Security Token Offerings State Capital Financing Feasibility Study

Prepared for Colorado State Treasurer Dave Young March 1, 2023

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Colorado Senate Bill 22-025 requested that the State Treasurer complete a feasibility study of the use of blockchain technology, as well as examine the potential use of Security Tokens to determine whether such use would:

- Increase the universe of potential investors in State financings, thereby increasing investor demand and potentially lowering interest rate costs;
- Reduce the State's financing transaction costs by addressing current marketplace inefficiencies; and
- Allow Coloradans and others who are so inclined to participate as investors in State financings.

To provide a foundation for this Feasibility Study (this "Study"), it was necessary to briefly describe the current financing processes the State uses, as well as the regulatory framework under which the State operates. Through an explanation and analysis of those processes, one could then better determine what the impacts might be of the use of new technologies. The State could also consider any costs that might be saved from a more traditional financing, as well as any new costs that might result from adding such tools. Last, and perhaps most pertinent to the legislation's direction, the State could determine whether such new technologies might expand the universe of potential investors in State financings, and whether they would prove beneficial to the State through lowered costs and greater efficiencies.

Our analysis is that the use of blockchain technology, as well as Security Tokens, would be feasible, and could be a beneficial addition to the State's current financing options. In fact, the cost of implementing this technology safely and effectively might be the most significant restriction at this point in time.

However, while providing new financing opportunities to Colorado, our limited analysis also indicates that it is more likely to financially benefit the State in the long term than in the short term. The technology is still in its infancy, and investors are less likely to embrace technology until it has repeatedly been proven to be safe, low-risk, and provide benefits in cost and efficiency. While the State may eventually find cost savings through the use of blockchain technology and Security Tokens, some financing costs might actually increase in the short term as the State markets a new product to curious, but uncertain investors.

This Study is broken into several sections. The first provides a basic introduction and overview into blockchain technology and its attendant issues. Our ultimate goal was to determine feasibility for use in State financings, and not to be a technical manual.

As the reader is undoubtedly aware, blockchain technology is new, so new in fact that its existence as of the date of this Study is briefer than the time required to pay off the vast majority of the State's financings, most of which last for up to 20 years. With that in mind, we tried to strike a balance between accessibility for the reader unfamiliar with this territory, as well as provide enough information so that the reader could understand the basics of what blockchain technology is, how it works, and the benefits and challenges of its use.

We then review the State's current approach to financings. In general, Colorado finances short- and long-term borrowing through competitive and negotiated offerings. We follow the specific path of each, reviewing the steps of a successful financing from inception to repayment.

In order to provide a full understanding of the financing process, the regulatory framework under which Colorado operates is next considered. State financings are subject to both federal and state law and regulations, including Colorado's Taxpayer's Bill of Rights. The use of any new technologies would still be subject to that same regulatory scheme.

We then examine the legal and practical considerations of adding blockchain technology and Security Tokens to the State's financing toolbox. We review what protections need to be available to investors who choose to utilize this technology, and what new costs would come to the State as a result.

As the final part of our analysis, we consider the current market for Security Tokens and the current state of blockchain technology. We hope that the comparison table at the end of this analysis allows the reader to easily see where blockchain technology and Security Tokens could add benefit to the State, and where current practice would not be superseded by technological changes.

Ultimately, the analysis indicates that blockchain technology and Security Tokens could, in the long term, potentially expand the investor universe, lower certain financing costs, and is feasible. While it does not appear that significant legislative change would be necessary to begin this process, legislation expressly authorizing the State to use digital ledger technology and, as well, adds the use of Security Tokens to the list of approved methods of financing, is recommended. As part of that legislation, it is also recommended that sufficient appropriations be included for the State Treasurer to obtain the additional technical and legal guidance needed to determine whether and when to use Security Tokens for state capital financings. Given the myriad of factors that must be considered for each and every State financing, including ensuring the safety and reliability of the State's security instruments, whether and when a Security Token financing is appropriate is best left to the State Treasurer to determine on a case-by-case basis.

This Study could not have been completed without the help, expertise, and guidance of many people both inside and outside the State system. A list of those who offered their advice and recommendations, often on short notice and with tight turnaround times is included at the start of this Study. Any errors or omissions from the Study, however, should be attributed solely to its authors.

1. Key Aspects of Blockchain Technology

Senate Bill 22-025 defines **"blockchain technology"** as "a mathematically secured, chronological, decentralized, distributed, and **digital ledger** or database that consists of records of transactions that cannot be altered retroactively." A digital ledger can be decentralized and shared when it operates through a network of computers (a "Network") that maintains identical copies of the digital ledger and updates records of transactions in parallel. "All blockchain technologies should have three constituent parts: peer-to-peer networking, consensus mechanisms, and (yes) blockchains, A.K.A. hash-linked data structures." [1]

Simply put, blockchain technology means that connected computers are in agreement over shared data.

#1: Connected Computers.
The computers are connected in a peer-to-peer network. If your computer is a part of a blockchain network it is talking directly to other computers on that network, not through a central server owned by a corporation or other central party.
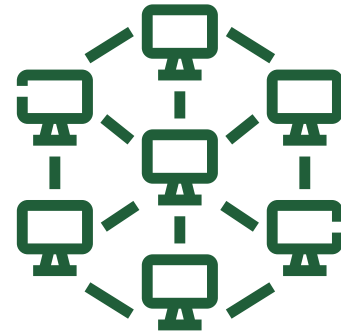
#2: Reach Agreement. Agreement between all of the connected computers is facilitated by using a consensus mechanism. That means that there are rules written in software that the connected computers run, and those rules help ensure that all the computers on the network stay in sync and agree with each other.

#3: Shared Data. And the thing they all agree on is this shared data called a blockchain. "Blockchain" just means the data is in a specific format. The blockchain format simply makes data easy for machines to verify the consistency of a long and growing log of data. Later data entries must always reference earlier entries, creating a linked chain of data. Any attempt to alter an early entry will necessitate altering every subsequent entry, otherwise digital signatures embedded in the data will reveal a mismatch. [2]

This is also referred to as "distributed ledger technology" or "DLT."

When blockchain technology is used to record ownership of a digital asset, the Network must restrict the ability to add or modify records to their owner. In other words, although all the computers on a Network share the same records, they can alter a record only upon a valid instruction from the user who controls the record. The consensus mechanism includes the means by which the Network agrees to the validity of such instructions.

A chief innovation of DLT has been to use cryptographic techniques to perform consensus mechanism functions. Specifically, a Network may allow users to control their records using "public/private key cryptography" and protect the records using a "cryptographic hash." A **private key "signature"** allows a Network to determine when to change a record, and **hashes allow the Network to keep the same records in the same order.**

While this section provides a generic description of how blockchains operate,[3] the most important point, as relevant to this Study, is that blockchain technology is just another way to manage data. Although blockchains have been applied in some novel ways, information in a digital ledger could be stored and controlled without using a blockchain.
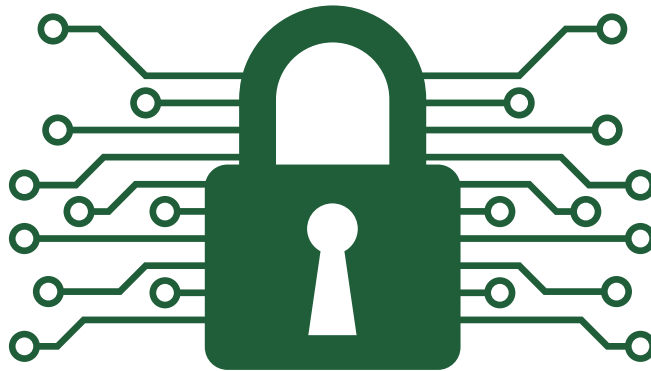
a. Controlling Records Through Public/Private Key Cryptography
Encryption is the process of encoding information so that it can be read only by someone with the "key" to the code. To use the simplest example, if we use a "key" with each letter of the alphabet assigned a sequential number, where a=1, b=2, etc., then the word "cab" would be encoded as "312." In this "symmetric cryptography," the same key both encodes and decodes the information.

There are also algorithms that create "key pairs,"[4] so information encoded with one key can be decoded only by the other key. If one key (the "public key") is shared with the Network, then the Network can use the public key to decode an encrypted instruction and confirm that it was sent by the holder of the other key (the "private key"). This is "asymmetric cryptography." As long as a user keeps the private key secret, that user is the only one who can send instructions that the Network can decode using the public key. This allows the user to digitally "sign" instructions by encoding them with the user's private key.[5]

A blockchain Network creates a digital ledger that connects each public key to specific records and only executes instructions regarding those records that the Network can decode using that public key. This has the effect of "locking" the record to the public key. It gives the user holding its private key exclusive control over the record's use by the Network.

b. Data Integrity Through Cryptographic Hashes

Once control of the records is established, a Network must ensure that every copy of the digital ledger on the Network executes valid instructions in parallel. A Network can accomplish this by creating a "blockchain." Network computers update the digital ledger by adding "blocks" of records based on decoded instructions. Although a variety of processes may be used, typically one computer in the Network will process instructions to create or propose a block of records of transactions. The other Network computers confirm the validity of the block and update their copy of the ledger using the records in the block. This keeps the copy of the ledger maintained by each computer in the Network in sync.
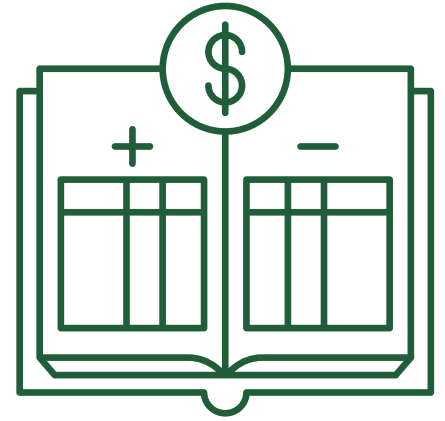
This process entails the risk that one computer in the Network could alter (intentionally or erroneously) one or more blocks, resulting in an inconsistent version of the ledger. A blockchain Network uses a "cryptographic hash" to resolve such conflicts.
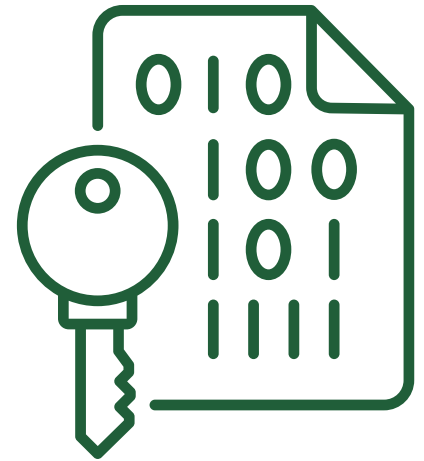
A hash is an algorithm that generates an alphanumeric string of a fixed length (e.g., 256 characters) that uniquely corresponds to a set of data.[6] The significance of a hash is that, if the hash string is sufficiently long, even a small change in the underlying data produces an entirely different hash. This allows a computer to confirm, by comparing the hash of current data to a previous hash, whether data has been altered.

A blockchain Network creates a hash for each block of records and includes that hash at the end of the block. The Network protocol requires each block to include the hash from the previous block, thereby "chaining" the blocks together. This accomplishes two things. First, it locks the block sequence, as the hash at the beginning of each block identifies the block that immediately preceded it. This makes the blockchain chronological.
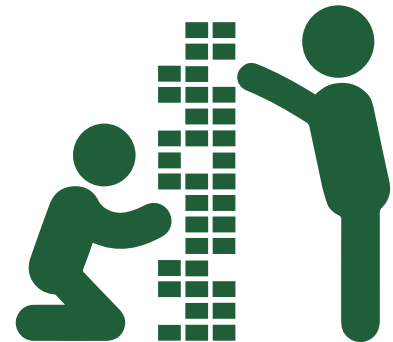
Second, the process prevents the retroactive alteration of a block from affecting copies of the distributed ledger maintained by other Network computers. Altering a block of records will cause the hash for that block to change. Because the new hash does not correspond to the hash included in any subsequent blocks, the computers in the Network will treat that block as corrupt and will not include those records in the ledger. This process preserves the integrity of the records stored by a blockchain Network.

c. Other Applications of Blockchain Technology

This high-level description of blockchain technology omits many details regarding how Networks operate and the range of functions they can perform. There are, however, a few key applications that are especially relevant to this Study.

(i) Wallets

Many people may use a Network without participating in the process of operating or maintaining the distributed ledger. For example, people may interact with Networks through applications known as **"wallets."** Core functions of a wallet are storing the user's public and private key pairs, entering and encoding with the appropriate private key instructions sent to the Network, and reporting the assets or other records the Network has recorded to a public key. Key pairs are much too long and random for an individual to memorize and enter manually, so a wallet simplifies that process for the user.

A wallet could be custodial or noncustodial.[7] A company providing a **custodial wallet** (a "Custodian") controls the private keys. Normally, the Custodian will maintain independent records of its customers' holdings in its internal systems rather than on the Network. The Custodian provides an application for users to enter transactions, which causes the Custodian to send the necessary instructions to the Network encoded with the appropriate private key. If a customer transacts with another customer, the Custodian may record the transaction in its internal records without sending any instructions to the Network.

With a **noncustodial wallet**, however, the user interacts directly with the Network. No one else has access to the user's private keys, so a noncustodial wallet may be regarded as more secure. But it comes with a risk: if the user loses a private key, the user loses control of the records locked to the related public key and there may be no way to restore access.

(ii) Smart Contracts

In addition to maintaining a distributed ledger, some Networks can execute programs commonly referred to as **"smart contracts."** Networks supporting smart contracts allow users to automate transactions and interact with other applications built on the Network. "Smart contracts are simply computer programs. The word 'contract' has no legal meaning in this context."[8] The computer program is stored on the blockchain and executed by the Network's computers, using data from the blockchain or other sources the Network can access. Generally, a smart contract will automatically transmit instructions to the Network upon the occurrence of specified conditions.[9]

(iii) Rewards and Gas

In an ideal world, blockchain use would be cost-free or cost neutral. But in reality, operators of a blockchain Network face substantial costs in acquiring and running the computers that create and validate blocks and maintain the distributed ledger. Those costs are passed on to users through rewards and **"gas"**, terms we discuss briefly here. Public Networks often compensate their operators by creating a "native" token, such as ether which is added to each new block as a reward. The block reward creates an incentive for operators to keep running the protocol and validate blocks within the established period. This block reward[10] may be locked to the public key of the operator who created or proposed the block, or the reward may be shared with operators who validate the block within a set time.

If a public Network supports smart contracts, it may also charge for the computational power required to run a contract's program. The Ethereum Network uses the term gas for this charge and the term has been used in reference to other Networks. Gas is paid in the Network's native token, and automatically deducted from the sender's wallet. The Network automatically distributes the gas collected from all of the transactions included in a block to the Network's operators in the same manner as the block reward. Some Networks have significantly lower gas costs, and private Networks may not require such charges.

The amount of gas required depends on the amount of work required to execute the smart contract. According to the website etherscan.io, as of February 6, 2023, the dollar value of the gas required to simply send ether to another user is a little more than $1, the cost of sending a popular stablecoin was under $3, and the cost of trading on some popular cryptocurrency liquidity pools was around $10. Gas prices can increase significantly if there is heavy demand for running smart contracts or if the native token appreciates in value. Increased gas prices can make smaller value transactions uneconomical. Although the Ethereum Network is, at present, the largest public Network that supports smart contracts, we note that other public Networks may allow for transaction processing charges that are lower and less volatile. Moreover, private Networks may not require such charges at all.

d. Public, Private, and Permissioned Networks

Networks may be classified as public or private, and either type may be permissioned. Generally, anyone may download a public Network that operates using an open-source protocol. This may result in a large number of computers throughout the world operating that Network in parallel. Information the public Network records can be accessed by any computer maintaining a copy of the distributed ledger, so the information is public. The actual identity of users can remain private, however, because they can provide their own public key, which makes them pseudonymous.

As the term suggests, access to a private Network is limited. A person must obtain credentials (such as a username/password) from an authorized source to gain access to the Network. This results in the identity of the users being known—at least to the administrator of the Network and often to the other users. If the users trust one another, the Network may use a simple consensus mechanism, which can make a private Network faster and more efficient than a public Network. Although any authorized user can access information recorded on the Network, the information is not publicly available.

A permissioned Network restricts the computers that can operate the full protocol. While any computer on the Network can send instructions and access records on the blockchain, only some permitted computers can perform other functions. For example, a permissioned Network might restrict the computers that participate in the consensus mechanism for adding and validating new blocks. It might also limit the computers that can add and execute smart contract programs. A permissioned Network allows a developer to control who operates the Network without necessarily restricting who can transact on the Network.

A Network can also use smart contracts to restrict who can use records and how records can be used. In fact, many blockchain "tokens" are created by a smart contract that establishes the parameters for their use. With regard to a Security Token, a smart contract program might include limiting the wallets to which the Security Token can be transferred. Such a feature would make sure that a Security Token can only be held in a wallet controlled by a user that has supplied information necessary to comply with various regulations or other requirements. This feature may be something the State will need if it decides to pursue use of Security Token Offerings, especially if the underlying Network is public and permissionless.

Ultimately, a Security Token will function through the combined operations of a Network, one or more smart contracts and other applications running outside of the Network. For brevity, we will refer to these combined operations as a **"Platform."** A "permissioned" Platform refers to a Platform that permits operators to create rules for who can use records or how records are used, regardless of whether these rules are implemented by the Network, smart contracts operating through the Network, or other means.

2. Digital Securities

As defined by Senate Bill 22-025, a "Security Token" is "a digital, liquid contract made verifiable and secure through the use of blockchain technology that establishes its owner's right to a fraction of a financial asset such as a stock, bond, or certificate of participation." We understand this to mean that the ownership of a financial asset is "made verifiable and secure" using blockchain technology. Article 8 of the Uniform Commercial Code[11] governs the ownership and transfer of securities and would apply to Security Tokens as well. Thus, the State should not need to enact new legislation specifically regarding the issuance and delivery of Security Tokens.

Article 8 governs transactions in investment securities and certain other financial assets. It defines a "security" as an obligation of an issuer or a share, participation, or other interest in an issuer or in property or an enterprise of an issuer:

(i) Which is represented by a security certificate in bearer or registered form, or the transfer of which may be registered upon books maintained for that purpose by or on behalf of the issuer;

(ii) Which is one of a class or series or by its terms is divisible into a class or series of shares, participations, interests, or obligations; and

(iii) Which:
(A) Is, or is of a type, dealt in or traded on securities exchanges or securities markets; or
(B) Is a medium for investment and by its terms expressly provides that it is a security governed by this article.[12]

Article 8 provides for three ways of obtaining a property interest in a security. First, if the security is represented by a certificate (a "certificated security"[13]), by acquiring possession of the certificate.[14] Second, by having the issuer (or its agent) register you as the owner of an uncertificated security.[15] Third, by having a securities intermediary (such as a clearing corporation, stock broker, or bank custodian) credit the security to your securities account, thereby creating a "security entitlement" to the security.[16] Article 8 refers to the owner of a security entitlement as an "entitlement holder."[17] "An entitlement holder's property interest with respect to a [security] is a pro rata property interest in all interests in that [security] held by the securities intermediary." [18]

Digital systems are commonly used to record ownership of publicly held uncertificated securities and security entitlements, which Article 8 allows. Therefore, these securities may already be held in a digital form and are divisible into smaller denominations. The issuer has complete discretion to set the minimum denomination, i.e., the smallest face amount, that will be issued and the increments for larger denominations. For example, while the State commonly sets a minimum denomination of $5,000 and multiples thereof for its securities (e.g., $10,000, $15,000), the State could choose a minimum denomination of $1,000 with $100 increments (e.g., $1,100, $1,200). In general, we believe this to be a much simpler approach, with many fewer complications than attempting to create fractional interests in existing or future State financings.

To refine the definition in light of Article 8, a "Security Token" is an uncertificated security or security entitlement that uses blockchain technology to record its registered owner or entitlement holder and any transfer thereof. A "Security Token Offering" is a capital financing method in which such Security Tokens are sold to investors.

3. Potential Economic Benefits of Security Token Offerings

There are three specific financial benefits that *might* arise from a Security Token Offering. First, if a Security Token Offering could increase the demand for Securities in the form of Security Tokens, this could lower the State's cost of capital financing.

Second, a Security Token Offering could decrease, or possibly eliminate, the underwriting discount or other costs that result from capital financings or are incurred for debt servicing. This would allow the State to obtain the same net proceeds from a Security Token Offering as it would from a traditional capital financing, while issuing a smaller par amount of its obligations. Blockchain technology is unlikely to reduce certain fixed costs, however, such as bond counsel, disclosure counsel and rating fees.

Third, blockchain technology could facilitate secondary market trading of Security Tokens, thereby increasing the liquidity of the Security Token and possibly reducing, or even eliminating, markups and markdowns. Increased liquidity and lowering traders' costs would not provide an immediate benefit for the State, but it could spur greater demand for Security Tokens in general and eventually lead to a lower cost of capital through a lower interest rate on the initial offering.

An understanding of how the State's capital financings are currently conducted will help identify areas in which Security Tokens might produce these benefits. As capital financings typically proceed on a negotiated, competitive, or direct basis, the next section provides an overview of these three processes.

4. Current Processes for State Capital Financing

a. Negotiated and Competitive Offerings
In negotiated and competitive offerings, the State offers and sells Securities, often to multiple investors. ("Securities" refers to any of the State's tax-exempt obligations, such as short-term notes or certificates of participation in a lease subject to annual appropriation.) One or more municipal securities dealers registered with the U.S. Securities and Exchange Commission and the Colorado Division of Securities ("Dealers") underwrite the offering (when acting in such capacity, "Underwriters"). An Underwriter buys the Securities from the State and sells them to investors. Both types of offerings involve the same participants, including the following:

- A financial adviser to assist in preparing, planning, and structuring the Securities, assisting in determining the method of sale, assisting with obtaining a rating, and providing guidance on the pricing and delivery of the Securities.

- A law firm to act as bond counsel for the offering. Bond counsel confirms that the offering is duly authorized and conducted in compliance with applicable laws and regulations and provides an opinion to investors that the State has the legal authority to issue the Securities and that the Securities qualify for federal and state income tax exemption. Bond counsel also prepares documents that establish the terms of the Securities (such as the trust indenture).

- A law firm to act as disclosure counsel who prepares the official statement which is the State's document to provide any material facts that a reasonable investor would consider in the purchase of the Securities. The official statement is the primary source of information for investors and other market professionals and establishes all continuing disclosure requirements of the State related to the issuance of the Securities.

- A bank to act as the registrar and paying agent for the Securities. A registrar maintains a record of the registered owners of the Securities and, if the Security is issued in certificated form, authenticates the Security certificate. A paying agent receives debt service payments from the State and distributes them to these registered owners. If the Security is secured by Leased Property (such as Certificates of Participation), the State will select a trustee who, in addition to acting as registrar and paying agent, will enforce the rights and remedies related to the Leased Property on behalf of the Security holders.

In general, the State will seek to have the Securities rated by a nationally recognized statistical rating agency, such as Moody's Investors Service or Standard & Poor's. "A favorable rating usually encourages investors to purchase the public offering, it enhances the credibility of the issuer, and it directly affects the prices the bonds will sell for. Only modest differences in bond ratings may have significant impacts on the amount of interest that issuers will be required to pay to bondholders." [19]

The key difference between a negotiated and competitive offering is when and how the Underwriter(s) are selected. The State generally uses negotiated sales for larger long-term financings and will use a competitive offering for short-term notes.

(i) Pricing the Offering

When the Colorado Department of the Treasury (the "Department") prices Securities, there are a number of variables that are established based on investor demand and preference at the time of pricing. First, the stated rate of interest paid on the Security (the "coupon rate") is set. Second, the offering price of the Security relative to the amount payable at maturity (the "par amount") is set. The combination of the coupon rate and the issuance price establish the yield which is the return earned by the investor. A Security may be offered at par, or a price above par (at a "premium") or below par (at a "discount"). For example, in July 2022, the State sold Series 2022A Education Loan Program Tax and Revenue Anticipation Notes (the "2022A ETRANs") in a par amount of $350 million of which $295 million had a coupon rate of 5% at a price of $103.0268 per $100 of par amount and $55 million had a coupon rate of 3.75% at a price of $102.062 per $100 of par amount, yielding gross proceeds of $360,774,700.

The State can measure the average rate of interest paid on the Securities by the True Interest Cost. The True Interest Cost takes into account the time value of money and is calculated by discounting the debt service on the Securities back to the proceeds received by the issuer, which takes into account issuance costs. The True Interest Cost of the 2022A ETRANs was 1.5374% per annum for a Security that had just under one year to maturity.

(ii) Negotiated Pricing

The Department selects the Underwriter early in the offering process through an RFP process. If the offering requires more than one Underwriter, the selected Underwriters form an underwriting syndicate and the Department appoints one member as the lead or managing Underwriter. Because they are engaged early in the process, the Underwriter or lead Underwriter of a syndicate takes an active role in determining the structure and terms of the Security and comments on the official statement.

As the term suggests, in a negotiated offering pricing is negotiated between the Department and the Underwriter(s) based on current market demand from investors. On the day of pricing, the Underwriter(s) solicit indications of interest from their customers to gauge demand for the Securities by holding an official order period. After the order period, the coupons and prices may be adjusted depending on the overall demand for the Securities. The Department will also negotiate an "underwriting discount," which consists of the difference between the price the Underwriter(s) will pay for the Security and the offering price.

(iii) Competitive Pricing

In a competitive offering, the Department selects the Underwriter(s) at the end of a competitive bidding process. The Department manages the bidding process using one of two main online auction services. The Department makes the preliminary official statement and notice of sale available to the market and any Dealer may bid on the Securities.

Based on the information in the preliminary official statement and notice of sale, the Dealers submit bids through the auction service after soliciting indications of interest from their customers. A bid includes the face amount of the Security to be purchased, the proposed coupon rate, and any premium. Although Dealers cannot see the other Dealers' actual bids, the auction site frequently used by the State notifies the Dealer if it is the best or second-best bid and if not, allows a Dealer to continuously improve its bid until the end of the auction period.

At the end of the auction, the service awards the Securities to the Dealers that bid the lowest True Interest Costs and allocates the offering among the bidders so as to produce the lowest average True Interest Cost. Only Dealers with winning bids become Underwriters for a competitive offering and the winning Dealers receive only up to the quantity of Securities specified in their bids. This process may result in different Underwriters offering the same Security with different coupon rates and prices, as was the case for the 2022A ETRANs. The underwriting discount is included in the bid and is reflected in the True Interest Cost.

(iv) Issuance of the Security

Regardless of how an offering is priced, once completed there is a closing at which the State delivers the Security and receives the net proceeds of the offering. The Security is delivered through the facilities of The Depository Trust Company ("DTC"), which acts as a clearing corporation[20] and a securities intermediary.[21] DTC receives a single certificate for the full amount of the Securities, making it the sole registered owner. After it receives the Security certificate, DTC credits to each Underwriter's securities account at DTC the amount of Securities allocated to that Underwriter. This gives each Underwriter a security entitlement to that amount of the Securities held by DTC. The Underwriter(s) completes the issuance process by crediting the Securities to the securities accounts of their customers and collecting the purchase price. This gives each customer a security entitlement to its share of the Underwriter's security entitlement from DTC. In this manner, the Securities are distributed in book-entry form to the ultimate investors in the offering.

Figure 1 illustrates the process of distributing a Security through DTC.
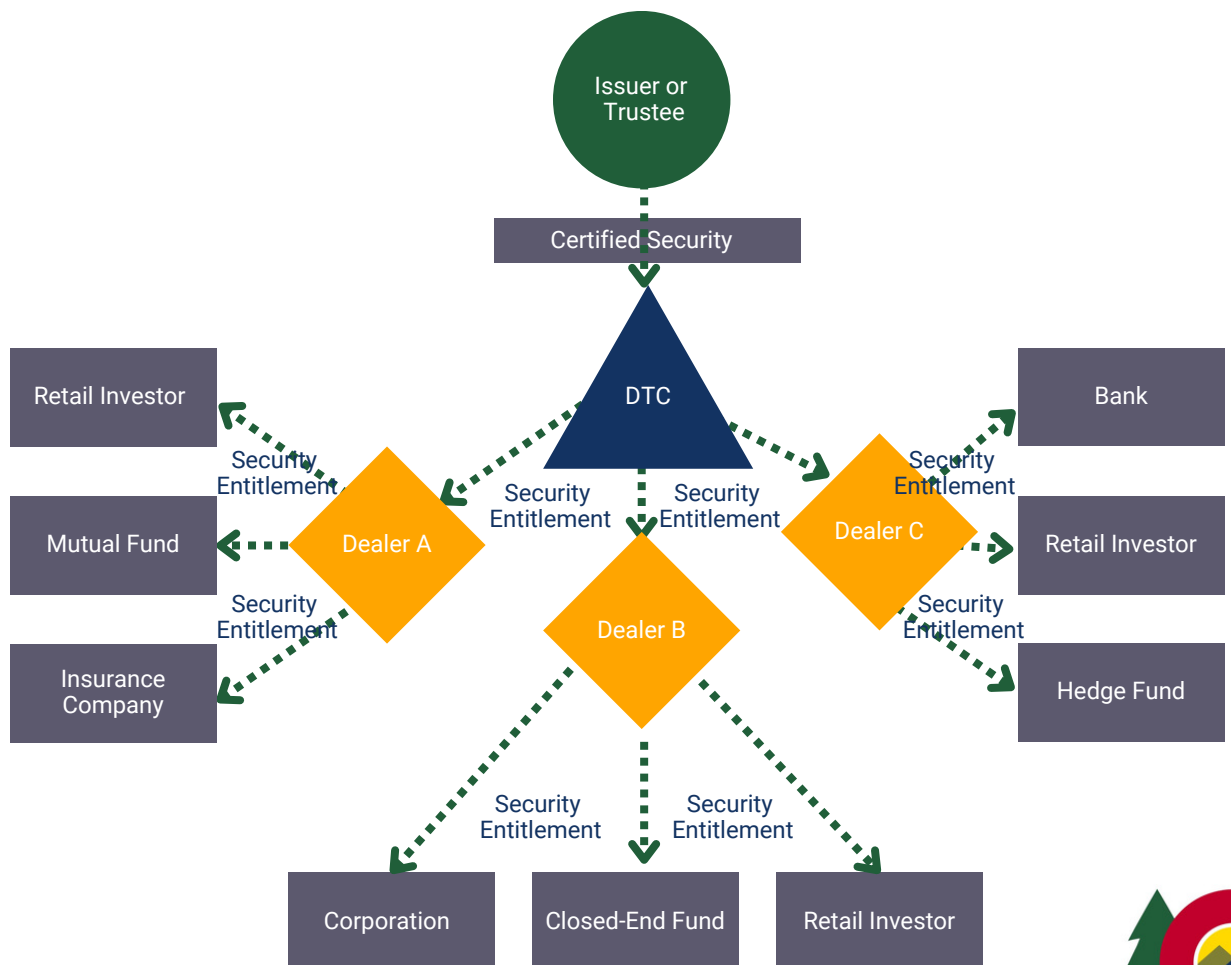
(v) Secondary Trading and Transferring the Securities

Dealers, particularly ones who are Underwriters, may make markets in the Securities by offering to buy and resell the Securities. For example, a customer may place an order with Dealer A to sell some of the Securities. Unless Dealer A wants to hold the Securities as inventory for future sales, the Dealer will solicit bids for the order from other Dealers.[22] Once Dealer A determines the highest price bid for the Securities, Dealer A will offer to purchase it from the customer for a somewhat lower price, so as to generate a "markdown" between the price the Dealer pays to the customer and the price the Dealer receives from the successful bidder, Dealer B. Dealer B will then resell the Securities to its customer at a somewhat higher price to generate a "markup." Markups and markdowns compensate the Dealers for executing the trade between their customers.

Trades generally must be completed within two business days.[23]

Trades are settled through the book entries by DTC and the Dealers shown in Figure 2.
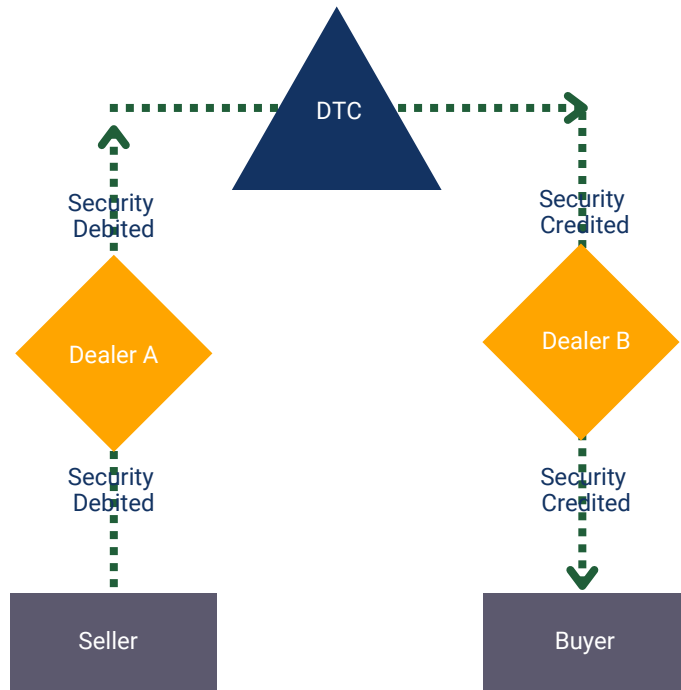
Historically, the trading volume of the State's Securities has been much lower than the volume of trading on the New York Stock Exchange or NASDAQ. For example, according to the Municipal Securities Rulemaking Board's Electronic Municipal Market Access ("EMMA"), in January 2023, 20 customers sold and 12 customers purchased 2022A ETRANs. The total face amount of 2022A ETRANs traded was $7,835,000, only 2.2% of the $350 million face amount of 2022A ETRANs outstanding. Traded amounts ranged from $3,775,000 to $20,000, with a median amount sold of $52,500 and a median amount purchased of $172,500. The two largest trades accounted for 82% of the amount traded. This is not necessarily representative of the trading volume for all of the State's Securities, which will vary by Security and with changing market conditions.

(vi) Debt Servicing and Retirement

DTC, as the sole registered owner of the Securities, receives all of the interest, principal, and any other amounts paid on the Securities. As securities intermediaries, DTC and the Dealers are required to "take action to obtain a payment or distribution made by the issuer of a [Security]" and are "obligated to its entitlement holder for a payment or distribution" so obtained.[24] This means DTC must pass on any payment it receives from the State to the Dealers, and the Dealers must credit the payment to their customers, which is how payments ultimately reach the Security holders.

This distribution of payments follows the same pattern as the distribution of the Securities depicted in Figure 1.

b. Direct Financings

In these financings, the Department deals directly with the lender or lessor in a direct financing, which simplifies the process and lowers costs. Direct financings are typically provided by a bank or other financial institution and finance the acquisition, improvement, or construction of specific capital assets. The lender or lessor receives a security interest in the capital assets being financed. This security interest allows the lender or lessor to sell the capital asset in the event that funds for debt service are not appropriated. Direct financings are closed by delivering a note or lease and security agreement directly to the lender or lessor, without using DTC's facilities.

5. Regulation of Security Token Offerings

Offerings of the State's Securities are subject to a variety of federal and state regulations. This section reviews major regulations that would apply to a Security Token Offering, namely securities and tax regulations, at the federal and state level.

a. Federal Securities Regulations

The State's Securities are exempt from the Securities Act of 1933 (the "Securities Act")[25] and, except as noted below, from the Securities Exchange Act of 1934 (the "Exchange Act").[26] These exemptions do not extend to the anti-fraud provisions of either act,[27] and the U.S. Securities and Exchange Commission ("SEC") has charged and sanctioned states and their officers under these provisions.[28] Municipal securities are also not exempt for purposes of determining whether intermediaries must register as brokers, dealers, or clearing agencies.[29] With certain exceptions (such as banks), any securities broker or dealer must register with the SEC[30] and join the Financial Industry Regulatory Authority ("FINRA").[31] A municipal securities dealer must also register with the Municipal Securities Rulemaking Board ("MSRB") and report municipal securities trades to EMMA.[32]

The SEC has used its authority over registered dealers to regulate municipal securities offerings more generally. Rule 15c2-12[33] serves as the principal regulation applying to any broker, dealer, or municipal securities dealer (a "Participating Underwriter") that participates in a primary offering of municipal securities in a principal amount of $1 million or more.

Under Rule 15c2-12, each Participating Underwriter must:

- Obtain and review an official statement that, except for specified information, the issuer deems final;

- In a noncompetitive bid offering, send any potential customer a copy of the preliminary official statement, if any, upon request, by the next business day; and

- Send the final official statement to a customer, when available and upon request, by the next business day.[34]

A Participating Underwriter must also obtain a written continuing disclosure agreement from the issuer for the benefit of the security holders. The agreement must require the issuer to furnish to the MSRB the following in an electronic format:

- Annual financial information and audited financial statements (if available); and

- Notice of specified events that may materially affect the security holders, such as a default, bankruptcy, change in ratings, bond calls, and modifications of security holders' rights.

Compliance with Rule 15c2-12 requires the active cooperation of the issuer. Consequently, Rule 15c2-12 has the effect of requiring the issuer of a municipal security to:

- Prepare and deliver an official statement; and

- Agree to deliver annual financial reports and notices to the MSRB.

The anti-fraud provisions of the Securities Act and the Exchange Act will impose liability on the issuer for any material misstatement or omission of material information in these disclosure documents.

Registered brokers and dealers are also subject to the SEC's Regulation Best Interest.[35] The core requirement of Regulation Best Interest is that a broker or dealer, "when making a recommendation of any securities transaction or investment strategy involving securities … to a retail customer"[36] shall act in the best interest of the retail customer at the time the recommendation is made, without placing the financial or other interest of the broker, dealer … ahead of the interest of the retail customer.

Regulation Best Interest details specific obligations to use due care and mitigate conflicts of interest. It also requires a broker or dealer to provide in writing "[a]ll material facts relating to the scope and terms of the relationship with the retail customer." [37] The broker or dealer must file a client relationship summary with the SEC on Form CRS.[38] It must deliver Form CRS to its retail customers and post the form on its website.

Registered brokers and dealers must also comply with the SEC's so-called customer protection rule, Rule 15c3-3,[39] which, among other things, requires them to "promptly obtain and … thereafter maintain … control of all fully-paid securities and excess margin securities carried by a broker or dealer for the account of customers."[40] Security entitlements to securities held by a clearing corporation, such as DTC, are deemed to be in the broker's or dealer's control.[41]

In 2021, the SEC issued an interpretation of the customer protection rule with respect to digital asset securities such as Security Tokens (the "CPR Interpretation")[42] The CPR Interpretation provides that a broker-dealer would not be subject to an SEC enforcement action if the broker-dealer complies with nine requirements, most of which relate to adoption of written policies, procedures, and controls. The second requirement is that "[t]he broker-dealer limit its business to dealing in, effecting transactions in, maintaining custody of, and/or operating an alternative trading system for digital asset securities …." [43] This has the effect of requiring existing full-service brokers and dealers to establish a special purpose subsidiary.

Section 17A of the Exchange Act also applies to municipal securities. Subsection (b)(1)[44] requires anyone performing the functions of a clearing agency, like the functions shown in Figures 1 and 2 above, to register with the SEC. DTC is a registered clearing agency, which is why it can hold, clear, and settle municipal securities. Subsection (c)(1)[45] requires anyone performing the functions of a transfer agent for securities registered under Section 12 of the Exchange Act, or securities issued by a registered investment company or insurance company, to register with the SEC. Municipal securities do not have to register under Section 12 unless they are listed on a national securities exchange, so the State does not have to employ a registered transfer agent.

b. Colorado Securities Regulations

The regulatory scheme for municipal securities in Colorado parallels the federal scheme. Securities "issued or guaranteed by ... any state, any political subdivision of a state, or any agency or corporate or other instrumentality of one or more of any of them," are exempt from registration under the Colorado Securities Act, but not from the anti-fraud provisions of the act.[46] Any person transacting business as a broker, dealer, or sales representative in the State must be licensed by the Colorado Division of Securities (the "Division").[47] A licensed broker or dealer is subject to the Division's regulations, including regulations prohibiting unfair and dishonest dealings.[48]

The Division does not regulate clearing agencies or transfer agents except to the extent they act as brokers or dealers.

c. Colorado Public Securities Act

The Colorado Public Securities Act (the "PSA")[49] "appl[ies] to bonds, notes, warrants, certificates, or other securities evidencing loans or the advancement of moneys, to be issued by or on behalf of the state or any political subdivision thereof or any district, public board, commission, authority, or other public body corporate in the state." [50] The PSA requires such Securities to be:

in such registered or bearer form, with or without interest coupons; be subject to such conditions for transfer; be subject to such provisions for conversion as to denomination or to bearer or registered form; be made registerable or payable, or both, by the treasurer or other officer of the issuing entity, or by such trustee, registrar, paying agent, or transfer agent within or without this state; be issued, transferred, and registered by such book entry; be in such denomination or denominations; bear such dates, signatures, and authentications; and be held in custody by such depository within or without this state, all as may be determined by the entity or the governing body of the entity authorized or empowered to issue such securities.[51]

These provisions of the PSA provide the authority, for example, to use DTC as a depository for the State's Securities. The State may rely on these provisions, among other things, to determine that a Platform can be used to register owners of Security Tokens, engage a transfer agent that can provide the Platform, establish the minimum denomination that may be transferred, and impose other restrictions on transfer required to comply with the regulations identified in this section.

d. Revised Uniform Unclaimed Property Act

Colorado's Revised Uniform Unclaimed Property Act ("RUUPA")[52] requires "holders" of property, including Securities, presumed abandoned to report that property to the Department.[53] As with any other security holding, a Security Token could become considered unclaimed property under RUUPA.

A "person obligated to hold for the account of, or to deliver or pay to, the owner property that is subject to [RUUPA]" is the "holder" of the property. [54] In addition to monitoring for abandoned property and filing reports, a holder must "pay or deliver to the [Department] the property described in the report."[55] With respect to an abandoned security, the Department makes efforts to transfer the security and ultimately may sell the security after holding it for three years.[56]

Currently, DTC is the sole owner of the State's Securities, so these Securities should never be abandoned. If an investor abandons a security entitlement to a State Security, the Dealer is the holder who is obligated to report and turn over the Security to the Department. At the appropriate time, the Department can instruct the Dealer to sell the security entitlement and deliver the proceeds to the Department. Switching to Security Tokens will create a direct relationship between some investors and the State, so the State or its agent may need to account for abandoned Security Tokens.

e. Federal Income Tax Regulation

As noted above, one key role played by bond counsel is to deliver an opinion that interest paid on the Securities is exempt from federal and state income taxation. Those using Security Tokens would anticipate the same exemption. To obtain a favorable bond counsel opinion, a Security must comply with complex requirements imposed by the Internal Revenue Code and related regulations. An explanation of these requirements is beyond the scope of this Study, but two requirements will be of relevance to Security Tokens.

First, for a Security to qualify for tax-exemption it must be in "registered form."[57]

Specifically, an obligation is in registered form if:

(1) the obligation: (a) is registered as to both principal and any stated interest with the issuer or its agent, and (b) may be transferred only by surrender of the old instrument and either (i) the reissuance by the issuer of the old instrument to the new holder or (ii) the issuance by the issuer of a new instrument to the new holder; or

(2) the right to the principal and stated interest on the obligation may be transferred only through a book-entry system maintained by the issuer or its agent; or

(3) the obligation is registered as to both principal and any interest with the issuer or its agent and is transferable through both of the methods described in (1) and (2), above.[58]

DTC's book-entry system satisfies the second condition for registered form.[59]

Second, "[p]ayors must file with [the] IRS and furnish to payees a Form 1099-INT, to report information regarding the aggregate amount of tax-exempt interest paid."[60] This includes any governmental unit, such as the State, but does not include payments to a corporation or financial institution, including DTC.[61] Consequently, the State currently does not have to file Form 1099-INTs regarding Securities held by DTC or direct financings with a corporation or financial institution. In addition, Dealers obtain Forms W-8 and W-9 as required from their customers.

f. Colorado Taxpayer's Bill of Rights

As noted in Section 2 of Senate Bill 22-025:

Section 3 of article XI of the State constitution prohibits the State from issuing general obligation debt, and section 20 of article X of the State constitution generally requires the State to obtain voter approval in advance before incurring any multiple-fiscal year direct or indirect district debt or other financial obligation whatsoever.

These sections of the State constitution are commonly called the "Taxpayer's Bill of Rights" or "TABOR."

The case of *In re Interrogatories On House Bill 99-1325* [62] is the leading State Supreme Court opinion interpreting the meaning of "general obligation debt" and "debt or other financial obligation" under TABOR. The court identified the following "characteristics of debt prohibited by [TABOR]: (1) obligations that pledge revenues of future years, (2) obligations that require the use of revenue from a tax otherwise available for general purposes, (3) obligations legally enforceable against the state in future years, or (4) obligations for which future legislatures do not have the discretion to appropriate funds." [63] But if "an appropriation is purely discretionary and nonobligatory," it is not prohibited. The court confirmed that TABOR allows financings "(a) when borrowed funds are repaid from the revenue generated by the improvement (special fund cases), (b) when the entity borrowing the money is a public entity independent from the state, and (c) when the state enters into a lease-purchase agreement for a building or other improvement, and the parties are not bound to renew the lease at the end of the year." [64] While the court did not provide as detailed an analysis of TABOR's voting requirements, it held that the notes in question required voter approval because "it is apparent that the payment obligations are likely to extend into multiple years because the State must make a pledge of its credit for the notes to be marketable." [65]

The criteria for general obligation debt and debt and other financial obligations depend on the terms and nature of the obligation rather than how the obligation is recorded or how those records are maintained. Hence, if a traditional Security would have been subject to TABOR, a Security Token representing the same obligation should also be subject to TABOR. Because a Security Token is simply another means of holding an interest in a financing, TABOR would not require voter approval to issue a Security Token representing a participation in a lease-agreement subject to annual renewal by appropriation of the rental payments.[66]

1. Can the State Issue Security Tokens Under Current Law?

New legislation should not be necessary for the State to issue Security Tokens, although we are recommending legislation authorizing the State Treasurer to determine when to use Security Tokens for capital financings. As explained in Section B.5.c., the PSA already permits Securities to "be issued, transferred, and registered by such book entry… as may be determined by the [issuer]." Article 8 allows Securities to be uncertificated and delivered by registering "the purchaser as the registered owner, upon original issue or registration of transfer."[67] As neither law requires any particular means of making book entries, blockchain technology could be used to record Security Token ownership and transfers. Both Article 8 and tax regulations require the book entries to be made by the "issuer or its agent," however, so the State would either have to maintain an authoritative copy of the distributed ledger itself or appoint an agent (such as a transfer agent) to do so.

A Security Token would permit an investor to have a direct ownership interest in the Security. Under the State's current process, investors receive a security entitlement to the Securities held by their Dealer or another securities intermediary. Because Securities are held in DTC's book-entry system, investors cannot obtain Security certificates or become registered owners of their Securities. In contrast, Security Tokens would be uncertificated securities, directly owned by their investors without any intermediaries.

Dealers could continue to create security entitlements for their customers, but they would, subject to compliance with the CPR Interpretation, maintain their Security Tokens directly on the Platform rather than through DTC. If the State's Security Token Platform supports smart contracts, Dealers could use them to clear and settle trades directly with one another rather than using DTC. Indeed, the Security Token's blockchain can be thought of as replacing DTC in Figures 1 and 2.

For the time being, the State would still need to use traditional means of making payments on Security Tokens. This is because rating agencies have yet to develop a methodology for rating payments using blockchain technologies. There are various "stablecoins" designed to represent a constant one-dollar value that can be transferred over various Networks.

However, holders of these stablecoins are subject to the credit risk of their issuer. A rating agency would factor this credit risk into the rating of a Security Token that obligates holders to accept a stablecoin as a medium for payment. Until rating agencies begin to rate stablecoins, they will not rate Security Tokens payable in stablecoins.

A Platform that replaces DTC must replace the compliance functions of DTC as well. This means the Platform would need to have several features to permit the State, Dealers, and investors to hold and trade Security Tokens in compliance with federal and state regulations. There are also practical considerations that should be addressed before the State relies on a Platform to record Security Tokens. The most important considerations are described below.

a. Legal Considerations

(i) Collection, Verification, and Protection of Personal Identifiable Information
Any Dealer creating a security entitlement to a Security Token must file and send Form 1099-INTs to entitlement holders who are individuals, and the State (or its agent) must do so in the event that an individual holds Security Tokens directly on the Platform. The form requires personal identifiable information such as the recipient's name, address, and taxpayer identification number (which would be a Social Security number in the case of an individual). None of this should be disclosed publicly in Platform records.

Therefore, the Platform needs to be designed to prevent unauthorized disclosure of personal identifiable information, which could include an interface to a private, off-blockchain record keeping system. Furthermore, the Platform should enable intermediaries, including transfer agents and Dealers, to collect and verify such information in accordance with applicable know-your-customer, anti-money laundering, and sanctions requirements. The Platform also needs to limit transfers of the Security Token to public keys linked to authorized users, i.e., users whose required personal information has been collected and verified.

Federal tax regulations require Security Tokens to be in registered form. The regulations do not specify that owners must be registered by name, and often securities intermediaries register customers by their account numbers. Nevertheless, bond counsel may wish to confirm with the Internal Revenue Service that registration of a Security Token to a public key will qualify as a registered form of an uncertificated security.

(ii) Restrictions on Secondary Trading
A Platform will need appropriate controls or permissions to limit certain types of smart contracts used to trade Security Tokens and other forms of systemic trading to registered Dealers or an alternative trading system operated by a registered Dealer. Otherwise, investors using the Platform might inadvertently violate the registration requirements of the Exchange Act and the Colorado Securities Act. Trading by unregistered dealers would also deprive investors in Security Tokens of the protections afforded by these acts.

The issuance of "registered warrants" by the State of California illustrates this risk. During a budget impasse in the summer of 2009, California did not have sufficient appropriated funds to meet its outlays. To bridge the impasse, California issued warrants to pay hundreds of thousands of creditors. The warrants were negotiable, matured on October 2, 2009, and paid interest at 3.75% per annum.[68] As major banks refused to advance funds against the warrants,[69] recipients began to offer their warrants for sale to anyone willing to buy them.

The developing secondary market for the warrants prompted the SEC staff to issue a press release advising that, in the view of the staff, California's warrants were municipal securities for purposes of federal securities laws.[70] The staff further warned that, "[p]ersons acting as intermediaries between buyers and sellers of the warrants may need to register as brokers, dealers or municipal securities dealers, or as alternative trading systems or national securities exchanges."[71]

There are currently many trading platforms for cryptocurrencies and other blockchain recorded assets, none of which are registered as national securities exchanges and only a few of which are registered as alternative trading systems.[72] If the Platform cannot prevent Security Tokens from being registered on one of these trading platforms, any trading conducted on these platforms may violate the Exchange Act.

Unrestricted use of smart contracts may also lead to inadvertent violations of dealer registration and licensing requirements. Many smart contracts and other applications developed to facilitate trading of cryptocurrency could also be used to trade Security Tokens. An investor who solicits trades can accidentally cross the line and be considered a dealer. The SEC staff has identified the following as some of the activities that may require a trader to register as a dealer:

- Advertising or otherwise letting others know that you are in the business of buying and selling securities;

- Doing business with the public (either retail or institutional); and

- Making a market in, or quote prices for both purchases and sales of, one or more securities.[73]

The SEC has proposed regulations providing that any "person that has or control[s] total assets of less than $50 million" could not be engaged in trading "as part of a regular business."[74] This would mitigate the risk of a retail trader of Security Tokens becoming a dealer; however, it is not known when the SEC will consider adopting this rule or, if adopted, whether it would include this provision.

A Platform that supports smart contracts or other applications might allow authorized users to engage in one of these activities by, for example, creating automated "liquidity pools," broadcasting offers, or otherwise conducting a "regular business" of trading. As important, investors trading with unregistered dealers would be deprived of the investor protections provided by SEC, FINRA, MSRB, and the Division's regulations, examinations, and enforcement powers. The use of blockchain technology does not diminish the need for these protections, as cryptocurrency trading has proved as prone to fraud, manipulation, conflicts of interest, and excessive fees as any other type of unregulated trading.

(iii) CPR Interpretation Requirements

The Platform should support a Dealer's compliance with the SEC's CPR Interpretation regarding its customer protection rule. Otherwise, Dealers may require their customers to hold all of the Security Tokens directly on the Platform, which will increase the costs of administering the Security Tokens. A Platform that satisfies the requirements of the CPR Interpretation should also provide greater security for investors in the Security Tokens.

Although a Dealer can address most of these requirements by adopting appropriate written policies, procedures, and controls, the fifth requirement would prevent a Dealer from maintaining custody of a Security Token "if the firm is aware of any material security or operational problems or weaknesses with the distributed ledger technology and associated network used to access and transfer the digital asset security, or is aware of other material risks posed to the broker-dealer's business by the digital asset security."[75] The CPR Interpretation includes a checklist of eight items for Dealers to consider, which would provide the starting point for the Department's assessment of any Platform.

(iv) Disclosure and Reporting Requirements

In connection with their Security Token activity, Dealers would also need to comply with the requirements to furnish preliminary and final official statements, trade confirmations, and other required information to their customers. While the Platform could be an authoritative record of compliance with these requirements, EMMA already provides a centralized repository for official statements, annual financial reports, and event notices, so replicating this information on the Platform would probably be inefficient. Still, Dealers may find it helpful to record the date and time they deliver information on the Platform, as this would provide an unalterable record of such deliveries. The Platform might also allow the State to broadcast information about important events to holders, such as when Security Tokens have been called.

The Platform will need to interface with the systems that Dealers use to report trade information to EMMA. Blockchain technology may provide an opportunity to increase the efficiency of the reporting process through development of applications that report trades as they are recorded by the Platform. Such applications might be extended to trades that do not involve a Dealer, thereby increasing market transparency.

(v) Abandoned Security Tokens

Security Tokens held directly by investors may pose novel challenges under the RUUPA, particularly if the Security Tokens are held in a noncustodial wallet. If an investor holds Security Tokens in a custodial wallet or as a security entitlement, the Custodian or securities intermediary would be the "holder" required to report and turn over abandoned Security Tokens or security entitlements. In contrast, the State would be the holder of Security Tokens directly registered to investors and held in a noncustodial wallet. The Department might be held to automatically comply with the requirements to report and turn over abandoned Security Tokens. Without the private key for such Security Tokens, however, the Department might be unable to sell them or return them to a claimant who did not already have the private key

b. Practical Considerations

(i) Reliability and Security

Any Platform used to record Security Tokens must continue to operate reliably until the Security Tokens have matured. This period **could go beyond 20 years** in the case of Certificates of Participation (COPs), which is **longer than blockchain technology has been in existence**. Thus, it may make sense to size any initial Security Tokens to a smaller obligation and limit the term to a few years, or even a year, until the Department is satisfied that the Platform will operate for an indefinite period. The Department may also wish to consider options to transfer the Security Tokens to DTC if the Platform proves unreliable.

Security is a critical aspect of **reliability** with blockchain technology and the Platform. The Department, with the assistance of technical specialists, will want to confirm that the Platform operates securely and provides sufficient incentives for validating blocks to ensure the continued security of its records. As part of these efforts, the Department and its technical specialists may need to consider risk-based cybersecurity measures appropriate to the Department's role as issuer, including, for example, maintaining non-blockchain-based backup records of Security Token transactions.

The explanation of blockchain technology in Section B.1 assumed that the consensus mechanism was sufficiently robust to prevent records from being altered retroactively. This depends on the nature of the consensus mechanism and, in a public Platform, the number of computers involved in validating blocks. If the security measures are too weak, various external actors (including malicious attackers or a sufficiently powerful computer) could alter the distributed ledger throughout the Platform.

(ii) Return of Security Tokens
Ideally, the Platform Network should have a smart contract or other feature that automatically returns Security Tokens to the State's wallet upon repayment. This would ensure that the Securities are removed from circulation without any action by their ultimate owners. Otherwise, non-interest-paying Security Tokens could remain in circulation, which could confuse investors and adversely affect the State's financial and credit reputation.

A blockchain Platform may require the holder of a Security Token to verify any transfer of the Security Token with its private key. This could prevent the State from canceling any Security Tokens held in noncustodial wallets without the holder's cooperation. While the State could condition a final payment on the transfer of the Security Token to a wallet maintained by the State, it is possible that some holders may not realize that the Security Token has been repaid or may otherwise fail to make the transfer. This approach also involves the risk of someone pretending to be acting as the State and directing investors to send Security Tokens to a different wallet. A Platform might combat this by not permitting an official notice to be broadcast unless encrypted with the State's private key.

(iii) Transaction Costs
Unless the people operating computers that create and validate blocks are compensated through some other means, which can be arranged in a permissioned Platform, investors in Security Tokens will need to pay gas or other charges to record transfers of their Security Tokens or other instructions through a blockchain Platform. Such charges may make it uneconomical to transact small denominations of Security Tokens, particularly where a permissionless Platform is used. As noted above, it can cost upward of $10 to transact with a cryptocurrency liquidity pool—a type of smart contract that might also be employed for trading Security Tokens. This would constitute 1% of a $1,000 Security Token. If the yield on the Security Token was comparable to the 1.5% rate on the 2022A ETRANs, this cost would eat up most of the investor's returns. Thus, these charges may limit the economic benefits to investors of the State of reducing the minimum denomination of its Security Tokens.

In the context of permissionless Platforms, these charges may also increase significantly during periods of heightened demands on the Platform's capacity or increases in the price of the native token. Such an increase may leave investors temporarily unable to sell their Security Tokens and decrease liquidity for the Security Tokens.

The Department will need to consider these costs, and the potential variability of these costs, when selecting a blockchain Platform for Security Tokens.

(iv) Energy Consumption
Certain Networks, particularly those using proof-of-work protocols, consume large amounts of electricity. For example, before switching to a proof-of-stake protocol, the Ethereum Network was estimated to use nearly 23 million megawatt hours per year, which produced emissions of over 11 million tons of carbon dioxide and other greenhouse emissions per year. Conversion to the proof-of-stake protocol was estimated to cut these amounts by more than 99%.[76] The Department will want to assess the environmental impact of any Platform used for Security Tokens.

(v) Licensing Blockchain Technology
Experts consulted for this feasibility study uniformly recommended that the State use an existing blockchain Platform rather than try to establish a proprietary Platform for its Security Tokens, with a focus on permissioned Platforms that have been designed for regulated financial services activities. If a permissioned Platform is used, the Department will likely need to negotiate a license or consortium participation agreement with the entity (or consortium) that operates the Platform. If a permissionless Platform is used, no contract or license would be needed to use the Platform itself, but as a practical matter the Department would likely need to engage qualified service providers to conduct and manage the technical aspects of using the Platform (e.g., deploying and administering smart contracts that govern Security Tokens). The Department may also need to develop licenses or terms of use regarding how Security Tokens may be used on the Platform.

c. Security Tokens Will Probably Require a Permissioned Platform
It is difficult to imagine how a truly open-source, public, permissionless Platform could include the features described above. None of the most widely used permissionless Networks, such as the Ethereum Network currently conform to these criteria. Therefore, Security Tokens are likely to require some form of permissioned Platform. This might be a private Platform, provided that qualified Dealers and investors can easily obtain permission to use the Platform. Another possibility would be a hybrid public Platform capable of implementing these features through secure smart contracts or other applications.

2. Prospective Demand for Security Tokens

To assess the potential impact of Security Token Offerings on the State's capital financings, survey questionnaires requesting feedback were sent to nine Underwriters. Five Underwriters responded. The responses ranged from highly supportive of the prospect of using Security Tokens for State financings to little experience with blockchain technology.

Overall, while the responses indicate that initial demand for Security Tokens would be limited and would not have an immediate effect on lowering the State's financing costs, the potential benefits of blockchain technology could eventually attract more investment and ultimately lower costs.

The responding Underwriters cautioned that it will take time for investors to become used to using blockchain technology. According to one:

Market acceptance would be the key to the widespread adoption of such an application. The cost, security or other benefits from the use of such an application would need to be sufficient to incentivize market participants to make the investments required for the implementation of the new technology. In the interim there would likely need to be parallel systems in place until such an application/technology would be adopted by the entire marketplace.

Another observed, "Given the relevant nascency and level of institutional and retail participants in the municipal Security Token market, it is our expectation that liquidity for Security Tokens will be significantly less than a nonblockchain-based municipal obligation." A third suggested that retail investors were ready to purchase Security Tokens, but "some large institutional investors are still not ready. They are in the process of adapting but this will take time."

With respect to current demand for Security Tokens, one Underwriter referenced recent conversations with institutional investors that would be interested in using Security Tokens to invest. Other Underwriters have yet to identify current customers who might be motivated to invest in or increase their investment in the State's capital financings if offered as Security Tokens. One of these Underwriters nevertheless expects "that the **State's Security Tokens will attract new investors** in the State's capital financings." Another expressed the view "that with the **State of Colorado leading the charge**, many other states and state agencies will take heed to the success of security tokens, thereby increasing the visibility of the financing mechanism." It is also noteworthy that one of the transfer agents we interviewed currently has over 1,600 Colorado residents trading on its Platform.

One Underwriter provided the following detailed explanation as to why investors might find Security Tokens attractive:

*1. The tokens will be permissioned and compliant with standard regulation (i.e. [Know Your Customer] and compliance approved users can hold it): This will **increase the pool of investors** as the number of participants in some public blockchains is large. Many of our large institutional investor clients want such tokens to be on public blockchains because they do not want trapped liquidity in private chains. The key driver for them was the potential for larger liquidity pools enabled by increased market reach and easier facilitation of interoperability across common public networks.*

*2. Streamlined Secondary Market Trading: Investors have significant benefits that come from operational efficiencies of blockchain like **real-time settlement, ability to quickly finance and refinance their tokens, repo-agreements, making the tokens a more attractive product compared to a traditional municipal obligation or even other products offering similar yields**. The efficiency gains make it easier and more cost-effective for investors to trade these tokens, leading to increased efficiency.*

*3. Transparency and enhanced access to information: **Improved transparency** and real-time access to related information can increase investor confidence in the market, potentially attract more investors.*

Most of the Underwriters questioned whether using blockchain technology to distribute official statements or other information would be an improvement over the current process, noting that such information is readily available through EMMA, the State's websites, and other sources. None of the Underwriters recommended using blockchain technology to send payments at this time.

The Underwriters surveyed were skeptical of whether initial Security Token Offerings could produce significant cost savings for the State. One observed, "While pricing and cost advantages may be hard to predict for early Blockchain transactions, it is reasonable to think that the market will become more efficient over time and the financing costs and expenses will reflect this directly through increased demand. This is likely more pronounced for early movers." Yet another believes "that the cost of capital should decrease because of a larger investor pool and increased liquidity" as Security Tokens gain acceptance in the market.

While recognizing the sample was small and unscientific, we found the questionnaire responses encouraging. Many Underwriters are optimistic about the prospects for using Security Token Offerings and some expressed interest in working with the Department. However, based on the responses, we would not expect an immediate benefit to the State from Security Token financing.

3. Current Blockchain Technology for Security Tokens

Many institutions are actively exploring blockchain applications for their businesses, including issuing their securities on blockchains. For example, Siemens recently announced the issuance of one of its bonds on a public blockchain.[77] Additionally, DTC has a web page devoted to blockchain technology,[78] although there have not been any recent developments.

As described below, initial indications are that Transfer Agents (defined below) could serve a useful role for the State using Security Tokens and blockchain technology for future State Security Token Offerings.

To assess the technology currently available, we contacted a few SEC-registered transfer agents ("Transfer Agents") that incorporate blockchain technology into their services. Although a registered Transfer Agent will not be required for the State's Security Tokens, a Transfer Agent qualified to maintain records for other types of tokenized securities is likely to already have a Platform that could support, or be upgraded to support, Security Tokens. Some of the Transfer Agents contacted did have options that could support the offering of Security Tokens.

Unlike DTC, which serves as an agent for its Dealers and other members, a Transfer Agent serves as the agent for the issuer—in the case of Security Tokens, the State. As the State's agent, it can perform the compliance functions on the State's behalf. For example, a Transfer Agent could vet investors before permitting them to transfer Security Tokens to their wallets, maintain the investors' personal identifiable information, obtain, file, and furnish tax forms, and distribute payments. A Transfer Agent's Platform may restrict how Security Tokens are transferred or allow the State to recall Security Tokens that have been repaid. In summary, it should be possible for a Transfer Agent to assume most of the administrative burden required to issue and manage the distribution of Security Tokens for the State.

A Transfer Agent would charge the State for its services, which may increase the cost of capital financing as compared to the current process. Based on our research, charges might include an annual fee plus activity-based charges (e.g., based on how many accounts and transactions are processed). The Department could obtain estimates of these charges when evaluating whether using Security Token Offerings will be beneficial for a capital financing.

We received material from four Transfer Agents while preparing this Study. The range of available Platforms varied. For example, one Transfer Agent currently focused on using blockchain technology for municipal securities. Another currently used its Platform to record mutual fund transactions. Another supported a broad range of assets, which were not limited to tokenized securities. This Transfer Agent demonstrated various features, such as an affiliated broker-dealer, alternative trading system, and application for distributing payments to security holders, that could be used for Security Tokens.

All of the Platforms are compatible with multiple Networks, so the State could select a Network based on its evaluation of its speed, security, resiliency, and cost (e.g., gas charges). The Platforms could operate on private as well as public Networks.

It should be kept in mind that these Platforms perform many of these functions without using blockchain technology. Indeed, although all of the Platforms will record the registered owners on a Network's ledger, they are required to keep a current copy of the ledger on their internal system to comply with SEC rules. The internal copy is the master securityholder file. The master securityholder file would govern in the event of any discrepancy between it and the records on the Network. This provides an added layer of protection against the Network's distributed ledger becoming inaccessible or corrupted.

4. Could Security Token Offerings Be in the Best Interests of Colorado?

The Department believes that Security Token Offerings could eventually yield significant benefits for the State. Market unfamiliarity may mean that initial financings do not realize savings. The following table summarizes the factors supporting this conclusion.

Potential Use and Benefits of Blockchain Technology for Capital Financings

Financing Step or Consideration	Potential Use and Impact of Blockchain Technology
Planning capital financings with financial advisor; preparing offering documents, bond counsel opinion, and other legal and related costs	Fixed costs that would not be altered by use of blockchain technology or Security Tokens.
Rating and rating fees	Fixed costs that would not be altered by use of blockchain technology or Security Tokens.
Retaining registrar; paying agent or trustee	A Transfer Agent's Platform could use blockchain technology to register Security Token owners. Some Platforms can distribute payments to owners, but this would not involve blockchain technology. Transfer Agent fees may be higher or lower than fees currently paid for these services. A trustee would still be required to hold collateral or provide fiduciary services.
Pricing	Underwriters may still be required to price the offering. The public may be invited to subscribe for Security Tokens directly on a noncompetitive basis rather than purchasing from an Underwriter. This may be done without using blockchain technology.
Marketing	If the State allows direct subscriptions, it will need to develop a program for direct marketing of Security Token Offerings. Depending on the Platform costs, Security Tokens may be offered in smaller denominations and increments, which may be more attractive to retail investors.
Closing	The State could use a Transfer Agent's Platform to deliver Security Tokens without relying on DTC's facilities. This would enable investors to purchase Security Tokens directly from the State and continue to hold the Security Tokens directly rather than through a securities intermediary.
Underwriters	It is unlikely that direct sales would encompass the full amount of a Security Token Offering, so Underwriters would still be needed. But to the extent that Security Tokens are sold directly to investors, this could reduce underwriting fees. The cost of a direct marketing program may offset this savings, however. A Platform may also reduce underwriting fees.
Liquidity	A Transfer Agent's Platform would permit Security Tokens to be transferred using blockchain technology and would provide benefits not available through DTC, such as immediate settlement and financing of trading. Trading should still be conducted through a Dealer or a Dealer's alternative trading system, but automation through smart contracts may reduce markups and markdowns. Whether blockchain technology will lower or raise trading costs will depend on the Platform selected, its underlying Network, and the volume of transactions.

Our assessment identified potential trade-offs from Security Token Offerings. For example, using blockchain technology to sell Security Tokens directly to the public may reduce the State's reliance on Underwriters or reduce their fees, but it will require expenditures to pay for the Platform used for the offering and to market the offering. Whether this trade-off would be favorable to the State will depend on the circumstances of each offering.

Given these trade-offs, we recommend continued evaluation of blockchain technology in the context of specific capital financings. Our work on this Study identified several Dealers and Transfer Agents eager to assist in this process. They require the details of the financing, however, before they can provide reliable cost estimates and other information the Department would require when deciding whether to use Security Token Offerings.

5. Recommended Legislation

As explained above, Colorado's current laws permit an uncertificated security, such as a Security Token, to be registered by such book entries as the issuer may determine. This should include book entries to a distributed ledger maintained with blockchain technology, such that a "Security Token" would be an uncertificated security that uses blockchain technology to record its registered owner and any transfer thereof. Given the novelty of blockchain technology, it may be helpful to give the State Treasurer express authority to issue Securities in the form of Security Tokens, as so defined, for such capital financings as the Treasurer may determine.

As also noted, any initial Security Token Offering will require the State Treasurer to evaluate and select an appropriate Platform for the Offering and negotiate agreements with its provider. The State Treasurer will need additional appropriations to employ technical and legal consultants to assist in this process. Although we anticipate that the Platform will be accessed through the internet, the State may need to procure additional equipment or applications to interface with the Platform on a secure and efficient basis, which would also require additional appropriations.

Endnotes

[1]   Peter Van Valkenburgh, What's a blockchain, anyway? (Apr. 25, 2017), https://www.coincenter.org/education/blockchain-101/whats-a-blockchain/.

[2]   Id.

[3]   More information on blockchain technology can be found in the Appendix of the Colorado Office of Economic Development & International Trade, Blockchain Council Report to the Community (Aug. 29, 2019), https://oedit.colorado.gov/sites/coedit/files/documents/blockchainreport_final_2-6-2019.pdf

[4]   These algorithms may be included in applications for using a Network and applications that may be downloaded for free from the Internet. Microsoft Windows currently includes a ssh-keygen function that will create key pairs.

[5]   A more complete description of symmetric and asymmetric encryption can be found in the U.S. Department of Homeland Security, Tech Note on Encryption Software Tools (Sept. 2013) included as an Appendix and available at https://www.dhs.gov/sites/default/files/publications/Encryption-Software-TN_0913-508.pdf.

[6]   For example, the Get-FileHash function built into Windows produces the following hash for the string "Security Token": 03E2950904A330DB619DCB6375499F7B2CC6932F81E3955E8CFE30B7740B7742. Get-FileHash will consistently produce the same hash for this string, but a completely different hash for "Security Tokens."

[7]   Jackson Wood, Custodial Wallets vs. Non-Custodial Wallets (Mar. 9, 2022), https://www.coindesk.com/learn/custodial-wallets-vs-non-custodial-crypto-wallets/.

[8]   Andreas M. Antonopolous & Dr. Gavin Wood, Mastering Ethereum at Ch. 7 (2d ed. 2019).

[9]   Ethereum Foundation, Introduction to Smart Contracts, https://ethereum.org/en/smart-contracts/ (last accessed Feb. 17, 2023).

[10]   This is commonly referred to as a "mining reward" for a proof-of-work protocol and a "staking reward" for a proof-of-stake protocol.

[11]   C.R.S. § 4-8-101 et seq.

[12]   C.R.S. § 4-8-102(a)(15).

[13]   C.R.S. § 4-8-102(a)(4).

[14]   C.R.S. § 4-8-301(a). As delivery of a certificated security requires a transfer of possession, the certificate must be in a tangible form.

[15]   C.R.S. § 4-8-301(b). "[A] security that is not represented by a certificate" is an "uncertificated security." C.R.S. § 4-8-102(a)(18).

[16]   C.R.S. § 4-8-501.

[17]   C.R.S. § 4-8-102(a)(8).

[18]   C.R.S. § 4-8-503(b).

[19]   Joel A. Mintz & Ronald H. Rosenberg, ABA FUNDAMENTALS OF MUNICIPAL FINANCE § 4 (2d ed. 2019).

[20]   C.R.S. § 4-8-102(a)(5). ("'Clearing corporation' means: (i) A person that is registered as a 'clearing agency' under the federal securities laws ….").

[21]   C.R.S. § 4-8-102(a)(14). ("'Securities intermediary' means: (i) A clearing corporation ….").

[22]   If Dealer A wanted to add the Security to its inventory or knew of another of its customers who wants to purchase the Security, the Dealer would execute the trade internally through book entries in Dealer A's record keeping system that debit the Security from the selling customer's securities account and credits the Security to either Dealer A's proprietary securities account or the securities account of the other customer.

[23]   MSRB Rule Book, Rule G-12(b)(ii).

[24]   C.R.S. § 4-8-505.

[25]   15 U.S.C. § 77c(a)(2) (The Securities Act "shall not apply to any of the following classes of securities: … Any security issued or guaranteed by … any State of the United States, or by any political subdivision of a State or Territory, or by any public instrumentality of one or more States or Territories ….").

[26] 15 U.S.C. § 78c(a)(12)(A) ("The term 'exempted security' or 'exempted securities' includes— … (ii) municipal securities, as defined in paragraph (29) of this subsection …."); 15 U.S.C. § 78c(a)(29) ("The term 'municipal securities' means securities which are direct obligations of, or obligations guaranteed as to principal or interest by, a State or any political subdivision thereof, or any agency or instrumentality of a State or any political subdivision thereof, or any municipal corporate instrumentality of one or more States ….").
[27] 15 U.S.C.§ 77q(c). Section 10(b) (15 U.S.C. § 78j(b)) of the Exchange Act applies to any security, including exempt securities.
[28] E.g., In the matter of the State of Illinois, Securities Act Release No. 9389 (Mar. 11, 2013), https://www.sec.gov/litigation/admin/2013/33-9389.pdf.
[29] 15 U.S.C. § 78c(a)(12)(B)(ii).
[30] 15 U.S.C. § 78o(a)(1).
[31] 15 U.S.C. § 78o(b)(1).
[32] MSRB Rule A-12(a).
[33] 17 C.F.R. § 240.15c2-12.
[34] If the issuer files the final official statement with the MSRB, this delivery obligation ends 25 days after the completion of the underwriting. Otherwise, the delivery obligation ends 90 days after the completion of the underwriting.
[35] 17 C.F.R. § 240.15l-1.
[36] 17 C.F.R. § 240.15l-1(a). "Retail customers" are natural persons (or their legal representative) who use the recommendation primarily for personal, family, or household purposes.
[37] 17 C.F.R. § 240.15l-1(a)(2)(i)(A).
[38] 17 C.F.R. § 240.17a-14.
[39] 17 C.F.R. § 240.15c3-3.
[40] Id. § 240.15c3-3(b)(1).
[41] Id. § 240.15c3-3(c)(1).
[42] Custody of Digital Asset Securities by Special Purpose Broker-Dealers, Exchange Act Release No. 90788, 86 Fed. Reg. 11627 (2021).
[43] Id. at 11631.
[44] 15 U.S.C. § 78q-1(b)(1).
[45] 15 U.S.C. § 78q-1(c)(1).
[46] C.R.S. § 11-51-307(a)(1).
[47] C.R.S. § 11-51-401(1).
[48] Colo. Code Regs. § 51-4.7. For example, this regulation requires a dealer to have reasonable grounds for believing that a recommendation to purchase, sell, or exchange a security would be suitable for a customer.
[49] C.R.S. § 11-57-101 et seq.
[50] C.R.S. § 11-57-101.
[51] C.R.S. § 11-57-102.
[52] C.R.S. § 38-13-101 et seq.
[53] C.R.S. § 38-13-401(1).
[54] C.R.S. § 38-13-102(12).
[55] C.R.S. § 38-13-603(1).
[56] C.R.S. § 38-13-603(4).
[57] I.R.C. §§ 103(b)(3) & 149.
[58] Fed. Tax Coordinator 2d (RIA) ¶ K-5568 (footnotes and cross-reference omitted).
[59] Id.
[60] Fed. Tax Coordinator 2d (RIA) § 3040.
[61] Id. §§ 3041, 3042 & 3065.
[62] 979 P.2d 549 (Colo. 1999).
[63] Id. at 554-55 (citations and footnotes omitted).
[64] Id. at 554-55 (citations and footnotes omitted).
[65] Id. at 558.

Endnotes

[66] Id. at 557 (citing Board of County Commissioners v. Dougherty, Dawkins, Strand & Bigelow, Inc., 890 P.2d 199 (Colo.App.1994)).

[67] C.R.S. § 4-8-301(b)(1).

[68] Ryan Knutson, Big Banks Don't Want California's IOUs, Wall St. J., July 7, 2009, at A3.

[69] Id.

[70] SEC Press Release 09-154, SEC Staff Statement on California IOUs (July 8, 2009), 2009 WL 1964970.

[71] Id.

[72] E.g., INX Securities, LLC and Securitize Markets ATS, https://www.sec.gov/files/data/alternative-trading-system-ats-list/atslist013123.pdf.

[73] SEC Division of Trading and Markets, Guide to Broker-Dealer Registration § II.B, https://www.sec.gov/about/reports-publications/investor-publications/guide-broker-dealer-registration#II.

[74] Further Definition of "As a Part of a Regular Business" in the Definition of Dealer and Government Securities Dealer, Exchange Act Release No. 94524, 87 Fed. Reg. 23054 (2022).

[75] Exchange Act Release No. 90788, supra note 41, 86 Fed. Reg. at 11631.

[76] Crypto Carbon Ratings Institute, The Merge: Implications on the Electricity Consumption and Carbon Footprint of the Ethereum Network (Sept. 2022), https://carbon-ratings.com/dl/eth-report-2022.

[77] Press release, Siemens, Siemens issues first digital bond on blockchain (Feb. 14, 2023), https://press.siemens.com/global/en/pressrelease/siemens-issues-first-digital-bond-blockchain%23:~:text=Siemens%20is%20one%20of%20the,underpinned%20by%20a%20public%20blockchain.

[78] Blockchain, DTCC, https://www.dtcc.com/blockchain (last visited February 27, 2023).