# PACIFIC PARADISE

March 7th, 2022

Attention: William Barker

We represent the small country of Pacific Paradise where we have been working to improve our response to the recent pandemic. We would like your assistance in planning our vaccination distribution strategy (VDS).

We receive vaccine doses into the country through three import depots (IDs). From there, we transport the vaccines to local vaccination centres (LVCs). Citizens from each Census Collection District (CCD) will then be assigned to visit an LVC to receive their vaccination. The map below gives an overview of our network, where red nodes are IDs and blue nodes are LVCs:
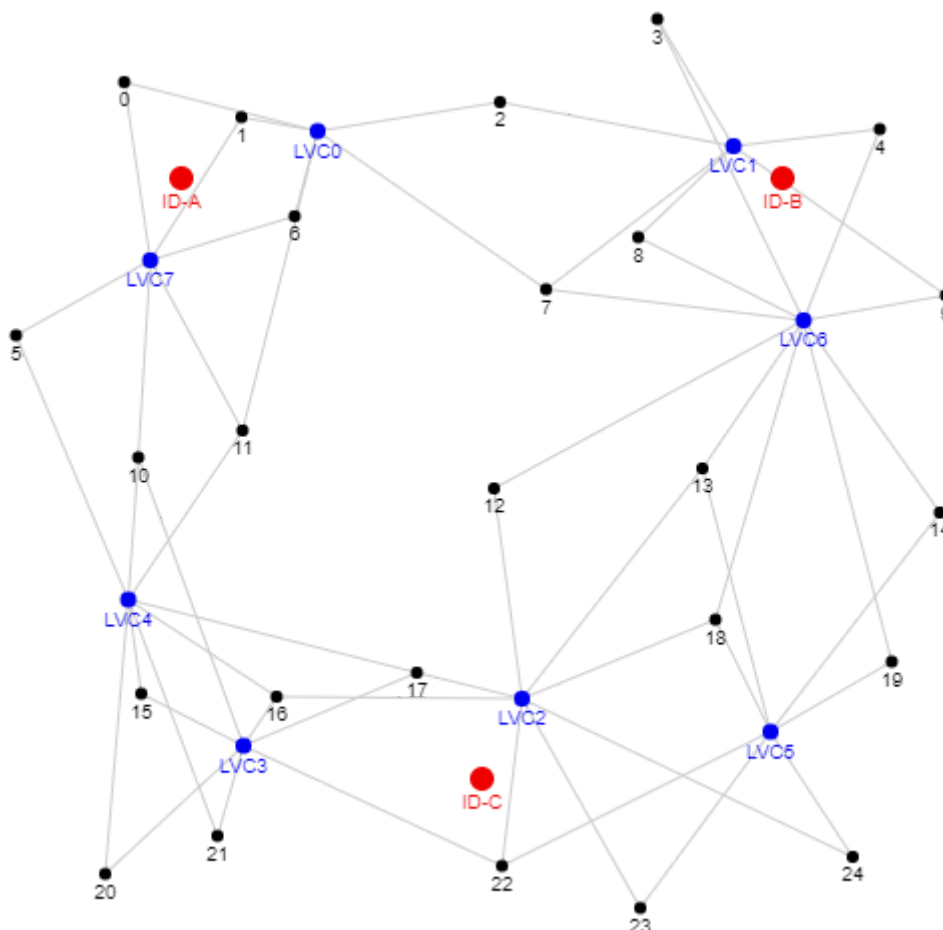
The table below shows the distances from each ID to each LVC:

	LVC0	LVC1	LVC2	LVC3	LVC4	LVC5	LVC6	LVC7
ID-A	14.4	55.2	62.1	57.0	42.4	80.7	63.7	8.8

ID-B	46.6	5.9	58.1	78.2	77.7	55.3	14.4	63.6
ID-C	66.7	68.0	8.9	24.0	39.6	29.2	55.9	61.5

Note that vaccines can be delivered from any ID to any LVC. However, citizens in each CCD are only permitted to attend one of their neighbouring LVCs, as shown by the connections on the map. The following table shows the population for each CCD, along with the average distance for citizens in the CCD to access each of the LVCs they can reach:

CCD	Population	LVC0	LVC1	LVC2	LVC3	LVC4	LVC5	LVC6	LVC7
0	4030	19.9	-	-	-	-	-	-	18.0
1	3355	7.7	-	-	-	-	-	-	16.9
2	3920	18.4	23.7	-	-	-	-	-	-
3	4271	-	14.8	-	-	-	-	33.5	-
4	4017	-	14.7	-	-	-	-	20.6	-
5	2382	-	-	-	-	28.7	-	-	15.4
6	3935	8.8	-	-	-	-	-	-	15.1
7	2316	27.7	23.5	-	-	-	-	25.9	-
8	4322	-	13.2	-	-	-	-	18.5	-
9	2151	-	25.9	-	-	-	-	14.4	-
10	3774	-	-	-	30.7	14.2	-	-	19.7
11	3699	30.8	-	-	-	20.4	-	-	19.3
12	4533	-	-	21.2	-	-	-	35.2	-
13	3734	-	-	29.2	-	-	27.2	17.9	-
14	2992	-	-	-	-	-	27.7	23.5	-
15	3624	-	-	-	11.4	9.5	-	-	-
16	4755	-	-	24.5	5.9	17.7	-	-	-
17	4045	-	-	10.8	18.8	29.7	-	-	-
18	4035	-	-	20.9	-	-	12.5	31.2	-
19	2238	-	-	-	-	-	14.0	35.2	-
20	4661	-	-	-	18.8	27.5	-	-	-
21	3026	-	-	-	9.4	25.2	-	-	-
22	3570	-	-	16.8	28.5	-	30.0	-	-
23	4090	-	-	24.0	-	-	21.9	-	-
24	2548	-	-	36.6	-	-	14.9	-	-

Previous consultants we have worked with requested these large tables as a Python file, so we have provided that [here](#).

The importation cost of a dose of vaccine varies between IDs, as shown in the following table:

	ID-A	ID-B	ID-C
Cost ($/dose)	177	142	155

Delivering vaccines from an ID to an LVC costs $0.20 per kilometre per dose. The cost for a citizen in a CCD to access an LVC is $1.00 per kilometre that they have to travel.

How should we plan to deliver vaccine doses to our citizens to minimise the total overall cost? Please provide us with the optimal cost for distributing all the vaccine.

$ 14992146

Communication 2

Thank you for your initial plan for distributing the vaccine to our vaccination clinics and citizens. Unfortunately, we have realised that this plan will not work for us since we have a maximum capacity at each ID of 37000 doses and a maximum number of doses that can be administered at each LVC of 16000.

Could you revise your proposal to take this into account? Please provide us with the optimal cost for distributing all the vaccine.

$ 15550355

Communication 3

Thank you for your revised plan. Moving forward, we anticipate that we will need to plan over a period of 6 weeks, and that the maximum number of weekly doses that can be delivered at an LVC is 2200.

Could you revise your proposal to take this into account? Please provide us with the optimal total cost for distributing all the vaccine across the 6 weeks.

$ 15569386

Communication 4

It seems your proposal will delay vaccinations to some CCDs until weeks where the nearby LVCs have high capacities. However, in practice there is a cost in delaying vaccinations, which we estimate to be $10 per person per week.

Could you revise your proposal to take this into account? Please provide us with the optimal cost for distributing all the vaccine.

$ 17479538

Communication 5

We want to ensure that the provision of vaccinations across the CCDs is fair. To achieve this, we want to ensure that the differences between the fraction of the population vaccinated in each CCD does not vary too much. Specifically, the difference between the minimum and maximum cumulative fraction vaccinated should be no more than 0.1 in each week.

Could you revise your proposal to take this into account? Please provide us with the optimal cost for distributing all the vaccine.

We look forward to reading your final report.