# JOINT UTILITIES

## Interconnection Technical Working Group

April 29th, 2016

# Substation Transformer Backfeeding: Background

- **Drivers behind Substation Transformer Backfeeding:**
  - Due to increased DER developer activity, substation transformer backfeeding has more potential to occur.
  - During low load periods, generation output from DERs can reverse current flows from the substation transformer into transmission system.
- **Substation Transformer Backfeeding – Issues and Concerns:**
  - The electric system was designed for one-way power flow. Circuit protection and voltage regulation assumes that power flows in one direction only.
    - Some substation designs require reverse power flow relays looking into the transformers, which will trip if the relay senses reverse power flow.
    - Load tap changer (LTC) and feeder head voltage regulator controllers were designed to control voltage in the forward direction only.
    - Radially-supplied or tapped substations with delta-wye winded transformers may experience phase over-voltage during a ground fault.
  - Protection and voltage control scheme re-designs will often be needed to allow backfeed into substation transformers.

# Substation Transformer Backfeeding: JU Approach

- **JU's current state for Substation Transformer Backfeeding:**
  - All overhead radial systems in NY allow substation transformer backfeeding, with design modifications as needed.
  - Substation transformer backfeeding will generally occur at lower levels of DER penetration and have greater impact on smaller substation transformers in more rural areas.
  - Voltage violations are likely to become a critical issue before substation transformer backfeeding.
- **Common Approaches by JU:**
  - LTC controllers to be replaced for where substation transformer backfeeding is anticipated, if not capable of bi-directional regulation with generation.
  - 3Vo protection is explored for delta-wye winded transformers fed by a single source transmission line (either radial or tapped transmission lines) where there is a risk for voltage rise due to ground fault.
  - Preliminary benchmarking with other jurisdictions indicates that the JU's approach is similar in many respects to what has been adopted elsewhere.

# Anti-Islanding: Background

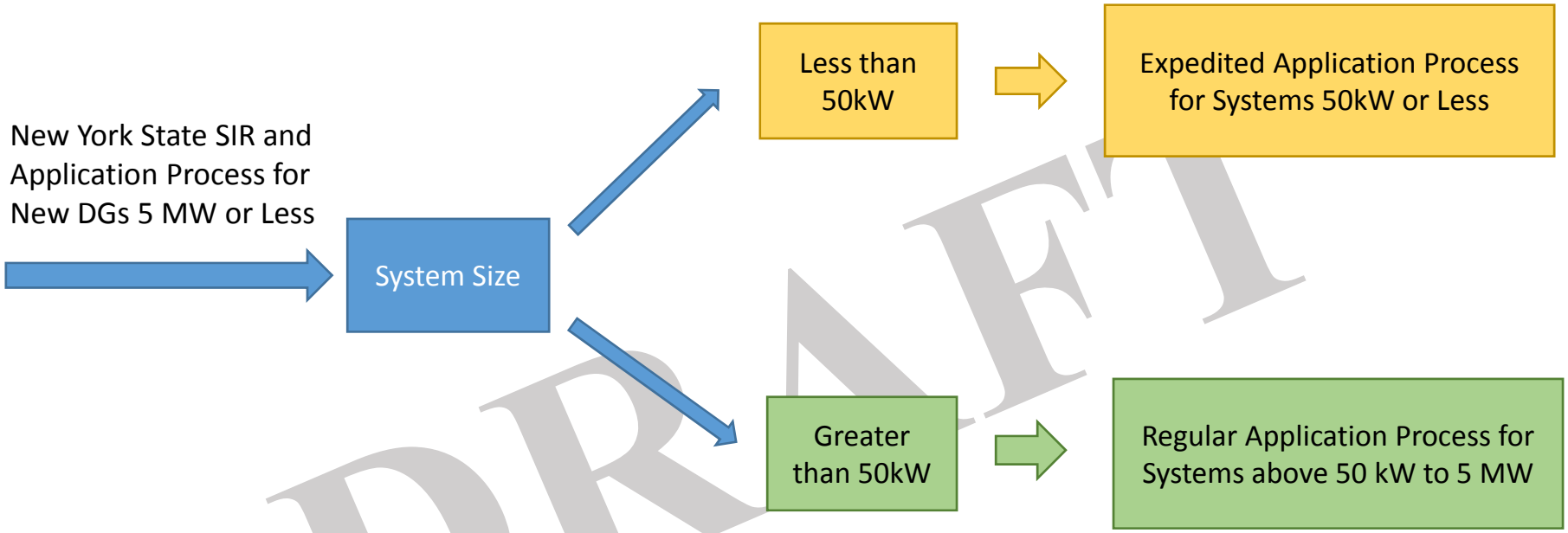
- **SIR Requirement on Anti-islanding:**
  - The generator-owner's protection and control equipment shall be capable of automatically disconnecting the generation upon detection of an islanding condition and upon detection of a utility system fault.
- **Islanding – Issues and Concerns:**
  - Utility has no control of voltage and frequency in the islanded system, and this situation may result in damage to other customers equipment.
  - Islanding can interfere with manual or automatic re-closing of distribution network.
  - Worker safety is a concern.
  - High-speed protection is needed to prevent anti-islanding in situations where inverters will not be able to detect islanding.

# Anti-Islanding: JU Approach

- **JU's approach to anti-islanding:**
  - **SANDIA recommendation followed by all utilities.**
    - Aggregate AC rating of all DER should not exceed 2/3 of the minimum feeder loading.
    - If an island consists of both rotation and inverter based DER, confirm that sum of all rotating machine AC ratings should be less than 25% of the total DER.
    - A minimum of 2/3 of the DER inverters in the system should be from the same manufacturer.
  - **All JU companies currently use Direct Transfer Trip (DTT) to implement anti-islanding.**
  - **Some utilities in JU are currently evaluating alternative options to DTT, because of the high cost and operational limitations.**
    - Con Edison is currently evaluating monitoring frequency and phase orientation at the DER site and compares it to a reference point in their system. If the reference point and phase angle is similar to the DER, then DER is allowed to generate.
    - NationalGrid is exploring Power Line Carrier Frequency Signal.

Source: SANDIA report; http://energy.sandia.gov/wp-content/gallery/uploads/SAND2012-1365-v2.pdf

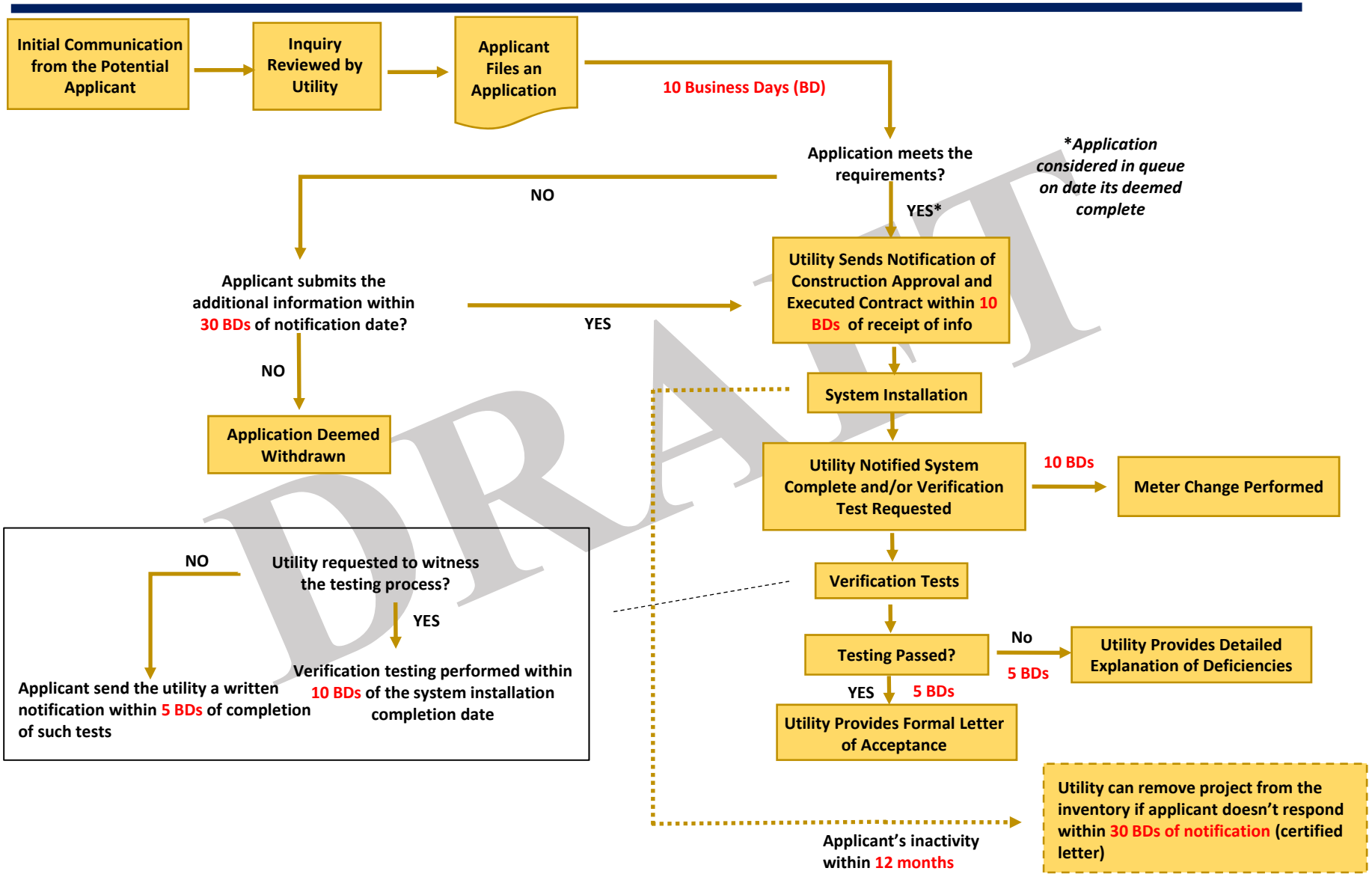
# New York SIR Application Process Overview



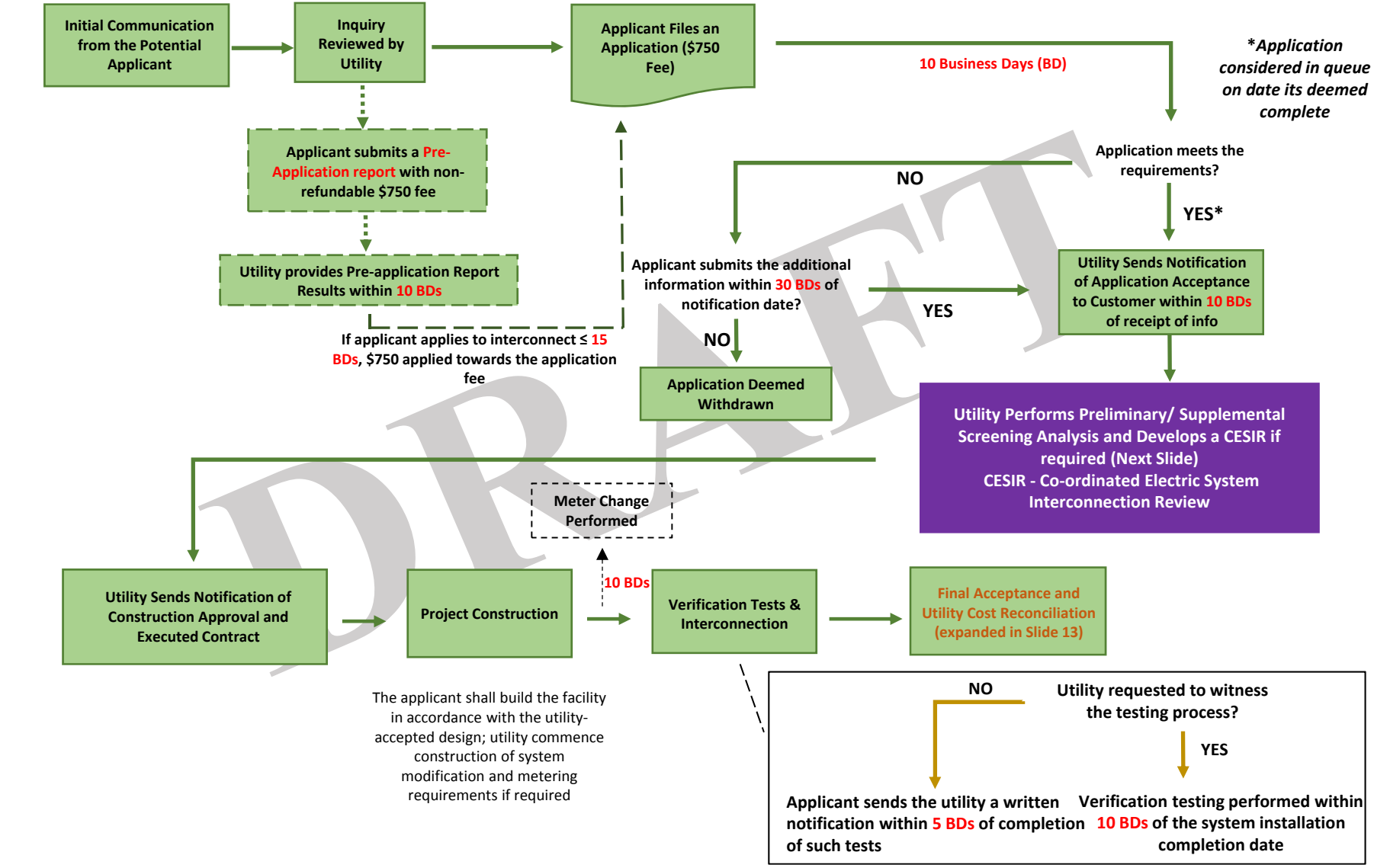



**Notes:** For inverter based systems above 50 kW up to 300 kW, certified and tested in accordance with the most recent revision of UL 1741, applicants and utilities are encouraged, but not required, to use the expedited application process.

# Flow Chart: Expedited Application Process for Systems 50kW or Less



# Flow Chart: Regular Application Process for Systems above 50 kW to 5 MW



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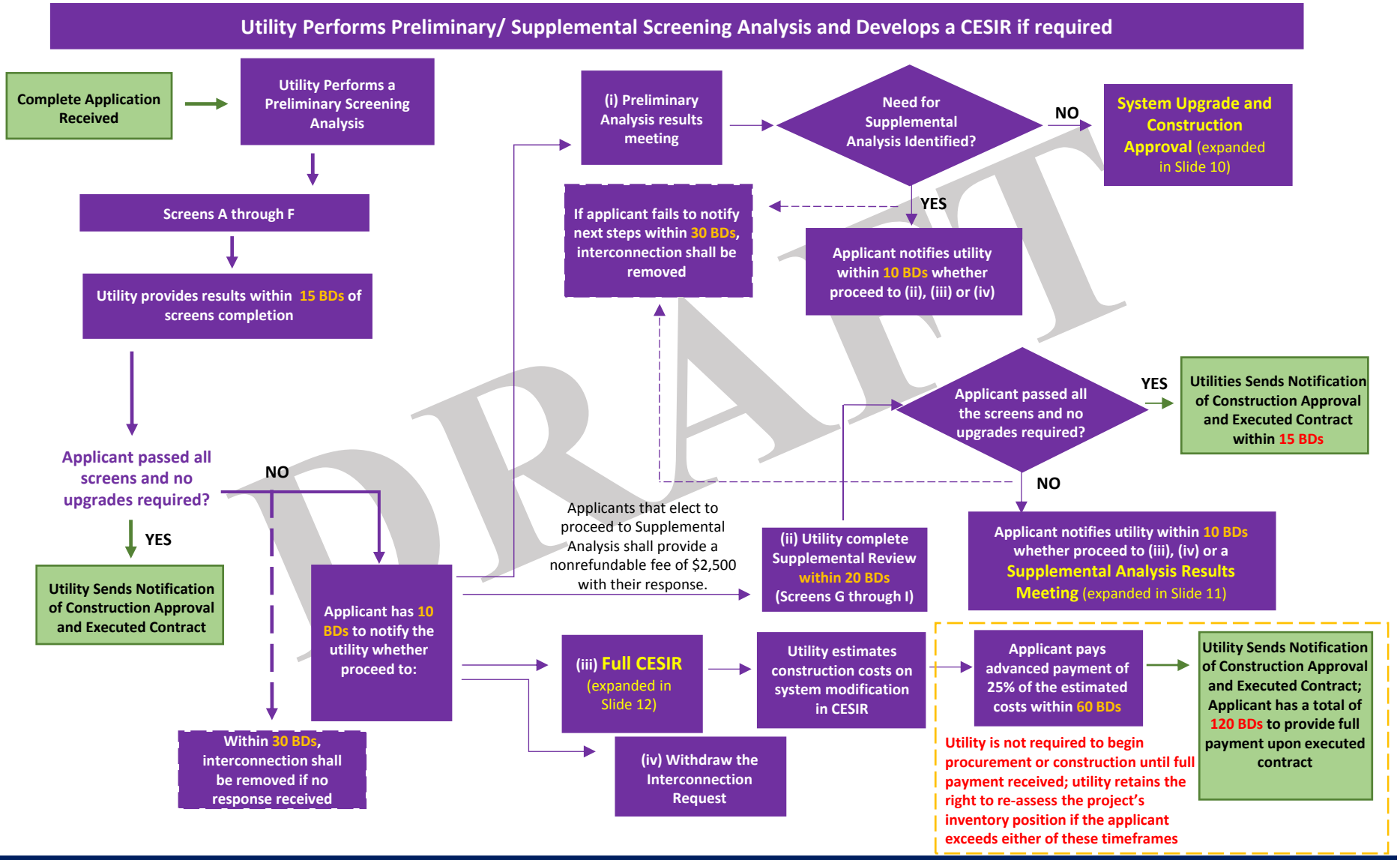

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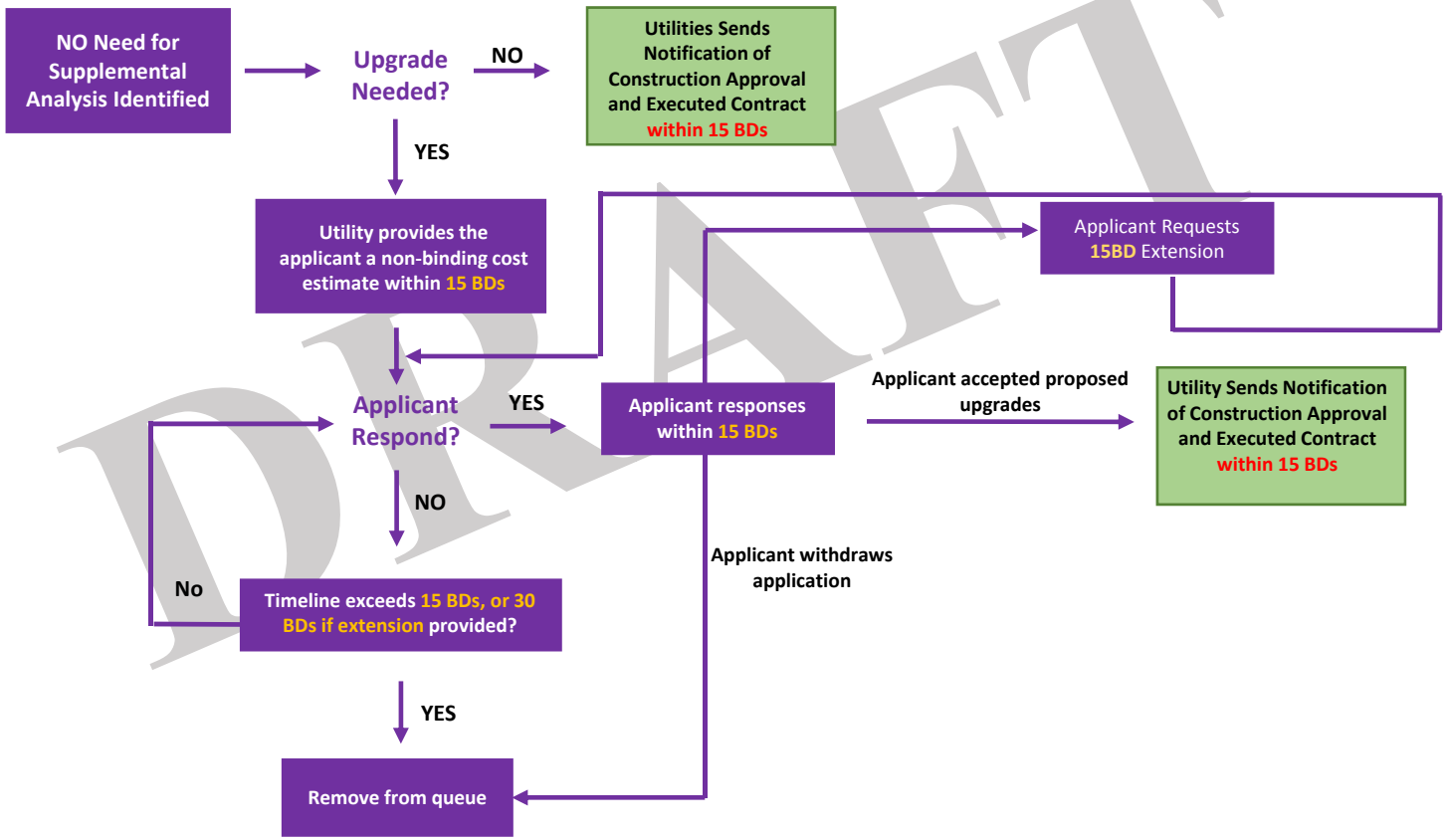
## System Upgrade and Construction Approval



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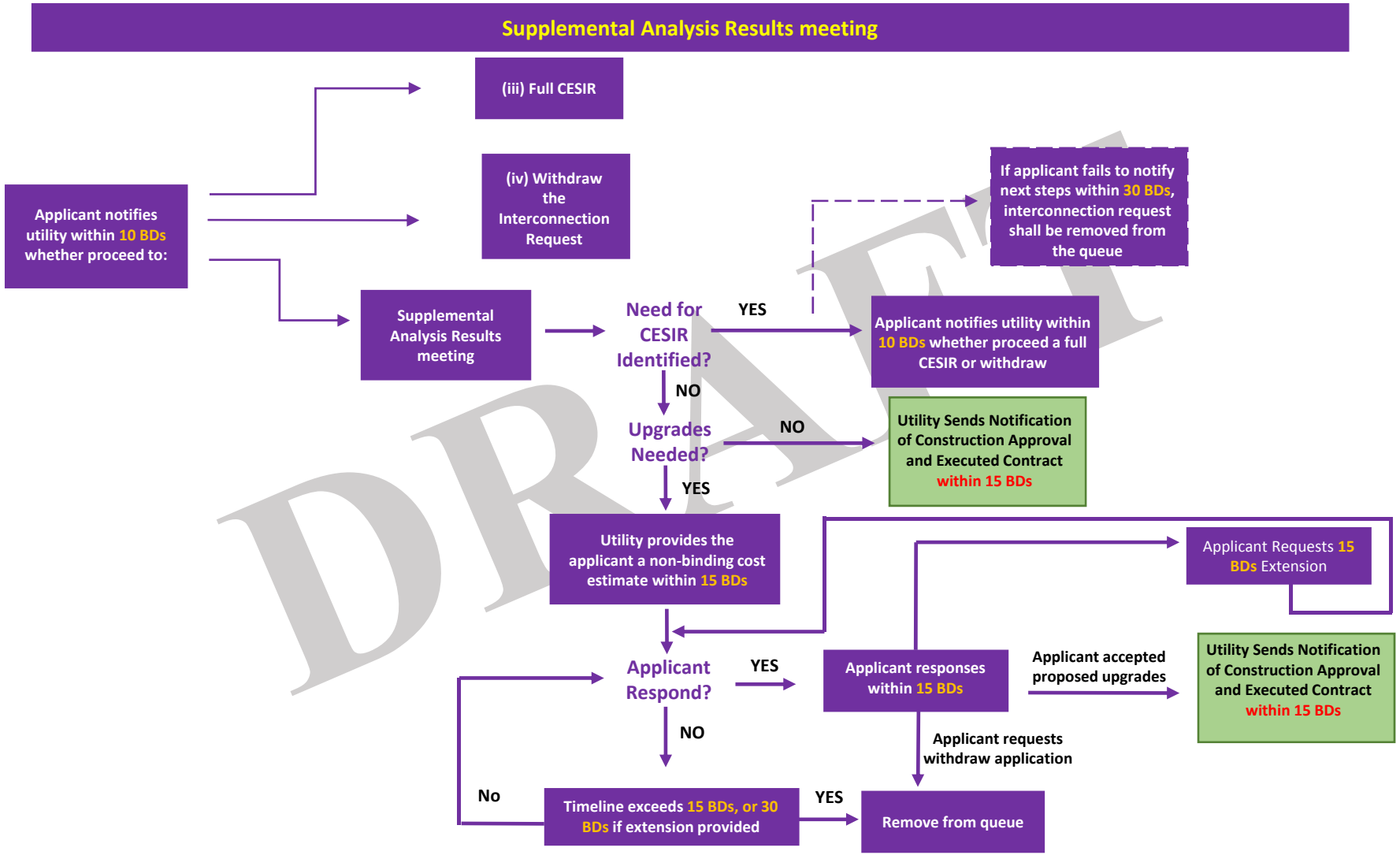

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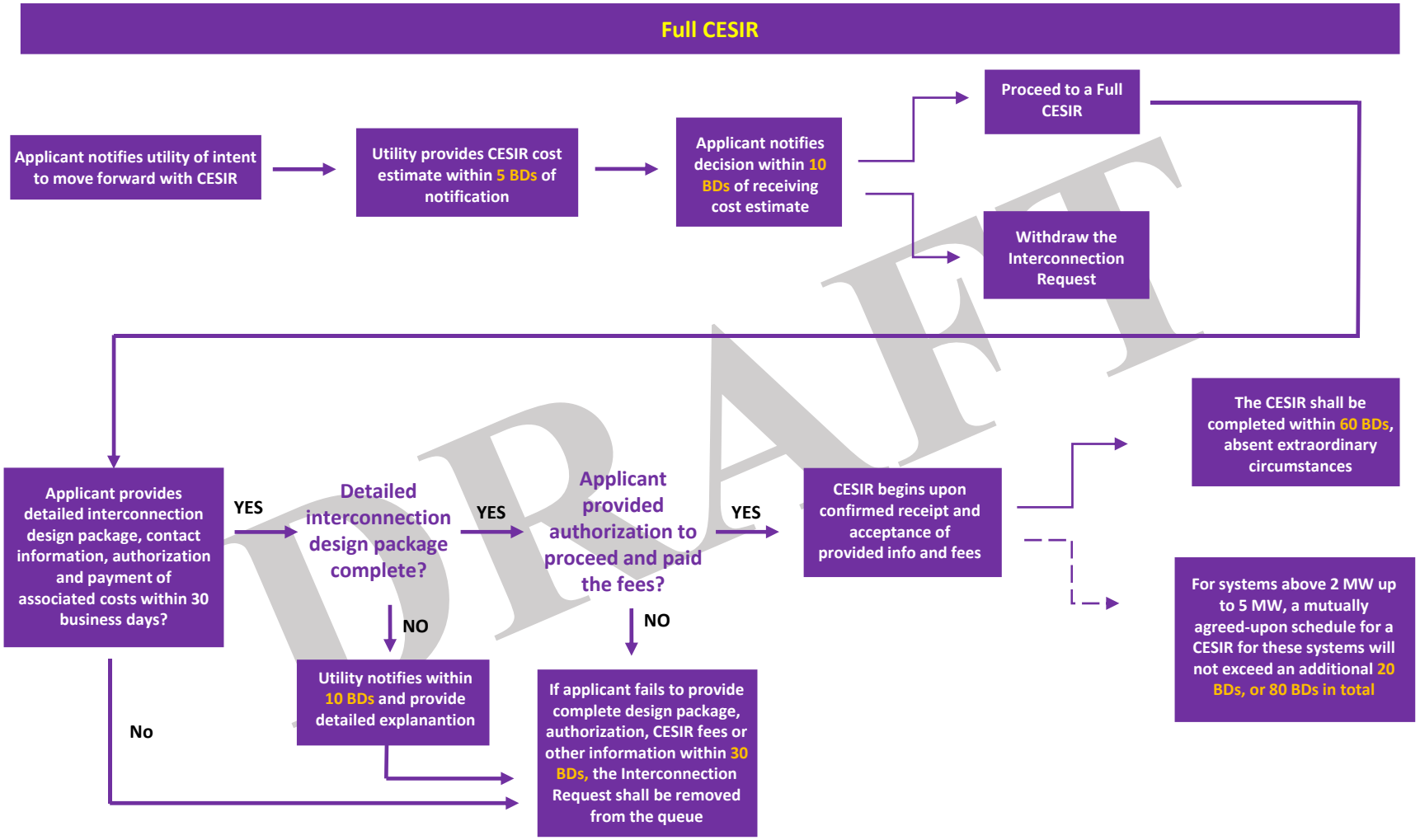

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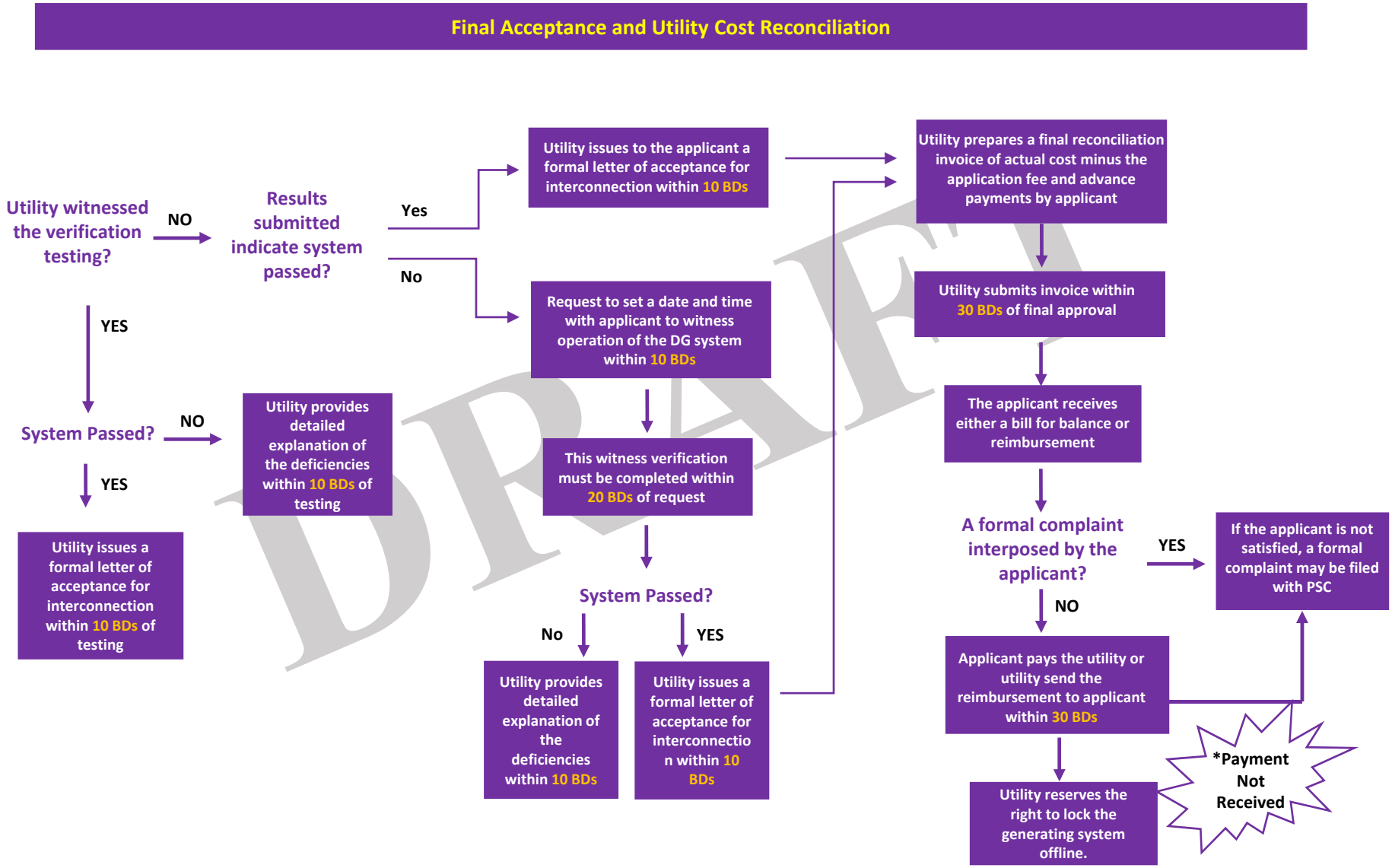
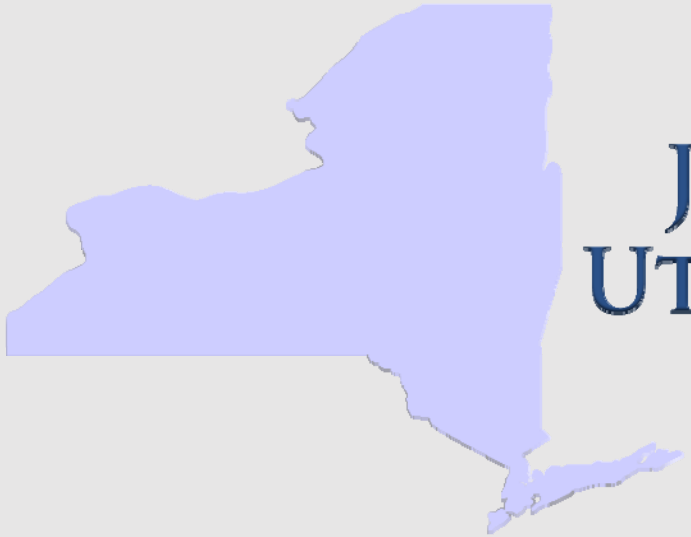


# Screening Items for Discussion

- **Red-zone map will be provided by the end of second quarter, 2016.**
- **How do developers envision tracking all the SIR timelines?**
- **When do developers envision applying for the supplemental screening process?**



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