AVENIS ENERGY

MOREE BESS AVENIS ENERGY

Site Based Stormwater Management Plan

MARCH 2023

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MOREE BESS AVENIS ENERGY
Site Based Stormwater Management Plan

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WSP
Level 12, 900 Ann Street
Fortitude Valley QLD 4006
GPO Box 2907
Brisbane QLD 4001

Tel: +61 7 3854 6200
Fax: +61 7 3854 6500
wsp.com

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	Name	Date	Signature
Prepared by:	Hiba Wilson	14/03/2024	
Reviewed by:	Fraser McLauchlan	25/03/2024	
Approved by:	Joe Manitta	08/04/2024	

WSP acknowledges that every project we work on takes place on First Peoples lands.
We recognise Aboriginal and Torres Strait Islander Peoples as the first scientists and engineers and pay our respects to Elders past and present.

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1 Purpose of Document

WSP has been commissioned by Avenis Energy to provide a Site Based Stormwater Management Plan (SBSMP) to support a Development Works (Civil Works) Application to Moree Shire Plain Council for the construction of a Battery Energy Storage Systems (BESS) yard on part of Lots 144 DP751780 and 8 DP751780 at Bulluss Dr, Moree NSW 2400, Australia.

This report outlines the design criteria, parameters, specifications, and implementation of the proposed water quantity infrastructure design for the proposed development.

1.1 Stormwater Management Objectives

The most important stormwater management objectives for the construction and operational phase have been identified as follows:

1.1.1 Construction

The stormwater management objectives for the construction phase are to minimise the nutrient and sediment load that gets generated by the earthworks and construction activities. They need to be retained on site and prevented from entering the natural watercourses. This can be addressed by including sedimentation basins on site that capture the sediments.

1.1.2 Operation

The main stormwater management objective for the operation phase is to limit the additional runoff that gets generated by the increased impervious area. This objective can be achieved by constructing on-site detention basins or tanks that limit the discharge flows to the pre-developed volumes.

2 Site Characteristics

2.1 Site Description

The proposed development is situated on approximately 4.084 ha of land at Bulluss Dr, Moree NSW 2400, Australia. Lots 144 DP751780 and 8 DP751780 (the red area in Figure 1 below) shows where the proposed BESS yard is located.

The following key elements define the immediate surrounds of the site:

- A vacant, cleared parcel of land surrounds the site in the west, south and east directions.
- To the north are existing industrial buildings, a power station and substation.
- An existing pond at Lot 82 DP751780 (to be refilled as part of the development)
- An existing detention basin and open channel at Lot 201 DP1186601 (external) – at the east side of the site. The open channel connects to Mehi River situated 1.7km north of the site.

2.2 Proposed Development

Figure 1 - Existing Site Context

2.3 Existing Topography

Based on the detailed site survey provided by the client, the existing levels range from an approximate peak level of RL 212.6 (AHD) on the southwestern boundary to an approximate low level of RL 212.0 (AHD) on the northeastern boundary of the site. This results in an average (west to east) grading of 0.5%. It is understood that site levels can be altered to ensure runoff can flow to the most advantageous areas for drainage and detention. Refer to Appendix A for the existing site survey plan prepared by Avenis Energy.

2.4 Existing Stormwater Infrastructure

According to the detailed site survey and information available through Before You Dig Search, there is no existing stormwater infrastructure within the site as seen in Figure 2 below.

2.5 Lawful Point of Discharge

The site stormwater is currently discharging via sheet flow into the urban stormwater open channel and ultimately flows into Mehi River. The proposed development will involve the construction of a new onsite combined detention and sediment basin and grassed swale to collect and treat the additional runoff ensuring no increased flows are released to the existing legal point of discharge.

Refer to Figure 2 below showing the existing stormwater infrastructure and discharge points surrounding the proposed development.

Figure 2 - Existing Stormwater Infrastructure

3 External Catchment

A catchment analysis was conducted to assess the basin within the site survey contours, design contours, and the developed General Arrangement (GA). The analysis aimed to understand the external catchment influences on the proposed site.

3.1 External Catchment Overview:

The analysis revealed a significant upstream undisturbed rural catchment that conveys through the proposed site. The catchment area, approximately 9 hectares in size, primarily consists of an average grassed surface. The average grading of the site is approx. 0.5%. The flow within this catchment moves from the southwest to the northeast direction. The time of concentration calculated is approximately 30 minutes for a flow path length of 378 minutes.

Please see the figure below of the applied catchment Drains Input.

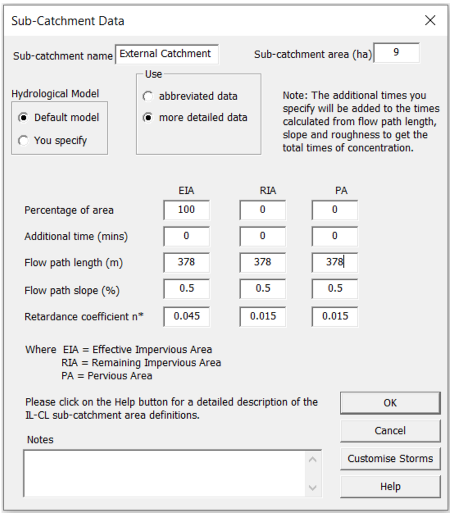

Figure 3 - Catchment Input Data - Drains

3.2 Impact on Proposed Infrastructure:

The BESS (Battery Energy Storage System) yard and the substations intersect with the external catchment. Runoff from the upstream catchments will be intercepted and diverted around the BESS yard by drains. Please refer to Appendix XX on the locations of the proposed drains. The drains will be designed for a minimum rainfall event of 1% AEP with 0.3m freeboard.

4 Stormwater Quality

4.1 Stormwater Quality Management

The proposed development will increase the sites impervious area and subsequently increase the pollutants running off the site. The pollutants will vary between the construction phase and the operational phase of the development. Since the proposed site is a largely unsealed yard, TSS is considered to be the primary urban pollutant attributed to this site.

To limit the impact of the anticipated pollutants, the WSUD best practice guidelines were adopted. NSW Water Sensitive Urban Design Guideline details the water quality control objectives for development as follows:

— 80% Total Suspended Solids Removed

— 45% Total Nitrogen Removed

— 60% Total Phosphorus Removed

— 90% Gross Pollutants Removed

Stormwater water quality measures reduce the impact of the contaminated runoff by treating the captured runoff. It is proposed to use water quality measures during the construction phase and operational phase to ensure minimal impact to the downstream catchments.

4.2 Proposed Stormwater Quality Treatment Train

The proposed stormwater quality treatment train incorporates the use of a Sedimentation Basin, Detention Basin and Grassed swales, as applicable based on the available layout.

The Sedimentation basin was modelled in MUSIC, in accordance with the current Water by Design Guidelines. Modelling parameters and outputs are provided in Appendix C of this report. For the stormwater layout plan for the location of the proposed detention, refer to Appendix XX.

Additionally, the site will be covered with a 100mm thick layer of 20mm blue stone. Aligned with the engineering hierarchy of controls, this measure is aimed at eliminating pollutants, contrasting with lower-tier engineering controls. Although challenging to quantify within standard MUSIC nodes, this approach is regarded as preferable for pollution control (elimination versus engineering controls). To incorporate this measure into the MUSIC model, a generic node with a 50% sediment removal efficiency has been employed. Literature review suggests that a reduction of raindrop impact energy by 89% led to over a 90% decrease in soil loss, indicating that soil detachment primarily resulted from raindrop impacts. – *"Young RA, Wiersma JL (1973) The role of rainfall impact in soil detachment and transport. Water Resoures Res 9: 1629-1636".* RUSLE calculations also support this approach by indicating a reduction in sediment generation based on soil cover. Therefore, adopting a 50% reduction is deemed suitable for this specific site, alongside other implemented measures.

4.3 MUSIC Modelling

Utilising the above-mentioned treatment train, a stormwater quality model was produced utilising the MUSIC software package. The MUSIC model output can be found in Appendix C. The following table details the resulting outputs of the proposed treatment train methodology.

Table 1 - Post-Development MUSIC Modelling Results

Pollutant	Required Pollutant Reduction (%)	Achieved Reduction (%)
Total Suspended Solids	80	89.2
Total Nitrogen	45	28.9
Total Phosphorous	60	60.2
Gross Pollutants	90	100

4.3.1 Gross Pollutants

GP removal targets are achieved based on the incorporated treatment measures in the MUSIC model.

4.3.2 Total Phosphorus

TP removal targets are achieved based on the incorporated treatment measures in the MUSIC model.

4.3.3 Total Suspended Solids.

TSS removal targets are achieved based on the incorporated treatment measures in the MUSIC model.

4.3.4 Total Nitrogen

The management of TN will be primarily through targeted removal of nitrogen generating material.

The key treatment measures include:

- Removal of vegetation across the primary footprint, via application of a 100mm thick gravel topping of unsealed areas. This removes grass growth and associated generation of nitrogen through grass clippings. It also removes fertilization of vegetation.
- Fully fencing of all yards and adding grates to stormwater entry points to reduce animal generated nitrogen.
- The circulation pathways around the BESS and general access areas are unsealed gravel topped roadways, trapping runoff at source.

It is proposed that the above treatment measures (removing TN generating nodes) be considered in lieu of meeting TN targets via alternative methods. That is, in the Hierarchy of Controls, adopting substitution and elimination of Nitrogen generating elements, as opposed to inclusion of the lower order measures such as Engineering Controls (i.e. larger bio beds/filtration zones) is considered appropriate for the unique nature of this development.

4.3.5 MUSIC Summary

Overall, the MUSIC model layout and results are shown in Appendix C. To be read in conjunction with the above discussion. All targets are met apart from TN, with the intention being the introduction of the gravel to eliminate the TN generators.

The input nodes for the BESS yard are Unsealed Roads (travelling through the Generic Gravel Node) and Industrial reflecting the individual cabinets and battery slabs, whilst reflecting the general site will be trafficked by industrial equipment for maintenance.

4.4 Stormwater Maintenance Plans

4.4.1 Sediment Basin

The proposed Sediment basin allows for the build-up of sediment and prevents sedimentation of downstream waterways. Debris removal and system maintenance is an ongoing function to ensure successful operation of the devices and prolong design life. The basin shall be desilted once sediment levels reach the demarcated maximum silt levels on the outlet pit. The frequency of this clean out will be determined during operations, based on observations of rate of sediment build up. Appropriate access to the Basin for maintenance activities will be allowed from the BESS yard and walkway platform.

4.4.2 Construction

Maintenance during the construction period is to be carried out by the contractor on a fortnightly basis and after every rain event; it will involve the following duties:

- Emptying of on-site refuse bins.
- Cleaning up any oil and grease spills on the pavement with suitable materials such as absorbents, bunds, handling equipment and then ensure proper disposal.
- Keeping the paved areas and gully grates free of debris; and
- Maintaining and/or replacing of sediment fences, inlet traps and sandbag check dams until full coverage of the landscaping works is achieved.

5 Stormwater Quantity

5.1 Stormwater Quantity Management

To ensure the proposed development's stormwater runoff will not cause an actionable nuisance to downstream properties, existing and developed stormwater peak flows from the proposed developable areas have been calculated and analysed. These have been modelled using the hydraulic software DRAINS. Australian Rainfall Runoff 2019 (ARR2019) rainfall data was used in the DRAINS analysis. The IL-CL model was used in the DRAINS analysis. Initial (IL) and Continuing Loss (CL) parameters were sourced from the ARR Data Hub for the location 29.4866 South and 149.8556 East. Figure 4 below shows the parameter inputted into the program.

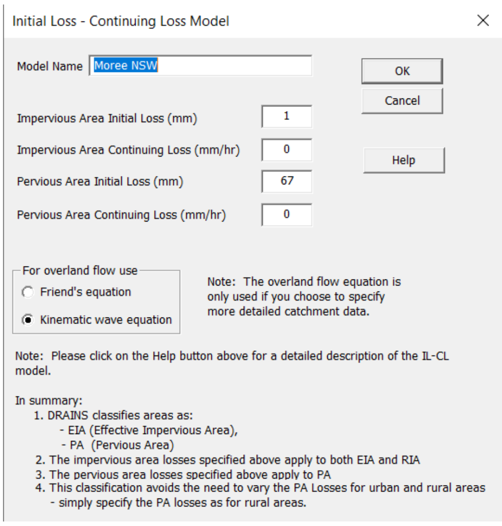

Figure 4 - Modelled Loss Parameters

5.2 Catchments

5.2.1 *Pre-Developed Catchments*

The existing catchment consists of an area of 4.08 hectares, with no impervious area. The pre-developed peak flows from the development area were analysed for 10% AEP (1 in 10 years) and 1% AEP (100 year ARI). DRAINS input parameters for the pre-developed catchments are depicted in Table 3.

Table 2: DRAINS Input Parameters (Pre-Developed)

Pre-Developed Catchments	Catchment Area (Hectares)	Imperviousness (%)
Pre-Catchment	4.082	0

In order to develop runoff hydrographs in the IL-CL model, DRAINS requires delineation of the Pervious Areas, Directly Connected Impervious areas and Indirectly Connected Impervious areas. For this development, there has been no Directly Connected Impervious Areas as there is no development connected directly to the stormwater network, rather overland flow over pervious areas is captured by urban stormwater open channel.

5.2.2 *Post-Developed Catchments*

Post-developed peak flows from the developed areas were analysed for 10% AEP (1 in 10 years) and 1% AEP (100 year ARI).

5.2.2.1 Stormwater Management

The stormwater management consists of graded overland flow paths designed to convey peak flows for storm events up to the 1% AEP (major storm event) to the designed low points of the site. The low points remain consistent with the existing pre-development site, being over sheet flow however there will be grassed swales at the north and east perimeter of the site and OSD basin at northeast side to convey flow to the discharge location and ultimately to the existing open channels. Please refer to the Appendix XX for the proposed swale and basin locations.

5.2.2.2 Catchment Areas

The following catchment areas listed in Table 3 have been utilised to assist with the proposed stormwater design network. Please refer to Appendix XX for the catchment plan.

Table 3 - DRAINS Input - Parameters (Post-Developed)

Post Developed Catchments	Catchment Area (Hectares)	Imperviousness (%)	Flow Path Slope (%)	Flow Path Length (m)
C1	1.456	96	1	218
C2	1.836	93	1	190
C3	0.790	90	1	111.6

5.2.3 *DRAINS Design*

The following design parameters have been used for the proposed stormwater network design analysis through DRAINS:

- Hydrological Design Storm Data (ARR & BOM Data)
  - Minor Storm = 10% AEP, 1 in 10-year event
  - Major Storm = 1% AEP, 1 in 100-year event

DRAINS peak flow analysis outputs for the Pre vs Post developed major and minor storm events are outlined below:

Table 4 - Catchment DRAINS Results

Catchment	Minor Storm (1 in 10 year)	Major Storm (1 in 100 year)
Pre-Developed Peak Runoff (m3/s)	0.228	0.593
Post-Developed Peak Runoff (m3/s)	0.166	0.308

5.3 Proposed Infrastructure

5.3.1 Proposed Overland Flow Strategy

The proposed overland flow strategy involves the use of appropriate site grading and earthworks to convey the 1% AEP (100 year ARI) stormwater flows. Overland flows are directed to the grassed swales and combined sediment and detention basin to the north of the site via sheet flow.

5.3.2 Proposed On-site Detention (OSD)

The stormwater attenuation strategy, proposed for the development, consists of a combined sediment and detention basin. The proposed basin will capture the flow from most of internal catchments. Table 5 details the detention volume, pit and orifice size to attenuate all flows up to 1% AEP (100-year ARI) to pre-developed conditions. The stormwater will be discharged into the existing urban stormwater open channel.

The proposed-on side detention basin is designed to hold more than 200kL of fire water to manage a BESS fire.

The combined sediment and detention basin will be maintained by the owner of the property and is not intended be handed over to Moree Shire Plains Council.

Table 5: Detention System Design Details (Area and Height includes Extended Detention for Water Quality)

OSD System	Internal Base Area (m^2)	Minimum Basin Height (m)	Storage Volume (m^3) (excl. extended sediment basin and weir)	Control Outlets
Detention Basin	1112m^2	0.58m	528m^3	Less than 1% AEP (100 year ARI) Inlet with a 225mm Orifice Plate on a ⌀375mm Pipe Outlet For 1% AEP (100 year ARI) Flow – 20m Wide Weir at RL 212.7m AHD

Due to drainage easement and the risk of overflowing to the substations, the weir level of the basin has been designed to provide 300mm freeboard above the maximum external peak 1% AEP (100 year ARI) flood level of 212.7mAHD.

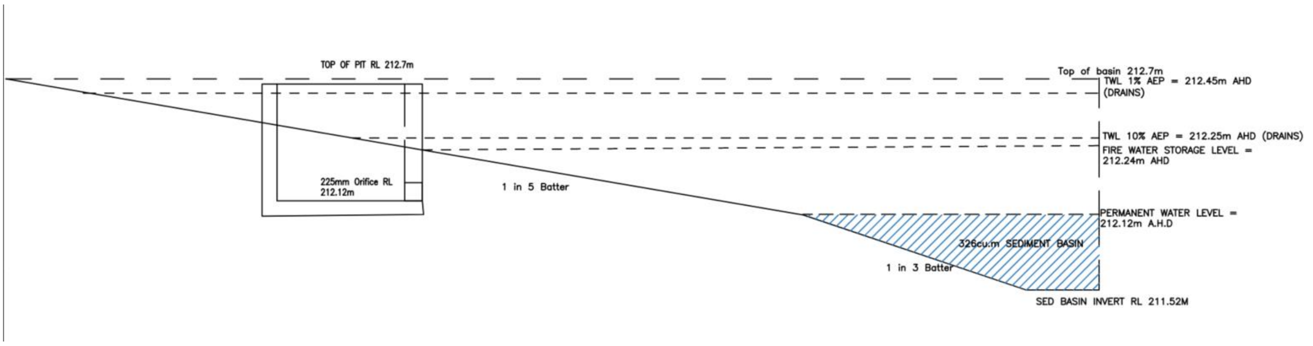

Figure 5 - Basin Longitudinal Section Sketch

6 Conclusion

This report addresses the stormwater quality and stormwater quantity for the BESS yard located at Bulluss Dr, Moree NSW 2400, Australia.

The stormwater network has been modelled with DRAINS software, demonstrating that the post developed attenuated peak run-off will not exceed the pre-developed peak run-off due to the on-site detention basins.

Stormwater quality has been considered in a holistic approach throughout the Development, incorporating all stormwater treatment requirements for the surrounding development into an end of line treatment method. It is inevitable the development will have an impact on the existing landform and stormwater runoff characteristics due to earthworks, change of landscape and impervious areas. By following the recommendations of this report and implementing appropriate measures during construction and operation of the development, it can be predicted that there will be minimal impact on the existing environment because of the proposed development.

7 Limitations

This report is provided by WSP Australia Pty Limited (*WSP*) for Avenis Energy (*Client*) to support the Operational Works (Civil Works) Application to Moree Shire Plains Council for the construction of a BESS yard on part of Lots 144 DP751780 and 8 DP751780 at Bulluss Dr, Moree NSW 2400, Australia.

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Appendix A

Site Survey Plan

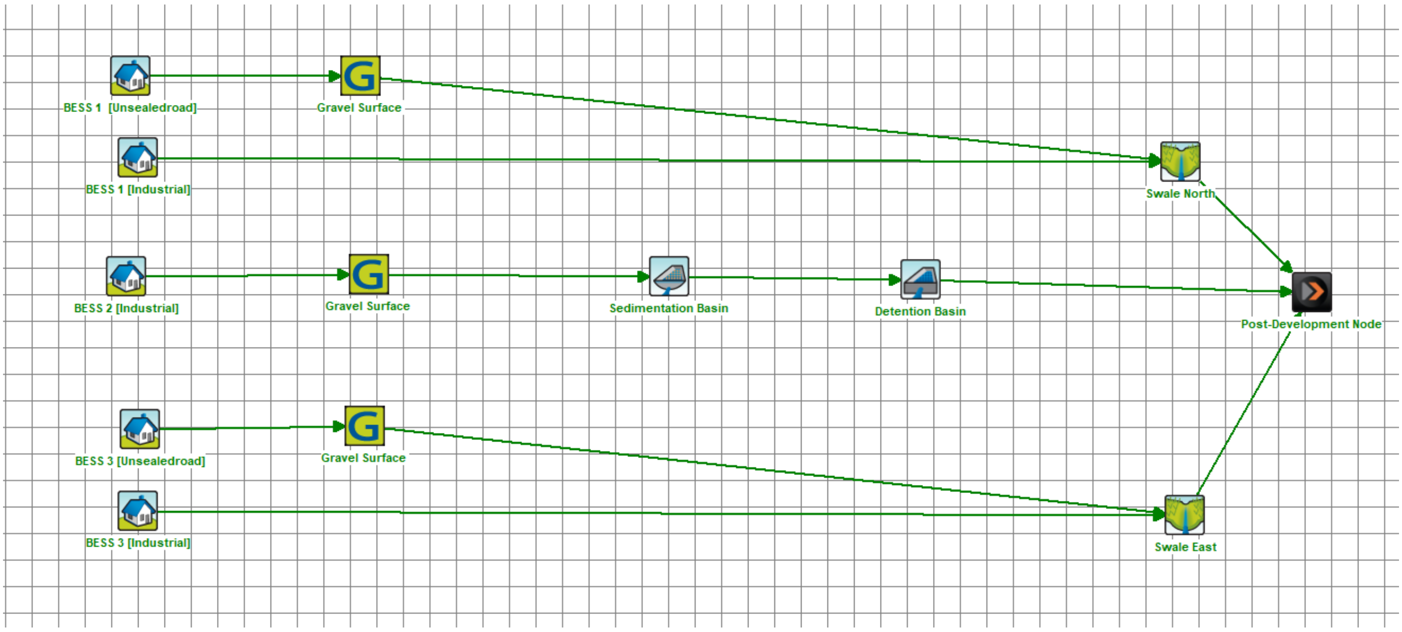
SURVEY DATUM:
AHD FROM PM 56945 RL 211.917 m (SCIMS)
HORIZONTAL - MGA GDA 2020 ZONE 55
LEAST SQUARES ADJUSTMEBNT BETWEEN
LOCAL CO-ORDINATED SCIMS MARKS

Appendix B

Development Application Drawing Package

Appendix C

MUSIC Model

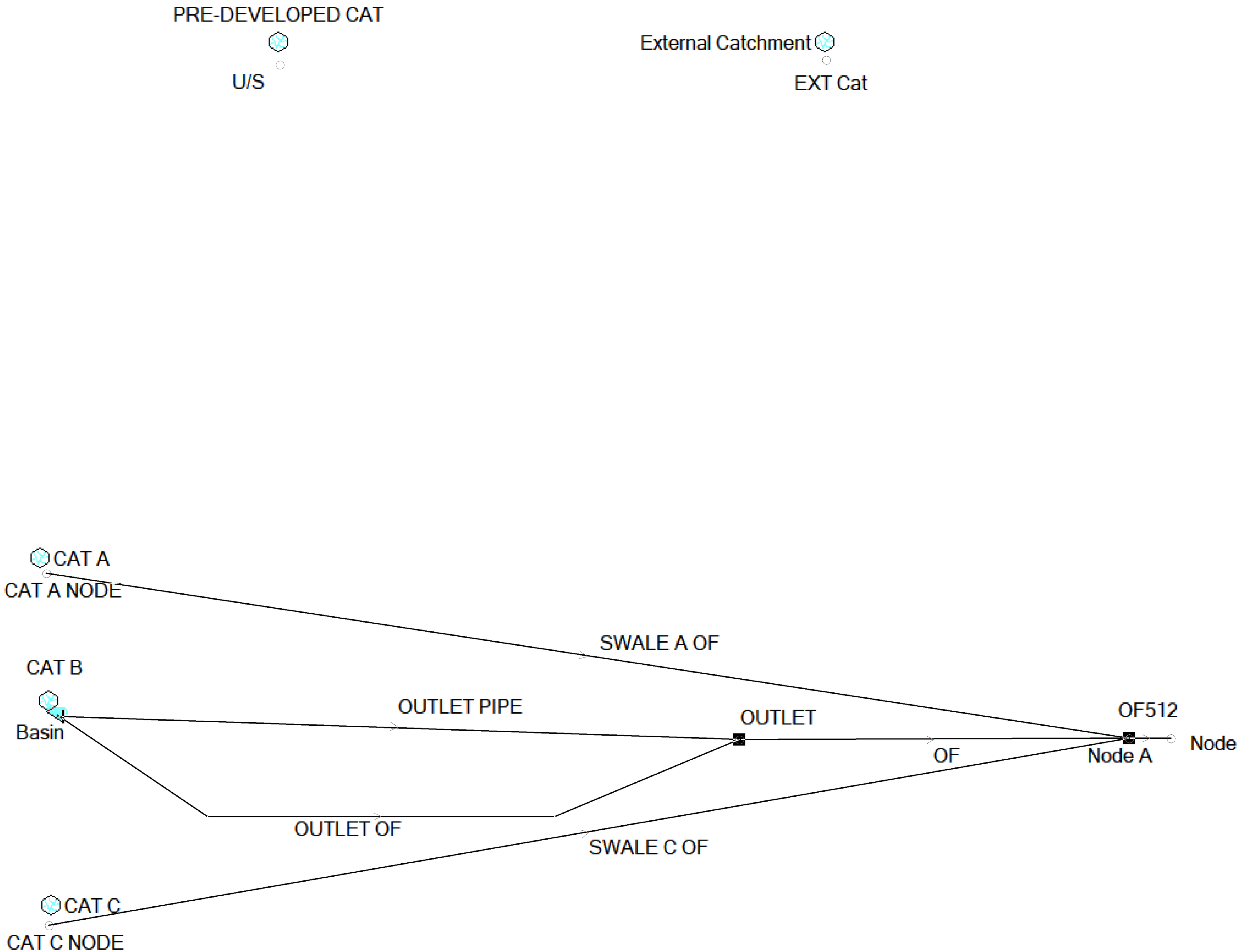


Treatment Train Effectiveness - Post-Development Node

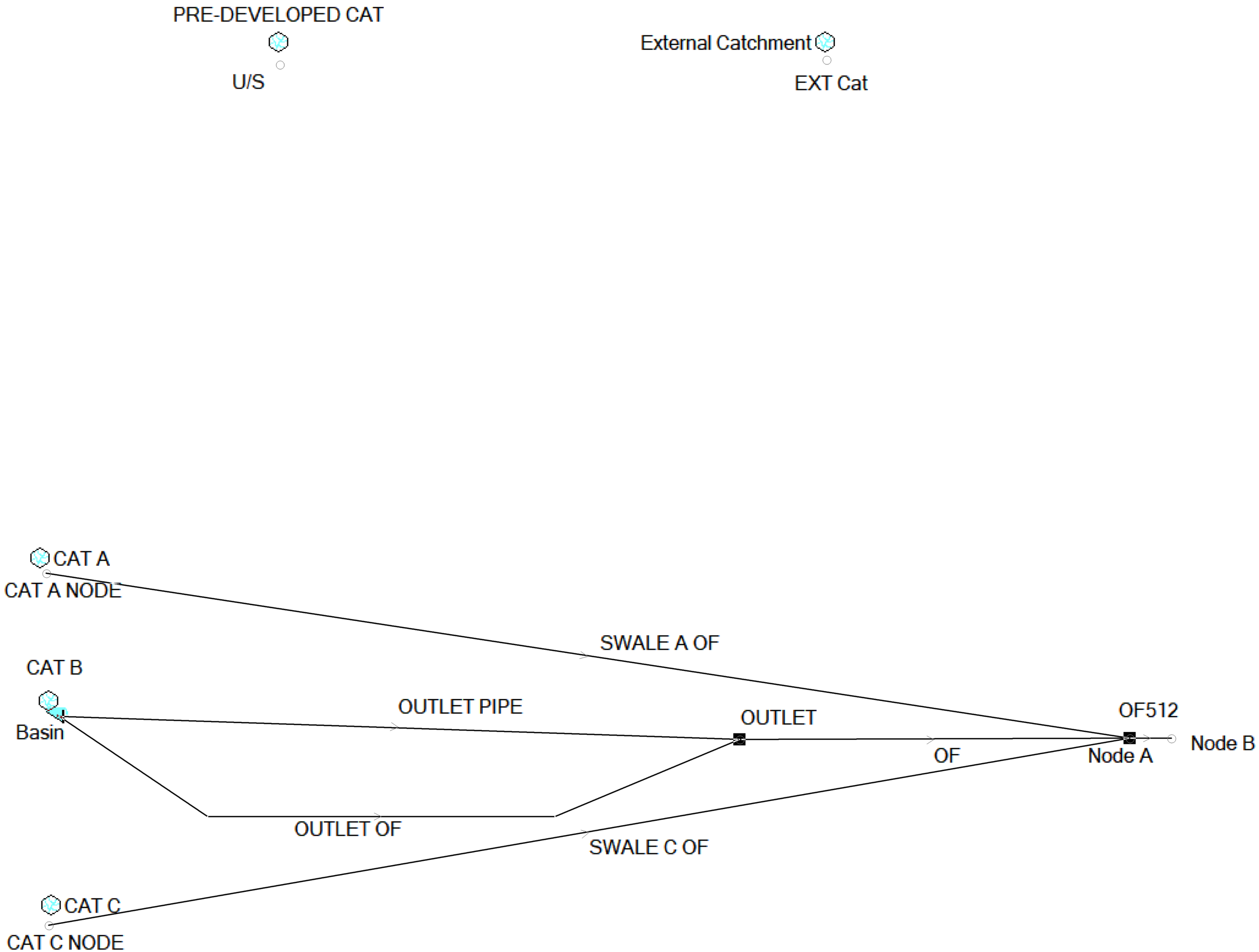
	Sources	Residual Load	% Reduction
Flow (ML/yr)	20.8	19.1	8.5
Total Suspended Solids (kg/yr)	4050	438	89.2
Total Phosphorus (kg/yr)	6.56	2.61	60.2
Total Nitrogen (kg/yr)	45.7	32.5	28.9
Gross Pollutants (kg/yr)	634	0	100

Appendix D

DRAINS Model


PRE-DEVELOPED CAT
U/S
External Catchment
EXT Cat
CAT A
CAT A NODE
SWALE A OF
CAT B
OUTLET PIPE
OUTLET
OF512
Basin
OF
Node A
Node B
OUTLET OF
SWALE C OF
CAT C
CAT C NODE

DRAINS MODEL Layout



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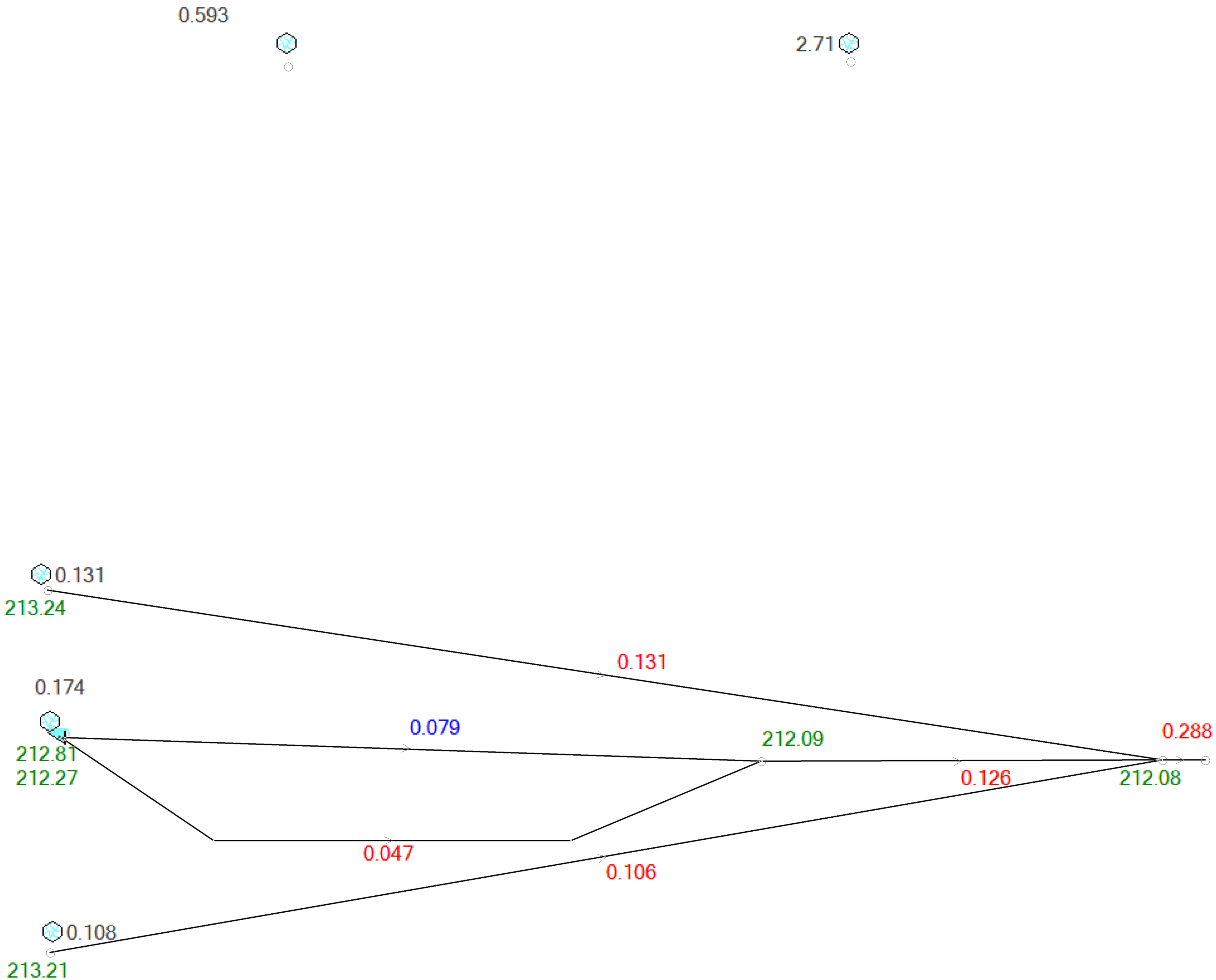
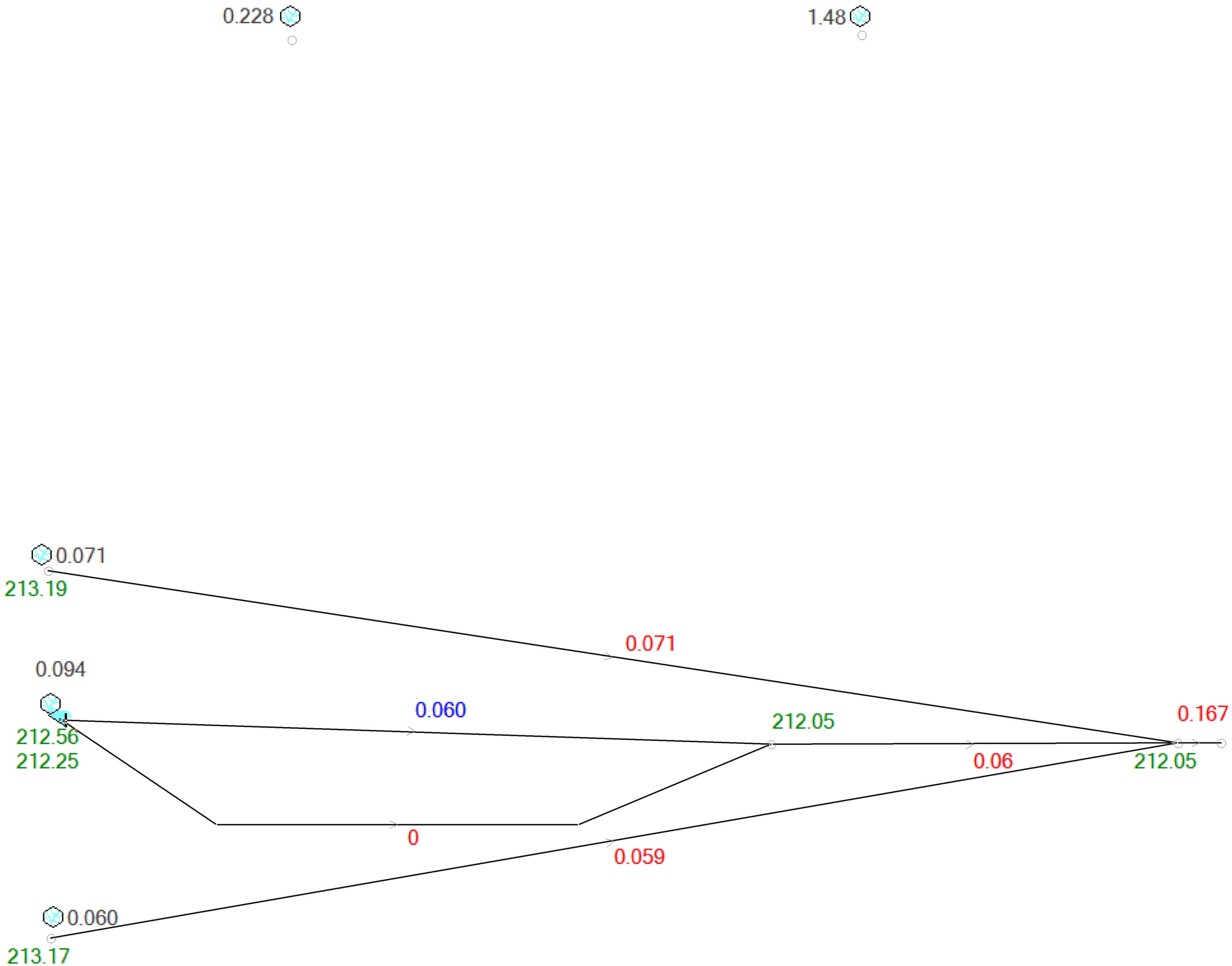


Q10 Results



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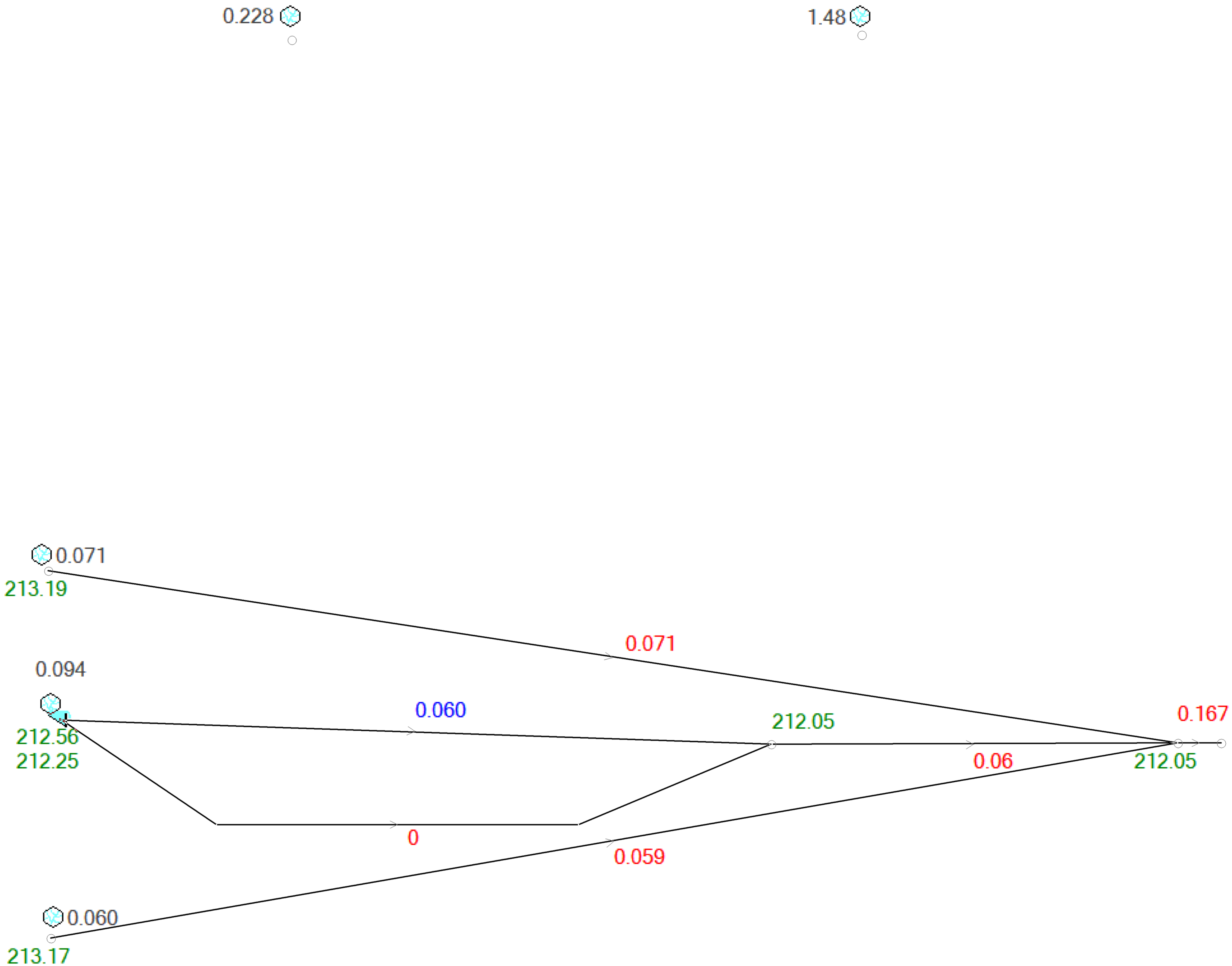

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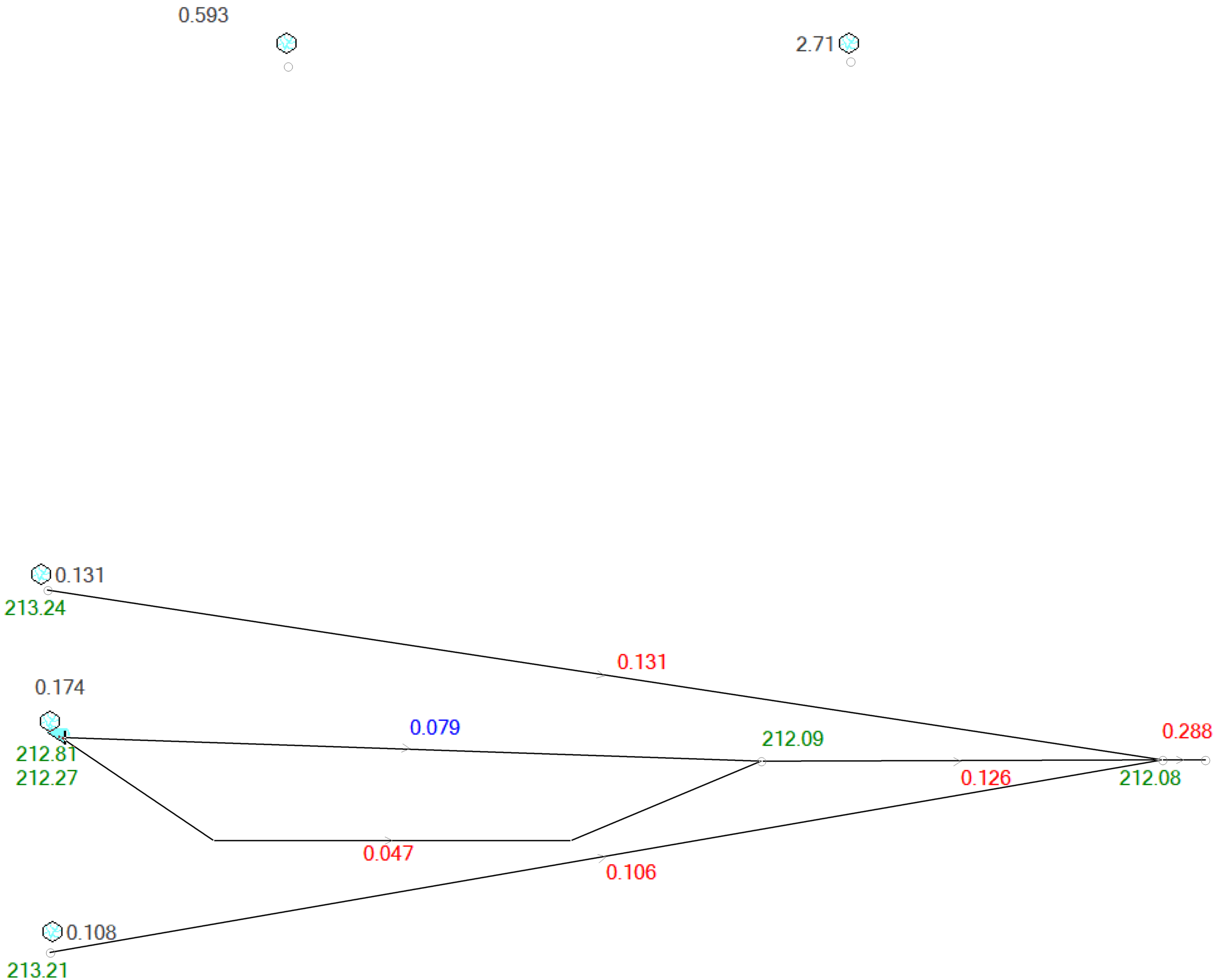
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