSD project cost estimates, regardless of phase or project delivery method, have certain essential components. These required components promote consistency across MSD’s projects and ensure alignment with the appropriate PDS. The Total Project Cost Estimate Summary summarizes the total project cost and cost development by component.

See Appendix C for Project Cost Estimate Summary templates for DBB and PDB delivery methods. Templates include Cost of Work as well as applicable estimate mark-up items and indirect costs factoring into the overall Total Project Cost. Note the Total Project Cost entry should be expressed to a degree of accuracy of no more than three significant digits (e.g.: a $25,395,537 detailed estimate will round to $25,400,000; a $5,322,437 detailed estimate will round to 5,320,000). See Estimate Mark-Ups and Indirect Project Costs information in Section 2.7 below for more information on these elements.

## 2.7. Project Cost Estimate Development Guidance

To provide consistency in the development and structure of cost estimates, guidance is provided below for the Body of the Estimate as well as Estimate Mark-Ups and Indirect Costs. To further support this effort MSD has developed several guidance tables herein.

### 2.7.1. Body of Estimate

- Estimate line-item structure: Each line item will be coded to a WBS and CSI code with a description of the type of material involved or the scope of the item that is being priced.
- Quantities: If the scope of an entire construction item or task is difficult to take off, it will be designated as a "lump sum." Quantities can also be expressed as a designated number of total individual labor hours to complete a task.
- Unit of measure : Each estimate line item will have a quantity of work expressed in its appropriate unit of measure.
- Pricing: This is the application of unit costs to the quantities for each unit of measure to be acquired or installed. Unit costs are determined by calculating variables in the following five categories:
    - Material cost: The material unit price will be derived from vendor quotes, source books such as those produced by RS Means, and historical cost data. Sources should be identified within the Assumptions section of the Estimate Report.
    - Labor cost: Labor unit price will be based on probable labor production rates and crew sizes. Labor cost = (quantity/labor production rate) x labor rate where the labor production rate is the number of units of work produced by a person in a specified period of time, usually hours or days. This rate varies between trades, projects, climatic conditions, job supervision, complexity of the installation process, and other factors.
    - Equipment cost: The Contractor's major construction equipment costs include the rental, transportation, handling on the job, operation and maintenance costs. The equipment costs will be allocated to each appropriate line item but may be shown as an individual line item if a major piece of equipment is used for many different work tasks during the project.
    - Subcontractor cost: The subcontractor's quote will be reviewed for items that are included and excluded from their quotation and the length of time the subcontractor will honor the price.
    - Other construction costs: This includes miscellaneous cost / expense items that are not included in the unit costs. They may include costs associated with the following factors: weather, crew transportation, soil conditions, hazardous material removal, utility relocations, wetland replacements, road/highway/special crossings, traffic control, ground water, labor strikes, material and/or subcontractor availability, general material economic conditions, complexity of the project, and construction phasing. These costs should be clearly explained within the Estimate Report.

### 2.7.2. Estimate Mark-Ups

Estimate mark-ups are costs that are expressed as a lump sum, deterministic units or calculated as a percentage of the subtotal of the estimated construction costs. These mark-ups represent costs that may be incurred by a contractor outside of the direct actions required to build the asset. Mark-ups are added to Cost of Work to obtain the OPCC. They are presented in the Project Cost Estimate Summary.

- Contractor's General Conditions: The contractor's general conditions take into account the cost of items that cannot be associated with a specific element of work but must be furnished to complete a project. The general conditions include cost items such as supervision, temporary facilities, office trailers, toilets, utilities, permits, photographs, small tools, etc. Estimates produced for MSD will calculate the contractor's general conditions, barring deviation for professional judgment, as a percentage of the Cost of Work (see Table 2-2).
- Contractor's Overhead & Profit (OH&P): Contractor's Overhead is cost of doing business. Contractor's Profit is the cost amount as compensation for risk and efforts to undertake and complete the project. Estimates produced for MSD, barring deviation for professional judgment, will calculate the Contractor's OH&P as a percentage of the Cost of Work (see Table 2-2).
- Design-Build Services Fee: Applies only to progressive design-build projects. Similar to Contractor's OH&P, the Design-Build Services Fee includes administrative costs, home office overhead, and profit, and is typically calculated as a percentage of the Cost of Work. The fee shall be commensurate with the services it provides and the risk it assumes in providing single point responsibility to MSD for the project. The Design-Build Services Fee is the combination of compensation for (a) all Design-Builder services during Phase 2 not included in the Cost of the Work and excluding Phase 2 work by the Engineer of Record, whose work during Phase 2 shall be accounted for in the Design Services Fee; (b) all Design-Builder overhead during Phase 2 including home office overhead; and (c) all Design-Builder profit for Phase 2 of the Project including any Design-Builder mark-ups for subcontractors engaged during Phase 2.
- Project Contingency: This represents the uncertainty inherent in every estimate. This uncertainty includes not knowing precise quantities, exact methods, site conditions, etc. Estimators are aware that these uncertainties exist and can estimate their probable cost based on professional judgment. The estimated cost of these uncertainties is called contingency. MSD's approach to contingency has been based on the framework developed by the AACE. The AACE RP No. 40R-08 (Contingency Estimating-General Principles) provides generic principles for the practice of estimating contingency. In general, the AACE provides four methods of estimating contingency: expert judgment, predetermined guidelines, simulation analysis, and parametric analysis. MSD has adopted the predetermined guideline option with some flexibility to allow for expert judgment (see Table 2-1). The project contingency percentage decreases as the design life cycle progresses. The project contingency should be applied to the Cost of Work plus contractor mark-ups, but before escalation.
- Bonds & Insurance: Contractors are required to submit a performance bond to guarantee satisfactory completion of a project. MSD typically requires this amount to be 1% of the construction subtotal (Cost of Work + OH&P + Project Contingency) amount. Contractors are also required to carry certain Liability and Vehicle Insurances. MSD will use an average of 1% of the construction subtotal to estimate Insurance costs.

- Escalation: used to accommodate price increases or decreases during the life of an asset or the life of a project contract. Escalation is included in financial analysis to evaluate anticipated cost changes in material and/or labor. OPCCs should be escalated to the mid-point of construction.

  Escalation values shall be retrieved from a table on MSD's capital project resource library Capital Project Resource Library - Metropolitan Sewer District of Greater Cincinnati (msdgc.org) (based on date needed and apply the multiplier). This table is updated quarterly by MSD staff to reflect changes in the local and national economies. Development of this table is described in Appendix B of this document.

- PDB Contingency: This applies only to PDB projects and shall be 10% of the Cost of Work plus all mark-ups and escalation to account for unforeseen site conditions, undisclosed hazardous environmental conditions, and additions to the scope of work. It shall be applied to all PDS Phases PDB Estimates.

- Market Contingency: This contingency is a factor that may be added to the estimate to account for uncertainties which may adversely impact the bidding market. Examples of these conditions include:

  - Reduced bidding competition from Contractors
  - Labor Availability from tradesmen
  - Sudden changes in material pricing (e.g., tariffs, rising costs, supply chain)
  - Other unforeseen conditions (e.g., COVID-19)

  The need for inclusion of this contingency in projects shall be evaluated by the Estimator on a project-by-project basis. This guide makes no recommendation for the value or the method for determining the value. Any value that is included in an estimate should be accompanied by an explanation in the estimate report.

- Program Contingency: Project budgets in the CIP do not include a contingency line item. MSD uses programmatic contingency to fund construction and design change orders for all projects in the capital program. Costs are allocated to specific capital projects into this line-item category after they are incurred as part of an annual allocation accounting process. This line item should not be populated for project estimates.

### 2.7.3. Indirect Project Costs

Indirect project costs include planning and design, certain pre-construction and construction services performed by the engineer-of-record (design consultant or design builder), right-of-way, and other miscellaneous expense. Indirect project costs are presented in the Total Project Cost Summary Table.

- Planning & Study Services: Project planning can be defined as making decisions now with the objective of influencing the future success of a capital improvement project. This future-oriented decision process involves:

  - Setting objectives
  - Gathering information
  - Evaluating and recommending alternatives through a Business Case Evaluation
  - Identifying key determinants that establish the design's philosophy

- Communicating the plan

Planning estimates, barring deviation for professional judgment, shall be based on the [escalated] OPCC according to the following formula:

- Planning Estimate = 17.016 * [OPCC]$^{.629}$
- OPCC – Latest estimated construction cost escalated to the mid-point of construction
- A minimum of $50,000 shall be used for the planning estimate.

- Design Services: Design Services includes professional services to complete the Design Phase. Design estimates, barring deviation for professional judgment, shall be based on the [escalated] OPCC according to the following formula:
  - Design Estimate = 5.418 * [OPCC]$^{.733}$
  - OPCC – Latest estimated construction cost escalated to the mid-point of construction
  - Design estimates for projects over $20,000,000 should be developed using a bottoms-up approach on an individual case-by-case basis. If no detailed estimate can be developed, the formula above may be utilized upon approval by MSD.
  - A minimum of $50,000 shall be used for the design estimate.
- Owner's Advisor Phase 1 Services (PDB): Owner's Advisor Phase 1 Services include support with various project implementation activities during Phase 1 of the PDB delivery process. Typical services include owner and Design-Builder partnering support, project execution planning, cost monitoring, design reviews and validation, facilitating meetings and reviews, etc. Refer to Table 2-3 for guidance on Owner's Advisor Phase 1 Services estimates.
- Design Services Fee (PDB): The Design Services Fee is the total compensation for all Phase 1 and Phase 2 services (design services and design support during construction) provided by the Design-Builder Engineer of Record, including all sub-consultants to the Engineer of Record. The Design Services Fee shall not include any mark-ups by the Design-Builder; such mark-ups, if any, shall be incorporated into the Preconstruction Fee. Design Services Fee estimates, barring deviation for professional judgment, shall be based on the [escalated] OPCC according to the following formula:
  - Design Estimate = 5.418 * [OPCC]$^{.733}$
  - OPCC – Latest estimated construction cost escalated to the mid-point of construction
  - Design Services Fee estimates for projects over $20,000,000 should be developed using a bottoms-up approach on an individual case-by-case basis. If no detailed estimate can be developed, the formula above may be utilized upon approval by MSD.
- Pre-Construction Fee:
  - DBB Projects: This cost category is no longer utilized.
  - PDB Projects: Pre-construction services will be performed by the Design-Builder as part of its Phase 1 services. The Preconstruction Fee is the combination of compensation for (a) all Phase 1 work by the Design-Builder, including all subcontractors to the Design-Builder; (b) all Design-Builder overhead for Phase 1, including home office overhead; (c) profit for such services provided during Phase 1 of the Project as defined in the Contract Documents; and (d) permit application fees. Refer to Table 2-3 for guidance on Pre-Construction Fee estimates.

- Construction Services: Construction Services estimates include the following, as well as any other engineering services during construction conducted by a consultant during the construction phase:
    - Project management
    - Construction administration
    - Field engineering
    - Inspection and Testing
    - Operations Manual System (OMS) Development
    - Special inspections
    - 360Water set-up
    - SCADA programming / integration

  Construction Services, barring deviation for professional judgment, shall be based on the [escalated] OPCC according to the following formulas by project type:.
    - Construction Services Estimate – Conveyance Projects = $8.779 * [OPCC]^{.678}$
    - Construction Services Estimate – Facility Projects without SCADA = $0.874 * [OPCC]^{.850}$
    - Construction Services Estimate – Facility Projects with SCADA = $3.106 * [OPCC]^{.808}$
    - Construction Services Estimate notes:
        - OPCC – Latest estimated construction cost escalated to the mid-point of construction
        - Construction services estimates for projects over $20,000,000 should be developed using a bottoms-up approach on an individual case-by-case basis. If no detailed estimate can be developed, the formula above may be utilized upon approval by MSD.
        - A minimum of $50,000 shall be used for the construction services estimate for conveyance projects and facilities projects without SCADA. A minimum of $100,000 shall be used for the construction services estimate for facility projects with SCADA.
- Owner's Advisor Phase 2 Services (PDB): Owner's Advisor Phase 2 Services include support with various project implementation activities during Phase 2 of the PDB delivery process. Typical services may include ongoing owner and Design-Builder partnering support, cost monitoring and support of incentive/award fee initiatives, late-stage design reviews and validation, construction monitoring and management, commissioning and start-up support, warranty period support, facilitating meetings and reviews, etc. Refer to Table 2-3 for guidance on Owner's Advisor Phase 2 Services estimates.
- Right-of-Way (ROW): The ROW estimate will include:
    - Appraisal costs
    - Title reports
    - Recording costs/mailing costs
    - Compensation to property owners for acquisition at Fair Market Value (FMV)

- Relocation costs, if applicable
- Property management costs/real estate tax bills/utilities
- Eminent domain costs (expert witness costs/court filing costs/settlement costs)
- ROW costs should be estimated based on the anticipated acquisition requirements for the project and developed in conjunction with or confirmed with the MSD ROW Group.
- Escalation (to the beginning date of construction) on the cost of ROW is then added to the ROW cost.

- Miscellaneous Expense: The Miscellaneous Expense estimate includes items that represent expenditures necessary to complete a project but cannot be categorized into discernible scheduled phases. Examples of Miscellaneous expense include:
  - Street opening permits and inspections
  - Environmental inspections
  - Geotechnical Report
  - Utility Relocation
  - Public Relations
  - Permit to Install (PTI)
  - Railroad Permits
  - Loan origination fees
  - 401/404 Creeks and Outfalls Certification

  Barring deviation for professional judgment, miscellaneous expense shall be based on the [escalated] OPCC according to the following formula:
  - Miscellaneous Expense = $562.7 * [OPCC]^{.372}$
  - OPCC – Latest estimated construction cost escalated to the mid-point of construction
  - A minimum of $10,000 shall be used for the miscellaneous expense estimate.
- Program Management: This indirect cost activity is only used in certain cases when it is deemed necessary to capitalize the costs of overhead for individual projects. The exact amount each project receives from the different allowances is based on a weighted average spend formula performed by MSD Accounting. In general, this indirect cost will be recorded as zero for the individual projects until the allocation is completed.

**Table 2-2: DBB - General Conditions, Overhead & Profit/PDB Design-Build Services Fee Calculation Guide**

| Cost of Work | DBB – General Conditions | DBB – Overhead & Profit | PDB – General Conditions | PDB – Design-Build Services Fee |
|---|---|---|---|---|
| Below $1,000,000 | 20% | 22% | N/A | N/A |
| $1,000,000 to $5,000,000 | 20% | 20% | N/A | N/A |
| $5,000,000 to $10,000,000 | 18% | 18% | 15% | 15% |
| $10,000,000 to $20,000,000 | 15% | 15% | 13% | 10% |
| $20,000,000 to $100,000,000 | 15% | 12% | 12% | 8% |
| Greater than $100,000,000 | 13% | 10% | 10% | 6% |

Table 2-3 on the following page provides a comprehensive summary of project cost estimating guidance based on the project phase and delivery method.

# Table 2-3: Project Cost Estimate Development Guidance by Project Phase and Delivery Method

METROPOLITAN SEWER DISTRICT OF GREATER CINCINNATI

**Table 2-3**
**Project Cost Estimate Development Guidance by Project Phase and Delivery Method**
**Project Costing Manual - Metropolitan Sewer District of Greater Cincinnati**

| Phase | Project Nomination | Planning (BCE) | Design (30%, 60%) | Design (90%) | Design (Final) |
|---|---|---|---|---|---|
| **MSD Estimate Class (Estimate Name)** | Class 5 | Class 4 (Baseline Project Estimate) | Class 3 | Class 2 | Class 1 |
| **MSD Stage Gate (SG)** | SG 1 | SG 2 | 30% - N/A, 60% - SG 3 | N/A | SG 4 |
| **Typical Estimating Method(s)** | Conceptual | Conceptual | Conceptual (30%) / Combination (60%) | Deterministic | Deterministic |
| **Applicable Delivery Methods** | DBB (excluding Local, Lateral Sewers), PDB | DBB, PDB | DBB (excluding Lateral Sewers at 60%), PDB | DBB | DBB |

| **Key Cost Estimate Components** | |
|---|---|
| Cost of Work | Costs for labor, materials, equipment, and other items to create the asset. |
| Opinion of Probable Construction Cost (OPCC) | Cost of Work plus contractor markups and other incidentals that are included in the contractor's bid estimate for the project to be completed. |
| Indirect Project Costs | Include planning and design, certain pre-construction and construction services performed by the engineer-of-record (design consultant or design builder), right-of-way, and other miscellaneous expense. |
| Total Project Cost | OPCC plus the addition of the indirect costs necessary to complete the construction and startup of an asset. |
| Life Cycle Cost | Total Project Cost plus the operation and maintenance costs over the life of the asset. Used to compare alternatives over the life of the assets. |
| **Project Cost Estimate Submittal Requirements** | |
| Document List | See Section 2.6.1 |
| Assumptions | See Section 2.6.2 |
| Parametric Measurements | See Section 2.6.3 |
| Body of Estimate (for Cost of Work or Base Construction) | See Section 2.6.4 |
| Total Project Cost Estimate Summary | See Section 2.6.5 |

| **Estimate Mark-Ups** - Add to Cost of Work to obtain OPCC | | | | | |
|---|---|---|---|---|---|
| General Conditions (GCs) | Based on % of Cost of Work - See Table 2-2 | Based on % of Cost of Work - See Table 2-2 | Based on % of Cost of Work - See Table 2-2 | Based on % of Cost of Work - See Table 2-2 | Based on % of Cost of Work - See Table 2-2 |
| Contractor's Overhead & Profit - OH&P (DBB) | Based on % of Cost of Work - See Table 2-2 | Based on % of Cost of Work - See Table 2-2 | Based on % of Cost of Work - See Table 2-2 | Based on % of Cost of Work - See Table 2-2 | Based on % of Cost of Work - See Table 2-2 |
| Design-Build Services Fee (PDB) | Based on % of Cost of Work - See Table 2-2 | Based on % of Cost of Work - See Table 2-2 | Based on % of Cost of Work - See Table 2-2 | Class 2 Estimates Typically N/A for PDB | Class 1 Estimates Typically N/A for PDB |
| Bonds & Insurance | 1% of Construction Sub-Total Each | 1% of Construction Sub-Total Each | 1% of Construction Sub-Total Each | 1% of Construction Sub-Total Each | 1% of Construction Sub-Total Each |
| Escalation (to Mid-Point of Construction) | Consult Capital Project Resource Library | Consult Capital Project Resource Library | Consult Capital Project Resource Library | Consult Capital Project Resource Library | Consult Capital Project Resource Library |
| Project Contingency | 40% (DBB) / 30% (PDB) of Cost of Work + Mark-ups, excluding escalation | 30% (DBB) / 20% (PDB) of Cost of Work + Mark-ups, excluding escalation | 30% Design: 20% (DBB) /10% (PDB) of Cost of Work+Mark-ups, excluding escalation<br>60% Design: 15% (DBB) /5% (PDB) of Cost of Work+Mark-ups, excluding escalation | 10% of Cost of Work + Mark-ups, excluding escalation (DBB only) | 5% of Cost of Work + Mark-ups, excluding escalation (DBB only) |
| MSD PDB Contingency (PDB) | 10% of Cost of Work + GCs + Mark-ups + Bonds & Insurance, including escalation | 10% of Cost of Work + GCs + Mark-ups + Bonds & Insurance, including escalation | 10% of Cost of Work + GCs + Mark-ups + Bonds & Insurance, including escalation | Class 2 Estimates Typically N/A for PDB | Class 1 Estimates Typically N/A for PDB |
| Market Contingency | Case by Case Basis | Case by Case Basis | Case by Case Basis | Case by Case Basis | Case by Case Basis |
| **Indirect Project Costs** - Add to OPCC to obtain Total Project Cost | | | | | |
| Planning & Study Services | | | | | |
| Planning Services | Based on the escalated OPCC. See Section 2.7.3. | Established / Actual | Established / Actual | Established / Actual | Established / Actual |
| Design Services | | | | | |
| Design Services (DBB) | Based on the escalated OPCC. See Section 2.7.3. | Based on the escalated OPCC - See Table 2-3 | Established / Actual | Established / Actual | Established / Actual |
| Owner's Adviser Phase 1 Services (PDB) | 1.5% of the escalated OPCC | 1.5% of the escalated OPCC | Established / Actual | Class 2 Estimates Typically N/A for PDB | Class 1 Estimates Typically N/A for PDB |
| Design Services Fee (PDB) | Based on the escalated OPCC. See Section 2.7.3. | Based on the escalated OPCC. See Section 2.7.3. | Established / Actual | Class 2 Estimates Typically N/A for PDB | Class 1 Estimates Typically N/A for PDB |
| Pre-Construction Services | | | | | |
| Pre-Construction Services (DBB) | N/A | N/A | N/A | N/A | N/A |
| Pre-Construction Fee (PDB) | 3% of the escalated OPCC | 3% of the escalated OPCC | Established / Actual | Class 2 Estimates Typically N/A for PDB | Class 1 Estimates Typically N/A for PDB |
| Construction Services | | | | | |
| Construction Services (DBB) | Based on the escalated OPCC. See Section 2.7.3. | Based on the escalated OPCC. See Section 2.7.3. | Based on the escalated OPCC. See Section 2.7.3. | Based on the escalated OPCC. See Section 2.7.3. | Established / Actual |
| Owner's Adviser Phase 2 Services (PDB) | 0.5% of the escalated OPCC | 0.5% of the escalated OPCC | 0.5% of the escalated OPCC | Class 2 Estimates Typically N/A for PDB | Class 1 Estimates Typically N/A for PDB |
| Right-of-Way (ROW) Costs | | | | | |
| Right-of-Way (ROW) Costs | Case by Case Basis, Confirm w/ MSD ROW | Case by Case Basis, Confirm w/ MSD ROW | Case by Case Basis, Confirm w/ MSD ROW | Established / Actual | Established / Actual |
| Right-of-Way (ROW) Costs Escalation | Consult Capital Project Resource Library | Consult Capital Project Resource Library | Consult Capital Project Resource Library | N/A | N/A |
| Miscellaneous Expense | | | | | |
| Miscellaneous Expense (DBB) | Based on the escalated OPCC. See Section 2.7.3. | Based on the escalated OPCC. See Section 2.7.3. | Established / Actual | Established / Actual | Established / Actual |
| Miscellaneous Expense (PDB) | Based on the escalated OPCC. See Section 2.7.3. | Based on the escalated OPCC. See Section 2.7.3. | Established / Actual | Class 2 Estimates Typically N/A for PDB | Class 1 Estimates Typically N/A for PDB |
| Program Management | See Section 2.7.3 | See Section 2.7.3 | See Section 2.7.3 | See Section 2.7.3 | See Section 2.7.3 |

NOTE: GUIDANCE / ITEM IN FIRST COLUMN APPLIES TO BOTH DESIGN-BID-BUILD (DBB) AND PROGRESSIVE DESIGN-BUILD (PDB) PROJECTS, UNLESS NOTED OTHERWISE IN PARENTHESES BEHIND ITEM

# 3. LIFE CYCLE AND PRESENT VALUE COST ANALYSIS

Life Cycle Cost is the Project Cost plus the operation and maintenance costs over the life of the asset.

## 3.1. Life Cycle Cost Analysis

Life cycle cost analysis (LCCA) is a method of project evaluation in which all costs arising from owning, operating, maintaining, and ultimately disposing of the asset are considered. Life cycle cost analysis is particularly suitable for evaluating asset design alternatives to ensure a required level of performance, engineering standards, system reliability, and even aesthetic considerations while taking into account that the alternatives differ in initial investment costs and useful life. Life cycle cost analysis can be applied to any capital investment decision in which higher initial costs are traded for reduced future cost or obligations. Life cycle cost analysis also provides a significantly better assessment of long-term cost-effectiveness of an asset than alternative economic methods that focus only on first costs with short-term operating related costs.

The MSD life cycle cost is the basic building block of the present value cost analysis method. The life cycle cost analysis method, as applied here, is used to compute the life cycle cost of the asset or a combination of interdependent systems over a given period of study (usually related to the useful life for capital assets) with all costs and revenues expressed in constant dollars (no inflation). While revenues do not often come into play in MSD life cycle cost analyses, if there are additional revenues to MSD associated with any alternative, they can be considered for incorporation into the analysis.

Estimators will assess all costs related to the initial capital investment based on estimating methodology as outlined earlier in this document. Based on the initial estimate of probable costs, the estimators will evaluate and assess all operation, repair, and maintenance costs including non-annual costs or cyclic costs, annual costs, and any startup costs as related to the initial capital investment. These cost assessments will begin in the year of the initial capital investment and over the useful life of the proposed project.

Each capital investment is unique, it is necessary to assign a useful life to major MSD capital assets. In most cases, generally accepted accounting principles require that capital assets be depreciated. Depreciation is the systematic and rational allocation of the historical cost of the capital assets over their estimated useful lives. The estimated useful life assigned to a capital asset will directly affect the life cycle cost analysis. Once established, estimated useful life for major categories of capital assets should be periodically compared to MSD's actual experience and appropriate adjustments should be made to reflect this experience. The MSD Useful Life of Capital Assets are provided below:

**Table 3-1: Useful Life of Capital Assets (Years)**

| CATEGORIES | USEFUL LIFE (YEARS) |
|---|---|
| **Building Category** | |
| Building Structures | 50 |
| Pump Station Structures | 40 |
| **Paving** | |
| Concrete | 30 |
| Asphalt | 20 |
| Gravel | 10 |
| **Conveyance Category** | |
| Force Mains | 40 |
| Gravity Sewers/Tunnels | 100 |
| Pipe Liners | 50 |
| **Equipment Category** | |
| Auxiliary Equipment | 15 |
| Computer Equipment | 5 |
| Process Equipment | 25 |
| Pumping Equipment | 10 |
| Electrical Equipment | 20 |
| HVAC Equipment | 20 |
| Instrumentation/Sensor Equipment | 10 |

If alternatives are being compared with differing useful lives, the study period shall be based on the alternative with the longer useful life. Many alternatives will be comprised of assets with differing useful lives. The life of the alternative may thus reflect some assets with short useful lives and others with longer lives. The life of the alternative may thus reflect a weighted average, based on cost or investment, of the useful lives of those components, or reflect the life of the predominant assets being purchased or constructed. Professional judgment may be exercised in determining the useful lives of the alternatives with components with varying useful lives, and in selection of the analysis study period.

Assets with useful lives remaining at the end of the study or analysis period shall be depreciated utilizing straight line depreciation as outlined in section 3.1.1 to derive a residual value at the end of the analysis period. It should be noted that the useful life for capital assets listed in Table 3-1 above represents the average useful life for these assets and is meant to be used for the purpose of life cycle analysis and the present value cost analysis. These average useful life values do not necessarily represent the current status of the asset within its life cycle, which may vary from the average value depending on the individual asset conditions and applications. All life cycle cost assessments may be escalated as necessary to account for predicted market variability.

Life cycle costs shall be developed utilizing the LCCA Worksheet located in the capital resource library Capital Project Resource Library - Metropolitan Sewer District of Greater Cincinnati (msdgc.org).

### 3.1.1. Depreciation

Depreciation is a form of capital recovery applicable to a property with a lifespan of more than one year, in which an appropriate portion of the asset's value is periodically decreased. The rationale underlying the depreciation concept is that physical assets lose value over time due to such factors as deterioration, wear, technological advancements, or obsolescence.

MSD will use the straight-line depreciation method which takes an equal amount of depreciation every year over the estimated useful life of the asset. The straight-line method takes the original cost less the salvage value divided by the number of years of life of the asset as follows:

Depreciation Straight Line Method: D = (C - S) / N Where:

D = Depreciation charge
C = Asset original cost
S = Salvage value
N = Asset useful life

While depreciation is not included in the present value calculations, residual values for assets shall be included in the LCCA evaluations unless exclusion of the residual value is approved by submitting a deviation based on best professional judgment.

## 3.2. Present Value Cost Analysis

Building on the life cycle costs analysis, the present value cost analysis is adjusted to reflect the time value of money. This adjustment is accomplished by utilizing the MSD discount rate. In calculating the present value cost analysis, all future costs are discounted to their present value equivalent (as of the base date) using the MSD minimum acceptable rate of return. The present value of an asset has little meaning by itself; however, it is most useful when compared to the present value of all the alternatives which can perform the same function, in order to determine which alternative is most cost effective for this purpose.

### 3.2.1. MSD Discount Rate

The discount rate is a financial metric used to determine the present value of future payments or expenditures. Discount rates may be real or nominal. Real discount rates apply to present value analyses where the costs and revenues are expressed in constant dollars (no inflation), while nominal discount rates apply to analyses where the costs and revenues are expressed in inflated dollars over the life of the project.

Historically, MSD has used the interest rate it is paying on recent bond issues as the basis for setting its discount rate. It must be understood that this interest rate is subsidized by virtue of the interest income received by the investors on the MSD's bonds not being subject to income tax. The Federal government borrowing does not receive a similar subsidy, and thus its borrowing cost may better reflect current market interest rates. Using the Federal government borrowing rate for analysis should only be considered once the source of the funding for a project is fully determined and shows that the Federal rate is more applicable.

The discount rate to bring future costs to their present value will be based on the current Bond Rate. In order to use the rate for calculations, a Real Interest Rate is needed, and the current Bond Rate is a Nominal Interest Rate and includes inflation. To remove inflation and adjust the rate, use the inflation rate calculated in the next section.

The current real discount rate to be used in conducting cost effectiveness analyses is as follows:

- Current Nominal Discount Rate (MSD Bond Rate) = 5%
- Inflation Rate from Section 3.2.2 = 2.1% (As of February 2024. See note on inflation rate in Section 3.2.2.)
- Calculation for Real Discount Rate = (1+ MSD Bond Rate) / (1 + Inflation Rate) - 1)*100 = ((1.05/1.021) -1)*100 = 2.8%

### 3.2.2. Inflation Rate

Inflation is defined for MSD as a rise in the general price level of goods and services produced in the economy. It should be noted that this is not the only definition of inflation, but it is the most appropriate for MSD purposes. The definition involves rising prices for current output. Rising prices for bonds, equity claims (stocks), and existing durable goods. Also, the price increases must occur across many lines of goods and services.

The terms inflation and escalation, for this text, are not considered to be synonymous. The following will be assumed by MSD:

- Inflation incorporates the overall economy growth/recession impact to the economic evaluations and is measured by incorporating both national and local economic inflation forecasts. Inflation is applied to the growth of all costs over time that is not related to the initial capital investment.
- Escalation is then defined as those price level changes predicted to occur for specific types or groups of goods and/or services and is measured by the rate of rise of some product-price index in percent per year (i.e., construction cost index or labor cost index)

Note: if a good or service is being escalated over a given time period, it should not be inflated during that same time period, and vice versa.

This inflation rate is the same as the cost growth rate used by MSD's rate consultant as part of the annual revenue requirement study, which is used to set customer rates.

This update will be evaluated and finalized in the first quarter of each year.

The inflation rate is calculated from Office of Management and Budget (OMB) Federal Real Discount Rate for projects of similar life as published every December (Circular A-94: Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs). The appropriate discount rate will vary depending on the expected useful life of the project. For projects with a useful life of over 30 years, the 30-year bond interest rate will be used. For the life cycle cost analysis, costs and revenues will be expressed in constant dollars (not inflated), thus the real discount rate will be used. The current rates that are used to inflate all future cash flows are as follow from OMB Circular A-94:

- OMB Nominal Interest Rate for 30 year: 4.7% (As of February 2024. Check OMB Circular A-94 for latest rate.)

- OMB Real Interest Rate for 30 year: 2.5% (As of February 2024. Check OMB Circular A-94 for latest rate.)
- Calculation for Inflation Rate = ((1 + OMB Nominal Rate) / (1 + OMB Real Rate) - 1)*100 = ((1.047/1.025)-1) *100 = 2.1% (As of February 2024. Check OMB Circular A-94 for latest nominal and real interest rates.)

For life cycle cost analyses, costs will be expressed in current dollars and will not be inflated.

## 4. PROFESSIONAL JUDGMENT

As a project's scope becomes more defined throughout Planning and Design, there may be instances when it is appropriate to deviate from the guidelines described in this manual. Deviation should only occur when the estimator utilizes best professional judgment and concludes that some individual guidelines do not match the project's expected costs. When it is justifiable that a deviation from the PCM is needed, it is necessary that documentation and approval processes are followed. This documentation should be noted in the Project Cost Estimate Template and the Estimate Report. The basis of deviation must include:

a. Information regarding the basis of the proposed deviation(s).
b. Clear documentation of the proposed deviation(s).
c. Identification and the proposed plan for management of all associated financial risks due to the proposed deviation. If the anticipated financial risks due to a deviation of indirect costs is anticipated to be minimal and/or nonexistent, the submitting agent must document reasoning for a nonexistent risk category.

Proper approval must be obtained before the proposed deviation can be submitted. Proposed deviations should be transmitted to the MSD Project Manager via e-mail for review and approval. The basis of deviation as outlined above must be included in the transmittal.

## 5. ESTIMATE REVIEW PROCESS

Estimates are a critical component in successful projects. It therefore is reasonable that the estimate should undergo a quality control process. The estimate should be evaluated not only for its quality and accuracy, but also to ensure that it contains all of the required information. When reviewing project cost analyses prepared by design consultants the Quality Assurance Quality Control Section (QAQC) within Wastewater Engineering will keep in mind the fundamentals described herein. The estimate review will be accomplished by critical assessment of the estimate and its associated documentation. The following section focuses on guidelines that QAQC will use to efficiently review estimates prepared by design consultants.

### 5.1. Basis of Evaluation

QAQC will assess the following for the basis of the estimate.

- The estimate complies with this PCM.
- The cost analysis is organized and complete.
- Scope and cost assumptions have been clearly identified.
- Economic impact assumptions have been clearly identified.

## 5.2. Methodology

QAQC will assess the following to ensure that methodology for analysis is sound:

- The methods, techniques, and procedures used in preparing the estimate are sound.
- The appropriate level of information available for the project type is available and being used.
- The financial analysis methods used for the economic analysis are appropriate.
- The level of detail in the analysis is sufficient for the purpose of the analysis.

## 5.3. Documentation

QAQC will assess the following:

- If the estimate report is documented clearly and is complete as outlined herein.
- If the estimate report is well-organized and presented at an appropriate level of detail.

All comments or issues identified by the QAQC Group will be provided in the form of formal review comments as part of the project technical review.

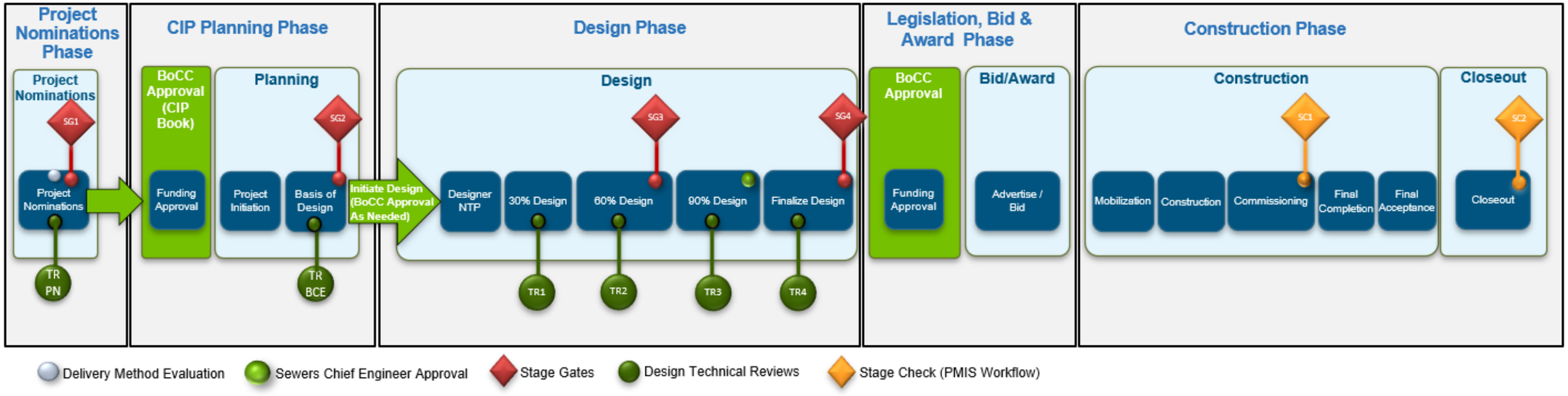


**Figure A-1: PDS Model – Design Bid Build Delivery (DBB)**

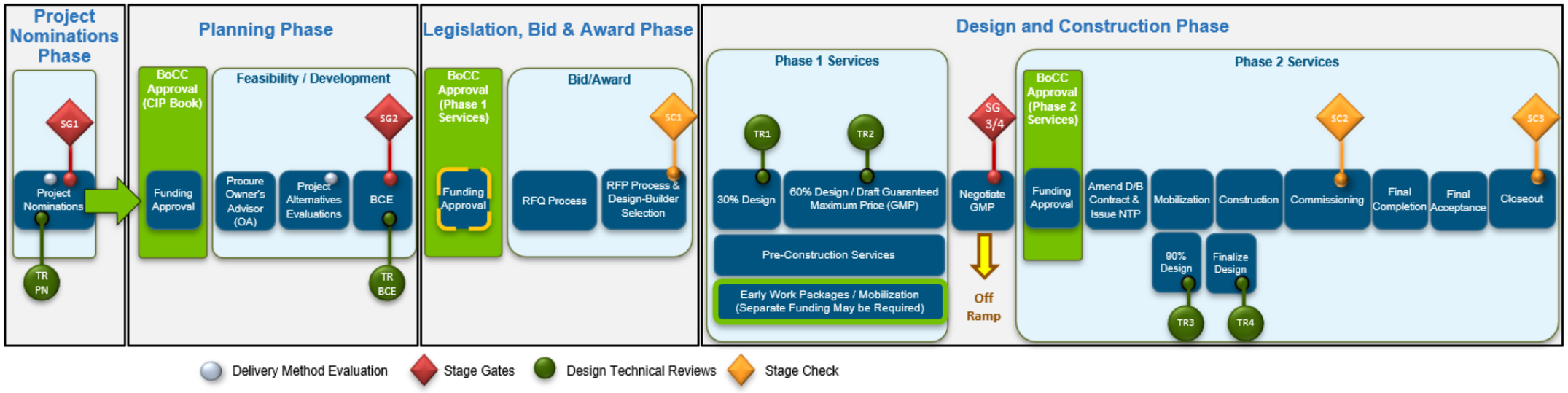


**Figure A-2: PDS Model – Progressive Design Build (PDB)**

# APPENDIX B DEVELOPMENT OF ESCALATION VALUES

A cost index is a dimensionless number used to adjust the cost of an item from one time period to another. Typically, an index documents the historic changes in cost as well as providing a mechanism for extrapolating this historic information to predict future cost changes. Although there are many existing general and more focused cost indices that are readily available, the basis of each index must be understood with regard to its specific project development characteristics before the user can assess which is most applicable to its work and location. Seldom does an index offer a perfect relationship but the index with the least individual application deficiencies is often accepted as a trade-off to its convenience.

Considering the size and complexity of the Capital Improvement Program (CIP) and the intent of MSD to closely track all relevant cost-related issues over time, MSD reasoned that in the same time it takes to determine the application issues that a published cost index data would and wouldn't satisfy, the majority of the work has already been completed toward the preparation of a "customized" composite cost index. Research on this customizing concept reinforces that the follow-up effort needed to ensure continuing applicability of the published index will probably approach the magnitude of the effort to maintain an MSD-specific index. Moreover, this same research indicates that during a period of high rates of escalation, a customized index is more responsive to changing conditions.

The use of a customized MSD/Cincinnati Wastewater Cost Index (MI) is consistent with MSD's business model goal of remaining a leader in its industry. The value of this customized approach includes the following:

- Functional in providing a context for estimating data
- Capable of guiding special studies aimed at future cost reduction
- Transparent when documenting project costs
- Flexible in the frequency of the publication and update, especially during rapid economic change
- Illustrates reasons for construction price fluctuations over time
- Provides accurate escalation factors for project commodity price projections
- Provides known capital expenditure factors for use in de- escalating dollars expended to compare with original and/or current approved baseline budgets

The index concept pursued by MSD was to build on the many applicable published indices and develop a composite that takes the most applicable characteristics of each of those indices as they relate to MSD and its local influences. This approach has been adopted while MSD's estimating database grows more robust and comprehensive.

Certain elements of various indices related differently to MSD's work. These differences result in the varying weight given to each index. The development process for the MI identified that, after weighting indices within the National and Local areas, it was necessary to further weight the national portion at 30% and the local portion at 70% to better correspond the MI to price changes being realized in the local area.

The following table identifies the six (6) published indices that are used to calculate the MI.

**Table B-1: Published Indices Used to Calculate the MI**

| INDEX | WEIGHT |
|---|---|
| R.S Means (National) | 30.0% |
| U.S. Bureau of Reclamation Construction Cost Trends | 25.0% |
| Engineering News Record Building Cost Index (National) | 20.0% |
| U.S. Army Corps of Engineers Civil Works Construction Cost Index | 25.0% |
| National Portion | 30% |
| R.S. Means (Cincinnati) | 70.0% |
| Engineering News Record Construction Cost Index (Cincinnati) | 30.0% |
| Local Portion | 70.0% |
| MSD Index | |

Once the MI has been calculated for the current quarter, it is compared to the previous quarter's value. The growth trend between the two is then projected ahead one more quarter. Knowing that economic trends may not last longer than a quarter, an average growth rate of 2.2% per year is added for all succeeding quarters. This average value is based on the average growth trend from the inception of the custom index in 2006.

Escalation and De-Escalation Multipliers and Inverse Multipliers - Updated tables can be found at the following links:

Capital Project Resource Library - Metropolitan Sewer District of Greater Cincinnati (msdgc.org)

Select the links for Escalation table or for the de-escalation table.

## APPENDIX C PROJECT COST ESTIMATE TEMPLATES

The images below are examples of templates to be used for project cost estimates.

- Design-Bid-Build – Project Cost Estimate Summary

### Design-Bid-Build - Project Cost Estimate Summary

METROPOLITAN SEWER DISTRICT OF GREATER CINCINNATI

| | | | |
|---|---|---|---|
| **Project Name** | | | |
| **Project Type** | Conveyance Project | | <---(pick from drop down list) |
| **Estimator Name** | | | |
| **Date of Estimate** | | | |
| **Class of Estimate** | | | <---(pick from drop down list) |
| **Escalation Dates** | | | |
| | *to Start Date of Const.* | *to Midpoint of Const.* | |

| Description | Conforms to PCM * | Rate | Amount | Totals |
|---|---|---|---|---|
| **Opinion of Probable Construction Cost (OPCC)** | | | | |
| **Cost of Work (COW):** | | | | |
| Contractor COW (Labor, Materials, Equipment, Other Costs to Create Asset) | ☐ | | $ 1,000,000 | |
| **General Conditions** (% of COW per Table 2-2) | ☐ | 0.0% | $ - | |
| **Contractor's Overhead & Profit** (% of COW per Table 2-2) | ☐ | 0.0% | $ - | |
| **Project Contingency** (% of COW + markups by Estimate Class, per Table 2-3) | ☐ | 0.0% | $ - | |
| **Construction Subtotal** | | | | $ 1,000,000 |
| **Insurance** (1% of the Construction Subtotal) | ☐ | 1.0% | $ 10,000 | |
| **Bonds** (1% of the Construction Subtotal) | ☐ | 1.0% | $ 10,000 | |
| **Insurance & Bonds Subtotal** | | | | $ 20,000 |
| **Escalation** (To Midpoint of Construction - per MSD Escalation Table) | ☐ | | $ - | |
| **Esalation Subtotal** | | | | $ - |
| **Market Contingency** (Consultant Evaluation) | ☐ | 0.0% | $ - | |
| **Market Contingency Subtotal** | | | | $ - |
| **OPCC Total** | | | | $ 1,020,000 |
| **Planning** | | | | |
| **Planning Services** (Class 5: per formula included in Section 2.7.3; Class 1-4: Established/Actual) | ☐ | | $ 102,392 | |
| **Planning Subtotal** | ☐ | | | $ 102,392 |
| **Design** | | | | |
| **Design Services** (Class 4-5: per formula included in Section 2.7.3; Class 1-3: Established/Actual) | ☐ | | $ 137,449 | |
| **Design Subtotal** | ☐ | | | $ 137,449 |
| **Pre-Construction Services** | | | | |
| **Pre-Construction Services** (NA for Design-Bid-Build) | | | $ - | |
| **Pre-Con Services Subtotal** | | | | $ - |
| **Construction Services** | | | | |
| **Construction Services** (Class 2-5: per formulas included in Section 2.7.3; Class 1: Established/Actual) | ☐ | | $ 104,058 | |
| **Construction Services Subtotal** | ☐ | | | $ 104,058 |
| **Right-of-Way** | | | | |
| **Right-of Way Costs** (Class 3-5: per MSD ROW Manager; Class 1-2: Established/Actual) | ☐ | | $ - | |
| **Right-of-Way Costs Escalation** (To Start Date of Construction - per MSD Escalation Table) | ☐ | | $ - | |
| **Right-of-Way Subtotal** | | | | $ - |
| **Miscellaneous Expense** | | | | |
| **Miscellaneous Expense** (Class 4-5: per formulas included in Section 2.7.3; Class 1-3: Established/Actual) | ☐ | | $ 96,711 | |
| **Miscellaneous Expense Subtotal** | | | | $ 96,711 |
| | | | **Total Project Cost** | $ 1,460,611 |

** If any items are not selected, estimator to provide detailed explanation within the estimate submittal*

| Cost Summary (LAR Format) | | |
|---|---|---|
| **Planning** | $ | 102,392 |
| **Design** | $ | 137,449 |
| **Pre-Construction Services** | $ | - |
| **Miscellaneous Expense** | $ | 96,711 |
| **Right-of-Way** | $ | - |
| **Construction** | $ | 1,020,000 |
| **Program Management** | $ | - |
| **Construction Services** | $ | 104,058 |
| **Total Estimate** | $ | 1,460,611 |

DBB Cost Estimate Page 1 of 2

### Scope of Work Summary (Optional)

METROPOLITAN SEWER DISTRICT OF GREATER CINCINNATI

[insert scope of work summary]

DBB Cost Estimate Page 2 of 2

**Figure C-3: Design-Bid-Build – Project Cost Estimate Summary**

- Progressive Design-Build – Project Cost Estimate Summary

## Progressive Design-Build - Project Cost Estimate Summary

METROPOLITAN SEWER DISTRICT OF GREATER CINCINNATI

| | | |
|---|---|---|
| Project Name | | |
| Estimator Name | | |
| Date of Estimate | | |
| Class of Estimate | | <---(pick from drop down list) |
| Escalation Dates | | |
| | *to Start Date of Const.* | *to Midpoint of Const.* |

| Description | Conforms to PCM * | Rate | Amount | Totals |
|---|---|---|---|---|
| **Opinion of Probable Construction Cost (OPCC)** | | | | |
| **Cost of Work (COW):** | | | | |
| Design-Builder COW (Labor, Materials, Equipment, Other Costs to Create Asset) | ☐ | | $ 1,000,000 | |
| **General Conditions** (% of COW, per Table 2-2) | ☐ | 0.0% | $ - | |
| **Design-Build Services Fee** (% of COW, per Table 2-2) | ☐ | 0.0% | $ - | |
| **Project Contingency** (% of COW + markups by Estimate Class, per Table 2-3) | ☐ | 0.0% | $ - | |
| **Construction Subtotal** | | | | $ 1,000,000 |
| **Insurance** (1% of the Construction Subtotal) | ☐ | 1.0% | $ 10,000 | |
| **Bonds** (1% of the Construction Subtotal) | ☐ | 1.0% | $ 10,000 | |
| **Insurance & Bonds Subtotal** | | | | $ 20,000 |
| **Escalation** (To Midpoint of Construction - per MSD Escalation Table) | ☐ | | $ - | |
| **Escalation Subtotal** | | | | $ - |
| **MSD PDB Contingency** (10% of Construction Subtotal, Bonds & Insurance, and Escalation) | ☐ | 10.0% | $ 102,000 | |
| **Market Contingency** (Consultant Evaluation) | ☐ | 0.0% | $ - | |
| **MSD PDB and Market Contingencies Subtotal** | | | | $ 102,000 |
| **OPCC Total** | | | | $ **1,122,000** |
| **Planning** | | | | |
| **Planning Services** (Class 5: per formula invluded in Section 2.7.3); Class 3-4: Established/Actual) | ☐ | | $ 108,718 | |
| **Planning Subtotal** | ☐ | | | $ **108,718** |
| **Design** | | | | |
| **Owner's Adviser Phase 1 Services** (Class 4-5: See Table 2-3; Class 3: Established/Actual) | ☐ | 1.5% | $ 16,830 | |
| **Design Services Fee** (Class 4-5: per formula included in Section 2.7.3; Class 3: Established/Actual) | ☐ | | $ 147,395 | |
| **Design Subtotal** | ☐ | | | $ **164,225** |
| **Pre-Construction Services** | | | | |
| **Pre-Construction Fee** (Class 4-5: See Table 2-3; Class 3: Established/Actual) | ☐ | 3.0% | $ 33,660 | |
| **Pre-Con Services Subtotal** | ☐ | | | $ **33,660** |
| **Construction Services** | | | | |
| **Owner's Adviser Phase 2 Services** (Class 3-5: See Table 2-3) | ☐ | 0.5% | $ 5,610 | |
| **Construction Services Subtotal** | ☐ | | | $ **5,610** |
| **Right-of-Way** | | | | |
| **Right-of Way Costs** (Class 3-5: per MSD ROW Manager) | ☐ | | $ - | |
| **Right-of-Way Costs Escalation** (To Start Date of Construction - per MSD Escalation Table) | ☐ | | $ - | |
| **Right-of-Way Services Subtotal** | | | | $ - |
| **Miscellaneous Expense** | | | | |
| **Miscellaneous Expense** (Class 4-5: per formula included in Section 2.7.3; Class 3: Established/Actual) | ☐ | | $ 100,202 | |
| **Miscellaneous Expense Subtotal** | ☐ | | | $ **100,202** |
| | | | **Total Project Cost** | $ **1,534,415** |

** If any items are not selected, estimator to provide detailed explanation within the estimate submittal*

| Cost Summary (LAR Format) | | |
|---|---|---|
| **Planning** | $ | 108,718 |
| **Design** | $ | 164,225 |
| **Pre-Construction Services** | $ | 33,660 |
| **Miscellaneous Expense** | $ | 100,202 |
| **Right-of-Way** | $ | - |
| **Construction** | $ | 1,122,000 |
| **Program Management** | $ | - |
| **Construction Services** | $ | 5,610 |
| **Total Estimate** | $ | 1,534,415 |

PDB Cost Estimate Page 1 of 2

## Scope of Work Summary (Optional)

METROPOLITAN SEWER DISTRICT OF GREATER CINCINNATI

[insert scope of work summary]

PDB Cost Estimate Page 2 of 2

**Figure C-4: Progressive Design-Build – Project Cost Estimate Summary**