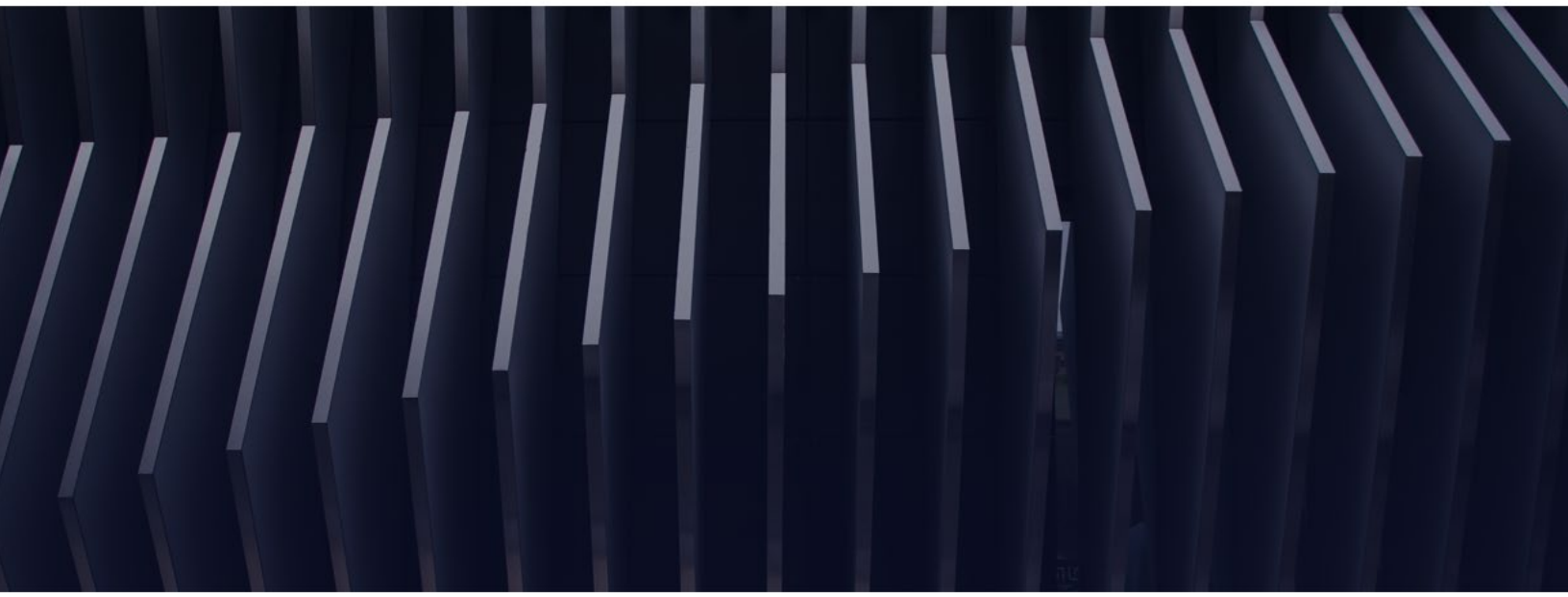
Wilshire Indexes

FT Wilshire Digital Asset Index Series Methodology

February 2024



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1. Introduction

Digital assets are cryptographically secured digital instruments for which the current and historical ownership and issuance is recorded on a distributed ledger or blockchain. The FT Wilshire Digital Asset Index Series is designed to provide users with a robust way to evaluate digital asset investments and prices by reference to single asset and multi-coin basket indexes.

Only eligible assets with prices derived from eligible exchanges are eligible for inclusion in the FT Wilshire Digital Asset Index Series. The eligibility criteria for assets and exchanges are summarized in Section 2. The calculation of prices for those assets is set out in Sections 3 and 4. The indexes calculated using those prices as an input are provided in Section 5. Specific index methodologies are set out in a series of Annexes to this document.

2. Exchange and Asset Due Diligence

The FT Wilshire Digital Asset Index Series has strict criteria for which digital asset exchanges qualify as a contributing price source. The qualifying exchanges also dictate the universe of available digital assets for which a Wilshire Indexes Blended Price (WIBP) can be calculated (see Section 3).

2.1 Exchange Benchmark Review

The semi-annual CCData[1] Exchange Benchmark Review (CDEBR) is used as the basis for the Wilshire Indexes Exchange Review. The CCEBR considers eight categories of criteria and a total score out of 100 is determined. For more information on the CCEBR the reader is directed to https://ccdata.io/research/exchange-benchmark-rankings.

Wilshire Indexes applies the following additional criteria to determine if an exchange qualifies as a price contributor:

(1) Exchanges must be rated A or AA or have an average score across all criteria of 75+
(2) The exchange provides digital asset trading in U.S. Dollars
(3) A contributing exchange satisfies criteria (1) and (2) in the two most recent CCEBRs.

2.1.1 Contributing Exchange Watchlist

If a current contributing exchange fails to meet the standards in criteria (1) and (2) it is placed on the Contributing Exchange Watchlist and reassessed at the following semi-annual CCEBR. If criteria (1) and (2) are still not met, the exchange loses its contributing exchange status.

2.1.2 Non-Contributing Exchange Watchlist

If a non-contributing exchange meets criteria (1) and (2) in the most recent CCEBR, but not the CCEBR prior to the most recent review, it is placed on the Non-Contributing Exchange Watchlist and reassessed at the following semi-annual CCEBR. If criteria (1), (2) and (3) are met, the exchange becomes a contributing exchange to the WIBP calculation (Section 3).

A flow chart describing the Wilshire Indexes Exchange Review process is detailed in Figure 1.

[1] See CCData | Leading Digital Asset Data & Index Provider

2.1.3 Loss of Eligibility

If a contributing exchange suffers a prolonged outage, has a costly security breech, restricts access to fund withdrawals, closes access to new market participants, or other events which puts price fidelity in doubt, said exchange may be removed as a price contributor.

2.2 Digital Asset Pricing Eligibility

To be eligible for the calculation of a WIBP digital assets must:

(1) Trade in U.S. Dollars on at least three contributing exchanges
(2) Have available custody of institutional quality
(3) Not be identified as a known scam or fraud.

If the number of contributing exchanges drops to zero, the digital asset is removed from any multi-coin index on a t+2 basis and pricing of the WIBP ceases.

2.2.1 Asset Watchlists

A digital asset which fails to meet criterion (1) in 2.2 due to the loss of pricing on 1 or 2 contributing exchanges will still have a WIBP calculated and are retained in any multi-coin index (see Section 5.2). However, pricing fidelity will no longer be considered robust.

The digital asset is placed on review and is reassessed at the next periodic reconstitution, where the problem may be rectified by listing on another contributing exchange or the promotion of other exchanges. If not, the asset is removed from any multi-coin index.

Digital assets which trade only on exchanges on the Non-Contributing Exchange Watchlist are included in the Secondary Asset Watchlist.

Digital assets which trade on three or more exchanges that are on either the Contributing Exchange Watchlist or the Non-Contributing Exchange Watchlist but which fail to meet criterion (1) in 2.2 are included in the Primary Asset Watchlist. Figure 2 illustrates the Asset Pricing Eligibility flow chart.

2.2.2 Annual Eligibility Review

The universe of digital assets for which a Wilshire Indexes Blended Price is calculated is reviewed annually in March using circulating market value data at midnight GMT on 31 December and at midnight GMT on 28th February[2].

Digital assets which are ranked lower than 200 by circulating market value on both dates are removed from the universe of digital assets for which a Wilshire Indexes Blended Price is calculated.

Digital assets which are ranked in the top 50 by circulating market value on both dates which do not have a Wilshire Indexes Blended Price calculated can be added to the universe if the criteria in Rule 2.2 are met.

[2] 29th February in a leap year

FIGURE 1 : THE WILSHIRE INDEXES EXCHANGE REVIEW FLOW CHART

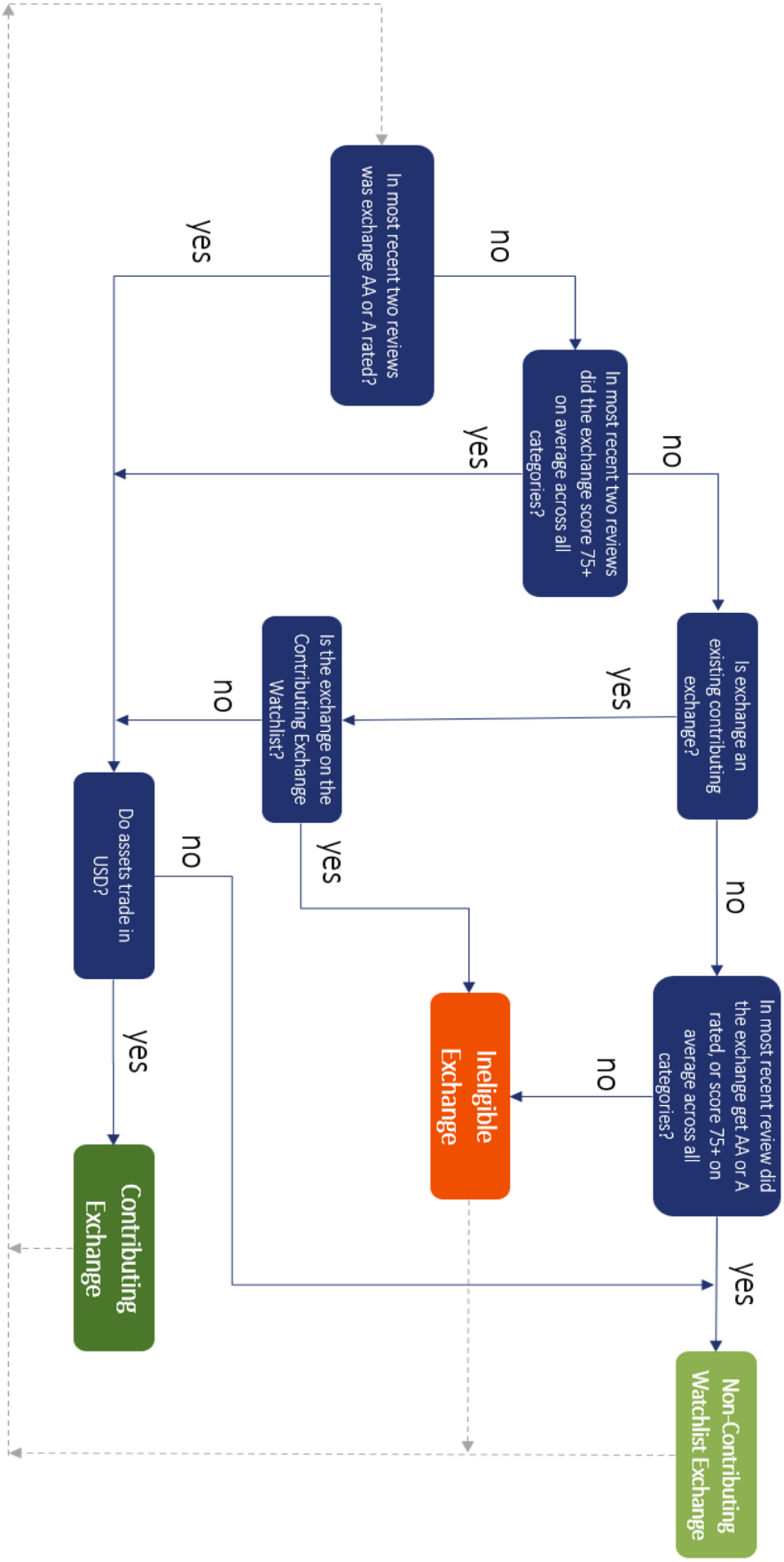
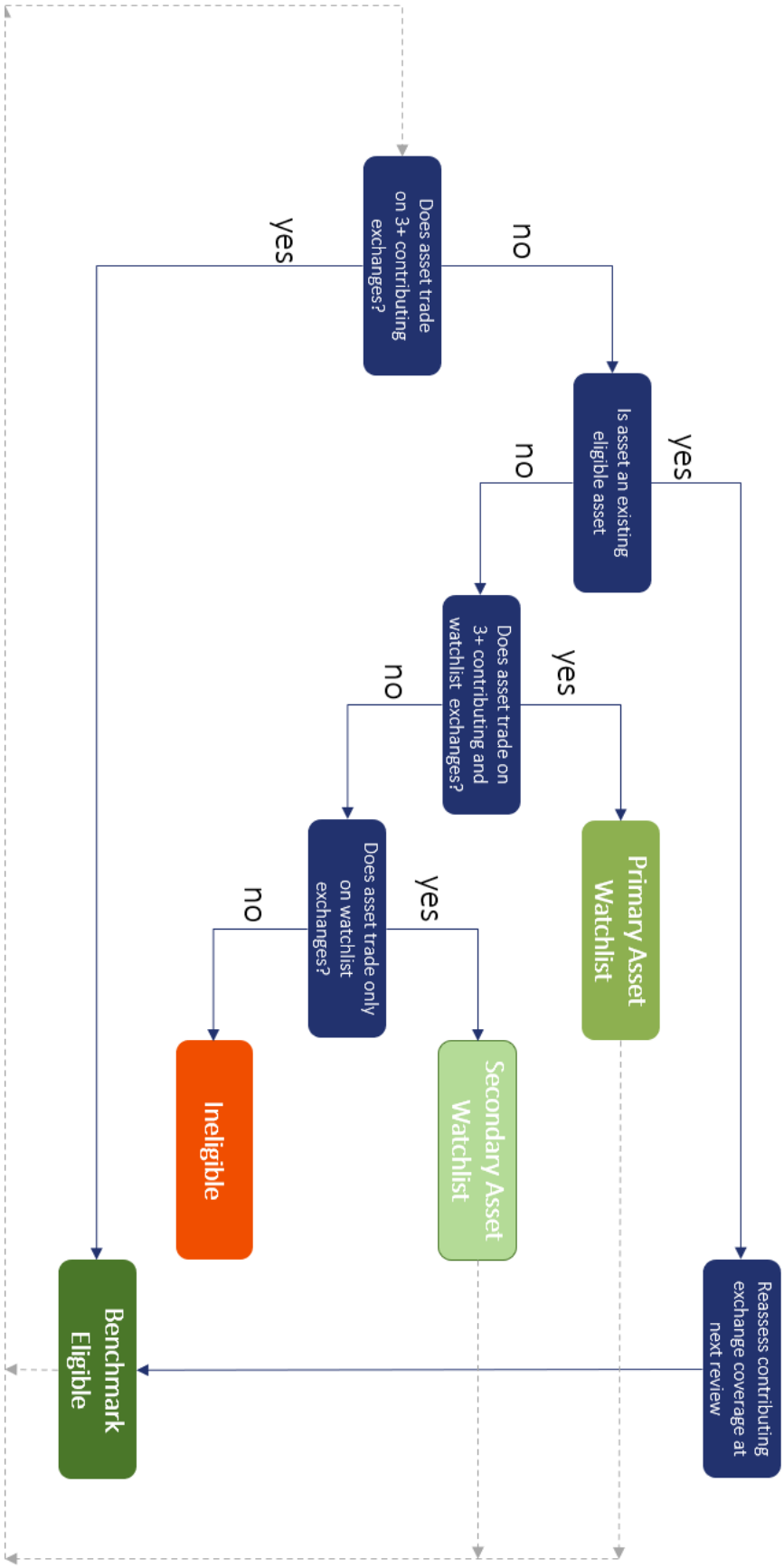


FIGURE 2 : THE WILSHIRE INDEXES ASSET PRICING ELIGIBILITY FLOW CHART



3. Blended Price Calculation

3.1 Wilshire Indexes Digital Asset Blended Price

The Wilshire Indexes Digital Asset Blended Price (WIBP) is the underlying input to all FT Wilshire Digital Asset Index Series products.

The WIBP is a trimmed volume-weighted average price calculated for all those digital assets which satisfy the minimum criteria for inclusion in an index (Section 5) using price and volume data from the contributing digital asset exchanges. The eligibility of contributing exchanges is detailed in Section 2.1.

The WIBP at time *t*, P_t is calculated as:

$$P_T = \sum w_{t,e} \cdot Q_{t,e}$$

where P_T is the WIBP, $w_{t,e}$ and $Q_{t,e}$ are the weights and traded price of contributing exchange *e* at time *t*. Weights are determined using an average of traded volumes on their respective exchanges and are detailed in subsection 3.1.2. Blended prices are updated on a trade-by-trade basis (tick frequency), and they are designed to be robust against both market outages/downtime and disruption, incorporating filters for outliers, stale prices and other deleterious data.

The WIBP is used as the index price for an individual digital asset. For example, the timeseries of the WIBP calculations for Bitcoin constitutes the FT Wilshire Bitcoin Blended Price Index.

3.1.1 Input Trade Data

The WIBP is calculated every time a new trade is executed on a contributing exchange. The necessary data required to update the WIBP are: Price in USD, traded volume, transaction time, exchange.

Currently, inclusion of traded price and volume data is restricted to trades made directly in USD.

An extension to the methodology to include digital assets which trade in fiat currencies other than USD or in other digital assets such as fiat stable coins may be considered in the future.

3.1.2 Exchange Weighting

The weight (importance) of an exchange in the WIBP is determined using an exponential weighted average (EWA) of the previous 24 cumulative hourly volume, traded on this exchange. This ensures that those exchanges with high turnover have a greater weight than those exchanges with lower traded volume. Additionally, it places an emphasis on more recent traded volume allowing for daily and regional effects on liquidity in the market to be captured.

At hour h (where $h \in [1, 24]$), the hourly cumulative volume on exchange e is the sum over the hour up to $t=T$ of the traded volume in that hour, where the cumulative volume of each separate exchange is updated on a rolling minute-by-minute basis. The volume included is only the volume deemed legitimate during the previous 24 hours, i.e., it excludes outlier volume or stale volume data (see Section 3.1.3. Note, at initiation no filtered data is available, meaning there is a run-in time of approximately 24 hours before the exchange weights are determined using data filtered for outliers.

The cumulative volume in any one hour period, $CV_{e,h}$ is:

$$CV_{e,h} = \sum\sum V_{e,t,m} \; ; \; t \in (T\text{-}1, T\,]^3 \; , \; m \in [1, 60]$$

where $V_{e,t,m}$ is the volume associated with the trade at time t in the one minute interval, m.

The EWA of the hourly cumulative volume for each exchange e is then calculated as:

$$EV_e = EWA(CV_e) = \alpha \cdot CV_{e,h} + (1 - \alpha) \cdot EWA(CV_{e,\,h\text{-}1})$$

where EV_e is the EWA for exchange e. The variable α is defined so that $\sum w_h \approx 0.9999$, i.e., 99.99% of the weight is captured by the 24 observations:

$$\alpha = 1 - \mathrm{Exp}(\mathrm{Log}(0.0001)/24) \approx 0.31871$$

and the exponential weights are: $w_{h\text{-}i} = \alpha \cdot (1 - \alpha)^I, \; I \in [0, 23\,]$

The weight each exchange contributes to the WIBP during the minute to $t \in [\,T, T{+}1\,)$ is:

$$w_T = \gamma_e \cdot EV_e \; / \sum \gamma_e \cdot EV_e$$

where $\gamma_e \in [0, 1]$ is a trust parameter for exchange e used to include or exclude an exchange depending on the validity of a trade observed at $t{>}T$. The trust parameter is defined in 3.1.3.1.

3.1.3 Data Filtering

In general, tick level data requires cleansing of deleterious values. For example, there are stale price and volume data. These are data that have not been updated recently such that they may no longer be representative of the wider market. This is common on low volume or illiquid exchanges. There are also outlier data. These data are the result of exchange disruption, market dislocation, incorrect data entry ("fat-finger" errors) and the like. Such data problems need to be correctly accounted for if an aggregate price which is robust to such events is to be determined. There are three data cleansing categories considered in this methodology:

(1) Data bounds – negative prices, zero volumes etc., future time stamps, trade duplicates
(2) Price level – "fat-finger" errors (e.g., 10x larger/smaller), stale (old) data
(3) Outliers – change from one tick to the next is outside an expected range.

The process of filtering occurs with each new trade on an eligible exchange, before the WIBP is calculated.

3.1.3.1 Trade Rejection and Trust Parameter

A traded volume and price pair $(V_t\,, Q_t)$ is rejected if any of the conditions (a. to d.) outlined below are held. Under such conditions the previous valid traded volume and price pair $(V_{t\text{-}1}\,, Q_{t\text{-}1})$ is retained.

a) Trades with time stamps in the future. Any new trade should have a time stamp after the previous price stamp time stamp, but before the current clock time, i.e. $t > T$, where T is the current clock minute (see 3.1.2).
b) Trades with time stamps in the past. These are newly received trades on a given exchange with a time stamp that occurs before the most recent trade on the exchange. Note this is not the same as stale trade data discussed below.
c) Duplicate trades, i.e., trades with the same trade ID, time stamp, volume, and price.
d) Negative volumes $V_t \leq 0$ and/or prices $Q_t \leq 0$.

[3] $t \in [\,T\text{-}1, T\,)$ should be read as $T\text{-}1 \leq t < T$, where T represents an actual clock minute, e.g. 13:59:00.000,

e) Price data entry errors, $Q_t > 1.25 \times P_{t'}$ or $Q_t < 0.75 \times Pt'$ where $P_{t'}$ is the current WIBP at t'.

The trust parameter provides a mechanism by which outliers and extreme volatility events can be excluded from the Wilshire Blended Price. The trust parameter, $\gamma_e = 1$ for each exchange e unless for any traded volume and price pair (V_t, Q_t), any of the conditions outlined below are held.

f) If price Q_t is either the maximum price or minimum price across all exchanges, that is if Q_t = Min($\mathbf{Q}$) or Q_t = Max($\mathbf{Q}$), where $\mathbf{Q}$ is the set of current traded prices across all contributing exchanges, then $\gamma_e = 0$ and the price and volume pair (V_t, Q_t) is excluded from the FT Wilshire Digital Asset Blended Price Index.
g) The price is deemed stale data in which case the trust parameter is $0 \leq \gamma_e < 1$. If after the application of the stale data filter (see below) the only available contributing exchange is time-penalised, then the maximum and minimum prices are retained in the calculation of the WIBP (condition (a) does not apply).
h) In the case of three available exchanges, the maximum or minimum price spans more than one exchange, condition (f) does not apply.

3.1.3.2 Stale Price Data

After the application of (a) to (e), the volume and price pair (V_t, Q_t) can still be excluded if it is deemed to be stale. The importance of price and volume pairs (V_t, Q_t) on an exchange diminishes with time such that after a specified interval the data is deemed stale and is removed from the calculation of the WIBP. This is achieved by adjusting the trust parameter such that $\gamma_e \in [0, 1)$. The trust parameter is reduced from an initial $\gamma_e = 1$ to $\gamma_e = 0$ incrementally depending on the time elapsed since the last valid trade on the exchange used in the calculation of the WIBP. The scaling of the trust parameter is:

$$\gamma_e = 1.0;\ 0 \leq \tau_e < 3$$

$$\gamma_e = 0.8;\ 3 \leq \tau_e < 6$$

$$\gamma_e = 0.6;\ 6 \leq \tau_e < 9$$

$$\gamma_e = 0.4;\ 9 \leq \tau_e < 12$$

$$\gamma_e = 0.2;\ 12 \leq \tau_e < 15$$

$$\gamma_e = 0.0;\ 15 \leq \tau_e$$

where τ_e is the time elapse in minutes since the last valid trade on exchange e.

3.1.3.3 Multiple Price Data

On highly liquid exchanges multiple valid trades can occur with the same time stamp. For exchange e, newly received price and volume pairs (V_t, Q_t) with time stamp t, only the last received trade is included in the calculations.

Under certain circumstances the conditions may be such that all prices are filtered out. In this instance the WIBP is not calculated and the previous value is retained.

4. Settlement Price Fixings

4.1 Wilshire Indexes Digital Asset Settlement Price

For equities and some other liquid assets including FX, settlement prices are often determined as a volume weighted average of trades over a short period of time (30 seconds to a few minutes) at the end of trading or, for continuous markets, at one or more fixed times during the day. However, the high volatility and price reversals observed in the digital asset markets mean a wider time frame for the settlement process is important in mitigating against unwanted effects when a stable estimate is desirable.

A Wilshire Indexes Digital Asset Blended Price is updated tick-by-tick and ticks occur at irregular times. For the settlement process a homogeneous time series is created, the FT Wilshire Digital Asset Blended Average Price Index.

4.1.1 Wilshire Indexes Digital Asset Blended Average Price Calculation

The Wilshire Indexes Digital Asset Blended Average Price (WIBAP) is the volume weighted average price (VWAP) calculated over a period of one minute using all valid trades which were used in the calculation of the relevant Wilshire Indexes Digital Asset Blended Price and their associated cumulative volume taken across all contributing exchanges in the given one-minute period.

For all $t \in [T\text{-}1, T)$, calculate the Wilshire Indexes Digital Asset Blended Average Price A_T using all volume and price pairs (V_t, Q_t) available in the specified period as:

$$A_T = \sum w_t \cdot Q_t$$

where $w_t = V_t / \sum V_t$ is the volume weight, where the volume V_t is the total volume traded across all contributing exchanges associated with valid trades, Q_t.

If in any one-minute period $[T\text{-}1, T)$ there are no valid trades, the previous value of A_T is used.

4.1.2 Wilshire Indexes Digital Asset Settlement Price Calculation

The Wilshire Indexes Digital Asset Settlement Price (WISP) is calculated as the exponentially weighted average (EWA) of the Wilshire Indexes Digital Asset Blended Average Prices (WIBAP), where the exponential weights are determined by:

$$w_{t\text{-}i} = \alpha \cdot (1 - \alpha)^i, \; i \in [0, 59]$$

The variable α is set so approximately 50% of the weight occurs in the last 15 minutes of observations before the settlement time of interest. That is:

$$\alpha = 1 - \mathrm{Exp}(\mathrm{Log}(0.5)/15) \approx 0.04516$$

The weights $w_{T\text{-}i}$ are normalized to ensure $\sum w_{T\text{-}i} = 1$ and the Wilshire Indexes Digital Asset Settlement Price at time T is:

$$S_t = \sum w_{t\text{-}i} \cdot A_{t\text{-}i}$$

where S_T is the Wilshire Indexes Digital Asset Settlement Price at time t and A_t is the Wilshire Indexes Blended Average at time t, where $t \in [T\text{-}60, T)$.

The EWA can be tuned to lengthen or shorten the period of time in which price observations are important to the average. As the digital asset market matures, where volatility is low or for specific client needs, the variable α can be increased, such

that when α=1, the Wilshire Indexes Digital Asset Settlement Price S_T is equal to the most recent Wilshire Indexes Digital Asset Blended Average, Price A_t.

5. FT Wilshire Digital Asset Index Series - Available Indexes

5.1 Single Coin Indexes

5.1.1 FT Wilshire Single Digital Asset Blended Price Index Series

Indexes in the FT Wilshire Single Digital Asset Blended Price Index Series are constructed from the time series of the corresponding Wilshire Indexes Digital Asset Blended Price (WIBP). Details of the available list of coins and tokens for which a WIBP is provided can be found on the Wilshire Indexes Digital Asset web page: FT Wilshire Digital Asset Index Series (wilshireindexes.com).

5.1.2 FT Wilshire Single Digital Asset Settlement Price Index Series

Indexes in the FT Wilshire Single Digital Asset Settlement Price Index Series are constructed using the hourly fixings time series of the corresponding Wilshire Indexes Digital Asset Settlement Price (WISP). Details of the available list of coins and tokens for which a WISP is provided can be found on the Wilshire Indexes Digital Asset web page: FT Wilshire Digital Asset Index Series (wilshireindexes.com).

5.1.3 FT Wilshire Staking Reward Index Series

The Wilshire Indexes Digital Asset Blended Prices form the basis for a series of total return indexes, the FT Wilshire Staking Reward Index Series, which include the rewards earned by staking assets to secure the network and process transactions. See Annex A of this document for the methodology of this index series.

5.2 Multi-Coin Indexes

This section summarises the available indexes within the FT Wilshire Multi-Coin Index Series. The methodology for these indexes is set out in Annex B to this document.

5.2.1 FT Wilshire Top 5 Digital Asset Index

The largest five digital assets by circulating market value in the eligible universe (Rules B2.1 and B2.3 in Annex B).

A 10% market value buffer is included to prevent unnecessary turnover. The smallest existing constituent is removed only if its circulating market value is 10% smaller than the smallest eligible constituent of the index.

Digital assets are equally weighted.

5.2.2 FT Wilshire ex Bitcoin Digital Asset Index

The largest five digital assets excluding Bitcoin by circulating market value in the eligible universe (Rules B2.1 and B2.3 in Annex B).

A 10% market value buffer is included to prevent unnecessary turnover. The smallest existing constituent is removed only if its circulating market value is 10% smaller than the smallest eligible constituent of the index.

Digital assets are equally weighted.

5.2.3 FT Wilshire Bitcoin & Ethereum Digital Asset Index

Bitcoin and Ethereum only, equally weighted

5.2.4 FT Wilshire Broad Market Digital Asset Index

Consists of the largest 25% of the eligible universe (Rules B2.1 and B2.3 in Annex B) by circulating market value.

A 10% market value buffer is included to prevent unnecessary turnover. The smallest existing constituent is removed only if its circulating market value is 10% smaller than the smallest eligible constituent of the index.

Constituents are weighted by the circulating market value using the estimate of circulating coins/tokens as at the cut-off date. The number of coins/tokens is fixed between index reconstitutions.

Several multi-coin indexes are calculated. The following sections set out the generic construction principles. The methodology for specific indexes may include additional eligibility requirements and these are provided in Section 6.

5.2.5 Thematic Indexes

Thematic indexes endeavor to provide exposure to a specific concept or theme. Themes are specified in DATS or are constructed from different DATS subsectors.

The following thematic digital asset indexes are available:

1. FT Wilshire Digital Asset Infrastructure Index, for further information see Annex C.

2. FT Wilshire Environmentally Focused Index – largest 10 digital asset by circulating value in the Environmentally Focused Digital Asset Taxonomy theme. Available in both liquidity adjusted equally weighted and market circulation weighted form.

3. FT Wilshire Decentralised Finance Index - largest 10 digital asset by circulating value in the Decentralised Finance Digital Asset Taxonomy theme. Available in both liquidity adjusted equally weighted and market circulation weighted form.

4. FT Wilshire Smart Contract Platform Index - largest 10 digital asset by circulating value in the Smart Contract Platform Digital Asset Taxonomy theme. Available in both liquidity adjusted equally weighted and market circulation weighted form.

5. FT Wilshire Layer 1 Index - largest 10 digital asset by circulating value in the Layer 1 Digital Asset Taxonomy theme. Available in both liquidity adjusted equally weighted and market circulation weighted form.

6. Index Construction

The following rules apply to all indexes comprising the FT Wilshire Digital Asset Index Series. Additional, specific rules for the FT Wilshire Staking Reward Index Series, the FT Wilshire Multi-Coin Index Series and the FT Wilshire Infrastructure Index are provided in the Annexes to this document.

6.1 Closing and Fixing Times

There is no concept of a closing time for digital assets. Digital assets trade continuously 24/7/365. However, for index purposes the designation of a single "official" closing time is useful. The official closing time for all indexes in the FT Wilshire Digital Asset Index Series is:

16.00 London, adjusted for daylight savings

Multiple fixings for different regions are also useful for mark-to-marketing, derivatives listing and NAV calculations. At each fixing time the last known index level ("last") and a formal settlement price are published. This is analogous to the derivatives market where the last price is separate from the official fixing (settlement) price.

An hourly settlement fixing is provided for all WISPs using the outlined methodology and is provided as a service analogous to the hourly FX market fixings.

An hourly snap is also provided for both WIBPs and multi-coin indexes.

6.2 Network Events

Network events occur in several forms.

6.2.1 Hard Forks

Where a material change to a digital asset's operation occurs such that the blockchain separates at a given block (e.g., perhaps due to a change in consensus mechanism). This can result in an entirely new coin being created. E.g., Ethereum -> Ethereum Classic (the original version) and Ethereum (the hard forked version).

Ordinarily, new digital assets that are a result of hard forks are eligible for inclusion in the index at the next periodic reconstitution if they satisfy the eligibility criteria as outlined in section 2.2.

In rare circumstances the hard fork may be deemed to have a material effect on the index. In such instances the hard fork may be included in the index outside the usual periodic reconstitution schedule provided the eligibility criteria outlined in section 2.2 is satisfied.

6.2.2 Soft Forks

A change in the software/network that (typically) does not result in the generation of a new digital asset. Soft Forks are included automatically without any operational overhead provided the digital asset continues to satisfy the criteria outlined in 2.2.

6.3 Capital Distributions

There are several mechanisms whereby capital distributions can occur.

- Air drops – rewards to holders of digital assets. Usually on an ad hoc basis. Infrequent, irregular and generally small in value. Airdrops are not included.

- Mining rewards – transaction verification via “mining” resulting in a payment. In the case of Proof-of-Work rewards are related to computer hardware and are not included.
- Emissions – holders are rewarded for maintaining a node/active balance on the network.
- Staking Rewards – holders who stake digital assets for transaction verification are rewarded for doing so.
- MEV Rewards – holders are rewarded for actively participating in transaction reordering within blocks to improve network efficiecny.

With the exception of the FT Wilshire Staking Reward Index Series where staking rewards are explicitly included in the index (see Annex A), capital distributions are not included in the index calculations.

Approval

This Methodology was approved by the Wilshire Indexes Index Management Committee

Annex A

FT Wilshire Staking Reward Index Series

A1 Introduction

The FT Wilshire Staking Reward Index Series is designed to provide investable benchmark total return indices for digital assets which are secured using a proof-of-stake consensus mechanism. These total returns include the rewards earned for securing the network and processing transactions.

There are two different types of FT Wilshire Staking Reward indexes:

1. FT Wilshire Staking Reward Index which is a simple interest and return calculation representative of the actual reward per unit digital asset earned.
2. FT Wilshire Compounded Staking Index which compounds the earned staking rewards and is representative of the reward earned by reinvesting earned staking rewards either as part of the digital asset protocol, re-staking or through pooling rewards into additional reward earning validators.

The FT Wilshire Staking Reward Index Series consists of the following indexes:

1. FT Wilshire Ethereum Staking Reward Index
2. FT Wilshire Ethereum Compounded Staking Reward Index.

A1.1 Staking Mechanisms

Different digital asset consensus mechanisms differ from asset to asset and each specific asset and associated staking indexes is dealt with separately in the following sections.

A1.2 Ethereum Staking

Ethereum uses a delegated proof-of-stake protocol for securing the network and validating transactions. Each validator stakes an integer 32 ETH and rewards are accrued over epochs containing multiple blocks. Epochs are approximately 6.4 minutes long and in one day there are ~225 epochs. Durning an epoch a total S Ethereum is staked by N validators (S ~ 32 x N ETH).

Ethereum has three components to its rewards: Consensus Rewards, Execution Rewards and Maximal Extracted Value (MEV) rewards. In a single block, a validator will earn Consensus rewards, might (with a certain probability) earn the execution rewards, may or may not earn MEV rewards depending on whether the MEV process is actively engaged in. Additionally, validators can be penalized if they misbehave.

The different reward mechanisms and penalties are explained in the following subsections.

A1.2.1 Consensus Rewards

These are rewards earned by all validators for helping secure the network.

A1.2.2 Execution Rewards

The execution rewards are probabilistic with rewards being earned by one randomly selected validator for proposing a block of transactions. The expected validator execution reward over D epochs is:

$$\sum_{i=1}^{D} \frac{1}{N_i} \cdot Execution\ Rewards(t)_i$$

where N is the number of validators in epoch D.

On a per Ethereum basis, the probabilistic nature of the execution rewards per validator becomes deterministic. That is:

$$\sum_{i=1}^{D} \frac{1}{N_i} \cdot Execution\ Rewards(t)_i \rightarrow \sum_{i=1}^{D} \frac{1}{32N_i} \cdot Execution\ Rewards(t)_i = \sum_{i=1}^{D} \frac{1}{S_i} \cdot Execution\ Rewards(t)_i$$

A1.2.3 Maximal Extracted Value (MEV) Rewards

Maximal Extracted Value are essentially an arbitrage gained by reordering transactions within a block. These rewards sit outside the formal staking rewards environment and can (in theory) be obtained by holders of Ethereum. i.e. obtaining these rewards is not dependent on being a network validator.

For this reason, MEV rewards are excluded from the FT Wilshire Ethereum Staking Reward Indexes

A1.2.4 Penalties

Some validators misbehave or act in ways which can be detrimental to the network health. Such badly behaving validators can be penalised and their staked assets can be slashed. These penalties are removed from the aggregate staking rewards.

A1.3 Annualised Yield

The annualized staking reward yield per ETH staked, $y(t)$, used in the calculation of the FT Wilshire Ethereum Staking Reward Indexes is the aggregate of all validator rewards and penalties per unit of Ethereum over all D epochs in the past 24 hours, multiplied by the days in year:

$$y(t) = 365 \cdot \sum_{i=1}^{D} \frac{Execution(t)_i + Concensus(t)_i - Penalties(t)_i}{S_i}$$

A2 Index Calculation

The index is calculated every day at 16:00 London time using the most recently available Ethereum staking yield and the 16.00 London time FT Wilshire Ethereum Blended Price Index.

A2.1 FT Wilshire Ethereum Staking Reward Index

The FT Wilshire Ethereum Staking Reward Index is a simple interest and return calculation and is calculated as:

$$Index(t) = Index(t-1) \cdot \frac{P(t)}{P(t-1)} + P(t) \cdot \frac{Index(0)}{P(0)} \cdot \sum_{i=1}^{D} \frac{Execution(t)_i + Concensus(t)_i - Penalties(t)_i}{S_i}$$

$$= Index(t-1) \cdot \frac{P(t)}{P(t-1)} + P(t) \cdot \frac{Index(0)}{P(0)} \cdot \frac{y(t)}{365}$$

Where P is the Wilshire Indexes Ethereum Blended Price at time t, $t-1$. $Index$ is the staking index level at time t, $t-1$ and $y(t)$ is the most recent yield per Ethereum available at time t.

A2.2 FT Wilshire Ethereum Compounded Staking Reward Index

The Ethereum network does not automatically reinvest ETH into a validator accounts. This is because validators consist of 32 ETH only. However, staking providers may pool rewarded assets into multiples of 32 ETH and hence effectively provide a compounded reward.

The FT Wilshire Ethereum Compounded Staking Index is:

$$Index(t) = Index(t-1) \cdot \left(\frac{P(t)}{P(t-1)} + \sum_{i=1}^{D} \frac{Execution(t)_i + Concensus(t)_i - Penalties(t)_i}{S_i} \right)$$

$$= Index(t-1) \cdot \left(\frac{P(t)}{P(t-1)} + \frac{y(t)}{365} \right)$$

Annex B

Multi-Coin Indexes

B1 Introduction

Multi-coin indexes select their constituents from an eligible universe according to a set of eligibility criteria. They are reconstituted on an quarterly basis and can be calculated according to different weighting schemes: equally weighted, liquidity adjusted equal weighted, and circulating market value.

B2 Eligibility

B2.1 Eligible Universe

The eligible universe of multi-coin digital asset indexes is the available universe of digital assets at the cut-off date, for which a FT Wilshire Digital Asset Blended Price Index is calculated. The eligible universe excludes (unless specified otherwise on a per-index basis):

- Digital assets listed in the Common Preferred Exclusions (Appendix A)
- Digital assets with privacy related functionality, specifically those which fall into the following DATS subsectors:
    - Privacy-Focused Smart Contract Platforms (70202020)
    - Optional Privacy Coins (70101015)
    - Default Privacy Coins (70101010)
- Digital assets which are classified as stablecoins in DATS. These are all digital assets in the Stable and Asset Backed sector (701030) which includes subsectors related to stablecoins collateralized using fiat, equity, commodity, fixed income, real assets, and crypto assets and algorithmic and non-collateralized stablecoins.
- Digital assets which cannot be cleared or custodied.

B2.2 Liquidity

Liquidity of eligible digital assets is determined using the 30-day median traded value as at the cut-off date across all contributing exchanges.

B2.3 Custody and Clearing

All constituents of digital asset indexes should have institutional grade custody available clearing facilities. In some jurisdictions, index products are cleared at the constituent level, not at the index level. However, not all digital assets are cleared by TradFi entities and enforcing constituent level clearing may mean there are insufficient digital assets eligible for selection. Consequently, digital asset indexes will only contain TradFI cleared digital assets where practicable and feasible, meaning in some instances a digital asset index may contain assets that are not individually cleared by TradFI facilities.

B2.4 Thematic Index Eligibility

Themes are defined by DATS. For a given theme, eligible constituents are those in the eligible universe which are classified as members of the theme at the implementation date.

Constituents for the thematic digital asset indexes are selected in the following way:

1) Remove all digital assets within the theme with a liquidity (B2.2) in the bottom decile

2) Rank the remaining digital assets by their circulating market value as at the cut-off date and select the largest 10, subject to Rules B2.1 and B2.3..
3) If there are fewer than 10 available assets, select all available assets subject to a minimum of 5.

B3 Thematic Index Weighting

Thematic indexes are calculated according to two weighting methodologies: Liquidity Adjusted Weighting and Circulating Market Value Weighting.

B3.1 Liquidity Adjusted Equal Weighting

Constituents' initial weights are adjusted to ensure the average constituent liquidity can be traded in a single day using at most 20% of the median traded value.

1) Equally weight the selected digital assets
2) For each constituent determine the maximum weight and days-to-trade liquidity (DTL) as:
    - Maximum Weight = 0.2 x Constituent Liquidity / Average Constituent Liquidity
    - DTL = Weight x Average Constituent Liquidity / (0.2 x Constituent Liquidity)
3) Set the weight for each constituent with DTL>1 equal to the Maximum Weight.
    - Redistribute the excess weight equally across remaining constituents with DTL < 1, such that sum of weights = 1, repeating the capping process if necessary.
    - In the case when all constituents have DTL >= 1 and there is available weight, redistribute across all constituents equally.

B3.2 Circulating Market Value Weighting

Constituents are weighted by the circulating market value using the estimate of circulating coins/tokens as at the cut-off date. The number of coins/tokens is fixed between index reconstitutions.

The index is calculated in real-time, 24/7/365 whenever a constituent Wilshire Indexes Blended Price is updated. The index is calculated in U.S. Dollars according to the formula:

$$Index_t = \frac{\sum WIBP_{i,t} \times coins_{i,r,} \times WAF_{i,r}}{Divisor}$$

Where $Index_t$ is the new index level at time t, $WIBP_{i,t}$ is the Wilshire Indexes Blended Price of the ith constituent and $coins_{i,r}$, $WAF_{i,r}$ are the respective number of coins in circulation and the weight adjustment factors for the ith constituent determined at the previous reconstitution *r*.

The $Divisor$ is a constant value which determines the numerical magnitude of the index (e.g. 10,000 on the starting date). The weight adjustment factors are scaling factors which ensure correct constituent weights.

B4 Index Maintenance

B4.1 Multi-Coin Index Reconstitution Dates

Multi-coin indexes are reconstituted quarterly in March, June, September and December. The cut-off date for the inclusion of information in a periodic index reconstitution is midnight UTC on the 1st day of the reconstitution month.

Reconstitutions are implemented (implementation date) five business days after the cut-off date at 4pm London.

B4.2 Intra-Reconstitution Additions and Deletions

In the event a constituent becomes ineligible for inclusion in an index it will be removed from any index for which it is a member. Deletion will take place two business days after the announcement to remove the asset is made. Deletion is made at the index close at the closing price, last known available price or zero.

Annex C

FT Wilshire Digital Asset Infrastructure Index

C1 Introduction

The FT Wilshire Digital Asset Infrastructure Index is a special case of a multi-coin index based on the DATS Digital Asset Infrastructure Theme. All the rules for the calculation of multi-coin indexes in Section 6.3 apply along with the following index specific rules.

C2 Digital Asset Infrastructure

Traditional infrastructure is broadly considered to be the various parts of a system/economy which facilitate its continued operation, e.g. energy, transport, telecoms, utilities, supply chain networks. With the advent of the internet, the concept of digital infrastructure extends traditional infrastructure to include the likes of computing, computer networks, storage/data and their hardware and software enablers.

This Digital Asset Infrastructure Index encompasses ideas from traditional and digital infrastructure with newer concepts which are applicable solely to digital assets, such as distributed ledger technology and decentralisation along with linkages between the two. The Digital Asset Infrastructure Theme is designed to capture those digital assets which are enablers of the digital asset economy and/or aid the traditional and digital infrastructure through, for example, the use of decentralization and distributed network intermediaries.

The Digital Asset Infrastructure Theme is defined using the Digital Asset Taxonomy System (DATS). The guide to the Digital Asset Taxonomy can be found at datsinfo.com.

C2.1 Digital Asset Infrastructure Theme

The Digital Asset Infrastructure Theme is defined using the Digital Asset Taxonomy System (DATS) and consists of the following sectors and subsectors.

Smart Contract Platforms:

- General Purpose (70202010)
- Security-Focused (70202015)
- Scalability-Focused (70202025)

Notarization and Supply Chain Management

- Data Notarization Platforms (70204010)
- Supply Chain Management Platforms (70204015)

Distributed Computation & Storage

- Crowdsourced Computation Platform (70205015)
- Crowdsourced Data Storage Platform (70205020)
- Cloud-Computing Intermediary (70205010)
- Smart Contract Oracles (70201060)

The following Table 1 describes in detail the key DATS sectors and subsectors from which the Digital Asset Infrastructure Theme is comprised.

Table 1 Key Digital Asset Infrastructure sectors and subsectors in DATS

General Purpose Smart Contract Platforms	Platforms for the computation and verification of multi- purpose Turing-complete contracts.
Security-Focused Smart Contract Platforms	Platforms that provide security-focused, Turing-complete contracts that can be created using functional programming languages with semantics that can be formally verified.
Scalability-Focused Smart Contact Platforms	Platforms that enable smart contracts to be processed and verified in parallel through techniques such as blockchain sharding and centralized database management systems.
Data Notarization Platforms	Notarization protocols that leverage public blockchains to timestamp general arbitrary data.
Supply Chain Management Platforms	Platforms that aim to use blockchains to provide tamper- proof supply chain management systems.
Cloud-Computing Intermediary	Platforms that enable smart contracts and their developers to source centralized cloud-computing resources via a tokenized intermediary.
Crowdsourced Computation Platform	Platforms that enable users to receive passive income by renting unused computational resources, which can then be purchased by smart contract applications and developers.
Crowdsourced Data Storage Platform	Platforms that enable users to receive passive income by renting unused storage space, which can then be purchased by smart contract applications, developers and consumers to store data in a decentralized fashion.

C3 Constituent Eligibility and Selection

Eligibility

Eligible constituents are those which are members of the Digital Asset Infrastructure theme outlined above, satisfy the eligibility criteria in sections B2.1 and B2.3 of Annex B and additionally are digital assets which:

- Do not utilise a proof-of-work consensus mechanism
- Have institutional grade custody available and clearing facilities and be permitted by a regulated exchange[4].

[4] For example, Xetra

Selection

Constituents of the FT Wilshire Digital Asset Infrastructure Index are selected from the Eligible Universe (see Eligibility above) in the following way:

1) Remove all digital assets within the Digital Asset Infrastructure theme with a liquidity (rule B2.2 in Annex 2) in the bottom decile of the eligible universe (see Eligibility above)
2) Rank the remaining digital assets by their circulating market value as at the cut-off date and select the largest 10
3) If there are fewer than 10 available assets select all available assets subject to a minimum of 5

C3.1 Circulating Market Value Weighting and Capping

Constituents are weighted by the circulating market value using the estimate of circulating coins/tokens as at the cut-off date. The number of coins/tokens is fixed between index reconstitutions.

Weights are capped at 25% with excess weight of any capped constituents distributed *pro rata* across the remaining uncapped constituents.

Formula B3.2 in Annex B is used to calculate the index.

Appendix A – Common Preferred Exclusions

The following is a list of digital assets in the current universe of blended price indexes and their tickers which are commonly requested for exclusion.

XRP/Ripple (XRP),

Dogecoin (DOGE),

Shiba Inu (SHIB),

Luna Classic (LUNC)

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