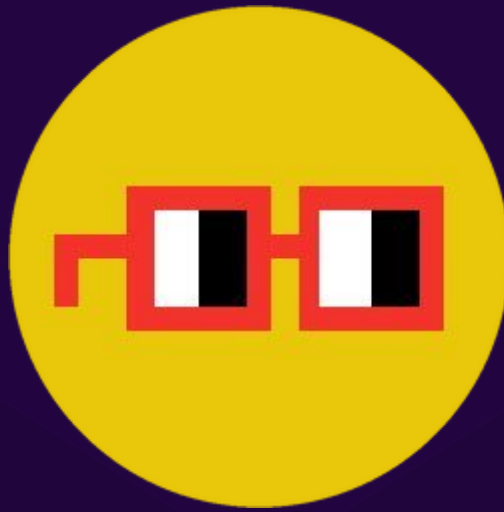




**SHERLOCK**

# **SHERLOCK SECURITY REVIEW FOR**



**Prepared for:**

**Nouns**

**Prepared by:**

**Sherlock**

**Lead Security Expert:**

**WATCHPUG**

**Dates Audited:**

**December 1 - December 4, 2022**

**Prepared on:**

**December 27, 2022**

## Introduction

This project solves the problem of allowing payers of token streams to create streams and fund them after the fact, i.e. first create the stream, then fund it later when funds are available.

## Scope

- `StreamFactory.sol`
- `Stream.sol`
- `IStream.sol`
- `solady/utils/LibClone.sol`
- `solady/utils/Clone.sol`

## Findings

Each issue has an assigned severity:

- Medium issues are security vulnerabilities that may not be directly exploitable or may require certain conditions in order to be exploited. All major issues should be addressed.
- High issues are directly exploitable security vulnerabilities that need to be fixed.

## Issues found

Medium	High
7	0

## Issues not fixed or acknowledged

Medium	High
0	0

## Security experts who found valid issues

WATCHPUG  
rvierdiiev  
KingNFT

hansfrieze  
pashov  
cccZ

Zarf  
bin2chen  
DecorativePineapple



joestakey  
adriro  
dic0de  
ctf\_sec

dipp  
obront  
chainNue  
0xZakk

csanuragjain  
jonatascm  
neko\_nyaa



## Issue M-1: Unnecessary precision loss in `_recipientBalance()`

Source: <https://github.com/sherlock-audit/2022-11-nounsdao-judging/issues/70>

### Found by

WATCHPUG

### Summary

Using `ratePerSecond()` to calculate the `_recipientBalance()` incurs an unnecessary precision loss.

### Vulnerability Detail

The current formula in `_recipientBalance()` to calculate the vested amount (balance) incurs an unnecessary precision loss, as it includes `div` before `mul`:

```
balance = elapsedTime_ * (RATE_DECIMALS_MULTIPLIER * tokenAmount_ / duration) /  
↳ RATE_DECIMALS_MULTIPLIER
```

This can be avoided and the improved formula can also save some gas.

### Impact

Precision loss in `_recipientBalance()`.

### Code Snippet

<https://github.com/sherlock-audit/2022-11-nounsdao/blob/main/src/Stream.sol#L341-L344>

### Tool used

Manual Review

### Recommendation

Consider changing to:

```
balance = elapsedTime_ * tokenAmount_ / duration
```



## Discussion

**eladmallel**

Fix PR: <https://github.com/nounsDAO/streamer/pull/7>

**jack-the-pug**

Fix confirmed!



## Issue M-2: Lack of sanity check for `stopTime`

Source: <https://github.com/sherlock-audit/2022-11-nounsdao-judging/issues/66>

### Found by

rvierdiev, pashov, jonatascm, WATCHPUG, chainNue, csanuragjain, hansfrieze, ctf\_sec

### Summary

We believe when the `stopTime` is before the current time, then it might be wrong.

### Vulnerability Detail

Creating a stream with a `stopTime` earlier than the current time is the equivalent of making a simple ERC20 transfer, except that a stream will be much more expensive in terms of gas cost.

Therefore, we believe there is no such use case and the system should include a sanity check to ensure `stopTime > block.timestamp`.

### Impact

If the user calls `createAndFundStream()` with a wrong/unintended `stopTime` that is earlier than the current time, the stream will not be able to be canceled.

### Code Snippet

<https://github.com/sherlock-audit/2022-11-nounsdao/blob/main/src/StreamFactory.sol#L184-L213>

### Tool used

Manual Review

### Recommendation

```
function createStream(
    address payer,
    address recipient,
    uint256 tokenAmount,
    address tokenAddress,
    uint256 startTime,
    uint256 stopTime,
```



```

        uint8 nonce
    ) public returns (address stream) {
        // These input checks are here rather than in Stream because these
↪ parameters are written
        // using clone-with-immutable-args, meaning they are already set when
↪ Stream is created and can't be
        // verified there. The main benefit of this approach is significant gas
↪ savings.
        if (payer == address(0)) revert PayerIsAddressZero();
        if (recipient == address(0)) revert RecipientIsAddressZero();
        if (tokenAmount == 0) revert TokenAmountIsZero();
        if (stopTime <= startTime) revert DurationMustBePositive();
        if (tokenAmount < stopTime - startTime) revert
↪ TokenAmountLessThanDuration();
+        if (stopTime <= block.timestamp) revert StopTimeLessThanCurrentTime();

        stream = streamImplementation.cloneDeterministic(
            encodeData(payer, recipient, tokenAmount, tokenAddress, startTime,
↪ stopTime),
            salt(
                msg.sender, payer, recipient, tokenAmount, tokenAddress,
↪ startTime, stopTime, nonce
            )
        );
        IStream(stream).initialize();

        emit StreamCreated(
            msg.sender, payer, recipient, tokenAmount, tokenAddress, startTime,
↪ stopTime, stream
        );
    }

```

## Discussion

**eladmallel**

Fix PR: <https://github.com/nounsDAO/streamer/pull/8>

**jack-the-pug**

Fix confirmed!



## Issue M-3: The rather harsh requirement of `tokenAmount` makes it inapplicable for certain tokens

Source: <https://github.com/sherlock-audit/2022-11-nounsdao-judging/issues/63>

### Found by

rvierdiiev, WATCHPUG

### Summary

The requirements for `tokenAmount >= stopTime - startTime` will not be suitable for all tokens and therefore need to be made less applicable for certain tokens like WBTC and EURS.

### Vulnerability Detail

Requiring the `tokenAmount >= stopTime - startTime` is suitable for USDC and WETH.

However, such requirements will be a bit too harsh for other popular tokens, eg, WBTC (decimals: 8) and EURS (decimals: 2). Therefore, make the system less applicable for those tokens.

For WBTC, it must be 0.31536 WBTC per year (worth about \$5,400) to meet this requirement, and for EURS, it must be at least 315,360 EURS per year (worth about \$315,000).

### Impact

The system will be inapplicable for certain tokens with higher per wei value, eg, WBTC and EURS.

### Code Snippet

<https://github.com/sherlock-audit/2022-11-nounsdao/blob/main/src/StreamFactory.sol#L200>

### Tool used

Manual Review

### Recommendation

Consider changing to `tokenAmount * RATE_DECIMALS_MULTIPLIER >= stopTime - startTime`.





## Discussion

**eladmallel**

Fix PR: <https://github.com/nounsDAO/streamer/pull/12>

**jack-the-pug**

Fix confirmed!

Notice: The fix should be merged together with <https://github.com/nounsDAO/streamer/pull/7>, otherwise, `ratePerSecond()` can be 0.



## Issue M-4: Two address tokens can be withdrawn by the payer even when the stream has began

Source: <https://github.com/sherlock-audit/2022-11-nounsdao-judging/issues/52>

### Found by

DecorativePineapple, rvierdiiev, hansfrieze, pashov

### Summary

It has been identified that if a stream has begun with a two address token the payer can withdraw the full amount via the rescueERC20 function.

### Vulnerability Detail

Two address tokens exists in the blockchain. For example, Synthetix's ProxyERC20 contract is such a token which exists in many forms (sUSD, sBTC...). A stream can be created with such tokens, but the payer can withdraw the full amount via the rescueERC20 function. The only check in the rescueERC20 function is that `tokenAddress == address(token())`, which is irrelevant in the case of two address tokens.

### Impact

This can make the payer be able to withdraw the funds that are deposited in the stream and break the system, because the balance of the stream contract is zero and the `recipient()` cannot withdraw the fair amount based on the rate and the time elapsed.

### Code Snippet

The payer can withdraw the full amount of token via the rescueERC20 function:

```
function rescueERC20(address tokenAddress, uint256 amount) external onlyPayer {
    if (tokenAddress == address(token())) revert CannotRescueStreamToken();

    IERC20(tokenAddress).safeTransfer(msg.sender, amount);
}
```

### Tool used

Manual Review



## Recommendation

Replace the address check with a balance check - record the balance of the token that's deposited in the stream before and after the transfer and assert that they are equal.

## Discussion

**eladmallel**

Fix PR: <https://github.com/nounsDAO/streamer/pull/6>

The PR fixes multiple issues because they were touching the same code.

**jack-the-pug**

Fix confirmed!



## Issue M-5: The `Stream` contract is designed to receive ETH but not implement function for withdrawal

Source: <https://github.com/sherlock-audit/2022-11-nounsdao-judging/issues/47>

### Found by

KingNFT, rvierdiev

### Summary

The `Stream` contract instances can receive ETH but can not withdraw, ETH occasionally sent by users will be stuck in those contracts.

### Vulnerability Detail

Shown as the test case, it can receive ETH normally.

```
contract StreamReceiveETHTest is StreamTest {
    function setUp() public override {
        super.setUp();
    }

    function test_receiveETH() public {
        s = Stream(
            factory.createStream(
                payer, recipient, STREAM_AMOUNT, address(token), startTime,
↪      stopTime
            )
        );

        vm.deal(payer, 10 ether);
        vm.prank(payer);
        (bool success, ) = address(s).call{value: 1 ether}("");
        assertEq(success, true);
        assertEq(address(s).balance, 1 ether);
    }
}
```

### Result

```
Running 1 test for test/Stream.t.sol:StreamReceiveETHTest
[PASS] test_receiveETH() (gas: 167691)
Test result: ok. 1 passed; 0 failed; finished in 1.25ms
```



## Impact

See Summary

## Code Snippet

<https://github.com/Vectorized/solady/blob/db4857b4a1e17ad035668b588b41a1c90139b99d/src/utis/LibClone.sol#L193-L204>

## Tool used

Manual Review

## Recommendation

Add a `rescueETH()` function which is similar with the existing `rescueERC20()`

## Discussion

**eladmallel**

Fix PR: <https://github.com/nounsDAO/streamer/pull/10>

**jack-the-pug**

Fix confirmed!



## Issue M-6: If the recipient is added to the USDC blacklist, then cancel() does not work

Source: <https://github.com/sherlock-audit/2022-11-nounsdao-judging/issues/37>

### Found by

Zarf, cccz, bin2chen, joestakey

### Summary

cancel() will send the vested USDC to the recipient, if the recipient is added to the USDC blacklist, then cancel() will not work

### Vulnerability Detail

When cancel() is called, it sends the vested USDC to the recipient and cancels future payments. Consider a scenario where if the payer intends to call cancel() to cancel the payment stream, a malicious recipient can block the address from receiving USDC by adding it to the USDC blacklist (e.g. by doing something malicious with that address, etc.), which prevents the payer from canceling the payment stream and withdrawing future payments

```
function cancel() external onlyPayerOrRecipient {
    address payer_ = payer();
    address recipient_ = recipient();
    IERC20 token_ = token();

    uint256 recipientBalance = balanceOf(recipient_);

    // This zeroing is important because without it, it's possible for recipient
    ↪ to obtain additional funds
    // from this contract if anyone (e.g. payer) sends it tokens after
    ↪ cancellation.
    // Thanks to this state update, `balanceOf(recipient_)` will only return
    ↪ zero in future calls.
    remainingBalance = 0;

    if (recipientBalance > 0) token_.safeTransfer(recipient_, recipientBalance);
}
```

### Impact

A malicious recipient may prevent the payer from canceling the payment stream and withdrawing future payments



## Code Snippet

<https://github.com/sherlock-audit/2022-11-nounsdao/blob/main/src/Stream.sol#L237-L249>

## Tool used

Manual Review

## Recommendation

Instead of sending tokens directly to the payer or recipient in `cancel()`, consider storing the number of tokens in variables and having the payer or recipient claim it later

## Discussion

**eladmallel**

Fix PR: <https://github.com/nounsDAO/streamer/pull/6>

The PR fixes multiple issues because they were touching the same code.

**jack-the-pug**

Fix confirmed!



## Issue M-7: Payer cannot withdraw accidental extra funds sent to the contract without canceling

Source: <https://github.com/sherlock-audit/2022-11-nounsdao-judging/issues/28>

### Found by

0xZakk, dic0de, cccz, WATCHPUG, neko\_nyaa, adriro, dipp, obront

### Summary

If a different ERC20 is accidentally sent to the contract, the Payer can withdraw it using the `rescueERC20` function. However, if they accidentally send extra of the streaming token's funds to the contract, the only way to withdraw it is to cancel the stream.

### Vulnerability Detail

The Nouns team seems to have made the decision that they should protect against accidental funds being sent into the contract. They implemented the `rescueERC20` function to accomplish this.

However, the `rescueERC20` function only works for non-stream tokens. If they accidentally send too much of the streaming token (which seems like a likely scenario), there is no similar rescue function to retrieve it.

Instead, their only option is to cancel the stream. In a protocol that's intended to be run via a governance system, canceling the stream could cause problems for the receiver (for example, if they are unable to pass a vote to restart the stream).

### Impact

If too many stream tokens are sent into the contract, the whole stream will need to be canceled to retrieve them.

### Code Snippet

<https://github.com/sherlock-audit/2022-11-nounsdao/blob/main/src/Stream.sol#L237-L259>

### Tool used

Manual Review





## Recommendation

Adjust the rescueERC20 function to also allow for withdrawing excess stream tokens, as follows:

```
function rescueERC20(address tokenAddress, uint256 amount) external onlyPayer {  
-   if (tokenAddress == address(token())) revert CannotRescueStreamToken();  
+   if (tokenAddress == address(token()) && amount < tokenBalance() -  
↪   remainingBalance) revert AmountExceedsBalance;  
  
    IERC20(tokenAddress).safeTransfer(msg.sender, amount);  
}
```

## Discussion

**eladmallel**

Fix PR: <https://github.com/nounsDAO/streamer/pull/6>

The PR fixes multiple issues because they were touching the same code.

**jack-the-pug**

Fix confirmed!

