Resilience Assessment Framework application – RAF APP – User guide

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Overview

This tool provides a framework to assess urban resilience to climate change, with focus on water, considering an objective-oriented approach and four **resilience dimensions**: organisational, considering governance relationships; spatial, covering urban space and environment; functional, focused on strategic services in the city (water, wastewater, stormwater, waste, energy and mobility); and physical, centred on infrastructure of these services. The resilience objectives are described through key criteria (expressing different points of view), which are evaluated by metrics. In this given scope, the metrics are described and associated to reference values, providing a user-friendly assessment to support a structured diagnosis. The app allows the use of a defined structure based on dimensions / objectives /criteria / metrics, specifically designed to address the referred scope.

The app can be used as a tool to support assessment, diagnosis and decision-making as well as the development of resilience plans, to monitor progress of a city or service or to compare different parts of the cities or services.

Login

A user with credentials can login into the RAF App.



Studies

After a successful login, the user will be redirected to the *studies* page, containing all his previously saved studies (for the city and year that the user has previously created or has been assigned access).



In this page the user can manage his previously saved studies:

- Create study: create a new study for the city or for another city
- Edit study: fill and change city information
- Clone city: make a copy of the study, e.g. for the city information in a previous year
- Check the city report: a summary of study results available for download
- Delete studies

If the city wants to assess different hazards existing in the city, different studies must be created. One study for each hazard.

For this, after creating a study and completing the assessment considering one selected hazard, the user has to clone the study already completed to assess a new hazard, giving a new name and editing only the hazard-related metrics. In case there is a service with no assessment for that hazard the user **deselects** the respective service in the RAF app - city location page - for the functional and physical dimensions.

For each study, the hazard under assessment needs to be identified and described in the City and Service profiles, in the hazard section.

However, for each hazard the user may have different variables.

So, when answering to the metrics of the scenarios (e.g., MP or MS) for one hazard (e.g. flooding), if there are differences regarding the impacts/consequences that depend on the type of variable, then the answer shall be done **for the variable that causes the most serious consequence**, and shall be indicated the variable in the comments. In this situation, it is still possible to create a different study for each variable if it deepens the assessment and facilitates the identification of solutions. However it is not recommended in order to keep parsimony.

City main page

4.1 Upper bar

The city main page can be accessed when creating a new study or when editing a previously created study.

At the upper bar, the user has two fixed options:

- go back to studies Studies
- open the App user guide Manual (this document)

The top of the page also presents the navigation bar, where the user can select where to go next. This bar contains the main App structure: City location, the four dimensions, and the results.

4.1 City Location

In **City Location** the user has a tab with General information, City Profile and Service Profile.



The **General** contains generic information about the city: city name, year of the study, a map (where the user can select the city to originate coordinates), the dimensions under assessment (organisational, spatial, functional and physical) and the services that are being assessed (water, wastewater, stormwater, waste, energy and mobility) within the functional and physical dimensions.

At this stage, the user has to select which dimensions and services are being assessed in the study of the city. If a dimension is selected at this stage, it will become available to access through the navigation bar and to explore the corresponding results in the end of the navigation bar. In a similar way, if a service is selected at this stage, it will appear available when entering the functional or physical dimension, whichever applicable, and also available to explore the corresponding results. In case of combined sewer systems, both wastewater and stormwater services need to be selected and answered for the applicable metrics. Those metrics that are not applicable have to be duly identified.

City profile contains information relevant for understanding the city context and the results of the resilience assessment. The information in **city and service profile** is the starting point for the assessment, with some metrics where the user has to specify what will be considered in the assessment.

City 🕡	Country (j)	Altitude (i)
New City	Country name	Range of altitudes, in m
Aetropolitan Area 👔	Urban area 👔	
(in km ²	in km² 😫	

In this section, the city context is presented in several boxes (Geographical characteristics, Climate, Population, Economy & governance and Built environment & infrastructures). The available fields have some guidelines in grey, and a button (()) to look for more details/explanations.

In the Climate box, some fields, when selected, unfold into other fields to complete. E.g.: if the user has data about some of the presented variables (temperature and rainfall), when selecting, more fields will unfold to complete with detailed data. Any comments should be provided in the answer field.

nate	
Clin	nate Type 👔
(Climate Type
	iade and environment variables (j) Temperature (*C)
	Annual T average Average T of the coldest month Average T of the hottest month
V	Rainfall (mm)
	Annual R average Average R of the wettest month Average R of the driest month
	Snowfall (cm)
	Vind (km/h)

In the Hazards section, the selected hazards are numbered and unfold into a table with variables. A value with the same units used above (Climate and environment variables section) should be provided.

Hazards										
Climate-re	lated hazards 🕧									
Plooding Combined sewer overflow (CSO) Heat wave Cold wave Wind storm Drought Specify hazard										
Scenarios										
Most proba	able scenario chara	acteristics 👔		Most	Most severe scenario characteristics 👔					
Num	Hazard	Variable	Value	Num	Hazard	Variable	Value			
1	Flooding	Temperature		1	Flooding	Temperature				
		Rainfall				Rainfall				
		Snowfall				Snowfall				
		Wind				Wind				
		Sea level				Sea level				
		(other)				(other)				
3	Heat wave	Temperature		3	Heat wave	e Temperature				
		Rainfall				Rainfall				
		Snowfall				Snowfall				
		Wind				Wind				
		Sea level				Sea level				
		(other)				(other)				

In the last box (Assessment scope), the user has to select the numbers correspondent to the selected hazards (Hazards section).

As	sessment s	cope												
	Area under	r assessmen	t											
	Urban a	litan area rea												
	□ Other (Specify)										
	Climate ha	zards												
	Most proba	ble scenario	characteristics	(i)				Most prob	able scenario	characteristics	(i)			
	1	2	3	4	5	6	7	□ 1	2	3	4	5	6	7

In **Service profile**, first the user has to select the service(s) to be assessed. For this, relevant information to both service and service infrastructure is presented.

For most of the metrics, there are four fields to be completed by the utilities in charge. If the service is managed by a single utility, only the Utility 1 field should be used.

ervices										
Wastewater	Stormwater	Waste	Energy	Mobility						
ontext characterization										
umber of utilities	Oetween utilities	5(1)								
] They serve diffe	rent populations	s/areas								
] They provide co	mplementary se	ervices for t	he same p	opulation/area						
] They provide the	e service to anot	her utility u	nder a prot	ocol/contract.						
] They are in con	currence in the s	same area								
entification of th	e utility(i)			XXX City Council	Utility	2	Utility :	3		Itility 4
ontracts duration	11			Utility 1	Utility	2	Utility :	3		Itility 4
eveloped activitie	es(i)			Utility 1	Utility	2	Utility :	3		Itility 4
escription of	the area cov	ered by	services							
entification of th	e areas served	by the ser	vice	Utility 1	Utility	2	Utility :	3		Itility 4
rea (km²)				Utility 1	Utility	2	Utility :	3		Itility 4
habitants(j)				Utility 1	Utility	2	Utility :	3		Itility 4
ther relevant info	ormation			Utility 1	Utility	2	Utility :	3	U	Itility 4
	Wastewater Wastewater dt characterize umber of utilities ervice relations I] They serve diffe] They provide the] They provide the] They provide the] They provide the] They are in com- entification of th ontracts duration eveloped activitie vescription of entification of th rea (km²) habitants① ther relevant info	BS Wastewater Stormwater At characterization umber of utilities() ervice relations between utilitie: 1 They serve different populations 1 They provide the service to anot 1 They provide the service to anot 1 They are in concurrence in the service to anot 1 They are in concurrence in the service to anot 2 They are in concurrence in the service to anot 2 entification of the utility() contracts duration() eveloped activities() vescription of the area cove entification of the areas served rea (km²) habitants() ther relevant information	Wastewater Stormwater Wastewater Wastewater Stormwater Wastewater dt characterization Integration Integration umber of utilities() Integration Integration arrive relations between utilities() Integration Integration They provide complementary services for the tree provide the service to another utility uillity on tracts duration() Integration of the utility() Integration of the utility() Integration of the area covered by the service (km²) habitants() ther relevant information	Wastewater Stormwater Waste Energy Mastewater Stormwater Waste Energy At characterization Integration Integration Integration Immber of utilities() Integration Integration Integration Integration Integration Integratin Integration	Wastewater Stormwater Waste Energy Mobility dt characterization dt characterization dt characterization umber of utilities()	Wastewater Stormwater Waste Energy Mobility dt characterization dt characterization umber of utilities()	Wastewater Stormwater Waste Energy Mobility At characterization At characterization umber of utilities() Image: Complementary services for the same population/area or they provide complementary services for the same population/area of they provide the service to another utility under a protocol/contract. ontracts duration() VUIIIty 1 outlity 1 Utility 2 eveloped activities() Utility 1 rea (km ²) Utility 1 habitants() Utility 1 Utility 1 Utility 2	BS Wastewater Stormwater Waste Energy Mobility At characterization Mobility umber of utilities()	Wastewater Stormwater Waste Energy Mobility dt characterization under of utilities() under of utilities()	Wastewater Stormwater Waste Energy Mobility At characterization under of utilities() under of utilities() anthold in the service relations between utilities()) They serve different populations/areas) They serve different populations/areas) They provide the service to another utility under a protocol/contract.) They provide the service to another utility under a protocol/contract.) They are in concurrence in the same area entification of the utility() xxx City Council Utility 2 Utility 3 U ontracts duration() Utility 1 Utility 2 Utility 3 U eveloped activities() Utility 1 Utility 2 Utility 3 U eveloped activities() Utility 1 Utility 2 Utility 3 U eveloped activities() Utility 1 Utility 2 Utility 3 U eveloped activities() Utility 1 Utility 2 Utility 3 U tree (km²) Utility 1 Utility 2 Utility 3 U habitants() Utility 1 Utility 2 Utility 3 U

4.2 Dimension tabs

In the tab inside each selected dimension, a box with a dropdown menu is available (Objective and criteria box). This is where the user may select the criterion within the objective to be assessed. Once the criterion is selected, the corresponding objective will appear above.



Obje	ctive Collective Engagement And Awareness								
Obje and (ojective d Criteria Citizens and communities engagement								
	Importance (Comprehensive								
Ref	PI / Question	+info	City Answer	Specify why					
1	PI: Community or "grassroots" organizations, networks and training	i	There is involvement in diverse grassroots organizations, either in sc	v					
	Question:Are grassroots or community organizations participating in pre- event planning and post-event response for each neighbourhood in the city?	E	Comments						
2	2 PI: Civil society links		Yes	······ v					
	Question:Are civil society organisations engaged (city DRR stakeholders have in place agreements with various NGOs, with NGO role defined in providing support in response, relief and meeting resource demands, high volunteer capacity as required, regular planning and coordination meetings)?	E	Comments						
3	PI: Engagement of vulnerable groups of the population	i	One or more major gaps in coverage or effective engagement.	· · · · · ·					
	Question:Theres is evidence of disaster resilience planning with or for the relevant groups of vulnerable population, and there is a confirmation from those groups of effective engagement.	E	Comments cultural issues act as engagement barriers, for romani population. Also lar	nguage barriers are detected					
4	PI: Citizen engagement techniques	i	Multiple media channels. No inbound data collection from mobiles. 1	· · · · · · · · · · · · · · · · · · ·					
	Question:How effective is the city at citizen engagement and communications in relation to DRR?	С	Comments						

The table that is displayed (see above picture) shows the metrics included in the selected criterion. A table with all the metrics within the dimension is available when selecting **ALL** in dropdown menu in the Objective and criteria box.

When this option is selected (ALL), a Search box is available to find a specific metric through some keywords.

Each metric has a reference number (left column), a given name (performance indicator, PI) and question, additional information (+info) and boxes for the city answer, additional comments or specifications in case the metric does not apply.

The user can filter the metrics by **importance**, to assess a specific set of metrics. Metrics importance can be:

- Essential: Integrates any city assessment, applicable to any city.
- **Complementary**: Integrates evaluation of specific or detailed city aspects.
- **Comprehensive**: To a comprehensive assessment of the city, may not be applicable to all cities

As metrics importance reflects an in deeper assessment path, a sequential inclusion of metrics is done when using the importance filter (box with a drop down menu):

- When selecting the **Essential (E)** filter, the user sees only the metrics with a **performance indicator (PI)** classified as E.
- When selecting the **Complementary (C)** filter, the user sees the metrics with a **PI** classified as E and C.
- When selecting the **Comprehensive (CH)** filter the user sees all metrics.

The user can find the information above selecting (i)

Each metric has also an (i) for the metric explanation (in the +info column).

There are three types of metrics to answer:

- Metrics with only one answer option to pick ("select option")
- Metrics with multiple options to pick ("select all applicable")
- Metrics to answer with an estimated figure (open field)

All metrics have the option "Not applicable in the city, explain why in comments." and a box to insert additional comments is provided.

In case no option is selected, a dropdown menu (the Specify why box) is available to specify the reason why the metric is not answered.

This framework has some metrics that precede other i.e. condition the existence of others. The conditioning relation between metrics is available in the annex of this manual.

When answering any of the metrics that condition others, verify whether the answer that you provide conditions the possibility of the dependent metrics to be answered. In such case, ensure the respective dependent metrics are answered as Not Applicable. See example below.

In this case, if the answer for metric 33 is yes, the dependent metric (34) must be answered.

33	PI: Early warning	i	Yes
	Question:Existence of Early Warning System for monitoring, forecasting and doing predictions on hazards (including climate change-related events)	E	Comments
34	PI: Reach of warning	i	less than 75% reached
	Question:Percentage of population reachable by early warning systems	С	Comments

If the answer is no, the dependent metric will be considered as Not Applicable (this option must be selected).

33	PI: Early warning	i	(No)
	Question:Existence of Early Warning System for monitoring, forecasting and doing predictions on hazards (including climate change-related events)	E	Comments
34	PI: Reach of warning	i	Not applicable in the city, explain why in comments.
	Question:Percentage of population reachable by early warning systems	С	Comments

Specifically, in Functional and Physical dimensions, firstly the service(s) to assess must be chosen.

Before moving to other dimension or to the results tab, it is recommended to save your data by clicking in SAVE button, at the top right corner (SAVE)

Results

Depending on the answers to the metrics, each metric /criteria/objective/dimension is classified with a **development level**: Advanced, Progressing or Incipient.



- Advanced metrics are those with higher development level, identified in graphs with a darker color.
- **Progressing** metrics have an <u>intermediate development level</u> and are identified in graphs with a color between the darker and the lighter.
- Incipient metrics have a lower development level and are identified in graphs with a lighter color.

The first section presents the **overall** results, gathering all dimensions' results. The user can see the overall city results in two charts (as % of all metrics of the assessment):

- Metrics in advanced, progressing or incipient level considering all resilience dimensions in the city, and also the unanswered and not applicable metrics (donut graph)
- Metrics in each development level by dimension (bar graph)



In **City Report**, the user can get a summary of city results (overall city results and overall results by dimension). The pdf file is available to download.

City 1 2018 overall resilience

Download Report



The user can choose to see more detailed results entering each dimension and using the available filters.

By selecting one dimension it is possible to see the results by service (if previously chosen for assessment), objective, criteria, importance and level.

- The assessment level can be
 - Strategic: metrics associated with higher level of decision making in the city and long term view decisions;
 - Tactical: metrics associated with intermediate decision making and implementation levels in the city and medium term view decisions.

Either in overall or within one dimension, it is possible to compare the current study results with another study (e.g. the same city in a previous year) using the option "**Compare with**".

In each dimension, the user may ask for the correspondent metrics table. This table will present all metrics within the dimension, the correspondent city answers and the associated development level. This metrics table is available to download (.xls file). The user can export any chart or table selecting = .

- Graph types are the same when selecting results within each dimension:
 - Organisational: overall dimension (donut) and results by objectives (bar graph)
 - Spatial: overall dimension (donut) and results by objectives (bar graph)
 - Functional: overall dimension (donut) and results by services (bar graph)
 - Physical: overall dimension (donut) and results by services (bar graph)

The user can cascade down, into more detail. For instance, when selecting results by objective, the graphs display the results for the overall objective (donut) and by criteria (bar graph). When the user is in the most detailed display of the results, i.e., selecting results by criteria, the graphs shows the overall criteria with a new graph type (spider graph for every metric within the criteria).



Specifically in this graph, when the user moves the mouse around, the metric's development level is presented in a box along with the metric's performance indicator (PI).

As in the other graphs, the spider graph also has an associated table with detailed information about the metrics within the selected criteria.

Final notes

To keep the changes made by the user, it is recommended to <u>SAVE</u> before leaving to "studies" or to select the "Results" tab in the Navigation Bar, otherwise everything changed by the user will not be recorded:

- Data will be temporarily kept when the user edits the answers and skips between dimension tabs without saving;
- The user should <u>Save</u> when skipping between objectives or dimension tabs, if the user really wants to save permanently those changes.

The user should be aware that skipping to the "Results" tab will save automatically all the changes made. If the user wants to exit the study and discard the changes:

- The user should not move to "Results" neither use the Save button;
- The user should move directly to Studies.

Either in the dimensions or in results tabs, the **<u>back</u>** button will always redirect the user to City Location.

Metrics dependencies

Organisational

Metrics	Dependencies
046 ((62/2)(4 (+ 4))	017
016 (If 3/2/1 selected)	018
	025
	026
O24 (If 3 or 2 selected)	027
	028
	029
O38 (if yes)	039
O30 (if 3/2/1 selected)	036, 040, 046, 048
O44 (if yes)	045
051 (ifuer)	052
USI (IFyes)	053
O58 (if 3/2/1 selected)	059, 060
O63 (if yes)	064
O54 organisational (if 3/2/1 selected)	SG6, S07, S08, S09, S16, S17, S27, S28; FMob12 FMob13, FMob14, FMob15, FMob16, FMob17, FMob35, FMob36, FMob38, FMob39,FMob40, FMob41, FMob42

Functional - Water

Functional - Wastewater

wiethes	Dependencies
EW/tc01 (if yoc/partially)	FWts02
PWISOI (II yes/partially)	FWts03
FWts06 (if yes)	FWts07
FWts56 (if 3/2/1 selected)	FWts57
FWts48 (if 3/2/1 selected)	FWts14, FWts15, FWts16, FWts17, FWts18, FWts19, FWts20, FWts21, FWts22, FWts23, FWts41, FWts42, FWts49, FWts58 to FWts67; PWts20, PWts36, PWts37, PWts38, PWts41, PWts42, FWts43, PWts44, PWts45, PWts46, PWts47, PWts48, PWts49

Functional - Stormwater

Metrics	Dependencies
FSut01 (if use / partially)	FSwt02
PSWLOI (II yes/partially)	FSwt03
FSwt06 (if yes)	FSwt07
FSwt46 (if 3/2/1 selected)	FSwt47
FSwt38 (if 3/2/1 selected)	FSwt14, FSwt15, FSwt16, FSwt17, FSwt18, FSwt31, FSwt32, FSwt39, FSwt48, FSwt49, FSwt50, FSwt51, FSwt52; PSwt20, PSwt35, PSwt36, PSwt37, PSwt40, PSwt41, PSwt42, PSwt43, PSwt44, PSwt45, PSwt46, PSwt47, PSwt48

Functional - Energy

Dependencies Metrics FEne02 FEne01 (if yes/partially) FEne06 (if yes) FEne07 FEne46 (if 3/2/1 selected) FEne47 FEne14, FEne15, FEne16, FEne17, FEne18, FEne31, FEne32, FEne39, FEne48, FEne49, FEne50, FEne51, FEne52; PEne16, PEne30, PEne31, PEne32, PEne35, PEne36, PEne37, PEne38, PEne39, PEne40, PEne41 FEne38 (if 3/2/1 selected)

Physical - Water

Metrics	Dependencies
	PWts02
PWts01 (if yes/partially)	PWts03
	PWts04
PWts01 (if yes/partially)	PWts36, PWts47

Physical - Stormwater

Metrics	Dependencies		
	PSwt02		
PSwt01 (if yes/partially)	PSwt03		
	PSwt04		
PSwt01 (if yes/partially)	PSwt35, PSwt46		

Physical - Energy

Metrics	Dependencies
	PEne02
PEne01 (if yes/partially)	PEne03
	PEne04
PEne01 (if yes/partially)	PEne30, PEne39

ivietrics	Dependencies
EM/w#01 (if use (portially)	FWwt02
rww.toi (ii yes/partialiy)	FWwt03
FWwt06 (if yes)	FWwt07
FWwt53 (if 3/2/1 selected)	FWwt54
FWwt45 (if 3/2/1 selected)	FWwt14, FWwt15, FWwt16, FWwt17, FWwt1 FWwt19, FWwt20, FWwt21, FWwt38, FWwt3 FWwt46, FWwt55, FWwt56, FWwt57, FWwt5 FWwt59, FWwt60, FWwt61, FWwt62, FWwt6 PWwt20, PWwt35, PWwt36, PWwt33, PWwt40, PWwt41, PWwt42, PWwt43, PWwt44, PWwt45, PWwt46, PWwt47, PWwt48

Functional - Waste

Metrics	Dependencies
FCI. 04 (15	FSIw02
FSIW01 (If yes/partially)	FSIw03
FSIw06 (if yes)	FSIw07
FSIw51 (if 3/2/1 selected)	FSIw52
FSIw43 (if 3/2/1 selected)	FSIw14, FSIw15, FSIw16, FSIw17, FSIw18, FSIw19,FSIw20, FSIw36, FSIw37, FSIw44, FSIw53, FSIw54, FSIw55, FSIw56, FSIw57, FSIw58, FSIw59, FSIw60; PSIw18, PSIw35, PSIw36, PSIw37, PSIw40, PSIw41, PSIw42, PSIw43, PSIw44, PSIw45, PSIw46, PSIw47, PSIw48

Functional - Mobility

Metrics	Dependencies
	FMob02
	FMob03
FMob01 (if existing)	FMob06
	FMob07
	FMob08

Physical - Wastewater

Metrics	Dependencies		
	PWwt02		
PWwt01 (if yes/partially)	PWwt03		
	PWwt04		
PWwt01 (if yes/partially)	PWwt35, PWwt46		

Physical - Waste

Metrics	Dependencies	
	PSIw02	
PSIw01 (if yes/partially)	PSIw03	
	PSIw04	
PSIw01 (if yes/partially)	PSIw35, PSIw46	

Physical - Mobility

Metrics	Dependencies
	PMob02
PMob01 (if yes/partially)	PMob03
PMob01 (if yes/partially)	PMob24

Spatial

S24

Organisational		Spatial		
Old REF N	IEW REF		Old REF	NEW REF
1 C	01		100a	S01
2 0	02		100b	502
2 0	02		101	\$02
50	05		101	303
4 C	04		102	S04
5 C	05		103	S05
6 C	06		104	S06
7 0	07		105	S07
8.0	08		106	\$08
80	08		100	308
90	109		107a	509
10 C	10		107b	S10
12 C	11		107c	S11
13 C	12		108	S12
14 0	13		109	\$13
14 0	14		110	C14
15 0	14		110	514
16 C	15		111	\$15
17a C	16		114	S16
17b C	17		115	S17
17c O	18		118	\$18
19 0	10		110	\$10
10 0	20		115	515
19 0	020		120	520
20 C	21		121	S21
21 C	22		122	S22
22 0	23		123	S23
222 0	24		124	\$24
250 0	27		124	527
230 0	2.5		125	323
23c C	26		126	\$26
23d C	27		127	S27
24 C	28		128	S28
25.0	129		129	\$29
25 0	20		125	525
20 0	150			
27 C	31			
28 C	32			
29 C	33			
30a 0	34			
20h C	-3-F			
300 0	35			
31 C	36			
32 C	37			
33 C	38			
34 0	39			
25.0	40			
33 0	40			
36 0	41			
37 C	42			
38 C	43			
39a O	44			
30h (45			
330 0				
40 0	40			
41 C	47			
42 C	48			
43a C	49			
43h ()	50			
	51			
440 0	51			
44b C	52			
44c C	53			
45 C	54			
97 C	55			
98 0	56			
00.0	57			
99 0	57			
49 C	58			
50 C	59			
51a C	60			
51h (61			
E2 0	62			
52 0				
53a C	201			
53b C	64			
54 C	65			
55a C	66			
55h 0	67			
550 0				
56a C	00			
56b C	169			
57 C	70			
58 C	71			
59 0	172			
60.0				
60 C	13			
61 C	74			

Functional	Functional	Functional	Functional	Functional	Functional
WATER	WASTEWATER	STORMWATER	WASTE	ENERGY	MOBILITY
Old REF. NEW REF	Old REF NEW REF	Old REF. NEW REF.	Old REF. NEW REF	Old REF NEW REF	Old REF NEW REF
200 EW/tc01	400 514/14/01	E00 E5wtt01	600 EShu01	700 EEno01	800 EMab01
300 FW(301	400 FWW101	500 F3W(01	000 F3IW01	700 FEIle01	800 FM0001
301 FWts02	401 FWWt02	501 FSWt02	601 FSIW02	701 FEne02	801 FMODU2
302 FWts03	402 FWwt03	502 FSwt03	602 FSIw03	702 FEne03	802 FMob03
303 FWts04	403 FWwt04	503 FSwt04	603 FSIw04	703 FEne04	803 FMob04
304 FWts05	404 FWwt05	504 FSwt05	604 FSIw05	704 FEne05	804 FMob05
305 FWts06	405 FWwt06	505 FSwt06	605 FSIw06	705 EEne06	805 FMob06
306 FW/ts07	406 EW/wt07	506 FSwt07	606 FSIW07	706 FEne07	806 EMob07
300 FWLS07	400 FWW107	500 F3wt07	000 F3IW07	700 FEIle07	800 FM0007
307 FWts08	407 FWWt08	507 FSWt08	607 FSIW08	707 FEne08	807 FIXIODU8
308 FWts09	408 FWwt09	508 FSwt09	608 FSIw09	708 FEne09	809 FMob09
309 FWts10	409 FWwt10	509 FSwt10	609 FSlw10	709 FEne10	810 FMob10
310 FWts11	410 FWwt11	510 FSwt11	610 FSlw11	710 FEne11	811 FMob11
311 FWts12	411 FWwt12	511 FSwt12	611 FSlw12	711 FEne12	812 FMob12
312 FWts13	412 FWwt13	512 FSwt13	612 FSIw13	712 FEne13	813 FMob13
313 FW/ts14	413 FW/wt14	513 FSwt14	613 FSIw14	713 FEne14	814 FMob14
214 514-15	414 514(++15	515 15wt14	613 T5IW14	715 1	010 514-515
514 FW(S15	414 FWW(15	515 F5W(15	014 F3IW15	713 FEIIE15	819 FIVIOD13
315 FWts16	415 FWwt16	517 FSwt16	615 FSIW16	/1/ FEne16	820 FMob16
316 FWts17	416 FWwt17	519 FSwt17	617 FSlw17	719 FEne17	821 FMob17
317 FWts18	417 FWwt18	521 FSwt18	619 FSlw18	721 FEne18	822 FMob18
318 FWts19	419 FWwt19	523 FSwt19	621 FSlw19	723 FEne19	823 FMob19
319 FWts20	421 FWwt20	525 FSwt20	622 FSIw20	725 FEne20	824 FMob20
320 FWts21	422 FW/wt21	527 FSwt21	623 FSIw21	727 FFne21	825 FMoh21
221 EW/tc22	422 5 1 1 1 1 2 2	527 F5W(21	624 EShu22	720 EEno22	820 EMob22
321 FW(322	423 FWW(22	525 F3W(22	024 F3IW22	723 FLIEZZ	829 FIVIOD22
322 FWts23	424 FWWt23	531 FSWt23	625 FSIW23	731 FEne23	830 FIVIOD23
323 FWts24	425 FWwt24	533 FSwt24	627 FSIw24	733 FEne24	831 FMob24
324 FWts25	426 FWwt25	534 FSwt25	628 FSIw25	734 FEne25	832 FMob25
325 FWts26	427 FWwt26	535 FSwt26	629 FSIw26	735 FEne26	833 FMob26
326 FWts27	428 FWwt27	538 FSwt27	631 FSlw27	738 FEne27	834 FMob27
327 FWts28	429 FWwt28	539 FSwt28	632 FSIw28	739 FEne28	835 FMob28
328 FW/ts29	431 FW/wt29	540 FSwt29	633 FSIw29	740 FEne29	836 FMob29
220 FWts20	432 51400023	E41 E5wt20	634 FShv20	740 FERe20	827 FMab20
329 FWIS50	432 FWW130	541 FSW(50	634 F3IW50	741 FEIle30	837 FIVIOD30
330 FWts31	433 FWWt31	542 FSWt31	635 FSIW31	742 FEne31	838 FM0031
331 FWts32	434 FWwt32	543 FSwt32	638 FSIw32	743 FEne32	839 FMob32
332 FWts33	435 FWwt33	544 FSwt33	639 FSlw33	744 FEne33	840 FMob33
333 FWts34	438 FWwt34	545 FSwt34	640 FSIw34	745 FEne34	841 FMob34
334 FWts35	439 FWwt35	546 FSwt35	641 FSlw35	746 FEne35	842 FMob35
335 FWts36	440 FWwt36	547 FSwt36	642 ESIw36	747 FEne36	843 FMob36
238 FW/tc27	441 EW/wr37	5/8 FSwt37	643 ESIW37	7/8 EEne37	848 EMob37
220 51//t=28	442 514(0+28	540 FSwt37	644 FShu39	740 [Enc37	850 FMab39
339 FW1538	442 FWW138	549 F3W138	044 F3IW38	749 FEIles8	859 FIVIOD38
340 FWts39	443 FWWt39	550 FSWt39	645 FSIW39	750 FEne39	860 FM0039
341 FWts40	444 FWwt40	551 FSwt40	646 FSIw40	751 FEne40	865 FMob40
342 FWts41	445 FWwt41	552 FSwt41	647 FSlw41	752 FEne41	866 FMob41
343 FWts42	446 FWwt42	553 FSwt42	648 FSIw42	753 FEne42	867 FMob42
344 FWts43	447 FWwt43	554 FSwt43	649 FSIw43	754 FEne43	
345 FW/ts44	448 FWwt44	555 FSwt44	650 FSIw44	755 FEne44	
346 FW/ts/15	449 EW/wt45	556 FSwt45	651 FSIW/15	756 FEne/15	
247 514-46	445 TWW(45	550 15wt45	651 T5IW45	750 1 Elle45	
547 FWL546	450 FWW146	557 F3W(40	052 F3IW40	737 FEIIe46	
348 FWts47	451 FWwt47	558 FSwt47	653 FSIw47	/58 FEne47	
349 FWts48	452 FWwt48	559 FSwt48	654 FSIw48	759 FEne48	
350 FWts49	453 FWwt49	561 FSwt49	655 FSIw49	761 FEne49	
351 FWts50	454 FWwt50	563 FSwt50	656 FSIw50	763 FEne50	
352 FWts51	455 FWwt51	565 ESwt51	657 ESIw51	765 FEne51	
353 FW/ts52	456 FW/wt52	567 FSwt52	658 FSIw52	767 FEne52	
254 514/4552	450 1 1 1 1 2 2	507 15wt52	650 FSIW52	760 FEne52	
354 FWts53	457 FWWt53	569 FSW(53	659 FSIW53	769 FENE53	
355 FWts54	458 FWwt54	570 FSwt54	660 FSIw54	770 FEne54	
356 FWts55	459 FWwt55		661 FSIw55		
357 FWts56	460 FWwt56		663 FSIw56		
358 FWts57	461 FWwt57		664 FSIw57		
359 FWts58	462 FWwt58		665 FSIw58		
360 FWts59	463 FWwt59		667 FSIw59		
361 FW/tc60	464 EW/14/60		668 ESIW60		
262 EM4-61			660 FSIW00		
502 FVV1501	405 FWW(01		C20 -21 -22		
363 FWts62	467 FWwt62		670 FSIw62		
364 FWts63	468 FWwt63				
365 FWts64	469 FWwt64				
366 FWts65	470 FWwt65				
367 FWts66					
368 FWts67					

369 FWts68 370 FWts69

Physical	Physical	Physical	Physical	Physical	Physical
WATER	WASTEWATER	STORMWATER	WASTE	ENERGY	MOBILITY
Old REF NEW REF					
1300 PWts01	1400 PWwt01	1500 PSwt01	1600 PSlw01	1700 PEne01	1800 PMob01
1300b PWts02	1400b PWwt02	1500b PSwt02	1600b PSlw02	1700b PEne02	1800b PMob02
1300c PWts03	1400c PWwt03	1500c PSwt03	1600c PSIw03	1700c PEne03	1800c PMob03
1300d PWts04	1400d PWwt04	1500d PSwt04	1600d PSIw04	1700d PEne04	1801 PMob04
1301 PWts05	1401 PWwt05	1501 PSwt05	1601 PSIw05	1701 PEne05	1802 PMob05
1302 PWts06	1402 PWwt06	1502 PSwt06	1602 PSIw06	1702 PEne06	1803 PMob06
1303 PWts07	1403 PWwt07	1503 PSwt07	1603 PSIw07	1703 PEne07	1804 PMob07
1304 PWts08	1404 PWwt08	1504 PSwt08	1604 PSIw08	1704 PEne08	1804b PMob08
1304b PWts09	1404b PWwt09	1504b PSwt09	1604b PSIw09	1704b PEne09	1804c PMob09
1304c PWts10	1404c PWwt10	1504c PSwt10	1604c PSlw10	1704c PEne10	1804d PMob10
1304d PWts11	1404d PWwt11	1504d PSwt11	1604d PSIw11	1704d PEne11	1804e PMob11
1304e PWts12	1404e PWwt12	1504e PSwt12	1604e PSIw12	1705 PEne12	1804f PMob12
1304f PWts13	1404f PWwt13	1504f PSwt13	1604f PSIw13	1706 PEne13	1806 PMob13
1305 PWts14	1405 PWwt14	1505 PSwt14	1605 PSlw14	1707 PEne14	1807 PMob14
1306 PWts15	1406 PWwt15	1506 PSwt15	1606 PSIw15	1710 PEne15	1810 PMob15
1307 PWts16	1407 PWwt16	1507 PSwt16	1607 PSlw16	1711 PEne16	1811 PMob16
1308 PWts17	1408 PWwt17	1508 PSwt17	1610 PSlw17	1712 PEne17	1812 PMob17
1309 PWts18	1409 PWwt18	1509 PSwt18	1611 PSlw18	1714 PEne18	1814 PMob18
1310 PWts19	1410 PWwt19	1510 PSwt19	1612 PSIw19	1714c PEne19	1819 PMob19
1311 PWts20	1411 PWwt20	1511 PSwt20	1614 PSIw20	1715 PEne20	1820 PMob20
1312 PWts21	1412 PWwt21	1512 PSwt21	1614c PSIw21	1716 PEne21	1821 PMob21
1314 PWts22	1414 PWwt22	1514 PSwt22	1615 PSIw22	1716b PEne22	1823b PMob22
1314c PWts23	1414c PWwt23	1514c PSwt23	1616 PSIw23	1716c PEne23	1824 PMob23
1315 PWts24	1415 PWwt24	1515 PSwt24	1616b PSlw24	1720 PEne24	1825 PMob24
1316 PWts25	1416 PWwt25	1516 PSwt25	1616c PSIw25	1720b PEne25	1826 PMob25
1316b PWts26	1416b PWwt26	1516b PSwt26	1617 PSIw26	1720c PEne26	1827 PMob26
1316c PWts27	1416d PWwt27	1516c PSwt27	1619 PSlw27	1721 PEne27	1828 PMob27
1317 PWts28	1419 PWwt28	1517 PSwt28	1620 PSIw28	1723b PEne28	1828b PMob28
1319 PWts29	1420 PWwt29	1519 PSwt29	1620b PSIw29	1724 PEne29	1829 PMob29
1320 PWts30	1420b PWwt30	1520 PSwt30	1620c PSIw30	1725 PEne30	1829b PMob30
1320b PWts31	1420c PWwt31	1520b PSwt31	1621 PSIw31	1726 PEne31	1829e PMob31
1320c PWts32	1421 PWwt32	1521 PSwt32	1622 PSIw32	1727 PEne32	1829f PMob32
1321 PWts33	1423b PWwt33	1523b PSwt33	1623b PSIw33	1728 PEne33	1829g PMob33
1323b PWts34	1424 PWwt34	1524 PSwt34	1624 PSIw34	1728b PEne34	1829h PMob34
1324 PWts35	1425 PWwt35	1525 PSwt35	1625 PSIw35	1729 PEne35	1831 PMob35
1325 PWts36	1426 PWwt36	1526 PSwt36	1626 PSIw36	1729b PEne36	1832 PMob36
1326 PWts37	1427 PWwt37	1527 PSwt37	1627 PSIw37	1729c PEne37	
1327 PWts38	1428 PWwt38	1528 PSwt38	1628 PSIw38	1729d PEne38	
1328 PWts39	1428b PWwt39	1528b PSwt39	1628b PSIw39	1730 PEne39	
1328b PWts40	1429 PWwt40	1529 PSwt40	1629 PSIw40	1731 PEne40	
1329 PWts41	1429b PWwt41	1529b PSwt41	1629b PSlw41	1732 PEne41	
1329b PWts42	1429c PWwt42	1529c PSwt42	1629c PSIw42		
1329c PWts43	1429d PWwt43	1529d PSwt43	1629d PSIw43		
1329d PWts44	1429e PWwt44	1529e PSwt44	1629e PSlw44		
1329e PWts45	1429f PWwt45	1529f PSwt45	1629f PSlw45		
1329f PWts46	1430 PWwt46	1530 PSwt46	1630 PSlw46		
1330 PWts47	1431 PWwt47	1531 PSwt47	1631 PSlw47		
1331 PWts48	1432 PWwt48	1532 PSwt48	1632 PSlw48		
1332 PWts49					